

## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

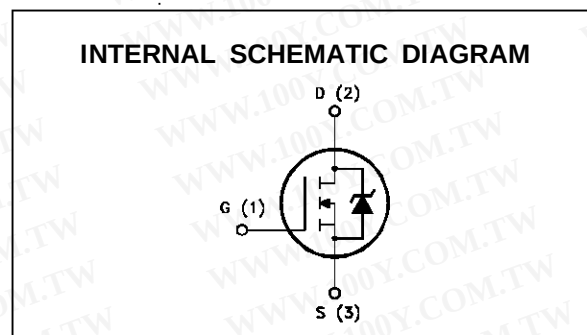
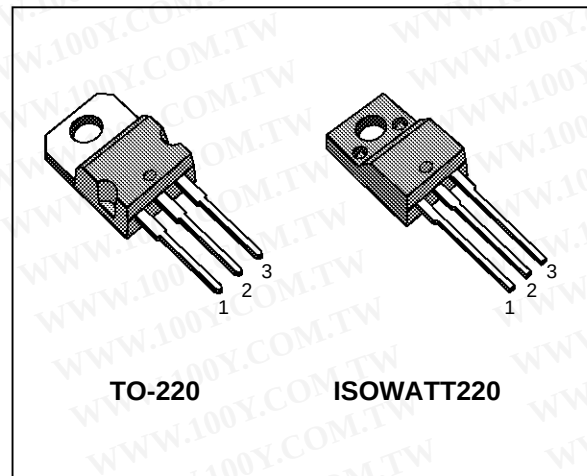
| TYPE     | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|----------|------------------|---------------------|----------------|
| IRF520   | 100 V            | < 0.27 $\Omega$     | 10 A           |
| IRF520FI | 100 V            | < 0.27 $\Omega$     | 7 A            |

- TYPICAL R<sub>DS(on)</sub> = 0.23  $\Omega$
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-54151736  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                              | Value      |          | Unit |
|---------------------|--------------------------------------------------------|------------|----------|------|
|                     |                                                        | IRF520     | IRF520FI |      |
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)             | 100        |          | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ ) | 100        |          | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                    | $\pm 20$   |          | V    |
| I <sub>D</sub>      | Drain Current (cont.) at T <sub>c</sub> = 25 °C        | 10         | 7        | A    |
| I <sub>D</sub>      | Drain Current (cont.) at T <sub>c</sub> = 100 °C       | 7          | 5        | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                                 | 40         | 40       | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C            | 70         | 35       | W    |
|                     | Derating Factor                                        | 0.47       | 0.23     | W/°C |
| V <sub>ISO</sub>    | Insulation Withstand Voltage (DC)                      | —          | 2000     | V    |
| T <sub>stg</sub>    | Storage Temperature                                    | -65 to 175 |          | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                    | 175        |          | °C   |

(●) Pulse width limited by safe operating area

## IRF520/FI

### THERMAL DATA

|                       |                                                |     | TO-220 | ISOWATT220 |      |
|-----------------------|------------------------------------------------|-----|--------|------------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case               | Max | 2.14   | 4.29       | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient            | Max |        | 62.5       | °C/W |
| R <sub>thc-s</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, δ < 1%)                          | 10        | 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> = 25 V)   | 36        | mJ   |
| E <sub>AR</sub> | Repetitive Avalanche Energy (pulse width limited by T <sub>j</sub> max, δ < 1%)                                              | 9         | mJ   |
| I <sub>AR</sub> | Avalanche Current, Repetitive or Not-Repetitive (T <sub>c</sub> = 100 °C, pulse width limited by T <sub>j</sub> max, δ < 1%) | 7         | A    |

### 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                                                | 100  |      |             | 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 x 0.8 T <sub>c</sub> = 125 °C |      |      | 250<br>1000 | 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 (\*)

| 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    | 2.9  | 4    | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10V I <sub>D</sub> = 5 A                                           |      | 0.23 | 0.27 | Ω    |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V | 10   |      |      | A    |

### DYNAMIC

| Symbol              | Parameter                    | Test Conditions                                                                    | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|------------------------------------------------------------------------------------|------|------|------|------|
| g <sub>fs</sub> (*) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> I <sub>D</sub> = 5 A | 2.7  | 4.5  |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0                               |      | 330  | 450  | pF   |
| C <sub>oss</sub>    | Output Capacitance           |                                                                                    |      | 90   | 120  | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |                                                                                    |      | 25   | 40   | pF   |

# ELECTRICAL CHARACTERISTICS (continued)

## SWITCHING RESISTIVE LOAD

| Symbol       | Parameter           | Test Conditions                               | Min. | Typ. | Max. | Unit |
|--------------|---------------------|-----------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on Time        | $V_{DD} = 50\text{ V}$ $I_D = 5\text{ A}$     |      | 10   | 15   | ns   |
| $t_r$        | Rise Time           | $R_{GS} = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ |      | 50   | 75   | ns   |
| $t_{d(off)}$ | Turn-off Delay Time | (see test circuit)                            |      | 25   | 40   | ns   |
| $t_f$        | Fall Time           |                                               |      | 20   | 30   | ns   |
| $Q_g$        | Total Gate Charge   | $I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$    |      | 15   | 25   | nC   |
| $Q_{gs}$     | Gate-Source Charge  | $V_{DD} = \text{Max Rating} \times 0.8$       |      | 7    |      | nC   |
| $Q_{gd}$     | Gate-Drain Charge   | (see test circuit)                            |      | 4    |      | nC   |

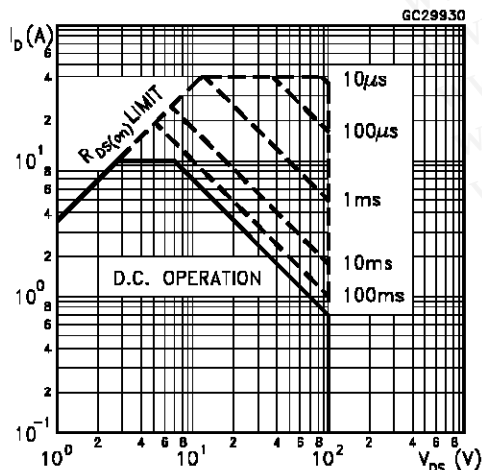
## SOURCE DRAIN DIODE

| Symbol             | Parameter                     | Test Conditions                                                                                               | Min. | Typ. | Max. | Unit          |
|--------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{SD}$           | Source-drain Current          |                                                                                                               |      |      | 10   | A             |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) |                                                                                                               |      |      | 40   | A             |
| $V_{SD} (*)$       | Forward On Voltage            | $I_{SD} = 10\text{ A}$ $V_{GS} = 0$                                                                           |      |      | 1.6  | V             |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 10\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$ $T_j = 150^\circ\text{C}$ |      | 80   |      | ns            |
| $Q_{rr}$           | Reverse Recovery Charge       |                                                                                                               |      | 0.22 |      | $\mu\text{C}$ |

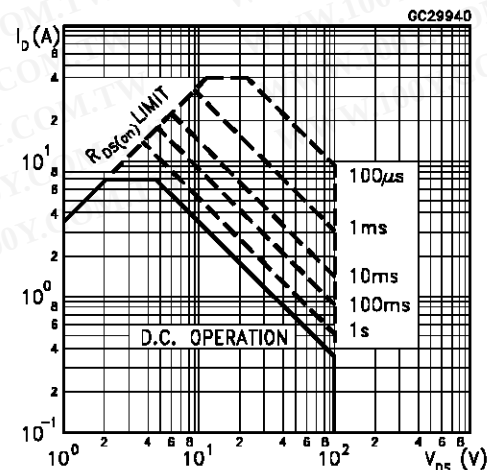
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

( $\bullet$ ) Pulse width limited by safe operating area

## Safe Operating Area for TO-220

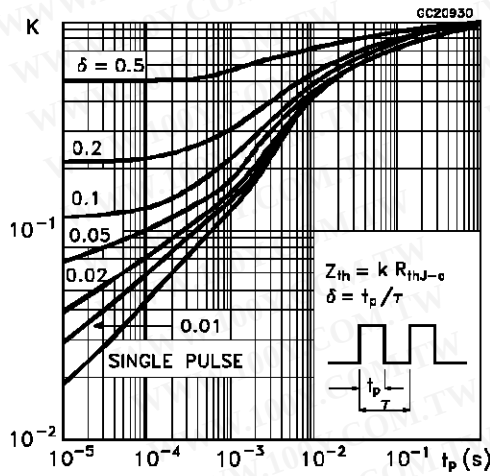


## Safe Operating Area for ISOWATT220

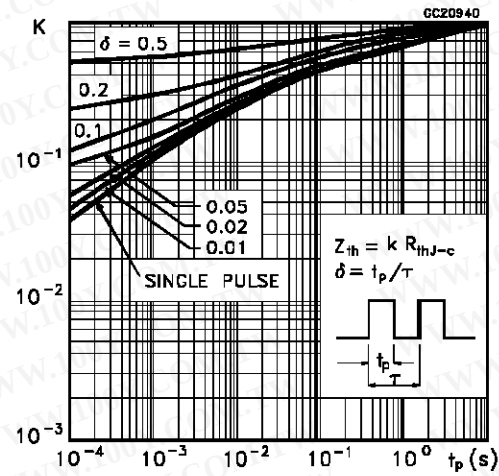


## IRF520/FI

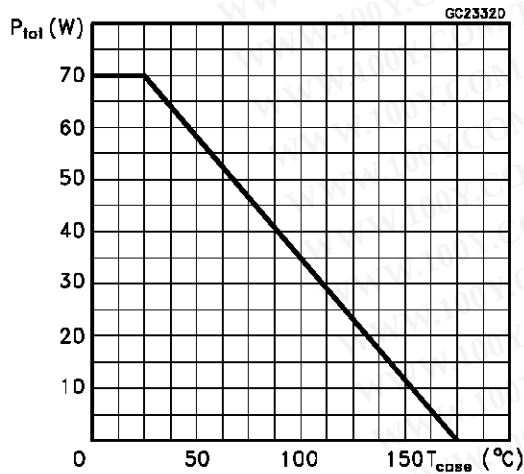
Thermal Impedance for TO-220



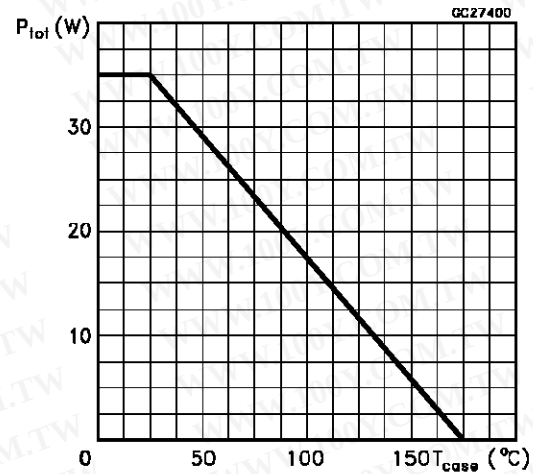
Thermal Impedance for ISOWATT220



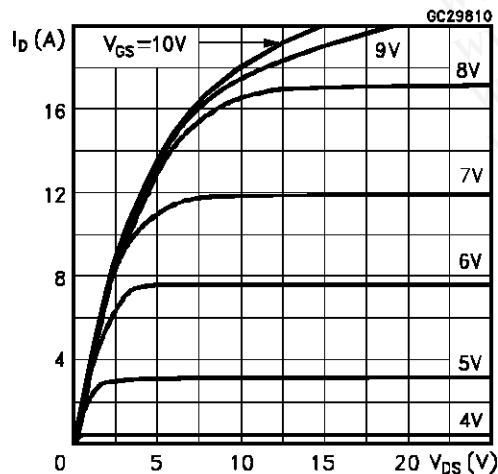
Derating Curve for TO-220



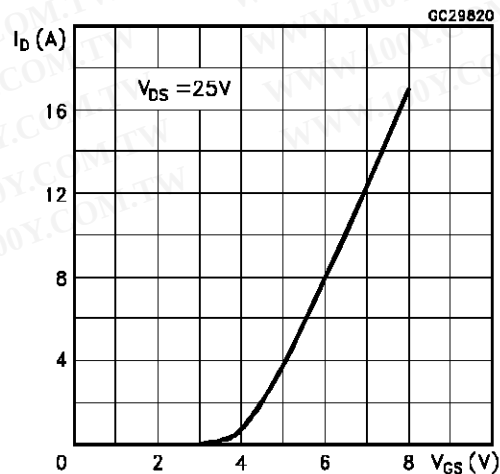
Derating Curve for ISOWATT220



Output Characteristics

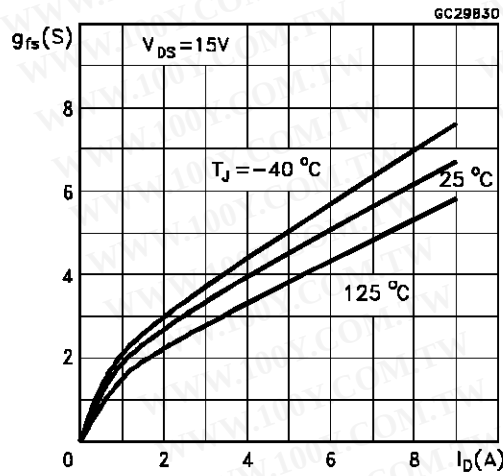


Transfer Characteristics

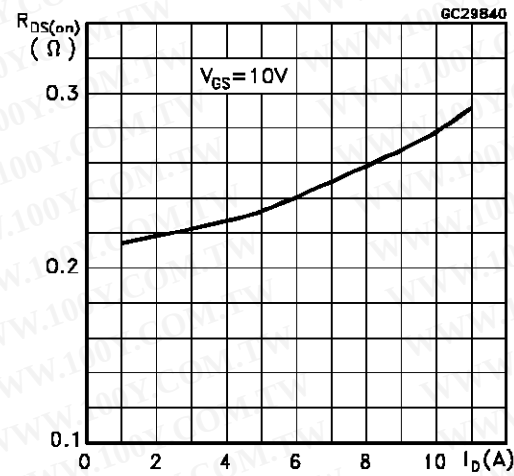




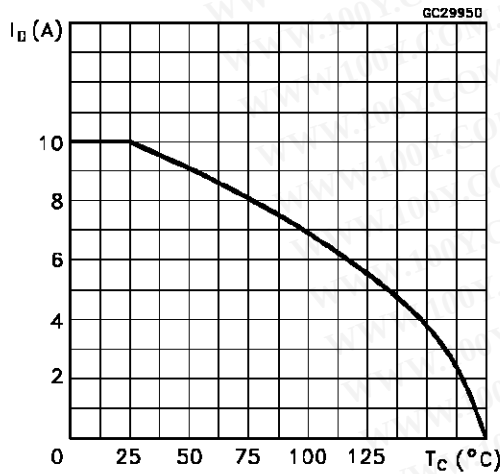
Transconductance



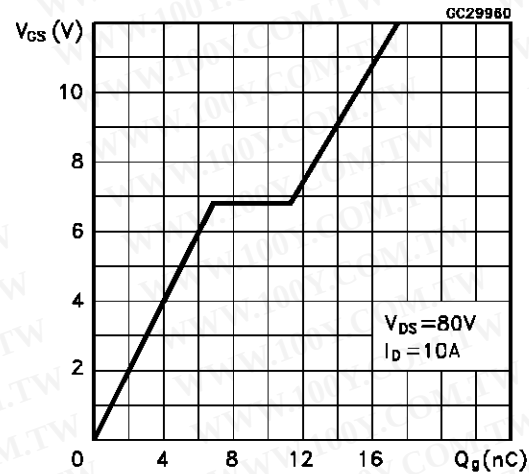
Static Drain-source On Resistance



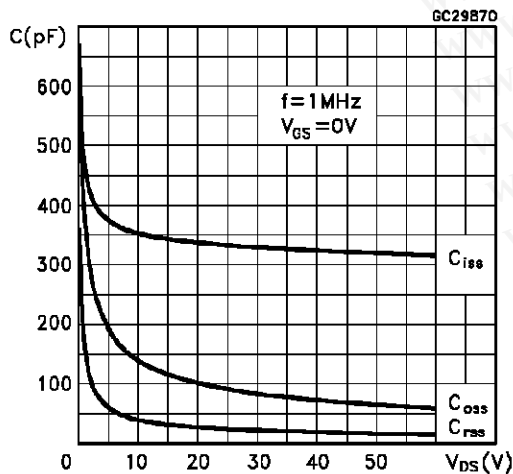
Maximum Drain Current vs Temperature



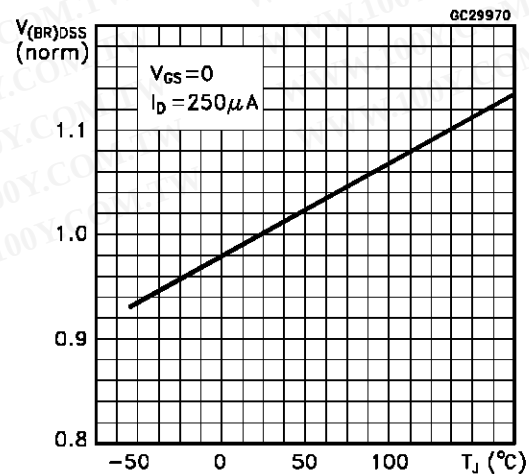
Gate Charge vs Gate-source Voltage



Capacitance Variations

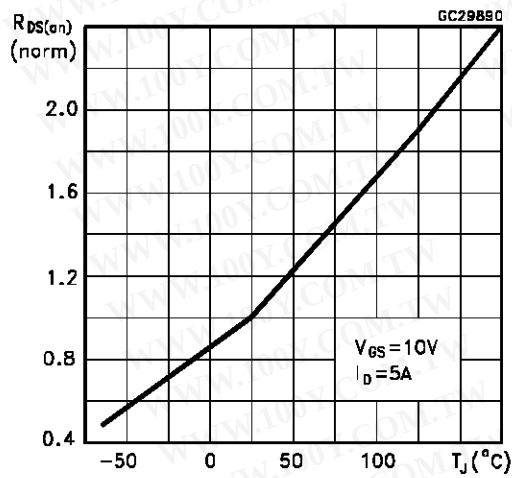


Normalized Breakdown Voltage vs Temperature

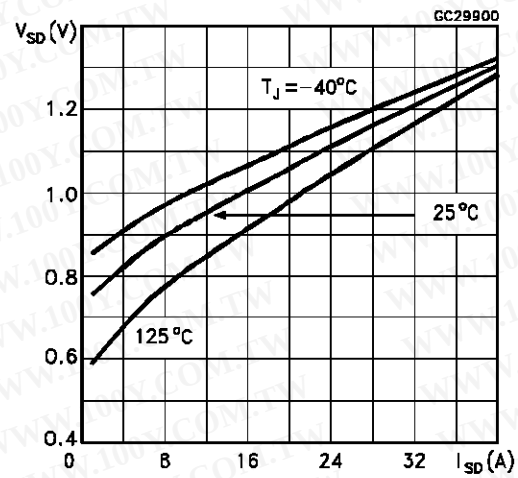


## IRF520/FI

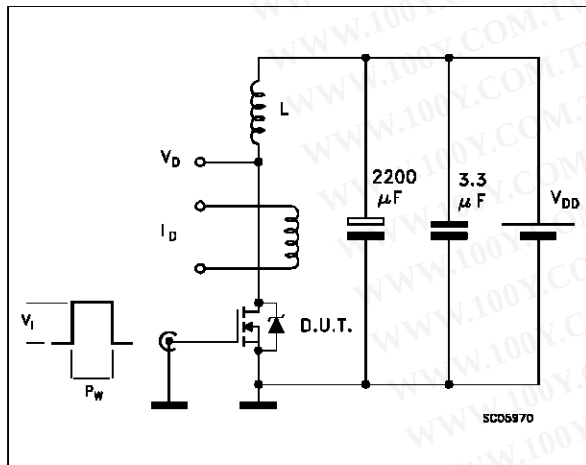
Normalized On Resistance vs Temperature



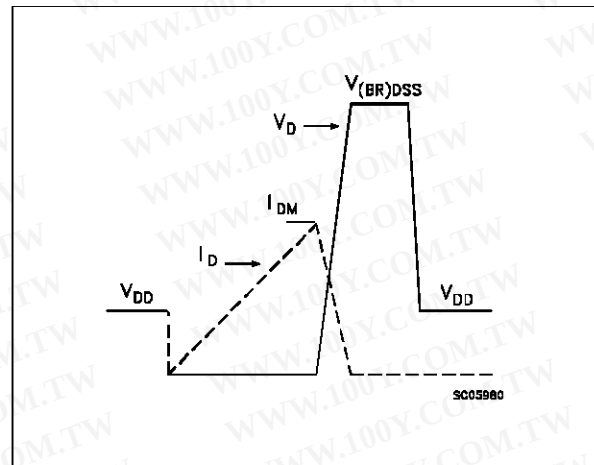
Source-drain Diode Forward Characteristics



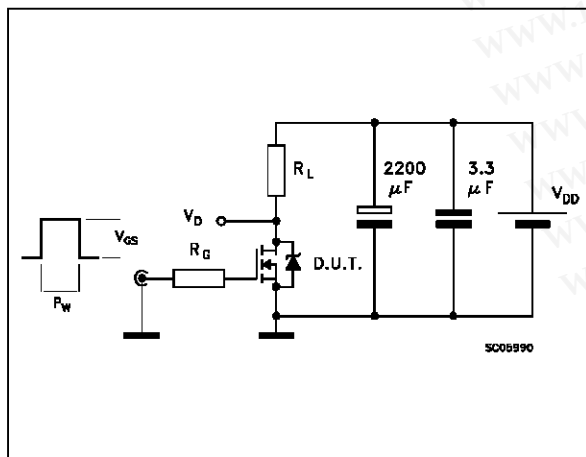
Unclamped Inductive Load Test Circuit



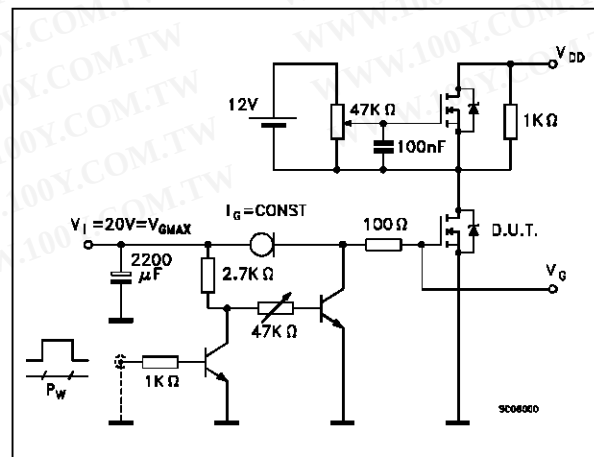
Unclamped Inductive Waveforms



Switching Time Test Circuit

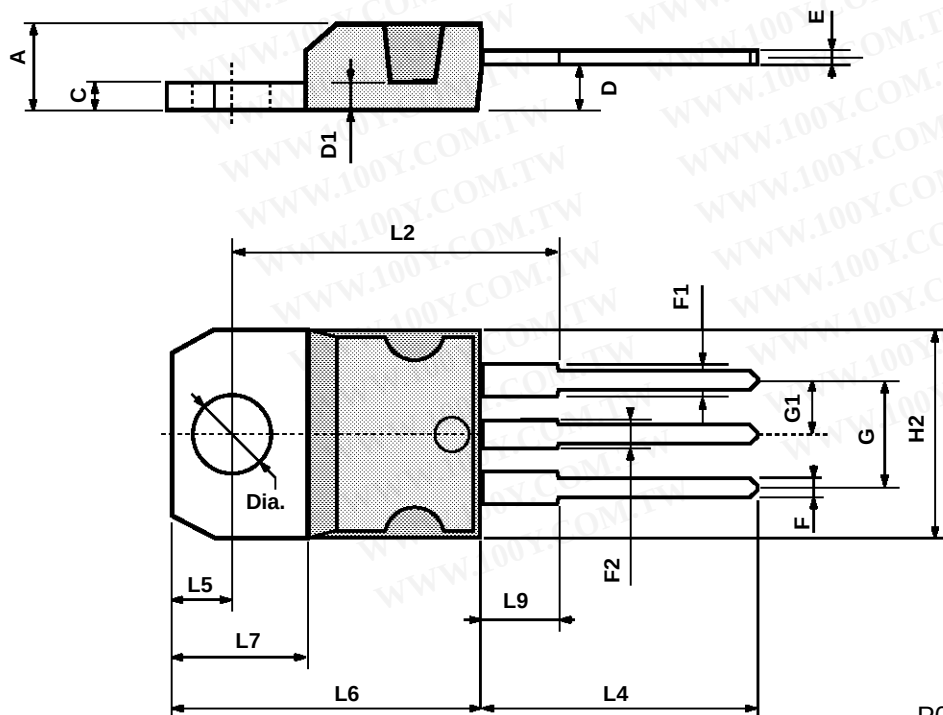


Gate Charge Test Circuit



# 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 |



IRF520/FI

# ISOWATT220 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    | 0.4  |      | 0.7  | 0.015 |       | 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 | 0.385 |       | 0.417 |
| 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 |

