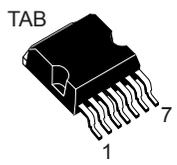
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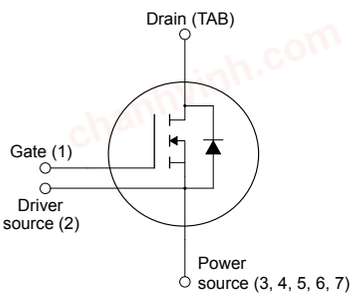
SCT040H120G3AG

Datasheet

Automotive-grade silicon carbide Power MOSFET 1200 V, 40 mΩ typ., 40 A in an H²PAK-7 package



H²PAK-7



Features

Order code	V_{DS}	$R_{DS(on)}$ typ.	I_D
SCT040H120G3AG	1200 V	40 mΩ	40 A

- AEC-Q101 qualified
- Very low $R_{DS(on)}$ over the entire temperature range
- High speed switching performances
- Very fast and robust intrinsic body diode
- Source sensing pin for increased efficiency

Applications

- Main inverter (electric traction)
- DC/DC converter for EV/HEV
- On board charger (OBC)

Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 3rd generation SiC MOSFET technology. The device features a very low $R_{DS(on)}$ over the entire temperature range combined with low capacitances and very high switching operations, which improve application performance in frequency, energy efficiency, system size and weight reduction.

STPOWER

Product status link
SCT040H120G3AG

Product summary	
Order code	SCT040H120G3AG
Marking	40H120G3AG
Package	H²PAK-7
Packing	Tape and reel

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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	
	Gate-source transient voltage, t_p < 1 µs, t ≤ 10 hours over lifetime	-11 to 25	
I_D(1)	Drain current (continuous) at T_C = 25 °C	40	A
	Drain current (continuous) at T_C = 100 °C	39	
I_{DM}(2)	Drain current (pulsed)	156	A
P_{TOT}	Total power dissipation at T_C = 25 °C	300	W
T_{stg}	Storage temperature range	-55 to 175	°C
T_J	Operating junction temperature range		°C

1. *I_D is limited by package.*
2. *Pulse width is limited by safe operating area.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.50	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

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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_{GS} = 0 V, V_{DS} = 1200 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 = 5 mA	1.8	3.0	4.2	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 15 V, I_D = 16 A		49		mΩ
		V_{GS} = 18 V, I_D = 16 A		40	54	
		V_{GS} = 18 V, I_D = 16 A, T_J = 175 °C		72		

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	-	1329	-	pF
C_{oss}	Output capacitance		-	78	-	pF
C_{rss}	Reverse transfer capacitance		-	10	-	pF
Q_g	Total gate charge	V_{DD} = 800 V, V_{GS} = -5 to 18 V, I_D = 16 A	-	54	-	nC
Q_{gs}	Gate-source charge		-	14	-	nC
Q_{gd}	Gate-drain charge		-	20	-	nC
R_g	Gate input resistance	f = 1 MHz, I_D = 0 A	-	1.6	-	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 = 16 A,	-	267	-	µJ
E_{off}	Turn-off switching energy	R_G = 15 Ω, V_{GS} = -5 V to 18 V	-	117	-	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 = 16 A, R_G = 15 Ω, V_{GS} = -5 to 18 V	-	12.9	-	ns
t_r	Rise time		-	21.1	-	ns
$t_{d(off)}$	Turn-off delay time		-	36.3	-	ns
t_f	Fall time		-	19.2	-	ns

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Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}(1)	Continuous diode forward current	T_C = 25 °C	-		40	A
		T_C = 100 °C	-		39	
V_{SD}	Diode forward voltage	I_{SD} = 16 A, V_{GS} = 0 V	-	2.6		V
t_{rr}	Reverse recovery time	I_{SD} = 16 A, di/dt = 1000 A/µs, V_{DD} = 800 V, V_{GS} = -5 V	-	14.7		ns
Q_{rr}	Reverse recovery charge		-	94.2		nC
I_{RRM}	Reverse recovery current		-	10.6		A

1. *I_{SD} is limited by package.*

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2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

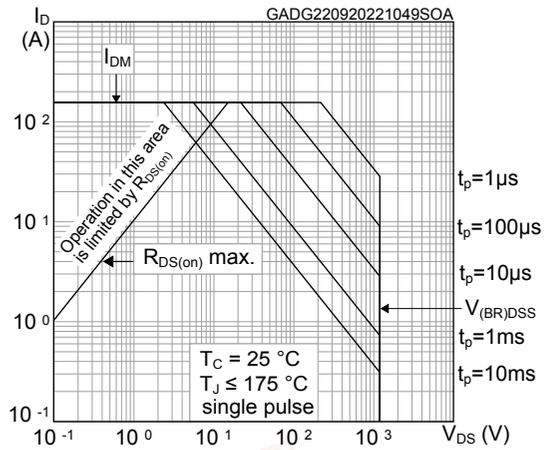


Figure 2. Maximum transient thermal impedance

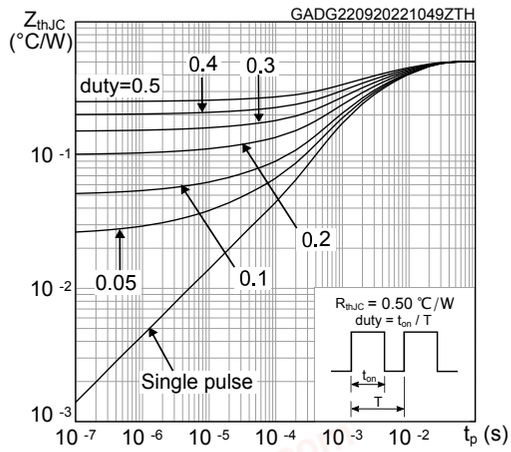


Figure 3. Typical output characteristics (T_J = 25 °C)

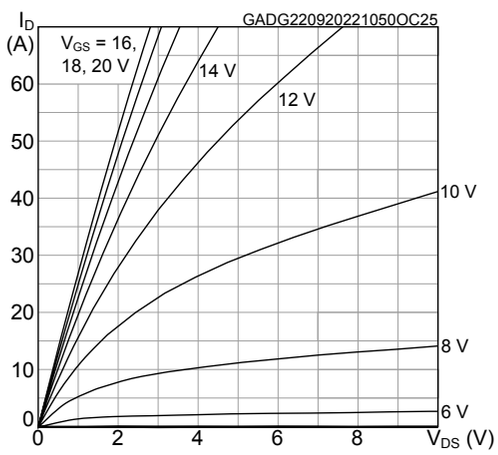


Figure 4. Typical output characteristics (T_J = 175 °C)

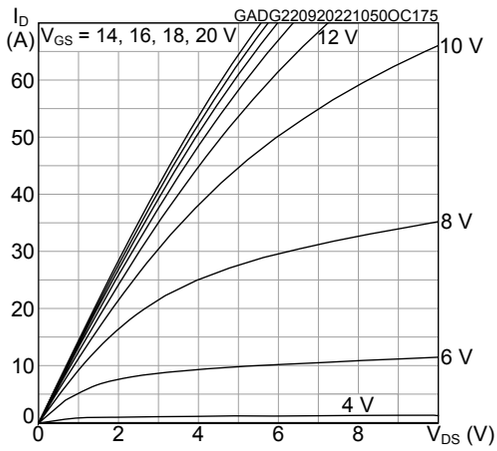


Figure 5. Typical transfer characteristics

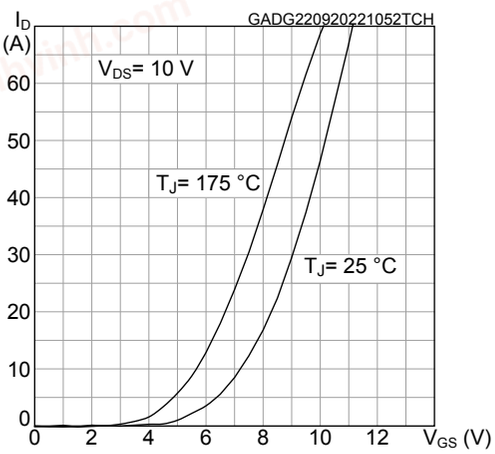
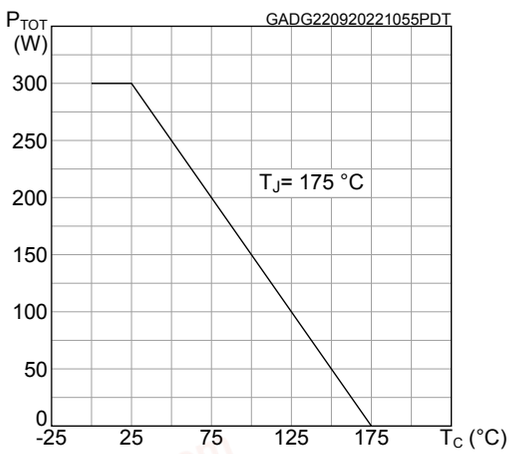


Figure 6. Total power dissipation



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Figure 7. Typical gate charge characteristics

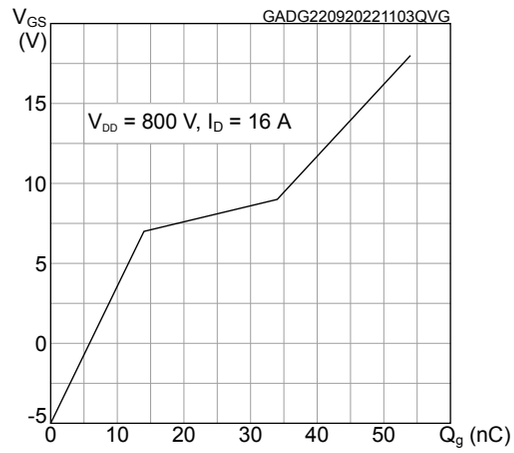


Figure 8. Typical capacitance characteristics

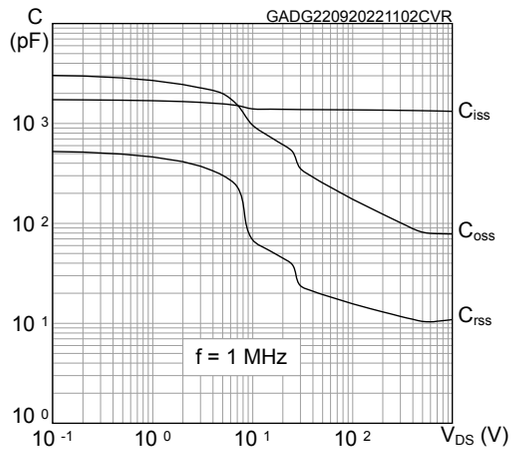


Figure 9. Typical switching energy vs R_g

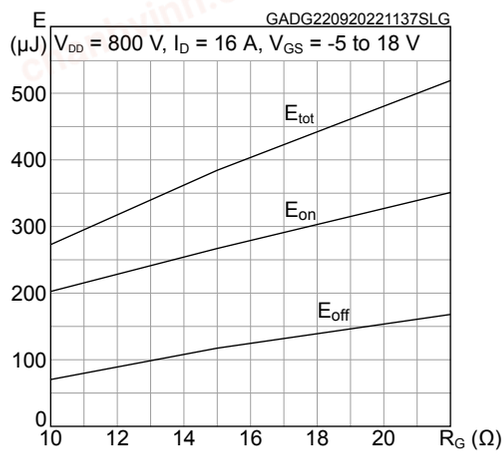


Figure 10. Typical switching energy vs V_{DS}

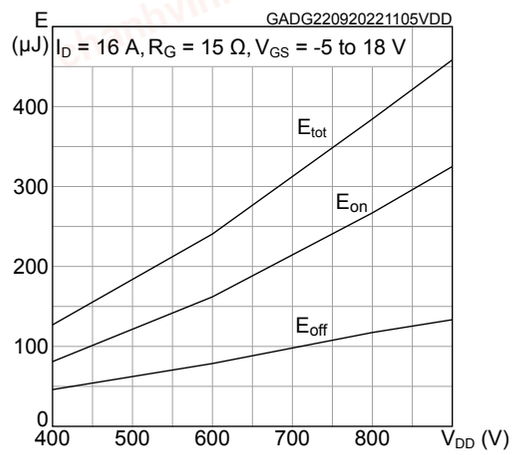


Figure 11. Typical switching energy vs drain current

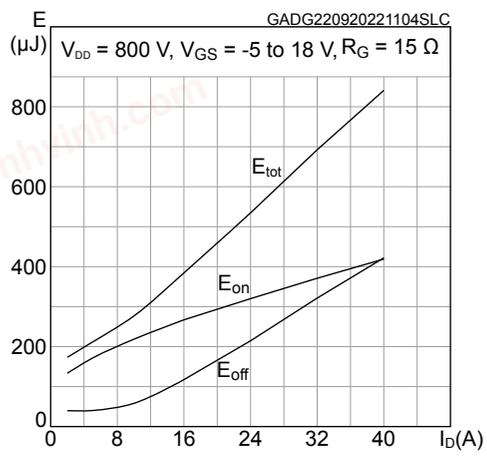
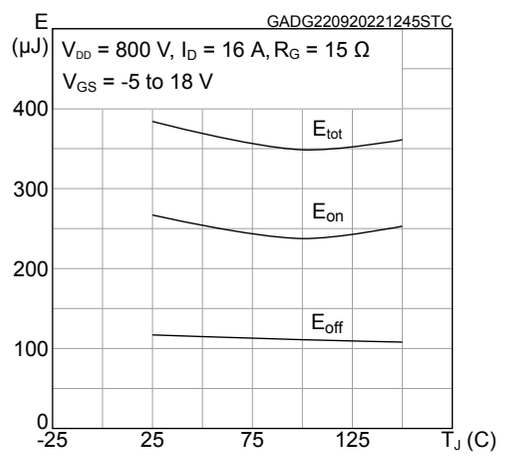


Figure 12. Typical switching energy vs T_C



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Figure 13. Normalized breakdown voltage vs temperature

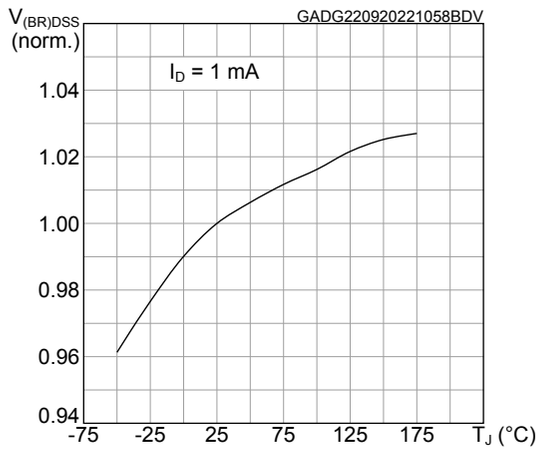


Figure 14. Normalized gate threshold vs temperature

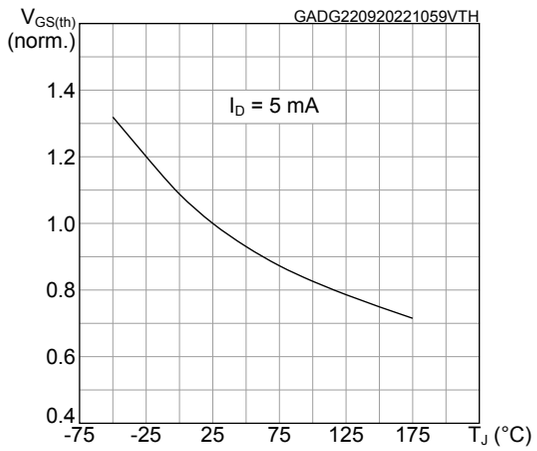


Figure 15. Normalized on-resistance vs temperature

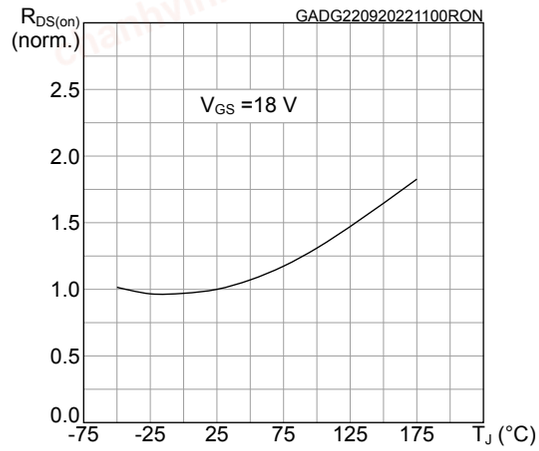


Figure 16. Typical reverse conduction characteristics (T_J = 25 °C)

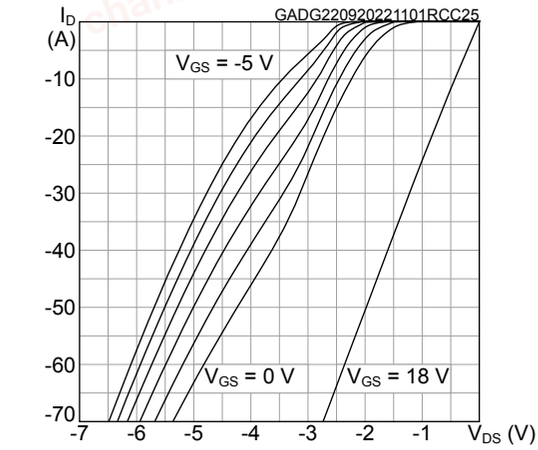
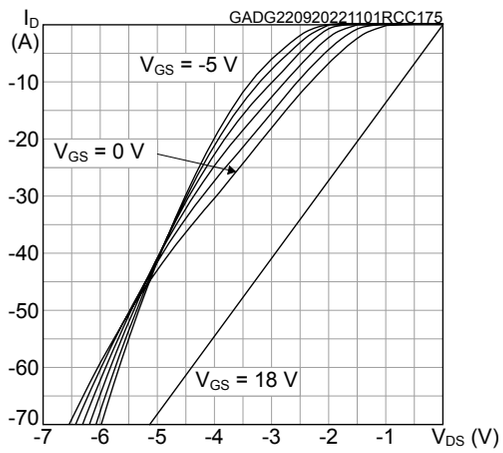


Figure 17. Typical reverse conduction characteristics (T_J = 175 °C)



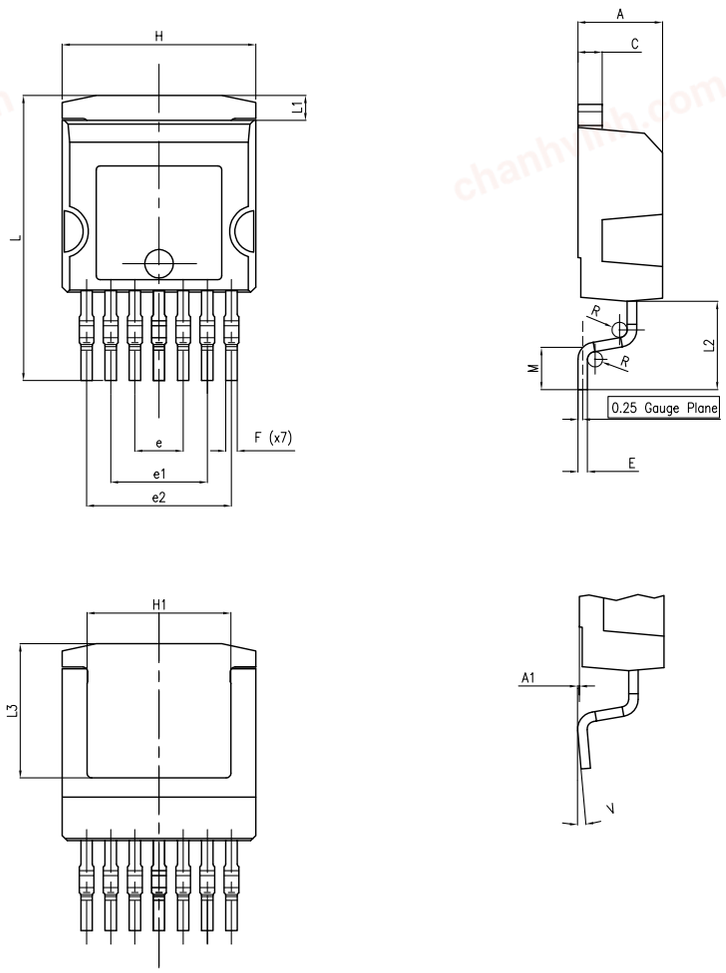
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3 Package information

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**



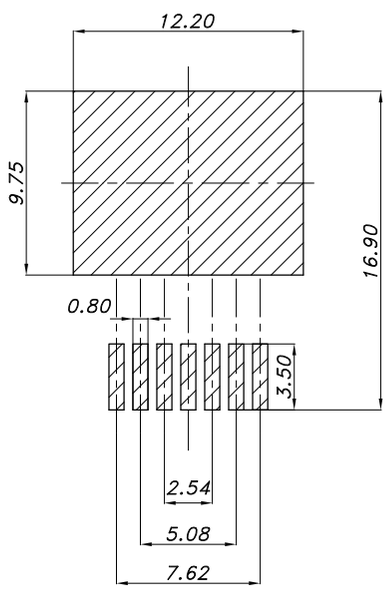
DM00249216_4

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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 19. **H²PAK-7 recommended footprint**



Note: Dimensions are in mm.

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3.2 H²PAK-2 packing information

Figure 20. **Tape outline**

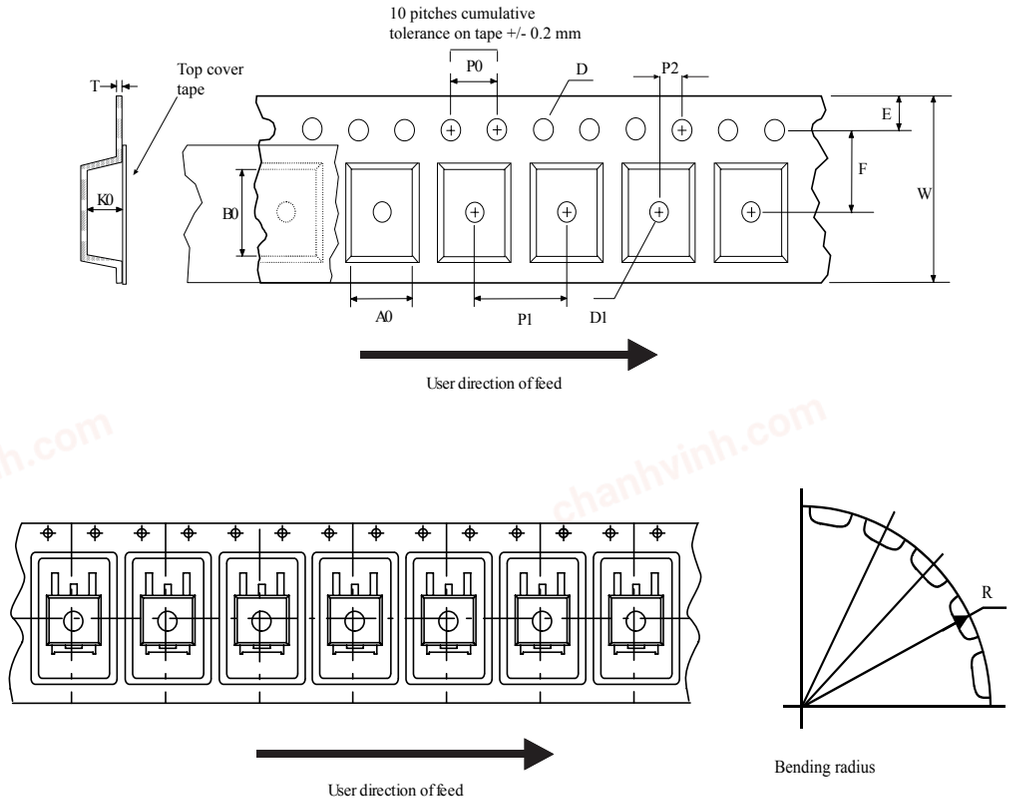
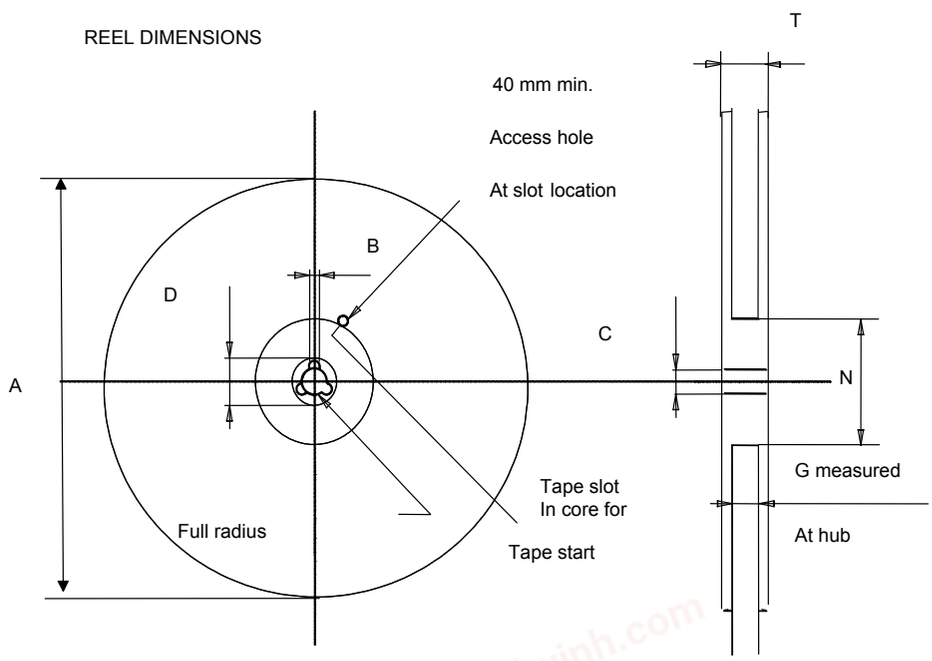


Figure 21. **Reel outline**



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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			

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Revision history

Table 10. **Document revision history**

Date	Revision	Changes
14-Oct-2022	1	First release.
21-Apr-2023	2	Updated Device summary on cover page.

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