

N-channel 800 V, 2.75 Ω typ., 2 A MDmesh™ K5 Power MOSFET in a DPAK package

Datasheet - production data

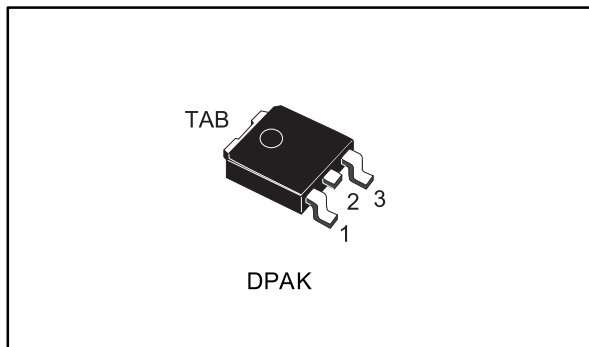
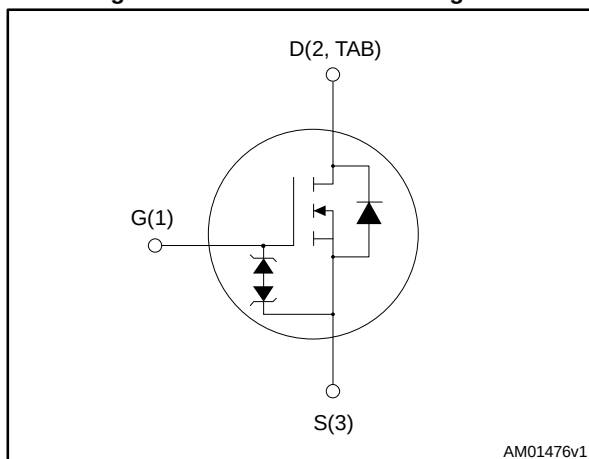


Figure 1: Internal schematic diagram



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Features

Order code	V _{DS}	R _{DS(on)} max	I _D
STD3LN80K5	800 V	3.25 Ω	2 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	Packing
STD3LN80K5	3LN80K5	DPAK	Tape and reel

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	2	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	1.25	A
$I_D^{(1)}$	Drain current (pulsed)	8	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	45	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:

⁽¹⁾Pulse width limited by safe operating area.

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

⁽³⁾ $V_{DS} \leq 640\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.78	$^{\circ}\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50	$^{\circ}\text{C}/\text{W}$

Notes:

⁽¹⁾When mounted on 1inch² FR-4 board, 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})	0.7	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$; $V_{DD} = 50\text{ V}$)	155	mJ

2 Electrical characteristics

(T_C = 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 _{DS} = 800 V, V _{GS} = 0 V			1	μA
		V _{DS} = 800 V, V _{GS} = 0 V, T _C = 125 °C ⁽¹⁾			50	μA
I _{GSS}	Gate body leakage current	V _{GS} = ± 20 V, V _{DS} = 0 V			±10	μA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 100 μA	3	4	5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 1 A		2.75	3.25	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	-	102	-	pF
C _{oss}	Output capacitance		-	11	-	pF
C _{rss}	Reverse transfer capacitance		-	0.1	-	pF
C _{otr} ⁽¹⁾	Equivalent capacitance time related	V _{DS} = 0 to 640 V, V _{GS} = 0 V	-	20	-	pF
C _{oer} ⁽²⁾	Equivalent capacitance energy related		-	7	-	pF
R _G	Intrinsic gate resistance	f = 1 MHz, I _D = 0 A	-	12	-	Ω
Q _g	Total gate charge	V _{DD} = 640 V, I _D = 2 A, V _{GS} = 10 V (see Figure 15: "Test circuit for gate charge behavior")	-	2.63	-	nC
Q _{gs}	Gate-source charge		-	0.91	-	nC
Q _{gd}	Gate-drain charge		-	1.53	-	nC

Notes:

⁽¹⁾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}

⁽²⁾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	$V_{DD} = 400\text{ V}$, $I_D = 1\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Test circuit for resistive load switching times" and Figure 19: "Switching time waveform")	-	6.2	-	ns
t_r	Rise time		-	7	-	ns
$t_{d(off)}$	Turn-off delay time		-	30	-	ns
t_f	Fall time		-	26	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		2	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		8	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 2\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	210		ns
Q_{rr}	Reverse recovery charge		-	0.8		μC
I_{RRM}	Reverse recovery current		-	7.6		A
t_{rr}	Reverse recovery time	$I_{SD} = 2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$, (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	345		ns
Q_{rr}	Reverse recovery charge		-	1.2		μC
I_{RRM}	Reverse recovery current		-	7.2		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	$I_{GS} = \pm 1\text{ mA}$, $I_D = 0\text{ A}$	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.

2.1 Electrical characteristics (curves)

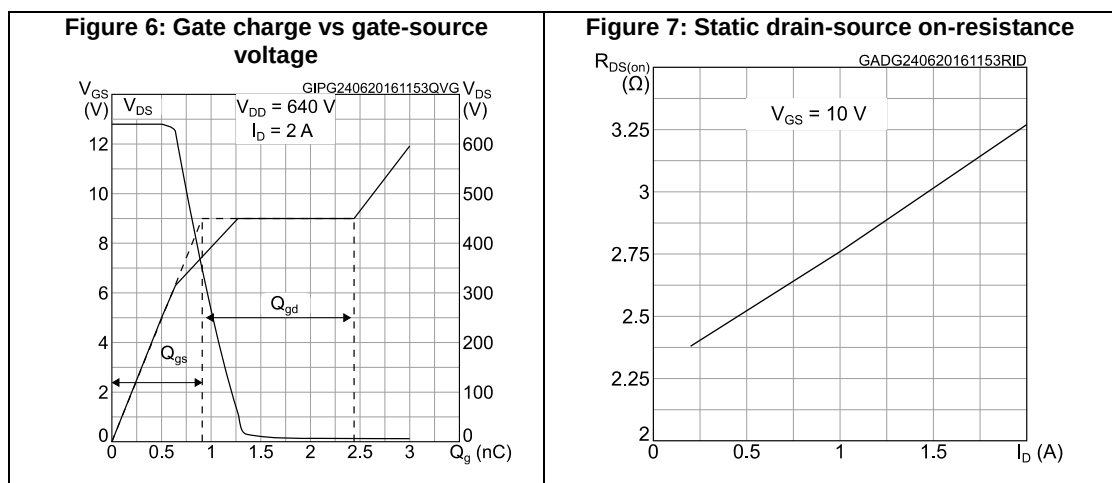
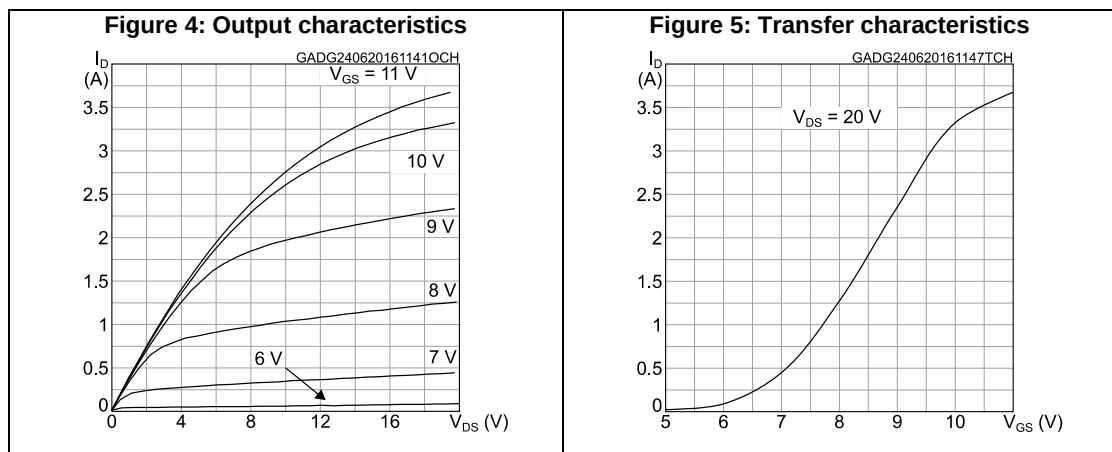
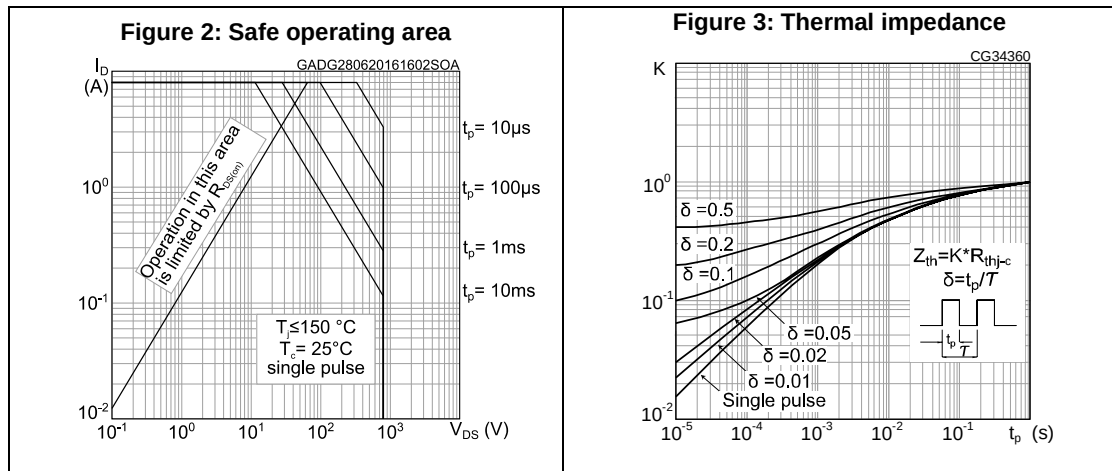


Figure 8: Capacitance variations

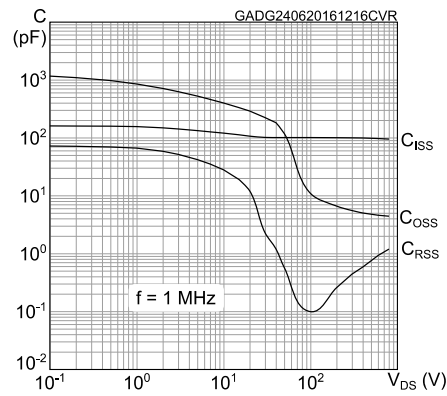


Figure 9: Source-drain diode forward characteristics

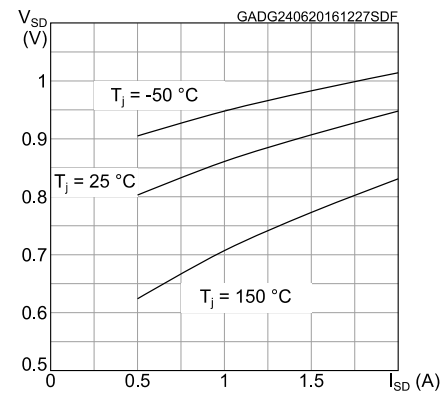


Figure 10: Normalized gate threshold voltage vs temperature

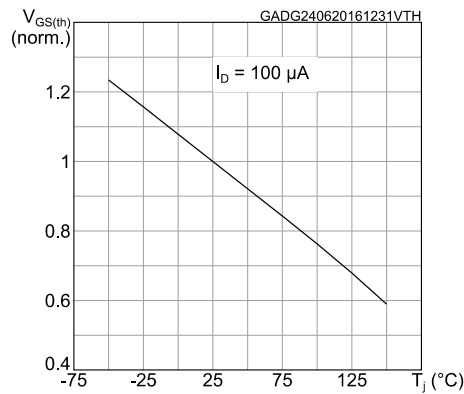
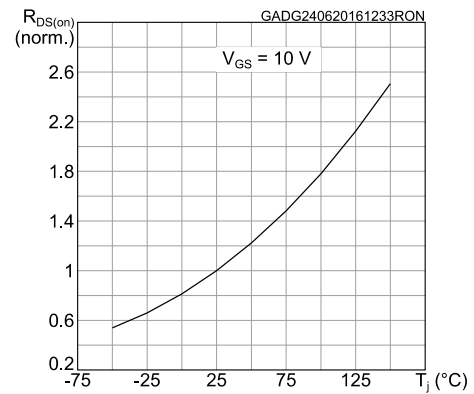
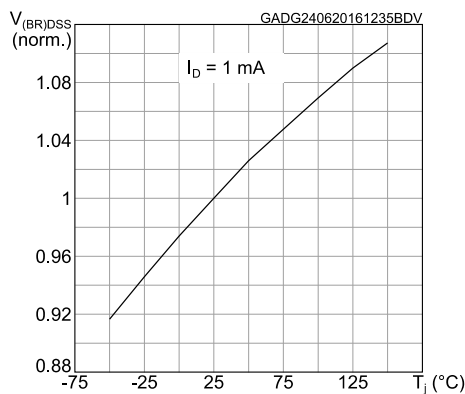
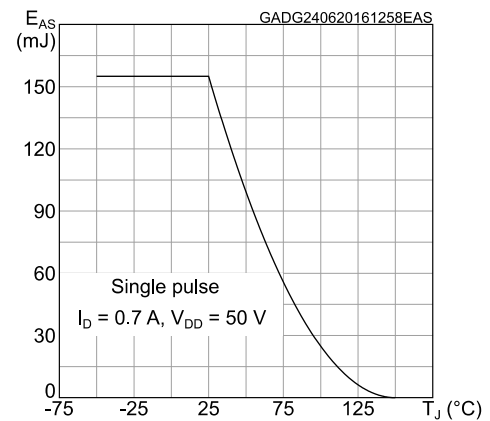
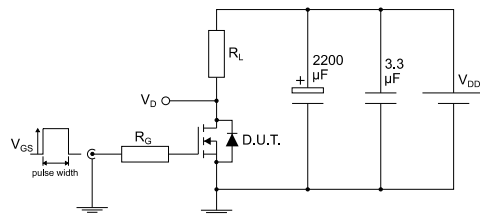


Figure 11: Normalized on-resistance vs temperature

Figure 12: Normalized $V_{(BR)DSS}$ vs temperatureFigure 13: Maximum avalanche energy vs starting T_J 

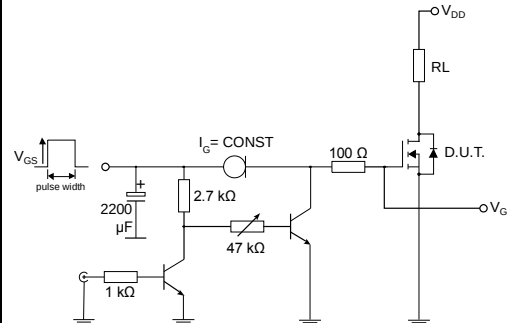
3 Test circuits

Figure 14: Test circuit for resistive load switching times



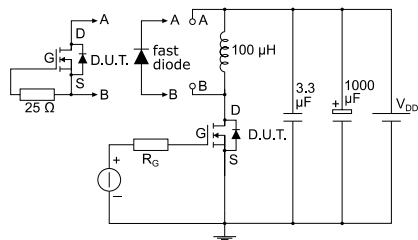
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Figure 15: Test circuit for gate charge behavior



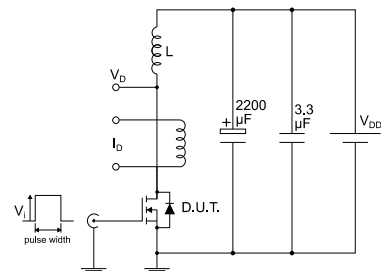
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Figure 16: Test circuit for inductive load switching and diode recovery times



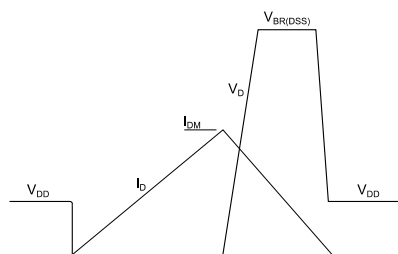
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Figure 17: Unclamped inductive load test circuit



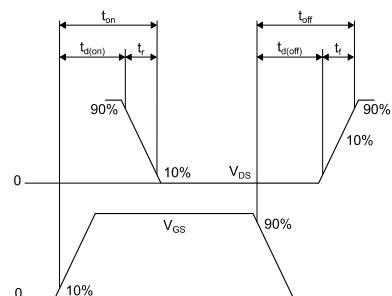
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Figure 18: Unclamped inductive waveform



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Figure 19: Switching time waveform



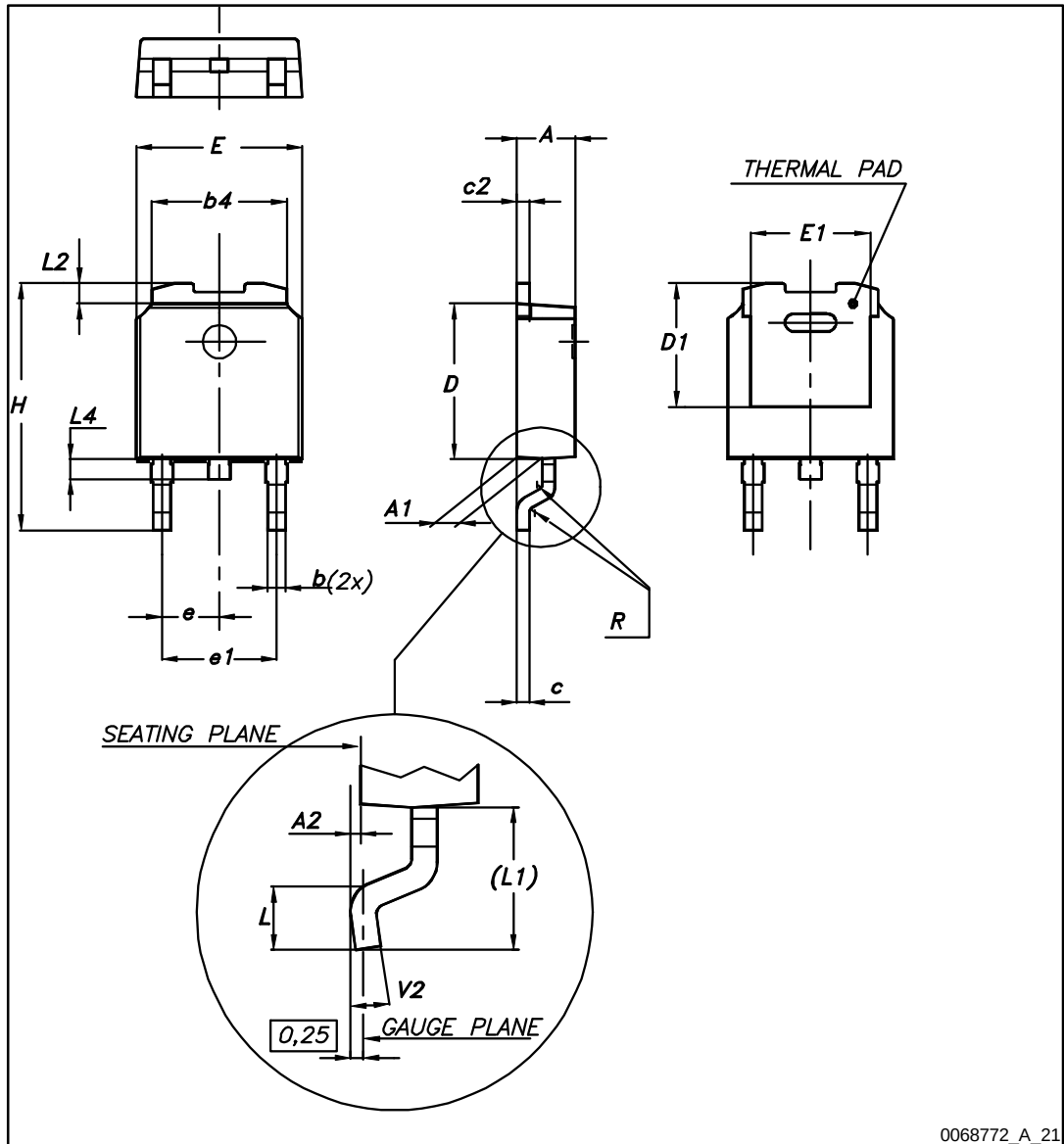
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4 Package information

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 package information

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

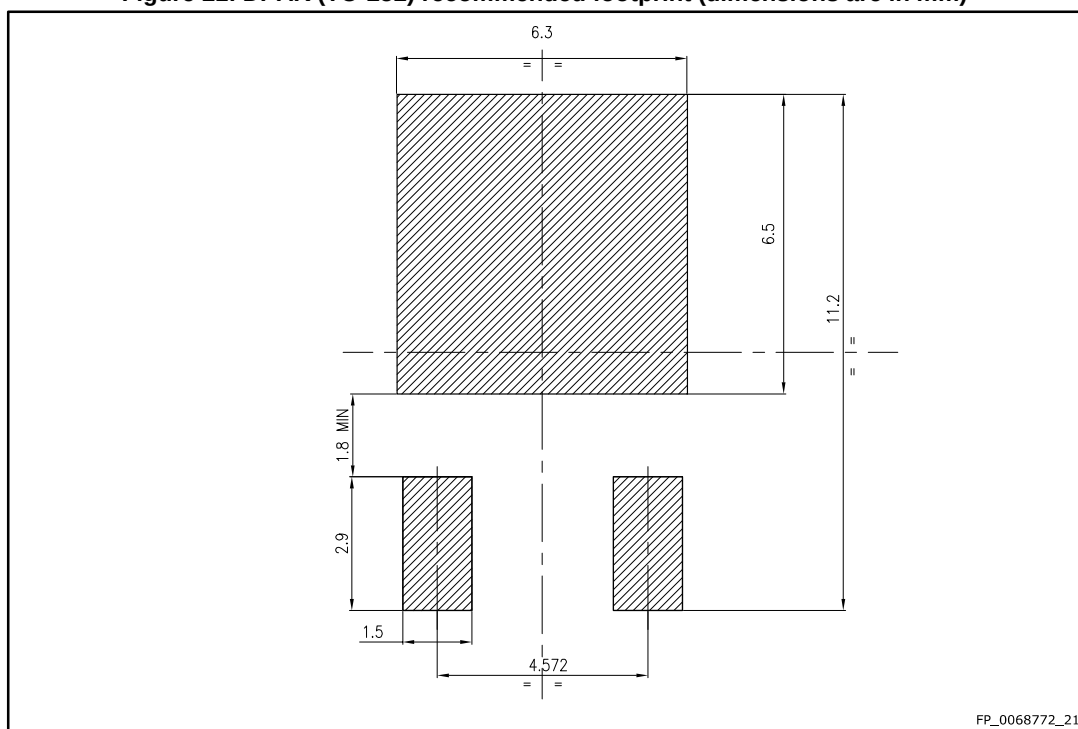


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Table 10: DPAK (TO-252) type A mechanical data

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	4.60	4.70	4.80
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 packing information

Figure 22: DPAK (TO-252) tape outline

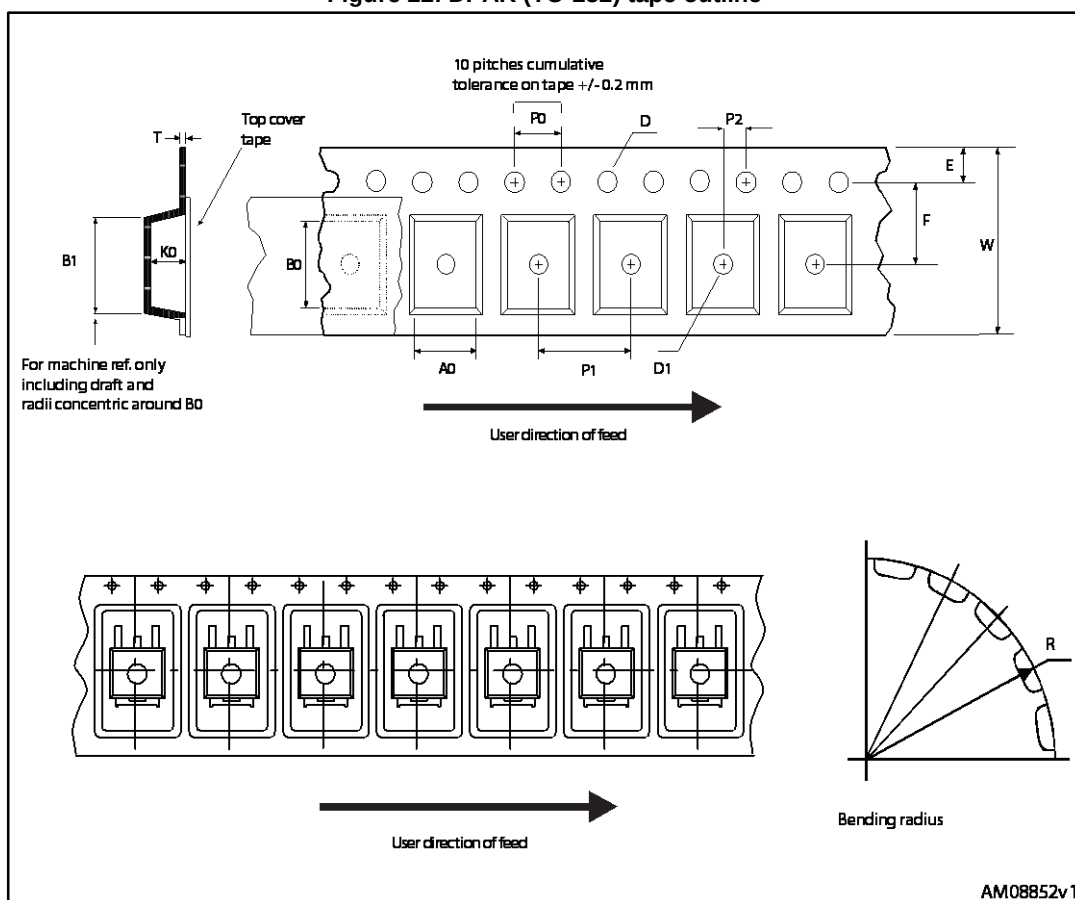


Figure 23: DPAK (TO-252) reel outline

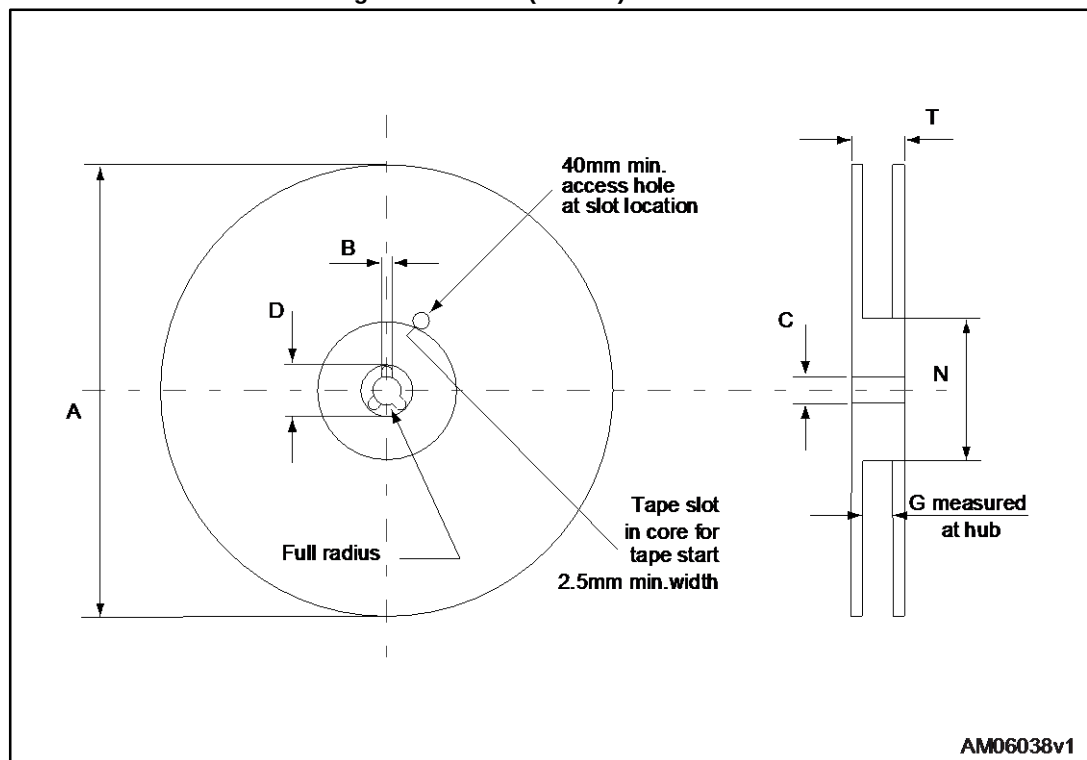


Table 11: DPAK (TO-252) tape and reel mechanical data

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
13-May-2015	1	Initial release
27-Jul-2016	2	Updated title and features in cover page. Updated Section 1: "Electrical ratings" and Section 2: "Electrical characteristics" . Added Section 2.1: "Electrical characteristics (curves)" . Document status promoted from preliminary to production data. Minor text changes.

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