

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

Datasheet - production data

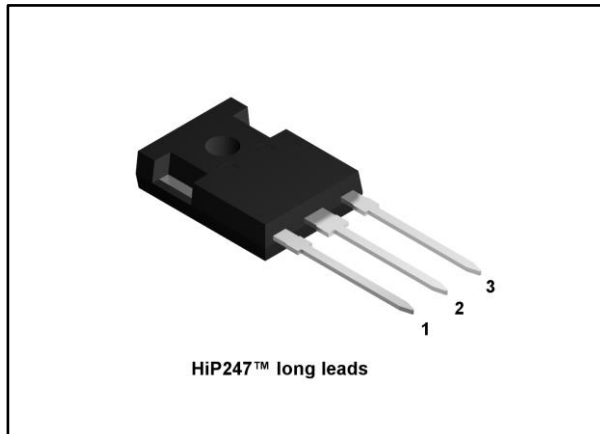
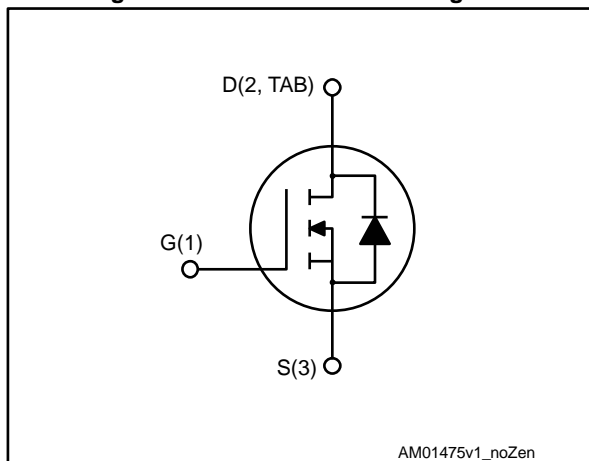


Figure 1: Internal schematic diagram



## Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability ( $T_J = 200\text{ }^\circ\text{C}$ )
- 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 $T_C = 25\text{ °C}$ (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 range	-55 to 200	°C
$T_j$	Operating junction temperature range		

**Notes:**

<sup>(1)</sup>Pulse width limited by safe operating area.

**Table 3: Thermal data**

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

## 2 Electrical characteristics

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

**Table 4: On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 1200\text{ V}$		1	25	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 1200\text{ V}$ , $T_{\text{J}} = 200\text{ °C}$		50		$\mu\text{A}$
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = -10\text{ to }22\text{ V}$			$\pm 100$	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 1\text{ mA}$	1.8	3.5		V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 20\text{ V}$ , $I_{\text{D}} = 20\text{ A}$		80	100	m $\Omega$
		$V_{\text{GS}} = 20\text{ V}$ , $I_{\text{D}} = 20\text{ A}$ $T_{\text{J}} = 150\text{ °C}$		90		m $\Omega$
		$V_{\text{GS}} = 20\text{ V}$ , $I_{\text{D}} = 20\text{ A}$ $T_{\text{J}} = 200\text{ °C}$		100		m $\Omega$

**Table 5: Dynamic**

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

**Table 6: Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$E_{\text{on}}$	Turn-on switching energy	$V_{\text{DD}} = 800\text{ V}$ , $I_{\text{D}} = 20\text{ A}$ , $R_{\text{G}} = 6.8\text{ }\Omega$ , $V_{\text{GS}} = -2\text{ to }20\text{ V}$	-	500	-	$\mu\text{J}$
$E_{\text{off}}$	Turn-off switching energy		-	350	-	$\mu\text{J}$
$E_{\text{on}}$	Turn-on switching energy	$V_{\text{DD}} = 800\text{ V}$ , $I_{\text{D}} = 20\text{ A}$ , $R_{\text{G}} = 6.8\text{ }\Omega$ , $V_{\text{GS}} = -2\text{ to }20\text{ V}$ $T_{\text{J}} = 150\text{ °C}$	-	500	-	$\mu\text{J}$
$E_{\text{off}}$	Turn-off switching energy		-	400	-	$\mu\text{J}$

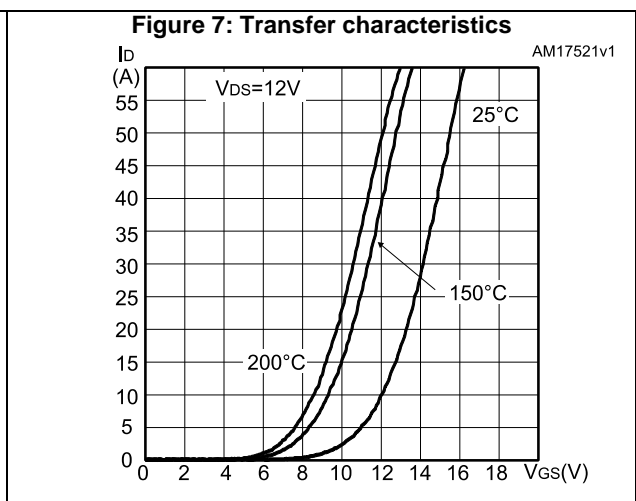
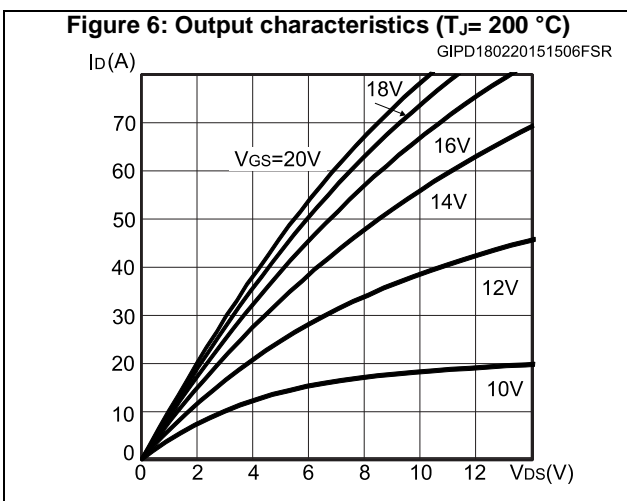
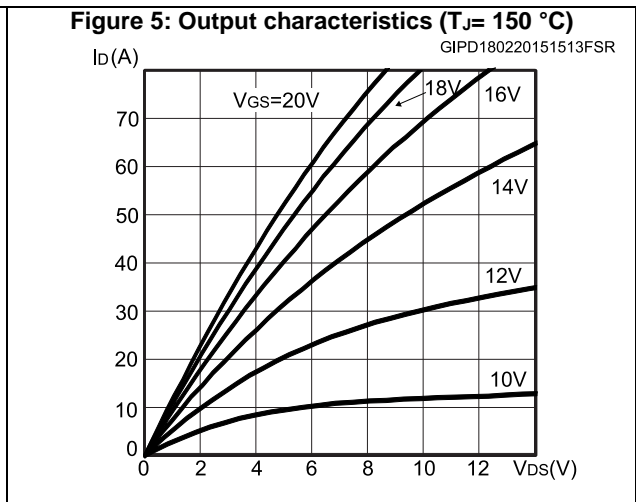
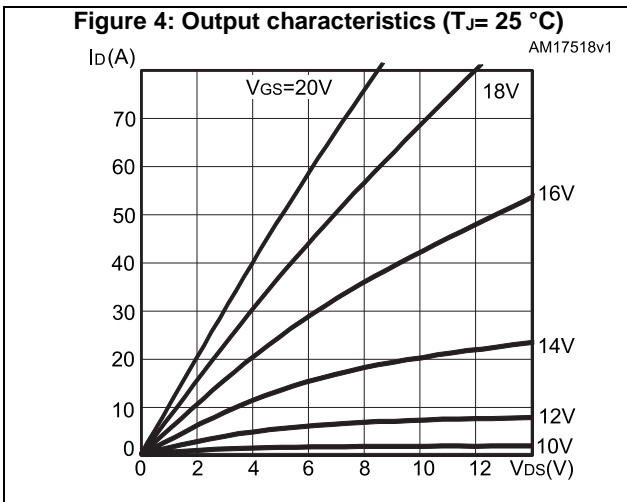
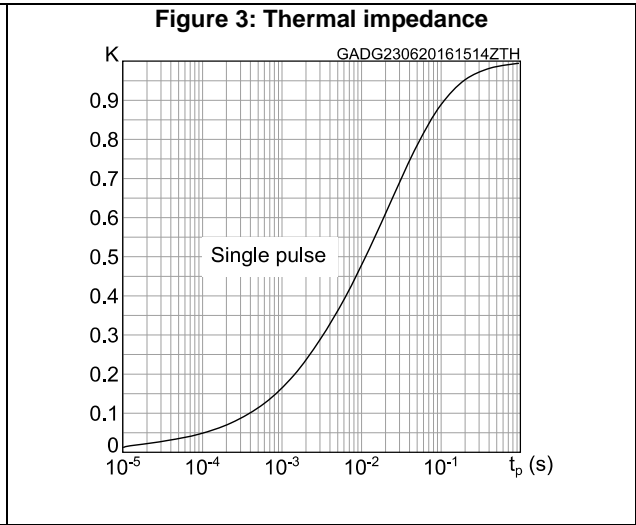
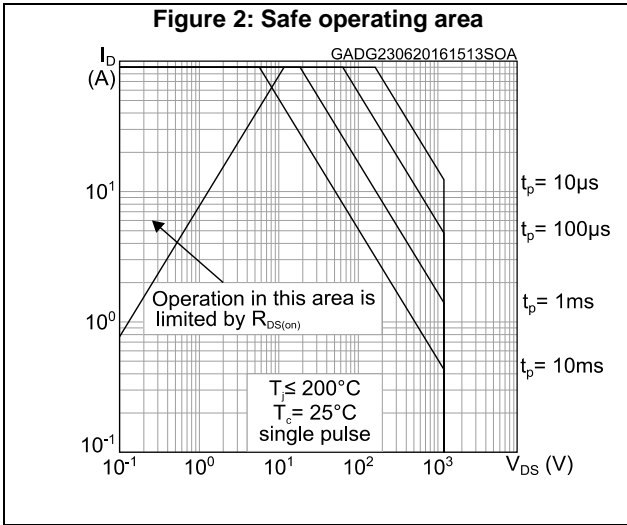
**Table 7: Switching times**

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



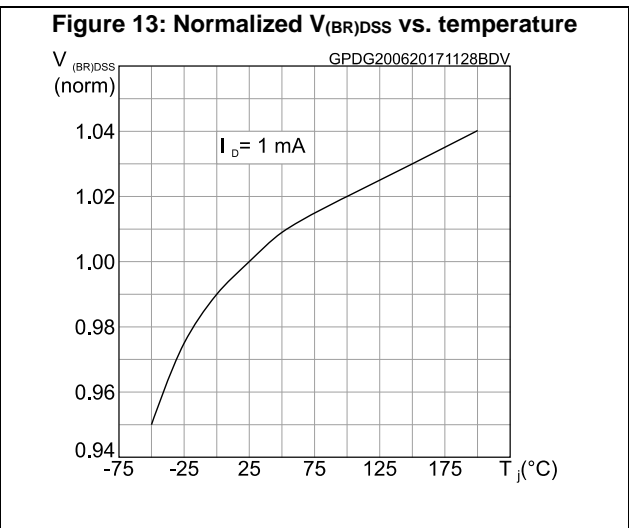
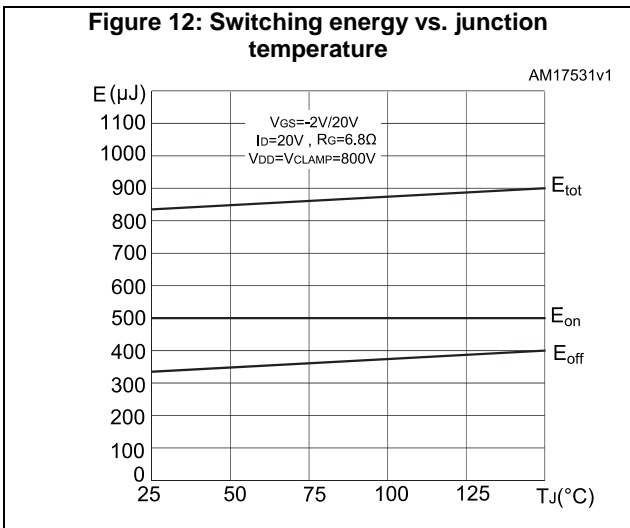
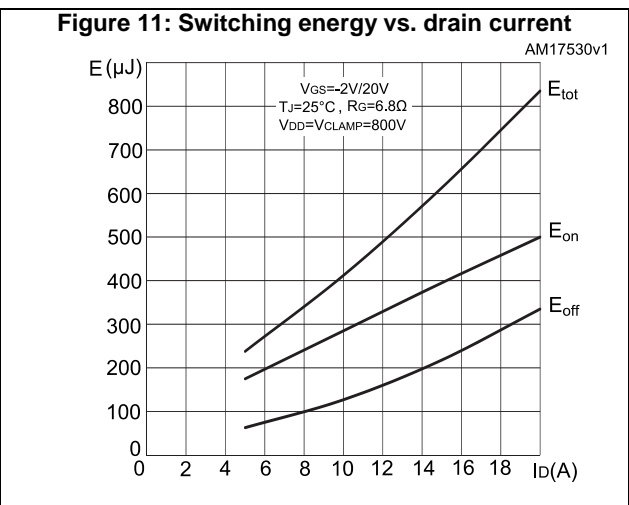
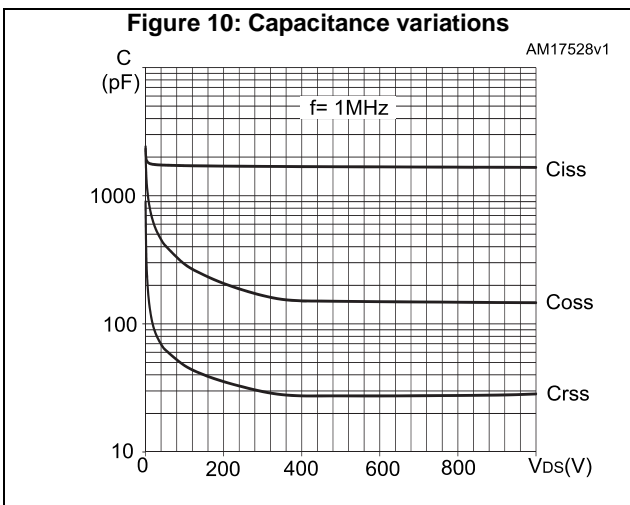
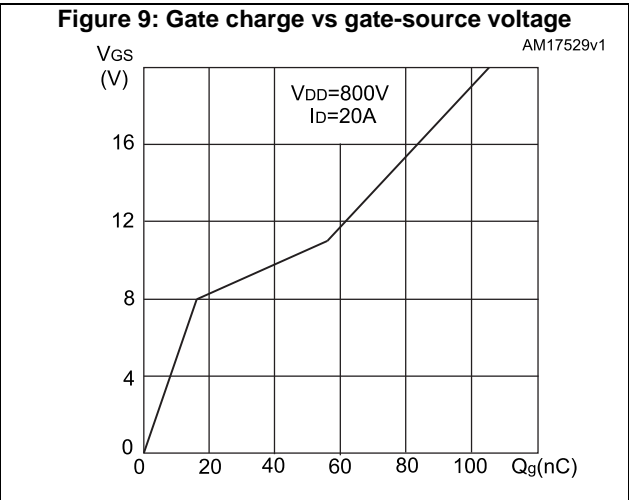
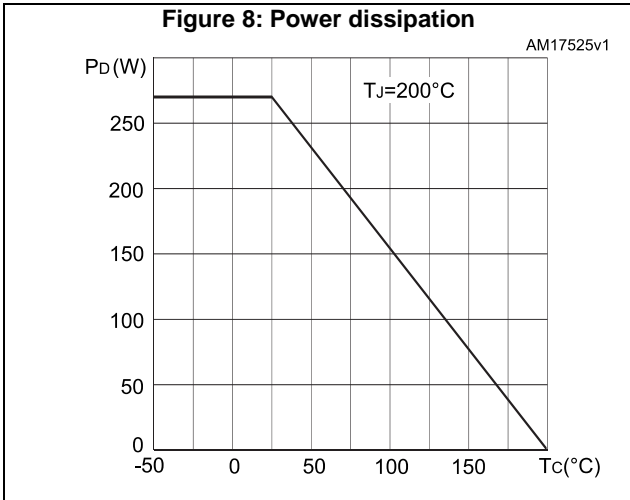


Figure 14: Normalized gate threshold voltage vs. temperature

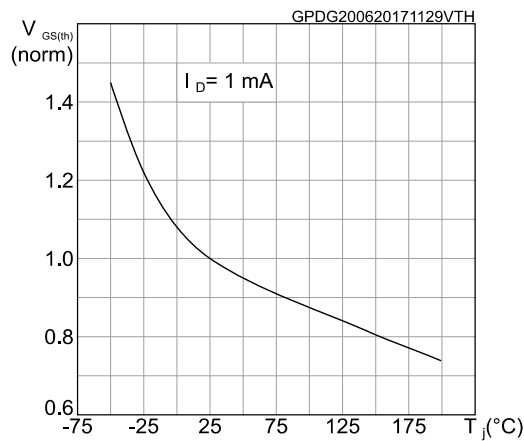


Figure 15: Normalized on-resistance vs. temperature

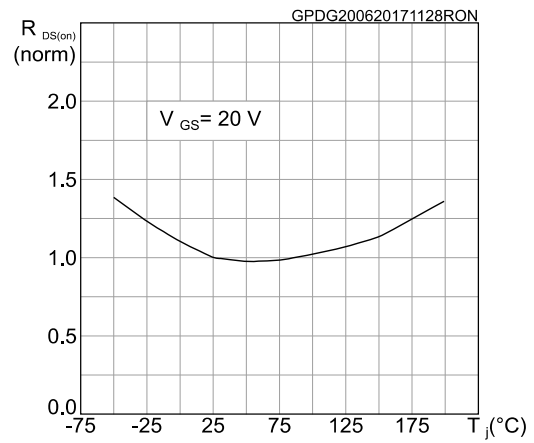


Figure 16: Body diode characteristics ( $T_J = -50 \text{ }^\circ\text{C}$ )

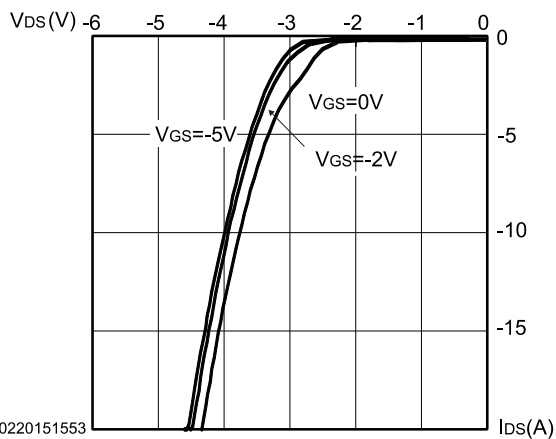


Figure 17: Body diode characteristics ( $T_J = 25 \text{ }^\circ\text{C}$ )

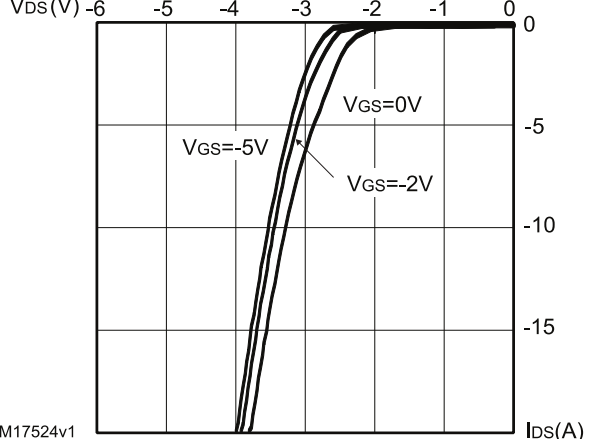


Figure 18: Body diode characteristics ( $T_J = 150 \text{ }^\circ\text{C}$ )

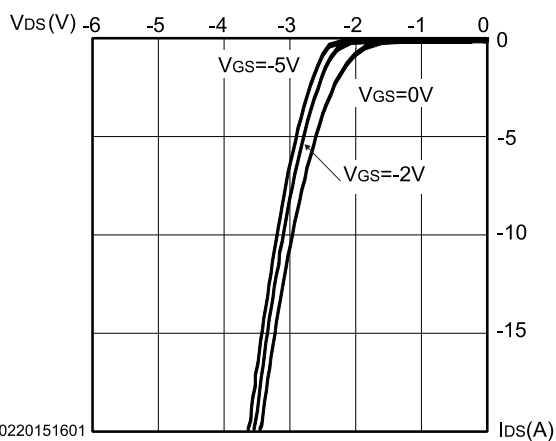


Figure 19: 3rd quadrant characteristics ( $T_J = -50 \text{ }^\circ\text{C}$ )

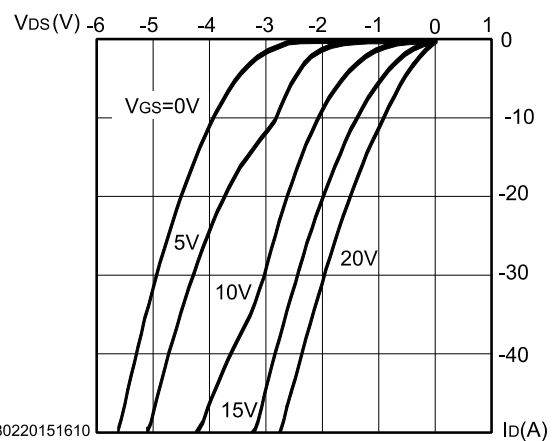




Figure 20: 3rd quadrant characteristics ( $T_J = 25\text{ }^\circ\text{C}$ )

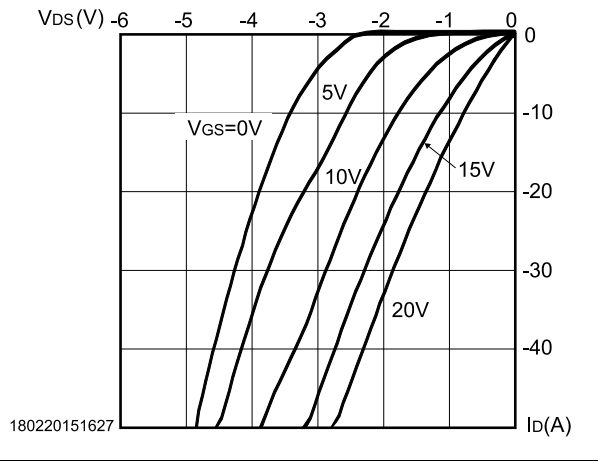
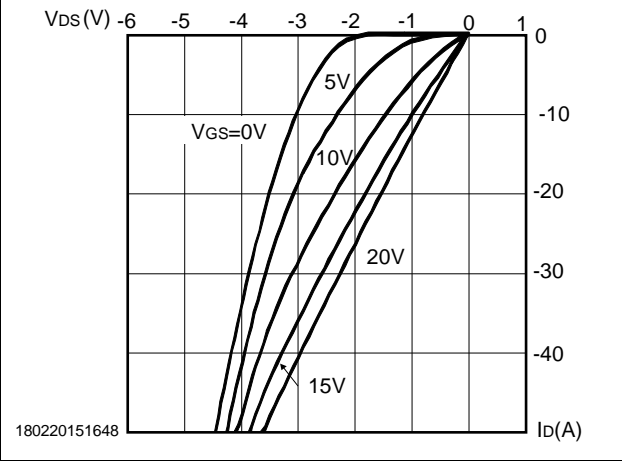


Figure 21: 3rd quadrant characteristics ( $T_J = 150\text{ }^\circ\text{C}$ )



### 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](http://www.st.com). ECOPACK® is an ST trademark.

#### 3.1 HiP247 long leads package information

Figure 22: HiP247™ long leads package outline

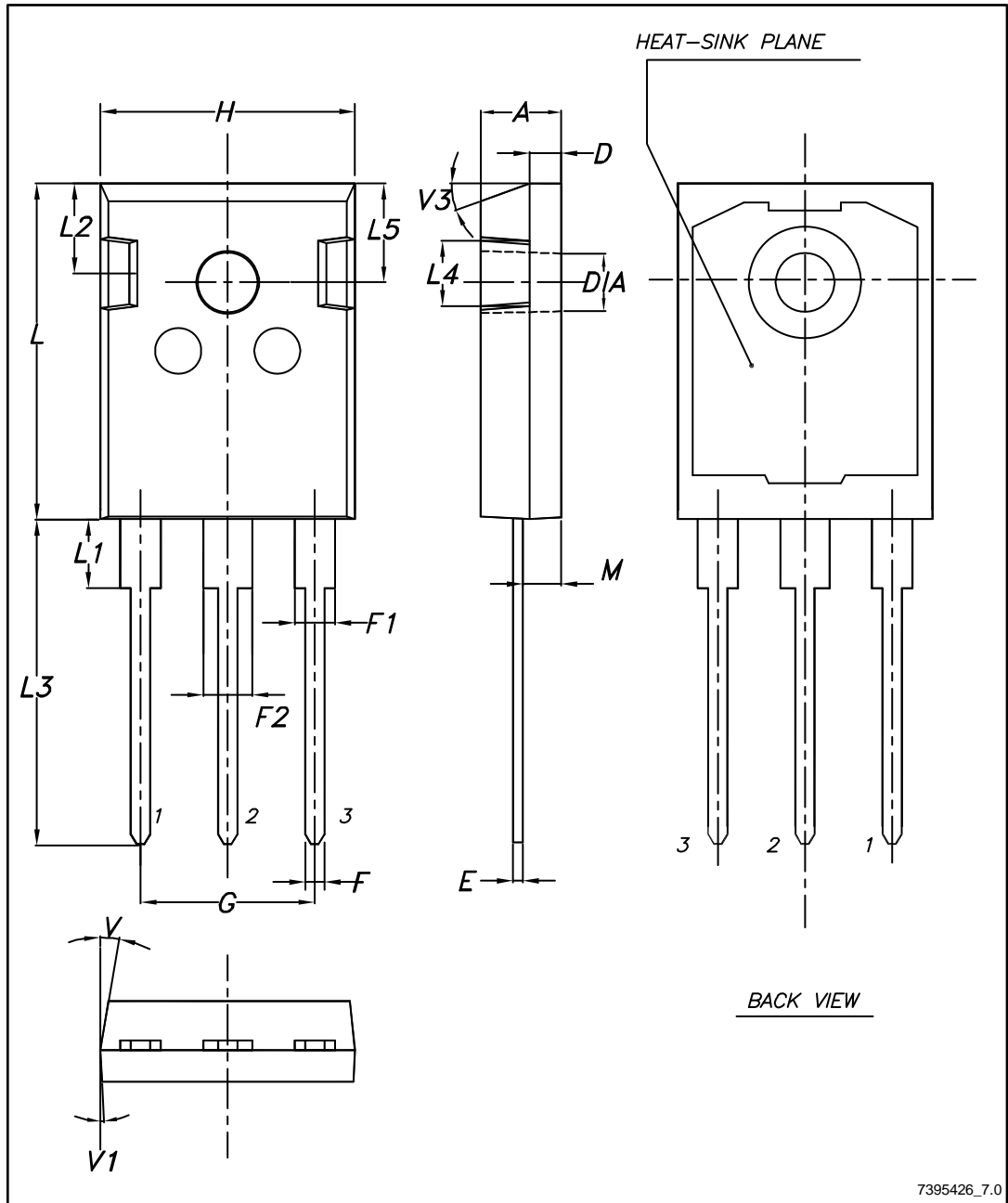


Table 9: HiP247™ long leads package mechanical data

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 <i>Section 1: "Electrical ratings"</i> and <i>Section 2: "Electrical characteristics"</i> . Updated <i>Figure 2: "Safe operating area"</i> , <i>Figure 3: "Thermal impedance"</i> , <i>Figure 13: "Normalized V(BR)DSS vs. temperature"</i> , <i>Figure 14: "Normalized gate threshold voltage vs. temperature"</i> and <i>Figure 15: "Normalized on-resistance vs. temperature"</i> . Document status promoted from preliminary to production data.

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