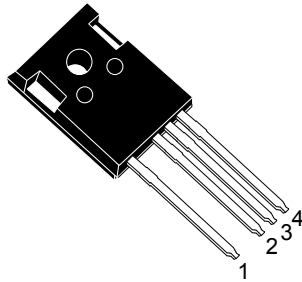
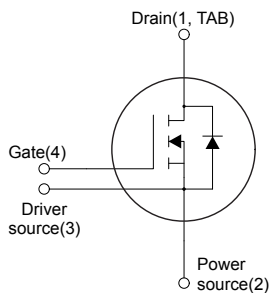


## Automotive-grade silicon carbide Power MOSFET 1200 V, 15 mΩ typ., 129 A in an HiP247-4 package



**HiP247-4**


ND1TPS2DS3G4



### Features

Order code	$V_{DS}$	$R_{DS(on)}$ typ.	$I_D$
SCT015W120G3-4AG	1200 V	15 mΩ	129 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

[SCT015W120G3-4AG](#)

#### Product summary

<b>Order code</b>	SCT015W120G3-4AG
<b>Marking</b>	015W120G34AG
<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 $T_C = 25 \text{ }^\circ\text{C}$	129	A
	Drain current (continuous) at $T_C = 100 \text{ }^\circ\text{C}$	102	
$I_{DM}^{(2)}$	Drain current (pulsed)	404	A
$P_{TOT}$	Total power dissipation at $T_C = 25 \text{ }^\circ\text{C}$	673	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	0.26	$^\circ\text{C/W}$
$R_{thJA}$	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	$V_{DS} = V_{GS}$ , $I_D = 10\text{ mA}$	2.0	3.1	4.2	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 15\text{ V}$ , $I_D = 60\text{ A}$		17.3		m $\Omega$
		$V_{GS} = 18\text{ V}$ , $I_D = 60\text{ A}$		15	20	
		$V_{GS} = 18\text{ V}$ , $I_D = 60\text{ A}$ , $T_J = 200\text{ °C}$		33		

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 800\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	3512	-	pF
$C_{oss}$	Output capacitance		-	183	-	pF
$C_{riss}$	Reverse transfer capacitance		-	28	-	pF
$Q_g$	Total gate charge	$V_{DD} = 800\text{ V}$ , $V_{GS} = -5\text{ to }18\text{ V}$ , $I_D = 60\text{ A}$	-	167	-	nC
$Q_{gs}$	Gate-source charge		-	45	-	nC
$Q_{gd}$	Gate-drain charge		-	59	-	nC
$R_g$	Gate input resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	1.6	-	$\Omega$

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{DD} = 800\text{ V}$ , $I_D = 60\text{ A}$ ,	-	844	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy	$R_G = 4.7\text{ }\Omega$ , $V_{GS} = -5\text{ V to }18\text{ V}$	-	835	-	$\mu\text{J}$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{ V}$ , $I_D = 60\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = -5\text{ to }18\text{ V}$	-	22	-	ns
$t_r$	Rise time		-	9	-	ns
$t_{d(off)}$	Turn-off delay time		-	52	-	ns
$t_f$	Fall time		-	27	-	ns

**Table 7. Reverse SiC diode characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Continuous diode forward current	$T_C = 25\text{ }^\circ\text{C}$	-		129	A
		$T_C = 100\text{ }^\circ\text{C}$	-		102	
$V_{SD}$	Diode forward voltage	$I_{SD} = 60\text{ A}$ , $V_{GS} = 0\text{ V}$	-	3.6		V
$t_{rr}$	Reverse recovery time	$I_{SD} = 60\text{ A}$ , $di/dt = 1000\text{ A}/\mu\text{s}$ , $V_{DD} = 800\text{ V}$	-	23		ns
$Q_{rr}$	Reverse recovery charge		-	250		nC
$I_{RRM}$	Reverse recovery current		-	19		A

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

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

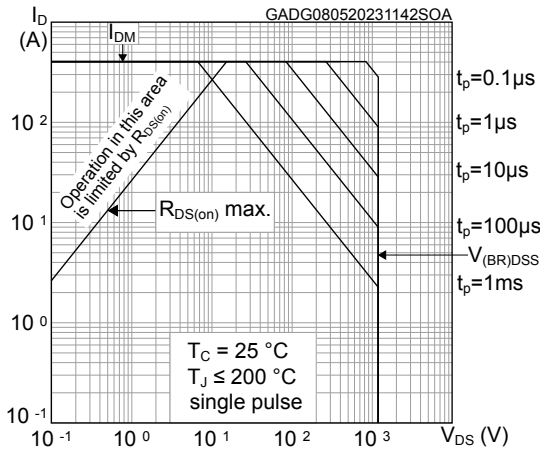


Figure 2. Maximum transient thermal impedance

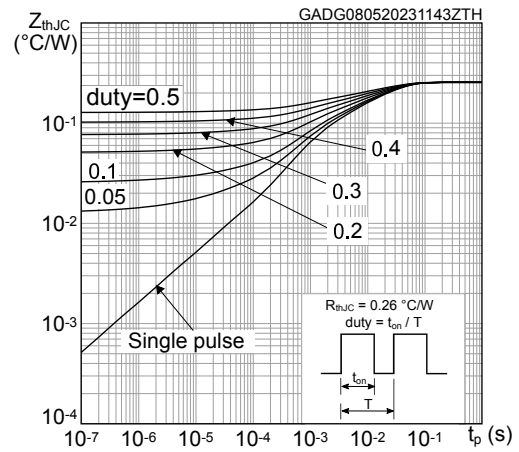


Figure 3. Typical output characteristics ( $T_J = 25\text{ °C}$ )

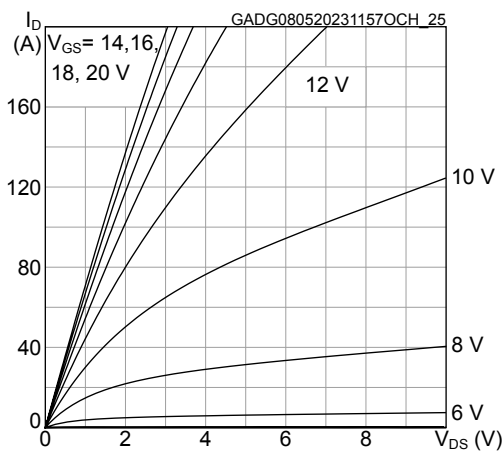


Figure 4. Typical output characteristics ( $T_J = 200\text{ °C}$ )

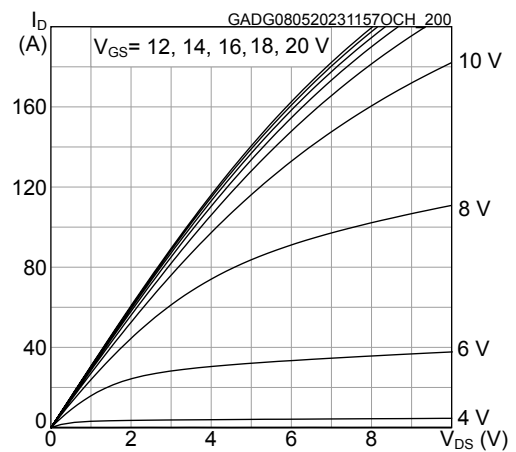


Figure 5. Typical transfer characteristics

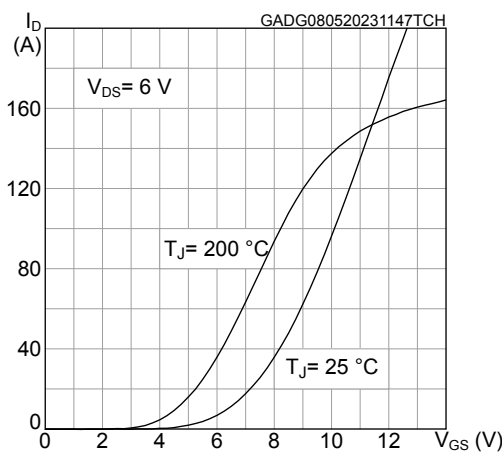


Figure 6. Total power dissipation

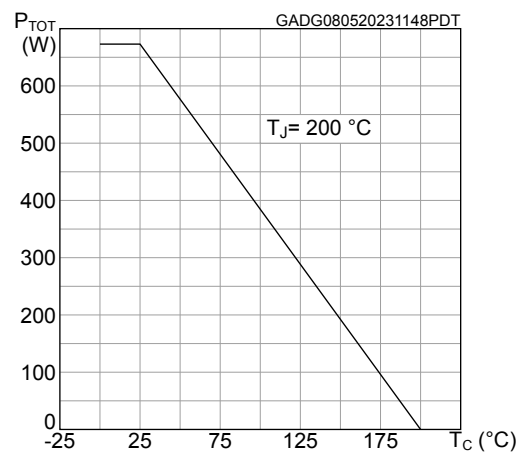


Figure 7. Typical gate charge characteristics

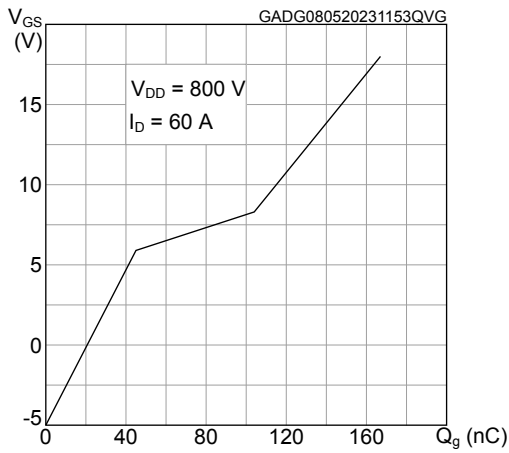


Figure 8. Typical capacitance characteristics

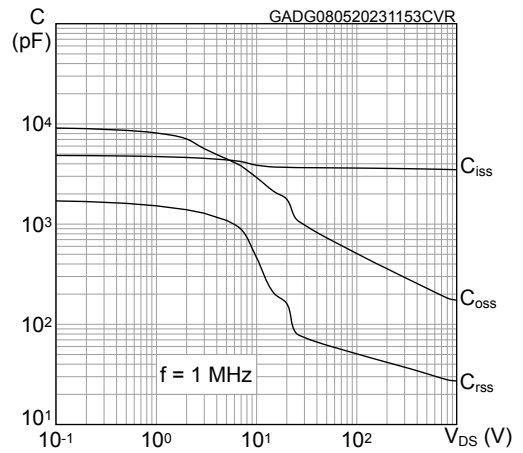


Figure 9. Typical switching energy vs supply voltage

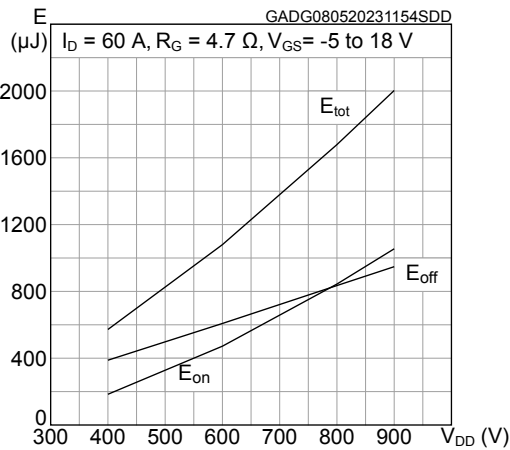


Figure 10. Typical switching energy vs drain current

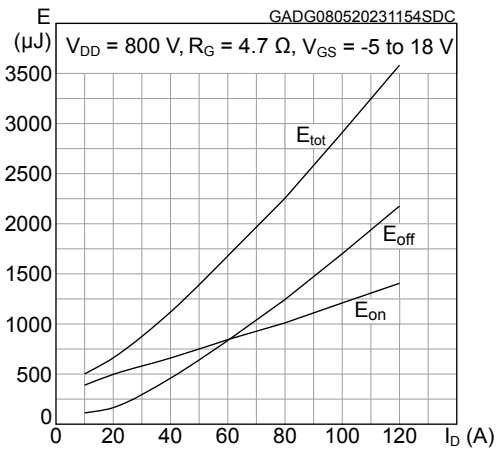


Figure 11. Typical switching energy vs gate resistance

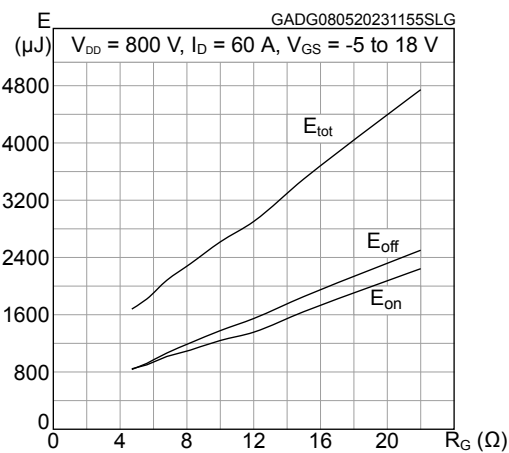


Figure 12. Normalized breakdown voltage vs temperature

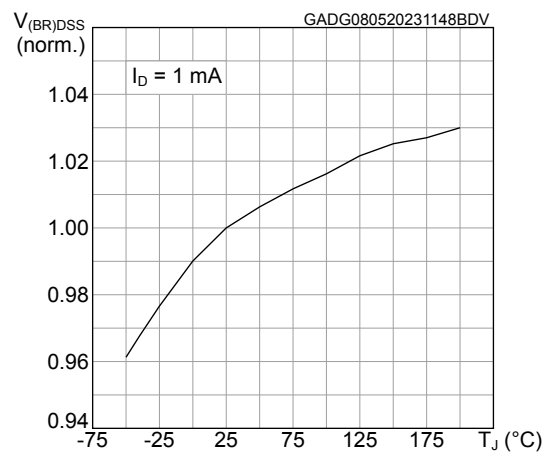


Figure 13. Normalized gate threshold vs temperature

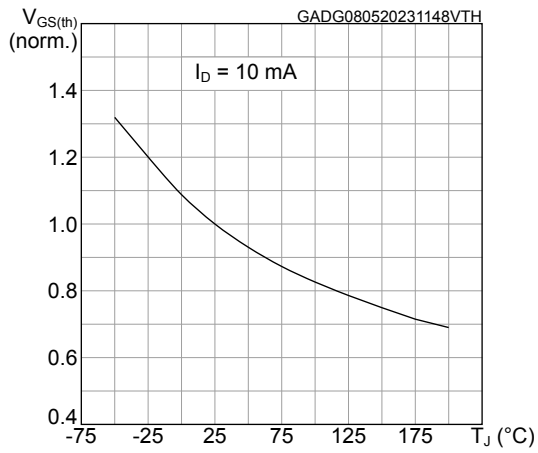


Figure 14. Normalized on-resistance vs temperature

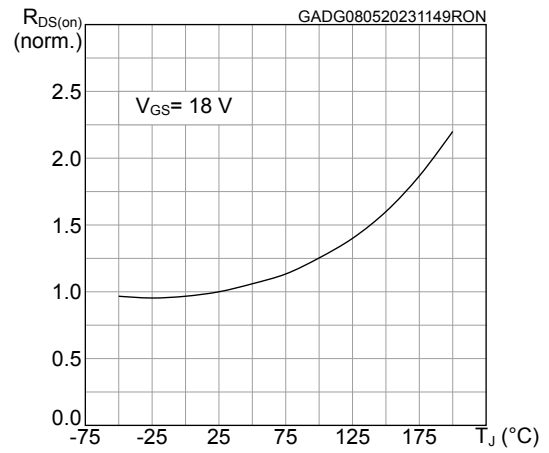


Figure 15. Typical reverse conduction characteristics ( $T_J = 25 \text{ }^\circ\text{C}$ )

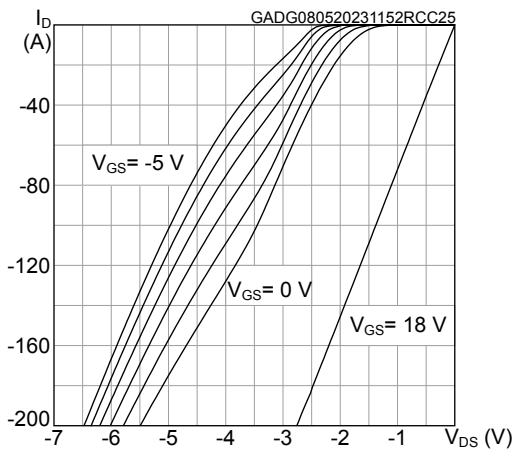
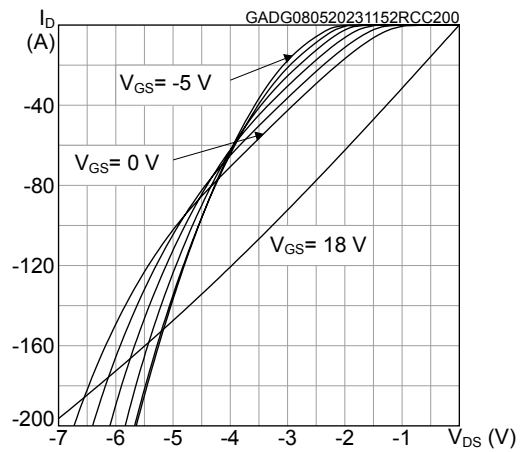


Figure 16. Typical reverse conduction characteristics ( $T_J = 200 \text{ }^\circ\text{C}$ )

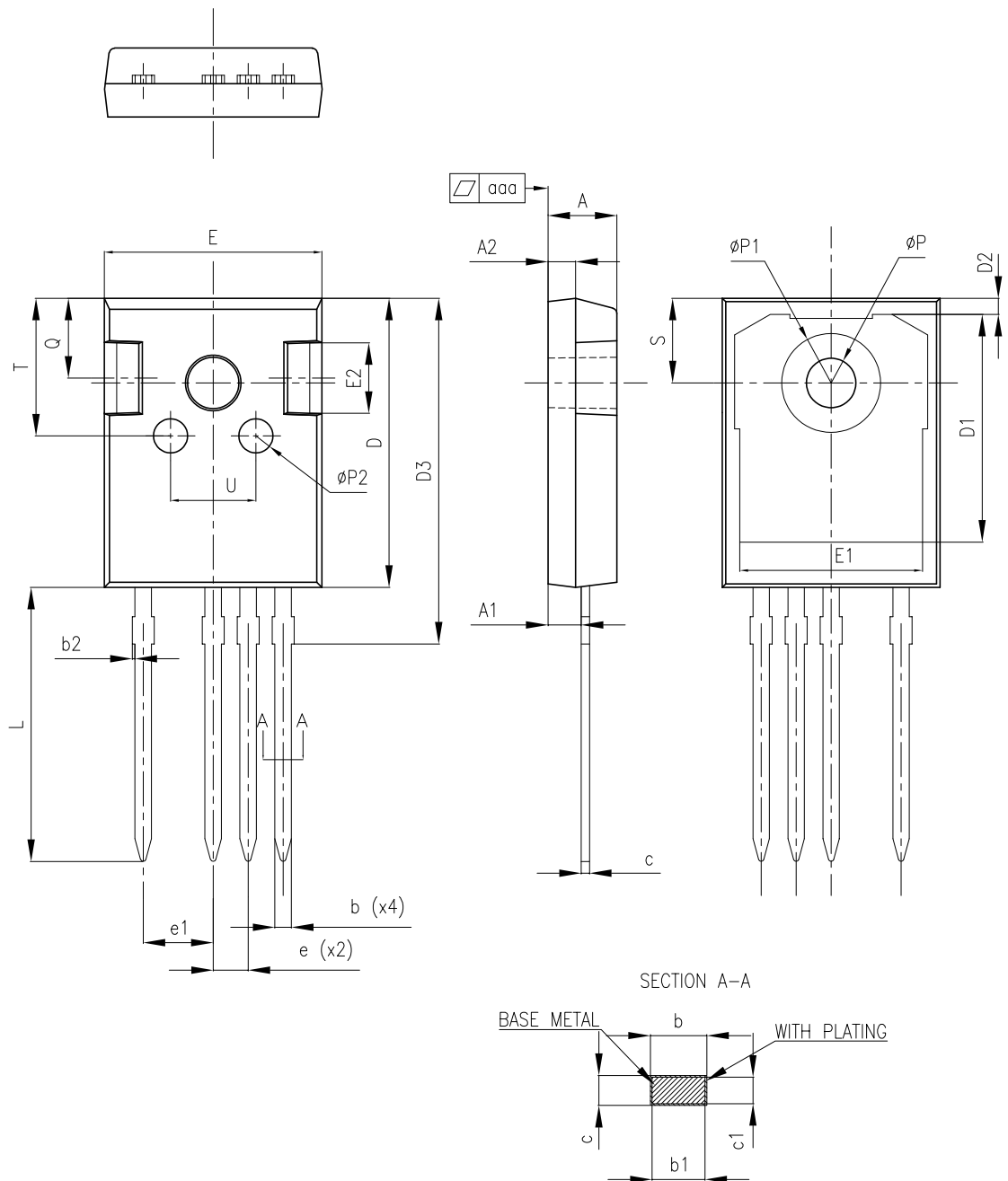


### 3 Package information

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 17. 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
16-May-2023	1	First release.
06-Dec-2023	2	Updated <a href="#">Table 3</a> . On/off states.

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