

Silicon carbide Power MOSFET 1200 V, 65 A, 59 mΩ (typ., $T_J=150\text{ }^{\circ}\text{C}$) in an HiP247™ package

Datasheet - production data

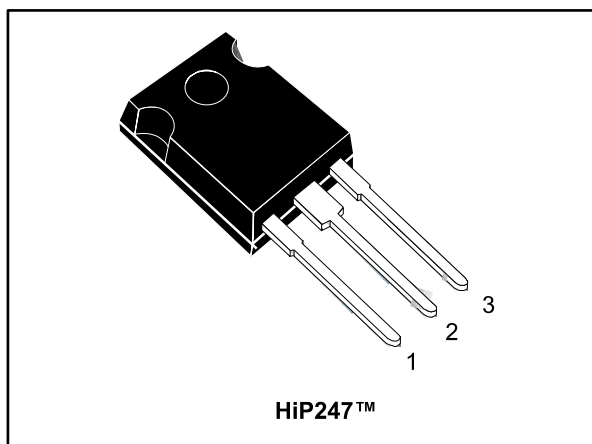
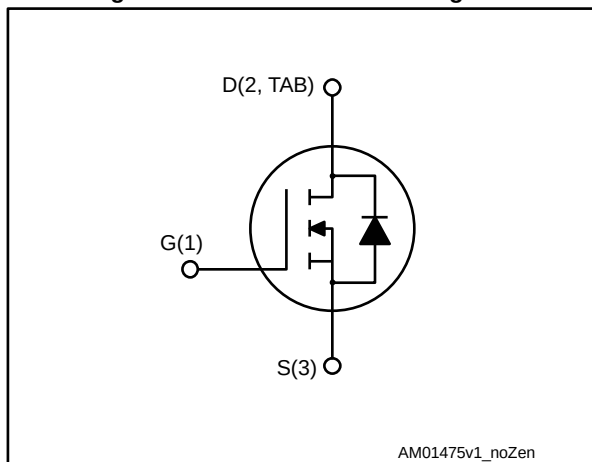


Figure 1: Internal schematic diagram



Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability ($T_J = 200\text{ }^{\circ}\text{C}$)
- Very fast and robust intrinsic body diode
- Low capacitance

Applications

- Solar inverters, UPS
- Motor drives
- High voltage DC-DC converters
- Switch mode power supplies

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 allows 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.

Table 1: Device summary

Order code	Marking	Package	Packaging
SCT50N120	SCT50N120	HiP247™	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	1200	V
V_{GS}	Gate-source voltage	-10 to 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	65	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	50	A
$I_{DM}^{(1)}$	Drain current (pulsed)	130	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	318	W
T_{stg}	Storage temperature range	-55 to 200	°C
T_j	Operating junction temperature range		°C

Notes:

⁽¹⁾Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.55	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	40	°C/W

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified).

Table 4: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I _{DSS}	Zero gate voltage drain current	V _{DS} = 1200 V, V _{GS} = 0 V		1	100	μA
		V _{DS} = 1200 V, V _{GS} = 0 V, T _J = 200 °C		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	1.8	3.0		V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 20 V, I _D = 40 A		52	69	mΩ
		V _{GS} = 20 V, I _D = 40 A, T _J = 150 °C		59		mΩ
		V _{GS} = 20 V, I _D = 40 A, T _J = 200 °C		70		mΩ

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 400 V, f = 1 MHz, V _{GS} = 0 V	-	1900	-	pF
C _{oss}	Output capacitance		-	170	-	pF
C _{rss}	Reverse transfer capacitance		-	30	-	pF
Q _g	Total gate charge	V _{DD} = 800 V, I _D = 40 A, V _{GS} = 0 to 20 V	-	122	-	nC
Q _{gs}	Gate-source charge		-	19	-	nC
Q _{gd}	Gate-drain charge		-	35	-	nC
R _g	Gate input resistance	f=1 MHz open drain	-	1.9	-	Ω

Table 6: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E _{on}	Turn-on switching energy	V _{DD} = 800 V, I _D = 40 A	-	530	-	μJ
E _{off}	Turn-off switching energy	R _G = 2.2 Ω, V _{GS} = -5 to 20 V	-	310	-	μJ
E _{on}	Turn-on switching energy	V _{DD} = 800 V, I _D = 40 A	-	670	-	μJ
E _{off}	Turn-off switching energy	R _G = 2.2 Ω, V _{GS} = -5 to 20 V, T _J = 150 °C	-	334	-	μJ

Table 7: Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V _{SD}	Diode forward voltage	I _F = 20 A, V _{GS} = 0 V	-	3.5	-	V
t _{rr}	Reverse recovery time	I _F = 40 A, di/dt = 2000/ns, V _{DD} = 800 V	-	55		ns
Q _{rr}	Reverse recovery charge		-	230	-	nC
I _{RRM}	Reverse recovery current		-	14	-	A

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

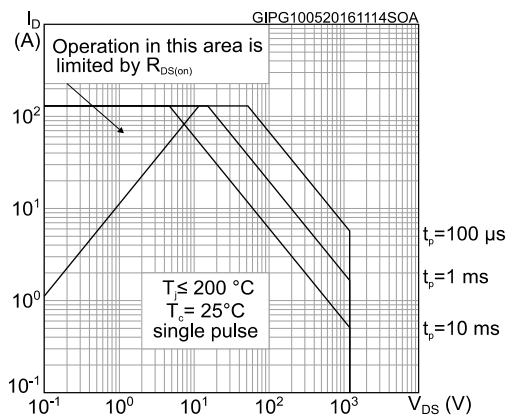


Figure 3: Thermal impedance

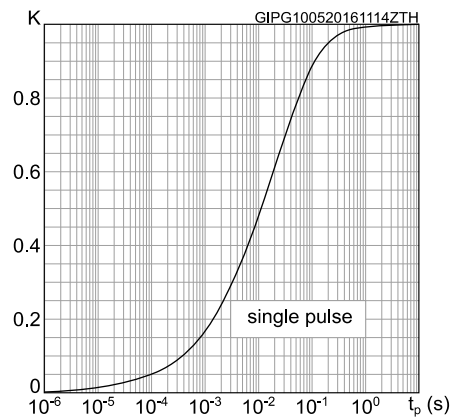
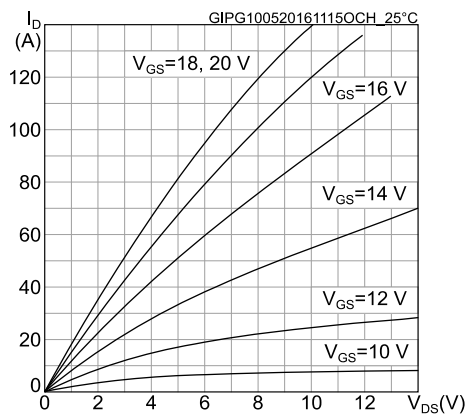
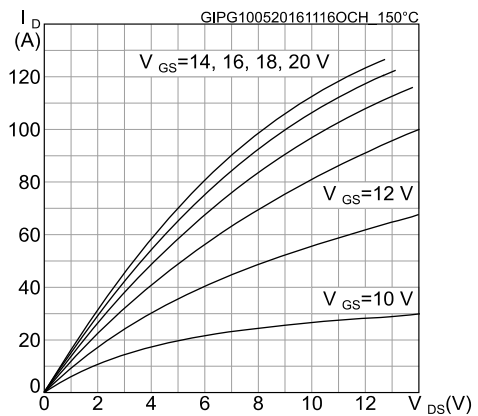
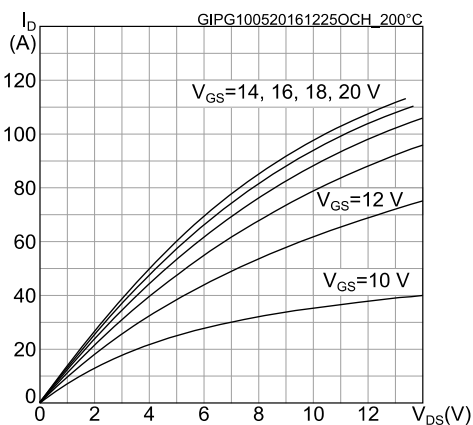
Figure 4: Output characteristics ($T_J = 25^\circ C$)Figure 5: Output characteristics ($T_J = 150^\circ C$)Figure 6: Output characteristics ($T_J = 200^\circ C$)

Figure 7: Transfer characteristics

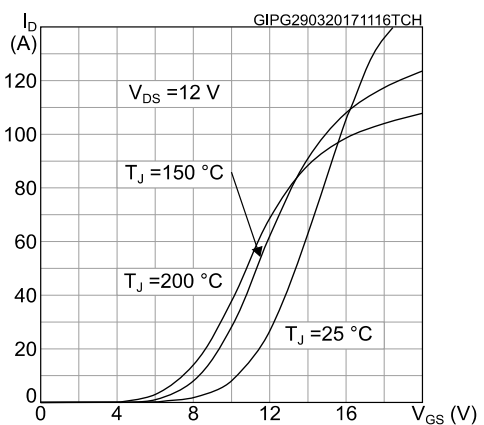


Figure 8: Power dissipation

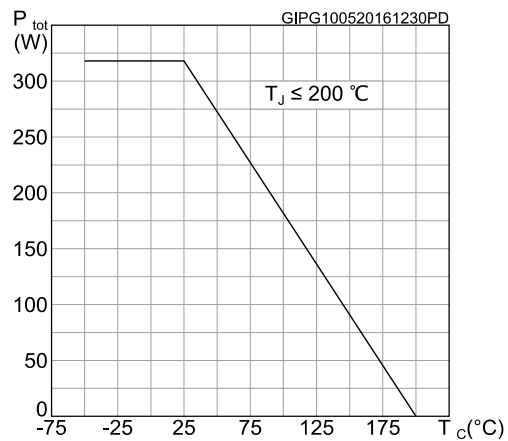


Figure 9: Gate charge vs gate-source voltage

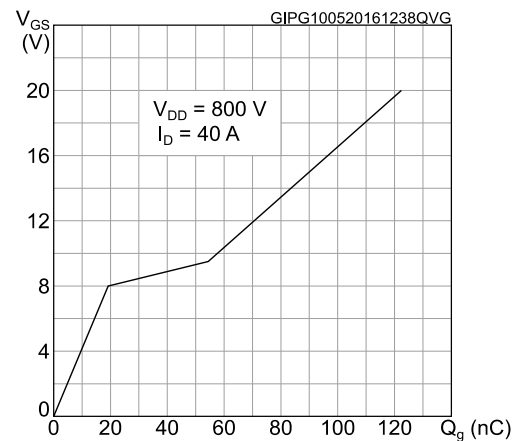


Figure 10: Capacitance variations

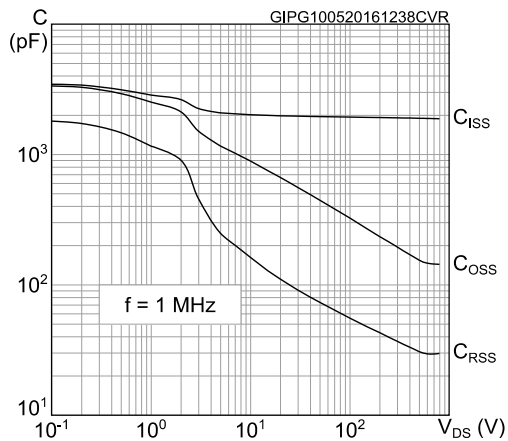


Figure 11: Switching energy vs. drain current

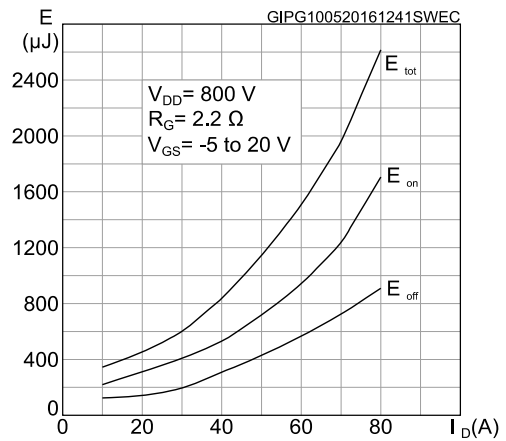


Figure 12: Switching energy vs. junction temperature

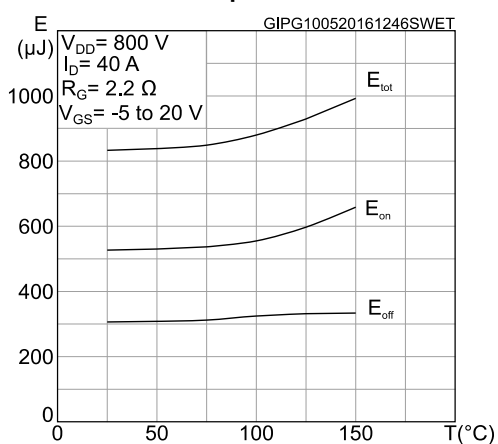
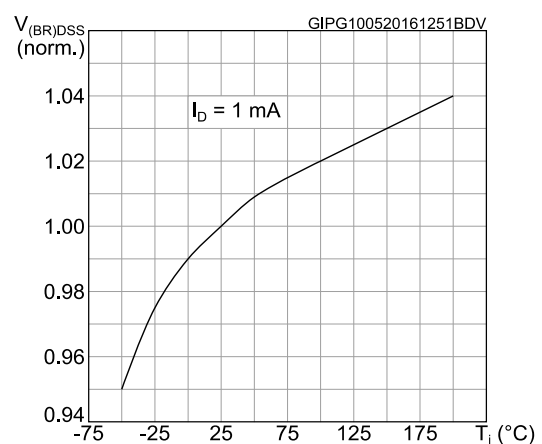
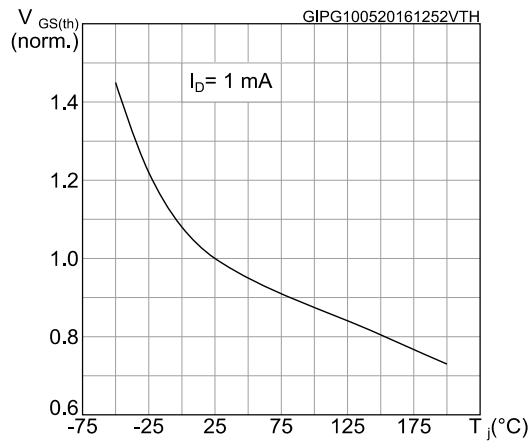
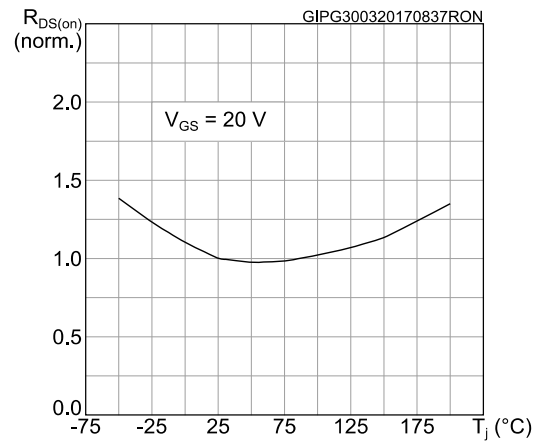
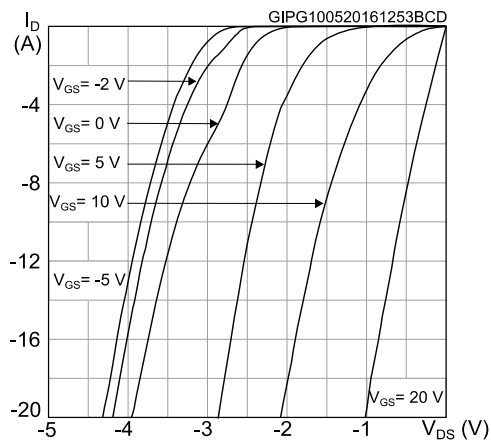
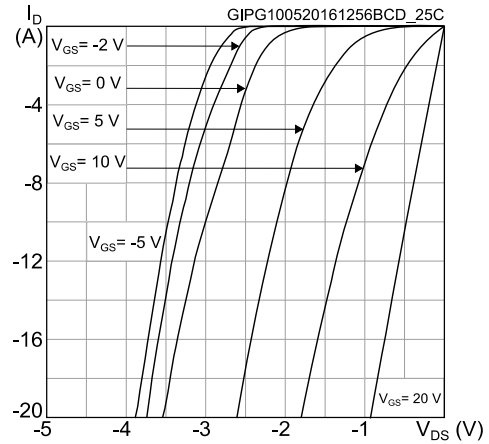
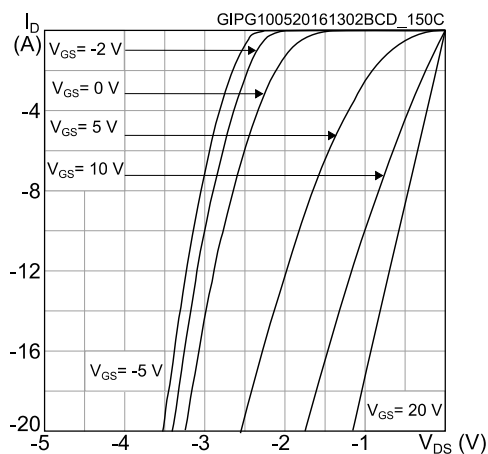
Figure 13: Normalized $V_{(BR)DSS}$ vs. temperature

Figure 14: Normalized gate threshold voltage vs. temperature**Figure 15: Normalized on-resistance vs. temperature****Figure 16: Reverse conduction characteristics ($T_J = -50^\circ\text{C}$)****Figure 17: Reverse conduction characteristics ($T_J = 25^\circ\text{C}$)****Figure 18: Reverse conduction characteristics ($T_J = 150^\circ\text{C}$)**

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 19: HiP247™ package outline

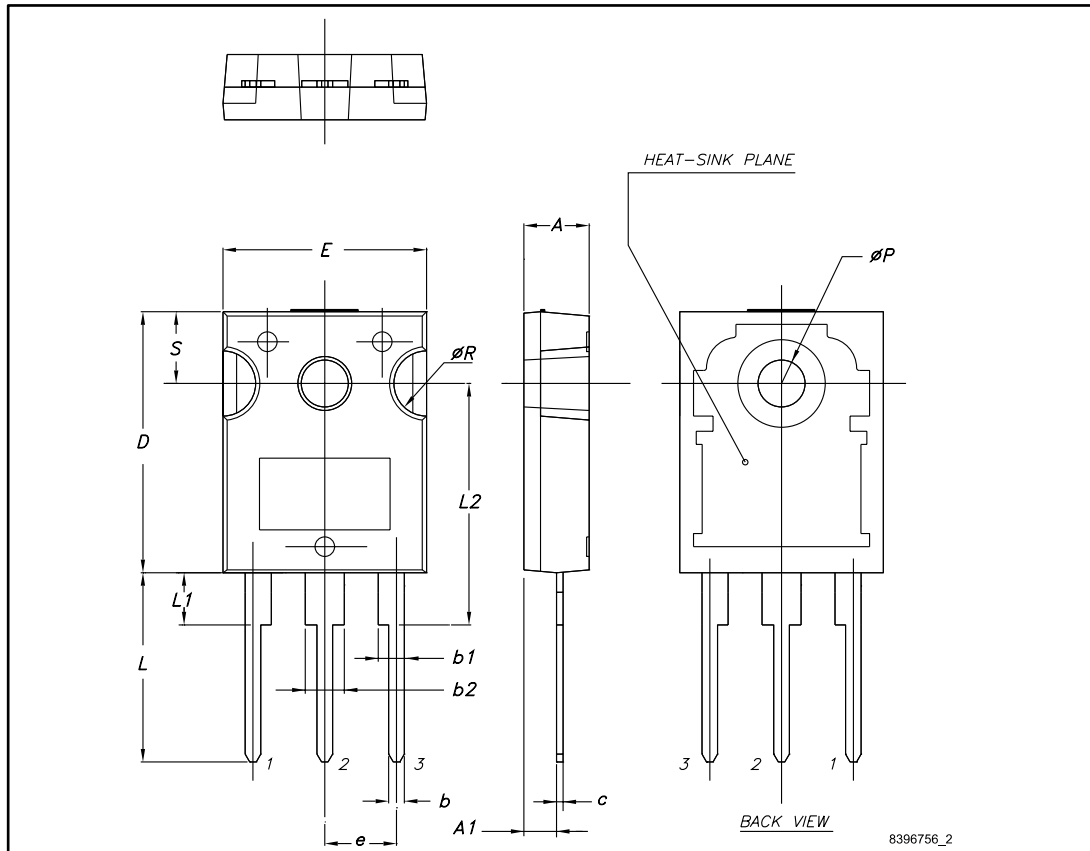


Table 8: HiP247™ package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

4 Revision history

Table 9: Document revision history

Date	Revision	Changes
17-Jun-2015	1	First release
12-May-2016	2	Modified title. Modified: Table 2: "Absolute maximum ratings", Table 4: "On/off states", Table 5: "Dynamic", Table 6: "Switching energy (inductive load)", and Table 7: "Reverse SiC diode characteristics". Added: Section 4.1: "Electrical characteristics (curves)". Minor text changes.
23-Jun-2016	3	Document status promoted from preliminary to production data.
03-Apr-2017	4	Modified Table 7: "Reverse SiC diode characteristics" Modified Figure 7: "Transfer characteristics" , Figure 15: "Normalized on-resistance vs. temperature" , Figure 16: "Reverse conduction characteristics ($T_J = -50\text{ }^{\circ}\text{C}$)" , Figure 17: "Reverse conduction characteristics ($T_J = 25\text{ }^{\circ}\text{C}$)" and Figure 18: "Reverse conduction characteristics ($T_J = 150\text{ }^{\circ}\text{C}$)" Updated Section 3: "Package information" Minor text changes.

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