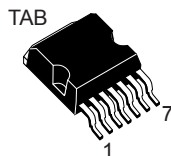
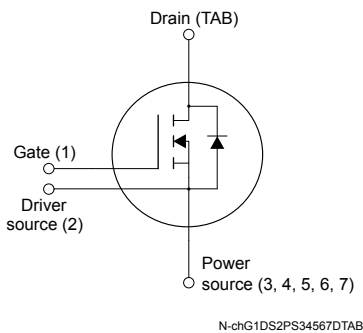


Silicon carbide Power MOSFET 650 V, 116 A, 18 mΩ (typ., $T_J = 25\text{ °C}$) in an H²PAK-7 package


H²PAK-7

Product status link
[SCTH90N65G2V-7](#)
Product summary

Order code	SCTH90N65G2V-7
Marking	SCT90N65
Package	H ² PAK-7
Packing	Tape and reel

Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
SCTH90N65G2V-7	650 V	24 mΩ	116 A

- Very high operating junction temperature capability ($T_J = 175\text{ °C}$)
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitances

Applications

- Switching applications
- Power supply for renewable energy systems
- High frequency DC-DC converters

Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2nd generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	650	V
V_{GS}	Gate-source voltage	-10 to 22	V
	Gate-source voltage (recommended operating values)	-5 to 18	
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	116	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	82	
$I_{DM}^{(1)}$	Drain current (pulsed)	220	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	484	W
T_{stg}	Storage temperature range	-55 to 175	°C
T_J	Operating junction temperature range		°C

1. Pulse width is limited by safe operating area.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.31	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	40	°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	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$			10	μA
		$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ °C}$		10		
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	1.9	3.2	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}, I_D = 50\text{ A}$		18	24	m Ω
		$V_{GS} = 18\text{ V}, I_D = 50\text{ A}, T_J = 175\text{ °C}$		27		

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 400\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	3380	-	pF
C_{oss}	Output capacitance		-	294	-	pF
C_{rSS}	Reverse transfer capacitance		-	49	-	pF
Q_g	Total gate charge	$V_{DD} = 400\text{ V}, I_D = 50\text{ A}, V_{GS} = -5\text{ to }18\text{ V}$	-	157	-	nC
Q_{gs}	Gate-source charge		-	43	-	nC
Q_{gd}	Gate-drain charge		-	42	-	nC
R_g	Gate input resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$	-	1	-	Ω

Table 5. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}, V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $R_G = 2.2\text{ }\Omega$	-	130	-	μJ
E_{off}	Turn-off switching energy		-	210	-	
E_{on}	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}, V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $R_G = 2.2\text{ }\Omega, T_C = 150\text{ °C}$	-	135	-	
E_{off}	Turn-off switching energy		-	200	-	

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 50\text{ A}$, $R_G = 2.2\ \Omega$, $V_{GS} = -5\text{ to }18\text{ V}$	-	26	-	ns
t_f	Fall time		-	16	-	ns
$t_{d(off)}$	Turn-off delay time		-	58	-	ns
t_r	Rise time		-	38	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Forward on voltage	$I_F = 30\text{ A}$, $V_{GS} = 0\text{ V}$	-	2.5	-	V
t_{rr}	Reverse recovery time	$I_F = 50\text{ A}$, $di/dt = 4000\text{ A}/\mu\text{s}$, $V_{DD} = 400\text{ V}$	-	17	-	ns
Q_{rr}	Reverse recovery charge		-	308	-	nC
I_{RRM}	Reverse recovery current		-	30	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

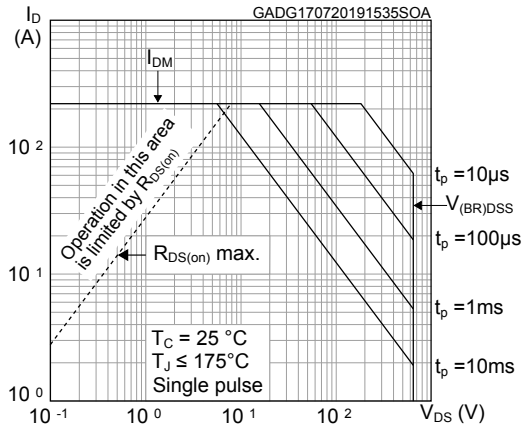


Figure 2. Maximum transient thermal impedance

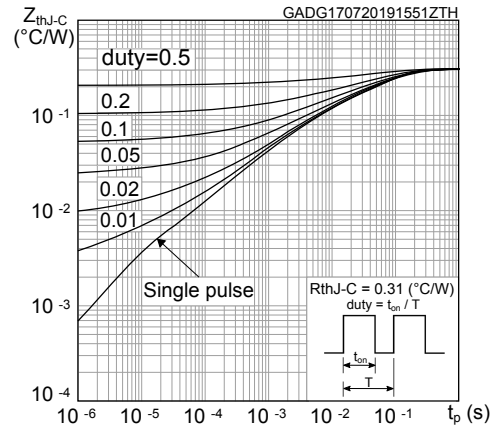


Figure 3. Typical output characteristics ($T_J = -50\text{ °C}$)

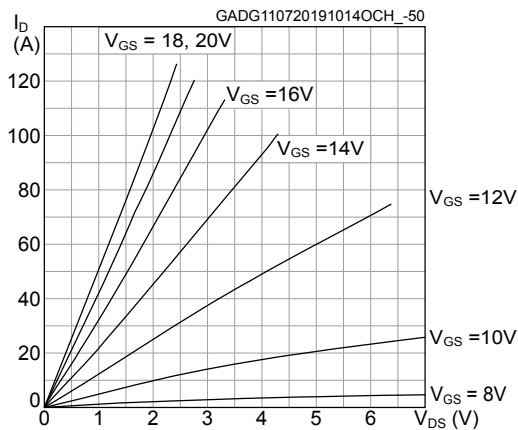


Figure 4. Typical output characteristics ($T_J = 25\text{ °C}$)

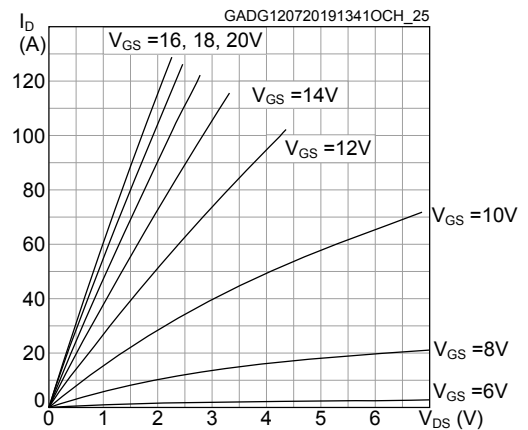


Figure 5. Typical output characteristics ($T_J = 175\text{ °C}$)

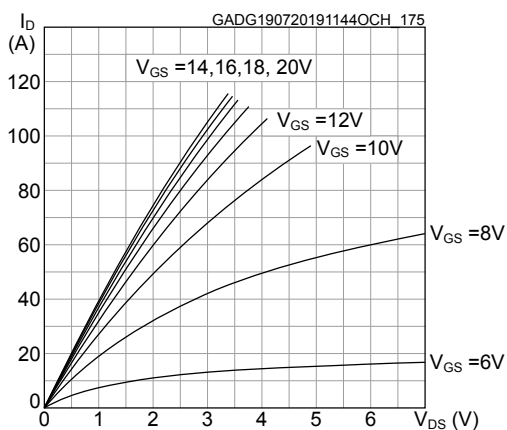


Figure 6. Typical transfer characteristics

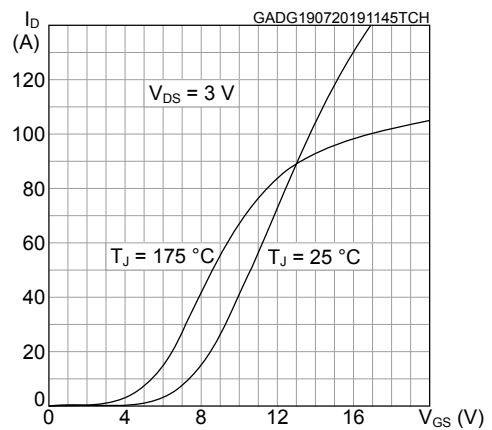


Figure 7. Typical capacitances

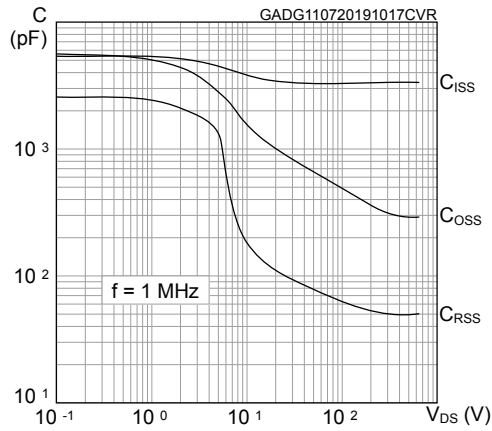


Figure 8. Typical gate charge

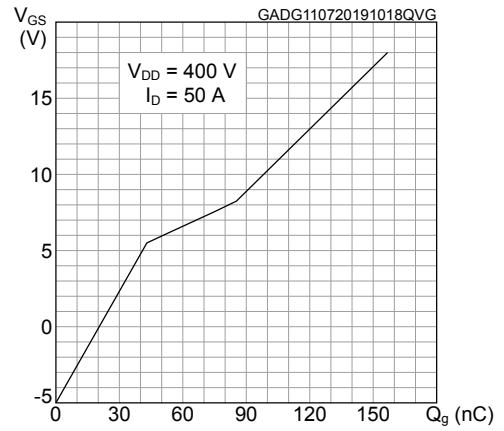


Figure 9. Maximum total power dissipation

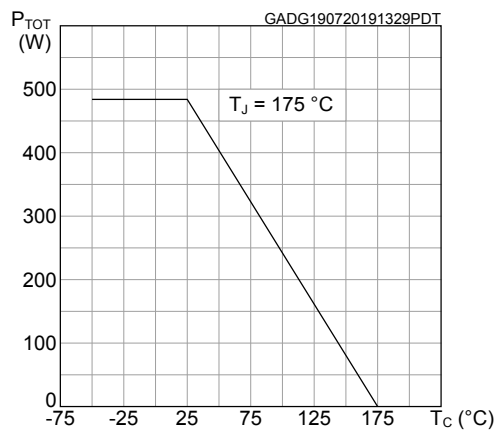


Figure 10. Typical drain-source on-resistance

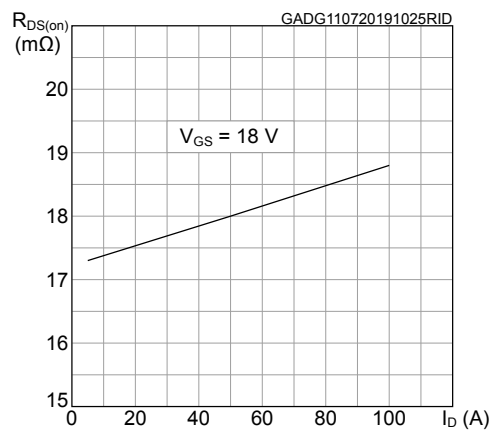


Figure 11. Normalized on-resistance vs temperature

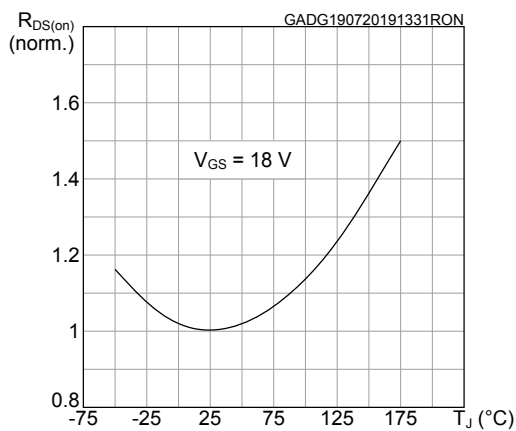


Figure 12. Normalized gate threshold voltage vs temperature

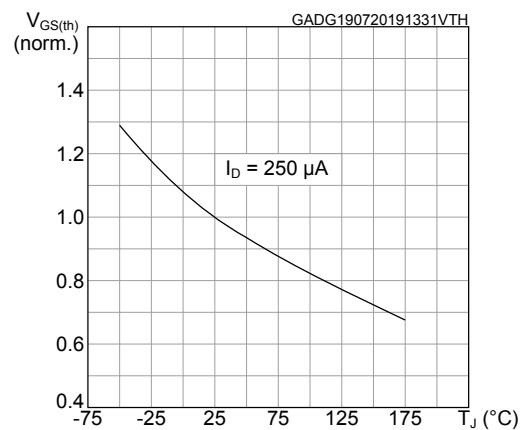


Figure 13. Normalized breakdown voltage vs temperature

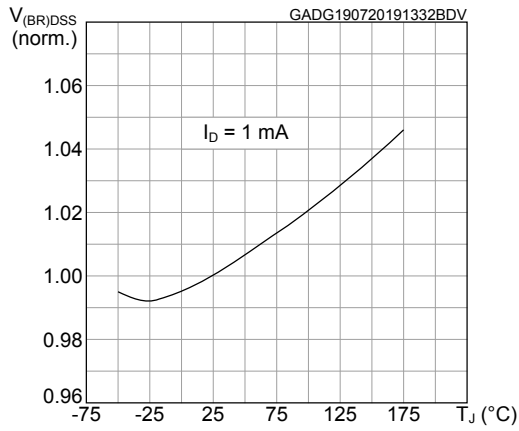


Figure 14. Typical switching energy vs drain current

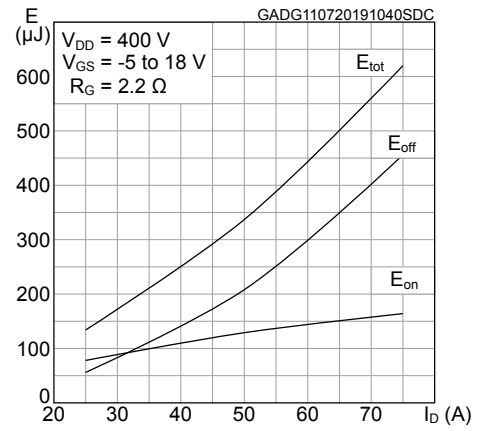


Figure 15. Typical switching energy vs temperature

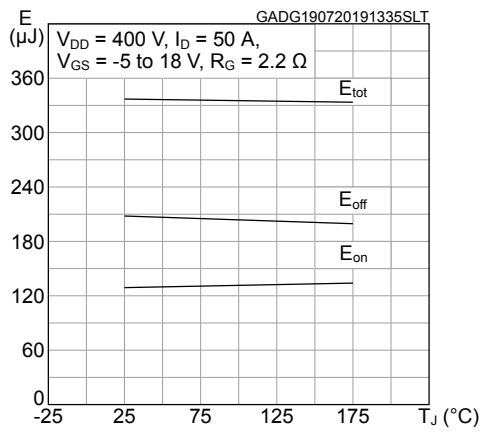


Figure 16. Typical reverse conduction characteristics (Tj = -50 °C)

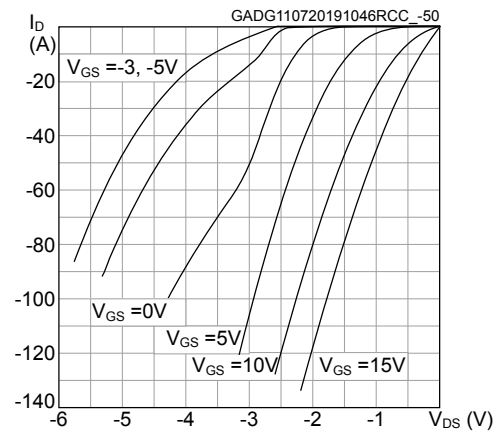


Figure 17. Typical reverse conduction characteristics (Tj = 25 °C)

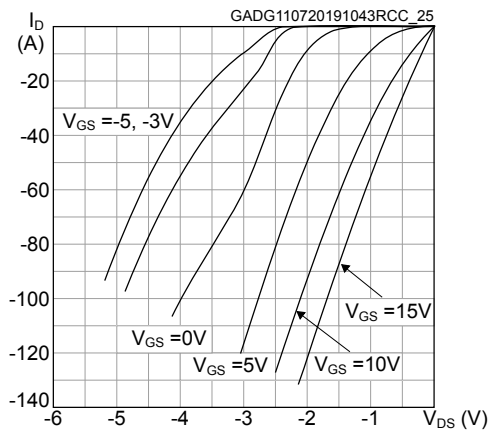
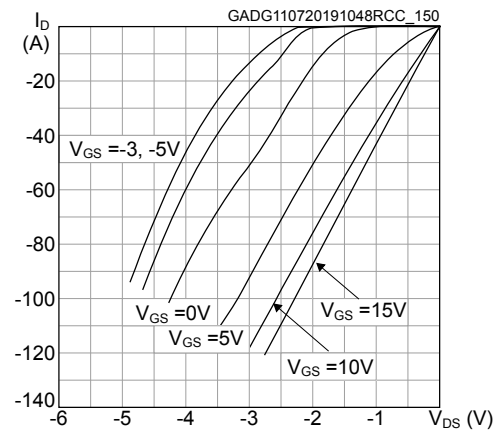


Figure 18. Typical reverse conduction characteristics (Tj = 150 °C)

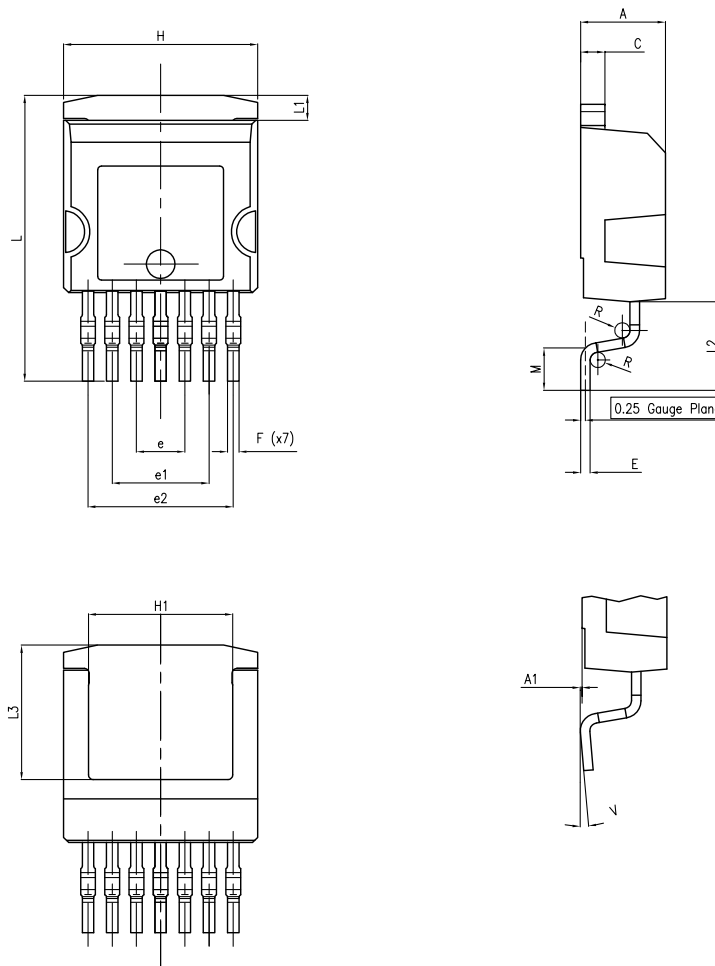


3 Package information

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. ECOPACK is an ST trademark.

3.1 H²PAK-7 package information

Figure 19. H²PAK-7 package outline

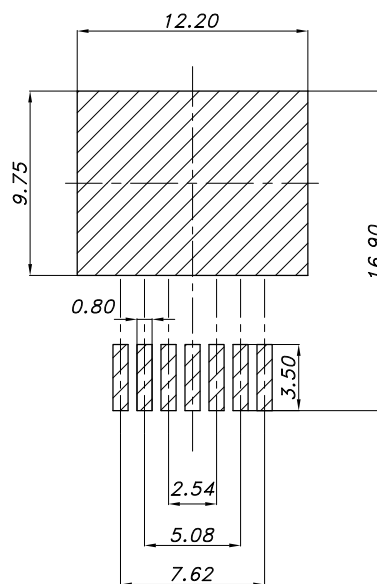


DM00249216_4

Table 8. H²PAK-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 20. H²PAK-7 recommended footprint

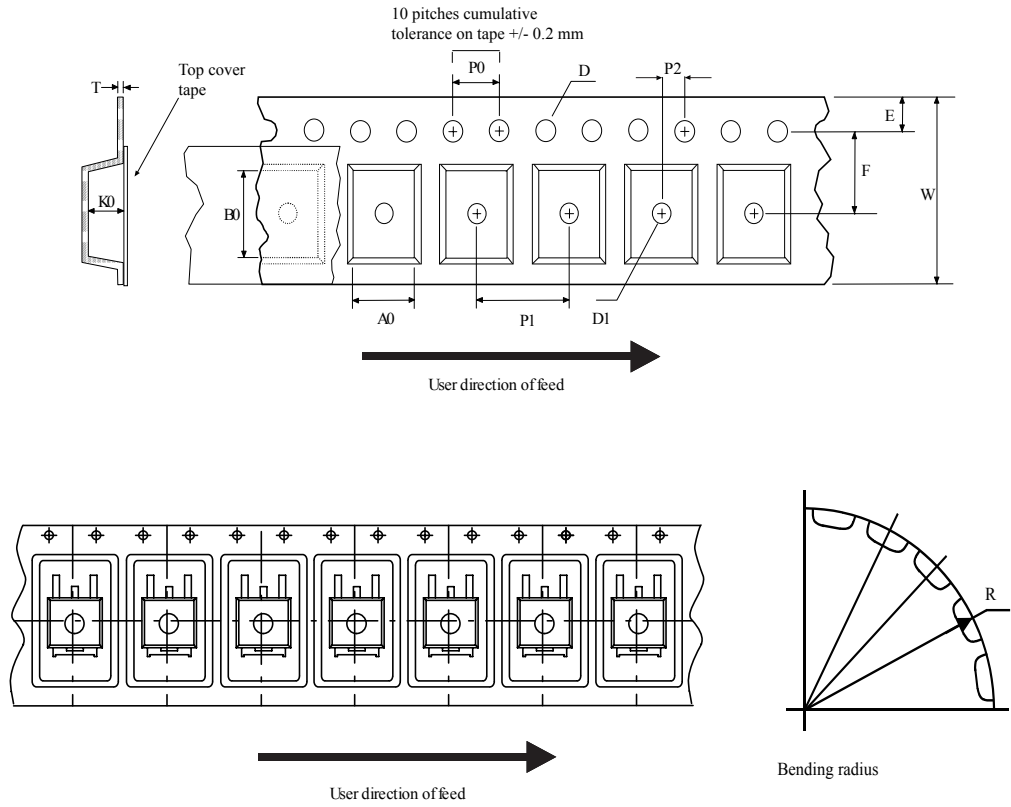


footprint_DM00249216_4

Note: Dimensions are in mm.

3.2 Packing information

Figure 21. Tape outline



AM08852v2

Figure 22. Reel outline

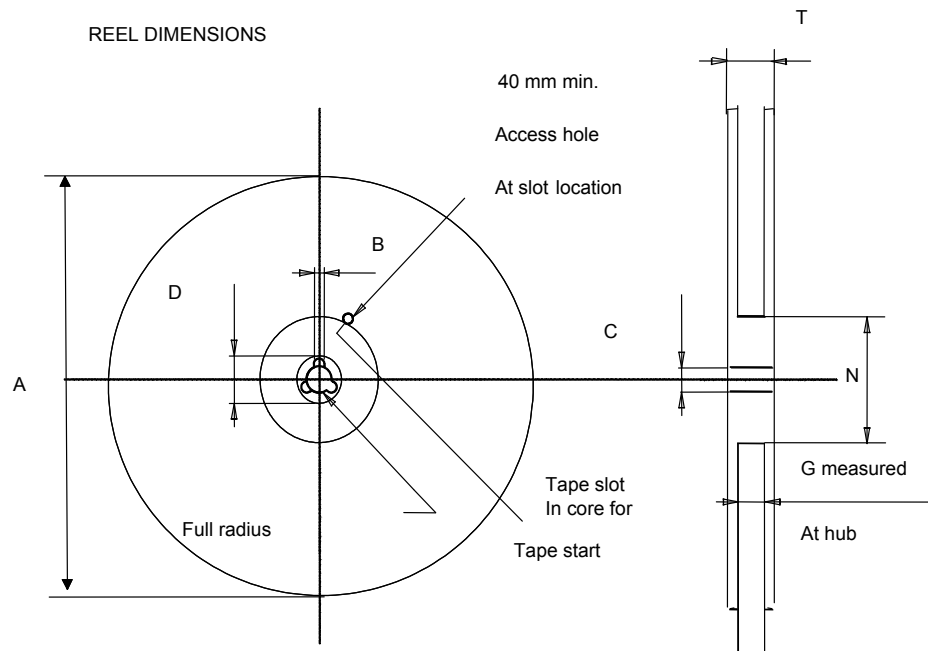


Table 9. Tape and reel mechanical data

Dim.	Tape		Dim.	Reel	
	mm			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
30-Mar-2017	1	First release
28-Jun-2018	2	Updated cover page. Updated <i>Section 2 Electrical characteristics</i> and <i>Section 3 Package information</i> . Minor text changes.
22-Jan-2019	3	Updated title and <i>features</i> on cover page. Updated <i>Table 1. Absolute maximum ratings</i> . Updated <i>Section 2 Electrical characteristics</i> and <i>Section 2.1 Electrical characteristics (curves)</i> . Minor text changes.
19-Jul-2019	4	Updated Section 1 Electrical ratings . Updated Section 2 Electrical characteristics and Section 2.1 Electrical characteristics (curves) . Minor text changes.

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