

# N-Channel 20 V (D-S) 175 °C MOSFET

## PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )  | $I_D$ (A) <sup>a</sup> |
|--------------|----------------------------|------------------------|
| 20           | 0.0060 at $V_{GS} = 10$ V  | 26                     |
|              | 0.0095 at $V_{GS} = 4.5$ V | 21                     |

## FEATURES

- TrenchFET® Power MOSFET
- 175 °C Junction Temperature
- PWM Optimized for High Efficiency
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC

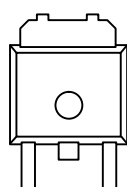


**RoHS**  
COMPLIANT

## APPLICATIONS

- Synchronous Buck DC/DC Conversion
  - Desktop
  - Server

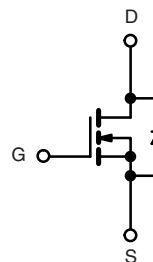
**TO-252**



Top View

Drain Connected to Tab

**Ordering Information:** SUD50N02-06P-E3 (Lead (Pb) free)



N-Channel MOSFET

## ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

| Parameter                                                 | Symbol         | Limit         | Unit             |
|-----------------------------------------------------------|----------------|---------------|------------------|
| Drain-Source Voltage                                      | $V_{DS}$       | 20            | V                |
| Gate-Source Voltage                                       | $V_{GS}$       | $\pm 20$      |                  |
| Continuous Drain Current <sup>a</sup>                     | $I_D$          | $T_A = 25$ °C | 26 <sup>a</sup>  |
|                                                           |                | $T_C = 25$ °C | 50 <sup>b</sup>  |
| Pulsed Drain Current                                      | $I_{DM}$       | 100           | A                |
| Continuous Source Current (Diode Conduction) <sup>a</sup> | $I_S$          | 26            |                  |
| Avalanche Current                                         | $I_{AS}$       | 45            |                  |
| Single Pulse Avalanche Energy                             | $E_{AS}$       | 101           | mJ               |
| Maximum Power Dissipation                                 | $P_D$          | $T_A = 25$ °C | 6.8 <sup>a</sup> |
|                                                           |                | $T_C = 25$ °C | 65               |
| Operating Junction and Storage Temperature Range          | $T_J, T_{stg}$ | - 55 to 175   | °C               |

## THERMAL RESISTANCE RATINGS

| Parameter                                | Symbol     | Typical       | Maximum | Unit |
|------------------------------------------|------------|---------------|---------|------|
| Maximum Junction-to-Ambient <sup>a</sup> | $R_{thJA}$ | $t \leq 10$ s | 18      | °C/W |
|                                          |            | Steady State  | 40      |      |
| Maximum Junction-to-Case                 | $R_{thJC}$ | 1.9           | 2.3     |      |

Notes:

a. Surface mounted on FR4 board,  $t \leq 10$  s.

b. Limited by package.

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

| Parameter                                                              | Symbol              | Test Conditions                                                                                                          | Min. | Typ. <sup>a</sup> | Max.   | Unit |
|------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------|------|-------------------|--------|------|
| Static                                                                 |                     |                                                                                                                          |      |                   |        |      |
| Drain-Source Breakdown Voltage                                         | V <sub>DS</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>D</sub> = 250 μA                                                              | 0.8  |                   | 3      |      |
| Gate-Body Leakage                                                      | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 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     |      |
| On-State Drain Current <sup>b</sup>                                    | I <sub>D(on)</sub>  | V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V                                                                            | 50   |                   |        | A    |
| Drain-Source On-State Resistance <sup>b</sup>                          | r <sub>DS(on)</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A                                                                            |      | 0.0046            | 0.006  | Ω    |
|                                                                        |                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C                                                   |      |                   | 0.0084 |      |
|                                                                        |                     | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A                                                                           |      | 0.0073            | 0.0095 |      |
| Forward Transconductance <sup>b</sup>                                  | g <sub>fs</sub>     | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A                                                                            | 15   |                   |        | S    |
| Dynamic <sup>a</sup>                                                   |                     |                                                                                                                          |      |                   |        |      |
| Input Capacitance                                                      | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 10 V, f = 1 MHz                                                                 |      | 2550              |        | pF   |
| Output Capacitance                                                     | C <sub>oss</sub>    |                                                                                                                          |      | 900               |        |      |
| Reverse Transfer Capacitance                                           | C <sub>rss</sub>    |                                                                                                                          |      | 415               |        |      |
| 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> = 50 A                                                   |      | 19                | 30     | nC   |
| Gate-Source Charge <sup>c</sup>                                        | Q <sub>gs</sub>     |                                                                                                                          |      | 7.5               |        |      |
| Gate-Drain Charge <sup>c</sup>                                         | Q <sub>gd</sub>     |                                                                                                                          |      | 6                 |        |      |
| Gate Resistance                                                        | R <sub>g</sub>      |                                                                                                                          | 0.5  | 1.5               | 2.4    | Ω    |
| Turn-On Delay Time <sup>c</sup>                                        | t <sub>d(on)</sub>  | V <sub>DD</sub> = 10 V, R <sub>L</sub> = 0.2 Ω<br>I <sub>D</sub> ≡ 50 A, V <sub>GEN</sub> = 10 V, R <sub>G</sub> = 2.5 Ω |      | 11                | 20     | ns   |
| Rise Time <sup>c</sup>                                                 | t <sub>r</sub>      |                                                                                                                          |      | 10                | 15     |      |
| Turn-Off Delay Time <sup>c</sup>                                       | t <sub>d(off)</sub> |                                                                                                                          |      | 24                | 35     |      |
| Fall Time <sup>c</sup>                                                 | t <sub>f</sub>      |                                                                                                                          |      | 9                 | 15     |      |
| Source-Drain Diode Ratings and Characteristic (T <sub>C</sub> = 25 °C) |                     |                                                                                                                          |      |                   |        |      |
| Pulsed Current                                                         | I <sub>SM</sub>     |                                                                                                                          |      |                   | 100    | A    |
| Diode Forward Voltage <sup>b</sup>                                     | V <sub>SD</sub>     | I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0 V                                                                             |      | 1.2               | 1.5    | V    |
| Source-Drain Reverse Recovery Time                                     | t <sub>rr</sub>     | I <sub>F</sub> = 50 A, dI/dt = 100 A/μs                                                                                  |      | 35                | 70     | ns   |

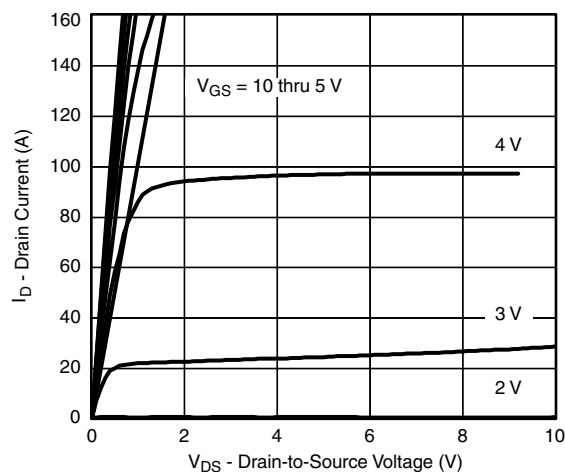
Notes:

a. Guaranteed by design, not subject to production testing.

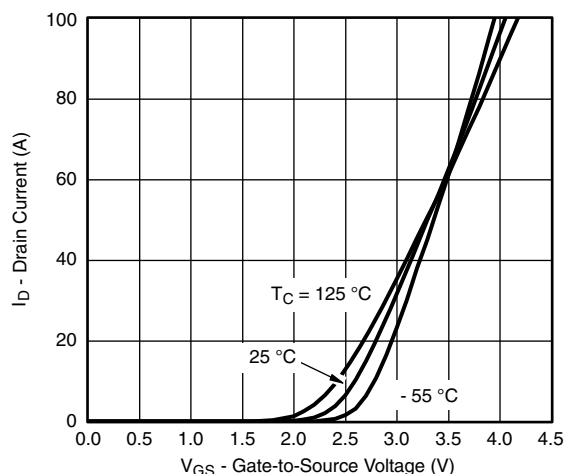
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

c. Independent of operating temperature.

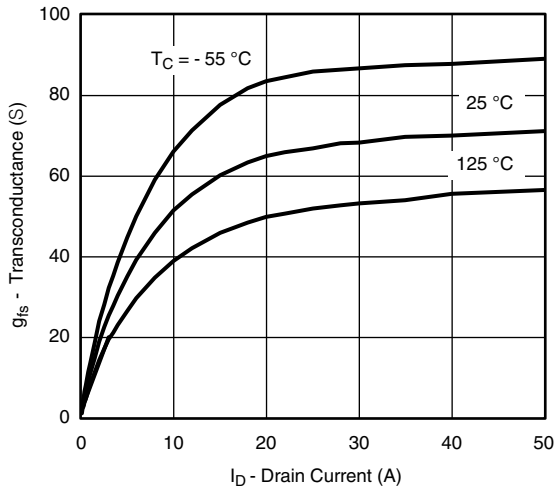
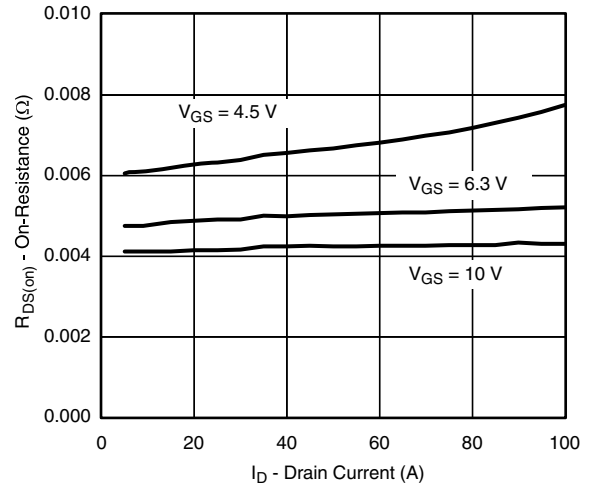
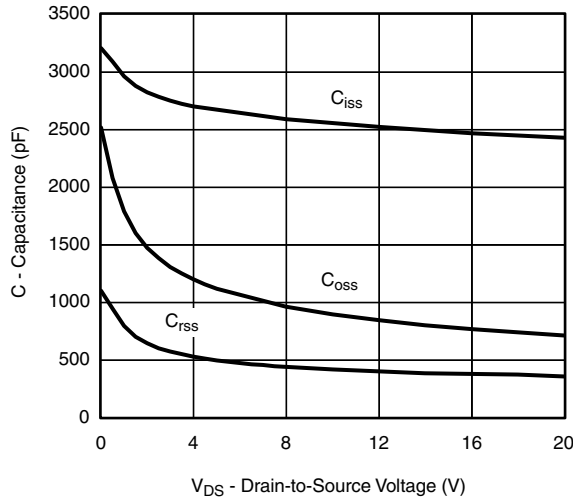
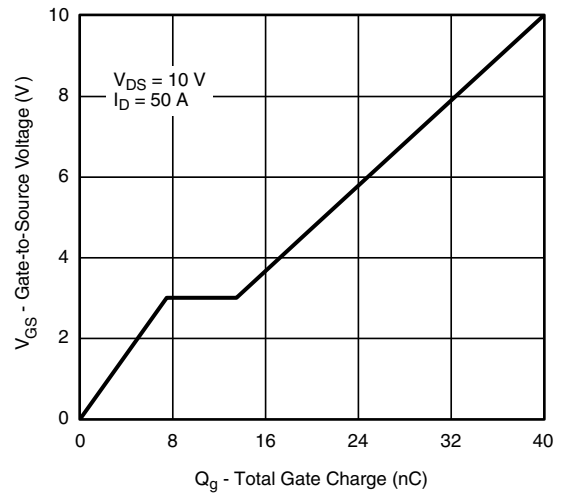
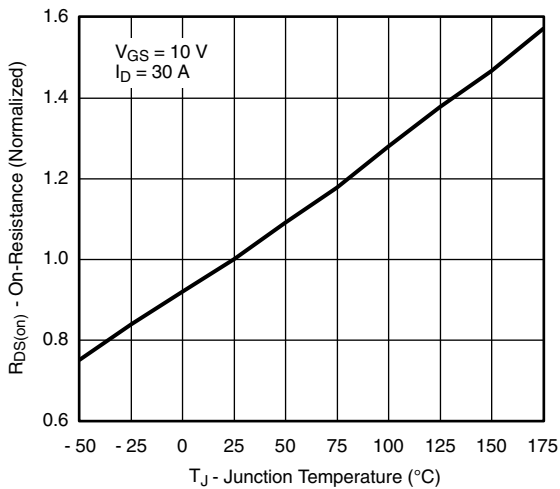
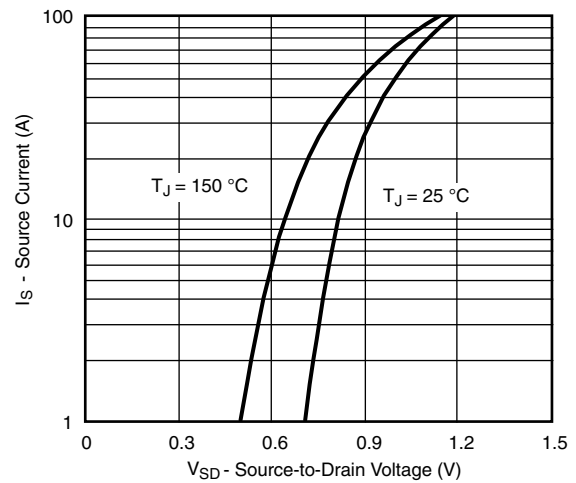
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**TYPICAL CHARACTERISTICS** ( $25\text{ }^\circ\text{C}$  unless noted)

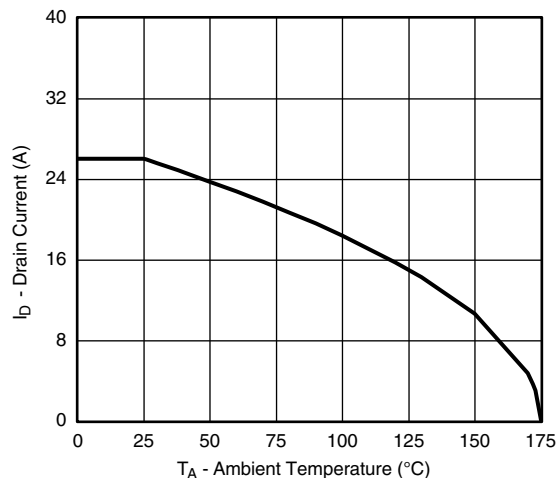
Output Characteristics



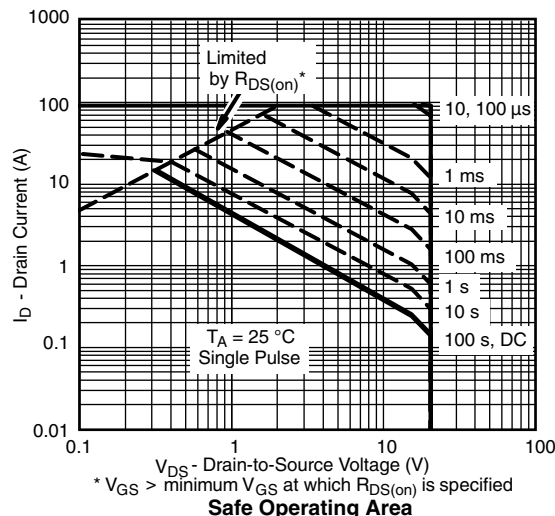
Transfer Characteristics

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

**Transconductance**

**On-Resistance vs. Drain Current**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

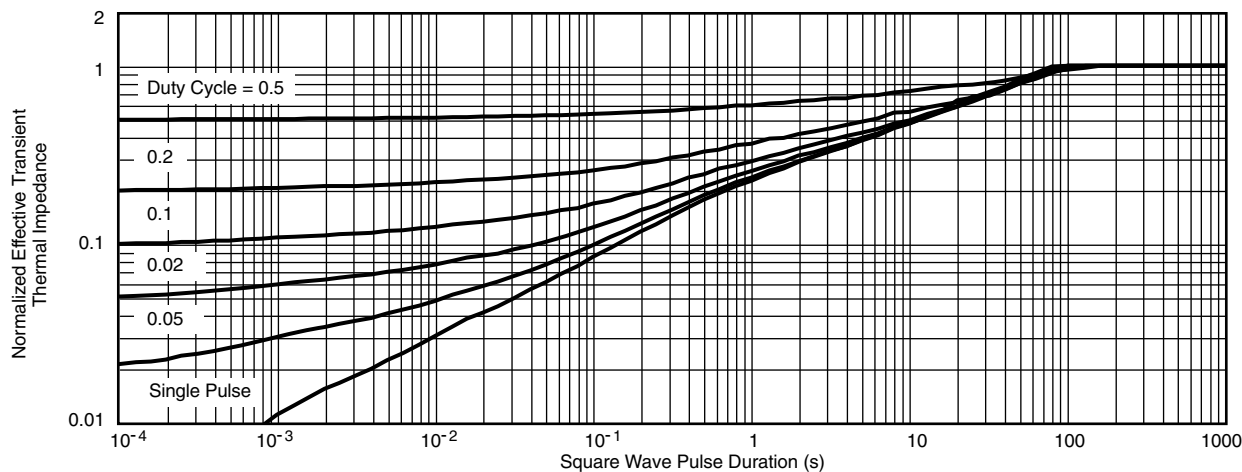
## THERMAL RATINGS



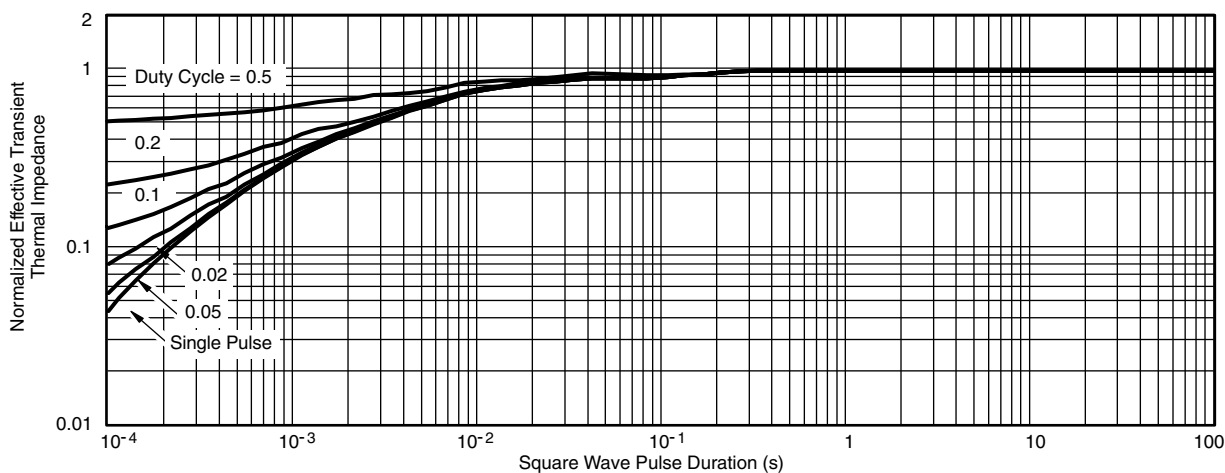
**Maximum Drain Current  
vs. Ambient Temperature**



**Safe Operating Area**



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

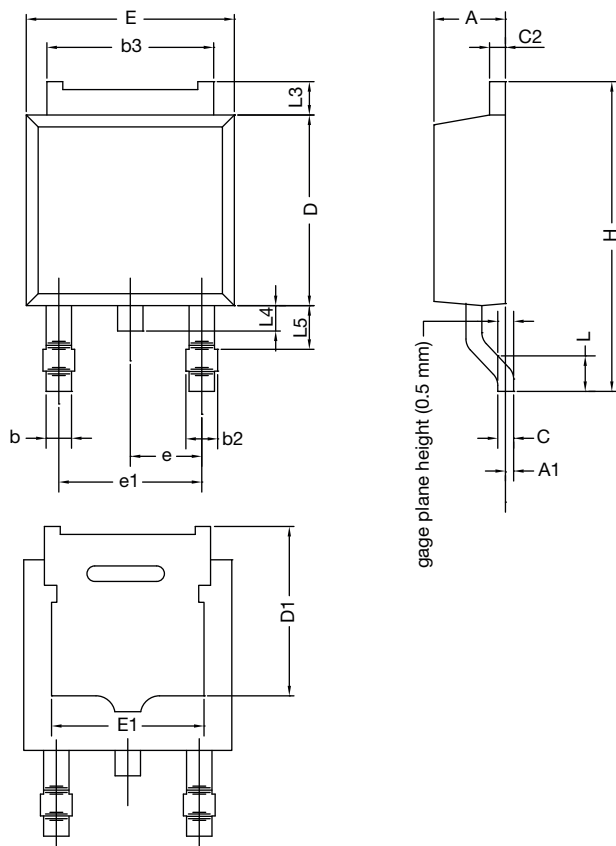


**Normalized Thermal Transient Impedance, Junction-to-Case**

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## TO-252AA Case Outline

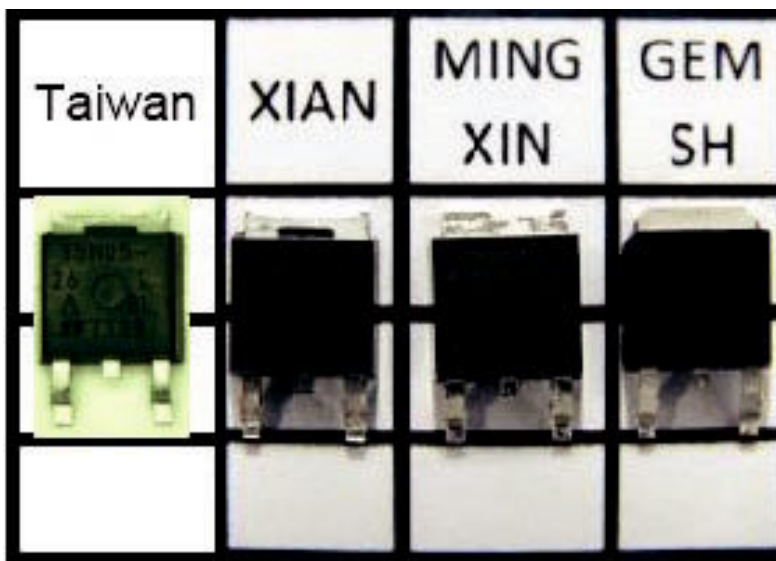


| DIM. | MILLIMETERS |       | INCHES    |       |
|------|-------------|-------|-----------|-------|
|      | MIN.        | MAX.  | MIN.      | MAX.  |
| A    | 2.18        | 2.38  | 0.086     | 0.094 |
| A1   | -           | 0.127 | -         | 0.005 |
| b    | 0.64        | 0.88  | 0.025     | 0.035 |
| 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 |

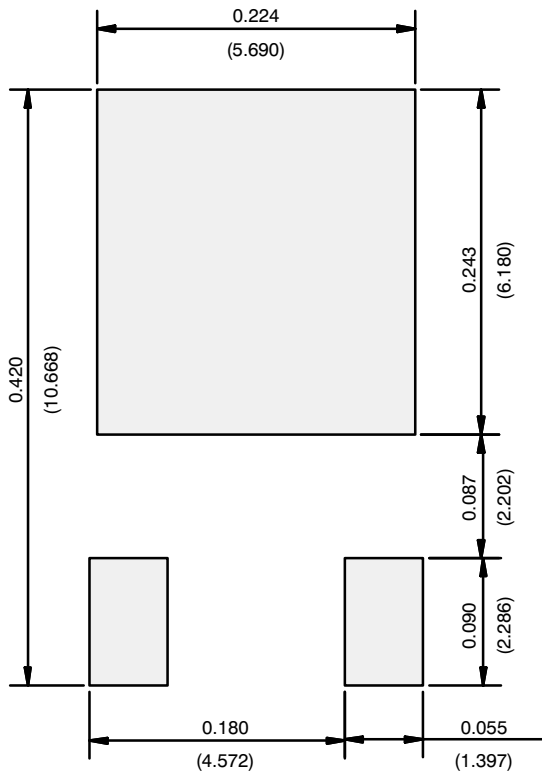
ECN: T13-0359-Rev. O, 03-Jun-13  
DWG: 5347

### Notes

- Dimension L3 is for reference only.
- Xi'an, Mingxin, and GEM SH actual photo.



## RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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