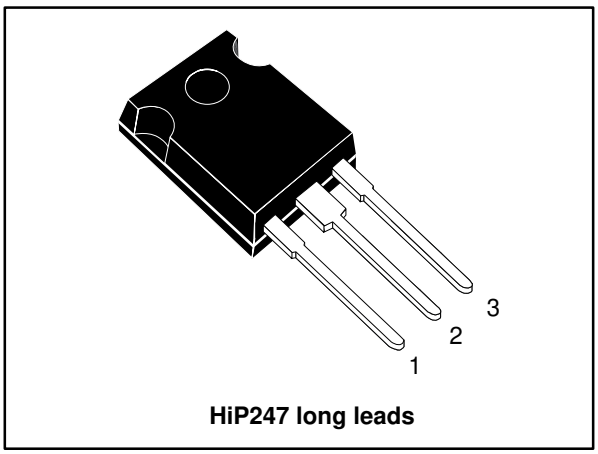
SCTWA20N120

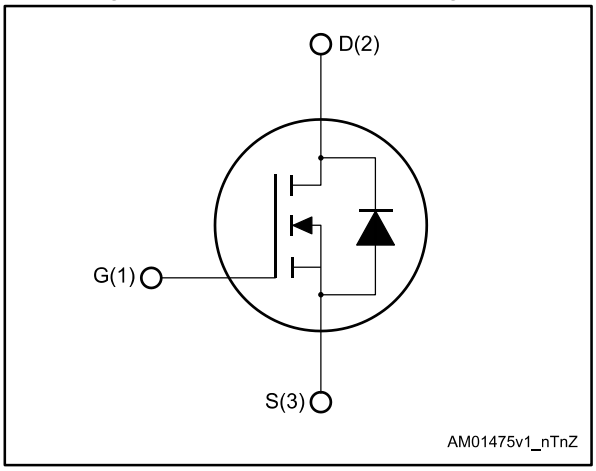
Silicon carbide Power MOSFET 1200 V, 20 A, 189 mΩ (typ., T_J=150 °C) N-channel in a HiP247 long leads package

Datasheet - preliminary data



HiP247 long leads

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 (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 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 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
SCTWA20N120	SCT20N120	HiP247 long leads	Tube

The device meets ECOPACK standards, an environmentally-friendly grade of products commonly referred to as “halogen-free”. See *Section 6: "Package information"*.

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	20	A
I_D	Drain current (continuous) at T_C = 100 °C	16	A
I_{DM}(1)	Drain current (pulsed)	45	A
P_{TOT}	Total dissipation at T_C = 25 °C	175	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 max	1	°C/W
$R_{thj\text{-}amb}$	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_{DS} = 1200 V, V_{GS} = 0 V			100	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} = 22 to -10 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 1 mA	2	3.5		V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 20 V, I_D = 10 A		169	239	mΩ
		V_{GS} = 20 V, I_D = 10 A, T_J = 150 °C		189		mΩ
		V_{GS} = 20 V, I_D = 10 A, T_J = 200 °C		220		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	-	650	-	pF
C_{oss}	Output capacitance		-	65	-	pF
C_{rss}	Reverse transfer capacitance		-	14	-	pF
Q_g	Total gate charge	V_{DD} = 800 V, I_D = 10 A, V_{GS} = 0 to 20 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 MHz open drain	-	7	-	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 = 10 A R_G= 6.8 Ω, V_{GS} = -2 to 20 V	-	160	-	µJ
E_{off}	Turn-off switching energy		-	90	-	µJ
E_{on}	Turn-on switching energy	V_{DD} = 800 V, I_D = 10 A R_G= 6.8 Ω, V_{GS} = -2 to 20 V T_J= 150 °C	-	165	-	µJ
E_{off}	Turn-off switching energy		-	100	-	µJ

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d\ (on)V}$	Turn-on delay time	V_{DD} = 800 V, I_D = 10 A R_G= 0 Ω, V_{GS} = 0 to 20 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 A, V_{GS} = -5 V	-	3.6	-	V
t_{rr}	Reverse recovery time	I_{SD} = 10 A, V_{GS} = -5 V, di/dt = 1650 A/µs V_R = 800 V	-	15	-	ns
Q_{rr}	Reverse recovery charge		-	75	-	nC
I_{RRM}	Reverse recovery current		-	8	-	A

2.2 Electrical characteristics (curves)

Figure 2: Safe operating area

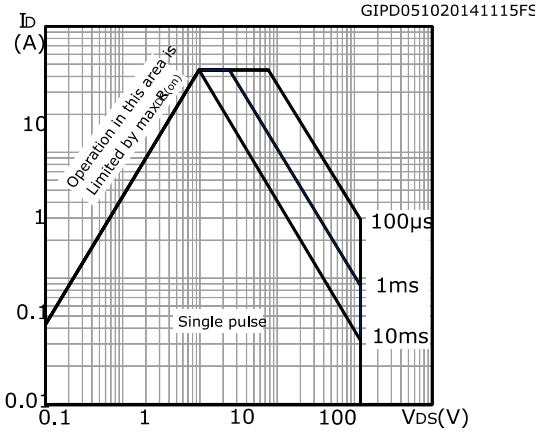


Figure 3: Thermal impedance

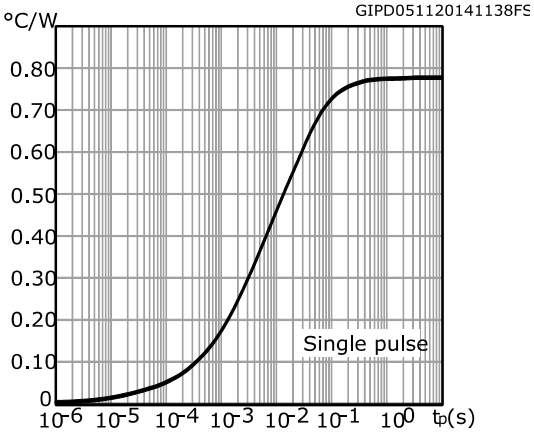


Figure 4: Output characteristics (T_J= 25 °C)

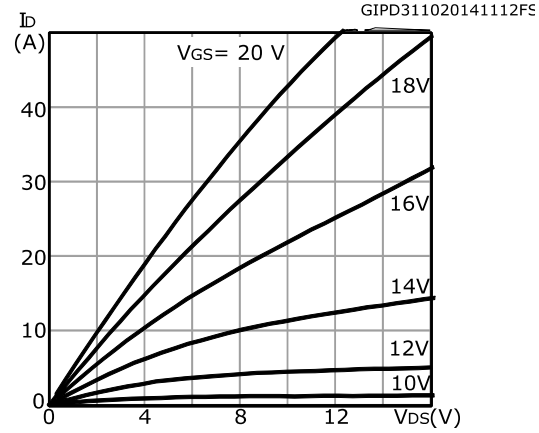


Figure 5: Output characteristics (T_J= 200 °C)

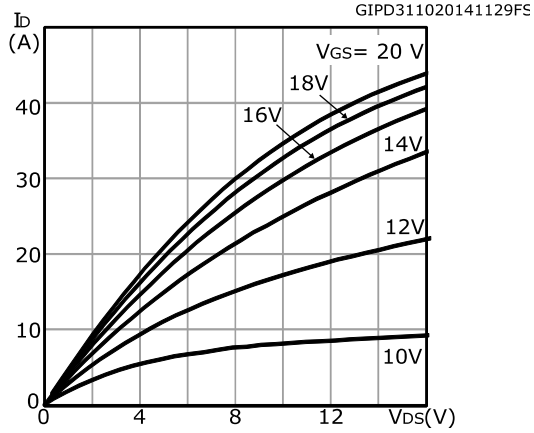


Figure 6: Transfer characteristics

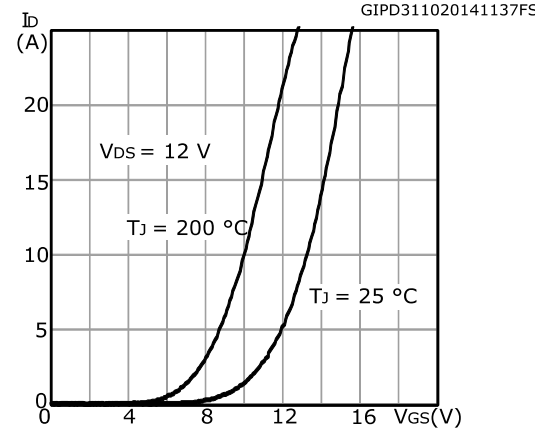


Figure 7: Body diode characteristics (T_J= -50 °C)

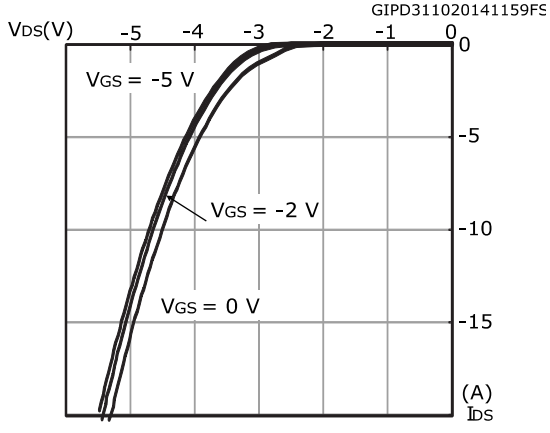


Figure 8: Body diode characteristics (T_J= 25 °C)

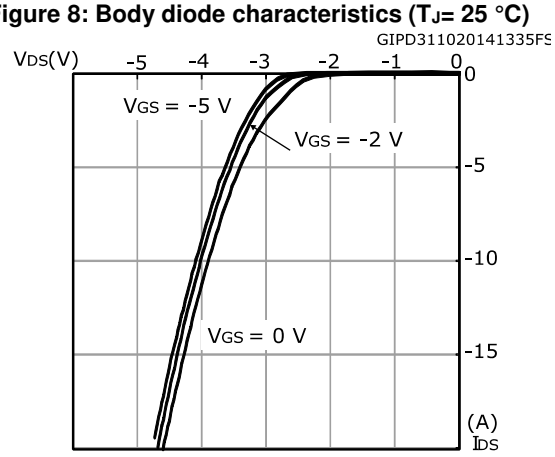


Figure 9: Body diode characteristics (T_J= 150 °C)

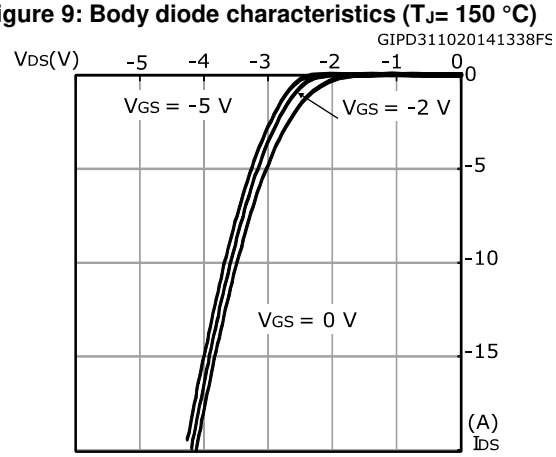


Figure 10: 3rd quadrant characteristics (T_J= -50 °C)

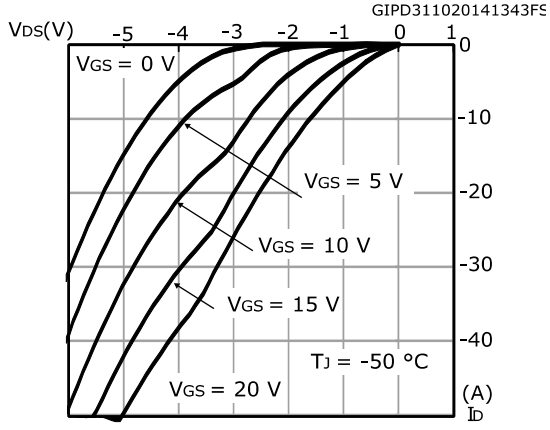


Figure 11: 3rd quadrant characteristics (T_J= 25 °C)

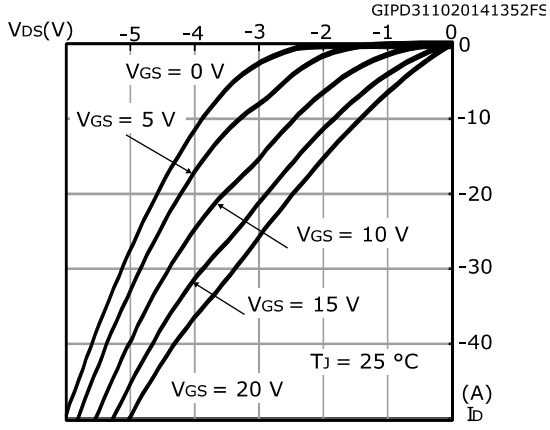


Figure 12: 3rd quadrant characteristics (T_J= 150 °C)

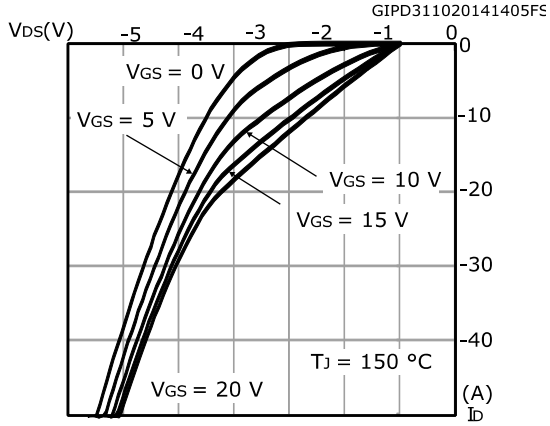


Figure 13: Normalized gate threshold voltage vs. temperature

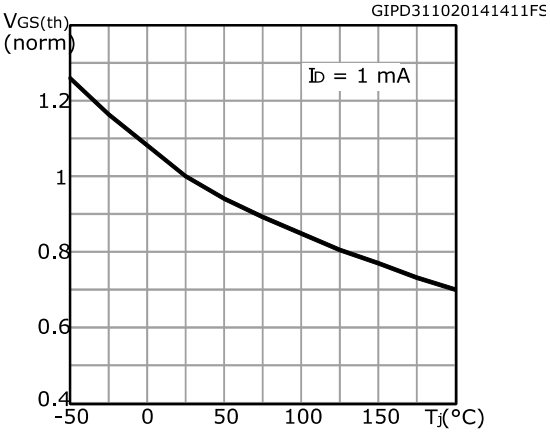


Figure 14: Normalized on-resistance vs. temperature

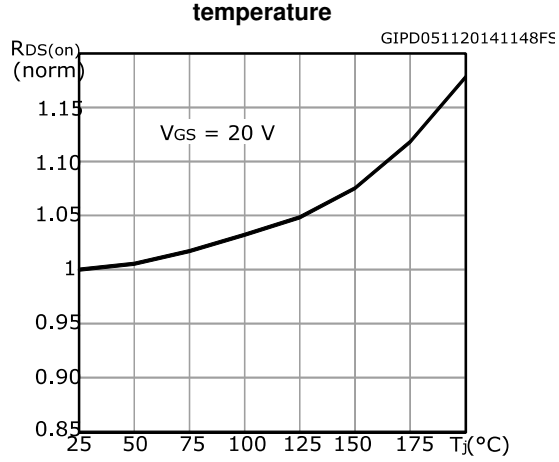
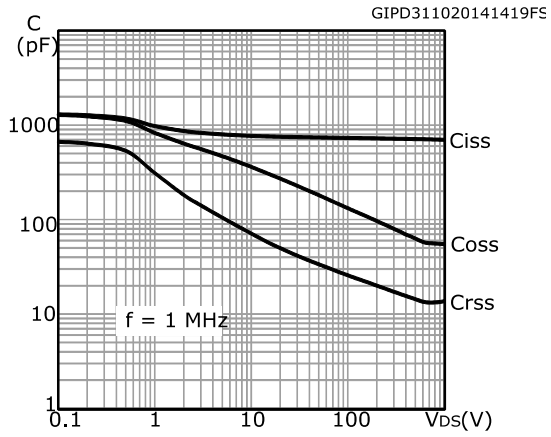


Figure 15: Capacitance variations



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 long leads package information

Figure 16: HiP247™ long leads package outline

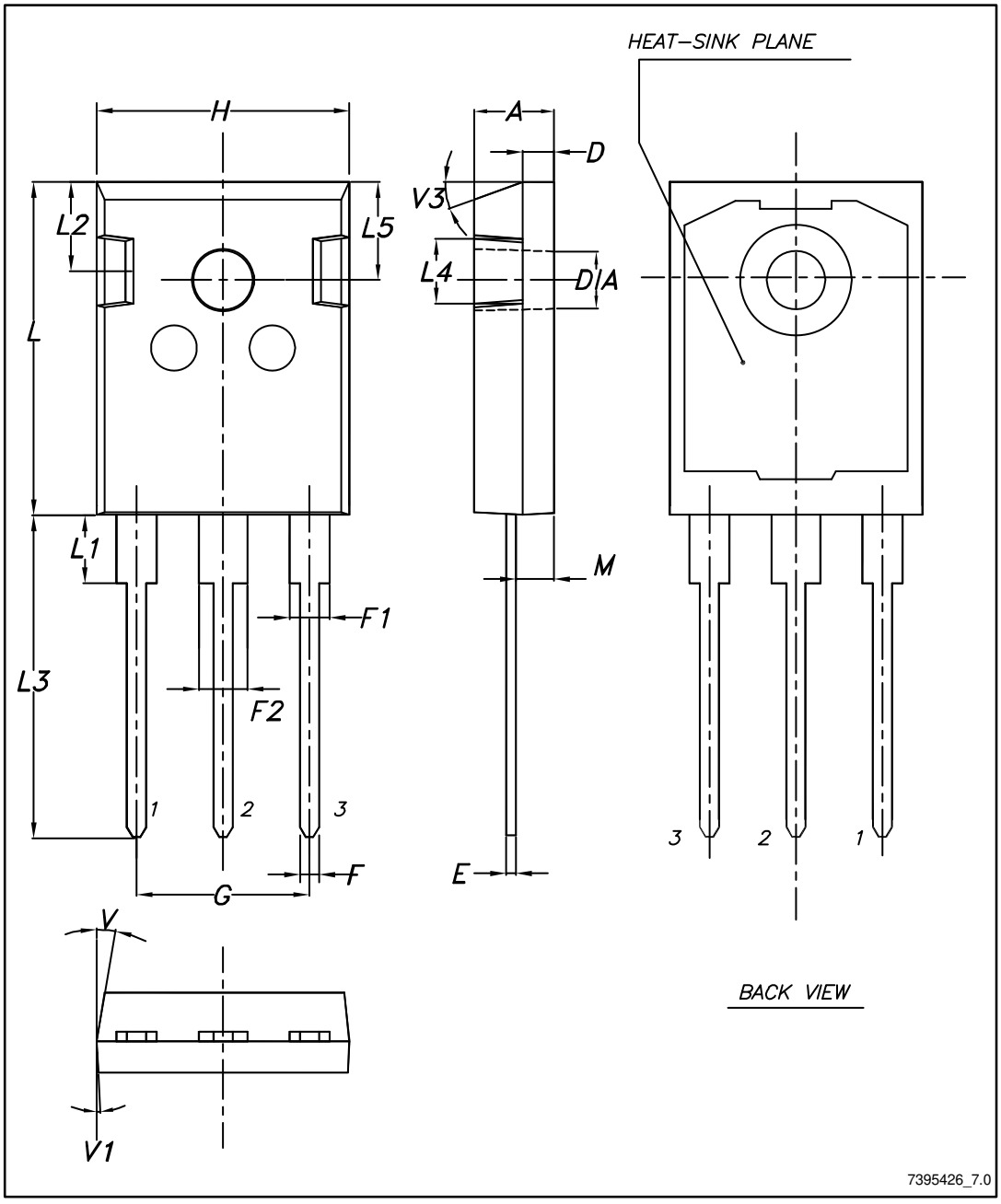


Table 9: HiP247™ long leads package mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.90		5.15
D	1.85		2.10
E	0.55		0.67
F	1.07		1.32
F1	1.90		2.38
F2	2.87		3.38
G		10.90 BSC	
H	15.77		16.02
L	20.82		21.07
L1	4.16		4.47
L2	5.49		5.74
L3	20.05		20.30
L4	3.68		3.93
L5	6.04		6.29
M	2.25		2.55
V		10°	
V1		3°	
V3		20°	
DIA	3.55		3.66

4 Revision history

Table 10: Document revision history

Date	Revision	Changes
07-Jun-2016	1	First release

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