

# BMF65R190F

N-channel Super Junction MOSFET

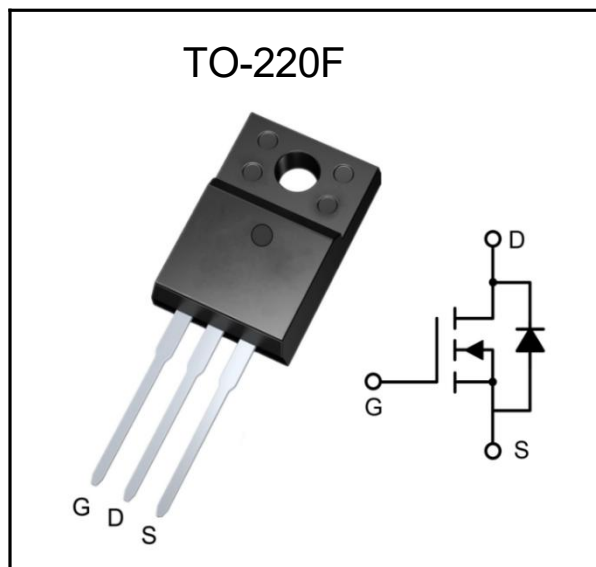
## Features

- $V_{(BR)DSS}=650V$ ,  $I_D=20A$
- $R_{DS(on)}@V_{GS}=10V$ , TYP=160m $\Omega$
- 100% avalanche tested
- Fast Switching
- Low Gate Charge
- Low  $R_{DS(on)}$  per chip area( Low FOM)

## Applications

- Switch Mode Power Supply(SMPS)
- TV and Lighting

## Package



## General Description

BMF65R190F is a N-channel power MOSFET designed according to super junction technology. This device has very low on-resistance and hard ruggedness for switching applications. It's very low conduction loss and fast switching can make applications more efficient and faster.

## Absolute Maximum Ratings ( $T_J=25^{\circ}C$ unless otherwise specified)

| Symbol          | Parameter                                        |                    | Value       | Units         |
|-----------------|--------------------------------------------------|--------------------|-------------|---------------|
| $V_{DS}$        | Drain-Source Voltage                             |                    | 650         | V             |
| $V_{GS}$        | Gate - Source Voltage                            |                    | $\pm 30$    |               |
| $I_D$           | Drain Current                                    | $T_C=25^{\circ}C$  | 20          | A             |
|                 |                                                  | $T_C=100^{\circ}C$ | 12.6        |               |
| $I_{DM}$        | Drain Current-Pulse <sup>1</sup>                 | $T_C=25^{\circ}C$  | 60          |               |
| $E_{AS}$        | Avalanche Energy <sup>2</sup>                    |                    | 421         | mJ            |
| $P_D$           | Power Dissipation                                | $T_C=25^{\circ}C$  | 33.3        | W             |
| $T_J, T_{stg}$  | Operating Junction and Storage Temperature Range |                    | -55 to +150 | $^{\circ}C$   |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case             |                    | 3.75        | $^{\circ}C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient          |                    | 80          |               |



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

| Parameter                            | Symbol              | Conditions                                                                                      | Min. | Typ. | Max. | Units |
|--------------------------------------|---------------------|-------------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristics                  |                     |                                                                                                 |      |      |      |       |
| Drain-Source Breakdown Voltage       | BV <sub>DSS</sub>   | V <sub>GS</sub> = 0V, I <sub>D</sub> =250uA                                                     | 650  | –    | –    | V     |
| Zero Gate Voltage Drain Current      | I <sub>DSS</sub>    | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V                                                      | –    | –    | 1    | uA    |
| Gate- Source Leakage Current         | I <sub>GSS</sub>    | V <sub>GS</sub> = ±30V, V <sub>DS</sub> =0V                                                     | –    | –    | ±100 | nA    |
| On Characteristics                   |                     |                                                                                                 |      |      |      |       |
| Gate Threshold Voltage               | V <sub>GS(TH)</sub> | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>DS</sub> =250uA                                      | 3    | 4    | 5    | V     |
| Static Drain-source On Resistance    | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =10A                                                       | –    | 160  | 190  | mΩ    |
| Dynamic Characteristics              |                     |                                                                                                 |      |      |      |       |
| Gate Resistance                      | R <sub>g</sub>      | f = 1 MHz                                                                                       | –    | 4.6  | –    | Ω     |
| Input capacitance                    | C <sub>iSS</sub>    | V <sub>DS</sub> =400V,<br>V <sub>GS</sub> =0V,<br>f = 250kHz                                    | –    | 1390 | –    | pF    |
| Output capacitance                   | C <sub>oSS</sub>    |                                                                                                 | –    | 40   | –    |       |
| Reverse transfer capacitance         | C <sub>rSS</sub>    |                                                                                                 | –    | 2.1  | –    |       |
| Switching Characteristics            |                     |                                                                                                 |      |      |      |       |
| Turn-on delay time                   | T <sub>d(on)</sub>  | V <sub>DD</sub> =400V,<br>V <sub>GS</sub> =30V,<br>I <sub>D</sub> =5.6A,<br>R <sub>G</sub> =10Ω | –    | 11   | –    | ns    |
| Turn-on Rise time                    | T <sub>r</sub>      |                                                                                                 | –    | 10   | –    |       |
| Turn -Off Delay Time                 | T <sub>d(off)</sub> |                                                                                                 | –    | 88   | –    |       |
| Turn -Off Fall time                  | T <sub>f</sub>      |                                                                                                 | –    | 9    | –    |       |
| Gate to Source Charge                | Q <sub>gs</sub>     | V <sub>DS</sub> =480V,<br>V <sub>GS</sub> =10V,<br>I <sub>D</sub> =10A                          | –    | 5.13 | –    | nC    |
| Gate to Drain Charge                 | Q <sub>gd</sub>     |                                                                                                 | –    | 10.8 | –    |       |
| Gate to Drain Charge                 | Q <sub>g</sub>      |                                                                                                 | –    | 32.5 | –    |       |
| Source - Drain Diode Characteristics |                     |                                                                                                 |      |      |      |       |
| Diode Forward Voltage                | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =10A                                                        | –    | –    | 1.4  | V     |
| Reverse Recovery Time                | t <sub>rr</sub>     | I <sub>SD</sub> =10A, d <sub>i</sub> /dt=100A/us                                                | –    | 100  | –    | ns    |
| Reverse Recovery Current             | I <sub>rr</sub>     |                                                                                                 | –    | 20   | –    | A     |
| Reverse Recovery Charge              | Q <sub>rr</sub>     |                                                                                                 | –    | 1.01 | –    | uC    |

#### Notes:

(1) Calculated continuous current based on maximum allowable junction temperature. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.

(2)  $L=30\text{ mH}, I_{AS}=5.3A, R_G=25\Omega$ , Start  $T_J=25^{\circ}\text{C}$ .



Typical Performance Characteristics

Figure 1: Output Characteristics

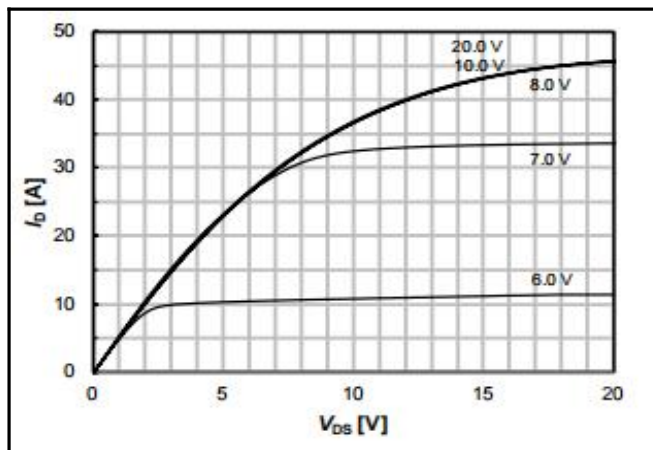


Figure 2: Capacitances

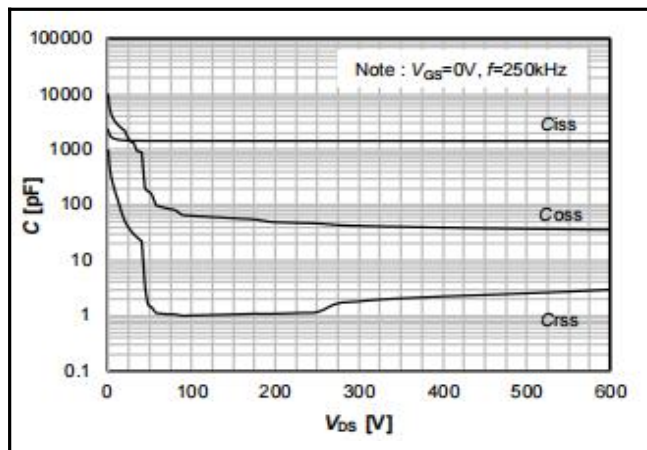


Figure 3: On-state Resistance

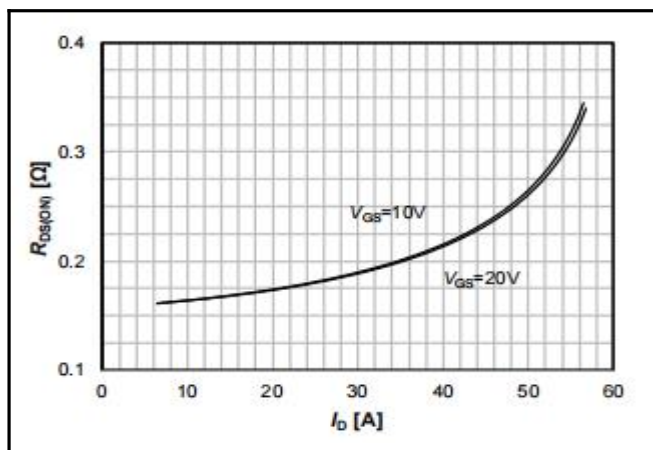


Figure 4: On-state Resistance with Temperature

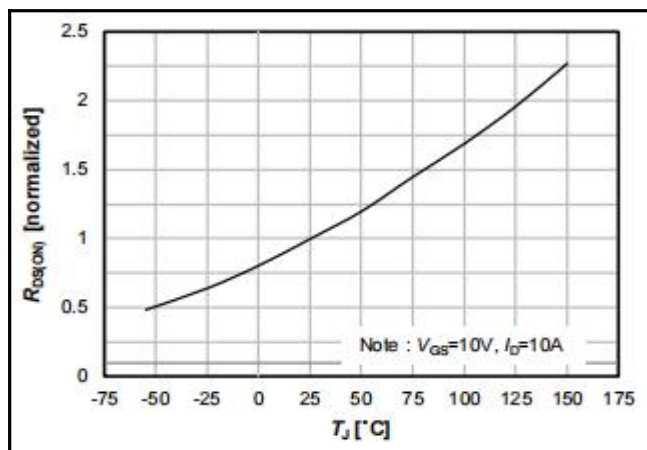


Figure 5: Transfer Characteristics

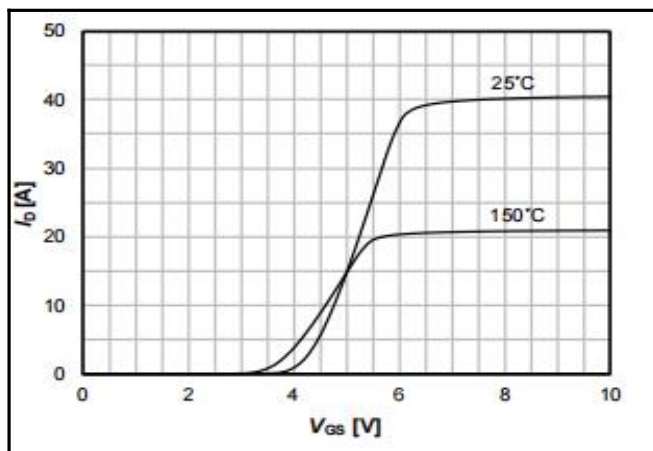
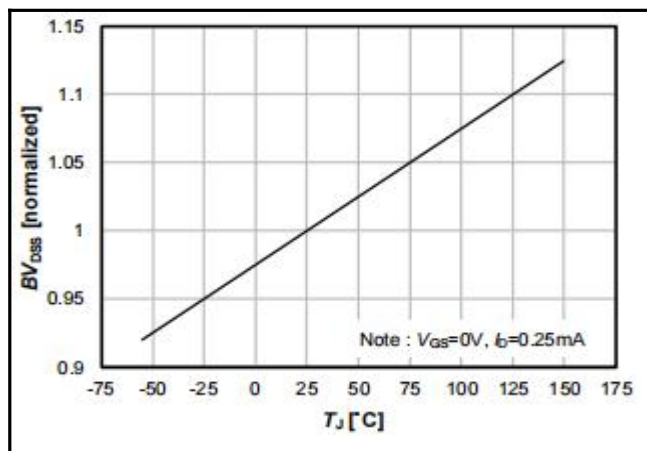


Figure 6: Breakdown Voltage with Temperature



Typical Performance Characteristics

Figure 7: Gate Charge

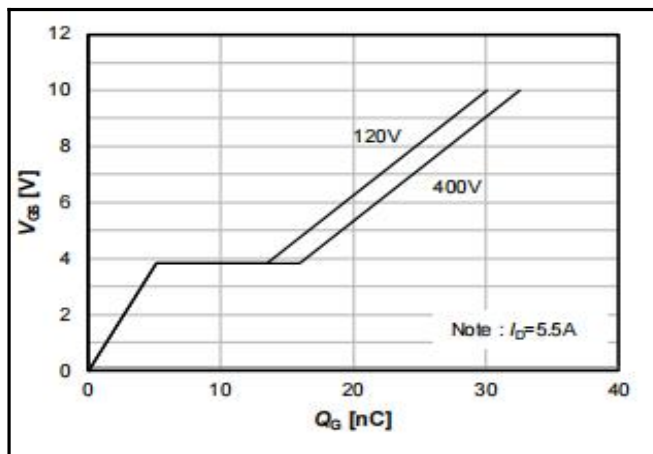


Figure 8: Maximum Drain Current

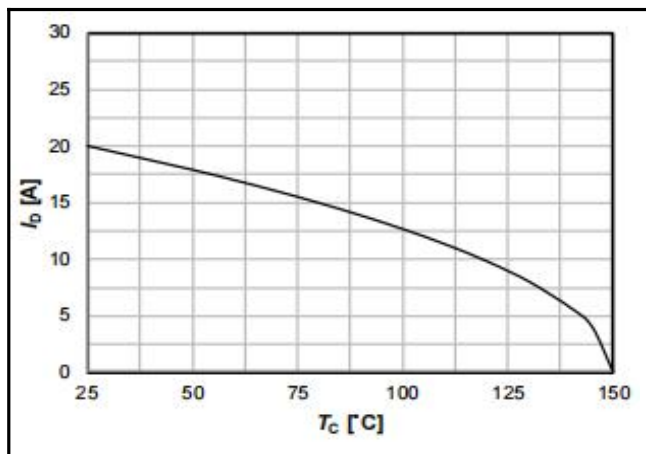


Figure 9: Maximum Transient Thermal Characteristics

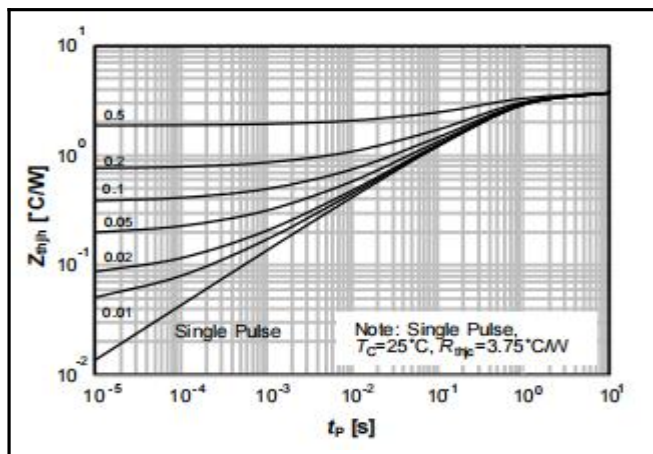


Figure 10: Body Diode Characteristics

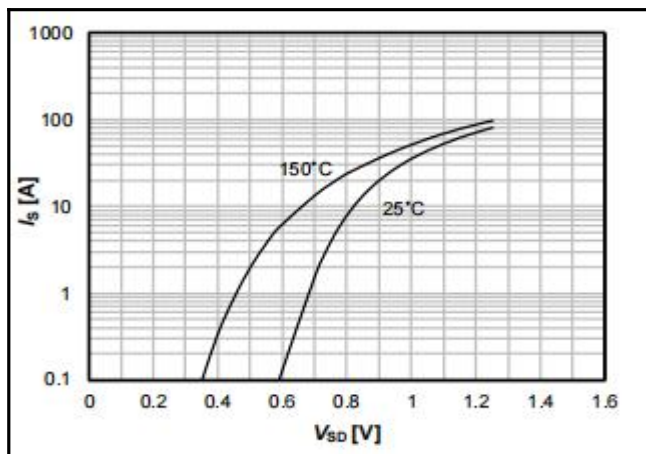
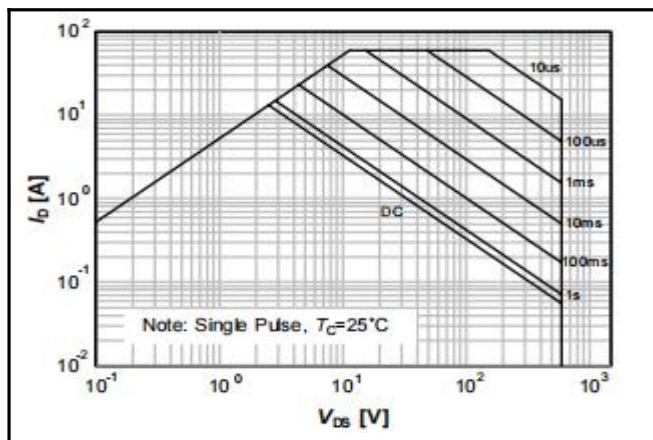


Figure 11: Safe Operating Area



Test Circuit and Waveform

Figure 12: Resistive Switching Test Circuit and Waveforms

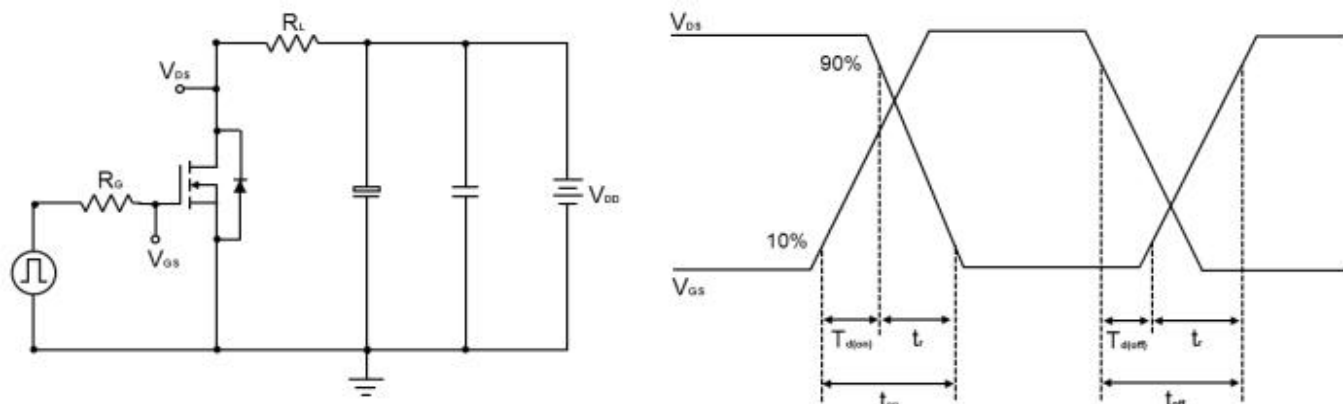


Figure 13: Diode Reverse Recovery Test Circuit and Waveforms

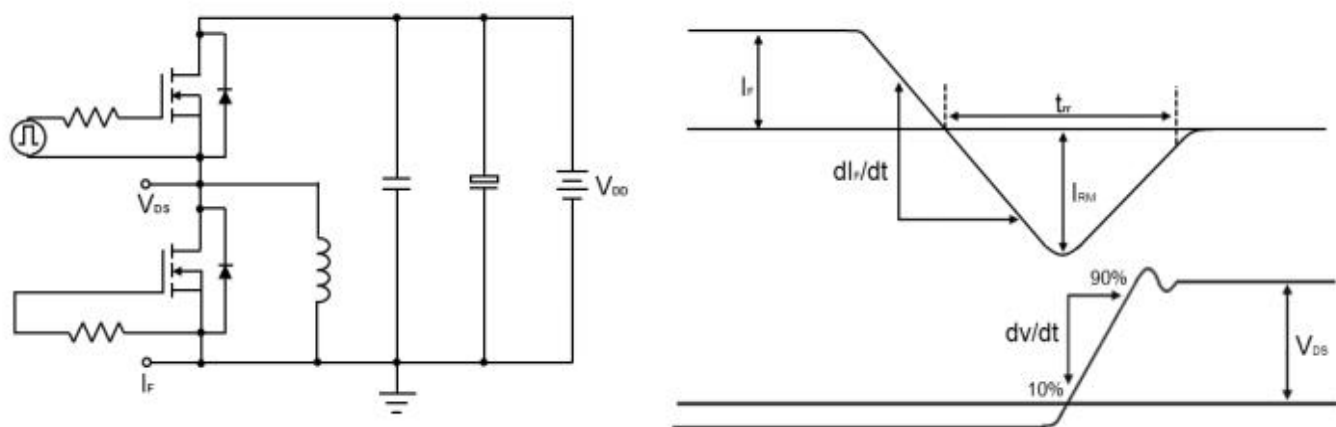
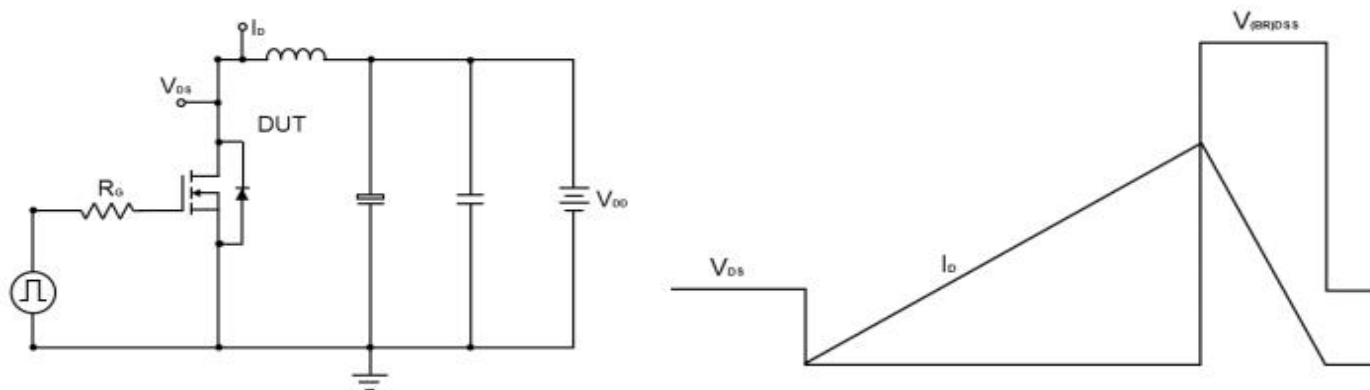
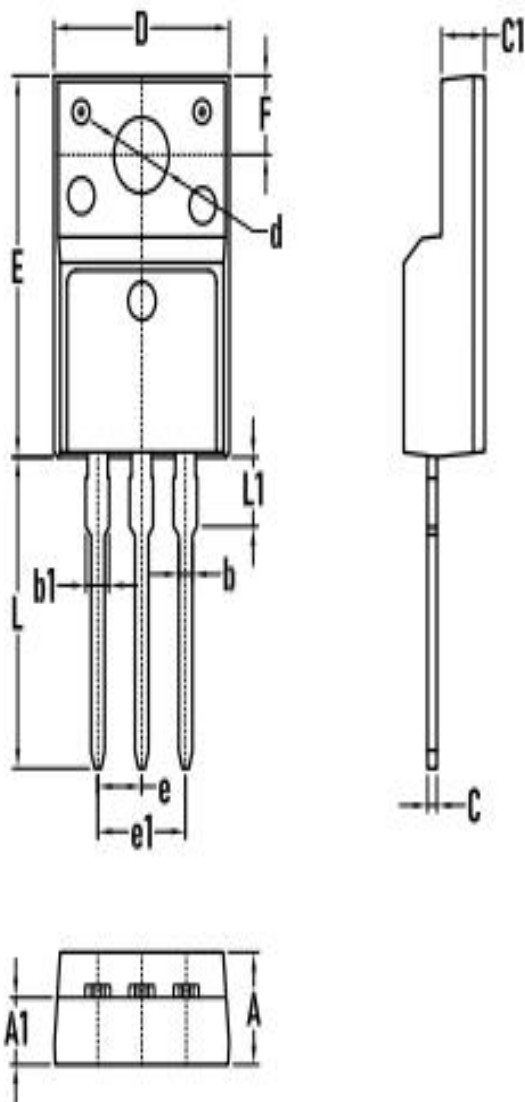


Figure 14: Unclamped Inductive Switching Test Circuit and Waveforms





| Symbol | Millimeters |       |       |
|--------|-------------|-------|-------|
|        | MIN.        | TYP.  | MAX.  |
| A      | 4.30        | 4.60  | 4.80  |
| A1     | 2.70        | 2.80  | 2.90  |
| b      | 0.70        | 0.80  | 0.90  |
| b1     | 1.20        | 1.30  | 1.40  |
| C      | 0.40        | 0.50  | 0.60  |
| C1     | 2.40        | 2.60  | 2.80  |
| D      | 9.90        | 10.00 | 10.20 |
| E      | 15.20       | 15.60 | 16.00 |
| e      | 2.44        | 2.54  | 2.64  |
| e1     | 4.88        | 5.08  | 5.26  |
| F      | 3.00        | 3.30  | 3.60  |
| L      | 12.70       | 13.20 | 13.70 |
| L1     | 2.70        | 2.90  | 3.10  |
| d      | 3.10        | 3.20  | 3.30  |

