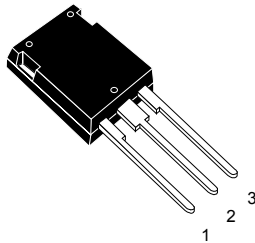
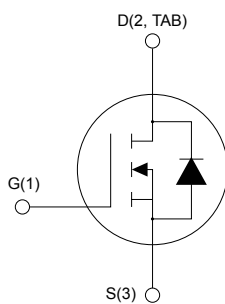


N-channel 1050 V, 110 mΩ typ., 46 A MDmesh DK5 Power MOSFET in a Max247 package


Max247


AM01475v1_noZen



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STY50N105DK5	1050 V	120 mΩ	46 A	625 W

- Fast-recovery body diode
- Best $R_{DS(on)} \times \text{area}$
- Low gate charge, input capacitance and resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness

Applications

- Switching applications

Description

This very high voltage N-channel Power MOSFET is part of the MDmesh DK5 fast-recovery diode series. The MDmesh DK5 combines very low recovery charge (Q_{rr}) and recovery time (t_{rr}) with an excellent improvement in $R_{DS(on)}$ * area and one of the most effective switching behaviors, ideal for half bridge and full bridge converters.

Product status link

[STY50N105DK5](#)

Product summary

Order code	STY50N105DK5
Marking	50N105DK5
Package	Max247
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	46	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	30	
$I_{DM}^{(1)}$	Drain current (pulsed)	184	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	625	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	50	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	V/ns
T_J	Operating junction temperature range	-55 to 150	$^\circ\text{C}$
T_{stg}	Storage temperature range		$^\circ\text{C}$

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 46\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$; $V_{DS}(\text{peak}) \leq V_{(BR)DSS}$, $V_{DD} = 840\text{ V}$.
3. $V_{DS} \leq 840\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.2	$^\circ\text{C}/\text{W}$
R_{thJA}	Thermal resistance, junction-to-ambient	30	$^\circ\text{C}/\text{W}$

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Single pulse avalanche energy (pulse width limited by T_J max.)	16	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AS}$, $V_{DD} = 50\text{ V}$)	1550	mJ

2 Electrical characteristics

$T_C = 25\text{ °C}$ unless otherwise specified.

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	1050			V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 1050\text{ V}$, $V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 1050\text{ V}$, $V_{GS} = 0\text{ V}$, $T_C = 125\text{ °C}^{(1)}$			100	
I_{GSS}	Gate-body leakage current	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 23\text{ A}$		110	120	m Ω

1. Defined by design, not subject to production test.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	6675	-	pF
C_{oss}	Output capacitance		-	370	-	pF
C_{rss}	Reverse transfer capacitance		-	10	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{GS} = 0\text{ V}$, $V_{DS} = 0\text{ to }840\text{ V}$	-	630	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	219	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	3	-	Ω
Q_g	Total gate charge	$V_{DD} = 840\text{ V}$, $I_D = 46\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 15. Test circuit for gate charge behavior)	-	204	-	nC
Q_{gs}	Gate-source charge		-	36	-	nC
Q_{gd}	Gate-drain charge		-	133	-	nC

1. $C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

2. $C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 525\text{ V}$, $I_D = 23\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	40.6	-	ns
t_r	Rise time		-	64.5	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	262	-	ns
t_f	Fall time		-	49.5	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		46	A
I_{SDM}	Source-drain current (pulsed)		-		184	A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 46 \text{ A}$, $V_{GS} = 0 \text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 46 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$ (see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	273		ns
Q_{rr}	Reverse recovery charge		-	3		μC
I_{RRM}	Reverse recovery current		-	23		A
t_{rr}	Reverse recovery time	$I_{SD} = 46 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	477		ns
Q_{rr}	Reverse recovery charge		-	10		μC
I_{RRM}	Reverse recovery current		-	42		A

1. Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 1. Forward bias safe operating area

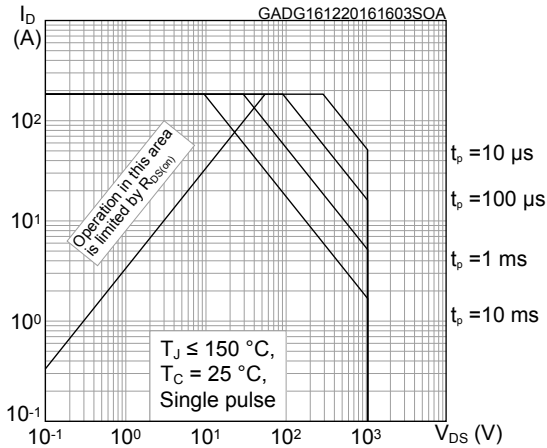


Figure 2. Thermal impedance

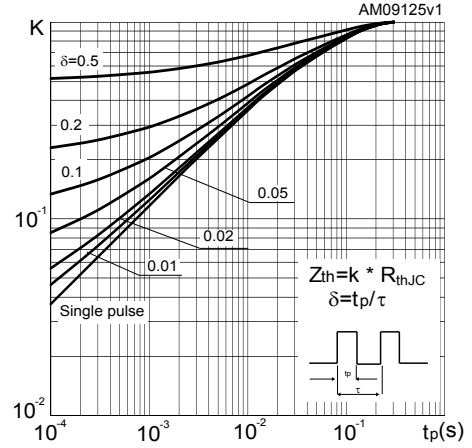


Figure 3. Output characteristics

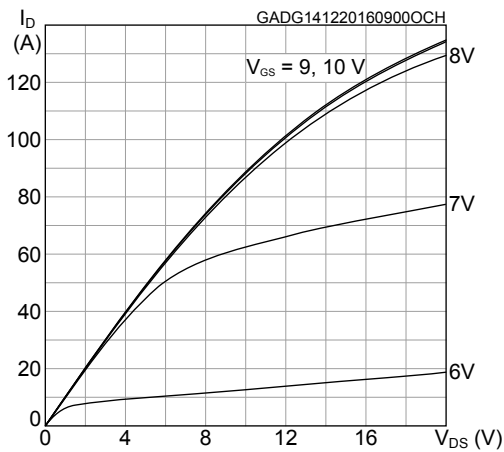


Figure 4. Transfer characteristics

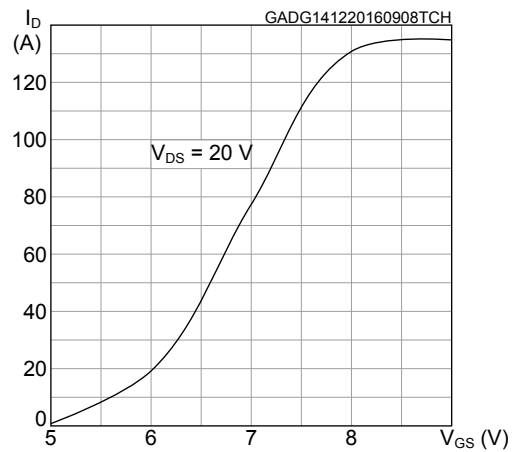


Figure 5. Gate charge vs gate-source voltage

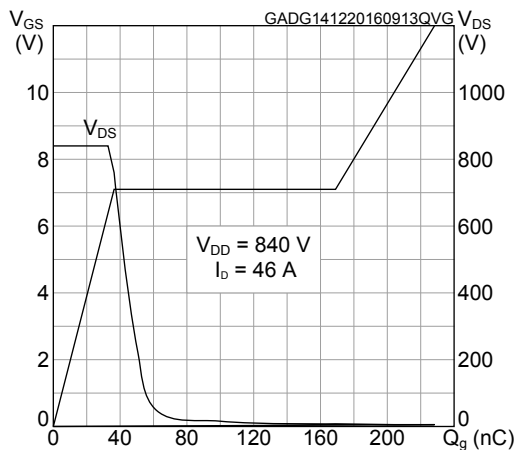


Figure 6. Static drain-source on-resistance

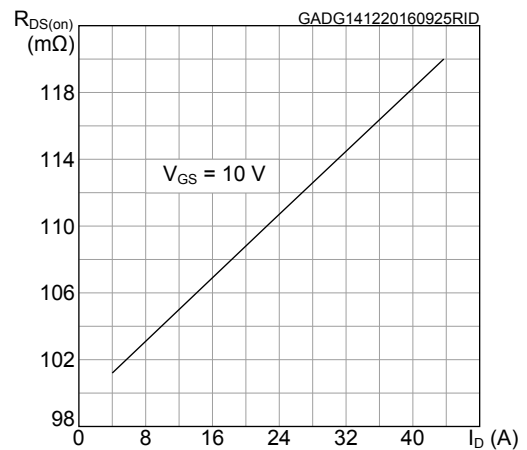


Figure 7. Capacitance variations

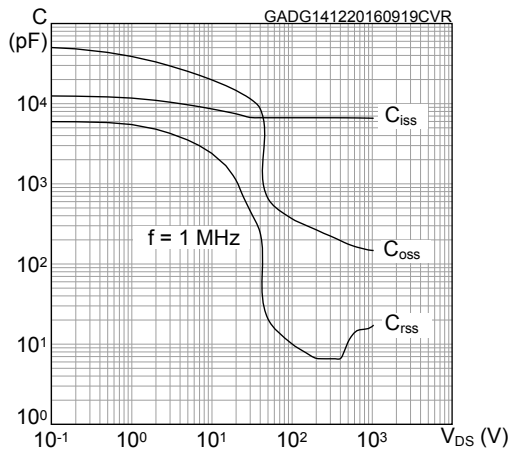


Figure 8. Normalized gate threshold voltage vs temperature

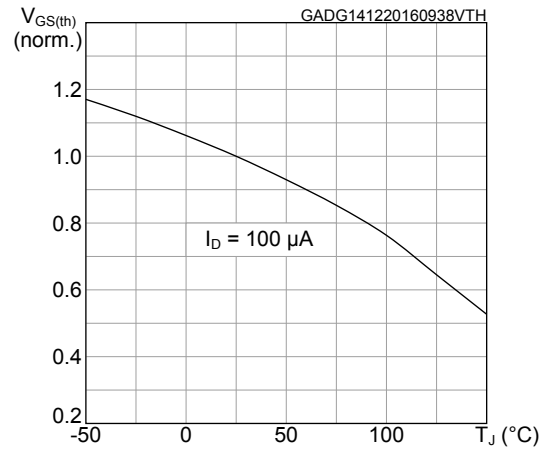


Figure 9. Normalized on-resistance vs temperature

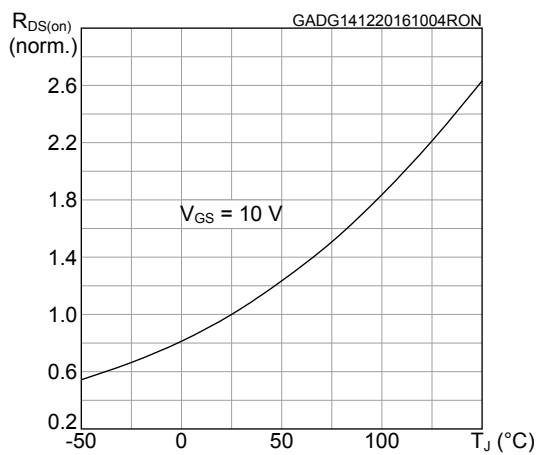


Figure 10. Normalized V_(BR)DSS vs temperature

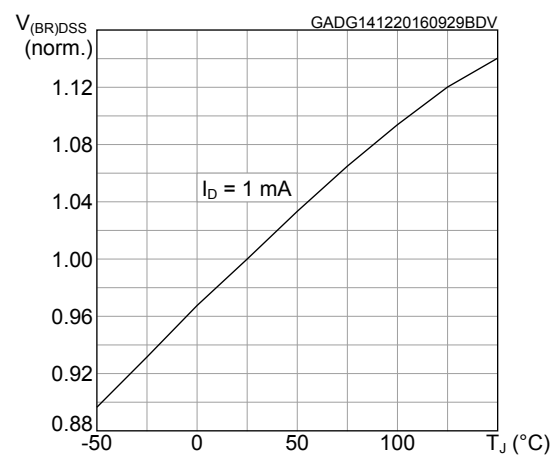


Figure 11. Source-drain diode forward characteristics

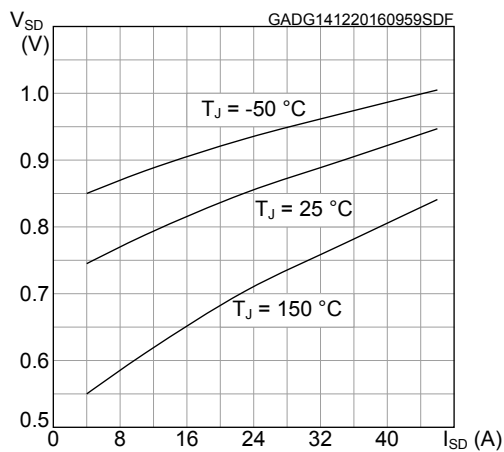
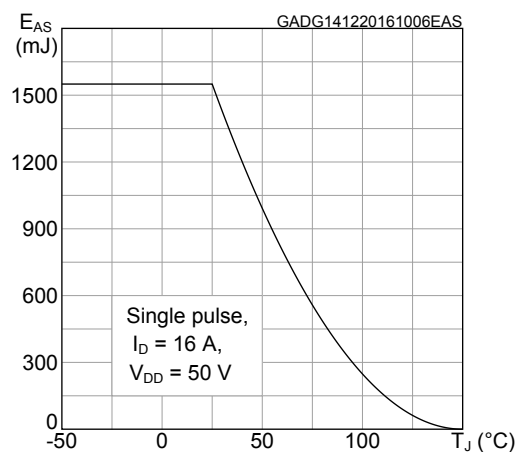
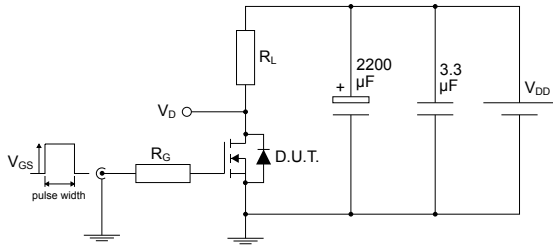


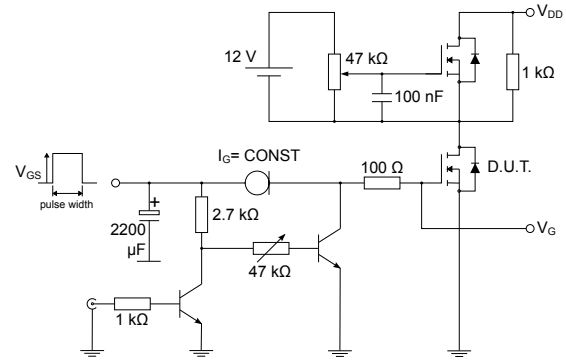
Figure 12. Maximum avalanche energy vs starting T_J



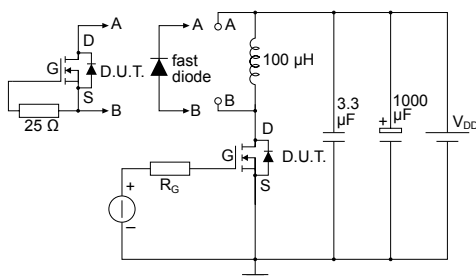
3 Test circuits

Figure 13. Test circuit for resistive load switching times


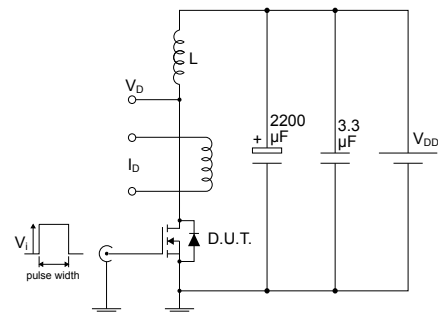
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Figure 14. Test circuit for gate charge behavior


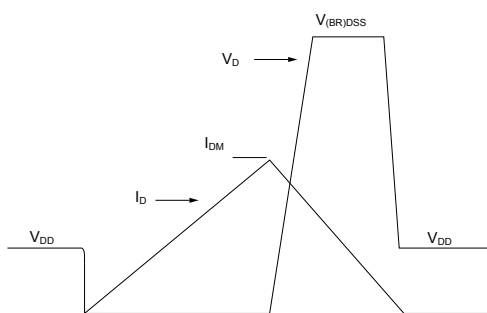
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Figure 15. Test circuit for inductive load switching and diode recovery times


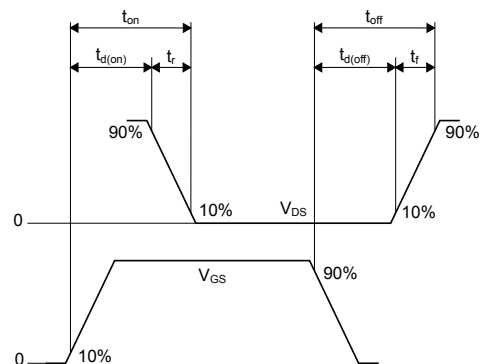
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Figure 16. Unclamped inductive load test circuit


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Figure 17. Unclamped inductive waveform


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Figure 18. Switching time waveform


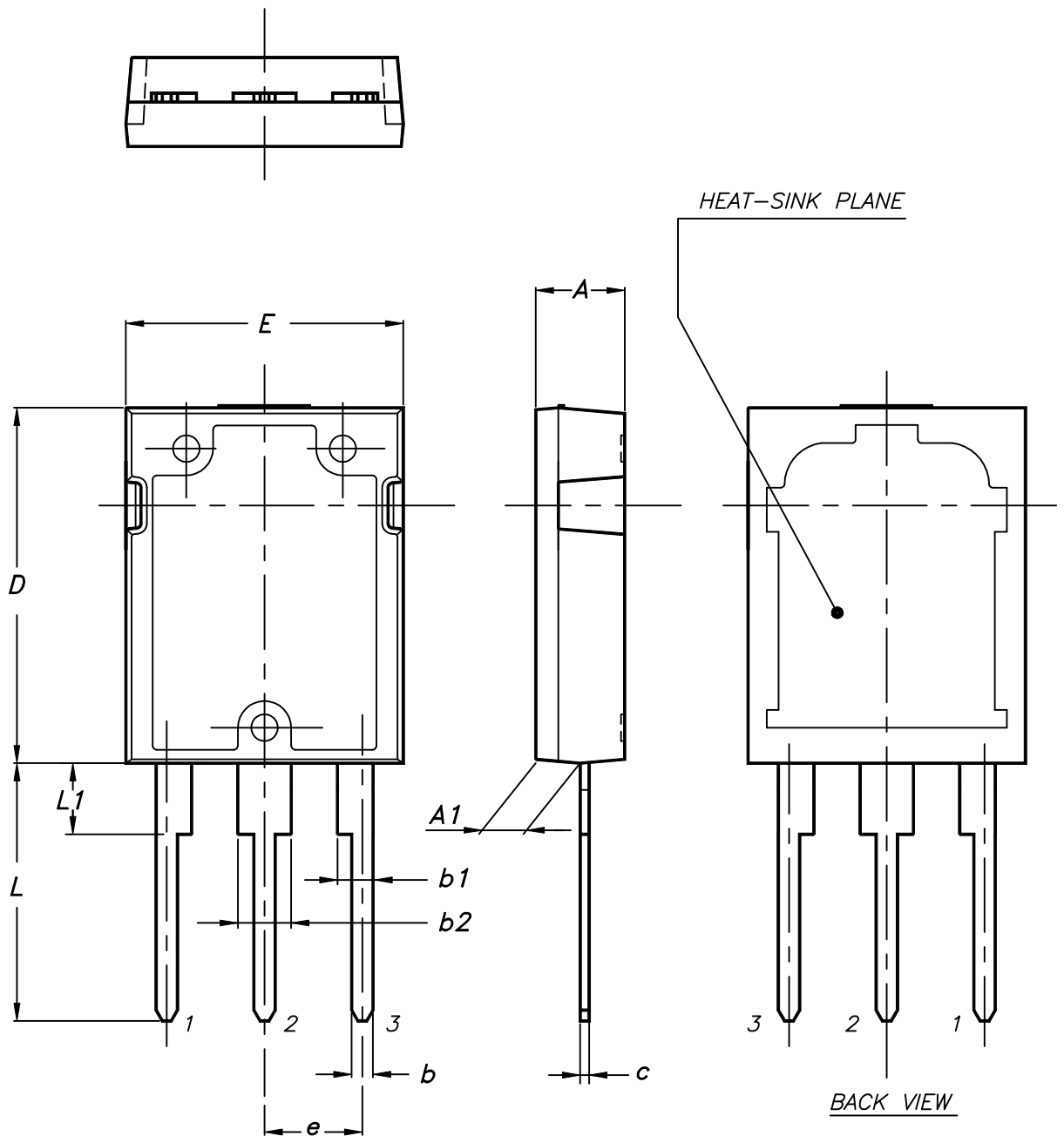
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4 Package information

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.

4.1 Max247 package information

Figure 19. Max247 package outline



0094330_5

Table 8. Max247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.70	-	5.30
A1	2.20	-	2.60
b	1.00	-	1.40
b1	2.00	-	2.40
b2	3.00	-	3.40
c	0.40	-	0.80
D	19.70	-	20.30
e	5.35	-	5.55
E	15.30	-	15.90
L	14.20	-	15.20
L1	3.70	-	4.30

Revision history

Table 9. Document revision history

Date	Revision	Changes
24-Jan-2013	1	First release
19-Dec-2016	2	Datasheet status promoted from preliminary to production data. Updated features, description and internal schematic diagram on cover page. Updated <i>Section 1: "Electrical ratings"</i> and <i>Section 2: "Electrical characteristics"</i> . Minor text changes.
12-Aug-2021	3	Updated Table 1. Absolute maximum ratings . Updated Section 4 Package information . Minor text changes.

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