



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.

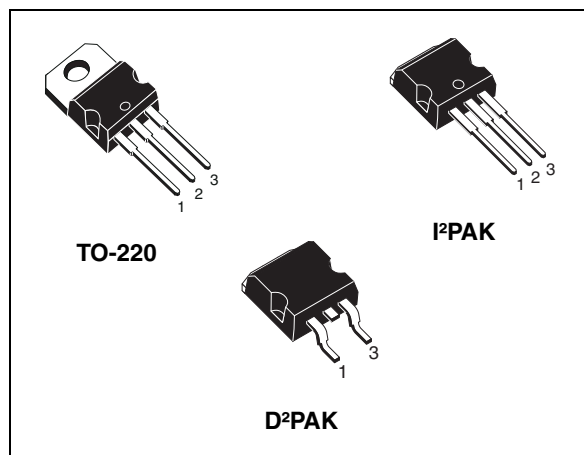


Figure 1. Internal schematic diagram

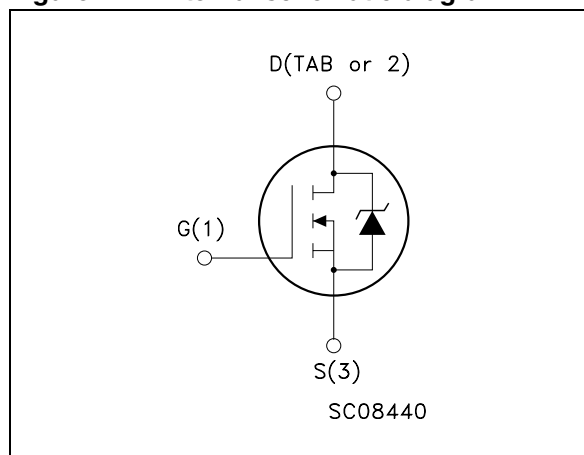


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB270N4F3	270N4F3	D ² PAK	Tape and reel
STI270N4F3	270N4F3	I ² PAK	Tube
STP270N4F3	270N4F3	TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, I ² PAK	D ² PAK	
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	40		V
V_{GS}	Gate-source voltage	± 20		V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	120	160	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	120	160	A
$I_{DM}^{(2)}$	Drain current (pulsed)	480	640	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	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. $I_{SD} \leq 120\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX}$
4. Starting $T_J = 25\text{ °C}$, $I_D = 80\text{ A}$, $V_{DD} = 32\text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-22, I ² PAK	D ² PAK	
$R_{thj-case}$	Thermal resistance junction-case max	0.45		°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max		35	°C/W
R_{thj-a}	Thermal resistance junction-ambient max	62.5		°C/W
T_I	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

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

Table 4. On/off states

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$		40			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$, $V_{DS} = \text{Max rating}$ @ $125\text{ }^{\circ}\text{C}$				10 100	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$				± 200	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$		2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 80\text{ A}$	TO-220 I ² PAK		2.5	2.9	m Ω
			D ² PAK		2.1	2.5	m Ω

Table 5. Dynamic

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

1. Pulsed: pulse duration=300 μs , 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	$V_{DD} = 20\text{ V}$, $I_D = 80\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 16)	-	22 180	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	$V_{DD} = 20\text{ V}$, $I_D = 80\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (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	D ² PAK		-		160	A
		TO-220		-		120	A
		I ² PAK		-			
$I_{SDM}^{(1)}$	Source-drain current (pulsed)	D ² PAK		-		640	A
		TO-220		-		480	A
		I ² PAK		-			
$V_{SD}^{(2)}$	Forward on voltage		$I_{SD}=80\text{ A}$, $V_{GS}=0$	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current		$I_{SD}=160\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=32\text{ V}$, $T_J=150\text{ }^{\circ}\text{C}$ (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

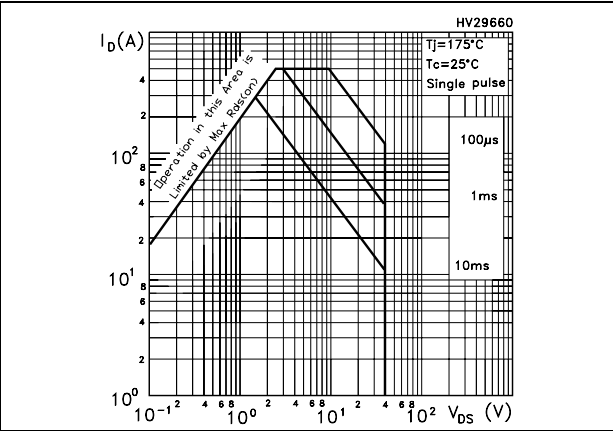


Figure 3. Thermal impedance

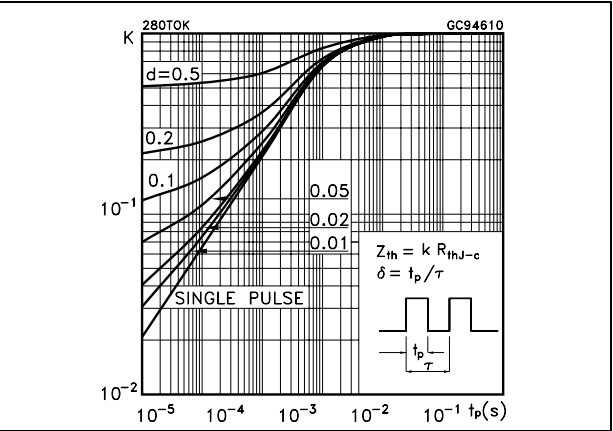


Figure 4. Output characteristics

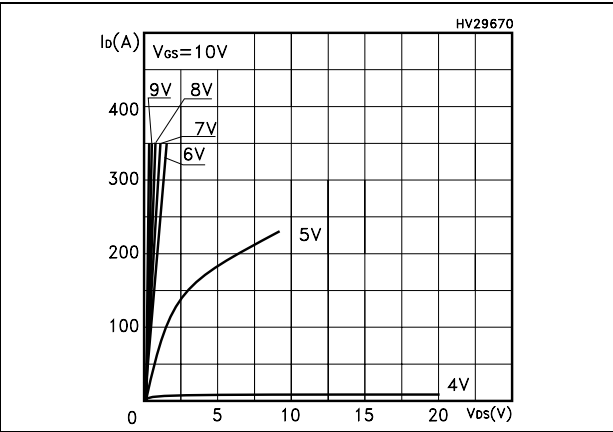


Figure 5. Transfer characteristics

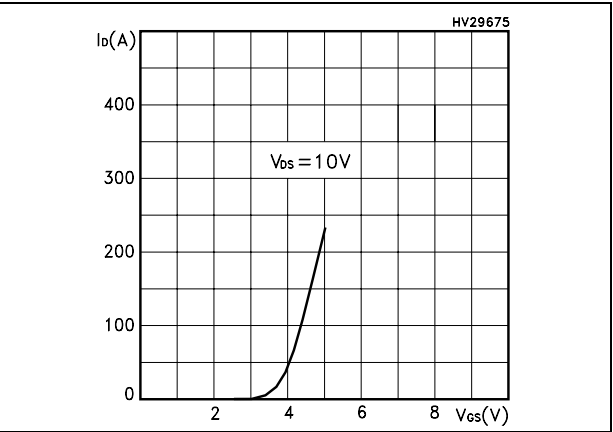


Figure 6. Static drain-source on resistance

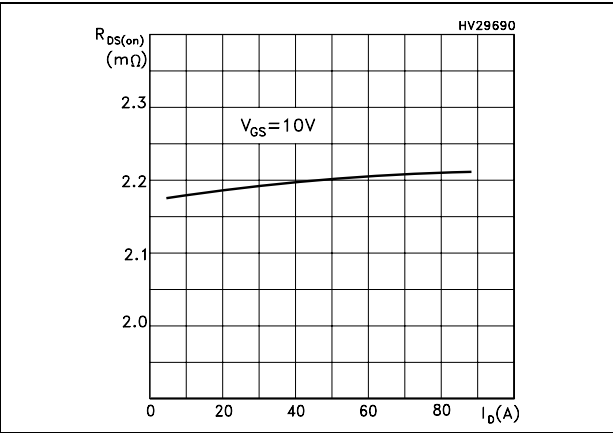


Figure 7. Normalized BVDS vs temperature

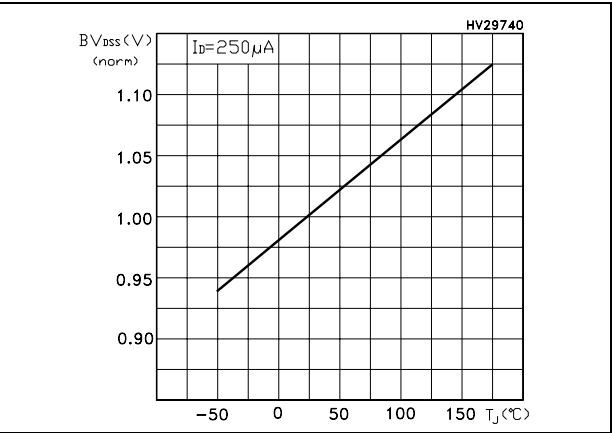


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

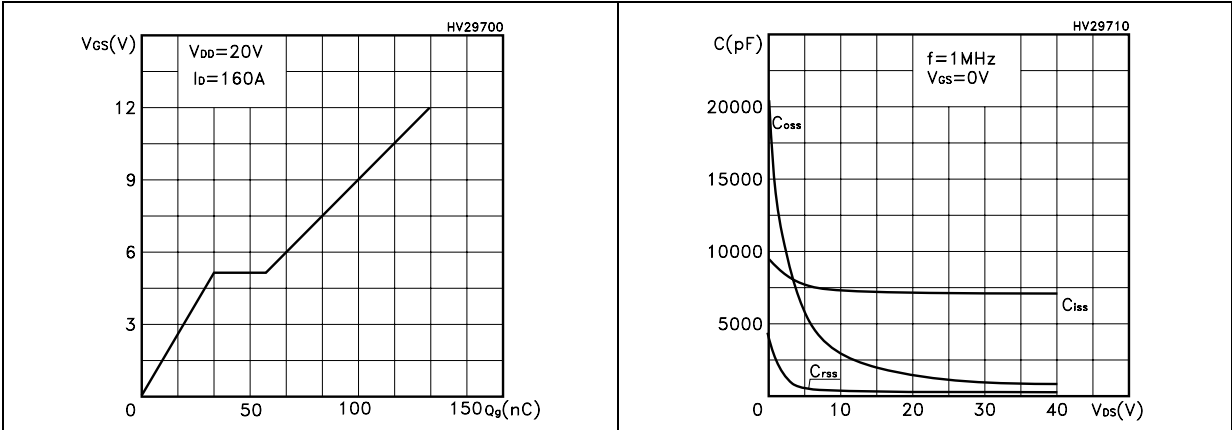


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

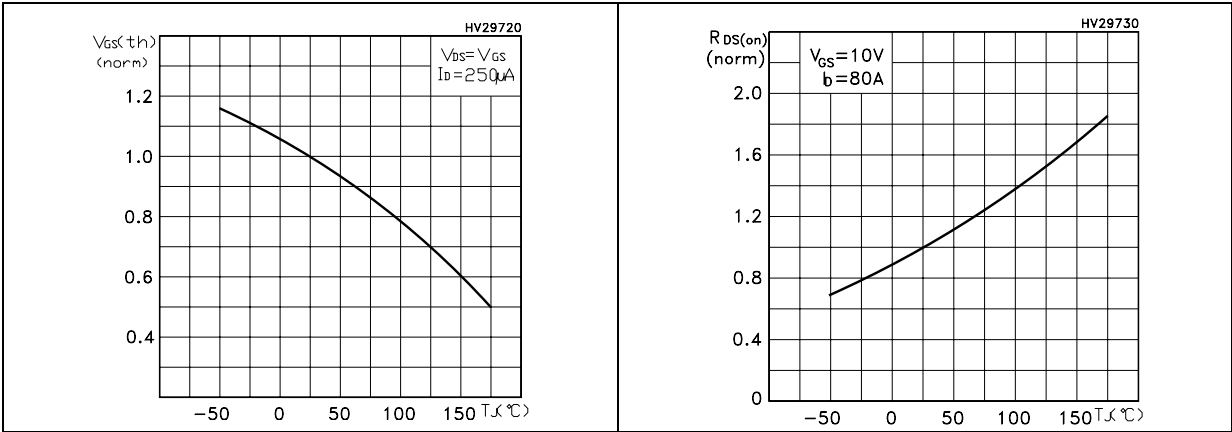
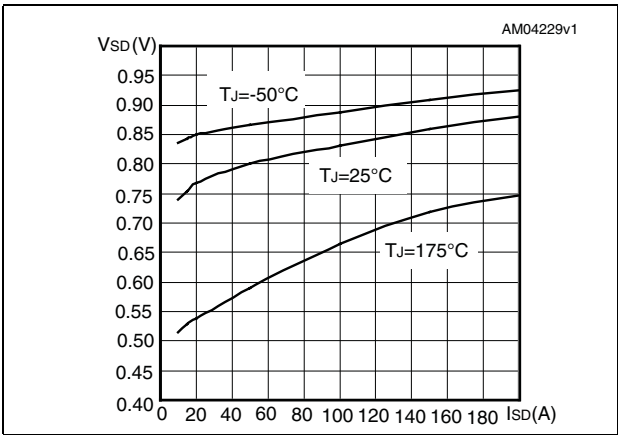


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

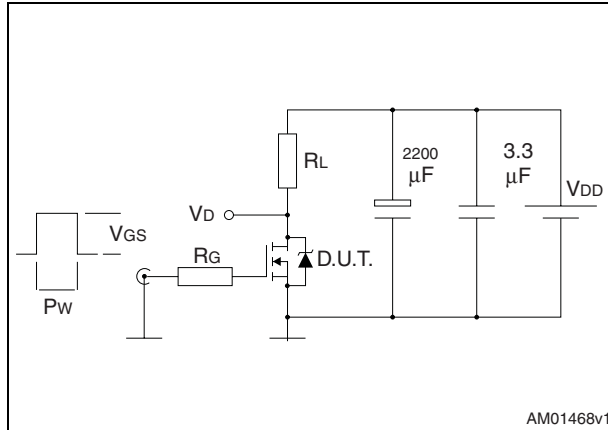


Figure 14. Gate charge test circuit

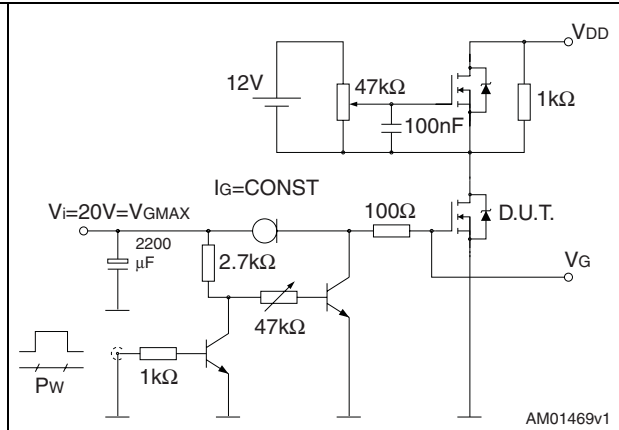


Figure 15. Test circuit for inductive load switching and diode recovery times

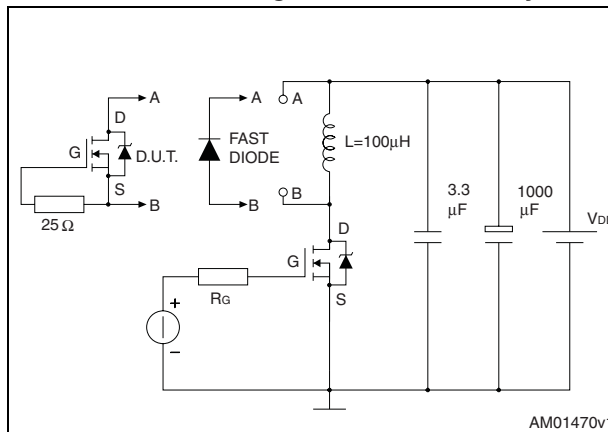


Figure 16. Unclamped inductive load test circuit

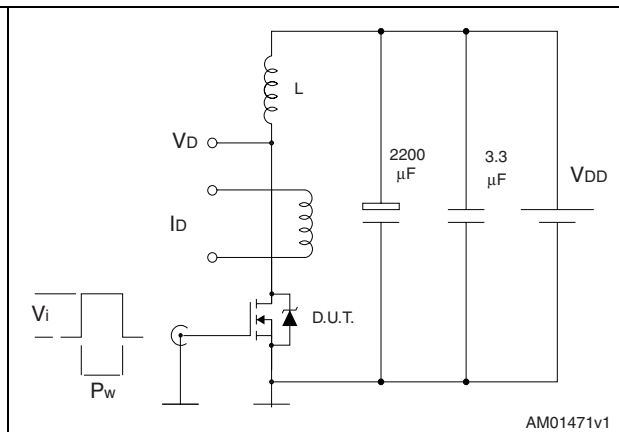


Figure 17. Unclamped inductive waveform

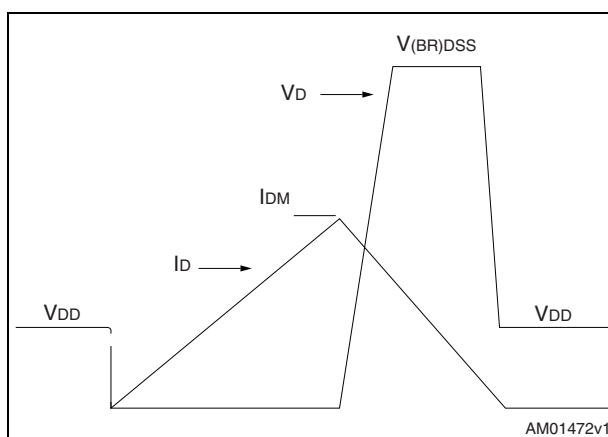
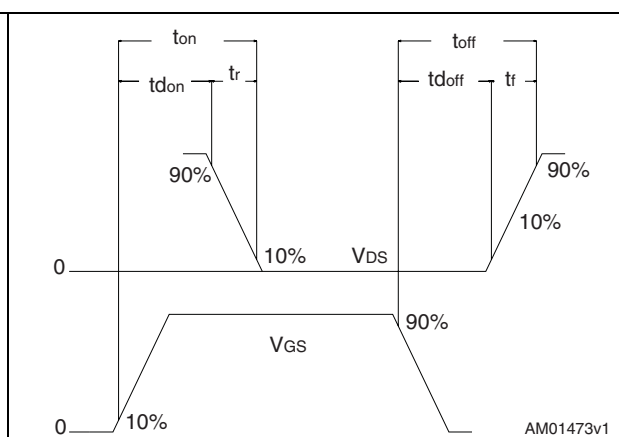


Figure 18. Switching time waveform

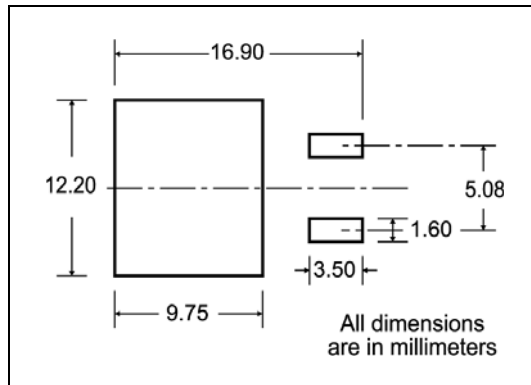


4 Package mechanical data

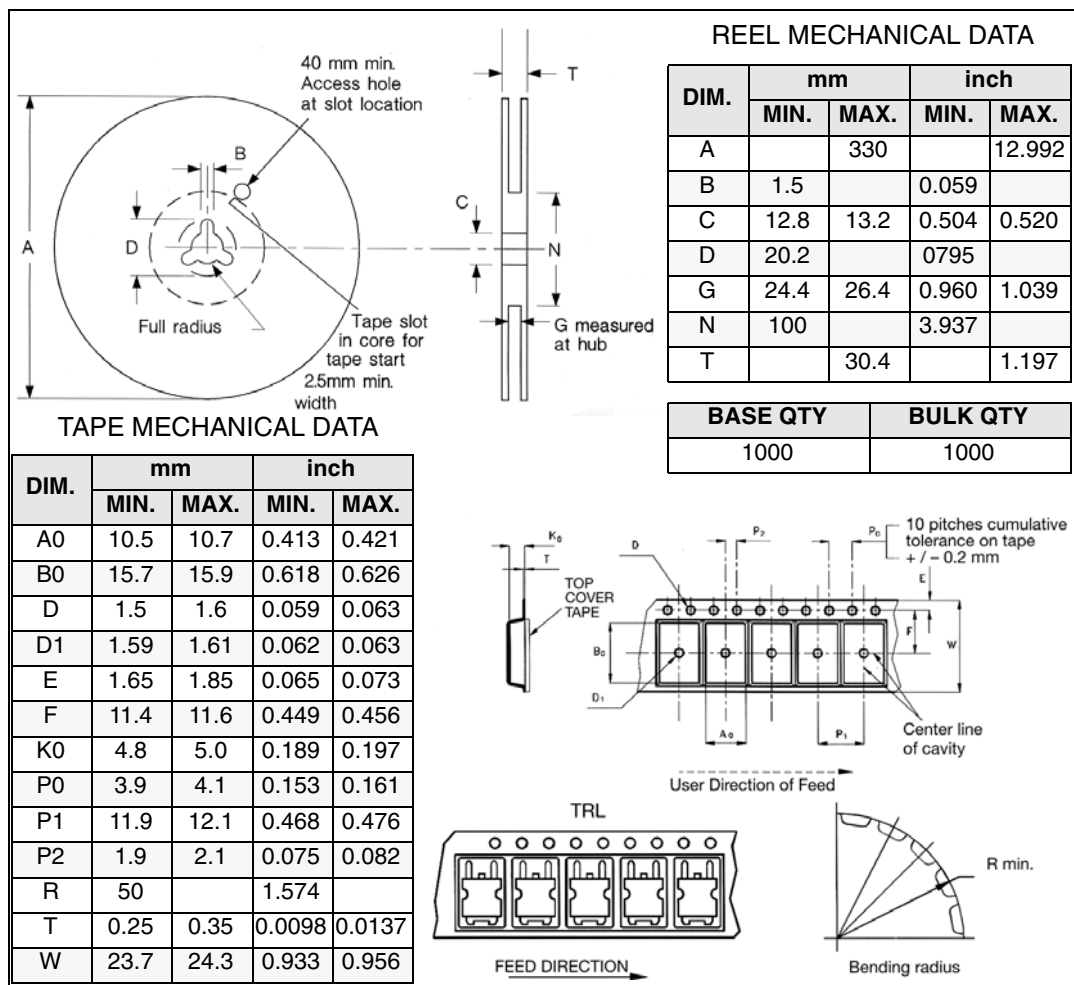
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



* 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

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