STP40N20
STB40N20 - STW40N20

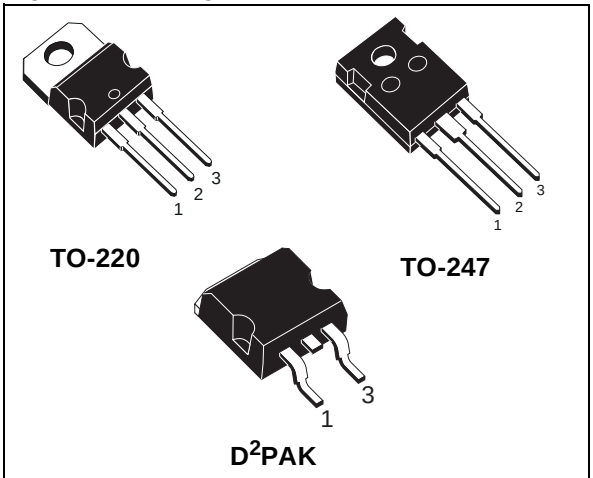
N-CHANNEL 200V - 0.038Ω - 40A TO-220/TO-247/D²PAK
LOW GATE CHARGE STripFET™ MOSFET

Table 1: General Features

TYPE	V_{DSS}	$R_{DS(on)}$	I_D	Pw
STP40N20	200 V	< 0.045 Ω	40 A	160 W
STW40N20	200 V	< 0.045 Ω	40 A	160 W
STB40N20	200 V	< 0.045 Ω	40 A	160 W

- TYPICAL R_{DS}(on) = 0.038 Ω
- GATE CHARGE MINIMIZED
- VERY LOW INTRINSIC CAPACITANCES
- VERY GOOD MANUFACTURING REPEATIBILITY
- EXCELLENT FIGURE OF MERIT (R_{DS}*Q_g)
- 100% AVALANCHE TESTED

Figure 1: Package



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, HIGH SPEED SWITCHING
- UPS

Figure 2: Internal Schematic Diagram

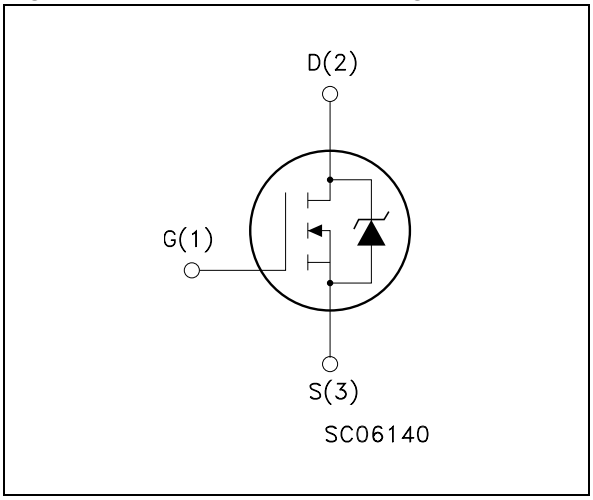


Table 2: Order Codes

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP40N20	P40N20	TO-220	TUBE
STW40N20	W40N20	TO-247	TUBE
STB40N20	B40N20	D²PAK	TAPE & REEL

Rev. 3

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	200	V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	200	V
V_{GS}	Gate- source Voltage	± 20	V
I_D	Drain Current (continuous) at T_C = 25°C	40	A
I_D	Drain Current (continuous) at T_C = 100°C	25	A
I_{DM} (•)	Drain Current (pulsed)	160	A
P_{TOT}	Total Dissipation at T_C = 25°C	160	W
	Derating Factor	1.28	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	12	V/ns
T_j T_{stg}	Operating Junction Temperature Storage Temperature	-55 to 150	°C

(•) Pulse width limited by safe operating area
(1) $I_{SD} \leq 40A$, $di/dt \leq 200$ A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX.}$

Table 4: Thermal Data

		TO-220/	TO-247	
Rthj-case	Thermal Resistance Junction-case Max	0.78		°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	50	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose	300		°C

Table 5: Avalanche Characteristics

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	40	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	230	mJ

ELECTRICAL CHARACTERISTICS (T_{CASE} =25°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 = 1mA, V_{GS} = 0	200			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating, T_C = 125 °C			1 10	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 20V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V, I_D = 20 A		0.038	0.045	Ω

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	V_{DS} = 15 V, I_D=20 A		30		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		2500 510 78		pF pF pF
$t_{d(on)}$ t_r $t_{d(off)}$ t_r	Turn-on Delay Time Rise Time Turn-off Delay Time Fall Time	V_{DD} = 100 V, I_D = 20 A, R_G= 4.7 Ω V_{GS} = 10 V (Resistive Load see, Figure 17)		20 44 74 22		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 160V, I_D = 40 A, V_{GS} = 10V		75 13.2 35.5		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)				40 160	A A
V_{SD} (1)	Forward On Voltage	I_{SD} = 20 A, V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 20 A, di/dt = 100A/µs V_{DD} = 100V, T_j = 25°C (see test circuit, Figure 18)		192 922 9.6		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 20 A, di/dt = 100A/µs V_{DD} = 100V, T_j = 150°C (see test circuit, Figure 18)		242 1440 11.9		ns nC A

(1) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(2) Pulse width limited by safe operating area.

Figure 3: Safe Operating Area For TO-220/ D²PAK

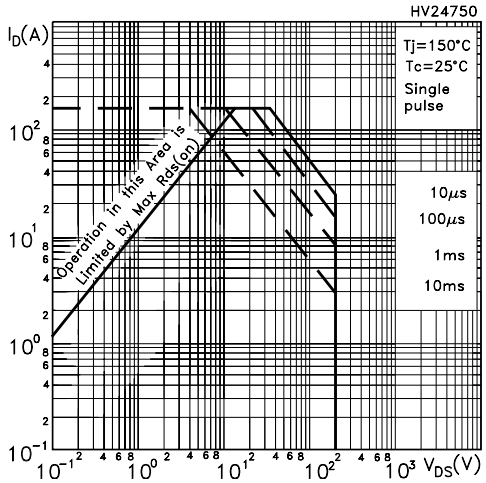


Figure 4: Safe Operating Area For TO-247

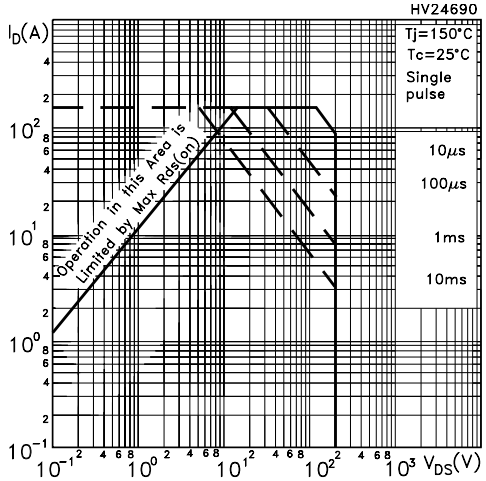


Figure 5: Output Characteristics

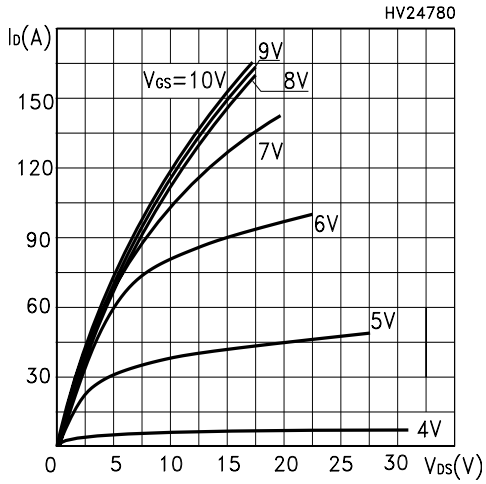


Figure 6: Thermal Impedance For TO-220/ D²PAK

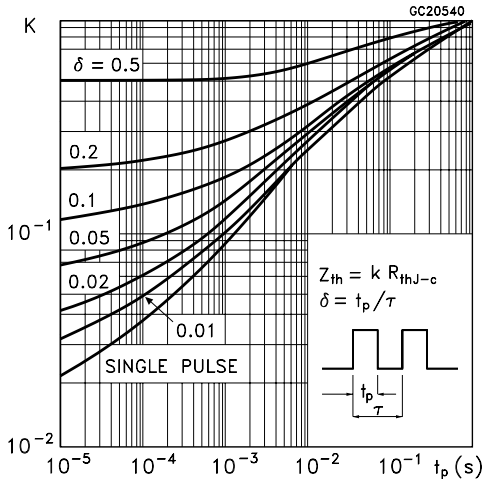


Figure 7: Thermal Impedance For TO-247

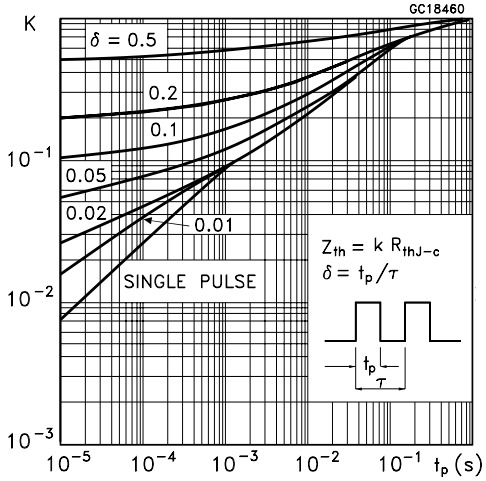


Figure 8: Transfer Characteristics

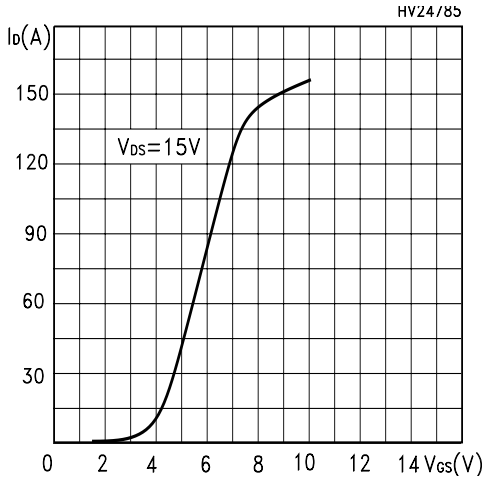


Figure 9: Transconductance

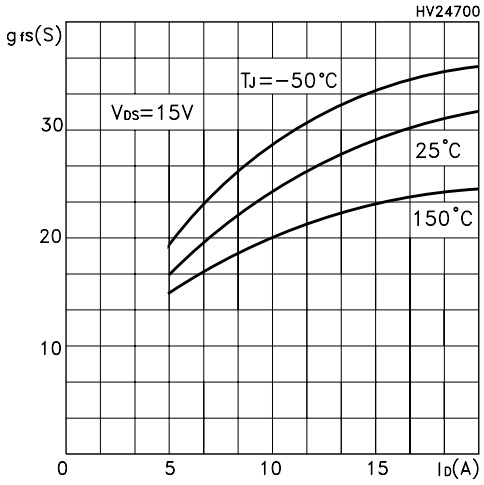


Figure 10: Gate Charge vs Gate-source Voltage

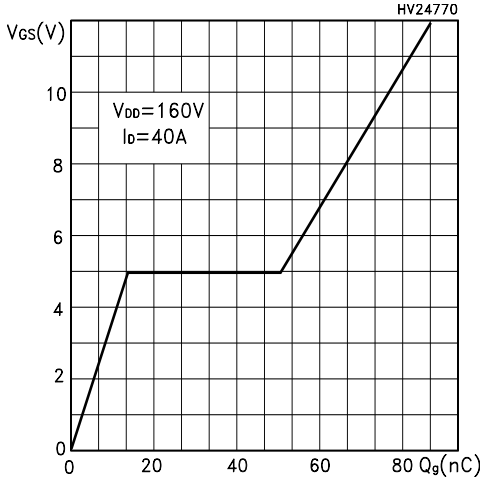


Figure 11: Normalized Gate Threshold Voltage vs Temperature

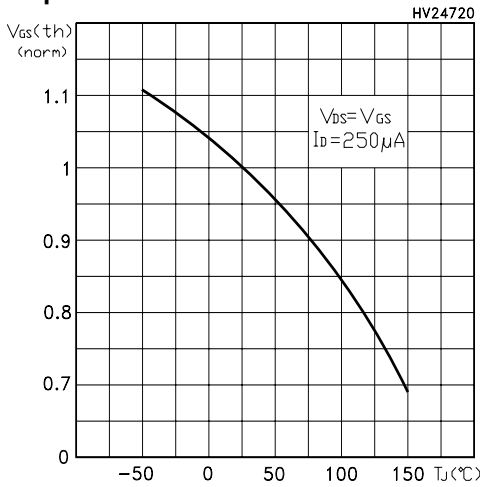


Figure 12: Static Drain-source On Resistance

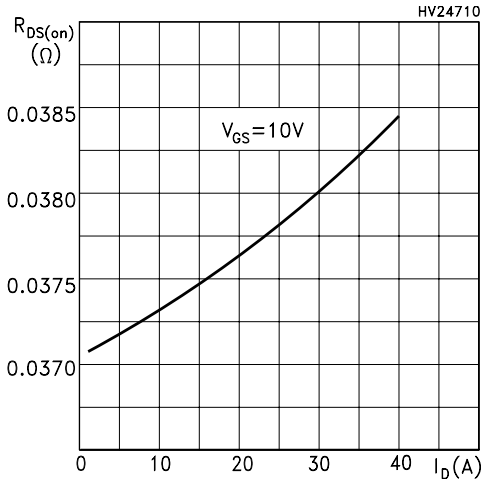


Figure 13: Capacitance Variations

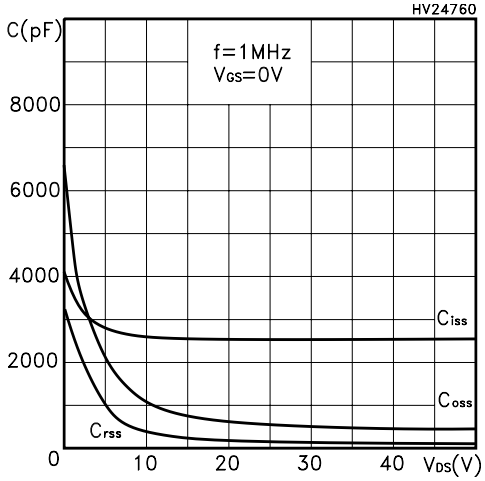


Figure 14: Normalized On Resistance vs Temperature

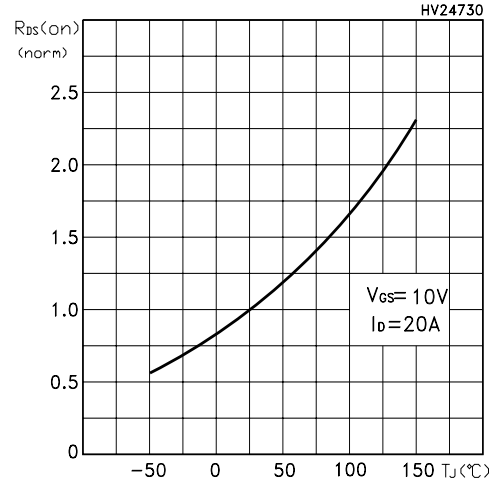


Figure 15: Source-Drain Forward Characteristics

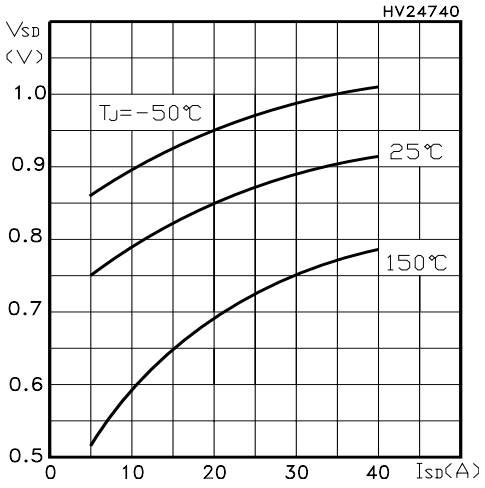


Figure 16: Unclamped Inductive Load Test Circuit

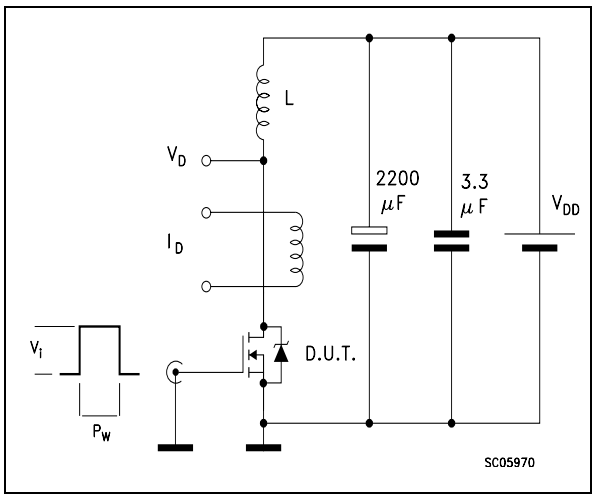


Figure 17: Switching Times Test Circuit For Resistive Load

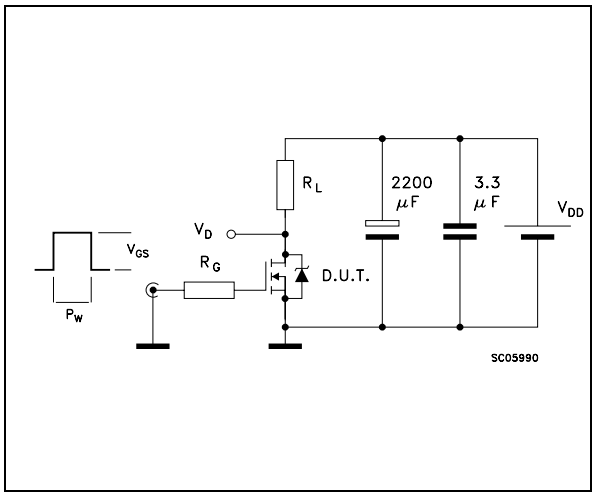


Figure 18: Test Circuit For Inductive Load Switching and Diode Recovery Times

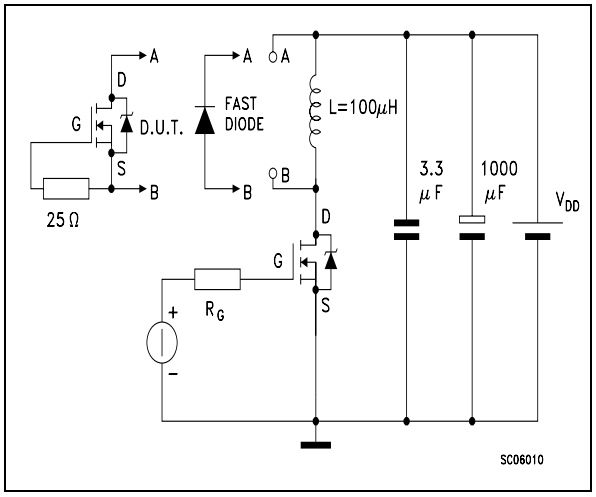


Figure 19: Unclamped Inductive Wafeform

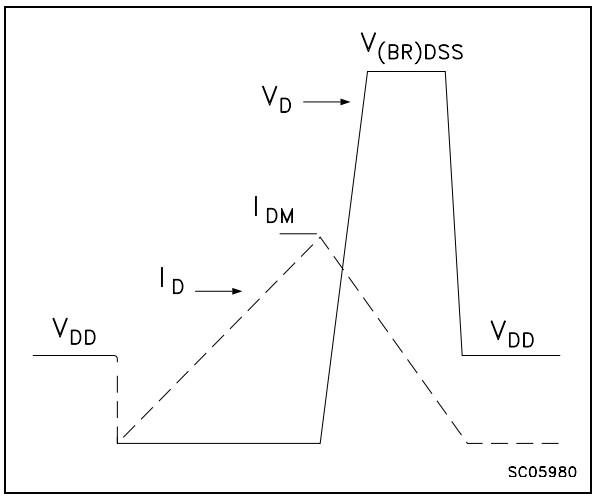
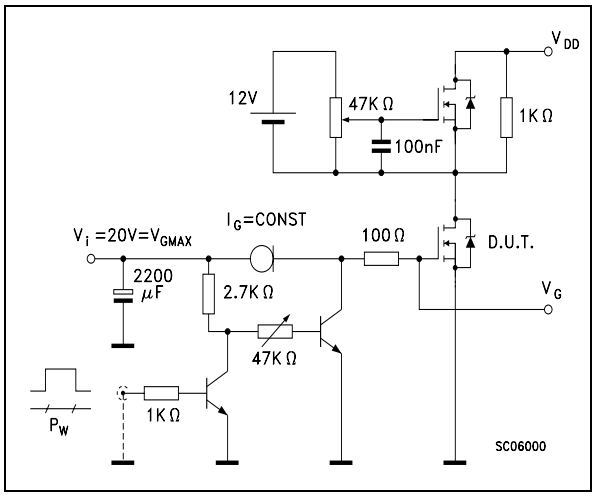
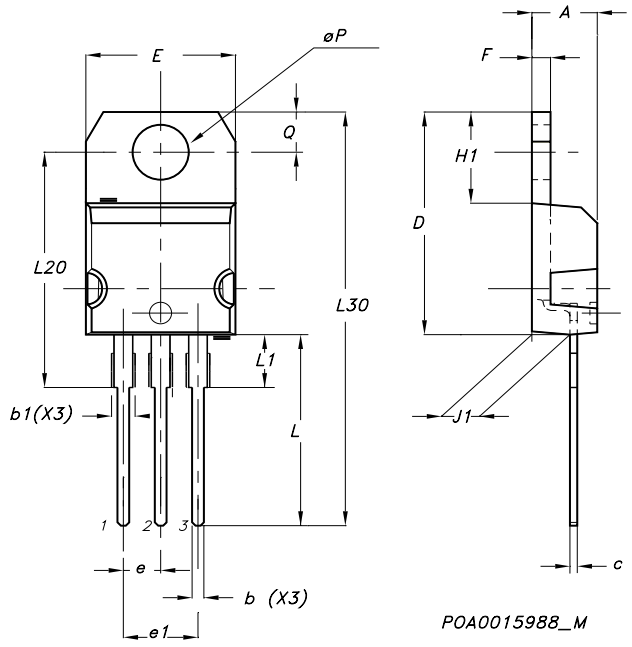


Figure 20: Gate Charge Test Circuit



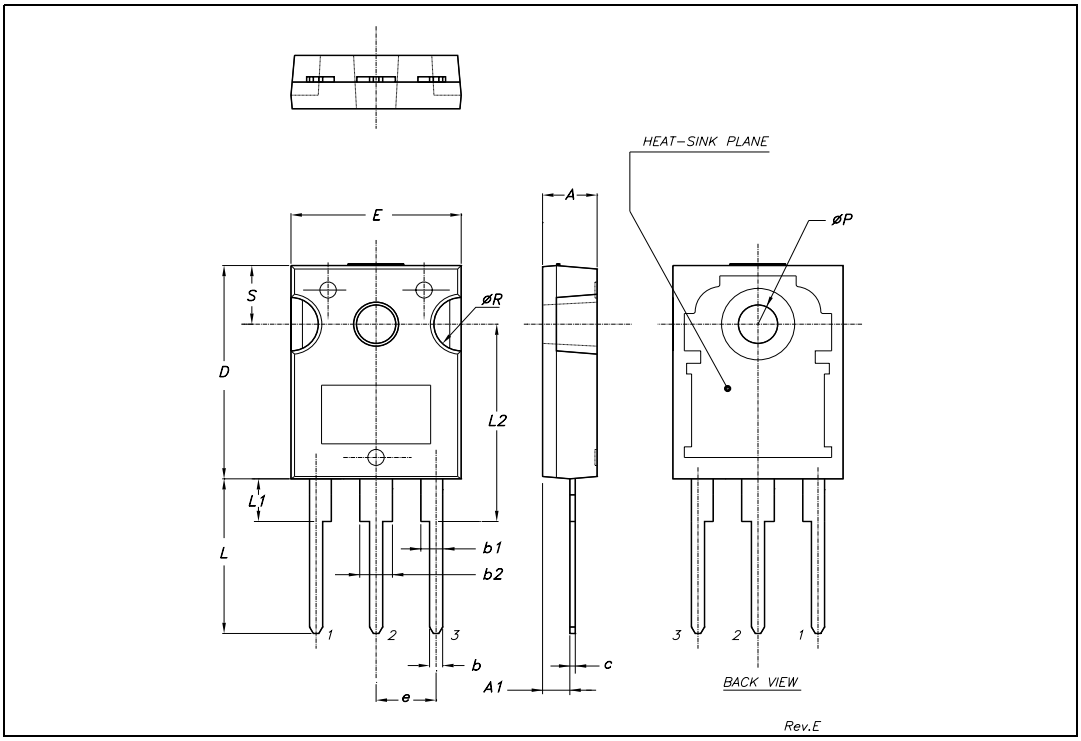
TO-220 MECHANICAL DATA

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



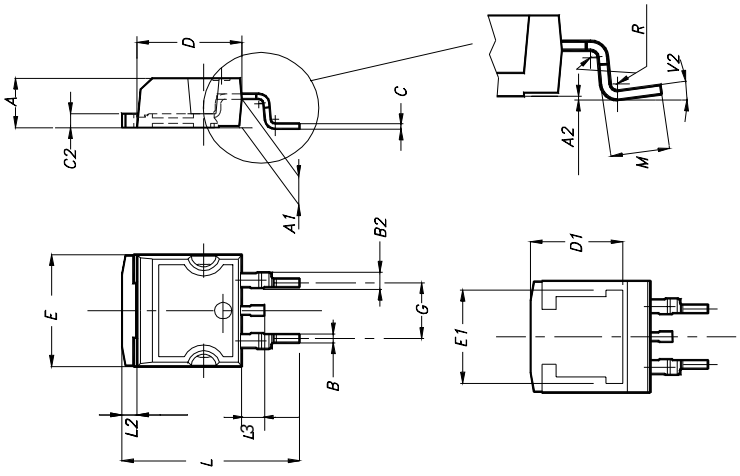
TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	

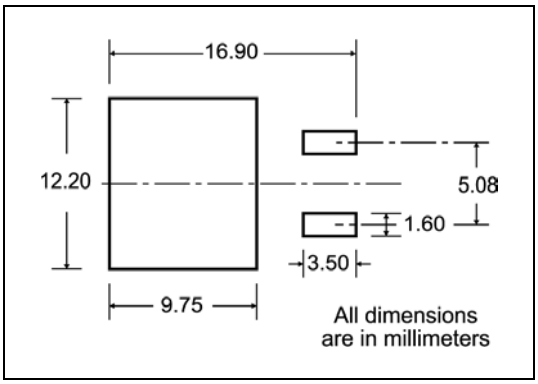


D²PAK MECHANICAL DATA

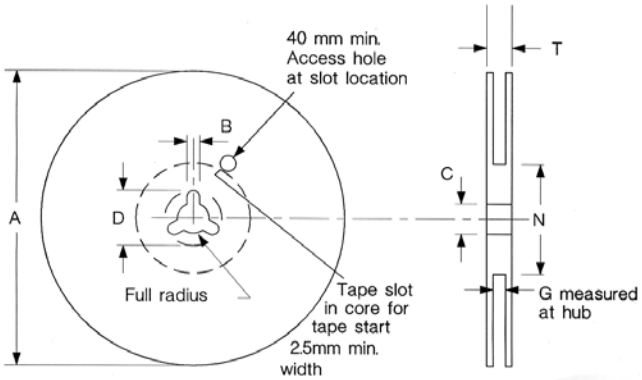
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334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



TAPE AND REEL SHIPMENT



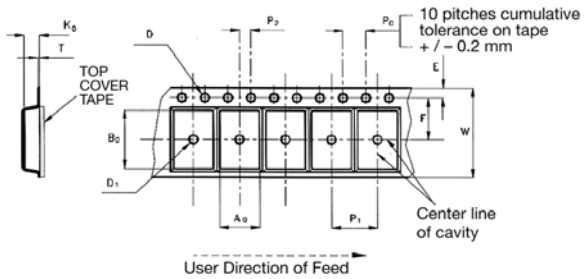
REEL MECHANICAL DATA

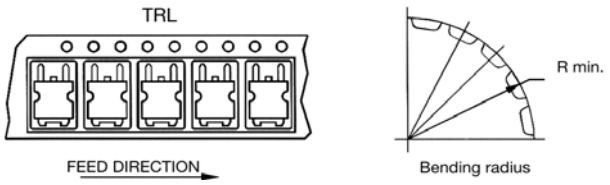
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

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

Table 9: Revision History

Date	Revision	Description of Changes
27-Sep-2004	1	First Release.
03-Feb-2005	2	Complete Version
03-Jun-2005	3	Update with D^2PAK

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