



# STP14NF12 STP14NF12FP

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

| TYPE        | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-------------|------------------|---------------------|----------------|
| STP14NF12   | 120 V            | < 0.18 Ω            | 14 A           |
| STP14NF12FP | 120 V            | < 0.18 Ω            | 14 A           |

- TYPICAL R<sub>DS(on)</sub> = 0.16Ω
- EXCEPTIONAL dv/dt CAPABILITY
- APPLICATION ORIENTED CHARACTERIZATION

## 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

## APPLICATIONS

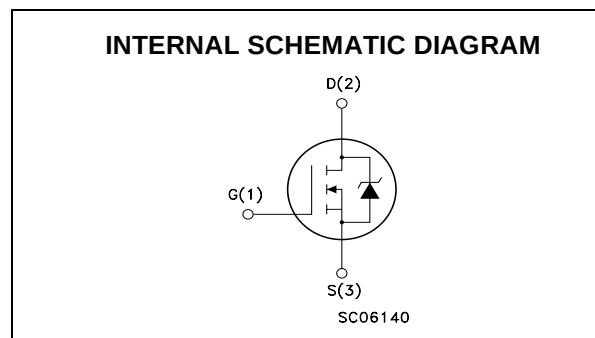
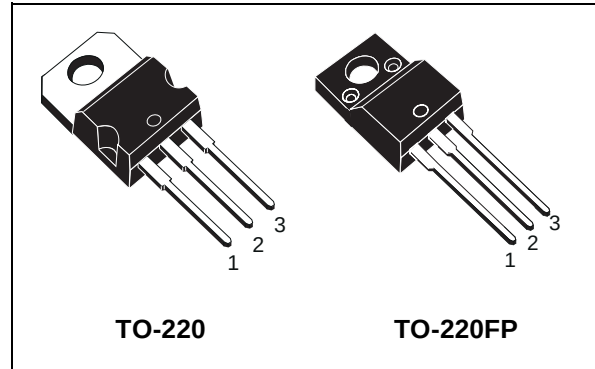
- HIGH-EFFICIENCY DC-DC CONVERTERS
- UPS AND MOTOR CONTROL

## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                            | Value      |             | Unit |
|---------------------|------------------------------------------------------|------------|-------------|------|
|                     |                                                      | STP14NF12  | STP14NF12FP |      |
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 120        |             | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 120        |             | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ±20        |             | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 14         | 8.5         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 9          | 6           | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 56         | 34          | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 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 <sub>AS</sub> (2) | Single Pulse Avalanche Energy                        | 60         |             | mJ   |
| V <sub>ISO</sub>    | Insulation Withstand Voltage (DC)                    | -          | 2500        | V    |
| T <sub>j</sub>      | Operating Junction Temperature                       | -55 to 175 |             | °C   |
| T <sub>stg</sub>    | Storage Temperature                                  |            |             |      |

(●) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 14A, di/dt ≤ 300A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.  
(2) Starting T<sub>j</sub> = 25°C, I<sub>D</sub> = 14A, V<sub>DD</sub> = 50V



## STP14NF12/STP14NF12FP

### THERMAL DATA

|                       |                                                | TO-220 | TO-220FP |      |
|-----------------------|------------------------------------------------|--------|----------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case Max           | 2.5    | 6        | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient Max        | 62.5   |          | °C/W |
| T <sub>I</sub>        | Maximum Lead Temperature For Soldering Purpose | 300    |          | °C   |

### 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                                          | 120  |      |         | 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>10 | µA<br>µA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±20V                                                                |      |      | ±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> = 7 A                |      | 0.16 | 0.18 | Ω    |

### DYNAMIC

| Symbol              | Parameter                    | Test Conditions                                       | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|-------------------------------------------------------|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance     | V <sub>DS</sub> = 15V, I <sub>D</sub> = 7 A           |      | 4    |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0 |      | 460  |      | pF   |
| C <sub>oss</sub>    | Output Capacitance           |                                                       |      | 70   |      | pF   |
| C <sub>rss</sub>    | 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                                           | $V_{DD} = 50\text{ V}$ , $I_D = 7\text{ A}$                                  |      | 16                 |      | ns             |
| $t_r$                         | Rise Time                                                    | $R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$<br>(Resistive Load, see Figure 3) |      | 25                 |      | ns             |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 80\text{ V}$ , $I_D = 14\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$     |      | 15.5<br>3.7<br>4.7 | 21   | nC<br>nC<br>nC |

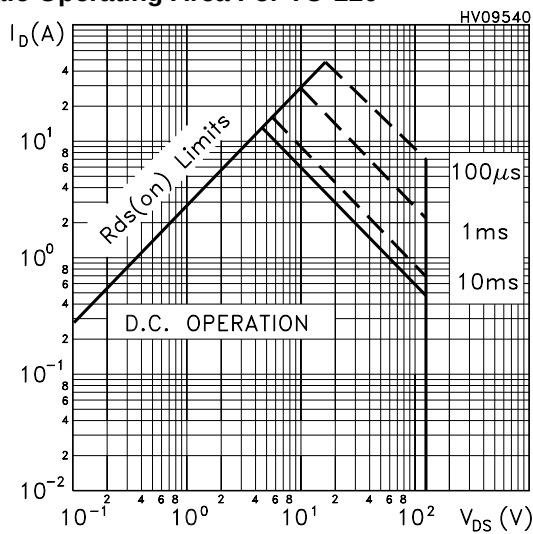
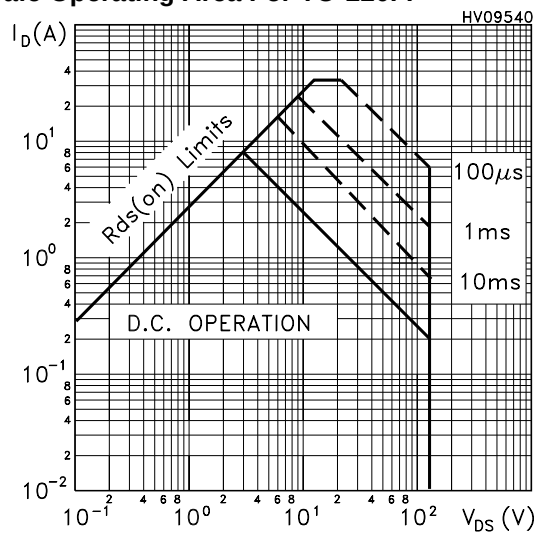
**SWITCHING OFF**

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

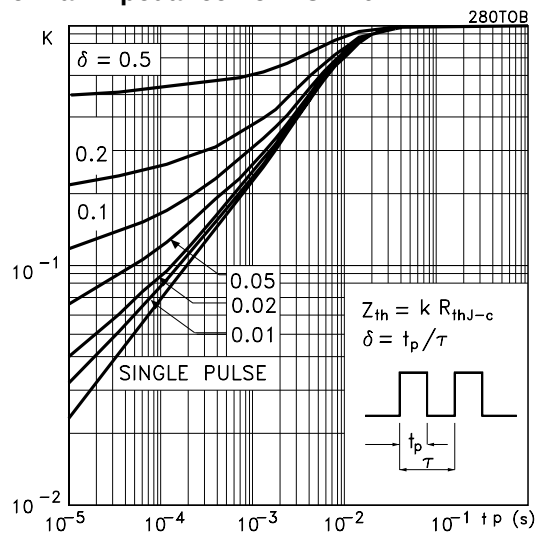
**SOURCE DRAIN DIODE**

| 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                                                           | $I_{SD} = 14\text{ A}$ , $V_{GS} = 0$                                                                                                               |      |                | 1.5  | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 14\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 50\text{ V}$ , $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 92<br>230<br>5 |      | ns<br>nC<br>A |

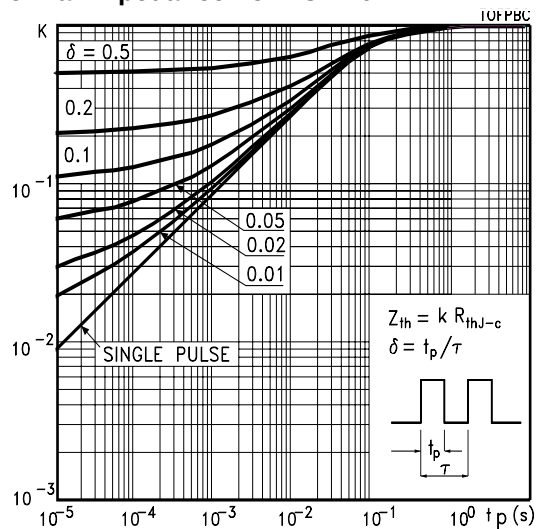
Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

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

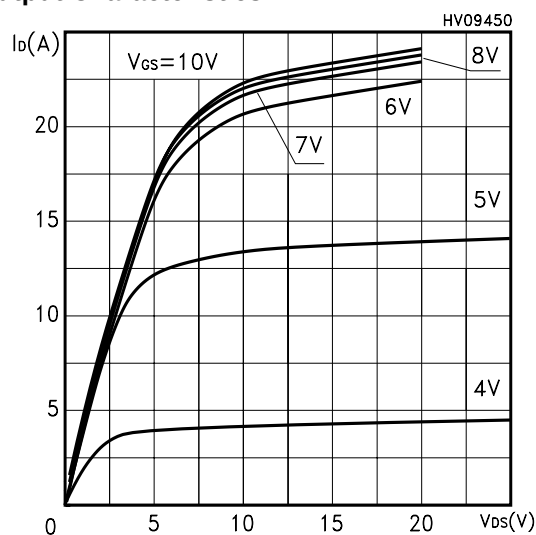
Thermal Impedance For TO-220



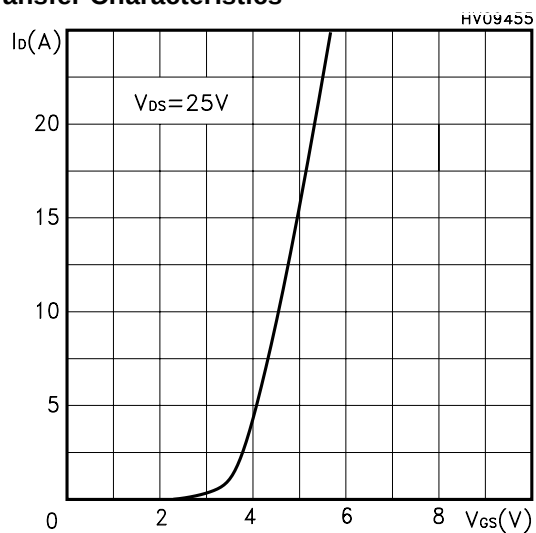
Thermal Impedance For TO-220FP



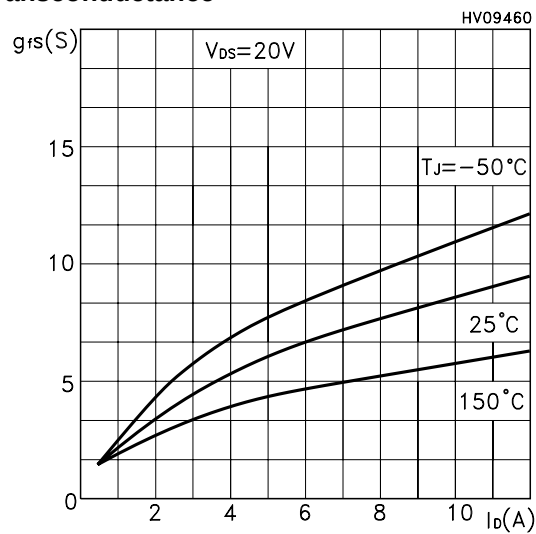
Output Characteristics



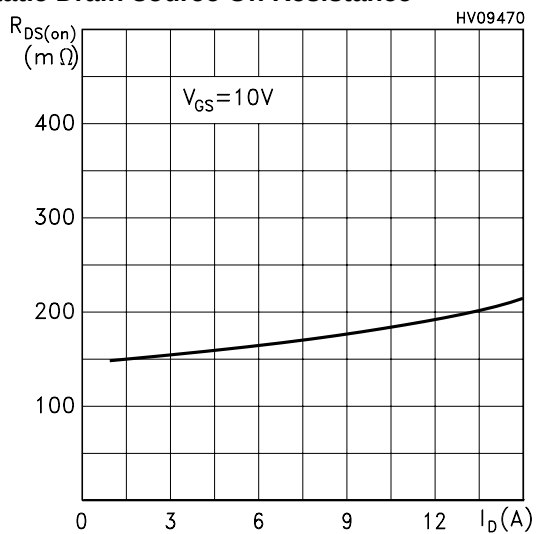
Transfer Characteristics



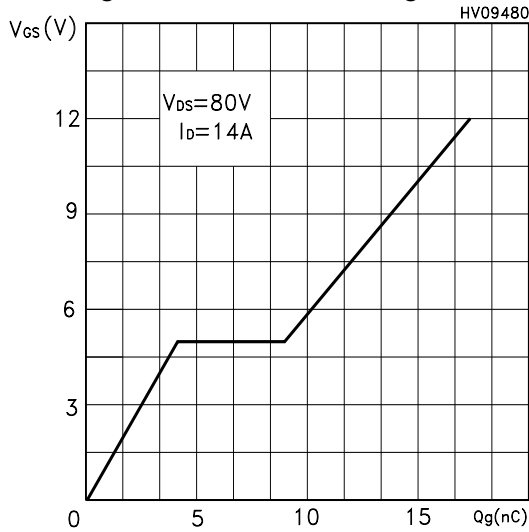
Transconductance



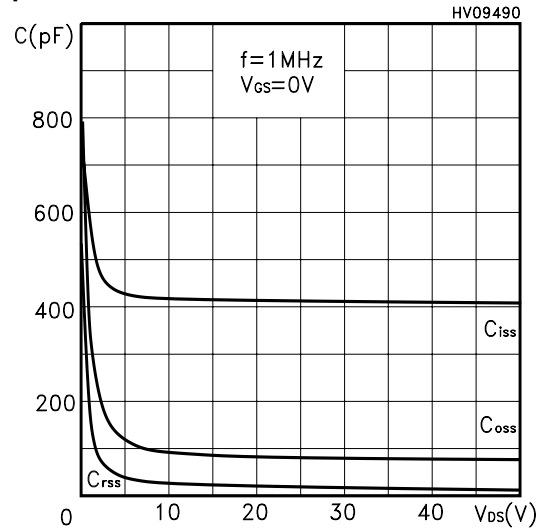
Static Drain-source On Resistance



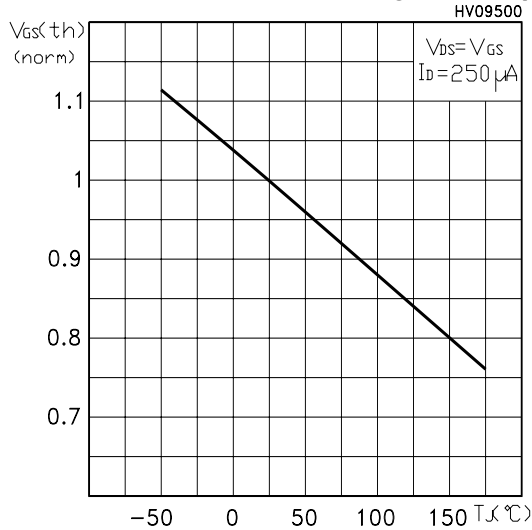
Gate Charge vs Gate-source Voltage



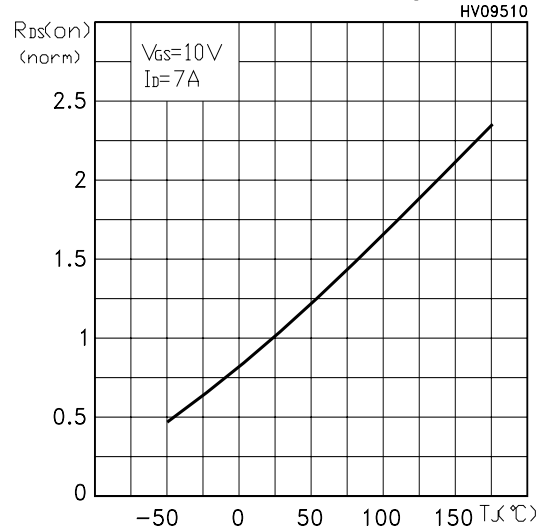
Capacitance Variations



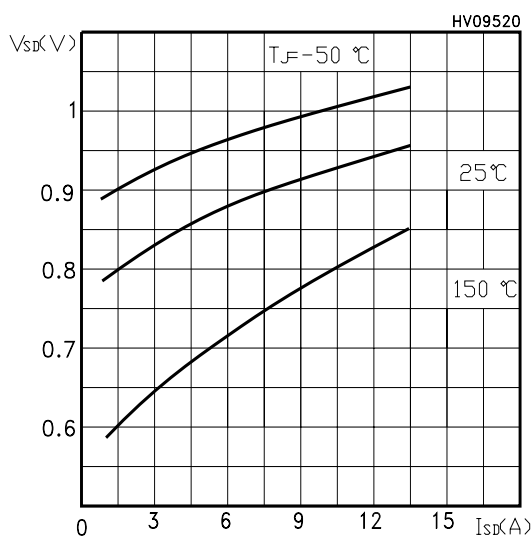
Normalized Gate Threshold Voltage vs Temp.



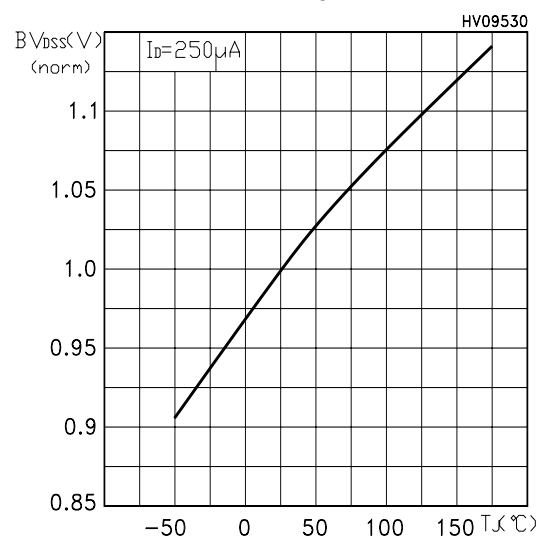
Normalized On Resistance vs Temperature



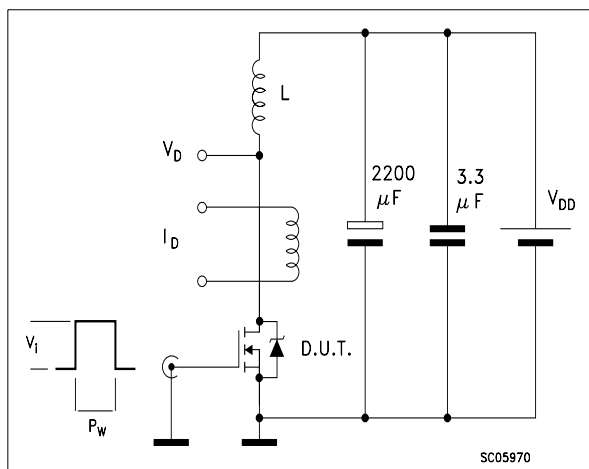
Source-drain Diode Forward Characteristics



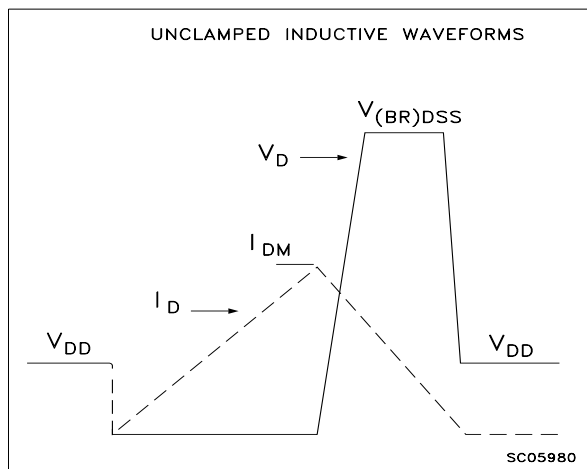
Normalized BVDSS vs Temperature



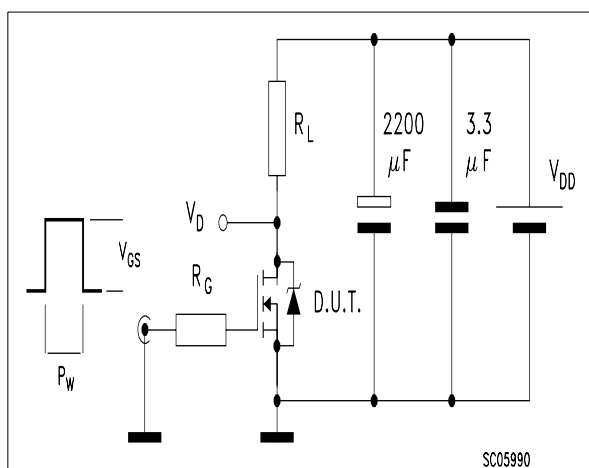
**Fig. 1: Unclamped Inductive Load Test Circuit**



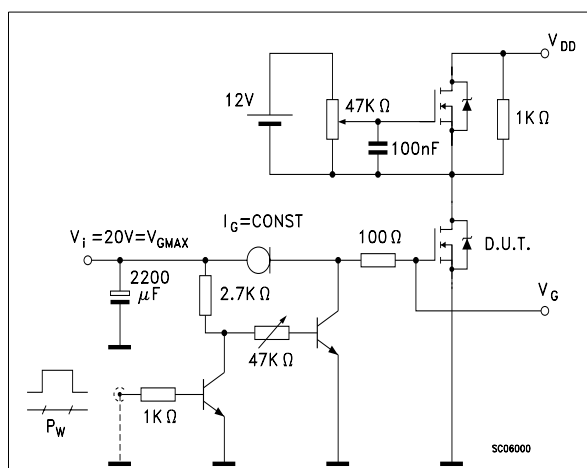
**Fig. 2: Unclamped Inductive Waveform**



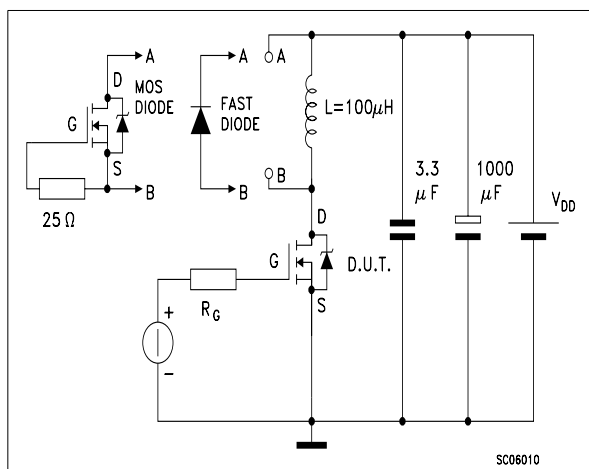
**Fig. 3: Switching Times Test Circuit For Resistive Load**



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

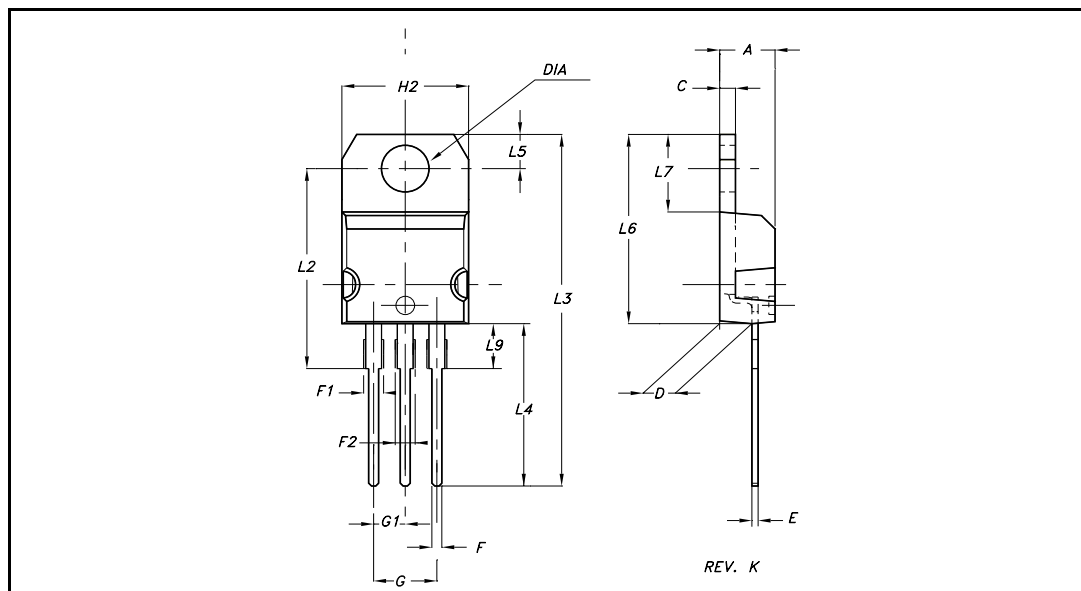


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



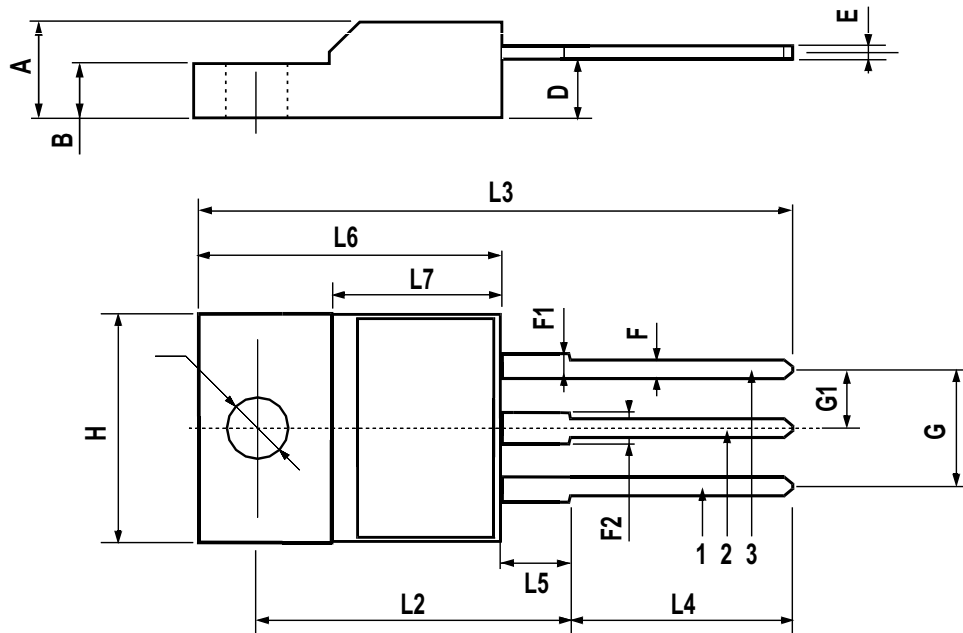
## TO-220 MECHANICAL DATA

| 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 |





Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2002 STMicroelectronics - Printed in Italy - All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco  
Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

© <http://www.st.com>