SCTH50N120-7

Silicon carbide Power MOSFET 1200 V, 65 A, 59 mΩ (typ., T_J = 150 °C) in an H^2PAK-7 package

Datasheet - production data

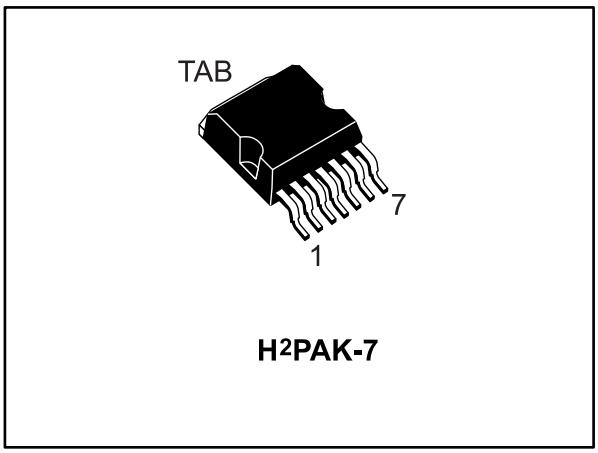
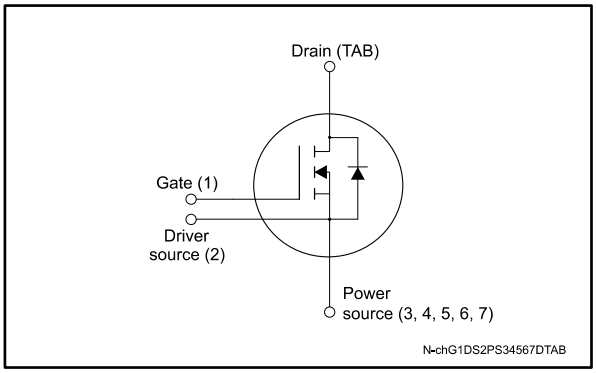


Figure 1: Internal schematic diagram



Features

- Very tight variation of on-resistance vs. temperature
- Very fast and robust intrinsic body diode
- Low capacitance
- Kelvin pin

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.

Table 1: Device summary

Order code	Marking	Package	Packing
SCTH50N120-7	SCT50N120	H^2PAK-7	Tape and reel

This is information on a product in full production.

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	1200	V
V_{GS}	Gate-source voltage	-10 to 22	V
I_D	Drain current (continuous) at T_C = 25 °C	65	A
I_D	Drain current (continuous) at T_C = 100 °C	50	A
I_{DM}(1)	Drain current (pulsed)	130	A
P_{TOT}	Total dissipation at T_C = 25 °C	270	W
T_{stg}	Storage temperature range	-55 to 175	°C
T_j	Operating junction temperature range		°C

Notes:

(1)Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.55	°C/W
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb	30	°C/W

Notes:

(1)When mounted on 1 inch² FR-4, 2 Oz copper board.

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified).

Table 4: On/off-states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero-gate voltage drain current	V_{DS} = 1200 V, V_{GS} = 0 V			10	µA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 175 °C		1		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	1.8	3.0	5.1	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 20 V, I_D = 40 A		52	69	mΩ
		V_{GS} = 20 V, I_D = 40 A, T_J = 150 °C		59		mΩ
		V_{GS} = 20 V, I_D = 40 A, T_J = 175 °C		65		mΩ

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 400 V, f = 1 MHz, V_{GS} = 0 V	-	1900	-	pF
C_{oss}	Output capacitance		-	170	-	pF
C_{rss}	Reverse transfer capacitance		-	30	-	pF
Q_g	Total gate charge	V_{DD} = 800 V, I_D = 40 A, V_{GS} = 0 to 20 V	-	122	-	nC
Q_{gs}	Gate-source charge		-	19	-	nC
Q_{gd}	Gate-drain charge		-	35	-	nC
R_g	Gate input resistance	f = 1 MHz open drain	-	1.9	-	Ω

Table 6: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 40 A R_G= 2.2 Ω, V_{GS} = -5 to 20 V	-	530	-	µJ
E_{off}	Turn-off switching energy		-	310	-	µJ
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 40 A R_G= 2.2 Ω, V_{GS} = -5 to 20 V T_J= 150 °C	-	670	-	µJ
E_{off}	Turn-off switching energy		-	334	-	µJ

Table 7: Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode forward voltage	I_F = 20 A, V_{GS} = 0 V	-	3.5	-	V
t_{rr}	Reverse recovery time	I_F = 40 A, di/dt = 2000/ns V_{DD} = 800 V	-	55		ns
Q_{rr}	Reverse recovery charge		-	230	-	nC
I_{RRM}	Reverse recovery current		-	14	-	A

2.2 Electrical characteristics (curves)

Figure 2: Safe operating area

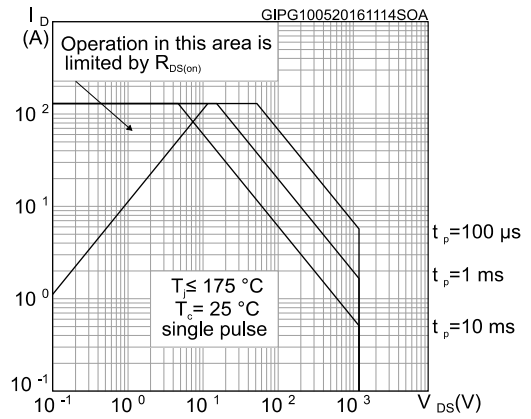


Figure 3: Thermal impedance

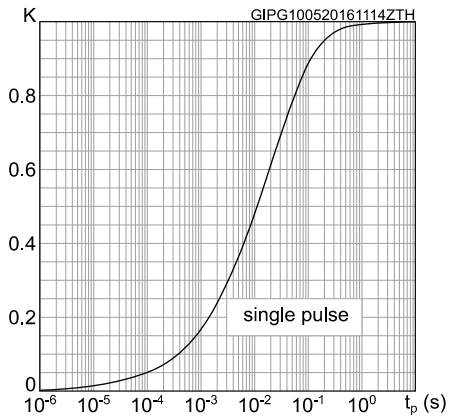


Figure 4: Output characteristics (T_J = 25 °C)

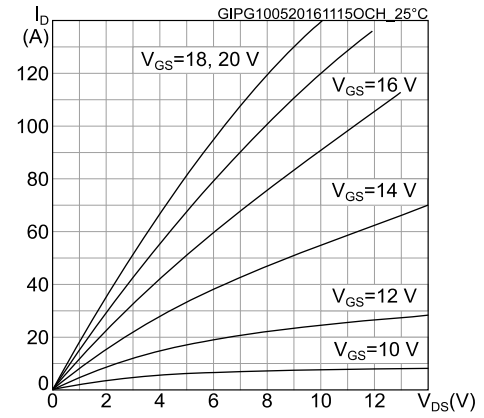


Figure 5: Output characteristics (T_J = 150 °C)

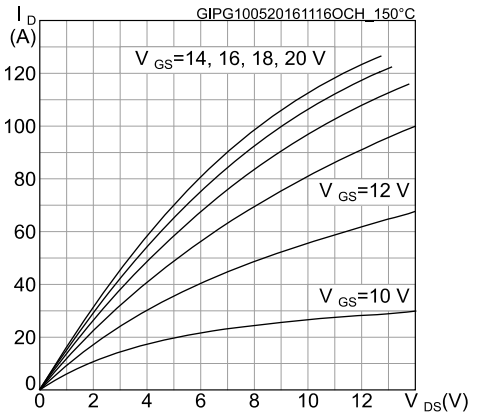


Figure 6: Transfer characteristics

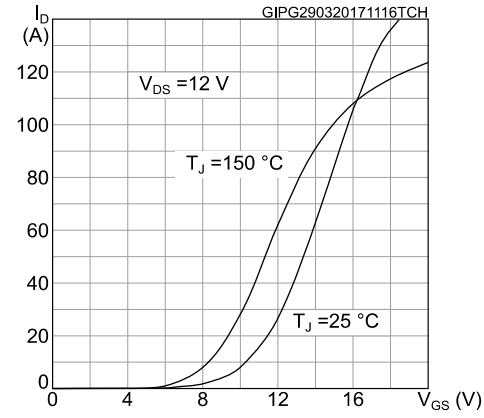


Figure 7: Power dissipation

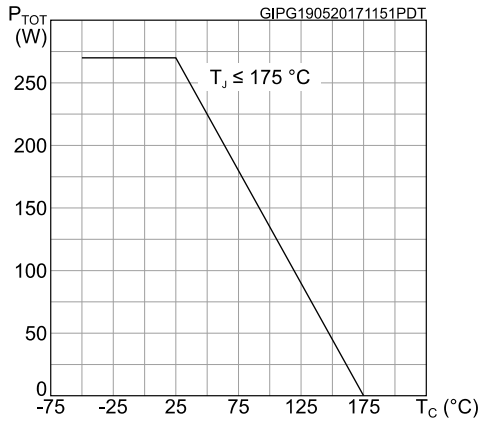


Figure 8: Gate charge vs gate-source voltage

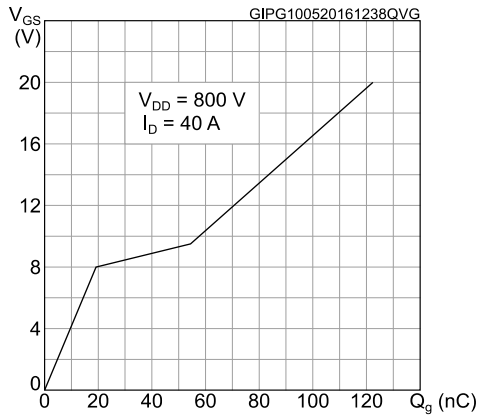


Figure 9: Capacitance variations

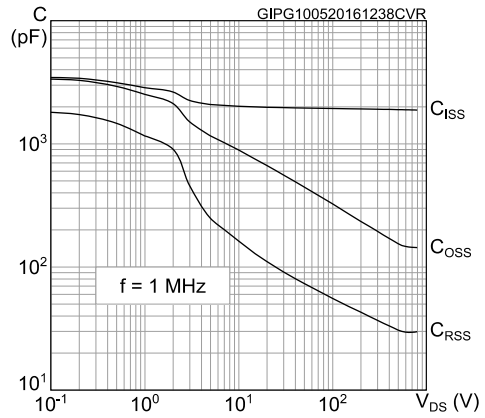


Figure 10: Switching energy vs. drain current

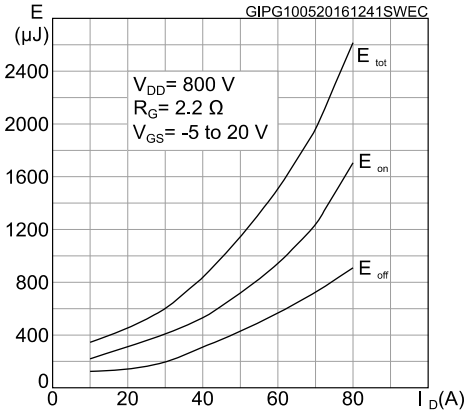


Figure 11: Switching energy vs. junction temperature

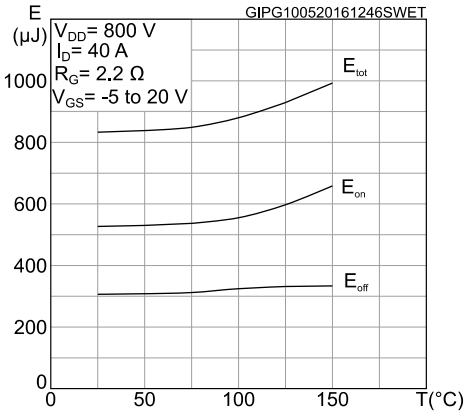


Figure 12: Normalized $V_{(BR)DSS}$ vs. temperature

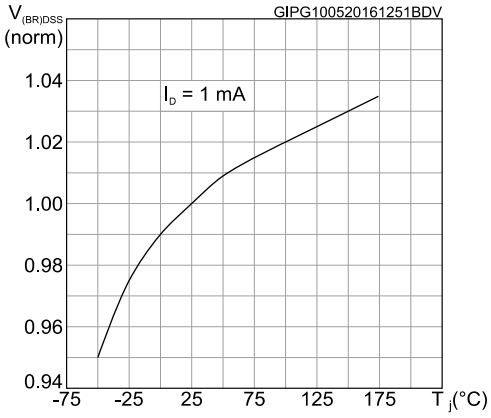


Figure 13: Normalized gate threshold voltage vs. temperature

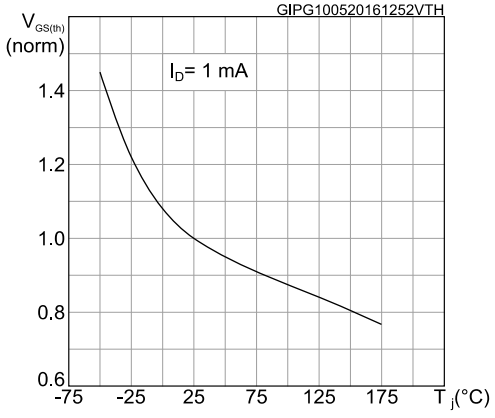


Figure 14: Normalized on-resistance vs. temperature

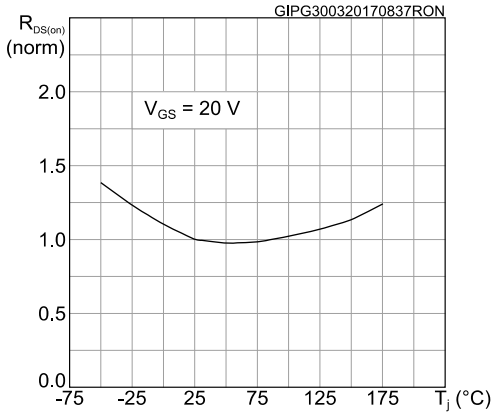


Figure 15: Reverse conduction characteristics (T_J = -50 °C)

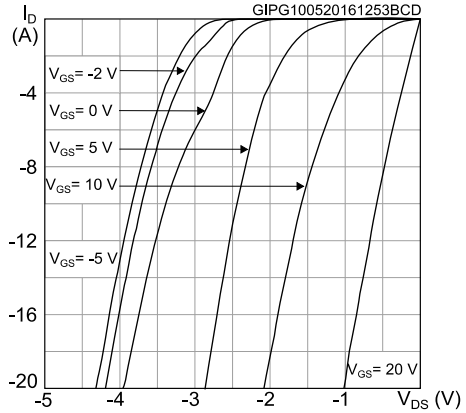


Figure 16: Reverse conduction characteristics (T_J = 25 °C)

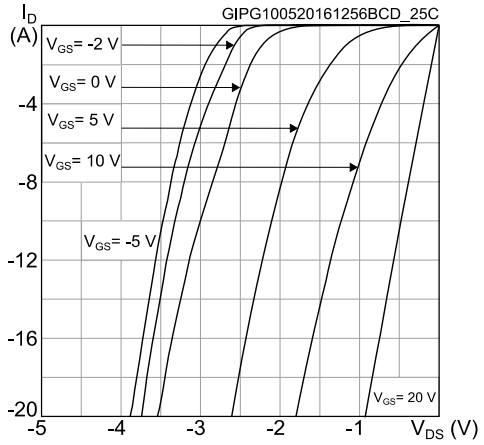
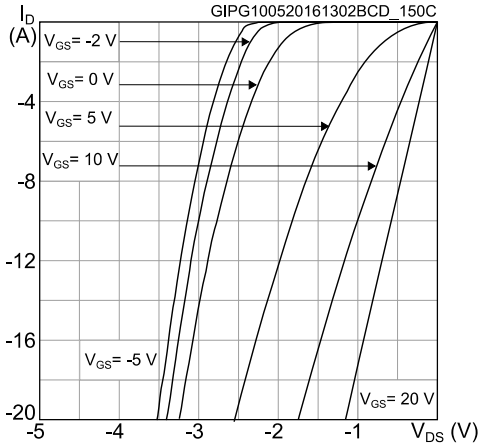


Figure 17: Reverse conduction characteristics (T_J = 150 °C)



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 18: H²PAK-7 package outline

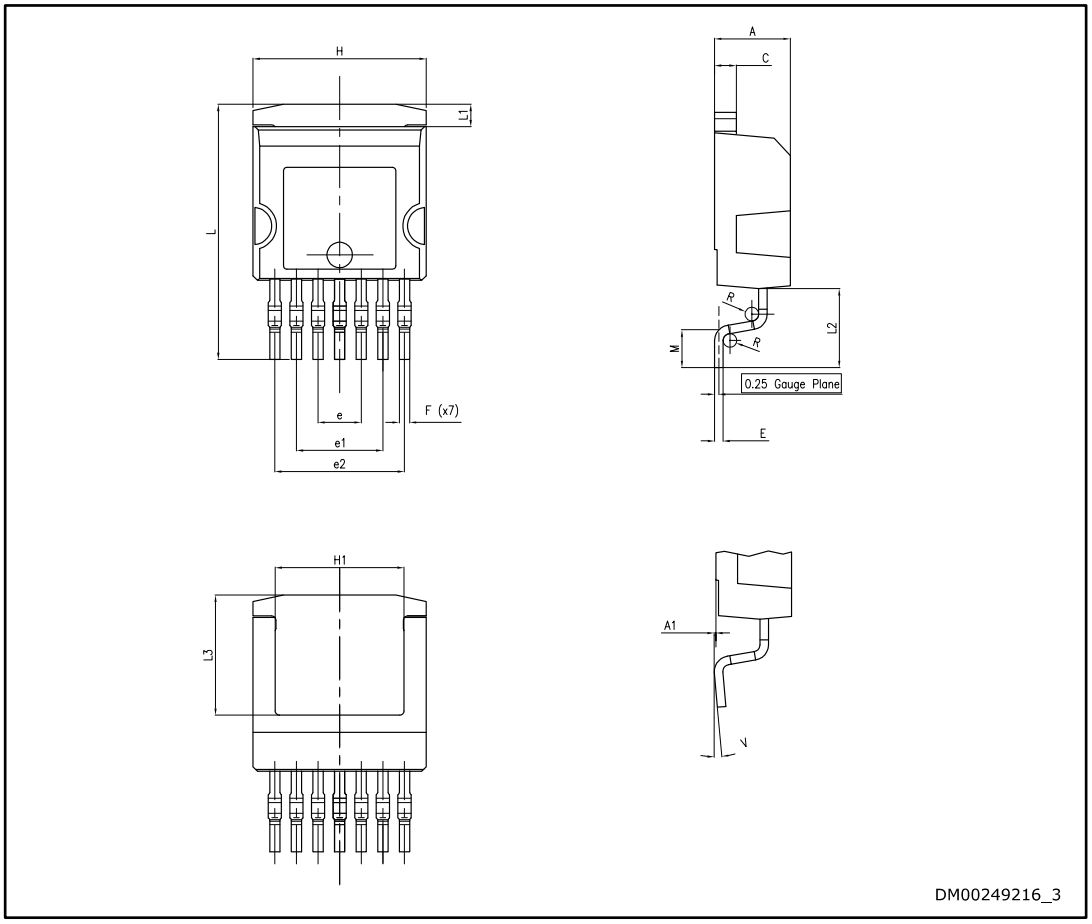
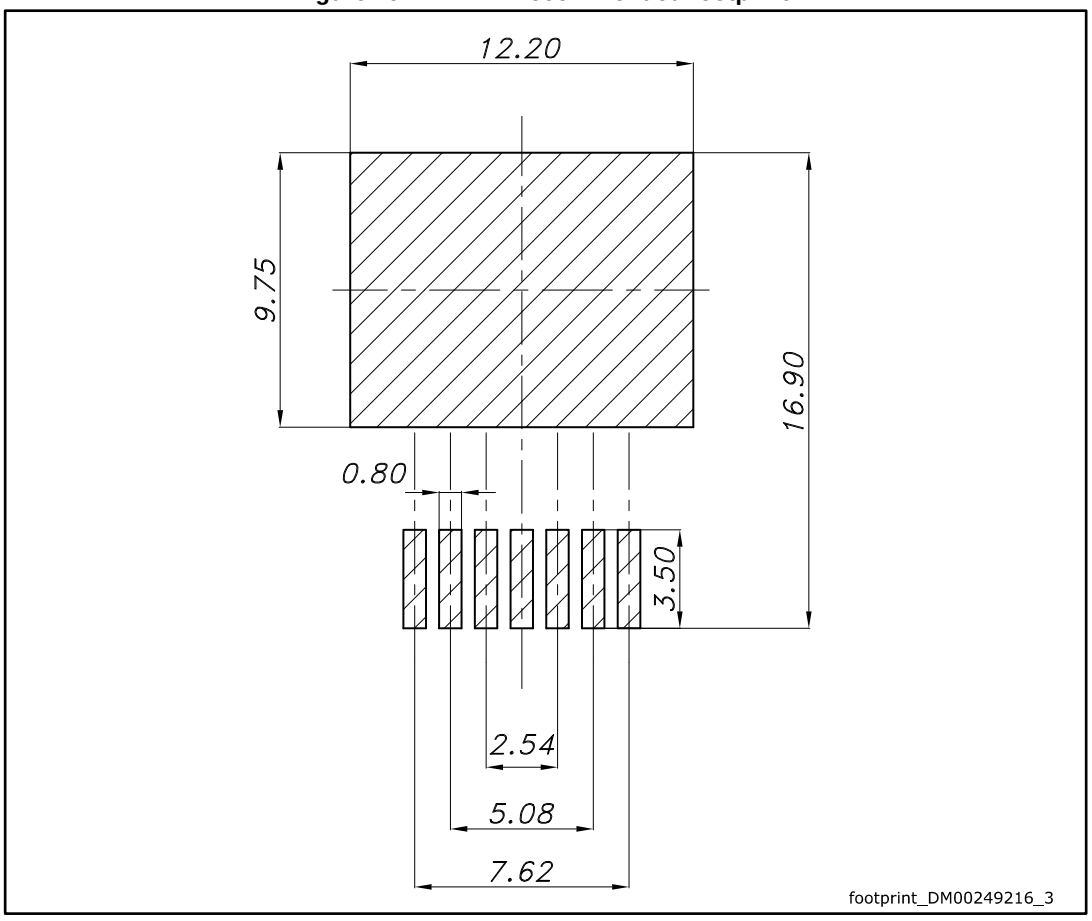


Table 8: H²PAK-7 package mechanical data

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 19: H²PAK-7 recommended footprint



Dimensions are in mm.

3.2 H²PAK packing information

Figure 20: Tape outline

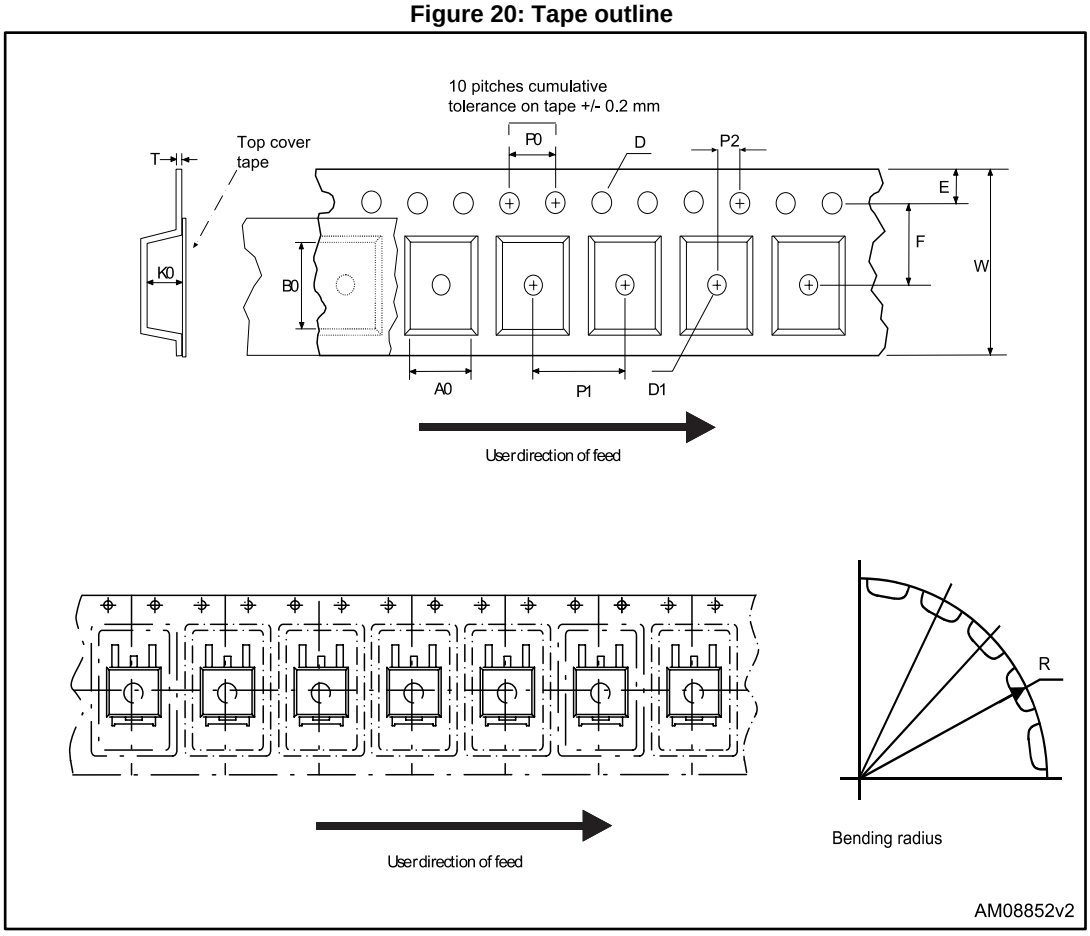


Figure 21: Reel outline

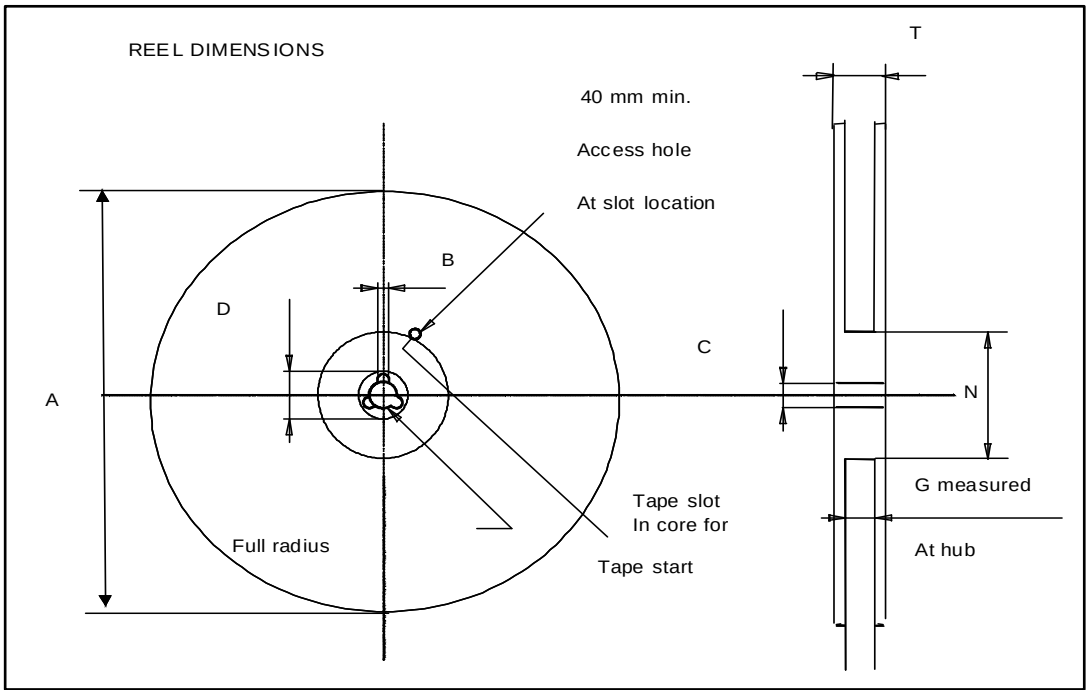


Table 9: Tape and reel mechanical data

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			

4 Revision history

Table 10: Document revision history

Date	Revision	Changes
22-May-2017	1	First release
23-May-2017	2	Datasheet promoted from preliminary to production data.

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