



**Absolute Maximum Ratings** ( $T_A = 25^{\circ}\text{C}$  Unless Otherwise Noted)

| Symbol                        | Parameter                              |                       | Rating     | Unit |
|-------------------------------|----------------------------------------|-----------------------|------------|------|
| Common Ratings                |                                        |                       |            |      |
| V <sub>DSS</sub>              | Drain-Source Voltage                   |                       | -100       | V    |
| V <sub>GSS</sub>              | Gate-Source Voltage                    |                       | ±25        |      |
| T <sub>J</sub>                | Maximum Junction Temperature           |                       | 150        | °C   |
| T <sub>STG</sub>              | Storage Temperature Range              |                       | -55 to 150 | °C   |
| I <sub>S</sub>                | Diode Continuous Forward Current       |                       | -19        | A    |
| I <sub>AS</sub> <sup>a</sup>  | Avalanche Current, Single pulse        | L=0.5mH               | -27        | A    |
| E <sub>AS</sub> <sup>a</sup>  | Avalanche Energy, Single pulse         | L=0.5mH               | 182        | mJ   |
| I <sub>DP</sub> <sup>b</sup>  | Pulse Drain Current Tested             | T <sub>C</sub> =25°C  | -152 °     | A    |
| I <sub>D</sub>                | Continuous Drain Current               | T <sub>C</sub> =25°C  | -38        |      |
|                               |                                        | T <sub>C</sub> =100°C | -24        |      |
| P <sub>D</sub>                | Maximum Power Dissipation              | T <sub>C</sub> =25°C  | 113        | W    |
|                               |                                        | T <sub>C</sub> =100°C | 45         |      |
| R <sub>θJC</sub>              | Thermal Resistance-Junction to Case    |                       | 1.1        | °C/W |
| I <sub>D</sub>                | Continuous Drain Current               | T <sub>A</sub> =25°C  | -5.2       | A    |
|                               |                                        | T <sub>A</sub> =70°C  | -4.1       |      |
| P <sub>D</sub>                | Maximum Power Dissipation              | T <sub>A</sub> =25°C  | 2.1        | W    |
|                               |                                        | T <sub>A</sub> =70°C  | 1.3        |      |
| R <sub>θJA</sub> <sup>d</sup> | Thermal Resistance-Junction to Ambient | Steady State          | 60         | °C/W |

Note a: UIS tested and pulse width limited by maximum junction temperature  $150^{\circ}\text{C}$  (initial temperature  $T_J=25^{\circ}\text{C}$ ).

Note b: Pulse width limited by max. junction temperature.

Note c: Wire limited.

Note d:  $R_{\theta\text{JA}}$  steady state  $t=999\text{s}$ .  $R_{\theta\text{JA}}$  is measured with the device mounted on  $1\text{in}^2$ , FR-4 board with 2oz. Copper.

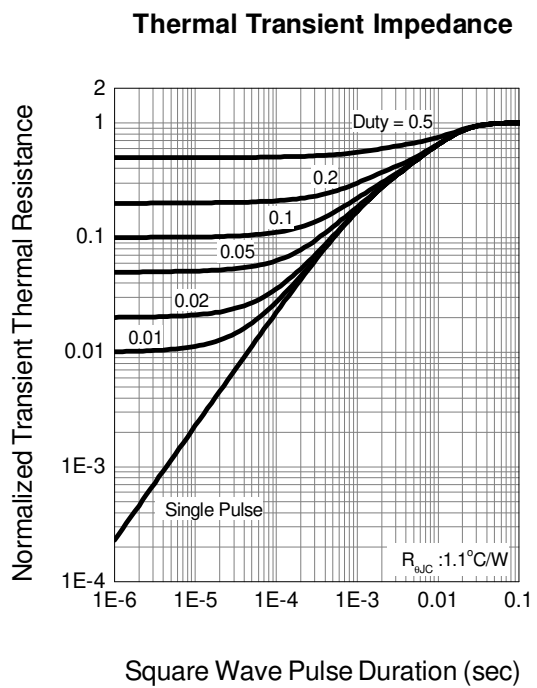
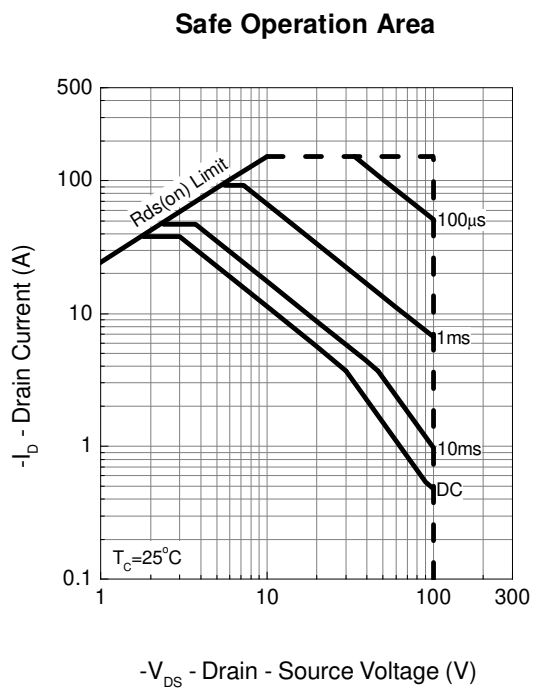
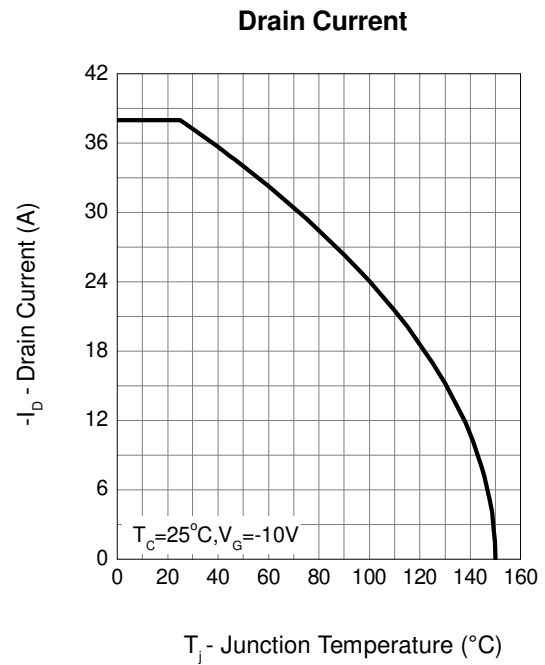
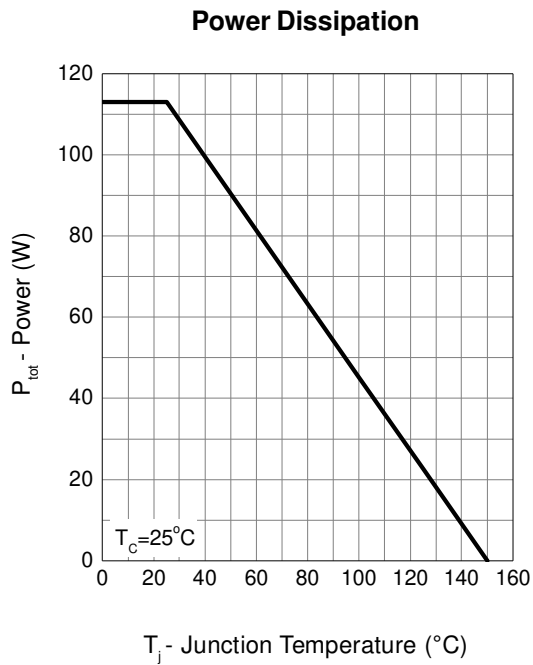
**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  Unless Otherwise Noted)

| Symbol                                   | Parameter                        | Test Conditions                                                                                              | Min. | Typ. | Max. | Unit |
|------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics                   |                                  |                                                                                                              |      |      |      |      |
| BV <sub>DSS</sub>                        | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =-250μA                                                                 | -100 | -    | -    | V    |
| I <sub>DSS</sub>                         | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =-80V, V <sub>GS</sub> =0V                                                                   | -    | -    | 1    | μA   |
|                                          |                                  | T <sub>J</sub> =85°C                                                                                         | -    | -    | -30  |      |
| V <sub>GS(th)</sub>                      | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =-250μA                                                   | -1   | -2   | -3   | V    |
| I <sub>GSS</sub>                         | Gate Leakage Current             | V <sub>GS</sub> =±25V, V <sub>DS</sub> =0V                                                                   | -    | -    | ±100 | nA   |
| R <sub>DS(ON)</sub> <sup>e</sup>         | Drain-Source On-state Resistance | V <sub>GS</sub> =-10V, I <sub>DS</sub> =-20A                                                                 | -    | 31   | 39   | mΩ   |
|                                          |                                  | V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-10A                                                                | -    | 36   | 49   | mΩ   |
| Diode Characteristics                    |                                  |                                                                                                              |      |      |      |      |
| V <sub>SD</sub> <sup>e</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =-1A, V <sub>GS</sub> =0V                                                                    | -    | -0.7 | -1   | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time            | I <sub>SD</sub> =-20A, dI <sub>SD</sub> /dt=100A/μs                                                          | -    | 60   | -    | ns   |
| Q <sub>rr</sub>                          | Reverse Recovery Charge          |                                                                                                              | -    | 95   | -    | nC   |
| Dynamic Characteristics <sup>f</sup>     |                                  |                                                                                                              |      |      |      |      |
| R <sub>G</sub>                           | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                                             | -    | 3.4  | 6.8  | Ω    |
| C <sub>iss</sub>                         | Input Capacitance                | V <sub>GS</sub> =0V, V <sub>DS</sub> =-30V, Frequency=1.0MHz                                                 | -    | 2467 | 3207 | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                              | -    | 268  | -    |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                              | -    | 126  | -    |      |
| t <sub>d(ON)</sub>                       | Turn-on Delay Time               | V <sub>DD</sub> =-30V, R <sub>L</sub> =30Ω, I <sub>DS</sub> =-1A, V <sub>GEN</sub> =-10V, R <sub>G</sub> =6Ω | -    | 15   | 27   | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                              | -    | 8    | 14   |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                              | -    | 54   | 97   |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                              | -    | 32   | 58   |      |
| Gate Charge Characteristics <sup>f</sup> |                                  |                                                                                                              |      |      |      |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =-50V, V <sub>GS</sub> =-10V, I <sub>DS</sub> =-20A                                          | -    | 54   | 76   | nC   |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                              | -    | 10   | -    |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                              | -    | 13   | -    |      |

Note e: Pulse test; pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ .

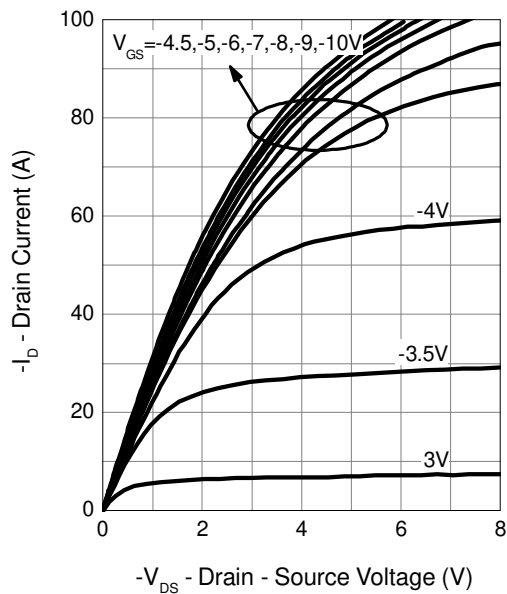
Note f: Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

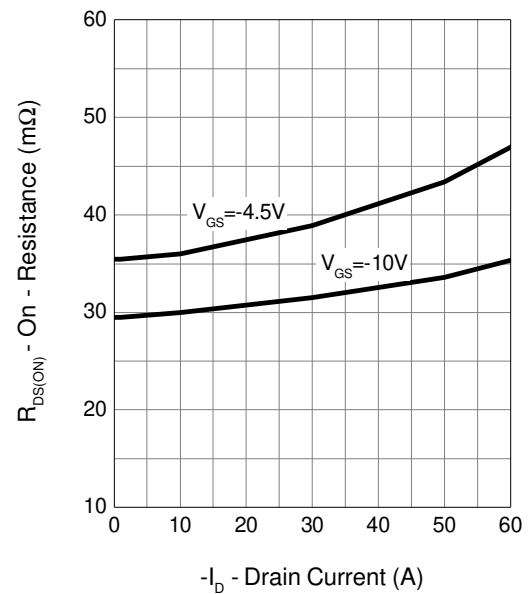


## Typical Operating Characteristics (Cont.)

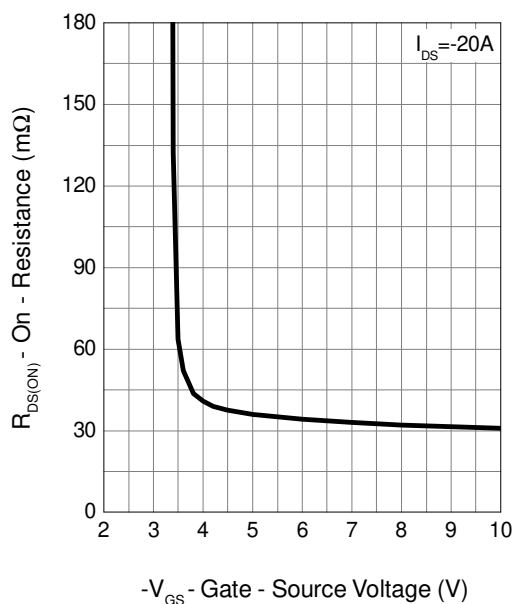
**Output Characteristics**



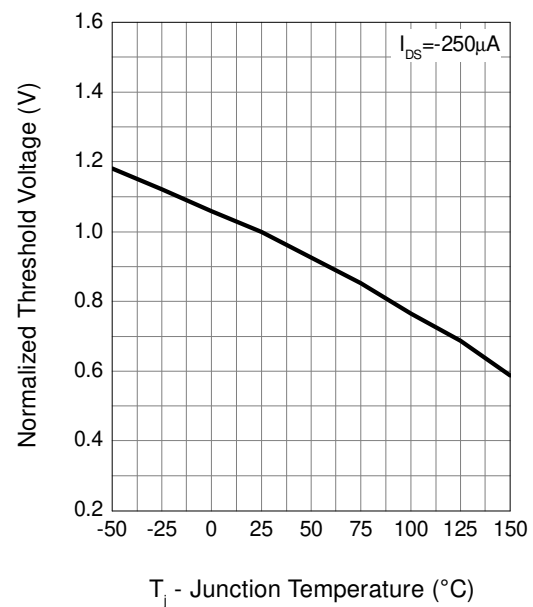
**Drain-Source On Resistance**



**Gate-Source On Resistance**

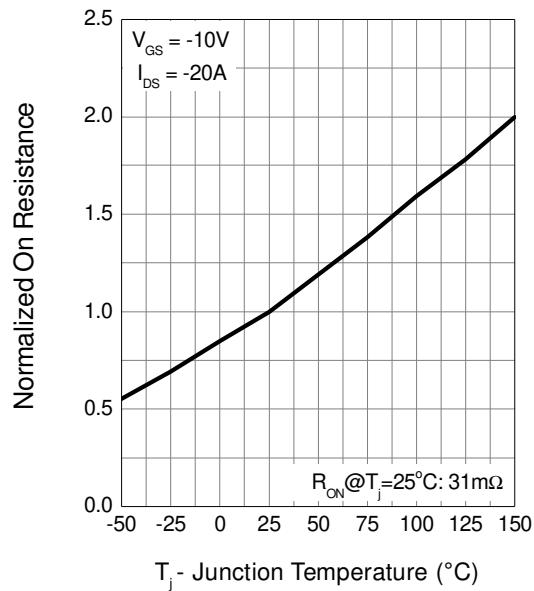


**Gate Threshold Voltage**

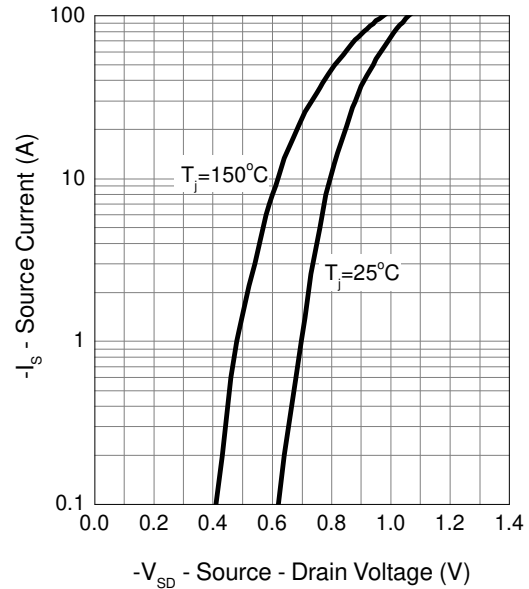


## Typical Operating Characteristics (Cont.)

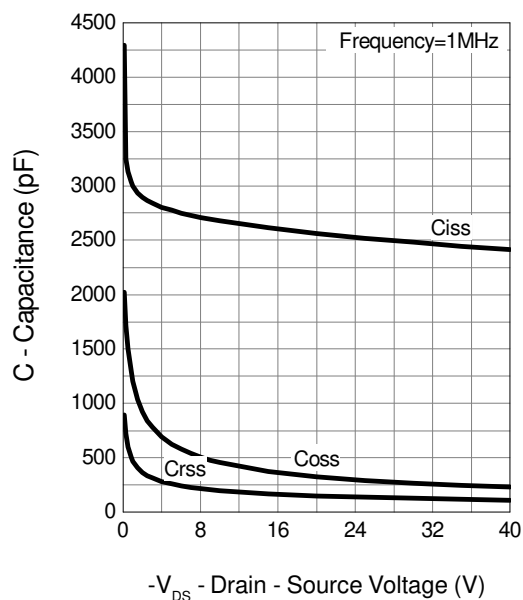
Drain-Source On Resistance



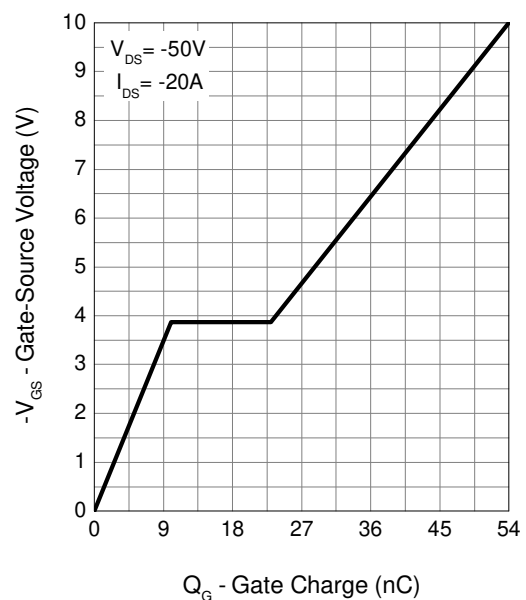
Source-Drain Diode Forward



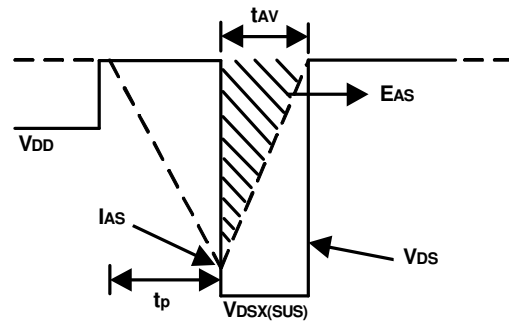
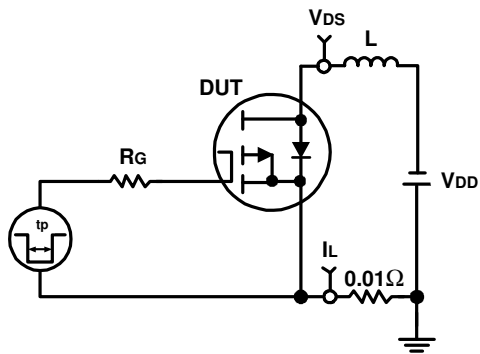
Capacitance



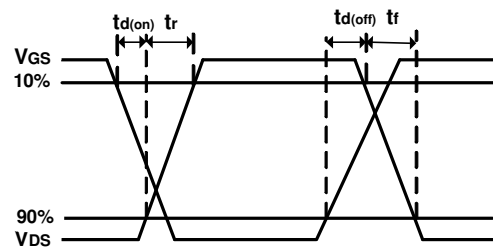
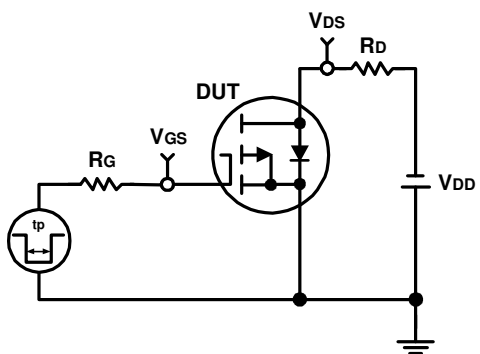
Gate Charge



## Avalanche Test Circuit and Waveforms



## Switching Time Test Circuit and Waveforms



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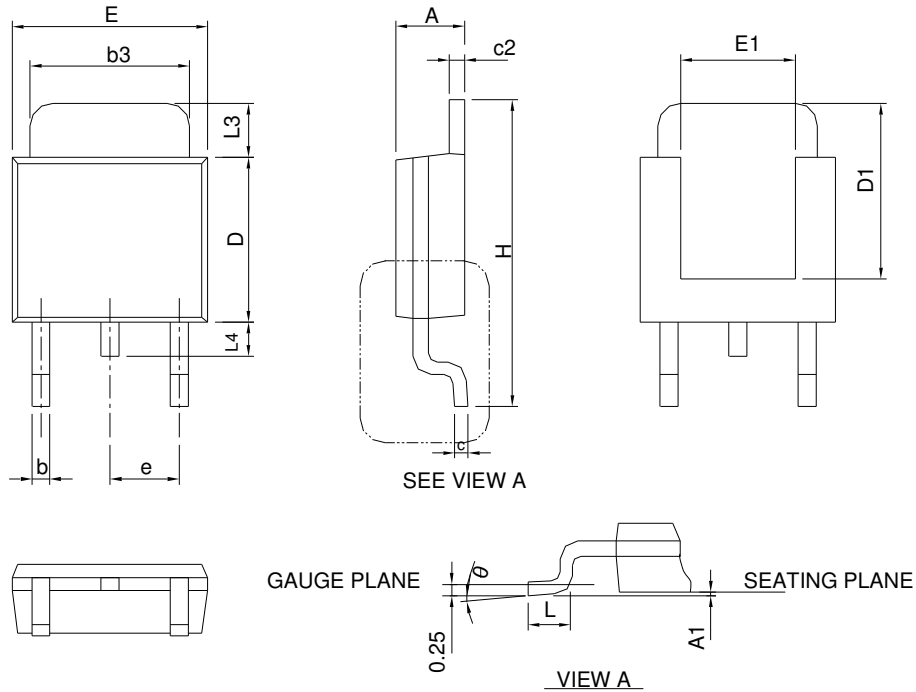
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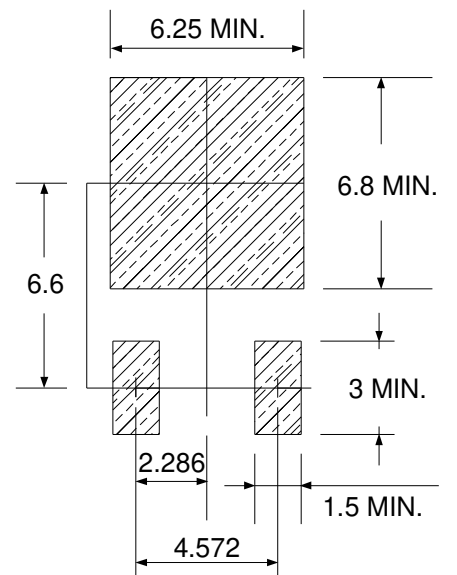
## Package Information



| SYMBOL | TO-252-2    |       |           |       |
|--------|-------------|-------|-----------|-------|
|        | MILLIMETERS |       | INCHES    |       |
|        | MIN.        | MAX.  | MIN.      | MAX.  |
| A      | 2.18        | 2.39  | 0.086     | 0.094 |
| A1     | -           | 0.13  | -         | 0.005 |
| b      | 0.50        | 0.89  | 0.020     | 0.035 |
| 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      | 5.33        | 6.22  | 0.210     | 0.245 |
| D1     | 4.57        | 6.00  | 0.180     | 0.236 |
| E      | 6.35        | 6.73  | 0.250     | 0.265 |
| E1     | 3.81        | 6.00  | 0.150     | 0.236 |
| e      | 2.29 BSC    |       | 0.090 BSC |       |
| H      | 9.40        | 10.41 | 0.370     | 0.410 |
| L      | 0.90        | 1.78  | 0.035     | 0.070 |
| L3     | 0.89        | 2.03  | 0.035     | 0.080 |
| L4     | -           | 1.02  | -         | 0.040 |
| θ      | 0°          | 8°    | 0°        | 8°    |

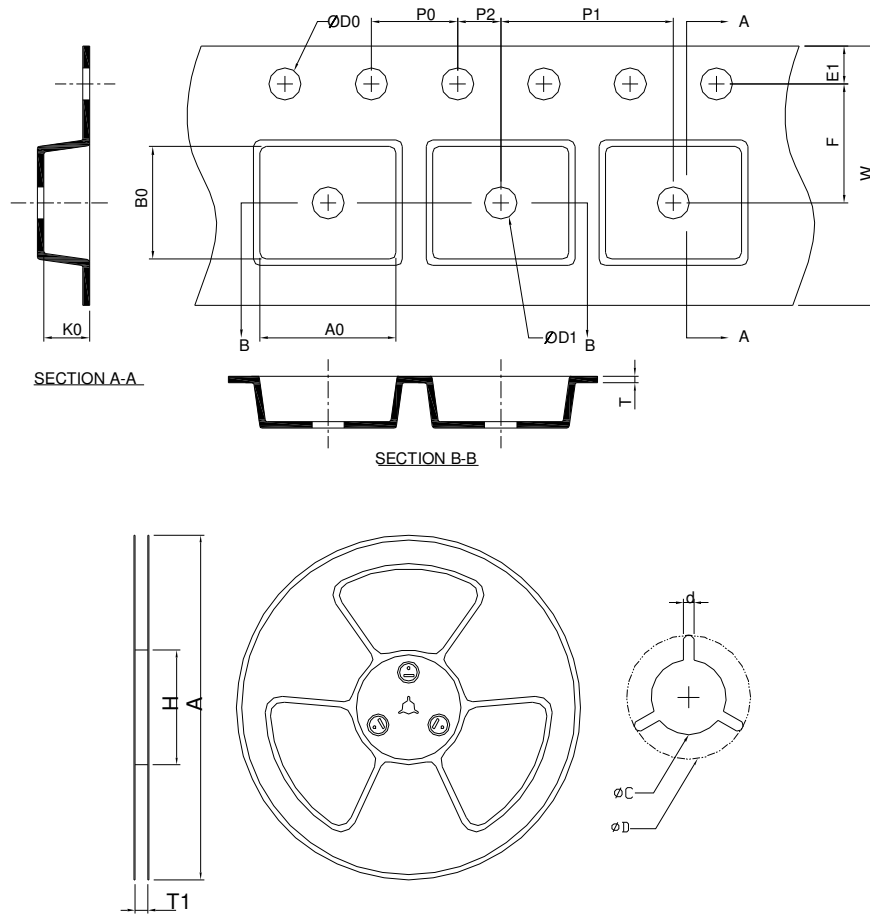
Note : Follow JEDEC TO-252 .

### RECOMMENDED LAND PATTERN



UNIT: mm

## Carrier Tape & Reel Dimensions

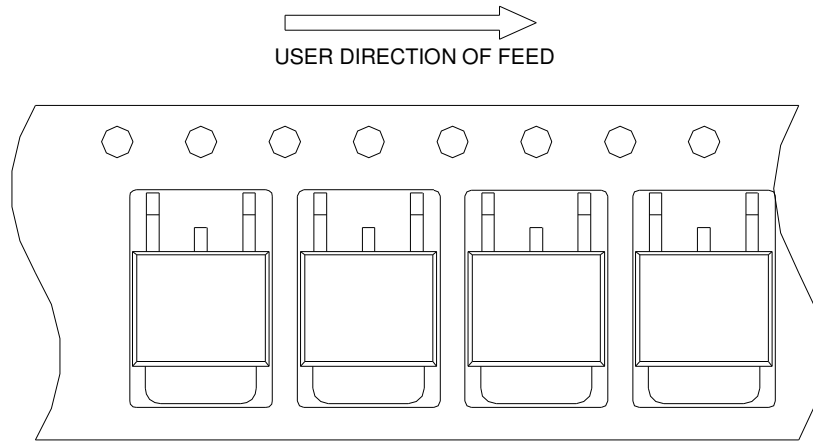


| Application | A          | H        | T1                 | C                  | d        | D                 | W         | E1         | F         |
|-------------|------------|----------|--------------------|--------------------|----------|-------------------|-----------|------------|-----------|
| TO-252-2    | 330.0±2.00 | 50 MIN.  | 16.4+2.00<br>-0.00 | 13.0+0.50<br>-0.20 | 1.5 MIN. | 20.2 MIN.         | 16.0±0.30 | 1.75±0.10  | 7.50±0.05 |
|             | P0         | P1       | P2                 | D0                 | D1       | T                 | A0        | B0         | K0        |
|             | 4.0±0.10   | 8.0±0.10 | 2.0±0.05           | 1.5+0.10<br>-0.00  | 1.5 MIN. | 0.6+0.00<br>-0.40 | 6.80±0.20 | 10.40±0.20 | 2.50±0.20 |

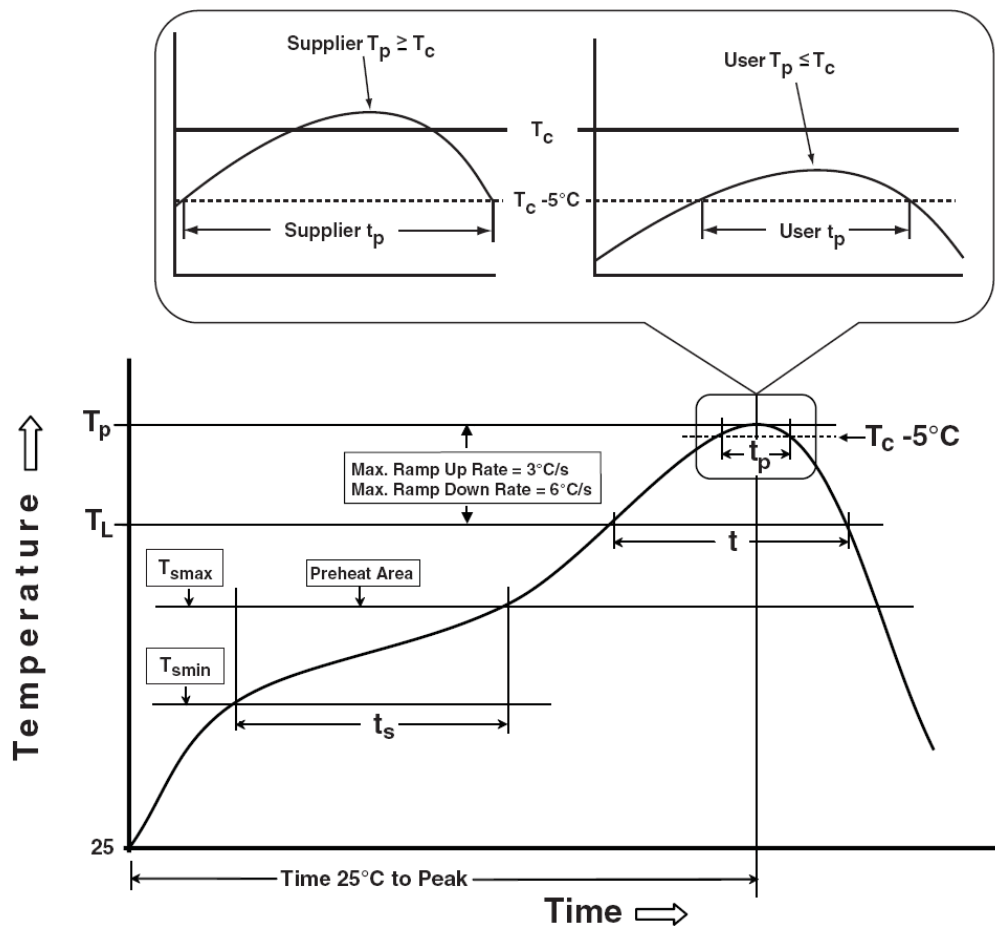
(mm)

## Taping Direction Information

TO-252-2



## Classification Profile



## Classification Reflow Profiles

| Profile Feature                                                                                                  | Sn-Pb Eutectic Assembly            | Pb-Free Assembly                   |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|
| <b>Preheat &amp; Soak</b>                                                                                        |                                    |                                    |
| Temperature min ( $T_{smin}$ )                                                                                   | 100 °C                             | 150 °C                             |
| Temperature max ( $T_{smax}$ )                                                                                   | 150 °C                             | 200 °C                             |
| Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )                                                                      | 60-120 seconds                     | 60-120 seconds                     |
| Average ramp-up rate ( $T_{smax}$ to $T_p$ )                                                                     | 3 °C/second max.                   | 3°C/second max.                    |
| Liquidous temperature ( $T_L$ )                                                                                  | 183 °C                             | 217 °C                             |
| Time at liquidous ( $t_L$ )                                                                                      | 60-150 seconds                     | 60-150 seconds                     |
| Peak package body Temperature ( $T_p$ )*                                                                         | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ )                                | 20** seconds                       | 30** seconds                       |
| Average ramp-down rate ( $T_p$ to $T_{smax}$ )                                                                   | 6 °C/second max.                   | 6 °C/second max.                   |
| Time 25°C to peak temperature                                                                                    | 6 minutes max.                     | 8 minutes max.                     |
| * Tolerance for peak profile Temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.          |                                    |                                    |
| ** Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum. |                                    |                                    |

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>≥350 |
|-------------------|--------------------------------|--------------------------------|
| <2.5 mm           | 235 °C                         | 220 °C                         |
| ≥2.5 mm           | 220 °C                         | 220 °C                         |

Table 2. Pb-free Process – Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>350-2000 | Volume mm <sup>3</sup><br>>2000 |
|-------------------|--------------------------------|------------------------------------|---------------------------------|
| <1.6 mm           | 260 °C                         | 260 °C                             | 260 °C                          |
| 1.6 mm – 2.5 mm   | 260 °C                         | 250 °C                             | 245 °C                          |
| ≥2.5 mm           | 250 °C                         | 245 °C                             | 245 °C                          |

## Reliability Test Program

| Test item     | Method        | Description                            |
|---------------|---------------|----------------------------------------|
| SOLDERABILITY | JESD-22, B102 | 5 Sec, 245°C                           |
| HTRB          | JESD-22, A108 | 1000 Hrs, 80% of VDS max @ $T_{jmax}$  |
| HTGB          | JESD-22, A108 | 1000 Hrs, 100% of VGS max @ $T_{jmax}$ |
| PCT           | JESD-22, A102 | 168 Hrs, 100%RH, 2atm, 121°C           |
| TCT           | JESD-22, A104 | 500 Cycles, -65°C~150°C                |

## Customer Service

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