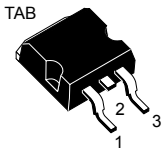
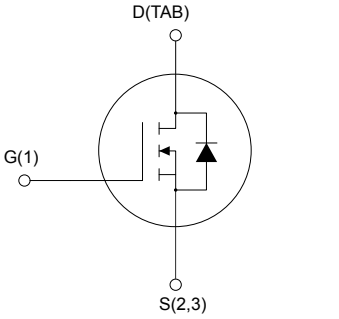
SCT20N120H

Datasheet

Silicon carbide Power MOSFET 1200 V, 20 A, 189 mΩ (typ., T_J=150 °C), in an H²PAK-2 package



H²PAK-2



Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability (T_J = 175 °C)
- Very fast and robust intrinsic body diode
- Low capacitance

Applications

- Solar inverters, UPS
- Motor drives
- High voltage DC-DC converters
- Switch mode power supplies

Description

This silicon carbide Power MOSFET is produced exploiting the advanced, innovative properties of wide bandgap materials. This results in unsurpassed on-resistance per unit area and very good switching performance almost independent of temperature. The outstanding thermal properties of the SiC material allow designers to use an industry-standard outline with significantly improved thermal capability. These features render the device perfectly suitable for high-efficiency and high power density applications.

Product status link
SCT20N120H

Product summary	
Order code	SCT20N120H
Marking	SCT20N120
Package	H²PAK-2
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 25	V
I_D	Drain current (continuous) at T_C = 25 °C	20	A
I_D	Drain current (continuous) at T_C = 100 °C	16	A
I_{DM} (1)	Drain current (pulsed)	45	A
P_{TOT}	Total power dissipation at T_C = 25 °C	150	W
T_{stg}	Storage temperature range	-55 to 175	°C
T_j	Operating junction temperature range		°C

1. *Pulse width limited by safe operating area.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	1	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	35	°C/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
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 1200 V			100	µA
		V_{GS} = 0 V, V_{DS} = 1200 V, T_J = 175 °C		50		
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	2	3.5		V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 20 V, I_D = 10 A		169	239	mΩ
		V_{GS} = 20 V, I_D = 10 A, T_J = 150 °C		189		
		V_{GS} = 20 V, I_D = 10 A, T_J = 175 °C		203		

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 400 V, f = 1 MHz, V_{GS} = 0 V	-	650	-	pF
C_{oss}	Output capacitance		-	65	-	pF
C_{rss}	Reverse transfer capacitance		-	14	-	pF
Q_g	Total gate charge	V_{DD} = 800 V, I_D = 10 A, V_{GS} = 0 to 20 V	-	45	-	nC
Q_{gs}	Gate-source charge		-	7	-	nC
Q_{gd}	Gate-drain charge		-	11.7	-	nC
R_g	Gate input resistance	f=1 MHz, I_D = 0 A	-	7	-	Ω

Table 5. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 10 A	-	160	-	µJ
E_{off}	Turn-off switching energy	R_G= 6.8 Ω, V_{GS} = -2 to 20 V	-	90	-	µJ
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 10 A	-	165	-	µJ
E_{off}	Turn-off switching energy	R_G= 6.8 Ω, V_{GS} = -2 to 20 V, T_J= 150 °C	-	100	-	µJ

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)V}$	Turn-on delay time	V_{DD} = 800 V, I_D = 10 A, R_G = 0 Ω, V_{GS} = 0 to 20 V	-	10	-	ns
$t_{f(V)}$	Fall time		-	17	-	ns
$t_{d(off)V}$	Turn-off delay time		-	27	-	ns

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{r(V)}$	Rise time	V_{DD} = 800 V, I_D = 10 A, R_G = 0 Ω, V_{GS} = 0 to 20 V	-	16	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode forward voltage	I_F = 5 A, V_{GS} = -5 V	-	3.6	-	V
t_{rr}	Reverse recovery time	I_{SD} =10 A, V_{GS} = -5 V, V_R = 800 V, dif/dt = 1650 A/µs	-	15	-	ns
Q_{rr}	Reverse recovery charge		-	75	-	nC
I_{rrm}	Peak reverse recovery current		-	8	-	A

2.1 Electrical characteristics (curves)

Characteristic curves are based on SCT20N120 in HiP247 package option

Figure 1. Safe operating area

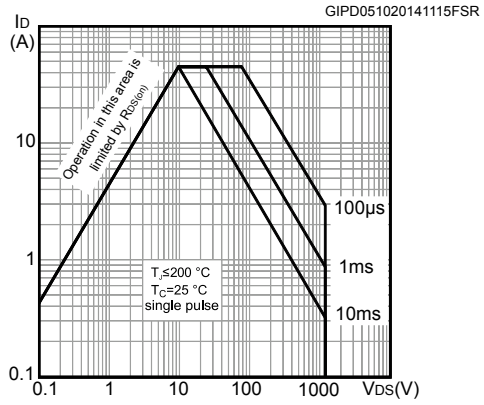


Figure 2. Maximum transient thermal impedance

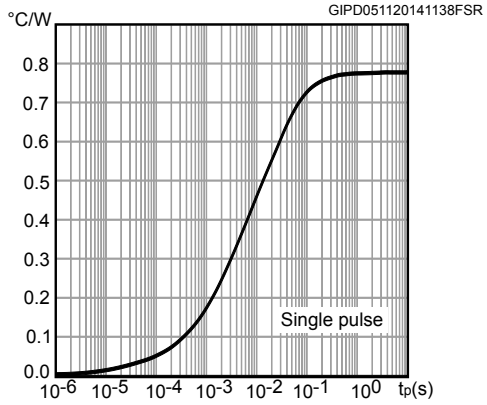


Figure 3. Output characteristics @ T_J = 25 °C

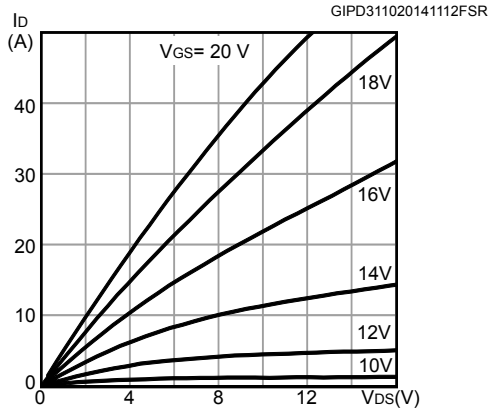


Figure 4. Output characteristics @ T_J = 200 °C

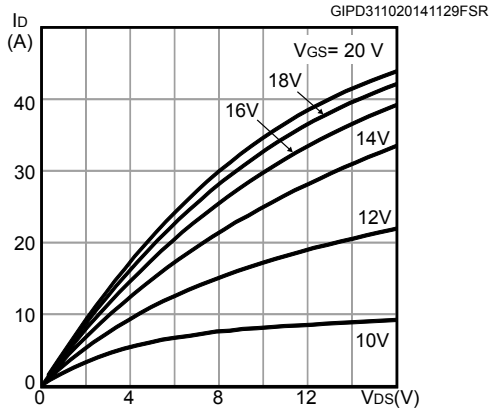


Figure 5. Transfer characteristics

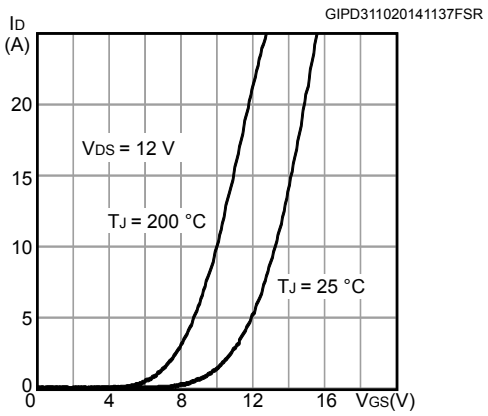


Figure 6. Body diode characteristics @ T_J = -50 °C

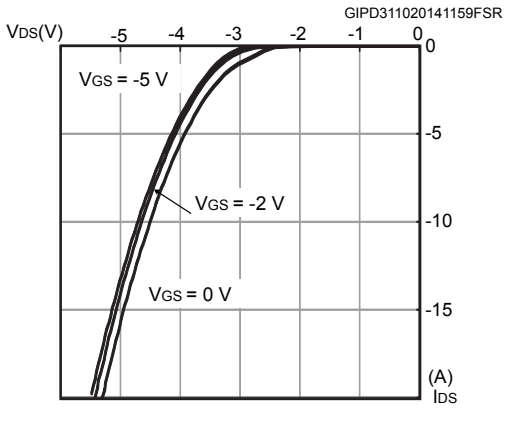


Figure 7. Body diode characteristics @ T_J = 25 °C

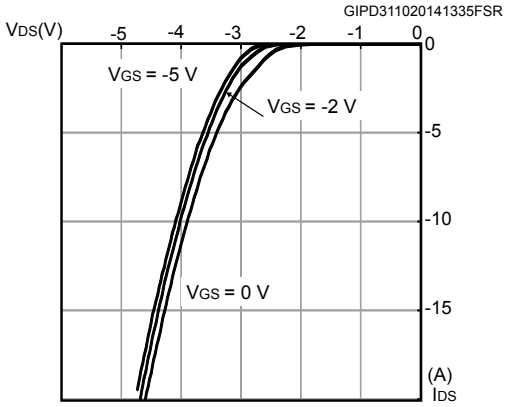


Figure 8. Body diode characteristics @ T_J = 150 °C

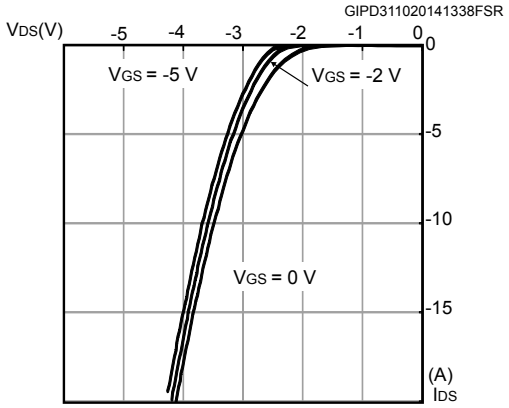


Figure 9. 3rd quadrant characteristics @ T_J = -50 °C

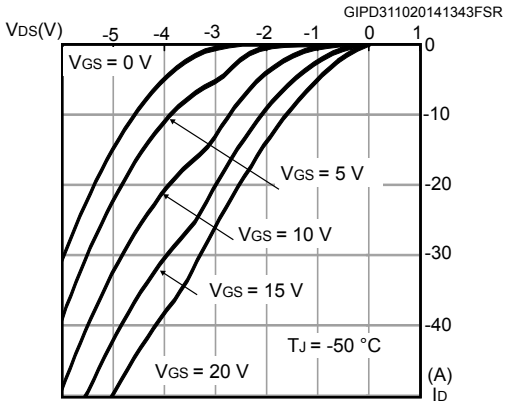


Figure 10. 3rd quadrant characteristics @ T_J = 25 °C

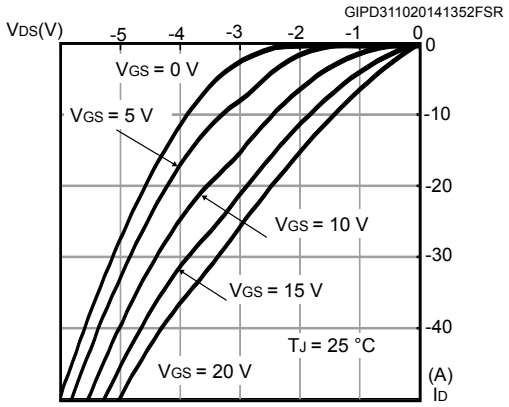


Figure 11. 3rd quadrant characteristics @ T_J = 150 °C

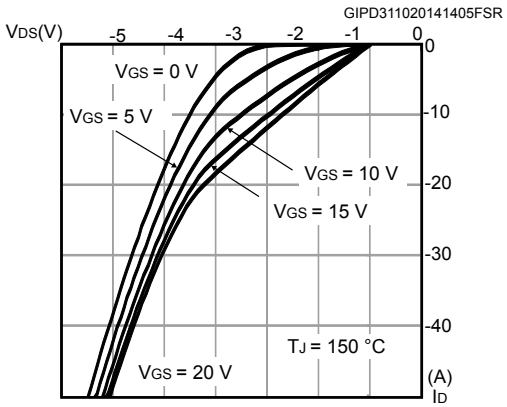


Figure 12. Normalized gate threshold vs. temperature

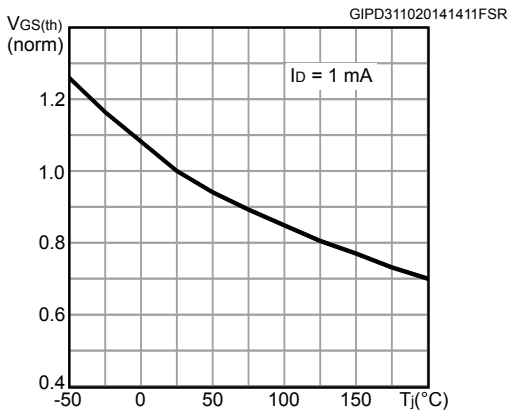


Figure 13. Normalized $R_{DS(on)}$ vs. temperature

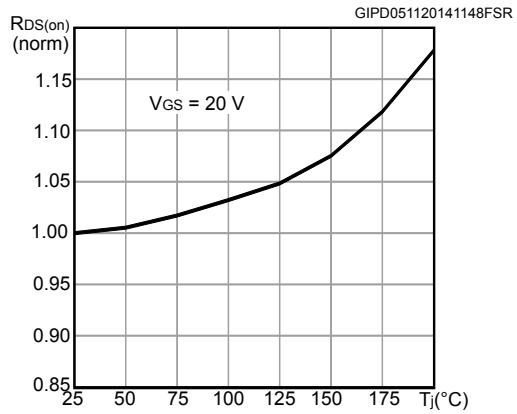
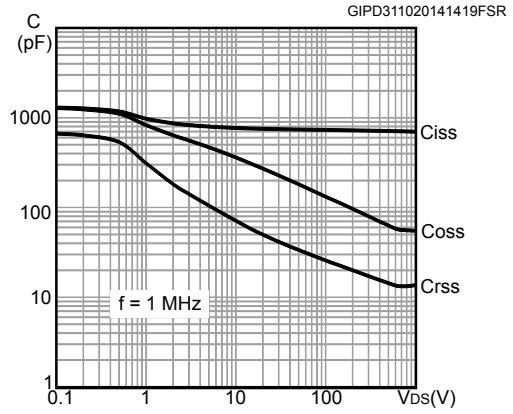


Figure 14. Capacitances variation



3 Test circuits

Figure 15. Switching test waveforms for transition times

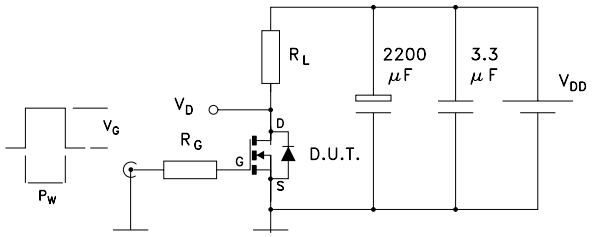


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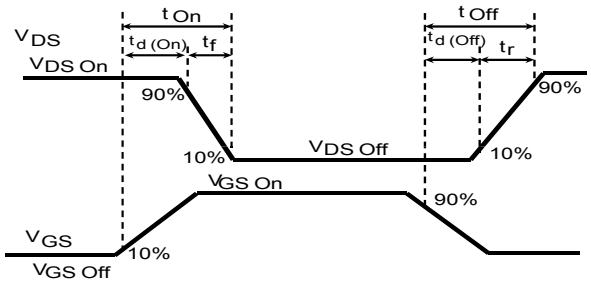
Figure 16. Clamped inductive switching waveform



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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 H²PAK-2 package information

Figure 17. **H²PAK-2 package outline**

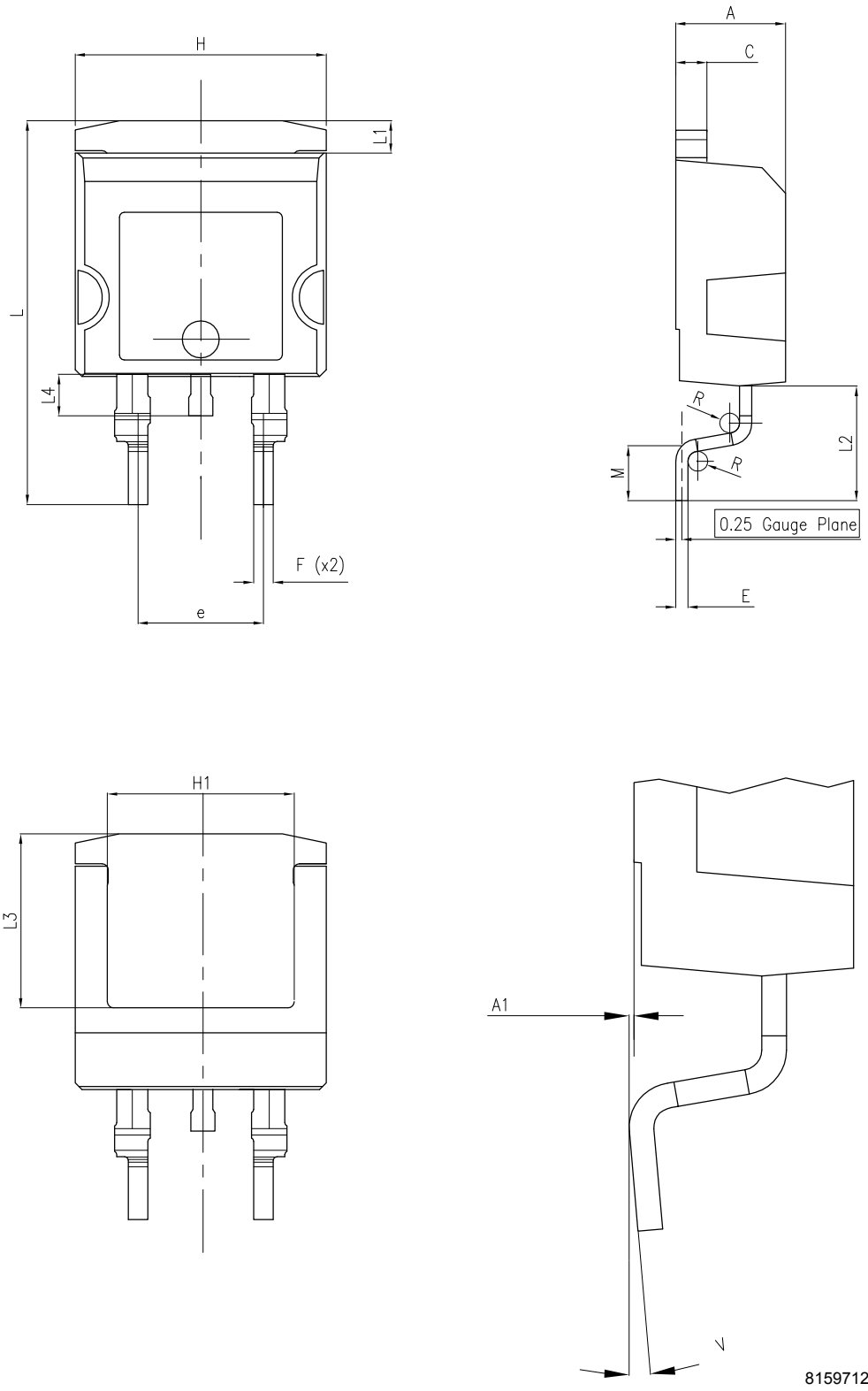
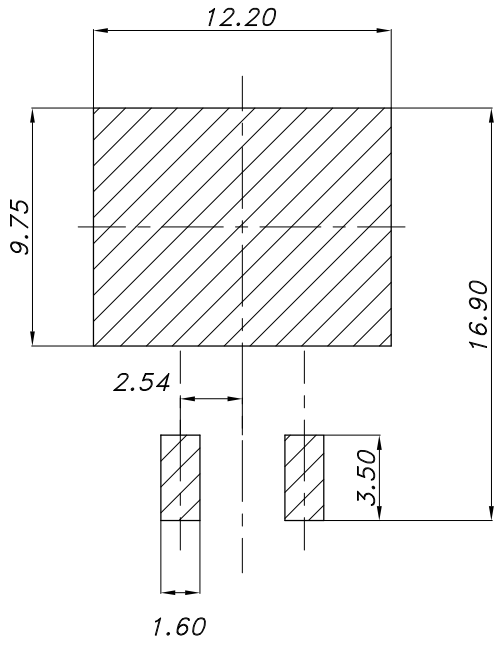


Table 8. **H²PAK-2 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0.03		0.20
C	1.17		1.37
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
H	10.00		10.40
H1	7.40		7.80
L	15.30	-	15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.5		1.7
M	2.6		2.9
R	0.20		0.60
V	0°		8°

Figure 18. **H²PAK-2 recommended footprint**



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Note: Dimensions are in mm.

4.2 Packing information

Figure 19. **Tape outline**

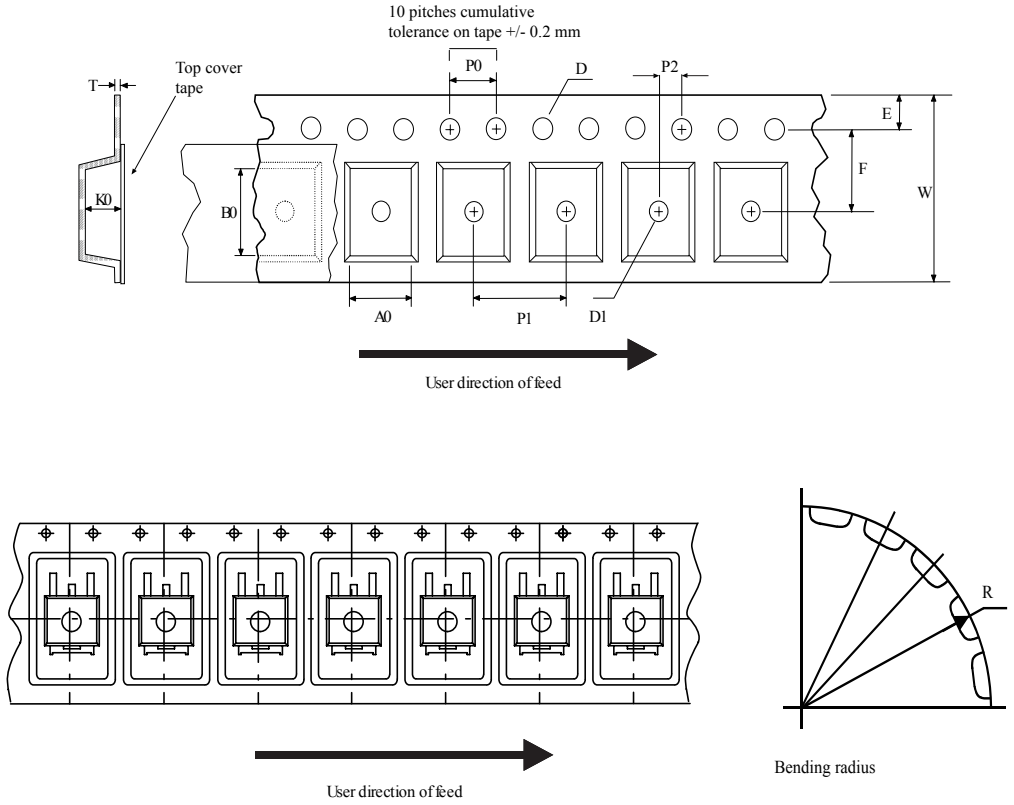

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Figure 20. **Reel outline**

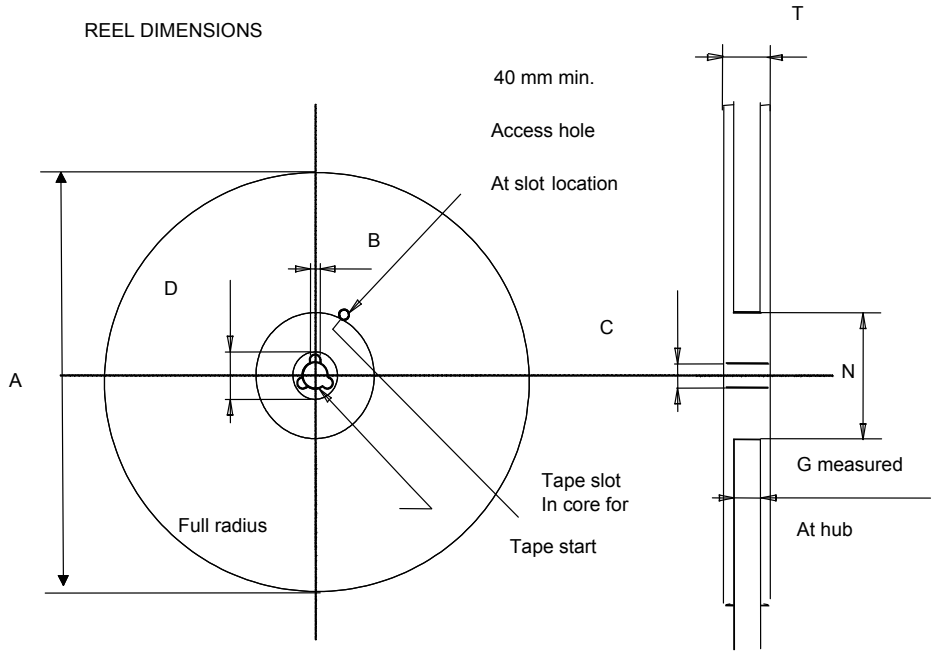

Table 9. **Tape and reel mechanical data**

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-Sep-2019	1	First release.
13-Dec-2019	2	Updated features in cover page, Table 1. Absolute maximum ratings and On/off states. Minor text changes.

Contents