

# STD4NB25T4-VB Datasheet

## Power MOSFET

| PRODUCT SUMMARY           |                        |      |
|---------------------------|------------------------|------|
| $V_{DS}$ (V)              | 250                    |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.64 |
| $Q_g$ (Max.) (nC)         | 14                     |      |
| $Q_{gs}$ (nC)             | 2.7                    |      |
| $Q_{gd}$ (nC)             | 7.8                    |      |
| Configuration             | Single                 |      |

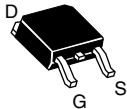
### FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Available in Tape and Reel
- Fast Switching
- Ease of Paralleling



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

**DPAK  
(TO-252)**



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted) |                         |                         |                                   |               |      |
|---|-------------------------|-------------------------|-----------------------------------|---------------|------|
| PARAMETER   |                         |                         | SYMBOL                            | LIMIT         | UNIT |
| Drain-Source Voltage  |                         |                         | V <sub>DS</sub>                   | 250           | V    |
| Gate-Source Voltage   |                         |                         | V <sub>GS</sub>                   | ± 20          |      |
| Continuous Drain Current  | V <sub>GS</sub> at 10 V | T <sub>C</sub> = 25 °C  | I <sub>D</sub>                    | 4.5           | A    |
|   |                         | T <sub>C</sub> = 100 °C |                                   | 3.0           |      |
| Pulsed Drain Current <sup>a</sup>   |                         |                         | I <sub>DM</sub>                   | 16            | W/°C |
| Linear Derating Factor  |                         |                         |                                   | 0.33          |      |
| Linear Derating Factor (PCB Mount) <sup>e</sup>                           |                         |                         |                                   | 0.020         |      |
| Single Pulse Avalanche Energy <sup>b</sup>                                |                         |                         | E <sub>AS</sub>                   | 130           | mJ   |
| Repetitive Avalanche Current <sup>a</sup>                                 |                         |                         | I <sub>AR</sub>                   | 4.5           | A    |
| Repetitive Avalanche Energy <sup>a</sup>                                  |                         |                         | E <sub>AR</sub>                   | 5.2           | mJ   |
| Maximum Power Dissipation   | T <sub>C</sub> = 25 °C  |                         | P <sub>D</sub>                    | 45            | W    |
| Maximum Power Dissipation (PCB Mount) <sup>e</sup>                        | T <sub>A</sub> = 25 °C  |                         |                                   | 2.5           |      |
| Peak Diode Recovery dV/dt <sup>c</sup>                                    |                         |                         | dV/dt                             | 4.8           | V/ns |
| Operating Junction and Storage Temperature Range                          |                         |                         | T <sub>J</sub> , T <sub>stg</sub> | - 55 to + 150 | °C   |
| Soldering Recommendations (Peak Temperature) <sup>d</sup>                 | for 10 s                |                         |                                   | 260           |      |

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ ; starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 14\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 3.8\text{ A}$  (see fig. 12).
- $I_{SD} \leq 3.8\text{ A}$ ,  $dI/dt \leq 90\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

**THERMAL RESISTANCE RATINGS**

| PARAMETER  | SYMBOL     | TYP. | MAX. | UNIT |
|--|------------|------|------|------|
| Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup> | $R_{thJA}$ | -    | 50   | °C/W |
| Maximum Junction-to-Ambient                          | $R_{thJA}$ | -    | 110  |      |
| Maximum Junction-to-Case                             | $R_{thJC}$ | -    | 3.0  |      |

**Note**

a. When mounted on 1" square PCB (FR-4 or G-10 material).

**SPECIFICATIONS** ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)

| PARAMETER                                 | SYMBOL                           | TEST CONDITIONS  |   | MIN. | TYP. | MAX.  | UNIT |
|---|----------------------------------|--|---|------|------|-------|------|
| Static                                    |                                  |  |   |      |      |       |      |
| Drain-Source Breakdown Voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA   |   | 250  | -    | -     | V    |
| V <sub>DS</sub> Temperature Coefficient   | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA  |   | -    | 0.36 | -     | V/°C |
| Gate-Source Threshold Voltage             | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA  |   | 2.0  | -    | 4.0   | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V   |   | -    | -    | ± 100 | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 250 V, V <sub>GS</sub> = 0 V   |   | -    | -    | 25    | μA   |
|   |                                  | V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C  |   | -    | -    | 250   |      |
| Drain-Source On-State Resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V   | I <sub>D</sub> = 2.3 A <sup>b</sup>   | -    | 0.64 | -     | Ω    |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 2.3 A <sup>b</sup>  |   | 1.5  | -    | -     | S    |
| Dynamic                                   |                                  |  |   |      |      |       |      |
| Input Capacitance                         | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5 <sup>c</sup>  |   | -    | 260  | -     | pF   |
| Output Capacitance                        | C <sub>oss</sub>                 |  |   | -    | 77   | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |  |   | -    | 15   | -     |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V   | I <sub>D</sub> = 4.4 A, V <sub>DS</sub> = 200 V,<br>see fig. 6 and 13 <sup>b, c</sup> | -    | -    | 14    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |  |   | -    | -    | 2.7   |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |  |   | -    | -    | 7.8   |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 125 V, I <sub>D</sub> = 4.4 A,<br>R <sub>G</sub> = 18 Ω, R <sub>D</sub> = 28 Ω,<br>see fig. 10 <sup>b, c</sup> |   | -    | 7.0  | -     | ns   |
| Rise Time                                 | t <sub>r</sub>                   |  |   | -    | 13   | -     |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |  |   | -    | 20   | -     |      |
| Fall Time                                 | t <sub>f</sub>                   |  |   | -    | 12   | -     |      |
| Internal Drain Inductance                 | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact   |   | -    | 4.5  | -     | nH   |
| Internal Source Inductance                | L <sub>S</sub>                   |  |   | -    | 7.5  | -     |      |
| Drain-Source Body Diode Characteristics   |                                  |  |   |      |      |       |      |
| Continuous Source-Drain Diode Current     | I <sub>S</sub>                   | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode   |   | -    | -    | 3.8   | A    |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |  |   | -    | -    | 15    |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 3.8 A, V <sub>GS</sub> = 0 V <sup>b</sup>   |   | -    | -    | 1.8   | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 4.4 A, dI/dt = 100 A/μs <sup>b</sup>  |   | -    | 200  | 400   | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |  |   | -    | 0.93 | 1.9   | μC   |
| Forward Turn-On Time                      | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )                                |   |      |      |       |      |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
 b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

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

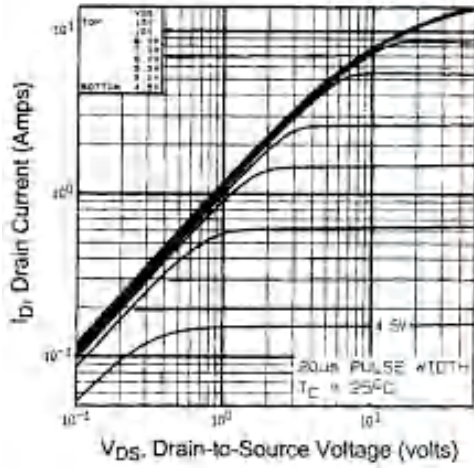


Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^{\circ}\text{C}$

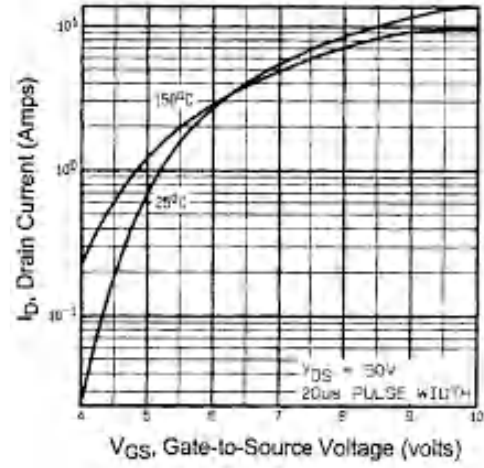


Fig. 3 - Typical Transfer Characteristics

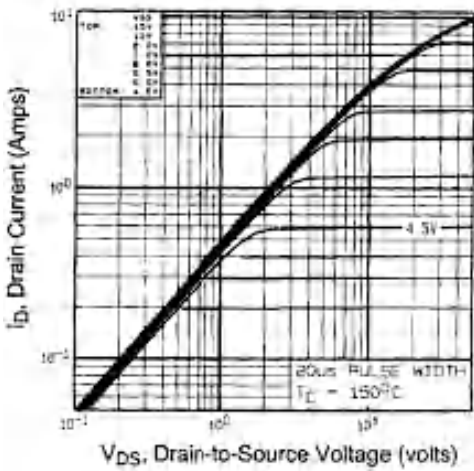


Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^{\circ}\text{C}$

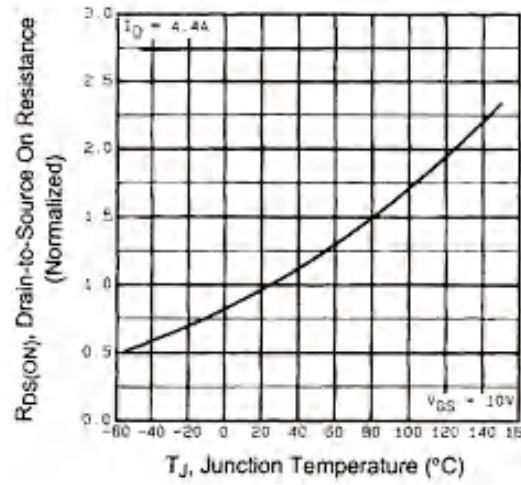


Fig. 4 - Normalized On-Resistance vs. Temperature

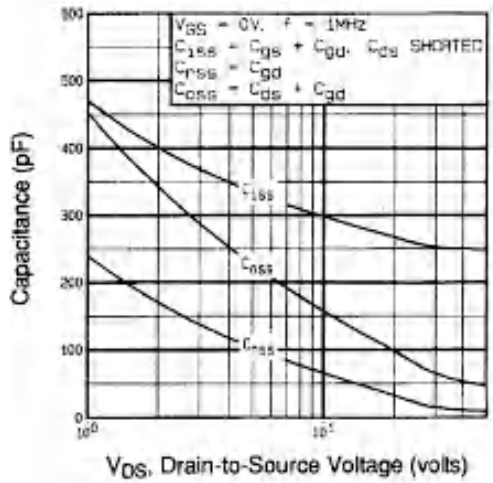


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage



Fig. 7 - Typical Source-Drain Diode Forward Voltage



Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

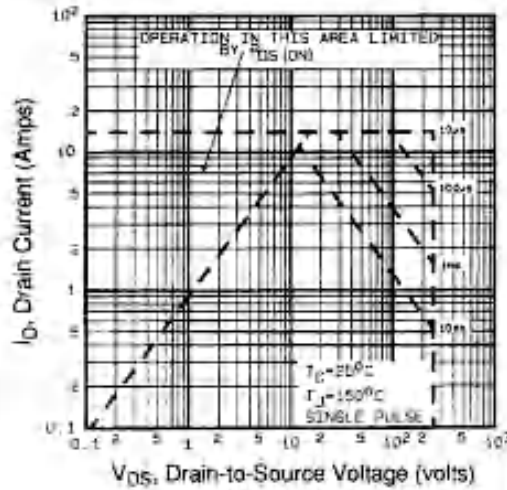


Fig. 8 - Maximum Safe Operating Area



Fig. 9 - Maximum Drain Current vs. Case Temperature

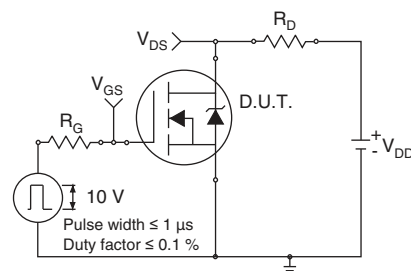


Fig. 10a - Switching Time Test Circuit

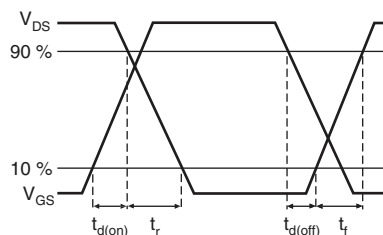


Fig. 10b - Switching Time Waveforms

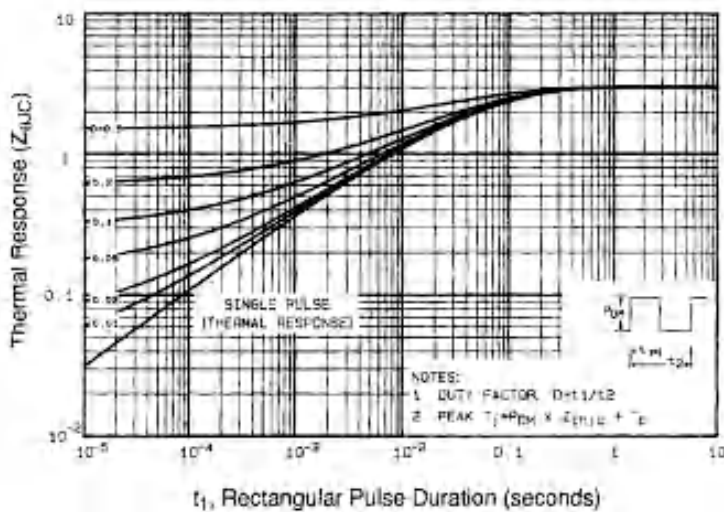


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

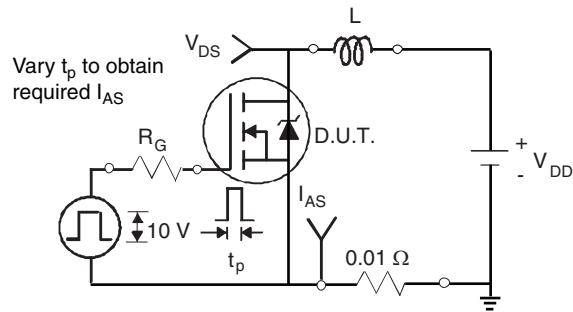


Fig. 12a - Unclamped Inductive Test Circuit

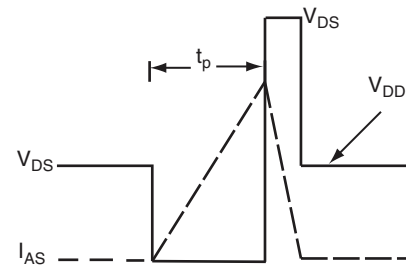


Fig. 12b - Unclamped Inductive Waveforms

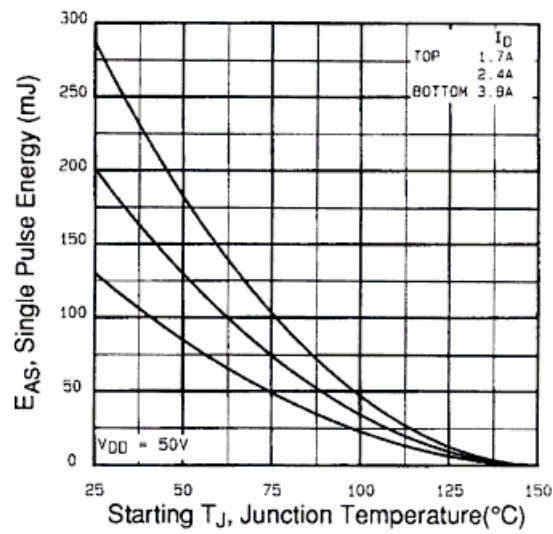


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

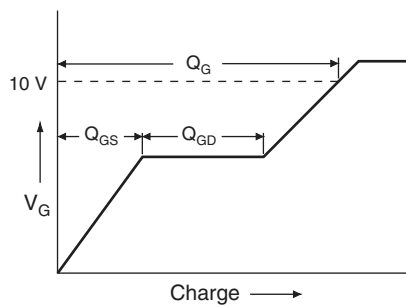


Fig. 13a - Basic Gate Charge Waveform

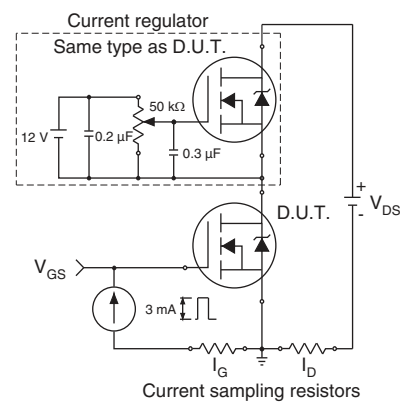
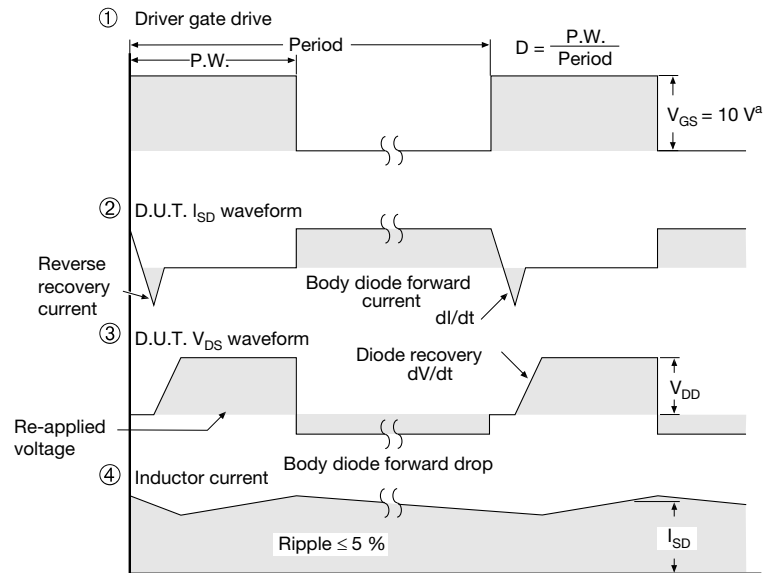
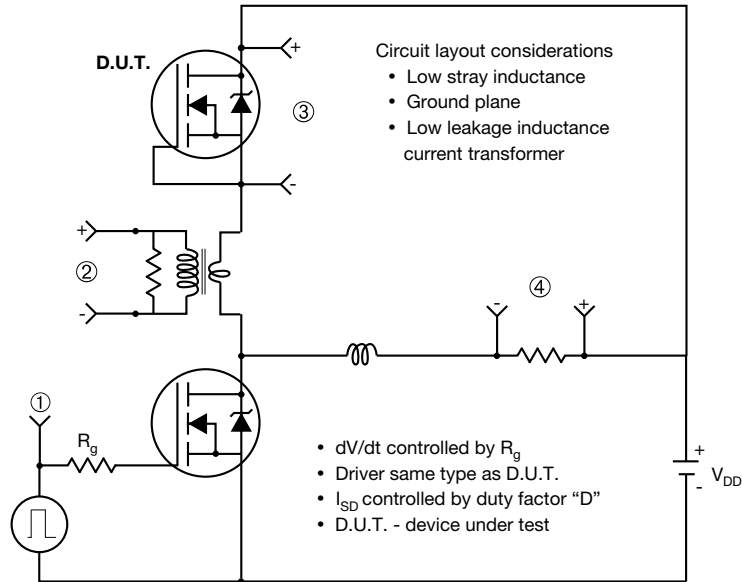


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery dV/dt Test Circuit



### Note

a.  $V_{GS} = 5 V$  for logic level devices

**Fig. 14 - For N-Channel**

TO-252AA Case Outline



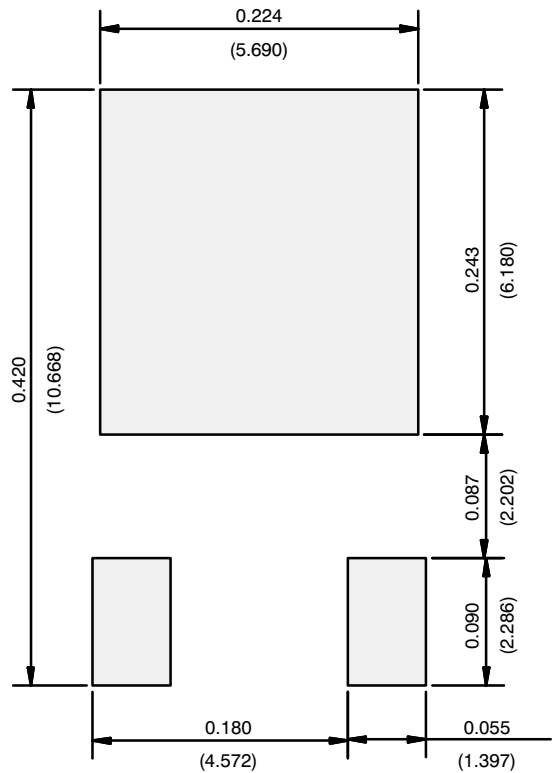
| DIM.   | MILLIMETERS |       | INCHES    |       |
|--|-------------|-------|-----------|-------|
|  | MIN.        | MAX.  | MIN.      | MAX.  |
| A  | 2.18        | 2.38  | 0.086     | 0.094 |
| A1   | -           | 0.127 | -         | 0.005 |
| b  | 0.64        | 0.88  | 0.025     | 0.035 |
| b2   | 0.76        | 1.14  | 0.030     | 0.045 |
| b3   | 4.95        | 5.46  | 0.195     | 0.215 |
| C  | 0.46        | 0.61  | 0.018     | 0.024 |
| C2   | 0.46        | 0.89  | 0.018     | 0.035 |
| D  | 5.97        | 6.22  | 0.235     | 0.245 |
| D1   | 4.10        | -     | 0.161     | -     |
| E  | 6.35        | 6.73  | 0.250     | 0.265 |
| E1   | 4.32        | -     | 0.170     | -     |
| H  | 9.40        | 10.41 | 0.370     | 0.410 |
| e  | 2.28 BSC    |       | 0.090 BSC |       |
| e1   | 4.56 BSC    |       | 0.180 BSC |       |
| L  | 1.40        | 1.78  | 0.055     | 0.070 |
| L3   | 0.89        | 1.27  | 0.035     | 0.050 |
| L4   | -           | 1.02  | -         | 0.040 |
| L5   | 1.01        | 1.52  | 0.040     | 0.060 |
| ECN: T16-0236-Rev. P, 16-May-16<br>DWG: 5347 |             |       |           |       |

Notes

- Dimension L3 is for reference only.



RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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