

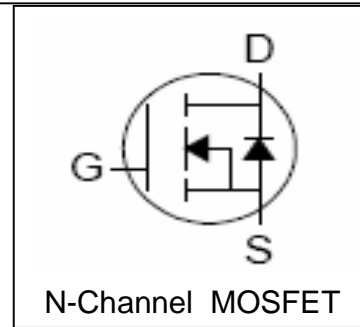
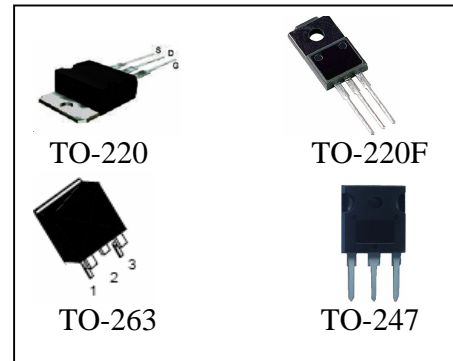
### Features

- 40V/280A,  
 $R_{DS(ON)} = 1.8m\Omega$  (Type) @  $V_{GS} = 10V, I_{DS} = 75A$
- Ultra Low On-Resistance
- Fast Switching and Fully Avalanche Rated
- 100% avalanche tested
- 175°C Operating Temperature
- Lead Free and Green Available

### Applications

- Switching Application Systems
- UPS

### Pin Description



### Absolute Maximum Ratings

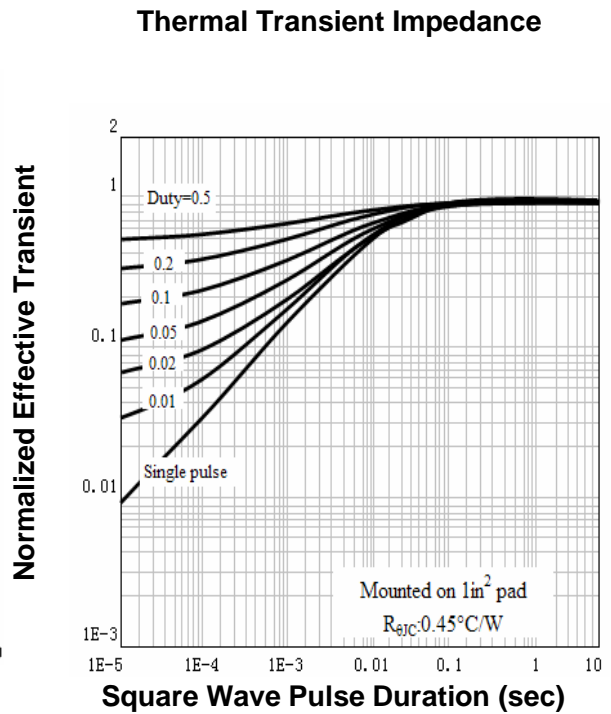
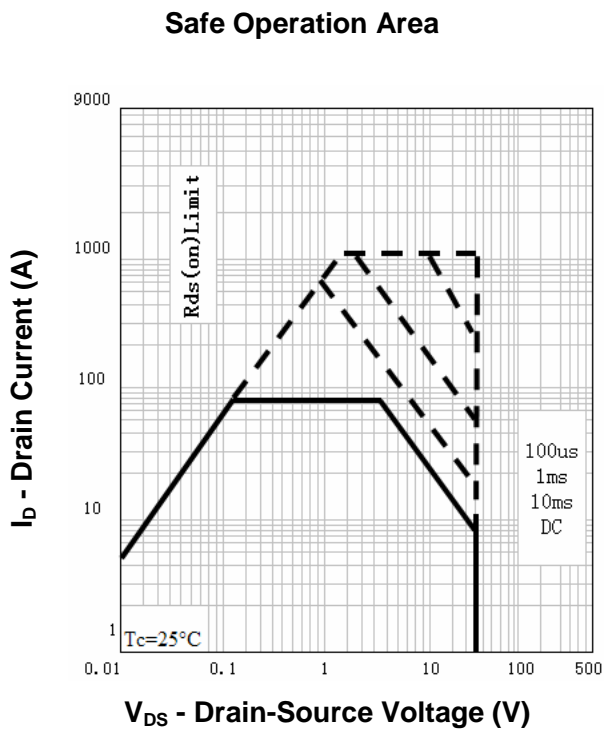
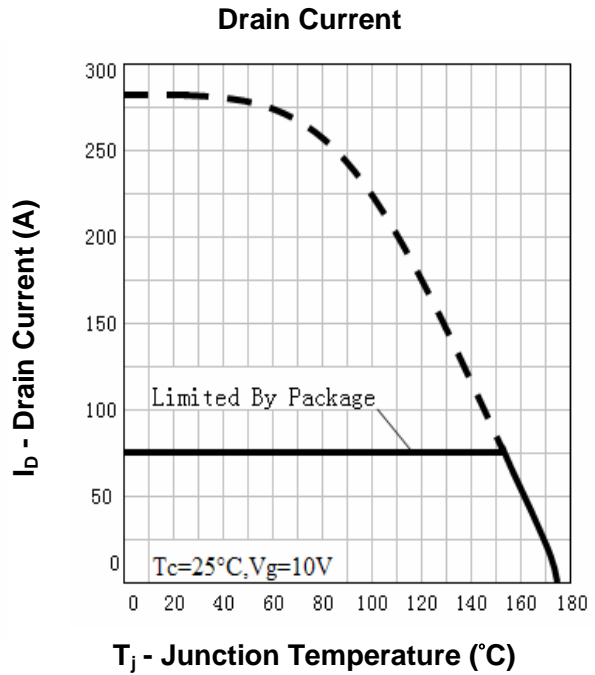
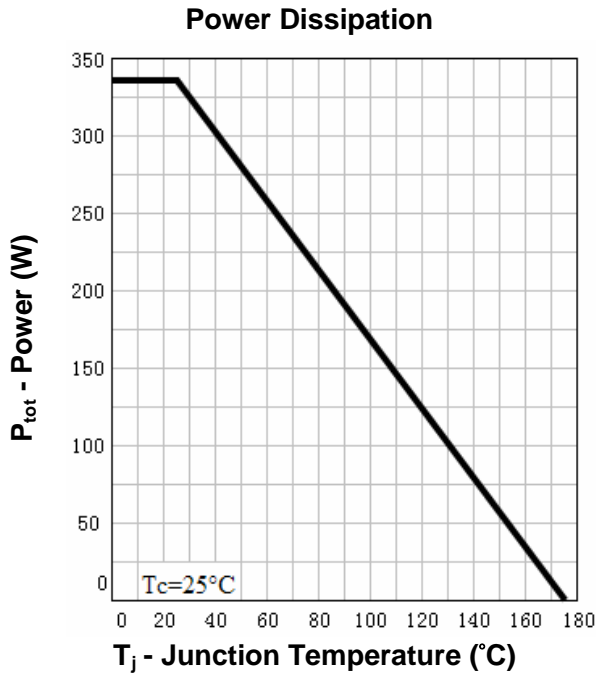
| Symbol   | Parameter                              | Rating                                  | Unit         |
|--|--|---|--------------|
| <b>Common Ratings</b> ( $T_C = 25^\circ C$ Unless Otherwise Noted) |  |   |              |
| $V_{DSS}$  | Drain-Source Voltage                   | 40                                      | V            |
| $V_{GSS}$  | Gate-Source Voltage                    | $\pm 20$                                |              |
| $T_J$  | 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>280               | A            |
| <b>Mounted on Large Heat Sink</b>                                  |  |   |              |
| $I_{DP}$   | 300 $\mu s$ Pulse Drain Current Tested | $T_C = 25^\circ C$<br>1100 <sup>①</sup> | A            |
| $I_D$  | Continuous Drain Current               | $T_C = 25^\circ C$<br>280 <sup>②</sup>  | A            |
|  |  | $T_C = 100^\circ C$<br>210 <sup>②</sup> |              |
| $P_D$  | Maximum Power Dissipation              | $T_C = 25^\circ C$<br>333               | W            |
|  |  | $T_C = 100^\circ C$<br>167              |              |
| $R_{\theta JC}$  | Thermal Resistance-Junction to Case    | 0.45                                    | $^\circ C/W$ |
| <b>Drain-Source Avalanche Ratings</b>                              |  |   |              |
| $E_{AS}$ <sup>③</sup>  | Avalanche Energy, Single Pulsed        | 1260                                    | mJ           |

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

| Symbol  | Parameter                        | Test Condition  | RU40280R |      |           | Unit       |
|---|----------------------------------|---|----------|------|-----------|------------|
|   |                                  |   | Min.     | Typ. | Max.      |            |
| <b>Static Characteristics</b>                     |                                  |   |          |      |           |            |
| $BV_{DSS}$  | Drain-Source Breakdown Voltage   | $V_{GS}=0V, I_{DS}=250\mu A$  | 40       |      |           | V          |
| $I_{DSS}$   | Zero Gate Voltage Drain Current  | $V_{DS}=40V, V_{GS}=0V$<br>$T_J=85^\circ\text{C}$                         |          |      | 1         | $\mu A$    |
|   |                                  |   |          |      | 30        |            |
| $V_{GS(th)}$                                      | Gate Threshold Voltage           | $V_{DS}=V_{GS}, I_{DS}=250\mu A$  | 2        | 3    | 4         | V          |
| $I_{GSS}$   | Gate Leakage Current             | $V_{GS}=\pm 20V, V_{DS}=0V$   |          |      | $\pm 100$ | nA         |
| $R_{DS(ON)}^{(4)}$                                | Drain-Source On-state Resistance | $V_{GS}=10V, I_{DS}=75A$  |          | 1.8  | 2.3       | m $\Omega$ |
| <b>Diode Characteristics</b>                      |                                  |   |          |      |           |            |
| $V_{SD}^{(4)}$                                    | Diode Forward Voltage            | $I_{SD}=75A, V_{GS}=0V$   |          |      | 1.2       | V          |
| $t_{rr}$  | Reverse Recovery Time            | $I_{SD}=75A, di_{SD}/dt=100A/\mu s$                                       |          | 84   |           | ns         |
| $Q_{rr}$  | Reverse Recovery Charge          |   |          | 125  |           | nC         |
| <b>Dynamic Characteristics</b> <sup>(5)</sup>     |                                  |   |          |      |           |            |
| $R_G$   | Gate Resistance                  | $V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$                                     |          | 1.0  |           | $\Omega$   |
| $C_{iss}$   | Input Capacitance                | $V_{GS}=0V,$<br>$V_{DS}=20V,$<br>Frequency=1.0MHz                         |          | 6400 |           | pF         |
| $C_{oss}$   | Output Capacitance               |   |          | 1040 |           |            |
| $C_{riss}$  | Reverse Transfer Capacitance     |   |          | 750  |           |            |
| $t_{d(ON)}$                                       | Turn-on Delay Time               |   |          | 29   |           |            |
| $t_r$   | Turn-on Rise Time                | $V_{DD}=20V, R_L=3\Omega,$<br>$I_{DS}=75A, V_{GEN}=10V,$<br>$R_G=6\Omega$ |          | 130  |           | ns         |
| $t_{d(OFF)}$                                      | Turn-off Delay Time              |   |          | 150  |           |            |
| $t_f$   | Turn-off Fall Time               |   |          | 125  |           |            |
| <b>Gate Charge Characteristics</b> <sup>(5)</sup> |                                  |   |          |      |           |            |
| $Q_g$   | Total Gate Charge                | $V_{DS}=32V, V_{GS}=10V,$<br>$I_{DS}=75A$                                 |          | 156  | 202       | nC         |
| $Q_{gs}$  | Gate-Source Charge               |   |          | 36   |           |            |
| $Q_{gd}$  | Gate-Drain Charge                |   |          | 50   |           |            |

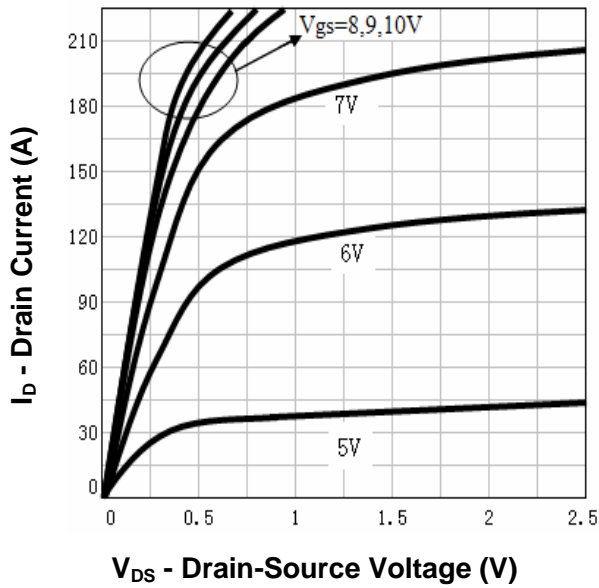
- Notes:
- ① Pulse width limited by safe operating area.
  - ② Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A..
  - ③ Limited by  $T_{Jmax}, I_{AS}=71A, V_{DD}=32V, R_G=47\Omega$ , Starting  $T_J=25^\circ\text{C}$ .
  - ④ Pulse test; Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
  - ⑤ Guaranteed by design, not subject to production testing.

**Typical Characteristics**

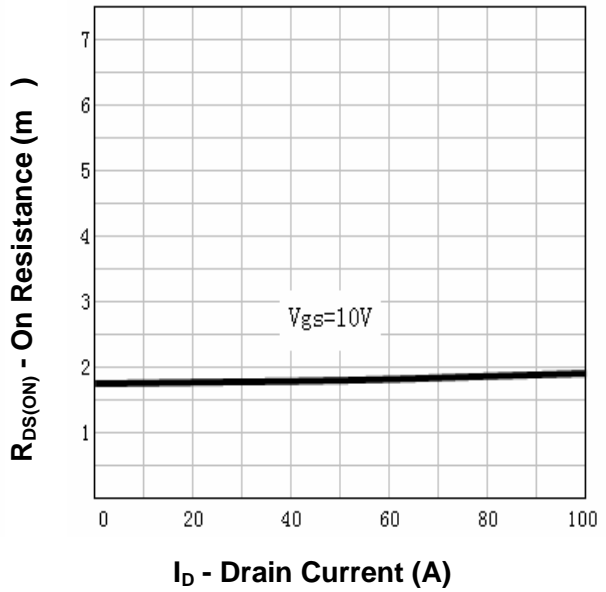


**Typical Characteristics**

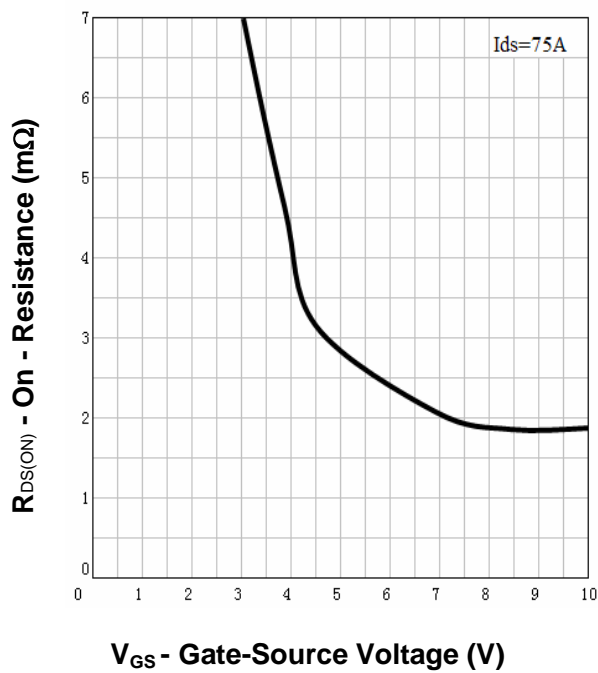
**Output Characteristics**



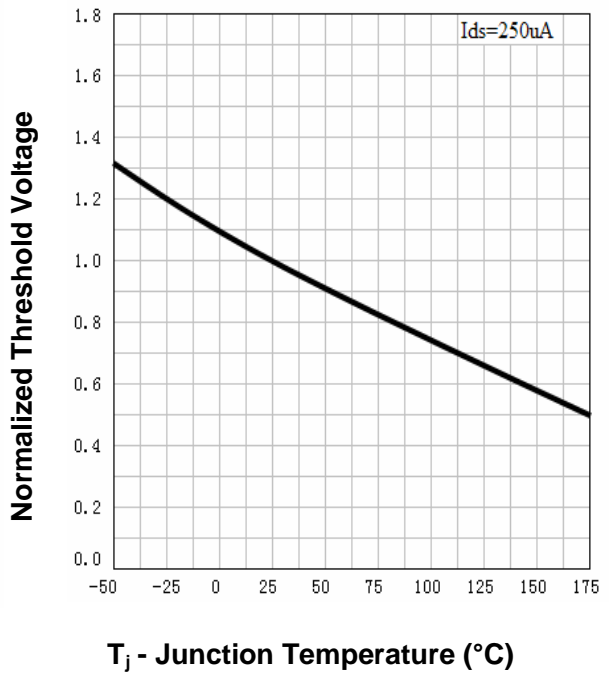
**Drain-Source On Resistance**



**Drain-Source On Resistance**

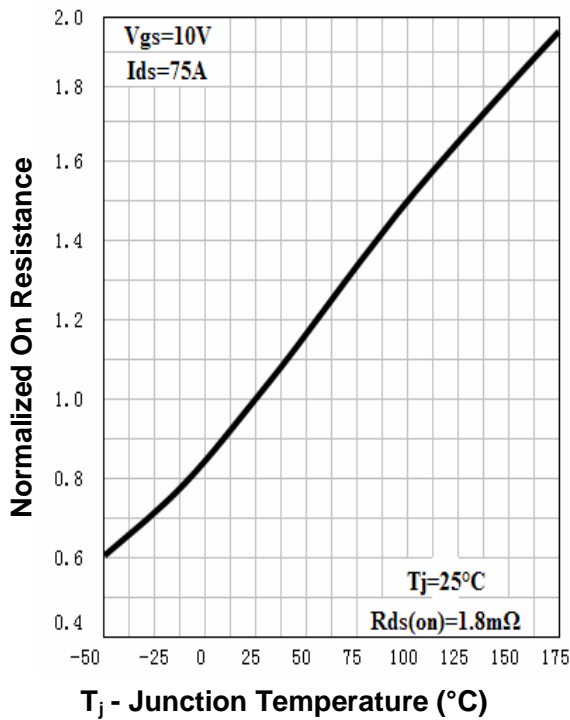


**Gate Threshold Voltage**

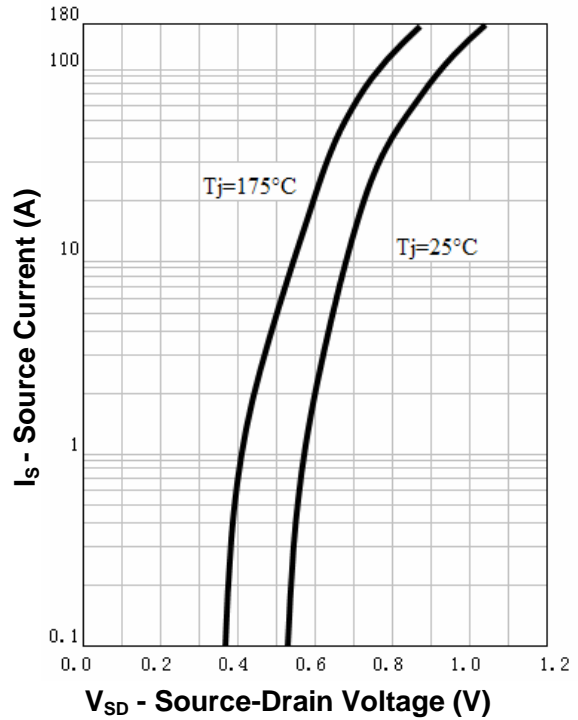


**Typical Characteristics**

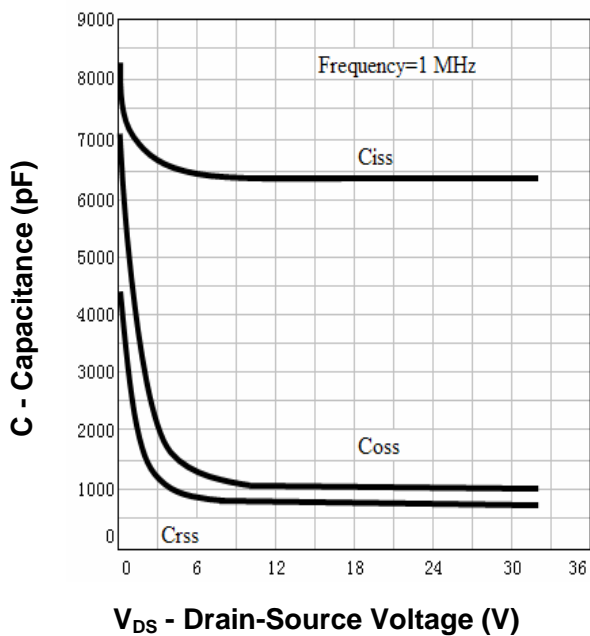
**Drain-Source On Resistance**



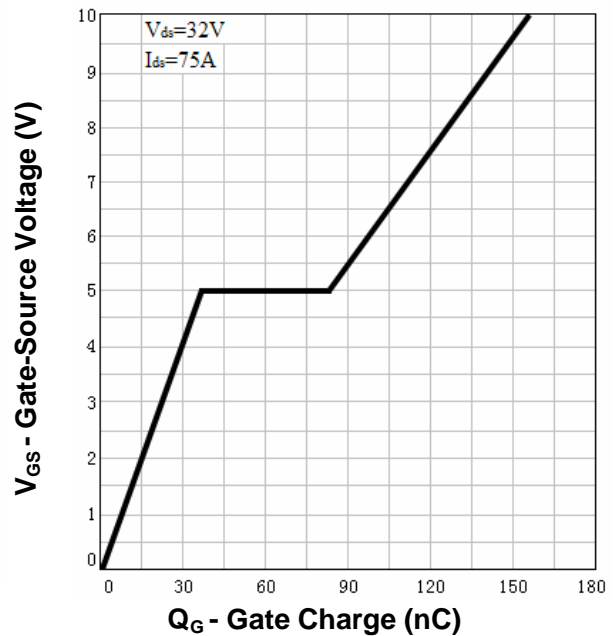
**Source-Drain Diode Forward**



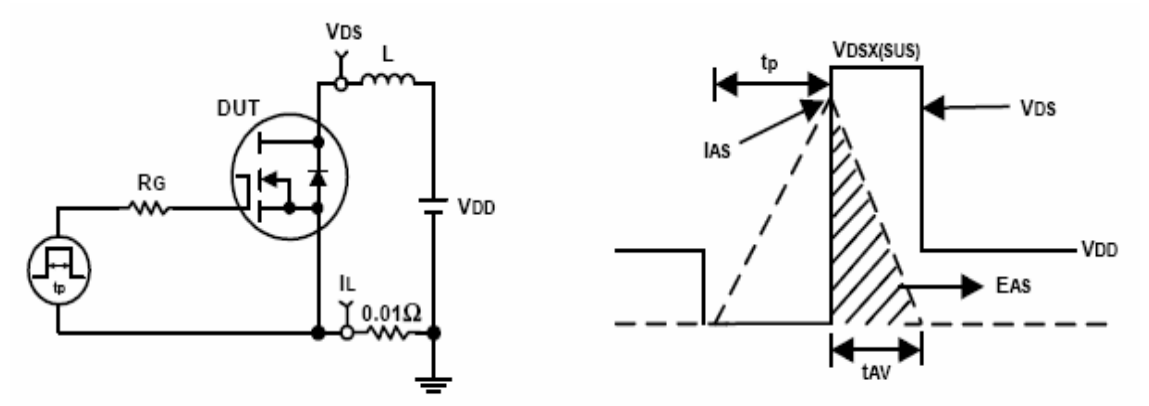
**Capacitance**



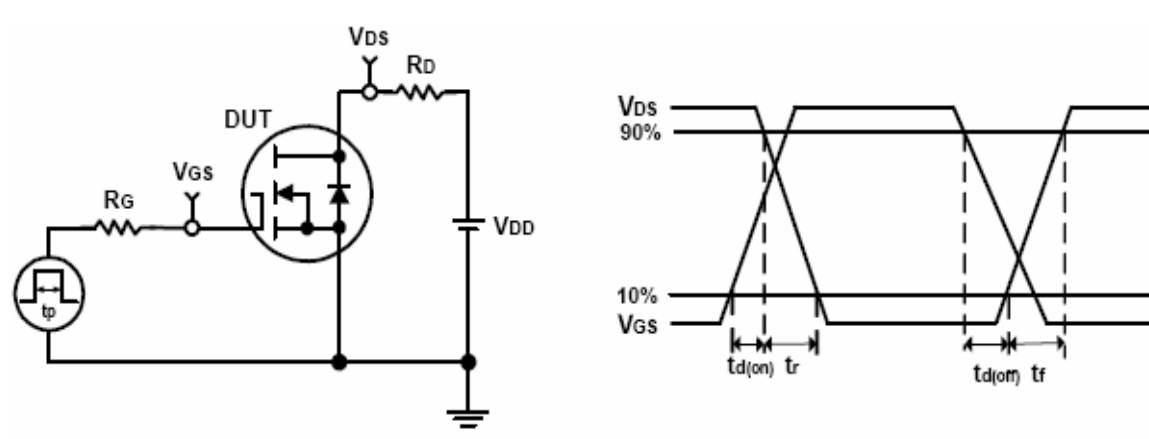
**Gate Charge**



**Avalanche Test Circuit and Waveforms**



**Switching Time Test Circuit and Waveforms**



**Ordering and Marking Information****RU40280****Package (Available)**

R : TO-220; S: TO-263 ; Q: TO-247

**Operating Temperature Range**

C : -55 to 175 °C

**Assembly Material**

G : Green &amp; Lead Free

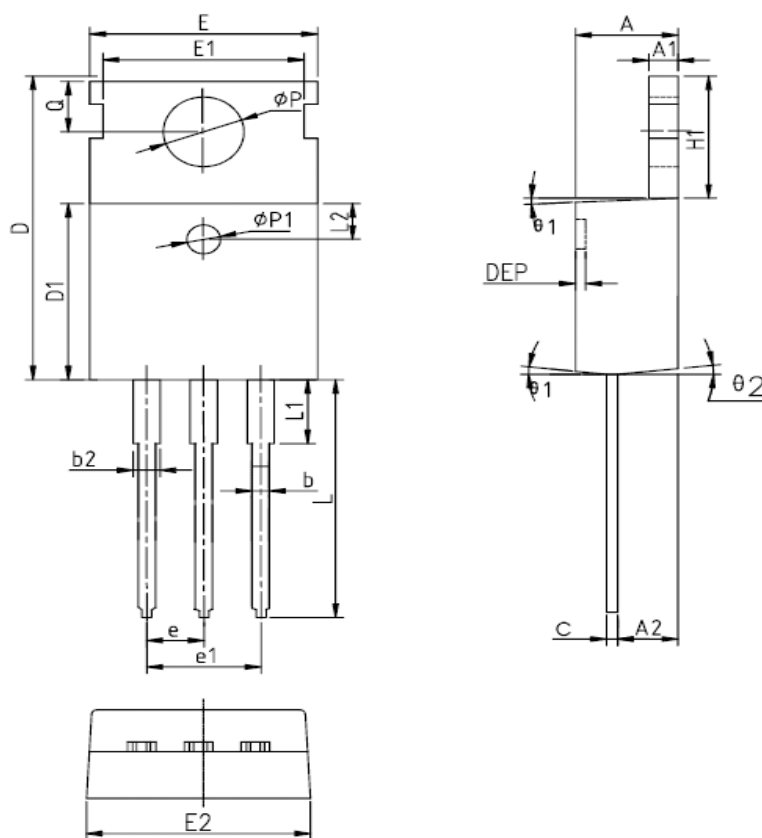
**Packaging**

T : TUBE

TR : Tape &amp; Reel

**Package Information**

**TO-220FB-3L**

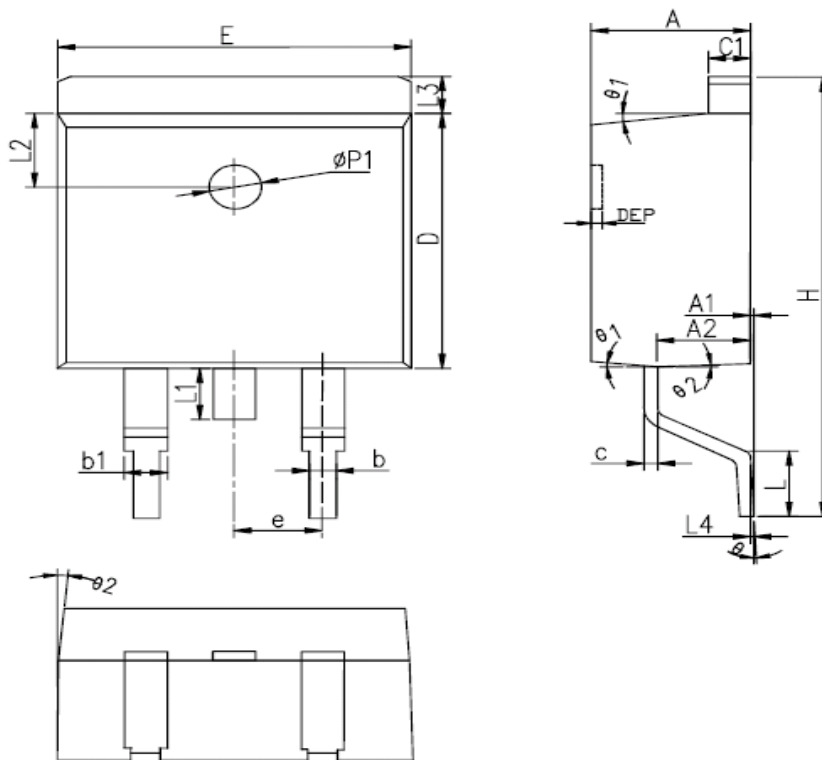


| SYMBOL | MM    |       |       | INCH  |       |       | SYMBOL     | MM       |      |       | INCH      |       |       |
|--------|-------|-------|-------|-------|-------|-------|------------|----------|------|-------|-----------|-------|-------|
|        | MIN   | NOM   | MAX   | MIN   | NOM   | 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**



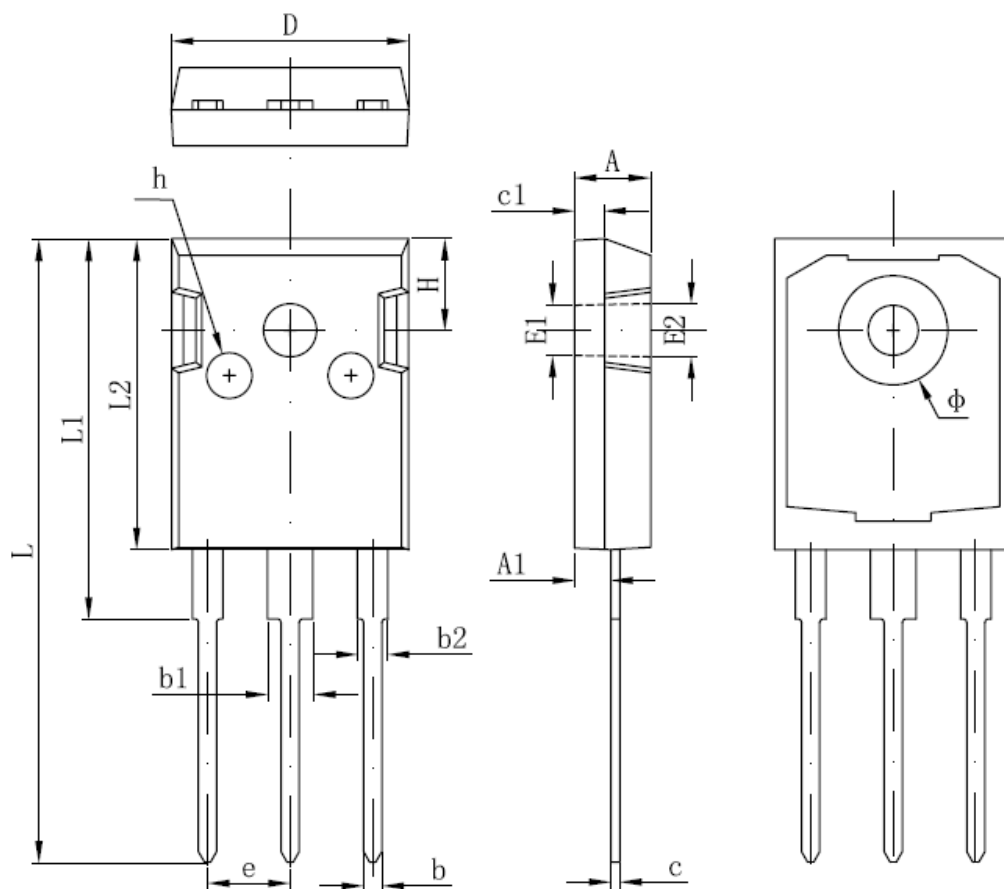
**TO-263-2L**



| 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 | L      | 2.00     | 2.30 | 2.60 | 0.079     | 0.090 | 0.102 |
| A1     | 0       | 0.10  | 0.25  | 0      | 0.004 | 0.010 | L3     | 1.17     | 1.27 | 1.40 | 0.046     | 0.050 | 0.055 |
| A2     | 2.59    | 2.69  | 2.79  | 0.102  | 0.106 | 0.110 | L1     | -        | -    | 1.70 | -         | -     | 0.067 |
| b      | 0.77    | -     | 0.90  | 0.030  | -     | 0.035 | L4     | 0.25BSC  |      |      | 0.01BSC   |       |       |
| b1     | 1.23    | -     | 1.36  | 0.048  | -     | 0.052 | L2     | 2.50REF. |      |      | 0.098REF. |       |       |
| c      | 0.34    | -     | 0.47  | 0.013  | -     | 0.019 | θ      | 0°       | -    | 8°   | 0°        | -     | 8°    |
| C1     | 1.22    | -     | 1.32  | 0.048  | -     | 0.052 | θ 1    | 5°       | 7°   | 9°   | 5°        | 7°    | 9°    |
| D      | 8.60    | 8.70  | 8.80  | 0.338  | 0.343 | 0.346 | θ 2    | 1°       | 3°   | 5°   | 1°        | 3°    | 5°    |
| E      | 10.00   | 10.16 | 10.26 | 0.394  | 0.4   | 0.404 | DEP    | 0.05     | 0.10 | 0.20 | 0.002     | 0.004 | 0.008 |
| e      | 2.54BSC |       |       | 0.1BSC |       |       | Øp1    | 1.40     | 1.50 | 1.60 | 0.055     | 0.059 | 0.063 |
| H      | 14.70   | 15.10 | 15.50 | 0.579  | 0.594 | 0.610 |        |          |      |      |           |       |       |

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

**TO-247**



| SYMBOL | MM         |        | INCH       |       | SYMBOL | MM         |        | INCH       |       |
|--------|------------|--------|------------|-------|--------|------------|--------|------------|-------|
|        | MIN        | MAX    | MIN        | MAX   |        | MIN        | MAX    | MIN        | MAX   |
| A      | 4.850      | 5.150  | 0,191      | 0.200 | E2     | 3.600 REF  |        | 0.142 REF  |       |
| A1     | 2.200      | 2.600  | 0.087      | 0.102 | L      | 40.900     | 41.300 | 1.610      | 1.626 |
| B      | 1.000      | 1.400  | 0.039      | 0.055 | L1     | 24.800     | 25.100 | 0.976      | 0.988 |
| b1     | 2.800      | 3.200  | 0.110      | 0.126 | L2     | 20.300     | 20.600 | 0.799      | 0.811 |
| b2     | 1.800      | 2.200  | 0.071      | 0.087 | Φ      | 7.100      | 7.300  | 0.280      | 0.287 |
| c      | 0.500      | 0.700  | 0.020      | 0.028 | e      | 5.450 TYP  |        | 0.215 TYP  |       |
| c1     | 1.900      | 2.100  | 0.075      | 0.083 | H      | 5.980 REF. |        | 0.235 REF. |       |
| D      | 15.450     | 15.750 | 0.608      | 0.620 | h      | 0.000      | 0.300  | 0.000      | 0.012 |
| E1     | 3.500 REF. |        | 0.138 REF. |       |        |            |        |            |       |

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

## Customer Service

**Worldwide Sales and Service:**

Sales@ruichips.com

**Technical Support:**

Technical@ruichips.com

**Investor Relations Contacts:**

Investor@ruichips.com

**Marcom Contact:**

Marcom@ruichips.com

**Editorial Contact:**

Editorial@ruichips.com

**HR Contact:**

HR@ruichips.com

**Legal Contact:**

Legal@ruichips.com

**Shen Zhen RUICHIPS Semiconductor CO., LTD**

Room 501, the 5floor An Tong Industrial Building,  
NO.207 Mei Hua Road Fu Tian Area Shen Zhen City, CHINA

**TEL:** (86-755) 8311-5334

**FAX:** (86-755) 8311-4278

**E-mail:** Sales-SZ@ruichips.com