

Silicon carbide Power MOSFET: 45 A, 1200 V, 80 mΩ, N-channel in HiP247™ package

Datasheet - production data

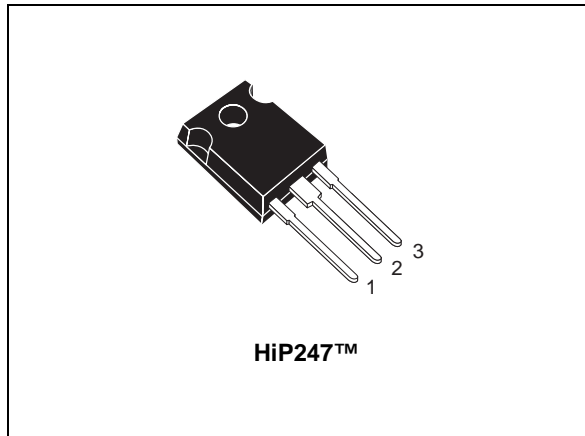
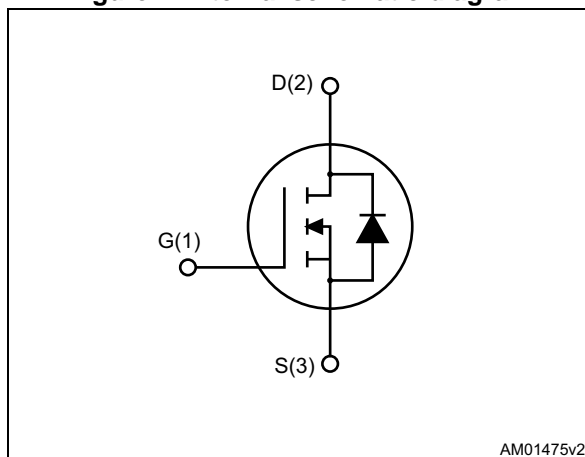


Figure 1. Internal schematic diagram



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 supply

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

Note: The device meets ECOPACK standards, an environmentally-friendly grade of products commonly referred to as "halogen-free". See [Section 3: Package mechanical data](#).

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	1200	V
V_{GS}	Gate-source voltage	-10/+25	V
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$ (limited by die)	45	A
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$ (limited by package)	40	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	34	A
$I_{DM}^{(1)}$	Drain current (pulsed)	90	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	270	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Max. 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	0.65	°C/W
Rthj-amb	Thermal resistance junction-ambient max	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 _{GS} = 0)	V _{DS} = 1200 V		1	100	μA
		V _{DS} = 1200 V, T _J = 200 °C		50		μA
I _{GSS}	Gate-body leakage current (V _{DS} = 0)	V _{GS} = +22 / -10 V			100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 1 mA	1.8	2.6		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		1700		pF
C _{oss}	Output capacitance		-	130	-	pF
C _{riss}	Reverse transfer capacitance			25		pF
Q _g	Total gate charge	V _{DD} = 800 V, I _D = 20 A, V _{GS} = 0 – 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 losses	$V_{DD} = 800\text{ V}$, $I_D = 20\text{ A}$	-	500	-	μJ
E_{off}	Turn-off switching losses	$R_G = 6.8\ \Omega$, $V_{GS} = -2/20\text{ V}$	-	350	-	μJ
E_{on}	Turn-on switching losses	$V_{DD} = 800\text{ V}$, $I_D = 20\text{ A}$	-	500	-	μJ
E_{off}	Turn-off switching losses	$R_G = 6.8\ \Omega$, $V_{GS} = -2/20\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$	-	400	-	μJ

Table 7. Switching times

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

Table 8. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V_{SD}	Diode forward voltage	$I_F = 10\text{ A}$, $V_{GS} = 0$	-	3.5	-	V
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 800\text{ V}$	-	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

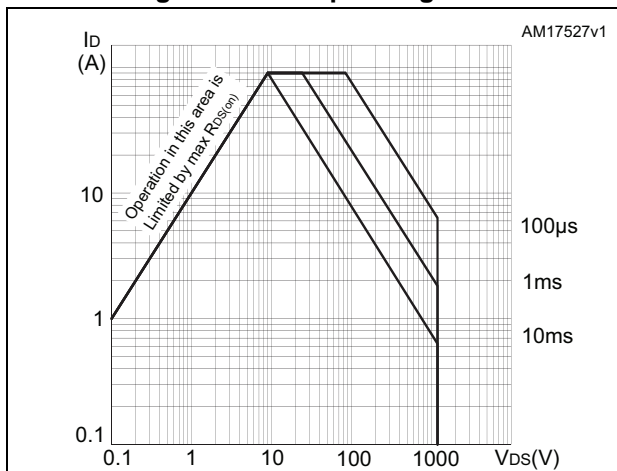


Figure 3. Thermal impedance

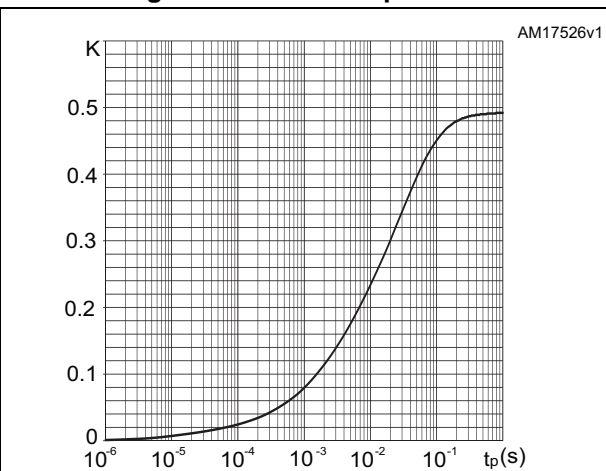


Figure 4. Output characteristics ($T_J=25^\circ\text{C}$)

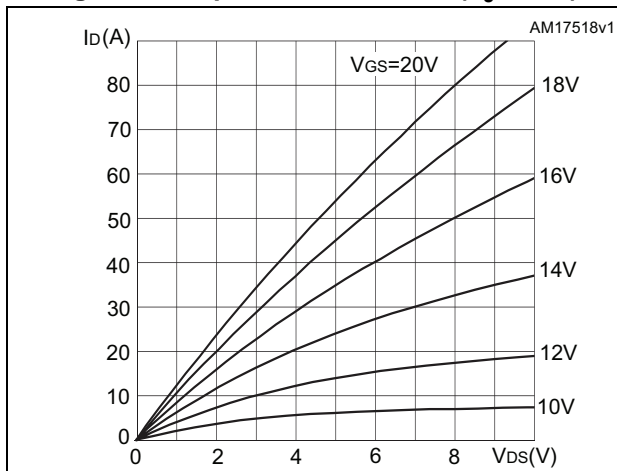


Figure 5. Output characteristics ($T_J=200^\circ\text{C}$)

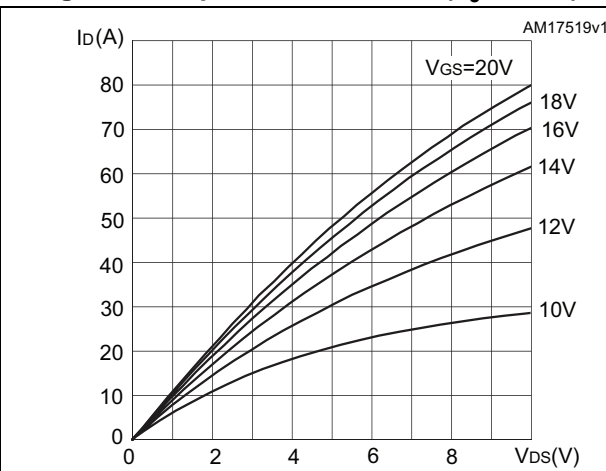


Figure 6. Transfer characteristics

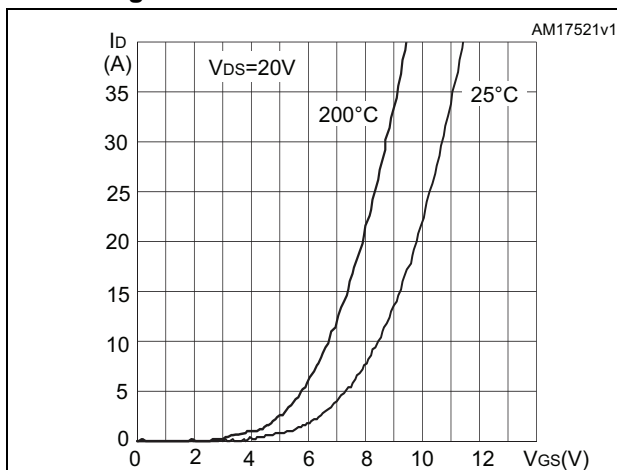


Figure 7. Power dissipation

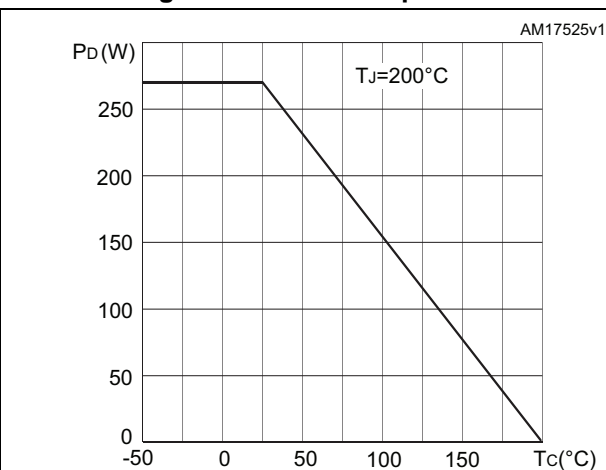


Figure 8. Gate charge vs gate-source voltage

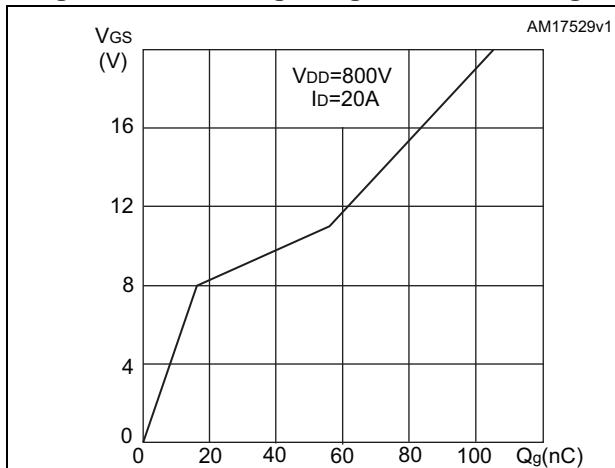


Figure 9. Capacitance variations

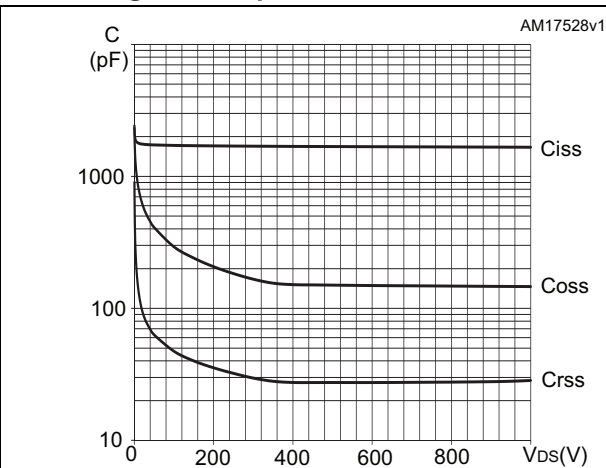


Figure 10. Switching energy vs. drain current

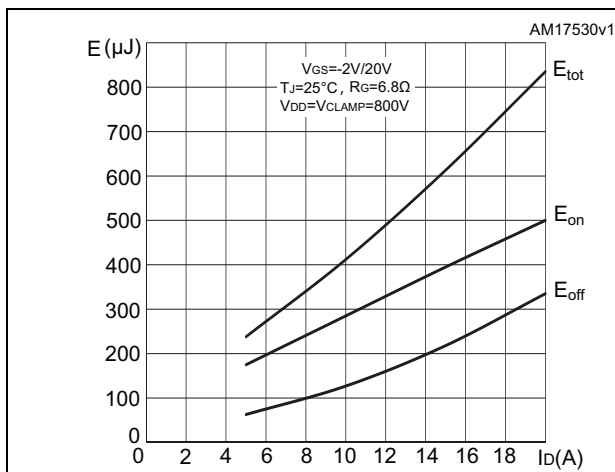


Figure 11. Switching energy vs. junction temperature

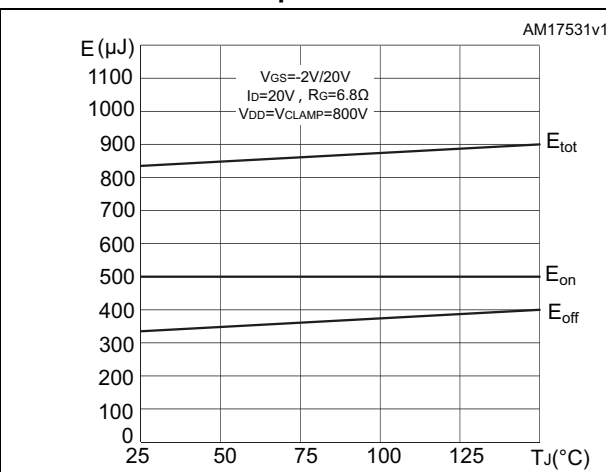


Figure 12. Normalized BV_{DSS} vs. temperature

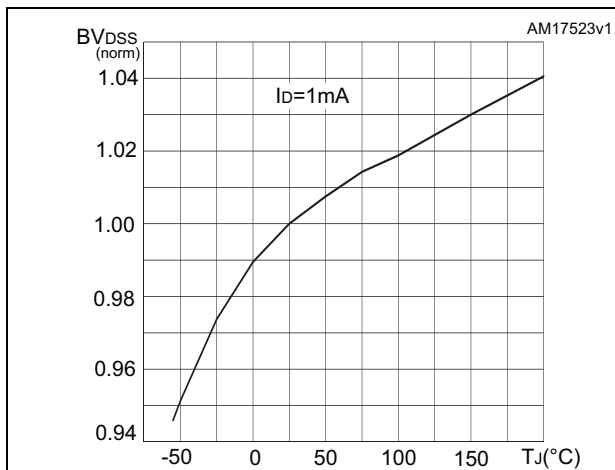


Figure 13. Normalized gate threshold voltage vs. temperature

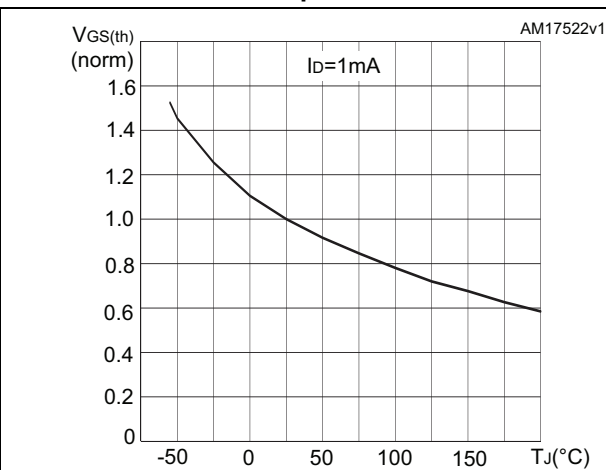


Figure 14. Normalized on-resistance vs. temperature

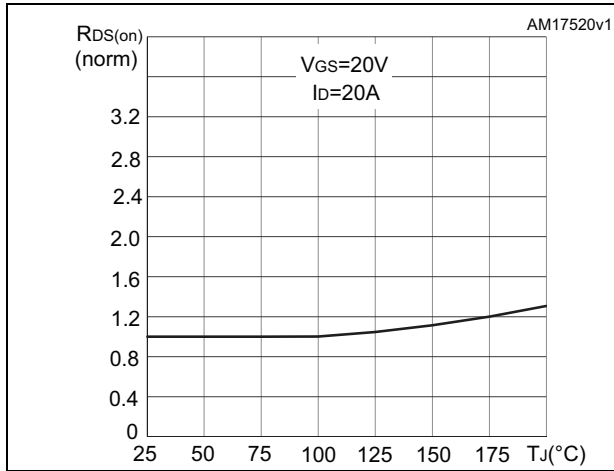
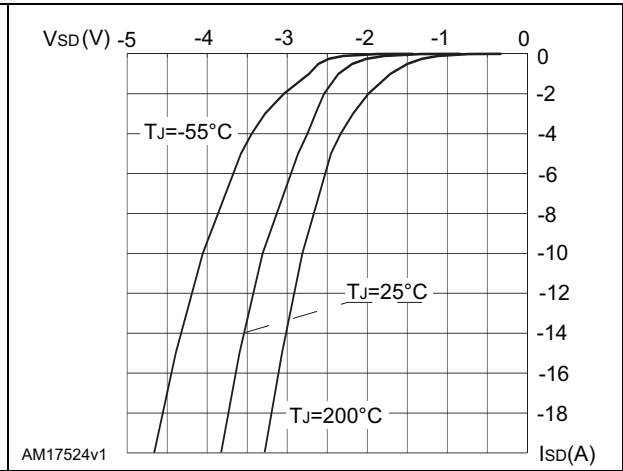


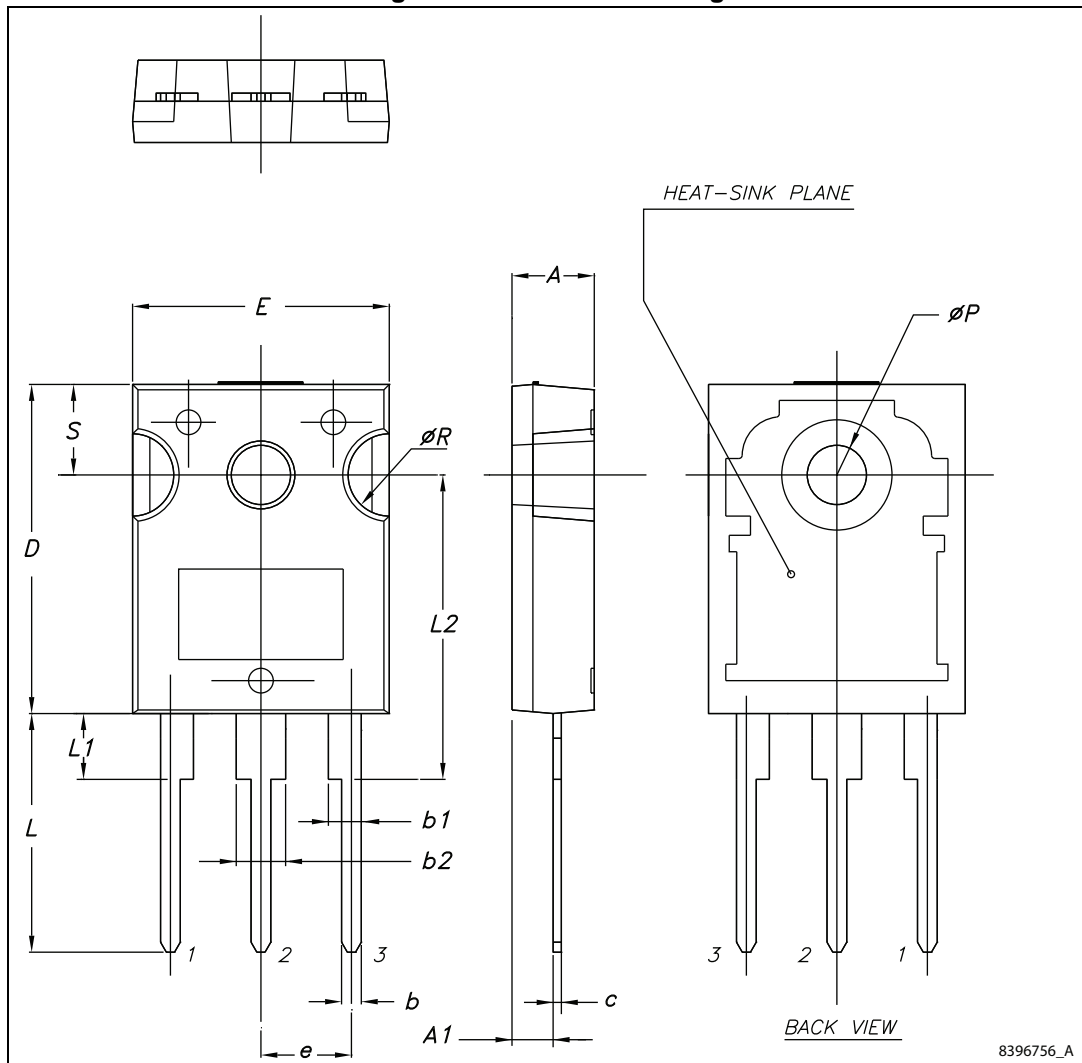
Figure 15. Body diode characteristics



3 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. ECOPACK® is an ST trademark.

Figure 16. 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

4 Revision history

Table 10. Document revision history

Date	Revision	Changes
10-May-2012	1	First release
21-May-2013	2	Updated t_{rr} value in Table 8 . Updated dynamic parameters in Table 5 , $V_{GS(th)}$ in Table 4 and E_{on} in Table 6 .
24-Jun-2013	3	Document status promoted from target to preliminary data. Added: Section 2.1: Electrical characteristics (curves)
11-Jul-2013	4	Updated Figure 4: Output characteristics ($T_J=25^{\circ}C$) and Figure 5: Output characteristics ($T_J=200^{\circ}C$) .
18-Dec-2013	5	Updated parameters in Table 2: Absolute maximum ratings and Table 4: On/off states .
27-May-2014	6	Added Table 7: Switching times . Updated Section 3: Package mechanical data . Minor text changes.
25-Sep-2014	7	Document status promoted from preliminary to production data.

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