



# STB140N10F4, STF140N10F4 STP140N10F4

N-channel 100 V, 5.2 mΩ, 60 A TO-220, D<sup>2</sup>PAK, TO-220FP  
STripFET™ DeepGATE™ Power MOSFET

Preliminary Data

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
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<sub>DS(on)</sub>
- 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.

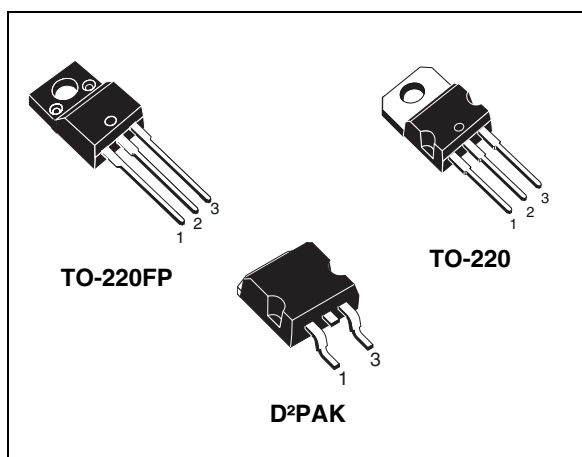


Figure 1. Internal schematic diagram

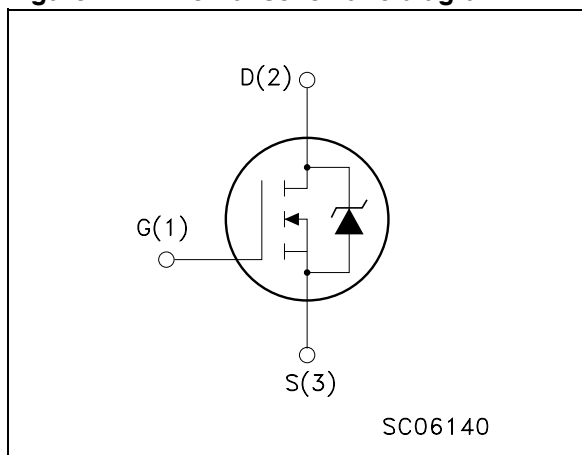


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB140N10F4	140N10F4	D <sup>2</sup> PAK	Tape and reel
STF140N10F4	140N10F4	TO-220FP	Tube
STP140N10F4	140N10F4	TO-220	Tube

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

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

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

**Table 3. Thermal data**

Symbol	Parameter	Value			Unit
		TO-220,	D <sup>2</sup> PAK	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case max	0.5		3.1	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max	--	35 <sup>(1)</sup>	--	
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	--	62.5	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300	--	300	$^\circ\text{C}$

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2 oz Cu

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	$I_D = 250 \mu A, V_{GS} = 0$	100			V
$I_{DSS}$	Zero gate voltage Drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}, T_C = 125^{\circ}C$			1 100	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 V$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 V, I_D = 30 A$		5.2	6.5	$m\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance			8980		pF
$C_{oss}$	Output capacitance	$V_{DS} = 25 V, f = 1 \text{ MHz},$ $V_{GS} = 0$		750		pF
$C_{rss}$	Reverse transfer capacitance			300		pF
$Q_g$	Total gate charge	$V_{DD} = 80 V, I_D = 60 A,$ $V_{GS} = 10 V$ <i>(see Figure 3)</i>		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	$V_{DD} = 50 V, I_D = 30 A,$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ <i>(see Figure 2)</i>		TBD TBD		ns ns
$t_{d(off)}$ $t_f$	Turn-off-delay time Fall time	$V_{DD} = 50 V, I_D = 30 A,$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ <i>(see Figure 2)</i>		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		$I_{SD} = 60 \text{ A}, V_{GS} = 0$		TBD	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current		$I_{SD} = 60 \text{ A}, V_{DD} = 25 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s},$ $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 4)</i>		TBD TBD TBD	ns nC A

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

Test circuit

### 3 Test circuit

Figure 2. Switching times test circuit for resistive load

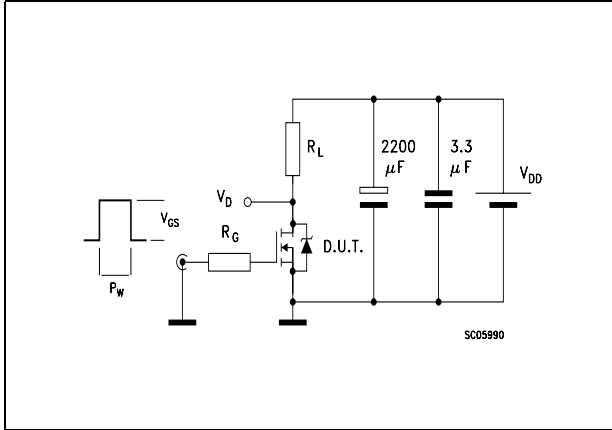


Figure 3. Gate charge test circuit

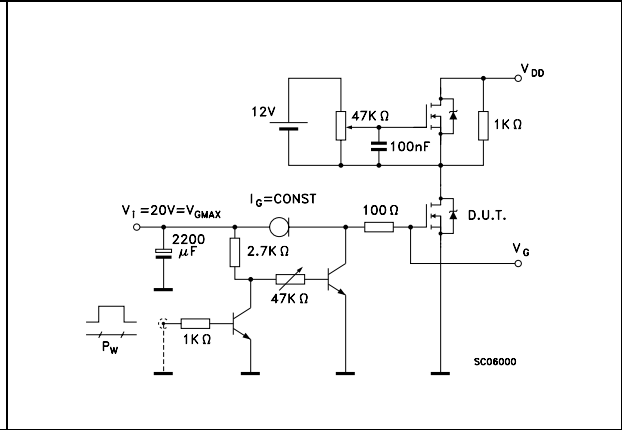


Figure 4. Test circuit for inductive load switching and diode recovery times

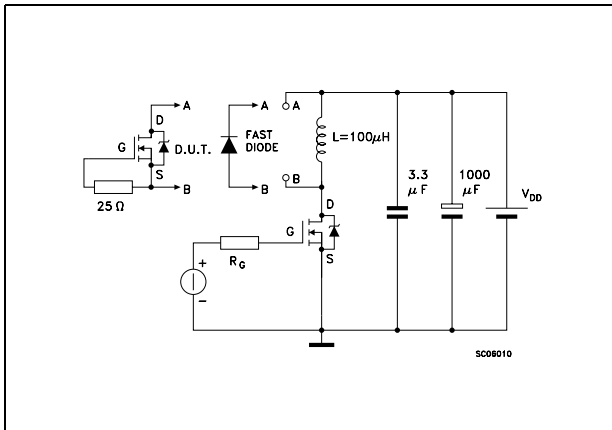


Figure 5. Unclamped inductive load test circuit

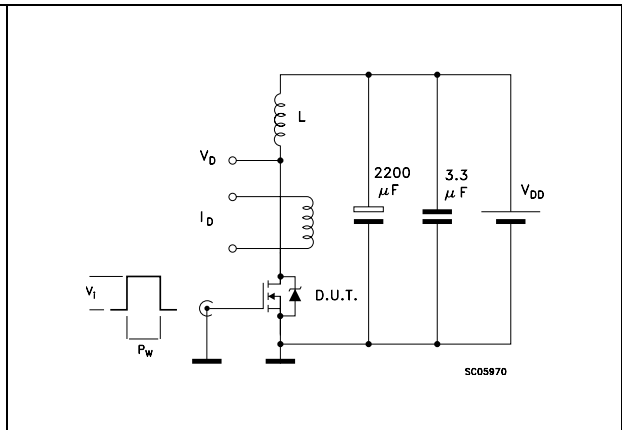


Figure 6. Unclamped inductive waveform

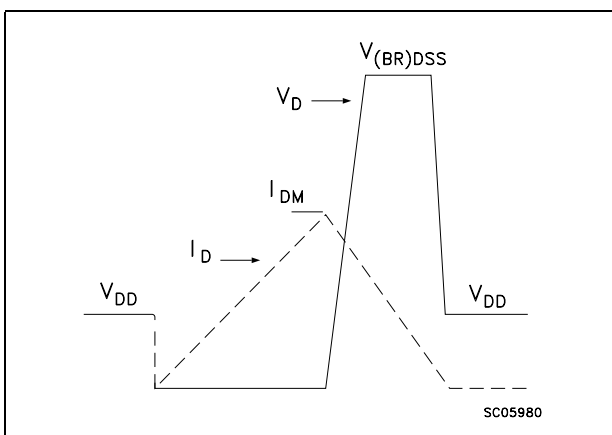
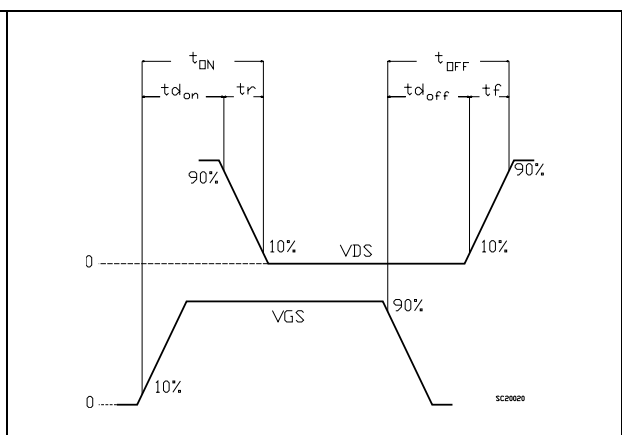


Figure 7. Switching time waveform

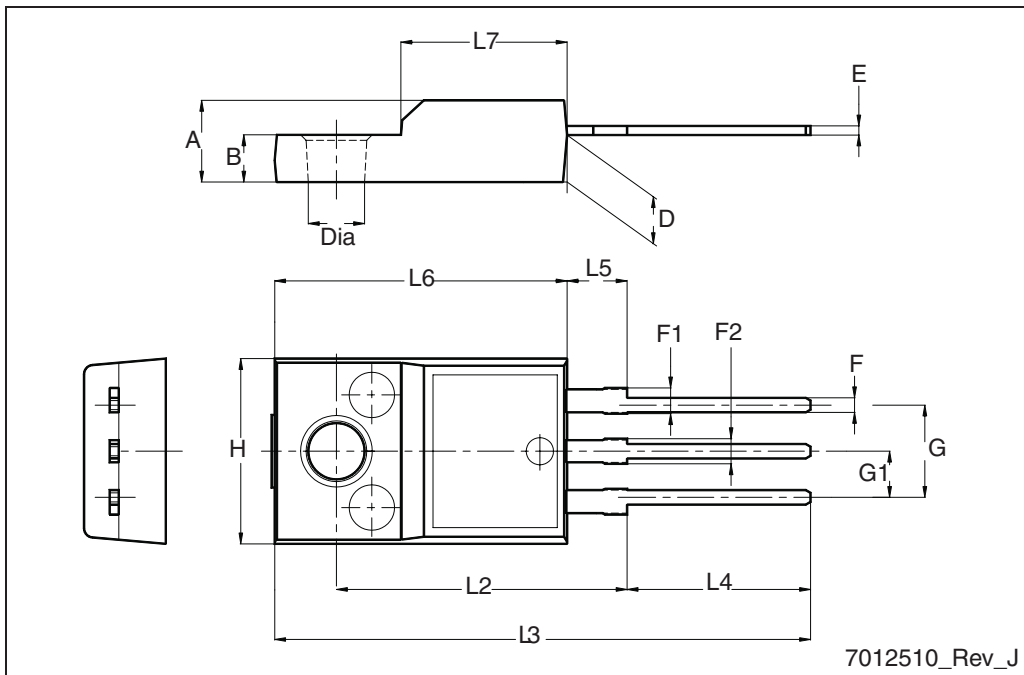


## 4 Package mechanical data

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](http://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

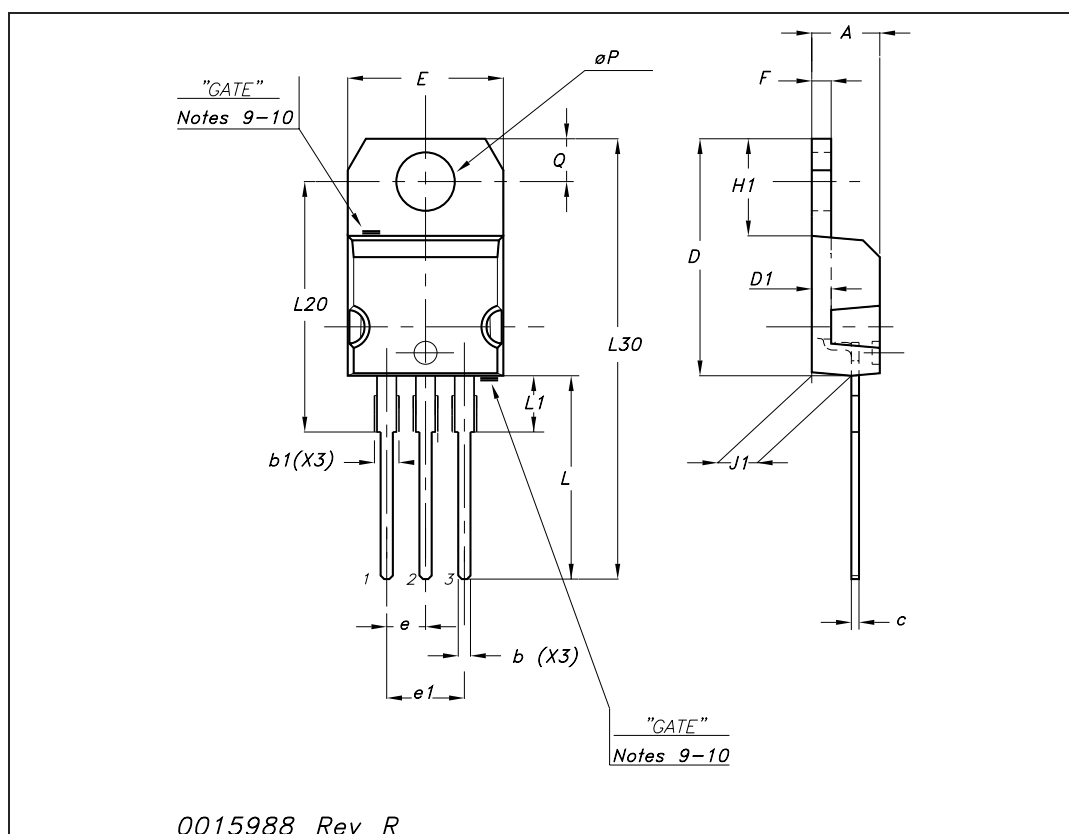


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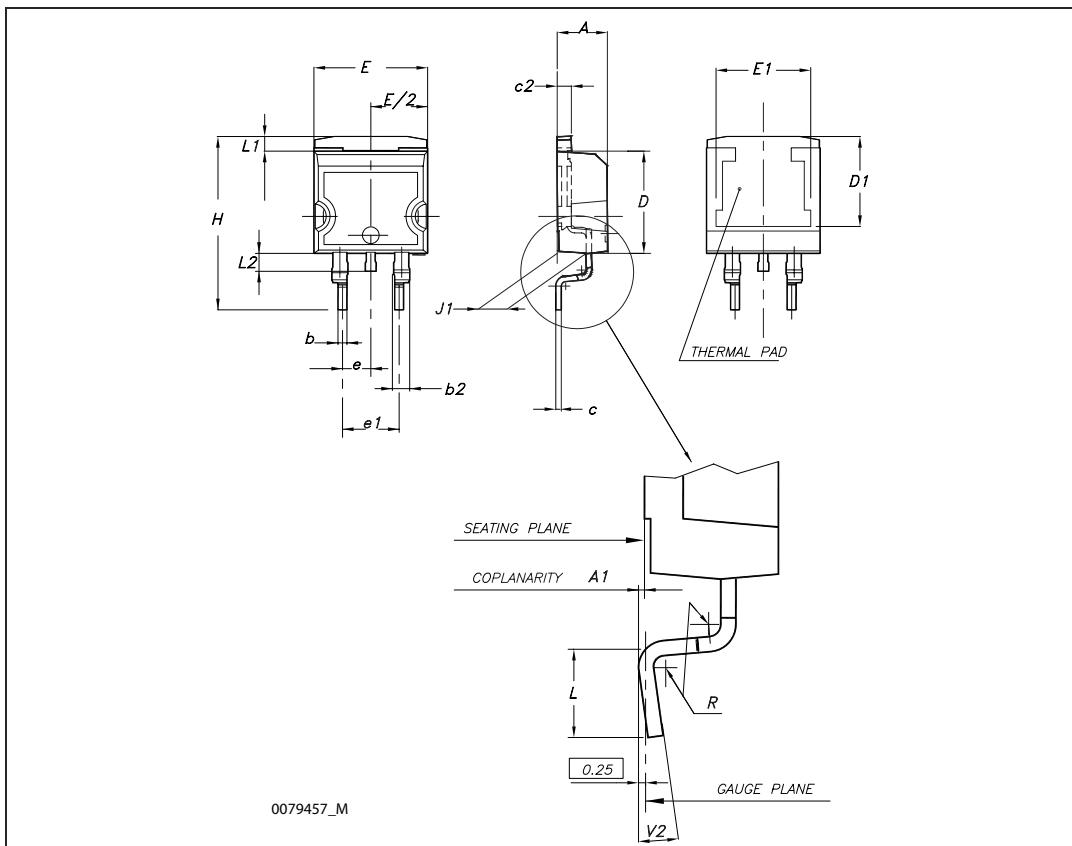
## TO-220 mechanical data

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



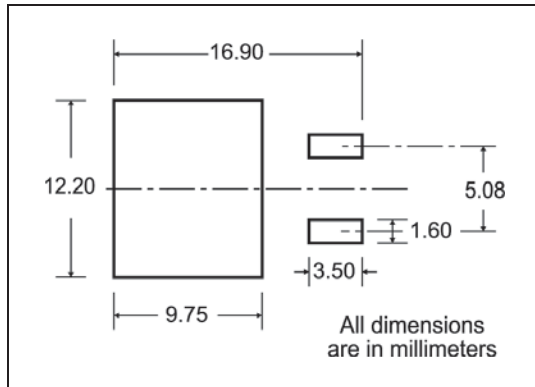
D<sup>2</sup>PAK (TO-263) mechanical data

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°



# 5 Packaging mechanical data

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



## TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

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

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
12-Jan-2008	1	First release

**STB140N10F4, STF140N10F4, STP140N10F4**

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