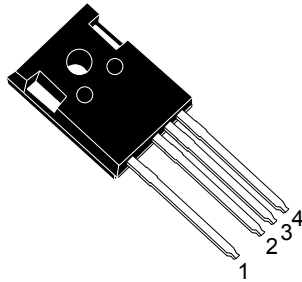
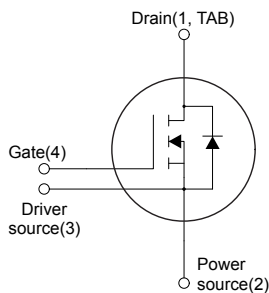


# Automotive-grade silicon carbide Power MOSFET 1200 V, 18.5 mΩ typ., 100 A in an HiP247-4 package



**HiP247-4**


ND1TPS2DS3G4



## Features

Order code	$V_{DS}$	$R_{DS(on)}$ typ.	$I_D$
SCT020W120G3-4AG	1200 V	18.5 mΩ	100 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 3<sup>rd</sup> generation SiC MOSFET technology. The device features a very low  $R_{DS(on)}$  over the entire temperature range combined with low capacitances and very high switching operations, which improve application performance in frequency, energy efficiency, system size and weight reduction.

### Product status link

[SCT020W120G3-4AG](#)

### Product summary

<b>Order code</b>	SCT020W120G3-4AG
<b>Marking</b>	20W120G34AG
<b>Package</b>	HiP247-4
<b>Packing</b>	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	V
	Gate-source voltage (recommended operating values)	-5 to 18	
	Gate-source transient voltage, $t_p < 1 \mu s$ , $t \leq 10$ hours over lifetime	-11 to 25	
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25 \text{ }^\circ\text{C}$	100	A
	Drain current (continuous) at $T_C = 100 \text{ }^\circ\text{C}$	81	
$I_{DM}^{(2)}$	Drain current (pulsed)	324	A
$P_{TOT}$	Total power dissipation at $T_C = 25 \text{ }^\circ\text{C}$	541	W
$T_{stg}$	Storage temperature range	-55 to 200	$^\circ\text{C}$
$T_J$	Operating junction temperature range		$^\circ\text{C}$

- $I_D$  is limited by package.
- Pulse width is limited by safe operating area.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.32	$^\circ\text{C/W}$
$R_{thJA}$	Thermal resistance, junction-to-ambient	40	$^\circ\text{C/W}$

## 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	$V_{GS} = 0\text{ V}$ , $V_{DS} = 1200\text{ V}$			10	$\mu\text{A}$
$I_{GSS}$	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	3.0	4.2	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 15\text{ V}$ , $I_D = 50\text{ A}$		19		m $\Omega$
		$V_{GS} = 18\text{ V}$ , $I_D = 50\text{ A}$		18.5	28	
		$V_{GS} = 18\text{ V}$ , $I_D = 50\text{ A}$ , $T_J = 200\text{ °C}$		41		

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 800\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	3465	-	pF
$C_{oss}$	Output capacitance		-	140	-	pF
$C_{riss}$	Reverse transfer capacitance		-	13.5	-	pF
$Q_g$	Total gate charge	$V_{DD} = 800\text{ V}$ , $V_{GS} = -5\text{ to }18\text{ V}$ , $I_D = 50\text{ A}$	-	121	-	nC
$Q_{gs}$	Gate-source charge		-	36	-	nC
$Q_{gd}$	Gate-drain charge		-	40	-	nC
$R_g$	Gate input resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	1.5	-	$\Omega$

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{DD} = 800\text{ V}$ , $I_D = 50\text{ A}$ ,	-	867	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$R_G = 6.8\text{ }\Omega$ , $V_{GS} = -5\text{ V to }18\text{ V}$	-	411	-	$\mu\text{J}$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{ V}$ , $I_D = 50\text{ A}$ , $R_G = 6.8\text{ }\Omega$ , $V_{GS} = -5\text{ to }18\text{ V}$	-	21	-	ns
$t_r$	Rise time		-	9	-	ns
$t_{d(off)}$	Turn-off delay time		-	47	-	ns
$t_f$	Fall time		-	22	-	ns

**Table 7. Reverse SiC diode characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Continuous diode forward current	$T_C = 25\text{ }^\circ\text{C}$	-		100	A
		$T_C = 100\text{ }^\circ\text{C}$	-		70	
$V_{SD}$	Diode forward voltage	$I_{SD} = 50\text{ A}$ , $V_{GS} = 0\text{ V}$	-	3		V
$t_{rr}$	Reverse recovery time	$I_{SD} = 50\text{ A}$ , $di/dt = 1000\text{ A}/\mu\text{s}$ , $V_{DD} = 800\text{ V}$	-	22.6		ns
$Q_{rr}$	Reverse recovery charge		-	206		nC
$I_{RRM}$	Reverse recovery current		-	15.4		A

1.  $I_{SD}$  is limited by package.

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

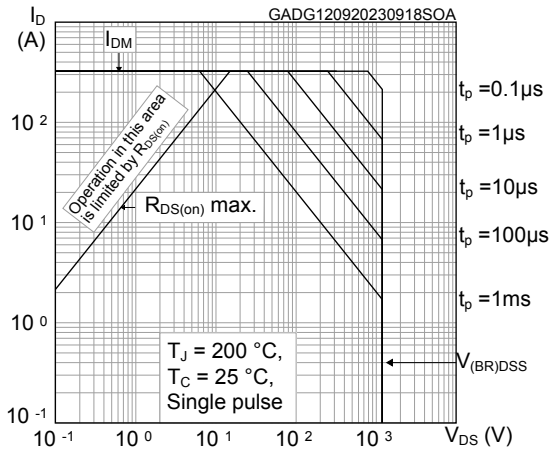


Figure 2. Maximum transient thermal impedance

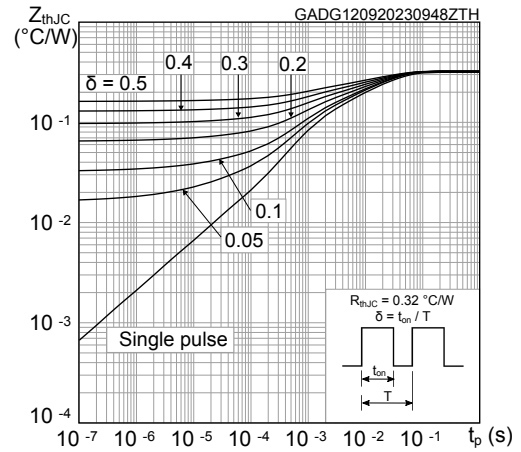


Figure 3. Typical output characteristics ( $T_J = 25\text{ °C}$ )

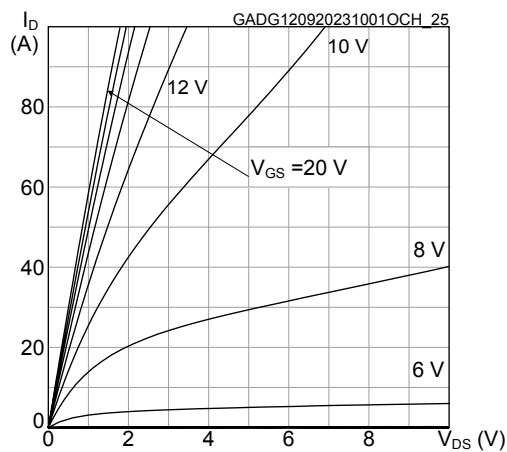


Figure 4. Typical output characteristics ( $T_J = 200\text{ °C}$ )

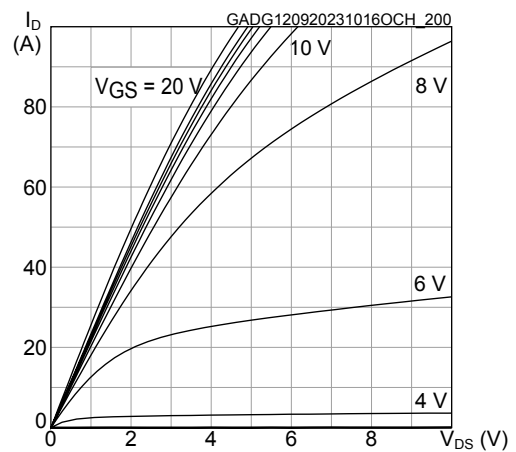


Figure 5. Typical transfer characteristics

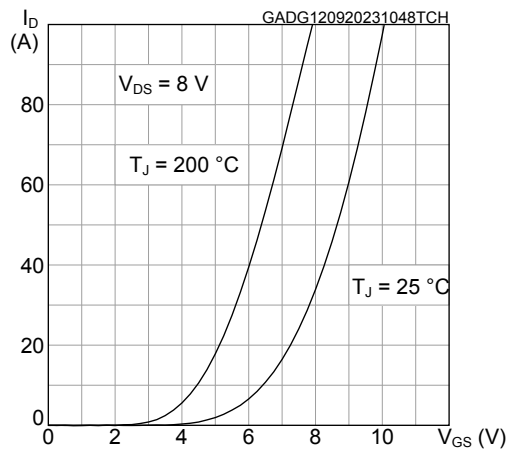
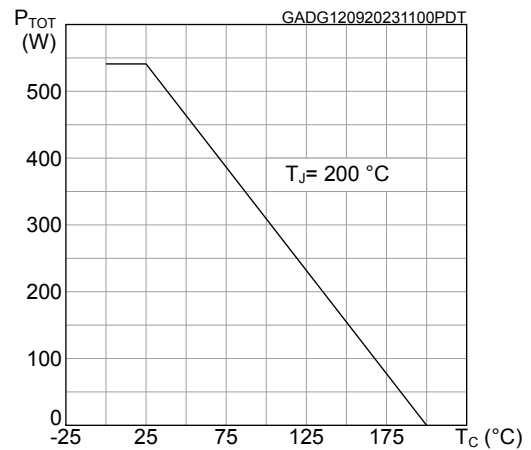
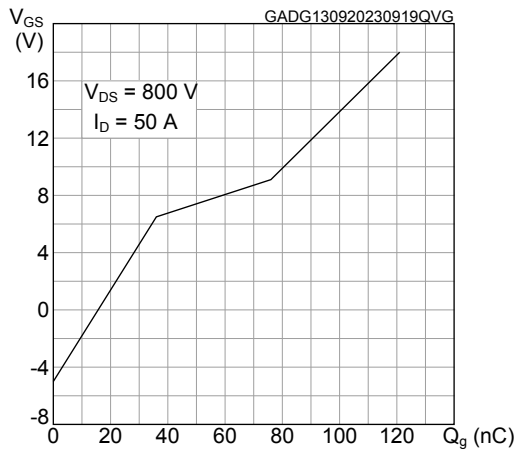


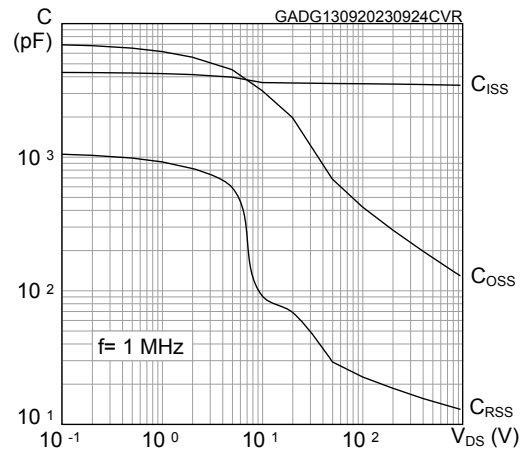
Figure 6. Total power dissipation



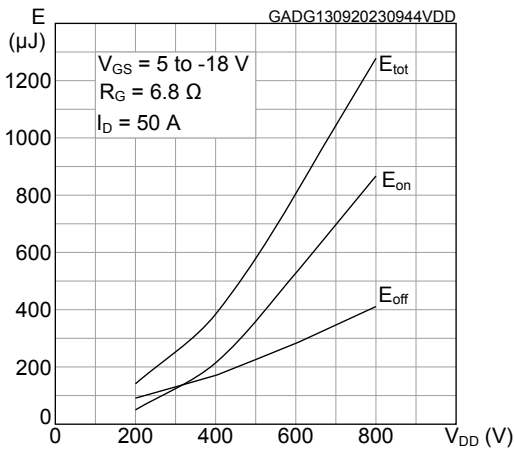
**Figure 7. Typical gate charge characteristics**



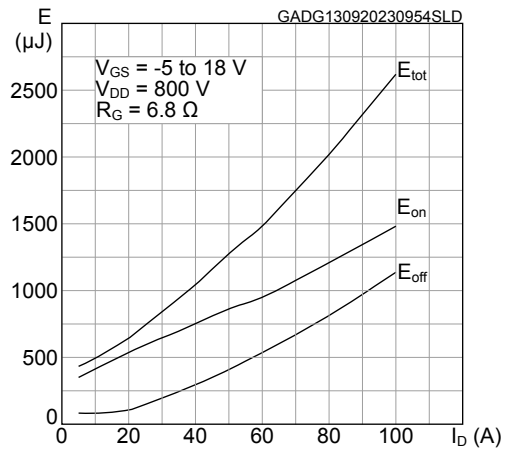
**Figure 8. Typical capacitance characteristics**



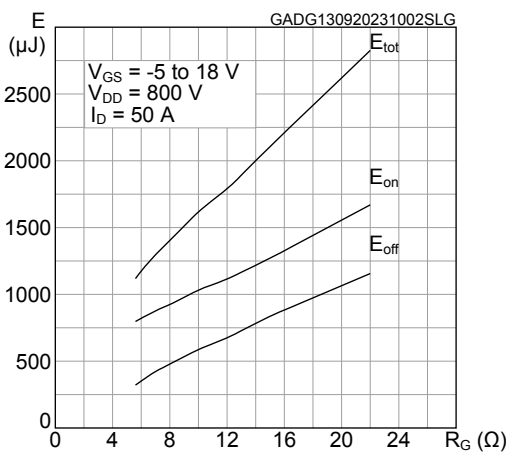
**Figure 9. Typical switching energy vs supply voltage**



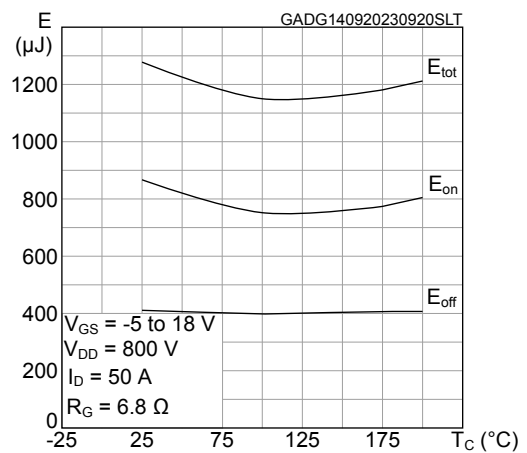
**Figure 10. Typical switching energy vs drain current**



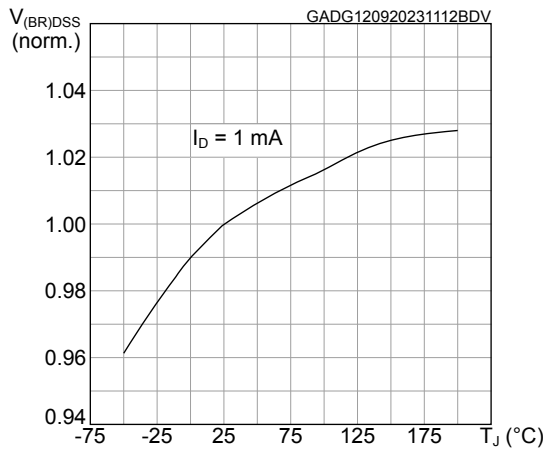
**Figure 11. Typical switching energy vs gate resistance**



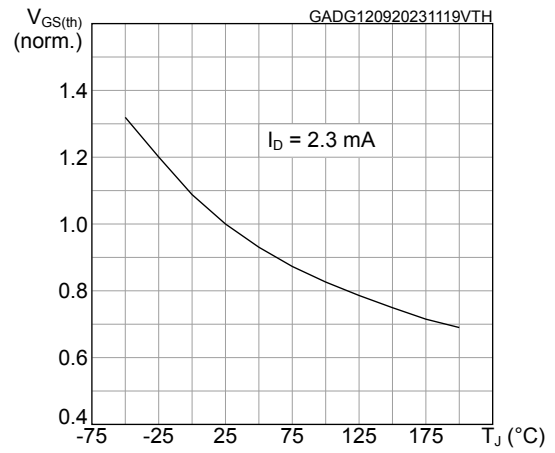
**Figure 12. Typical switching energy vs temperature**



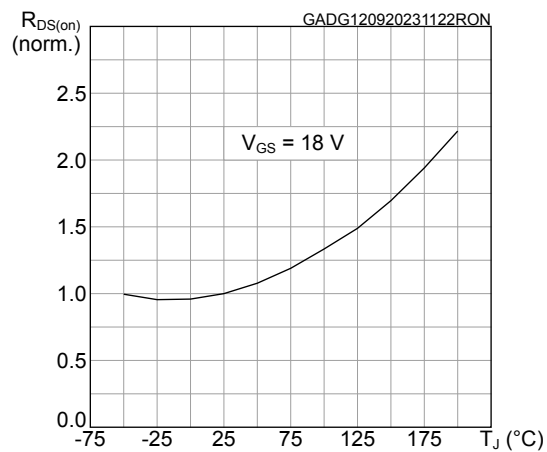
**Figure 13. Normalized breakdown voltage vs temperature**



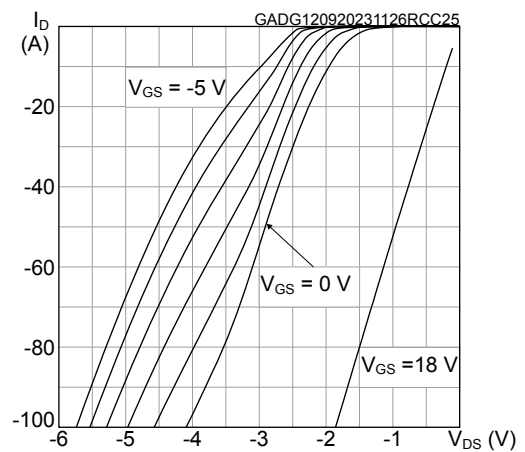
**Figure 14. Normalized gate threshold vs temperature**



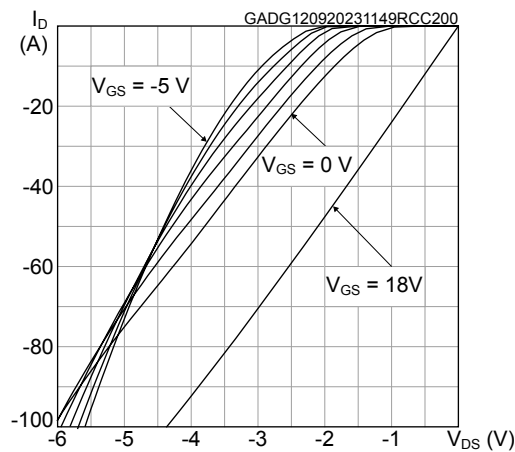
**Figure 15. Normalized on-resistance vs temperature**



**Figure 16. Typical reverse conduction characteristics ( $T_J = 25^\circ\text{C}$ )**



**Figure 17. Typical reverse conduction characteristics ( $T_J = 200^\circ\text{C}$ )**

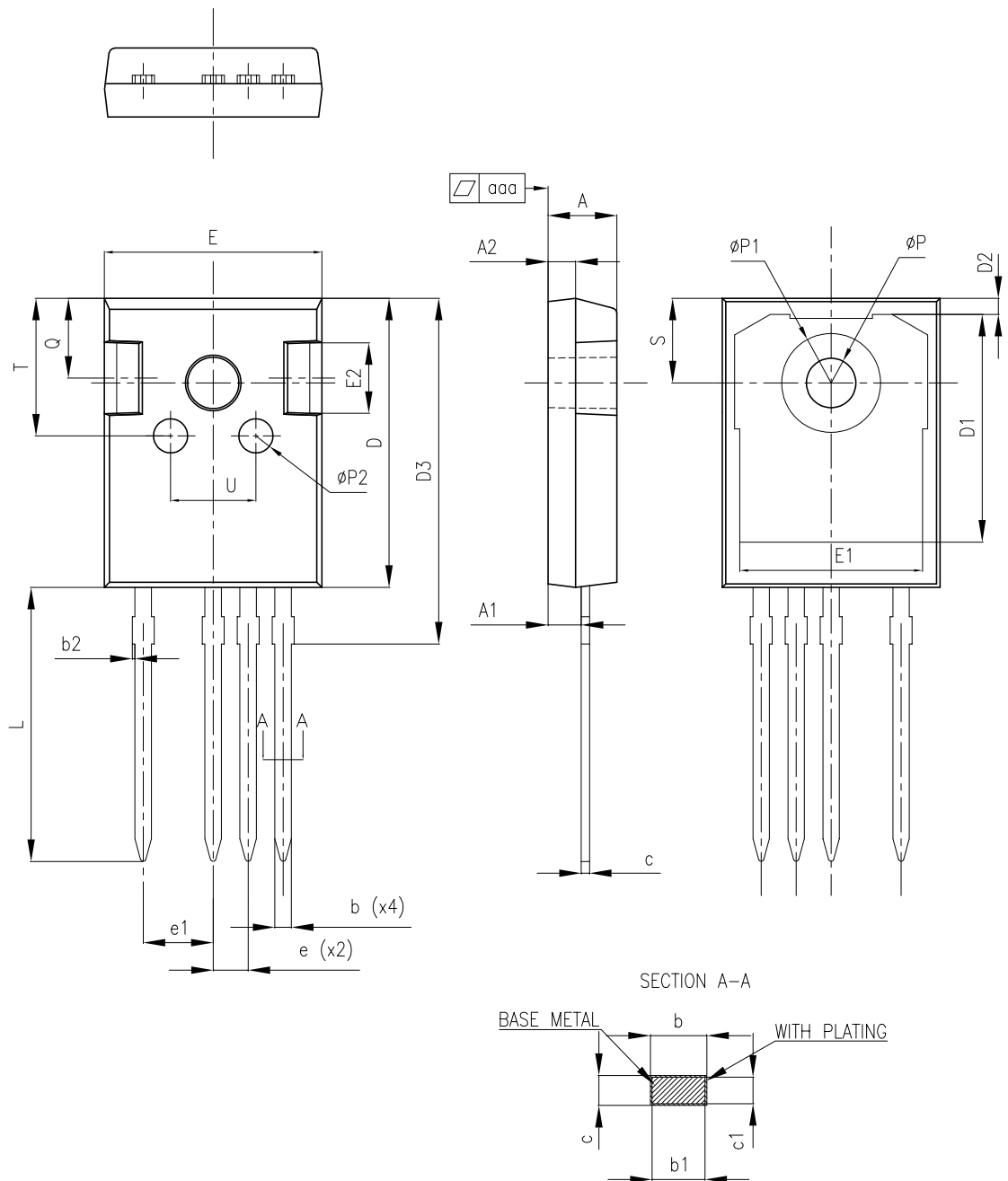


### 3 Package information

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 HiP247-4 package information

Figure 18. HiP247-4 package outline





**Table 8. HiP247-4 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		1.29
b1	1.15	1.20	1.25
b2	0		0.20
c	0.59		0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
D3	24.97	25.12	25.27
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
P	3.50	3.60	3.70
P1			7.40
P2	2.40	2.50	2.60
Q	5.60		6.00
S		6.15	
T	9.80		10.20
U	6.00		6.40
aaa		0.04	0.10

## Revision history

Table 9. Document revision history

Date	Revision	Changes
14-Sep-2023	1	First release.

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