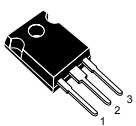
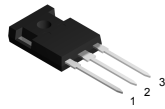


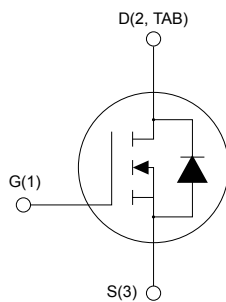
## N-channel 950 V, 120 mΩ typ., 38 A, MDmesh DK5 Power MOSFETs in TO-247 and TO-247 long leads packages



TO-247



TO-247 long leads



AM01475v1\_noZen



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STW40N95DK5	950 V	130 mΩ	38 A
STWA40N95DK5			

- Fast-recovery body diode
- Best R<sub>DS(on)</sub> × area
- Low gate charge, input capacitance and resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness

### Applications

- Switching applications

### Description

These very high voltage N-channel Power MOSFETs are part of the MDmesh DK5 fast-recovery diode series. The MDmesh DK5 combines very low recovery charge (Q<sub>rr</sub>) and recovery time (t<sub>rr</sub>) with an excellent improvement in R<sub>DS(on)</sub> \* area and one of the most effective switching behaviors, ideal for half bridge and full bridge converters.

#### Product status links

[STW40N95DK5](#)
[STWA40N95DK5](#)

#### Product summary

Order code	STW40N95DK5
Marking	40N95DK5
Package	TO-247
Packing	Tube
Order code	STWA40N95DK5
Marking	40N95DK5
Package	TO-247 long leads
Packing	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 30$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	38	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	24	
$I_{DM}^{(1)}$	Drain current (pulsed)	152	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	450	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	50	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	50	V/ns
$T_{stg}$	Storage temperature range	-55 to 150	$^\circ\text{C}$
$T_J$	Operating junction temperature range		$^\circ\text{C}$

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 38\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS}(\text{peak}) \leq V_{(BR)DSS}$ ,  $V_{DD} = 760\text{ V}$ .
3.  $V_{DS} \leq 760\text{ V}$ .

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.28	$^\circ\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance, junction-to-ambient	50	$^\circ\text{C}/\text{W}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Maximum current during repetitive or single pulse avalanche	13	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	730	mJ

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0\text{ V}$	950			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 950\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 950\text{ V}$ , $T_C = 125\text{ }^\circ\text{C}^{(1)}$			100	$\mu\text{A}$
$I_{GSS}$	Gate-source leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DD} = V_{GS}$ , $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 19\text{ A}$		120	130	m $\Omega$

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

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	3480	-	pF
$C_{oss}$	Output capacitance		-	235	-	pF
$C_{rSS}$	Reverse transfer capacitance		-	2.3	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{GS} = 0\text{ V}$ , $V_{DS} = 0\text{ to }760\text{ V}$	-	371	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	134	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	2	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 760\text{ V}$ , $I_D = 38\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 14. Test circuit for gate charge behavior)	-	100	-	nC
$Q_{gs}$	Gate source charge		-	19.5	-	nC
$Q_{gd}$	Gate drain charge		-	67.6	-	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%  $V_{DSS}$ .

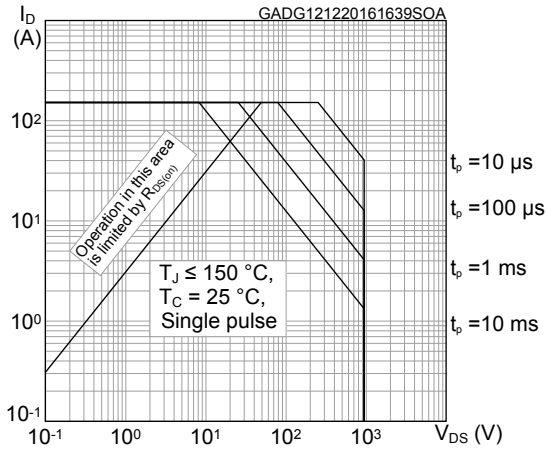
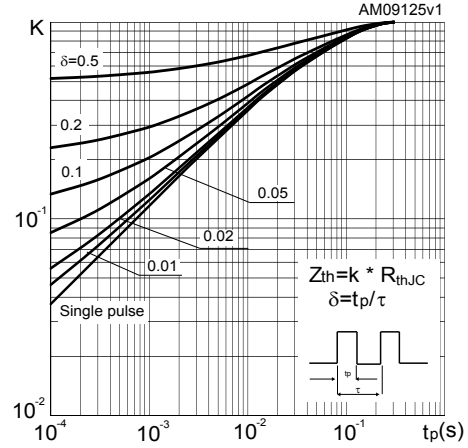
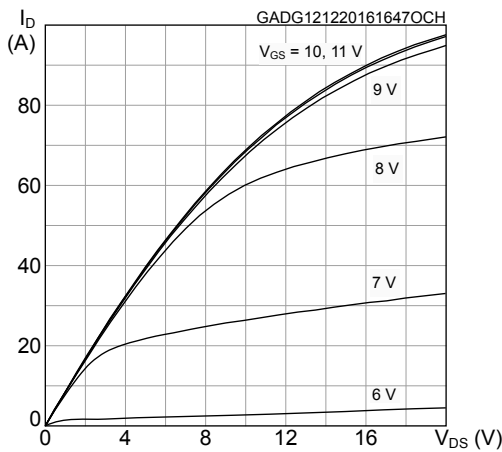
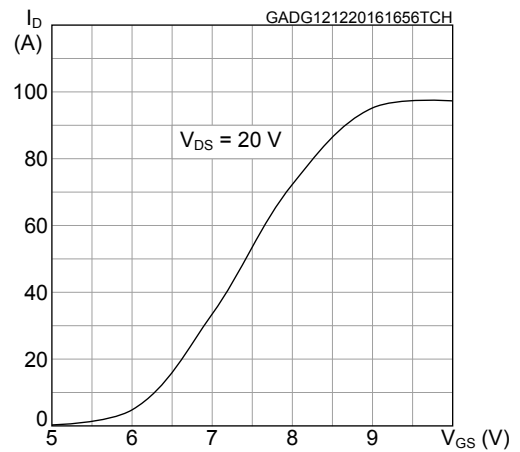
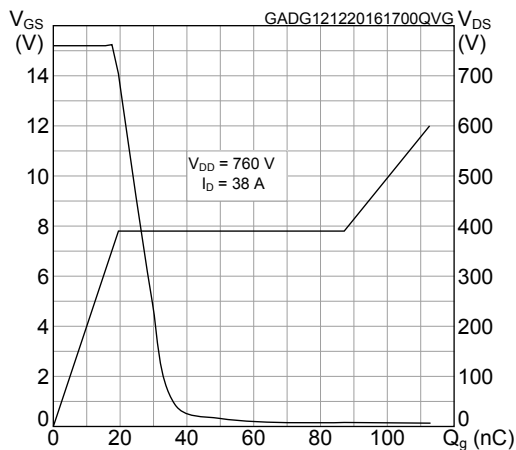
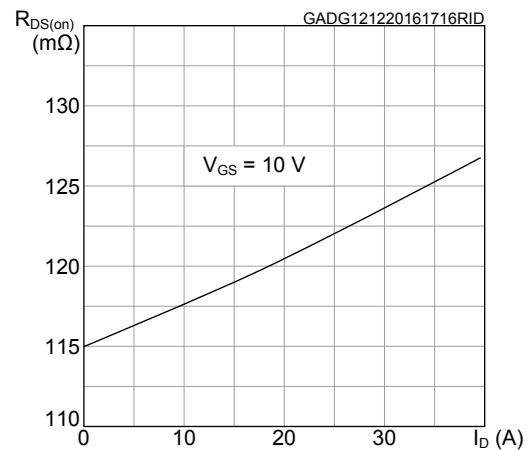
**Table 6. Switching times**

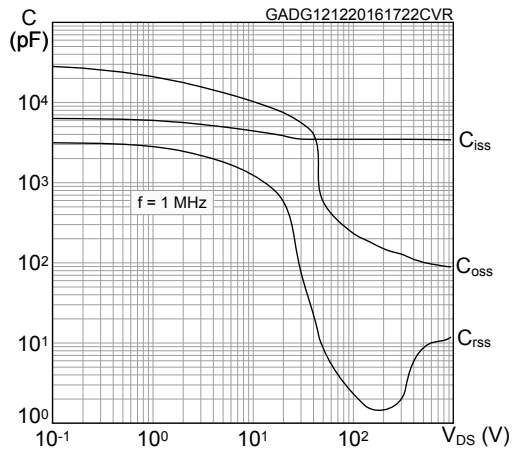
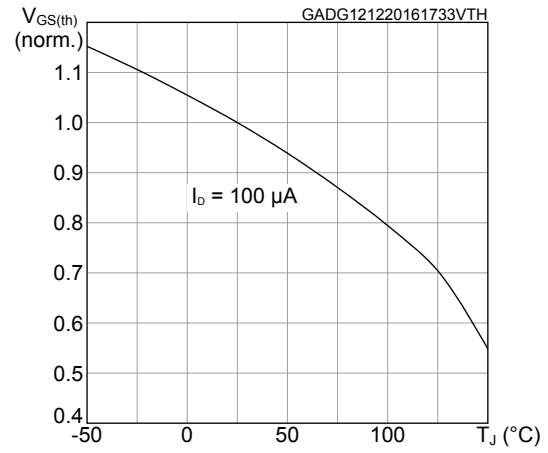
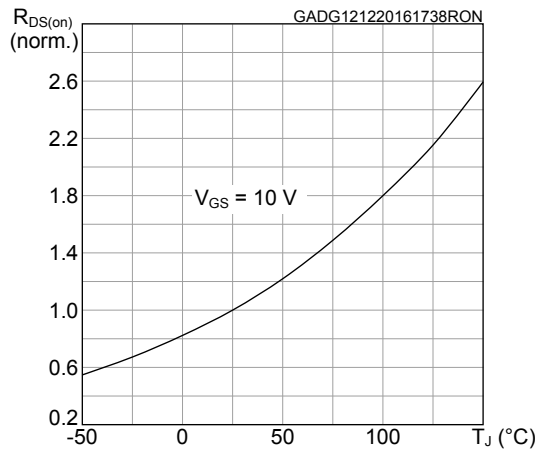
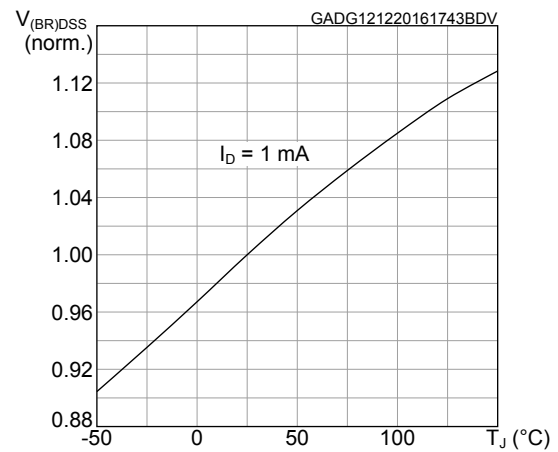
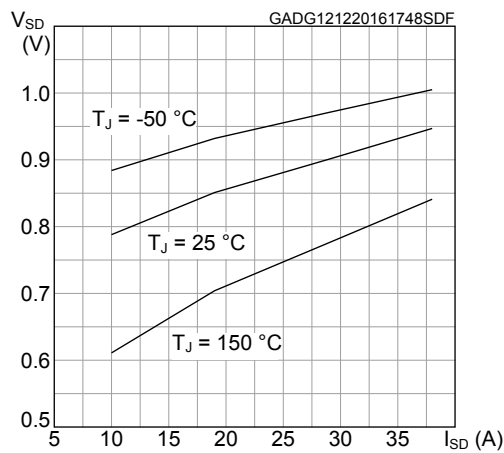
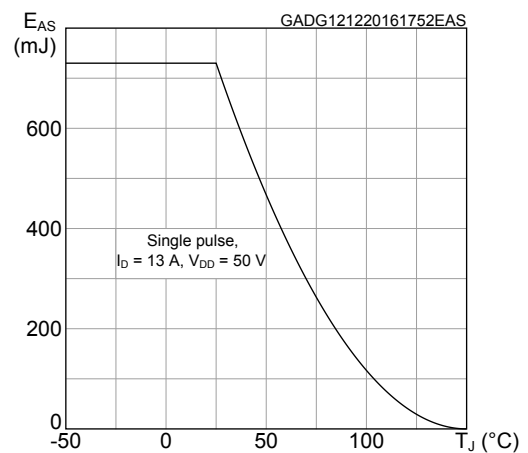
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DS} = 475\text{ V}$ , $I_D = 19\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$	-	30	-	ns
$t_r$	Rise time		-	15	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	82	-	ns
$t_f$	Fall time		-	11	-	ns

**Table 7. Source-drain diode**

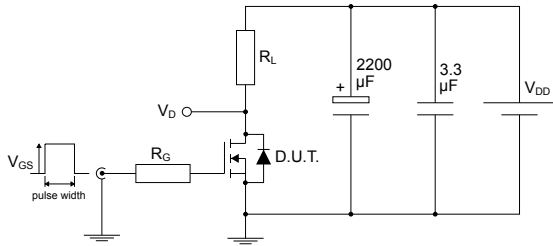
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		38	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		152	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 38\text{ A}, V_{GS} = 0\text{ V}$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 19\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$ $V_{DD} = 60\text{ V}$	-	170		ns
$Q_{rr}$	Reverse recovery charge	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	1.4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	15		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 19\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$ $V_{DD} = 60\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	340		ns
$Q_{rr}$	Reverse recovery charge	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	30		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

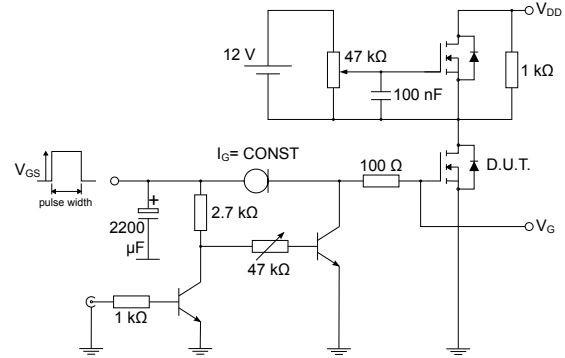
**2.1 Electrical characteristics (curves)**
**Figure 1. Forward bias safe operating area**

**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**


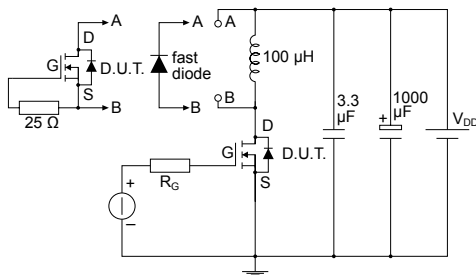
### 3 Test circuits

**Figure 13. Test circuit for resistive load switching times**


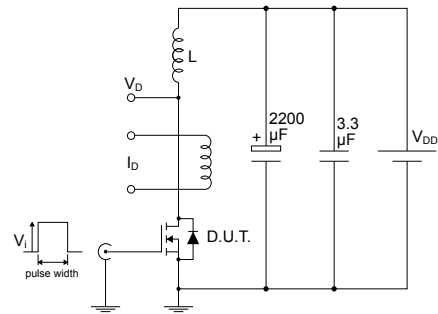
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**Figure 14. Test circuit for gate charge behavior**


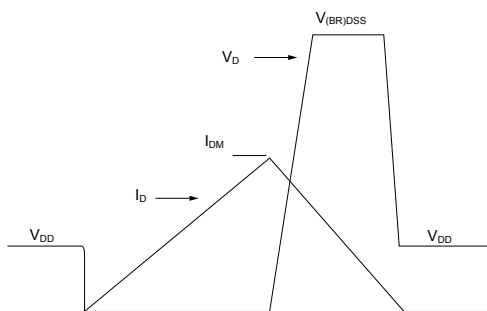
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**Figure 15. Test circuit for inductive load switching and diode recovery times**


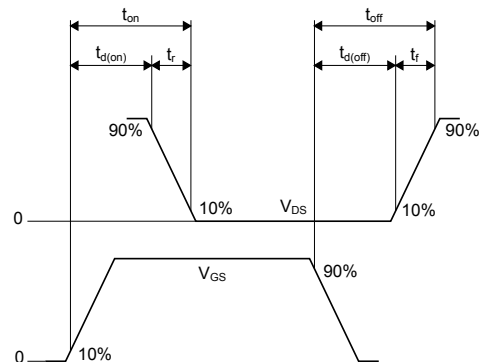
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**Figure 16. Unclamped inductive load test circuit**


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**Figure 17. Unclamped inductive waveform**


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**Figure 18. Switching time waveform**


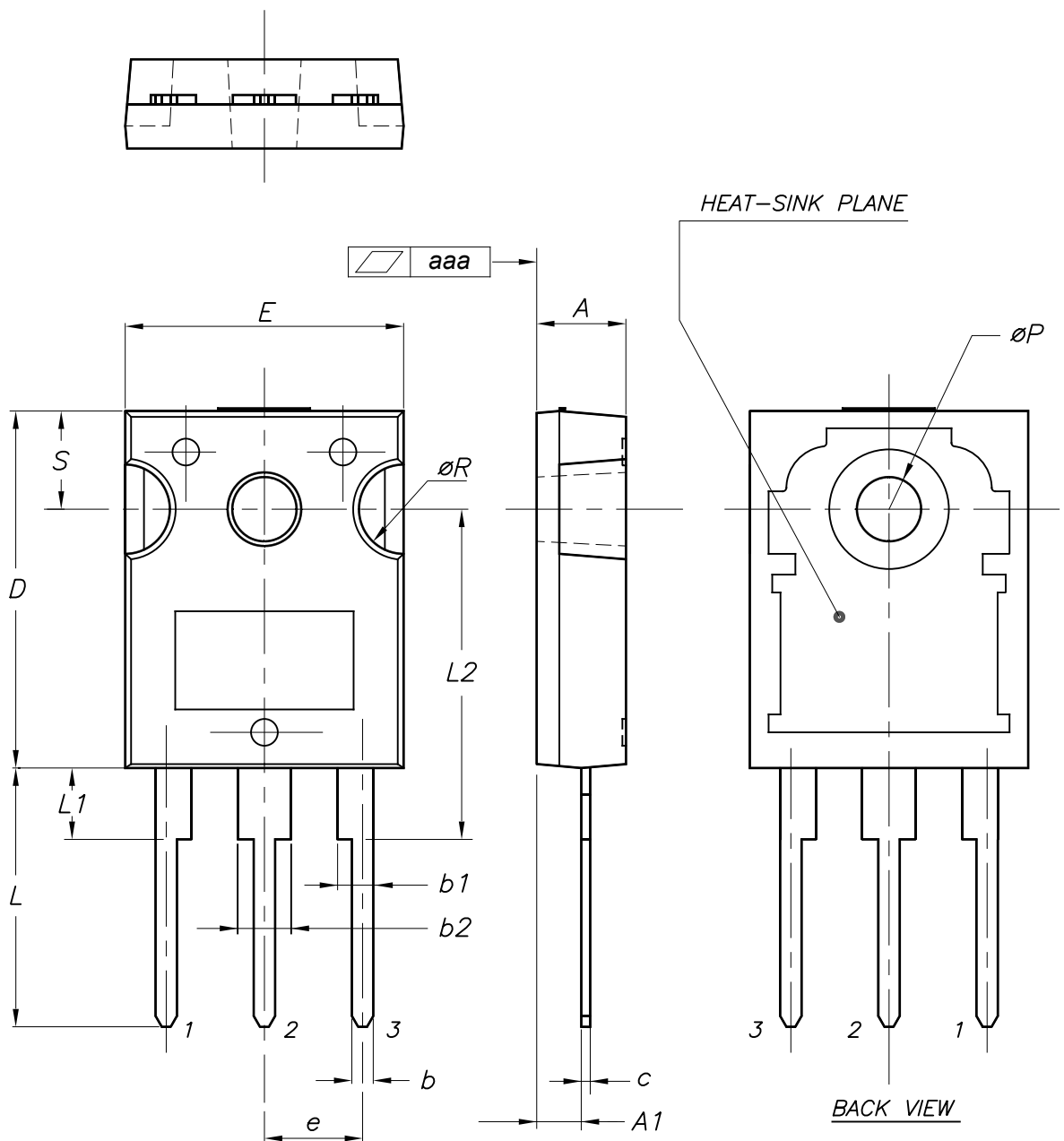
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## 4 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 TO-247 package information

Figure 19. TO-247 package outline



0075325\_10

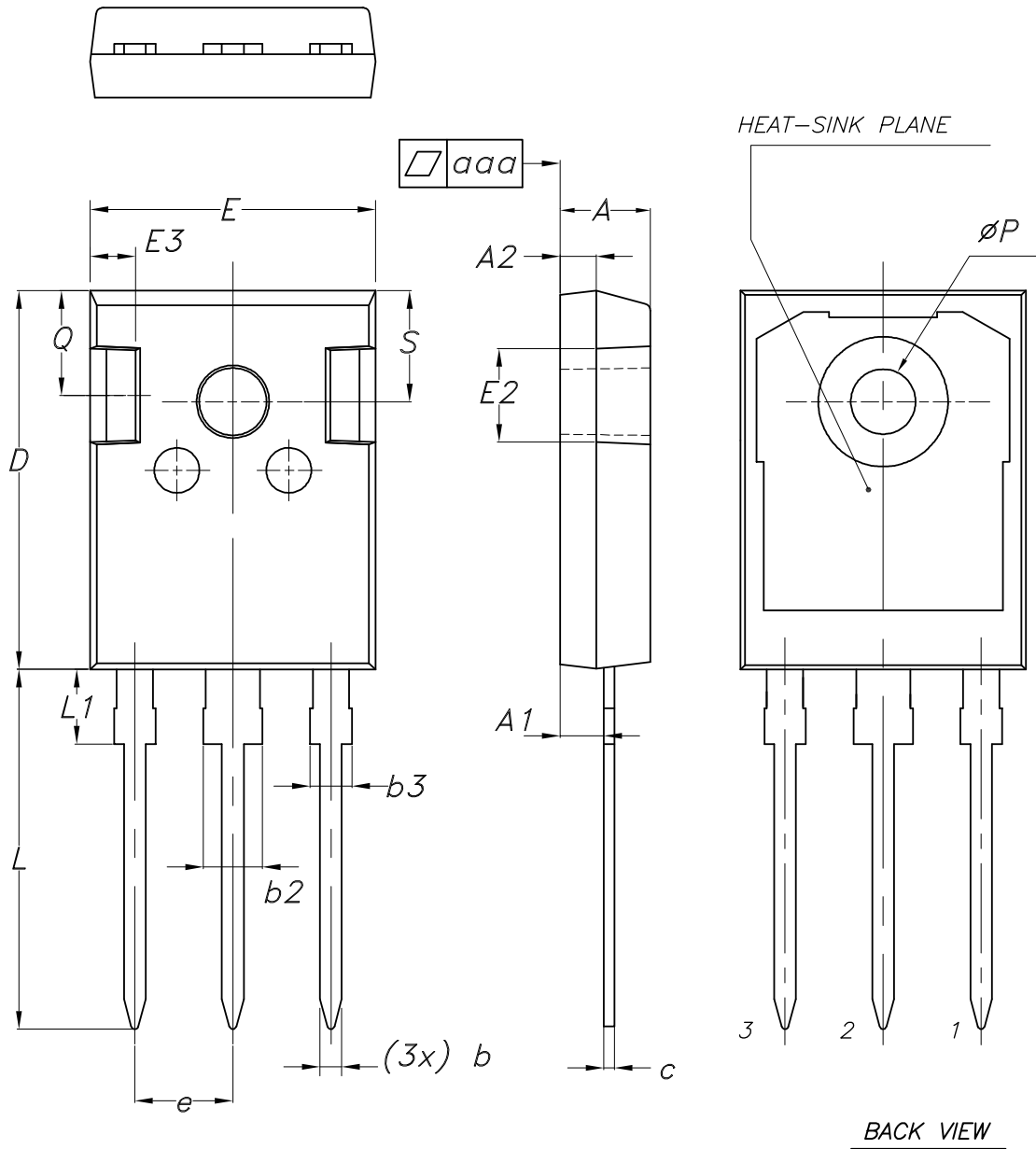


**Table 8. TO-247 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70
aaa		0.04	0.10

## 4.2 TO-247 long leads package information

Figure 20. TO-247 long leads package outline



8463846\_3

**Table 9. TO-247 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
aaa		0.04	0.10

## Revision history

**Table 10. Document revision history**

Date	Revision	Changes
19-Sep-2013	1	First release.
13-Nov-2015	2	Updated title, features and description in cover page. Updated Section 10 : "Electrical characteristics" and Section 12.1:"TO-247 package information" Minor text changes.
12-Apr-2016	3	Updated title,silhouette and description in cover page. Updated <i>Table 2: "Absolute maximum ratings"</i> . Updated <i>Section 10: "Electrical characteristics"</i> . Added <i>Figure 21: "TO-247 long lead package outline"</i> . Minor text changes
12-Dec-2016	4	Datasheet status promoted from preliminary to production data. Updated document title on cover page. Updated <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 4: "Thermal data"</i> , <i>Table 5: "On/off states"</i> , <i>Table 6: "Dynamic"</i> and <i>Table 8: "Source-drain diode"</i> . Added <i>Section 2.1: "Electrical characteristics (curves)"</i> . Minor text changes
11-Aug-2021	5	Updated <a href="#">Table 1. Absolute maximum ratings</a> . Updated <a href="#">Section 4 Package information</a> . Minor text changes.

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## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>2</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>3</b>
<b>2.1</b>	Electrical characteristics (curves) .....	<b>5</b>
<b>3</b>	<b>Test circuits</b> .....	<b>7</b>
<b>4</b>	<b>Package information</b> .....	<b>8</b>
<b>4.1</b>	TO-247 package information .....	<b>8</b>
<b>4.2</b>	TO-247 long leads package information .....	<b>10</b>
	<b>Revision history</b> .....	<b>12</b>

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