

Automotive-grade N-channel 40 V, 1.6 mΩ typ., 160 A STripFET™ F3 Power MOSFET in a D²PAK package

Datasheet - production data

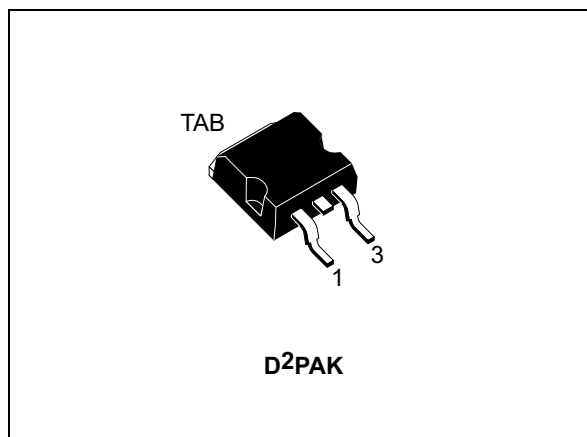
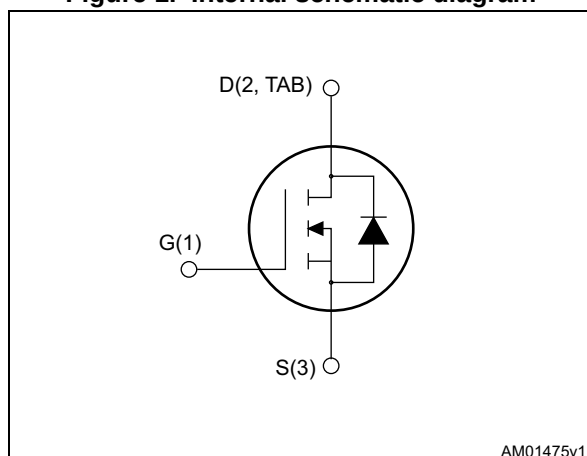


Figure 1. Internal schematic diagram



Features

Type	V _{DS}	R _{DS(on)} max	I _D	P _{TOT}
STB270N4F3	40 V	2.0 mΩ	160 A	330 W

- Designed for automotive applications and AEC-Q101 qualified
- 100% avalanche tested
- Standard threshold drive

Applications

- Switching application

Description

This device is an N-channel Power MOSFET developed using STripFET™ F3 technology. It is designed to minimize on-resistance and gate charge to provide superior switching performance.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB270N4F3	270N4F3	D ² PAK	Tape and reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	40	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	160	A
$I_D^{(1)}$	Drain current (continuous) at $T_C=100\text{ }^\circ\text{C}$	160	A
$I_{DM}^{(2)}$	Drain current (pulsed)	640	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	330	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	3.5	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	1	J
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

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 $T_J=25\text{ }^\circ\text{C}$, $I_D=80\text{ A}$, $V_{DD}=32\text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.45	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35	$^\circ\text{C}/\text{W}$

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 ($V_{GS} = 0$)	$V_{DS} = 40\text{ V}$ $V_{DS} = 40\text{ V}$, $T_j = 125\text{ }^{\circ}\text{C}$			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	$V_{GS} = 10\text{ V}$, $I_D = 80\text{ A}$		1.6	2.0	$\text{m}\Omega$

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}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	7400		pf
C_{oss}	Output capacitance		-	1800		pF
C_{rss}	Reverse transfer capacitance		-	47		pF
Q_g	Total gate charge	$V_{DD} = 20\text{ V}$, $I_D = 160\text{ A}$	-	110	150	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$	-	27		nC
Q_{gd}	Gate-drain charge	(see Figure 14)	-	25		nC

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

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay 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	-	ns
t_r	Rise time		-	180	-	ns
$t_{d(off)}$	Turn-off delay time		-	110	-	ns
t_f	Fall time		-	45	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		160	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		640	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=80\text{ A}$, $V_{GS}=0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD}=160\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=32\text{ V}$, $T_j=150\text{ }^\circ\text{C}$ (see Figure 15)	-	70		ns
Q_{rr}	Reverse recovery charge		-	225		nC
I_{RRM}	Reverse recovery current		-	3.2		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

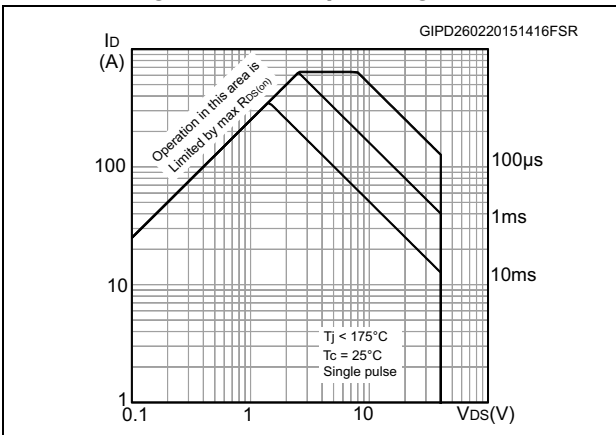


Figure 3. Thermal impedance

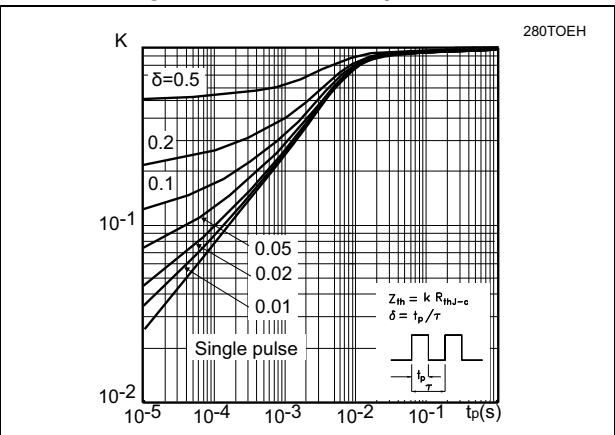


Figure 4. Output characteristics

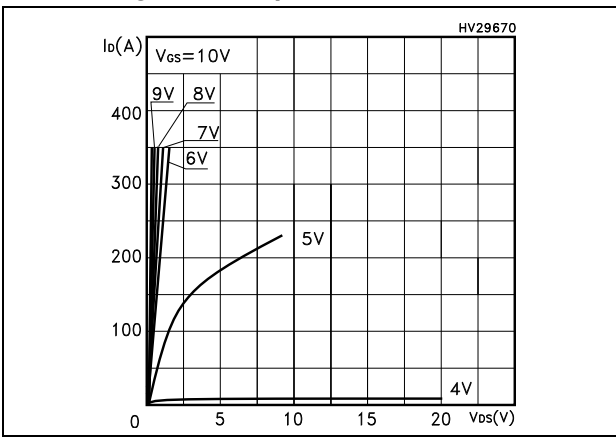


Figure 5. Transfer characteristics

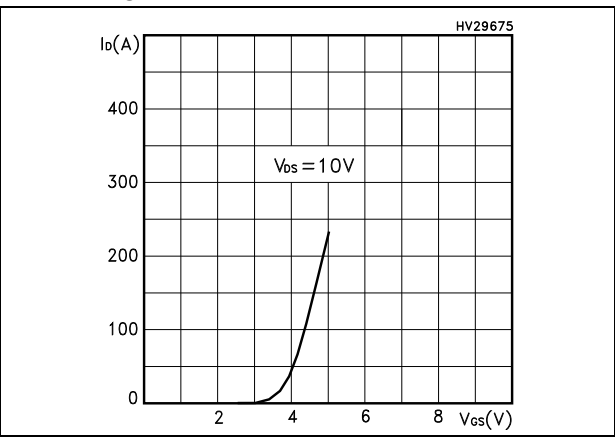


Figure 6. Static drain-source on-resistance

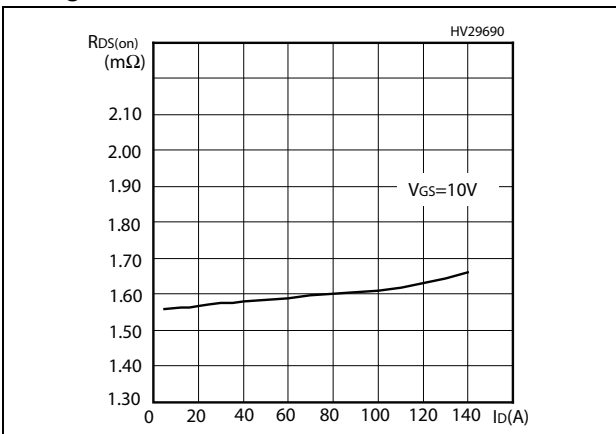


Figure 7. Normalized $B_{V_{DS}}$ vs temperature

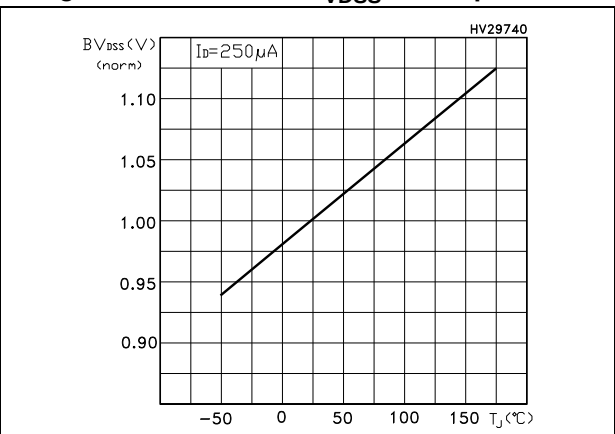


Figure 8. Gate charge vs gate-source voltage

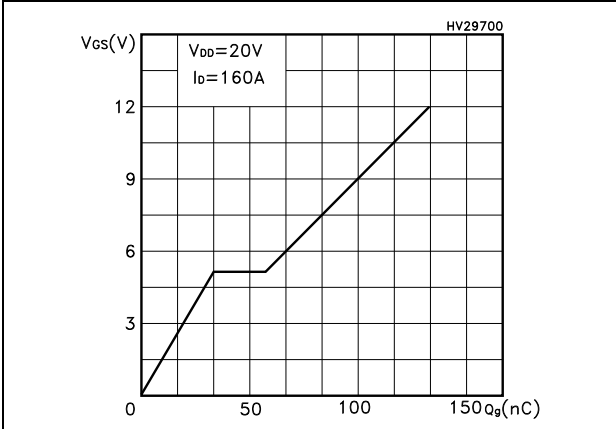


Figure 9. Capacitance variations

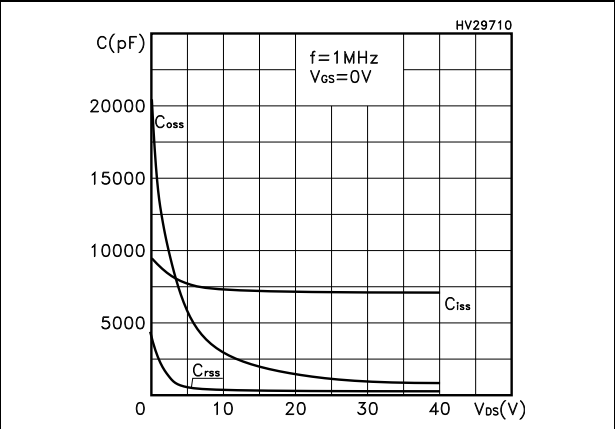


Figure 10. Normalized gate threshold voltage vs temperature

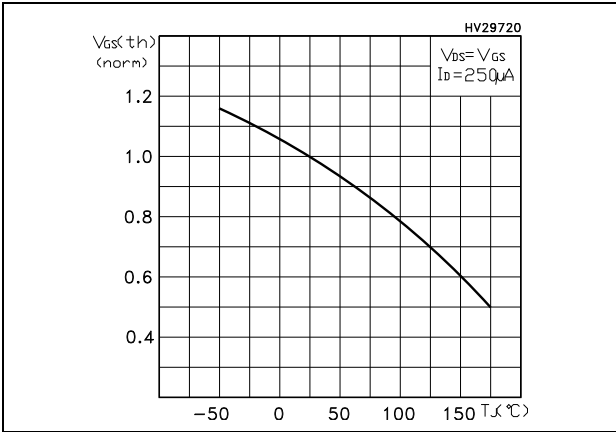


Figure 11. Normalized on resistance vs temperature

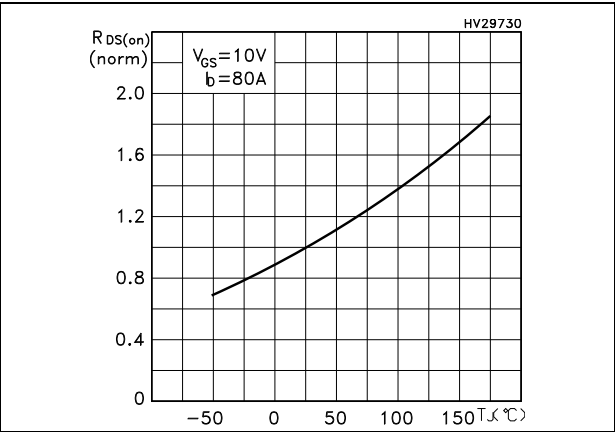
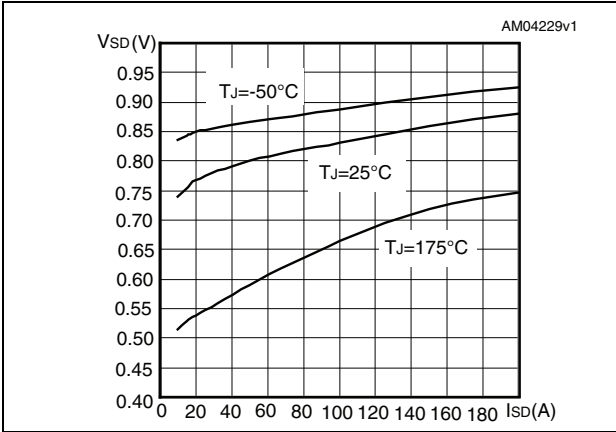


Figure 12. Source-drain diode forward characteristics



4 Package information

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.

4.1 D²PAK package information

Figure 19. D²PAK (TO-263) outline

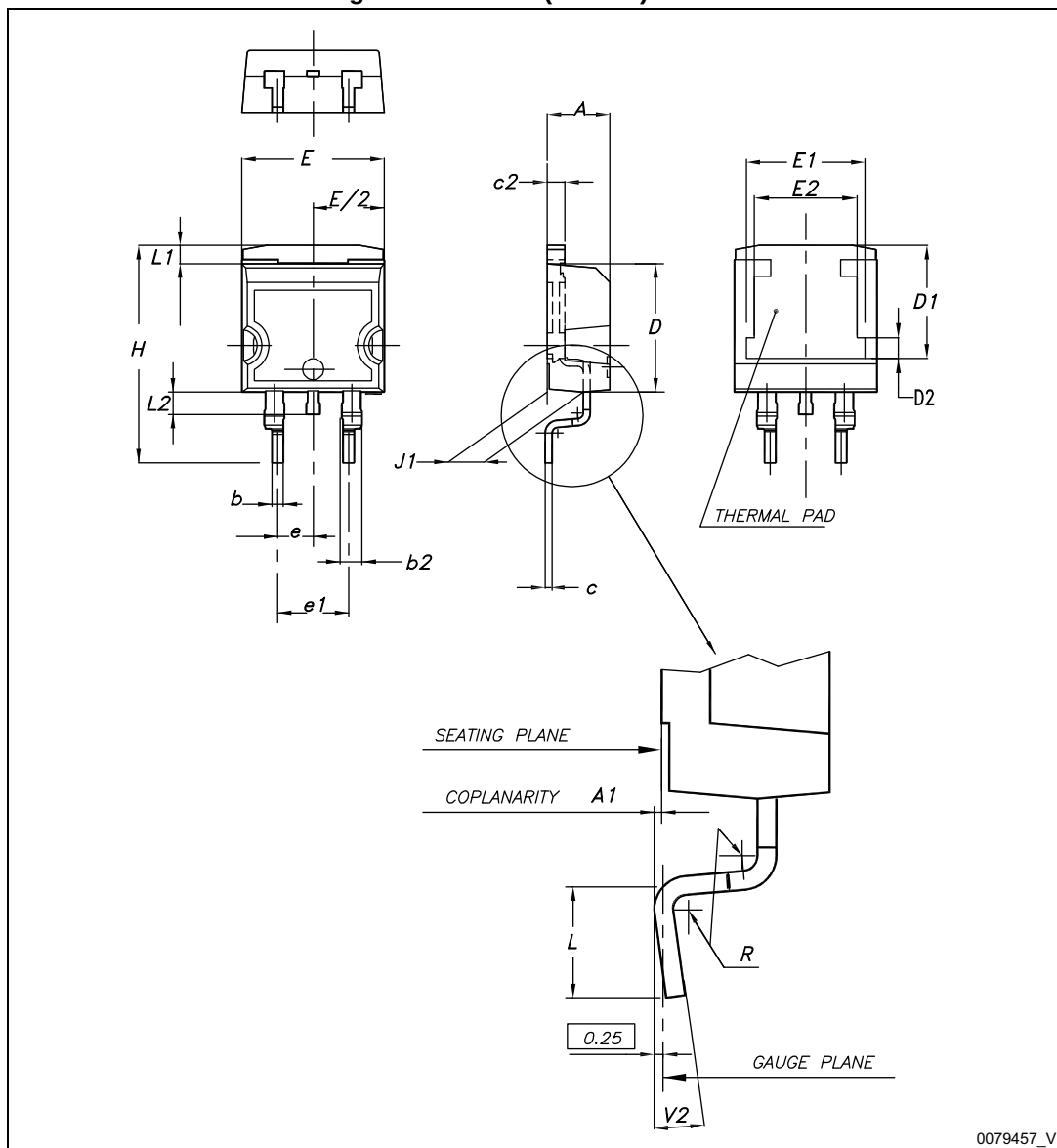
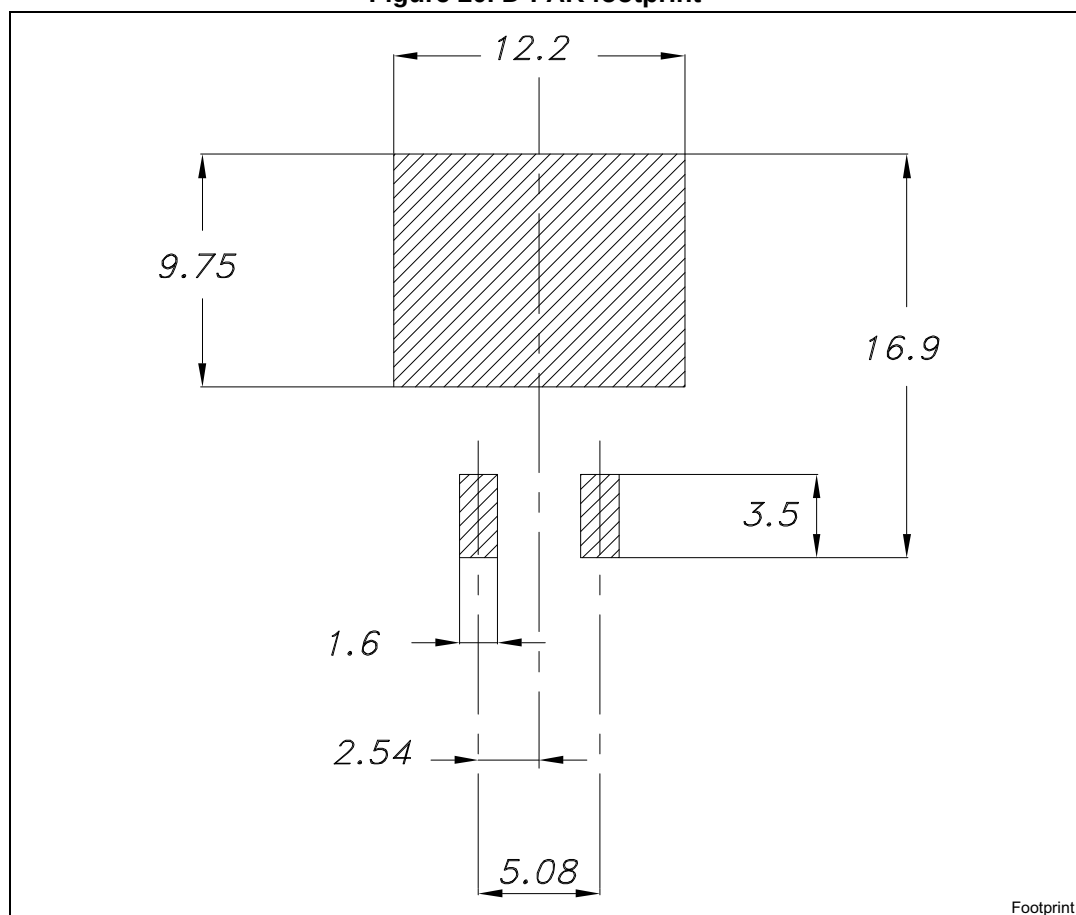


Table 8. D²PAK (TO-263) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10		10.40
E1	8.50	8.70	8.90
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 20. D²PAK footprint^(a)

a. All dimension are in millimeters

5 Packing information

Figure 21. Tape

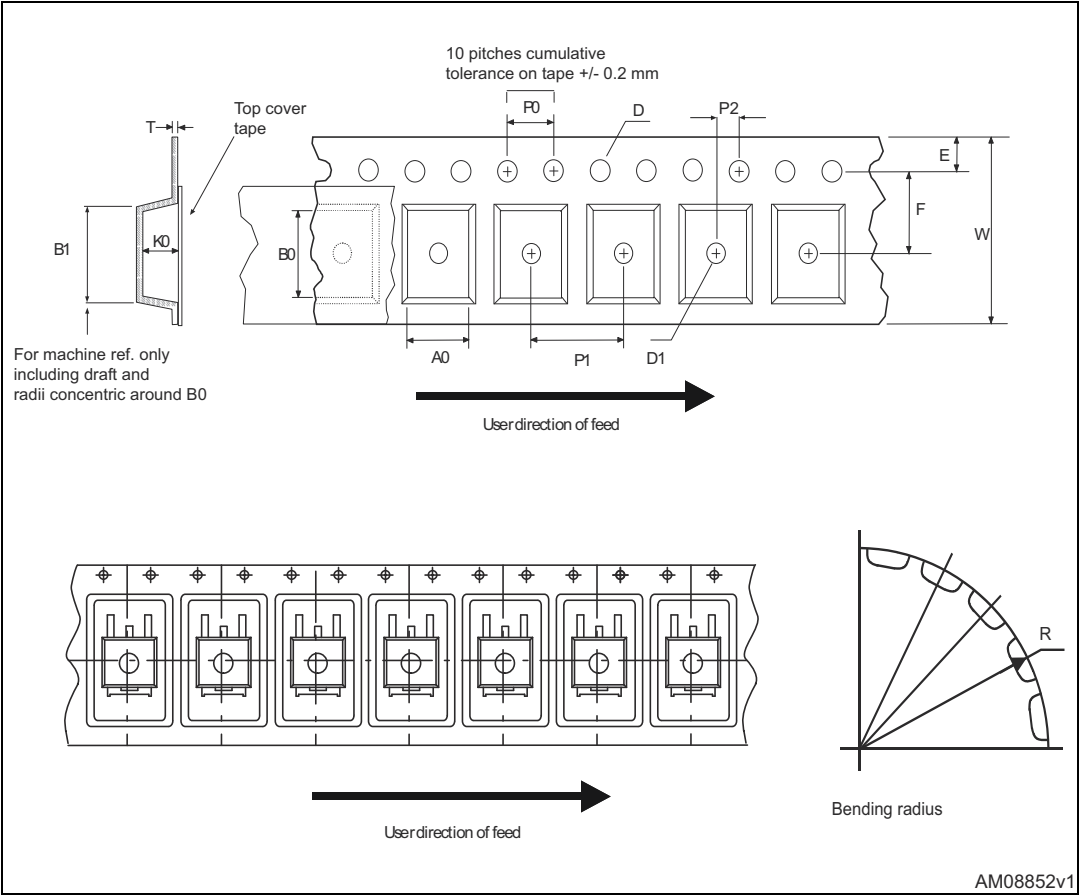
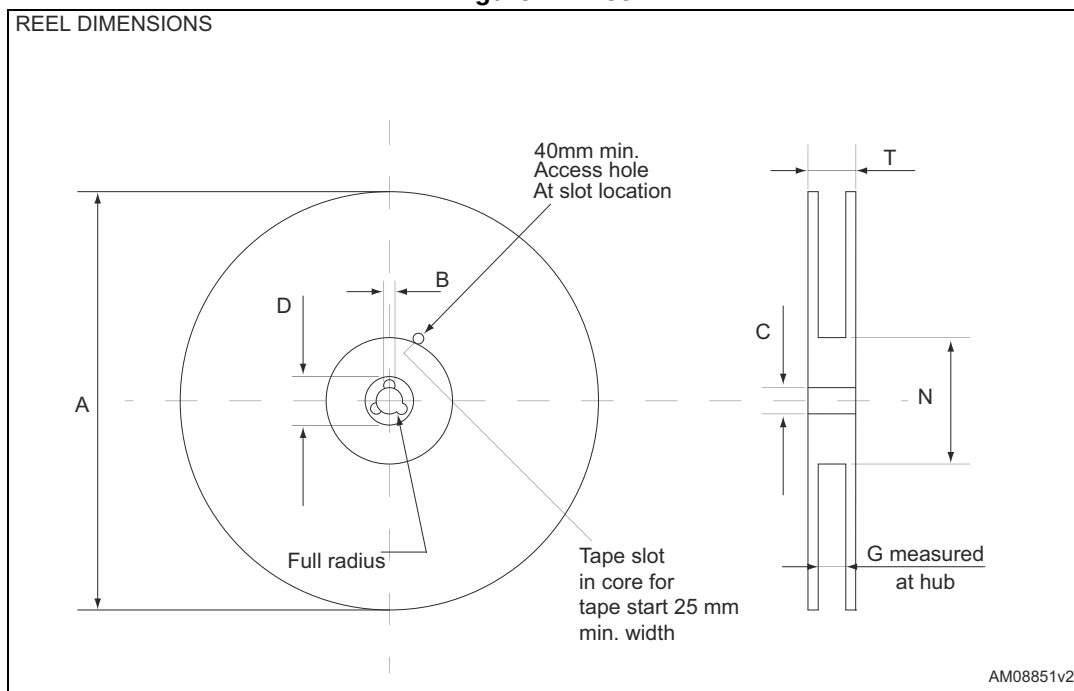


Figure 22. Reel

Table 9. D²PAK (TO-263) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

6 Revision history

Table 10. 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
14-Jul-2009	4	Removed package and mechanical data: TO-220
26-Feb-2015	5	The part number STI270N4F3 has been moved to a separate document. Updated title, features and description cover page. Updated Table 2: Absolute maximum ratings , Table 3: Thermal data . Updated Section 4: Package information and Section 5: Packing information . Minor text changes.

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