



# Our extensive package range provides maximum flexibility

	Miniaturization										Medium Power					
2 Pins	 DSN0402 (SOD992) 0.4 x 0.2 x 0.12	 DSN0603-2 (SOD962) 0.6 x 0.3 x 0.3	 DSN1006-2 (SOD993) 1.0 x 0.6 x 0.3	 DSN1006U-2 (SOD995) 1.0 x 0.6 x 0.3	 DFN1006D-2 (SOD882D) 1.0 x 0.6 x 0.37	 DFN1006-2 (SOD882) 1.0 x 0.6 x 0.48	 SOD523 1.2 x 0.8 x 0.6	 DFN1608D-2 (SOD1608) 1.6 x 0.8 x 0.37	 DSN1608-2 (SOD963/SOD964) 1.6 x 0.8 x 0.25/0.29	 SOD323F 1.7 x 1.25 x 0.7	 SOD323 1.7 x 1.25 x 0.95	 SOD123F 2.6 x 1.6 x 1.1	 CFP3 (SOD123W) 2.6 x 1.7 x 1.0	 CFP5 (SOD128) 3.8 x 2.6 x 1.0	 CFP15 (SOT1289) 5.8 x 4.3 x 0.78	 D2PAK (SOT404) 11.0 x 10.0 x 4.3
3 Pins	 DFN1006B-3 (SOT883B) 1.0 x 0.6 x 0.37	 DFN1006-3 (SOT883) 1.0 x 0.6 x 0.48	 DFN1010D-3 (SOT1215) 1.1 x 1.0 x 0.37	 SOT663 1.6 x 1.2 x 0.55	 SOT323 2.0 x 1.25 x 0.95	 SOT23 2.9 x 1.3 x 1.0	 DFN2020-3 (SOT1061) 2.0 x 2.0 x 0.62	 DFN2020D-3 (SOT1061D) 2.0 x 2.0 x 0.62	 SOT89 4.5 x 2.5 x 1.5	 DPAK (SOT428) 6.6 x 6.1 x 2.3						
4/5 Pins	 WLCSP4* 0.8 x 0.8 x 0.35	 WLCSP5* 1.51 x 1.14 x 0.65	 SOT665 1.6 x 1.2 x 0.55	 SOT353 2.0 x 1.25 x 0.95	 SOT143B 2.9 x 1.3 x 1.0	 LPAK56 (SOT669) 5.0 x 6.0 x 1.0	 SOT223 6.5 x 3.5 x 1.65									
6 Pins	 DFN1010B-6 (SOT1216) 1.1 x 1.0 x 0.37	 DFN1010-6 (SOT891) 1.0 x 1.0 x 0.48	 DFN1410-6 (SOT886) 1.45 x 1.0 x 0.48	 WLCSP6 1.48 x 0.98 x 0.35	 SOT666 1.6 x 1.2 x 0.55	 SOT363 2.0 x 1.25 x 0.95	 DFN2020-6 (SOT1118) 2.0 x 2.0 x 0.62	 DFN2020D-6 (SOT1118D) 2.0 x 2.0 x 0.62	 DFN2020MD-6 (SOT1220) 2.0 x 2.0 x 0.62	 SOT457 2.9 x 1.5 x 1.0						
≥ 7 Pins	 DFN2110-9 (SOT1178) 2.1 x 1.0 x 0.48	 DFN2111-7 (SOT1358) 2.1 x 1.1 x 0.5	 DFN2510A-10 (SOT1176) 2.5 x 1.0 x 0.48	 DFN2520-9 (SOT1333) 2.5 x 2.0 x 0.48	 DFN2521-12 (SOT1156-1) 2.5 x 2.1 x 0.5	 LPAK33 (SOT1210) 3.3 x 3.3 x 0.85	 DFN4020-14 (SOT1334) 4.0 x 2.0 x 0.48	 DFN4040-32 (SOT1318-1) 4.0 x 4.0 x 0.5	 DFN5050-32 (SOT617-3) 5.0 x 5.0 x 0.85	 LPAK56D (SOT1205) 5.0 x 6.0 x 1.0						

\* The exact position of the balls and package dimensions vary.

Your global partner for discretes



# Discretes semiconductors selection guide 2016

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transistors**

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# Our commitment: quality and reliability

## AEC-Q101

- ▶ We qualify our products according to the automotive AEC-Q101 standard and even exceed it's requirements, for instance when doing extended lifetime testing.



- ▶ All our processes and manufacturing plants are subject to regular international and internal audits, including the following:
  - ▶ ISO9001
  - ▶ ISO/TS 16949 for automotive sites
  - ▶ ISO14001
  - ▶ OHSAS18001

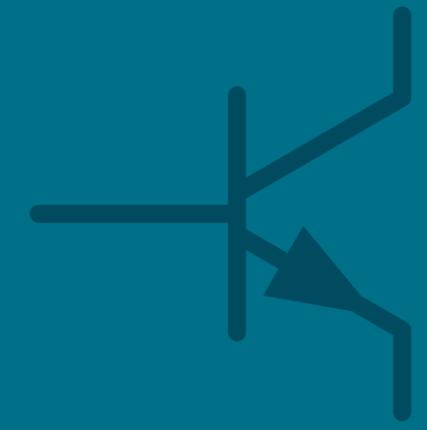


- ▶ NXP's Design for Excellence (DfX) program ensures that each new development builds on past learning and that best practices are always employed. The result is continual product improvement.



- ▶ Zero defect is our goal. To ensure continuous improvement failure analysis and the determination to find root causes is performed at all stages of development and production by adoption of quality-analysis tools and methods (e.g. Six-Sigma, Safe-Launch).

Rigorous attention to detail and commitment to quality have yielded a very low product failure rate of a single-digit part per billion (ppb).



## Bipolar transistors

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# Bipolar transistors portfolio

What you get when you choose NXP for bipolar transistors

### A comprehensive portfolio for all applications

Best in class performing transistors from general-purpose to low  $V_{CEsat}$  transistors

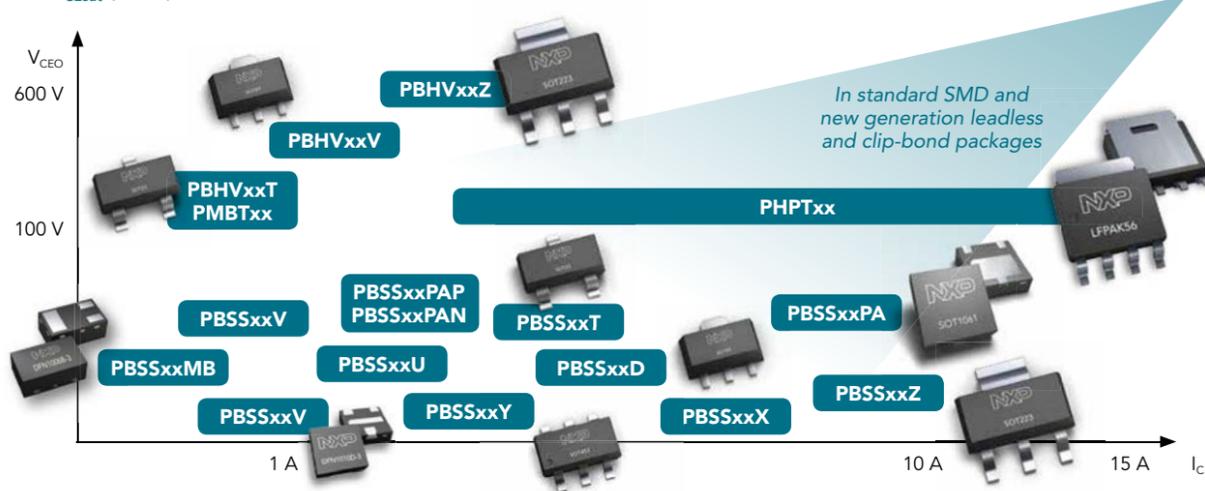
### A broad range of packages

Many options for leaded SMD, medium-power clip-bond and ultra-small leadless packages.

### A quality product from an experienced, high volume supplier

- ▶ NXP is strongly committed to automotive quality standards
- ▶ NXP has a track record of more than 60 years in developing and producing transistors
- ▶ NXP is the #1 in small-signal discretes with a high production capacity

### Low $V_{CEsat}$ (BISS) transistors



# Medium-power Bipolar transistors in LFPAK56



**LFPAK56 (SOT669)**  
Single package  
5 x 6 x 1.1 mm



**LFPAK56D (SOT1205)**  
Dual package  
5 x 6 x 1.1 mm

### Applications

- ▶ Power management
- ▶ Loadswitch
- ▶ Linear-mode voltage regulator
- ▶ Backlight units
- ▶ Motor drive
- ▶ LED lighting
- ▶ Relay replacement
- ▶ IGBT drive

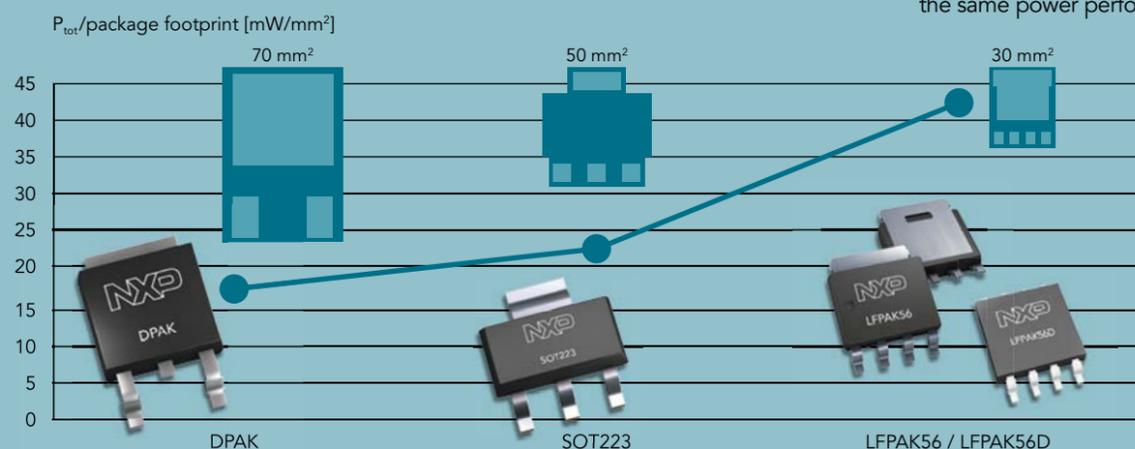
### In the spotlight

#### Bipolar transistors in LFPAK56 and LFPAK56D power packages

- High thermal power dissipation up to 3.7 W,  $V_{ce0}$  up to 100 V
- Most types AECQ-101 qualified ( $I_c = 3$  A up to 15 A)
- 2 types in LFPAK56D with current gain matching of 5% and 10%
- Reduced PCB area requirements compared to transistors in DPAK
- Suitable for high-temperature applications up to 175 °C

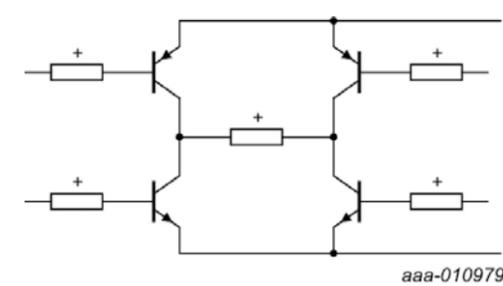
### LFPAK: Same power dissipation but half the size

55% package size reduction while retaining the same power performance



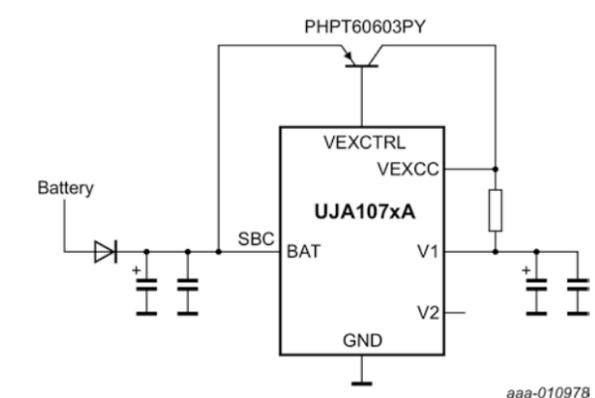
Reduced PCB area requirements comparison of DPAK, SOT223 and LFPAK

### Motor drive (2x PHPT60603NY/PY) or a double LFPAK56D (PHPT610030NK/PK)



aaa-010979

### IVN – System Basis Chip (PHPT60603PY) External pass transistor, linear regulator



aaa-010978

### High-power transistors (single)

Package											LFPAK56 (SOT669)
											
Size (mm)											5 x 6 x 1.1
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	h <sub>FE</sub> min/typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	V <sub>CEsat</sub> typ (mV); I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 0.05 A	V <sub>CEsat</sub> max (mV)	@ I <sub>C</sub> (A)	@ I <sub>B</sub> (A)	Polarity	
60	3	8	200 / 400	0.5	2	50	270	3	0.3	NPN	PHPT60603NY
			200 / 400	0.5	2	70	360	3	0.3	PNP	PHPT60603PY
150 / 250	0.5		10	50	330	3	0.3	NPN	PHPT61003NY		
150 / 220	0.5		10	70	360	2	0.2	PNP	PHPT61003PY		
100	3	6	150 / 250	0.5	10	50	300	2	0.2	NPN	PHPT61002NYC
			150 / 220	0.5	10	70	400	2	0.2	PNP	PHPT61002PYC

### High-current, high-power transistors

Package						LFPAK56 (SOT669)
						
Size (mm)						5 x 6 x 1.1
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> min/typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	Polarity	
40	6	200/400	0.5	2	NPN	PHPT60406NY
40	6	200/400	0.5	2	PNP	PHPT60406PY
40	10	200/400	0.5	2	NPN	PHPT60410NY
40	10	200/400	0.5	2	PNP	PHPT60410PY
40	15	200/400	0.5	2	NPN	PHPT60415NY
40	15	200/400	0.5	2	PNP	PHPT60415PY
60	6	200/400	0.5	2	NPN	PHPT60606NY
60	6	150/250	0.5	2	PNP	PHPT60606PY
60	10	200/400	0.5	2	NPN	PHPT60610NY
60	10	150/250	0.5	2	PNP	PHPT60610PY
100	6	150/250	0.5	10	NPN	PHPT61006NY
100	6	150/220	0.5	10	PNP	PHPT61006PY
100	10	150/250	0.5	10	NPN	PHPT61010NY
100	10	150/220	0.5	10	PNP	PHPT61010PY

### High-power transistors (double)

Package												LFPAK56D (SOT1205)
												
Size (mm)												5 x 6 x 1.1
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	h <sub>FE</sub> typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	V <sub>CEsat</sub> typ (mV); I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 0.05 A	V <sub>CEsat</sub> max (mV)	@ I <sub>C</sub> (A)	@ I <sub>B</sub> (A)	Polarity	h <sub>FE1</sub> / h <sub>FE2</sub>	
100	3	6	150	0.5	10	50	300	3	0.2	2XNPN	-	PHPT610030NK
						70	400	3	0.2	2XPNP	-	PHPT610030PK
						50 / 70	300 / 400	3	0.2	NPN/PNP	-	PHPT610030NPK
						50	300	3	0.2	2XNPN	0.95	PHPT610035NK
						70	400	3	0.2	2XPNP	0.9	PHPT610035PK

### Low V<sub>CEsat</sub> (BISS) transistors single NPN

types in **bold** represent new products

Package							SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)	
												
Size (mm)							6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62	
P <sub>tot</sub> (mW)							1700	1650	750	1300	1300	
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	h <sub>FE</sub> min/typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	V <sub>CEsat</sub> typ (mV); I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 0.05 A						
12	5.3	10.6	300 / 530	0.5	2	18			PBSS301NX			
	5.8	11.6	300 / 530	0.5	2	18	PBSS301NZ					
	6	7	280 / 440	0.5	2	20				PBSS4612PA		
20	3	5	220 / 390	0.5	2	40			PBSS4320X			
	4	15	300 / 450	0.5	2	30				PBSS301ND		
	5	10	300 / 450	0.5	2	35			PBSS4520X			
	5.3	10.6	300 / 570	0.5	2	20			PBSS302NX			
	5.8	10.2	300 / 570	0.5	2	20	PBSS302NZ					
	6	7	280 / 440	0.5	2	20					PBSS4620PA	
	7	15	300 / 550	0.5	2	12			PBSS4021NX			
	8	20	300 / 550	0.5	2	9	PBSS4021NZ					
	3	5	300 / 490	0.5	2	45			PBSS4330X			
	3	5	300 / 465	0.5	2	40					PBSS4330PA	PBSS4330PAS
30	3.5	6	300 / 500	0.5	2	70				PBSS4032ND <sup>3)</sup>		
	4.7	10	300 / 500	0.5	2	57			PBSS4032NX <sup>3)</sup>			
	5.1	10.2	300 / 480	0.5	2	20			PBSS303NX			
	5.4	10	300 / 500	0.5	2	57	PBSS4032NZ <sup>3)</sup>					
	5.5	11	300 / 480	0.5	2	20	PBSS303NZ					
	6	7	280 / 450	0.5	2	21					PBSS4630PA	
	2.0	3.0	300 / -	0.5	5	140			PBSS4240X			
40	4	15	300 / 520	0.5	2	35				PBSS302ND		
	4	10	300 / 500	0.5	2	21			PBSS4540X			
	5	10	300 / 500	0.5	2	25	PBSS4540Z					
50	2	5	300 / -	0.5	2	90 <sup>2)</sup>			PBSS4250X			
	3.0	5.0	200 / 280	0.5	2	65				PBSS4350D		
	3.0	5.0	300 / 460	0.5	2	50			PBSS4350X			
60	3	6	200 / 360	0.5	5	45					PBSS4360PAS	
	3	6	200 / -	0.5	5	45	<b>PBSS4360Z</b>					
	3.45	5.7	345 / 570	0.5	2	40				PBSS303ND		
	4.7	9.4	300 / 520	0.5	2	25			PBSS304NX			
	5.2	10.4	300 / 520	0.5	2	25	PBSS304NZ					
	6	7	280 / 440	0.5	2	22					PBSS4560PA	
	6.2	15	300 / 500	0.5	2	17			PBSS4041NX			
	7	15	300 / 500	0.5	2	13	PBSS4041NZ					
	3	6	240 / 360	0.5	2	40				PBSS304ND		
	4	10	250 / 400	0.5	2	25			PBSS4480X			
80	4.6	9.2	300 / 470	0.5	2	25			PBSS305NX			
	5.1	10.2	300 / 470	0.5	2	25	PBSS305NZ					
	5.6	7	270 / 425	0.5	2	25					PBSS4580PA	
100			150 / 290	0.25	10	75				PBSS8110D		
			150 / 290	0.25	10	73			PBSS8110X			
			150 / 290	0.25	10	73	PBSS8110Z					
	3	4	170 / 275	0.5	2	45				PBSS305ND		
	4.5	9	200 / 330	0.5	2	27			PBSS306NX			
	5.1	10.2	200 / 330	0.5	2	27	PBSS306NZ					
5.2	6	180 / 285	0.5	2	30					PBSS8510PA		

<sup>1)</sup> I<sub>C</sub> / I<sub>B</sub> = 20 <sup>2)</sup> V<sub>CEsat</sub> (max) <sup>3)</sup> Optimized for high-speed switching

Low  $V_{CEsat}$  (BISS) transistors single PNP

types in **bold** represent new products

Package							SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)
Size (mm)							6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62
$P_{tot}$ (mW)							1700	1650	750	1300	1300
$V_{CEO}$ (V)	$I_C$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_C$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A					
12	5.3	10.6	250 / 400	0.5	2	20		PBSS301PX			
	5.7	11.4	250 / 400	0.5	2	20	PBSS301PZ				
	6	7	220 / 335	0.5	2	20			PBSS5612PA		
20	3	5	200 / -	0.5	2	80 <sup>2)</sup>			PBSS5320D		
			220 / 450	0.5	2	50		PBSS5320X			
	4	15	250 / 400	0.5	2	35			PBSS301PD		
	5	10	300 / 430	0.5	2	45		PBSS5520X			
	5.1	10.2	250 / 370	0.5	2	25		PBSS302PX			
	5.5	11	250 / 370	0.5	2	25	PBSS302PZ				
	6	7	230 / 345	0.5	2	25			PBSS5620PA		
30	6.2	15	250 / 400	0.5	2	18		PBSS4021PX			
	6.6	20	250 / 400	0.5	2	16	PBSS4021PZ				
	2.7	5	200 / 350	0.5	2	87			PBSS4032PD <sup>3)</sup>		
	3	5	200 / 380	0.5	2	50		PBSS5330X			
			200 / 320	0.5	2	45			PBSS5330PA	PBSS5330PAS	
	4.2	10	200 / 350	0.5	2	70		PBSS4032PX <sup>3)</sup>			
	4.4	10	200 / 350	0.5	2	70	PBSS4032PZ <sup>3)</sup>				
40	5.1	10.2	250 / 400	0.5	2	25		PBSS303PX			
	5.3	10.6	250 / 400	0.5	2	25	PBSS303PZ				
	6	7	200 / 335	0.5	2	25			PBSS5630PA		
	2.0	3.0	215 / -	0.5	5	170		PBSS5240X			
	4	15	200 / 310	0.5	2	46			PBSS302PD		
			250 / 370	0.5	2	33		PBSS5540X			
	5	10	250 / 350	0.5	2	40 <sup>1)</sup>	PBSS5540Z				
50	2.0	5	200 / -	0.5	2	90 <sup>2)</sup>		PBSS5250X			
	3.0	5.0	200 / 300	0.5	2	70			PBSS5350D		
			200 / 375	0.5	2	70		PBSS5350X			
			200 / 300	0.5	2	70	PBSS5350Z				
60	3	6	130 / 220	0.5	5	55				PBSS5360PAS	
			130 / -	0.5	5	55	PBSS5360Z				
	4.2	8.4	200 / 295	0.5	2	35		PBSS304PX			
	4.5	9	200 / 295	0.5	2	35	PBSS304PZ				
	5	6	170 / 260	0.5	2	35			PBSS5560PA		
	5	15	200 / 300	0.5	2	30		PBSS4041PX			
80	5.7	15	200 / 300	0.5	2	22	PBSS4041PZ				
	3	5	155 / 225	0.5	2	55			PBSS304PD		
			180 / 265	0.5	2	40			PBSS5580PA		
	4.0	10	200 / 300	0.5	2	35		PBSS5480X			
			200 / 280	0.5	2	36		PBSS305PX			
100	4.5	9	200 / 280	0.5	2	36	PBSS305PZ				
	1.0	3.0	150 / 350	0.5	5	100			PBSS9110D		
			150 / 350	0.5	5	90		PBSS9110X			
			150 / -	0.5	5	90	PBSS9110Z				
	2	3	175 / 275	0.5	2	65			PBSS305PD		
120	2.7	4	180 / 295	0.5	2	45				PBSS9410PA	
	3.7	7.4	200 / 300	0.5	2	45		PBSS306PX			
	4.1	8.2	200 / 300	0.5	5	45	PBSS306PZ				

<sup>1)</sup>  $I_C / I_B = 20$  <sup>2)</sup>  $V_{CEsat}$  (max) <sup>3)</sup> Optimized for high-speed switching

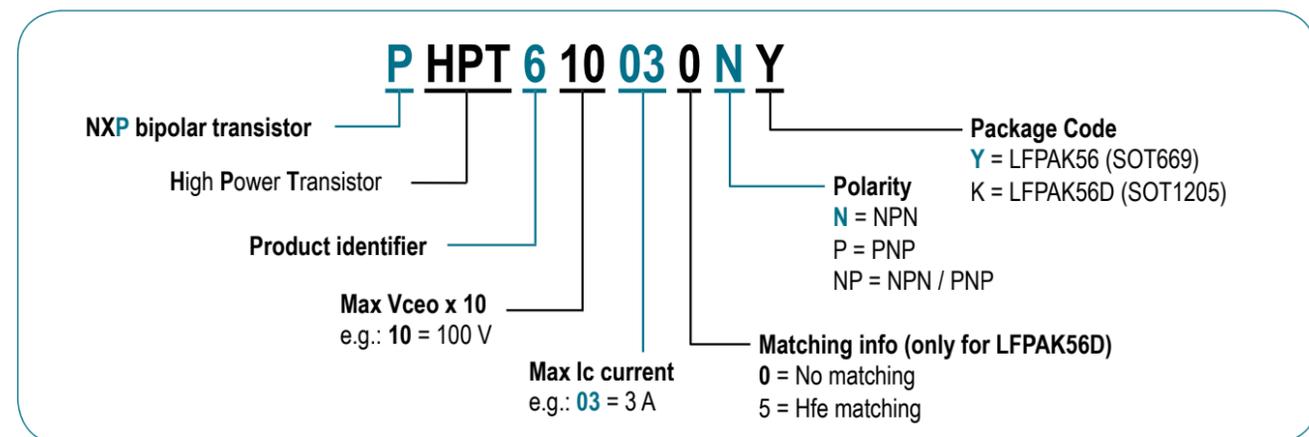
Low  $V_{CEsat}$  (BISS) double transistors

types in **bold** represent new products

Package										SOT96 (SO8)	SOT457 (SC-74)	SOT666	DFN2020-6 (SOT1118)	DFN2020D-6 (SOT1118D)
Size (mm)										4.9 x 3.9 x 1.75	2.9 x 1.5 x 1.0	1.6 x 1.2 x 0.55	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62
$P_{tot}$ (mW)										2000 <sup>2)</sup>	750	500	1300	1300
$V_{CEO}$ (V)	$I_C$ (A)	Polarity	$h_{FE}$ min/typ	@ $I_C$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	$V_{CEsat}$ max (mV)	@ $I_C$ (A)	@ $I_B$ (A)					
15	0.5	2 x NPN	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05			PBSS2515VS		
		2 x PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05			PBSS3515VS		
		NPN / PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05			PBSS2515VPN		
		NPN / PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05					
20	7.5	NPN / NPN	300	0.5	2	15	150	4	0.2	PBSS4021SN				
	6.3	PNP / PNP	250	0.5	2	24	225	4	0.2	PBSS4021SP				
	7.5 / 6.3	NPN / PNP	300 / 250	0.5	2	15 / 24	150 / 225	4	0.2	PBSS4021SPN				
30	1	NPN / NPN	210	0.5	2	75	100	0.5	0.05				PBSS4130PAN	
		PNP / PNP	170	0.5	2	85	140	0.5	0.05				PBSS5130PAP	
		NPN / PNP	210 / 170	0.5	2	75 / 85	100 / 140	0.5	0.05				PBSS4130PANP	
	2	NPN / NPN	230	0.5	2	60	80	0.5	0.05				PBSS4230PAN	
		PNP / PNP	210	0.5	2	75	110	0.5	0.05				PBSS5230PAP	
		NPN / PNP	230 / 210	0.5	2	60 / 75	80 / 100	0.5	0.05				PBSS4230PANP	
		5.7	NPN / NPN	300	0.5	2	57	250	4	0.4	PBSS4032SN <sup>3)</sup>			
4.8	PNP / PNP	200	0.5	2	70	390	4	0.4	PBSS4032SP <sup>3)</sup>					
5.7 / 4.8	NPN / PNP	300 / 200	0.5	2	57 / 70	250 / 390	4	0.4	PBSS4032SPN <sup>3)</sup>					
40	1.0	NPN / PNP	300 / 250	0.5	5	130 / 150	500	1	0.1		PBSS4140DPN			
	2.0	NPN / PNP	300 / 250	0.5	5	80 / 100	400 / 530	2	0.2		PBSS4240DPN			
50	2.7	2 x NPN	300	0.5	2	50	340	2.7	0.27	PBSS4350SS				
		2 x PNP	200	0.5	2	60	370	2.7	0.27	PBSS5350SS				
		NPN / PNP	300 / 200	0.5	2	50 / 60	340 / 370	2.7	0.27	PBSS4350SPN				
60	1.0	2 x NPN	200	0.5	5	115	250	1	0.1		PBSS4160DS			
		2 x PNP	150	0.5	5	120	330	1	0.1		PBSS5160DS			
		NPN / PNP	200 / 150	0.5	5	115 / 120	250 / 330	1	0.1		PBSS4160DPN			
	1	NPN / NPN	150	0.5	2	90	120	0.5	0.05				PBSS4160PAN	PBSS4160PANS
		PNP / PNP	120	0.5	2	125	180	0.5	0.05				PBSS5160PAP	PBSS5160PAPS
		NPN / PNP	150 / 120	0.5	2	90 / 125	120 / 180	0.5	0.05				PBSS4160PANP	PBSS4160PANPS
	2	NPN / NPN	210	0.5	2	70	90	0.5	0.05				PBSS4260PAN	PBSS4260PANS
		PNP / PNP	140	0.5	2	100	140	0.5	0.05				PBSS5260PAP	PBSS5260PAPS
		NPN / PNP	210 / 140	0.5	2	70 / 100	90 / 140	0.5	0.05				PBSS4260PANP	PBSS4260PANPS
	6.7	NPN / NPN	300	0.5	2	20	190	4	0.2	PBSS4041SN				
5.9	PNP / PNP	200	0.5	2	35	330	4	0.2	PBSS4041SP					
6.7 / 5.9	NPN / PNP	300 / 200	0.5	2	20 / 35	190 / 330	4	0.2	PBSS4041SPN					
120	1	NPN / NPN	240	0.1	2	90	120	0.5	0.05				PBSS4112PAN	
		PNP / PNP	190	0.1	2	150	220	0.5	0.05				PBSS5112PAP	
		NPN / PNP	240 / 190	0.1	2	90 / 150	120 / 220	0.5	0.05				PBSS4112PANP	

<sup>1)</sup>  $I_C / I_B = 20$  <sup>2)</sup> Device mounted on a ceramic PCB, Al2O3, standard footprint <sup>3)</sup> Optimized for high-speed switching

### Nomenclature for high-power transistors



### Low $V_{CEsat}$ (BISS) transistors single NPN

Package		SOT23	SOT323 (SC-70)	SOT363 (SC-88)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)	DFN1010D-3 (SOT1215)
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37	1.1 x 1.0 x 0.37
$P_{tot}$ (mW)		480	350	430	250	250	750
$V_{CE0}$ (V)	$I_c$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_c$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_c = 0.5$ A; $I_b = 0.05$ A	
15	0.5	1	200 / 325	0.01	2	-	PBSS2515M PBSS2515MB
20	1	3	350 / 470	0.1	2	110 <sup>2)</sup>	PBSS4120T
	2	5	220 / 330	0.1	2	45	PBSS4320T
	4.3	8	300 / 550	0.5	2	21	PBSS4021NT
30	1	1.5	230 / 380	0.5	2	90	PBSS4130QA
		3	300 / 450	0.5	2	120 <sup>2)</sup>	PBSS4130T
	2	3	300 / 450	0.5	2	70	PBSS4230T
			230 / 380	0.5	2	75	PBSS4230QA
	2.6	5	300 / 500	0.5	2	80	PBSS4032NT <sup>3)</sup>
40	0.5	1	200 / 550	0.01	2	200 <sup>2)</sup>	PBSS2540M PBSS2540MB
			300 / 440	0.5	5	130	PBSS4140U
	2.0		300 / 510	0.5	5	120	PMMT491A
			300 / 420	0.5	5	130	PBSS4140T
	3.0		350 / 470	0.1	2	70	PBSS4240Y
			300 / 450	0.5	2	70	PBSS4240T
50	2	5	300 / 495	0.5	2	60	PBSS4350T
60	1.0	1.5	150 / 240	0.5	2	90	PBSS4160QA
			200 / 420	0.5	5	120	PBSS4160U
			200 / 350	0.5	5	110	PBSS4160T
	2	3	150 / 240	0.5	2	75	PBSS4260QA
	3.8	8	300 / 500	0.5	2	29	PBSS4041NT
100	1.0	3.0	150 / 400	0.25	10	80	PBSS8110Y
			150 / 300	0.25	10	70	PBSS8110T

<sup>1)</sup>  $I_c / I_b = 20$  <sup>2)</sup>  $V_{CEsat}$  (max) <sup>3)</sup> Optimized for high-speed switching

### Low $V_{CEsat}$ (BISS) transistors single PNP

Package		SOT23	SOT323 (SC-70)	SOT363 (SC-88)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)	DFN1010D-3 (SOT1215)
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37	1.1 x 1.0 x 0.37
$P_{tot}$ (mW)		480	350	430	250	250	750
$V_{CE0}$ (V)	$I_c$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_c$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_c = 0.5$ A; $I_b = 0.05$ A	
15	0.5	1	200 / 260	0.01	2	150	PBSS3515M PBSS3515MB
20	1	2	300 / 450	0.1	2	125 <sup>2)</sup>	PBSS5120T
		3	225 / -	0.5	2	80 <sup>2)</sup>	PBSS5220T
		5	220 / 420	0.5	2	50	PBSS5320T
	3.5	8	250 / 400	0.5	2	35	PBSS4021PT
30	1	1.5	180 / 295	0.5	2	85	PBSS5130QA
			260 / 350	0.5	2	110	PBSS5130T
	2	3	300 / 450	0.1	2	70	PBSS5230T
			180 / 295	0.5	2	70	PBSS5230QA
	2.4	5	200 / 320	0.5	2	95	PBSS4032PT <sup>3)</sup>
40	0.5	1	200 / 380	0.01	2	220	PBSS3540M PBSS3540MB
			300 / 520	0.1	5	130	PBSS5140U
	1.0	2.0	300 / 800	0.1	5	130	PMMT591A
			300 / 510	0.1	5	130	PBSS5140T
			300 / -	0.1	2	110 <sup>2)</sup>	PBSS5240Y
			300 / 450	0.1	2	70	PBSS5240T
50	2.0	3	200 / -	0.5	2	90 <sup>2)</sup>	PBSS5250T
		5	200 / 360	0.5	2	55	PBSS5350T
60	1.0	1.5	120 / 185	0.5	2	125	PBSS5160QA
			150 / 250	0.5	5	135	PBSS5160U
			150 / 250	0.5	5	120	PBSS5160T
	1.7	2.5	120 / 185	0.5	2	105	PBSS5260QA
	2.7	8	200 / 300	0.5	2	49	PBSS4041PT
100	1.0	3.0	150 / -	0.25	5	93	PBSS9110Y
			150 / 350	0.5	5	95	PBSS9110T

<sup>1)</sup>  $I_c / I_b = 20$  <sup>2)</sup>  $V_{CEsat}$  (max) <sup>3)</sup> Optimized for high-speed switching

#### In the spotlight

##### Low $V_{CEsat}$ transistors in DFN1010D-3: 2 A on 1.1 mm<sup>2</sup> footprint

High  $I_c$  performance on ultra-small footprint

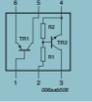
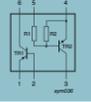
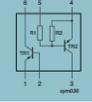
$V_{CE}$  30 V and 60 V

Leadless DFN1010D-3 (SOT1215) SMD package with solderable sidepads (1.1 x 1.0 x 0.37)

AEC-Q101 qualified



## Low $V_{CEsat}$ (BISS) load switches

Package				SOT457 (SC-74)	SOT363 (SC-88)	
Size (mm)				2.9 x 1.5 x 1.0		
$P_{tot}$ (mW)				750 <sup>1)</sup>	600 <sup>1)</sup>	
$V_{CEO}$ (V)	$I_C$ (A)	$V_{CEsat}$ max (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	R1, R2 (k $\Omega$ )	  		
15	0.5	250	2.2	PBL1501Y		
			4.7	PBL1502Y		
			10	PBL1503Y		
			22	PBL1504Y		
20	1	150	2.2	PBL2001D		
			4.7	PBL2002D		
			10	PBL2003D		
			22	PBL2004D		
	1.8	70	2.2	PBL2021D		
			4.7	PBL2022D		
			10	PBL2023D		
			22	PBL2024D		
40	0.5	350	2.2	PBL4001Y		
			4.7	PBL4002Y		
			10	PBL4003Y		
			22	PBL4004Y		
	47			47	PBL4005Y	
				2.2	PBL4001D	
				4.7	PBL4002D	
				10	PBL4003D	
	22			22	PBL4004D	
				47	PBL4005D	
				2.2	PBL6001D	
				4.7	PBL6002D	
60	1	180	10	PBL6003D		
			22	PBL6004D		
			47	PBL6005D		
			2.2	PBL6021D		
	1.5	100	4.7	PBL6022D		
			10	PBL6023D		
			22	PBL6024D		

<sup>1)</sup> Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

<sup>2)</sup> Device mounted on an FR4 PCB, single-sided copper, tin-plated, and standard footprint

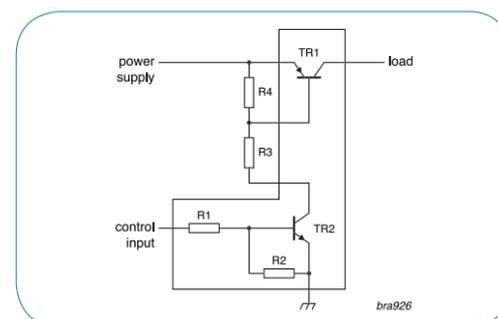
### Key features and benefits

- ▶ Very small input current drives high load current
- ▶ High efficiency and low-voltage drop due to low  $V_{CEsat}$  (BISS) pass transistor
- ▶ Replaces expensive P-MOSFETs
- ▶ Inherent reverse-current blocking
- ▶ Automotive qualified according to AEC-Q101

### Key applications

- ▶ Fan driver
- ▶ Battery-charge switch
- ▶ Supply-line switch
- ▶ High-side load

### Low $V_{CEsat}$ (BISS) load switch – the optimal choice for supply-line and high-side switches

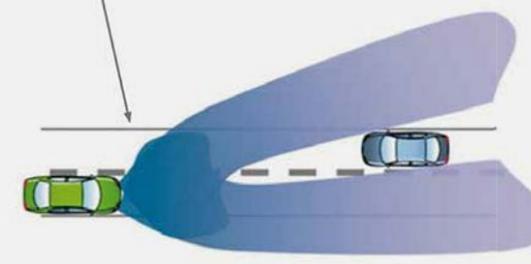


## DFN2020D-6 with solderable sidepads

Application example: LED lighting in automotive

### Matrix light sketch

LEDs can be selectively controlled to shape the front beam



DFN2020D-6 (SOT1118D)

Dual package  
2.0 x 2.0 x 0.62 mm

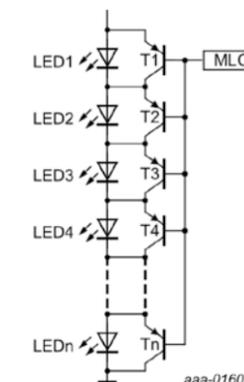
### PBSS5160PAPS in DFN2020D-6

- ▶ Industry's first low  $V_{CEsat}$  transistor in DFN2020 with 100% solderable sidepads, AOI suitable
- ▶ Enables individual dimming in the LED front light matrix solution
- ▶ Saves PCB space by replacing two DFN2020D-3 or two SOT89 packages
- ▶ Ideal solution for multilayer PCB designs

### Key package benefits

- ▶ AEC-Q101 qualified
- ▶ Suitable for AOI of solder joints
- ▶ Exposed heat sink for excellent thermal and electrical conductivity
- ▶ Package size of only 2 x 2 mm and a height of only 0.62 mm
- ▶ Single version available in DFN2020D-3
- ▶ DFN2020 is an approved and widely available package platform

### Dimming transistor application



### Low $V_{CEsat}$ double transistors portfolio on DFN2020D-6

types in **bold** represent new products

$V_{CEO}$ (V)	$I_C$ (A)	Polarity	$h_{FE}$ min	@ $I_C$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	Product
20	2	NPN / NPN	230	0.5	2	60	PBSS4220PANS
		PNP / PNP	210	0.5	2	70	<b>PBSS5220PAPS</b>
60	1	NPN / NPN	150	0.5	2	90	PBSS4160PANS
		PNP / PNP	120	0.5	2	125	PBSS5160PAPS
		NPN / PNP	150 / 120	0.5	2	90 / 125	PBSS4160PANPS
		NPN / NPN	210	0.5	2	70	<b>PBSS4260PANS</b>
60	2	PNP / PNP	140	0.5	2	100	<b>PBSS5260PAPS</b>
		NPN / PNP	210 / 140	0.5	2	70 / 100	<b>PBSS4260PANPS</b>

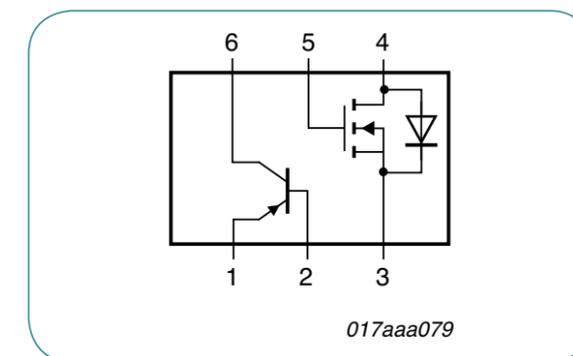
### High-voltage low $V_{CEsat}$ (BISS) transistors

types in **bold** represent new products

Package			SOT223 (SC-73)	SOT89 (SC-62)	SOT1215	SOT23
Size (mm)			6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	1.1 x 1.0 x 0.37	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)			1700	1300	750	250
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (A)				
NPN	150	0.5			<b>PBHV8115QA</b>	
		1	PBHV8115Z	PBHV8115X		PBHV8115T
		2	PBHV8215Z			
	180	1				PBHV8118T
		400	0.5	PBHV8540Z	PBHV8540X	
	500	1	PBHV8140Z			
PNP	140	0.5			<b>PBHV9115QA</b>	
		1	PBHV9115Z	PBHV9115X		PBHV9115T
	150	2	PBHV9215Z			
		0.5	PBHV9560Z			
	600	0.1	PBHV3160Z			
		0.25	PBHV9040Z	PBHV9040X		PBHV9040T
	400	0.5	PBHV9540Z			
		0.15	PBHV3160Z			PBHV9050T
	500	0.25	PBHV9050Z			

### Low $V_{CEsat}$ (BISS) transistor PNP – N-channel MOSFET combination

Package											DFN2020-6 (SOT1118)
Size (mm)											2.0 x 2.0 x 0.62
P <sub>tot</sub> (mW)											1300
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE min</sub>	h <sub>FE max</sub>	@ I <sub>C</sub> (mA)	@ V <sub>CE</sub> (V)	R <sub>CEsat</sub> typ (mΩ)	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	R <sub>Dson</sub> typ (mΩ)	
40	2	300	800	100	5	240	30	0.7	0.66	390	PBSM5240PF
		100	-	100	5	240	30	0.7	0.66	390	PBSM5240PFH



Combination of low  $V_{CEsat}$  transistor with N-channel MOSFET in the very small and ultrathin leadless package DFN2020-6 (SOT1118)

In the spotlight

#### High-voltage low $V_{CEsat}$ (BISS) transistors in SOT223, SOT23 & SOT89

- Voltage  $V_{CEO}$  up to 600 V
- Current  $I_C$  up to 4 A (continuous), 10 A (peak)
- $V_{CEsat}$  down to 33 mV
- AEC-Q101 qualified
- New high-voltage low  $V_{CEsat}$  (BISS) in DFN1010D-3



### Low $V_{CEsat}$ (BISS) RETs

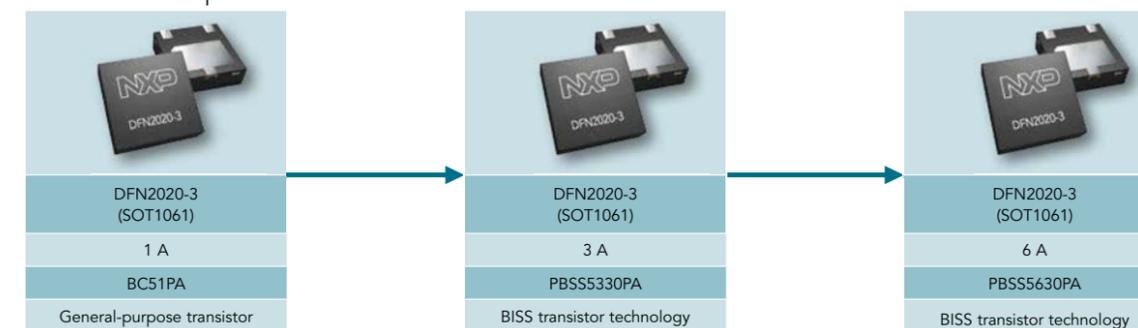
Package						SOT23	
Size (mm)						2.9 x 1.3 x 1.0	
P <sub>tot</sub> (mW)						250	
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	R1 = R2	R1 (kΩ)	R2 (kΩ)	NPN	PNP	
40	600	R1 = R2	1	1	PBRN113ET	PBRP113ET	
			2.2	2.2	PBRN123ET	PBRP123ET	
		R1 ≠ R2	1	10	PBRN113ZT	PBRP113ZT	
			2.2	10	PBRN123YT	PBRP123YT	

### Advantages of low $V_{CEsat}$ (BISS) technology

Our BISS (Breakthrough In Small-Signal) transistors show lowest  $V_{CEsat}$  values due to an innovative mesh-emitter technology and further technology improvement. They also reduce board space due to improved collector-current capabilities as shown below.

#### Improved collector-current capabilities

▶ 17.87 mm<sup>2</sup> footprint



RETs 100 mA single - Part 1

Package					SOT23		SOT323 (SC-70)			
Size (mm)					2.9 x 1.3 x 1.0		2.0 x 1.25 x 0.95			
P <sub>tot</sub> (mW)					250		200			
V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN	PNP	NPN	PNP		
50	100		1	1		PDTA113ET	PDTA113EU			
			2.2	2.2	PDTC123ET	PDTA123ET	PDTC123EU	PDTA123EU		
			4.7	4.7	PDTC143ET	PDTA143ET	PDTC143EU	PDTA143EU		
			10	10	PDTC114ET	PDTA114ET	PDTC114EU	PDTA114EU		
			22	22	PDTC124ET	PDTA124ET	PDTC124EU	PDTA124EU		
			47	47	PDTC144ET	PDTA144ET	PDTC144EU	PDTA144EU		
			100	100	PDTC115ET	PDTA115ET	PDTC115EU	PDTA115EU		
			1	10		PDTA113ZT		PDTA113ZU		
			2.2	10	PDTC123YT	PDTA123YT	PDTC123YU	PDTA123YU		
			2.2	47	PDTC123JT	PDTA123JT	PDTC123JU	PDTA123JU		
		4.7	10	PDTC143XT	PDTA143XT	PDTC143XU	PDTA143XU			
		4.7	47	PDTC143ZT	PDTA143ZT	PDTC143ZU	PDTA143ZU			
		10	47	PDTC114YT	PDTA114YT	PDTC114YU	PDTA114YU			
		22	47	PDTC124XT	PDTA124XT	PDTC124XU	PDTA124XU			
		47	10	PDTC144VT	PDTA144VT	PDTC144VU	PDTA144VU			
		47	22	PDTC144WT	PDTA144WT	PDTC144WU	PDTA144WU			
		2.2	-	PDTC123TT	PDTA123TT	PDTC123TU	PDTA123TU			
		4.7	-	PDTC143TT	PDTA143TT	PDTC143TU	PDTA143TU			
		10	-	PDTC114TT	PDTA114TT	PDTC114TU	PDTA114TU			
		22	-	PDTC124TT	PDTA124TT	PDTC124TU	PDTA124TU			
47	-	PDTC144TT	PDTA144TT	PDTC144TU	PDTA144TU					
100	-	PDTC115TT	PDTA115TT	PDTC115TU	PDTA115TU					

RETs 100 mA single - Part 2

types in **bold** represent new products

Package					DFN1006-3 (SOT883)		DFN1006B-3 (SOT883B)		SOT1215	
Size (mm)					1.0 x 0.6 x 0.48		1.0 x 0.6 x 0.37		1.1 x 1.0 x 0.37	
P <sub>tot</sub> (mW)					250		250		750	
V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN	PNP	NPN	PNP	NPN	PNP
50	100		1	1		PDTA113EM	PDTA113EMB	PDTA113EMB		
			2.2	2.2	PDTC123EM	PDTA123EM	PDTC123EMB	PDTA123EMB		
			4.7	4.7	PDTC143EM	PDTA143EM	PDTC143EMB	PDTA143EMB	<b>PDTC143EQA</b>	<b>PDTA143EQA</b>
			10	10	PDTC114EM	PDTA114EM	PDTC114EMB	PDTA114EMB	<b>PDTC114EQA</b>	<b>PDTA114EQA</b>
			22	22	PDTC124EM	PDTA124EM	PDTC124EMB	PDTA124EMB	<b>PDTC124EQA</b>	<b>PDTA124EQA</b>
			47	47	PDTC144EM	PDTA144EM	PDTC144EMB	PDTA144EMB	<b>PDTC144EQA</b>	<b>PDTA144EQA</b>
			100	100	PDTC115EM	PDTA115EM	PDTC115EMB	PDTA115EMB		
			1	10		PDTA113ZM		PDTA113ZMB		
			2.2	10	PDTC123YM	PDTA123YM	PDTC123YMB	PDTA123YMB		
			2.2	47	PDTC123JM	PDTA123JM	PDTC123JMB	PDTA123JMB	<b>PDTC123XQA</b>	<b>PDTA123XQA</b>
		4.7	10	PDTC143XM	PDTA143XM	PDTC143XMB	PDTA143XMB	<b>PDTC143XQA</b>	<b>PDTA143XQA</b>	
		4.7	47	PDTC143ZM	PDTA143ZM	PDTC143ZMB	PDTA143ZMB	<b>PDTC143ZQA</b>	<b>PDTA143ZQA</b>	
		10	47	PDTC114YM	PDTA114YM	PDTC114YMB	PDTA114YMB	<b>PDTC114YQA</b>	<b>PDTA114YQA</b>	
		22	47	PDTC124XM	PDTA124XM	PDTC124XMB	PDTA124XMB			
		47	10	PDTC144VM	PDTA144VM	PDTC144VMB	PDTA144VMB			
		47	22	PDTC144WM	PDTA144WM	PDTC144WMB	PDTA144WMB			
		2.2	-	PDTC123TM	PDTA123TM	PDTC123TMB	PDTA123TMB			
		4.7	-	PDTC143TM	PDTA143TM	PDTC143TMB	PDTA143TMB			
		10	-	PDTC114TM	PDTA114TM	PDTC114TMB	PDTA114TMB			
		22	-	PDTC124TM	PDTA124TM	PDTC124TMB	PDTA124TMB			
47	-	PDTC144TM	PDTA144TM	PDTC144TMB	PDTA144TMB					
100	-	PDTC115TM	PDTA115TM	PDTC115TMB	PDTA115TMB					

RETs 100 mA double

types in **bold** represent new products

Package					DFN1010B-6 (SOT1216)			SOT363 (SC-88)			SOT666				
Size (mm)					1.1 x 1.0 x 0.37			2.0 x 1.25 x 0.95			1.6 x 1.2 x 0.55				
P <sub>tot</sub> (mW)					350			300			300				
V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN / NPN	NPN / PNP	PNP / PNP	NPN / NPN	NPN / PNP	PNP / PNP	NPN / NPN	NPN / PNP	PNP / PNP		
50	100	R1 = R2	2.2	2.2					PUMH20	PUMD20	PUMB20	PEMH20	PEMD20	PEMB20	
			4.7	4.7					PUMH15	PUMD15	PUMB15	PEMH15	PEMD15	PEMB15	
			10	10	<b>PQMH11</b>	<b>PQMD3</b>	<b>PQMB11</b>			PUMH11	PUMD3	PUMB11	PEMH11	PEMD3	PEMB11
			22	22		<b>PQMD2</b>				PUMH1	PUMD2	PUMB1	PEMH1	PEMD2	PEMB1
			47	47	<b>PQMH2</b>	<b>PQMD12</b>				PUMH2	PUMD12	PUMB2	PEMH2	PEMD12	PEMB2
			100	100						PUMH24	PUMD24	PUMB24	PEMH24	PEMD24	PEMB24
			2.2	47	<b>PQMH10</b>	<b>PQMD10</b>				PUMH10	PUMD10	PUMB10	PEMH10	PEMD10	PEMB10
			4.7	10						PUMH18	PUMD18	PUMB18	PEMH18	PEMD18	PEMB18
			4.7	47	<b>PQMH13</b>	<b>PQMD13</b>				PUMH13	PUMD13	PUMB13	PEMH13	PEMD13	PEMB13
			10	47	<b>PQMH9</b>					PUMH9	PUMD9	PUMB9	PEMH9	PEMD9	PEMB9
		22	47		<b>PQMD16</b>				PUMH16	PUMD16	PUMB16	PEMH16	PEMD16	PEMB16	
		47	22						PUMH17	PUMD17	PUMB17	PEMH17	PEMD17	PEMB17	
		47 / 2.2	47 / 47						PUMD48				PEMD48		
		2.2	-						PUMH30	PUMD30	PUMB30	PEMH30	PEMD30	PEMB30	
		4.7	-						PUMH7	PUMD6	PUMB3	PEMH7	PEMD6	PEMB3	
		10	-						PUMH4	PUMD4	PUMB4	PEMH4	PEMD4	PEMB4	
		22	-						PUMH19	PUMD19	PUMB19	PEMH19	PEMD19	PEMB19	
		47	-						PUMH14	PUMD14	PUMB14	PEMH14	PEMD14	PEMB14	

RETs 500 mA

types in **bold** represent new products

Package					SOT457 (SC-74)		SOT23		SOT323 (SC-70)		SOT1215			
Size (mm)					2.9 x 1.5 x 1.0		2.9 x 1.3 x 1.0		2.0 x 1.25 x 0.95		1.1 x 1.0 x 0.37			
P <sub>tot</sub> (mW)					750		250		200		750			
V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN / NPN	NPN / PNP	NPN	PNP	NPN	PNP	NPN	PNP		
50	500	R1 = R2	1	1				PDTD113ET	PDTB113ET	PDTD113EU	PDTB113EU	<b>PDTD113EQA</b>	<b>PDTB113EQA</b>	
			2.2	2.2					PDTD123ET	PDTB123ET	PDTD123EU	PDTB123EU	<b>PDTD123EQA</b>	<b>PDTB123EQA</b>
			4.7	4.7					PDTD143ET	PDTB143ET	PDTD143EU	PDTB143EU	<b>PDTD143EQA</b>	<b>PDTB143EQA</b>
			10	10					PDTD114ET	PDTB114ET	PDTD114EU	PDTB114EU	<b>PDTD114EQA</b>	<b>PDTB114EQA</b>
			10	10					PDTD114ET	PDTB114ET	PDTD114EU	PDTB114EU	<b>PDTD114EQA</b>	<b>PDTB114EQA</b>
		R1 ≠ R2	1	10	PIMN31	PIMC31			PDTD113ZT	PDTB113ZT	PDTD113ZU	PDTB113ZU	<b>PDTD113ZQA</b>	<b>PDTB113ZQA</b>
			2.2	10					PDTD123YT	PDTB123YT	PDTD123YU	PDTB123YU	<b>PDTD123YQA</b>	<b>PDTB123YQA</b>
			4.7	10					PDTD143XT	PDTB143XT	PDTD143XU	PDTB143XU	<b>PDTD143XQA</b>	<b>PDTB143XQA</b>
			2.2	-					PDTD123TT	PDTB123TT				
			2.2	-					PDTD123TT	PDTB123TT				

### Single transistors NPN

types in **bold** represent new products

Package		SOT23	SOT323 (SC-70)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)			
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37			
P <sub>tot</sub> (mW)		250	200	750	250	250			
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min/typ	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)					
25	100	450	1200	100					
30	100	110 - 200	450 - 800	100	BC848B	PMST5089			
		350	900	100	BC848W	PMST5088			
32	100	110 - 420	220 - 800	100	BCW31 / 32 / 33				
		180 - 380	310 - 630	250	BCW60B / C / D				
45	100	110 - 420	220 - 800	100	BC847 / A / B / C	BC847W / AW / BW / CW	BC847AQA / BQA / CQA	BC847AM / BM / CM	BC847AMB / BMB / CMB
		120 - 380	220 - 630	100	BCX70G / H / J / K				
		110 - 200	220 - 450	100	BCW71 / 72				
50	100	210 - 290	340 - 460	100 - 150	2PD601ART 2PD601ARL 2PD601ASL	2PD601ARW / SW			
		250	650	100	PMBT6428	PMST6428			
60	100	110 - 200	220 - 450	100	BCV71 / 72				
65	100	110 - 200	220 - 450	100	BC846 / A / B	BC846W / AW / BW	<b>BC846BM</b>	BC846BMB	
80	100	20	80	60	BSS64				
50	150	120 - 200	240 - 400	80	NXP3875Y / G				
	150	120 - 270	270 - 560	100		2PC4081Q / R / S	2PC4617QM / RM	2PC4617QMB / RMB	
	200	210	340	100	2PD601BRL				
45	500	100 - 250	250 - 600	100	BC817 / -16 / -25 / -40	BC817W / -16W / -25W / -40W	BC817 / -25QA / -40QA		
		100	600	100	BCX19				
50	500	85 - 170	170 - 340	140 - 180	2PD602AQL 2PD602ARL 2PD602ASL	2PD1820AR / S			
60	500	50	-	100		PMSTA05			
80	500	100	-	50		PMSTA06			

### Single transistors PNP

types in **bold** represent new products

Package		SOT23	SOT323 (SC-70)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)			
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37			
P <sub>tot</sub> (mW)		250	200	750	250	250			
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min/typ	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)					
30	100	125 - 220	500 - 800	100	BC858B	BC858W			
32	100	120 - 215	260 - 500	100	BCW29 / 30				
		180 - 380	310 - 630	100	BCW61B / C / D				
45	100	210 - 290	340 - 460	70 - 80	2PB709ART 2PB709ARL 2PB709ASL	2PB709ARW / SW			
		180 - 380	310 - 630	100	BCX71H / J / K				
		120 - 215	260 - 500	100	BCW69 / 70				
60	100	125 - 420	250 - 800	100	BC857 / A / B / C	BC857W / AW / BW / CW	BC857AQA / BQA / CQA	BC857AM / BM / CM	BC857AMB / BMB / CMB
		120	260	150	BCW89				
65	100	125 - 200	250 - 475	100	BC856 / A / B	BC856W / AW / BW	<b>BC856BM</b>	<b>BC856BMB</b>	
100	100	30	-	50	BSS63				
50	150	120 - 270	270 - 560	100		2PA1756Q / R / S		2PA1774QMB / RMB / SMB	
	200	210	340	100	2PB709BRL				
25	500	290	460	100	2PB709BSL				
		100	600	80	BCX18				
45	500	100 - 250	250 - 600	80	BC807 / -16 / -25 / -40	BC807W / -16W / -25W / -40W	BC807 / -25QA / -40QA		
		100	600	80	BCX17				
50	500	85 - 170	170 - 340	100 - 140	2PB710ARL 2PB710ASL	2PB1219AQ / R / S			
60	500	100	-	50		PMSTA55			
80	500	100	-	50		PMSTA56			

### Double transistors

Package		SOT457 (SC-74)	SOT363 (SC-88)	SOT666	DFN1010B-6 (SOT1216)				
Size (mm)		2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.0 x 1.0 x 0.37				
P <sub>tot</sub> (mW)		750	300	300	350				
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)				
NPN	40	100	120	450	100	PUMX1	PEMX1		
	45	100	200	450	100	BC847DS	BC847BS	BC847BV	BC847QAS
	65	100	110	-	100	BC846S			
			200	450	100	BC846DS	BC846BS		
50	150	120	560	100		PUMX2			
PNP	45	500	160	400	80	BC817DS			
	40	100	120	450	100	PIMT1	PUMT1	PEMT1	
	45	100	200	450	100		BC857BS	BC857BV	BC857QAS
	65	100	110	-	100		BC856S		
NPN / PNP	200	450	100	450	100		BC856BS		
	45	500	160	400	80	BC807DS			
	40	100	120	450	100		PUMZ1	PEMZ1	
NPN / PNP	45	100	200	450	100		BC847BPN	BC847BVN	BC847QAPN
	50	100	120	560	100	PIMZ2	PUMZ2		
	65	100	200	450	100		BC846BPN		
	12	500	200	-	250 / 100			PEMZ7	
45	500	160	160	100 / 800	BC817DPN				

### Single and double switching transistors

types in **bold** represent new products

Package		SOT223 (SC-73)	SOT89 (SC-62)	SOT23	SOT323 (SC-70)	SOT363 (SC-88)	SOT666	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)				
Size (mm)		6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37				
P <sub>tot</sub> (mW)		1700	1300	250	200	300	300	250	250				
Configuration		single	single	single	single	double	double	single	single				
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)	t <sub>off</sub> (ns)							
NPN	12	100	40	120	400	20		BSV52					
	40	200	100	300	180	1200		PMBS3904	PMSS3904				
					300	250							
	15	600	40	120	500	20		PMBT2369	PMST2369				
	40	200	100	300	300	250		MMBT3904					
	30	600	100	300	250	250		PMBT3904	PMST3904	PMBT3904YS	PMBT3904VS	PMBT3904M	PMBT3904MB
								PMBT2222	PMST2222				
	40	600	100	300	300	250		PZT4401	PXT4401	PMBT4401	PMST4401	<b>PMBT4401YS</b>	
									MMBT2222A				
	40	800	100	300	300	250		PZT2222A	PXT2222A	PMBT2222A	PMST2222A	<b>PMBT2222AYS</b>	
								BSR14					
PNP	40	100	100	300	150	700		PMBS3906	PMSS3906				
	40	200	100	300	250	300		MMBT3906					
								PMBT3906	PMST3906	PMBT3906YS	PMBT3906VS	PMBT3906M	PMBT3906MB
	40	600	100	300	200	350	300	PZT4403	PXT4403	PMBT4403	PMST4403	<b>PMBT4403YS</b>	
						365	300			PMBT2907			
	60	600	100	300	200	300	300			BSR16			
365						300			PMST2907A				
NPN / PNP	40	200	100	300	300 / 250	250 / 300		PZT2907A	PXT2907A	PMBT2907A		<b>PMBT2907AYS</b>	
										PMBT3946YPN	PMBT3946VFN		

### Medium-power general-purpose transistors

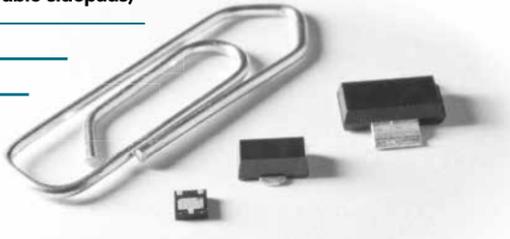
Package						SOT223 (SC-73)	SOT89 (SC-62)	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)
Size (mm)						6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62
P <sub>tot</sub> (mW)						1700	1300	1300	1300
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)				
NPN	20	2	85 - 160	375	40	BCP68 / -25	BC868 / -25	BC68PA / BC68-25PA	BC68PAS / BC68-25PAS
	45	1	63 - 100	160 - 250	100	BCP54 / -10 / -16	BCX54 / -10 / -16	BC54PA / BC54-10PA / BC54-16PA	BC54PAS / BC54-10PAS / BC54-16PAS
	60	1	63 - 100	160 - 250	100	BCP55 / -10 / -16	BCX55 / -10 / -16	BC55PA / BC55-10PA / BC55-16PA	BC55PAS / BC55-10PAS / BC55-16PAS
	80	1	63 - 100	160 - 250	100	BCP56 / -10 / -16	BCX56 / -10 / -16	BC56PA / BC56-10PA / BC56-16PA	BC56PAS / BC56-10PAS / BC56-16PAS
PNP	20	2	85 - 160	250 - 375	40	BCP69 / -16 / -25	BC869 / -16 / -25	BC69PA / BC69-16PA / BC69-25PA	BC69PAS / BC569-16PAS / BC69-25PAS
	45	1	63 - 100	160 - 250	115 <sup>1)</sup> - 145 <sup>1)</sup>	BCP51 / -10 / -16	BCX51 / -10 / -16	BC51PA / BC51-10PA / BC51-16PA	BC51PAS / BC51-10PAS / BC51-16PAS
	60	1	63 - 100	160 - 250	100	BCP52 / -10 / -16	BCX52 / -10 / -16	BC52PA / BC52-10PA / BC52-16PA	BC52PAS / BC52-10PAS / BC52-16PAS
	80	1	63 - 100	160 - 250	115 <sup>1)</sup> - 145 <sup>1)</sup>	BCP53 / -10 / -16	BCX53 / -10 / -16	BC53PA / BC53-10PA / BC53-16PA	BC53PAS / BC53-10PAS / BC53-16PAS

<sup>1)</sup> Typical value

**In the spotlight**

**Medium-power transistors in DFN2020-3 and DFN2020D-3 (with solderable sidepads)**

- Excellent electrical performance on a small 2 x 2 mm footprint
- 80% board space reduction (DFN2020 vs. SOT89)
- 100% solderable sidepads (DFN2020D-3)
- V<sub>CEO</sub> ranging from 20 V to 80 V
- High collector-current capability I<sub>C</sub> up to 2 A
- AEC-Q101 qualified



### High-voltage transistors

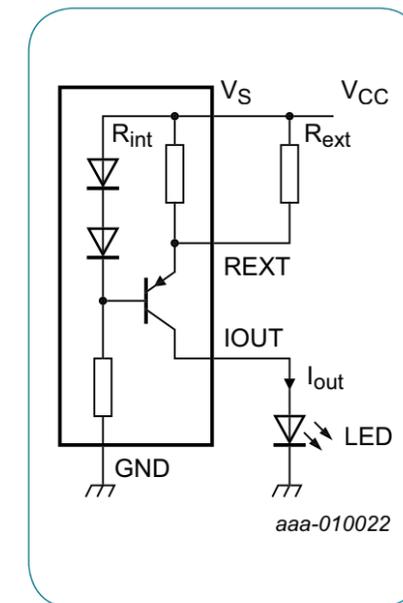
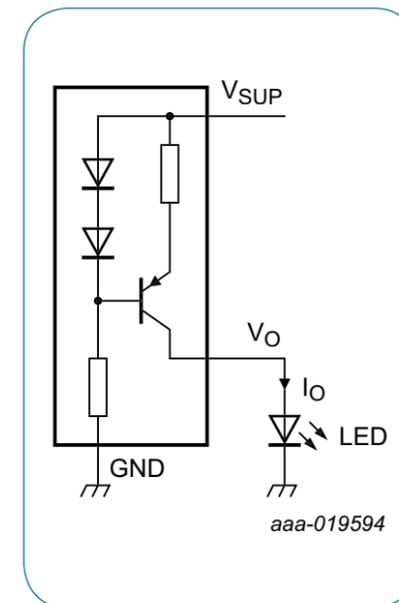
Package						SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	SOT23	SOT323 (SC-70)
Size (mm)						6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95
P <sub>tot</sub> (mW)						1700	1300	750	250	200
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)					
NPN	80	100	20	-	60					BSS64
	140	300	60	250	100					PMBT5550
	160	300	80	250	100					PMBT5551 / BSR19A
	250	100	50	-	60	BF722	BF622			BF822
	300	100	50	-	60	BF720	BF620			BF820
	350	100	40	-	70	PZTA42	PXTA42			PMBTA42
PNP	400	300	50	200	20	BSP19	BST39			PMBTA44
	100	100	30	-	50	PZTA44			BSS63	
	250	100	50	-	60	BF723			BF823	
	300	100	50	-	60	BF623				BF821
2 x NPN	300	100	40	-	50	PZTA92	PXTA92			PMBTA92
							PMBTA42DS			

For high-voltage transistors with increased performance please refer to our high-voltage low V<sub>CEsat</sub> (BISS) transistor portfolio on page 18.

### LED driver

Package		SOT457	SOT23
Size (mm)		2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)		750	480
V <sub>S</sub> supply voltage [V]		LED drive current [mA] @ V <sub>S</sub> =10V	
18		10	NCR401T
		20	NCR402T
40		10	NCR401U
		20	NCR402U
		50	NCR405U

#### Voltage reference for SOT457



#### Key features and benefits

- ▶ Single-chip constant-current source with reduced component count
- ▶ Very small footprint for smaller designs

#### Key applications

- ▶ Constant-current LED driver
- ▶ Generic constant-current source
- ▶ Active bias control for audio amplifiers

### Constant-current source

Package						SOT353 (SC-88A)
Size (mm)						2.0 x 1.25 x 0.95
P <sub>tot</sub> (mW)						335
Type						PSS12021SAY
Description	maximum supply voltage	maximum supply current	typical stabilized output current	minimum stabilized output current	maximum stabilized output current	
Parameter	V <sub>S</sub> max (V)	I <sub>S</sub> max (mA)	I <sub>out</sub> typ (µA)	I <sub>out</sub> min (mA)	I <sub>out</sub> max (mA)	
Value	75	2.2	15	0.015	50	

### Darlington transistors

Package					SOT223 (SC-73)	SOT89 (SC-62)	SOT23
Size (mm)					6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)					1700	1300	250
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	f <sub>T</sub> min (MHz)			
NPN	30	500	10000	125			PMBTA13
			20000		PZTA14	PXTA14	PMBTA14
	45	1000	2000	200			BCV27
			2000		BSP50	BST50	
	60	500	10000	220			BCV47
			2000		BSP51	BST51	
80	1000	2000	200				
PNP	30	500	20000	125			PMBTA64
			220			BCV28	BCV26
	45	1000	2000	200			
			10000		BSP60	BST60	BCV48
	60	500	10000	220			BCV46
			2000		BSP61	BST61	
80	1000	2000	200				
							BSP62
							BST62

### Schmitt triggers

Package							SOT143B
Size (mm)							2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)							250
Polarity	V <sub>CE0</sub> (V) TR1	V <sub>CE0</sub> (V) TR2	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	V <sub>CEsat</sub> typ (mV)	
NPN	30	6	100	110	800	250	BCV63 / B
PNP	30	6	100	220	475	250	BCV64B

### Low-noise transistors

Package							SOT23	SOT323 (SC-70)
Size (mm)							2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95
P <sub>tot</sub> (mW)							250	200
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	Noise figure max (dB)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)		
NPN	30	100	4	200	450	100	BC849B	BC849BW
				420	800	100	BC849C	BC849CW
	45	100	4	200	450	100	BC850B	BC850BW
				420	800	100	BC850C	BC850CW
PNP	30	100	4	220	475	100	BC859B	BC859BW
				420	800	100	BC859C	BC859CW
	45	100	4	220	475	100	BC860B	BC860BW
				420	800	100	BC860C	BC860CW

### Matched-pair transistors

types in **bold** represent new products

Package								SOT143B	SOT457 (SC-74)	SOT353 (SC-88A)	SOT363 (SC-88)	SOT666	LFPK56D (SOT1205)
Size (mm)								2.9 x 1.3 x 1.0	2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	5 x 6 x 1.1
P <sub>tot</sub> (mW)								250	750	300	300	300	1250
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	h <sub>FE1</sub> /h <sub>FE2</sub>	V <sub>BE1</sub> - V <sub>BE2</sub> (mV)							
NPN	30	100	110	800	0.7 <sup>1)</sup>	n.a.	BCV61/A/B/C <sup>1)</sup>						
						n.a.	BCM61B <sup>1)</sup>						
	45	100	200	450	0.9 <sup>1)</sup>	2		BCM847DS		BCM847BS		BCM847BV	
						2			PMP4501G		PMP4501Y		PMP4501V
	65	100	200	450	0.9	2			PMP4201G		PMP4201Y		PMP4201V
						2				BCM846BS			
100	3000	150	400	0.95	n.a.							<b>PHPT610035NK</b>	
Configuration													
PNP	30	100	100	800	0.7 <sup>1)</sup>	n.a.	BCV62/A/B/C <sup>1)</sup>						
						n.a.	BCM62B <sup>1)</sup>						
	45	100	200	450	0.9 <sup>1)</sup>	2		BCM857DS		BCM857BS		BCM857BV	
						2			PMP5501G		PMP5501Y		PMP5501V
	65	100	200	450	0.9	2			PMP5201G		PMP5201Y		PMP5201V
						2				BCM856DS		BCM856BS	
100	3000	150	220	0.9	n.a.							<b>PHPT610035PK</b>	
Configuration													

<sup>1)</sup> I<sub>C1</sub> / I<sub>E2</sub>

**In the spotlight**

**New transistors in LFPK56D (SOT1205) power package**

- High thermal power dissipation up to 3 W
- V<sub>ce0</sub> up to 100 V
- All types AECQ-101 qualified
- 2 types with current gain matching of 5% and 10%
- Reduced PCB size requirements
- High-temperature applications up to 175 °C
- For LED lighting, motor drive, linear regulators, backlight units, PowerMOS, and IGBT drive



#### Key features

- ▶ Current gain matching to 2, 5, or 10%
- ▶ Base-emitter voltage matching to 2 mV
- ▶ Choice of standard double transistor pinout or application-optimized pinout
- ▶ Common-emitter configuration for 5-pin type
- ▶ Range of small, very small, and ultra-small packages

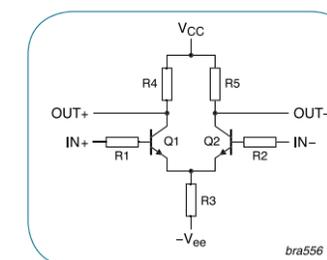
#### Key benefits

- ▶ Improved performance of current mirror and differential amplifier circuits
- ▶ Drop-in replacement for standard double transistors (BCM series)
- ▶ Simplified board layout (PMP series)
- ▶ Eliminates the need for costly additional trimming

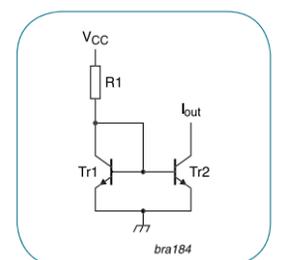
#### Key applications

- ▶ Current mirrors
- ▶ Differential and instrumentation amplifiers
- ▶ Logarithmic amplifiers
- ▶ Comparators

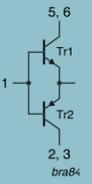
Differential amplifier



Current mirror



## MOSFET driver

$V_{CE0}$ (V)	$I_c$ (A)	$I_{cm}$ [A]	Type	Package	Remark	Configuration
30	0.1	0.2	BCV65	SOT143B 	General-purpose transistors	
40	0.6	1	PMD2001D	SOT457 	Switching transistors with reduced storage time	
	1	2	PMD3001D		Low $V_{CEsat}$	

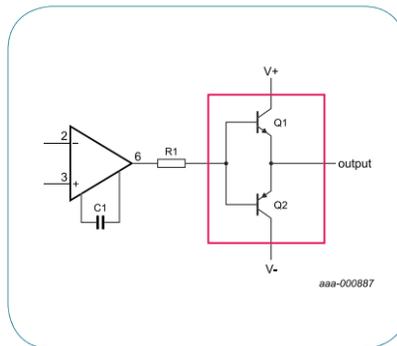
### Key features and benefits

- ▶ Three different configurations
- ▶ Types available with standard, switching, and low  $V_{CEsat}$  (BISS) transistors
- ▶ Small footprint

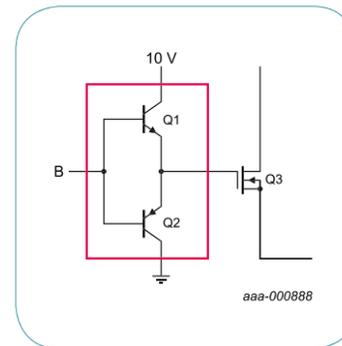
### Key applications

- ▶ Power management
  - (Half) bridge push-pull driver
  - Isolated DC/DC converters
  - Secondary synchronous rectification
- ▶ Peripheral driver
  - (Half) bridge push-pull driver
  - Motor driver
  - Brushless DC motor driver
  - Op-amp output current booster

Op-amp booster

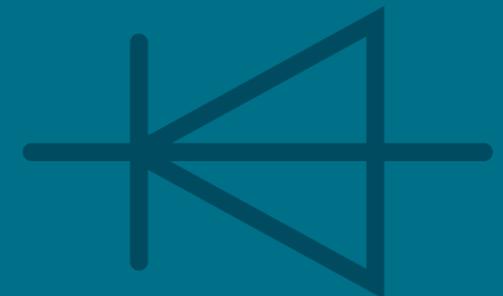


MOSFET driver for faster switching, lower losses



## Medium-frequency transistors

						SOT23	SOT323 (SC-70)
Package							
Size (mm)						2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95
$P_{tot}$ (mW)						250	200
Polarity	$V_{CE0}$ (V)	$I_c$ (mA)	$h_{FE}$ min	$h_{FE}$ max	$f_T$ typ (MHz)		
NPN	15	100	40	-	500	BF570	
	20	25		85	>275	BF520	BFS20W
		30	65	225	260	BF519	
	40	25	67	220	380	BF840	
PNP	30	25	25	50	250	BF824	BF824W
	40		50	-	>325	BF550	



## Diodes

### Schottky barrier diodes and rectifiers

33

- Medium-power low VF Schottky rectifiers single  $\geq 1$  A - Flatpower packages 33
- Medium-power low VF Schottky rectifiers single  $\geq 200$  mA - DSN packages 34
- Medium-power low VF Schottky rectifiers single  $\geq 200$  mA - leadless (DFN) packages 35
- Medium-power low VF Schottky rectifiers single  $\geq 200$  mA - leaded packages 36
- Medium-power low VF Schottky rectifiers dual  $\geq 200$  mA 37
- General-purpose Schottky diodes  $\leq 250$  mA 38
- Low-capacitance Schottky diodes 39

### Zener diodes

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- General-purpose Zener diodes 40
- Zener diodes specifications 41

### Switching diodes

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- General-purpose, high-speed switching diodes < 90 V 42
- General-purpose, high-speed switching diodes 100 V 42
- General-purpose, switching diodes  $\geq 100$  V 43
- PN-rectifier 43
- Controlled-avalanche switching diodes 44
- Low-leakage current-switching diodes 44

# What you get when you choose NXP for diodes and rectifiers

## A comprehensive portfolio for all kind of applications

NXP is continually innovating parts by reducing power consumption and size while boosting performance and reliability

## A broad range of packages

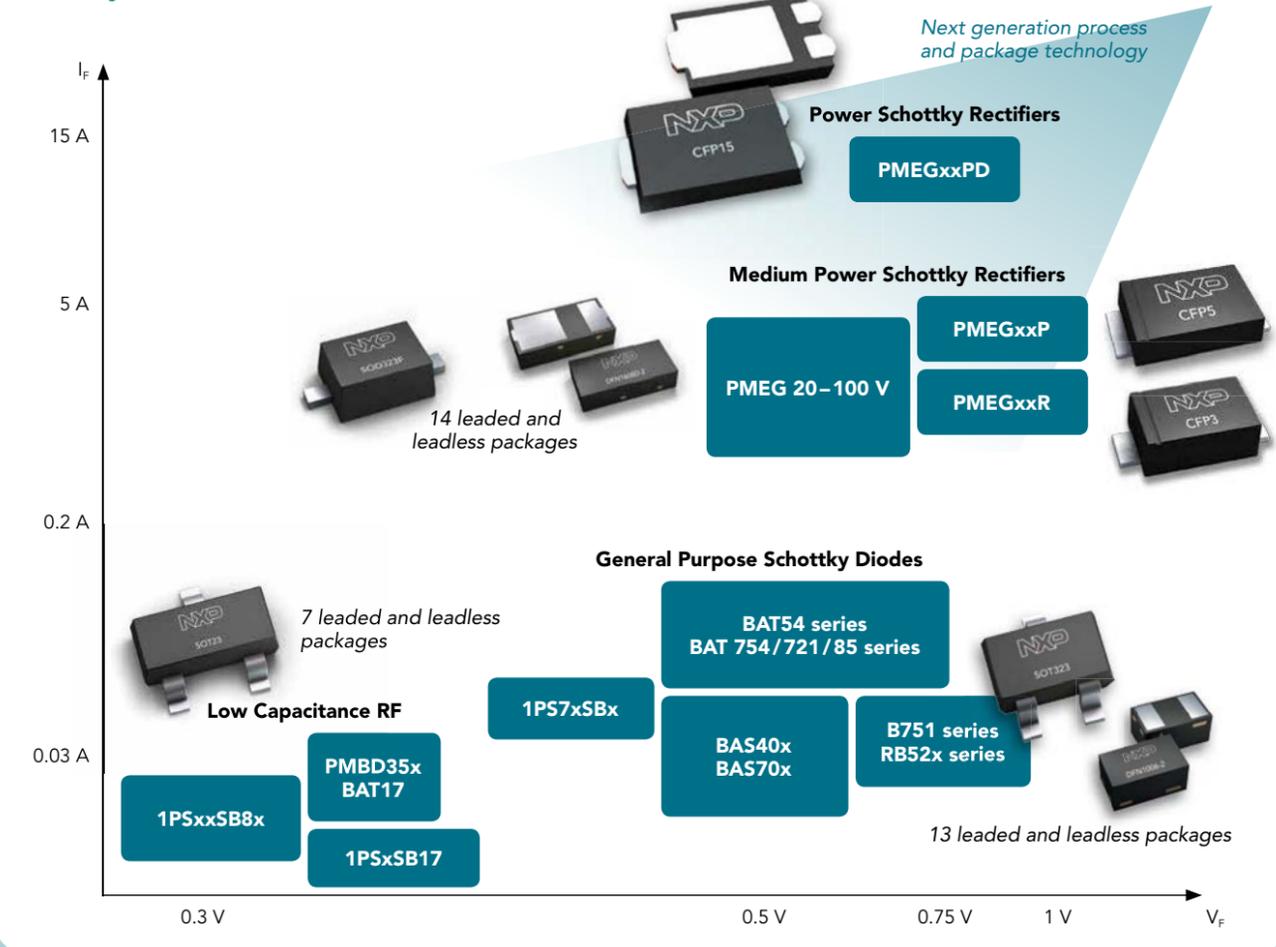
Including standard leaded SMD, medium-power clip-bond and ultra-small leadless packages with dimensions down to 0.6 x 0.3 x 0.3 mm

## A quality product from an experienced, high volume supplier

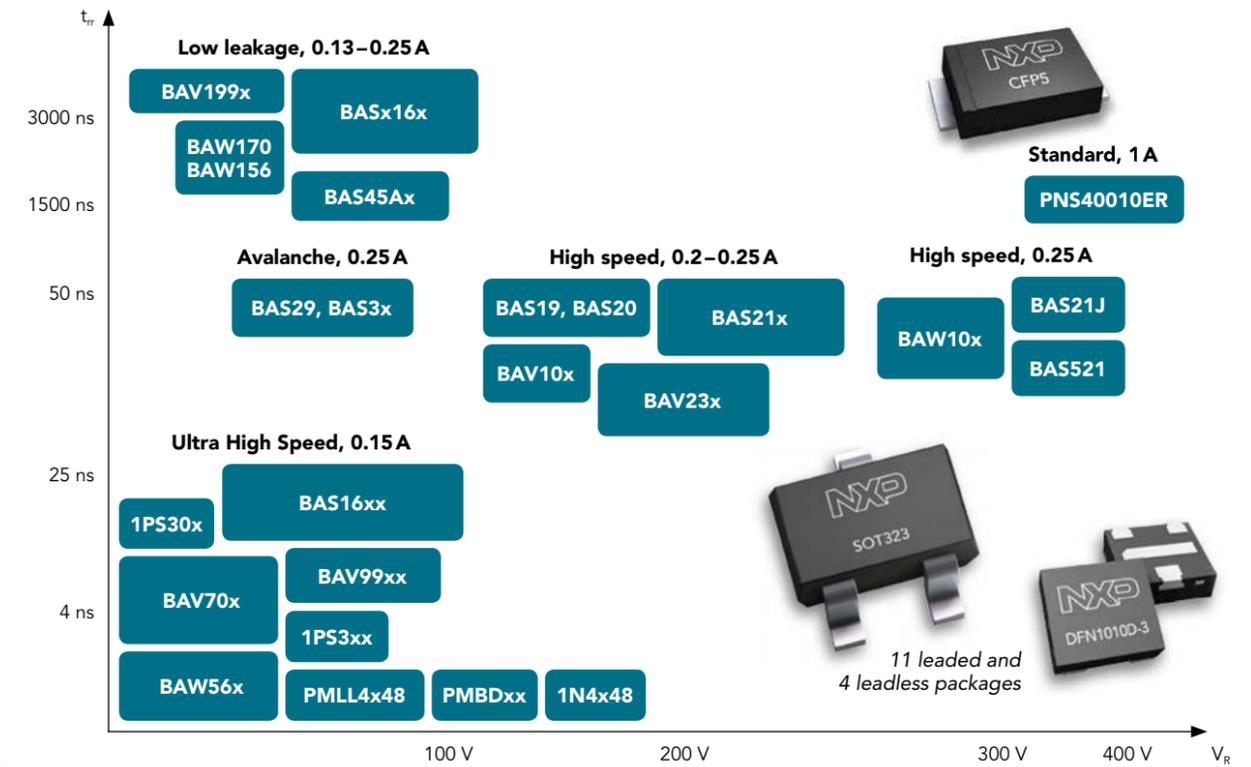
- ▶ NXP is strongly committed to automotive quality standards
- ▶ NXP has a track record of more than 60 years in developing and producing diodes
- ▶ NXP is the #1 in small-signal discretes with a high production capacity

## Portfolio Overview Diodes

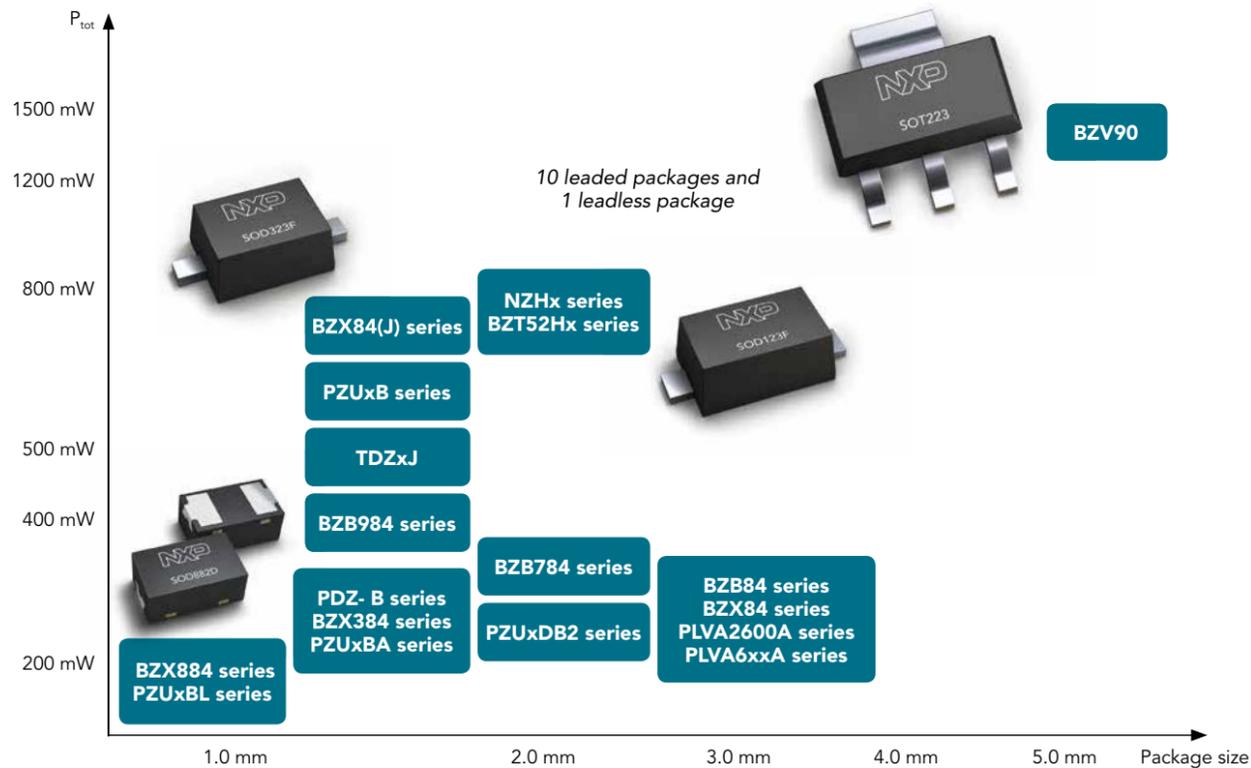
### Schottky Diodes



### Switching Diodes



### Zener Diodes

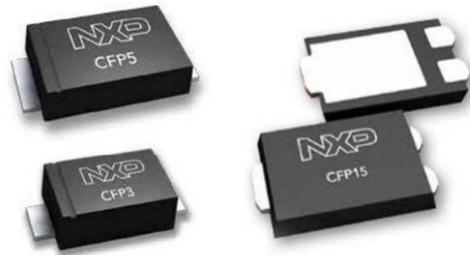


# NXP's FlatPower packages

## CFP3, CFP5, and CFP15

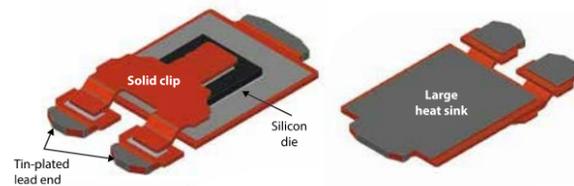
The medium-power solution for shrinking designs

### Small SMD FlatPower packages in three different versions



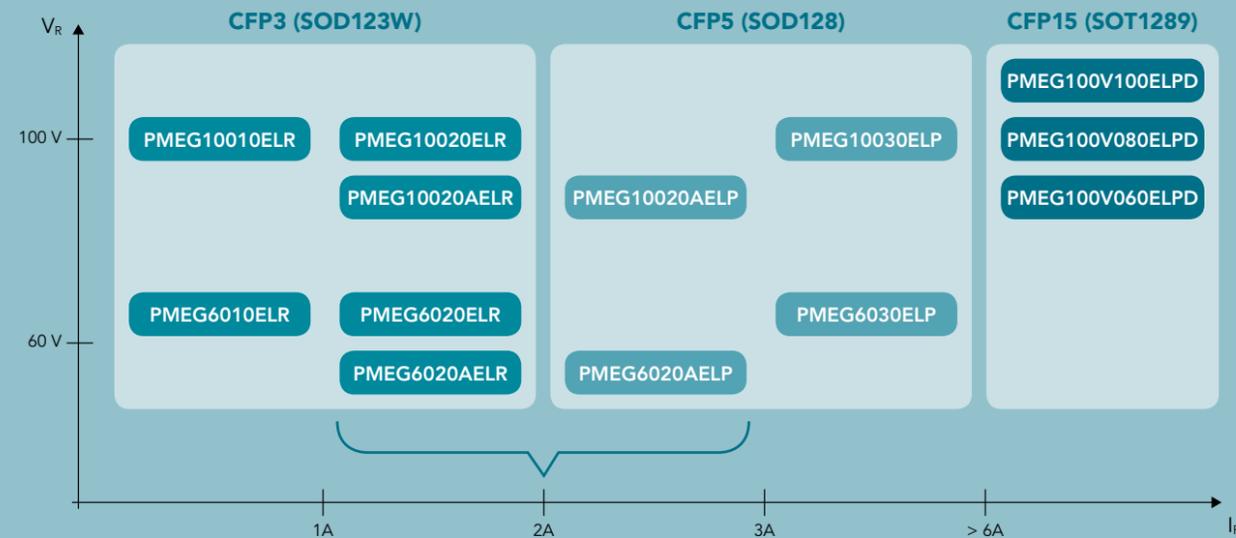
- ▶ Flat geometry, of down to 0.78 mm height
- ▶ Halogen-free mold compound
- ▶ AEC-Q101 qualified

### Robust design



- ▶ High-power capability due to wire-free clip-bond technology and heatsink
- ▶ Automatic optical inspection of solder joint due to tin-plated lead ends
- ▶ Benchmark flat design of only 0.7 mm height

### Low $I_R$ Schottky Portfolio, AEC-Q101



NXP offers more than 200 products in FlatPower packages, to support a wide range of applications for medium-power rectification and surge protection.

## Schottky barrier diodes and rectifiers

### Medium-power low $V_F$ Schottky rectifiers single $\geq 1$ A - FlatPower packages

types in **bold** represent new products

$I_F$ max (A)	$V_R$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Package	CFP15 (SOT1289)	CFP5 (SOD128)	CFP3 (SOD123W)
				Size (mm)	5.8 x 4.3 x 0.78	3.8 x 2.5 x 1.0	2.6 x 1.7 x 1.0
				$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	2150	1050	950
				Optimization			
1	20	340	1	Low $V_F$			PMEG2010ER
		450	0.05	Low $I_R$			PMEG2010BER
	30	360	1.5	Low $V_F$		PMEG3010EP	PMEG3010ER
		450		Low $I_R$		PMEG3010BEP	PMEG3010BER
	40	490	0.05	Low $V_F$		PMEG4010EP	PMEG4010ER
				Low $V_F$		PMEG4010ETP	PMEG4010ETR
	60	530	0.06	Low $V_F$		PMEG6010EP	PMEG6010ER
		530		Low $V_F$			PMEG6010ETR
	100	660	0.0003	Low $I_R$			PMEG6010ELR
		770	0.00015	Low $I_R$			PMEG10010ELR
2	30	360	3	Low $V_F$		PMEG3020EP	
		420	1.5	Low $V_F$		PMEG3020CEP	PMEG3020ER
		450	0.1	Low $I_R$		PMEG3020BEP	
		520	0.05	Low $I_R$		PMEG3020DEP	PMEG3020BER
	40	490	0.1	Low $V_F$		PMEG4020EP	PMEG4020ER
				Low $V_F$		PMEG4020ETP	PMEG4020ETR
	60	530	0.2	Low $V_F$		PMEG6020EP	PMEG6020ER
		530		Low $V_F$		PMEG6020ETP	PMEG6020ETR
		680	0.0007	Low $I_R$		PMEG6020AELP	PMEG6020AELR
		760	0.0003	Low $I_R$			PMEG6020ELR
770	Low $I_R$			PMEG10020AELP	PMEG10020AELR		
830	0.00015	Low $I_R$			PMEG10020ELR		
3	30	360	5	Low $V_F$		PMEG3030EP	
		450	0.15	Low $I_R$		PMEG3030BEP	
	40	490	0.2	Low $V_F$		PMEG4030EP	
				Low $V_F$		PMEG4030ETP	
	60	540	0.1	Low $I_R$			PMEG4030ER
		530		0.2	Low $V_F$		PMEG6030EP
		475	0.4	Low $V_F$		PMEG6030EVP	
		530	0.2	Low $V_F$		PMEG6030ETP	
	690	0.001	Low $I_R$		PMEG6030ELP		
	100	770	0.00045	Low $I_R$		PMEG10030ELP	
4.5	60	530	0.4	Low $V_F$		PMEG6045ETP	
5	30	360	8	Low $V_F$		PMEG3050EP	
		450	0.25	Low $I_R$		PMEG3050BEP	
45	490	0.3	Low $V_F$			PMEG4050EP	
			Low $V_F$		PMEG4050ETP		
			Low $V_F$		PMEG045V050EPD		
60	560	0.4	Low $V_F$		PMEG060V050EPD		
6	100	850	0.001	Low $I_R$		PMEG100V060ELPD	
8	100	850	0.001	Low $I_R$		PMEG100V080ELPD	
10	45	490	0.6	Low $V_F$		PMEG045V100EPD	
		540	0.5	Low $I_R$		PMEG45U10EPD	
	60	560	0.7	Low $V_F$		PMEG060V100EPD	
	100	850	0.001	Low $I_R$		PMEG100V100ELPD	
15	45	550	0.1	Low $I_R$		PMEG045T150EPD	
		580		Low $I_R$		PMEG45T15EPD	
	490	1	Low $V_F$		PMEG045V150EPD		
	50	550	0.1	Low $I_R$		PMEG050T150EPD	
500	1	Low $V_F$		PMEG050V150EPD			

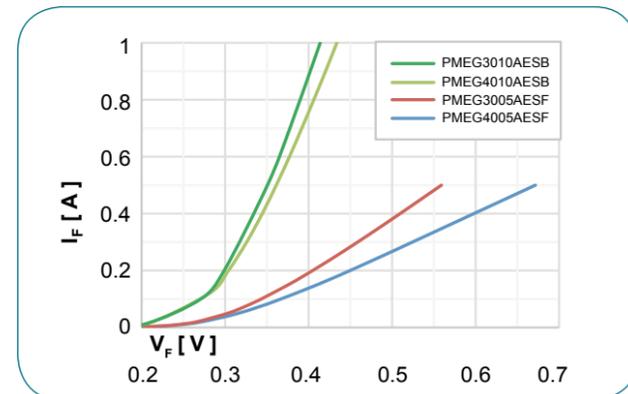
Medium-power low  $V_F$  Schottky rectifiers single  $\geq 200$  mA - Leadless DSN packages types in bold represent new products

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_F$ max	Package	DSN0603-2 (SOD962)	DSN1006-2 (SOD993)	DSN1006U-2 (SOD995)
				Size (mm)	0.6 x 0.3 x 0.3	1.0 x 0.6 x 0.28	1.0 x 0.6 x 0.28
				$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	525	1.000	1.190
Optimization							
0.2	20	420	0.045	Low $V_F$	<b>PMEG2002AESF</b>		
		490	0.0035	Low $I_R$	PMEG2002ESF		
	30	470	0.08	Low $V_F$	<b>PMEG3002AESF</b>		
		535	0.009	Low $I_R$	PMEG3002ESF		
40	525	0.08	Low $V_F$	<b>PMEG4002AESF</b>			
	600	0.0065	Low $I_R$	PMEG4002ESF			
0.5	20	550	0.045	Low $V_F$	<b>PMEG2005AESF</b>		
		620	0.0035	Low $I_R$	PMEG2005ESF		
	30	630	0.08	Low $V_F$	<b>PMEG3005AESF</b>		
		720	0.009	Low $I_R$	PMEG3005ESF		
40	820	0.08	Low $V_F$	<b>PMEG4005AESF</b>			
	880	0.0065	Low $I_R$	PMEG4005ESF			
1	30	480	1.25	Low $V_F$		<b>PMEG3010AESB</b>	<b>PMEG3010AESA</b>
		565	0.045	Low $I_R$		PMEG3010ESF	
	40	505	0.115	Low $V_F$		<b>PMEG4010AESB</b>	
		610	0.04	Low $I_R$		PMEG4010ESB	
	60	625	0.65	Low $V_F$		<b>PMEG6010AESB</b>	
		730	0.03	Low $I_R$		PMEG6010ESB	

Forward characteristic survey of Schottkys in DSN1006-2

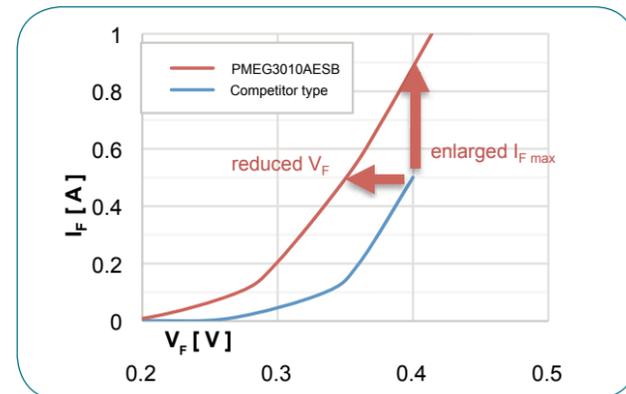
$V_R: 30V, I_F: I_A$  (typical data)

Selected DSN Schottky rectifier



This diagram shows the broad variety of the DSN portfolio

PMEG3010AESB versus competitor type



NXP type has higher forward current specified and has benchmark low  $V_F$

In the spotlight

**PMEG3010AESB, PMEG6010ESB, low  $V_F$  Schottky Rectifier**

- 30 / 40 / 60 V, 1A Schottky rectifier in DSN1006-2 (SOD993) package
- Low forward voltage,  $V_F$  max = 480 mV @ 1 A (PMEG3010AESB)
- Low leakage current,  $I_R$  max = 30  $\mu$ A @ 60 V (PMEG6010ESB)
- High surge capability up to  $I_{FSM} = 10$  A
- Ideal for LED backlighting in mobile applications



Medium-power low  $V_F$  Schottky rectifiers single  $\geq 200$  mA - Leadless DFN packages types in bold represent new products

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_F$ max	Package	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)	DFN1608D-2 (SOD1608)	DFN1006-2 (SOD882)	DFN1006D-2 (SOD882D)
				Size (mm)	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62	1.6 x 0.8 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37
				$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	960	960	780	565	660
Optimization									
0.2	30	480	0.05	low $V_F$				PMEG3002AEL	PMEG3002AELD
	40	600	0.01	low $I_R$				PMEG4002EL	PMEG4002ELD
	60	600	0.1	low $V_F$					PMEG6002ELD
0.5	20	390	0.2	low $V_F$					PMEG2005BELD
		410	0.3	low $V_F$			PMEG2005EPK		
		440	1.5	low $V_F$				PMEG2005AEL	PMEG2005AELD
	500	0.03	low $I_R$				PMEG2005EL	PMEG2005ELD	
	30	500	0.5	low $V_F$				PMEG3005EL	PMEG3005ELD
1	20	375	1.9	low $V_F$	PMEG2010EPA	<b>PMEG2010EPAS</b>			
		415	0.6	low $V_F$			PMEG2010EPK		
	490	0.2	low $V_F$					PMEG2010BELD	
	40	600	0.02	low $I_R$			PMEG4010EPK		
1.5	20	420	0.9	low $V_F$			PMEG2015EPK		
	40	610	0.03	low $I_R$			PMEG4015EPK		
2	20	420	1.9	low $V_F$	PMEG2020EPA	<b>PMEG2020EPAS</b>			
		450	0.9	low $V_F$			PMEG2020EPK		
	30	470	2.5	low $V_F$	PMEG3020EPA	<b>PMEG3020EPAS</b>			
	40	535	0.1	low $V_F$	PMEG4020EPA	<b>PMEG4020EPAS</b>			
	530	0.2	low $V_F$			PMEG4020EPK			
	60	575	0.25	low $V_F$	PMEG6020EPA	<b>PMEG6020EPAS</b>			

**Features and benefits**

- ▶ 33% lower  $V_F$  on same footprint
- ▶ Low profile of 0.37 mm
- ▶ Solderable side pads
- ▶ Visual solder inspection

**Applications**

- ▶ Handheld equipment
- ▶ Smartphone backlight units
- ▶ Battery chargers
- ▶ Shrunk PCB designs

Differentiated portfolio

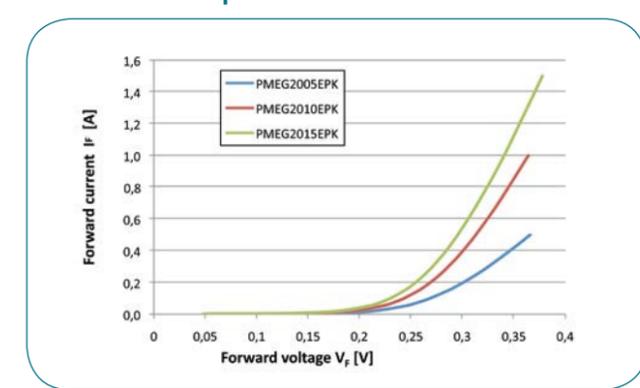
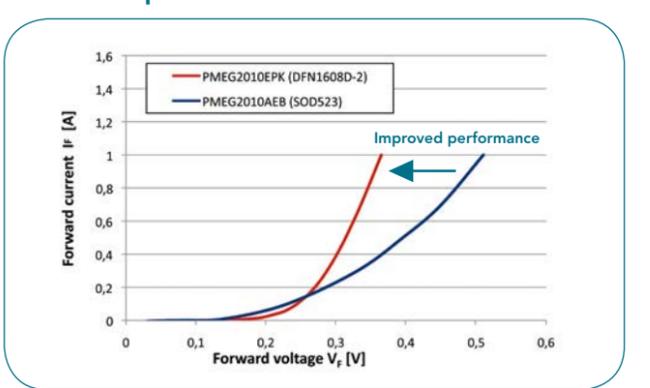


Diagram shows the variety of characteristics in DFN1608D-2 (SOD1608)

with best performance



PMEG2010EPK shows significant  $V_F$  improvement compared to the SOD523 device

### Medium-power low $V_F$ Schottky rectifiers single $\geq 200$ mA - Leaded packages

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Package	SOT457 (SC-74)	SOT23	SOD123F	SOT323 (SC-70)	SOD323F (SC-90)	SOD323 (SC-76)	SOT666	SOD523 (SC-79)				
					Size (mm)	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6			
					$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	540	420	830	400	830	570	570	500			
					Optimization											
0.2	30	480	0.05	low $V_F$								PMEG3002EJ			PMEG3002AEB	
	40	600	0.01	low $I_R$									PMEG4002EJ			PMEG4002EB
	60	600	0.1	low $V_F$									PMEG6002EJ			PMEG6002EB
0.5	20	390	0.2	low $V_F$		PMEG2005ET	PMEG2005EH		PMEG2005EJ	PMEG2005AEA	PMEG2005AEV					
		480	0.03	low $I_R$												PMEG2005EB
	30	430	0.15	low $V_F$		PMEG3005ET	PMEG3005EH		PMEG3005EJ	PMEG3005AEA	PMEG3005AEV					
		500	0.5	low $V_F$												PMEG3005EB
		470	0.1	low $V_F$		PMEG4005ET	PMEG4005EH		PMEG4005EJ	PMEG4005AEA	PMEG4005AEV					
40	550	1.1	low $V_F$		BAT720		1PS70SB20									
1	20	430	0.2	low $V_F$		PMEG2010AET	PMEG2010AEH									
		500	0.2	low $V_F$		PMEG2010ET	PMEG2010EH		PMEG2010EJ	PMEG2010BEA	PMEG2010BEV					
		550	0.07	low $I_R$					PMEG2010AEJ	PMEG2010EA BAT760	PMEG2010EV BAT960					
		620	1.5	low $V_F$											PMEG2010AEB	
	30	450	1	low $V_F$	1PS74SB23											
		520	0.1	low $I_R$			PMEG3010CEH		PMEG3010CEJ							
		560	0.15	low $V_F$			PMEG3010ET	PMEG3010EH		PMEG3010EJ	PMEG3010BEA	PMEG3010BEV				
		680	0.5	low $V_F$											PMEG3010EB	
		570	0.05	low $I_R$				PMEG4010CEH		PMEG4010CEJ						
		600	0.02	low $I_R$												
40	640	0.05	low $V_F$		PMEG4010ET	PMEG4010EH		PMEG4010EJ	PMEG4010BEA	PMEG4010BEV						
60	650	0.35	low $V_F$	PMEG6010AED												
	660	0.05	low $I_R$			PMEG6010CEH		PMEG6010CEJ								
1.5	20	660	0.2	low $I_R$			PMEG2015EH		PMEG2015EJ	PMEG2015EA	PMEG2015EV					
	30	500	1	low $V_F$			PMEG3015EH		PMEG3015EJ		PMEG3015EV					
2	10	460	3	low $V_F$			PMEG1020EH		PMEG1020EJ	PMEG1020EA	PMEG1020EV					
	20	525	0.2	low $V_F$			PMEG2020EH		PMEG2020EJ	PMEG2020AEA						
	30	620	1	low $V_F$			PMEG3020EH		PMEG3020EJ							
3	10	530	3	low $V_F$			PMEG1030EH		PMEG1030EJ							

In the spotlight

#### Schottky Rectifier in SOD123F and SOD323F

Broad portfolio base of 36 types, 20 / 60 V, 0.2 - 3 A

Optimized either for low  $V_F$  or low  $I_R$

High surge capability up to 10 A

High thermal capability due to flat-lead design

AEC-Q101 qualified

Ideal for DC/DC conversion, free-wheeling, reverse polarity protection

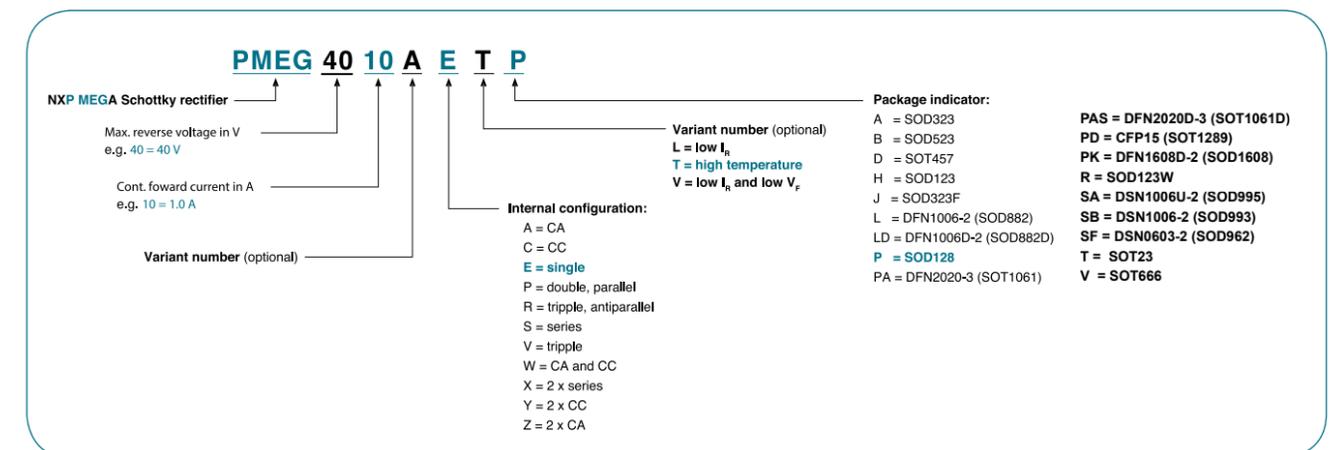


### Medium-power low $V_F$ Schottky rectifiers dual $\geq 200$ mA

types in **bold** represent new products

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Optimization	Package	SOT223 (SC-73)	SOT23	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)	SOT666	
						Size (mm)	6.5 x 3.5 x 1.65	2.9 x 1.3 x 1.0	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.63	1.6 x 1.2 x 0.55
						$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	1500	250	1000	1000	300
						Diagram					
0.2	30	480	0.03	low $V_F$						PMEG3002TV	
	60	600	0.1	low $V_F$						PMEG6002TV	
0.5	20	390	0.2	low $V_F$			PMEG2005CT				
	30	430	0.15	low $V_F$			PMEG3005CT				
0.5	40	470	0.1	low $V_F$			PMEG4005CT				
	25	450	1.0	low $V_F$		BAT120S					
low $V_F$					BAT120C						
low $V_F$					BAT120A						
1.0	40	500	0.05	low $V_F$				PMEG4010CPA	<b>PMEG4010CPAS</b>		
				low $V_F$				PMEG6010CPA	<b>PMEG6010CPAS</b>		
60	650	0.35	low $V_F$		BAT160S						
			low $V_F$		BAT160C						
			low $V_F$		BAT160A						
			low $V_F$		BAT160A						
2.0	20	420	1.0	low $V_F$				PMEG2020CPA	<b>PMEG2020CPAS</b>		
				low $V_F$				PMEG3020CPA	<b>PMEG3020CPAS</b>		

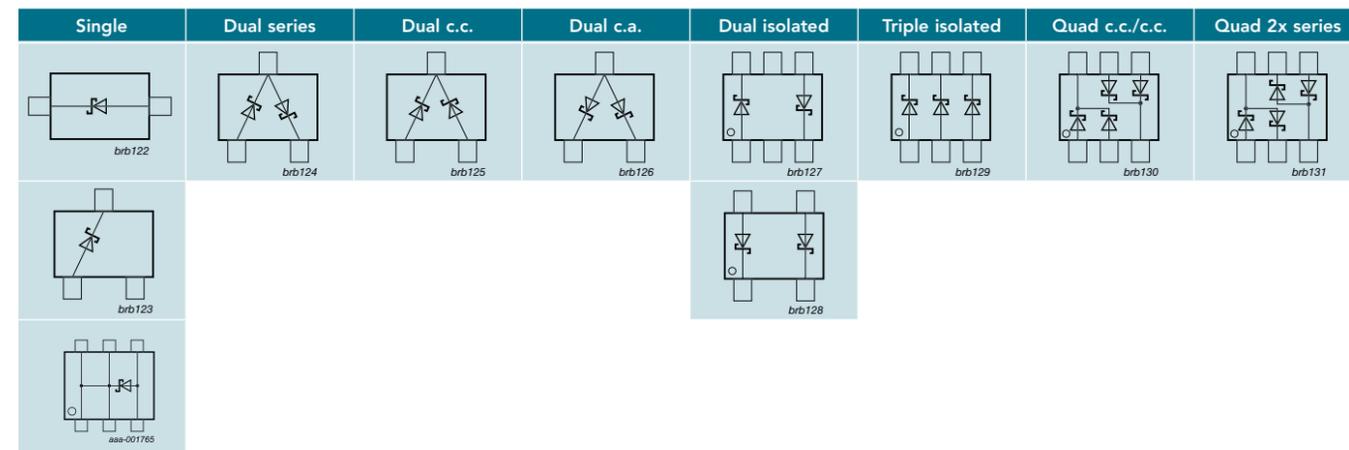
### Low $V_F$ (MEGA) Schottky rectifier nomenclature



General-purpose Schottky diodes ≤ 250 mA

I <sub>F</sub> max (mA)	V <sub>R</sub> max (V)	V <sub>F</sub> max (mV)	@ I <sub>F</sub> (mA)	I <sub>F</sub> max (μA)	@ V <sub>R</sub> (V)	Package	SOD80C (MiniMelf)	SOD68 (DO-34)	SOT23	SOT143B	SOD123F	SOT323 (SC-70)	SOT363 (SC-88)	SOD323F (SC-90)	SOD323 (SC-76)	SOT666	SOD523 (SC-79)	DFN1006-2 (SOD882)/DFN1006-3 (SOT883)				
																						
							3.5 x 1.5 x 1.5	3.04 x 1.6 x 0.55	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6	1.0 x 0.6 x 0.48				
							P <sub>tot</sub> (mW)	300	500	250	250	830	250	300	550	400	300	500	250			
70	70	750	10	0.1	50	single			BAS70		BAS70H	BAS70W			1PS76SB70		1PS79SB70	BAS70L				
						dual series			BAS70-04			BAS70-04W										
						dual c.c.			BAS70-05			BAS70-05W										
						dual c.a.			BAS70-06			BAS70-06W										
						dual isolated				BAS70-07					BAS70-07S				BAS70-07V			
						triple isolated													BAS70VV			
120	40	500	10	1	30	single			BAS40		BAS40H	BAS40W			1PS76SB40		RB751S40	RB751CS40				
						dual series			BAS40-04			BAS40-04W										
						dual c.c.			BAS40-05			BAS40-05W										
						dual c.a.			BAS40-06			BAS40-06W										
						dual isolated				BAS40-07									BAS40-07V			
						quad c.c./c.c.											1PS88SB48		BAS40-05V			
200	30	300	10	30	10	single												1PS79SB31				
						single			BAT754													
						dual series			BAT754S													
						dual c.c.			BAT754C													
						dual c.a.			BAT754A													
						triple isolated									BAT754L							
	40	400	10	2	25	single	BAS85	BAT85	BAT54		BAT54H	BAT54W		BAT54J	1PS76SB10		1PS79SB10	BAT54L				
						dual series			BAT54S			BAT54SW										
						dual c.c.			BAT54C			BAT54CW									BAT54CM	
						dual c.a.			BAT54A			BAT54AW										
						dual isolated				BAT74				BAT74S				BAT74V				
						triple isolated												BAT54VV				
	50	450	10	5	40	single	BAS86	BAT86											RB521S30			
						single														RB520S30	RB521CS30L	
						single			BAT721									1PS76SB21				
						dual series			BAT721S													
						dual c.c.			BAT721C													
						dual c.a.			BAT721A													
60	200	200	1	10	single																	
					single																	
					single																	
					dual series																	
					dual c.c.																	
					dual c.a.																	
250	100	850	250	4	75	single					BAT46WH				BAT46WJ							

Diodes



Low-capacitance Schottky diodes

I <sub>F</sub> max (mA)	V <sub>R</sub> max (V)	V <sub>F</sub> max (mV)	@ I <sub>F</sub> (mA)	C <sub>d</sub> max (pF)	@ V <sub>R</sub> = 0 V	Package	SOT23	SOT323 (SC-70)	SOT363 (SC-88)	SOD323 (SC-76)	SOT666	SOD523 (SC-79)	DFN1006-2 (SOD882)	
														
							2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6	1.0 x 0.6 x 0.48	
							P <sub>tot</sub> (mW)	250	250	300	400	300	500	250
30	4	450	1	1	single	BAT17				1PS76SB17			1PS79SB17	
					triple isolated						1PS66SB17			
					dual series	PMBD353 PMBD354 <sup>1)</sup>								
					single		1PS70SB82						1PS10SB82	
					triple isolated			1PS88SB82		1PS66SB82				
					dual series		1PS70SB84							
15	340	1	1	dual c.c.		1PS70SB85								
				dual c.a.		1PS70SB86								

<sup>1)</sup> Diodes have matched capacitance

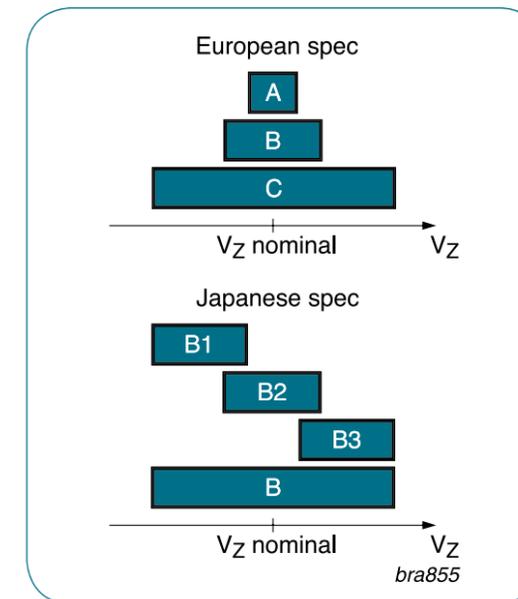
## General-purpose Zener diodes

$I_f$ max (mA)	$P_{ZSM}$ (W)	$V_z$ nom (V)	$V_z$ tolerance	Note	Configuration	Series	Package	Size (mm)	$P_{tot}$ (mW)
500	-	3.3-24	C	Europe	Single 	1N47xxA series	SOD66 (DO-41)	4.8 x 2.6 x 0.81	1000
	60	3.6-75				BZV85 series			
250	-	2.1-36	About 2%	Special	Single 	NZX series	SOD27 (DO-35)	4.25 x 1.85 x 0.56	400
	40	2.4-75	B, C	Europe		BZX79 series			
400	40	2.4-75	C	Europe	Single 	BZV90 series	SOT223 (SC-73)	6.5 x 3.5 x 1.65	1500
250	40	2.4-75	C	Europe	Single 	BZV49 series	SOT89 (SC-62)	4.5 x 2.5 x 1.5	1000
250	40	2.4-75	B, C	Europe	Single 	BZV55 series	SOD80C (MiniMelf)	3.5 x 1.5 x 1.5	400
200	40	2.4-75	B, C	Europe	Dual c.a. 	BZB84 series	SOT23	2.9 x 1.3 x 1.0	250
			A, B, C		BZX84 series				
250	30	5-6.8	0.2 V	Ave	Single 	PLVA600A series			
250	-	3.0-30	About 2.5%	Special	Single 	NZH series	SOD123F	2.6 x 1.6 x 1.1	830
	40	2.4-75	B, C	Europe		BZT52H series			
200	40	10	B2	Japan	Dual isolated 	PZU10DB2 series	SOT353 (SC-88A)	2.0 x 1.25 x 0.95	300
200	40	2.4-15	C	Europe	Dual c.a. 	BZB784 series	SOT323 (SC-70)	2.0 x 1.25 x 0.95	350
200	30	100	C	Europe	Back-to-back 	BZB100A	SOD323 (SC-76)	1.7 x 1.25 x 0.95	300
			B2		PDZ-B series				
250	40	2.4-75	B, C	Europe	Single 	BZX384 series			
200	40	2.4-36	B, B1, B2, B3	Japan		PZUxBA series			
200	60	100	C	Europe		BZX100A	SOD323F (SC-90)		
200	40	2.4-36	B, B1, B2, B3	Japan	Single 	PZUxB series		1.7 x 1.25 x 0.7	550
250	40	2.4-75	B, C	Europe		BZX84J series			
200	40	2.4-15	C	Europe	Dual c.a. 	BZB984 series	SOT663	1.6 x 1.2 x 0.55	350
200	40	2.4-75	B, C	Europe	Single 	BZX585 series	SOD523 (SC-79)	1.2 x 0.8 x 0.6	300
200	40	2.4-75	B, C	Europe	Single 	BZX884 series	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48	250
			B, B2			PZUxBL series			
250	40	2.4-30	B	Europe	Single 	TDZxJ series	SOD323F	1.7 x 1.25 x 0.7	500

Notes:  
 Japan: B selection: app. 5%  $V_z$  tolerance, B1, B2, B3 selections: app. 2%  $V_z$  tolerance in sequential intervals  
 Europe: A selection: app. 1%  $V_z$  tolerance, B selection: app. 2%  $V_z$  tolerance, C selection: app. 5%  $V_z$  tolerance;  
 the selections are in overlapping intervals  
 Ave: low-voltage avalanche regulator diodes  
 Dual c.a.: dual common anode

## Zener diodes specifications

### Differences in Zener specifications



### European spec (BZV, BZX, BZB, 1N47)

y =	C-series ±5%	B-series ±2%	A-series ±1%
$V_z$ (V)	$V_z$ (V)	$V_z$ (V)	$V_z$ (V)
BZX84-y2V4	2.2 - 2.6	2.35 - 2.45	2.37 - 2.43
BZX84-y2V7	2.5 - 2.9	2.65 - 2.75	2.67 - 2.73
BZX84-y3V0	2.8 - 3.2	2.94 - 3.06	2.97 - 3.03
BZX84-y3V3	3.1 - 3.5	3.23 - 3.37	3.26 - 3.34
BZX84-y3V6	3.4 - 3.8	3.53 - 3.67	3.56 - 3.64
BZX84-y3V9	3.7 - 4.1	3.82 - 3.98	3.86 - 3.94
BZX84-y4V3	4 - 4.6	4.21 - 4.39	4.25 - 4.35
BZX84-y4V7	4.4 - 5	4.61 - 4.79	4.65 - 4.75
BZX84-y5V1	4.8 - 5.4	5 - 5.2	5.04 - 5.16
BZX84-y5V6	5.2 - 6	5.49 - 5.71	5.54 - 5.66
BZX84-y6V2	5.8 - 6.6	6.08 - 6.32	6.13 - 6.27
BZX84-y6V8	6.4 - 7.2	6.66 - 6.94	6.73 - 6.87
BZX84-y7V5	7 - 7.9	7.35 - 7.65	7.42 - 7.58
BZX84-y8V2	7.7 - 8.7	8.04 - 8.36	8.11 - 8.29
BZX84-y9V1	8.5 - 9.6	8.92 - 9.28	9 - 9.2
BZX84-y10	9.4 - 10.6	9.8 - 10.2	9.9 - 10.1
BZX84-y11	10.4 - 11.6	10.8 - 11.2	10.8 - 11.11
BZX84-y12	11.4 - 12.7	11.8 - 12.2	11.88 - 12.12
BZX84-y13	12.4 - 14.1	12.7 - 13.3	12.87 - 13.13
BZX84-y15	13.8 - 15.6	14.7 - 15.3	14.85 - 15.15
BZX84-y16	15.3 - 17.1	15.7 - 16.3	15.84 - 16.16
BZX84-y18	16.8 - 19.1	17.6 - 18.4	17.82 - 18.18
BZX84-y20	18.8 - 21.2	19.6 - 20.4	19.8 - 20.2
BZX84-y22	20.8 - 23.3	21.6 - 22.4	21.78 - 22.22
BZX84-y24	22.8 - 25.6	23.5 - 24.5	23.76 - 24.24
BZX84-y27	25.1 - 28.9	26.5 - 27.5	26.73 - 27.27
BZX84-y30	28 - 32	29.4 - 30.6	29.70 - 30.30
BZX84-y33	31 - 35	32.3 - 33.7	32.67 - 33.33
BZX84-y36	34 - 38	35.3 - 36.7	35.64 - 36.36
BZX84-y39	37 - 41	38.2 - 39.8	38.61 - 39.39
BZX84-y43	40 - 46	42.1 - 43.9	42.57 - 43.43
BZX84-y47	44 - 50	46.1 - 47.9	-
BZX84-y51	48 - 54	50 - 52	50.49 - 51.51
BZX84-y56	52 - 60	54.9 - 57.1	-
BZX84-y62	58 - 66	60.8 - 63.2	-
BZX84-y68	64 - 72	66.6 - 69.4	-
BZX84-y75	70 - 79	73.5 - 76.5	74.25 - 75.75

### Japanese spec (PZU, PDZ)

y =	B-series ± 5%	B1-series ± 2%	B2-series ± 2%	B3-series ± 2%
$V_z$ (V)	$V_z$ (V)	$V_z$ (V)	$V_z$ (V)	$V_z$ (V)
PZU2.4y	2.3 - 2.6	-	-	-
PZU2.7y	2.5 - 2.9	2.5 - 2.75	2.65 - 2.9	-
PZU3.0y	2.8 - 3.2	2.8 - 3.05	2.95 - 3.2	-
PZU3.3y	3.1 - 3.5	3.1 - 3.35	3.25 - 3.5	-
PZU3.6y	3.4 - 3.8	3.4 - 3.65	3.55 - 3.8	-
PZU3.9y	3.7 - 4.1	3.7 - 3.97	3.87 - 4.1	-
PZU4.3y	4.01 - 4.48	4.01 - 4.21	4.15 - 4.34	4.28 - 4.48
PZU4.7y	4.42 - 4.9	4.42 - 4.61	4.55 - 4.75	4.69 - 4.9
PZU5.1y	4.84 - 5.37	4.84 - 5.04	4.98 - 5.2	5.14 - 5.37
PZU5.6y	5.31 - 5.92	5.31 - 5.55	5.49 - 5.73	5.67 - 5.92
PZU6.2y	5.86 - 6.53	5.86 - 6.12	6.06 - 6.33	6.26 - 6.53
PZU6.8y	6.47 - 7.14	6.47 - 6.73	6.65 - 6.93	6.86 - 7.14
PZU7.5y	7.06 - 7.84	7.06 - 7.36	7.28 - 7.6	7.52 - 7.84
PZU8.2y	7.76 - 8.64	7.76 - 8.1	8.02 - 8.36	8.28 - 8.64
PZU9.1y	8.56 - 9.55	8.56 - 8.93	8.85 - 9.23	9.15 - 9.55
PZU10y	9.45 - 10.55	9.45 - 9.87	9.77 - 10.21	10.11 - 10.55
PZU11y	10.44 - 11.56	10.44 - 10.88	10.76 - 11.22	11.1 - 11.56
PZU12y	11.42 - 12.6	11.42 - 11.9	11.74 - 12.24	12.08 - 12.6
PZU13y	12.47 - 13.96	12.47 - 13.03	12.91 - 13.49	13.37 - 13.96
PZU14y	-	-	13.7 - 14.3	-
PZU15y	13.84 - 15.52	13.84 - 14.46	14.34 - 14.98	14.85 - 15.52
PZU16y	15.37 - 17.09	15.37 - 16.01	15.85 - 16.51	16.35 - 17.09
PZU18y	16.94 - 19.03	16.94 - 17.7	17.56 - 18.35	18.21 - 19.03
PZU20y	18.86 - 21.08	18.86 - 19.7	19.52 - 20.39	20.21 - 21.08
PZU22y	20.88 - 23.17	20.88 - 21.77	21.54 - 22.47	22.23 - 23.17
PZU24y	22.93 - 25.57	22.93 - 23.96	23.72 - 24.78	24.54 - 25.57
PZU27y	25.1 - 28.9	-	-	-
PZU30y	28 - 32	-	-	-
PZU33y	31 - 35	-	-	-
PZU36y	34 - 38	-	-	-

### NZX-series in SOD27

	$V_z$ (V)	$V_z$ (V)	$V_z$ (V)	$V_z$ (V)	
NZX2V1B	2.0 - 2.2	NZX6V2D	6.1 - 6.4	NZX14C	13.8 - 14.3
NZX2V4A	2.3 - 2.5	NZX6V2E	6.3 - 6.6	NZX15A	14.1 - 14.7
NZX2V4B	2.4 - 2.6	NZX6V8A	6.4 - 6.7	NZX15B	14.5 - 15.1
NZX2V7A	2.5 - 2.7	NZX6V8B	6.6 - 6.9	NZX15C	14.9 - 15.5
NZX2V7B	2.6 - 2.8	NZX6V8C	6.7 - 7	NZX15X	14.35 - 15.09
NZX2V7C	2.7 - 2.9	NZX6V8D	6.9 - 7.2	NZX16A	15.3 - 15.9
NZX3V0A	2.8 - 3	NZX7V5A	7 - 7.3	NZX16B	15.7 - 16.5
NZX3V0B	2.9 - 3.1	NZX7V5B	7.2 - 7.6	NZX16C	16.3 - 17.1
NZX3V0C	3 - 3.2	NZX7V5C	7.3 - 7.7	NZX18A	16.9 - 17.7
NZX3V3A	3.1 - 3.3	NZX7V5D	7.5 - 7.9	NZX18B	17.5 - 18.3
NZX3V3B	3.2 - 3.4	NZX7V5X	7.07 - 7.45	NZX18C	18.1 - 19
NZX3V3C	3.3 - 3.5	NZX8V2A	7.7 - 8.1	NZX20A	18.8 - 19.7
NZX3V6A	3.4 - 3.6	NZX8V2B	7.9 - 8.3	NZX20B	19.5 - 20.4
NZX3V6B	3.5 - 3.7	NZX8V2C	8.1 - 8.5	NZX20C	20.2 - 21.2
NZX3V6C	3.6 - 3.8	NZX8V2D	8.3 - 8.7	NZX22A	20.9 - 21.9
NZX3V9A	3.7 - 3.9	NZX9V1A	8.5 - 8.9	NZX22B	21.6 - 22.6
NZX3V9B	3.8 - 4	NZX9V1B	8.7 - 9.1	NZX22C	22.3 - 23.3
NZX3V9C	3.9 - 4.1	NZX9V1C	8.9 - 9.3	NZX24A	22.9 - 24
NZX4V3A	4 - 4.2	NZX9V1D	9.1 - 9.5	NZX24B	23.6 - 24.7
NZX4V3B	4.1 - 4.3	NZX9V1E	9.3 - 9.7	NZX24C	24.3 - 25.5
NZX4V3C	4.2 - 4.4	NZX10A	9.5 - 9.9	NZX24X	22.61 - 23.77
NZX4V3D	4.3 - 4.5	NZX10B	9.7 - 10.1	NZX27A	25.2 - 26.6
NZX4V7A	4.4 - 4.6	NZX10C	9.9 - 10.3	NZX27B	26.2 - 27.6
NZX4V7B	4.5 - 4.7	NZX10D	10.2 - 10.6	NZX27C	27.2 - 28.6
NZX4V7C	4.6 - 4.8	NZX11A	10.4 - 10.8	NZX27X	26.99 - 28.39
NZX4V7D	4.7 - 4.9	NZX11B	10.7 - 11.1	NZX30A	28.2 - 29.6
NZX5V1A	4.8 - 5	NZX11C	10.9 - 11.3	NZX30B	29.2 - 30.6
NZX5V1B	4.9 - 5.1	NZX11D	11.1 - 11.6	NZX30C	30.2 - 31.6
NZX5V1C	5 - 5.2	NZX12A	11.4 - 11.9	NZX30X	29.02 - 30.51
NZX5V1D	5.1 - 5.3	NZX12B	11.6 - 12.1	NZX33A	31.2 - 32.6
NZX5V6A	5.2 - 5.5	NZX12C	11.9 - 12.4	NZX33B	32.2 - 33.6
NZX5V6B	5.3 - 5.6	NZX12D	12.2 - 12.7	NZX33C	33.2 - 34.5
NZX5V6C	5.4 - 5.7	NZX12X	11.44 - 12.03	NZX36A	34.2 - 35.7
NZX5V6D	5.5 - 5.8	NZX13A	12.4 - 12.9	NZX36B	35.3 - 36.8
NZX5V6E	5.6 - 5.9	NZX13B	12.6 - 13.1	NZX36C	36.4 - 38
NZX6V2A	5.7 - 6	NZX13C	12.9 - 13.4	NZX36X	35.36 - 37.19
NZX6V2B	5.8 - 6.1	NZX14A	13.2 - 13.7		
NZX6V2C	6 - 6.3	NZX14B	13.5 - 14		

### General-purpose high-speed switching diodes < 90V

types in **bold** represent new products

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (mA)	I <sub>R</sub> max (nA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	SOD80C (MiniMelf)	SOT23	SOT143B	SOT323 (SC-70)	SOT363 (SC-88)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	
							Size (mm)	3.5 x 1.5 x 1.5	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48
							P <sub>tot</sub> (mW)	500	250	250	200	300	540	250
50	1	50	100	50	4			BAL74						
								BAV74						
70	1	50	1000	70	4			BAL99						
										BAS28				
75	1	50	1000	75	4									
		100	5000	75	4		BAS32L							
80	1	50	500	80	4					1PS300				
										1PS301				
										1PS302				
90	1	50	500	80	4			BAW56		BAW56W		<b>BAW56QA</b>	BAW56M	
											BAW56S			
											BAW756S			

### General-purpose, high-speed switching diodes 100V

types in **bold** represent new products

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (mA)	I <sub>R</sub> max (nA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	SOT23	SOD123F	SOT323 (SC-70)	SOT363 (SC-88)	SOD323 (SC-76)	SOD323F (SC-90)	SOT666	SOD523 (SC-79)	DFN1010D-3 (SOT1215)	DFN1006-2 (SOD882)	DFN1006-3 (SOT883)	DFN1006D-2 (SOD882D)	
							Size (mm)	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37
							P <sub>tot</sub> (mW)	250	830	200	300	400	550	180	500	540	250	250	250
100	1	50	500	80	4			BAS16H			BAS316	BAS16J		BAS516		BAS16L		BAS16LD	
							BAS16		BAS16W			<b>BAS16QA</b>							
									BAS16VY			BAS16VV							
							BAV70		BAV70W				<b>BAV70QA</b>		BAV70M				
									BAS16VY			BAS16VV							
									BAS16VY			BAS16VV							
							BAV99		BAV99W				<b>BAV99QA</b>						

### General-purpose switching diodes ≥ 100V

types in **bold** represent new products

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (mA)	I <sub>R</sub> max (nA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	SOD80C (MiniMelf)	SOT457 (SC-74)	SOT23	SOT143B	SOD123F	SOT323 (SC-70)	SOT353 (SC-88A)	SOT363 (SC-88)	SOD323 (SC-76)	SOD323F (SC-90)	SOD523 (SC-79)					
							Size (mm)	3.5 x 1.5 x 1.5	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.2 x 0.8 x 0.6				
							P <sub>tot</sub> (mW)	300	500	250	250	830	350		300	400	550	500				
100	1	100	100	100	50				BAS19													
150	1	100	100	150	50		BAS102															
									BAS20													
≥200	1	100	100	200	50		BAS103				BAS21H				BAS321							
									BAS21		BAS21W											
										BAS21												
										BAS21												
										BAS21												
										BAS21												
										BAS21												
										BAS21												
										BAS21												
										BAS21												
300	1.1	100	150	250	50												BAS21J	BAS521				

### PN-rectifier

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (A)	I <sub>R</sub> max (μA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	CFP3 SOD123W	
							Size (mm)	2.6 x 1.7 x 1.0
							P <sub>tot</sub> (mW)	950
400	1.1	1	1	400	1800		PNS40010ER	

**In the spotlight**

**Dual high-speed switching diode BAS21PG in SOT353 (SC-88A)**

V<sub>R</sub> max = 250 V, I<sub>F</sub> max = 225 mA, dual isolated configuration

Low leakage current: I<sub>R</sub> max = 100 nA

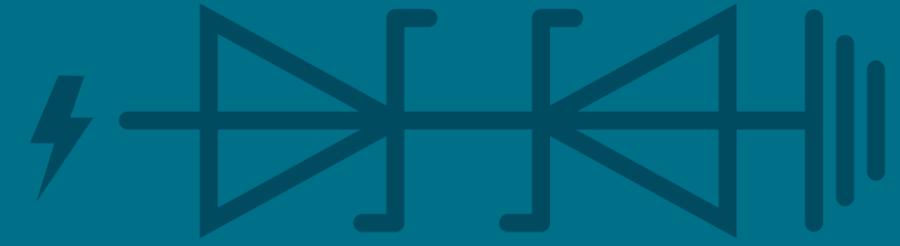
High-speed switching: t<sub>tr</sub> max = 50 ns

Low capacitance: C<sub>d</sub> max = 2 pF

AEC-Q101 qualified

### Controlled-avalanche switching diodes

$V_R$ max (V)	$V_F$ max (V)	@ $I_F$ (mA)	$I_R$ max (nA) @ $V_R$ max	$I_{FSM}$ max (A)	$I_{FRM}$ max (mA)	$C_d$ max (pF)	$t_{rr}$ max (ns)	Package	SOT23	SOT143B
										
									Size (mm)	2.9 x 1.3 x 1.0
$P_{tot}$ (mW)	250	250								
60	1	200	100	9	600	2.5	6			BAS56
90	1	200	100	10	600	35	50		BAS29	
									BAS31	
									BAS35	



## ESD protection, TVS, filtering and signal conditioning

### Low-leakage current-switching diodes

types in **bold** represent new products

$V_R$ max (V)	$V_F$ max (V)	@ $I_F$ (mA)	$I_R$ max (nA) @ $V_R$ max	$t_{rr}$ max (μs)	Package	SOD80C (MiniMelf)	SOD68 (DO-34)	SOT23	SOD123F	SOT323 (SC-70)	SOD323 (SC-76)	SOD523 (SC-79)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	DFN1006-2 (SOD882)
															
						Size (mm)	3.5 x 1.5 x 1.5	3.04 x 1.6 x 0.55	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.2 x 0.8 x 0.6	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48
$P_{tot}$ (mW)	300	500	250	830	250	400	500	540	250	250					
75	1	10	5	3					BAS116H		BAS416	BAS716			<b>BAS116L</b>
								BAS116					<b>BAS116QA</b>		
								BAV199		BAV199W					
								BAW156							
								BAV170					<b>BAV170QA</b>	<b>BAV170M</b>	
125	1	100	1	1.5 typ		BAS45AL	BAS45A								

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# ESD protection, TVS devices, and EMI filtering

## What you get when you choose NXP

### Solutions for wide application fields

- ▶ High-speed data lines
- ▶ General interfaces
- ▶ Automotive protection
- ▶ Supply lines

### A broad range of packages that simplify PCB design

### A quality product from an experienced, high volume supplier

- ▶ NXP is strongly committed to automotive quality standards
- ▶ NXP has a track record of more than 12 years in developing and producing ESD / TVS devices
- ▶ NXP is the #1 in ESD protection with a high production capacity

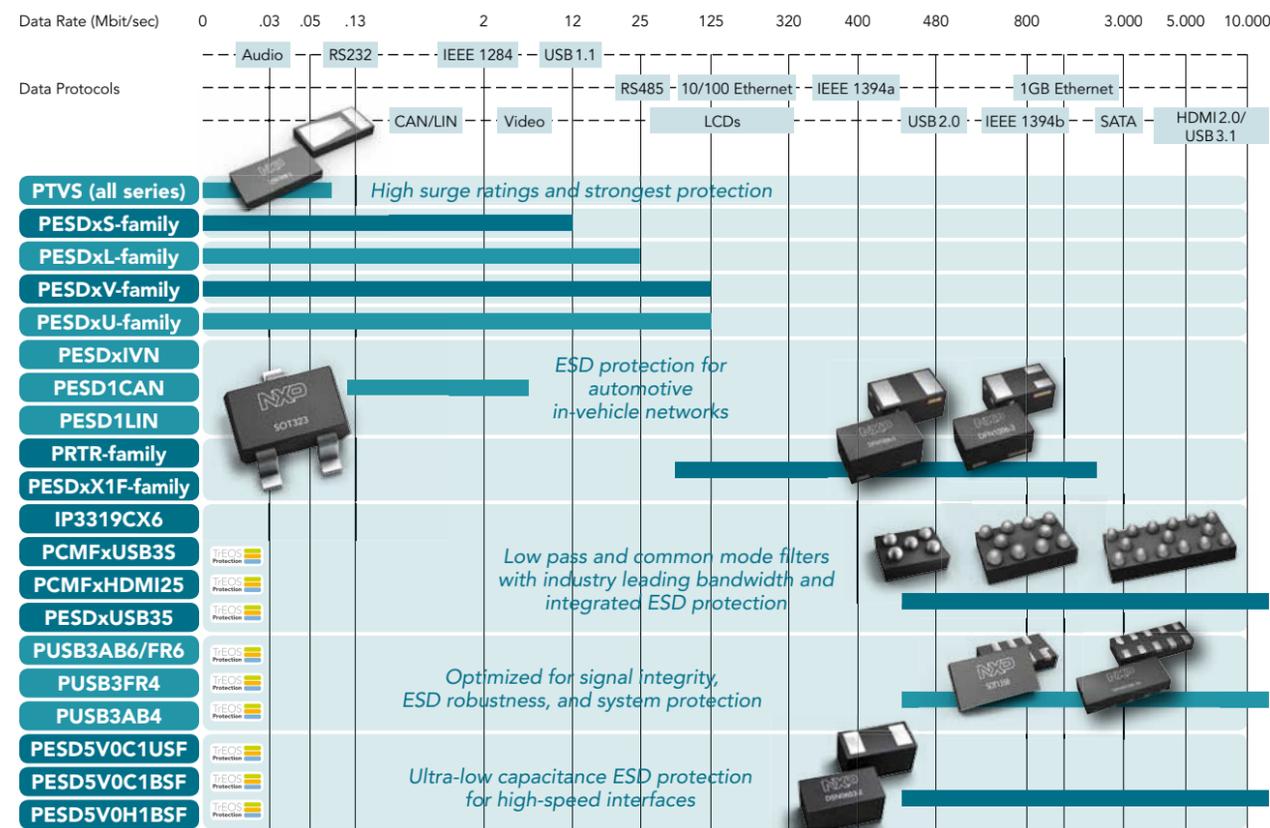
USB3 / Type C  
 USB2 / Type C  
 USB Vbus / charger port / Type C  
 NFC antenna  
 Wireless charging  
 Audio speaker  
 Battery contact, Vbat  
 Keys / buttons  
 SIM, SD3  
 Audio



CAN, LIN  
 FlexRay  
 BroadR-Reach  
 SENT  
 LVDS



### Portfolio Overview Diodes



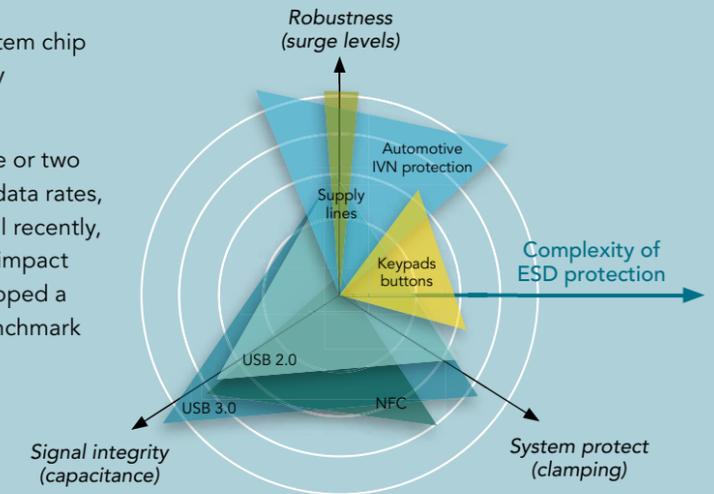
## The best system-chip protection for high-speed data lines (USB 3.1, Type-C connector)

### ESD protection characteristics that count

There are three key parameters for a perfect ESD protection device:

- ▶ High robustness against ESD pulses
- ▶ Low clamping / dynamic resistance – to protect the system chip
- ▶ Low capacitance – to maintain excellent signal integrity in high-speed interfaces

Some applications require good performance in only one or two of these areas. For the latest interfaces with the highest data rates, optimum performance in all three parameters is key. Until recently, improving one of these key parameters had a negative impact on the others. Addressing this challenge, NXP has developed a new ESD technology (TrEOS Protection) that delivers benchmark performance in all three key parameters.



**Extremely low clamping voltage**  
 Absorbing highest ESD pulses THE key for reliable system protection



▶ Low capacitance down to 0.1 pF  
 ▶ High robustness up to 9A, 8/20 μs  
 ▶ Packages optimized for communications interfaces

### TrEOS Protection devices

Type	device	VRWM (V)	Uni- or bidirectional	Cd typ (pF)	ESD rating max (kV) (Ω)	Rdyn TLP (Ω)	Number of protected lines	Package	Size (mm)
PUSB3FR4	ESD protection	3.3	uni	0.29	15	0.27	4	DFN2510A-10	2.5 x 1.0 x 0.48
PUSB3FR6	ESD protection	3.3	uni	0.35	15	0.29	6	DFN2111-7	2.1 x 1.1 x 0.48
PUSB3AB4	ESD protection	3.3	bi	0.17	15	0.4	4	DFN2510A-10	2.5 x 1.0 x 0.48
PUSB3AB6	ESD protection	3.3	bi	0.15	15	0.4	6	DFN2111-7	2.1 x 1.1 x 0.48
PCMF1USB3S	Common Mode Filter with ESD protection	5	uni	0.3	15	0.14	2	WLCSP5	0.8 x 1.2 x 0.5
PCMF2USB3S	Common Mode Filter with ESD protection	5	uni	0.3	15	0.14	4	WLCSP10	1.6 x 1.2 x 0.5
PCMF3USB3S	Common Mode Filter with ESD protection	5	uni	0.3	15	0.14	6	WLCSP15	2.4 x 1.2 x 0.5
PESD3V3C1BSF	ESD protection	3.3	bi	0.2	20	0.23	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0R1BSF	ESD protection	5	bi	0.1	10	0.45	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0H1BSF	ESD protection	5	bi	0.15	15	0.25	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0C1BSF	ESD protection	5	bi	0.2	20	0.23	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0C1USF	ESD protection	5	uni	0.45	20	0.1	1	DSN0603-2	0.6 x 0.3 x 0.3

ESD protection, TVS, filtering and signal conditioning

# Tiny but mighty – DSN0402

## Reliable ESD protection on minimal space

### DSN0402-2 (SOD992) features and benefits

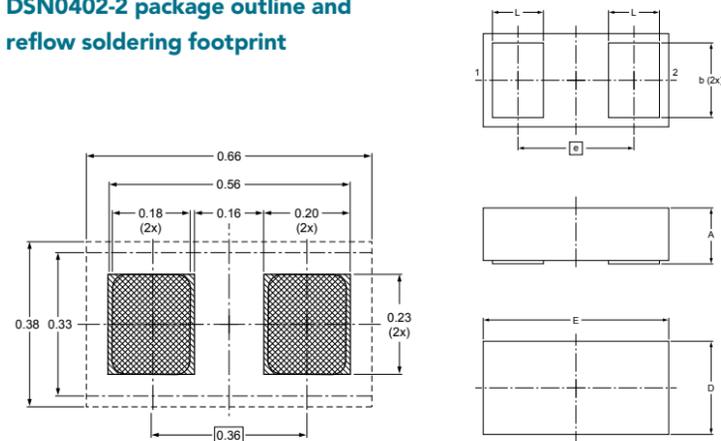
- ▶ Ultra-small dimensions: 0.4 x 0.2 mm (01005 inch)
- ▶ 45% less package area compared to DSN0603-2
- ▶ Only 120 µm in height
- ▶ Coated sidewalls enable easier soldering
- ▶ Polarity marking
- ▶ Halogen and antimony free; RoHS compliant



DSN0402-2 (SOD992)

Single package  
0.4 x 0.2 x 0.12 mm

### DSN0402-2 package outline and reflow soldering footprint



Dimensions (mm are the original dimensions)

Unit	A	E	D	L	b	e
max	0.14	0.42	0.22	0.12	0.17	
nom	0.12	0.40	0.20	0.11	0.16	0.25
min	0.10	0.38	0.18	0.10	0.15	

### Ultra-low capacitance in DSN0402

Type	V <sub>rwM</sub> (V)	Config	C <sub>d</sub> typ (pF)	C <sub>d</sub> max (pF)	V <sub>esd</sub> (kV)
PESD5V0F1BSH	5 V	Bi	0.25 pF	0.3 pF	8 kV

## Ultra low-capacitance ESD protection devices

### Ultra low-capacitance ESD protection devices – Part I

types in **bold** represent new products

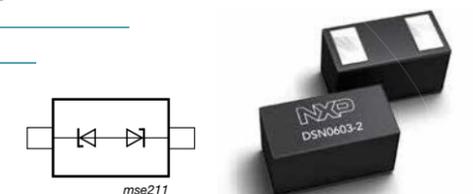
Unidirectional	Bidirectional	V <sub>rwM</sub> (V)	C <sub>d</sub> typ (pF)	C <sub>d</sub> max (pF)	ESD rating <sup>[1]</sup> max (kV)	Configuration	Type	Package	Size (mm)	
										Number of protected lines
		5	0.45	0.5	20		<b>PESD5V0C1USF</b>	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3	
		5	0.6	0.75	10		PESD5V0F1USF			
		5	0.95	1.15	8		PESD5V0X1ULD	DFN1006D-2 (SOD882D)	1.0 x 0.6 x 0.37	
			1.55	1.75	15		PESD5V0X1UALD			
		16	0.83	0.98	8		PESD16VX1UL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48	
		5	0.95	1.15	8		PESD5V0X1UB	SOD523 (SC-79)	1.2 x 0.8 x 0.6	
			1.55	1.75	15		PESD5V0X1UAB			
		80	0.6	0.75	30			NUP1301U	SOT323	2.0 x 1.25 x 0.95
								NUP1301	SOT23	2.9 x 1.3 x 1.0
0	1	5	0.3	0.4	8			<b>PESD5V0F1BSH</b>	DSN0402-2 (SOD992)	0.4 x 0.2 x 0.12
		3.3	0.2	0.25	20	<b>PESD3V3C1BSF</b>			0.6 x 0.3 x 0.3	
		5	0.1	0.15	10	<b>PESD5V0R1BSF</b>				
			0.15	0.2	15	<b>PESD5V0H1BSF</b>				
		5.5	0.2	0.25	20	<b>PESD5V0C1BSF</b>				
			0.25	0.3	10	PESD5V0F1BSF		DSN0603-2 (SOD962)		
		3.3	–	1.1	20	PESD5V0F1BRSF				
		5.0	–	1.1		<b>PESD3V3X1BCSF</b>				
		18	0.28	0.45	10	<b>PESD5V0X1BCSF</b>				
		24	0.25	0.4	10	<b>PESD18VF1BSF</b>				
						<b>PESD24VF1BSF</b>				
		5	0.4	0.55	10	PESD5V0F1BLD		DFN1006D-2 (SOD882D)	1.0 x 0.6 x 0.37	
		3.3	1.3	1.6	9	PESD5V0F1BRDL				
		5.5	0.4	0.55	10	PESD3V3X1BL		DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48	
			0.49	0.6	8	PESD5V0F1BL				
			0.85	0.95	15	PESD5V0X1BCL				
			0.9	1.3	9	PESD5V0X1BCAL				
			18	0.35	0.5	10				PESD5V0X1BL
		24	0.3	0.45	10	PESD18VF1BL				
						PESD24VF1BL				

<sup>[1]</sup> according to IEC 61000-4-2 (contact discharge)

### In the spotlight

#### Ultra low-capacitance ESD protection in DSN0603-2: PESD5V0H1BSF

- Bidirectional protection for one data line in DSN0603-2
- Ultra-low line capacitance of 0.15 pF
- Ultra-low clamping
- Minimized capacitance variation over voltage
- High ESD robustness = 15 kV
- Ultra-small package DSN0603-2 (0.6 x 0.3 x 0.3 mm)



ESD protection, TVS, filtering and signal conditioning

## Ultra low-capacitance ESD protection devices – Part 2

types in **bold** represent new products

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line typ</sub> (pF)	C <sub>line max</sub> (pF)	ESD rating <sup>(1)</sup> max (kV)	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional								
2	1	5	0.5	0.65	10		PESD5V0X2UMB	DFN1006B-3 (SOT883B)	1.0 x 0.6 x 0.37
							PESD5V0X2UM	DFN1006-3 (SOT883)	1.0 x 0.6 x 0.48
			PESD5V0X2UAMB	DFN1006B-3 (SOT883B)	1.0 x 0.6 x 0.37				
			PESD5V0X2UAM	DFN1006-3 (SOT883)	1.0 x 0.6 x 0.48				
	0	5.5	1	1.5	8		PESD5V0X1BQ	SOT663	1.6 x 1.2 x 0.55
							PESD5V0X1BT	SOT23	2.9 x 1.3 x 1.0
	0	5.5	1.8	-	12		PRTR5V0U2X	SOT143B	2.9 x 1.3 x 1.0
							PRTR5V0U2AX		
							1	1.5	8

<sup>(1)</sup> according to IEC 61000-4-5 (contact discharge)

### In the spotlight

#### Lowest capacitance ESD protection in DFN1006B-3: PESD5V0X2UAMB

Unidirectional double protection for two signal lines

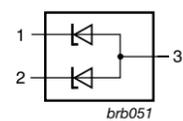
Ultra-low line capacitance of 0.8 pF

Very low package height of 0.37 mm typ

High ESD robustness of 15 kV

AEC-Q101 qualified

Ideal for high-speed data lines, portable electronics, and communication systems



brb051



## Ultra low-capacitance ESD protection devices – Part 3

types in **bold** represent new products

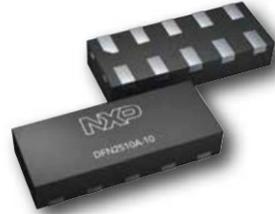
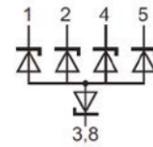
Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line typ</sub> (pF)	C <sub>line max</sub> (pF)	ESD rating <sup>(1)</sup> max (kV)	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional								
4	0	5.5	1	-	8		IP4220CZ6	SOT457 (SC-74)	2.9 x 1.5 x 1.0
							IP4221CZ6-S	DFN1410-6 (SOT886)	1.45 x 1.0 x 0.48
							IP4221CZ6-XS	DFN1010-6 (SOT891)	1.0 x 1.0 x 0.48
							PRTR5V0U4D	SOT457 (SC-74)	2.9 x 1.5 x 1.0
	0	5.5	0.8	-	12		IP4285CZ9-TBB	DFN2110-9 (SOT1178)	2.1 x 1.0 x 0.48
							PUSB2X4D	SOT457 (SC-74)	2.9 x 1.5 x 1.0
							PUSB2X4Y	SOT363 (SC-88)	2.0 x 1.25 x 0.95
	0	5.5	0.6	-	8		IP4283CZ10-TBR	DFN2510A-10 (SOT1176)	2.5 x 1.0 x 0.48

<sup>(1)</sup> according to IEC 61000-4-5 (contact discharge)

In the spotlight

**PUSB3AB4 - ESD protection in very small DFN2510A-10 package for USB3.1 @ 10 Gbps and Thunderbolt**

- Protects four very fast data lines of sensitive system chips
- Lowest clamping in the 0.2 pF class
- Very small DFN2510A-10 package (2.5 x 1.0 x 0.48 mm)
- Capacitance < 0.2 pF



Ultra low-capacitance ESD protection devices – Part 4

types in **bold** represent new products

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line typ</sub> (pF)	C <sub>line max</sub> (pF)	ESD rating <sup>[1]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional									
4	0	5.5	0.5	-	10	-		IP4294CZ10-TBR	DFN2510A-10 (SOT1176)	2.5 x 1.0 x 0.48
								PUSB3F96		
		3.3	0.27	-	15	0.1		PUSB3FR4		
0	3	3.3	0.17	0.2				PUSB3AB4		
5	4	5	0.55	0.7	8	0.1		PESD5V0F5UF	DFN1410-6 (SOT886)	1.45 x 1.0 x 0.48
								PESD5V0F5UV	SOT666	1.6 x 1.2 x 0.55
0	6	5.5	0.27	0.35	10			PUSB3TB6	DFN2111-7 (SOT1358)	2.1 x 1.1 x 0.48
6	0	3.3	0.25	-	15	0.1		PUSB3FR6		
0	6	3.3	0.15	0.2	15			PUSB3AB6		

<sup>[1]</sup> according to IEC 61000-4-2 (contact discharge)

Low-capacitance ESD protection devices – Part I

types in **bold** represent new products

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line typ</sub> (pF)	C <sub>line max</sub> (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional										
1	0	3.3	34	40	45	30	0.3		PESD3V3L1UL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48
		5	25	30	42	26	0.1		PESD5V0L1UL		
		5	25	30	42	26	0.1		PESD5V0L1ULD	DFN1006D-2 (SOD882D)	1.0 x 0.6 x 0.37
		3.3	34	40	45	30	0.3		PESD3V3L1UB	SOD523 (SC-79)	1.2 x 0.8 x 0.6
		5	25	30	42	26	0.1		PESD5V0L1UB		
		5	25	30	42	26	0.1		PESD5V0L1UA	SOD323 (SC-76)	1.7 x 1.25 x 0.95
		5	12	15	10	30	0.1		PESD5V0L1USF	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3
		3.3	2.6	3.1	-	9	0.1 (@ 3 V)		PESD3V3U1UL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48
		5	2	2.6	-	9	0.1		PESD5V0U1UL		
		3.3	2.6	3.1	-	9	0.1 (@ 3 V)		PESD3V3U1UB	SOD523 (SC-79)	1.2 x 0.8 x 0.6
		5	2	2.6	-	9	0.1		PESD5V0U1UB		
		3.3	2.6	3.1	-	9	0.1 (@ 3 V)		PESD3V3U1UA	SOD323 (SC-76)	1.7 x 1.25 x 0.95
		5	2	2.6	-	9	0.1		PESD5V0U1UA		
		0	1	5.5	12	15.4	35		30	0.1	
3.3	101			-	500	30	2	PESD3V3L1BA	SOD323 (SC-76)	1.7 x 1.25 x 0.95	
5	75			-	500	30	1	PESD5V0L1BA			
12	19			-	200	30	0.05	PESD12VL1BA			
15	16			-	200	30	0.05	PESD15VL1BA			
24	11			-	200	23	0.05	PESD24VL1BA			

<sup>[1]</sup> 8 / 20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321

<sup>[2]</sup> according to IEC 61000-4-2 (contact discharge)

ESD protection, TVS, filtering and signal conditioning

## Low-capacitance ESD protection devices – Part 2

types in **bold** represent new products

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line</sub> typ (pF)	C <sub>line</sub> max (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional										
0	1	5	11	13	45	30	0.01		PESD5V0V1BL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48
		5	11	13	45	30	0.01		PESD5V0V1BLD	DFN1006D-2 (SOD882D)	1.0 x 0.6 x 0.37
		5	11	13	45	30	0.01		PESD5V0V1BB	SOD523 (SC-79)	1.2 x 0.8 x 0.6
		5	11	13	45	30	0.01		PESD5V0V1BA	SOD323 (SC-76)	1.7 x 1.25 x 0.95
		5	5.3	6	10	20	0.1		PESD5V0V1BCSF	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3
		5	5.3	6	20	25	0.1		PESD5V0V1BDSF		
		5.5	3.5	4.5	8	15	0.1		PESD5V0V1BSF		
		12	17	25	290	30	0.01		PESD12VV1BL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48
		15	8	10	-	15	0.1		IP4302CX2/A	WLCSP2	0.7 x 0.52 x 0.40
		5	2.9	3.5	-	10	0.1		PESD5V0U1BL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48
									PESD5V0U1BLD	DFN1006D-2 (SOD882D)	1.0 x 0.6 x 0.37
									PESD5V0U1BB	SOD523 (SC-79)	1.2 x 0.8 x 0.6
									PESD5V0U1BA	SOD323 (SC-76)	1.7 x 1.25 x 0.95
PESD5V0U1BBL	DFN1006-2 (SOD882)							1.0 x 0.6 x 0.48			
2	1	3.3	22	28	30	15	0.3		PESD3V3L2UM	DFN1006-3 (SOT883)	1.0 x 0.6 x 0.48
									PESD5V0L2UM	DFN1006B-3 (SOT883B)	1.0 x 0.6 x 0.37
									PESD5V0L2UMB	DFN1006-3 (SOT883)	1.0 x 0.6 x 0.37
									PESD5V0L2UU	SOT323 (SC-70)	2.0 x 1.25 x 0.95
									PESD6V0L2UU	SOT323 (SC-70)	2.0 x 1.25 x 0.95

<sup>[1]</sup> 8 / 20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321

<sup>[2]</sup> according to IEC 61000-4-5 (contact discharge)

In the spotlight

### PESD12VV1BL: Lowest capacitance ESD protection in DFN1006-2

Bidirectional protection for one data line

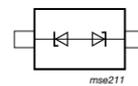
Very low line capacitance of 17 pF

High ESD robustness of 30 kV

AEC-Q101 qualified

Ultra-small package DFN1006-2 (SOD882) with a height of only 0.48 mm typ

Ideal for portable electronics, communication systems, or audio and video equipment



## Low-capacitance ESD protection devices – Part 3

types in **bold** represent new products

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line</sub> typ (pF)	C <sub>line</sub> max (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional										
0	2	3.3	101	-	350	30	2		PESD3V3L2BT	SOT23	2.9 x 1.3 x 1.0
		5	75			30	1		PESD5V0L2BT		
		12	19			30	0.05		PESD12VL2BT		
		15	16	30	0.05	PESD15VL2BT					
		24	11	23	0.05	PESD24VL2BT					
		35	45	130	0.1	PESD5V0S2BT					
		-	-	-	-	PESD5V0U2BT					
		5	2.9	3.5	-	10	0.1		PESD5V0U2BM	DFN1006-3 (SOT883)	1.0 x 0.6 x 0.48
									PESD5V0U2BMB	DFN1006B-3 (SOT883B)	1.0 x 0.6 x 0.37
									<b>PESD5V0V2BM</b>	DFN1006-3 (SOT883)	1.0 x 0.6 x 0.37
									<b>PESD5V0V2BMB</b>	DFN1006B-3 (SOT883B)	1.0 x 0.6 x 0.37
									PESD5V0U1BL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48
		4	3	3.3	22	28	30		20	0.3	
5	16			19	30	20	0.025	PESD5V0L4UF			
3.3	22			28	30	20	0.3	PESD3V3L4UW	SOT665	1.6 x 1.2 x 0.55	
5	16			19	30	20	0.025	PESD5V0L4UW	SOT665	1.6 x 1.2 x 0.55	
4	3	3.3	22	28	30	20	0.3		PESD3V3L4UG	SOT353 (SC-88A)	2.0 x 1.25 x 0.95
		5	16	19	30	20	0.025		PESD5V0L4UG		
		3.3	13	17	25	10	1		PESD3V3V4UK	DFN1010-6 (SOT891)	1.0 x 1.0 x 0.48
		5	12	15	25	15	0.3		PESD5V0V4UK		
		9	6.5	10	28	8	0.1		PESD9V0V4UK		
		3.3	15	18	16	12	0.3		PESD3V3V4UW	SOT665	1.6 x 1.2 x 0.55
		5	12	15	16	12	0.025		PESD5V0V4UW		

<sup>[1]</sup> 8 / 20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321

<sup>[2]</sup> according to IEC 61000-4-5 (contact discharge)

ESD protection, TVS, filtering and signal conditioning

Low-capacitance ESD protection devices – Part 4

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line typ</sub> (pF)	C <sub>line max</sub> (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional										
0	4	5	2.9	3.5	-	10	0.1		PESD5V0U4BF	DFN1410-6 (SOT886)	1.45 x 1.0 x 0.48
		5	2.9	3.5	-	10	0.1		PESD5V0U4BW	SOT665	1.6 x 1.2 x 0.55
5	4	3.3	20	24	28	15	2		PESD3V3LSUK	DFN1010-6 (SOT891)	1.0 x 1.0 x 0.48
		5	18.5	22	30	20	0.5		PESD5V0LSUK		
		3.3	22	28	25	20	0.3		PESD3V3LSUF	DFN1410-6 (SOT886)	1.45 x 1.0 x 0.48
		5	16	19	25	20	0.025		PESD5V0LSUF		
		3.3	22	28	25	20	0.3		PESD3V3LSUV	SOT666	1.6 x 1.2 x 0.55
		5	16	19	25	20	0.025		PESD5V0LSUV		
		3.3	22	28	25	20	0.3		PESD3V3LSUY	SOT363 (SC-88)	2.0 x 1.25 x 0.95
		5	16	19	25	20	0.025		PESD5V0LSUY		
0	5	5	2.9	3.5	-	10	0.1		PESD5V0U5BF	DFN1410-6 (SOT886)	1.45 x 1.0 x 0.48
		5	2.9	3.5	-	10	0.1		PESD5V0U5BV	SOT666	1.6 x 1.2 x 0.55

<sup>[1]</sup> 8 / 20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321

<sup>[2]</sup> according to IEC 61000-4-5 (contact discharge)

Standard ESD protection devices – Part I

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line typ</sub> (pF)	C <sub>line max</sub> (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)		
Unidirectional	Bidirectional												
1	0	5	35	42	40	30	0.1		PESD5V0S1USF	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3		
		3.3	207	300	150	30	2		PESD3V3S1UL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48		
		5	152	200	150	30	1		PESD5V0S1UL				
		12	38	75	150	30	0.05		PESD12VS1UL				
		15	32	70	150	30	0.05		PESD15VS1UL				
		24	23	50	150	23	0.05		PESD24VS1UL				
		36	18	30	150	30	0.01		PESD36VS1UL				
		5	152	200	150	30	1		PESD5V0S1ULD	DFN1006D-2 (SOD882D)	1.0 x 0.6 x 0.37		
		12	38	75	150	30	0.05		PESD12VS1ULD				
		15	32	70	150	30	0.05		PESD15VS1ULD				
		24	23	50	150	23	0.05		PESD24VS1ULD				
		3.3	207	300	330	30	2		PESD3V3S1UB			SOD523 (SC-79)	1.2 x 0.8 x 0.6
		5	152	200	260	30	1		PESD5V0S1UB				
		12	38	75	180	30	0.05		PESD12VS1UB	SOD323 (SC-76)	1.7 x 1.25 x 0.95		
		15	32	70	160	30	0.05		PESD15VS1UB				
		24	23	50	160	23	0.05		PESD24VS1UB	SOD323 (SC-76)	1.7 x 1.25 x 0.95		
		5	480	530	890	30	4		PESD5V0S1UA				
		12	160	180	600	30	0.1		PESD12VS1UA	SOD323F (SC-90)	1.7 x 1.25 x 0.7		
		24	23	50	160	23	0.05		PESD24VS1UA				
		5	480	530	890	30	4		PESD5V0S1UJ	SOD523 (SC-79)	1.2 x 0.8 x 0.6		
		12	160	180	600	30	0.1		PESD12VS1UJ				
		2.5	229	300	260	30	6		PESD5Z2.5	SOD523 (SC-79)	1.2 x 0.8 x 0.6		
		3.3	172	200	260	30	0.05		PESD5Z3.3				
		5	89	150	180	30	0.05		PESD5Z5.0				
6	78	150	180	30	0.01	PESD5Z6.0							
7	69	150	180	30	0.01	PESD5Z7.0							
12	35	75	200	30	0.01	PESD5Z12							
0	1	5.5	35	45	100	30	0.1		PESD5V0S1BSF	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3		
		5	35	45	130	30	0.1		PESD5V0S1BL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48		
		5	35	45	130	30	0.1		PESD5V0S1BLD	DFN1006D-2 (SOD882D)	1.0 x 0.6 x 0.37		
		5	35	45	130	30	0.1		PESD5V0S1BB	SOD523 (SC-79)	1.2 x 0.8 x 0.6		
		5	35	45	130	30	0.1		PESD5V0S1BA	SOD323 (SC-76)	1.7 x 1.25 x 0.95		

<sup>[1]</sup> 8 / 20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321

<sup>[2]</sup> according to IEC 61000-4-2 (contact discharge)

Standard ESD protection devices – Part 2

types in **bold** represent new products

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line typ</sub> (pF)	C <sub>line max</sub> (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>pk</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)		
Unidirectional	Bidirectional												
2	1	3.3	200	275	150	23	3		PESD3V3S2UQ	SOT663	1.6 x 1.2 x 0.55		
		5	150	215	150	30	0.3		PESD5V0S2UQ				
		12	38	100	150	30	0.03		PESD12VS2UQ				
		15	32	70	150	30	0.05		PESD15VS2UQ				
		24	23	50	150	23	0.05		PESD24VS2UQ				
		3.3	207	300	330	30	2		PESD3V3S2UT				
		5.2	152	200	260	30	1	PESD5V2S2UT					
		12	38	75	180	30	1	PESD12VS2UT					
		15	32	70	160	30	1	PESD15VS2UT					
		24	23	50	160	23	1	PESD24VS2UT					
		36	17	35	160	30	1 (@ 30 V)	PESD36VS2UT					
		3.3	207	300	330	30	2	PESD3V3S2UAT		PESD3V3S2UAT	SOT23	2.9 x 1.3 x 1.0	
		5	152	200	260	30	1	PESD5V0S2UAT					
		15	32	70	160	30	0.05	PESD15VS2UAT					
		24	23	50	160	23	0.05	PESD24VS2UAT					
		0	2	5	35	45	130	30	0.1		<b>PESD5V0S2BQA</b>	SOT1215	1.1 x 1.0 x 0.37
4	3	3.3	110	300	110	30	1 (@ 3 V)		PESD3V3S4UF	DFN1410-6 (SOT886)	1.45 x 1.0 x 0.48		
		5	85	220	110	30	0.1 (@ 4.3 V)		PESD5V0S4UF				
		3	107	125	-	8	1		BZA956A	SOT665	1.6 x 1.2 x 0.55		
		4	90	105	-	8	0.5		BZA962A				
		4.3	78	90	-	8	0.1		BZA968A				
		3	200	240	-	8	2		BZA856A				
		3	200	240	-	8	2		BZA456A	SOT457 (SC-74)	2.9 x 1.5 x 1.0		
		4	165	200	-	15	0.7		BZA462A				
		15	37	48	-	8	0.1		BZA420A				
		3.3	215	300	200	30	0.8		PESD3V3S4UD				
		5	165	220	200	30	0.2		PESD5V0S4UD				
		24	40	70	200	23	0.015		PESD24VS4UD				
		5	4	3.3	215	300	200	30	0.8		PESD3V3S5UD	SOT457 (SC-74)	2.9 x 1.5 x 1.0
				5	165	220	200	30	0.2		PESD5V0S5UD		
12	73			100	200	30	0.015	PESD12VS5UD					
15	60			90	200	30	0.015	PESD15VS5UD					
24	45			70	200	23	0.015	PESD24VS5UD					
0	4	5	45	75	-	15	0.1		BZA408B				

<sup>[1]</sup> 8 / 20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321

<sup>[2]</sup> according to IEC 61000-4-2 (contact discharge)

USB 2.0 protection and filtering

types in **bold** represent new products

Baseband interface	Number of protected lines	R <sub>line</sub>	C <sub>line</sub> (pF)	Remark	Type	Package	Size (mm)		
USB2.0 (Plastic package)	2		1.0	ESD protection for up to 2 ultra high-speed datalines	PRTR5V0U2X	SOT143B	2.9 x 1.3 x 1.0		
			1.8	ESD protection for up to 2 ultra high-speed datalines with 12 kV ESD robustness	PRTR5V0U2AX				
	3 + 1				ESD protection for up to 2 ultra high-speed datalines	PRTR5V0U2F	DFN1410-6 (SOT886)	1.45 x 1.0 x 0.48	
					USB protection for USB OTG with 5.5 V Vbat protection	PUSBM5V5X4-TL	DFN1616-6 (SOT1189)		
					USB protection for USB OTG with 12 V Vbat protection	PUSBM12VX4-TL			
					USB protection for USB OTG with 30 V Vbat protection	PUSBM30VX4-TL			
	4			0.8	Very low clamp ESD protection for USB2.0 high-speed with 12 kV IEC ESD protection	<b>PUSB2X4Y</b>	SOT363 (SC-88)	2.0 x 1.25 x 0.95	
					Very low clamp ESD protection for USB2.0 high-speed with 12 kV IEC ESD protection	<b>PUSB2X4D</b>	SOT457 (SC-74)		
					Dual ESD protection for USB2.0 high-speed, SD-card, SIM card	IP4220CZ6	DFN1410-6 (SOT886)		
					Dual ESD protection for USB2.0 high-speed, SD-card, SIM card	PRTR5V0U4D			
					ESD protection for USB2.0 high-speed, SD-card, SIM card	IP4221CZ6-S	DFN1410-6 (SOT886)		
					Dual ESD protection for USB2.0 high-speed, SD-card, SIM-card	IP4221CZ6-XS	DFN1010-6 (SOT891)		

ESD protection, TVS, filtering and signal conditioning

Common Mode Filter for USB 2.0

types in **bold** represent new products

Baseband interface	Number of protected lines	C <sub>line</sub> (pF)	ESD rating <sup>[1]</sup> max (kV)	Remark	Type	Package	Size (mm)
USB2.0	2	1.5	15	Common Mode filter with ESD protection for high-speed interfaces such as USB 2.0	<b>IP3319CX6</b>	WLCSP6	1.34 x 0.95 x 0.57

<sup>[1]</sup> according to IEC 61000-4-2 (contact discharge)

**In the spotlight**

**IP3319CX6 - Common Mode Filter for USB2.0**

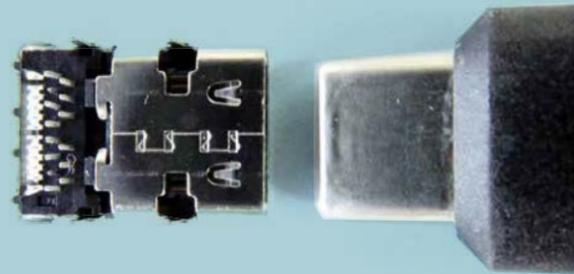
- Very wide differential pass band >1 GHz
- Very broadband Common Mode attenuation
- Very low clamping ESD protection, excellent SoC protection
- Very small WLCSP6 package (footprint area 1.34 x 0.95 mm)

# NXP paves the way for USB Type-C connector

## USB 3.x protection and filtering



USB Type-C evaluation board with NXP protection solutions



USB Type-C receptacle

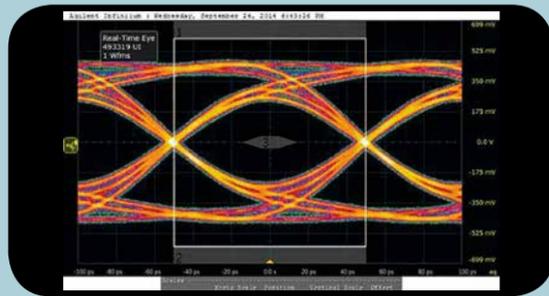
USB Type-C plug

### PUSB3FR4 and the new Type-C connector

The perfect match. PUSB3FR4 supports protection for the new Type-C connector, in order to enable direction-agnostic connection, faster charging and the smallest solution to support SuperSpeed USB.

### USB 3.1 introduces data rates up to 10 Gbps

As shown in the eye diagram, NXP offers protection, which supports data rates up to 10 Gbps with low capacitance and optimized package layouts.



PUSB3FR4 on standard FR4 testboard

# Common Mode Filter for USB 3.x



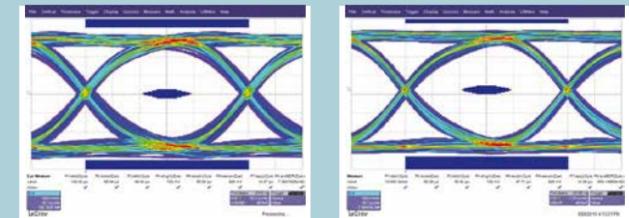
### NXP's Common Mode Filter offer:

- ▶ Best in class system-level protection due to deep snap-back and very low dynamic resistance
- ▶ Very wide-band Common Mode rejection to cover all critical frequencies
- ▶ Improved RF performance and small footprint compared to separate ESD/CMF solutions
- ▶ Protection for MIPI CSI, DSI, USB3.x, and HDMI 2.0

### Key Features of PCMFxUSB3S

- ▶ ESD protection is available in the same footprint, allowing last-minute changes between Common Mode Filter with ESD (PCMF) and ESD protection only (PESD)
- ▶ No ferrite saturation, widest differential pass-band compared to other Si-based solutions and Ferrite-based solutions with additional 15GHz ESD protection
- ▶ Lowest ESD-clamping compared to all other Common Mode Filters: provides high system-level robustness even for the most sensitive USB3.1 transceiver
- ▶ Strongest Common Mode rejection for the USB3.1 fundamentals at 2.5 and 5 GHz of all USB3 Common Mode Filters
- ▶ Smallest footprint
- ▶ PCMF1USB3S allows very easy RF-routing together with the new USB Type-C connector

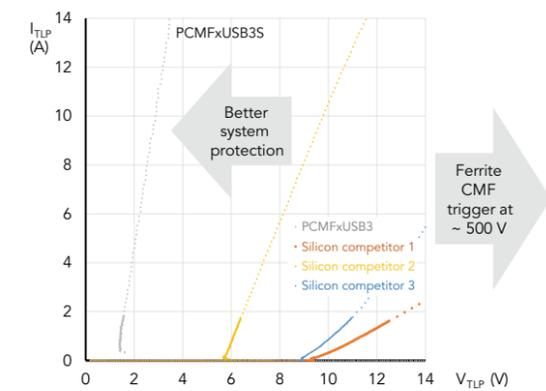
### USB 3.x 10 Gbps eye diagrams



PCMFxUSB3S

Only test board

### Clamping performance of PCMFxUSB3S compared to other silicon Common Mode Filter



The superior system-level protection is shown in the lower TLP clamping voltage

ESD protection, TVS, filtering and signal conditioning

## USB 3.x and eSATA protection and filtering for high-speed and super-speed lines

types in **bold** represent new products

Baseband interface	Number of protected lines	C <sub>d</sub> (pF)	ESD rating max (kV)	R <sub>dyn</sub> (Ω)	Remark	Type	Package	Size (mm)
USB3.0 - 5 Gbps	4	0.55	8	0.3 / 0.4	ESD Protection for high-speed interfaces	IP4292CZ10-TBR	DFN2510A-10 (SOT1176)	2.5 x 1.0 x 0.48
		0.5	10			PUSB3F96		
USB3.1 - 10 Gbps	4	0.17	15	0.4	TrEOS Protection	PUSB3AB4	DFN2111-7 (SOT1358)	2.1 x 1.1 x 0.48
		0.29	15			PUSB3FR6		
		0.27	15			PUSB3TB6		
	6	0.15	15	0.4		PUSB3AB6	DFN2510A-10 (SOT1176)	2.5 x 1.0 x 0.48
						PUSB3FR4		
	1	0.1	10	0.45		PESD5V0R1BSF	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3
						PESD5V0H1BSF		
						PESD5V0C1BSF		
						PESD3V3CIBSF		
						PESD5V0C1USF		
	2	0.25	15	0.16		PESD1USB3S	WLCSP5	1.2 x 0.8 x 0.6
PCMF1USB3S								

[http://www.nxp.com/products/discretes-and-logic/esd-protection-tvs-filtering-and-signal-conditioning/usb-type-c-protection-family:GRP\\_13811](http://www.nxp.com/products/discretes-and-logic/esd-protection-tvs-filtering-and-signal-conditioning/usb-type-c-protection-family:GRP_13811)

## Common Mode Filter for USB 3.x

types in **bold** represent new products

Baseband interface	Number of protected line pairs	Type	Differential Mode 3dB frequency	Common Mode rejection 800 MHz - 10 GHz	C <sub>d</sub> typical	V <sub>RFWM</sub>	ESD rating	Channel series resistance	Package	Size (mm)
USB3.x	1	PCMF1USB3S	6 GHz	>12	0.3	5	15	3	WLCSP5	0.8 x 1.2 x 0.5
	2	PCMF2USB3S							WLCSP10	1.6 x 1.2 x 0.5
	3	PCMF3USB3S							WLCSP15	2.4 x 1.2 x 0.5
	1	PESD1USB3S	17 GHz	ESD protection only	0.5				WLCSP5	0.8 x 1.2 x 0.5
	2	PESD2USB3S							WLCSP10	1.6 x 1.2 x 0.5
	3	PESD3USB3S							WLCSP15	2.4 x 1.2 x 0.5

<sup>1</sup> according to IEC 61000-4-2 (contact discharge)

## Common Mode Filter for video interfaces

types in **bold** represent new products

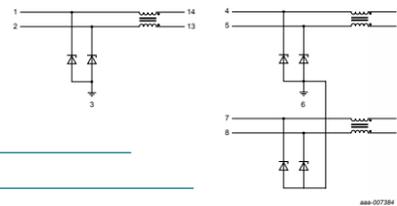
Baseband interface	Number of protected line pairs unidirectional	Number of protected line pairs bidirectional	Type	Differential Mode 3 dB frequency (typ.)	$C_{line}$ pF typical	$V_{RWM}$	ESD rating <sup>(1)</sup> max (kV)	Channel series resistance	Package	Size (mm)
MIPI D-PHY	2		PCMF2DFN1	>2 GHz	0.8			5 Ω	DFN2520-9 (SOT1333)	2.5 x 2.0 x 0.48
	3		PCMF3DFN1	>2 GHz					DFN4020-14 (SOT1334)	4.0 x 2.0 x 0.48
HDMI2.0	1	0	PCMF1HDMI2S	>6 GHz	0.3	5	15	3 Ω	WLCSP5	0.8 x 1.2 x 0.5
	2		PCMF2HDMI2S						WLCSP10	1.6 x 1.2 x 0.5
	3		PCMF3HDMI2S						WLCSP15	2.4 x 1.2 x 0.5

<sup>(1)</sup> according to IEC 61000-4-2 (contact discharge)

### In the spotlight

#### PCMFxHDMI2S series: 1, 2 and 3 line pair Common Mode Filters with ESD protection for HDMI 1.4 and 2.0

- Very wide differential pass band >6 GHz
- Very broadband Common Mode attenuation
- Very low clamping ESD protection, excellent SoC protection
- Smallest footprint



## Ethernet protection

types in **bold** represent new products

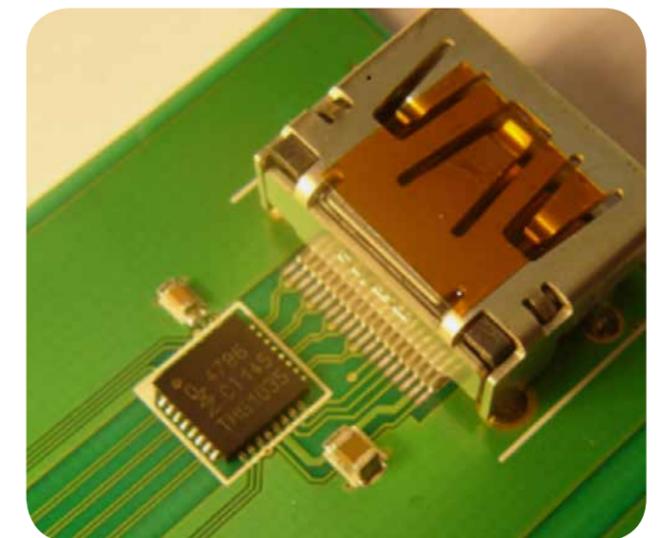
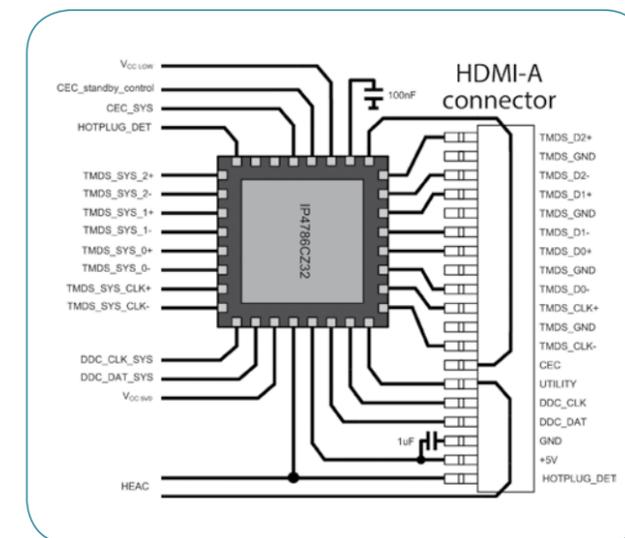
Baseband interface	Number of protected lines	$C_{line}$ (pF)	Remark	Type	Package	Size (mm)
LAN	1	0.6	Ethernet ESD protection $V_{RWM} = 3.3$ V	PESD3V3U1UT	SOT23	2.9 x 1.3 x 1.0
			Ethernet ESD protection $V_{RWM} = 5.0$ V	PESD5V0U1UT		
			Ethernet ESD protection $V_{RWM} = 12$ V	PESD12VU1UT		
			Ethernet ESD protection $V_{RWM} = 15$ V	PESD15VU1UT		
	Ethernet ESD protection $V_{RWM} = 24$ V	PESD24VU1UT				
	4	1	Ethernet ESD protection	IP4220CZ6	SOT457 (SC-74)	2.9 x 1.5 x 1.0

## HDMI and memory-card signal conditioning

types in **bold** represent new products

Interface	Number of protected lines	Buffer	Level shifter	$C_{line}$ (pF)	Resistor (Ω)	LDO	Remark	Type	Package	Size (mm)
HDMI tx	5			-		-	Fully integrated for HDMI control lines including buffer for DDC, CEC, and Hot Plug module	IP4791CZ12	DFN2521-12 (SOT1156)	2.5 x 2.1 x 0.48
	13	yes	yes	100 Ω differential impedance	internal	CEC LDO, 5 V LDO	Fully integrated HDMI source solution with current limiter, buffer, and level shifter for DDC, CEC, and Hot Plug	IP4786CZ32	DFN5050-32 (SOT617)	5.0 x 5.0 x 0.85
							Fully integrated HDMI sink solution with buffer, and level shifter for DDC, CEC, and Hot Plug			
							Fully integrated HDMI source solution with enhanced ESD protection, current limiter, buffer, and level shifter for DDC, CEC, and Hot Plug			
HDMI2.0	13	yes	yes	100 Ω differential impedance	integrated	-	Fully integrated HDMI source solution with small package, current limiter, buffer, and level shifter for DDC, CEC, and Hot Plug	IP4786CZ32S	DFN4040-32 (SOT1318-1)	4.0 x 4.0 x 0.50
							Fully integrated HDMI source solution with current limiter, buffer, and level shifter for DDC, CEC, and Hot Plug	<b>IP4786CZ32</b>		5.0 x 5.0 x 0.85
							Fully integrated HDMI source solution with enhanced ESD protection, current limiter, buffer, and level shifter for DDC, CEC, and Hot Plug	<b>IP4787CZ32</b>	DFN5050-32 (SOT617)	5.0 x 5.0 x 0.85
							Fully integrated HDMI source solution with enhanced ESD protection, current limiter, buffer, and level shifter for DDC, CEC, and Hot Plug	<b>IP4788CZ32</b>		5.0 x 5.0 x 0.85
							Fully integrated HDMI source solution in a small package with current limiter, buffer, and level shifter for DDC, CEC, and Hot Plug	<b>IP4786CZ32S</b>	DFN4040-32 (SOT1318-1)	4.0 x 4.0 x 0.5
SD3.0	6	yes	yes	-	internal	-	SD 3.0-compliant memory card with integrated dual voltage-level translator with EMI filter and ESD protection	<b>IP4856CX25/C</b>	WLCSP25	2.4 x 2.4 x 0.4
							Fully integrated SD 3.0 card level shifter with buffer technology, LDO, and EMI filter	IP4855CX25	WLCSP25	2.4 x 2.4 x 0.4

### The IP478x-series offers a complete HDMI-interface in one package.

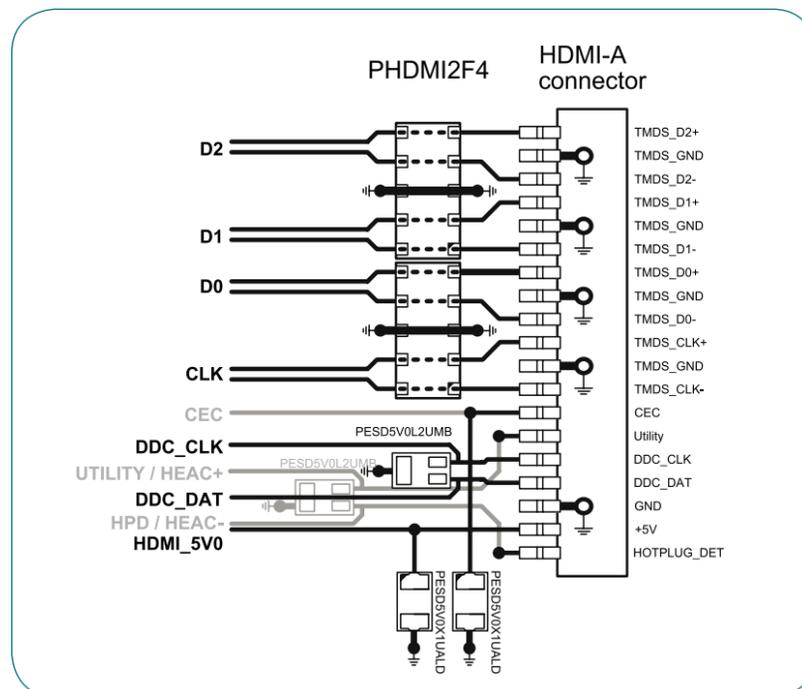


## Video interface protection

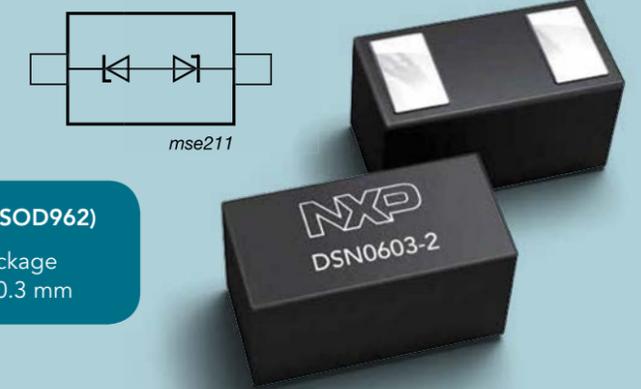
types in **bold** represent new products

Baseband interface	Number of protected lines	C <sub>line</sub> (pF)	Remark	Type	Package	Size (mm)
Display port	4	0.6	ESD protection for ultra high-speed interfaces	IP4283CZ10-TBR		2.5 x 1.0 x 0.48
		0.55	ESD protection for ultra high-speed interfaces	IP4292CZ10-TBR		
		0.5	ESD protection for ultra high-speed interfaces	IP4294CZ10-TBR		
			ESD protection for ultra high-speed interfaces	<b>PHDMI2F4</b>		
		0.8	ESD protection for ultra high-speed interfaces	IP4285CZ9-TBB		
HDMI	4	0.6	ESD protection for ultra high-speed interfaces	IP4283CZ10-TBR	DFN2510A-10 (SOT1176)	2.5 x 1.0 x 0.48
		0.8	ESD protection for ultra high-speed interfaces	IP4285CZ9-TBB	DFN2110-9 (SOT1178)	2.1 x 1.0 x 0.48
		0.55	ESD protection for ultra high-speed interfaces	IP4292CZ10-TBR	DFN2510A-10 (SOT1176)	2.5 x 1.0 x 0.48
		0.5	ESD protection for HDMI 2.0	<b>PHDMI2F4</b>		
			ESD protection for ultra high-speed interfaces	IP4294CZ10-TBR		
LVDS	4	0.8	Very low clamp ESD protection with 12 kV IEC ruggedness	<b>PUSB2X4D</b>	SOT457 (SC-74)	2.9 x 1.5 x 1.0
		0.8	Very low clamp ESD protection with 12 kV IEC ruggedness	<b>PUSB2X4Y</b>	SOT363 (SC-88)	2.0 x 1.25 x 0.95

### PHDMI2F4 PESD HDMI application schematic



## NFC antenna protection



**DSN0603-2 (SOD962)**  
Single package  
0.6 x 0.3 x 0.3 mm

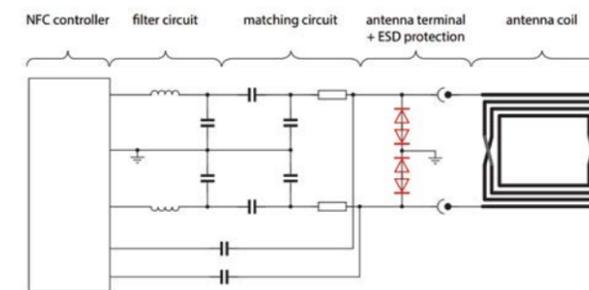
### Features

- ▶ Bidirectional configuration, allowing operating voltages up to 18 or 24 V
- ▶ Very low capacitance, enabling easy design of the antenna-matching circuit
- ▶ Very small voltage dependency of the diode capacitance, avoiding intermodulation distortion
- ▶ Small form-factor packages of 1006 (0402 inch) and 0603 (0201 inch) standard size

### Benefits

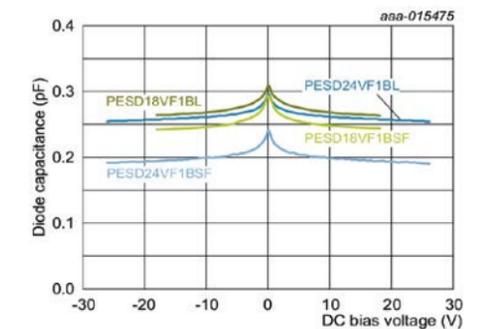
The phone's NFC antenna is often integrated into the battery cover or the battery itself and is connected to the NFC tags via small contacts on the phone, creating an entry point for ESD strikes that are potentially hazardous to the NFC IC. These new NXP devices are optimized for the requirements of the NFC system and ensure the best-possible protection of the NFC IC.

### Circuit diagram



Using tiny packages makes PCB design more flexible

### Diode capacitance versus bias voltage

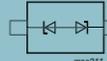


The highly linear diode capacitance, with very small variation, minimizes signal degradation

ESD protection, TVS, filtering and signal conditioning

## NFC antenna protection

types in **bold** represent new products

Interface	Number of protected lines (Bidirectional)	V <sub>RWM</sub> [V]	C <sub>line, typ</sub> [pF]	C <sub>line, max</sub> [pF]	ESD rating <sup>[1]</sup> max [kV]	Configuration	Type	Package	Size
NFC Antenna	1	18	0.28	0.45	10		<b>PESD18VF1BSF</b>	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3
							<b>PESD1NFC-SF</b>		1.0 x 0.6 x 0.48
			PESD18VF1BL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48				
			<b>PESD1NFC-L</b>		1.0 x 0.6 x 0.48				
		24	0.25	0.4	10		<b>PESD24VF1BSF</b>	DSN0603-2 (SOD962)	0.6 x 0.3 x 0.3
							<b>PESD2NFC-SF</b>		1.0 x 0.6 x 0.48
			PESD24VF1BL	DFN1006-2 (SOD882)	1.0 x 0.6 x 0.48				
			<b>PESD2NFC-L</b>		1.0 x 0.6 x 0.48				

<sup>[1]</sup> according to IEC 61000-4-2 (contact discharge)

### LCD/camera protection and filtering

Baseband interface	Number of protected lines	Line small-signal equivalents			Digital interface clock speed (MHz)	Insertion loss S21 ~ -3 dB (MHz)	Type	Package	Size (mm)	
		R <sub>line</sub> (Ω)	C <sub>line</sub> (pF)	L <sub>line</sub> (nH)						
	4	40	18	-	~100	300	IP4252CZ8-4 -TTL	DFN1714-8 (SOT1166) 	1.7 x 1.35 x 0.52	
		100	45	-	~40	130	IP4254CZ8-4-TTL			
			15	-	~110	330	IP4251CZ8-4-TTL			
		200	45	-	~35	110	IP4253CZ8-4-TTL			
	6	40	18	-	~100	300	IP4252CZ12-6-TTL	DFN2514-12 (SOT1167) 	2.5 x 1.35 x 0.53	
		100	45	-	~40	130	IP4254CZ12-6-TTL			
			15	-	~110	330	IP4251CZ12-6-TTL			
		200	45	-	~35	110	IP4253CZ12-6-TTL			
	100	54	-	~35	98	PEMI6CSP/RW	WLCSP15 	2.36 x 1.05 x 0.61		
		8	40	18	-	~100	300	IP4252CZ16-8-TTL	DFN3314-16 (SOT1168) 	3.3 x 1.35 x 0.53
			100	45	-	~40	130	IP4254CZ16-8-TTL		
				15	-	~110	330	IP4251CZ16-8-TTL		
200	45	-	~35	110	IP4253CZ16-8-TTL					
100	54	-	~35	98	PEMI8CSP/RW/P	WLCSP20 	3.16 x 1.05 x 0.61			

### Audio interface protection and filtering

Baseband interface	Number of protected lines	Line small-signal equivalents		Remark	Type	Package	Size (mm)
		R <sub>line</sub>	C <sub>line</sub> (pF)				
Audio	2	-	18	2 line bidirectional with I <sub>ppm</sub> =9A	PESD5V0V2BM	SOT883 	1.0 x 0.6 x 0.48
		-	-	-	PESD5V0V2BMB	SOT883B 	1.0 x 0.6 x 0.37
		68 Ω	110	Single-ended or differential microphone	IP4049CX5/LF	WLCSP5 	0.91 x 1.28 x 0.65

### Memory- and SIM-card protection and filtering

types in **bold** represent new products

Baseband interface	Number of protected lines	Line small-signal equivalents		Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
		R <sub>line</sub>	C <sub>line</sub> (pF)					
SIM card	3	47 Ω / 100 Ω	20	~20	Integrated SIM-card EMI filter and ESD protection	IP4264CZ8-20-TTL	DFN1714-8 (SOT1166) 	1.7 x 1.35 x 0.52
	4	-	1	~240	Quad-channel, low-capacitance ESD protection	IP4221CZ6-S	DFN1410-6 (SOT886) 	1.0 x 1.0 x 0.48
						IP4221CZ6-XS	DFN1010-6 (SOT891) 	1.0 x 1.0 x 0.48
SD-card / MMC	6	40 Ω	12	>52	(Mini) SD card/trans flash ESD protection, EMI filter	<b>IP4252CZ12-6-TTL</b>	DFN2514-12 (SOT1167) 	2.5 x 1.35 x 0.53
		40 Ω / 100 Ω	11	-	6-channel Micro-SD memory-card interface ESD protection filter	IP4340CX15	WLCSP15 	1.56 x 1.56 x 0.5
SD 3.0	6	-	0.27	5000	6-line bidirectional ESD protection for ultra high-speed interfaces	<b>PUSB3TB6</b>	DFN2111-7 (SOT1358) 	2.1 x 1.1 x 0.5
			0.35			<b>PUSB3FR6</b>		
			0.15			<b>PUSB3AB6</b>		

## Automotive high-speed network protection

types in **bold** represent new products

Number of protected lines	V <sub>RWM</sub> (V)	C <sub>line</sub> typ (pF)	I <sub>RM</sub> max @3V (μA)	ESD rating <sup>(1)</sup> max (kV)	Configuration	Type	Package	Size (mm)
4	5.5	0.5	1	10		<b>PESD2LVDS</b>	DFN2510A-10 (SOT1176)	2.5 x 1.0 x 0.5
	5.5	0.6	1	8		PESD1LVDS	DFN2510-10 (SOT1165)	2.5 x 1.0 x 0.48
	5.5	0.6	1	8		PRTR5V0U4D	SOT457	2.9 x 1.5 x 1.0

<sup>(1)</sup> according to IEC 61000-4-2 (contact discharge)

## Automotive in-vehicle network bus line protection

types in **bold** represent new products

Number of protected lines bidirectional	V <sub>RWM</sub> (V)	C <sub>line</sub> typ (pF)	C <sub>line</sub> max (pF)	P <sub>PP</sub> <sup>(1)</sup> max (W)	ESD rating <sup>(2)</sup> max (kV)	I <sub>r</sub> max [μA] @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)
1	15 (diode 1) 24 (diode 2)	13	17	160	23	0.05		PESD1LIN	SOD323 (SC-76)	1.7 x 1.25 x 0.95
2	24	11	17	200	23	0.05		PESD1CAN	SOT23	2.9 x 1.3 x 1.0
		25	30	230	30	0.01		PESD2CAN		
		11	17	200	23	0.05		PESD1FLEX	SOT323	
		9.3	12	150	23	0.05		PESD1CAN-U	SOT323	2.0 x 1.25 x 0.95
1	26.5	9.3	11	150	23	0.05		PESD1IVN-U	SOT323	2.0 x 1.25 x 0.95
2								PESD2IVN-U		

<sup>(1)</sup> 8 / 20 μs surge pulse according to IEC 61000-4-5

<sup>(2)</sup> according to IEC 61000-4-2 (contact discharge)

### In the spotlight

#### PESD2IVN-U: CAN bus protection in very small SOT323 package

Protection for 2 in-vehicle network BUS lines

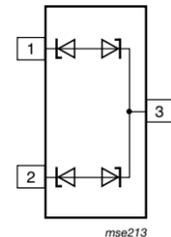
High reverse standoff voltage V<sub>RWM</sub> = 26.5 V

Very small SOT323 package (2.0 x 1.25 x 0.95 mm)

AEC-Q101 compliant

ESD robustness of up to 23 kV (contact)

Very good capacitance matching



## Surge protection for charger ports in mobile devices

A new powerful surge protection device in a 1.6 x 0.8 mm small, and 0.25 mm low package for slim mobiles



DSN1608-2 (SOD963)

Single package  
1.6 x 0.8 x 0.25 mm

Surge pulses from the power supply, e.g. via a car charger, are a severe threat for the charger port VBUS line of smart phones and other portables. Supply voltages of these chargers often exceed the 5 V level – requiring high reverse standoff voltages.

NXP's PTVSxZ1USK series is ideally suited to protect the charger port and offers

- ▶ Superior electrical performance
- ▶ High PCB design flexibility
- ▶ Easy routing

### Features and benefits

- ▶ 7 types from V<sub>RWM</sub> = 5 to 26 V
- ▶ High surge rating
- ▶ Very compact and thin package
- ▶ Low leakage current: down to 1 nA, reduces power consumption
- ▶ Dynamic resistance down to 0.06 Ohm
- ▶ High ESD robustness: V<sub>ESD</sub> = 30 kV (IEC61000-4-2)

### TVS diodes for mobile applications in DSN1608-2

Type	Package	Type	Package	V <sub>RWM</sub> (V)	V <sub>br</sub> min (V)	V <sub>br</sub> max (V)	V <sub>ci</sub> @ I <sub>ppm</sub> 8/20μs (V)	I <sub>ppm</sub> 8/20μs (A)	P <sub>ppm</sub> 8/20μs (W)	V <sub>ci</sub> @ I <sub>ppm</sub> 10/1000μs (V)	I <sub>ppm</sub> 10/1000μs (A)	P <sub>ppm</sub> 10/1000μs (W)	I <sub>rm</sub> typ @ V <sub>RWM</sub> (nA)	I <sub>rm</sub> max @ V <sub>RWM</sub> (nA)	Rdyn (TLF) - 8/20μs
PTVS5V0Z1USK	SOD964 1.6 x 0.8 x 0.37	PTVS5V0Z1USKN	SOD963 1.6 x 0.8 x 0.25	5	6.4	7.80	18	80	1200	12	20	200	1	1000	0.06
PTVS7V5Z1USK		PTVS7V5Z1USKN		7.5	8.33	9.65	24	92	2000	13.9	17.5	200	0.1	200	0.08
PTVS10VZ1USK		PTVS10VZ1USKN		10	11.1	12.9	27.5	73	2000	17.8	11.1	170	0.1	200	0.1
PTVS12VZ1USK		PTVS12VZ1USKN		12	13.3	15.4	29	65	2100	19.9	10.1	180	0.1	200	0.1
PTVS15VZ1USK		PTVS15VZ1USKN		15	16.7	19.4	35.4	52	1700	27.6	7.5	175	0.1	200	0.1
PTVS18VZ1USK		PTVS18VZ1USKN		18	20	23.2	40.5	41	1700	30.2	6.9	190	0.1	200	0.17
PTVS20VZ1USK		PTVS20VZ1USKN		20	22.2	25.4	47	38	1800	36.0	6	175	0.1	200	0.16
PTVS26VZ1USK	PTVS26VZ1USKN	26	28.9	33.4	61	30	1600	48.0	3.76	150	0.1	200	0.16		

### Battery and charger port protection – PESD devices

Baseband interface	Number of protected lines	C <sub>line</sub> (pF)	V <sub>RWM</sub> (V)	I <sub>ppm</sub> 8/20μs (A)	Type	Package	Size (mm)
Battery & charger protection	1 x uni	160	12	22.5	PESD12VS1UJ	SOD323F (SC-90)	1.7 x 1.25 x 0.7
		480	5	22.5	PESD5V0S1UJ		
		160	12	47	PESD12VS1UA	SOD323 (SC-76)	1.7 x 1.25 x 0.95
		480	5	47	PESD5V0S1UA		
Battery & charger protection	2 x bi	18	5	9	PESD5V0V2BM	SOT883	1.0 x 0.6 x 0.48
		18	5	9	PESD5V0V2BMB	SOT883B	1.0 x 0.6 x 0.37
		35	5	15	PESD5V0S2BQA	SOT1215	1.1 x 1.0 x 0.37

TVS diodes for mobile applications

Power (W) / 1000 $\mu$ s waveform <sup>(1)</sup>	V <sub>RWM</sub> (V)	V <sub>BR min</sub> (V) @ I <sub>r</sub>	V <sub>BR typ</sub> (V) @ I <sub>r</sub>	V <sub>BR max</sub> (V) @ I <sub>r</sub>	I <sub>r</sub> (mA)	V <sub>CL max</sub> <sup>(1)</sup> (V) @ I <sub>PP</sub>	I <sub>PP</sub> <sup>(1)</sup> (A)	I <sub>RM typ</sub> ( $\mu$ A) @ V <sub>RWM</sub>	I <sub>RM max</sub> ( $\mu$ A) @ V <sub>RWM</sub>	Type	Package	Size (mm)
300	7.5	8.33	8.77	9.21	1	12.9	23.3	0.3	50	PTVS7V5U1UPA	DFN2020-3 (SOT1061)	2.0 x 2.0 x 0.62
	10	11.1	11.7	12.3	1	17	17.6	0.008	2.5	PTVS10VU1UPA		
	12	13.3	14	14.7	1	19.9	15.1	0.005	2.5	PTVS12VU1UPA		
	15	16.7	17.6	18.5	1	24.4	12.3	0.001	0.1	PTVS15VU1UPA		
	18	20	21	22.1	1	29.2	10.3	0.001	0.1	PTVS18VU1UPA		
	26	28.9	30.4	31.9	1	42.1	7	0.001	0.1	PTVS26VU1UPA		

<sup>(1)</sup> 10 / 1000  $\mu$ s according to IEC 61643-321

TVS diodes, 24/40 W

Power (W) / 1000 $\mu$ s waveform <sup>(1)</sup>	V <sub>RWM</sub> (V)	V <sub>BR min</sub> (V) @ I <sub>r</sub>	V <sub>BR typ</sub> (V) @ I <sub>r</sub>	V <sub>BR max</sub> (V) @ I <sub>r</sub>	I <sub>r</sub> (mA)	ESD rating <sup>(1)</sup> max (kV)	C <sub>lim typ</sub> (pF)	V <sub>CL max</sub> <sup>(1)</sup> (V) @ I <sub>PP</sub>	I <sub>PP</sub> <sup>(1)</sup> (A)	I <sub>RM max</sub> ( $\mu$ A) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)	
24	3	5.32	5.6	5.88	20	30	210	8	3	5		MMBZ5V6AL	SOT23	2.9 x 1.3 x 1.0	
	3	5.89	6.2	6.51	1	30	175	8.7	2.76	0.2		MMBZ6V2AL			
	4.5	6.48	6.8	7.14	1	30	150	9.6	2.5	0.3		MMBZ6V8AL			
	6	8.65	9.1	9.56	1	30	155	14	1.7	0.1		MMBZ9V1AL			
	6.5	9.5	10	10.5	1	30	130	14.2	1.7	0.02		MMBZ10VAL			
40	8.5	11.4	12	12.6	1	30	110	17	2.35	0.005		MMBZ12VAL			
	12	14.25	15	15.75	1	30	85	21	1.9	0.005		MMBZ15VAL			
	14.5	17.1	18	18.9	1	30	70	25	1.6	0.005		MMBZ18VAL			
	17	19	20	21	1	30	65	28	1.4	0.005		MMBZ20VAL			
	22	25.65	27	28.35	1	30	48	40	1	0.005		MMBZ27VAL			
	26	31.35	33	34.65	1	30	45	46	0.87	0.005		MMBZ33VAL			
	8.5	11.4	12	12.6	1	30	110	17	2.35	0.005					MMBZ12VDL
	12.8	14.3	15	15.8	1	30	85	21.2	1.9	0.005					MMBZ15VDL
	14.5	17.1	18	18.9	1	30	70	25	1.6	0.005					MMBZ18VCL
	17	19	20	21	1	30	65	28	1.4	0.005					MMBZ20VCL
22	25.65	27	28.35	1	30	48	38	1	0.005	MMBZ27VCL					
26	31.35	33	34.65	1	30	45	46	0.87	0.005	MMBZ33VCL					

<sup>(1)</sup> 10 / 1000  $\mu$ s according to IEC 61643-321 <sup>(2)</sup> according to IEC 61000-4-2 (contact discharge)

TVS diodes, 400 W

Power (W) / 10/1000 $\mu$ s waveform <sup>(1)</sup>	V <sub>RWM</sub> (V)	V <sub>BR min</sub> (V) @ I <sub>r</sub>	V <sub>BR typ</sub> (V) @ I <sub>r</sub>	V <sub>BR max</sub> (V) @ I <sub>r</sub>	I <sub>r</sub> (mA)	V <sub>CL max</sub> <sup>(1)</sup> (V) @ I <sub>PP</sub>	I <sub>PP</sub> <sup>(1)</sup> (A)	I <sub>RM typ</sub> ( $\mu$ A) @ V <sub>RWM</sub>	I <sub>RM max</sub> ( $\mu$ A) @ V <sub>RWM</sub>	Type (T <sub>j max</sub> = 150 °C)	Type (T <sub>j max</sub> = 185 °C)	Package	Size (mm)
350	3.5	5.20	5.60	6.00	10	8.0	43.8	5	600	PTVS3V3S1UR	PTVS3V3S1UTR	SOD123W	2.6 x 1.7 x 1.0
400	5.0	6.40	6.70	7.00	10	9.2	43.5	5	400	PTVS5V0S1UR	PTVS5V0S1UTR		
	6.0	6.67	7.02	7.37	10	10.3	38.8	5	400	PTVS6V0S1UR	PTVS6V0S1UTR		
	6.5	7.22	7.60	7.98	10	11.2	35.7	5	250	PTVS6V5S1UR	PTVS6V5S1UTR		
	7.0	7.78	8.20	8.60	10	12.0	33.3	3	100	PTVS7V0S1UR	PTVS7V0S1UTR		
	7.5	8.33	8.77	9.21	1	12.9	31.0	0.2	50	PTVS7V5S1UR	PTVS7V5S1UTR		
	8.0	8.89	9.36	9.83	1	13.6	29.4	0.03	25	PTVS8V0S1UR	PTVS8V0S1UTR		
	8.5	9.44	9.92	10.40	1	14.4	27.8	0.01	10	PTVS8V5S1UR	PTVS8V5S1UTR		
	9.0	10.00	10.55	11.10	1	15.4	26.0	0.005	5	PTVS9V0S1UR	PTVS9V0S1UTR		
	10	11.10	11.70	12.30	1	17.0	23.5	0.005	2.5	PTVS10VS1UR	PTVS10VS1UTR		
	11	12.20	12.85	13.50	1	18.2	22.0	0.005	2.5	PTVS11VS1UR	PTVS11VS1UTR		
	12	13.30	14.00	14.70	1	19.9	20.1	0.005	2.5	PTVS12VS1UR	PTVS12VS1UTR		
	13	14.40	15.15	15.90	1	21.5	18.6	0.001	0.1	PTVS13VS1UR	PTVS13VS1UTR		
	14	15.60	16.40	17.20	1	23.2	17.2	0.001	0.1	PTVS14VS1UR	PTVS14VS1UTR		
	15	16.70	17.60	18.50	1	24.4	16.4	0.001	0.1	PTVS15VS1UR	PTVS15VS1UTR		
	16	17.80	18.75	19.70	1	26.0	15.4	0.001	0.1	PTVS16VS1UR	PTVS16VS1UTR		
	17	18.90	19.90	20.90	1	27.6	14.5	0.001	0.1	PTVS17VS1UR	PTVS17VS1UTR		
	18	20.00	21.00	22.10	1	29.2	13.7	0.001	0.1	PTVS18VS1UR	PTVS18VS1UTR		
	20	22.20	23.35	24.50	1	32.4	12.3	0.001	0.1	PTVS20VS1UR	PTVS20VS1UTR		
	22	24.40	25.60	26.90	1	35.5	11.3	0.001	0.1	PTVS22VS1UR	PTVS22VS1UTR		
	24	26.70	28.10	29.50	1	38.9	10.3	0.001	0.1	PTVS24VS1UR	PTVS24VS1UTR		
	26	28.90	30.40	31.90	1	42.1	9.5	0.001	0.1	PTVS26VS1UR	PTVS26VS1UTR		
	28	31.10	32.80	34.40	1	45.4	8.8	0.001	0.1	PTVS28VS1UR	PTVS28VS1UTR		
	30	33.30	35.10	36.80	1	48.4	8.3	0.001	0.1	PTVS30VS1UR	PTVS30VS1UTR		
	33	36.70	38.70	40.60	1	53.3	7.5	0.001	0.1	PTVS33VS1UR	PTVS33VS1UTR		
36	40.00	42.10	44.20	1	58.1	6.9	0.001	0.1	PTVS36VS1UR	PTVS36VS1UTR			
40	44.40	46.80	49.10	1	64.5	6.2	0.001	0.1	PTVS40VS1UR	PTVS40VS1UTR			
43	47.80	50.30	52.80	1	69.4	5.8	0.001	0.1	PTVS43VS1UR	PTVS43VS1UTR			
45	50.00	52.65	55.30	1	72.7	5.5	0.001	0.1	PTVS45VS1UR	PTVS45VS1UTR			
48	53.30	56.10	58.90	1	77.4	5.2	0.001	0.1	PTVS48VS1UR	PTVS48VS1UTR			
51	56.70	59.70	62.70	1	82.4	4.9	0.001	0.1	PTVS51VS1UR	PTVS51VS1UTR			
54	60.00	63.15	66.30	1	87.1	4.6	0.001	0.1	PTVS54VS1UR	PTVS54VS1UTR			
58	64.40	67.80	71.20	1	93.6	4.3	0.001	0.1	PTVS58VS1UR	PTVS58VS1UTR			
60	66.70	70.20	73.70	1	96.8	4.1	0.001	0.1	PTVS60VS1UR	PTVS60VS1UTR			
64	71.10	74.85	78.60	1	103.0	3.9	0.001	0.1	PTVS64VS1UR	PTVS64VS1UTR			

ESD protection, TVS, filtering and signal conditioning

TVS diodes, 600 W

Power (W) (10 / 1000 µs waveform) (1)	V <sub>RWM</sub> (V)	V <sub>BR min</sub> (V) @ I <sub>R</sub>	V <sub>BR typ</sub> (V) @ I <sub>R</sub>	V <sub>BR max</sub> (V) @ I <sub>R</sub>	I <sub>R</sub> (mA)	V <sub>CL max</sub> (V) @ I <sub>PP</sub>	I <sub>PP</sub> (A)	I <sub>RM typ</sub> (µA) @ V <sub>RWM</sub>	I <sub>RM max</sub> (µA) @ V <sub>RWM</sub>	Type (T <sub>j max</sub> = 150 °C)	Type (T <sub>j max</sub> = 185 °C)	Package	Size (mm)
3.5	5.20	5.60	6.00	10	8	75	5	600	PTVS3V3P1UP	PTVS3V3P1UTP	SOD128 	3.8 x 2.6 x 1.0	
5	6.40	6.70	7.00	10	9.2	65.2	5	400	PTVS5V0P1UP	PTVS5V0P1UTP			
6	6.67	7.02	7.37	10	10.3	58.3	5	400	PTVS6V0P1UP	PTVS6V0P1UTP			
6.5	7.22	7.60	7.98	10	11.2	53.6	5	250	PTVS6V5P1UP	PTVS6V5P1UTP			
7	7.78	8.20	8.60	10	12	50	3	100	PTVS7V0P1UP	PTVS7V0P1UTP			
7.5	8.33	8.77	9.21	1	12.9	46.5	0.2	50	PTVS7V5P1UP	PTVS7V5P1UTP			
8	8.89	9.36	9.83	1	13.6	44.1	0.03	25	PTVS8V0P1UP	PTVS8V0P1UTP			
8.5	9.44	9.92	10.40	1	14.4	41.7	0.01	10	PTVS8V5P1UP	PTVS8V5P1UTP			
9	10.00	10.55	11.10	1	15.4	39	0.005	5	PTVS9V0P1UP	PTVS9V0P1UTP			
10	11.10	11.70	12.30	1	17	35.3	0.005	2.5	PTVS10VP1UP	PTVS10VP1UTP			
11	12.20	12.85	13.50	1	18.2	33	0.005	2.5	PTVS11VP1UP	PTVS11VP1UTP			
12	13.30	14.00	14.70	1	19.9	30.2	0.005	2.5	PTVS12VP1UP	PTVS12VP1UTP			
13	14.40	15.15	15.90	1	21.5	27.9	0.001	0.1	PTVS13VP1UP	PTVS13VP1UTP			
14	15.60	16.40	17.20	1	23.2	25.9	0.001	0.1	PTVS14VP1UP	PTVS14VP1UTP			
15	16.70	17.60	18.50	1	24.4	24.6	0.001	0.1	PTVS15VP1UP	PTVS15VP1UTP			
16	17.80	18.75	19.70	1	26	23.1	0.001	0.1	PTVS16VP1UP	PTVS16VP1UTP			
17	18.90	19.90	20.90	1	27.6	21.7	0.001	0.1	PTVS17VP1UP	PTVS17VP1UTP			
18	20.00	21.00	22.10	1	29.2	20.5	0.001	0.1	PTVS18VP1UP	PTVS18VP1UTP			
20	22.20	23.35	24.50	1	32.4	18.5	0.001	0.1	PTVS20VP1UP	PTVS20VP1UTP			
22	24.40	25.60	26.90	1	35.5	16.9	0.001	0.1	PTVS22VP1UP	PTVS22VP1UTP			
24	26.70	28.10	29.50	1	38.9	15.4	0.001	0.1	PTVS24VP1UP	PTVS24VP1UTP			
26	28.90	30.40	31.90	1	42.1	14.2	0.001	0.1	PTVS26VP1UP	PTVS26VP1UTP			
28	31.10	32.80	34.40	1	45.4	13.2	0.001	0.1	PTVS28VP1UP	PTVS28VP1UTP			
30	33.30	35.10	36.80	1	48.4	12.4	0.001	0.1	PTVS30VP1UP	PTVS30VP1UTP			
33	36.70	38.70	40.60	1	53.3	11.3	0.001	0.1	PTVS33VP1UP	PTVS33VP1UTP			
36	40.00	42.10	44.20	1	58.1	10.3	0.001	0.1	PTVS36VP1UP	PTVS36VP1UTP			
40	44.40	46.80	49.10	1	64.5	9.3	0.001	0.1	PTVS40VP1UP	PTVS40VP1UTP			
43	47.80	50.30	52.80	1	69.4	8.6	0.001	0.1	PTVS43VP1UP	PTVS43VP1UTP			
45	50.00	52.65	55.30	1	72.7	8.3	0.001	0.1	PTVS45VP1UP	PTVS45VP1UTP			
48	53.30	56.10	58.90	1	77.4	7.8	0.001	0.1	PTVS48VP1UP	PTVS48VP1UTP			
51	56.70	59.70	62.70	1	82.4	7.3	0.001	0.1	PTVS51VP1UP	PTVS51VP1UTP			
54	60.00	63.15	66.30	1	87.1	6.9	0.001	0.1	PTVS54VP1UP	PTVS54VP1UTP			
58	64.40	67.80	71.20	1	93.6	6.4	0.001	0.1	PTVS58VP1UP	PTVS58VP1UTP			
60	66.70	70.20	73.70	1	96.8	6.2	0.001	0.1	PTVS60VP1UP	PTVS60VP1UTP			
64	71.10	74.85	78.60	1	103	5.8	0.001	0.1	PTVS64VP1UP	PTVS64VP1UTP			

(1) 10 / 1000 µs according to IEC 61643-321

In the spotlight

High-temperature TVS series in FlatPower package

Available in 400 W (PTVSxS1UTR) and 600 W (PTVSxP1UTP) power classes with 35 devices each

Very high maximal junction temperature of 185 °C

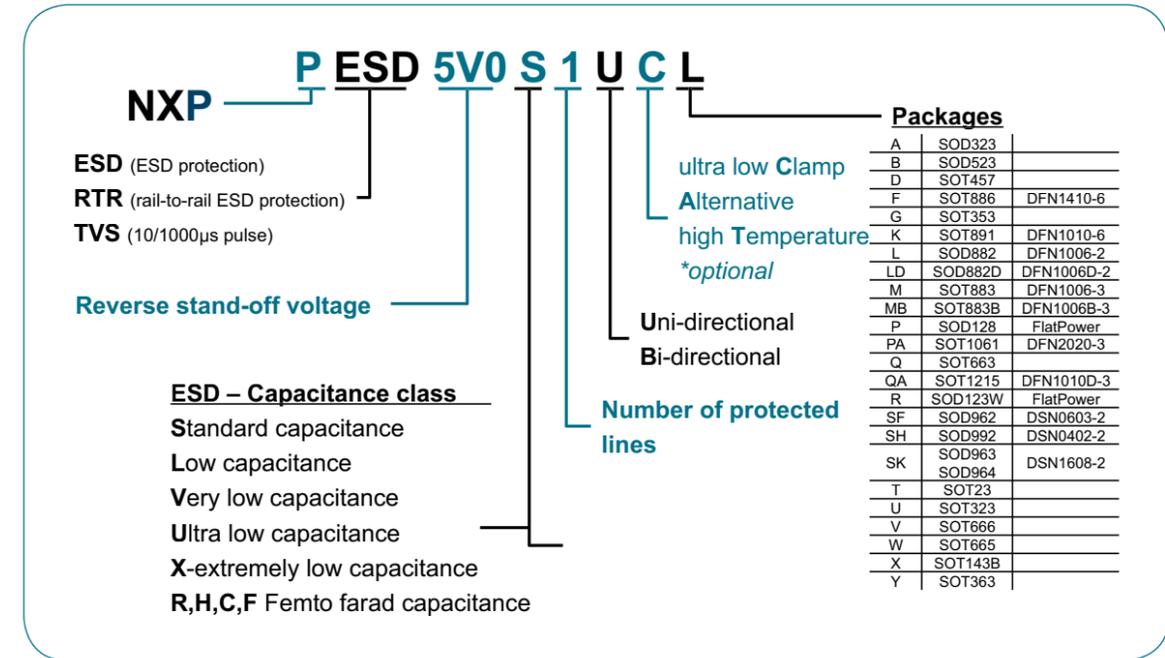
Reverse standoff voltages from 3.3 to 64 V

Low height, high performance - save board space by replacing SMA & SMB packages with low-profile SOD123W and SOD128 packages

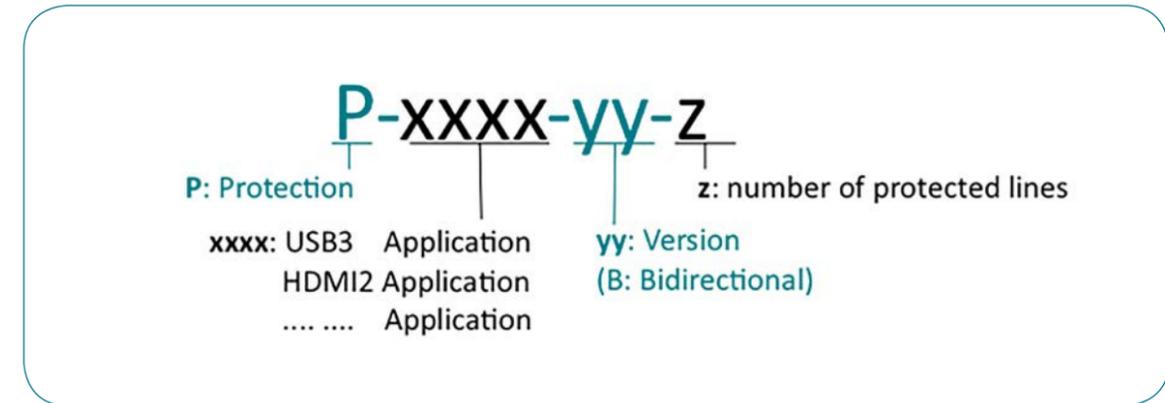
AEC-Q101 qualified



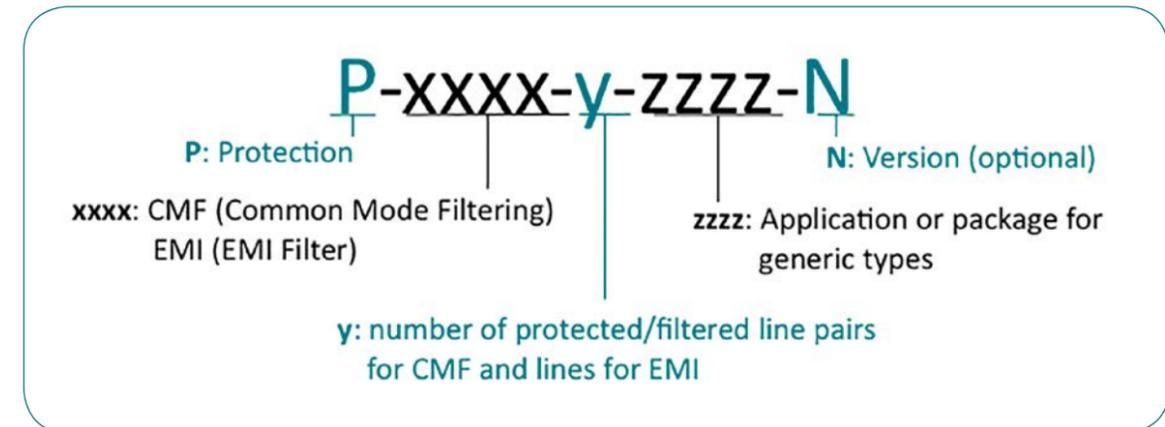
Protection and signal-conditioning nomenclature



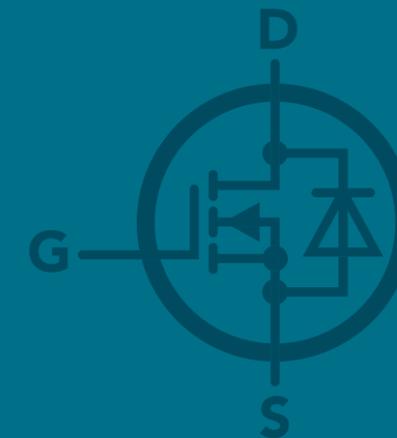
Application specific protection nomenclature



Application specific filtering nomenclature



ESD protection, TVS, filtering and signal conditioning



## MOSFETs

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# Small-signal MOSFET portfolio

What you get when you choose NXP for small-signal MOSFETs

## A comprehensive portfolio for all applications

Best in class performing transistors from commodity to low R<sub>DSon</sub> MOSFETs

## A broad range of packages

Many options for WLCSP, leaded SMD and ultra-small leadless packages.

## A quality product from an experienced, high volume supplier

- ▶ NXP is strongly committed to automotive quality standards
- ▶ NXP has a track record of more than 60 years in developing and producing discretes
- ▶ NXP is the #1 in small-signal discretes with a high production capacity

### Leaded packages

### Leadless packages

### WLCSP

High R<sub>DSon</sub>



- ▶ 2N7002 family
- ▶ NX7002AK family
- ▶ BSS84 family
- ▶ BSS138 family
- ▶ NX3008 family



Low R<sub>DSon</sub>

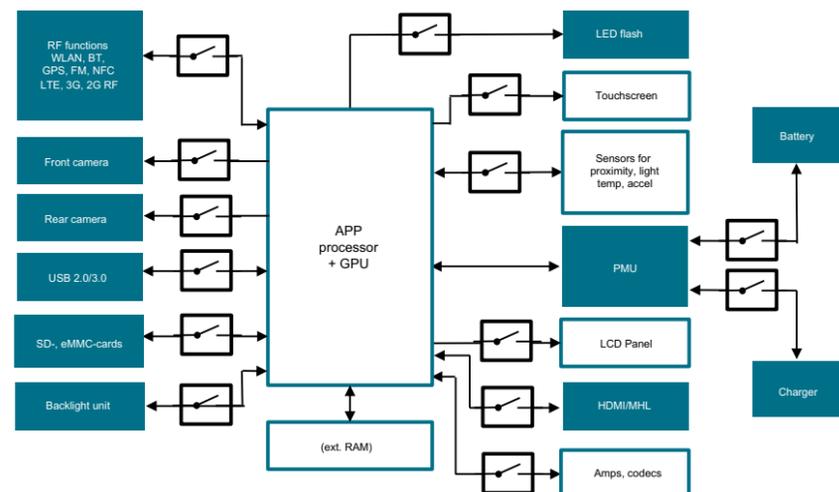
- ▶ PMT.../ PHT... SOT223
- ▶ PMV ... SOT23
- ▶ PMN ... SOT457
- ▶ PMF ... SOT323
- ▶ PMG ... SOT363

- ▶ PMPB ... single DFN2020
- ▶ PMDPB ... dual DFN2020
- ▶ PMZ ... single DFN1006
- ▶ PMXB ... single DFN1010
- ▶ PMDXB ... dual DFN1010

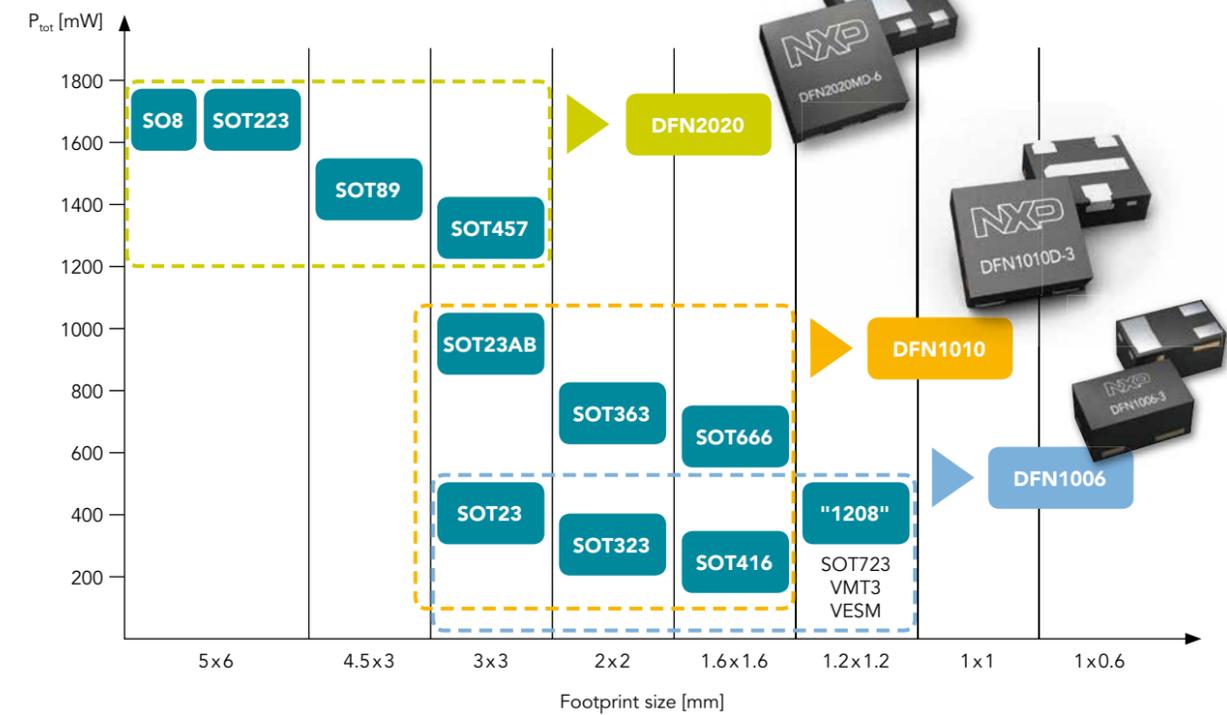


- ▶ PMCM4 ... WLCSP4
- ▶ PMCM6 ... WLCSP6

### Block diagram for typical MOSFET application



### Leadless DFN packages replace leaded packages



Leadless packages provide the same power capability compared to larger packages on a smaller size or provide a better thermal performance on the same footprint size. For that reason they replace established leaded packages in many applications.

### Leadless DFN and WLCSP packages – dedicated solutions for your application



Small-signal MOSFETs in ultra-small DFN1006 and DFN1006B packages

types in **bold** represent new products

Package											DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)					
Size (mm)											1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37					
P <sub>tot</sub> (mW)											250	250					
Polarity	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th) min</sub> (V)	V <sub>GS(th) max</sub> (V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection (kV)	R <sub>DS(on)</sub> typ (mΩ) @ V <sub>GS</sub> =						ESD protection (kV)	
										10 V	4.5 V	2.5 V	1.8 V	1.5 V	1.2 V		
N-channel	20	8	1.9	0.45	0.95	5.3	16	1.6	2	-	120	160	210	270	-	<b>PMZ130UNE</b>	
			1.6	0.45	0.95	5.3	16	1.6	2	-	170	200	240	300	-		<b>PMZB150UNE</b>
			1	0.5	0.95	6	86	0.45	2	-	270	360	470	600	-	<b>PMZ290UNE2</b>	<b>PMZB290UNE2</b>
			0.6	0.45	0.95	5.6	19	0.4	1	-	470	620	845	1125	2210	PMZ600UNE	PMZB600UNE
			1.5	0.45	0.95	5	17	1.6	2	-	210	240	270	300	-	<b>PMZ200UNE</b>	<b>PMZB200UNE</b>
	30	8	1	0.45	0.95	4	12	0.8	2	-	390	460	30	610	-	<b>PMZ390UNE</b>	<b>PMZB390UNE</b>
			0.59	0.45	0.95	4	12	0.6	2	-	550	660	770	890	-	<b>PMZ550UNE</b>	<b>PMZB550UNE</b>
			0.45	1.1	2.1	5	12	0.5	2	1000	1300	-	-	-	-	2N700BKM	2N7002BKMB
	60	20	0.35	1.1	2.1	4.7	6.9	1	2	2200	2500	-	-	-	-	NX7002BKM	NX7002BKMB
			1.4	0.45	0.95	4	26	1.3	1.8	-	330	420	520	-	-	PMZ350UPE	PMZB350UPE
P-channel	20	8	0.5	0.45	0.95	2.3	13.5	1.19	1	-	1020	1270	1700	2300	3500	PMZ950UPE	PMZB950UPE
			1	0.45	0.95	2.9	22	1.45	2	-	430	470	750	950	-	<b>PMZ320UPE</b>	<b>PMZB320UPE</b>
	30	8	0.41	0.45	0.95	3	14	0.7	2	-	1200	1700	2100	3000	-	<b>PMZ1200UNE</b>	<b>PMZB1200UPE</b>
			0.23	1.1	2.1	13	48	0.26	1	4500	5700	-	-	-	-	BSS84AKM	BSS84AKMB

**Key features**

- ▶ N- and P-channel
- ▶ Low R<sub>DS(on)</sub> down to 120 mΩ
- ▶ I<sub>D</sub> up to 1.9 A
- ▶ Low voltage drive (V<sub>GS(th)</sub> = 0.65 V typ)
- ▶ Voltage range of 20 to 60 V
- ▶ ESD protection of up to 2 kV

**Package**

- ▶ 1.0 x 0.6 mm footprint
- ▶ Single package with different heights:
  - 0.5 mm for DFN1006 (SOT883)
  - 0.37 mm for DFN1006B (SOT883B)
- ▶ Power dissipation (P<sub>tot</sub>) of 360 mW

**Key applications**

- ▶ Smartphones
- ▶ Wearables
- ▶ Tablets

**DFN1006 – The ideal replacement for SOT416**



Small-signal MOSFETs in DFN1010D-3 single and DFN1010B-3 dual packages

types in **bold** represent new products

Package											DFN1010D-3 (SOT1215)	DFN1010B-6 (SOT1216)						
Size (mm)											1.1 x 1.0 x 0.37	1.1 x 1.0 x 0.37						
P <sub>tot</sub> (mW)											1000	350						
Configuration	Polarity	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th) min</sub> (V)	V <sub>GS(th) max</sub> (V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection (kV)	R <sub>DS(on)</sub> typ (mΩ) @ V <sub>GS</sub> =						ESD protection (kV)	
											10 V	4.5 V	2.5 V	1.8 V	1.5 V	1.2 V		
Single	N-channel	12	8	3.2	0.4	0.9	6	18	6.6	1	-	34	39	46	50	121	PMXB40UNE	
		20	8	3.2	0.5	0.9	6	17	5.7	1	-	42	48	56	64	-	PMXB43UNE	
		30	20	3.2	1	2	3	11	3.6	-	49	56	-	-	-	-	PMXB56EN	
				3.2	1	2.5	3	11	6	1	44	56	-	-	-	-	PMXB65ENE	
	80	20	1.1	1.3	2.7	2	9	3	2	345	390	-	-	-	-	PMXB60ENEA		
	P-channel	12	8	3.2	0.4	1	6.2	27	6.7	1.5	-	59	78	120	198	880	PMXB65UPE	
		20	8	2.9	0.4	1	6	29	6.8	1	-	69	86	130	205	950	PMXB75UPE	
				1.2	0.45	0.95	3	18	1.25	1.5	-	350	450	600	760	1200	PMXB350UPE	
30		20	2.4	1	2.5	4	16	6.2	1	100	125	-	-	-	-	PMXB120EPE		
Dual	N-ch	20	8	0.6	0.45	0.95	5.6	19	0.4	1	-	470	620	845	1125	2210		PMDXB600UNE
		30	8	0.59	0.45	0.95	4	12	0.6	2	-	550	660	770	890	-		PMDXB550UNE
		60	20	0.26	1.1	2.1	4.7	6.9	1	2	2200	2500	-	-	-	-		NX7002BKXB
	P-ch	20	8	0.5	0.45	0.95	2.3	13.5	1.19	1	-	1020	1270	1700	2300	3500		PMDXB950UPE
		30	8	0.41	0.45	0.95	3	14	0.7	2	-	1200	1700	2100	3000	-		PMDXB1200UPE
		30	8	0.41	0.45	0.95	3	14	0.7	2	-	1200	1700	2100	3000	-		PMDXB1200UPE
Complementary	N	20	8	0.6	0.45	0.95	5.6	19	0.4	1	-	470	620	845	1125	2210		
	P	20	8	0.5	0.45	0.95	2.3	13.5	1.19	1	-	1020	1270	1700	2300	3500		PMCB900UE
	N	30	8	0.59	0.45	0.95	4	12	0.6	2	-	550	660	770	890	-		
	P	30	8	0.41	0.45	0.95	3	14	0.7	2	-	1200	1700	2100	3000	-		PMCB1000UE

**Key features**

- ▶ N- and P-channel
- ▶ Low R<sub>DS(on)</sub> to 34 mΩ
- ▶ I<sub>D</sub> to 3.2 A
- ▶ Low voltage drive (V<sub>GS(th)</sub> = 0.65 V typ)
- ▶ Voltage range of 12 to 80 V
- ▶ ESD protection to more than 1 kV

**Package**

- ▶ 1.1 x 1.0 x 0.37 mm package size
- ▶ Single and dual packages
- ▶ High power dissipation (P<sub>tot</sub>) of 1000 mW single and 350 mW for dual package
- ▶ Single package with tin-plated, solderable side pads for improved mounting and automotive conformity

**DFN1010B-6 dual – The ideal replacement for SOT363**



# DFN2020 – The low $R_{DSon}$ choice for values $> 10\text{ m}\Omega$

In the spotlight

## PMPB15XP – Low $R_{DSon}$ P-channel MOSFET in DFN2020

12 V P-channel with  $R_{DSon}$  of 15 m $\Omega$  @  $V_{GS} = 4.5\text{ V}$  (typ)

$I_D$  max of 11.8 A for medium current load switch

Small and leadless ultrathin SMD plastic package: 2.0 x 2.0 x 0.65 mm

Exposed drain pad for excellent thermal conduction

$R_{DSon}$  specified to 1.8 V for low drive voltages



DFN2020MD-6 (SOT1220)

Single package  
2 x 2 x 0.65 mm

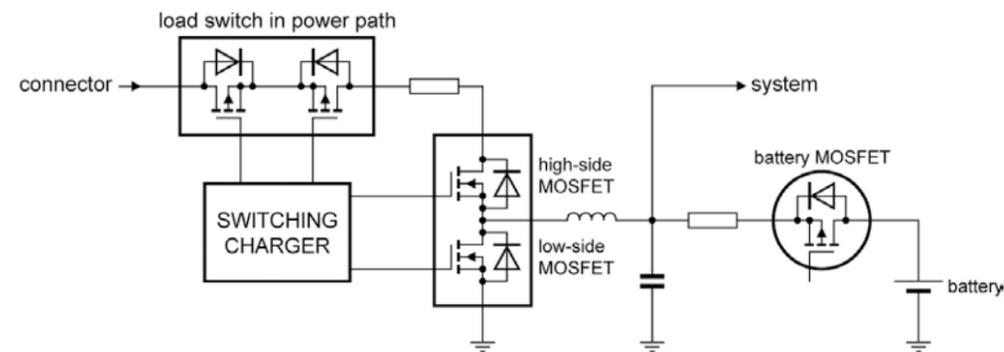
### Key features

- ▶ N- and P-channel
- ▶ Low  $R_{DSon}$  down to 10 m $\Omega$
- ▶  $I_D$  up to 13 A
- ▶ Low voltage drive ( $V_{GS(th)} = 0.65\text{ V}$  typ)
- ▶ Voltage range of 12 to 100 V
- ▶ ESD protection of 3 kV

### Package

- ▶ 2.0 x 2.0 x 0.65 mm package size
- ▶ Single and dual packages
- ▶ High power dissipation ( $P_{tot}$ ) of 1250 mW for single and dual packages
- ▶ Single package with tin-plated, solderable side pads for improved mounting and automotive conformity

### Generic charging path application



### Products for charging path application

Type	Package	$V_{DS}/V_{GS}$ (V)	$I_D$ (A)	ESD protection (kV)	$R_{DSon}$ typ (m $\Omega$ ) @ $V_{GS} =$				Application
					10 V	4.5 V	2.5 V	1.8 V	
PMPB15XP	DFN2020MD-6	12 / 12	11.8	1.5	-	15	17	21	Charger Switch, Battery FET
PMPB20EN	DFN2020MD-6	30 / 20	10.4	-	16.5	20.5	-	-	Buck Converter
PMPB10XNE	DFN2020MD-6	20 / 18	12.9	2.2	-	10	12	16	Battery Pack

## Small-signal MOSFETs

### Small-signal MOSFETs in DFN2020MD-6 single and DFN2020-6 dual packages

types in **bold** represent new products

Package		DFN2020MD-6 (SOT1220)	DFN2020-6 (SOT1118)													
Size (mm)		2.0 x 2.0 x 0.65	2.0 x 2.0 x 0.65													
$P_{tot}$ (mW)		1250	1250													
Configuration	Polarity	$V_{DS}$ (V)	$V_{GS}$ (V)	$I_D$ (A)	$V_{GS(th)}$ min (V)	$V_{GS(th)}$ max (V)	$t_{on}$ typ (ns)	$t_{off}$ typ (ns)	$Q_g$ typ (nC)	ESD protection (kV)	$R_{DSon}$ typ (m $\Omega$ ) @ $V_{GS} =$					
											10 V	4.5 V	2.5 V	1.8 V		
Single	N-channel	20	12	8	11.3	0.4	1	9	26	8.8	2	-	14	17	21	<b>PMPB12UNE</b>
				12.9	0.4	0.9	13	54	23	2.2	-	10	12	16	PMPB10XNE	
				5.9	0.75	1.25	16	49	31	2	-	14	20	-	<b>PMPB20XNEA</b>	
				10.4	0.4	0.9	9	31	13.4	-	-	18	21	23	PMPB15XN	
				10.1	0.4	0.9	9	31	11.6	2.1	-	19	23	31	PMPB23XNE	
		30	12	11.3	0.4	0.9	12	54	24	2.2	-	13	14	17	PMPB13XNE	
				5	0.4	0.9	8	33	12.4	2.1	-	28	32	37	PMPB29XNE	
			5.5	0.45	1.2	6	21	5.1	-	-	37	55	-	PMPB33XN		
			20	13	1	2	9	17	13.7	-	12	14	-	-	PMPB11EN	
				10.4	1	2	9	9	7.2	-	16.5	20.5	-	-	PMPB20EN	
	60	20	4	1.3	2.7	4.5	13.5	7.5	1	42	48	-	-	<b>PMPB55ENEAE</b>		
			3	1.3	2.7	4	10.5	6.2	2.7	72	85	-	-	PMPB85ENEAE		
		80	2.8	1.3	2.7	5	15	9.9	2.8	80	92	-	-	PMPB95ENEAE		
			1.9	1.3	2.7	3.5	9.5	4.8	2	175	195	-	-	PMPB215ENEAE		
	P-channel	12	12	11.8	0.47	0.9	18	85	67	-	-	15	17	21	PMPB15XP	
				10.3	0.47	0.9	16	43	28.8	-	-	19	21	27	PMPB19XP	
				10.3	0.47	0.9	13	92	30	2.4	-	19	22	28	PMPB20XPE	
				5	0.47	0.9	12	91	30	2.3	-	28	31	36	PMPB29XPE	
				7.9	0.47	0.9	12	62	15	-	-	30	35	45	PMPB33XP	
		30	12	5	0.47	0.9	15	28	14	-	-	47	54	74	PMPB47XP	
8.8				1	2.5	10	28	30	-	24	32	-	-	PMPB27EP		
20			6.8	1	2.5	7.4	27	17	-	40	55	-	-	PMPB48EP		
			5	0.47	0.9	9	57	15.6	2.3	-	39	45	56	PMPB43XPE		
			5	0.47	0.9	9	57	15.6	2.3	-	39	45	56	PMPB43XPE		
Dual	N-ch	20	12	5.3	0.4	0.9	4	40	14.4	-	-	32	40	60	PMDPB30XN	
				3.1	0.75	1.25	9	19	2.9	2	-	55	72	-	<b>PMDPB56XNEA</b>	
	P-channel	30	12	3.1	0.5	1.5	6	18	1.65	1.8	-	95	130	-	<b>PMDPB95XNE2</b>	
				4.5	0.45	0.95	7	41	6.3	2	-	58	74	97	PMDPB58UPE	
		20	8	3.7	0.45	0.95	6	47	5.4	2	-	82	107	142	PMDPB85UPE	
				4.5	0.47	0.9	4	135	16.5	-	-	55	75	110	PMDPB55XP	
		12	4.2	0.75	1.25	7	33	5	2	-	66	98	-	PMDPB70XPE		
				3.7	0.4	1	6	120	5.7	-	-	80	95	120	PMDPB80XP	
			30	12	3.8	0.45	1	3	112	5.2	-	-	70	89	-	PMDPB70XP
					3.7	0.4	1	6	120	5.7	-	-	80	95	120	PMF8032XP
MOSFET-Schottky	P	20	12	3.7	0.4	1	6	120	5.7	-	-	80	95	120	PMF8040XP	
				3.7	0.4	1	6	120	5.7	-	-	80	95	120	PMF8040XP	
Pre-biased NPN	P	30	12	3.4	0.45	1	3	112	5.2	-	-	85	105	-	PMC85XP	
Complementary	N	20	12	5.3	0.4	0.9	4	40	14.4	-	-	26	33	50		
	P	20	12	4.5	0.4	0.9	4	40	8.1	-	-	55	75	110	PMCPB5530X	

MOSFETs

# Small-signal MOSFETs in WLCSP4 and WLCSP6 packages

## Key features

- ▶ N- and P-channel
- ▶ Low  $R_{DSon}$  down to 15 mΩ
- ▶  $I_D$  up to 9.6 A
- ▶ Low voltage drive ( $V_{GSth} = 0.6$  V typ)
- ▶  $V_{DS}$  voltage of 12V
- ▶ ESD protection of 2 kV

## Package

- ▶ Two package outlines
  - WLCSP4: 0.78x0.78 mm package size
  - WLCSP6: 1.48x0.98 mm package size
- ▶ Ultra-low height of 0.35 mm
- ▶ High power dissipation ( $P_{tot}$ ) of 1300 mW

### WLCSP6

Single package  
1.48 x 0.98 x 0.35 mm



### In the spotlight

#### PMCM6501VPE- Ultra-low $R_{DSon}$ P-ch MOSFET in WLCSP6

12 V P-ch with  $R_{DSon}$  of typ. 19 mΩ @  $V_{GS} = 4.5$  V

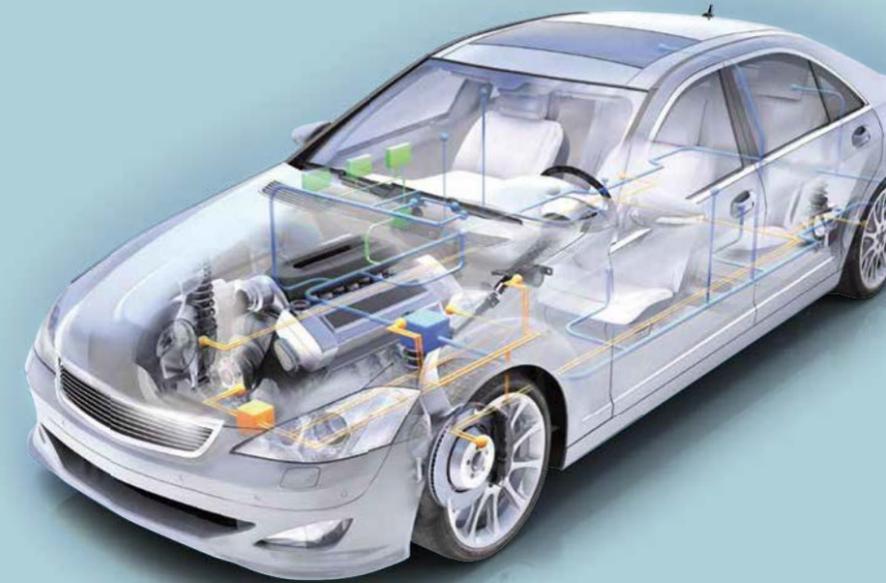
$I_D$  max of 8.2 A for high current load switch

Ultra-small footprint: 1.48 x 0.98 x 0.35 mm

Low voltage gate drive with  $V_{GSth}$  typ. 0.6V

$R_{DSon}$  specified down to 1.8 V for low drive voltages

# Small-signal MOSFETs for automotive



### DFN2020MD-6 (SOT1220)

Single package  
2 x 2 x 0.65 mm

- ▶ Broad portfolio of standard leaded packages in SOT23 and SOT457 and innovative leadless DFN packages with solderable side pads
- ▶ Low  $R_{DSon}$  MOSFETs with  $R_{DSon}$  down to 14 mΩ
- ▶ Standard high  $R_{DSon}$  MOSFETs in different packages with 2 kV ESD protection
- ▶ Broad portfolio of 60 V low  $R_{DSon}$  MOSFETs

### In the spotlight

#### PMPB85ENEA - Automotive-compliant 60 V N-channel MOSFET with $I_D$ max of 4.4 A in DFN2020MD-6 (SOT1220)

60 V N-channel with  $R_{DSon}$  of typ. 72mΩ @  $V_{GS} = 10$  V

Small and leadless ultrathin SMD plastic package: 2.0 x 2.0 x 0.65 mm

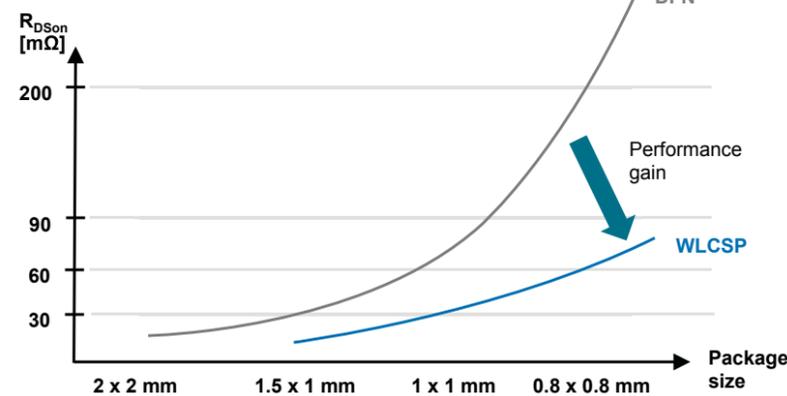
Exposed drain pad for excellent thermal conduction

ESD protection to 2 kV HBM

AEC-Q101 qualified

types in **bold** represent new products

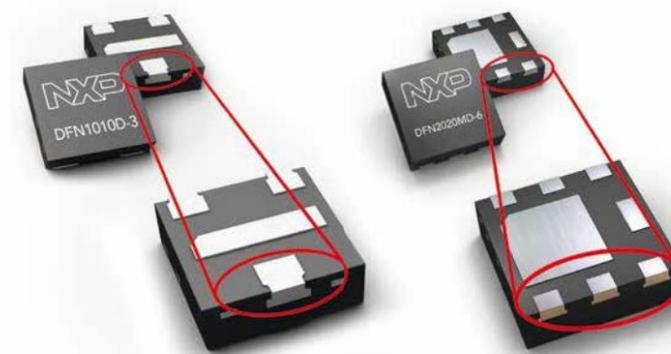
Package											WLCSP4	WLCSP6			
Size (mm)											0.78 x 0.78 x 0.35	1.48 x 0.98 x 0.35			
$P_{tot}$ (mW)											1300	1300			
Polarity	$V_{DS}$ (V)	$V_{GS}$ (V)	$I_D$ (A)	$V_{GS(th)min}$ (V)	$V_{GS(th)max}$ (V)	$t_{on}$ typ (ns)	$t_{off}$ typ (ns)	$Q_G$ typ (nC)	ESD protection (kV)	$R_{DSon}$ typ (mΩ) @ $V_{GS} =$					
										4.5 V	2.5 V	1.8 V	1.5 V		
N	12	8	5	0.4	0.9	6.3	27	5.5	2	57	66	77	90	PMCM440VNE	
			6	0.4	0.9	6.3	30	6	2	36	46	60	86	PMCM4401VNE	
			8.4	0.4	0.9	11	80	15.4	2	21	24	28	33		PMCM650VNE
			9.6	0.4	0.9	10.8	97.5	16.1	2	15	18	22	30		PMCM6501VNE
P	12	8	4.9	0.4	0.9	4.8	25.1	6.8	2	55	77	110	-	PMCM4401VPE	
			8.2	0.4	0.9	8	72	19.6	2	19	25	37	-		PMCM6501VPE



### MOSFETs in WLCSP

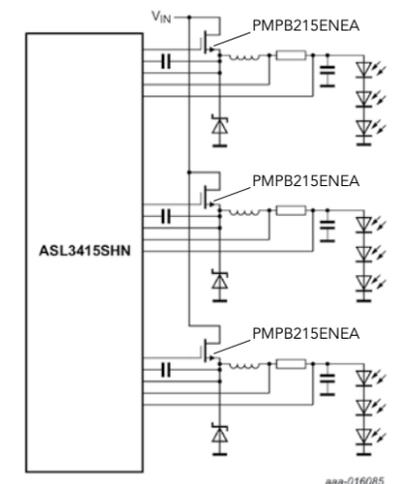
- ▶ Improved  $R_{DSon}$  performance compared to DFN packages
- ▶ Smallest footprint
- ▶ High power capability of 1300 mW
- ▶ Ideal for mobile and space-constrained applications

### DFN1010 and DFN2020 with solderable side pads



Tin plated solderable side pads enable automatic optical inspection (AOI)

### Reference design for LED lighting





Small-signal MOSFETs single (N-channel)

types in **bold** represent new products

Package													SOT223	SOT457 (SC-74)	SOT23	SOT323 (SC-70)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)	
Size (mm)													6.5 x 3.5 x 1.65	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37	
P <sub>tot</sub> (mW)													1700	600	250	200	250	250	
V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th) min</sub> (V)	V <sub>GS(th) max</sub> (V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection (kV)	R <sub>DS(on)</sub> typ (mΩ) @ V <sub>GS</sub> =										
									10 V	4.5 V	2.5 V	1.8 V							
20	8	4.7	0.45	1	8.2	39.5	6.2	2	-	24	29	40			<b>PMN28UNEA</b>	<b>PMV28UNEA</b>			
		1.9	0.4	1	8	31	2.2	2	-	63	77	114				<b>PMF63UNE</b>			
		2.2	0.4	1	6	21	2.6	2	-	64	78	110				<b>PMV65UNE</b>			
		1.9	0.45	0.95	5.3	16	1.6	2	-	120	155	195					<b>PMZ130UNE</b>		
		1.6	0.45	0.95	5.3	16	1.6	2	-	155	190	235						<b>PMZB150UNE</b>	
	1	0.5	0.95	6	86	0.45	2	-	270	360	470						<b>PMZ290UNE2</b>	<b>PMZB290UNE2</b>	
	0.6	0.45	0.95	5.6	19	0.4	1	-	470	620	845					PMZ600UNE	PMZB600UNE		
	6.3	0.75	1.25	16	44	9.9	2	-	16	24	-				<b>PMV20XNEA</b>				
	8.6	0.47	0.9	7	135	7.7	-	-	15	18	22				PMV16XN				
	9.1	0.4	0.9	9	31	12	1	-	15	19	22			<b>PMN16XNE</b>					
5.4	0.4	0.9	7	35	6.2	-	-	24	30	40				PMV30UN2					
6	0.4	0.9	5.5	22	5.1	1	-	28	38	42			<b>PMN30UNE</b>						
30	8	1.5	0.45	0.95	5	17	1.6	2	-	210	240	270						<b>PMZ200UNE</b>	<b>PMZB200UNE</b>
		1	0.45	0.95	4	12	0.8	2	-	390	460	530						<b>PMZ390UNE</b>	<b>PMZB390UNE</b>
		0.59	0.45	0.95	4	12	0.6	2	-	550	660	770						<b>PMZ550UNE</b>	<b>PMZB550UNE</b>
		0.4	0.6	1.1	26	88	0.52	2	-	1000	1400	2000				NX3008NBK	NX3008NBKW		
	7.2	0.4	0.9	8	33	12.4	2	-	19	22	17				PMV20XNE				
	5.7	0.4	0.9	9	34	7	-	-	33	42	54			<b>PMN30UN</b>					
	4.4	0.4	0.9	9	34	7	-	-	36	43	56				PMV40UN2				
	0.9	0.5	1.5	8	11	0.74	2	-	234	324	-					<b>PMF250XNE</b>			
	7.6	1	2	9	9	7.2	-	17	21	-	-				PMV20EN				
	5.5	1	2.5	8	33	12.6	2	17	22	-	-			<b>PMN25ENEA</b>	<b>PMV25ENEA</b>				
	3.9	1	2.5	6.3	14.1	6	2	30	39	-	-				<b>PMV50ENEA</b>				
	3.1	1	2.5	18	78	6.5	-	28	37	-	-				PMV37EN2				
	4.5	1	2.5	3	11	6	1	30	44	-	-			<b>PMN40ENE</b>					
	5.1	1	2	3	11	3.6	-	35	43	-	-				PMV45EN2				
2.1	1	2.5	3	15	2.6	2	70	90	-	-				<b>PMV90ENE</b>					
0.18	0.8	1.5	10	51	0.34	-	2700	3000	4000	-				NX3020NAK	NX3020NAKW				
40	20	3.1	1	2.5	-	-	-	1	65	88	-	-			<b>PMV65ENEA</b>				
		2.5	1	2.5	14	14	2.4	1	95	120	-	-				PMV130ENEA			
55	10	0.3	0.4	1.3	4	11	1	3	-	2300	2400	3100				B5H111BK			
60	20	3.1	1.3	2.7	9	33	12.7	2	46	52	-	-			<b>PMN55ENEA</b>	<b>PMV55ENEA</b>			
		2.1	1.3	2.7	6.4	15.9	5.9	2	96	108	-	-			<b>PMN120ENEA</b>	<b>PMV120ENEA</b>			
		1.5	1.3	2.7	6.3	13	3.9	2	176	196	-	-			<b>PMN230ENEA</b>	<b>PMV230ENEA</b>			
		0.8	1.3	2.7	5.3	10.2	2.4	2	300	332	-	-				<b>PMV450ENEA</b>			
		0.19	0.8	1.5	6	11	0.33	yes	2800	3500	4500	-	-			<b>NX138AK</b>	<b>NX138AKW</b>		
		0.27	0.5	1.5	7.9	12.5	0.49	2	2100	2200	2600	-	-			<b>NX138BK</b>	<b>NX138BKW</b>		
		0.1	0.6	1.4	2	5		2	2800	3800	-	-				BSN20BK			
		0.19	1.1	2.1	12	34	0.33	yes	3000	3700	-	-				NX7002AK	NX7002AKW		
0.27	1.1	2.1	4.7	6.9	1	2	2200	2500	-	-				NX7002BK	NX7002BKW	NX7002BKM	NX7002BKMB		
100	20	1.5	1.3	2.7	4.8	9.3	4.5	1	285	300	-	-			<b>PMT280ENEA</b>				
		1.1	1.3	2.7	5.7	10.2	2.9	1	527	555	-	-			<b>PMT560ENEA</b>				



Small-signal MOSFETs dual

types in **bold** represent new products

											SOT363 (SC-88)	SOT666	DFN2020-6 (SOT1118)	DFN1010B-6 (SOT1216)								
Package																						
Size (mm)											2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	2.0 x 2.0 x 0.65	1.0 x 1.0 x 0.37								
P <sub>tot</sub> (mW)											300	300	1250	350								
Polarity	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th)</sub> min (V)	V <sub>GS(th)</sub> max (V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection (kV)		R <sub>DSon</sub> typ (mΩ) @ V <sub>GS</sub> =											
											10 V	4.5 V	2.5 V	1.8 V								
N-channel	20	8	0.8	0.5	0.95	10	117	0.45	2		-	290	420	600								
			0.6	0.45	0.95	5.6	19	0.4	1			-	470	620	845							
	30	8	5.3	0.4	0.9	4	40	14.4	-			32	40	60								
			0.59	0.45	0.95	4	12	0.6	2			-	550	660	770							
	60	20	0.35	0.6	1.1	26	88	0.52	2			-	1000	1400	2000	NX3008NBKS	NX3008NBKV					
			3.1	0.75	1.25	9	19	2.9	2			-	55	72	-							
			3.1	0.5	1.5	6	18	1.65	1.8			-	95	130	-							
			1	0.5	1.5	6.5	14	0.7	2			-	170	240	-	PMGD175XNE						
	P-channel	20	8	0.18	0.8	1.5	10	51	0.34	yes		2700	3000	4000	-	NX3020NAKS	NX3020NAKV					
				0.18	0.8	1.5	6	11	0.33	yes			2800	3500	4500	-	NX138AKS					
				0.26	0.5	1.5	7.9	12.5	0.49	2			2100	2200	2600	-	NX138BKS					
				0.17	1.1	2.1	12	34	0.33	yes			3000	3700	-	-	NX7002AKS					
0.26				1.1	2.1	4.7	6.9	1	2			2200	2500	-	-	NX7002BKS				NX7002BKXB		
0.55				0.5	1.3	48	152	0.76	2			-	670	1200	1800					PMDT670UPE		
P-channel	20	8	4.5	0.45	0.95	7	41	6.3	2		-	58	74	97					PMDPB58UPE			
			0.5	0.45	0.95	2.3	13.5	1.19	1			-	1020	1270	1700					PMDXB950UPE		
			3.7	0.45	0.95	6	47	5.4	2			-	82	107	142					PMDPB85UPE		
			4.5	0.47	0.9	4	135	16.5	-			-	55	75	110					PMDPB55XP		
	30	12	4.2	0.75	1	7	33	5	2			-	66	98	-					PMDPB70XPE		
			3.7	0.4	1	6	120	5.7	-			-	80	95	120					PMDPB80XP		
	50	20	8	0.41	0.45	0.95	3	14	0.7	2		-	1200	1700	2100						PMDXB1200UPE	
				0.2	0.6	1.1	49	103	0.55	2			-	2800	5300	-						
				3.8	0.45	1	3	112	5.2	-			-	70	89	-						PMDPB70XP
				0.16	1.1	2.1	24	73	0.26	1			4500	5700	-	-	BSS84AKS	BSS84AKV				

Small-signal MOSFETs complementary

types in **bold** represent new products

Package	Type	Polarity	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th)</sub> min (V)	V <sub>GS(th)</sub> max (V)		t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection (kV)	R <sub>DSon</sub> typ (mΩ) @ V <sub>GS</sub> =					
													10 V	4.5 V	2.5 V	1.8 V	1.5 V	1.2 V
 SOT666 (1.6 x 1.2 x 0.55)	NX1029X	N	60	20	0.33	1.1	2.1		11	19	0.5	2	1000	1300	-	-	-	-
		P	50	20	0.17	1.1	2.1		24	73	0.26	1	4500	5100	-	-	-	-
	NX3008CBKV	N	30	8	0.4	0.6	1.1		26	88	0.52	2	-	1000	1400	2000	-	-
		P	30	8	0.22	0.6	1.1		49	103	0.55	2	-	2800	5300	-	-	-
PMDT290UCE	N	20	8	0.8	0.5	0.95		10	117	0.45	2	-	290	420	600	-	-	
	P	20	8	0.55	0.5	1.3		48	152	0.76	2	-	670	1200	1800	-	-	
 SOT363 (SC-88) (2.0 x 1.25 x 0.95)	NX3008CBKS	N	30	8	0.35	0.6	1.1		26	88	0.52	2	-	1000	1400	2000	-	-
		P	30	8	0.2	0.6	1.1		49	103	0.55	2	-	2800	5300	-	-	-
 DFN1010B-6 (1.1 x 1.0 x 0.37)	PMCB900UE	N	20	8	0.6	0.45	0.95		5.6	19	0.4	1	-	470	620	845	1125	2210
		P	20	8	0.5	0.45	0.95		2.3	13.5	1.19	1	-	1020	1270	1700	2300	3500
	PMCB1000UE	N	30	8	0.59	0.45	0.95		4	12	0.6	2	-	550	660	770	890	-
		P	30	8	0.41	0.45	0.95		3	14	0.7	2	-	1200	1700	2100	3000	-
 DFN2020-6 (2.0 x 2.0 x 0.65)	PMCPB5530X	N	20	12	5.3	0.4	0.9		19	56	14.4	-	-	26	33	50	-	-
		P	20	12	4.5	0.47	0.9		18	56	16.5	-	-	55	75	110	-	-

MOSFETs

# 4 steps select a power MOSFET

- 1 Select a voltage, e.g. 40 V
- 2 Select a package, e.g. LFPAK56
- 3 Choose an  $R_{DSon}$  from our extensive range
- 4 Select a type and visit [www.nxp.com/mosfets](http://www.nxp.com/mosfets) to download datasheets and models, and order samples

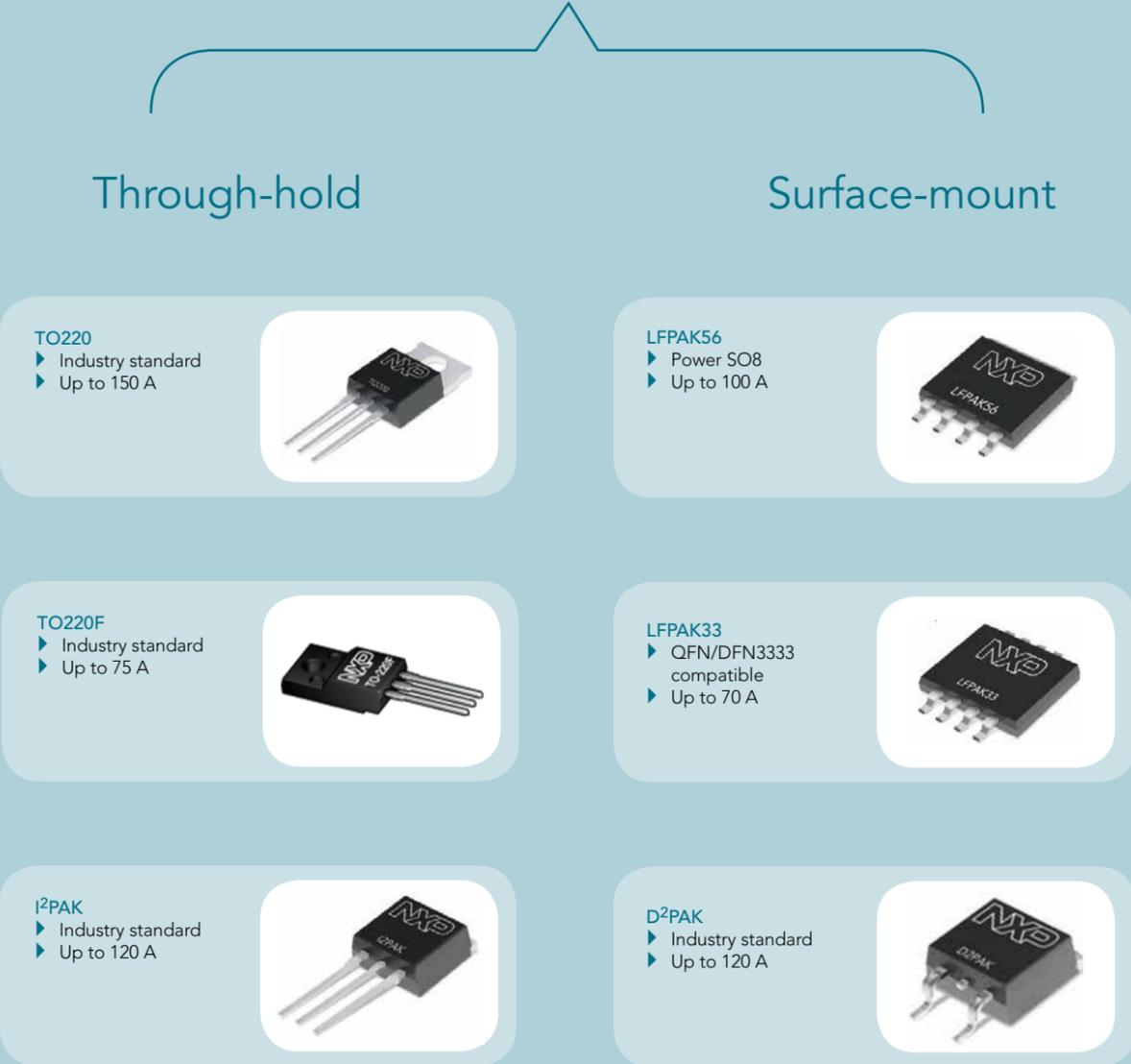
**PSMN part numbering**

The diagram shows the following segments and their meanings:

- PSM** (Power silicon)
- N** (Channel: N = N-channel)
- 4R0** ( $R_{DSon}$  in m $\Omega$ : 4R0 means 4 m $\Omega$  max at 25 °C)
- (Voltage rating:  $BV_{DSS}$  rating)
- 30** (Voltage rating)
- Y** (Package type: B = D<sup>2</sup>PAK, D = DPAK, E = I<sup>2</sup>PAK, K = SO8, L = QFN3333, P = TO220, Y = LFPAK56, X = TO220F (FULLPACK), M = LFPAK33, N = QFN2020)
- L** (Gate threshold voltage: L = Logic level, S = Standard level)
- D** (Technology family: C = NextPower, D = NextPowerS3, E = NextPower Live)

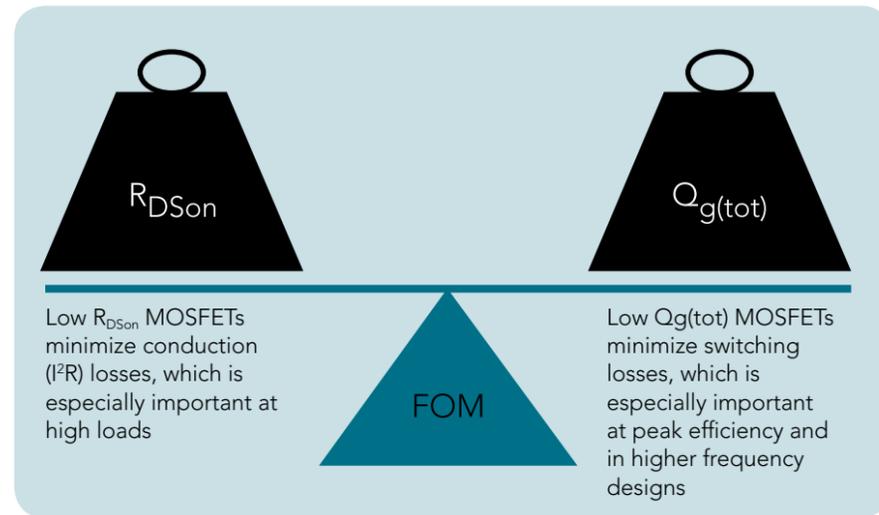
# High-performance power MOSFETs

## MOSFET package selection



# Featured product: NextPowerS3

NextPowerS3 – perfectly balanced for DC/DC switching applications



## The challenge

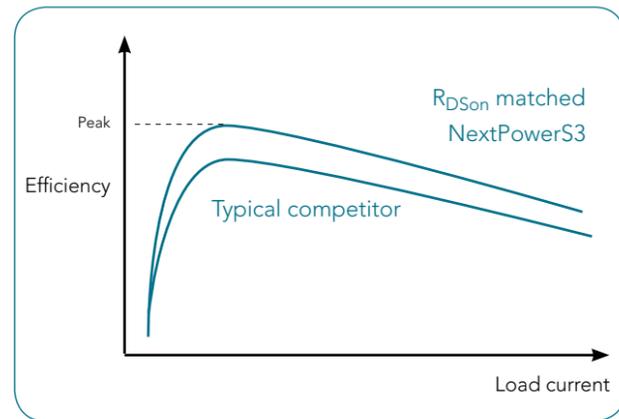
Low  $R_{DS(on)}$  MOSFETs typically need a big die.

Low  $Q_{g(tot)}$  MOSFETs typically need a small die.

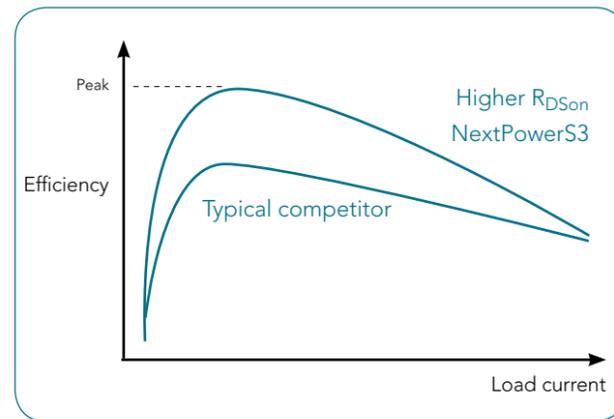
The challenge for manufacturers is to create optimized power MOSFETs that have both low  $R_{DS(on)}$  and low  $Q_{g(tot)}$ .

Welcome to NextPowerS3.

The Figure of Merit (FOM) of a MOSFET is calculated as the product of the  $R_{DS(on)}$  and  $Q_{g(tot)}$ . A low FOM indicates good MOSFET performance in switching applications.



Comparing the performance of a NextPowerS3 MOSFET with a competitor of similar  $R_{DS(on)}$  typically shows an efficiency performance advantage across the load range. Since conduction losses are the same for both devices, the advantage is more noticeable at lower loads where switching losses contribute proportionally more.



Using a NextPowerS3 MOSFET, with a higher  $R_{DS(on)}$  than a competitor device, reduces the  $Q_{g(tot)}$  still further, resulting in an improved peak efficiency. At higher loads, increased conduction losses cancel out the switching advantages and the two parts show similar performance.

# Featured product: NextPowerS3

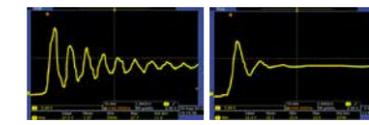
## High switching frequencies



Increasing switching frequency from 300 KHz to 1 MHz allows a 70 - 80% reduction in inductor size. NextPowerS3's excellent switching performance enables such design choices with minimal loss of efficiency.

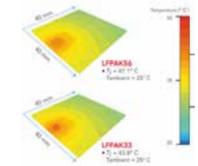
## Low spiking

Typical competitor NextPowerS3



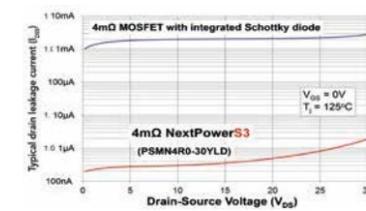
Thanks to optimised output capacitance, body diode and channel structure, NextPowerS3 MOSFETs exhibit "soft-recovery" switching behaviour, resulting in lower voltage spikes, faster decays and virtually no gate glitches.

## Thermal efficiency



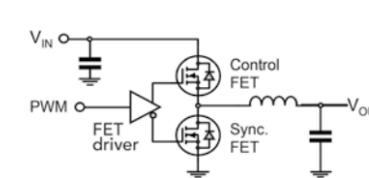
Packaged in the copper-clip based LFPACK package, NextPowerS3 features excellent thermal performance. As  $R_{DS(on)}$  rises with temperature, keeping MOSFETs cool helps efficiency as well as reliability.

## Low leakage



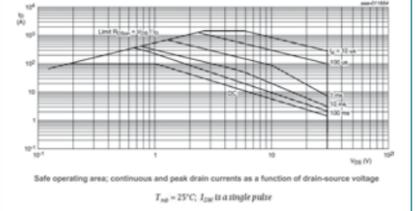
Unique SchottkyPlus technology offers the benefits of an integrated Schottky diode without the problems associated with leakage current.

## Specialist high sides



The NextPowerS3 portfolio contains devices with multiple busbars and low  $R_g$  optimized for use as control FETs, further improving system efficiencies.

## Improved SOA

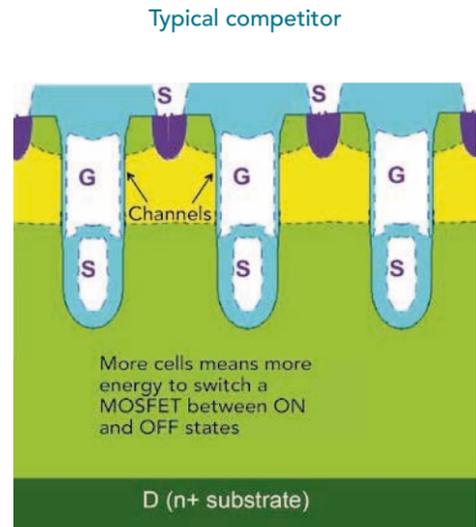


A wide cell pitch makes NextPowerS3 an excellent choice for hot-swap, e-Fuse, and power OR-ing applications.

Package	Type number	$V_{DS}$ [max] (V)	$R_{DS(on)}$ [max] @ $V_{GS} = 10$ V (m $\Omega$ )	$R_{DS(on)}$ [max] @ $V_{GS} = 4.5$ V (m $\Omega$ )	$I_D$ [max] (A)	$Q_{g(tot)}$ [typ] (nC)
LFPACK33 (SOT1210)	PSMN2R4-30MLD	30	2.4	3.2	70	16
	PSMN4R2-30MLD	30	4.3	5.7	70	9.2
	PSMN7R5-30MLD	30	7.6	10.3	57	5.8
Power-SO (LFPACK56)	PSMN0R9-30YLD	30	0.87	1.09	100	51
	PSMN1R0-30YLD	30	1.02	1.3	100	38
	PSMN1R2-30YLD	30	1.24	1.6	100	32
	PSMN1R4-30YLD	30	1.42	1.85	100	27.6
	PSMN2R4-30YLD	30	2.4	3.1	100	18
	PSMN3R0-30YLD	30	3.1	4	100	14.5
	PSMN4R0-30YLD	30	4	5.5	95	9.6
	PSMN6R0-30YLD	30	6	8.35	66	6.7
	PSMN6R1-30YLD	30	6	8.35	66	6.8
	PSMN7R5-30YLD	30	7.5	10.2	51	5.8
	PSMN1R0-40YLD	40	1.1		100	54
PSMN1R4-40YLD	40	1.4		100	45	

# Featured product: NextPowerS3 – the technology

**NextPower Live! MOSFETs**  
**for a non-stop world**  
 Reliable linear-mode performance  
**AND** low  $R_{DSon}$  efficiency  
 in *hot-swap* and *soft-start* applications



### The importance of cell design

The outstanding performance of NextPowerS3 is largely attributable to NXP's unique "Super-junction" technology and optimization of cell structures.

Most manufacturers of low-voltage MOSFETs use "Split Gate" technology to achieve low  $R_{DSon}$ .

NextPowerS3 uses a different approach to its cell design.

### The drive for $R_{DSon}$

A MOSFET's  $R_{DSon}$  is given by the formula:

$$R_{DSon} = R_{channel} + R_{drift} + R_{substrate} + (R_{package})$$

Many manufacturers focus on reducing  $R_{channel}$  to drive  $R_{DSon}$  down.

NXP's Super-junction allows for an optimization of all three components for reduction in  $R_{DSon}$ , while also enhancing switching performance and Safe Operating Area (SOA).

### Maximizing switching performance

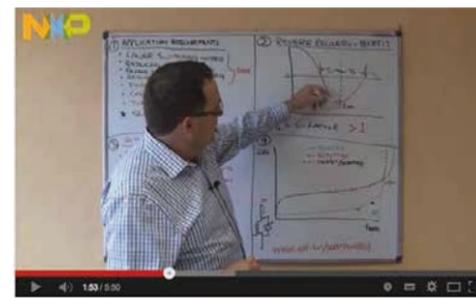
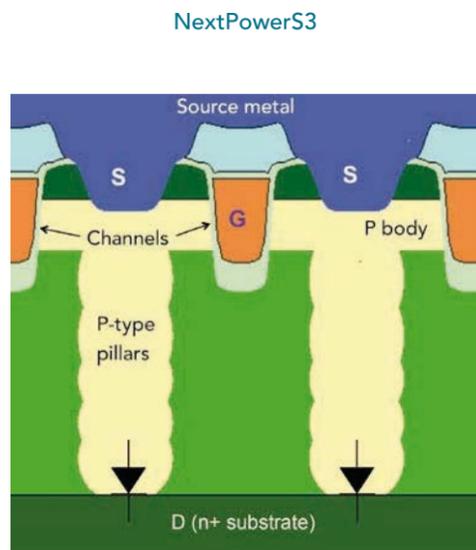
Switching losses result from the energy required to charge / discharge all the cell capacitances across the device. The total charge required is referred to as  $Q_{g(tot)}$ .

With NextPower S3,  $Q_{g(tot)}$  is lower and switching losses are kept to a minimum. This is especially beneficial at peak efficiency and in higher-frequency designs, which have a higher number of switching events.

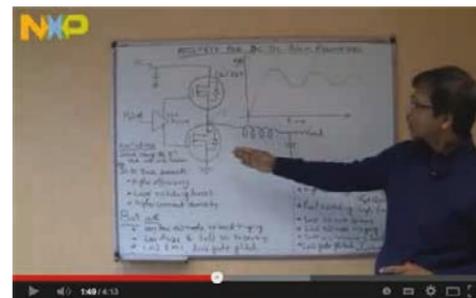
### SOA and other benefits

When a device is operating in its linear mode, the channel current generates localized heating effects, which can cause failure.

NXP has optimized the cell structure to keep this heating effect under control. As a result, NextPowerS3 enjoys a particularly strong SOA, which is important in hot-swap, e-Fuse, and power OR-ing designs.



Reverse recovery and diode leakage in SMPS  
[www.nxp.com/quicklearning33](http://www.nxp.com/quicklearning33)



NextPowerS3 MOSFETs for DC/DC buck regulators  
[www.nxp.com/quicklearning32](http://www.nxp.com/quicklearning32)



MOSFETs

### Non-stop applications

- ▶ Cloud computing
- ▶ Network storage
- ▶ Communications infrastructure
- ▶ Industrial process control
- ▶ Transaction processing
- ▶ Traffic monitoring & signaling
- ▶ CCTV security

### Non-stop equipment

- ▶ Blade and rack servers
- ▶ Routers, switches & base stations
- ▶ RAID arrays
- ▶ Industrial PCs
- ▶ Programmable Logic Controllers (PLCs)
- ▶ CCTV digital video recorders
- ▶ "Hot-swap" & "soft-start" systems

## Featured product: NextPower Live

Mobile phones, ATMs, the internet, traffic signals – so much of our daily life depends on 24/7/365 computers, communications, and storage, made possible by rack-based systems that can be maintained with the power on. NextPower Live MOSFETs are designed specifically for such applications:

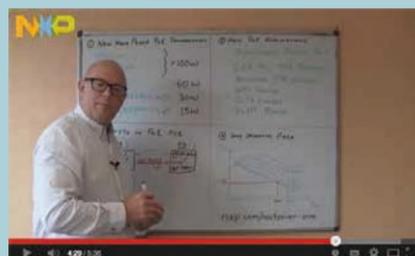
- ▶ When a replacement board is plugged into a live system, it is important that the in-rush current is carefully controlled, so as to protect the components on the board and ensure that other parts of the system experience no power disruption. This application requires MOSFETs with strong linear mode performance and a wide safe operating area (SOA) to manage current effectively and reliably.
- ▶ Once the replacement board is safely installed, the MOSFET is turned fully ON. In this mode of operation, a low  $R_{DS(on)}$  is of primary importance, helping to keep temperatures low while maximizing system efficiency.
- ▶ Only NextPower Live MOSFETs offer reliable linear mode performance **AND** low  $R_{DS(on)}$  efficiency.

### NextPower Live portfolio

Package	30 V for 12 V supplies used in computing applications	100 V for 48 V supplies used in computing telecommunications
D <sup>2</sup> PAK (SOT404)	PSMN1R5-30BLE PSMN3R4-30BLE	PSMN4R8-100BSE PSMN7R6-100BSE
TO220		PSMN4R8-100PSE PSMN7R8-100PSE
LFPAK56 (Power-SO8)	PSMN2R0-30YLE	PSMN013-100YSE
LFPAK33		(specifically for PoE applications) PSMN040-100MSE PSMN075-100MSE



Power MOSFET operation in linear mode  
[www.nxp.com/quicklearning34](http://www.nxp.com/quicklearning34)



MOSFETs for Power-over-Ethernet (PoE) PSE applications  
[www.nxp.com/quicklearning36](http://www.nxp.com/quicklearning36)



Next Power Live! MOSFETs for HOT SWAP and Power over Ethernet  
[www.nxp.com/quicklearning29](http://www.nxp.com/quicklearning29)

## Featured product: NextPower Cordless

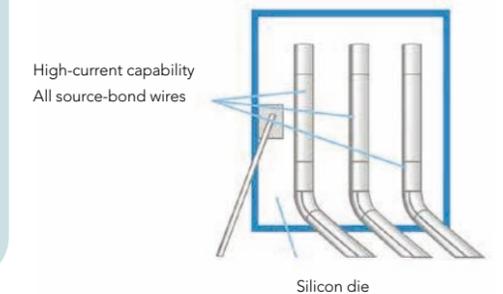
▶ Battery-powered tools, including everything from small engraving devices and screwdrivers to heavy-duty saws and agricultural tools, present a wide variety of requirements for driving the motor. The MOSFETs used in these systems have to perform at demanding levels and must have:

- ▶ Low on-resistance for optimum battery life
- ▶ Low thermal resistance for reduced junction temperature (for greater reliability)
- ▶ High current capability (when the motor stalls, for example)
- ▶ Choice of logic- and standard-level gate drives, depending on battery voltage
- ▶ Excellent avalanche ruggedness to withstand high-load conditions
- ▶ Environmental robustness (wide operating/storage temperatures, harsh vibrations)
- ▶ Competitive cost

Overall, the motor-control MOSFET needs to deliver automotive-grade performance at a commercially competitive price



Typical Power Tools MOSFET internal construction

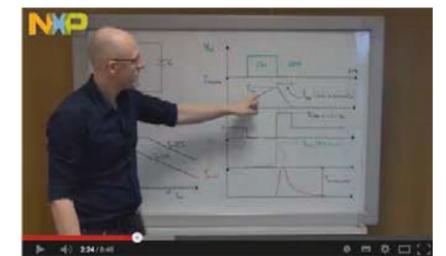


NXP has developed a range of MOSFETs specifically aimed at motor-control applications. These are based on our highly reliable, automotive-qualified silicon, with specific package enhancements such as thicker wires and multiple bond points (“stitch bonding”) to spread the current evenly over the die surface.

NXP’s long history in automotive MOSFETs means we have the know-how to produce devices with excellent avalanche ruggedness. The same expertise deployed in power steering and ABS systems worldwide is put to use in our devices for motor control and that means performance you can count on.

Max current ( $I_D(max)$ ) depends largely on the number and diameter of the aluminium bond wires. The NXP Power Tools portfolio is typically based on a standard of three 500  $\mu m$  wires, allowing for an  $I_D(max)$  rating of up to 150 A in a TO220 package.

Some low  $R_{DS(on)}$  devices, based on NXP’s LFPAK56 (Power-SO8 compatible) package, can support an  $I_D(max)$  of 300A, perfect for power tool applications where the motor control MOSFETs must be able to support high torque levels, even during “locked-rotor” events.



Single-shot avalanche ruggedness  
[www.nxp.com/quicklearning35](http://www.nxp.com/quicklearning35)



NextPower Cordless MOSFETs for battery-powered tools  
[www.nxp.com/quicklearning28](http://www.nxp.com/quicklearning28)

### NextPower Cordless portfolio

Type number	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 4.5 V (mΩ)	I <sub>D</sub> [max] (A)	EAS at rated current [mJ]	Package	Gate threshold
PSMN0R9-30YLD	30	0.87	1.09	300	-		Logic Level
PSMN1R0-30YLD	30	1.02	1.3	300	-		Logic Level
PSMN2R0-30YL	30	2	2.63	100	151	LFPAK56	Logic Level
PSMN2R0-30YLE	30	2	3.5	100	370	LFPAK56	Logic Level
PSMN2R5-30YL	30	2.4	3.16	100	103	LFPAK56	Logic Level
PSMN2R6-30YLC	30	2.8	3.65	100	50	LFPAK56	Logic Level
PSMN1R9-40PL	40	1.7	1.94	150	1008	TO220 (SOT78)	Logic Level
PSMN2R1-40PL	40	2.2	2.6	150	622	TO220 (SOT78)	Logic Level
PSMN1R5-40PS	40	1.6	-	120	1400	TO220 (SOT78)	Standard Level
PSMN2R2-40PS	40	2.1	-	100	1240	TO220 (SOT78)	Standard Level
PSMN2R5-60PL	60	2.6	3.15	150	655	TO220 (SOT78)	Logic Level
PSMN2R6-60PS	60	2.9	-	150	519	TO220 (SOT78)	Standard Level
PSMN3R3-60PL	60	3.4	3.8	130	404	TO220 (SOT78)	Logic Level
PSMN3R9-60PS	60	3.9	-	130	372	TO220 (SOT78)	Standard Level
PSMN4R2-60PL	60	4.3	4.3	130	372	TO220 (SOT78)	Logic Level
PSMN7R6-60PS	60	7.8	-	92	110	TO220 (SOT78)	Standard Level

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)



Heavy-duty tools with large batteries require MOSFETs that withstand higher currents. NXP's TO-220 NextPower Cordless devices handle up to 150A. The high-reliability LFPAK56 is ideal for smaller tools and space-constrained applications.

### Power MOSFETs 20 - 25 V

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 4.5 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
LFPAK56; Power-SO8 (SOT669)	PH3120L	20	2.65	3.7	100	48.5
	PH2520U	20		2.7	100	78
	PSMN0R9-25YLC	25	0.99	1.25	100	51
	PSMN1R1-25YLC	25	1.15	1.5	100	39
	PSMN1R2-25YL	25	1.2	1.85	100	50.6
	PSMN1R2-25YLC	25	1.3	1.7	100	31
	PSMN1R5-25YL	25	1.5	2.2	100	36
	PSMN2R2-25YLC	25	2.4	3.15	100	18
	PSMN2R9-25YLC	25	3.15	4.1	100	16
	PSMN4R0-25YLC	25	4.5	5.8	84	10.9
	PSMN6R0-25YLB	25	6.1	7.9	73	9
	PSMN6R5-25YLC	25	6.5	8.5	64	8.4
	PH2925U	25		3	100	92
	LFPAK33 (SOT1210)	PSMN2R8-25MLC	25	2.8	3.75	70
PSMN3R9-25MLC		25	4.15	5.55	70	9.7
PSMN9R0-25MLC		25	8.65	11.3	55	5.4
D <sup>2</sup> PAK (SOT404)	PHB66NQ03LT	25	10.5		66	12
DPAK (SOT428)	PHD38N02LT	20			44.7	15.1
	PHD97NQ03LT	25	6.3	10.6	75	11.7
SO8 (SOT96-1)	PSMN006-20K	20		5	32	32

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

Power MOSFETs 30V – Part 1

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DS(on)</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DS(on)</sub> [max] @ V <sub>GS</sub> = 4.5 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
LFPAK56; Power-SO8 (SOT669)	PSMN0R9-30YLD	30	0.87	1.09	300	51
	PSMN1R0-30YLD	30	1.02	1.3	300	38.2
	PSMN1R0-30YLC	30	1.15	1.4	100	50
	PSMN1R2-30YLD	30	1.24	1.6	100	32
	PSMN1R2-30YLC	30	1.25	1.65	100	38
	PSMN1R3-30YL	30	1.3	1.95	100	46.6
	PSMN1R4-30YLD	30	1.42	1.85	100	27.6
	PSMN1R5-30YL	30	1.5	1.9	100	36.2
	PSMN1R5-30YLC	30	1.55	2.05	100	30
	PSMN1R7-30YL	30	1.7	2.1	100	36.2
	PSMN2R0-30YL	30	2	2.63	100	30
	PSMN2R0-30YLE	30	2	3.5	100	87
	PSMN2R2-30YLC	30	2.15	2.8	100	26
	PSMN2R4-30YLD	30	2.4	3.1	100	18
	PSMN2R5-30YL	30	2.4	3.16	100	27
	PSMN2R6-30YLC	30	2.8	3.65	100	18
	PSMN3R0-30YL	30	3	4.04	100	21
	PSMN3R0-30YLD	30	3.1	4	100	14.5
	PSMN3R2-30YLC	30	3.5	4.55	100	14.2
	PSMN3R5-30YL	30	3.5	4.61	100	19
	PSMN4R0-30YL	30	4	5.25	100	17.6
	PSMN4R0-30YLD	30	4	5.5	95	9.6
	PSMN4R1-30YLC	30	4.35	5.7	92	11
	PSMN4R5-30YLC	30	4.8	6.1	84	9.6
	PSMN5R0-30YL	30	5	6.7	91	14.1
	PSMN6R0-30YL	30	6	7.87	79	11
	PSMN6R0-30YLD	30	6	8.35	66	6.7
	PSMN6R1-30YLD	30	6	8.35	66	6.4
	PSMN6R0-30YLB	30	6.5	8.1	71	9
	PSMN7R0-30YL	30	7	9.1	76	10
	PSMN7R0-30YLC	30	7.1	8.9	61	7.9
	PSMN7R5-30YLD	30	7.5	10.2	51	5.8
	PSMN9R1-30YL	30	9.1	13.6	57	8.4
	PSMN9R5-30YLC	30	9.8	12.1	44	5
	PSMN011-30YLC	30	11.6	14.5	37	4.9
	PSMN013-30YLC	30	13.6	16.9	32	4
LFPAK33 (SOT1210)	PSMN2R4-30MLD	30	2.4	3.2	70	16
	PSMN2R9-30MLC	30	2.95	3.8	70	16.7
	PSMN3R0-30MLC	30	3.15	4.05	70	16.1
	PSMN4R2-30MLD	30	4.3	5.7	70	9.2
	PSMN4R4-30MLC	30	4.65	6	70	10.6
	PSMN7R0-30MLC	30	7	9	67	8.2
	PSMN7R5-30MLD	30	7.6	10.3	57	5.8
	PSMN9R8-30MLC	30	9.8	12.4	50	5
	PSMN013-30MLC	30	13.6	16.9	39	3.7
	PSMN020-30MLC	30	18.1	27	31.8	4.6
DPAK (SOT404)	PSMNR90-30BL	30	1	1.4	120	118
	PSMN1R5-30BLE	30	1.5	1.85	120	228
	PSMN1R8-30BL	30	1.8	2.1	100	83
	PSMN1R6-30BL	30	1.9	2.2	100	101
	PSMN2R0-30BL	30	2.1	2.9	100	55
	PSMN2R7-30BL	30	3	3.7	100	32
	PSMN3R4-30BL	30	3.3	3.8	100	31
	PSMN3R4-30BLE	30	3.4	5	120	81
	PSMN4R3-30BL	30	4.1	5.2	100	19
	PSMN017-30BL	30	17	23.3	32	5.1
	PSMN022-30BL	30	22.6	29.6	30	4.4

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Power MOSFETs 30V – Part 2

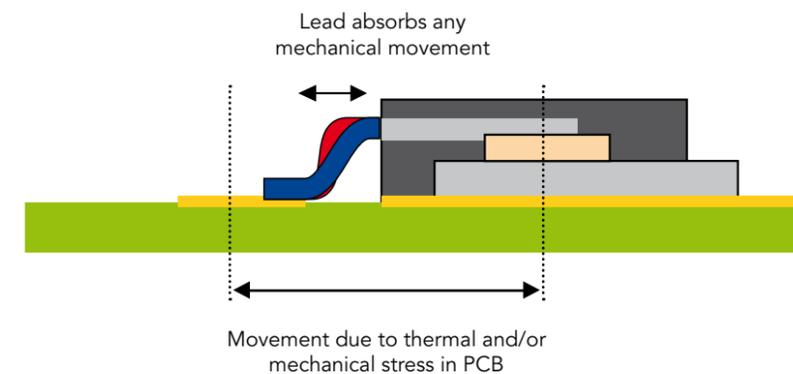
types in **bold** represent new products

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DS(on)</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DS(on)</sub> [max] @ V <sub>GS</sub> = 4.5 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
DPAK (SOT428)	PHD101NQ03LT	30	5.5		75	23
	PHD71NQ03LT	30	10		75	13.2
TO-220AB (SOT78)	PSMN1R1-30PL	30	1.3	1.6	120	118
	PSMN1R6-30PL	30	1.7	2.1	100	101
	PSMN1R8-30PL	30	1.8	2.3	100	83
	PSMN2R0-30PL	30	2.1	2.8	100	55
	PSMN2R7-30PL	30	2.7	3.6	100	32
	PSMN3R4-30PL	30	3.4	4.1	100	31
	PSMN4R3-30PL	30	4.3	6.2	100	19
	PHP36N03LT	30	17	22	43.4	18.5
	PSMN017-30PL	30	17	23.4	32	5.1
	PSMN022-30PL	30	22	34	30	4.4
LFPAK (SOT226)	PSMN1R1-30EL	30	1.3	1.6	120	118
	PSMN017-30EL	30	17	23.4	32	5.1
SO8 (SOT96-1)	PHK31NQ03LT	30	4.4	5.6	30.4	33
	PSMN005-30K	30	5.5	8		34
	PHK18NQ03LT	30	8.9	12.5	20.3	10.6
	PHK13N03LT	30	20	26	13.8	10.7
	PHK12NQ03LT	30		14	11.8	

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

LFPAK for mechanical and thermal ruggedness

NXP LFPAK



LFPAK pins provide compliance while allowing for thermal expansion due to temperature differences between the MOSFET and the PCB, and allowing for mechanical strain due to PCB bending and flexing

### Power MOSFETs 40V

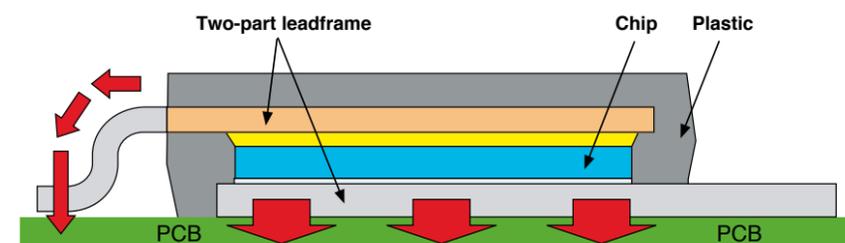
types in **bold** represent new products

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 4.5 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)	
LFPAK56; Power-SO8 (SOT669)	PSMN1R0-40YLD	40	1.1	1.4	100	59	
	PSMN1R4-40YLD	40	1.4	1.85	100	45	
	PSMN1R6-40YLC	40	1.55	1.8	100	59	
	PSMN1R8-40YLC	40	1.8	2.1	100	45	
	PSMN2R6-40YS	40	2.8		100	63	
	PSMN3R3-40YS	40	3.3		100	49	
	PH4840S	40	4.1		94.5	67	
	PSMN4R0-40YS	40	4.2		100	38	
	PSMN5R8-40YS	40	5.7		90	28.8	
	PSMN8R3-40YS	40	8.6		70	20	
	PSMN014-40YS	40	14		46	12	
	D <sup>2</sup> PAK (SOT404)	PSMN1R1-40BS	40	1.3		120	136
		PSMN2R2-40BS	40	2.2		100	130
PSMN2R8-40BS		40	2.9		100	71	
PSMN4R5-40BS		40	4.5		100	35	
TO-220AB (SOT78)	PSMN1R5-40PS	40	1.6		150	136	
	PSMN1R9-40PL	40	1.7	1.94	150	230	
	PSMN2R1-40PL	40	2.2	2.6	150	168.9	
	PSMN2R2-40PS	40	2.1		100	110	
	PSMN2R8-40PS	40	2.8		100	71	
	PSMN4R5-40PS	40	4.6		100	35	
	PSMN8R0-40PS	40	7.6		77	17	
I <sup>2</sup> PAK (SOT226)	PSMN1R5-40ES	40	1.6		120	136	

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### Power-SO8 (LFPAK) Design

- ▶ Low thermal resistance
- ▶ Low electrical resistance
- ▶ Low inductance



### Power MOSFETs 55 - 60V

types in **bold** represent new products

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)	
LFPAK56; Power-SO8 (SOT669)	PH955L	55	8.3	62.5	42	
	<b>PSMN4R0-60YS</b>	<b>60</b>	<b>4</b>	<b>100</b>	<b>56</b>	
	<b>PSMN4R1-60YL</b>	<b>60</b>	<b>4.1</b>	<b>100</b>	<b>103</b>	
	<b>PSMN5R2-60YL</b>	<b>60</b>	<b>5.2</b>	<b>100</b>	<b>78.4</b>	
	PSMN5R5-60YS	60	5.2	100	56	
	<b>PSMN5R6-60YL</b>	<b>60</b>	<b>5.6</b>	<b>100</b>	<b>66.8</b>	
	PSMN7R0-60YS	60	6.4	89	45	
	<b>PSMN7R5-60YL</b>	<b>60</b>	<b>7.5</b>	<b>86</b>	<b>60.6</b>	
	PSMN8R5-60YS	60	8	76	39	
	PSMN012-60YS	60	11.1	59	28.4	
	<b>PSMN013-60YL</b>	<b>60</b>	<b>13</b>	<b>53</b>	<b>33.2</b>	
	PSMN017-60YS	60	15.7	44	20	
	PSMN030-60YS	60	24.7	29	13	
	LFPAK33 (SOT1210)	PSMN011-60ML	60	11.3	61	37.2
		PSMN011-60MS	60	11.3	61	23
D2PAK (SOT404)	PHB191NQ06LT	55	3.7	75	95.6	
	PHB21N06LT	55	70	19		
	PHB20N06T	55	75	20.3	11	
	PSMN1R7-60BS	60	2	120	137	
	PSMN3R0-60BS	60	3.2	100	130	
	PSMN004-60B	60	3.6	75	168	
	PSMN4R6-60BS	60	4.4	100	70.8	
	PSMN7R6-60BS	60	7.8	92	38.7	
	PSMN015-60BS	60	14.8	50	20.9	
	PHB32N06LT	60	37	34	17	
DPAK (SOT428)	PHD20N06T	55	77	18	11	
	PHP191NQ06LT	55	3.7	75	95.6	
TO-220AB (SOT78)	PHP20N06T	55	75	20.3	11	
	PSMN2R0-60PS	60	2.2	120	137	
	PSMN2R5-60PL	60	2.6	150	223	
	PSMN2R6-60PS	60	2.6	150	140	
	PSMN3R0-60PS	60	3	100	130	
	PSMN3R3-60PL	60	3.4	130	175	
	PSMN3R9-60PS	60	3.9	130	103	
	PSMN4R2-60PL	60	3.9	130	151	
	PSMN4R6-60PS	60	4.6	100	70.8	
	PSMN7R6-60PS	60	7.8	92	38.7	
	PSMN015-60PS	60	14.8	50	20.9	
	I <sup>2</sup> PAK (SOT226)	PSMN2R0-60ES	60	2.2	120	137
		PSMN3R0-60ES	60	3	100	130

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### Power MOSFETs 75 - 80 V

types in **bold** represent new products

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DS(on)</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)	
LFPAK56; Power-SO8 (SOT669)	<b>PSMN8R0-80YL</b>	<b>80</b>	<b>8</b>	<b>100</b>	<b>104</b>	
	PSMN8R2-80YS	80	8.5	82	55	
	<b>PSMN010-80YL</b>	<b>80</b>	<b>10</b>	<b>84</b>	<b>84.7</b>	
	PSMN011-80YS	80	11	67	45	
	PSMN013-80YS	80	12.9	60	37	
	<b>PSMN014-80YL</b>	<b>80</b>	<b>14</b>	<b>62</b>	<b>56.9</b>	
	PSMN018-80YS	80	18	45	26	
	<b>PSMN025-80YL</b>	<b>80</b>	<b>25</b>	<b>37</b>	<b>34.3</b>	
	PSMN026-80YS	80	27.5	34	20	
	PSMN041-80YL	80	41	25	21.9	
	PSMN045-80YS	80	45	24	12.5	
	D2PAK (SOT404)	PSMN005-75B	75	5	75	165
		PSMN008-75B	75	8.5	75	122.8
PHB110NQ08T		75	9	75	113.1	
PHB29N08T		75		27	19	
PSMN2R8-80BS		80	3	120	139	
PSMN3R3-80BS		80	3.5	120	111	
PSMN4R4-80BS		80	4.5	100	125	
PSMN5R0-80BS		80	5.1	100	101	
PSMN6R5-80BS		80	6.9	100	71	
PSMN8R7-80BS		80	8.7	90	52	
PSMN012-80BS		80	11	74	36	
PSMN017-80BS		80	17	50	26	
PSMN050-80BS		80	46	22	11	
TO-220AB (SOT78)		PSMN005-75P	75	5	75	165
		PHP79NQ08LT	75	16	73	30
	PHP29N08T	75		27	19	
	PSMN3R3-80PS	80	3.3	120	139	
	PSMN3R5-80PS	80	3.5	120	139	
	PSMN4R4-80PS	80	4.1	100	112	
	PSMN4R3-80PS	80	4.3	120	111	
	PSMN5R0-80PS	80	4.7	100	87	
	PSMN6R5-80PS	80	6.9	100	71	
	PSMN8R7-80PS	80	8.7	90	52	
	PSMN012-80PS	80	11	74	36	
	PSMN017-80PS	80	17	50	26	
	I2PAK (SOT226)	PSMN3R3-80ES	80	3.3	120	139
		PSMN3R5-80ES	80	3.5	120	139
		PSMN4R3-80ES	80	4.3	120	111

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### Power MOSFETs 100 V

types in **bold** represent new products

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DS(on)</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
LFPAK56; Power-SO8 (SOT669)	<b>PSMN012-100YL</b>	<b>100</b>	<b>11.9</b>	<b>85</b>	<b>118</b>
	PSMN012-100YS	100	12	60	64
	PSMN013-100YSE	100	13	82	75
	<b>PSMN015-100YL</b>	<b>100</b>	<b>14.7</b>	<b>69</b>	<b>86.3</b>
	PSMN016-100YS	100	16.3	51	54
	<b>PSMN019-100YL</b>	<b>100</b>	<b>18</b>	<b>56</b>	<b>72.4</b>
	PSMN020-100YS	100	20.5	43	41
	<b>PSMN021-100YL</b>	<b>100</b>	<b>21.5</b>	<b>49</b>	<b>65.6</b>
	PH20100S	100	23	34.3	39
	PSMN028-100YS	100	27.5	42	33
	PSMN038-100YL	100	37.5	30	21.6
	PSMN039-100YS	100	39.5	28.1	23
	PSMN069-100YS	100	72.4	17	14
LFPAK33 (SOT1210)	PSMN040-100MSE	100	36.6	30	30
	PSMN075-100MSE	100	71	18	16.4
D2PAK (SOT404)	PSMN3R8-100BS	100	3.9	120	170
	PSMN4R8-100BSE	100	4.8	120	196
	PSMN5R6-100BS	100	5.6	100	141
	PSMN7R0-100BS	100	6.8	100	125
	PSMN7R6-100BSE	100	7.6	75	128
	PSMN009-100B	100	8.8	75	156
	PSMN9R5-100BS	100	9.6	89	82
	PSMN013-100BS	100	13.9	68	59
	PSMN015-100B	100	15	75	90
	PSMN016-100BS	100	16	57	49
	PHB45NQ10T	100	25	47	61
	PSMN027-100BS	100	26.8	37	30
	PHB47NQ10T	100	28	47	66
	PSMN034-100BS	100	34.5	32	23.8
	PHB27NQ10T	100	50	28	30
PHB18NQ10T	100	90	18	21	
DPAK (SOT428)	PSMN025-100D	100	25	47	61
TO-220AB (SOT78)	PSMN4R3-100PS	100	4.3	120	170
	<b>PSMN4R8-100PSE</b>	<b>100</b>	<b>5</b>	<b>120</b>	<b>196</b>
	PSMN5R0-100PS	100	5	120	170
	PSMN5R6-100PS	100	5.6	100	141
	PSMN7R0-100PS	100	6.8	100	125
	<b>PSMN7R8-100PSE</b>	<b>100</b>	<b>7.8</b>	<b>83</b>	<b>128</b>
	PSMN8R5-100PS	100	8.5	100	111
	PSMN009-100P	100	8.8	75	156
	PSMN9R5-100PS	100	9.6	89	82
	PSMN013-100PS	100	13.9	68	59
	PSMN015-100P	100	15	75	90
	PSMN016-100PS	100	16	57	49
	PHP45NQ10T	100	25	47	61
	PSMN027-100PS	100	26.8	37	30
	PSMN034-100PS	100	34.5	32	23.8
PHP18NQ10T	100	90	18	21	
I2PAK (SOT226)	PSMN4R3-100ES	100	4.3	120	170
	PSMN5R0-100ES	100	5	120	170
	PSMN7R0-100ES	100	6.8	100	125
	PSMN8R5-100ES	100	8.5	100	111
	PSMN013-100ES	100	13.9	68	59
SC-73 (SOT223)	PHT6NQ10T	100	90	6.5	21
	PHT4NQ10T	100	250	3.5	7.4
SO8 (SOT96-1)	PSMN038-100K	100	38		43
	PHKD3NQ10T	100	90	3	21

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### Power MOSFETs 105 - 150V

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
LFPAK56; Power-SO8 (SOT669)	PSMN059-150Y	150	59	43	27.9
	PSMN030-150B	150	30	55.5	98
D <sup>2</sup> PAK (SOT404)	PSMN035-150B	150	35	50	79
	PHB45NQ15T	150	42	45.1	32
	PSMN063-150D	150	63	29	55
TO-220AB (SOT78)	PHP45NQ11T	105	25	47	60
	PSMN015-110P	110	15	75	90
	PHP27NQ11T	110	50	27.6	30
	PHP23NQ11T	110	70	23	22
	PHP18NQ11T	110	90	18	21
	PSMN6R3-120PS	120	6.7	70	207.1
	PSMN7R8-120PS	120	7.9	70	167
	PSMN030-150P	150	30	55.5	98
	PSMN035-150P	150	35	50	79
	PHP30NQ15T	150	63	29	55
	PHP28NQ15T	150	65	28.5	24
	I <sup>2</sup> PAK (SOT226)	PSMN6R3-120ES	120	6.7	70
PSMN7R8-120ES		120	7.9	70	167
SO8 (SOT96-1)	PHK5NQ15T	150	75	5	29
	PSMN085-150K	150	85	-	40

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### P-channel

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 4.5 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
SO8 (SOT96-1)	PMK30EP	-30	19	30	-14.9	50
	PMK35EP	-30	19	35	-14.9	42
	PHP225	-30	250	400	-	10
	PMK50XP	-20	-	50	-7.9	10
	PHK04P02T	-16	-	120	-4.66	7.2

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### Multi-chip

Package	Type number	Channel type	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
SO8 (SOT96-1)	PHP225	P	-30	250	-	10
	PHKD6N02LT	N	20	-	10.9	15.3
	PHKD13N03LT	N	30	20	10.4	10.7
	PHN203	N	30	30	6.3	14.6
	PHN210T	N	30	100	3.4	6
	PHC21025	N/P	30	250	-	10
	PHKD3NQ10T	N	100	90	3	21
	PHC2300	N/P	300	6000	-	6.24

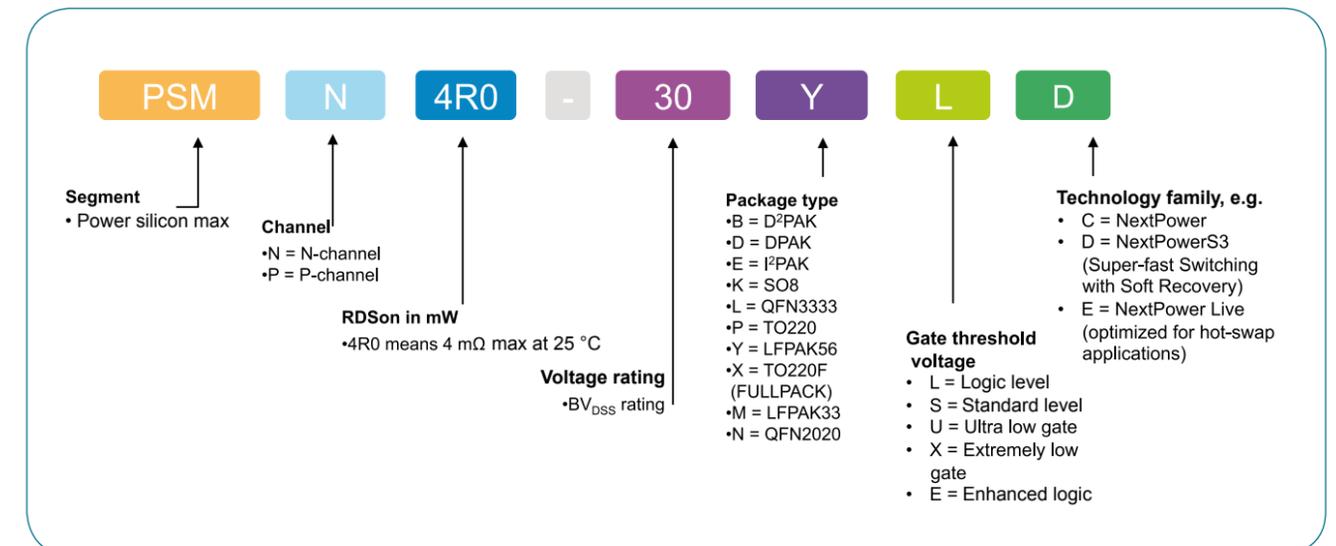
For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### Power MOSFETs 200V

Package	Type number	V <sub>DS</sub> [max] (V)	R <sub>DSon</sub> [max] @ V <sub>GS</sub> = 10 V (mΩ)	I <sub>D</sub> [max] (A)	Q <sub>G(tot)</sub> [typ] (nC)
LFPAK56; Power-SO8 (SOT669)	PSMN102-200Y	200	102	21.5	30.7
	PSMN057-200B	200	57	39	96
D <sup>2</sup> PAK (SOT404)	PSMN070-200B	200	70	35	77
	PHB33NQ20T	200	77	32.7	32.2
	PHB20NQ20T	200	130	20	65
DPAK (SOT428)	PSMN130-200D	200	130	20	65
	PHD9NQ20T	200	400	8.7	24
TO-220AB (SOT78)	PSMN057-200P	200	57	39	96
	PSMN070-200P	200	70	35	77
	PHP33NQ20T	200	77	32.7	32.2
	PHP20NQ20T	200	130	20	65
	PHP9NQ20T	200	400	8.7	24

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

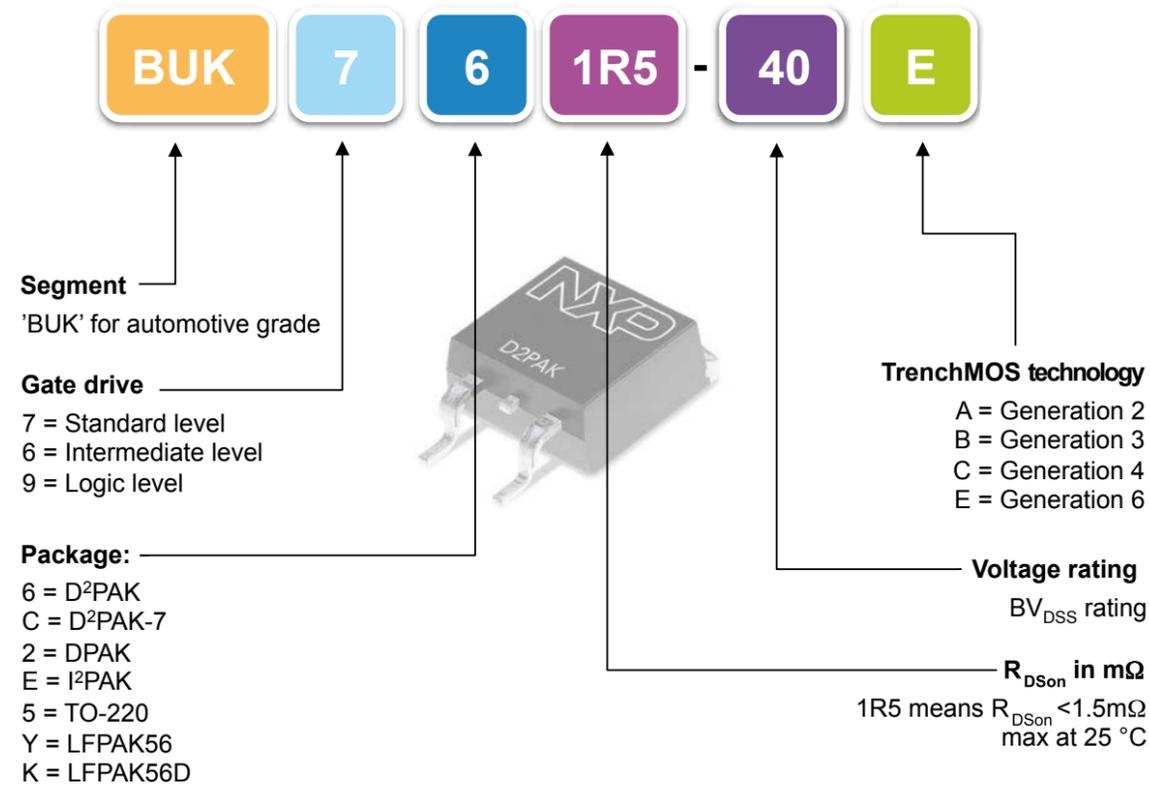
### PSMN part numbering



# 4 steps to select an automotive MOSFET

- 1 Select a voltage, e.g. 40 V
- 2 Select a package, e.g D<sup>2</sup>PAK
- 3 Choose an  $R_{DSon}$  from our extensive range
- 4 Select a 'BUK' type and visit [www.nxp.com/automotivemosfets](http://www.nxp.com/automotivemosfets) to download datasheets and models, and order samples

## Automotive-grade MOSFET product numbering



# High-performance automotive MOSFETs

## MOSFET package selection

### Through-hole

#### TO220

- ▶ Industry standard
- ▶ 120 A



#### I<sup>2</sup>PAK

- ▶ Industry standard
- ▶ 120 A



### Surface-mount

### Premium performance

#### D<sup>2</sup>PAK-7

- ▶ Highest performance
- ▶ 190 A



#### D<sup>2</sup>PAK

- ▶ Industry standard
- ▶ 120 A



### Space saving

#### LFPAK56

- ▶ PowerSO8
- ▶ 100 A



#### LFPAK56D

- ▶ Dual Power-SO8
- ▶ 40 A per channel



#### DPAK

- ▶ Industry standard
- ▶ Proven reliability
- ▶ 100 A



#### SOT223

- ▶ Industry standard
- ▶ Proven reliability

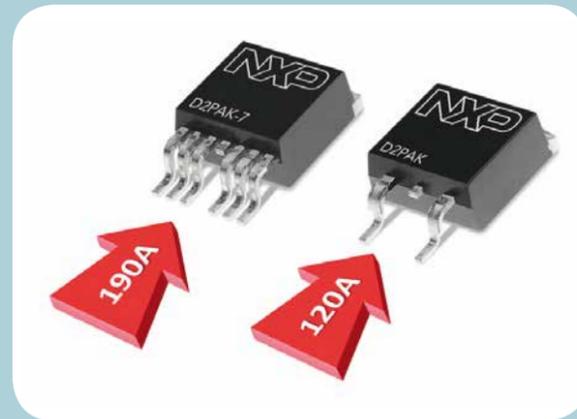


All packages are automotive AEC-Q101 qualified to 175 °C and RoHS compliant

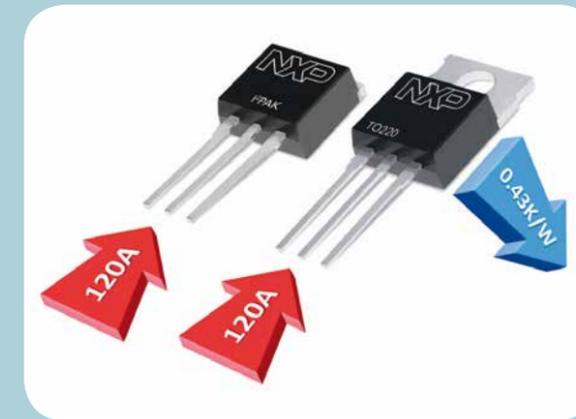
# D<sup>2</sup>PAK Family

## D<sup>2</sup>PAK Family - Premium performance SMD products

The NXP D<sup>2</sup>PAK portfolio is ideally suited for high power automotive application areas such as powertrain and chassis & safety. Combining advanced TrenchMOS technology with high current packaging enables a product that delivers ultra low on-state resistance and thermal performance within an industry standard footprint. NXP offers the broadest range of automotive grade D<sup>2</sup>PAK across V<sub>DS</sub> 30V-100V.



Fully AEC-Q101 qualified to 175 °C

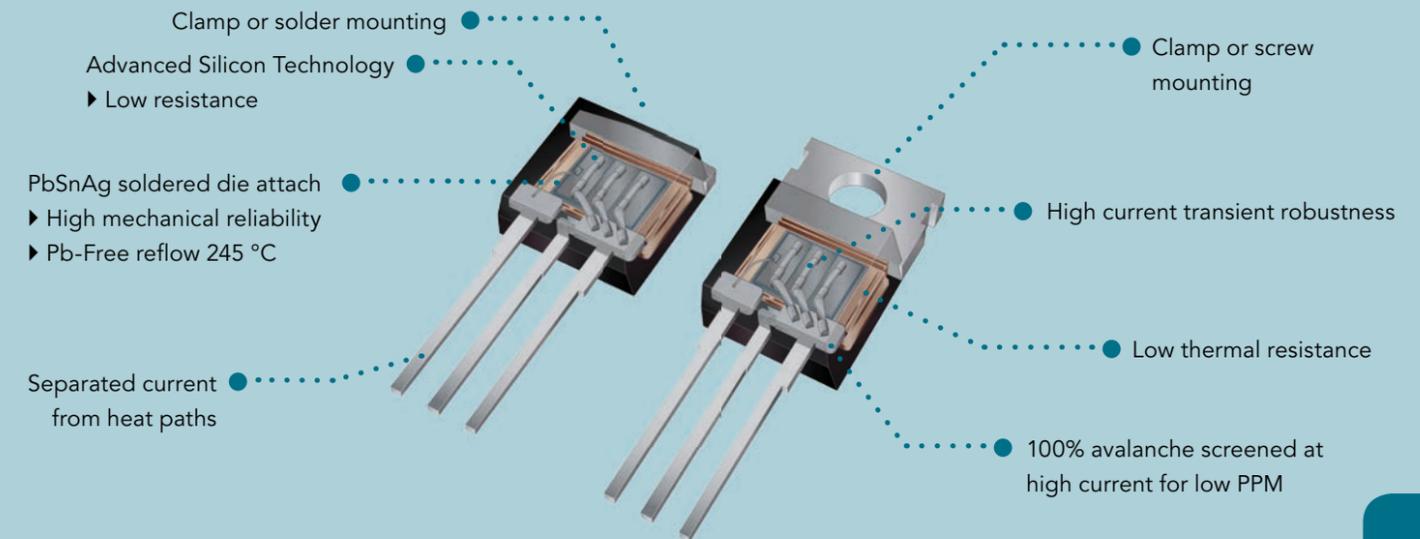
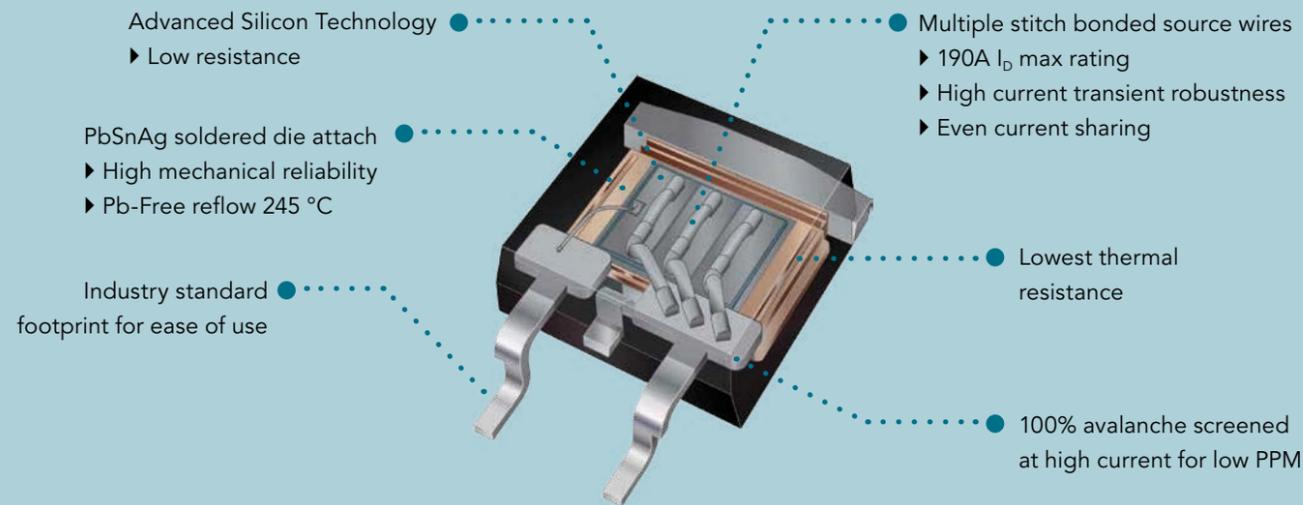


Fully AEC-Q101 qualified to 175 °C

# I<sup>2</sup>PAK/TO-220

## I<sup>2</sup>PAK/TO-220 - High performance through-hole products

Providing industry leading performance for through hole products NXP's I<sup>2</sup>PAK/TO-220 portfolio enables the separation of the electrical and thermal pathways to optimise module performance. The convenience of the tab for screw mounting on the TO-220 is complemented by industry standard footprint and excellent current handling performance. Similarly the I<sup>2</sup>PAK can be readily soldered down to form a low resistance path.



### POWERTRAIN

- ▶ Engine Control
- ▶ Gearbox/Clutch
- ▶ Engine Fan
- ▶ Electric Vehicle
- ▶ Micro-Hybrid drive
- ▶ DCDC converters



### CHASSIS & SAFETY

- ▶ Electric Power Steering (EPS)
- ▶ Vehicle Stability (ESP)
- ▶ Braking Systems (ABS)
- ▶ Electric Parking Brake (EPB)



### BODY & SECURITY

- ▶ Climate control (HVAC)
- ▶ Wiper Systems



### POWERTRAIN

- ▶ Engine Control
- ▶ Engine Fan
- ▶ Electric Vehicle
- ▶ Micro-Hybrid drive
- ▶ DCDC converters



### CHASSIS & SAFETY

- ▶ Electric Power Steering (EPS)
- ▶ Braking Systems (ABS)
- ▶ Electric Parking Brake (EPB)



### BODY & SECURITY

- ▶ Climate Control (HVAC)
- ▶ Wiper Systems
- ▶ Electric Horn

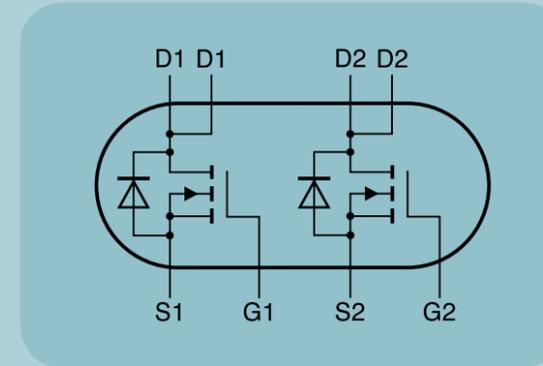
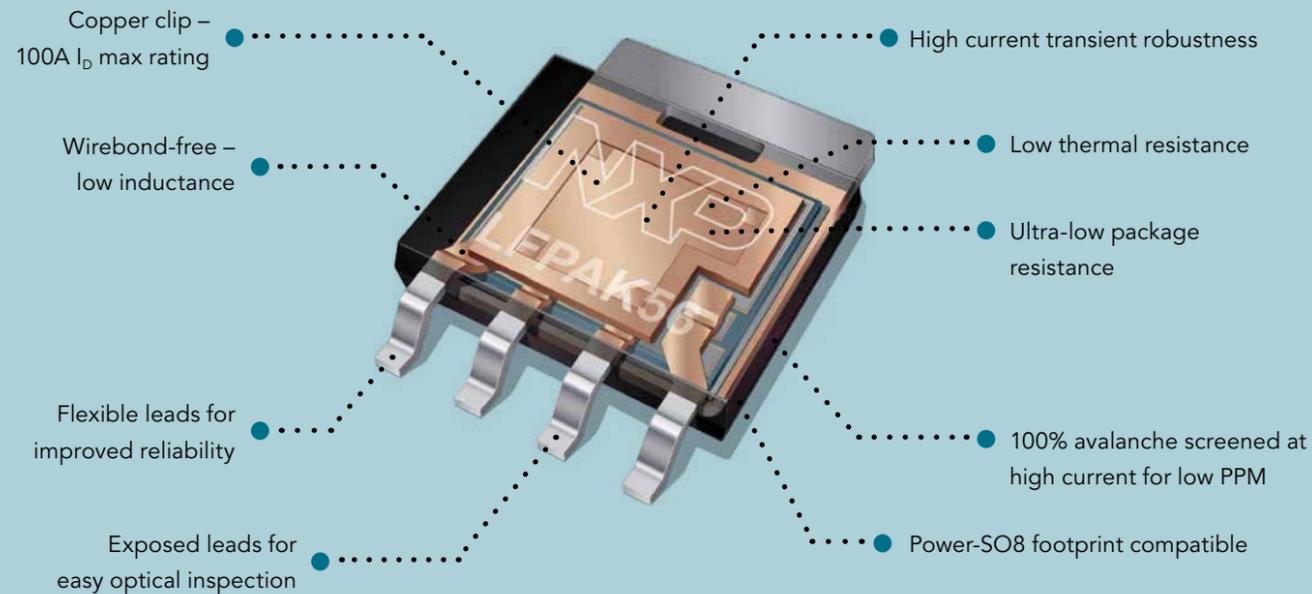
# LFPAK56

## The Power-SO8 that packs a punch

Providing a true alternative to DPAK, NXP's LFPAK56 portfolio gives industry-leading performance in a truly innovative, automotive-grade package. Saving a considerable amount of space compared to traditional DPAK solutions, the LFPAK56 offers designers flexibility and reliability without compromising thermal performance.



Fully AEC-Q101 qualified to 175 °C

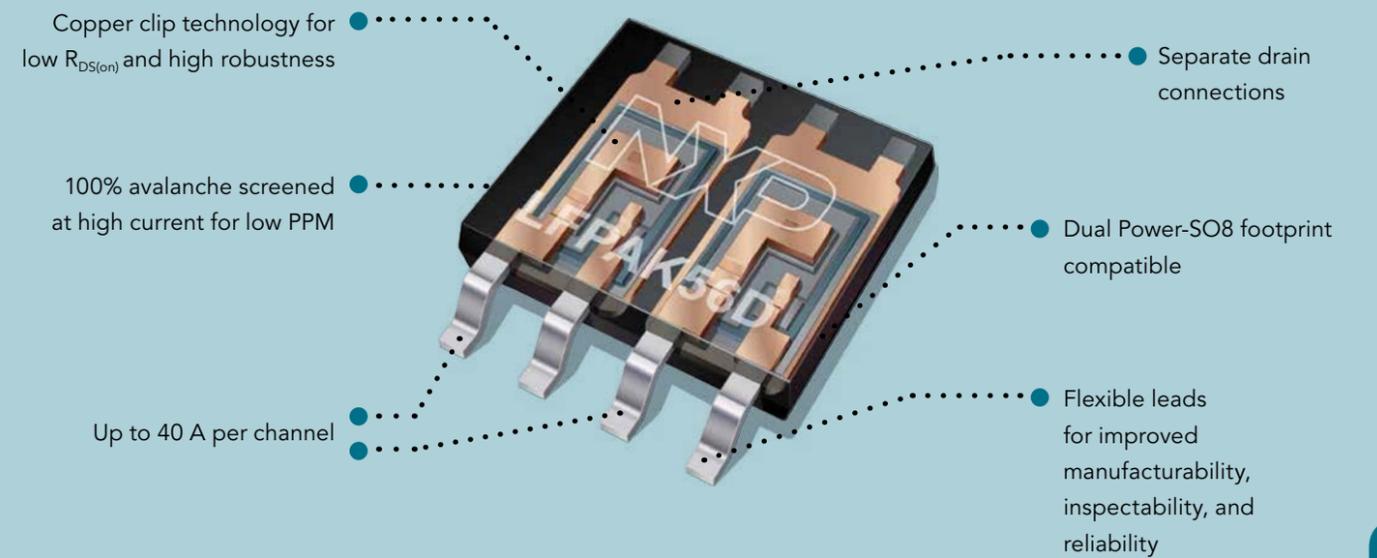


Fully AEC-Q101 qualified to 175 °C

# LFPAK56D

## The ultimate dual MOSFET

Packing even more into the Power-SO8 footprint, the LFPAK56D fits two MOSFETs into one robust package without compromising on performance. NXP's cutting-edge copper-clip technology allows for exceptional current handling, ultra-low package resistance, and supreme robustness and reliability. Perfect for situations where space is at a premium, the LFPAK56D offers power performance.



### POWERTRAIN

- ▶ Engine management
- ▶ Gearbox / clutch
- ▶ Engine fan
- ▶ Fuel / water pump
- ▶ Auxiliary valves



### CHASSIS & SAFETY

- ▶ Vertical stability (ESP)
- ▶ Braking systems (ABS)
- ▶ Airbag
- ▶ Electric Parking Brake (EPB)



### BODY & SECURITY

- ▶ Body control module
- ▶ Climate control (HVAC)
- ▶ Wiper systems
- ▶ Electric windows
- ▶ Electric mirrors
- ▶ Electric seats
- ▶ Sunroof
- ▶ Lighting

### LFPAK56D footprint comparison

Product	Pad layout	Footprint area
		31 mm <sup>2</sup>
		62 mm <sup>2</sup>
		140 mm <sup>2</sup>



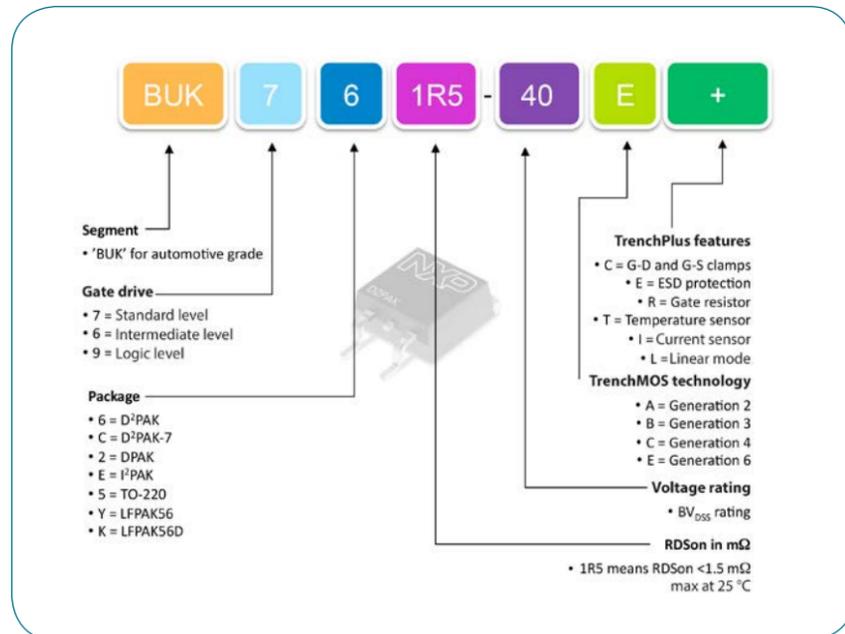
### 30 V N-channel automotive TrenchMOS

types in **bold** represent new products

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]
LFPAK56; Power-SO8 (SOT669)	BUK9Y07-30B	30	6	7	75	1.42
	BUK7Y07-30B	30	7		75	1.42
	BUK9Y11-30B	30	9	11	59	2
	BUK7Y10-30B	30	10		67	1.76
	BUK9Y22-30B	30	19	22	37.7	2.53
	BUK7Y20-30B	30	20		39.5	2.53
LFPAK56D (SOT1205)	BUK7K5R1-30E	30	5.1		40	2.21
	BUK7K5R6-30E	30	5.6		40	2.36
	<b>BUK9K5R1-30E</b>	<b>30</b>	<b>4.4</b>	<b>5.3</b>	<b>40</b>	<b>2.21</b>
	<b>BUK9K5R6-30E</b>	<b>30</b>	<b>4.7</b>	<b>5.8</b>	<b>40</b>	<b>2.36</b>
D <sup>2</sup> PAK (SOT404)	BUK962R8-30B	30	2.4	2.8	75	0.5
	BUK762R7-30B	30	2.7		75	0.5
	BUK763R4-30B	30	3.4		75	0.59
	BUK9605-30A	30	4.6	5	75	0.65
	BUK9607-30B	30	5	7	75	0.95
	BUK7607-30B	30	7		75	0.95
DPAK (SOT428)	BUK9214-30A	30	12	14	63	1.4
	BUK6213-30A	30	13		55	1.4
TO-220AB (SOT78A)	BUK952R8-30B	30	2.4	2.8	75	0.5
	BUK9507-30B	30	5	7	75	0.95
	BUK7507-30B	30	7		75	0.95

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

#### Automotive TrenchMOS part numbering



### 40 V N-channel automotive TrenchMOS – Part I

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]	
LFPAK56; Power-SO8 (SOT669)	BUK9Y3R0-40E	40	2.5	3	100	0.77	
	BUK7Y3R5-40E	40	3.5		100	0.9	
	BUK9Y3R5-40E	40	3.6	3.8	100	0.9	
	BUK9Y4R4-40E	40	3.7	4.4	100	1.02	
	BUK7Y4R4-40E	40	4.4		100	1.02	
	BUK9Y7R6-40E	40	6	7.6	79	1.58	
	BUK7Y7R6-40E	40	7.6		79	1.58	
	BUK9Y09-40B	40	8	9	75	1.42	
	BUK7Y08-40B	40	8		75	1.42	
	BUK9Y12-40E	40	10	12	52	2.31	
	BUK9Y14-40B	40	11	14	56	1.8	
	BUK7Y12-40E	40	12		52	2.31	
	BUK7Y13-40B	40	13		58	1.8	
	BUK9Y21-40E	40	17	21	33	3.33	
	BUK7Y21-40E	40	21		33	3.33	
	BUK9Y27-40B	40	24	27	34	2.53	
	BUK9Y29-40E	40	25	29	25	4.03	
	BUK7Y25-40B	40	25		35.3	2.53	
	LFPAK56D (SOT1205)	BUK7Y29-40E	40	29		26	4.03
		BUK7K6R2-40E	40	5.8			2.21
BUK9K6R2-40E		40	6	6.2	40	2.21	
BUK9K6R8-40E		40	6.1	7.2	40	2.36	
BUK7K6R8-40E		40	6.8			2.36	
BUK9K8R7-40E		40	8	9.4	30	2.84	
BUK7K8R7-40E		40	8.5			2.84	
BUK9K18-40E		40	16	19.5	30	3.96	
BUK7K18-40E		40	19		24.2	3.96	
BUK9K25-40E		40	24	29	18.2	4.68	
BUK7K25-40E		40	25			4.68	
D <sup>2</sup> PAK (SOT404)		BUK961R6-40E	40	1.4	1.6	120	0.43
	BUK762R0-40E	40	2		120	0.51	
	BUK962R6-40E	40	2.4	2.8	100	0.57	
	BUK762R6-40E	40	2.6		100	0.57	
	BUK963R1-40E	40	2.7	3.1	100	0.64	
	BUK963R2-40B	40	2.8	3.2	100	0.5	
	BUK762R9-40E	40	2.9		100	0.64	
	BUK763R1-40B	40	3.1		75	0.5	
	BUK964R1-40E	40	3.5	4.1	75	0.82	
	BUK9604-40A	40	4	4.4	75	0.5	
	BUK964R4-40B	40	4	4.4	75	0.59	

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

40V N-channel automotive TrenchMOS – Part 2

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]
D <sup>2</sup> PAK (SOT404)	BUK764R0-40E	40	4		75	0.82
	BUK965R4-40E	40	4.4	5.4	75	1.09
	BUK7604-40A	40	4.5		75	0.5
	BUK765R3-40E	40	4.9		75	1.09
	BUK9606-40B	40	5	6.4	75	0.74
	BUK765R2-40B	40	5.2		75	0.74
	BUK9609-40B	40	7	9	75	0.95
	BUK768R1-40E	40	7.2		75	1.56
	BUK7608-40B	40	8		75	0.95
	BUK761R6-40E	40	1.57		120	0.43
	BUK761R7-40E	40	1.6		120	0.46
DPAK (SOT428)	BUK9209-40B	40	7	9	75	0.95
	BUK7208-40B	40	8		75	0.95
TO-220AB (SOT78A)	BUK751R8-40E	40	1.8		120	0.43
	BUK752R3-40E	40	2.3		120	0.51
	BUK953R2-40B	40	2.8	3.2	100	0.5
	BUK753R1-40E	40	3.1		100	0.64
	BUK9504-40A	40	4	4.4	75	0.5
	BUK954R4-40B	40	4	4.4	75	0.59
	BUK9506-40B	40	5	6.4	75	0.74
	BUK755R2-40B	40	5.2		75	0.74
	BUK9509-40B	40	7	9	75	0.95
	BUK758R3-40E	40	7.4		75	1.56
FPAK (SOT226)	BUK7508-40B	40	8		75	0.95
	BUK7E1R8-40E	40	1.8		120	0.43
	BUK7E1R9-40E	40	1.9		120	0.46
	BUK7E2R3-40E	40	2.3		120	0.51
	BUK7E3R1-40E	40	3.1		100	0.64
	BUK9E04-40A	40	4	4.4	75	0.5
	BUK7E04-40A	40	4.5		75	0.5
BUK7E8R3-40E	40	7.4		75	1.56	

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

55 - 60V N-channel automotive TrenchMOS – Part I

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]
LFPAK56; Power-SO8 (SOT669)	BUK9Y12-55B	55	11	12	61.8	1.42
	BUK7Y12-55B	55	12		61.8	1.42
	BUK9Y19-55B	55	17.3	19	46	1.8
	BUK7Y18-55B	55	18		47.4	1.76
	BUK9Y40-55B	55	36	40	26	2.5
	BUK9Y4R8-60E	60	4.1	4.8	100	0.63
	BUK7Y4R8-60E	60	4.8		100	0.63
	BUK9Y6R0-60E	60	5.2	6	100	0.77
	BUK9Y7R2-60E	60	5.6	7.2	100	0.9
	BUK7Y6R0-60E	60	6		100	0.77
	BUK7Y7R2-60E	60	7.2		100	0.9
	BUK9Y8R7-60E	60	7.5	8.7	86	1.02
	BUK7Y8R7-60E	60	8.7		87	1.02
	BUK9Y15-60E	60	13	15	53	1.58
	BUK7Y15-60E	60	15		53	1.59
	BUK9Y25-60E	60	21.5	25	34	2.31
	BUK7Y25-60E	60	25		34	2.31
	BUK9Y43-60E	60	38	43	22	3.33
	BUK7Y43-60E	60	43		22	3.33
	LFPAK56D (SOT1205)	BUK9Y59-60E	60	52	59	16.7
BUK7Y59-60E		60	59		17	4.03
BUK7K12-60E		60	9.3			2.21
BUK9K12-60E		60	10.7	11.5	35	2.21
BUK7K13-60E		60	10		40	2.36
BUK9K13-60E		60	11.2	12.5	40	2.36
BUK7K17-60E		60	14			2.84
BUK9K17-60E		60	15.6	17	26	2.84
BUK7K35-60E		60	30		20.7	3.96
BUK9K35-60E		60	32	35	22	3.96
D <sup>2</sup> PAK (SOT404)	BUK7K52-60E	60	45		15.4	4.68
	BUK9K52-60E	60	49	55	16	4.68
	BUK964R2-55B	55	3.7	4.2	75	0.5
	BUK764R0-55B	55	4		75	0.5
	BUK9606-55B	55	5.4	6	75	0.58
	BUK9606-55A	55	5.8	6.3	75	0.5
	BUK7606-55B	55	6		75	0.59
	BUK7606-55A	55	6.3		75	0.5
	BUK9608-55B	55	7	8.4	75	0.74
	BUK7607-55B	55	7.1		75	0.74
BUK9608-55A	55	7.5	8	75	0.59	

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

## 55 - 60 V N-channel automotive TrenchMOS – Part 2

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]
D <sup>2</sup> PAK (SOT404)	BUK7608-55A	55	8		75	0.59
	BUK9612-55B	55	10	12	75	0.95
	BUK7610-55AL	55	10		75	0.5
	BUK7611-55A	55	11		75	0.9
	BUK7611-55B	55	11		75	0.95
	BUK9614-55A	55	13	14	73	1
	BUK9616-55A	55	15	16	66	
	BUK9620-55A	55	18	20	54	1.2
	BUK7620-55A	55	20		54	1.2
	BUK9624-55A	55	21.7	24	46	1.4
	BUK7624-55A	55	24		47	
	BUK9628-55A	55	25	28	42	1.5
	BUK7628-55A	55	28		42	
	BUK9635-55A	55	32	35	34	1.8
	BUK7635-55A	55	35		35	1.7
	BUK9675-55A	55	68	75	20	2.4
	BUK7675-55A	55	75		20.3	2.4
	BUK962R5-60E	60	2.3	2.5	120	0.43
	BUK762R4-60E	60	2.4		120	0.43
	BUK962R8-60E	60	2.5	2.8	120	0.46
	BUK762R6-60E	60	2.6		120	0.46
	BUK963R3-60E	60	3	3.3	120	0.51
	BUK763R1-60E	60	3.1		120	0.51
	BUK964R2-60E	60	3.9	4.2	100	0.57
	BUK763R9-60E	60	3.9		100	0.57
	BUK964R8-60E	60	4.4	4.8	100	0.64
	BUK764R4-60E	60	4.5		100	0.64
	BUK966R5-60E	60	5.9	6.5	75	0.82
	BUK766R0-60E	60	6		75	0.82
	BUK969R0-60E	60	8	9	75	1.09
	BUK768R3-60E	60	8.3		75	1.09
	BUK9614-60E	60	12.8	14	56	1.56
	BUK7613-60E	60	13		58	1.56
D <sup>2</sup> PAK-7 (SOT427)	BUK9C10-55BIT	55	9	10	75	0.78
DPAK (SOT428)	BUK9212-55B	55	10	12	75	0.95
	BUK7210-55B	55	10		75	0.95
	BUK7212-55B	55	12		75	0.95
	BUK9215-55A	55	13.6	15	62	1.3
	BUK7215-55A	55	15		62	1.3
	BUK9219-55A	55	17.6	19	55	1.3

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

## 55 - 60 V N-channel automotive TrenchMOS – Part 3

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]	
DPAK (SOT428)	BUK7219-55A	55	19		55	1.3	
	BUK9222-55A	55	20	22	48	1.5	
	BUK9225-55A	55	22	25	43	1.6	
	BUK7222-55A	55	22		48	1.5	
	BUK7230-55A	55	30		38	1.7	
	BUK9237-55A	55	33	37	32	1.94	
	BUK7237-55A	55	37		32.3	1.9	
	BUK9245-55A	55	40	45	28	2.1	
	BUK9277-55A	55	69	77	18	2.93	
	BUK7277-55A	55	77		18	2.9	
	BUK92150-55A	55	125	140	11	4.1	
	BUK72150-55A	55	150		11	4.1	
	TO-220AB (SOT78A)	BUK954R2-55B	55	3.7	4.2	75	0.5
		BUK754R0-55B	55	4		75	0.5
		BUK7506-55A	55	6.3		75	0.5
BUK9508-55B		55	7	8.4	75	0.74	
BUK7507-55B		55	7.1		75	0.74	
BUK7508-55A		55	8		75	0.59	
BUK7509-55A		55	9		75	0.71	
BUK9511-55A		55	10	11	75	0.9	
BUK9512-55B		55	10	12	75	0.95	
BUK7511-55B		55	11		75	0.95	
BUK9514-55A		55	13	14	73	1	
BUK9518-55A		55	16	18	61	1.1	
BUK7516-55A		55	16		65.7	1.1	
BUK7520-55A		55	20		54	1.2	
BUK7528-55A		55	28		42	1.5	
BUK9535-55A		55	32	35	34	1.8	
BUK7535-55A		55	35		35	1.7	
BUK9575-55A		55	68	75	20	2.4	
BUK7575-55A		55	75		20.3	2.4	
BUK953R5-60E		60	3.4	3.7	120	0.51	
BUK954R8-60E		60	4.5	4.9	100	0.64	
I <sup>2</sup> PAK (SOT226)		BUK9E06-55B	55	5.4	6	75	0.58
		BUK9E06-55A	55	5.8	6.3	75	0.5
		BUK9E08-55B	55	7	8.4	75	0.74
		BUK7E2R6-60E	60	2.6		120	0.43
		BUK7E3R5-60E	60	3.5		120	0.51
		BUK7E4R6-60E	60	4.6		100	0.64
	BUK7E13-60E	60	13		58	1.56	

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

### 75 - 80 V N-channel automotive TrenchMOS

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]
LFPAK56; Power-SO8 (SOT669)	BUK9Y19-75B	75	18	19	48.2	1.42
	BUK7Y18-75B	75	18		49	1.42
	BUK9Y30-75B	75	28	30	34	1.8
	BUK7Y28-75B	75	28		35.5	1.76
	BUK9Y58-75B	75	53	58	20.73	2.53
	BUK7Y7R8-80E	80	7.8		100	0.63
	BUK9Y8R5-80E	80	8	8.5	100	0.63
	BUK7Y9R9-80E	80	9.9		89	0.77
	BUK9Y11-80E	80	10	11	84	0.77
	BUK9Y14-80E	80	14	15	62	1.02
	BUK7Y14-80E	80	14		65	1.02
	BUK9Y25-80E	80	25	27	37	1.58
	BUK7Y25-80E	80	25		39	1.58
	BUK9Y41-80E	80	41	45	24	2.33
	BUK7Y41-80E	80	41		25	2.31
	BUK9Y72-80E	80	72	78	15	3.33
	BUK7Y72-80E	80	72		16	3.33
	BUK9Y107-80E	80	98	107	11.8	4.03
BUK7Y98-80E	80	98		12.3	4.03	
D <sup>2</sup> PAK (SOT404)	BUK9606-75B	75	5.5	6.1	75	0.5
	BUK7606-75B	75	5.6		75	0.5
	BUK9609-75A	75	8.5	9	75	0.65
	BUK7609-75A	75	9		75	0.65
	BUK7613-75B	75	13		75	0.95
	BUK9616-75B	75	14	16.4	67	0.95
	BUK7623-75A	75	23		53	1.1
	BUK763R8-80E	80	3.8		120	0.43
	BUK964R2-80E	80	4	4.2	120	0.43
	BUK764R2-80E	80	4.2		120	0.46
	BUK964R7-80E	80	4.5	4.7	120	0.46
	BUK769R6-80E	80	9.6		75	0.82
	BUK9611-80E	80	10	11	75	0.82
DPAK (SOT428)	BUK7214-75B	75	14		69	0.95
	BUK9217-75B	75	15	17	64	0.95
	BUK9226-75A	75	24.6	26	45	1.3
	BUK7226-75A	75	26		45	1
TO-220AB (SOT78A)	BUK9506-75B	75	5.5	6.1	75	0.5
	BUK7509-75A	75	9		75	0.65
	BUK7513-75B	75	13		75	0.95
	BUK753R8-80E	80	4		120	0.43

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### 100 V N-channel automotive TrenchMOS – Part I

types in **bold** represent new products

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>D</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]	
LFPAK56; Power-SO8 (SOT669)	BUK9Y12-100E	100	11.9	12	85	0.63	
	BUK7Y12-100E	100	12		85	0.63	
	BUK9Y15-100E	100	14.7	15	69	0.77	
	BUK7Y15-100E	100	15		68	0.77	
	BUK9Y19-100E	100	18	19	56	0.9	
	BUK7Y19-100E	100	19		56	0.9	
	BUK9Y22-100E	100	21.5	22	49	1.02	
	BUK7Y22-100E	100	22		49	1.02	
	BUK9Y38-100E	100	37.5	38	30	1.58	
	BUK7Y38-100E	100	38		30	1.58	
	BUK9Y53-100B	100	49	53	23	2	
	BUK7Y53-100B	100	53		24.8	1.76	
	BUK9Y65-100E	100	63.3	65	19	2.31	
	BUK7Y65-100E	100	65		19	2.31	
	BUK9Y104-100B	100	99	104	14.8	2.53	
	BUK7Y102-100B	100	102		15	2.53	
	BUK9Y113-100E	100	110	113	12	3.33	
	BUK7Y113-100E	100	113		12	3.33	
	BUK9Y153-100E	100	146	153	9.4	4.03	
	BUK7Y153-100E	100	153		9.4	4.03	
LFPAK56D (SOT1205)	<b>BUK7K29-100E</b>	<b>100</b>	<b>24.5</b>		<b>29.5</b>	<b>2.21</b>	
	BUK9K29-100E	100	27	29	30	2.21	
	<b>BUK7K32-100E</b>	<b>100</b>	<b>27.5</b>		<b>29</b>	<b>2.36</b>	
	BUK9K32-100E	100	31	33	26	2.36	
	<b>BUK7K45-100E</b>	<b>100</b>	<b>37.6</b>		<b>21.4</b>	<b>2.84</b>	
	BUK9K45-100E	100	42	45	21	2.84	
	<b>BUK7K89-100E</b>	<b>100</b>	<b>82.5</b>		<b>13</b>	<b>3.96</b>	
	BUK9K89-100E	100	85	89	12.5	3.96	
	<b>BUK7K134-100E</b>	<b>100</b>	<b>121</b>		<b>9.8</b>	<b>4.68</b>	
	BUK9K134-100E	100	154	159	8.5	4.68	
	D <sup>2</sup> PAK (SOT404)	BUK765R0-100E	100	5		120	0.43
		BUK965R8-100E	100	5.6	5.8	120	0.43
		BUK768R1-100E	100	8.1		100	0.57
BUK969R3-100E		100	8.9	9.3	100	0.57	
BUK9610-100B		100	9.7	10	75	0.5	
BUK7610-100B		100	10		75	0.5	
BUK7613-100E		100	13		72	0.82	
BUK9615-100E		100	14	15	66	0.82	
BUK9615-100A		100	14.4	15	75	0.65	
BUK9620-100B		100	18.5	20	63	0.75	

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## 100V N-channel automotive TrenchMOS – Part 2

types in **bold** represent new products

Package name	Type number	V <sub>DS</sub> [max] [V]	R <sub>DSon</sub> [max] @ 10 V [mΩ]	R <sub>DSon</sub> [max] @ 5 V [mΩ]	I <sub>b</sub> [max] @ 25 °C [A]	R <sub>th(j-mb)</sub> [max] [K/W]
D <sup>2</sup> PAK (SOT404)	BUK7620-100A	100	20		63	0.75
	BUK7626-100B	100	26		49	0.95
	BUK9628-100A	100	27	28	49	0.9
	BUK9629-100B	100	27	29	46	0.95
	BUK7628-100A	100	28		47	0.9
	BUK7631-100E	100	31		34	1.56
	BUK7635-100A	100	35		41	1
	BUK9637-100E	100	36	37	31	1.56
	BUK9640-100A	100	39	40	39	0.95
	BUK7640-100A	100	40		37	1.1
	BUK9660-100A	100	58	60	26	1.4
	BUK7660-100A	100	60		26	1.4
	BUK9675-100A	100	72	75	23	1.5
	BUK7675-100A	100	75		23	1.5
	BUK96180-100A	100	173	180	11	2.8
DPAK (SOT428)	BUK7227-100B	100	27		48	0.95
	BUK9230-100B	100	28	30	47	0.95
	BUK9240-100A	100	38.6	40	33	1.3
	BUK7240-100A	100	40		34	1.3
	BUK9275-100A	100	72	75	21.7	1.7
TO-220AB (SOT78A)	BUK755R4-100E	100	5.2		120	0.43
	BUK9510-100B	100	9.7	10	75	0.5
	BUK7510-100B	100	10		75	0.5
	BUK9515-100A	100	14.4	15	75	0.65
	BUK7515-100A	100	15		75	0.5
	BUK9520-100B	100	18.5	20	63	0.75
	BUK9520-100A	100	19	20	63	0.75
	BUK7520-100A	100	20		63	0.75
	BUK7526-100B	100	26		49	0.95
	BUK9529-100B	100	27	29	46	0.95
	BUK7528-100A	100	28		47	0.9
	BUK9535-100A	100	34	35	41	1
	BUK7535-100A	100	35		41	1
	BUK9575-100A	100	72	75	23	1.5
	BUK7575-100A	100	75		23	1.5
FPAK (SOT226)	BUK7E5R2-100E	100	5.2		120	0.43

For the most current product information go to [www.nxp.com/mosfets](http://www.nxp.com/mosfets) (updated daily!)

# Quick learning videos



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What is LFPAK?  
[www.nxp.com/quicklearning41](http://www.nxp.com/quicklearning41)



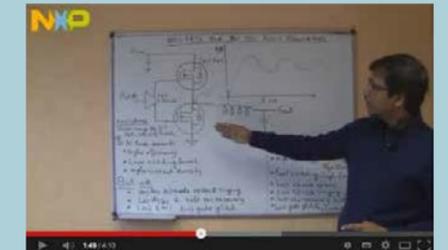
LFPAK Power-SO8 vs. DPAK  
[www.nxp.com/quicklearning18](http://www.nxp.com/quicklearning18)



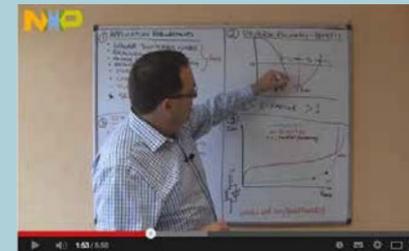
NextPower Cordless MOSFETs for battery-powered tools  
[www.nxp.com/quicklearning28](http://www.nxp.com/quicklearning28)



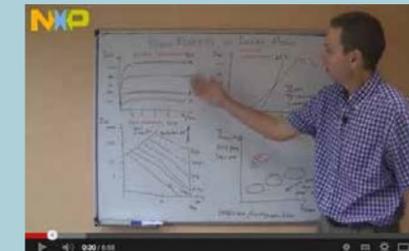
Next Power Live! MOSFETs for HOT SWAP and Power over Ethernet  
[www.nxp.com/quicklearning29](http://www.nxp.com/quicklearning29)



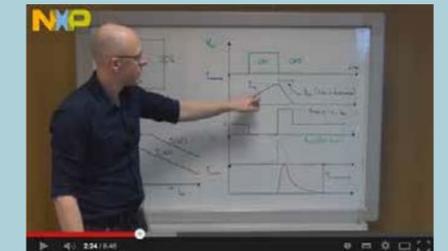
NextPowerS3 MOSFETs for DC/DC buck regulators  
[www.nxp.com/quicklearning32](http://www.nxp.com/quicklearning32)



Reverse recovery and diode leakage in SMPS  
[www.nxp.com/quicklearning33](http://www.nxp.com/quicklearning33)



Power MOSFET operation in Linear Mode  
[www.nxp.com/quicklearning34](http://www.nxp.com/quicklearning34)



Single-shot avalanche ruggedness  
[www.nxp.com/quicklearning35](http://www.nxp.com/quicklearning35)



Power MOSFETs and thermal modelling  
[www.nxp.com/quicklearning43](http://www.nxp.com/quicklearning43)

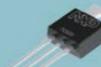


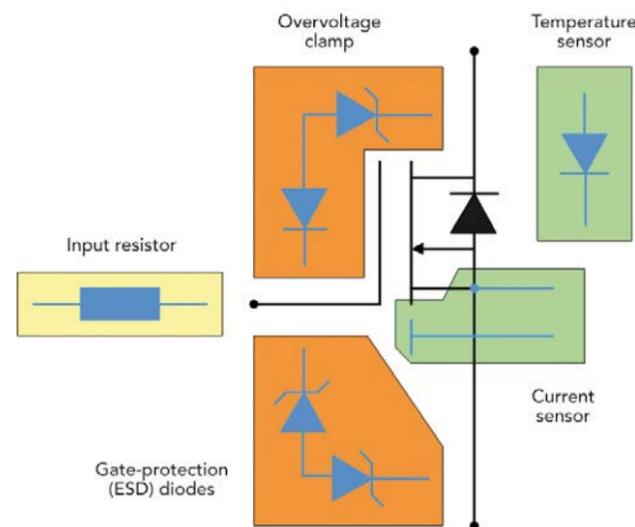
MOSFETs for Power-over-Ethernet (PoE) PSE applications  
[www.nxp.com/quicklearning36](http://www.nxp.com/quicklearning36)

## TrenchPLUS MOSFETs

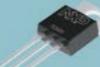
TrenchPLUS is a range of standard MOSFETs with additional protection features, such as current and temperature sensing components, overvoltage clamps, and gate-protection (ESD) diodes. The system microcontroller can use data gathered from these

sensors to implement cost-effective protection features, thus eliminating the need to design with protected power devices. All the standard products listed below offer one or more "PLUS" features. Custom versions can be developed for high-volume applications.

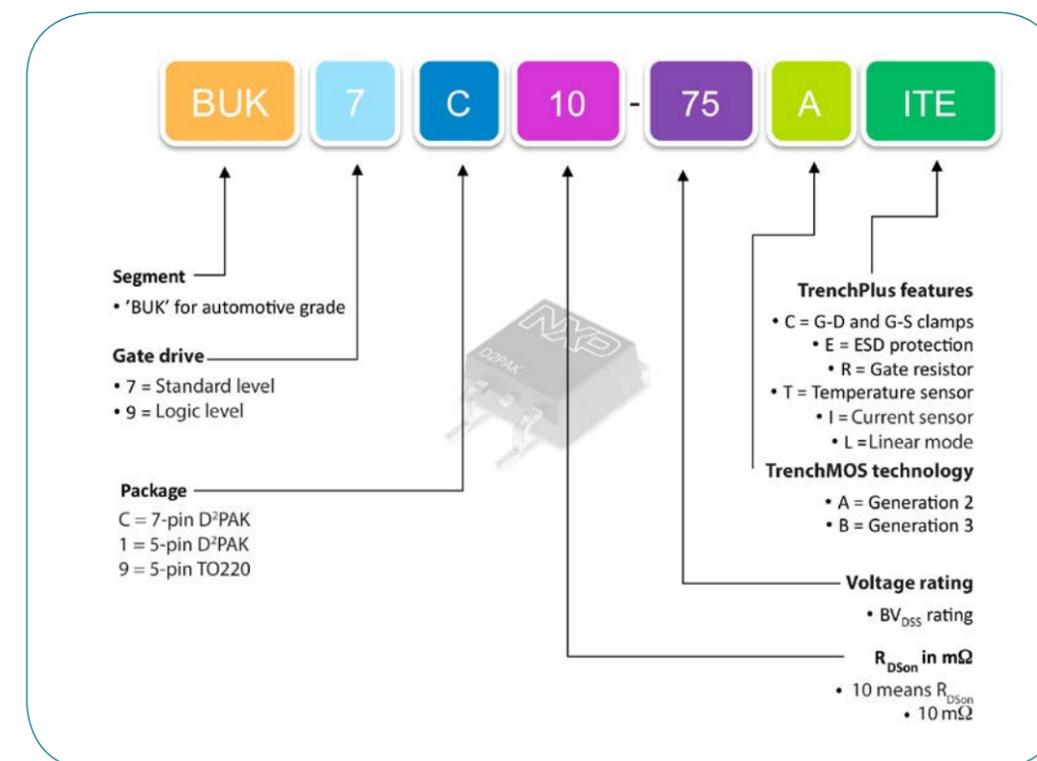
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (max) @ 10 V (mΩ)	R <sub>DS(on)</sub> (max) @ 5 V (mΩ)	I <sub>D</sub> (max) @ 25 °C (A)	Temperature sensing	Current sensing	Gate source clamps	Gate drain clamps	Gate resistor	Surface-mount package		Leaded package	
									7-pin D <sup>2</sup> PAK (SOT427)	5-pin D <sup>2</sup> PAK (SOT426)	TO220AB (SOT78C)	5-pin TO220 (SOT263B-01)
												
34	6		75			•	•	•			BUK7L06-34ARC	
34	11		75			•	•	•			BUK7L11-34ARC	
40	4.1		75	•							BUK714R1-40BT	
40	5		75		•	•					BUK7105-40AIE	BUK7905-40AIE
40	5		75	•		•					BUK7105-40ATE	BUK7905-40ATE
40	5		75									BUK7905-40AI
40	6		75	•	•	•			BUK7C06-40AITE			



## TrenchPLUS MOSFETs

V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (max) @ 10 V (mΩ)	R <sub>DS(on)</sub> (max) @ 5 V (mΩ)	I <sub>D</sub> (max) @ 25 °C (A)	Temperature sensing	Current sensing	Gate source clamps	Gate drain clamps	Gate resistor	Surface-mount package		Leaded package	
									7-pin D <sup>2</sup> PAK (SOT427)	5-pin D <sup>2</sup> PAK (SOT426)	TO220AB (SOT78C)	5-pin TO220 (SOT263B-01)
												
40	6.6	7	75	•		•	•				BUK9107-40ATC	BUK9907-40ATC
40	8		75	•		•	•				BUK7107-40ATC	BUK7907-40ATC
40	8		75		•	•					BUK7108-40AIE	BUK7908-40AIE
55	6.6	7	75	•		•					BUK9107-55ATE	
55	7		75		•	•					BUK7107-55AIE	BUK7907-55AIE
55	7		75	•		•					BUK7107-55ATE	BUK7907-55ATE
55	8		75	•	•	•			BUK7C08-55AITE			
55	9	10	75	•	•						BUK9C10-55BIT	
75	9		75		•	•					BUK7109-75AIE	BUK7909-75AIE
75	9		75	•		•					BUK7109-75ATE	BUK7909-75ATE
75	10		75	•	•	•					BUK7C10-75AITE	

### Automotive TrenchPLUS part numbering



# The next generation of packaging

DFN / DSN packages – high performance on a smaller footprint

**100% solderable side pads**

- ▶ Improved electro-thermal behaviour
- ▶ For visual solder inspection

**Heat sink at die pad**

- ▶ For high power on a small footprint
- ▶ Enabling smaller designs

**Smallest packages**

- ▶ Outline down to 0.4 x 0.2 mm
- ▶ Height down to 0.12 mm
- ▶ For ultra-compact and slim designs

True power packages for smart efficiency – with solid wireless-clip design

**The miniaturization of power**

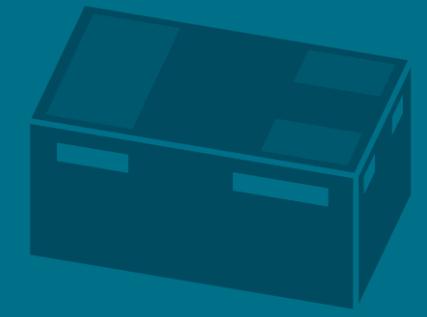
- ▶ Only 1 mm in height
- ▶ Excellent electro-thermal behavior
- ▶ For high-temperature use (175 °C)

**FlatPower: CFP15 (SOT1289) / CFP5 (SOD128) / CFP3 (SOD123W)**

- ▶ Same performance as SMA / SMB on a much smaller footprint

**LFPACK56/56D (SOT669 / SOT1205)**

- ▶ Same performance as DPAK, on a much smaller footprint



## Packages

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### Packing details glass diodes, single ended and through hole packages

Pins/leads	Package	Packing method and tape/reel/tube dimensions	Package	Ordering code (12 NC ending)	Packing quantity
2	SOD27	26 mm tape ammo pack, axial		-143	5000 pcs
		52 mm tape ammo pack, axial		-133	10000 pcs
		52 mm reel pack, axial		-113	10000 pcs
	SOD66	52 mm tape ammo pack, axial		-133	10000 pcs
		52 mm reel pack, axial		-113	10000 pcs
	SOD68	26 mm tape ammo pack, axial		-143	5000 pcs
		52 mm reel pack, axial		-113	10000 pcs
		52 mm tape ammo pack, axial		-133	10000 pcs
	3	SOT78 (TO-220)	Rail packing, 50 pcs/tube, tube length = 520 mm		-127
SOT186A (TO-220F)		Rail packing, 50 pcs/tube, tube length = 520 mm		-127	20 tubes x 50 pcs
I2PAK (SOT226)		Rail packing, 50 pcs/tube, tube length = 520 mm		-127	20 tubes x 50 pcs
5	SOT263B-1	Rail packing		-127	20 tubes x 50 pcs

### Package cross reference list – Part I

Type	Competitor	NXP	Pins/Leads	Type	Competitor	NXP	Pins/Leads
μQFN-10L	ST	DFN2510A-10 (SOT1176)	10	FM8	Toshiba	SOT96	8
μQFN-10L	ST	DFN2520-9 (SOT1333)	9	FS6*	Toshiba	DFN1010B-6 (SOT1216)	6
μQFN-2L	ST	DFN1006-2 (SOD882)	2	GMD2	Rohm	DSN0603-2 (SOD962)	2
6 Lead DFN	ON Semi	DFN2020-6 (SOT1118)	6	HUML2020L8 (Dual)	Rohm	DFN2020-6 (SOT1118)	6
CL2	Toshiba	DSN0402-2 (SOD992)	2	HUML2020L8 (Single)	Rohm	DFN2020MD-6 (SOT1220)	6
CLP0603	Vishay	DSN0603-2 (SOD962)	2	KMD2	Rohm	DFN1608D-2 (SOD1608)	2
CMAK/ CMPAK	Renesas	SOT323	3	LDPAK(S)-(1)	Renesas	D <sup>2</sup> PAK (SOT404)	3
CMPAK/ CMAK	Renesas	SOT323	3	LFPAK	Renesas	LFPAK (SOT669)	5
CMPAK-5(T)	Renesas	SOT353	5	LG A 1.0 x 0.6mm	Texas Instruments	DFN1006B-3 (SOT883B)	3
CMPAK-6	Renesas	SOT363	6	LLD	Renesas	SOD80C	2
CP4	Toshiba	SOT143B	4	LLDS	Rohm	SOD80C	2
CS6	Toshiba	DFN1010-6 (SOT891)	6	LLP1006-2L	Vishay	DFN1006-2 (SOD882)	2
CST3	Toshiba	DFN1006-3 (SOT883)	3	LLP1006-2L	Vishay	DFN1006D-2 (SOD882D)	2
CST3	Toshiba	DFN1006B-3 (SOT883B)	3	LLP1006-2M	Vishay	DFN1006-2 (SOD882)	2
CTS2 (fsc)	Toshiba	DFN1006-2 (SOD882)	2	LLP1006-2M	Vishay	DFN1006D-2 (SOD882D)	2
CTS2 (fsc)	Toshiba	DFN1006D-2 (SOD882D)	2	LLP75-7L	Vishay	DFN1616-6 (SOT1189)	6
D <sup>2</sup> PAK	ON Semi	D <sup>2</sup> PAK (SOT404)	3	LPDS/LPTS	Rohm	D <sup>2</sup> PAK (SOT404)	3
D <sup>2</sup> PAK	Vishay	D <sup>2</sup> PAK (SOT404)	3	LPTS/LPDS	Rohm	D <sup>2</sup> PAK (SOT404)	3
D <sup>2</sup> PAK 3	ON Semi	D <sup>2</sup> PAK (SOT404)	3	M-Flat	Toshiba	SOD128	2
D <sup>2</sup> PAK*	Diodes Inc.	D <sup>2</sup> PAK (SOT404)	3	Micro 3	Int. Rectifier	SOT23	3
DFN1006-3	Diodes Inc.	DFN1006-3 (SOT883)	3	Micro 6	Int. Rectifier	SOT457	6
DFN1006H4-3	Diodes Inc.	DFN1006-3 (SOT883)	3	Micro FOOT 0.8 x 0.8*	Vishay	DFN1010D-3 (SOT1215)	3
DFN1411*	Diodes Inc.	DFN1010D-3 (SOT1215)	3	Micro FOOT 1 x 1.2*	Vishay	DFN1010D-3 (SOT1215)	3
DFN2	ST	DSN0603-2 (SOD962)	2	Micro FOOT 1 x 1.5*	Vishay	DFN1010D-3 (SOT1215)	3
DPK	ON Semi	DPK (SOT428)	3	Micro FOOT 1.6 x 1.6*	Vishay	DFN2020MD-6 (SOT1220)	6
DS014	Infineon	SOT 108	14	Micro FOOT 1 x 1*	Vishay	DFN1010D-3 (SOT1215)	3
DSN2, 0.6 x 0.3	ON Semi	DSN0603-2 (SOD962)	2	Micro FOOT*	Vishay	DFN2020MD-6 (SOT1220)	6
DSN2, 0.4 x 0.2	ON Semi	DSN0402-2 (SOD992)	2	MicroFET	Fairchild	DFN2020MD-6 (SOT1220)	6
DSN2, 1.0 x 0.6	ON Semi	DSN1006-2 (SOD993)	2	MicroFET 1.6 x 1.6*	Fairchild	DFN2020MD-6 (SOT1220)	6
DSN2, 1.6 x 0.8	ON Semi	DFN1608D-2 (SOD1608)	2	MiniMelf	Diodes Inc.	SOD80C	2
DSN2, 1.0 x 0.6	ON Semi	DFN1006D-2 (SOD882D)	2	MiniMelf	ST	SOD80C	2
DSN2, 1.6 x 0.8	ON Semi	DFN1608D-2 (SOD1608)	2	MiniMelf	Vishay	SOD80C	2
EMD2	Rohm	SOD523	2	MP6	Renesas	DSN0603-2 (SOD962)	2
EMD3/EMT3	Rohm	DFN1006-3 (SOT883)	3	MPAK	Renesas	SOT23	3
EMD5/EMT5	Rohm	SOT665	5	MPAK	Renesas	SOT23	3
EMD6/EMT6/WEMT6	Rohm	SOT666	6	MPAK-4R	Renesas	SOT143B	4
EMT3	Rohm	DFN1006-3 (SOT883)	3	MPT3	Rohm	SOT89	3
EMT3/EMD3	Rohm	DFN1006-3 (SOT883)	3	PG-TD SON-8	Infineon	LFPAK (SOT669)	5
EMT3F*	Rohm	DFN1006-3 (SOT883)	3	PMDT	Rohm	SOD128	2
EMT5*	Rohm	SOT666	6	PMDU	Rohm	SOD123W	2
EMT5/EMD5	Rohm	SOT665	5	PowerDI123	Diodes Inc.	SOD123F	2
EMT6	Rohm	SOT666	6	PowerDI123	Diodes Inc.	SOD123W	2
EMT6/EMD6/WEMT6	Rohm	SOT666	6	PowerDI323	Diodes Inc.	SOD323F	2
ES6	Toshiba	SOT666	6	PowerDi5	Diodes Inc.	CFP15 (SOT1289)	3
ES6 ESV	Toshiba	SOT666	6	PowerFLAT (6 x 5)	ST	LFPAK (SOT669)	5
ESC/TESC	Toshiba	SOD523	2	PowerFLAT (6 x 5)	ST	LFPAK56D (SOT1205)	5
ESM	Toshiba	DFN1006-3 (SOT883)	3	PowerPAK SC-70	Vishay	DFN2020-6 (SOT1118)	6
ESV	Toshiba	SOT665	5	PowerPAK SC-70	Vishay	DFN2020MD-6 (SOT1220)	6
ESV	Toshiba	SOT666	6	PowerPAK SC-70	Vishay	DFN2020MD-6 (SOT1220)	6

Types with \* show footprint compability only

Package cross reference list – Part 2

Type	Competitor	NXP	Pins/Leads	Type	Competitor	NXP	Pins/Leads
PowerPAK SC706L	Vishay	DFN2020-3 (SOT1061)	3	SLP1610N2	Semtech	DFN1608D-2 (SOD1608)	2
PowerPak SC-70-6L	Vishay	DFN2020-6 (SOT1118)	6	SLP1610P4	Semtech	DFN2510A-10 (SOT1176)	10
PowerPAK SC-75*	Vishay	DFN2020MD-6 (SOT1220)	6	SLP1610P4	Semtech	DFN2520-9 (SOT1333)	9
PowerPak SC-75-6L*	Vishay	DFN2020MD-6 (SOT1220)	6	SLP1616P6	Semtech	DFN1616-6 (SOT1189)	6
PowerPAK SO-8	Vishay	LPAK (SOT669)	5	SLP1713P8	Semtech	DFN1714-8 (SOT1166)	8
PW-Mini	Toshiba	SOT89	3	SLP1713P8	Semtech	DFN1714U-8 (SOT983)	8
S08	Vishay	SOT96	8	SLP2010P8T	Semtech	DFN2110-9 (SOT1178)	9
SC2	Toshiba	DSN0603-2 (SOD962)	2	SLP2513P12	Semtech	DFN2514-12 (SOT1167)	12
SC59	Diodes Inc.	SOT23	3	SLP3313P16	Semtech	DFN3314-16 (SOT1168)	16
SC70	ON Semi	SOT323	3	SM6 VS-6	Toshiba	SOT457	6
SC-70	ON Semi	SOT323	3	SMA flat	ST	SOD128	2
SC-70, 3 leads	Vishay	SOT323	3	SMD TO-263	Renesas	D*PAK (SOT404)	3
SC70-3	Vishay	SOT323	3	SMD0402	Rohm	DSN0402-2 (SOD992)	2
SC70-3	AOS	SOT323	3	SMD6/SMT6	Rohm	SOT457	6
SC70-5L	Semtech	SOT353	5	SMD6/SMZ6	Rohm	SOT457	6
SC70-6	Vishay	SOT363	6	SMFPAK-6	Renesas	SOT666	6
SC70-6	AOS	SOT363	6	S-Mini	Toshiba	SOT23	3
SC70-6	Fairchild	SOT363	6	S-Mini TSM	Toshiba	SOT23	3
SC70-6L	Semtech	SOT363	6	SMPAK	Renesas	DFN1006-3 (SOT883)	3
SC74 TSOP6	Infineon	SOT457	6	SMPC TO-277A	Vishay	CFP15 (SOT1289)	3
SC-74 TSOP-6	ON Semi	SOT457	6	SMT3	Rohm	SOT23	3
SC75	Infineon	DFN1006-3 (SOT883)	3	SMT5*	Rohm	SOT457	6
SC75	ON Semi	DFN1006-3 (SOT883)	3	SMT6	Rohm	SOT457	6
SC-75	ON Semi	DFN1006-3 (SOT883)	3	SMZ6/SMD6	Rohm	SOT457	6
SC-75	Semtech	DFN1006-3 (SOT883)	3	SO-8 FL	ON Semi	LPAK (SOT669)	5
SC75A	Vishay	DFN1006-3 (SOT883)	3	SOD-123	ST	SOD123F	2
SC-75A	Vishay	DFN1006-3 (SOT883)	3	SOD-123-FL	ON Semi	SOD123F	2
SC79	Infineon	SOD523	2	SOD-123-FL	ON Semi	SOD123W	2
SC-88	ON Semi	SOT363	6	SOD323	Infineon	SOD323	2
SC88/SC 7 0-6/SOT 363 6 LEAD	ON Semi	SOT363	6	SOD323	Vishay	SOD323	2
SC-88A	ON Semi	SOT353	5	SOD323	Semtech	SOD323	2
SC89	Fairchild	SOT666	6	SOD-323	ON Semi	SOD323	2
SC-89	Semtech	SOT666	6	SOD-323	Diodes Inc.	SOD323	2
SC89-3	Vishay	DFN1006-3 (SOT883)	3	SOD-323	ST	SOD323	2
SC89-3	ON Semi	DFN1006-3 (SOT883)	3	SOD523	Diodes Inc.	SOD523	2
SC89-3	Fairchild	DFN1006-3 (SOT883)	3	SOD523	Vishay	SOD523	2
SC89-6	Vishay	SOT666	6	SOD523	Semtech	SOD523	2
SC89-6	AOS	SOT666	6	SOD-523	ON Semi	SOD523	2
SC89-6	Fairchild	SOT666	6	SOD-523	ST	SOD523	2
SC89-6lead	Vishay	SOT666	6	SOD882	ST	DFN1006-2 (SOD882)	2
S-Flat	Toshiba	SOD123F	2	SOD882T	ST	DFN1006D-2 (SOD882D)	2
S-Flat	Toshiba	SOD123W	2	SOD923-2*	ON Semi	DFN1006-2 (SOD882)	2
SLP0402P2X3	Semtech	DSN0402-2 (SOD992)	2	SOIC-8 NB	ON Semi	SOT96	8
SLP1006P2	Semtech	DFN1006-2 (SOD882)	2	SON 2x2	Texas Instruments	DFN2020MD-6 (SOT1220)	6
SLP1006P2T	Semtech	DFN1006D-2 (SOD882D)	2	SON 3x3*	Texas Instruments	DFN2020MD-6 (SOT1220)	6
SLP1006P3	Semtech	DFN1006-3 (SOT883)	3	SOP8	Rohm	SOT96	8
SLP1006P3T	Semtech	DFN1006B-3 (SOT883B)	3	SOP-8	Renesas	SOT96	8
SLP1510N6	Semtech	DFN1410-6 (SOT886)	6	SOPH	Rohm	SOT 108	14
				SOT 143	Infineon	SOT143B	4

Types with \* show footprint compability only

Package cross reference list – Part 3

Type	Competitor	NXP	Pins/Leads	Type	Competitor	NXP	Pins/Leads
SOT063*	ON Semi	DFN101 OB-6 (SOT1216)	6	SOT666	Infineon	SOT666	6
SOT-143	Semtech	SOT143B	4	SOT723*	ON Semi	DFN1010D-3 (SOT1215)	3
SOT-143	Diodes Inc.	SOT143B	4	SOT723-3*	ON Semi	DFN1010D-3 (SOT1215)	3
SOT223	Vishay	SOT223	4	SOT89	Infineon	SOT89	3
SOT223	Infineon	SOT223	4	SOT89	Diodes Inc.	SOT89	3
SOT223	Fairchild	SOT223	4	SOT-89	ON Semi	SOT89	3
SOT223	ON Semi	SOT223	4	SOT89-3L	Diodes Inc.	SOT89	3
SOT223	Diodes Inc.	SOT223	4	SOT963	ON Semi	DFN1010-6 (SOT891)	6
SOT-223	ON Semi	SOT223	4	SOT963*	Diodes Inc.	DFN1010B-6 (SOT1216)	6
SOT-223	Diodes Inc.	SOT223	4	SRP-F	Renesas	SOD123W	2
SOT23	Infineon	SOT23	3	SS CSP2	Toshiba	DFN1006-3 (SOT883)	3
SOT23	ST	SOT23	3	SSD3/SST3	Rohm	SOT23	3
SOT23	Vishay	SOT23	3	SSM	Toshiba	DFN1006-3 (SOT883)	3
SOT23	Semtech	SOT23	3	SSOT3	Fairchild	SOT23	3
SOT23	Diodes Inc.	SOT23	3	SSOT6	Fairchild	SOT457	6
SOT23	AOS	SOT23	3	SSOT6 FLMP	Fairchild	SOT457	6
SOT23	ON Semi	SOT23	3	SST3	Rohm	SOT23	3
SOT-23	ON Semi	SOT23	3	SST3/SSD3	Rohm	SOT23	3
SOT-23	Diodes Inc.	SOT23	3	ST01005	STM	DSN0402-2 (SOD992)	2
SOT23-3	Diodes Inc.	SOT23	3	Stmite flat	ST	SOD123W	2
SOT23-3	AOS	SOT23	3	T0263	Diodes Inc.	D*PAK(SOT404)	3
SOT23-3	ON Semi	SOT23	3	T0263-3	Infineon	D*PAK (SOT404)	3
SOT23-5	AOS	SOT457	6	Thin PowerPAK SC70	Vishay	DFN2020MD-6 (SOT1220)	6
SOT23-5	Diodes Inc.	SOT457	6	Thin PowerPAK SC-70	Vishay	DFN2020-6 (SOT1118)	6
SOT23-6	Diodes Inc.	SOT457	6	Thin PowerPAK SC-70	Vishay	DFN2020MD-6 (SOT1220)	6
SOT23-6	ST	SOT457	6	Thin PowerPAK SC75*	Vishay	DFN2020MD-6 (SOT1220)	6
SOT23-6	Diodes Inc.	SOT457	6	TO-220S	Renesas	D*PAK (SOT404)	3
SOT23-6L	Semtech	SOT457	6	TO-220SM	Toshiba	D*PAK (SOT404)	3
SOT23F	Toshiba	SOT23	3	TO-252 (MP-3ZK)	Renesas	DPAK (SOT428)	3
SOT23F	Diodes Inc.	SOT23	3	TO-252 reverse, TO-252	Vishay	DPAK (SOT428)	3
SOT26	Diodes Inc.	SOT457	6	TO-252, TO-252 reverse	Vishay	DPAK (SOT428)	3
SOT323	Infineon	SOT323	3	TO-252-3/-3-23	Infineon	DPAK (SOT428)	3
SOT323	Diodes Inc.	SOT323	3	TO-263 3-lead	Vishay	D*PAK (SOT404)	3
SOT323	Fairchild	SOT323	3	TO-263AB	Vishay	D*PAK (SOT404)	3
SOT-323	Diodes Inc.	SOT323	3	TSLP-2-1	Infineon	DFN1006-2 (SOD882)	2
SOT-323	ST	SOT323	3	TSLP-2-7/-17	Infineon	DFN1006D-2 (SOD882D)	2
SOT353	Diodes Inc.	SOT353	5	TSLP-3-1, -15	Infineon	DFN1006B-3 (SOT883B)	3
SOT353	Vishay	SOT353	5	TSLP-3-4	Infineon	DFN1006-3 (SOT883)	3
SOT353	Diodes Inc.	SOT363	6	TSLP-9-1	Infineon	DFN2510A-10 (SOT 1176)	10
SOT363	Infineon	SOT363	6	TSLP-9-1	Infineon	DFN2520-9 (SOT1333)	9
SOT363	Diodes Inc.	SOT363	6	TSMT5*	Rohm	SOT457	6
SOT-363	Diodes Inc.	SOT363	6	TSMT6	Rohm	SOT457	6
SOTS23	Diodes Inc.	DFN1006-3 (SOT883)	3	TSNP-2-2	Infineon	DFN1608D-2 (SOD 1608)	2
SOTS23F	Fairchild	DFN1006-3 (SOT883)	3	TSOP6	Vishay	SOT457	6
SOT-553	ON Semi	SOT665	5	TSOP6	AOS	SOT457	6
SOT563	Diodes Inc.	SOT666	6	TSOP6	ON Semi	SOT457	6
SOT-563	ON Semi	SOT666	6	TSOP-6	Renesas	SOT457	6
SOTS63-6	ON Semi	SOT666	6	TSOP-6/ TSOP6	Vishay	SOT457	6
SOTS63F	Fairchild	SOT666	6	TSSLP-2-1	Infineon	DSN0603-2 (SOD962)	2

Types with \* show footprint compability only

Package cross reference list – Part 4

Type	Competitor	NXP	Pins/Leads
TSSOP20	Toshiba	SOT360	20
TSSOP20	Renesas	SOT360	20
TSST8*	Rohm	DFN2020MD-6 (SOT1220)	6
TUMT3	Rohm	SOT323	3
TUMT5*	Rohm	DFN2020-6 (SOT1118)	6
TUMT6*	Rohm	DFN2020-6 (SOT1118)	6
UDFN 1.6 x 1.6	ON Semi	DFN1616-6 (SOT1189)	6
UDFN 1.7 x 1.35, 0.4P	ON Semi	DFN1714U-8 (SOT983)	8
UDFN 10 2.5 x 1, 0.5P	ON Semi	DFN2520-9 (SOT1333)	9
UDFN 10 2.5 x 2	ON Semi	DFN2520-9 (SOT1333)	9
UDFN10 2.5 x 1, 0.5P	ON Semi	DFN2510A-10 (SOT1176)	10
UDFN12, 2.5 x 1.35, 0.4P	ON Semi	DFN2514-12 (SOT1167)	12
U-DFN2020-3 Type B 2.0 x 2.0 x 0.6	Diodes Inc.	DFN2020-3 (SOT1061)	3
U-DFN2020-6	Diodes Inc.	DFN2020MD-6 (SOT1220)	6
UDFN2020-6 Type B	Diodes Inc.	DFN2020-6 (SOT1118)	6
UDFN2020-6 Type E	Diodes Inc.	DFN2020MD-6 (SOT1220)	6
U-DFN2523-6*	Diodes Inc.	DFN2020MD-6 (SOT1220)	6
UDFN6	Toshiba	DFN2020-6 (SOT1118)	6
UDFN6	ON Semi	DFN2020MD-6 (SOT1220)	6
UDFN-6 WDFN6	ON Semi	DFN2020MD-6 (SOT1220)	6
UDFN6B	Toshiba	DFN2020MD-6 (SOT1220)	6
UDRN 16 4 x 2	ON Semi	DFN4020-14 (SOT1334)	14
UF6	Toshiba	SOT363	6
UF6/ USV/ US6	Toshiba	SOT363	6
UFP	Renesas	SOD523	2
UMD2	Rohm	SOD323F	2
UMD3/UMT3	Rohm	SOT323	3
UMD5/UMT5	Rohm	SOT353	5
UMD6/ UMT6	Rohm	SOT363	6
UMLP 1.6 x 1.6*	Fairchild	DFN2020MD-6 (SOT1220)	6
UMT3	Rohm	SOT323	3
UMT3F*	Rohm	SOT323	3
UMT5/ UMD5	Rohm	SOT353	5
UMT6	Rohm	SOT363	6
UMT6/ UMD6	Rohm	SOT363	6
UPAK (SOT89)	Renesas	SOT89	3
URP	Renesas	SOD323	2
US6	Toshiba	SOT363	6
US6/ UF6/ USV	Toshiba	SOT363	6
use	Toshiba	SOD323	2
US-Flat	Toshiba	SOD323F	2
USM	Toshiba	SOT323	3
USV	Toshiba	SOT353	5
USV	Toshiba	SOT363	6
USV/ US6/ UF6/	Toshiba	SOT363	6
VESM*	Toshiba	DFN1010D-3 (SOT1215)	3
VML0806*	Rohm	DFN1006B-3 (SOT883B)	3
VML1006	Rohm	DFN1006-3 (SOT883)	3

Types with \* show footprint compability only

Package cross reference matrix – Part I

Pins/Leads	NXP	Industry standard names	Size (l x w x h) (mm)	P <sub>tot</sub> (mW)	Package	Competitor synonyms									
						Rohm	Toshiba	ON Semi	Renesas	Infineon	Diodes Inc	ST	Vishay	Semtech	
2	DSN0402-2 (SOD992)		0.4 x 0.2 x 0.12			SMD0402	CL2	DSN2 0.4 x 0.2		WLL-2-2		ST01005		SLP0402P2X3	
	DSN1006-2 (SOD993)		1.0 x 0.6 x 0.3					DSN2 1.0 x 0.6							
	DSN1006U-2 (SOD995)		1.0 x 0.6 x 0.3					DSN2 1.0 x 0.6							
	DFN1006-2 (SOD882)		1.0 x 0.6 x 0.48	250		(VMN2)	CTS2 (fSC)	(SOD923-2)		TSLP-2-1	XI-DFN1006-2	SOD 882 uQFN-2L	LLP1006-2M LLP1006-2L	SLP1006P2	
	DFN1006D-2 (SOD882D)		1.0 x 0.6 x 0.37	250		(VMN2)	CTS2 (fSC)	DSN2 1.0 x 0.6		TSLP-2-7/ -17	X2-DFN1006-2	SOD882T	LLP1006-2L LLP1006-2M	SLP1006P2T	
	DFN1608D-2 (SOD1608)		1.6 x 0.8 x 0.37	780		KMD2		DSN2 1.6 x 0.8		TSNP-2-2				SLP1610N2	
	DSN0603-2 (SOD962)		0.6 x 0.3 x 0.3	525		GMD2	SC2	DSN2, X3DFN-2 WLCSP2	MP6	TSS-LP-2-1	X3-DFN0603-2	DFN2	CLP0603	SLP0603P2X3	
	SOD80C	Mini-Melf	3.5 x 1.5 x 1.5	300		LLDS			LLD		MiniMelf	MiniMelf	MiniMelf		
	SOD123F		2.6 x 1.6 x 1.1	830			S-Flat	SOD-123-FL			PowerDI123	SOD-123			
	SOD123W		2.6 x 1.7 x 1.0	900		PMDU	S-Flat	SOD-123-FL	SRP-F		PowerDI123	Stmite flat			
	SOD128		3.8 x 2.5 x 1.0	1000		PMDT	M-Flat					SMA flat			
	SOD323	SC-76	1.7 x 1.25 x 0.95	400			USC	SOD-323	URP	SOD323	SOD-323	SOD-323	SOD-323	SOD323	
	SOD323F	SC-90	1.7 x 1.25 x 0.7	830		UMD2	US-Flat				PowerDI323				
	SOD523	SC-79	1.2 x 0.8 x 0.6	500		EMD2	ESC/ TESC	SOD-523	UFP	SC79	SOD523	SOD-523	SOD523	SOD523	
	3	CFP15 (SOT1289)		5.8 x 4.3 x 0.78	1200						PowerDi5		SMPC TO-277A		
		DFN1006-3 (SOT883)	SC-101	1.0 x 0.6 x 0.48	250		VML1006	SS CSP2	XDFN3		TSLP-3-4	X1 -DFN 1006-3		SLP1006P3	
		DFN1006B-3 (SOT883B)		1.0 x 0.6 x 0.37	250		VML1006	CST3	XDFN3		TSLP-3-1, -15	X2-DFN1006-3		SLP1006P3T	
		DFN1010D-3 (SOT1215)		1.1 x 1.0 x 0.37	325		(VMT3)	(VESM)	(SOT723)			X2-DFN1010-3			
		DFN2020-3 (SOT1061)	HU-SON3	2.0 x 2.0 x 0.62	1300				WDFN3			U-DFN2020-3 Type B 2.0 x 2.0 x 0.6		PowerPAK SC706L	
		DFN2020D-3 (SOT1061D)		2.0 x 2.0 x 0.62	1300				WDFN3			U-DFN2020-3 Type B 2.0 x 2.0 x 0.6		PowerPAK SC706L	
DPAK (SOT428)			6.6 x 6.1 x 2.3					DPAK	TO-252 (MP-3ZK)	TO-252-3/-3-2 3			TO-252, TO-252 reverse		
D2PAK (SOT404)			11.0 x 11.0 x 4.3			LPDS/ LPTS	TO-220SM	D2PAK D2PAK 3	TO-220S / SMD TO-263 LDKPAK(S)-11)	T0263-3	T0263 (D2PAK)		TO-263 3-lead TO-263AB / D2PAK		
SOT23			2.9 x 1.3 x 1.0	250		SSD3/ SST3	S-Mini TSM	SOT-23	MPAK	SOT23	SOT-23	SOT23	SOT23	SOT23	
SOT89		SC-62	4.5 x 2.5 x 1.5	1300		MPT3	PW-Mini	SOT-89	UPAK (SOT89)	SOT89	SOT89				
SOT323	SC-70	2.0 x 1.25 x 0.95	200		UMD3/ UMT3 TUMT3	USM	SC-70	CMAK/ CMPAK	SOT323	SOT-323	SOT-323	SC-70 3 leads	SOT-323		

Types in brackets (...) show footprint compability only

Package cross reference matrix – Part 2

Pins/leads	NXP	Industry standard names	Size (l x w x h) (mm)	P <sub>tot</sub> (mW)	Package	Competitor synonyms									
						Rohm	Toshiba	ON Semi	Renesas	Infineon	Diodes Inc	ST	Vishay	Semtech	
4	LFPAK56 (SOT669)	Power-S08	4.9 x 4.45 x 1.0	3000				SO-8 FL	LFPAK	PG-TD-SON-8	Power-DI5060-8	PowerFLAT (6x5)	PowerPAK SO-8		
	SOT143B		2.9 x 1.3 x 1.0	250			CP4		MPAK-4R	SOT143	SOT-143				SOT-143
	SOT223	SC-73	6.5 x 3.5 x 1.65	1700				SOT-223		SOT223	SOT-223			SOT223	
5	SOT353	SC-88 A	2.0 x 1.25 x 0.95	300		UMD5/UMT5	USV	SC-88 A	CMPAK-5C0		SOT353		SOT353		SC70-5L
	SOT665		1.6 x 1.2 x 0.55	300		EMD5/EMT5	ESV	SOT-553	VSON-5						
6	DFN1010-6 (SOT891)	x SON6	1.0 x 1.0 x 0.48				CS6	SOT963							
	DFN1010B-6 (SOT1216)		1.1 x 1.0 x 0.37	350		VMT6)	(FS6)	(SOT063)			(SOT963)				
	DFN1410-6 (SOT886)	x SON6	1.45 x 1.0 x 0.48	250											SLP1510N6
	DFN1616-6 (SOT1189)	H x SON6	1.6 x 1.6 x 0.48					UDFN 1.6 x 1.6					LLP75-/L		SLP1616P6
	DFN2020-6 (SOT1118)		2.0 x 2.0 x 0.62	1300		HU-ML2020L8 (Dual)	UDFN6	6 Lead DFN WDFN6			UDFN2020-6 Type B		PowerPAK SC-70 Thin PowerPAK SC-70		
	DFN2020D-6 (SOT1118D)		2.0 x 2.0 x 0.62	1300		HU-ML2020L8 (Dual)	UDFN6	6 Lead DFN WDFN6			UDFN2020-6 Type B		PowerPAK SC-70 Thin PowerPAK SC-70		
8	DFN2020MD-6 (SOT1220)		2.0 x 2.0 x 0.62	1250		HU-ML2020L8 (Single)	UDFN6B	UDFN-6 WDFN6			UDFN2020-6 Type E		PowerPAK SC-70 Thin PowerPAK SC-70		
	SOT363	SC-88	2.0 x 1.25 x 0.95	300		UMD6/UMT6	US6 UF6 USV	SC-88	CMPAK-6	SOT363	SOT-363		SC70-6	SC70-6L	
	SOT457	SC-74	2.9 x 1.5 x 1.0	750		SMD6/SMT6	SM6 VS-6	SC-74 TSOP-6	TSOP-6	SC74 TSOP6	SOT23-6 SOT26		TSOP6 TSOP-6	SOT23-6L	
	SOT666		1.6 x 1.2 x 0.55	300		EMD6/EMT6 WEMT6	ES6 ESV	SOT-563	SMFPAK-6	SOT666	SOT563		SC89-6lead	SC-89	
8	LFPAK56D (SOT1205)		4.9 x 4.45 x 1.0	3000								PowerFLAT (6x5)			
	SOT96	S08	4.9 x 3.9 x 1.75	1500			SOP8	FM8	SOIC-8 NB	SOP-8			S08		
	DFN1714-8 (SOT1166)	HUSON8	1.7 x 1.35 x 0.52											SLP1713P8	
9	DFN1714U-8 (SOT983)	H x SON8	1.7 x 1.35 x 0.48					UDFN 1.7 x 1.35, 0.4P						SLP1713P8	
	DFN2110-9 (SOT1178)	x SON9	2.1 x 1.0 x 0.48											SLP2010P8T	
10	DFN2520-9 (SOT1333)							WDFN 10 2.5 x 2 UDFN10 2.5 x 2							
	DFN2510-10 (SOT1165)	x SON10	2.5 x 1.0 x 0.48					UDFN10 2.5 x 1, 0.5P		TSLP-9-1		pQFN-10L		SLP1610P4	
	DFN2510A-10 (SOT1176)	x SON10	2.5 x 1.0 x 0.48					UDFN10 2.5 x 1, 0.5P		TSLP-9-1		pQFN-10L		SLP1610P4	
	DFN2626-10 (SOT1197)		2.6 x 2.6 x 0.48					UDFN10 2.6 x 2.6, 0.5P						SLP2626P10	

Types in brackets (...) show footprint compatibility only

Package cross reference matrix – Part 3

Pins/leads	NXP	Industry standard names	Size (l x w x h) (mm)	P <sub>tot</sub> (mW)	Package	Competitor synonyms									
						Rohm	Toshiba	ON Semi	Renesas	Infineon	Diodes Inc	ST	Vishay	Semtech	
12	DFN2512-12 (SOT1158)	H x SON12	2.5 x 1.2 x 0.48					UDFN12, 2.5 x 1.2, 0.4P							
	DFN2514-12 (SOT1167)	HU-SON12	2.5 x 1.35 x 0.53					UDFN12, 2.5 x 1.35, 0.4P						SLP2513P12	
14	DFN4020-14 (SOT1334)		4.0 x 2.0 x 0.48					WDFN 16 4 x 2 UDRN 16 4 x 2							
	SOT108	S014	8.65 x 3.9 x 1.75			SOP14						DS014			
16	DFN3312-16 (SOT1159)	H x SON16	3.3 x 1.2 x 0.48					UDFN 16, 3.5 x 1.2, 0.4P							
	DFN3314-16 (SOT1168)	HU-SON16	3.3 x 1.35 x 0.53											SLP3313P16	
20	SOT360	TSSOP20	6.5 x 4.4 x 1.1									TSSOP20	TSSOP20		

Types in brackets (...) show footprint compatibility only

Tape and reel pack for SMD and WLCSFP packages

**Choose 10k reels for higher efficiency**

- ▶ Optimized handling and production
- ▶ Reduced packaging and environmental impact
- ▶ Available for many products

## Product orientation (tape and reel pack)

2 pin packages	Orientation in tape	Package	Packing 12NC ending	
			DFN1006-2 (SOD882)	315
			DFN1006D-2 (SOD882D)	315
			DFN1608D-2 (SOD1608)	315
			DSN0603-2 (SOD962)	315
			DSN0402-2 (SOD992)	315
			DSN1006-2 (SOD993)	315
			DSN1006U-2 (SOD995)	315
			DSN1608-2 (SOD963, SOD964)	315
			SOD80	115, 135
			SOD123F	115
		CFP3 (SOD123W)	115	
		CFP5 (SOD128)	115	
		SOD323	115, 135	
		SOD323F	115	
	SOD523	115, 135, 315, 335		

3 pin packages	Orientation in tape	Package	Packing 12NC ending	Orientation in tape	Package	Packing 12NC ending	
			SOT89	146		DFN1010D-3 (SOT1215)	147
						DFN2020-3 (SOT1061)	115, 135
						DFN2020D-3 (SOT1061D)	115, 135
						SOT89	115, 135
						SOT663	115
						CFP15 (SOT1289)	139, 146
						DPAK (SOT428)	118
				D2PAK (SOT404)	118		
					SOT89	147	

4 pin packages	Orientation in tape	Package	Packing 12NC ending	Orientation in tape	Package	Packing 12NC ending	
			LFPAK56 (SOT669)	115			
			WL CSP4	084			

5 pin packages	Orientation in tape	Package	Packing 12NC ending	Orientation in tape	Package	Packing 12NC ending	
			WL CSP5	087		SOT353	115, 135
						SOT665	115

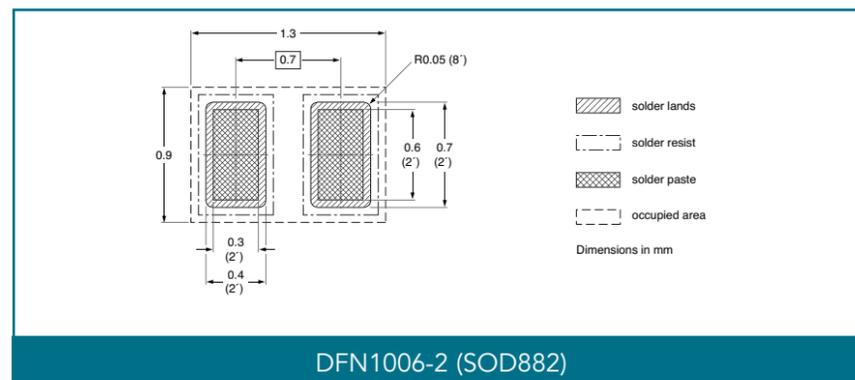
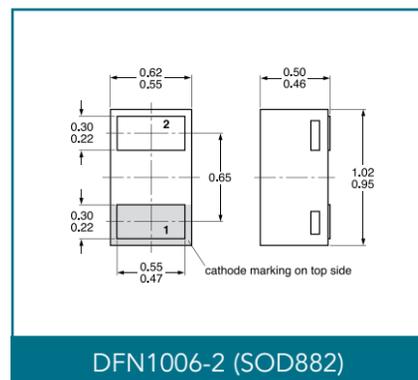
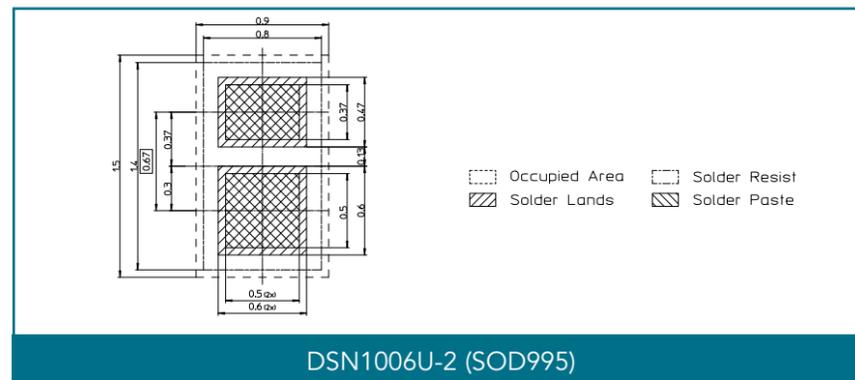
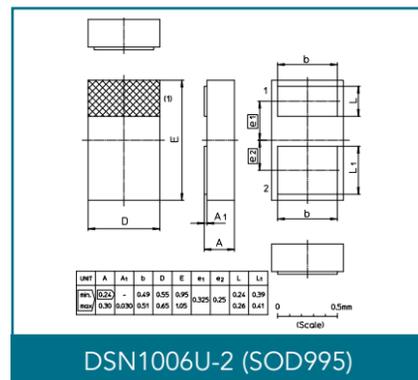
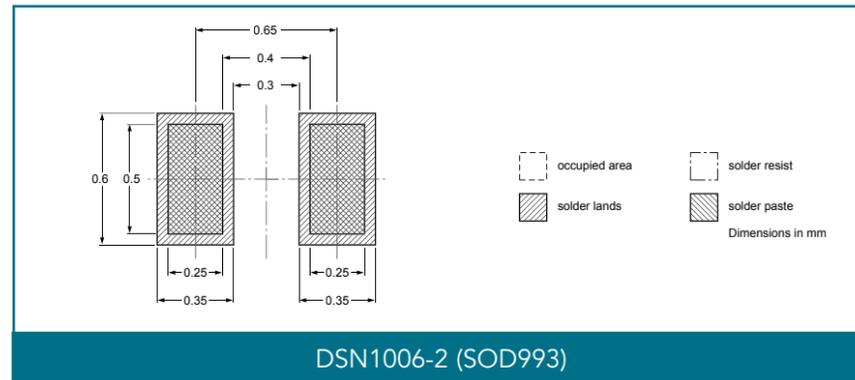
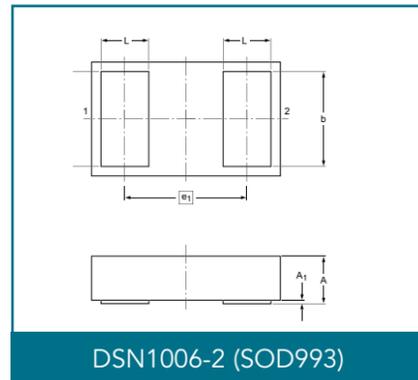
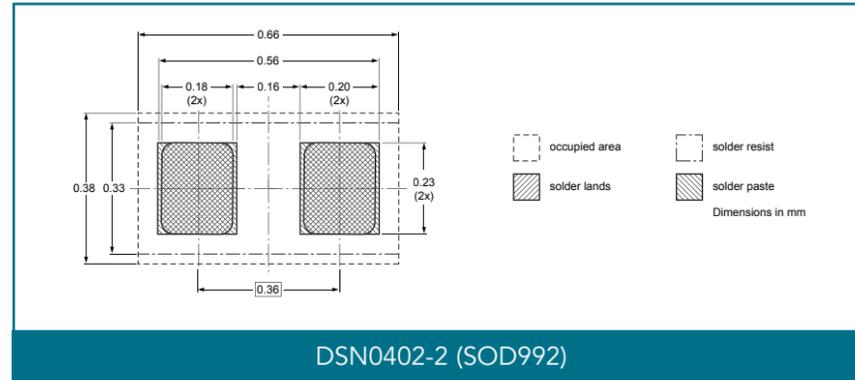
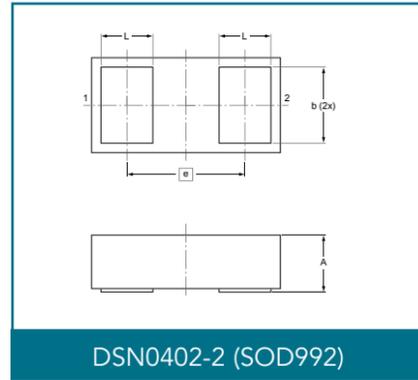
> 6 pin packages	Orientation in tape	Package	Packing 12NC ending	Orientation in tape	Package	Packing 12NC ending	
			DFN1410-6 (SOT886)	115		DFN2020-6 (SOT1118)	115
			DFN1616-6 (SOT1189)	115		DFN2020D-6 (SOT1118D)	115
			DFN2020MD-6 (SOT1220)	184		DFN2020MD-6 (SOT1220)	115
			LFPAK33 (SOT1210)	115		DFN1010B-6 (SOT1216)	147
			LFPAK56D (SOT1205)	115		SOT363	115, 135
			WL CSP6	023		SOT457	115, 135
					SOT666	115, 315	

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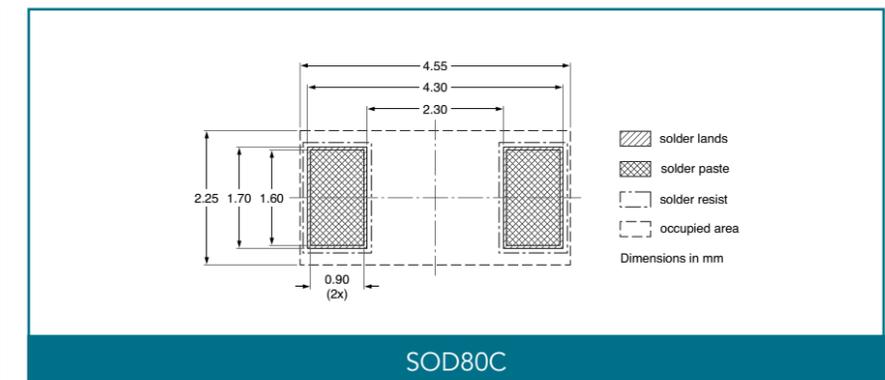
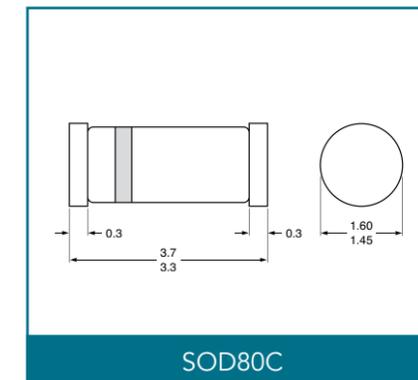
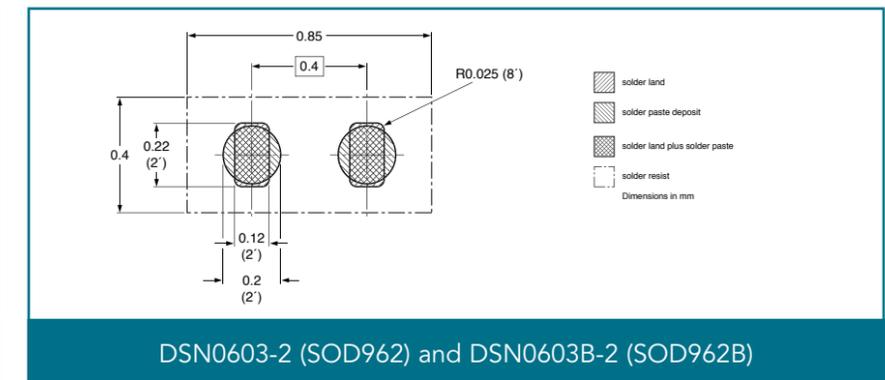
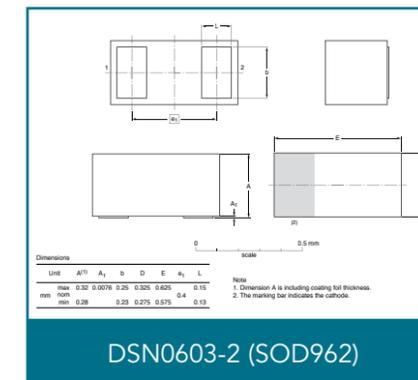
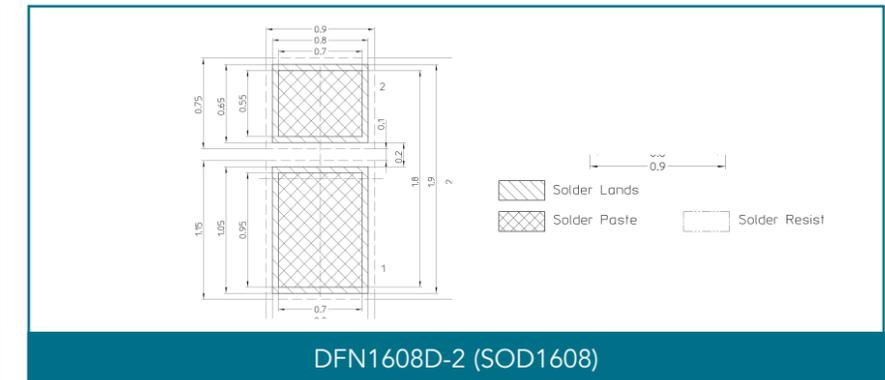
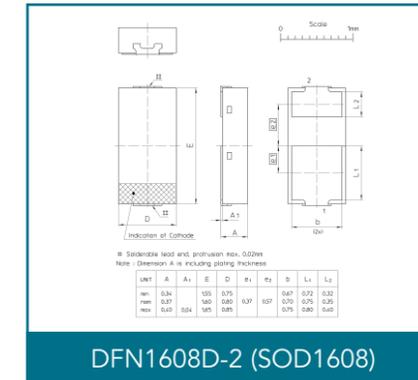
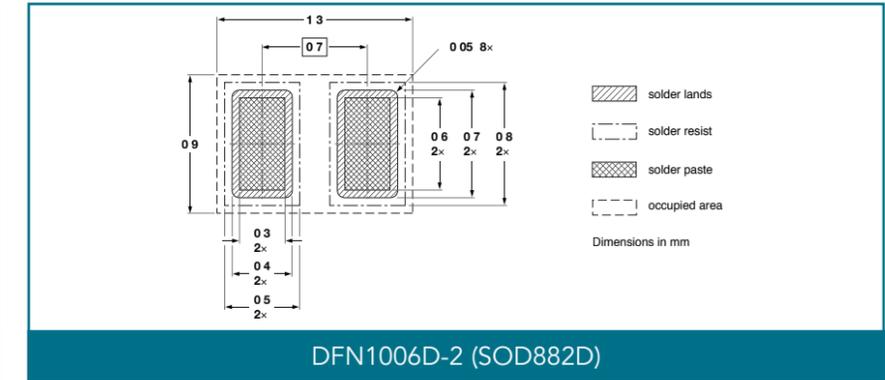
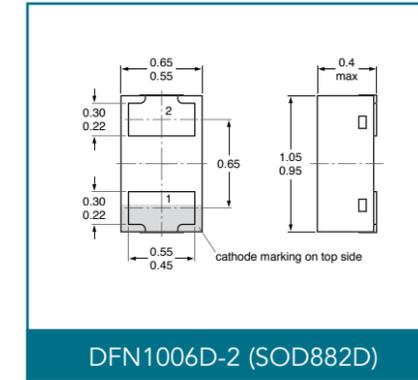
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### 2-pin SMD packages



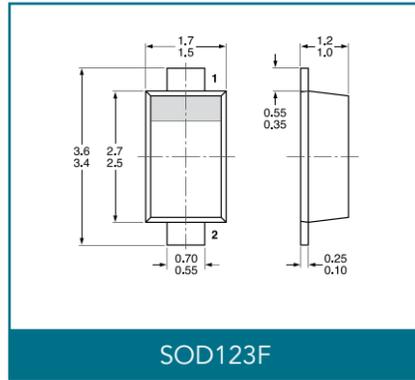
Dimensions in mm

### 2-pin SMD packages

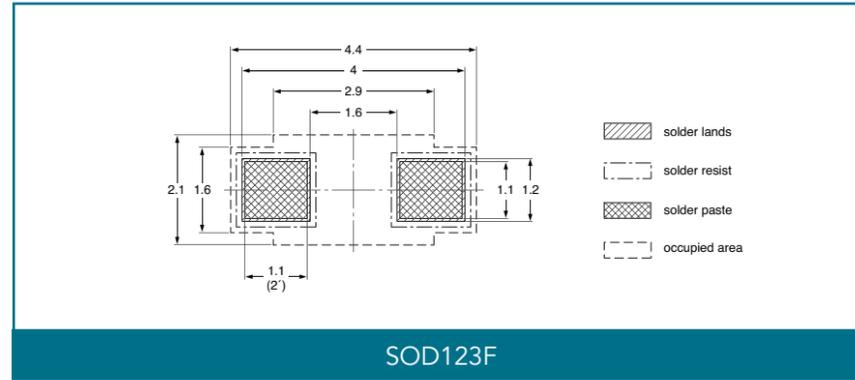


Dimensions in mm

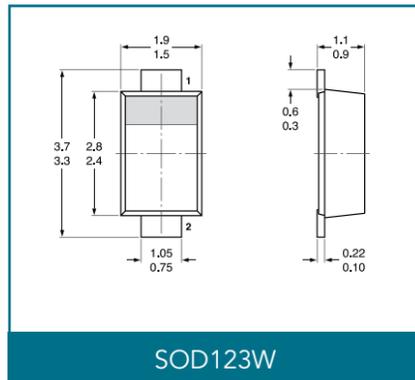
### 2-pin SMD packages



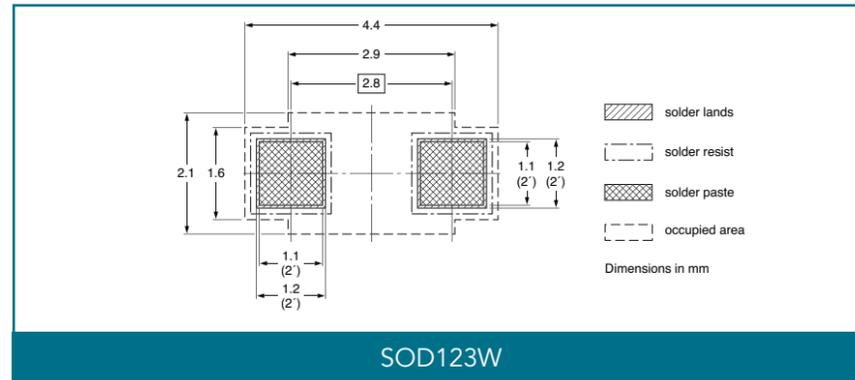
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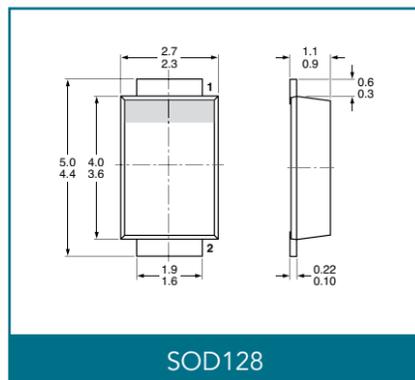
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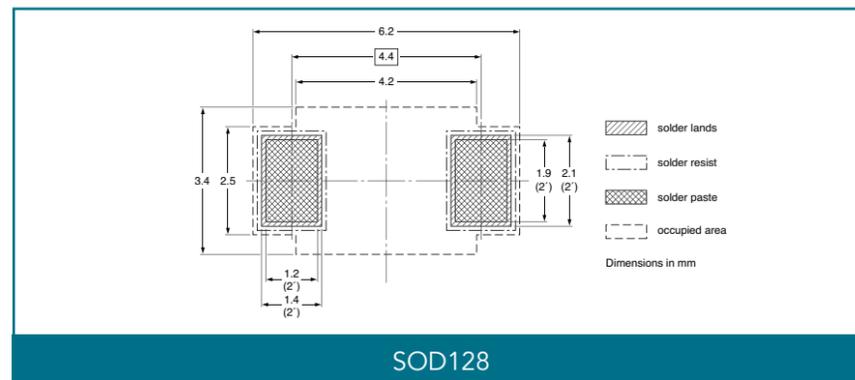
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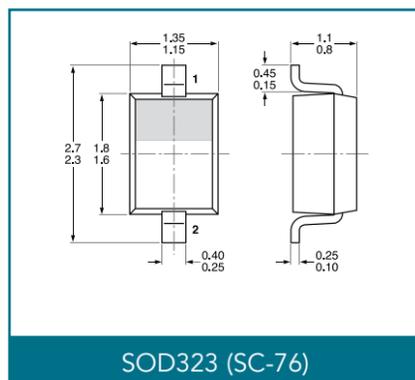
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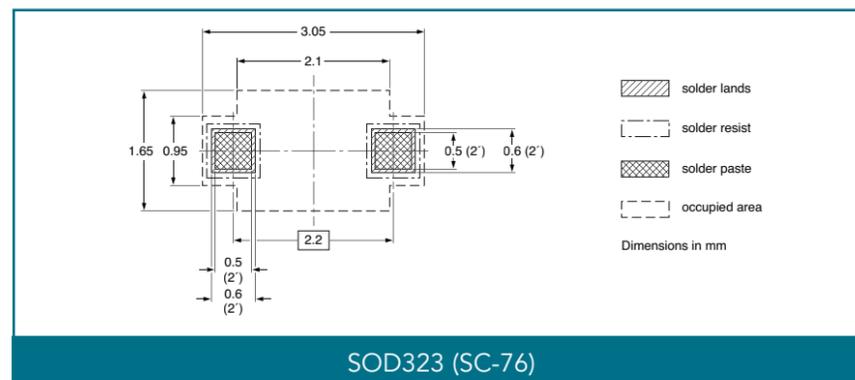
SOD128



SOD128



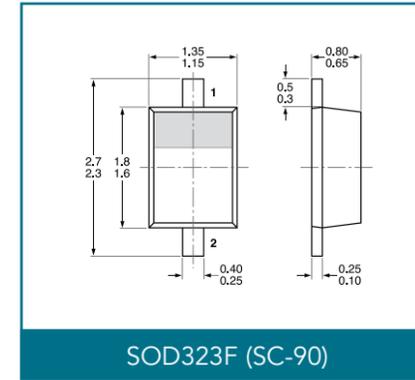
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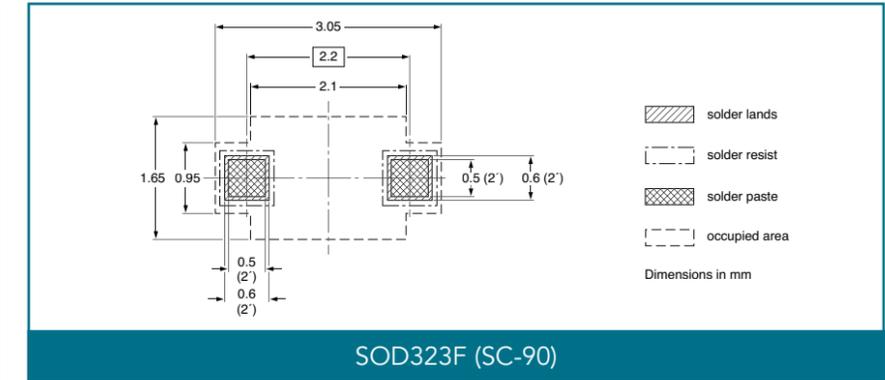
SOD323 (SC-76)

Dimensions in mm

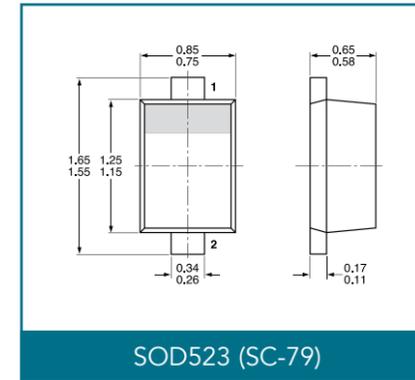
### 2-pin SMD packages



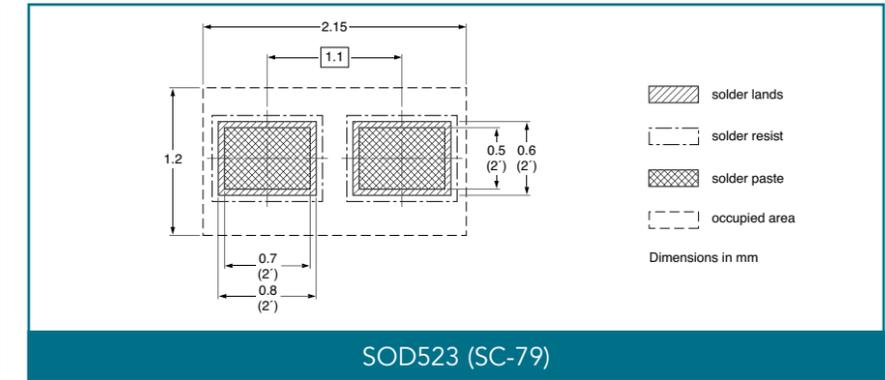
SOD323F (SC-90)



SOD323F (SC-90)

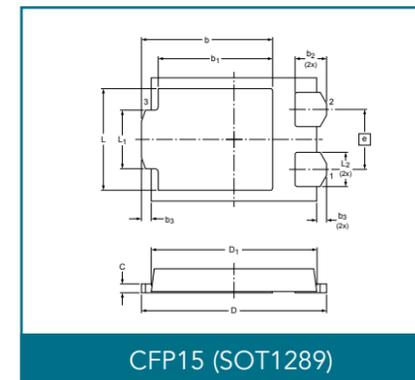


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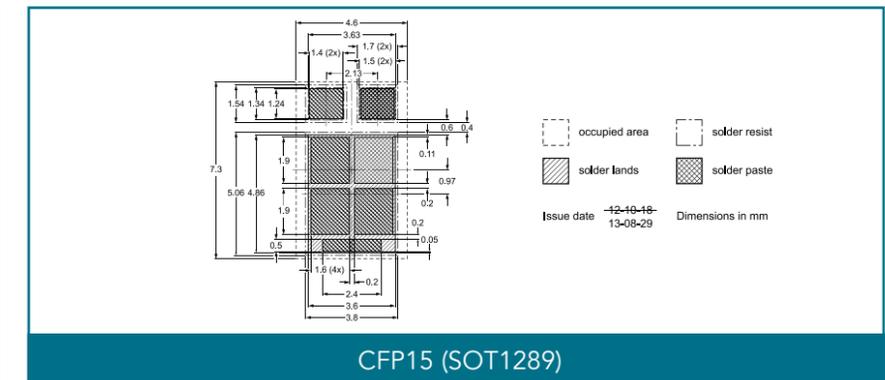


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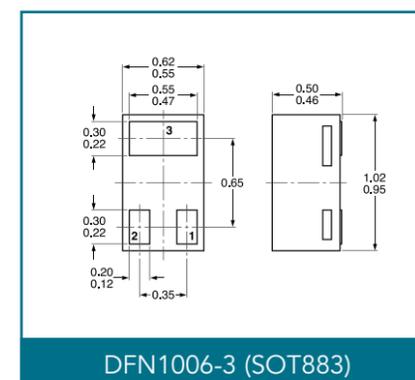
### 3-pin SMD packages



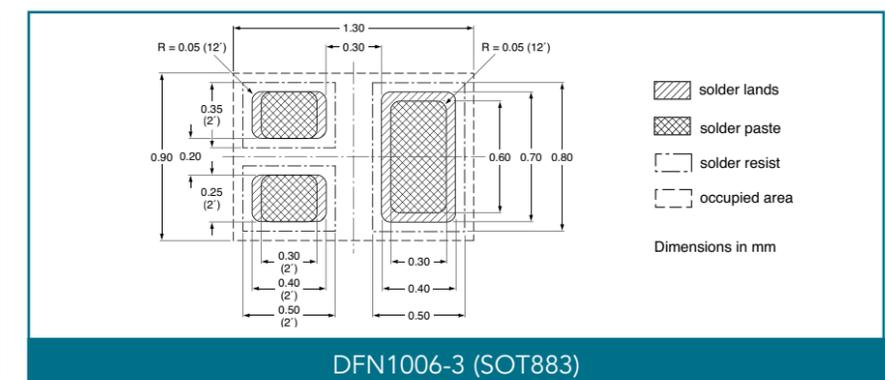
CFP15 (SOT1289)



CFP15 (SOT1289)



DFN1006-3 (SOT883)



DFN1006-3 (SOT883)

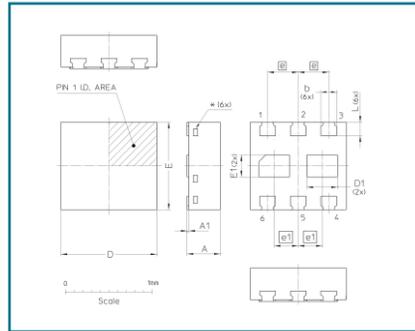
Dimensions in mm



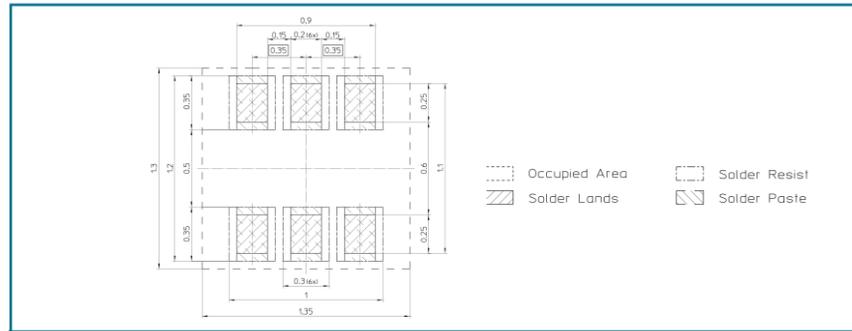


6-pin SMD packages

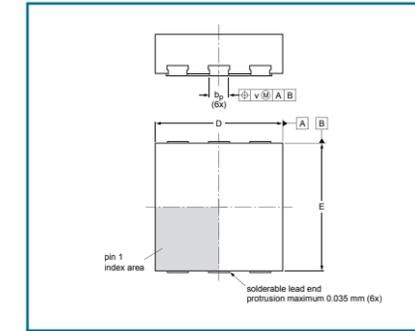
6-pin SMD packages



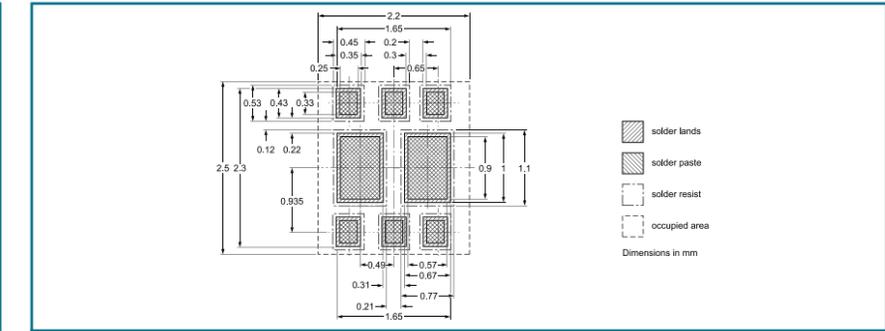
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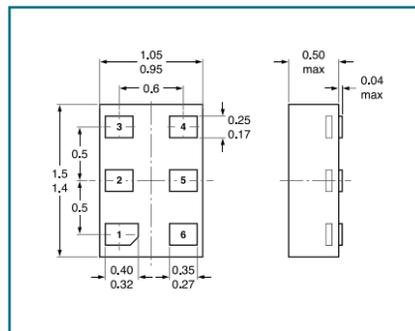
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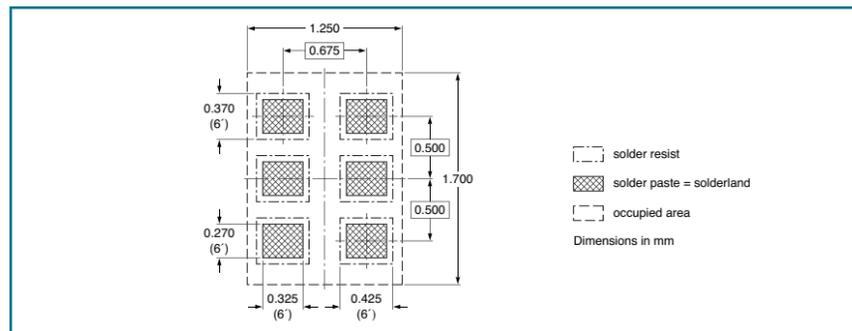
DFN2020D-6 (SOT1118D)



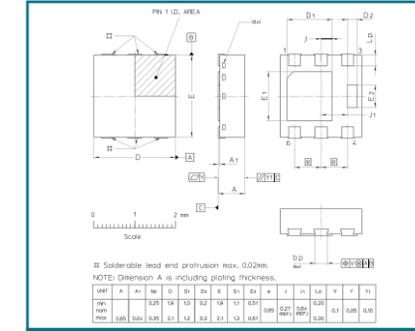
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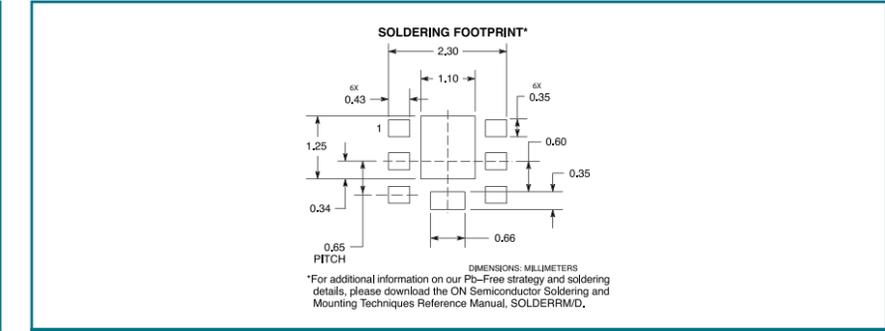
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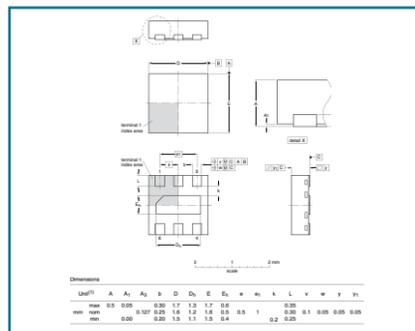
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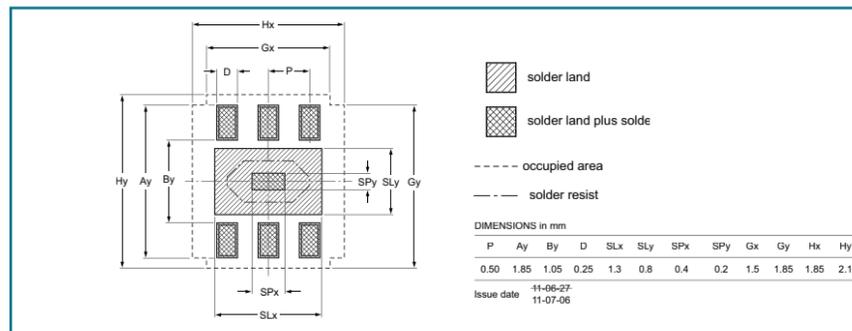
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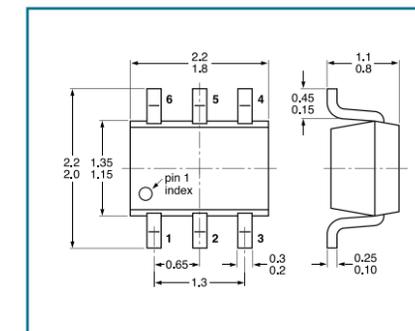
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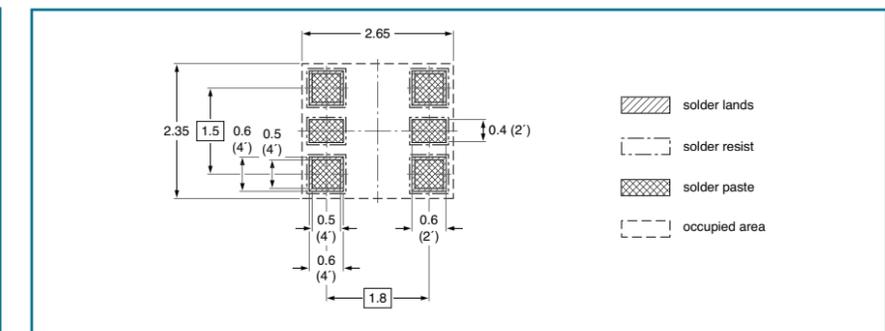
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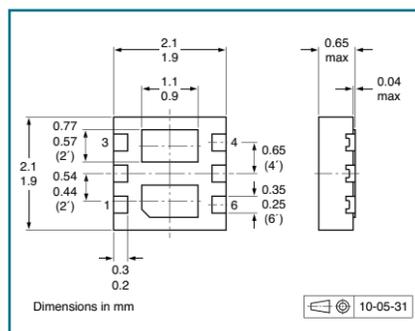
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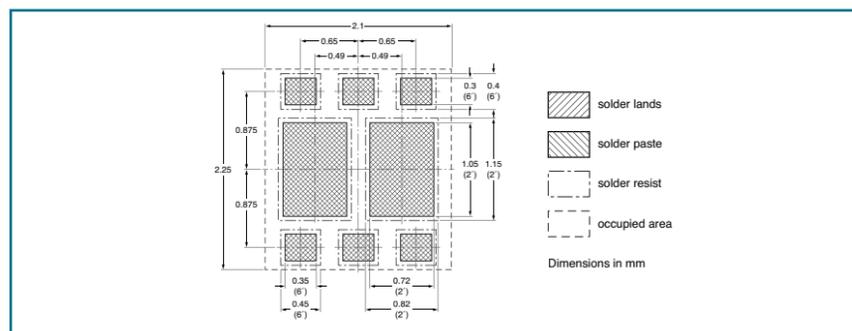
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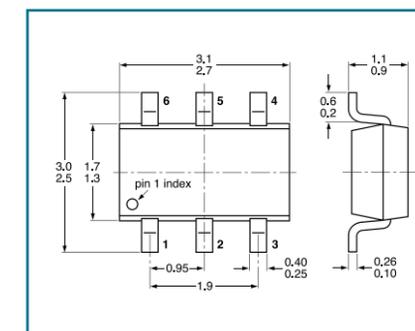
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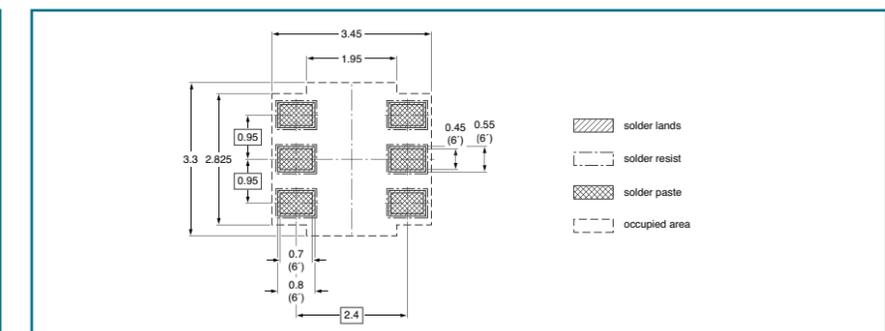
DFN2020-6 (SOT1118)



DFN2020-6 (SOT1118)



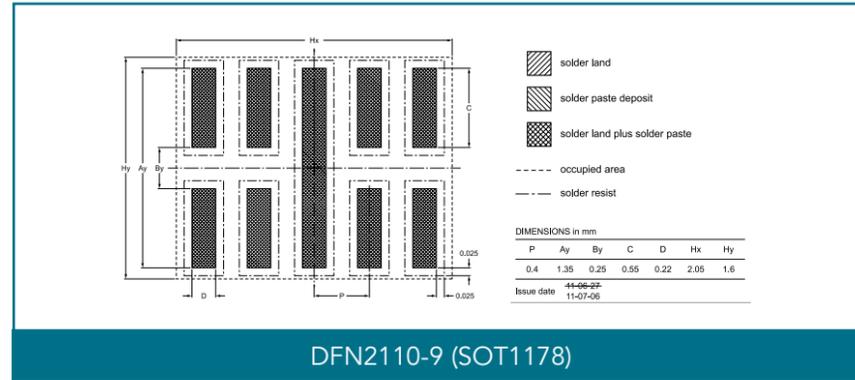
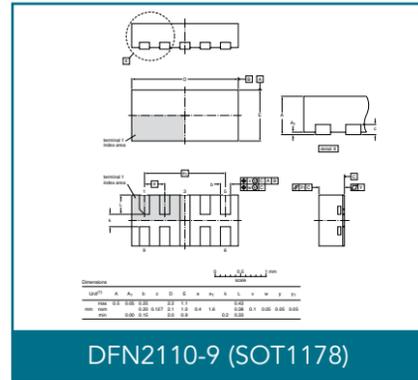
SOT457 (SC-74)



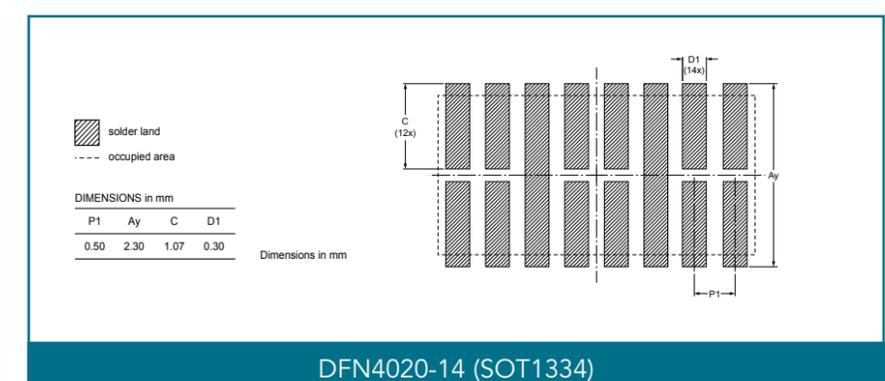
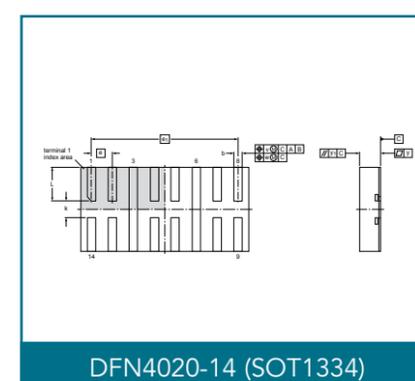
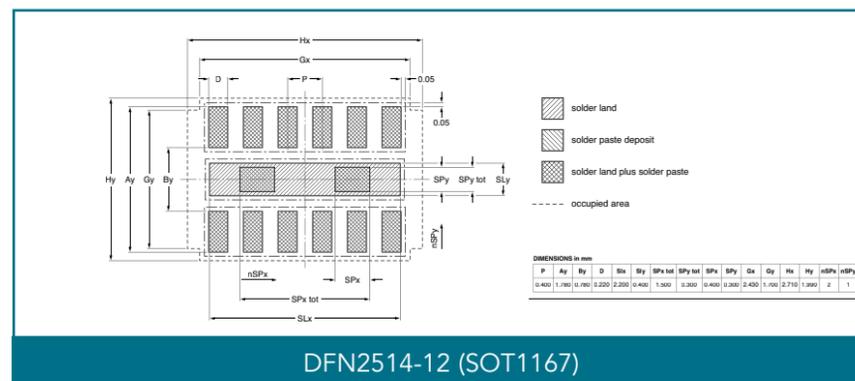
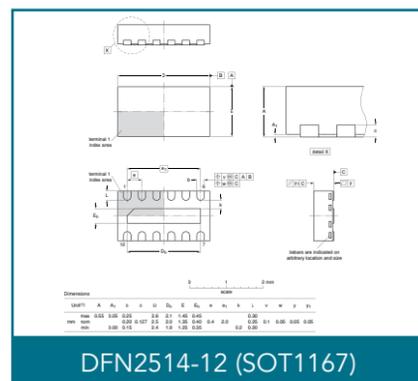
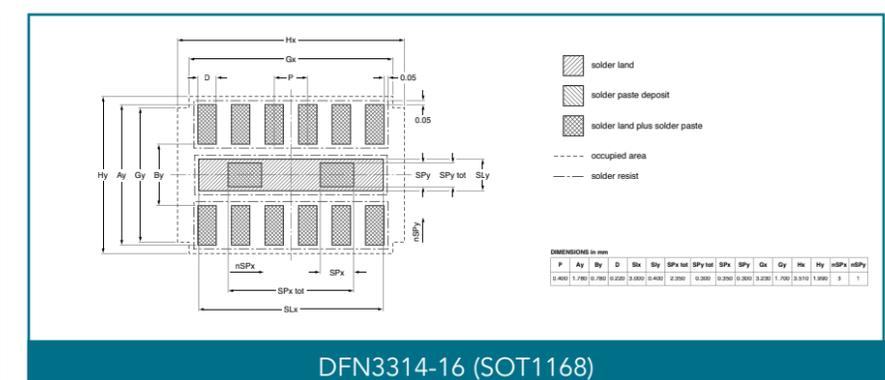
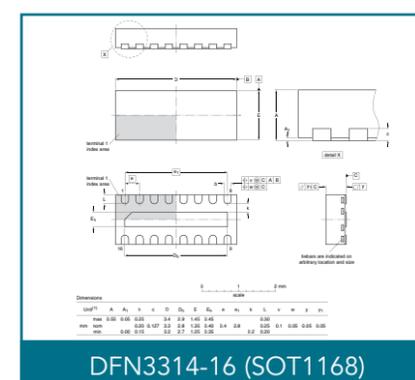
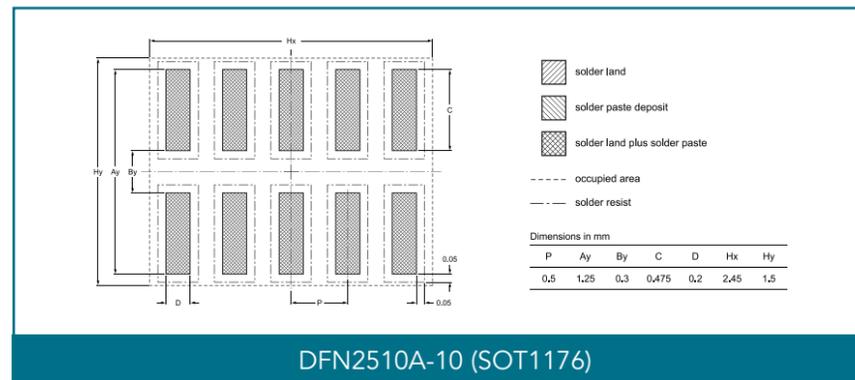
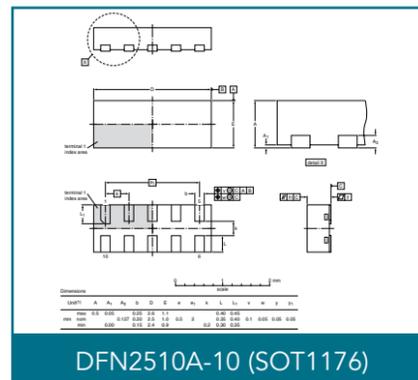
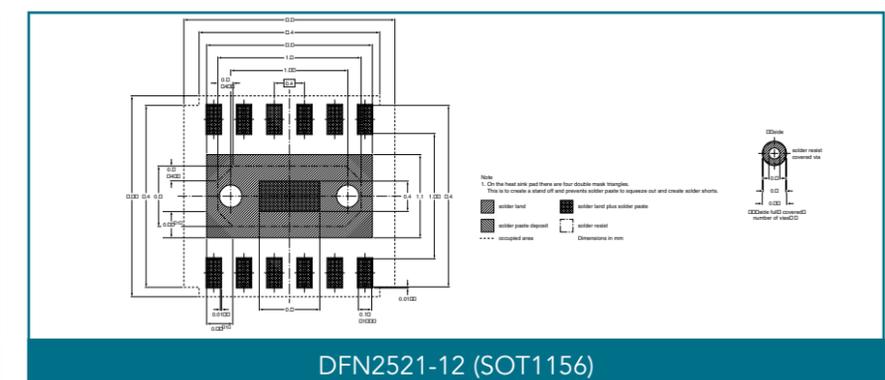
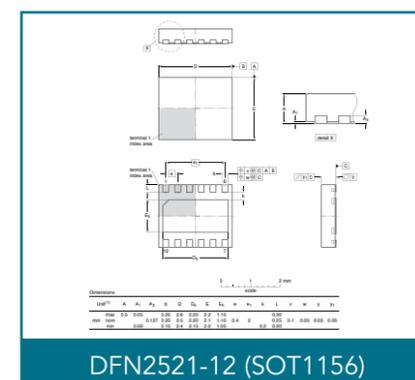
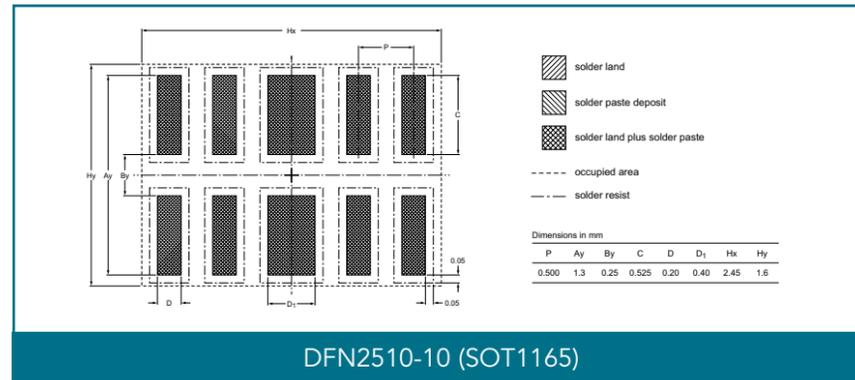
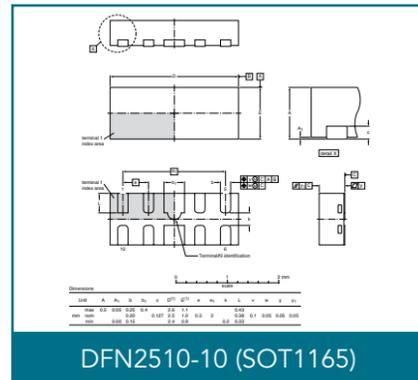
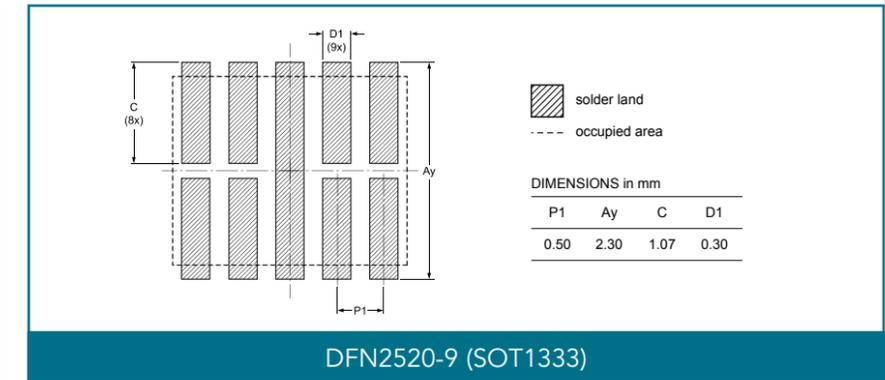
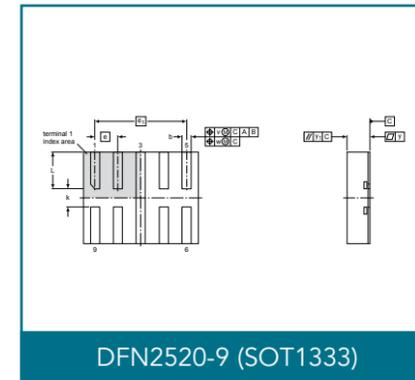
SOT457 (SC-74)



More than 8-pin SMD packages



More than 8-pin SMD packages



More than 8-pin SMD packages

DFN5050-32 (SOT617)

Generic footprint pattern. Refer to the package outline drawing for actual layout.

Legend: solder land, solder paste deposit, solder land plus solder paste, occupied area.

DIMENSIONS in mm

P	Ax	Ay	Bx	By	C	D	D1	SLx	SLy	SPx(1)	SPy(1)	SPx	SPy	Gx	Gy	Hx	Hy
0.500	6.000	6.000	4.200	4.200	0.900	0.200	3.100	3.100	1.800	0.700	0.700	5.300	5.300	6.250	6.250		

Issue date: 03-06-15

Single-ended and through-hole packages

DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub> (2)	b <sub>2</sub> (2)	c	D	D <sub>1</sub>	E	e	L	L <sub>1</sub> (1)	L <sub>2</sub> (1) max.	p	q	Q
mm	4.7	1.40	0.9	1.6	1.3	0.7	16.0	6.6	10.3	9.7	2.54	15.0	3.30	3.8	3.0	2.6
	4.1	1.25	0.6	1.0	1.0	0.4	15.2	5.9	9.7			12.8	2.79	3.0	2.7	2.2

Notes:  
1. Lead shoulder designs may vary.  
2. Dimension includes excess dambar.

0 5 10 mm scale

SOT360 (TSSOP20)

Generic footprint pattern. Refer to the package outline drawing for actual layout.

Legend: solder land, occupied area.

DIMENSIONS in mm

P1	P2	Ay	By	C	D1	D2	Gx	Gy	Hx	Hy
0.650	0.750	7.250	4.300	1.300	0.400	0.600	6.900	5.300	7.300	7.450

DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub>	b <sub>2</sub>	c	D	D <sub>1</sub>	E	e	e <sub>1</sub>	j	K	L	L <sub>1</sub>	L <sub>2</sub> (1) max.	P	Q	q	r(2)	w
mm	4.6	2.9	0.9	1.1	1.4	0.7	15.8	6.5	10.3	2.54	5.08	2.7	0.6	14.4	3.30	3	3.2	2.6	3.0	2.5	0.4
	4.0	2.5	0.7	0.9	1.0	0.4	15.2	6.3	9.7			1.7	0.4	13.5	2.79		3.0	2.3	2.6		

Notes:  
1. Terminal dimensions within this zone are uncontrolled.  
2. Both recesses are  $\varnothing 2.5 \times 0.8$  max. depth.

0 5 10 mm scale

SOT519 (SSOP16)

Generic footprint pattern. Refer to the package outline drawing for actual layout.

Legend: solder land, occupied area.

DIMENSIONS in mm

P1	P2	Ay	By	C	D1	D2	Gx	Gy	Hx	Hy
0.635	0.680	6.600	4.200	1.200	0.450	0.500	5.245	4.500	5.500	6.850

DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub>	c	D max.	D <sub>1</sub>	E	e	L	L <sub>1</sub>	Q
mm	4.5	1.40	0.85	1.3	0.7	11	1.6	10.3	2.54	15.0	3.30	2.6
	4.1	1.27	0.60	1.0	0.4		1.2	9.7		13.5	2.79	2.2

0 5 10 mm scale

Glass diodes

SOD27 (DO-35)

SOD66 (DO-41)

SOD68 (DO-34)

DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	c	D	D <sub>1</sub>	E	e	L	L <sub>2</sub>	L <sub>3</sub> (1)	L <sub>4</sub> (2) max.	m	∅p	p <sub>1</sub>	q	Q	Q <sub>1</sub>	Q <sub>2</sub>	R	w	
mm	4.5	1.39	0.85	0.7	15.8	6.4	10.3	1.7	9.8	5.9	5.2	2.4	0.5	0.8	3.8	4.3	3.0	2.0	4.5	8.2	0.5	0.4
	4.1	1.27	0.70	0.4	15.2	5.9	9.7		9.7	5.3	5.0	1.6		0.6	3.6	4.1	2.7					

0 5 10 mm scale

Type Number	Page Number	Type Number	Page Number	Type Number	Page Number	Type Number	Page Number	Type Number	Page Number
1N47xxA series	40	2PD601BRL	22	BAS70-04W	38	BAT160A	37	BC52PAS / BC52-10PAS / BC52-16PAS	24
1PS10SB82	39	2PD601BSL	22	BAS70-05	38	BAT160C	37	BC53PA / BC53-10PA / BC53-16PA	24
1PS66SB17	39	2PD602AQL	22	BAS70-05W	38	BAT160S	37	BC53PAS / BC53-10PAS / BC53-16PAS	24
1PS66SB82	39	2PD602ARL	22	BAS70-06	38	BAT720	36	BC54PA / BC54-10PA / BC54-16PA	24
1PS70SB20	36	2PD602ASL	22	BAS70-06W	38	BAT721	38	BC54PAS / BC54-10PAS / BC54-16PAS	24
1PS70SB82	39	2PD1820AR / S	22	BAS70-07	38	BAT721A	38	BC55PA / BC55-10PA / BC55-16PA	24
1PS70SB84	39	BAL74	42	BAS70-07S	38	BAT721C	38	BC55PAS / BC55-10PAS / BC55-16PAS	24
1PS70SB85	39	BAL99	42	BAS70-07V	38	BAT721S	38	BC56PA / BC56-10PA / BC56-16PA	24
1PS70SB86	39	BAS16	42	BAS70H	38	BAT754	38	BC56PAS / BC56-10PAS / BC56-16PAS	24
1PS74SB23	36	BAS16H	42	BAS70L	38	BAT754A	38	BC68PA / BC68-25PA	24
1PS76SB10	38	BAS16J	42	BAS70VV	38	BAT754C	38	BC68PAS / BC68-25PAS	24
1PS76SB17	39	BAS16L	42	BAS70W	38	BAT754L	38	BC69PA / BC69-16PA / BC69-25PA	24
1PS76SB21	38	BAS16LD	42	BAS70XY	38	BAT754S	38	BC69PAS / BC69-16PAS / BC69-25PAS	24
1PS76SB40	38	BAS16QA	42	BAS85	38	BAT760	36	BC807 / -16 / -25 / -40	22
1PS76SB70	38	BAS16VV	42	BAS86	38	BAT854AW	38	BC807 / -25QA / -40QA	22
1PS79SB10	38	BAS16VY	42	BAS101	43	BAT854CW	38	BC807DS	23
1PS79SB17	39	BAS16W	42	BAS101S	43	BAT854SW	38	BC807W / -16W / -25W / -40W	22
1PS79SB30	38	BAS19	43	BAS116	44	BAT854W	38	BC817 / -16 / -25 / -40	22
1PS79SB31	38	BAS20	43	BAS116H	44	BAT960	36	BC817 / -25QA / -40QA	22
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PTVS20VP1UP	72	PTVS48VS1UTR	71	PUMD20	21	PZU2.4y	41		
PTVS20VP1UTP	72	PTVS51VP1UP	72	PUMD24	21	PZU2.7y	41		
PTVS20VS1UR	71	PTVS51VP1UTP	72	PUMD30	21	PZU3.0y	41		
PTVS20VS1UTR	71	PTVS51VS1UR	71	PUMD48	21	PZU3.3y	41		
PTVS20VZ1USK	69	PTVS51VS1UTR	71	PUMH1	21	PZU3.6y	41		
PTVS20VZ1USKN	69	PTVS54VP1UP	72	PUMH2	21	PZU3.9y	41		
PTVS22VP1UP	72	PTVS54VP1UTP	72	PUMH4	21	PZU4.3y	41		
PTVS22VP1UTP	72	PTVS54VS1UR	71	PUMH7	21	PZU4.7y	41		
PTVS22VS1UR	71	PTVS54VS1UTR	71	PUMH9	21	PZU5.1y	41		
PTVS22VS1UTR	71	PTVS58VP1UP	72	PUMH10	21	PZU5.6y	41		
PTVS24VP1UP	72	PTVS58VP1UTP	72	PUMH11	21	PZU6.2y	41		
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PTVS26VS1UTR	71	PTVS64VP1UP	72	PUMH19	21	PZU11y	41		
PTVS26VU1UPA	70	PTVS64VP1UTP	72	PUMH20	21	PZU12y	41		
PTVS26VZ1USK	69	PTVS64VS1UR	71	PUMH24	21	PZU13y	41		



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