

## N-channel 800 V, 0.400 $\Omega$ typ., 12 A MDmesh™ K5 Power MOSFET in a D<sup>2</sup>PAK package

Datasheet - production data

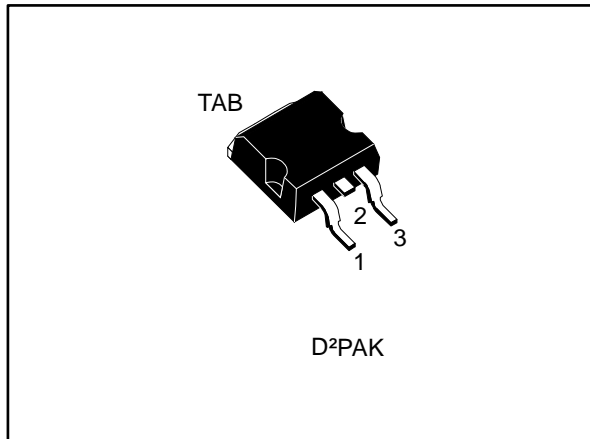
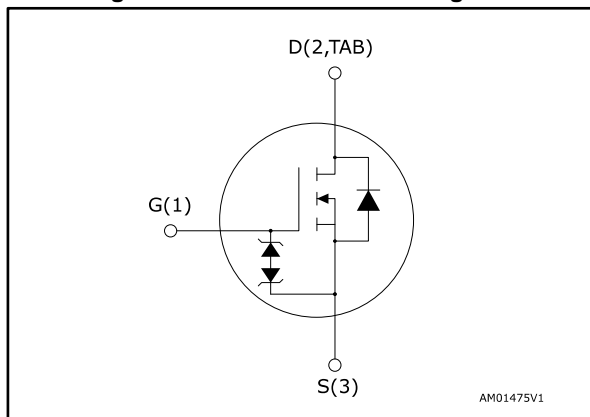


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STB14N80K5	800 V	0.445 $\Omega$	12 A

- Industry's lowest R<sub>DS(on)</sub> x area
- Industry's best figure of merit (FoM)
- Ultra-low gate charge
- 100% avalanche tested
- Zener-protected

### Applications

- Switching applications

### Description

This very high voltage N-channel Power MOSFET is designed using MDmesh™ K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.

Table 1: Device summary

Order code	Marking	Package	Packing
STB14N80K5	14N80K5	D <sup>2</sup> PAK	Tape and reel

---

## Contents

<b>1</b>	<b>Electrical ratings .....</b>	<b>3</b>
<b>2</b>	<b>Electrical characteristics .....</b>	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits .....</b>	<b>9</b>
<b>4</b>	<b>Package information .....</b>	<b>10</b>
	4.1 D2PAK (TO-263) type A package information.....	10
	4.2 D2PAK (TO-263) packing information.....	13
<b>5</b>	<b>Revision history .....</b>	<b>15</b>

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 30$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	12	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	7.4	A
$I_D^{(1)}$	Drain current (pulsed)	48	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	130	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	50	
$T_{stg}$	Storage temperature range	- 55 to 150	$^\circ\text{C}$
$T_J$	Operating junction temperature range		

**Notes:**

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

<sup>(2)</sup> $I_{SD} \leq 12\text{ A}$ ,  $di/dt \leq 100\text{ A}/\mu\text{s}$ ;  $V_{DS(\text{peak})} < V_{(BR)DSS}$ ,  $V_{DD} = 640\text{ V}$

<sup>(3)</sup> $V_{DS} \leq 640\text{ V}$

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj\text{-case}}$	Thermal resistance junction-case	0.96	$^\circ\text{C}/\text{W}$
$R_{thj\text{-pcb}}^{(1)}$	Thermal resistance junction-pcb	30	$^\circ\text{C}/\text{W}$

**Notes:**

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

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{j\text{max}}$ )	4	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	270	mJ

## 2 Electrical characteristics

$T_C = 25\text{ °C}$  unless otherwise specified

**Table 5: On/off-state**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	800			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 800\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 800\text{ V}$ $T_C = 125\text{ °C}$ <sup>(1)</sup>			50	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 6\text{ A}$		0.400	0.445	$\Omega$

**Notes:**

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

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	620	-	pF
$C_{oss}$	Output capacitance		-	60	-	pF
$C_{rss}$	Reverse transfer capacitance		-	0.8	-	pF
$C_{o(tr)}$ <sup>(1)</sup>	Equivalent capacitance time related	$V_{DS} = 0\text{ to }640\text{ V}$ , $V_{GS} = 0\text{ V}$	-	107	-	pF
$C_{o(er)}$ <sup>(2)</sup>	Equivalent capacitance energy related		-	39	-	pF
$R_g$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	6.5	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 640\text{ V}$ , $I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 16: "Test circuit for gate charge behavior"</a> )	-	22	-	nC
$Q_{gs}$	Gate-source charge		-	4.3	-	nC
$Q_{gd}$	Gate-drain charge		-	16.5	-	nC

**Notes:**

<sup>(1)</sup> Time related is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

<sup>(2)</sup> Energy related is defined as a constant equivalent capacitance giving the same stored energy as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$ , $I_D = 6\text{ A}$ , $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ see ( <i>Figure 15: "Test circuit for resistive load switching times"</i> and <i>Figure 20: "Switching time waveform"</i> )	-	12.5	-	ns
$t_r$	Rise time		-	8	-	ns
$t_{d(off)}$	Turn-off delay time		-	33	-	ns
$t_f$	Fall time		-	10	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		48	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12\text{ A}$ , $V_{GS} = 0\text{ V}$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ (see <i>Figure 17: "Test circuit for inductive load switching and diode recovery times"</i> )	-	365		ns
$Q_{rr}$	Reverse recovery charge		-	4.77		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	26		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <i>Figure 17: "Test circuit for inductive load switching and diode recovery times"</i> )	-	485		ns
$Q_{rr}$	Reverse recovery charge		-	5.85		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	24		A

**Notes:**<sup>(1)</sup>Pulse width limited by safe operating area<sup>(2)</sup>Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

Table 9: Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	$I_{GS} = \pm 1\text{ mA}$ , $I_D = 0\text{ A}$	30	-	-	V

The built-in back-to-back Zener diodes are specifically designed to enhance the ESD performance of the device. The Zener voltage facilitates efficient and cost-effective device integrity protection, thus eliminating the need for additional external componentry.

## 2.2 Electrical characteristics (curves)

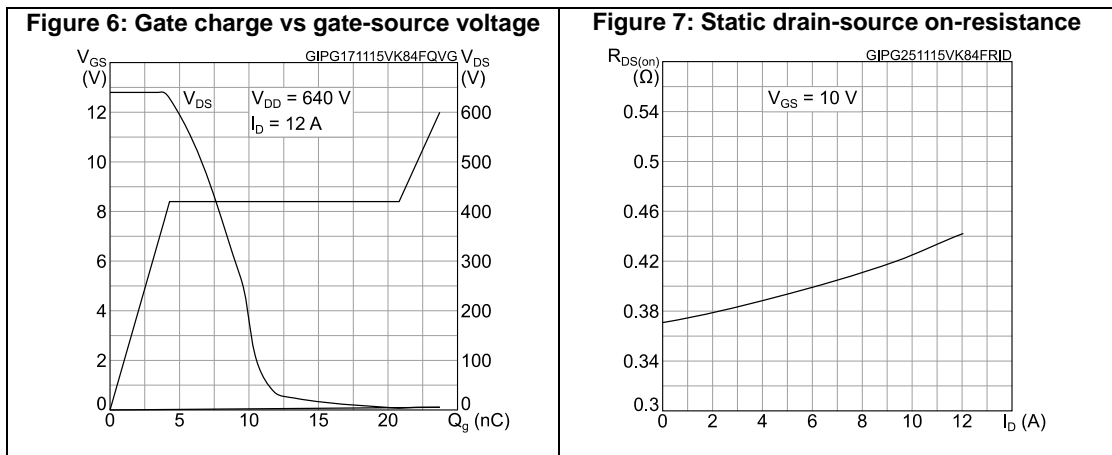
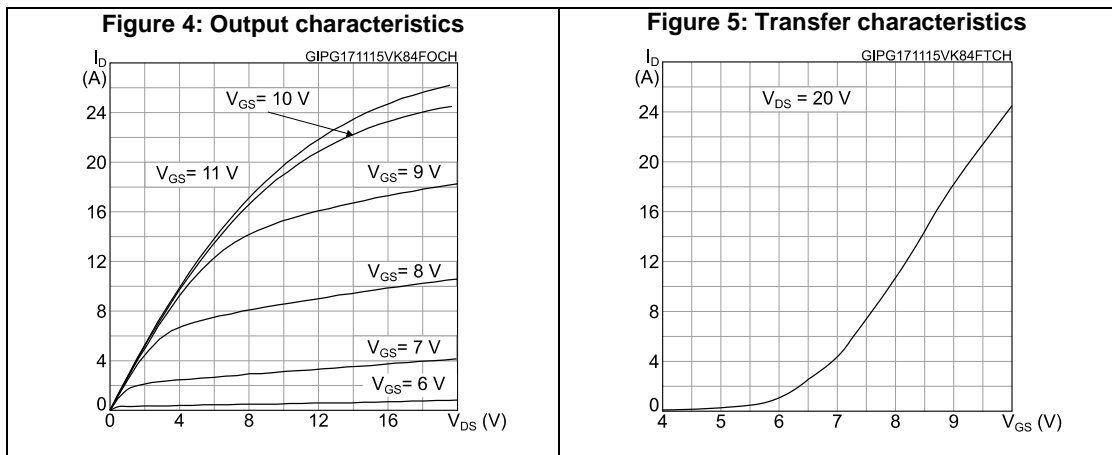
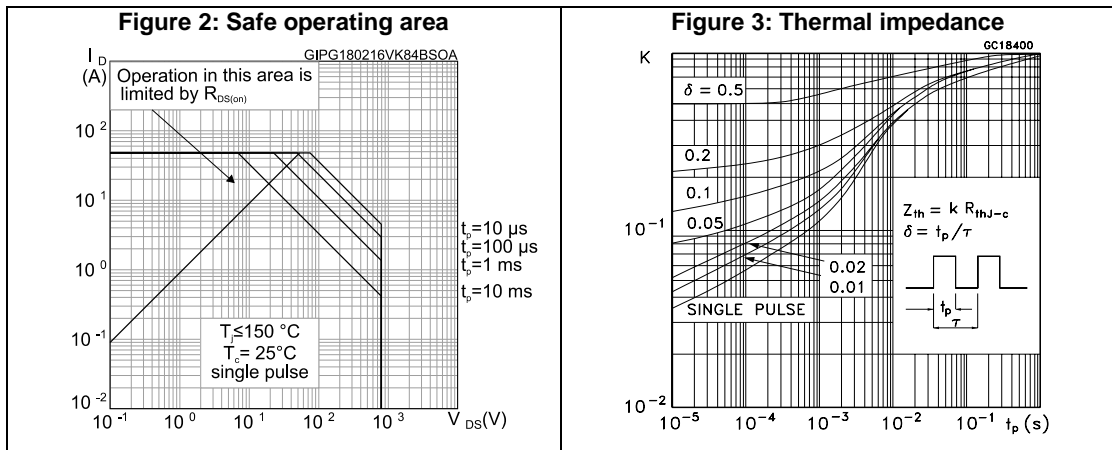


Figure 8: Capacitance variations

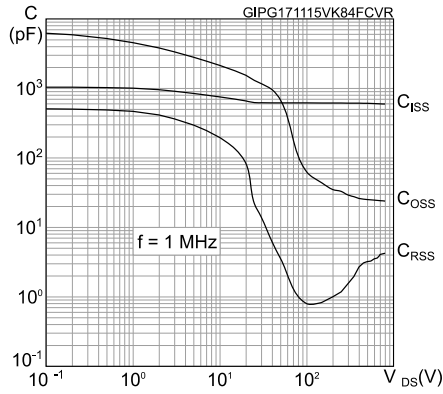


Figure 9: Normalized gate threshold voltage vs temperature

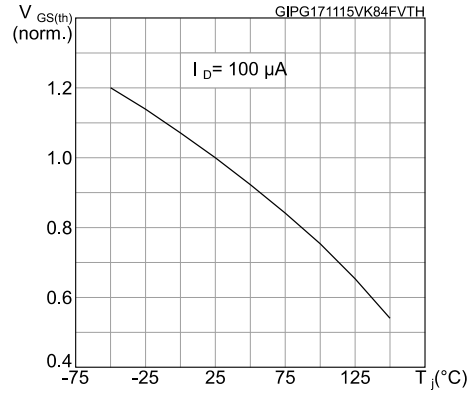


Figure 10: Normalized on-resistance vs temperature

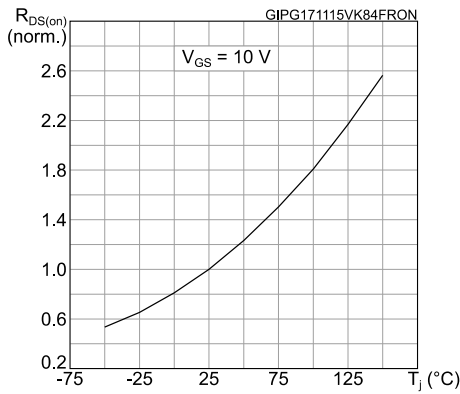


Figure 11: Normalized  $V_{(BR)DSS}$  vs temperature

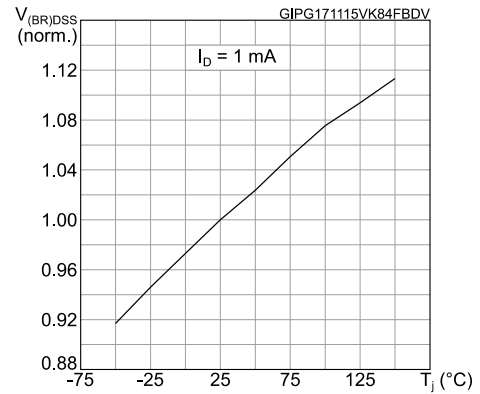


Figure 12: Maximum avalanche energy vs starting  $T_J$

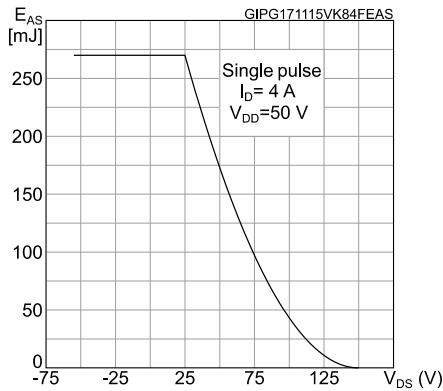


Figure 13: Source-drain diode forward characteristics

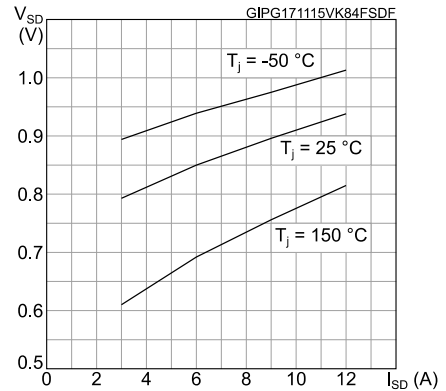
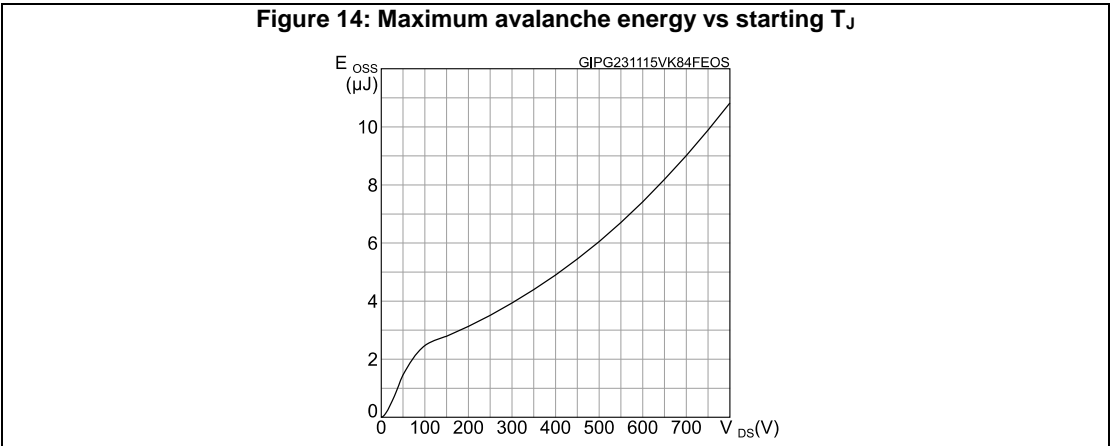


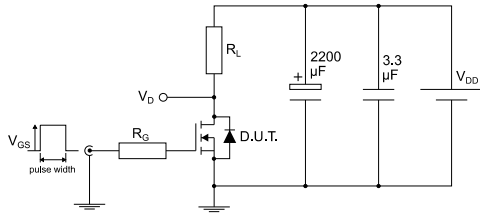
Figure 14: Maximum avalanche energy vs starting  $T_J$





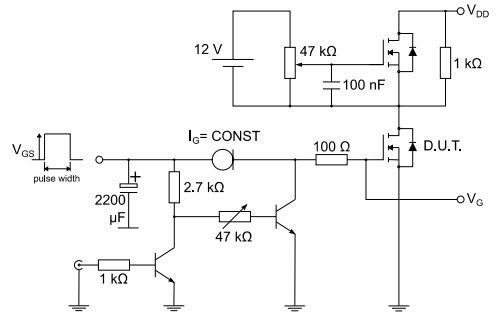
### 3 Test circuits

**Figure 15: Test circuit for resistive load switching times**



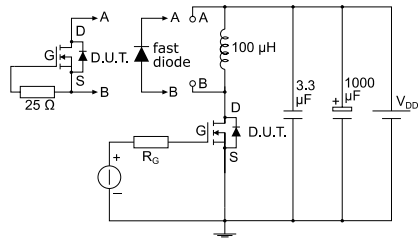
AM01468v1

**Figure 16: Test circuit for gate charge behavior**



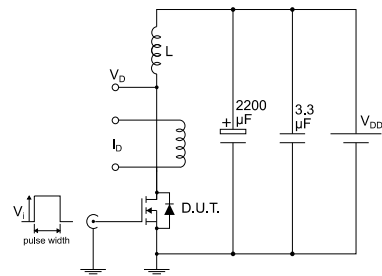
AM01469v1

**Figure 17: Test circuit for inductive load switching and diode recovery times**



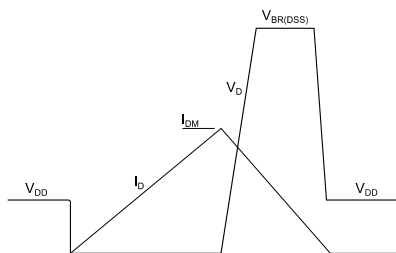
AM01470v1

**Figure 18: Unclamped inductive load test circuit**



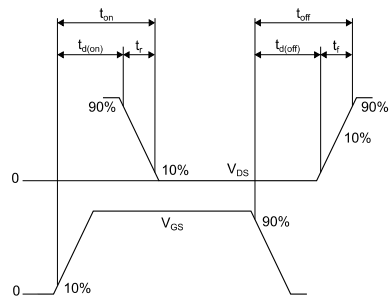
AM01471v1

**Figure 19: Unclamped inductive waveform**



AM01472v1

**Figure 20: Switching time waveform**



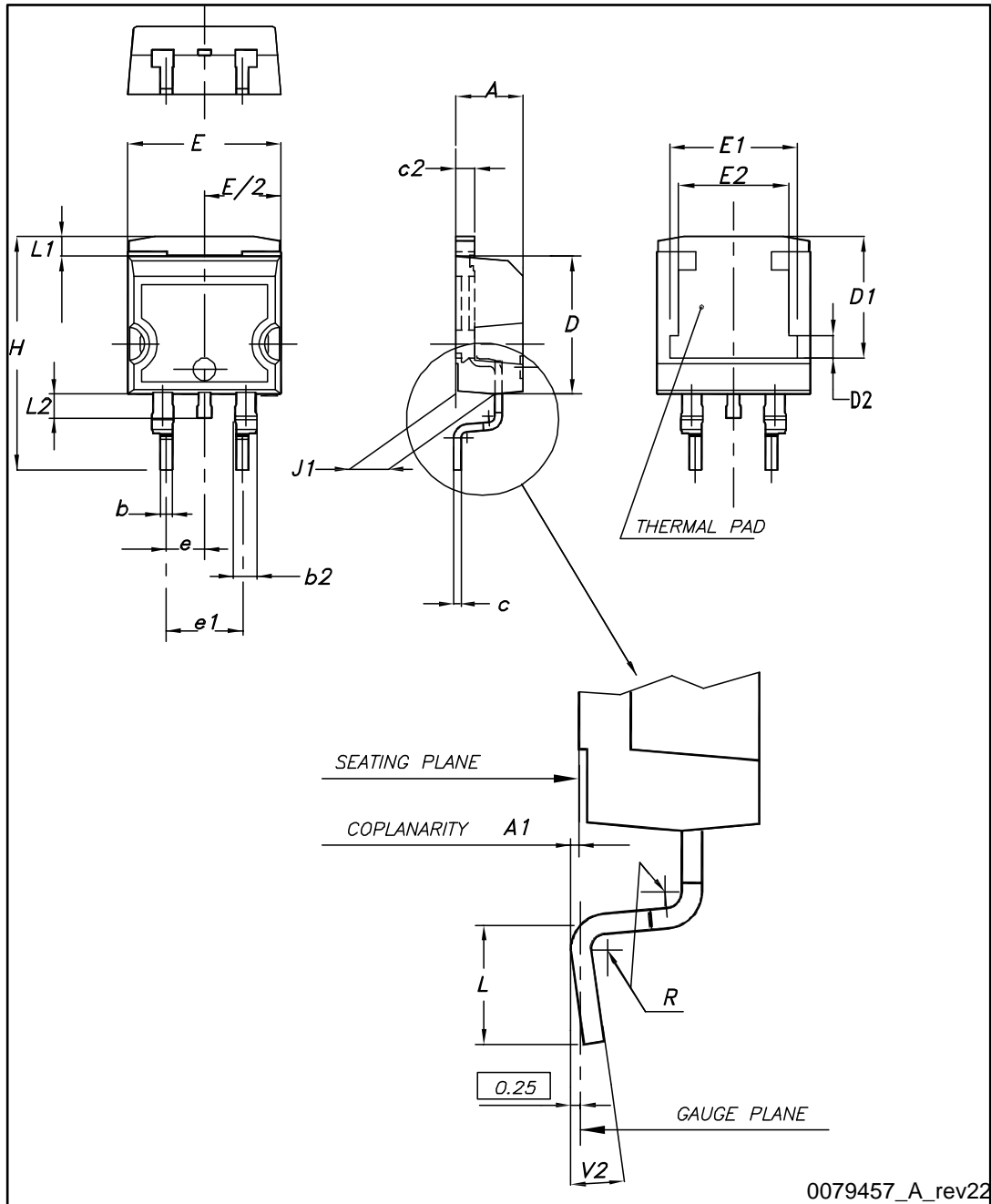
AM01473v1

## 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 (TO-263) type A package information

Figure 21: D<sup>2</sup>PAK (TO-263) type A package outline

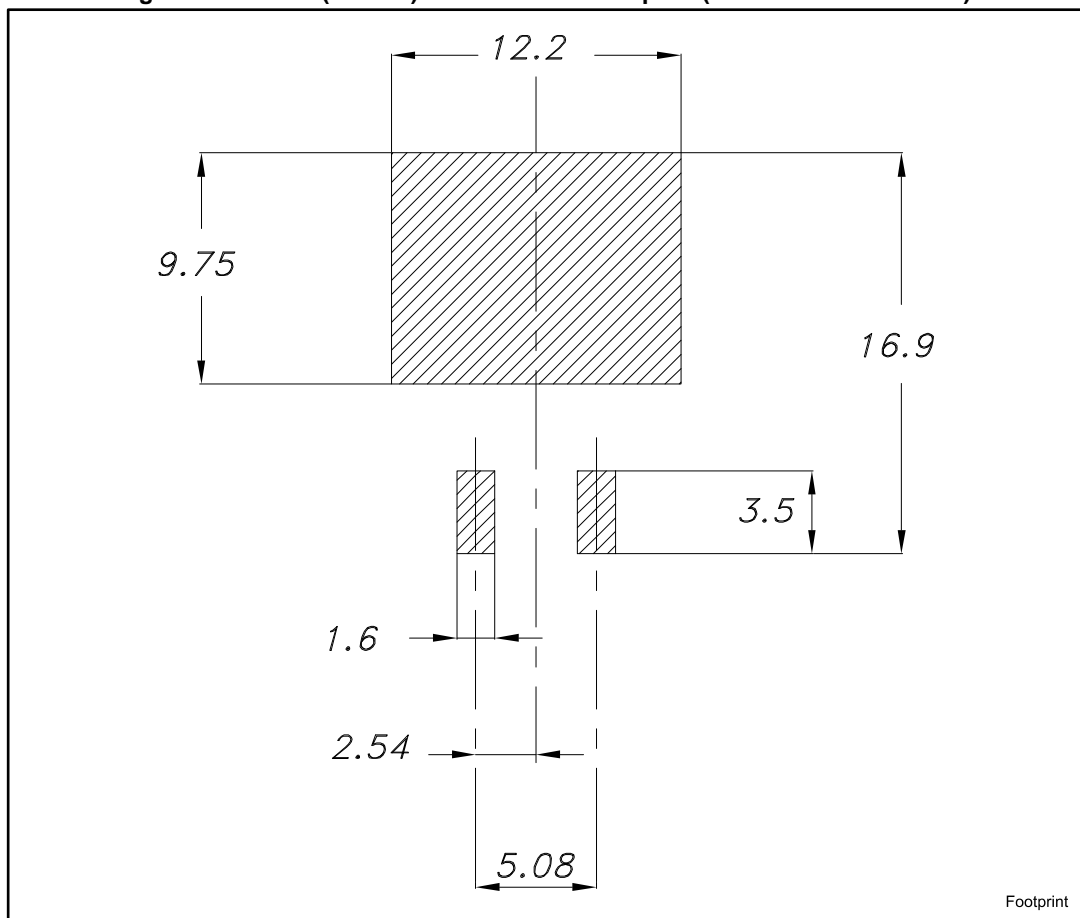


0079457\_A\_rev22

Table 10: 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 22: D<sup>2</sup>PAK (TO-263) recommended footprint (dimensions are in mm)



### 4.2 D<sup>2</sup>PAK (TO-263) packing information

Figure 23: Tape outline

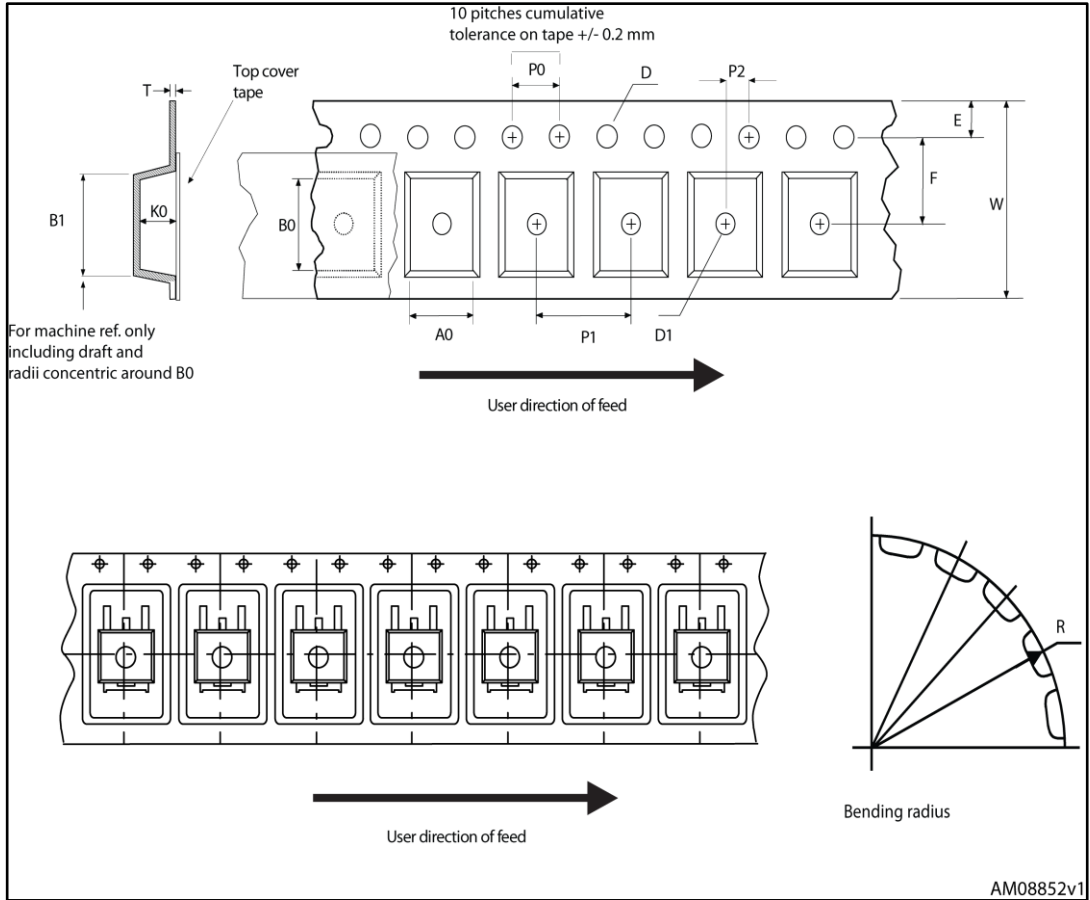
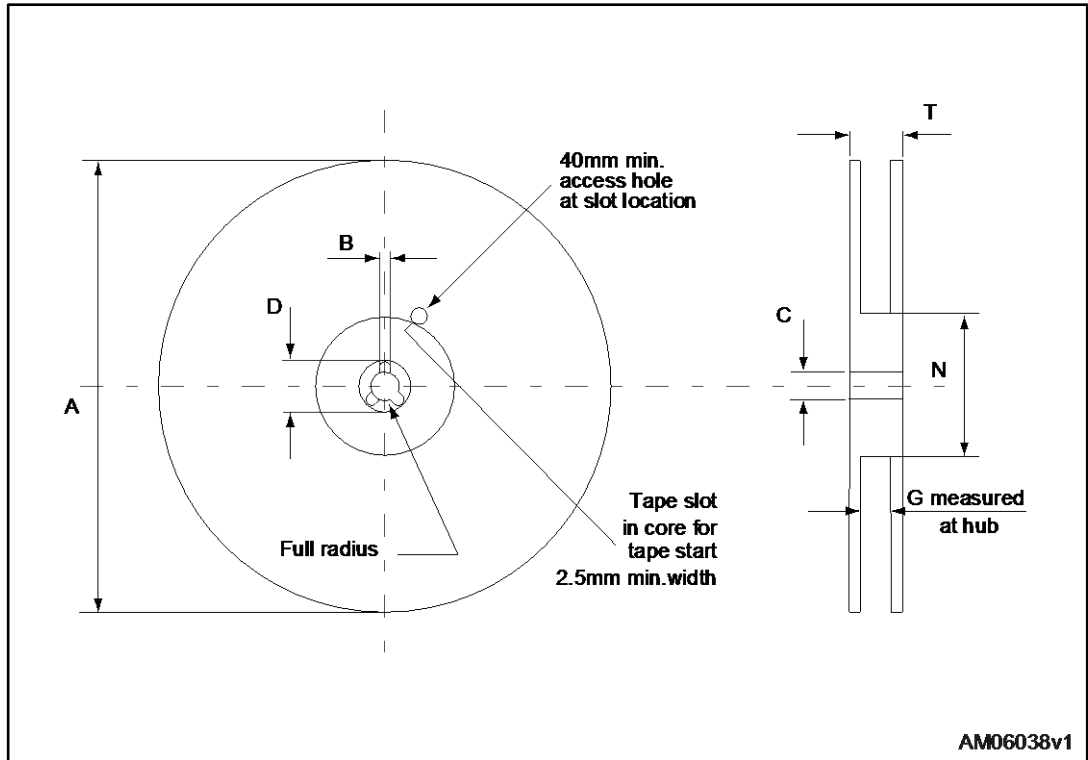


Figure 24: Reel outline



AM06038v1

Table 11: 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 12: Document revision history

Date	Revision	Changes
18-Feb-2016	1	First release.

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2016 STMicroelectronics – All rights reserved





Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.