



# STW6NA80 STH6NA80FI

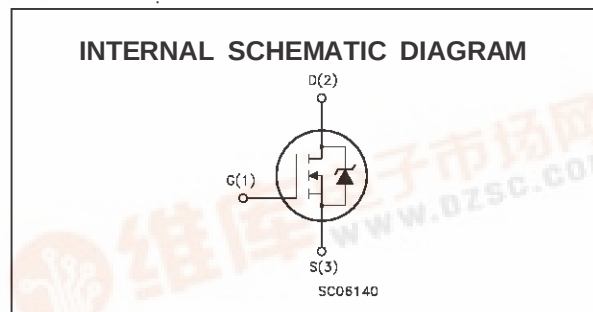
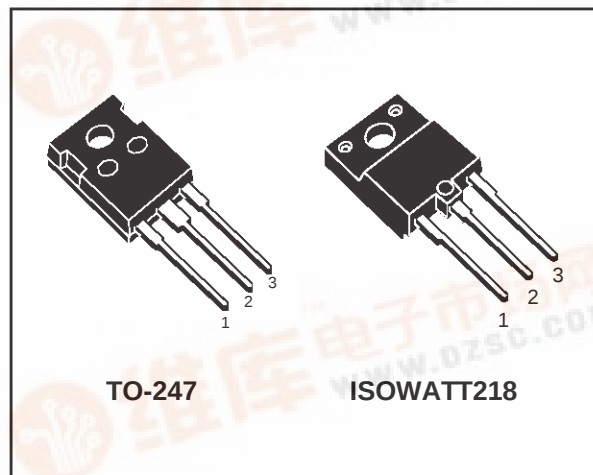
N - CHANNEL 800V - 1.8Ω - 5.4A - TO-247/ISOWATT218  
FAST POWER MOS TRANSISTOR

| TYPE       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------|------------------|---------------------|----------------|
| STW6NA80   | 800 V            | < 2.2 Ω             | 5.4 A          |
| STH6NA80FI | 800 V            | < 2.2 Ω             | 3.4 A          |

- TYPICAL R<sub>DS(on)</sub> = 1.8 Ω
- AVALANCE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- APPLICATION ORIENTED CHARACTERIZATION

## 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.)



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                             | Value      |            | Unit |
|---------------------|-------------------------------------------------------|------------|------------|------|
|                     |                                                       | STW6NA80   | STH6NA80FI |      |
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)            | 800        |            | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 800        |            | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                   | ± 30       |            | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C  | 5.4        | 3.4        | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C | 3.4        | 2.1        | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                                | 22         | 22         | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C           | 150        | 60         | W    |
|                     | Derating Factor                                       | 1.2        | 0.48       | W/°C |
| V <sub>ISO</sub>    | Insulation Withstand Voltage (DC)                     | —          | 4000       | 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

## STW6NA80-STH6NA80FI

### THERMAL DATA

|                       |                                                |     |  | TO-247 | ISOWATT218 |      |
|-----------------------|------------------------------------------------|-----|--|--------|------------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case               | Max |  | 0.83   | 2.08       | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient            | Max |  | 30     |            | °C/W |
| R <sub>thc-sink</sub> | Thermal Resistance Case-sink                   | Typ |  | 0.1    |            | °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%)                          | 5.4       | 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)   | 150       | mJ   |
| E <sub>AR</sub> | Repetitive Avalanche Energy (pulse width limited by T <sub>j</sub> max, δ < 1%)                                              | 5.8       | 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%) | 3.4       | 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                                                | 800  |      |          | 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> = 100 °C |      |      | 25<br>50 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 30 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                                                          | 2.25 | 3    | 3.75       | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V I <sub>D</sub> = 3 A<br>V <sub>GS</sub> = 10 V I <sub>D</sub> = 3 A T <sub>c</sub> = 100 °C |      | 1.8  | 2.2<br>4.4 | Ω<br>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                            | 5.4  |      |            | 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> × R <sub>DS(on)max</sub> I <sub>D</sub> = 3 A | 3    | 5.5               |                   | S              |
| C <sub>iss</sub><br>C <sub>oss</sub><br>C <sub>rss</sub> | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0                               |      | 1250<br>140<br>35 | 1700<br>190<br>50 | pF<br>pF<br>pF |

# ELECTRICAL CHARACTERISTICS (continued)

## SWITCHING ON

| Symbol                        | Parameter                                                    | Test Conditions                                                                                                          | Min. | Typ.          | Max.      | Unit           |
|-------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|---------------|-----------|----------------|
| $t_{d(on)}$<br>$t_r$          | Turn-on Time<br>Rise Time                                    | $V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$<br>(see test circuit, figure 3) |      | 40<br>100     | 55<br>135 | ns<br>ns       |
| $(di/dt)_{on}$                | Turn-on Current Slope                                        | $V_{DD} = 640\text{ V}$ $I_D = 6\text{ A}$<br>$R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$<br>(see test circuit, figure 5)  |      | 180           |           | A/ $\mu$ s     |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 640\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$                                                        |      | 55<br>8<br>24 | 75        | nC<br>nC<br>nC |

## SWITCHING OFF

| Symbol                          | Parameter                                             | Test Conditions                                                                                                         | Min. | Typ.            | Max.             | Unit           |
|---------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------|-----------------|------------------|----------------|
| $t_{r(voff)}$<br>$t_f$<br>$t_c$ | Off-voltage Rise Time<br>Fall Time<br>Cross-over Time | $V_{DD} = 640\text{ V}$ $I_D = 6\text{ A}$<br>$R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$<br>(see test circuit, figure 5) |      | 75<br>25<br>110 | 100<br>35<br>150 | ns<br>ns<br>ns |

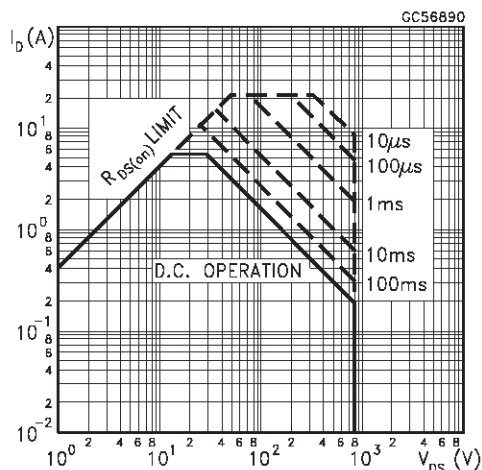
## SOURCE DRAIN DIODE

| Symbol                            | Parameter                                                                    | Test Conditions                                                                                                                                       | Min. | Typ.              | Max.      | Unit               |
|-----------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------------|-----------|--------------------|
| $I_{SD}$<br>$I_{SDM}(\bullet)$    | Source-drain Current<br>Source-drain Current (pulsed)                        |                                                                                                                                                       |      |                   | 5.4<br>22 | A<br>A             |
| $V_{SD} (*)$                      | Forward On Voltage                                                           | $I_{SD} = 6\text{ A}$ $V_{GS} = 0$                                                                                                                    |      |                   | 1.6       | V                  |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$<br>(see test circuit, figure 5) |      | 800<br>15.2<br>38 |           | ns<br>$\mu$ C<br>A |

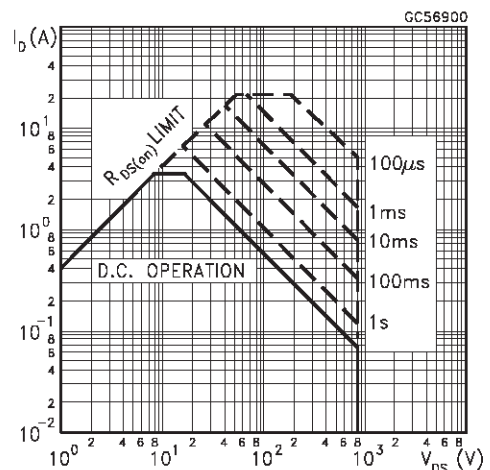
(\*) Pulsed: Pulse duration = 300  $\mu$ s, duty cycle 1.5 %

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

## Safe Operating Area for TO-247

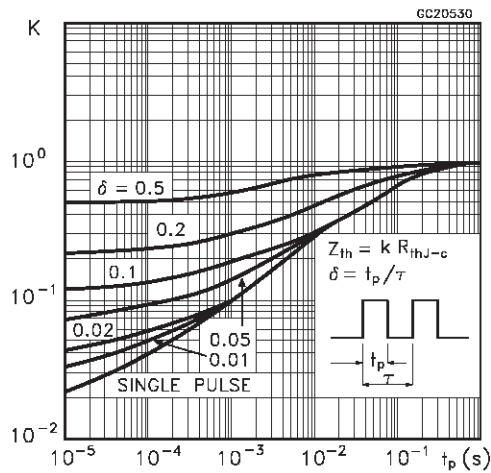


## Safe Operating Area for ISOWATT218

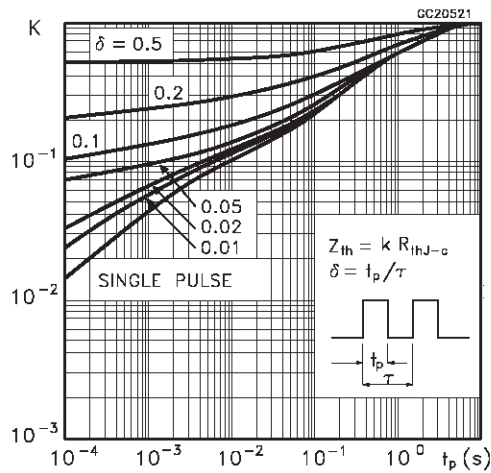


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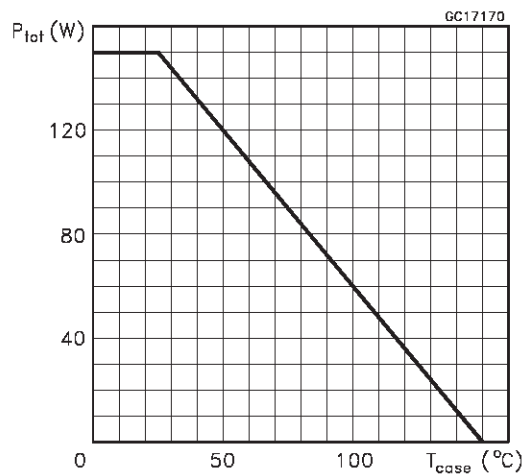
Thermal Impedance for TO-247



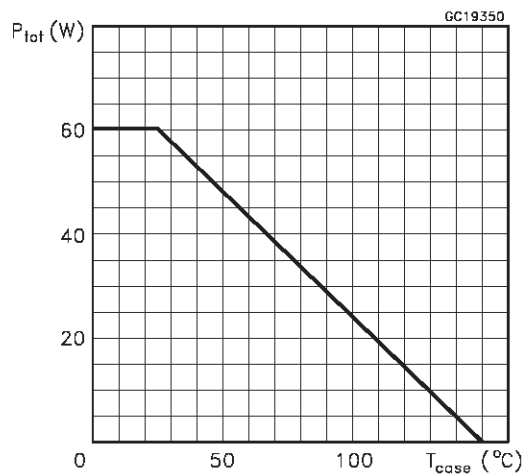
Thermal Impedance for ISOWATT218



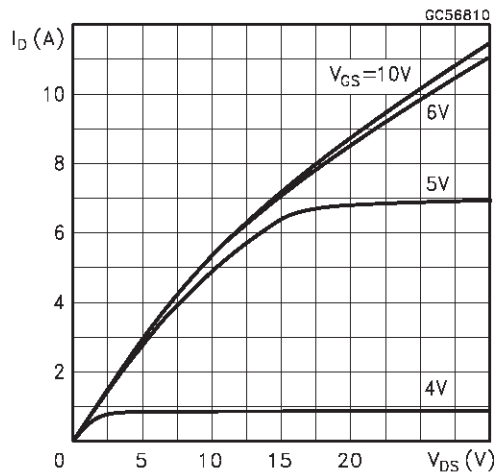
Derating Curve for TO-247



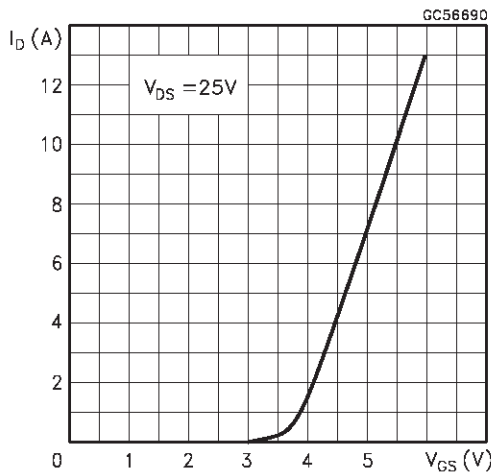
Derating Curve for ISOWATT218



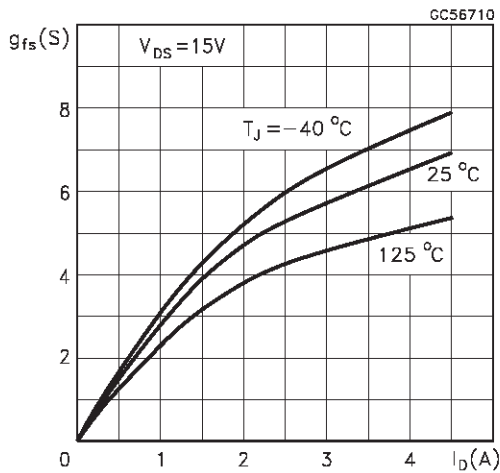
Output Characteristics



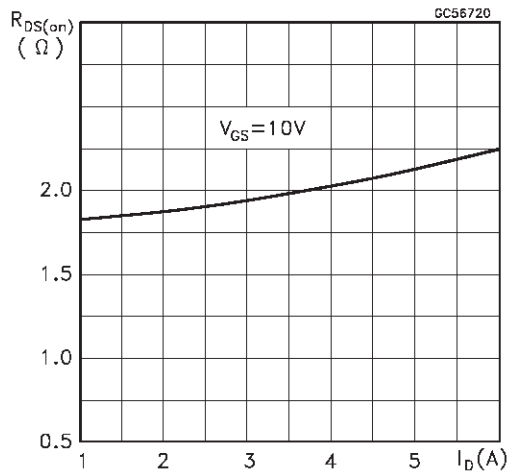
Transfer Characteristics



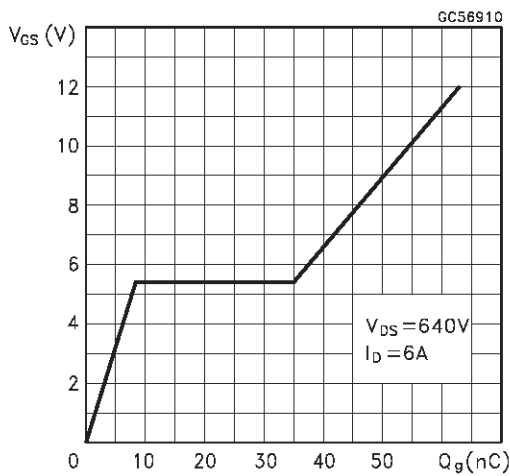
Transconductance



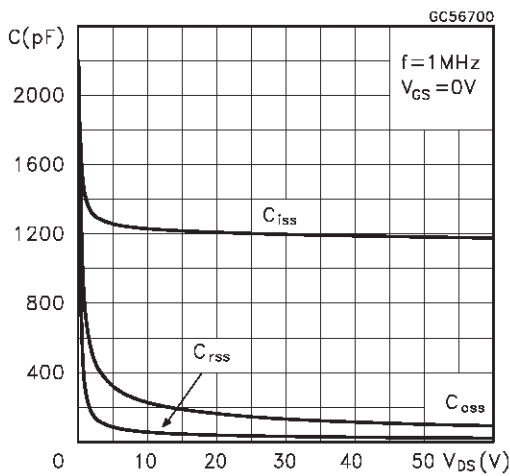
Static Drain-source On Resistance



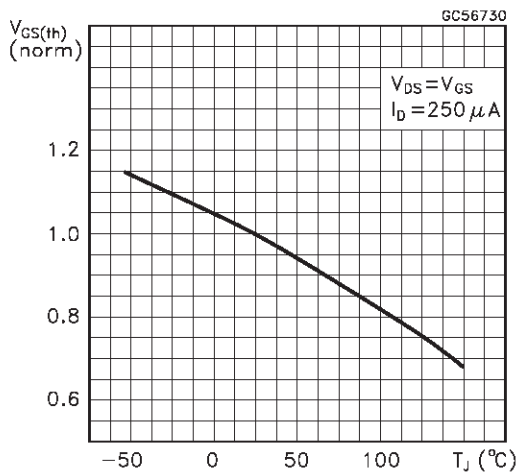
Gate Charge vs Gate-source Voltage



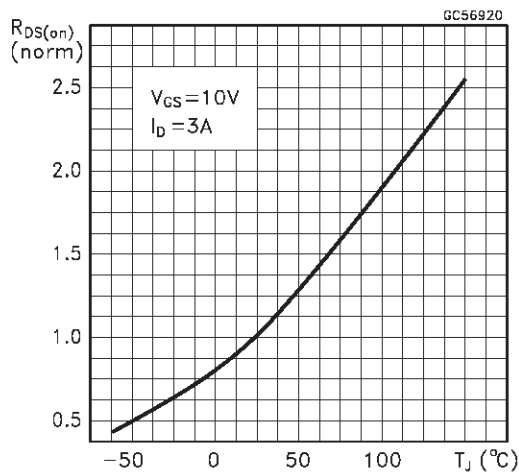
Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature

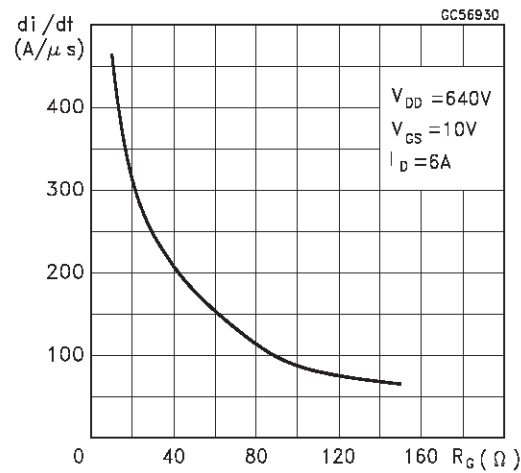


Normalized On Resistance vs Temperature

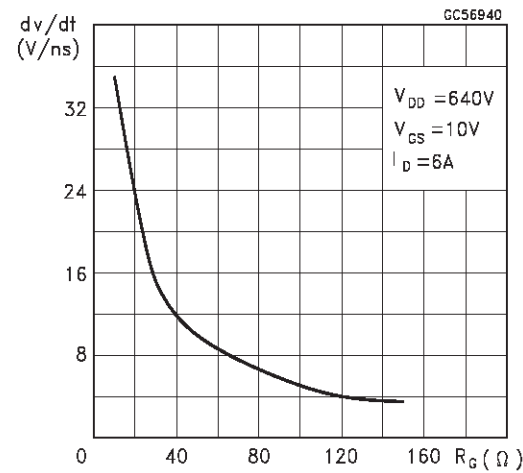


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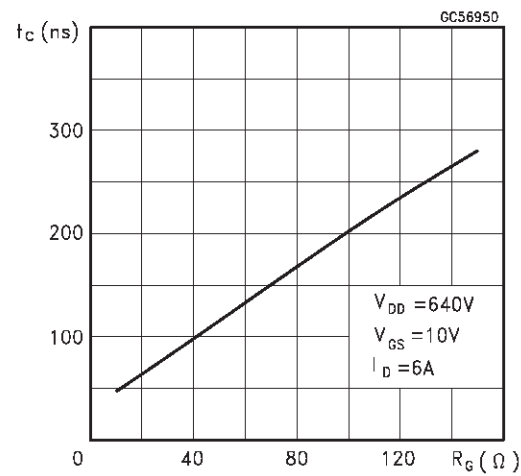
Turn-on Current Slope



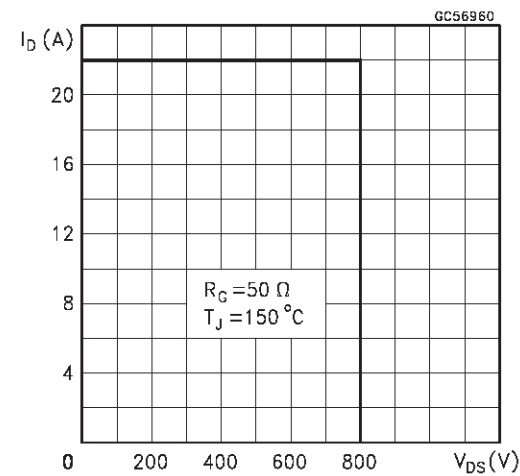
Turn-off Drain-source Voltage Slope



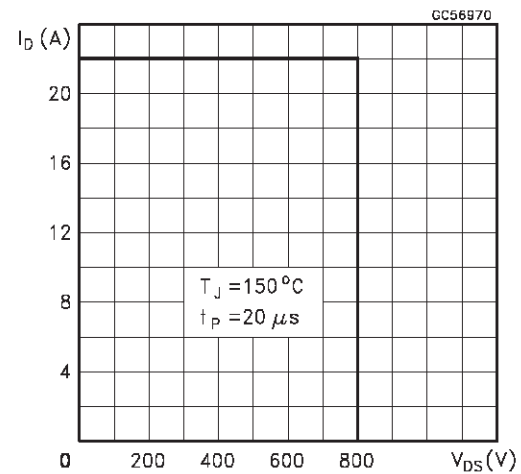
Cross-over Time



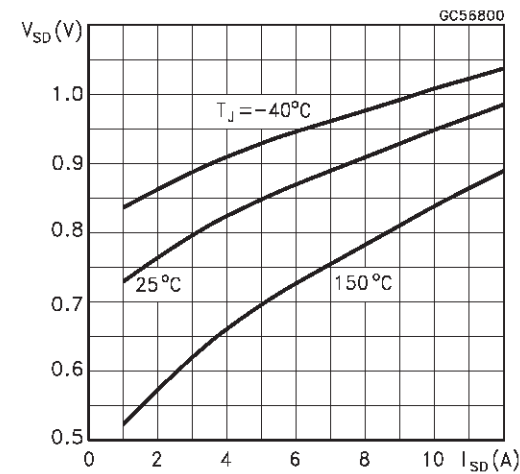
Switching Safe Operating Area



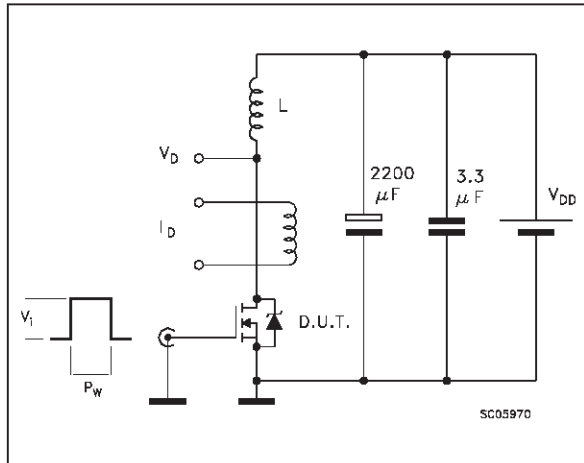
Accidental Overload Area



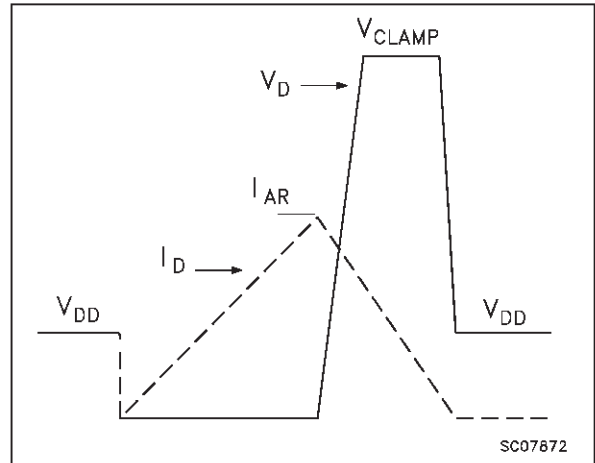
Source-drain Diode Forward Characteristics



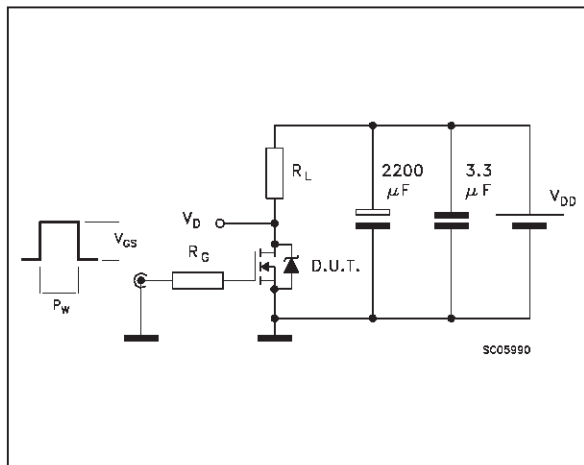
**Fig. 1:** Unclamped Inductive Load Test Circuit



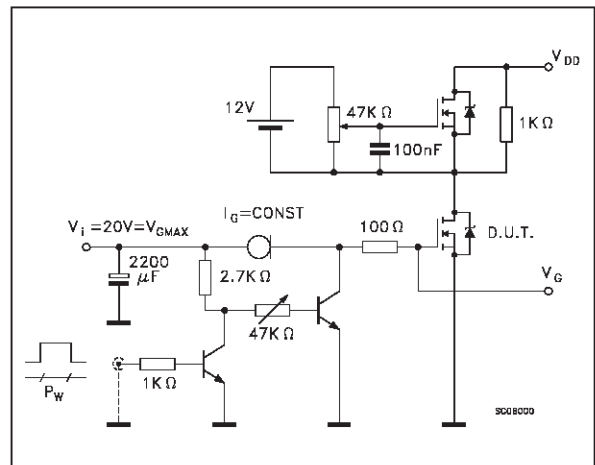
**Fig. 2:** Unclamped Inductive Waveform



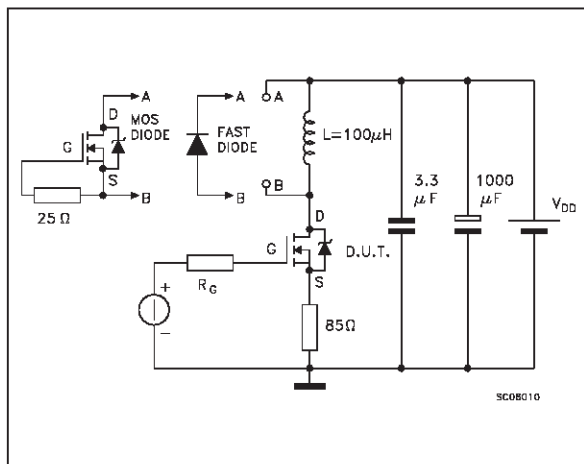
**Fig. 3:** Switching Times Test Circuits For Resistive Load



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

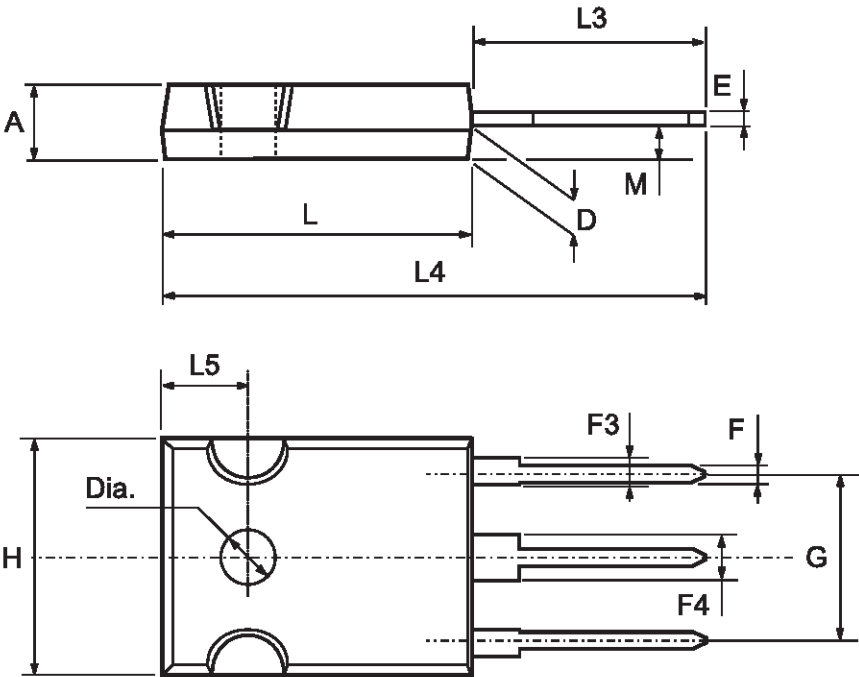


**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



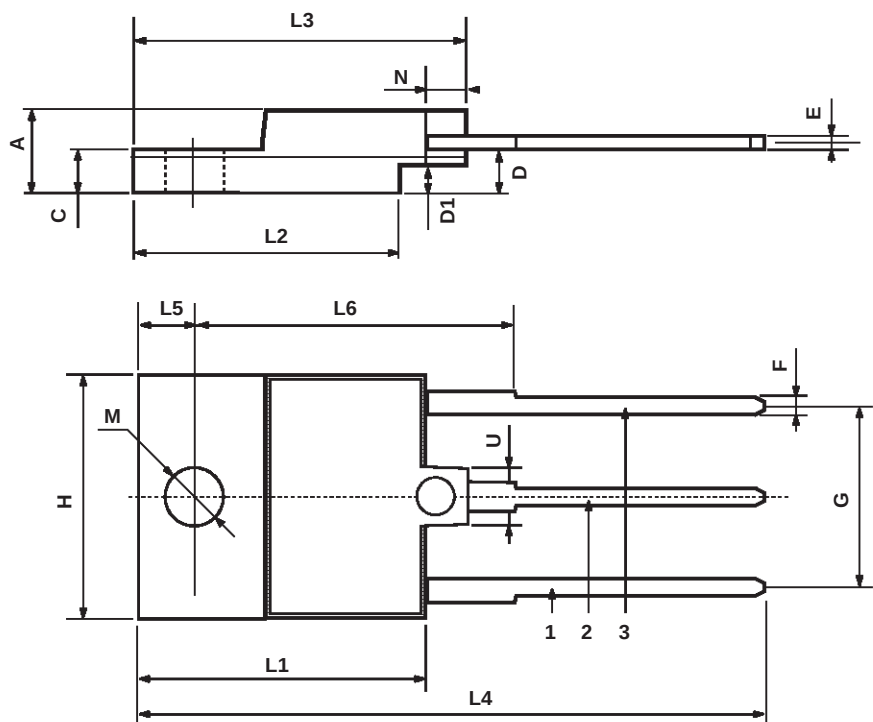
TO-247 MECHANICAL DATA

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.7  |      | 5.3  | 0.185 |       | 0.209 |
| D    | 2.2  |      | 2.6  | 0.087 |       | 0.102 |
| E    | 0.4  |      | 0.8  | 0.016 |       | 0.031 |
| F    | 1    |      | 1.4  | 0.039 |       | 0.055 |
| F3   | 2    |      | 2.4  | 0.079 |       | 0.094 |
| F4   | 3    |      | 3.4  | 0.118 |       | 0.134 |
| G    |      | 10.9 |      |       | 0.429 |       |
| H    | 15.3 |      | 15.9 | 0.602 |       | 0.626 |
| L    | 19.7 |      | 20.3 | 0.776 |       | 0.779 |
| L3   | 14.2 |      | 14.8 | 0.559 | 0.413 | 0.582 |
| L4   |      | 34.6 |      |       | 1.362 |       |
| L5   |      | 5.5  |      |       | 0.217 |       |
| M    | 2    |      | 3    | 0.079 |       | 0.118 |
| Dia  | 3.55 |      | 3.65 | 0.140 |       | 0.144 |



ISOWATT218 MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 5.35  |      | 5.65  | 0.210 |       | 0.222 |
| C    | 3.3   |      | 3.8   | 0.130 |       | 0.149 |
| D    | 2.9   |      | 3.1   | 0.114 |       | 0.122 |
| D1   | 1.88  |      | 2.08  | 0.074 |       | 0.081 |
| E    | 0.75  |      | 1     | 0.029 |       | 0.039 |
| F    | 1.05  |      | 1.25  | 0.041 |       | 0.049 |
| G    | 10.8  |      | 11.2  | 0.425 |       | 0.441 |
| H    | 15.8  |      | 16.2  | 0.622 |       | 0.637 |
| L1   | 20.8  |      | 21.2  | 0.818 |       | 0.834 |
| L2   | 19.1  |      | 19.9  | 0.752 |       | 0.783 |
| L3   | 22.8  |      | 23.6  | 0.897 |       | 0.929 |
| L4   | 40.5  |      | 42.5  | 1.594 |       | 1.673 |
| L5   | 4.85  |      | 5.25  | 0.190 |       | 0.206 |
| L6   | 20.25 |      | 20.75 | 0.797 |       | 0.817 |
| M    | 3.5   |      | 3.7   | 0.137 |       | 0.145 |
| N    | 2.1   |      | 2.3   | 0.082 |       | 0.090 |
| U    |       | 4.6  |       |       | 0.181 |       |



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