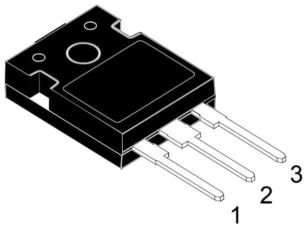
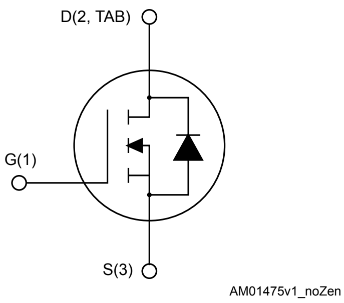
Silicon carbide Power MOSFET 1200 V, 91 A, 21 mΩ (typ., T_J = 25 °C) in an HiP247 package



HiP247



Product status link
SCTW70N120G2V

Product summary	
Order code	SCTW70N120G2V
Marking	SCT70N120G2
Package	HiP247
Packing	Tube

Features

Order code	V_{DS}	$R_{DS(on)}$ typ.	I_D
SCTW70N120G2V	1200 V	21 mΩ	91 A

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

Applications

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

Description

This silicon carbide Power MOSFET is produced exploiting the advanced, innovative properties of wide bandgap materials. This results in unsurpassed on-resistance per unit area and very good switching performance almost independent of temperature. The outstanding thermal properties of the SiC material allow designers to use an industry-standard outline with significantly improved thermal capability. These features render the device perfectly suitable for high-efficiency and high power density applications.

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	
I_D	Drain current (continuous) at T_C = 25 °C	91	A
	Drain current (continuous) at T_C = 100 °C	69	
I_{DM} (1)	Drain current (pulsed)	274	A
P_{TOT}	Total power dissipation at T_C = 25 °C	547	W
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
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.32	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	50	°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
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 150 °C		100		
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = -10 to +22 V		±10		nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 1 mA	1.9	2.45	4.9	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 18 V, I_D = 50 A		21	30	mΩ
		V_{GS} = 18 V, I_D = 50 A, T_J = 200 °C		46		

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	-	3540	-	pF
C_{oss}	Output capacitance		-	176	-	pF
C_{rss}	Reverse transfer capacitance		-	28	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	1	-	Ω
Q_g	Total gate charge	V_{DD} = 800 V, I_D = 50 A, V_{GS} = -5 to +18 V	-	150	-	nC
Q_{gs}	Gate-source charge		-	28	-	nC
Q_{gd}	Gate-drain charge		-	63	-	nC

Table 5. Switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 50 A	-	1019	-	µJ
E_{off}	Turn-off switching energy	R_G= 3.4 Ω, V_{GS} = -5 to +18 V	-	378	-	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 = 50 A R_G= 3.4 Ω, V_{GS} = -5 to +18 V	-	16	-	ns
t_r	Rise time		-	9.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	37	-	ns
t_f	Fall time		-	22	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V_{SD}	Forward on voltage	I_{SD} = 50 A, V_{GS} = 0 V	-	2.7	-	V
t_{rr}	Reverse recovery time	I_{SD} = 50 A, V_{DD} = 800 V, V_{GS} = -5 to +18 V	-	11.16	-	ns
Q_{rr}	Reverse recovery charge		-	276	-	nC
I_{RRM}	Reverse recovery current		-	40	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

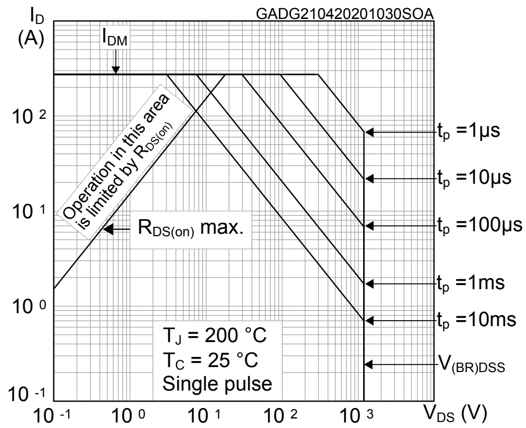


Figure 2. Maximum transient thermal impedance

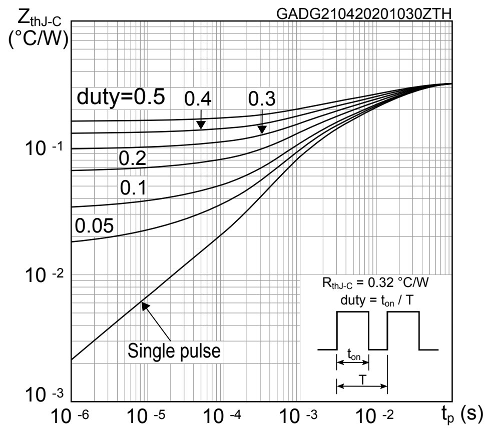


Figure 3. Typical output characteristics (T_J = 25 °C)

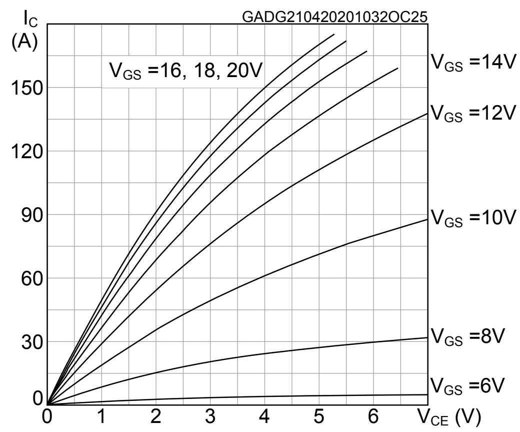


Figure 4. Typical output characteristics (T_J = 200 °C)

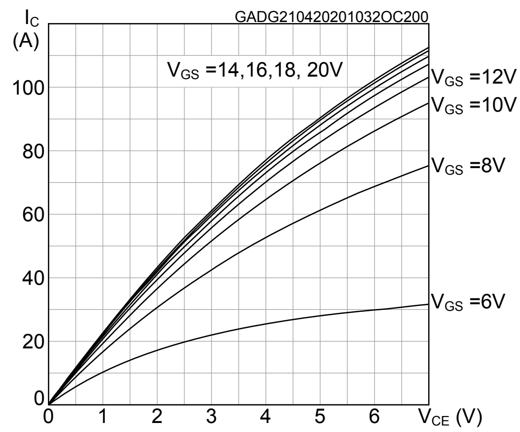


Figure 5. Typical transfer characteristics

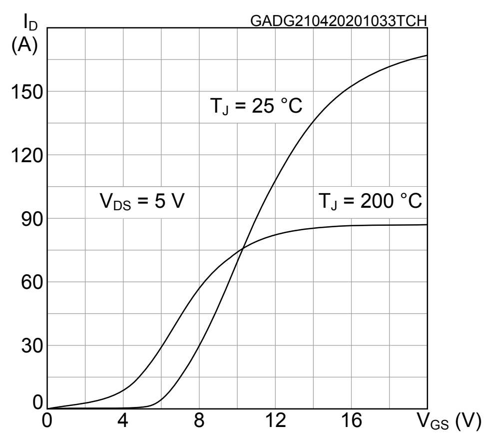


Figure 6. Total power dissipation

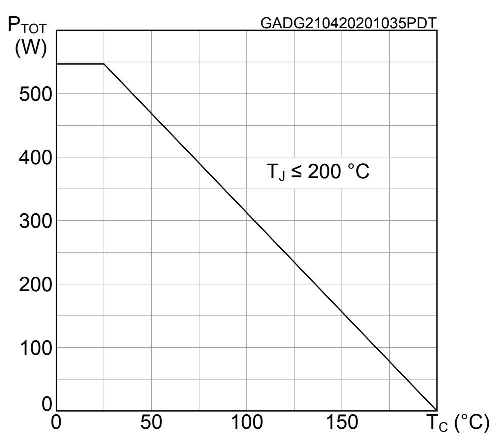


Figure 7. Typical gate charge characteristics

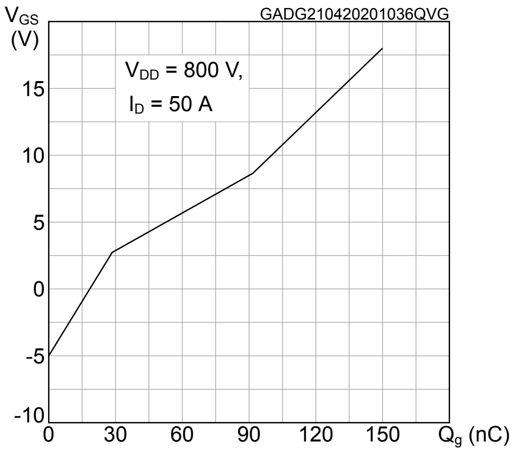


Figure 8. Typical capacitance characteristics

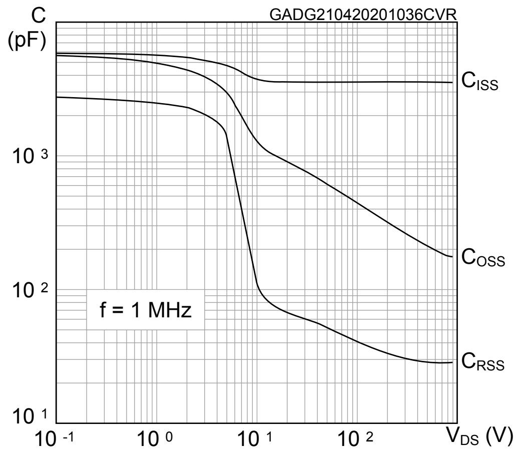


Figure 9. Typical switching energy vs drain current

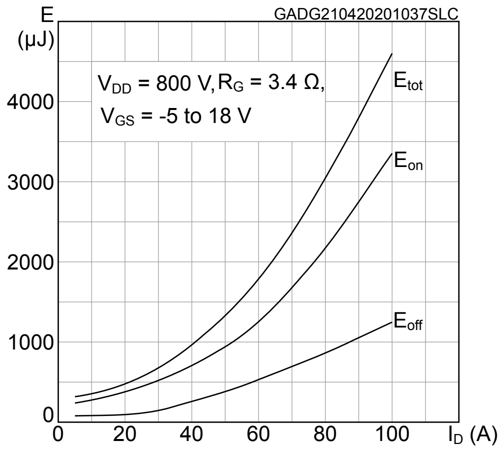


Figure 10. Typical switching energy vs temperature

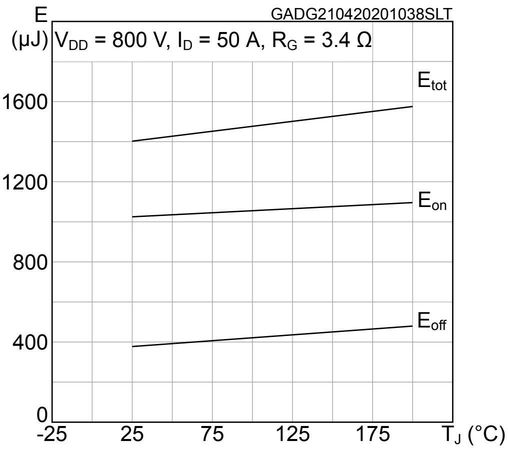


Figure 11. Normalized breakdown voltage vs temperature

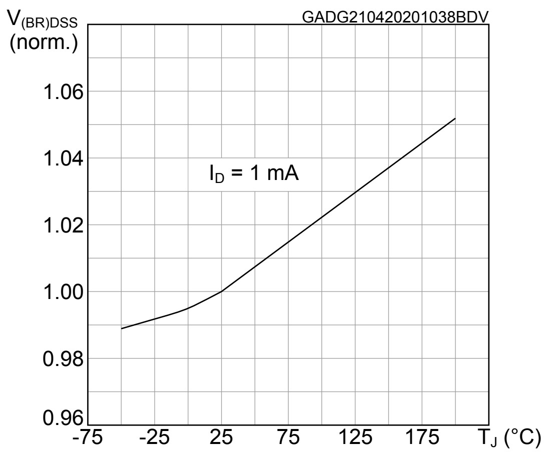


Figure 12. Normalized gate threshold vs temperature

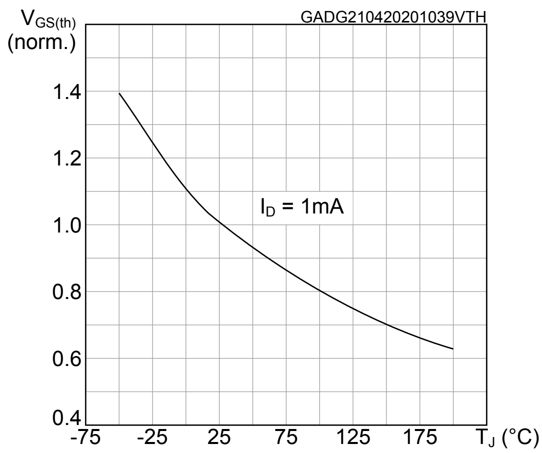


Figure 13. Normalized on-resistance vs temperature

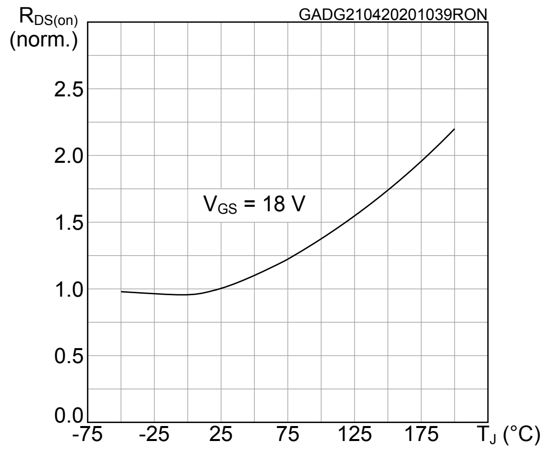


Figure 14. Typical drain-source on-resistance

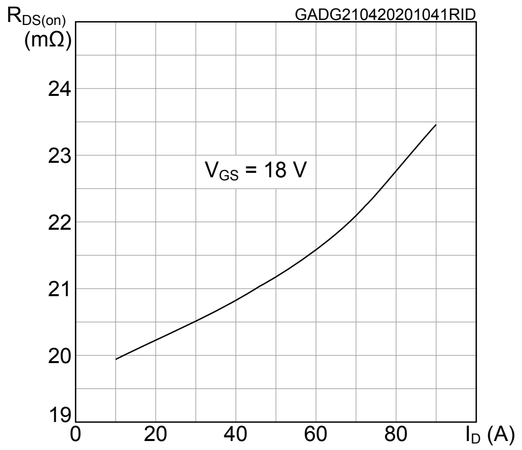


Figure 15. Typical reverse conduction characteristics (T_J = 25 °C)

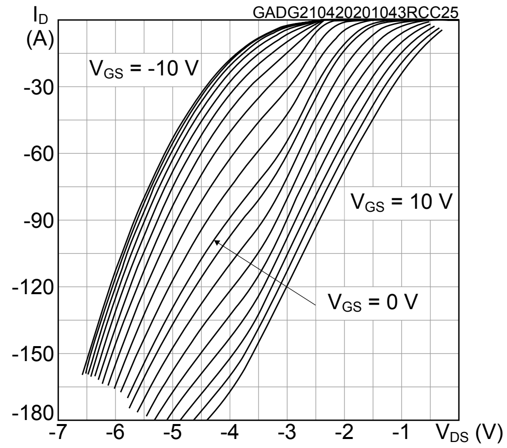


Figure 16. Typical reverse conduction characteristics (T_J = 200 °C)

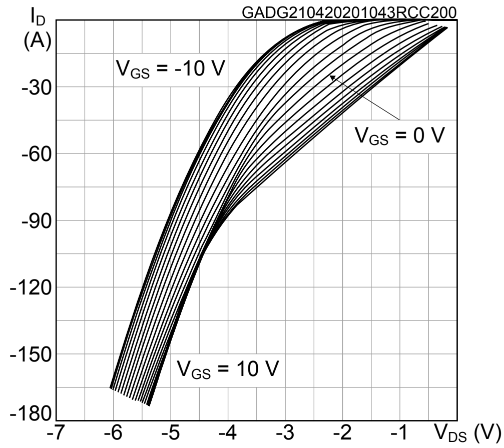
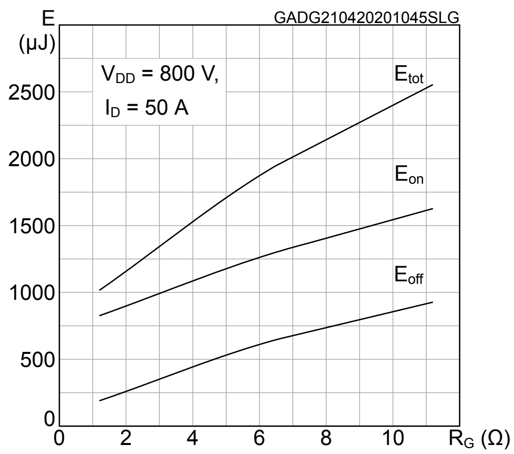


Figure 17. Typical switching energy vs gate resistance



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

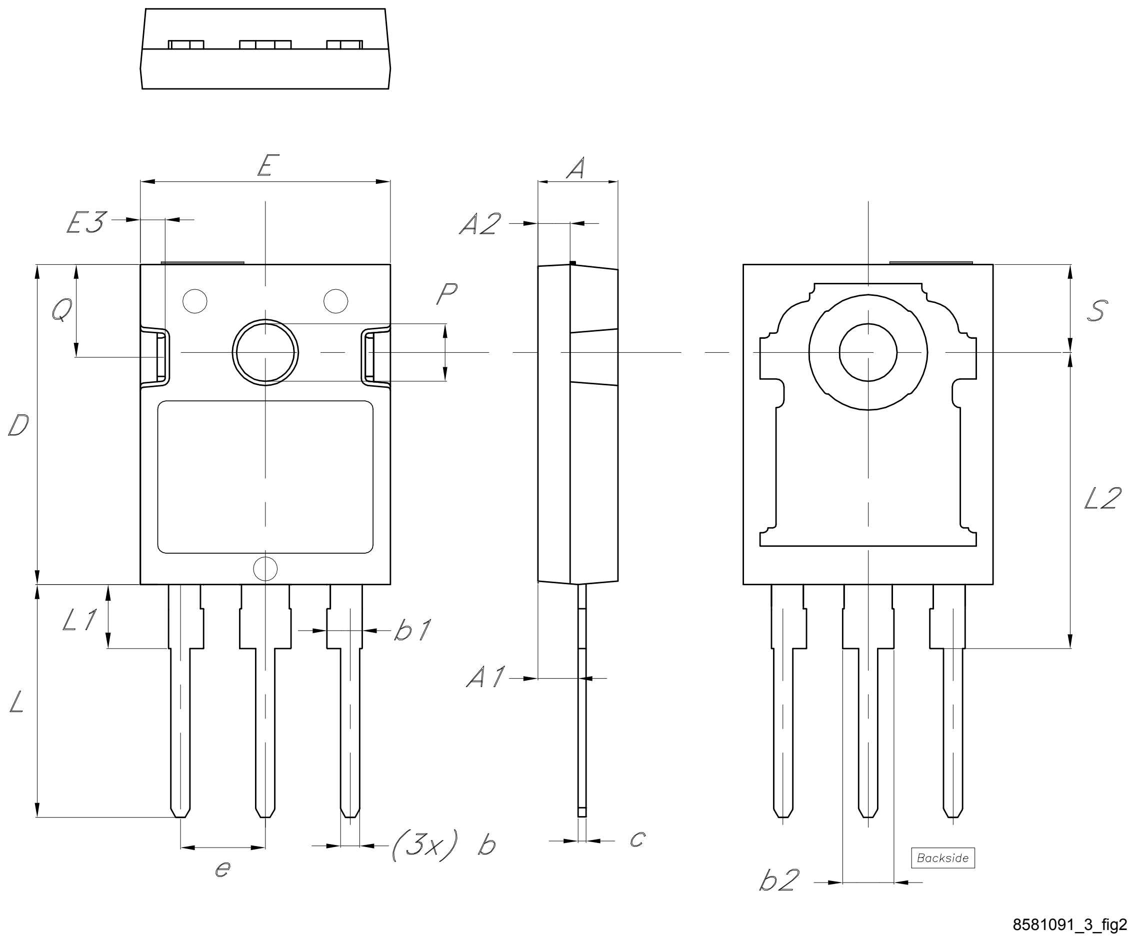


Table 8. **HiP247 package mechanical data**

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

Revision history

Table 9. Document revision history

Date	Revision	Changes
26-Jan-2017	1	First release
22-May-2020	2	Updated T*itle, Internal schematic, Features, Description* and *Device summary* in cover page. Updated *Section 1 Electrical ratings*. Updated *Section 2 Electrical characteristics*. Updated *Section 2.1 Electrical characteristics (curves)*. Updated *Section 3 Package information*.
31-Aug-2020	3	Modified Table 7. Reverse SiC diode characteristics. Modified Figure 9. Typical switching energy vs drain current.

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