

## L3502S-VB Datasheet

### N-Channel 20-V (D-S),175°C MOSFET



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

| PRODUCT SUMMARY   |                           |                        |
|-------------------|---------------------------|------------------------|
| $V_{(BR)DSS}$ (V) | $r_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) <sup>a</sup> |
| 20                | 0.006 @ $V_{GS} = 4.5$ V  | 85                     |
|                   | 0.009 @ $V_{GS} = 2.5$ V  | 85                     |

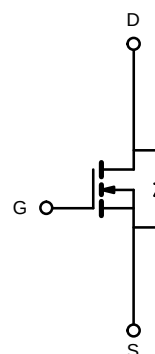
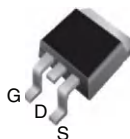
#### FEATURES

- Trench Power MOSFET
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2011/65/EU

#### APPLICATIONS

- OR-ing
- Server
- DC/DC

D<sup>2</sup>PAK (TO-263)



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED) |                           |                |                  |                  |
|-----------------------------------------------------------------------------|---------------------------|----------------|------------------|------------------|
| Parameter                                                                   |                           | Symbol         | Limit            | Unit             |
| Drain-Source Voltage                                                        |                           | $V_{DS}$       | 20               | V                |
| Gate-Source Voltage                                                         |                           | $V_{GS}$       | $\pm 12$         |                  |
| Continuous Drain Current ( $T_J = 175^\circ\text{C}$ )                      | $T_C = 25^\circ\text{C}$  | $I_D$          | 85 <sup>a</sup>  | A                |
|                                                                             | $T_C = 100^\circ\text{C}$ |                | 75               |                  |
| Pulsed Drain Current                                                        |                           | $I_{DM}$       | 240              |                  |
| Avalanche Current                                                           |                           | $I_{AR}$       | 30               |                  |
| Repetitive Avalanche Energy <sup>b</sup>                                    |                           | $E_{AR}$       | 45               | mJ               |
| Power Dissipation                                                           |                           | $P_D$          | 120 <sup>a</sup> | W                |
| Operating Junction and Storage Temperature Range                            |                           | $T_J, T_{stg}$ | -55 to 175       | $^\circ\text{C}$ |

| THERMAL RESISTANCE RATINGS |                                 |            |       |                    |
|----------------------------|---------------------------------|------------|-------|--------------------|
| Parameter                  |                                 | Symbol     | Limit | Unit               |
| Junction-to-Ambient        | PCB Mount (TO-263) <sup>c</sup> | $R_{thJA}$ | 40    | $^\circ\text{C/W}$ |
|                            | Free Air (TO-220AB)             |            | 62.5  |                    |
| Junction-to-Case           |                                 | $R_{thJC}$ | 1.25  |                    |

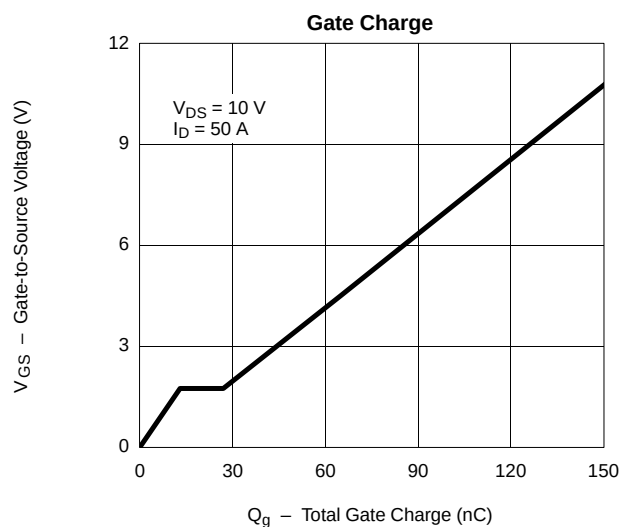
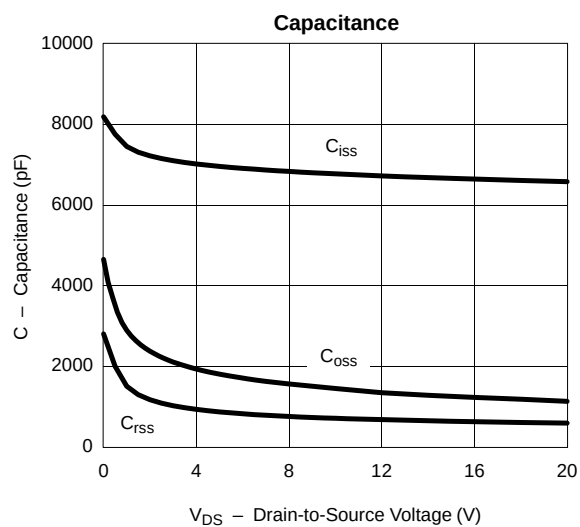
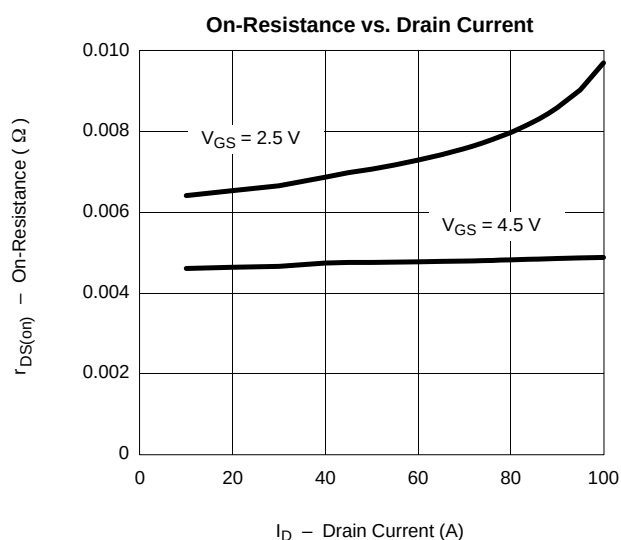
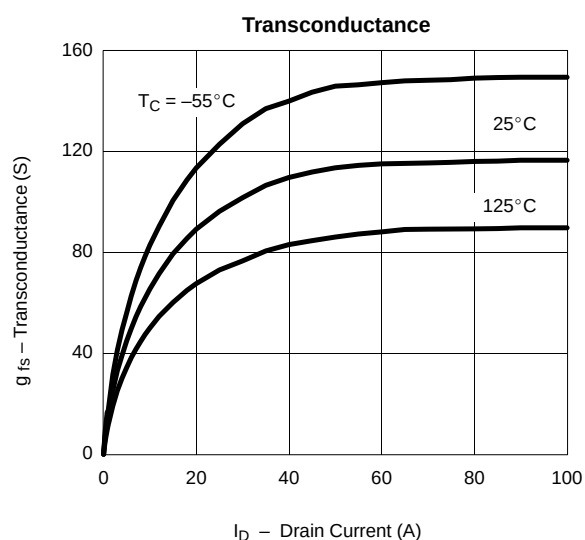
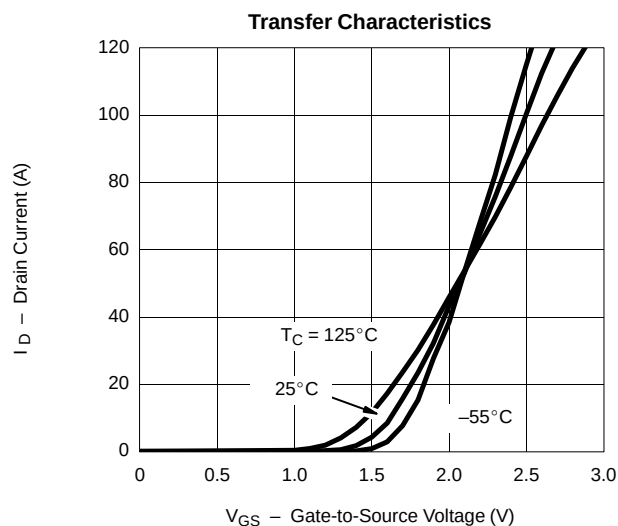
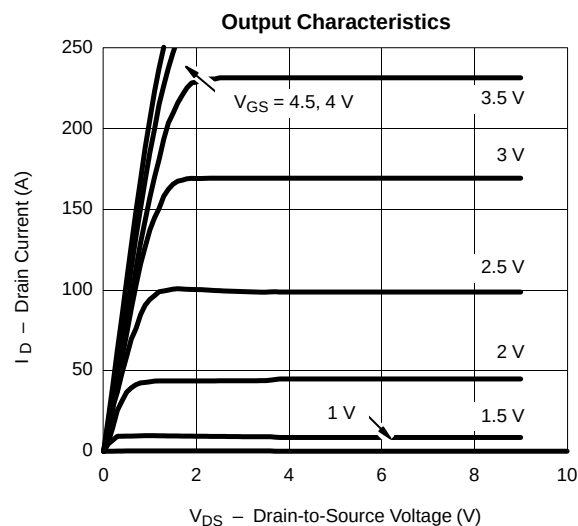
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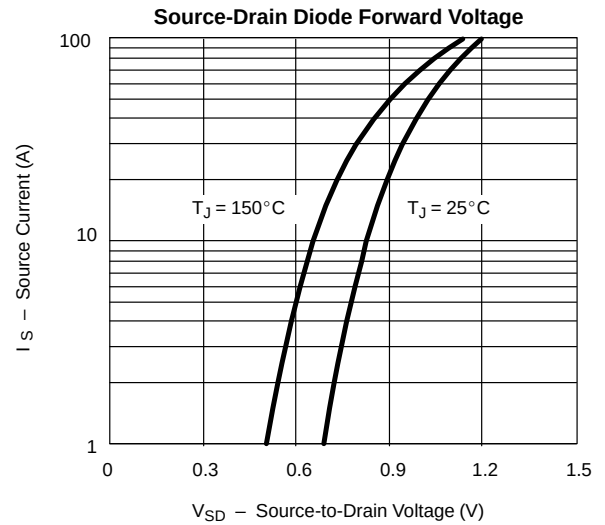
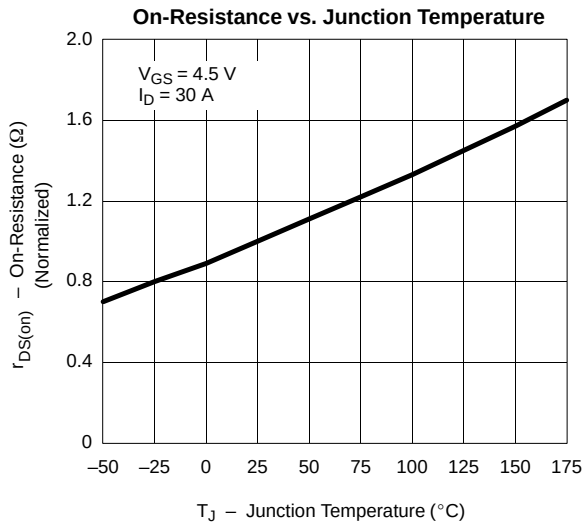
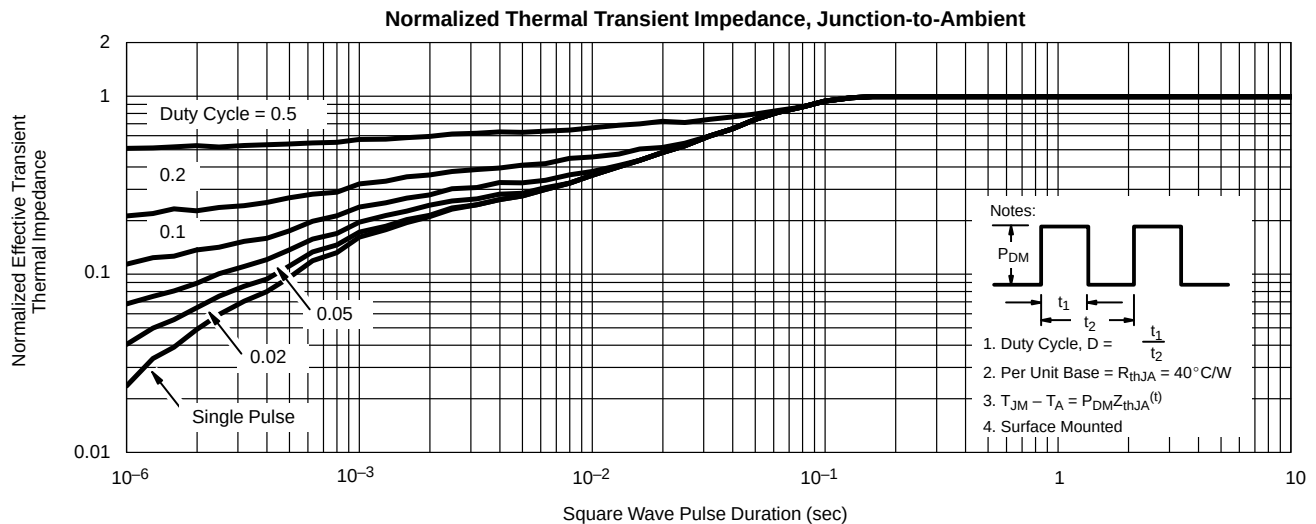
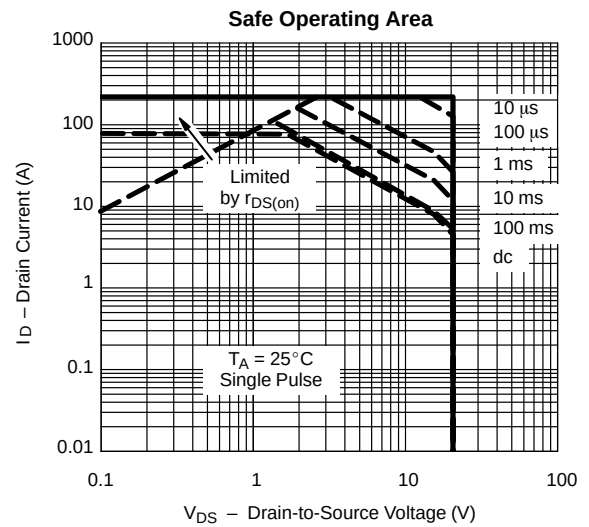
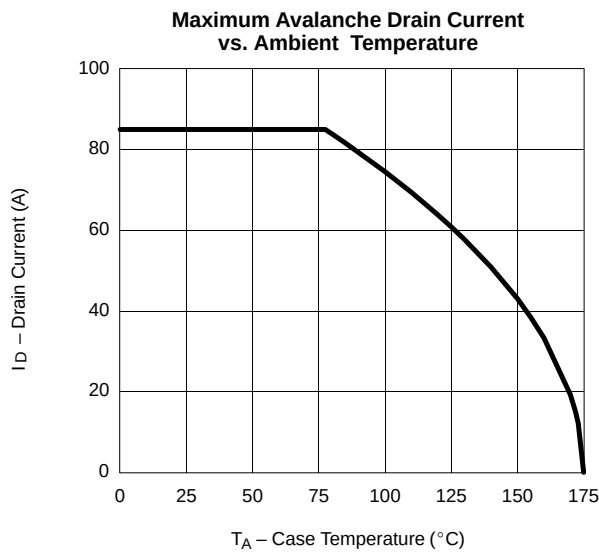
- See SOA curve for voltage derating.
- Duty cycle  $\leq 1\%$ .
- When mounted on 1" square PCB (FR-4 material).

| MOSFET SPECIFICATIONS (T <sub>J</sub> =25 °C UNLESS OTHERWISE NOTED)                 |                      |                                                                                                                            |     |        |       |      |
|--------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------|-----|--------|-------|------|
| Parameter                                                                            | Symbol               | Test Condition                                                                                                             | Min | Typ    | Max   | Unit |
| Static                                                                               |                      |                                                                                                                            |     |        |       |      |
| Drain-Source Breakdown Voltage                                                       | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                             | 20  |        |       | V    |
| Gate Threshold Voltage                                                               | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>DS</sub> = 250 μA                                                               | 0.6 |        |       |      |
| Gate-Body Leakage                                                                    | I <sub>GSS</sub>     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 12 V                                                                            |     |        | ± 100 | nA   |
| Zero Gate Voltage Drain Current                                                      | I <sub>DSS</sub>     | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V                                                                              |     |        | 1     | μA   |
|                                                                                      |                      | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C                                                      |     |        | 50    |      |
|                                                                                      |                      | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175°C                                                      |     |        | 150   |      |
| On-State Drain Current <sup>a</sup>                                                  | I <sub>D(on)</sub>   | V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 4.5 V                                                                             | 120 |        |       | A    |
| Drain-Source On-State Resistance <sup>a</sup>                                        | r <sub>DS(on)</sub>  | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 30 A                                                                             |     | 0.006  |       | Ω    |
|                                                                                      |                      | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 30 A, T <sub>J</sub> = 125°C                                                     |     | 0.009  |       |      |
|                                                                                      |                      | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 30 A, T <sub>J</sub> = 175°C                                                     |     | 0.0111 |       |      |
|                                                                                      |                      | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 20 A                                                                             |     | 0.009  |       |      |
| Forward Transconductance <sup>a</sup>                                                | g <sub>fs</sub>      | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 30 A                                                                               | 20  |        |       | S    |
| Dynamic <sup>b</sup>                                                                 |                      |                                                                                                                            |     |        |       |      |
| Input Capacitance                                                                    | C <sub>iss</sub>     | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 20 V, f = 1 MHz                                                                   |     | 6600   |       | pF   |
| Output Capacitance                                                                   | C <sub>oss</sub>     |                                                                                                                            |     | 1150   |       |      |
| Reversen Transfer Capacitance                                                        | C <sub>rss</sub>     |                                                                                                                            |     | 600    |       |      |
| Total Gate Charge <sup>c</sup>                                                       | Q <sub>g</sub>       | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 85 A                                                     |     | 65     | 130   | nC   |
| Gate-Source Charge <sup>c</sup>                                                      | Q <sub>gs</sub>      |                                                                                                                            |     | 13     |       |      |
| Gate-Drain Charge <sup>c</sup>                                                       | Q <sub>gd</sub>      |                                                                                                                            |     | 14     |       |      |
| Turn-On Delay Time <sup>c</sup>                                                      | t <sub>d(on)</sub>   | V <sub>DD</sub> = 10 V, R <sub>L</sub> = 0.12 Ω<br>I <sub>D</sub> ≈ 85 A, V <sub>GEN</sub> = 4.5 V, R <sub>G</sub> = 2.5 Ω |     | 25     | 40    | ns   |
| Rise Time <sup>c</sup>                                                               | t <sub>r</sub>       |                                                                                                                            |     | 120    | 180   |      |
| Turn-Off Delay Time <sup>c</sup>                                                     | t <sub>d(off)</sub>  |                                                                                                                            |     | 80     | 120   |      |
| Fall Time <sup>c</sup>                                                               | t <sub>f</sub>       |                                                                                                                            |     | 100    | 150   |      |
| Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C) <sup>b</sup> |                      |                                                                                                                            |     |        |       |      |
| Pulsed Current                                                                       | I <sub>SM</sub>      |                                                                                                                            |     |        | 240   | A    |
| Forward Voltage <sup>a</sup>                                                         | V <sub>SD</sub>      | I <sub>F</sub> = 100 A, V <sub>GS</sub> = 0 V                                                                              |     | 1.2    | 1.5   | V    |
| Reverse Recovery Time                                                                | t <sub>rr</sub>      | I <sub>F</sub> = 50 A, di/dt = 100 A/μs                                                                                    |     | 45     | 100   | ns   |

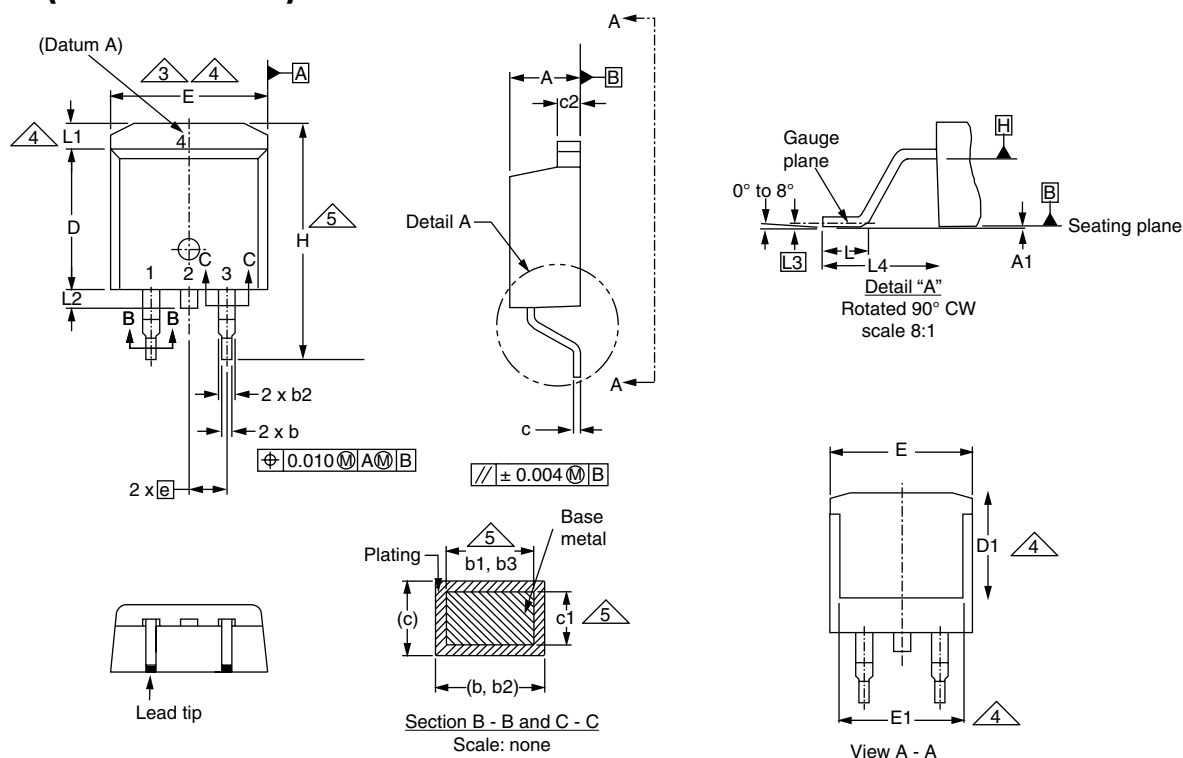
Notes:

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

**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**


**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

**THERMAL RATINGS**


## TO-263AB (HIGH VOLTAGE)



|      | MILLIMETERS |      | INCHES |       |
|------|-------------|------|--------|-------|
| DIM. | MIN.        | MAX. | MIN.   | MAX.  |
| A    | 4.06        | 4.83 | 0.160  | 0.190 |
| A1   | 0.00        | 0.25 | 0.000  | 0.010 |
| b    | 0.51        | 0.99 | 0.020  | 0.039 |
| b1   | 0.51        | 0.89 | 0.020  | 0.035 |
| b2   | 1.14        | 1.78 | 0.045  | 0.070 |
| b3   | 1.14        | 1.73 | 0.045  | 0.068 |
| c    | 0.38        | 0.74 | 0.015  | 0.029 |
| c1   | 0.38        | 0.58 | 0.015  | 0.023 |
| c2   | 1.14        | 1.65 | 0.045  | 0.065 |
| D    | 8.38        | 9.65 | 0.330  | 0.380 |

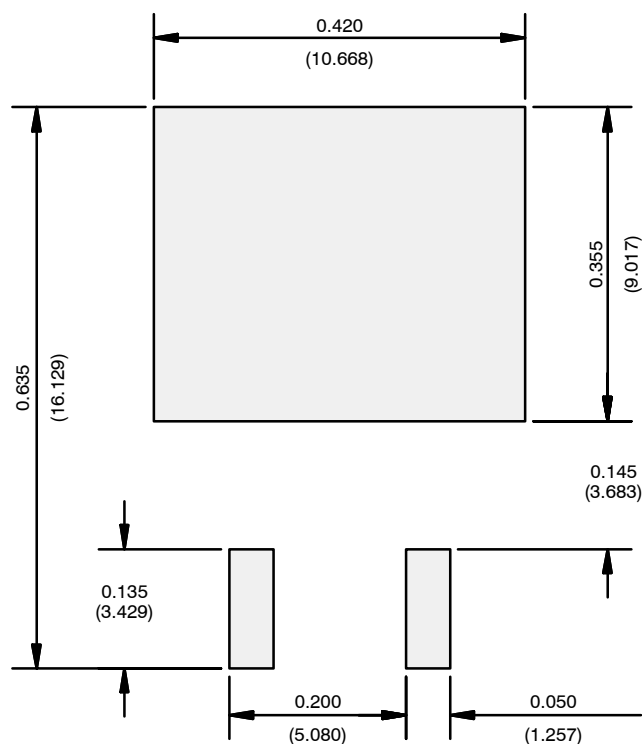
|      | MILLIMETERS |       | INCHES    |       |
|------|-------------|-------|-----------|-------|
| DIM. | MIN.        | MAX.  | MIN.      | MAX.  |
| D1   | 6.86        | -     | 0.270     | -     |
| E    | 9.65        | 10.67 | 0.380     | 0.420 |
| E1   | 6.22        | -     | 0.245     | -     |
| e    | 2.54 BSC    |       | 0.100 BSC |       |
| H    | 14.61       | 15.88 | 0.575     | 0.625 |
| L    | 1.78        | 2.79  | 0.070     | 0.110 |
| L1   | -           | 1.65  | -         | 0.066 |
| L2   | -           | 1.78  | -         | 0.070 |
| L3   | 0.25 BSC    |       | 0.010 BSC |       |
| L4   | 4.78        | 5.28  | 0.188     | 0.208 |

ECN: S-82110-Rev. A, 15-Sep-08  
DWG: 5970

## Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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