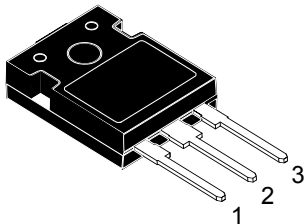
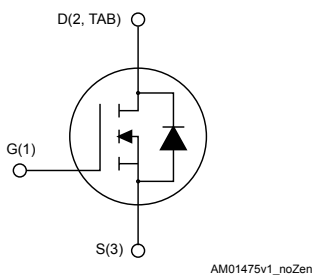


## Silicon carbide Power MOSFET 650 V, 55 mΩ typ., 45 A in an HiP247 package


**HiP247**

**Product status link**
[SCTW35N65G2V](#)
**Product summary**

<b>Order code</b>	SCTW35N65G2V
<b>Marking</b>	SCTW35N65G2V
<b>Package</b>	HiP247
<b>Packing</b>	Tube

### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
SCTW35N65G2V	650 V	67 mΩ	45 A

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

### Applications

- Switching mode power supply
- DC-DC converters
- Industrial motor control

### 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.

# 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 range)	-5 to 20	
$I_D$	Drain current (continuous) at $T_C = 25\text{ °C}$	45	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	35	
$I_{DM}^{(1)}$	Drain current (pulsed)	90	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	240	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	0.72	°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	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$			5	$\mu\text{A}$
$I_{GSS}$	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	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	1.8	3.2	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 20\text{ V}, I_D = 20\text{ A}$		45	67	m $\Omega$
		$V_{GS} = 18\text{ V}, I_D = 20\text{ A}$		55		
		$V_{GS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 200\text{ °C}$		68		

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 400\text{ V}, f = 1\text{ MHz}$	-	1370	-	pF
$C_{oss}$	Output capacitance		-	125	-	pF
$C_{rss}$	Reverse transfer capacitance		-	30	-	pF
$R_g$	Intrinsic gate resistance	$f = 1\text{ MHz}$	-	2	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 400\text{ V}, I_D = 20\text{ A}, V_{GS} = 0\text{ to }20\text{ V}$	-	73	-	nC
$Q_{gs}$	Gate-source charge		-	14	-	nC
$Q_{gd}$	Gate-drain charge		-	27	-	nC

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{DD} = 400\text{ V}, I_D = 20\text{ A},$	-	100	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$R_G = 4.7\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$	-	35	-	$\mu\text{J}$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}, I_D = 20\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$	-	16	-	ns
$t_f$	Fall time		-	14	-	ns
$t_{d(off)}$	Turn-off delay time		-	35	-	ns
$t_r$	Rise time		-	9	-	ns

**Table 7. Reverse diode characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_F = 20\text{ A}$ ,	-	3.3	-	V
$t_{rr}$	Reverse recovery time	$V_{DD} = 400\text{ V}$ , $I_F = 20\text{ A}$ , $di/dt = 1000\text{ A}/\mu\text{s}$	-	18	-	ns
$Q_{rr}$	Reverse recovery charge		-	85	-	nC
$I_{RRM}$	Reverse recovery current		-	7	-	A

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

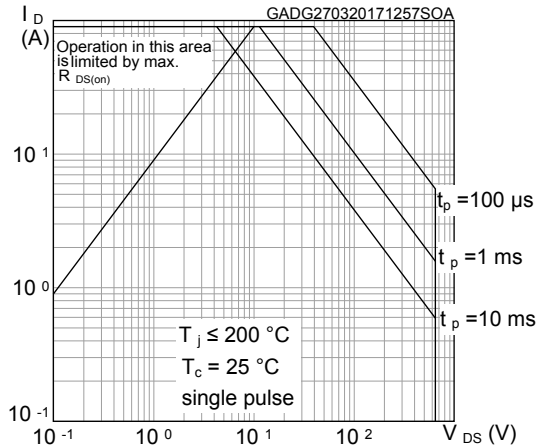


Figure 2. Thermal impedance

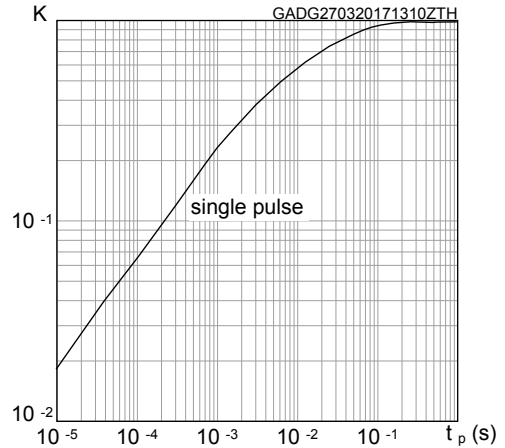


Figure 3. Output characteristics ( $T_J = 25\text{ }^\circ\text{C}$ )

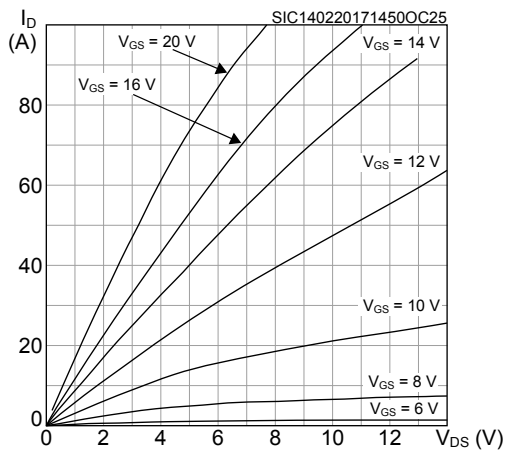


Figure 4. Output characteristics ( $T_J = 175\text{ }^\circ\text{C}$ )

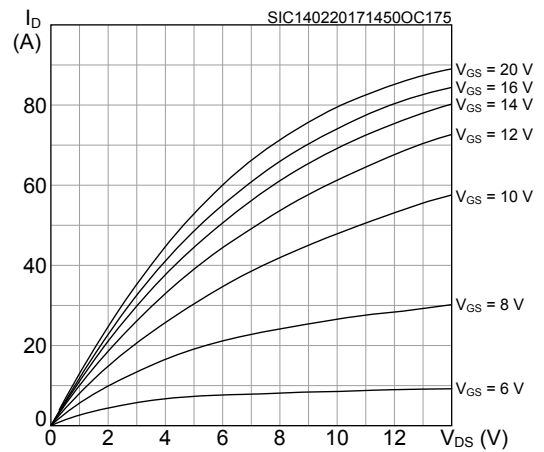


Figure 5. Transfer characteristics

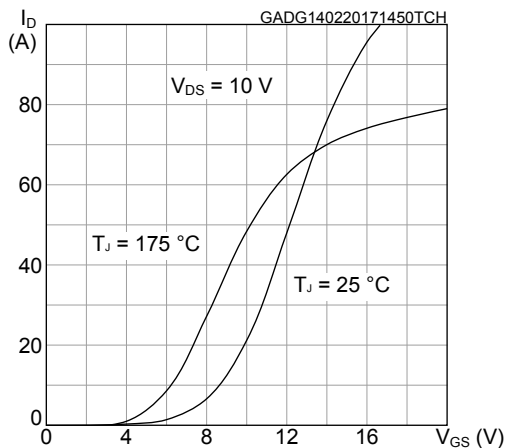
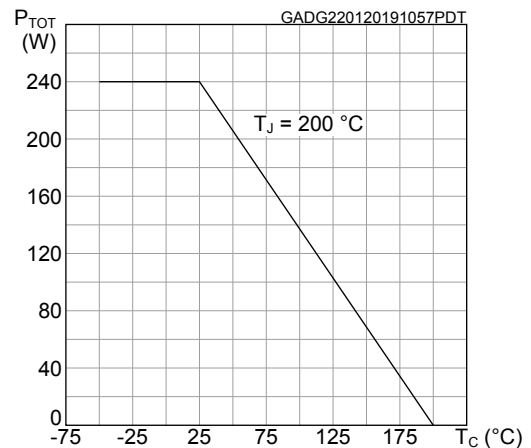
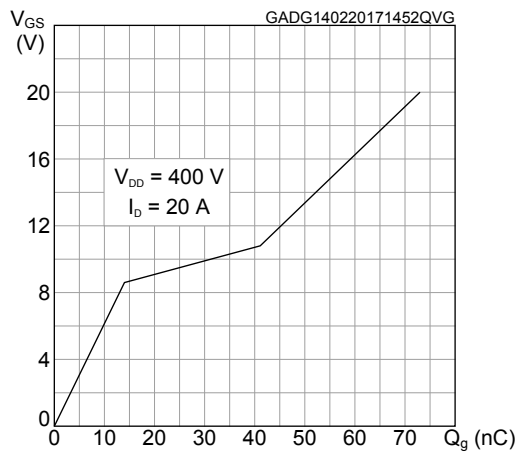


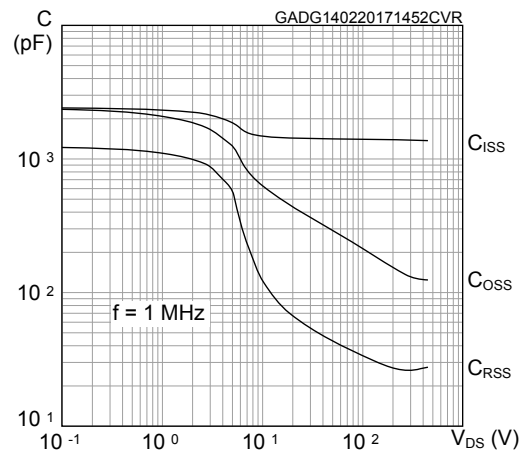
Figure 6. Total power dissipation



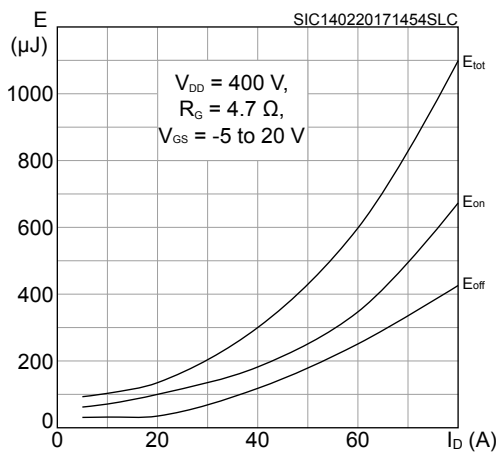
**Figure 7. Gate charge vs gate-source voltage**



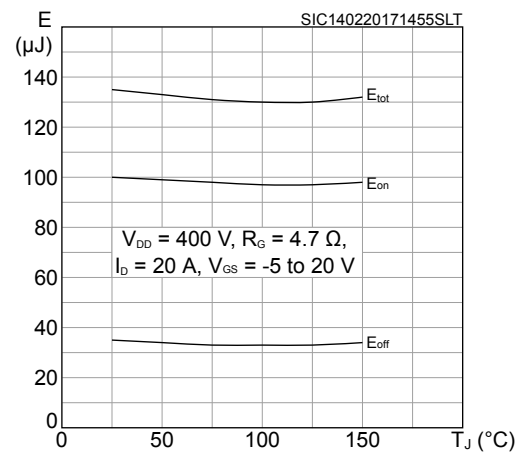
**Figure 8. Capacitance variations**



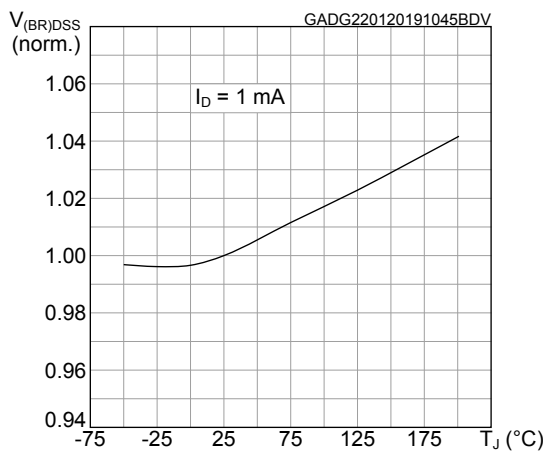
**Figure 9. Switching energy vs drain current**



**Figure 10. Switching energy vs junction temperature**



**Figure 11. Normalized  $V_{(BR)DSS}$  vs temperature**



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

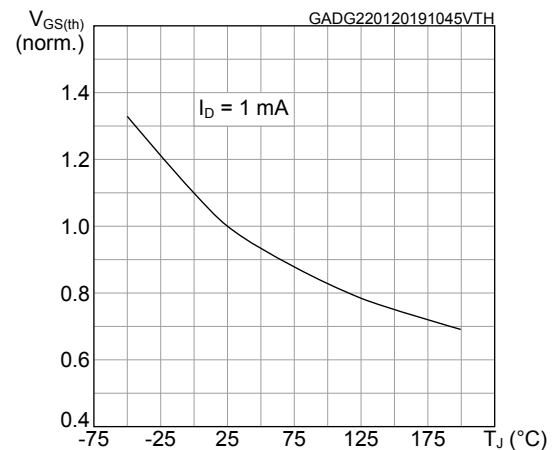


Figure 13. Normalized on-resistance vs temperature

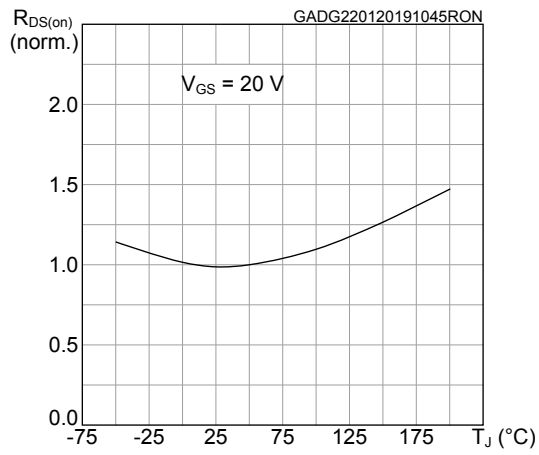


Figure 14. Reverse conduction characteristics ( $T_J = 25$  °C)

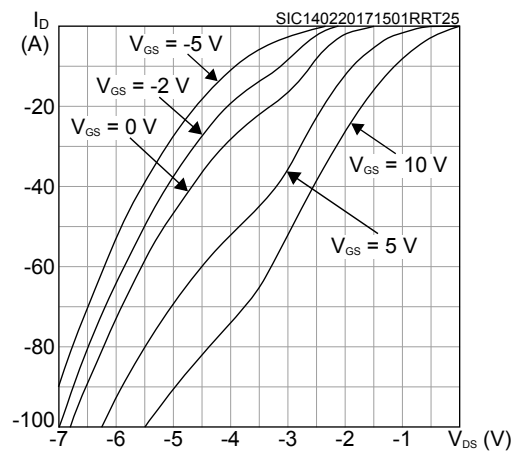
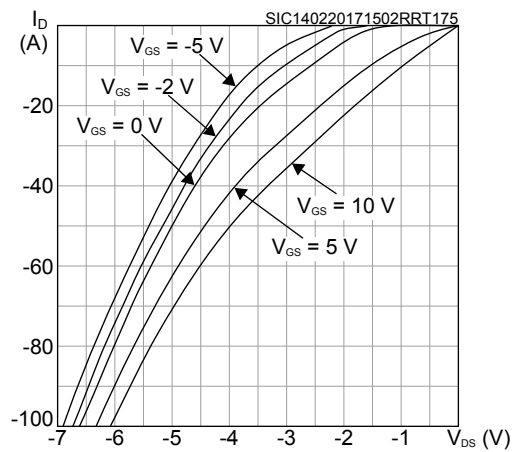


Figure 15. Reverse conduction characteristics ( $T_J = 175$  °C)

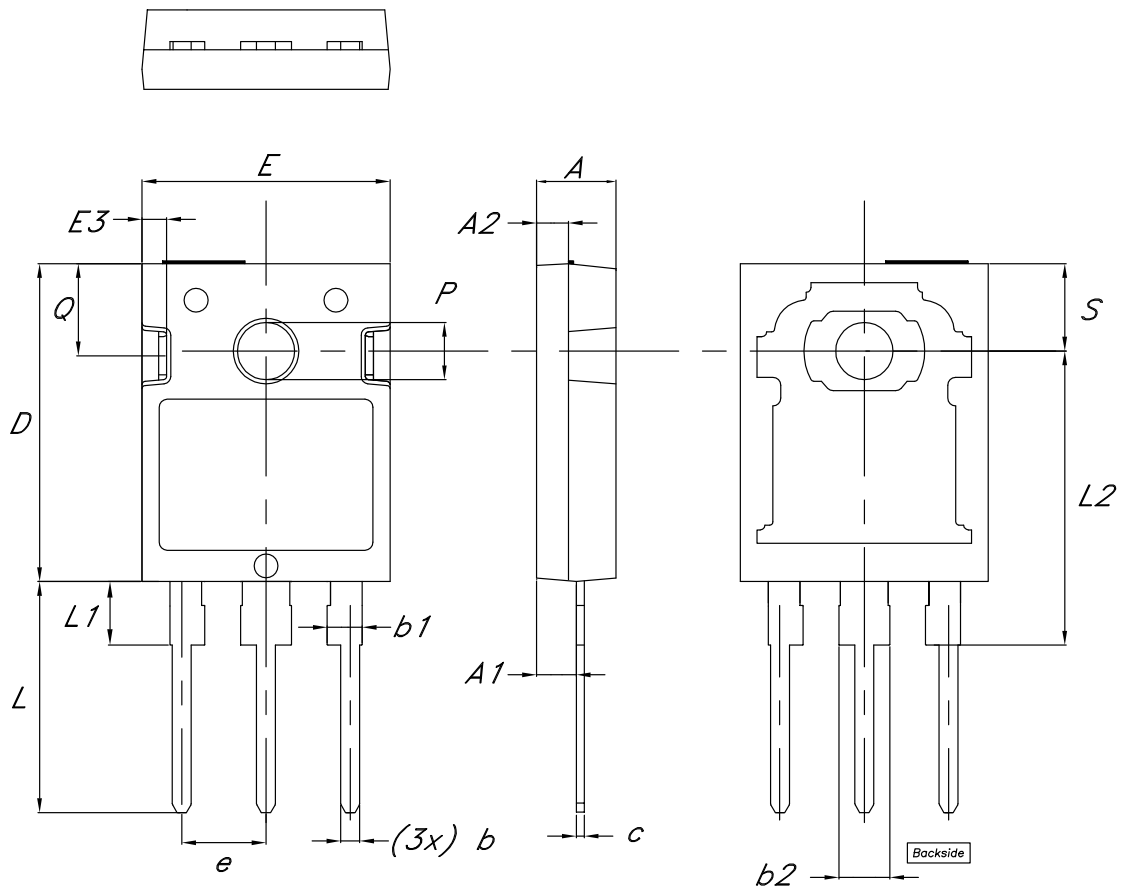


### 3 Package information

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 16. 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
31-Mar-2017	1	First release
12-Dec-2017	2	Modified title. Modified <i>Table 4: "On/off-states"</i> . Minor text changes.
04-Oct-2019	3	Updated title, features and description in cover page. Removed maturity status indication from cover page. The document status is production data. Updated <i>Section 3.1 HiP247 package information</i> . Content reworked to improve readability.
20-Dec-2019	4	Updated <i>Table 1. Absolute maximum ratings</i> . Minor text changes.
25-Jan-2021	5	Updated features and applications in cover page. Updated <i>Table 3. On/off-states</i> . Updated $V_{SD}$ value from 4.5 V to 3.3 V in <i>Table 7. Reverse diode characteristics</i> . Minor text changes.

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## 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>	Electrical characteristics (curves) .....	<b>5</b>
<b>3</b>	<b>Package information</b> .....	<b>8</b>
<b>3.1</b>	HiP247 package information .....	<b>8</b>
	<b>Revision history</b> .....	<b>10</b>

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