

### Features

- 60V/125A,  
 $R_{DS(ON)} = 5.5m$  (tpy.) @  $V_{GS} = 10V$
- Super High Dense Cell Design
- Ultra Low On-Resistance
- 100% avalanche tested
- Lead Free and Green Devices Available  
 (RoHS Compliant)

### Applications

- DC-DC Converters
- Inverter Systems

### Pin Description



### Absolute Maximum Ratings

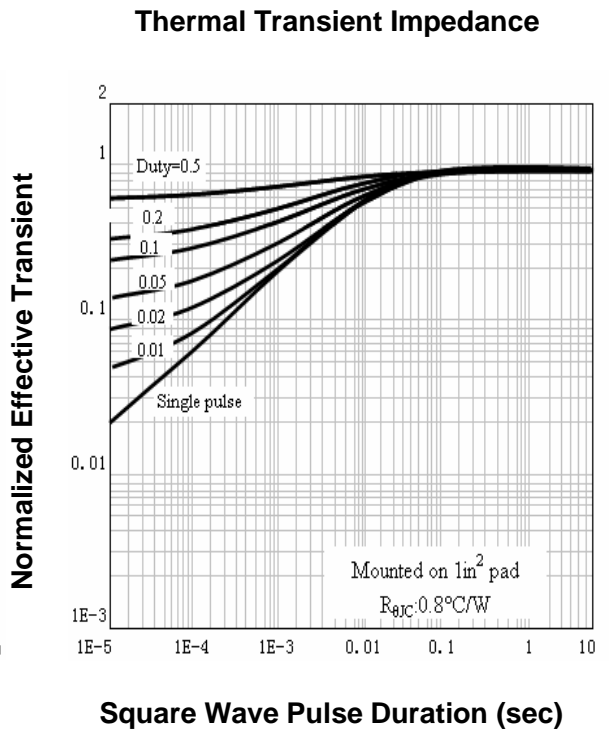
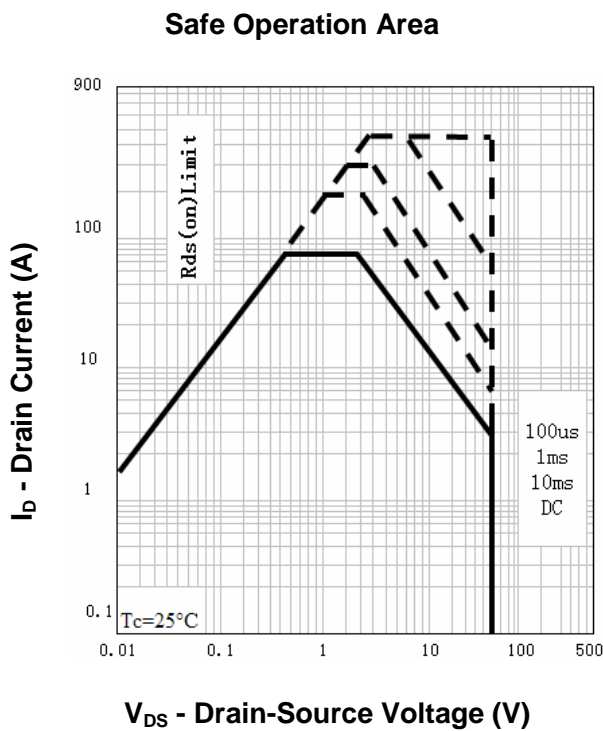
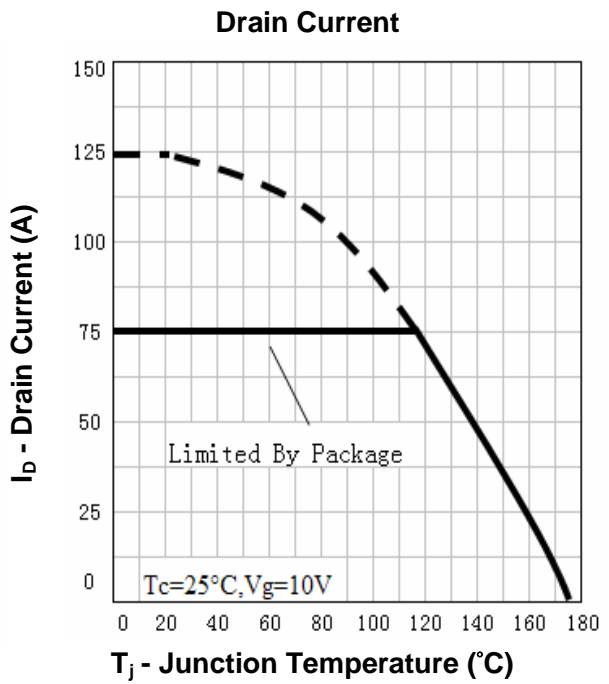
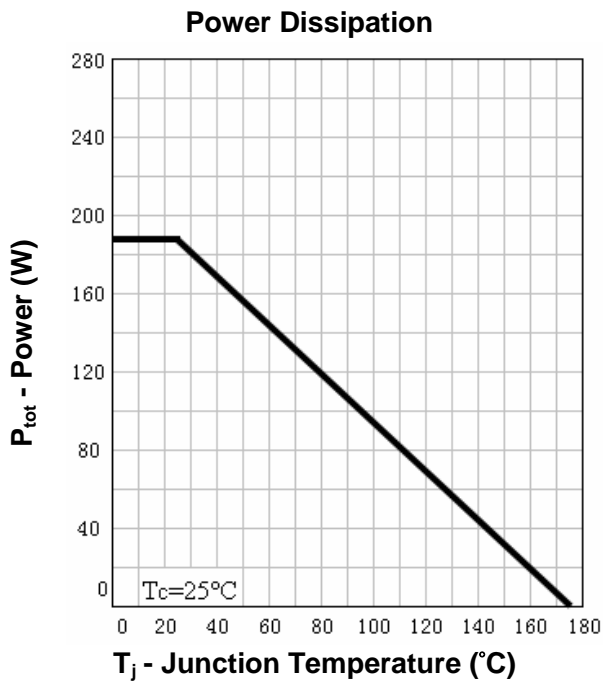
| Symbol                                                             | Parameter                              | Rating                                 | Unit         |
|--------------------------------------------------------------------|----------------------------------------|----------------------------------------|--------------|
| <b>Common Ratings</b> ( $T_C = 25^\circ C$ Unless Otherwise Noted) |                                        |                                        |              |
| $V_{DSS}$                                                          | Drain-Source Voltage                   | 60                                     | V            |
| $V_{GSS}$                                                          | Gate-Source Voltage                    | $\pm 25$                               |              |
| $T_J$                                                              | Maximum Junction Temperature           | 175                                    | $^\circ C$   |
| $T_{STG}$                                                          | Storage Temperature Range              | -55 to 175                             | $^\circ C$   |
| $I_S$                                                              | Diode Continuous Forward Current       | $T_C = 25^\circ C$<br>125 <sup>①</sup> | A            |
| <b>Mounted on Large Heat Sink</b>                                  |                                        |                                        |              |
| $I_{DP}$                                                           | 300 $\mu s$ Pulse Drain Current Tested | $T_C = 25^\circ C$<br>480 <sup>②</sup> | A            |
| $I_D$                                                              | Continuous Drain Current               | $T_C = 25^\circ C$<br>125 <sup>①</sup> | A            |
|                                                                    |                                        | $T_C = 100^\circ C$<br>92              |              |
| $P_D$                                                              | Maximum Power Dissipation              | $T_C = 25^\circ C$<br>188              | W            |
|                                                                    |                                        | $T_C = 100^\circ C$<br>94              | W            |
| $R_{\theta JC}$                                                    | Thermal Resistance-Junction to Case    | 0.8                                    | $^\circ C/W$ |
| <b>Drain-Source Avalanche Ratings</b>                              |                                        |                                        |              |
| $E_{AS}$ <sup>③</sup>                                              | Avalanche Energy, Single Pulsed        | 441                                    | mJ           |

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

| Symbol                                            | Parameter                        | Test Condition                                                              | RU60120R |      |           | Unit       |
|---------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------|----------|------|-----------|------------|
|                                                   |                                  |                                                                             | Min.     | Typ. | Max.      |            |
| <b>Static Characteristics</b>                     |                                  |                                                                             |          |      |           |            |
| $BV_{DSS}$                                        | Drain-Source Breakdown Voltage   | $V_{GS}=0V, I_{DS}=250\mu A$                                                | 60       |      |           | V          |
| $I_{DSS}$                                         | Zero Gate Voltage Drain Current  | $V_{DS}=60V, V_{GS}=0V$<br>$T_J=85^\circ\text{C}$                           |          |      | 1<br>10   | $\mu A$    |
| $V_{GS(th)}$                                      | Gate Threshold Voltage           | $V_{DS}=V_{GS}, I_{DS}=250\mu A$                                            | 2        | 3    | 4         | V          |
| $I_{GSS}$                                         | Gate Leakage Current             | $V_{GS}=\pm 25V, V_{DS}=0V$                                                 |          |      | $\pm 100$ | nA         |
| $R_{DS(ON)}^{(4)}$                                | Drain-Source On-state Resistance | $V_{GS}=10V, I_{DS}=32A$                                                    |          | 5.5  | 6         | m $\Omega$ |
| <b>Diode Characteristics</b>                      |                                  |                                                                             |          |      |           |            |
| $V_{SD}^{(4)}$                                    | Diode Forward Voltage            | $I_{SD}=32A, V_{GS}=0V$                                                     |          |      | 1.2       | V          |
| $t_{rr}$                                          | Reverse Recovery Time            | $I_{SD}=32A, di_{SD}/dt=100A/\mu s$                                         |          | 48   |           | ns         |
| $Q_{rr}$                                          | Reverse Recovery Charge          |                                                                             |          | 96   |           | nC         |
| <b>Dynamic Characteristics</b> <sup>(5)</sup>     |                                  |                                                                             |          |      |           |            |
| $R_G$                                             | Gate Resistance                  | $V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$                                       |          | 1.8  |           | $\Omega$   |
| $C_{iss}$                                         | Input Capacitance                | $V_{GS}=0V,$<br>$V_{DS}=30V,$<br>Frequency=1.0MHz                           |          | 3870 |           | pF         |
| $C_{oss}$                                         | Output Capacitance               |                                                                             |          | 580  |           |            |
| $C_{riss}$                                        | Reverse Transfer Capacitance     |                                                                             |          | 263  |           |            |
| $t_{d(ON)}$                                       | Turn-on Delay Time               |                                                                             |          | 32   |           |            |
| $t_r$                                             | Turn-on Rise Time                | $V_{DD}=30V, R_L=1\Omega,$<br>$I_{DS}=32A, V_{GEN}=10V,$<br>$R_G=4.7\Omega$ |          | 108  |           |            |
| $t_{d(OFF)}$                                      | Turn-off Delay Time              |                                                                             |          | 85   |           |            |
| $t_f$                                             | Turn-off Fall Time               |                                                                             |          | 45   |           |            |
| <b>Gate Charge Characteristics</b> <sup>(5)</sup> |                                  |                                                                             |          |      |           |            |
| $Q_g$                                             | Total Gate Charge                | $V_{DS}=48V, V_{GS}=10V,$<br>$I_{DS}=32A$                                   |          | 105  |           | nC         |
| $Q_{gs}$                                          | Gate-Source Charge               |                                                                             |          | 30   |           |            |
| $Q_{gd}$                                          | Gate-Drain Charge                |                                                                             |          | 45   |           |            |

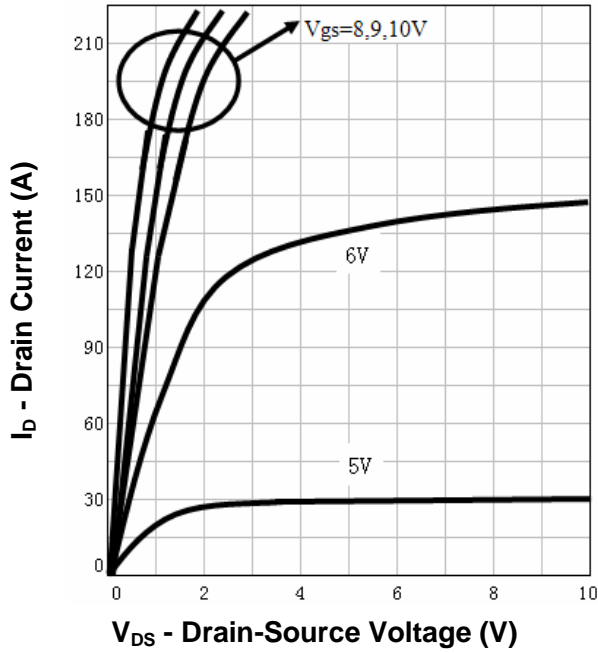
- Notes: ① Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.  
 ② Pulse width limited by safe operating area.  
 ③ Limited by  $T_{Jmax}, I_{AS}=42A, V_{DD}=48V, R_G=47\Omega$ , Starting  $T_J=25^\circ\text{C}$ .  
 ④ Pulse test; Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .  
 ⑤ Guaranteed by design, not subject to production testing.

**Typical Characteristics**

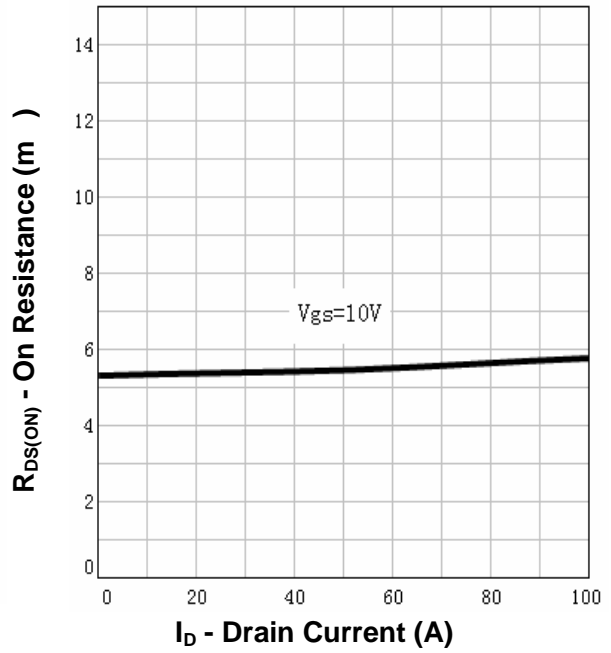


**Typical Characteristics**

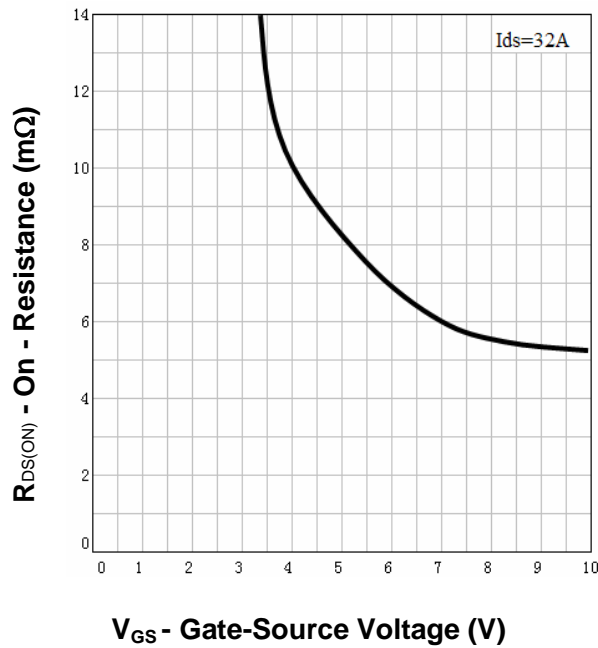
**Output Characteristics**



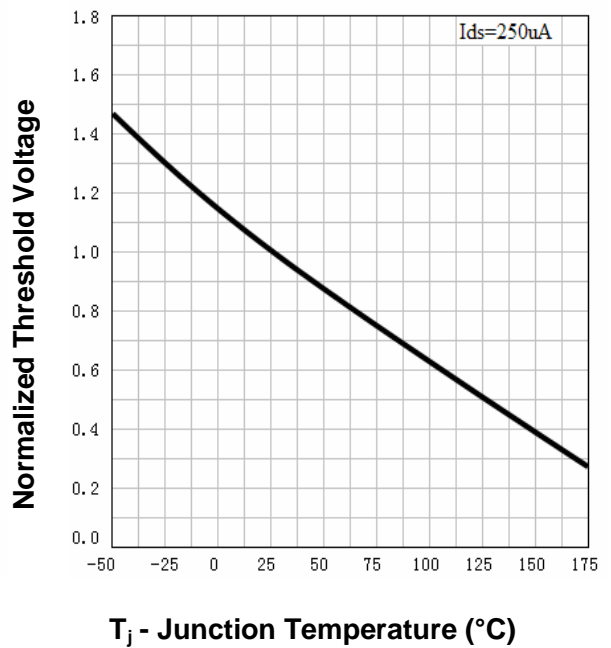
**Drain-Source On Resistance**



**Drain-Source On Resistance**

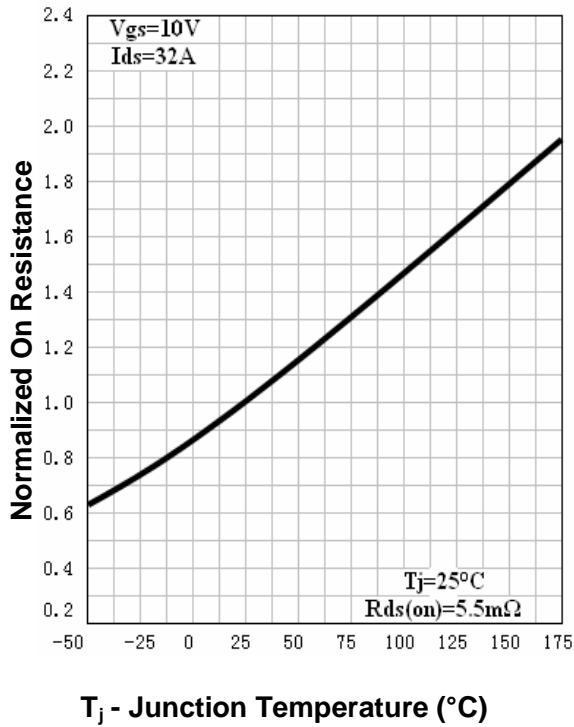


**Gate Threshold Voltage**

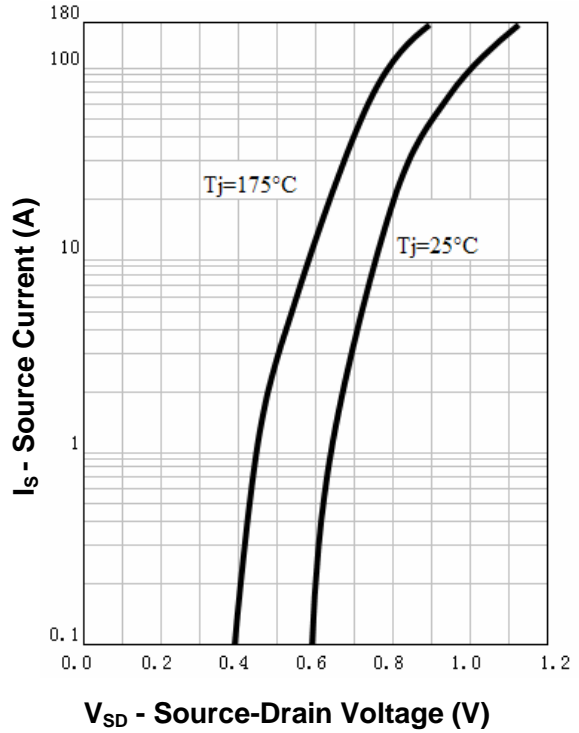


**Typical Characteristics**

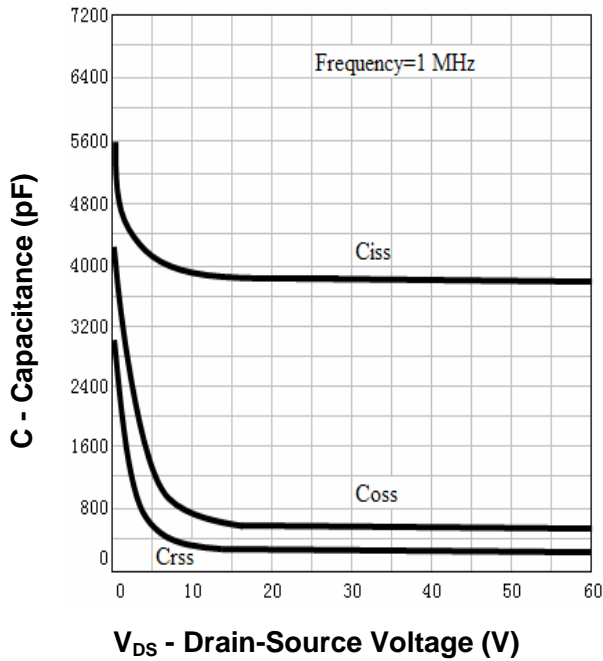
**Drain-Source On Resistance**



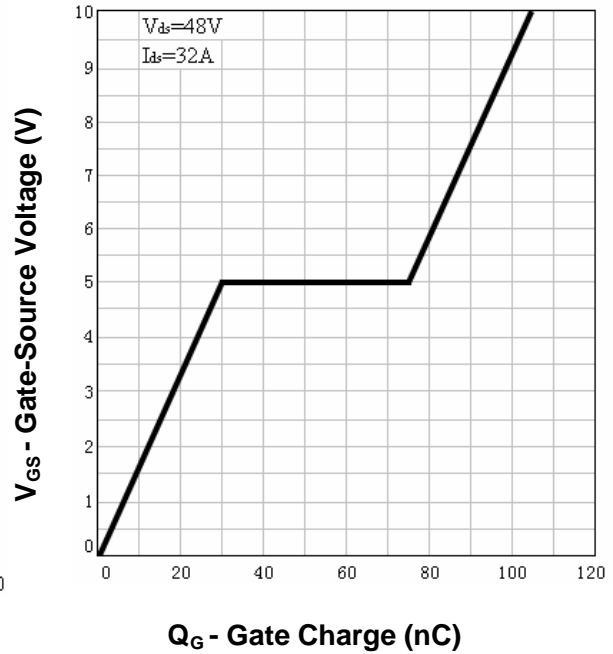
**Source-Drain Diode Forward**



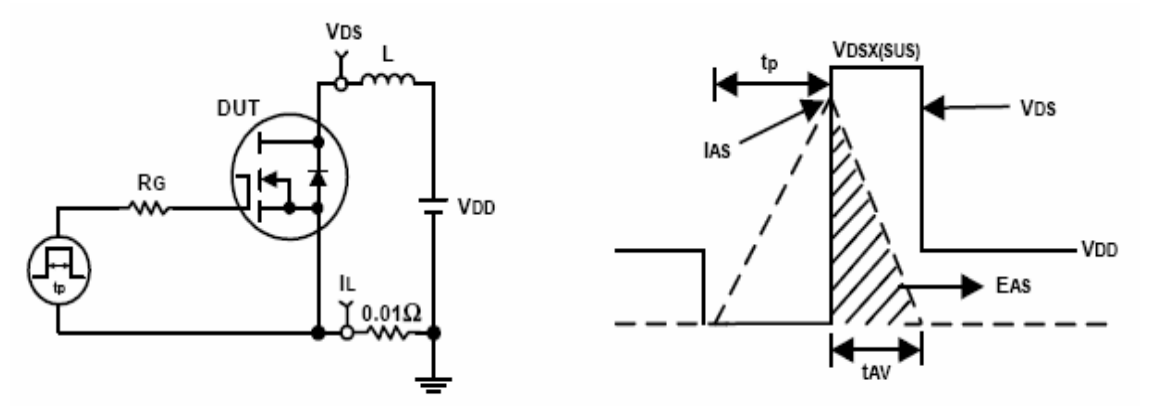
**Capacitance**



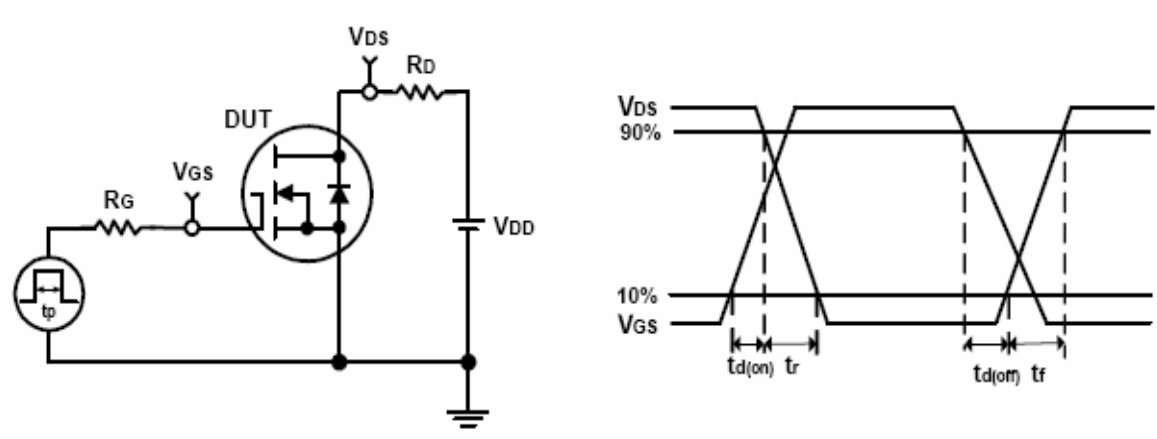
**Gate Charge**



**Avalanche Test Circuit and Waveforms**



**Switching Time Test Circuit and Waveforms**



**Ordering and Marking Information****RU60120****Package (Available)**

R : TO220

**Operating Temperature Range**

C : -55 to 175 °C

**Assembly Material**

G : Green &amp; Lead Free

**Packaging**

T : TUBE

**Package Information**
**TO-220FB-3L**


| SYMBOL | MM    |       |       | INCH  |       |       | SYMBOL     | MM       |      |       | INCH      |       |       |
|--------|-------|-------|-------|-------|-------|-------|------------|----------|------|-------|-----------|-------|-------|
|        | MIN   | NOM   | MAX   | MIN   | NOM   | MAX   |            | MIN      | NOM  | MAX   | MIN       | NOM   | MAX   |
| A      | 4.40  | 4.57  | 4.70  | 0.173 | 0.180 | 0.185 | $\phi p1$  | 1.40     | 1.50 | 1.60  | 0.055     | 0.059 | 0.063 |
| A1     | 1.27  | 1.30  | 1.33  | 0.050 | 0.051 | 0.052 | e          | 2.54BSC  |      |       | 0.1BSC    |       |       |
| A2     | 2.35  | 2.40  | 2.50  | 0.093 | 0.094 | 0.098 | e1         | 5.08BSC  |      |       | 0.2BSC    |       |       |
| b      | 0.77  | -     | 0.90  | 0.030 | -     | 0.035 | H1         | 6.40     | 6.50 | 6.60  | 0.252     | 0.256 | 0.260 |
| b2     | 1.23  | -     | 1.36  | 0.048 | -     | 0.054 | L          | 12.75    | -    | 13.17 | 0.502     | -     | 0.519 |
| C      | 0.48  | 0.50  | 0.52  | 0.019 | 0.020 | 0.021 | L1         | -        | -    | 3.95  | -         | -     | 0.156 |
| D      | 15.40 | 15.60 | 15.80 | 0.606 | 0.614 | 0.622 | L2         | 2.50REF. |      |       | 0.098REF. |       |       |
| D1     | 9.00  | 9.10  | 9.20  | 0.354 | 0.358 | 0.362 | $\phi p$   | 3.57     | 3.60 | 3.63  | 0.141     | 0.142 | 0.143 |
| DEP    | 0.05  | 0.10  | 0.20  | 0.002 | 0.004 | 0.008 | Q          | 2.73     | 2.80 | 2.87  | 0.107     | 0.110 | 0.113 |
| E      | 9.70  | 9.90  | 10.10 | 0.382 | 0.389 | 0.398 | $\theta 1$ | 5°       | 7°   | 9°    | 5°        | 7°    | 9°    |
| E1     | -     | 8.70  | -     | -     | 0.343 | -     | $\theta 2$ | 1°       | 3°   | 5°    | 1°        | 3°    | 5°    |
| E2     | 9.80  | 10.00 | 10.20 | 0.386 | 0.394 | 0.401 |            |          |      |       |           |       |       |

ALL DIMENSIONS REFER TO JEDEC STANDARD  
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS



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