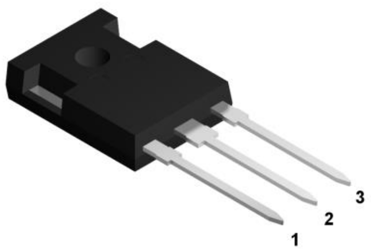
SCTWA50N120

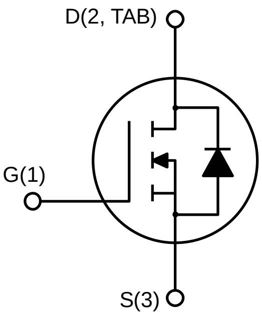
Silicon carbide Power MOSFET 1200 V, 65 A, 59 mΩ (typ., TJ=150 °C) in an HiP247™ long leads package

Datasheet - production data



HiP247™ long leads

Figure 1: Internal schematic diagram



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Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability (T_J = 200 °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
SCTWA50N120	SCT50N120	HiP247™ long leads	Tube

Contents

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 °C	65	A
I_D	Drain current (continuous) at T_C = 100 °C	50	A
I_{DM}[(1)]	Drain current (pulsed)	130	A
P_{TOT}	Total dissipation at T_C = 25 °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
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.55	°C/W
$R_{thj\text{-}amb}$	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 R_G= 2.2 Ω, V_{GS} = -5 to 20 V	-	530	-	µJ
E_{off}	Turn-off switching energy		-	310	-	µJ
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 40 A R_G= 2.2 Ω, V_{GS} = -5 to 20 V T_J= 150 °C	-	670	-	µJ
E_{off}	Turn-off switching energy		-	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

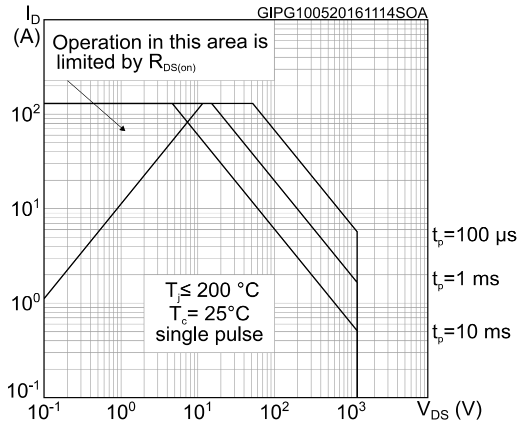


Figure 3: Thermal impedance

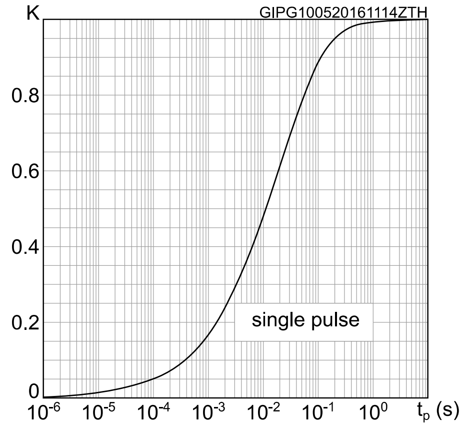


Figure 4: Output characteristics (T_J= 25 °C)

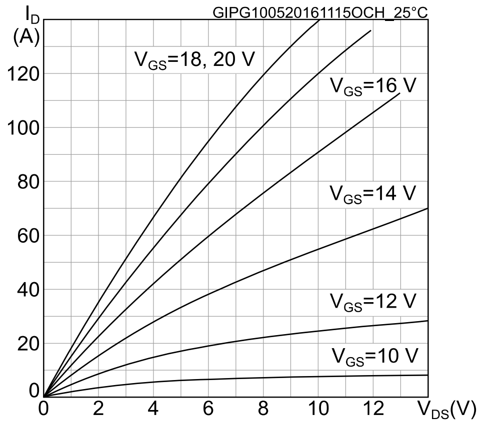


Figure 5: Output characteristics (T_J= 150 °C)

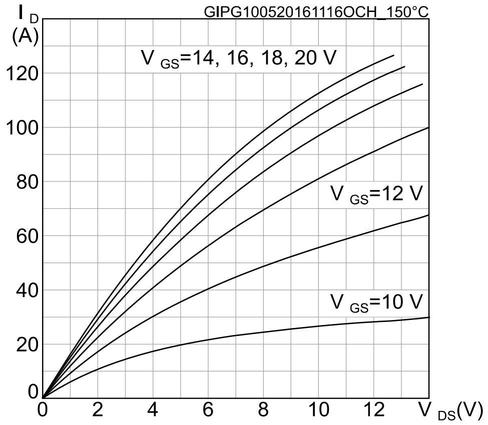


Figure 6: Output characteristics (T_J= 200 °C)

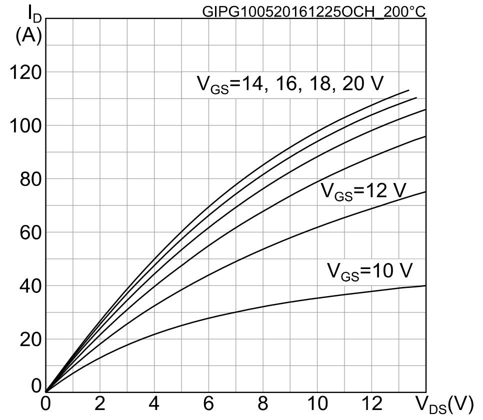


Figure 7: Transfer characteristics

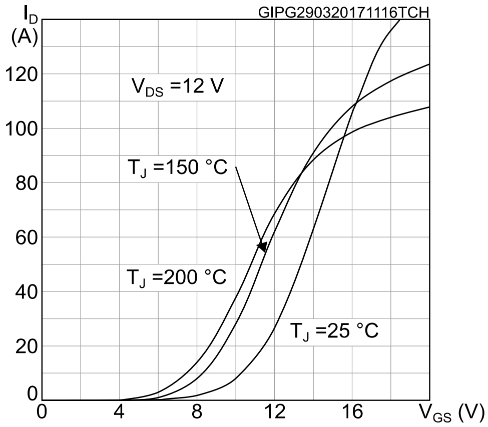


Figure 8: Power dissipation

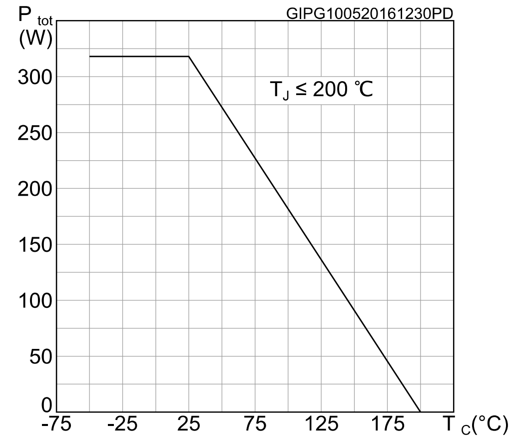


Figure 9: Gate charge vs gate-source voltage

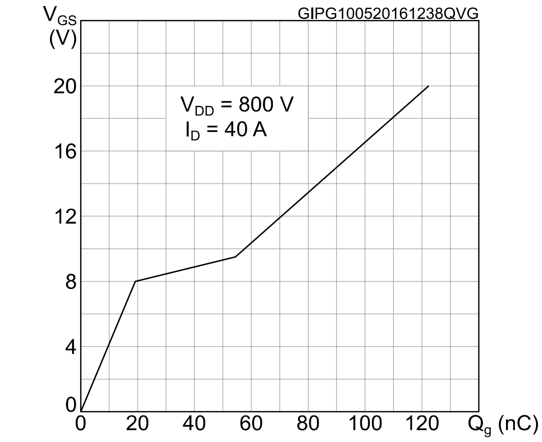


Figure 10: Capacitance variations

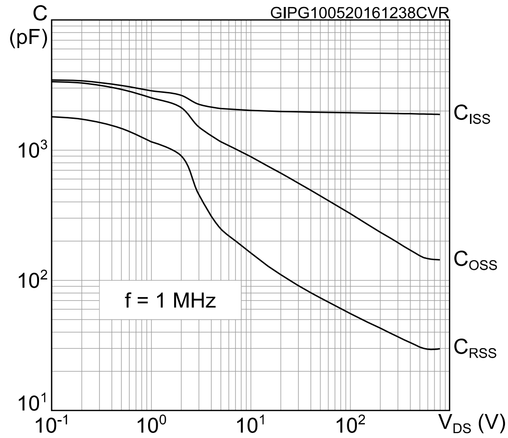


Figure 11: Switching energy vs. drain current

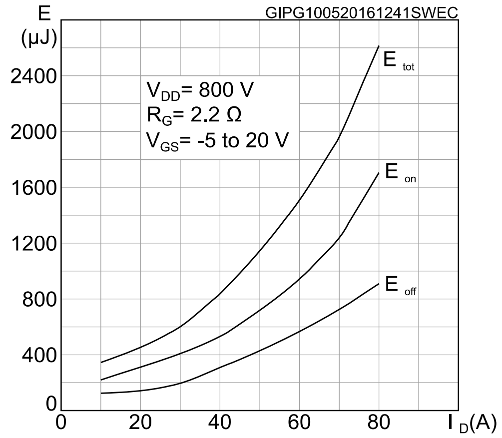


Figure 12: Switching energy vs. junction temperature

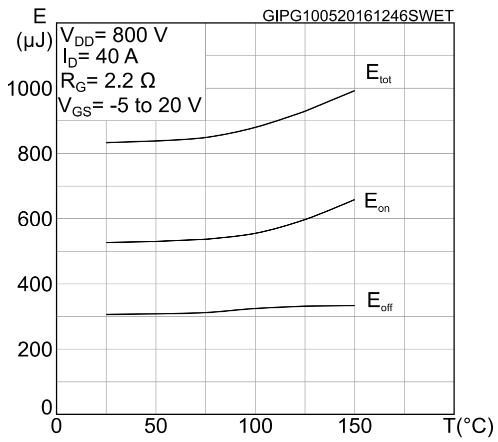


Figure 13: Normalized $V_{(BR)DSS}$ vs. temperature

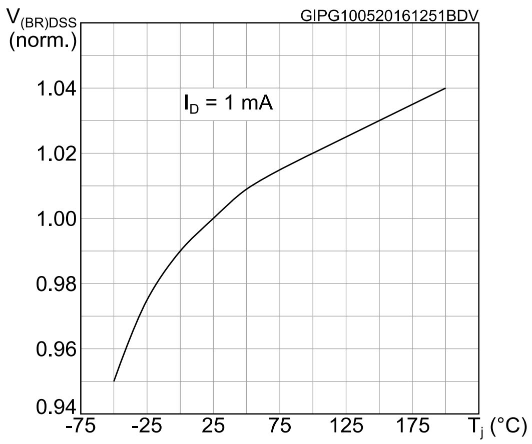


Figure 14: Normalized gate threshold voltage vs. temperature

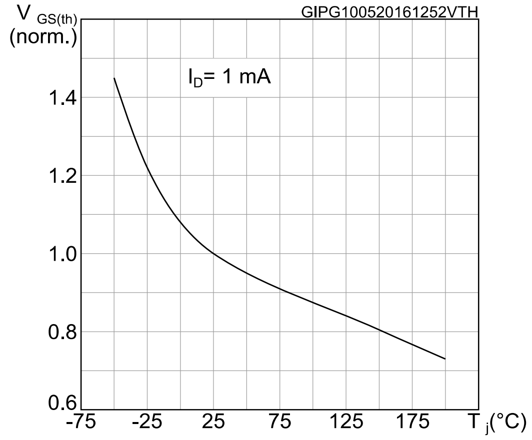


Figure 15: Normalized on-resistance vs. temperature

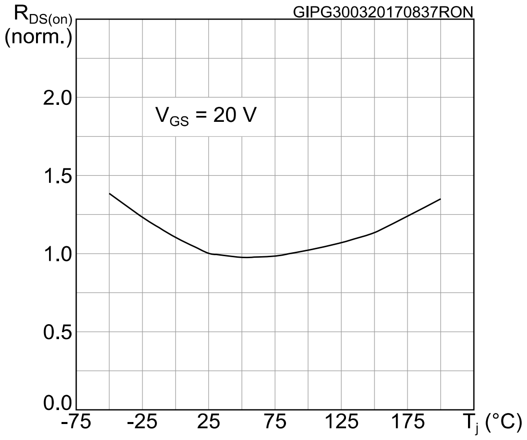


Figure 16: Reverse conduction characteristics (T_J = -50 °C)

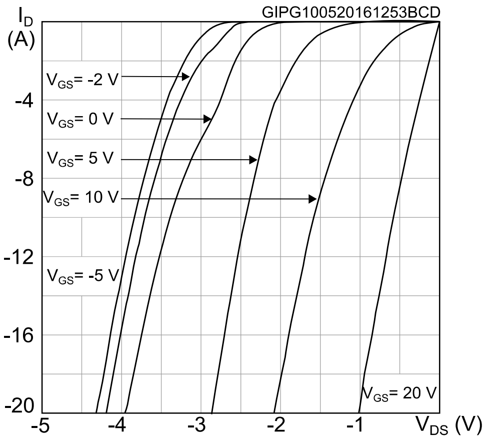


Figure 17: Reverse conduction characteristics (T_J = 25 °C)

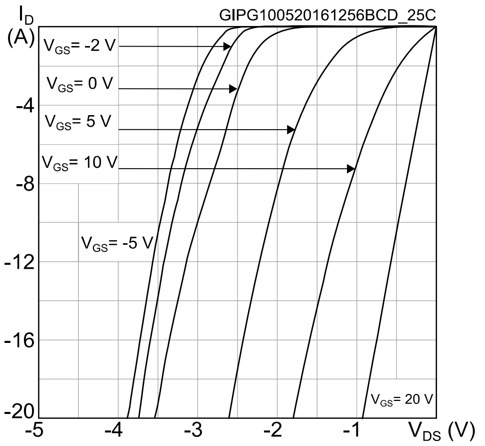
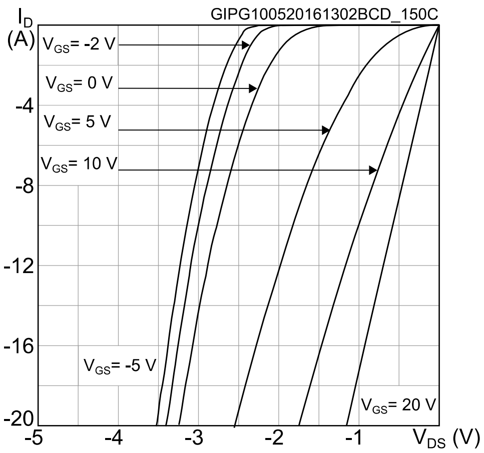


Figure 18: Reverse conduction characteristics (T_J = 150 °C)



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™ long leads package information

Figure 19: HiP247™ long leads package outline

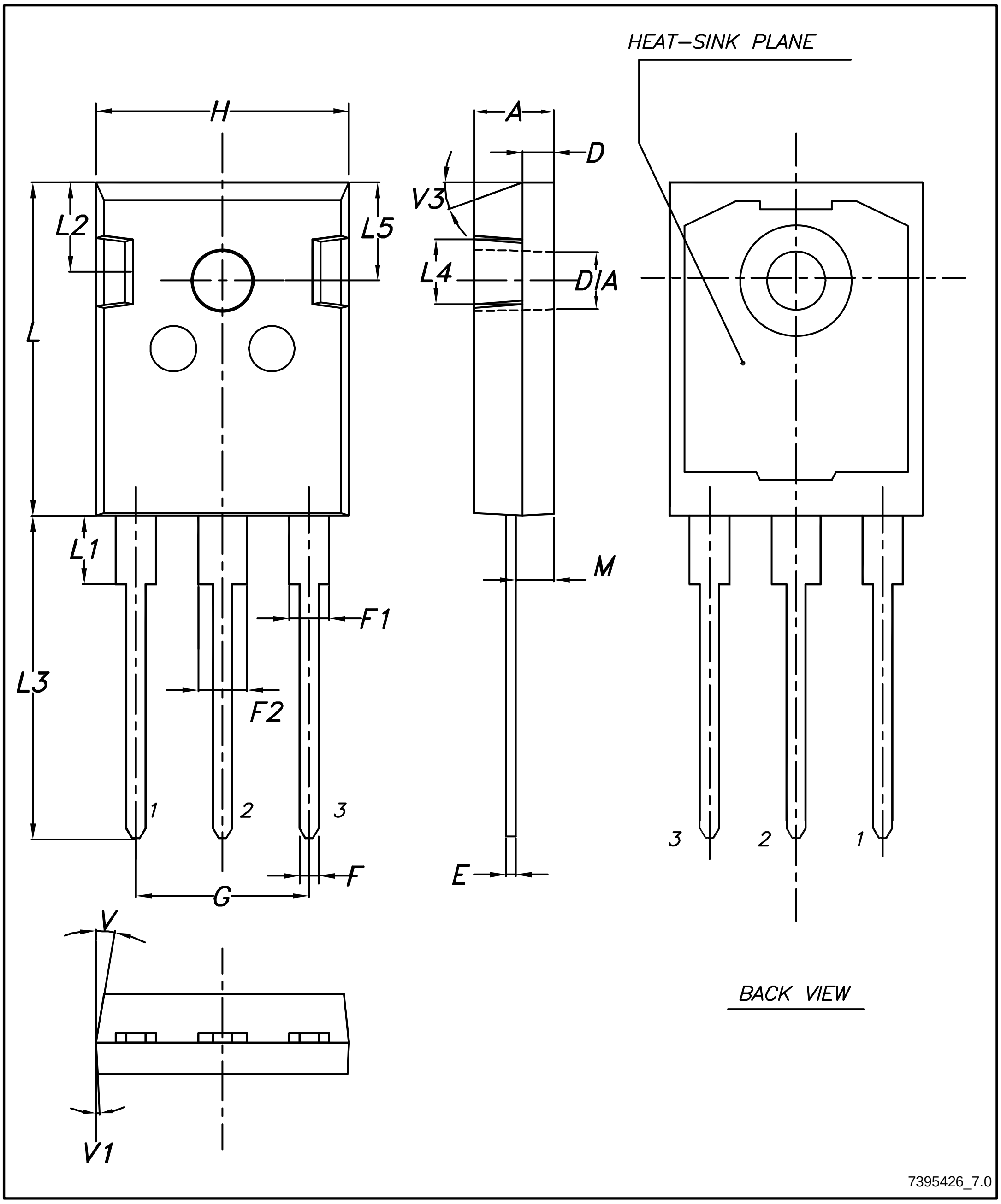


Table 8: HiP247™ long leads package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90		5.15
D	1.85		2.10
E	0.55		0.67
F	1.07		1.32
F1	1.90		2.38
F2	2.87		3.38
G	10.90 BSC		
H	15.77		16.02
L	20.82		21.07
L1	4.16		4.47
L2	5.49		5.74
L3	20.05		20.30
L4	3.68		3.93
L5	6.04		6.29
M	2.25		2.55
V		10°	
V1		3°	
V3		20°	
DIA	3.55		3.66

4 Revision history

Table 9: Document revision history

Date	Revision	Changes
07-Jun-2016	1	First release
14-Sep-2016	2	Document status changed from preliminary to production data.
03-Apr-2017	3	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 °C)"*, *Figure 17: "Reverse conduction characteristics (T_J = 25 °C)"* and *Figure 18: "Reverse conduction characteristics (T_J = 150 °C)"* Minor text changes.