

## Silicon carbide Power MOSFET: 20 A, 1200 V, 189 mΩ (typ., T<sub>J</sub>=150 °C), N-channel in a HiP247™

Datasheet - production data

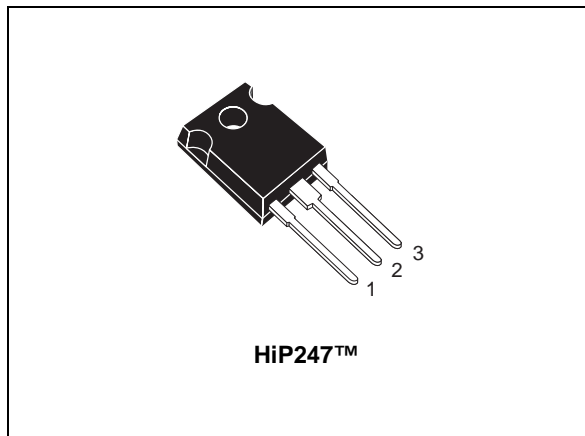
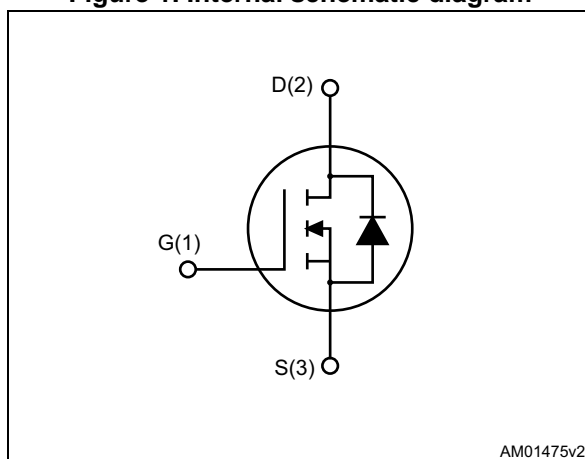


Figure 1. Internal schematic diagram



### Features

- Very tight variation of on-resistance vs. temperature
- Slight variation of switching losses vs. temperature
- Very high operating temperature capability (200 °C)
- Very fast and robust intrinsic body diode
- Low capacitance
- Easy to drive

### 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, combined with the device's housing in the proprietary HiP247™ package, 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
SCT20N120	SCT20N120	HiP247™	Tube

*Note:* The device meets ECOPACK standards, an environmentally-friendly grade of products commonly referred to as "halogen-free". See [Section 4: Package mechanical data](#).

# Contents

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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/+25	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ °C}$	20	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ °C}$	16	A
$I_{DM}^{(1)}$	Drain current (pulsed)	45	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	175	W
$T_{stg}$	Storage temperature	-55 to 200	°C
$T_j$	Operating junction temperature		°C

1. Pulse width limited by safe operating area.

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case max	1	°C/W
Rthj-amb	Thermal resistance junction-ambient max	40	°C/W

## 2 Electrical characteristics

(T<sub>CASE</sub> = 25 °C unless otherwise specified).

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = 1200 V			100	μA
		V <sub>DS</sub> = 1200 V, T <sub>J</sub> = 200 °C		50		μA
I <sub>GSS</sub>	Gate-body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = +22 /-10 V			100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1 mA	2	3.5		V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 20 V, I <sub>D</sub> = 10 A		169	239	mΩ
		V <sub>GS</sub> = 20 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 150 °C		189		mΩ
		V <sub>GS</sub> = 20 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 200 °C		220		mΩ

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance		-	650	-	pF
C <sub>oss</sub>	Output capacitance	V <sub>DS</sub> = 400 V, f = 1 MHz, V <sub>GS</sub> = 0	-	65	-	pF
C <sub>rss</sub>	Reverse transfer capacitance		-	14	-	pF
Q <sub>g</sub>	Total gate charge		-	45	-	nC
Q <sub>gs</sub>	Gate-source charge	V <sub>DD</sub> = 800 V, I <sub>D</sub> = 10 A, V <sub>GS</sub> = 0 / 20 V	-	7	-	nC
Q <sub>gd</sub>	Gate-drain charge		-	11.7	-	nC
R <sub>g</sub>	Gate input resistance	f=1 MHz open drain	-	7	-	Ω

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching losses	$V_{DD} = 800\text{ V}$ , $I_D = 10\text{ A}$	-	160	-	$\mu\text{J}$
$E_{off}$	Turn-off switching losses	$R_G = 6.8\ \Omega$ , $V_{GS} = -2/20\text{ V}$	-	90	-	$\mu\text{J}$
$E_{on}$	Turn-on switching losses	$V_{DD} = 800\text{ V}$ , $I_D = 10\text{ A}$	-	165	-	$\mu\text{J}$
$E_{off}$	Turn-off switching losses	$R_G = 6.8\ \Omega$ , $V_{GS} = -2/20\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$	-	100	-	$\mu\text{J}$

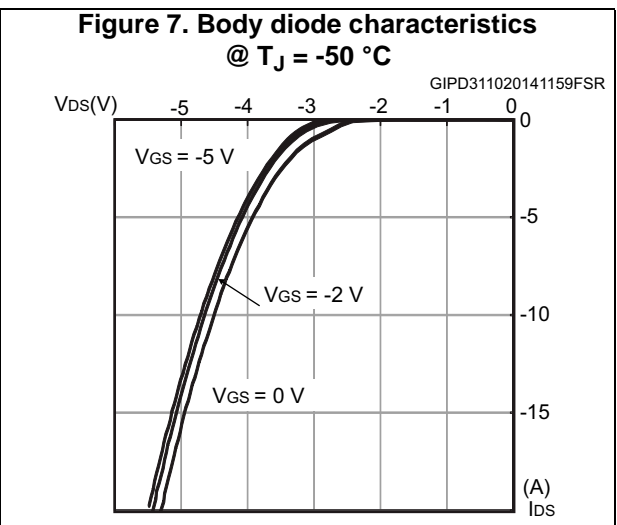
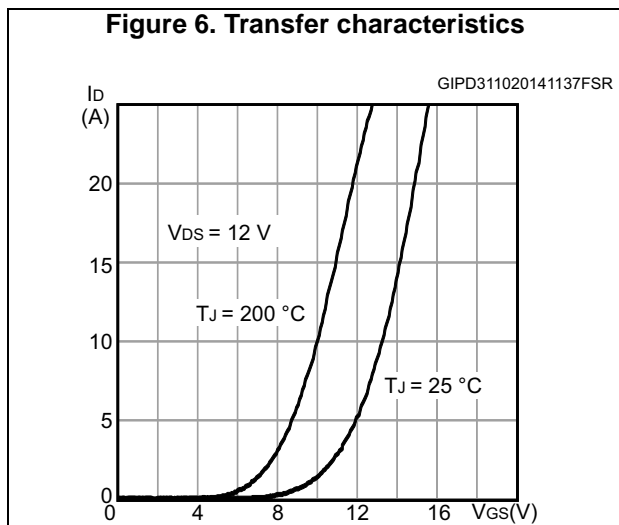
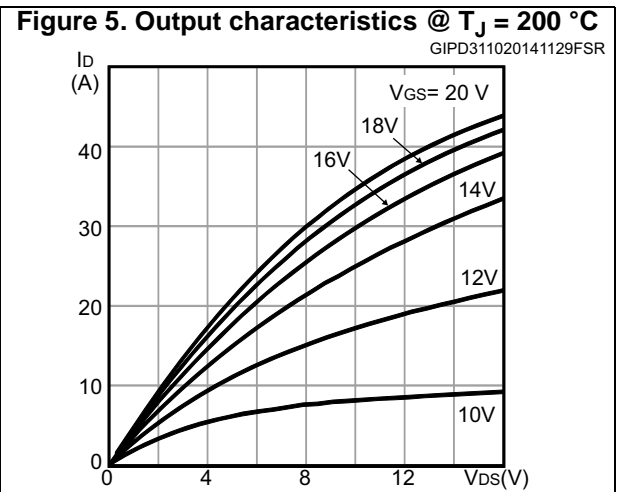
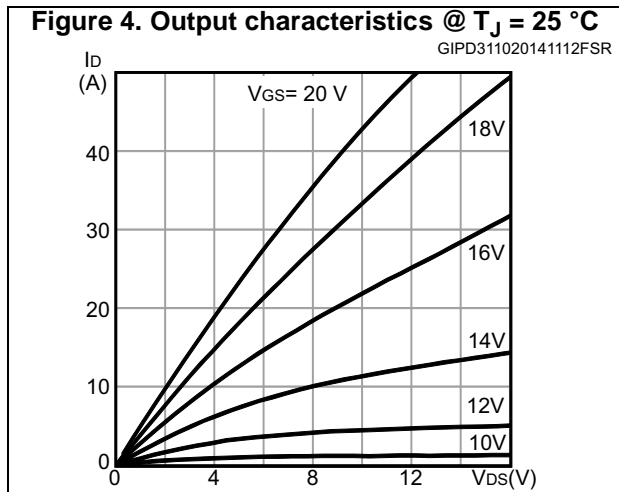
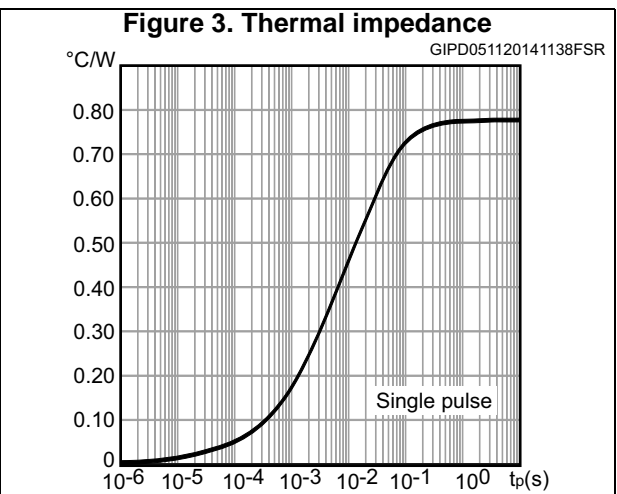
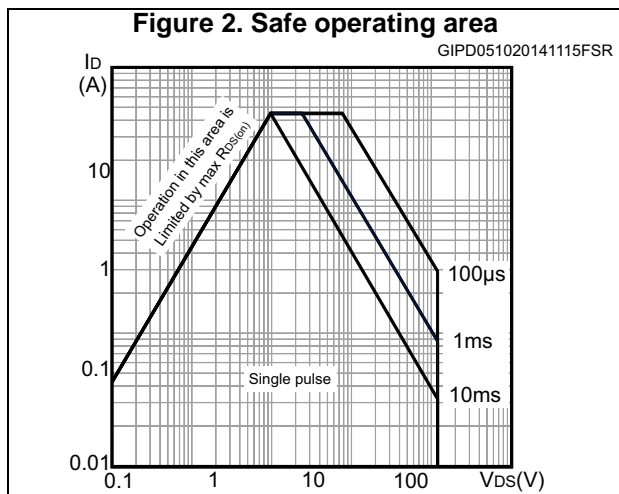
Table 7. Switching times

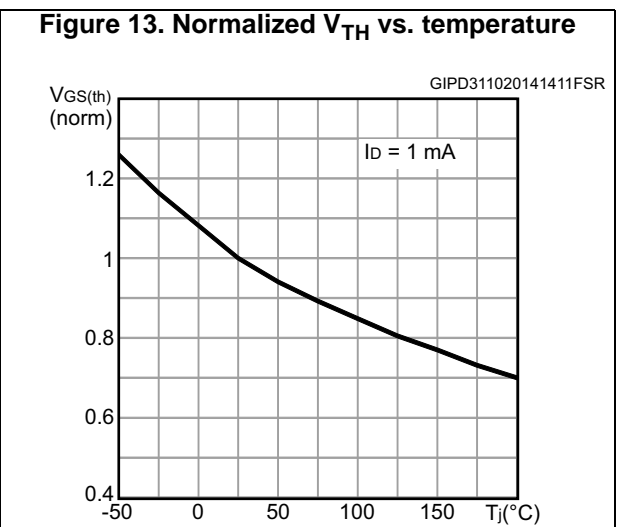
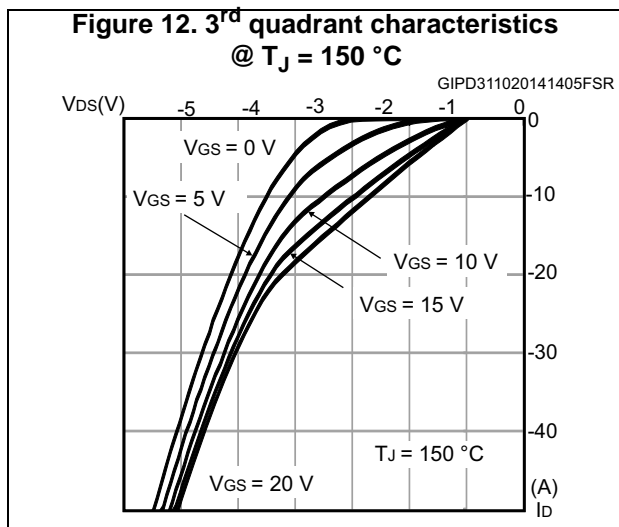
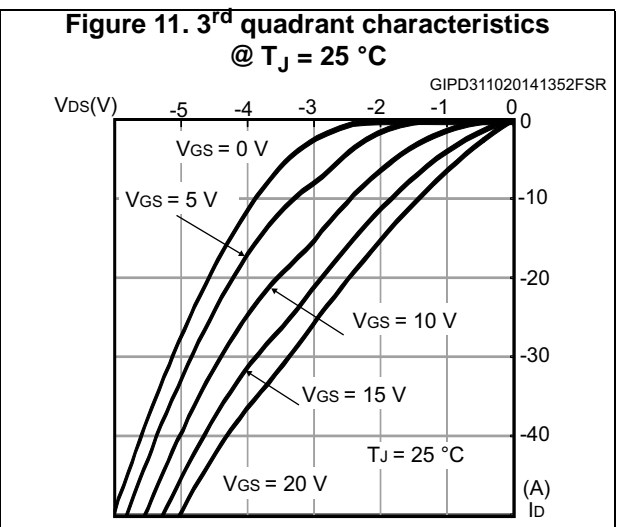
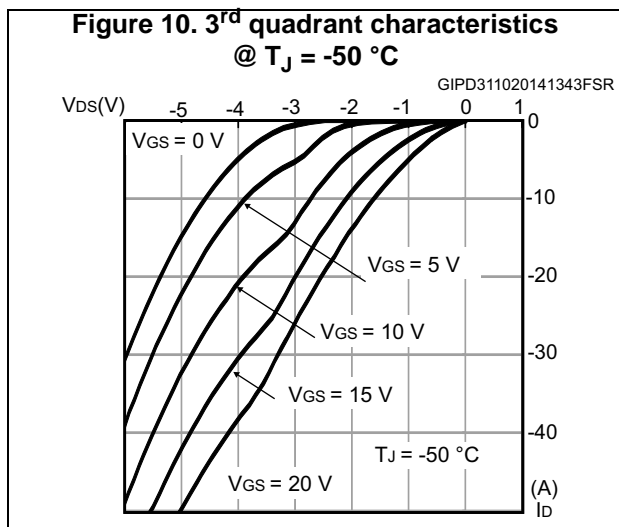
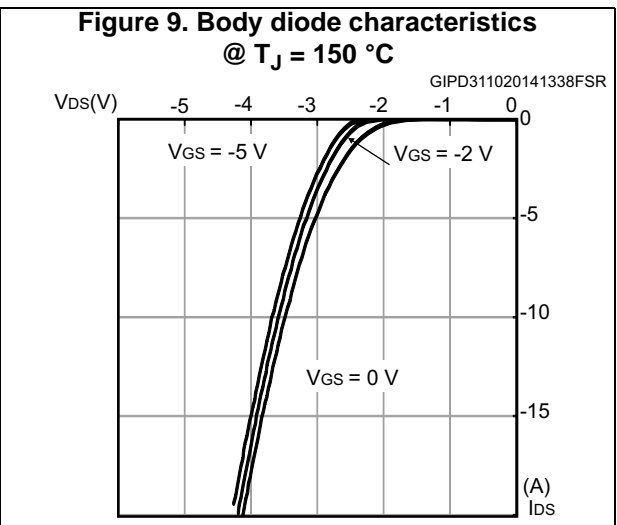
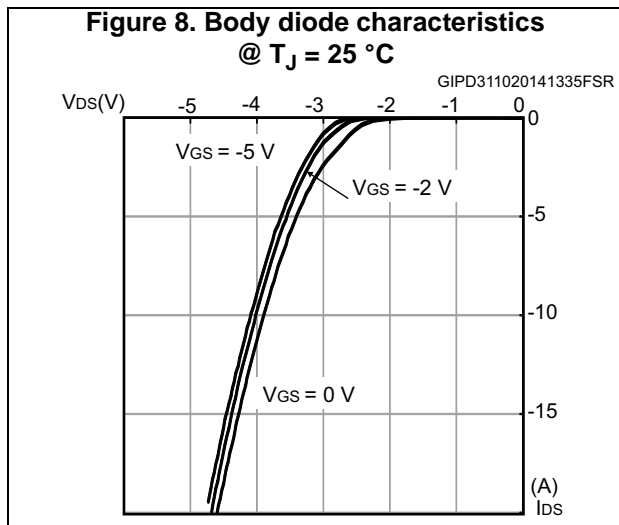
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)V}$	Turn-on delay time	$V_{DD} = 800\text{ V}$ , $I_D = 10\text{ A}$ , $R_G = 0\ \Omega$ , $V_{GS} = 0/20\text{ V}$	-	10	-	ns
$t_f(V)$	Fall time		-	17	-	ns
$t_{d(off)V}$	Turn-off delay time		-	27	-	ns
$t_r(V)$	Rise time		-	16	-	ns

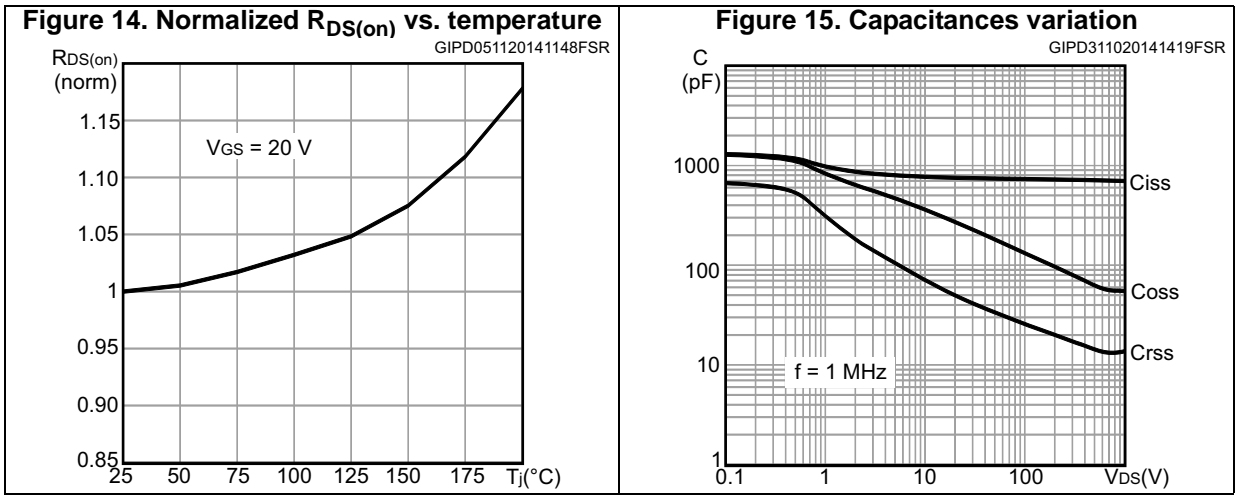
Table 8. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Diode forward voltage	$I_F = 5\text{ A}$ , $V_{GS} = -5\text{ V}$	-	3.6	-	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 10\text{ A}$ , $V_{GS} = -5\text{ V}$ , $V_R = 800\text{ V}$ , $dif/dt = 1650\text{ A}/\mu\text{s}$	-	15	-	ns
$Q_{rr}$	Reverse recovery charge		-	75	-	nC
$I_{rrm}$	Peak reverse recovery current		-	8	-	A

## 2.1 Electrical characteristics (curves)



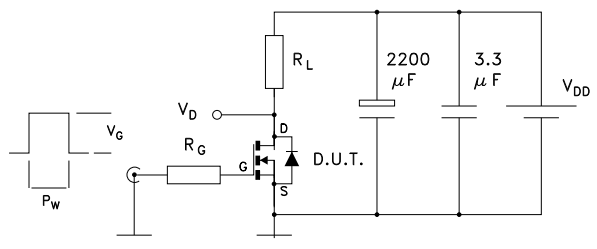






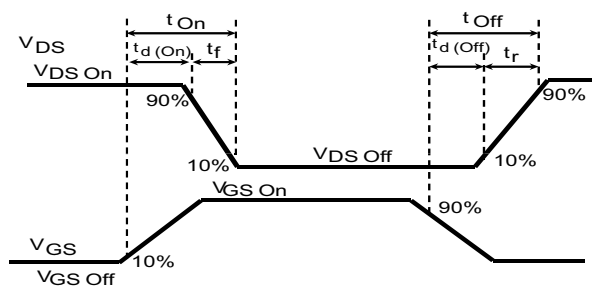
### 3 Test circuits

Figure 16. Switching test waveforms for transition times



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Figure 17. Clamped inductive switching waveform

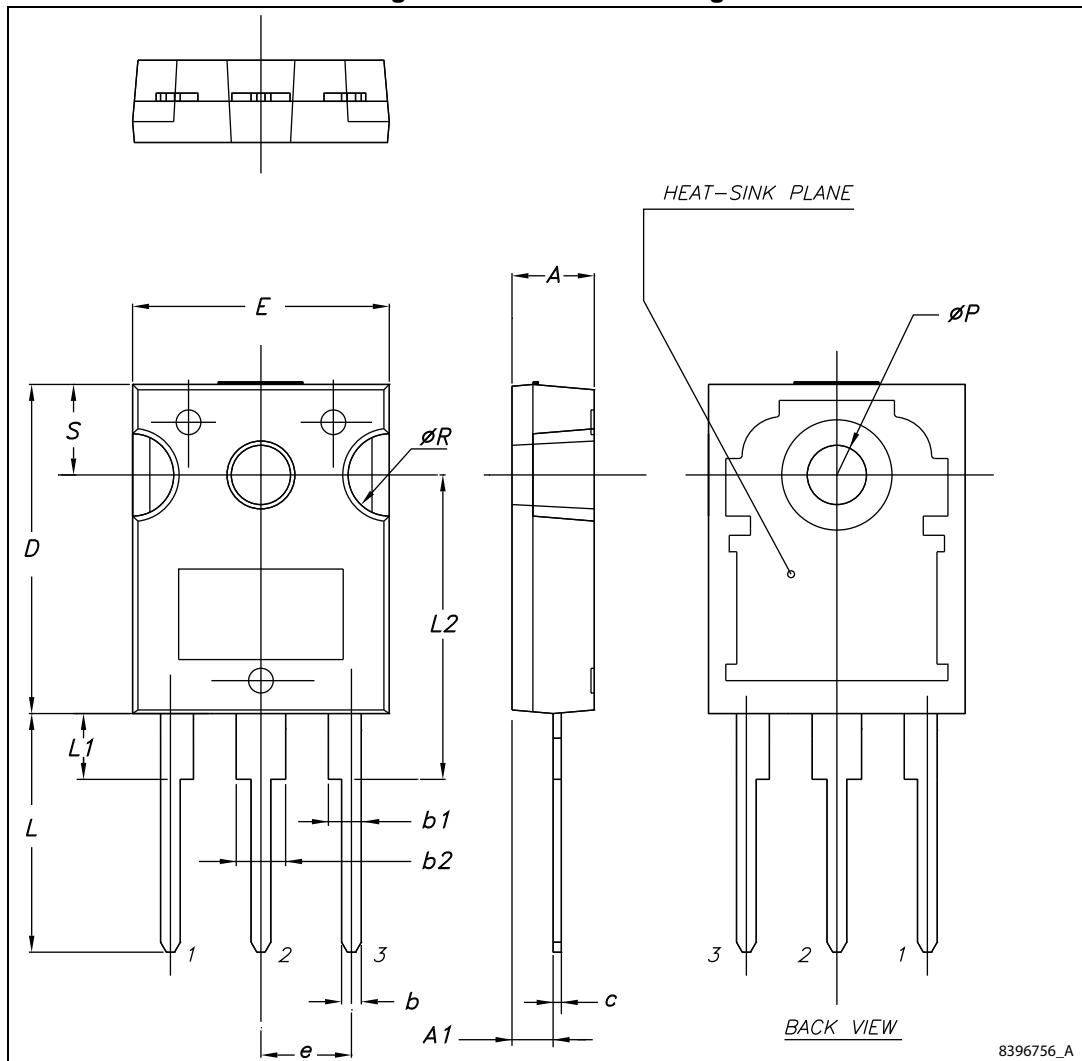


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## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Figure 18. HiP247™ drawing



8396756\_A

Table 9. HiP247™ 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

## 5 Revision history

**Table 10. Document revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
07-Nov-2014	1	First release
17-Feb-2015	2	Updated title in cover page.
20-Feb-2015	3	Updated Figure 3: Thermal impedance. Minor text changes.
17-Dec-2015	4	Updated title in cover page and <a href="#">Table 4: On/off states</a> .

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