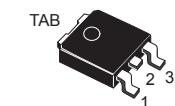
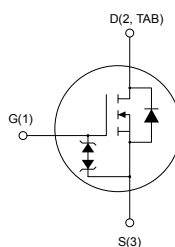


Automotive-grade N-channel 950 V, 0.95 Ω typ., 9 A MDmesh K5 Power MOSFET in a DPAK package



DPAK



AM01476v1_tab

Features

Order code	V_{DS}	$R_{DS(on)max.}$	I_D	P_{TOT}
STD7N95K5AG	950 V	1.25 Ω	9 A	110 W

- AEC-Q101 qualified 
- 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.



Product status link

[STD7N95K5AG](#)

Product summary ⁽¹⁾

Order code	STD7N95K5AG
Marking	7N95K5
Package	DPAK
Packing	Tape and reel

1. The HTRB test was performed at 80% $V_{(BR)DSS}$ in compliance with AEC-Q101 rev. C. All the other tests were performed according to rev. D.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	9	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	6	A
$I_{DM}^{(1)}$	Drain current (pulsed)	13	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	110	W
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_J max.)	3	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	90	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	V/ns
T_J	Operating junction temperature range	-55 to 150	$^{\circ}\text{C}$
T_{stg}	Storage temperature range		

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 9\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DS(peak)} \leq V_{(BR)DSS}$.
3. $V_{DS} \leq 760\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	1.15	$^{\circ}\text{C}/\text{W}$
$R_{thJB}^{(1)}$	Thermal resistance, junction-to-board	50	$^{\circ}\text{C}/\text{W}$

1. When mounted on 1 inch² FR-4 board, 2 oz Cu.

2 Electrical characteristics

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

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	V _{GS} = 0 V, I _D = 1 mA	950			V
I _{DSS}	Zero gate voltage drain current	V _{GS} = 0 V, V _{DS} = 950 V			1	μA
		V _{GS} = 0 V, V _{DS} = 950 V, T _c = 125 °C ⁽¹⁾			50	μA
I _{GSS}	Gate body leakage current	V _{DS} = 0, V _{GS} = ±20 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 = 3 A		0.95	1.25	Ω

1. Defined by design, not subject to production test.

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz	-	430	-	pF
C _{oss}	Output capacitance		-	36	-	pF
C _{o(tr)} ⁽¹⁾	Equivalent capacitance time related	V _{GS} = 0 V, V _{DS} = 0 to 760 V	-	52	-	pF
C _{o(er)} ⁽²⁾	Equivalent capacitance energy related		-	19	-	pF
R _G	Intrinsic gate resistance	f = 1 MHz, I _D = 0 A	-	7	-	Ω
Q _g	Total gate charge	V _{DD} = 760 V, I _D = 6 A, V _{GS} = 0 to 10 V, (see Figure 15. Test circuit for gate charge behavior)	-	9.6	-	nC
Q _{gs}	Gate-source charge		-	3.2	-	nC
Q _{gd}	Gate-drain charge		-	4.4	-	nC

1. C_{o(tr)} is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

2. C_{o(er)} is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 475 V, I _D = 3 A, R _G = 4.7 Ω,	-	13	-	ns
t _r	Rise time	V _{GS} = 10 V (see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	11	-	ns
t _{d(off)}	Turn-off delay time		-	30	-	ns
t _f	Fall time		-	18	-	ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		9	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		13	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 6\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 6\text{ A}$, $V_{DD} = 60\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$, (see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	420		ns
Q_{rr}	Reverse recovery charge		-	4.8		μC
I_{RRM}	Reverse recovery current		-	17		A
t_{rr}	Reverse recovery time	$I_{SD} = 6\text{ A}$, $V_{DD} = 60\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	620		ns
Q_{rr}	Reverse recovery charge		-	6.7		μC
I_{RRM}	Reverse recovery current		-	14.5		A

1. Pulse width limited by safe operating area.

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Table 7. 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 1. Safe operating area

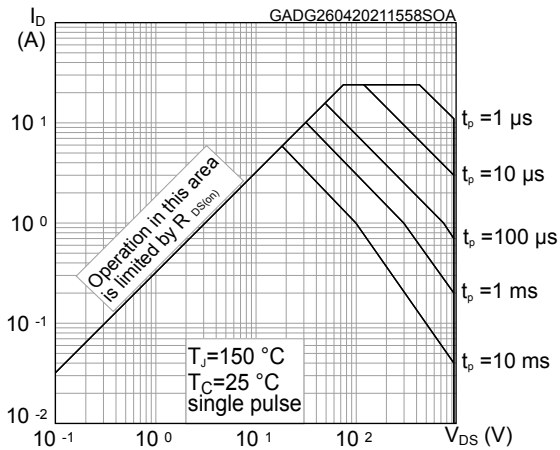


Figure 2. Maximum transient thermal impedance

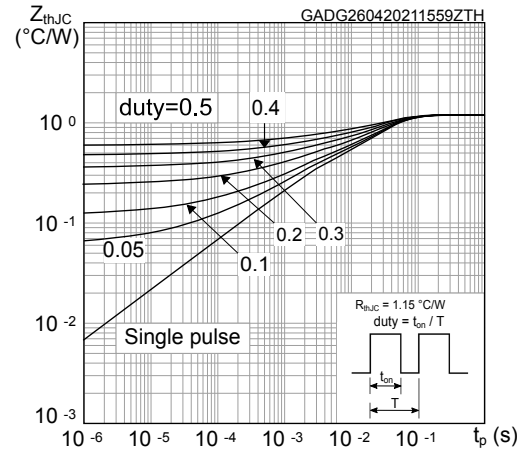


Figure 3. Typical output characteristics

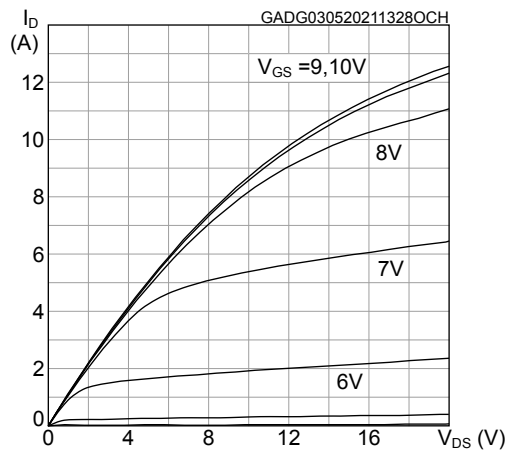


Figure 4. Typical transfer characteristics

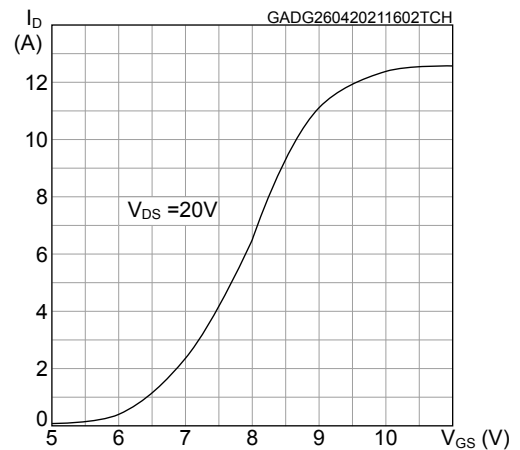


Figure 5. Typical gate charge characteristics

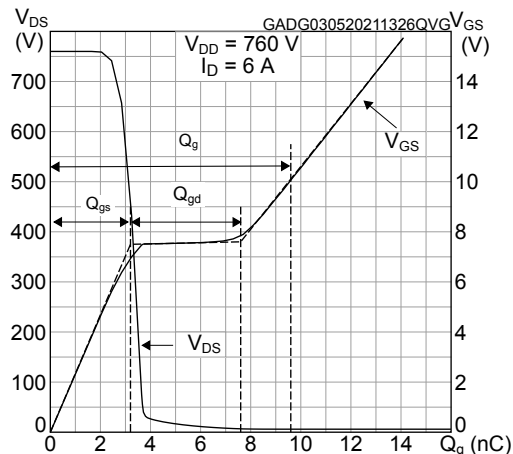


Figure 6. Typical drain-source on-resistance

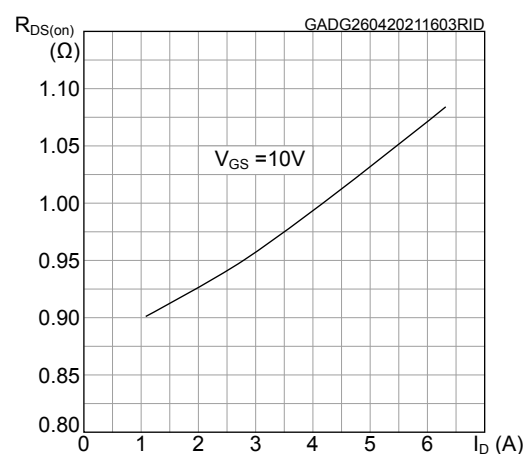


Figure 7. Typical capacitance characteristics

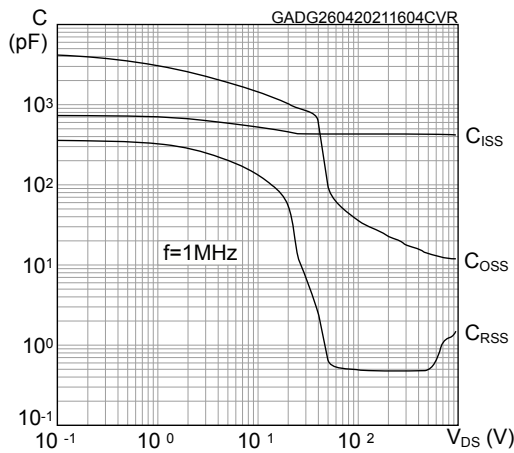


Figure 8. Typical output capacitance stored energy

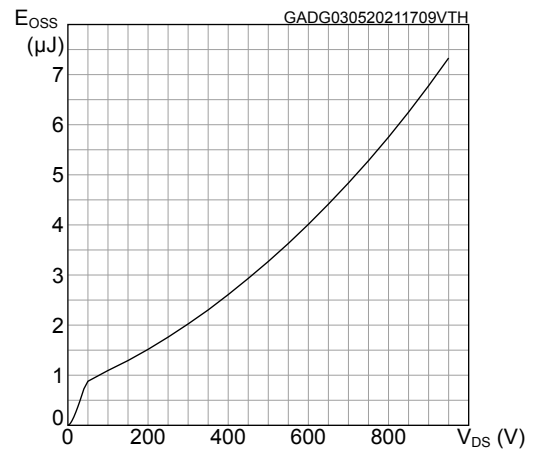


Figure 9. Normalized gate threshold vs temperature

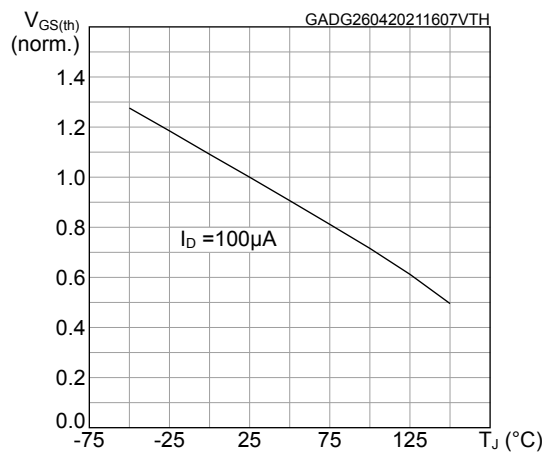


Figure 10. Normalized on-resistance vs temperature

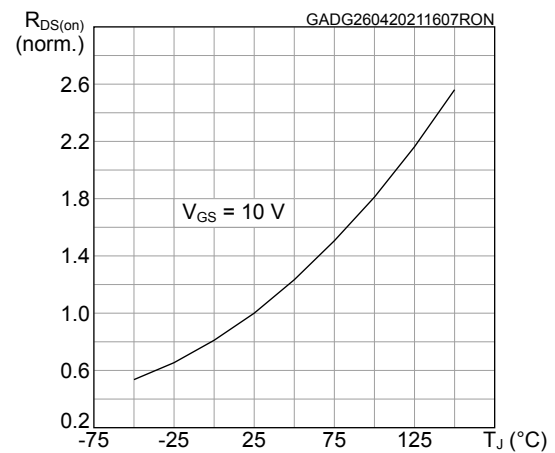


Figure 11. Typical reverse diode forward characteristics

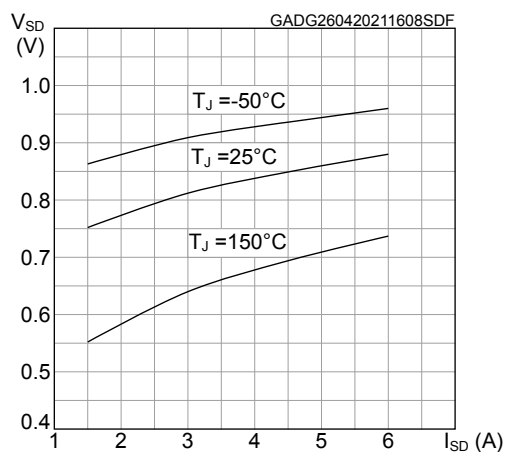


Figure 12. Normalized breakdown voltage vs temperature

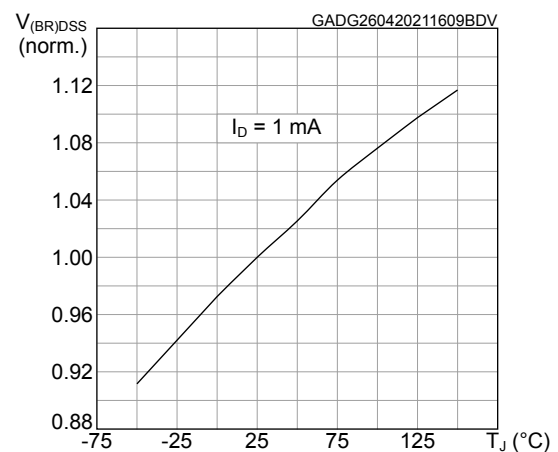
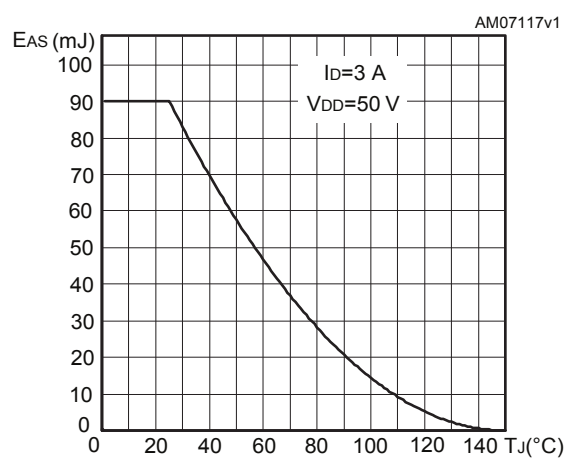
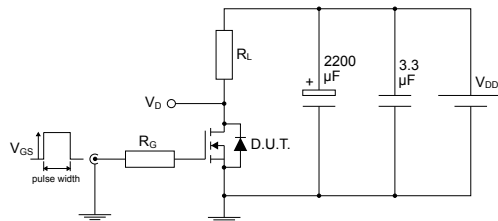


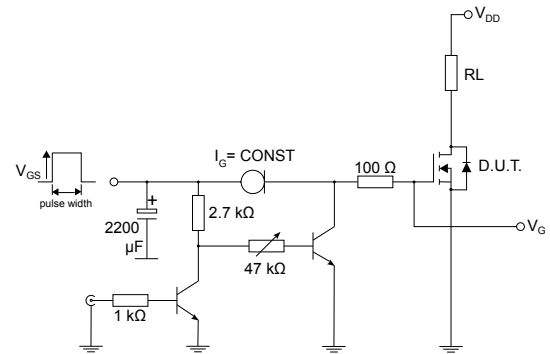
Figure 13. Maximum avalanche energy vs starting T_J



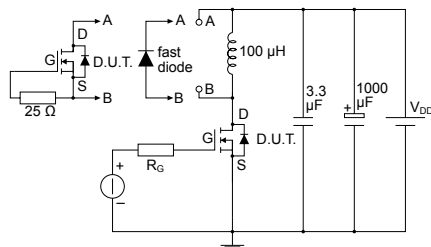
3 Test circuits

Figure 14. Test circuit for resistive load switching times


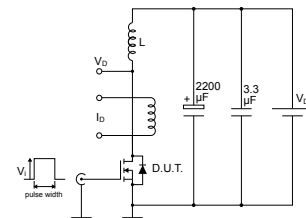
AM01468v1

Figure 15. Test circuit for gate charge behavior


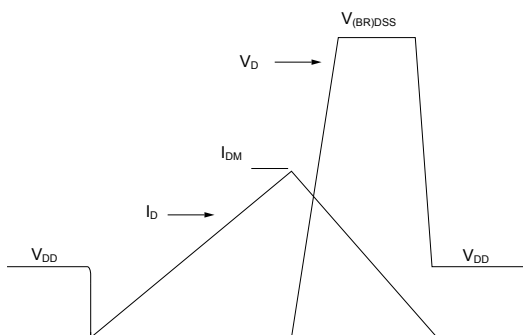
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Figure 16. Test circuit for inductive load switching and diode recovery times


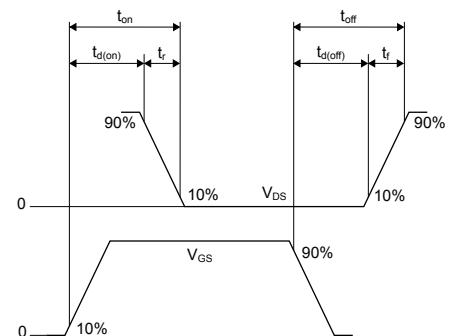
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Figure 17. Unclamped inductive load test circuit


AM01471v1

Figure 18. Unclamped inductive waveform


AM01472v1

Figure 19. Switching time waveform


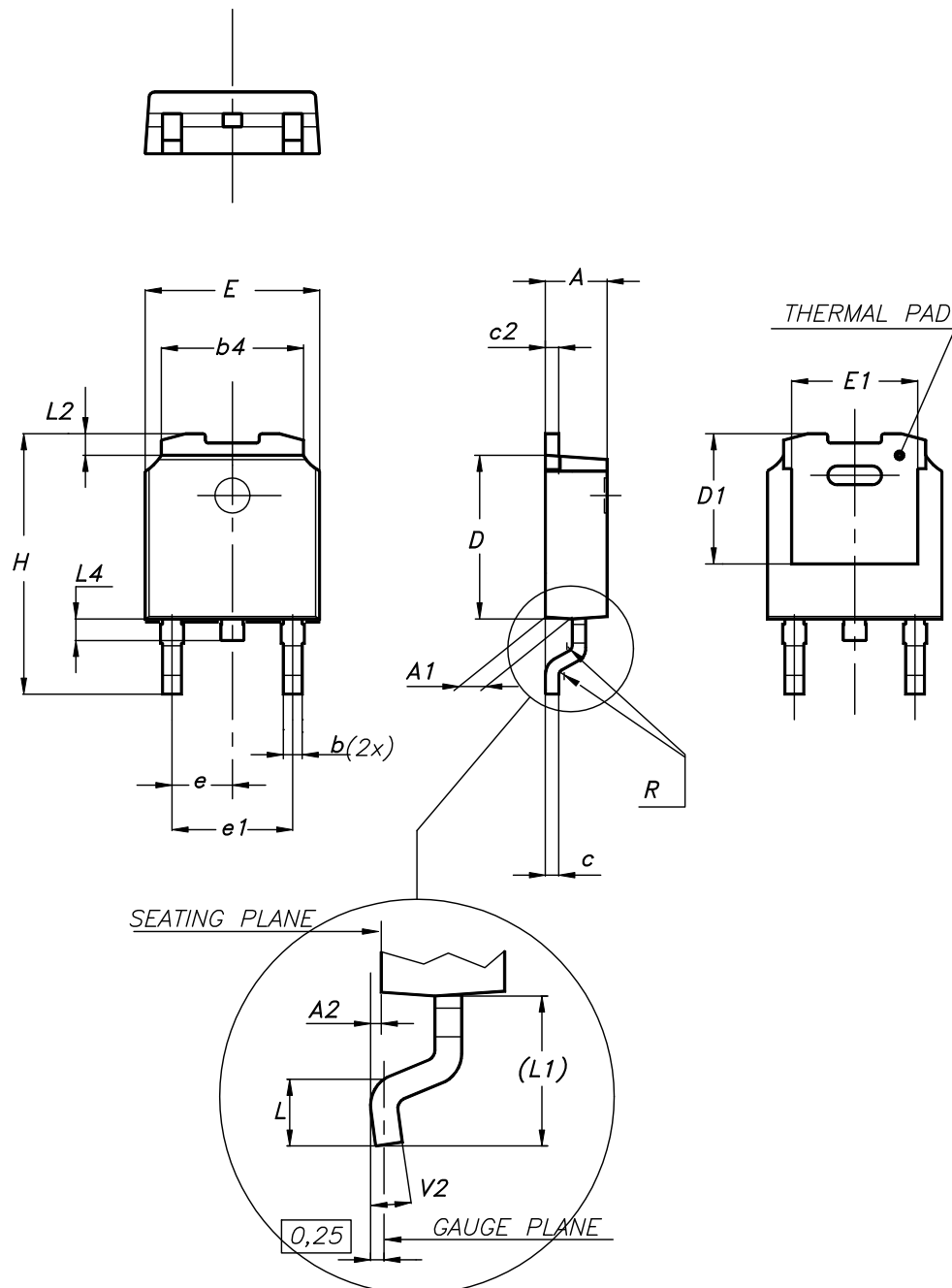
AM01473v1

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. ECOPACK is an ST trademark.

4.1 DPAK (TO-252) type A2 package information

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



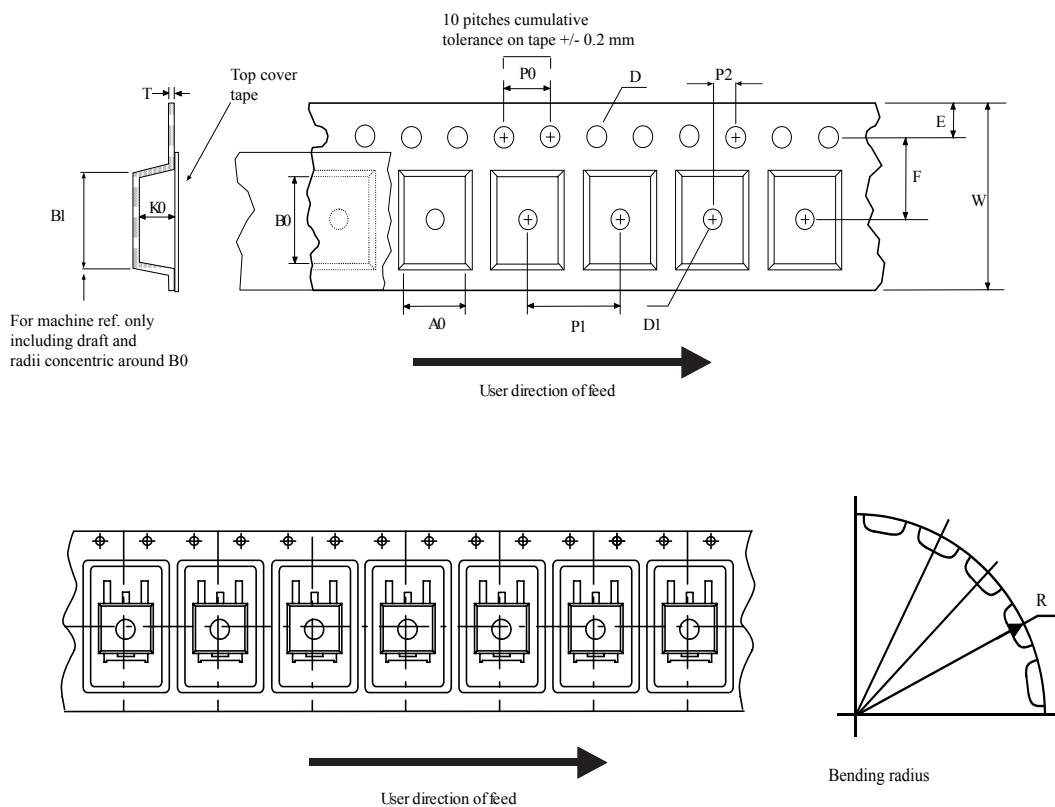
0068772_type-A2_rev30

Table 8. 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	2.159	2.286	2.413
e1	4.445	4.572	4.699
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°

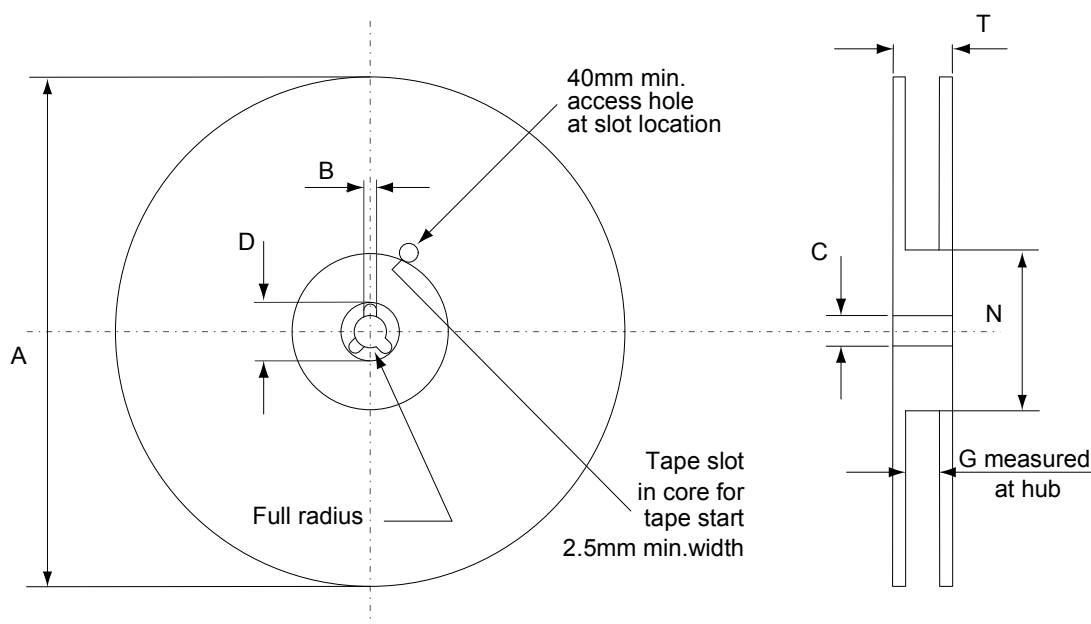
4.2 DPAK (TO-252) packing information

Figure 21. DPAK (TO-252) tape outline



AM08852v1

Figure 22. DPAK (TO-252) reel outline



AM06038v1

Table 9. 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			

Revision history

Table 10. Document revision history

Date	Revision	Changes
05-May-2021	1	First release.

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