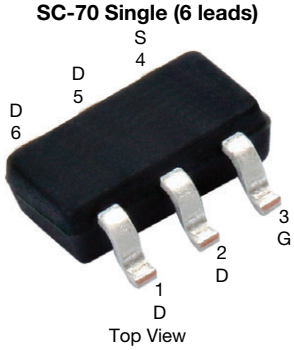
Automotive P-Channel 60 V (D-S) MOSFET



Marking Code: 9D

FEATURES

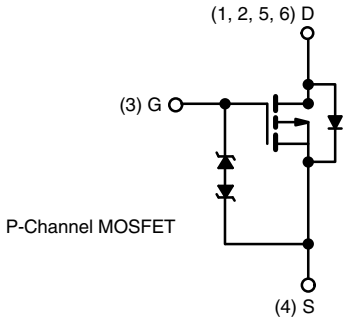
- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 % R_g and UIS tested
- Typical ESD protection: 800 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

HALOGEN FREE



PRODUCT SUMMARY	
V_{DS} (V)	-60
$R_{DS(on)}$ (Ω) at V_{GS} = -10 V	0.290
$R_{DS(on)}$ (Ω) at V_{GS} = -4.5 V	0.395
I_D (A)	-1.6
Configuration	Single
Package	SC-70

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V_{DS}	-60	V
Gate-source voltage		V_{GS}	± 20	
Continuous drain current	T_C = 25 °C [a]	I_D	-1.6	A
	T_C = 125 °C		-1	
Continuous source current (diode conduction) [a]		I_S	-1.6	
Pulsed drain current [b]		I_{DM}	-6.7	
Single pulse avalanche current	L = 0.1 mH	I_{AS}	-8	
Single pulse avalanche energy		E_{AS}	3.2	mJ
Maximum power dissipation [b]	T_C = 25 °C	P_D	2.7	W
	T_C = 125 °C		0.5	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +150	°C

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-ambient	PCB mount [c]	R_{thJA}	125	°C/W
Junction-to-foot (drain)		R_{thJF}	45	

Notes

a. Package limited
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %
c. When mounted on 1" square PCB (FR4 material)

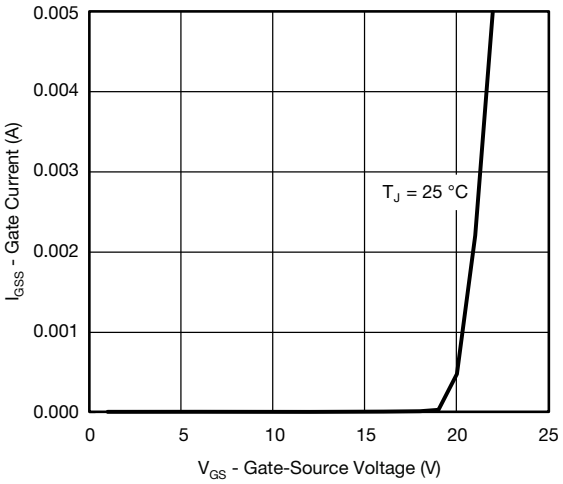
SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = -250 µA		-60	-	-	V
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = -250 µA		-1.5	-2.0	-2.5	
Gate-source leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 12 V		-	-	± 5	µA
		V_{DS} = 0 V, V_{GS} = ± 20 V		-	-	± 5	mA
Zero gate voltage drain current	I_{DSS}	V_{GS} = 0 V	V_{DS} = -60 V	-	-	-1	µA
		V_{GS} = 0 V	V_{DS} = -60 V, T_J = 125 °C	-	-	-50	
		V_{GS} = 0 V	V_{DS} = -60 V, T_J = 150 °C	-	-	-150	
On-state drain current [a]	$I_{D(on)}$	V_{GS} = -10 V	V_{DS} ≤ -5 V	-5	-	-	A
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} = -10 V	I_D = -2 A	-	0.230	0.290	Ω
		V_{GS} = -10 V	I_D = -2 A, T_J = 125 °C	-	-	0.470	
		V_{GS} = -10 V	I_D = -2 A, T_J = 150 °C	-	-	0.566	
		V_{GS} = -4.5 V	I_D = -1 A	-	0.305	0.395	
Forward transconductance [b]	g_{fs}	V_{DS} = -10 V, I_D = -1.5 A		-	3	-	S
Dynamic [b]							
Input capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = -25 V, f = 1 MHz	-	284	355	pF
Output capacitance	C_{oss}			-	36	45	
Reverse transfer capacitance	C_{rss}			-	28	35	
Total gate charge [c]	Q_g	V_{GS} = -4.5 V	V_{DS} = -30 V, I_D = -1 A	-	3.6	5.4	nC
Gate-source charge [c]	Q_{gs}			-	1.2	-	
Gate-drain charge [c]	Q_{gd}			-	1.7	-	
Gate resistance	R_g	f = 1 MHz		3.1	6.05	9	Ω
Turn-on delay time [c]	$t_{d(on)}$	V_{DD} = -30 V, R_L = 30 Ω I_D ≅ -1 A, V_{GEN} = -4.5 V, R_g = 1 Ω		-	44	66	ns
Rise time [c]	t_r			-	25	38	
Turn-off delay time [c]	$t_{d(off)}$			-	13	20	
Fall time [c]	t_f			-	9	14	
Source-Drain Diode Ratings and Characteristics [b]							
Pulsed current [a]	I_{SM}			-	-	-6.7	A
Forward voltage	V_{SD}	I_F = -0.5 A, V_{GS} = 0 V		-	-0.8	-1.2	V

Notes

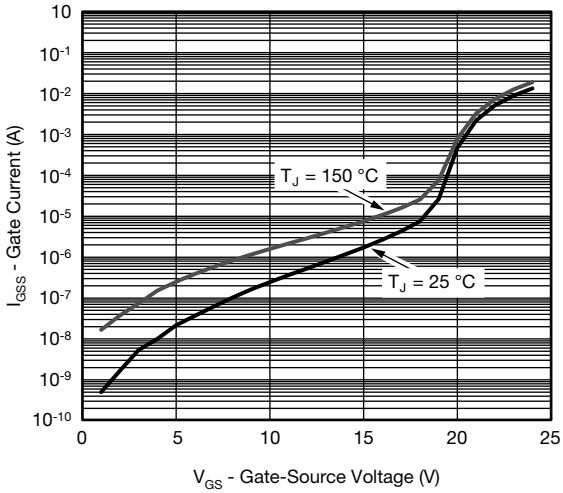
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %
b. Guaranteed by design, not subject to production testing
c. Independent of operating temperature

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.

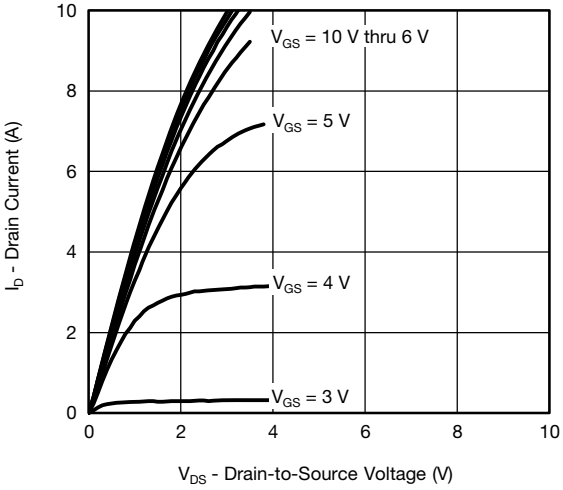
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



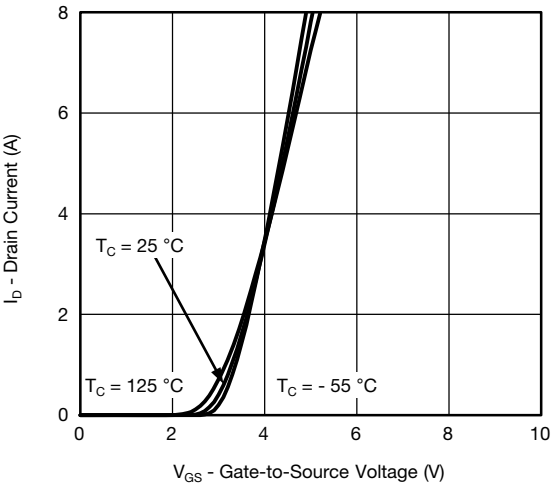
Gate Current vs. Gate-Source Voltage



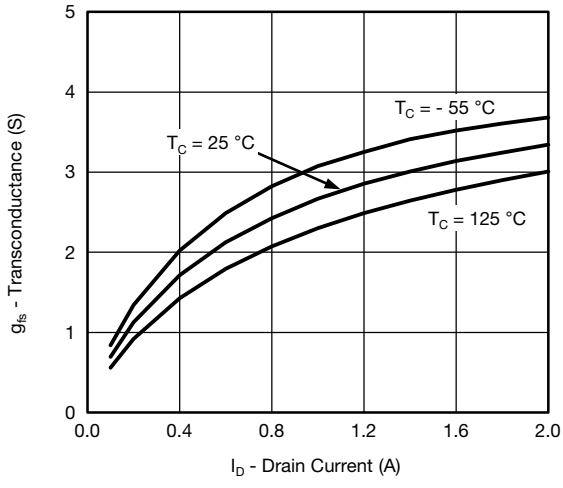
Gate Current vs. Gate-Source Voltage



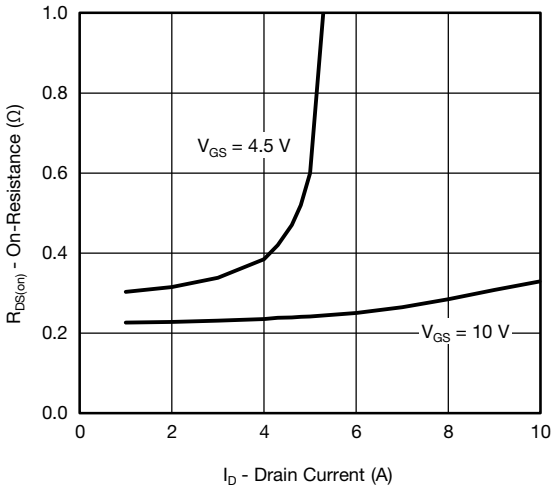
Output Characteristics



Transfer Characteristics

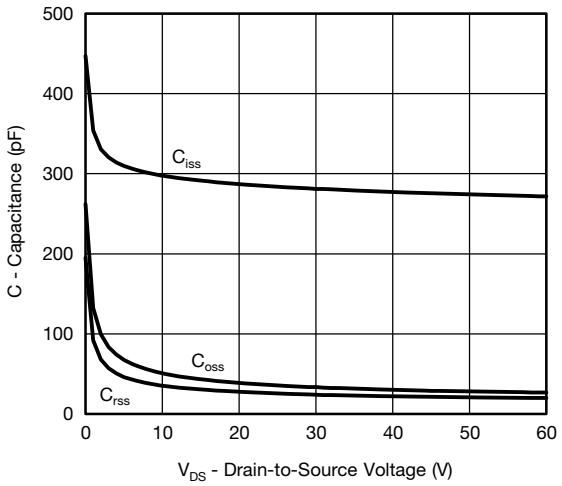


Transconductance

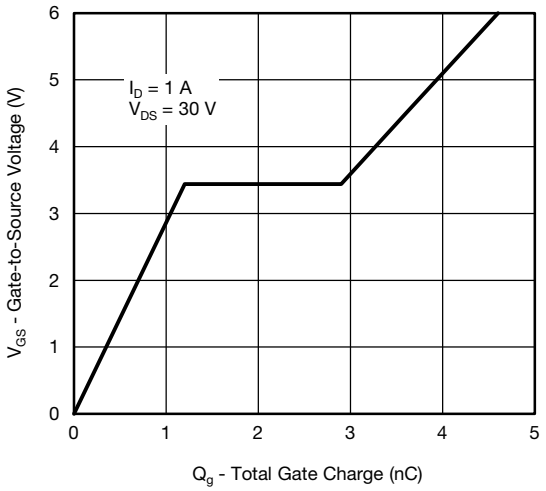


On-Resistance vs. Drain Current

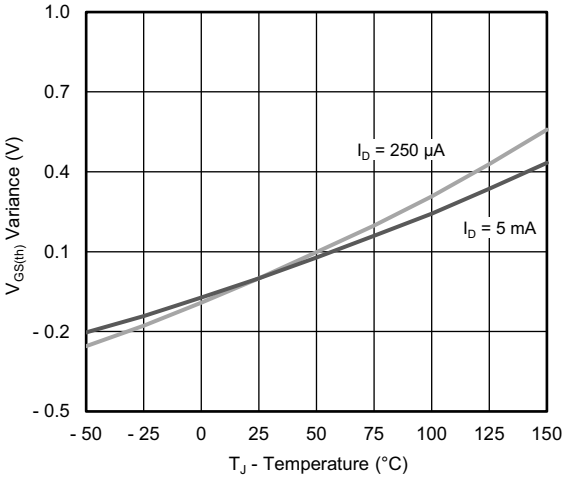
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



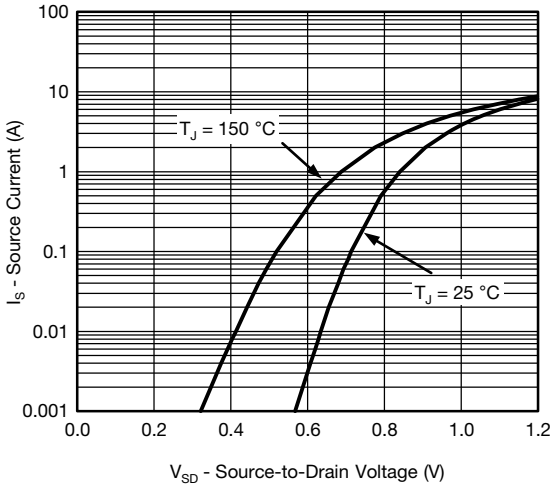
Capacitance



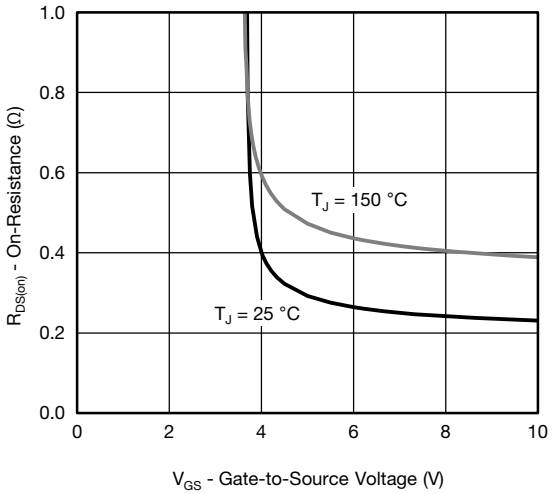
Gate Charge



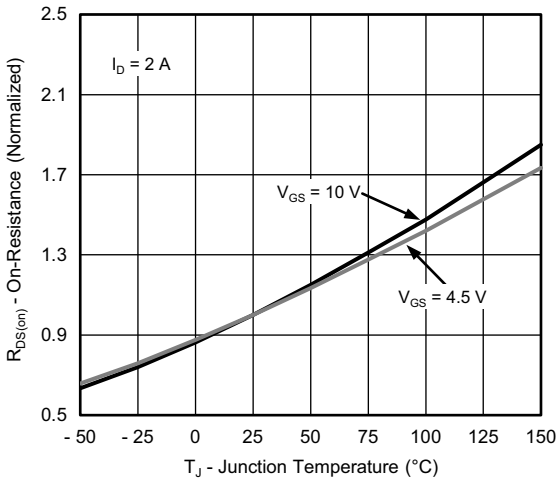
Threshold Voltage



Source Drain Diode Forward Voltage

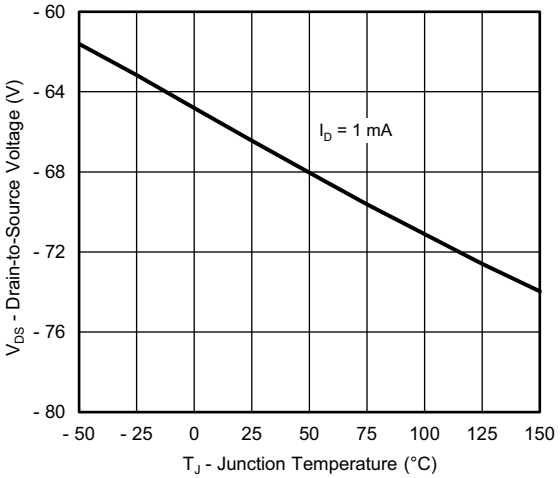


On-Resistance vs. Gate-to-Source Voltage

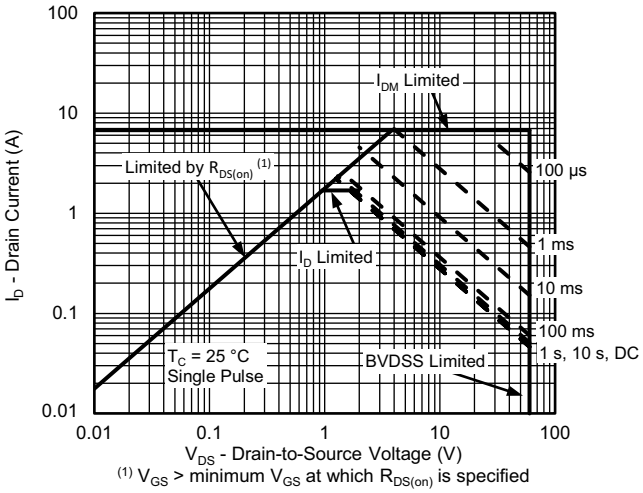


On-Resistance vs. Junction Temperature

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

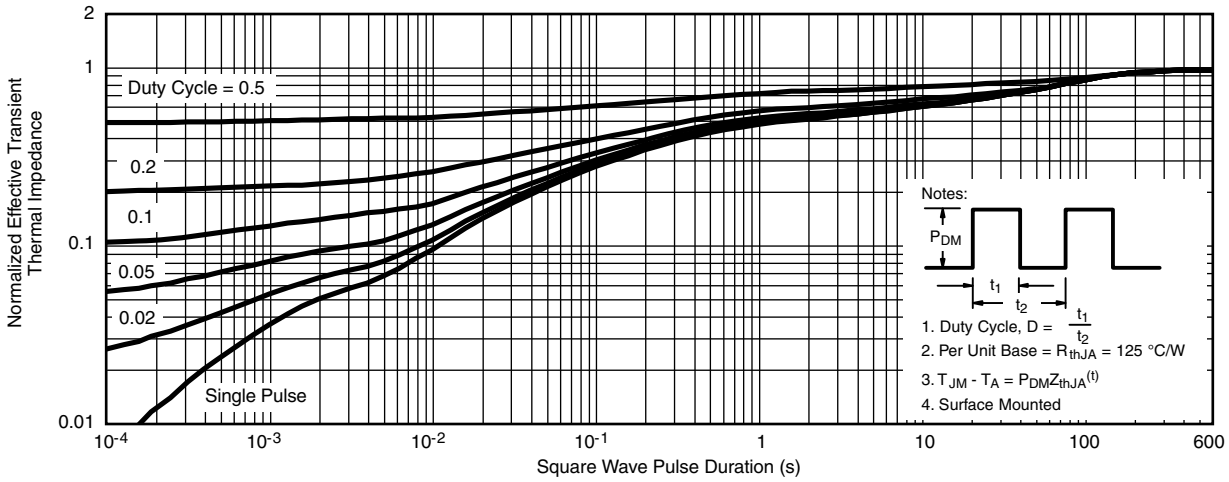


Drain Source Breakdown vs. Junction Temperature

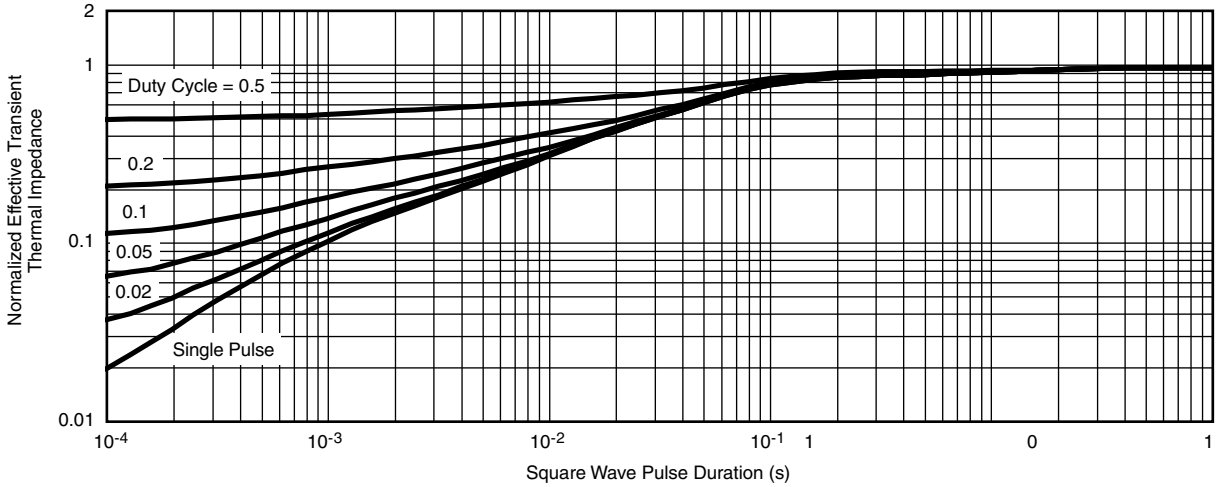


Safe Operating Area

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



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

Note

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Foot (25 °C)

  are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions

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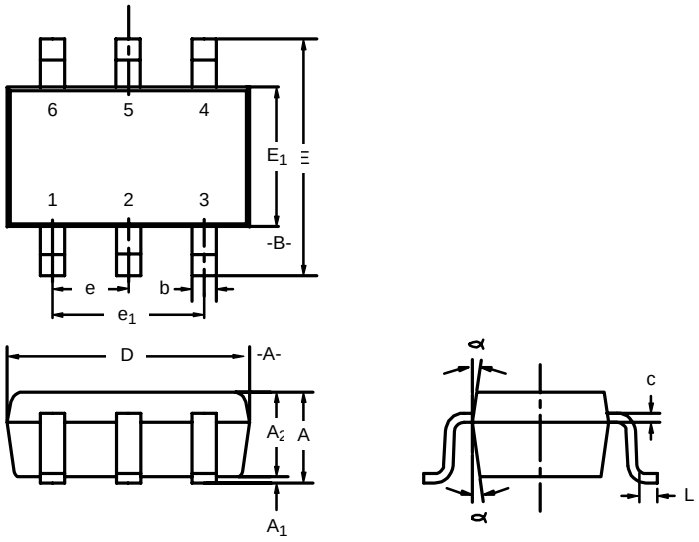
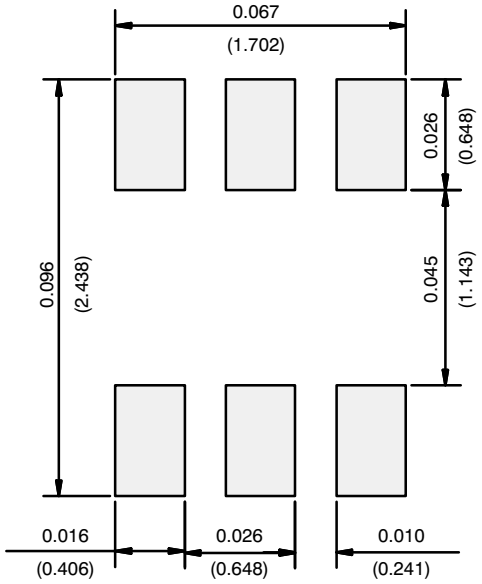
SC-70: 6-LEADS



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.90	–	1.10	0.035	–	0.043
A_1	–	–	0.10	–	–	0.004
A_2	0.80	–	1.00	0.031	–	0.039
b	0.15	–	0.30	0.006	–	0.012
c	0.10	–	0.25	0.004	–	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E_1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e_1	1.20	1.30	1.40	0.047	0.051	0.055
L	0.10	0.20	0.30	0.004	0.008	0.012
α	7°Nom			7°Nom		

ECN: S-03946—Rev. B, 09-Jul-01
DWG: 5550

RECOMMENDED MINIMUM PADS FOR SC-70: 6-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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