

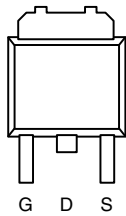
## P-Channel 40-V (D-S) MOSFET

**PRODUCT SUMMARY**

$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 40	0.005 at $V_{GS} = -10$ V	- 110	185 nC

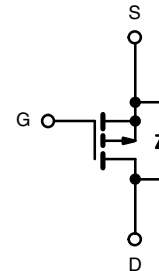
**FEATURES**

- TrenchFET<sup>®</sup> Power MOSFET


**RoHS  
COMPLIANT**
**TO-263**


Top View

Drain Connected to Tab



P-Channel MOSFET

**Ordering Information:** SUM110P04-05-E3 (Lead (Pb)-free)

**ABSOLUTE MAXIMUM RATINGS**  $T_A = 25$  °C, unless otherwise noted

Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	- 40	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current ( $T_J = 175$ °C)	$I_D$	$T_C = 25$ °C	- 110 <sup>a</sup>	
		$T_C = 70$ °C	- 110 <sup>a</sup>	
		$T_A = 25$ °C	39 <sup>b, c</sup>	
		$T_A = 70$ °C	33 <sup>b, c</sup>	
Pulsed Drain Current	$I_{DM}$	240	A	
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C		110
		$T_A = 25$ °C		10 <sup>b, c</sup>
Avalanche Current	$I_{AS}$	75		mJ
Single-Pulse Avalanche Energy	$E_{AS}$	281		
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	375	
		$T_C = 70$ °C	262	
		$T_A = 25$ °C	15 <sup>b, c</sup>	
		$T_A = 70$ °C	10.5 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 175	°C	
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260		

**THERMAL RESISTANCE RATINGS**

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	$R_{thJA}$	8	10	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	0.33	0.4	

Notes:

a. Package limited.

b. Surface Mounted on 1" x 1" FR4 board.

 c.  $t = 10$  s.

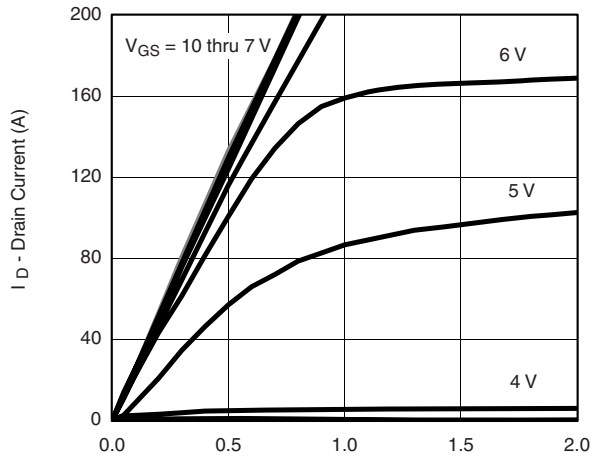
d. Maximum under Steady State conditions is 40 °C/W.

SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-40			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		-40		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-5.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-2	-3	-4	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = -10\text{ V}$	-120			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -20\text{ A}$		0.0041	0.005	$\Omega$
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -20\text{ A}$		75		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		11300		pF
Output Capacitance	$C_{oss}$			1510		
Reverse Transfer Capacitance	$C_{rss}$			1000		
Total Gate Charge	$Q_g$	$V_{DS} = -20\text{ V}, V_{GS} = -10\text{ V}, I_D = -110\text{ A}$		185	280	nC
Gate-Source Charge	$Q_{gs}$			48		
Gate-Drain Charge	$Q_{gd}$			42		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		4.0		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -20\text{ V}, R_L = 0.18\text{ }\Omega$ $I_D \cong -110\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		25	40	ns
Rise Time	$t_r$			290	440	
Turn-Off Delay Time	$t_{d(off)}$			110	165	
Fall Time	$t_f$			35	55	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			-110	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				-240	
Body Diode Voltage	$V_{SD}$	$I_S = -20\text{ A}$		-0.8	-1.5	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		70	105	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			130	200	nC
Reverse Recovery Fall Time	$t_a$			37		ns
Reverse Recovery Rise Time	$t_b$			33		

## 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.

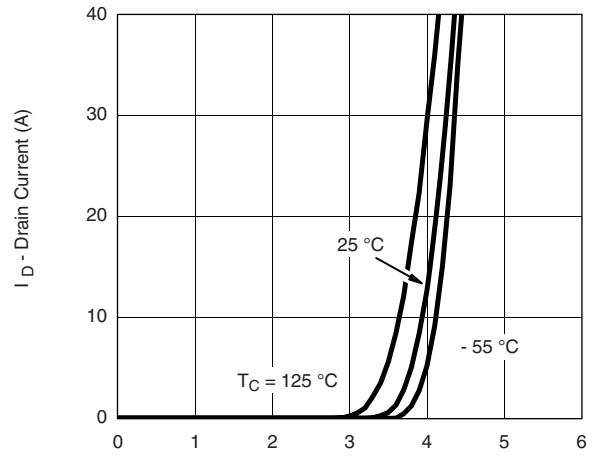
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted


$V_{GS} = 10$  thru  $7$  V

$I_D$  - Drain Current (A)

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

**Output Characteristics**

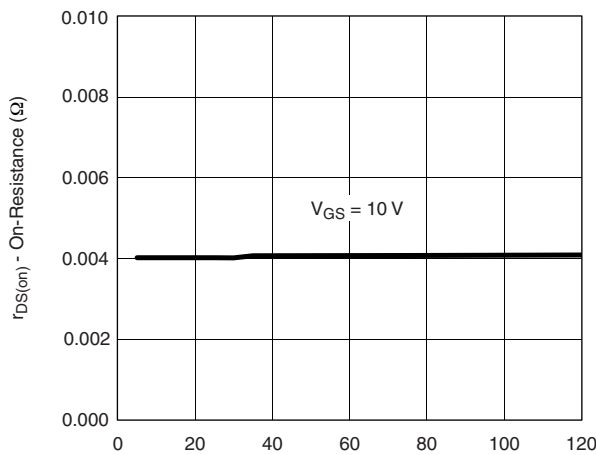


$T_C = 125$  °C

$I_D$  - Drain Current (A)

$V_{GS}$  - Gate-to-Source Voltage (V)

**Transfer Characteristics**

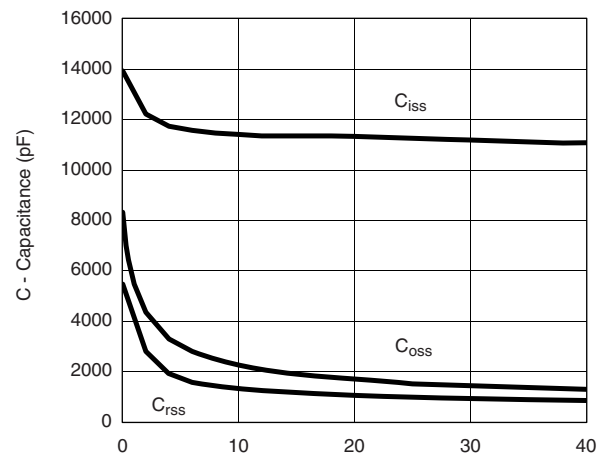


$V_{GS} = 10$  V

$r_{DS(on)}$  - On-Resistance ( $\Omega$ )

$I_D$  - Drain Current (A)

**On-Resistance vs. Drain Current**



$C_{iss}$

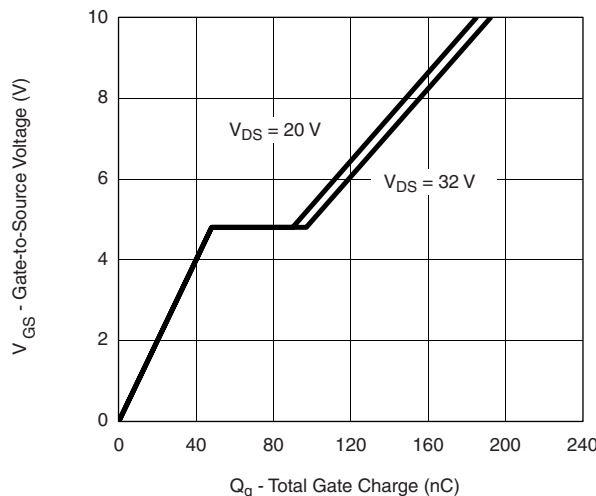
$C_{oss}$

$C_{rss}$

$C$  - Capacitance (pF)

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

**Capacitance**



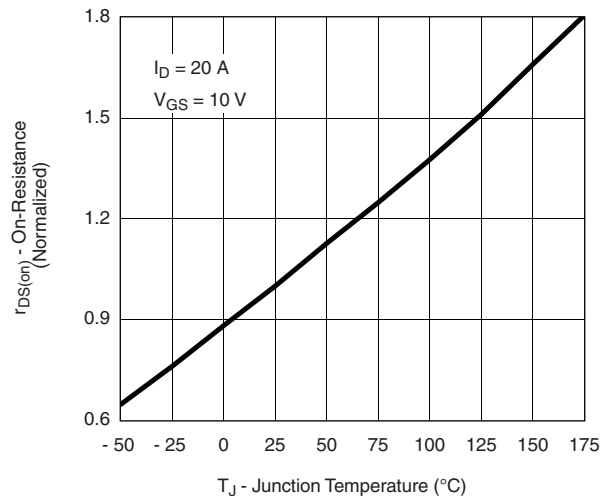
$V_{GS}$  - Gate-to-Source Voltage (V)

$V_{DS} = 20$  V

$V_{DS} = 32$  V

$Q_g$  - Total Gate Charge (nC)

**Gate Charge**



$I_D = 20$  A

$V_{GS} = 10$  V

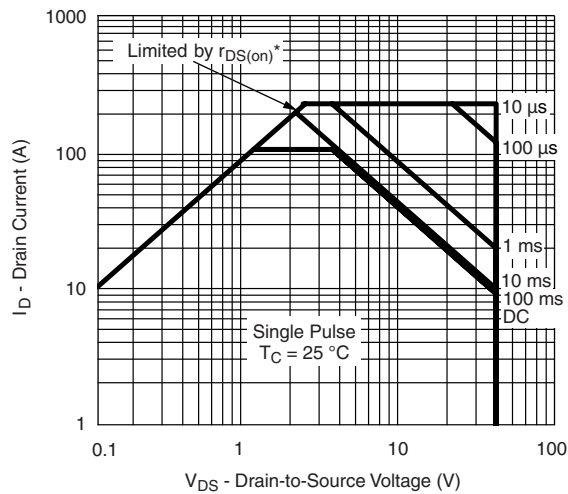
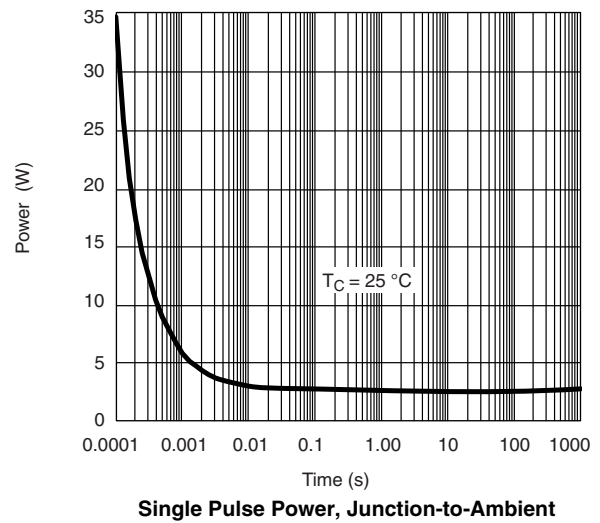
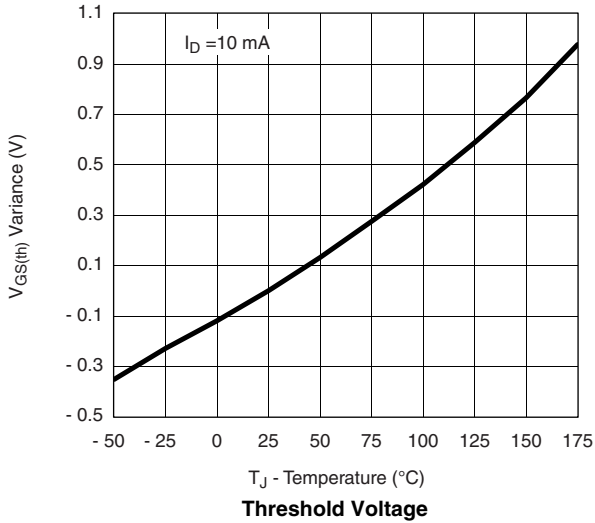
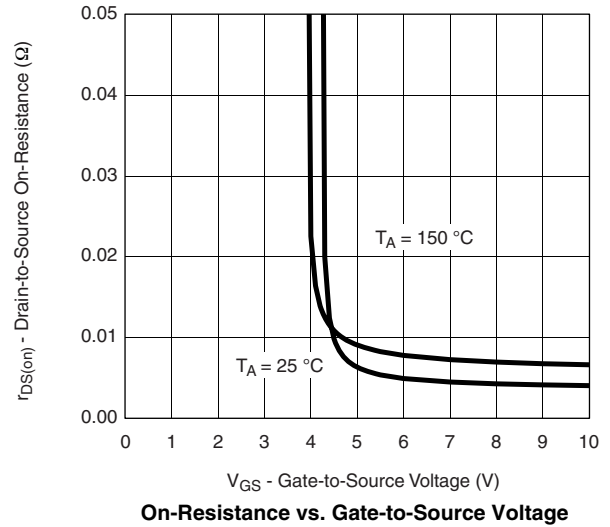
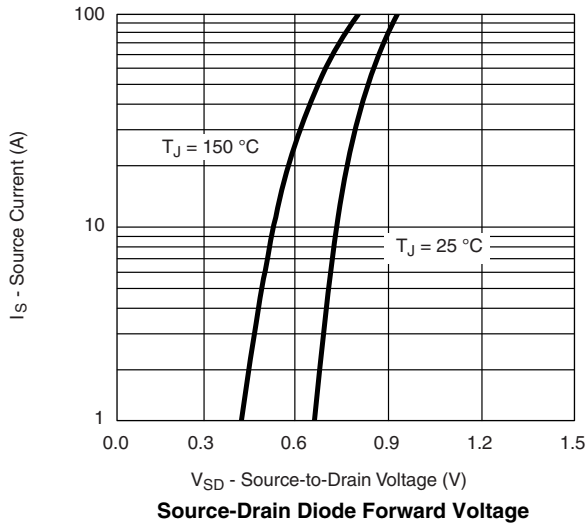
$r_{DS(on)}$  - On-Resistance (Normalized)

$T_J$  - Junction Temperature ( $^{\circ}$ C)

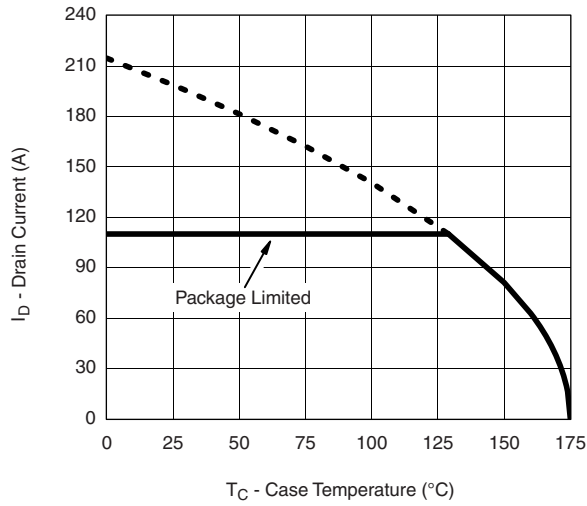
**On-Resistance vs. Junction Temperature**



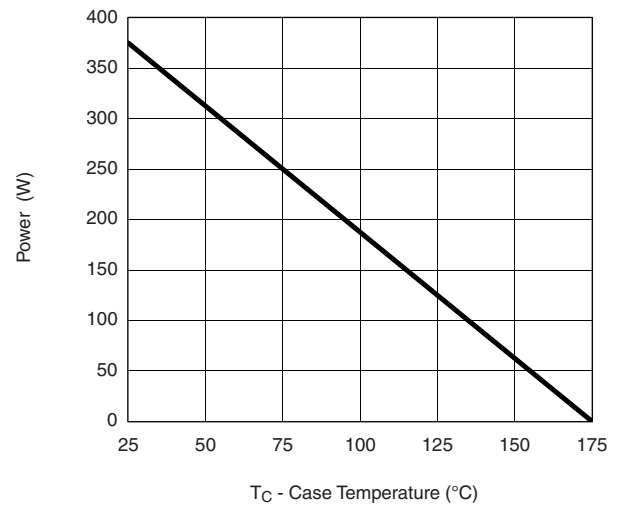
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



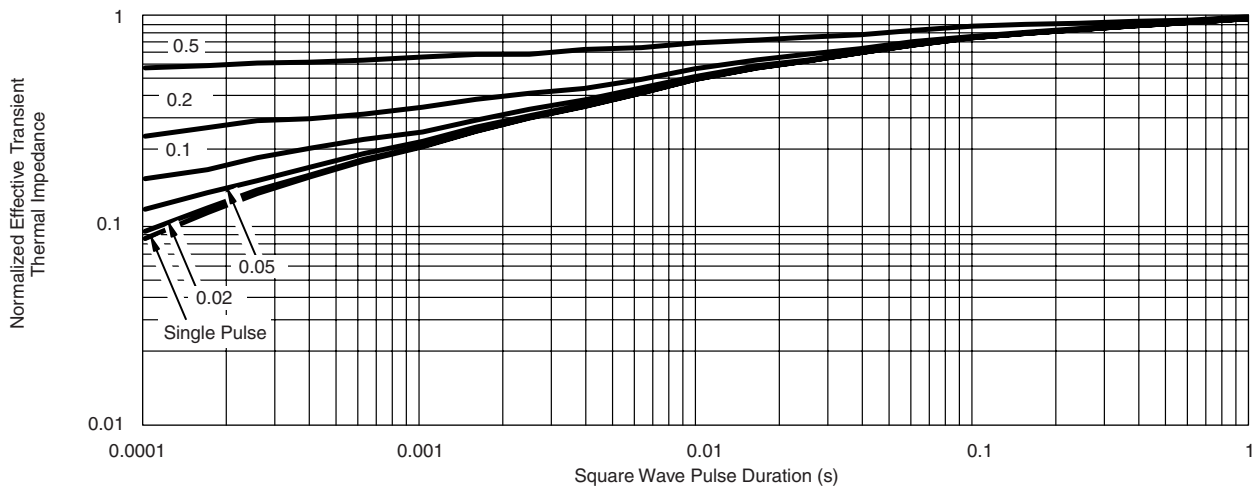
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**Max. Avalanche and Drain Current vs. Case Temperature\***



**Power Derating, Junction-to-Case**



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

\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 175\text{ °C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper power 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.

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# TO-263 (D<sup>2</sup>PAK): 3-LEAD



DIM.	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	0.160	0.190	4.064	4.826	
b	0.020	0.039	0.508	0.990	
b1	0.020	0.035	0.508	0.889	
b2	0.045	0.055	1.143	1.397	
c*	Thin lead	0.013	0.018	0.330	0.457
	Thick lead	0.023	0.028	0.584	0.711
c1	Thin lead	0.013	0.017	0.330	0.431
	Thick lead	0.023	0.027	0.584	0.685
c2	0.045	0.055	1.143	1.397	
D	0.340	0.380	8.636	9.652	
D1	0.220	0.240	5.588	6.096	
D2	0.038	0.042	0.965	1.067	
D3	0.045	0.055	1.143	1.397	
D4	0.044	0.052	1.118	1.321	
E	0.380	0.410	9.652	10.414	
E1	0.245	-	6.223	-	
E2	0.355	0.375	9.017	9.525	
E3	0.072	0.078	1.829	1.981	
e	0.100 BSC		2.54 BSC		
K	0.045	0.055	1.143	1.397	
L	0.575	0.625	14.605	15.875	
L1	0.090	0.110	2.286	2.794	
L2	0.040	0.055	1.016	1.397	
L3	0.050	0.070	1.270	1.778	
L4	0.010 BSC		0.254 BSC		
M	-	0.002	-	0.050	
ECN: T13-0707-Rev. K, 30-Sep-13					
DWG: 5843					

**Notes**

- Plane B includes maximum features of heat sink tab and plastic.
- No more than 25 % of L1 can fall above seating plane by max. 8 mils.
- Pin-to-pin coplanarity max. 4 mils.
- \*: Thin lead is for SUB, SYB.  
Thick lead is for SUM, SYM, SQM.
- Use inches as the primary measurement.
- This feature is for thick lead.

**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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