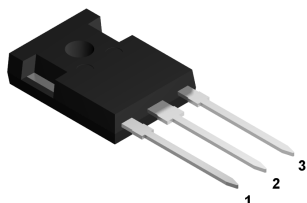
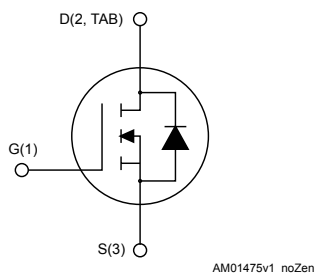


Automotive-grade silicon carbide Power MOSFET 1200 V, 75 mΩ typ., 33 A in an HiP247 long leads package



HiP247 long leads



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
SCTWA40N120G2AG	1200 V	105 mΩ	33 A

- AEC-Q101 qualified 
- Very high operating junction temperature capability (T_J = 200 °C)
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance
- 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

($T_C = 25\text{ }^{\circ}\text{C}$ 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
		$V_{GS} = 18\text{ V}$, $I_D = 20\text{ A}$, $T_J = 200\text{ }^{\circ}\text{C}$		195		

Table 4. Dynamic, based on HiP247 package option

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, based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DD} = 800\text{ V}$, $I_D = 20\text{ A}$,	-	200	-	μJ
E_{off}	Turn-off switching energy	$R_G = 4.5\text{ }\Omega$, $V_{GS} = -5\text{ to }18\text{ V}$	-	77	-	μJ

Table 6. Switching times, based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{ V}$, $R_G = 4.5\text{ }\Omega$, $V_{GS} = -5\text{ to }18\text{ V}$	-	11	-	V
t_r	Rise time		-	5	-	ns
$t_{d(off)}$	Turn-off-delay time		-	18	-	nC
t_f	Fall time		-	13	-	A

Table 7. Reverse SiC diode characteristics, based on HiP247 package option

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	$I_{SD} = 20\text{ A}$, $di/dt = 2000\text{ A}/\mu\text{s}$, $V_{DD} = 800\text{ V}$, $V_{GS} = -5\text{ to }18\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	19	-	ns
Q_{rr}	Reverse recovery charge		-	132	-	nC
I_{RRM}	Reverse recovery current		-	20	-	A

2.1 Electrical characteristics (curves), based on HiP247 package option

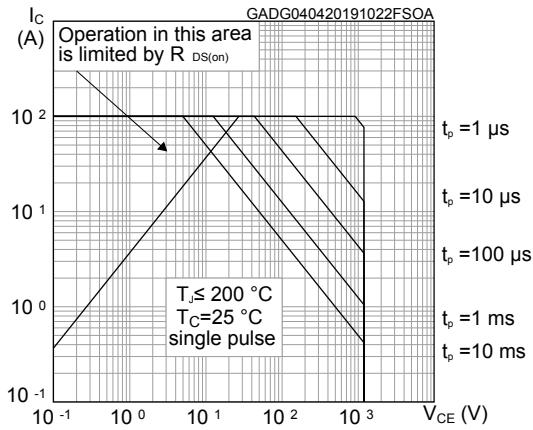
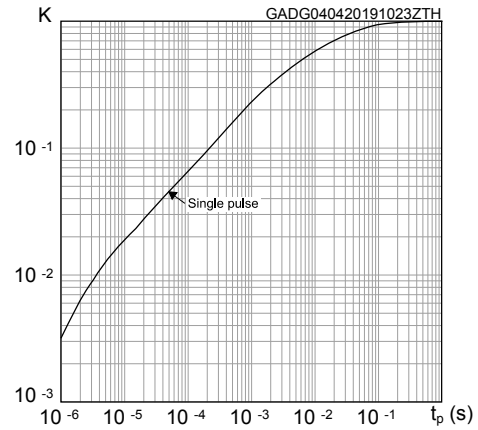
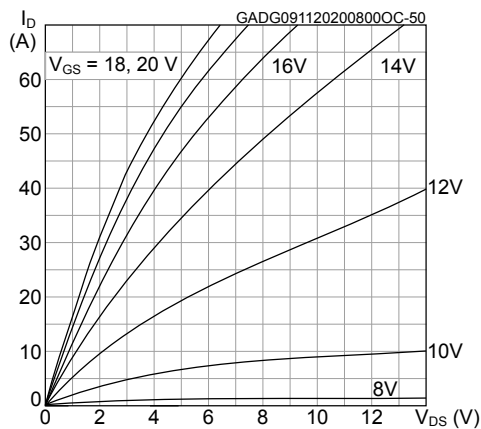
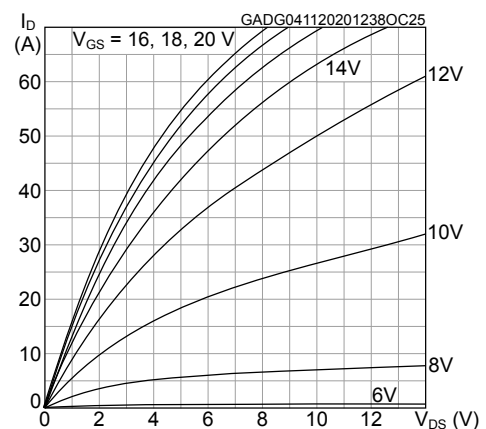
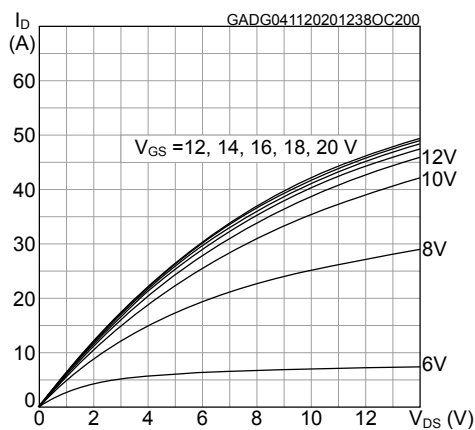
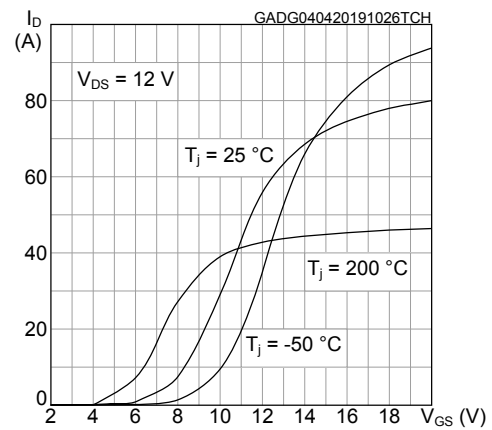
Figure 1. Safe operating area

Figure 2. Thermal impedance

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

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

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

Figure 6. Transfer characteristics


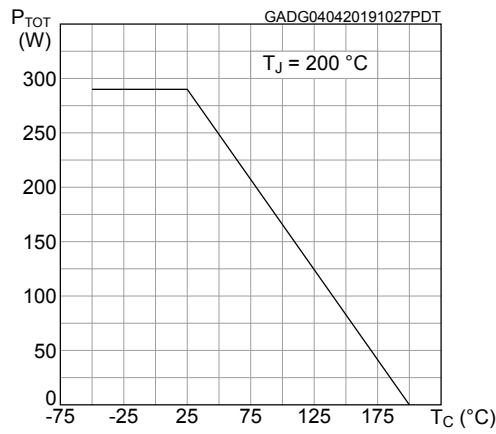
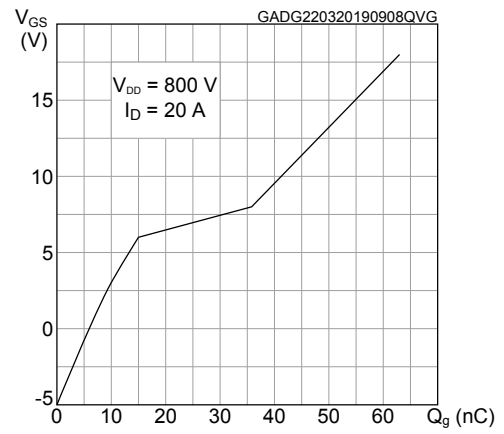
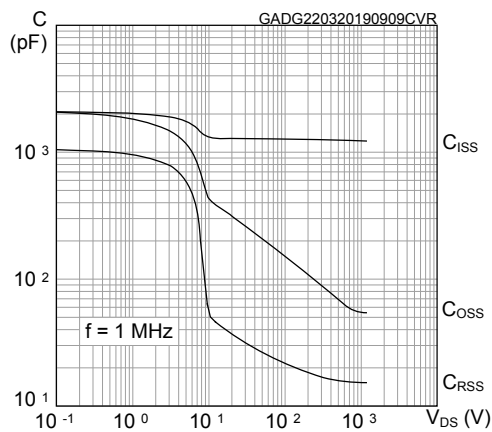
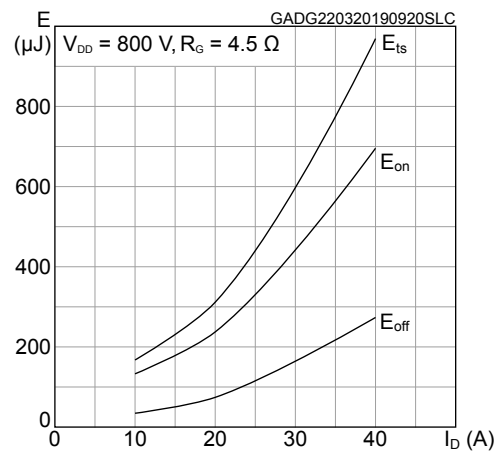
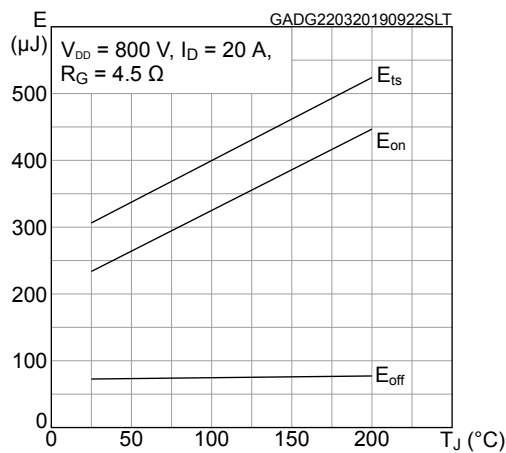
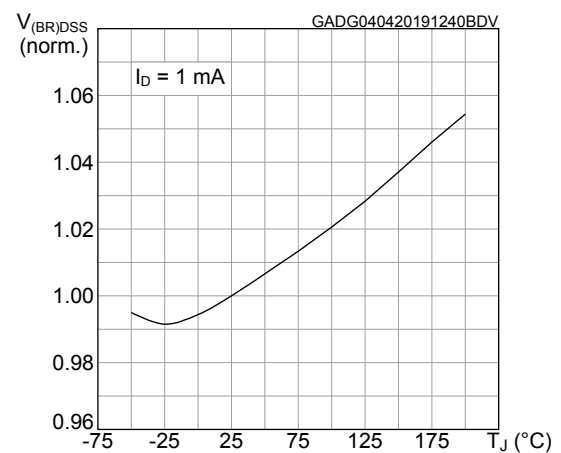
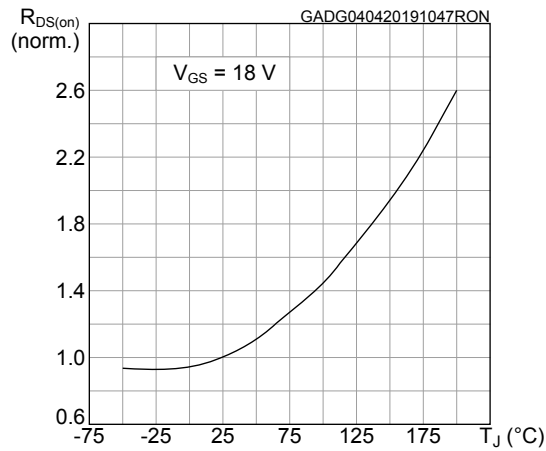
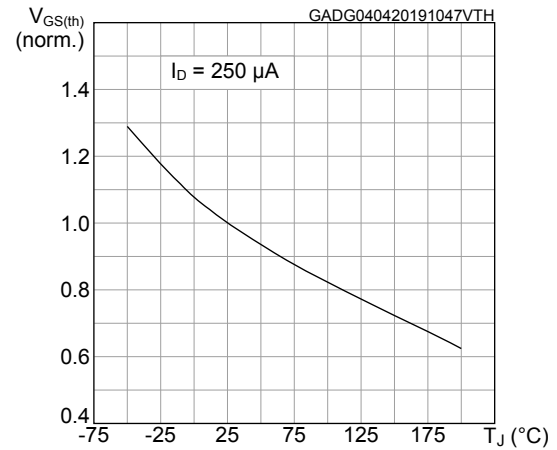
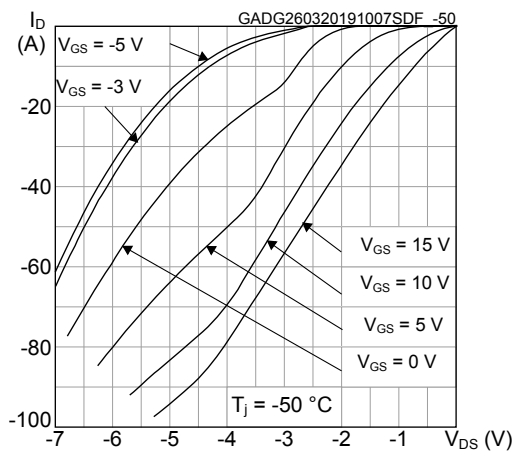
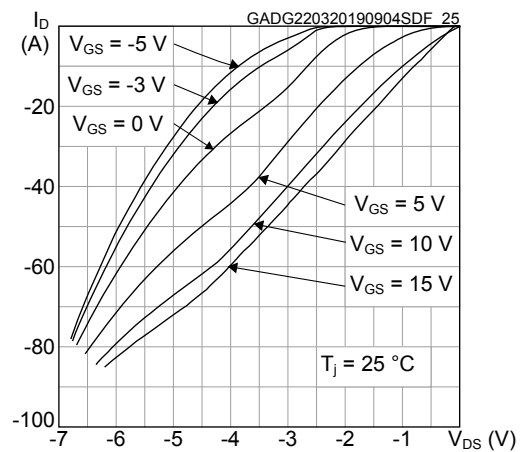
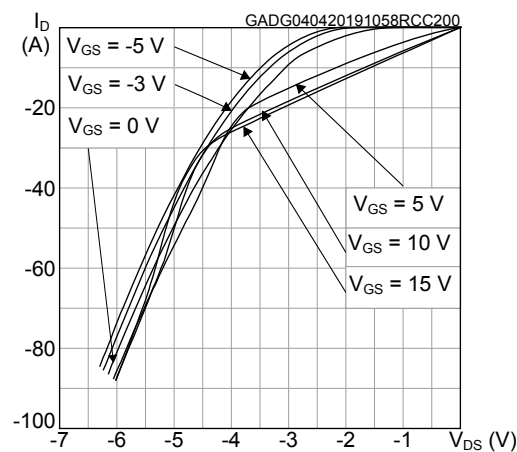
Figure 7. Total power dissipation

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


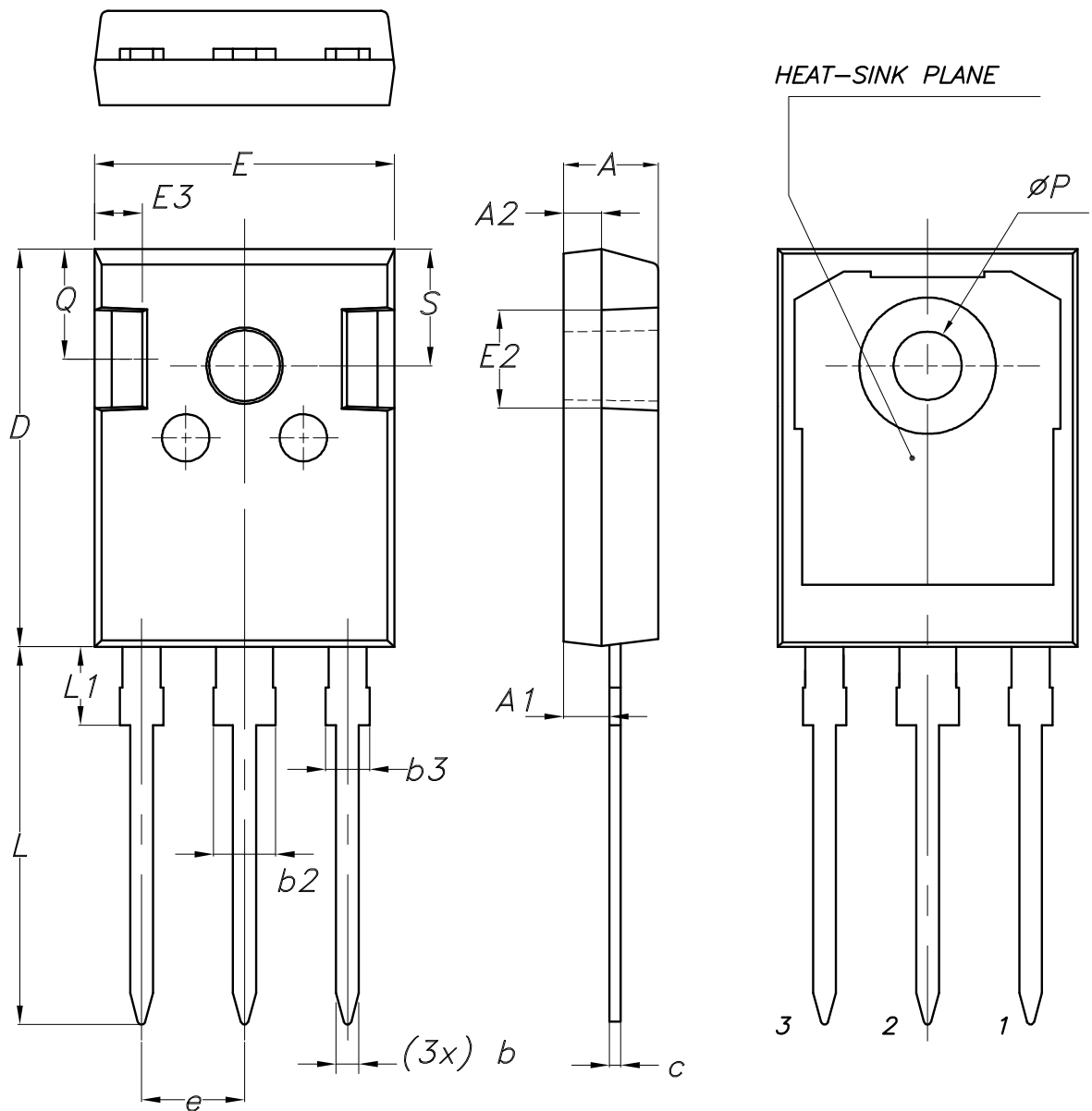
Figure 13. Normalized on-resistance vs temperature

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_2_F

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

Revision history

Table 9. Document revision history

Date	Version	Changes
09-Dec-2020	1	First release.

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