


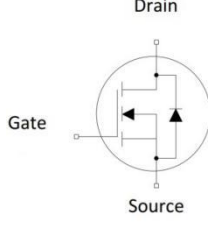



## N-channel 700V, 11A, 0.38Ω Super-Junction Power MOSFET

|  |   |                              |      |                  |       |       |     |             |         |
|--|---|------------------------------|------|------------------|-------|-------|-----|-------------|---------|
| <p><b>Description</b></p> <p>Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFET , designed according to the SJ principle. The resulting device has extremely low on resistance,making it especially suitable for applications which require superior power density and outstanding efficiency.</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>◆ Very low FOM <math>R_{DS(on)} \times Q_g</math></li> <li>◆ 100% UIS tested</li> <li>◆ RoHS compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>◆ Power factor correction (PFC).</li> <li>◆ Switched mode power supplies (SMPS).</li> <li>◆ Uninterrupted power supply (UPS).</li> </ul> | <p><b>Product Summary</b></p> <table> <tr> <td><math>V_{DS} @ T_{j,25^{\circ}C}</math></td> <td>700V</td> </tr> <tr> <td><math>R_{DS(on),max}</math></td> <td>0.38Ω</td> </tr> <tr> <td><math>I_D</math></td> <td>11A</td> </tr> <tr> <td><math>Q_{g,typ}</math></td> <td>19.2 nC</td> </tr> </table> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><b>TO-252</b></p> </div> <div style="text-align: center;">  <p><b>TO-251</b></p> </div> <div style="text-align: center;">  <p><b>TO-220F</b></p> </div> </div> <div style="text-align: center; margin-top: 20px;">  <p>Drain</p> <p>Gate</p> <p>Source</p> <p><b>N-Channel MOSFET</b></p> </div> <div style="text-align: center; margin-top: 20px;">  </div> | $V_{DS} @ T_{j,25^{\circ}C}$ | 700V | $R_{DS(on),max}$ | 0.38Ω | $I_D$ | 11A | $Q_{g,typ}$ | 19.2 nC |
| $V_{DS} @ T_{j,25^{\circ}C}$   | 700V  |                              |      |                  |       |       |     |             |         |
| $R_{DS(on),max}$   | 0.38Ω   |                              |      |                  |       |       |     |             |         |
| $I_D$  | 11A   |                              |      |                  |       |       |     |             |         |
| $Q_{g,typ}$  | 19.2 nC   |                              |      |                  |       |       |     |             |         |

### Marking information

| Product     | Package | Marking     | Packing method |
|-------------|---------|-------------|----------------|
| RMA70R380SN | TO-252  | RMA70R380SN | Reel           |
| RMG70R380SN | TO-251  | RMG70R380SN | Tube           |
| RMC70R380SN | TO-220F | RMC70R380SN | Tube           |

### Absolute Maximum Ratings

| Parameter   | Symbol         | Value       | Unit      |
|---|----------------|-------------|-----------|
| Drain-Source Voltage  | $V_{DSS}$      | 700         | V         |
| Continuous drain current<br>( $T_C = 25^{\circ}C$ )<br>( $T_C = 100^{\circ}C$ ) | $I_D$          | 11<br>7     | A<br>A    |
| Pulsed drain current <sup>1)</sup>  | $I_{DM}$       | 33          | A         |
| Gate-Source voltage   | $V_{GSS}$      | ±30         | V         |
| Avalanche energy, single pulse <sup>2)</sup>                                    | $E_{AS}$       | 210         | mJ        |
| Avalanche current, repetitive <sup>3)</sup>                                     | $I_{AR}$       | 1.6         | A         |
| Power Dissipation TO-252 /TO-251 ( $T_C = 25^{\circ}C$ )<br>- Derate above 25°C | $P_D$          | 118<br>0.94 | W<br>W/°C |
| Power Dissipation TO-220F ( $T_C = 25^{\circ}C$ )<br>- Derate above 25°C        | $P_D$          | 33<br>0.26  | W<br>W/°C |
| Operating and Storage Temperature Range   | $T_J, T_{STG}$ | -55 to +150 | °C        |
| Continuous diode forward current  | $I_S$          | 11          | A         |
| Diode pulse current   | $I_{S,pulse}$  | 33          | A         |

**Thermal Characteristics**

| Parameter  | Symbol            | Value        |         | Unit                        |
|--|-------------------|--------------|---------|-----------------------------|
|  |                   | TO252/TO-251 | TO-220F |                             |
| Thermal Resistance, Junction-to-Case   | $R_{\theta JC}$   | 1.32         | 3.6     | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient  | $R_{\theta JA}$   | 87           | 62      | $^{\circ}\text{C}/\text{W}$ |
| Soldering temperature, wave soldering only allowed at leads. (1.6mm from case for 10s) | $T_{\text{sold}}$ | 260          | 260     | $^{\circ}\text{C}$          |

**Electrical Characteristics**
 $T_c = 25^{\circ}\text{C}$  unless otherwise noted

| Parameter                            | Symbol               | Test Condition   | Min. | Typ. | Max. | Unit          |
|--------------------------------------|----------------------|--|------|------|------|---------------|
| <b>Static characteristics</b>        |                      |  |      |      |      |               |
| Drain-source breakdown voltage       | $BV_{\text{DSS}}$    | $V_{\text{GS}}=0\text{ V}, I_{\text{D}}=250\mu\text{A}$  | 700  | -    | -    | V             |
| Gate threshold voltage               | $V_{\text{GS(th)}}$  | $V_{\text{DS}}=V_{\text{GS}}, I_{\text{D}}=250\mu\text{A}$   | 2.5  |      | 4.0  | V             |
| Drain cut-off current                | $I_{\text{DSS}}$     | $V_{\text{DS}}=700\text{ V}, V_{\text{GS}}=0\text{ V},$<br>$T_j = 25^{\circ}\text{C}$<br>$T_j = 125^{\circ}\text{C}$ | -    | -    | 1    | $\mu\text{A}$ |
| Gate leakage current, Forward        | $I_{\text{GSSF}}$    | $V_{\text{GS}}=30\text{ V}, V_{\text{DS}}=0\text{ V}$  | -    | -    | 100  | nA            |
| Gate leakage current, Reverse        | $I_{\text{GSSR}}$    | $V_{\text{GS}}=-30\text{ V}, V_{\text{DS}}=0\text{ V}$   | -    | -    | -100 | nA            |
| Drain-source on-state resistance     | $R_{\text{DS(on)}}$  | $V_{\text{GS}}=10\text{ V}, I_{\text{D}}=5.5\text{ A}$<br>$T_j = 25^{\circ}\text{C}$                                 | -    | 0.34 | 0.38 | $\Omega$      |
| <b>Dynamic characteristics</b>       |                      |  |      |      |      |               |
| Input capacitance                    | $C_{\text{iss}}$     | $V_{\text{DS}} = 100\text{ V}, V_{\text{GS}} = 0\text{ V},$<br>$f = 1\text{ MHz}$                                    | -    | 852  | -    | pF            |
| Output capacitance                   | $C_{\text{oss}}$     |  | -    | 37   | -    |               |
| Reverse transfer capacitance         | $C_{\text{rss}}$     |  | -    | 2.0  | -    |               |
| Turn-on delay time                   | $t_{\text{d(on)}}$   | $V_{\text{DD}} = 400\text{ V}, I_{\text{D}} = 5.5\text{ A}$<br>$R_{\text{G}} = 25\Omega, V_{\text{GS}}=10\text{ V}$  | -    | 16.3 | -    | ns            |
| Rise time                            | $t_{\text{r}}$       |  | -    | 35   | -    |               |
| Turn-off delay time                  | $t_{\text{d(off)}}$  |  | -    | 78   | -    |               |
| Fall time                            | $t_{\text{f}}$       |  | -    | 39.5 | -    |               |
| <b>Gate charge characteristics</b>   |                      |  |      |      |      |               |
| Gate to source charge                | $Q_{\text{gs}}$      | $V_{\text{DD}}=560\text{ V}, I_{\text{D}}=5.5\text{ A},$<br>$V_{\text{GS}}=0\text{ to }10\text{ V}$                  | -    | 3.1  | -    | nC            |
| Gate to drain charge                 | $Q_{\text{gd}}$      |  | -    | 8.2  | -    |               |
| Gate charge total                    | $Q_{\text{g}}$       |  | -    | 19.2 | -    |               |
| Gate plateau voltage                 | $V_{\text{plateau}}$ |  | -    | 5.5  | -    | V             |
| <b>Reverse diode characteristics</b> |                      |  |      |      |      |               |
| Diode forward voltage                | $V_{\text{SD}}$      | $V_{\text{GS}}=0\text{ V}, I_{\text{F}}=5.5\text{ A}$  | -    | 0.85 | -    | V             |
| Reverse recovery time                | $t_{\text{rr}}$      | $V_{\text{R}}=400\text{ V}, I_{\text{F}}=5.5\text{ A},$<br>$dI_{\text{F}}/dt=100\text{ A}/\mu\text{s}$               | -    | 310  | -    | ns            |
| Reverse recovery charge              | $Q_{\text{rr}}$      |  | -    | 2.8  | -    | $\mu\text{C}$ |
| Peak reverse recovery current        | $I_{\text{rm}}$      |  | -    | 16.8 | -    | A             |

**Notes:**

- Limited by maximum junction temperature, maximum duty cycle is 0.75.
- $I_{\text{AS}} = 3\text{ A}, V_{\text{DD}} = 50\text{ V},$  Starting  $T_j = 25^{\circ}\text{C}.$

**Electrical Characteristics Diagrams**

Figure 1. Output Characteristics

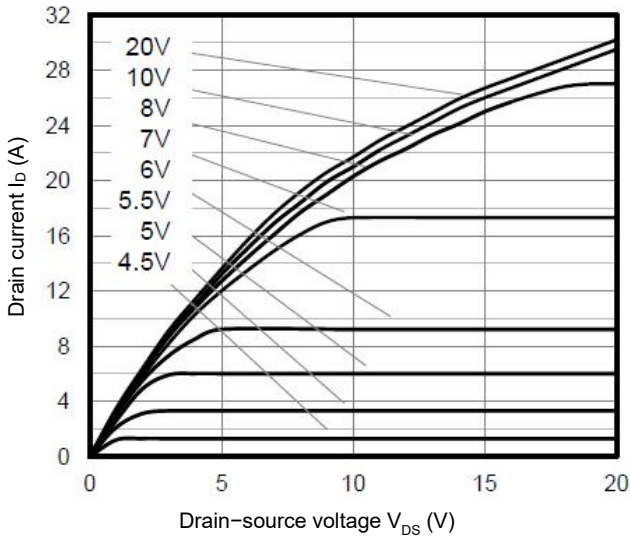


Figure 2. Transfer Characteristics

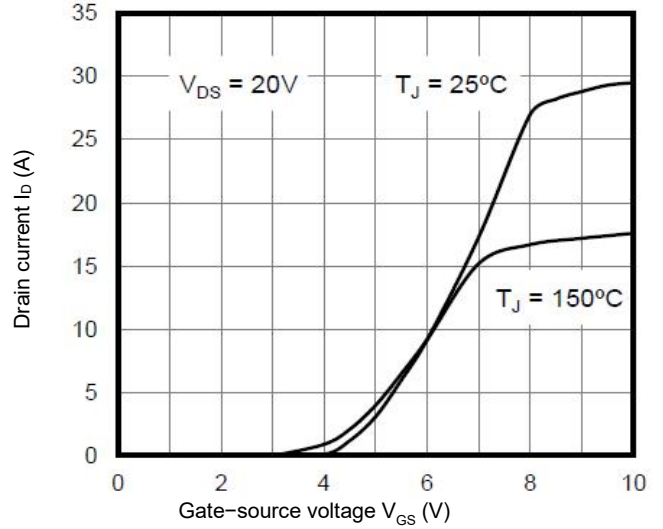


Figure 3. On-Resistance vs. Drain Current

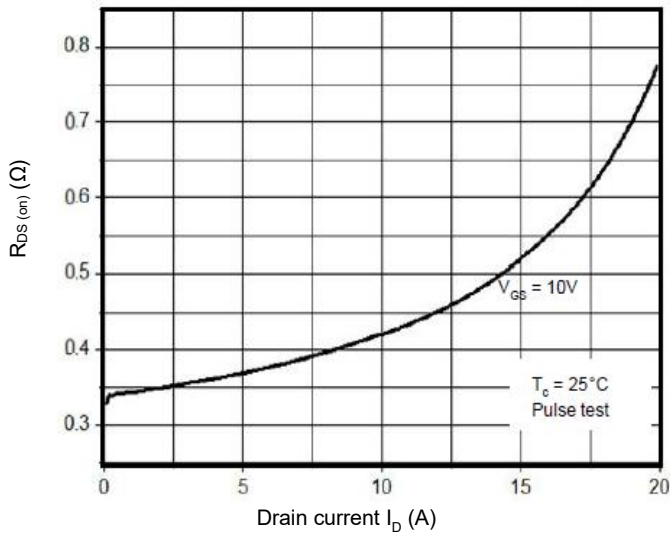


Figure 4. Capacitance Characteristics

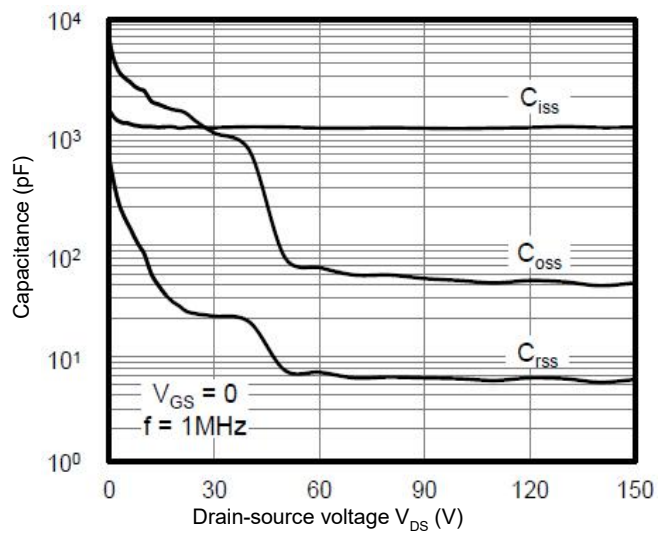


Figure 5. Gate Charge Characteristics

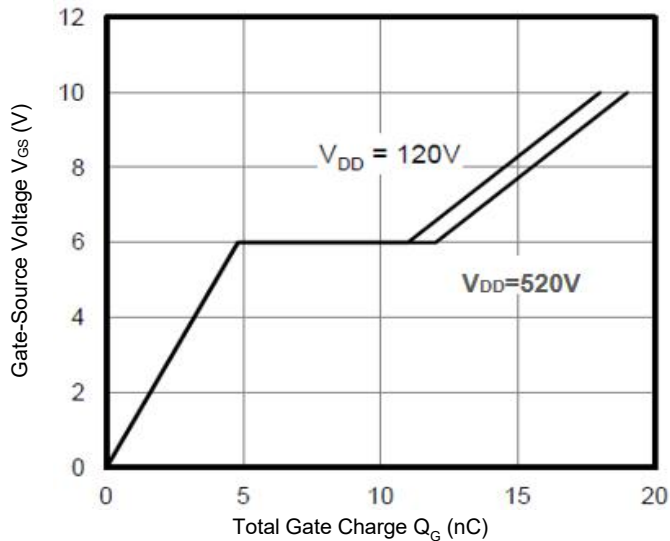


Figure 6. Body Diode Forward Voltage

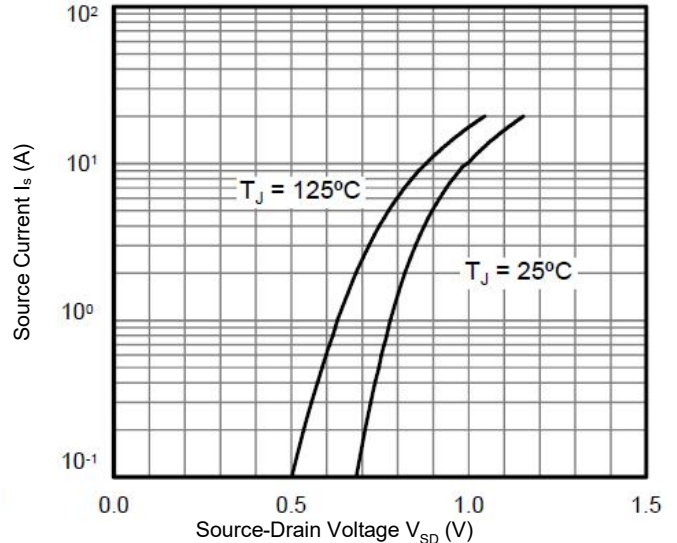


Figure 7. Breakdown Voltage vs. Temperature

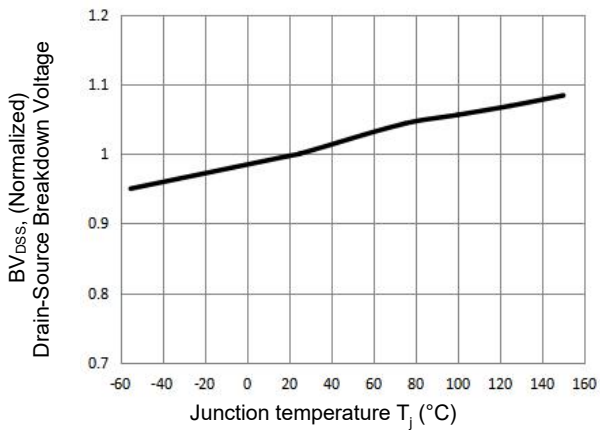


Figure 8. On-Resistance vs. Temperature

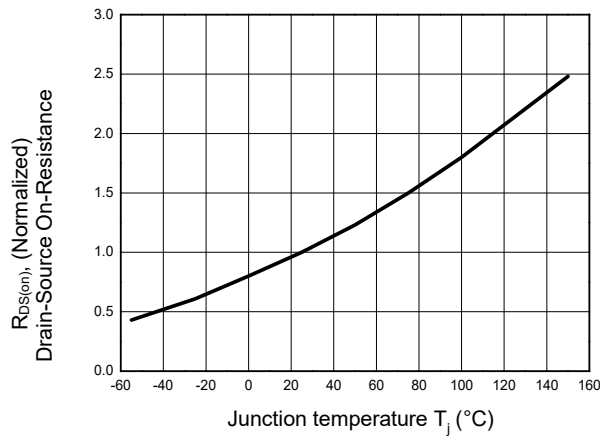


Figure 9. Maximum Safe Operating Area  
TO-252/TO-251

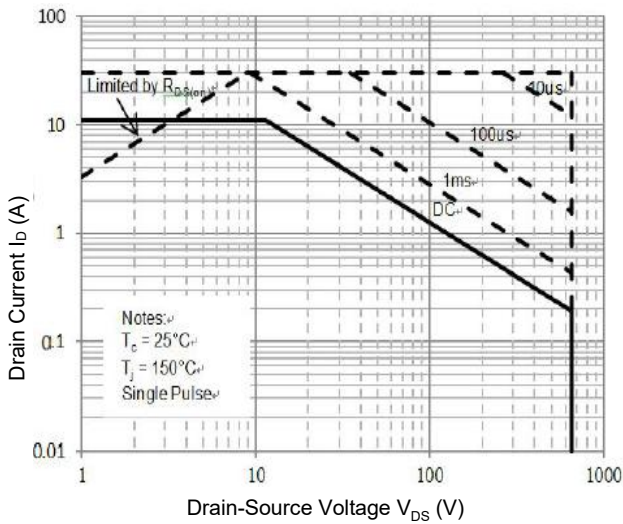
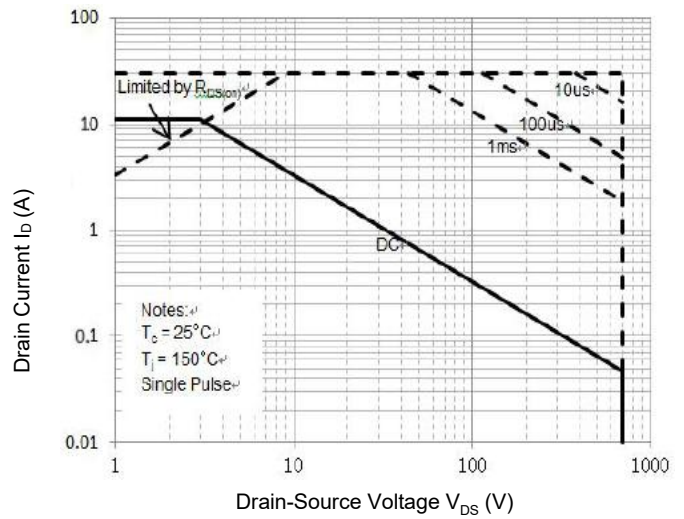
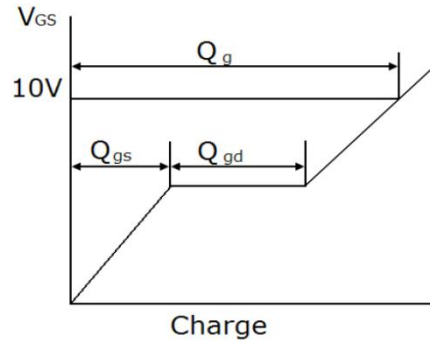
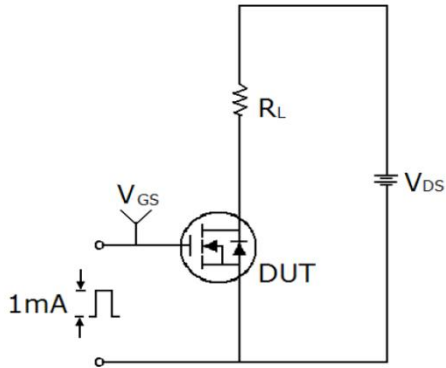


Figure 10. Maximum Safe Operating Area  
TO-220F

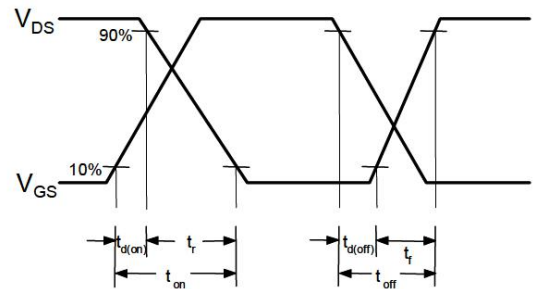
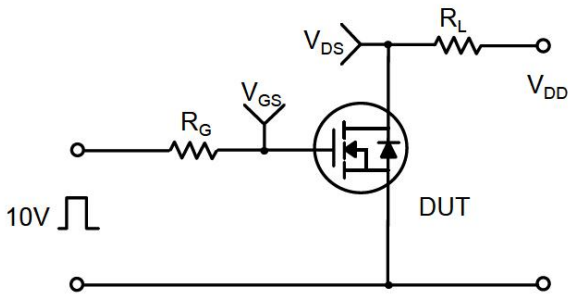


**Test Circuits**

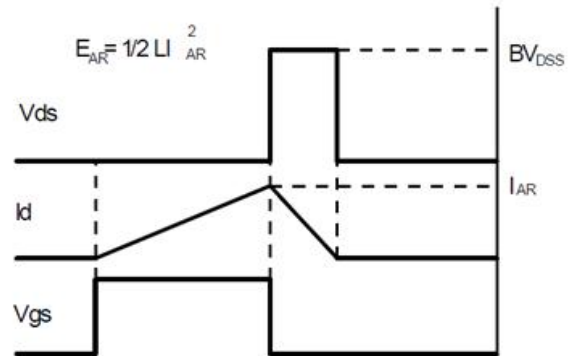
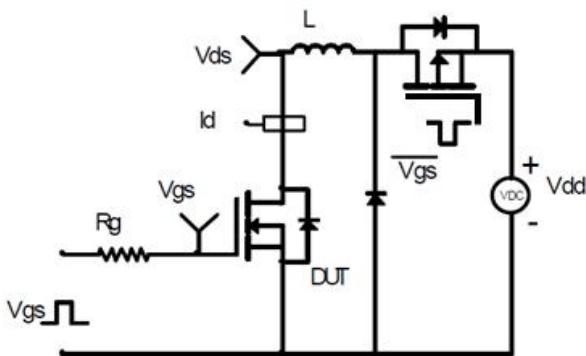
**Gate Charge Test Circuit & Waveform**



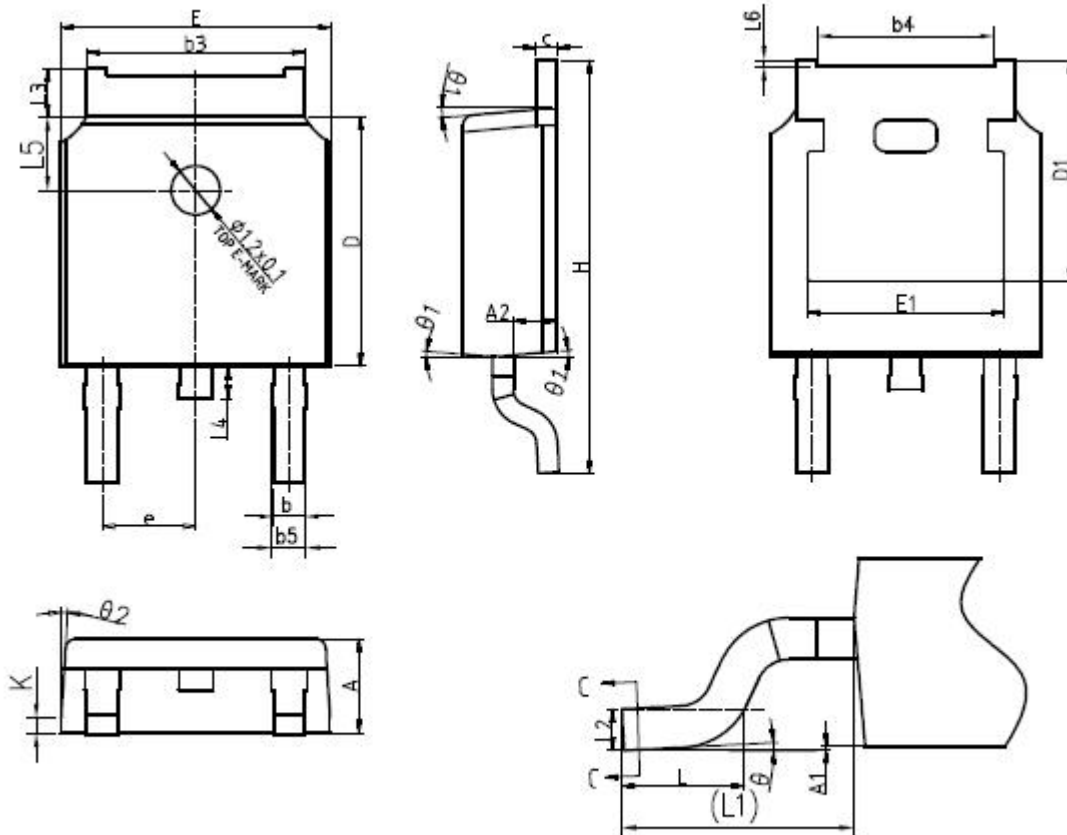
**Switching Test Circuit & Waveform**



**Unclamped Inductive Switching Test Circuit & Waveform**



Mechanical Dimensions for TO-252



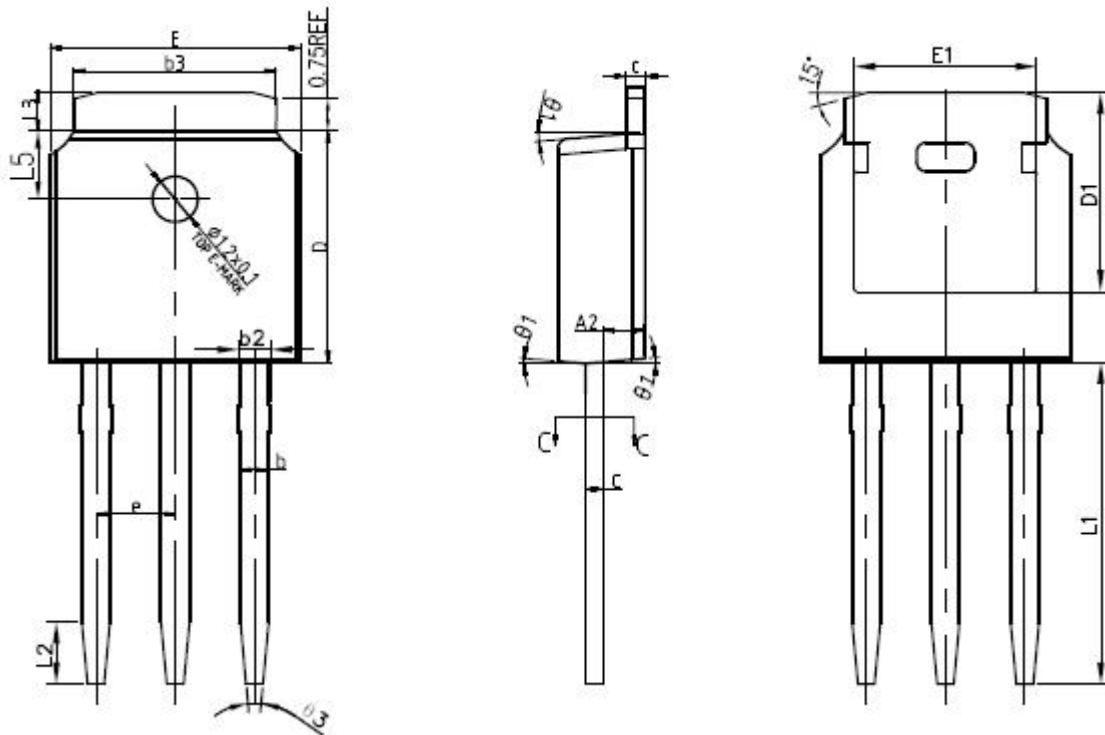
单位: mm

| SYMBOL | mm      |      |      |
|--------|---------|------|------|
|        | MIN     | NOM  | MAX  |
| *A     | 2.20    | 2.30 | 2.38 |
| *A1    | 0.00    | -    | 0.10 |
| A2     | 0.97    | 1.07 | 1.17 |
| *b     | 0.72    | 0.78 | 0.85 |
| b1     | 0.71    | 0.76 | 0.81 |
| *b3    | 5.23    | 5.33 | 5.46 |
| b4     | 4.27    | 4.32 | 4.37 |
| b5     | 0.72    | 0.88 | 0.93 |
| *c     | 0.47    | 0.53 | 0.58 |
| c1     | 0.46    | 0.51 | 0.56 |
| *D     | 6.00    | 6.10 | 6.20 |
| D1     | 5.30REF |      |      |

|          |          |       |       |
|----------|----------|-------|-------|
| *E       | 6.50     | 6.60  | 6.70  |
| E1       | 4.70     | 4.83  | 4.92  |
| *e       | 2.286BSC |       |       |
| L        | 1.40     | 1.50  | 1.70  |
| L1       | 2.90REF  |       |       |
| L2       | 0.51BSC  |       |       |
| *L3      | 0.90     | -     | 1.25  |
| *L4      | 0.60     | 0.80  | 1.00  |
| L5       | 1.70     | 1.80  | 1.90  |
| L6       | 0        | 0.047 | 0.123 |
| theta    | 0°       | -     | 8°    |
| *theta 1 | 5°       | 7°    | 9°    |
| theta 2  | 5°       | 7°    | 9°    |
| K        | 0.40REF  |       |       |

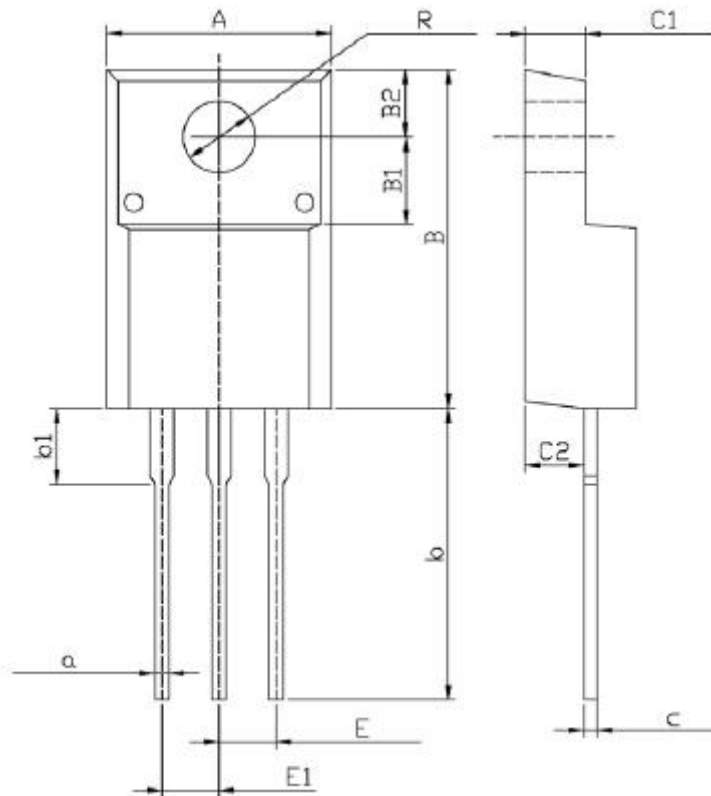


Mechanical Dimensions for TO-251



| SYMBOL       | MM       |      |      |
|--------------|----------|------|------|
|              | MIN      | NOM  | MAX  |
| *A           | 2.20     | 2.30 | 2.38 |
| *A2          | 0.97     | 1.07 | 1.17 |
| *b           | 0.72     | 0.78 | 0.85 |
| b1           | 0.71     | 0.76 | 0.81 |
| *b2          | 0.72     | 0.88 | 0.95 |
| *b3          | 5.23     | 5.33 | 5.46 |
| *c           | 0.47     | 0.53 | 0.58 |
| c1           | 0.46     | 0.51 | 0.56 |
| *D           | 6.00     | 6.10 | 6.20 |
| D1           | 5.30REF  |      |      |
| *E           | 6.50     | 6.60 | 6.70 |
| E1           | 4.70     | 4.83 | 4.92 |
| *e           | 2.286BSC |      |      |
| *L1          | 9.20     | 9.40 | 9.60 |
| L2           | 1.25     | 1.35 | 1.45 |
| *L3          | 0.90     | 1.02 | 1.25 |
| L5           | 1.70     | 1.80 | 1.90 |
| * $\theta 1$ | 5°       | 7°   | 9°   |
| $\theta 2$   | 5°       | 7°   | 9°   |
| $\theta 3$   | 11°      | 13°  | 15°  |
| K            | 0.40REF  |      |      |

Mechanical Dimensions for TO-220F



| Symbol | Dimensions In Millimeters |      | Symbol | Dimensions In Millimeters |      |
|--------|---------------------------|------|--------|---------------------------|------|
|        | Min                       | Max  |        | Min                       | Max  |
| C      | 4.3                       | 4.7  | b1     | 2.9                       | 3.9  |
| A      | 9.7                       | 10.3 | a      | 0.55                      | 0.75 |
| B      | 14.7                      | 15.3 | E      | 2.29                      | 2.79 |
| B1     | 3.8                       | 4.0  | E1     | 2.29                      | 2.79 |
| B2     | 2.9                       | 3.1  | C1     | 2.5                       | 2.9  |
| R      | 3.0                       | 3.4  | C2     | 2.5                       | 2.7  |
| b      | 12.5                      | 13.5 | c      | 0.5                       | 0.7  |



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