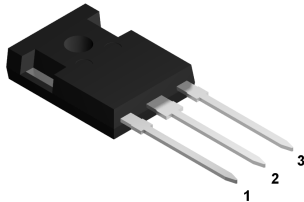
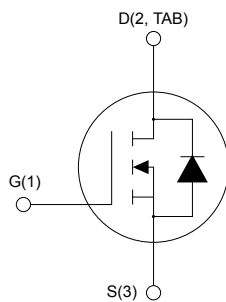


Automotive-grade silicon carbide Power MOSFET 1200 V 75 mΩ typ., 33 A in an HiP247 long leads package



HiP247 long leads


AM01475v1_noZen



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
SCTWA40N120G2AG	1200 V	105 mΩ	33 A

- AEC-Q101 qualified 
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance
- Very high operating junction temperature capability ($T_J = 200\text{ °C}$)
- Source sensing pin for increased efficiency

Applications

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

Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2nd 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

[SCTWA40N120G2AG](#)

Product summary

Order code	SCTWA40N120G2AG
Marking	SCT40N120G2AG
Package	HiP247 long leads
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	1200	V
V_{GS}	Gate-source voltage	-10 to 22	
	Gate-source voltage (recommended operational values)	-5 to 18	
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	33	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	25	
$I_{DM}^{(1)}$	Drain current (pulsed)	100	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	290	W
T_{stg}	Storage temperature range	-55 to 200	°C
T_J	Operating junction temperature range		°C

1. Pulse width limited by safe operating area.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.6	°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	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200			V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$			10	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	1.9	3.2	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}, I_D = 20\text{ A}$		75	105	m Ω
		$V_{GS} = 18\text{ V}, I_D = 20\text{ A}, T_J = 200\text{ °C}$		195		

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iSS}	Input capacitance	$V_{DS} = 800\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	1230	-	pF
C_{oSS}	Output capacitance		-	56	-	pF
C_{rSS}	Reverse transfer capacitance		-	15	-	pF
Q_g	Total gate charge	$V_{DS} = 800\text{ V}, V_{GS} = -5\text{ to }18\text{ V}, I_D = 20\text{ A}$	-	63	-	nC
Q_{gs}	Gate-source charge		-	15	-	nC
Q_{gd}	Gate-drain charge		-	20	-	nC
R_G	Gate input resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$	-	1	-	Ω

Table 5. Switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 800\text{ V}, I_D = 20\text{ A},$	-	235	-	μJ
E_{off}	Turn-off switching energy	$R_G = 4.7\ \Omega, V_{GS} = -5\text{ to }18\text{ V}$	-	77	-	μJ

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{ V}, I_D = 20\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = -5\text{ to }18\text{ V}$	-	11	-	ns
t_r	Rise time		-	5	-	ns
$t_{d(off)}$	Turn-off-delay time		-	18	-	ns
t_f	Fall time		-	13	-	ns

Table 7. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode forward voltage	$I_{SD} = 20\text{ A}$, $V_{GS} = 0\text{ V}$	-	3.4	-	V
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 2000\text{ A}/\mu\text{s}$, $V_{DD} = 800\text{ V}$, $V_{GS} = -5\text{ to }18\text{ V}$	-	19	-	ns
Q_{rr}	Reverse recovery charge		-	132	-	nC
I_{RRM}	Reverse recovery current		-	20	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

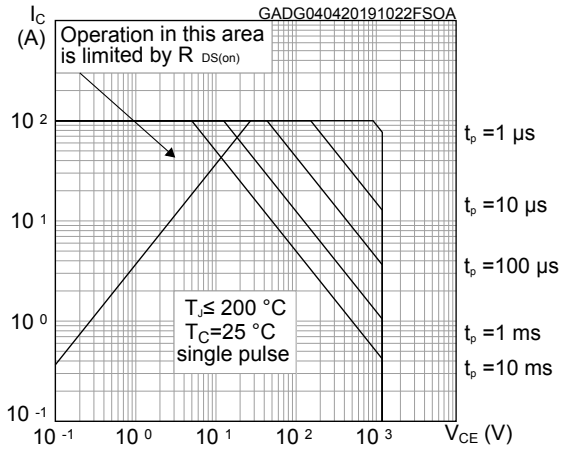


Figure 2. Normalized transient thermal impedance

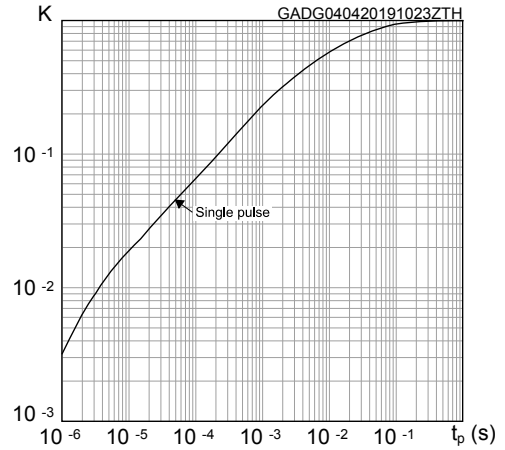


Figure 3. Output characteristics ($T_J = -50\text{ }^\circ\text{C}$)

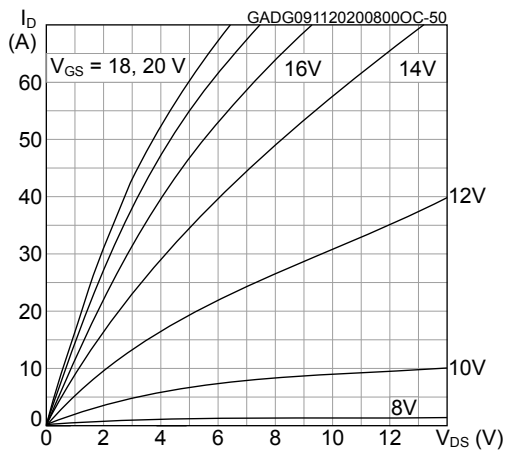


Figure 4. Output characteristics ($T_J = 25\text{ }^\circ\text{C}$)

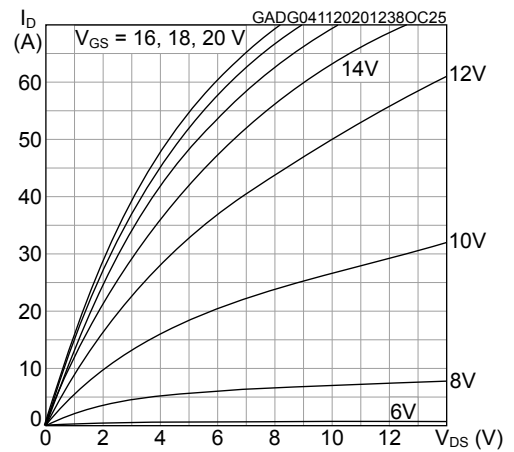


Figure 5. Output characteristics ($T_J = 200\text{ }^\circ\text{C}$)

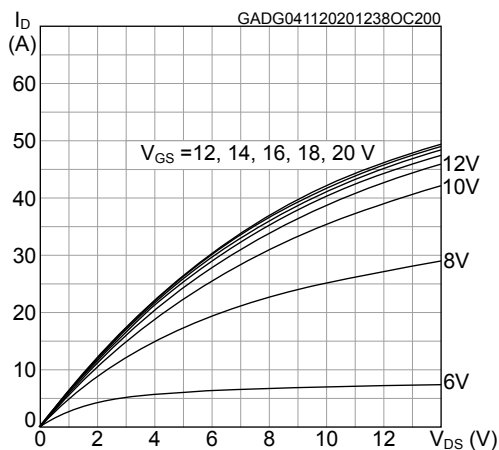


Figure 6. Transfer characteristics

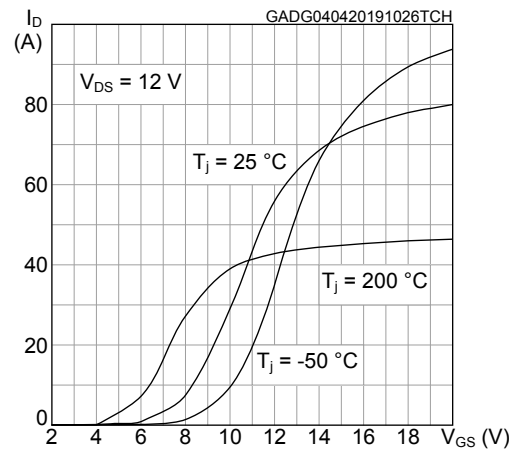


Figure 7. Total power dissipation

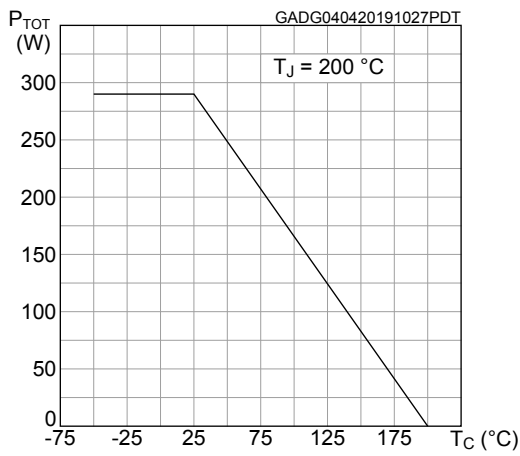


Figure 8. Gate charge vs gate-source voltage

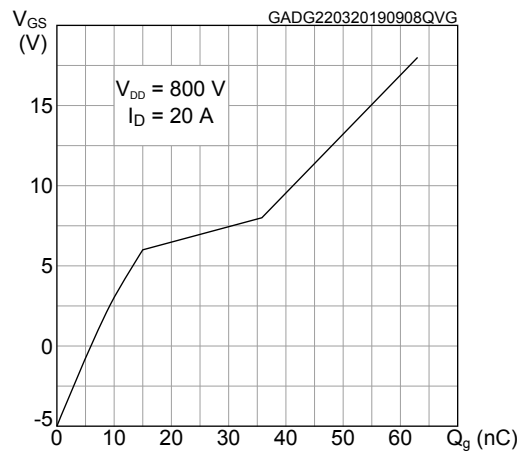


Figure 9. Capacitance variations

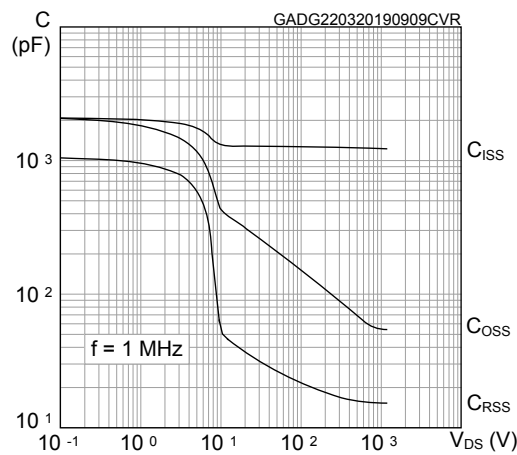


Figure 10. Switching energy vs drain current

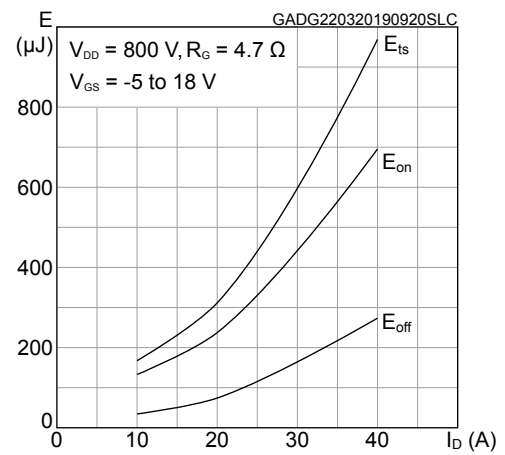


Figure 11. Switching energy vs junction temperature

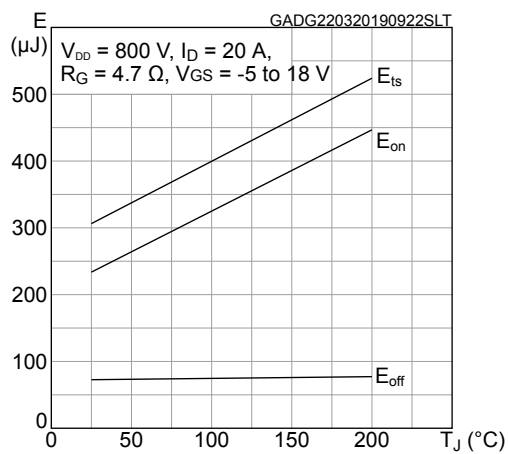


Figure 12. Normalized $V_{(BR)DSS}$ vs temperature

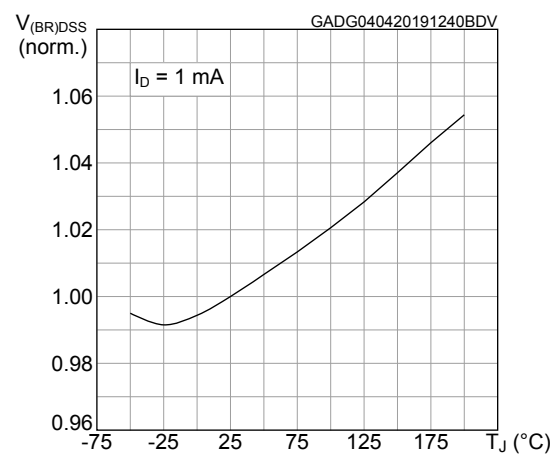


Figure 13. Normalized on-resistance vs temperature

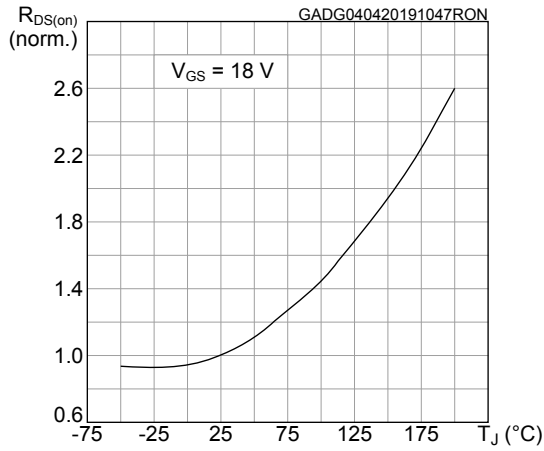


Figure 14. Normalized gate threshold voltage vs temperature

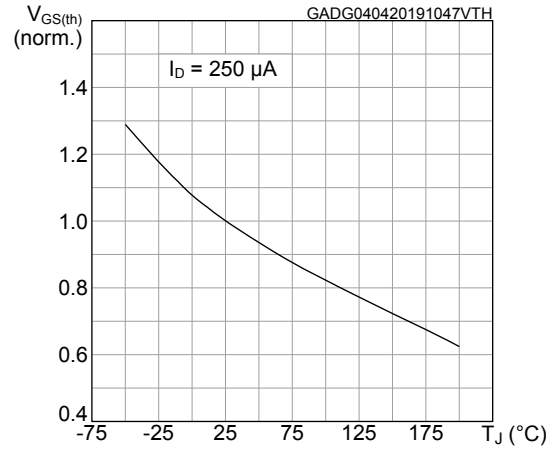


Figure 15. Reverse conduction characteristics (T_J = -50 °C)

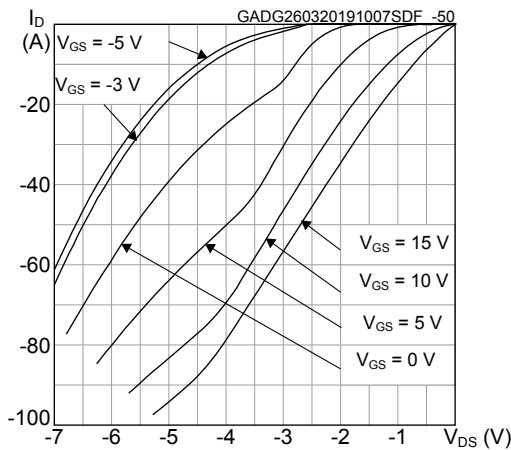


Figure 16. Reverse conduction characteristics (T_J = 25 °C)

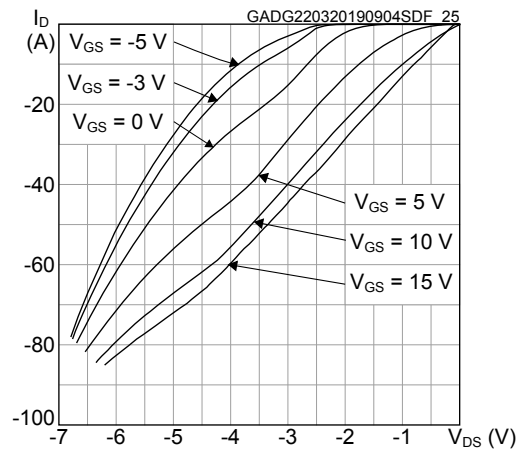
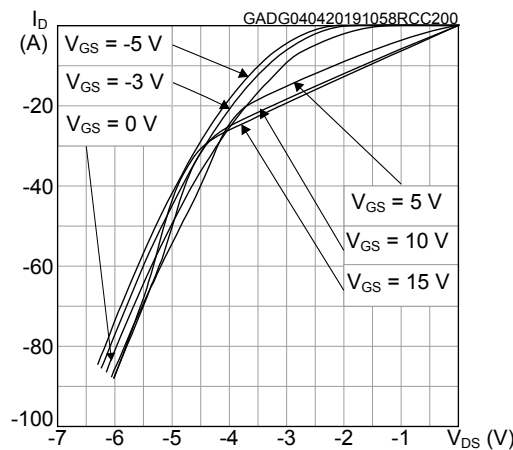


Figure 17. Reverse conduction characteristics (T_J = 200 °C)

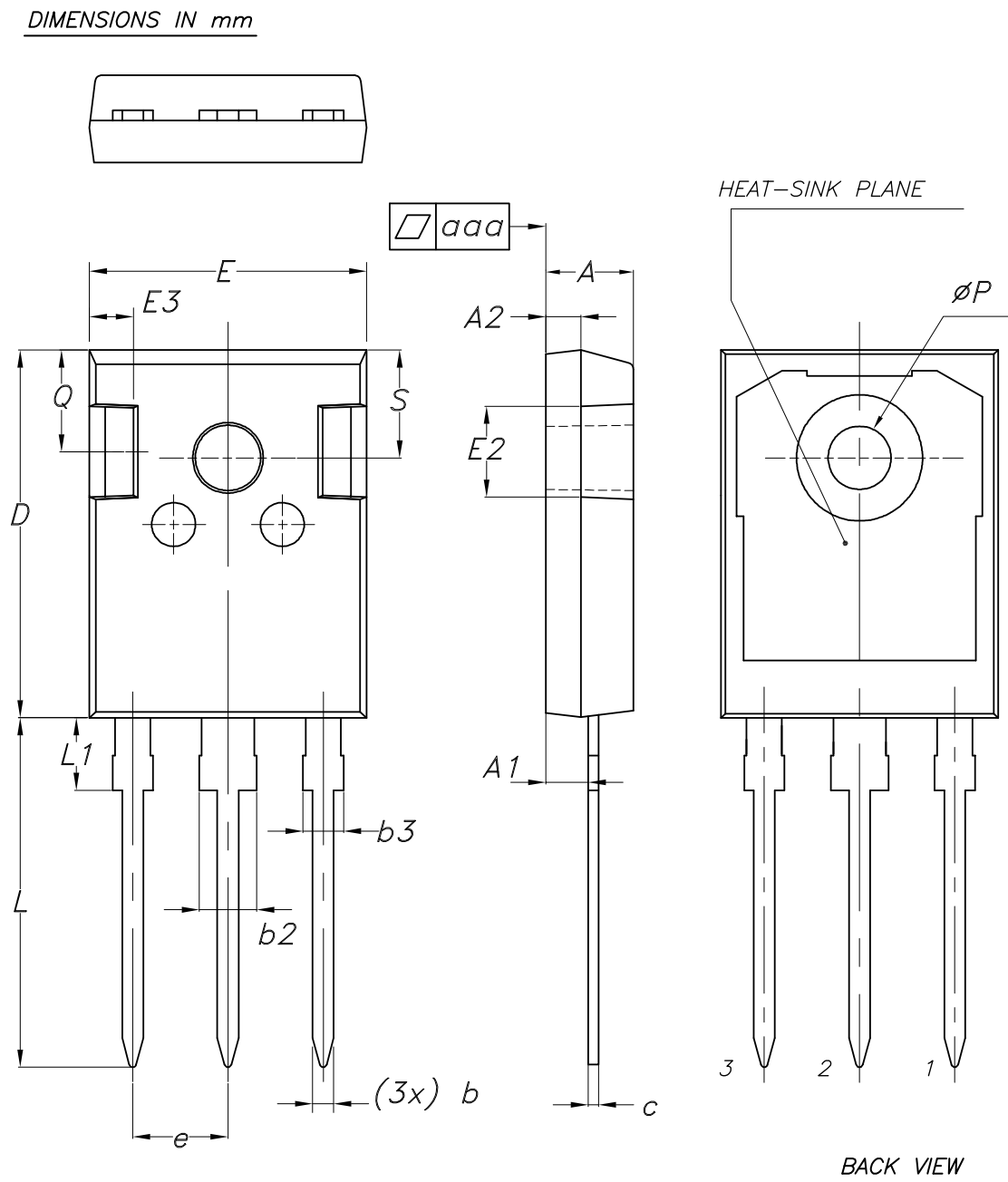


3 Package information

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. ECOPACK is an ST trademark.

3.1 HiP247 long leads package information

Figure 18. HiP247 long leads package outline



8463846_3

Table 8. HiP247 long leads package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16		1.26
b2			3.25
b3			2.25
c	0.59		0.66
D	20.90	21.00	21.10
E	15.70	15.80	15.90
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1			4.30
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25
aaa		0.04	0.10

Revision history

Table 9. Document revision history

Date	Version	Changes
09-Dec-2020	1	First release.
06-Jul-2021	2	Updated Table 4. Dynamic. Updated Table 5. Switching energy. Updated Table 6. Switching times. Updated Table 7. Reverse SiC diode characteristics. Updated Section 2.1 Electrical characteristics (curves). Updated Table 8. HIP247 long leads package mechanical data.

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