

Silicon carbide Power MOSFET 1200 V, 65 A, 59 mΩ
(typ., $T_J = 150\text{ }^\circ\text{C}$) in an H²PAK-7 package

Datasheet - production data

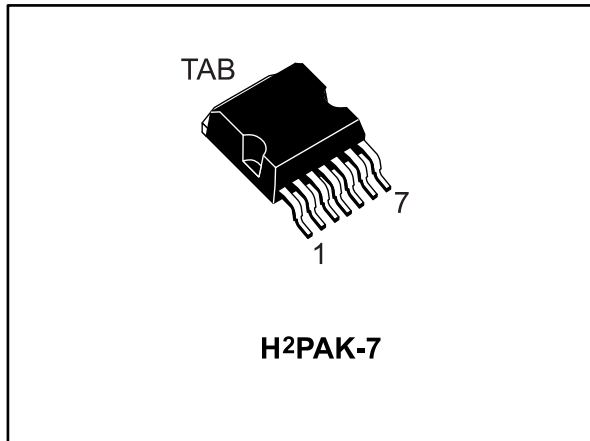
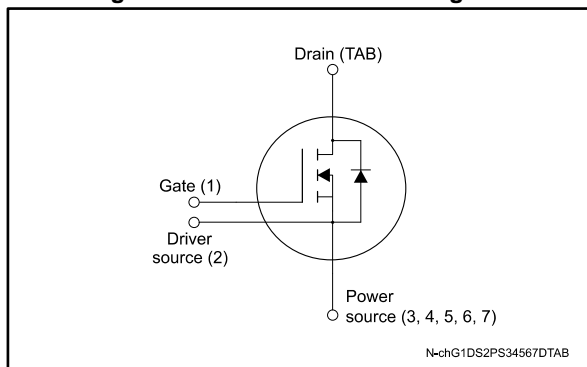


Figure 1: Internal schematic diagram



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 ² PAK-7	Tape and reel

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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 $T_C = 25\text{ °C}$	65	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	50	A
$I_{DM}^{(1)}$	Drain current (pulsed)	130	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	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
$R_{thj-case}$	Thermal resistance junction-case	0.55	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	30	°C/W

Notes:

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

2 Electrical characteristics

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

Table 4: On/off-states

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

Table 5: Dynamic

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

Table 6: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 800\text{ V}, I_D = 40\text{ A}, R_G = 2.2\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$	-	530	-	μJ
E_{off}	Turn-off switching energy		-	310	-	μJ
E_{on}	Turn-on switching energy	$V_{DD} = 800\text{ V}, I_D = 40\text{ A}, R_G = 2.2\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}, T_J = 150\text{ °C}$	-	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	$I_F = 20 \text{ A}$, $V_{GS} = 0 \text{ V}$	-	3.5	-	V
t_{rr}	Reverse recovery time	$I_F = 40 \text{ A}$, $di/dt = 2000/\text{ns}$ $V_{DD} = 800 \text{ V}$	-	55	-	ns
Q_{rr}	Reverse recovery charge		-	230	-	nC
I_{RRM}	Reverse recovery current		-	14	-	A

2.2 Electrical characteristics (curves)

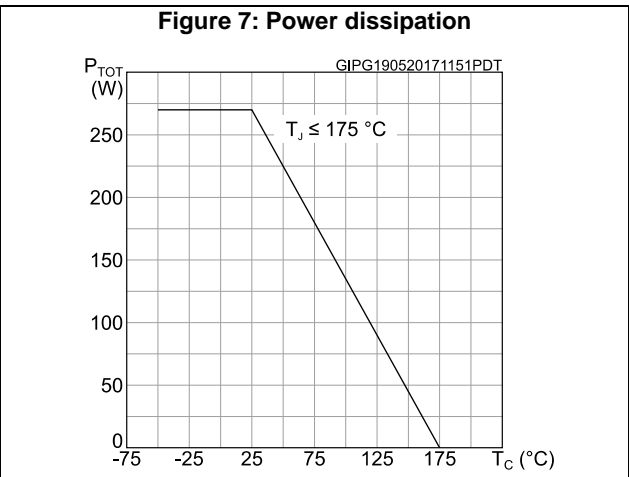
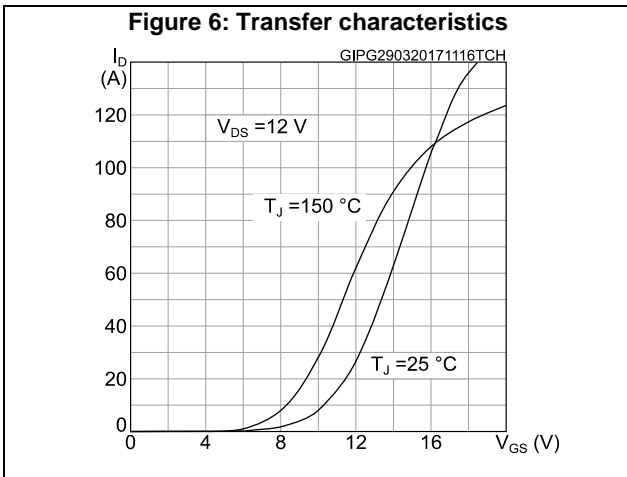
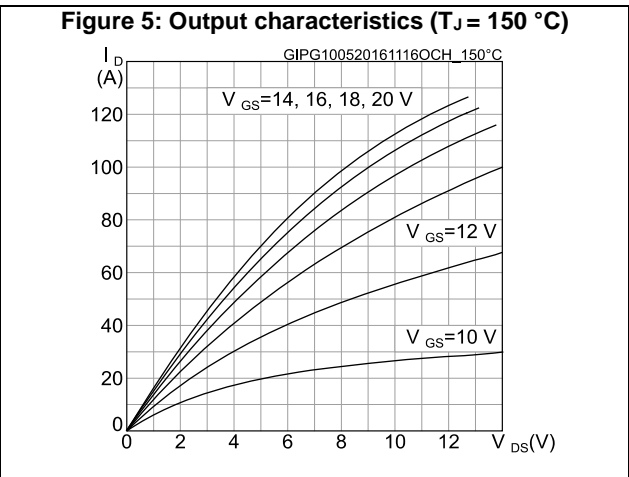
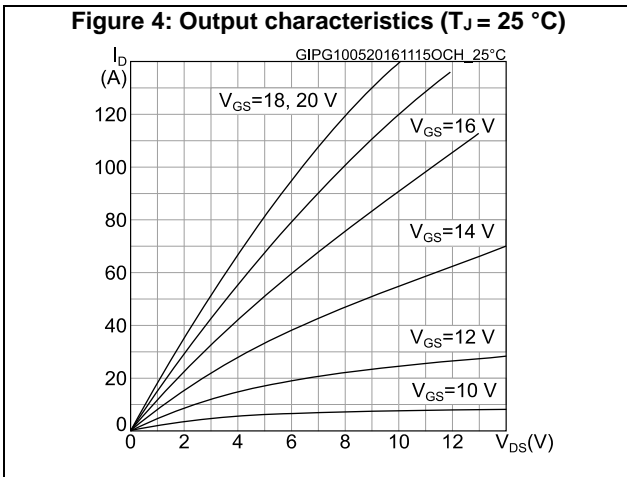
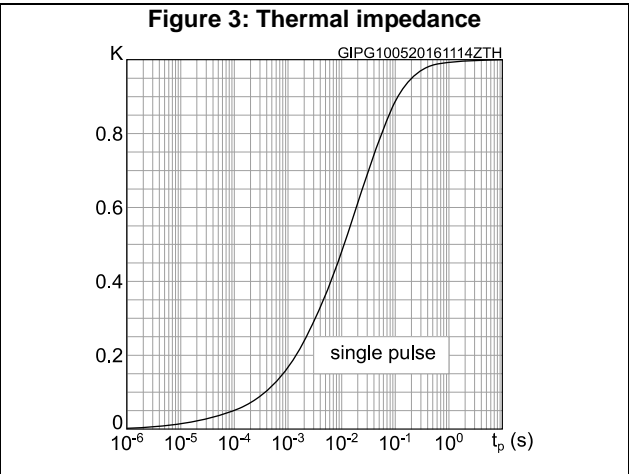
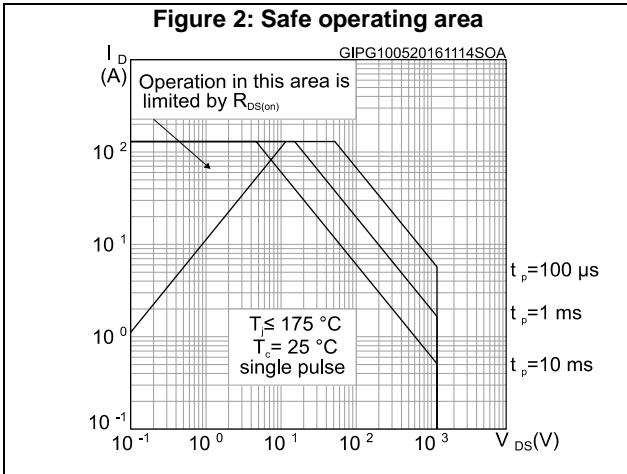


Figure 8: Gate charge vs gate-source voltage

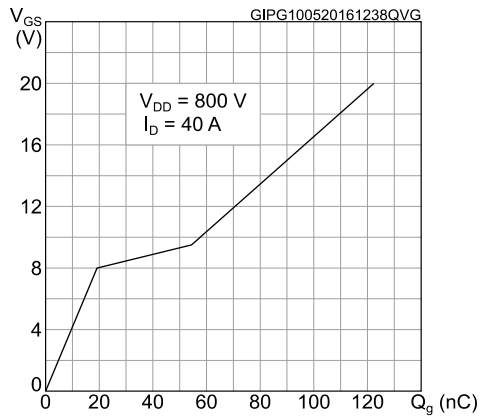


Figure 9: Capacitance variations

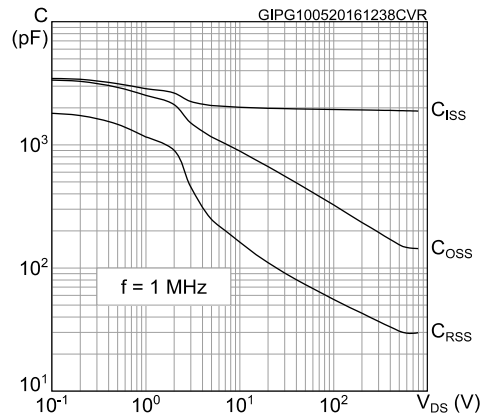


Figure 10: Switching energy vs. drain current

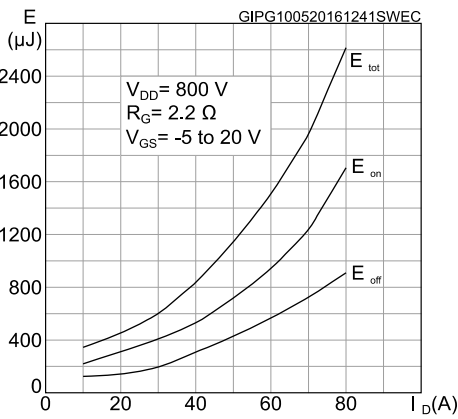


Figure 11: Switching energy vs. junction temperature

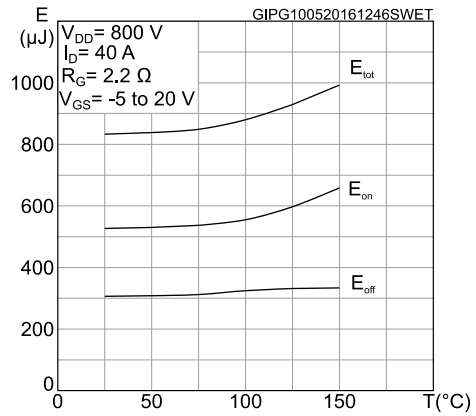


Figure 12: Normalized $V_{(BR)DSS}$ vs. temperature

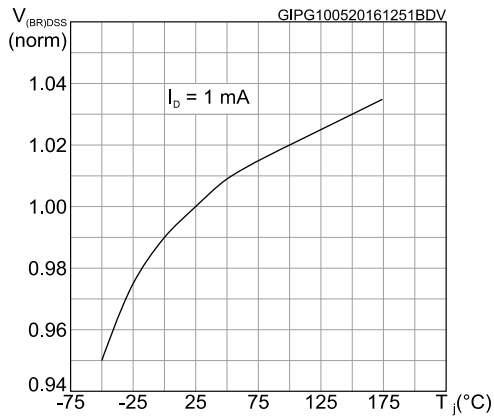


Figure 13: Normalized gate threshold voltage vs. temperature

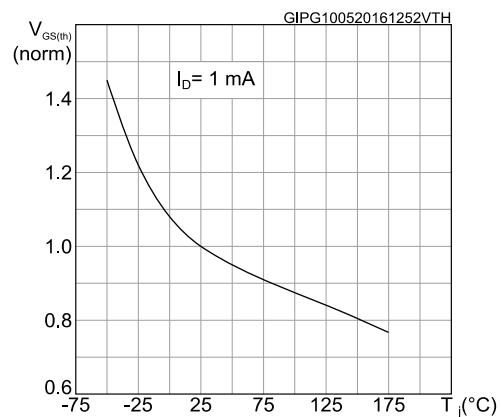


Figure 14: Normalized on-resistance vs. temperature

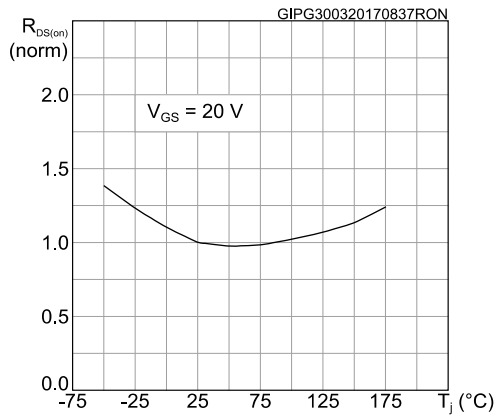


Figure 15: Reverse conduction characteristics ($T_J = -50\text{ °C}$)

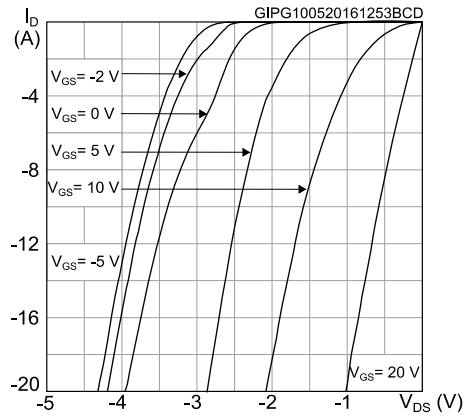


Figure 16: Reverse conduction characteristics ($T_J = 25\text{ °C}$)

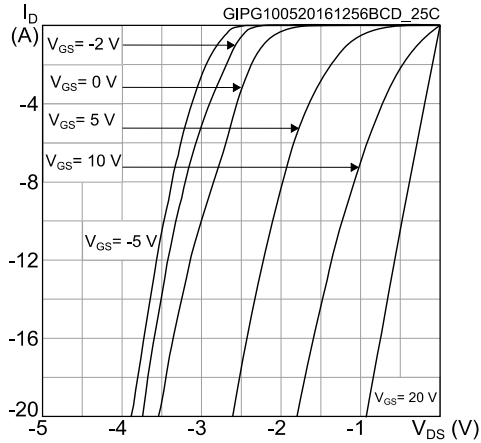
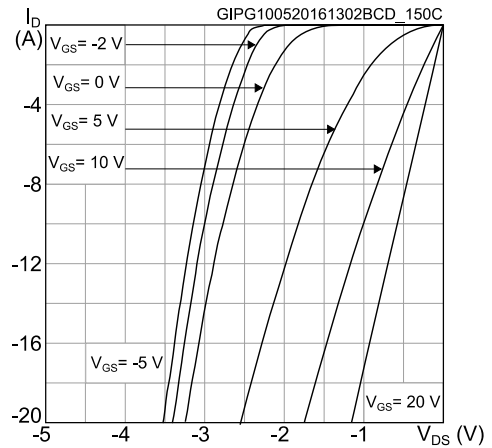


Figure 17: Reverse conduction characteristics ($T_J = 150\text{ °C}$)



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. ECOPACK® is an ST trademark.

3.1 H²PAK-7 package information

Figure 18: H²PAK-7 package outline

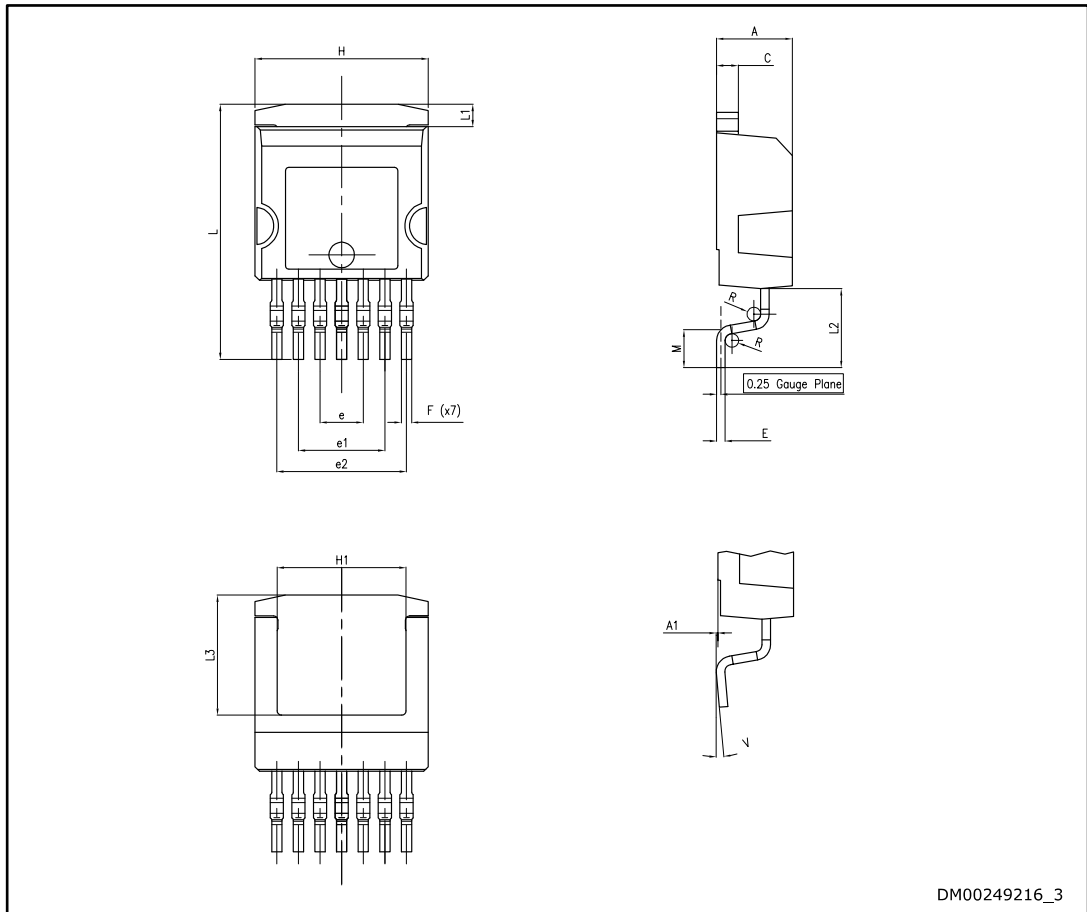
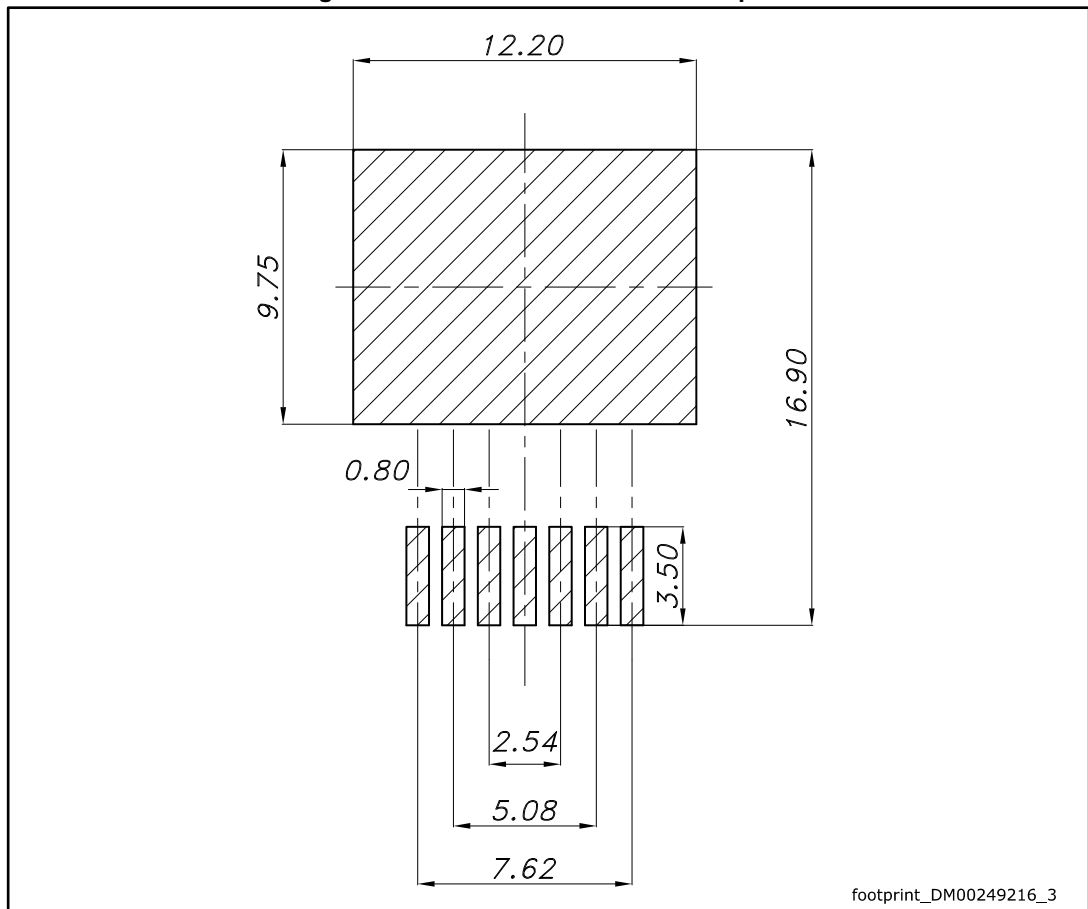


Table 8: H²PAK-7 package mechanical data

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



footprint_DM00249216_3



Dimensions are in mm.

3.2 H²PAK packing information

Figure 20: Tape outline

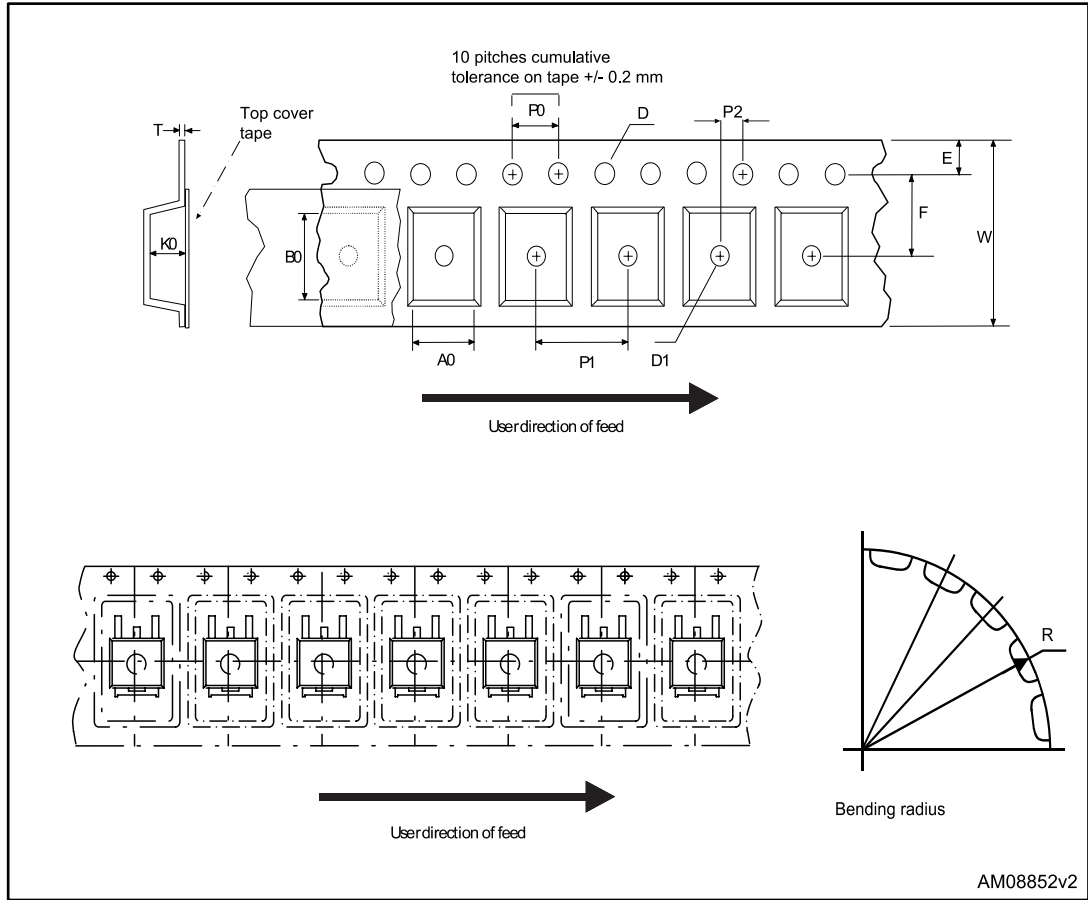


Figure 21: Reel outline

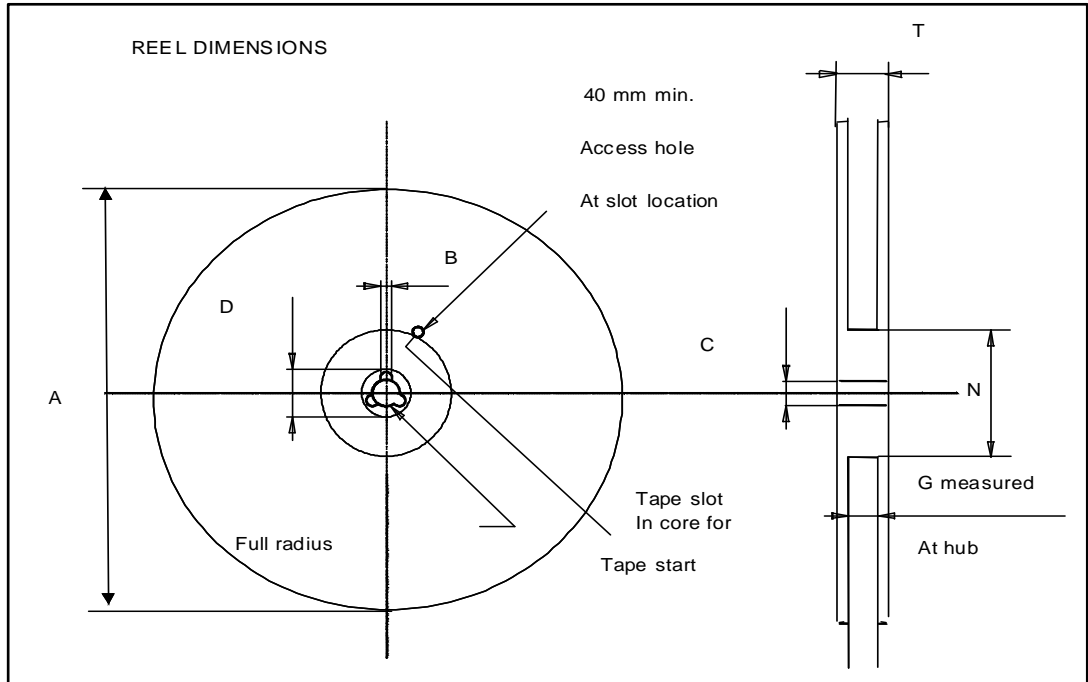


Table 9: Tape and reel mechanical data

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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