

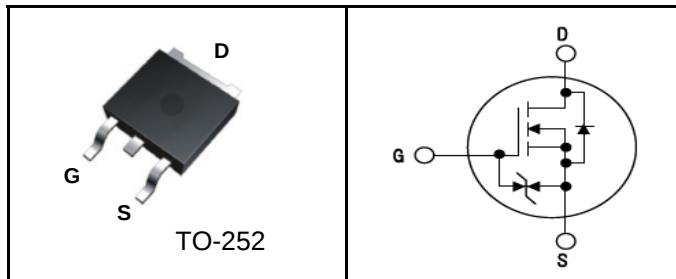
## 600V N-Channel Super Junction MOSFET

### Features

- $BV_{DSS}=600V$ ,  $I_D=10.9A$
- $R_{DS(on)}:0.35\Omega$  (Max) @  $V_{GS}=10V$
- Very Low FOM ( $R_{DS(on)} \times Q_g$ )
- Extremely low switching loss
- Excellent stability and uniformity
- 100% Avalanche Tested
- Built-in ESD Diode

### Application

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- TV power & LED Lighting Power
- AC to DC Converters
- Telecom



### Device Marking and Package Information

| Ordering code | Package | Marking   |
|---------------|---------|-----------|
| MPSD60M350B   | TO-252  | MP60M350B |

### Absolute Maximum Ratings $T_C=25^\circ C$ unless otherwise specified

| Symbol         | Parameter                                                    | Value       | Unit       |
|----------------|--------------------------------------------------------------|-------------|------------|
| $V_{DSS}$      | Drain-Source Voltage                                         | 600         | V          |
| $V_{GS}$       | Gate-Source Voltage                                          | $\pm 20$    | V          |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ C$ )            | 10.9        | A          |
|                | Drain Current - Continuous ( $T_C = 100^\circ C$ )           | 6.9         | A          |
| $I_{DM}^{1)}$  | Drain Current - Pulsed                                       | 33.0        | A          |
| $E_{AS}^{2)}$  | Single Pulsed Avalanche Energy                               | 141         | mJ         |
| $I_{AR}$       | Avalanche Current                                            | 1.8         | A          |
| dv/dt          | MOSFET dv/dt ruggedness, $V_{DS}=0\dots 480V$                | 50          | V/ns       |
| dv/dt          | Reverse diode dv/dt, $V_{DS}=0\dots 480V$ , $I_{DS}\leq I_D$ | 15          | V/ns       |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ C$ )                     | 91          | W          |
| $V_{ESD(G-S)}$ | Gate source ESD(HBM-C=100pF, R=1.5K $\Omega$ )               | 2000        | V          |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                      | -55 to +150 | $^\circ C$ |

### Thermal Resistance Characteristics

| Symbol          | Parameter                                     | Value | Unit         |
|-----------------|-----------------------------------------------|-------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max.    | 1.37  | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Max. | 62.5  | $^\circ C/W$ |

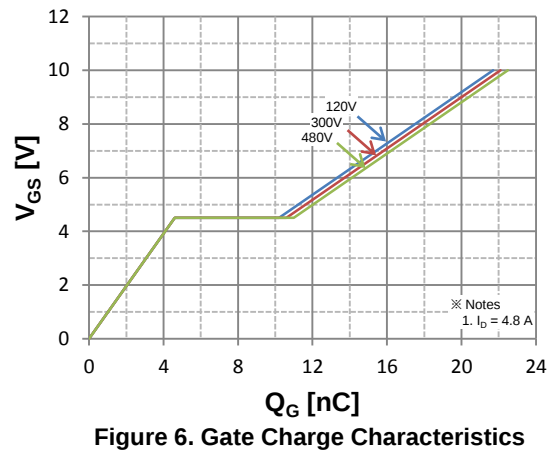
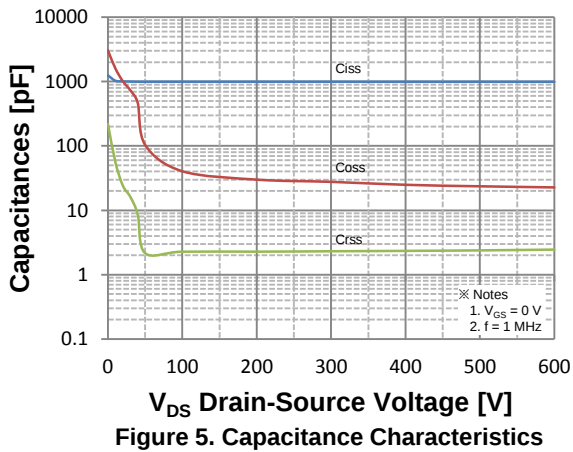
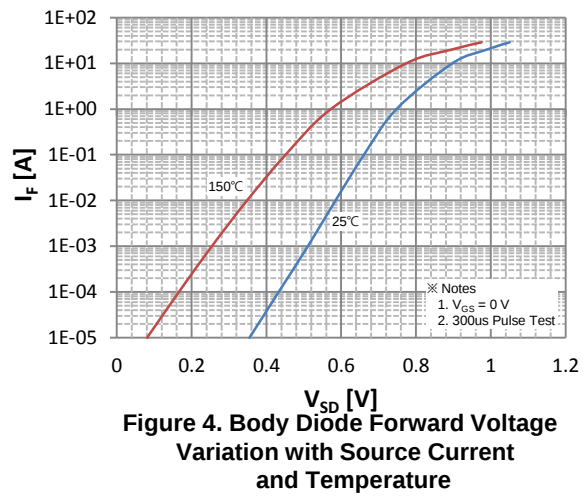
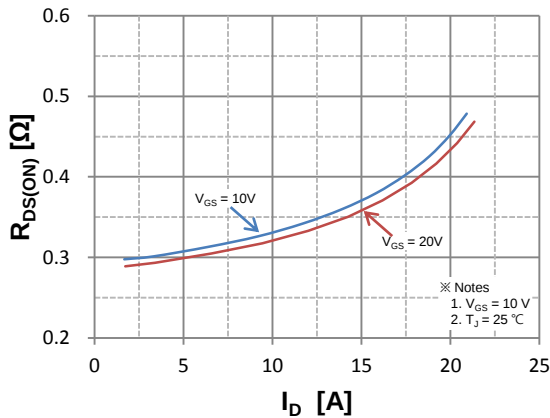
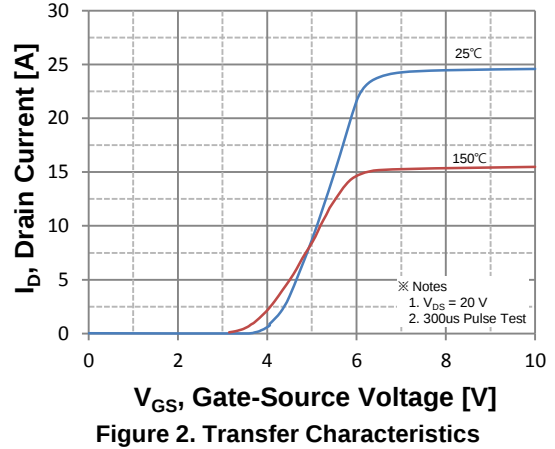
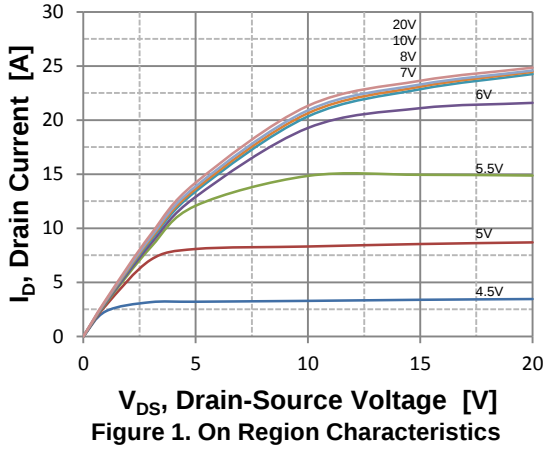
## Electrical Characteristics $T_j=25^\circ\text{C}$ unless otherwise specified

| Symbol                                                 | Parameter                                             | Test Conditions                                                                              | Min | Typ   | Max  | Unit |
|--------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------|-----|-------|------|------|
| On Characteristics                                     |                                                       |                                                                                              |     |       |      |      |
| V <sub>GS</sub>                                        | Gate Threshold Voltage                                | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 370 μA                                  | 2.0 | -     | 4.0  | V    |
| R <sub>DS(ON)</sub>                                    | Static Drain-Source On-Resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.8 A                                               | -   | 0.305 | 0.35 | Ω    |
| Off Characteristics                                    |                                                       |                                                                                              |     |       |      |      |
| BV <sub>DSS</sub>                                      | Drain-Source Breakdown Voltage                        | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1mA                                                  | 600 | -     | -    | V    |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                       | V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0                                                 | -   | -     | 1    | μA   |
|                                                        |                                                       | V <sub>DS</sub> = 600 V, T <sub>C</sub> = 150°C                                              | -   | -     | 100  | μA   |
| I <sub>GSS</sub>                                       | Gate-Body Leakage Current                             | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V                                               | -   | -     | ±1   | μA   |
| Dynamic Characteristics                                |                                                       |                                                                                              |     |       |      |      |
| C <sub>iss</sub>                                       | Input Capacitance                                     | V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V,<br>f = 1.0 MHz                               | -   | 990   | -    | pF   |
| C <sub>oss</sub>                                       | Output Capacitance                                    |                                                                                              | -   | 25    | -    | pF   |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                          |                                                                                              | -   | 2.4   | -    | pF   |
| Switching Characteristics                              |                                                       |                                                                                              |     |       |      |      |
| t <sub>d(on)</sub>                                     | Turn-On Time                                          | V <sub>DS</sub> = 300 V, I <sub>D</sub> = 4.8 A,<br>R <sub>G</sub> = 25 Ω<br><br>(Note 3,4)  | -   | 28    | -    | ns   |
| t <sub>r</sub>                                         | Turn-On Rise Time                                     |                                                                                              | -   | 20    | -    | ns   |
| t <sub>d(off)</sub>                                    | Turn-Off Delay Time                                   |                                                                                              | -   | 114   | -    | ns   |
| t <sub>f</sub>                                         | Turn-Off Fall Time                                    |                                                                                              | -   | 17    | -    | ns   |
| Q <sub>g(</sub>                                        | Total Gate Charge                                     | V <sub>DS</sub> = 480 V, I <sub>D</sub> = 4.8 A,<br>V <sub>GS</sub> = 10 V<br><br>(Note 3,4) | -   | 22.6  | -    | nC   |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                    |                                                                                              | -   | 4.6   | -    | nC   |
| Q <sub>gd</sub>                                        | Gate-Drain Charge                                     |                                                                                              | -   | 6.4   | -    | nC   |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                       |                                                                                              |     |       |      |      |
| I <sub>S</sub>                                         | Maximum Continuous Drain-Source Diode Forward Current |                                                                                              | -   | -     | 10.9 | A    |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain-Source Diode Forward Current     |                                                                                              | -   | -     | 33   | A    |
| V <sub>SD</sub>                                        | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 4.8 A                                                | -   | -     | 1.3  | V    |
| t <sub>rr</sub>                                        | Reverse Recovery Time                                 | V <sub>R</sub> = 400 V, I <sub>F</sub> = 4.8 A<br>di <sub>F</sub> /dt = 100 A/μs             | -   | 250   | -    | ns   |
| Q <sub>rr</sub>                                        | Reverse Recovery Charge                               |                                                                                              | -   | 2.6   | -    | μC   |

### Notes :

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $I_{AS}=1.8\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , Starting  $T_j=25^\circ\text{C}$
3. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
4. Essentially Independent of Operating Temperature

## Typical Characteristics



## Typical Characteristics (continued)

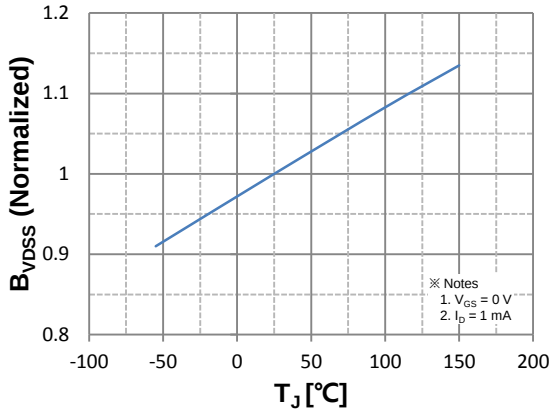


Figure 7. Breakdown Voltage Variation vs. Temperature

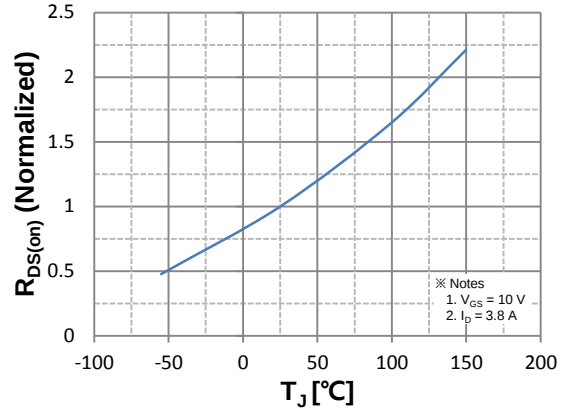


Figure 8. On-Resistance Variation vs. Temperature

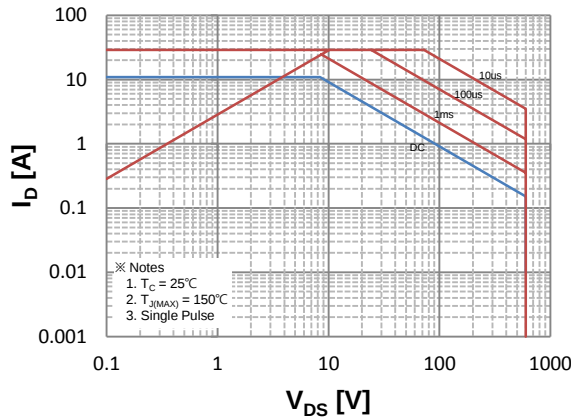


Figure 9. Maximum Safe Operating Area

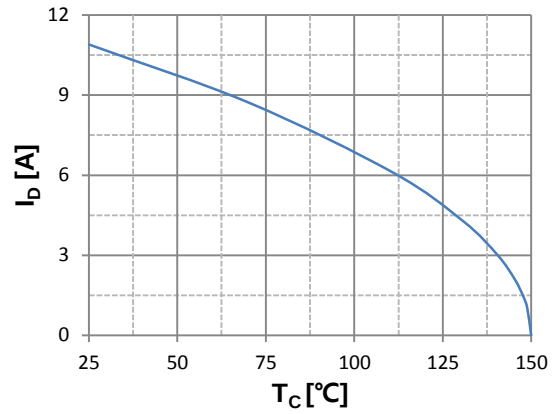


Figure 10. Maximum Drain Current vs. Case Temperature

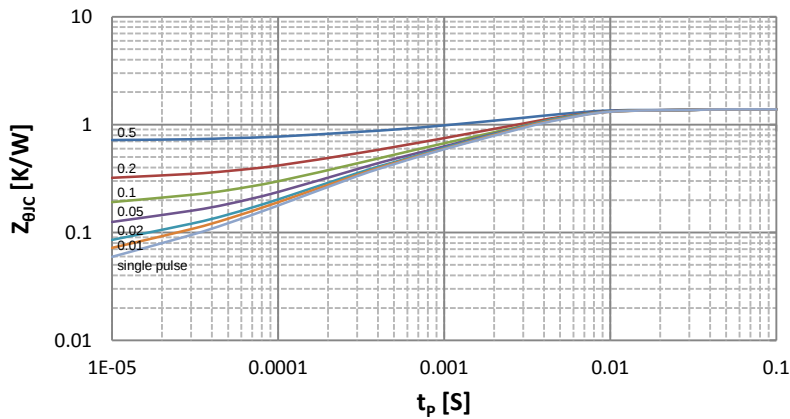


Figure 11. Transient Thermal Response Curve

Fig 12. Gate Charge Test Circuit & Waveform

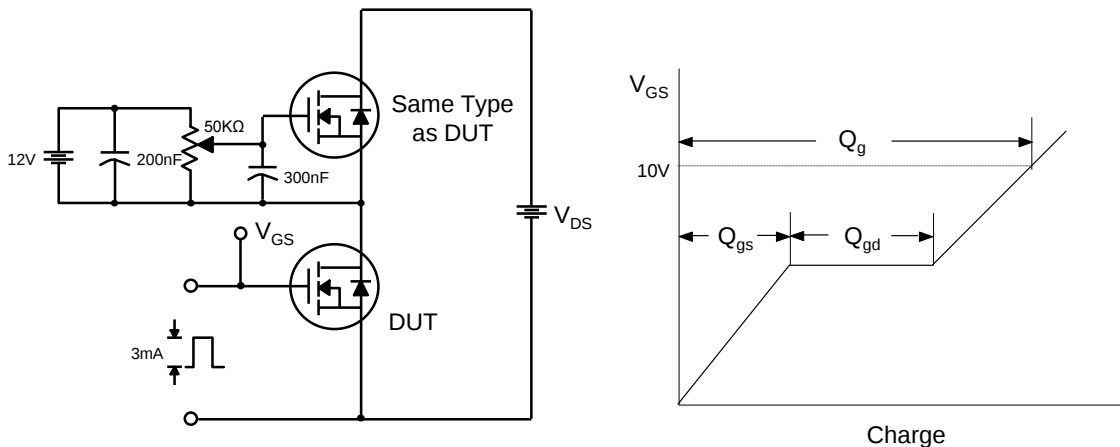


Fig 13. Resistive Switching Test Circuit & Waveforms

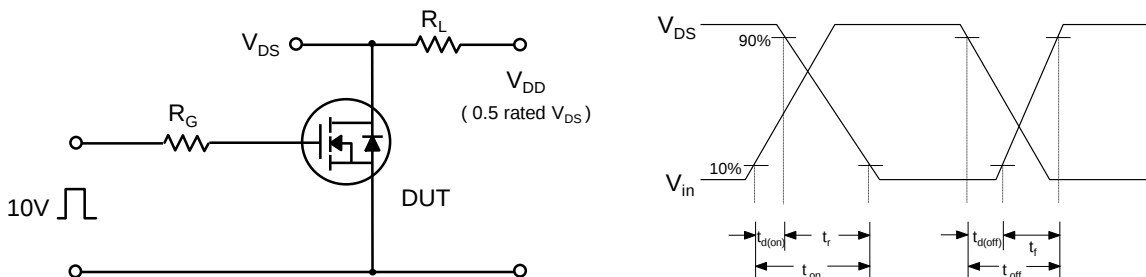


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

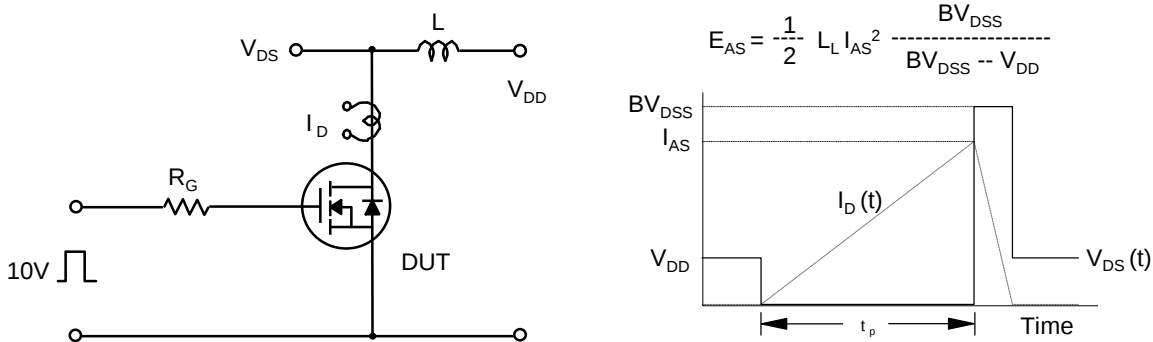
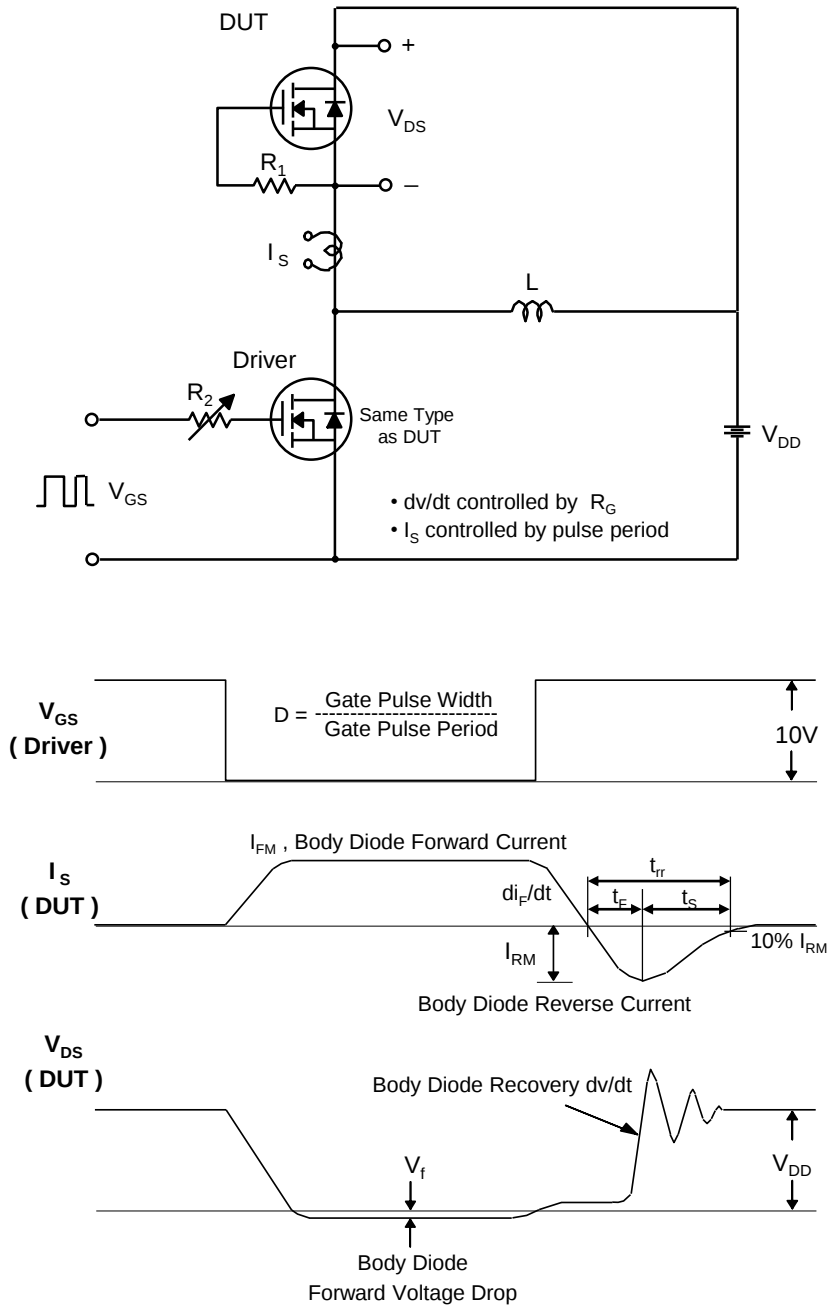
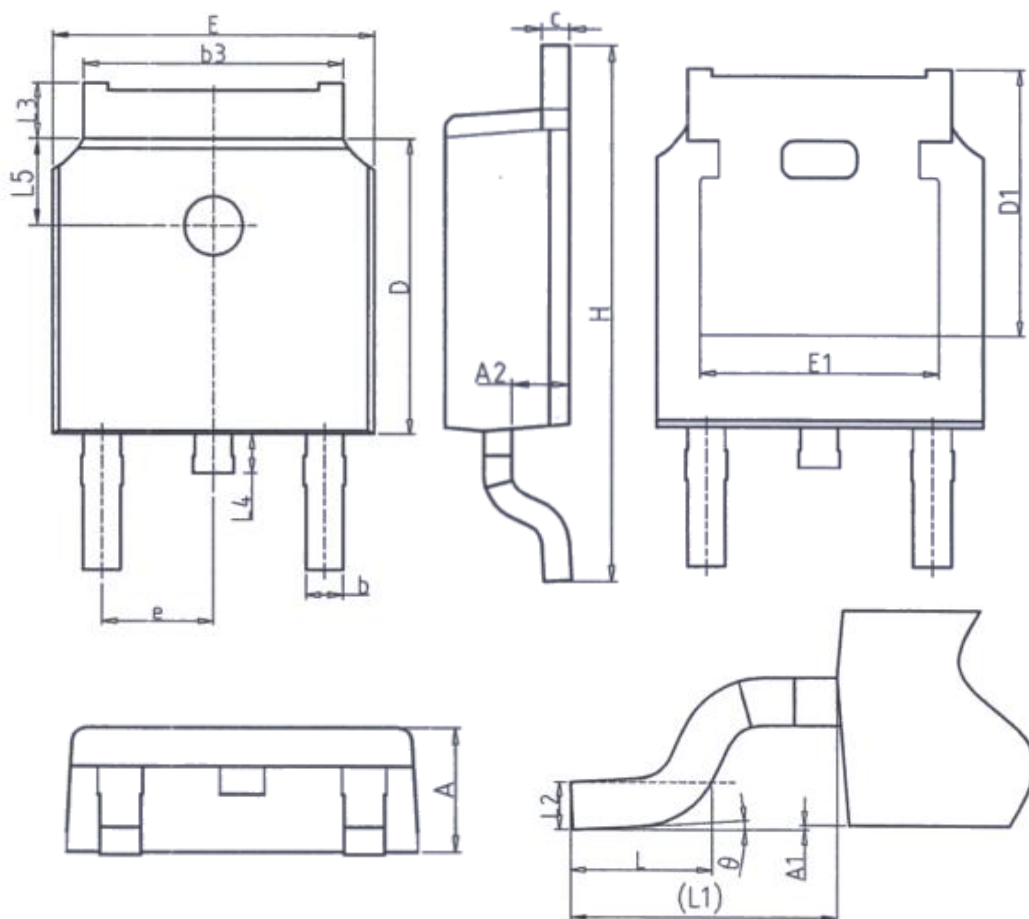


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



## TO-252



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

| Unit: mm |          |       |
|----------|----------|-------|
| Symbol   | Min.     | Max.  |
| e        | 2.286BSC |       |
| H        | 9.40     | 10.50 |
| L        | 1.38     | 1.75  |
| L1       | 2.90REF  |       |
| L2       | 0.51BSC  |       |
| L3       | 0.88     | 1.28  |
| L4       | —        | 1.00  |
| L5       | 1.65     | 1.95  |
| $\theta$ | 0°       | 8°    |