

## Si1013R-T1-GE3-VB Datasheet

### P-Channel 20 V (D-S) MOSFET



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

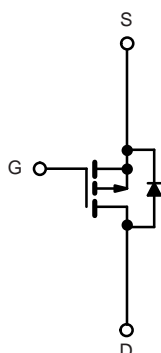
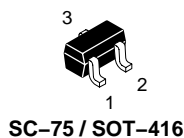
PRODUCT SUMMARY			
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (TYP.) (nC)
-20	0.450 at $V_{GS} = -4.5$ V	-0.55	1
	0.500 at $V_{GS} = -2.5$ V	-0.50	
	0.600 at $V_{GS} = -1.8$ V	-0.38	

#### FEATURES

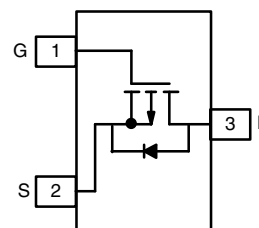
- Trench power MOSFET
- 100 % R tested
- Fast switching speed

#### APPLICATIONS

- Load / power switch for portable devices
- Drivers: relays, solenoids, displays
- Battery operated systems



P-Channel MOSFET



Top View

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		$V_{DS}$	-20	V
Gate-Source Voltage		$V_{GS}$	$\pm 12$	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ )	$T_A = 25^\circ\text{C}$	$I_D$	-0.55 <sup>b, c</sup>	A
	$T_A = 70^\circ\text{C}$		-0.45 <sup>b, c</sup>	
Pulsed Drain Current ( $t = 300 \mu\text{s}$ )		$I_{DM}$	-1.8	
Continuous Source-Drain Diode Current		$I_S$	-0.16 <sup>b, c</sup>	W
Maximum Power Dissipation	$T_A = 25^\circ\text{C}$	$P_D$	0.19 <sup>b, c</sup>	
	$T_A = 70^\circ\text{C}$		0.12 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient <sup>a, b</sup>	$t \leq 5$ s	$R_{thJA}$	440	530	$^\circ\text{C/W}$
	Steady State		540	650	

#### Notes

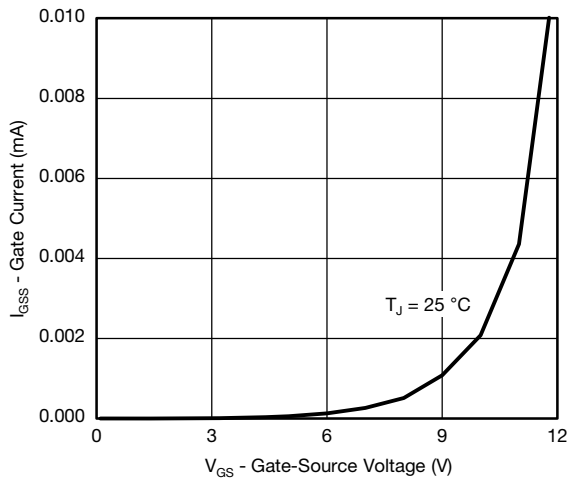
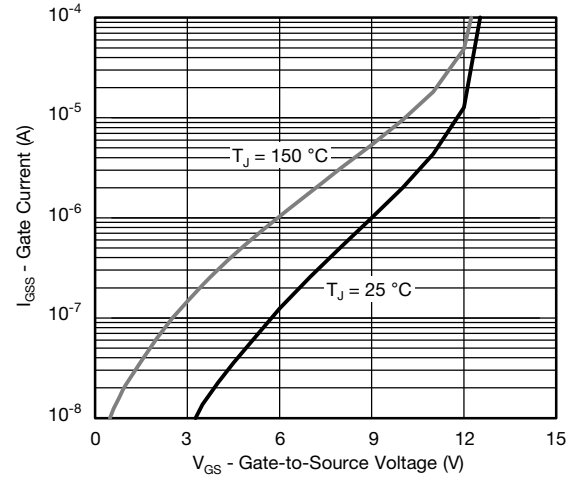
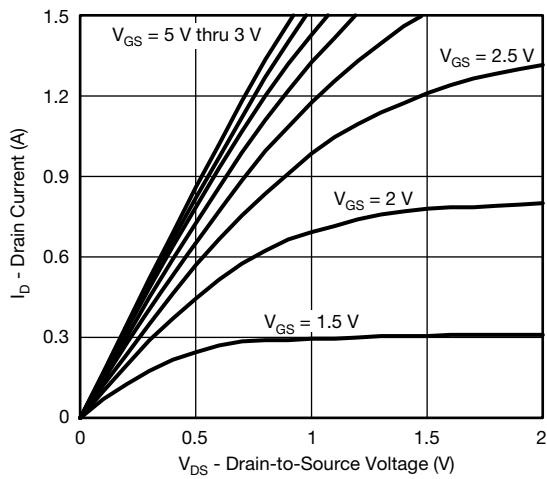
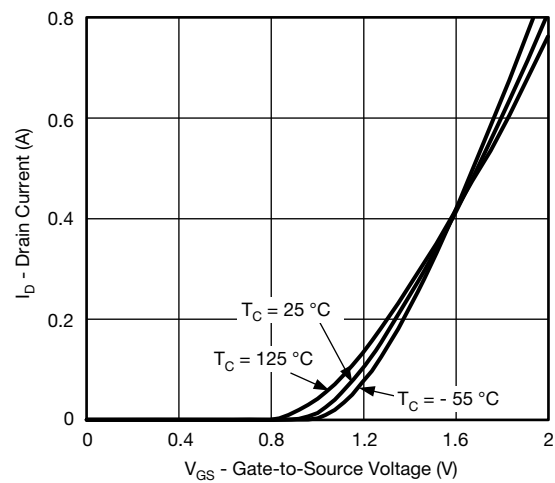
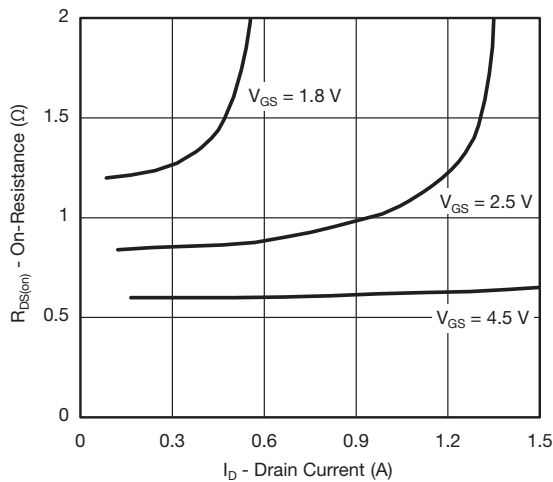
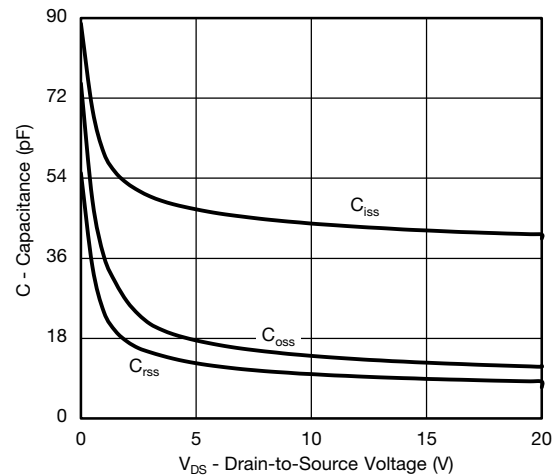
- a. Maximum under steady state conditions is  $650^\circ\text{C/W}$ .  
b. Surface mounted on 1" x 1" FR4 board.  
c.  $t = 5$  s.

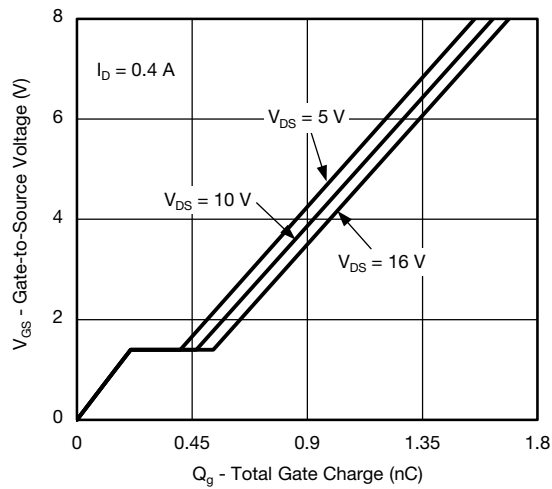
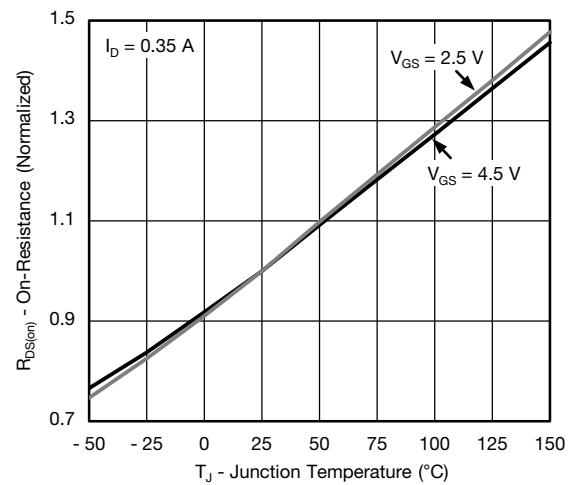
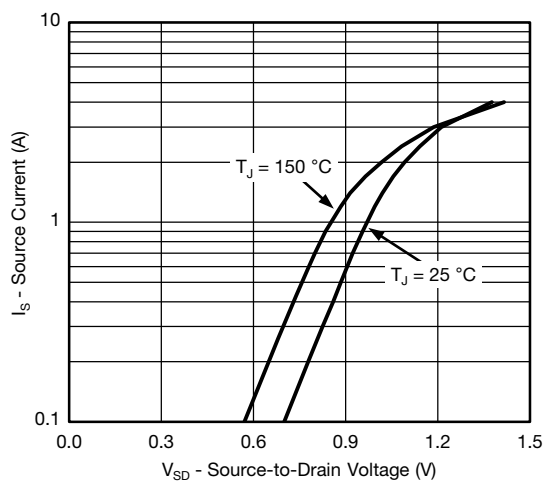
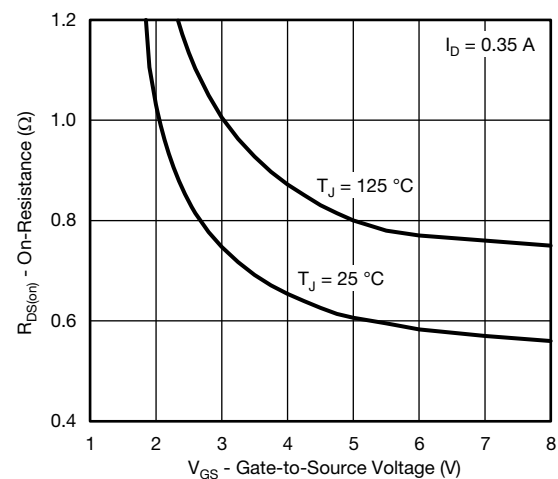
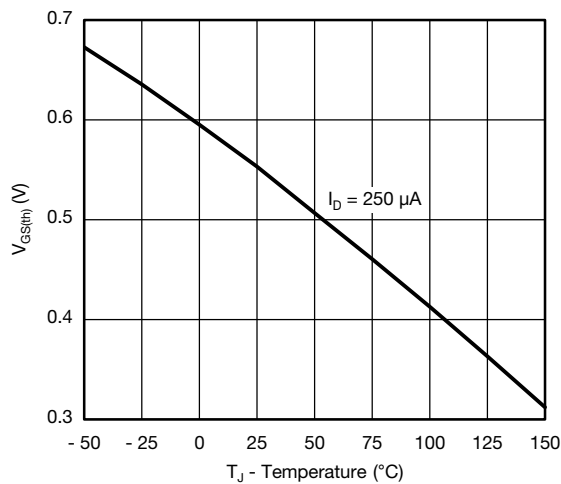
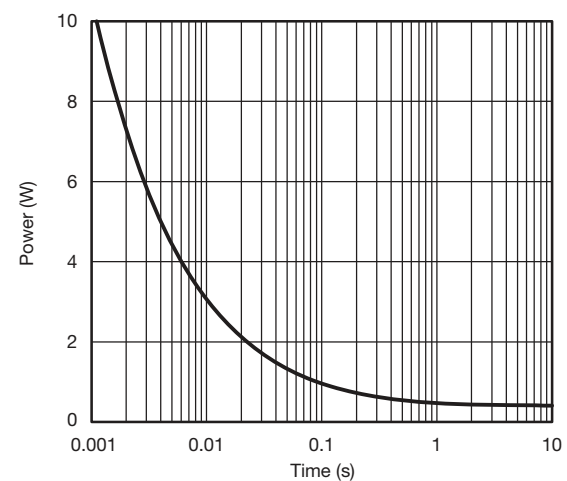
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0, I <sub>D</sub> = -250 μA	-20	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = -250 μA	-	-12	-	mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>		-	1.8	-	
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	-0.4	-	-1	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V	-	-	± 30	μA
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 4.5 V	-	-	± 1	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V	-	-	-1	
		V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 85 °C	-	-	-10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = ≥ 5 V, V <sub>GS</sub> = -4.5 V	-1.5	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.4 A	-	0.450	-	Ω
		V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -0.2 A	-	0.500	-	
		V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -0.1 A	-	0.600	-	
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = 0.4 A	-	1	-	S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	45	-	pF
Output Capacitance	C <sub>oss</sub>		-	15	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	10	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.4 A	-	1.65	2.50	nC
		V <sub>DS</sub> = -0 V, V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -0.4	-	1	2	
Gate-Source Charge	Q <sub>gs</sub>		-	0.2	-	
Gate-Drain Charge	Q <sub>gd</sub>		-	0.26	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz	2.4	12	24	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -10 V, R <sub>L</sub> = 33.3 Ω I <sub>D</sub> ≅ -0.3 A, V <sub>GEN</sub> = -4.5 V, R <sub>g</sub> = 1 Ω	-	9	18	ns
Rise Time	t <sub>r</sub>		-	10	20	
Turn-Off DelayTime	t <sub>d(off)</sub>		-	10	20	
Fall Time	t <sub>f</sub>		-	8	16	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -10 V, R <sub>L</sub> = 33.3 Ω I <sub>D</sub> ≅ -0.3 A, V <sub>GEN</sub> = -8 V, R <sub>g</sub> = 1 Ω	-	1	2	
Rise Time	t <sub>r</sub>		-	8	16	
Turn-Off DelayTime	t <sub>d(off)</sub>		-	9	18	
Fall Time	t <sub>f</sub>		-	5	10	
Drain-Source Body Diode Characteristics						
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>		-	-	-1.5	A
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = -0.3 A	-	-0.8	-1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = -0.3 A, dI/dt = 100 A/μs	-	16	24	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>		-	8	16	nC
Reverse Recovery Fall Time	t <sub>a</sub>		-	11	-	ns
Reverse Recovery Rise Time	t <sub>b</sub>		-	5	-	

**Notes**

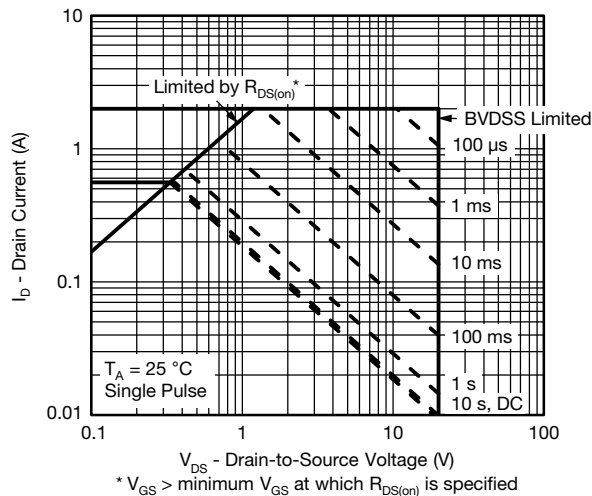
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

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.

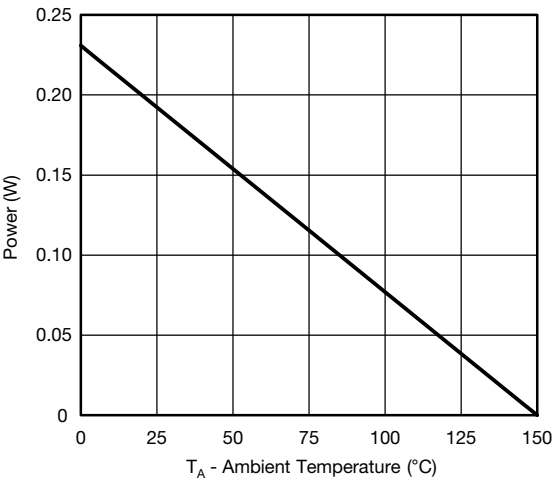
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Gate Current vs. Gate-Source Voltage**

**Gate Current vs. Gate-Source Voltage**

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current**

**Capacitance**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-to-Source Voltage**

**Threshold Voltage**

**Single Pulse Power, Junction-to-Ambient**

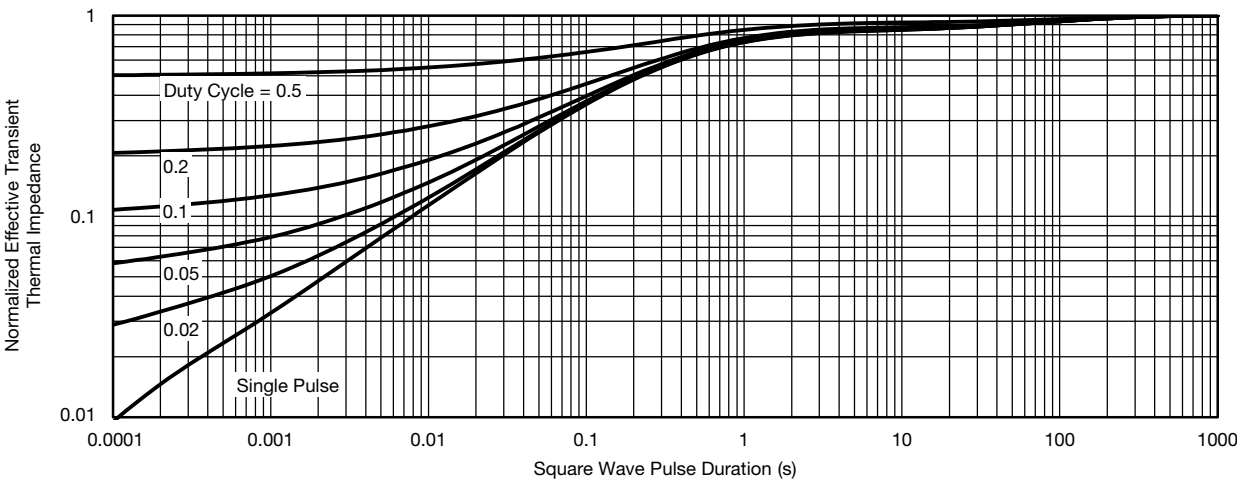
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Safe Operating Area, Junction-to-Ambient**

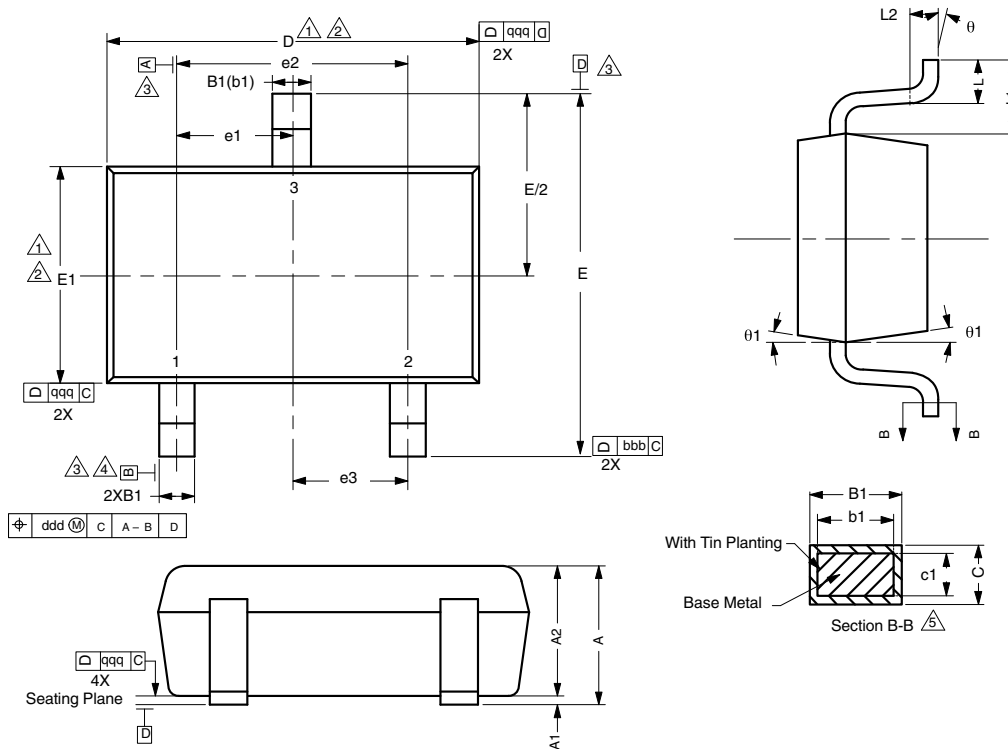


**Power Derating, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

## SC-75: 3 Leads



DWG: 5868

### Notes

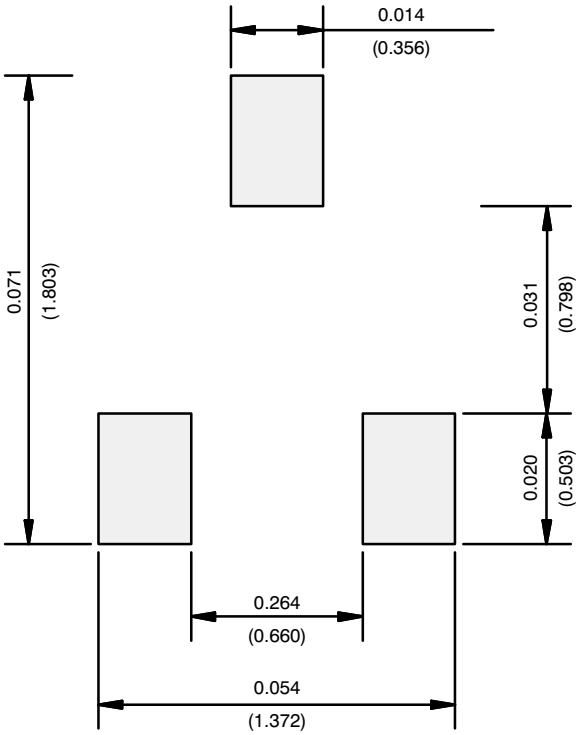
Dimensions in millimeters will govern.

1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash protrusions or gate burrs shall not exceed 0.10 mm per end. Dimension E1 does not include Interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.10 mm per side.
2. Dimensions D and E1 are determined at the outmost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
3. Datums A, B and D to be determined 0.10 mm from the lead tip.
4. Terminal positions are shown for reference only.
5. These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.

DIMENSIONS	TOLERANCES
aaa	0.10
bbb	0.10
ccc	0.10
ddd	0.10

DIM.	MILLIMETERS			NOTE
	MIN.	NOM.	MAX.	
A	-	-	0.80	
A1	0.00	-	0.10	
A2	0.65	0.70	0.80	
B1	0.19	-	0.24	5
b1	0.17	-	0.21	
c	0.13	-	0.15	5
c1	0.10	-	0.12	5
D	1.48	1.575	1.68	1, 2
E	1.50	1.60	1.70	
E1	0.66	0.76	0.86	1, 2
e1	0.50 BSC			
e2	1.00 BSC			
e3	0.50 BSC			
L	0.15	0.205	0.30	
L1	0.40 ref.			
L2	0.15 BSC			
q	0°	-	8°	
q1	4°	-	10°	

RECOMMENDED MINIMUM PADS FOR SC-75: 3-Lead



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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