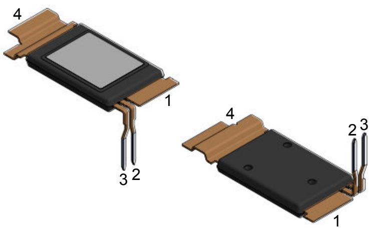
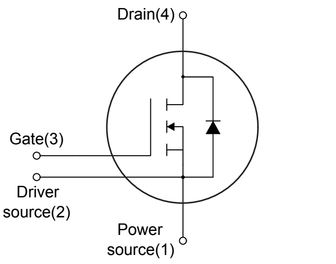
SCTHS250N120G3AG

Datasheet

Automotive-grade silicon carbide Power MOSFET 1200 V, 8.5 mΩ typ., 239 A in a STPAK package



STPAK



Product status link
SCTHS250N120G3AG

Product summary	
Order code	SCTHS250N120G3AG
Marking	SC250N12G3AG
Package	STPAK
Packing	Tray

Features

Order code	V_{DS}	$R_{DS(on)}$ typ.	I_D
SCTHS250N120G3AG	1200 V	8.5 mΩ	239 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
- Very high operating junction temperature capability (T_J = 200 °C)
- Source sensing pin for increased efficiency

Application

- Main inverter (electric traction)

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.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
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	Drain current (continuous) at T_C = 25 °C	239	A
	Drain current (continuous) at T_C = 100 °C	180	
I_{DM} (1)	Drain current (pulsed)	720	A
P_{TOT}	Total power dissipation at T_C = 25 °C	994	W
V_{ISO}	Insulation withstand voltage applied between each pin and the heat sink plate (DC voltage, t = 1 s)	4.3	kV
T_{stg}	Storage temperature range	-55 to 200	°C
T_J	Operating junction temperature range		

1. *Pulse width is limited by safe operating area.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.176	°C/W

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			20	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 = 10 mA	2.0	3.2	4.4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 18 V, I_D = 120 A		8.5	10.5	mΩ
		V_{GS} = 18 V, I_D = 120 A, T_J = 175 °C		14		
		V_{GS} = 18 V, I_D = 120 A, T_J = 200 °C		15.3		

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	-	7370	-	pF
C_{oss}	Output capacitance		-	363	-	pF
C_{rss}	Reverse transfer capacitance		-	56	-	pF
R_g	Gate input resistance	f = 1 MHz, I_D = 0 A	-	0.65	-	Ω
Q_g	Total gate charge	V_{DD} = 800 V, V_{GS} = -5 to 18 V, I_D = 120 A	-	304	-	nC
Q_{gs}	Gate-source charge		-	81	-	nC
Q_{gd}	Gate-drain charge		-	114	-	nC

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 = 120 A, R_G = 4.7 Ω, V_{GS} = -5 V to 18 V	-	2156	-	µJ
E_{off}	Turn-off switching energy		-	2611	-	µJ

Table 6. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode forward voltage	I_{SD} = 120 A, V_{GS} = 0 V	-	3.1	-	V
t_{rr}	Reverse recovery time	I_{SD} = 120 A, di/dt = 1 kA/µs, V_{GS} = -5 to 18 V, V_{DD} = 800 V	-	38.6	-	ns
Q_{rr}	Reverse recovery charge		-	530	-	nC
I_{RRM}	Reverse recovery current		-	24.5	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

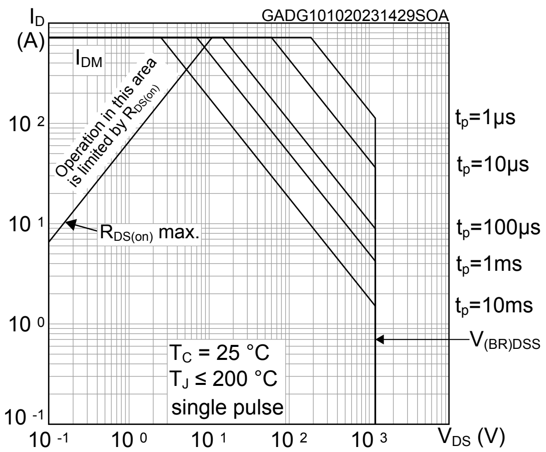


Figure 2. Maximum transient thermal impedance

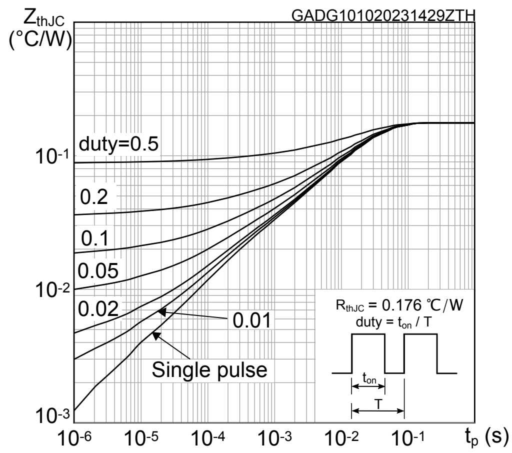


Figure 3. Typical output characteristics (T_J = 25 °C)

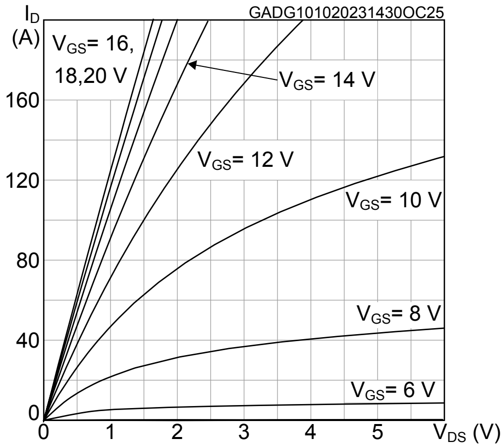


Figure 4. Typical output characteristics (T_J = 200 °C)

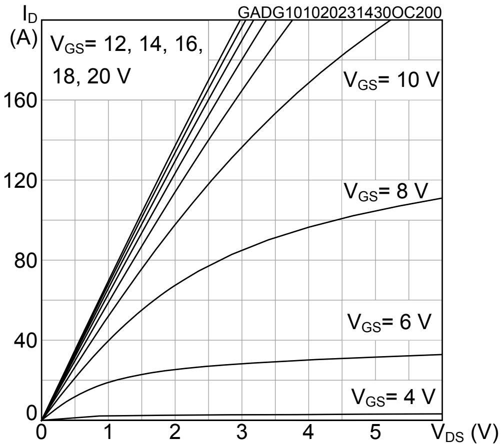


Figure 5. Typical transfer characteristics

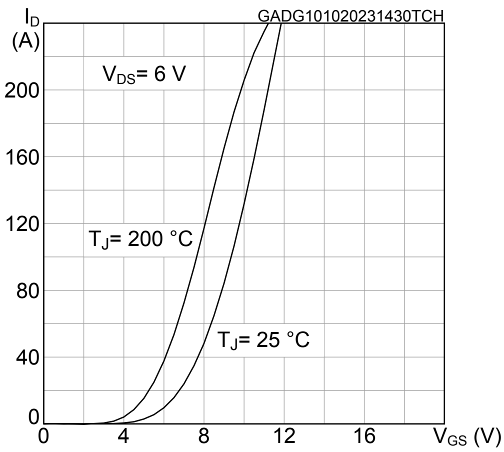


Figure 6. Total power dissipation

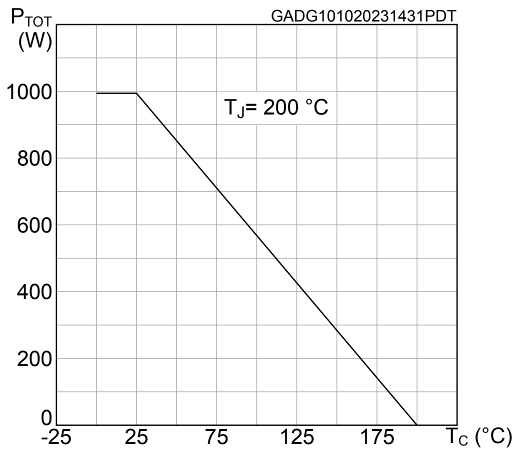


Figure 7. Typical gate charge characteristics

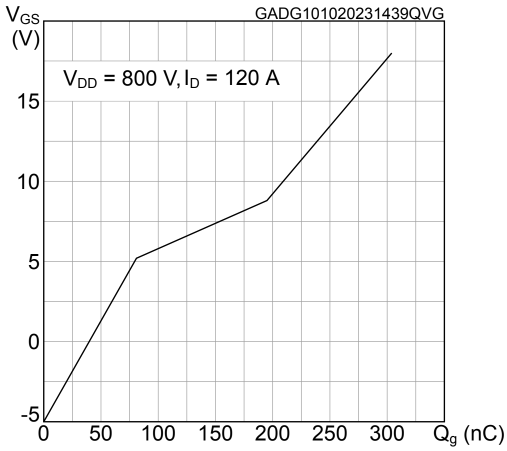


Figure 8. Typical capacitance characteristics

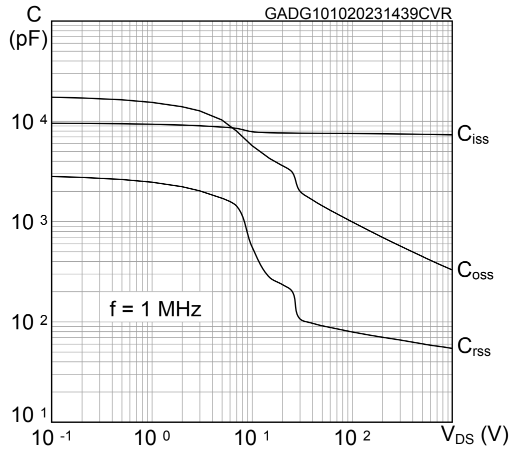


Figure 9. Typical switching energy vs drain current

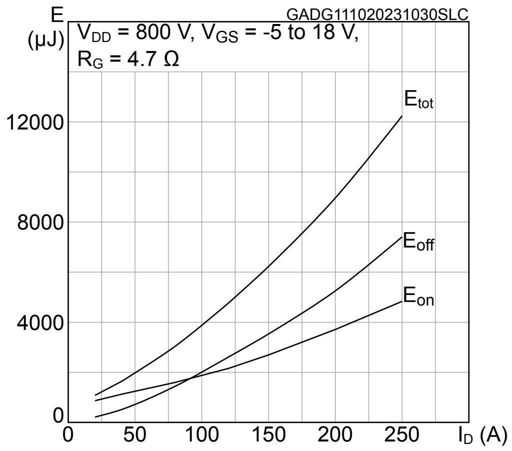


Figure 10. Typical switching energy vs gate resistance

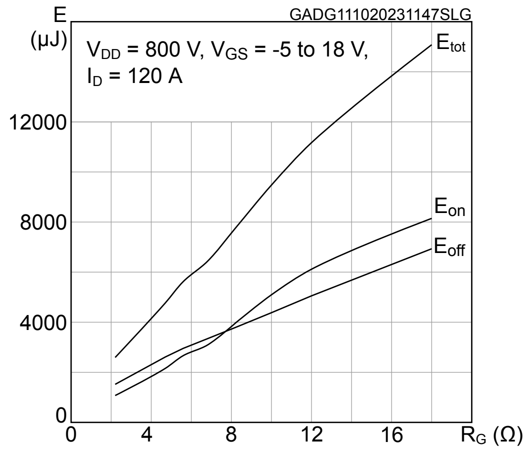


Figure 11. Switching energy vs. junction temperature

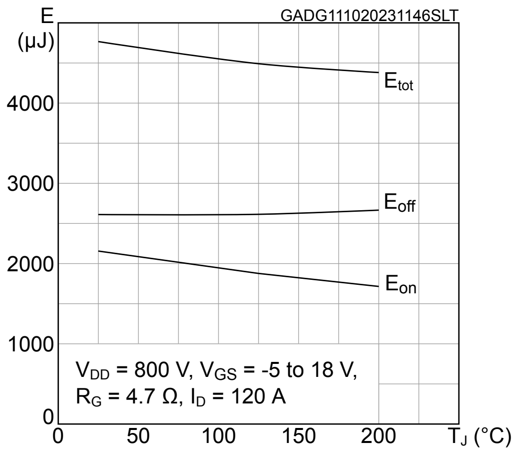


Figure 12. Normalized breakdown voltage vs temperature

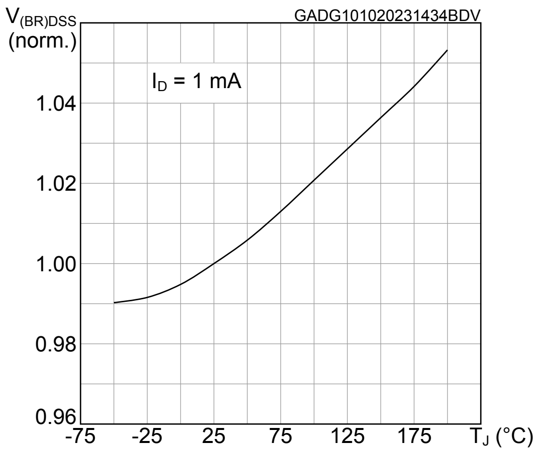


Figure 13. Normalized gate threshold vs temperature

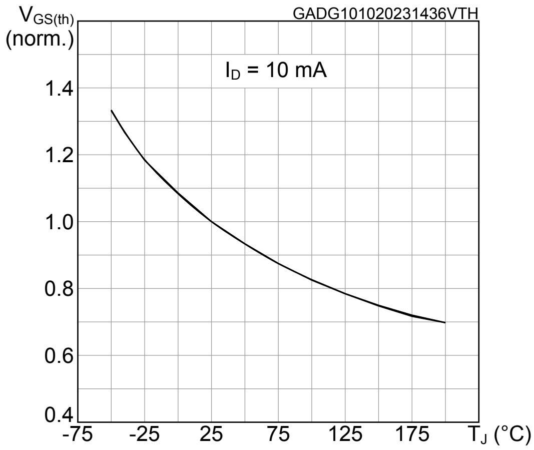


Figure 14. Normalized on-resistance vs temperature

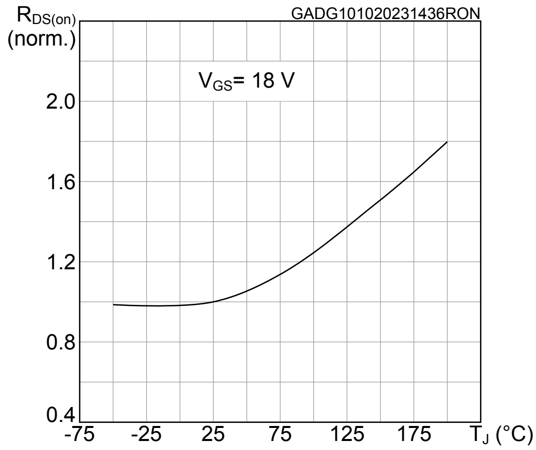


Figure 15. Typical reverse conduction characteristics (T_J = 25 °C)

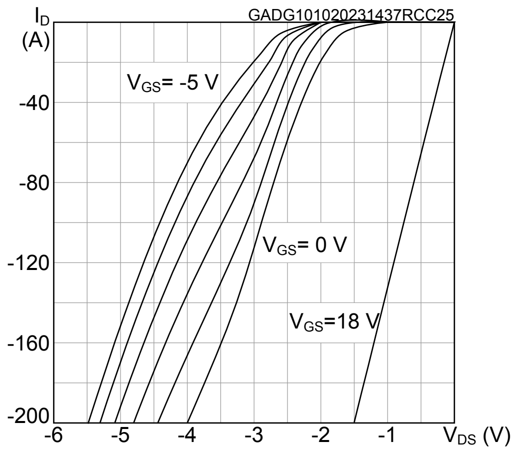
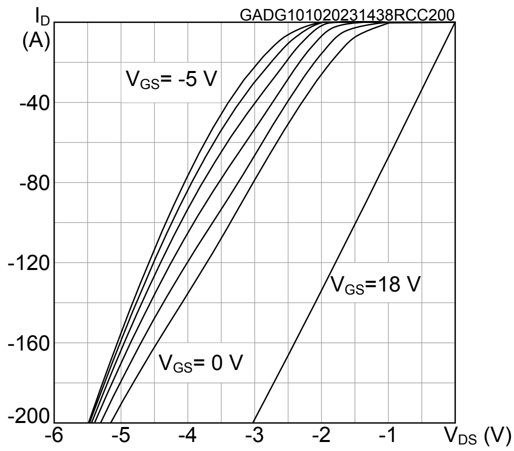


Figure 16. Typical reverse conduction characteristics (T_J = 200 °C)



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 STPAK package information

Figure 17. STPAK package outline

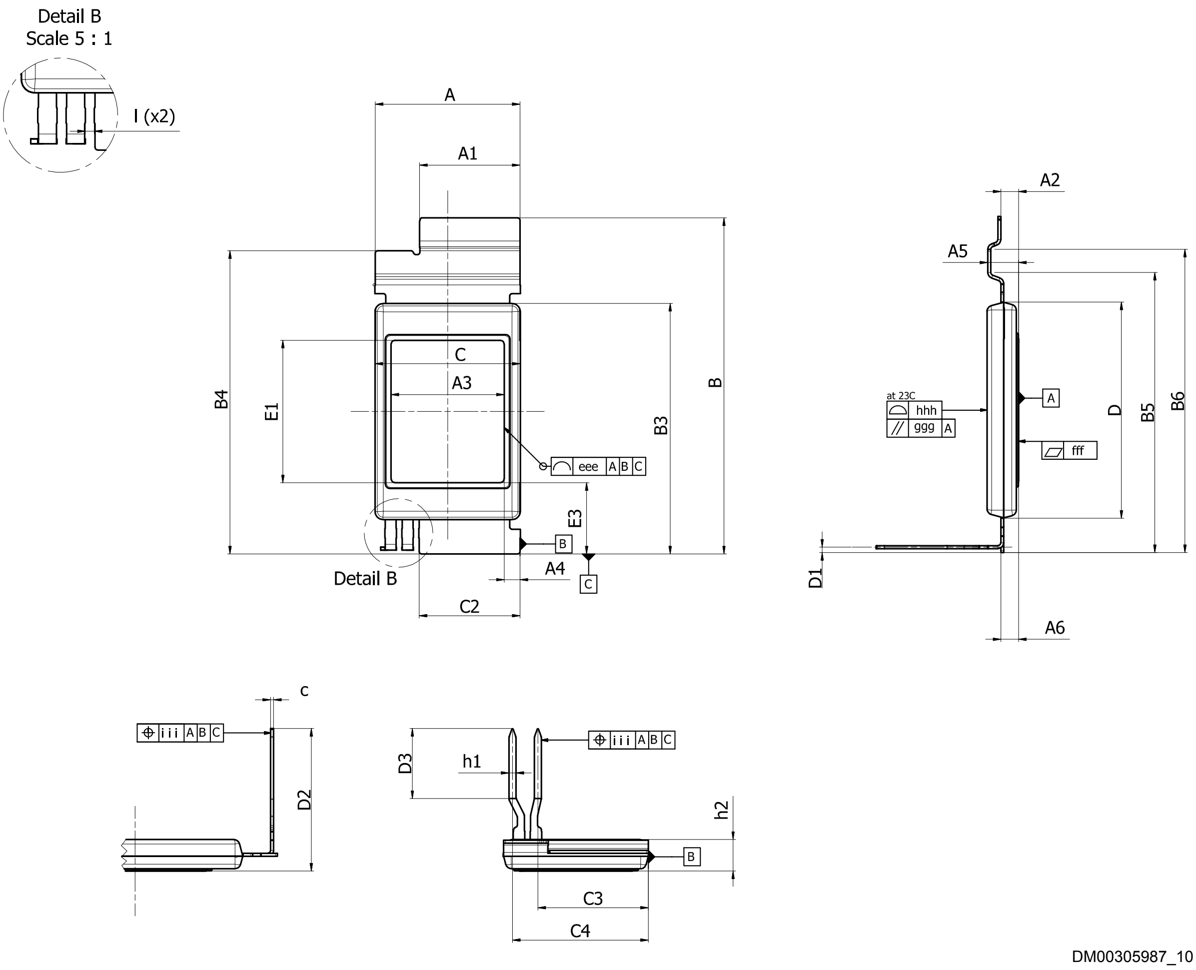


Table 7. **STPAK package mechanical data**

Ref.	Dimensions			Notes
	mm			
	Min.	Typ.	Max.	
A	18.60	18.80	19.00	
A1	12.85	13.05	13.25	
A2	2.00	2.30	2.60	
A3	13.40	13.90	14.40	Exposed Pad
A4	1.95	2.45	2.95	
A5	3.80	4.00	4.20	
A6	2.10	2.30	2.50	
B	43.40	43.70	44.00	
B3	32.20	32.50	32.80	
B4	39.10	39.40	39.70	
B5	36.07	36.37	36.67	
B6	39.07	39.37	39.67	
c	0.34	0.39	0.44	
C		18.55	19.10	Encompass both large and small cav.
C2	12.90	13.10	13.30	
C3		14.35		
C4		17.65		
D	27.90	28.10	28.30	
D1		0.69		
D2	18.50	19.00	19.50	
D3	9.10	9.60	10.10	
E1	17.20	17.70	18.20	Exposed pad
E3	9.15	9.65	10.15	
h1	0.85	0.90	0.95	x2 - Pins width
h2	4.00	4.10	4.20	
l	0.60	0.70	0.80	
eee	0.50			
fff	0.10 at 23 °C – 0.05 at 220 °C			Convex with center higher than edges
ggg	0.05			
hhh	0.10			
iii	0.60			

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
24-Oct-2023	1	First release.
24-Jun-2024	2	Updated Features on cover page. Updated Table 7. STPAK package mechanical data.

Contents