

N-channel 800 V, 0.95 Ω typ., 5 A MDmesh™ K5 Power MOSFET in a DPAK package

Datasheet - production data

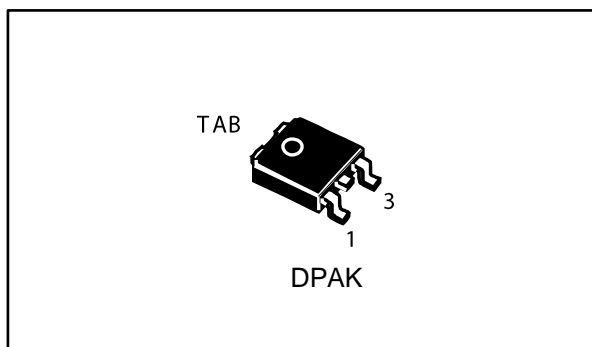
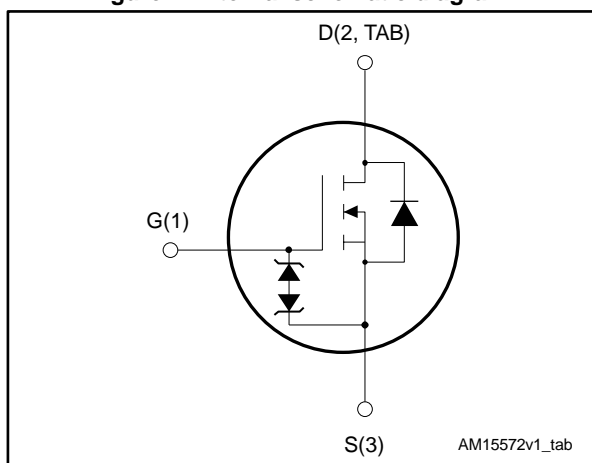


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STD7LN80K5	800 V	1.15 Ω	5 A

- Industry's lowest R_{DS(on)} 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
STD7LN80K5	7LN80K5	DPAK	Tape and reel

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves)	6
3	Test circuits	8
4	Package information	9
	4.1 DPAK (TO-252) type A2 package information.....	10
	4.2 DPAK (TO-252) packing information.....	13
5	Revision history	15

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	5	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	3.4	A
$I_D^{(2)}$	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	85	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(4)}$	MOSFET dv/dt ruggedness	50	V/ns
T_{stg}	Storage temperature	- 55 to 150	$^\circ\text{C}$
T_j	Operating junction temperature		

Notes:

⁽¹⁾Limited by maximum junction temperature.

⁽²⁾Pulse width limited by safe operating area.

⁽³⁾ $I_{SD} \leq 5\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$, $V_{DD}=640\text{ V}$

⁽⁴⁾ $V_{DS} \leq 640\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	1.47	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50	$^\circ\text{C}/\text{W}$

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})	1.5	A
E_{AS}	(Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$; $V_{DD} = 50\text{ V}$)	200	mJ

2 Electrical characteristics

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

Table 5: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	800			V
I_{DSS}	Zero gate voltage Drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$			50	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$			± 10	μA
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}$, $I_D = 2.5\text{ A}$		0.95	1.15	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	270	-	pF
C_{oss}	Output capacitance		-	22	-	pF
C_{rss}	Reverse transfer capacitance		-	0.5	-	pF
$C_{o(er)}^{(1)}$	Equivalent capacitance energy related	$V_{DS} = 0\text{ to }640\text{ V}$, $V_{GS} = 0\text{ V}$	-	17	-	nC
$C_{o(tr)}^{(2)}$	Equivalent capacitance time related		-	48	-	nC
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	7.5	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 5\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 15: "Test circuit for gate charge behavior")	-	12	-	nC
Q_{gs}	Gate-source charge		-	2.6	-	nC
Q_{gd}	Gate-drain charge		-	8.6	-	nC

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	$V_{DD} = 400\text{ V}$, $I_D = 2.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Test circuit for resistive load switching times" and Figure 19: "Switching time waveform")	-	9.3	-	ns
t_r	Rise time		-	6.7	-	ns
$t_{d(off)}$	Turn-off-delay time		-	23.6	-	ns
t_f	Fall time		-	17.4	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		20	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5\text{ A}$, $V_{GS} = 0\text{ V}$,	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	276		ns
Q_{rr}	Reverse recovery charge		-	2.13		μC
I_{RRM}	Reverse recovery current		-	15.4		A
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	402		ns
Q_{rr}	Reverse recovery charge		-	2.79		μC
I_{RRM}	Reverse recovery current		-	13.9		A

Notes:

(1) Pulse width is 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	$I_{GS} = \pm 1\text{ mA}$, $I_D = 0\text{ A}$	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)

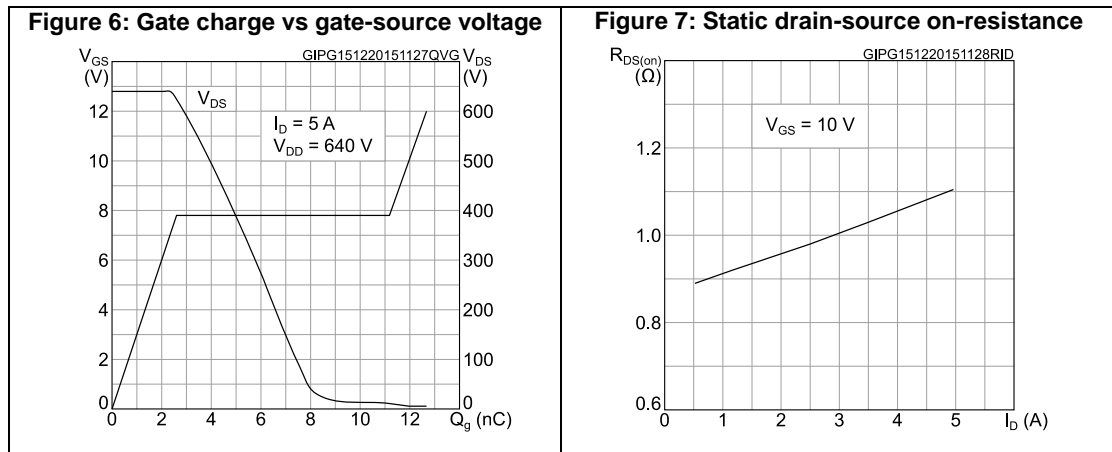
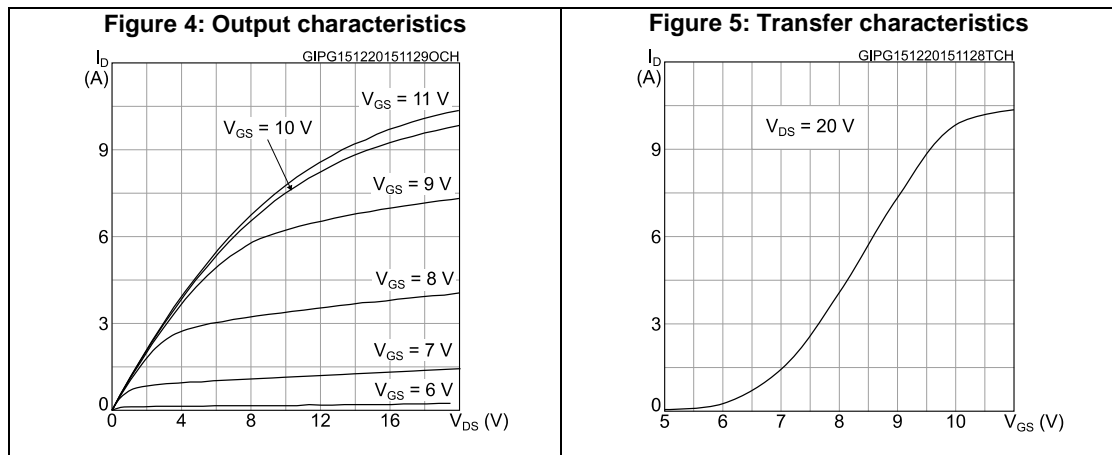
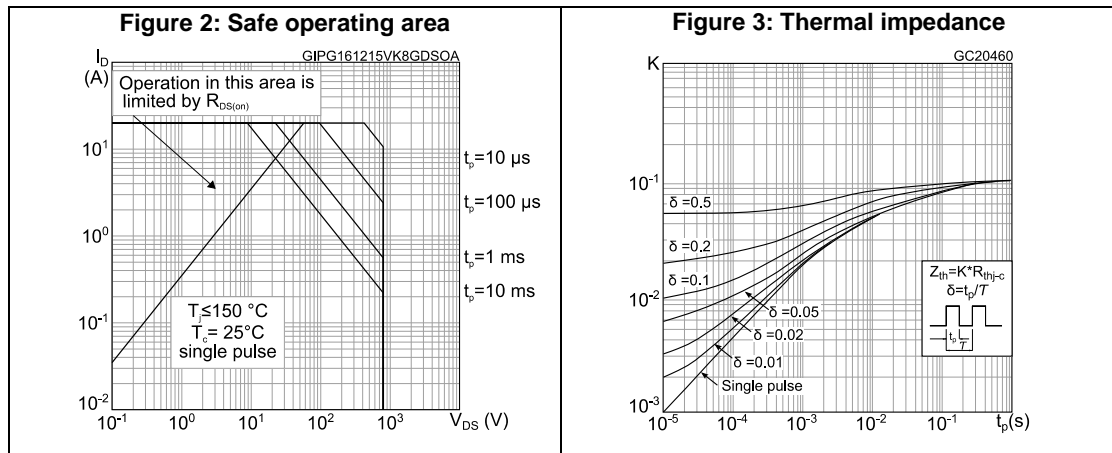


Figure 8: Capacitance variations

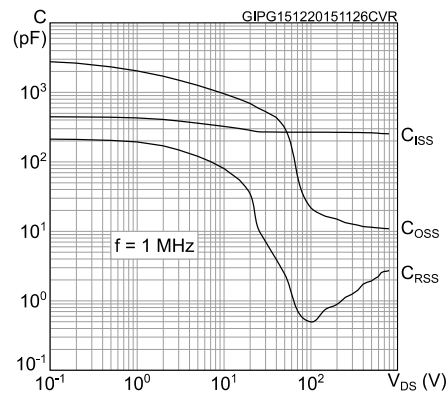


Figure 9: Normalized gate threshold voltage vs temperature

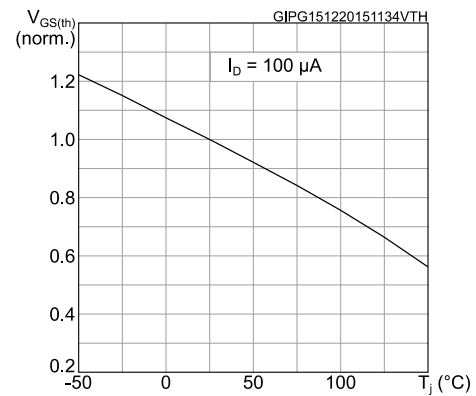
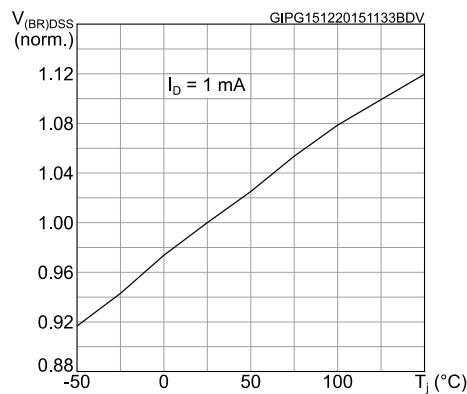
Figure 10: Normalized $V_{(BR)DSS}$ vs temperature

Figure 11: Normalized on-resistance vs temperature

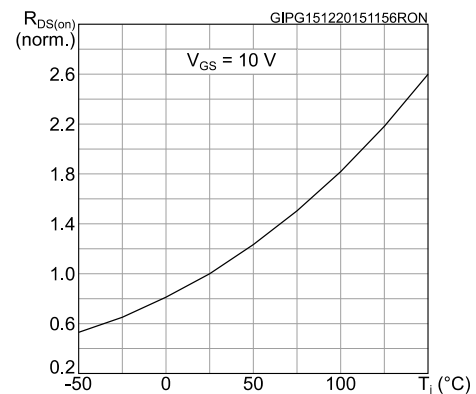
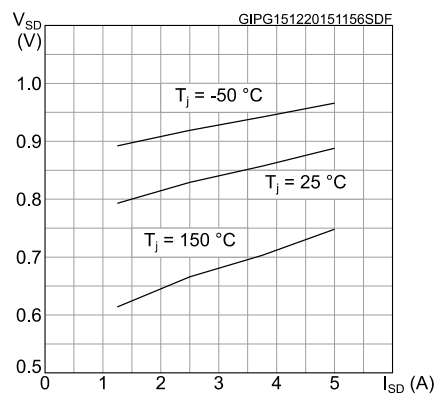
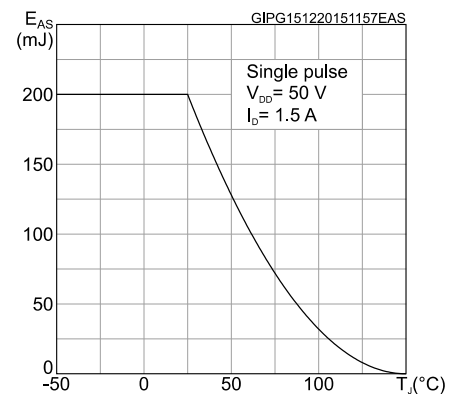
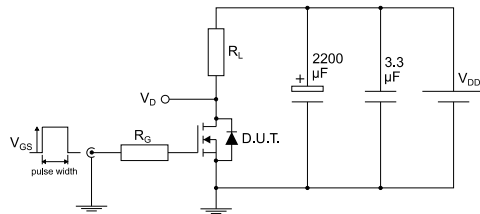


Figure 12: Source-drain diode forward characteristics

Figure 13: Maximum avalanche energy vs starting T_J 

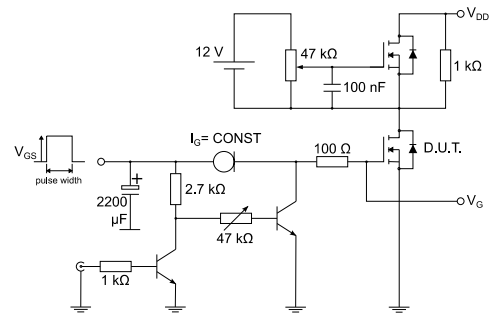
3 Test circuits

Figure 14: Test circuit for resistive load switching times



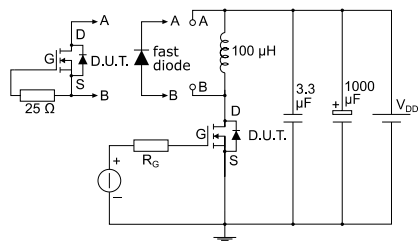
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Figure 15: Test circuit for gate charge behavior



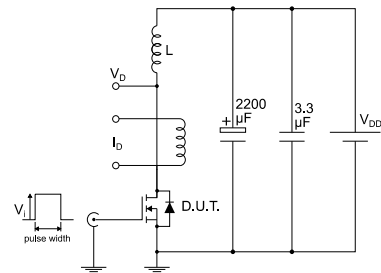
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Figure 16: Test circuit for inductive load switching and diode recovery times



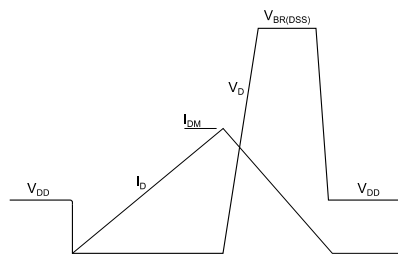
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Figure 17: Unclamped inductive load test circuit



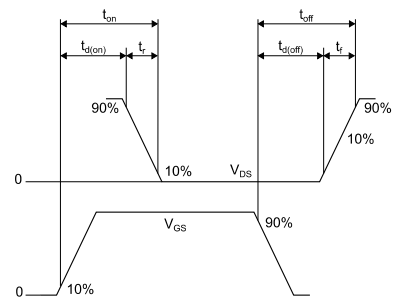
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Figure 18: Unclamped inductive waveform



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Figure 19: Switching time waveform



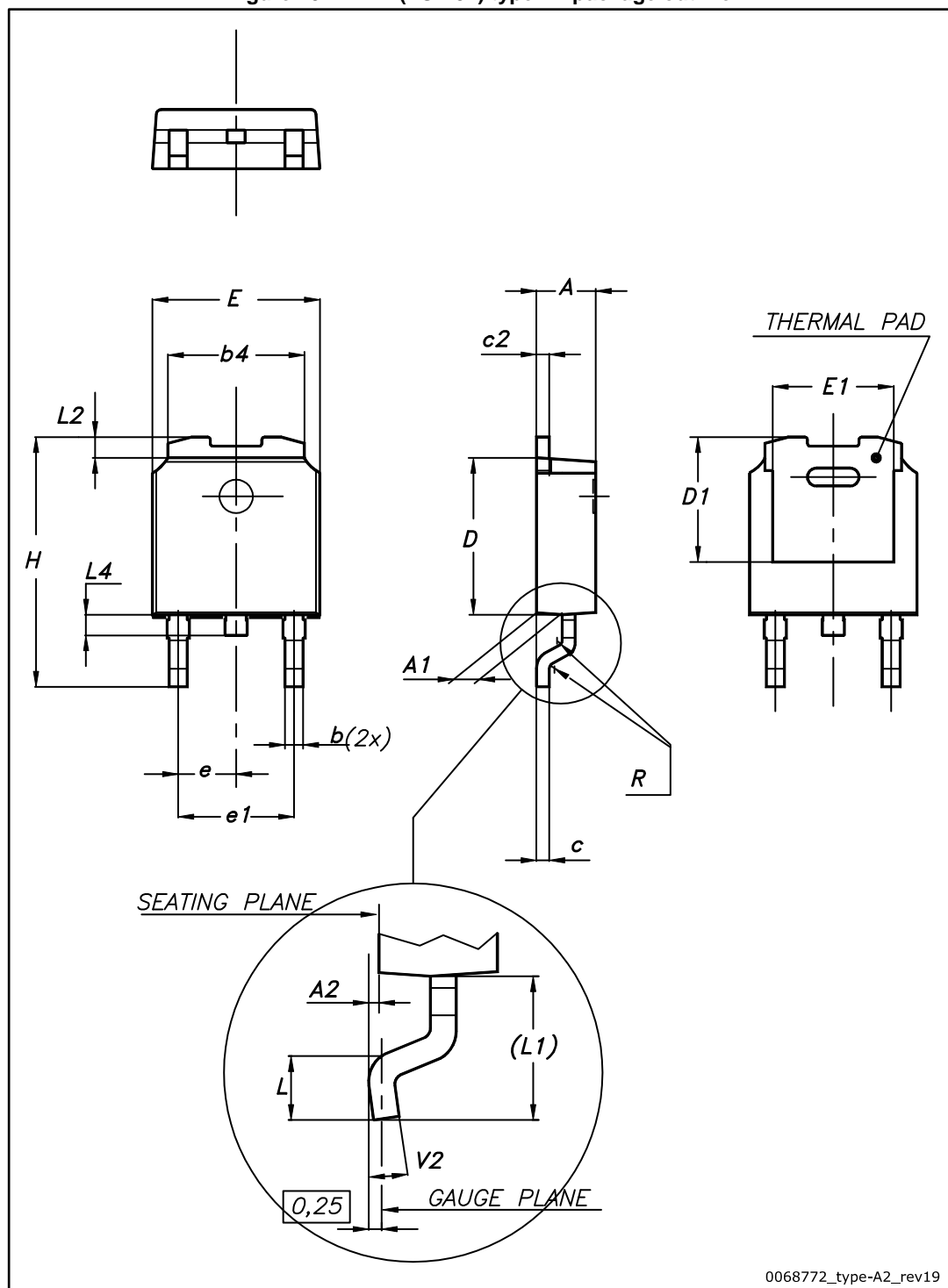
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4 Package information

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 DPAK (TO-252) type A2 package information

Figure 20: DPAK (TO-252) type A2 package outline

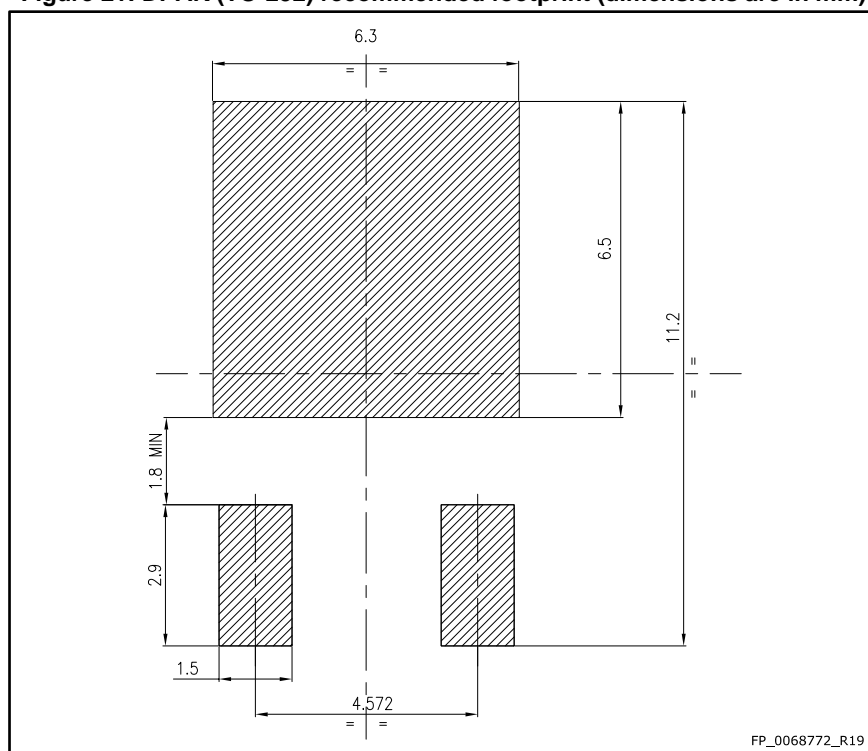


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Table 10: DPAK (TO-252) type A2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	5.10	5.20	5.30
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 21: DPAK (TO-252) recommended footprint (dimensions are in mm)



4.2 DPAK (TO-252) packing information

Figure 22: DPAK (TO-252) tape outline

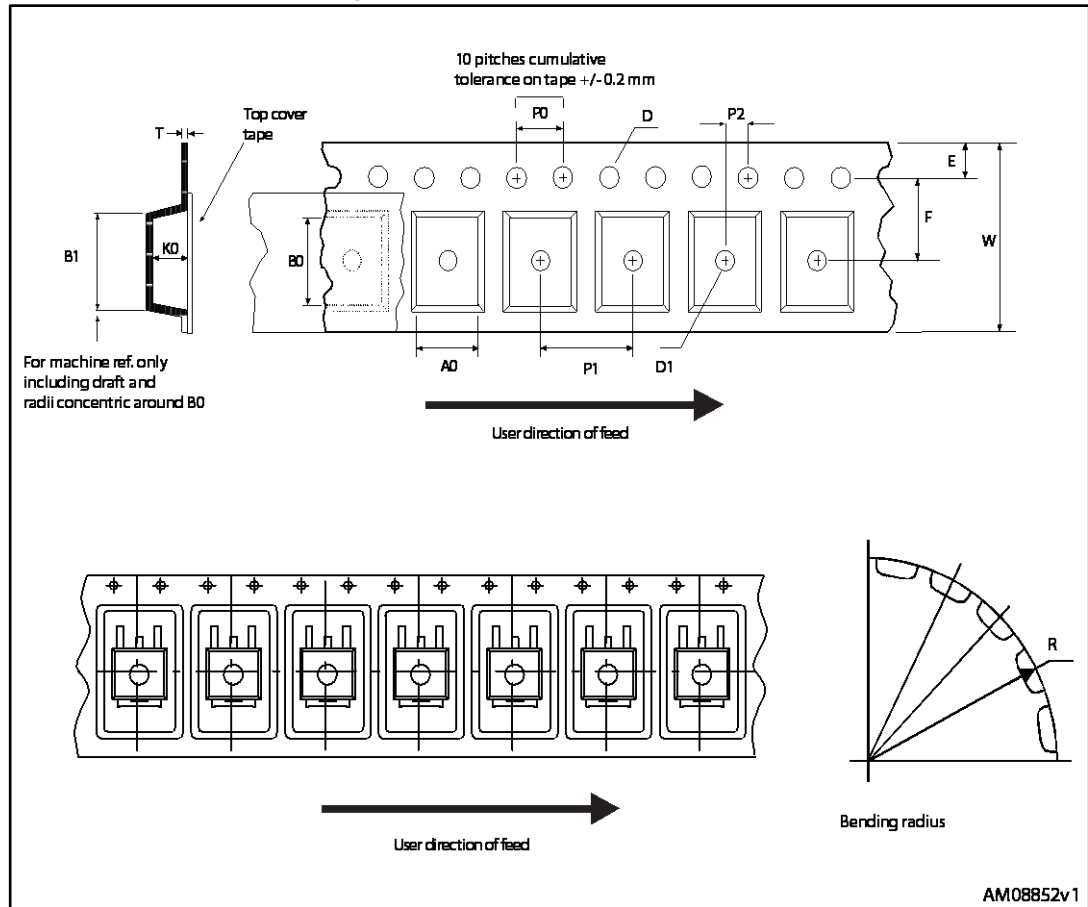


Figure 23: DPAK (TO-252) reel outline

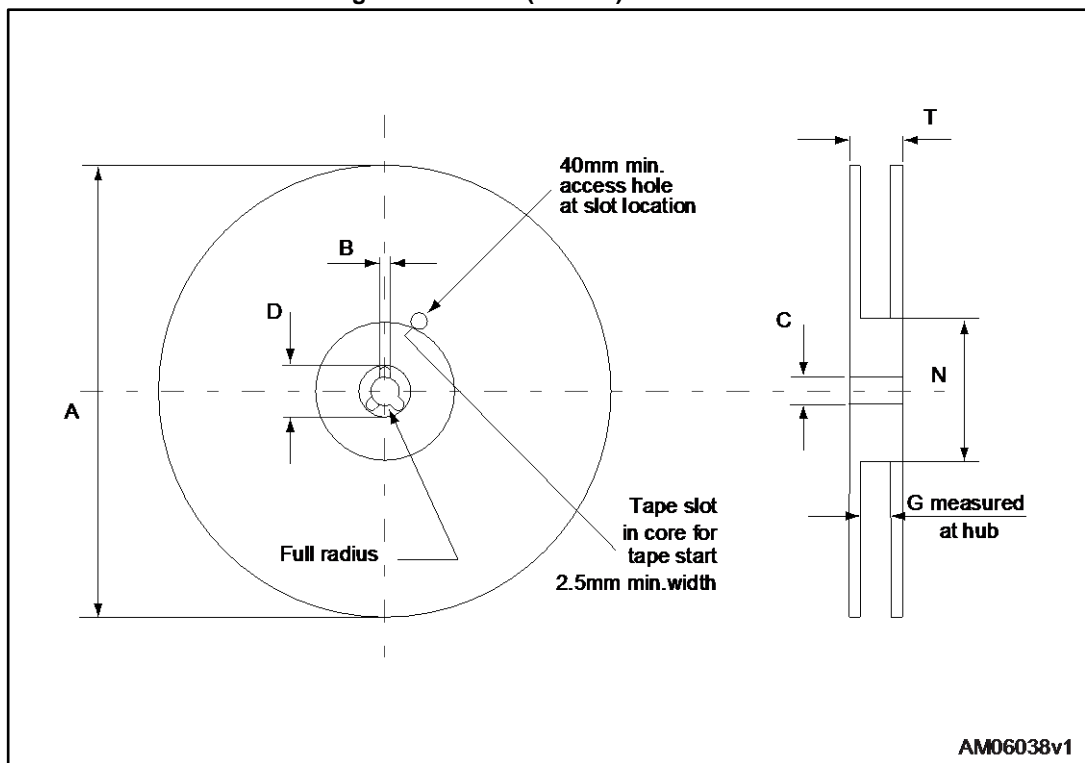


Table 11: DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

5 Revision history

Table 12: Document revision history

Date	Revision	Changes
16-Dec-2015	1	First release.

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