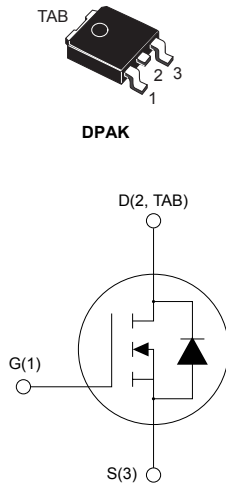


Automotive-grade N-channel 500 V, 700 mΩ typ., 7.5 A, MDmesh Power MOSFET in a DPAK package




AM01475v1_noZen



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STD5NM50AG	500 V	800 mΩ	7.5 A

- AEC-Q101 qualified 
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Applications

- Switching applications

Description

This N-channel Power MOSFET is developed using STMicroelectronics' revolutionary MDmesh technology, which associates the multiple drain process with the company's PowerMESH horizontal layout. This device offers extremely low on-resistance, high dv/dt, and excellent avalanche characteristics. Using STMicroelectronics's proprietary strip technique, this Power MOSFET boasts an overall dynamic performance that is superior to similar products on the market.

Product status link

[STD5NM50AG](#)

Product summary

Order code	STD5NM50AG
Marking	D5NM50
Package	DPAK
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Gate-source voltage	500	V
V_{DGR}	Drain-gate voltage ($R_{GS} = 20\text{ k}\Omega$)	500	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	7.5	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	4.7	
$I_{DM}^{(1)}$	Drain current (pulsed)	30	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	100	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature range	-55 to 150	$^\circ\text{C}$
T_j	Operating junction temperature range		$^\circ\text{C}$

1. Pulse width limited by safe operating area.

2. $I_{SD} \leq 5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS(\text{peak})} < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-to-case	1.25	$^\circ\text{C}/\text{W}$
$R_{thJA}^{(1)}$	Thermal resistance junction-to-ambient	50	$^\circ\text{C}/\text{W}$

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

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_{jmax})	2.5	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	300	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	500			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 500\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 500\text{ V}$, $T_C = 125\text{ °C}^{(1)}$			10	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 30\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 2.5\text{ A}$		700	800	m Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	415	-	pF
C_{oss}	Output capacitance		-	88	-	pF
C_{riss}	Reverse transfer capacitance		-	12	-	pF
$C_{oss\ eq.}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}$, $V_{GS} = 0\text{ V}$	-	50	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	3	-	Ω
Q_g	Total gate charge	$V_{DD} = 400\text{ V}$, $I_D = 7.5\text{ A}$, $V_{GS} = 0\text{ to } 10\text{ V}$ (see Figure 13. Test circuit for gate charge behavior)	-	13	-	nC
Q_{gs}	Gate-source charge		-	5	-	nC
Q_{gd}	Gate-drain charge		-	6	-	nC

1. $C_{oss\ eq.}$ 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}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 250\text{ V}$, $I_D = 2.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	16	-	ns
t_r	Rise time		-	8	-	ns
$t_{d(Voff)}$	Off-voltage rise time	$V_{DD} = 400\text{ V}$, $I_D = 5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14. Test circuit for inductive load switching and diode recovery times and Figure 17. Switching time waveform)	-	14	-	ns
t_f	Fall time		-	6	-	ns
t_c	Cross-over time		-	13	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		7.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		30	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 7.5\text{ A}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$	-	185		ns
Q_{rr}	Reverse recovery charge		-	1.1		μC
I_{RRM}	Reverse recovery current	(see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	11.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$	-	270		ns
Q_{rr}	Reverse recovery charge		-	1.6		μC
I_{RRM}	Reverse recovery current		(see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	12	

1. Pulse width is limited by safe operating area
2. Pulse test: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

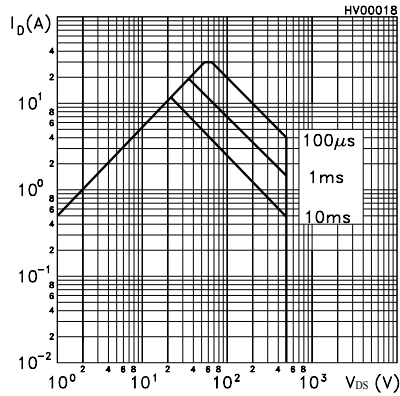


Figure 2. Thermal impedance

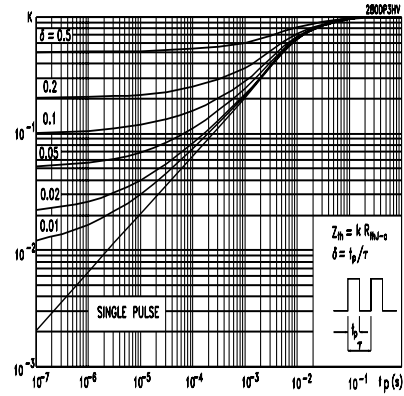


Figure 3. Output characteristics

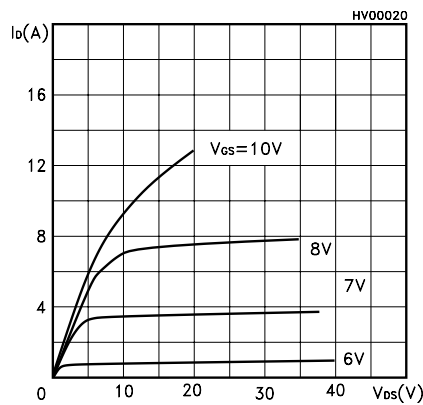


Figure 4. Transfer characteristics

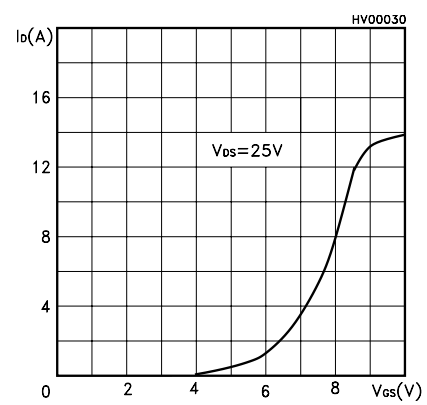


Figure 5. Normalized gate threshold voltage vs temperature

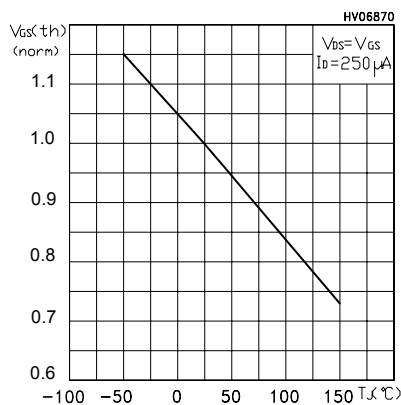


Figure 6. Normalized $V_{(BR)DSS}$ vs temperature

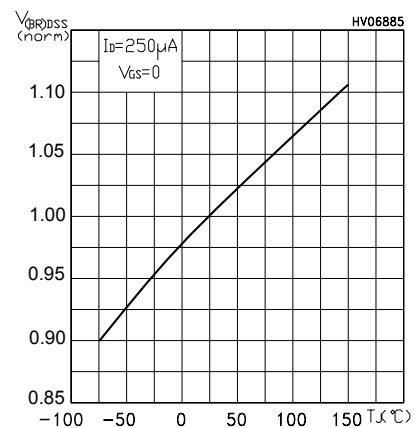


Figure 7. Static drain-source on-resistance

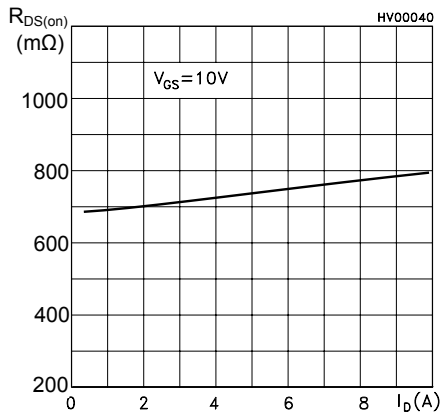


Figure 8. Normalized on-resistance vs temperature

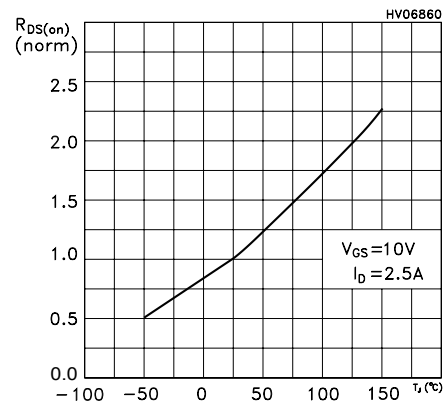


Figure 9. Gate charge vs gate-source voltage

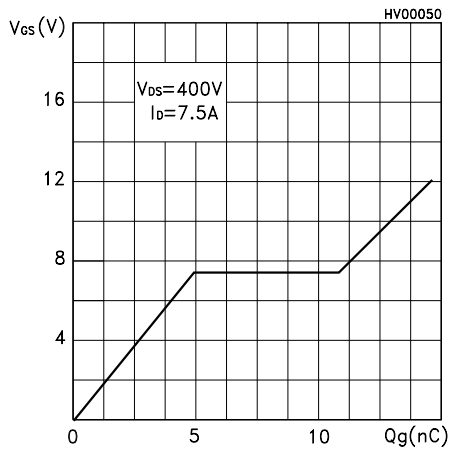


Figure 10. Capacitance variations

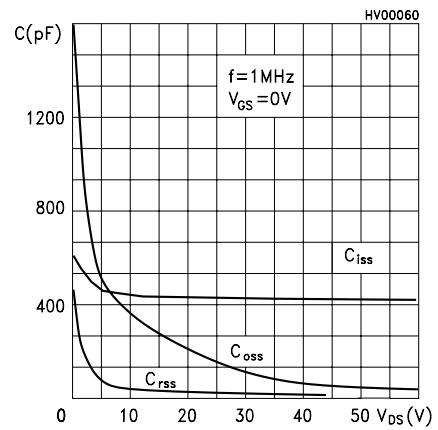
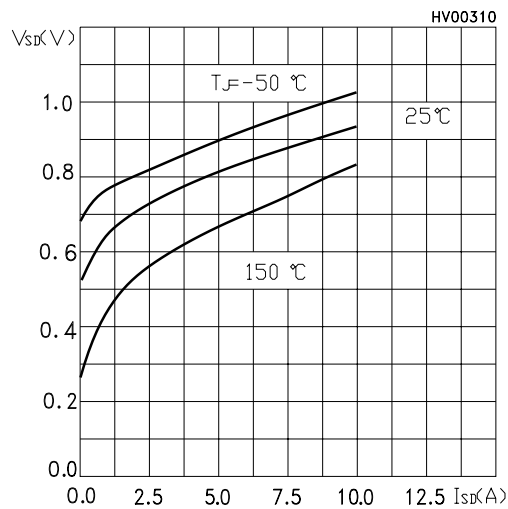


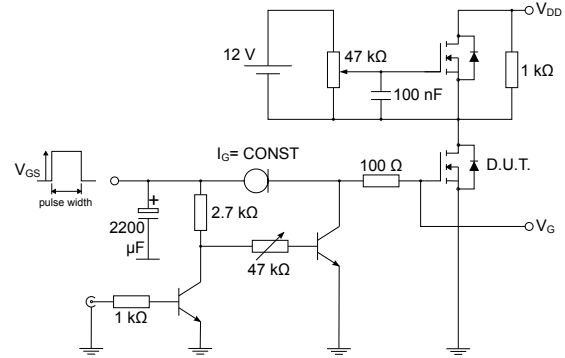
Figure 11. Source-drain diode forward characteristics



3 Test circuits

Figure 12. Test circuit for resistive load switching times


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Figure 13. Test circuit for gate charge behavior


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Figure 14. Test circuit for inductive load switching and diode recovery times


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Figure 15. Unclamped inductive load test circuit


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Figure 16. Unclamped inductive waveform


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Figure 17. Switching time waveform

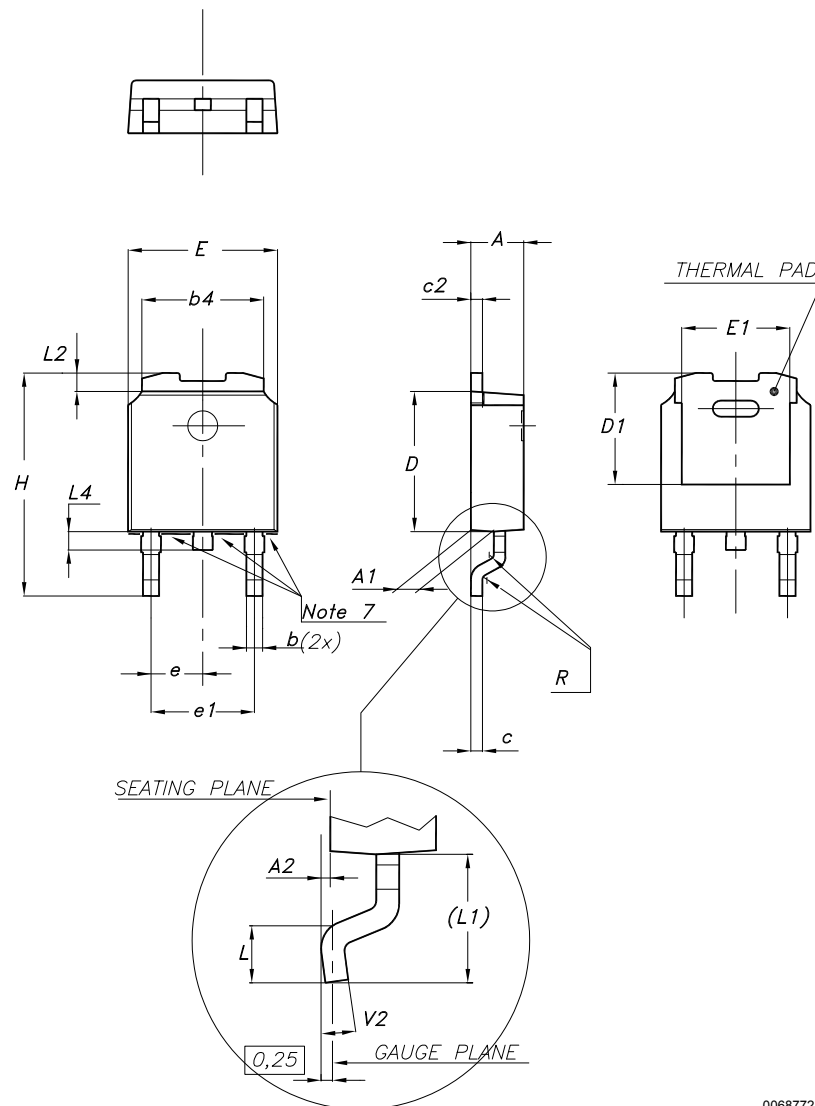

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4 Package information

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 18. DPAK (TO-252) type A2 package outline

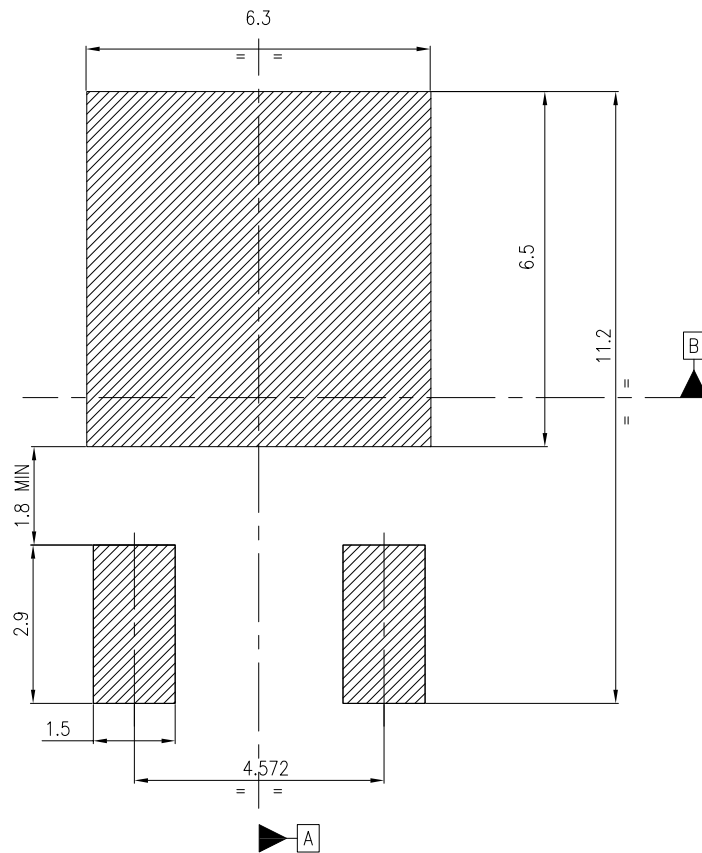


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Table 8. DPAK (TO-252) type A2 mechanical data

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°

Figure 19. DPAK (TO-252) recommended footprint (dimensions are in mm)



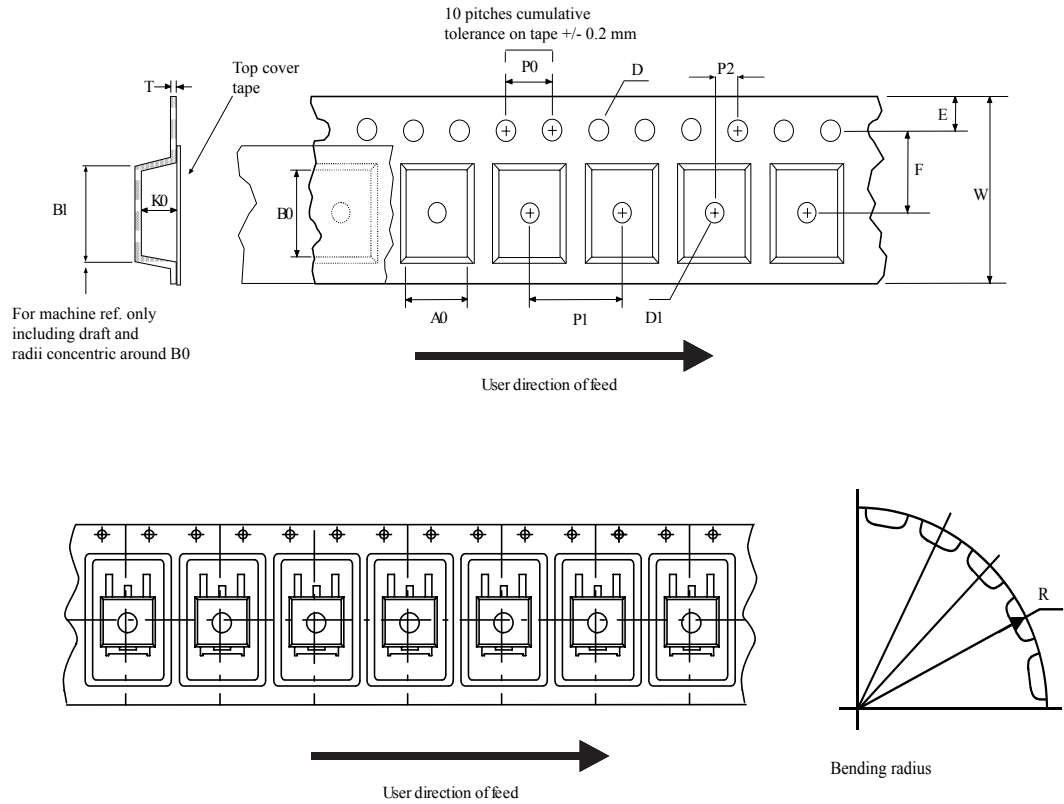
Notes:

- 1) This footprint is able to ensure insulation up to 630 Vrms (according to CEI IEC 664-1)
- 2) The device must be positioned within $\boxed{\oplus 0.05 \text{ A B}}$

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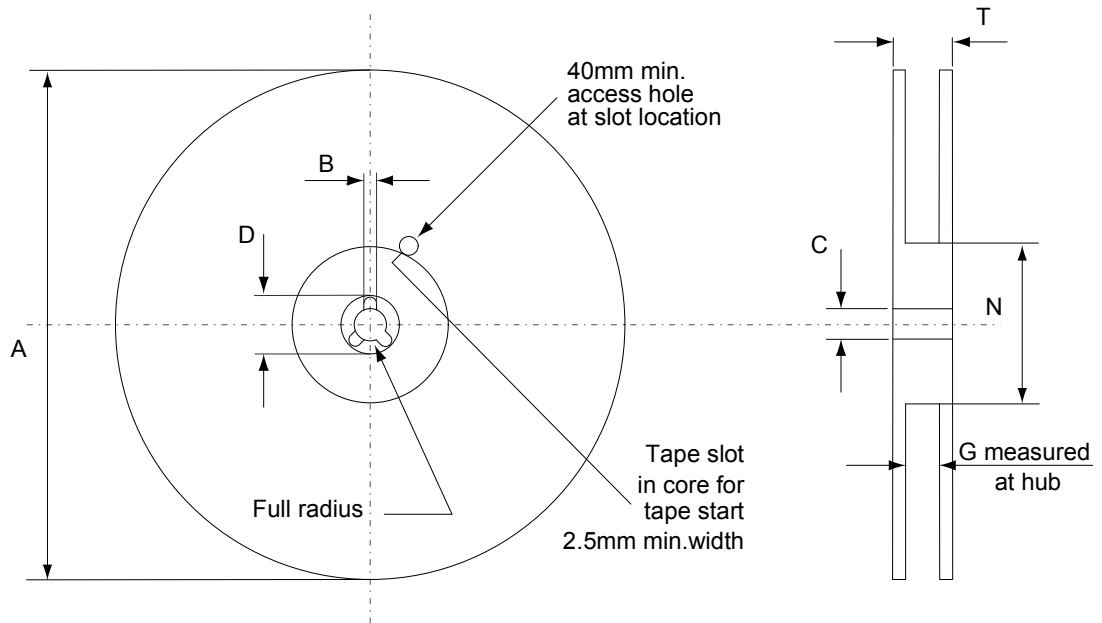
4.2 DPAK (TO-252) packing information

Figure 20. DPAK (TO-252) tape outline



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Figure 21. DPAK (TO-252) reel outline



AM06038v1

Table 9. DPAK (TO-252) tape and reel mechanical data

Dim.	Tape		Dim.	Reel	
	mm			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	Version	Changes
12-Sep-2018	1	Initial release.
09-Apr-2019	2	Updated <i>Section 4.1 DPAK (TO-252) type A package information.</i> Minor text changes.
20-Sep-2023	3	Updated <i>Section 4.1 DPAK (TO-252) type A2 package information.</i> Minor text changes.

Contents

1	Electrical ratings	2
2	Electrical characteristics	3
2.1	Electrical characteristics (curves)	5
3	Test circuits	7
4	Package information	8
4.1	DPAK (TO-252) type A2 package information	8
4.2	DPAK (TO-252) packing information	11
	Revision history	13

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