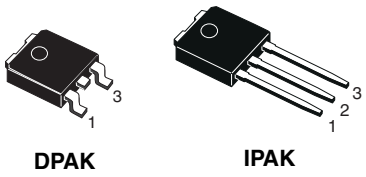
STD20NF06L
STD20NF06L-1

N-channel 60V - 0.032Ω - 24A - DPAK - IPAK
STripFET™ II Power MOSFET

General features

Type	V_{DSS}	$R_{DS(on)}$	I_D
STD20NF06L	60V	<0.040Ω	24A
STD20NF06L-1	60V	<0.040Ω	24A

- Exceptional dv/dt capability
- 100% avalanche tested
- Application oriented characterization



DPAK IPAK

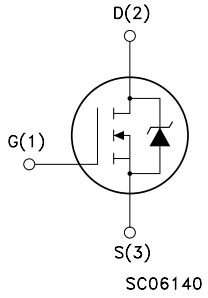
Description

This Power MOSFET is the latest development of STMicroelectronics unique “Single Feature Size™” stripbased 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

- Switching application

Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STD20NF06L	D20NF06L	DPAK	Tape & reel
STD20NF06L-1	D20NF06L-1	IPAK	Tube

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	60	V
V_{GS}	Gate-source voltage	± 18	V
I_D	Drain current (continuous) at T_C = 25°C	24	A
I_D	Drain current (continuous) at T_C = 100°C	17	A
I_{DM} (1)	Drain current (pulsed)	96	A
P_{TOT}	Total dissipation at T_C = 25°C	60	W
	Derating factor	0.4	W/°C
dv/dt (2)	Peak diode recovery voltage slope	10	V/ns
E_{AS} (3)	Single pulse avalanche energy	225	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 175	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 24A$, di/dt ≤ 300A/ns, V_{DD} = 80% $V_{(BR)DSS}$
3. Starting Tj = 25°C, $I_D = I_{AR}$, V_{DD} = 60V

Table 2. Thermal data

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case Max	2.5	°C/W
Rthj-pcb(1)	Thermal resistance junction-pcb Max	50	°C/W
T_l	Maximum lead temperature for soldering purpose	275	°C

1. When mounted on 1 inch² FR-4 board, 2 oz of Cu

2 Electrical characteristics

(Tcase =25°C unless otherwise specified)

Table 3. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 250µA, V_{GS}= 0	60			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating,Tc = 125°C			1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±18V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250µA	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10V, I_D= 12A V_{GS}= 5V, I_D= 12A		0.032	0.040 0.050	Ω Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} =25V, I_D = 12A		20		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25V, f=1MHz, V_{GS}=0		660 170 70		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=30V, I_D = 20A V_{GS} =10V *(see Figure 12)*		13 3.5 8		nC nC nC

1. Pulsed: pulse duration = 300µs, duty cycle 1.5%

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD}=30V, I_D=10A,		11		ns
t_r	Rise time	R_G=4.7Ω, V_{GS}=10V		50		ns
$t_{d(off)}$	Turn-off delay time	*(see Figure 13)*		20		ns
t_f	Fall time			12		ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				24	A
I_{SDM}	Source-drain current (pulsed)				96	A
V_{SD} (1)	Forward on voltage	I_{SD}=20A, V_{GS}=0			1.5	V
t_{rr}	Reverse recovery time	I_{SD}=20A, di/dt = 100A/µs,		56		ns
Q_{rr}	Reverse recovery charge	V_{DD}=20V, Tj=150°C		108		nC
I_{RRM}	Reverse recovery current	*(see Figure 16)*		4		A

1. Pulsed: pulse duration = 300µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

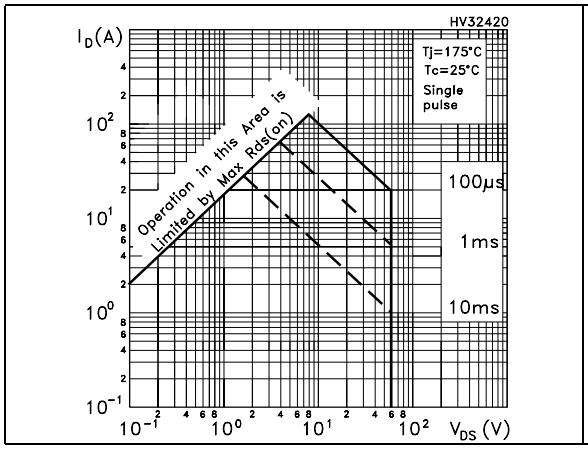


Figure 2. Thermal impedance

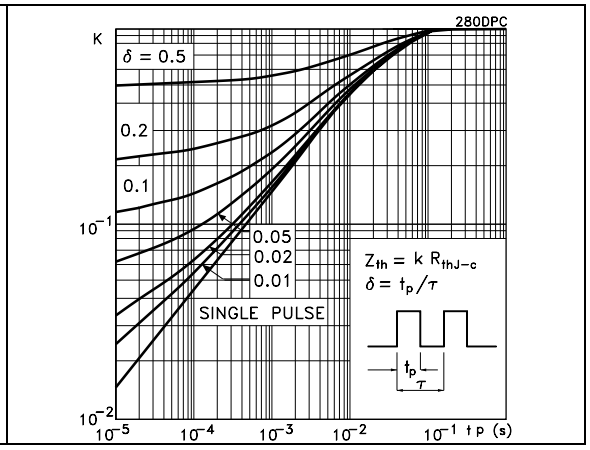


Figure 3. Output characterisics

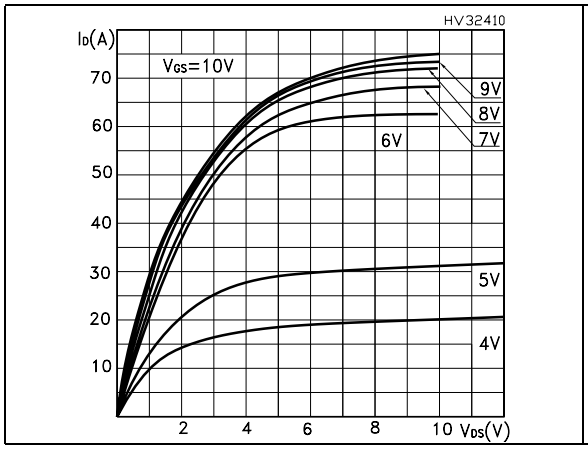


Figure 4. Transfer characteristics

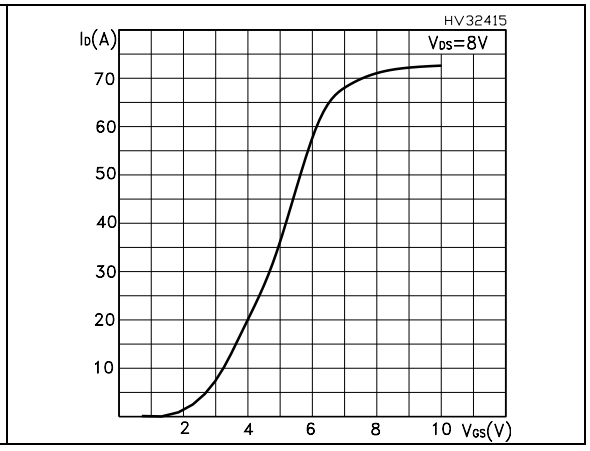


Figure 5. Normalized B_{VDSS} vs temperature

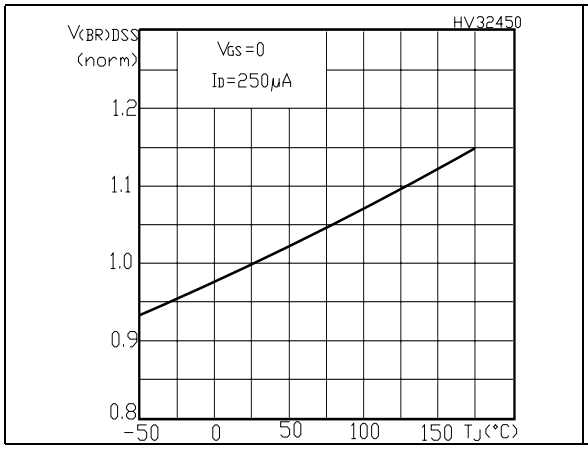


Figure 6. Static drain-source on resistance

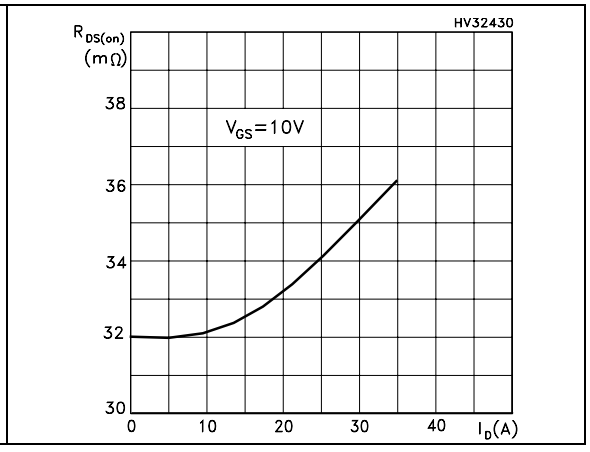


Figure 7. Gate charge vs gate-source voltage

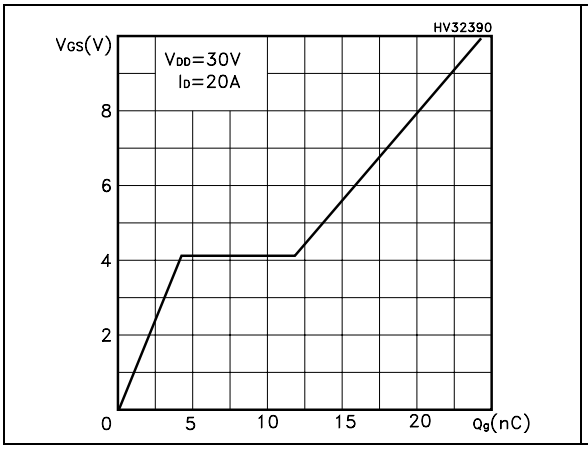


Figure 8. Capacitance variations

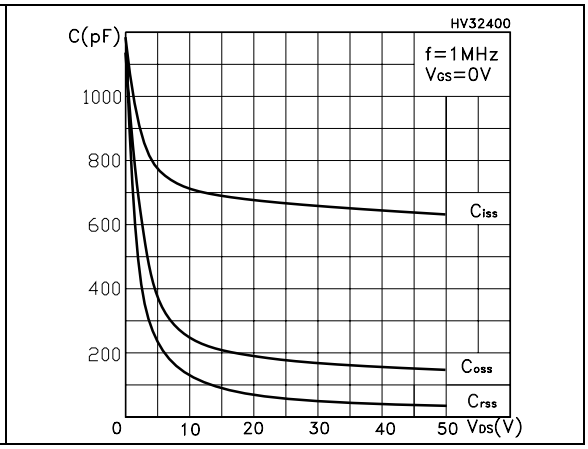


Figure 9. Normalized gate threshold voltage vs temperature

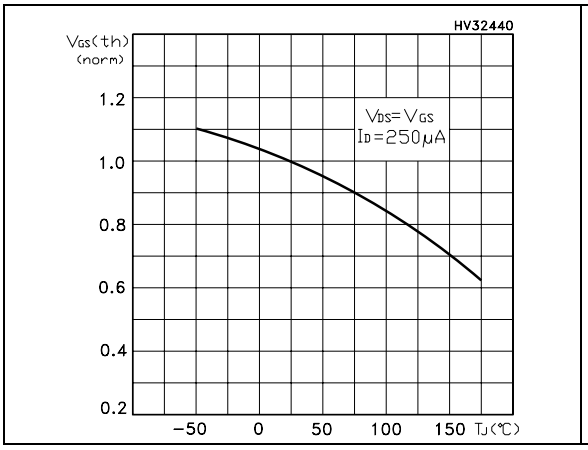
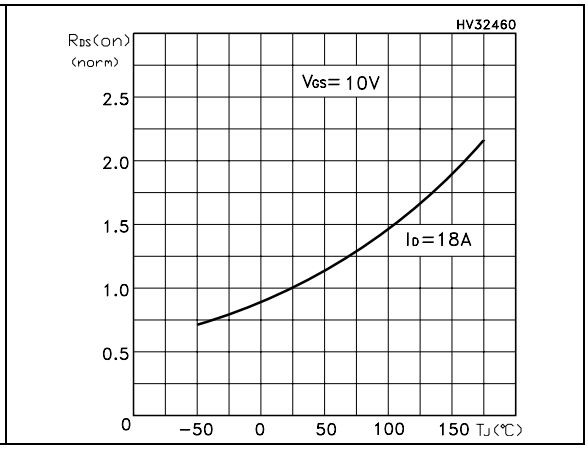


Figure 10. Normalized on resistance vs temperature



3 Test circuits

Figure 11. Switching times test circuit for resistive load

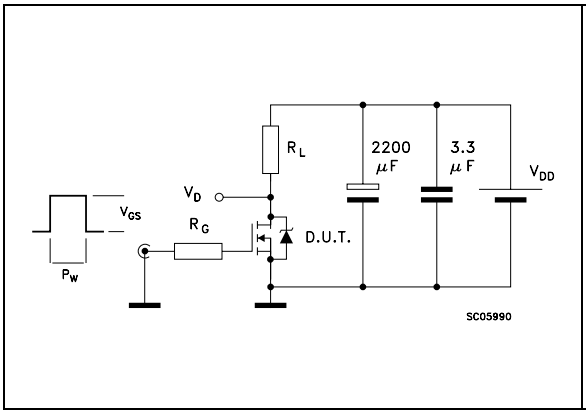


Figure 12. Gate charge test circuit

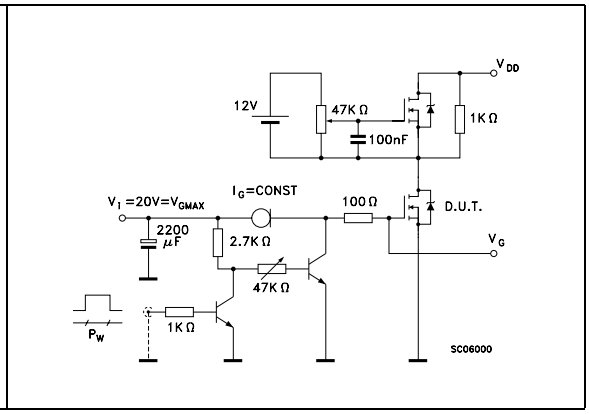


Figure 13. Test circuit for inductive load switching and diode recovery times

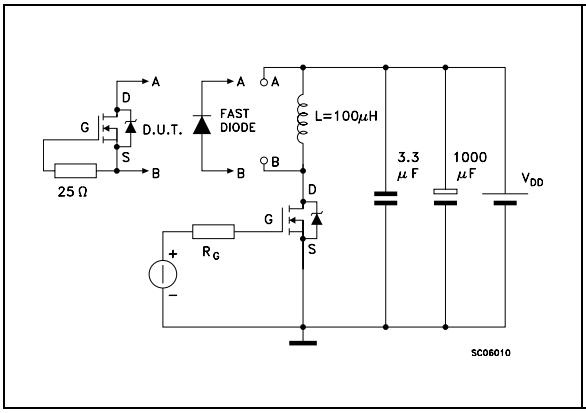


Figure 14. Unclamped inductive load test circuit

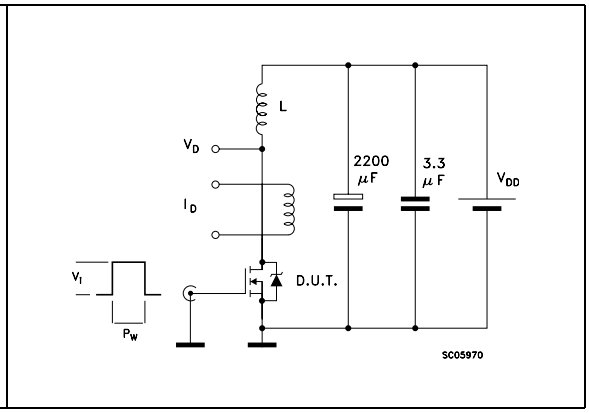


Figure 15. Unclamped inductive waveform

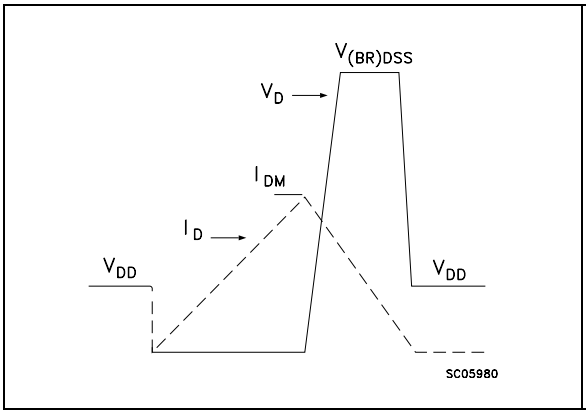
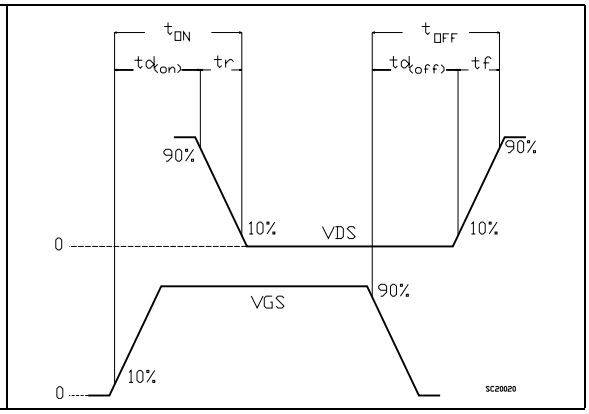


Figure 16. Switching time waveform

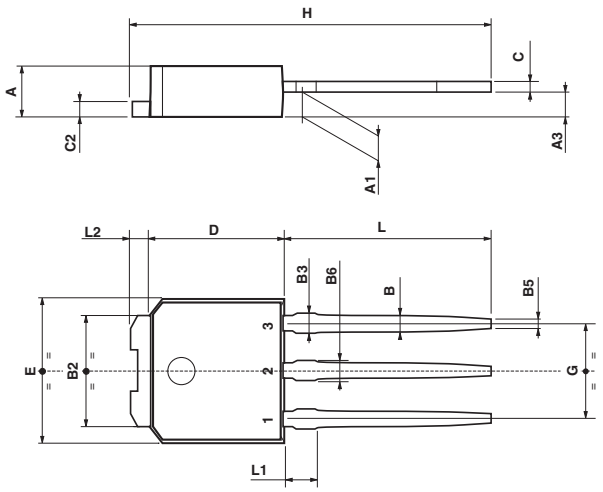


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at : *www.st.com*

TO-251 (IPAK) MECHANICAL DATA

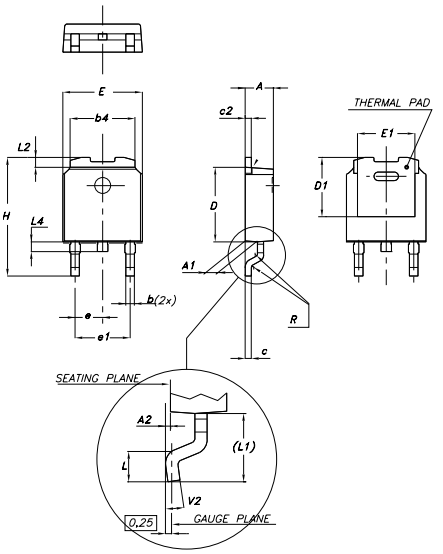
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



0068771-E

DPAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



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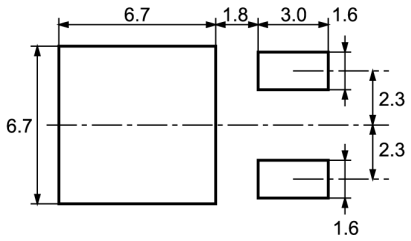
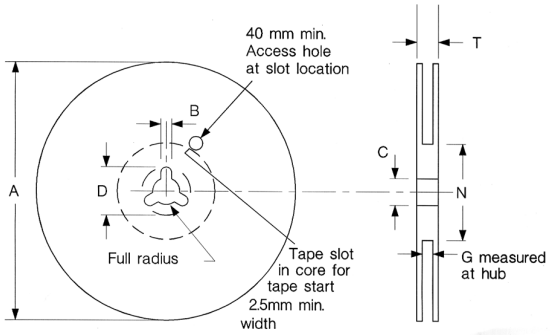
5 Packing mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



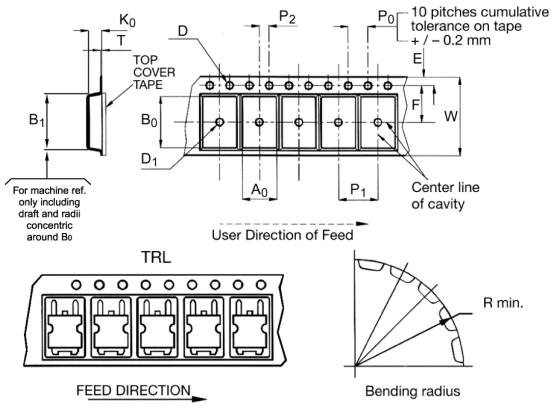
REEL MECHANICAL DATA

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		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



6 Revision history

Table 7. Revision history

Date	Revision	Changes
19-Apr-2005	2	Added package IPAK
08-Jun-2006	3	Graphical updates
03-Jul-2006	4	New template, no content change

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