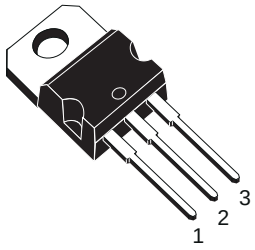
# STP14NF12
# STP14NF12FP

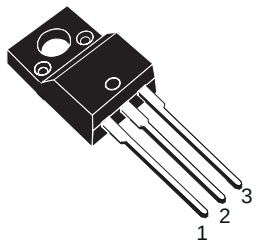
## N-CHANNEL 120V - 0.16Ω - 14A TO-220/TO-220FP
## LOW GATE CHARGE STripFET™ POWER MOSFET

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STP14NF12 | 120 V | < 0.18 Ω | 14 A |
| STP14NF12FP | 120 V | < 0.18 Ω | 14 A |

- TYPICAL $R_{DS}(on)$ = 0.16Ω
- EXCEPTIONAL dv/dt CAPABILITY
- APPLICATION ORIENTED CHARACTERIZATION




**TO-220**

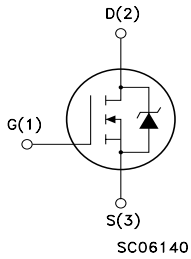



**TO-220FP**

### DESCRIPTION

This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer application. It is also intended for any application with low gate charge drive requirements

### INTERNAL SCHEMATIC DIAGRAM




### APPLICATIONS

- HIGH-EFFICIENCY DC-DC CONVERTERS
- UPS AND MOTOR CONTROL

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | STP14NF12 | STP14NF12FP | |
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 120 | | V |
| $V_{DGR}$ | Drain-gate Voltage ($R_{GS}$ = 20 kΩ) | 120 | | V |
| $V_{GS}$ | Gate- source Voltage | ±20 | | V |
| $I_D$ | Drain Current (continuous) at $T_C$ = 25°C | 14 | 8.5 | A |
| $I_D$ | Drain Current (continuous) at $T_C$ = 100°C | 9 | 6 | A |
| $I_{DM}$ (●) | Drain Current (pulsed) | 56 | 34 | A |
| $P_{TOT}$ | Total Dissipation at $T_C$ = 25°C | 60 | 25 | W |
| | Derating Factor | 0.4 | 0.17 | W/°C |
| dv/dt (1) | Peak Diode Recovery voltage slope | 9 | | V/ns |
| $E_{AS}$ (2) | Single Pulse Avalanche Energy | 60 | | mJ |
| $V_{ISO}$ | Insulation Withstand Voltage (DC) | - | 2500 | V |
| $T_j$ | Operating Junction Temperature | -55 to 175 | | °C |
| $T_{stg}$ | Storage Temperature | | | |

(●) Pulse width limited by safe operating area

(1) $I_{SD}$ ≤14A, di/dt ≤300A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_j$ ≤ $T_{JMAX.}$
(2) Starting $T_j$ = 25°C, $I_D$ = 14A, $V_{DD}$ = 50V

## THERMAL DATA

| | | TO-220 | TO-220FP | |
|---|---|---|---|---|
| Rthj-case | Thermal Resistance Junction-case Max | 2.5 | 6 | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | | °C/W |
| $T_l$ | Maximum Lead Temperature For Soldering Purpose | 300 | | °C |

## ELECTRICAL CHARACTERISTICS ($T_{CASE}$ = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D$ = 250 µA, $V_{GS}$ = 0 | 120 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS}$ = 0) | $V_{DS}$ = Max Rating | | | 1 | µA |
| | | $V_{DS}$ = Max Rating, $T_C$ = 125 °C | | | 10 | µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ±20V | | | ±100 | nA |

ON (1)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS}$ = 10V, $I_D$ = 7 A | | 0.16 | 0.18 | Ω |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward Transconductance | $V_{DS}$ = 15V , $I_D$ = 7 A | | 4 | | S |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, f = 1 MHz, $V_{GS}$ = 0 | | 460 | | pF |
| $C_{oss}$ | Output Capacitance | | | 70 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 30 | | pF |

**ELECTRICAL CHARACTERISTICS** (CONTINUED)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$ = 50 V, $I_D$ = 7 A | | 16 | | ns |
| $t_r$ | Rise Time | $R_G$ = 4.7Ω $V_{GS}$ = 10V (Resistive Load, see Figure 3) | | 25 | | ns |
| $Q_g$ | Total Gate Charge | $V_{DD}$ = 80 V, $I_D$ = 14 A, | | 15.5 | 21 | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{GS}$ = 10V | | 3.7 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 4.7 | | nC |

SWITCHING OFF

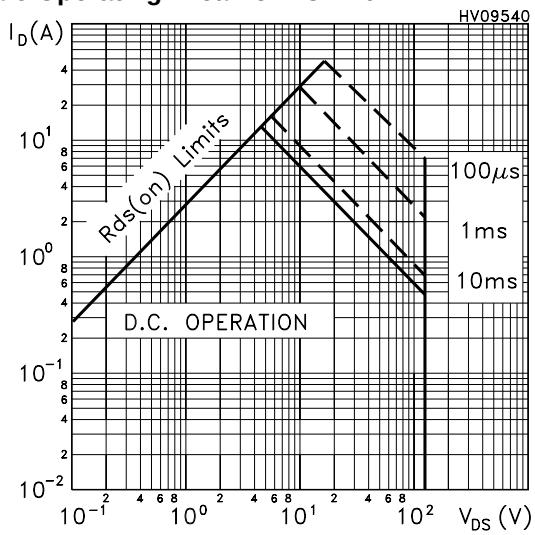
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(off)}$ | Turn-off-Delay Time | $V_{DD}$ = 50 V, $I_D$ = 7 A, | | 32 | | ns |
| $t_f$ | Fall Time | $R_G$ = 4.7Ω, $V_{GS}$ = 10V (Resistive Load, see Figure 3) | | 8 | | ns |

SOURCE DRAIN DIODE

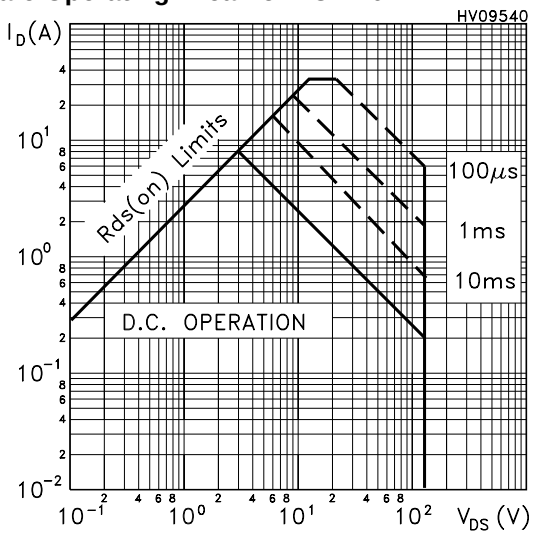
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain Current | | | | 14 | A |
| $I_{SDM}$ (2) | Source-drain Current (pulsed) | | | | 56 | A |
| $V_{SD}$ (1) | Forward On Voltage | $I_{SD}$ = 14 A, $V_{GS}$ = 0 | | | 1.5 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 14 A, di/dt = 100A/µs, | | 92 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | $V_{DD}$ = 50 V, $T_j$ = 150°C | | 230 | | nC |
| $I_{RRM}$ | Reverse Recovery Current | (see test circuit, Figure 5) | | 5 | | A |

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

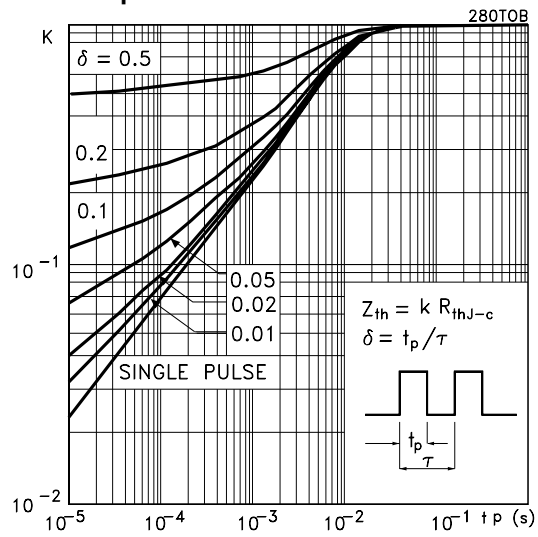
**Safe Operating Area For TO-220**



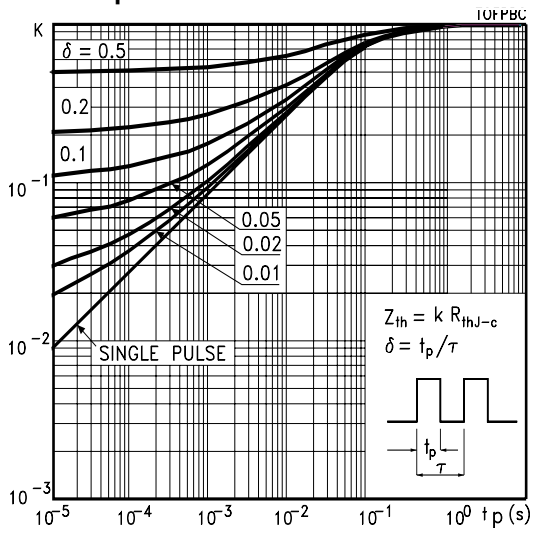

**Safe Operating Area For TO-220FP**



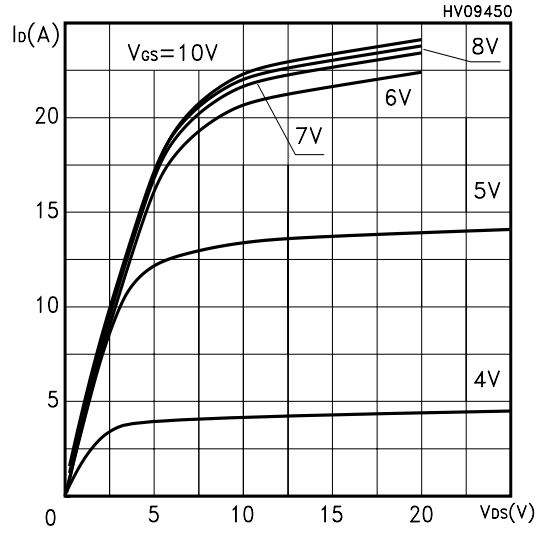
### Thermal Impedance For TO-220



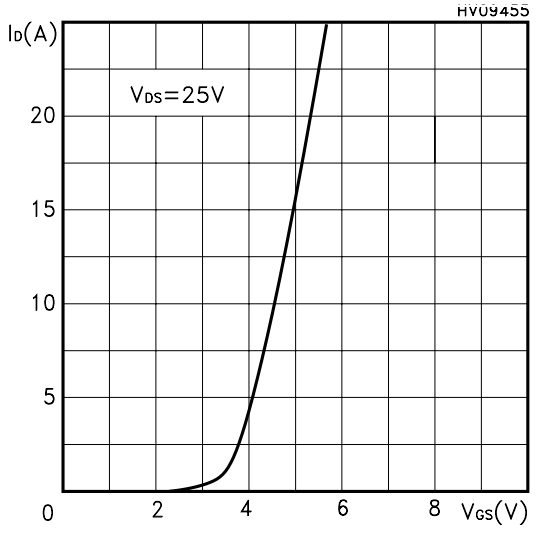

### Thermal Impedance For TO-220FP



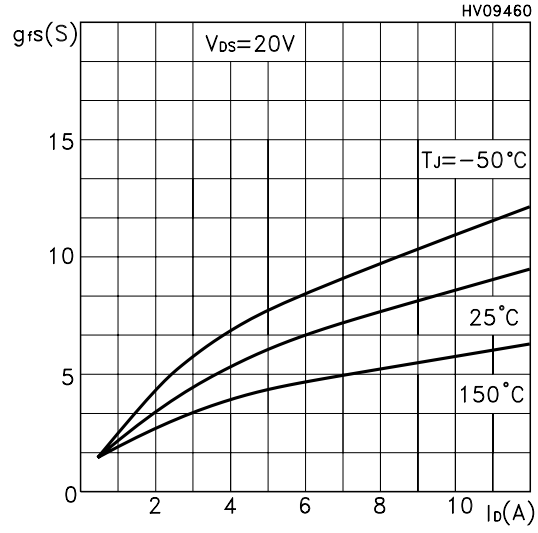

### Output Characteristics



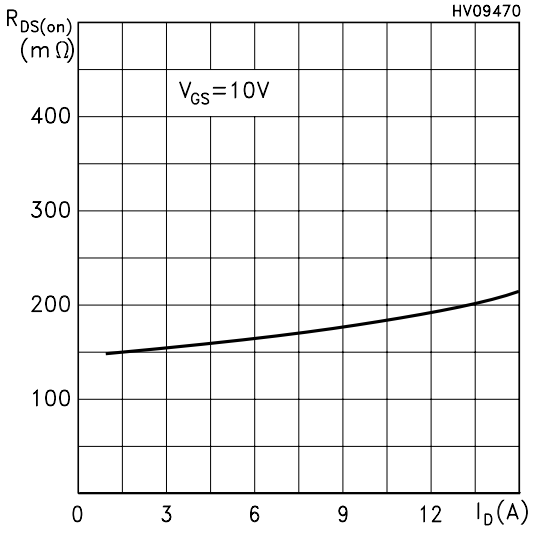

### Transfer Characteristics



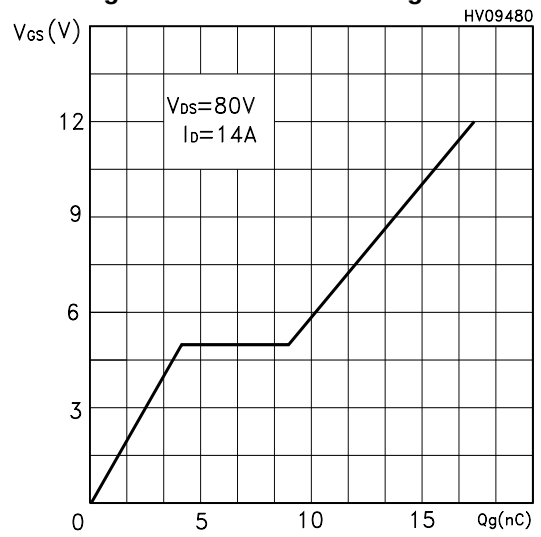

### Transconductance



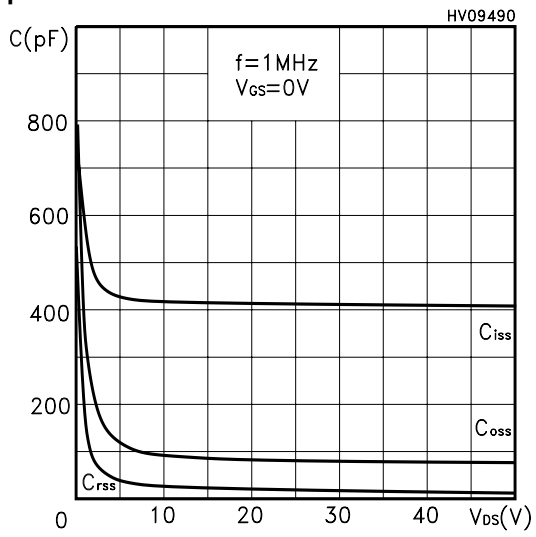

### Static Drain-source On Resistance



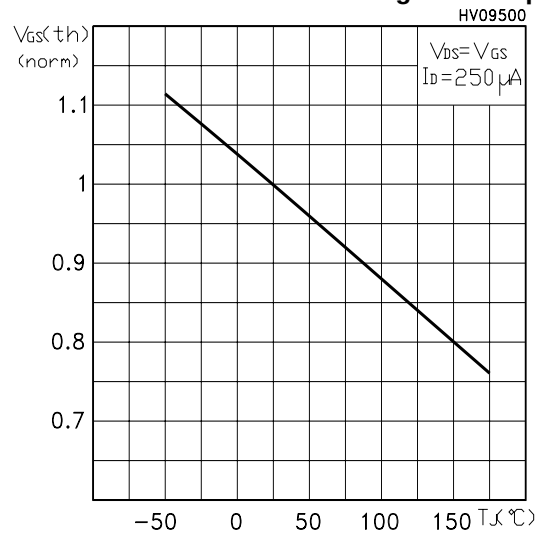
### Gate Charge vs Gate-source Voltage



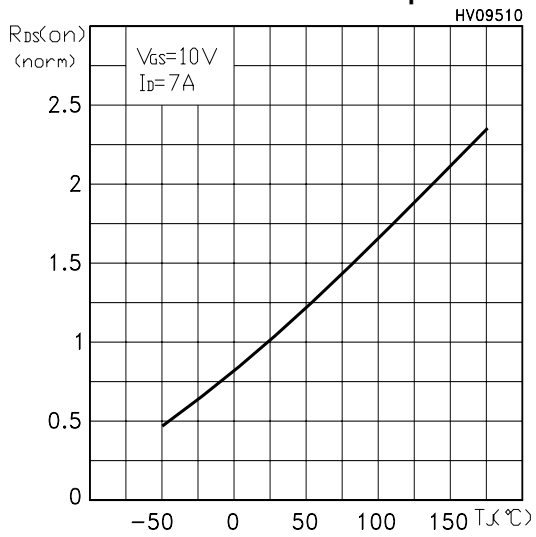

### Capacitance Variations



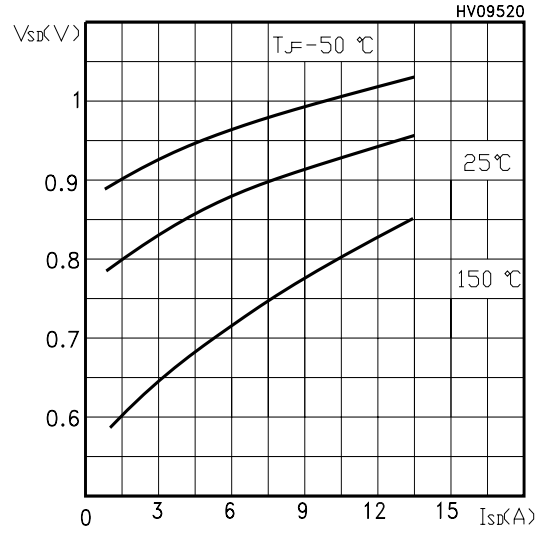

### Normalized Gate Threshold Voltage vs Temp.




### Normalized On Resistance vs Temperature




### Source-drain Diode Forward Characteristics




### Normalized BVDSS vs Temperature

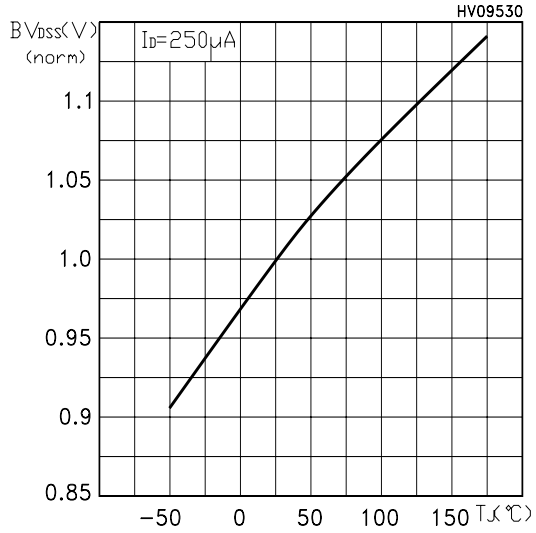


**Fig. 1:** Unclamped Inductive Load Test Circuit

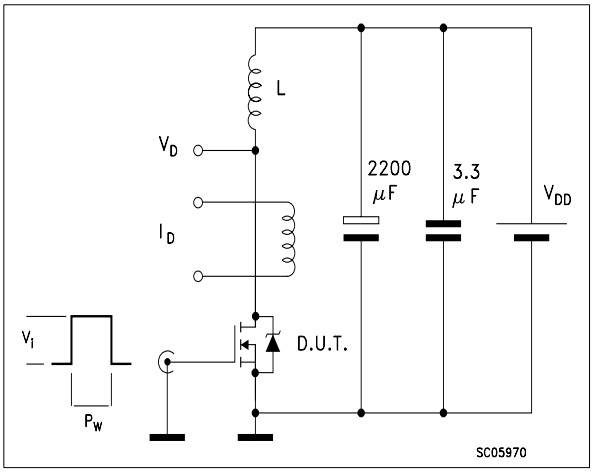



**Fig. 2:** Unclamped Inductive Waveform

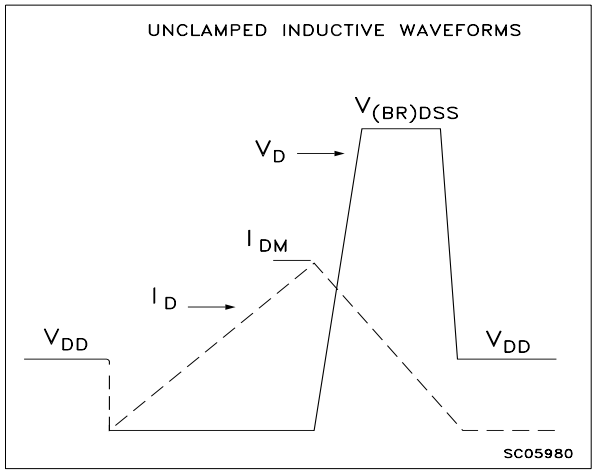



**Fig. 3:** Switching Times Test Circuit For Resistive Load

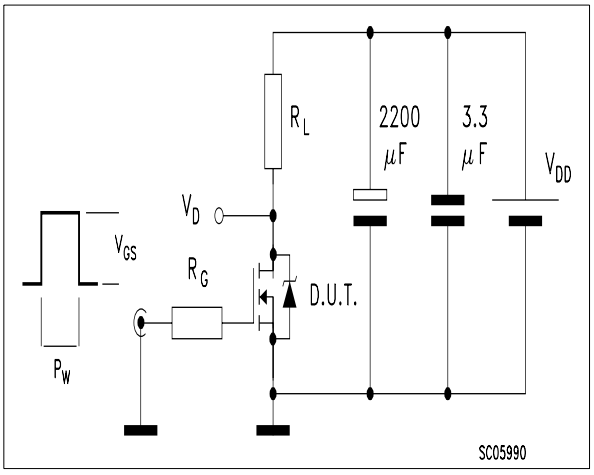



**Fig. 4:** Gate Charge test Circuit

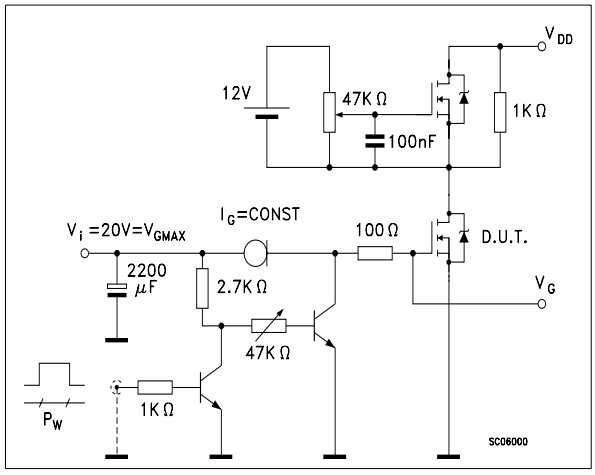
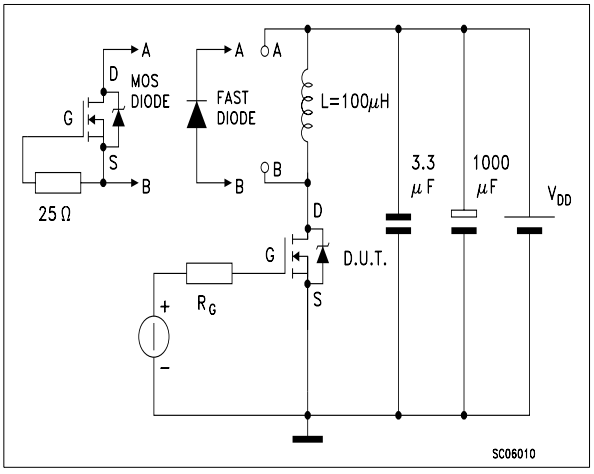
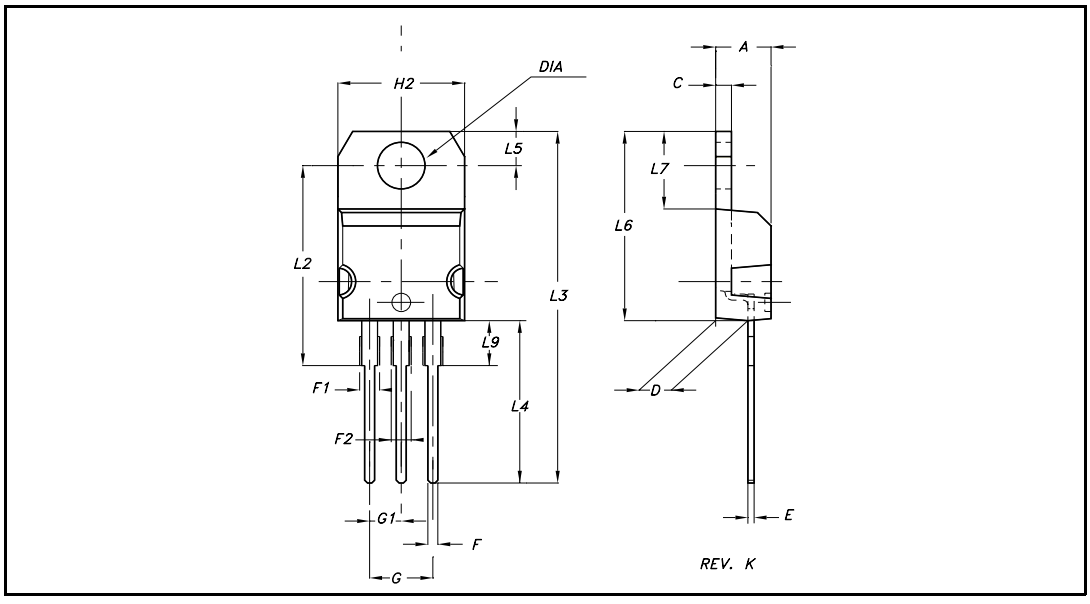



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



# 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 |
| 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 | | 0.066 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| G | 4.95 | | 5.15 | 0.194 | | 0.202 |
| G1 | 2.40 | | 2.70 | 0.094 | | 0.106 |
| H2 | 10 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.40 | | | 0.645 | |
| L3 | | 28.90 | | | 1.137 | |
| L4 | 13 | | 14 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.20 | | 6.60 | 0.244 | | 0.259 |
| L9 | 3.50 | | 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 |