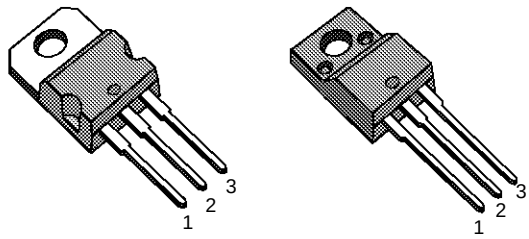
SGS-THOMSON MICROELECTRONICS

# STP32N05L
# STP32N05LFI

## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STP32N05L | 50 V | < 0.055 Ω | 32 A |
| STP32N05LFI | 50 V | < 0.055 Ω | 19 A |

- TYPICAL $R_{DS(on)}$ = 0.045 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

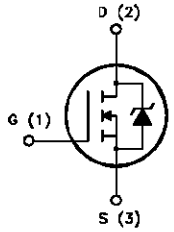



**TO-220** **ISOWATT220**

### 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.)

**INTERNAL SCHEMATIC DIAGRAM**




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | STP32N05L | STP32N05LFI | |
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 50 | | V |
| $V_{DGR}$ | Drain- gate Voltage ($R_{GS}$ = 20 kΩ) | 50 | | V |
| $V_{GS}$ | Gate-source Voltage | ± 15 | | V |
| $I_D$ | Drain Current (continuous) at $T_c$ = 25 °C | 32 | 19 | A |
| $I_D$ | Drain Current (continuous) at $T_c$ = 100 °C | 22 | 13 | A |
| $I_{DM}$(•) | Drain Current (pulsed) | 128 | 128 | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 °C | 105 | 40 | W |
| | Derating Factor | 0.7 | 0.27 | W/°C |
| $V_{ISO}$ | Insulation Withstand Voltage (DC) | — | 2000 | V |
| $T_{stg}$ | Storage Temperature | -65 to 175 | | °C |
| $T_j$ | Max. Operating Junction Temperature | 175 | | °C |

(•) Pulse width limited by safe operating area

## THERMAL DATA

| | | | TO-220 | ISOWATT220 | |
|---|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 1.43 | 3.75 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction-ambient | Max | 62.5 | | °C/W |
| $R_{thc\text{-}sink}$ | Thermal Resistance Case-sink | Typ | 0.5 | | °C/W |
| $T_l$ | Maximum Lead Temperature For Soldering Purpose | | 300 | | °C |

## AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$) | 32 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25\ ^oC$, $I_D = I_{AR}$, $V_{DD} = 25$ V) | 200 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$) | 50 | mJ |
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\ ^oC$, pulse width limited by $T_j$ max, $\delta < 1\%$) | 22 | A |

## ELECTRICAL CHARACTERISTICS ($T_{case} = 25\ ^oC$ unless otherwise specified)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D = 250\ \mu A$ $V_{GS} = 0$ | 50 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS} = 0$) | $V_{DS}$ = Max Rating<br>$V_{DS}$ = Max Rating x 0.8 $T_c = 125\ ^oC$ | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS} = 0$) | $V_{GS} = \pm 15$ V | | | ± 100 | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$ $I_D = 250\ \mu A$ | 1 | 1.6 | 2.5 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 5$ V $I_D = 16$ A | | 0.045 | 0.055 | Ω |
| $I_{D(on)}$ | On State Drain Current | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$V_{GS} = 10$ V | 32 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (*) | Forward Transconductance | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 16$ A | 10 | 22 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS} = 25$ V f = 1 MHz $V_{GS} = 0$ | | 980<br>320<br>80 | 1300<br>450<br>110 | 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 | $V_{DD}$ = 25 V $I_D$ = 16 A<br>$R_G$ = 50 Ω $V_{GS}$ = 5 V<br>(see test circuit, figure 3) | | 60<br>430 | 90<br>630 | ns<br>ns |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{DD}$ = 40 V $I_D$ = 32 A<br>$R_G$ = 50 Ω $V_{GS}$ = 5 V<br>(see test circuit, figure 5) | | 130 | | A/µs |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}$ = 40 V $I_D$ = 32 A $V_{GS}$ = 5 V | | 25<br>9<br>12 | 35 | 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 | $V_{DD}$ = 40 V $I_D$ = 32 A<br>$R_G$ = 50 Ω $V_{GS}$ = 5 V<br>(see test circuit, figure 5) | | 90<br>140<br>250 | 130<br>200<br>350 | ns<br>ns<br>ns |

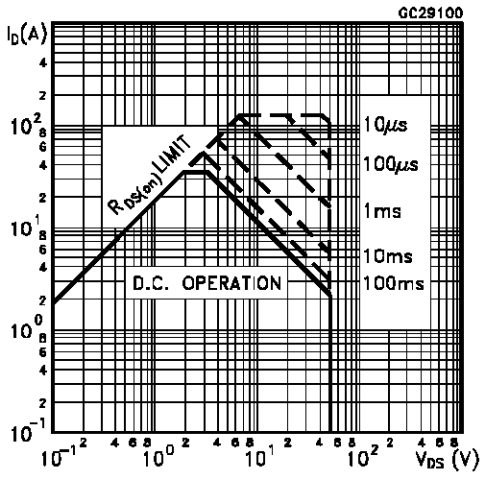
SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$(•) | Source-drain Current<br>Source-drain Current (pulsed) | | | | 32<br>128 | A<br>A |
| $V_{SD}$ (*) | Forward On Voltage | $I_{SD}$ = 32 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 | $I_{SD}$ = 32 A di/dt = 100 A/µs<br>$V_{DD}$ = 25 V $T_j$ = 150 °C<br>(see test circuit, figure 5) | | 100<br>0.2<br>4 | | ns<br>µC<br>A |

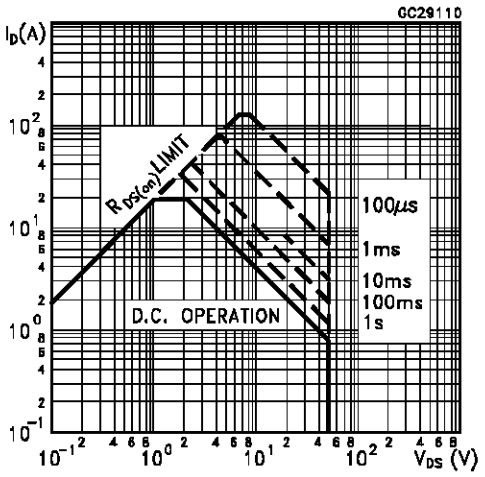
(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

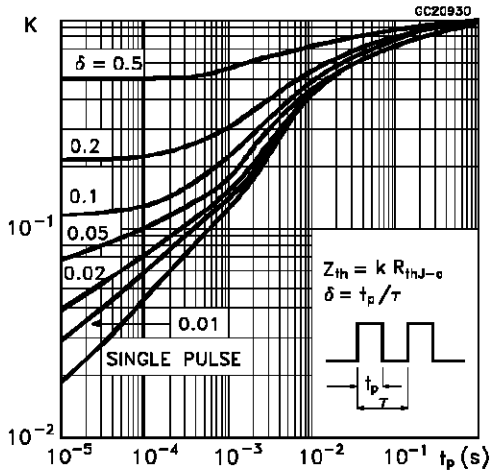
Safe Operating Areas For TO-220



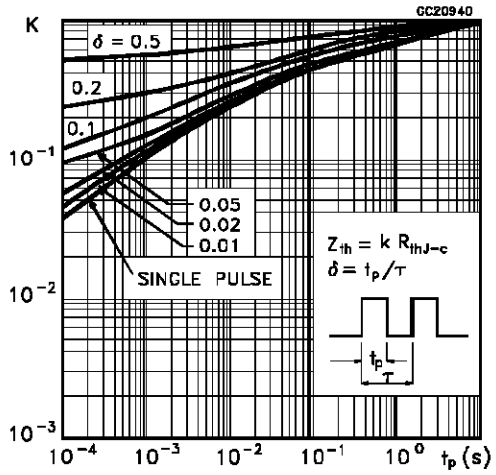

Safe Operating Areas For ISOWATT220



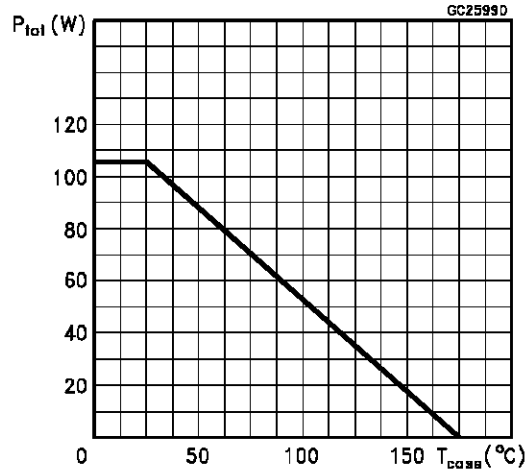
Thermal Impedance For TO-220



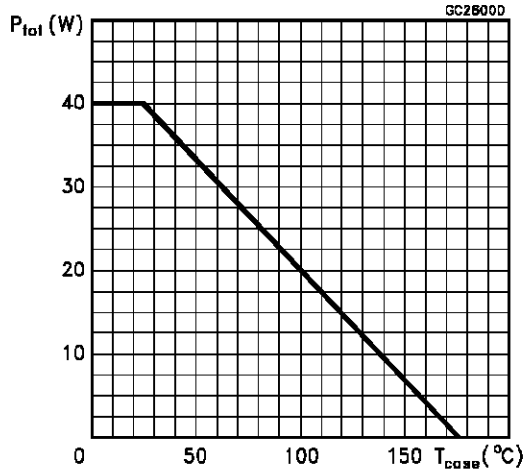

Thermal Impedance For ISOWATT220



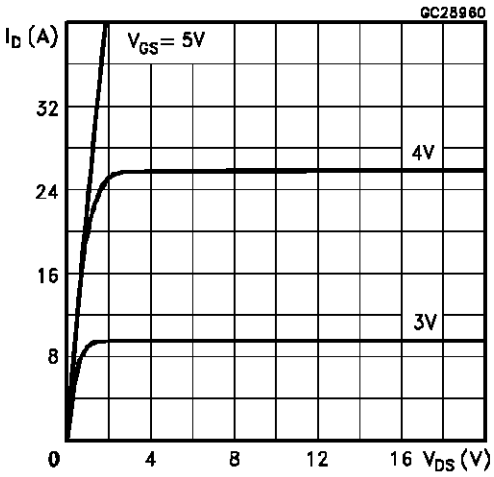

Derating Curve For TO-220



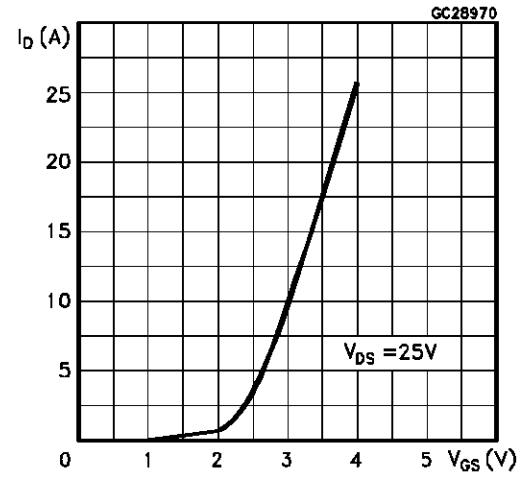

Derating Curve For ISOWATT220



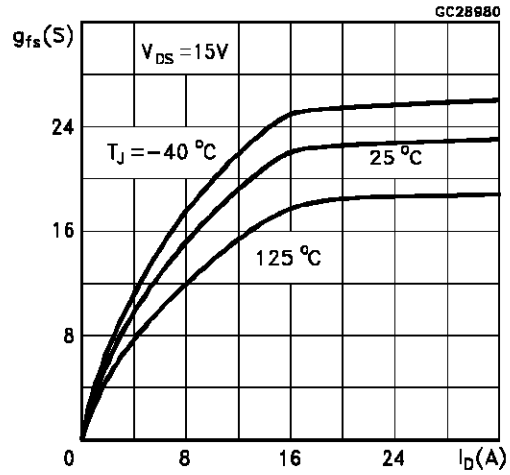

Output Characteristics



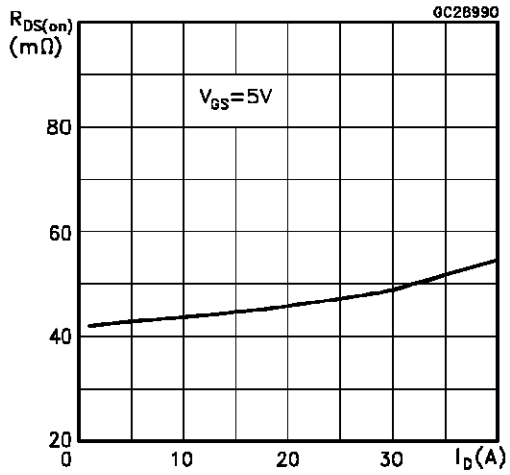

Transfer Characteristics



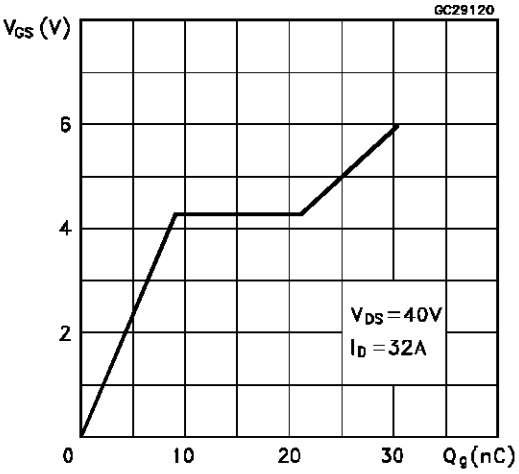
Transconductance



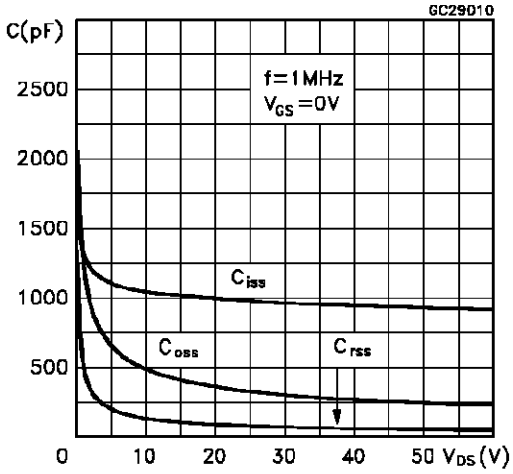

Static Drain-source On Resistance



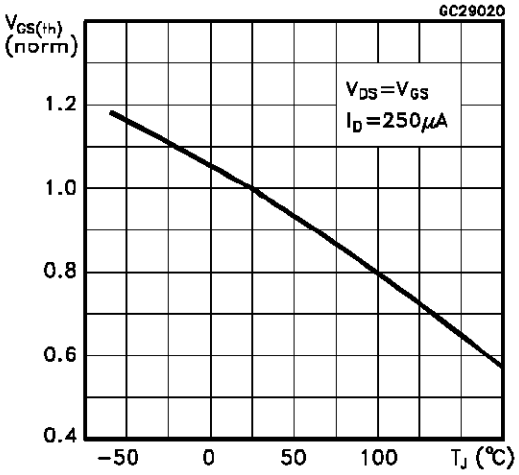

Gate Charge vs Gate-source Voltage



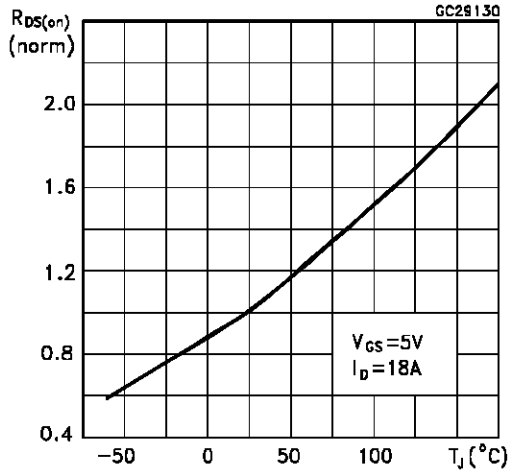

Capacitance Variations



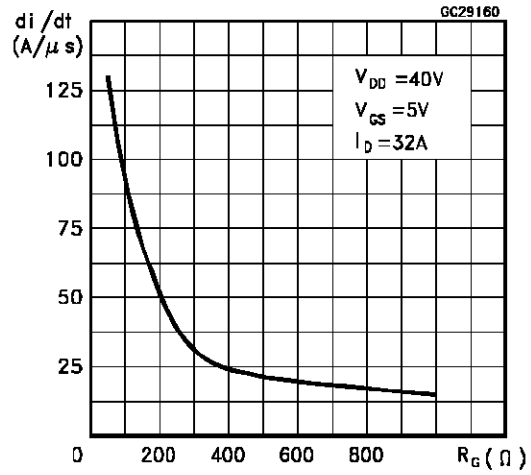

Normalized Gate Threshold Voltage vs Temperature



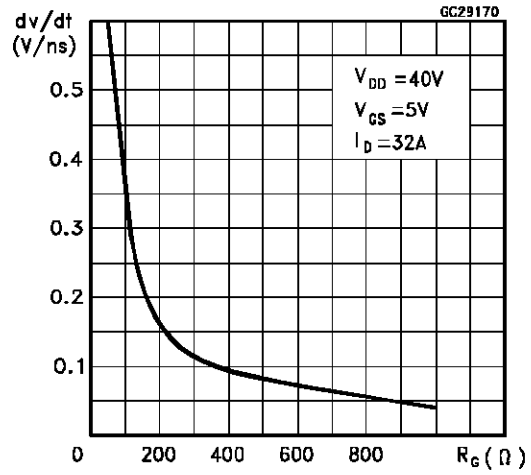

Normalized On Resistance vs Temperature



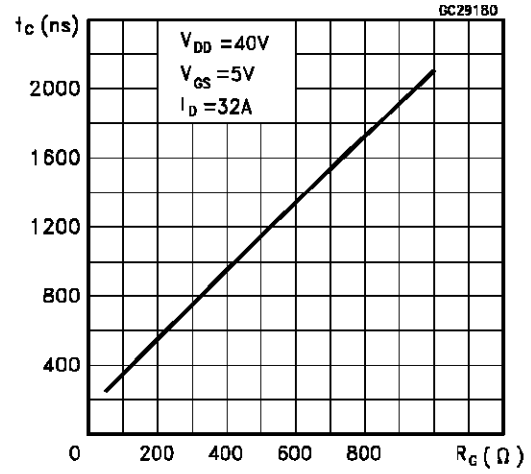
Turn-on Current Slope



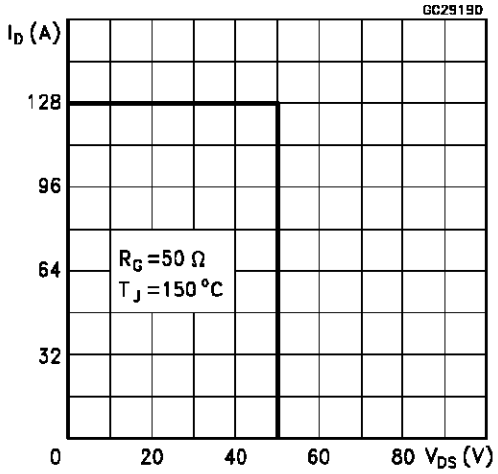

Turn-off Drain-source Voltage Slope



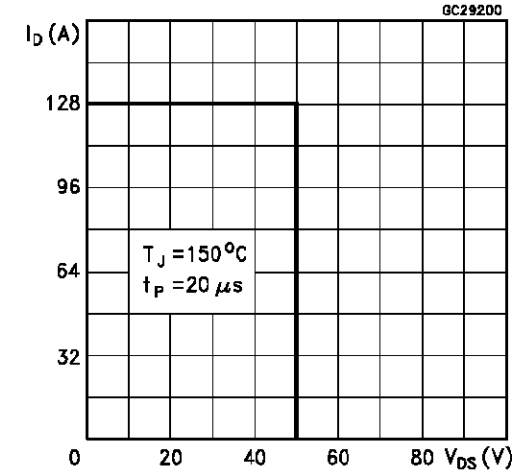

Cross-over Time




Switching Safe Operating Area




Accidental Overload Area




Source-drain Diode Forward Characteristics

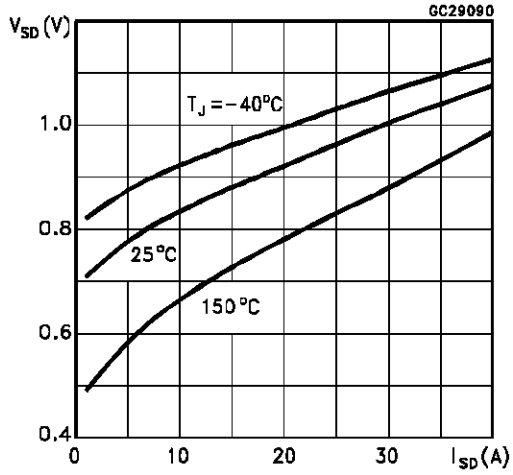


**Fig. 1:** Unclamped Inductive Load Test Circuits

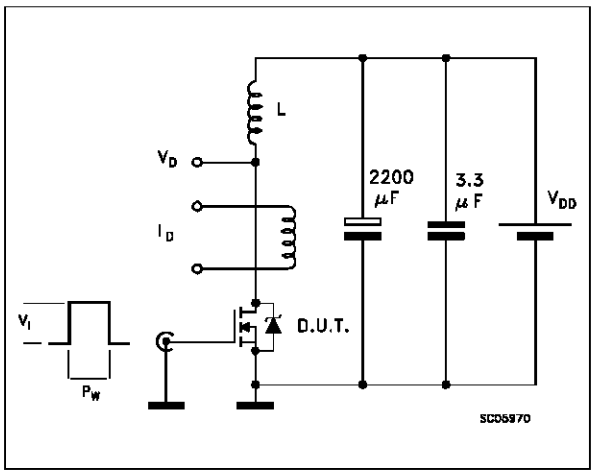



**Fig. 2:** Unclamped Inductive Waveforms

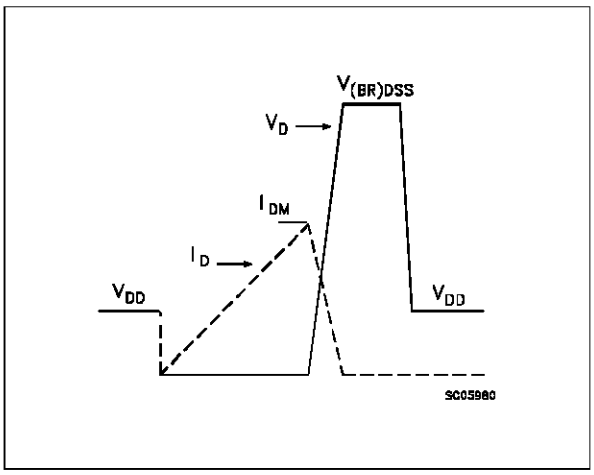



**Fig. 3:** Switching Times Test Circuits For Resistive Load

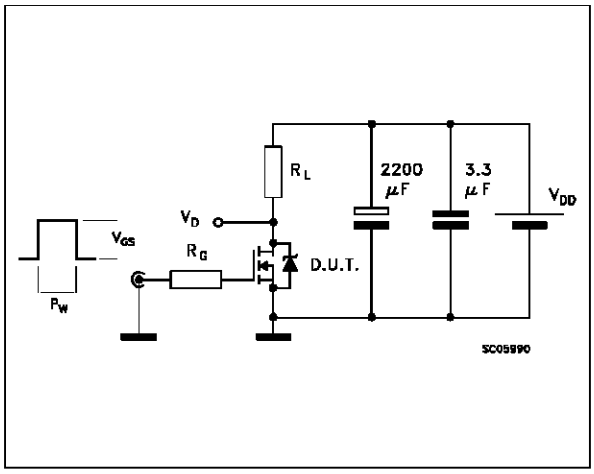



**Fig. 4:** Gate Charge Test Circuit

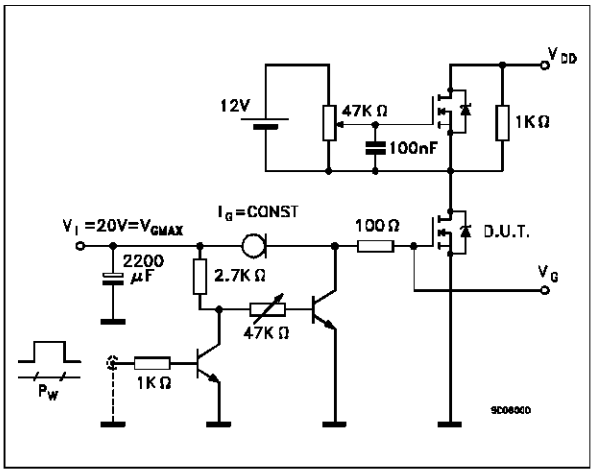
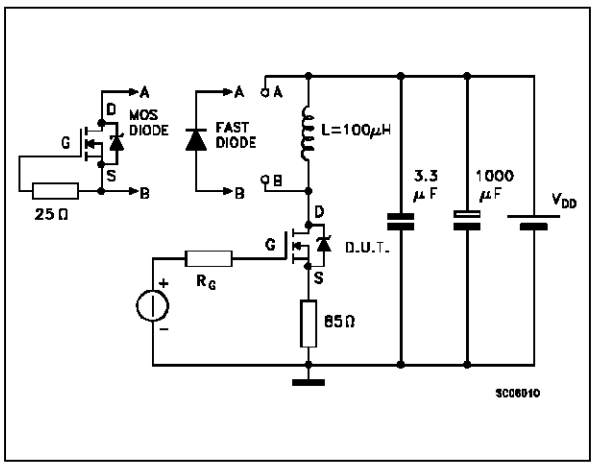
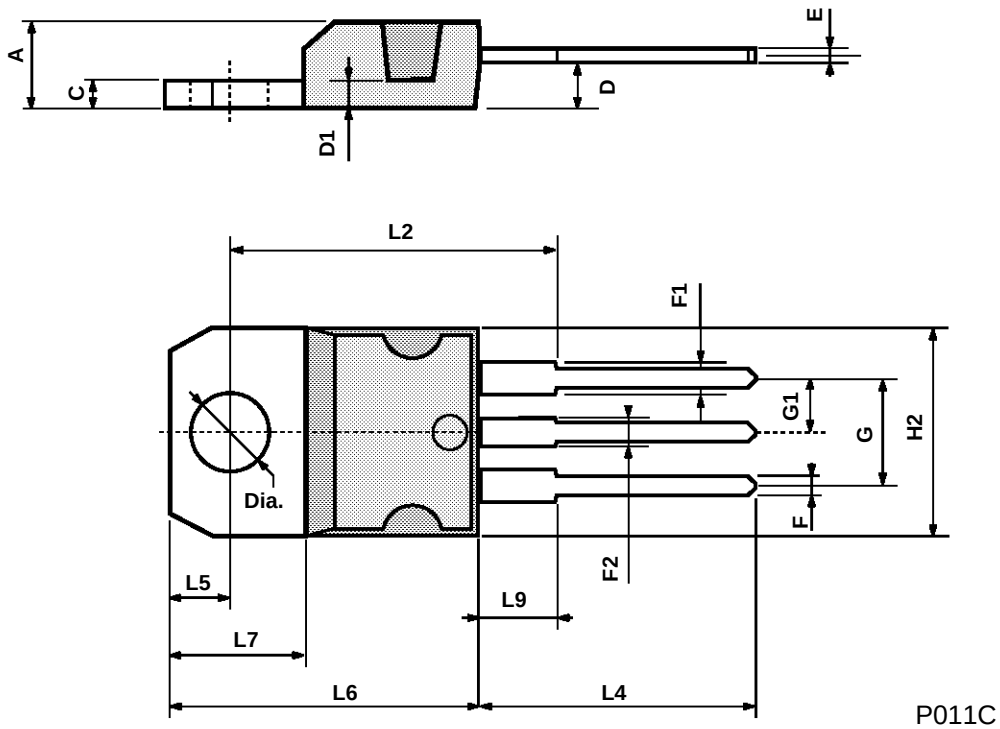



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



## TO-220 MECHANICAL DATA

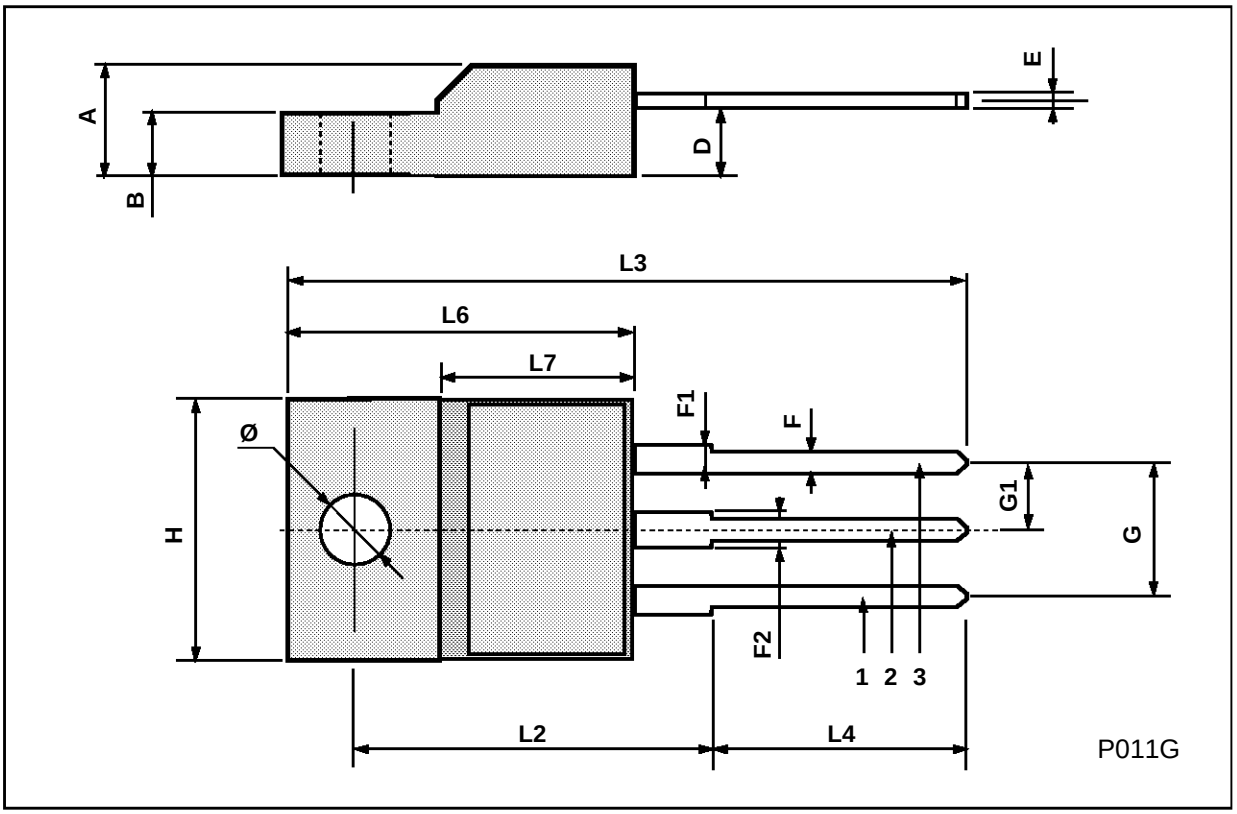
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 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 |




P011C

## 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 |



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