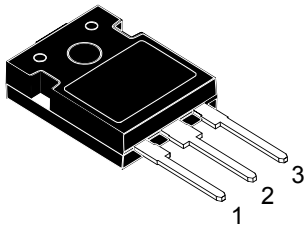
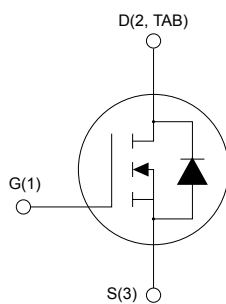


## Automotive-grade silicon carbide Power MOSFET 1700 V, 64 mΩ typ., 43 A in an HiP247 package



**HiP247**


AM01475v1\_noZen



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
SCT20N170AG	1700 V	86 mΩ	43 A

- AEC-Q101 rev. C qualified 
- Very fast and robust intrinsic body diode
- Low capacitances
- Very high operating junction temperature capability (T<sub>J</sub> = 200 °C)

### Applications

- Main inverter (electric traction)
- DC/DC converter for EV/HEV
- On board charger (OBC)

### 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

[SCT20N170AG](#)

#### Product summary

Order code	SCT20N170AG
Marking	SCT20N170AG
Package	HiP247
Packing	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	1700	V
$V_{GS}$	Gate-source voltage	-10 to 22	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ °C}$	43	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	32	
$I_{DM}^{(1)}$	Drain current (pulsed)	129	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	313	W
$T_{stg}$	Storage temperature range	-55 to 200	°C
$T_J$	Operating junction temperature range		°C

1. Pulse width is limited by safe operating area.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.56	°C/W
$R_{thJA}$	Thermal resistance, junction-to-ambient	40	°C/W

## 2 Electrical characteristics

$T_C = 25\text{ °C}$  unless otherwise specified.

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	1700			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 1700\text{ V}$			10	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = -10\text{ V to } 22\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 1\text{ mA}$	1.8	3.0		V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 20\text{ V}$ , $I_D = 20\text{ A}$		64	86	m $\Omega$
		$V_{GS} = 20\text{ V}$ , $I_D = 20\text{ A}$ , $T_J = 150\text{ °C}$		104		
		$V_{GS} = 20\text{ V}$ , $I_D = 20\text{ A}$ , $T_J = 200\text{ °C}$		134		

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 400\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	1568	-	pF
$C_{oss}$	Output capacitance		-	141	-	pF
$C_{rss}$	Reverse transfer capacitance		-	21	-	pF
$R_G$	Gate input resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	6.9	-	$\Omega$
$Q_g$	Total gate charge	$V_{DS} = 1000\text{ V}$ , $I_D = 25\text{ A}$ , $V_{GS} = -5\text{ to } 20\text{ V}$	-	101	-	nC
$Q_{gs}$	Gate-source charge		-	48	-	nC
$Q_{gd}$	Gate-drain charge		-	23	-	nC

**Table 5. Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{DD} = 1000\text{ V}$ , $I_D = 25\text{ A}$	-	623	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 0\text{ V to } 20\text{ V}$	-	180	-	$\mu\text{J}$
$E_{+on}$	Turn-on switching energy	$V_{DD} = 1000\text{ V}$ , $I_D = 25\text{ A}$ , $R_G = 4.7\text{ }\Omega$ ,	-	1162	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$V_{GS} = 0\text{ V to } 20\text{ V}$ , $T_J = 200\text{ °C}$	-	183	-	$\mu\text{J}$

**Table 6. Reverse SiC diode characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Diode forward voltage	$I_F = 25\text{ A}$ , $V_{GS} = 0\text{ V}$	-	3.8	-	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 25\text{ A}$ , $V_{GS} = 0\text{ V}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 1000\text{ V}$	-	13	-	ns
$Q_{rr}$	Reverse recovery charge		-	280	-	nC
$I_{RRM}$	Reverse recovery current		-	37	-	A

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

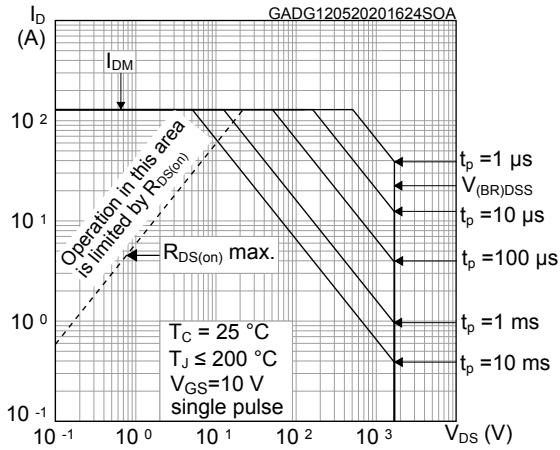


Figure 2. Maximum transient thermal impedance

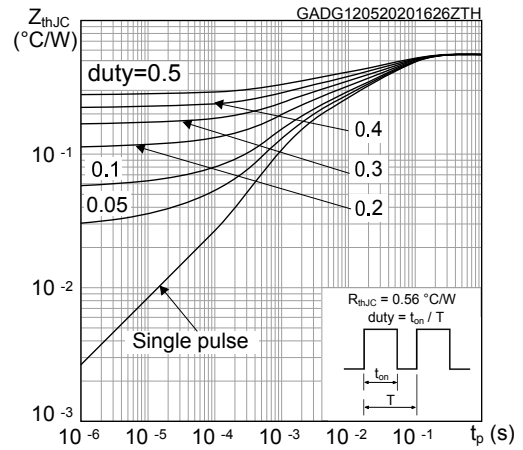


Figure 3. Typical output characteristics ( $T_J = 25\text{ °C}$ )

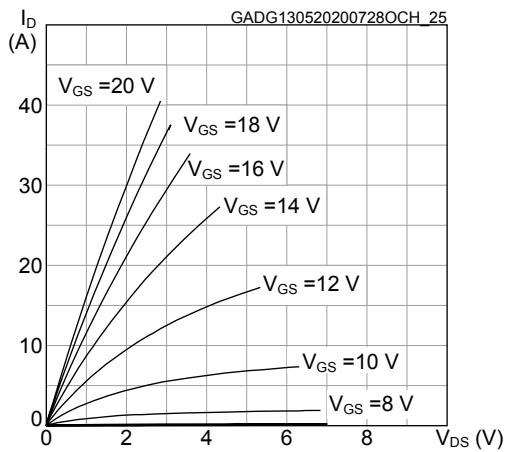


Figure 4. Typical output characteristics ( $T_J = 200\text{ °C}$ )

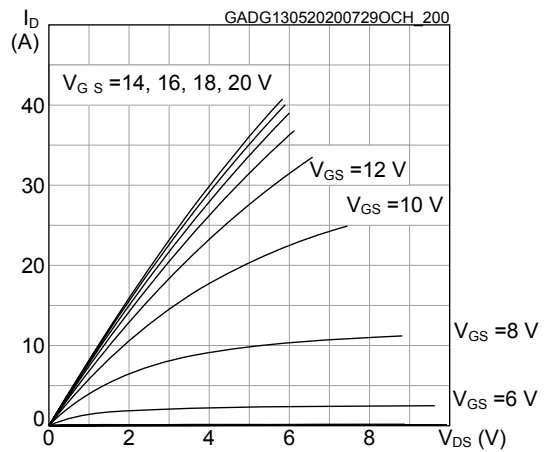


Figure 5. Typical transfer characteristics

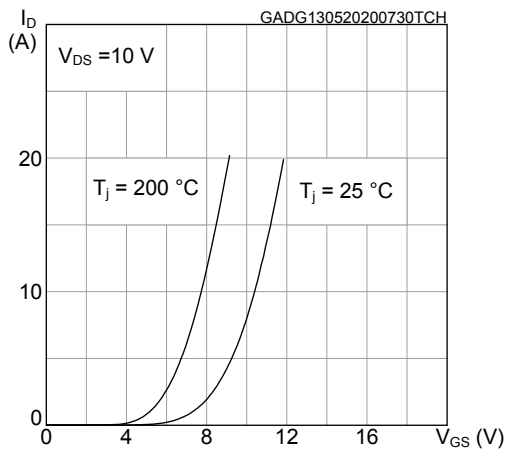
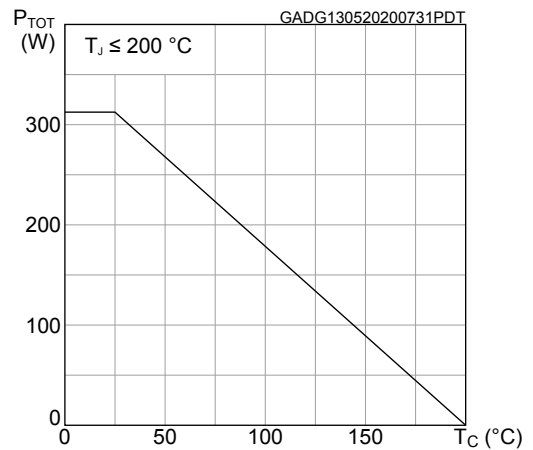
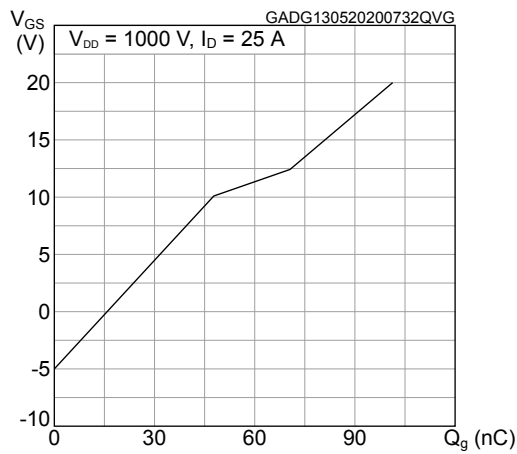


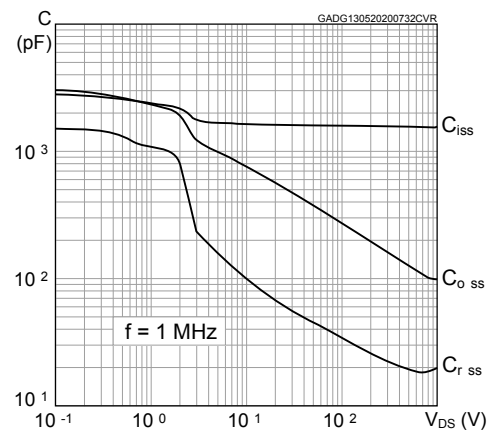
Figure 6. Total power dissipation



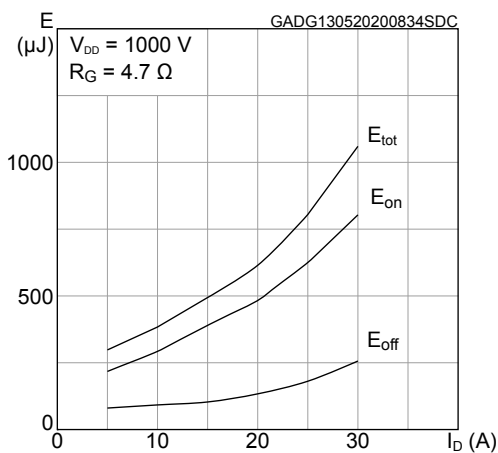
**Figure 7. Typical gate charge characteristics**



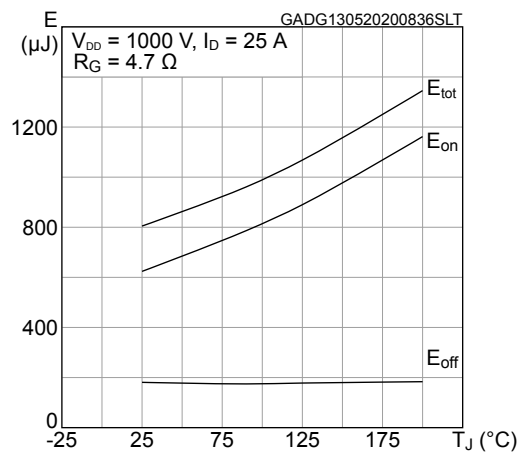
**Figure 8. Typical capacitance characteristics**



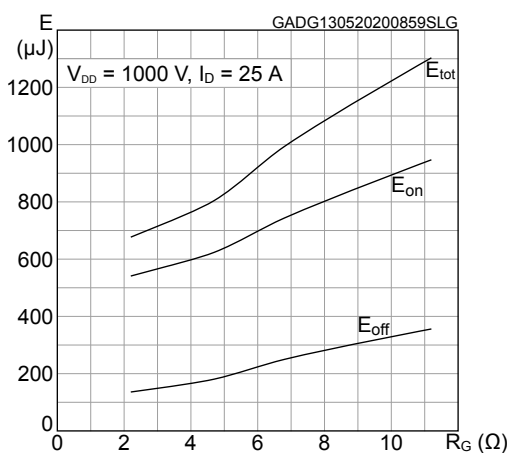
**Figure 9. Typical switching energy vs  $I_D$**



**Figure 10. Typical switching energy vs temperature**



**Figure 11. Typical switching energy vs  $R_G$**



**Figure 12. Typical drain-source on-resistance**

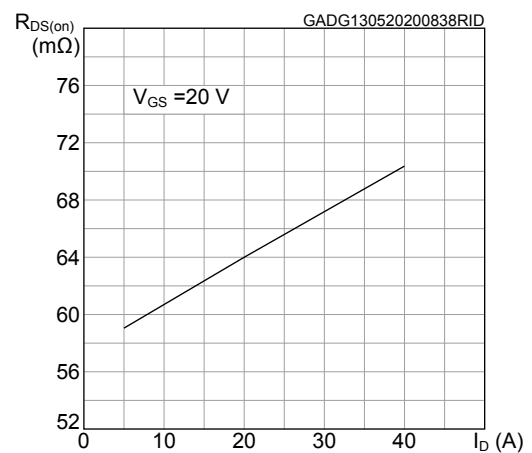


Figure 13. Normalized breakdown voltage vs temperature

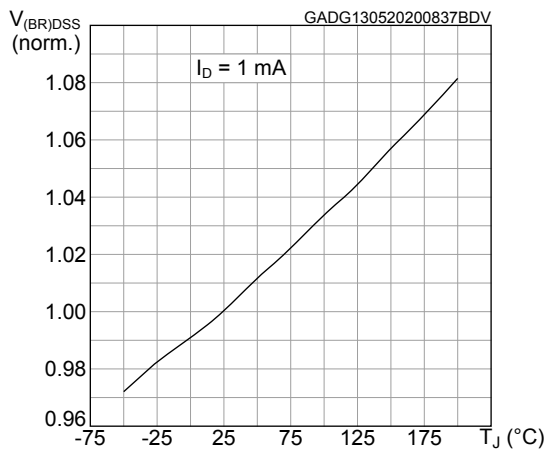


Figure 14. Normalized gate threshold vs temperature

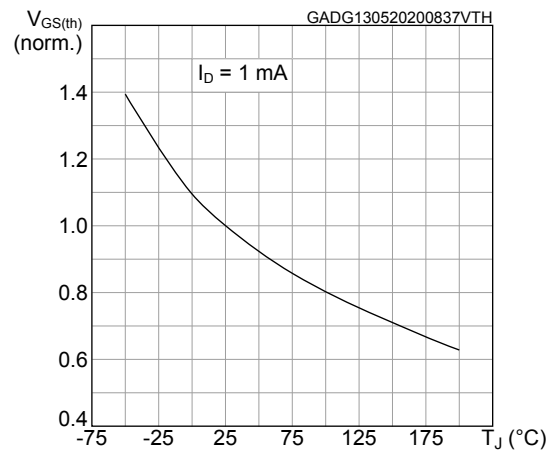


Figure 15. Normalized on-resistance vs temperature

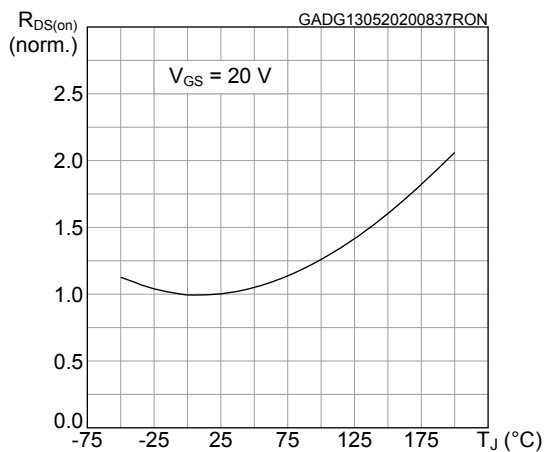


Figure 16. Typical reverse conduction characteristics (T\_J = 25 °C)

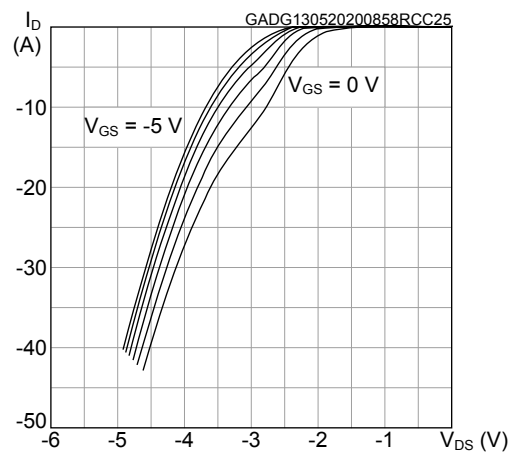
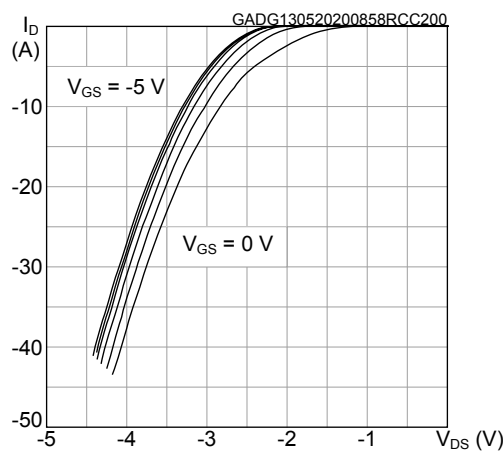


Figure 17. Typical reverse conduction characteristics (T\_J = 200 °C)

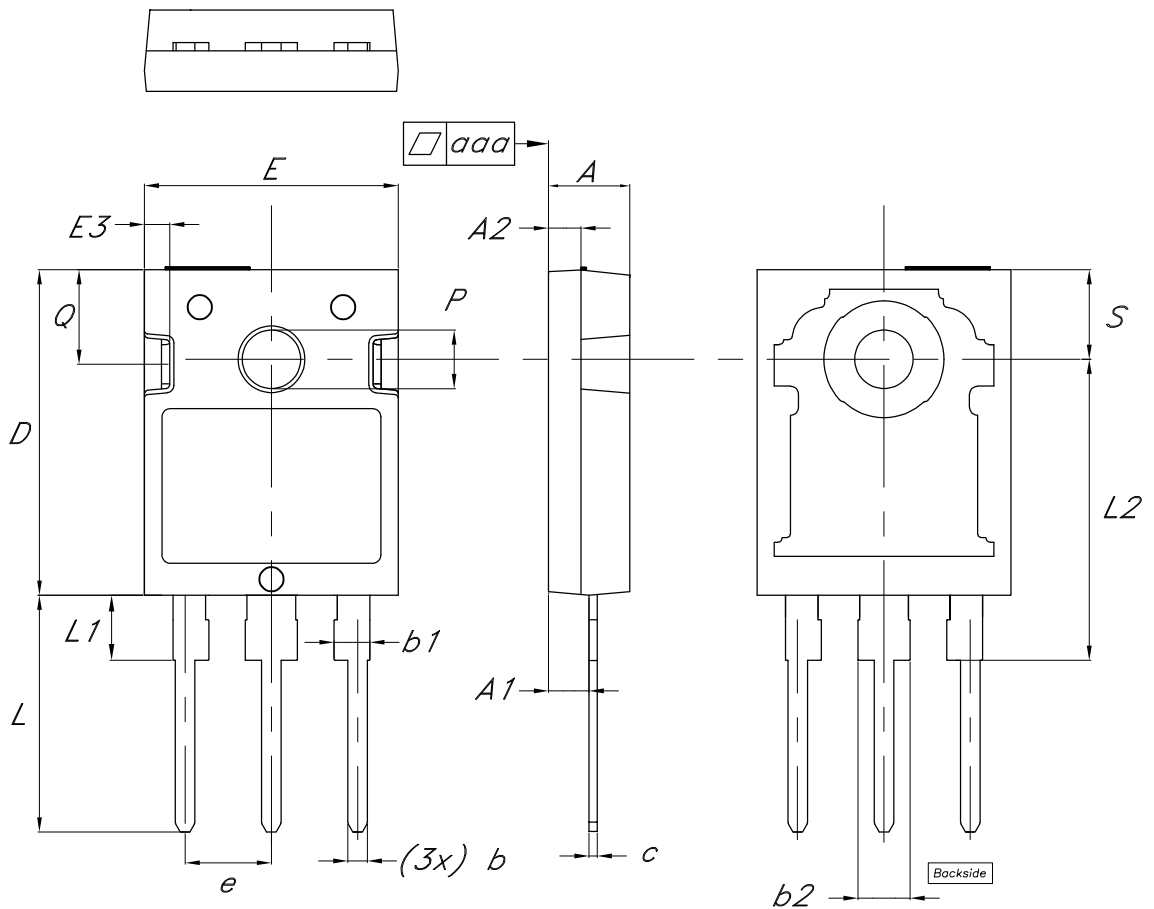


### 3 Package information

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 package information

Figure 18. HiP247 package outline



8581091\_4

**Table 7. 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
aaa		0.04	0.10



## Revision history

**Table 8. Document revision history**

Date	Revision	Changes
12-May-2020	1	First release.
8-Jun-2020	2	Modified title.
31-Jul-2020	3	Modified <a href="#">Table 3. On/off states.</a> Minor text changes.
24-Jun-2021	4	Updated <a href="#">Features</a> in cover page. Minor text changes.

---

## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>2</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>3</b>
<b>2.1</b>	<b>Electrical characteristics (curves)</b> .....	<b>4</b>
<b>3</b>	<b>Package information</b> .....	<b>7</b>
<b>3.1</b>	<b>HiP247 package information</b> .....	<b>7</b>
	<b>Revision history</b> .....	<b>9</b>

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2021 STMicroelectronics – All rights reserved