



STP5NC50 - STP5NC50FP STB5NC50 - STB5NC50-1

N-CHANNEL 500V - 1.3Ω - 5.5A TO-220/FP/D²PAK/I²PAK

PowerMesh™II MOSFET

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5NC50	500 V	< 1.5Ω	5.5A
STP5NC50FP	500 V	< 1.5Ω	5.5A
STB5NC50	500 V	< 1.5Ω	5.5A
STB5NC50-1	500 V	< 1.5Ω	5.5A

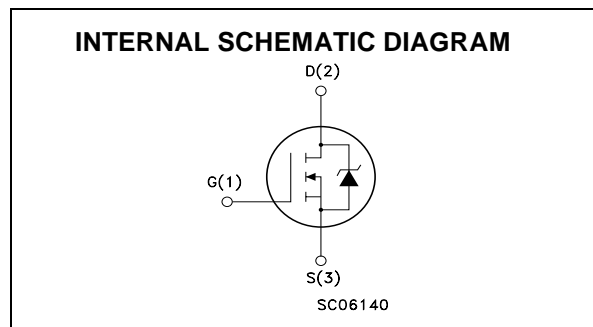
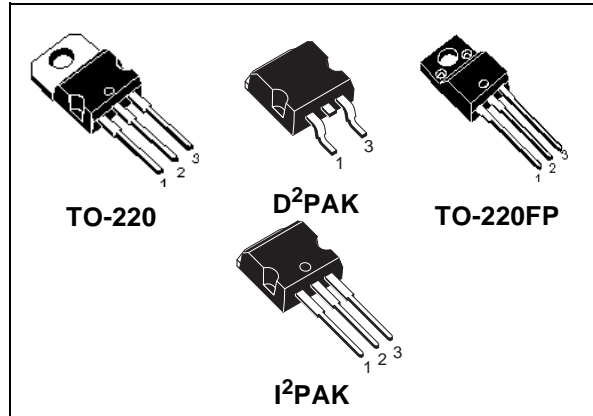
- TYPICAL R_{DS(on)} = 1.3Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

DESCRIPTION

The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron*area figure of merit while keeping the device at the leading edge for what concerns switching speed, gate charge and ruggedness.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVES



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5NC50 STB5NC50/-1	STP5NC50FP	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500		V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	500		V
V _{GS}	Gate- source Voltage	±30		V
I _D	Drain Current (continuous) at T _C = 25°C	5.5	5.5(*)	A
I _D	Drain Current (continuous) at T _C = 100°C	3.5	3.5(*)	A
I _{DM} (●)	Drain Current (pulsed)	22	22	A
P _{TOT}	Total Dissipation at T _C = 25°C	100	35	W
	Derating Factor	0.8	0.28	W/°C
dv/dt(1)	Peak Diode Recovery voltage slope	3.5		V/ns
V _{ISO}	Insulation Withstand Voltage (DC)	-	2500	V
T _j	Operating Junction Temperature	-55 to 175		°C
T _{stg}	Storage Temperature	-65 to 175		°C

(●)Pulse width limited by safe operating area

(1)I_{SD} ≤ 5.5A, di/dt ≤ 100A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.

(*)Limited only by maximum temperature allowed

STP5NC50 - STP5NC50FP - STB5NC50 - STB5NC50-1

THERMAL DATA

		TO-220 D ² PAK I ² PAK	TO-220FP	
Rthj-case	Thermal Resistance Junction-case Max	1.25	3.57	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5		°C/W
T _l	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)	5.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	280	mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250µA, V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating, T _C = 125 °C			1 50	µA µA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ±30V			±100	nA

ON ⁽¹⁾

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250µA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V, I _D = 2 A		1.3	1.5	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 = 2.5A		4		S
C _{iss}	Input Capacitance	V _{DS} = 25V, f = 1 MHz, V _{GS} = 0		480		pF
C _{oss}	Output Capacitance			80		pF
C _{rss}	Reverse Transfer Capacitance			11.5		pF

ELECTRICAL CHARACTERISTICS
(CONTINUED)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 250V, I_D = 2.5A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 3)		14		ns
t_r	Rise Time			15		ns
Q_g	Total Gate Charge	$V_{DD} = 400V, I_D = 5.5A,$ $V_{GS} = 10V$		17.5	24.5	nC
Q_{gs}	Gate-Source Charge			3		nC
Q_{gd}	Gate-Drain Charge			9		nC

SWITCHING OFF

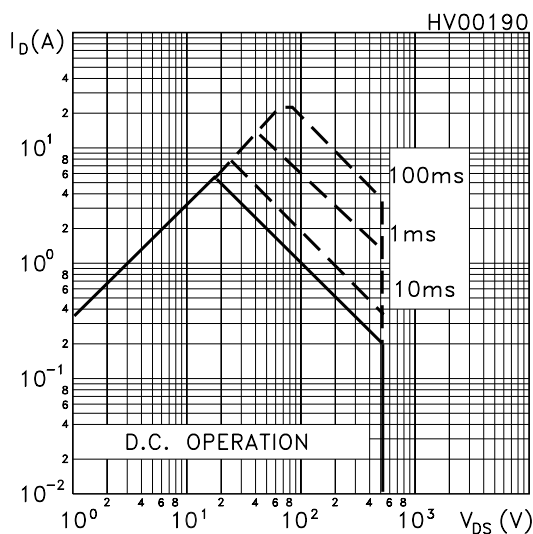
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400V, I_D = 5.5A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 5)		12		ns
t_f	Fall Time			14		ns
t_c	Cross-over Time			20		ns

SOURCE DRAIN DIODE

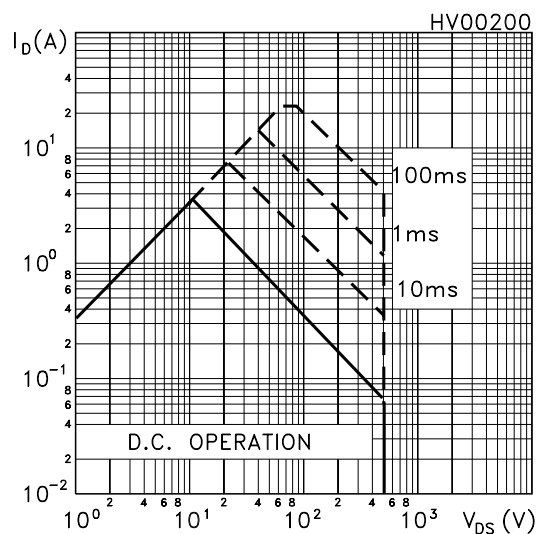
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				5.5	A
$I_{SDM(2)}$	Source-drain Current (pulsed)				22	A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 5.5A, V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5.5A, di/dt = 100A/\mu s,$ $V_{DD} = 100V, T_j = 150^\circ C$ (see test circuit, Figure 5)		360		ns
Q_{rr}	Reverse Recovery Charge			1.6		μC
I_{RRM}	Reverse Recovery Current			9		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/D2PAK/I2PAK

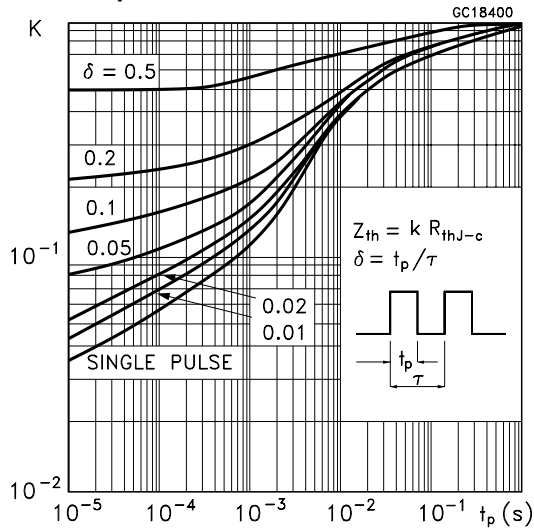


Safe Operating Area for TO-220FP

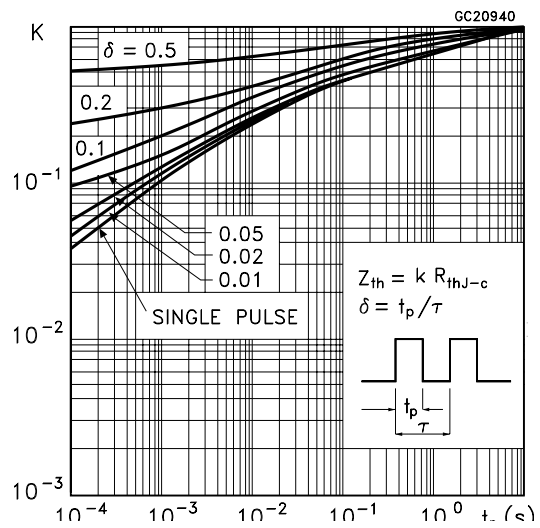


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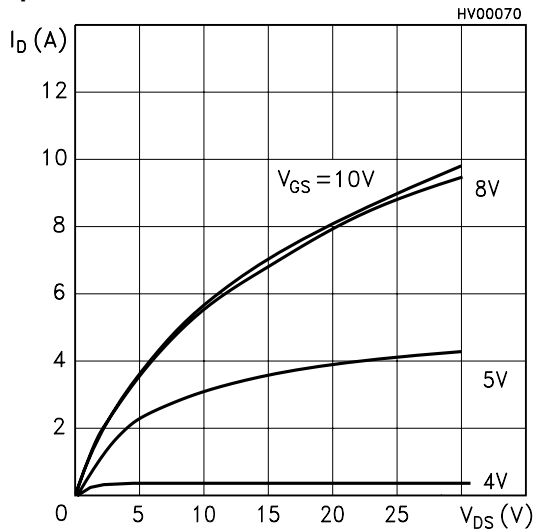
Thermal Impedance for TO-220/D2PAK/I2PAK



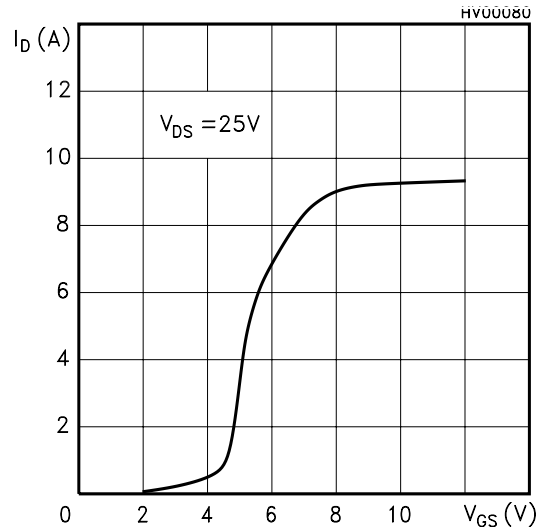
Thermal Impedance for TO-220FP



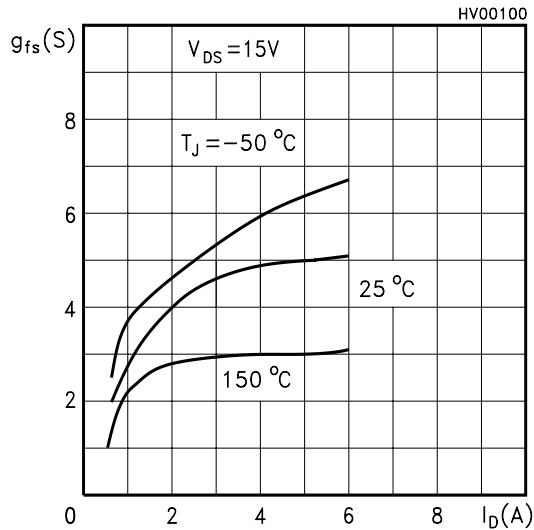
Output Characteristics



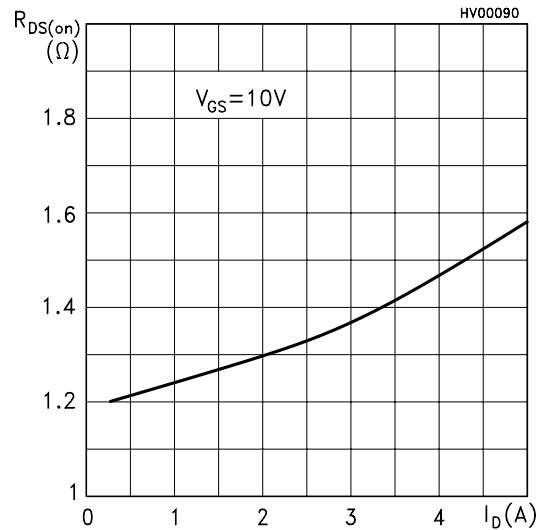
Transfer Characteristics



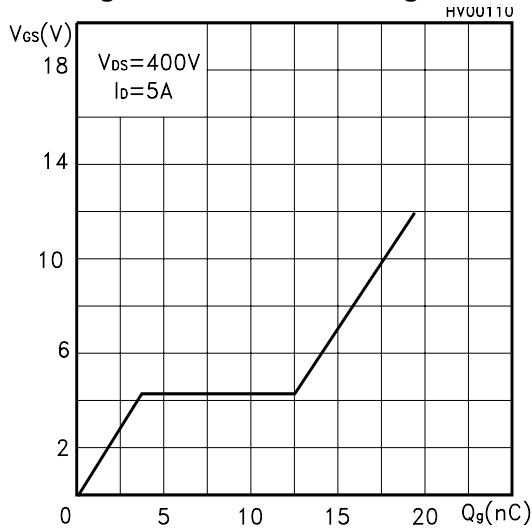
Transconductance



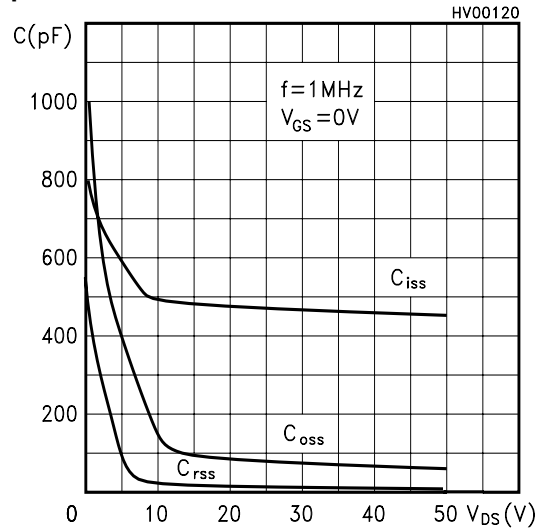
Static Drain-source On Resistance



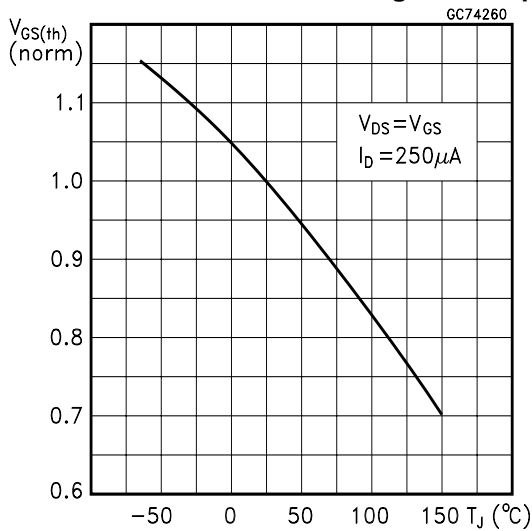
Gate Charge vs Gate-source Voltage



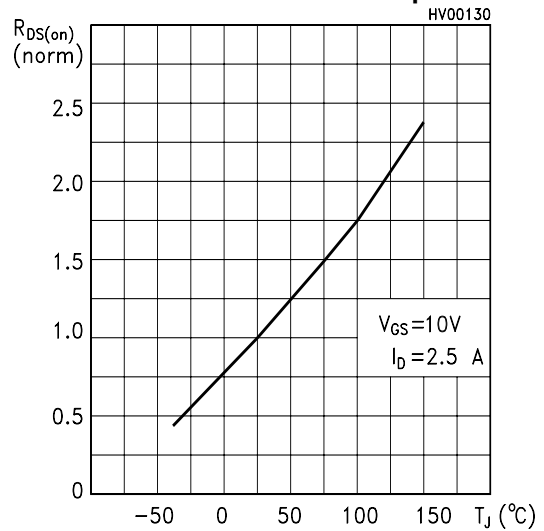
Capacitance Variations



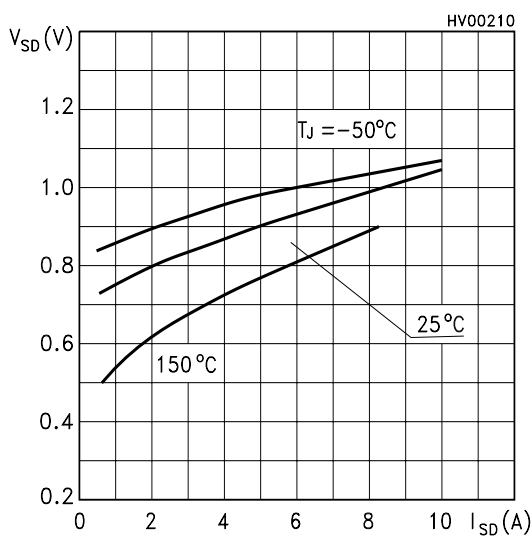
Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



STP5NC50 - STP5NC50FP - STB5NC50 - STB5NC50-1

Fig. 1: Unclamped Inductive Load Test Circuit

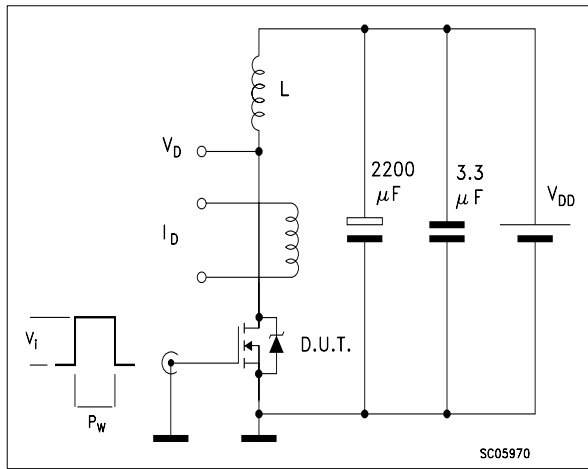


Fig. 2: Unclamped Inductive Waveform

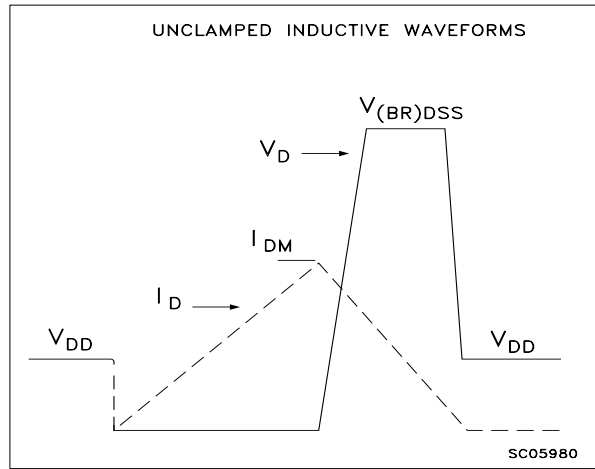


Fig. 3: Switching Times Test Circuit For Resistive Load

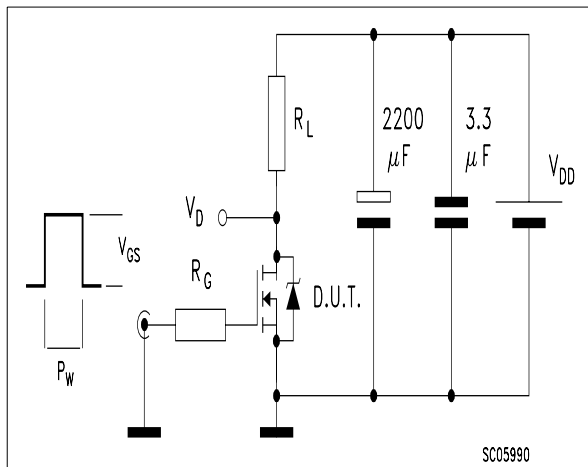


Fig. 4: Gate Charge test Circuit

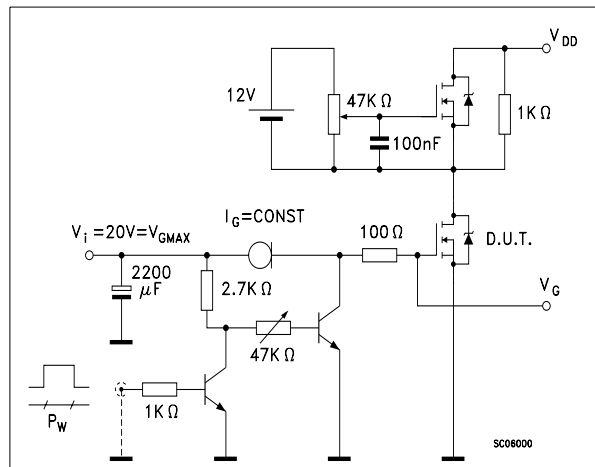
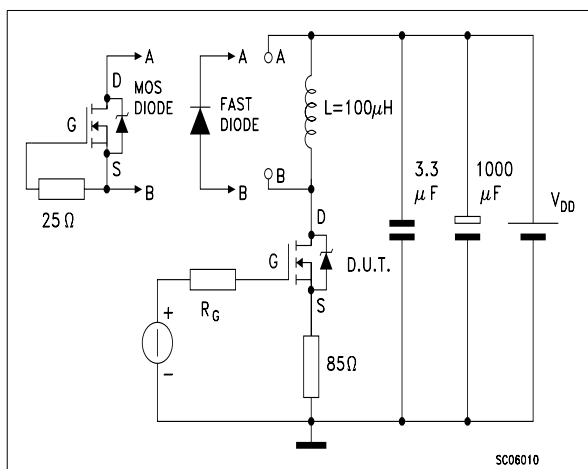
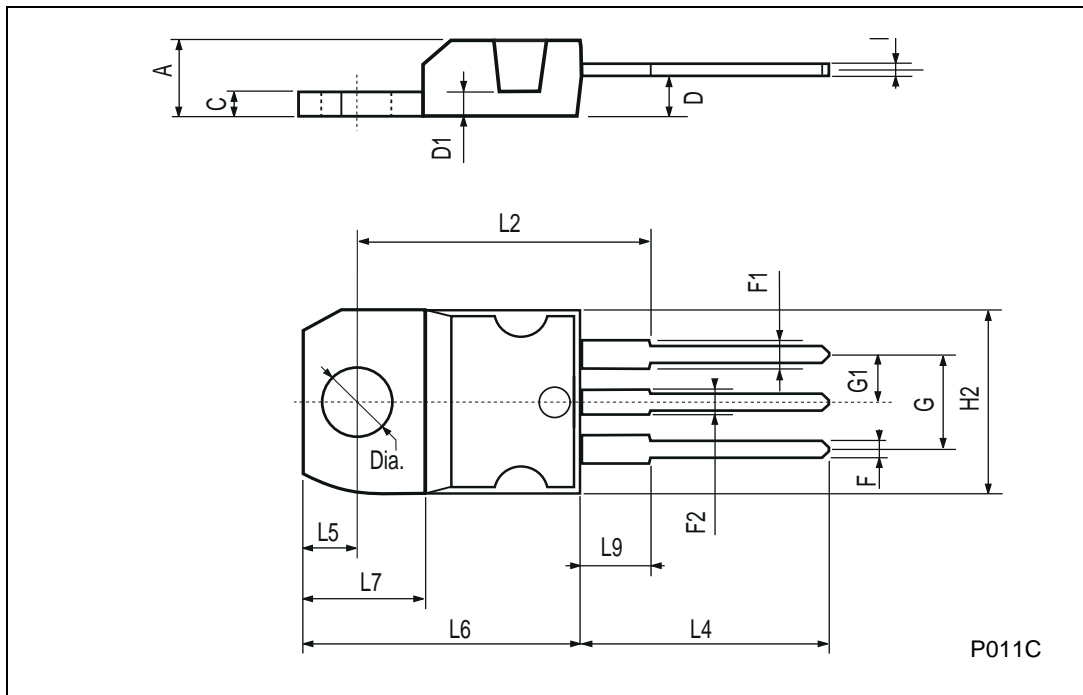


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



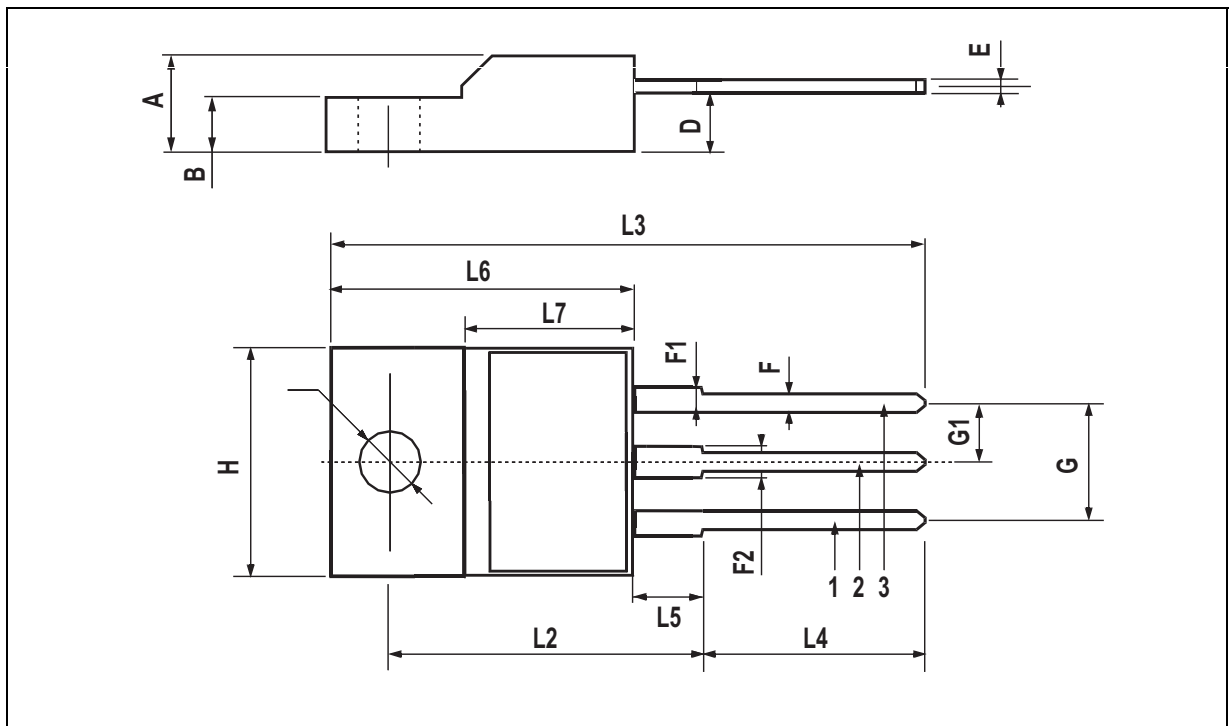
TO-220 MECHANICAL DATA

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



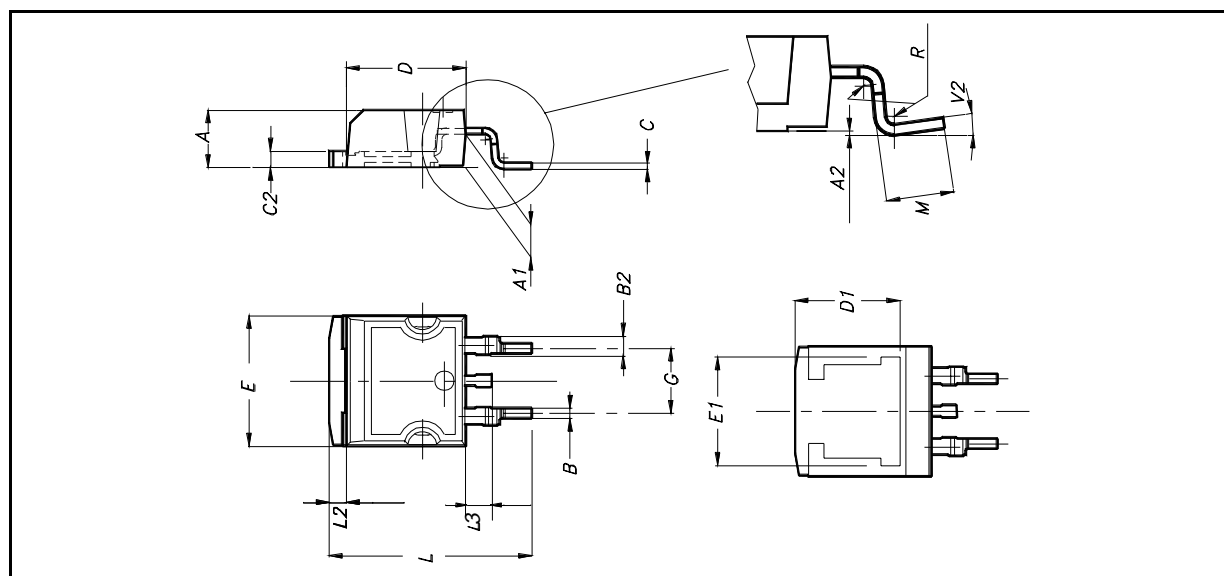
TO-220FP MECHANICAL DATA

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		1.5	0.045		0.067
F2	1.15		1.5	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	0.385		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



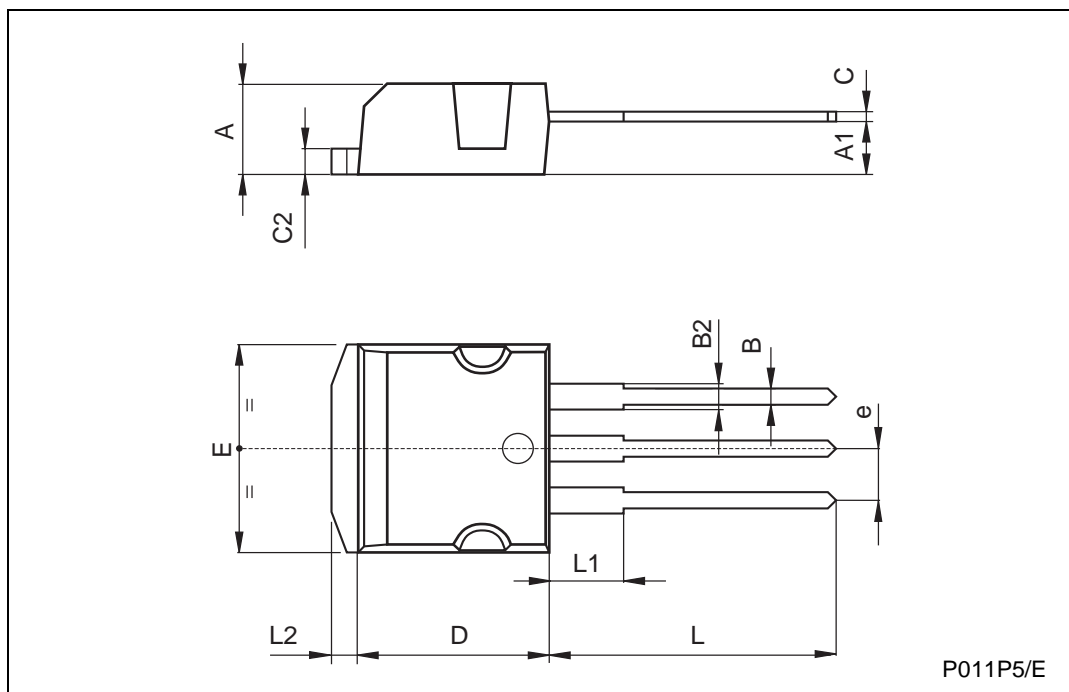
D²PAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°			

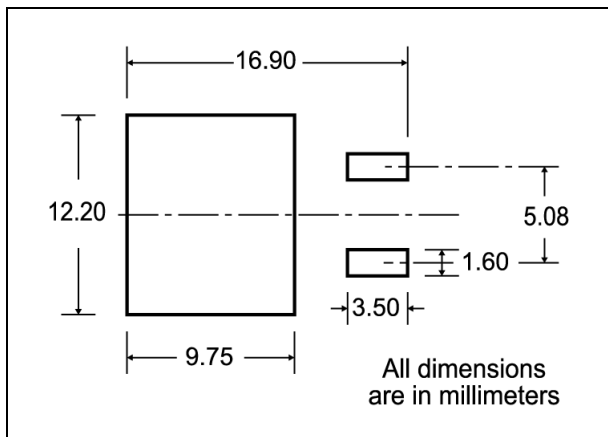


TO-262 (I²PAK) MECHANICAL DATA

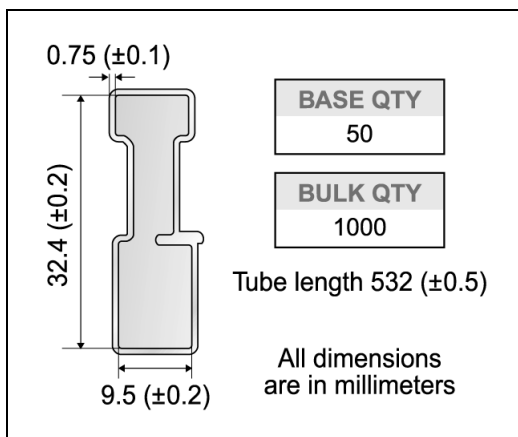
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
e	2.4		2.7	0.094		0.106
E	10		10.4	0.393		0.409
L	13.1		13.6	0.515		0.531
L1	3.48		3.78	0.137		0.149
L2	1.27		1.4	0.050		0.055



D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

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	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

* on sales type



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