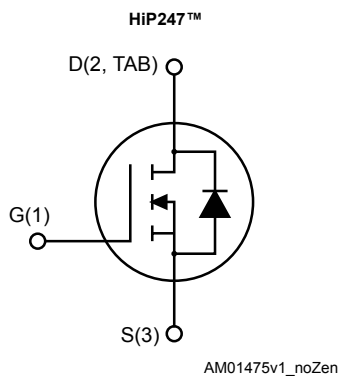
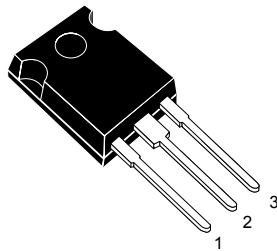


Silicon carbide Power MOSFET 1200 V, 12 A, 520 mΩ (typ., $T_J = 150\text{ °C}$) in an HiP247™ package



Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability ($T_J = 200\text{ °C}$)
- 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, 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.

Product status link

[SCT10N120](#)

Product summary

Order code	SCT10N120
Marking	SCT10N120
Package	HiP247™
Packing	Tube

The device meets ECOPACK standards, an environmentally-friendly grade of products commonly referred to as “halogen-free”.

1 Electrical ratings

Table 1. 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 $T_C = 25\text{ °C}$	12	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	10	A
$I_{DM}^{(1)}$	Drain current (pulsed)	24	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	150	W
T_{stg}	Storage temperature range	-55 to 200	°C
T_j	Operating junction temperature range		°C

1. Pulse width limited by safe operating area.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.17	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	40	°C/W

2 Electrical characteristics

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

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200			V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$			10	μA
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 200\text{ °C}$ ⁽¹⁾			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.8	3.5		V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 20\text{ V}, I_D = 6\text{ A}$		500	690	m Ω
		$V_{GS} = 20\text{ V}, I_D = 6\text{ A}, T_J = 150\text{ °C}$		520		m Ω
		$V_{GS} = 20\text{ V}, I_D = 6\text{ A}, T_J = 200\text{ °C}$		580		m Ω

1. Defined by design, not subject to production test.

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 400\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	290	-	pF
C_{oss}	Output capacitance		-	30	-	pF
C_{riss}	Reverse transfer capacitance		-	9	-	pF
Q_g	Total gate charge	$V_{DD} = 800\text{ V}, I_D = 6\text{ A}, V_{GS} = 0\text{ to }20\text{ V}$	-	22	-	nC
Q_{gs}	Gate-source charge		-	3	-	nC
Q_{gd}	Gate-drain charge		-	10	-	nC
R_g	Gate input resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$	-	8	-	Ω

Table 5. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 800\text{ V}, I_D = 6\text{ A}$	-	90	-	μJ
E_{off}	Turn-off switching energy	$R_G = 10\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$	-	30	-	μJ
E_{on}	Turn-on switching energy	$V_{DD} = 800\text{ V}, I_D = 6\text{ A}$	-	104	-	μJ
E_{off}	Turn-off switching energy	$R_G = 10\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}, T_J = 150\text{ °C}$	-	33	-	μJ

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{ V}$, $I_D = 6\text{ A}$, $R_G = 10\ \Omega$, $V_{GS} = -5\text{ to }20\text{ V}$	-	7	-	ns
t_f	Fall time		-	17	-	ns
$t_{d(off)}$	Turn-off delay time		-	14	-	ns
t_r	Rise time		-	12	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V_{SD}	Diode forward voltage	$I_F = 6\text{ A}$, $V_{GS} = 0\text{ V}$	-	4.3	-	V
t_{rr}	Reverse recovery time	$I_{SD} = 6\text{ A}$, $di/dt = 2000\text{ A}/\mu\text{s}$ $V_{DD} = 800\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	16	-	ns
Q_{rr}	Reverse recovery charge		-	107	-	nC
I_{RRM}	Reverse recovery current		-	12	-	A

2.1 Electrical characteristics curves

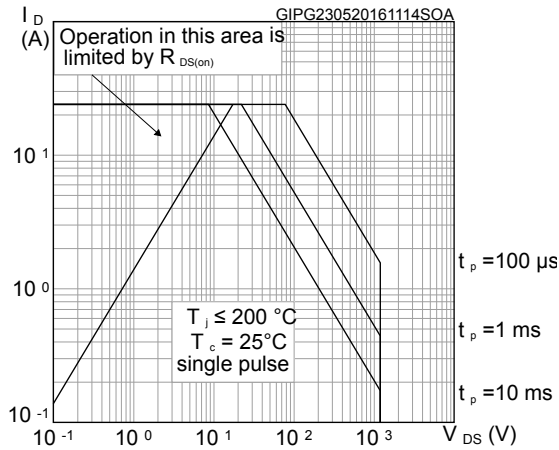
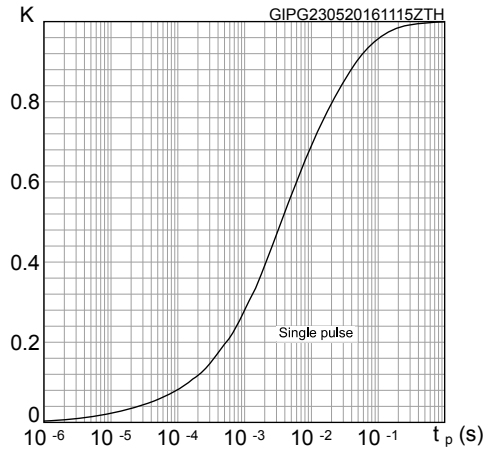
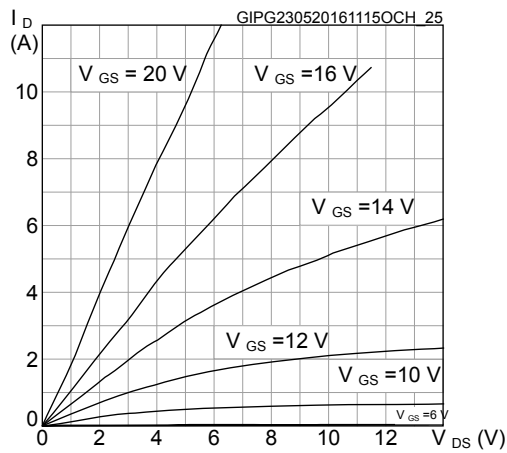
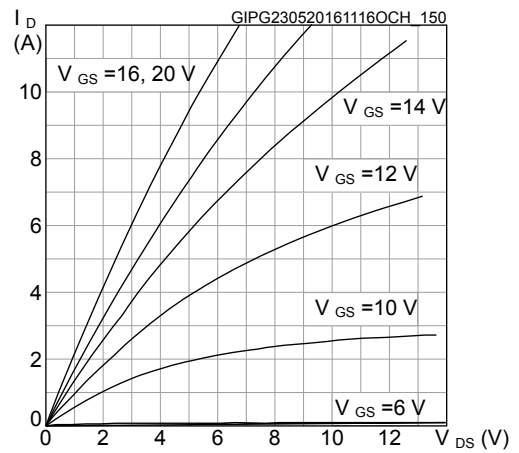
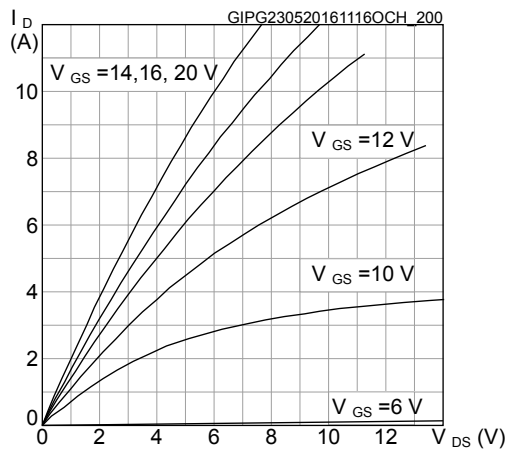
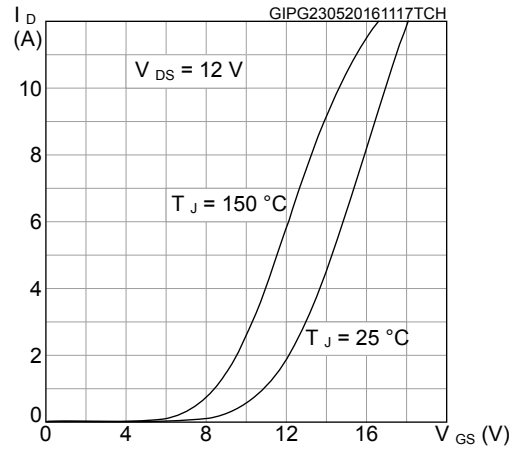
Figure 1. Safe operating area

Figure 2. Thermal impedance

Figure 3. Output characteristics ($T_J = 25\text{ °C}$)

Figure 4. Output characteristics ($T_J = 150\text{ °C}$)

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

Figure 6. Transfer characteristics


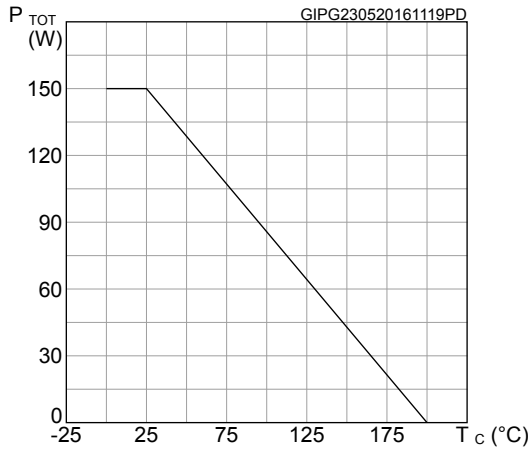
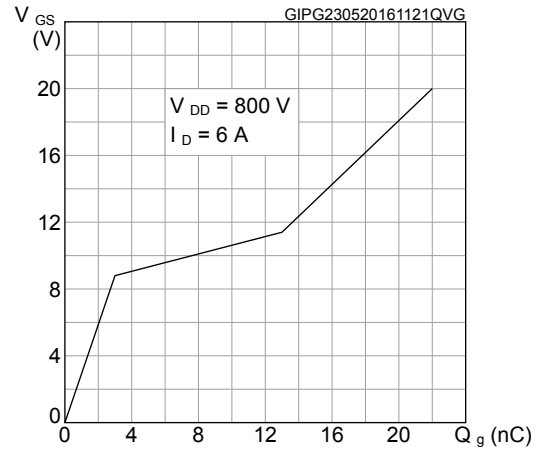
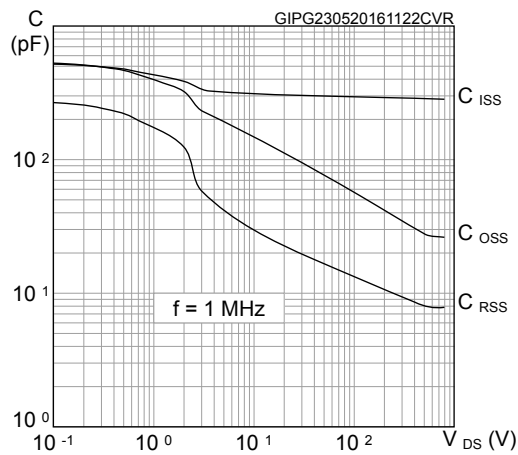
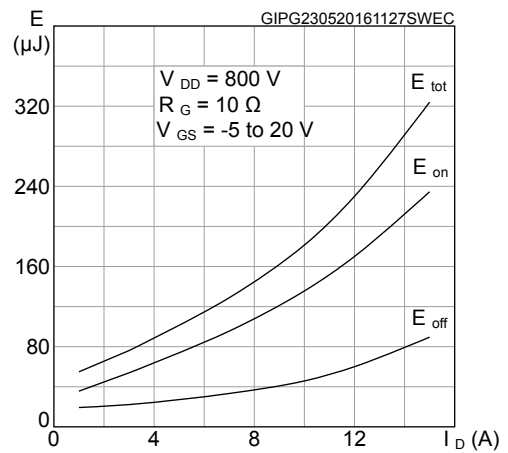
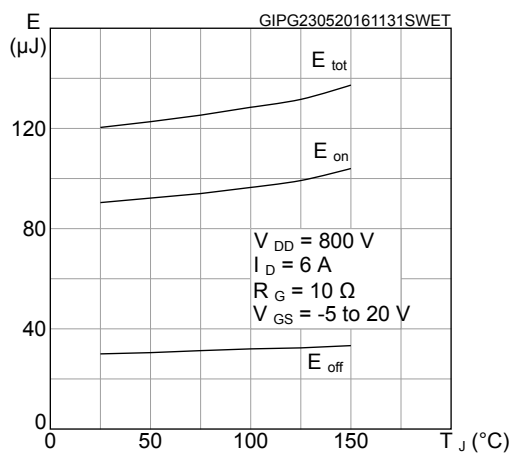
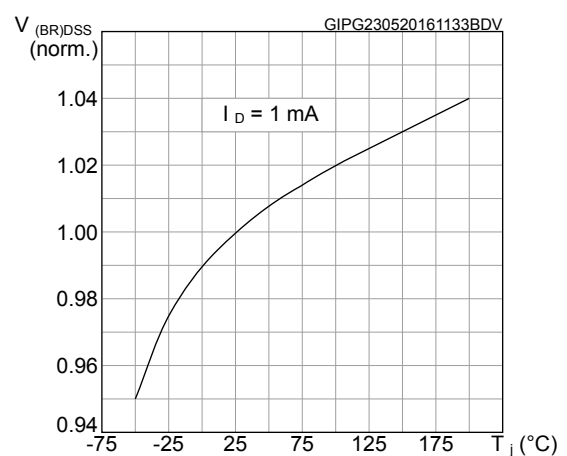
Figure 7. Power dissipation

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 $V_{(BR)DSS}$ vs. temperature


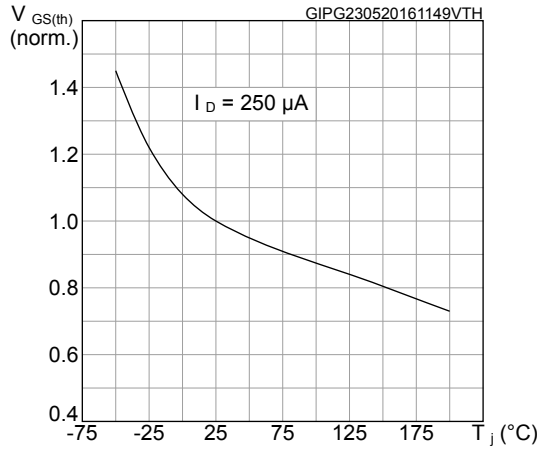
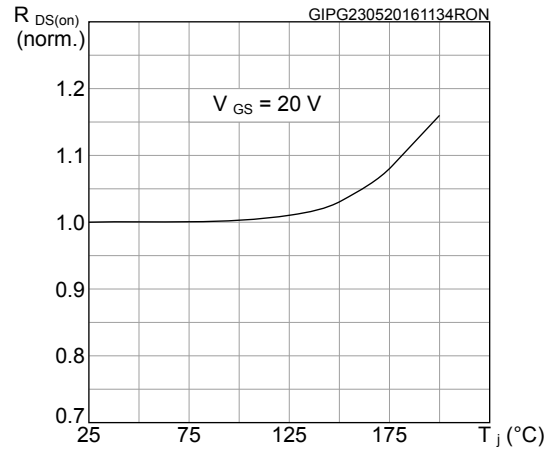
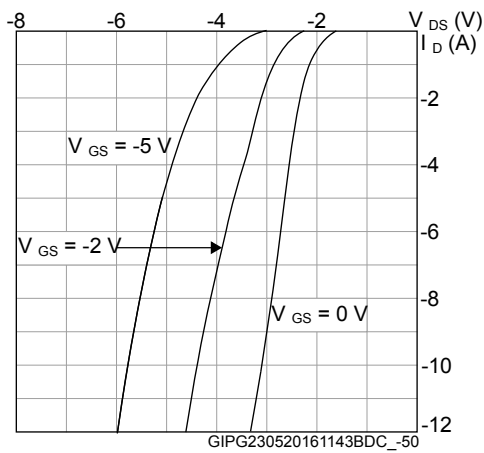
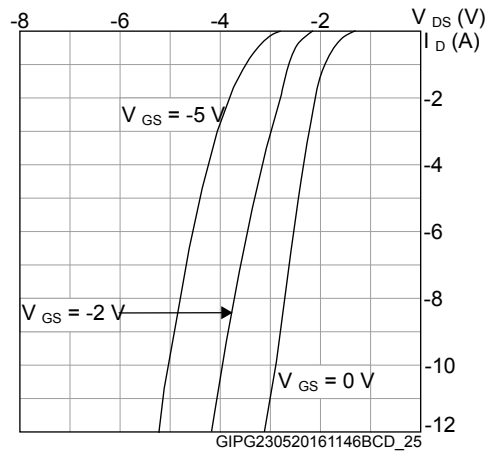
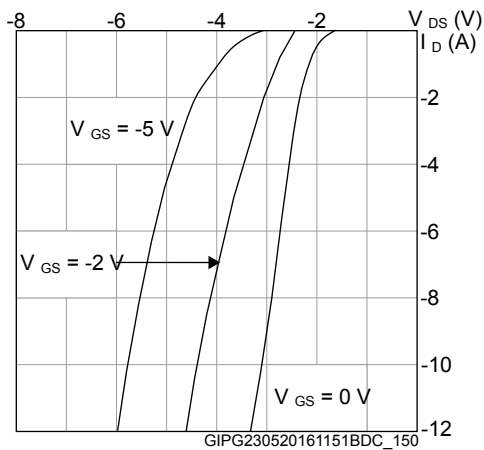
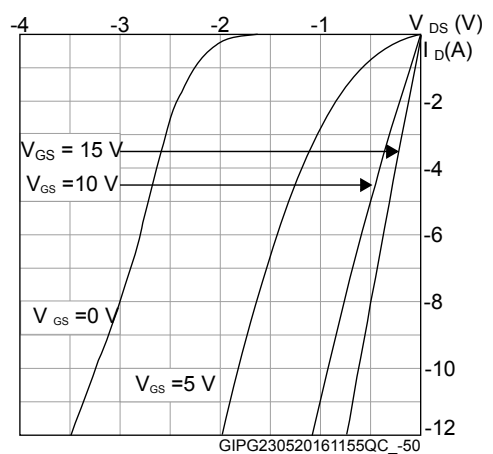
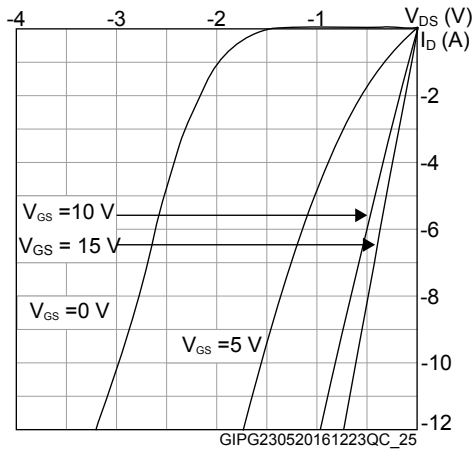
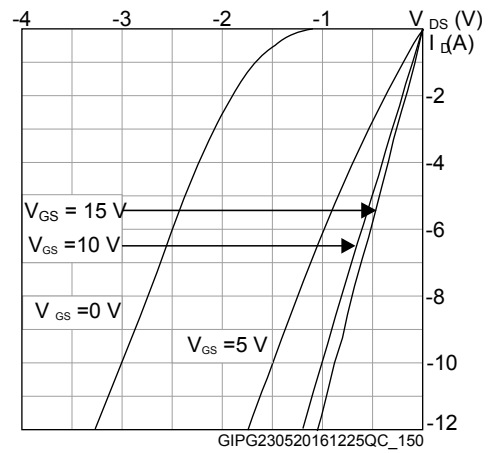
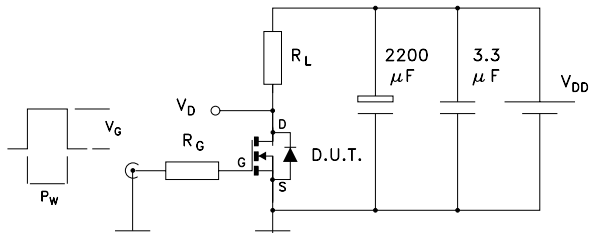
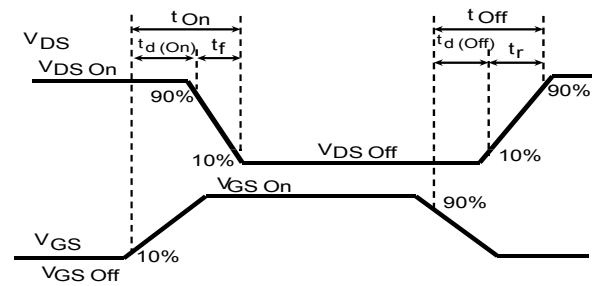
Figure 13. Normalized gate threshold voltage vs. temperature

Figure 14. Normalized on-resistance vs. temperature

Figure 15. Body diode characteristics (T_J = -50 °C)

Figure 16. Body diode characteristics (T_J = 25 °C)

Figure 17. Body diode characteristics (T_J = 150 °C)

Figure 18. 3rd quadrant characteristics (T_J = -50 °C)


Figure 19. 3rd quadrant characteristics ($T_J = 25\text{ }^\circ\text{C}$)

Figure 20. 3rd quadrant characteristics ($T_J = 150\text{ }^\circ\text{C}$)


3 Test circuits

Figure 21. Switching test waveforms for transition times


GIPD101020141511FSR

Figure 22. Clamped inductive switching waveform


GIPD101020141502FSR

4 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.

4.1 HiP247 package information

Figure 23. HiP247™ package outline

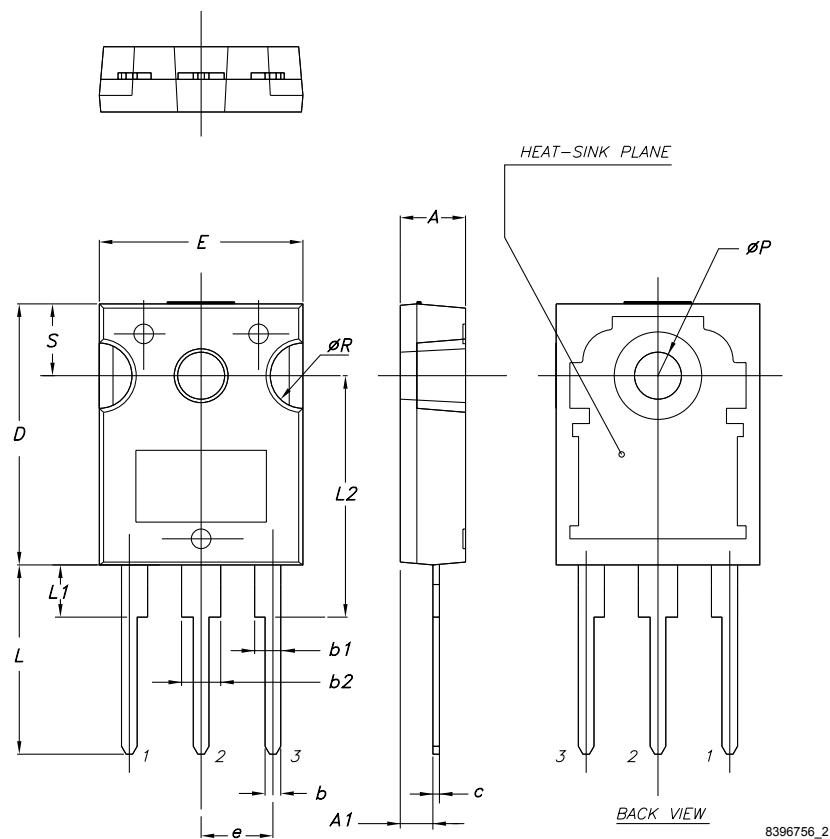


Table 8. HiP247™ package mechanical data

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

Dim.	mm		
	Min.	Typ.	Max.
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

Revision history

Table 9. Document revision history

Date	Revision	Changes
23-Feb-2016	1	First release
23-May-2016	2	<p>Modified: title, features and <i>Figure 1: "Internal schematic diagram"</i> in cover page</p> <p>Modified: <i>Table 2: "Absolute maximum ratings"</i> and <i>Table 3: "Thermal data"</i></p> <p>Modified: <i>Table 4: "On/off states"</i>, <i>Table 5: "Dynamic"</i>, <i>Table 6: "Switching energy (inductive load)"</i>, <i>Table 7: "Switching times"</i> and <i>Table 8: "Reverse SiC diode characteristics"</i></p> <p>Added: <i>Section 4.1: "Electrical characteristics (curves)"</i></p> <p>Minor text changes</p>
21-Mar-2018	3	<p>Removed maturity status indication from cover page. The document status is production data.</p> <p>Updated Section 2.1 Electrical characteristics curves.</p> <p>Minor text changes.</p>

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