

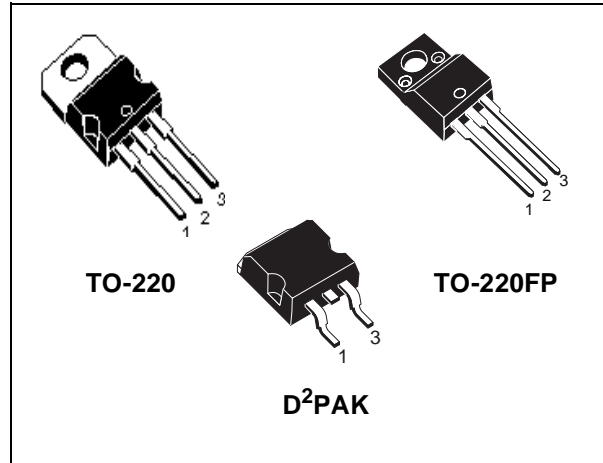


STP6NK90Z - STP6NK90ZFP STB6NK90Z

N-CHANNEL 900V - 1.56Ω - 5.8A TO-220/TO-220FP/D²PAK
Zener-Protected SuperMESH™ Power MOSFET

TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STP6NK90Z	900 V	< 2 Ω	5.8 A	140 W
STP6NK90ZFP	900 V	< 2 Ω	5.8 A	30 W
STB6NK90Z	900 V	< 2 Ω	5.8 A	140 W

- TYPICAL R_{DS(on)} = 1.56 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- GATE CHARGE MINIMIZED
- VERY LOW INTRINSIC CAPACITANCES
- VERY GOOD MANUFACTURING REPEATABILITY



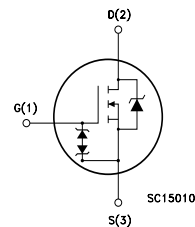
DESCRIPTION

The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, special care is taken to ensure a very good dv/dt capability for the most demanding applications. Such series complements ST full range of high voltage MOSFETs including revolutionary MDmesh™ products.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- IDEAL FOR OFF-LINE POWER SUPPLIES, ADAPTORS AND PFC
- LIGHTING

INTERNAL SCHEMATIC DIAGRAM



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP6NK90Z	P6NK90Z	TO-220	TUBE
STP6NK90ZFP	P6NK90ZFP	TO-220FP	TUBE
STB6NK90ZT4	B6NK90Z	D ² PAK	TAPE & REEL

STP6NK90Z - STP6NK90ZFP - STB6NK90Z**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value		Unit
		STP6NK90Z / STB6NK90Z	STP6NK90ZFP	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	900		V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	900		V
V _{GS}	Gate- source Voltage	± 30		V
I _D	Drain Current (continuous) at T _C = 25°C	5.8	5.8 (*)	A
I _D	Drain Current (continuous) at T _C = 100°C	3.65	3.65 (*)	A
I _{DM} (•)	Drain Current (pulsed)	23.2	23.2 (*)	A
P _{TOT}	Total Dissipation at T _C = 25°C	140	30	W
	Derating Factor	1.12	0.24	W/°C
V _{ESD(G-S)}	Gate source ESD(HBM-C=100pF, R=1.5KΩ)	4000		V
dv/dt (1)	Peak Diode Recovery voltage slope	4.5		V/ns
V _{iso}	Insulation Withstand Voltage (DC)	--	2500	V
T _j T _{stg}	Operating Junction Temperature Storage Temperature	-55 to 150		°C

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 5.8A, di/dt ≤ 200A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.

(*) Limited only by maximum temperature allowed

THERMAL DATA

		TO-220	D ² PAK	TO-220FP	Unit
R _{thj-case}	Thermal Resistance Junction-case Max	0.89		4.2	°C/W
R _{thj-pcb}	Thermal Resistance Junction-pcb Max (When mounted on minimum Footprint)		60		°C/W
R _{thj-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)	5.8	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	300	mJ

GATE-SOURCE ZENER DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV _{GSO}	Gate-Source Breakdown Voltage	I _{gs} = ± 1mA (Open Drain)	30			V

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.

STP6NK90Z - STP6NK90ZFP - STB6NK90Z**ELECTRICAL CHARACTERISTICS** ($T_{CASE} = 25^{\circ}C$ UNLESS OTHERWISE SPECIFIED)

ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1mA, V_{GS} = 0$	900			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}, T_C = 125^{\circ}C$			1 50	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20V$			± 10	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 100\mu A$	3	3.75	4.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V, I_D = 2.9 A$		1.56	2	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (1)$	Forward Transconductance	$V_{DS} = 15V, I_D = 2.9 A$		5		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$		1350 130 26		pF pF pF
$C_{oss \text{ eq.}} (3)$	Equivalent Output Capacitance	$V_{GS} = 0V, V_{DS} = 0V \text{ to } 720V$		70		pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	$V_{DD} = 450 V, I_D = 3 A$ $R_G = 4.7\Omega, V_{GS} = 10 V$ (Resistive Load see, Figure 3)		17 20		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 720 V, I_D = 5.8 A,$ $V_{GS} = 10V$		46.5 8.5 25		nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	$V_{DD} = 450 V, I_D = 3 A$ $R_G = 4.7\Omega, V_{GS} = 10 V$ (Resistive Load see, Figure 3)		45 20		ns ns
$t_r(V_{off})$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 720V, I_D = 5.8 A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (Inductive Load see, Figure 5)		11 12 20		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)				5.8 23.2	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 5.8 A, V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 5.8 A, di/dt = 100A/\mu s$ $V_{DD} = 36V, T_j = 150^{\circ}C$ (see test circuit, Figure 5)		840 5880 14		ns nC A

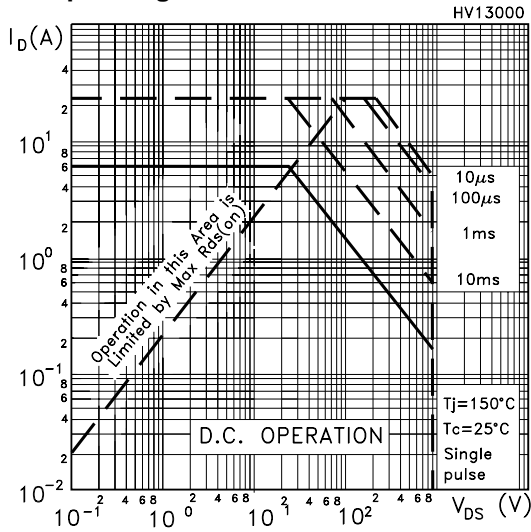
Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.

2. Pulse width limited by safe operating area.

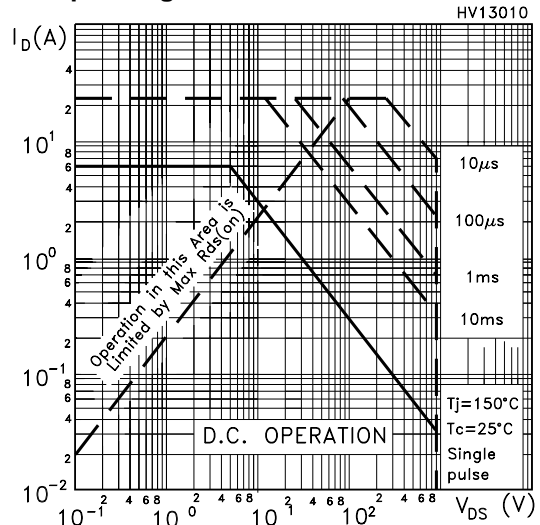
3. $C_{oss \text{ eq.}}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS} .

STP6NK90Z - STP6NK90ZFP - STB6NK90Z

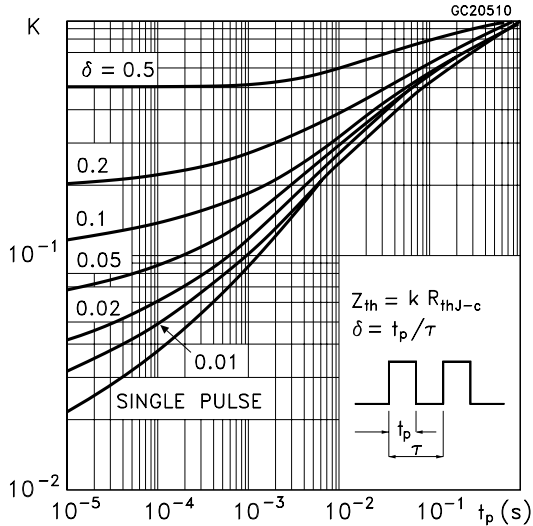
Safe Operating Area For TO-220/D2PAK



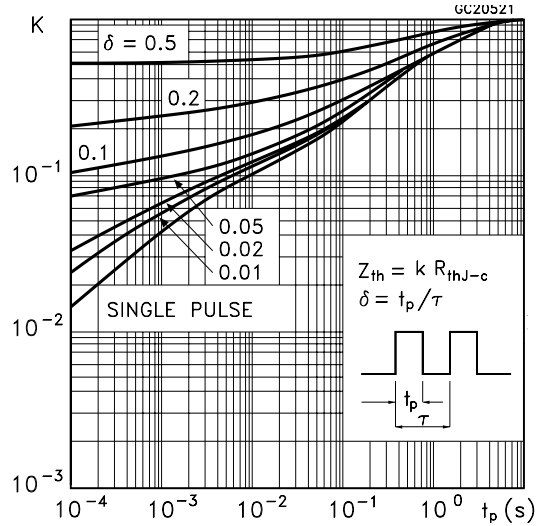
Safe Operating Area For TO-220FP



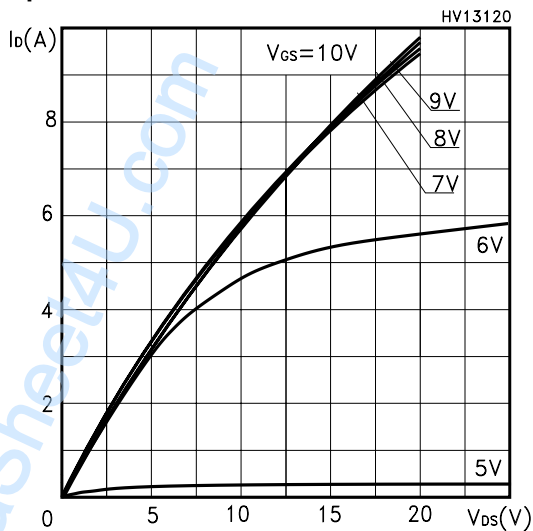
Thermal Impedance For TO-220/D2PAK



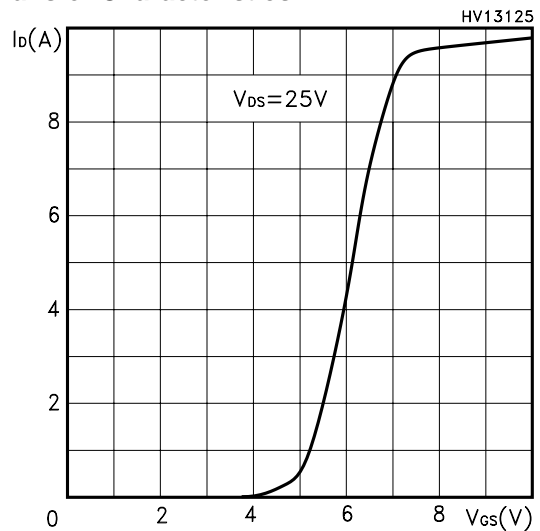
Thermal Impedance For TO-220FP



Output Characteristics

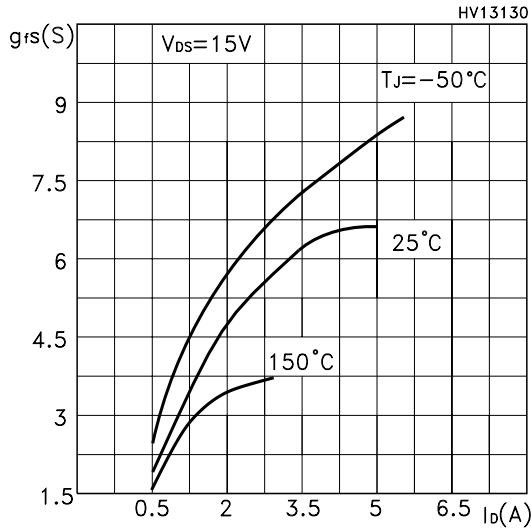


Transfer Characteristics

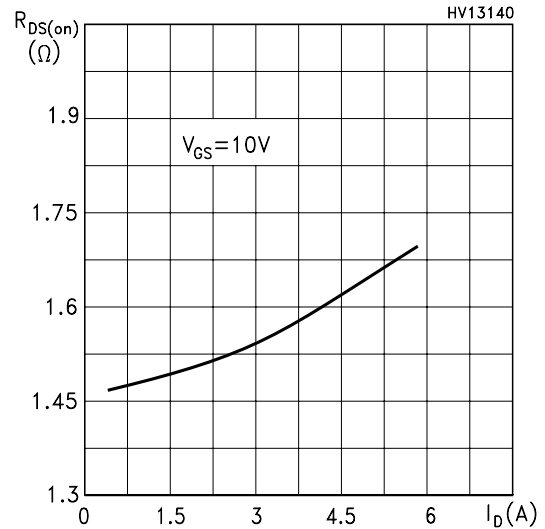


STP6NK90Z - STP6NK90ZFP - STB6NK90Z

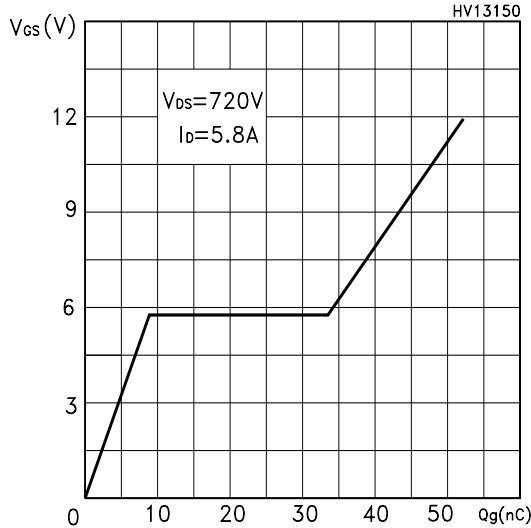
Transconductance



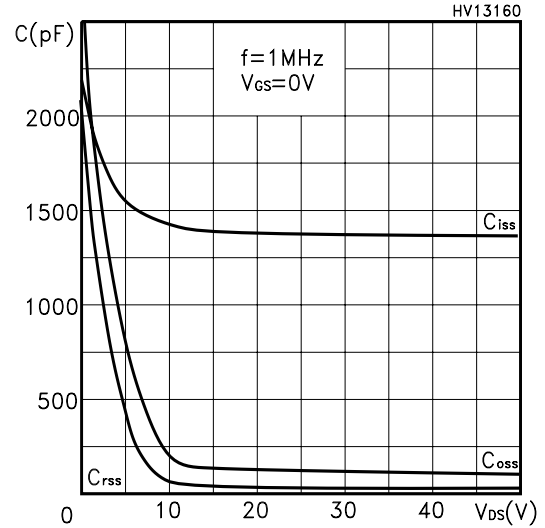
Static Drain-source On Resistance



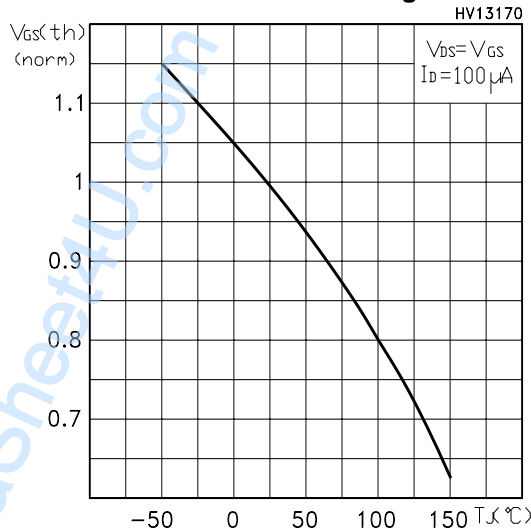
Gate Charge vs Gate-source Voltage



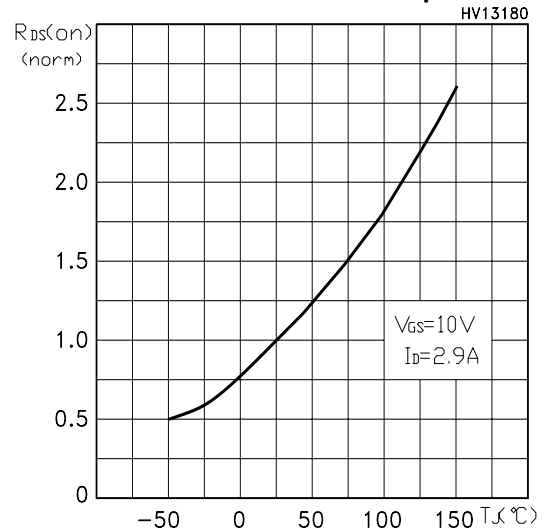
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.

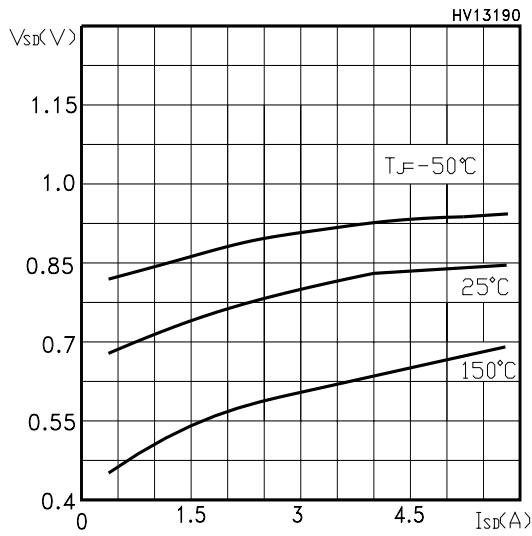


Normalized On Resistance vs Temperature

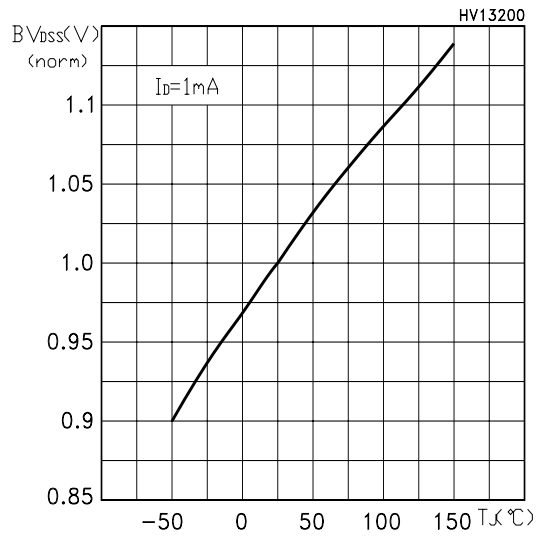


STP6NK90Z - STP6NK90ZFP - STB6NK90Z

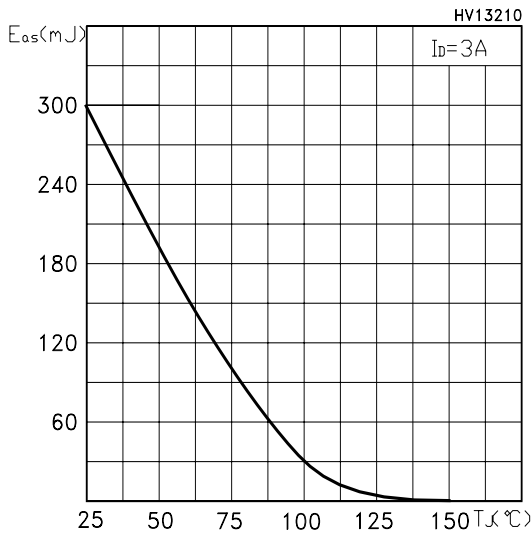
Source-drain Diode Forward Characteristics



Normalized BVDSS vs Temperature



Maximum Avalanche Energy vs Temperature



STP6NK90Z - STP6NK90ZFP - STB6NK90Z

Fig. 1: Unclamped Inductive Load Test Circuit

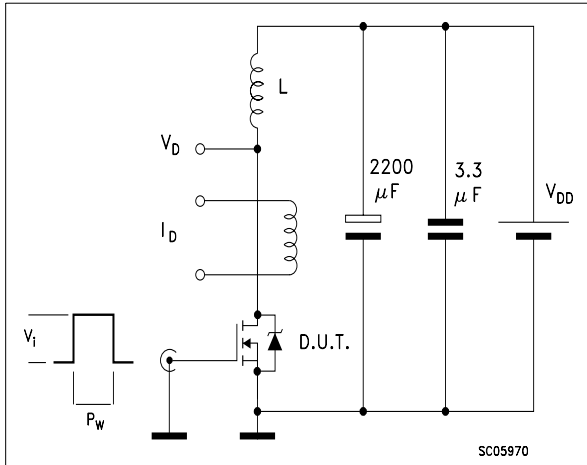


Fig. 2: Unclamped Inductive Waveform

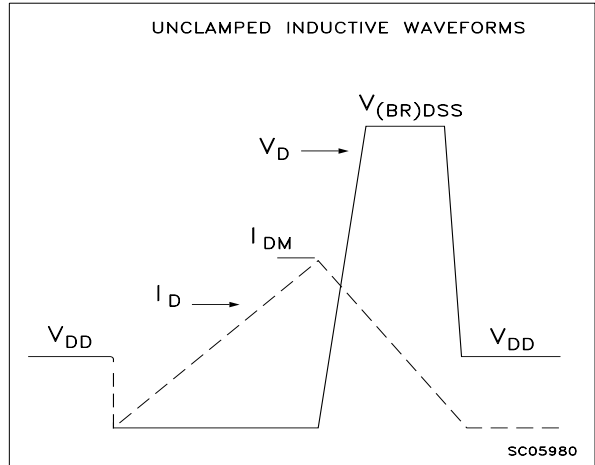


Fig. 3: Switching Times Test Circuit For Resistive Load

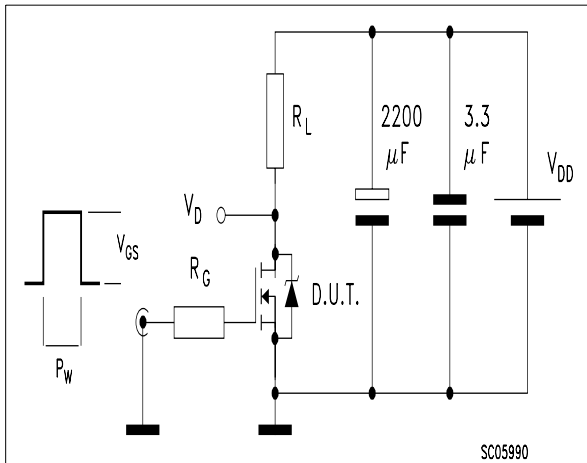


Fig. 4: Gate Charge test Circuit

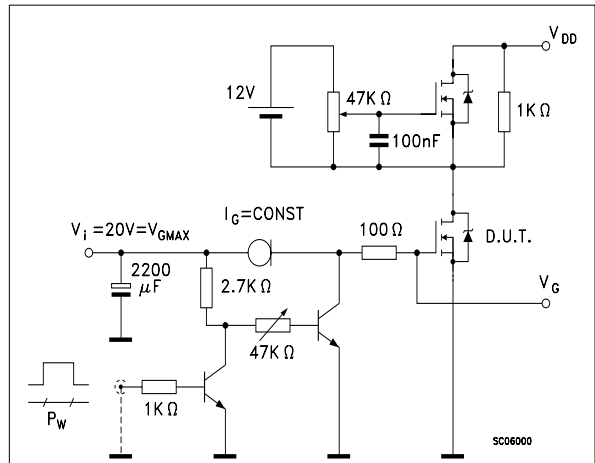
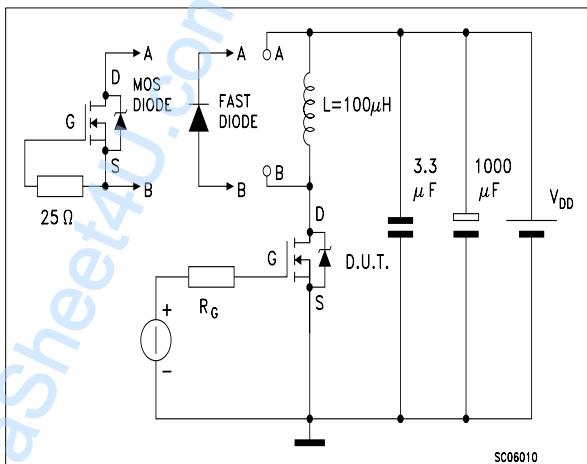
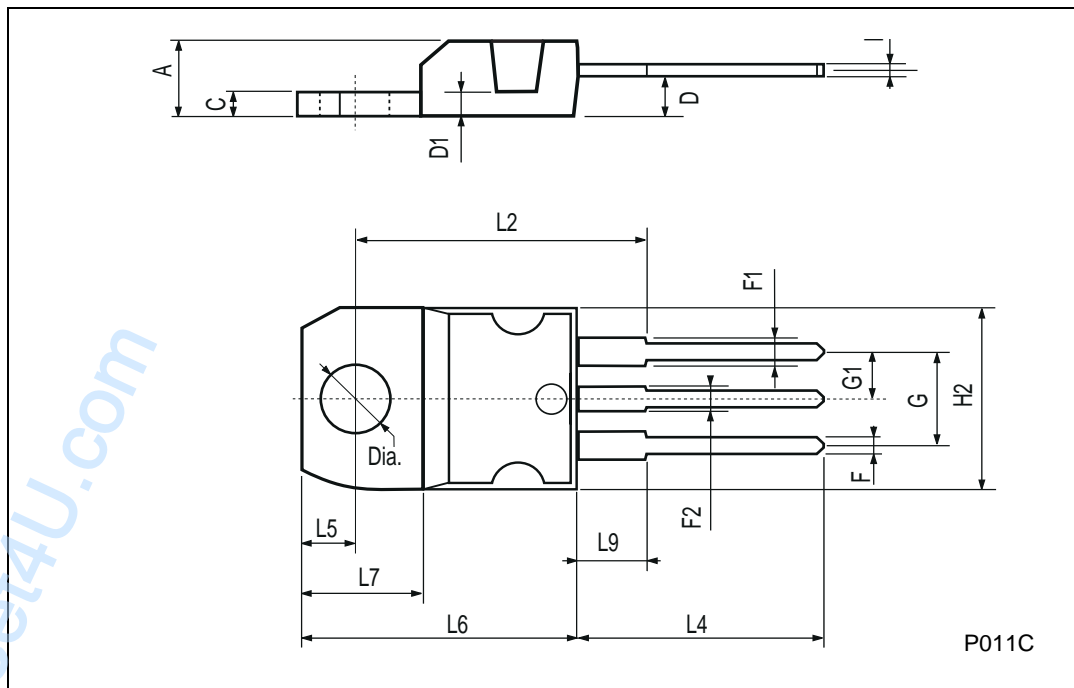


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



STP6NK90Z - STP6NK90ZFP - STB6NK90Z**TO-220 MECHANICAL DATA**

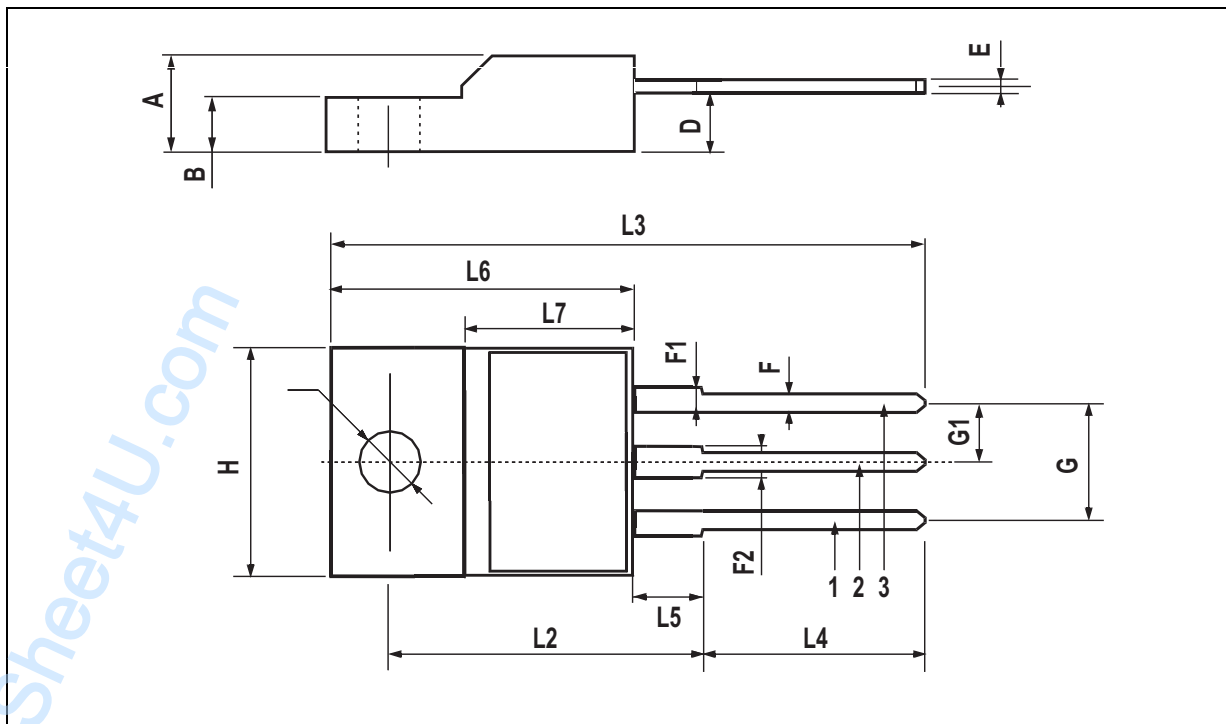
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
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



STP6NK90Z - STP6NK90ZFP - STB6NK90Z

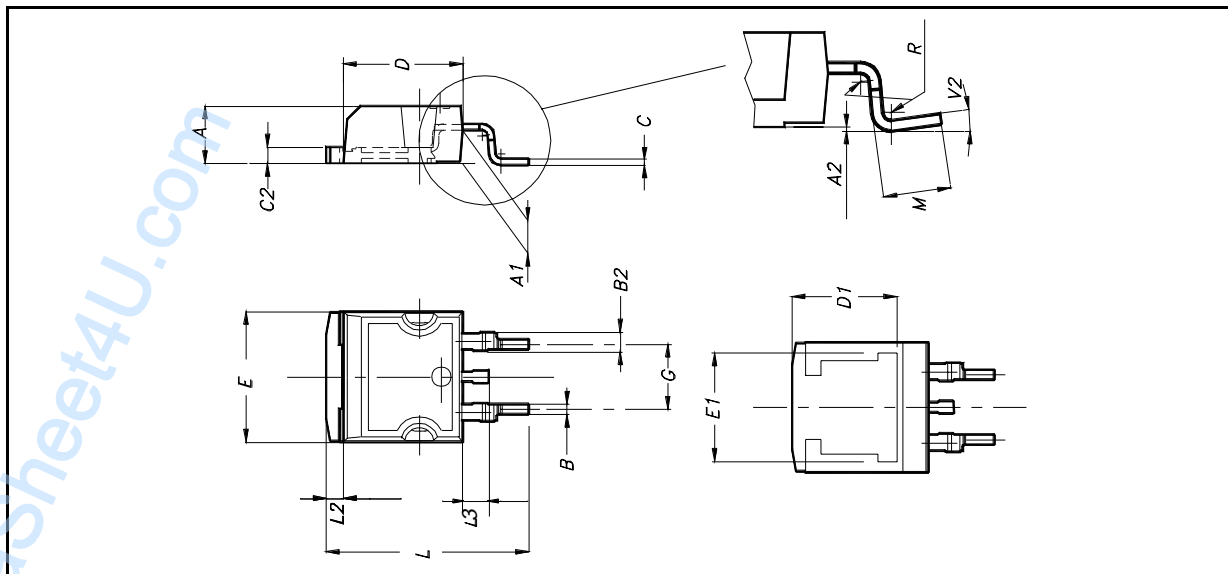
TO-220FP MECHANICAL DATA

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	.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



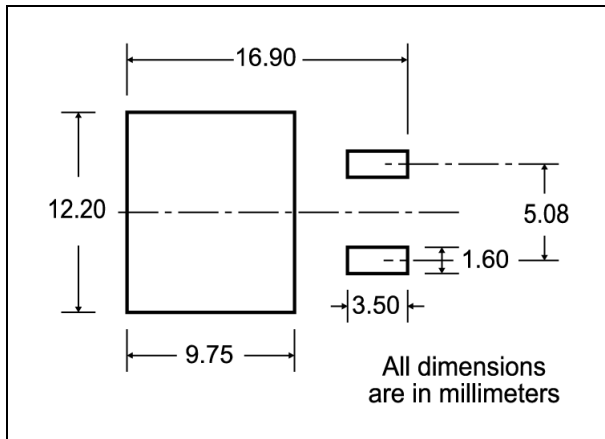
STP6NK90Z - STP6NK90ZFP - STB6NK90Z**D²PAK MECHANICAL DATA**

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°		4°			

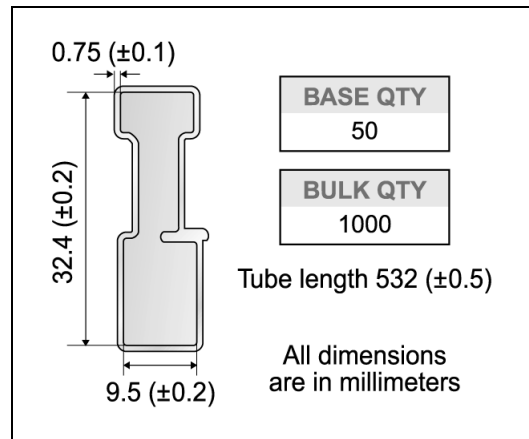


STP6NK90Z - STP6NK90ZFP - STB6NK90Z

D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

Diagram showing the tape mechanical data. The tape width is A. The distance from the center to the edge of the mounting tabs is B. The distance between the centers of the mounting tabs is C. The distance from the center to the edge of the mounting tabs is D. The distance from the center to the edge of the mounting tabs is E. The distance from the center to the edge of the mounting tabs is F. The distance from the center to the edge of the mounting tabs is G. The distance from the center to the edge of the mounting tabs is T. The distance from the center to the edge of the mounting tabs is N. The distance from the center to the edge of the mounting tabs is G measured at hub. The distance from the center to the edge of the mounting tabs is 40 mm min. Access hole at slot location. The distance from the center to the edge of the mounting tabs is 2.5mm min. width. The distance from the center to the edge of the mounting tabs is Full radius. The distance from the center to the edge of the mounting tabs is Tape slot in core for tape start.

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

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

Diagram showing the reel mechanical data. The distance from the center to the edge of the mounting tabs is K₀. The distance from the center to the edge of the mounting tabs is T. The distance from the center to the edge of the mounting tabs is D. The distance from the center to the edge of the mounting tabs is P₂. The distance from the center to the edge of the mounting tabs is P₀. The distance from the center to the edge of the mounting tabs is E. The distance from the center to the edge of the mounting tabs is F. The distance from the center to the edge of the mounting tabs is W. The distance from the center to the edge of the mounting tabs is B₀. The distance from the center to the edge of the mounting tabs is D₁. The distance from the center to the edge of the mounting tabs is A₀. The distance from the center to the edge of the mounting tabs is P₁. The distance from the center to the edge of the mounting tabs is Center line of cavity. The distance from the center to the edge of the mounting tabs is 10 pitches cumulative tolerance on tape + / - 0.2 mm. The distance from the center to the edge of the mounting tabs is User Direction of Feed. The distance from the center to the edge of the mounting tabs is FEED DIRECTION. The distance from the center to the edge of the mounting tabs is Bending radius. The distance from the center to the edge of the mounting tabs is R min.

* on sales type



STP6NK90Z - STP6NK90ZFP - STB6NK90Z

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