



# STB24NF10 STP24NF10

N-channel 100V - 0.0055Ω - 26A - TO-220 - D<sup>2</sup>PAK  
Low gate charge STripFET™ II Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STB24NF10	100V	<0.060Ω	26A
STP24NF10	100V	<0.060Ω	26A

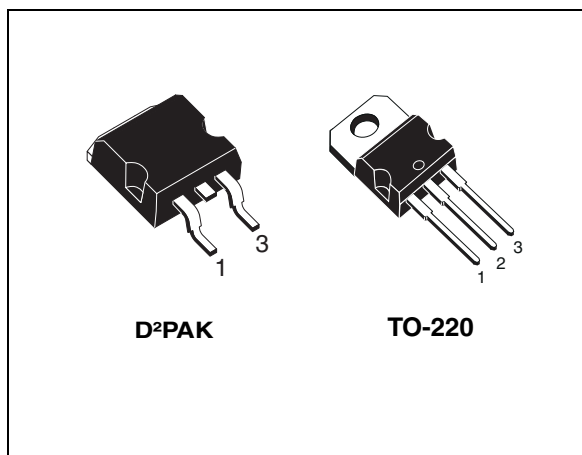
- Exceptional dv/dt capability
- 100% avalanche tested
- Application oriented characterization

## Description

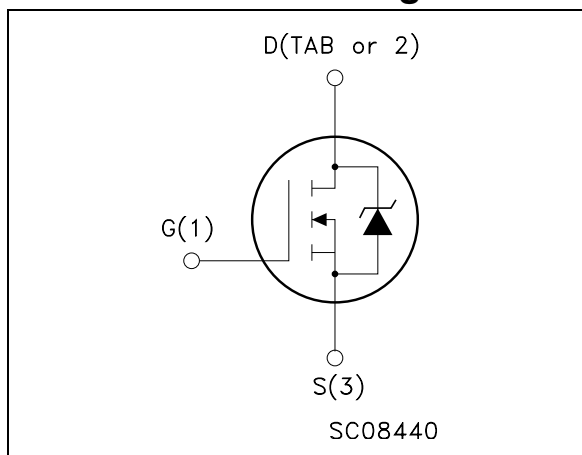
This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize the on-resistance. It is therefore suitable as primary switch in advanced high-efficiency, high-frequency isolated DC-DC converters for Telecom and Computer application. It is also intended for any applications with low gate drive requirements.

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STP24NF10	P24NF10	TO-220	Tube
STB24NF10	B24NF10	D <sup>2</sup> PAK	Tape & reel

# Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	100	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS}=20k\Omega$ )	100	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	26	A
$I_D$	Drain current (continuous) at $T_C=100^\circ\text{C}$	18	A
$I_{DM}^{(1)}$	Drain current (pulsed)	104	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	85	W
	Derating factor	0.57	W/°C
$dv/dt^{(2)}$	Peak diode recovery voltage slope	9	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	220	mJ
$T_J$	Operating junction temperature	-55 to 175	°C
$T_{stg}$	Storage temperature		

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 24\text{A}$ ,  $di/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{DD}=80\%V_{(BR)DSS}$
3. Starting  $T_j = 25^\circ\text{C}$ ,  $I_D=12\text{A}$ ,  $V_{DD}=30\text{V}$

**Table 2. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case Max	1.76	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient Max	62.5	°C/W
$T_j$	Maximum lead temperature for soldering purpose	300	°C

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0$	100			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 12A$		0.055	0.060	$\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 12A$		10		S
$C_{iss}$	Input capacitance	$V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$		870		pF
$C_{oss}$	Output capacitance			125		pF
$C_{rss}$	Reverse transfer capacitance			50		pF
$Q_g$	Total gate charge	$V_{DD} = 80V, I_D = 24A$		30	41	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10V$		6		nC
$Q_{gd}$	Gate-drain charge	(see Figure 7)		10		nC

1. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

**Table 5. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50V, I_D = 12A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 12)		60		ns
$t_r$	Rise time			15		ns
$t_{d(off)}$	Turn-off delay time			50		ns
$t_f$	Fall time			20		ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				26	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				104	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=24A, V_{GS}=0$			1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD}=24A,$ $di/dt = 100A/\mu s,$ $V_{DD}=30V, T_j=150^\circ C$ (see Figure 14)		100		ns
$Q_{rr}$	Reverse recovery charge			375		nC
$I_{RRM}$	Reverse recovery current			7.5		A

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

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

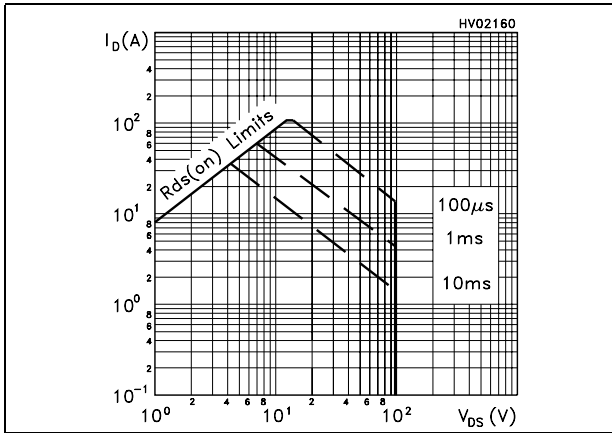


Figure 2. Thermal impedance

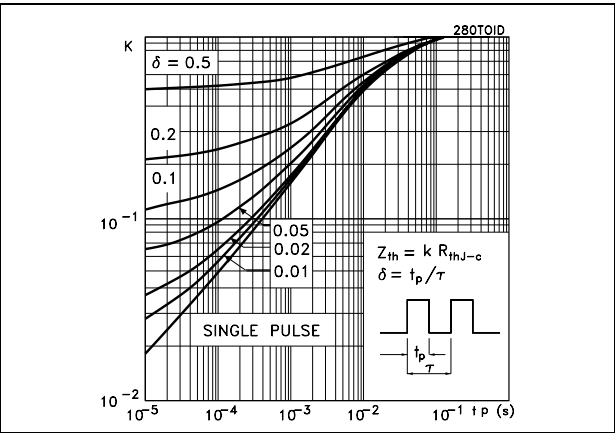


Figure 3. Output characteristics

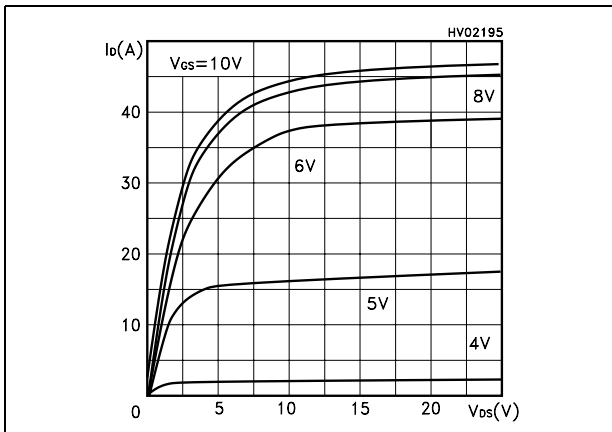


Figure 4. Transfer characteristics

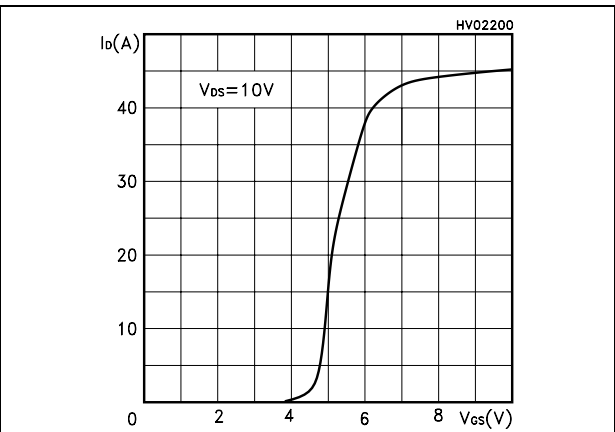


Figure 5. Transconductance

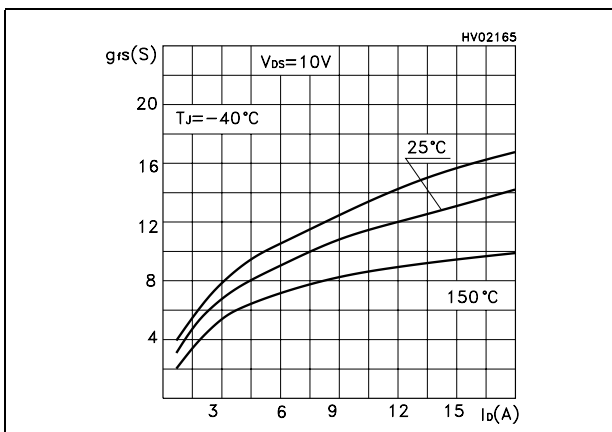


Figure 6. Static drain-source on resistance

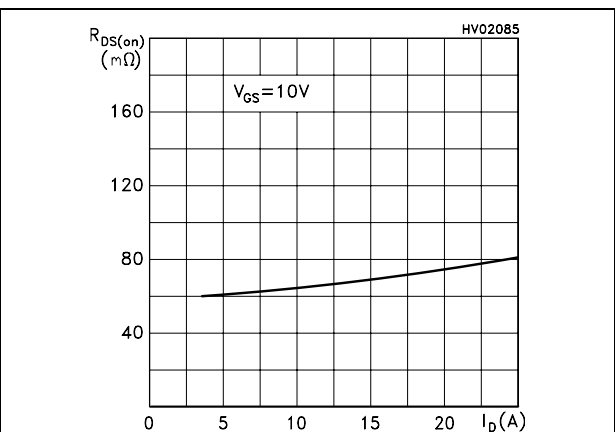


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

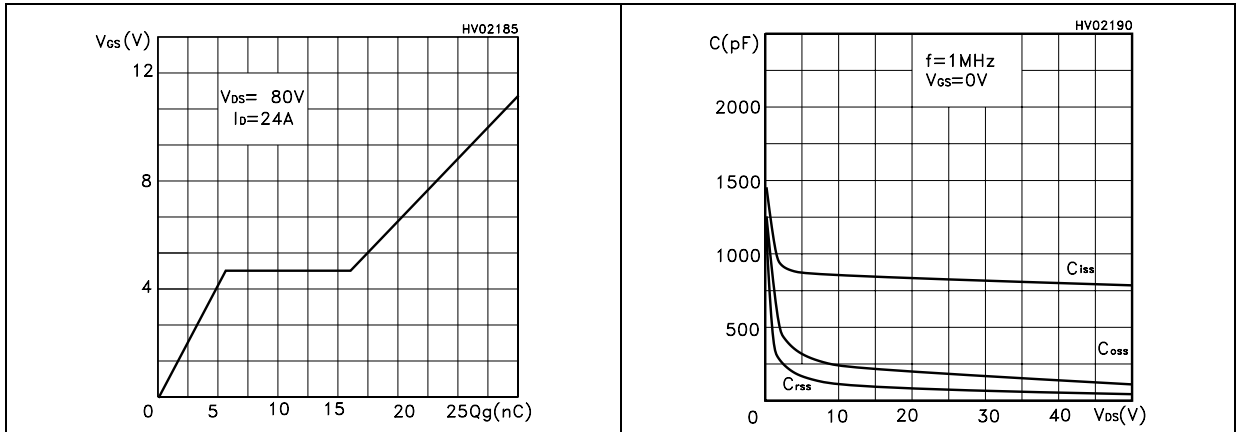


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

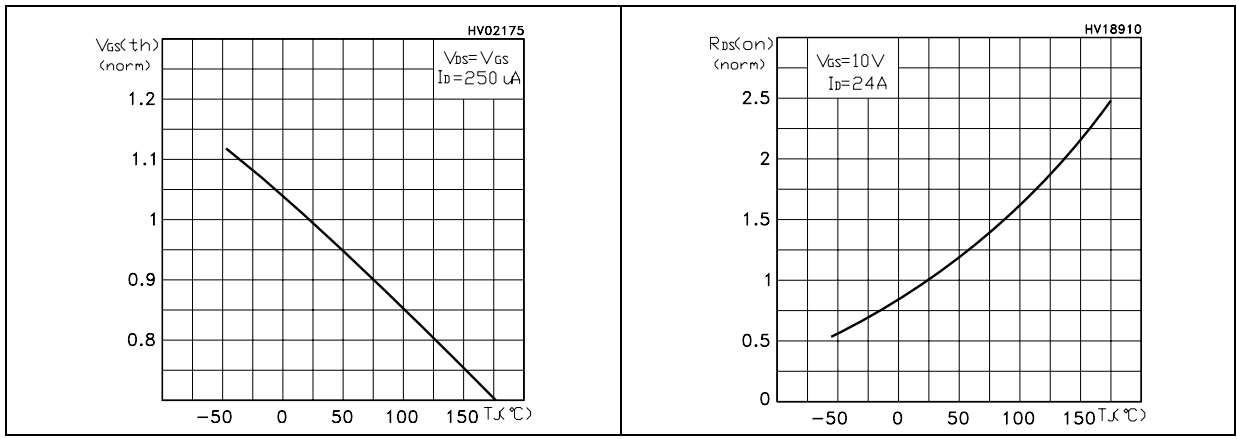
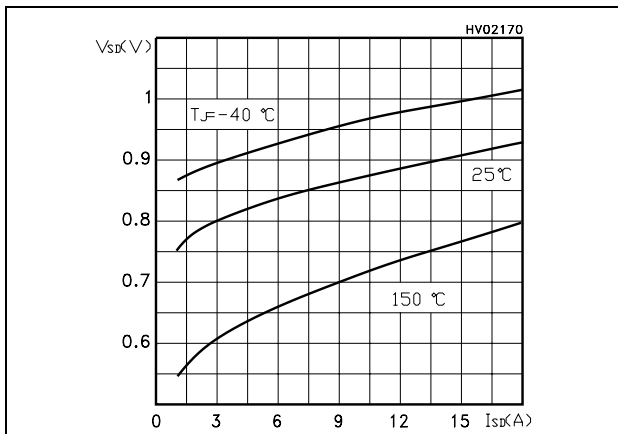


Figure 11. Source-drain diode forward characteristics



### 3 Test circuit

Figure 12. Switching times test circuit for resistive load



Figure 13. Gate charge test circuit

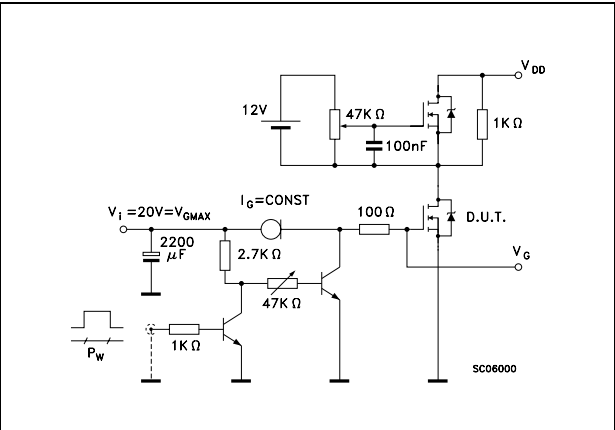


Figure 14. Test circuit for inductive load switching and diode recovery times



Figure 15. Unclamped inductive load test circuit

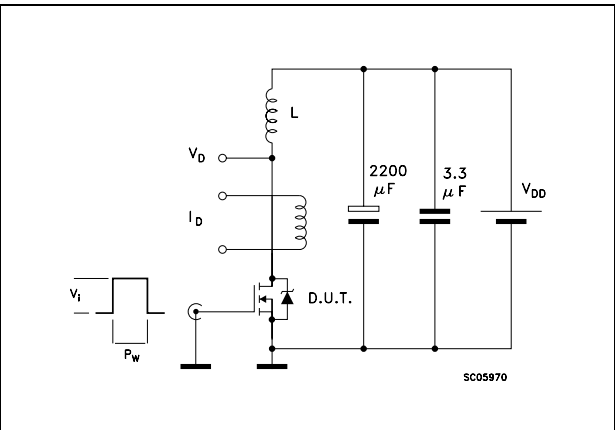
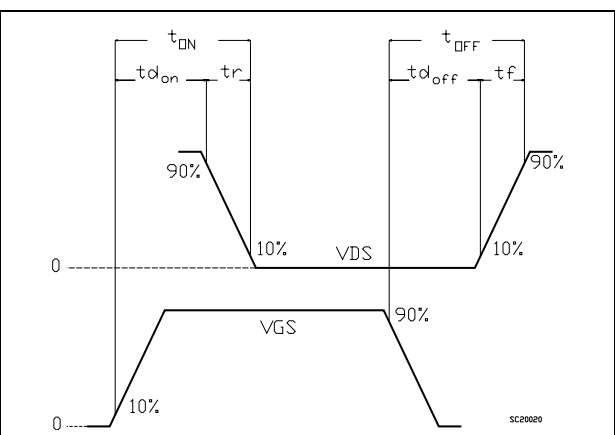


Figure 16. Unclamped inductive waveform



Figure 17. Switching time waveform



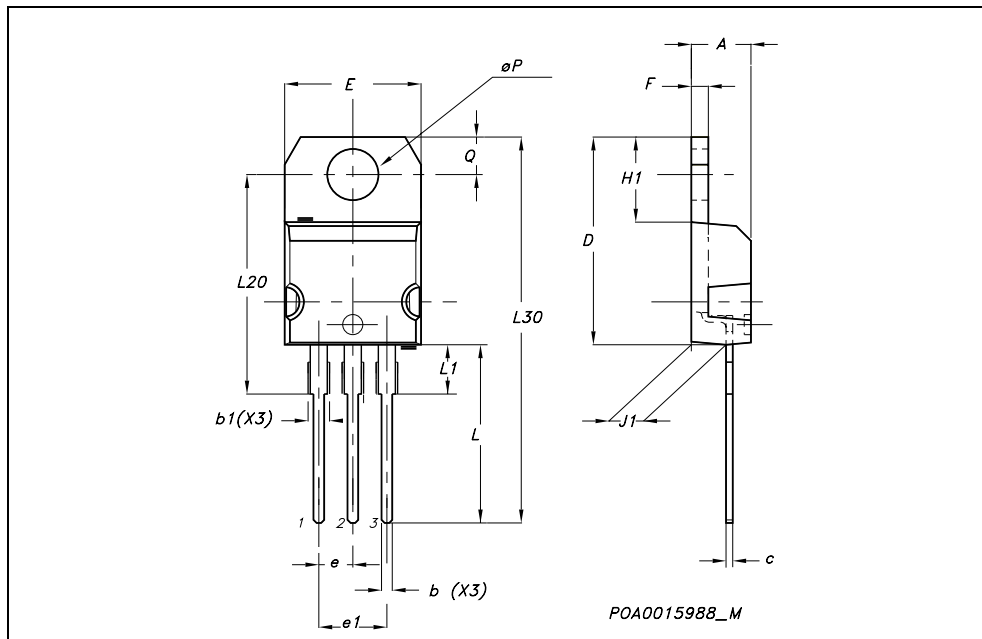


## 4 Package mechanical data

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](http://www.st.com)

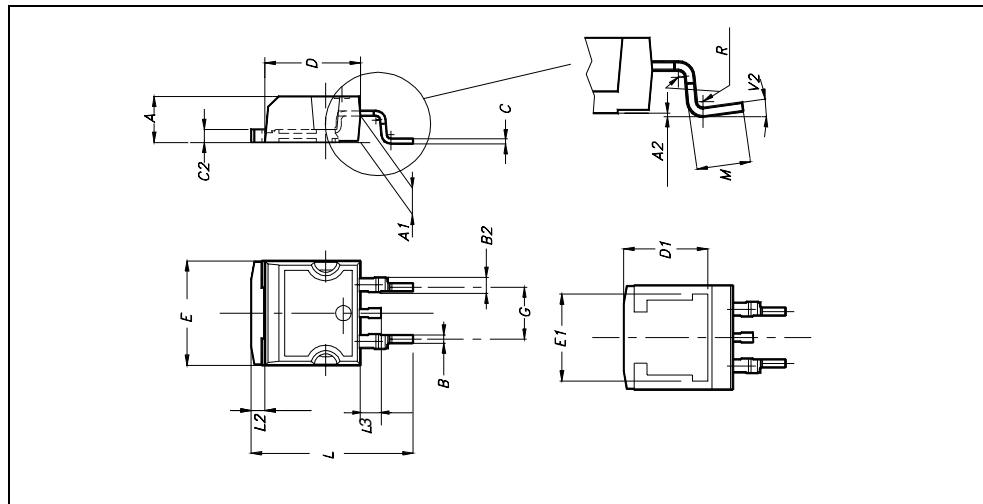
**TO-220 MECHANICAL DATA**

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



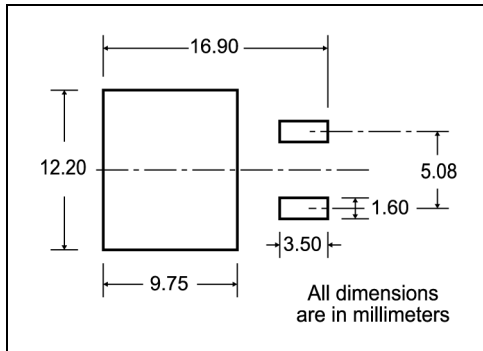
<b>D<sup>2</sup>PAK MECHANICAL DATA</b>
-----------------------------------------

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°		4°			



# 5 Packaging mechanical data

## D<sup>2</sup>PAK FOOTPRINT



## TAPE AND REEL SHIPMENT

**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

**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

10 pitches cumulative tolerance on tape +/- 0.2 mm

TRL

FEED DIRECTION

Bending radius R min.

\* on sales type

## 6 Revision history

Table 7. Revision history

Date	Revision	Changes
09-Sep-2004	6	Complete version
09-Aug-2006	7	New template, no content change

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