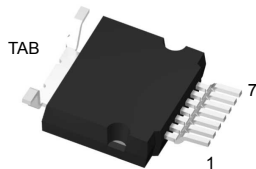
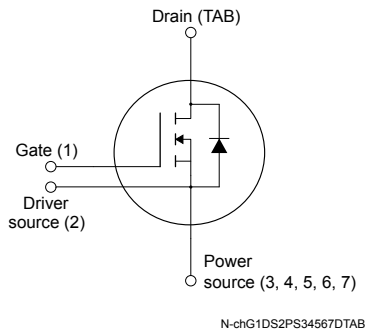


Automotive-grade silicon carbide Power MOSFET 650 V, 29 mΩ typ., 60 A in an HU3PAK package



HU3PAK



Features

Order code	V_{DS}	$R_{DS(on)}$ typ.	I_D
SCT027HU65G3AG	650 V	29 mΩ	60 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

- DC/DC converter for EV/HEV
- Main inverter (electric traction)
- 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.



Product status link

[SCT027HU65G3AG](#)

Product summary

Order code	SCT027HU65G3AG
Top-side marking	27HU65AG
Back-side marking	SCT27HU65G3AG
Package	HU3PAK
Packing	Tape and reel

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, $t_p < 1 \mu s$, $t \leq 10$ hours over lifetime	-11 to 25	
I_D	Drain current (continuous) at $T_C = 25^\circ C$	60 ⁽¹⁾	A
	Drain current (continuous) at $T_C = 100^\circ C$	58	
$I_{DM}^{(2)}$	Drain current (pulsed)	230	A
P_{TOT}	Total power dissipation at $T_C = 25^\circ C$	300	W
T_{stg}	Storage temperature range	-55 to 175	$^\circ C$
T_J	Operating junction temperature range		$^\circ C$

1. Limited by bonding wires.

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	$^\circ C/W$
R_{thJA}	Thermal resistance, junction-to-ambient	50	$^\circ C/W$

2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 650\text{ V}$			10	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	$V_{DS} = V_{GS}$, $I_D = 5\text{ mA}$	1.8	3.0	4.2	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 15\text{ V}$, $I_D = 30\text{ A}$		38		m Ω
		$V_{GS} = 18\text{ V}$, $I_D = 30\text{ A}$		29	39.3	
		$V_{GS} = 18\text{ V}$, $I_D = 30\text{ A}$, $T_J = 175\text{ }^{\circ}\text{C}$		39		

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 400\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	1277	-	pF
C_{oss}	Output capacitance		-	135	-	pF
C_{rss}	Reverse transfer capacitance		-	17.2	-	pF
Q_g	Total gate charge	$V_{DD} = 400\text{ V}$, $V_{GS} = -5\text{ to }18\text{ V}$, $I_D = 30\text{ A}$	-	60.4	-	nC
Q_{gs}	Gate-source charge		-	19.5	-	nC
Q_{gd}	Gate-drain charge		-	21.9	-	nC
R_g	Gate input resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	1.6	-	Ω

Table 5. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 400\text{ V}$, $I_D = 30\text{ A}$,	-	108	-	μJ
E_{off}	Turn-off switching energy	$R_G = 5.6\text{ }\Omega$, $V_{GS} = -5\text{ V to }18\text{ V}$	-	77	-	μJ

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 30\text{ A}$, $R_G = 5.6\text{ }\Omega$, $V_{GS} = -5\text{ to }18\text{ V}$	-	15	-	ns
t_r	Rise time		-	6	-	ns
$t_{d(off)}$	Turn-off delay time		-	26	-	ns
t_f	Fall time		-	13	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Continuous diode forward current	$T_C = 25\text{ }^{\circ}\text{C}$	-		60 ⁽¹⁾	A
		$T_C = 100\text{ }^{\circ}\text{C}$	-		58	
V_{SD}	Diode forward voltage	$I_{SD} = 30\text{ A}$, $V_{GS} = 0\text{ V}$	-	2.9		V
t_{rr}	Reverse recovery time	$I_{SD} = 30\text{ A}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $V_{DD} = 400\text{ V}$	-	14		ns
Q_{rr}	Reverse recovery charge		-	74.2		nC
I_{RRM}	Reverse recovery current		-	8.7		A

1. Limited by bonding wires.

2.1 Electrical characteristics (curves)

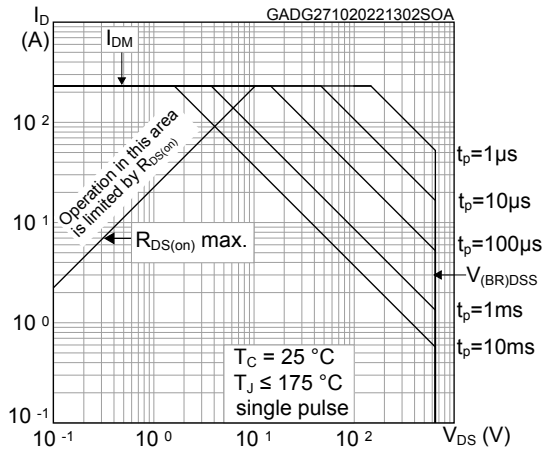
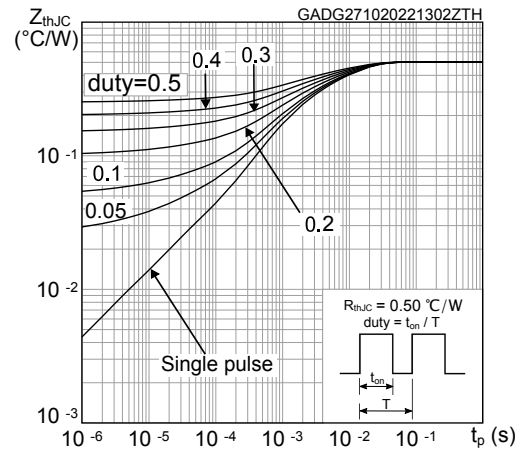
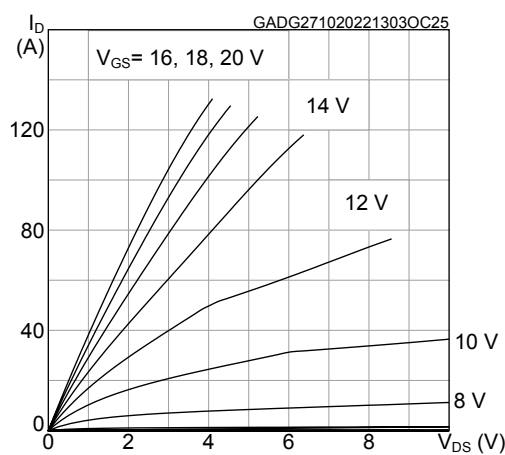
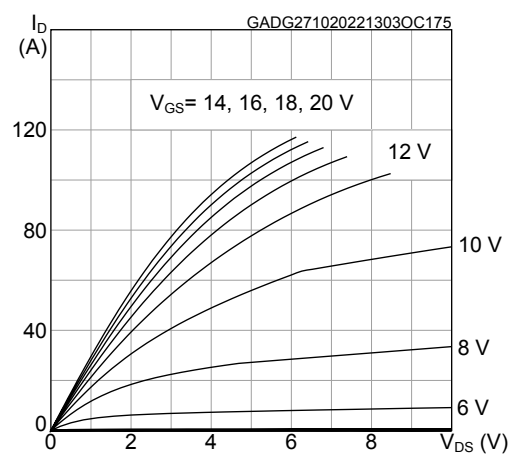
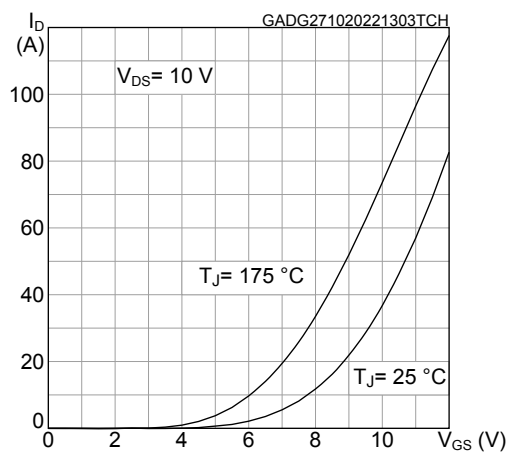
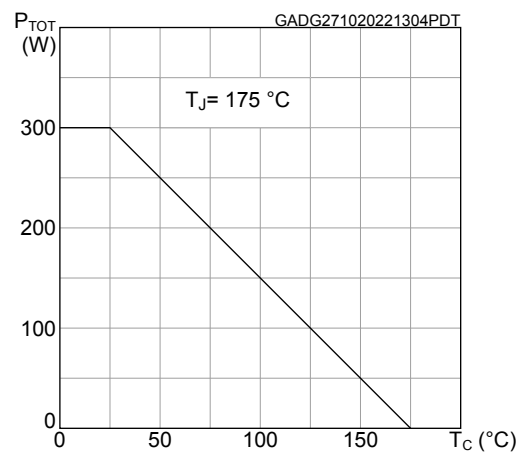
Figure 1. Safe operating area

Figure 2. Maximum transient thermal impedance

Figure 3. Typical output characteristics ($T_J = 25\text{ °C}$)

Figure 4. Typical output characteristics ($T_J = 175\text{ °C}$)

Figure 5. Typical transfer characteristics

Figure 6. Total power dissipation


Figure 7. Typical gate charge characteristics

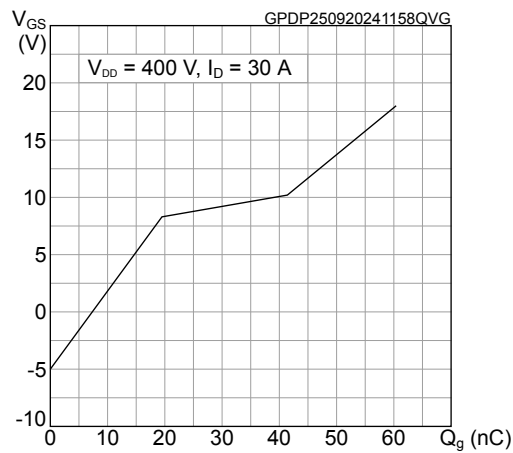


Figure 8. Typical capacitance characteristics

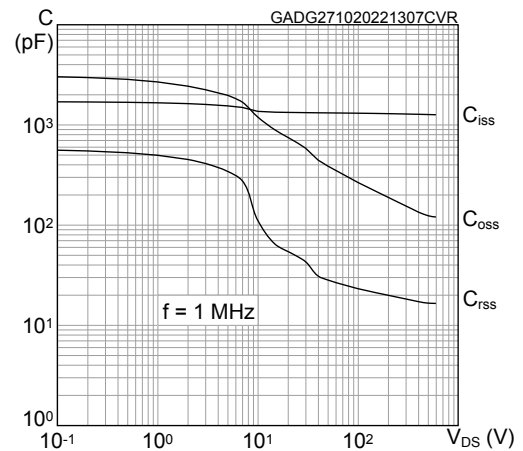


Figure 9. Typical switching energy vs drain current

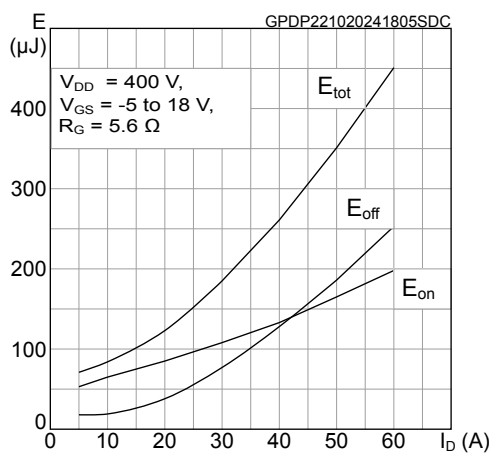


Figure 10. Typical switching energy vs gate resistance

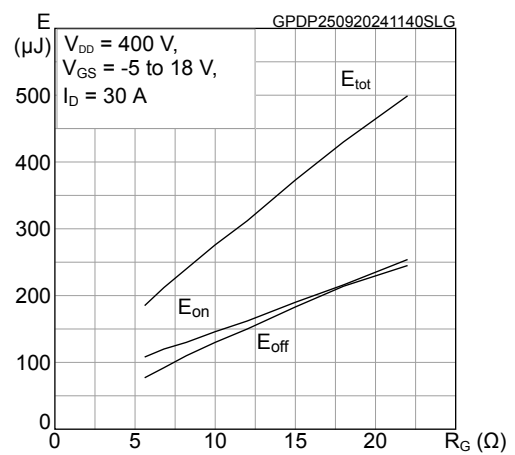


Figure 11. Typical switching energy vs supply voltage

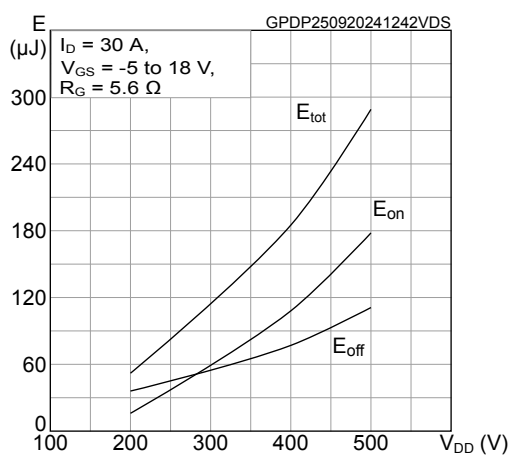


Figure 12. Maximum continuous drain current vs case temperature

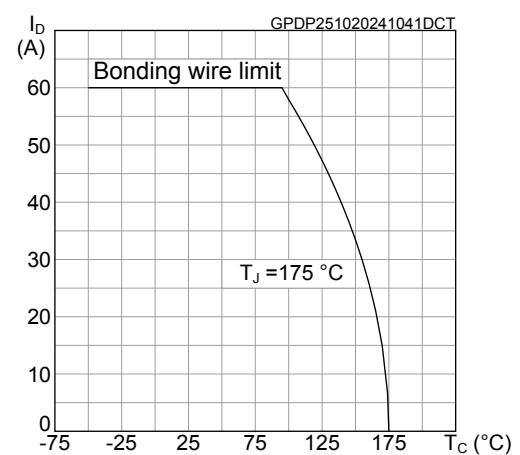
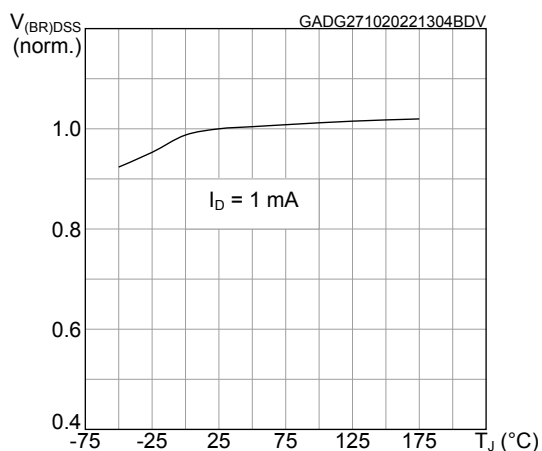
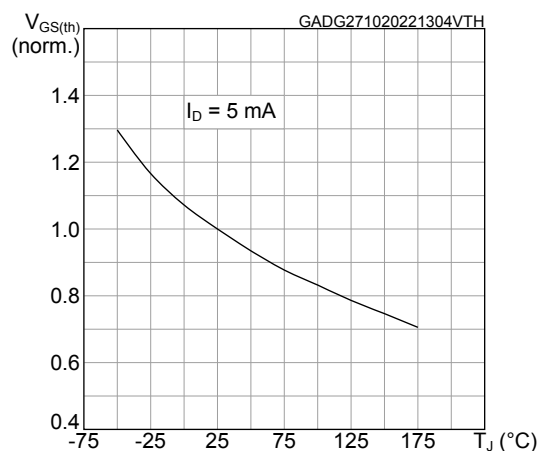
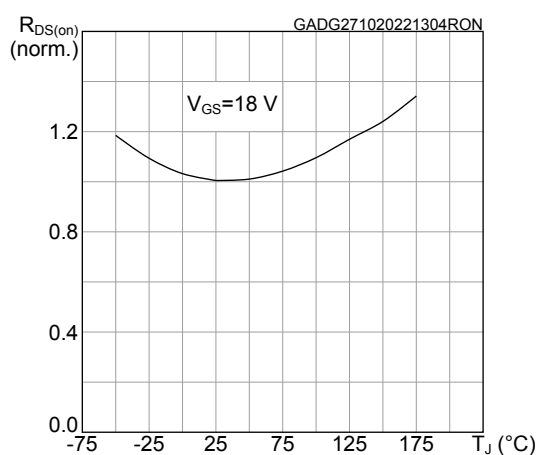
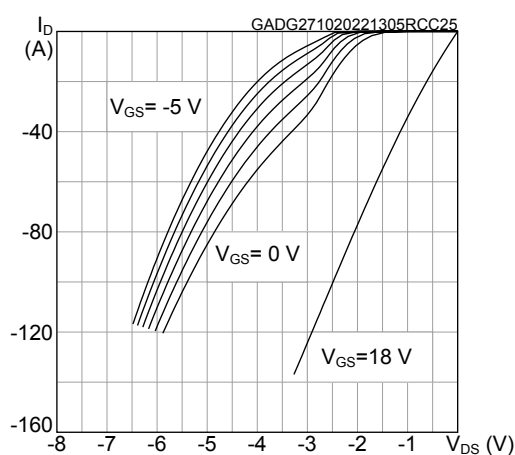
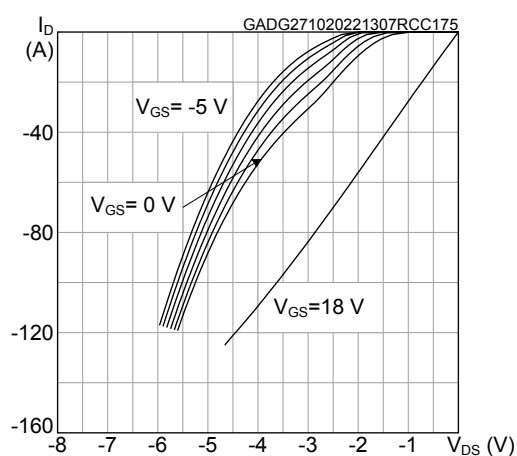


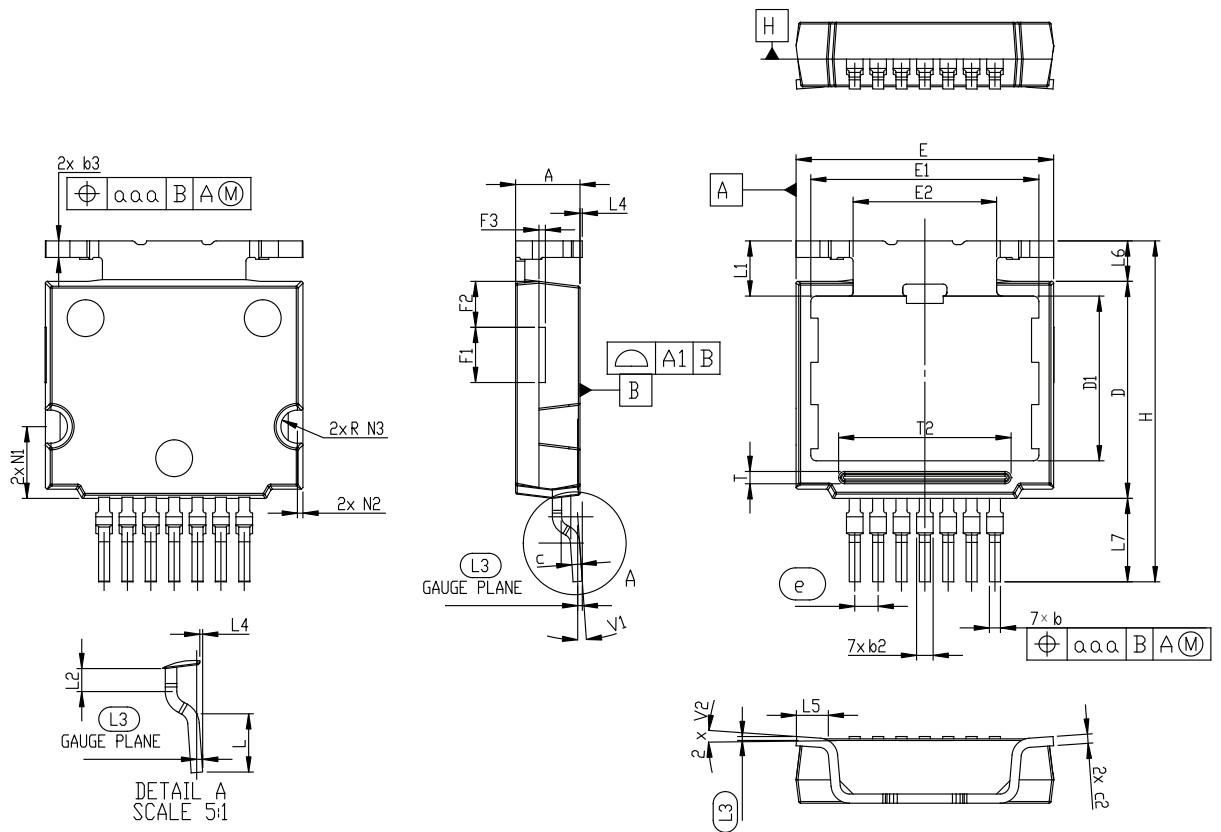
Figure 13. Normalized breakdown voltage vs temperature

Figure 14. Normalized gate threshold vs temperature

Figure 15. Normalized on-resistance vs temperature

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

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


3 Package information

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 18. HU3PAK package outline

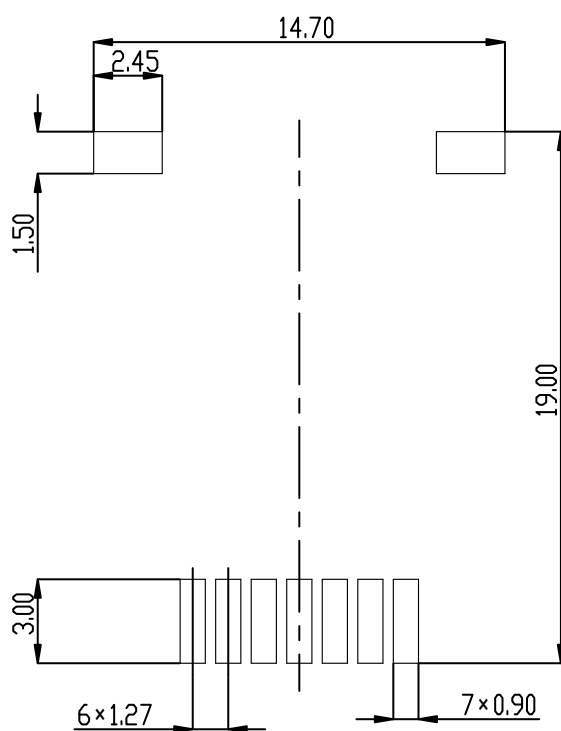


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Table 8. HU3PAK package mechanical data

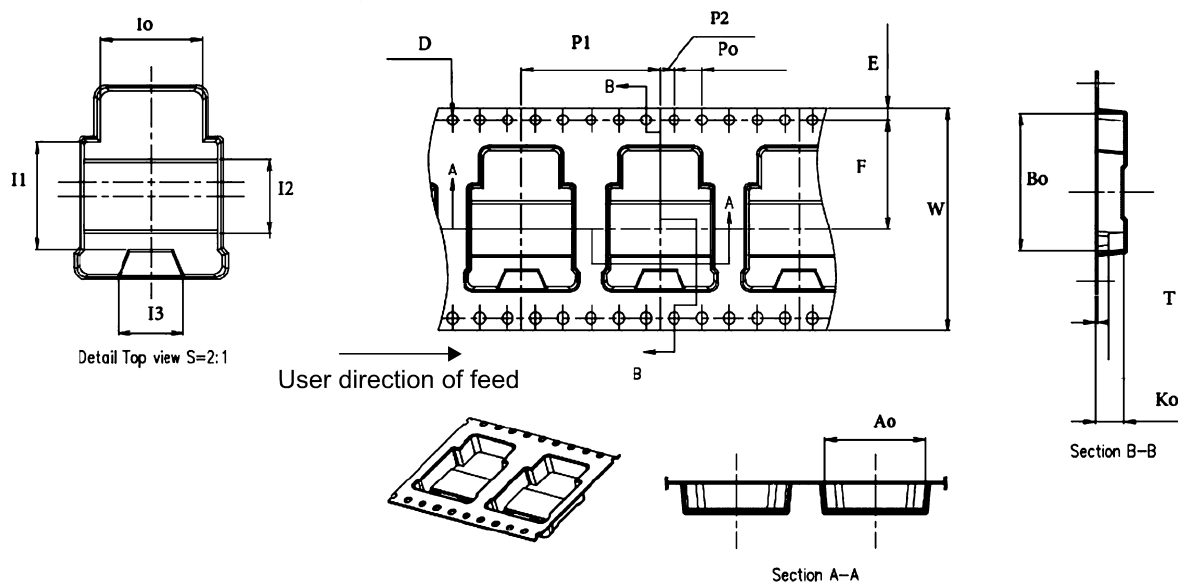
Ref.	Dimensions		
	mm		
	Min.	Typ.	Max.
A	3.40	3.50	3.60
A1		0.05	
b	0.50	0.60	0.70
b2	0.50	0.70	1.00
b3	0.80	0.90	1.00
c	0.40	0.50	0.60
c2	0.40	0.50	0.60
D	11.70	11.80	11.90
D1	8.80	8.955	9.10
E	13.90	14.00	14.10
E1	12.30	12.40	12.50
E2	7.75	7.80	7.85
e		1.27	
H	18.00	18.58	19.00
aaa		0.10	
L	2.40	2.52	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 °

Figure 19. HU3PAK recommended footprint (dimensions in mm)



3.2 HU3PAK packing information

Figure 20. HU3PAK carrier tape outline

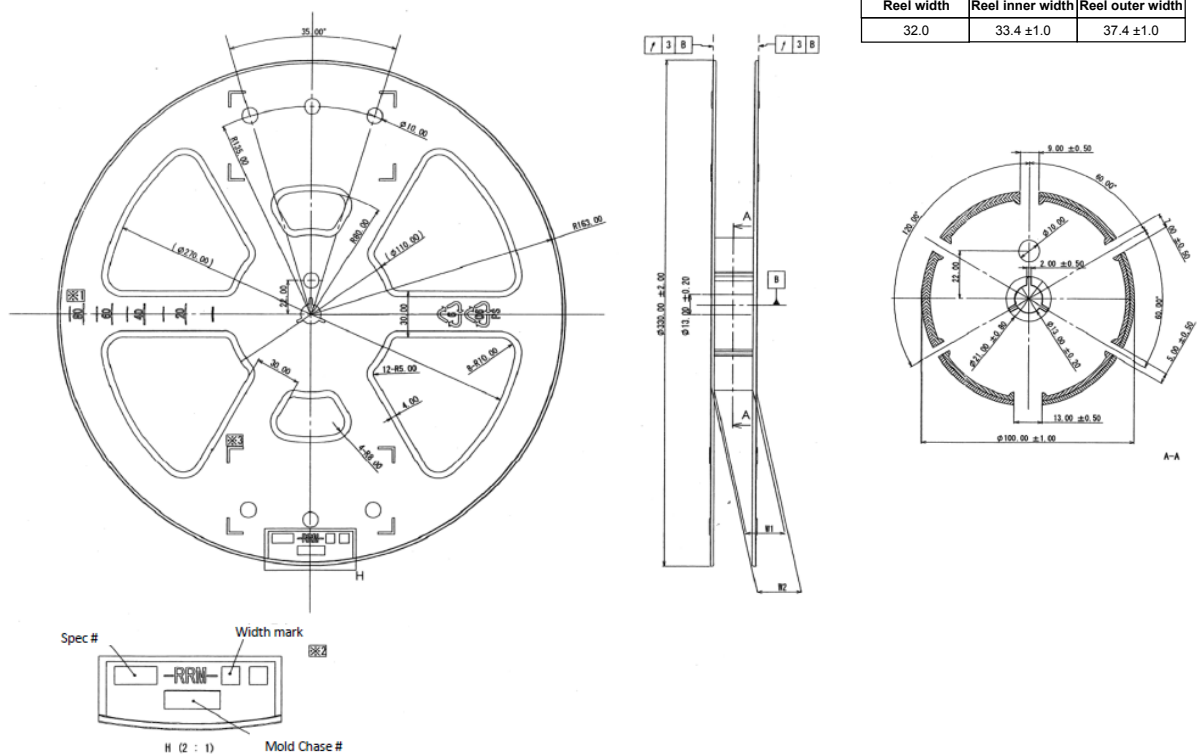


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Table 9. HU3PAK tape mechanical data

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

Figure 21. HU3PAK reel outline (dimensions are in mm)



DM00345054_3_reel

Revision history

Table 10. Document revision history

Date	Revision	Changes
07-Nov-2022	1	First release.
04-Nov-2024	2	Updated <i>Device summary</i> on cover page. Updated <i>Table 4. Dynamic</i>. Updated <i>Table 5. Switching energy (inductive load)</i>. Updated <i>Table 6. Switching times</i>. Updated <i>Table 7. Reverse SiC diode characteristics</i>. Updated <i>Figure 7. Typical gate charge characteristics</i>. Updated <i>Figure 9. Typical switching energy vs drain current</i>. Updated <i>Figure 10. Typical switching energy vs gate resistance</i>. Updated <i>Figure 11. Typical switching energy vs supply voltage</i>. Inserted <i>Figure 12. Maximum continuous drain current vs case temperature</i>. Minor text changes.
09-Dec-2024	3	Updated <i>Table 6. Switching times</i> .
24-Jan-2025	4	Updated Table 5. Switching energy (inductive load) .

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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