STB12NM50ND
STD12NM50ND

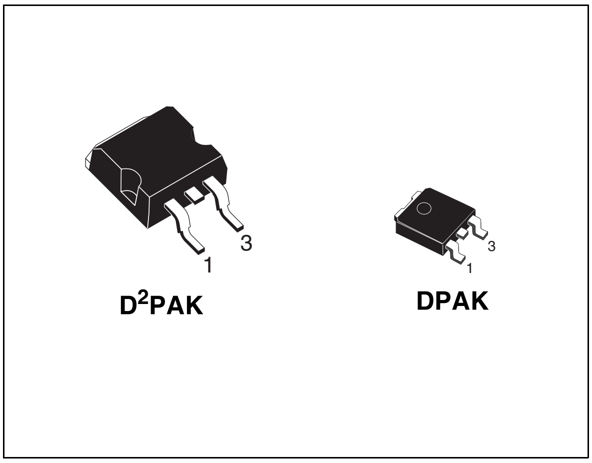
N-channel 500 V, 0.29 Ω, 11 A, FDmesh™ II Power MOSFET (with fast diode), D^{2}PAK, DPAK

Preliminary Data

Features

Type	V_{DSS} (@Tjmax)	$R_{DS(on)}$ max	I_D
STB12NM50ND	550 V	0.38 Ω	11 A
STD12NM50ND	550 V	0.38 Ω	11 A

- The worldwide best $R_{DS(on)}$* area amongst the fast recovery diode devices
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance
- Extremely high dv/dt and avalanche capabilities



Application

- Switching applications

Description

The FDmesh™ II series belongs to the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the company's strip layout and associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode.Strongly recommended for bridge topologies, in ZVS phase-shift converters.

Figure 1. Internal schematic diagram

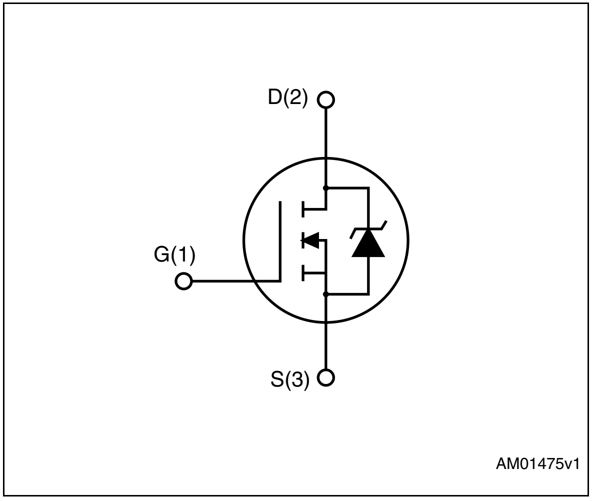


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB12NM50ND	12NM50ND	D^{2}PAK	Tape and reel
STD12NM50ND	12NM50ND	DPAK	Tape and reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS}=0)	500	V
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at T_C = 25 °C	11	A
I_D	Drain current (continuous) at T_C = 100 °C	6.9	A
I_{DM} (1)	Drain current (pulsed)	44	A
P_{TOT}	Total dissipation at T_C = 25 °C	100	W
dv/dt (2)	Peak diode recovery voltage slope	40	V/ns
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Operating junction temperature	150	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq$ 11 A, di/dt $\leq$ 600 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	D²PAK	DPAK	Unit
Rthj-case	Thermal resistance junction-case max	1.25		°C/W
Rthj-pcb	Thermal resistance junction-pcb max	30	50	°C/W
T_l	Maximum lead temperature for soldering purposes	300		°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max)	5	A
E_{AS}	Single pulse avalanche energy (starting Tj = 25 °C, I_D = I_{AS}, V_{DD} = 50 V)	350	mJ

2 Electrical characteristics

(T_{CASE}=25°C unless otherwise specified)

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS}= 0	500			V
dv/dt[1]	Drain-source voltage slope	V_{DD} = 400 V,I_D = 11 A, V_{GS} = 10 V		44		V/ns
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating,@125 °C			1 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 5.5 A		0.29	0.38	Ω

1. Value measured at turn off under inductive load

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs}[1]	Forward transconductance	V_{DS} =15 V, I_D= 5.5 A		8		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f =1 MHz, V_{GS} = 0		TBD TBD TBD		pF pF pF
$C_{oss\ eq.}$[2]	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 400 V		TBD		pF
Rg	Gate input resistance	f=1 MHz Gate DC Bias=0 Test signal level=20 mV open drain		TBD		Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 400 V, I_D = 11 A V_{GS} = 10 V *(see Figure 3)*		TBD TBD TBD		nC nC nC

1. Pulsed: pulse duration = 300 µs, duty cycle 1.5%
2. $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 250 V, I_D = 5.5 A, R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 2)*		TBD TBD TBD TBD		ns ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)				11 44	A A
V_{SD}(2)	Forward on voltage	I_{SD} = 11 A, V_{GS}=0			TBD	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 11 A, di/dt =100 A/µs, V_{DD} = 100 V *(see Figure 4)*		TBD TBD TBD		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	V_{DD} = 100 V di/dt =100 A/µs, I_{SD} = 11 A Tj = 150 °C *(see Figure 4)*		TBD TBD TBD		ns nC A

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

3 Test circuits

Figure 2. Switching times test circuit for resistive load

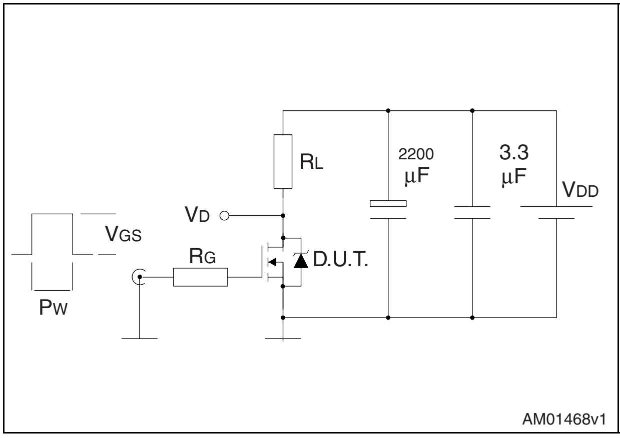


Figure 3. Gate charge test circuit

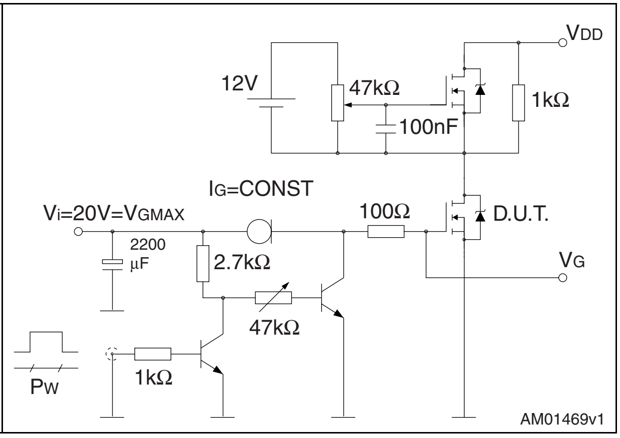


Figure 4. Test circuit for inductive load switching and diode recovery times

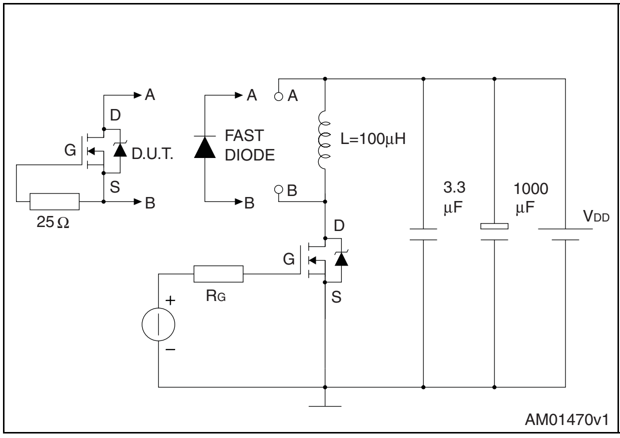


Figure 5. Unclamped Inductive load test circuit

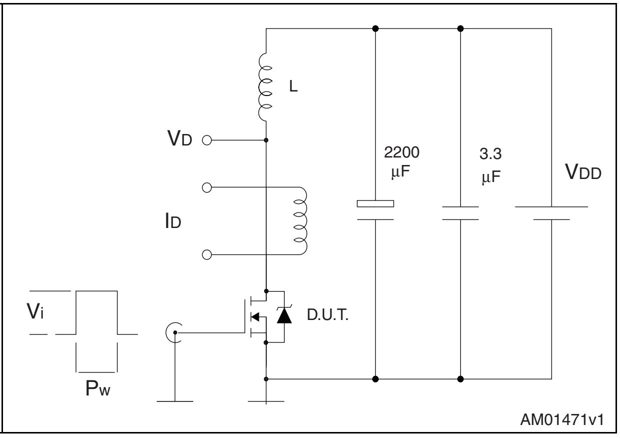


Figure 6. Unclamped inductive waveform

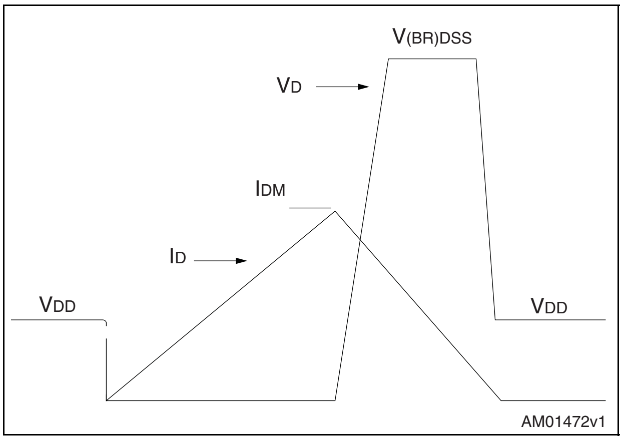
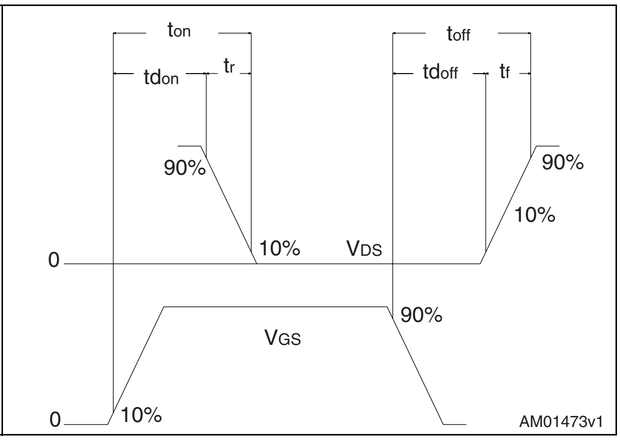


Figure 7. Switching time waveform

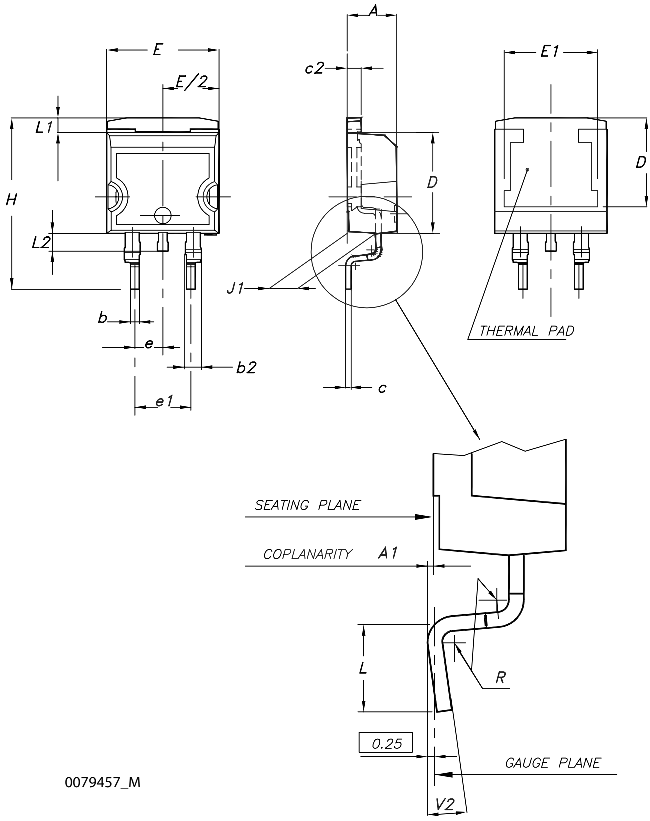


4 Package mechanical data

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*

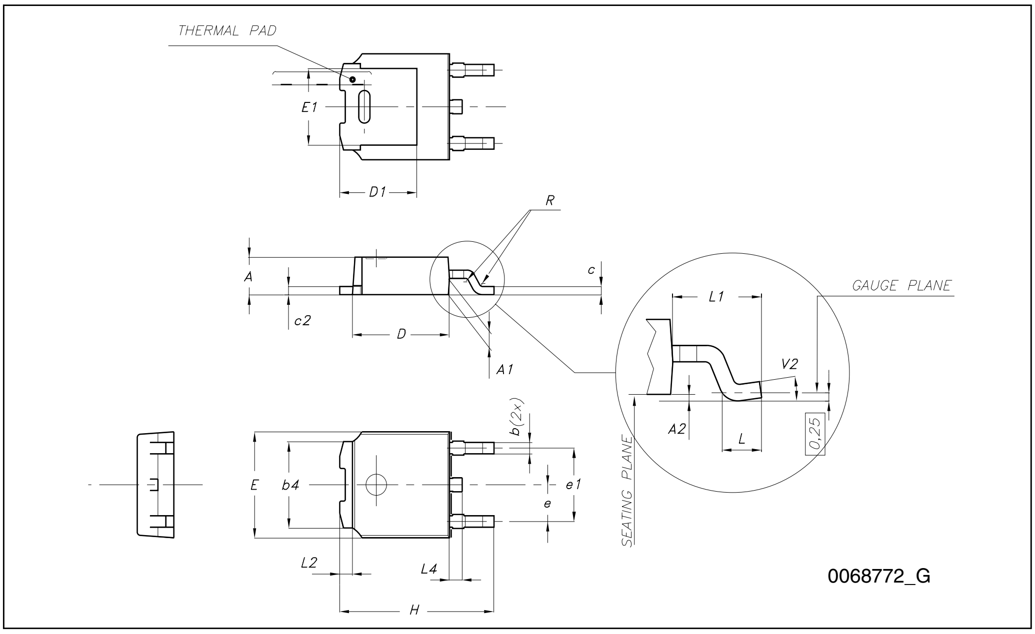
D^{2}PAK (TO-263) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°



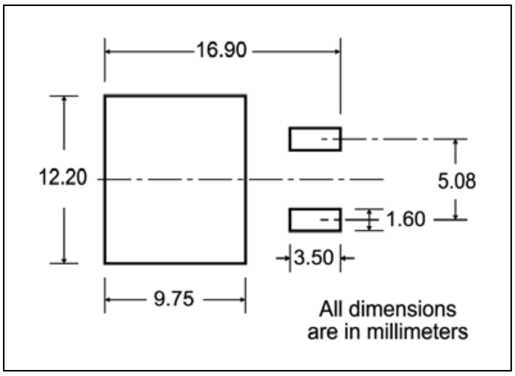
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °

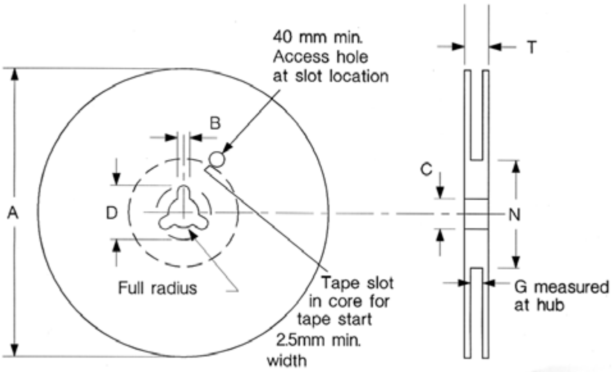


5 Packaging mechanical data

D^{2}PAK FOOTPRINT



TAPE AND REEL SHIPMENT



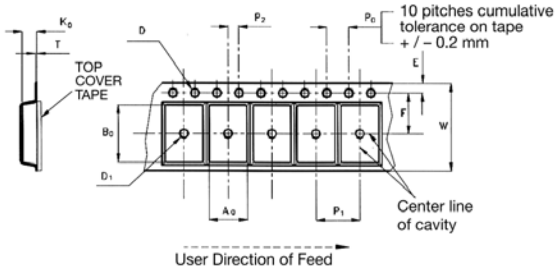
REEL MECHANICAL DATA

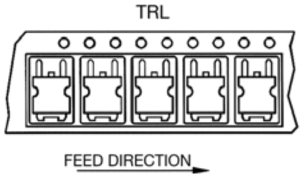
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

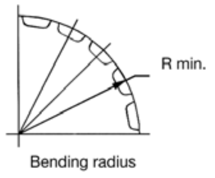
BASE QTY	BULK QTY
1000	1000

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

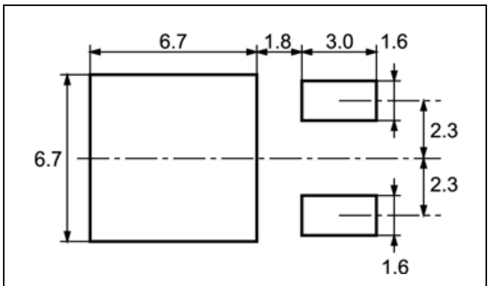






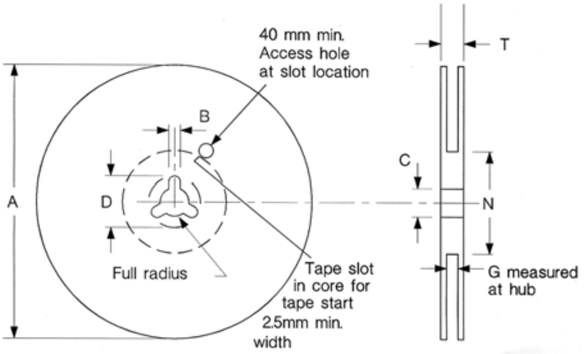
* on sales type

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



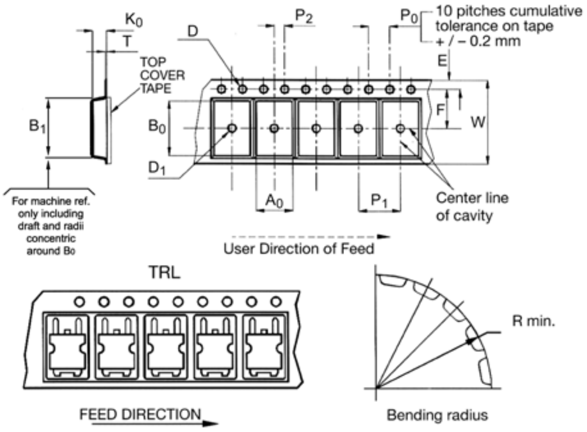
REEL MECHANICAL DATA

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 9. Document revision history

Date	Revision	Changes
23-Sep-2008	1	First release

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