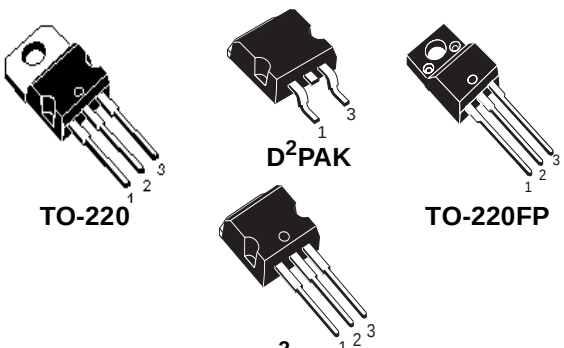
STP4NC80Z - STP4NC80ZFP
STB4NC80Z - STB4NC80Z-1

N-CHANNEL 800V - 2.4Ω - 4A TO-220/FP/D²PAK/I²PAK
Zener-Protected PowerMESH™III MOSFET

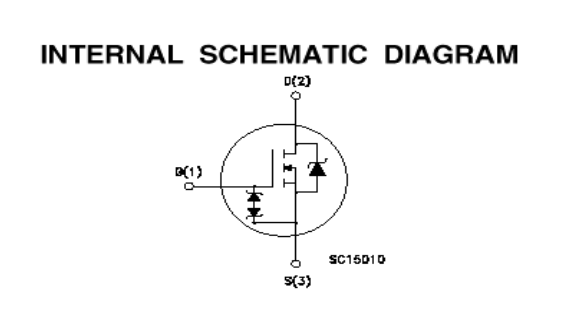
TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STP4NC80Z/FP	800V	< 2.8 Ω	4 A
STB4NC80Z/-1	800V	< 2.8 Ω	4 A

- TYPICAL $R_{DS}(on)$ = 2.4 Ω
- EXTREMELY HIGH dv/dt AND CAPABILITY
- GATE-TO- SOURCE ZENER DIODES
- 100% AVALANCHE TESTED
- VERY LOW GATE INPUT RESISTANCE
- GATE CHARGE MINIMIZED



DESCRIPTION

The third generation of MESH OVERLAY™ Power MOSFETs for very high voltage exhibits unsurpassed on-resistance per unit area while integrating back-to-back Zener diodes between gate and source. Such arrangement gives extra ESD capability with higher ruggedness performance as requested by a large variety of single-switch applications.



APPLICATIONS

- SINGLE-ENDED SMPS IN MONITORS, COMPUTER AND INDUSTRIAL APPLICATION
- WELDING EQUIPMENT

ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP4NC80Z	P4NC80Z	TO-220	TUBE
STP4NC80ZFP	P4NC80ZFP	TO-220FP	TUBE
STB4NC80ZT4	B4NC80Z	D²PAK	TAPE & REEL
STB4NC80Z-1	B4NC80Z	I²PAK	TAPE & REEL

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP(B)4NC80Z(-1)	STP4NC80ZFP	
V_{DS}	Drain-source Voltage (V_{GS} = 0)	800		V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	800		V
V_{GS}	Gate- source Voltage	± 25		V
I_D	Drain Current (continuos) at T_C = 25°C	4	4(*)	A
I_D	Drain Current (continuos) at T_C = 100°C	2.5	2.5(*)	A
I_{DM} (•)	Drain Current (pulsed)	16	16(*)	A
P_{TOT}	Total Dissipation at T_C = 25°C	100	35	W
	Derating Factor	0.8	0.28	W/°C
I_{GS}	Gate-source Current	±50		mA
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100pF, R=15KΩ)	2.5		KV
dv/dt(1)	Peak Diode Recovery voltage slope	3		V/ns
V_{ISO}	Insulation Winthstand Voltage (DC)	--	2000	V
T_{stg}	Storage Temperature	–65 to 150		°C
T_j	Max. Operating Junction Temperature	150		°C

(•)Pulse width limited by safe operating area
(1)I_{SD} ≤4A, di/dt ≤100A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_j ≤ T_{JMAX}
.(*)Pulse width Limited by maximum temperature allowed

THERMAL DATA

		TO-220 / D^2PAK / I^2PAK	TO-220FP	
Rthj-case	Thermal Resistance Junction-case Max	1.25	3.57	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	30		°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)	4	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	225	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 = 250 µA, V_{GS} = 0	800			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	I_D = 1 mA, V_{GS} = 0		0.9		V/°C
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating			1	µA
		V_{DS} = Max Rating, T_C = 125 °C			50	µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ±20V			±10	µA

ELECTRICAL CHARACTERISTICS (CONTINUED)

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	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 A		2.4	2.8	Ω

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 = 2A		4		S
C_{iss}	Input Capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		1200		pF
C_{oss}	Output Capacitance			90		pF
C_{rss}	Reverse Transfer Capacitance			11		pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	V_{DD} = 400 V, I_D = 2 A		27		ns
t_r	Rise Time	R_G = 4.7Ω V_{GS} = 10V (see test circuit, Figure 3)		10		ns
Q_g	Total Gate Charge	V_{DD} = 640V, I_D = 4A, V_{GS} = 10V		27	36.5	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			10		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	V_{DD} = 640V, I_D = 4 A,		11		ns
t_f	Fall Time	R_G = 4.7Ω, V_{GS} = 10V (see test circuit, Figure 5)		10		ns
t_c	Cross-over Time			24		ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4	A
I_{SDM} (2)	Source-drain Current (pulsed)				16	A
V_{SD} (1)	Forward On Voltage	I_{SD} = 4 A, V_{GS} = 0			1.6	V
t_{rr}	Reverse Recovery Time	I_{SD} = 4 A, di/dt = 100A/µs,		560		ns
Q_{rr}	Reverse Recovery Charge	V_{DD} = 50V, T_j = 150°C (see test circuit, Figure 5)		3.4		µC
I_{RRM}	Reverse Recovery Current			13		A

GATE-SOURCE ZENER DIODE

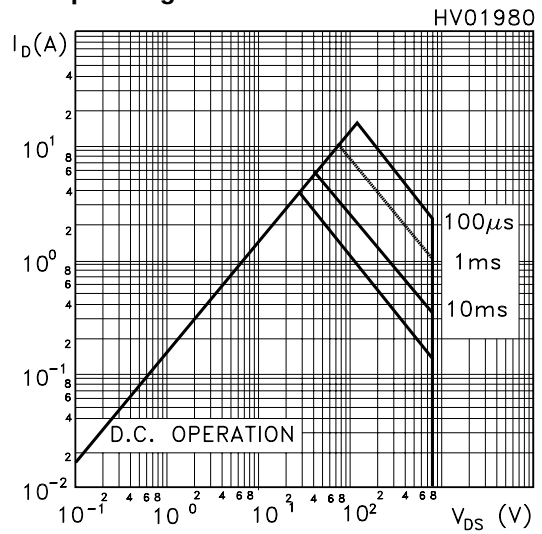
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{GSO}	Gate-Source Breakdown Voltage	Igs=± 1mA (Open Drain)	25			V
αT	Voltage Thermal Coefficient	T=25°C Note(3)		1.3		10^{-4}/°C
Rz	Dynamic Resistance	I_D = 50 mA,		90		Ω

Note: 1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
2. Pulse width limited by safe operating area.
3. $\Delta V_{BV} = \alpha T\ (25°\text{-}T)\ BV_{GSO}(25°)$

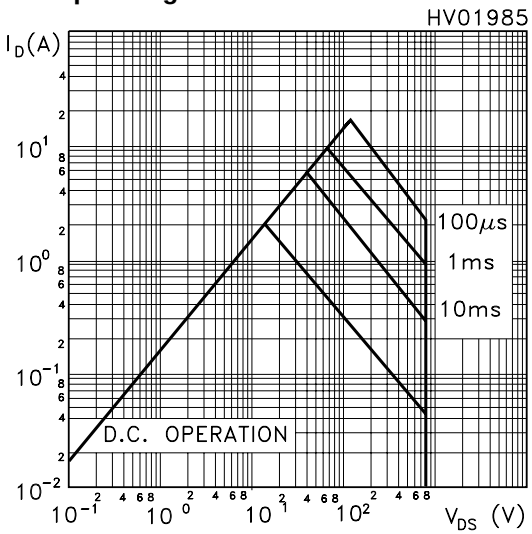
PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

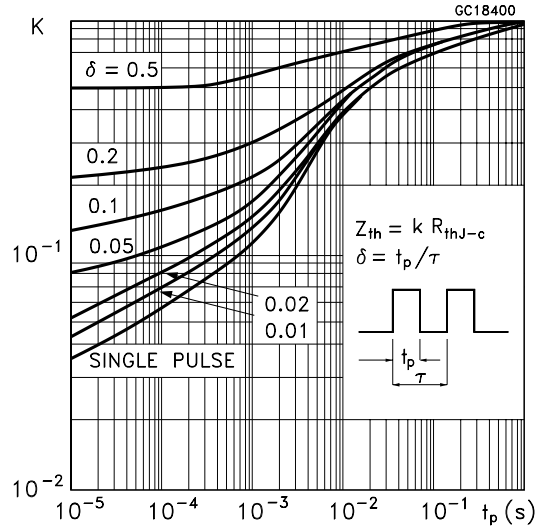
Safe Operating Area For TO-220/D²PAK/I²PAK



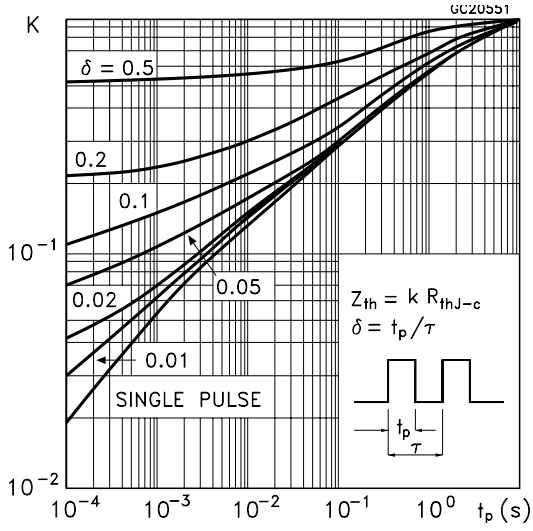
Safe Operating Area For TO-220FP



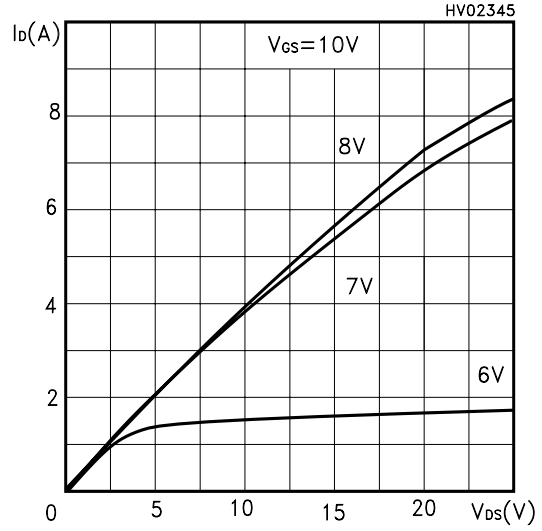
Thermal Impedance For TO-220/D²PAK/I²PAK



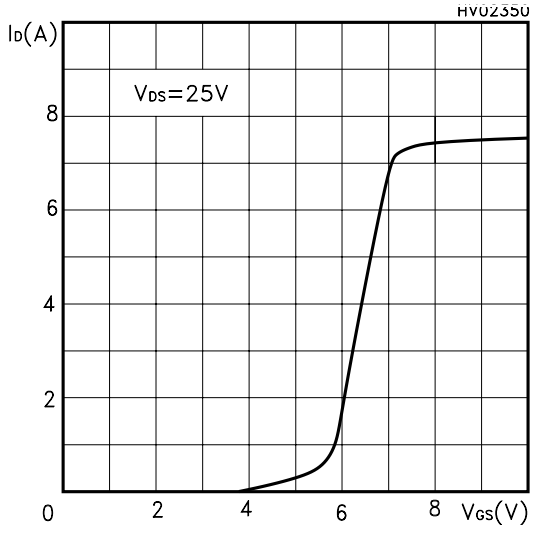
Thermal Impedance For TO-220FP



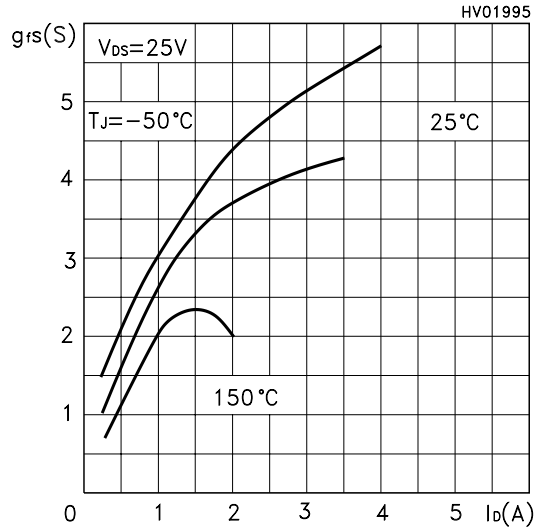
Output Characteristics



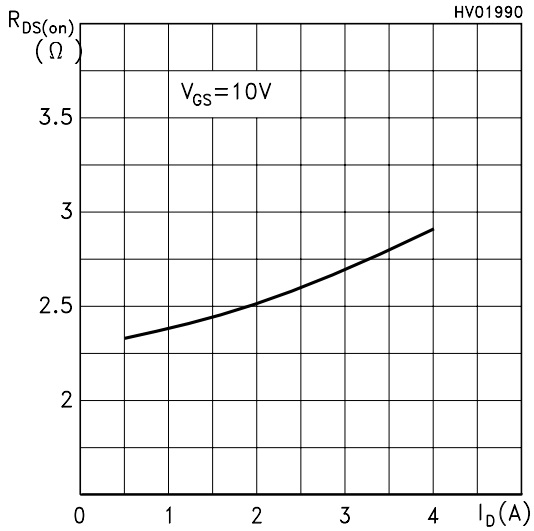
Transfer Characteristics



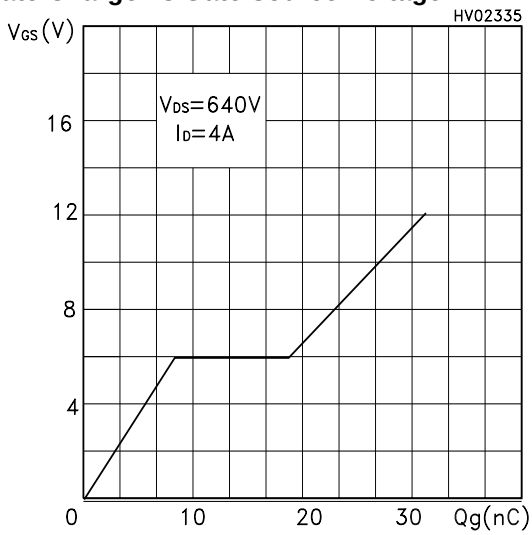
Transconductance



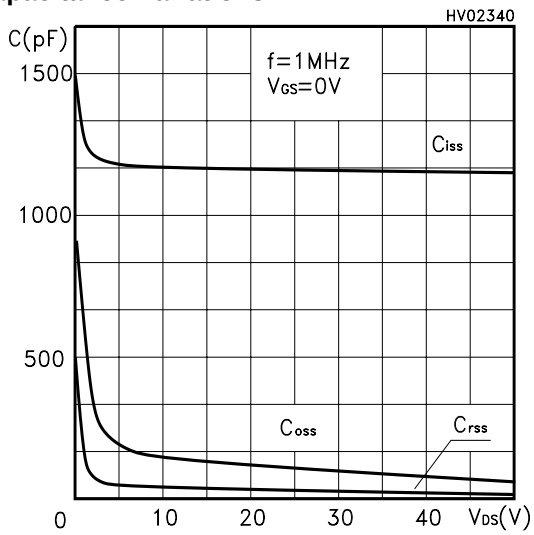
Static Drain-source On Resistance



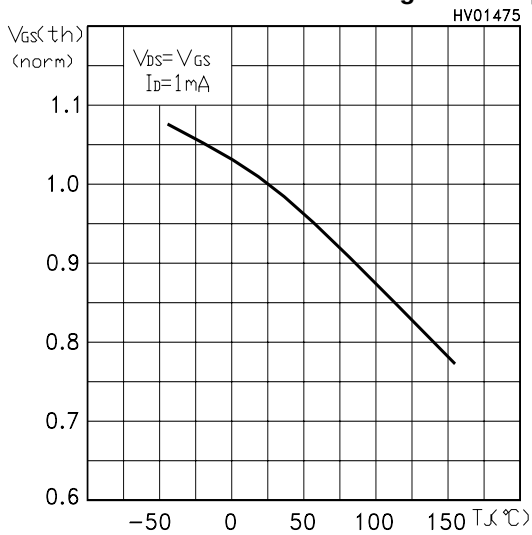
Gate Charge vs Gate-source Voltage



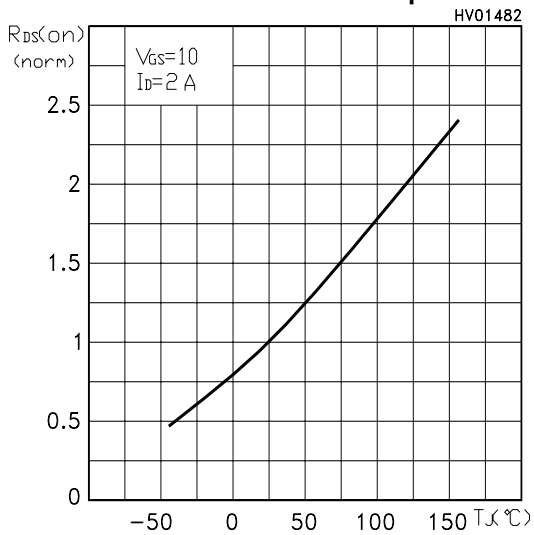
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

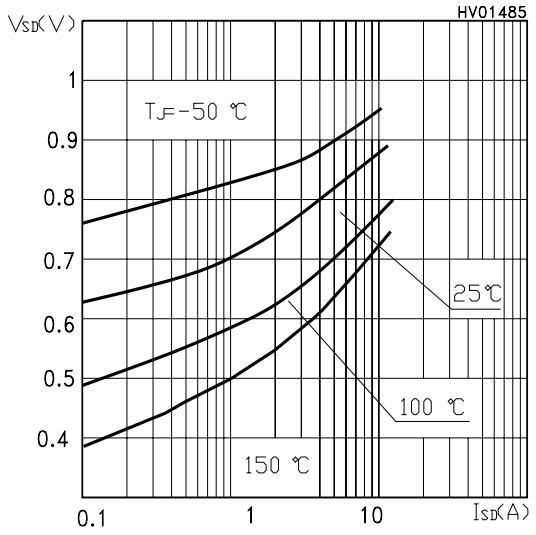


Fig. 1: Unclamped Inductive Load Test Circuit

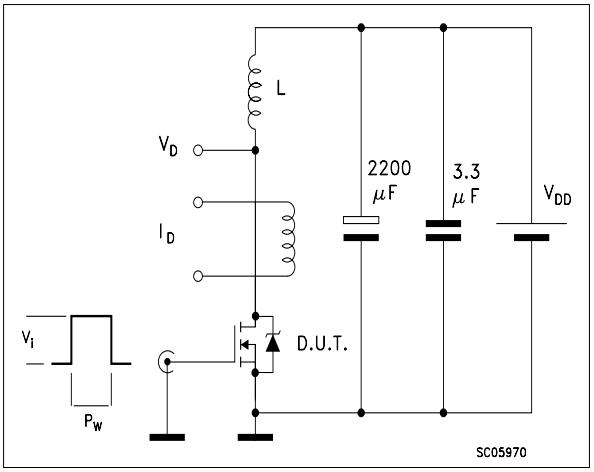


Fig. 2: Unclamped Inductive Waveform

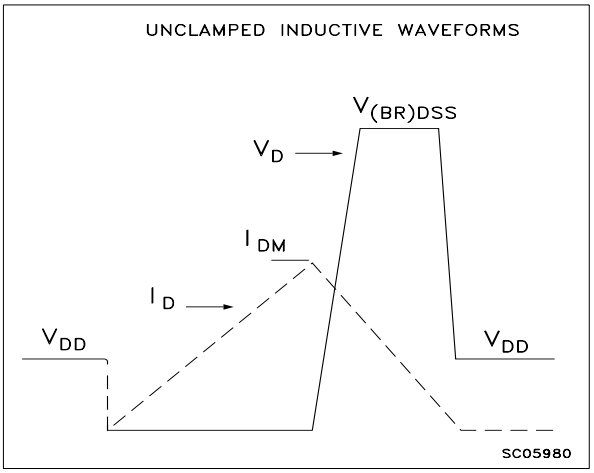


Fig. 3: Switching Times Test Circuits For Resistive Load

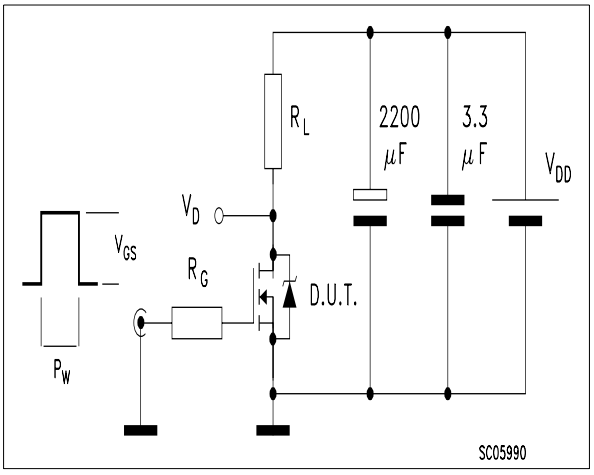


Fig. 4: Gate Charge test Circuit

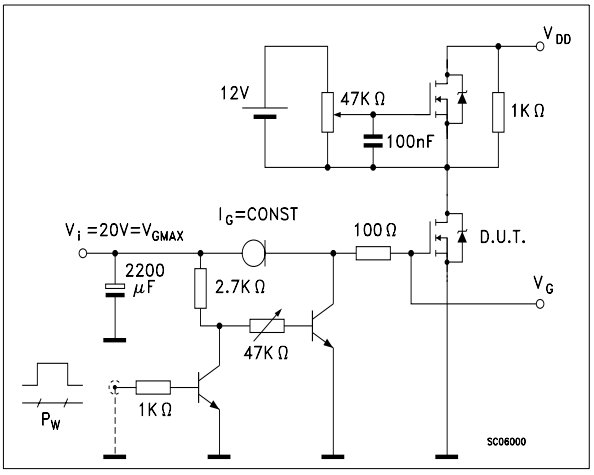
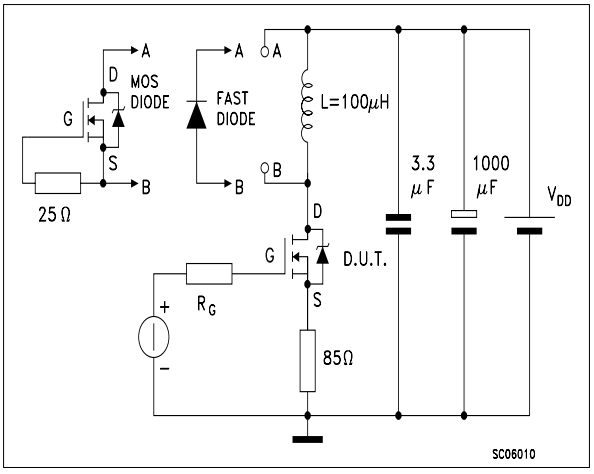
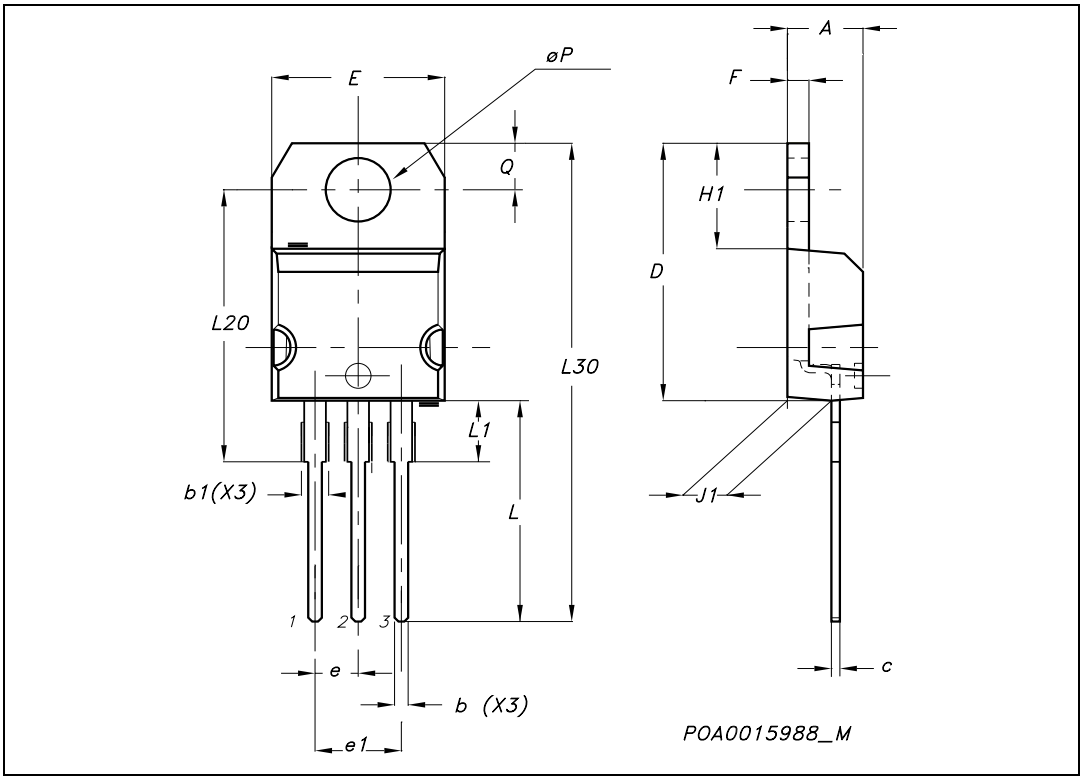


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



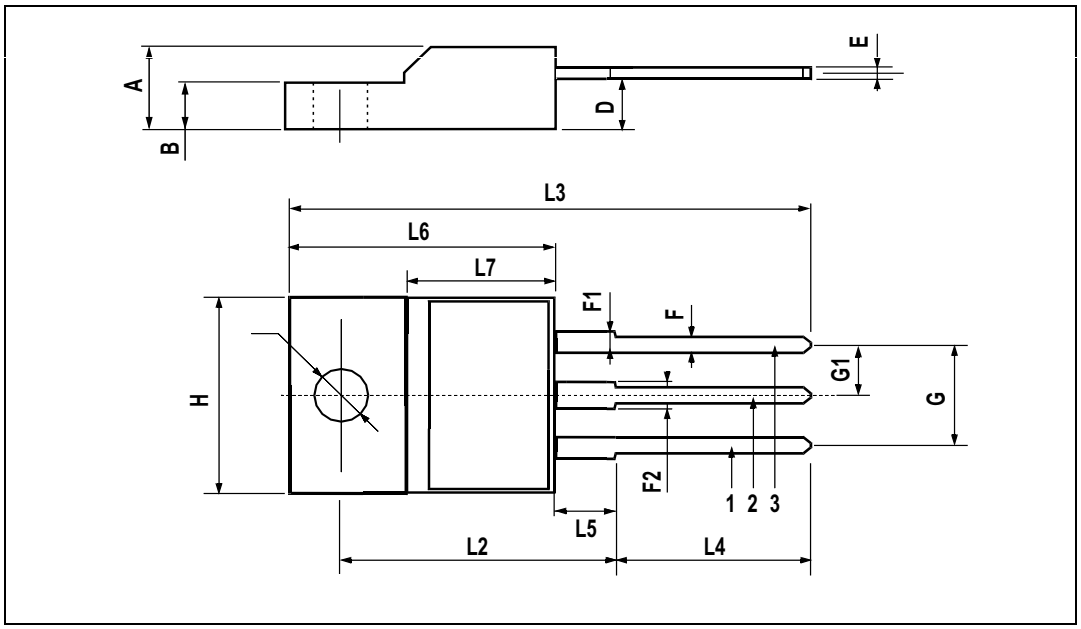
TO-220 MECHANICAL DATA

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



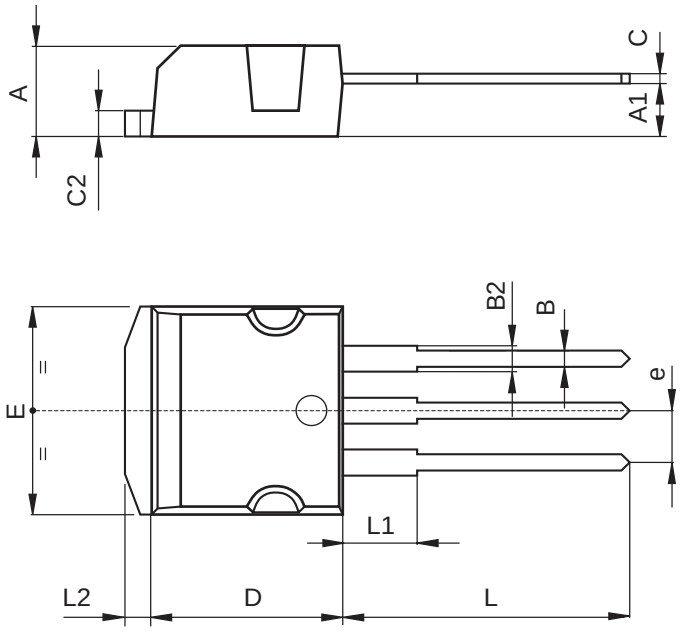
TO-220FP MECHANICAL DATA

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-262 (I^2PAK) MECHANICAL DATA

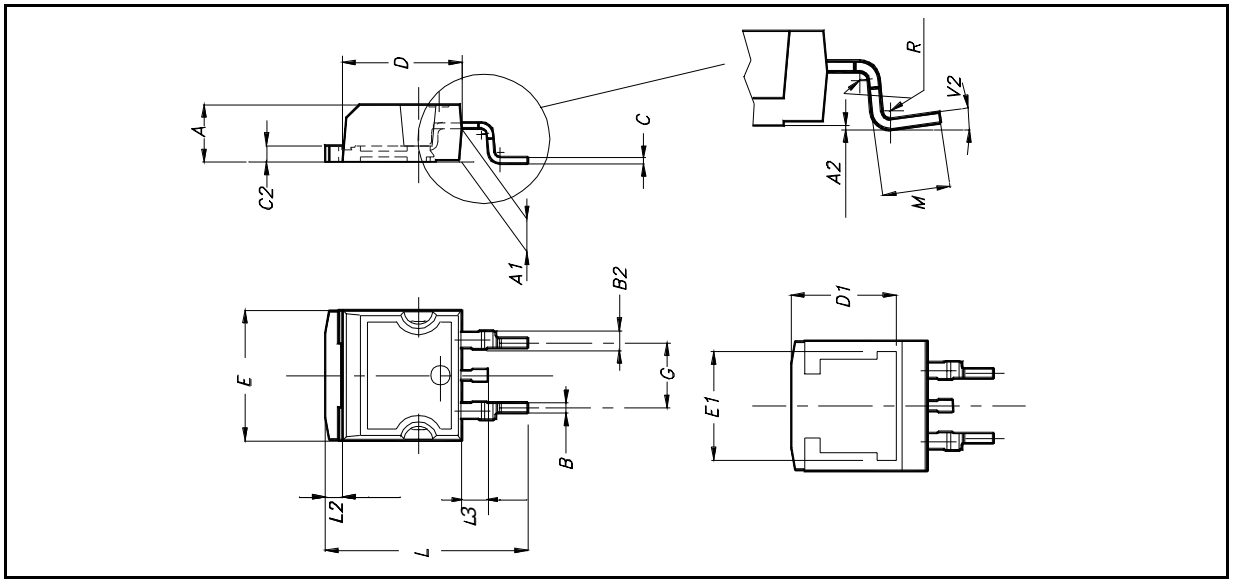
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
e	2.4		2.7	0.094		0.106
E	10		10.4	0.393		0.409
L	13.1		13.6	0.515		0.531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



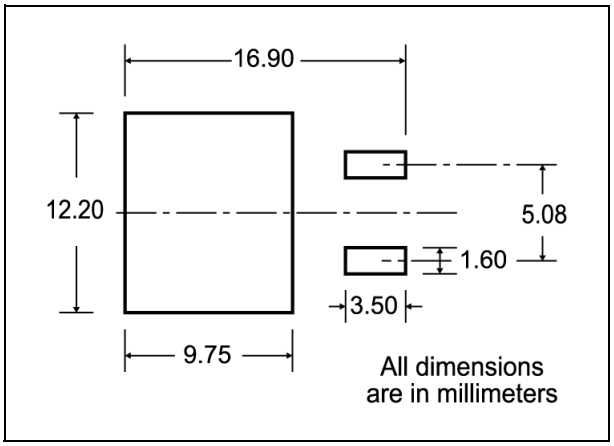
P011P5/E

D²PAK MECHANICAL DATA

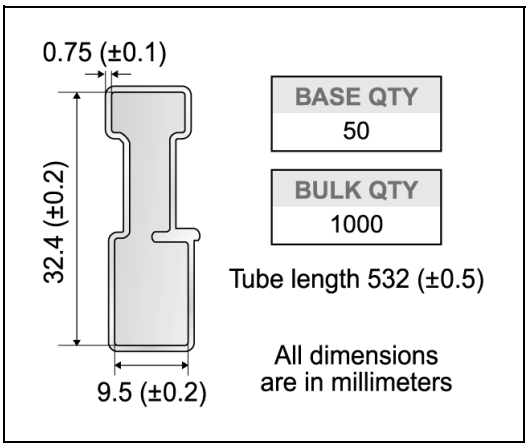
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
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	0º		4º			



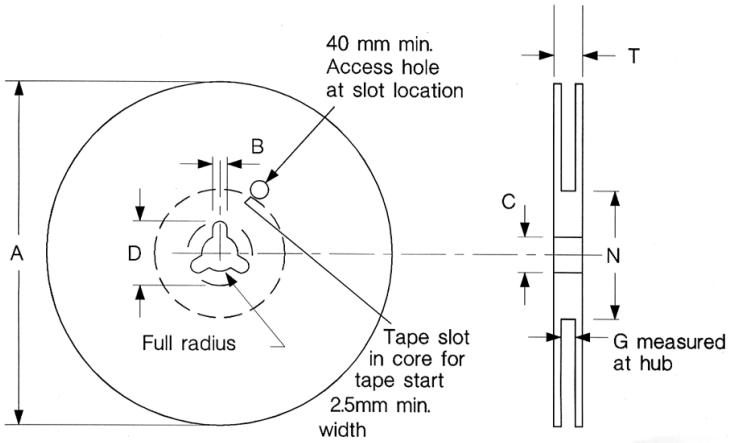
D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*



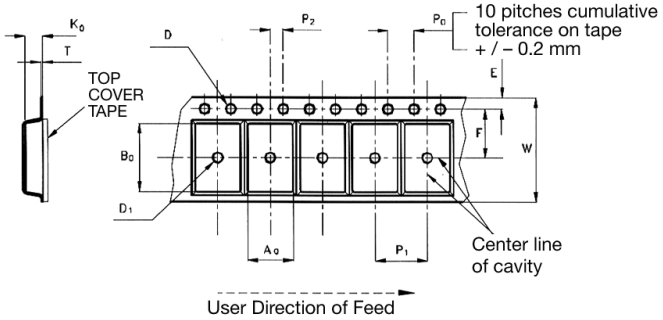
REEL MECHANICAL DATA

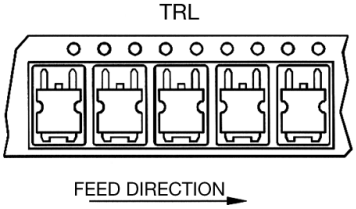
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

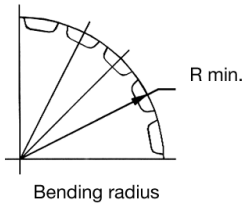
BASE QTY	BULK QTY
1000	1000

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







* on sales type