

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

Datasheet - production data

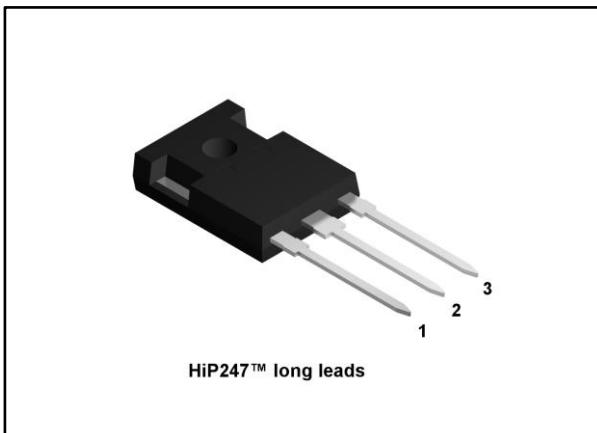
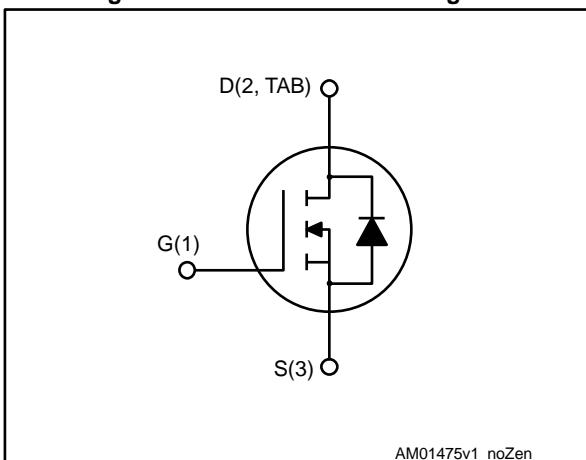


Figure 1: Internal schematic diagram



Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability (T_J = 200 °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

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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 $T_C = 25^\circ\text{C}$	65	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	50	A
$I_{DM}^{(1)}$	Drain current (pulsed)	130	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	318	W
T_{stg}	Storage temperature range	-55 to 200	$^\circ\text{C}$
T_j	Operating junction temperature range		$^\circ\text{C}$

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	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	40	$^\circ\text{C}/\text{W}$

2 Electrical characteristics

($T_{CASE} = 25^\circ C$ 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
		$V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 200^\circ C$		10		μA
I_{GS}	Gate-body leakage current	$V_{DS} = 0 V, V_{GS} = -10 \text{ to } 22 V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1 \text{ mA}$	1.8	3.0		V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 20 V, I_D = 40 A$		52	69	$m\Omega$
		$V_{GS} = 20 V, I_D = 40 A, T_J = 150^\circ C$		59		$m\Omega$
		$V_{GS} = 20 V, I_D = 40 A, T_J = 200^\circ C$		70		$m\Omega$

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 400 V, f = 1 \text{ MHz}, V_{GS} = 0 V$	-	1900	-	pF
C_{oss}	Output capacitance		-	170	-	pF
C_{rss}	Reverse transfer capacitance		-	30	-	pF
Q_g	Total gate charge	$V_{DD} = 800 V, I_D = 40 A, V_{GS} = 0 \text{ to } 20 V$	-	122	-	nC
Q_{gs}	Gate-source charge		-	19	-	nC
Q_{gd}	Gate-drain charge		-	35	-	nC
R_g	Gate input resistance	$f=1 \text{ MHz open drain}$	-	1.9	-	Ω

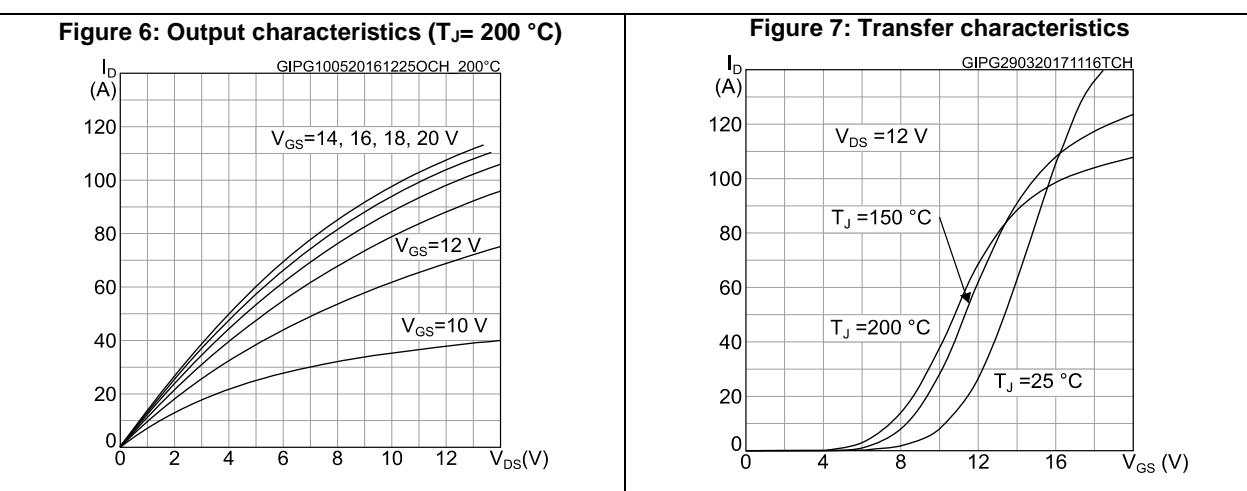
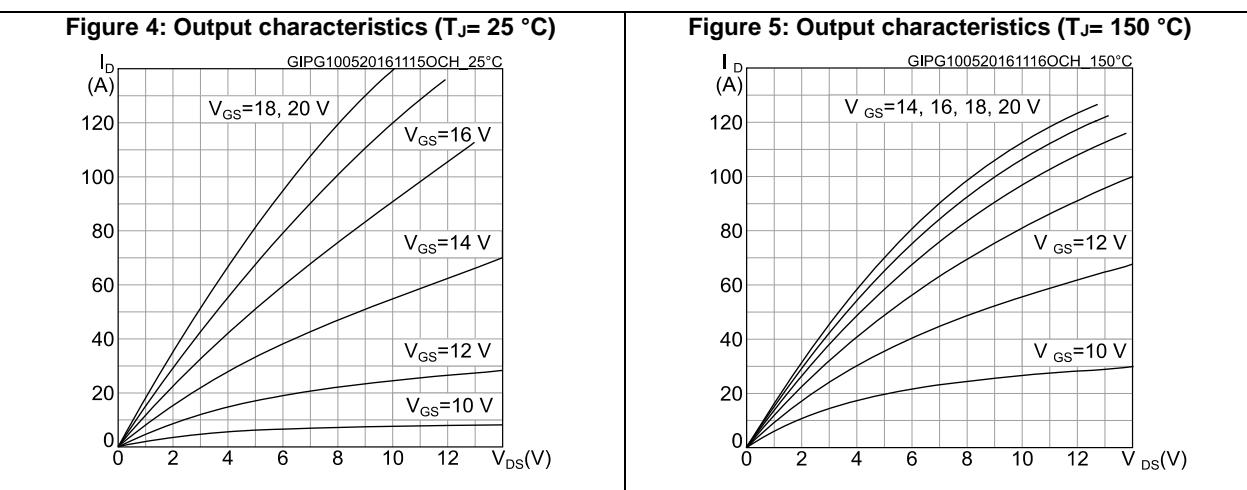
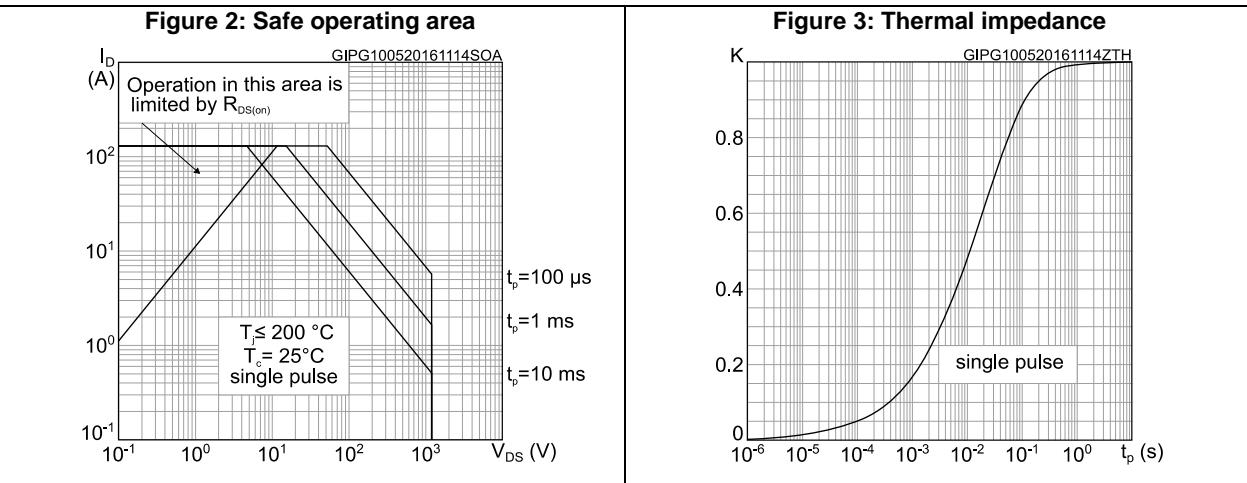
Table 6: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 800 V, I_D = 40 A$ $R_G = 2.2 \Omega, V_{GS} = -5 \text{ to } 20 V$	-	530	-	μJ
E_{off}	Turn-off switching energy		-	310	-	μJ
E_{on}	Turn-on switching energy	$V_{DD} = 800 V, I_D = 40 A$ $R_G = 2.2 \Omega, V_{GS} = -5 \text{ to } 20 V$ $T_J = 150^\circ C$	-	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	$I_F = 20 A, V_{GS} = 0 V$ $I_F = 40 A, di/dt = 2000/ns$ $V_{DD} = 800 V$	-	3.5	-	V
t_{rr}	Reverse recovery time		-	55		ns
Q_{rr}	Reverse recovery charge		-	230	-	nC
I_{RRM}	Reverse recovery current		-	14	-	A

2.1 Electrical characteristics (curves)



Electrical characteristics

SCTWA50N120

Figure 8: Power dissipation

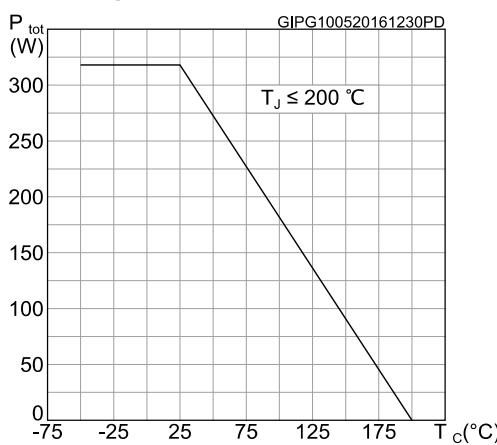


Figure 9: Gate charge vs. gate-source voltage

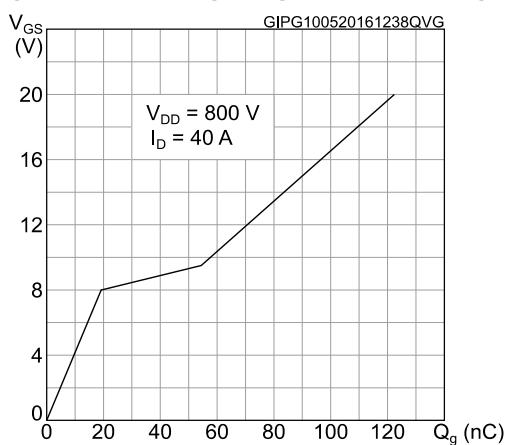


Figure 10: Capacitance variations

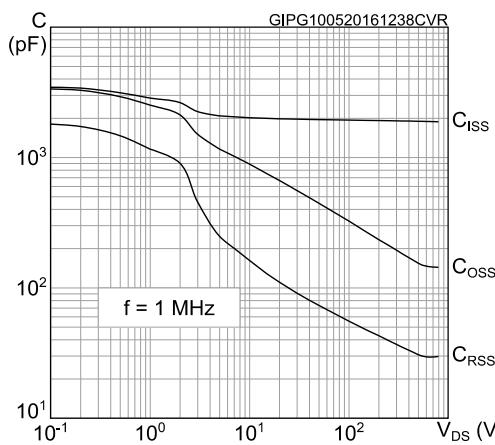


Figure 11: Switching energy vs. drain current

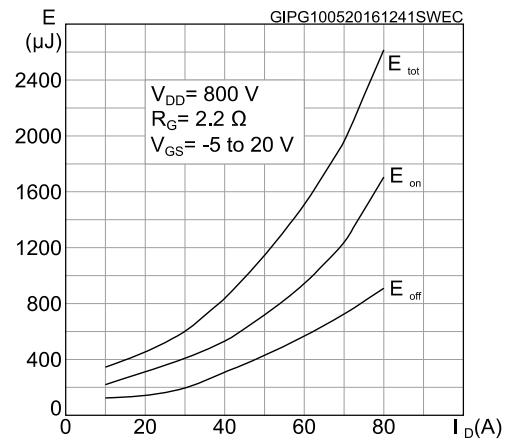


Figure 12: Switching energy vs. junction temperature

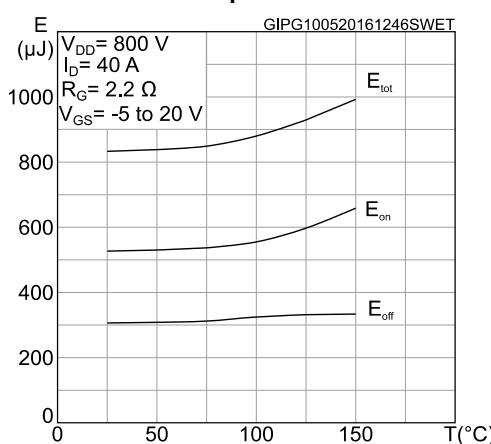


Figure 13: Normalized $V_{(BR)DSS}$ vs. temperature

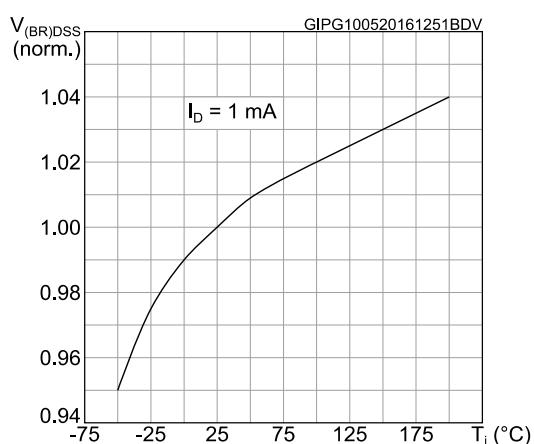


Figure 14: Normalized gate threshold voltage vs. temperature

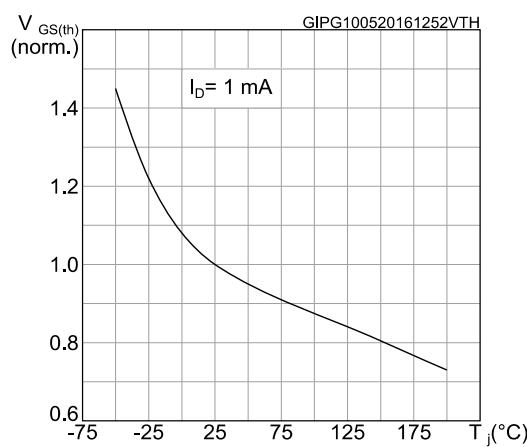
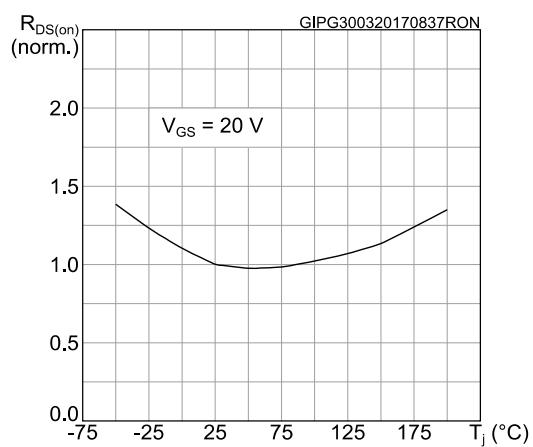
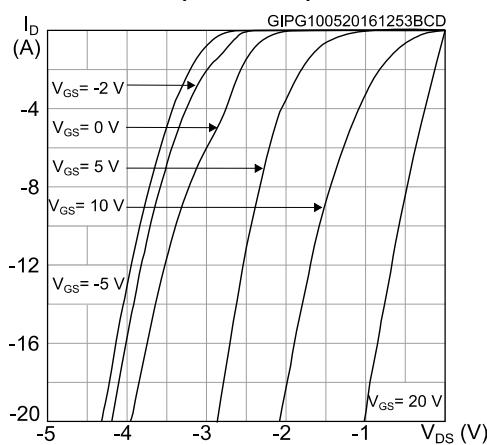
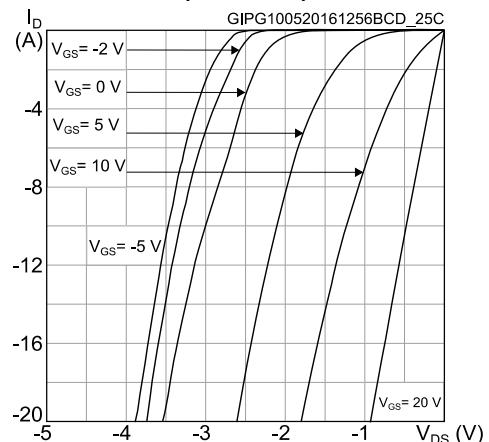
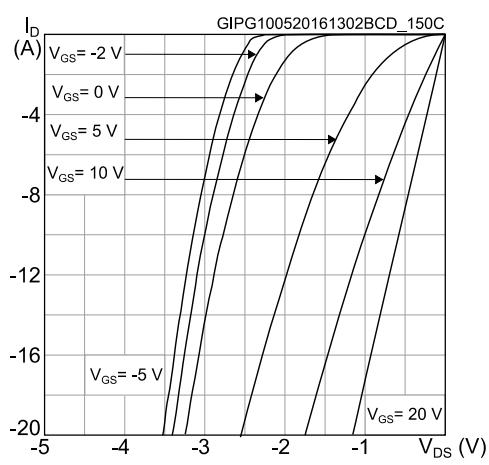


Figure 15: Normalized on-resistance vs. temperature

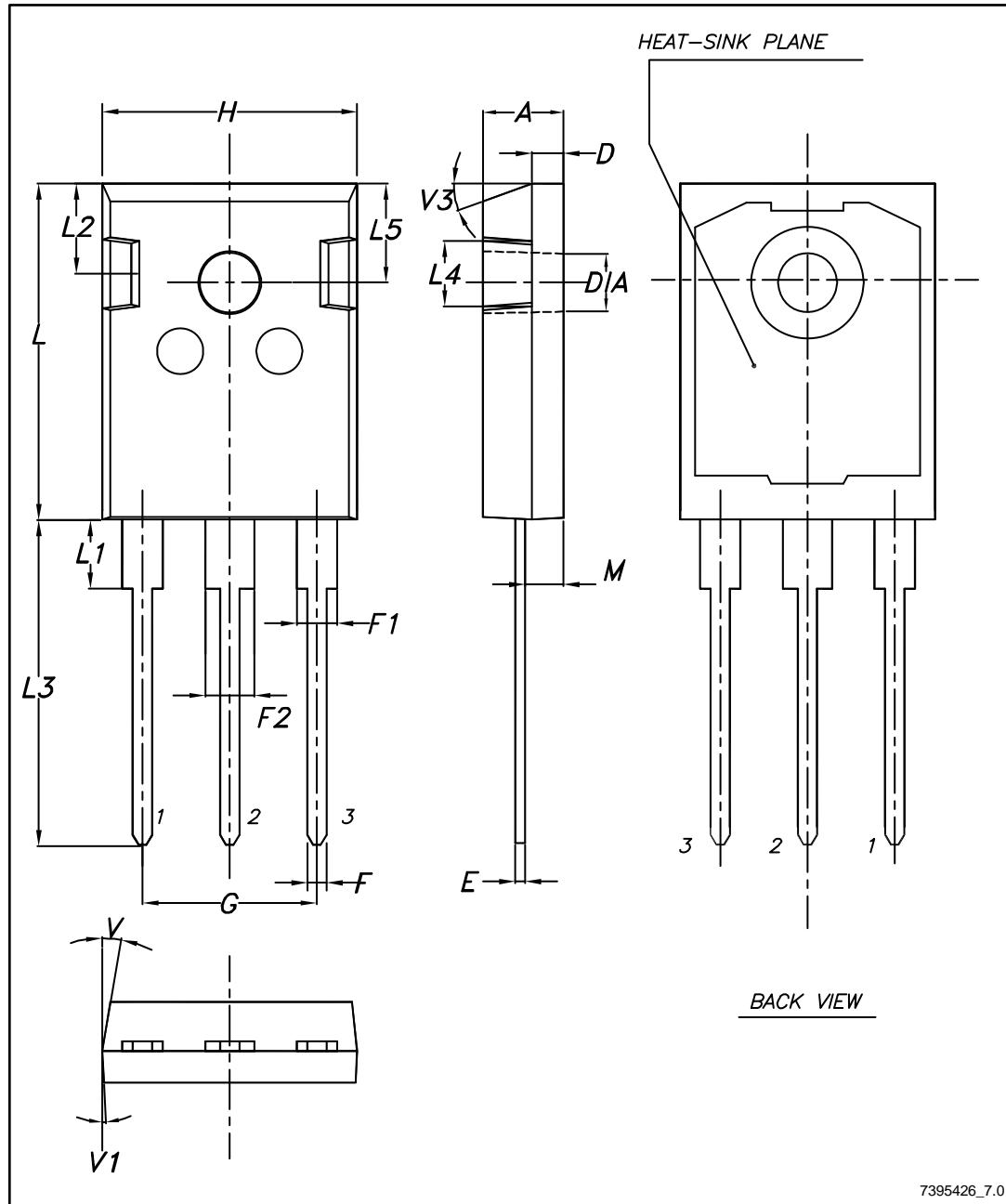
Figure 16: Reverse conduction characteristics ($T_j = -50^\circ\text{C}$)Figure 17: Reverse conduction characteristics ($T_j = 25^\circ\text{C}$)Figure 18: Reverse conduction characteristics ($T_j = 150^\circ\text{C}$)

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™ long leads package information

Figure 19: HiP247™ long leads package outline



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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 <i>Table 7: "Reverse SiC diode characteristics"</i> Modified <i>Figure 7: "Transfer characteristics"</i> , <i>Figure 15: "Normalized on-resistance vs. temperature"</i> , <i>Figure 16: "Reverse conduction characteristics ($T_J = -50 \text{ }^{\circ}\text{C}$)"</i> , <i>Figure 17: "Reverse conduction characteristics ($T_J = 25 \text{ }^{\circ}\text{C}$)"</i> and <i>Figure 18: "Reverse conduction characteristics ($T_J = 150 \text{ }^{\circ}\text{C}$)"</i> Minor text changes.

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