



# STP3NB90 STP3NB90FP

N-CHANNEL 900V - 4  $\Omega$  - 3.5 A TO-220/TO-220FP

PowerMesh™ MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>	P <sub>w</sub>
STP3NB90	900 V	< 4.2 $\Omega$	3.5 A	110 W
STP3NB90FP	900 V	< 4.2 $\Omega$	3.5 A	35 W

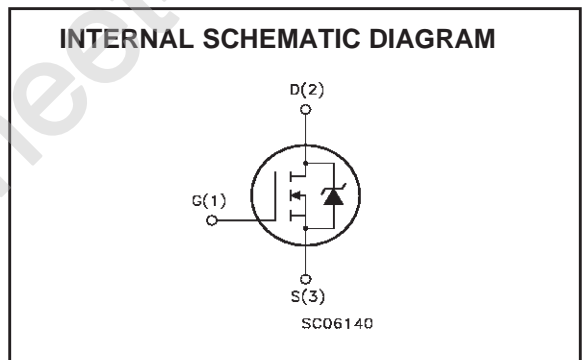
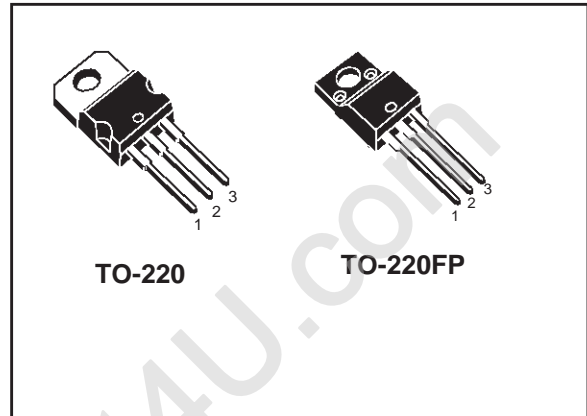
- TYPICAL R<sub>DS(on)</sub> = 4  $\Omega$
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- GATE CHARGE MINIMIZED
- VERY LOW INTRINSIC CAPACITANCES

## DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest R<sub>DS(on)</sub> per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

## APPLICATIONS

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



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP3NB90	P3NB90	TO-220	TUBE
STP3NB90FP	P3NB90FP	TO-220FP	TUBE

## STP3NB90 - STP3NB90FP

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP3NB90	STP3NB90FP	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	900		V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	900		V
V <sub>GS</sub>	Gate- source Voltage	±30		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	3.5	3.5 (*)	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	2.2	1.26 (*)	A
I <sub>DM</sub> (*)	Drain Current (pulsed)	14	14 (*)	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	110	30	W
	Derating Factor	0.87	0.24	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	4.5		V/ns
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	-	2000	V
T <sub>j</sub> T <sub>stg</sub>	Operating Junction Temperature Storage Temperature	-55 to 150		°C

(\*)Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 3.5A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>jMAX</sub>

(\*) Limited only by maximum temperature allowed

### THERMAL DATA

		TO-220	TO-220FP	
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	1.14	4.2	°C/W
R <sub>thj-amb</sub> T <sub>l</sub>	Thermal Resistance Junction-ambient Max Maximum Lead Temperature For Soldering Purpose	62.5 300		°C/W °C

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	3.5	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	230	mJ

**ELECTRICAL CHARACTERISTICS** ( $T_{CASE} = 25\text{ }^{\circ}\text{C}$  UNLESS OTHERWISE SPECIFIED)  
ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}, V_{GS} = 0$	900			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}, T_C = 125\text{ }^{\circ}\text{C}$			1 50	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 30\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}, I_D = 1.7\text{ A}$		4	4.2	$\Omega$

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs(1)}$	Forward Transconductance	$V_{DS} = 15\text{ V}; I_D = 1.7\text{ A}$		3		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$		690 82 8.5		pF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 450\text{ V}, I_D = 1.75\text{ A}$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (Resistive Load see , Figure 3)		17 12		ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 720\text{ V}, I_D = 3.5\text{ A},$ $V_{GS} = 10\text{ V}$		22 7.3 9.2		nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ $t_f$	Turn-off Delay Time Fall Time	$V_{DD} = 450\text{ V}, I_D = 1.75\text{ A}$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (Resistive Load see , Figure 3)		26 39		ns ns
$t_{r(Voff)}$ $t_f$ $t_c$	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 720\text{ V}, I_D = 3.5\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (Inductive Load see , Figure 5)		16 20 25		ns ns ns

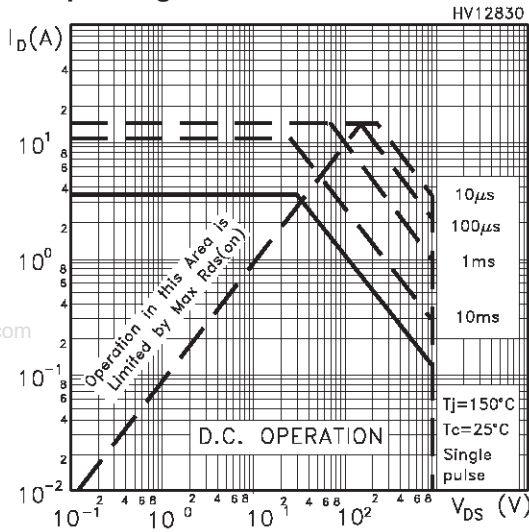
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM(2)}$	Source-drain Current Source-drain Current (pulsed)				3.5 14	A A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 3.5\text{ A}, V_{GS} = 0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 3.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$ $V_{DD} = 100\text{ V}, T_j = 150\text{ }^{\circ}\text{C}$ (see test circuit, Figure 5)		630 3.5 11		ns $\mu\text{C}$ A

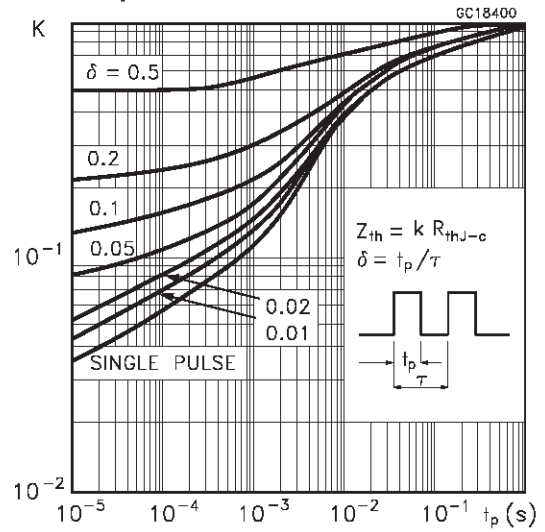
Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

# STP3NB90 - STP3NB90FP

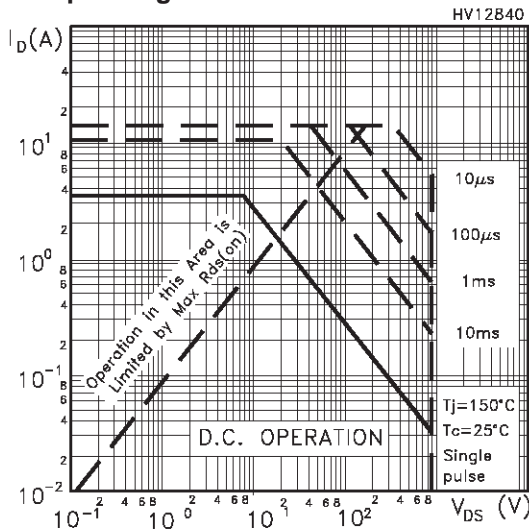
## Safe Operating Area For TO-220



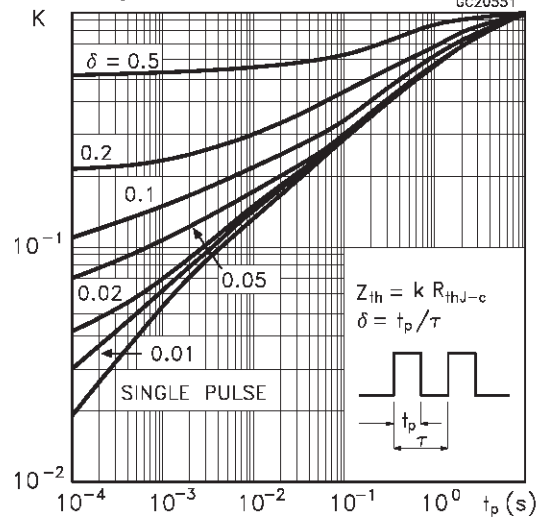
## Thermal Impedance For TO-220



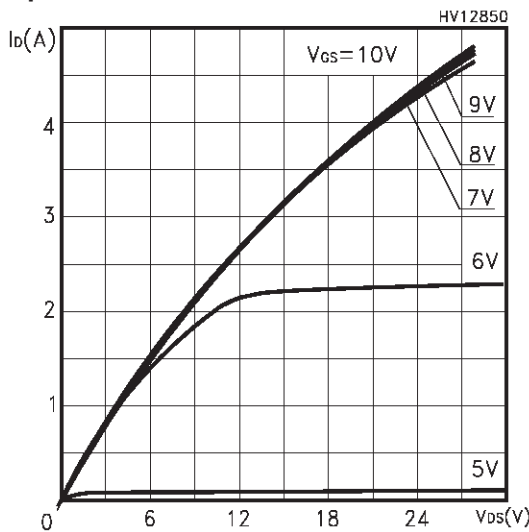
## Safe Operating Area For TO-220FP



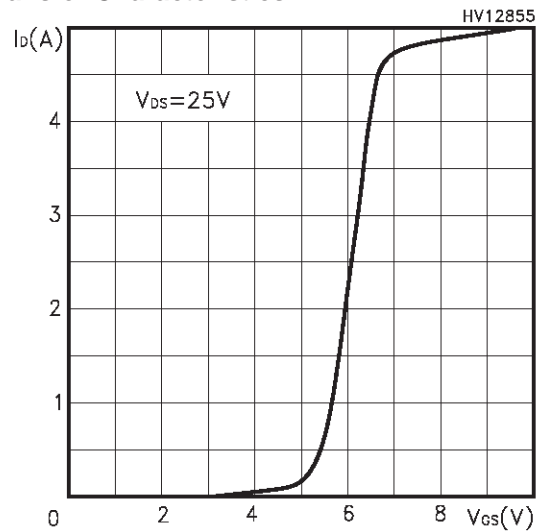
## Thermal Impedance For TO-220FP



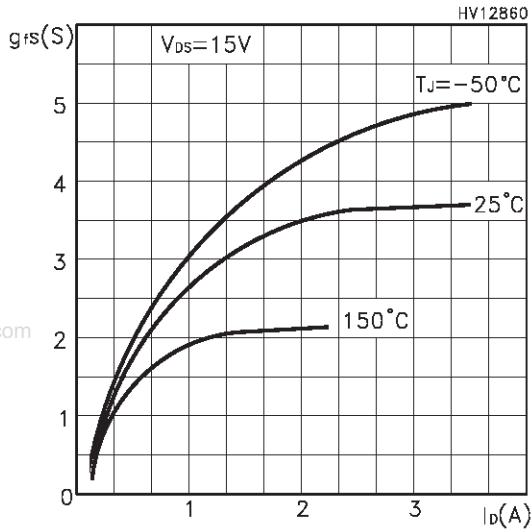
## Output Characteristics



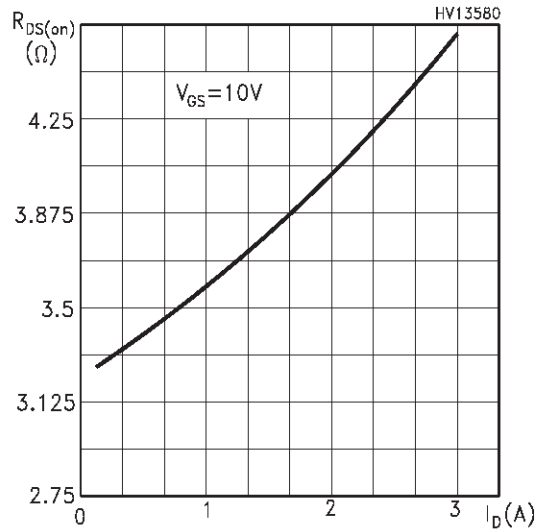
## Transfer Characteristics



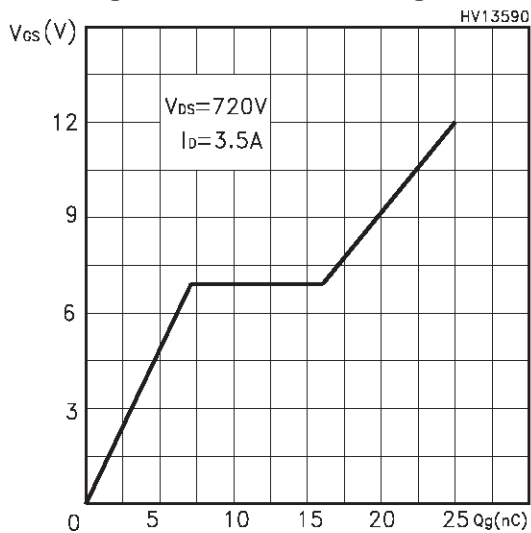
Transconductance



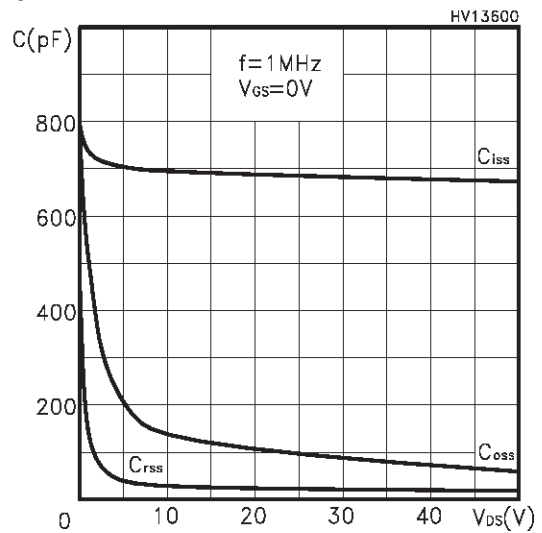
Static Drain-source On Resistance



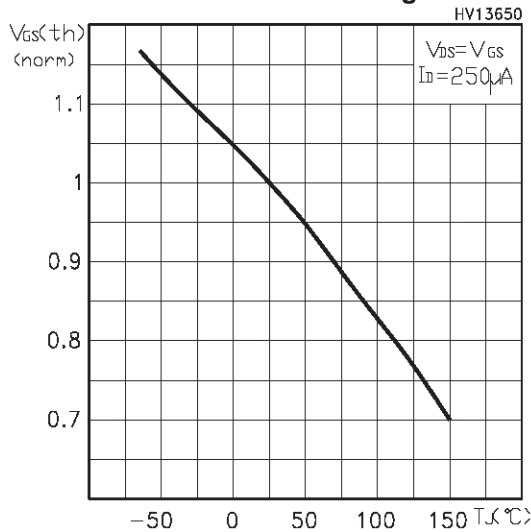
Gate Charge vs Gate-source Voltage



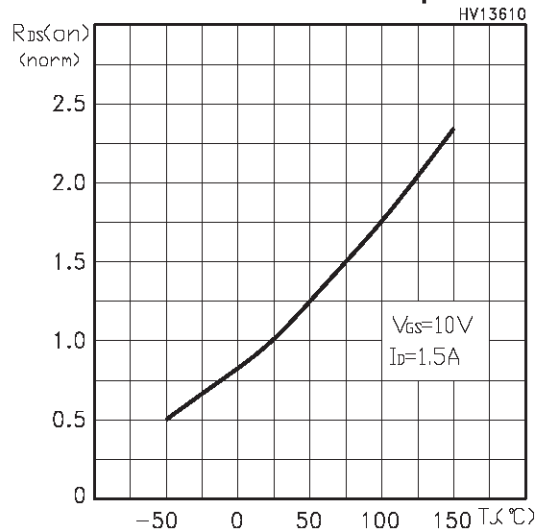
Capacitance Variations



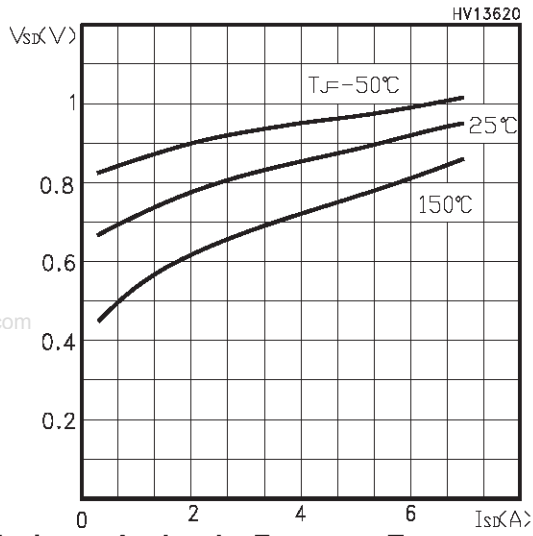
Normalized Gate Threshold Voltage vs Temp.



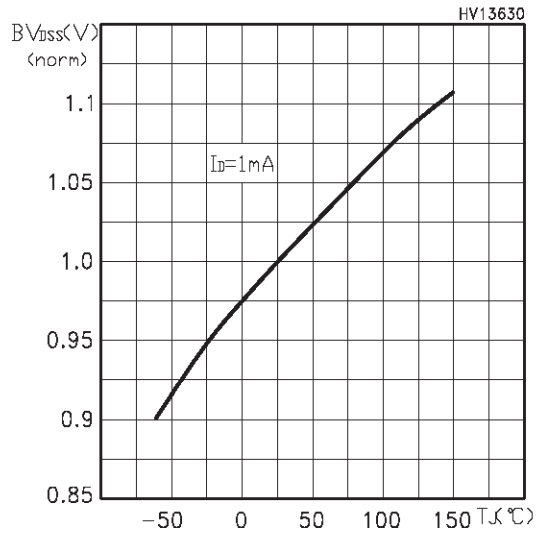
Normalized On Resistance vs Temperature



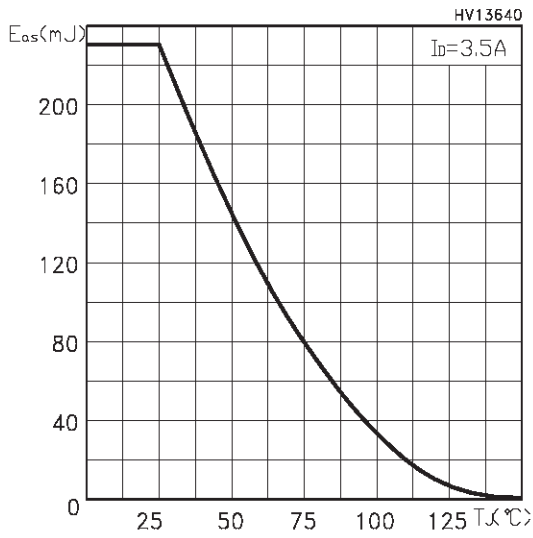
Source-drain Diode Forward Characteristics



Normalized BVDSS vs Temperature



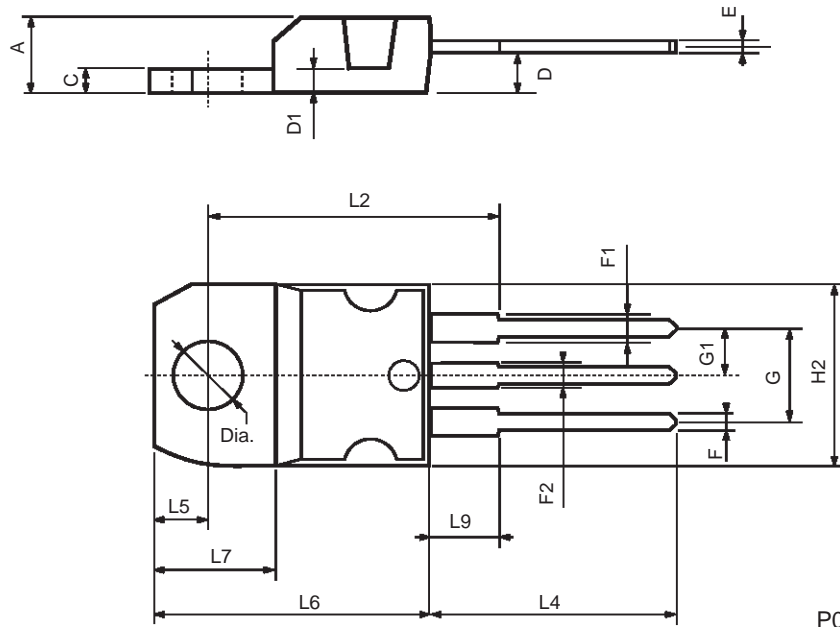
Maximum Avalanche Energy vs Temperature





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

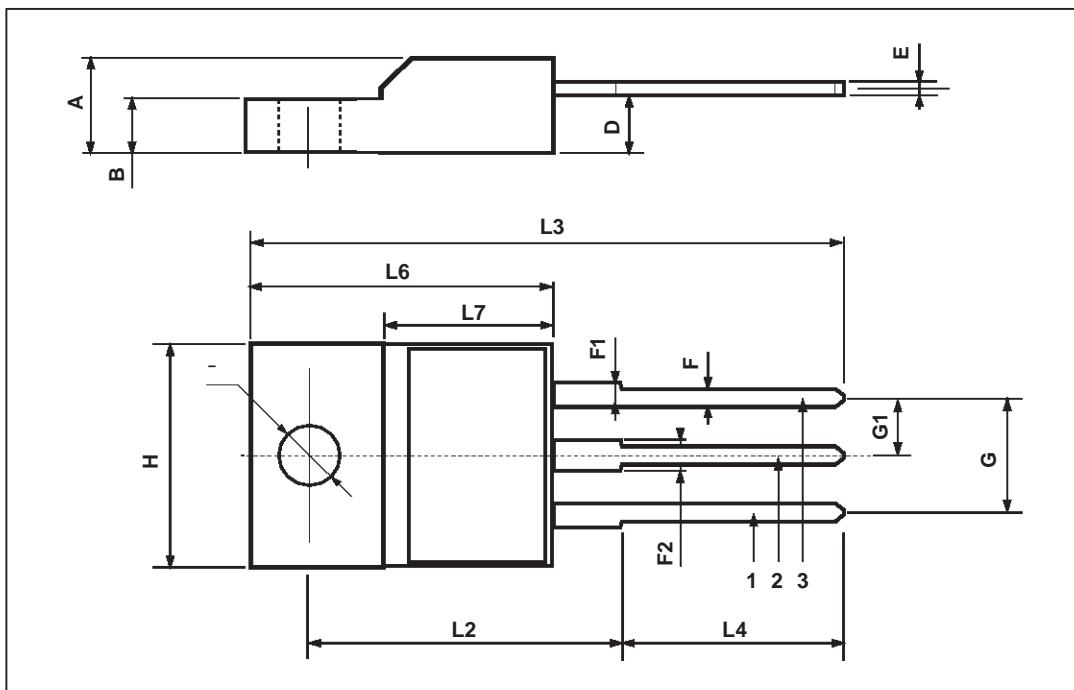




TO-220FP MECHANICAL DATA

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

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