



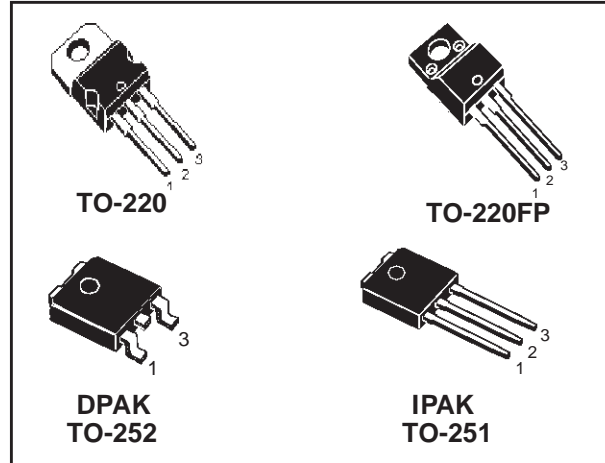
STP8NM60, STP8NM60FP STD5NM60, STD5NM60-1

N-CHANNEL 600V - 0.9Ω - 8A TO-220/TO-220FP/DPAK/IPAK

MDmesh™ Power MOSFET

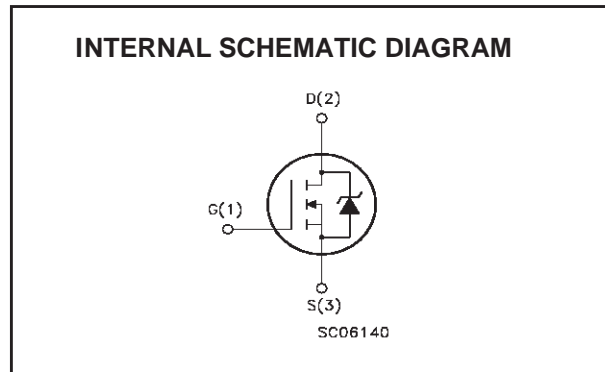
TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STP8NM60	600 V	< 1 Ω	8 A	100 W
STP8NM60FP	600 V	< 1 Ω	8 A(*)	30 W
STD5NM60	600 V	< 1 Ω	5 A	96 W
STD5NM60-1	600 V	< 1 Ω	5 A	96 W

- TYPICAL R_{DS(on)} = 0.9Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- 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

The MDmesh™ family is very suitable for increase the power density of high voltage converters allowing system miniaturization and higher efficiencies.

ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP8NM60	P8NM60	TO-220	TUBE
STP8NM60FP	P8NM60FP	TO-220FP	TUBE
STD5NM60T4	D5NM60	DPAK	TAPE & REEL
STD5NM60-1	D5NM60	IPAK	TUBE

STP8NM60, STP8NM60FP, STD5NM60, STD5NM60-1

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value			Unit
		STP8NM60	STP8NM60FP	STD5NM60 STD5NM60-1	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600			V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	600			V
V _{GS}	Gate- source Voltage	± 30			V
I _D	Drain Current (continuous) at T _C = 25°C	8	8 (*)	5	A
I _D	Drain Current (continuous) at T _C = 100°C	5	5 (*)	3.1	A
I _{DM} (1)	Drain Current (pulsed)	32	32 (*)	20	A
P _{TOT}	Total Dissipation at T _C = 25°C	100	30	96	W
	Derating Factor	0.8	0.24	0.4	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	15	15	15	V/ns
V _{ISO}	Insulation Withstand Voltage (DC)	-	2500	-	V
T _j	Operating Junction Temperature	-55 to 150			°C
T _{stg}	Storage Temperature	-55 to 150			°C

(1) Pulse width limited by safe operating area

(1) I_{SD} ≤ 5A, di/dt ≤ 400A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.

(*) Limited only by maximum temperature allowed

THERMAL DATA

		TO-220	TO-220FP	DPAK IPAK	
R _{thj-case}	Thermal Resistance Junction-case Max	1.25	4.16	1.3	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max	62.5			°C/W
T _I	Maximum Lead Temperature For Soldering Purpose	300			°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max)	2.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	200	mJ

ELECTRICAL CHARACTERISTICS (TCASE = 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 = 250μA	3	4	5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V, I _D = 2.5 A		0.9	1	Ω

STP8NM60, STP8NM60FP, STD5NM60, STD5NM60-1

**ELECTRICAL CHARACTERISTICS (TCASE =25°C UNLESS OTHERWISE SPECIFIED)
DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} = I_{D(on)} \times R_{DS(on)max}$, $I_D = 2.5A$		2.4		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V$, $f = 1$ MHz, $V_{GS} = 0$		440 100 10		pF pF pF
C_{oss} eq. (2)	Equivalent Output Capacitance	$V_{GS} = 0V$, $V_{DS} = 0V$ to 480V		50		pF
R_G	Gate Input Resistance	$f = 1$ MHz Gate DC Bias = 0 Test Signal Level = 20mV Open Drain		4		Ω

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	$V_{DD} = 300$ V, $I_D = 2.5$ A $R_G = 4.7\Omega$ $V_{GS} = 10$ V (Resistive Load see, Figure 3)		14 10		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400V$, $I_D = 5$ A, $V_{GS} = 10V$		13 5 6	18	nC nC nC

SWITCHING OFF

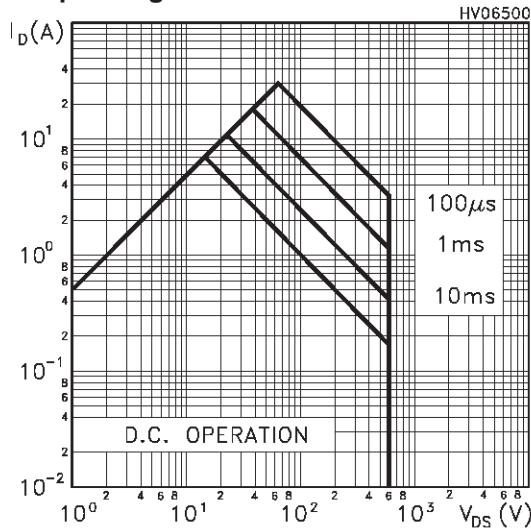
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	$V_{DD} = 300$ V, $I_D = 2.5$ A $R_G = 4.7\Omega$ $V_{GS} = 10$ V (Resistive Load see, Figure 3)				ns ns
$t_r(V_{off})$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 480V$, $I_D = 5$ A, $R_G = 4.7\Omega$, $V_{GS} = 10V$ (Inductive Load see, Figure 5)		7 10 17		ns ns ns

SOURCE DRAIN DIODE

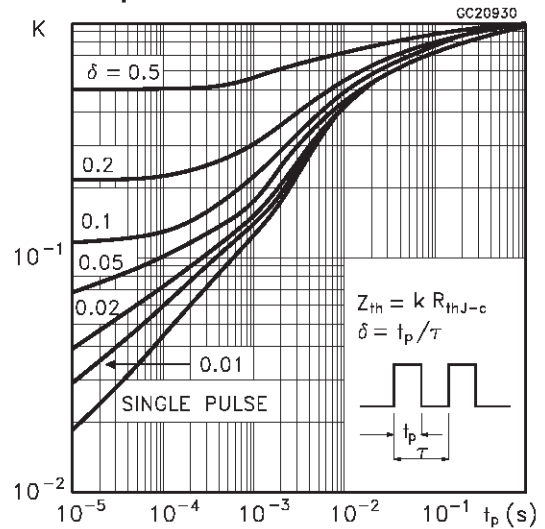
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				8 32	A A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 5$ A, $V_{GS} = 0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 5$ A, $di/dt = 100A/\mu s$ $V_{DD} = 100V$, $T_j = 25^\circ C$ (see test circuit, Figure 5)		300 1.9 13		ns μC A

Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.
2. Pulse width limited by safe operating area.

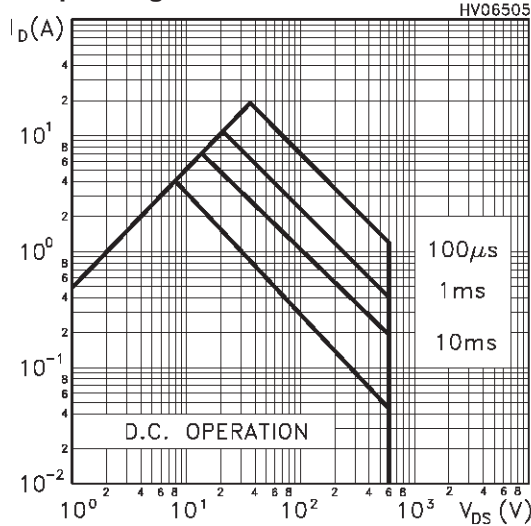
Safe Operating Area For TO-220



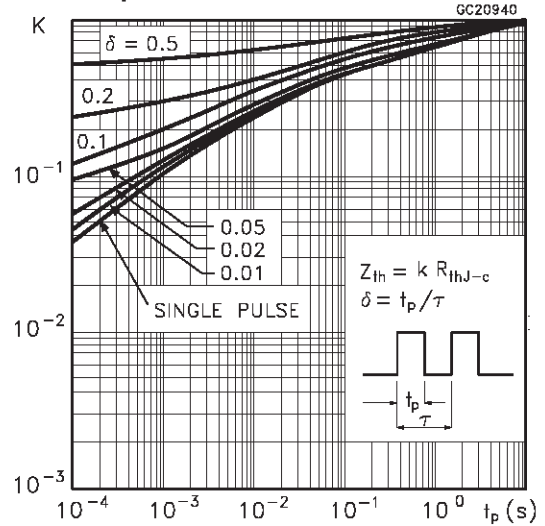
Thermal Impedance For TO-220



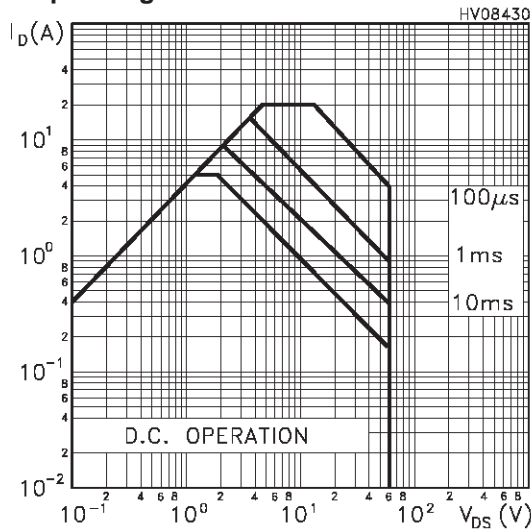
Safe Operating Area For TO-220FP



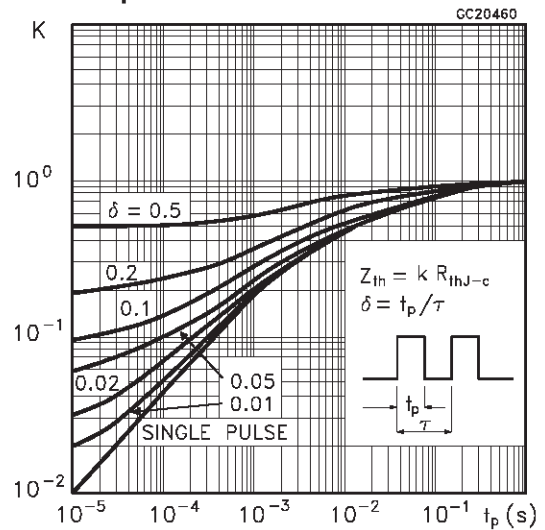
Thermal Impedance For TO-220FP



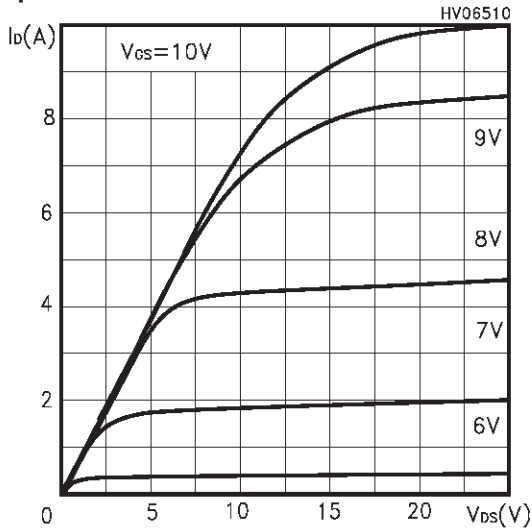
Safe Operating Area For DPAK/IPAK



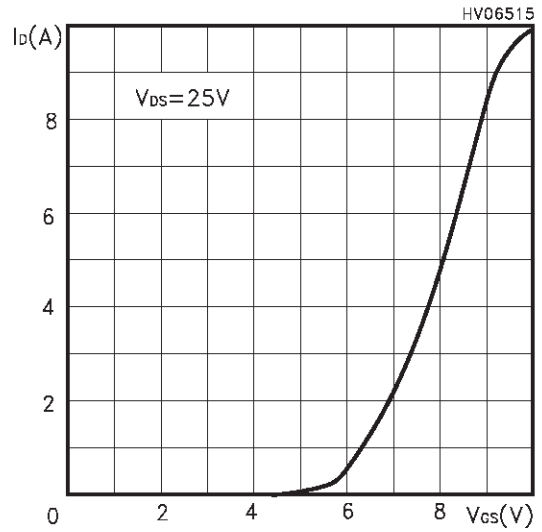
Thermal Impedance For DPAK/IPAK



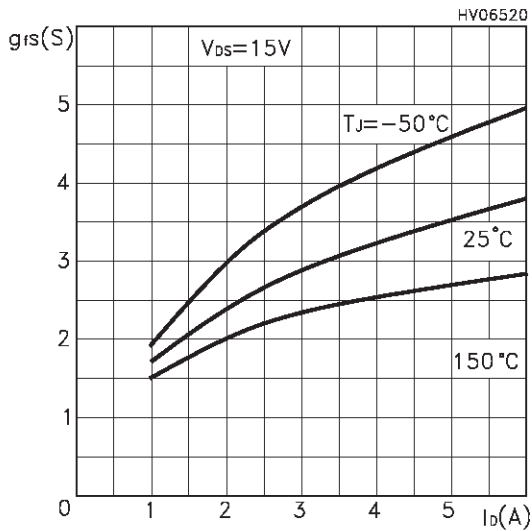
Output Characteristics



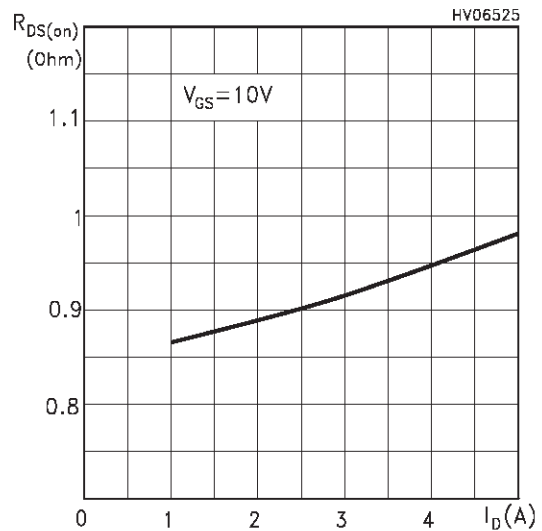
Transfer Characteristics



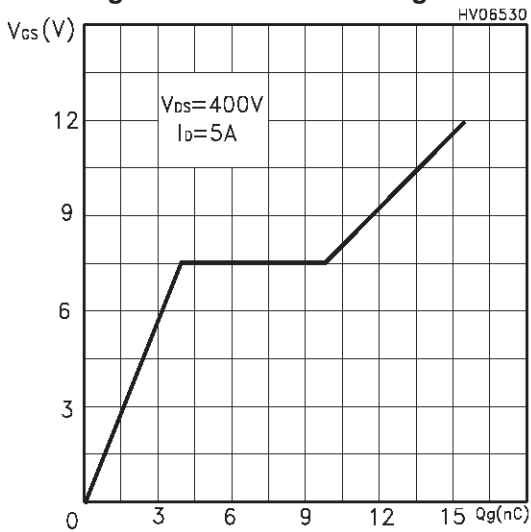
Transconductance



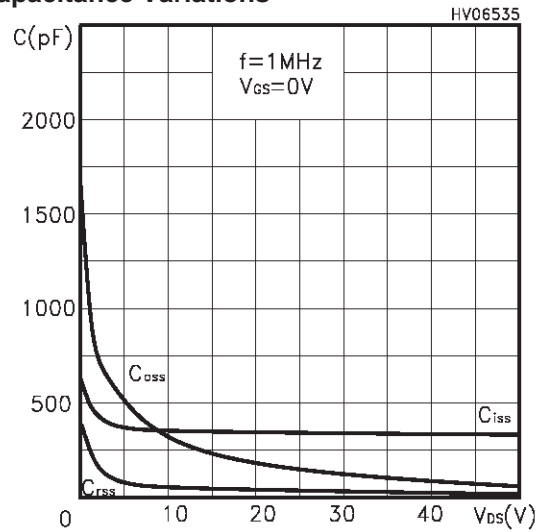
Static Drain-source On Resistance



Gate Charge vs Gate-source Voltage

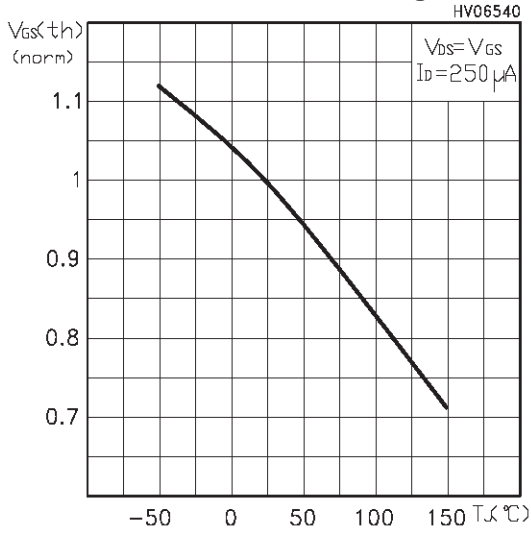


Capacitance Variations

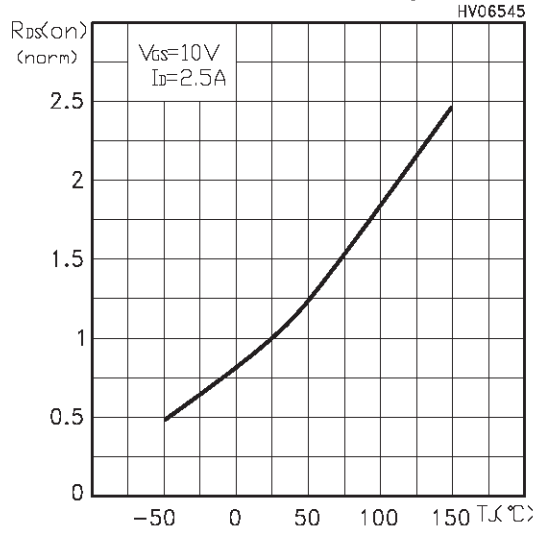


STP8NM60, STP8NM60FP, STD5NM60, STD5NM60-1

Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

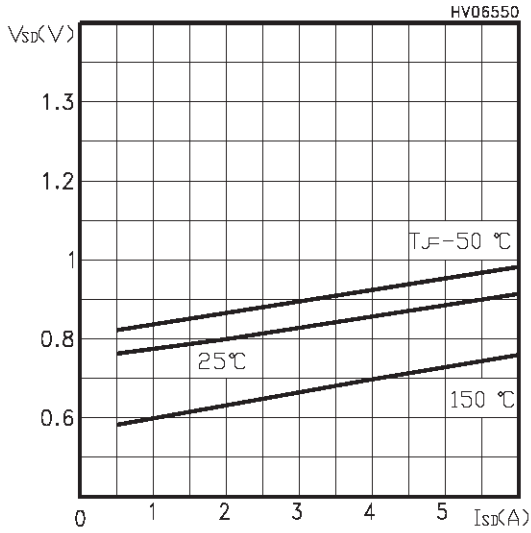


Fig. 1: Unclamped Inductive Load Test Circuit

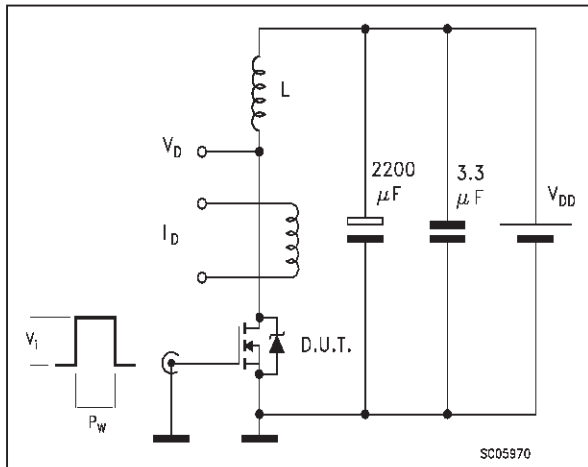


Fig. 2: Unclamped Inductive Waveform

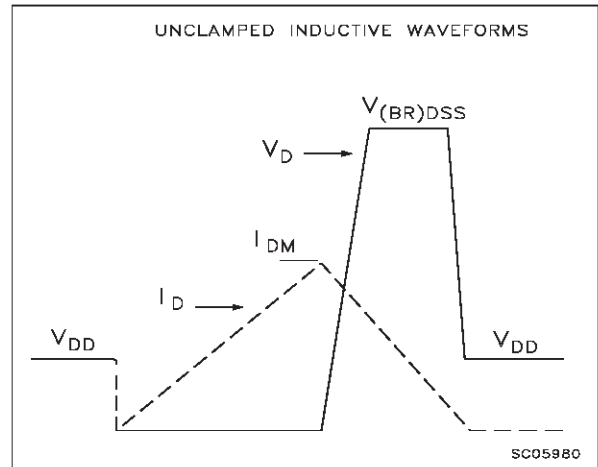


Fig. 3: Switching Times Test Circuit For Resistive Load

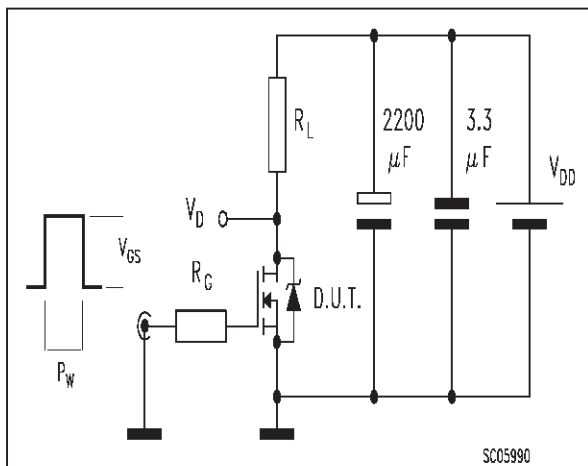


Fig. 4: Gate Charge test Circuit

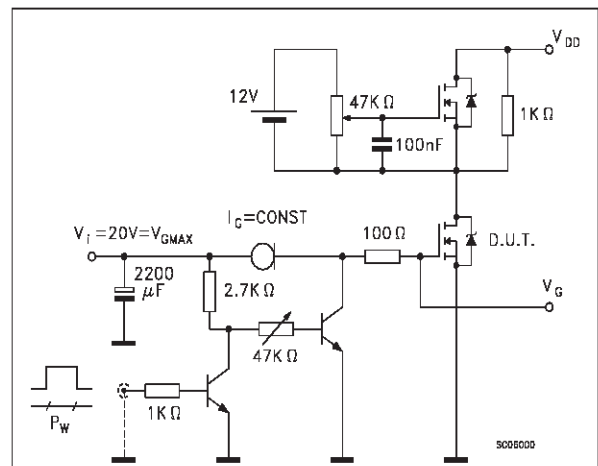
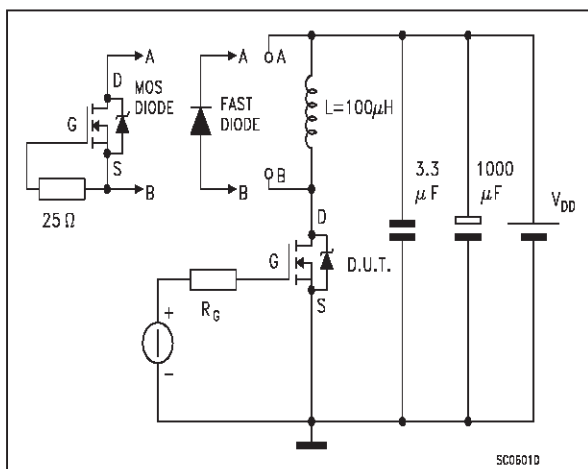
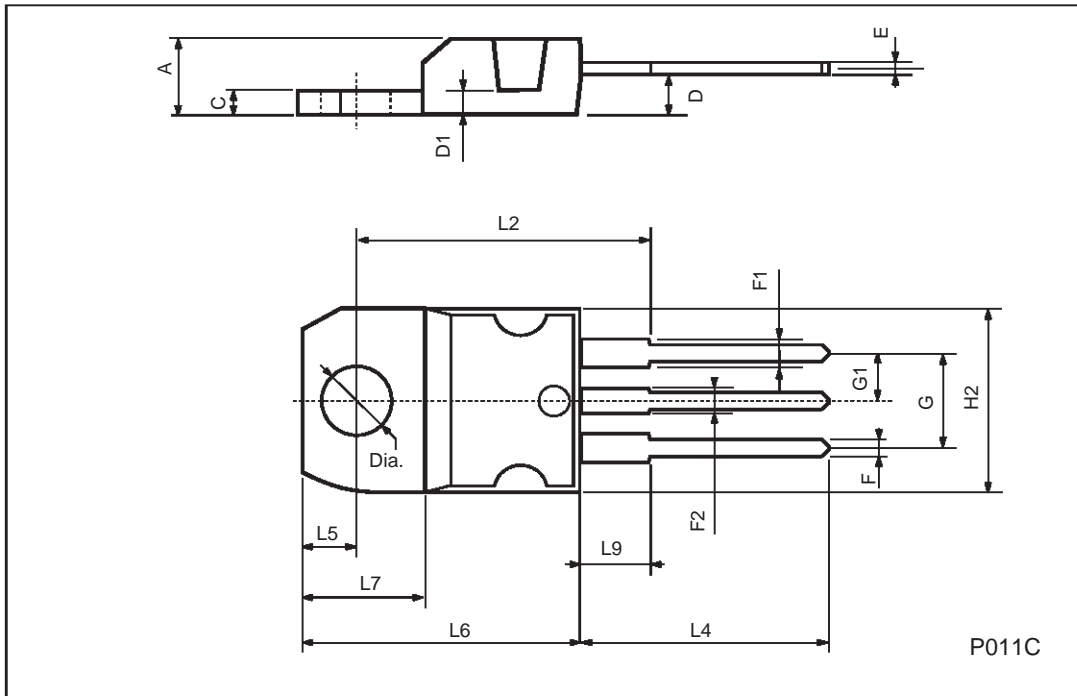


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



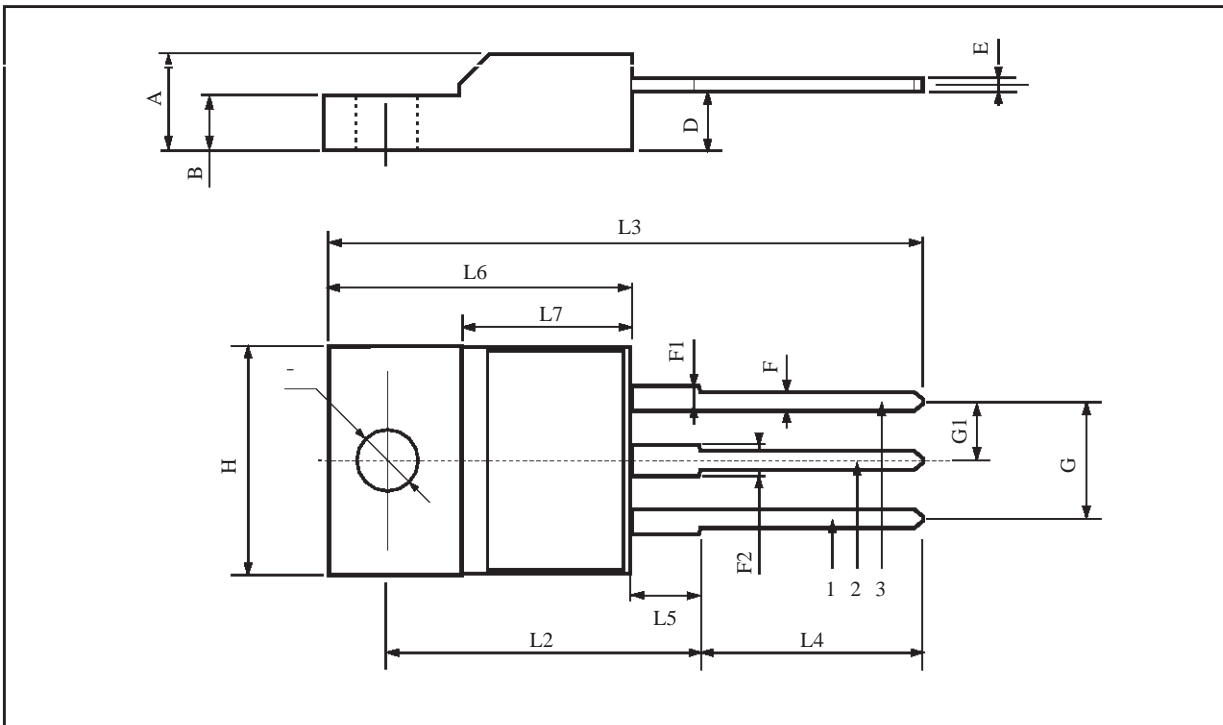
TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
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



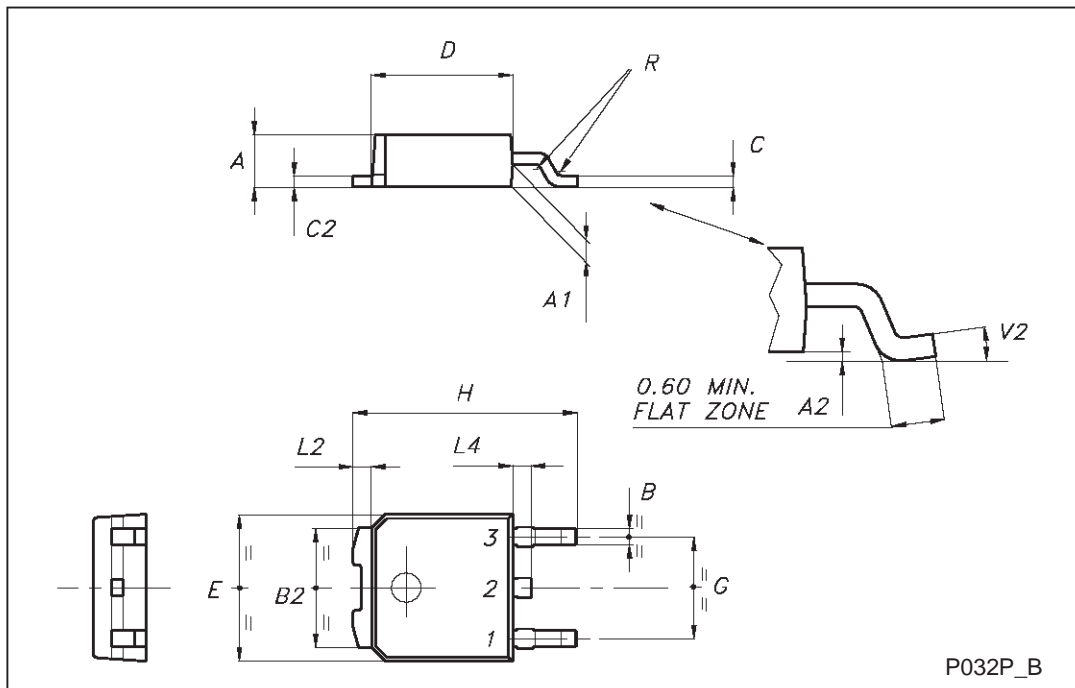
TO-220FP MECHANICAL DATA

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



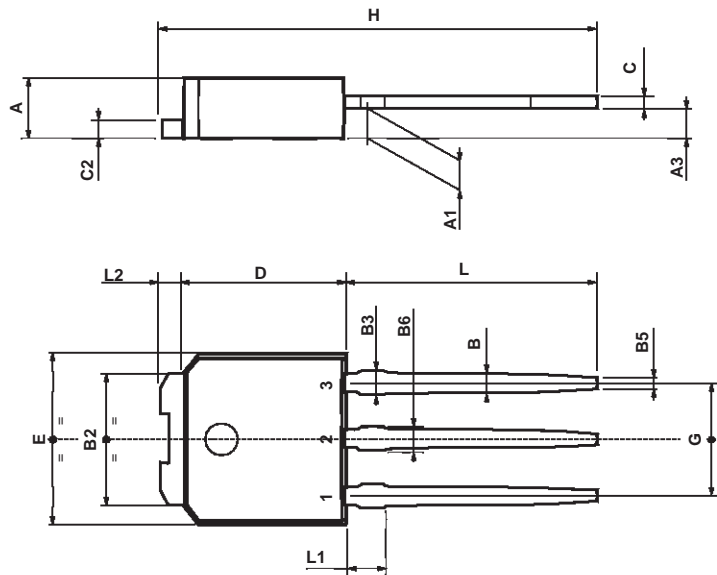
TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0°		8°	0°		0°



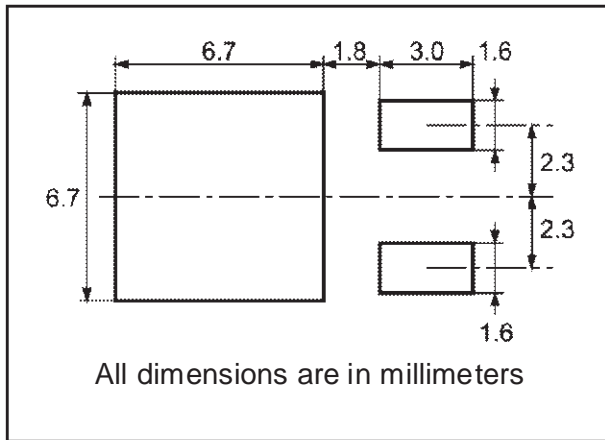
TO-251 (IPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039

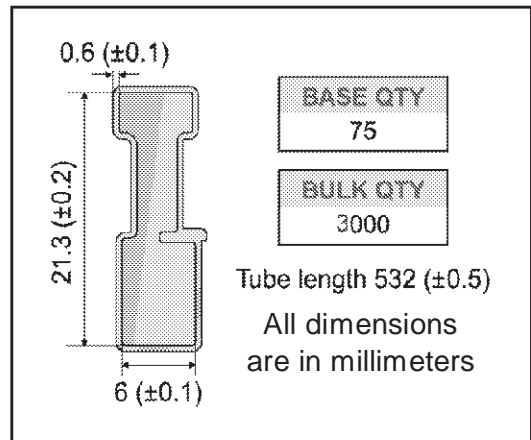


0068771-E

DPAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

TOP COVER TAPE

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

10 pitches cumulative tolerance on tape +/- 0.2 mm

For machine ref. only including draft and radii concentric around B0

*on sales type



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