

Silicon carbide Power MOSFET 1200 V, 45 A, 90 mΩ (typ., $T_J = 150^\circ\text{C}$), in an HiP247™ long leads package

Datasheet - production data

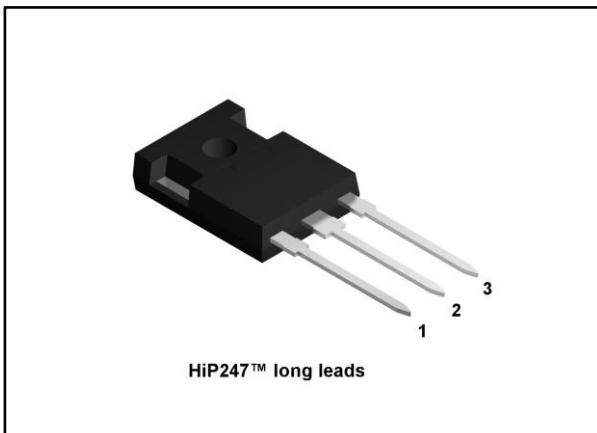
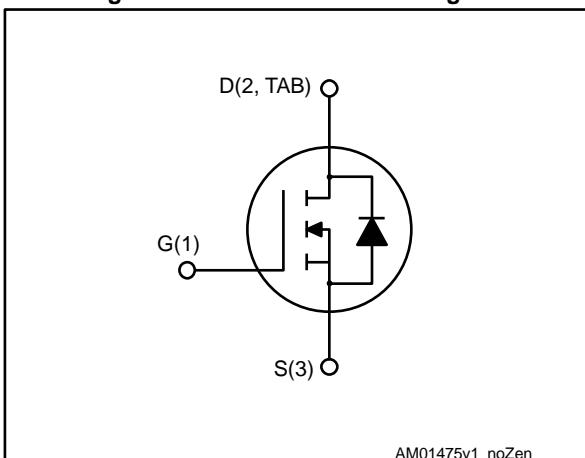


Figure 1: Internal schematic diagram



Features

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

Applications

- Solar inverters, UPS
- Motor drives
- High voltage DC-DC converters
- Switch mode power 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 allow 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
SCTWA30N120	SCT30N120	HiP247™ long leads	Tube

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

Notes:

(1)Pulse width limited by safe operating area.

Table 3: Thermal data

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

2 Electrical characteristics

($T_{case} = 25^\circ C$ unless otherwise specified)

Table 4: On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0 V, V_{DS} = 1200 V$		1	25	μA
		$V_{GS} = 0 V, V_{DS} = 1200 V, T_J = 200^\circ C$		50		μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0 V, V_{GS} = -10 \text{ to } 22 V$			± 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	$m\Omega$
		$V_{GS} = 20 V, I_D = 20 A, T_J = 150^\circ C$		90		$m\Omega$
		$V_{GS} = 20 V, I_D = 20 A, T_J = 200^\circ C$		100		$m\Omega$

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{GS}=0 V, V_{DS}=400 V, f=1 \text{ MHz}$	-	1700	-	pF
C_{oss}	Output capacitance		-	130	-	pF
C_{rss}	Reverse transfer capacitance		-	25	-	pF
R_G	Intrinsic gate resistance	$f = 1 \text{ MHz}, I_D=0 A$	-	5	-	Ω
Q_g	Total gate charge	$V_{DD} = 800 V, I_D = 20 A$ $V_{GS} = 0 \text{ to } 20 V$	-	105	-	nC
Q_{gs}	Gate-source charge		-	16	-	nC
Q_{gd}	Gate-drain charge		-	40	-	nC

Table 6: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 800 V, I_D = 20 A, R_G = 6.8 \Omega, V_{GS} = -2 \text{ to } 20 V$	-	500	-	μJ
E_{off}	Turn-off switching energy		-	350	-	μJ
E_{on}	Turn-on switching energy	$V_{DD} = 800 V, I_D = 20 A, R_G = 6.8 \Omega, V_{GS} = -2 \text{ to } 20 V$ $T_J = 150^\circ C$	-	500	-	μJ
E_{off}	Turn-off switching energy		-	400	-	μJ

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)V}$	Turn-on delay time	$V_{DD} = 800 V, I_D = 20 A, R_G = 0 \Omega, V_{GS} = 0 \text{ to } 20 V$	-	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	$I_F = 10 \text{ A}, V_{GS} = 0 \text{ V}$	-	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)

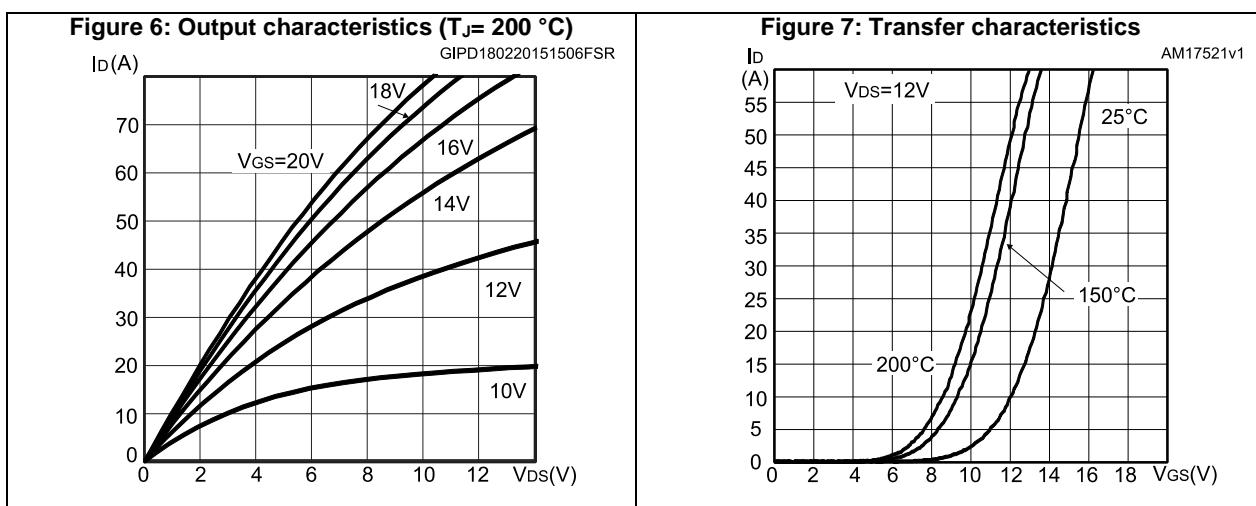
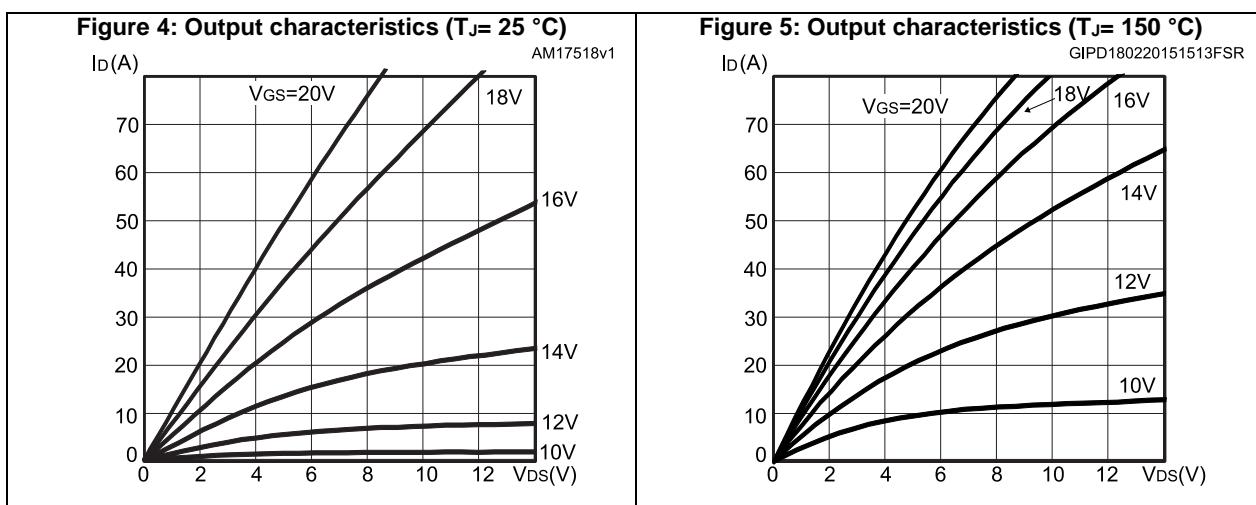
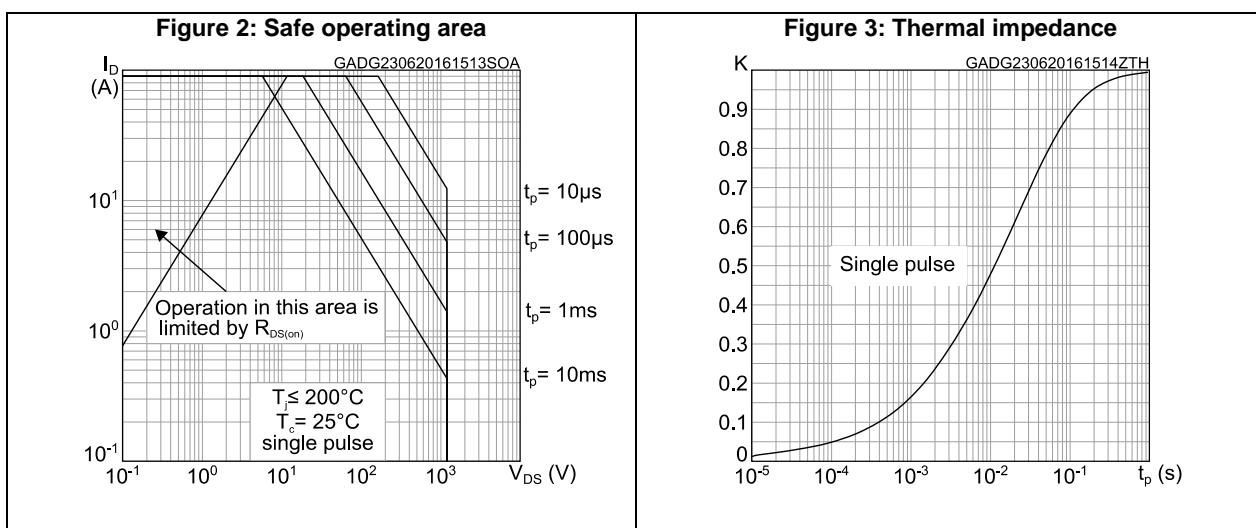
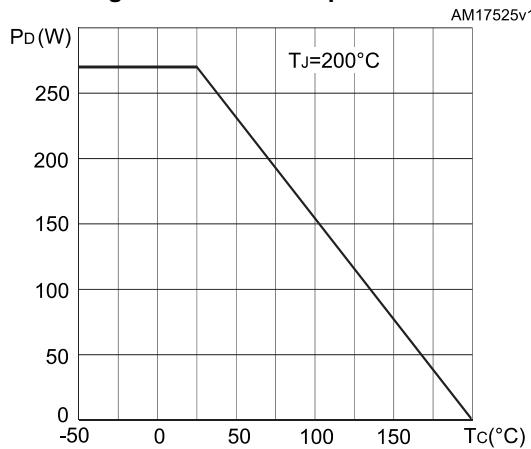
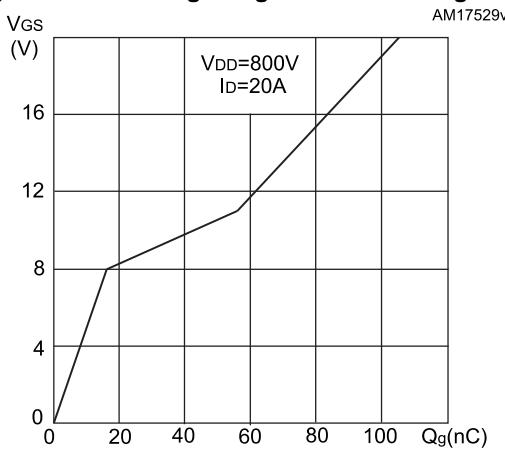
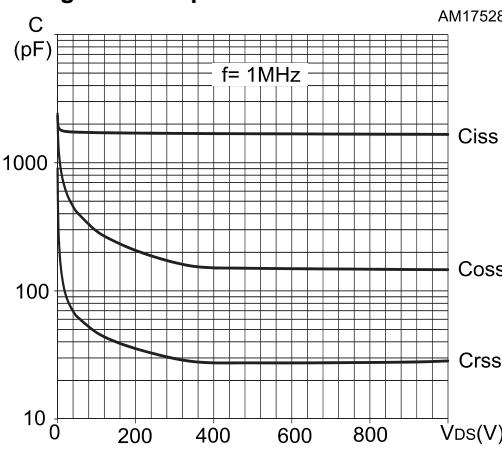
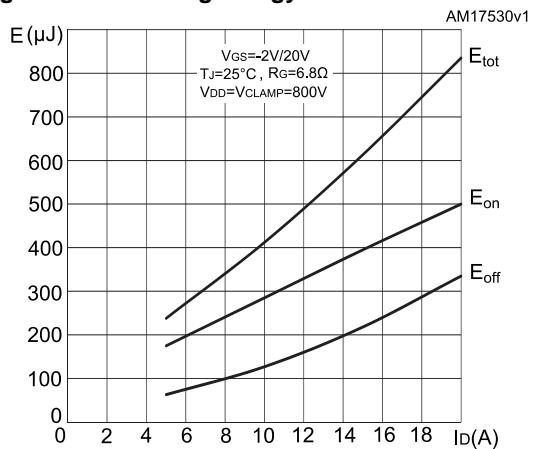
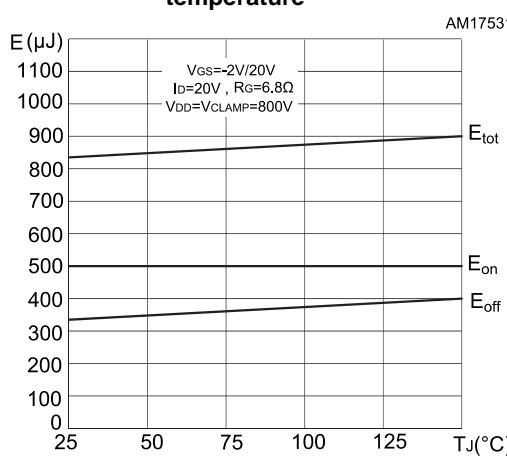
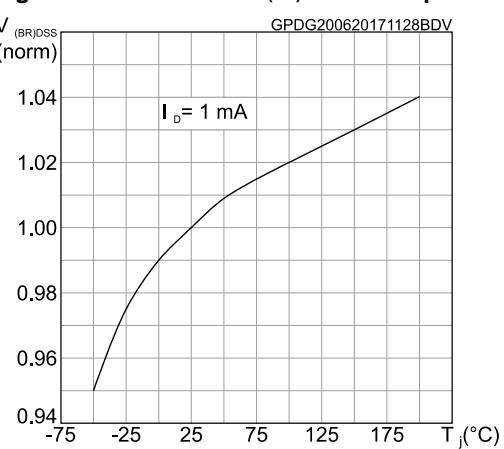


Figure 8: Power dissipation**Figure 9: Gate charge vs gate-source voltage****Figure 10: Capacitance variations****Figure 11: Switching energy vs. drain current****Figure 12: Switching energy vs. junction temperature****Figure 13: Normalized V_{(BR)DSS} vs. temperature**

Electrical characteristics

SCTWA30N120

Figure 14: Normalized gate threshold voltage vs. temperature

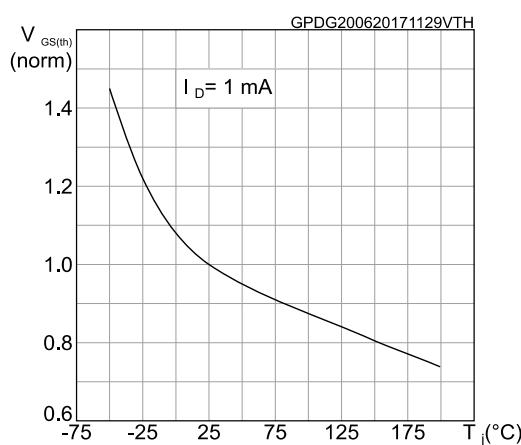


Figure 15: Normalized on-resistance vs. temperature

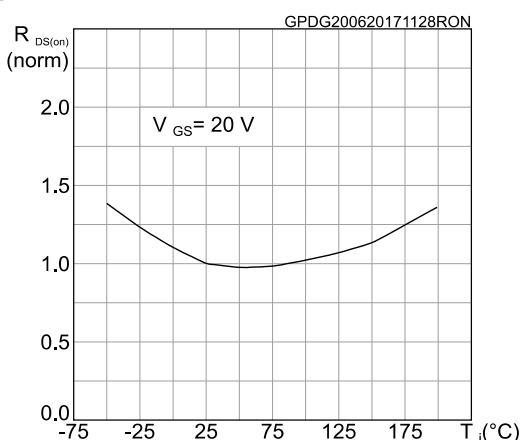


Figure 16: Body diode characteristics ($T_J = -50 \text{ °C}$)

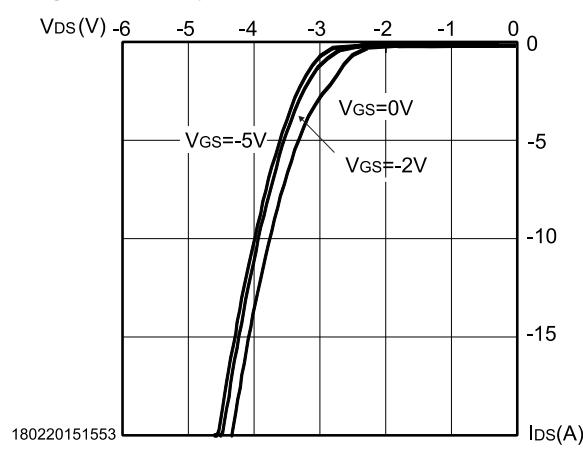


Figure 17: Body diode characteristics ($T_J = 25 \text{ °C}$)

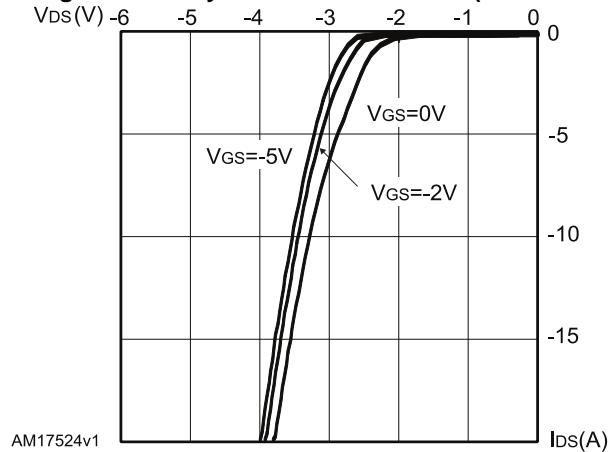


Figure 18: Body diode characteristics ($T_J = 150 \text{ °C}$)

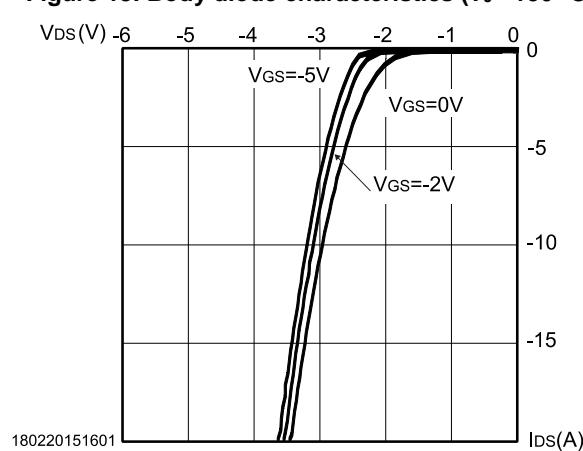
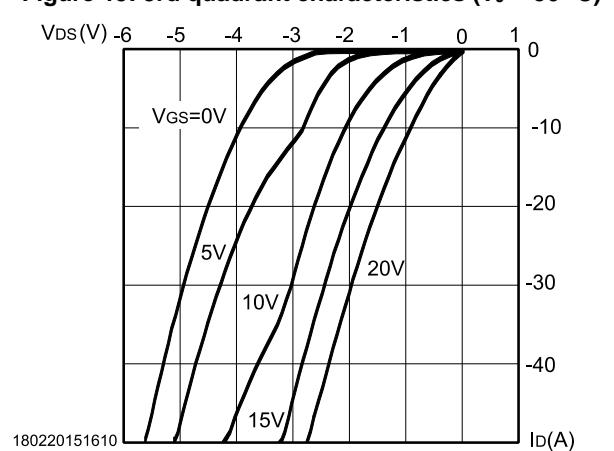
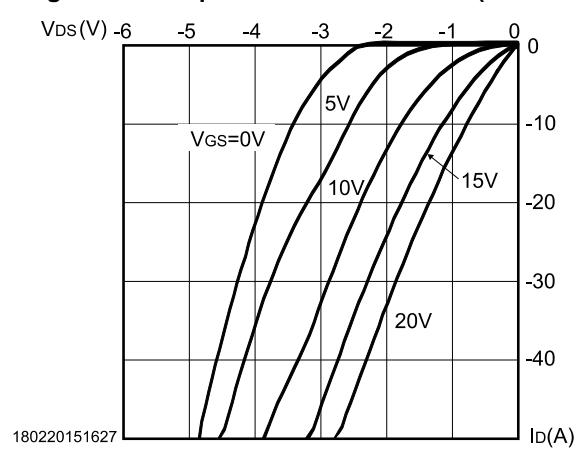
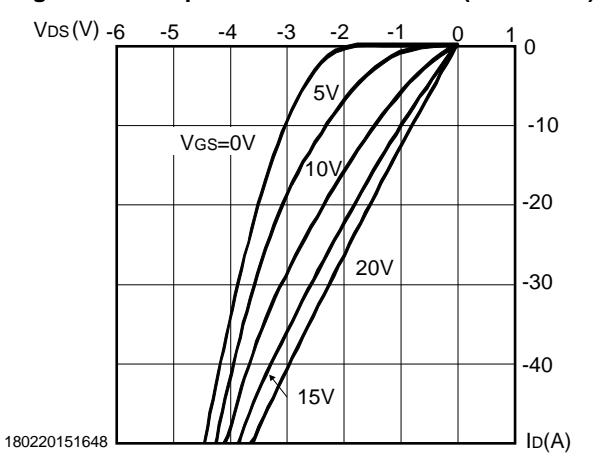


Figure 19: 3rd quadrant characteristics ($T_J = -50 \text{ °C}$)



SCTWA30N120**Electrical characteristics****Figure 20: 3rd quadrant characteristics ($T_J = 25^\circ\text{C}$)****Figure 21: 3rd quadrant characteristics ($T_J = 150^\circ\text{C}$)**

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 long leads package information

Figure 22: HiP247™ long leads package outline

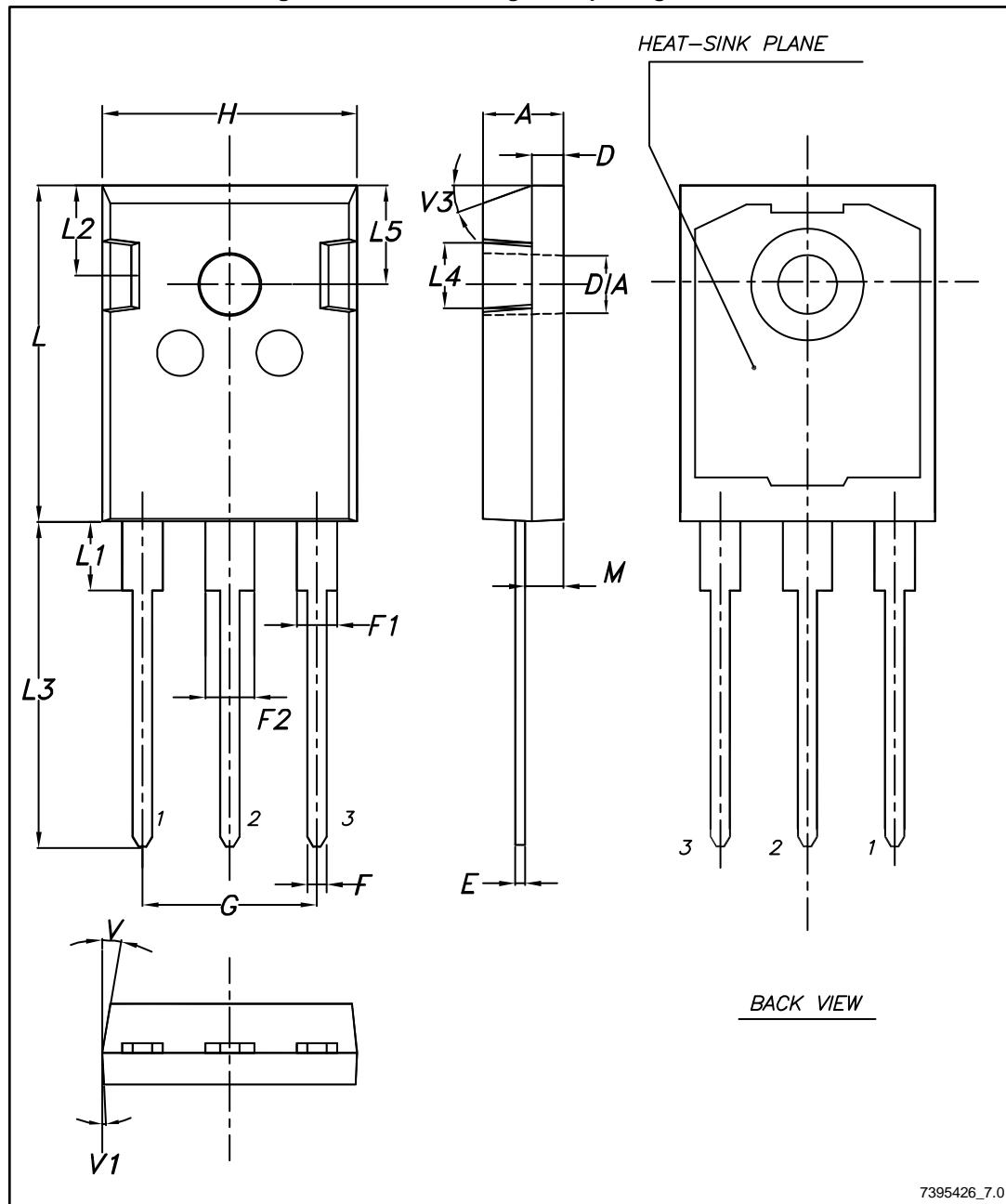


Table 9: HiP247™ long leads package mechanical data

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
11-Jan-2016	1	First release.
19-Jun-2017	2	Updated title, features in cover page. Minor text edit in Section 1: "Electrical ratings" and Section 2: "Electrical characteristics" . Updated Figure 2: "Safe operating area" , Figure 3: "Thermal impedance" , Figure 13: "Normalized V(BR)DSS vs. temperature" , Figure 14: "Normalized gate threshold voltage vs. temperature" and Figure 15: "Normalized on-resistance vs. temperature" . Document status promoted from preliminary to production data.

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