



STB20NM60A-1 STP20NM60A - STF20NM60A

N-CHANNEL 650V@T_{jmax} - 0.25Ω - 20A I²PAK/TO-220/TO-220FP
MDmesh™ MOSFET

TYPE	V _{DSS} @T _{jmax}	R _{DS(on)}	I _D
STB20NM60A-1	650 V	< 0.29 Ω	20 A
STP20NM60A	650 V	< 0.29 Ω	20 A
STF20NM60A	650 V	< 0.29 Ω	20 A

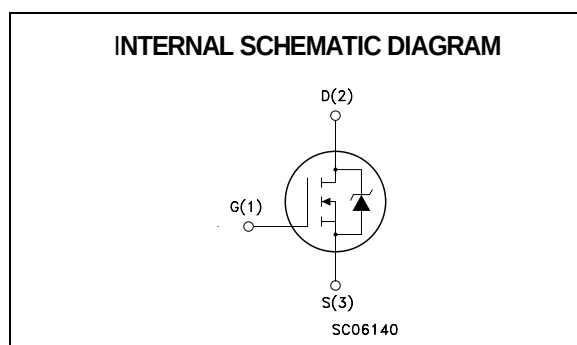
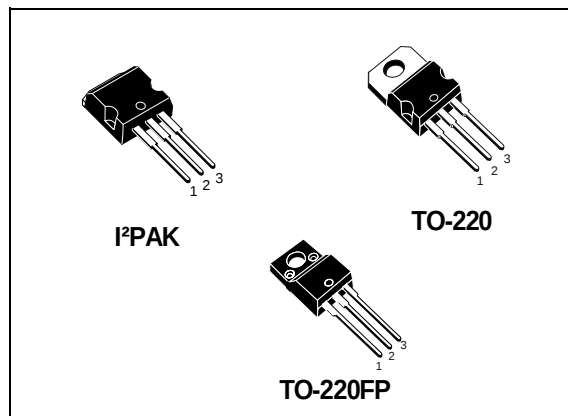
- TYPICAL R_{DS(on)} = 0.25Ω
- HIGH dv/dt
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE

DESCRIPTION

The MDmesh™ is a new revolutionary MOSFET technology that associates the Multiple Drain process with the Company's PowerMESH™ horizontal layout. The resulting product has an outstanding low on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar competition's products.

APPLICATIONS

- SPECIFICALLY DESIGNED FOR ADAPTERS QUASI-RESONANT CONFIGURATION



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STB20NM60A-1	B20NM60A	I ² PAK	TUBE
STP20NM60A	P20NM60A	TO-220	TUBE
STF20NM60A	F20NM60A	TO-220FP	TUBE

STB20NM60A-1/STP20NM60A/STF20NM60A

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STB20NM60A-1 STP20NM60A	STF20NM60A	
V _{GS}	Gate-source Voltage	±30		V
I _D	Drain Current (continuous) at T _C = 25°C	20	20(*)	A
I _D	Drain Current (continuous) at T _C = 100°C	12.6	12.6(*)	A
I _{DM} (•)	Drain Current (pulsed)	80	80(*)	A
P _{TOT}	Total Dissipation at T _C = 25°C	192	45	W
	Derating Factor	1.2	0.36	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	15		V/ns
V _{ISO}	Insulation Withstand Voltage (DC)	--	2500	V
T _{stg}	Storage Temperature	-55 to 150		°C
T _j	Max. Operating Junction Temperature			

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 20A, di/dt ≤ 400 A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.

(*) Limited only by maximum temperature allowed

THERMAL DATA

		I ² PAK/TO-220	TO-220FP	
R _{thj-case}	Thermal Resistance Junction-case Max	0.65	2.8	°C/W
R _{thj-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) 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	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V, I _D = 10A		0.25	0.29	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)
DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$, $I_D = 10A$		11		S
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $f = 1\text{ MHz}$, $V_{GS} = 0$		1630		pF
C_{oss}	Output Capacitance			350		pF
C_{rss}	Reverse Transfer Capacitance			33		pF
$C_{oss\text{ eq.}}$ (2)	Equivalent Output Capacitance	$V_{GS} = 0V$, $V_{DS} = 0V\text{ to }400V$		150		pF

(1) Pulsed: Pulse duration = 300 μ s, 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
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 300V$, $I_D = 10\text{ A}$ $R_G = 4.7\Omega$, $V_{GS} = 10V$ (see test circuit, Figure 3)		20		ns
t_r	Rise Time			16		ns
Q_g	Total Gate Charge	$V_{DD} = 400V$, $I_D = 20A$, $V_{GS} = 10V$		45	60	nC
Q_{gs}	Gate-Source Charge			8.2		nC
Q_{gd}	Gate-Drain Charge			19		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off Delay Time	$V_{DD} = 300V$, $I_D = 20\text{ A}$, $R_G = 4.7\Omega$, $V_{GS} = 10V$ (see test circuit, Figure 5)		46		ns
t_f	Fall Time			20		ns

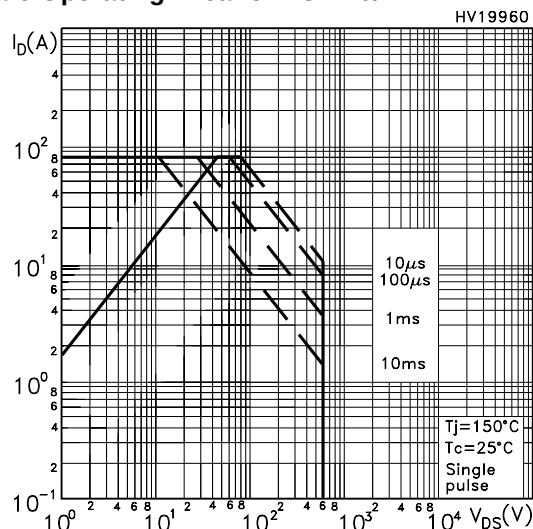
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				20	A
I_{SDM} (2)	Source-drain Current (pulsed)				80	A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 20\text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 20\text{ A}$, $di/dt = 100A/\mu s$, $V_{DD} = 50\text{ V}$, $T_j = 25^\circ C$ (see test circuit, Figure 5)		432		ns
Q_{rr}	Reverse Recovery Charge			5.1		μC
I_{rrm}	Reverse Recovery Current			23.6		A
t_{rr}	Reverse Recovery Time	$I_{SD} = 20\text{ A}$, $di/dt = 100A/\mu s$, $V_{DD} = 50\text{ V}$, $T_j = 150^\circ C$ (see test circuit, Figure 5)		595		ns
Q_{rr}	Reverse Recovery Charge			7.3		μC
I_{rrm}	Reverse Recovery Current			24.8		A

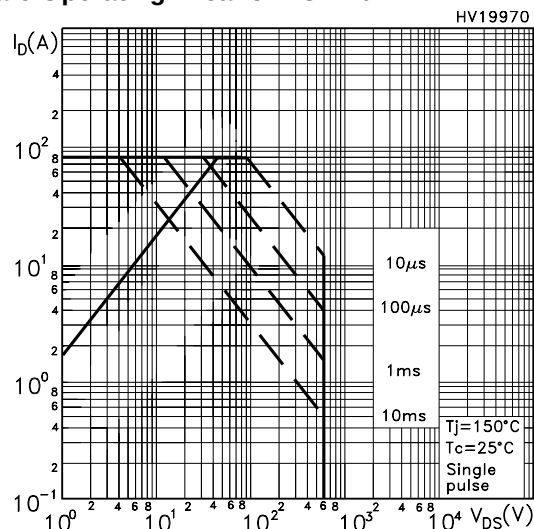
Note: 1. Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %.

2. Pulse width limited by safe operating area.

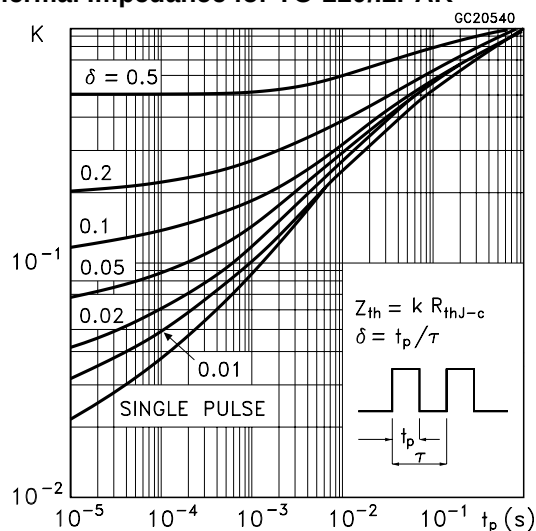
Safe Operating Area for TO-220/I2PAK



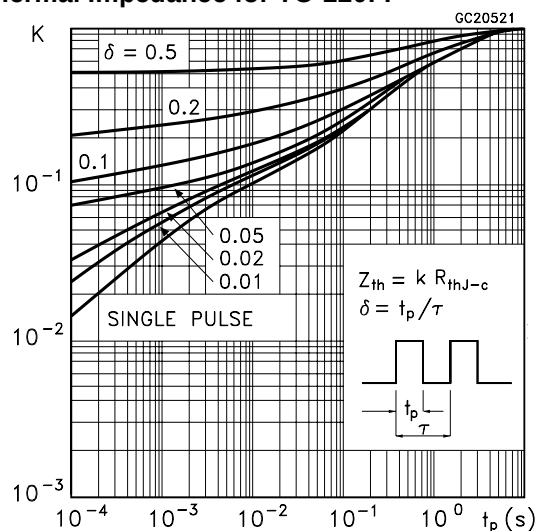
Safe Operating Area for TO-220FP



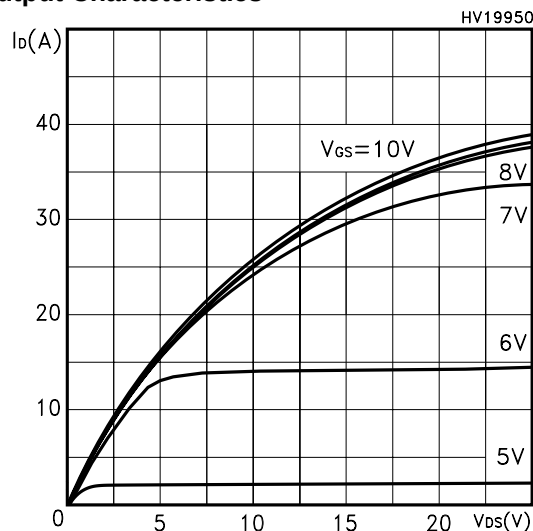
Thermal Impedance for TO-220/I2PAK



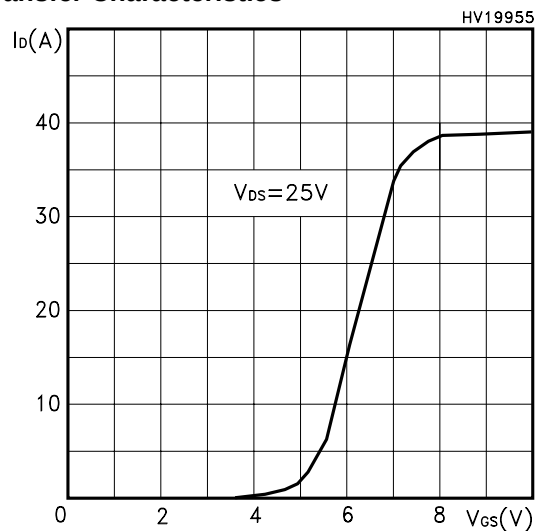
Thermal Impedance for TO-220FP



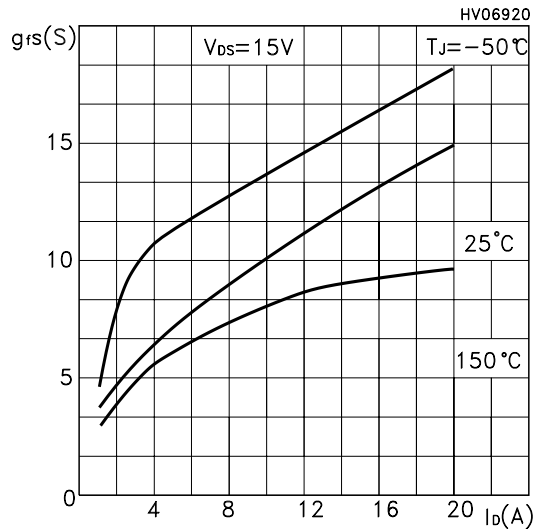
Output Characteristics



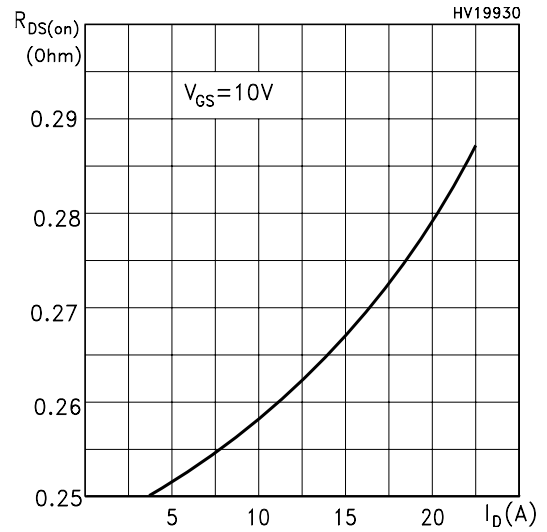
Transfer Characteristics



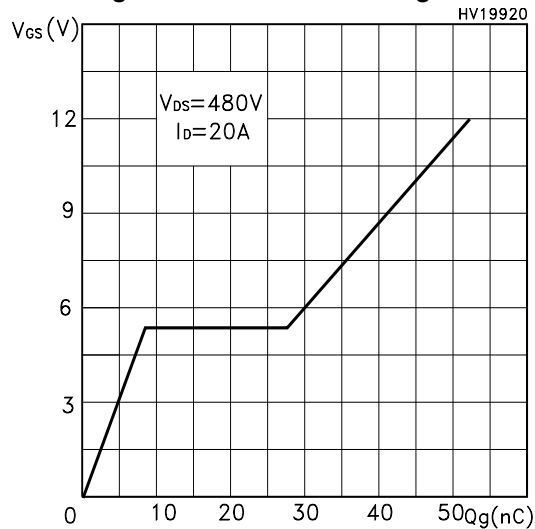
Transconductance



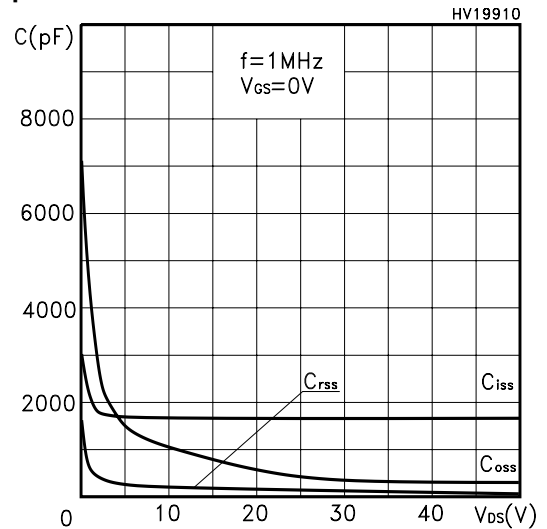
Static Drain-Source On Resistance



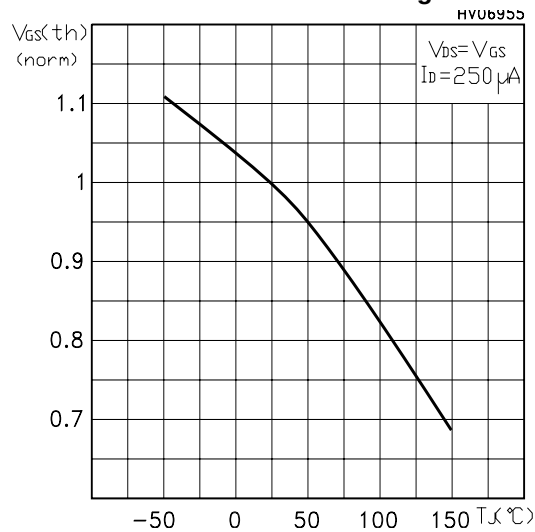
Gate Charge vs Gate-source Voltage



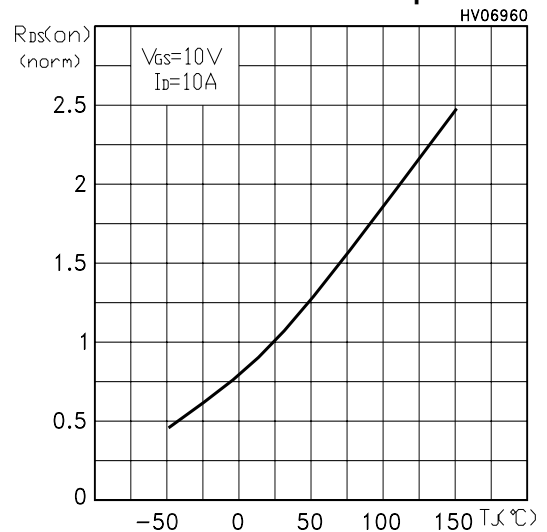
Capacitance Variations



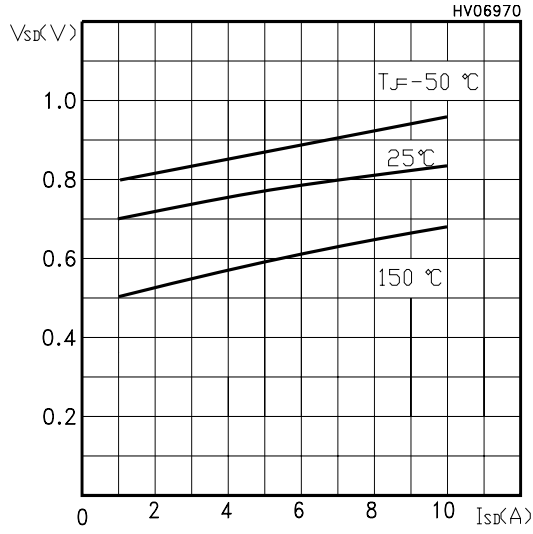
Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



Normalized BVDSS vs Temperature

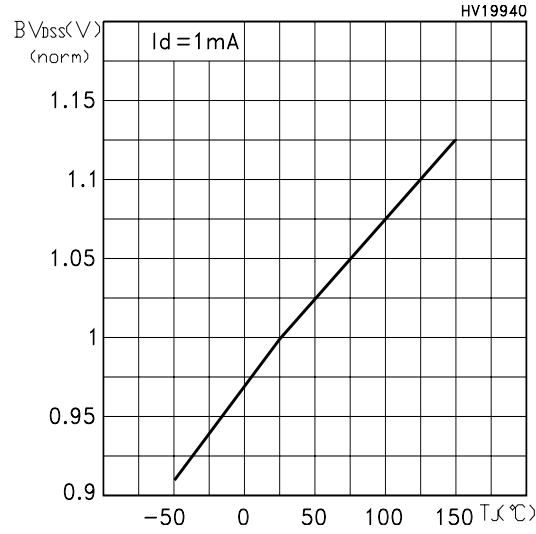


Fig. 1: Unclamped Inductive Load Test Circuit

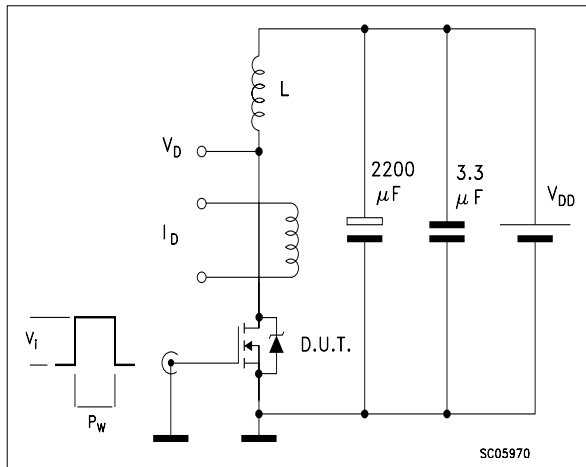


Fig. 2: Unclamped Inductive Waveform

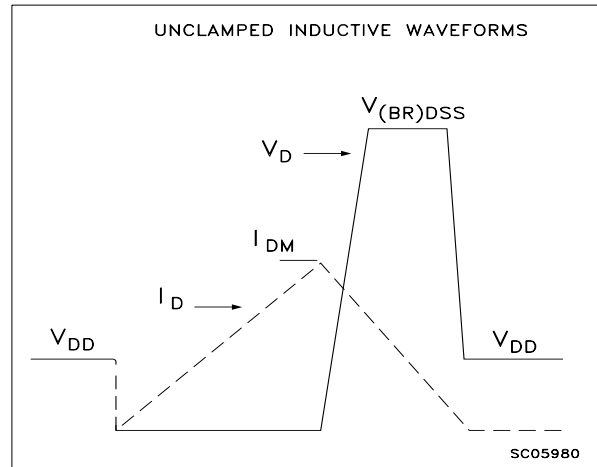


Fig. 3: Switching Times Test Circuit For Resistive Load

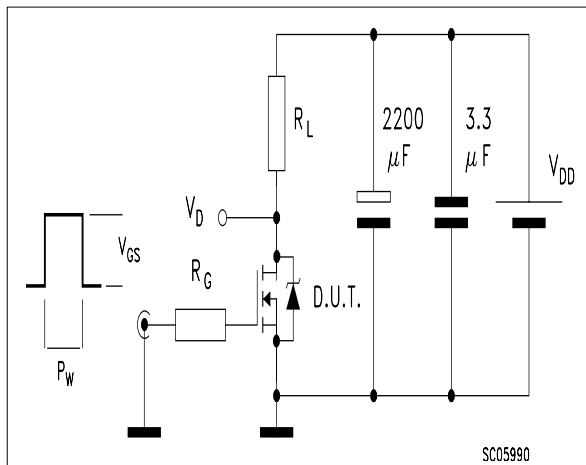


Fig. 4: Gate Charge test Circuit

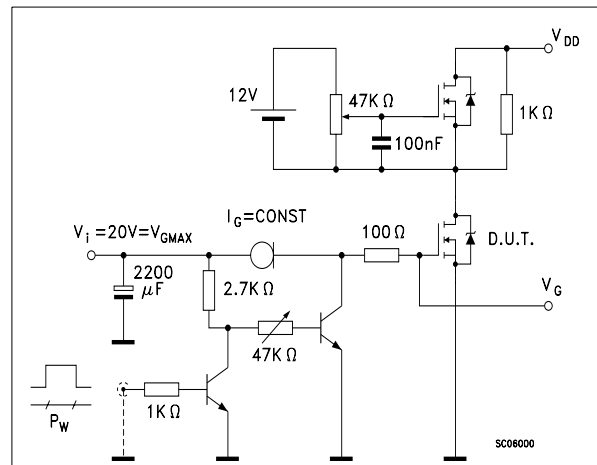
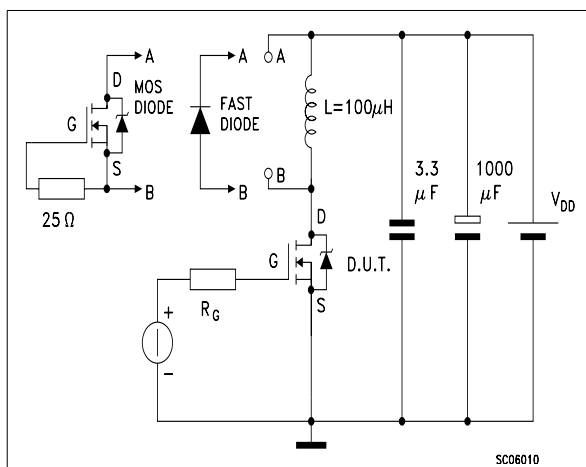
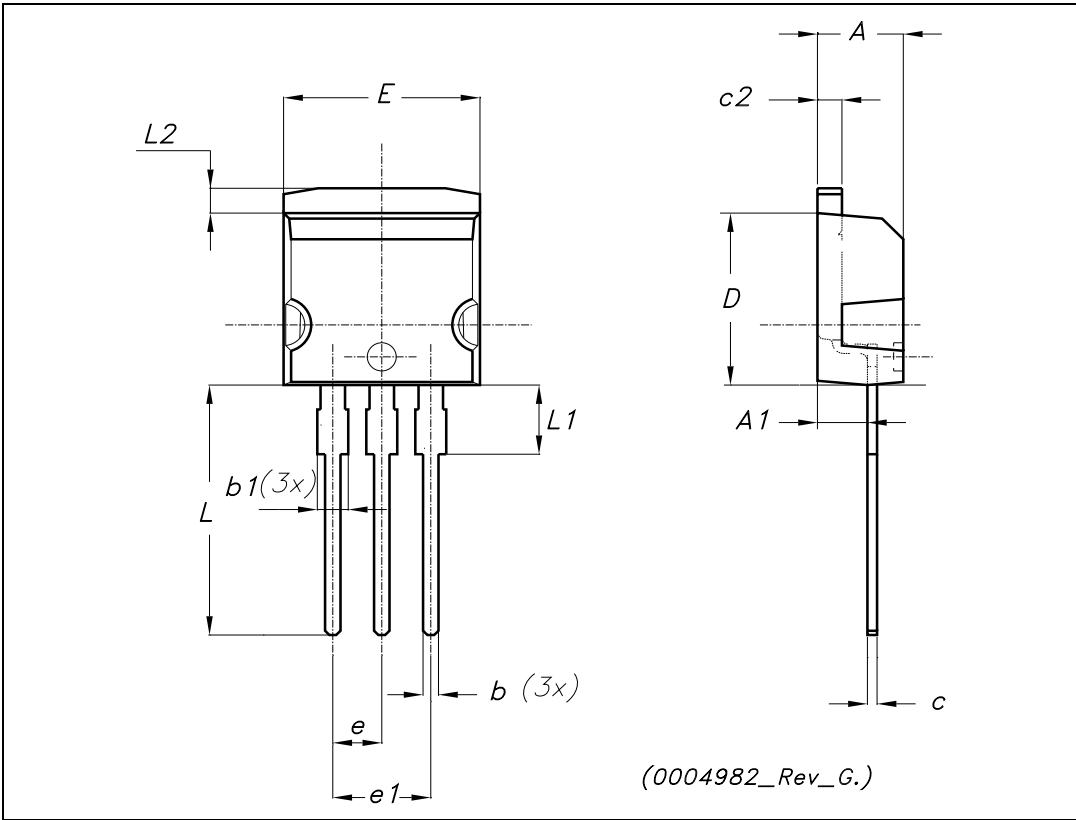


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



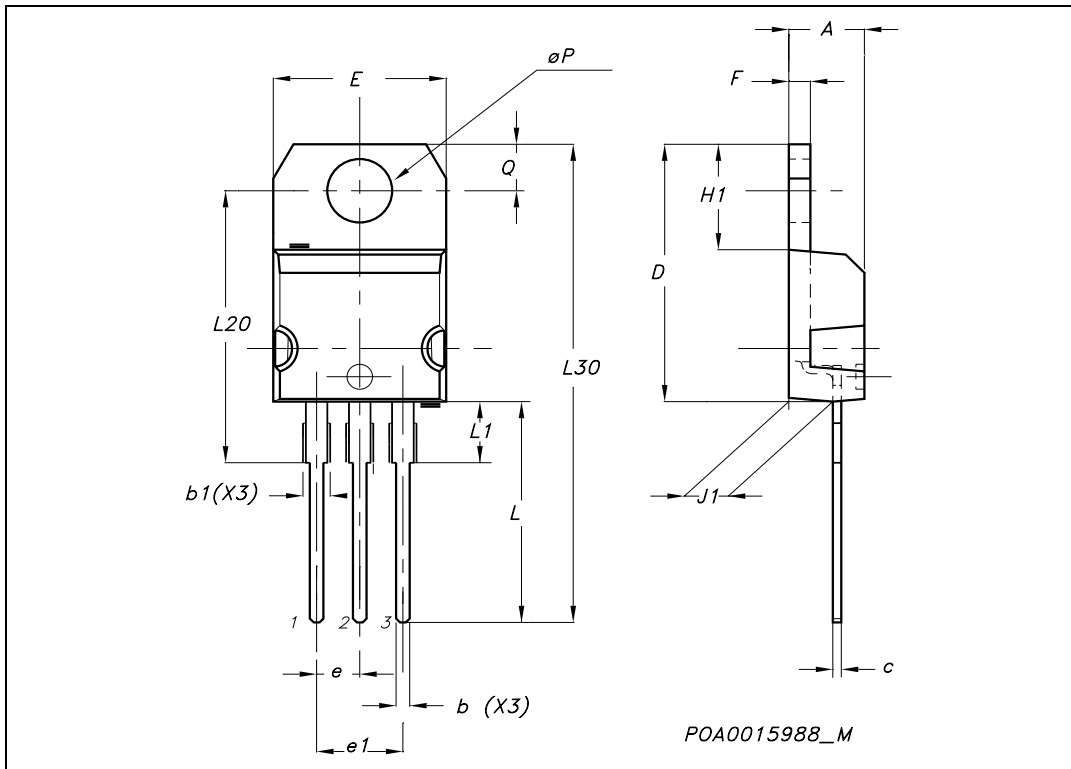
TO-262 (I²PAK) MECHANICAL DATA

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



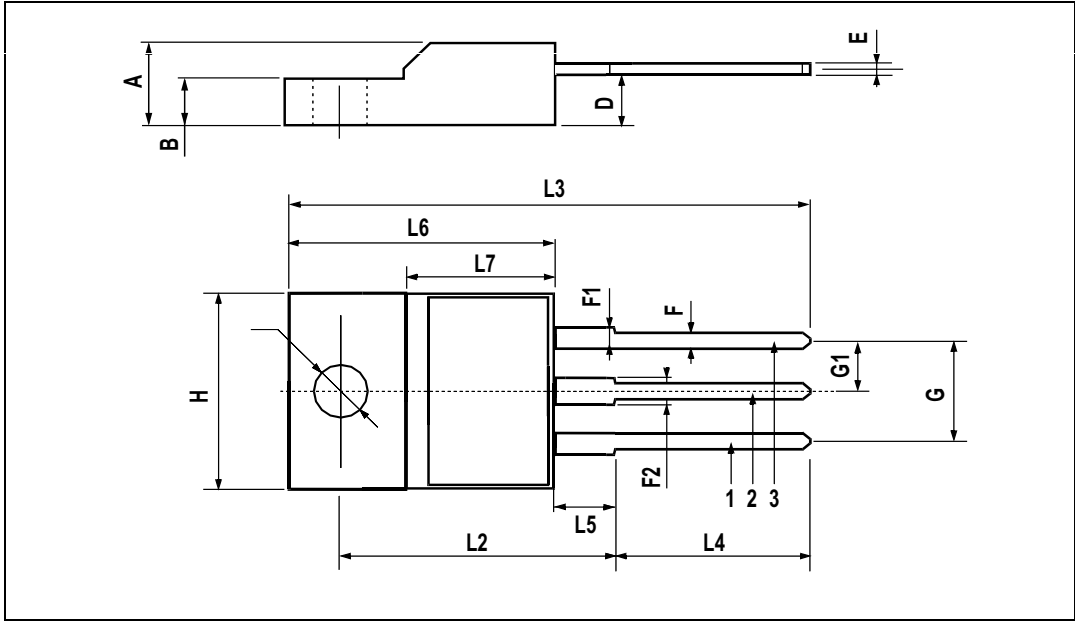
TO-220 MECHANICAL DATA

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
Ø	3		3.2	0.118		0.126



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