

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

Datasheet - production data

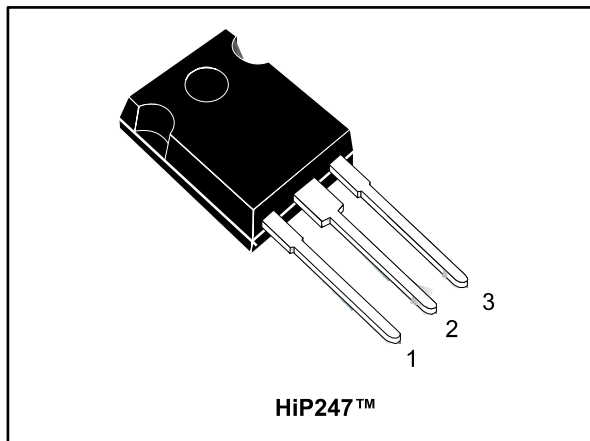
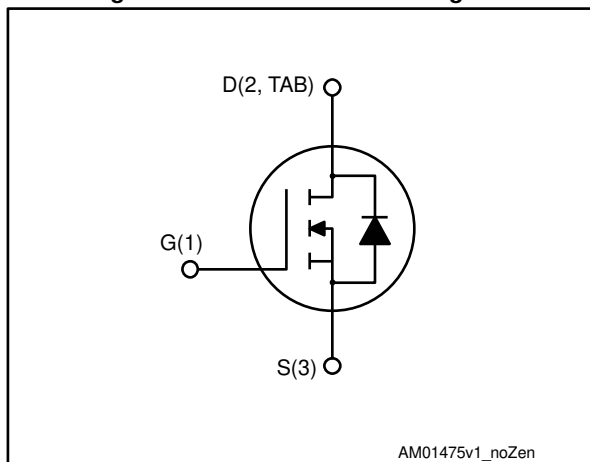


Figure 1: Internal schematic diagram



### Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability (T<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
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:**

<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
$C_{riss}$	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 MHz open drain	-	1.9	-	$\Omega$

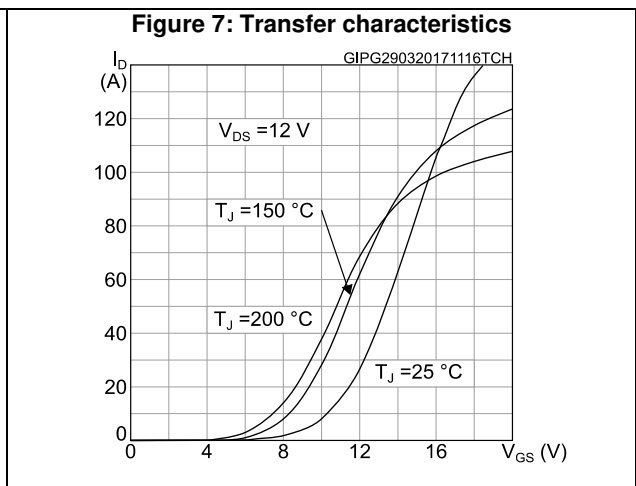
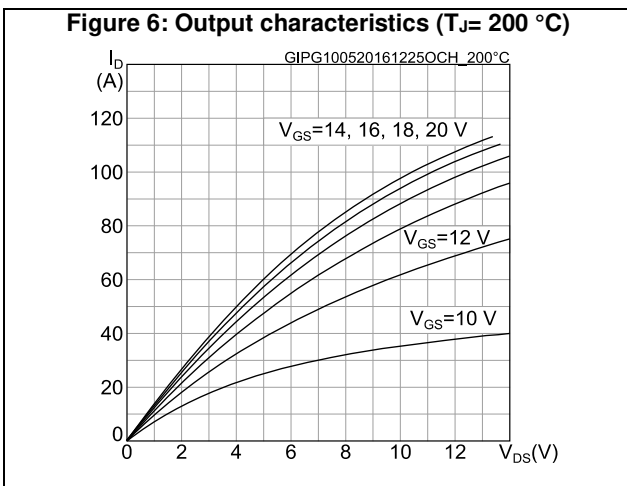
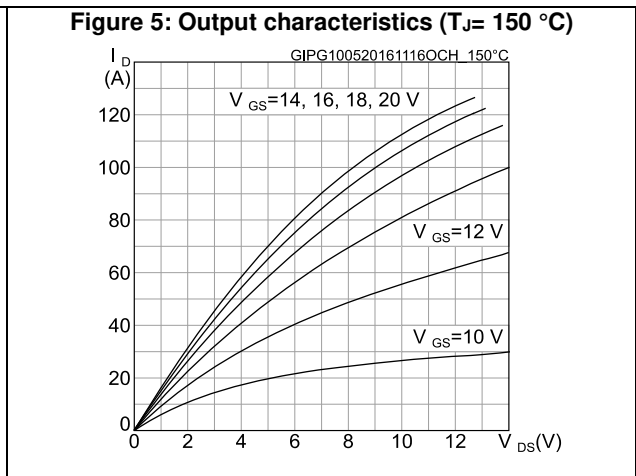
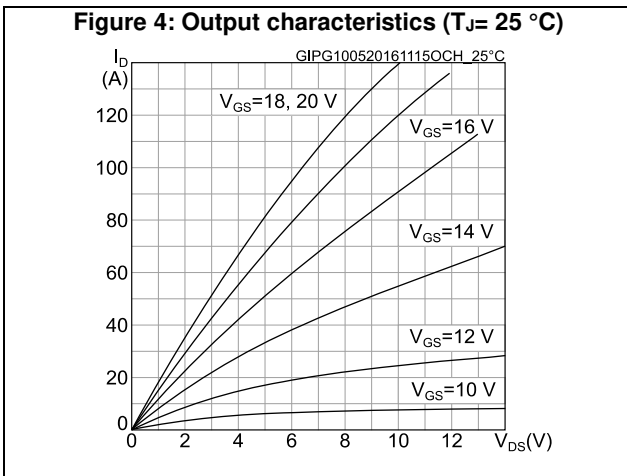
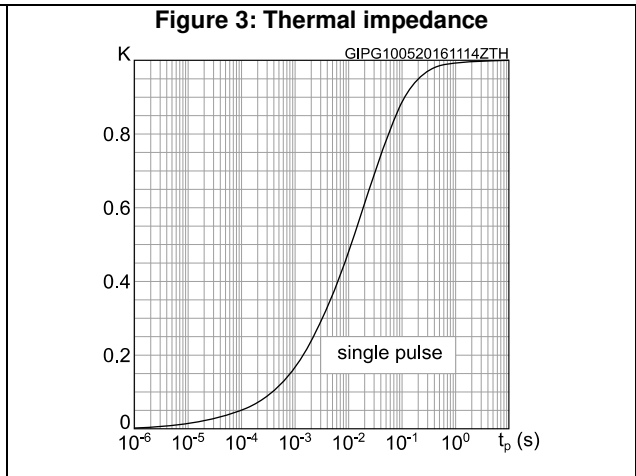
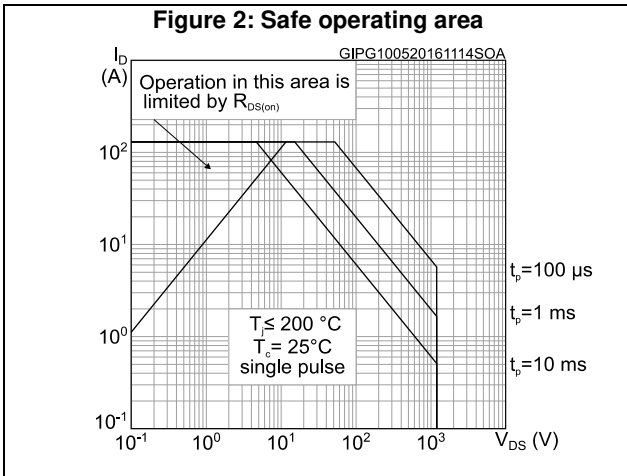
**Table 6: Switching energy (inductive load)**

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	$R_G = 2.2\ \Omega, V_{GS} = -5\text{ to }20\text{ V}$	-	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	$R_G = 2.2\ \Omega, V_{GS} = -5\text{ to }20\text{ V}, T_J = 150\text{ °C}$	-	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)



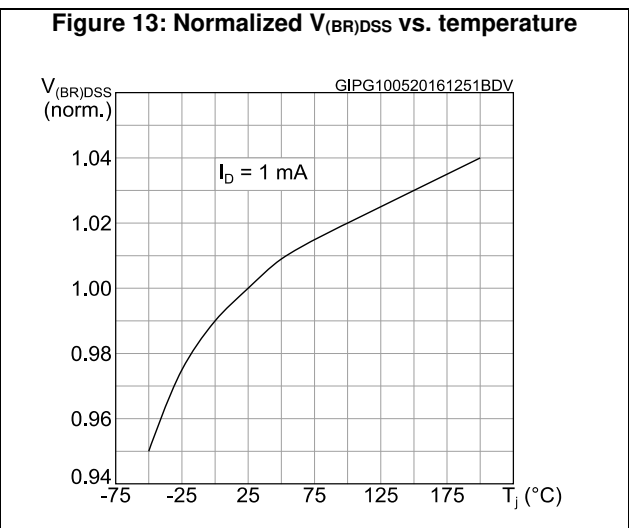
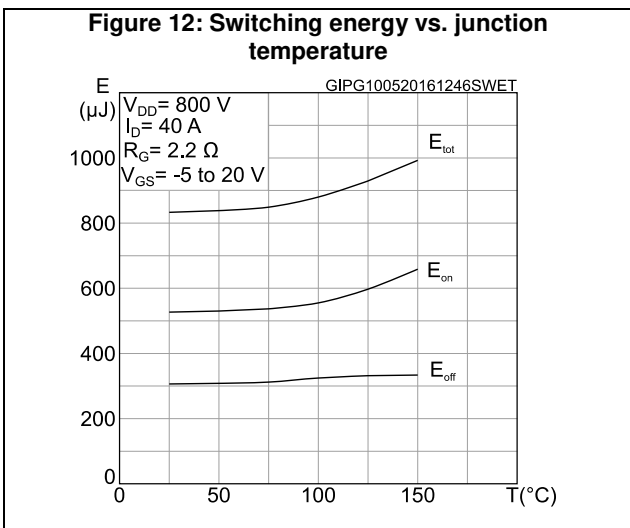
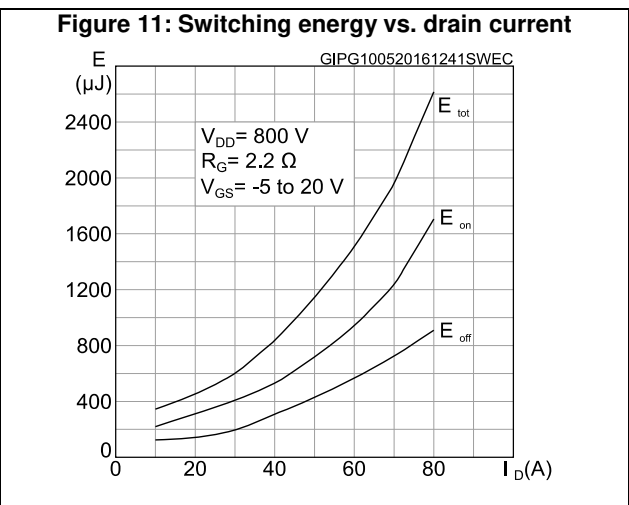
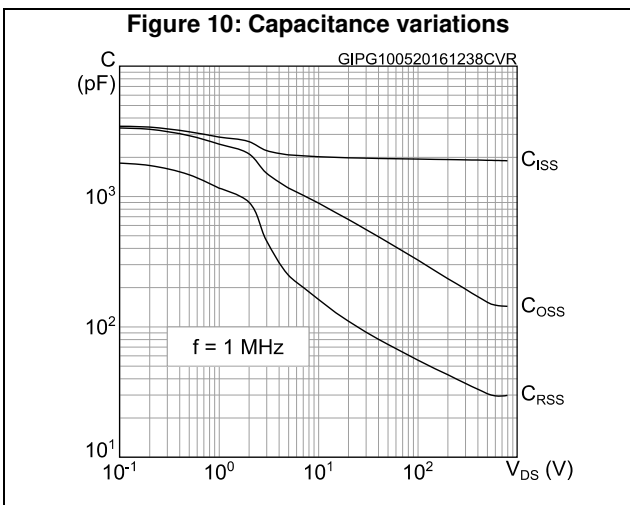
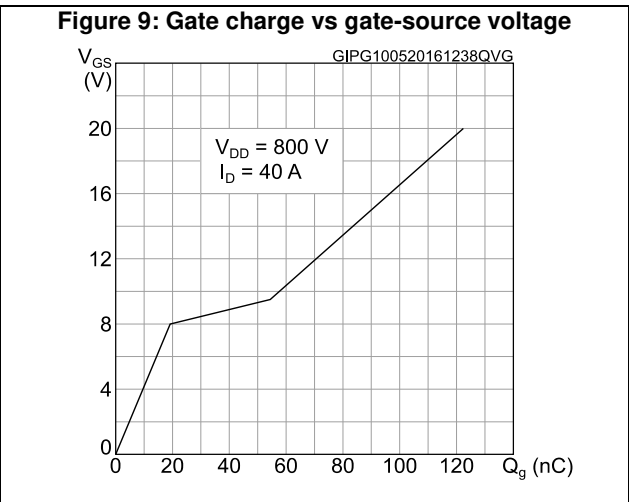
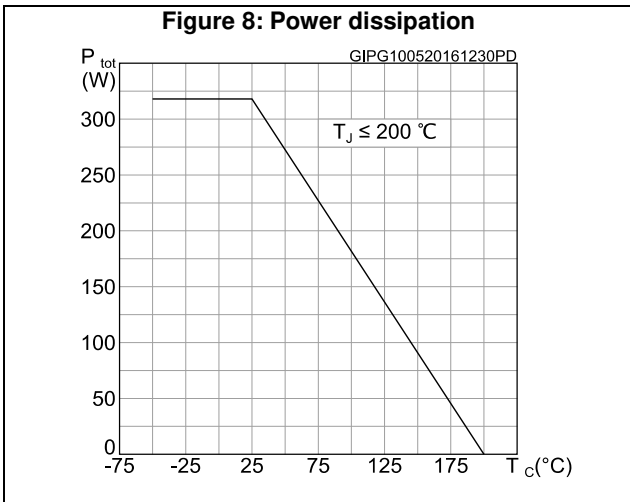


Figure 14: Normalized gate threshold voltage vs. temperature

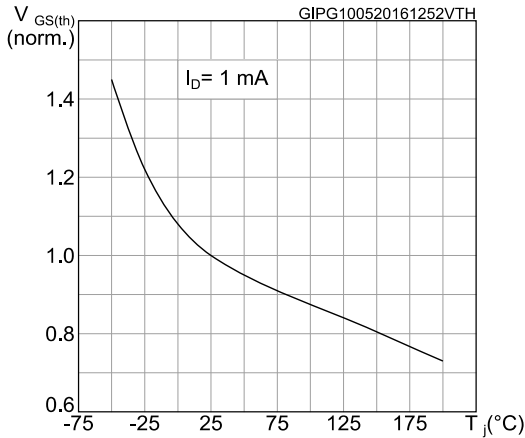


Figure 15: Normalized on-resistance vs. temperature

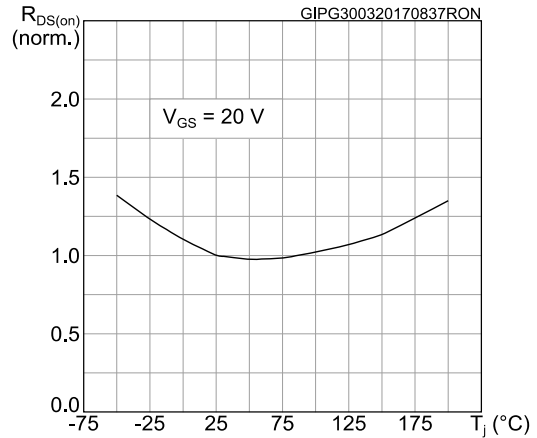


Figure 16: Reverse conduction characteristics ( $T_J = -50 \text{ }^\circ\text{C}$ )

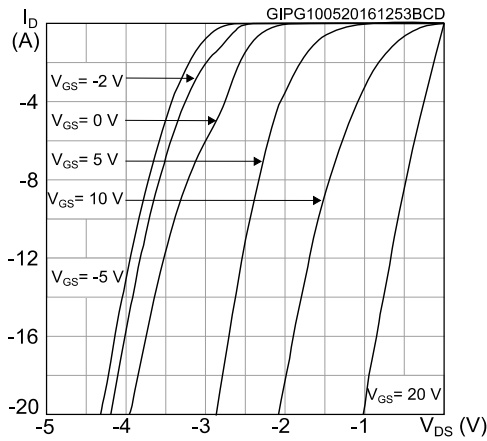


Figure 17: Reverse conduction characteristics ( $T_J = 25 \text{ }^\circ\text{C}$ )

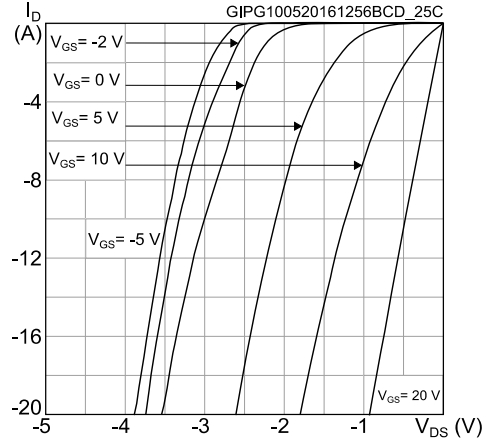
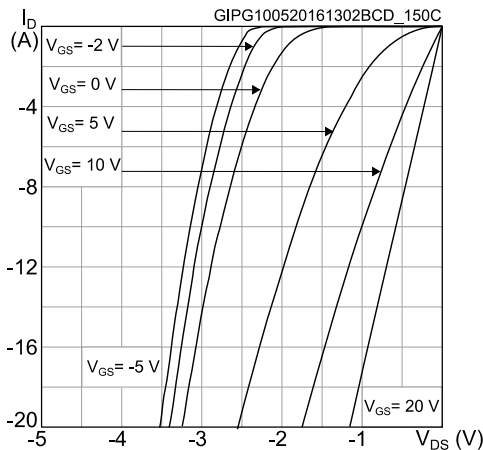


Figure 18: Reverse conduction characteristics ( $T_J = 150 \text{ }^\circ\text{C}$ )



### 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](http://www.st.com). ECOPACK® is an ST trademark.

#### 3.1 HiP247™ package information

Figure 19: HiP247™ package outline

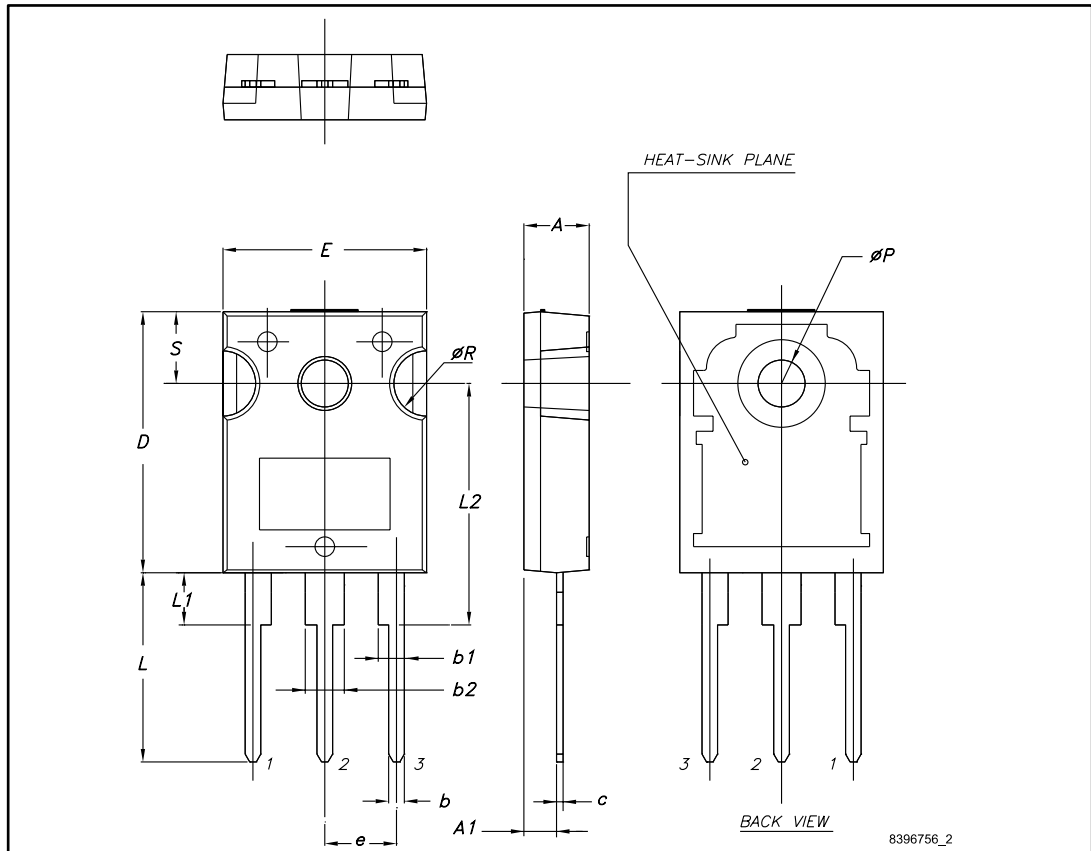




Table 8: HiP247™ package mechanical data

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 <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<sub>J</sub> = -50 °C)"</i> , <i>Figure 17: "Reverse conduction characteristics (T<sub>J</sub> = 25 °C)"</i> and <i>Figure 18: "Reverse conduction characteristics (T<sub>J</sub> = 150 °C)"</i> Updated <i>Section 3: "Package information"</i> Minor text changes.

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