## Multi-Epi Super Junction MOSFET

Lead Free Package and Finish

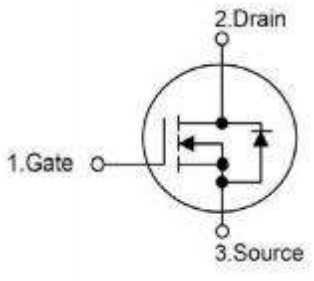
| $I_D$ | $R_{DS(ON)}$(Max.) | $V_{DSS}$ |
|---|---|---|
| 20A | 190mΩ | 650V |

### Applications:

- Switch Mode Power Supply(SMPS)
- Uninterruptible Power Supply(UPS)
- PFC stages for server & telecom
- Consumer

### Features:

- New revolutionary high voltage technology
- Better RDS(on) in TO-220F
- Ultra Low Gate Charge cause lower driving requirements
- Periodic avalanche rated
- Ultra low effective capacitances


Not to Scale

### Ordering Information

| Part Number | Package | Marking |
|---|---|---|
| RS65R190F | TO-220F | RS65R190F |

### Absolute Maximun Ratings Tc=25℃ unless otherwise specified

| Symbol | Parameter | RS65R190F | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | 650 | V |
| $I_D$ | Continuous Drain Current (TC = 25℃) | 20 | A |
| | Continuous Drain Current (TC = 100℃) | 12.7 | |
| $I_{DM}$ | Pulsed Drain Current (Note*1) | 60 | |
| $P_D$ | Power Dissipation(Tc=25℃) | 34 | W |
| $V_{GS}$ | Gate-to-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulse Avalanche Engergy | 450 | mJ |
| $T_L$ | Maximum Temperature for Soldering Leads at 0.063in(1.6mm)from Case for 10 seconds | 300 | ℃ |
| $T_{PKG}$ | Package Body for 10 seconds | 260 | |
| $T_J$ and $T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to 150 | |

*Drain Current Limited by Maximum Junction Temperature

Caution:Stresses greater than those listed in the"Absolute Maximum Ratings"Table may cause permanent damage to the device.

### Thermal Resistance

| Symbol | Parameter | RS65R190F | Units | Test Conditions |
|---|---|---|---|---|
| RθJC | Junction-to-Case | 3.7 | ℃/W | Drain lead soldered to water cooled heatsink ,PD Adjusted for a peak junction temperature of +150℃. |
| RθJA | Junction-to-Ambient | 62 | | 1 cubic foot chamber ,free air. |

**OFF Characteristics** TJ=25℃ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| BVDSS | Drain-to-source Breakdown Voltage | 650 | -- | -- | V | VGS = 0V, ID = 250μA, TJ= 25℃ |
| | | -- | 650 | -- | V | VGS = 0V, ID = 250μA, TJ= 150℃ |
| IDSS | Drain-to-Source Leakage Current | -- | -- | 1.0 | μA | VDS=700V,VGS=0V |
| IGSS | Gate-to-Source Forward Leakage | -- | -- | 100 | nA | VGS=+30V VDS=0V |
| | Gate-to-Source Reverse Leakage | -- | -- | -100 | | VGS=-30V VDS=0V |

**ON Characteristics** TJ=25℃ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| RDS(on) | Static Drain-to-Source On-Resistance | -- | 170 | 190 | mΩ | VGS=10V,ID=7.3A |
| VGS(TH) | Gate Threshold Voltage | 2.0 | -- | 4.0 | V | VGS=VDS,ID=250μA |
| $R_G$ | Gate Resistance | -- | 3.0 | -- | Ω | VGS= 0V,f = 1.0MHz |

**Resistive Switching Characteristics** Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| td(ON) | Turn-on Delay Time | -- | 40 | -- | ns | VDS=350V ID=20A RG=25Ω VGS=10V |
| trise | Rise Time | -- | 75 | -- | | |
| td(OFF) | Turn-OFF Delay Time | -- | 172 | | | |
| tfall | Fall Time | -- | 54 | | | |

**Dynamic Characteristics** Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Ciss | Input Capacitance | -- | 1820 | -- | pF | VGS=0V VDS=100V f=1.0MHz |
| Coss | Output Capacitance | -- | 82 | -- | | |
| Crss | Reverse Transfer Capacitance | -- | 36 | -- | | |
| Qg | Total Gate Charge | -- | 53 | -- | nC | VDS=560V ID=20A VGS=10V |
| Qgs | Gate-to-Source Charge | -- | 13 | -- | | |
| Qgd | Gate-to-Drain("Miller"）Charge | -- | 20 | -- | | |

## Source-Drain Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| IS | Continuous Source Current | -- | -- | 20 | A | Integral pn-diode in MOSFET |
| ISM | Maximum Pulsed Current | -- | -- | 60 | A | |
| VSD | Diode Forward Voltage | -- | -- | 1.4 | V | IS=20A,VGS=0V Tj=25℃ |
| trr | Reverse Recovery Time | -- | 324 | -- | nS | VR=100V,VGS=0V IS=20A,di/dt=100A/μs |
| Qrr | Reverse Recovery Charge | -- | 9.4 | -- | μC | |
| Irrm | Peak Reverse Recovery Current | -- | 35.7 | -- | A | |

**Notes:**

*1.Repetitive rating;pulse width limited by maximum junction temperature.

**Typical Feature curve** $T_J$=25℃, unless otherwise noted

**Figure1. Output Characteristics**

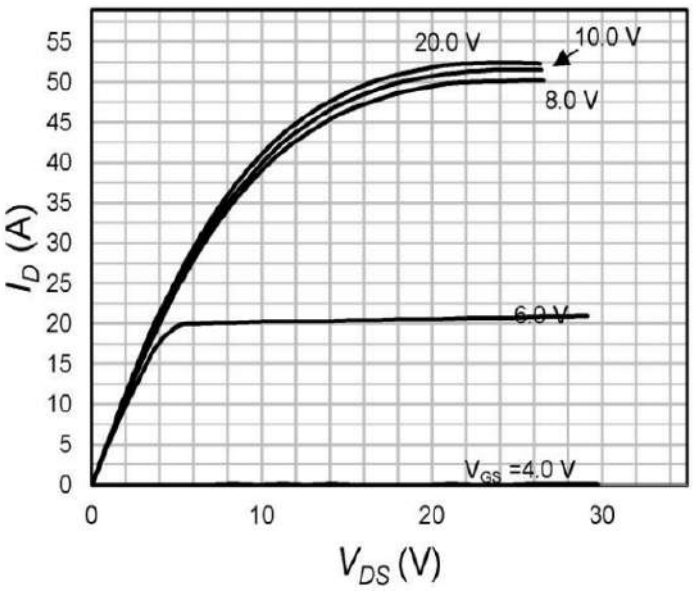



**Figure2. Transfer Characteristics**

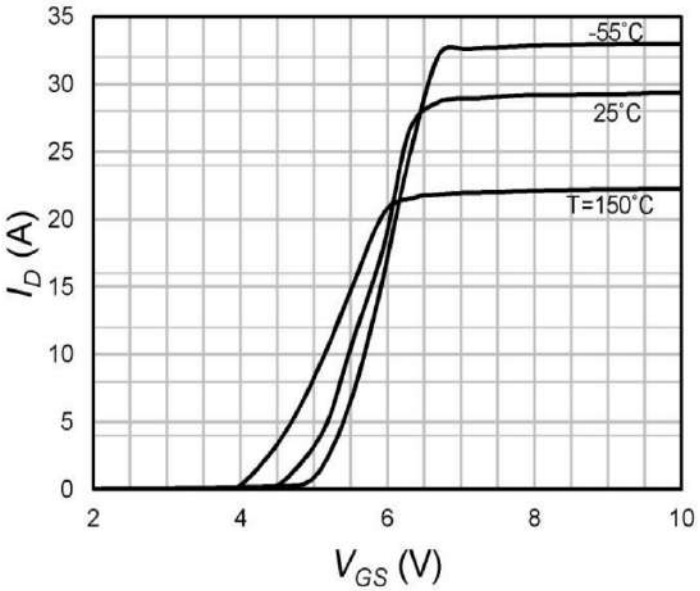


**Figure 3. On-Resistance VS.Drain Current**

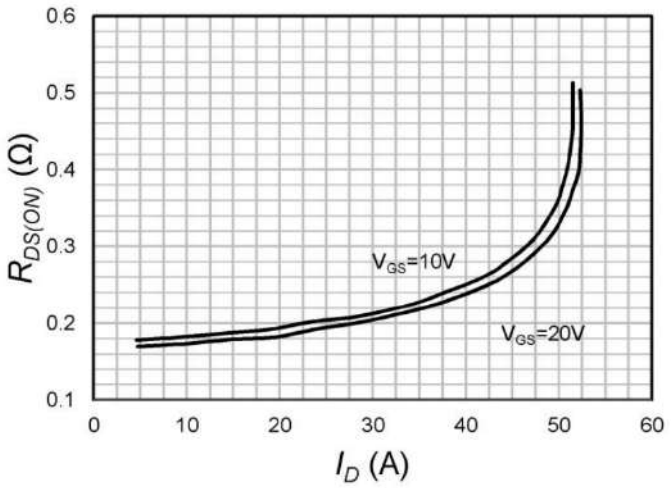



**Figure 4. Capacitance**

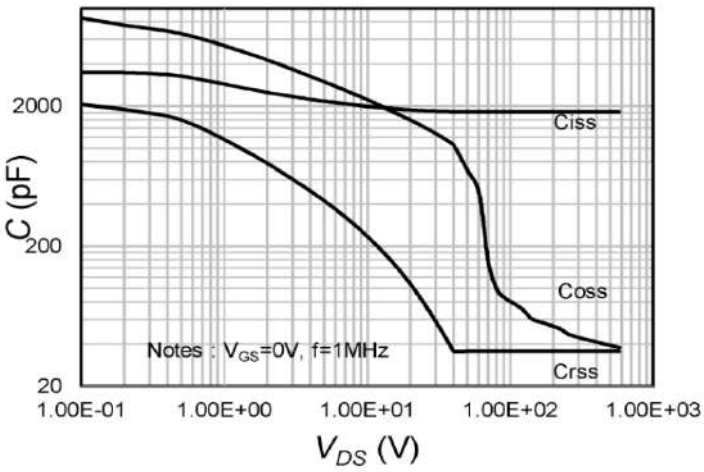



**Figure 5. Gate Charge**

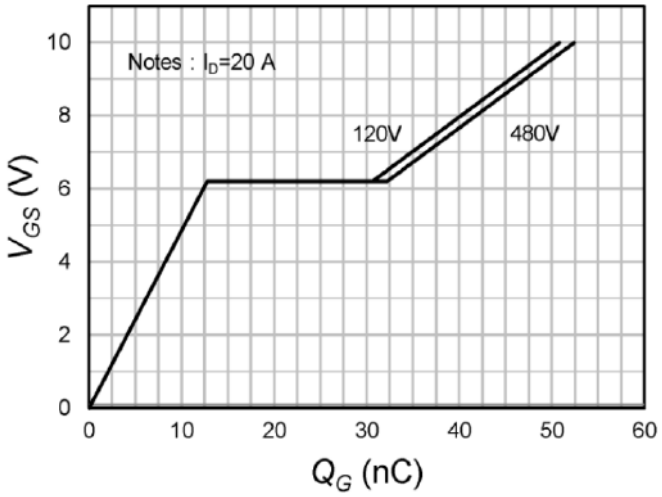



**Figure 6.Body Diode Forward Voltage**

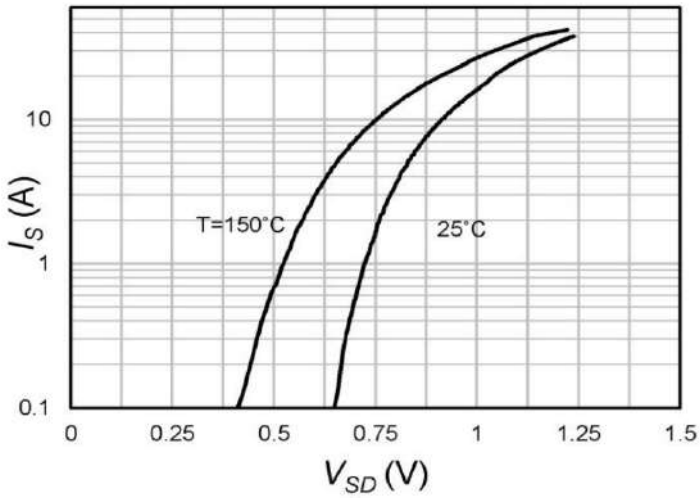



**Figure 7.On-Resistan ce vs. Junction Temperature**

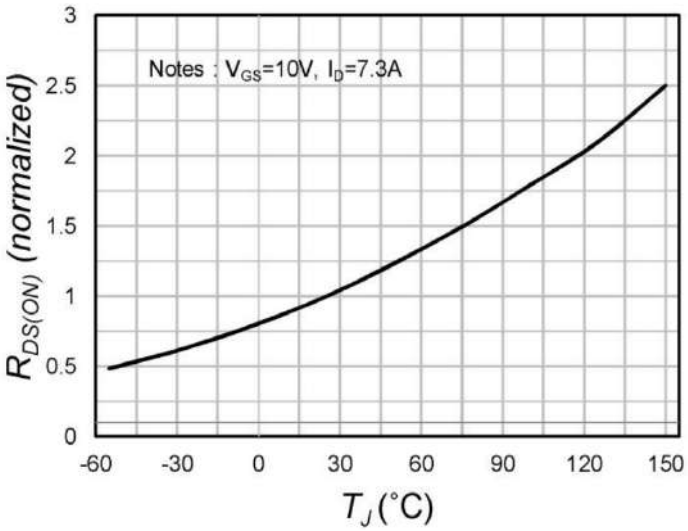



**Figure 8.Bearkdown Voltage vs. Junction Temperature**

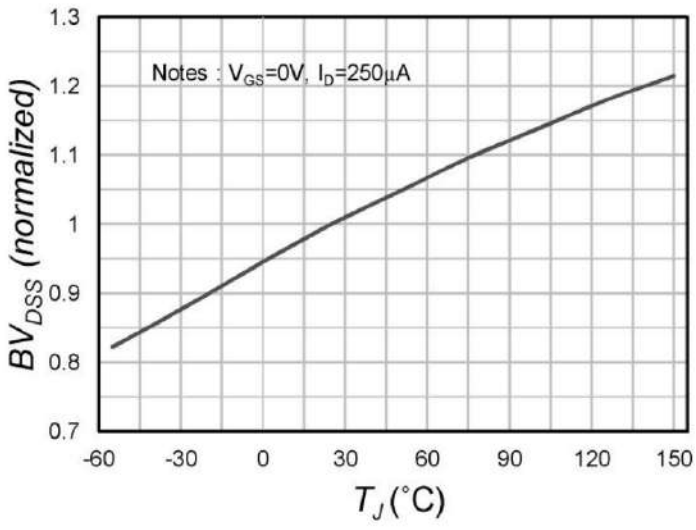


**Figure 9.$V_{GS}$ Vrariation vs. Junction Temperature**

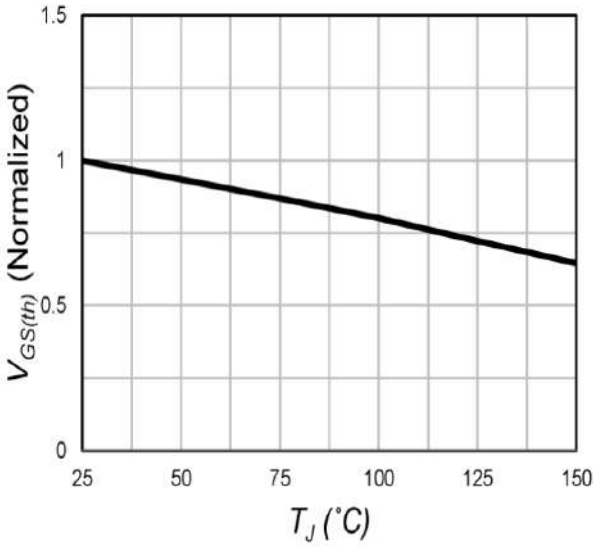



**Figure 10.Transient Thermal Impedance**

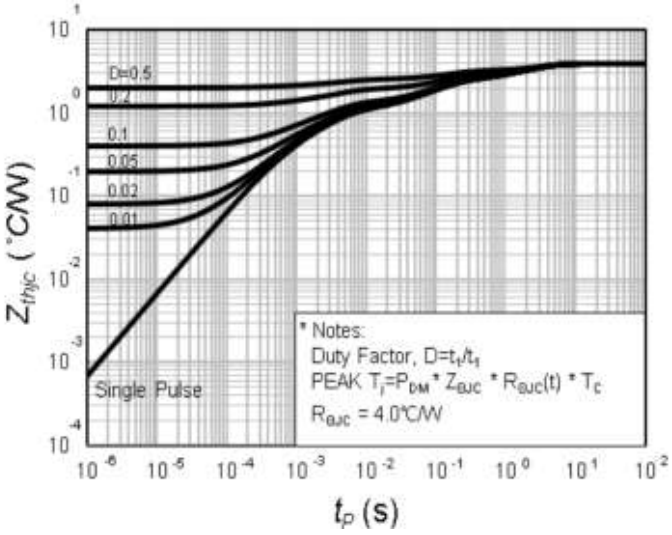
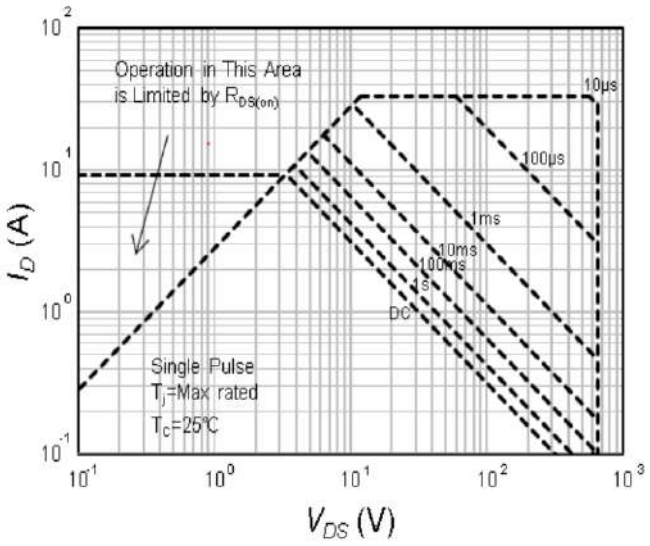



**Figure 11.Safe operation area for**



## Test Circuits and Waveforms

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

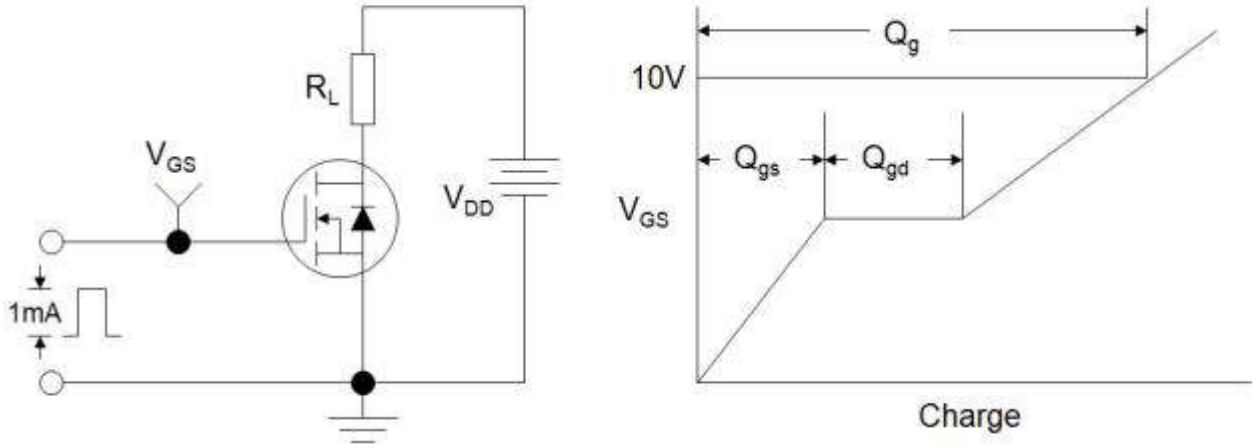



**Figure B: Resistive Switching Test Circuit and Waveform**

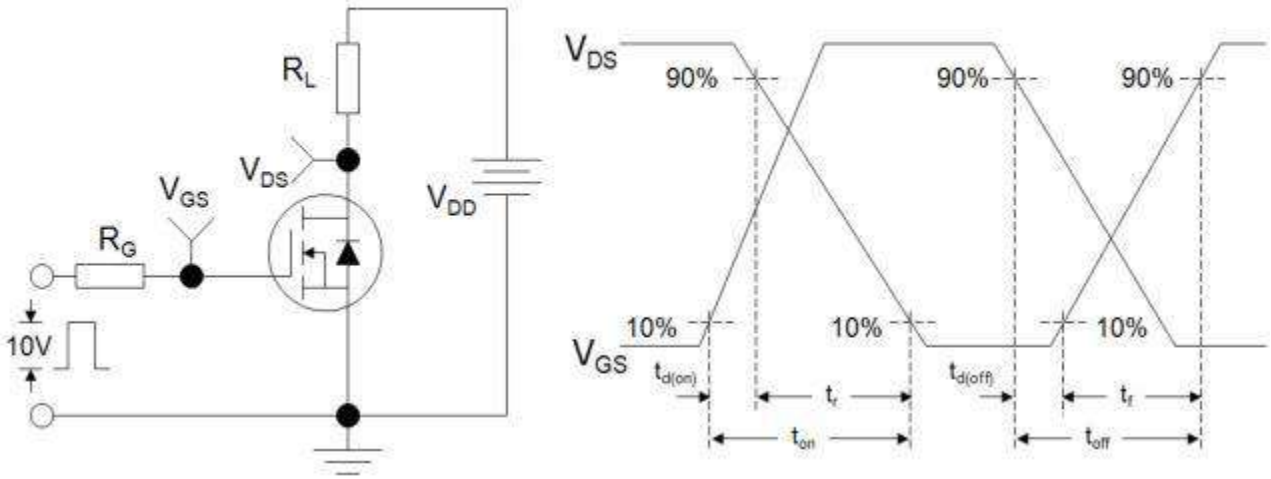
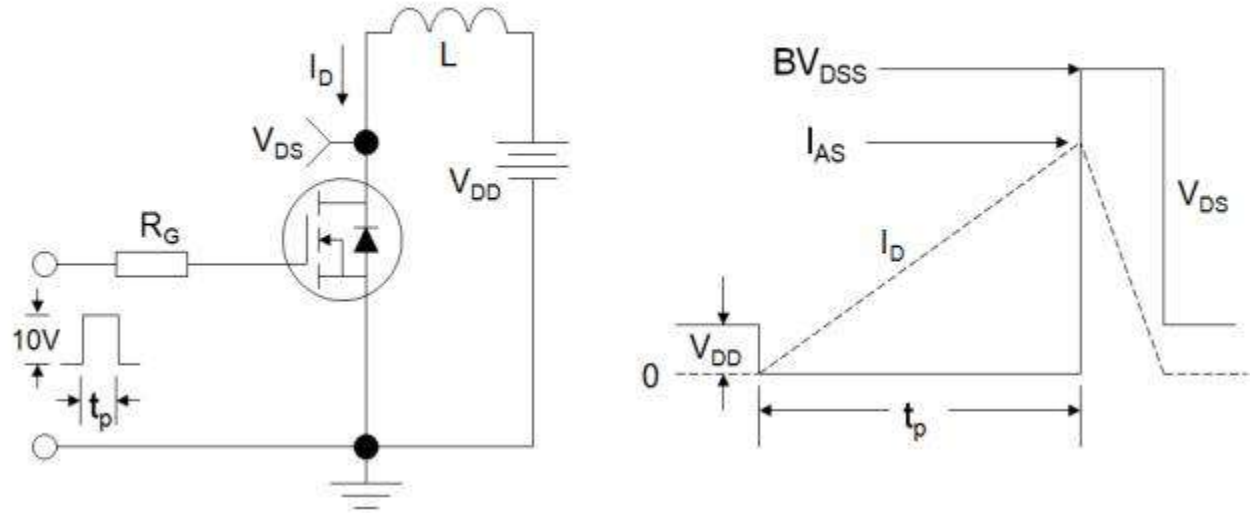
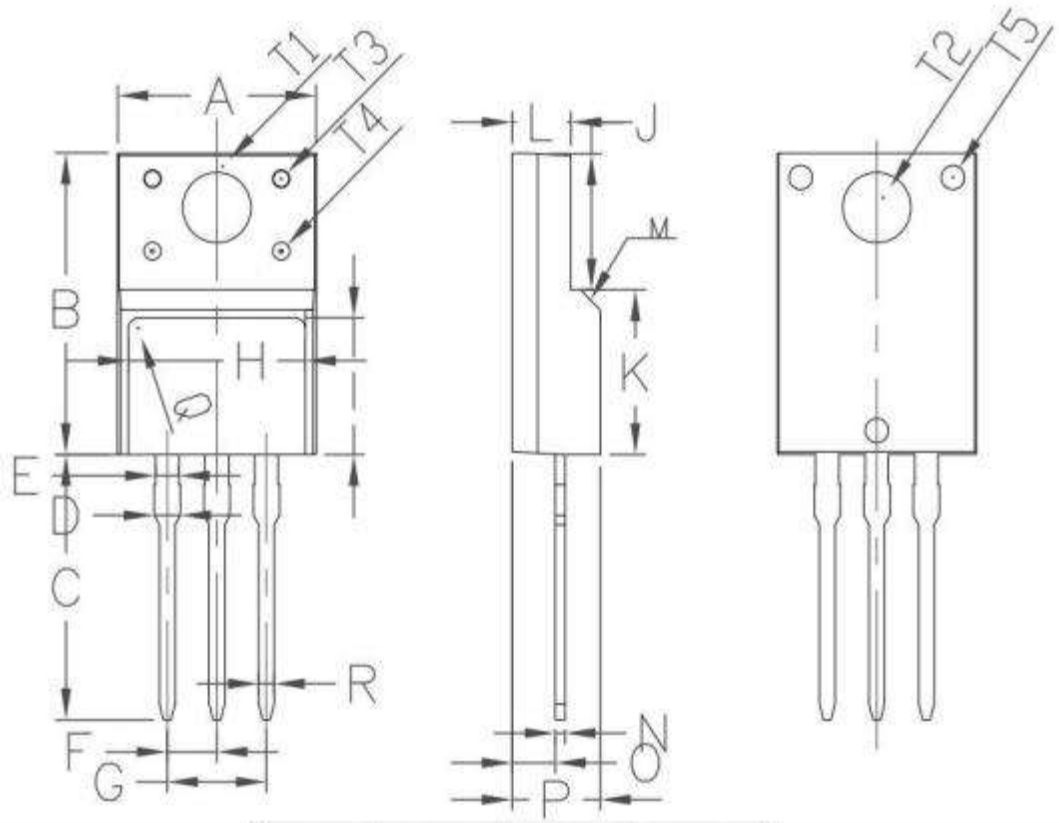



**Figure C: Unclamped Inductive Switching Test Circuit and Waveform**



## Package outline drawing

Unit:mm




| Symbol | Min | Non | Max |
|---|---|---|---|
| A | 9.96 | 10.16 | 10.36 |
| B | 15.67 | 15.87 | 16.07 |
| C | 13.14 | 13.34 | 13.54 |
| D | 1.20 | 1.30 | 1.40 |
| E | | 1.20 | |
| F | | 2.54 | |
| G | | 5.08 | |
| H | 7.60 | 7.80 | 8.00 |
| I | 7.10 | 7.30 | 7.50 |
| J | 6.48 | 6.68 | 6.88 |
| K | 8.99 | 9.19 | 9.39 |
| L | 2.34 | 2.54 | 2.74 |
| M | | 45° | |
| N | 0.49 | 0.50 | 0.52 |
| O | 2.15 | 2.35 | 2.55 |
| P | 4.50 | 4.70 | 4.90 |
| Q | | 0.50 | |
| S | 4° | 4.5° | 5° |
| T1 | | 3.45 | |
| T2 | | 3.18 | |
| T3 | | 1.50 | |
| T4 | | 1.20 | |
| T5 | | 1.50 | |
| R | 0.77 | 0.8 | 0.83 |

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