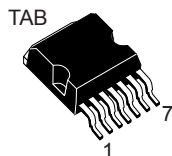
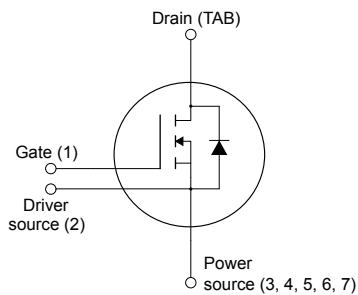


# Automotive-grade silicon carbide Power MOSFET 1200 V, 18.5 mΩ typ., 100 A in an H<sup>2</sup>PAK-7 package



**H<sup>2</sup>PAK-7**


N-chG1DS2PS34567DTAB



## Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> typ.	I <sub>D</sub>
SCT020H120G3AG	1200 V	18.5 mΩ	100 A

- AEC-Q101 qualified 
- Very low R<sub>DS(on)</sub> over the entire temperature range
- High speed switching performances
- Very fast and robust intrinsic body diode
- Source sensing pin for increased efficiency

## Applications

- Main inverter (electric traction)
- DC/DC converter for EV/HEV
- On board charger (OBC)

## Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 3<sup>rd</sup> generation SiC MOSFET technology. The device features a very low R<sub>DS(on)</sub> over the entire temperature range combined with low capacitances and very high switching operations, which improve application performance in frequency, energy efficiency, system size and weight reduction.

### Product status link

[SCT020H120G3AG](#)

### Product summary

<b>Order code</b>	SCT020H120G3AG
<b>Marking</b>	20H120G3AG
<b>Package</b>	H <sup>2</sup> PAK-7
<b>Packing</b>	Tape and reel

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	1200	V
$V_{GS}$	Gate-source voltage	-10 to 22	V
	Gate-source voltage (recommended operating values)	-5 to 18	
	Gate-source transient voltage, $t_p < 1 \mu s$ , $t \leq 10$ hours over lifetime	-11 to 25	
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25 \text{ }^\circ\text{C}$	100	A
	Drain current (continuous) at $T_C = 100 \text{ }^\circ\text{C}$	70	
$I_{DM}^{(2)}$	Drain current (pulsed)	281	A
$P_{TOT}$	Total power dissipation at $T_C = 25 \text{ }^\circ\text{C}$	555	W
$T_{stg}$	Storage temperature range	-55 to 175	$^\circ\text{C}$
$T_J$	Operating junction temperature range		$^\circ\text{C}$

- $I_D$  is limited by package.
- Pulse width is limited by safe operating area.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.27	$^\circ\text{C/W}$
$R_{thJA}$	Thermal resistance, junction-to-ambient	50	$^\circ\text{C/W}$

## 2 Electrical characteristics

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

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}$			10	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 2.3\text{ mA}$	1.8	3.0	4.2	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 15\text{ V}, I_D = 50\text{ A}$		19		m $\Omega$
		$V_{GS} = 18\text{ V}, I_D = 50\text{ A}$		18.5	28	
		$V_{GS} = 18\text{ V}, I_D = 50\text{ A}, T_J = 175\text{ °C}$		37		

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 800\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	3465	-	pF
$C_{oss}$	Output capacitance		-	140	-	pF
$C_{riss}$	Reverse transfer capacitance		-	13.5	-	pF
$Q_g$	Total gate charge	$V_{DD} = 800\text{ V}, V_{GS} = -5\text{ to }18\text{ V}, I_D = 50\text{ A}$	-	121	-	nC
$Q_{gs}$	Gate-source charge		-	36	-	nC
$Q_{gd}$	Gate-drain charge		-	40	-	nC
$R_g$	Gate input resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$	-	1.5	-	$\Omega$

**Table 5. Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{DD} = 800\text{ V}, I_D = 50\text{ A},$	-	1088	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$R_G = 18\text{ }\Omega, V_{GS} = -5\text{ to }18\text{ V}$	-	909	-	$\mu\text{J}$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{ V}, I_D = 50\text{ A},$ $R_G = 18\text{ }\Omega, V_{GS} = -5\text{ to }18\text{ V}$	-	54	-	ns
$t_r$	Rise time		-	57	-	ns
$t_{d(off)}$	Turn-off delay time		-	101	-	ns
$t_f$	Fall time		-	34	-	ns

**Table 7. Reverse SiC diode characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Continuous diode forward current	$T_C = 25\text{ }^\circ\text{C}$	-		100	A
		$T_C = 100\text{ }^\circ\text{C}$	-		70	
$V_{SD}$	Diode forward voltage	$I_{SD} = 50\text{ A}, V_{GS} = 0\text{ V}$	-	3		V
$t_{rr}$	Reverse recovery time	$I_{SD} = 50\text{ A}, di/dt = 1000\text{ A}/\mu\text{s},$ $V_{DD} = 800\text{ V}, V_{GS} = -5\text{ V}$	-	22.6		ns
$Q_{rr}$	Reverse recovery charge		-	206		nC
$I_{RRM}$	Reverse recovery current		-	15.4		A

1.  $I_{SD}$  is limited by package.

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

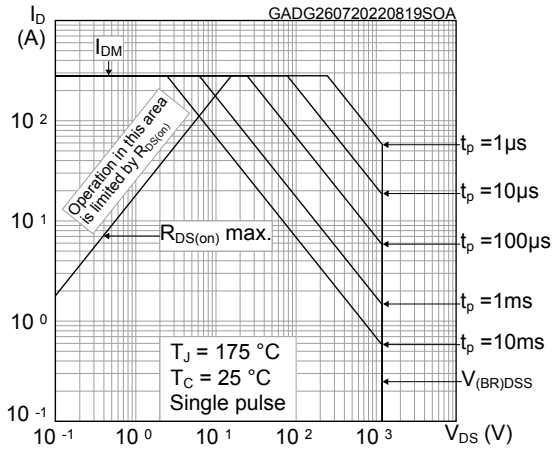


Figure 2. Maximum transient thermal impedance

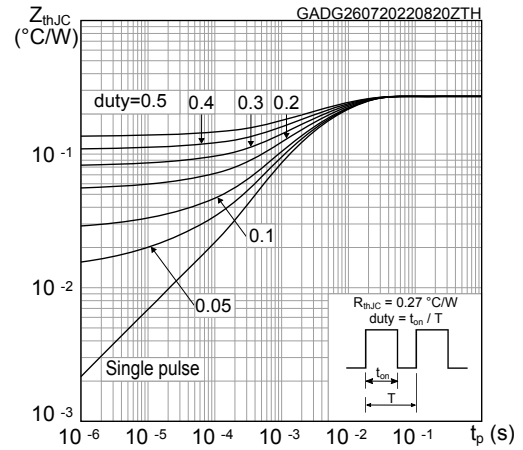


Figure 3. Typical output characteristics ( $T_J = 25^\circ\text{C}$ )

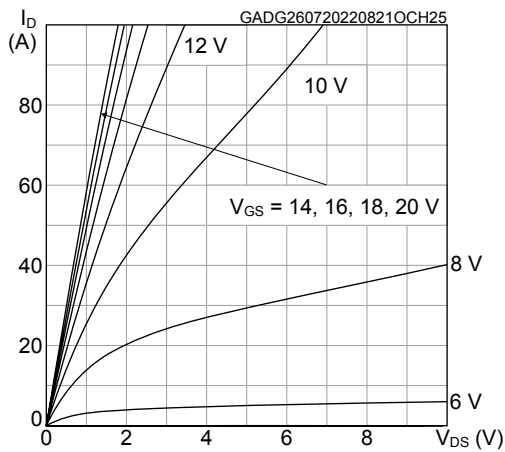


Figure 4. Typical output characteristics ( $T_J = 175^\circ\text{C}$ )

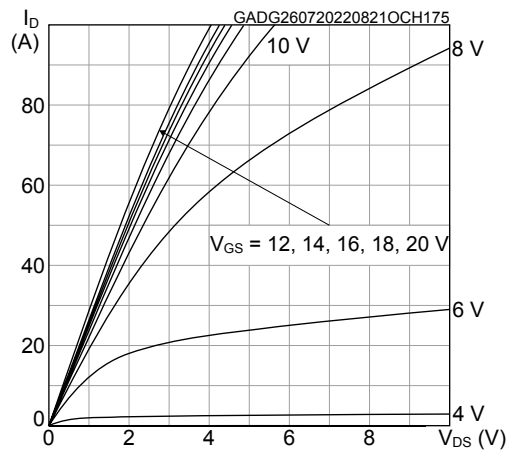


Figure 5. Typical transfer characteristics

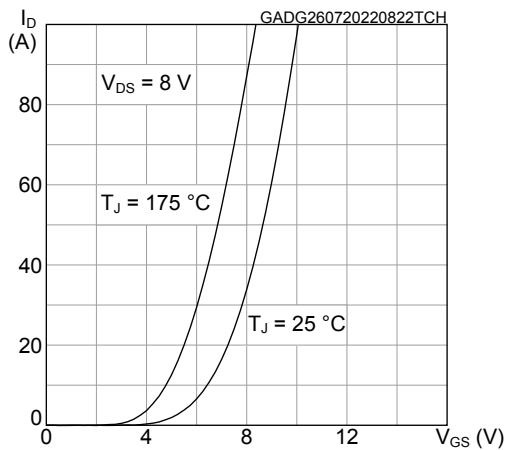
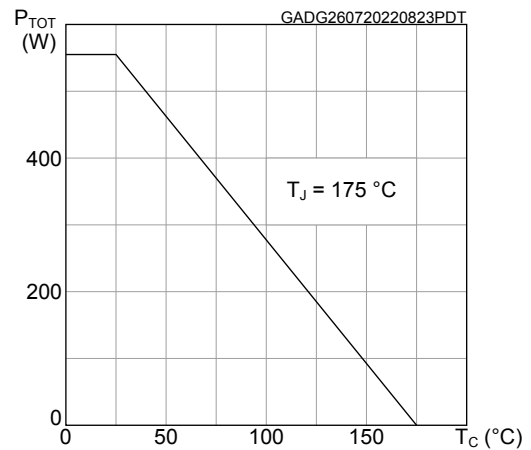
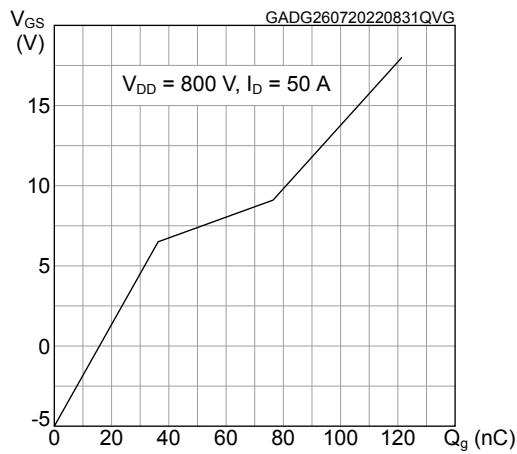


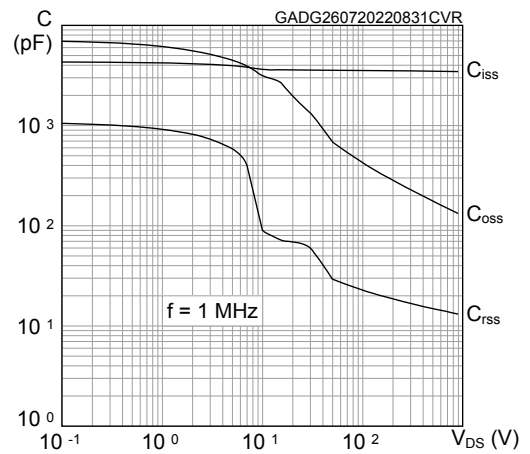
Figure 6. Total power dissipation



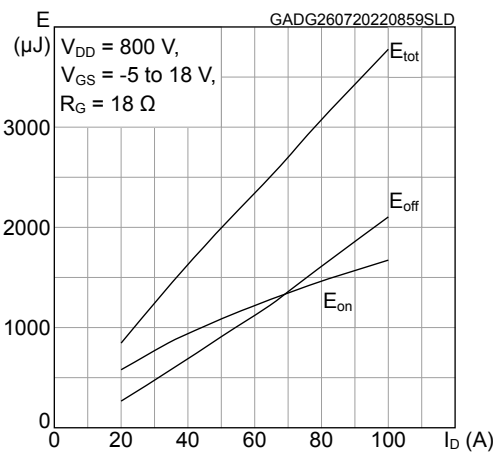
**Figure 7. Typical gate charge characteristics**



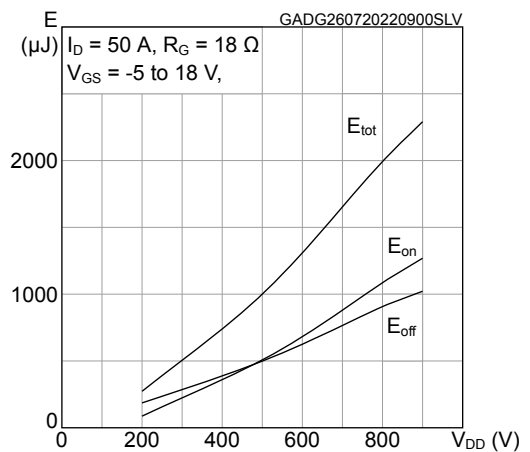
**Figure 8. Typical capacitance characteristics**



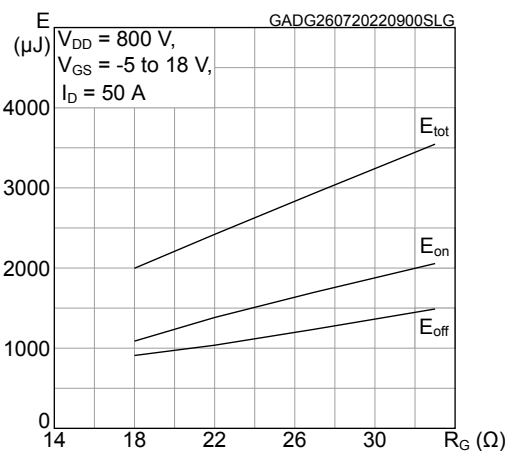
**Figure 9. Typical switching energy vs drain current**



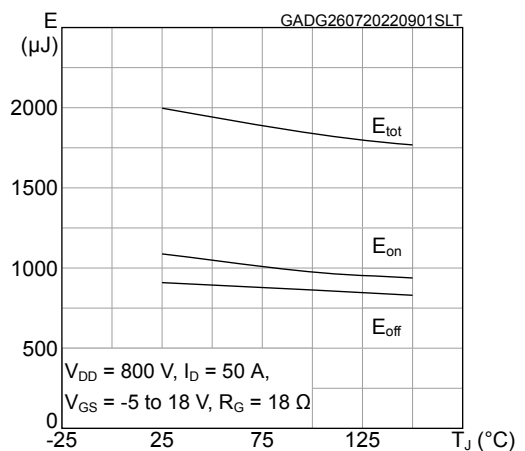
**Figure 10. Typical switching energy vs supply voltage**



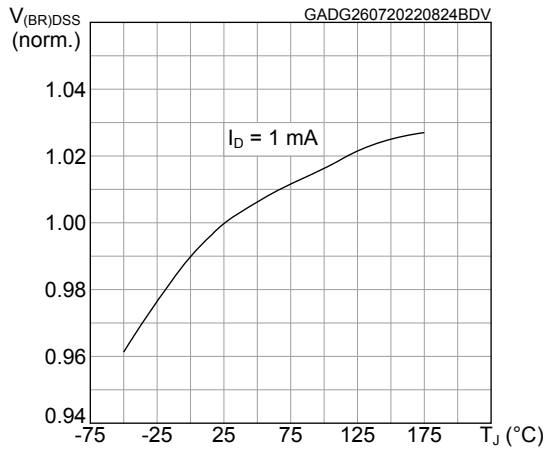
**Figure 11. Typical switching energy vs gate resistance**



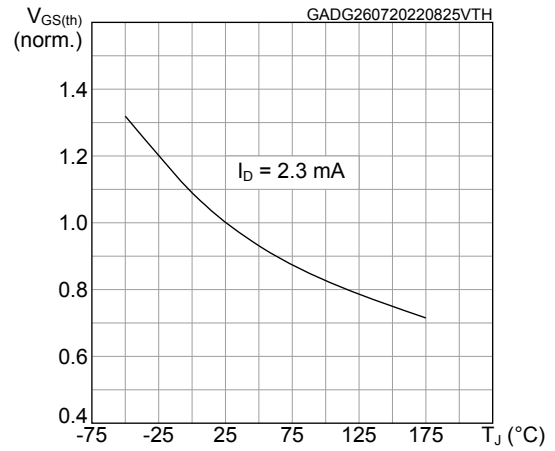
**Figure 12. Typical switching energy vs temperature**



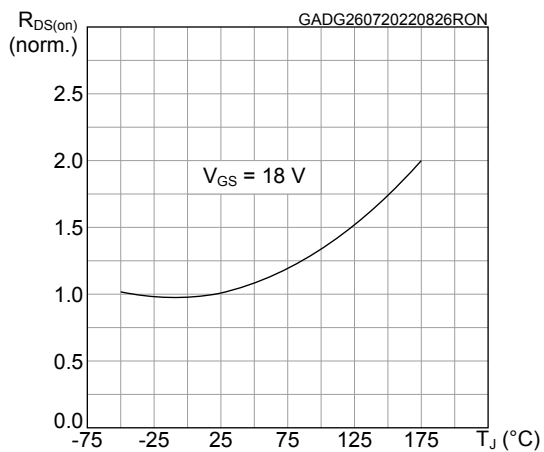
**Figure 13. Normalized breakdown voltage vs temperature**



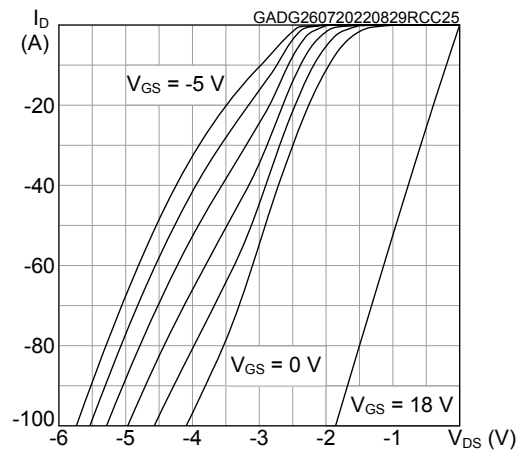
**Figure 14. Normalized gate threshold vs temperature**



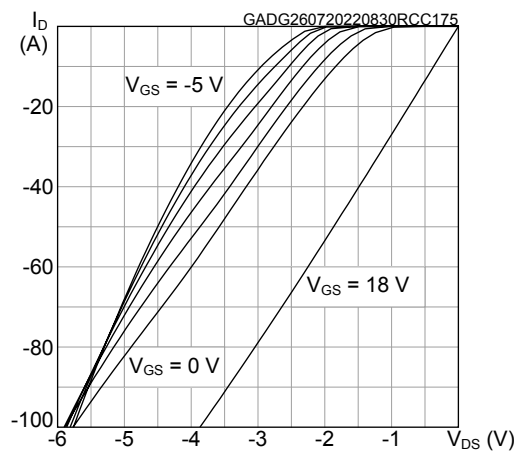
**Figure 15. Normalized on-resistance vs temperature**



**Figure 16. Typical reverse conduction characteristics ( $T_J = 25^\circ\text{C}$ )**



**Figure 17. Typical reverse conduction characteristics ( $T_J = 175^\circ\text{C}$ )**

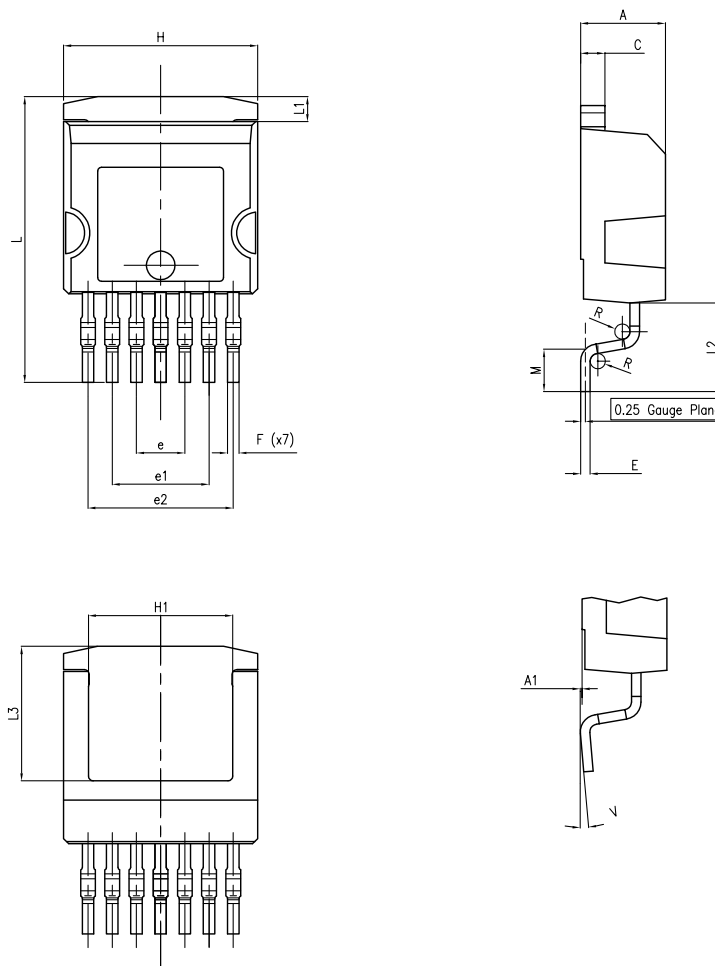


### 3 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

#### 3.1 H<sup>2</sup>PAK-7 package information

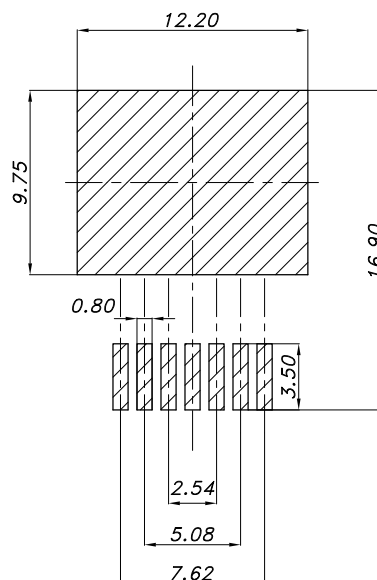
Figure 18. H<sup>2</sup>PAK-7 package outline



**Table 8. H<sup>2</sup>PAK-7 package mechanical data**

Dim.	mm	
	Min.	Max.
A	4.30	4.80
A1	0.03	0.20
C	1.17	1.37
e	2.34	2.74
e1	4.88	5.28
e2	7.42	7.82
E	0.45	0.60
F	0.50	0.70
H	10.00	10.40
H1	7.40	7.60
L	14.75	15.25
L1	1.27	1.40
L2	4.35	4.95
L3	6.85	7.25
M	1.90	2.50
R	0.20	0.60
V	0°	8°

**Figure 19. H<sup>2</sup>PAK-7 recommended footprint**

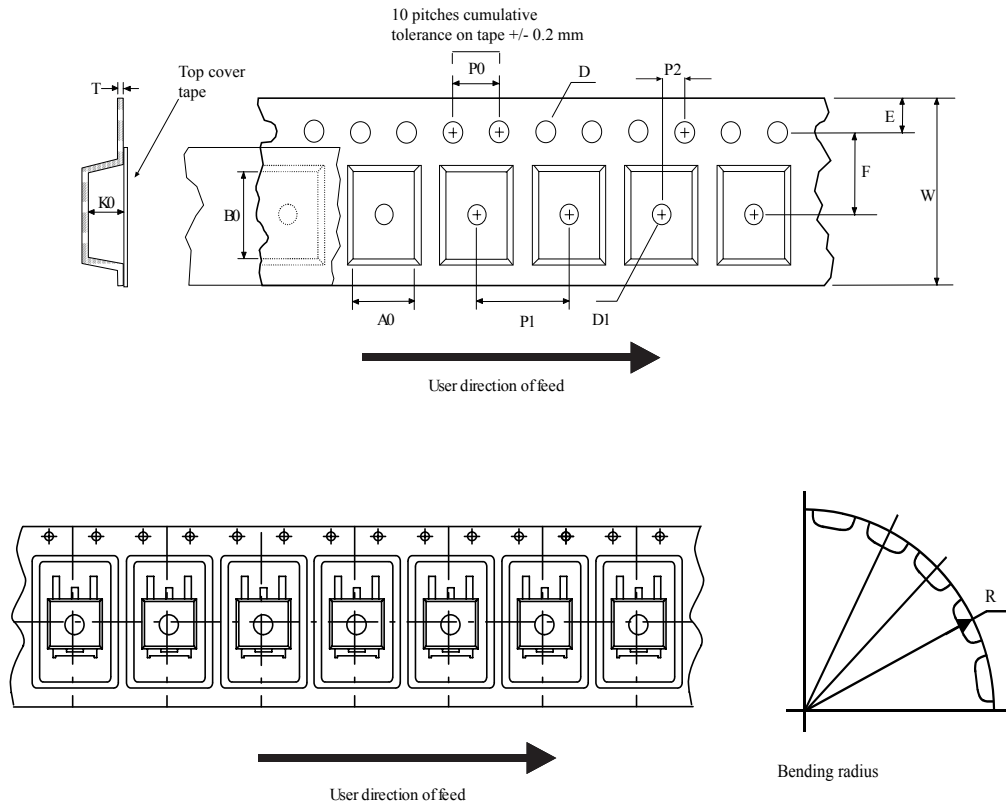


footprint\_DM00249216\_4

*Note: Dimensions are in mm.*

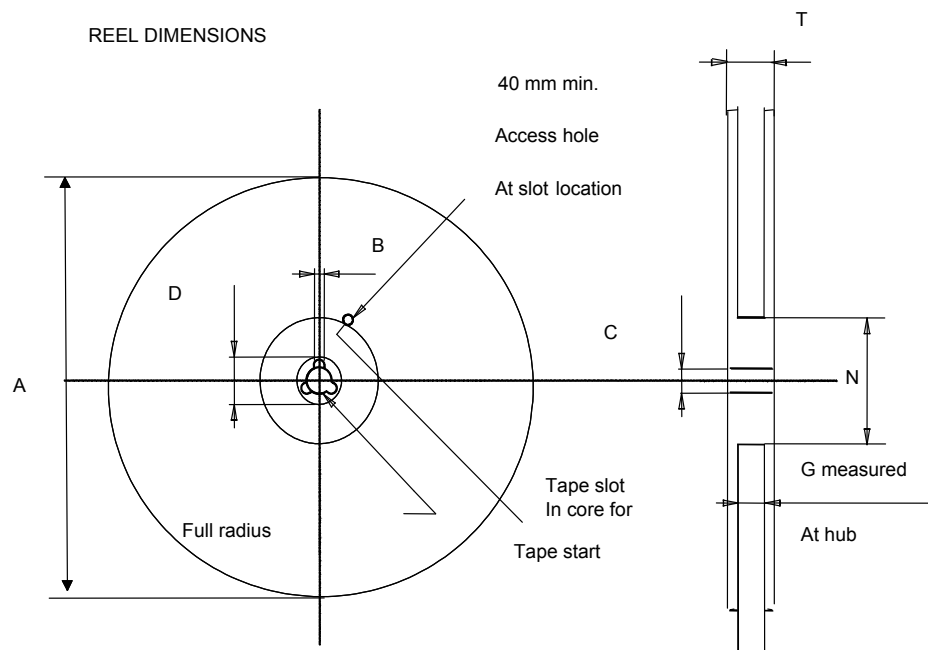
### 3.2 Packing information

Figure 20. Tape outline



AM08852v2

Figure 21. Reel outline



**Table 9. 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			

## Revision history

**Table 10. Document revision history**

Date	Revision	Changes
27-Sep-2022	1	First release.

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