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# MPSU70M1K5

Power MOSFET

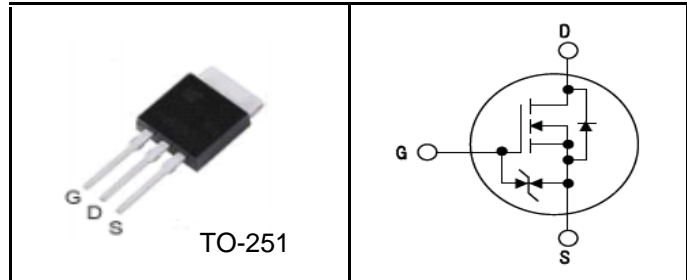
## 700V Super-Junction Power MOSFET

### Features

- Very Low FOM ( $R_{DS(on)} \times Qg$ )
- 100% Avalanche Tested
- RoHS compliant

### Application

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



### Device Marking and Package Information

| Device     | Package | Marking  |
|------------|---------|----------|
| MPSU70M1K5 | TO-251  | MP70M1K5 |

### Absolute Maximum Ratings T<sub>J</sub>=25°C unless otherwise specified

| Symbol                            | Parameter  | Value       | Unit |
|-----------------------------------|--|-------------|------|
| V <sub>DSS</sub>                  | Drain-Source Voltage   | 700         | V    |
| V <sub>GS</sub>                   | Gate-Source Voltage  | ±20         | V    |
| I <sub>D</sub> <sup>1)</sup>      | Drain Current - Continuous (T <sub>C</sub> = 25°C)                               | 5.0         | A    |
|                                   | Drain Current - Continuous (T <sub>C</sub> = 100°C)                              | 3.2         | A    |
| I <sub>DM</sub> <sup>2)</sup>     | Drain Current - Pulsed   | 8.4         | A    |
| E <sub>AS</sub> <sup>3)</sup>     | Single Pulsed Avalanche Energy   | 43          | mJ   |
| I <sub>AR</sub>                   | Avalanche Current  | 1           | A    |
| dv/dt                             | MOSFET dv/dt ruggedness, V <sub>DS</sub> =0...560V                               | 50          | V/ns |
| dv/dt                             | Reverse diode dv/dt, V <sub>DS</sub> =0...560V, I <sub>DS</sub> ≤ I <sub>D</sub> | 15          | V/ns |
| P <sub>D</sub>                    | Power Dissipation (T <sub>C</sub> = 25°C)  | 49          | W    |
| V <sub>ESD(G-S)</sub>             | Gate source ESD(HBM-C=100pF, R=1.5KΩ)  | 2500        | V    |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range  | -55 to +150 | °C   |

### Thermal Resistance Characteristics

| Symbol           | Parameter           | Typ. | Max. | Unit |
|------------------|---------------------|------|------|------|
| R <sub>θJC</sub> | Junction-to-Case    | -    | 2.54 | °C/W |
| R <sub>θJA</sub> | Junction-to-Ambient | -    | 62.5 | °C/W |



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### Electrical Characteristics T<sub>J</sub>=25°C unless otherwise specified

| Symbol  | Parameter   | Test Conditions  | Min. | Typ. | Max. | Unit |
|---|---|--|------|------|------|------|
| <b>On Characteristics</b>                                     |   |  |      |      |      |      |
| V <sub>GS</sub>   | Gate Threshold Voltage                                | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 60 μA                               | 2.5  | -    | 3.5  | V    |
| R <sub>DS(ON)</sub>   | Static Drain-Source On-Resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.1 A   | -    | 1.35 | 1.5  | Ω    |
| <b>Off Characteristics</b>                                    |   |  |      |      |      |      |
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                        | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA   | 700  | -    | -    | V    |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current                       | V <sub>DS</sub> = 700 V, V <sub>GS</sub> = 0 V, T <sub>C</sub> = 25°C                    | -    | -    | 1    | μA   |
|   |   | V <sub>DS</sub> = 700 V, V <sub>GS</sub> = 0 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   |
| <b>Dynamic Characteristics</b>                                |   |  |      |      |      |      |
| C <sub>iss</sub>  | Input Capacitance                                     | V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V,<br>f = 1.0 MHz                           | -    | 245  | -    | pF   |
| C <sub>oss</sub>  | Output Capacitance                                    |  | -    | 13   | -    | pF   |
| C <sub>riss</sub>   | Reverse Transfer Capacitance                          |  | -    | 1.7  | -    | pF   |
| <b>Switching Characteristics</b>                              |   |  |      |      |      |      |
| t <sub>d(on)</sub>  | Turn-On Time  | V <sub>DS</sub> = 350 V, I <sub>D</sub> = 1.5 A,<br>R <sub>G</sub> = 25 Ω<br>(Note 4,5)  | -    | 20   | -    | ns   |
| t <sub>r</sub>  | Turn-On Rise Time                                     |  | -    | 18   | -    | ns   |
| t <sub>d(off)</sub>   | Turn-Off Delay Time                                   |  | -    | 50   | -    | ns   |
| t <sub>f</sub>  | Turn-Off Fall Time                                    |  | -    | 20   | -    | ns   |
| Q <sub>g</sub>  | Total Gate Charge                                     | V <sub>DS</sub> = 560 V, I <sub>D</sub> = 1.5 A,<br>V <sub>GS</sub> = 10 V<br>(Note 4,5) | -    | 5.5  | -    | nC   |
| Q <sub>gs</sub>   | Gate-Source Charge                                    |  | -    | 1.1  | -    | nC   |
| Q <sub>gd</sub>   | Gate-Drain Charge                                     |  | -    | 2.2  | -    | nC   |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |  |      |      |      |      |
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |  | -    | -    | 5.0  | A    |
| I <sub>SM</sub>   | Maximum Pulsed Drain-Source Diode Forward Current     |  | -    | -    | 8.4  | A    |
| V <sub>SD</sub>   | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 5.0 A  | -    | -    | 1.3  | V    |
| t <sub>rr</sub>   | Reverse Recovery Time                                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.5 A  | -    | 135  | -    | ns   |
| Q <sub>rr</sub>   | Reverse Recovery Charge                               | di <sub>F</sub> /dt = 100 A/μs   | -    | 0.6  | -    | μC   |

#### Notes :

- Limited by T<sub>J</sub> max. Maximum duty cycle D=0.50
- Repetitive Rating : Pulse width limited by maximum junction temperature
- I<sub>AS</sub>=1A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub> =25°C
- Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
- Essentially Independent of Operating Temperature



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Typical Characteristics  $T = 25^{\circ}\text{C}$ , unless otherwise noted

Figure 1. On Region Characteristics

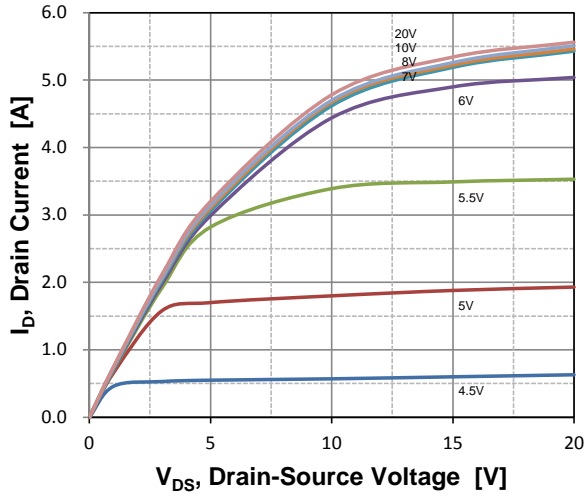


Figure 2. Transfer Characteristics

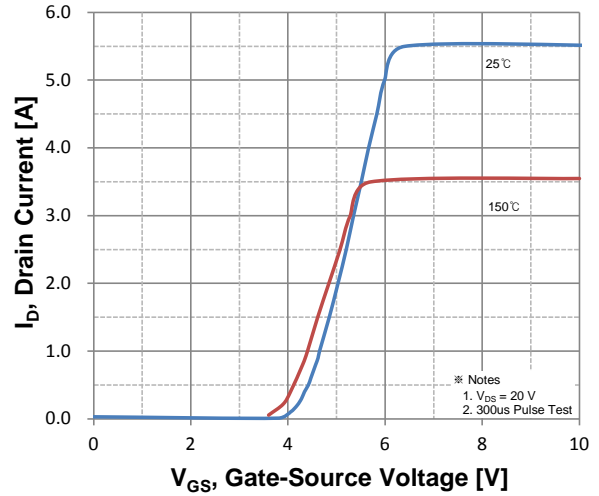


Figure 3. On Resistance Variation vs. Drain Current and Gate Voltage

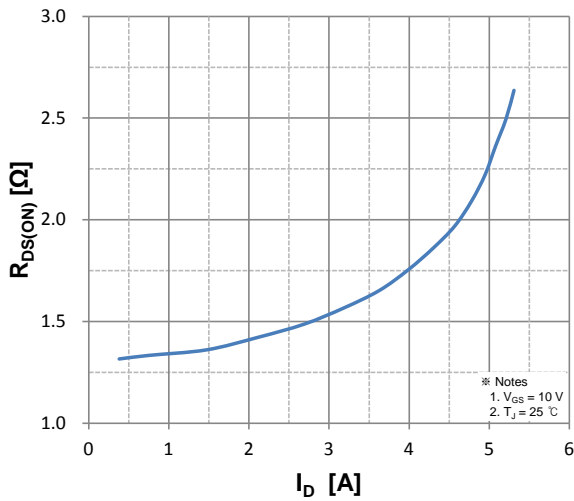


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

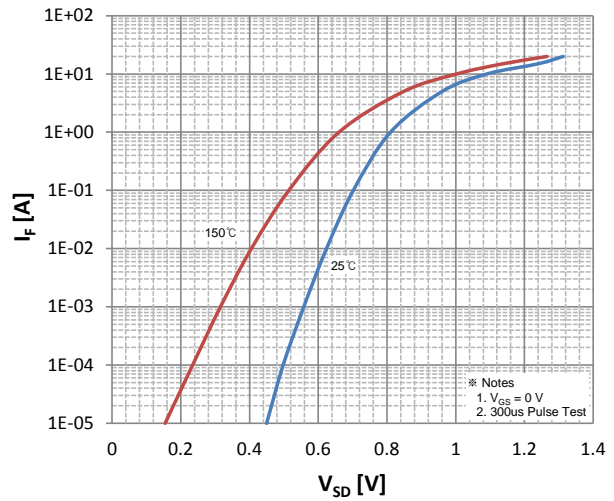


Figure 5. Capacitance Characteristics

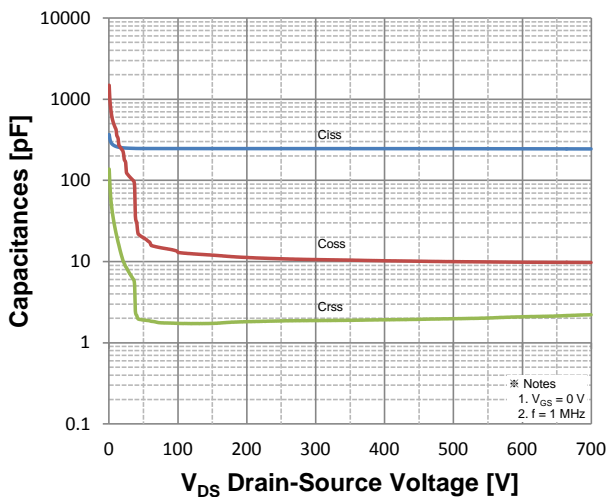
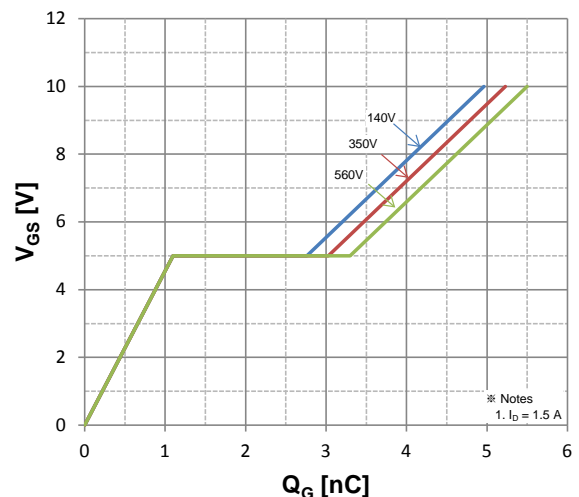


Figure 6. Gate Charge Characteristics



### Typical Characteristics $T = 25^{\circ}\text{C}$ , unless otherwise noted

Figure 7. Breakdown Voltage Variation vs. Temperature

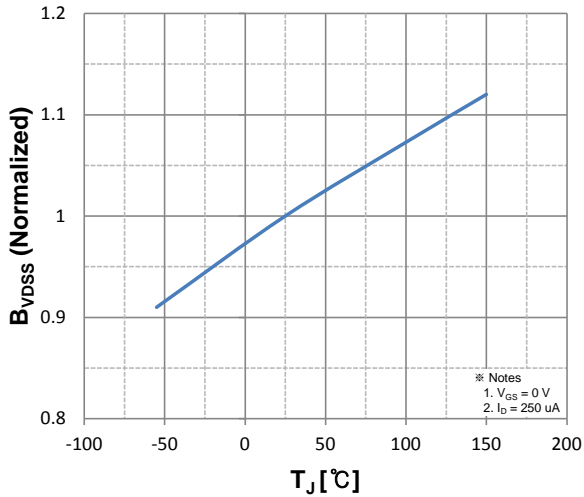


Figure 8. On-Resistance Variation vs. Temperature

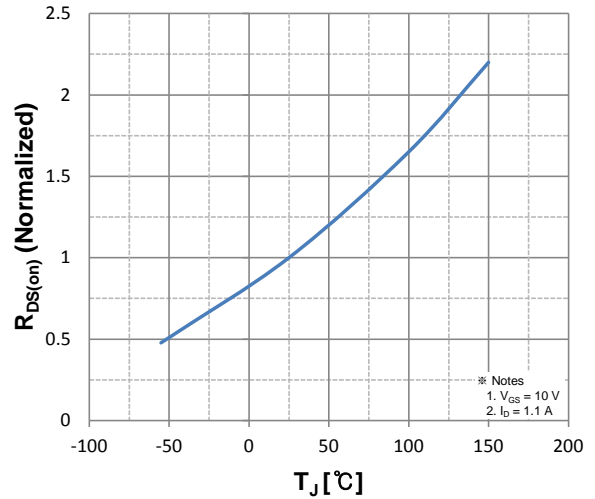


Figure 9. Maximum Safe Operating Area

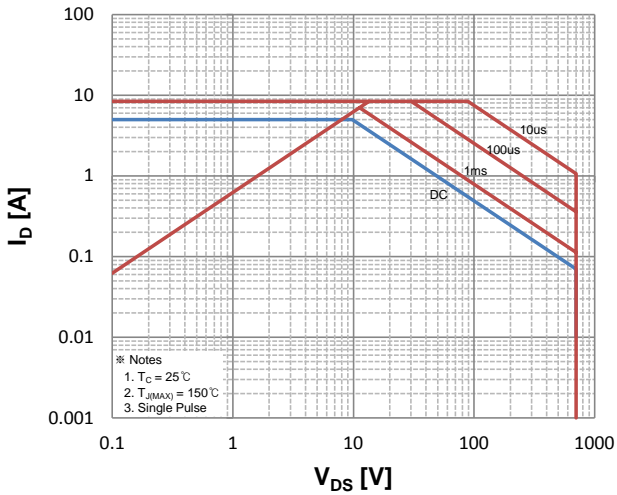


Figure 10. Maximum Drain Current vs. Temperature

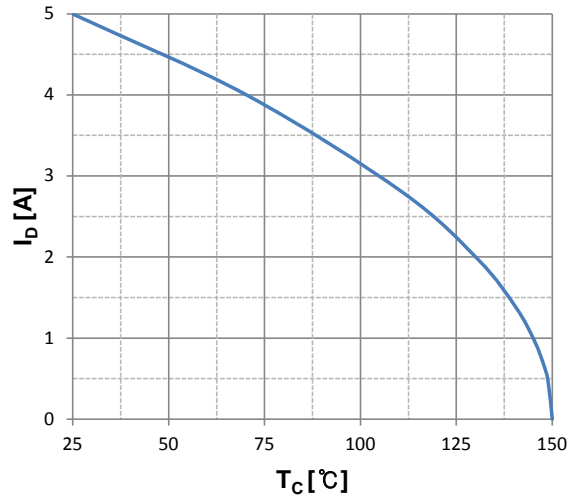


Figure 11. Transient Thermal Response Curve

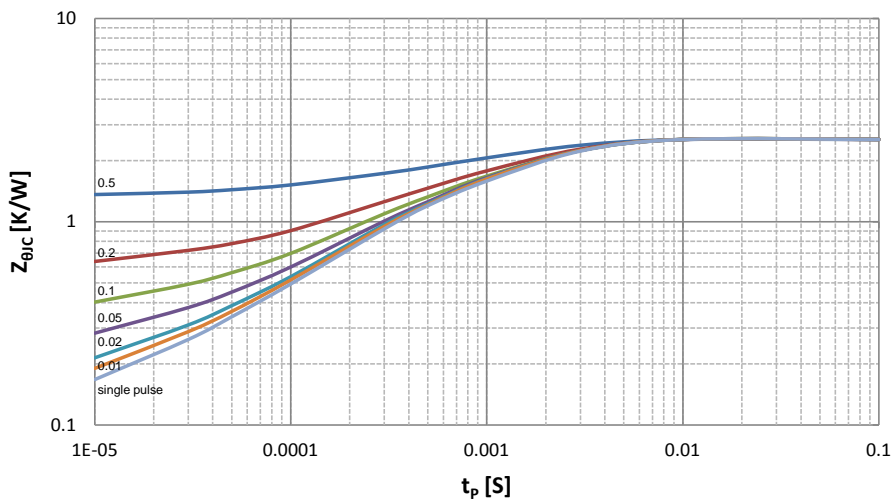


Figure 12. Gate Charge Test Circuit and Waveform

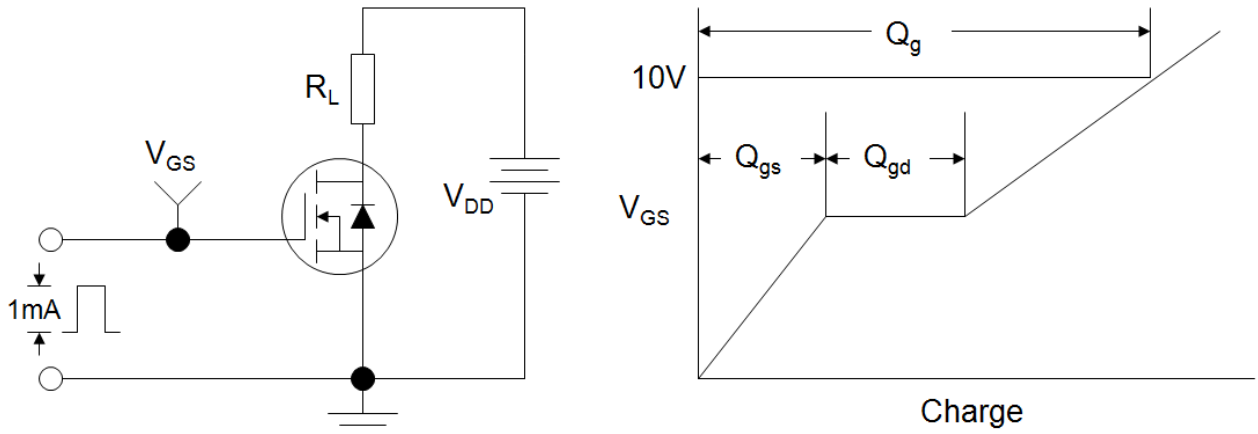


Figure 13. Resistive Switching Test Circuit and Waveform

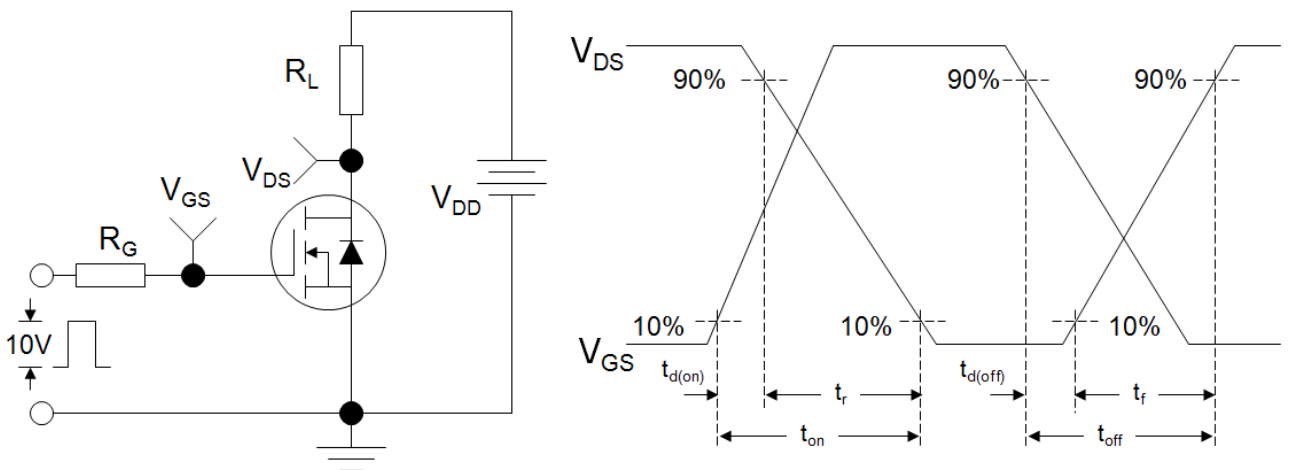
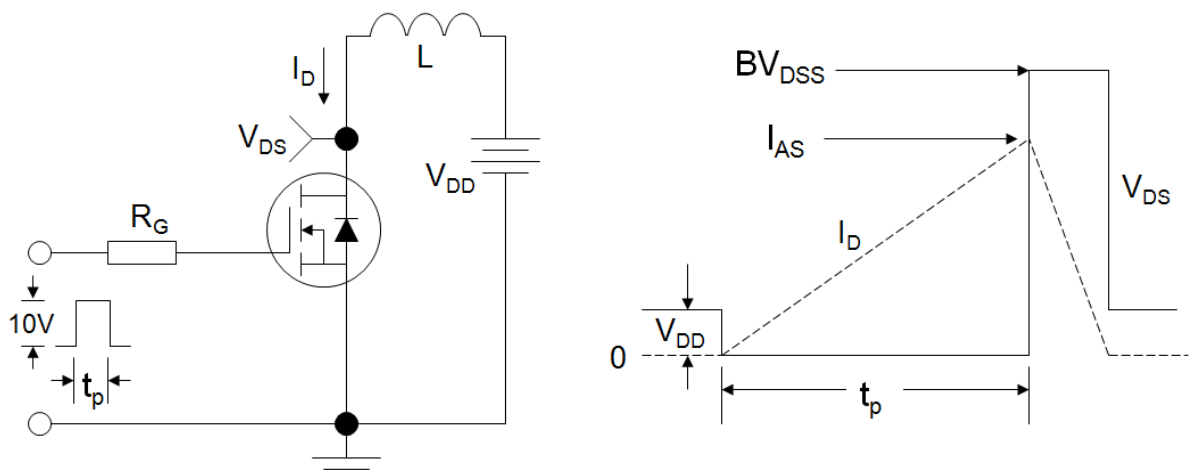


Figure 14. Unclamped Inductive Switching Test Circuit and Waveform





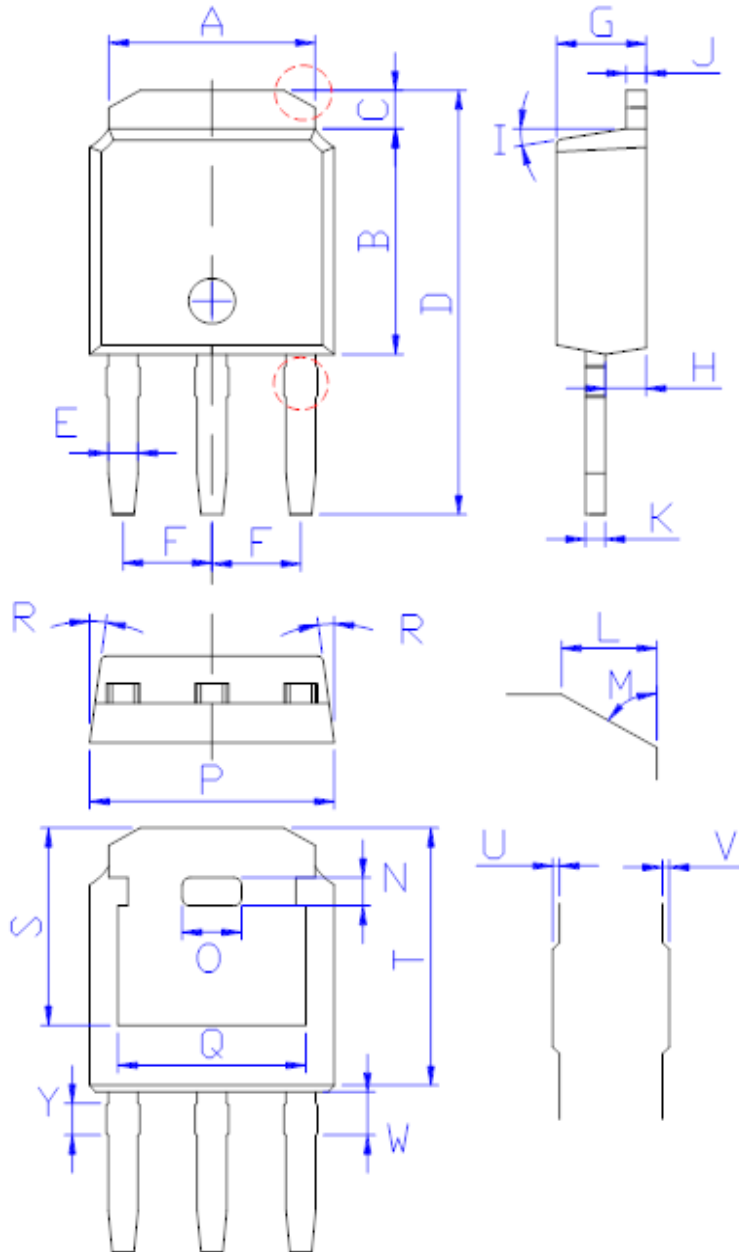
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## Power MOSFET

### Outline Dimension

unit: mm



| DIM | MILLIMETERS  |
|-----|--------------|
| A   | 5.34 ± 0.30  |
| B   | 6.00 ± 0.30  |
| C   | 1.05 ± 0.30  |
| D   | 11.31 ± 0.30 |
| E   | 0.76 ± 0.15  |
| F   | 2.28 ± 0.15  |
| G   | 2.30 ± 0.30  |
| H   | 1.06 ± 0.30  |
| I   | (4-10)°      |
| J   | 0.51 ± 0.15  |
| K   | 0.52 ± 0.15  |
| L   | 0.80 ± 0.30  |
| M   | 60°          |
| N   | 0.75 ± 0.30  |
| O   | 1.80 ± 0.30  |
| P   | 6.60 ± 0.30  |
| Q   | 4.85 ± 0.30  |
| R   | (4-8.5)°     |
| S   | 5.30 ± 0.30  |
| T   | 6.90 ± 0.30  |
| U   | 0.05 ± 0.05  |
| V   | 0.05 ± 0.05  |
| W   | 1.15 ± 0.25  |
| Y   | 0.85 ± 0.25  |

(单位: mm)

#### PIN Connections

1. Gate
2. Drain
3. Source