STB270N4F3
STI270N4F3, STP270N4F3

N-channel 40 V, 2.1 mΩ, 160 A, TO-220, D²PAK, I²PAK STripFET™ III Power MOSFET

Preliminary data

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D	P_{TOT}
STB270N4F3	40 V	< 2.5 mΩ	160 A	330 W
STI270N4F3	40 V	< 2.9 mΩ	120 A	330 W
STP270N4F3	40 V	< 2.9 mΩ	120 A	330 W

- 100% avalanche tested
- Standard threshold drive

Applications

- High current, switching application
  - Automotive

Description

This STripFET™ III Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance providing superior switching performances.

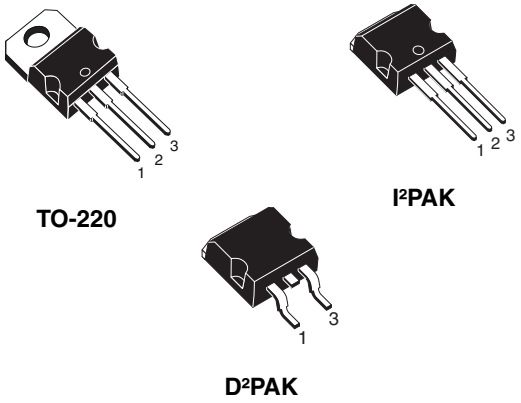


Figure 1. Internal schematic diagram

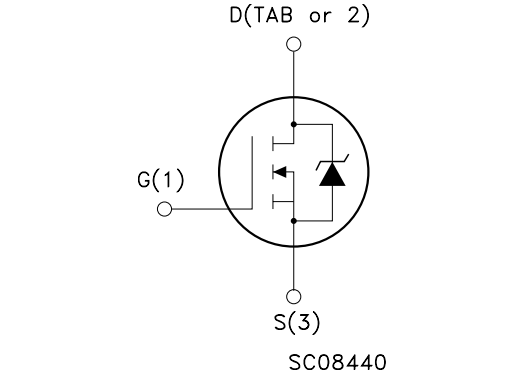


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB270N4F3	270N4F3	D²PAK	Tape and reel
STI270N4F3	270N4F3	I²PAK	Tube
STP270N4F3	270N4F3	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, I²PAK	D²PAK	
V_{DS}	Drain-source voltage (V_{GS} = 0)	40		V
V_{GS}	Gate-source voltage	± 20		V
I_D(1)	Drain current (continuous) at T_C = 25 °C	120	160	A
I_D(1)	Drain current (continuous) at T_C=100 °C	120	160	A
I_{DM}(2)	Drain current (pulsed)	480	640	A
P_{TOT}	Total dissipation at T_C = 25 °C	330		W
	Derating factor	2.2		W/°C
dv/dt(3)	Peak diode recovery voltage slope	3.5		V/n
E_{AS}(4)	Single pulse avalanche energy	1		J
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175		°C

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 120$ A, di/dt $\leq$ 200 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$
4. Starting T_j=25 °C, I_D =80 A, V_{DD}= 32 V

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-22, I²PAK	D²PAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.45		°C/W
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb max		35	°C/W
$R_{thj\text{-}a}$	Thermal resistance junction-ambient max	62.5		°C/W
T_l	Maximum lead temperature for soldering purpose (for 10 sec, 1.6 mm from case)	300		°C

1. When mounted on 1inch² FR-4 board, 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		40			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating @125 °C				10 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±20 V				±200	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= 80 A	**TO-220 I²PAK**		2.5	2.9	mΩ
			D²PAK		2.1	2.5	mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} =15 V, I_D = 80 A	-	200		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25 V, f=1 MHz, V_{GS}=0	-	7400 1800 47		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge gate-drain charge	V_{DD}=20 V, I_D = 160 A V_{GS} =10 V *(see Figure 14)*	-	110 27 25	150	nC nC nC

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

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}=20 V, I_D= 80 A, R_G=4.7 Ω, V_{GS}=10 V *(see Figure 16)*	-	22 180	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	V_{DD}=20 V, I_D= 80 A, R_G=4.7 Ω, V_{GS}=10 V *(see Figure 16)*	-	110 45	-	ns ns

Table 7. Source drain diode

Symbol	Parameter		Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current	**D²PAK**		-		160	A
		TO-220 I²PAK		-		120	A
I_{SDM}(1)	Source-drain current (pulsed)	**D²PAK**		-		640	A
		TO-220 I²PAK		-		480	A
V_{SD}(2)	Forward on voltage		I_{SD}=80 A, V_{GS}=0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current		I_{SD}=160 A, di/dt = 100 A/µs, V_{DD}=32 V, Tj=150 °C *(see Figure 15)*	-	70 225 3.2		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

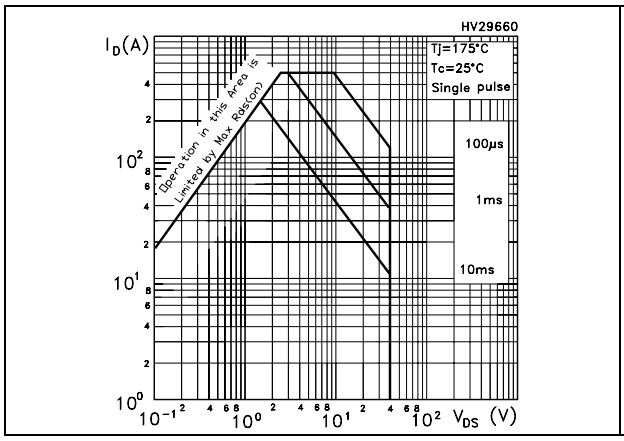


Figure 3. Thermal impedance

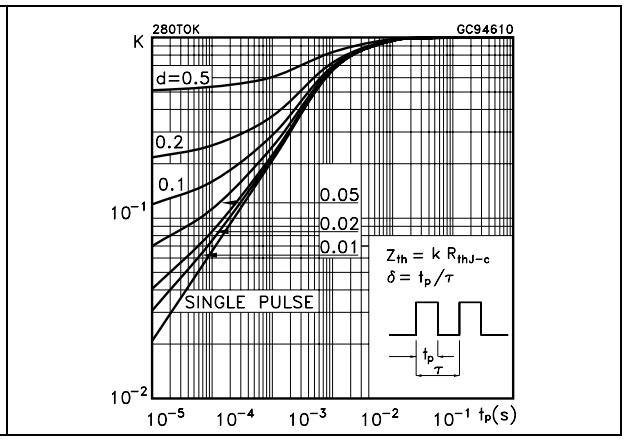


Figure 4. Output characteristics

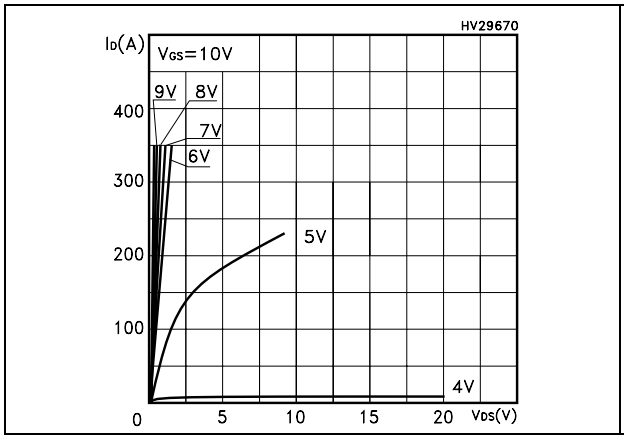


Figure 5. Transfer characteristics

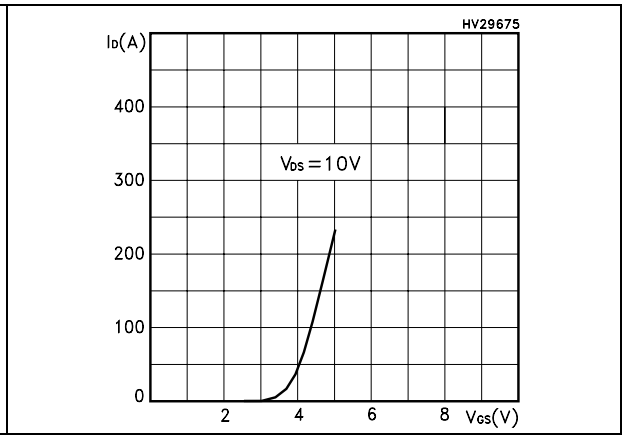


Figure 6. Static drain-source on resistance

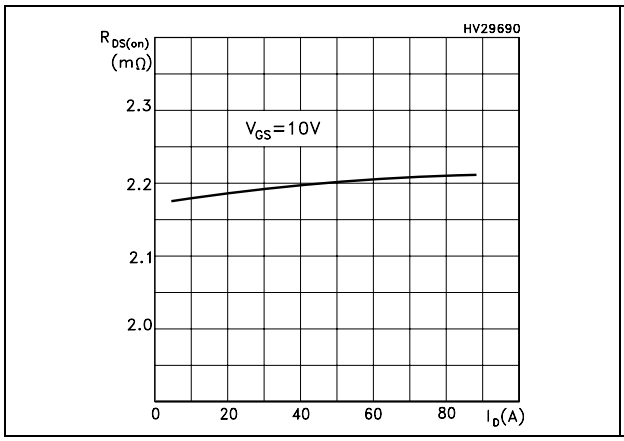


Figure 7. Normalized B_{VDSS} vs temperature

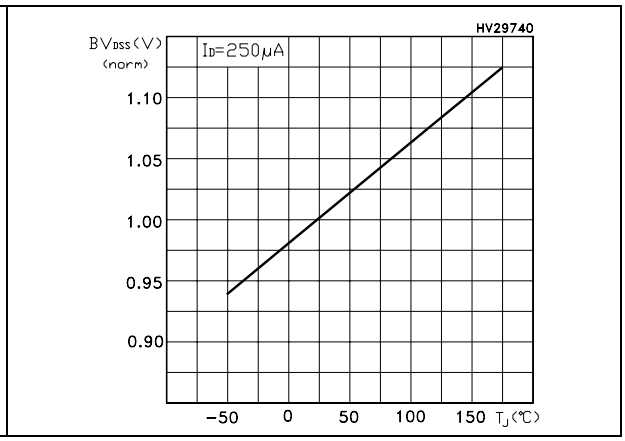


Figure 8. Gate charge vs gate-source voltage

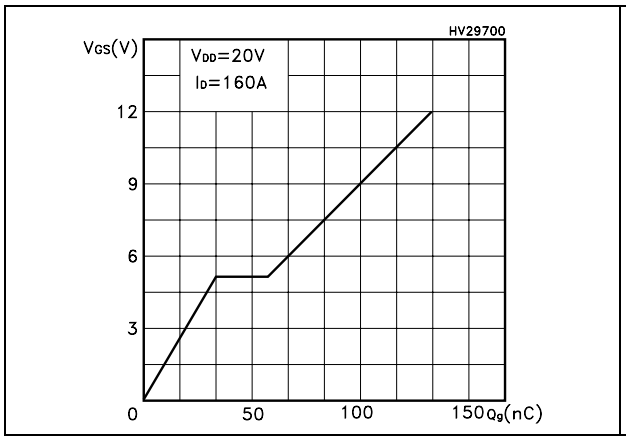


Figure 9. Capacitance variations

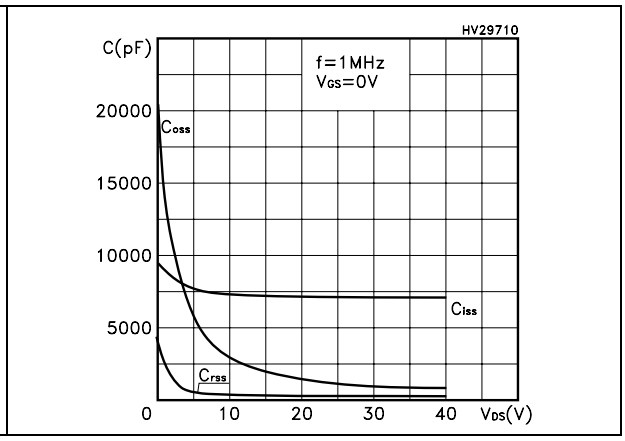


Figure 10. Normalized gate threshold voltage vs temperature

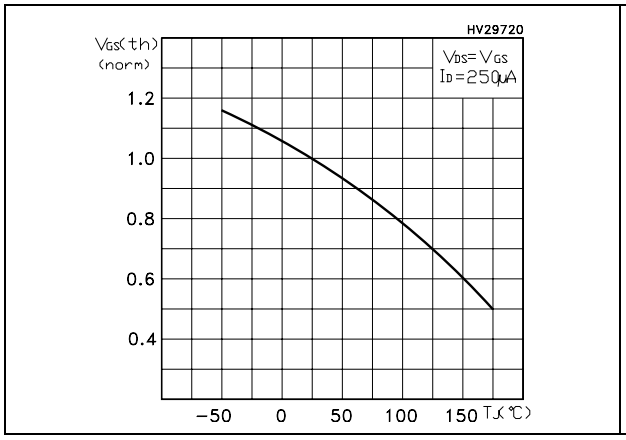


Figure 11. Normalized on resistance vs temperature

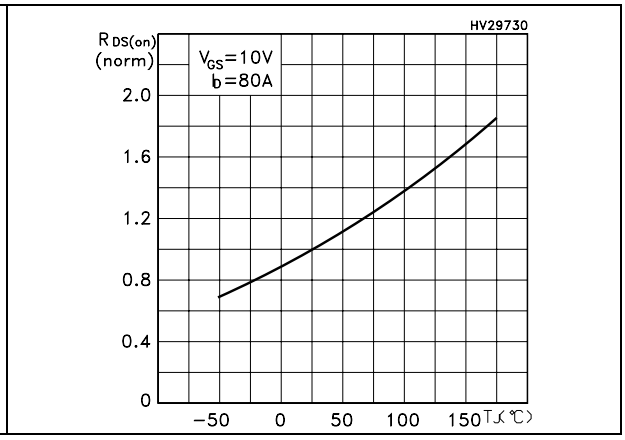
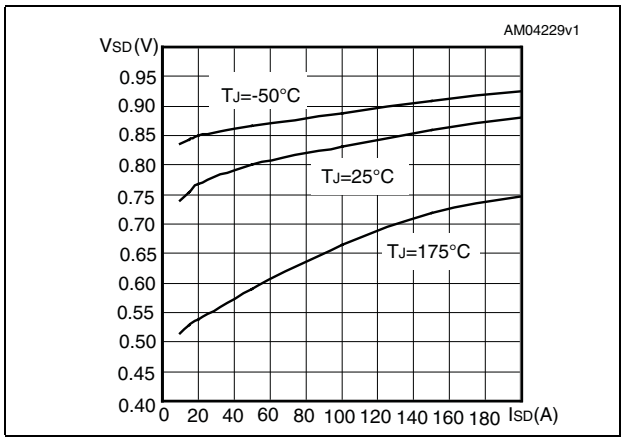


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

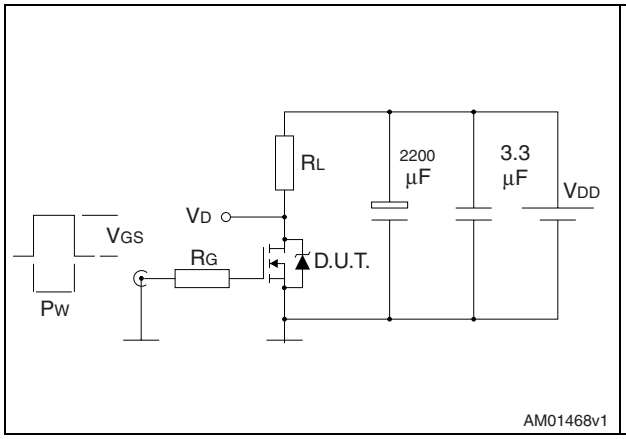


Figure 14. Gate charge test circuit

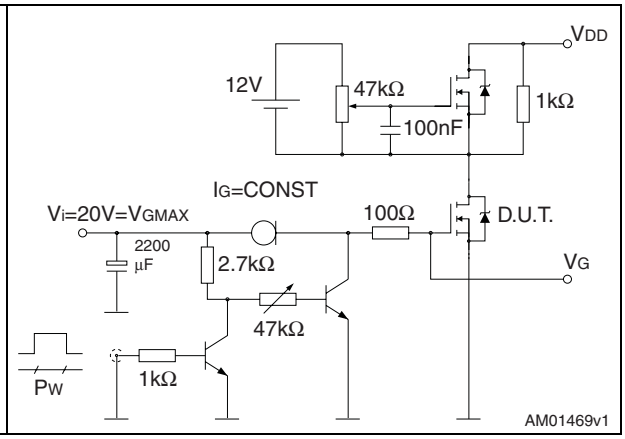


Figure 15. Test circuit for inductive load switching and diode recovery times

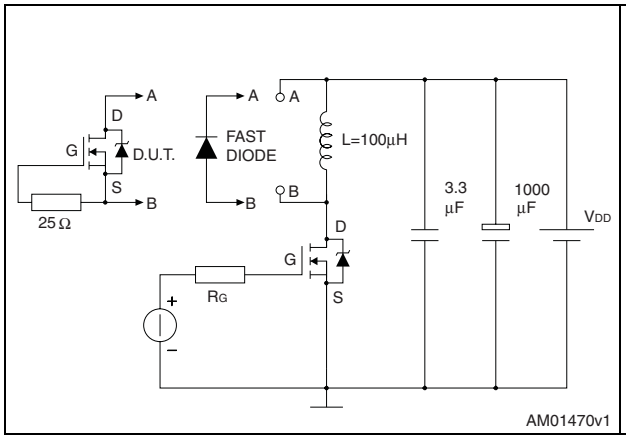


Figure 16. Unclamped inductive load test circuit

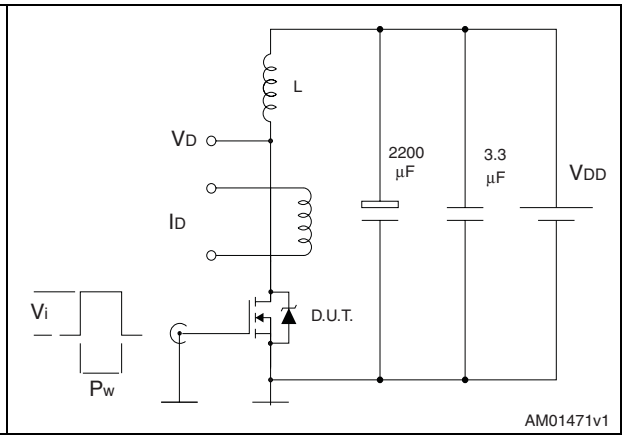


Figure 17. Unclamped inductive waveform

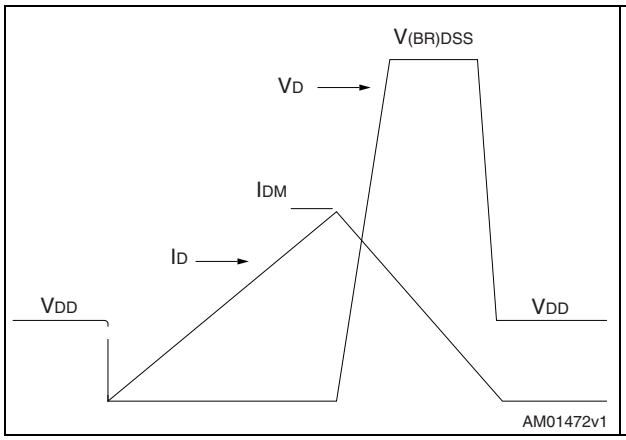
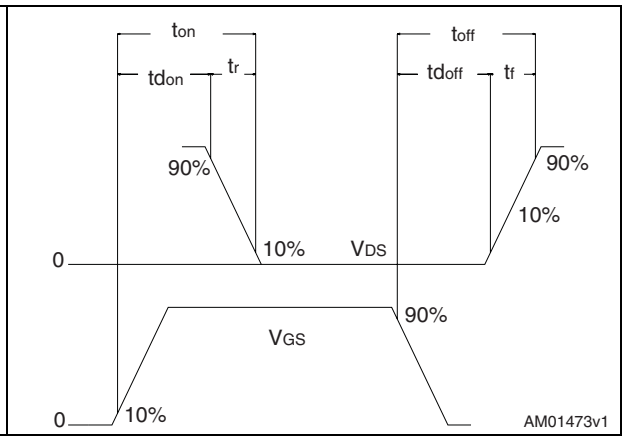


Figure 18. Switching time waveform

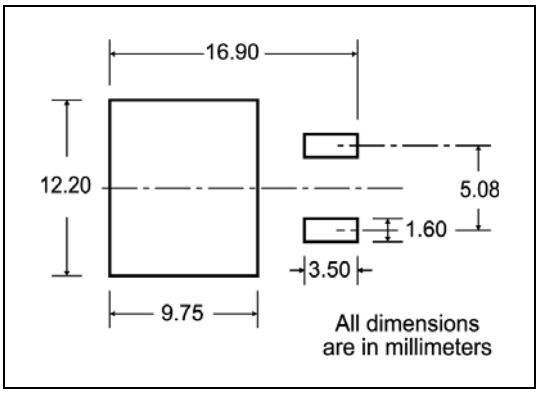


4 Package mechanical data

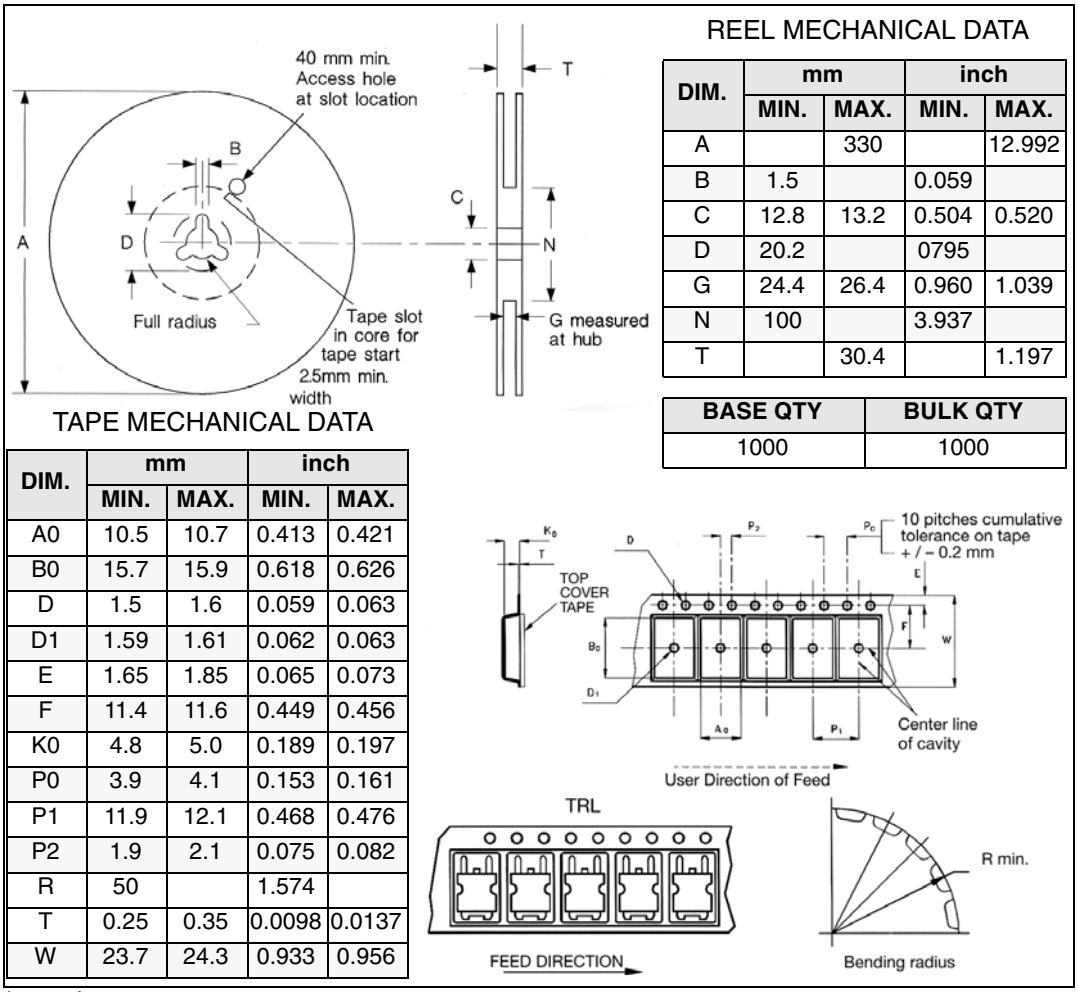
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

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

* on sales type

6 Revision history

Table 8. Revision history

Date	Revision	Changes
07-Feb-2007	1	Initial release.
02-Apr-2008	2	Some value changes on *Table 2*
06-May-2009	3	Changed: *Description* and *Figure 12: Source-drain diode forward characteristics*