



STP200NF04 STB200NF04 - STB200NF04-1

N-CHANNEL 40V - 120A TO-220/D²PAK/I²PAK
STripFET™ II POWER MOSFET

PRELIMINARY DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STP200NF04	40 V	< 0.0037 Ω	120 A	310 W
STB200NF04	40 V	< 0.0037 Ω	120 A	310 W
STB200NF04-1	40 V	< 0.0037 Ω	120 A	310 W

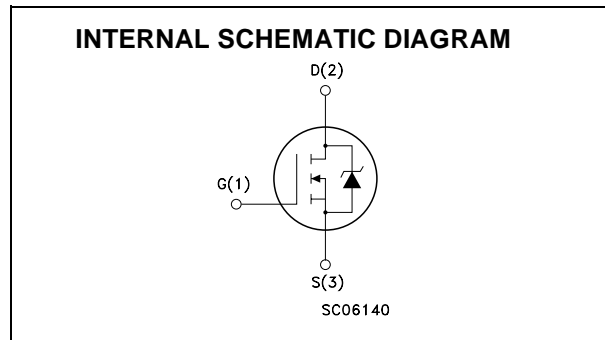
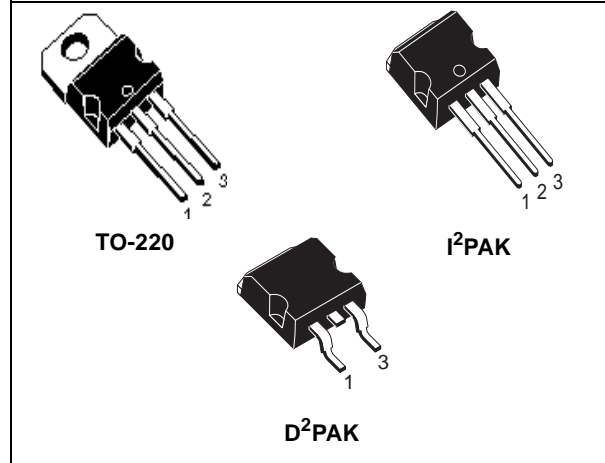
- STANDARD THRESHOLD DRIVE
- 100% AVALANCHE TESTED

DESCRIPTION

This MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

APPLICATIONS

- HIGH CURRENT, HIGH SWITCHING SPEED
- AUTOMOTIVE



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP200NF04	P200NF04	TO-220	TUBE
STB200NF04T4	B200NF04	D ² PAK	TAPE & REEL
STB200NF04-1	B200NF04	I ² PAK	TUBE

STP200NF04 - STB200NF04 - STB200NF04-1

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	40	V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	40	V
V _{GS}	Gate- source Voltage	± 20	V
I _D (#)	Drain Current (continuous) at T _C = 25°C	120	A
I _D (#)	Drain Current (continuous) at T _C = 100°C	120	A
I _{DM} (•)	Drain Current (pulsed)	480	A
P _{TOT}	Total Dissipation at T _C = 25°C	310	W
	Derating Factor	2.07	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	1.5	V/ns
E _{AS} (2)	Single Pulse Avalanche Energy	1.3	J
T _j T _{stg}	Operating Junction Temperature Storage Temperature	-55 to 175	°C

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 120A, di/dt ≤ 500A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.

(2) Starting T_j = 25°C, I_d = 60A, V_{DD} = 30 V

(#) Current Limited by Package

THERMAL DATA

		TO-220 / I ² PAK / D ² PAK	
R _{thj-case}	Thermal Resistance Junction-case Max	0.48	°C/W
R _{thj-pcb}	Thermal Resistance Junction-pcb Max	See Curve on page 4	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient (Free air) Max	62.5	°C/W
T _I	Maximum Lead Temperature For Soldering Purpose	300	°C

ELECTRICAL CHARACTERISTICS (TCASE = 25°C UNLESS OTHERWISE SPECIFIED)

ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA, V _{GS} = 0	40			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 = 250μA	2		4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V, I _D = 90 A			0.0037	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 90\text{ A}$		150		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$		5100 1600 600		pF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	$V_{DD} = 20\text{ V}, I_D = 90\text{ A}$ $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		30 320		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 20\text{ V}, I_D = 120\text{ A},$ $V_{GS} = 10\text{ V}$ (see, Figure 4)		170 30 45	210	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	$V_{DD} = 20\text{ V}, I_D = 90\text{ A}$ $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		140 120		ns ns

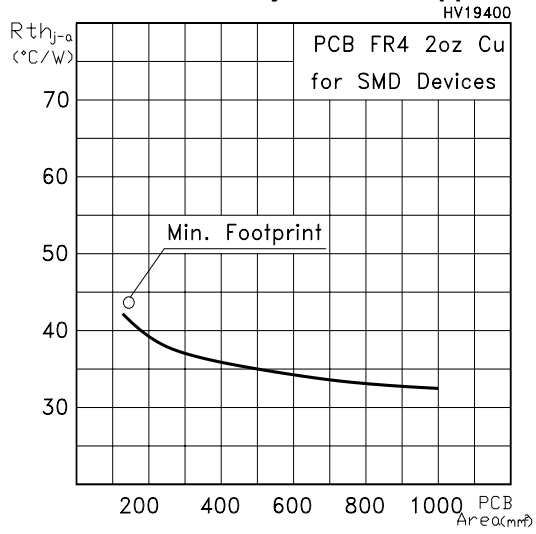
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				120 480	A A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 120\text{ A}, V_{GS} = 0$			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 120\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}, T_j = 150^\circ\text{C}$ (see test circuit, Figure 5)		85 190 4.5		ns nC A

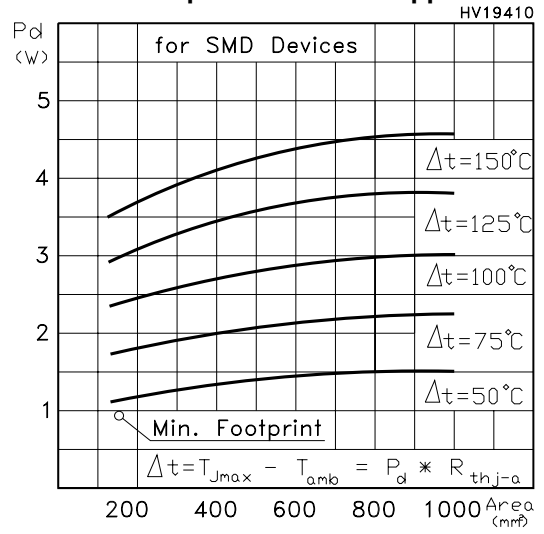
Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.
2. Pulse width limited by safe operating area.

STP200NF04 - STB200NF04 - STB200NF04-1

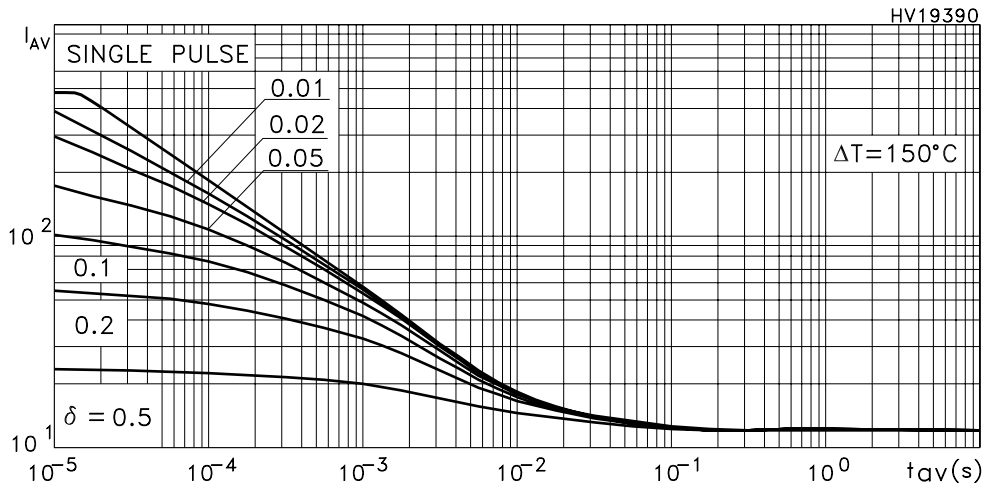
Thermal Resistance Rthj-a vs PCB Copper Area



Max Power Dissipation vs PCB Copper Area



Allowable I_{AV} vs. Time in Avalanche



The previous curve gives the safe operating area for unclamped inductive loads, single pulse or repetitive, under the following conditions:

$$P_{D(AVE)} = 0.5 * (1.3 * BV_{DSS} * I_{AV})$$

$$E_{AS(AR)} = P_{D(AVE)} * t_{AV}$$

Where:

I_{AV} is the Allowable Current in Avalanche

$P_{D(AVE)}$ is the Average Power Dissipation in Avalanche (Single Pulse)

t_{AV} is the Time in Avalanche

To derate above 25 °C, at fixed I_{AV} , the following equation must be applied:

$$I_{AV} = 2 * (T_{jmax} - T_{CASE}) / (1.3 * BV_{DSS} * Z_{th})$$

Where:

$Z_{th} = K * R_{th}$ is the value coming from Normalized Thermal Response at fixed pulse width equal to T_{AV} .

SPICE THERMAL MODEL

Parameter	Node	Value
CTHERM1	1 - 2	1.4958E-3
CTHERM2	2 - 3	3.5074E-2
CTHERM3	3 - 4	5.939E-2
CTHERM4	4 - 5	9.7411E-2
CTHERM5	5 - 6	8.8596E-2
CTHERM6	6 - 7	8.2755E-1
R THERM1	1 - 2	0.0384
R THERM2	2 - 3	0.0624
R THERM3	3 - 4	0.072
R THERM4	4 - 5	0.0912
R THERM5	5 - 6	0.1008
R THERM6	6 - 7	0.1152

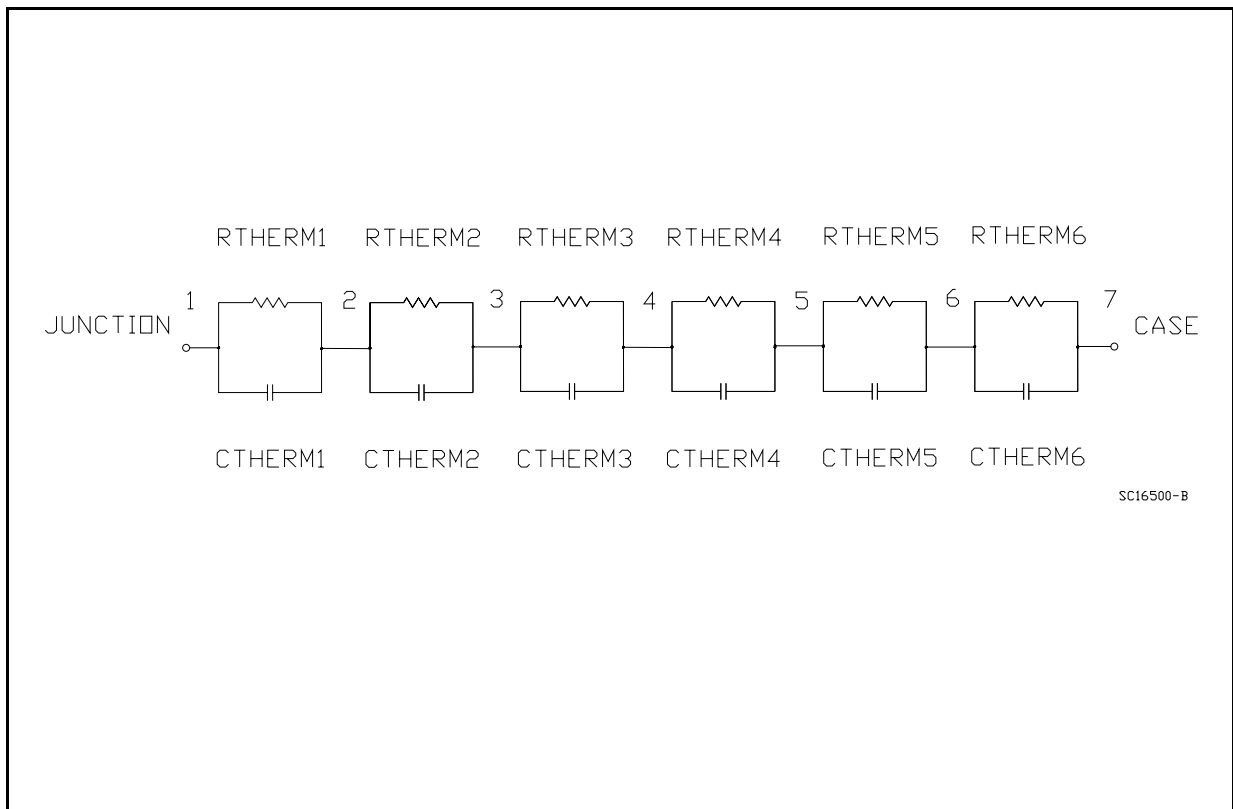


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform

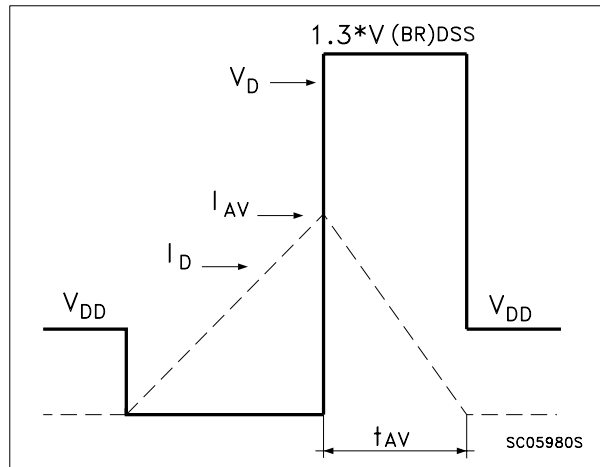


Fig. 3: Switching Times Test Circuit For Resistive Load



Fig. 3.1: Inductive Load Switching And Diode Recovery Times Waveform

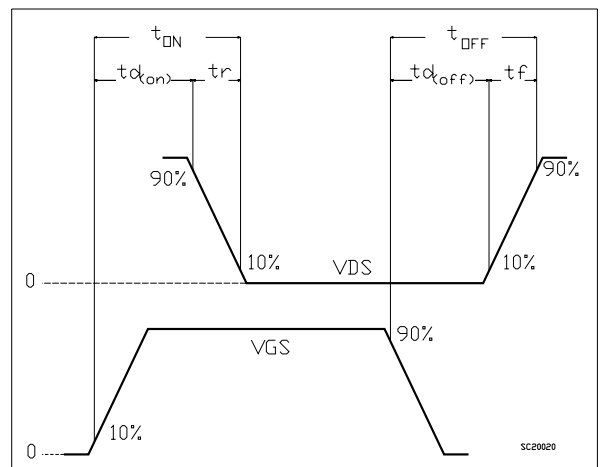


Fig. 4: Gate Charge test Circuit

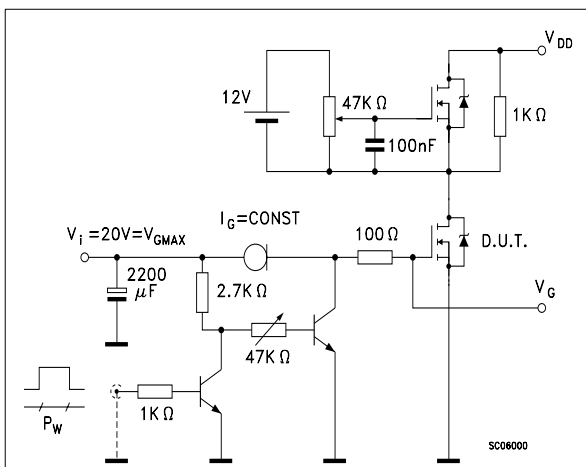


Fig. 4.1: Gate Charge test Waveform

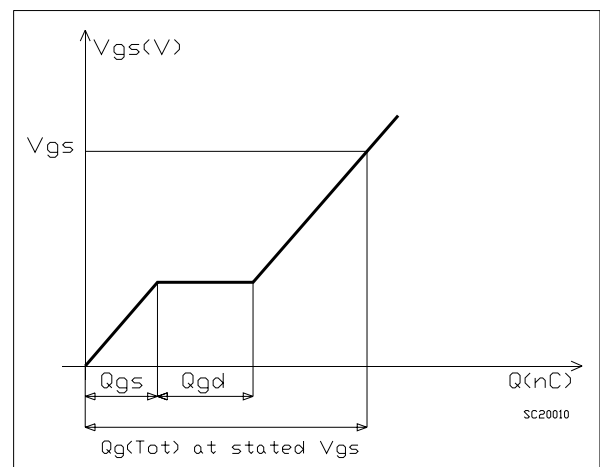


Fig. 5: Test Circuit For Diode Recovery Times

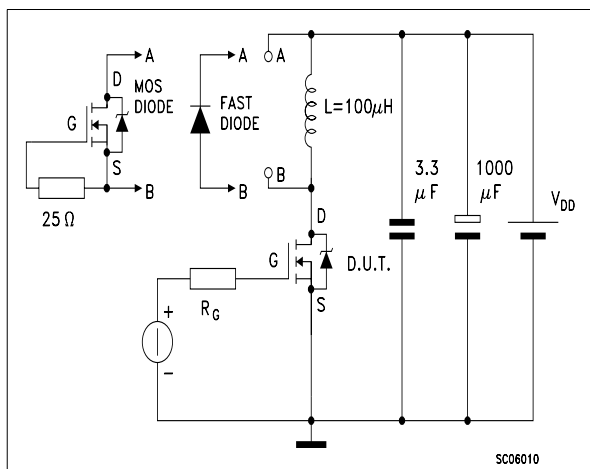
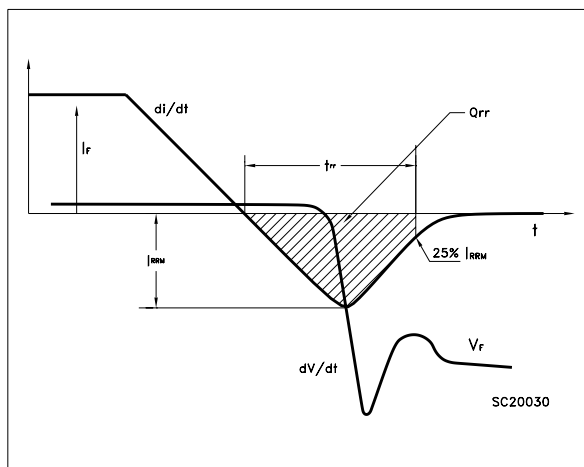
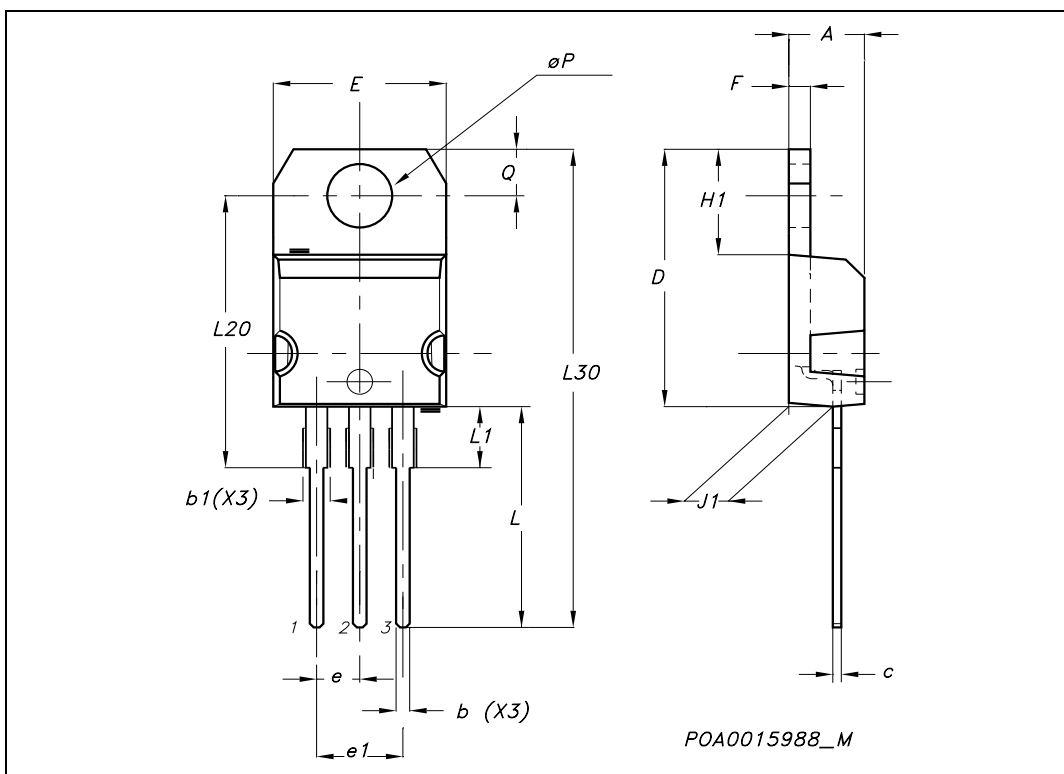


Fig. 5.1: Diode Recovery Times Waveform



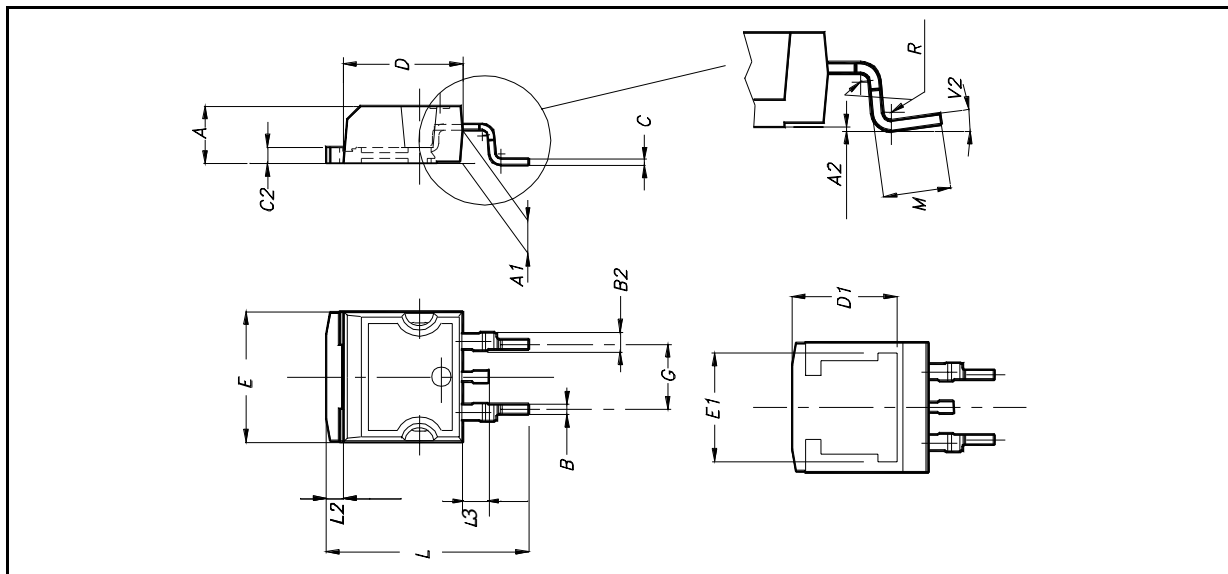
TO-220 MECHANICAL DATA

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



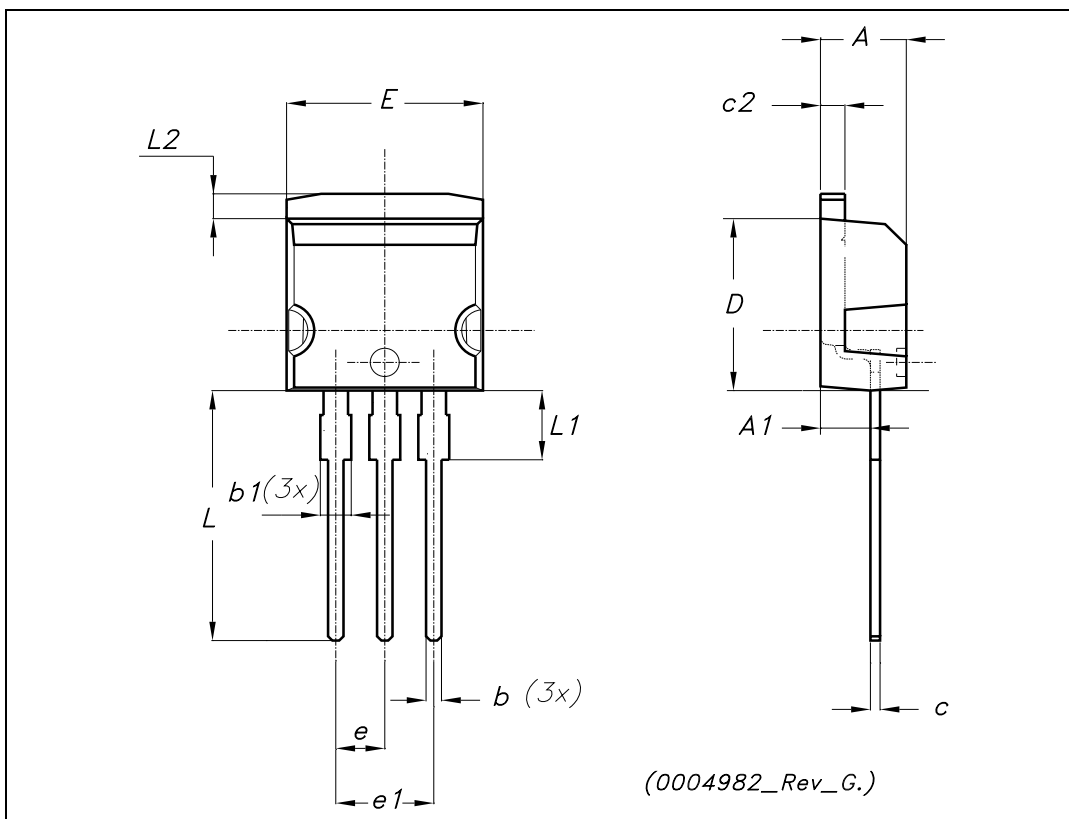
D²PAK MECHANICAL DATA

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°		8°			

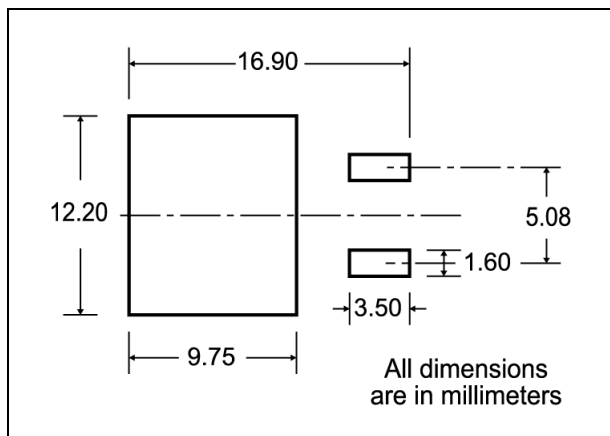


TO-262 (I²PAK) MECHANICAL DATA

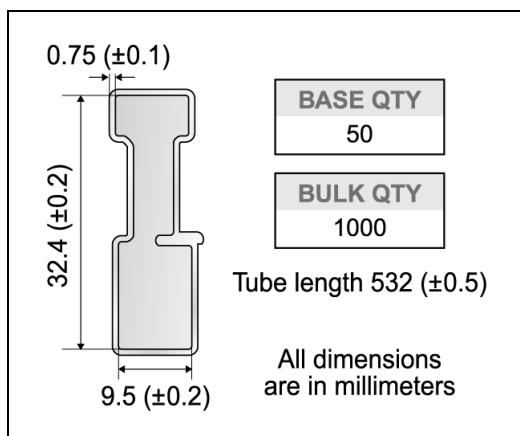
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

Diagram showing the tape mechanical data. It includes a circular reel view with dimensions A (outer diameter), B (slot width), C (slot depth), D (slot diameter), and D1 (inner diameter). A note indicates a 40 mm min. access hole at the slot location. A side view shows dimensions T (tape thickness), N (slot depth), and G (measured at hub). A note indicates a tape slot in the core for tape start with a 2.5 mm min. width. The full radius is also indicated.

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

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

Diagram showing the reel mechanical data. It includes a top view of the reel with dimensions K₀ (reel diameter), D (cavity diameter), D₁ (inner diameter), B₀ (cavity width), A₀ (cavity length), P₁ (pitch), P₂ (pitch), P₀ (pitch), E (cavity depth), F (cavity depth), W (cavity width), and R (bending radius). A note indicates a 10 pitches cumulative tolerance on tape ± 0.2 mm. The center line of the cavity is also shown. The user direction of feed and the bending radius are also indicated.

* on sales type
12/13

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2003 STMicroelectronics - Printed in Italy - All Rights Reserved
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco
Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

© <http://www.st.com>