

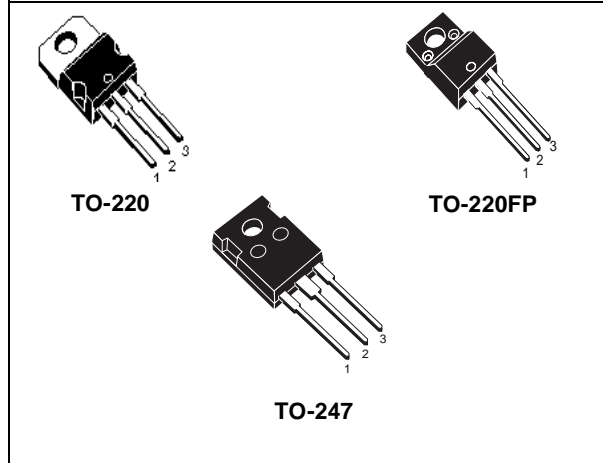


STP20NM60FD - STF20NM60D STW20NM60FD

N-CHANNEL 600V - 0.26Ω - 20A TO-220/TO-220FP/TO-247
FDmesh™ POWER MOSFET (with FAST DIODE)

TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STP20NM60FD	600 V	< 0.29 Ω	20 A	192 W
STF20NM60D	600 V	< 0.29 Ω	20 A	45 W
STW20NM60FD	600 V	< 0.29 Ω	20 A	214 W

- TYPICAL R_{DS(on)} = 0.26Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE
- TIGHT PROCESS CONTROL AND HIGH MANUFACTURING YIELDS



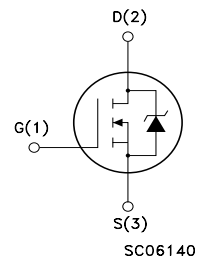
DESCRIPTION

The FDmesh™ associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

APPLICATIONS

- ZVS PHASE-SHIFT FULL BRIDGE CONVERTERS FOR SMPS AND WELDING EQUIPMENT

INTERNAL SCHEMATIC DIAGRAM



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP20NM60FD	P20NM60FD	TO-220	TUBE
STF20NM60D	F20NM60D	TO-220FP	TUBE
STW20NM60FD	W20NM60FD	TO-247	TUBE

STP20NM60FD - STF20NM60D - STW20NM60FD

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value			Unit
		STP20NM60FD	STF20NM60D	STW20NM60FD	
V_{DS}	Drain-source Voltage ($V_{GS} = 0$)	600			V
V_{DGR}	Drain-gate Voltage ($R_{GS} = 20 \text{ k}\Omega$)	600			V
V_{GS}	Gate- source Voltage	± 30			V
I_D	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	20	20 (*)	20	A
I_D	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	12.6	12.6 (*)	12.6	A
$I_{DM} (\bullet)$	Drain Current (pulsed)	80	80 (*)	80	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	192	45	214	W
	Derating Factor	1.20	0.36	1.42	W/ $^\circ\text{C}$
$dv/dt (1)$	Peak Diode Recovery voltage slope	20			V/ns
V_{ISO}	Insulation Withstand Voltage (DC)	-	2500	-	V
T_j T_{stg}	Operating Junction Temperature Storage Temperature	- 65 to 150			$^\circ\text{C}$ $^\circ\text{C}$

(\bullet) Pulse width limited by safe operating area

(1) $I_{SD} \leq 20 \text{ A}$, $di/dt \leq 400 \text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$.

(*) Limited only by maximum temperature allowed

THERMAL DATA

		TO-220	TO-220FP	TO-247	
Rthj-case	Thermal Resistance Junction-case Max	0.65	2.8	0.585	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5		30	$^\circ\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose	300			$^\circ\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	10	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 35 \text{ V}$)	700	mJ

STP20NM60FD - STF20NM60D - STW20NM60FD

ELECTRICAL CHARACTERISTICS (T_{CASE} = 25°C UNLESS OTHERWISE SPECIFIED) ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA, V _{GS} = 0	600			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating, T _C = 125 °C			1 10	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ±30V			±100	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	3	4	5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V, I _D = 10 A		0.26	0.29	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (1)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} , I _D = 10A		9		S
C _{iss} C _{oss} C _{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V _{DS} = 25V, f = 1 MHz, V _{GS} = 0		1310 580 30		pF pF pF
C _{oss} eq. (3)	Equivalent Output Capacitance	V _{GS} = 0V, V _{DS} = 0V to 480V		190		pF
R _G	Gate Input Resistance	f=1 MHz Gate DC Bias = 0 Test Signal Level = 20mV Open Drain		2.7		Ω

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{d(on)} t _r	Turn-on Delay Time Rise Time	V _{DD} = 300V, I _D = 10A R _G = 4.7Ω V _{GS} = 10V (Resistive Load see, Figure 3)		25 12		ns ns
Q _g Q _{gs} Q _{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V _{DD} = 480V, I _D = 20A, V _{GS} = 10V		37 10 17	52	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{r(Voff)} t _f t _c	Off-voltage Rise Time Fall Time Cross-over Time	V _{DD} = 480 V, I _D = 20A, R _G = 4.7Ω, V _{GS} = 10V (Inductive Load see, Figure 5)		8 22 30		ns ns ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I _{SD} I _{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				20 80	A A
V _{SD} (1)	Forward On Voltage	I _{SD} = 20 A, V _{GS} = 0			1.5	V
t _{rr} Q _{rr} I _{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I _{SD} = 20 A, di/dt = 100A/μs, V _{DD} = 60 V, T _j = 150°C (see test circuit, Figure 5)		340 2.8 17		ns μC A

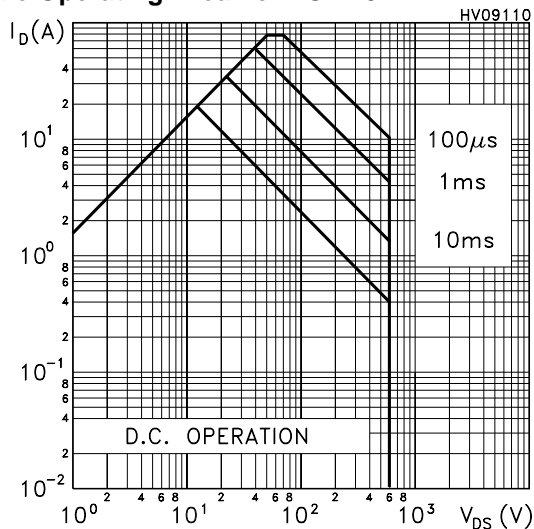
Note: 1. Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %.

2. Pulse width limited by safe operating area.

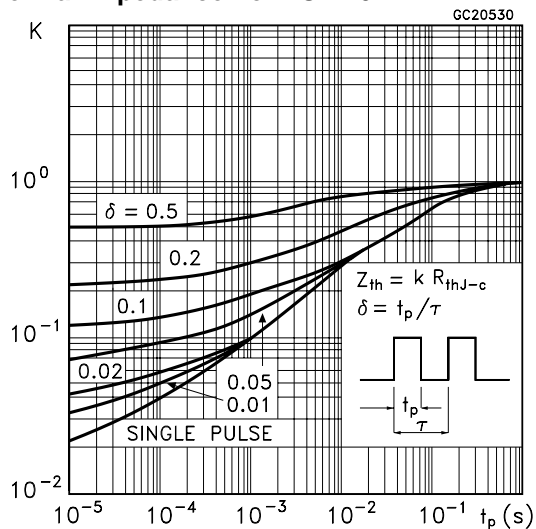
3. C_{oss} eq. is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80%



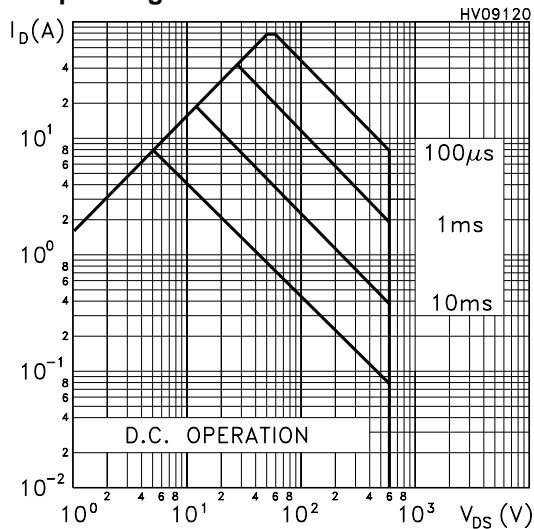
Safe Operating Area For TO-220



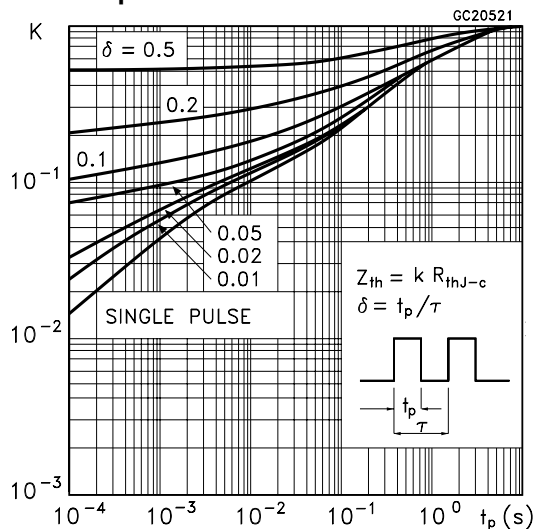
Thermal Impedance For TO-220



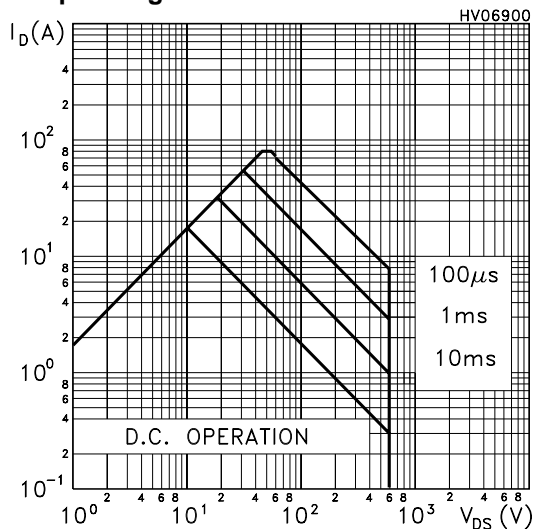
Safe Operating Area For TO-220FP



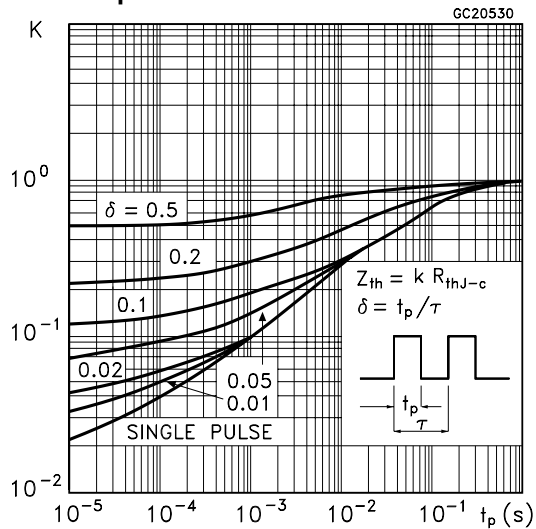
Thermal Impedance For TO-220FP



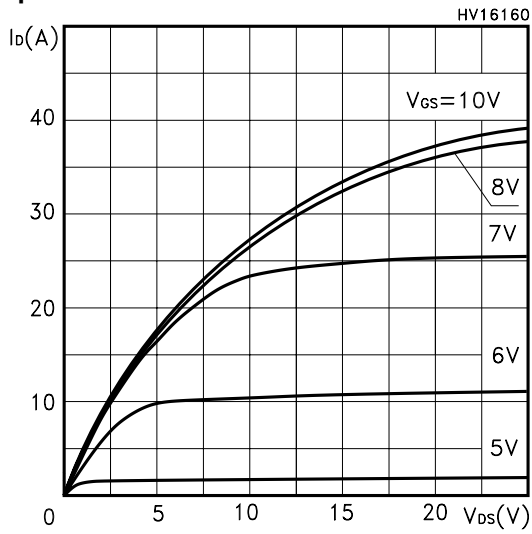
Safe Operating Area For TO-247



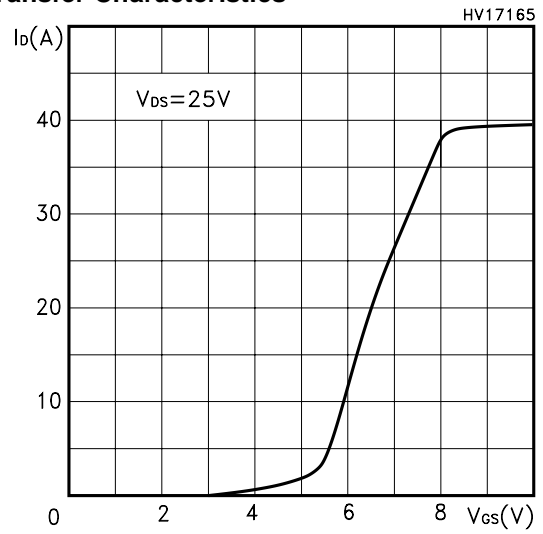
Thermal Impedance For TO-247



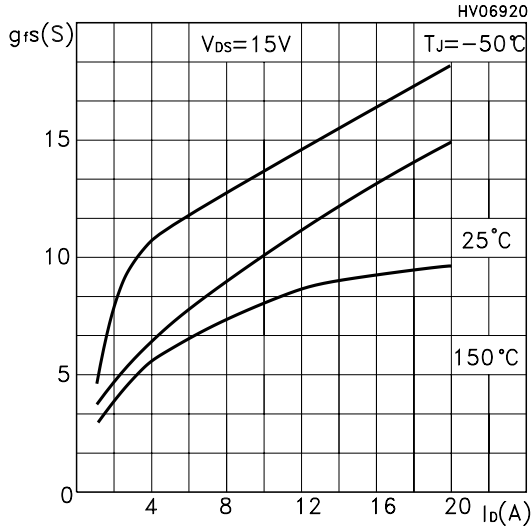
Output Characteristics



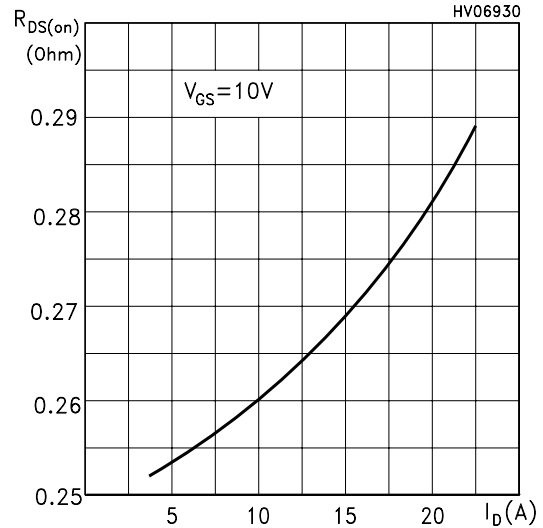
Transfer Characteristics



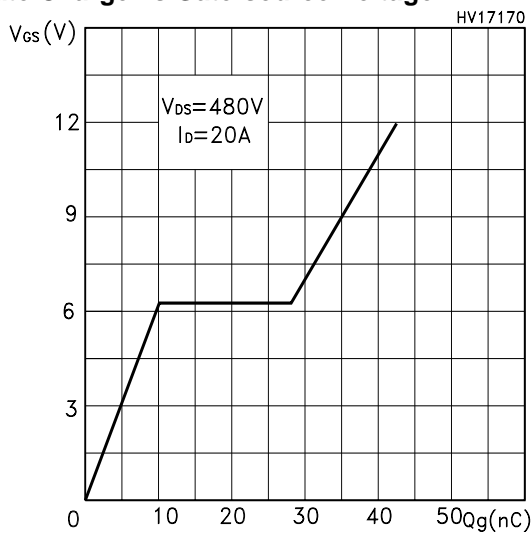
Transconductance



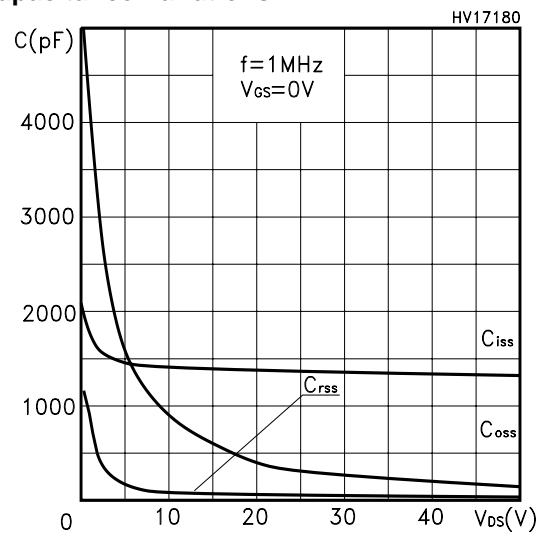
Static Drain-source On Resistance



Gate Charge vs Gate-source Voltage

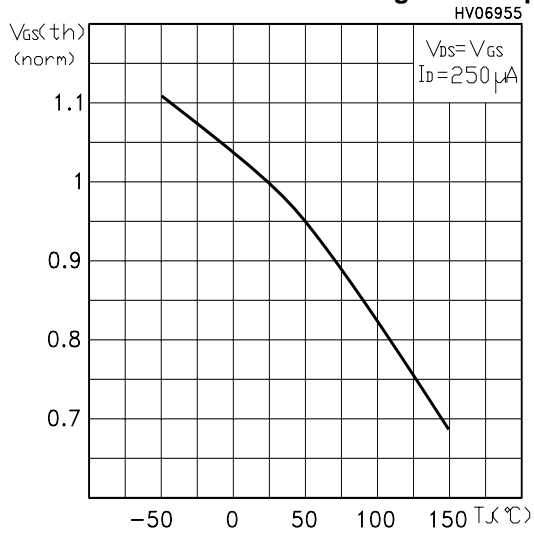


Capacitance Variations

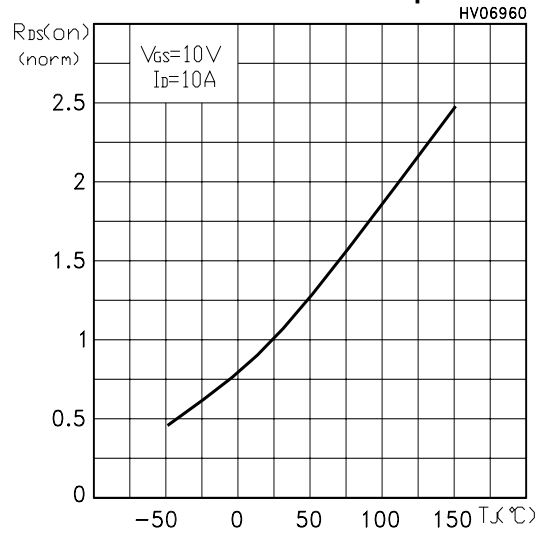


STP20NM60FD - STF20NM60D - STW20NM60FD

Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

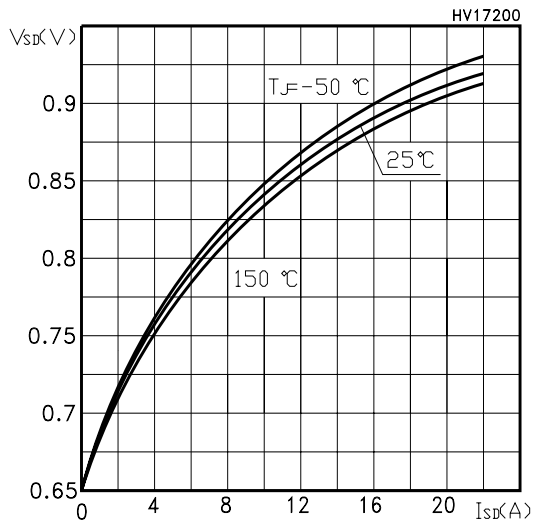


Fig. 1: Unclamped Inductive Load Test Circuit

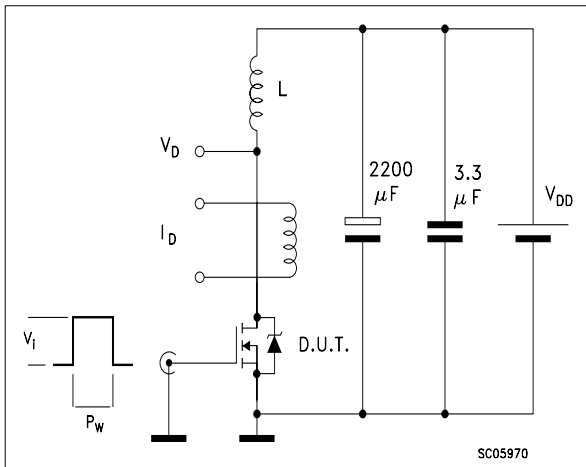


Fig. 2: Unclamped Inductive Waveform

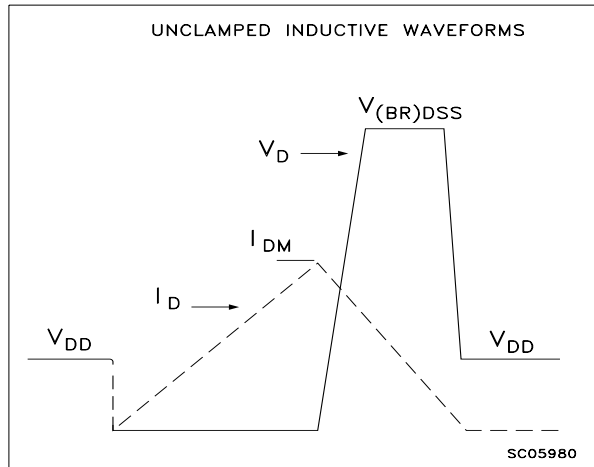


Fig. 3: Switching Times Test Circuit For Resistive Load

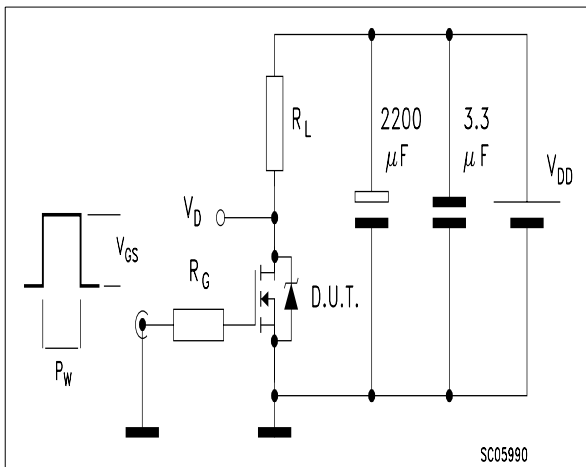


Fig. 4: Gate Charge test Circuit

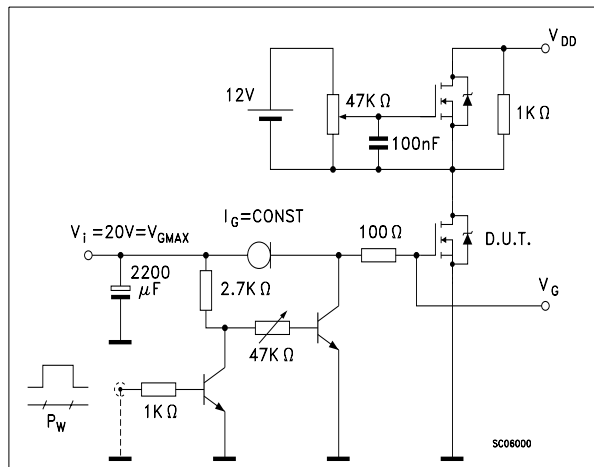
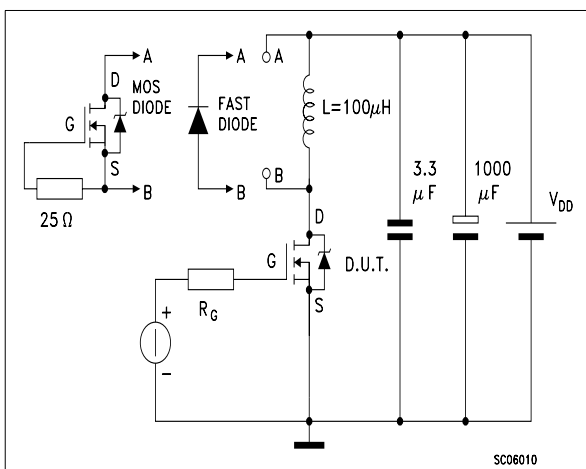
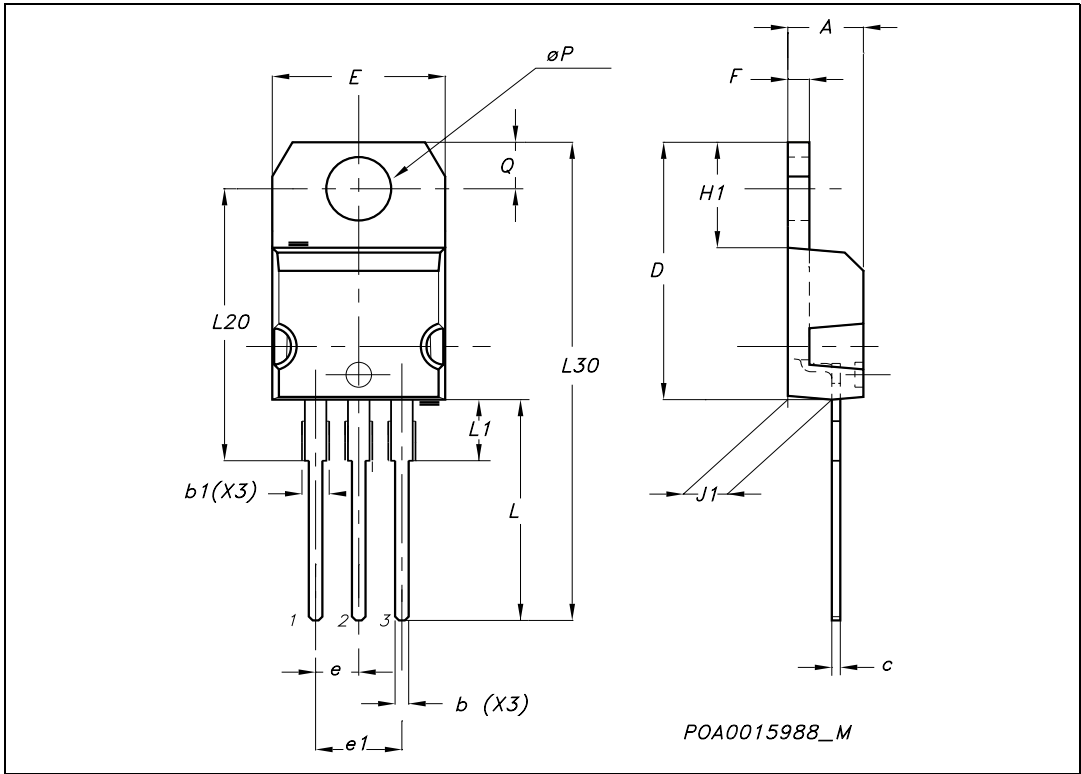


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



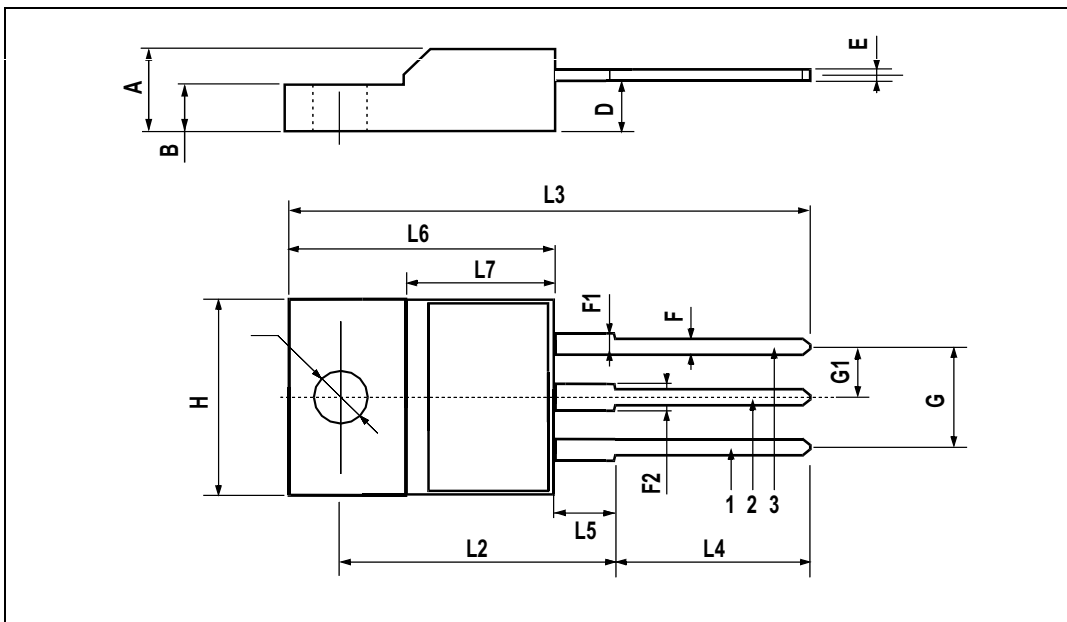
TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



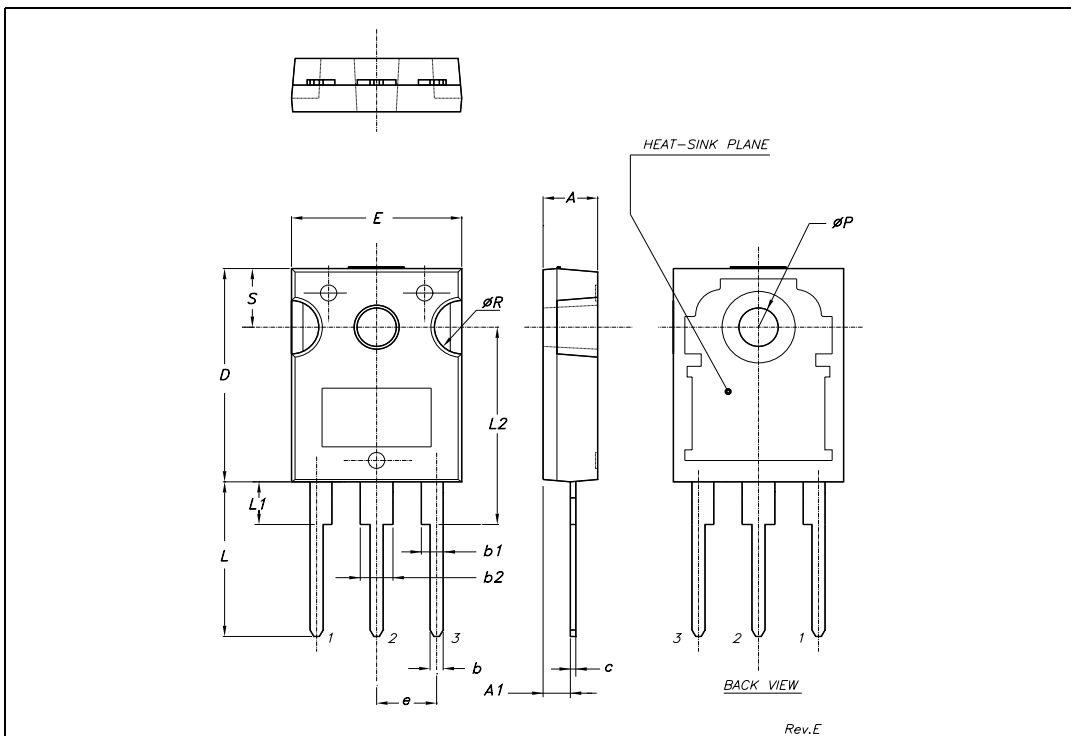
TO-220FP MECHANICAL DATA

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
∅	3		3.2	0.118		0.126



TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	



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

© 2003 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>