


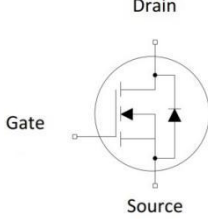



N-channel 650V, 15A, 0.28Ω Super-Junction Power MOSFET

| | | | | | | | | | |
|--|--|-----------------------------|------|------------------|-------|-------|-----|-------------|-------|
| <p>Description</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>Features</p> <ul style="list-style-type: none"> ◆ Very low FOM $R_{DS(on)} \times Q_g$ ◆ 100% UIS tested ◆ RoHS compliant <p>Applications</p> <ul style="list-style-type: none"> ◆ Power factor correction (PFC). ◆ Switched mode power supplies (SMPS). ◆ Uninterrupted power supply (UPS). | <p>Product Summary</p> <table> <tr> <td>$V_{DS} @ T_{j,25^\circ C}$</td> <td>650V</td> </tr> <tr> <td>$R_{DS(on),max}$</td> <td>0.28Ω</td> </tr> <tr> <td>I_D</td> <td>15A</td> </tr> <tr> <td>$Q_{g,typ}$</td> <td>26 nC</td> </tr> </table> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>TO-252</p> </div> <div style="text-align: center;">  <p>TO-251</p> </div> <div style="text-align: center;">  <p>TO-220F</p> </div> </div> <div style="text-align: center; margin-top: 20px;">  <p>Drain</p> <p>Gate</p> <p>Source</p> <p>N-Channel MOSFET</p> </div> <div style="text-align: center; margin-top: 20px;">  </div> | $V_{DS} @ T_{j,25^\circ C}$ | 650V | $R_{DS(on),max}$ | 0.28Ω | I_D | 15A | $Q_{g,typ}$ | 26 nC |
| $V_{DS} @ T_{j,25^\circ C}$ | 650V | | | | | | | | |
| $R_{DS(on),max}$ | 0.28Ω | | | | | | | | |
| I_D | 15A | | | | | | | | |
| $Q_{g,typ}$ | 26 nC | | | | | | | | |

Marking information

| Product | Package | Marking | Packing method |
|-------------|---------|-------------|----------------|
| RMA65R280SN | TO-252 | RMA65R280SN | Reel |
| RMG65R280SN | TO-251 | RMG65R280SN | Tube |
| RMC65R280SN | TO-220F | RMC65R280SN | Tube |

Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|----------------|-------------|------|
| Drain-Source Voltage | V_{DSS} | 650 | V |
| Continuous drain current ($T_C = 25^\circ C$) | I_D | 15 | A |
| ($T_C = 100^\circ C$) | | 9 | A |
| Pulsed drain current ¹⁾ | I_{DM} | 45 | A |
| Gate-Source voltage | V_{GSS} | ± 30 | V |
| Avalanche energy, single pulse ²⁾ | E_{AS} | 320 | mJ |
| Avalanche current, repetitive ³⁾ | I_{AR} | 2.2 | A |
| Power Dissipation TO-252 /TO-251 ($T_C = 25^\circ C$) | P_D | 132 | W |
| - Derate above 25°C | | 1.06 | W/°C |
| Power Dissipation TO-220F ($T_C = 25^\circ C$) | P_D | 34 | W |
| - Derate above 25°C | | 0.27 | W/°C |
| Operating and Storage Temperature Range | T_J, T_{STG} | -55 to +150 | °C |
| Continuous diode forward current | I_S | 15 | A |

| | | | |
|---------------------|---------------|----|---|
| Diode pulse current | $I_{S,pulse}$ | 45 | A |
|---------------------|---------------|----|---|

Thermal Characteristics

| Parameter | Symbol | Value | | Unit |
|--|-----------------|--------------|---------|-----------------------------|
| | | TO252/TO-251 | TO-220F | |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.93 | 3.4 | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 106 | 58 | $^{\circ}\text{C}/\text{W}$ |
| Soldering temperature, wave soldering only allowed at leads. (1.6mm from case for 10s) | T_{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 |
|--------------------------------------|---------------|--|-------------|---------|------|---------------|
| Static characteristics | | | | | | |
| Drain-source breakdown voltage | BV_{DSS} | $V_{GS}=0\text{ V}, I_D=250\mu\text{A}$ | 650 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$ | 2.5 | | 4.0 | V |
| Drain cut-off current | I_{DSS} | $V_{DS}=650\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^{\circ}\text{C}$ $T_j = 125^{\circ}\text{C}$ | - - | - 10 | 1 | μA |
| Gate leakage current, Forward | I_{GSSF} | $V_{GS}=30\text{ V}, V_{DS}=0\text{ V}$ | - | - | 100 | nA |
| Gate leakage current, Reverse | I_{GSSR} | $V_{GS}=-30\text{ V}, V_{DS}=0\text{ V}$ | - | - | -100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=7.5\text{ A}$ $T_j = 25^{\circ}\text{C}$ | - - - | 0.24 | 0.28 | Ω |
| Dynamic characteristics | | | | | | |
| Input capacitance | C_{iss} | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$ | - | 1126 | - | pF |
| Output capacitance | C_{oss} | | - | 41 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 2.4 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 400\text{ V}, I_D = 7.5\text{ A}$ $R_G = 25\Omega, V_{GS}=10\text{ V}$ | - | 20 | - | ns |
| Rise time | t_r | | - | 40 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 95 | - | |
| Fall time | t_f | | - | 43 | - | |
| Gate charge characteristics | | | | | | |
| Gate to source charge | Q_{gs} | $V_{DD}=520\text{ V}, I_D=7.5\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 3.6 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 10.5 | - | |
| Gate charge total | Q_g | | - | 26 | - | |
| Gate plateau voltage | $V_{plateau}$ | | - | 5.5 | - | V |
| Reverse diode characteristics | | | | | | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=7.5\text{ A}$ | - | 0.85 | - | V |
| Reverse recovery time | t_{rr} | $V_R=400\text{ V}, I_F=7.5\text{ A},$ $dI_F/dt=100\text{ A}/\mu\text{s}$ | - | 405 | - | ns |
| Reverse recovery charge | Q_{rr} | | - | 4.0 | - | μC |
| Peak reverse recovery current | I_{rrm} | | - | 21 | - | A |

Notes:

1. Limited by maximum junction temperature, maximum duty cycle is 0.75.
2. $I_{AS} = 4A$, $V_{DD} = 50V$, Starting $T_j = 25^{\circ}C$.

Electrical Characteristics Diagrams

Figure 1. Output Characteristics

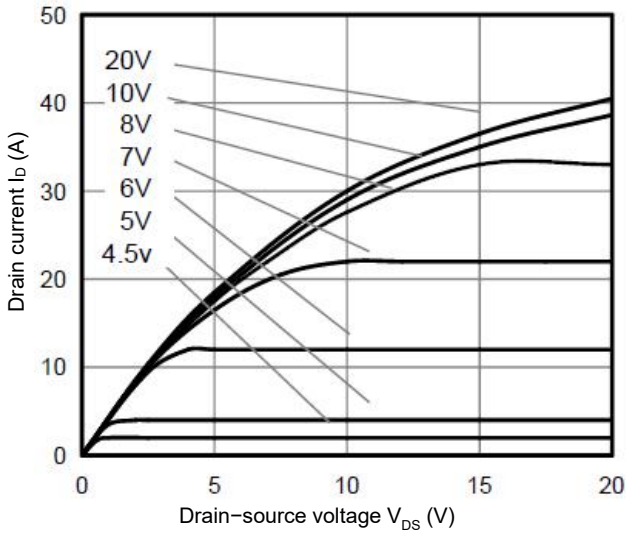


Figure 2. Transfer Characteristics

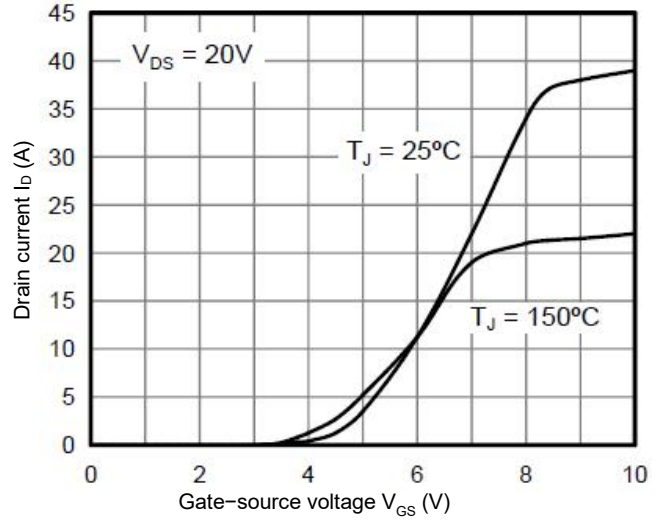


Figure 3. On-Resistance vs. Drain Current

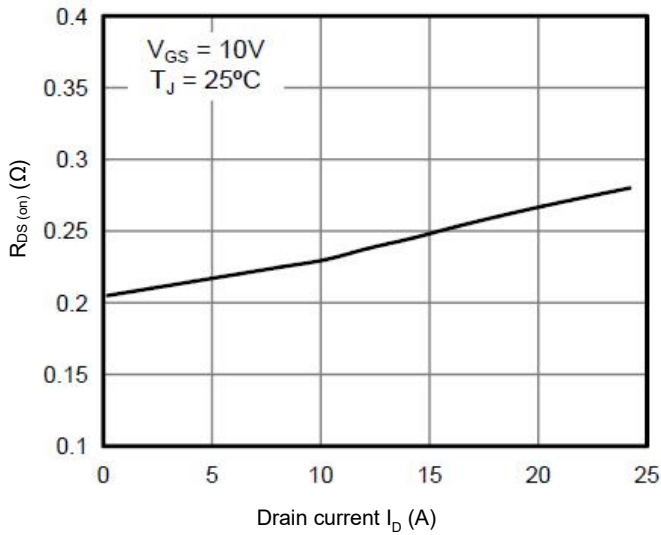


Figure 4. Capacitance Characteristics

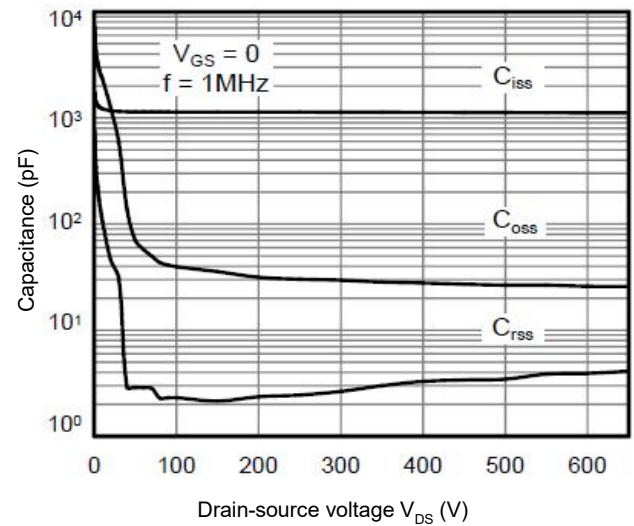


Figure 5. Gate Charge Characteristics

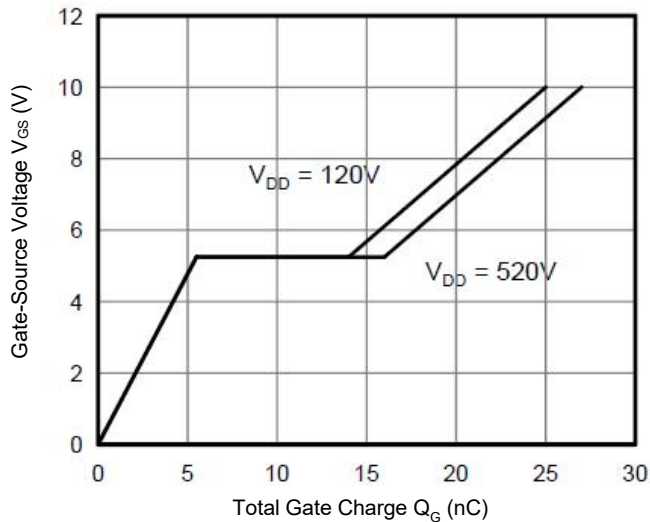


Figure 6. Body Diode Forward Voltage

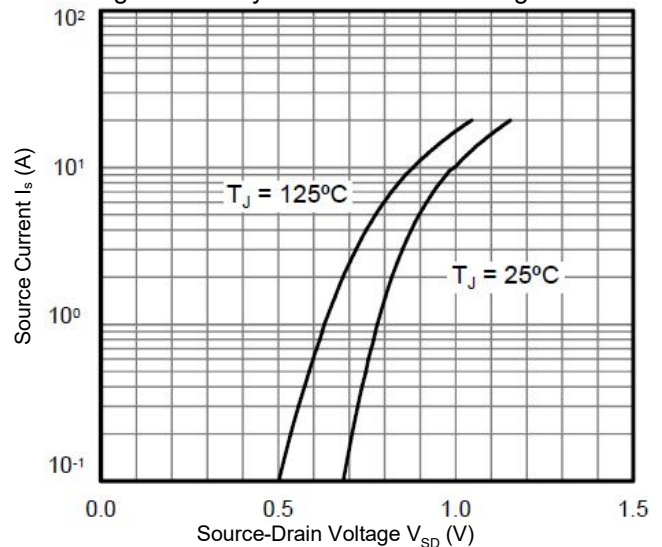


Figure 7. Breakdown Voltage vs. Temperature

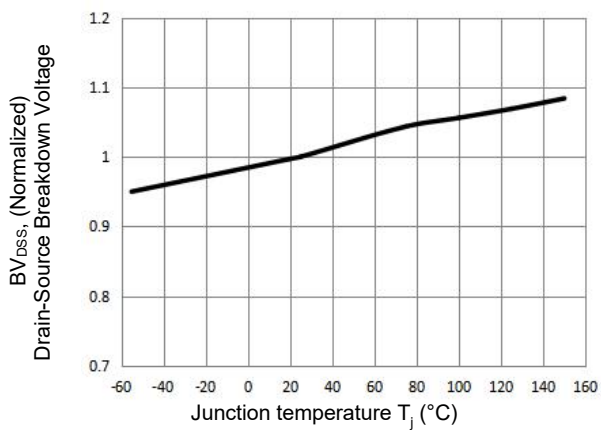


Figure 8. On-Resistance vs. Temperature

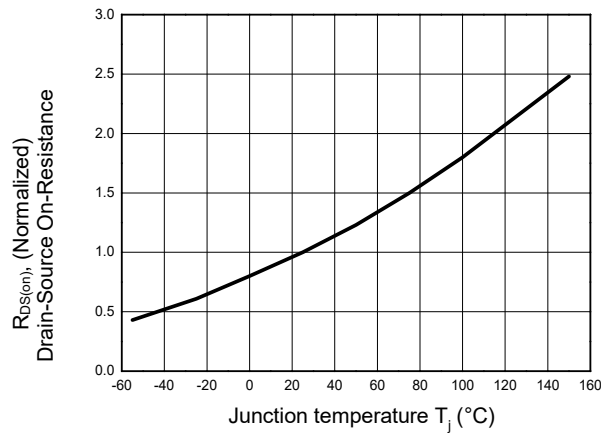


Figure 9. Maximum Safe Operating Area
TO-252/TO-251

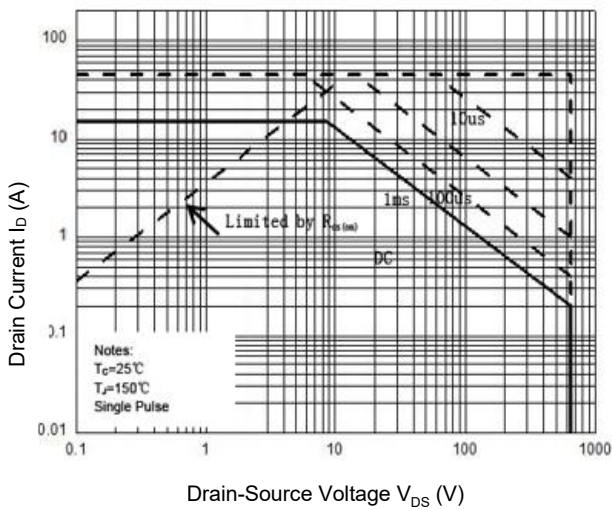
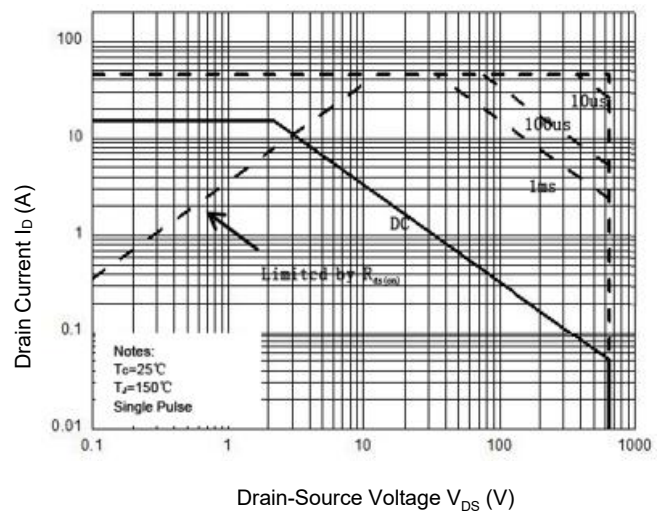
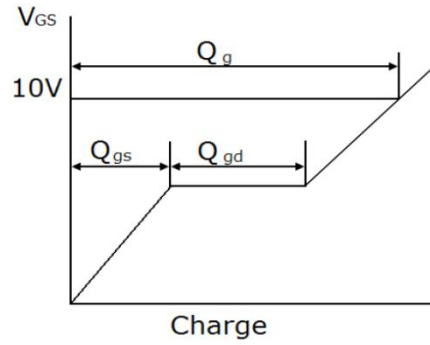
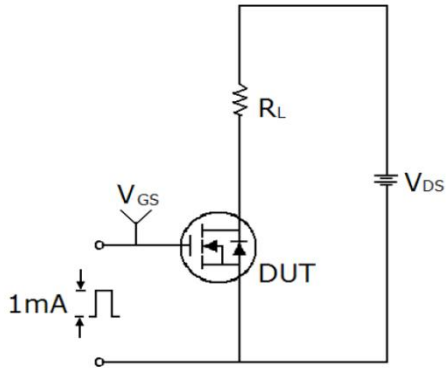


Figure 10. Maximum Safe Operating Area
TO-220F

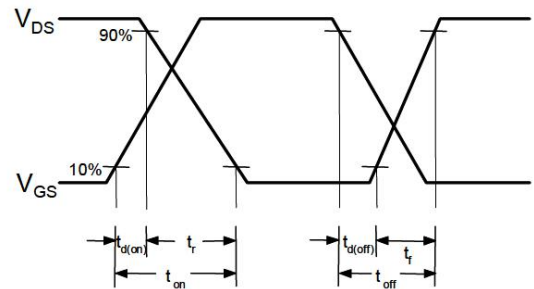
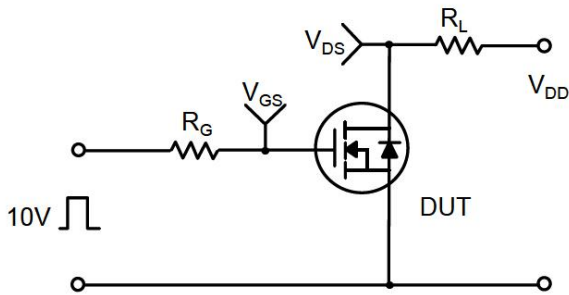


Test Circuits

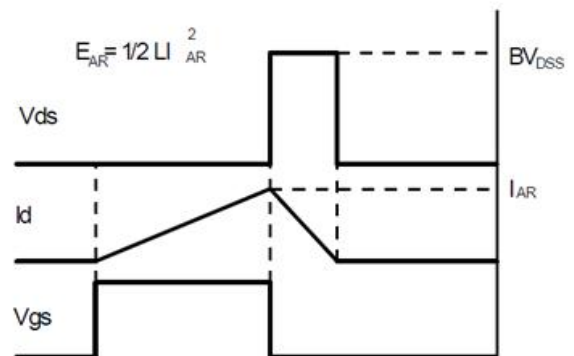
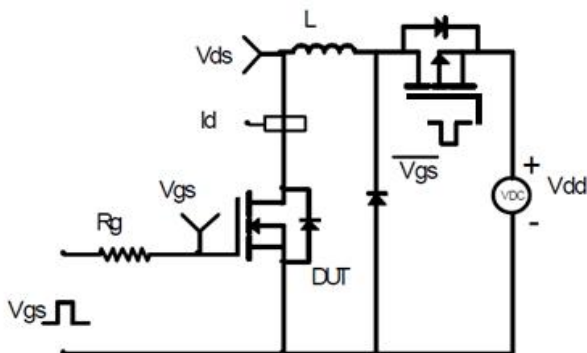
Gate Charge Test Circuit & Waveform



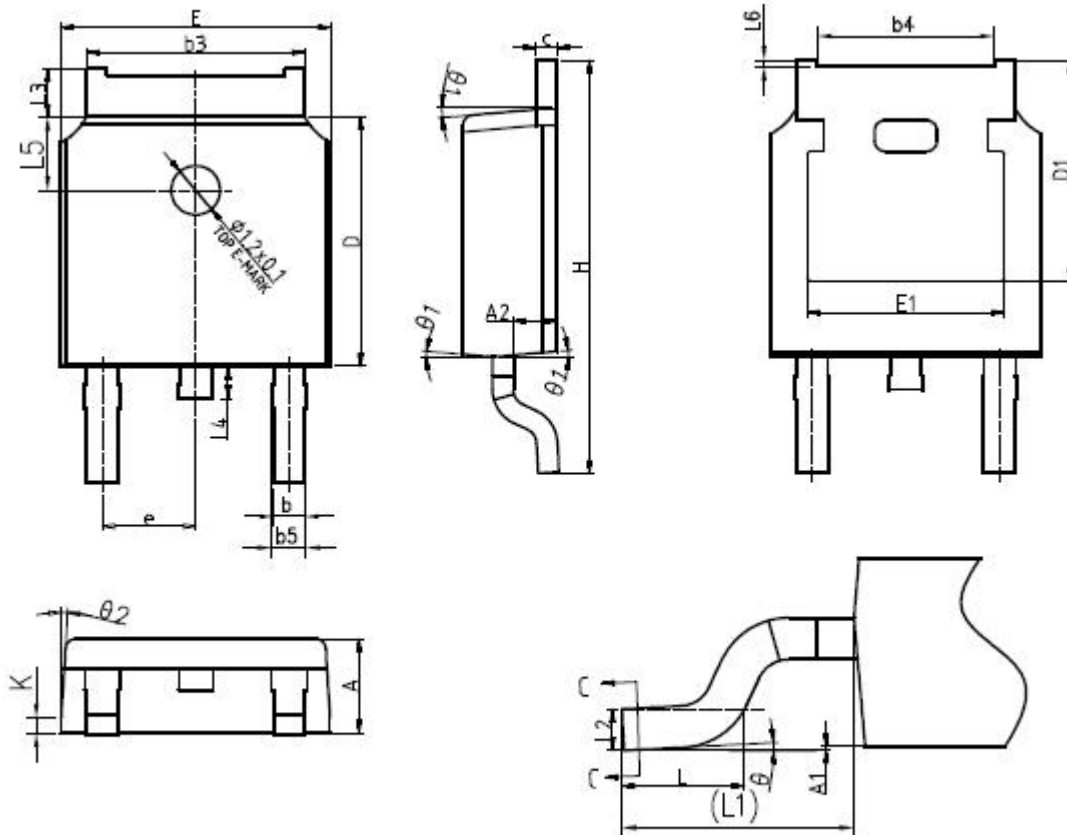
Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Mechanical Dimensions for TO-252

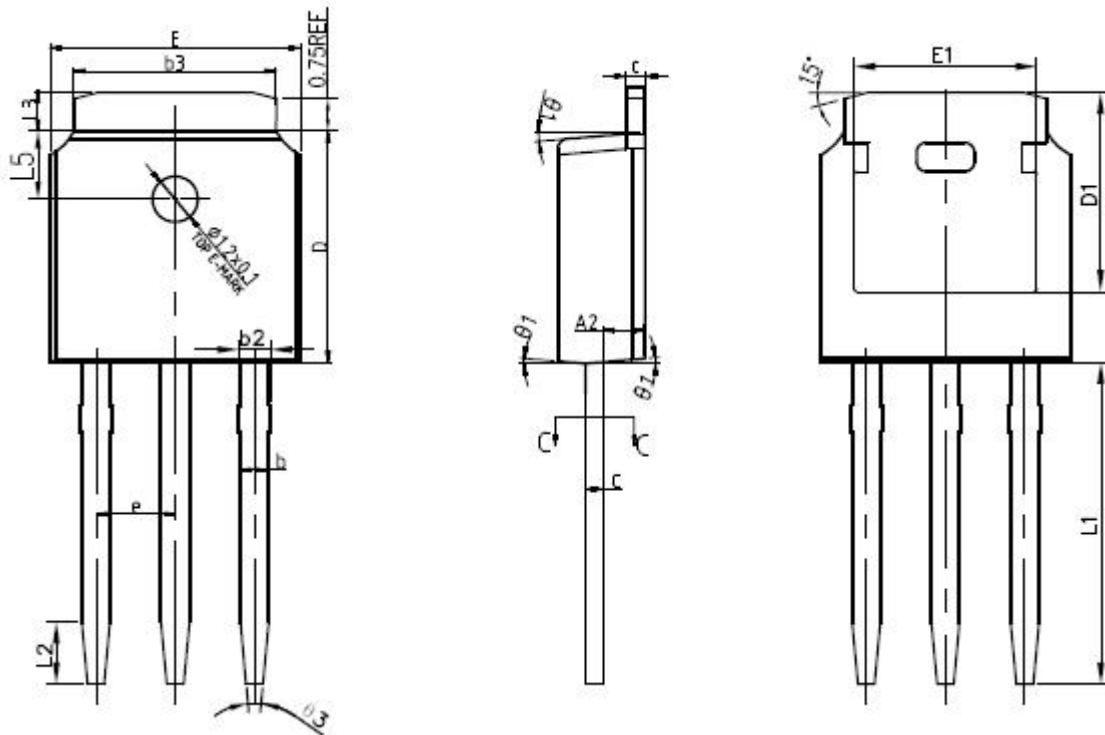


单位: mm

| 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 | | |

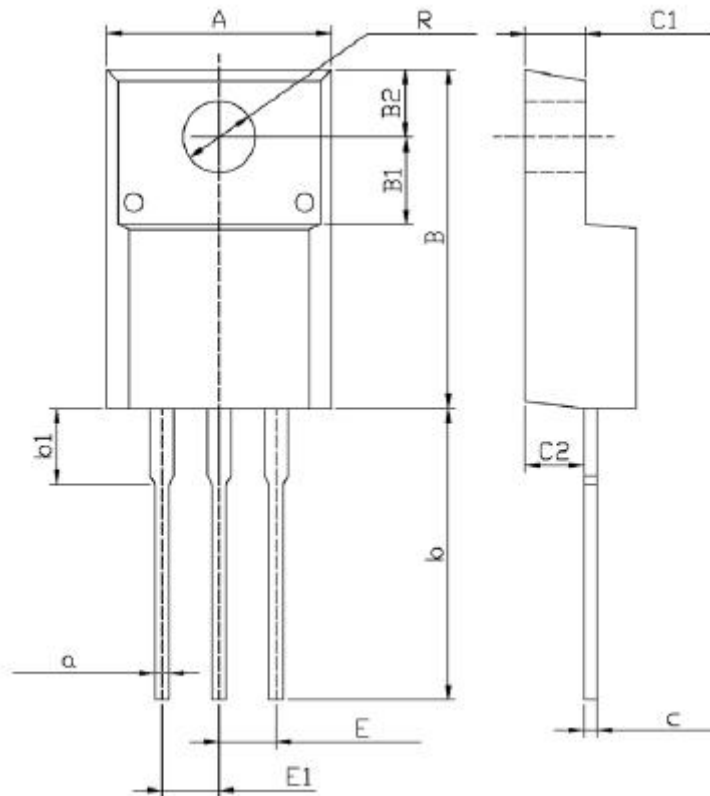
| | | | |
|-----|----------|-------|-------|
| *E | 6.50 | 6.60 | 6.70 |
| E1 | 4.70 | 4.83 | 4.92 |
| *e | 2.286BSC | | |
| L | 1.40 | 1.50 | 1.70 |
| L1 | 2.90REF | | |
| L2 | 0.51BSC | | |
| *L3 | 0.90 | - | 1.25 |
| *L4 | 0.60 | 0.80 | 1.00 |
| L5 | 1.70 | 1.80 | 1.90 |
| L6 | 0 | 0.047 | 0.123 |
| θ | 0° | - | 8° |
| *θ1 | 5° | 7° | 9° |
| θ2 | 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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