



# IRF620 IRF620FP

N-CHANNEL 200V - 0.6Ω - 6A TO-220/FP  
PowerMesh™II MOSFET

| TYPE     | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|----------|------------------|---------------------|----------------|
| IRF620   | 200 V            | < 0.8 Ω             | 6 A            |
| IRF620FP | 200 V            | < 0.8 Ω             | 6 A            |

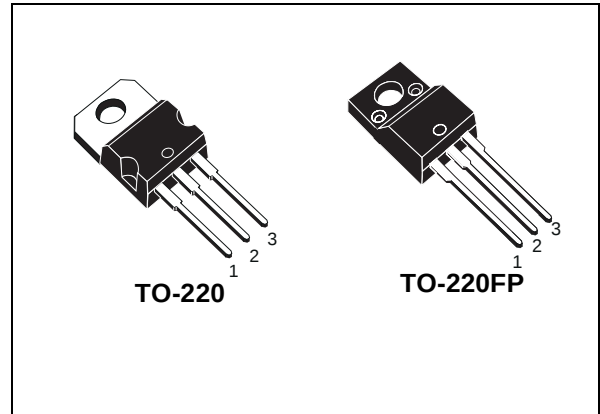
- TYPICAL R<sub>DS(on)</sub> = 0.6 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

## DESCRIPTION

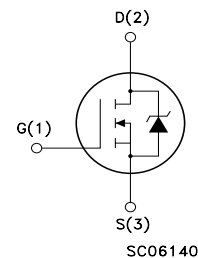
The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron\*area figure of merit while keeping the device at the leading edge for what concerns switching speed, gate charge and ruggedness.

## APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVES



## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                            | Value      |          | Unit |
|---------------------|------------------------------------------------------|------------|----------|------|
|                     |                                                      | IRF620     | IRF620FP |      |
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 200        |          | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 200        |          | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ±20        |          | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 6          | 6 (**)   | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 3.8        | 3.8 (**) | A    |
| I <sub>DM</sub> (•) | Drain Current (pulsed)                               | 24         | 24       | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 70         | 30       | W    |
|                     | Derating Factor                                      | 0.56       | 0.24     | W/°C |
| dv/dt (1)           | Peak Diode Recovery voltage slope                    | 5          | 5        | V/ns |
| V <sub>ISO</sub>    | Insulation Withstand Voltage (DC)                    | --         | 2000     | V    |
| T <sub>stg</sub>    | Storage Temperature                                  | -65 to 150 |          | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                  | 150        |          | °C   |

(•) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 6A, di/dt ≤ 300A/μs, V<sub>DD</sub> ≤ V(BR)DSS, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

(\*\*) Limited only by Maximum Temperature Allowed

**THERMAL DATA**

|                       |                                                | TO-220 | TO-220FP |      |
|-----------------------|------------------------------------------------|--------|----------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case Max           | 1.79   | 4.17     | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient Max        | 62.5   |          | °C/W |
| R <sub>thc-sink</sub> | Thermal Resistance Case-sink Typ               | 0.5    |          | °C/W |
| T <sub>l</sub>        | Maximum Lead Temperature For Soldering Purpose | 300    |          | °C   |

**AVALANCHE CHARACTERISTICS**

| Symbol          | Parameter                                                                                                                  | Max Value | Unit |
|-----------------|----------------------------------------------------------------------------------------------------------------------------|-----------|------|
| I <sub>AR</sub> | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)                                | 6         | A    |
| E <sub>AS</sub> | Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V) | 160       | mJ   |

**ELECTRICAL CHARACTERISTICS (T<sub>CASE</sub> = 25 °C UNLESS OTHERWISE SPECIFIED)**
**OFF**

| Symbol               | Parameter                                             | Test Conditions                                                                       | Min. | Typ. | Max.    | Unit     |
|----------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 µA, V <sub>GS</sub> = 0                                          | 200  |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C |      |      | 1<br>50 | µA<br>µA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±20 V                                                               |      |      | ±100    | nA       |

**ON <sup>(1)</sup>**

| Symbol              | Parameter                         | Test Conditions                                                                           | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|-------------------------------------------------------------------------------------------|------|------|------|------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 µA                               | 2    | 3    | 4    | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3 A                                              |      | 0.6  | 0.8  | Ω    |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>V <sub>GS</sub> = 10 V | 6    |      |      | A    |

**DYNAMIC**

| Symbol              | Parameter                    | Test Conditions                                                                        | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|----------------------------------------------------------------------------------------|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>I <sub>D</sub> = 3A | 1.5  | 4    |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0                                 |      | 350  |      | pF   |
| C <sub>oss</sub>    | Output Capacitance           |                                                                                        |      | 70   |      | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |                                                                                        |      | 35   |      | pF   |

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING ON

| Symbol      | Parameter          | Test Conditions                                                                                                            | Min. | Typ. | Max. | Unit |
|-------------|--------------------|----------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 100\text{ V}$ , $I_D = 3\text{ A}$<br>$R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$<br>(see test circuit, Figure 3) |      | 18   |      | ns   |
| $t_r$       | Rise Time          |                                                                                                                            |      | 30   |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 160\text{ V}$ , $I_D = 6\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$                                                   |      | 19   | 27   | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                                                                            |      | 4.5  |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                                                                            |      | 7.5  |      | nC   |

## SWITCHING OFF

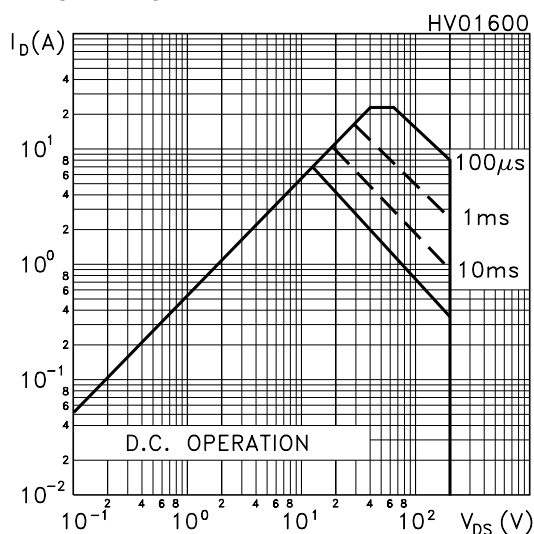
| Symbol        | Parameter             | Test Conditions                                                                                                              | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{DD} = 160\text{ V}$ , $I_D = 6\text{ A}$ ,<br>$R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$<br>(see test circuit, Figure 5) |      | 40   |      | ns   |
| $t_f$         | Fall Time             |                                                                                                                              |      | 10   |      | ns   |
| $t_c$         | Cross-over Time       |                                                                                                                              |      | 65   |      | ns   |

## SOURCE DRAIN DIODE

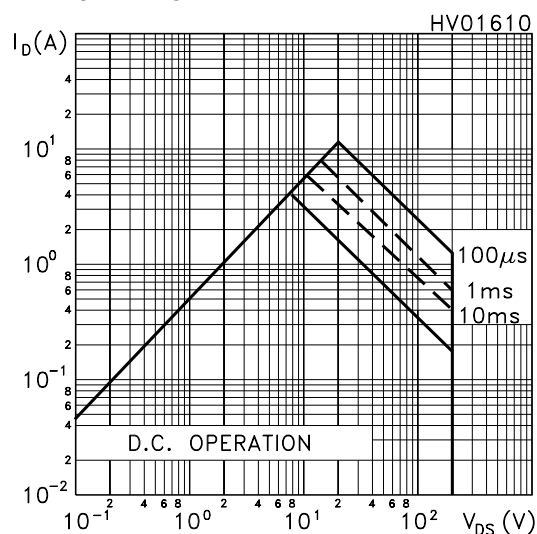
| Symbol       | Parameter                     | Test Conditions                                                                                                                                   | Min. | Typ. | Max. | Unit |
|--------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{SD}$     | Source-drain Current          |                                                                                                                                                   |      |      | 6    | A    |
| $I_{SDM(2)}$ | Source-drain Current (pulsed) |                                                                                                                                                   |      |      | 24   | A    |
| $V_{SD(1)}$  | Forward On Voltage            | $I_{SD} = 6\text{ A}$ , $V_{GS} = 0$                                                                                                              |      |      | 1.5  | V    |
| $t_{rr}$     | Reverse Recovery Time         | $I_{SD} = 6\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 100\text{ V}$ , $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 155  |      | ns   |
| $Q_{rr}$     | Reverse Recovery Charge       |                                                                                                                                                   |      | 700  |      | nC   |
| $I_{RRM}$    | Reverse Recovery Current      |                                                                                                                                                   |      | 9    |      | A    |

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

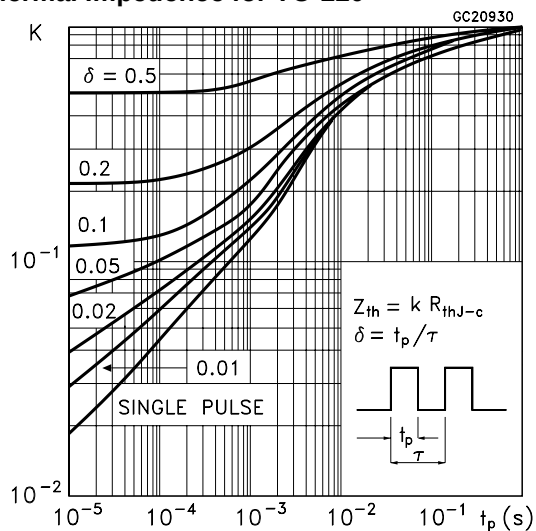
## Safe Operating Area for TO-220



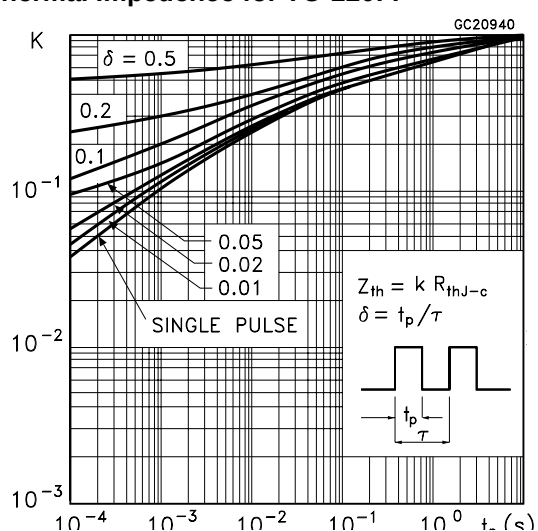
## Safe Operating Area for TO-220FP



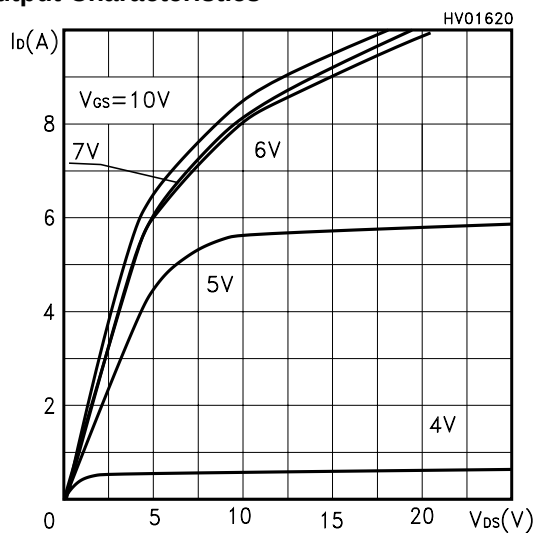
Thermal Impedance for TO-220



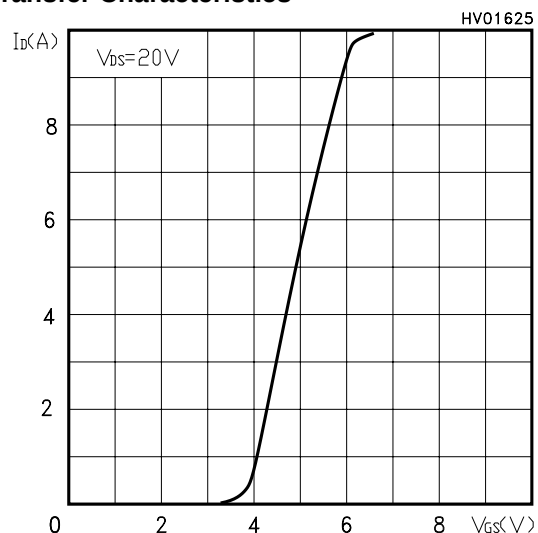
Thermal Impedance for TO-220FP



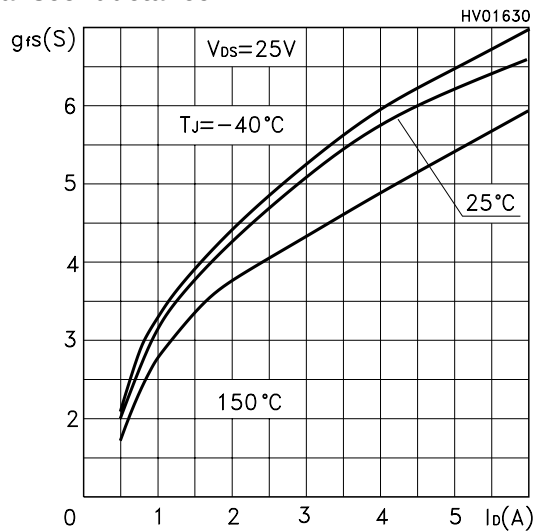
Output Characteristics



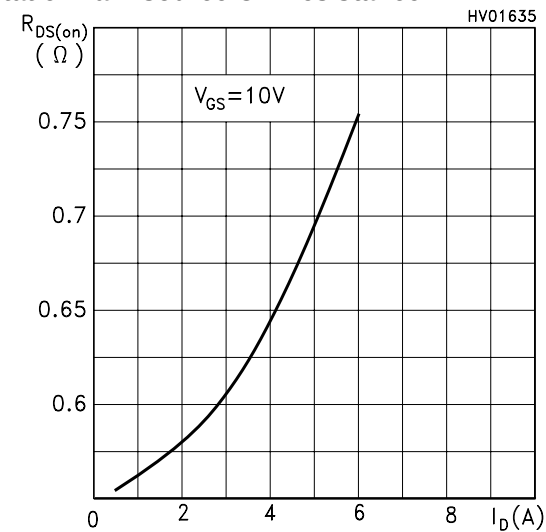
Transfer Characteristics



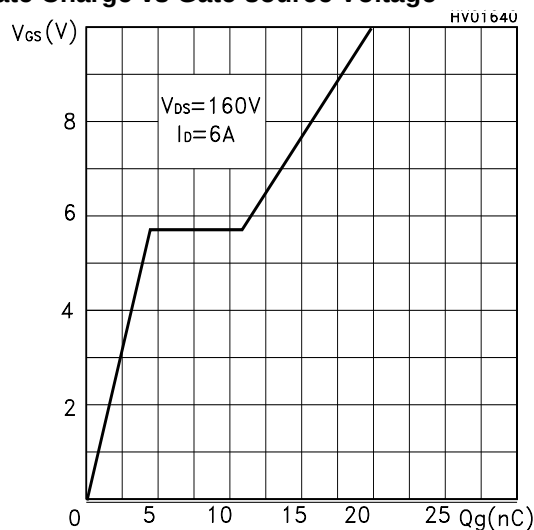
Transconductance



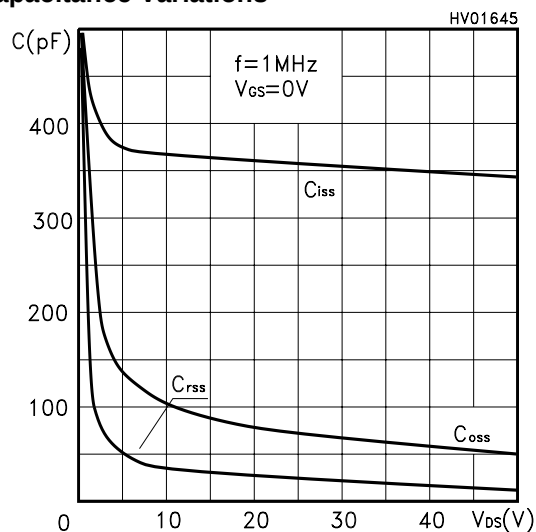
Static Drain-source On Resistance



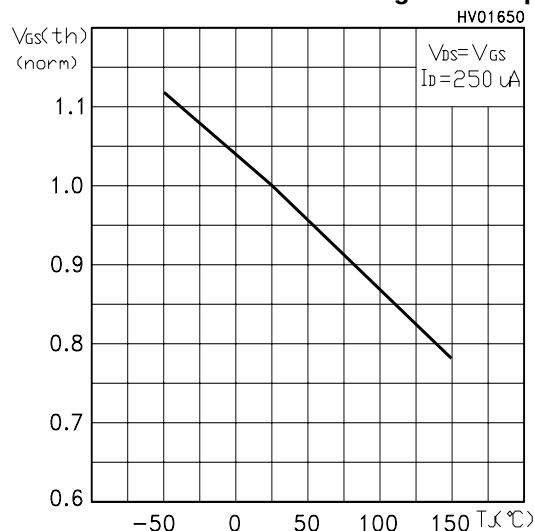
Gate Charge vs Gate-source Voltage



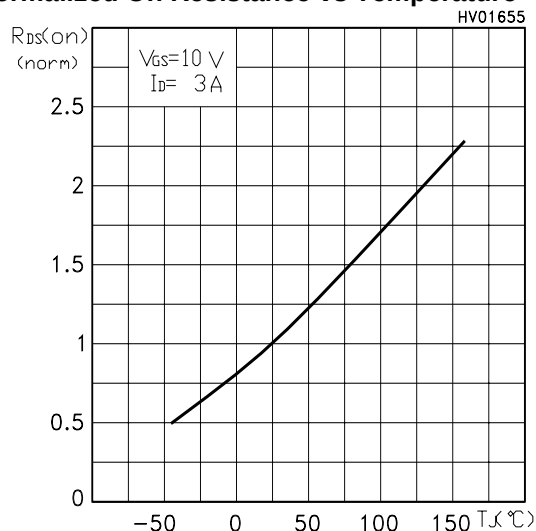
Capacitance Variations



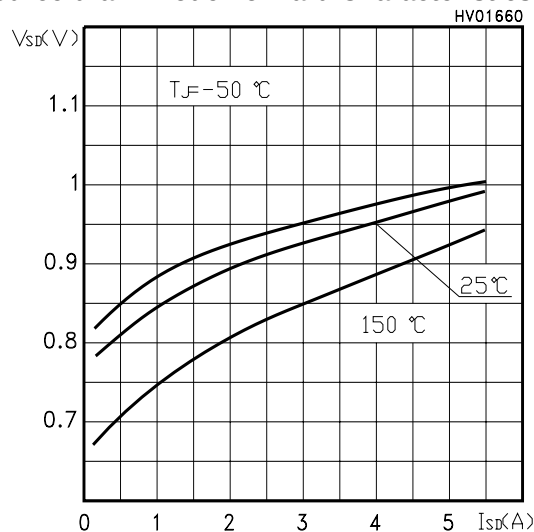
Normalized Gate Threshold Voltage vs Temp.



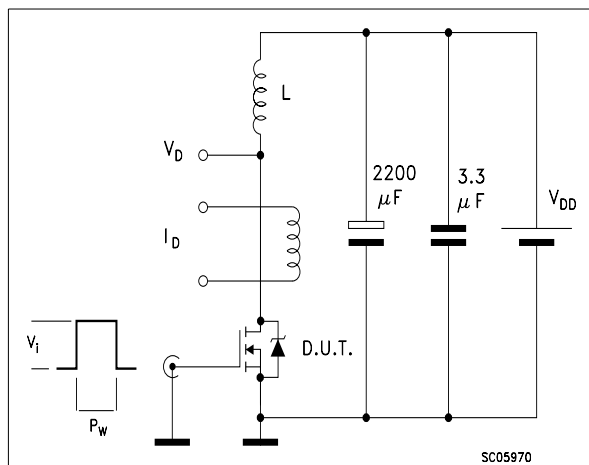
Normalized On Resistance vs Temperature



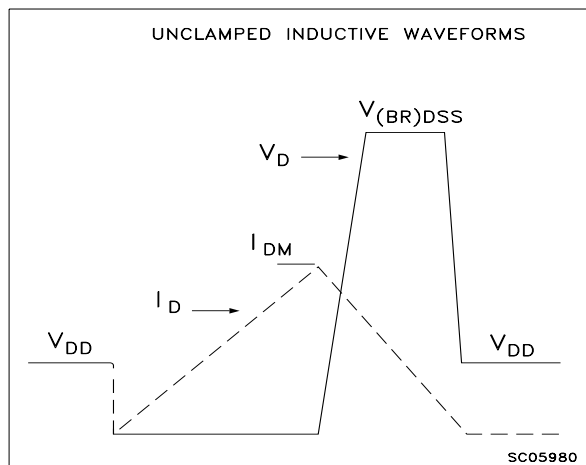
Source-drain Diode Forward Characteristics



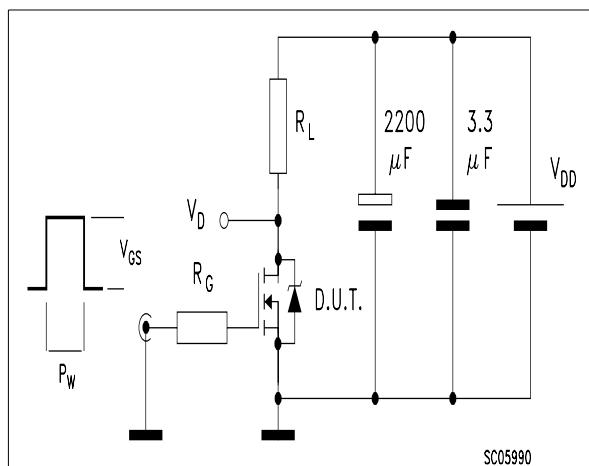
**Fig. 1: Unclamped Inductive Load Test Circuit**



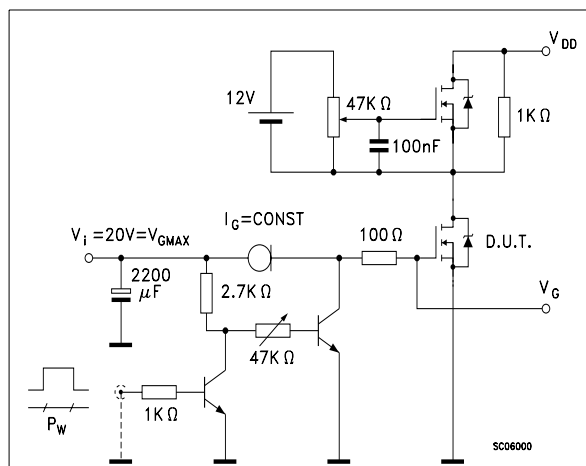
**Fig. 2: Unclamped Inductive Waveform**



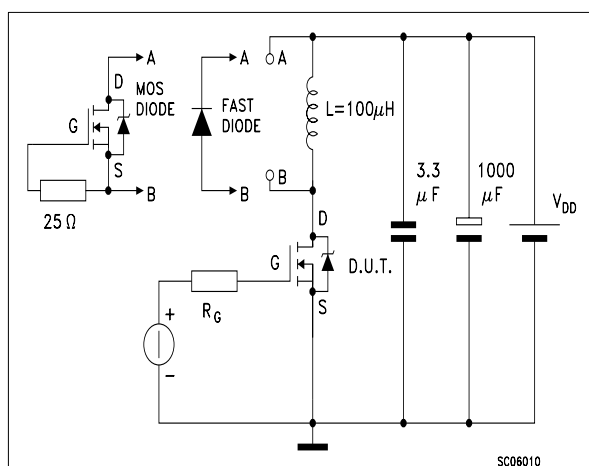
**Fig. 3: Switching Times Test Circuit For Resistive Load**



**Fig. 4: Gate Charge test Circuit**

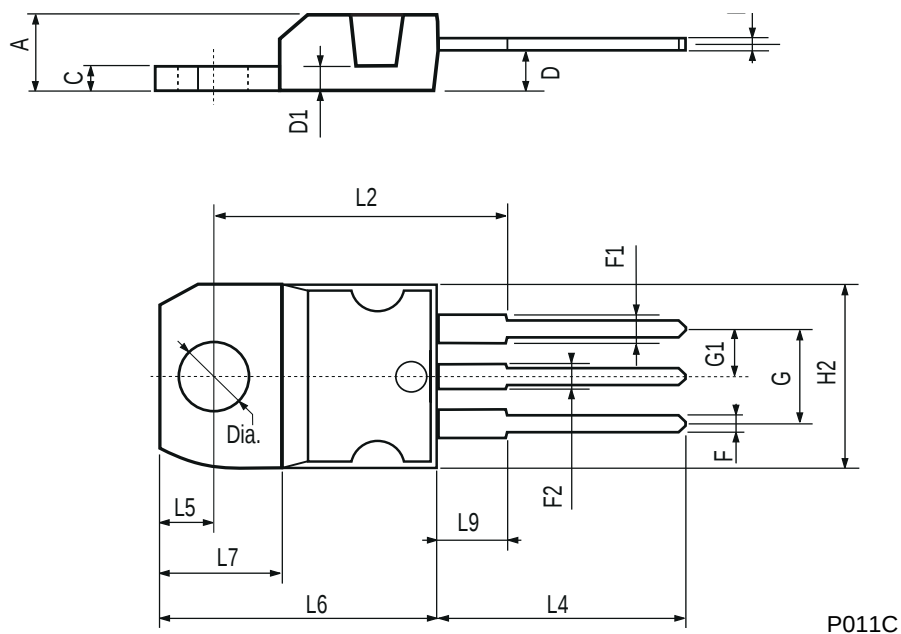


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



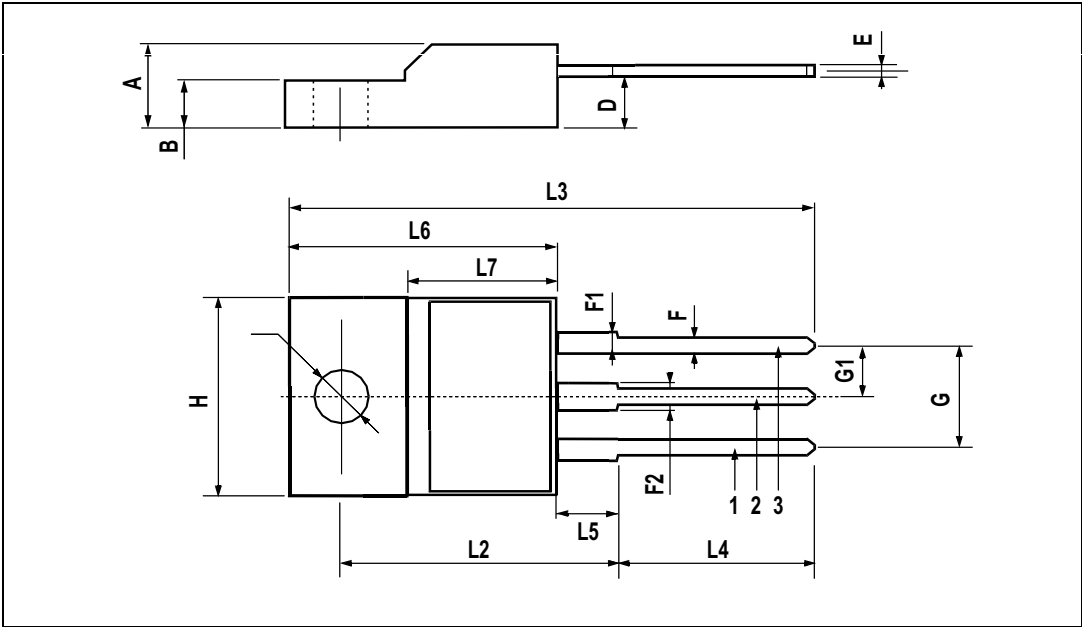
## TO-220 MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| C    | 1.23  |      | 1.32  | 0.048 |       | 0.051 |
| D    | 2.40  |      | 2.72  | 0.094 |       | 0.107 |
| D1   |       | 1.27 |       |       | 0.050 |       |
| E    | 0.49  |      | 0.70  | 0.019 |       | 0.027 |
| F    | 0.61  |      | 0.88  | 0.024 |       | 0.034 |
| F1   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| F2   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| G    | 4.95  |      | 5.15  | 0.194 |       | 0.203 |
| G1   | 2.4   |      | 2.7   | 0.094 |       | 0.106 |
| H2   | 10.0  |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16.4 |       |       | 0.645 |       |
| L4   | 13.0  |      | 14.0  | 0.511 |       | 0.551 |
| L5   | 2.65  |      | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |      | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.2   |      | 6.6   | 0.244 |       | 0.260 |
| L9   | 3.5   |      | 3.93  | 0.137 |       | 0.154 |
| DIA. | 3.75  |      | 3.85  | 0.147 |       | 0.151 |



TO-220FP MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |       |       |
|------|------|-----|------|-------|-------|-------|
|      | MIN. | TYP | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.4  |     | 4.6  | 0.173 |       | 0.181 |
| B    | 2.5  |     | 2.7  | 0.098 |       | 0.106 |
| D    | 2.5  |     | 2.75 | 0.098 |       | 0.108 |
| E    | 0.45 |     | 0.7  | 0.017 |       | 0.027 |
| F    | 0.75 |     | 1    | 0.030 |       | 0.039 |
| F1   | 1.15 |     | 1.7  | 0.045 |       | 0.067 |
| F2   | 1.15 |     | 1.7  | 0.045 |       | 0.067 |
| G    | 4.95 |     | 5.2  | 0.195 |       | 0.204 |
| G1   | 2.4  |     | 2.7  | 0.094 |       | 0.106 |
| H    | 10   |     | 10.4 | 0.393 |       | 0.409 |
| L2   |      | 16  |      |       | 0.630 |       |
| L3   | 28.6 |     | 30.6 | 1.126 |       | 1.204 |
| L4   | 9.8  |     | 10.6 | .0385 |       | 0.417 |
| L5   | 2.9  |     | 3.6  | 0.114 |       | 0.141 |
| L6   | 15.9 |     | 16.4 | 0.626 |       | 0.645 |
| L7   | 9    |     | 9.3  | 0.354 |       | 0.366 |
| Ø    | 3    |     | 3.2  | 0.118 |       | 0.126 |



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