



# STW10NC60 STH10NC60FI

N-CHANNEL 600V - 0.6Ω - 10A - TO-247/ISOWATT218

PowerMesh™II MOSFET

| TYPE        | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-------------|------------------|---------------------|----------------|
| STW10NC60   | 600 V            | < 0.75 Ω            | 10 A           |
| STH10NC60FI | 600 V            | < 0.75 Ω            | 10 A (*)       |

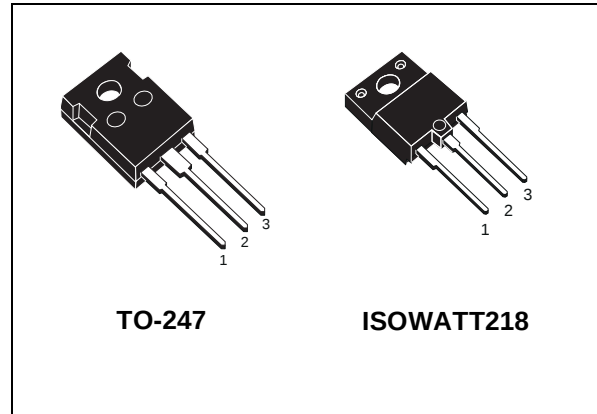
- TYPICAL R<sub>DS(on)</sub> = 0.6 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

## 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

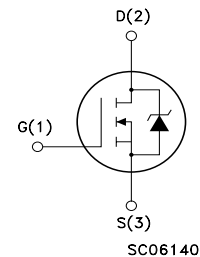
- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVER



TO-247

ISOWATT218

## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                            | Value       |             | Unit |
|---------------------|------------------------------------------------------|-------------|-------------|------|
|                     |                                                      | STW10NC60   | STH10NC60FI |      |
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 600         |             | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 600         |             | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ±30         |             | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 10          | 10 (*)      | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 6.3         | 6.3 (*)     | A    |
| I <sub>DM</sub> (1) | Drain Current (pulsed)                               | 40          | 40 (*)      | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 160         | 60          | W    |
|                     | Derating Factor                                      | 1.28        | 0.48        | W/°C |
| dv/dt               | Peak Diode Recovery voltage slope                    | 3.5         |             | V/ns |
| V <sub>ISO</sub>    | Insulation Withstand Voltage (DC)                    | -           | 2500        | V    |
| T <sub>stg</sub>    | Storage Temperature                                  | - 55 to 150 |             | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                  |             |             |      |

(\*) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 10A, di/dt ≤ 100A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>

(\*) Limited only by Maximum Temperature Allowed

## THERMAL DATA

|                |                                                | TO-247 | ISOWATT218 |      |
|----------------|------------------------------------------------|--------|------------|------|
| Rthj-case      | Thermal Resistance Junction-case Max           | 0.78   | 2.08       | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient Max        | 30     |            | °C/W |
| T <sub>I</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)                                | 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> = 50 V) | 820       | mJ   |

## ELECTRICAL CHARACTERISTICS (TCASE = 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                                          | 600  |      |         | 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> = ±30V                                                                |      |      | ±100    | nA       |

ON (1)

| 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> = 250µA | 2    | 3    | 4    | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10V, I <sub>D</sub> = 4.5 A              |      | 0.6  | 0.75 | Ω    |

## DYNAMIC

| Symbol              | Parameter                    | Test Conditions                                       | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|-------------------------------------------------------|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance     | V <sub>DS</sub> = 20 V, I <sub>D</sub> = 4.5A         |      | 9    |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0 |      | 1420 |      | pF   |
| C <sub>oss</sub>    | Output Capacitance           |                                                       |      | 205  |      | 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 | $V_{DD} = 300V, I_D = 4.5 A$<br>$R_G = 4.7\Omega, V_{GS} = 10V$ |      | 20   |      | ns   |
| $t_r$       | Rise Time          | (see test circuit, Figure 3)                                    |      | 16   |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 480V, I_D = 9.0 A,$<br>$V_{GS} = 10V$                 |      | 55   | 77   | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                 |      | 4.5  |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                 |      | 31   |      | nC   |

## SWITCHING OFF

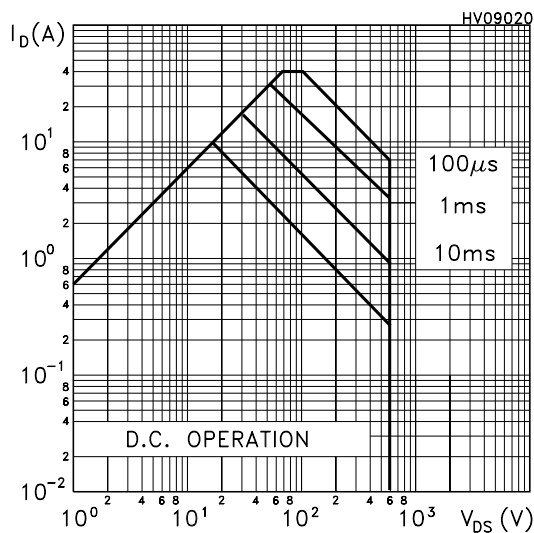
| Symbol        | Parameter             | Test Conditions                                                   | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|-------------------------------------------------------------------|------|------|------|------|
| $t_{d(off)}$  | Turn-off Delay Time   | $V_{DD} = 300 V, I_D = 4.5 A$<br>$R_G = 4.7\Omega, V_{GS} = 10 V$ |      | 64   |      | ns   |
| $t_f$         | Fall Time             | (Resistive Load see, Figure 3)                                    |      | 32   |      | ns   |
| $t_{r(voff)}$ | Off-voltage Rise Time | $V_{DD} = 480V, I_D = 9.0 A,$<br>$R_G = 4.7\Omega, V_{GS} = 10V$  |      | 19   |      | ns   |
| $t_f$         | Fall Time             | (Inductive Load see, Figure 5)                                    |      | 13   |      | ns   |
| $t_c$         | Cross-over Time       |                                                                   |      | 32   |      | ns   |

## SOURCE DRAIN DIODE

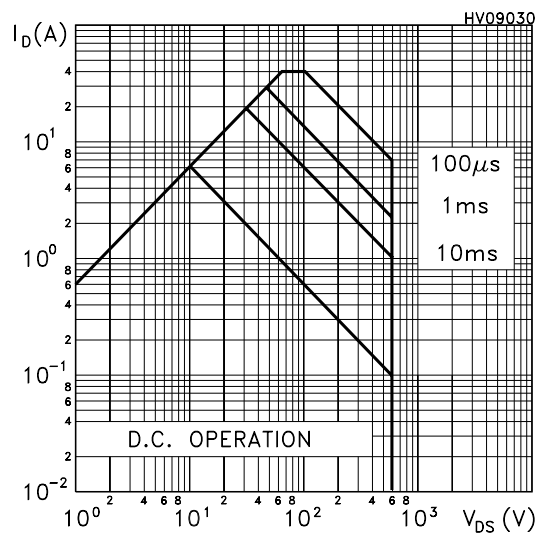
| Symbol        | Parameter                     | Test Conditions                                                           | Min. | Typ. | Max. | Unit    |
|---------------|-------------------------------|---------------------------------------------------------------------------|------|------|------|---------|
| $I_{SD}$      | Source-drain Current          |                                                                           |      |      | 10   | A       |
| $I_{SDM} (2)$ | Source-drain Current (pulsed) |                                                                           |      |      | 40   | A       |
| $V_{SD} (1)$  | Forward On Voltage            | $I_{SD} = 9 A, V_{GS} = 0$                                                |      |      | 1.6  | V       |
| $t_{rr}$      | Reverse Recovery Time         | $I_{SD} = 9 A, di/dt = 100A/\mu s,$<br>$V_{DD} = 100V, T_J = 150^\circ C$ |      | 600  |      | ns      |
| $Q_{rr}$      | Reverse Recovery Charge       | (see test circuit, Figure 5)                                              |      | 4.7  |      | $\mu C$ |
| $I_{RRM}$     | Reverse Recovery Current      |                                                                           |      | 15.5 |      | A       |

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

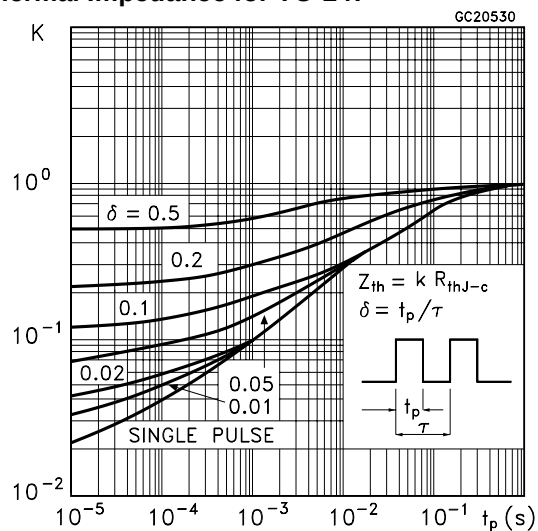
## Safe Operating Area for TO-247



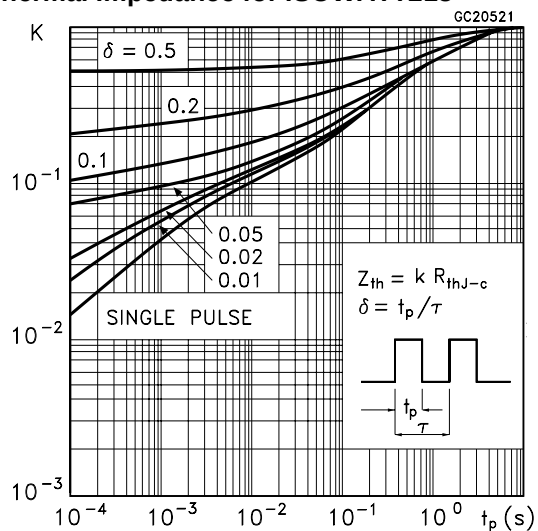
## Safe Operating Area for ISOWATT218



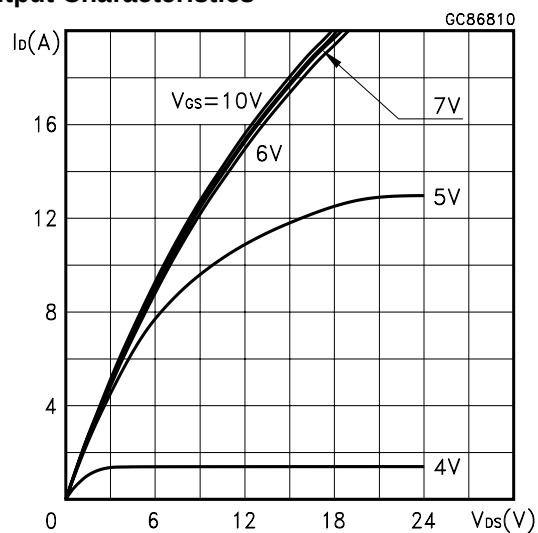
Thermal Impedance for TO-247



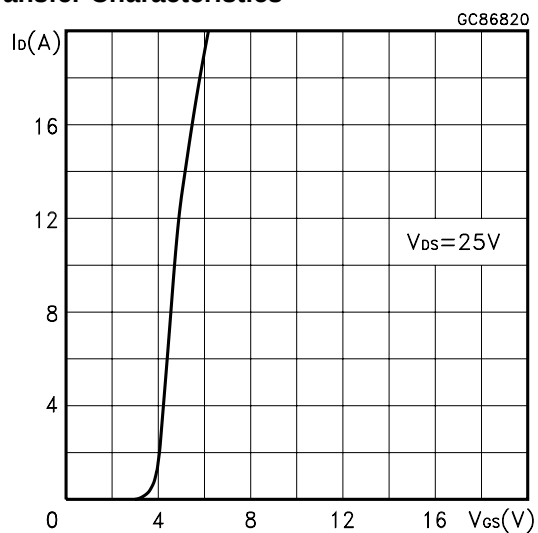
Thermal Impedance for ISOWATT218



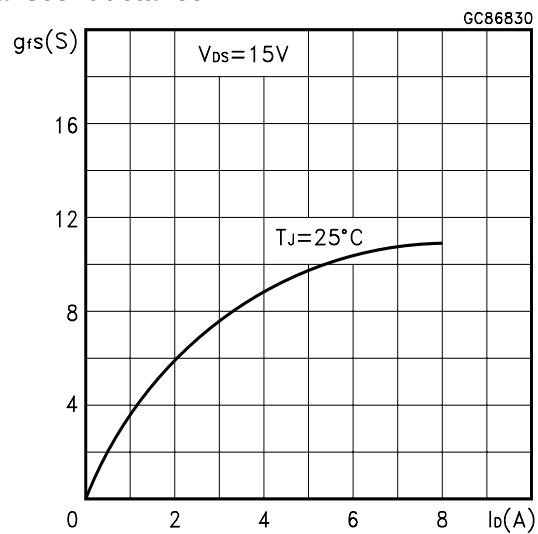
Output Characteristics



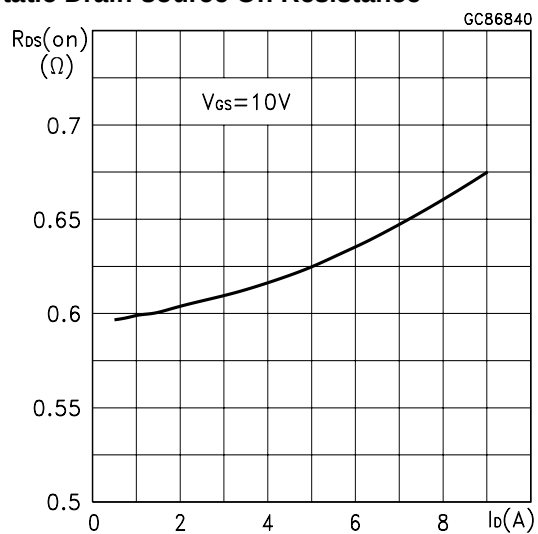
Transfer Characteristics



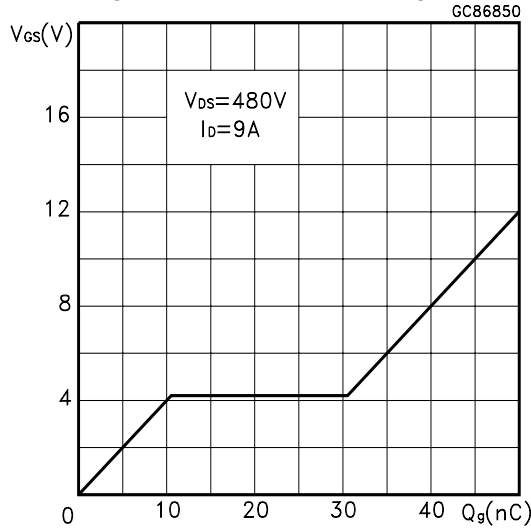
Transconductance



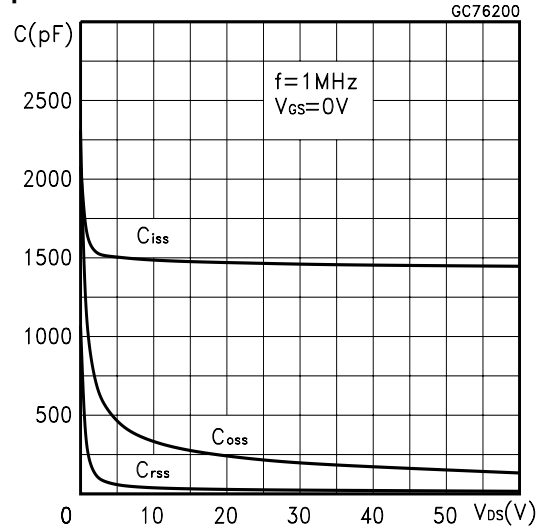
Static Drain-source On Resistance



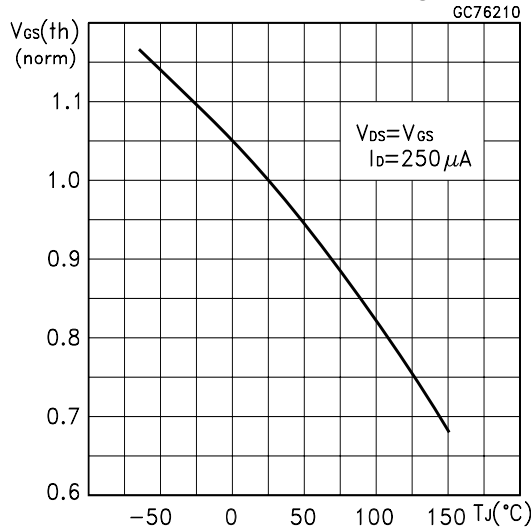
Gate Charge vs Gate-source Voltage



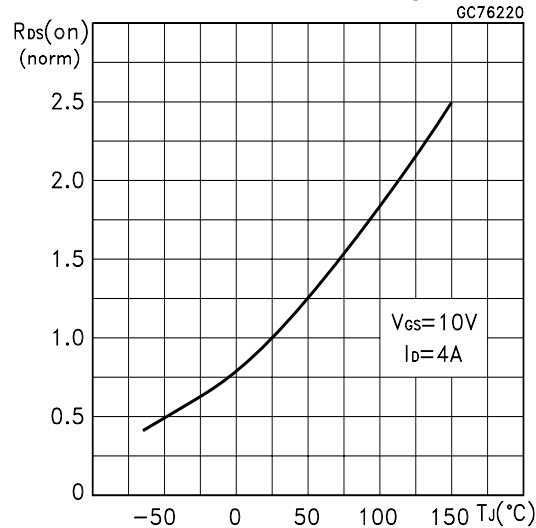
Capacitance Variations



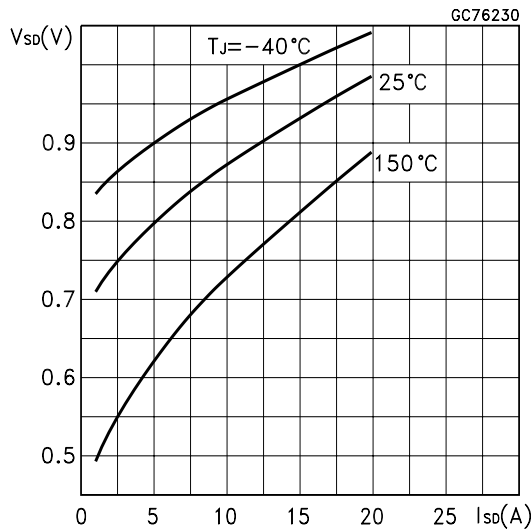
Normalized Gate Threshold Voltage vs Temp.



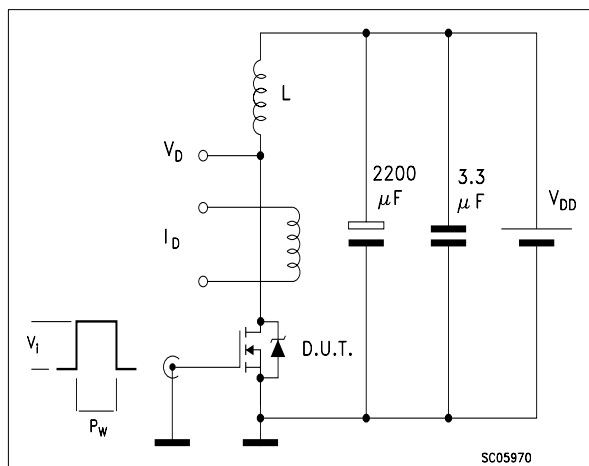
Normalized On Resistance vs Temperature



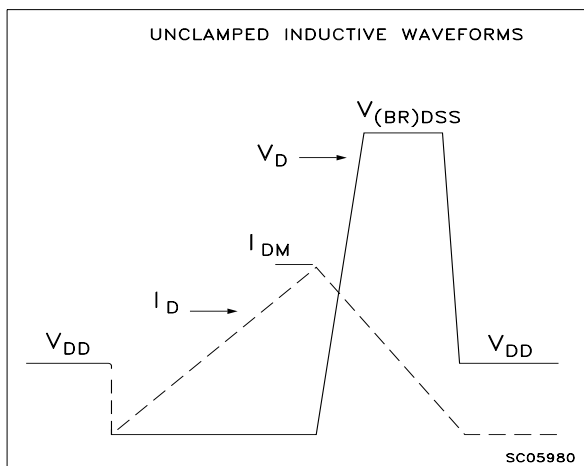
Source-drain Diode Forward Characteristics



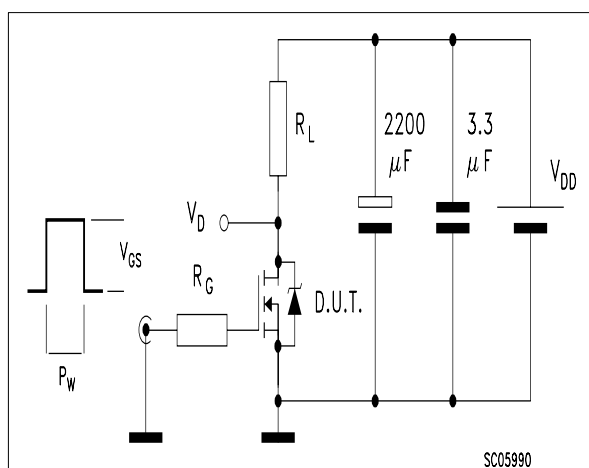
**Fig. 1: Unclamped Inductive Load Test Circuit**



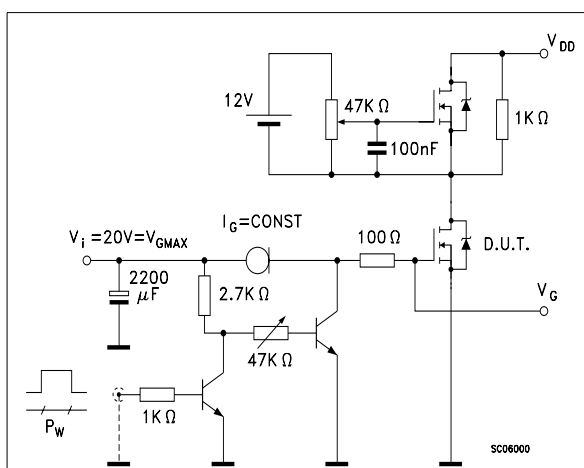
**Fig. 2: Unclamped Inductive Waveform**



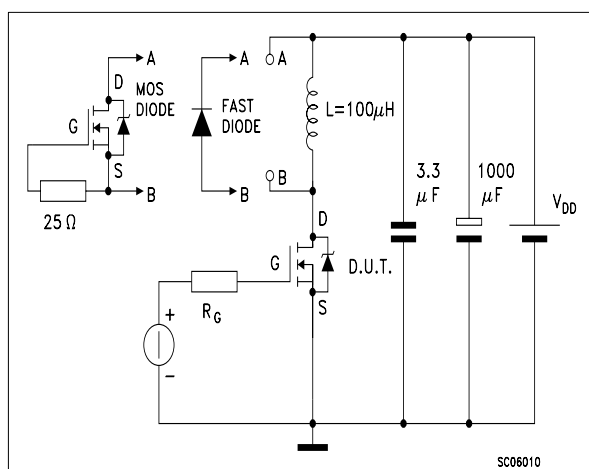
**Fig. 3: Switching Times Test Circuit For Resistive Load**



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



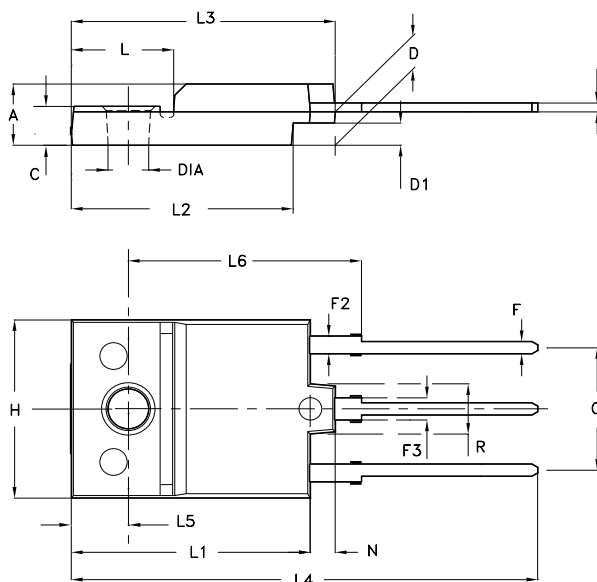
**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**





## ISOWATT218 MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 5.35  |      | 5.65  | 0.211 |       | 0.222 |
| C    | 3.30  |      | 3.80  | 0.130 |       | 0.150 |
| D    | 2.90  |      | 3.10  | 0.114 |       | 0.122 |
| D1   | 1.88  |      | 2.08  | 0.074 |       | 0.082 |
| E    | 0.75  |      | 0.95  | 0.030 |       | 0.037 |
| F    | 1.05  |      | 1.25  | 0.041 |       | 0.049 |
| F2   | 1.50  |      | 1.70  | 0.059 |       | 0.067 |
| F3   | 1.90  |      | 2.10  | 0.075 |       | 0.083 |
| G    | 10.80 |      | 11.20 | 0.425 |       | 0.441 |
| H    | 15.80 |      | 16.20 | 0.622 |       | 0.638 |
| L    |       | 9    |       |       | 0.354 |       |
| L1   | 20.80 |      | 21.20 | 0.819 |       | 0.835 |
| L2   | 19.10 |      | 19.90 | 0.752 |       | 0.783 |
| L3   | 22.80 |      | 23.60 | 0.898 |       | 0.929 |
| L4   | 40.50 |      | 42.50 | 1.594 |       | 1.673 |
| L5   | 4.85  |      | 5.25  | 0.191 |       | 0.207 |
| L6   | 20.25 |      | 20.75 | 0.797 |       | 0.817 |
| N    | 2.1   |      | 2.3   | 0.083 |       | 0.091 |
| R    |       | 4.6  |       |       | 0.181 |       |
| DIA  | 3.5   |      | 3.7   | 0.138 |       | 0.146 |



- Weight : 4.9 g (typ.)
- Maximum Torque (applied to mounting flange) Recommended: 0.8 Nm; Maximum: 1 Nm
- The side of the dissipator must be flat within 80 µm

P025C/A

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