STB140N10F4, STF140N10F4 STP140N10F4

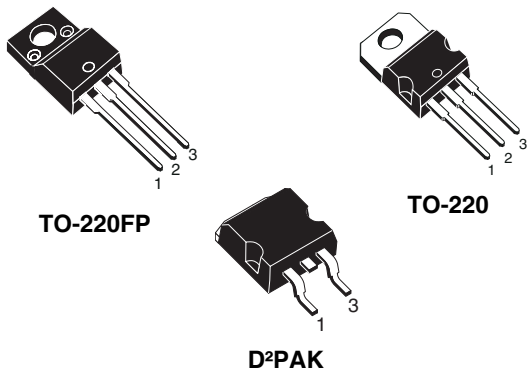
N-channel 100 V, 5.2 mΩ, 60 A TO-220, D²PAK, TO-220FP STripFET™ DeepGATE™ Power MOSFET

Preliminary Data

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STB140N10F4	100 V	< 6.5 mΩ	140 A
STF140N10F4	100 V	< 6.5 mΩ	55 A
STP140N10F4	100 V	< 6.5 mΩ	140 A

- Exceptional dv/dt capability
- Extremely low on-resistance $R_{DS(on)}$
- 100% avalanche tested



Application

- Switching applications

Description

This Power MOSFET is among the latest developments that use an advanced technology (STripFET™ DeepGATE™ technology), which has been especially tailored to minimize on-state resistance, provide superior switching performance and withstand high energy pulse in avalanche and commutation mode. 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.

Figure 1. Internal schematic diagram

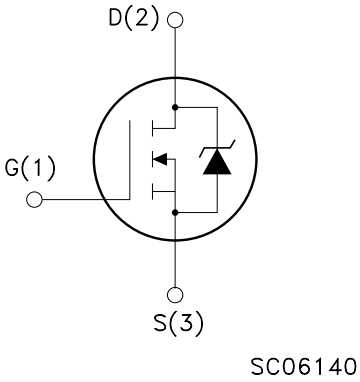


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB140N10F4	140N10F4	D²PAK	Tape and reel
STF140N10F4	140N10F4	TO-220FP	Tube
STP140N10F4	140N10F4	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, D²PAK	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	100		V
V_{GS}	Gate- source voltage	± 20		V
I_D	Drain current (continuous) at T_C = 25 °C	140	55	A
I_D	Drain current (continuous) at T_C = 100 °C	100	38	A
I_{DM} (1)	Drain current (pulsed)	560	220	A
P_{TOT}	Total dissipation at T_C = 25 °C	300	48	W
	Derating factor	2	0.32	W/°C
E_{AS} (2)	Single pulse avalanche energy	TBD		mJ
T_{stg}	Storage temperature	– 55 to 175		°C
T_j	Max. operating junction temperature			

1. Pulse width limited by safe operating area
2. Starting T_j = 25 °C, I_D= 32.5 A, V_{DD}= 45 V

Table 3. Thermal data

Symbol	Parameter	Value			Unit
		TO-220,	D²PAK	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.5		3.1	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max	--	35(1)	--	
$R_{thj\text{-}a}$	Thermal resistance junction-ambient max	62.5	--	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300	--	300	°C

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

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	I_D = 250 µA, V_{GS} = 0	100			V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = max rating V_{DS} = max rating,T_C=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	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 30 A		5.2	6.5	mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0		8980		pF
C_{oss}	Output capacitance			750		pF
C_{rss}	Reverse transfer capacitance			300		pF
Q_g	Total gate charge	V_{DD} = 80 V, I_D = 60 A, V_{GS} = 10 V *(see Figure 3)*		140		nC
Q_{gs}	Gate-source charge			TBD		nC
Q_{gd}	Gate-drain charge			TBD		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 50 V, I_D = 30 A R_G = 4.7 Ω V_{GS} = 10 V *(see Figure 2)*		TBD TBD		ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time	V_{DD} = 50 V, I_D = 30 A, R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 2)*		TBD TBD		ns ns

Table 7. Source drain diode

Symbol	Parameter		Test conditions	Min.	Typ.	Max	Unit
I_{SD}	Source-drain current	TO-220, DPAK				140	A
		TO-220FP				55	A
I_{SDM} (1)	Source-drain current (pulsed)	TO-220, DPAK				560	A
		TO-220FP				220	A
V_{SD} (2)	Forward on voltage		I_{SD} = 60 A, V_{GS} = 0			TBD	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current		I_{SD} = 60 A, V_{DD} = 25 V di/dt = 100 A/µs, T_j = 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 circuit

Figure 2. Switching times test circuit for resistive load

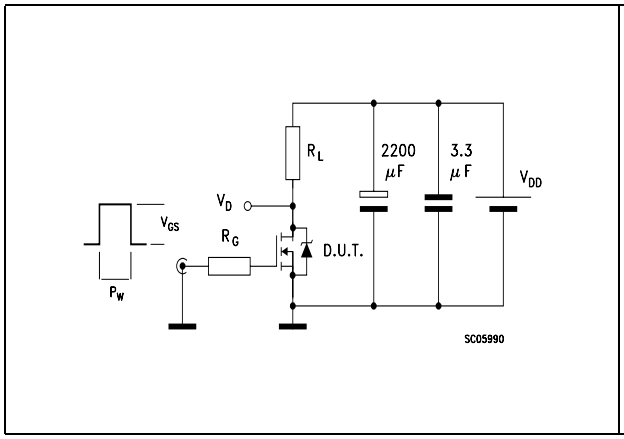


Figure 3. Gate charge test circuit

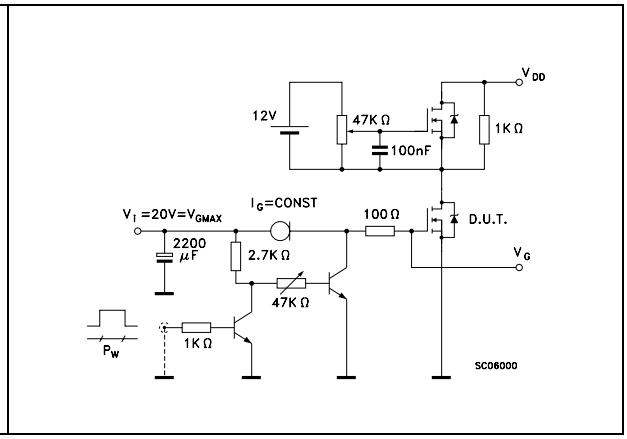


Figure 4. Test circuit for inductive load switching and diode recovery times

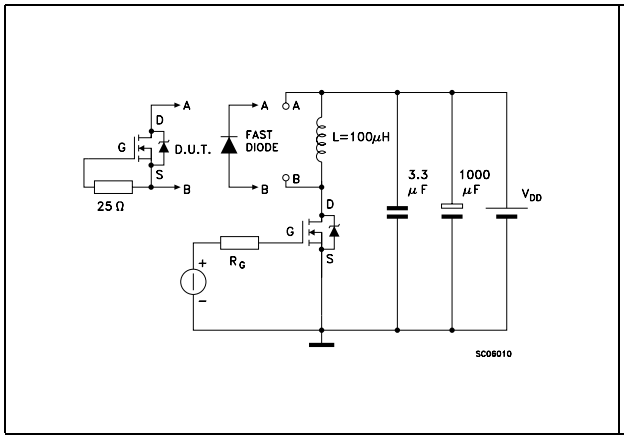


Figure 5. Unclamped inductive load test circuit

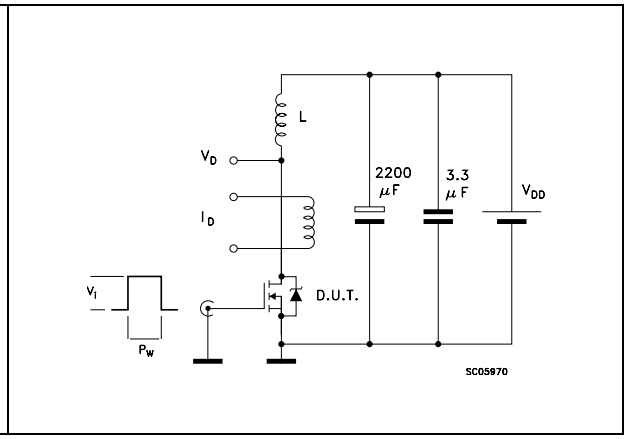


Figure 6. Unclamped inductive waveform

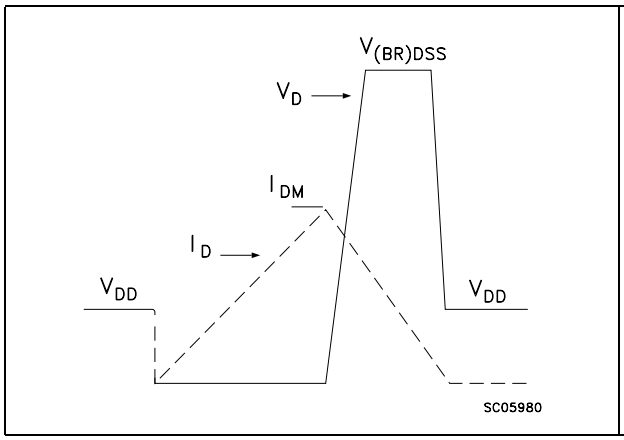
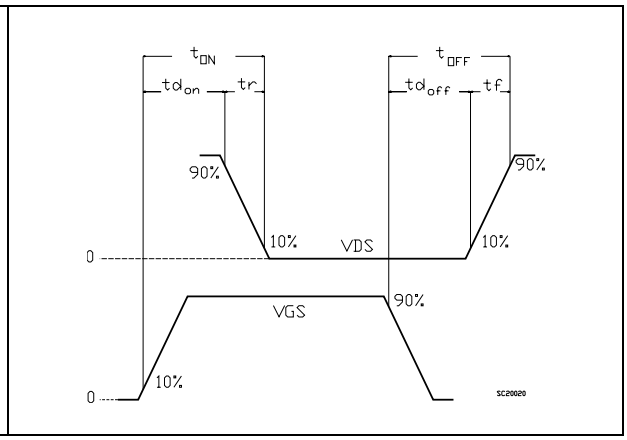


Figure 7. Switching time waveform

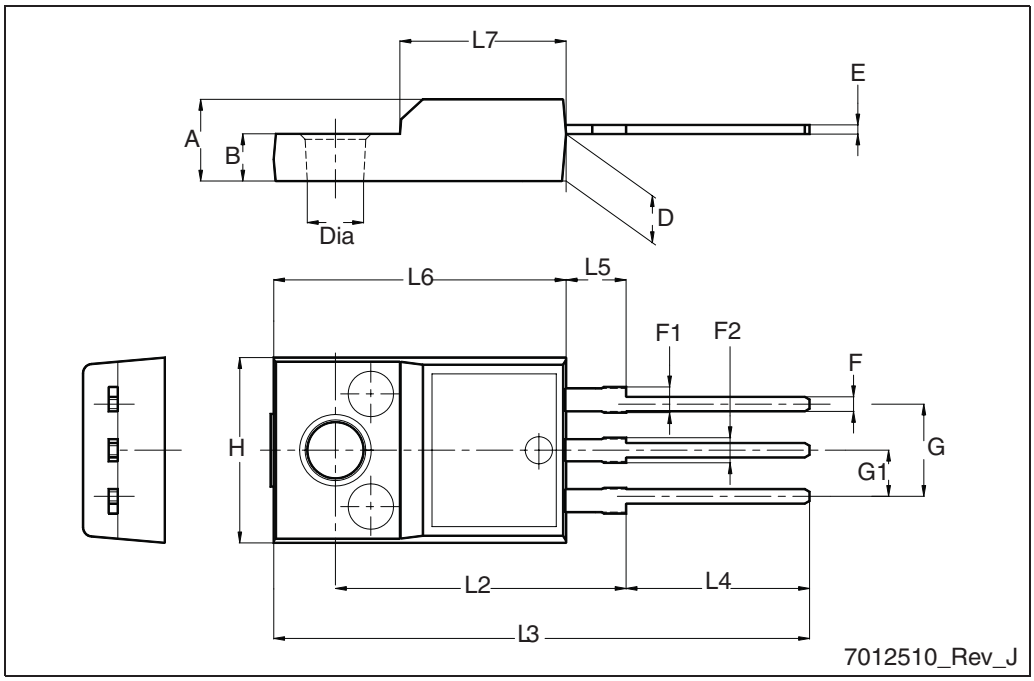


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

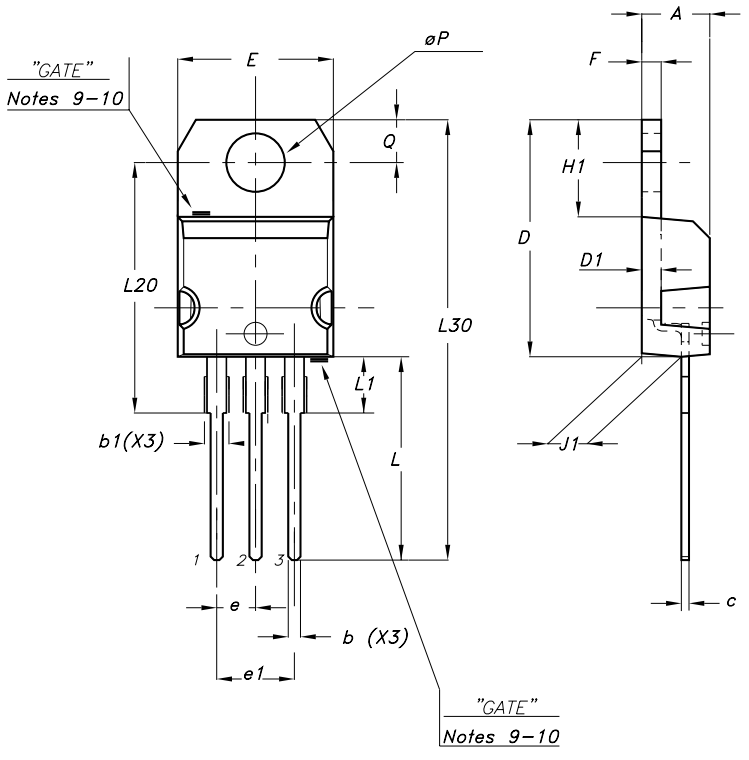
TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.5
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2



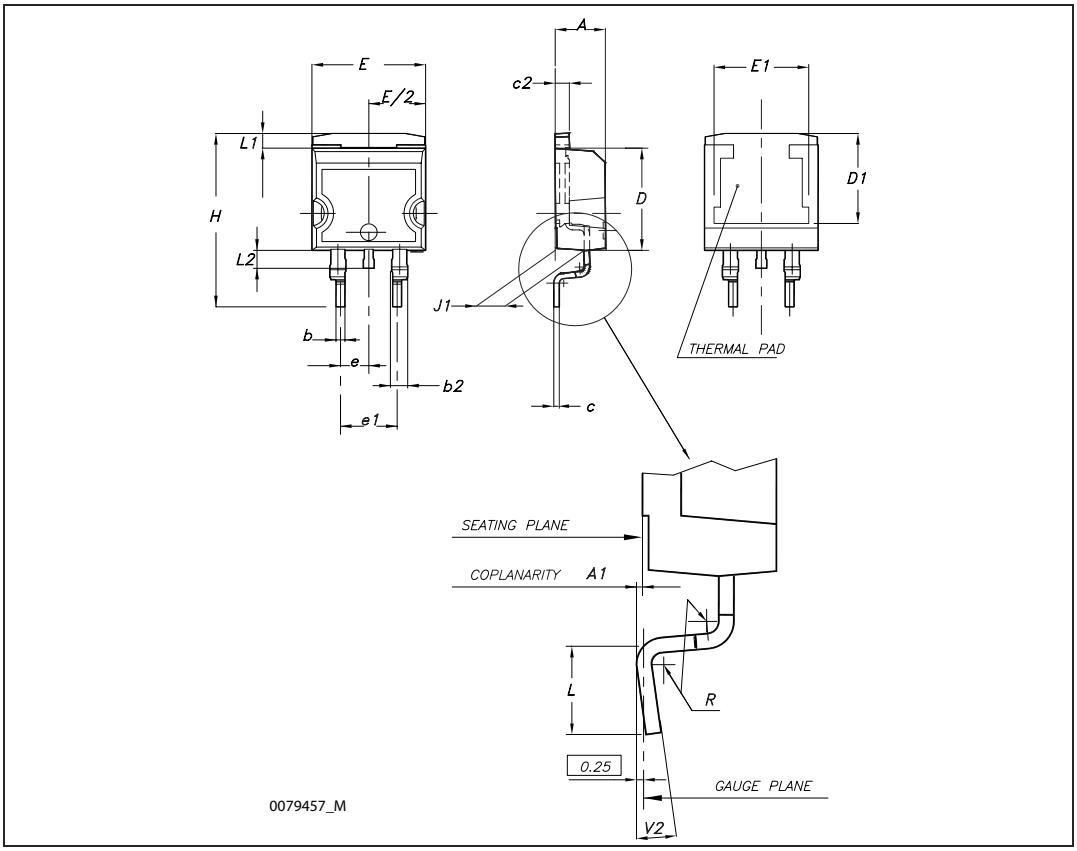
TO-220 mechanical data

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	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
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		0.051
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	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



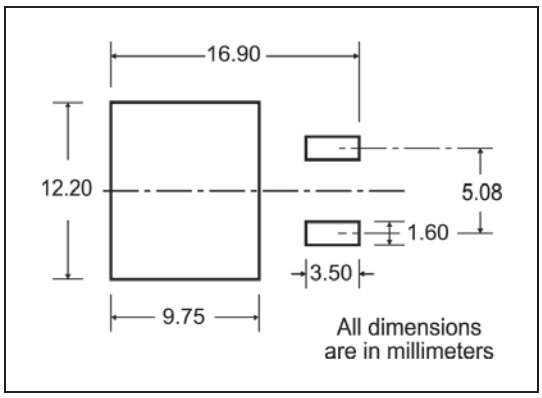
D²PAK (TO-263) mechanical data

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°

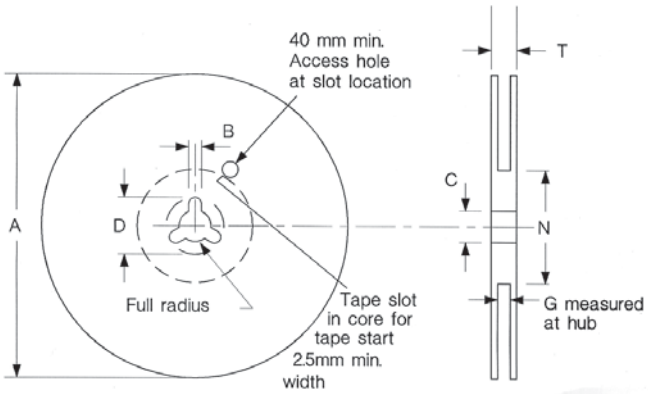


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



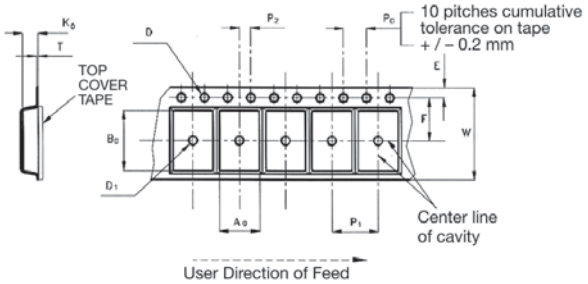
REEL MECHANICAL DATA

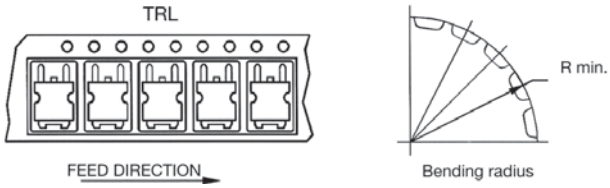
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

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





6 Revision history

Table 8. Document revision history

Date	Revision	Changes
12-Jan-2008	1	First release

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