

## N-Channel 55-V (D-S), 175 °C MOSFET

| PRODUCT SUMMARY   |                            |           |             |
|-------------------|----------------------------|-----------|-------------|
| $V_{(BR)DSS}$ (V) | $r_{DS(on)}$ ( $\Omega$ )  | $I_D$ (A) | $Q_g$ (Typ) |
| 55                | 0.006 at $V_{GS} = 10$ V   | 110       | 65          |
|                   | 0.0085 at $V_{GS} = 4.5$ V | 92        |             |

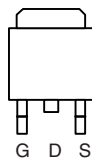
### FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- 175 °C Junction Temperature
- Low Thermal Resistance Package


 Available  
**RoHS\***  
 COMPLIANT

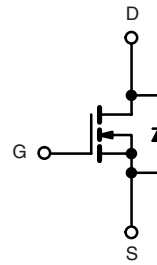
### APPLICATIONS

- Industrial

**TO-263**


Top View

Ordering Information: SUM110N05-06L  
 SUM110N05-06L-E3 (Lead (Pb)-free)



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted |                            |                |                  |      |
|--|----------------------------|----------------|------------------|------|
| Parameter  |                            | Symbol         | Limit            | Unit |
| Drain-Source Voltage   |                            | $V_{DS}$       | 55               | V    |
| Gate-Source Voltage  |                            | $V_{GS}$       | $\pm 20$         |      |
| Continuous Drain Current ( $T_J = 175$ °C)                     | $T_C = 25$ °C              | $I_D$          | 110              | A    |
|  | $T_C = 125$ °C             |                | 63               |      |
| Pulsed Drain Current   |                            | $I_{DM}$       | 240              |      |
| Avalanche Current  |                            | $I_{AR}$       | 60               |      |
| Repetitive Avalanche Energy <sup>a</sup>                       | L = 0.1 mH                 | $E_{AR}$       | 180              | mJ   |
| Maximum Power Dissipation                                      | $T_C = 25$ °C              | $P_D$          | 158 <sup>b</sup> | W    |
|  | $T_A = 25$ °C <sup>c</sup> |                | 3.7              |      |
| Operating Junction and Storage Temperature Range               |                            | $T_J, T_{stg}$ | - 55 to 175      | °C   |

| THERMAL RESISTANCE RATINGS |                        |            |            |      |
|----------------------------|------------------------|------------|------------|------|
| Parameter                  |                        | Symbol     | Limit      | Unit |
| Junction-to-Ambient        | PCB Mount <sup>c</sup> | $R_{thJA}$ | 40         | °C/W |
| Junction-to-Case           |                        |            | $R_{thJC}$ |      |

Notes:

- Duty cycle  $\leq 1$  %.
- See SOA curve for voltage derating.
- When Mounted on 1" square PCB (FR-4 material).

\* Pb containing terminations are not RoHS compliant, exemptions may apply.

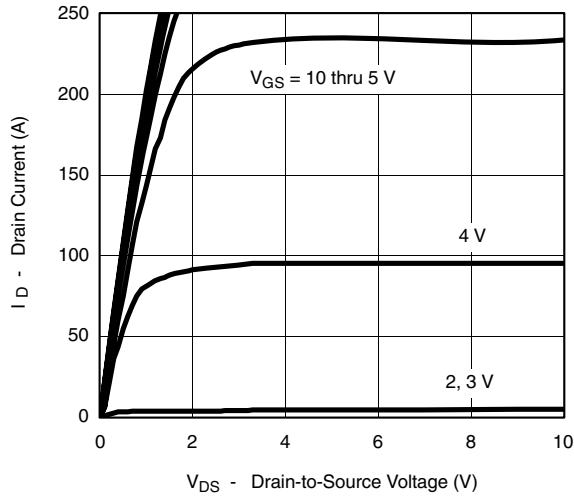
| <b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted                     |               |  |      |        |           |               |
|---|---------------|--|------|--------|-----------|---------------|
| Parameter   | Symbol        | Test Conditions  | Min. | Typ.   | Max.      | Unit          |
| <b>Static</b>   |               |  |      |        |           |               |
| Drain-Source Breakdown Voltage  | $V_{(BR)DSS}$ | $V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$  | 55   |        |           | V             |
| Gate-Threshold Voltage  | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$  | 1    |        | 3         |               |
| Gate-Body Leakage   | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$  |      |        | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{DS} = 55\text{ V}, V_{GS} = 0\text{ V}$  |      |        | 1         | $\mu\text{A}$ |
|   |               | $V_{DS} = 55\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$   |      |        | 50        |               |
|   |               | $V_{DS} = 55\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$   |      |        | 250       |               |
| 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>   | $r_{DS(on)}$  | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}$  |      | 0.0047 | 0.006     | $\Omega$      |
|   |               | $V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$   |      | 0.0066 | 0.0085    |               |
|   |               | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}, T_J = 125\text{ }^\circ\text{C}$   |      |        | 0.0102    |               |
|   |               | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}, T_J = 175\text{ }^\circ\text{C}$   |      |        | 0.0132    |               |
| Forward Transconductance <sup>a</sup>   | $g_{fs}$      | $V_{DS} = 15\text{ V}, I_D = 30\text{ A}$  | 30   |        |           | S             |
| <b>Dynamic<sup>b</sup></b>  |               |  |      |        |           |               |
| Input Capacitance   | $C_{iss}$     | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$  |      | 3300   |           | $\mu\text{F}$ |
| Output Capacitance  | $C_{oss}$     |  |      | 625    |           |               |
| Reverse Transfer Capacitance  | $C_{rss}$     |  |      | 310    |           |               |
| Total Gate Charge <sup>c</sup>  | $Q_g$         | $V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 110\text{ A}$   |      | 65     | 100       | nC            |
| Gate-Source Charge <sup>c</sup>   | $Q_{gs}$      |  |      | 15     |           |               |
| Gate-Drain Charge <sup>c</sup>  | $Q_{gd}$      |  |      | 16     |           |               |
| Turn-On Delay Time <sup>c</sup>   | $t_{d(on)}$   | $V_{DD} = 30\text{ V}, R_L = 0.27\text{ }\Omega$<br>$I_D \cong 110\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$ |      | 15     | 25        | ns            |
| Rise Time <sup>c</sup>  | $t_r$         |  |      | 15     | 25        |               |
| Turn-Off Delay Time <sup>c</sup>  | $t_{d(off)}$  |  |      | 35     | 55        |               |
| Fall Time <sup>c</sup>  | $t_f$         |  |      | 15     | 25        |               |
|   |               |  |      |        |           |               |
| <b>Source-Drain Diode Ratings and Characteristics</b> $T_C = 25\text{ }^\circ\text{C}$ <sup>b</sup> |               |  |      |        |           |               |
| Continuous Current  | $I_S$         |  |      |        | 110       | A             |
| Pulsed Current  | $I_{SM}$      |  |      |        | 240       |               |
| Forward Voltage <sup>a</sup>  | $V_{SD}$      | $I_F = 110\text{ A}, V_{GS} = 0\text{ V}$  |      | 1.0    | 1.5       | V             |
| Reverse Recovery Time   | $t_{rr}$      | $I_F = 110\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$   |      | 70     | 125       | ns            |
| Peak Reverse Recovery Charge  | $I_{RM(REC)}$ |  |      | 2.5    | 5         | A             |
| Reverse Recovery Charge   | $Q_{rr}$      |  |      | 0.09   | 0.31      | $\mu\text{C}$ |

Notes:

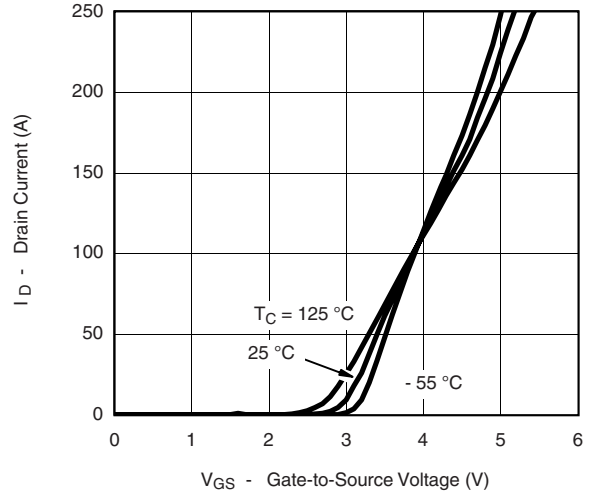
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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.

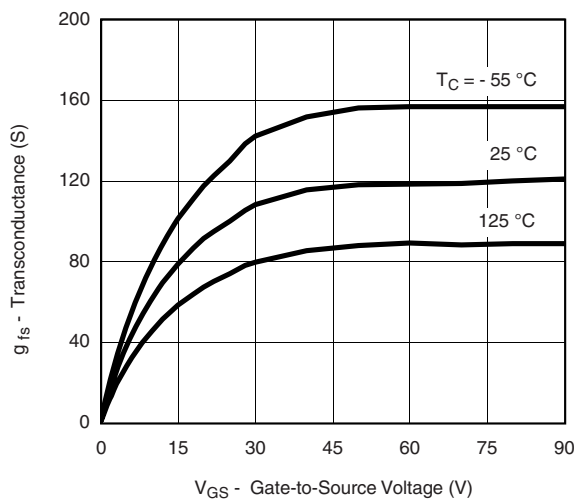
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



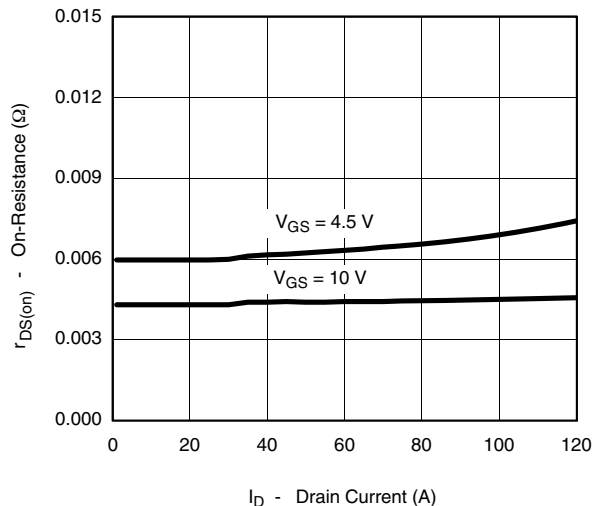
**Output Characteristics**



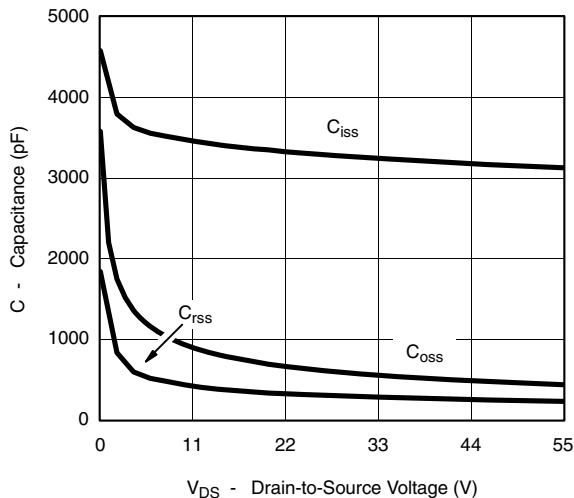
**Transfer Characteristics**



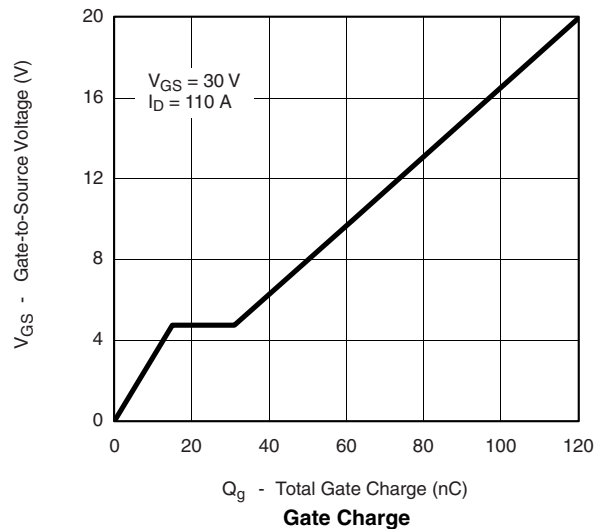
**Transconductance**



**On-Resistance vs. Drain Current**

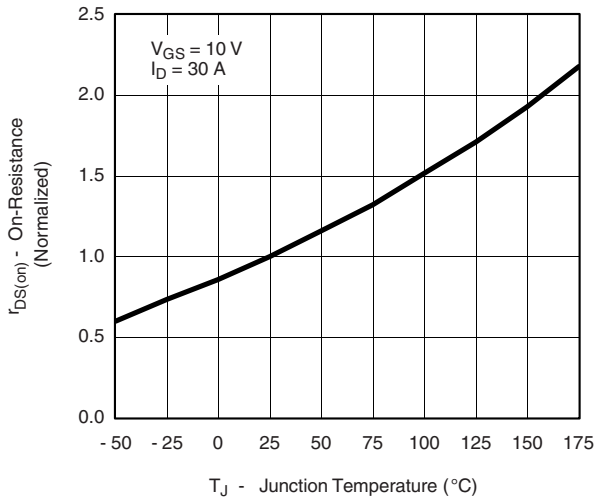


**Capacitance**

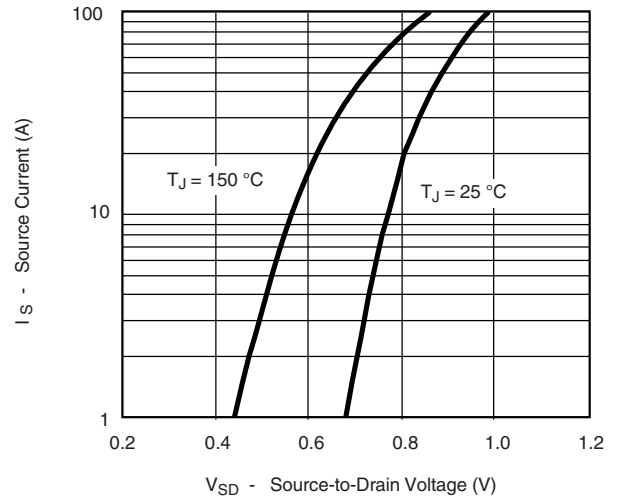


**Gate Charge**

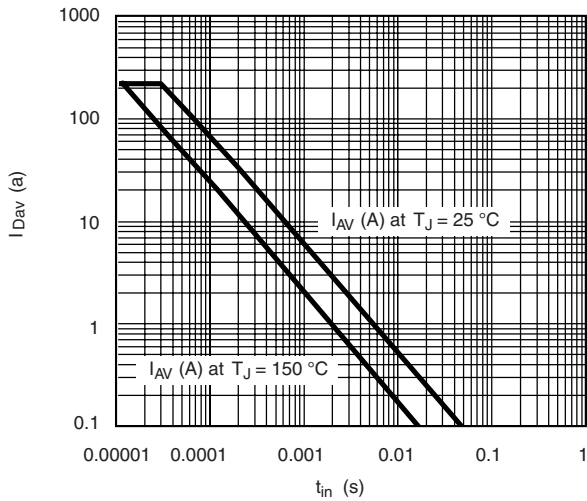
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



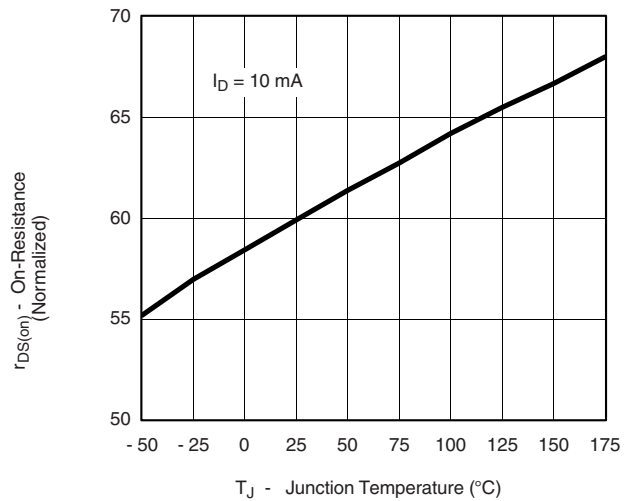
**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**

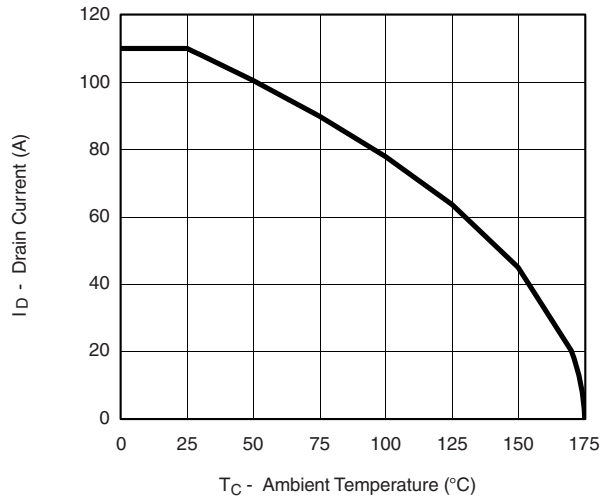


**Avalanche Current vs. Time**

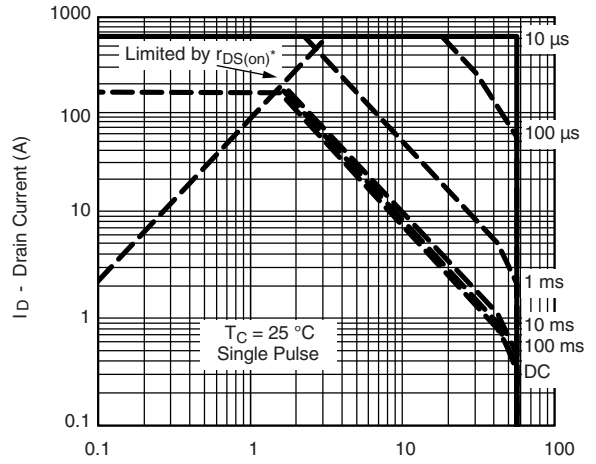


**On-Resistance vs. Junction Temperature**

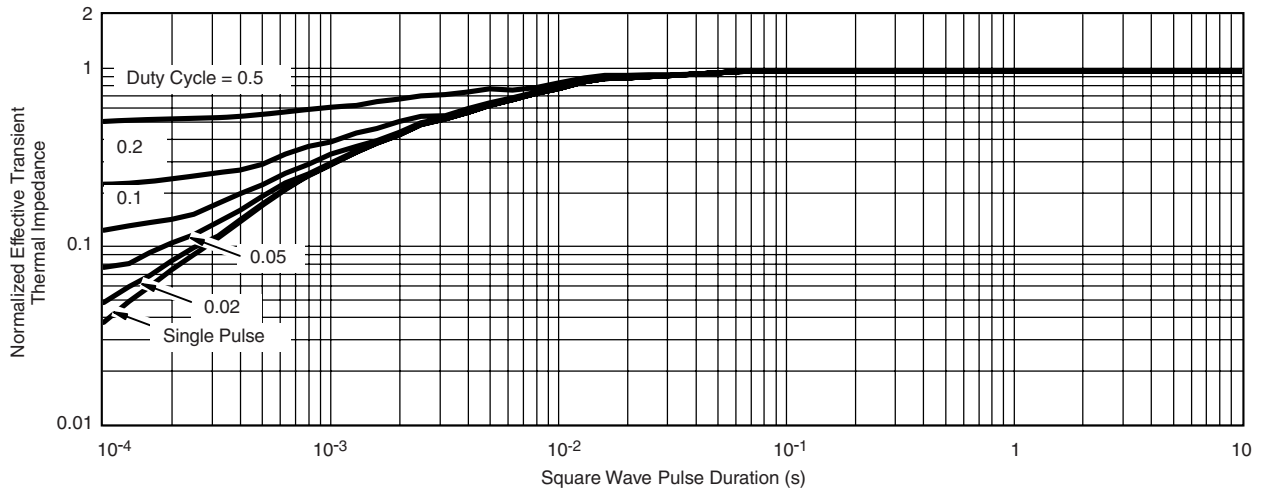
**THERMAL RATINGS**



$T_C$  - Ambient Temperature (°C)  
**Maximum Drain Current vs. Case Temperature**



$V_{DS}$  - Drain-to-Source Voltage (V)  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified  
**Safe Operating Area**



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

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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  |       |
| 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: T10-0738-Rev. J, 03-Jan-11  
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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