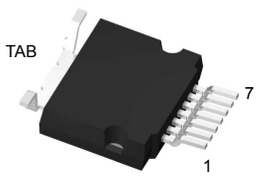
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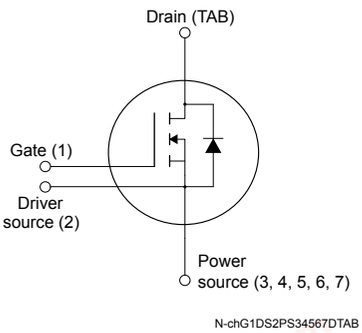
SCT055HU65G3AG

Datasheet

Automotive-grade silicon carbide Power MOSFET 650 V, 58 mΩ typ., 30 A in an HU3PAK package



HU3PAK



STPOWER

Product status link
SCT055HU65G3AG

Product summary	
Order code	SCT055HU65G3AG
Marking	SCT55HU65G3AG
Package	HU3PAK
Packing	Tape and reel

Features

Order code	V_{DS}	$R_{DS(on)}$ typ.	I_D
SCT055HU65G3AG	650 V	58 mΩ	30 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.

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1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	650	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	30	A
	Drain current (continuous) at T_C = 100 °C	30	
I_{DM}(2)	Drain current (pulsed)	132	A
P_{TOT}	Total power dissipation at T_C = 25 °C	185	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	0.81	°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	650			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 650 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	1.8	3.0	4.2	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 15 V, I_D = 15 A		76		mΩ
		V_{GS} = 18 V, I_D = 15 A		58	72	
		V_{GS} = 18 V, I_D = 15 A, T_J = 175 °C		69		

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	-	721	-	pF
C_{oss}	Output capacitance		-	73	-	pF
C_{rss}	Reverse transfer capacitance		-	11	-	pF
Q_g	Total gate charge	V_{DD} = 400 V, V_{GS} = -5 to 18 V, I_D = 15 A	-	29	-	nC
Q_{gs}	Gate-source charge		-	9	-	nC
Q_{gd}	Gate-drain charge		-	10.7	-	nC
R_g	Gate input resistance	f = 1 MHz, I_D = 0 A	-	1.4	-	Ω

Table 5. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{DD} = 400 V, I_D = 15 A, R_G = 5.6 Ω, V_{GS} = -5 V to 18 V	-	27.5	-	µJ
E_{off}	Turn-off switching energy		-	19.3	-	µJ

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 400 V, I_D = 15 A, R_G = 5.6 Ω, V_{GS} = -5 to 18 V	-	9.2	-	ns
t_f	Rise time		-	7.9	-	ns
$t_{d(off)}$	Turn-off delay time		-	14.2	-	ns
t_r	Fall time		-	12.1	-	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	-		30	A
		T_C = 100 °C	-		30	
V_{SD}	Diode forward voltage	I_{SD} = 15 A, V_{GS} = 0 V	-	3		V
t_{rr}	Reverse recovery time	I_{SD} = 15 A, di/dt = 3000 A/µs, V_{DD} = 400 V	-	12		ns
Q_{rr}	Reverse recovery charge		-	132		nC
I_{RRM}	Reverse recovery current		-	18		A

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

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2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

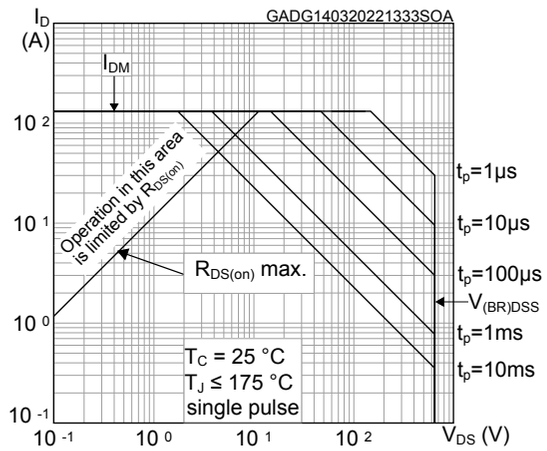


Figure 2. Maximum transient thermal impedance

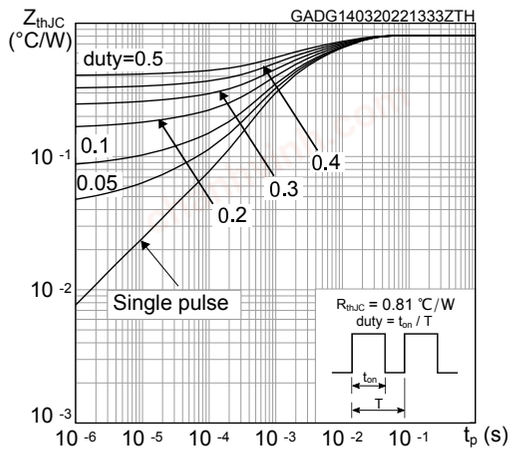


Figure 3. Typical output characteristics (T_J = 25 °C)

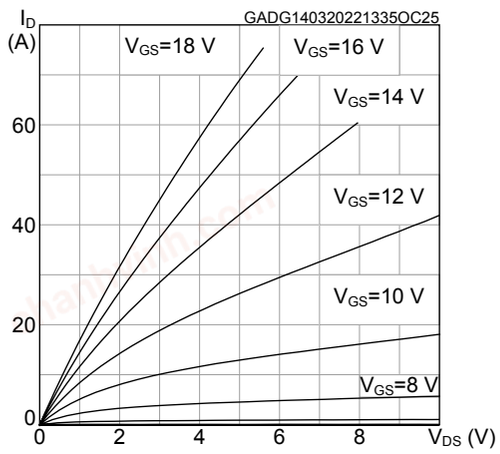


Figure 4. Typical output characteristics (T_J = 175 °C)

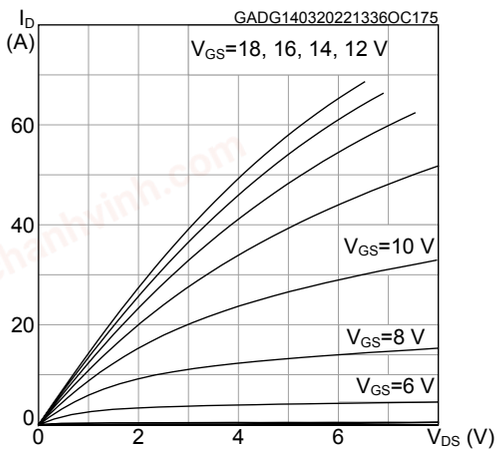


Figure 5. Typical transfer characteristics

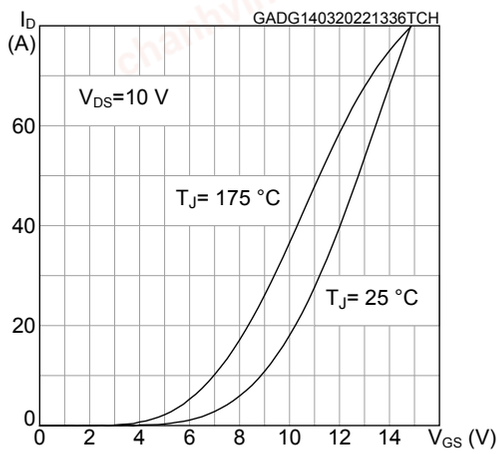
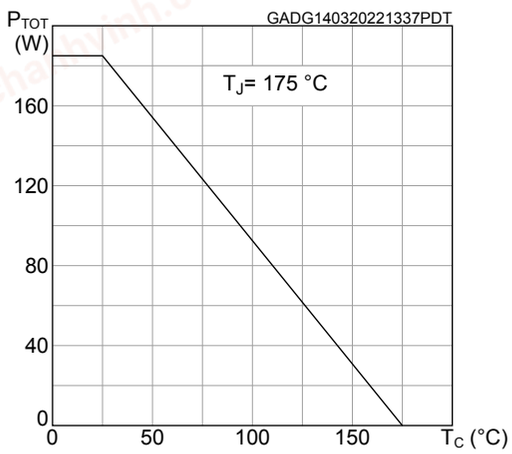


Figure 6. Total power dissipation



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Figure 7. Typical gate charge characteristics

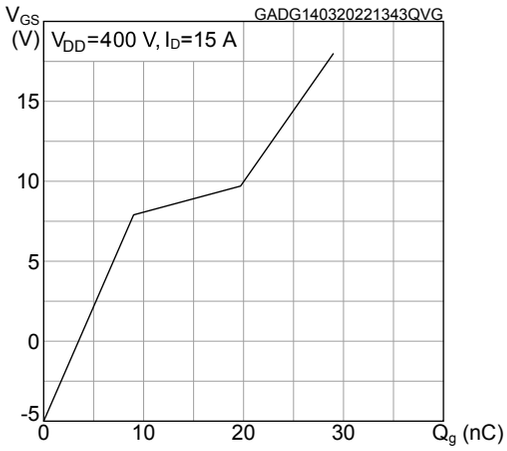


Figure 8. Typical capacitance characteristics

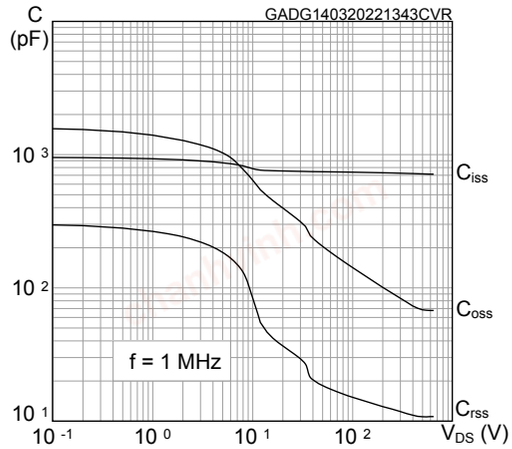


Figure 9. Typical switching energy vs drain current

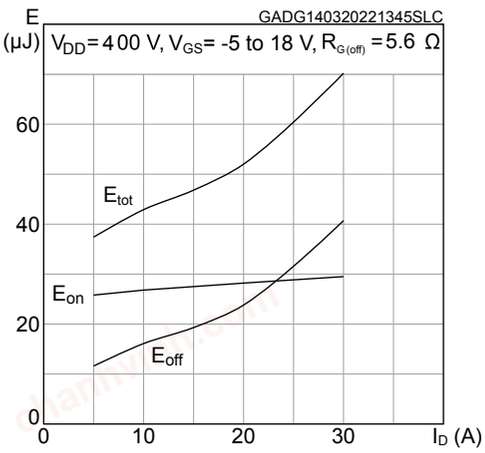


Figure 10. Typical switching energy vs gate resistance

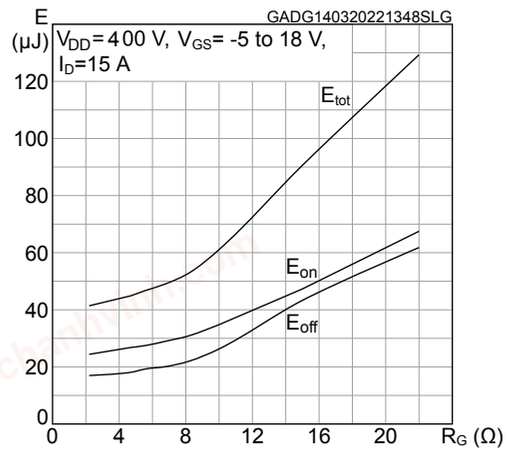


Figure 11. Typical switching energy vs V_{DS}

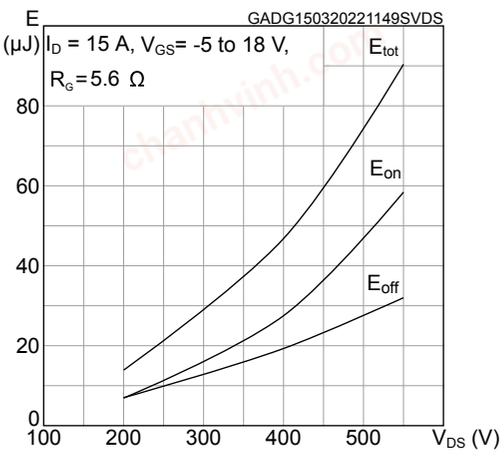
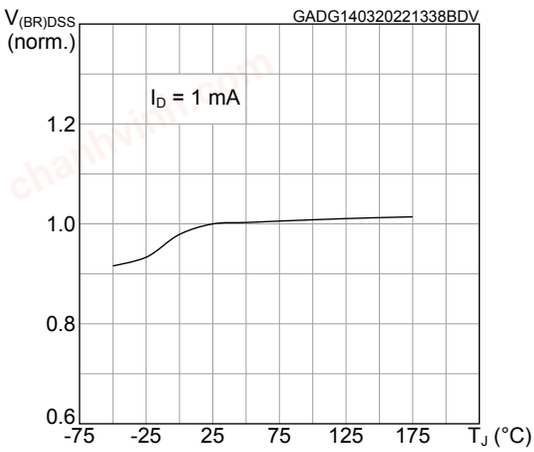


Figure 12. Normalized breakdown voltage vs temperature



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Figure 13. Normalized gate threshold vs temperature

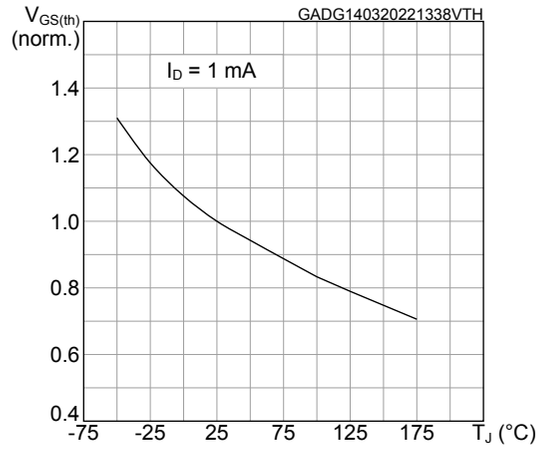


Figure 14. Normalized on-resistance vs temperature

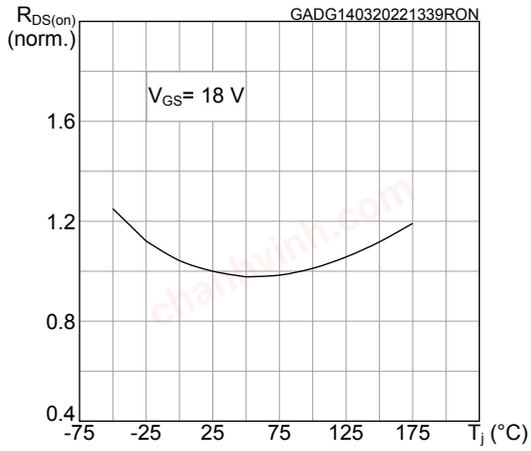


Figure 15. Typical reverse conduction characteristics (T_J= 25°C)

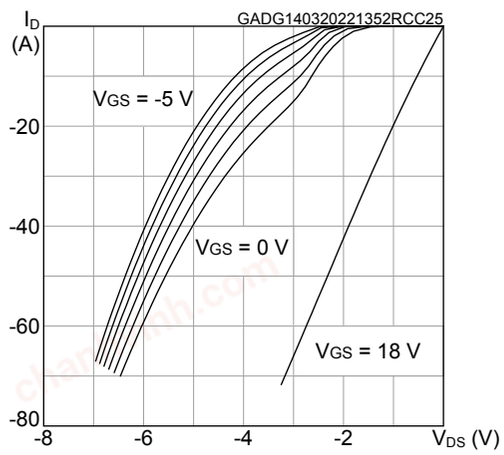
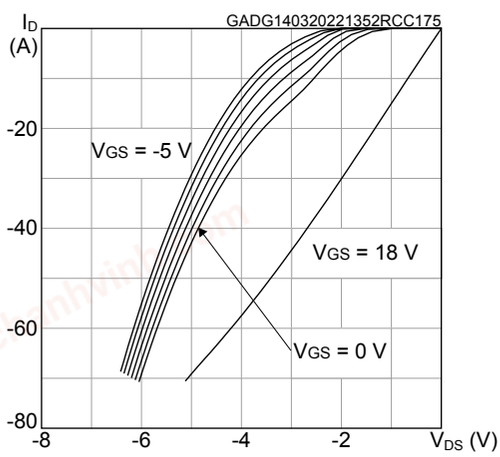


Figure 16. Typical reverse conduction characteristics (T_J= 175°C)



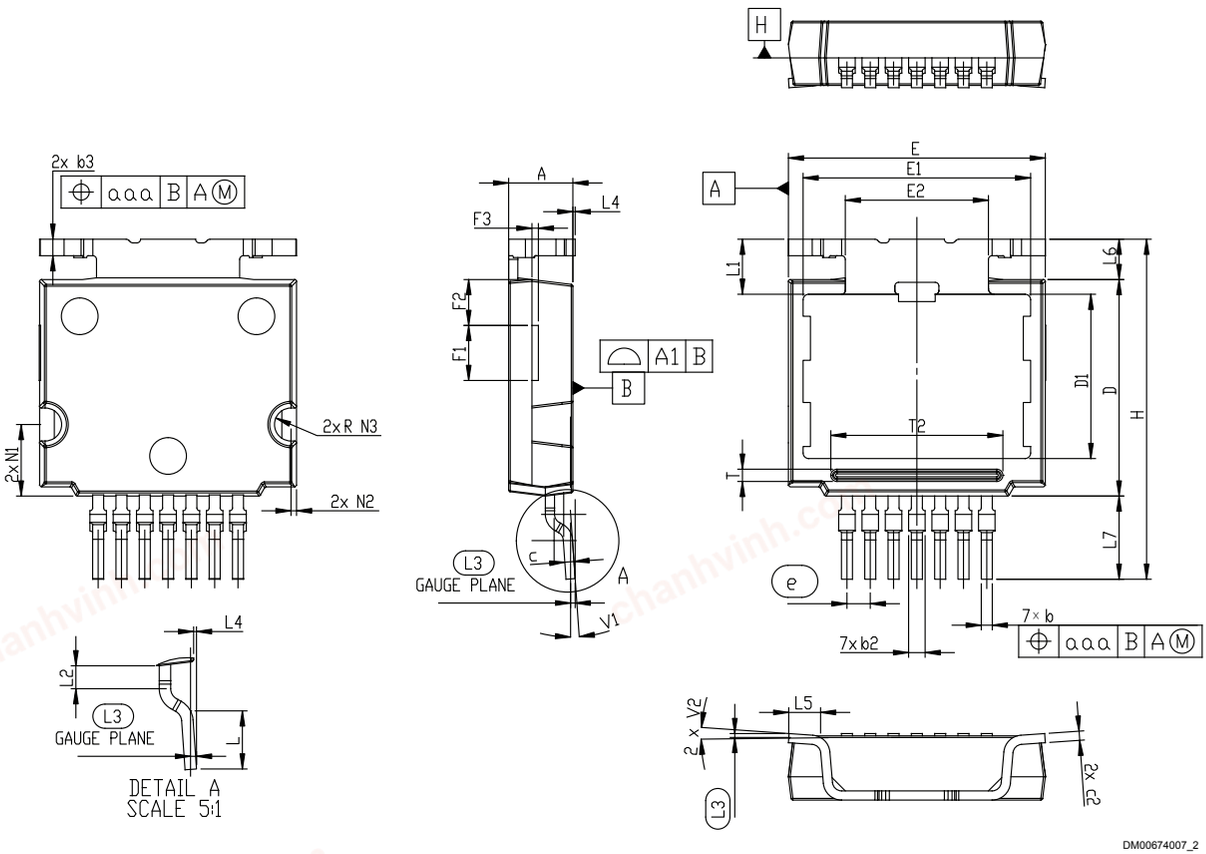
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3 Package information

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 HU3PAK package information

Figure 17. **HU3PAK package outline**



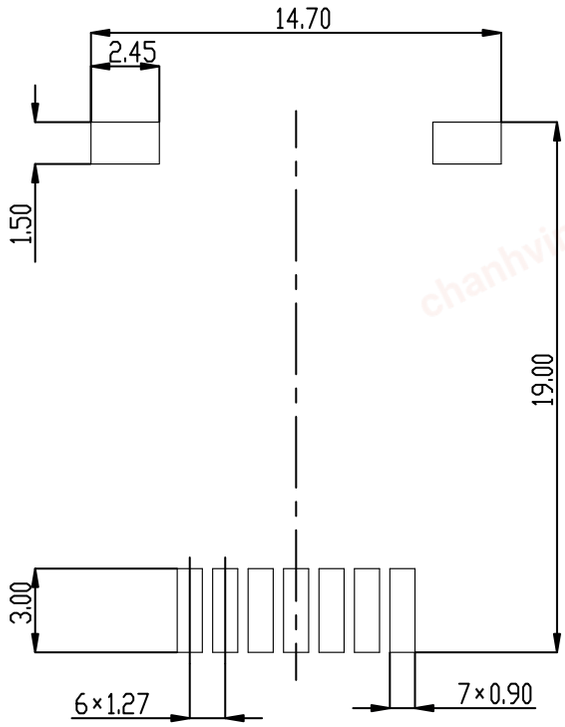
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Table 8. **HU3PAK package mechanical data**

Ref.	Dimensions		
	mm		
	Min.	Typ.	Max.
A	3.40	3.50	3.60
A1		0.05	
b	0.50	0.60	0.70
b2	0.50	0.70	1.00
b3	0.80	0.90	1.00
c	0.40	0.50	0.60
c2	0.40	0.50	0.60
D	11.70	11.80	11.90
D1	8.80	8.955	9.10
E	13.90	14.00	14.10
E1	12.30	12.40	12.50
E2	7.75	7.80	7.85
e		1.27	
H	18.00	18.58	19.00
aaa		0.10	
L	2.40	2.52	2.60
L1		3.05	
L2	0.90	1.00	1.10
L3		0.26	
L4	0.075	0.125	0.175
L5	1.83	1.93	2.03
L6	2.14	2.24	2.34
L7	4.44	4.54	4.64
F1	2.90	3.00	3.10
F2	2.40	2.50	2.60
F3	0.25	0.35	0.45
N1	3.80	3.90	4.00
N2	0.25	0.30	0.45
N3	0.80	0.90	1.00
T	0.50	0.67	0.70
T2	9.18	9.38	9.43
V1		0 °	8 °
V2		0 °	8 °

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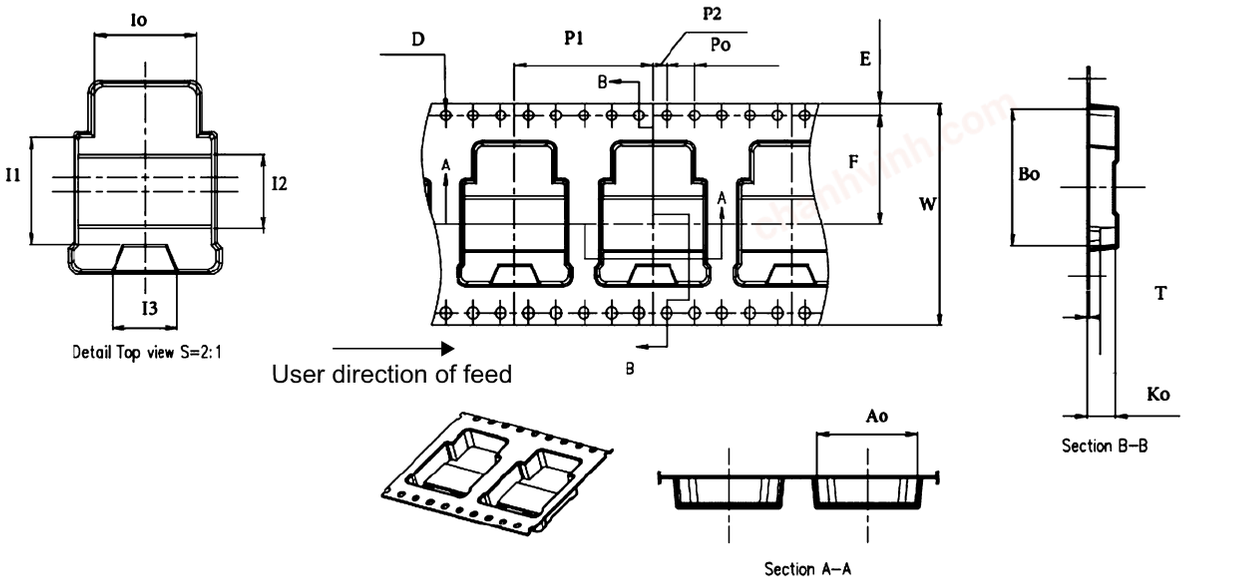
Figure 18. **HU3PAK recommended footprint (dimensions in mm)**



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3.2 HU3PAK packing information

Figure 19. **HU3PAK carrier tape outline**



DM00345054_3

Table 9. **HU3PAK tape mechanical data**

Dimension	Value
	mm
A0	14.40 ±0.10
B0	19.70
D	1.50 ±0.10
E	1.75 ±0.10
F	15.65 ±0.10
I0	11.00
I1	11.60 ±0.10
I2	8.00
I3	7.00
K0	4.20
P0	4.00 ±0.10
P1	20.00 ±0.10
P2	2.00 ±0.10
T	0.40 ±0.50
W	32.00 ±0.30

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Figure 20. **HU3PAK reel outline**

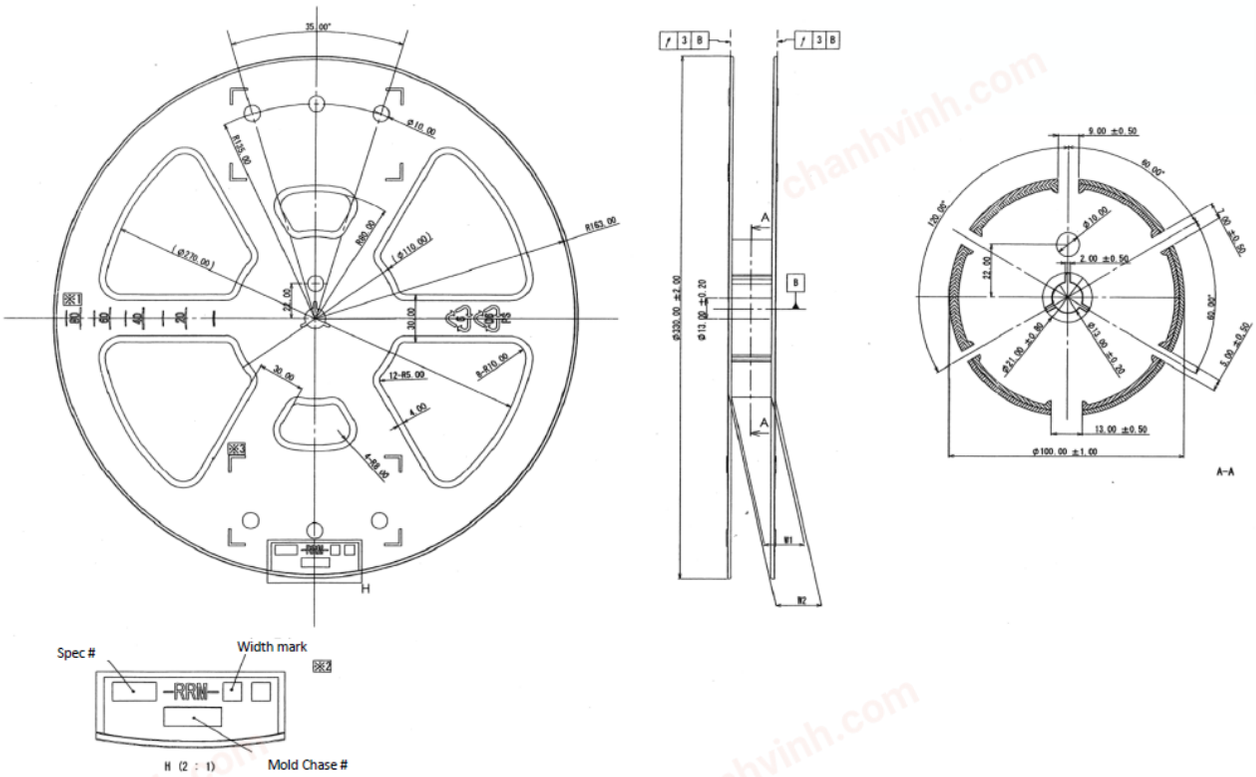


Table 10. **HU3PAK reel mechanical data**

Dimension	Value
	mm
Reel width	32.0
Reel inner width	33.4 ±1.0
Reel outer width	37.4 ±1.0

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Revision history

Table 11. **Document revision history**

Date	Revision	Changes
16-Mar-2022	1	First release.

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Contents

1 **Electrical ratings** 2

2 **Electrical characteristics** 3

2.1 Electrical characteristics (curves) 5

3 **Package information** 8

3.1 HU3PAK package information 8

3.2 HU3PAK packing information 11

Revision history 13

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