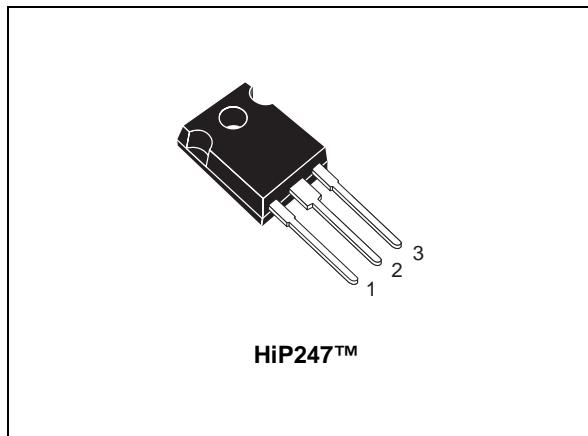
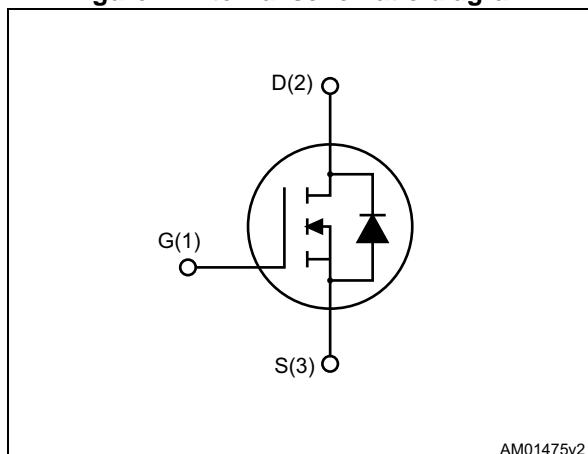


## Silicon carbide Power MOSFET: 20 A, 1200 V, 189 mΩ (typ., T<sub>J</sub>=150 °C), N-channel in a HiP247™

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**

<b>Symbol</b>	<b>Parameter</b>	<b>Value</b>	<b>Unit</b>
$V_{DS}$	Drain-source voltage	1200	V
$V_{GS}$	Gate-source voltage	-10/+25	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	20	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	16	A
$I_{DM}^{(1)}$	Drain current (pulsed)	45	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	175	W
$T_{stg}$	Storage temperature	-55 to 200	${}^\circ\text{C}$
$T_j$	Operating junction temperature		${}^\circ\text{C}$

1. Pulse width limited by safe operating area.

**Table 3. Thermal data**

<b>Symbol</b>	<b>Parameter</b>	<b>Value</b>	<b>Unit</b>
Rthj-case	Thermal resistance junction-case max	1	${}^\circ\text{C}/\text{W}$
Rthj-amb	Thermal resistance junction-ambient max	40	${}^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 1200 \text{ V}$ $V_{DS} = 1200 \text{ V}, T_J = 200^\circ\text{C}$		50	100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = +22 / -10 \text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1 \text{ mA}$	2	3.5		V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 20 \text{ V}, I_D = 10 \text{ A}$		169	239	$\text{m}\Omega$
		$V_{GS} = 20 \text{ V}, I_D = 10 \text{ A}, T_J = 150^\circ\text{C}$		189		$\text{m}\Omega$
		$V_{GS} = 20 \text{ V}, I_D = 10 \text{ A}, T_J = 200^\circ\text{C}$		220		$\text{m}\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 400 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0$	-	650	-	pF
$C_{oss}$	Output capacitance		-	65	-	pF
$C_{rss}$	Reverse transfer capacitance		-	14	-	pF
$Q_g$	Total gate charge	$V_{DD} = 800 \text{ V}, I_D = 10 \text{ A}, V_{GS} = 0 / 20 \text{ V}$	-	45	-	nC
$Q_{gs}$	Gate-source charge		-	7	-	nC
$Q_{gd}$	Gate-drain charge		-	11.7	-	nC
$R_g$	Gate input resistance	$f=1 \text{ MHz}$ open drain	-	7	-	$\Omega$

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

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

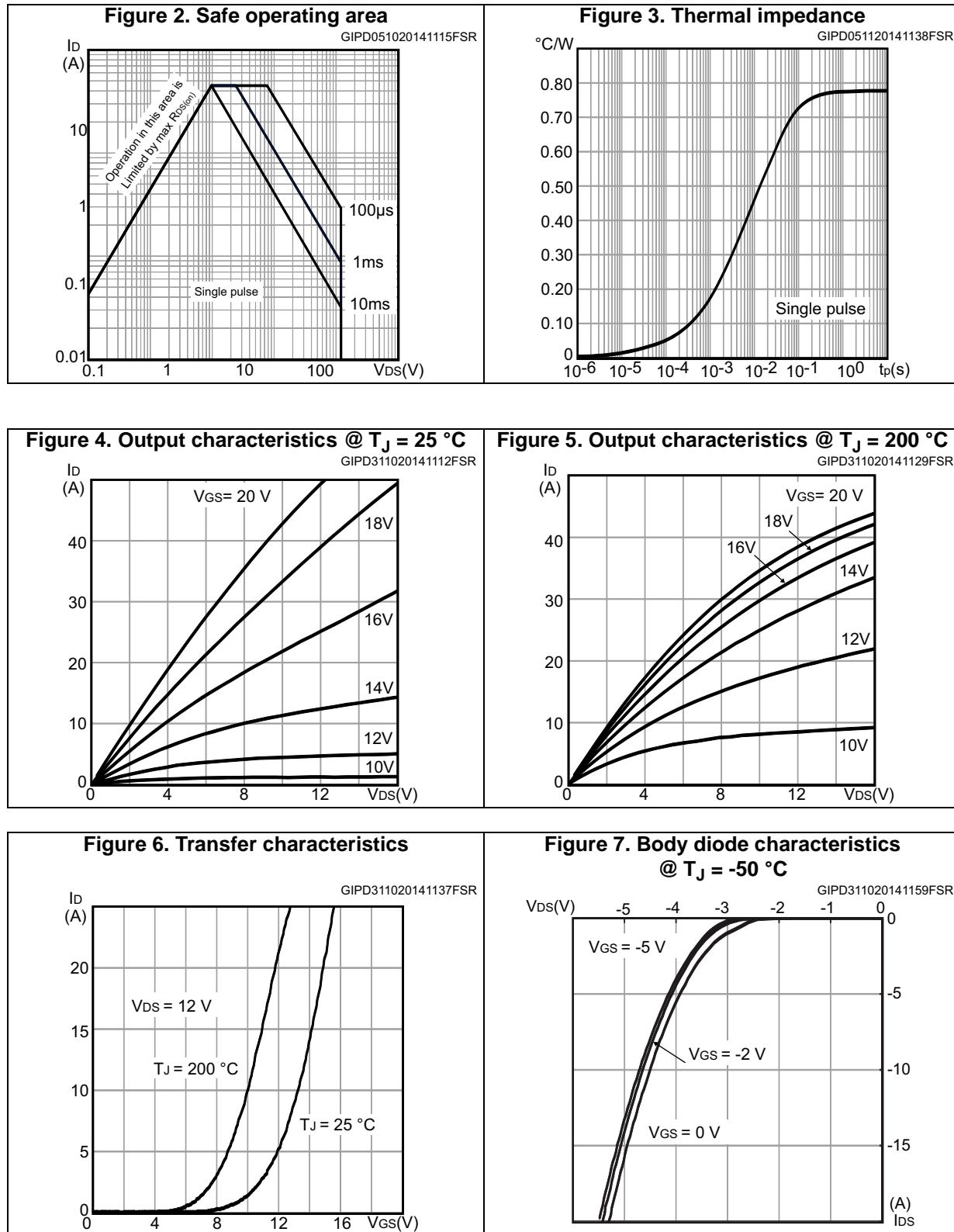
**Table 7. Switching times**

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

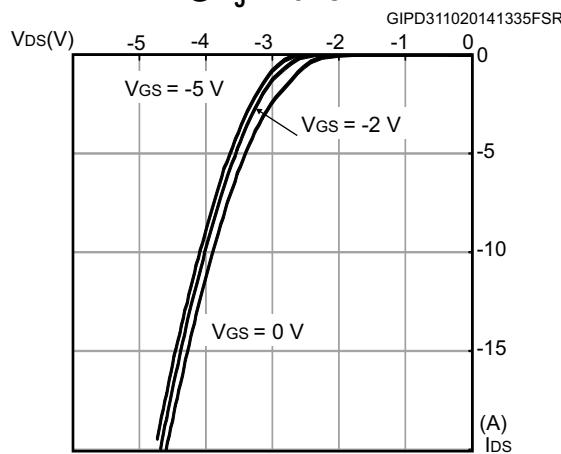
**Table 8. Reverse SiC diode characteristics**

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

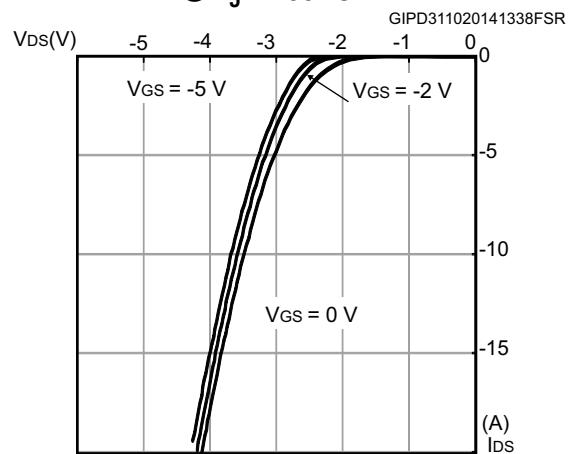
## 2.1 Electrical characteristics (curves)



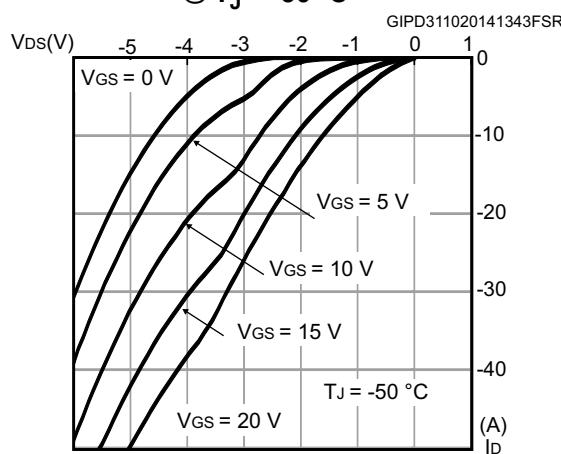
**Figure 8. Body diode characteristics  
@  $T_J = 25^\circ\text{C}$**



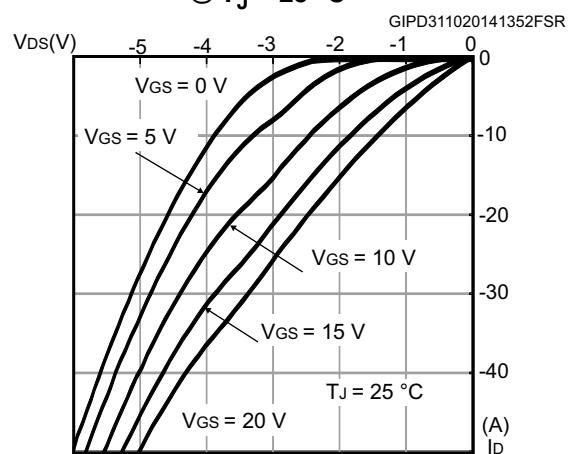
**Figure 9. Body diode characteristics  
@  $T_J = 150^\circ\text{C}$**



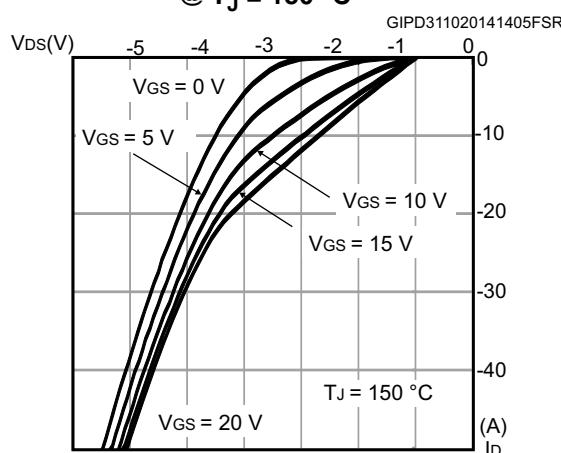
**Figure 10. 3<sup>rd</sup> quadrant characteristics  
@  $T_J = -50^\circ\text{C}$**



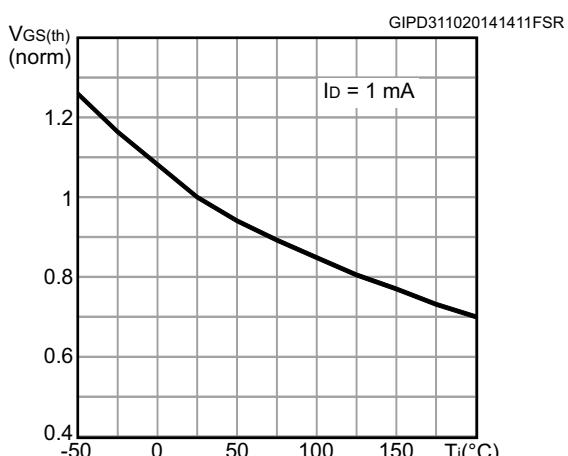
**Figure 11. 3<sup>rd</sup> quadrant characteristics  
@  $T_J = 25^\circ\text{C}$**

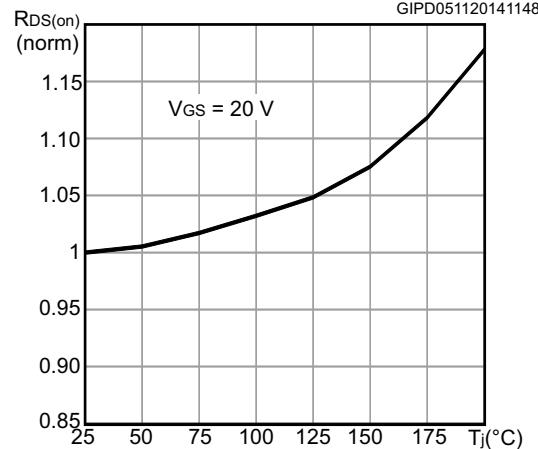
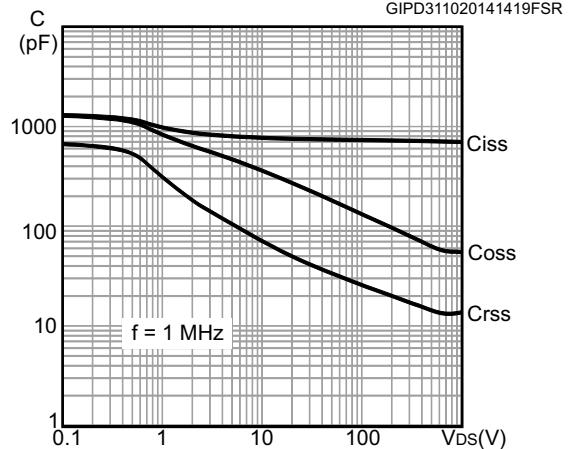


**Figure 12. 3<sup>rd</sup> quadrant characteristics  
@  $T_J = 150^\circ\text{C}$**



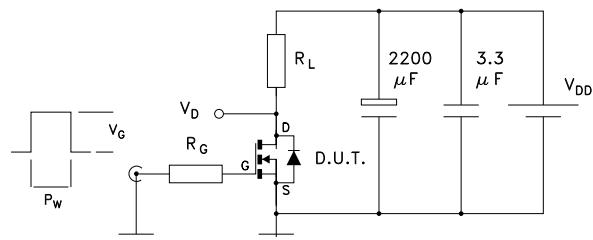
**Figure 13. Normalized  $V_{TH}$  vs. temperature**



**Figure 14. Normalized  $R_{DS(on)}$  vs. temperature****Figure 15. Capacitances variation**

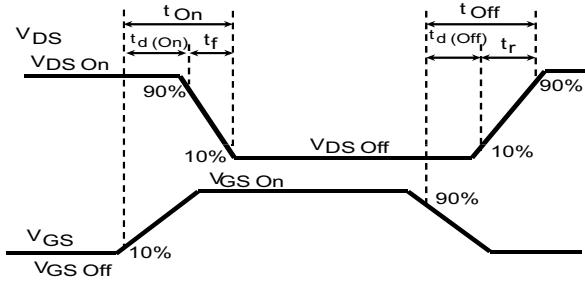
### 3 Test circuits

**Figure 16. Switching test waveforms for transition times**



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**Figure 17. Clamped inductive switching waveform**

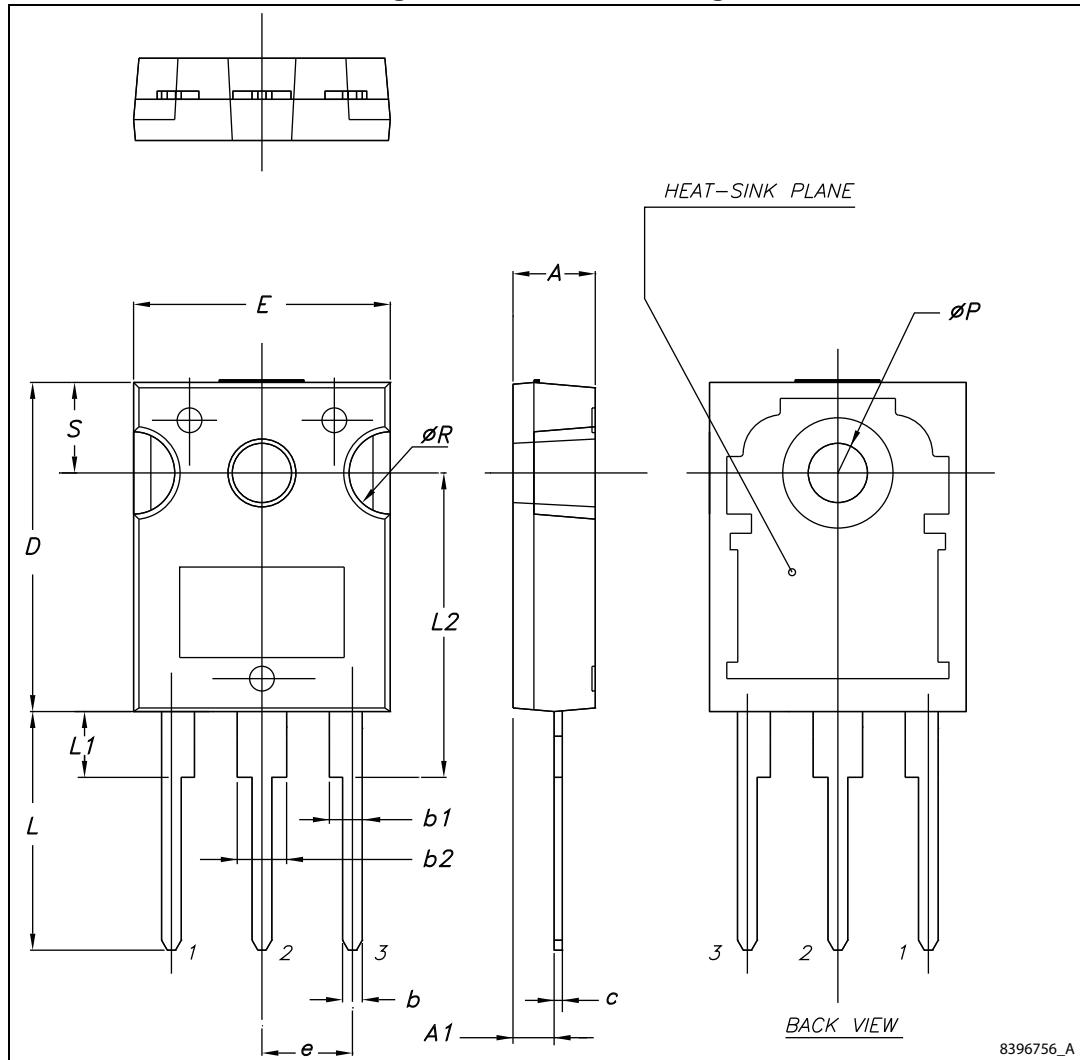


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## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® 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.

Figure 18. HiP247™ drawing



**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**

Date	Revision	Changes
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 <i>Table 4: On/off states</i> .

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