



# STP45NF3LL - STP45NF3LLFP STB45NF3LL

N-CHANNEL 30V - 0.014Ω - 45A TO-220 - TO220FP - D<sup>2</sup>PAK  
STripFET II™ POWER MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP45NF3LL	30 V	<0.018Ω	45 A
STP45NF3LLFP	30 V	<0.018Ω	45 A
STB45NF3LL	30 V	<0.018Ω	27 A

- TYPICAL R<sub>DS(on)</sub> = 0.014Ω @4.5V
- OPTIMAL R<sub>DS(ON)</sub> x Q<sub>g</sub> TRADE-OFF @ 4.5V
- CONDUCTION LOSSES REDUCED
- SWITCHING LOSSES REDUCED
- ADD SUFFIX "T4" FOR ORDERING IN TAPE & REEL

## DESCRIPTION

This application specific Power MOSFET is the third generation of STMicroelectronics unique "Single Feature™" strip-based process. The resulting transistor shows the best trade-off between on-resistance and gate charge. When used as high and low side in buck regulators, it gives the best performance in terms of both conduction and switching losses. This is extremely important for motherboards where fast switching and high efficiency are of paramount importance.

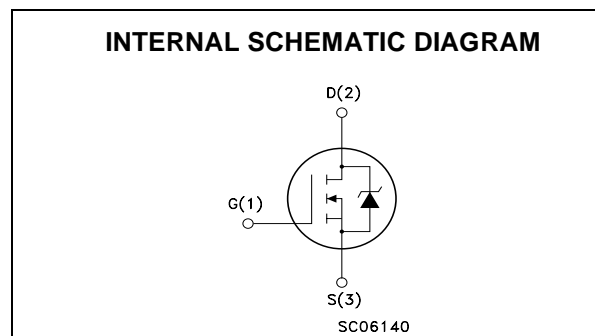
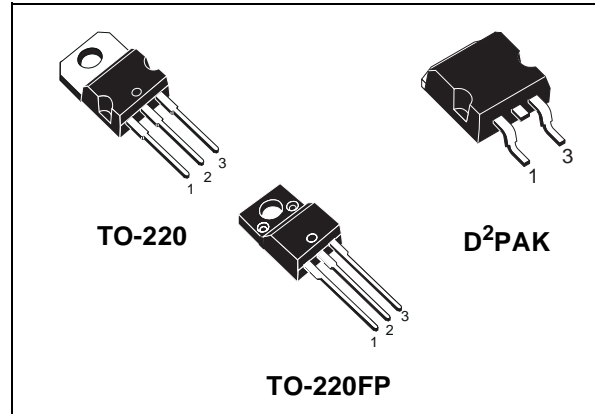
## APPLICATIONS

- SPECIFICALLY DESIGNED AND OPTIMISED FOR HIGH EFFICIENCY DC/DC CONVERTERS

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		TO-220/D <sup>2</sup> PAK	TO-220FP	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	30		V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	30		V
V <sub>GS</sub>	Gate- source Voltage	± 16		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	45	27	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	32	19	A
I <sub>DM</sub> (●)	Drain Current (pulsed)	180	108	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	70	25	W
	Derating Factor	0.46	0.167	W/°C
E <sub>AS</sub> (1)	Single Pulse Avalanche Energy	241		mJ
V <sub>iso</sub>	Insulation Withstand Voltage (DC)	--	2500	V
T <sub>stg</sub>	Storage Temperature	- 55 to 175		°C
T <sub>j</sub>	Max. Operating Junction Temperature			

(●) Pulse width limited by safe operating area  
November 2002



(1) Starting T<sub>j</sub> = 25°C, I<sub>D</sub> = 22.5A, V<sub>DD</sub> = 24V

## STP45NF3LL - STB45NF3LL

### THERMAL DATA

		TO-220 D <sup>2</sup> PAK	TO-220FP	
Rthj-case	Thermal Resistance Junction-case Max	2.14	6	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5		°C/W
T <sub>I</sub>	Maximum Lead Temperature For Soldering Purpose	300		°C

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

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			1 10	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 16 V			±100	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	1			V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 22.5 A V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 22.5 A		0.014 0.016	0.018 0.020	Ω Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (1)	Forward Transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 22.5 A		20		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		800		pF
C <sub>oss</sub>	Output Capacitance			250		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			60		pF

**ELECTRICAL CHARACTERISTICS (CONTINUED)**

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 15\text{ V}, I_D = 22.5\text{ A}$		17		ns
$t_r$	Rise Time	$R_G = 4.7\Omega, V_{GS} = 4.5\text{ V}$ (Resistive Load, see Fig. 3)		100		ns
$Q_g$	Total Gate Charge	$V_{DD} = 24\text{ V}, I_D = 45\text{ A},$		12.5	17	nC
$Q_{gs}$	Gate-Source Charge	$V_{GS} = 5\text{ V}$		4.6		nC
$Q_{gd}$	Gate-Drain Charge			5.2		nC

**SWITCHING OFF**

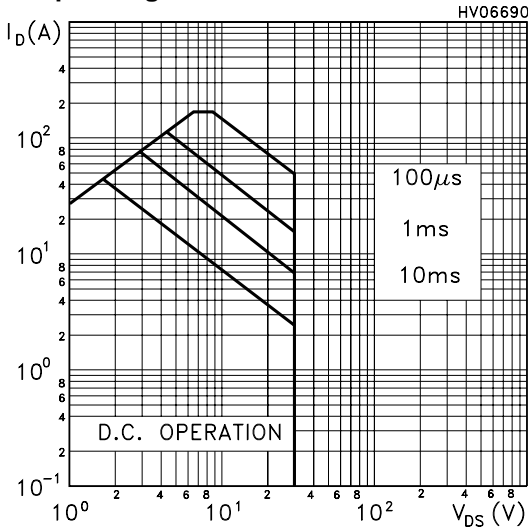
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off-Delay Time	$V_{DD} = 15\text{ V}, I_D = 22.5\text{ A},$		20		ns
$t_f$	Fall Time	$R_G = 4.7\Omega, V_{GS} = 4.5\text{ V}$ (Resistive Load, see Fig. 3)		21		ns

**SOURCE DRAIN DIODE**

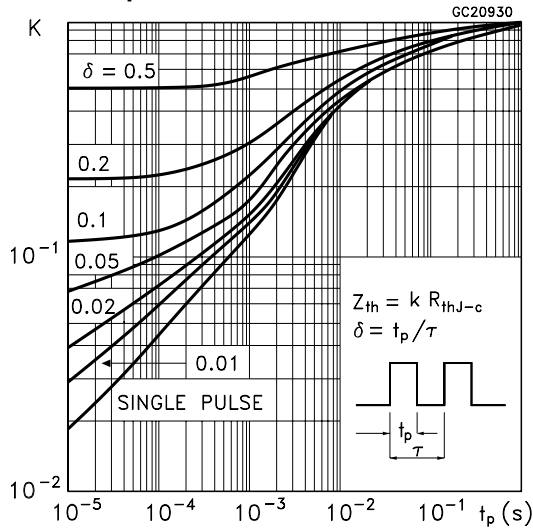
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				45	A
$I_{SDM(2)}$	Source-drain Current (pulsed)				180	A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 45\text{ A}, V_{GS} = 0$			1.3	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 45\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$		35		ns
$Q_{rr}$	Reverse Recovery Charge	$V_{DD} = 15\text{ V}, T_j = 150^\circ\text{C}$		44		nC
$I_{RRM}$	Reverse Recovery Current	(see test circuit, Figure 5)		2.5		A

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 2. Pulse width limited by safe operating area.

**Safe Operating Area for TO-220/D2PAK**

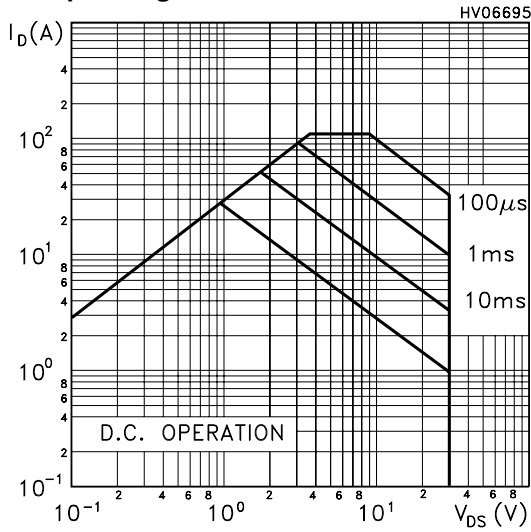


**Thermal Impedance for TO-220/D2PAK**

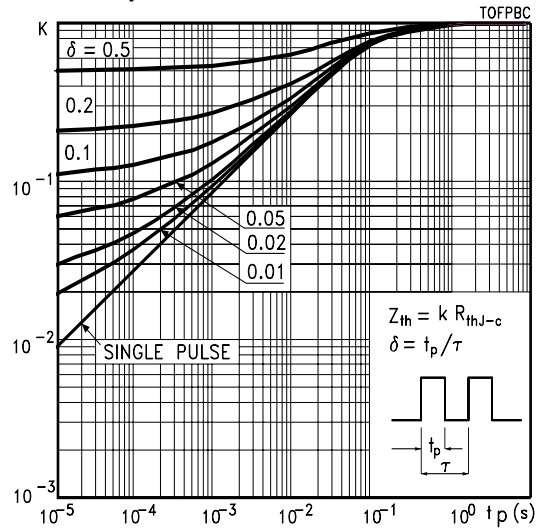


# STP45NF3LL - STB45NF3LL

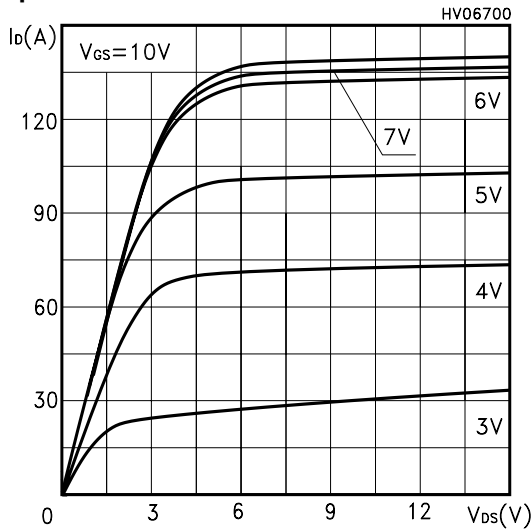
## Safe Operating Area for TO-220FP



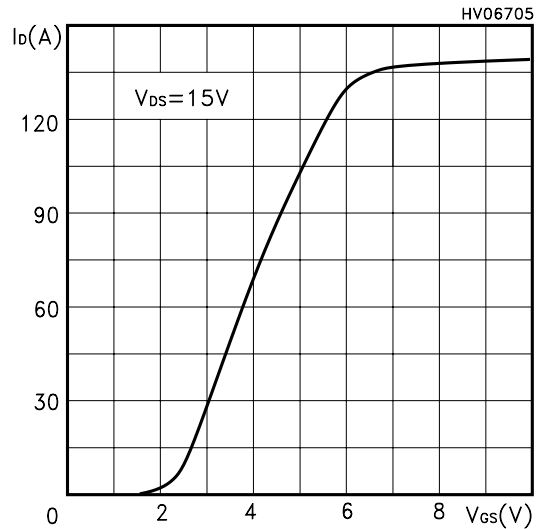
## Thermal Impedance for TO-220FP



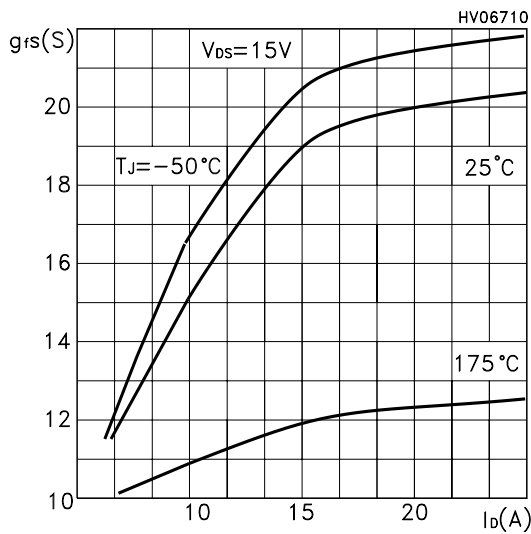
## Output Characteristics



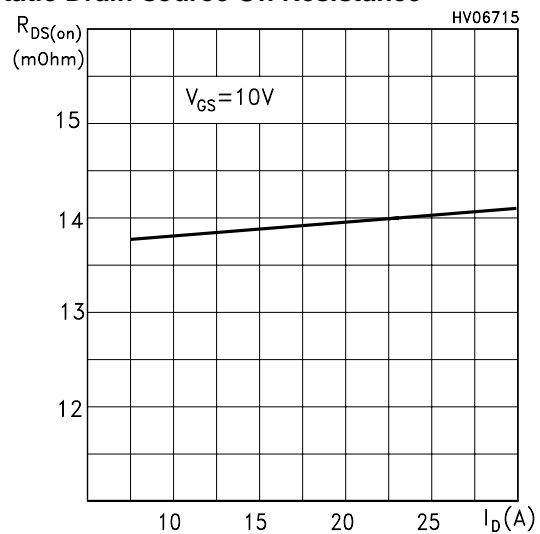
## Transfer Characteristics



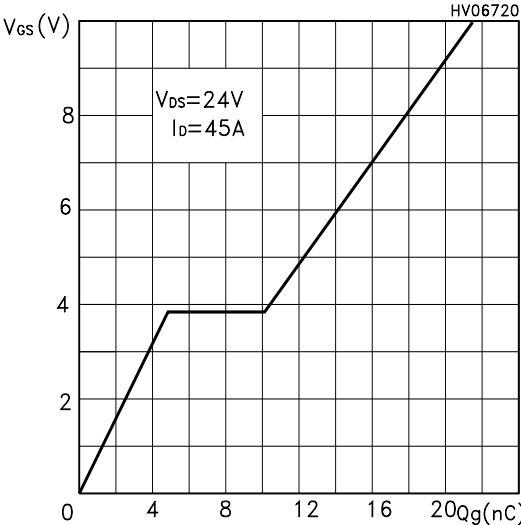
## Transconductance



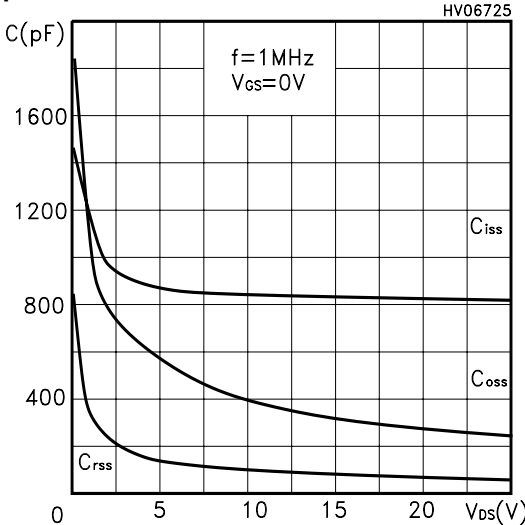
## Static Drain-source On Resistance



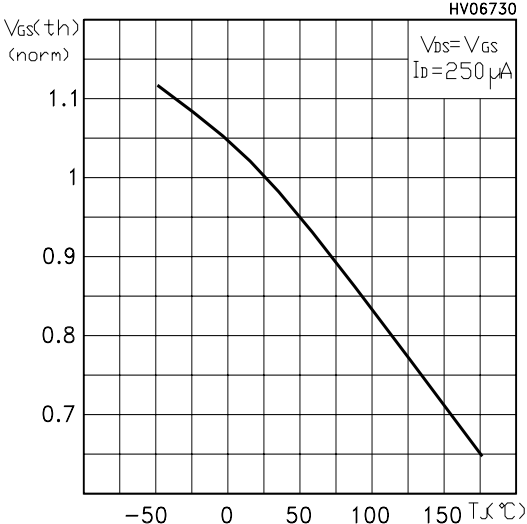
Gate Charge vs Gate-source Voltage



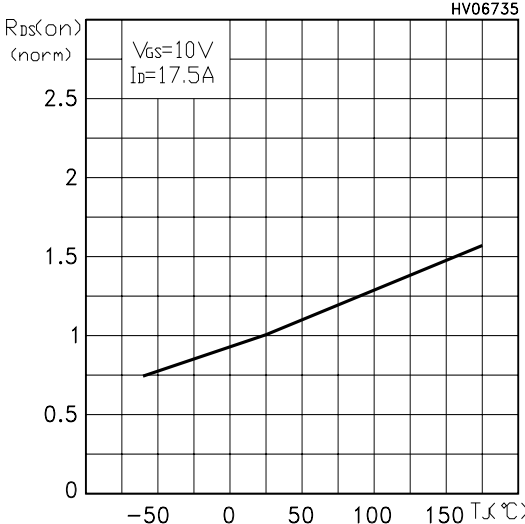
Capacitance Variations



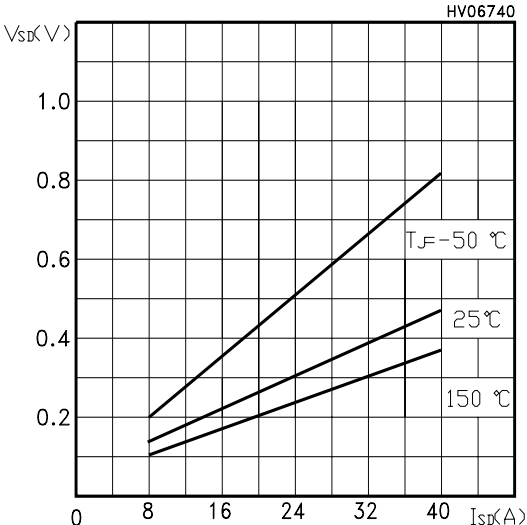
Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



Normalized Breakdown Voltage vs Tj

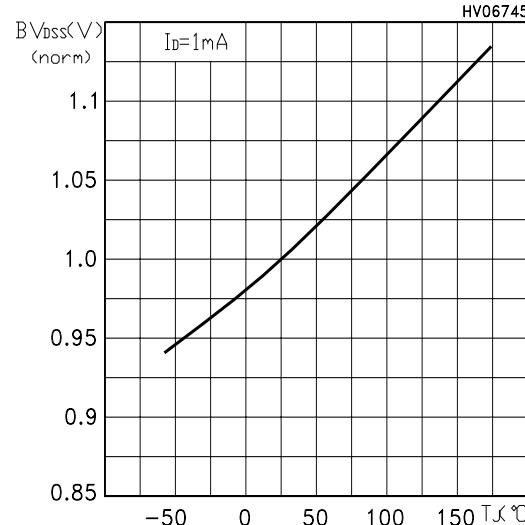


Fig. 1: Unclamped Inductive Load Test Circuit

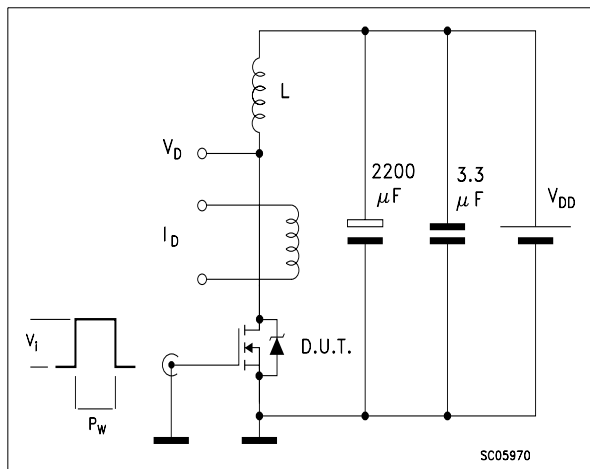


Fig. 2: Unclamped Inductive Waveform

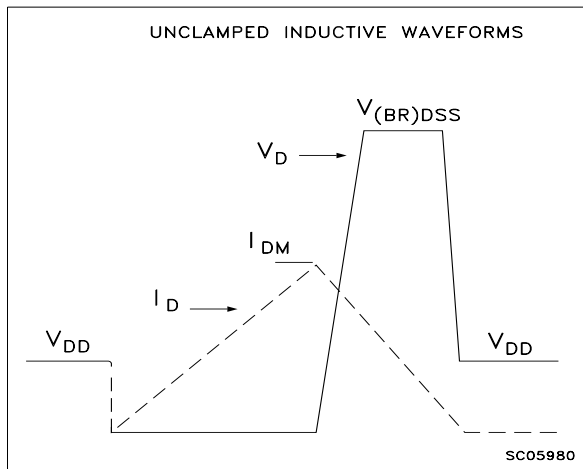


Fig. 3: Switching Times Test Circuit For Resistive Load

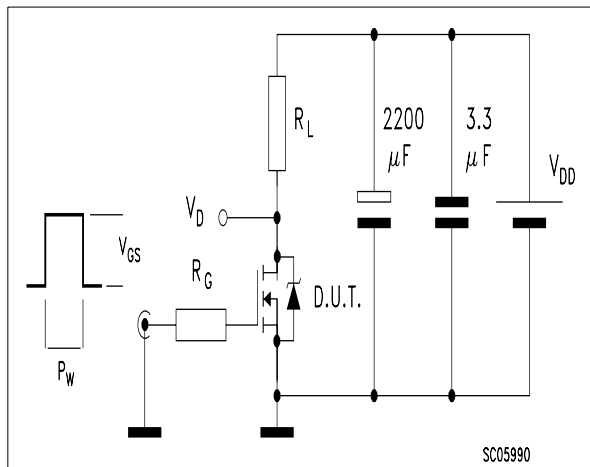


Fig. 4: Gate Charge test Circuit

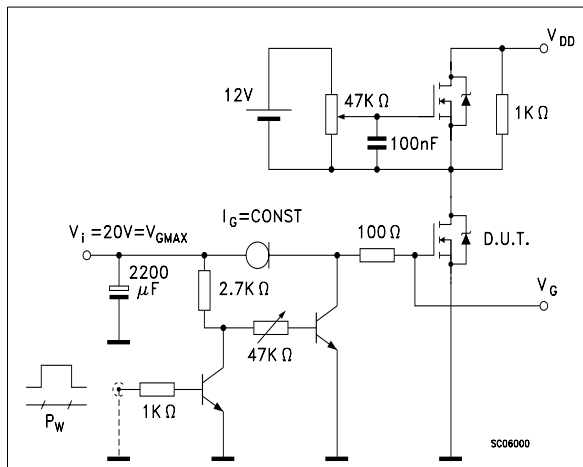
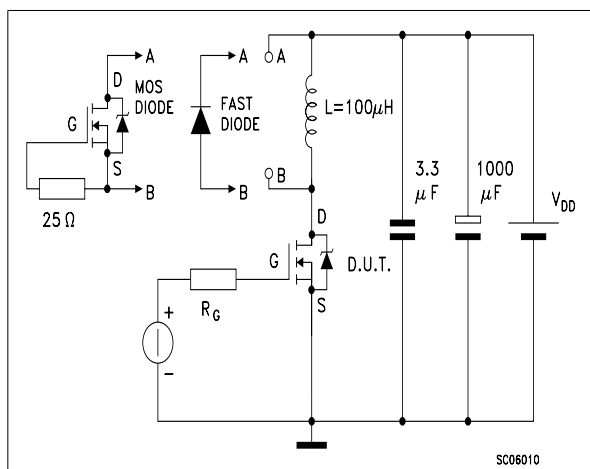
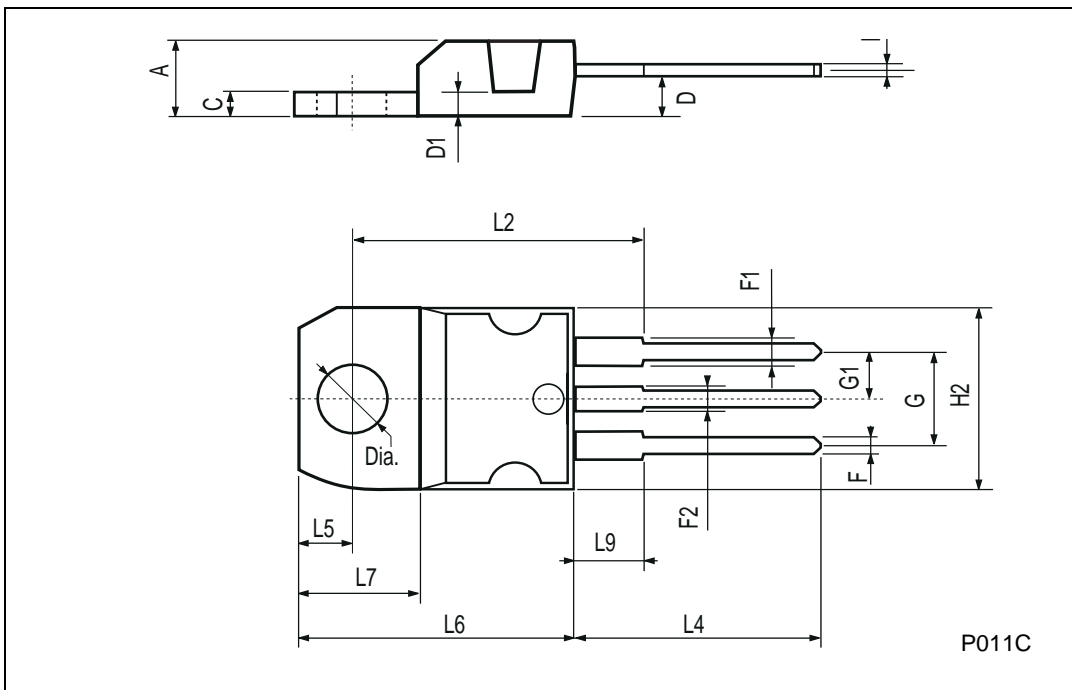


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



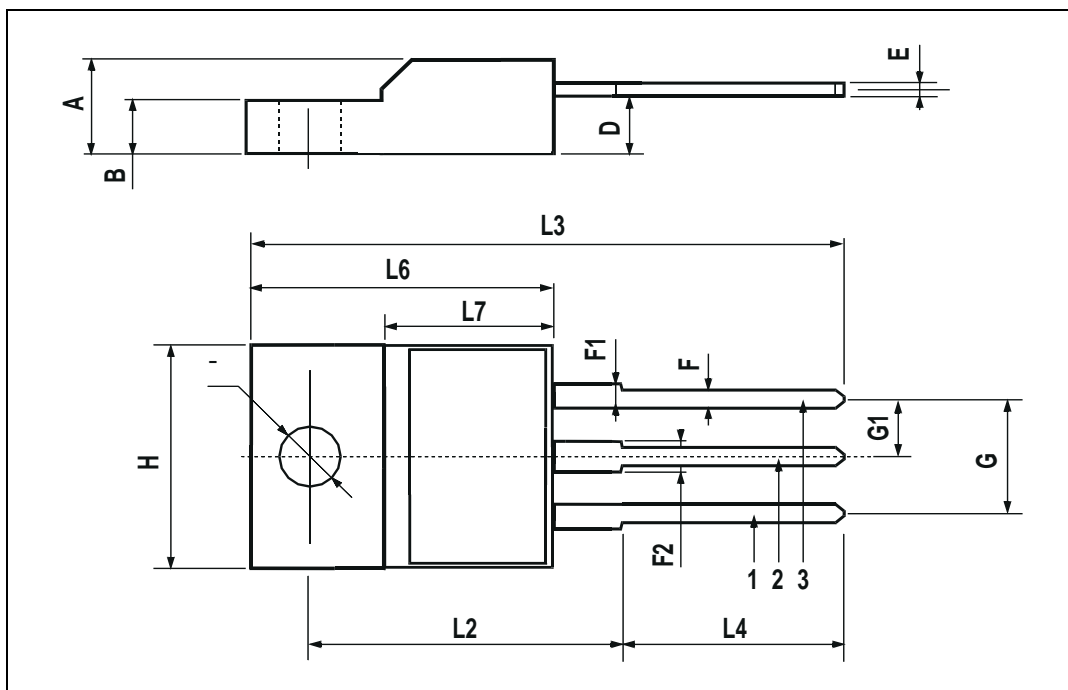
**TO-220 MECHANICAL DATA**

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**

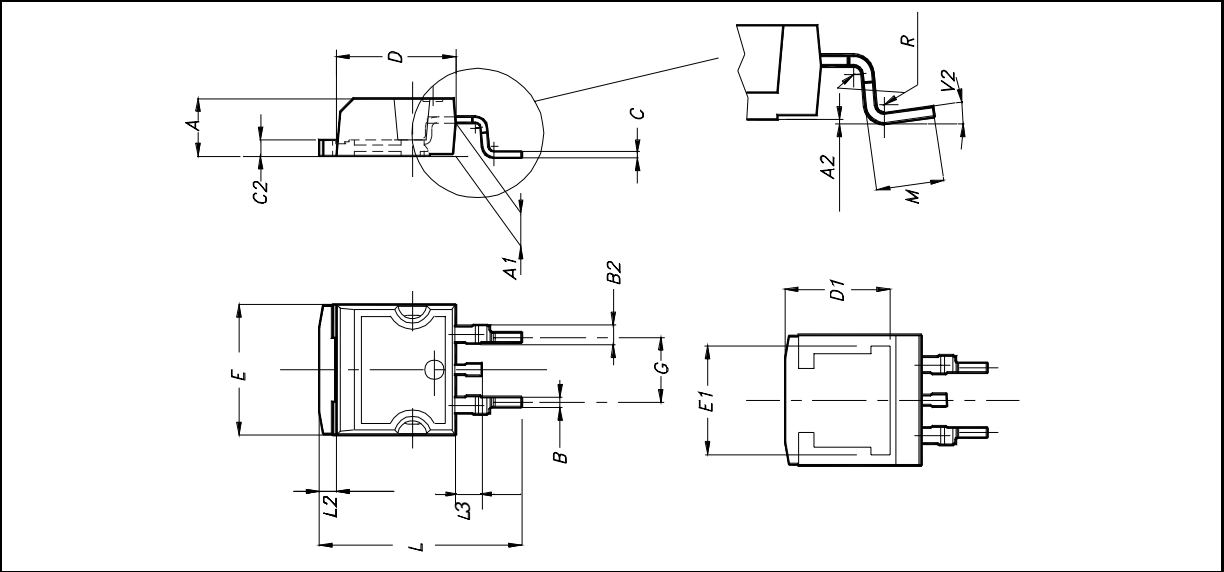
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
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



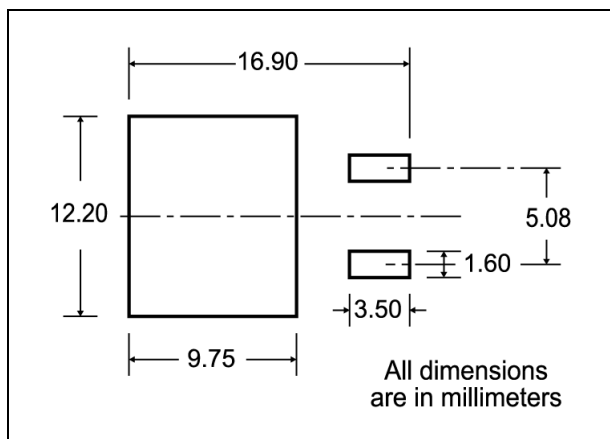


**D<sup>2</sup>PAK MECHANICAL DATA**

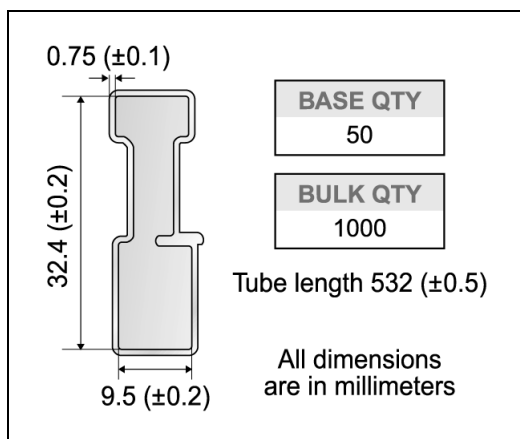
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
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°			



**D<sup>2</sup>PAK 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

**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

10 pitches cumulative tolerance on tape + / - 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius

R min.

\* on sales type

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