

N-Channel Super Junction Power MOSFET III

General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

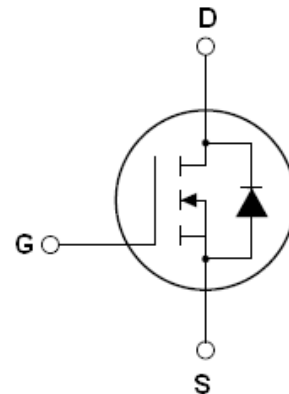
Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant
- Halogen-free

Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)

| | | |
|-----------------|-----|------------|
| V_{DS} | 600 | V |
| $R_{DS(ON)TYP}$ | 500 | m Ω |
| I_D | 7 | A |



Schematic diagram

Package Marking And Ordering Information

| Device | Device Package | Marking |
|-----------|----------------|---------|
| RM7N600IP | TO251 | 7N600 |
| RM7N600LD | TO252 | 7N600 |



TO-251



TO-252

Absolute Maximum Ratings ($T_C=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|-----------------|------------|------------------|
| Drain-Source Voltage ($V_{GS}=0V$) | V_{DS} | 600 | V |
| Gate-Source Voltage ($V_{DS}=0V$), AC ($f>1$ Hz) | V_{GS} | ± 30 | V |
| Continuous Drain Current at $T_C=25^\circ\text{C}$ | $I_{D(DC)}$ | 7 | A |
| Pulsed drain current (Note 1) | $I_{DM(pluse)}$ | 21 | A |
| Maximum Power Dissipation ($T_C=25^\circ\text{C}$) | P_D | 63 | W |
| Single pulse avalanche energy (Note2) | E_{AS} | 162 | mJ |
| Avalanche current (Note 1) | I_{AR} | 1.4 | A |
| Repetitive Avalanche energy, t_{AR} limited by T_{Jmax} (Note 1) | E_{AR} | 0.2 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55...+150 | $^\circ\text{C}$ |

Thermal Characteristic

| | | | |
|---|-----------------|-----|-----------------------------|
| Thermal Resistance, Junction-to-Case ^(Note 2) | $R_{\theta JC}$ | 2.0 | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient ^(Note 2) | $R_{\theta JA}$ | 62 | $^{\circ}\text{C}/\text{W}$ |

Electrical Characteristics ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|--------------|--|-----|------|-----------|---------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu\text{A}$ | 600 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=600V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 30V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics ^(Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$ | 2.5 | - | 4.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=3A$ | - | 500 | 580 | m |
| Forward Transconductance | g_{FS} | $V_{DS}=10V, I_D=3A$ | - | 5.0 | - | S |
| Dynamic Characteristics ^(Note 4) | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=50V, V_{GS}=0V,$ $F=1.0\text{MHz}$ | - | 587 | - | PF |
| Output Capacitance | C_{oss} | | - | 31 | - | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 4.0 | - | PF |
| Switching Characteristics ^(Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DS}=400V, I_D=7A$ $V_{GS}=10V, R_{GEN}=25$ | - | 39 | - | nS |
| Turn-on Rise Time | t_r | | - | 25 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 100 | - | nS |
| Turn-Off Fall Time | t_f | | - | 18 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=480V, I_D=7A,$ $V_{GS}=10V$ | - | 14.5 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 3.0 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 5.2 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage ^(Note 3) | V_{SD} | $V_{GS}=0V, I_S=7A$ | - | 0.9 | 1.2 | V |
| Diode Forward Current ^(Note 2) | I_S | | - | - | 6.3 | A |
| Reverse Recovery Time | t_{rr} | $T_J = 25^{\circ}\text{C}, I_F = I_S$ $di/dt = 100\text{A}/\mu\text{s}$ (Note3) | - | 250 | - | nS |
| Reverse Recovery Charge | Q_{rr} | | - | 2.1 | - | nC |
| Forward Turn-On Time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition: $T_J=25^{\circ}\text{C}, V_{DD}=50V, I_{AS}=1.4A, R_g=25\Omega$

RATING AND CHARACTERISTICS CURVES (RM7N600LD(IP))

Figure 1. Output Characteristics

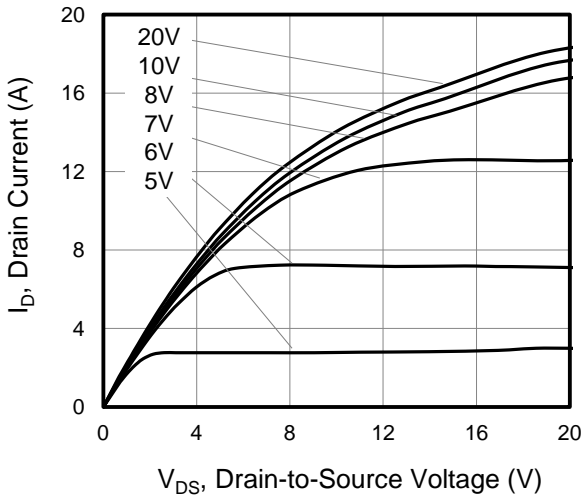


Figure 2. Transfer Characteristics

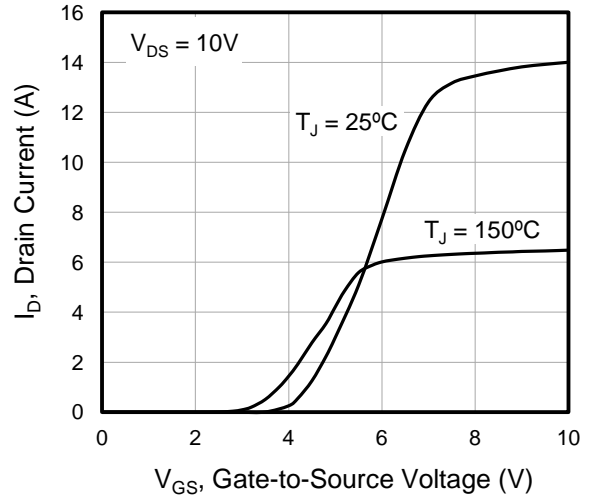


Figure 3. On-Resistance vs. Drain Current

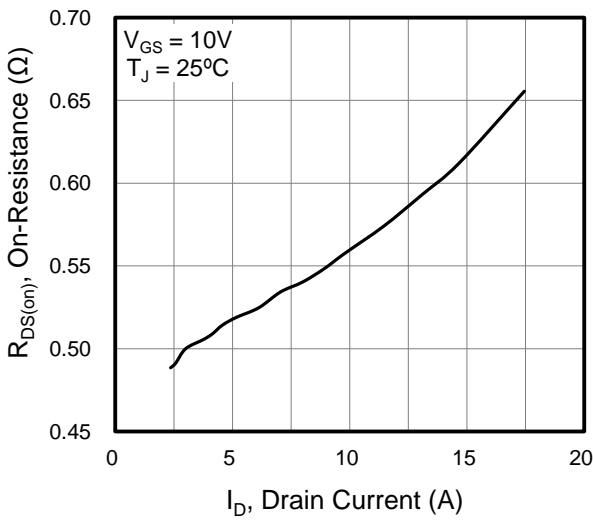


Figure 4. Capacitance

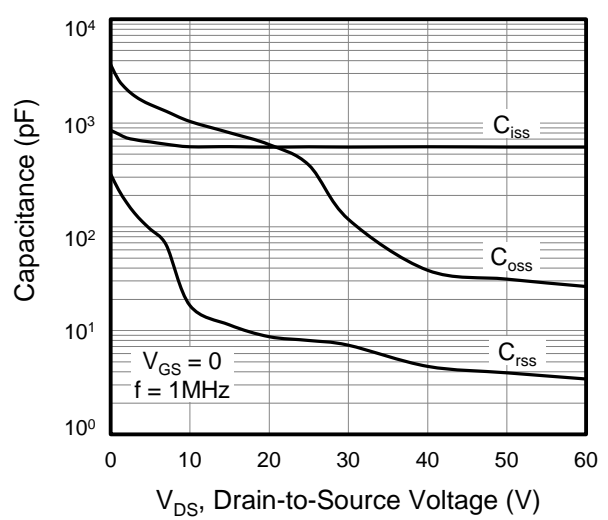


Figure 5. Gate Charge

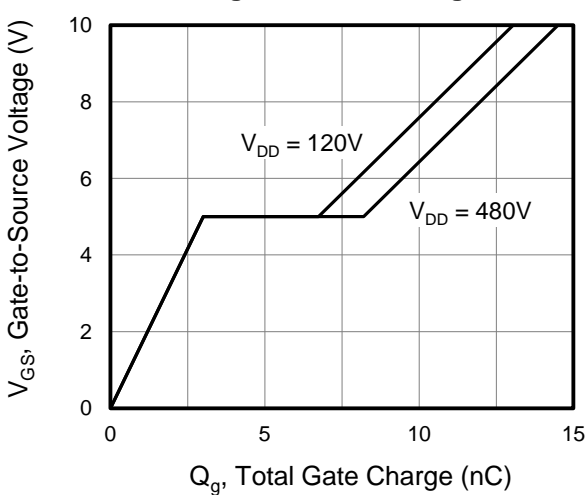
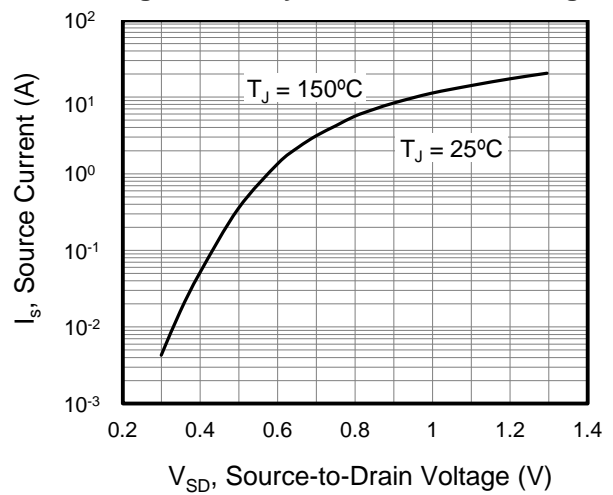


Figure 6. Body Diode Forward Voltage



RATING AND CHARACTERISTICS CURVES (RM7N600LD(IP))

Figure 7. On-Resistance vs. Junction Temperature

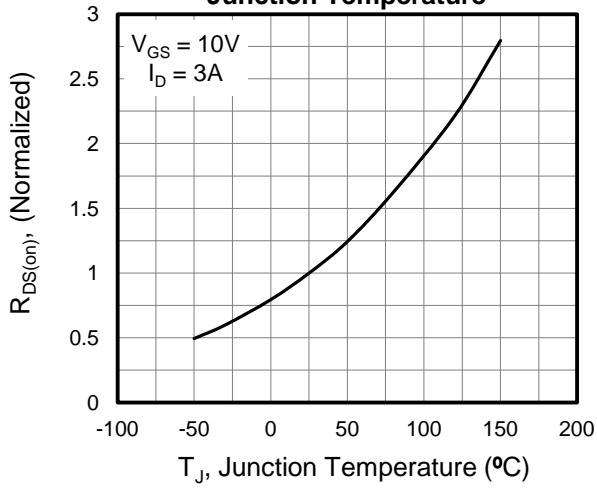


Figure 8. Threshold Voltage vs. Junction Temperature

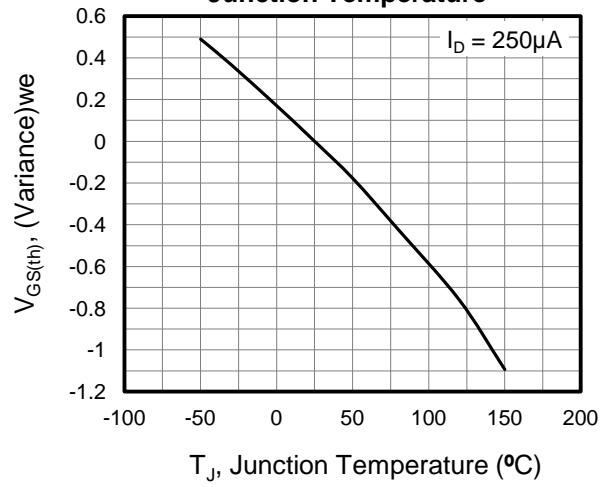


Figure 9. Transient Thermal Impedance TO-220, TO-251, TO-252, TO-262, TO-263

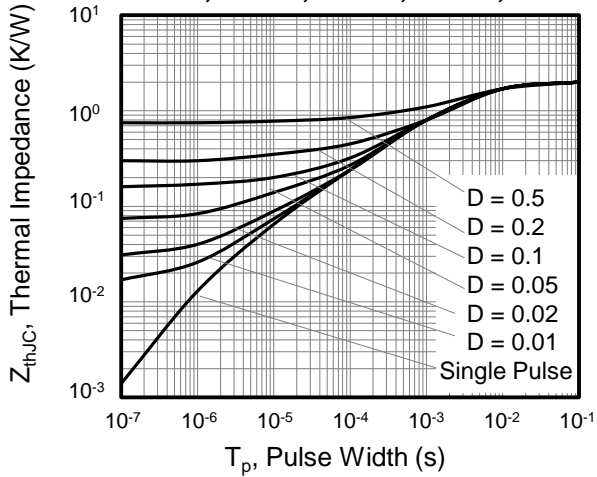


Figure 10. Transient Thermal Impedance TO-220F

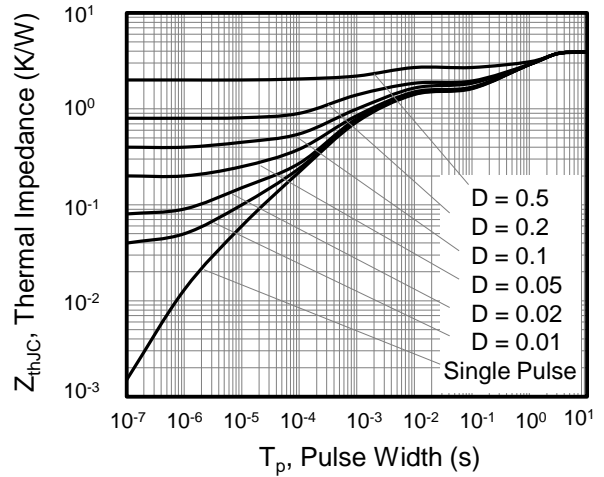


Figure A: Gate Charge Test Circuit and Waveform

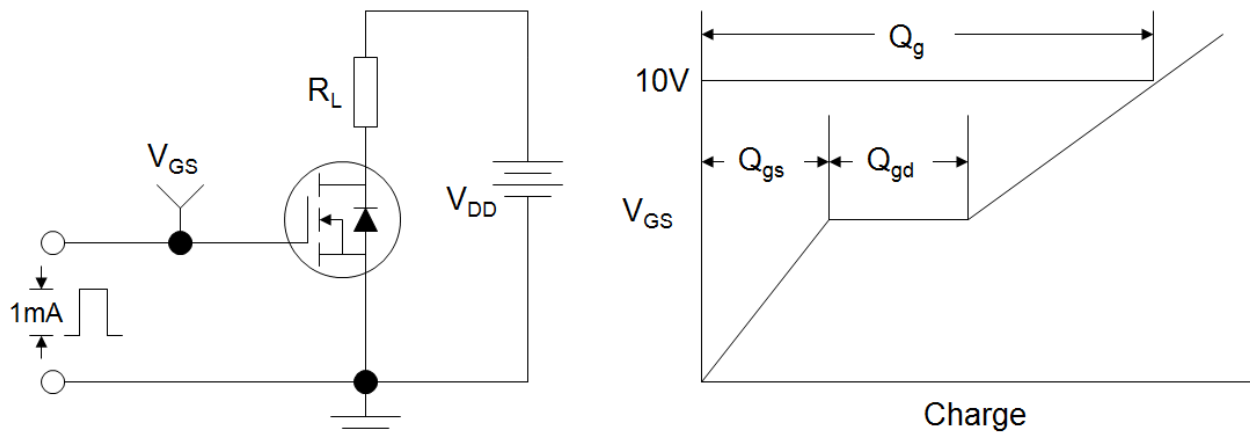


Figure B: Resistive Switching Test Circuit and Waveform

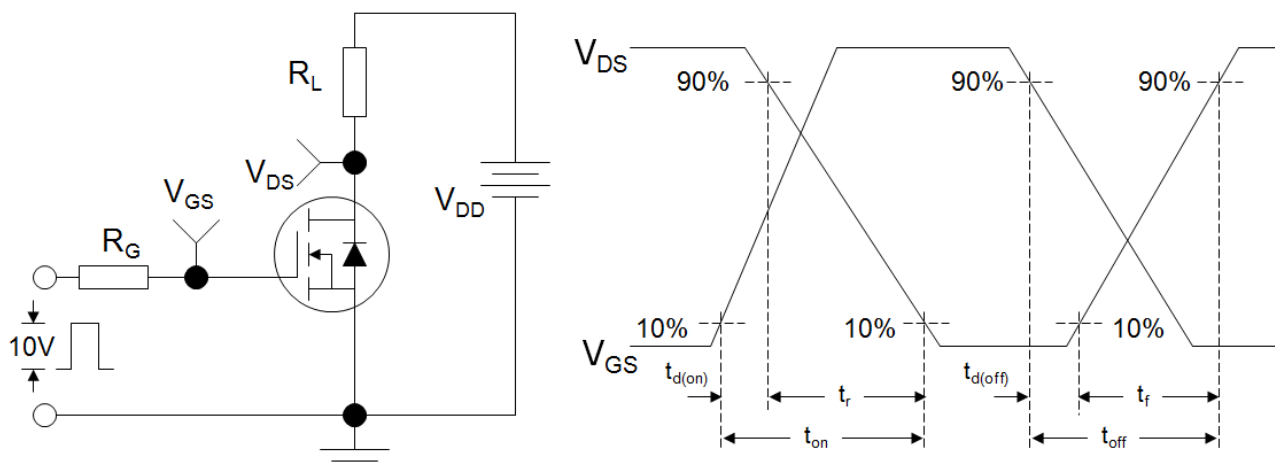
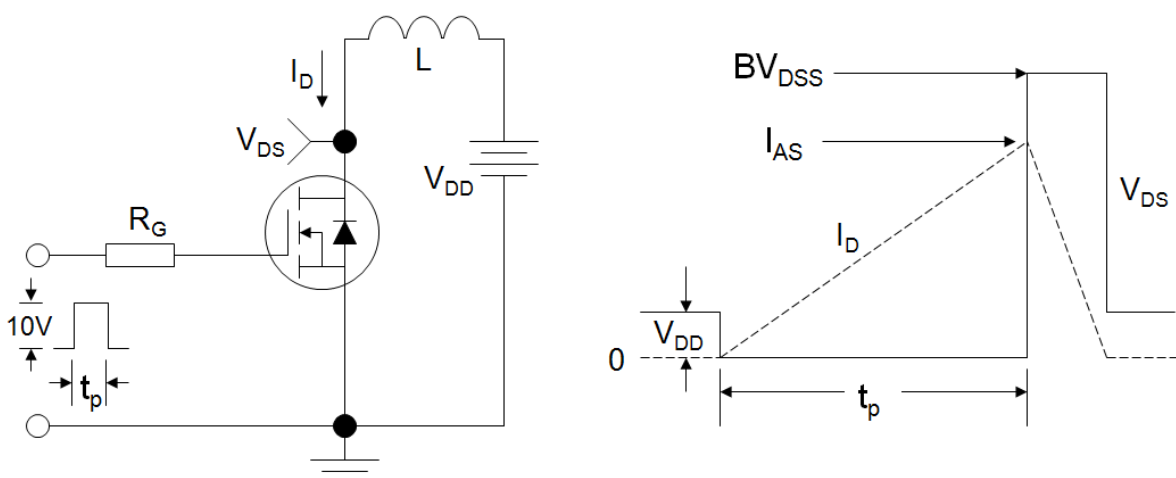
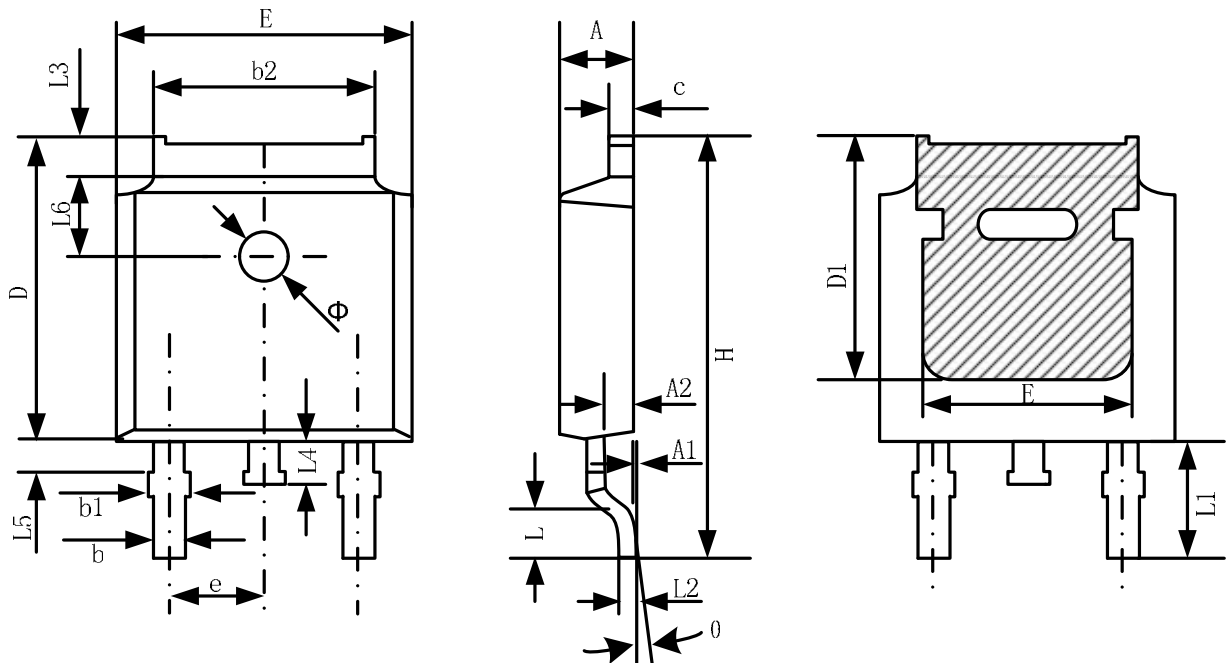


Figure C: Unclamped Inductive Switching Test Circuit and Waveform

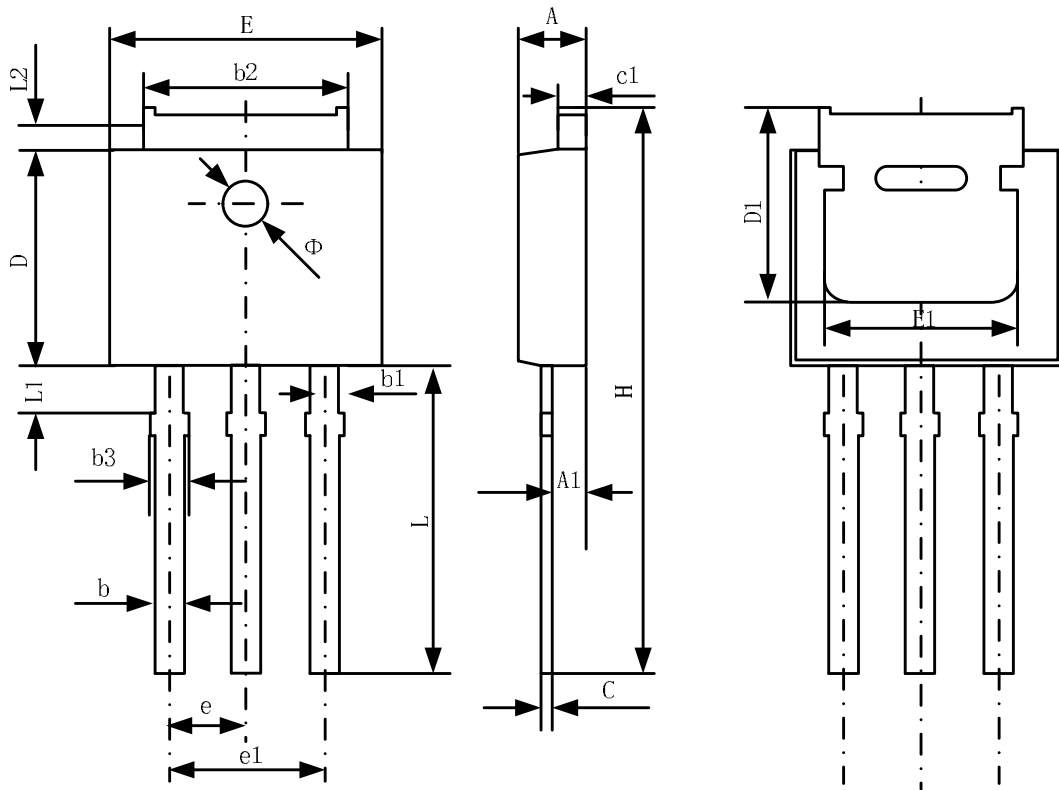


TO-252-2 Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 2.20 | 2.38 | 0.087 | 0.094 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.90 | 1.10 | 0.035 | 0.043 |
| b | 0.72 | 0.85 | 0.028 | 0.033 |
| b1 | 0.72 | 0.90 | 0.028 | 0.035 |
| b2 | 5.13 | 5.46 | 0.202 | 0.215 |
| c | 0.47 | 0.60 | 0.019 | 0.024 |
| D | 6.00 | 6.20 | 0.236 | 0.244 |
| D1 | 5.25 | -- | 0.207 | -- |
| E | 6.50 | 6.70 | 0.256 | 0.264 |
| E1 | 4.70 | -- | 0.185 | -- |
| e | 2.19 | 2.39 | 0.086 | 0.094 |
| H | 9.80 | 10.40 | 0.386 | 0.409 |
| L | 1.40 | 1.70 | 0.055 | 0.067 |
| L1 | 2.90 REF | | 0.114 REF | |
| L2 | 0.508 BSC | | 0.020 BSC | |
| L3 | 0.90 | 1.25 | 0.035 | 0.049 |
| L4 | 0.60 | 1.00 | 0.024 | 0.039 |
| L5 | 0.15 | 0.75 | 0.006 | 0.030 |
| L6 | 1.80 REF | | 0.071 REF | |
| Φ | 1.20 | 1.40 | 0.047 | 0.055 |
| θ | 0° | 8° | 0° | 8° |

TO-251 Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 2.20 | 2.35 | 0.087 | 0.093 |
| A1 | 0.90 | 1.10 | 0.035 | 0.043 |
| b | 0.56 | 0.69 | 0.022 | 0.027 |
| b1 | 0.77 | 0.90 | 0.030 | 0.035 |
| b2 | 5.23 | 5.43 | 0.206 | 0.214 |
| b3 | | 1.05 | 0.000 | 0.041 |
| C | 0.46 | 0.59 | 0.018 | 0.023 |
| c1 | 0.46 | 0.59 | 0.018 | 0.023 |
| D | 6.00 | 6.20 | 0.236 | 0.244 |
| D1 | 5.20 | | 0.205 | |
| E | 6.50 | 6.70 | 0.256 | 0.264 |
| E1 | 4.60 | 5.00 | 0.181 | |
| e | 2.24 | 2.34 | 0.088 | 0.092 |
| e1 | 4.47 | 4.67 | 0.176 | 0.184 |
| H | 16.18 | 16.78 | 0.637 | 0.661 |
| L | 9.00 | 9.60 | 0.354 | 0.378 |
| L1 | 0.95 | 1.35 | 0.037 | 0.053 |
| L2 | 0.90 | 1.25 | 0.035 | 0.049 |

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