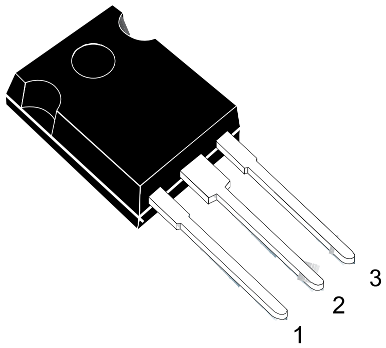
ST(意法) SCT30N120 PDF

深圳创唯电子有限公司

SCT30N120

Silicon carbide Power MOSFET 1200 V, 45 A, 90 mΩ (typ., T_J = 150 °C) in an HiP247™ package

Datasheet - production data



HiP247™

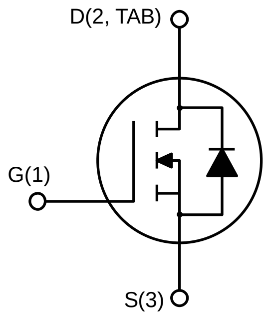
Features

- 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 supply

Figure 1: Internal schematic diagram



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
SCT30N120	SCT30N120	HiP247™	Tube

Contents

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 °C (limited by die)	45	A
I_D	Drain current (continuous) at T_C = 25 °C (limited by package)	40	A
I_D	Drain current (continuous) at T_C = 100 °C	34	A
I_{DM} [(1)]	Drain current (pulsed)	90	A
P_{TOT}	Total dissipation at T_C = 25 °C	270	W
T_{stg}	Storage temperature range	-55 to 200	°C
T_j	Operating junction temperature range		°C

Notes:

[(1)]Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.65	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	40	°C/W

2 Electrical characteristics

(T_{CASE} = 25 °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	25	µA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 200 °C		50		µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V; V_{GS} = -10 to 22 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 1 mA	1.8	3.5		V
$R_{DS(on)}$	Static drain-source on- resistance	V_{GS} = 20 V, I_D = 20 A		80	100	mΩ
		V_{GS} = 20 V, I_D = 20 A, T_J = 150 °C		90		mΩ
		V_{GS} = 20 V, I_D = 20 A, T_J = 200 °C		100		mΩ

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 400 V, f = 1 MHz, V_{GS} = 0 V	-	1700	-	pF
C_{oss}	Output capacitance		-	130	-	pF
C_{rss}	Reverse transfer capacitance		-	25	-	pF
Q_g	Total gate charge	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0 to 20 V	-	105	-	nC
Q_{gs}	Gate-source charge		-	16	-	nC
Q_{gd}	Gate-drain charge		-	40	-	nC
R_g	Gate input resistance	f=1 MHz open drain	-	5	-	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 = 20 A, R_G = 6.8 Ω, V_{GS} = -2 to 20 V	-	500	-	µJ
E_{off}	Turn-off switching energy		-	350	-	µJ
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 20 A, R_G = 6.8 Ω, V_{GS} = -2 to 20 V T_J = 150 °C	-	500	-	µJ
E_{off}	Turn-off switching energy		-	400	-	µJ

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 800 V, I_D = 20 A, R_G = 0 Ω, V_{GS} = 0 to 20 V	-	19	-	ns
t_f	Fall time		-	28	-	ns
$t_{d(off)}$	Turn-off delay time		-	45	-	ns
t_r	Rise time		-	20	-	ns

Table 8: Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V_{SD}	Diode forward voltage	I_F = 10 A, V_{GS} = 0 V	-	3.5	-	V
t_{rr}	Reverse recovery time	I_{SD} = 20 A, di/dt = 100 A/µs V_{DD} = 800 V	-	140		ns
Q_{rr}	Reverse recovery charge		-	140	-	nC
I_{RRM}	Reverse recovery current		-	2	-	A

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

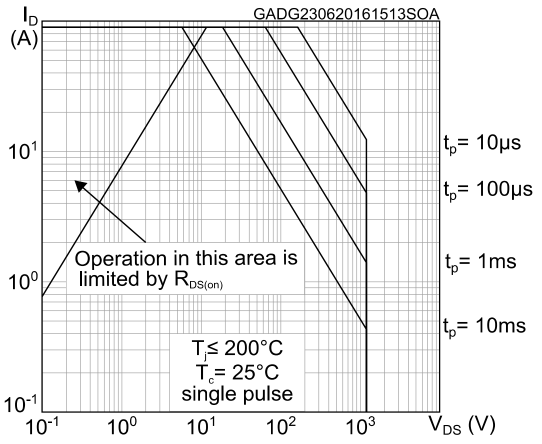


Figure 3: Thermal impedance

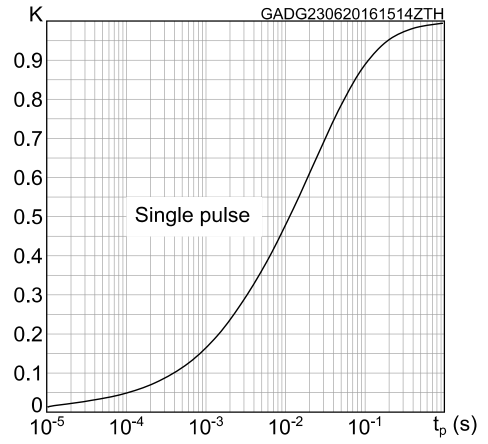


Figure 4: Output characteristics (T_J = 25 °C)

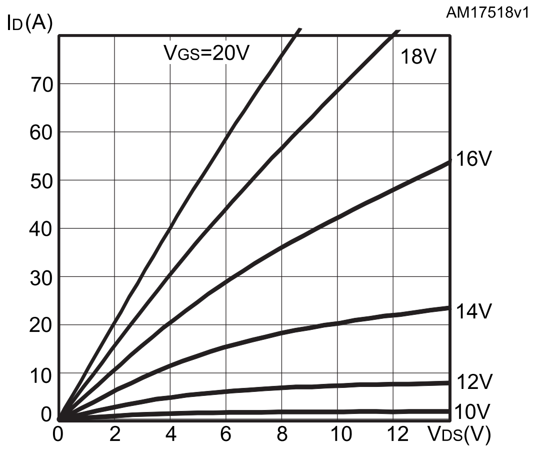


Figure 5: Output characteristics (T_J = 150 °C)

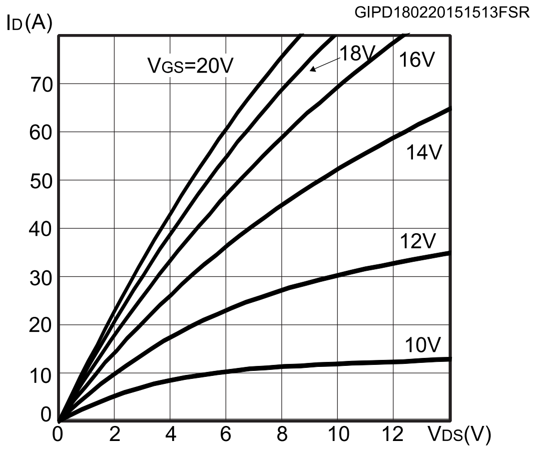


Figure 6: Output characteristics (T_J = 200 °C)

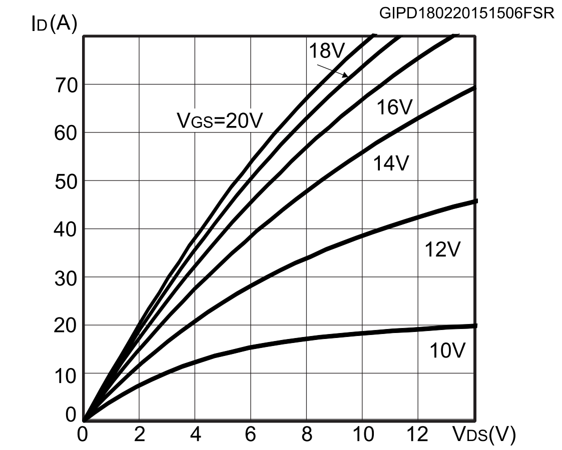


Figure 7: Transfer characteristics

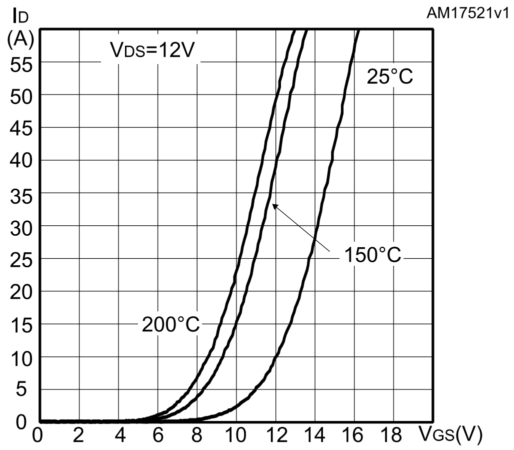


Figure 8: Power dissipation

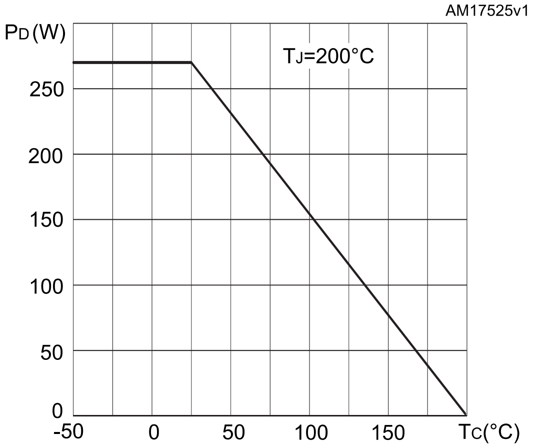


Figure 9: Gate charge vs gate-source voltage

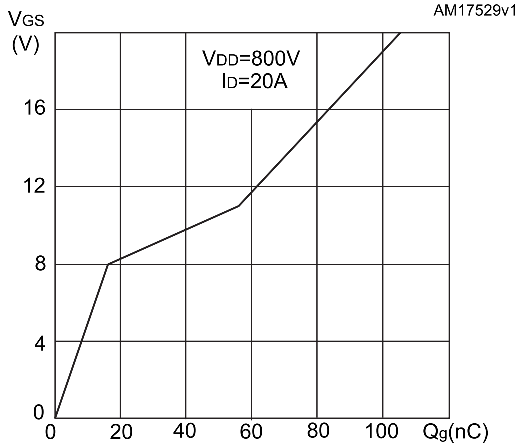


Figure 10: Capacitance variations

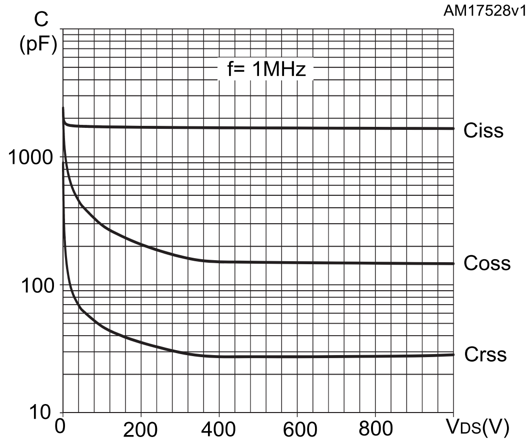


Figure 11: Switching energy vs. drain current

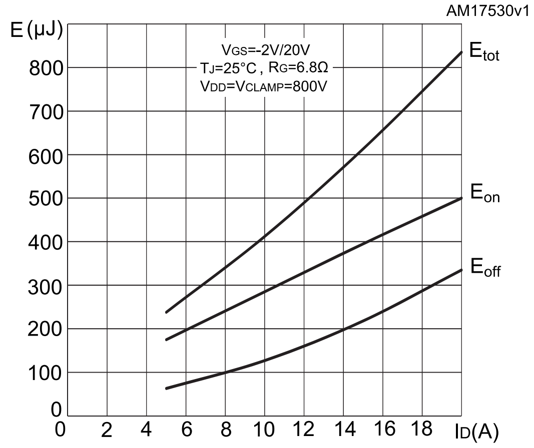


Figure 12: Switching energy vs. junction temperature

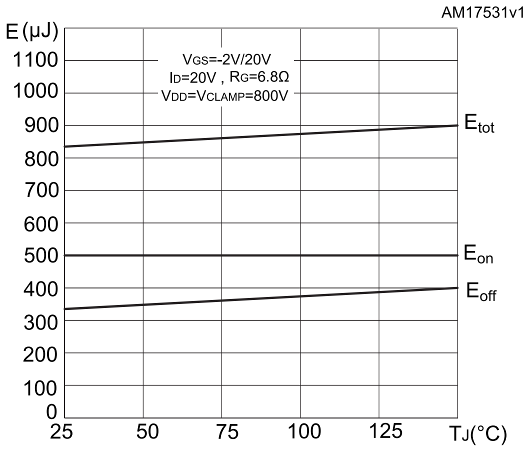


Figure 13: Normalized $V_{(BR)DSS}$ vs. temperature

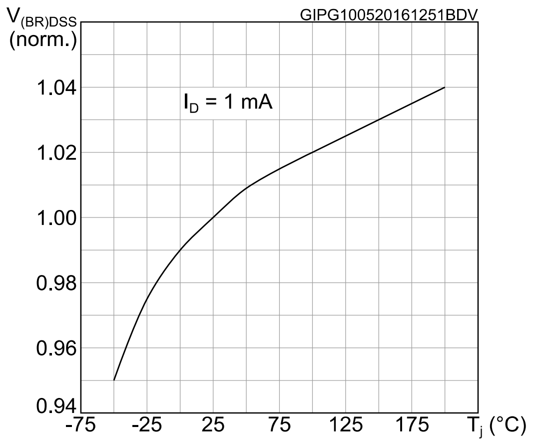


Figure 14: Normalized gate threshold voltage vs. temperature

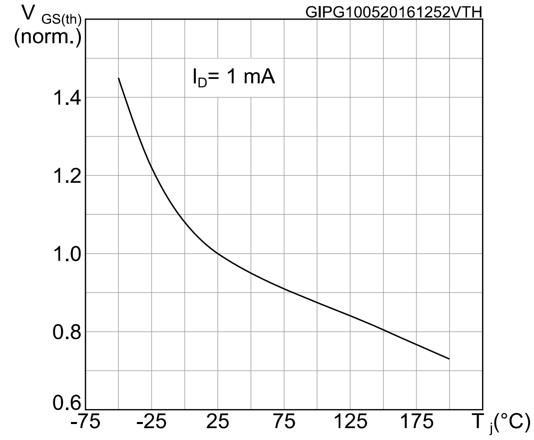


Figure 15: Normalized on-resistance vs. temperature

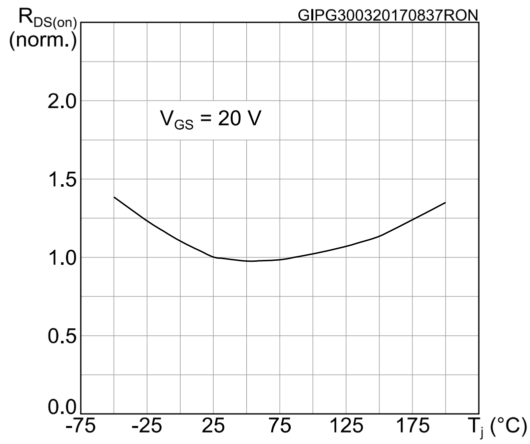


Figure 16: Body diode characteristics (T_J = -50 °C)

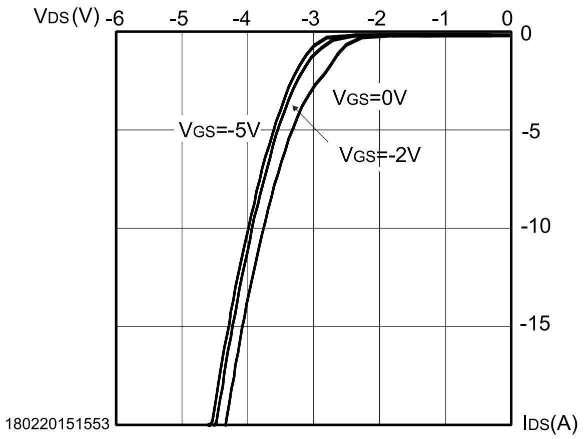


Figure 17: Body diode characteristics (T_J = 25 °C)

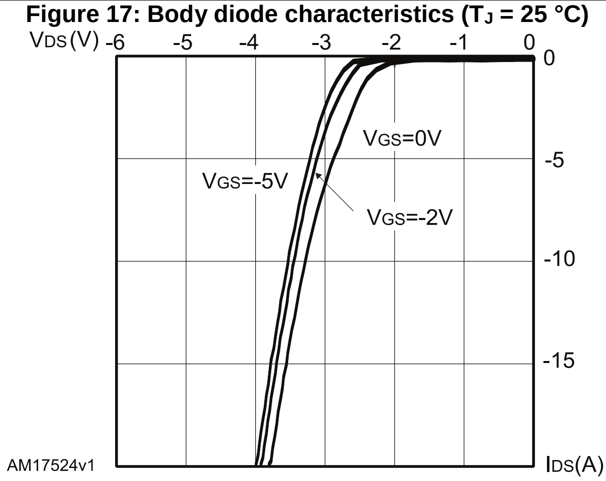


Figure 18: Body diode characteristics (T_J = 150 °C)

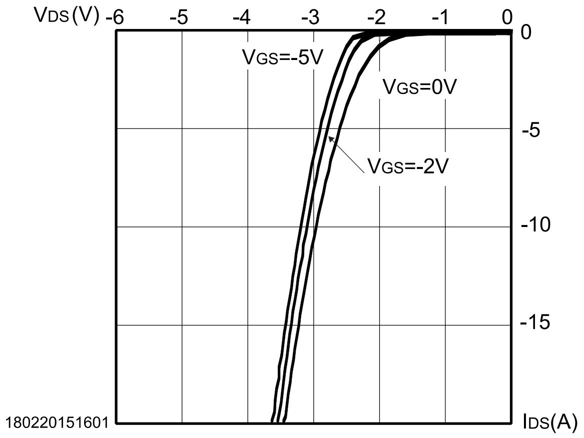


Figure 19: 3rd quadrant characteristics (T_J = -50 °C)

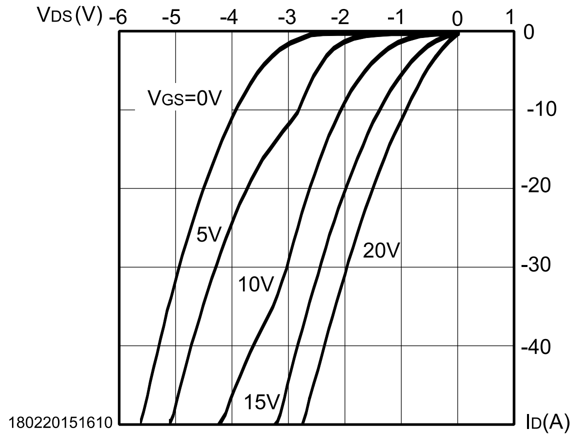


Figure 20: 3rd quadrant characteristics (T_J = 25 °C)

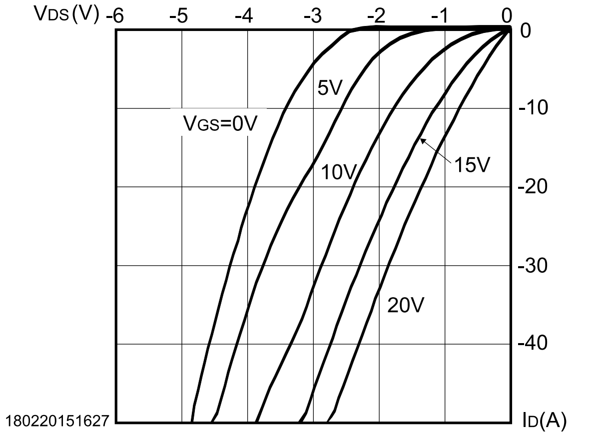
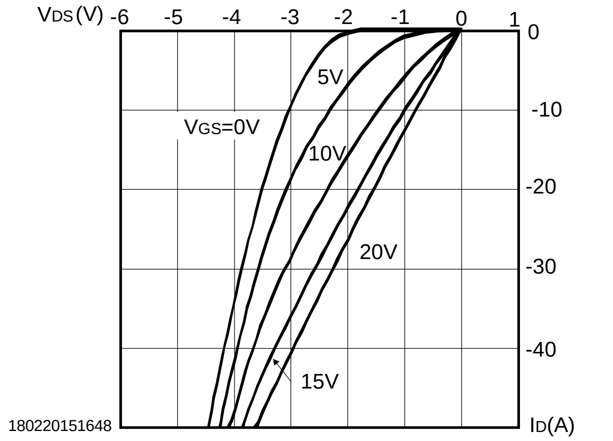


Figure 21: 3rd quadrant characteristics (T_J = 150 °C)



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***. ECOPACK® is an ST trademark.

3.1 HiP247 package information

Figure 22: HiP247™ package outline

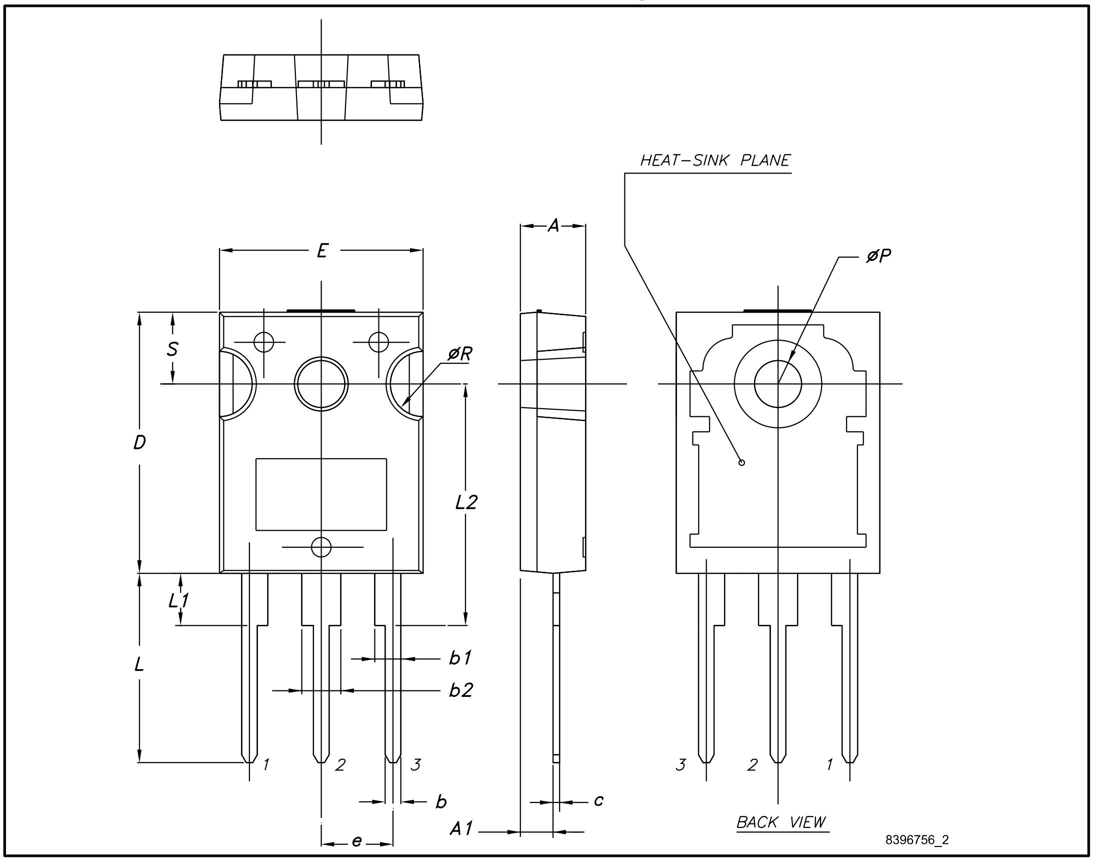


Table 9: HiP247™ package mechanical data

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 10: Document revision history

Date	Revision	Changes
10-May-2012	1	First release
21-May-2013	2	Updated trr value in Table8. Updated dynamic parameters in Table5, VGS(th) in Table4 and Eon in Table6.
24-Jun-2013	3	Document status promoted from target to preliminary data. Added: Section2.1: Electrical characteristics (curves)
11-Jul-2013	4	Updated Figure6: Output characteristics (TJ=200°C) and Figure7: Transfer characteristics.
18-Dec-2013	5	Updated parameters in Table2: Absolute maximum ratings and Table4: On/off states.
27-May-2014	6	Added Table7: Switching times. Updated Section3: Package mechanical data. Minor text changes.
25-Sep-2014	7	Document status promoted from preliminary to production data.
17-Feb-2015	8	Updated title in cover page.
20-Feb-2015	9	Updated Section2.1: Electrical characteristics (curves).
24-Jul-2016	10	Updated title and features in cover page. Updated *Figure 2: "Safe operating area" and Figure 3: "Thermal impedance"*. Minor text changes.
11-May-2017	11	Updated *Table 4: "On/off states"* and *Section 2.1: "Electrical characteristics (curves)"*. Minor text changes.