



# STP60NF06 STP60NF06FP

N-CHANNEL 60V - 0.014Ω - 60A TO-220/TO-220FP  
STripFET™ POWER MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP60NF06	60 V	< 0.016 Ω	60A
STP60NF06FP	60 V	< 0.016 Ω	60A

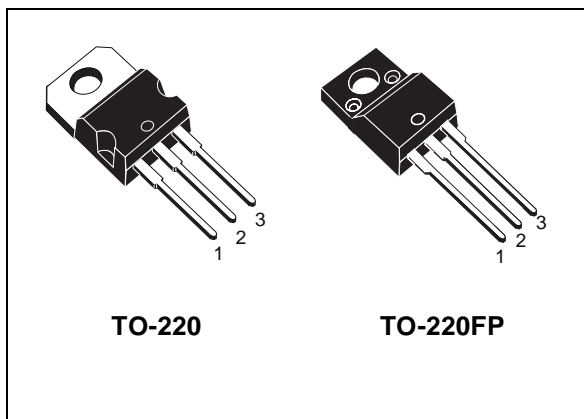
- TYPICAL R<sub>DS(on)</sub> = 0.014Ω
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- APPLICATION ORIENTED CHARACTERIZATION

## 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

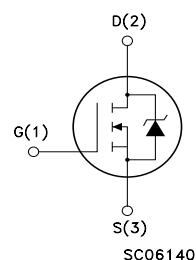
- HIGH-EFFICIENCY DC-DC CONVERTERS
- UPS AND MOTOR CONTROL
- AUTOMOTIVE



TO-220

TO-220FP

## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP60NF06	STP60NF06FP	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	60		V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	60		V
V <sub>GS</sub>	Gate- source Voltage	± 20		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	60	37	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	42	26	A
I <sub>DM</sub> (●)	Drain Current (pulsed)	240	148	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	110	42	W
	Derating Factor	0.73	0.28	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	4		V/ns
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	--	2500	V
T <sub>stg</sub>	Storage Temperature	-65 to 175		°C
T <sub>j</sub>	Max. Operating Junction Temperature			

(●) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 60A, di/dt ≤ 400 A/μs, V<sub>DD</sub> ≤ 24V, T<sub>j</sub> ≤ T<sub>JMAX</sub>

January 2002

1/9

**STP60NF06 - STP60NF06FP****THERMAL DATA**

			TO-220	TO-220FP	
Rthj-case	Thermal Resistance Junction-case	Max	1.36	3.57	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	Max	62.5		°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)	30	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> = 30 V)	360	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	60			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			1 10	μA 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		4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 30 A		0.014	0.016	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> = 30 A		20		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		1810		pF
C <sub>oss</sub>	Output Capacitance			360		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			125		pF

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 30\text{ V}$ , $I_D = 30\text{ A}$		16		ns
$t_r$	Rise Time	$R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$ (see test circuit, Figure 3)		108		ns
$Q_g$	Total Gate Charge	$V_{DD} = 48\text{ V}$ , $I_D = 60\text{ A}$ , $V_{GS} = 10\text{ V}$		49	66	nC
$Q_{gs}$	Gate-Source Charge			18		nC
$Q_{gd}$	Gate-Drain Charge			14		nC

## SWITCHING OFF

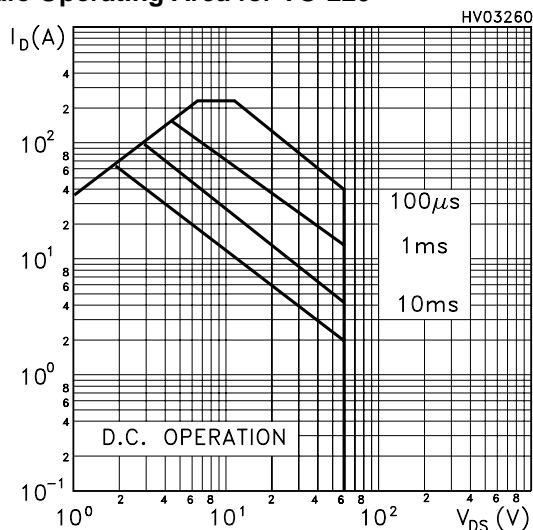
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off-Delay Time	$V_{DD} = 30\text{ V}$ , $I_D = 30\text{ A}$ ,		43		ns
$t_f$	Fall Time	$R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$ (see test circuit, Figure 3)		20		ns
$t_{d(off)}$	Off-voltage Rise Time	$V_{clamp} = 48\text{ V}$ , $I_D = 60\text{ A}$		40		ns
$t_f$	Fall Time	$R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$		12		ns
$t_c$	Cross-over Time	(see test circuit, Figure 3)		21		ns

## SOURCE DRAIN DIODE

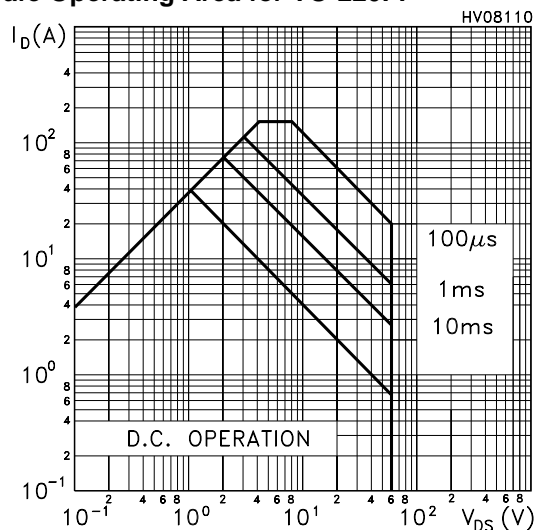
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				60	A
$I_{SDM(2)}$	Source-drain Current (pulsed)				240	A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 60\text{ A}$ , $V_{GS} = 0$			1.3	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 60\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,		73		ns
$Q_{rr}$	Reverse Recovery Charge	$V_{DD} = 25\text{ V}$ , $T_j = 150^\circ\text{C}$		182		nC
$I_{RRM}$	Reverse Recovery Current	(see test circuit, Figure 5)		5		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

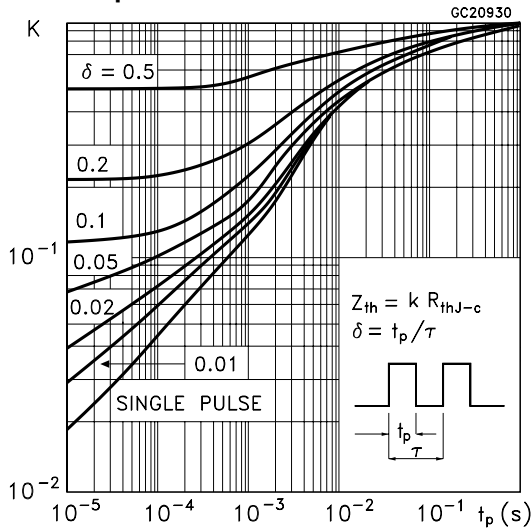


## Safe Operating Area for TO-220FP

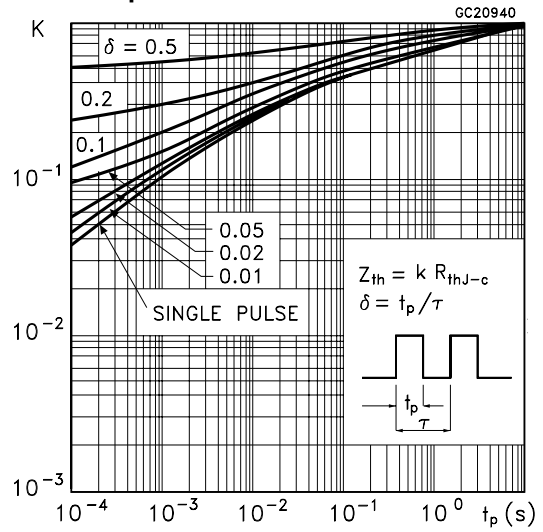


## STP60NF06 - STP60NF06FP

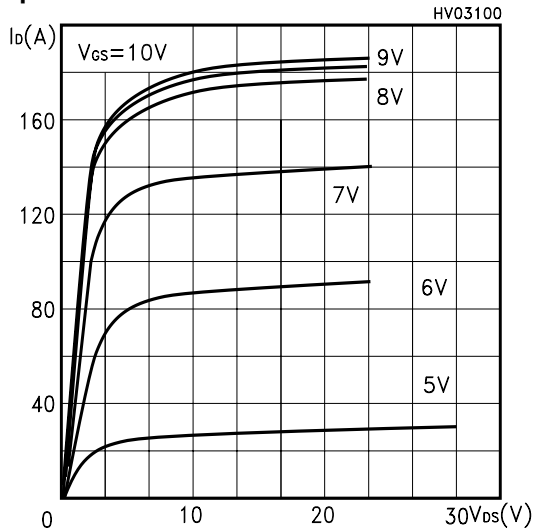
**Thermal Impedance for TO-220**



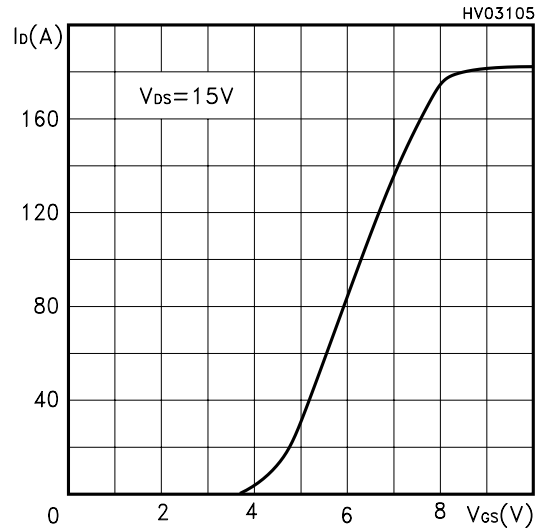
**Thermal Impedance for TO-220FP**



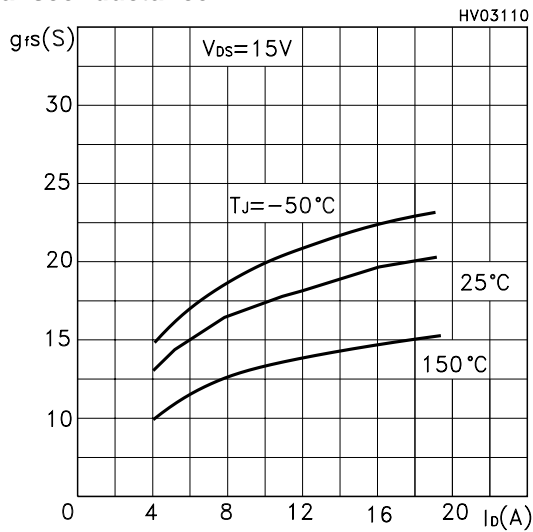
**Output Characteristics**



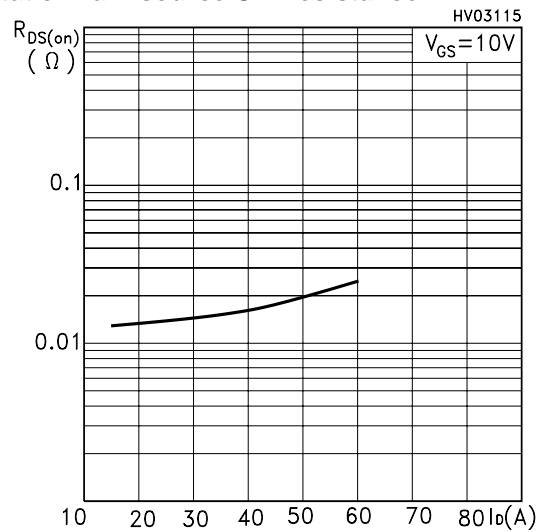
**Transfer Characteristics**



**Transconductance**

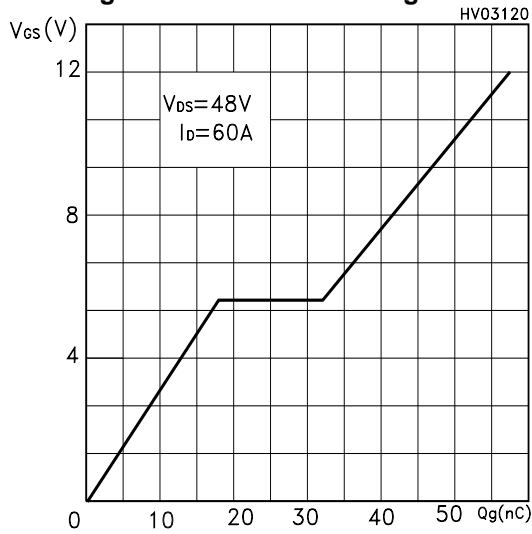


**Static Drain-source On Resistance**

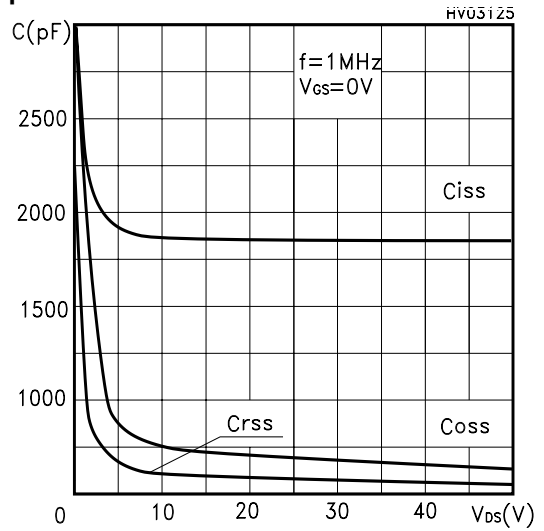


STP60NF06 - STP60NF06FP

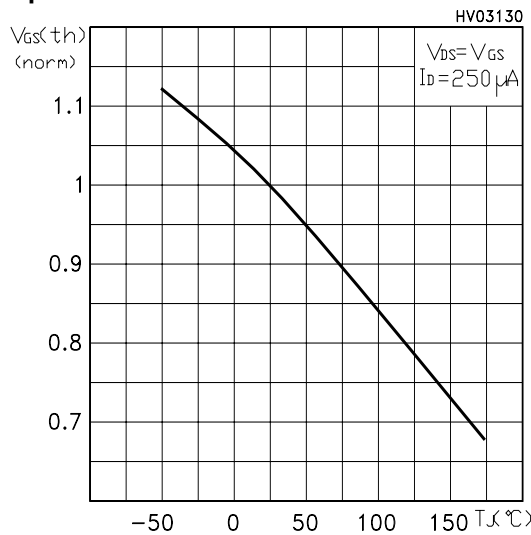
Gate Charge vs Gate-source Voltage



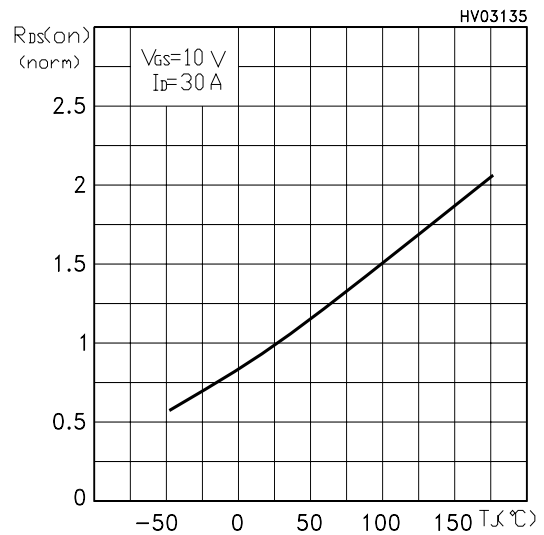
Capacitance Variations



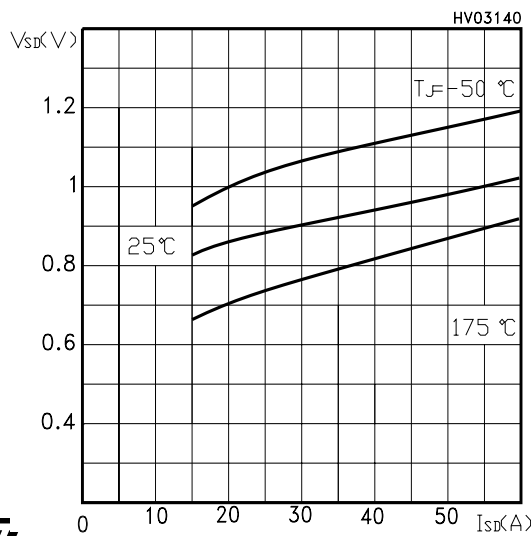
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature

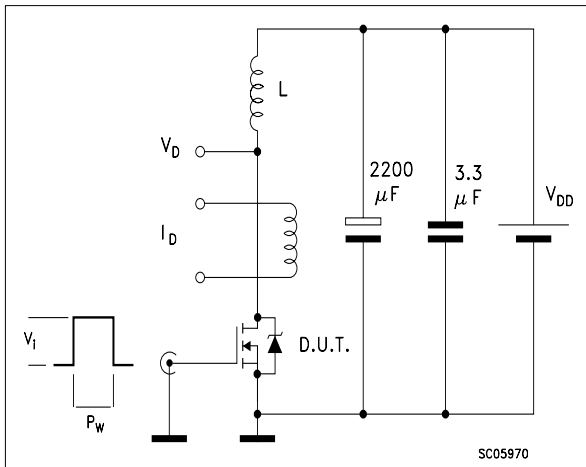


Source-drain Diode Forward Characteristics

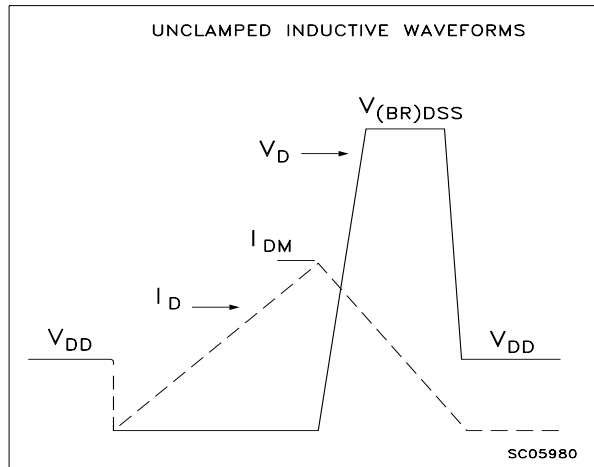


## STP60NF06 - STP60NF06FP

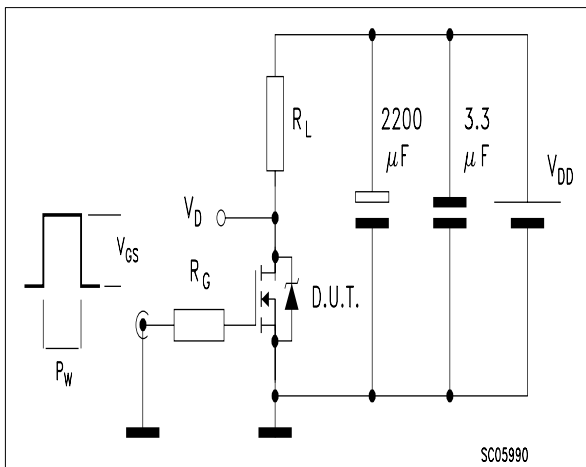
**Fig. 1: Unclamped Inductive Load Test Circuit**



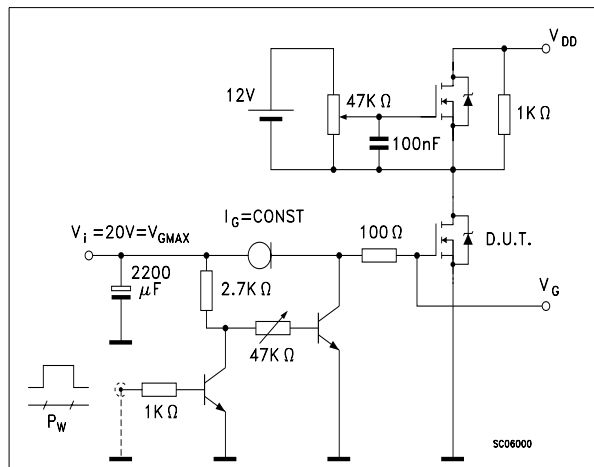
**Fig. 2: Unclamped Inductive Waveform**



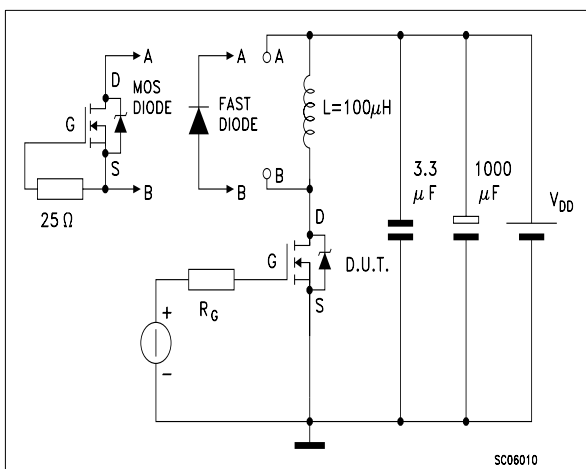
**Fig. 3: Switching Times Test Circuit For Resistive Load**



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

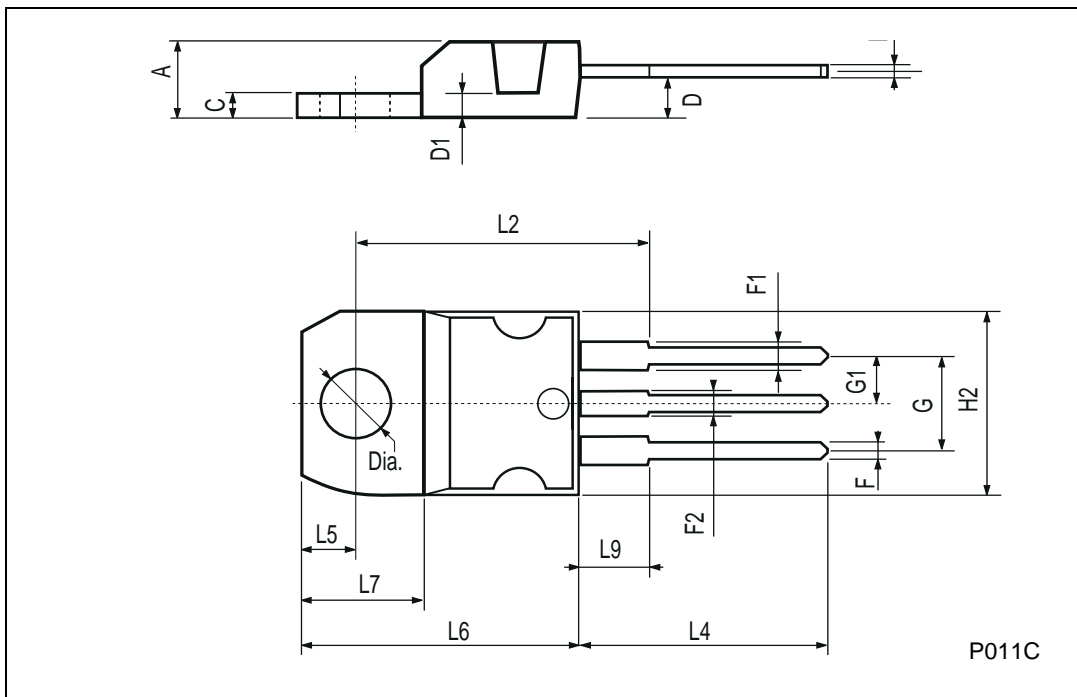


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



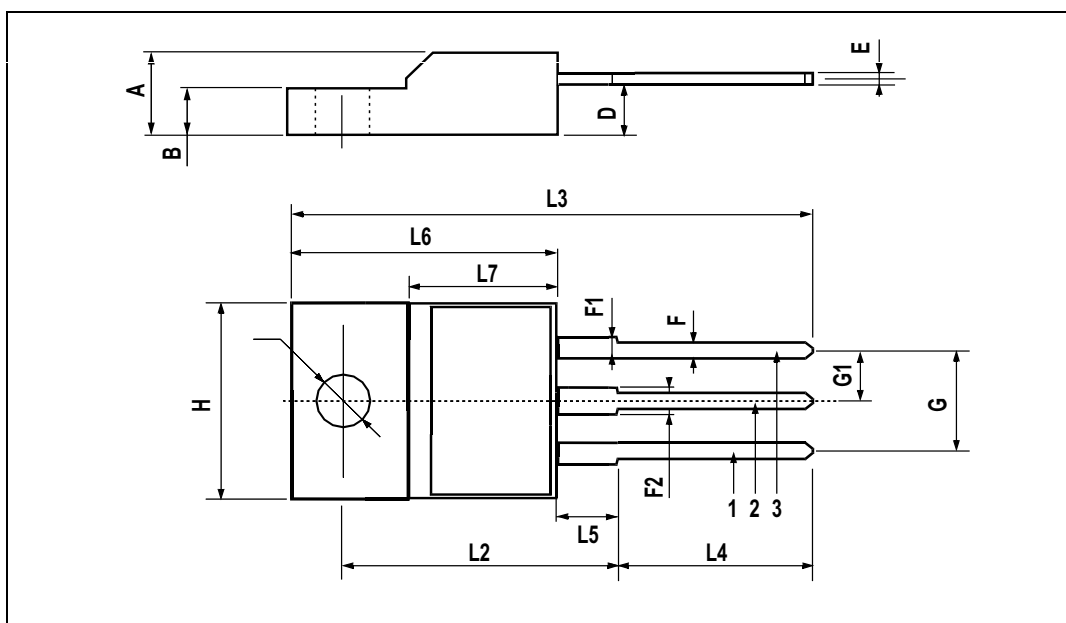
**TO-220 MECHANICAL DATA**

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
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



**STP60NF06 - STP60NF06FP****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





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