

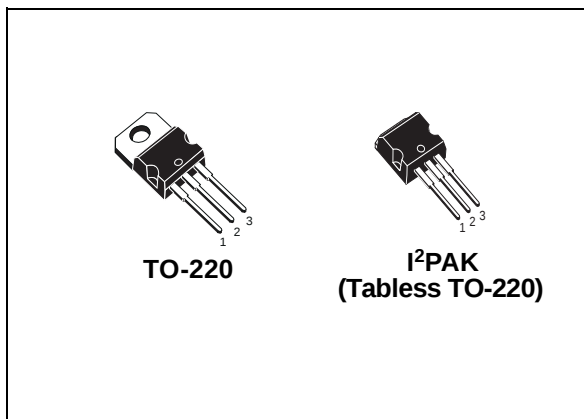


STP20NM50FD STB20NM50FD-1

N-CHANNEL 500V - 0.22Ω - 20A TO-220/I²PAK
FDmesh™ Power MOSFET (with FAST DIODE)

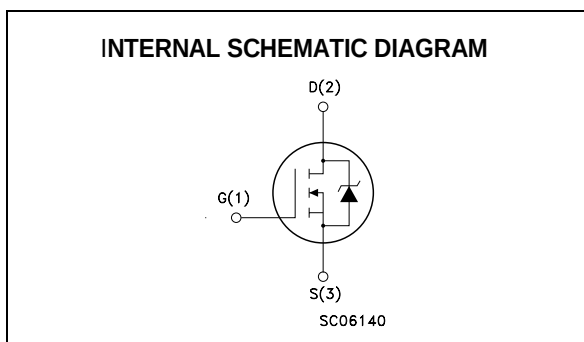
TYPE	V _{DSS}	R _{DS(on)}	R _{DS(on)} *Q _g	I _D
STP20NM50FD	500V	<0.25Ω	8.36 Ω*nC	20 A
STB20NM50FD-1	500V	<0.25Ω	8.36 Ω*nC	20 A

- TYPICAL R_{DS(on)} = 0.22Ω
- 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

ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP20NM50FD	P20NM50FD	TO-220	TUBE
STB20NM50FD-1	B20NM50FD-1	I ² PAK	TUBE

STP20NM50FD/STB20NM50FD-1

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage ($V_{GS} = 0$)	500	V
V_{DGR}	Drain-gate Voltage ($R_{GS} = 20\text{ k}\Omega$)	500	V
V_{GS}	Gate- source Voltage	± 30	V
I_D	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	20	A
I_D	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	14	A
$I_{DM}(\bullet)$	Drain Current (pulsed)	80	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	192	W
	Derating Factor	1.2	W/ $^\circ\text{C}$
$dv/dt(1)$	Peak Diode Recovery voltage slope	20	V/ns
T_{stg}	Storage Temperature	-65 to 150	$^\circ\text{C}$
T_j	Max. Operating Junction Temperature	150	$^\circ\text{C}$

($\bullet$) Pulse width limited by safe operating area

(1) $I_{SD} \leq 20\text{A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$.

THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	0.65	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient	Max	62.5	$^\circ\text{C}/\text{W}$
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

ELECTRICAL CHARACTERISTICS (TCASE = 25 $^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED) ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$, $T_C = 125^\circ\text{C}$			1 10	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 30\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$, $I_D = 10\text{A}$		0.22	0.25	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$, $I_D = 10A$		9		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V$, $f = 1\text{ MHz}$, $V_{GS} = 0$		1380 290 40		pF pF pF
$C_{oss\text{ eq.}}$ (2)	Equivalent Output Capacitance	$V_{GS} = 0V$, $V_{DS} = 0V$ to $400V$		130		pF
R_g	Gate Input Resistance	$f=1\text{ MHz}$ Gate DC Bias=0 Test Signal Level=20mV Open Drain		2.8		Ω

(1) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.(2) $C_{oss\text{ eq.}}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS} .**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	$V_{DD} = 250V$, $I_D = 10\text{ A}$ $R_G = 4.7\Omega$, $V_{GS} = 10V$ (see test circuit, Figure 3)		22 20		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400V$, $I_D = 20A$, $V_{GS} = 10V$		38 18 10	53	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	$V_{DD} = 400V$, $I_D = 20\text{ A}$, $R_G = 4.7\Omega$, $V_{GS} = 10V$ (see test circuit, Figure 5)		6 15 30		ns ns ns

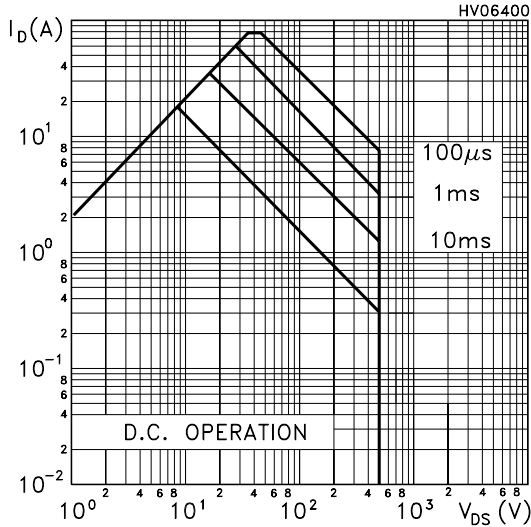
SOURCE DRAIN DIODE

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	$I_{SD} = 20\text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 20\text{ A}$, $di/dt = 100A/\mu s$, $V_{DD} = 60V$, $T_j = 150^\circ C$ (see test circuit, Figure 5)		245 2 16		ns μC A

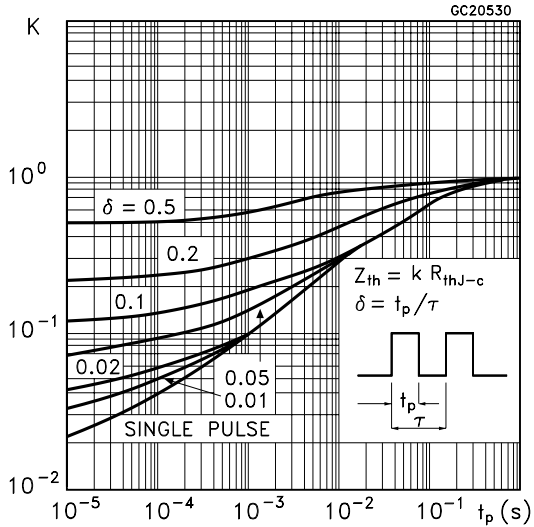
Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.

2. Pulse width limited by safe operating area.

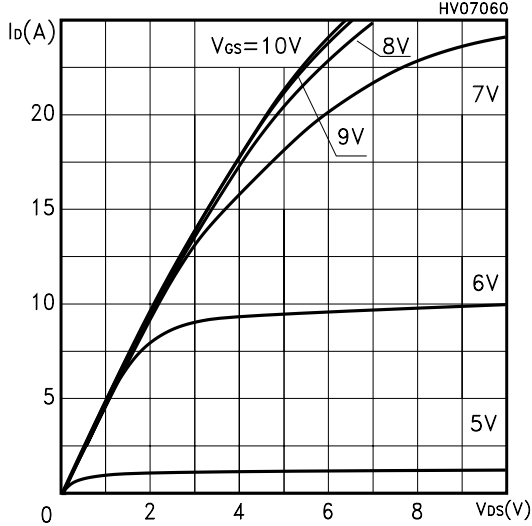
Safe Operating Area For TO-220 / I²PAK



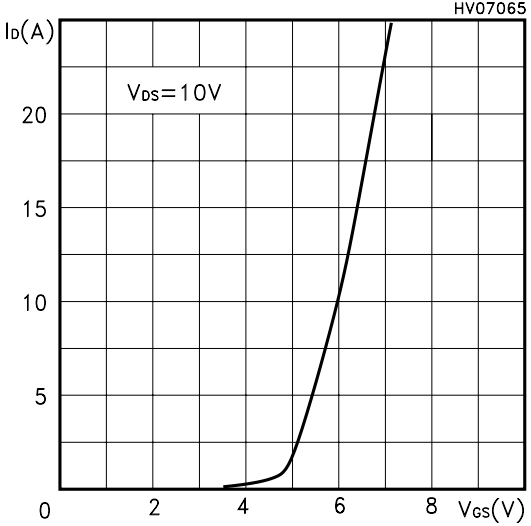
Thermal Impedance For TO-220 / I²PAK



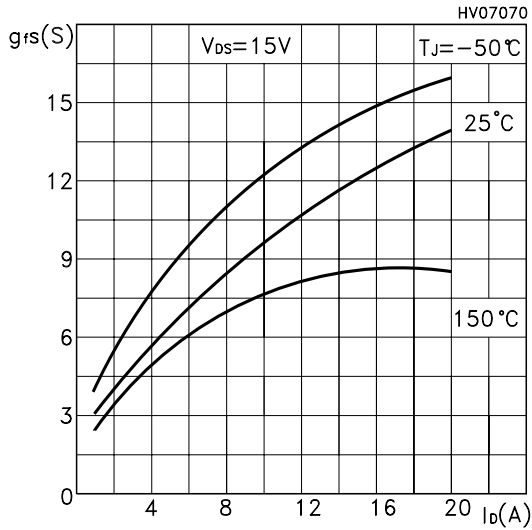
Output Characteristics



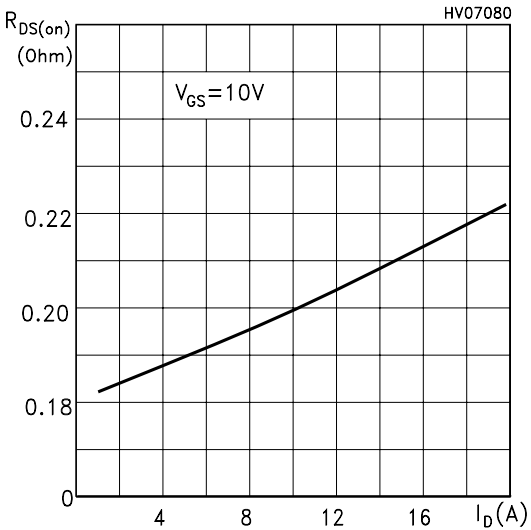
Transfer Characteristics



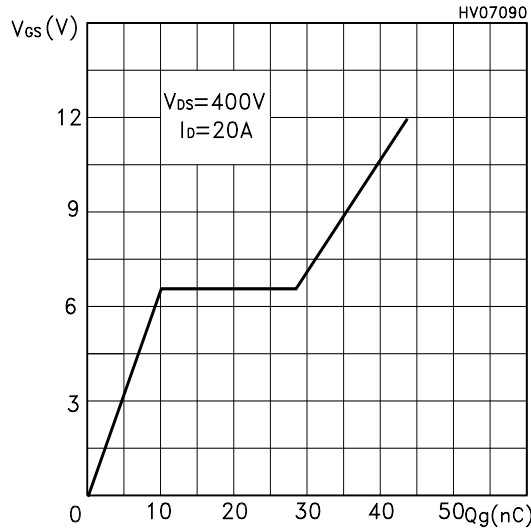
Transconductance



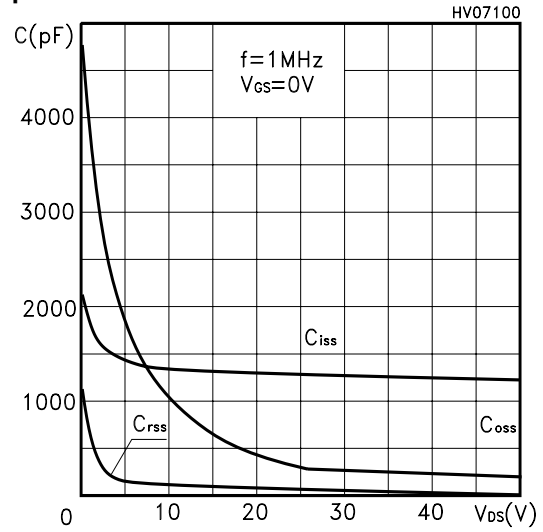
Static Drain-source On Resistance



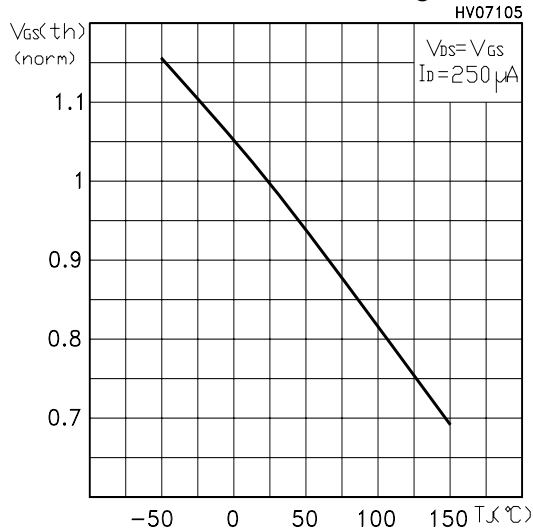
Gate Charge vs Gate-source Voltage



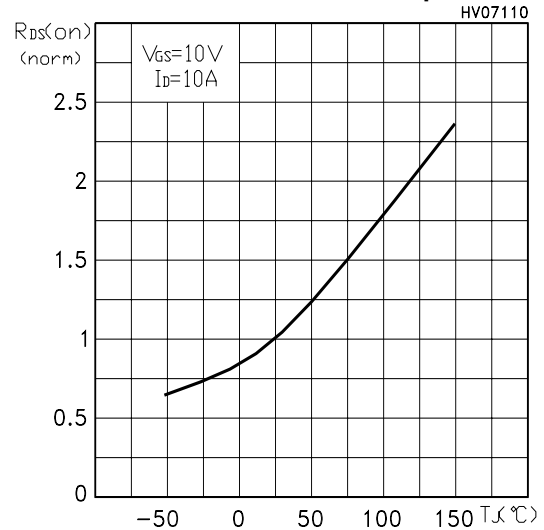
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

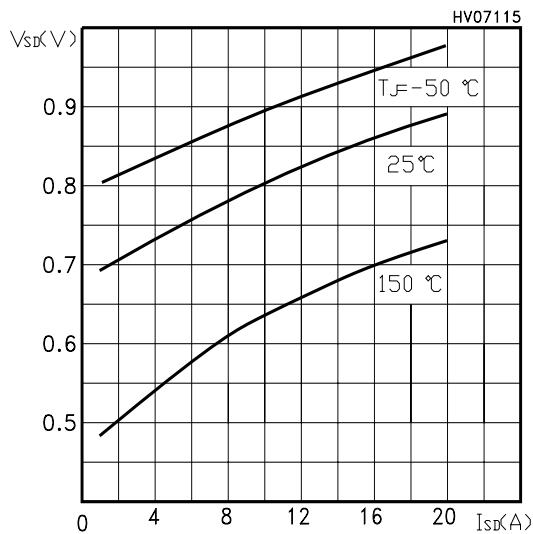


Fig. 1: Unclamped Inductive Load Test Circuit

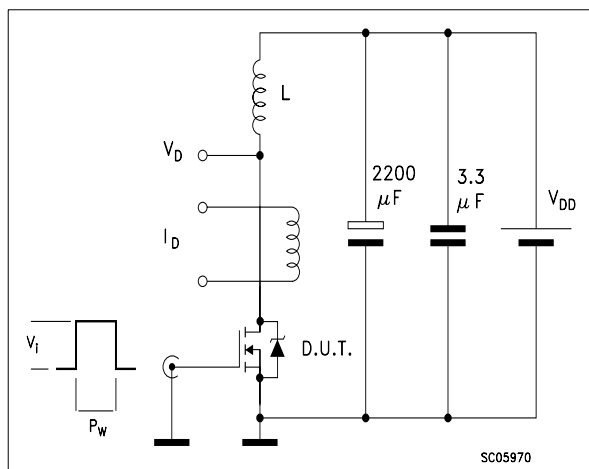


Fig. 2: Unclamped Inductive Waveform

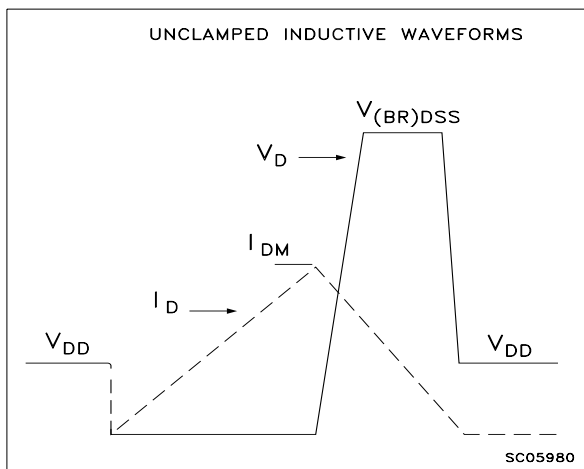


Fig. 3: Switching Times Test Circuit For Resistive Load

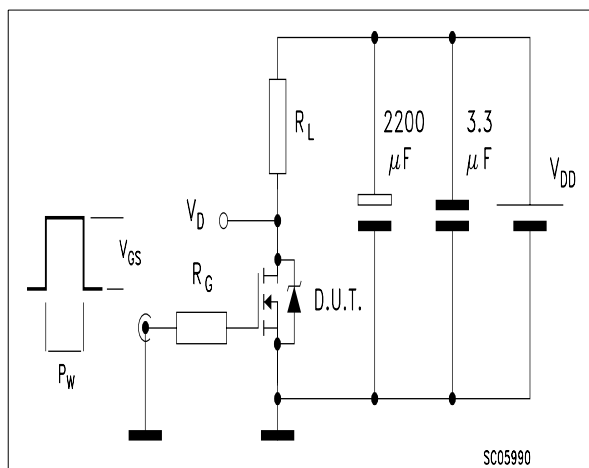


Fig. 4: Gate Charge test Circuit

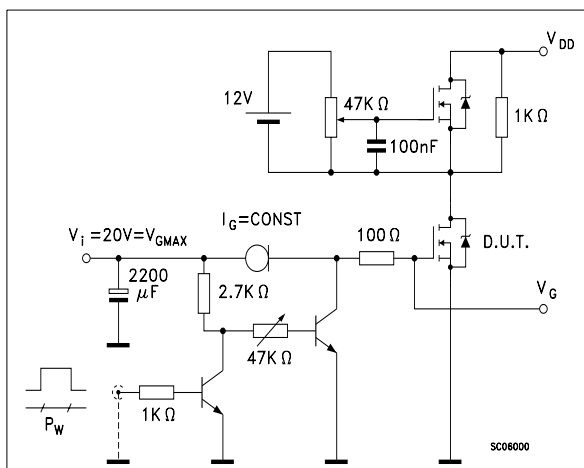
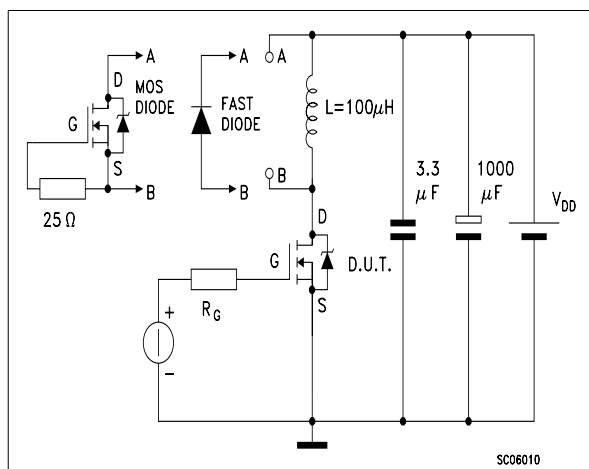
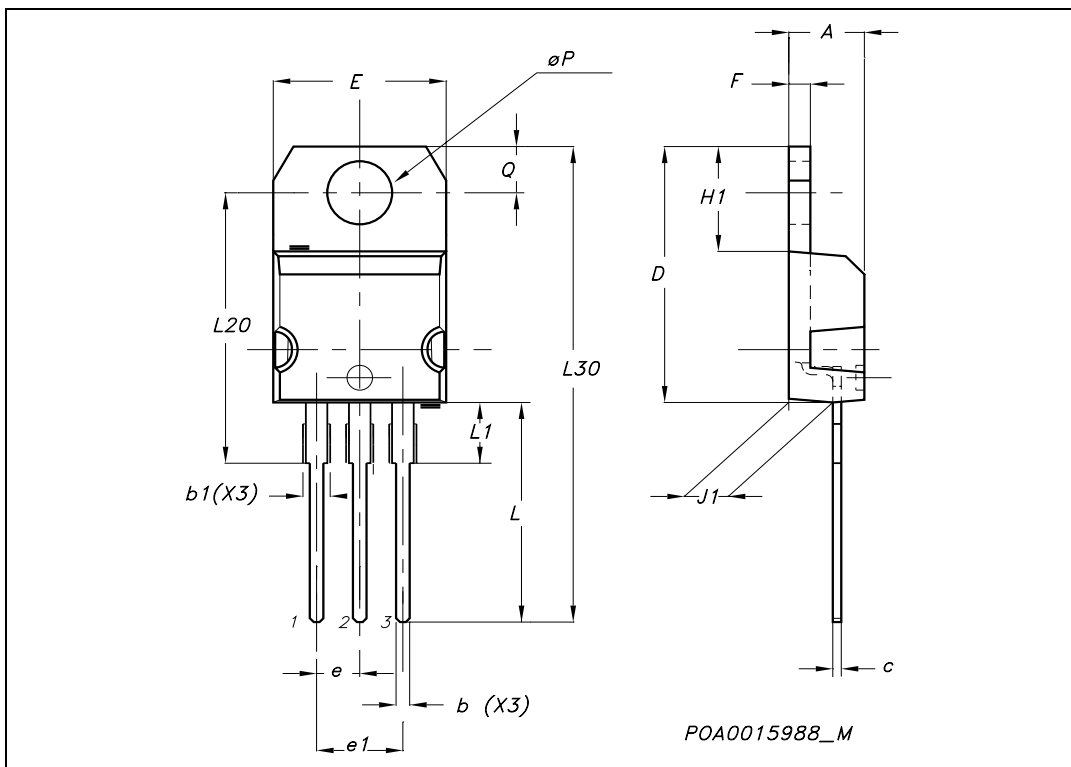


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



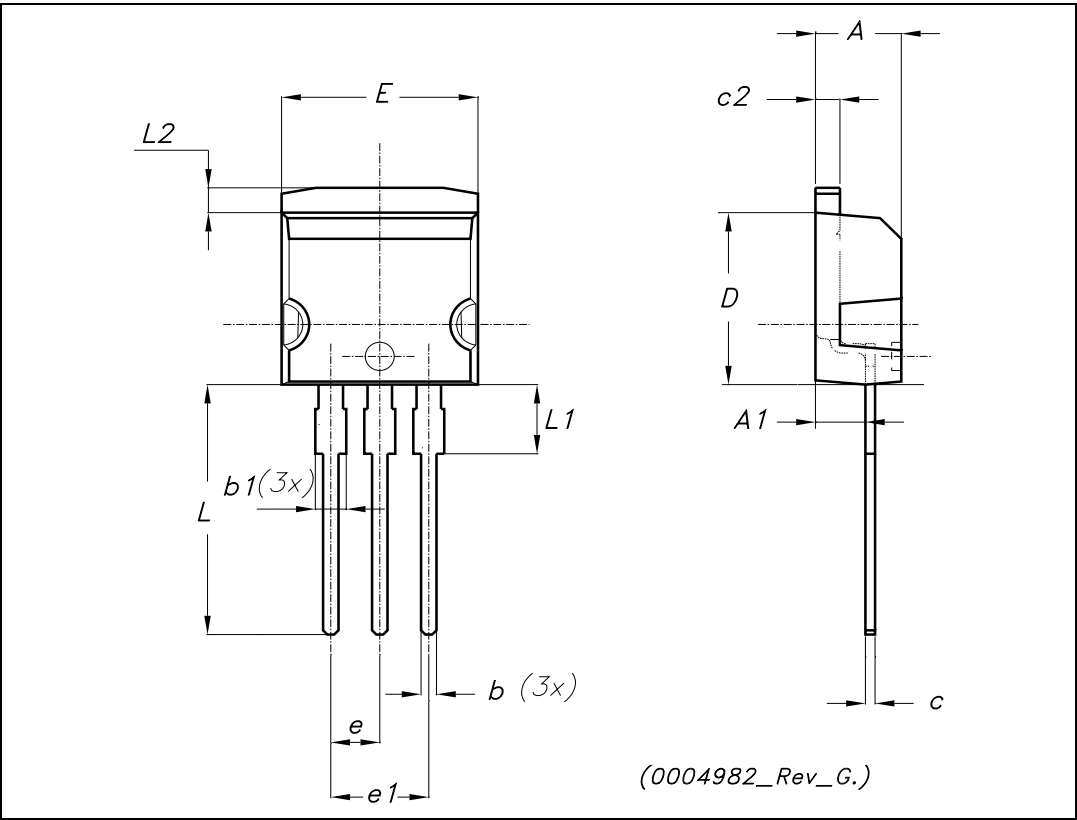
TO-220 MECHANICAL DATA

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-262 (I²PAK) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



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>