

EM6K31N-VB Datasheet

Dual N-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
60	1.200 at $V_{GS} = 10$ V	0.3	0.75
	1.300 at $V_{GS} = 8$ V	0.28	
	1.500 at $V_{GS} = 4.5$ V	0.25	
	1.650 at $V_{GS} = 2.5$ V	0.15	

FEATURES

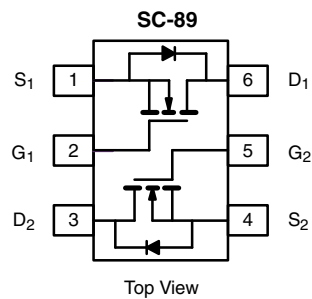
- TrenchFET® Power MOSFET
- 100 % R_g Tested



RoHS
COMPLIANT

APPLICATIONS

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



ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 12	
Continuous Drain Current ($T_J = 150$ °C) ^a	I_D	$T_A = 25$ °C	0.30 ^{a, b}
		$T_A = 70$ °C	0.25 ^{a, b}
Pulsed Drain Current	I_{DM}	2	A
Continuous Source-Drain Diode Current	I_S	0.18 ^{a, b}	A
Maximum Power Dissipation ^a	P_D	$T_A = 25$ °C	0.22 ^{a, b}
		$T_A = 70$ °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	R_{thJA}	$t \leq 5$ s	470	565
		Steady State	560	675

Notes:

- a. Surface mounted on 1" x 1" FR4 board.
 b. $t = 5$ s.

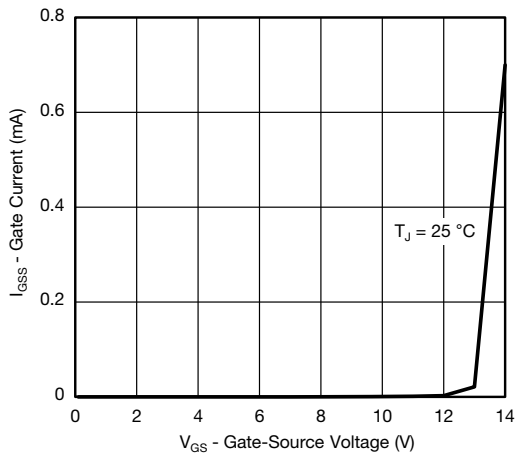
SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		17		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-1.8		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		1.6		V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$			± 30	μA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$			± 1	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			1	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$			3	A
		$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	2			
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 0.3\text{ A}$		1.200		Ω
		$V_{GS} = 8\text{ V}, I_D = 0.2\text{ A}$		1.300		
		$V_{GS} = 4.5\text{ V}, I_D = 0.2\text{ A}$		1.500		
		$V_{GS} = 2.5\text{ V}, I_D = 0.15\text{ A}$		1.650		
Forward Transconductance	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 0.5\text{ A}$		7.5		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		40		pF
Output Capacitance	C_{oss}			14		
Reverse Transfer Capacitance	C_{rss}			8		
Total Gate Charge	Q_g	$V_{DS} = 10\text{ V}, V_{GS} = 8\text{ V}, I_D = 0.6\text{ A}$		1.3	2	nC
				0.75	1.2	
Gate-Source Charge	Q_{gs}	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 0.6\text{ A}$		0.15		
Gate-Drain Charge	Q_{gd}			0.13		
Gate Resistance	R_g		$f = 1\text{ MHz}$	2.4	12.2	24.4
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 20\text{ }\Omega$ $I_D \cong 0.5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		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}	$I_S = 0.5\text{ A}$		0.8	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 0.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$		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:

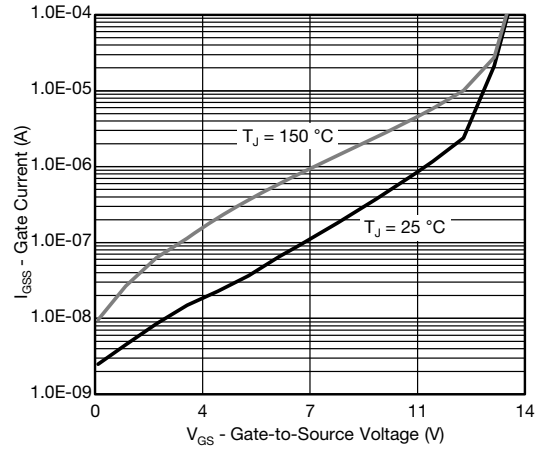
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 b. Guaranteed by design, not subject to production testing.

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.

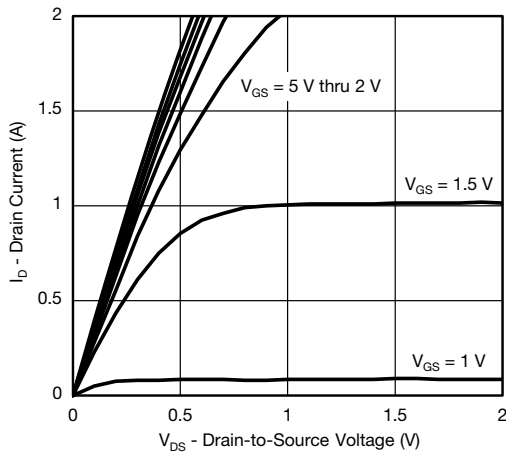
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



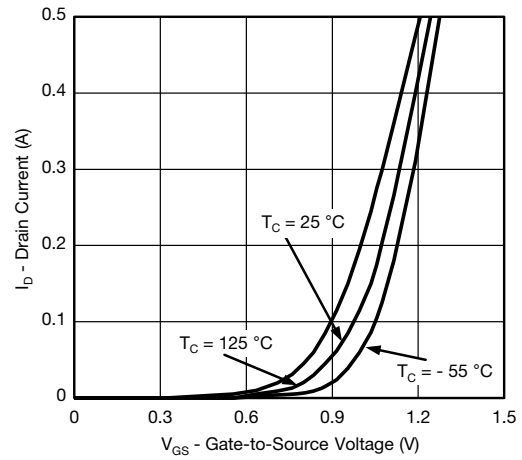
Gate Current vs. Gate-Source Voltage



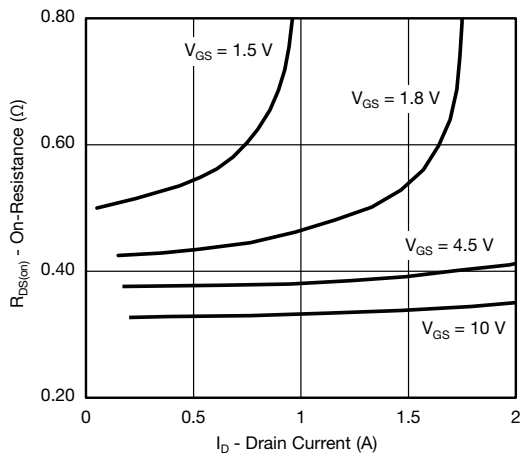
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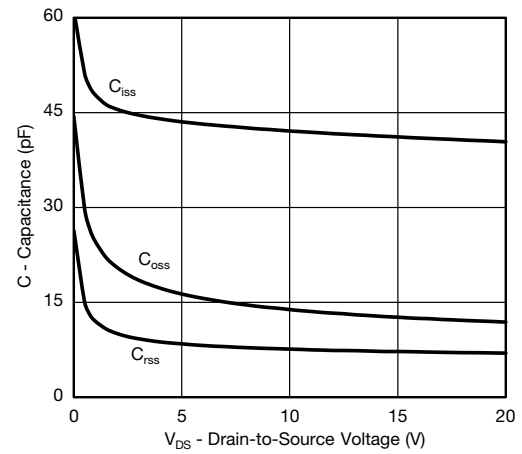
Output Characteristics



Transfer Characteristics

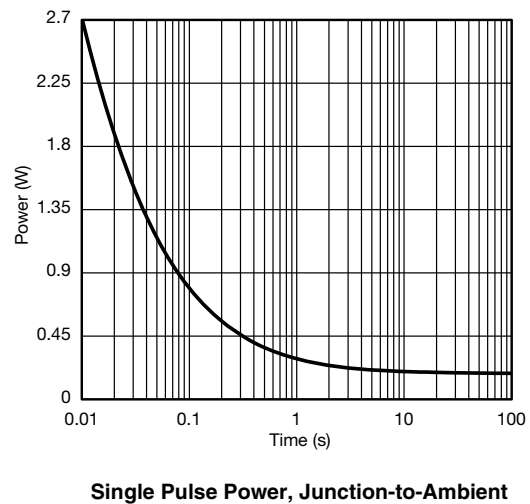
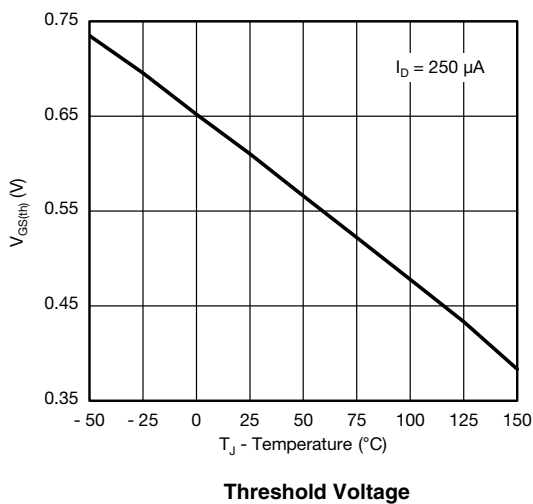
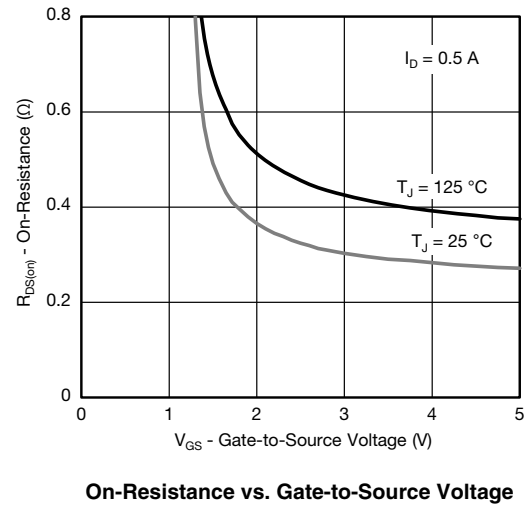
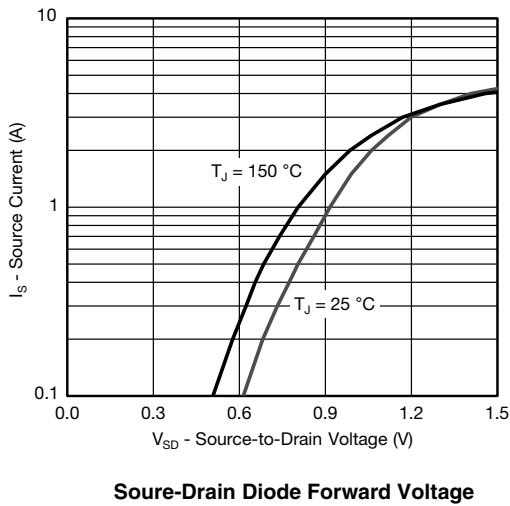
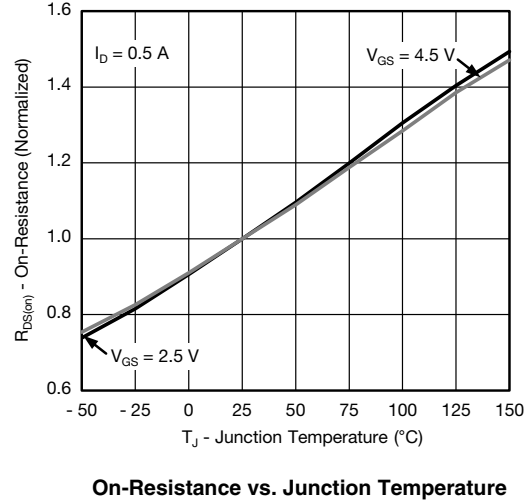
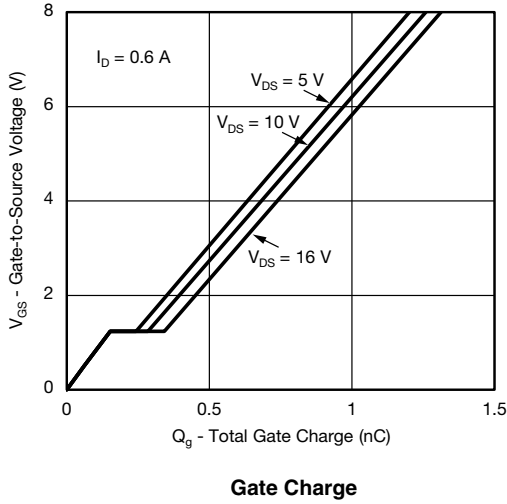


On-Resistance vs. Drain Current

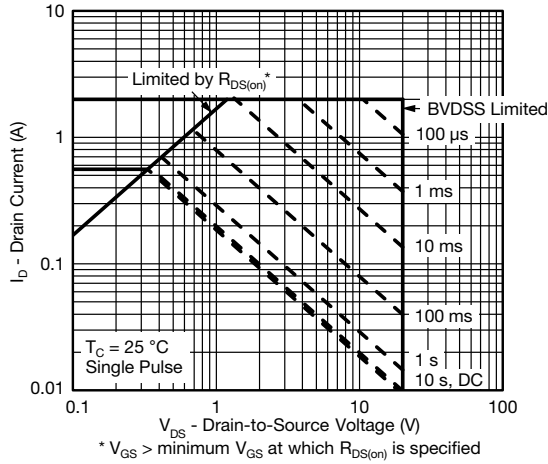


Capacitance

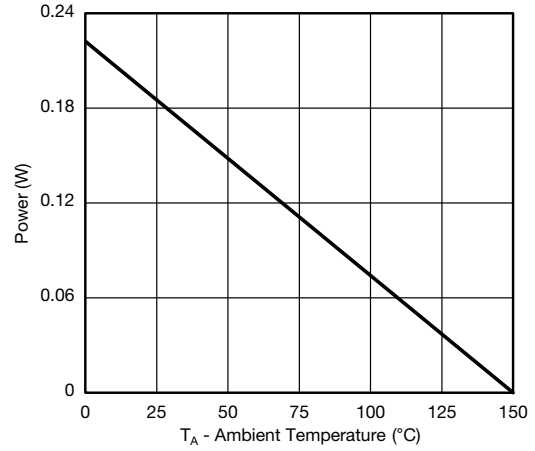
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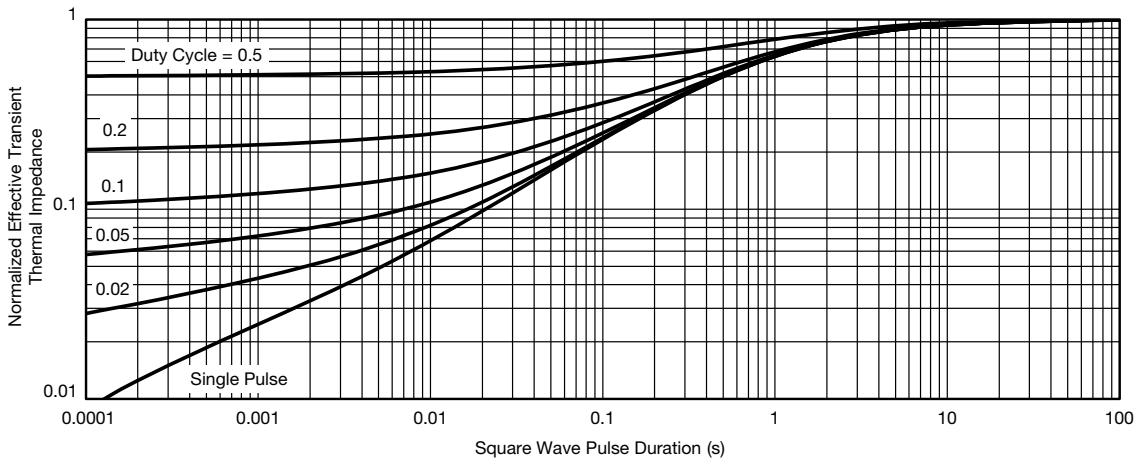


Safe Operating Area, Junction-to-Ambient



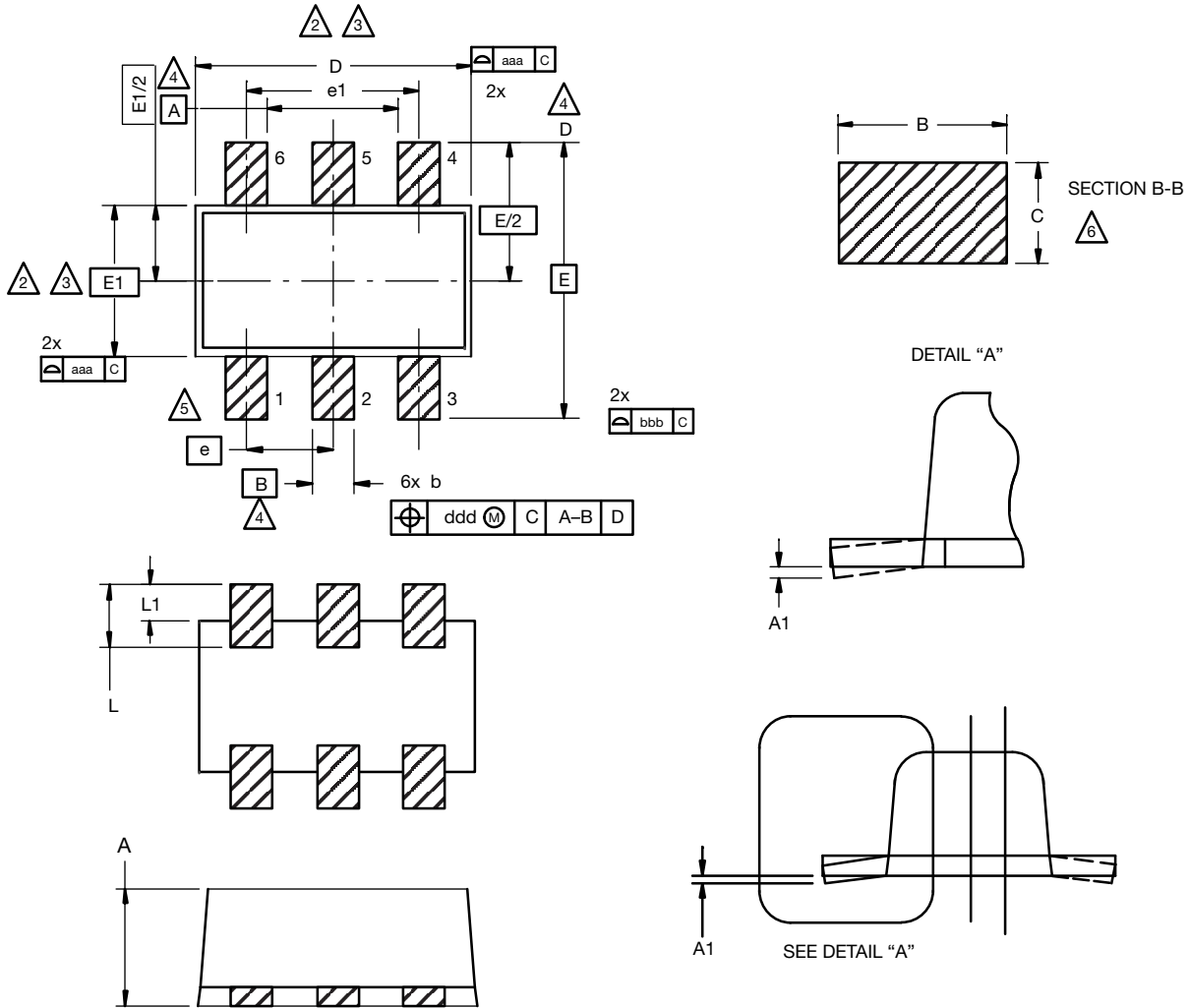
Power Derating, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)} = 150\text{ }^\circ\text{C}$, 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.



Normalized Thermal Transient Impedance, Junction-to-Ambient

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

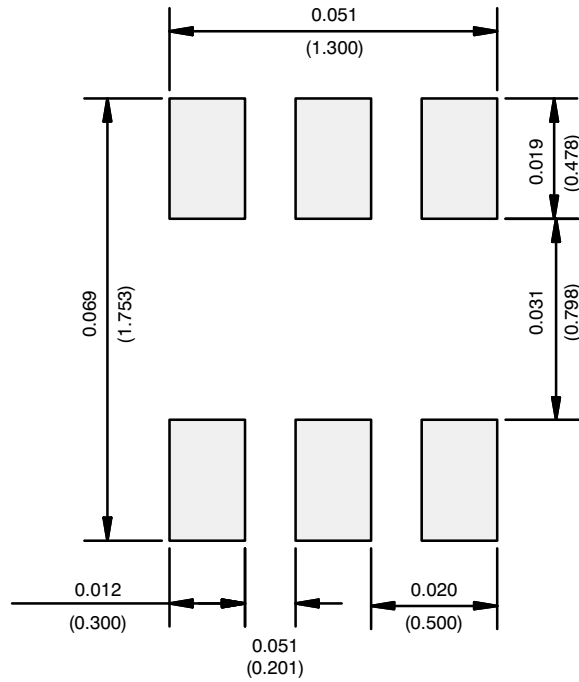


Notes

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

RECOMMENDED MINIMUM PADS FOR SC-89: 6-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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