Wuxi Unigroup Microelectronics Co.,Ltd

# 700V Super-Junction Power MOSFET

## DESCRIPTION

**700V super-junction Power MOSFET**

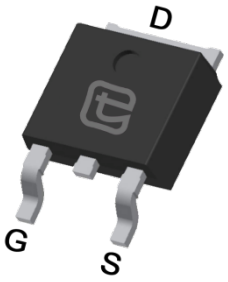
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs，designed according to the SJ principle. The SJ MOSFET is a price-performance optimized product enabling to target cost sensitive applications in Consumer and Lighting markets，designed by Wuxi Unigroup Microelectronics Company.

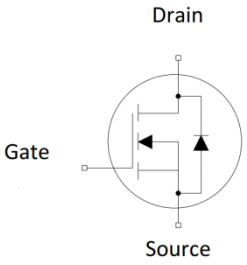
## FEATURES

- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

## APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)




RoHS

## Device Marking and Package Information

| Device | Package | Marking |
|---|---|---|
| TPD70R600M | TO-252 | 70R600M |

## Key Performance Parameters

| Parameter | Value | Unit |
|---|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 700 | V |
| $R_{DS(on),max}$ | 0.6 | Ω |
| $I_D$ | 7 | A |
| $Q_{g,typ}$ | 13 | nC |
| $I_{DM}$ | 21 | A |

| **Absolute Maximum Ratings** $T_C$ = 25ºC, unless otherwise noted | | | | |
|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Value** | **Unit** |
| Drain-Source Voltage ($V_{GS}$ = 0V) | | $V_{DSS}$ | 700 | V |
| Continuous Drain Current | $T_C$ = 25ºC | $I_D$ | 7 | A |
| | TC = 100ºC | | 4.2 | |
| Pulsed Drain Current | (note1) | $I_{DM}$ | 21 | A |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | V |
| Single Pulse Avalanche Energy | (note2) | $E_{AS}$ | 142 | mJ |
| Repetitive Avalanche Energy | (note2) | $E_{AR}$ | 0.21 | mJ |
| Avalanche Current | | $I_{AR}$ | 1.3 | A |
| MOSFET dv/dt ruggedness, $V_{DS}$ = 0...480V | | dv/dt | 50 | V/ns |
| Power Dissipation | | $P_D$ | 63 | W |
| Continuous Body Diode Current | | $I_S$ | 6 | A |
| Pulsed Diode Forward Current | (note1) | $I_{SM}$ | 21 | |
| Reverse diode dv/dt | (note3) | dv/dt | 15 | V/ns |
| Maximum diode commutation speed | (note3) | $di_f/dt$ | 500 | A/us |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55~+150 | ºC |

| **Thermal Resistance** | | | |
|---|---|---|---|
| **Parameter** | **Symbol** | **Value** | **Unit** |
| Thermal Resistance, Junction-to-Case | $R_{thJC}$ | 2.0 | ºC/W |
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 62 | |

**Specifications** $T_J$ = 25ºC, unless otherwise noted

| Parameter | Symbol | Test Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250μA | 700 | -- | -- | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 700V, $V_{GS}$ = 0V, $T_J$ = 25ºC | -- | -- | 1 | μA |
| | | $V_{DS}$ = 700V, $V_{GS}$ = 0V, $T_J$ = 150ºC | -- | -- | 100 | |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = ±30V | -- | -- | ±100 | nA |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 2.5 | -- | 4.0 | V |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10V, $I_D$ = 3.5A | -- | 0.53 | 0.6 | Ω |
| Gate resistance | $R_G$ | f = 1.0MHz open drain | -- | 7 | -- | Ω |
| **Dynamic** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = 100V, f = 1.0MHz | -- | 509 | -- | pF |
| Output Capacitance | $C_{oss}$ | | -- | 23 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 1.5 | -- | |
| Total Gate Charge | $Q_g$ | $V_{DD}$ = 520V, $I_D$ = 7A, $V_{GS}$ = 10V | -- | 13 | -- | nC |
| Gate-Source Charge | $Q_{gs}$ | | -- | 2.8 | -- | |
| Gate-Drain Charge | $Q_{gd}$ | | -- | 5.6 | -- | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$ = 400V, $I_D$ = 7A, $R_G$ = 25Ω | -- | 55 | -- | ns |
| Turn-on Rise Time | $t_r$ | | -- | 61 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 117 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 42 | -- | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Body Diode Voltage | $V_{SD}$ | $T_J$ = 25ºC, $I_{SD}$ = 3.5A, $V_{GS}$ = 0V | -- | 0.9 | 1.2 | V |
| Reverse Recovery Time | $t_{rr}$ | $V_R$ = 400V, $I_F$ = 7A, $di_F/dt$ = 100A/μs | -- | 321 | -- | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | -- | 3.4 | -- | μC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | -- | 21.2 | -- | A |

**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS}$ = 2.4A, $V_{DD}$ = 50V, $R_G$ = 25Ω, Starting $T_J$ = 25°C
3. Identical low side and high side switch with identical $R_G$

**Typical Characteristics** $T_J$ = 25ºC, unless otherwise noted

**Figure 1. Output Characteristics**

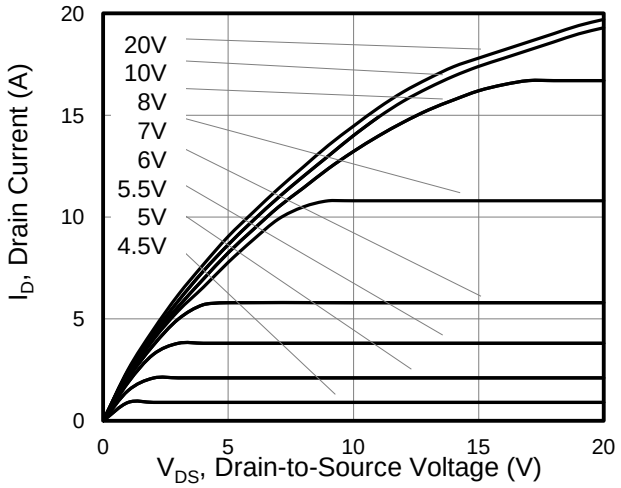



**Figure 2. Transfer Characteristics**

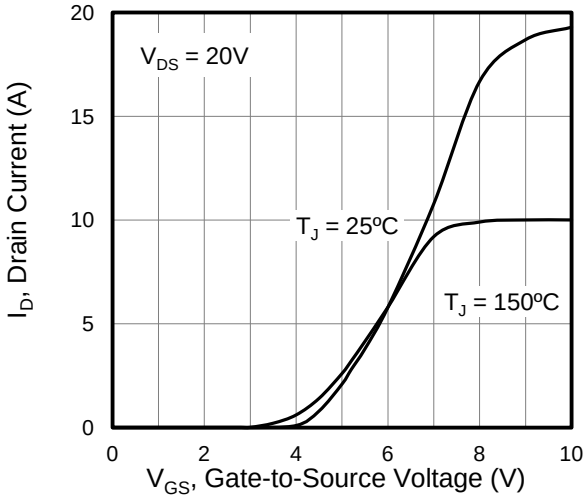



**Figure 3. On-Resistance vs. Drain Current**

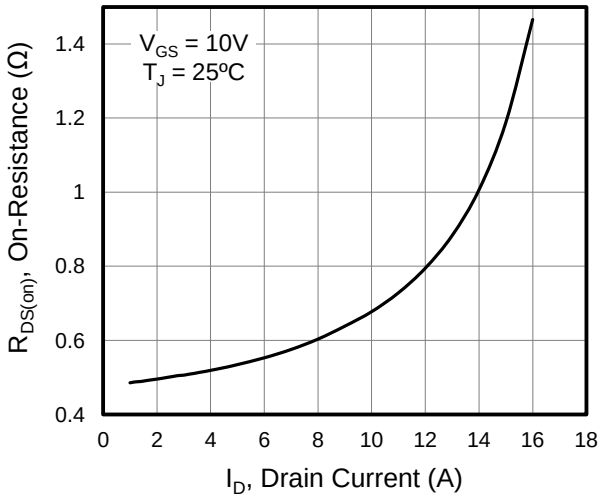



**Figure 4. Capacitance**

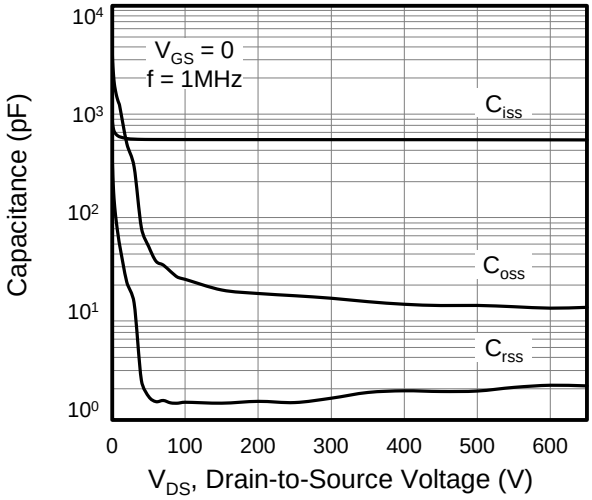



**Figure 5. Gate Charge**

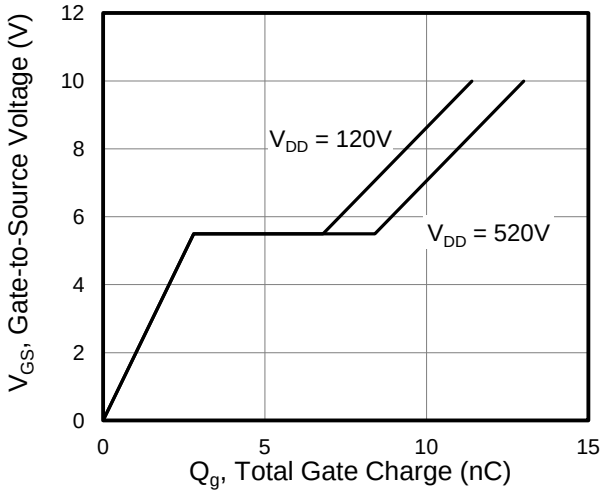
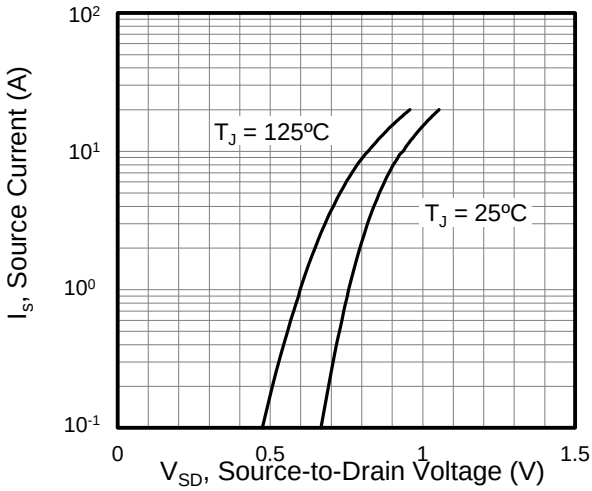



**Figure 6. Body Diode Forward Voltage**



**Typical Characteristics** $T_J$ = 25ºC, unless otherwise noted

**Figure 7. On-Resistance vs. Junction Temperature**

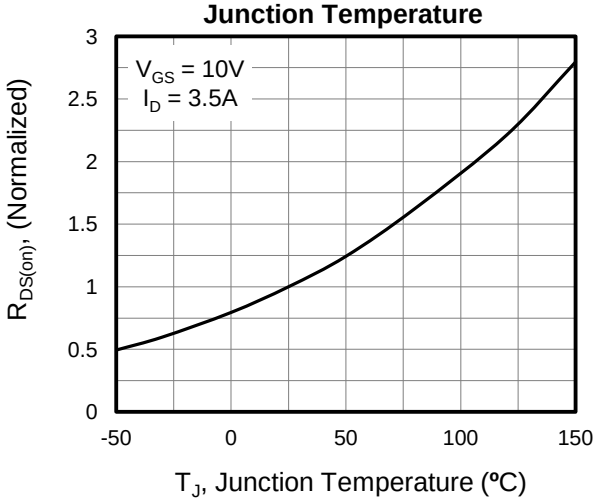



**Figure 8.Breakdown voltage vs. Junction Temperature**

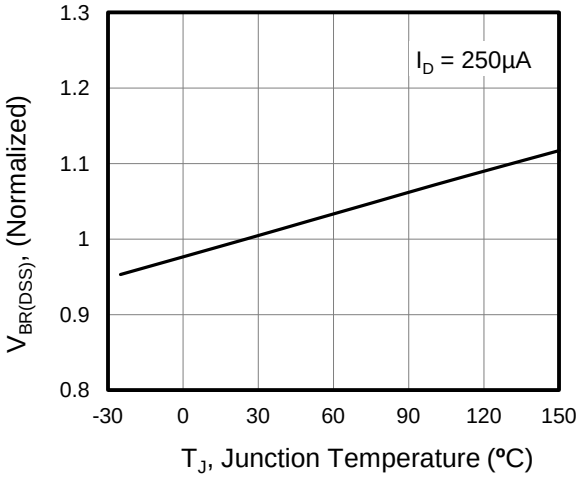



**Figure 9. Transient Thermal Impedance TO-252**

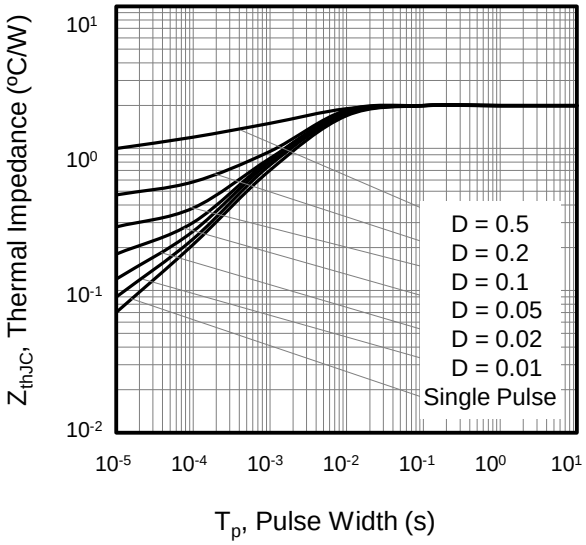



**Figure 10. Safe operation area for TO-252**

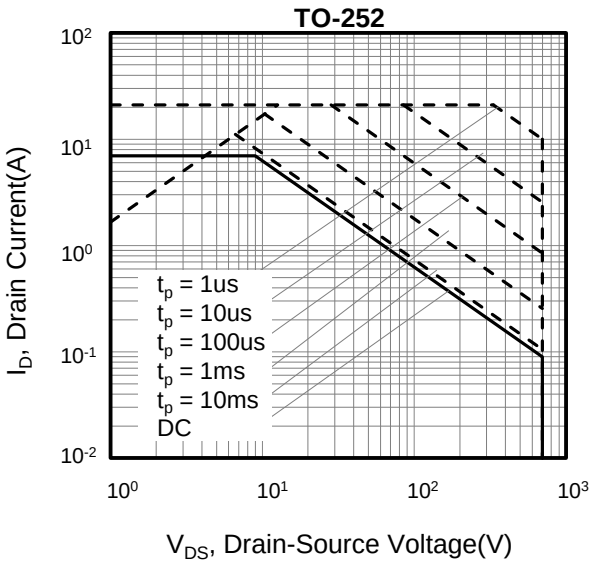


**Figure A：Gate Charge Test Circuit and Waveform**

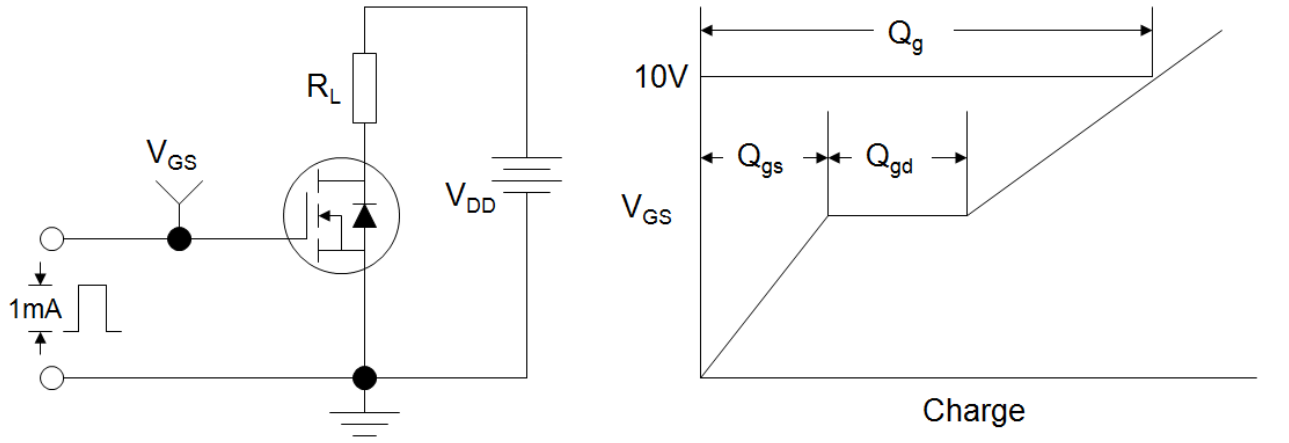



**Figure B：Resistive Switching Test Circuit and Waveform**

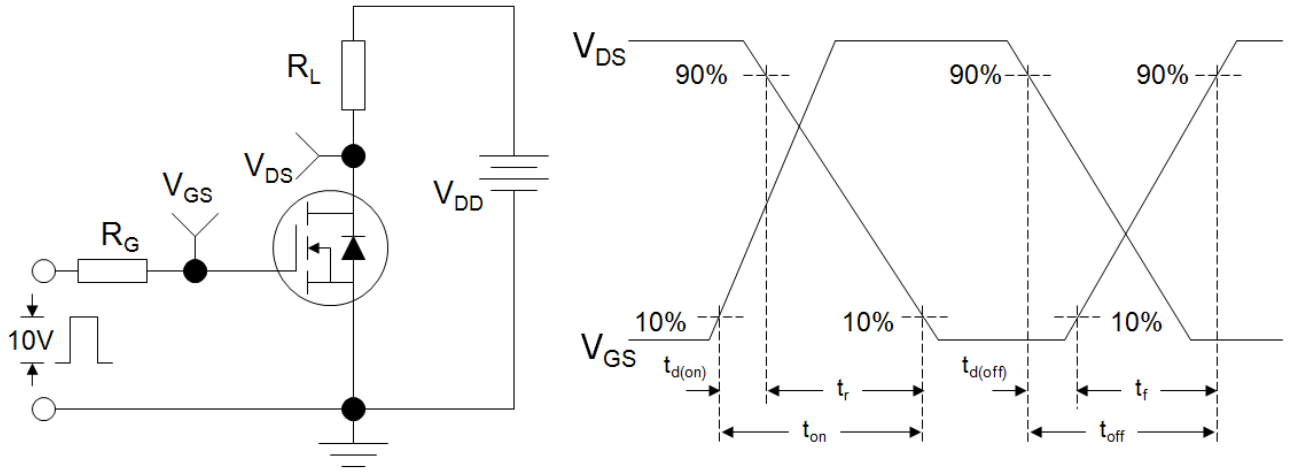
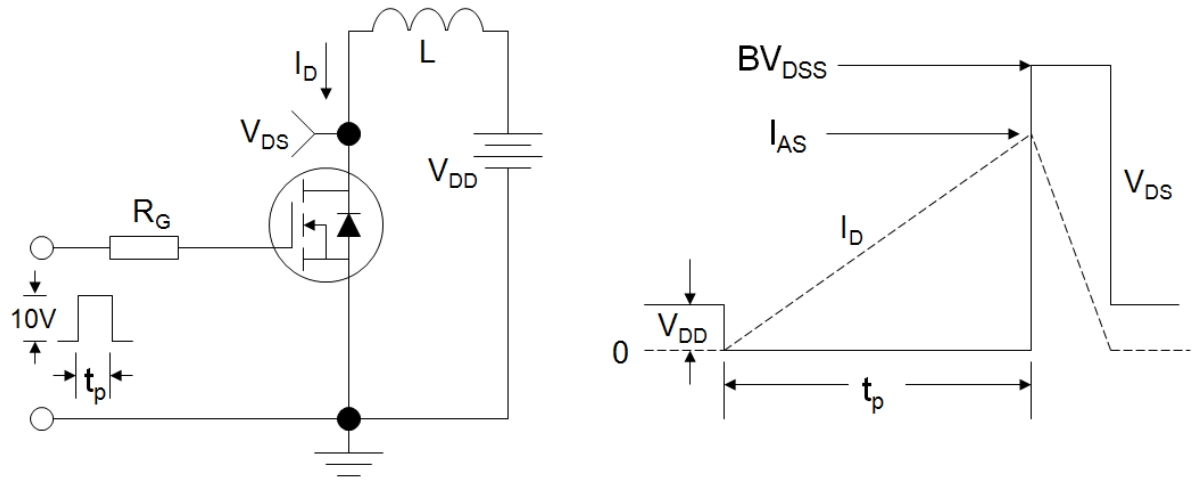
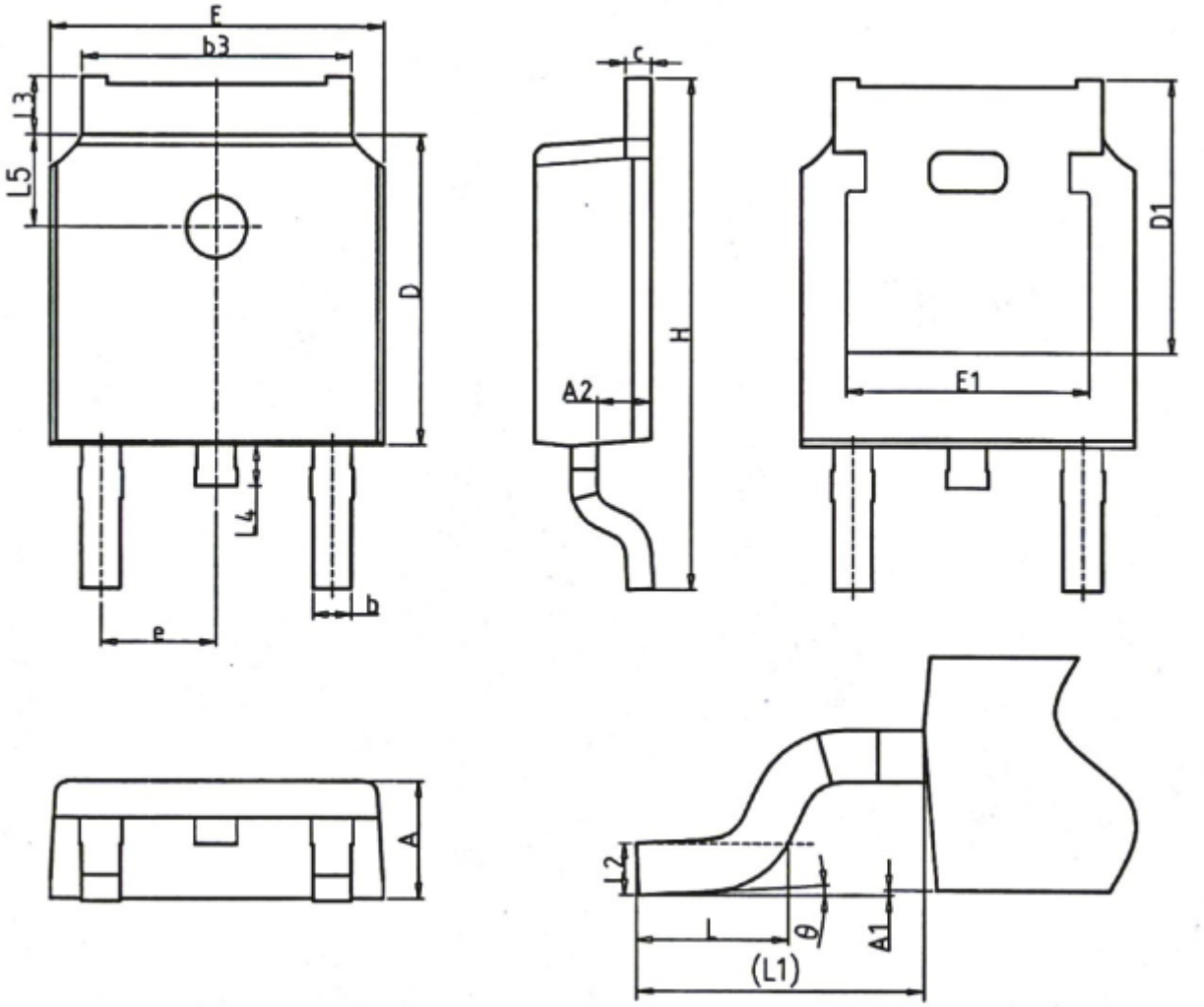



**Figure C：Unclamped Inductive Switching Test Circuit and Waveform**



# TO-252




| Unit:mm | | | |
|---|---|---|---|
| Symbol | Min. | Nom | Max. |
| A | 2.20 | 2.30 | 2.40 |
| A1 | 0.00 | - | 0.20 |
| A2 | 0.97 | 1.07 | 1.17 |
| b | 0.68 | 0.78 | 0.90 |
| b3 | 5.20 | 5.33 | 5.50 |
| c | 0.43 | 0.53 | 0.63 |
| D | 5.98 | 6.10 | 6.22 |
| D1 | 5.30 REF | | |
| E | 6.40 | 6.60 | 6.80 |
| E1 | 4.63 | - | - |

| Unit:mm | | | |
|---|---|---|---|
| Symbol | Min. | Nom | Max. |
| e | 2.286 BSC | | |
| H | 9.40 | 10.10 | 10.50 |
| L | 1.38 | 1.50 | 1.75 |
| L1 | 2.90 REF | | |
| L2 | 0.51 BSC | | |
| L3 | 0.88 | - | 1.28 |
| L4 | - | - | 1.00 |
| L5 | 1.65 | 1.80 | 1.95 |
| θ | 0° | - | 8° |

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