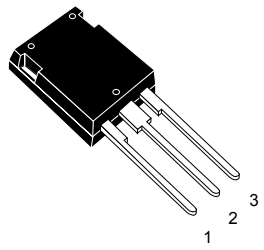
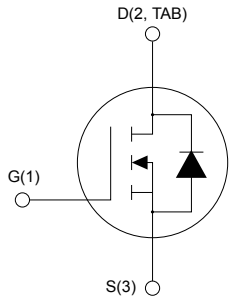
STY50N105DK5

Datasheet

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



Max247



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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 $R_{DS(on)}$ x 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 °C	46	A
	Drain current (continuous) at T_C = 100 °C	30	
I_{DM}(1)	Drain current (pulsed)	184	A
P_{TOT}	Total power dissipation at T_C = 25 °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	°C
T_{stg}	Storage temperature range		°C

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

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.2	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	30	°C/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°C, I_D = I_{AS}, V_{DD} = 50 V)	1550	mJ

2 Electrical characteristics

T_C = 25 °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 mA, V_{GS} = 0 V	1050			V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 1050 V, V_{GS} = 0 V			1	µA
		V_{DS} = 1050 V, V_{GS} = 0 V, T_C = 125 °C(1)			100	
I_{GSS}	Gate-body leakage current	V_{GS} = ±20 V, V_{DS} = 0 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 100 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 23 A		110	120	mΩ

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 V, f = 1 MHz, V_{GS} = 0 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 V, V_{DS} = 0 to 840 V	-	630	-	pF
$C_{o(er)}$(2)	Equivalent capacitance energy related		-	219	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	3	-	Ω
Q_g	Total gate charge	V_{DD} = 840 V, I_D = 46 A, V_{GS} = 0 to 10 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 V, I_D = 23 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	40.6	-	ns
t_r	Rise time		-	64.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	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 A, V_{GS} = 0 V	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 46 A, di/dt = 100 A/µs,	-	273		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V	-	3		µC
I_{RRM}	Reverse recovery current	(see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	23		A
t_{rr}	Reverse recovery time	I_{SD} = 46 A, di/dt = 100 A/µs,	-	477		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_J = 150 °C	-	10		µC
I_{RRM}	Reverse recovery current	(see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	42		A

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

2.1 Electrical characteristics (curves)

Figure 1. Forward bias safe operating area

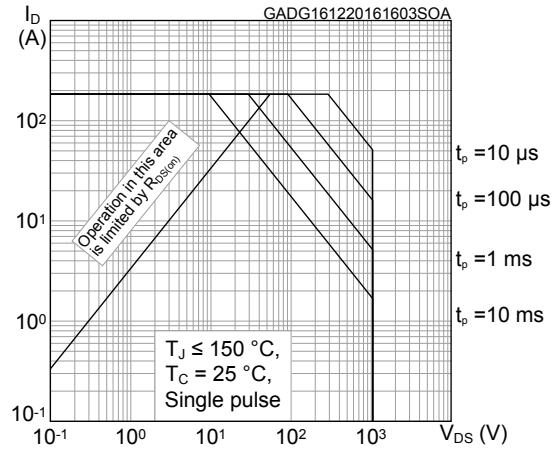


Figure 2. Thermal impedance

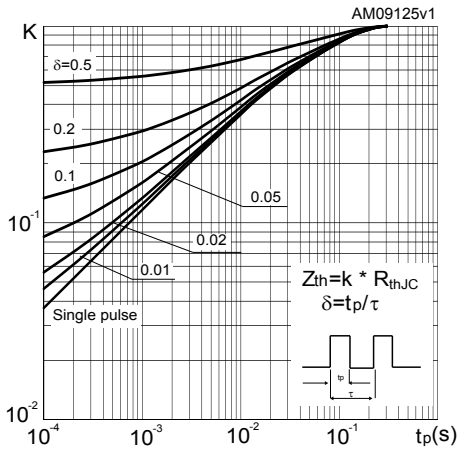


Figure 3. Output characteristics

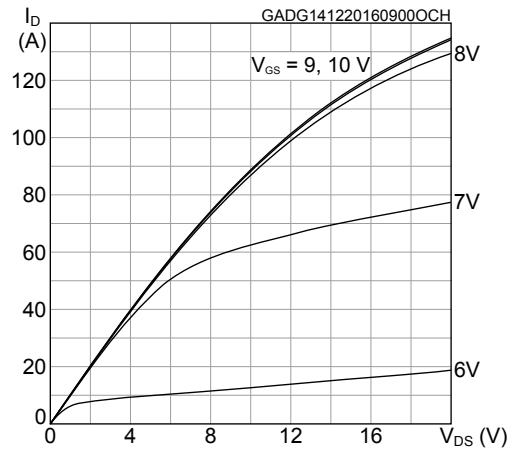


Figure 4. Transfer characteristics

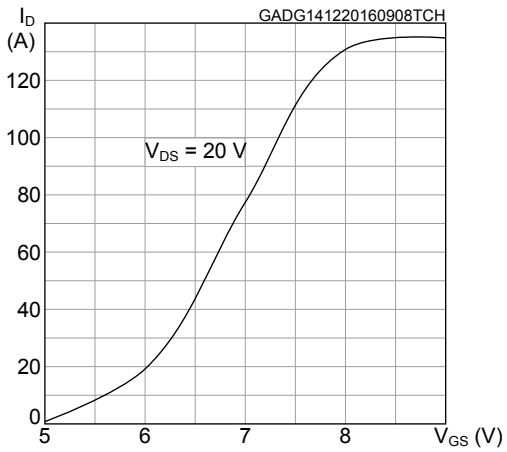


Figure 5. Gate charge vs gate-source voltage

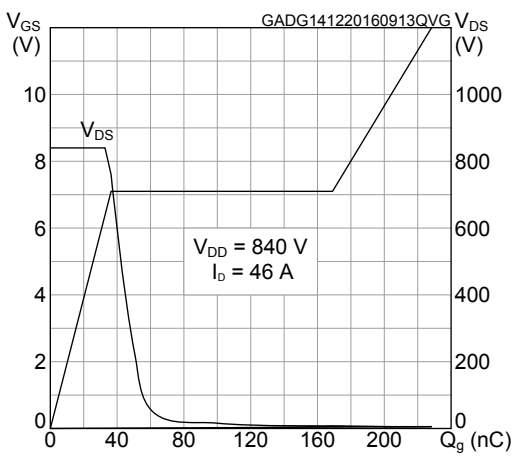


Figure 6. Static drain-source on-resistance

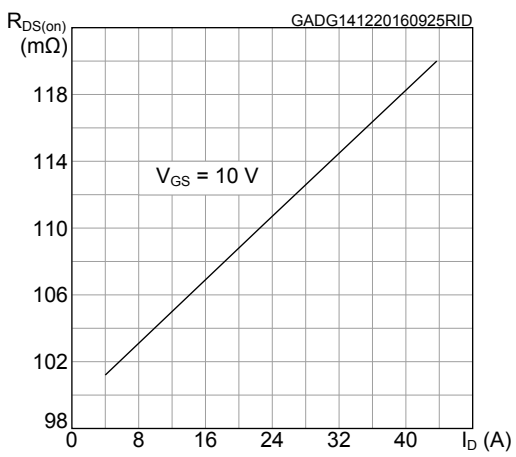


Figure 7. Capacitance variations

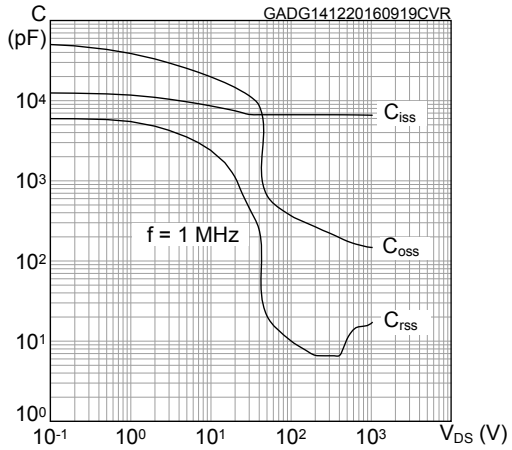


Figure 8. Normalized gate threshold voltage vs temperature

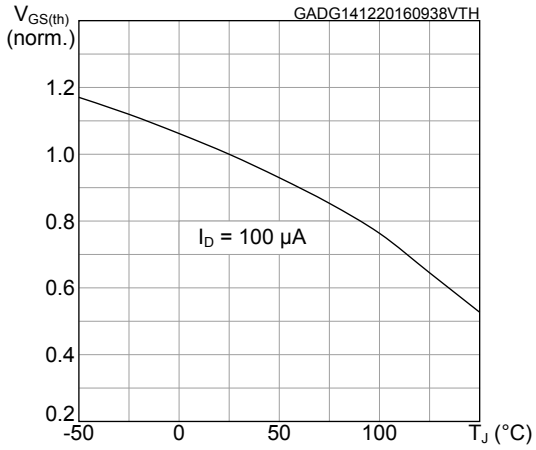


Figure 9. Normalized on-resistance vs temperature

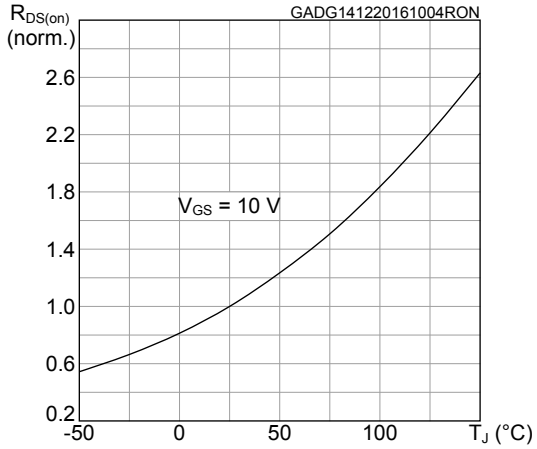


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

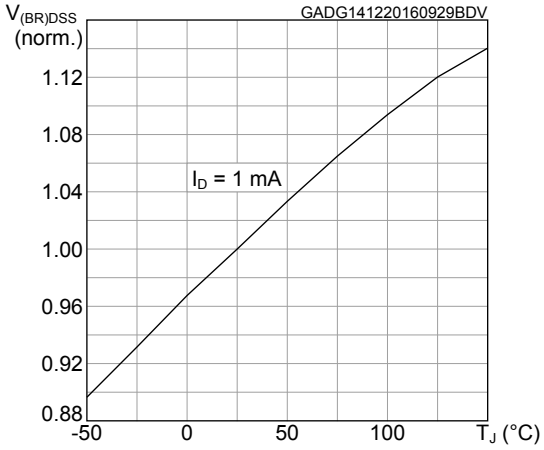


Figure 11. Source-drain diode forward characteristics

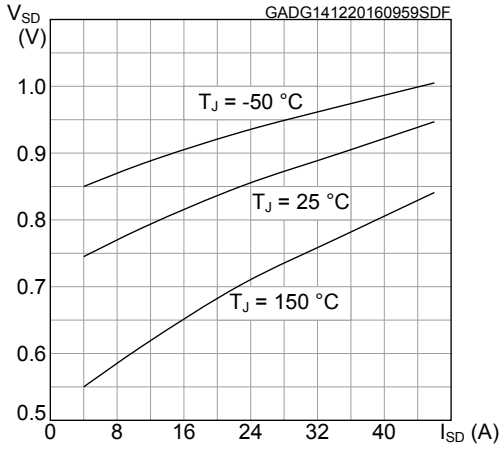
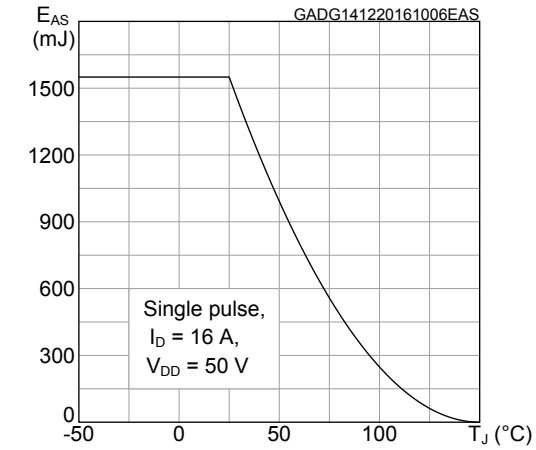


Figure 12. Maximum avalanche energy vs starting T_J



3 Test circuits

Figure 13. Test circuit for resistive load switching times

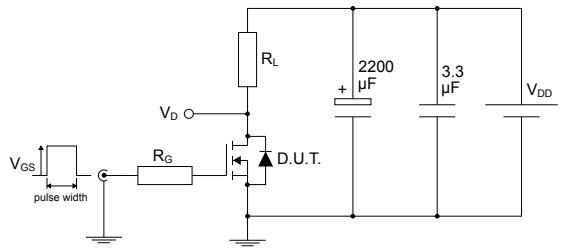


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Figure 14. Test circuit for gate charge behavior

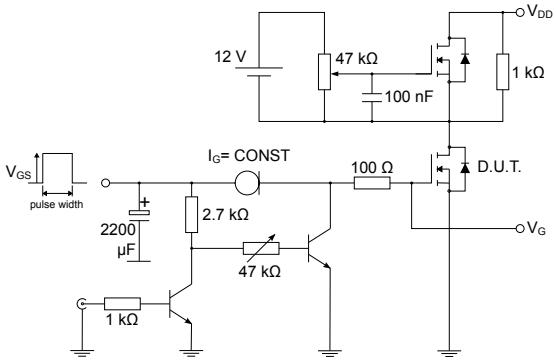

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Figure 15. Test circuit for inductive load switching and diode recovery times

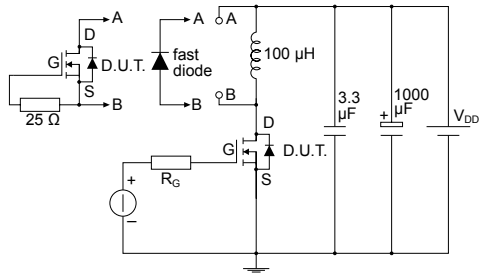

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Figure 16. Unclamped inductive load test circuit

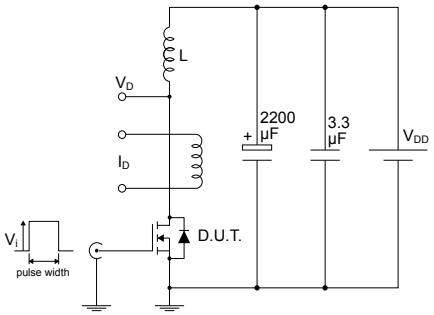

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Figure 17. Unclamped inductive waveform

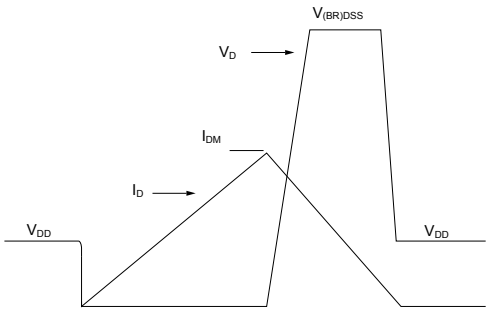

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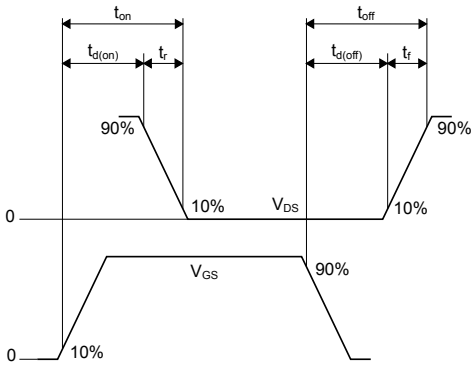
Figure 18. Switching time waveform



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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

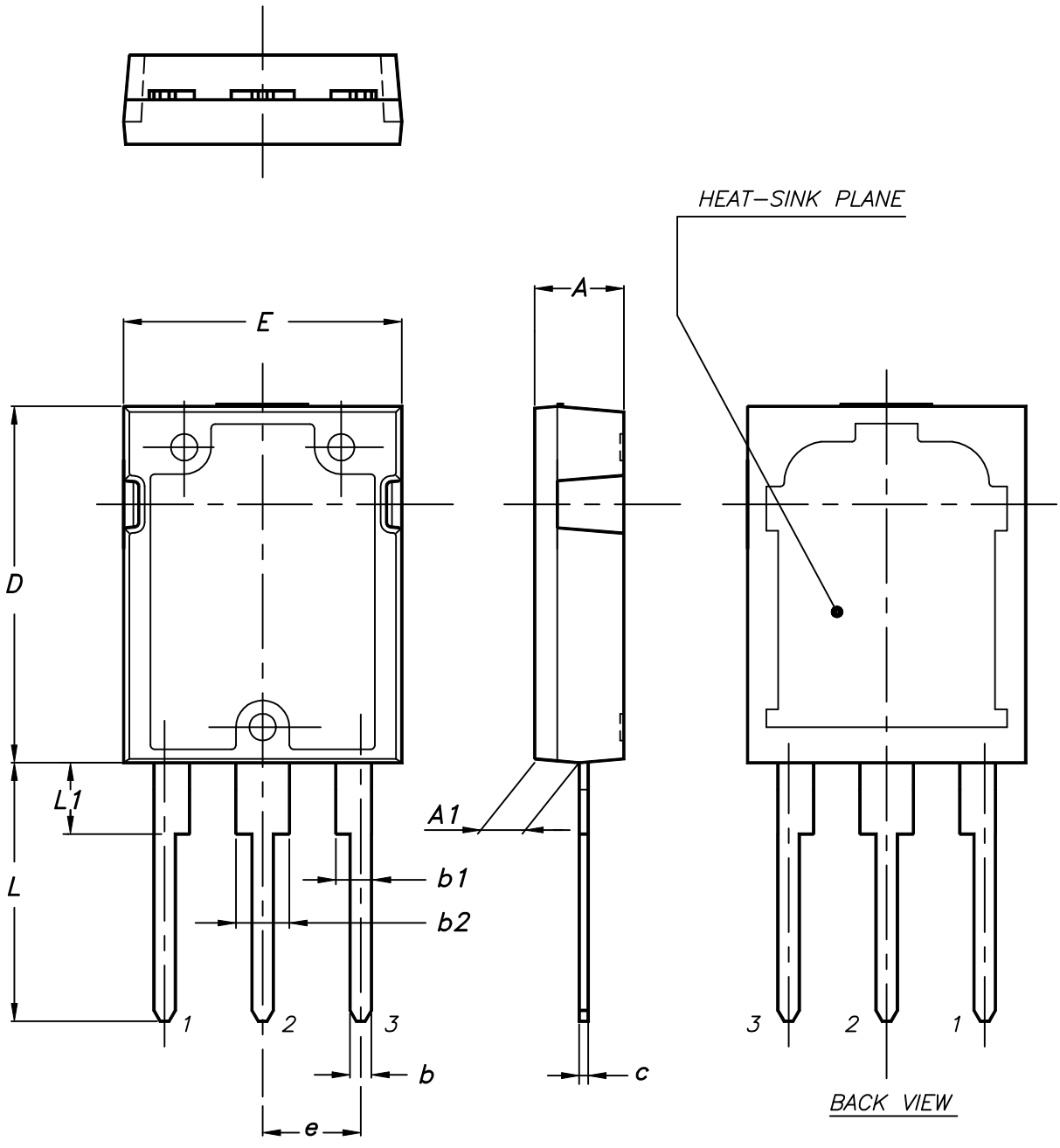

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Table 8. **Max247 package mechanical data**

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 *Section 1: "Electrical ratings"* and *Section 2: "Electrical characteristics"*. Minor text changes.
12-Aug-2021	3	Updated Table 1. Absolute maximum ratings. Updated Section 4 Package information. Minor text changes.

Contents