STB30N80K5

N-channel 800 V, 0.15 Ω typ., 24 A, MDmesh™ K5 Power MOSFET in a D²PAK package

Datasheet - production data

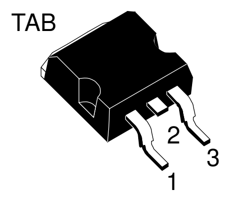
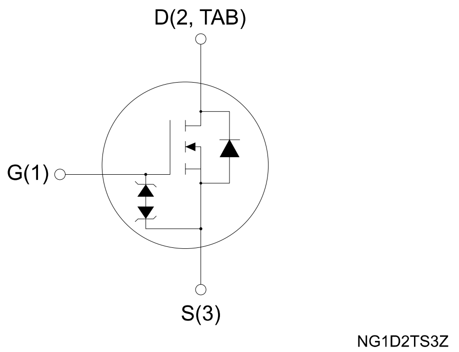


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STB30N80K5	800 V	0.18 Ω	24 A

- Industry's lowest $R_{DS(on)}$ x area
- Industry's best FoM (figure of merit)
- 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	Packaging
STB30N80K5	30N80K5	D²PAK	Tape and reel

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	800	V
V_{GS}	Gate-source voltage	±30	V
I_D	Drain current (continuous) at T_C = 25 °C	24	A
I_D	Drain current (continuous) at T_C = 100 °C	15	A
I_{DM} (1)	Drain current (pulsed)	96	A
P_{TOT}	Total dissipation at T_C = 25 °C	250	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	°C
T_j	Operating junction temperature range		

Notes:

(1)Pulse width limited by safe operating area.

(2)I_{SD}< 24 A, di/dt < 100 A/µs, V_{DSpeak} < $V_{(BR)DSS}$, V_{DD}= 80% $V_{(BR)DSS}$

(3)V_{DS}= 640 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.5	°C/W
$R_{thj-pcb}$ (1)	Thermal resistance junction-pcb	30	°C/W

Notes:

(1)When mounted on FR-4 board of 1 inch², 2 oz Cu

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax}.)	8	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	440	mJ

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 5: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS}= 0 V	800			V
I_{DSS}	Zero gate voltage drain current	V_{GS}= 0 V, V_{DS} = 800 V			1	µA
		V_{GS}= 0 V, V_{DS} = 800 V, T_C= 125 °C (1)			50	µA
I_{GSS}	Gate source leakage current	V_{DS}= 0 V, V_{GS} = ± 20 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DD} = V_{GS}, I_D = 100 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 12 A		0.15	0.18	Ω

Notes:

(1)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 V, f = 1 MHz, V_{GS}= 0 V	-	1530	-	pF
C_{oss}	Output capacitance		-	145	-	pF
C_{rss}	Reverse transfer capacitance		-	1.2	-	pF
$C_{o(er)}$ (1)	Equivalent capacitance energy related	V_{GS} = 0 V, V_{DS} = 0 to 640 V	-	91	-	pF
$C_{o(tr)}$ (2)	Equivalent capacitance time related		-	244	-	pF
Q_g	Total gate charge	V_{DD} = 640 V, I_D = 24 A, V_{GS} = 10 V (see *Figure 16: "Test circuit for gate charge behavior"*)	-	43	-	nC
Q_{gs}	Gate-source charge		-	12.8	-	nC
Q_{gd}	Gate-drain charge		-	24.2	-	nC
R_g	Gate input resistance	f =1 MHz, I_D= 0 A	-	3.5	-	Ω

Notes:

(1)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}

(2)Time 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_{DS} = 400 V, I_D= 12 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 15: "Test circuit for resistive load switching times"*)	-	21	-	ns
t_r	Rise time		-	15	-	ns
$t_{d(off)}$	Turn-off delay time		-	100	-	ns
t_f	Fall time		-	13.5	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		24	A
I_{SDM}(1)	Source-drain current (pulsed)		-		96	A
V_{SD}(2)	Forward on voltage	I_{SD}= 24 A, V_{GS} = 0 V	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 24 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 17: "Test circuit for inductive load switching and diode recovery times"*)	-	555		ns
Q_{rr}	Reverse recovery charge		-	9.95		µC
I_{RRM}	Reverse recovery current		-	36		A
t_{rr}	Reverse recovery time	I_{SD} = 24 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 17: "Test circuit for inductive load switching and diode recovery times"*)	-	765		ns
Q_{rr}	Reverse recovery charge		-	13.2		µC
I_{RRM}	Reverse recovery current		-	34.5		A

Notes:

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300 µs, 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}= ±1 mA, I_D = 0 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 2: Safe operating area

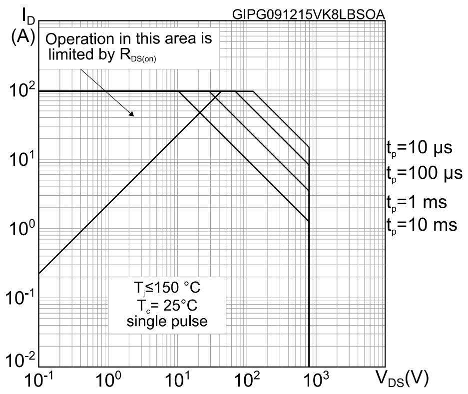


Figure 3: Thermal impedance

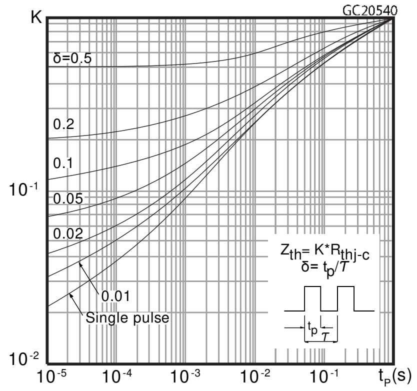


Figure 4: Output characteristics

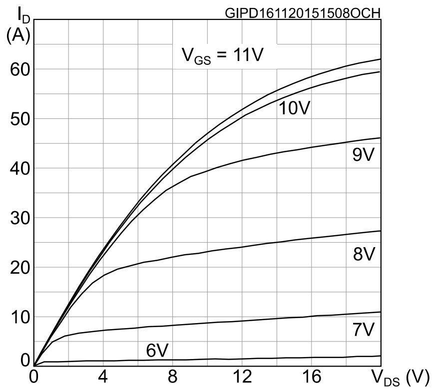


Figure 5: Transfer characteristics

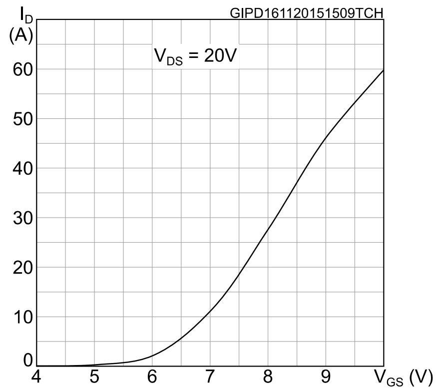


Figure 6: Gate charge vs gate-source voltage

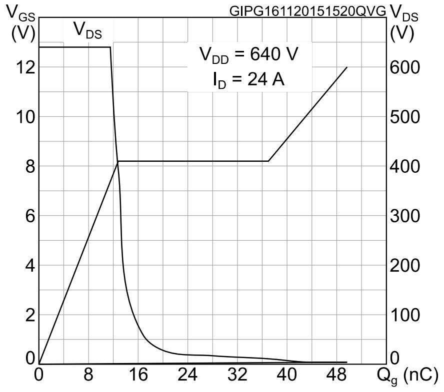


Figure 7: Static drain-source on-resistance

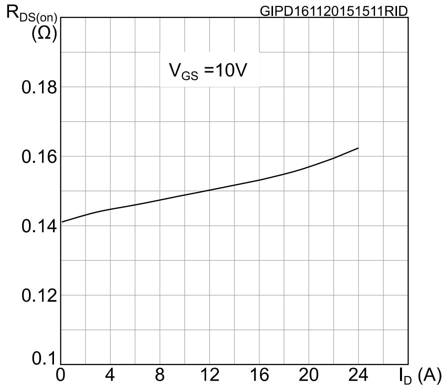


Figure 8: Capacitance variations

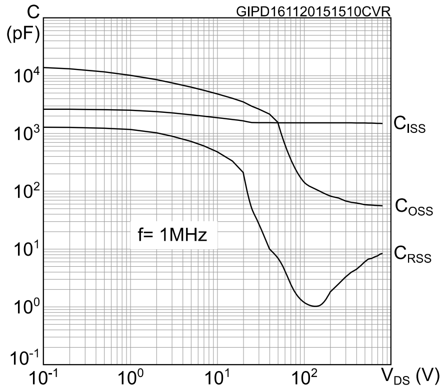


Figure 9: Normalized gate threshold voltage vs temperature

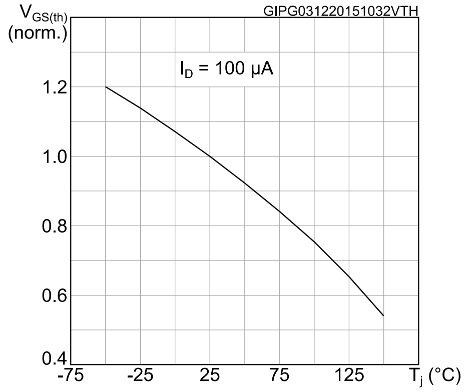


Figure 10: Normalized on-resistance vs temperature

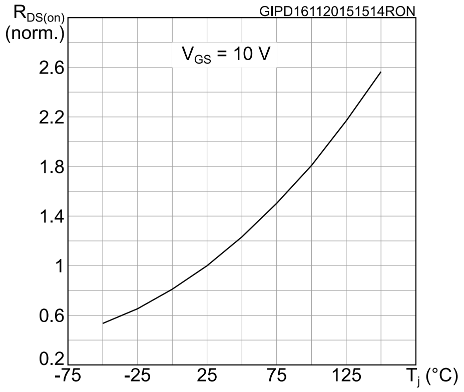


Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

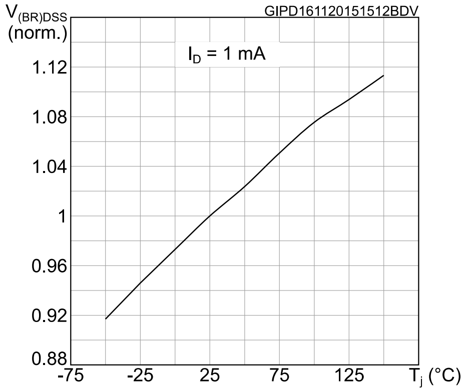


Figure 12: Maximum avalanche energy vs starting T_J

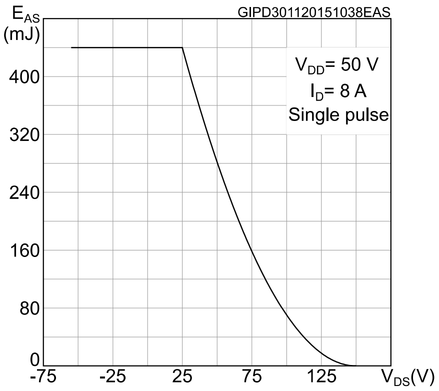


Figure 13: Source-drain diode forward characteristics

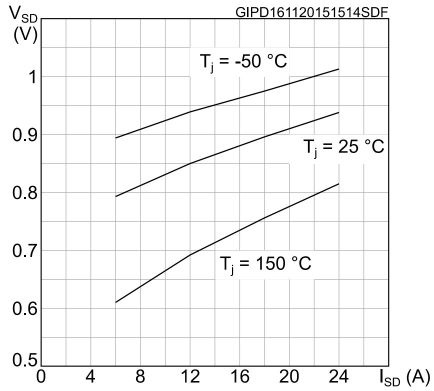
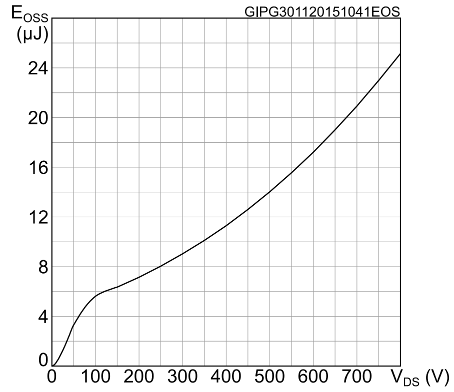


Figure 14: Output capacitance stored energy



3 Test circuits

Figure 15: Test circuit for resistive load switching times

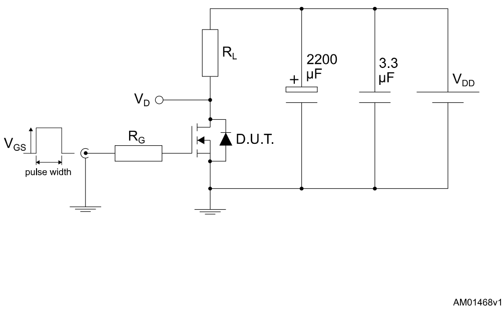


Figure 16: Test circuit for gate charge behavior

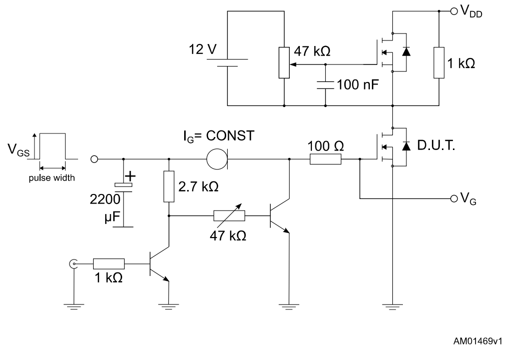


Figure 17: Test circuit for inductive load switching and diode recovery times

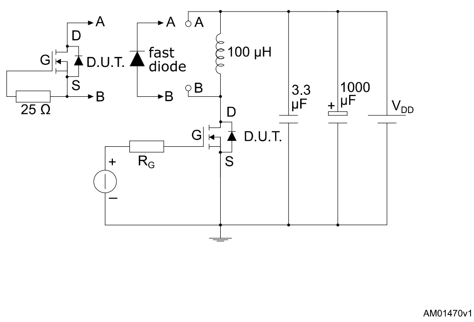


Figure 18: Unclamped inductive load test circuit

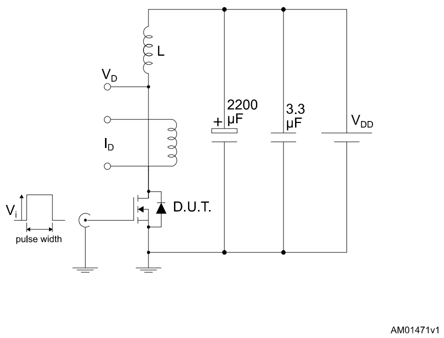


Figure 19: Unclamped inductive waveform

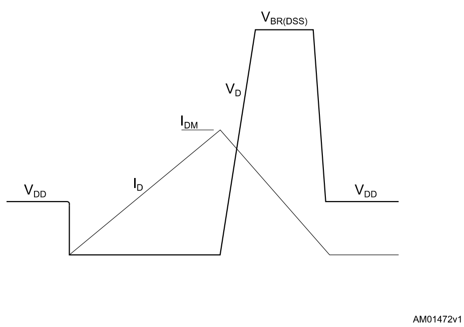
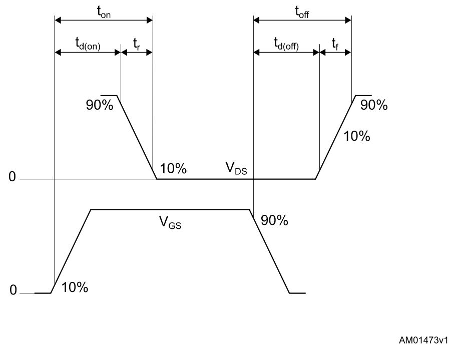


Figure 20: Switching time waveform



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 D^2PAK package information

Figure 21: D^2PAK (TO-263) type A package outline

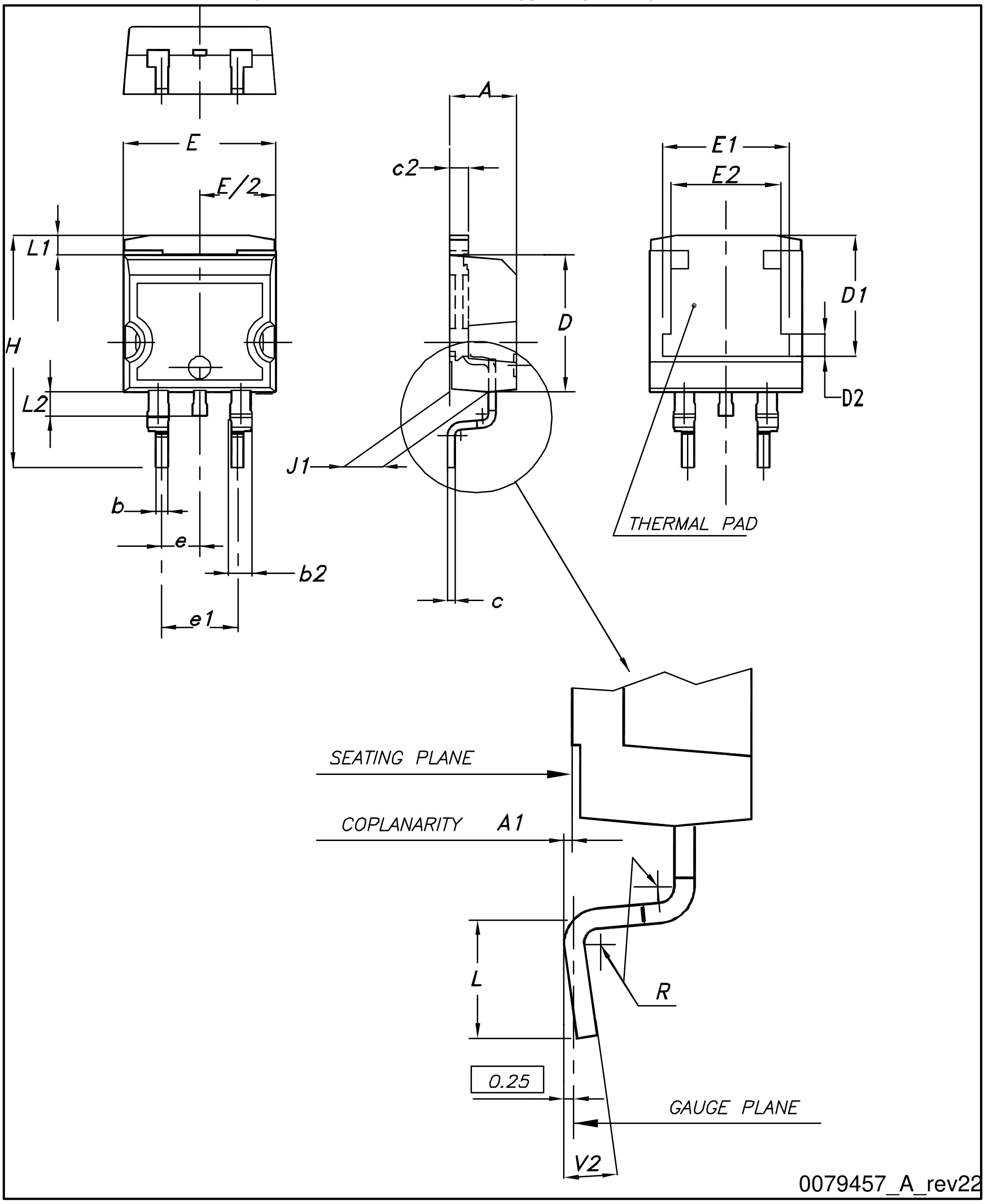
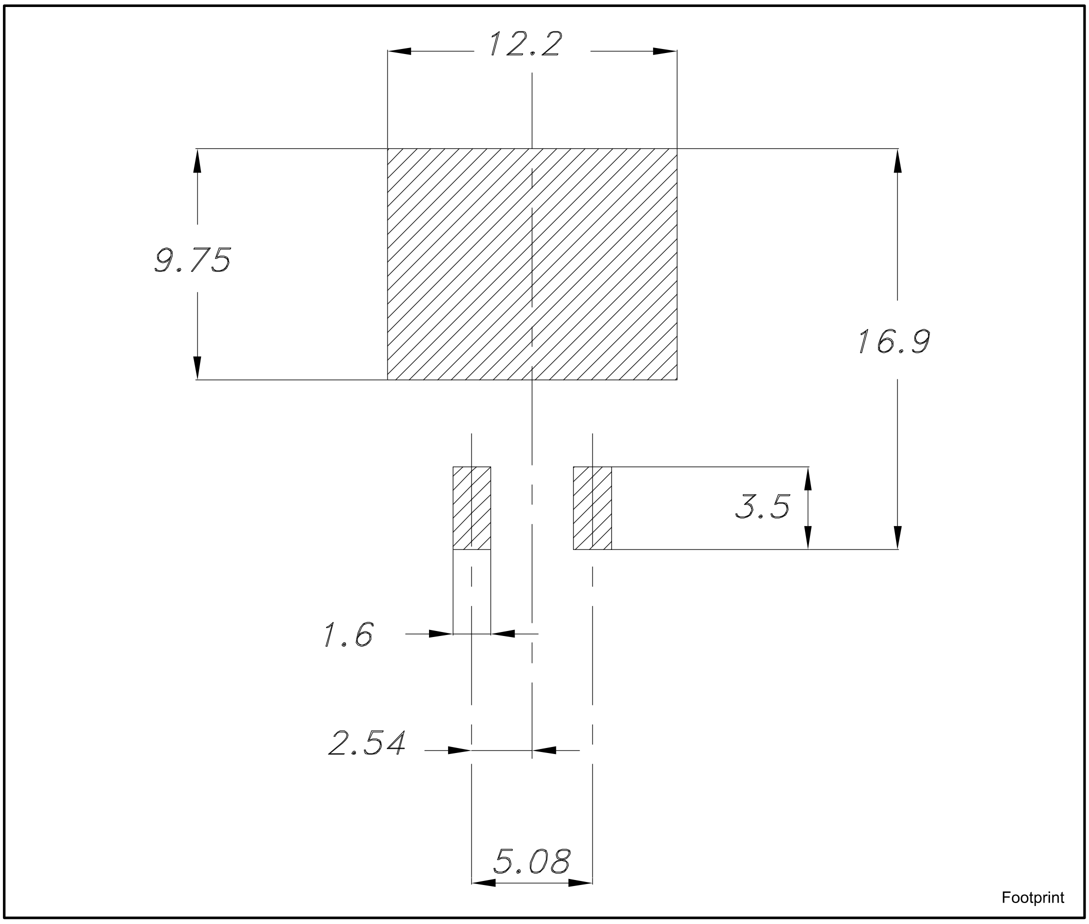


Table 10: D²PAK (TO-263) type A package mechanical data

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: D²PAK (TO-263) recommended footprint (dimensions are in mm)



4.2 D²PAK packaging information

Figure 23: Tape outline

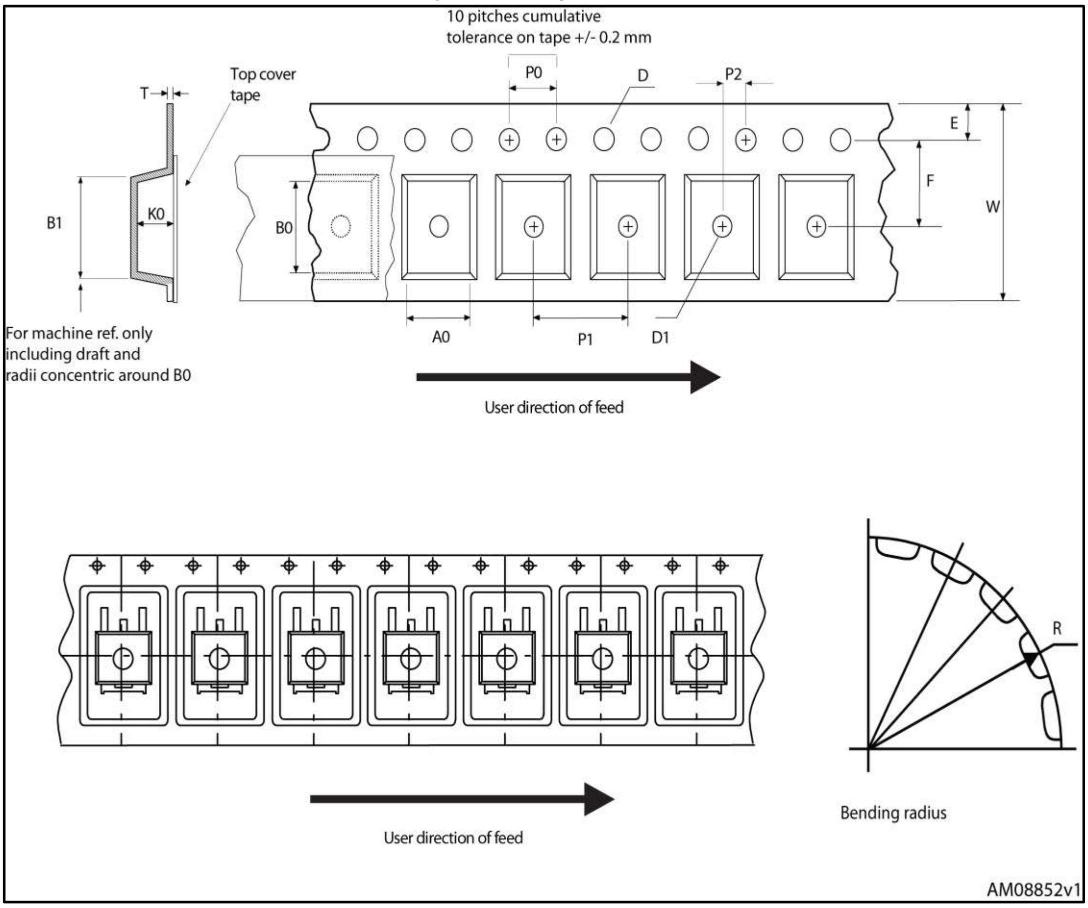


Figure 24: Reel outline

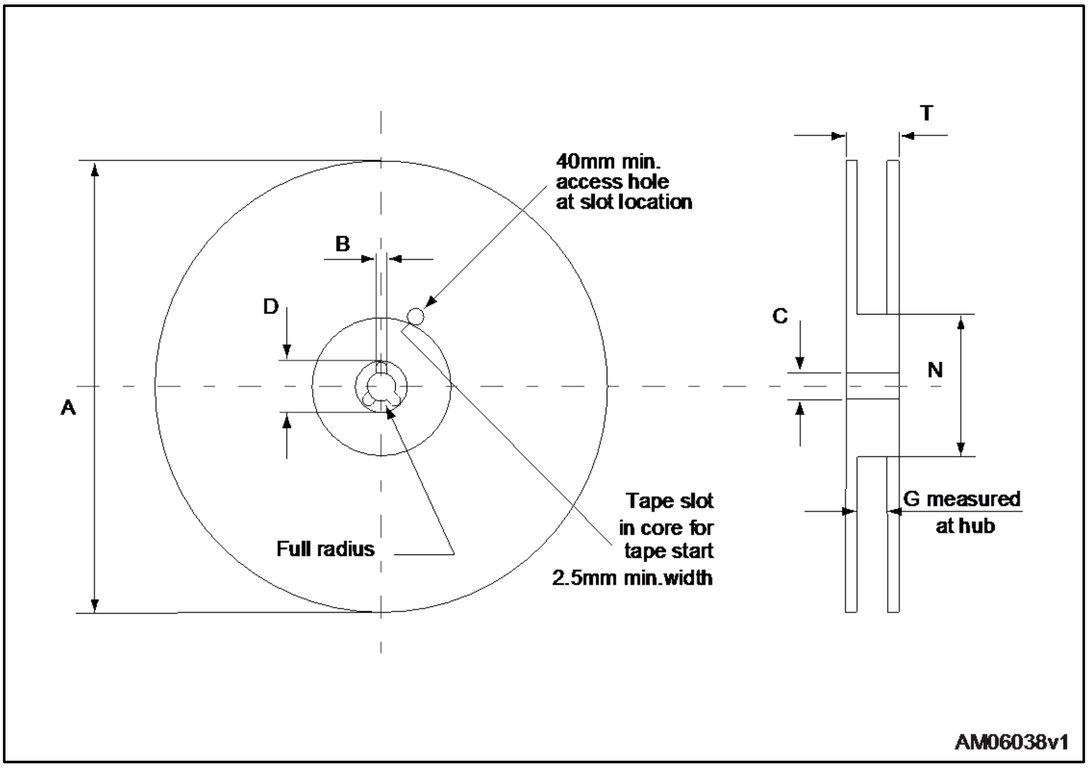


Table 11: D²PAK tape and reel mechanical data

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
14-Dec-2015	1	First release.
06-Jul-2016	2	Modified: features in cover page. Added: note in *Table 5: "On/off states"*. Modified: *Figure 3: "Thermal impedance"*. Minor text changes.

IMPORTANT NOTICE – PLEASE READ CAREFULLY