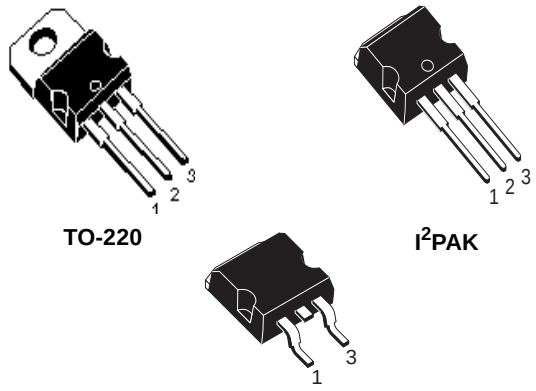
STP200NF04
STB200NF04 - STB200NF04-1

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

PRELIMINARY DATA

TYPE	V_{DSS}	$R_{DS(on)}$	I_D	Pw
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

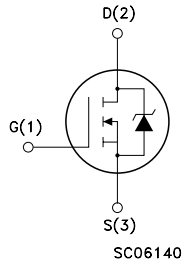
- STANDARD THRESHOLD DRIVE
- 100% AVALANCHE TESTED



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.

INTERNAL SCHEMATIC DIAGRAM



APPLICATIONS

- HIGH CURRENT, HIGH SWITCHING SPEED
- AUTOMOTIVE

ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP200NF04	P200NF04	TO-220	TUBE
STB200NF04T4	B200NF04	D²PAK	TAPE & REEL
STB200NF04-1	B200NF04	I²PAK	TUBE

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 (continuos) at T_C = 25°C	120	A
I_D (#)	Drain Current (continuos) 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^2PAK / D^2PAK	
Rthj-case	Thermal Resistance Junction-case Max	0.48	°C/W
Rthj-pcb	Thermal Resistance Junction-pcb Max	See Curve on page 4	°C/W
Rthj-amb	Thermal Resistance Junction-ambient (Free air) Max	62.5	°C/W
T_l	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 V, I_D = 90 A		150		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25V, f = 1 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 V, I_D = 90 A R_G = 4.7Ω V_{GS} = 10 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} = 20V, I_D = 120 A, V_{GS} = 10V (see, Figure 4)		170 30 45	210	nC nC nC

SWITCHING OFF

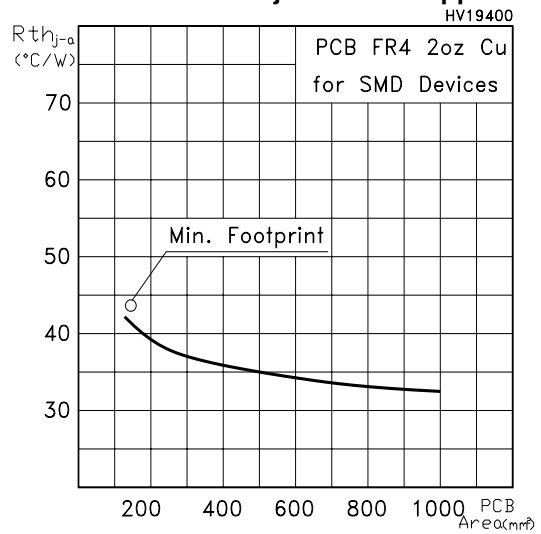
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	V_{DD} = 20 V, I_D = 90 A R_G = 4.7Ω V_{GS} = 10 V (Resistive Load see, Figure 3)		140 120		ns ns

SOURCE DRAIN DIODE

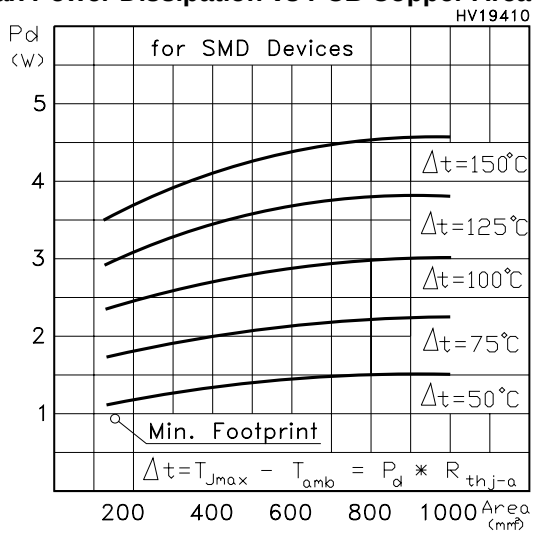
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				120 480	A A
V_{SD} (1)	Forward On Voltage	I_{SD} = 120 A, V_{GS} = 0			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 120 A, di/dt = 100A/µs V_{DD} = 30V, T_j = 150°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.

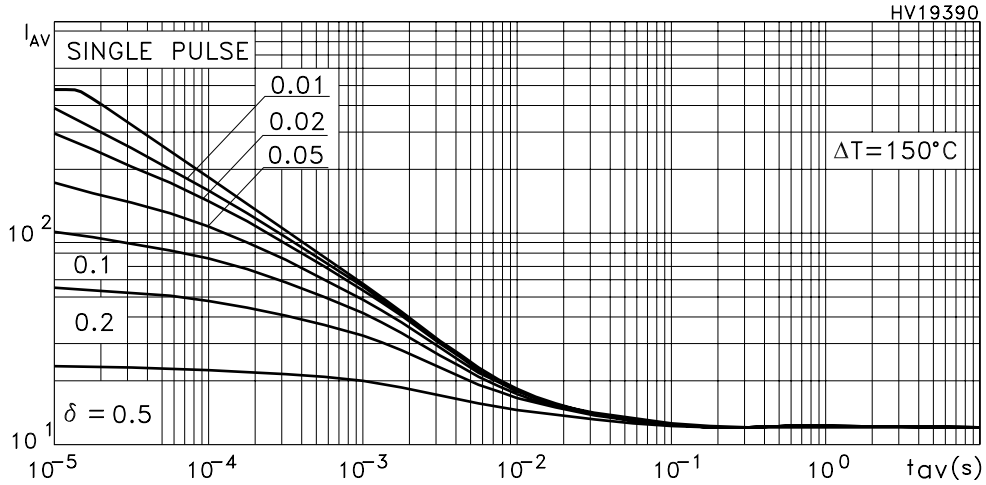
Thermal Resistance Rthj-a vs PCB Copper Area



Max Power Dissipation vs PCB Copper Area



Allowable Iav 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
RTHERM1	1 - 2	0.0384
RTHERM2	2 - 3	0.0624
RTHERM3	3 - 4	0.072
RTHERM4	4 - 5	0.0912
RTHERM5	5 - 6	0.1008
RTHERM6	6 - 7	0.1152

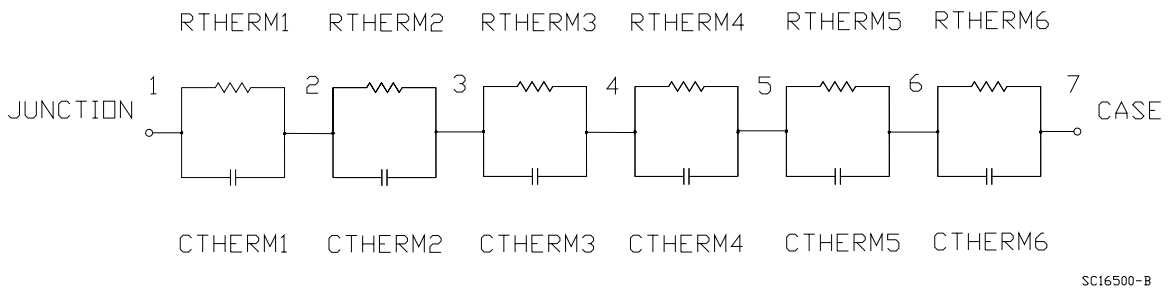


Fig. 1: Unclamped Inductive Load Test Circuit

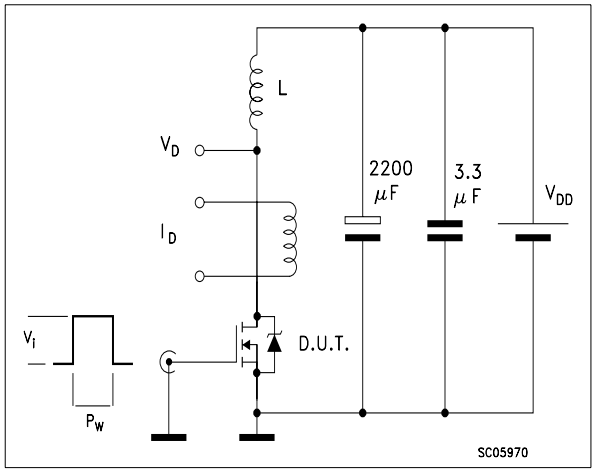


Fig. 2: Unclamped Inductive Waveform

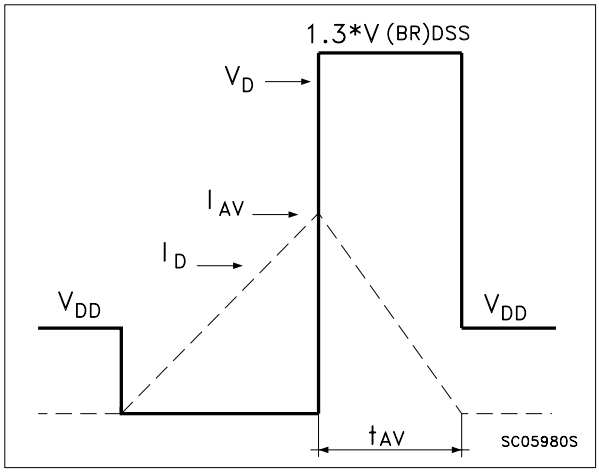


Fig. 3: Switching Times Test Circuit For Resistive Load

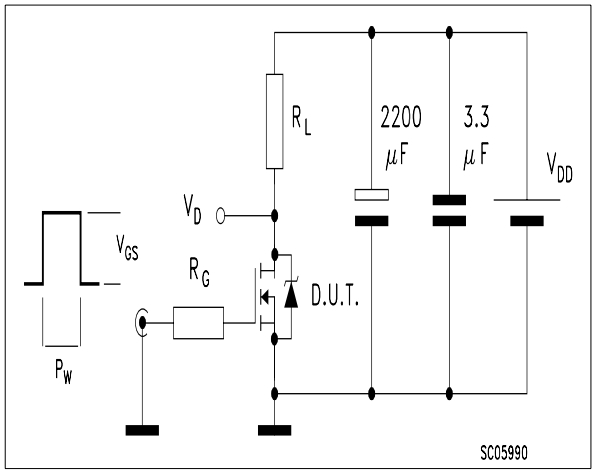


Fig. 3.1: Inductive Load Switching And Diode Recovery Times Waveform

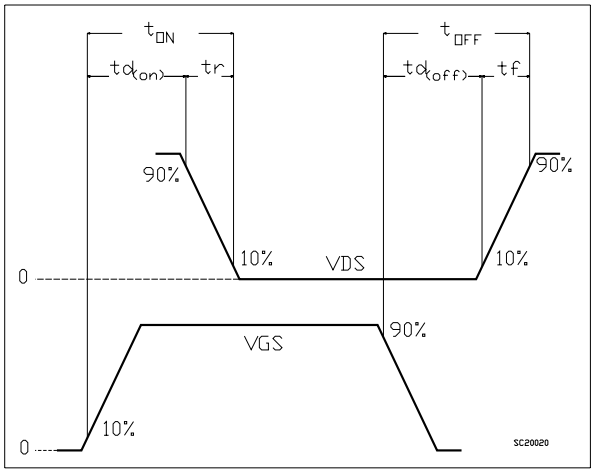


Fig. 4: Gate Charge test Circuit

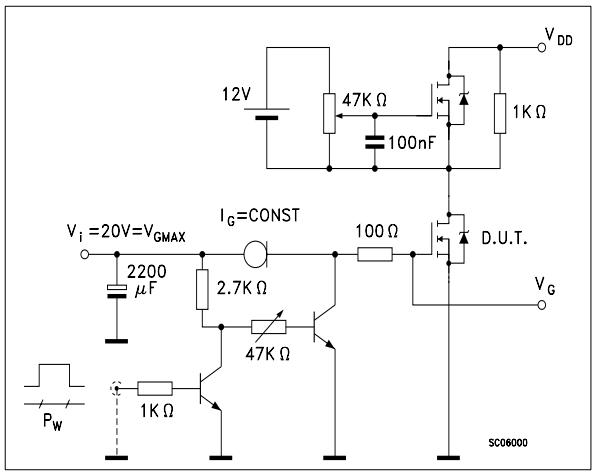


Fig. 4.1: Gate Charge test Waveform

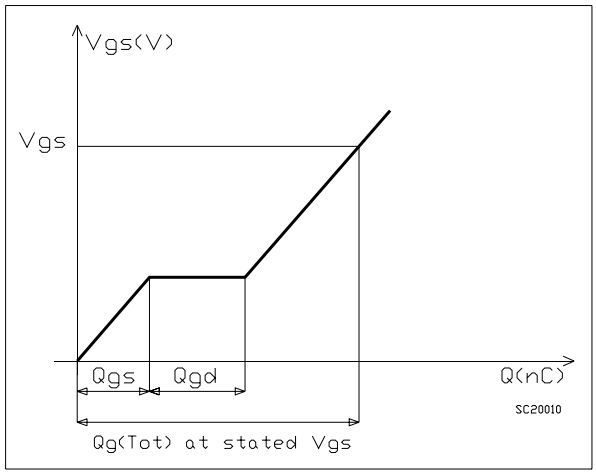


Fig. 5: Test Circuit For Diode Recovery Times

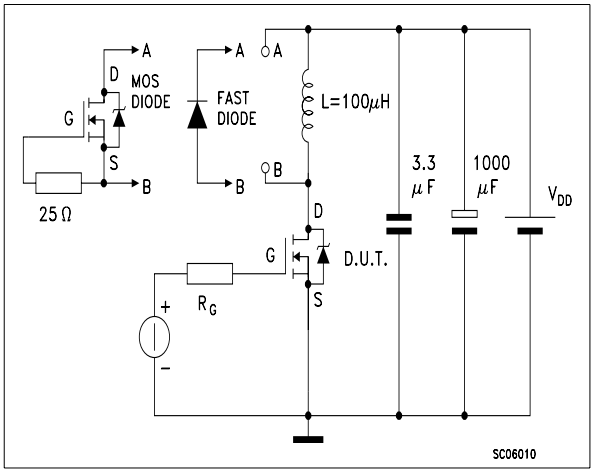
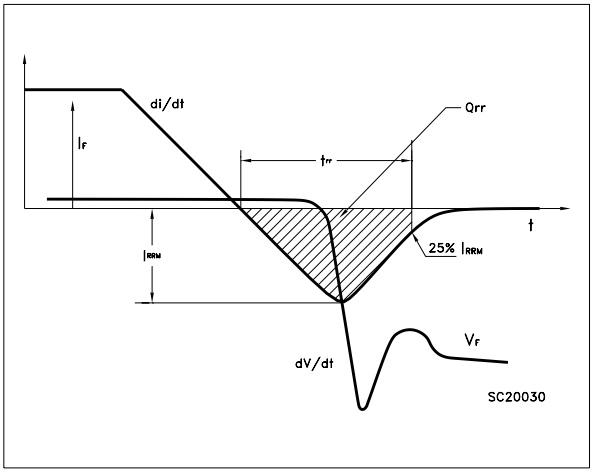
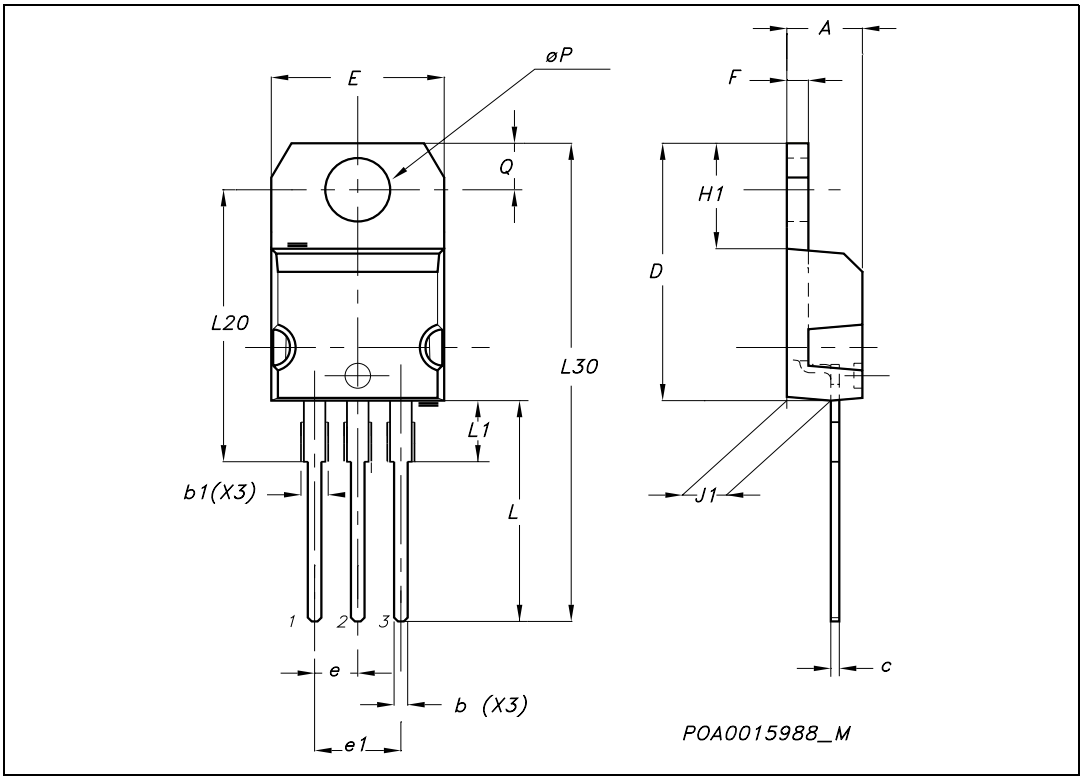


Fig. 5.1: Diode Recovery Times Waveform



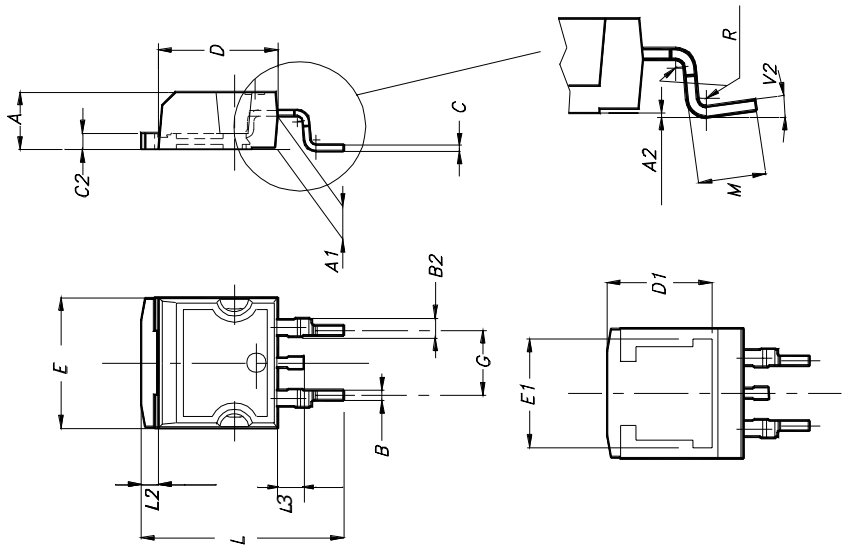
TO-220 MECHANICAL DATA

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



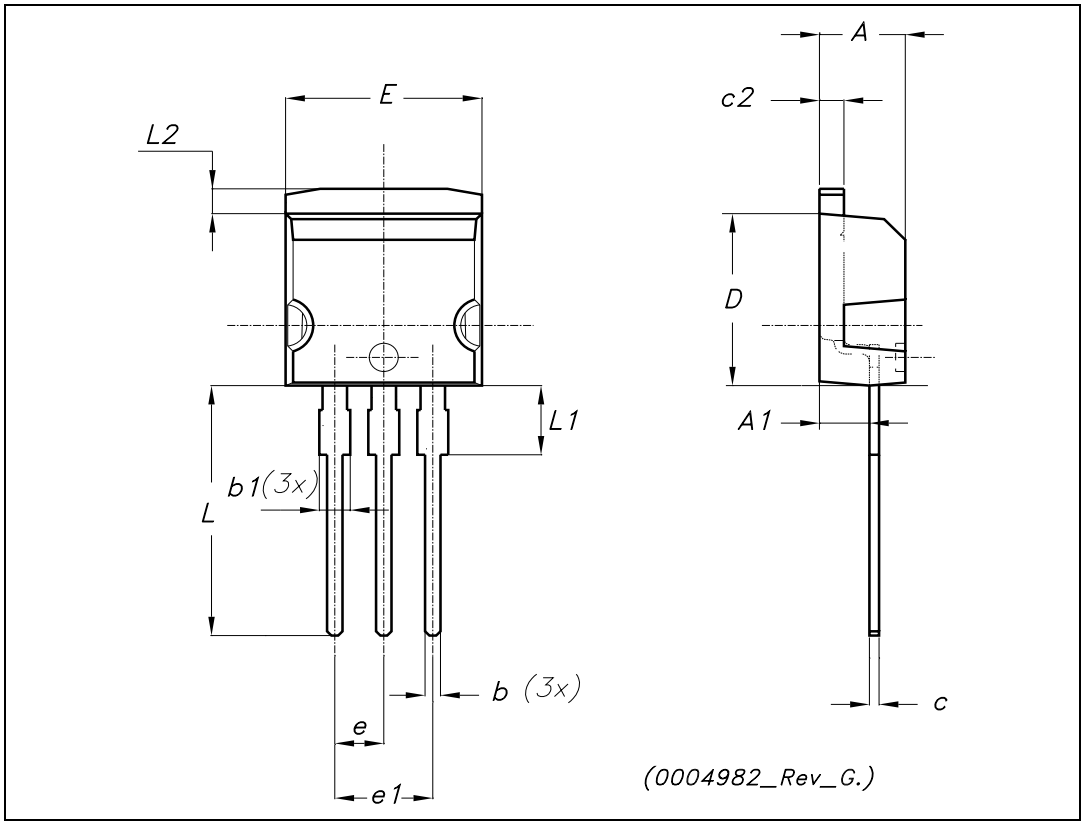
D^2PAK MECHANICAL DATA

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		8º			

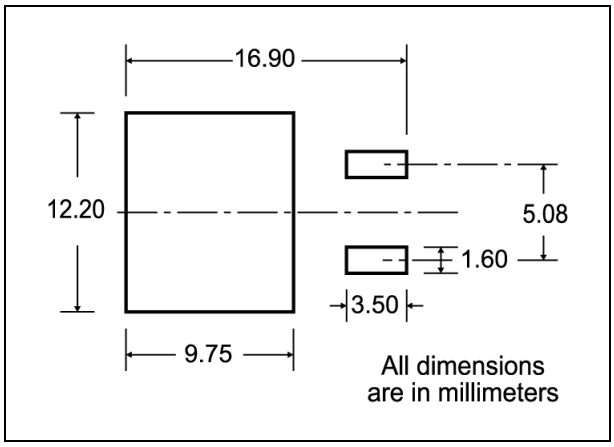


TO-262 (I^2PAK) MECHANICAL DATA

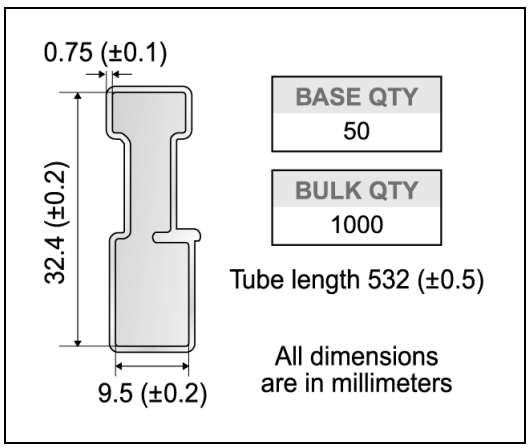
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		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



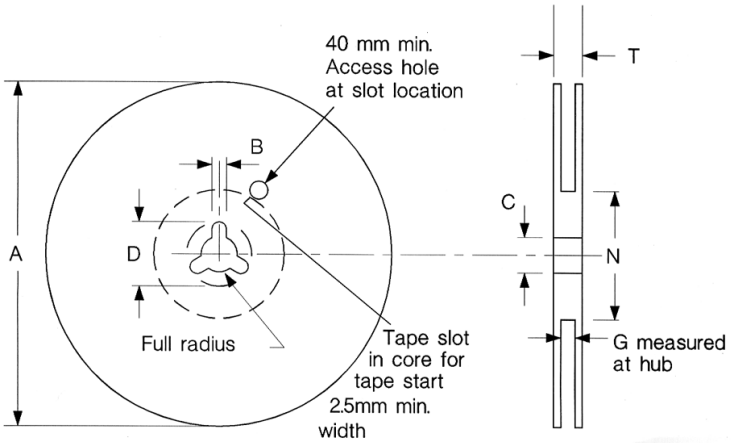
D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*



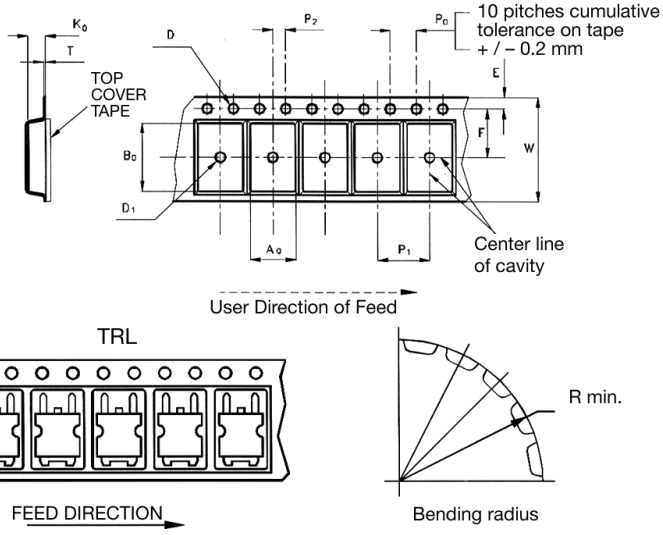
REEL MECHANICAL DATA

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