

Silicon carbide Power MOSFET 1200 V, 65 A, 59 mΩ (typ., T<sub>J</sub>=150 °C) in an HiP247™ long leads package

Datasheet - production data

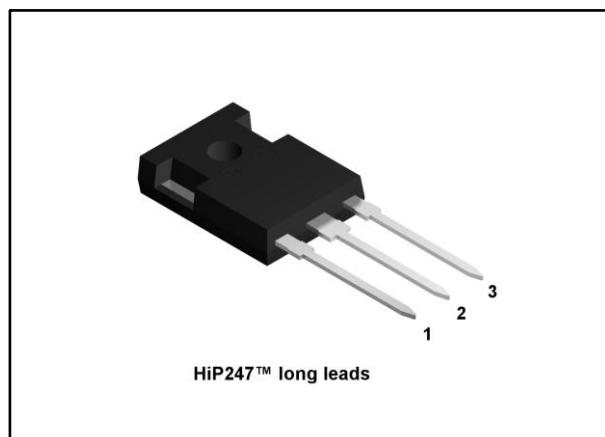
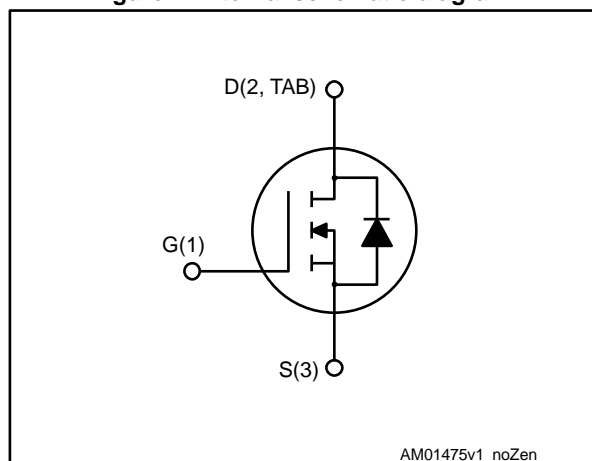


Figure 1: Internal schematic diagram



## Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability (T<sub>J</sub> = 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 $T_C = 25\text{ °C}$	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:**

<sup>(1)</sup>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

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

**Table 4: On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 1200\text{ V}$ , $V_{GS} = 0\text{ V}$		1	100	$\mu\text{A}$
		$V_{DS} = 1200\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 200\text{ °C}$		10		$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = -10\text{ to }22\text{ V}$			$\pm 100$	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	$V_{GS} = 20\text{ V}$ , $I_D = 40\text{ A}$		52	69	m $\Omega$
		$V_{GS} = 20\text{ V}$ , $I_D = 40\text{ A}$ , $T_J = 150\text{ °C}$		59		m $\Omega$
		$V_{GS} = 20\text{ V}$ , $I_D = 40\text{ A}$ , $T_J = 200\text{ °C}$		70		m $\Omega$

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 400\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	1900	-	pF
$C_{oss}$	Output capacitance		-	170	-	pF
$C_{rss}$	Reverse transfer capacitance		-	30	-	pF
$Q_g$	Total gate charge	$V_{DD} = 800\text{ V}$ , $I_D = 40\text{ A}$ , $V_{GS} = 0\text{ to }20\text{ V}$	-	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	-	$\Omega$

**Table 6: Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{DD} = 800\text{ V}$ , $I_D = 40\text{ A}$	-	530	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$R_G = 2.2\text{ }\Omega$ , $V_{GS} = -5\text{ to }20\text{ V}$	-	310	-	$\mu\text{J}$
$E_{on}$	Turn-on switching energy	$V_{DD} = 800\text{ V}$ , $I_D = 40\text{ A}$	-	670	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$R_G = 2.2\text{ }\Omega$ , $V_{GS} = -5\text{ to }20\text{ V}$ , $T_J = 150\text{ °C}$	-	334	-	$\mu\text{J}$

**Table 7: Reverse SiC diode characteristics**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$V_{SD}$	Diode forward voltage	$I_F = 20\text{ A}$ , $V_{GS} = 0\text{ V}$	-	3.5	-	V
$t_{rr}$	Reverse recovery time	$I_F = 40\text{ A}$ , $di/dt = 2000/\text{ns}$ , $V_{DD} = 800\text{ V}$	-	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

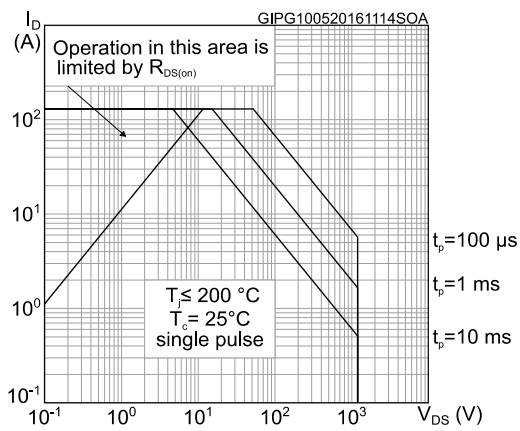


Figure 3: Thermal impedance

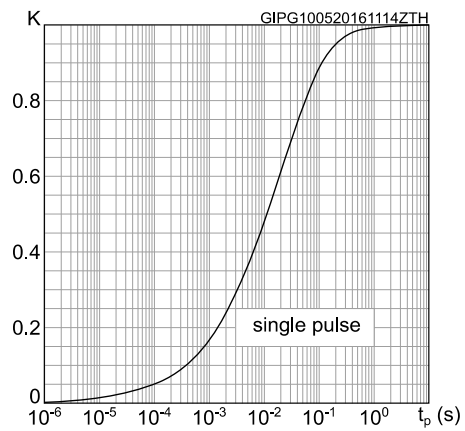
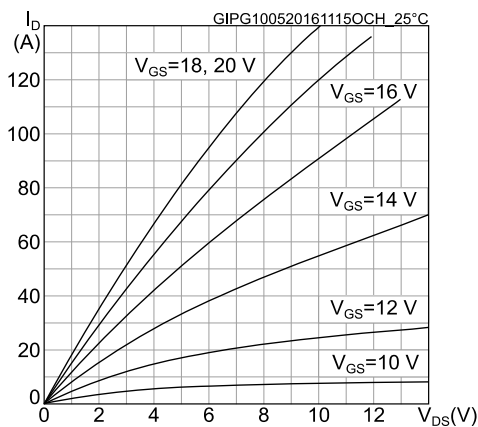
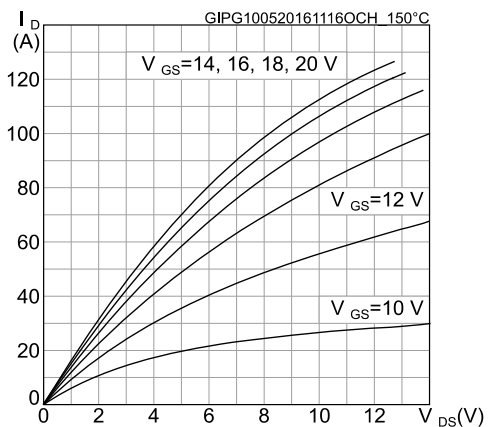
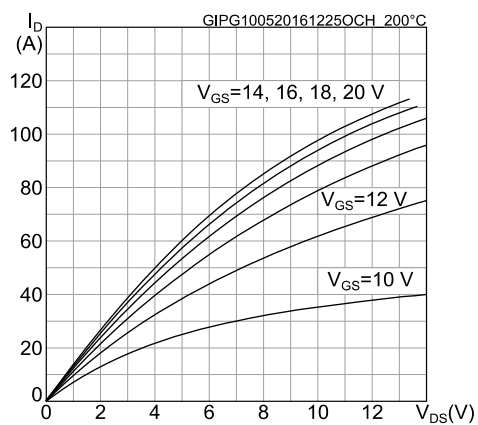
Figure 4: Output characteristics (T<sub>J</sub> = 25 °C)Figure 5: Output characteristics (T<sub>J</sub> = 150 °C)Figure 6: Output characteristics (T<sub>J</sub> = 200 °C)

Figure 7: Transfer characteristics

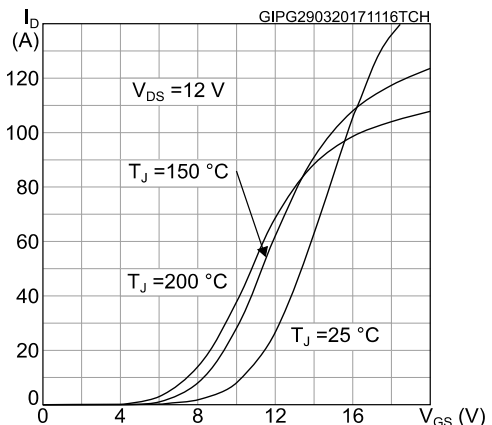


Figure 8: Power dissipation

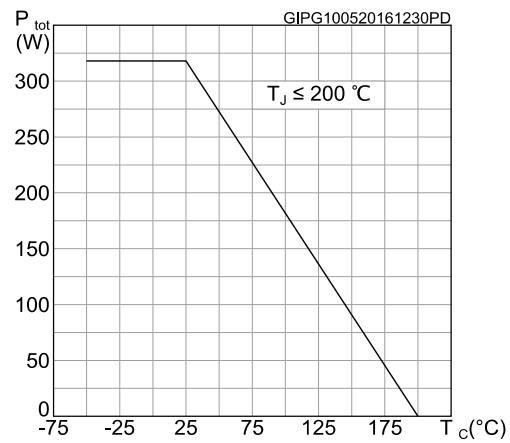


Figure 9: Gate charge vs gate-source voltage

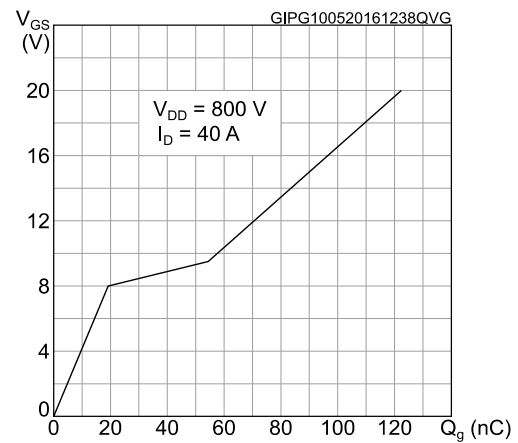


Figure 10: Capacitance variations

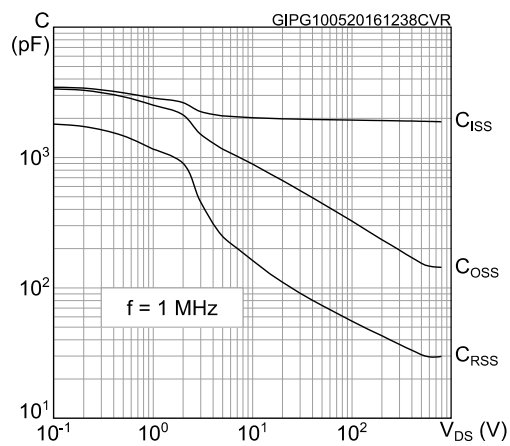


Figure 11: Switching energy vs. drain current

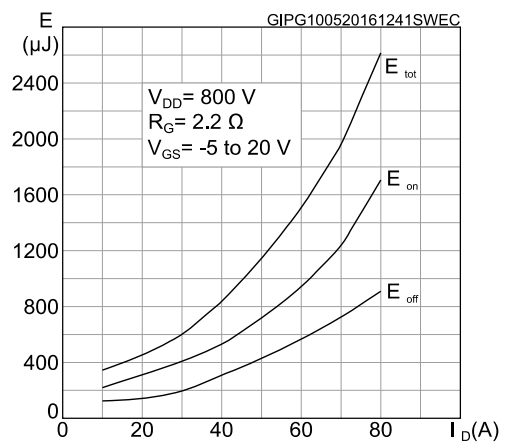
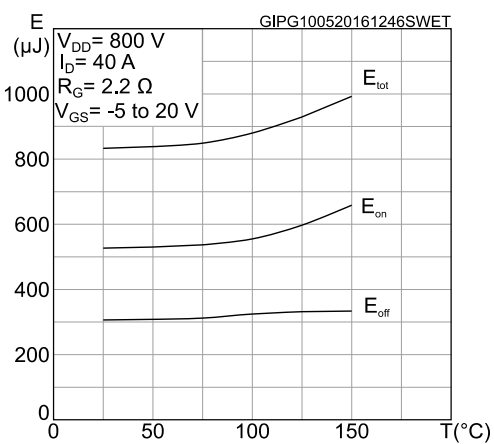
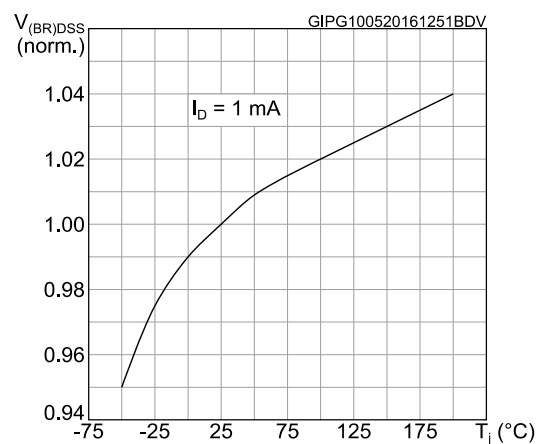
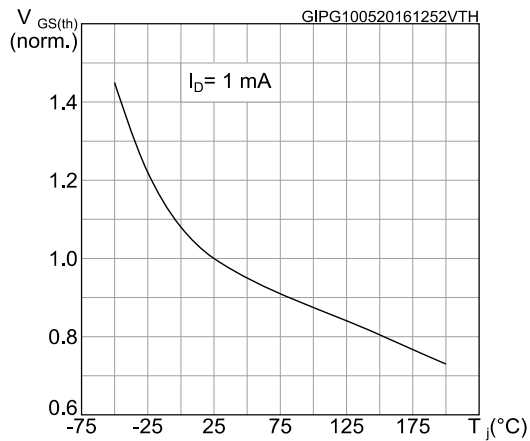
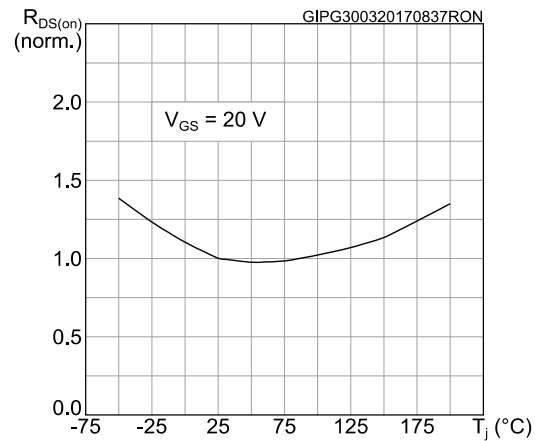
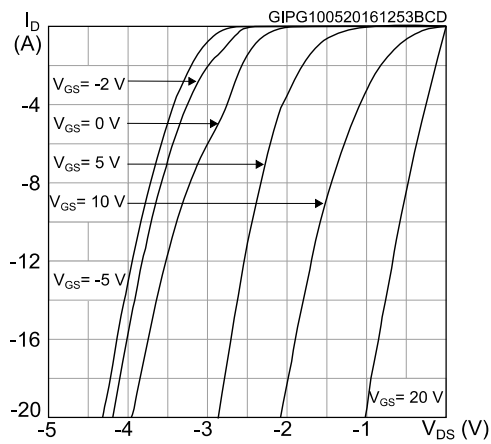
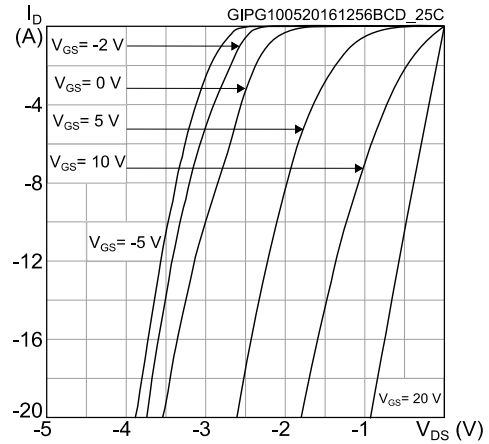
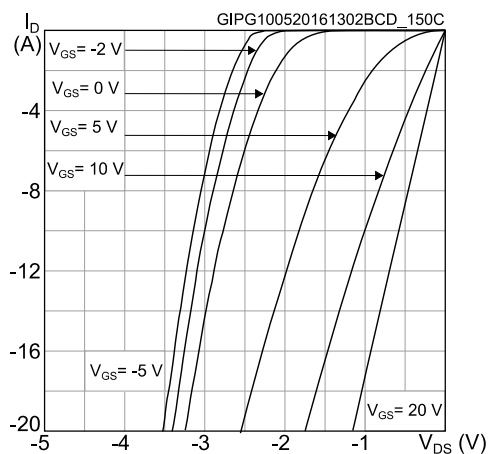


Figure 12: Switching energy vs. junction temperature

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

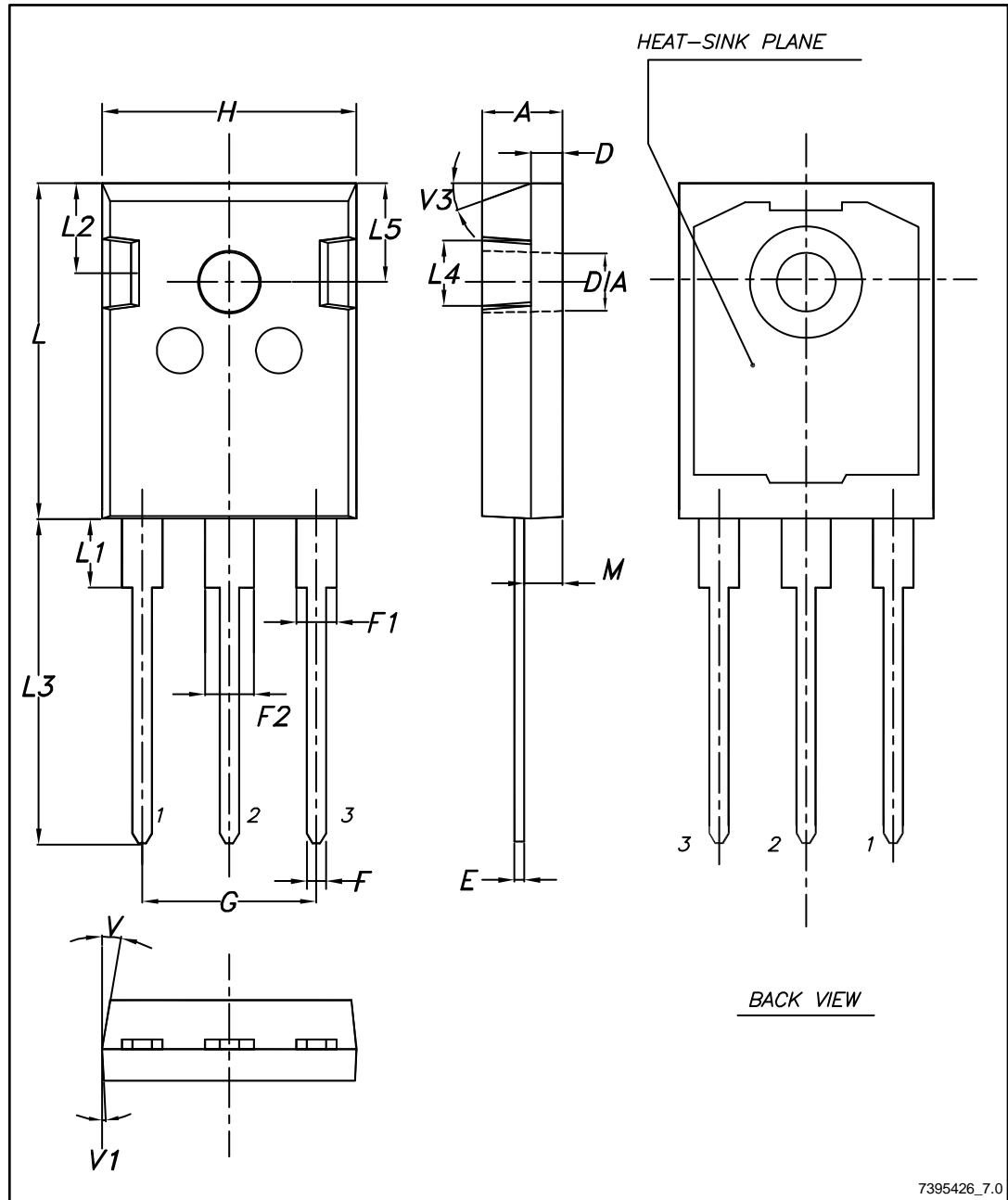
**Figure 14: Normalized gate threshold voltage vs. temperature****Figure 15: Normalized on-resistance vs. temperature****Figure 16: Reverse conduction characteristics ( $T_J = -50$  °C)****Figure 17: Reverse conduction characteristics ( $T_J = 25$  °C)****Figure 18: Reverse conduction characteristics ( $T_J = 150$  °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](http://www.st.com). ECOPACK® is an ST trademark.

#### 3.1 HiP247™ long leads package information

Figure 19: HiP247™ long leads package outline



7395426\_7.0

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

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