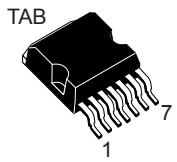
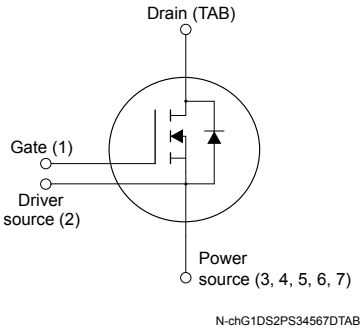
Silicon carbide Power MOSFET 1200 V, 21 mΩ typ., 90 A in an H²PAK-7 package



H²PAK-7



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
SCTH70N120G2V-7	1200 V	30 mΩ	90 A

- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance
- Source sensing pin for increased efficiency

Applications

- Switching mode power supply
- DC-DC converters
- Industrial motor control

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.

Product status link
SCTH70N120G2V-7

Product summary	
Order code	SCTH70N120G2V-7
Marking	SCT70N12
Package	H²PAK-7
Packing	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	
I_D	Drain current (continuous) at T_C = 25 °C	90	A
	Drain current (continuous) at T_C = 100 °C	63	
I_{DM}(1)	Drain current (pulsed)	253	A
P_{TOT}	Total power dissipation at T_C = 25 °C	469	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_{thJC}	Thermal resistance, junction-to-case	0.32	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

2 Electrical characteristics

T_C = 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	1200			V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 1200 V, V_{GS} = 0 V			10	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = -10 to 22 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 1 mA	1.90	2.45	4.90	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 18 V, I_D = 50 A		21	30	mΩ
		V_{GS} = 18 V, I_D = 50 A, T_J = 175 °C		41		

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 800 V, f = 1 MHz, V_{GS} = 0 V	-	3540	-	pF
C_{oss}	Output capacitance		-	176	-	pF
C_{rss}	Reverse transfer capacitance		-	28	-	pF
R_G	Gate input resistance	f = 1 MHz, I_D = 0 A	-	1	-	Ω
Q_g	Total gate charge	V_{DD} = 800 V, I_D = 50 A, V_{GS} = -5 to 18 V	-	150	-	nC
Q_{gs}	Gate-source charge		-	28	-	nC
Q_{gd}	Gate-drain charge		-	63	-	nC

Table 5. Switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{DD} = 800 V, V_{GS} = -5 to 18 V, I_D = 50 A, R_G = 3.3 Ω	-	932	-	µJ
E_{off}	Turn-off switching energy		-	226	-	µJ

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 800 V, I_D = 50 A, R_G = 3.3 Ω, V_{GS} = -5 to 18 V	-	15.5	-	ns
t_r	Rise time		-	9	-	ns
$t_{d(off)}$	Turn-off delay time		-	36	-	ns
t_f	Fall time		-	18	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Forward on voltage	I_{SD} = 50 A, V_{GS} = 0 V	-	2.7	-	V
t_{rr}	Reverse recovery time	I_{SD} = 50 A, V_{GS} = -5 to 18 V, V_{DD} = 800 V	-	11.16	-	ns
Q_{rr}	Reverse recovery charge		-	276	-	nC
I_{RRM}	Reverse recovery current		-	40	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

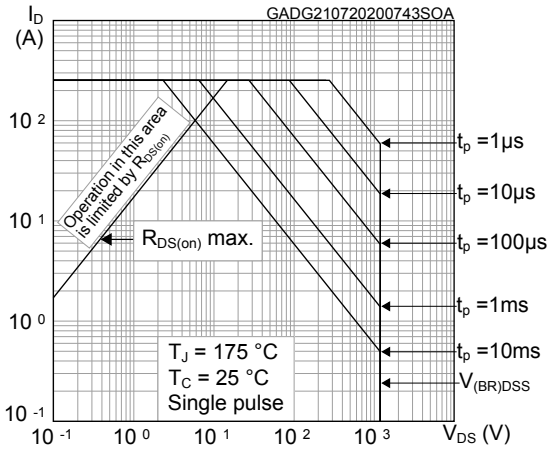


Figure 2. Maximum transient thermal impedance

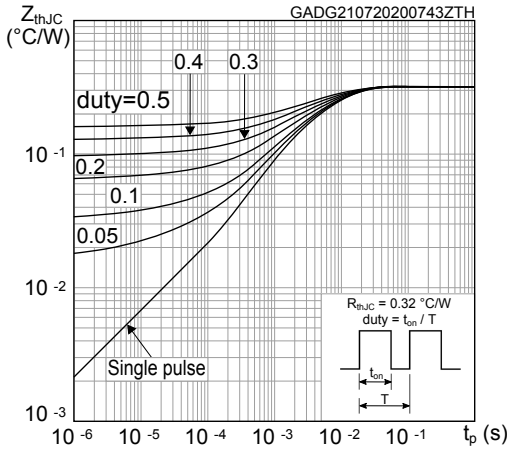


Figure 3. Typical output characteristics (T_J = 25 °C)

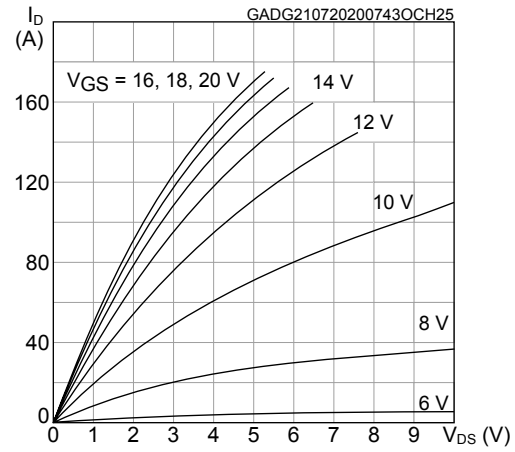


Figure 4. Typical output characteristics (T_J = 175 °C)

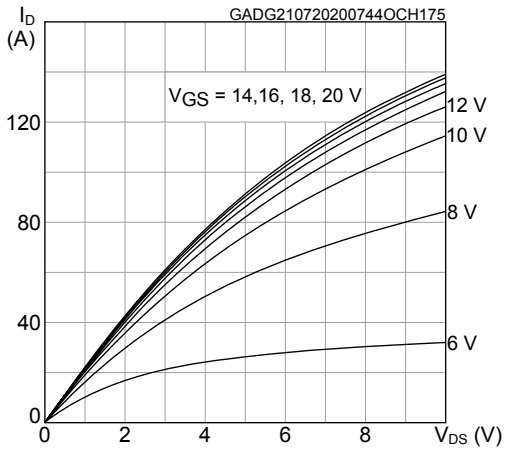


Figure 5. Typical transfer characteristics

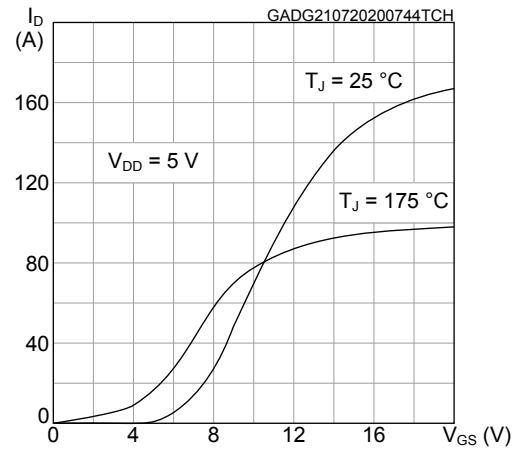


Figure 6. Total power dissipation

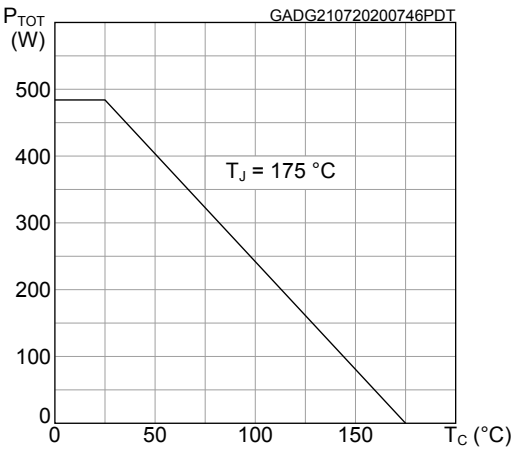


Figure 7. Typical gate charge characteristics

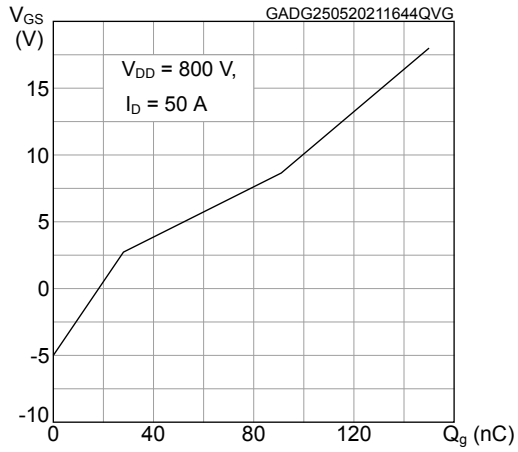


Figure 8. Typical capacitance characteristics

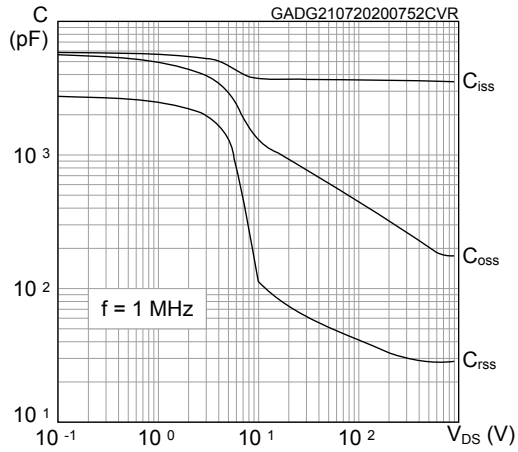


Figure 9. Typical switching energy vs drain current

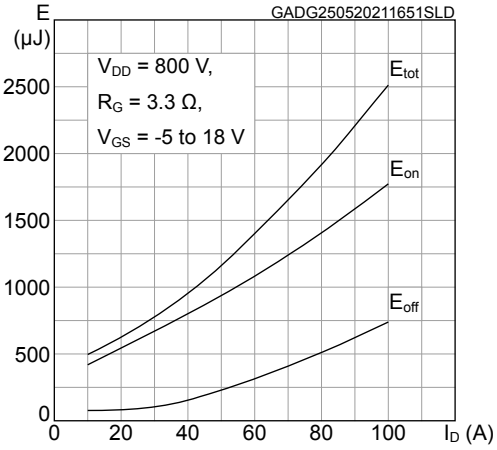


Figure 10. Typical switching energy vs temperature

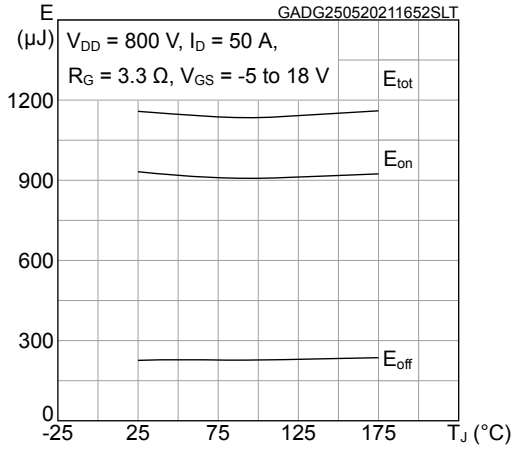


Figure 11. Normalized on-resistance vs temperature

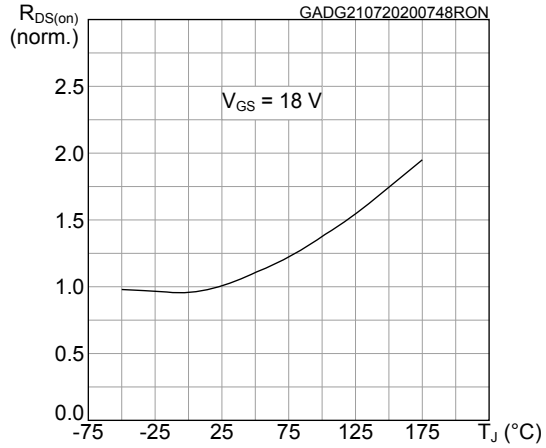


Figure 12. Typical switching energy vs gate resistance

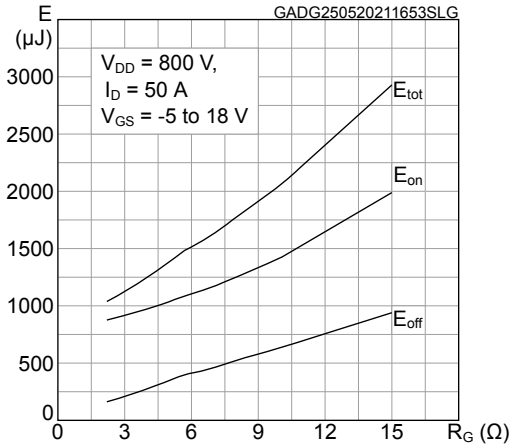


Figure 13. Normalized breakdown voltage vs temperature

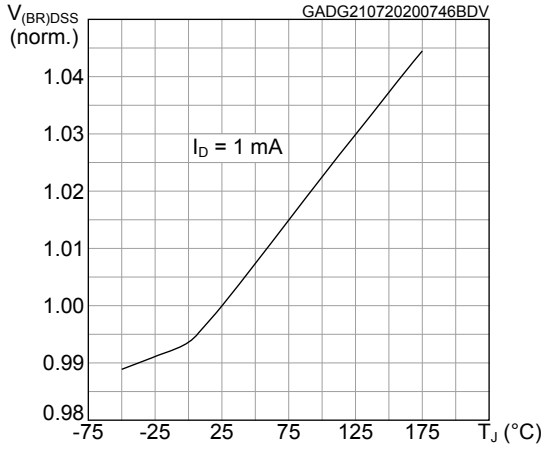


Figure 14. Normalized gate threshold vs temperature

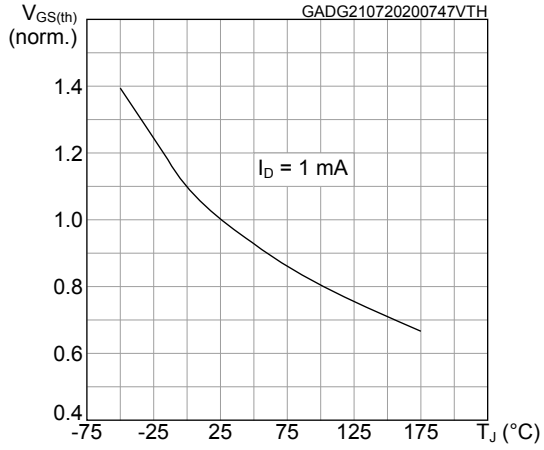


Figure 15. Typical reverse conduction characteristics (T_J = 25 °C)

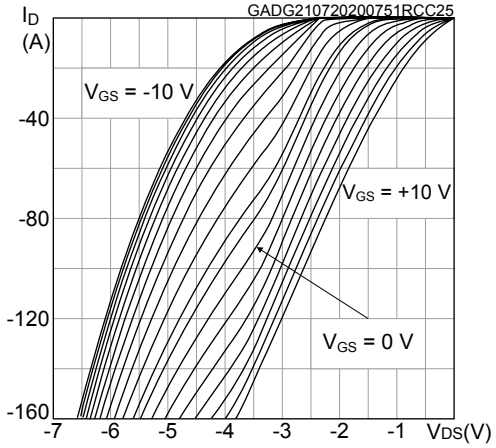
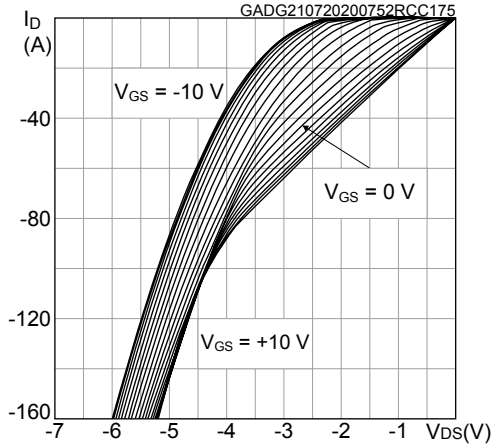


Figure 16. Typical reverse conduction characteristics (T_J = 175 °C)



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 17. **H²PAK-7 package outline**

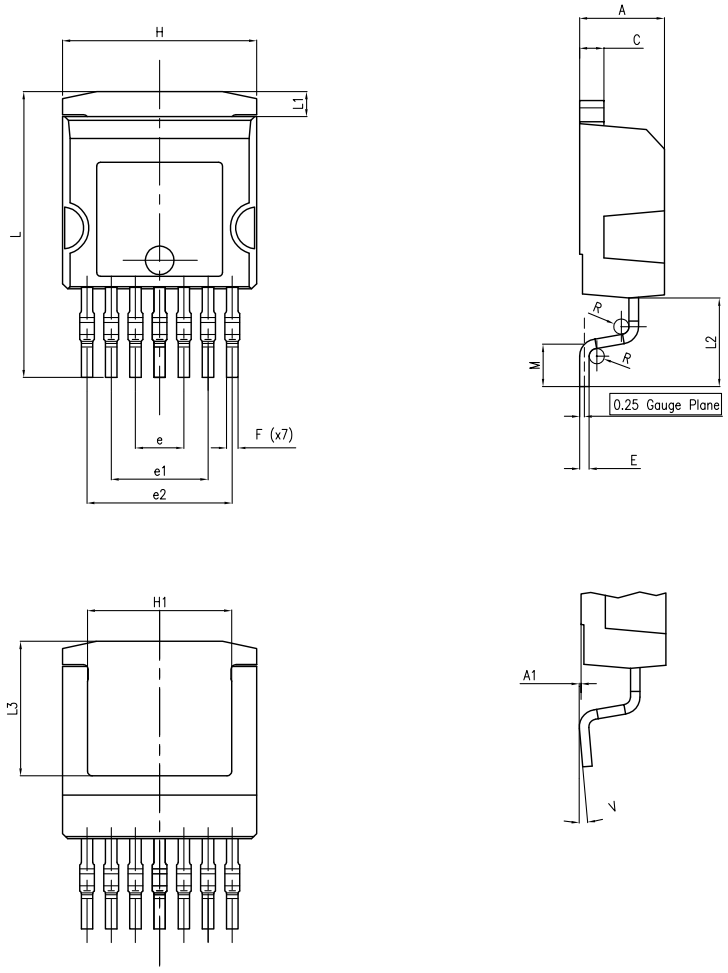


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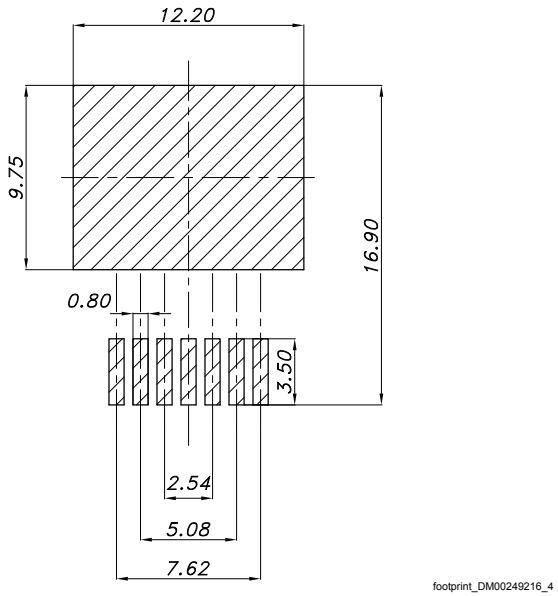
Table 8. **H²PAK-7 package mechanical data**

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 18. **H²PAK-7 recommended footprint**



Note: Dimensions are in mm.

3.2 Packing information

Figure 19. **Tape outline**

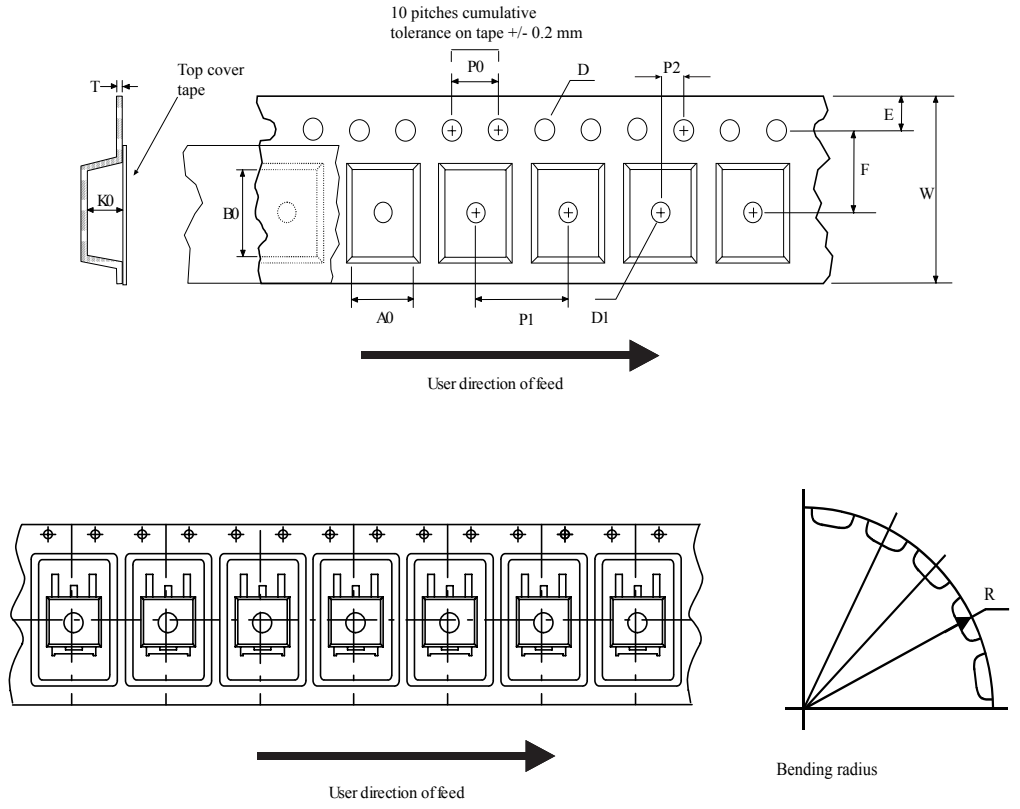


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Figure 20. **Reel outline**

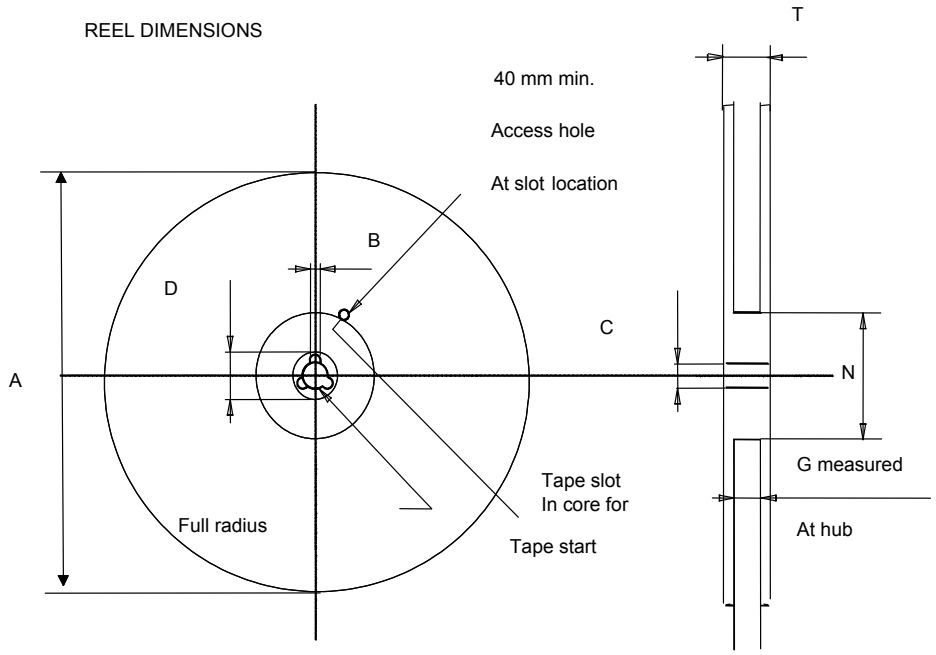

Table 9. **Tape and reel mechanical data**

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
11-Aug-2020	1	First release.
26-May-2021	2	Updated title, *Features* and *Applications* in cover page. Updated *Table 3. On/off states, Table 5. Switching energy* and *Table 6. Switching times.* Updated *Figure 7. Typical gate charge characteristics, Figure 9. Typical switching energy vs drain current, Figure 10. Typical switching energy vs temperature* and *Figure 12. Typicalswitching energy vs gate resistance.* Minor text changes.
07-Jul-2021	3	Modified Figure 15. Typical reverse conduction characteristics (T_J = 25 °C) and Figure 16. Typical reverse conduction characteristics (T_J = 175 °C).

Contents