



STP100NF04 STB100NF04, STB100NF04-1

N-CHANNEL 40V - 0.0043Ω - 120A TO-220/D²PAK/I²PAK
STripFET™ II POWER MOSFET

AUTOMOTIVE SPECIFIC

TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STP100NF04	40 V	< 0.0046 Ω	120 A	300 W
STB100NF04	40 V	< 0.0046 Ω	120 A	300 W
STB100NF04-1	40 V	< 0.0046 Ω	120 A	300 W

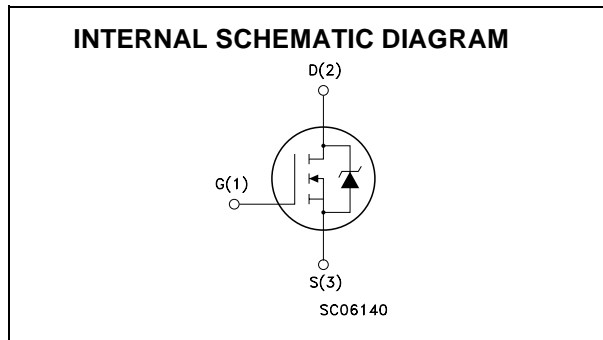
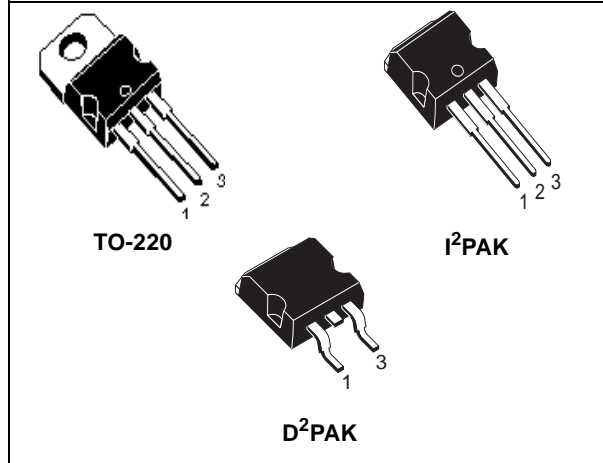
- TYPICAL R_{DS(on)} = 0.0043 Ω
- STANDARD THRESHOLD DRIVE
- 100% AVALANCHE TESTED

DESCRIPTION

This Power Mosfet is the latest development of ST-Microelectronics 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



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP100NF04	P100NF04	TO-220	TUBE
STB100NF04T4	B100NF04	D ² PAK	TAPE & REEL
STB100NF04-1	B100NF04	I ² PAK	TUBE

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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	300	W
	Derating Factor	2	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	6	V/ns
E _{AS} (2)	Single Pulse Avalanche Energy	1.2	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 ≤ 300A/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	0.5	°C/W
R _{thj-pcb}	Thermal Resistance Junction-pcb Max	See Curve on page 6	°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 = 50 A		0.0043	0.0046	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		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 1300 160		pF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	$V_{DD} = 20\text{ V}, I_D = 60\text{ A}$ $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		35 220		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 32\text{ V}, I_D = 120\text{ A},$ $V_{GS} = 10\text{ V}$ (see, Figure 4)		110 35 35	150	nC nC nC

SWITCHING OFF

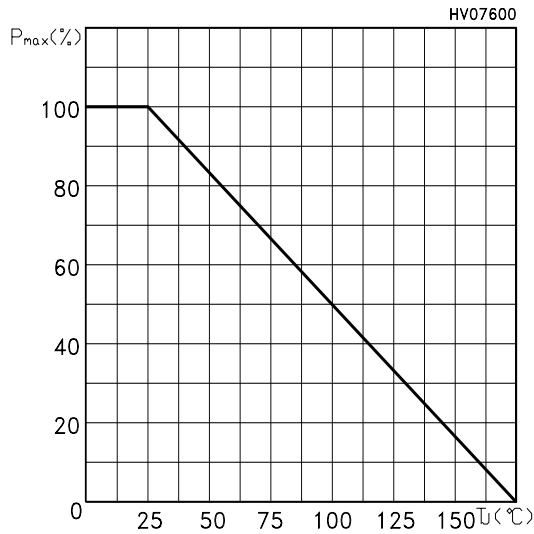
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	$V_{DD} = 20\text{ V}, I_D = 60\text{ A}$ $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		80 50		ns ns

SOURCE DRAIN DIODE

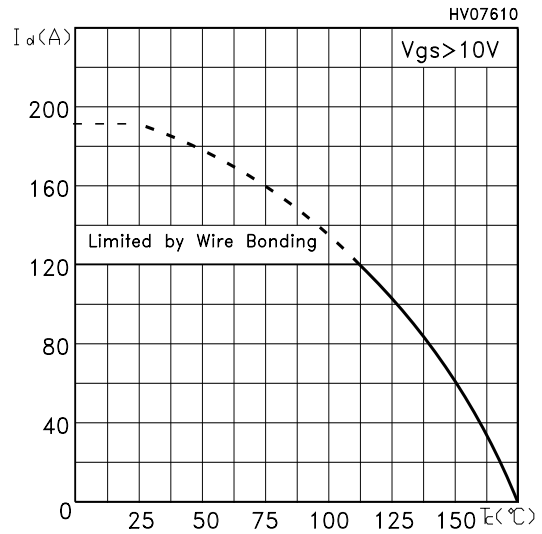
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				120 480	A A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 120\text{ A}, V_{GS} = 0$			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 120\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}, T_j = 150^\circ\text{C}$ (see test circuit, Figure 5)		75 185 5		ns nC A

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

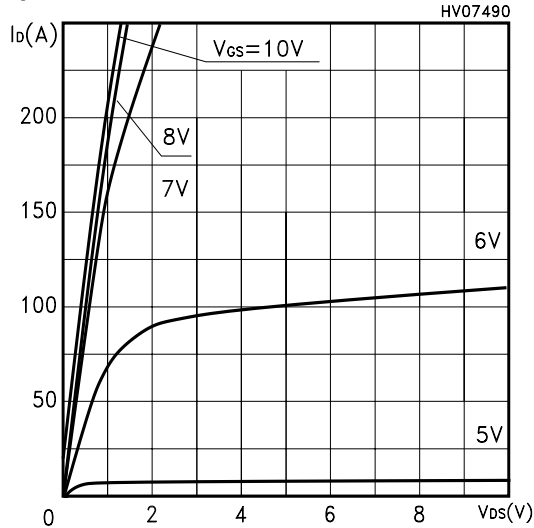
Power Derating vs Tc



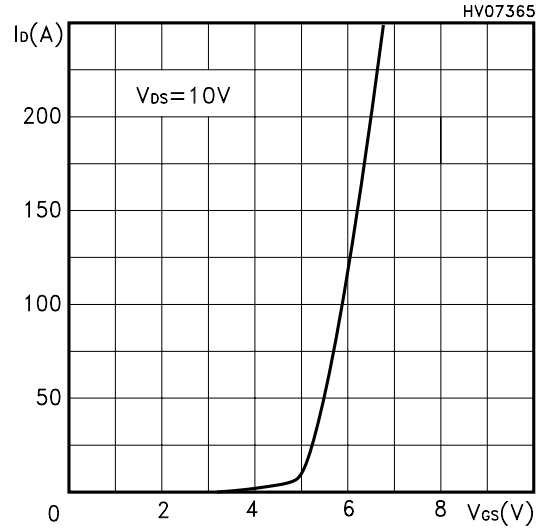
Max Id Current vs Tc



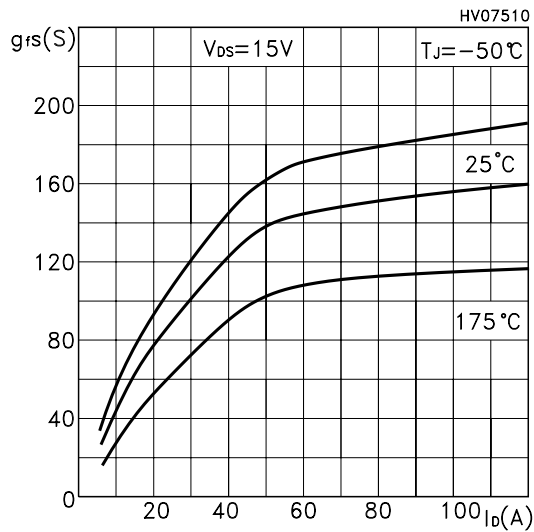
Output Characteristics



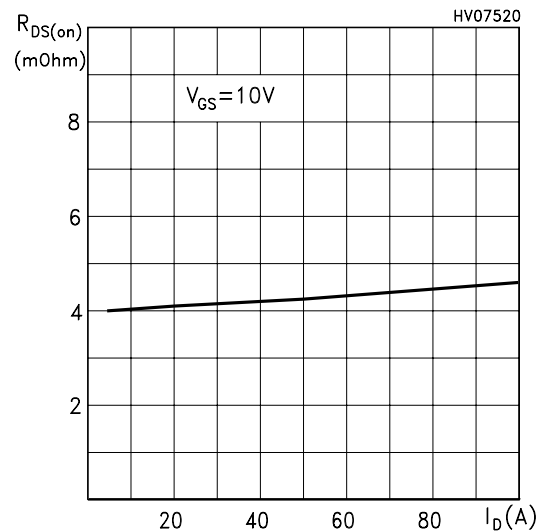
Transfer Characteristics



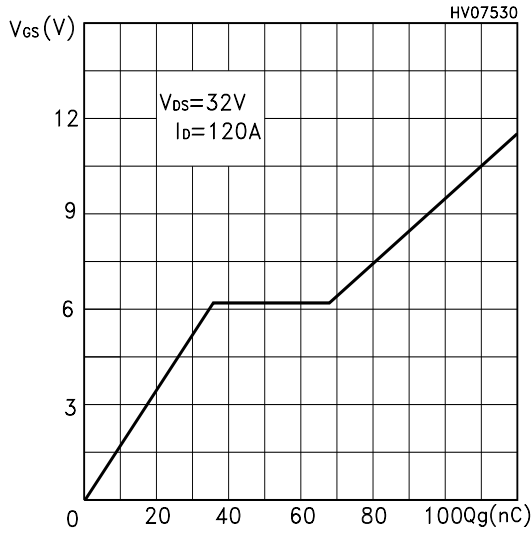
Transconductance



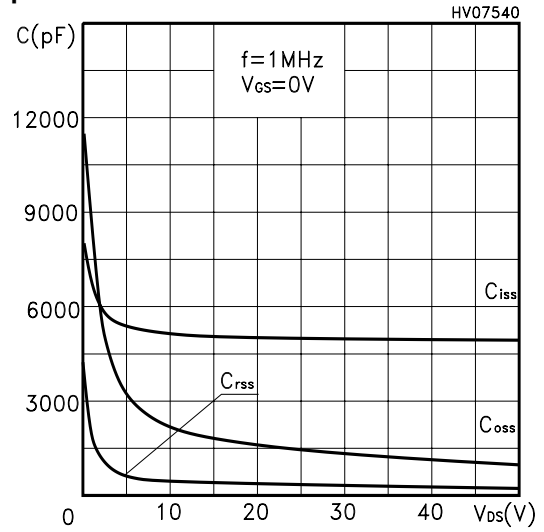
Static Drain-source On Resistance



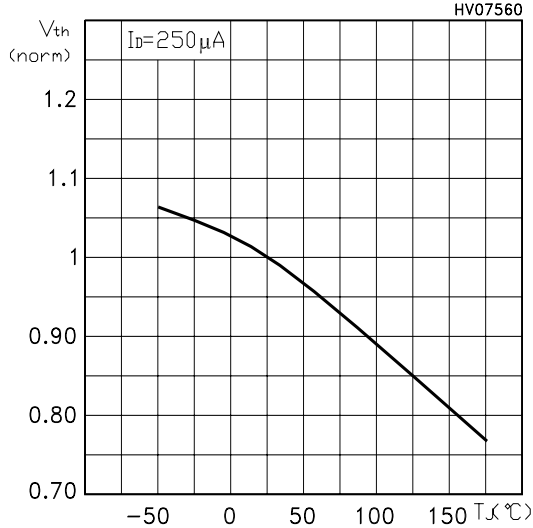
Gate Charge vs Gate-source Voltage



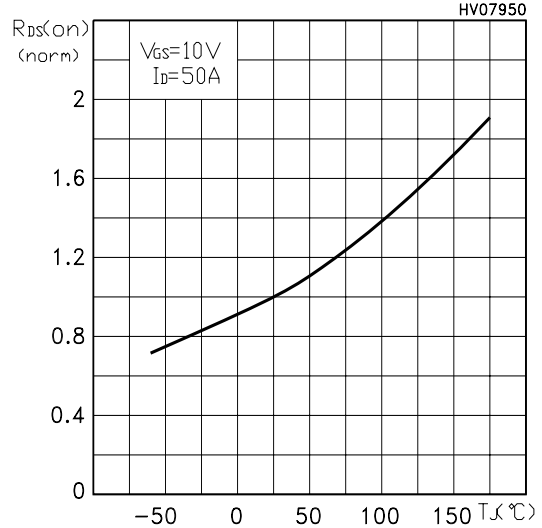
Capacitance Variations



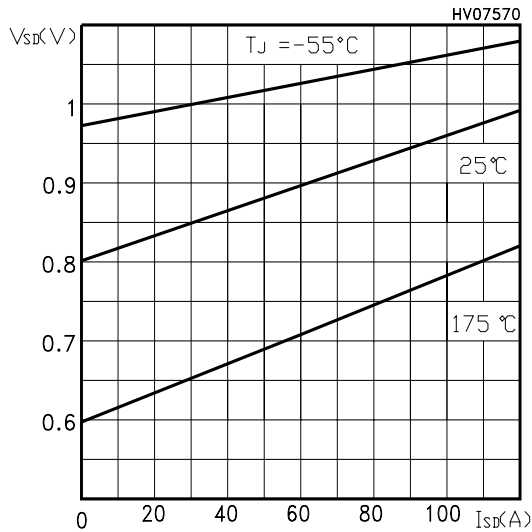
Normalized Gate Threshold Voltage vs Temp.



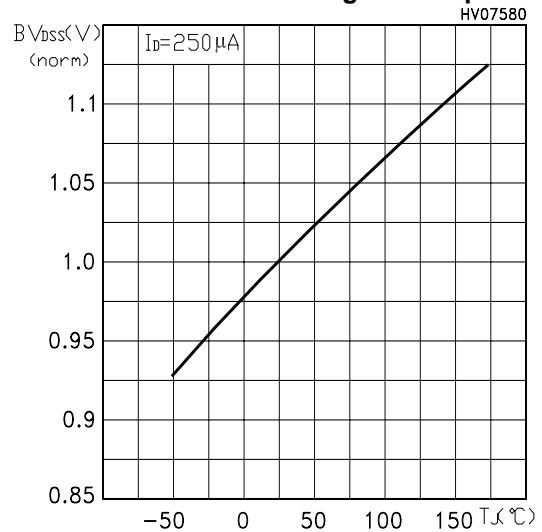
Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

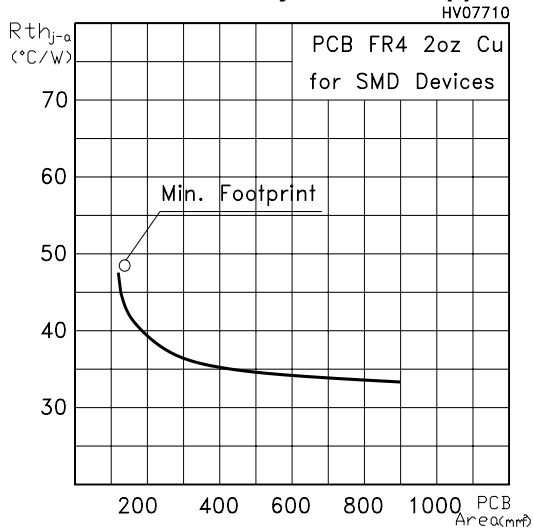


Normalized Breakdown voltage vs Temperature

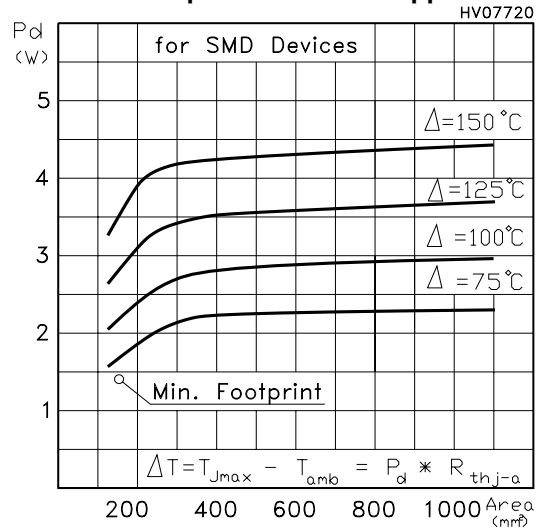


STP100NF04, STB100NF04, STB100NF04-1

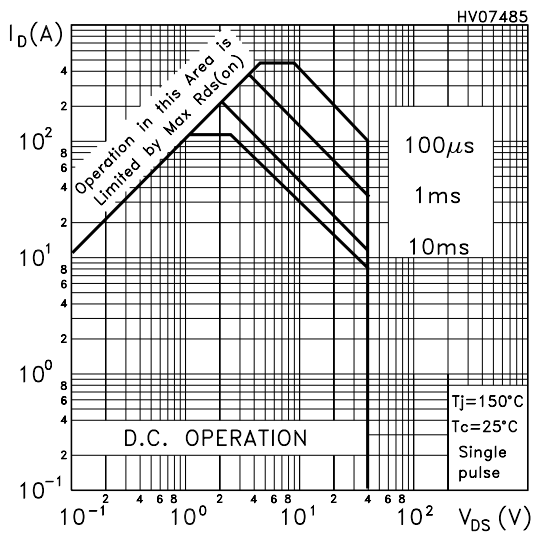
Thermal Resistance Rthj-a vs PCB Copper Area



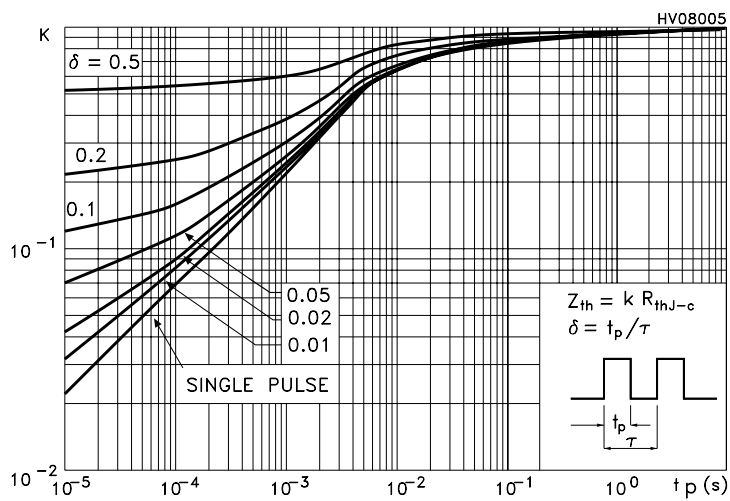
Max Power Dissipation vs PCB Copper Area



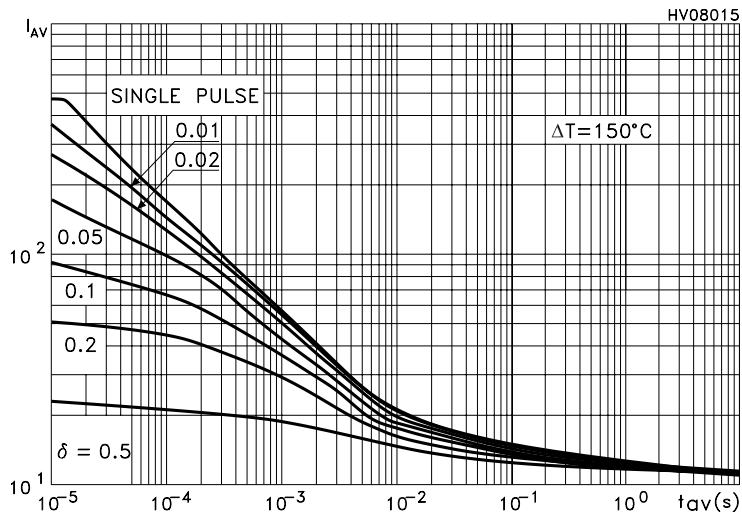
Safe Operating Area



Thermal Impedance



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	5 - 4	0.011
CTHERM2	4 - 3	0.0012
CTHERM3	3 - 2	0.05
CTHERM4	2 - 1	0.1
R THERM1	5 - 4	0.09
R THERM2	4 - 3	0.02
R THERM3	3 - 2	0.11
R THERM4	2 - 1	0.17

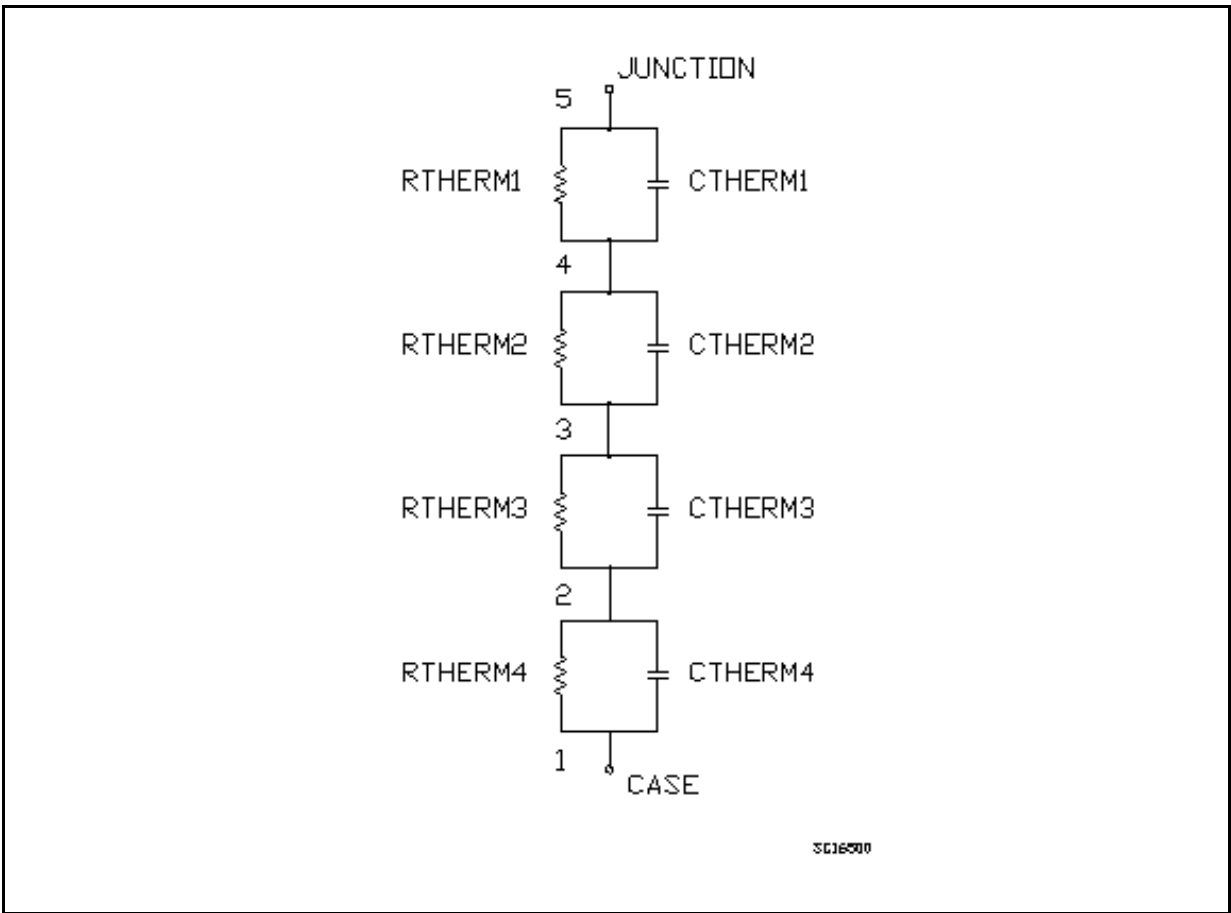


Fig. 1: Unclamped Inductive Load Test Circuit

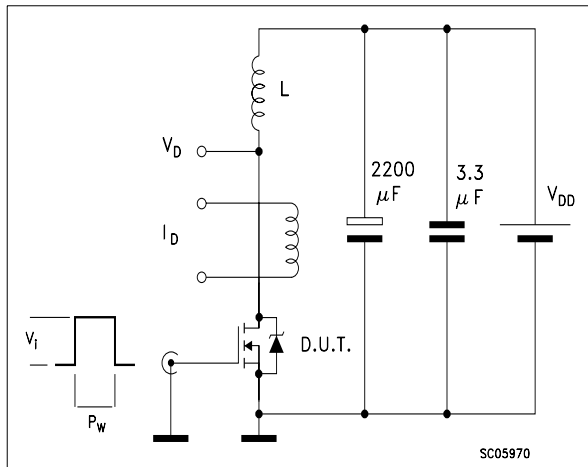


Fig. 2: Unclamped Inductive Waveform

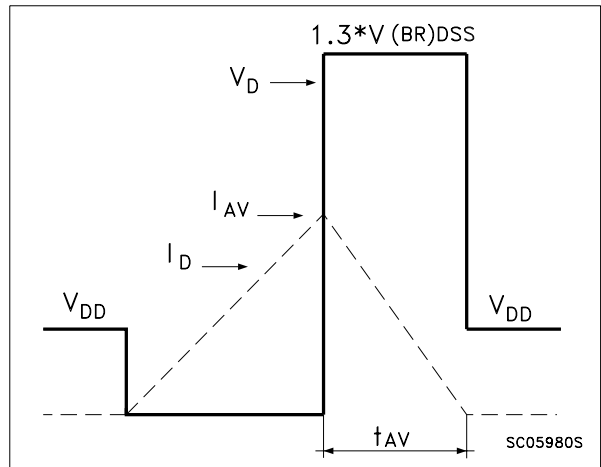


Fig. 3: Switching Times Test Circuit For Resistive Load

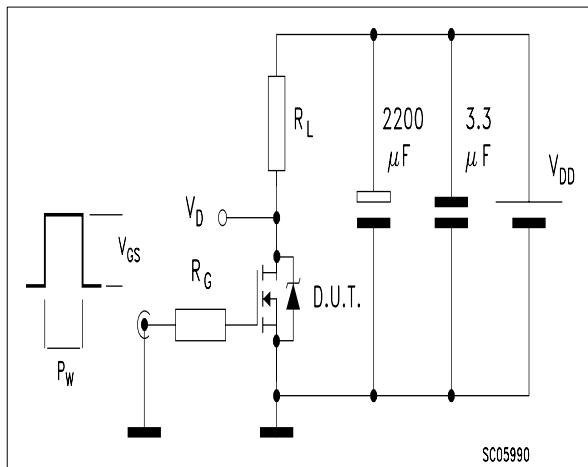


Fig. 3.1: Inductive Load Switching And Diode Recovery Times Waveform

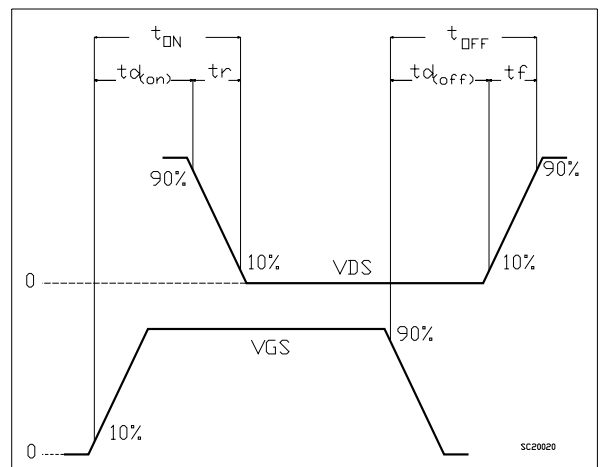


Fig. 4: Gate Charge test Circuit

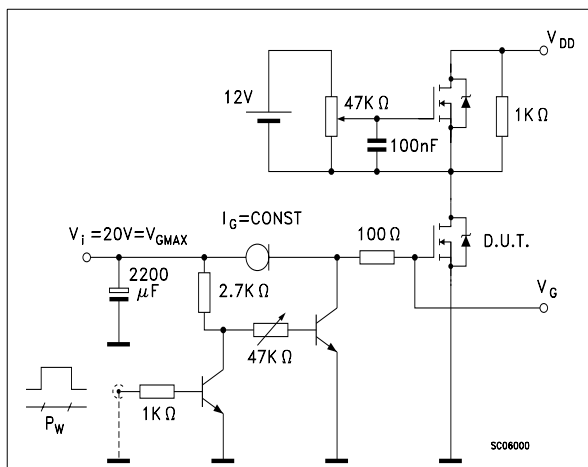


Fig. 4.1: Gate Charge test Waveform

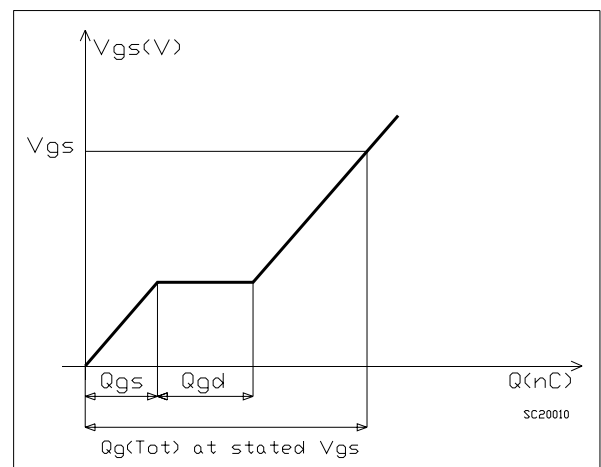


Fig. 5: Test Circuit For Diode Recovery Times

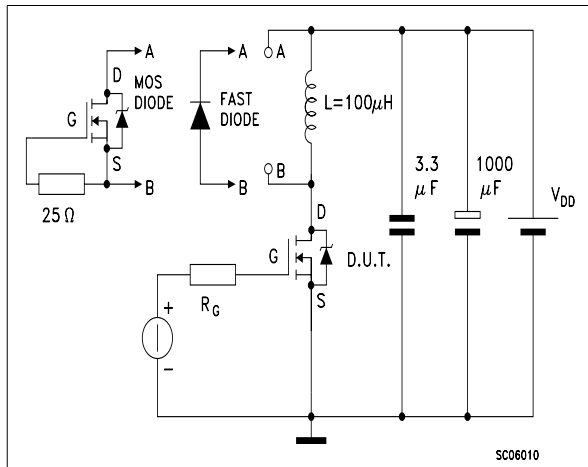
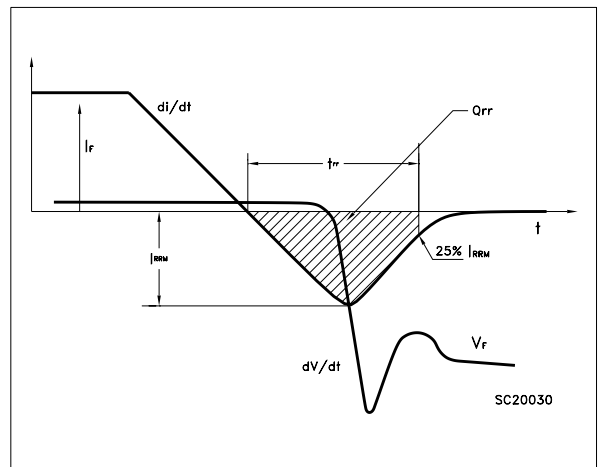
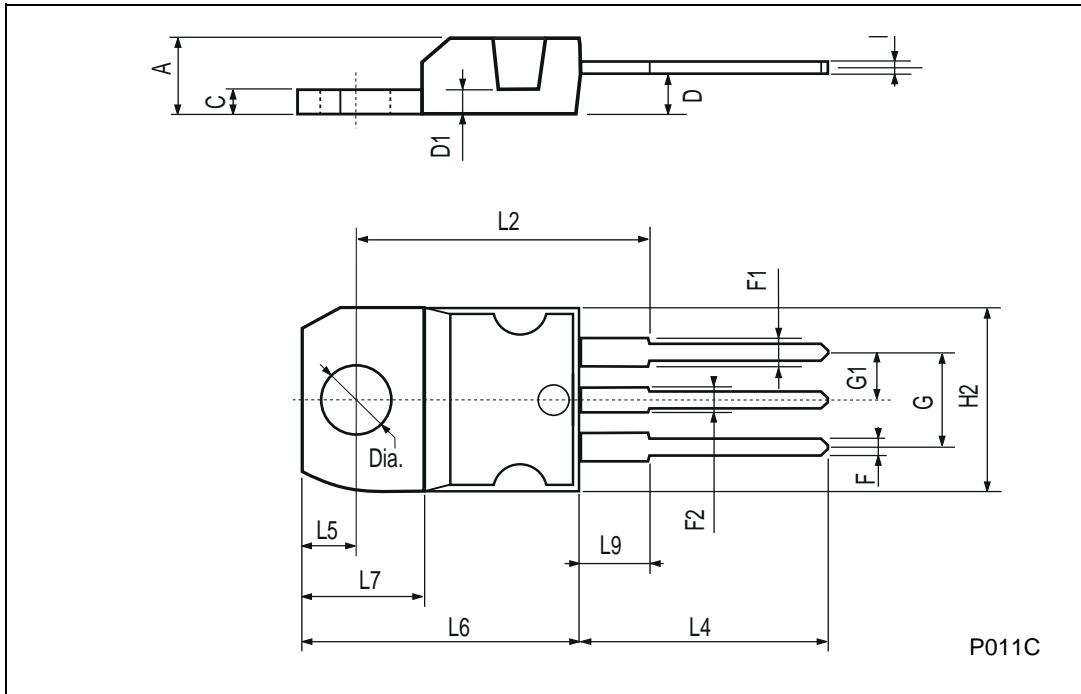


Fig. 5.1: Diode Recovery Times Waveform



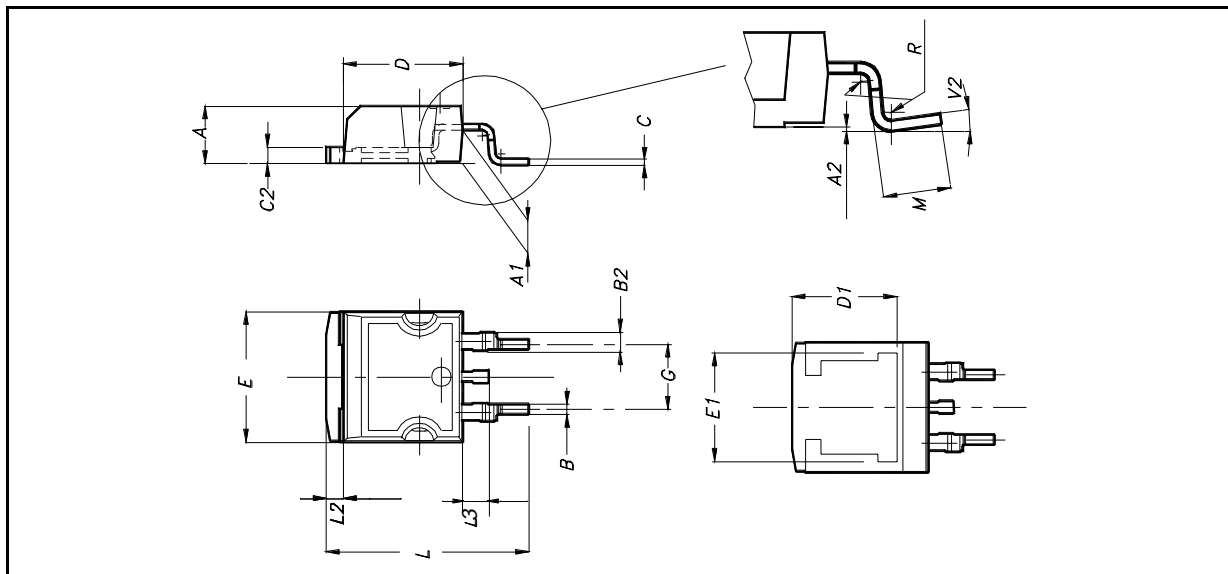
TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
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



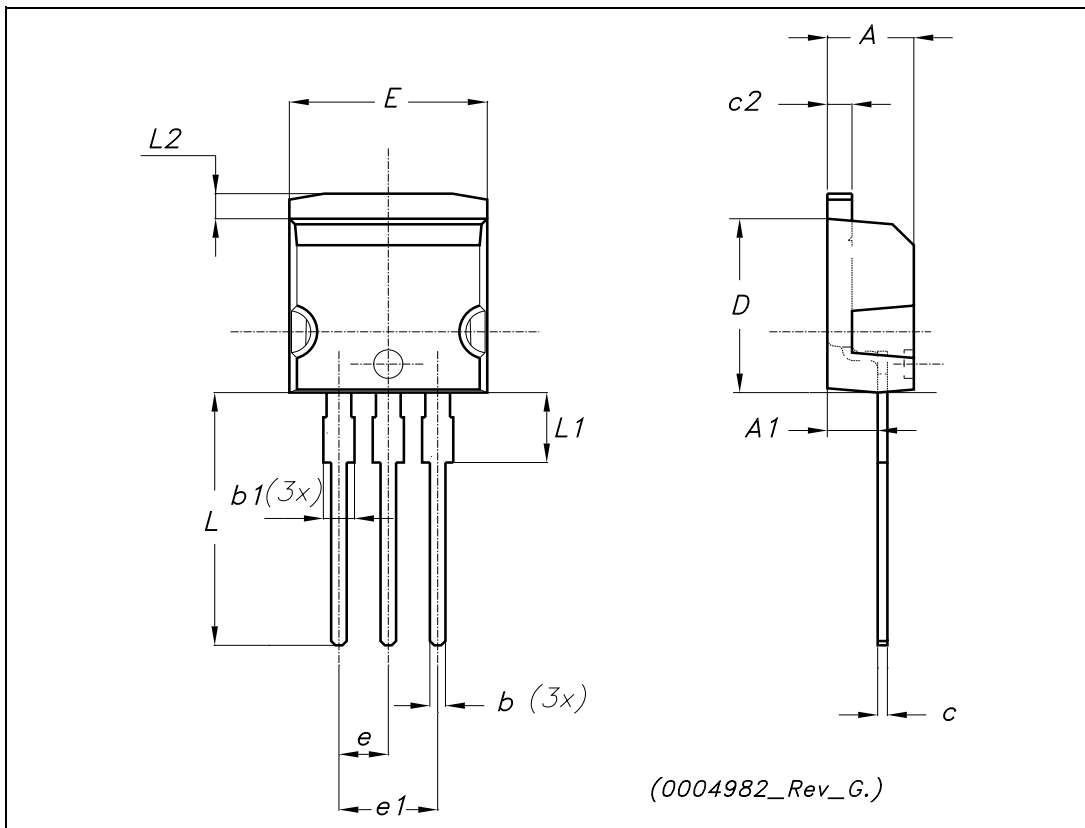
D²PAK MECHANICAL DATA

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°			

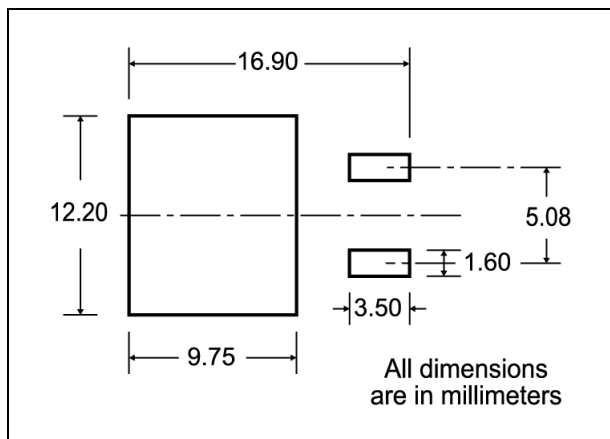


TO-262 (I²PAK) MECHANICAL DATA

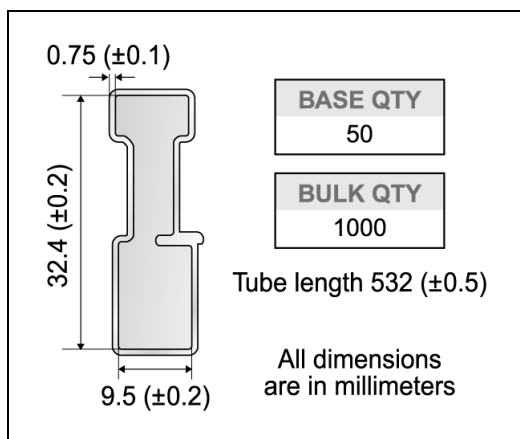
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		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, B, C, D, and a full radius. A 40 mm min. access hole is shown at the slot location. A tape slot in the core for tape start is 2.5 mm min. wide. A side view shows dimensions T, C, N, and 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	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

Diagrams showing the tape and reel shipment details. The top view shows the tape with dimensions K₀, D, P₂, P₀, E, F, W, B₀, D₁, A₀, P₁, and the center line of cavity. A note indicates a 10-pitch cumulative tolerance on tape of ±0.2 mm. The side view shows the top cover tape and the user direction of feed. The bottom view shows the reel with dimensions TRL and FEED DIRECTION. The bending radius is labeled as R min.

* on sales type
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