P-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (TYP.) (nC)
-20	0.760 at V_{GS} = -4.5 V	-0.45	1
	1.040 at V_{GS} = -2.5 V	-0.40	
	1.500 at V_{GS} = -1.8 V	-0.32	

SC-89 (3 leads)

Top View

Marking Code: 6

Ordering Information:
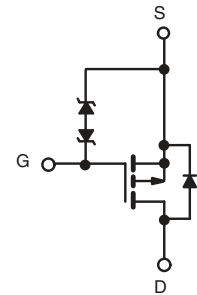Si1013CX-T1-GE3 (Lead (Pb)-free and Halogen-free)
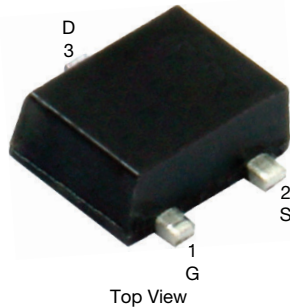
FEATURES
- TrenchFET® power MOSFET
- 100 % R_g tested
- Typical ESD protection: 1000 V (HBM)
- Fast switching speed
- Material categorization:
  for definitions of compliance please see www.vishay.com/doc?99912

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

P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	-20	V
Gate-Source Voltage		V_{GS}	± 8	
Continuous Drain Current (T_J = 150 °C)	T_A = 25 °C	I_D	-0.45 [b, c]	A
	T_A = 70 °C		-0.36 [b, c]	
Pulsed Drain Current (t = 300 µs)		I_{DM}	-1.5	
Continuous Source-Drain Diode Current	T_A = 25 °C	I_S	-0.16 [b, c]	
Maximum Power Dissipation	T_A = 25 °C	P_D	0.19 [b, c]	W
	T_A = 70 °C		0.12 [b, c]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +150	°C

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient [a, b]	t ≤ 5 s	R_{thJA}	440	530	°C/W
	Steady State		540	650	

Notes
a. Maximum under steady state conditions is 650 °C/W.
b. Surface mounted on 1" x 1" FR4 board.
c. t = 5 s.

For technical questions, contact: pmostechsupport@vishay.com

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

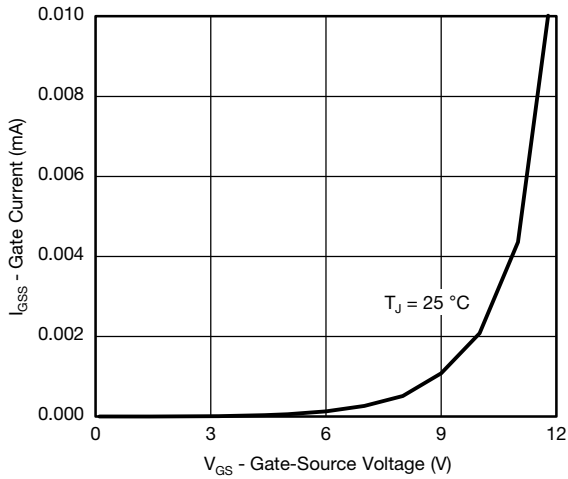| PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0, I_D = -250 µA	-20	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = -250 µA	-	-12	-	mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		-	1.8	-	
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = -250 µA	-0.4	-	-1	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V	-	-	± 30	µA
		V_{DS} = 0 V, V_{GS} = ± 4.5 V	-	-	± 1	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = -20 V, V_{GS} = 0 V	-	-	-1	
		V_{DS} = -20 V, V_{GS} = 0 V, T_J = 85 °C	-	-	-10	
On-State Drain Current [a]	$I_{D(on)}$	V_{DS} = ≥ 5 V, V_{GS} = -4.5 V	-1.5	-	-	A
Drain-Source On-State Resistance [a]	$R_{DS(on)}$	V_{GS} = -4.5 V, I_D = -0.4 A	-	0.630	0.760	Ω
		V_{GS} = -2.5 V, I_D = -0.2 A	-	0.865	1.040	
		V_{GS} = -1.8 V, I_D = -0.1 A	-	1.200	1.500	
Forward Transconductance	g_{fs}	V_{DS} = -10 V, I_D = 0.4 A	-	1	-	S
Dynamic [b]						
Input Capacitance	C_{iss}	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz	-	45	-	pF
Output Capacitance	C_{oss}		-	15	-	
Reverse Transfer Capacitance	C_{rss}		-	10	-	
Total Gate Charge	Q_g	V_{DS} = -10 V, V_{GS} = -4.5 V, I_D = -0.4 A	-	1.65	2.50	nC
		V_{DS} = -0 V, V_{GS} = -2.5 V, I_D = -0.4	-	1	2	
Gate-Source Charge	Q_{gs}		-	0.2	-	
Gate-Drain Charge	Q_{gd}		-	0.26	-	
Gate Resistance	R_g	f = 1 MHz	2.4	12	24	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 33.3 Ω, I_D ≅ -0.3 A, V_{GEN} = -4.5 V, R_g = 1 Ω	-	9	18	ns
Rise Time	t_r		-	10	20	
Turn-Off DelayTime	$t_{d(off)}$		-	10	20	
Fall Time	t_f		-	8	16	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 33.3 Ω, I_D ≅ -0.3 A, V_{GEN} = -8 V, R_g = 1 Ω	-	1	2	
Rise Time	t_r		-	8	16	
Turn-Off DelayTime	$t_{d(off)}$		-	9	18	
Fall Time	t_f		-	5	10	
Drain-Source Body Diode Characteristics						
Pulse Diode Forward Current [a]	I_{SM}		-	-	-1.5	A
Body Diode Voltage	V_{SD}	I_S = -0.3 A	-	-0.8	-1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = -0.3 A, dI/dt = 100 A/µs	-	16	24	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	8	16	nC
Reverse Recovery Fall Time	t_a		-	11	-	ns
Reverse Recovery Rise Time	t_b		-	5	-	

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

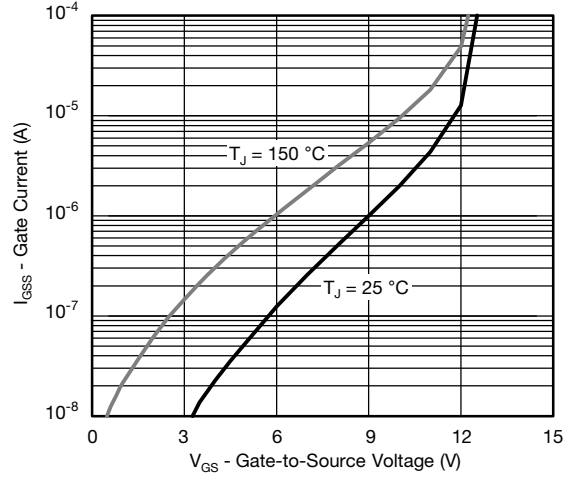S14-1601-Rev. B, 11-Aug-14   **2**   Document Number: 67995
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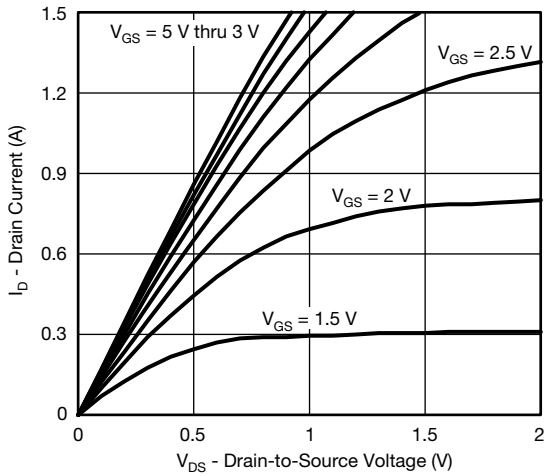
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)
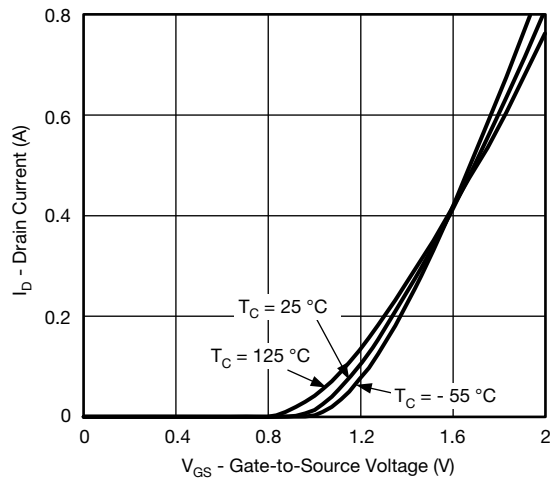

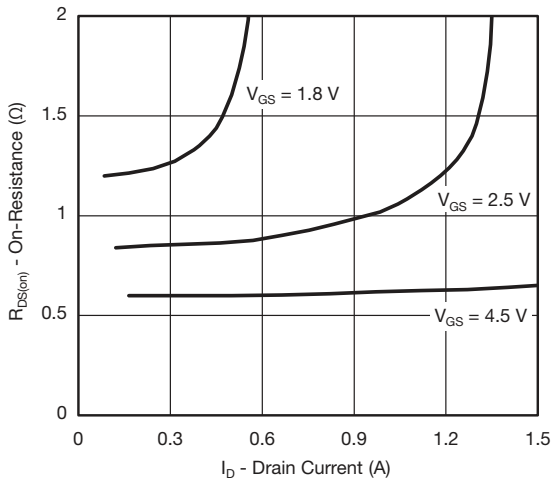Gate Current vs. Gate-Source Voltage

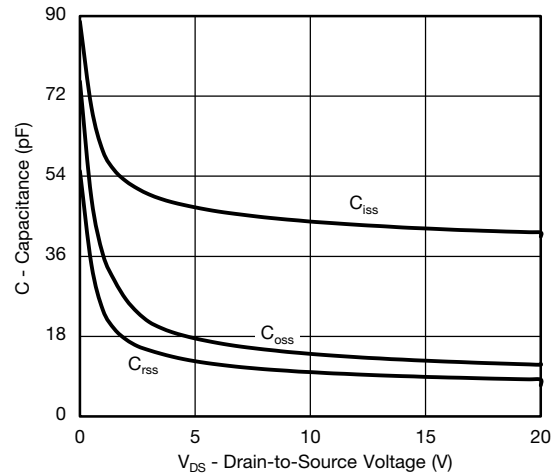
Gate Current vs. Gate-Source Voltage
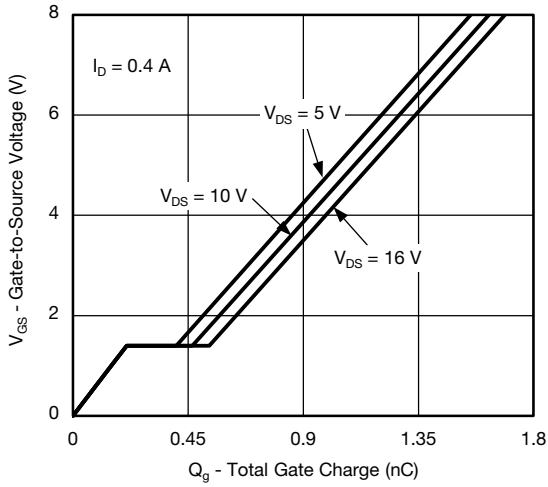

Output Characteristics

Transfer Characteristics

On-Resistance vs. Drain Current

Capacitance

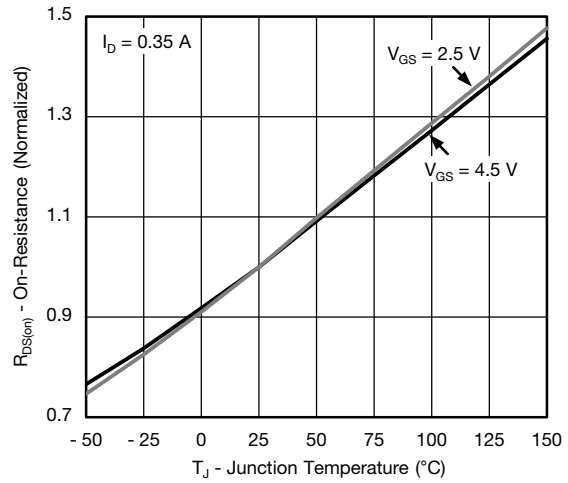For technical questions, contact: pmostechsupport@vishay.com

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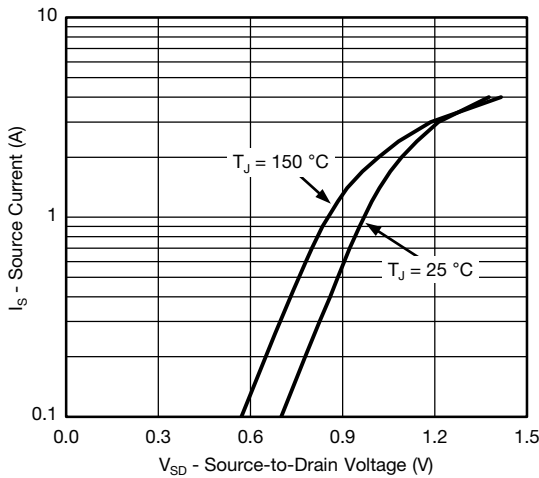ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

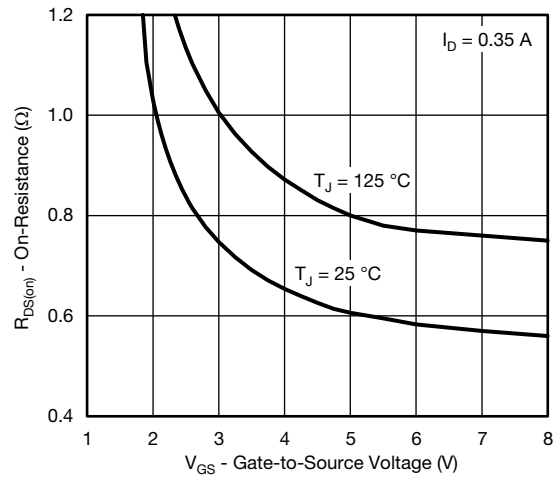## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)
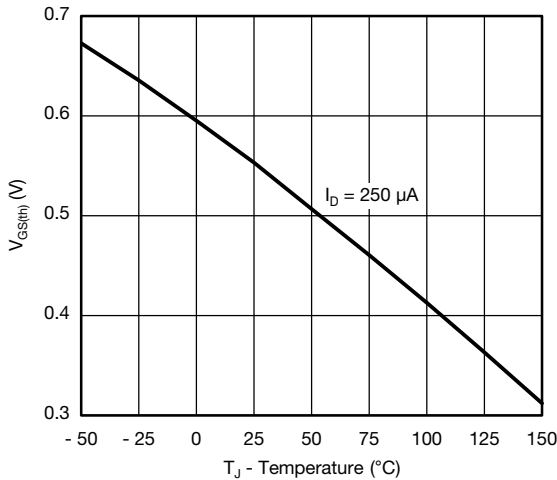

Gate Charge

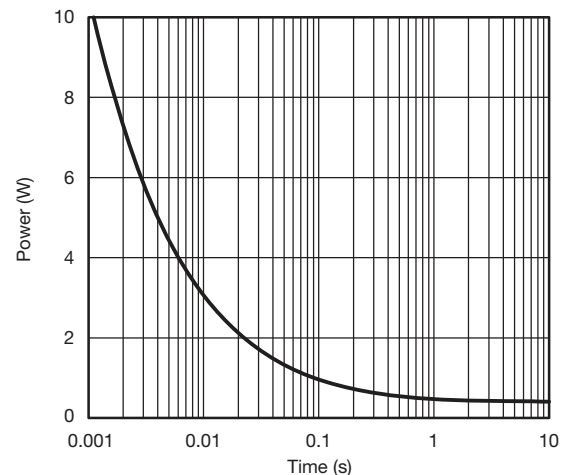**On-Resistance vs. Junction Temperature**

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

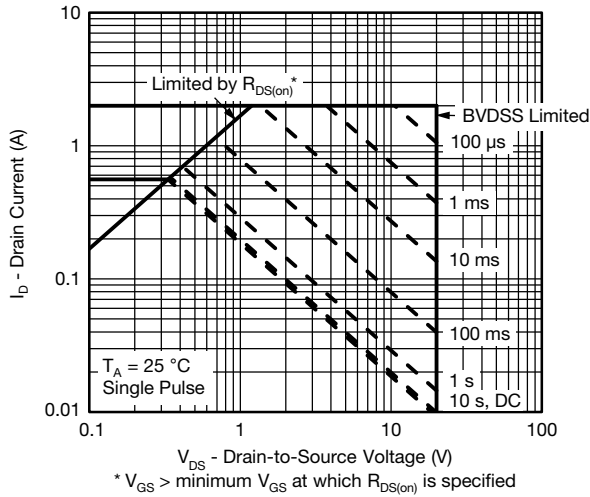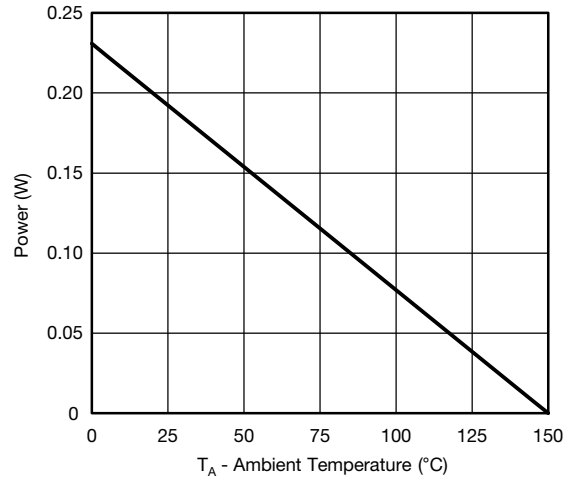

Threshold Voltage

Single Pulse Power, Junction-to-Ambient

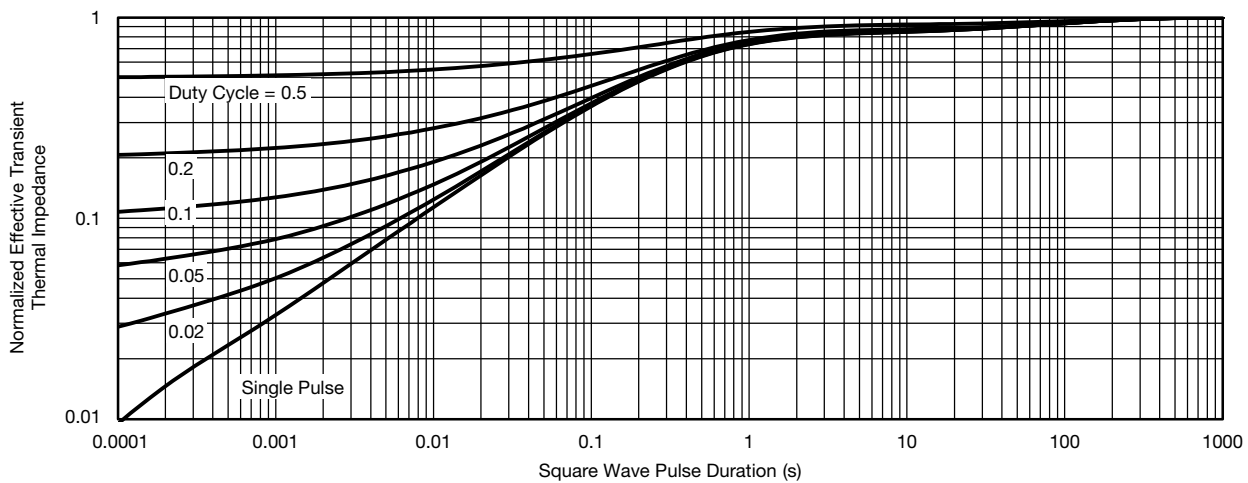For technical questions, contact: pmostechsupport@vishay.com

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Safe Operating Area, Junction-to-Ambient

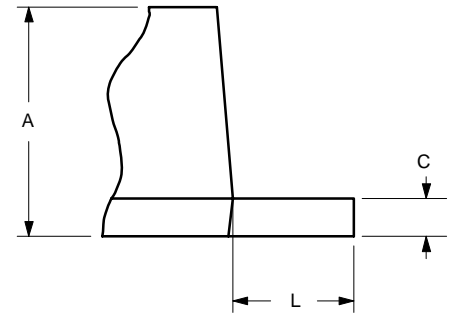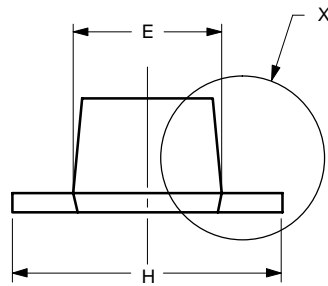**Power Derating, Junction-to-Ambient**

Normalized Thermal Transient Impedance, Junction-to-Ambient

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SC89-3
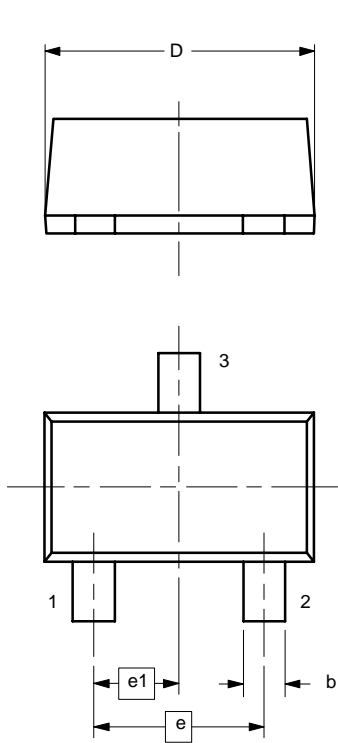
Dim	MILLIMETERS		INCHES	
	Min	**Max**	**Min**	**Max**
A	0.60	0.80	0.024	0.031
b	0.23	0.33	0.009	0.013
C	0.10	0.20	0.004	0.008
D	1.50	1.70	0.059	0.067
E	0.75	0.95	0.030	0.037
e	1.00 BSC		0.040 BSC	
e₁	0.50 BSC		0.020 BSC	
H	1.50	1.70	0.059	0.067
L	0.30	0.50	0.012	0.020

ECN: S-03946—Rev. B, 09-Jul-01
DWG: 5869

DETAIL X

RECOMMENDED MINIMUM PADS FOR SC-89: 3-Lead
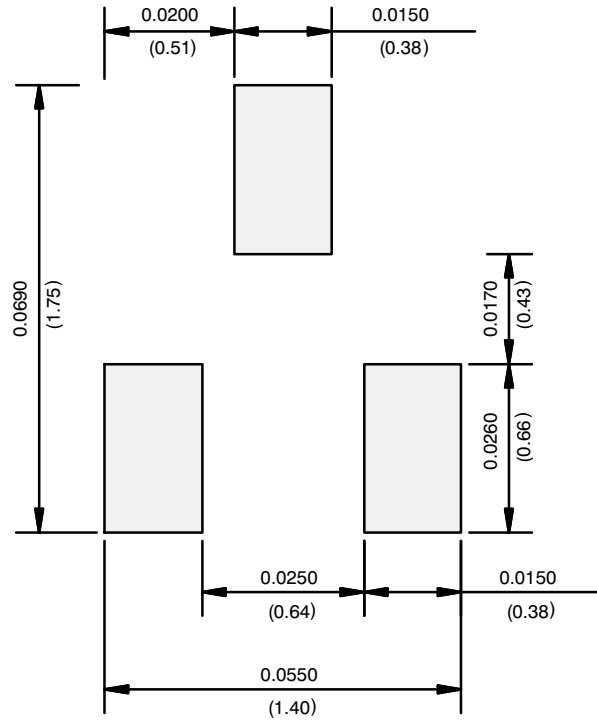
Recommended Minimum Pads
Dimensions in Inches/(mm)

APPLICATION NOTE

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