

## Automotive-grade N-channel 200 V, 0.066 $\Omega$ typ., 30 A, STripFET™ Power MOSFET in D<sup>2</sup>PAK package

Datasheet - production data

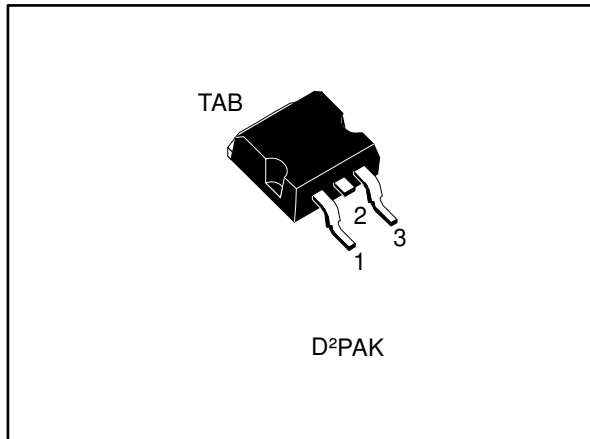
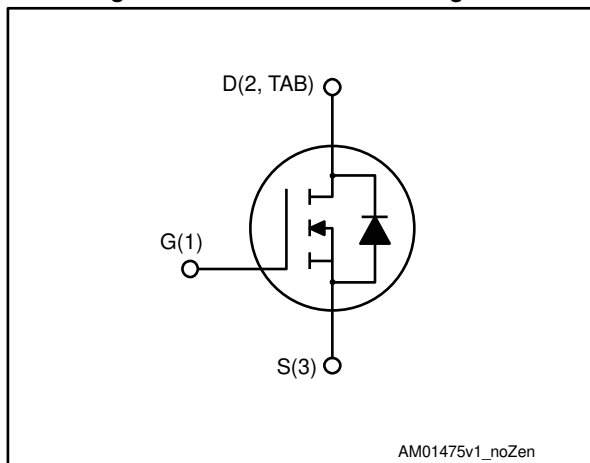


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STB30NF20L	200 V	0.075 $\Omega$	30 A	150 W

- AEC-Q101 qualified
- Gate charge minimized
- 100% avalanche tested
- Excellent FoM (figure of merit)
- Very low intrinsic capacitance



### Applications

- Switching applications

### Description

This N-channel enhancement mode Power MOSFET benefits from the latest refinement of STMicroelectronics' unique "single feature size" strip-based process, which decreases the critical alignment steps to offer exceptional manufacturing reproducibility. The result is a transistor with extremely high packing density for low on-resistance, rugged avalanche characteristics and low gate charge.

Table 1: Device summary

Order code	Marking	Package	Packaging
STB30NF20L	30NF20L	D <sup>2</sup> 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	200	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	30	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	19	A
$I_{DM}^{(1)}$	Drain current (pulsed)	120	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	10	V/ns
$T_{stg}$	Storage temperature range	- 55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature range		

**Notes:**

(1) Pulse width is limited by safe operating area.

(2)  $I_{SD} \leq 30\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case	1	$^\circ\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance junction-ambient	62.5	$^\circ\text{C}/\text{W}$

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax.}$ )	30	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	140	mJ

## 2 Electrical characteristics

(T<sub>CASE</sub> = 25 °C unless otherwise specified)

**Table 5: On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0 V	200			V
I <sub>DSS</sub>	Zero gate voltage drain current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 200 V			1	μA
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 200 V, T <sub>C</sub> = 125 °C <sup>(1)</sup>			10	μA
I <sub>GSS</sub>	Gate source leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	μA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1	2	3	V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 5 V, I <sub>D</sub> = 15 A		0.066	0.075	Ω

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0 V	-	1990	-	pF
C <sub>oss</sub>	Output capacitance		-	297	-	pF
C <sub>rss</sub>	Reverse transfer capacitance		-	42	-	pF
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 160 V, I <sub>D</sub> = 30 A, V <sub>GS</sub> = 0 to 10 V (see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> )	-	65	-	nC
Q <sub>gs</sub>	Gate-source charge		-	7	-	nC
Q <sub>gd</sub>	Gate-drain charge		-	21	-	nC

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 100\text{ V}$ , $I_D = 15\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 13</a> : "Test circuit for resistive load switching times" and <a href="#">Figure 18</a> : "Switching time waveform")	-	14	-	ns
$t_r$	Rise time		-	12	-	ns
$t_{d(off)}$	Turn-off delay time		-	68	-	ns
$t_f$	Fall time		-	14	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current	$V_{SD} = 1.5\text{ V}$	-		30	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		120	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 30\text{ A}$ , $V_{GS} = 0\text{ V}$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 30\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see <a href="#">Figure 15</a> : "Test circuit for inductive load switching and diode recovery times")	-	140		ns
$Q_{rr}$	Reverse recovery charge		-	0.75		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	13		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 30\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 15</a> : "Test circuit for inductive load switching and diode recovery times")	-	170		ns
$Q_{rr}$	Reverse recovery charge		-	1.1		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	14		A

**Notes:**

(1)Pulse width is limited by safe operating area.

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

## 2.1 Electrical characteristics (curves)

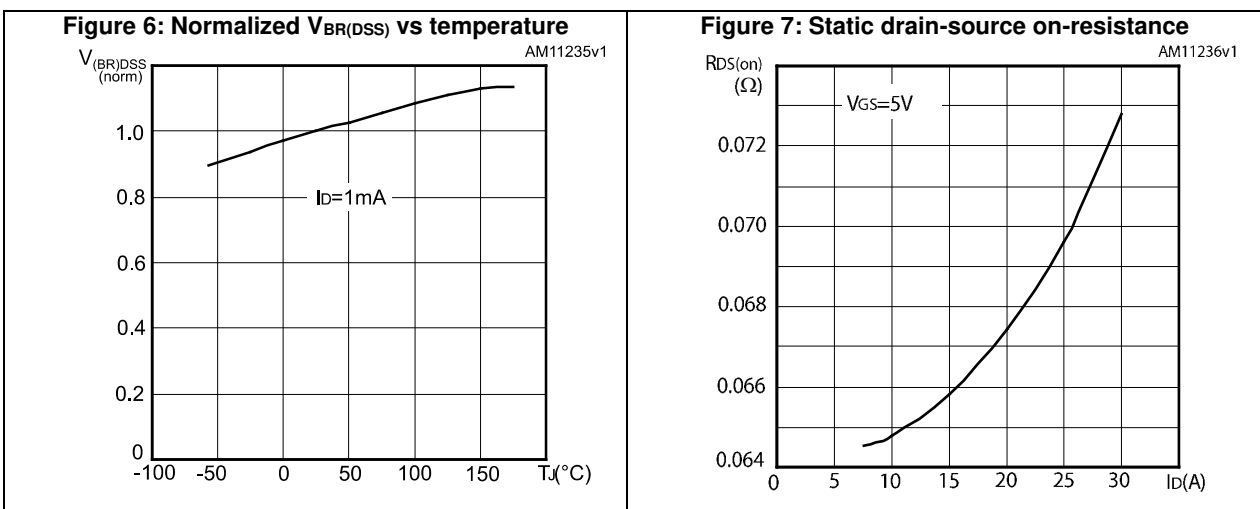
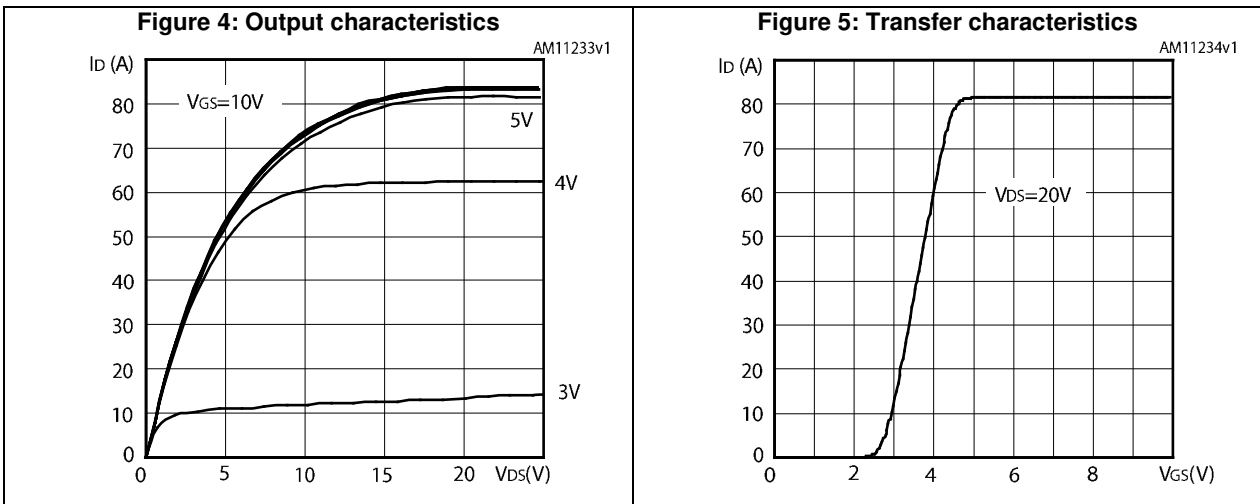
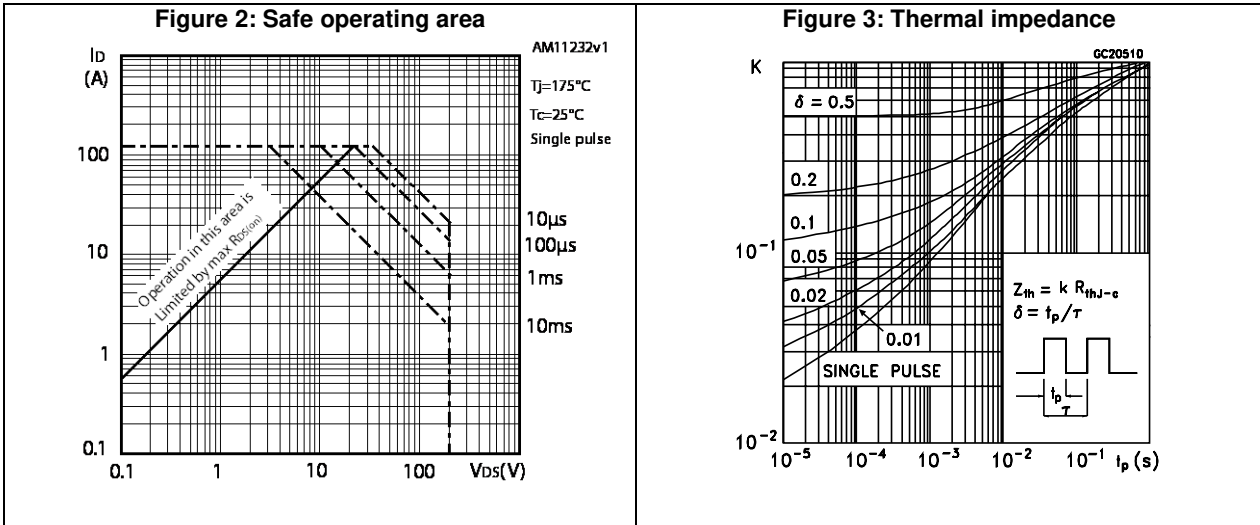


Figure 8: Gate charge vs gate-source voltage

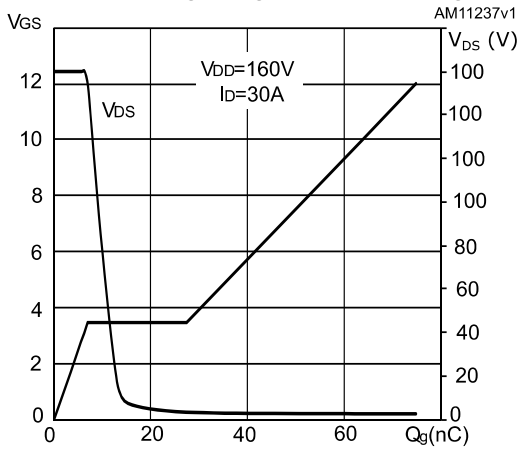


Figure 9: Capacitance variations

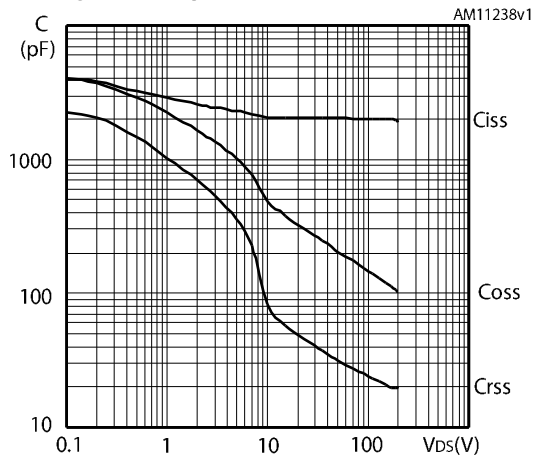


Figure 10: Normalized gate threshold voltage vs temperature

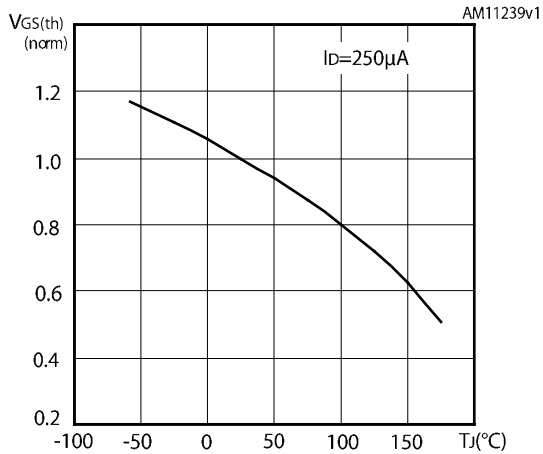


Figure 11: Normalized on-resistance vs temperature

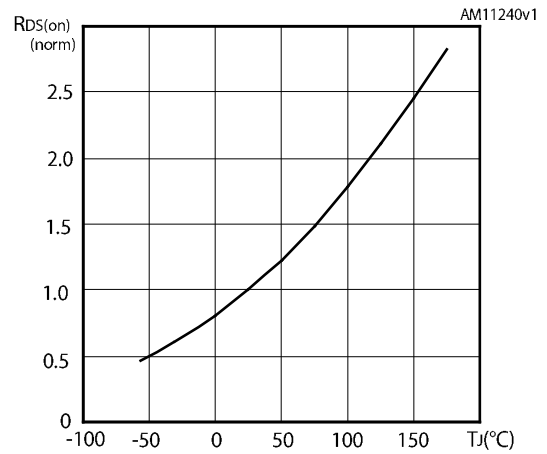
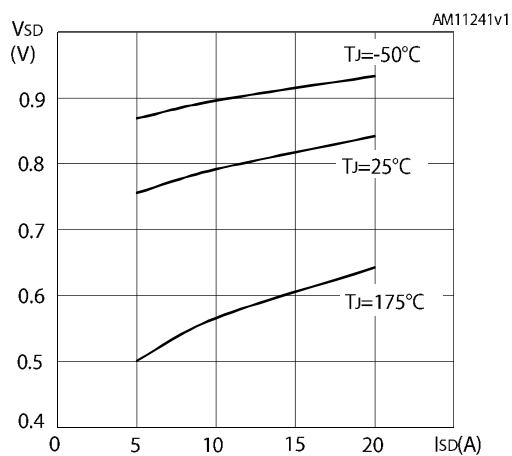
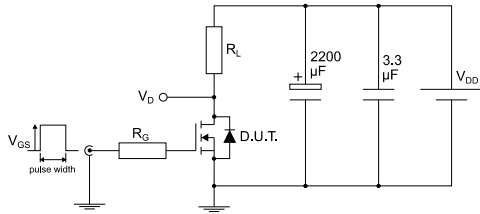


Figure 12: Source-drain diode forward characteristics



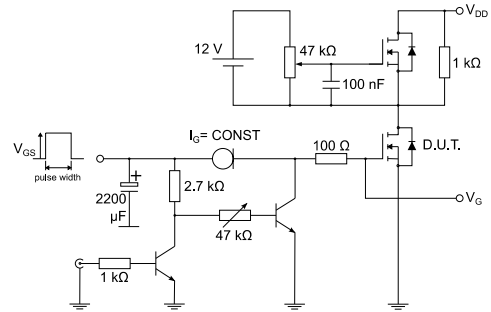
### 3 Test circuits

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



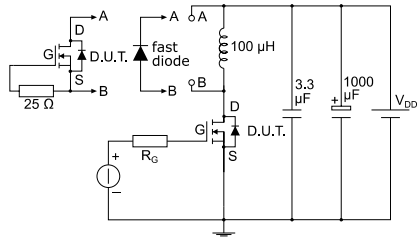
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**Figure 14: Test circuit for gate charge behavior**



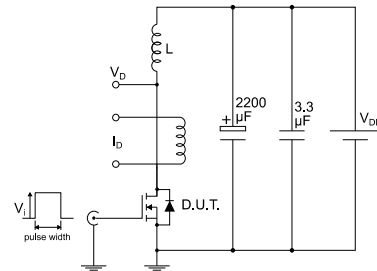
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



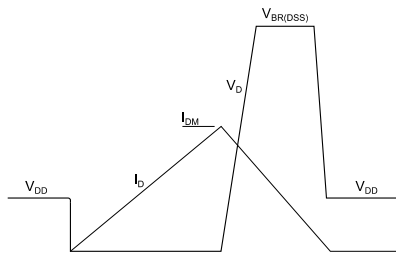
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**Figure 16: Unclamped inductive load test circuit**



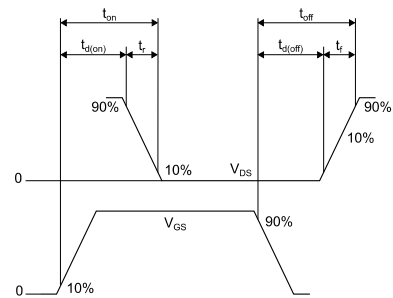
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**Figure 17: Unclamped inductive waveform**



AM01472v1

**Figure 18: Switching time waveform**



AM01473v1



## 4 Package 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](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

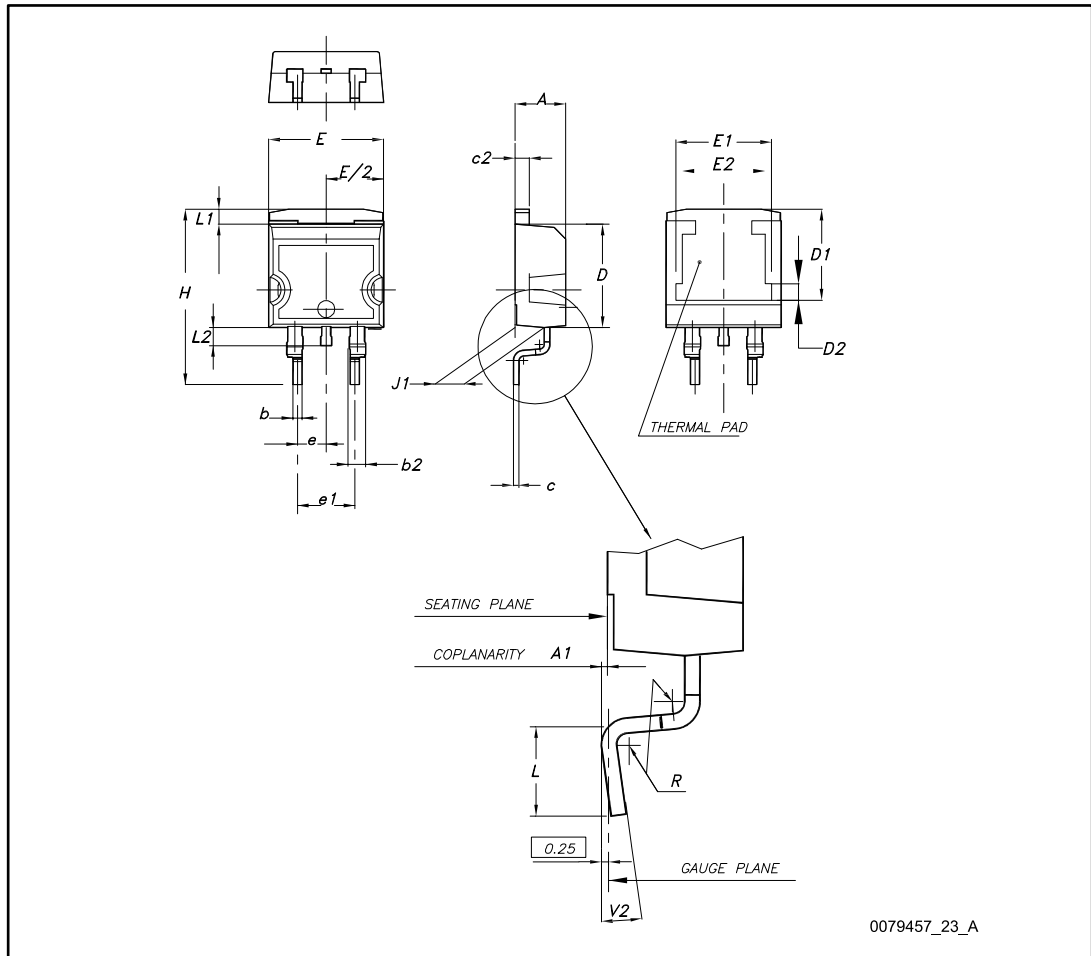
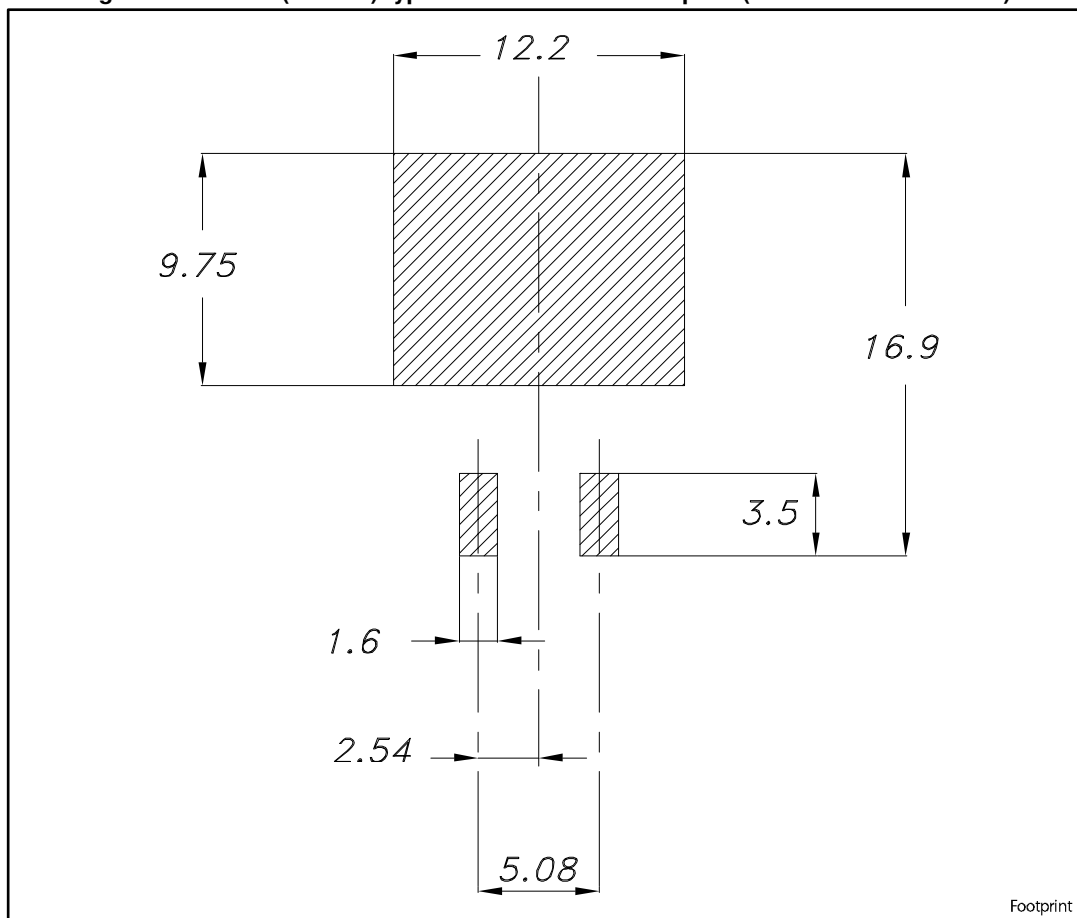


Table 9: D<sup>2</sup>PAK (TO-263) type A package mechanical data

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	10.00		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	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 20: D<sup>2</sup>PAK (TO-263) type A recommended footprint (dimensions are in mm)



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

Figure 21: D<sup>2</sup>PAK type A tape outline

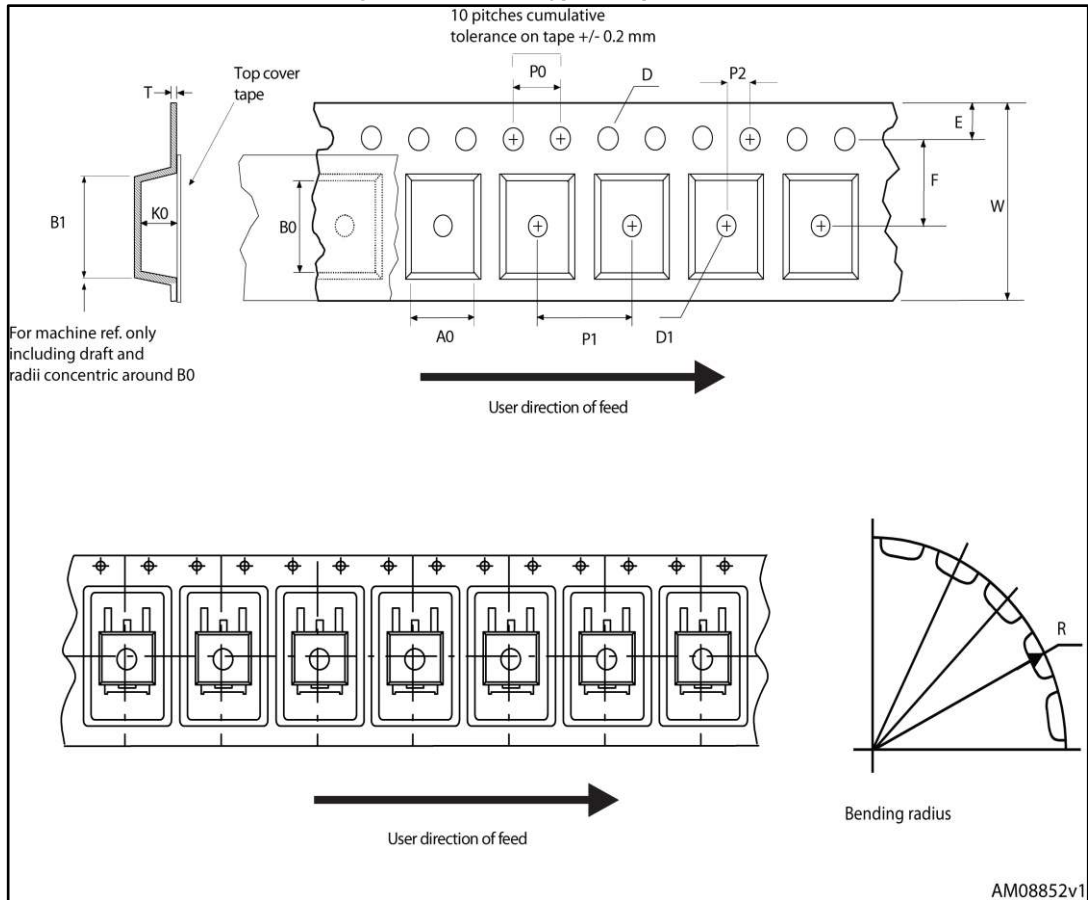


Figure 22: D<sup>2</sup>PAK type A reel outline

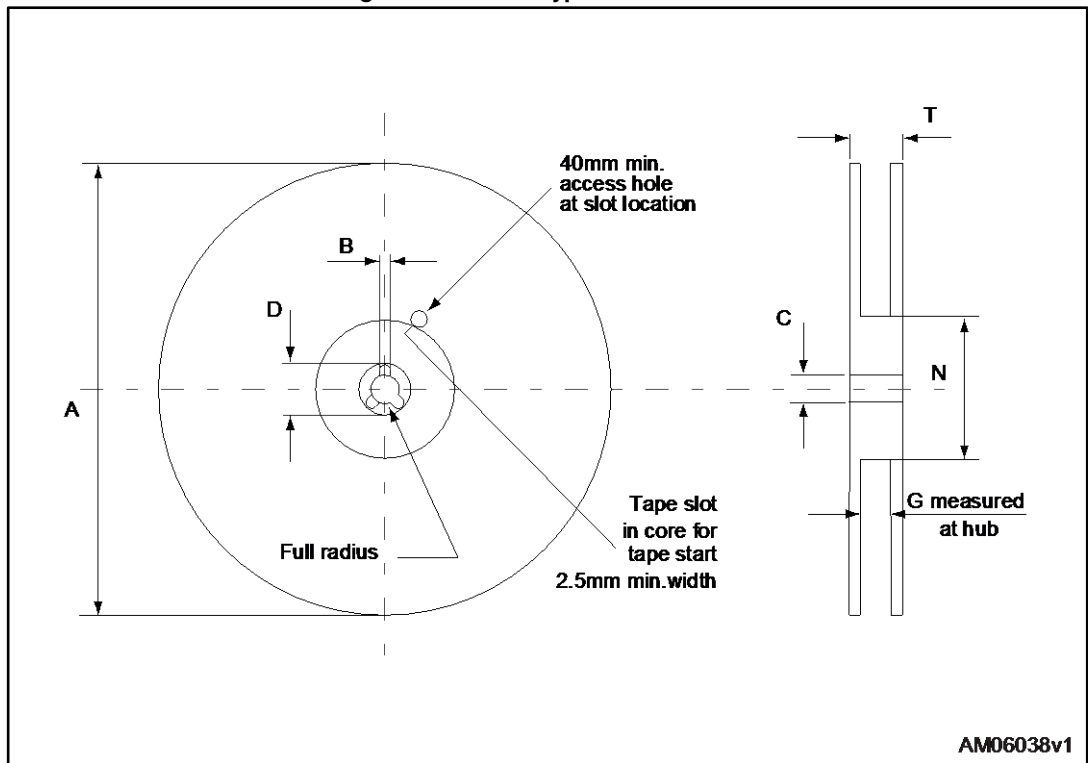


Table 10: D<sup>2</sup>PAK type A tape and reel mechanical data

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 11: Document revision history

Date	Revision	Changes
01-Feb-2012	1	First release
07-Mar-2012	2	$P_{TOT}$ in cover page and in <i>Table 2</i> has been updated. <i>Figure 2</i> , <i>Figure 6</i> , <i>Figure 10</i> and <i>Figure 11</i> have been updated.
02-Mar-2017	3	Updated title and features on cover page. Updated <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 5: "On/off states"</i> and <i>Figure 3: "Thermal impedance"</i> . Minor text changes

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