

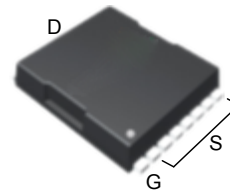
## Features

- 40V/570A,  
 $R_{DS(ON)} = 0.6 \text{ m}\Omega$  (typ.) @  $V_{GS}=10\text{V}$   
 $R_{DS(ON)} = 0.9 \text{ m}\Omega$  (typ.) @  $V_{GS}=4.5\text{V}$
- 100% UIS +  $R_g$  Tested
- Reliable and Rugged
- Lower  $R_{DS(ON)}$  to Minimize Conduction Losses
- Lead Free and Green Devices Available (RoHS Compliant)

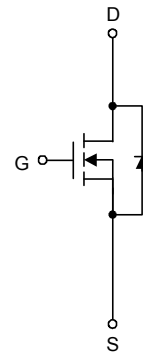
## Applications

- SMPS Synchronous Rectification
- Load Switch
- DC-DC Conversion
- Or-ing

## Pin Description



TO-LL



N-Channel MOSFET

## 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                   |                       | 40         | V    |
| V <sub>GSS</sub>              | Gate-Source Voltage                    |                       | ±20        |      |
| T <sub>J</sub>                | Maximum Junction Temperature           |                       | 175        | °C   |
| T <sub>STG</sub>              | Storage Temperature Range              |                       | -55 to 175 |      |
| I <sub>S</sub> <sup>a</sup>   | Diode Continuous Forward Current       | T <sub>C</sub> =25°C  | 570        | A    |
| I <sub>D</sub> <sup>a</sup>   | Continuous Drain Current               | T <sub>C</sub> =25°C  | 570        |      |
|                               |                                        | T <sub>C</sub> =100°C | 350        |      |
| I <sub>DM</sub> <sup>b</sup>  | Pulsed Drain Current                   | T <sub>C</sub> =25°C  | 1600       |      |
| P <sub>D</sub>                | Maximum Power Dissipation              | T <sub>C</sub> =25°C  | 375        | W    |
|                               |                                        | T <sub>C</sub> =100°C | 187        |      |
| R <sub>θJC</sub>              | Thermal Resistance-Junction to Case    | Steady State          | 0.85       | °C/W |
| I <sub>S</sub> <sup>c</sup>   | Diode Continuous Forward Current       | T <sub>A</sub> =25°C  | 2.2        | A    |
| I <sub>D</sub> <sup>c</sup>   | Continuous Drain Current               | T <sub>A</sub> =25°C  | 29         | A    |
|                               |                                        | T <sub>A</sub> =70°C  | 24.3       |      |
| I <sub>DM</sub> <sup>b</sup>  | Pulsed Drain Current                   | T <sub>A</sub> =25°C  | 116        | A    |
| P <sub>D</sub> <sup>c</sup>   | Maximum Power Dissipation              | T <sub>A</sub> =25°C  | 3          | W    |
|                               |                                        | T <sub>A</sub> =70°C  | 2.1        |      |
| R <sub>θJA</sub> <sup>c</sup> | Thermal Resistance-Junction to Ambient |                       | 50         | °C/W |
| I <sub>AS</sub> <sup>d</sup>  | Avalanche Current, Single pulse        | L=0.5mH               | 85         | A    |
| E <sub>AS</sub> <sup>d</sup>  | Avalanche Energy, Single pulse         | L=0.5mH               | 1800       | mJ   |

Note a : Maximum continue current is limited by bonding wire.

Note b : Pulse width is limited by maximum junction temperature  $175^\circ\text{C}$ .

Note c :  $R_{\theta JA}$  steady state  $t=999\text{s}$ .

Note d : UIS tested and pulse width limited by maximum junction temperature  $175^\circ\text{C}$  (Initial temperature  $T_J=25^\circ\text{C}$ ).

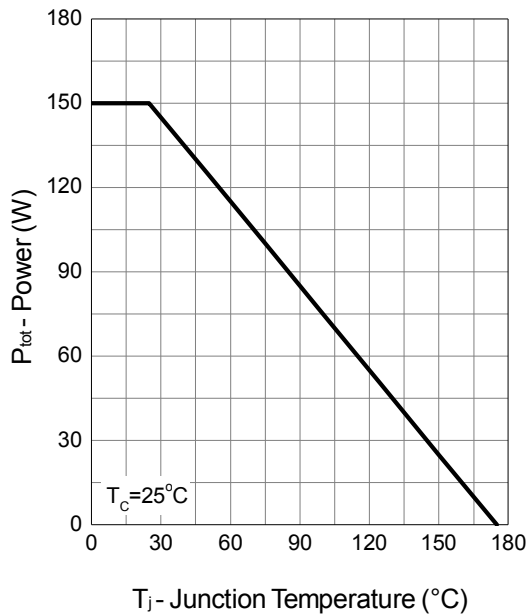
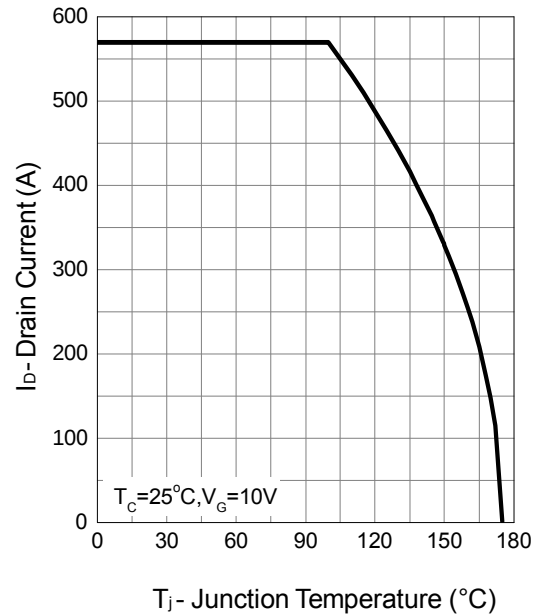
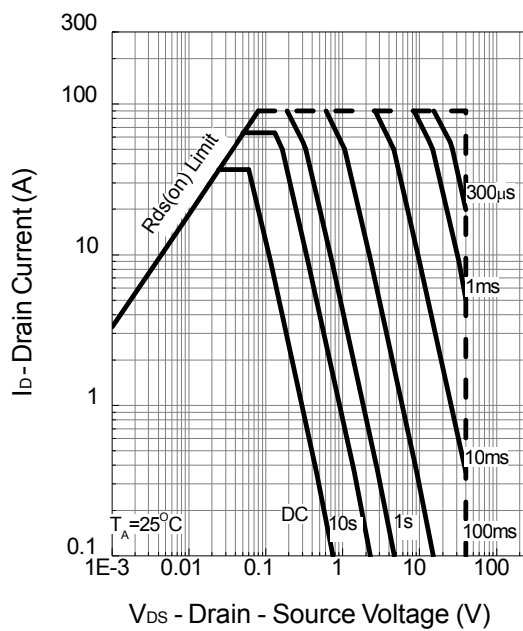
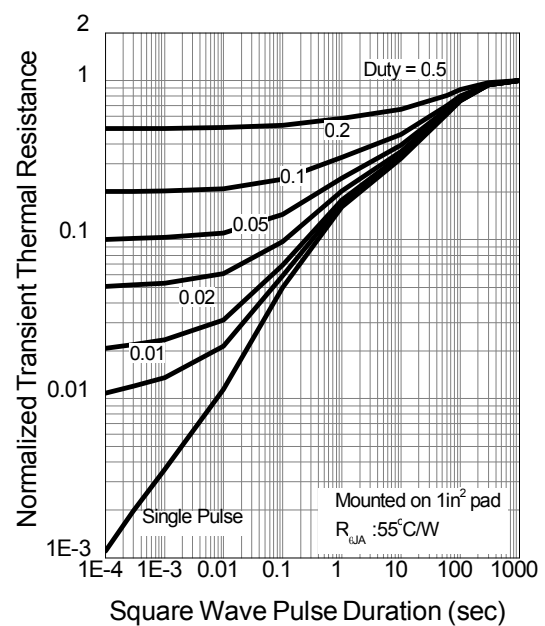
## Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

| 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                                                                     | 40   | -          | -        | V    |
| I <sub>DSS</sub>                         | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =85°C                                               | -    | -          | 1<br>30  | μA   |
| V <sub>GS(th)</sub>                      | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA                                                       | 1.5  | 2          | 2.5      | V    |
| I <sub>GSS</sub>                         | Gate Leakage Current             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                                      |      | -          | ±100     | nA   |
| R <sub>DS(ON)</sub>                      | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =25A<br>T <sub>J</sub> =125°C                                             | -    | 0.6<br>1.4 | 0.8<br>- | mΩ   |
|                                          |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =25A                                                                     | -    | 0.9        | 1.3      |      |
| Gfs                                      | Forward Transconductance         | V <sub>DS</sub> =5V, I <sub>DS</sub> =20A                                                                       | -    | 3.5        | -        | S    |
| Diode Characteristics                    |                                  |                                                                                                                 |      |            |          |      |
| V <sub>SD</sub> <sup>e</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =20A, V <sub>GS</sub> =0V                                                                       | -    | 0.78       | 1.1      | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time            | I <sub>SD</sub> =25A, dI <sub>SD</sub> /dt=100A/μs<br>V <sub>dd</sub> =20V                                      | -    | 61         | -        | ns   |
| t <sub>a</sub>                           | Charge Time                      |                                                                                                                 | -    | 31         | -        |      |
| t <sub>b</sub>                           | Discharge Time                   |                                                                                                                 | -    | 30         | -        |      |
| Q <sub>rr</sub>                          | Reverse Recovery Charge          |                                                                                                                 | -    | 67         | -        | nC   |
| Dynamic Characteristics <sup>f</sup>     |                                  |                                                                                                                 |      |            |          |      |
| R <sub>G</sub>                           | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                                                | 0.6  | 0.9        | 2        | Ω    |
| C <sub>iss</sub>                         | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =20V,<br>Frequency=1.0MHz                                               | -    | 5230       | -        | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                                 | -    | 2000       | -        |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                                 | -    | 175        | -        |      |
| t <sub>d(ON)</sub>                       | Turn-on Delay Time               | V <sub>DD</sub> =20V, R <sub>L</sub> =20Ω,<br>I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V,<br>R <sub>G</sub> =1Ω | -    | 18.8       | -        | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                                 | -    | 9.8        | -        |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                                 | -    | 50         | -        |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                                 | -    | 90.8       | -        |      |
| Gate Charge Characteristics <sup>f</sup> |                                  |                                                                                                                 |      |            |          |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =20V, V <sub>GS</sub> =10V,<br>I <sub>DS</sub> =25A                                             | -    | 88.98      | -        | nC   |
| Q <sub>gth</sub>                         | Threshold Gate Charge            |                                                                                                                 | -    | 15.84      | -        |      |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                                 | -    | 24.75      | -        |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                                 | -    | 15.63      | -        |      |

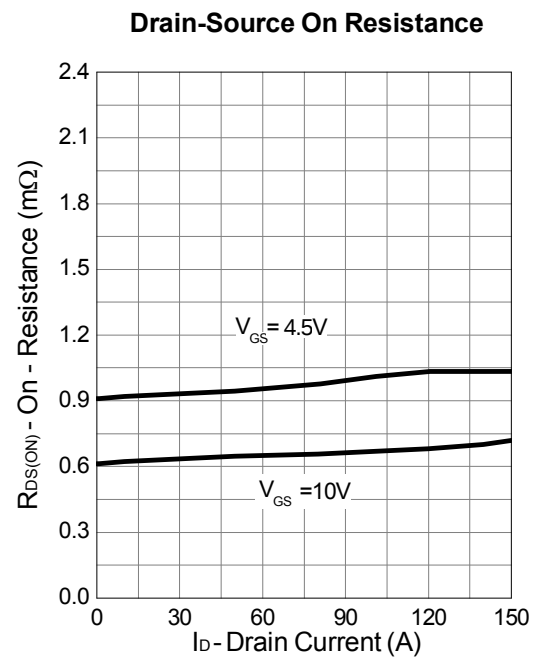
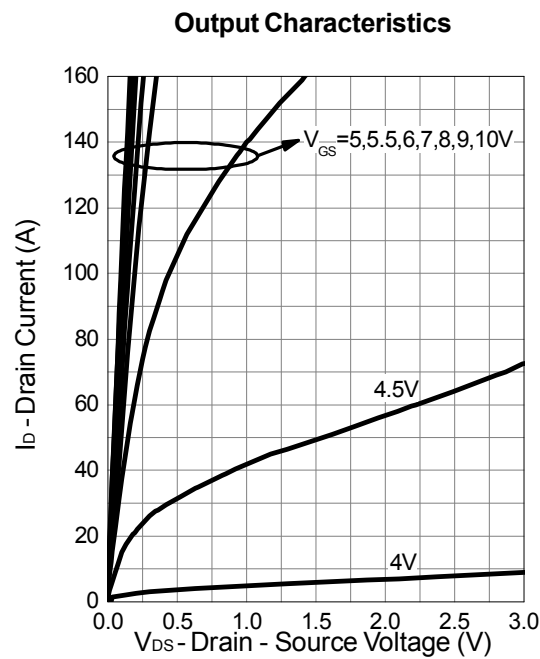
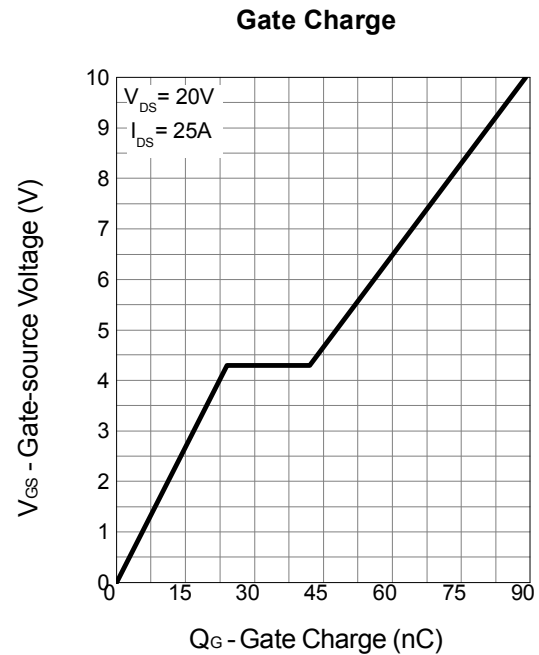
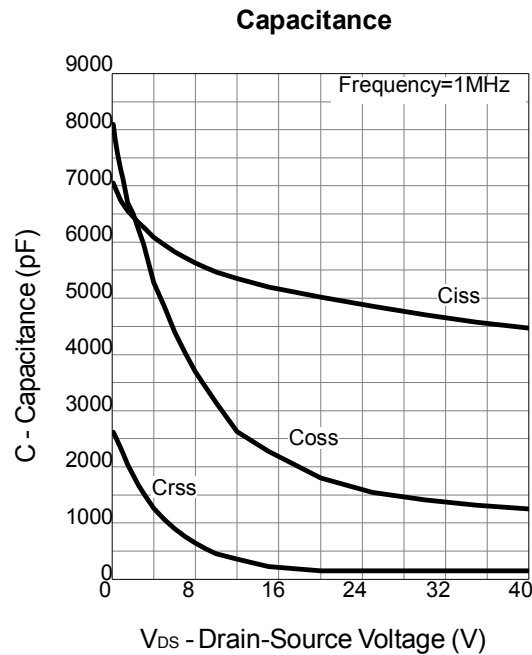
Note e<sup>†</sup> Pulse test ; pulse width≤300μs, duty cycle≤2%.

Note f<sup>†</sup> Guaranteed by design, not subject to production testing.

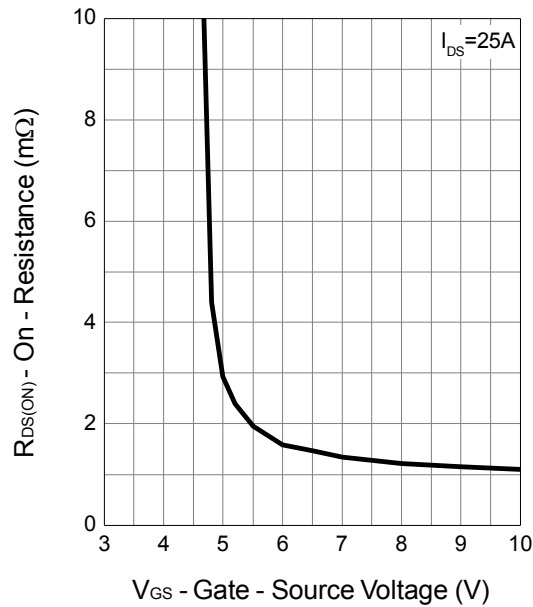
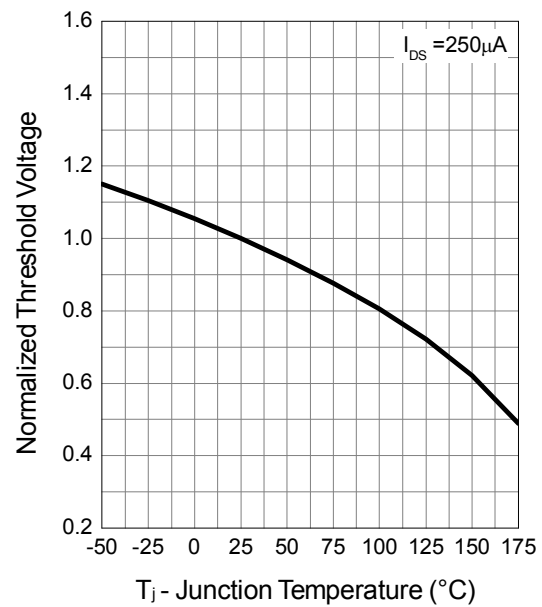
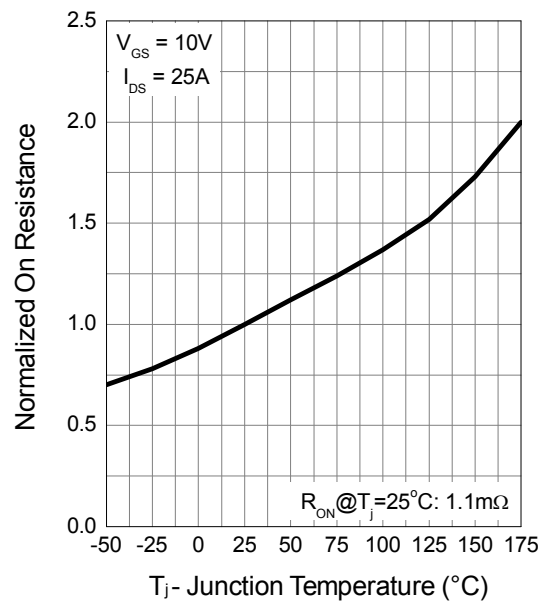
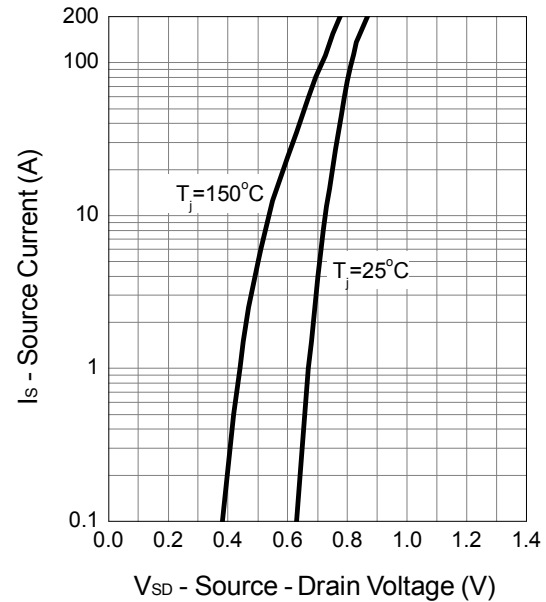
## Typical Operating Characteristics

**Power Dissipation**

**Drain Current**

**Safe Operation Area**

**Thermal Transient Impedance**


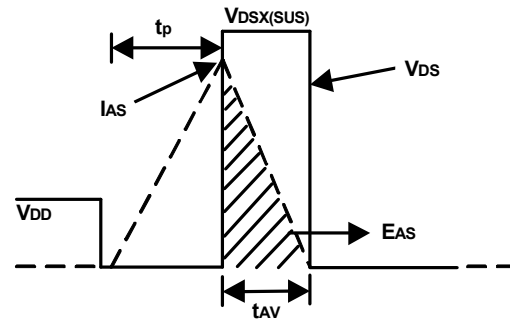
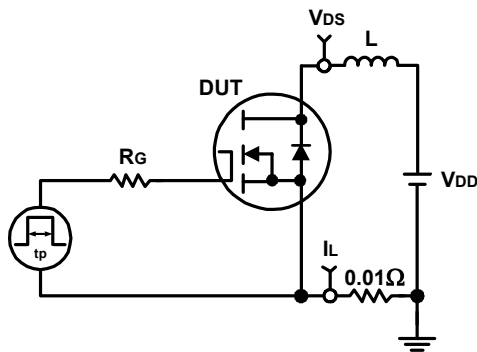
## Typical Operating Characteristics (Cont.)



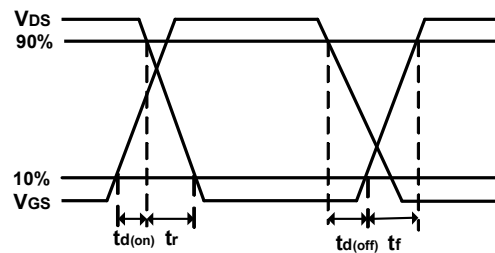
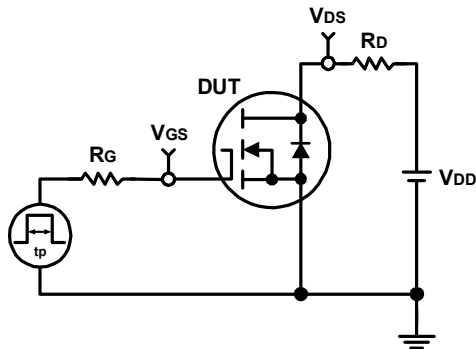
## Typical Operating Characteristics (Cont.)

**Gate-Source On Resistance**

**Gate Threshold Voltage**

**Drain-Source On Resistance**

**Source-Drain Diode Forward**


## Avalanche Test Circuit and Waveforms

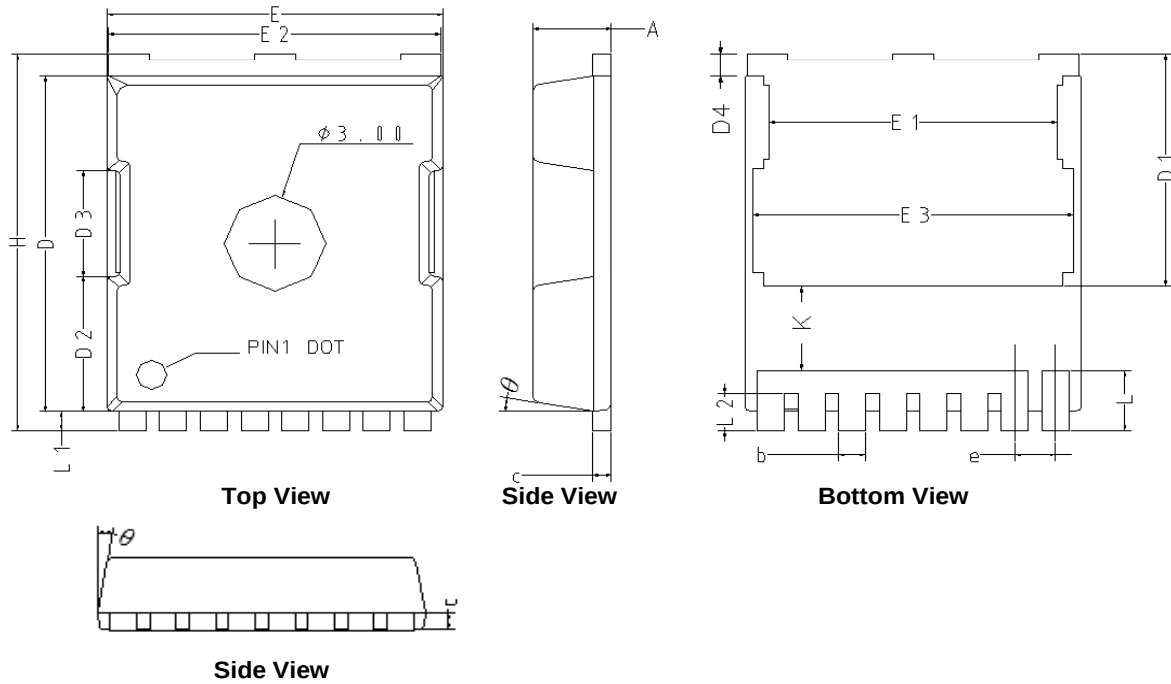


## Switching Time Test Circuit and Waveforms



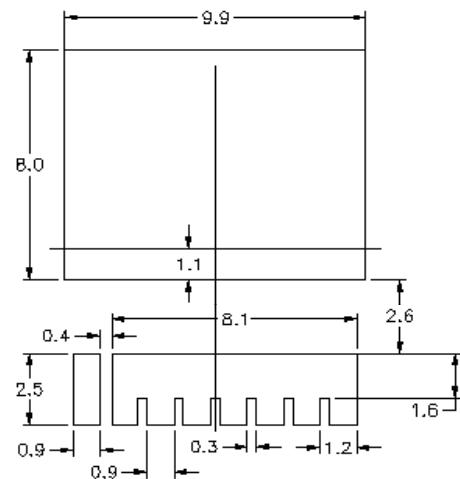
## Package Information

### TOLL



| SYMBOLS  | TO-LL       |       |            |       |
|----------|-------------|-------|------------|-------|
|          | MILLIMETERS |       | INCHES     |       |
|          | MIN.        | MAX.  | MIN.       | MAX.  |
| A        | 2.20        | 2.40  | 0.087      | 0.094 |
| b        | 0.70        | 0.90  | 0.028      | 0.035 |
| c        | 0.40        | 0.60  | 0.016      | 0.024 |
| D        | 10.23       | 10.63 | 0.403      | 0.419 |
| D1       | 7.05        | 7.45  | 0.278      | 0.293 |
| D2       | 3.98        | 4.38  | 0.157      | 0.172 |
| D3       | 3.10        | 3.50  | 0.122      | 0.138 |
| D4       | 0.50        | 0.90  | 0.020      | 0.035 |
| E        | 9.70        | 10.10 | 0.382      | 0.398 |
| E1       | 8.30        | 8.70  | 0.327      | 0.343 |
| E2       | 9.60        | 10.00 | 0.378      | 0.394 |
| E3       | 9.26        | 9.66  | 0.365      | 0.380 |
| H        | 11.53       | 11.93 | 0.454      | 0.470 |
| e        | 1.2 BSC     |       | 0.0472 BSC |       |
| K        | 2.43        | 2.83  | 0.096      | 0.111 |
| L        | 1.65        | 2.05  | 0.065      | 0.081 |
| L1       | 0.40        | 0.80  | 0.016      | 0.031 |
| L2       | 0.95        | 1.35  | 0.037      | 0.053 |
| $\theta$ | 6°          | 10°   | 6°         | 10°   |

### RECOMMENDED LAND PATTERN



UNIT: mm