



STF6N62K3, STI6N62K3 STP6N62K3, STU6N62K3

N-channel 620 V, 0.95 Ω , 5.5 A SuperMESH3™ Power MOSFET
in TO-220FP, I²PAK, TO-220, IPAK

Features

Order codes	V _{DSS}	R _{DS(on)} max.	I _D	P _w
STF6N62K3	620 V	< 1.2 Ω	5.5 A	30 W
STI6N62K3				90 W
STP6N62K3				90 W
STU6N62K3				90 W

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

Applications

- Switching applications

Description

These SuperMESH3™ Power MOSFETs are the result of improvements applied to STMicroelectronics' SuperMESH™ technology, combined with a new optimized vertical structure. These devices boast an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering them suitable for the most demanding applications.

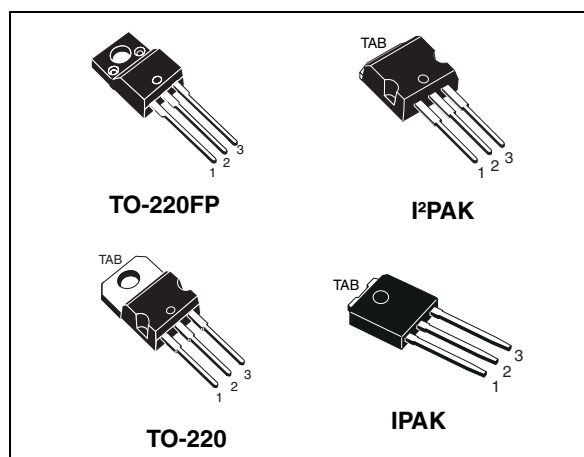


Figure 1. Internal schematic diagram

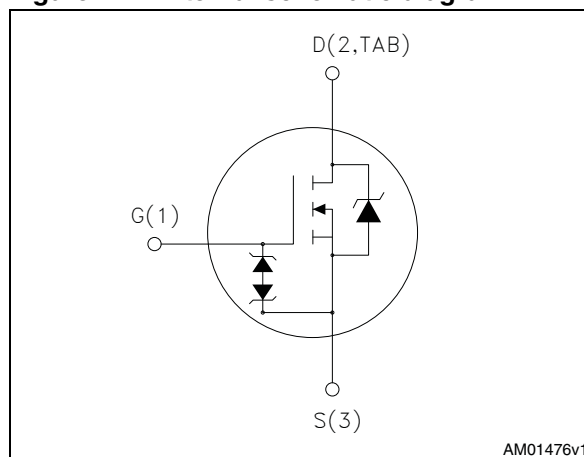


Table 1. Device summary

Order codes	Marking	Package	Packaging
STF6N62K3	6N62K3	TO-220FP	Tube
STI6N62K3		I ² PAK	Tube
STP6N62K3		TO-220	Tube
STU6N62K3		IPAK	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value				Unit
		TO-220	I ² PAK	IPAK	TO-220FP	
V _{DS}	Drain-source voltage	620				V
V _{GS}	Gate- source voltage	± 30				V
I _D	Drain current (continuous) at T _C = 25 °C	5.5			5.5 ⁽¹⁾	A
I _D	Drain current (continuous) at T _C = 100 °C	3			3 ⁽¹⁾	A
I _{DM} ⁽²⁾	Drain current (pulsed)	22			22 ⁽¹⁾	A
P _{TOT}	Total dissipation at T _C = 25 °C	90			30	W
I _{AR} ⁽³⁾	Avalanche current, repetitive or not-repetitive	5.5				A
E _{AS} ⁽⁴⁾	Single pulse avalanche energy	140				mJ
ESD	Gate-source human body model (R=1.5 kΩ C=100 pF)	2.5				kV
dv/dt ⁽⁵⁾	Peak diode recovery voltage slope	12				V/ns
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25 °C)				2500	V
T _{stg}	Storage temperature	-55 to 150				°C
T _j	Max. operating junction temperature	150				°C

1. Limited by package.
2. Pulse width limited by safe operating area.
3. Pulse width limited by T_j max.
4. Starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.
5. $I_{SD} \leq 5.5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	TO-220	I ² PAK	IPAK	TO-220FP	Unit
$R_{thj-case}$	Thermal resistance junction-case max.	1.39			4.17	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max.	62.5		100	62.5	$^{\circ}\text{C}/\text{W}$

2 Electrical characteristics

($T_C = 25\text{ °C}$ unless otherwise specified)

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	620			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 620\text{ V}$ $V_{DS} = 620\text{ V}$, $T_C = 125\text{ °C}$			0.8 50	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 9	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 2.8\text{ A}$		0.95	1.2	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	875 100 17	-	pF pF pF
$C_{oss(er)}^{(1)}$	Equivalent output capacitance energy related	$V_{GS} = 0$, $V_{DS} = 0\text{ to }480\text{ V}$	-	28	-	pF
$C_{oss(tr)}^{(2)}$	Equivalent output capacitance time related		-	63	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	3.5	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 496\text{ V}$, $I_D = 5.5\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 20)	-	34 4 22	-	nC nC nC

1. Is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

2. Is defined as a constant equivalent capacitance giving the same storage energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 310 \text{ V}$, $I_D = 2.75 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GS} = 10 \text{ V}$ (see Figure 19)	-	22	-	ns
t_r	Rise time			12		ns
$t_{d(off)}$	Turn-off-delay time			49		ns
t_f	Fall time			20		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				27	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5.5 \text{ A}$, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 5.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ (see Figure 24)	-	290		ns
Q_{rr}	Reverse recovery charge			1900		nC
I_{RRM}	Reverse recovery current			13.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 5.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 24)	-	335		ns
Q_{rr}	Reverse recovery charge			2400		nC
I_{RRM}	Reverse recovery current			14.5		A

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Table 8. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}^{(1)}$	Gate-source breakdown voltage ($I_D = 0$)	$I_{gs} = \pm 1 \text{ mA}$	30	-		V

1. The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, I²PAK

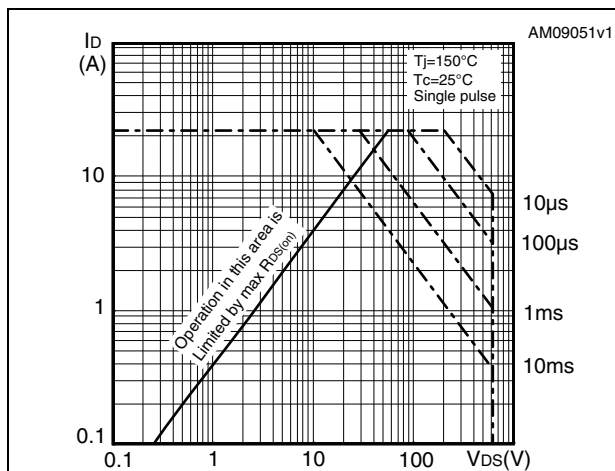


Figure 3. Thermal impedance for TO-220, I²PAK

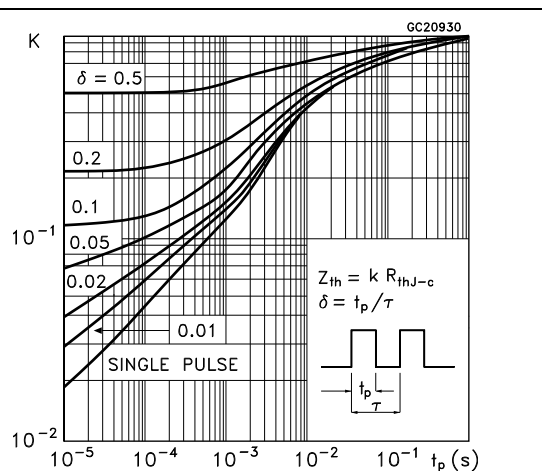


Figure 4. Safe operating area for IPAK

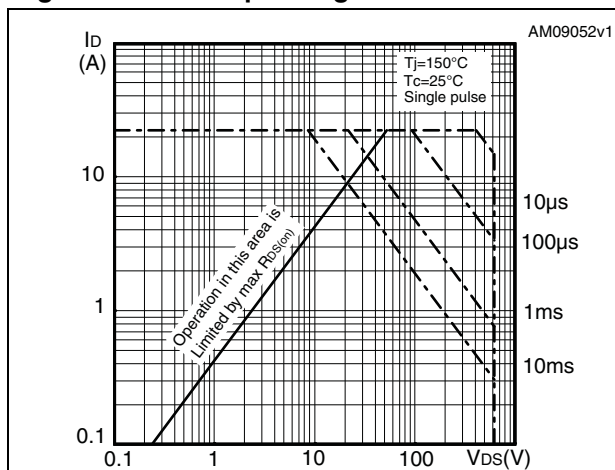


Figure 5. Thermal impedance for IPAK

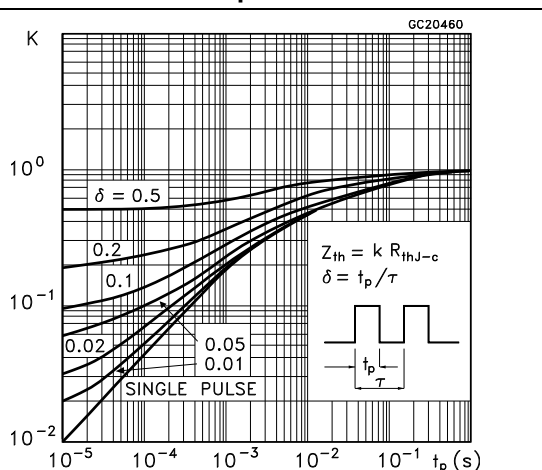


Figure 6. Safe operating area for TO-220FP

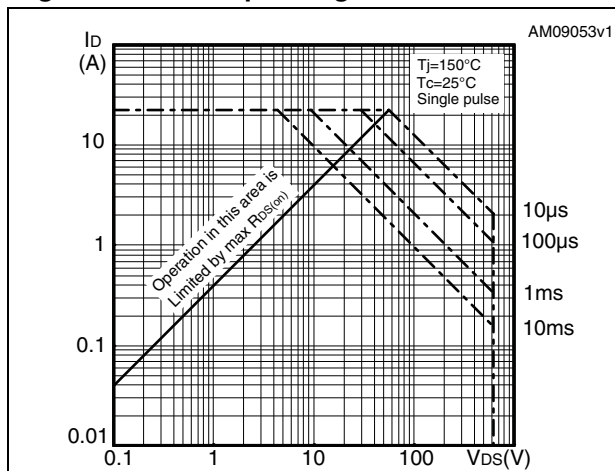


Figure 7. Thermal impedance for TO-220FP

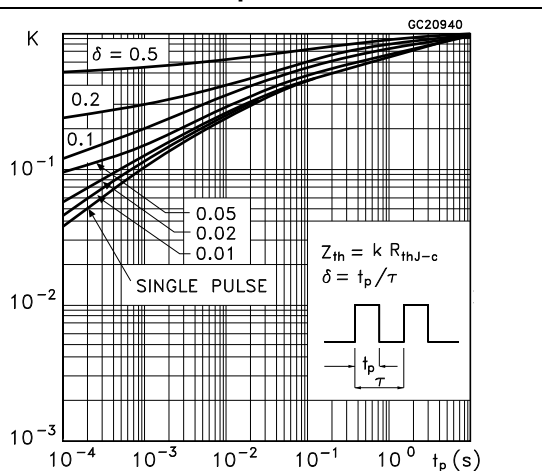


Figure 8. Output characteristics

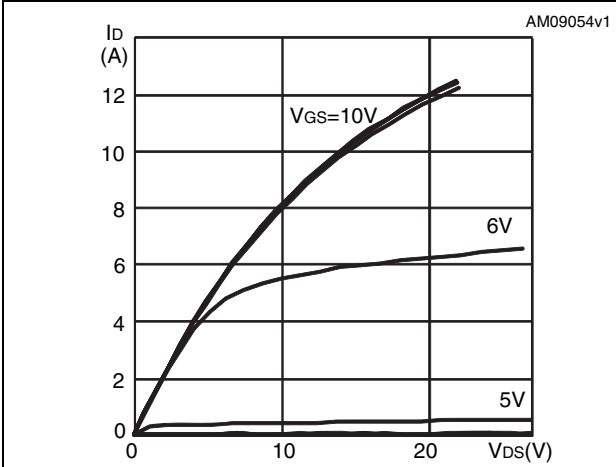


Figure 9. Transfer characteristics

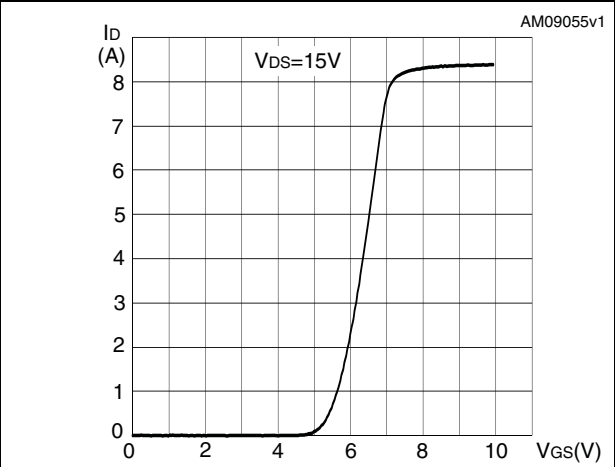


Figure 10. Gate charge vs gate-source voltage

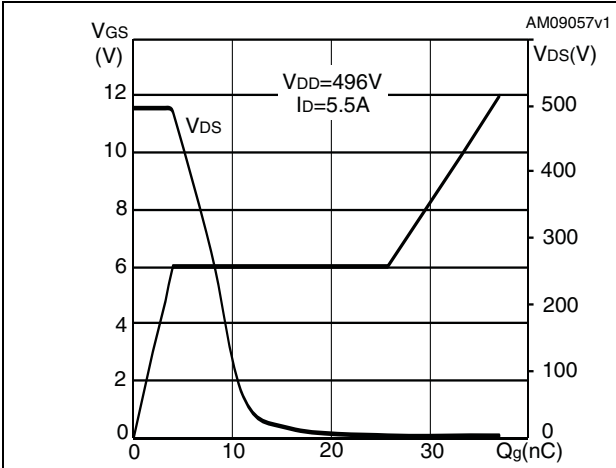


Figure 11. Static drain-source on resistance

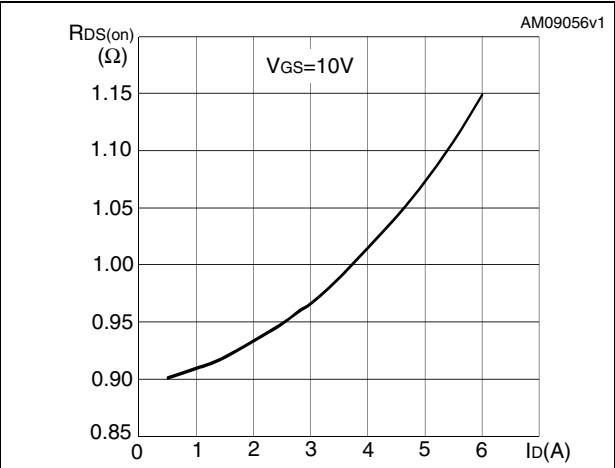


Figure 12. Capacitance variations

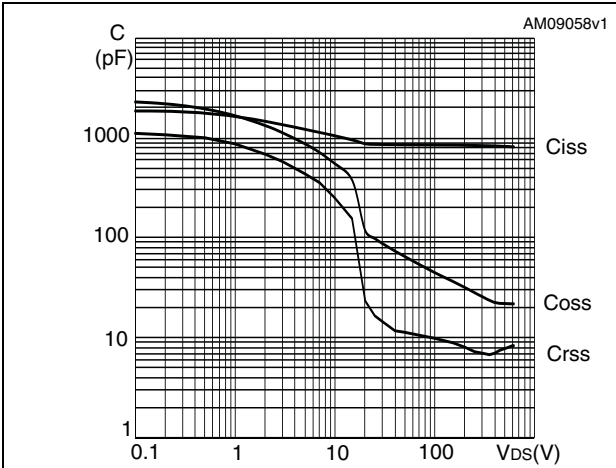


Figure 13. Output capacitance stored energy

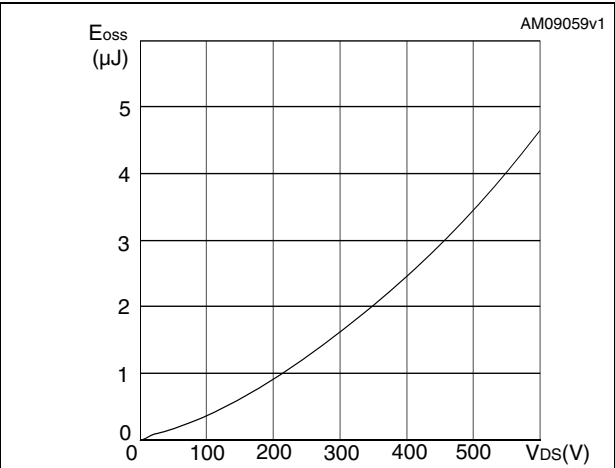


Figure 14. Normalized gate threshold voltage vs temperature

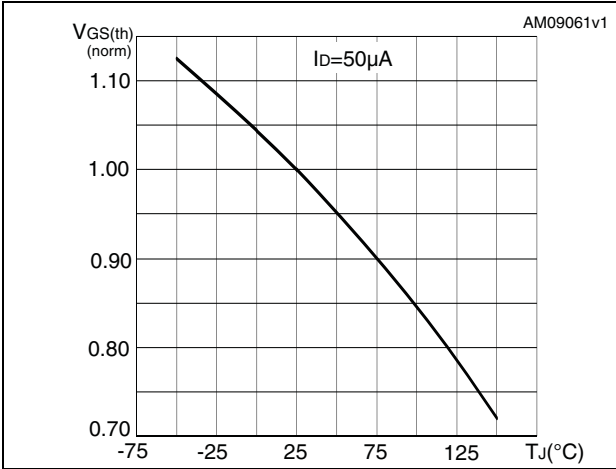


Figure 15. Normalized on resistance vs temperature

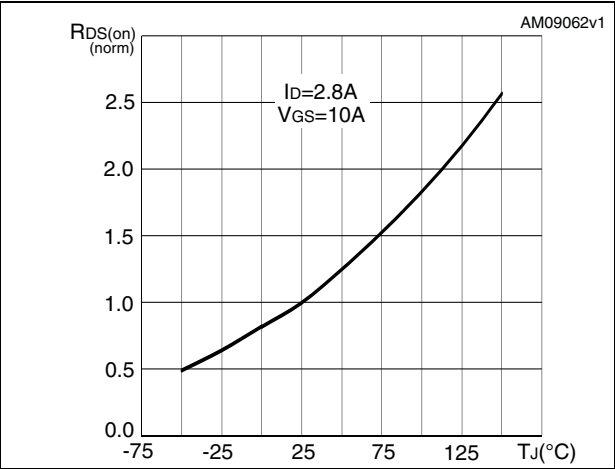


Figure 16. Normalized B_{VDSS} vs temperature

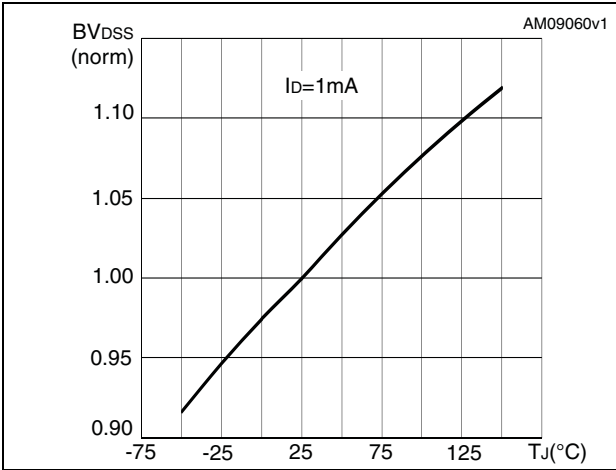


Figure 17. Source-drain diode forward characteristics

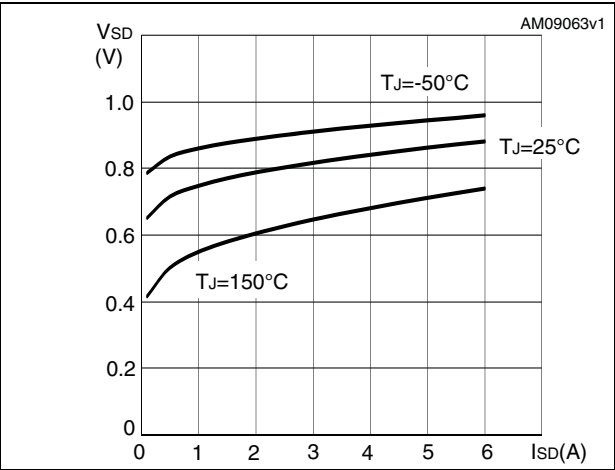
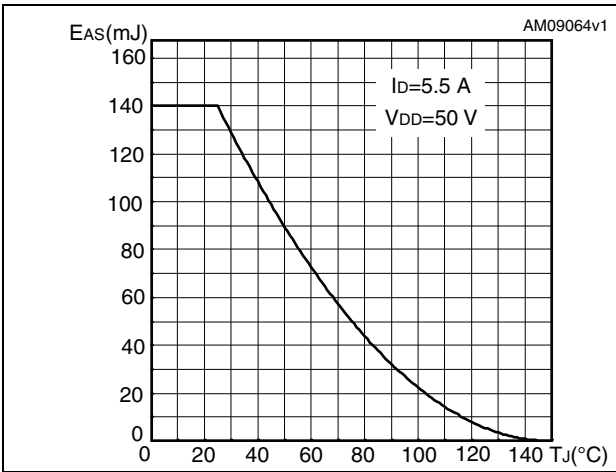


Figure 18. Maximum avalanche energy vs temperature



3 Test circuits

Figure 19. Switching times test circuit for resistive load

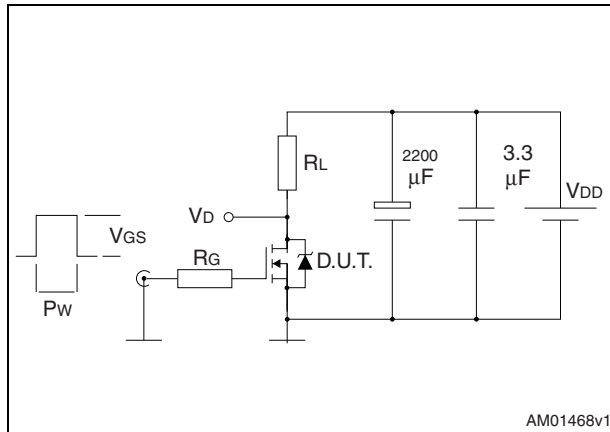


Figure 20. Gate charge test circuit

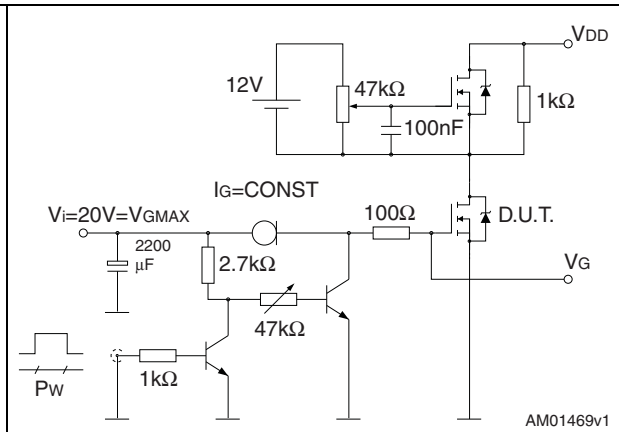


Figure 21. Test circuit for inductive load switching and diode recovery times

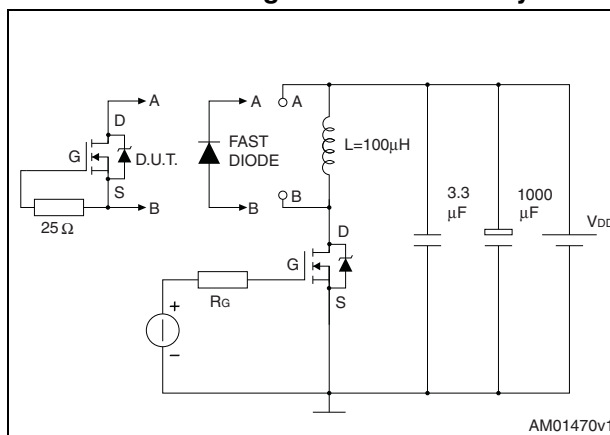


Figure 22. Unclamped Inductive load test circuit

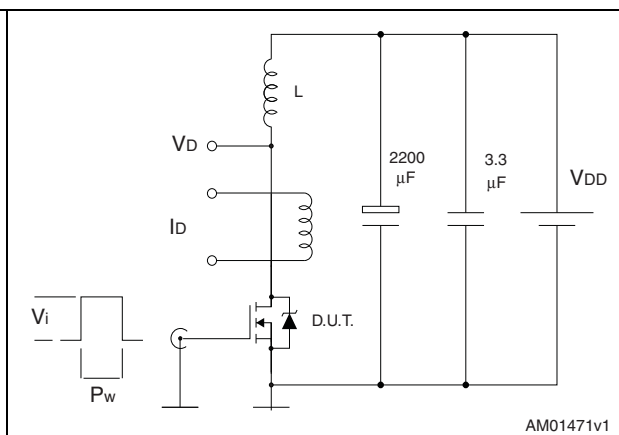


Figure 23. Unclamped inductive waveform

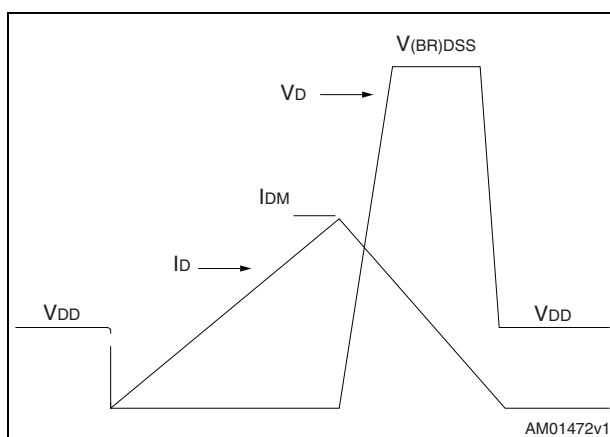
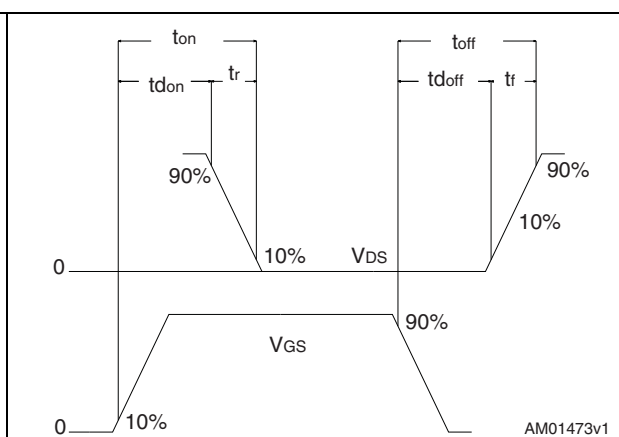


Figure 24. Switching time waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

Table 9. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 25. TO-220FP drawing

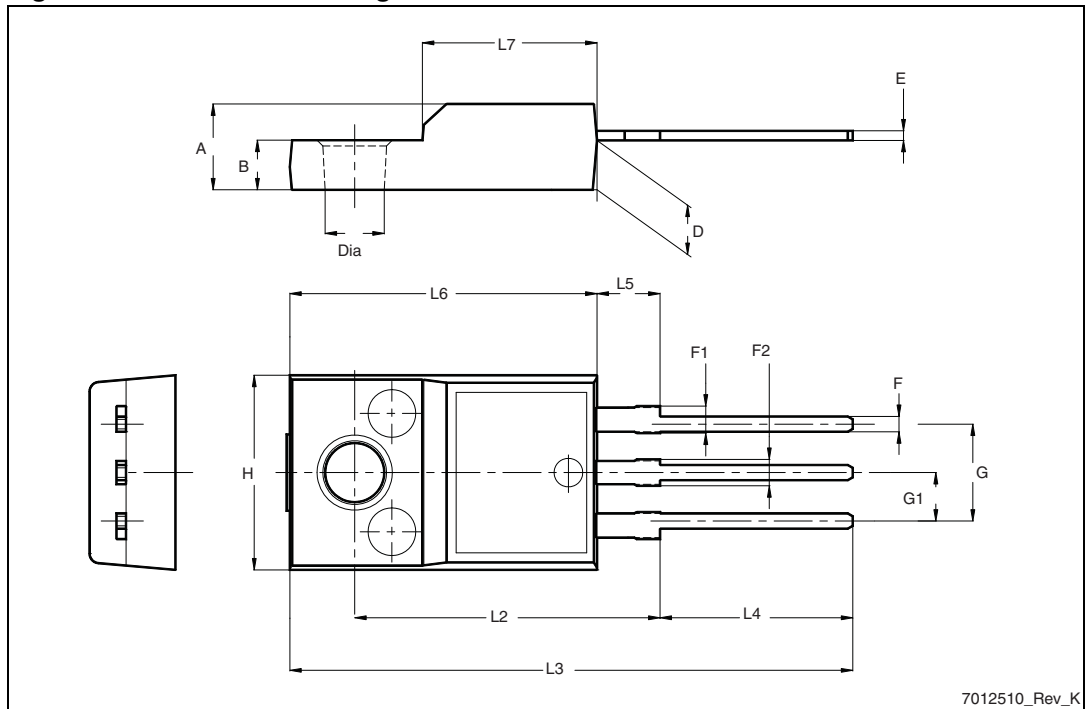
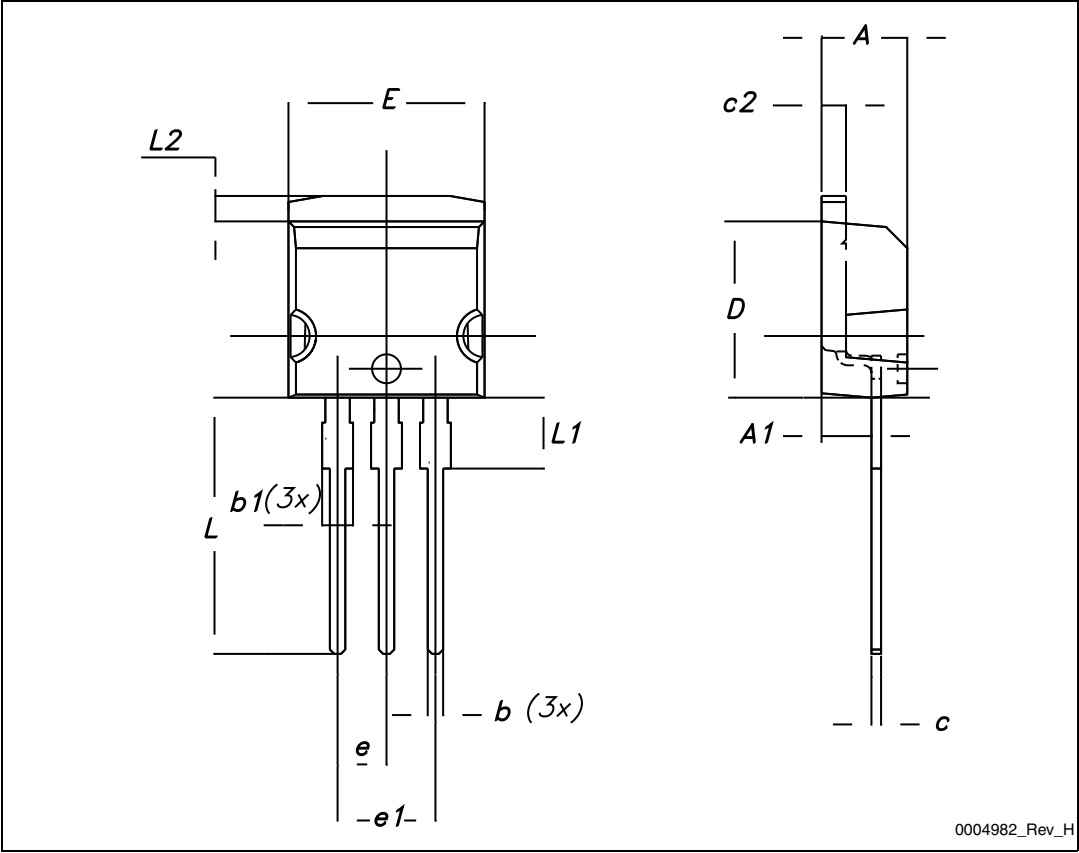


Table 10. I²PAK (TO-262) mechanical data

DIM.	mm.		
	min.	typ	max.
A	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
e	2.40		2.70
e1	4.95		5.15
E	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

Figure 26. I²PAK (TO-262) drawing



0004982_Rev_H

Table 11. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 27. TO-220 type A drawing

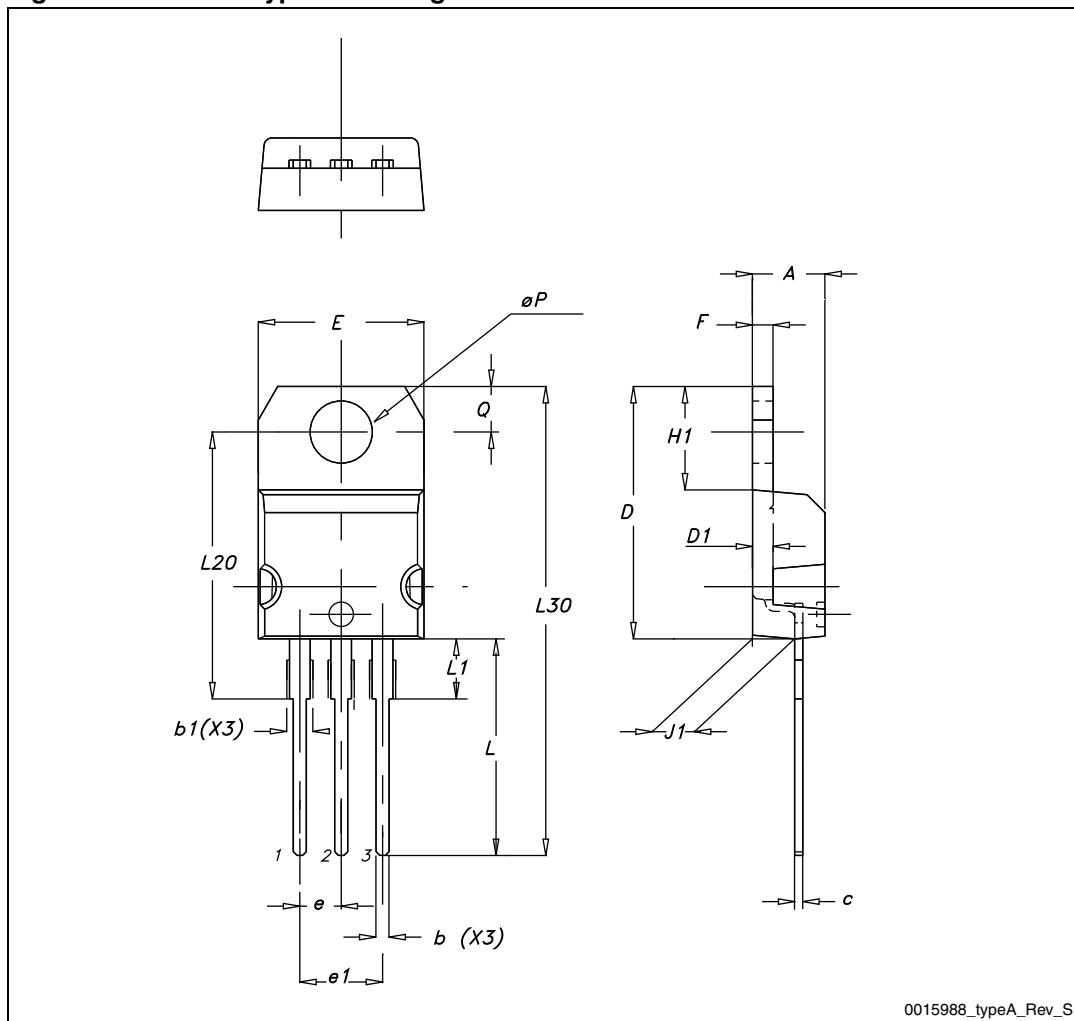
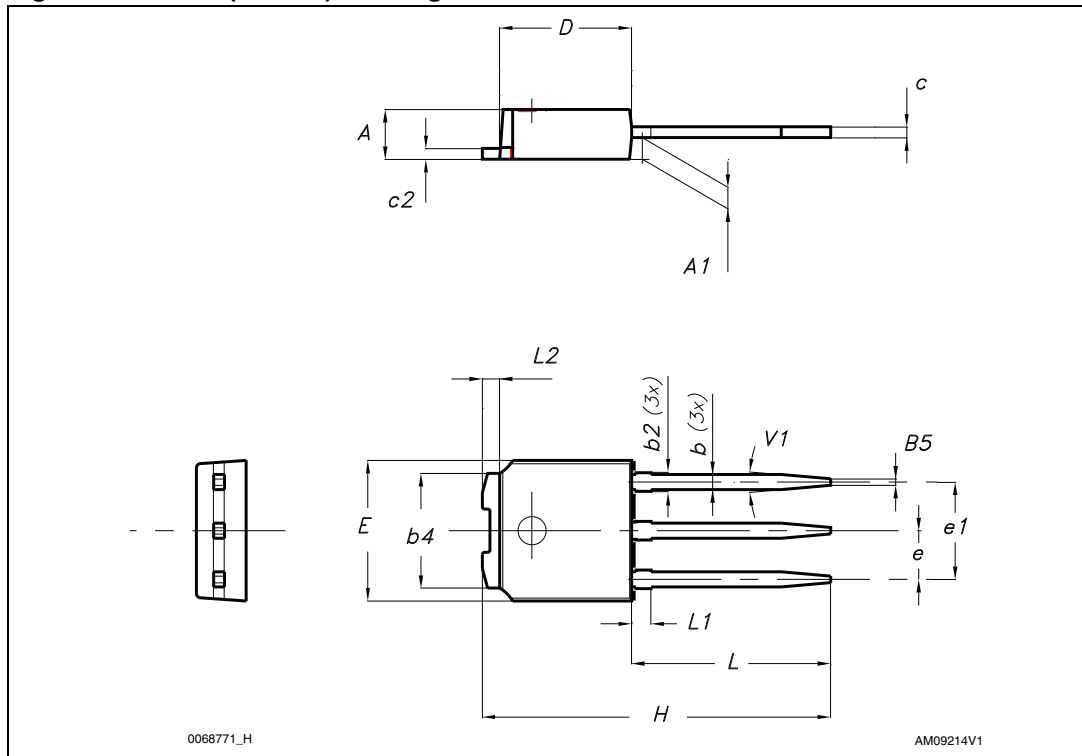


Table 12. IPAK (TO-251) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.3	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10 °	

Figure 28. IPAK (TO-251) drawing



5 Revision history

Table 13. Document revision history

Date	Revision	Changes
19-May-2006	1	First release.
02-May-2011	2	R _G value has been updated.
06-Dec-2011	3	Removed p/n STD6N62K3 in DPAK.

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