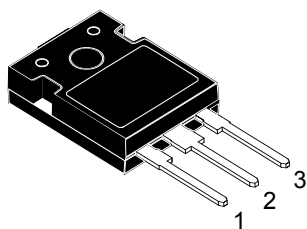
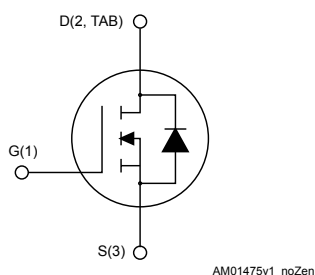


Automotive-grade silicon carbide Power MOSFET 1200 V, 33 A, 75 mΩ (typ., $T_J = 25\text{ }^{\circ}\text{C}$) in an HiP247 package



HiP247



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
SCTW40N120G2VAG	1200 V	105 mΩ	33 A

- AEC-Q101 qualified 
- Very high operating junction temperature capability ($T_J = 200\text{ }^{\circ}\text{C}$)
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance

Applications

- Charger
- Power supply for renewable energy systems
- High frequency DC-DC converters

Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2nd generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.

Product status link

[SCTW40N120G2VAG](#)

Product summary

Order code	SCTW40N120G2VAG
Marking	SCT40N120G2VAG
Package	HiP247
Packing	Tube

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 operational values)	-5 to 18	
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	33	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	25	
$I_{DM}^{(1)}$	Drain current (pulsed)	100	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	290	W
T_{stg}	Storage temperature range	-55 to 200	°C
T_J	Operating junction temperature range		°C

1. Pulse width is limited by safe operating area.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.6	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	40	°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	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	1200			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 1200\text{ V}$			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	$V_{DS} = V_{GS}$, $I_D = 1\text{ mA}$	1.9	3.2	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}$, $I_D = 20\text{ A}$		75	105	m Ω
		$V_{GS} = 18\text{ V}$, $I_D = 20\text{ A}$, $T_J = 200\text{ }^{\circ}\text{C}$		195		

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 800\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	1230	-	pF
C_{oss}	Output capacitance		-	56	-	pF
C_{rss}	Reverse transfer capacitance		-	15	-	pF
Q_g	Total gate charge	$V_{DD} = 800\text{ V}$, $V_{GS} = -5\text{ to }18\text{ V}$, $I_D = 20\text{ A}$	-	63	-	nC
Q_{gs}	Gate-source charge		-	15	-	nC
Q_{gd}	Gate-drain charge		-	20	-	nC
R_g	Gate input resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	1	-	Ω

Table 5. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 800\text{ V}$, $I_D = 20\text{ A}$, $R_G = 4.5\text{ }\Omega$, $V_{GS} = -5\text{ V to }18\text{ V}$	-	200	-	μJ
E_{off}	Turn-off switching energy		-	77	-	μJ

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{ V}$, $I_D = 20\text{ A}$, $R_G = 4.5\text{ }\Omega$, $V_{GS} = -5\text{ to }18\text{ V}$	-	11	-	ns
t_r	Rise time		-	5	-	ns
$t_{d(off)}$	Turn-off delay time		-	18	-	ns
t_f	Fall time		-	13	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode forward voltage	$I_{SD} = 20\text{ A}$, $V_{GS} = 0\text{ V}$	-	3.4	-	V
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 5000\text{ A}/\mu\text{s}$, $V_{DD} = 800\text{ V}$	-	19	-	ns
Q_{rr}	Reverse recovery charge		-	132	-	nC
I_{RRM}	Reverse recovery current		-	20	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

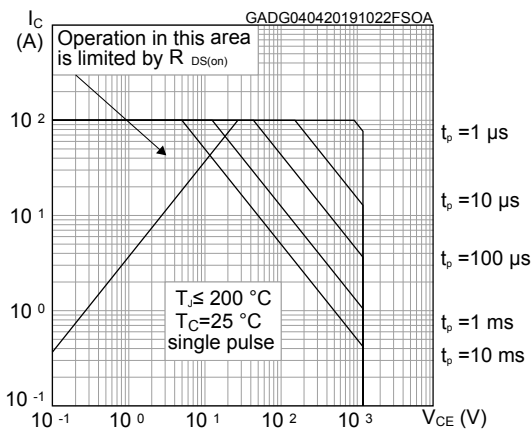


Figure 2. Thermal impedance

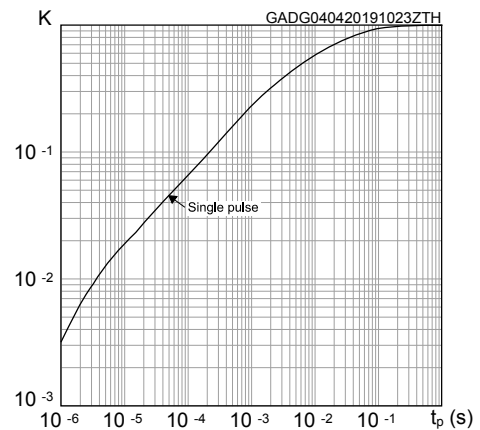


Figure 3. Output characteristics ($T_J = -50^\circ C$)

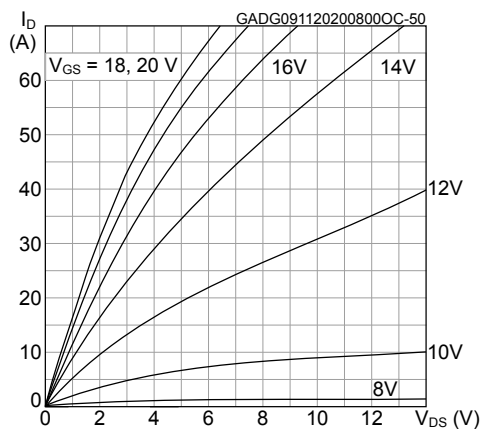


Figure 4. Output characteristics ($T_J = 25^\circ C$)

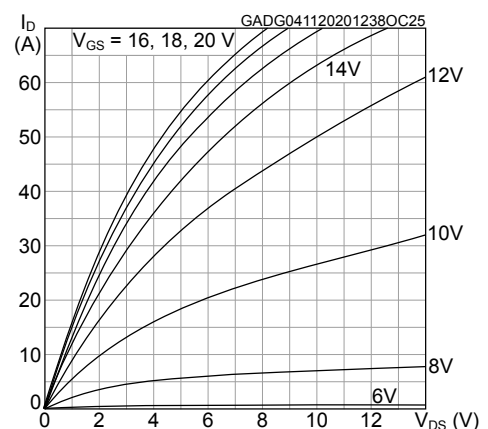


Figure 5. Output characteristics ($T_J = 200^\circ C$)

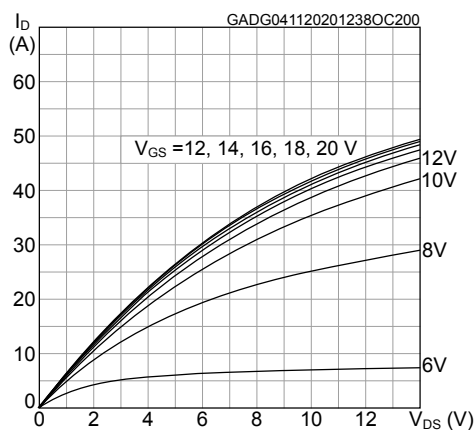


Figure 6. Transfer characteristics

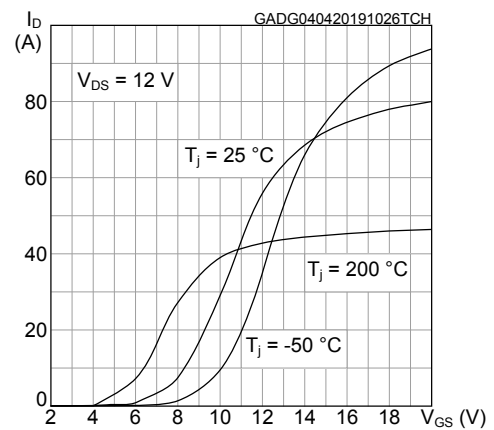


Figure 7. Total power dissipation

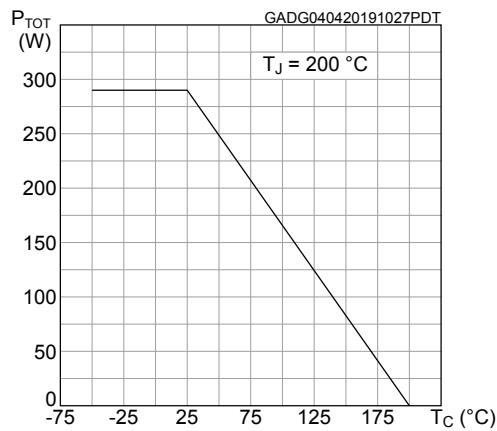


Figure 8. Gate charge vs gate-source voltage

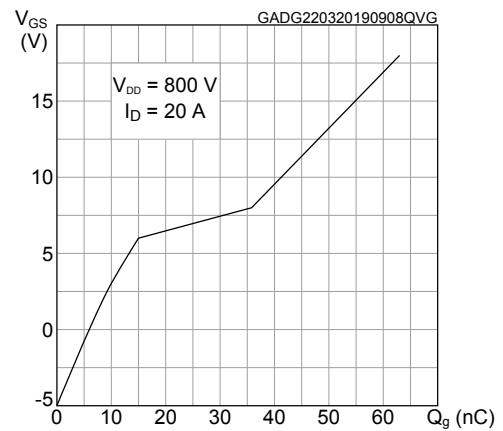


Figure 9. Capacitance variations

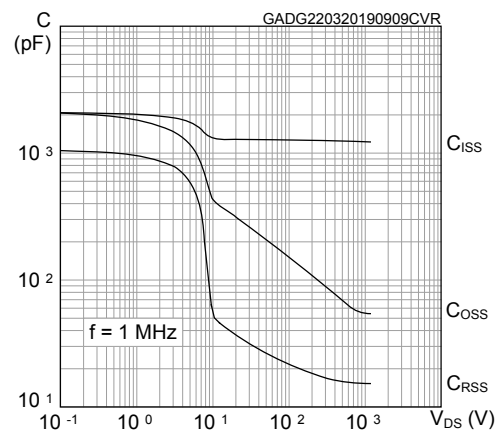


Figure 10. Switching energy vs drain current

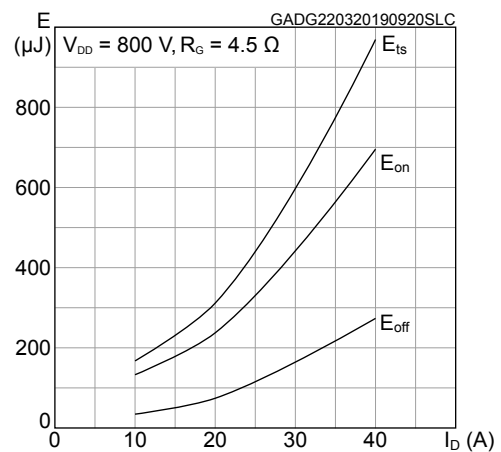


Figure 11. Switching energy vs junction temperature

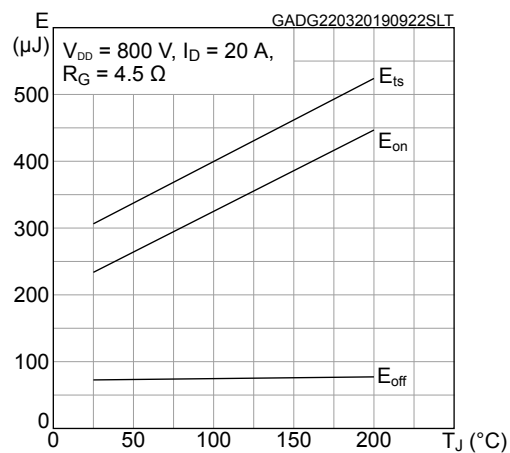


Figure 12. Normalized $V_{(BR)DSS}$ vs temperature

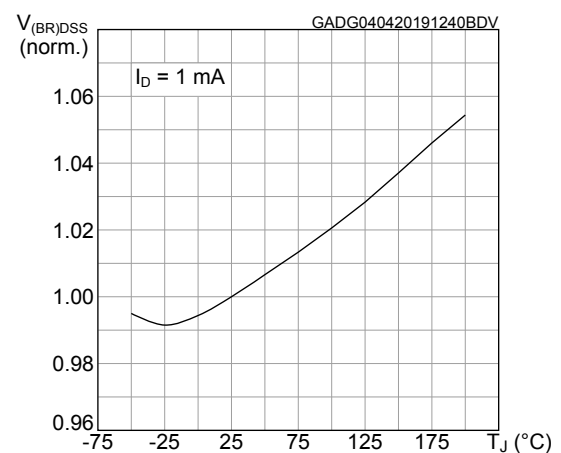


Figure 13. Normalized on-resistance vs temperature

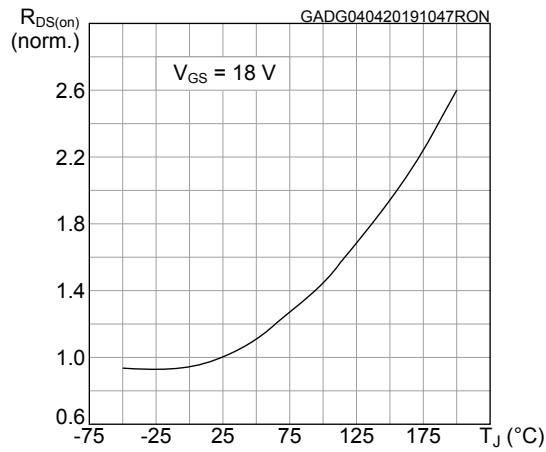


Figure 14. Normalized gate threshold voltage vs temperature

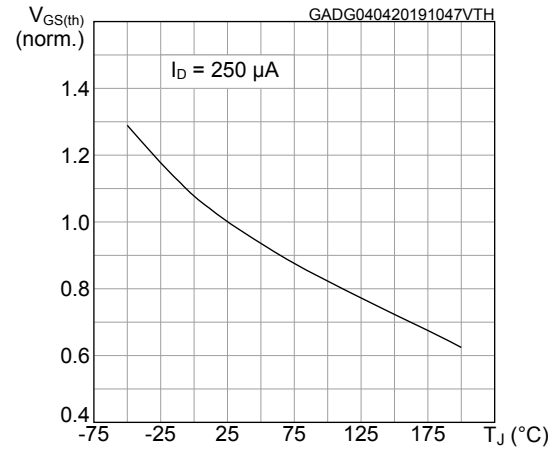


Figure 15. Reverse conduction characteristics ($T_J = -50\text{ °C}$)

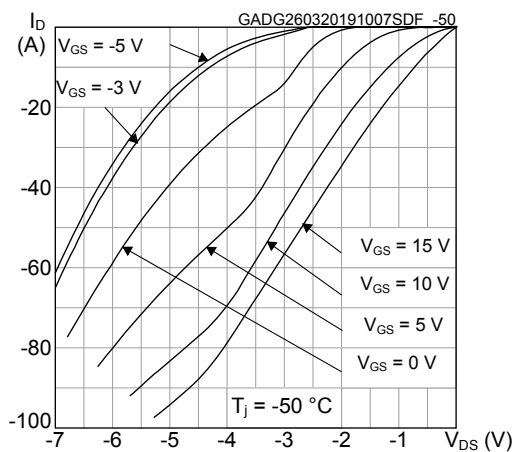


Figure 16. Reverse conduction characteristics ($T_J = 25\text{ °C}$)

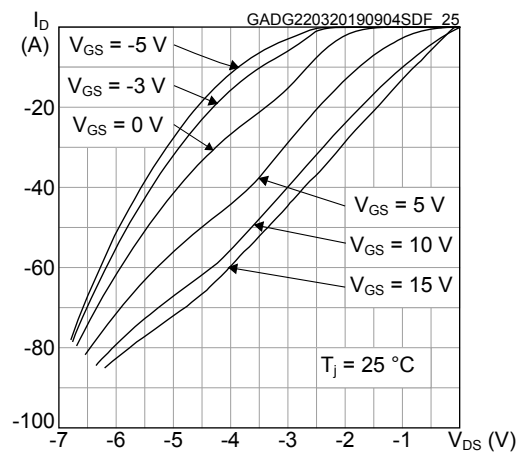
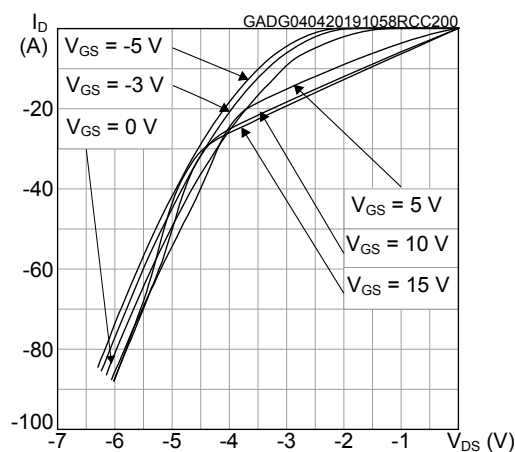


Figure 17. Reverse conduction characteristics ($T_J = 200\text{ °C}$)

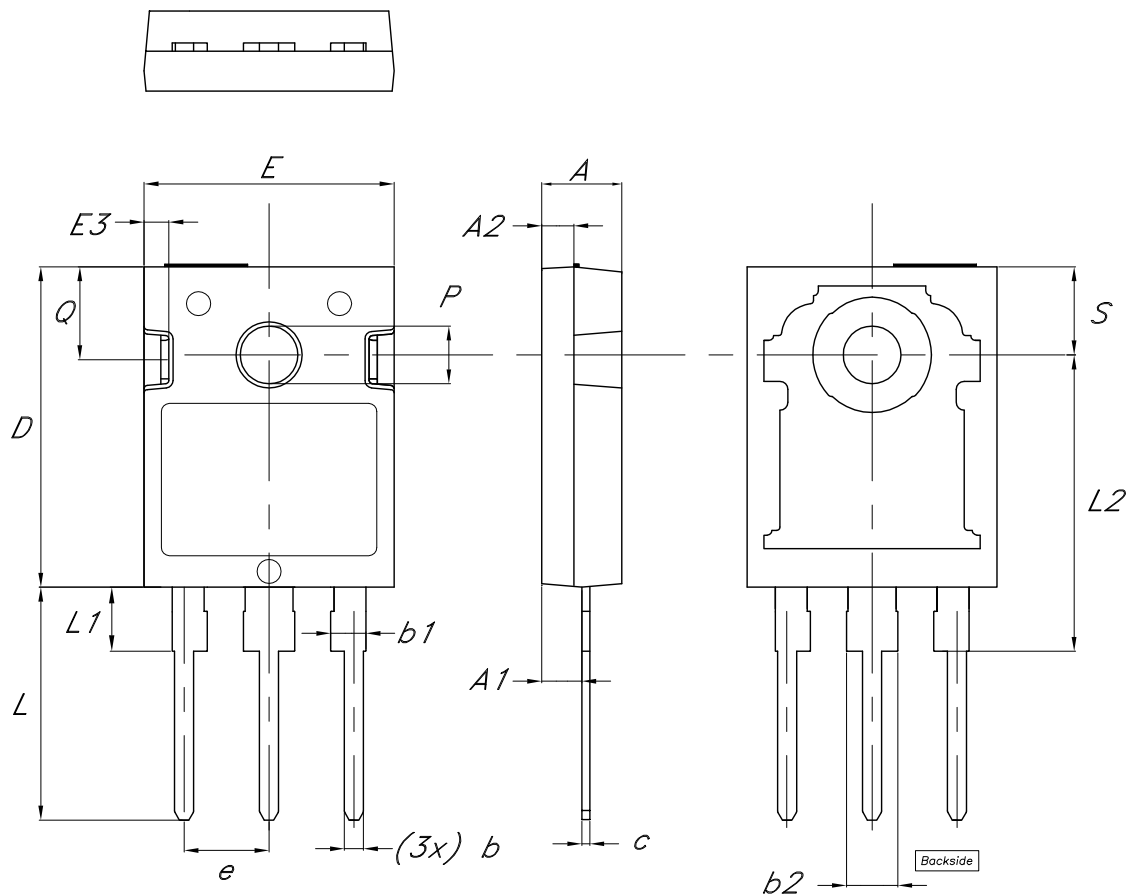


3 Package information

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 HiP247 package information

Figure 18. HiP247 package outline



8581091_3_fig2

Table 8. HiP247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85	5.00	5.15
A1	2.20		2.60
A2	1.90	2.00	2.10
b	1.00		1.40
b1	2.00		2.40
b2	3.00		3.40
c	0.40		0.80
D	19.85	20.00	20.15
E	15.45	15.60	15.75
E3	1.45		1.65
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2	18.30	18.50	18.70
P	3.55		3.65
Q	5.65		5.95
S	5.30	5.50	5.70

Revision history

Table 9. Document revision history

Date	Version	Changes
09-Apr-2019	1	First release.
21-Jul-2020	2	Updated <i>Table 3. On/off states</i> and <i>Table 7. Reverse SiC diode characteristics</i> . Updated <i>Section 3 Package information</i> .
12-Nov-2020	3	Updated <i>Section 2.1 Electrical characteristics (curves)</i> . Minor text changes.

Contents

1	Electrical ratings	2
2	Electrical characteristics.....	3
2.1	Electrical characteristics (curves)	5
3	Package information.....	8
3.1	HiP247 package information	8
	Revision history	10

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