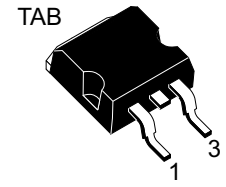
STB270N4F3

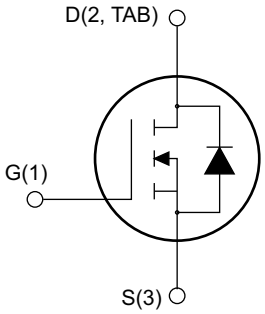
Automotive-grade N-channel 40 V, 1.6 mΩ typ., 160 A STripFET™ F3 Power MOSFET in a D^{2}PAK package

Datasheet - production data



D^{2}PAK

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	D²PAK	Tape and reel

Contents

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 °C	160	A
I_D(1)	Drain current (continuous) at T_C=100 °C	160	A
I_{DM}(2)	Drain current (pulsed)	640	A
P_{TOT}	Total dissipation at T_C = 25 °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	°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
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.45	°C/W
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb max	35	°C/W

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} = 40 V V_{DS} = 40 V, T_j = 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		1.6	2.0	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}	Input capacitance	V_{DS} =25 V, f=1 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 V, I_D = 160 A V_{GS} =10 V *(see Figure 14)*	-	110	150	nC
Q_{gs}	Gate-source charge		-	27		nC
Q_{gd}	Gate-drain charge		-	25		nC

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

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD}=20 V, I_D= 80 A, R_G=4.7 Ω, V_{GS}=10 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 A, V_{GS}=0	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD}=160 A, di/dt = 100 A/µs, V_{DD}=32 V, Tj=150 °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

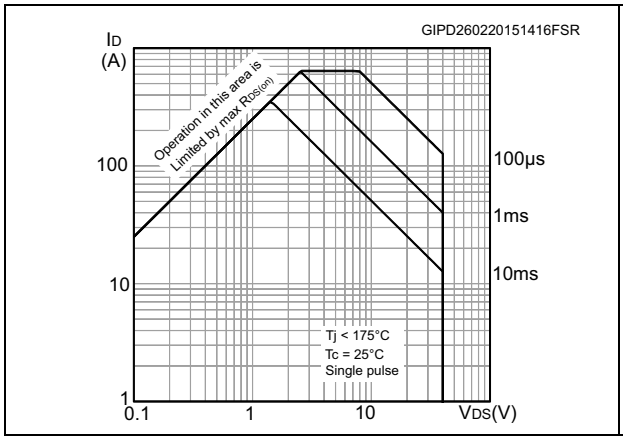


Figure 3. Thermal impedance

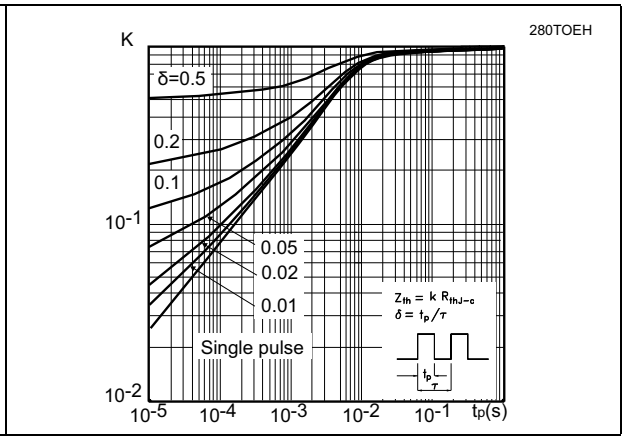


Figure 4. Output characteristics

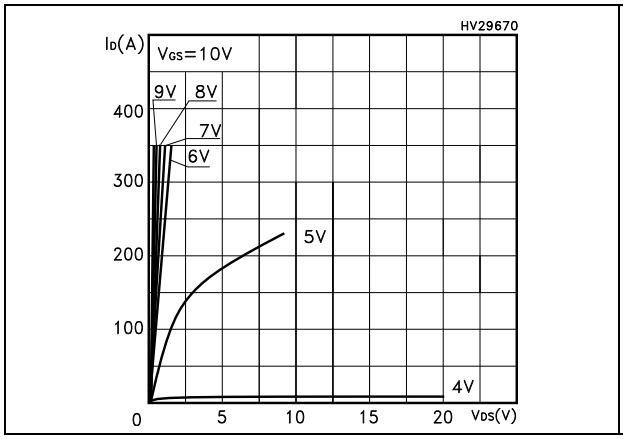


Figure 5. Transfer characteristics

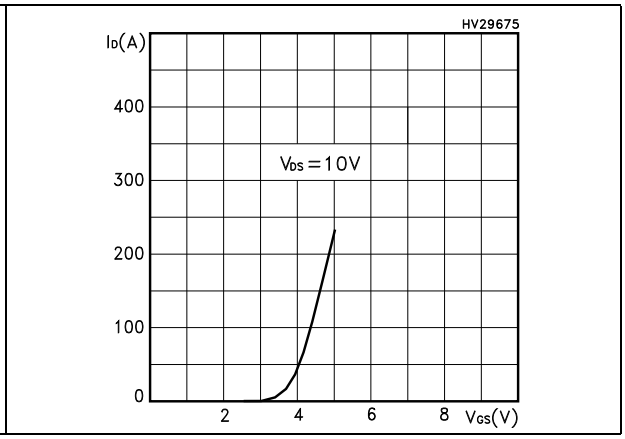


Figure 6. Static drain-source on-resistance

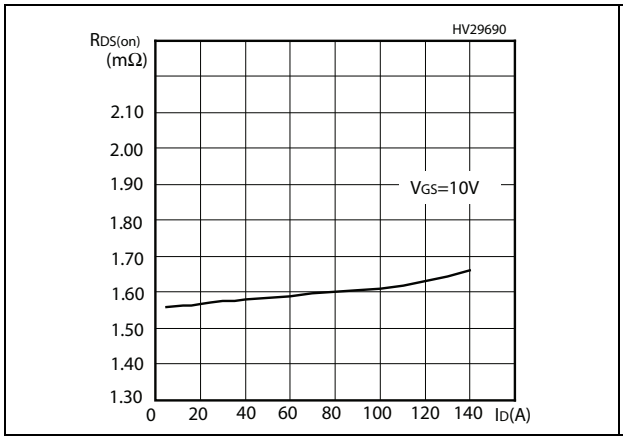


Figure 7. Normalized B_{VDSS} vs temperature

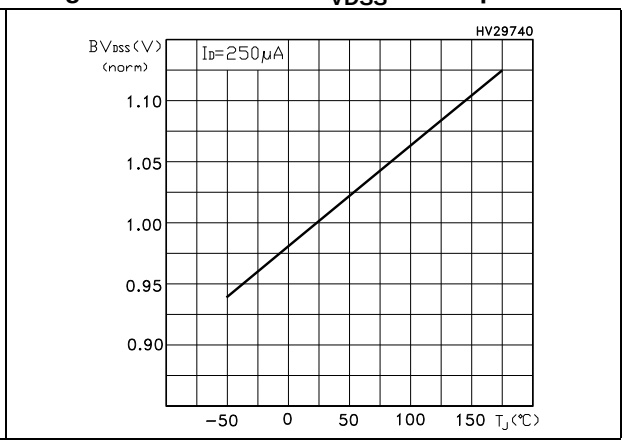


Figure 8. Gate charge vs gate-source voltage

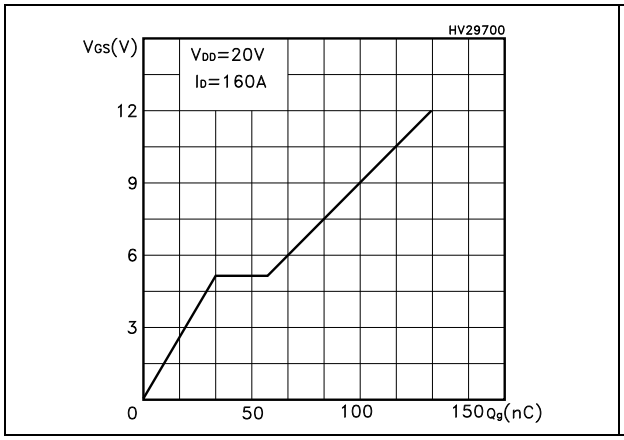


Figure 9. Capacitance variations

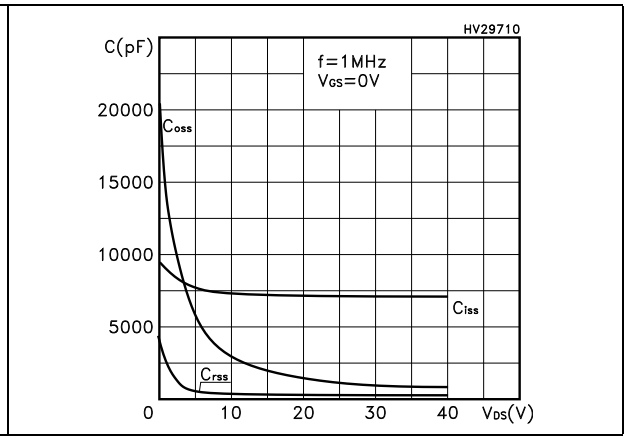


Figure 10. Normalized gate threshold voltage vs temperature

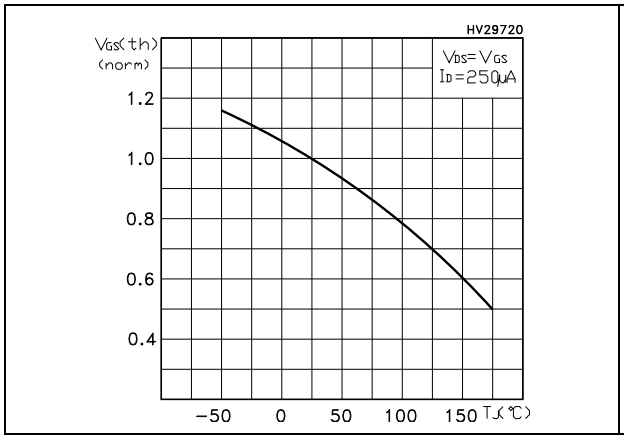


Figure 11. Normalized on resistance vs temperature

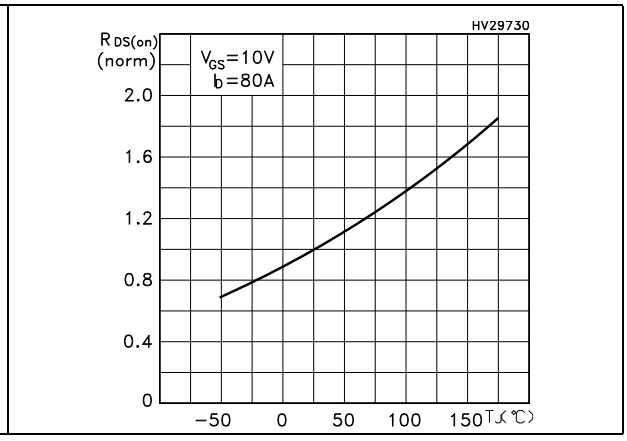
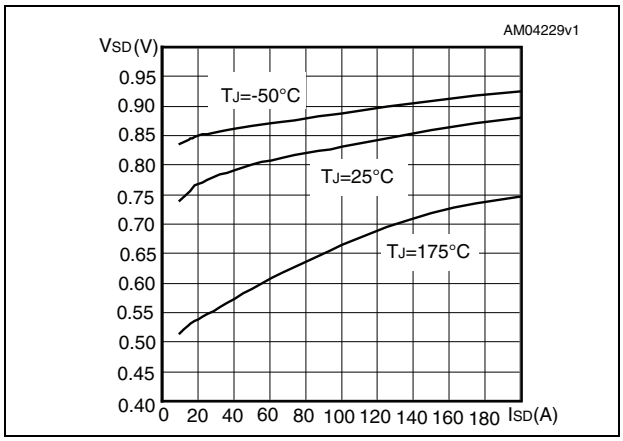


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

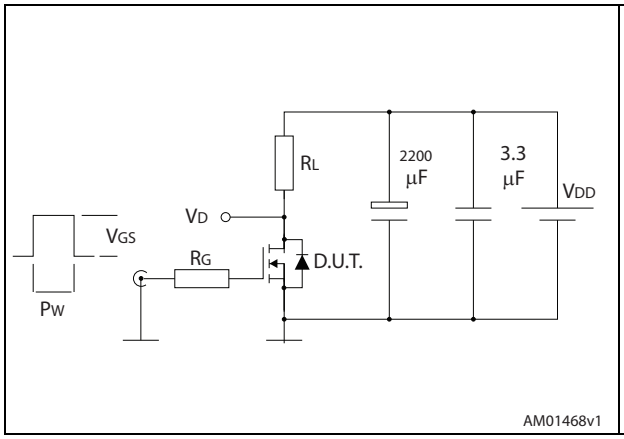


Figure 14. Gate charge test circuit

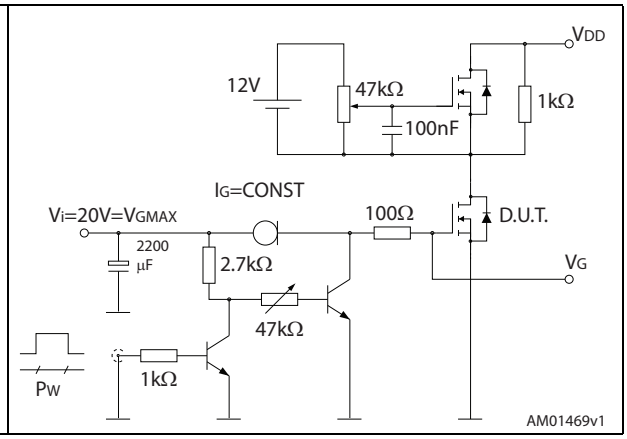


Figure 15. Test circuit for inductive load switching and diode recovery times

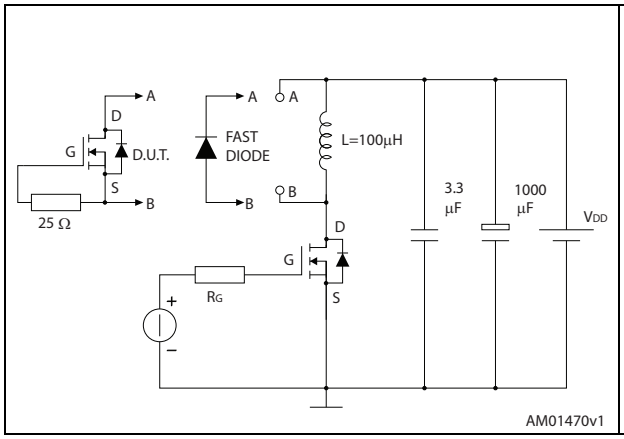


Figure 16. Unclamped inductive load test circuit

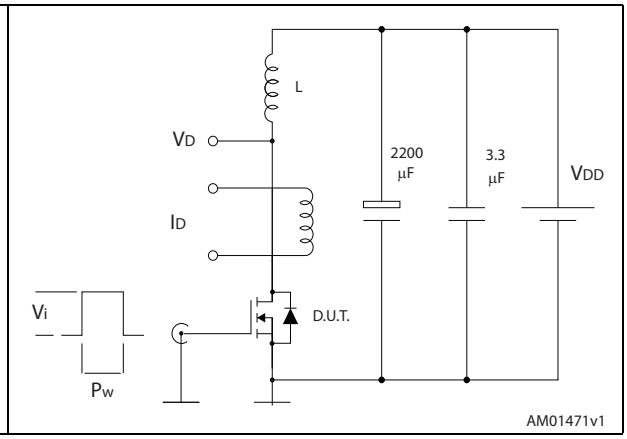


Figure 17. Unclamped inductive waveform

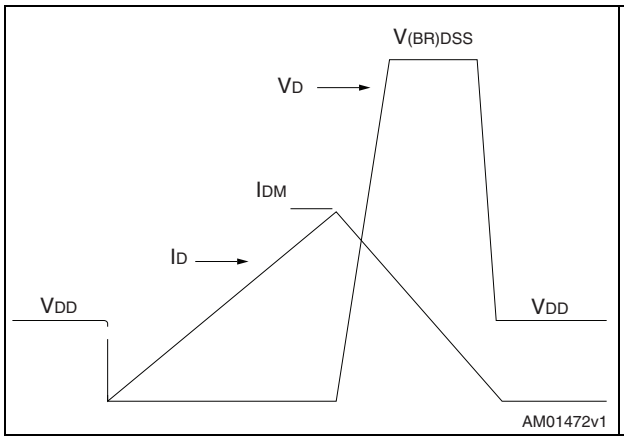
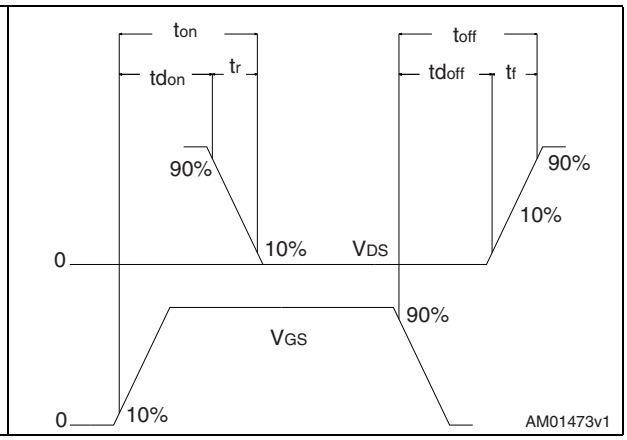


Figure 18. Switching time waveform



4 Package 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

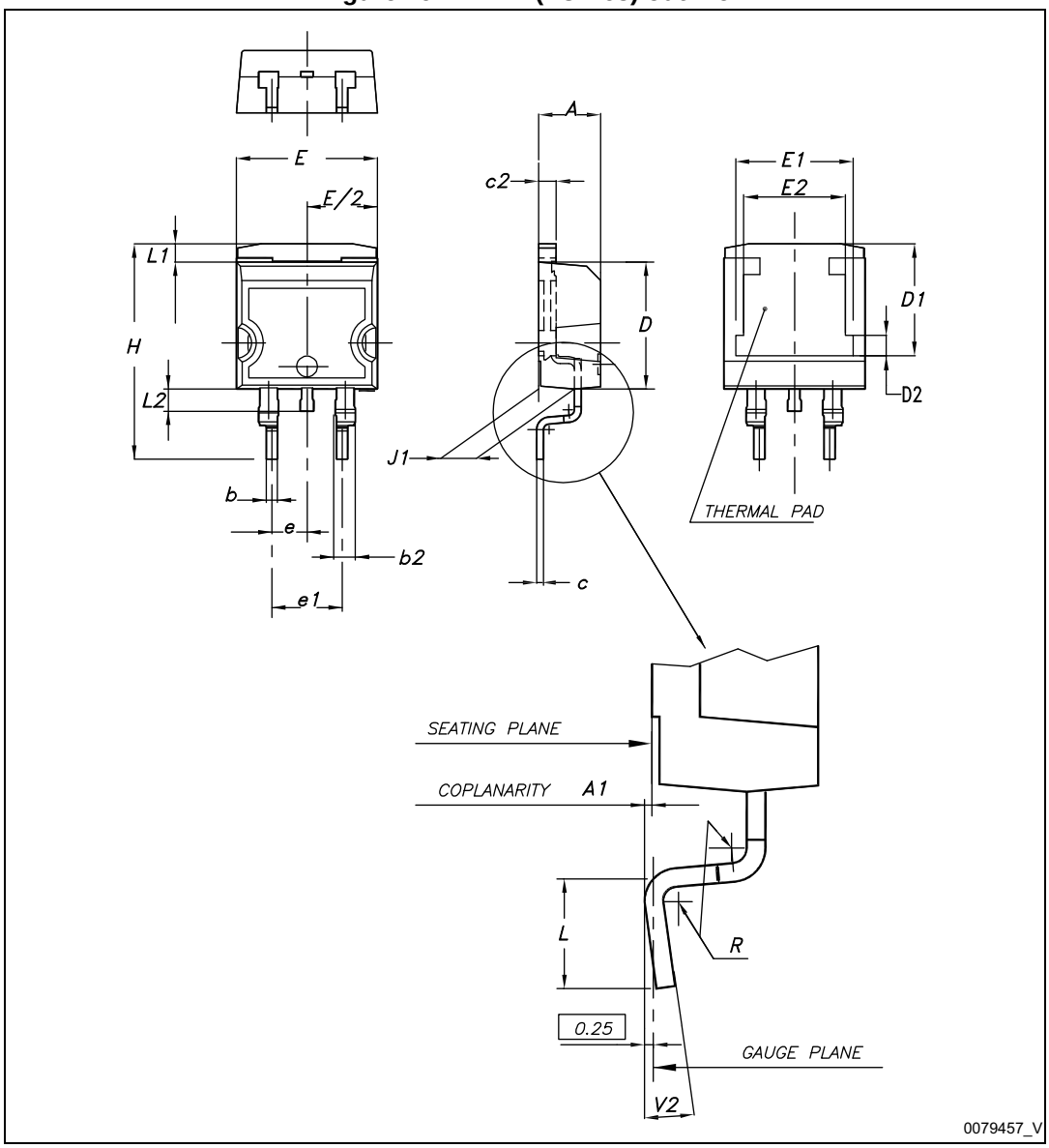
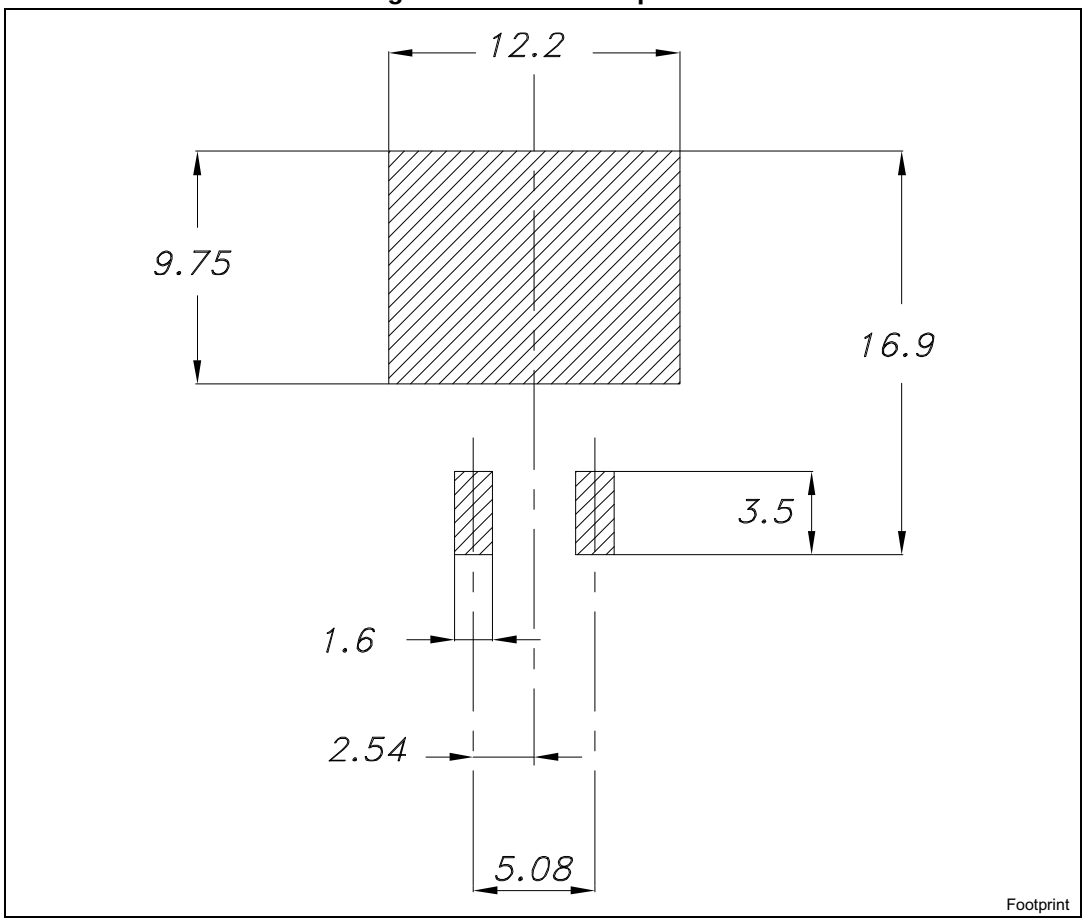


Table 8. D²PAK (TO-263) mechanical data

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

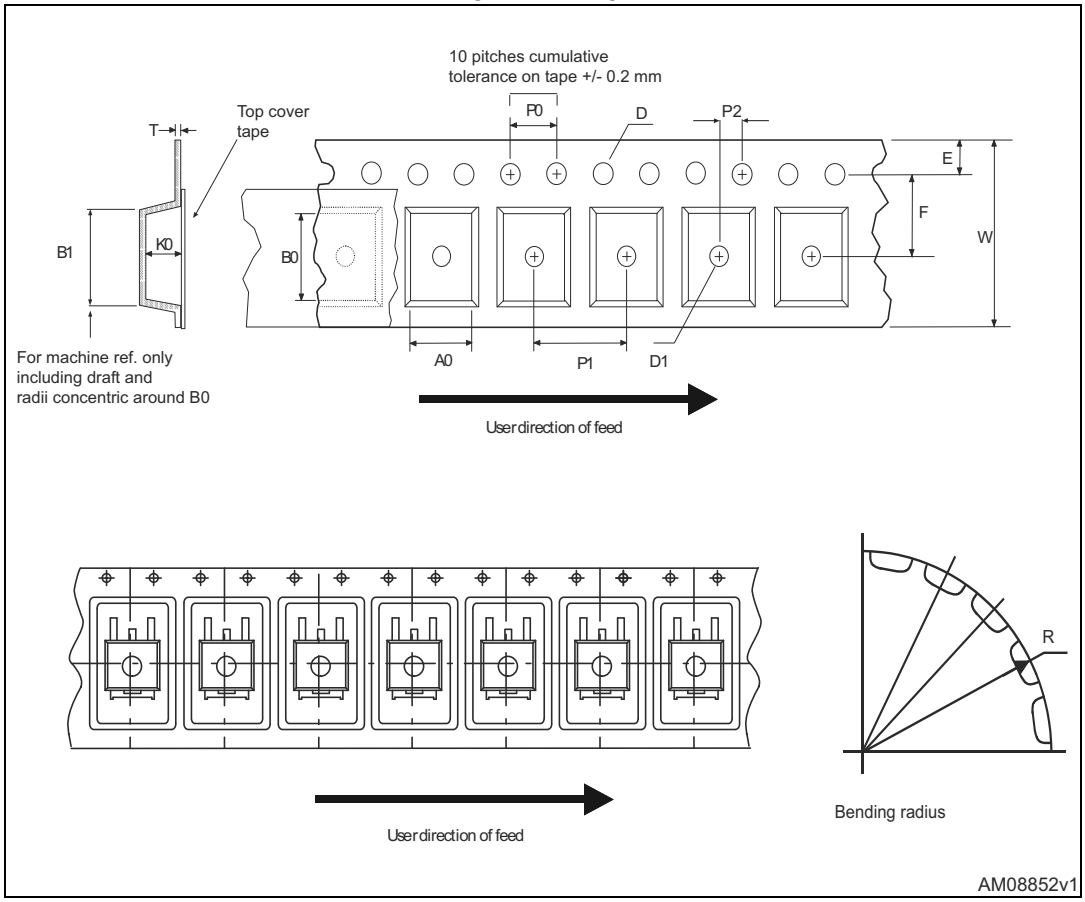


Figure 22. Reel

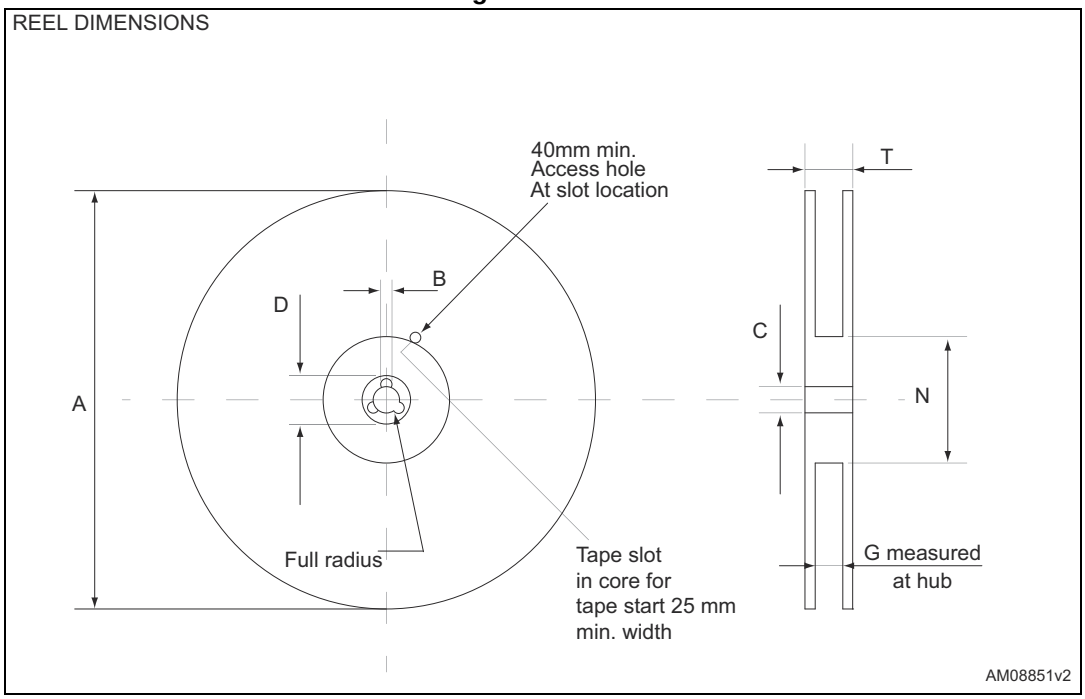


Table 9. D²PAK (TO-263) tape and reel mechanical data

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.