Dual N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY

| V_{DS} (V)	$R_{DS(on)max}$ (Ω)	I_D (A)	Q_g (Typ.)
20	0.360 at V_{GS} = 4.5 V	0.6	0.75
	0.420 at V_{GS} = 2.5 V	0.4	
	0.520 at V_{GS} = 1.8 V	0.2	
	0.720 at V_{GS} = 1.5 V	0.05	

FEATURES

- TrenchFET® Power MOSFET
- 100 % R_g Tested
- Gate-Source ESD Protected: 1000 V

Pb-free

RoHS COMPLIANT

APPLICATIONS

- Load/Power Switching for Portable Devices
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits

SC-89

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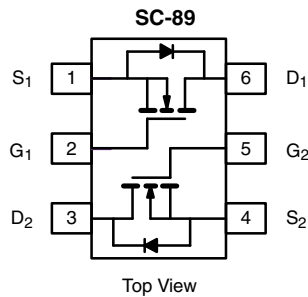
ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	20	V
Gate-Source Voltage		V_{GS}	± 12	
Continuous Drain Current (T_J = 150 °C)[a]	T_A = 25 °C	I_D	0.60[a, b]	A
	T_A = 70 °C		0.49[a, b]	
Pulsed Drain Current		I_{DM}	2	
Continuous Source-Drain Diode Current	T_A = 25 °C	I_S	0.18[a, b]	A
Maximum Power Dissipation[a]	T_A = 25 °C	P_D	0.22[a, b]	W
	T_A = 70 °C		0.14[a, b]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typ.	Max.	Unit
Maximum Junction-to-Ambient[b]	t ≤ 5 s	R_{thJA}	470	565	°C/W
	Steady State		560	675	

Notes:
a. Surface mounted on 1" x 1" FR4 board.
b. t = 5 s.

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 V, I_D = 250 µA	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA		17		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			3	
On-State Drain Current[a]	$I_{D(on)}$	V_{DS} = ≥ 5 V, V_{GS} = 4.5 V	2			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 0.5 A		0.300		Ω
		V_{GS} = 2.5 V, I_D = 0.2 A		0.350		
		V_{GS} = 1.8 V, I_D = 0.2 A		0.420		
		V_{GS} = 1.5 V, I_D = 0.05 A		0.500		
Forward Transconductance	g_{fs}	V_{DS} = 10 V, I_D = 0.5 A		7.5		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz		43		pF
Output Capacitance	C_{oss}			14		
Reverse Transfer Capacitance	C_{rss}			8		
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 8 V, I_D = 0.6 A		1.3	2	nC
		V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 0.6 A		0.75	1.2	
Gate-Source Charge	Q_{gs}			0.15		
Gate-Drain Charge	Q_{gd}			0.13		
Gate Resistance	R_g	f = 1 MHz	2.4	12.2	24.4	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 10 V, R_L = 20 Ω I_D ≅ 0.5 A, V_{GEN} = 4.5 V, R_g = 1 Ω		11	20	ns
Rise Time	t_r			16	24	
Turn-Off Delay Time	$t_{d(off)}$			26	39	
Fall Time	t_f			11	20	
Drain-Source Body Diode Characteristics						
Pulse Diode Forward Current[a]	I_{SM}				2	A
Body Diode Voltage	V_{SD}	I_S = 0.5 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = 0.5 A, dl/dt = 100 A/µs		10	15	ns
Body Diode Reverse Recovery Charge	Q_{rr}			2	4	nC
Reverse Recovery Fall Time	t_a			5		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.

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.
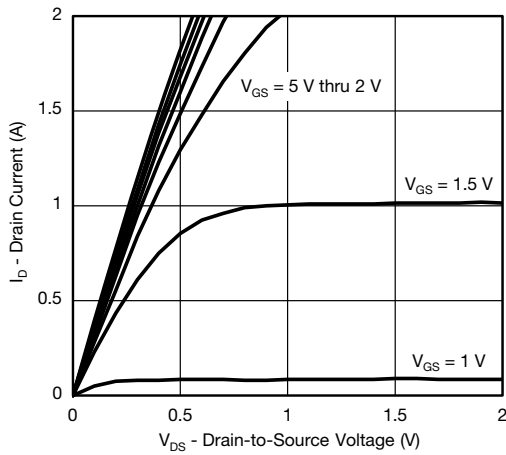
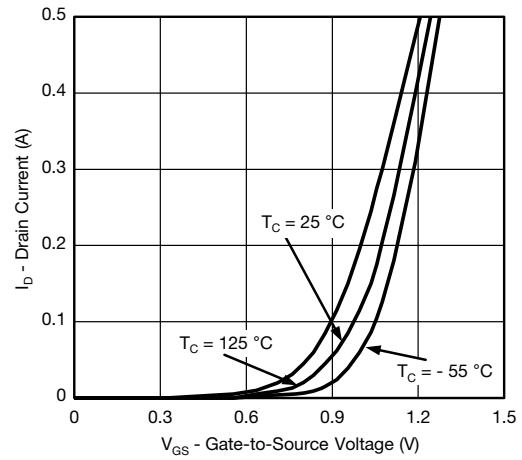**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)
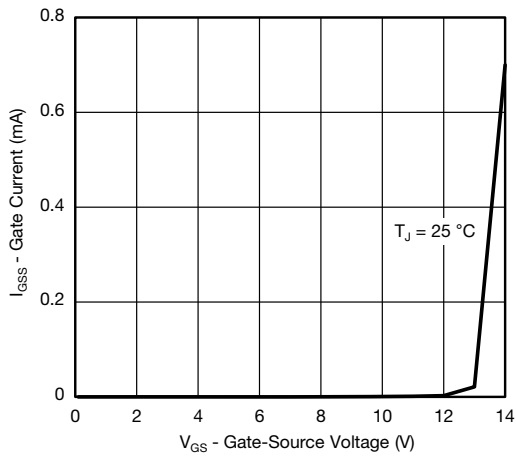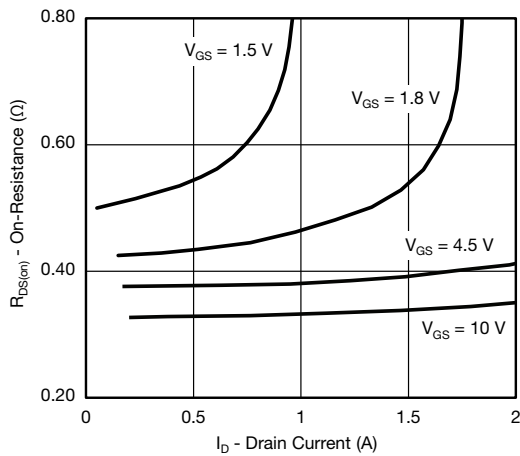
Gate Current vs. Gate-Source Voltage
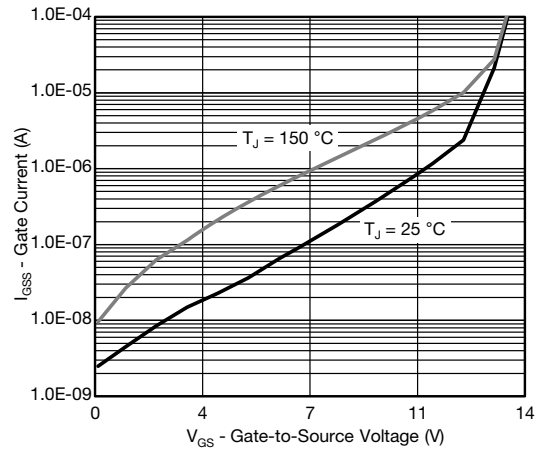
Gate Current vs. Gate-Source Voltage

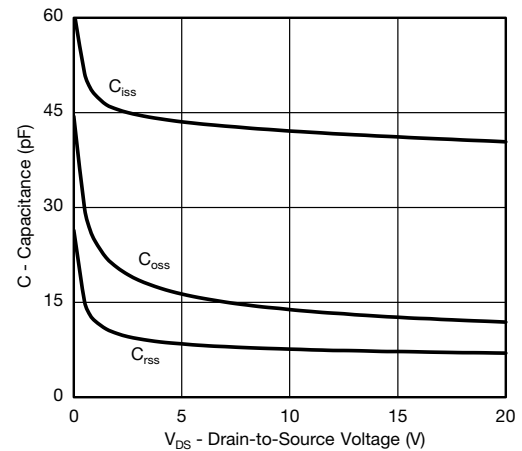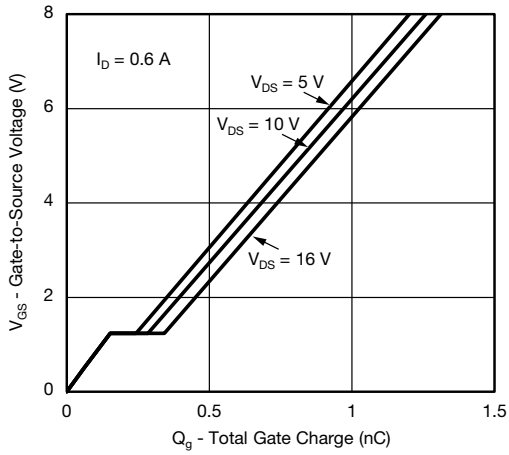**Output Characteristics**

Transfer Characteristics
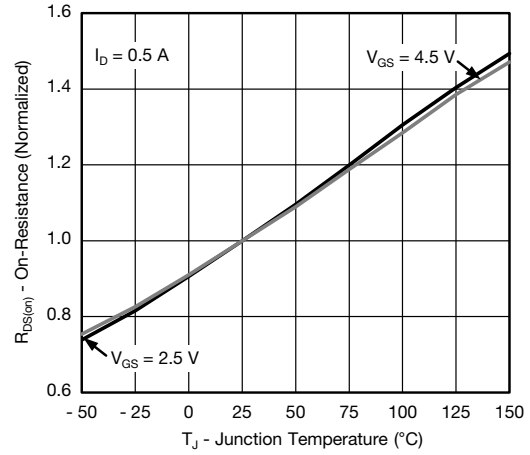
On-Resistance vs. Drain Current
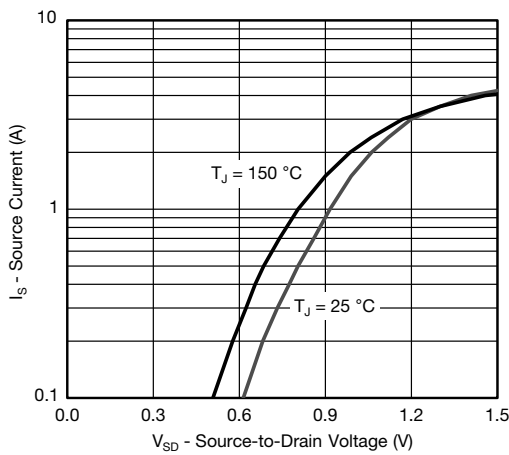
Capacitance

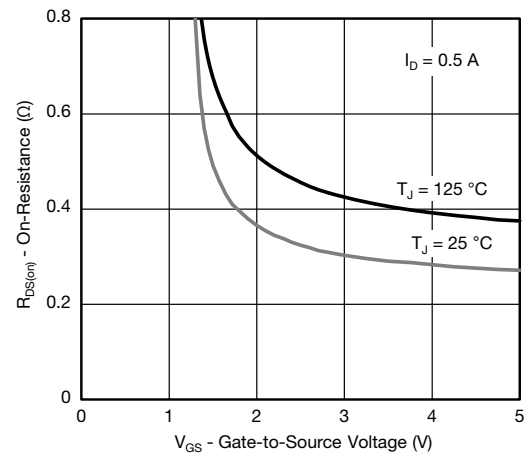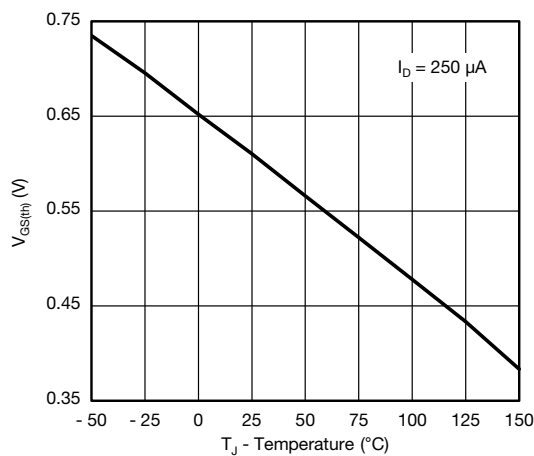## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

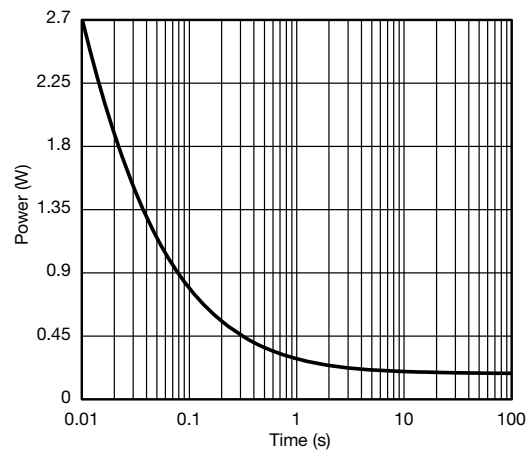Gate Charge

On-Resistance vs. Junction Temperature

Soure-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage
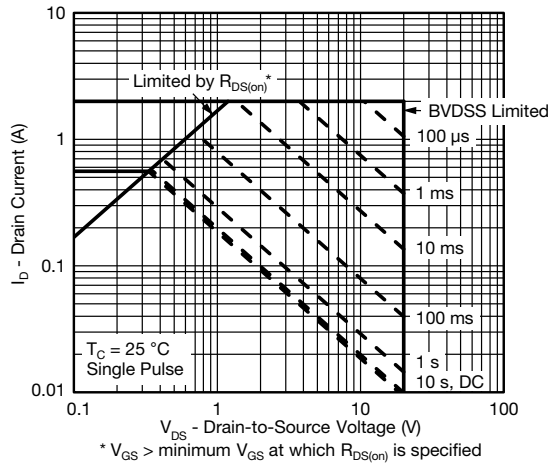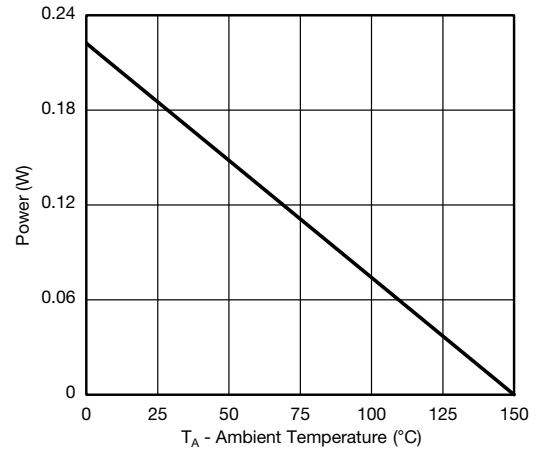
Single Pulse Power, Junction-to-Ambient

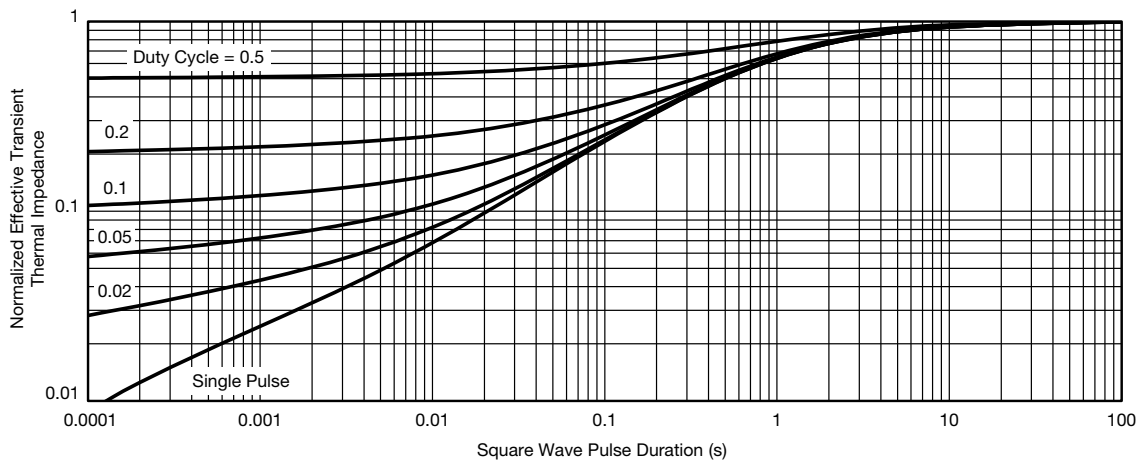## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Limited by $R_{DS(on)}$*

BVDSS Limited

100 μs

1 ms

10 ms

100 ms

1 s

10 s, DC

T_C = 25 °C
Single Pulse

I_D - Drain Current (A)

V_{DS} - Drain-to-Source Voltage (V)

* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

Power (W)

T_A - Ambient Temperature (°C)

Power Derating, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)}$ = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

Duty Cycle = 0.5

0.2

0.1

0.05

0.02

Single Pulse

Normalized Effective Transient Thermal Impedance

Square Wave Pulse Duration (s)

Normalized Thermal Transient Impedance, Junction-to-Ambient

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

SECTION B-B

DETAIL "A"

SEE DETAIL "A"
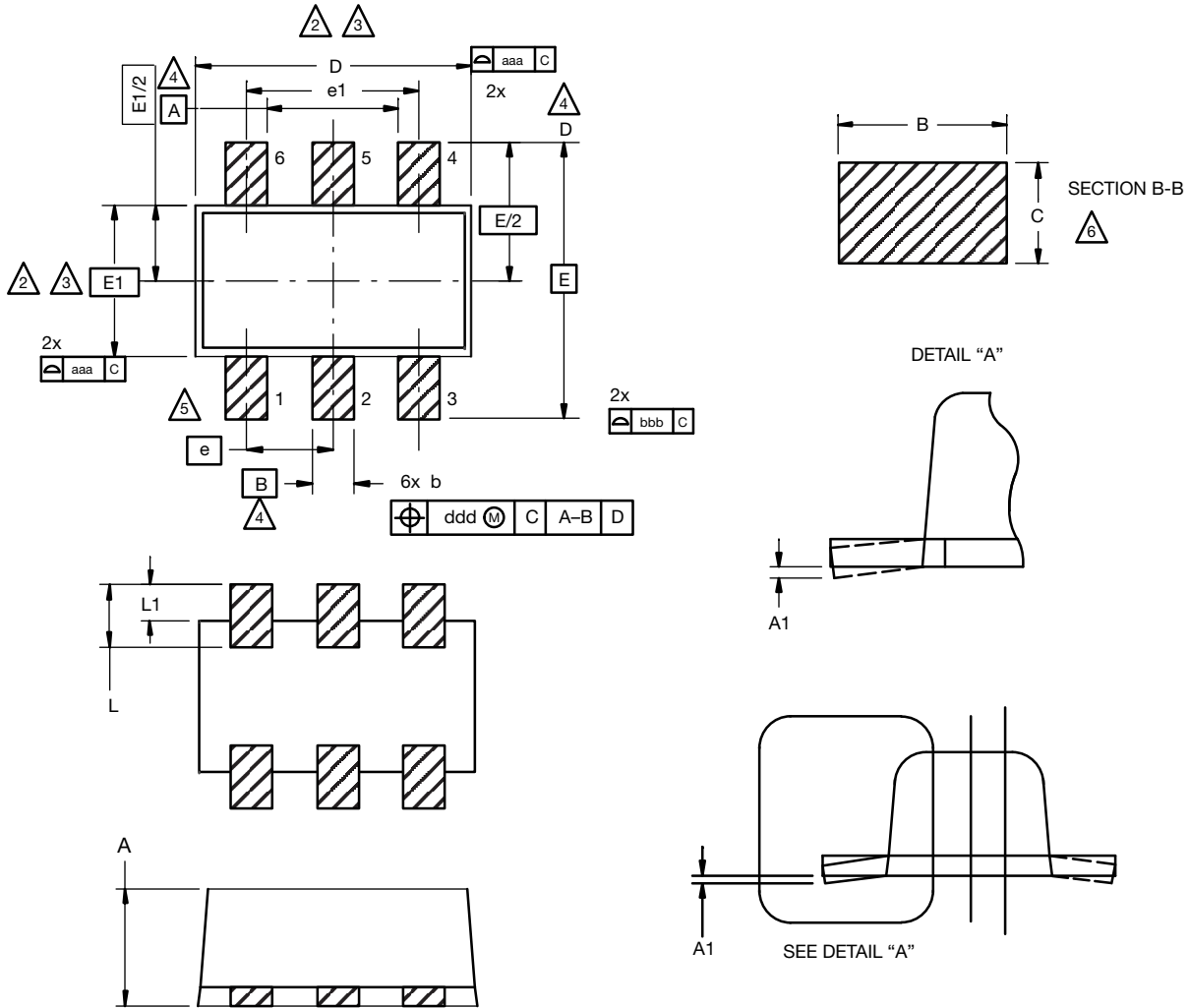
Notes

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

RECOMMENDED MINIMUM PADS FOR SC-89: 6-Lead

0.051
(1.300)

0.019
(0.478)

0.031
(0.798)

0.069
(1.753)

0.012
(0.300)

0.020
(0.500)

0.051
(0.201)
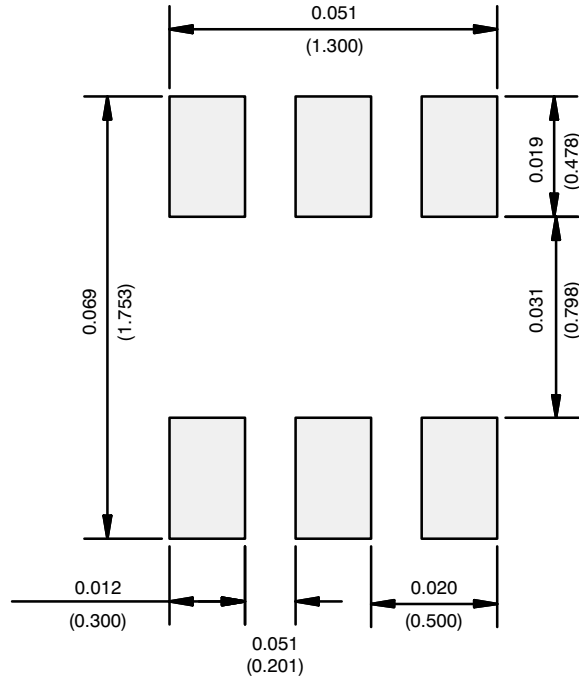
Recommended Minimum Pads
Dimensions in Inches/(mm)

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DMN2990UFB-7B SSM3K35CT,L3F IPLK60R1K0PFD7ATMA1 2N7002W-G MCAC30N06Y-TP IPWS65R035CFD7AXKSA1

MCQ7328-TP SSM3J143TU,LXHF DMN12M3UCA6-7 PJMF280N65E1_T0_00201 PJMF380N65E1_T0_00201

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