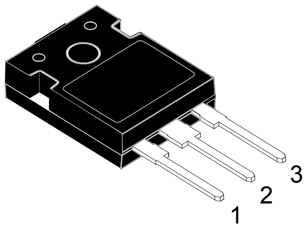
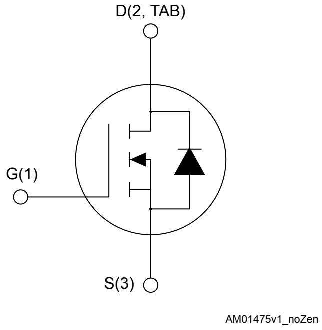
SCTW40N120G2VAG

Datasheet

Automotive-grade silicon carbide Power MOSFET 1200 V, 75 mΩ typ., 33 A in an HiP247 package



HiP247



STPOWER

Product status link
SCTW40N120G2VAG

Product summary	
Order code	SCTW40N120G2VAG
Marking	SCT40N120G2VAG
Package	HiP247
Packing	Tube

Features

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

- AEC-Q101 qualified
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance
- Very high operating junction temperature capability (T_J = 200 °C)

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 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.

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 voltage (pulsed, t_p = 25 ns repetitive overshoot during switching for an accumulated time of 10 h)	-11 to 25	
I_D	Drain current (continuous) at T_C = 25 °C	33	A
	Drain current (continuous) at T_C = 100 °C	25	
I_{DM}[1]	Drain current (pulsed)	100	A
P_{TOT}	Total power dissipation at T_C = 25 °C	290	W
T_{stg}	Storage temperature range	-55 to 200	°C
T_J	Operating junction temperature range		°C

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

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.6	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	40	°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_{DS} = 1200 V, V_{GS} = 0 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	1.9	3.2	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 18 V, I_D = 20 A		75	105	mΩ
		V_{GS} = 18 V, I_D = 20 A, T_J = 200 °C		195		

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	-	1230	-	pF
C_{oss}	Output capacitance		-	56	-	pF
C_{rss}	Reverse transfer capacitance		-	15	-	pF
Q_g	Total gate charge	V_{DS} = 800 V, V_{GS} = -5 to 18 V, I_D = 20 A	-	63	-	nC
Q_{gs}	Gate-source charge		-	15	-	nC
Q_{gd}	Gate-drain charge		-	20	-	nC
R_G	Gate input resistance	f = 1 MHz, I_D = 0 A	-	1	-	Ω

Table 5. Switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 20 A, R_G = 4.7 Ω, V_{GS} = -5 to 18 V	-	235	-	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 V, I_D = 20 A, R_G = 4.7 Ω, V_{GS} = -5 to 18 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 A, V_{GS} = 0 V	-	3.4	-	V
t_{rr}	Reverse recovery time	I_{SD} = 20 A, di/dt = 2000 A/µs, V_{DD} = 800 V, V_{GS} = -5 to 18 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

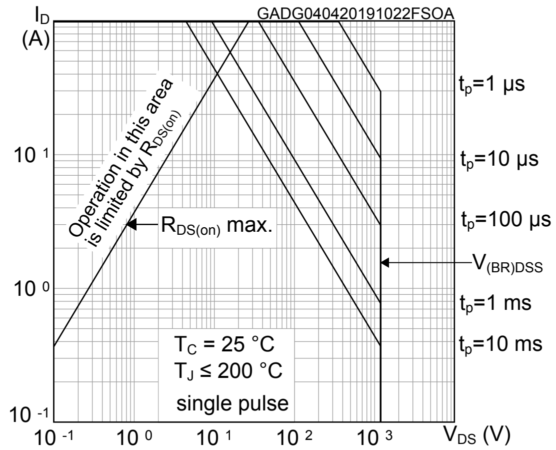


Figure 2. Maximum transient thermal impedance

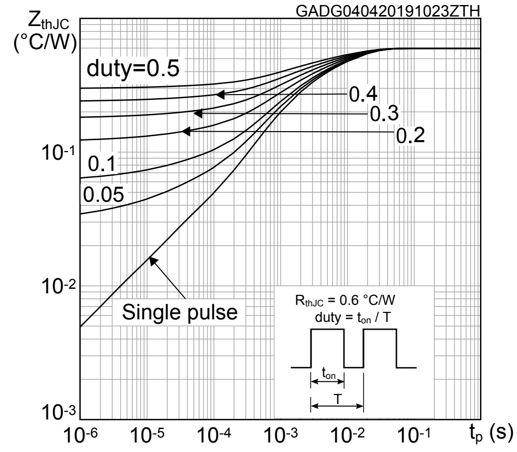


Figure 3. Output characteristics (T_J = -50 °C)

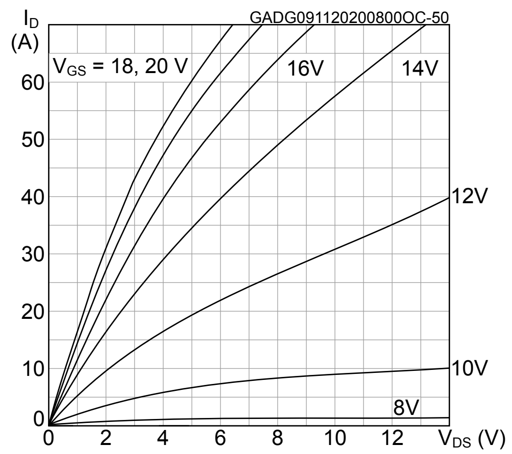


Figure 4. Output characteristics (T_J = 25 °C)

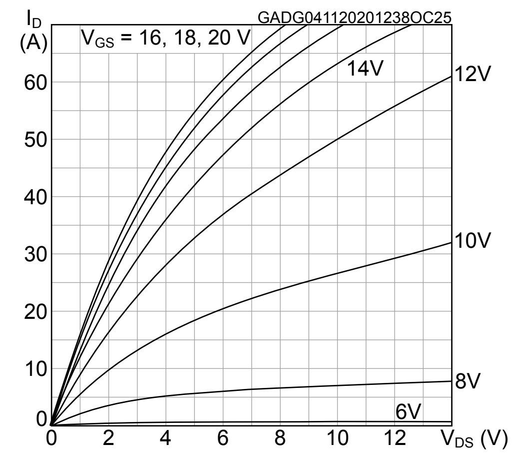


Figure 5. Output characteristics (T_J = 200 °C)

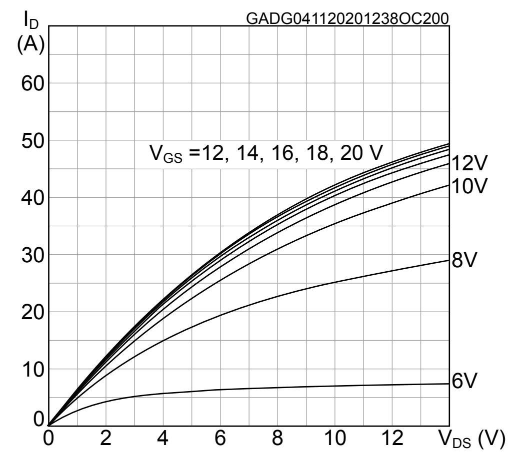


Figure 6. Transfer characteristics

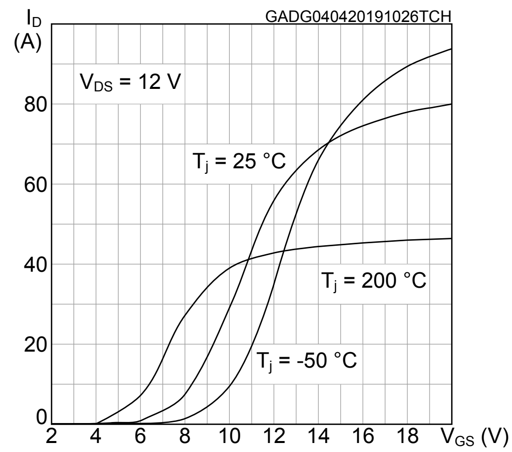


Figure 7. Total power dissipation

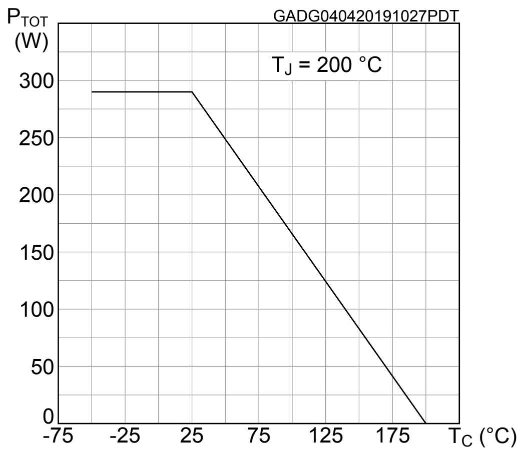


Figure 8. Gate charge vs gate-source voltage

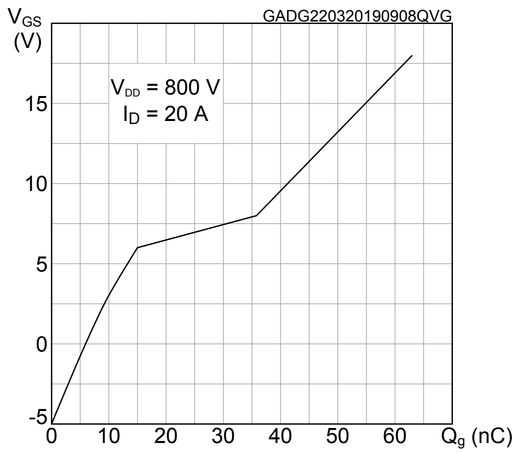


Figure 9. Capacitance variations

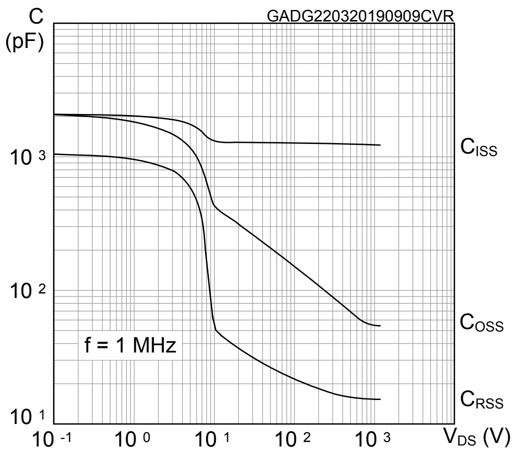


Figure 10. Switching energy vs drain current

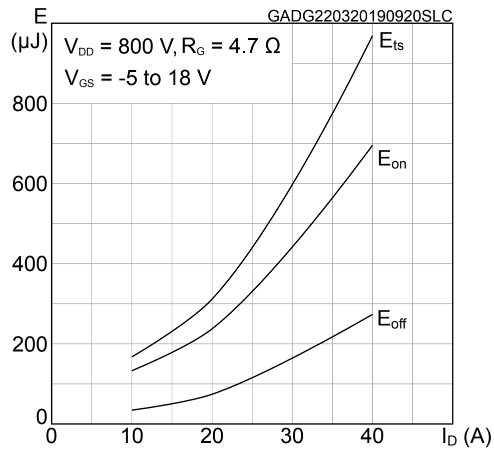


Figure 11. Switching energy vs junction temperature

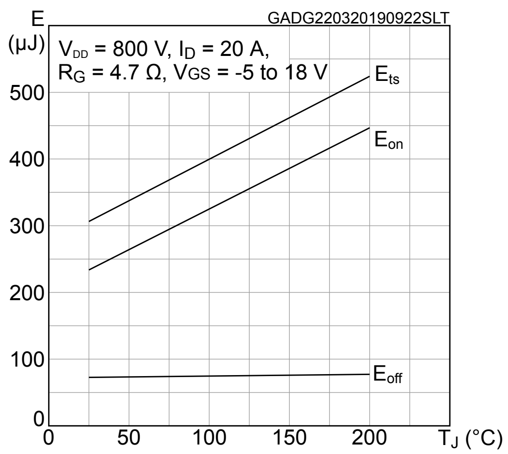


Figure 12. Normalized $V_{(BR)DSS}$ vs temperature

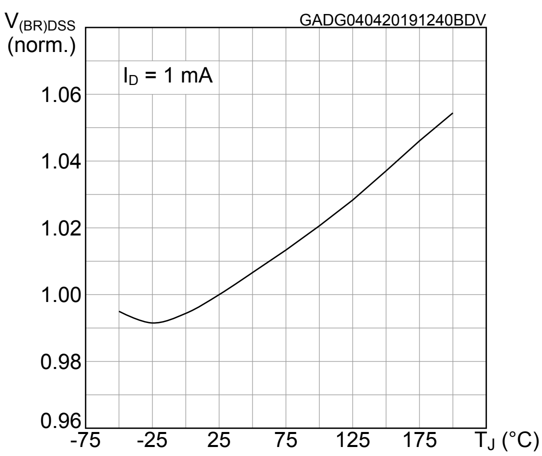


Figure 13. Normalized on-resistance vs temperature

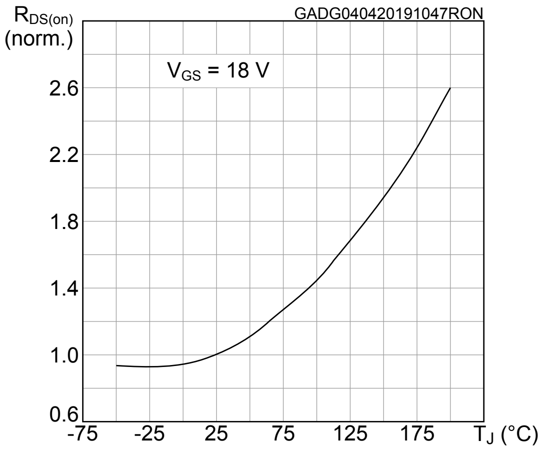


Figure 14. Normalized gate threshold voltage vs temperature

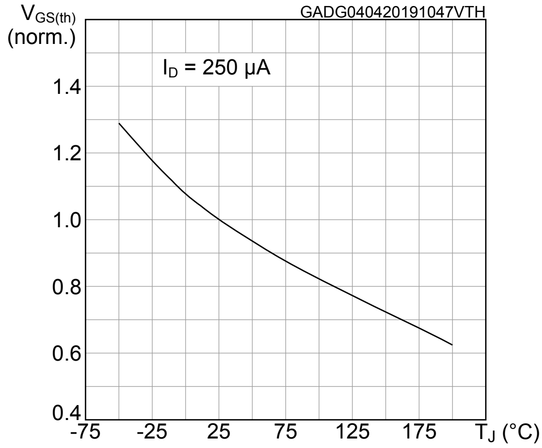


Figure 15. Reverse conduction characteristics (T_J = -50 °C)

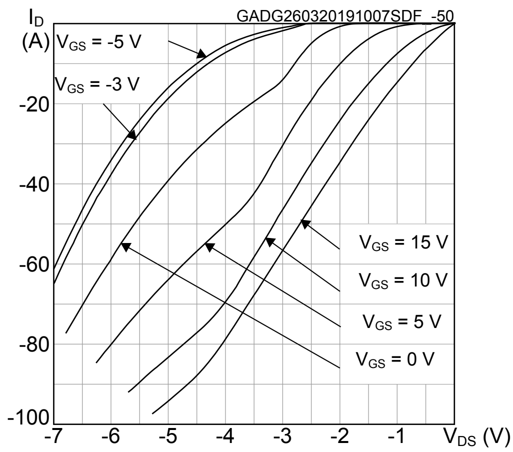


Figure 16. Reverse conduction characteristics (T_J = 25 °C)

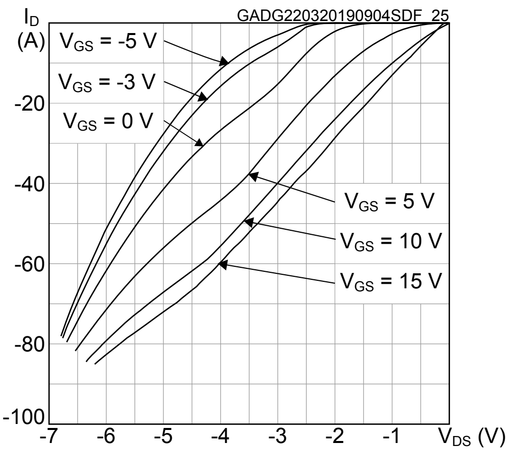
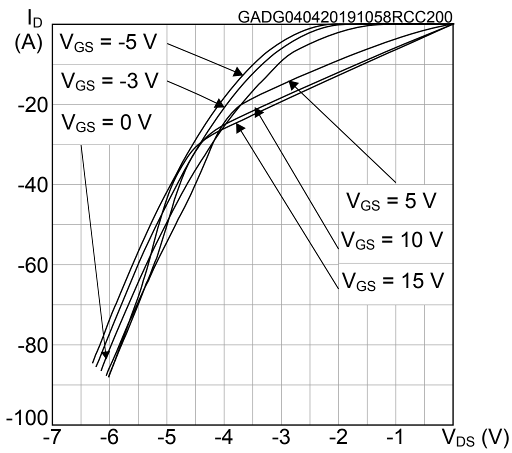


Figure 17. Reverse conduction characteristics (T_J = 200 °C)



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 HiP247 package information

Figure 18. HiP247 package outline

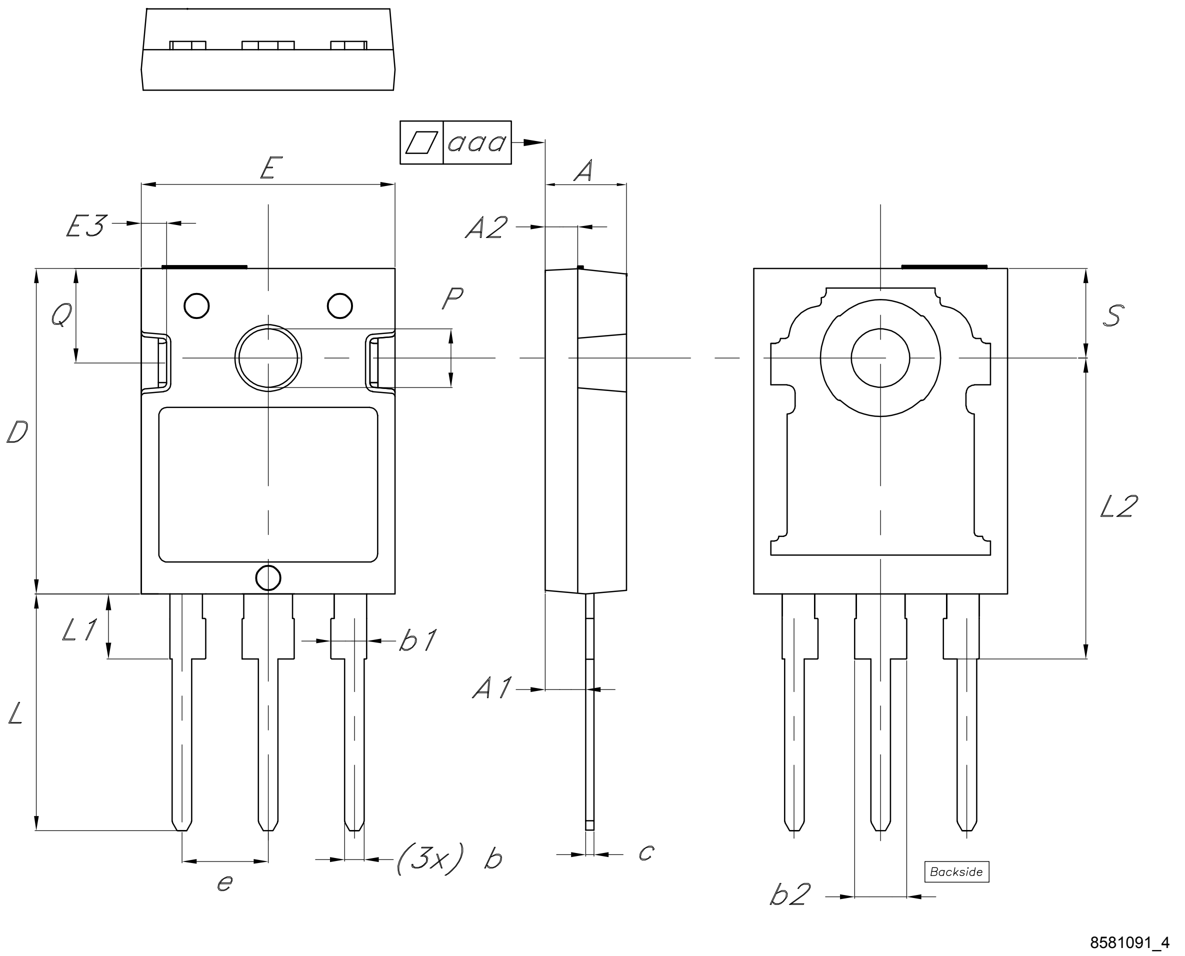


Table 8. **HiP247 package mechanical data**

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
aaa		0.04	0.10

Revision history

Table 9. Document revision history

Date	Revision	Changes
09-Apr-2019	1	First release.
21-Jul-2020	2	Updated *Table 3. On/off states* and *Table 7. Reverse SiC diode characteristics*. Updated *Section 3 Package information*.
12-Nov-2020	3	Updated *Section 2.1 Electrical characteristics (curves)*. Minor text changes.
06-Sep-2021	4	Modified *Table 5. Switching energy (inductive load)*. Updated *Section 3.1 HiP247 package information.*
23-Nov-2021	5	Modified Table 1. Absolute maximum ratings. Modified Figure 1. Safe operating area and Figure 2. Maximum transient thermal impedance.

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