



# STP20N20 STF20N20 - STD20N20

N-CHANNEL 200V - 0.10Ω - 18A TO-220/TO-220FP/DPAK  
LOW GATE CHARGE STripFET™ II MOSFET

**Table 1: General Features**

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>d</sub>	P <sub>TOT</sub>
STD20N20	200 V	< 0.125 Ω	18 A	90 W
STF20N20	200 V	< 0.125 Ω	18 A	25 W
STP20N20	200 V	< 0.125 Ω	18 A	90 W

- TYPICAL R<sub>DS(on)</sub> = 0.10 Ω
- EXCEPTIONAL dv/dt CAPABILITY
- LOW GATE CHARGE
- 100% AVALANCHE TESTED

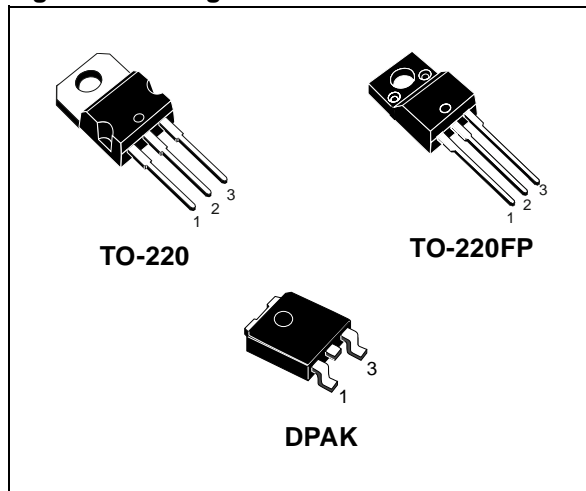
## DESCRIPTION

This MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters.

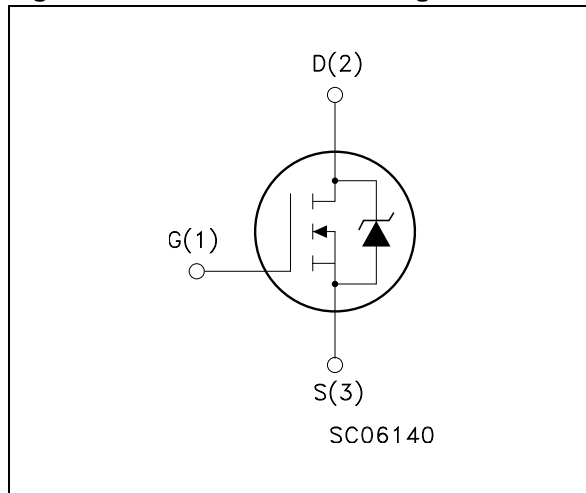
## APPLICATIONS

- HIGH CURRENT SWITCHING APPLICATIONS
- HIGH EFFICIENCY DC-DC CONVERTERS
- PRIMARY SIDE SWITCH

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Codes**

SALES TYPE	MARKING	PACKAGE	PACKAGING
STD20N20T4	D20N20	DPAK	TAPE & REEL
STF20N20	F20N20	TO-220FP	TUBE
STP20N20	P20N20	TO-220	TUBE

**Table 3: Absolute Maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220/DPAK	TO-220FP	
$V_{DS}$	Drain-source Voltage ( $V_{GS} = 0$ )	200		V
$V_{DGR}$	Drain-gate Voltage ( $R_{GS} = 20\text{ k}\Omega$ )	200		V
$V_{GS}$	Gate- source Voltage	$\pm 20$		V
$I_D$	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	18		A
$I_D$	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	11		A
$I_{DM}(\bullet)$	Drain Current (pulsed)	72		A
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	90	25	W
	Derating Factor	0.72	0.2	W/ $^\circ\text{C}$
$dv/dt(1)$	Peak Diode Recovery voltage slope	15		V/ns
$T_j$ $T_{stg}$	Operating Junction Temperature Storage Temperature	-50 to 150		$^\circ\text{C}$

( $\bullet$ ) Pulse width limited by safe operating area  
 (1)  $I_{SD} \leq 18\text{A}$ ,  $di/dt \leq 400\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$

**Table 4: Thermal Data**

		TO-220	DPAK	TO-220FP	
Rthj-case	Thermal Resistance Junction-case Max	1.38	1.38	5	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	50(#)	62.5	$^\circ\text{C}/\text{W}$
$T_l$	Maximum Lead Temperature For Soldering Purpose	300			$^\circ\text{C}$

(#) When mounted on 1inch<sup>2</sup> FR-4, 2 Oz copper board.

**Table 5: Avalanche Characteristics**

Symbol	Parameter	Max Value	Unit
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)	18	A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{V}$ )	110	mJ

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

**Table 6: On/Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	200			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$ , $T_C = 125^\circ\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$ , $I_D = 10\text{ A}$		0.10	0.125	$\Omega$

## ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (1)	Forward Transconductance	$V_{DS} = 25\text{ V}$ , $I_D = 10\text{ A}$		13		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		940 197 30		pF pF pF
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$	Turn-on Delay Time Rise Time Turn-off Delay Time Fall Time	$V_{DD} = 100\text{ V}$ , $I_D = 10\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 17)		15 30 40 10		ns ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 160\text{ V}$ , $I_D = 20\text{ A}$ , $V_{GS} = 10\text{ V}$ (see Figure 20)		28 5.6 14.5	39	nC nC nC

Table 8: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}$ (2)	Source-drain Current Source-drain Current (pulsed)				18 72	A A
$V_{SD}$ (1)	Forward On Voltage	$I_{SD} = 20\text{ A}$ , $V_{GS} = 0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 20\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ , $T_j = 25^\circ\text{C}$ (see Figure 18)		155 775 10		ns nC A
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 20\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ , $T_j = 150^\circ\text{C}$ (see Figure 18)		183 1061 11.6		ns nC A

(1) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

(2) Pulse width limited by safe operating area.

Figure 3: Safe Operating Area For TO-220/ DPAK

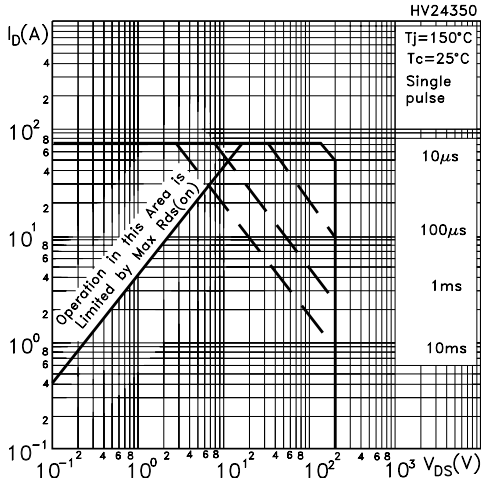


Figure 4: Safe Operating Area For TO-220FP

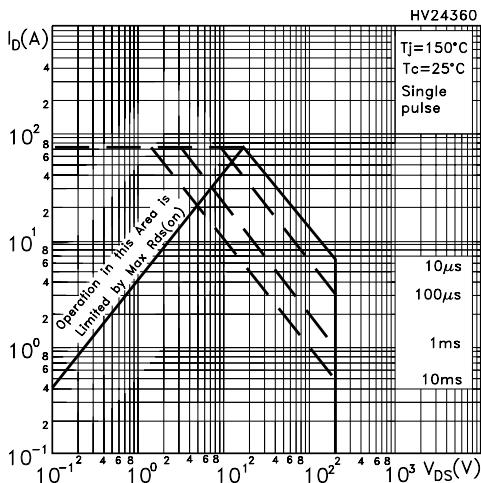


Figure 5: Output Characteristics

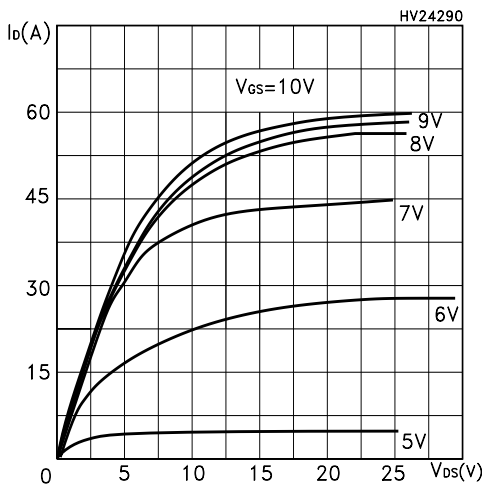


Figure 6: Thermal Impedance For TO-220/ DPAK

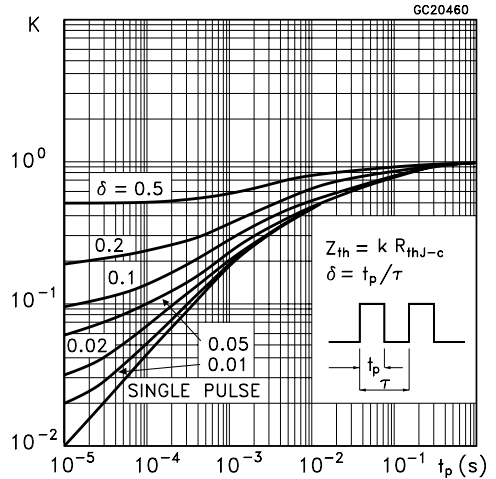


Figure 7: Thermal Impedance For TO-220FP

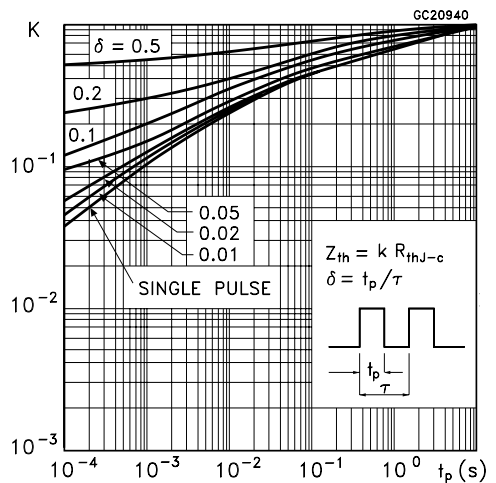


Figure 8: Transfer Characteristics

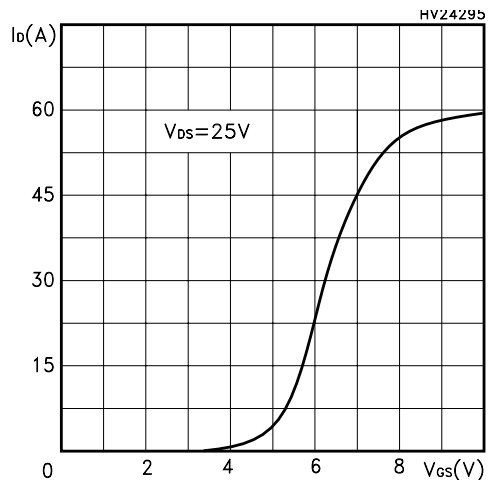


Figure 9: Transconductance

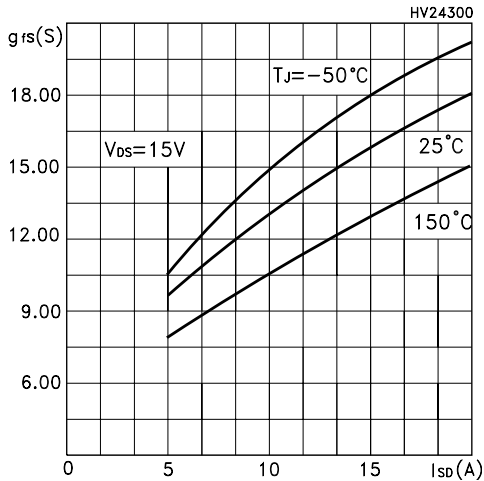


Figure 10: Gate Charge vs Gate-source Voltage

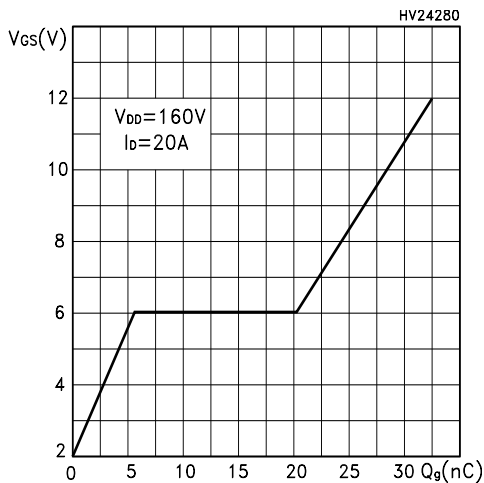


Figure 11: Normalized Gate Threshold Voltage vs Temperature

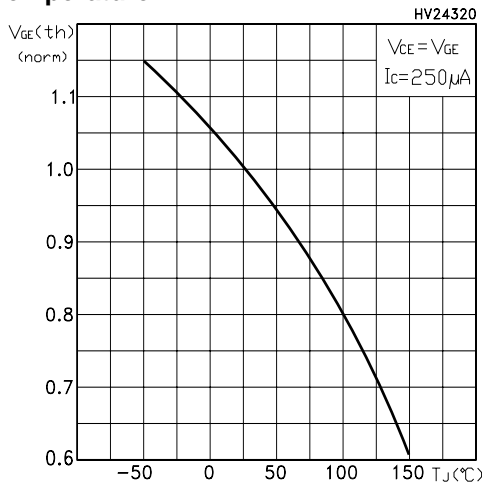


Figure 12: Static Drain-source On Resistance

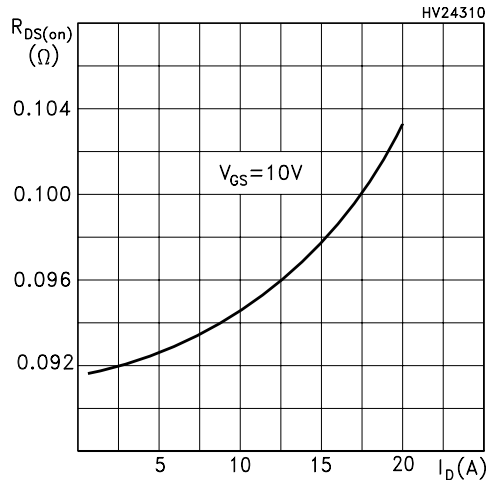


Figure 13: Capacitance Variations

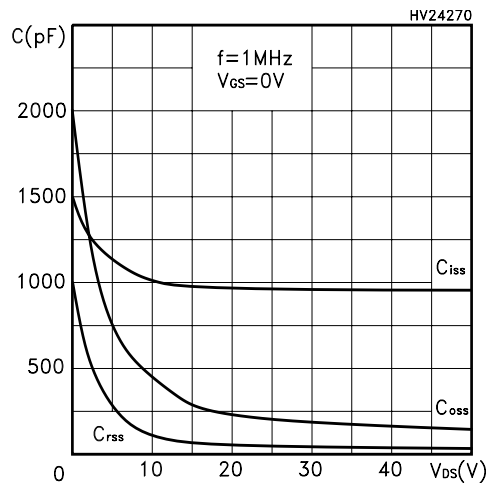


Figure 14: Normalized On Resistance vs Temperature

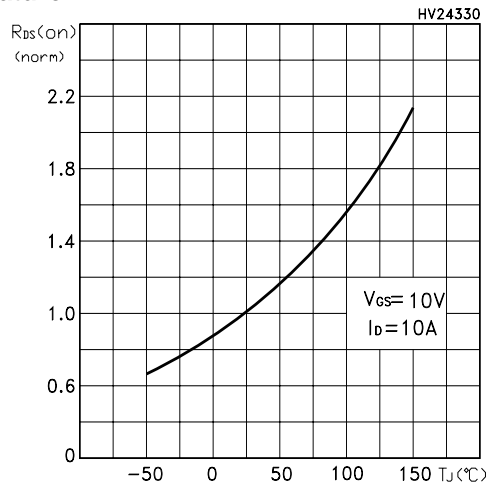


Figure 15: Source-Drain Forward Characteristics

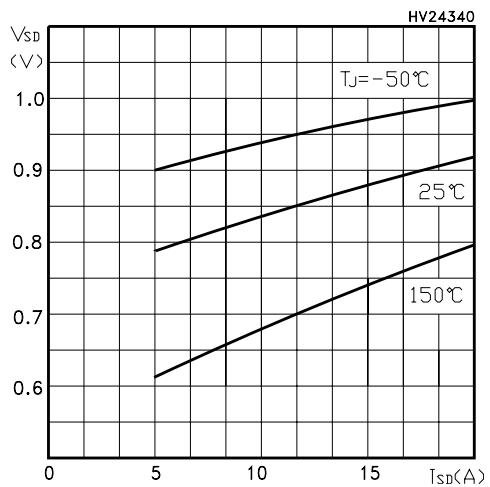


Figure 16: Unclamped Inductive Load Test Circuit

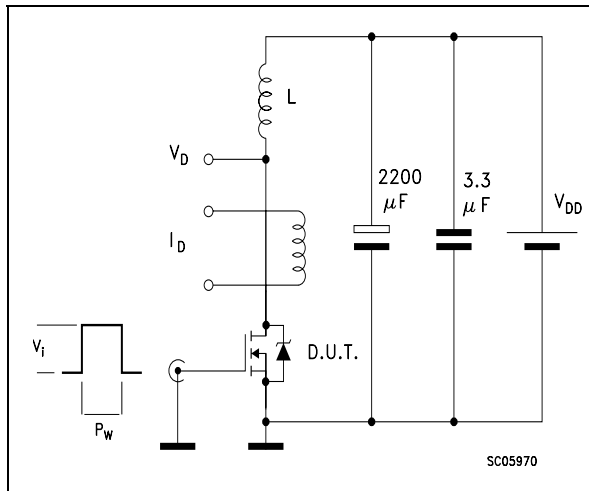


Figure 17: Switching Times Test Circuit For Resistive Load

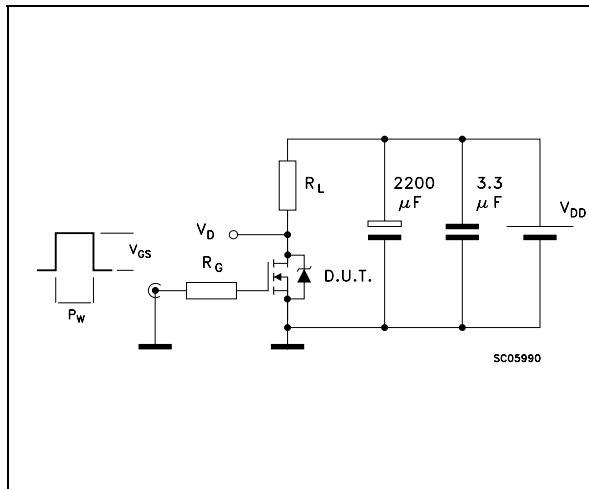


Figure 18: Test Circuit For Inductive Load Switching and Diode Recovery Times

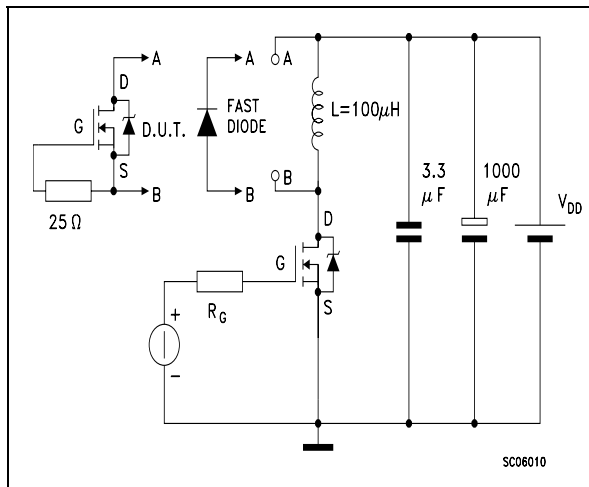


Figure 19: Unclamped Inductive Waferform

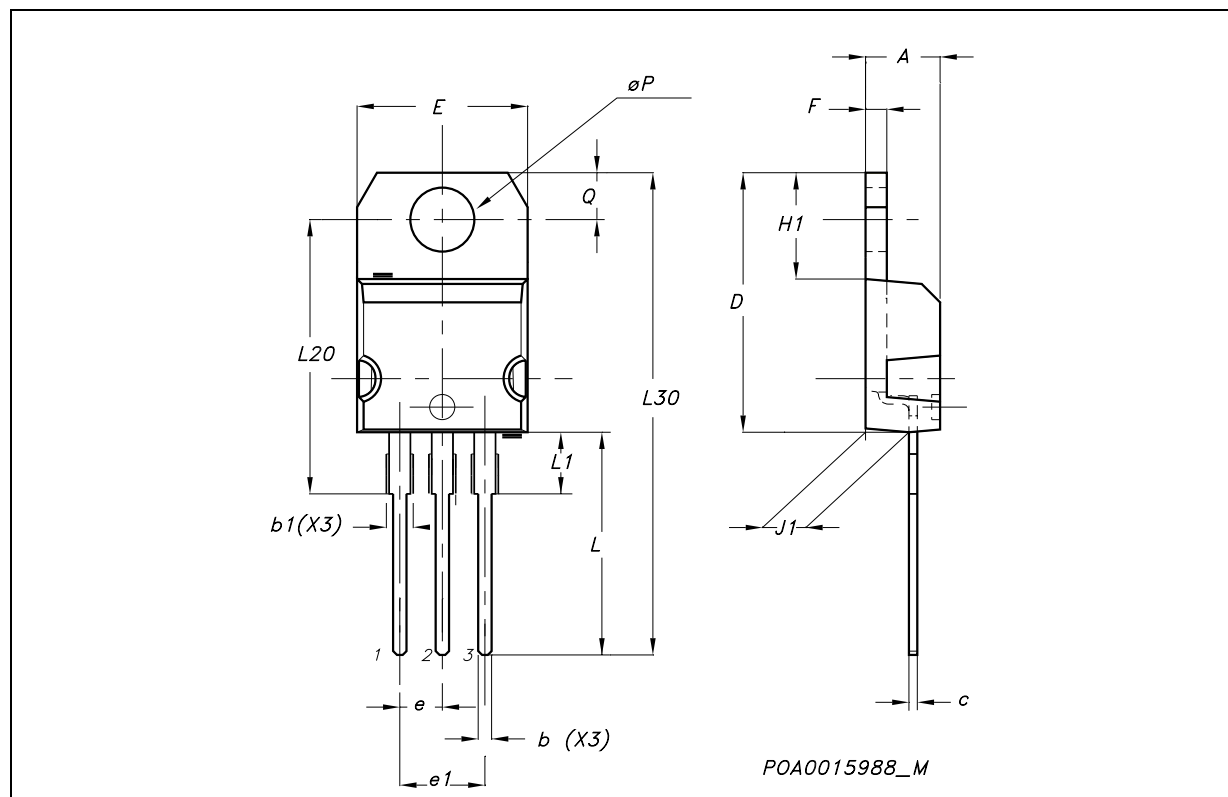


Figure 20: Gate Charge Test Circuit



TO-220 MECHANICAL DATA

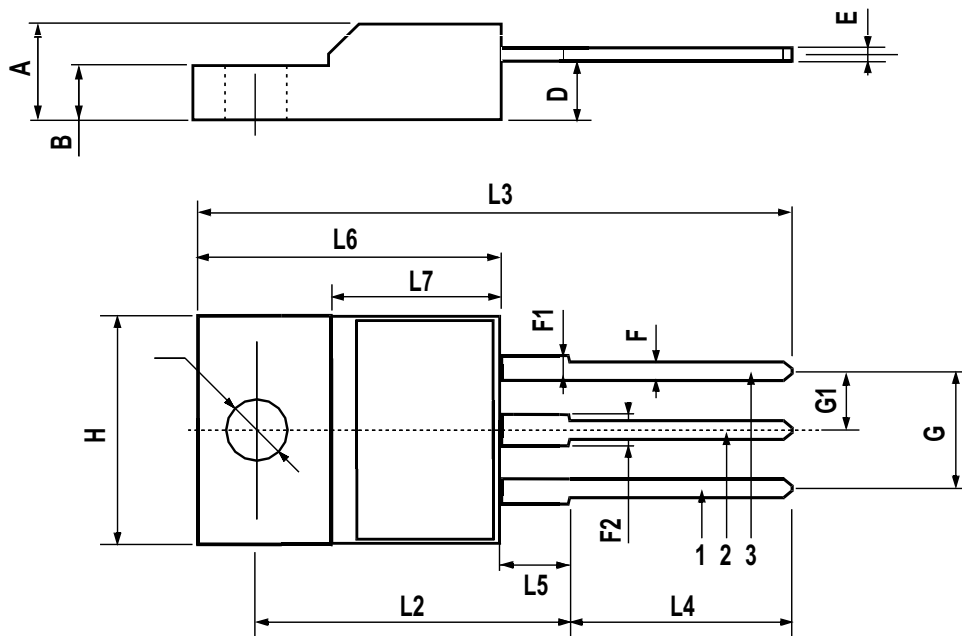
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		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





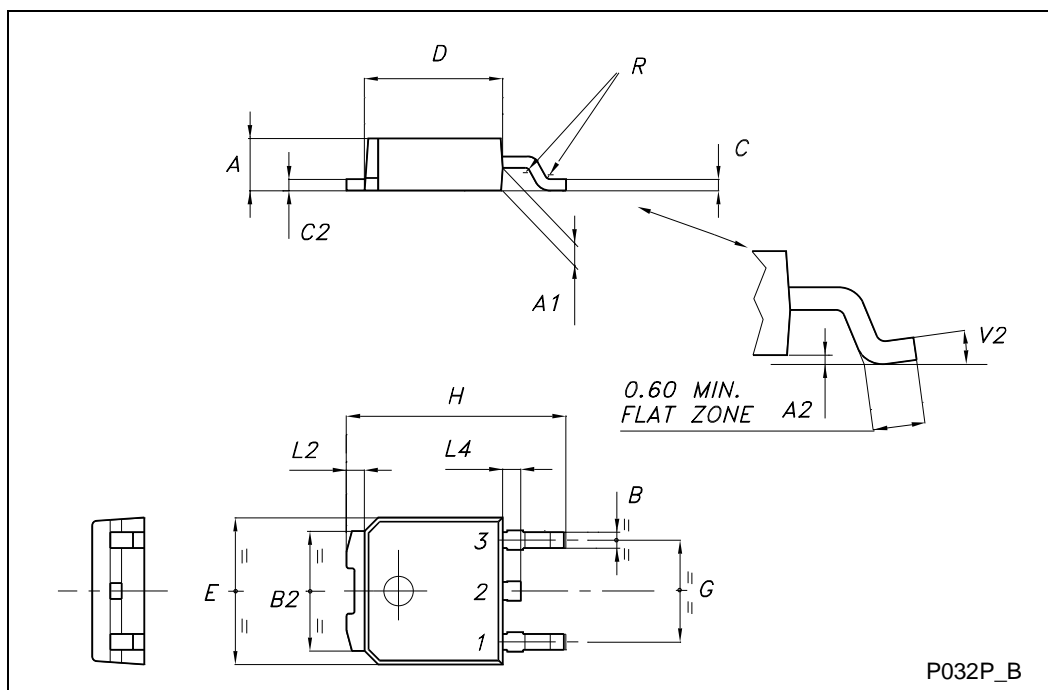
**TO-220FP MECHANICAL DATA**

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

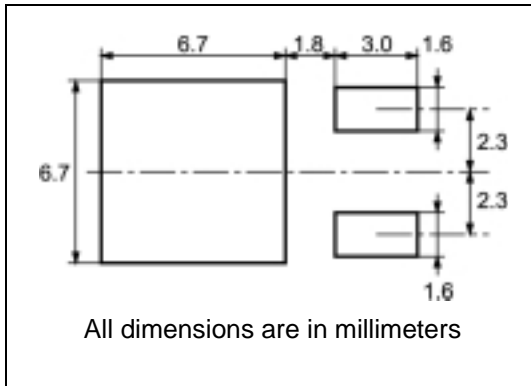


TO-252 (DPAK) MECHANICAL DATA

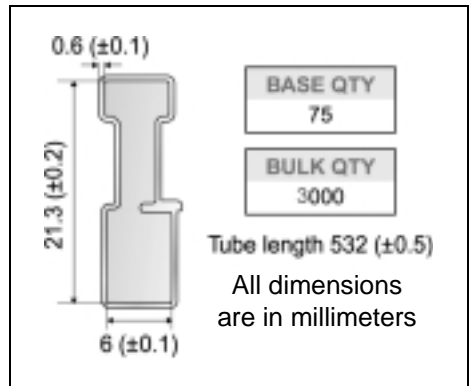
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0°		8°	0°		0°



**DKPAK 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

**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	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

**TAPE MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

TOP COVER TAPE

User Direction of Feed

Center line of cavity

FEED DIRECTION

Bending radius

R min.

\* on sales type

**Table 9: Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
06-Dec-2004	1	Data Brief
07-Dec-2004	2	First Revision
12-Jan-2005	3	Final datasheet

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