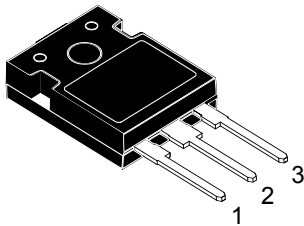
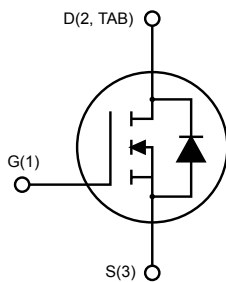


## Silicon carbide Power MOSFET 650 V, 119 A, 18 mΩ (typ., T<sub>J</sub> = 25 °C) in an HiP247 package


**HiP247**


AM01475v1\_noZen



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
SCTW90N65G2V	650 V	24 mΩ	119 A

- Very high operating junction temperature capability (T<sub>J</sub> = 200 °C)
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitances

### Applications

- Switching applications
- Power supply for renewable energy systems
- High frequency DC-DC converters

### Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2<sup>nd</sup> generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.

#### Product status link

[SCTW90N65G2V](#)

#### Product summary

<b>Order code</b>	SCTW90N65G2V
<b>Marking</b>	SCT90N65G2V
<b>Package</b>	HiP247
<b>Packing</b>	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	650	V
$V_{GS}$	Gate-source voltage	-10 to 22	V
	Gate-source voltage (recommended operating values)	-5 to 18	
$I_D$	Drain current (continuous) at $T_C = 25\text{ °C}$	119	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	90	
$I_{DM}^{(1)}$	Drain current (pulsed)	220	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	565	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
$R_{thj-case}$	Thermal resistance junction-case	0.31	°C/W
$R_{thj-amb}$	Thermal resistance junction-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	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
		$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ °C}$		10		
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.9	3.2	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}, I_D = 50\text{ A}$		18	24	m $\Omega$
		$V_{GS} = 18\text{ V}, I_D = 50\text{ A}, T_J = 200\text{ °C}$		30		

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 400\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	3380	-	pF
$C_{oss}$	Output capacitance		-	294	-	pF
$C_{rSS}$	Reverse transfer capacitance		-	49	-	pF
$Q_g$	Total gate charge	$V_{DD} = 400\text{ V}, I_D = 50\text{ A}, V_{GS} = -5\text{ to }18\text{ V}$	-	157	-	nC
$Q_{gs}$	Gate-source charge		-	43	-	nC
$Q_{gd}$	Gate-drain charge		-	42	-	nC
$R_g$	Gate input resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$	-	1	-	$\Omega$

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}, V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $R_G = 2.2\text{ }\Omega$	-	130	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy		-	210	-	
$E_{on}$	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}, V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $R_G = 2.2\text{ }\Omega, T_C = 150\text{ °C}$	-	135	-	
$E_{off}$	Turn-off switching energy		-	200	-	

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$ , $I_D = 50\text{ A}$ , $R_G = 2.2\ \Omega$ , $V_{GS} = -5\text{ V to }18\text{ V}$	-	26	-	ns
$t_f$	Fall time		-	16	-	ns
$t_{d(off)}$	Turn-off delay time		-	58	-	ns
$t_r$	Rise time		-	38	-	ns

**Table 7. Reverse SiC diode characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Forward on voltage	$I_F = 30\text{ A}$ , $V_{GS} = 0\text{ V}$	-	2.5	-	V
$t_{rr}$	Reverse recovery time	$I_F = 50\text{ A}$ , $di/dt = 4000\text{ A}/\mu\text{s}$ , $V_{DD} = 400\text{ V}$	-	17	-	ns
$Q_{rr}$	Reverse recovery charge		-	308	-	nC
$I_{RRM}$	Reverse recovery current		-	30	-	A

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

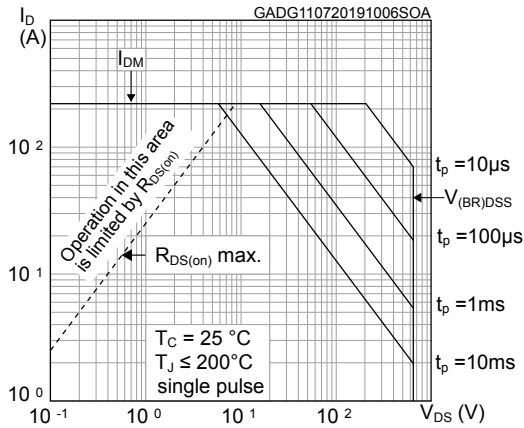


Figure 2. Maximum transient thermal impedance

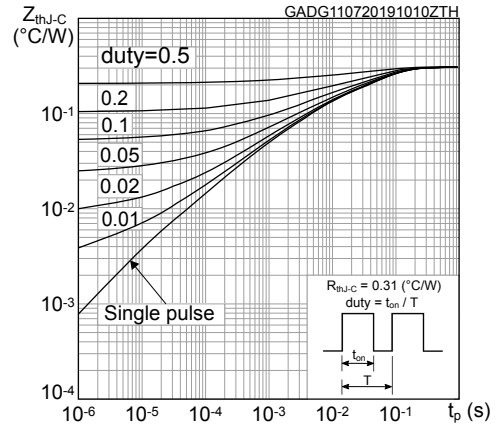


Figure 3. Typical output characteristics ( $T_J = -50\text{ °C}$ )

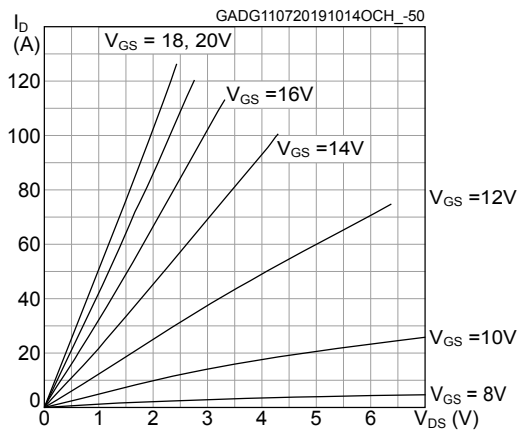


Figure 4. Typical output characteristics ( $T_J = 25\text{ °C}$ )

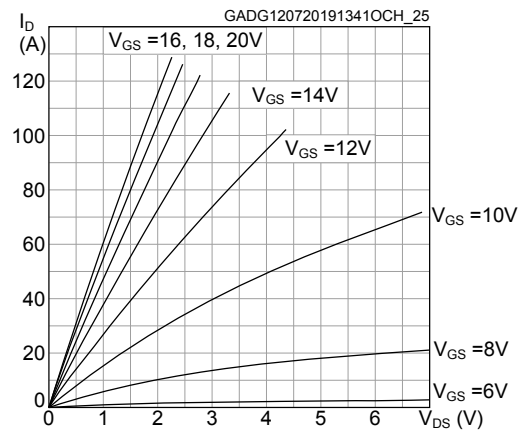


Figure 5. Typical output characteristics ( $T_J = 200\text{ °C}$ )

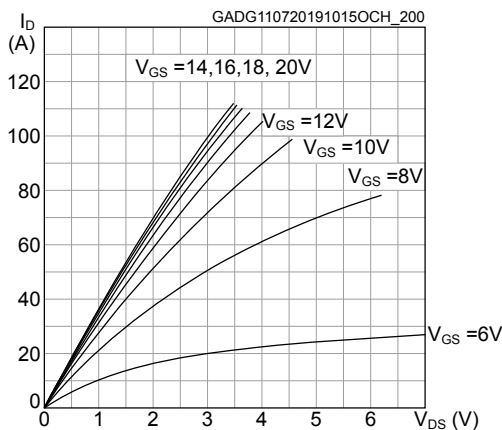
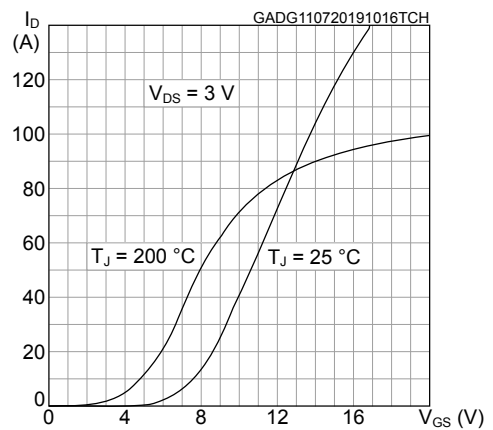
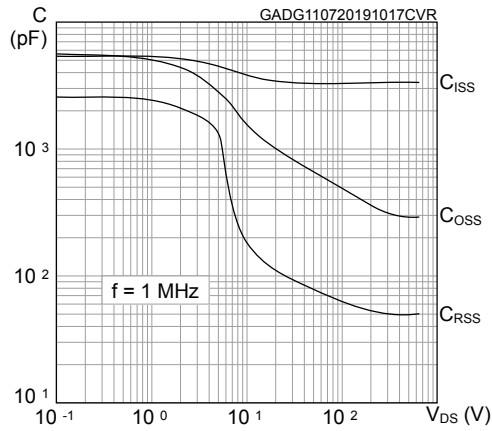


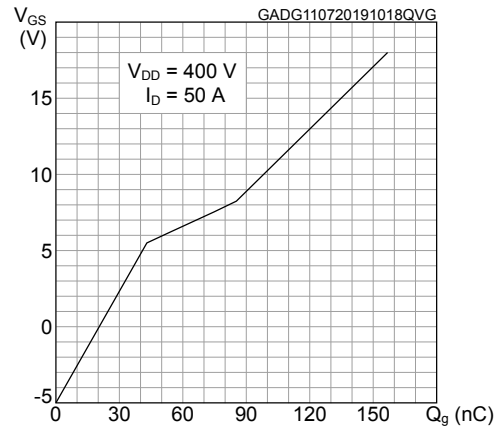
Figure 6. Typical transfer characteristics



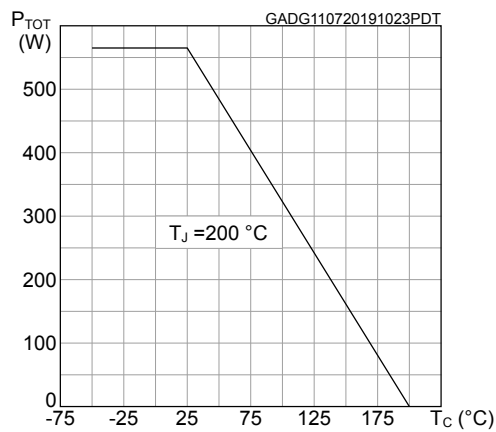
**Figure 7. Typical capacitances**



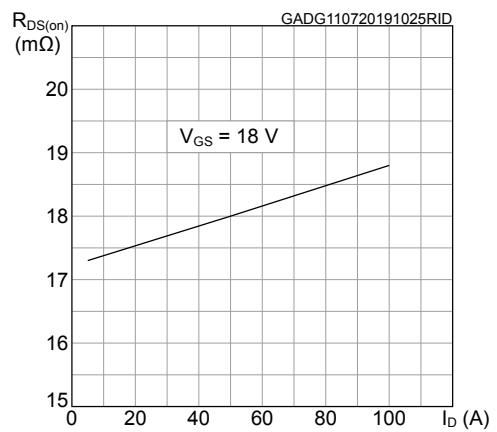
**Figure 8. Typical gate charge**



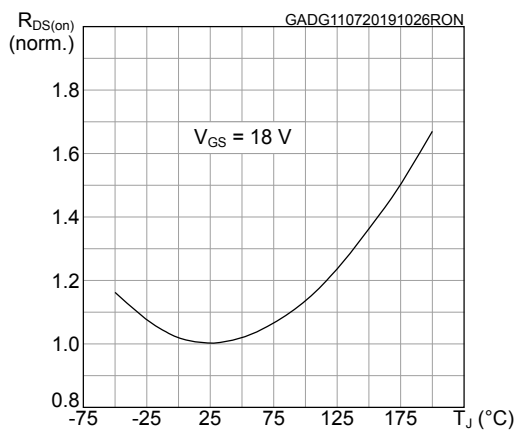
**Figure 9. Maximum total power dissipation**



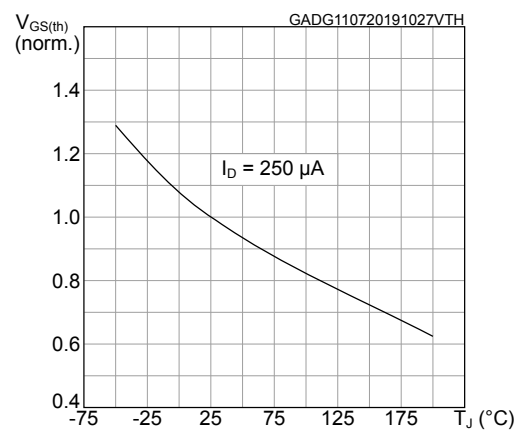
**Figure 10. Typical drain-source on-resistance**



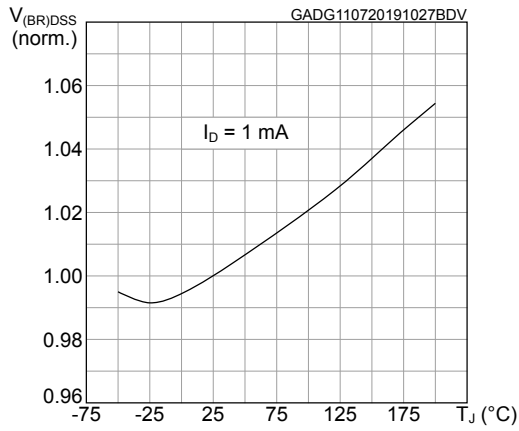
**Figure 11. Normalized on-resistance vs temperature**



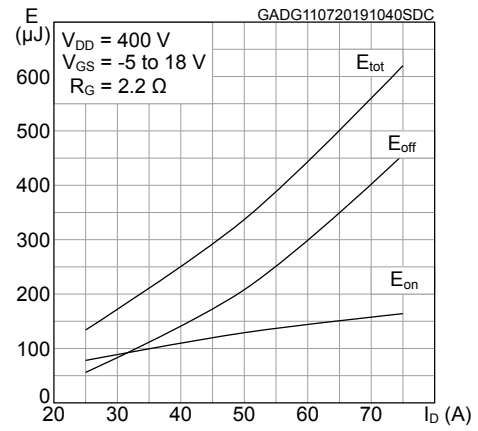
**Figure 12. Normalized gate threshold voltage vs temperature**



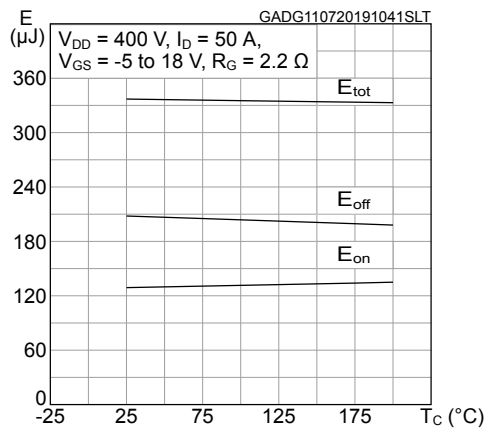
**Figure 13. Normalized breakdown voltage vs temperature**



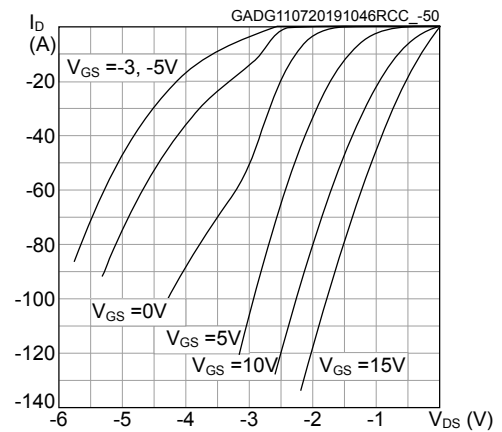
**Figure 14. Typical switching energy vs drain current**



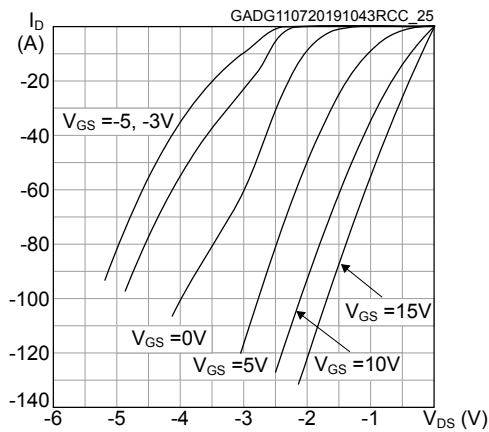
**Figure 15. Typical switching energy vs temperature**



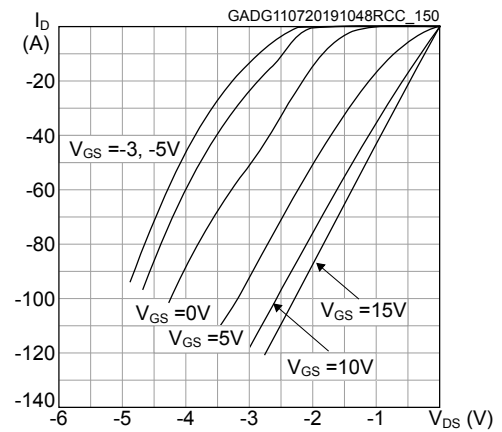
**Figure 16. Typical reverse conduction characteristics (Tj = -50 °C)**



**Figure 17. Typical reverse conduction characteristics (Tj = 25 °C)**



**Figure 18. Typical reverse conduction characteristics (Tj = 150 °C)**

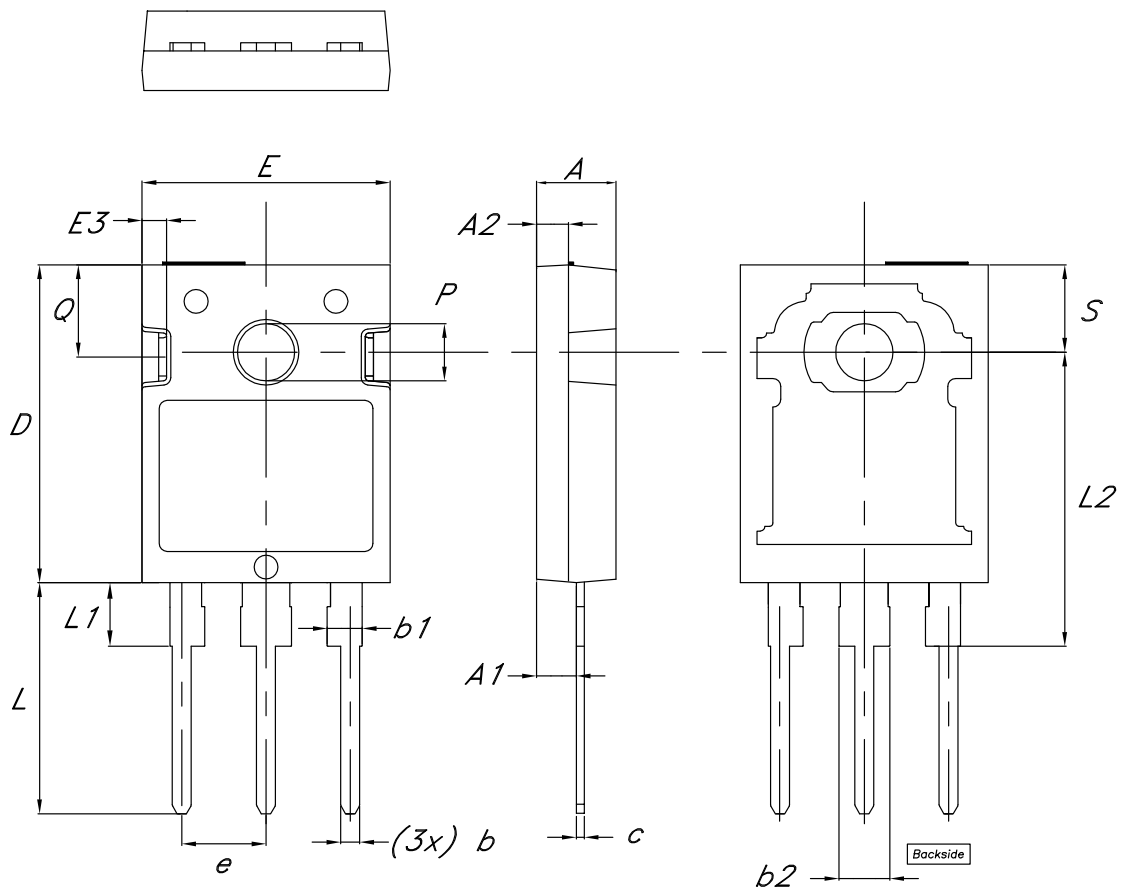


### 3 Package information

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 19. 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
15-Sep-2016	1	First release
29-Mar-2017	2	Updated <i>Table 7: "Switching times"</i> and <i>Table 8: "Reverse diode characteristics"</i> . Updated <i>Section 2.1: "Electrical characteristics (curves)"</i> . Minor text changes
25-Jun-2018	3	Updated cover page. Updated <i>Section 2 Electrical characteristics</i> and <i>Section 3 Package information</i> . Minor text changes.
24-Jan-2019	4	Modified <i>Table 1. Absolute maximum ratings</i> , <i>Table 3. On/off states</i> . Modified <i>Figure 1. Safe operating area</i> and <i>Figure 2. Normalized thermal impedance</i> . Minor text changes.
15-Jul-2019	5	Updated <a href="#">Section 1 Electrical ratings</a> . Updated <a href="#">Section 2 Electrical characteristics</a> and <a href="#">Section 2.1 Electrical characteristics (curves)</a> . Minor text changes.

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