

## Automotive-grade N-Channel 40 V, 5.5 mΩ typ., 80 A STripFET™ F6 Power MOSFET in a D<sup>2</sup>PAK package

Datasheet - production data

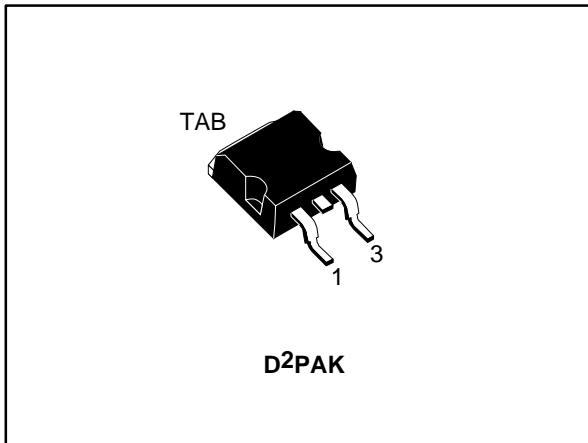


Figure 1: Internal schematic diagram

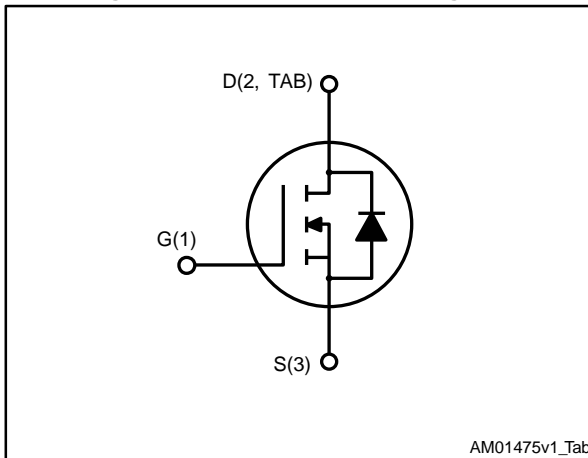


Table 1: Device summary

Order code	Marking	Package	Packaging
STB80N4F6AG	80N4F6	D <sup>2</sup> PAK	Tape and Reel

### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STB80N4F6AG	40 V	6 mΩ	80 A

- Designed for automotive applications and AEC-Q101 qualified
- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R<sub>DS(on)</sub> in all packages.

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source voltage	40	V
V <sub>GS</sub>	Gate-source voltage	± 20	V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	80	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	56	A
I <sub>DM</sub> <sup>(1)</sup>	Drain current (pulsed)	320	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	70	W
I <sub>AV</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>J</sub> max)	40	A
E <sub>AS</sub>	Single pulse avalanche energy (Starting T <sub>J</sub> = 25 °C, = I <sub>D</sub> = I <sub>AV</sub> , V <sub>DD</sub> = 25 V)	149	mJ
T <sub>stg</sub>	Storage temperature	- 55 to 175	°C
T <sub>j</sub>	Max. operating junction temperature	175	°C

**Notes:**

<sup>(1)</sup> Pulse width limited by safe operating area.

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case max.	2.14	°C/W
R <sub>thj-pcb</sub> <sup>(1)</sup>	Thermal resistance junction-ambient max.	35	°C/W

**Notes:**

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

## 2 Electrical characteristics

( $T_C = 25\text{ }^\circ\text{C}$  unless otherwise specified).

**Table 4: On/Off States**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$	40			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0\text{ V}$ )	$V_{DS} = 40\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 40\text{ V}$ $T_J = 125\text{ }^\circ\text{C}$			100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0\text{ V}$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	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	$V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$		5.5	6	m $\Omega$

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	2150	-	pF
$C_{oss}$	Output capacitance		-	335	-	pF
$C_{rss}$	Reverse transfer capacitance		-	160	-	pF
$Q_g$	Total gate charge	$V_{DD} = 20\text{ V}$ , $I_D = 80\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> )	-	36	-	nC
$Q_{gs}$	Gate-source charge		-	11	-	nC
$Q_{gd}$	Gate-drain charge		-	9	-	nC

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}$ , $I_D = 40\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	10.5	-	ns
$t_r$	Rise time		-	7.6	-	ns
$t_{d(off)}$	Turn-off-delay time		-	46.1	-	ns
$t_f$	Fall time		-	11.9	-	ns

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source drain current				80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}= 40\text{ A}$ , $V_{GS}= 0\text{ V}$			1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD}= 80\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD}= 32\text{ V}$ (See <a href="#">Figure 17: "Unclamped inductive waveform"</a> )		41.1		ns
$Q_{RR}$	Reverse recovery charge			43.6		nC
$I_{RRM}$	Reverse recovery current			2.1		A

**Notes:**

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

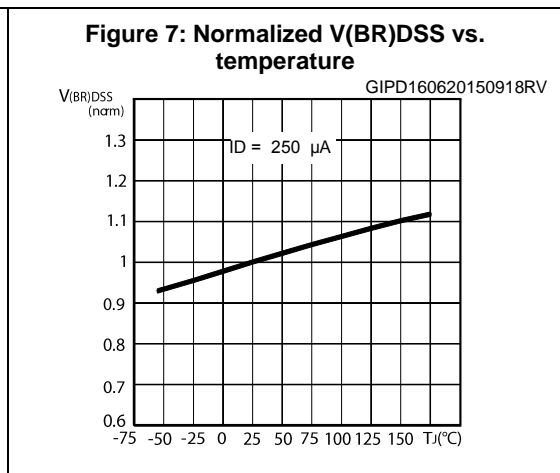
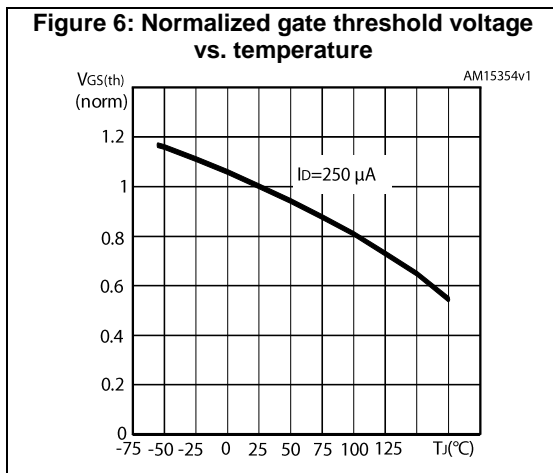
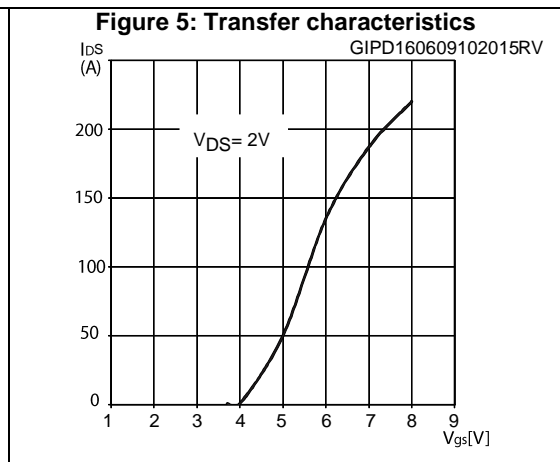
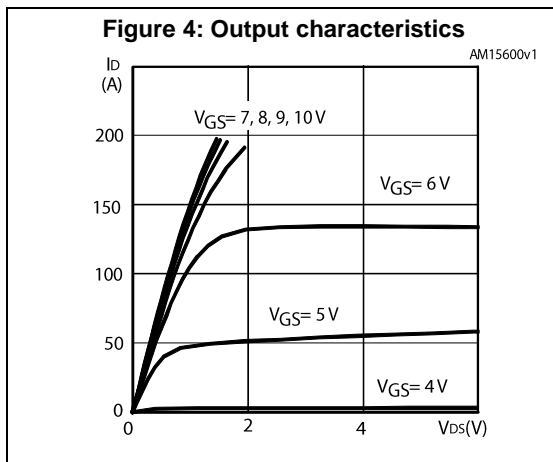
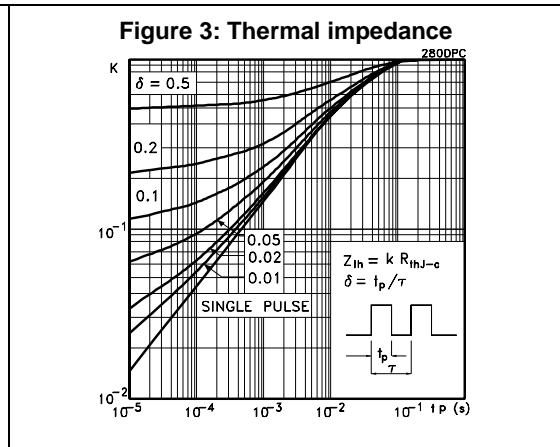
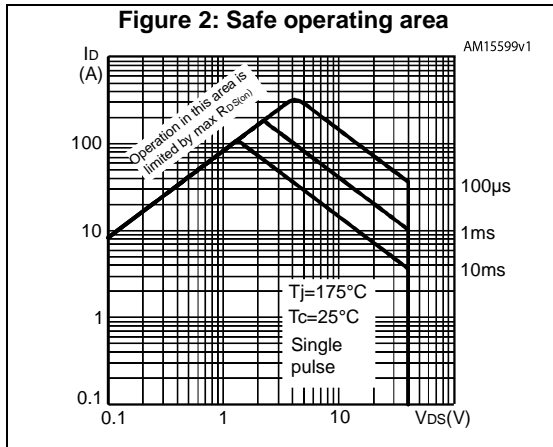


Figure 8: Static drain-source on-resistance

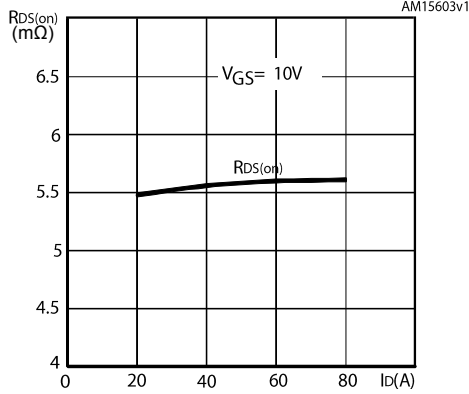


Figure 9: Normalized on-resistance vs. temperature

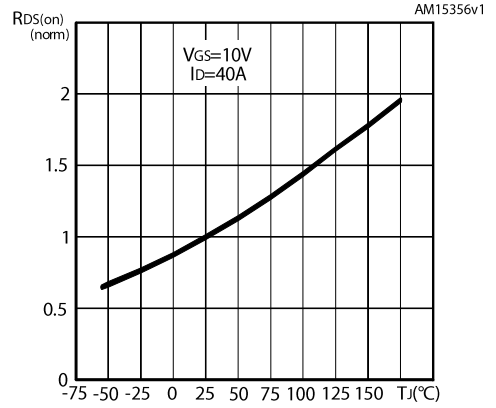


Figure 10: Gate charge vs. gate-source voltage

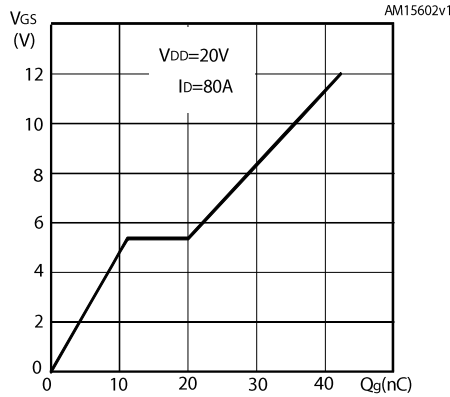


Figure 11: Capacitance variations

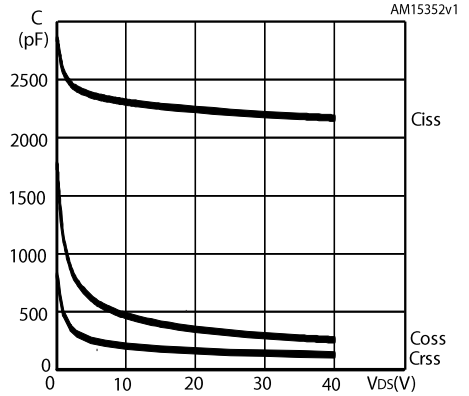
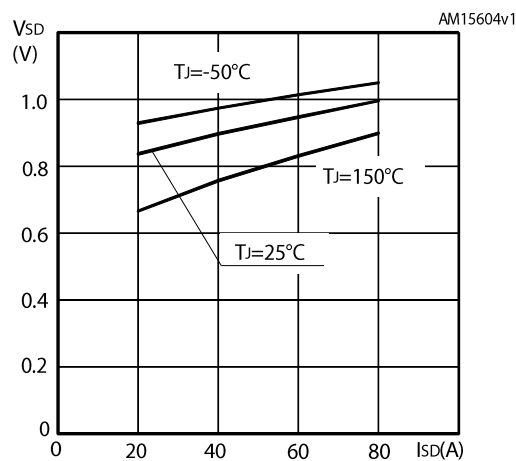
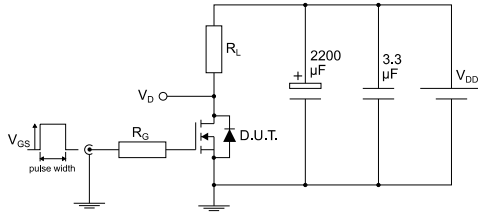


Figure 12: Source-drain diode forward characteristics



### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



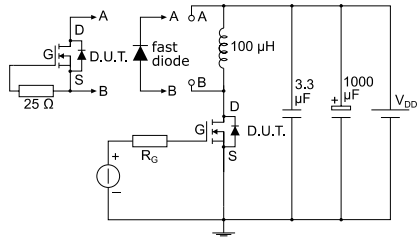
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**Figure 14: Test circuit for gate charge behavior**



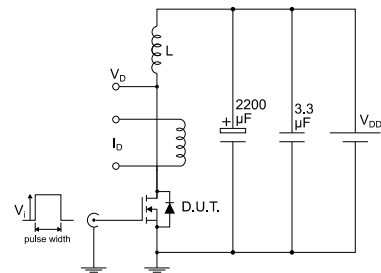
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



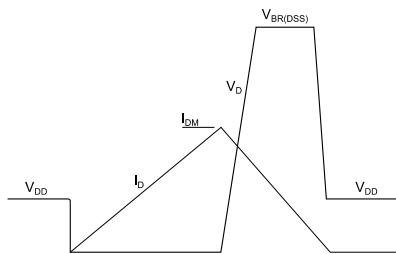
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**Figure 16: Unclamped inductive load test circuit**



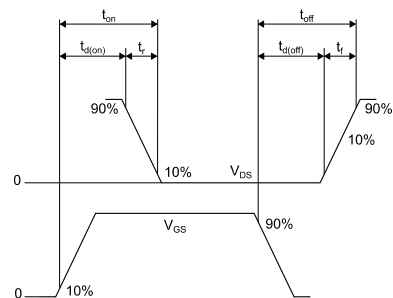
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**Figure 17: Unclamped inductive waveform**



AM01472v1

**Figure 18: Switching time waveform**



AM01473v1



## 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.

### 4.1 D<sup>2</sup>PAK package information

Figure 19: D<sup>2</sup>PAK (TO-263) type A package outline

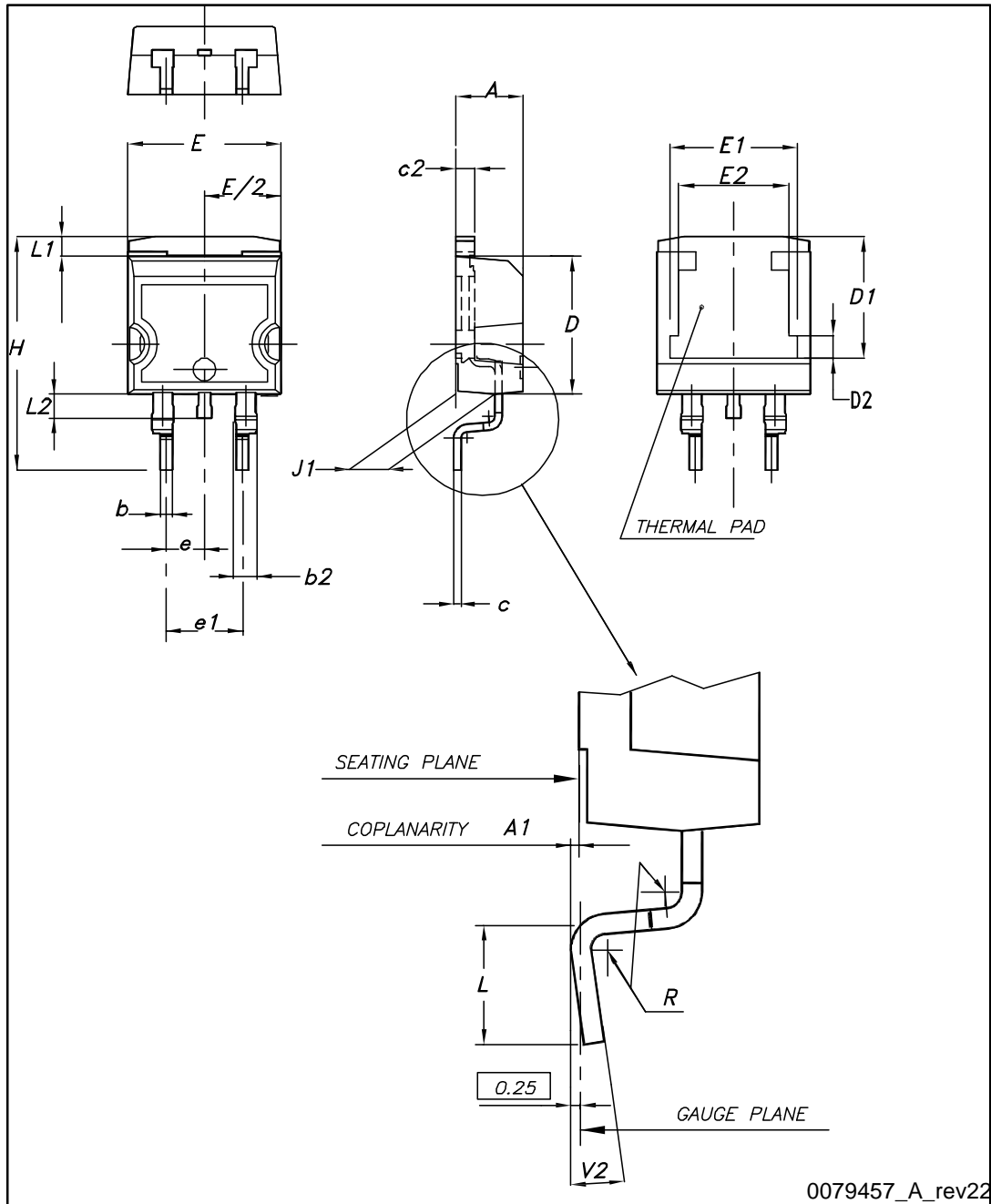
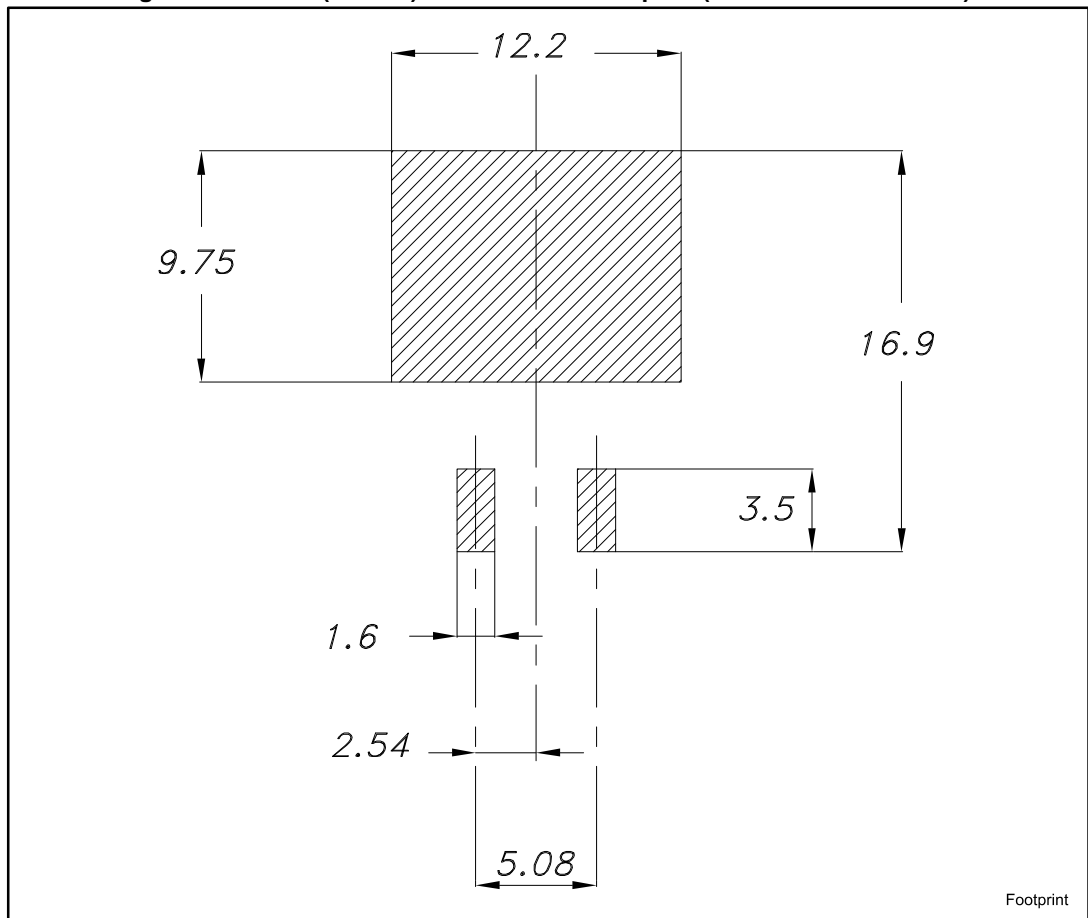


Table 8: D<sup>2</sup>PAK (TO-263) type A package mechanical data

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: D<sup>2</sup>PAK (TO-263) recommended footprint (dimensions are in mm)



Footprint

### 4.2 D<sup>2</sup>PAK packing information

Figure 21: Tape outline

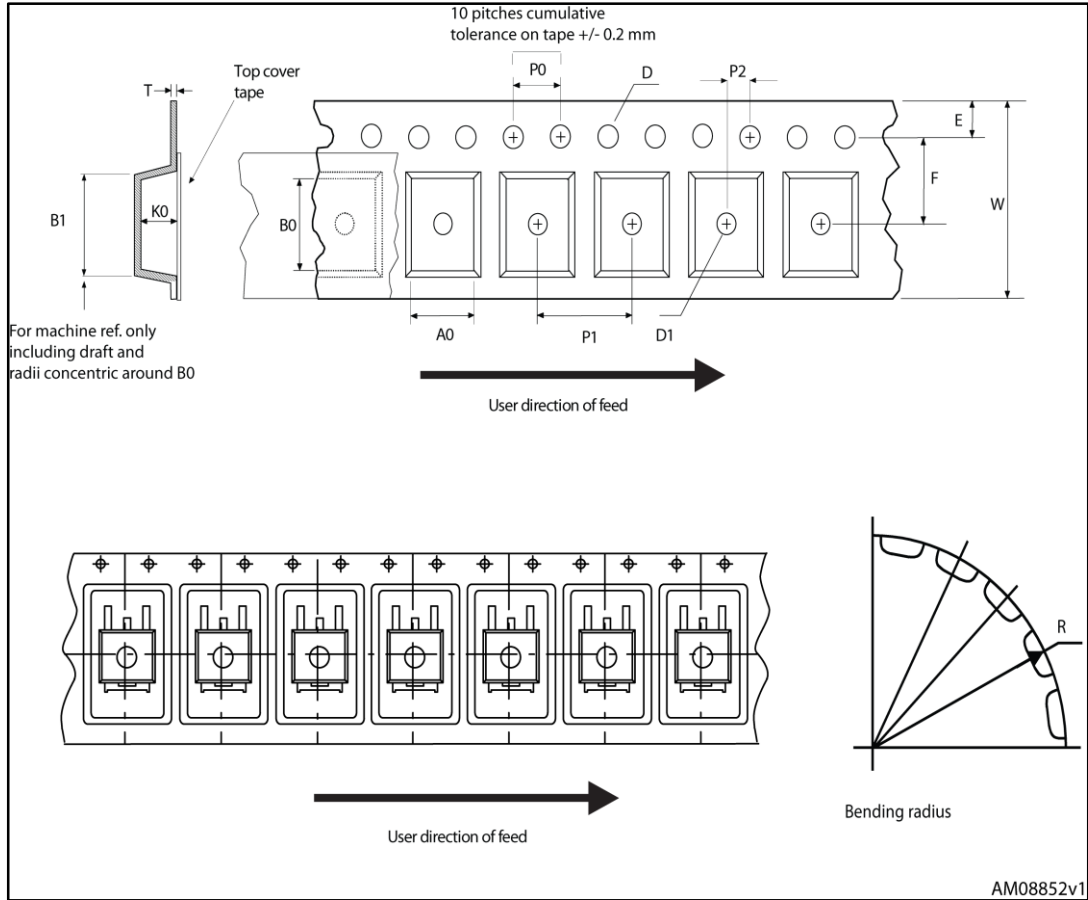
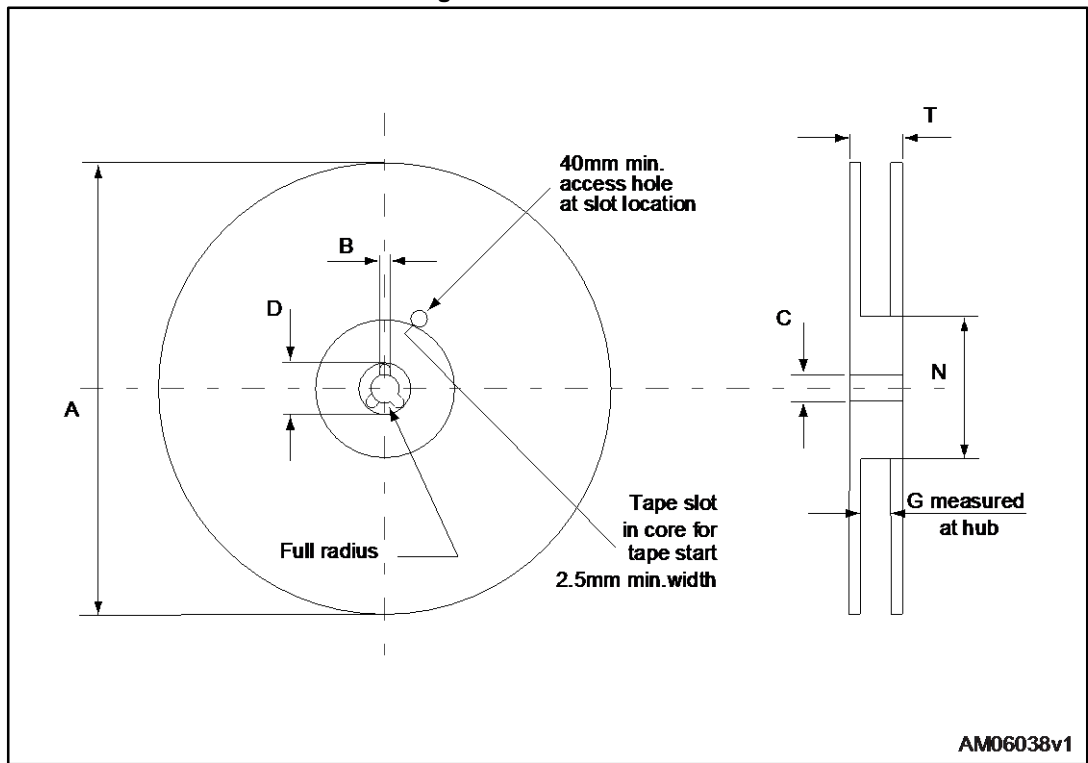


Figure 22: Reel outline



AM06038v1

Table 9: D<sup>2</sup>PAK 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 quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

## 5 Revision history

Table 10: Document revision history

Date	Revision	Changes
16-Jun-2015	1	Initial release
18-Nov-2015	2	Document status promoted from preliminary to production data. Updated title and features in cover page.

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