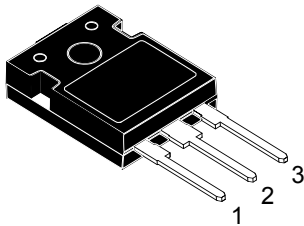
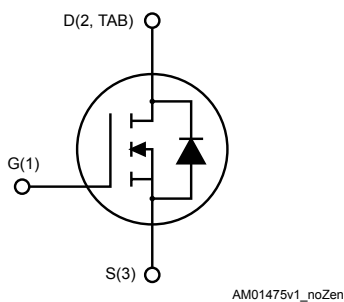


Automotive-grade silicon carbide Power MOSFET 1200 V, 20 A, 189 mΩ (typ., $T_J=150\text{ }^{\circ}\text{C}$), in an HiP247 package



HiP247



Features

- AEC-Q101 qualified 
- Very tight variation of on-resistance vs. temperature
- Very high operating temperature capability ($T_J = 200\text{ }^{\circ}\text{C}$)
- Very fast and robust intrinsic body diode
- Low capacitance

Applications

- Motor drives
- EV chargers
- 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

[SCT20N120AG](#)

Product summary

Order code	SCT20N120AG
Marking	
Package	HiP247™
Packing	Tube

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 $T_C = 25\text{ °C}$	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 power dissipation at $T_C = 25\text{ °C}$	153	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	1.14	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	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	$V_{GS} = 0\text{ V}$, $V_{DS} = 1200\text{ V}$			10	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 1200\text{ V}$, $T_J = 200\text{ °C}$		50		
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = -10\text{ to }25\text{ V}$			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	m Ω
		$V_{GS} = 20\text{ V}$, $I_D = 10\text{ A}$, $T_J = 150\text{ °C}$		189		
		$V_{GS} = 20\text{ V}$, $I_D = 10\text{ A}$, $T_J = 200\text{ °C}$		220		

Table 4. Dynamic

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

Table 5. Switching energy (inductive load)

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

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)V}$	Turn-on delay time	$V_{DD} = 800\text{ V}$, $I_D = 10\text{ A}$, $R_G = 0\ \Omega$, $V_{GS} = 0\text{ to }20\text{ V}$	-	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 7. 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	$I_{SD} = 10\text{ A}$, $V_{GS} = -5\text{ V}$, $V_R = 800\text{ V}$, $di/dt = 1650\text{ A}/\mu\text{s}$	-	15	-	ns
Q_{rr}	Reverse recovery charge		-	75	-	nC
I_{rrm}	Peak reverse recovery current		-	8	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

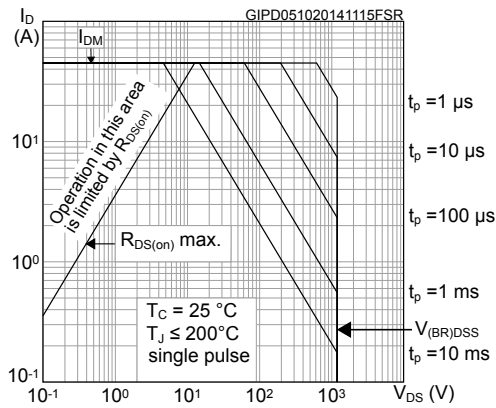


Figure 2. Maximum transient thermal impedance

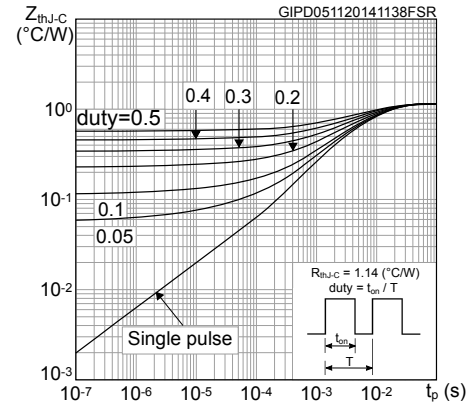


Figure 3. Output characteristics @ $T_J = 25\text{ °C}$

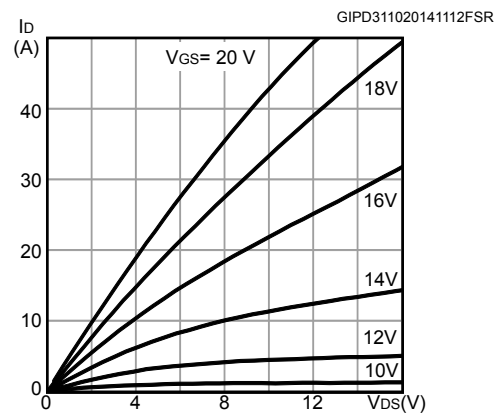


Figure 4. Output characteristics @ $T_J = 200\text{ °C}$

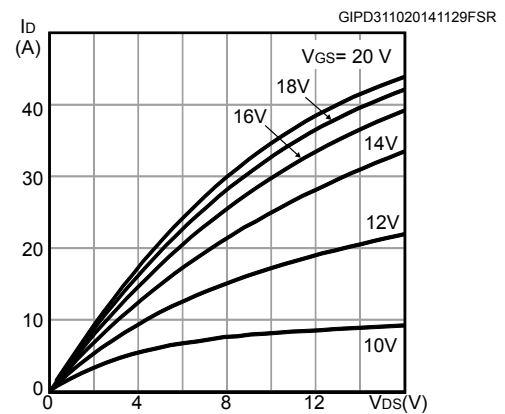


Figure 5. Transfer characteristics

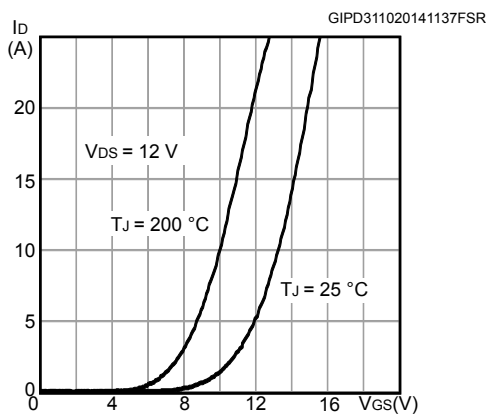


Figure 6. Body diode characteristics @ $T_J = -50\text{ °C}$

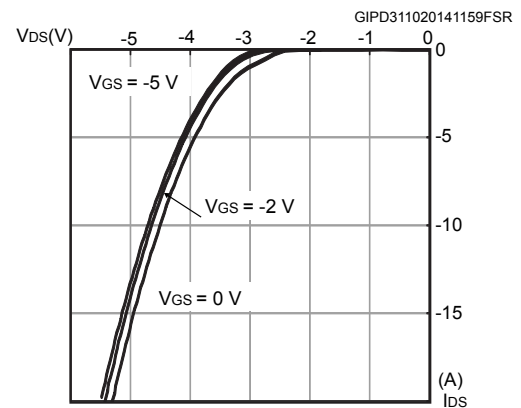


Figure 7. Body diode characteristics @ $T_J = 25\text{ }^{\circ}\text{C}$

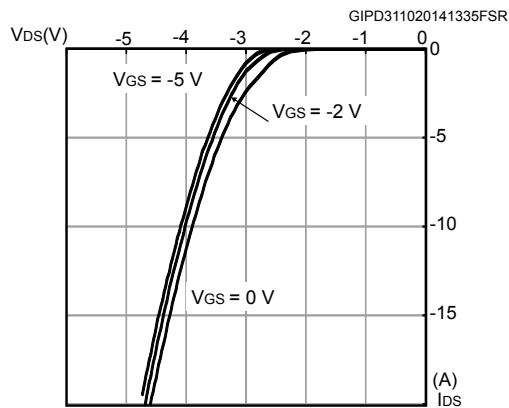


Figure 8. Body diode characteristics @ $T_J = 150\text{ }^{\circ}\text{C}$

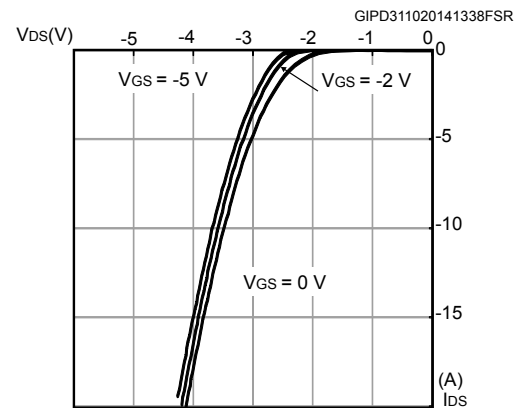


Figure 9. 3rd quadrant characteristics @ $T_J = -50\text{ }^{\circ}\text{C}$

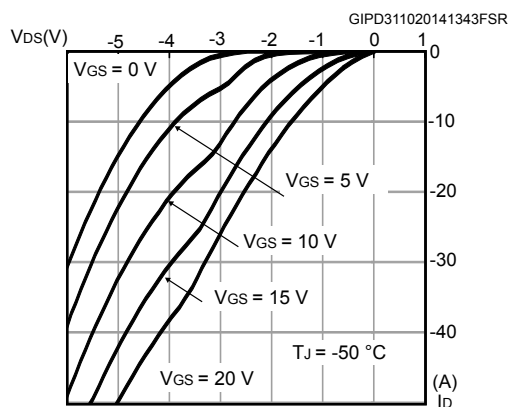


Figure 10. 3rd quadrant characteristics @ $T_J = 25\text{ }^{\circ}\text{C}$

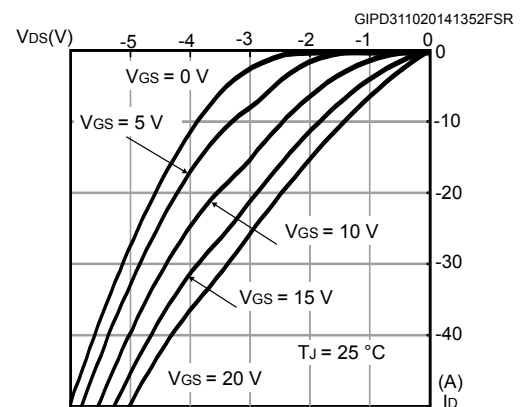


Figure 11. 3rd quadrant characteristics @ $T_J = 150\text{ }^{\circ}\text{C}$

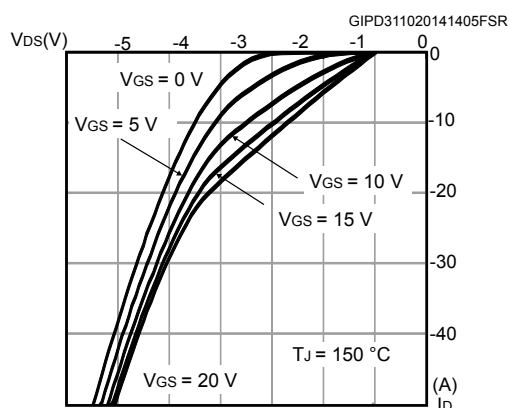


Figure 12. Normalized gate threshold vs. temperature

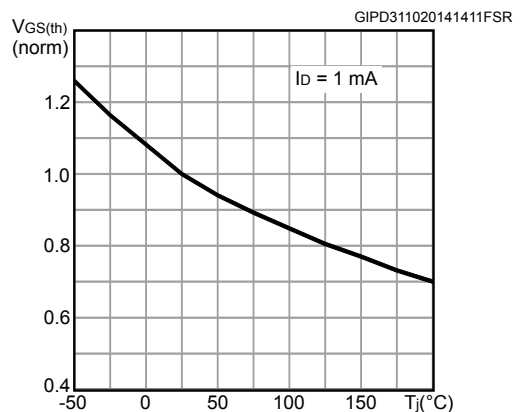


Figure 13. Normalized $R_{DS(on)}$ vs. temperature

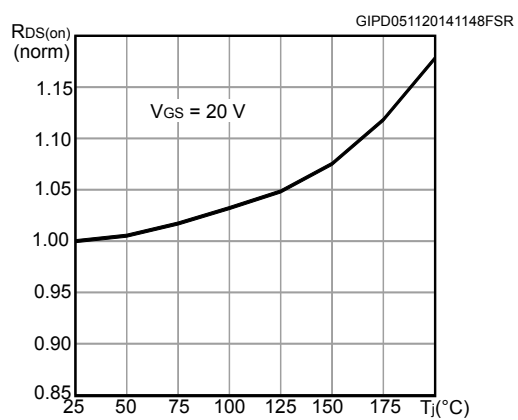
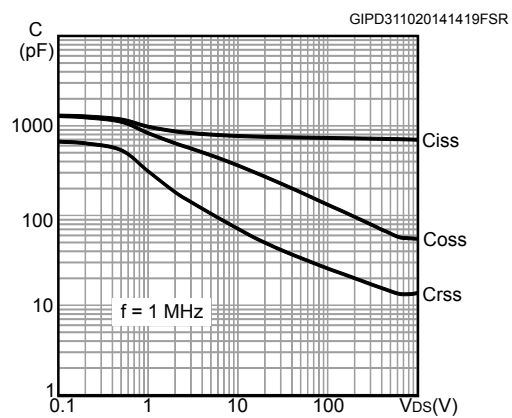
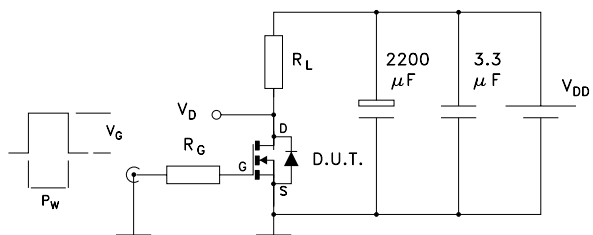


Figure 14. Capacitances variation



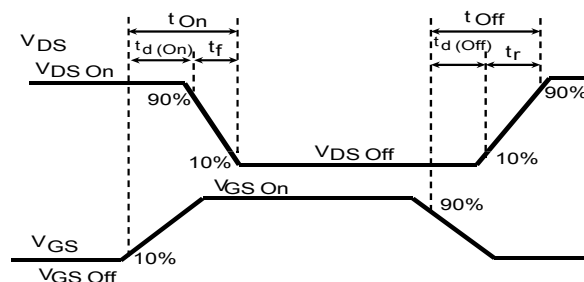
3 Test circuits

Figure 15. Switching test waveforms for transition times



GIPD101020141511FSR

Figure 16. Clamped inductive switching waveform



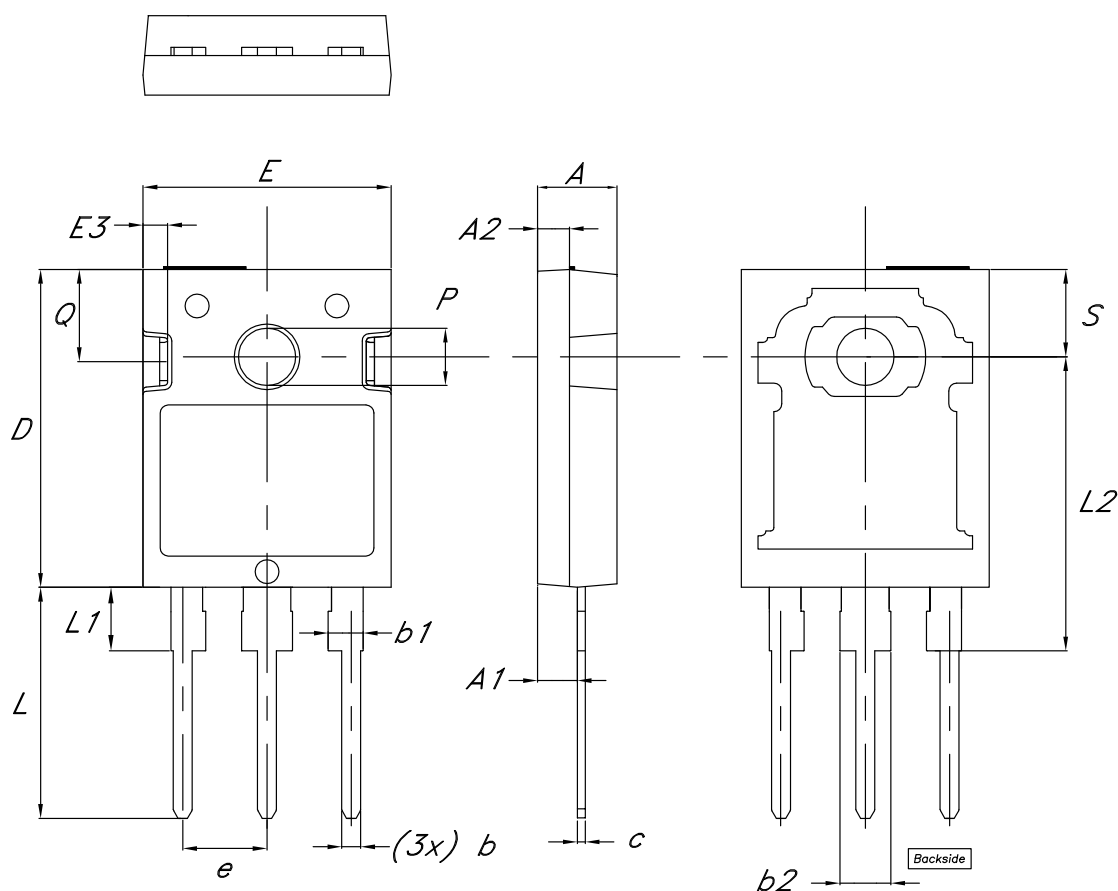
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4 Package information

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 17. HiP247 package outline



8581091_2

Table 8. HiP247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85	5.00	5.15
A1	2.20		2.60
A2	1.90	2.00	2.10
b	1.00		1.40
b1	2.00		2.40
b2	3.00		3.40
c	0.40		0.80
D	19.85	20.00	20.15
E	15.45	15.60	15.75
E3	1.45		1.65
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2	18.30	18.50	18.70
P	3.55		3.65
Q	5.65		5.95
S	5.30	5.50	5.70

Revision history

Table 9. Document revision history

Date	Revision	Changes
21-Mar-2018	1	First release
01-Mar-2019	2	Updated <i>Table 3. On/off states</i> . Updated package information.
21-Oct-2019	3	Updated Table 1. Absolute maximum ratings , Table 2. Thermal data , Figure 1. Safe operating area and Figure 2. Maximum transient thermal impedance . Minor text changes.

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