Complementary N- and P-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (mA)
N-Channel	20	0.70 at V_{GS} = 4.5 V	600
		0.85 at V_{GS} = 2.5 V	500
		1.25 at V_{GS} = 1.8 V	350
P-Channel	- 20	1.2 at V_{GS} = - 4.5 V	- 400
		1.6 at V_{GS} = - 2.5 V	- 300
		2.7 at V_{GS} = - 1.8 V	- 150

FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- TrenchFET® Power MOSFETs
- 2000 V ESD Protection
- Very Small Footprint
- High-Side Switching
- Low On-Resistance:
  N-Channel, 0.7 Ω
  P-Channel, 1.2 Ω
- Low Threshold: ± 0.8 V (Typ.)
- Fast Switching Speed: 14 ns
- 1.8 V Operation
- Compliant to RoHS Directive 2002/95/EC

Pb-free
RoHS COMPLIANT
HALOGEN FREE

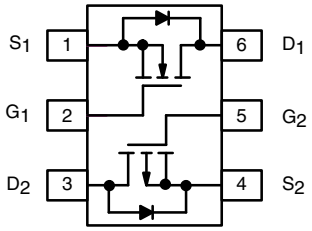
BENEFITS

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Low Battery Voltage Operation

APPLICATIONS

- Replace Digital Transistor, Level-Shifter
- Battery Operated Systems
- Power Supply Converter Circuits

SOT-563
SC-89



Top View

Marking Code: A

Ordering Information: Si1016X-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)							
			N-Channel		P-Channel		
Parameter		Symbol	5 s	Steady State	5 s	Steady State	Unit
Drain-Source Voltage		V_{DS}	20		- 20		V
Gate-Source Voltage		V_{GS}	± 6				
Continuous Drain Current (T_J = 150 °C)[a]	T_A = 25 °C	I_D	515	485	- 390	- 370	mA
	T_A = 85 °C		370	350	- 280	- 265	
Pulsed Drain Current[b]		I_{DM}	650		- 650		
Continuous Source Current (Diode Conduction)[a]		I_S	450	380	- 450	- 380	
Maximum Power Dissipation[a]	T_A = 25 °C	P_D	280	250	280	250	mW
	T_A = 85 °C		145	130	145	130	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150				°C
Gate-Source ESD Rating (HBM, Method 3015)		ESD	2000				V

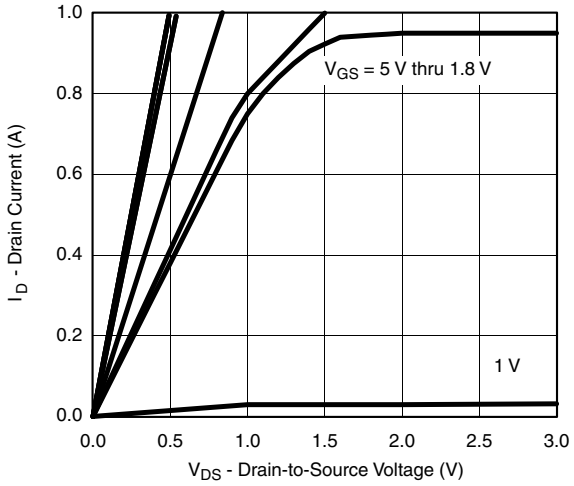
Notes:
a. Surface mounted on FR4 board.
b. Pulse width limited by maximum junction temperature.

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)							
Parameter	**Symbol**	**Test Conditions**		**Min.**	**Typ.**	**Max.**	**Unit**
Static							
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	0.45		1	V
		V_{DS} = V_{GS}, I_D = - 250 µA	P-Ch	- 0.45		- 1	
Gate Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 4.5 V	N-Ch		± 0.5	± 1.0	µA
			P-Ch		± 1.0	± 2.0	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 16 V, V_{GS} = 0 V	N-Ch		0.3	100	nA
		V_{DS} = - 16 V, V_{GS} = 0 V	P-Ch		- 0.3	- 100	
		V_{DS} = 16 V, V_{GS} = 0 V, T_J = 85 °C	N-Ch			5	µA
		V_{DS} = - 16 V, V_{GS} = 0 V, T_J = 85 °C	P-Ch			- 5	
On State Drain Current[a]	$I_{D(on)}$	V_{DS} = 5 V, V_{GS} = 4.5 V	N-Ch	700			mA
		V_{DS} = - 5 V, V_{GS} = - 4.5 V	P-Ch	- 700			
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 600 mA	N-Ch		0.41	0.70	Ω
		V_{GS} = - 4.5 V, I_D = - 350 mA	P-Ch		0.80	1.2	
		V_{GS} = 2.5 V, I_D = 500 mA	N-Ch		0.53	0.85	
		V_{GS} = - 2.5 V, I_D = - 300 mA	P-Ch		1.20	1.6	
		V_{GS} = 1.8 V, I_D = 350 mA	N-Ch		0.70	1.25	
		V_{GS} = - 1.8 V, I_D = - 150 mA	P-Ch		1.80	2.7	
Forward Transconductance[a]	g_{fs}	V_{DS} = 10 V, I_D = 400 mA	N-Ch		1.0		S
		V_{DS}= - 10 V, I_D = - 250 mA	P-Ch		0.4		
Diode Forward Voltage[a]	V_{SD}	I_S = 150 mA, V_{GS} = 0 V	N-Ch		0.8	1.2	V
		I_S = - 150 mA, V_{GS} = 0 V	P-Ch		- 0.8	- 1.2	
Dynamic[b]							
Total Gate Charge	Q_g	N-Channel V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 250 mA P-Channel V_{DS} = - 10 V, V_{GS} = - 4.5 V, I_D = - 250 mA	N-Ch		750		pC
			P-Ch		1500		
Gate-Source Charge	Q_{gs}		N-Ch		75		
			P-Ch		150		
Gate-Drain Charge	Q_{gd}		N-Ch		225		
			P-Ch		450		
Turn-On Time	t_{ON}	N-Channel V_{DD} = 10 V, R_L = 47 Ω I_D ≅ 200 mA, V_{GEN} = 4.5 V, R_g = 10 Ω P-Channel V_{DD} = - 10 V, R_L = 47 Ω I_D ≅ - 200 mA, V_{GEN} = - 4.5 V, R_g = 10 Ω	N-Ch		5		ns
			P-Ch		5		
Turn-Off Time	t_{OFF}		N-Ch		25		
			P-Ch		35		

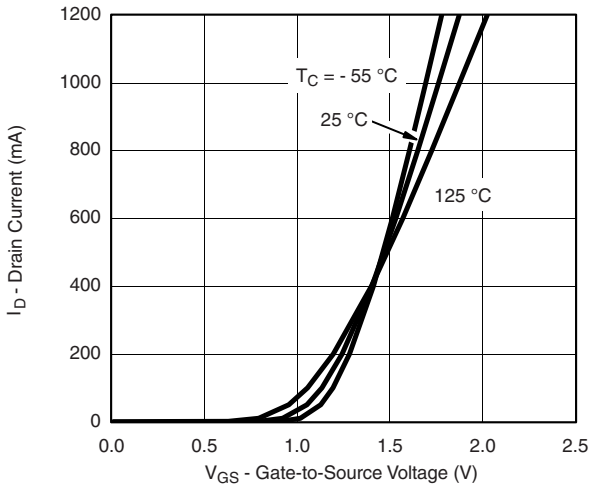
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

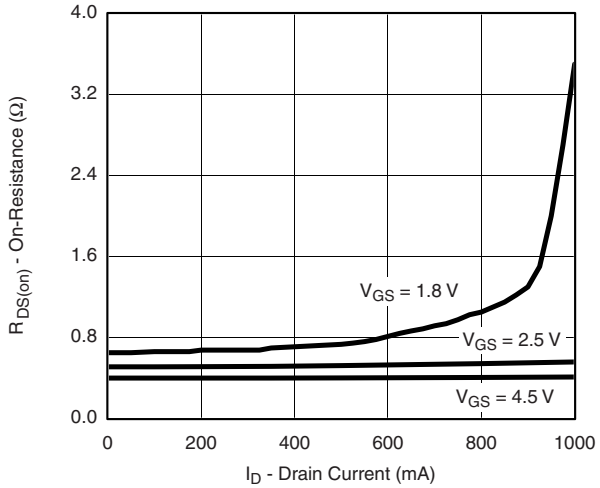
N-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



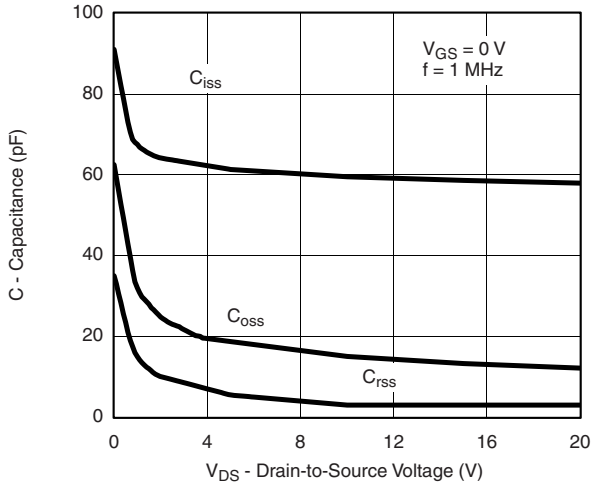
Output Characteristics



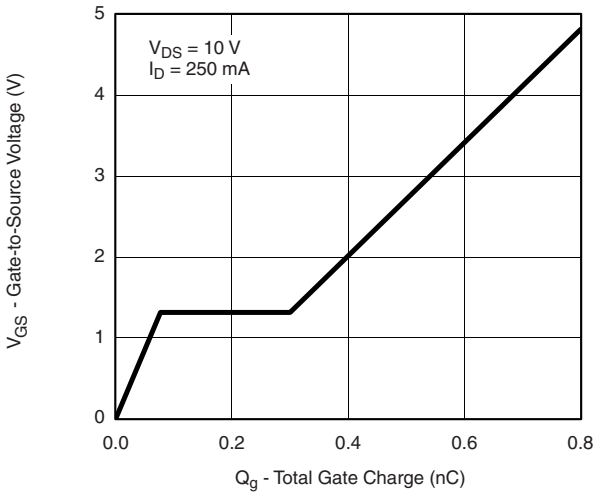
Transfer Characteristics



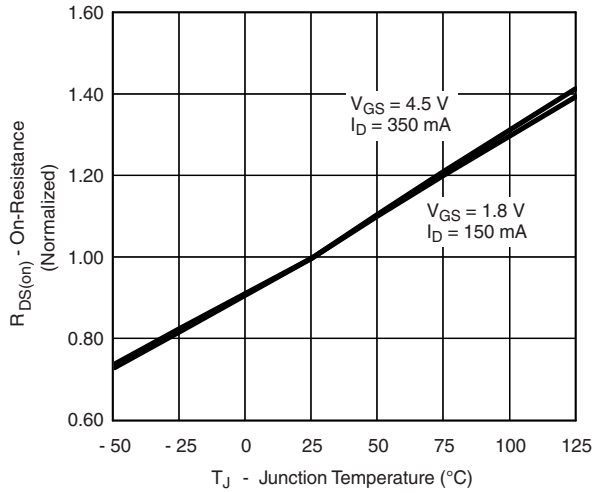
On-Resistance vs. Drain Current



Capacitance

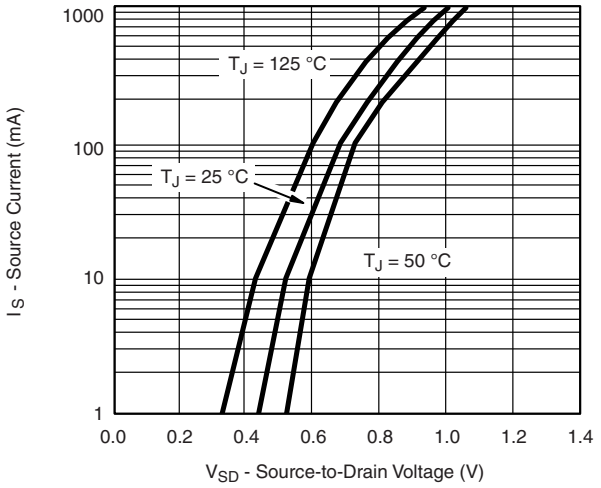


Gate Charge

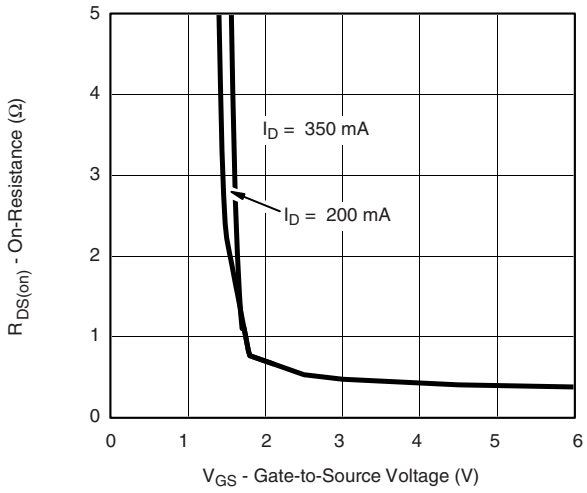


On-Resistance vs. Junction Temperature

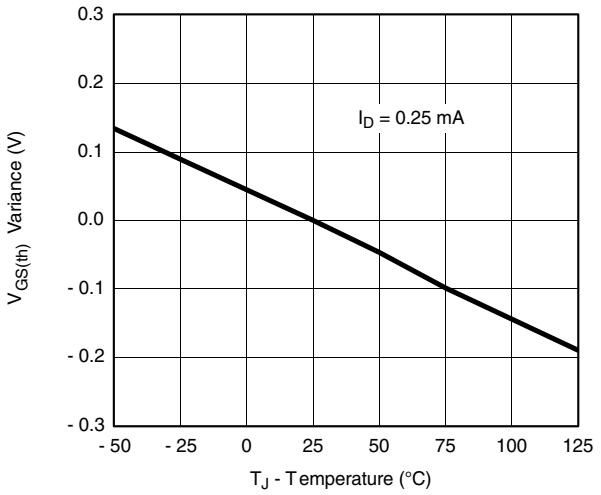
N-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



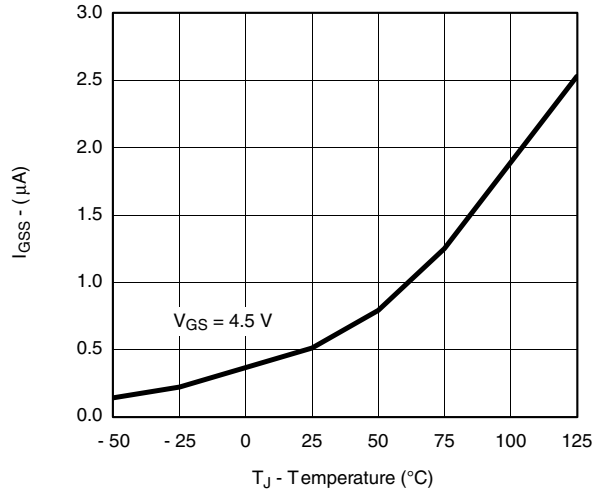
Source-Drain Diode Forward Voltage



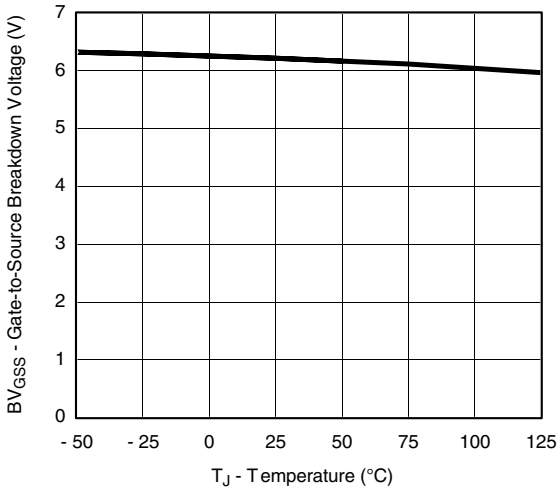
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage Variance vs. Temperature

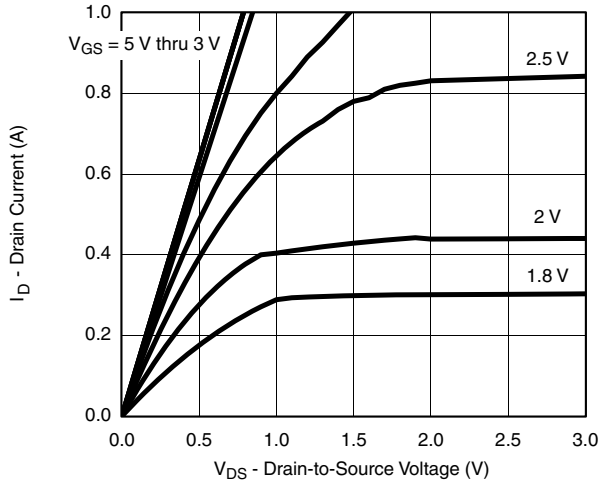


I_{GSS} vs. Temperature

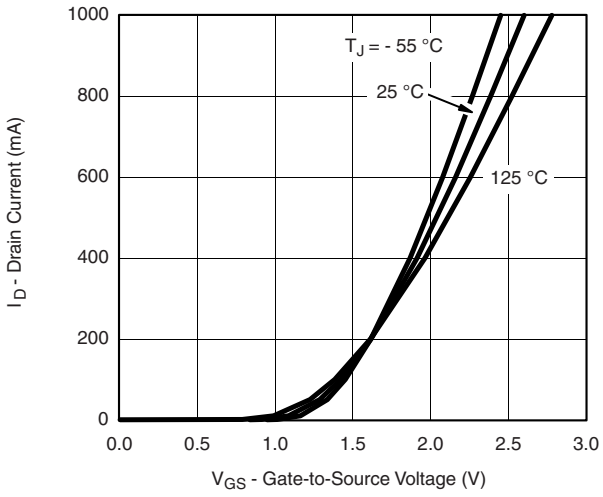


BV_{GSS} vs. Temperature

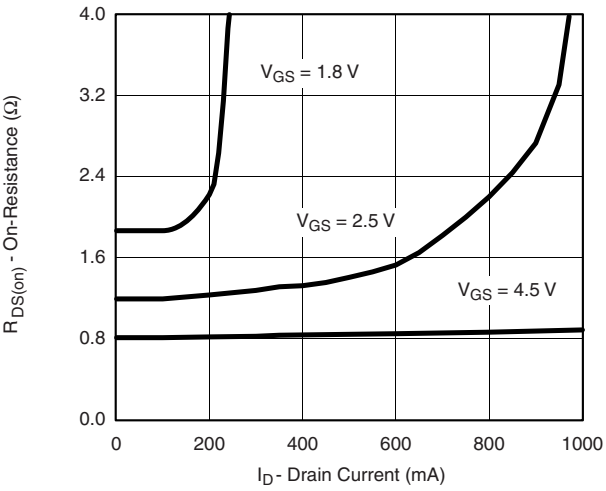
P-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



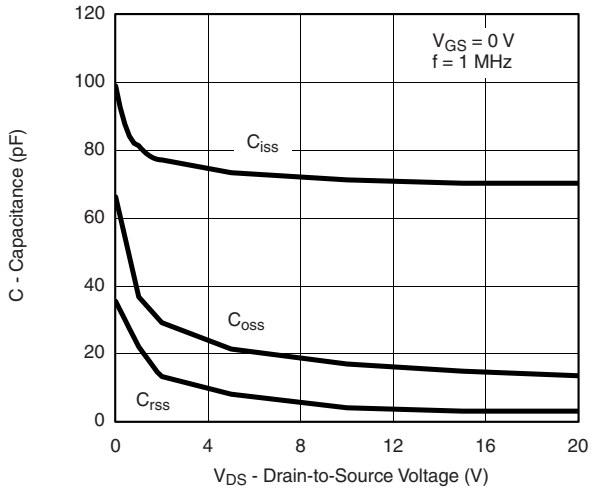
Output Characteristics



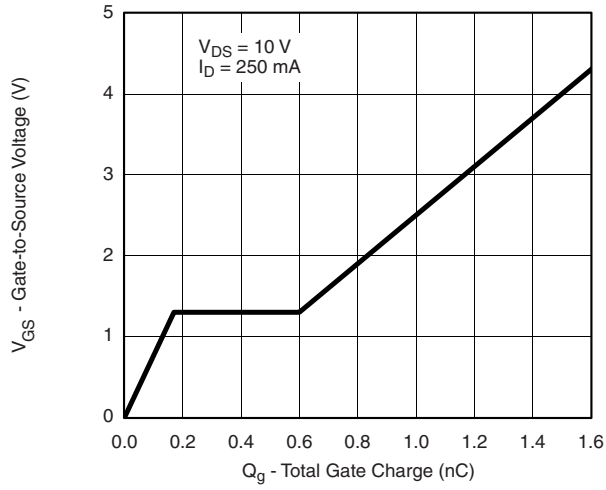
Transfer Characteristics



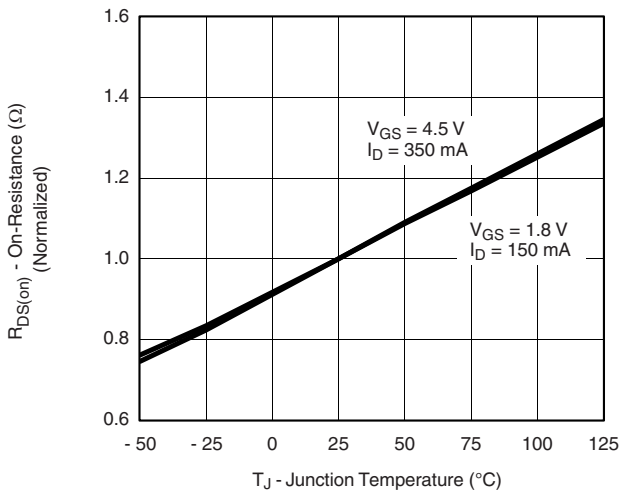
On-Resistance vs. Drain Current



Capacitance

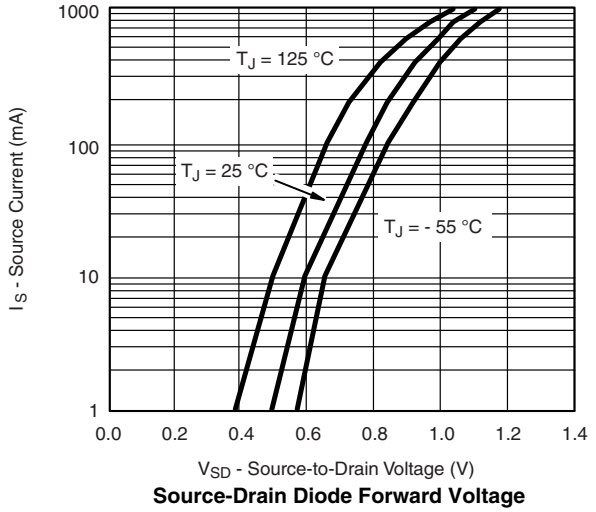


Gate Charge

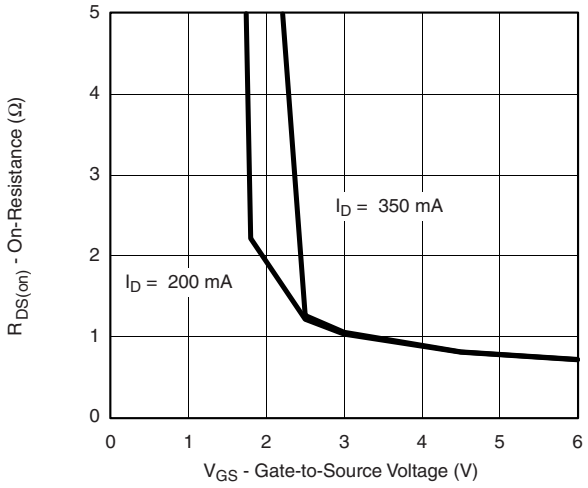


On-Resistance vs. Junction Temperature

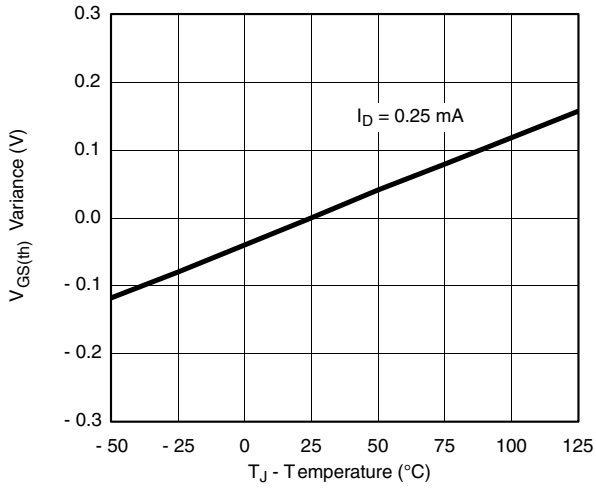
P-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



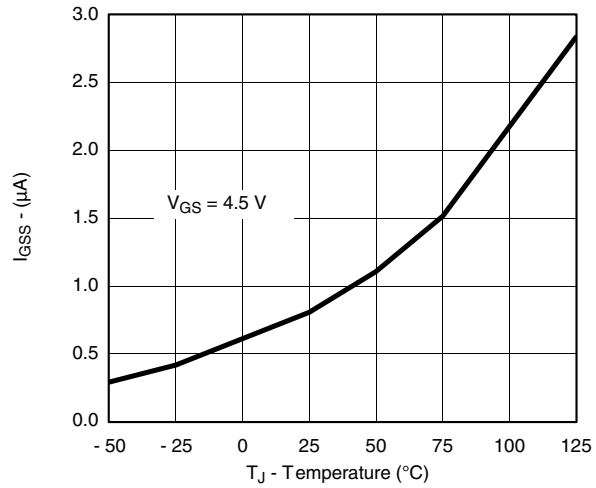
Source-Drain Diode Forward Voltage



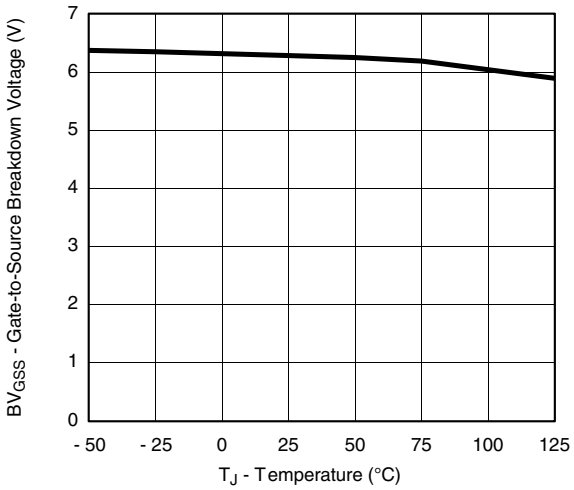
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage Variance vs. Temperature

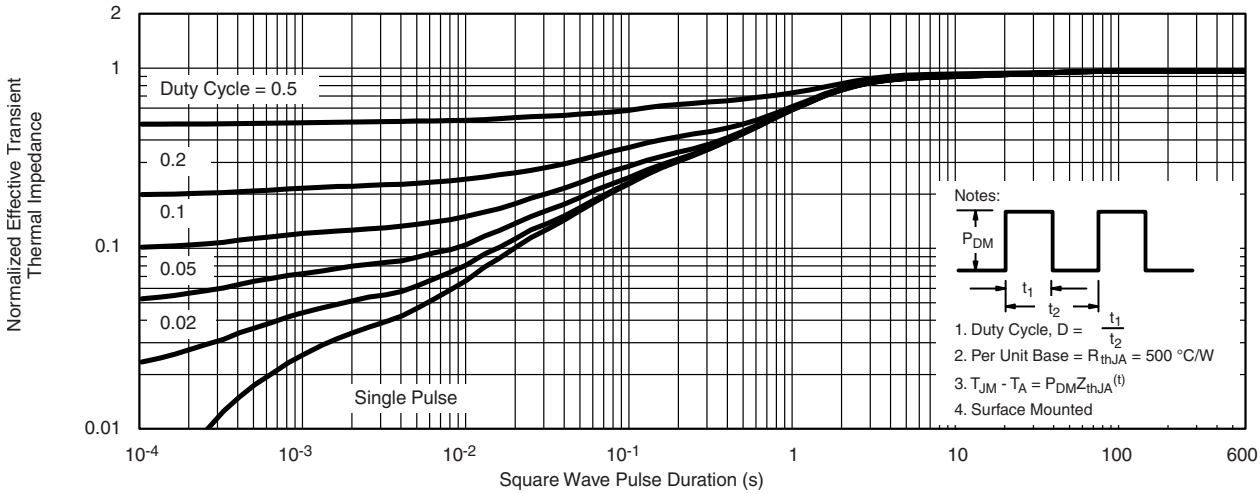


I_{GSS} vs. Temperature



BV_{GSS} vs. Temperature

N- OR P-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient

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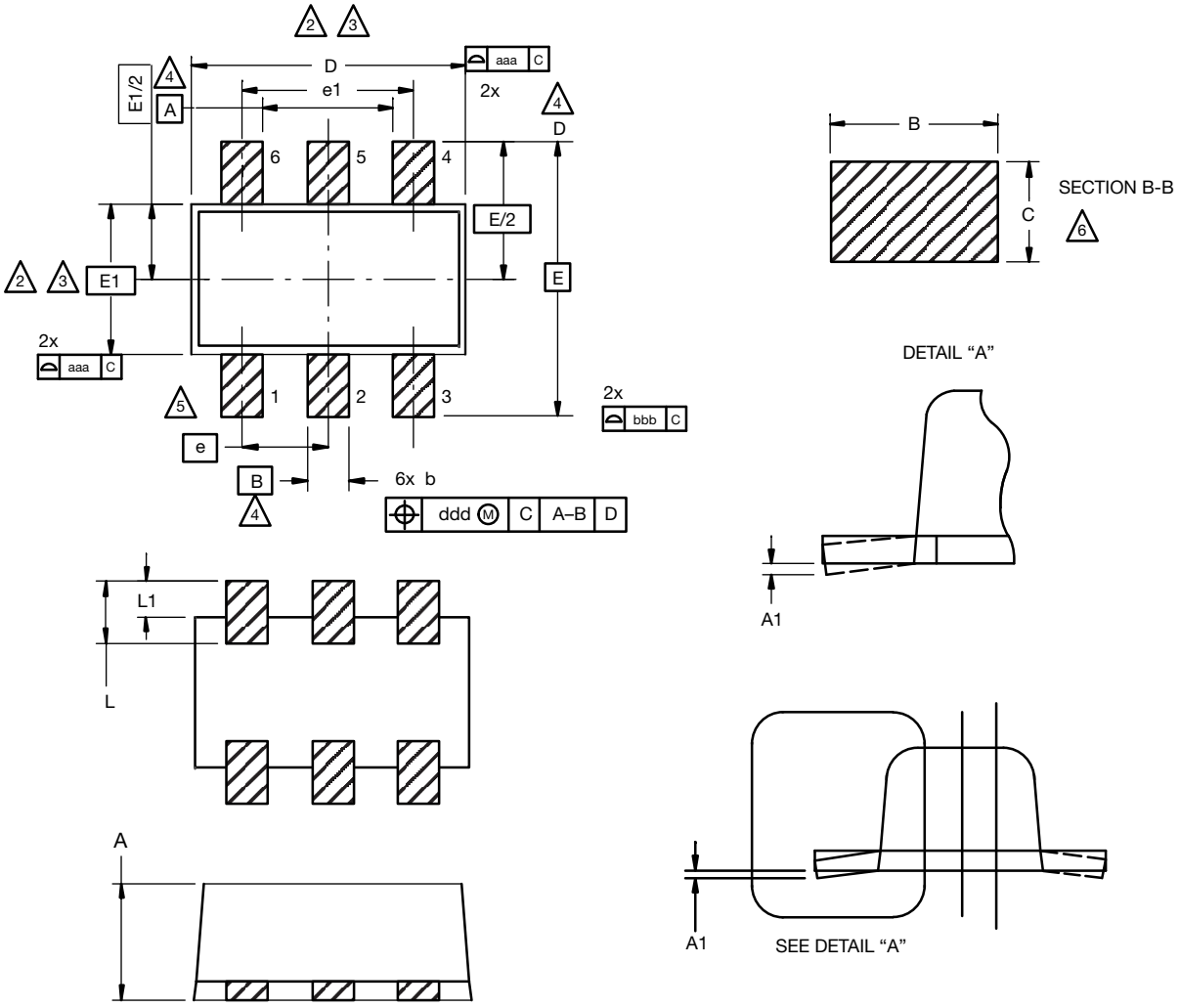
SC-89 6-Leads (SOT-563F)



Notes

1. Dimensions in millimeters.

2. Dimension D does not include mold flash, protrusions or gate burrs. Mold flush, protrusions or gate burrs shall not exceed 0.15 mm per dimension E1 does not include interlead flash or protrusion, interlead flash or protrusion shall not exceed 0.15 mm per side.

3. Dimensions D and E1 are determined at the outmost extremes of the plastic body exclusive of mold flash, the bar burrs, gate burrs and interlead flash, but including any mismatch between the top and the bottom of the plastic body.

4. Datums A, B and D to be determined 0.10 mm from the lead tip.

5. Terminal numbers are shown for reference only.

6. These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.

DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.56	0.58	0.60
A1	0	0.02	0.10
b	0.15	0.22	0.30
c	0.10	0.14	0.18
D	1.50	1.60	1.70
E	1.50	1.60	1.70
E1	1.15	1.20	1.25
e	0.45	0.50	0.55
e1	0.95	1.00	1.05
L	0.25	0.35	0.50
L1	0.10	0.20	0.30
C14-0439-Rev. C, 11-Aug-14 DWG: 5880			

For technical questions, contact: analogswitchtechsupport@vishay.com

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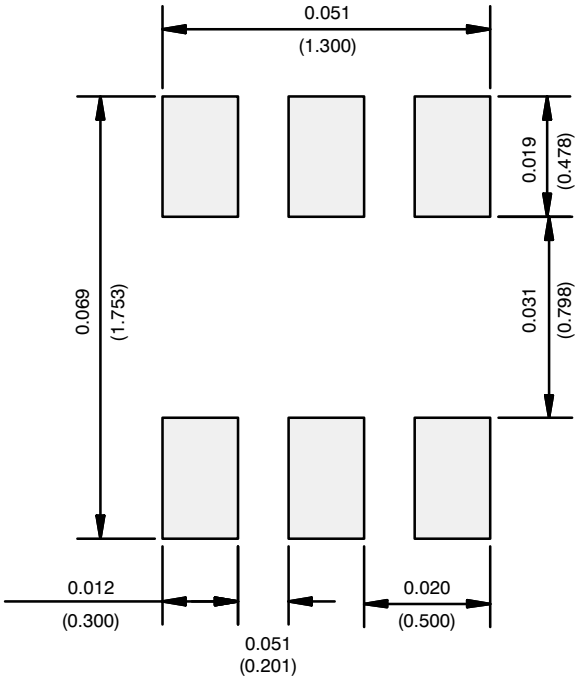
RECOMMENDED MINIMUM PADS FOR SC-89: 6-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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APPLICATION NOTE

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