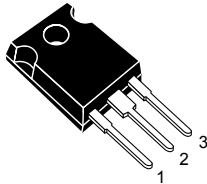
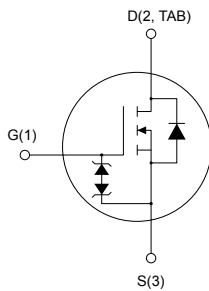


# N-channel 1500 V, 1.6 $\Omega$ typ., 7 A MDmesh K5 Power MOSFET in a TO-247 package


**TO-247**


AM01476v1\_tab



## Features

Order code	$V_{DS}$	$R_{DS(on)}$ max.	$I_D$
STW12N150K5	1500 V	1.9 $\Omega$	7 A

- Ultra-low gate charge
- Very low FoM (figure of merit)
- Zener-protected
- 100% avalanche tested

## Applications

- Switching applications

## Description

This very high voltage N-channel Power MOSFET is designed using MDmesh K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.

### Product status link

[STW12N150K5](#)

### Product summary

Order code	STW12N150K5
Marking	12N150K5
Package	TO-247
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 $T_C = 25\text{ }^{\circ}\text{C}$	7	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	4	
$I_{DM}^{(1)}$	Drain current (pulsed)	28	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	250	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4.5	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 is limited by safe operating area.
2.  $I_{SD} \leq 7\text{ A}$ ,  $di/dt = 100\text{ A}/\mu\text{s}$ ,  $V_{DS}(\text{peak}) < V_{(BR)DSS}$ .
3.  $V_{DD} \leq 1200\text{ V}$ .

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.5	$^{\circ}\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance, junction-to-ambient	50	$^{\circ}\text{C}/\text{W}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or non-repetitive (pulse width limited by $T_J$ max.)	2	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	900	mJ

## 2 Electrical characteristics

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

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	1500	-	-	V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 1500\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 1500\text{ V}$ , $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$	-	-	50	
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 3.5\text{ A}$	-	1.6	1.9	$\Omega$

1. Specified by design, not tested in production.

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	1360	-	pF
$C_{oss}$	Output capacitance		-	80	-	pF
$C_{rss}$	Reverse transfer capacitance		-	0.7	-	pF
$C_{o(tr)}^{(1)}$	Equivalent output capacitance time related	$V_{DS} = 0\text{ to }1200\text{ V}$ , $V_{GS} = 0\text{ V}$	-	82	-	pF
$C_{o(er)}^{(2)}$	Equivalent output capacitance energy related		-	32	-	pF
$R_g$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	3	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 1200\text{ V}$ , $I_D = 7\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$ (see the Figure 15. Test circuit for gate charge behavior)	-	47	-	nC
$Q_{gs}$	Gate-source charge		-	8	-	nC
$Q_{gd}$	Gate-drain charge		-	32	-	nC

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

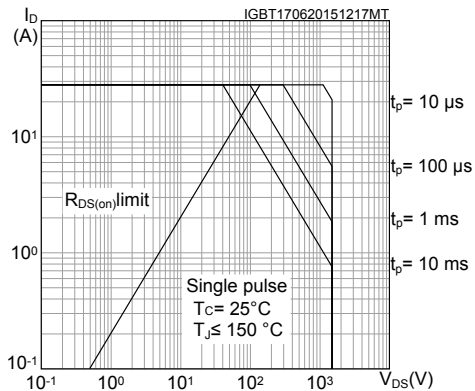
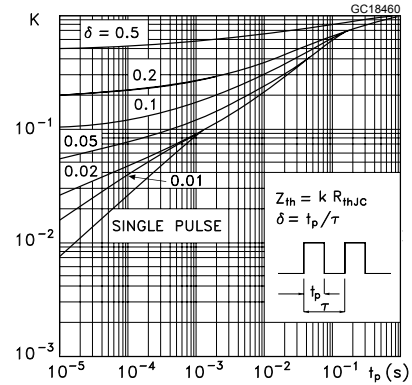
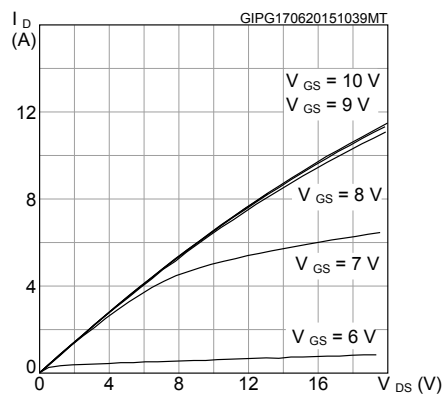
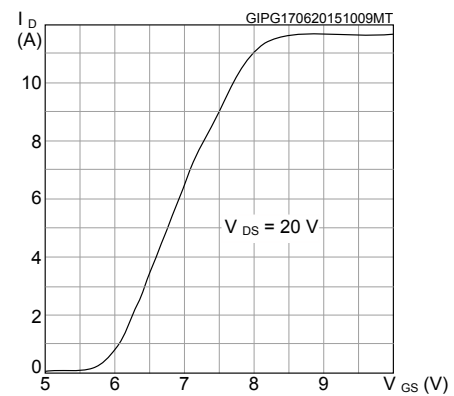
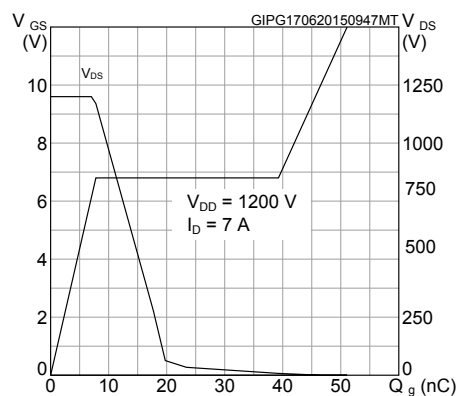
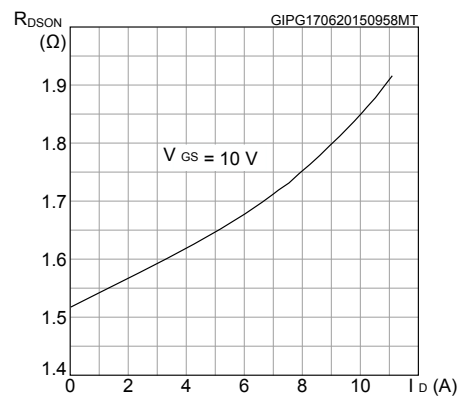
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 750\text{ V}$ , $I_D = 3.5\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$	-	25	-	ns
$t_r$	Rise time		-	8	-	ns
$t_{d(off)}$	Turn-off delay time	(see the Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	90	-	ns
$t_f$	Fall time		-	37	-	ns

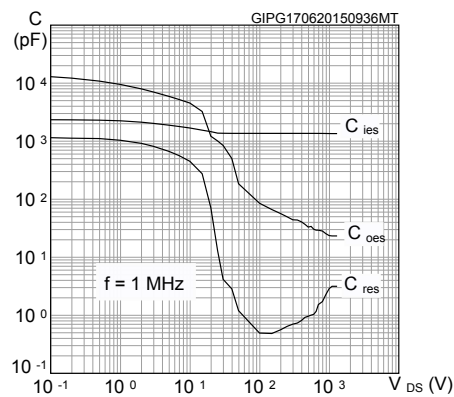
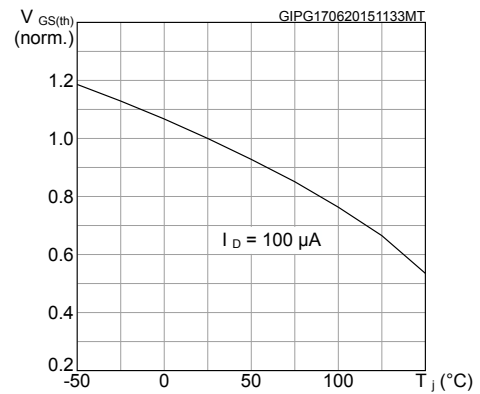
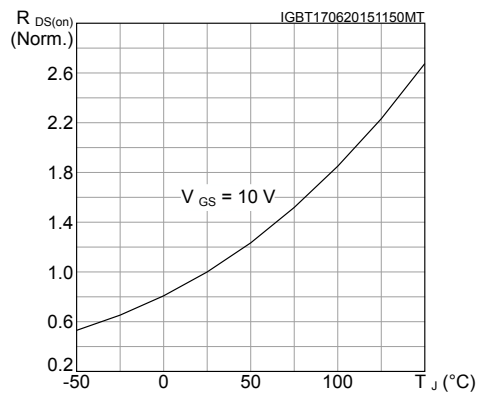
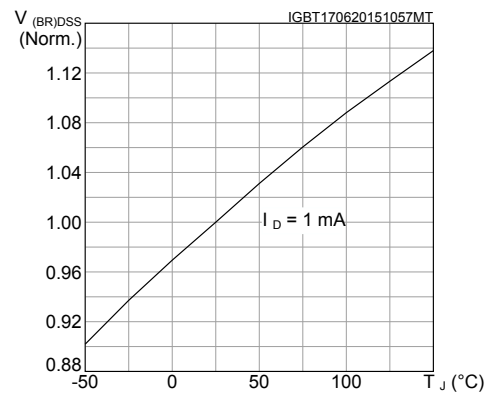
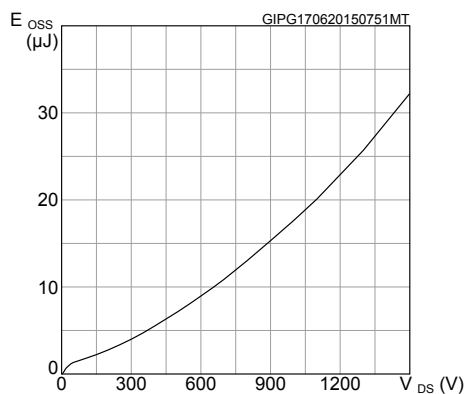
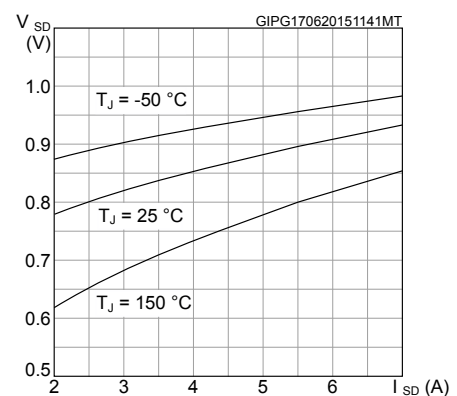
**Table 7. Source-drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-	-	7	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	28	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 7\text{ A}$	-	-	1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 7\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$	-	302	-	ns
$Q_{rr}$	Reverse recovery charge		-	3.71	-	$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see the Figure 16. Test circuit for inductive load switching and diode recovery times)	-	24.6	-	A
$t_{rr}$	Reverse recovery time	$I_{SD} = 7\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	432	-	ns
$Q_{rr}$	Reverse recovery charge		-	4.71	-	$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see the Figure 16. Test circuit for inductive load switching and diode recovery times)	-	21.8	-	A

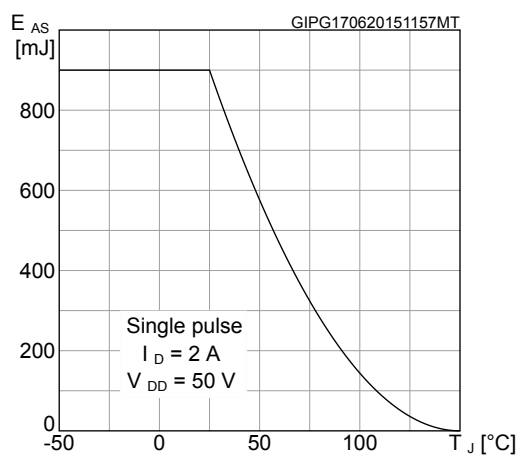
1. Pulse width is limited by safe operating area.
2. Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

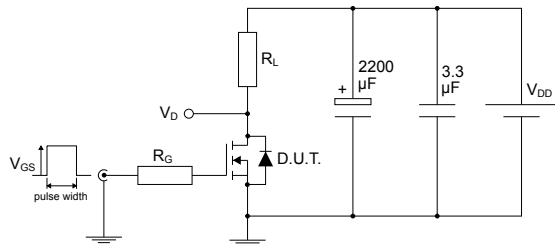
**Figure 1. Safe operating area**

**Figure 2. Normalized transient thermal impedance**

**Figure 3. Typical output characteristics**

**Figure 4. Typical transfer characteristics**

**Figure 5. Typical gate charge characteristics**

**Figure 6. Typical drain-source on-resistance**


**Figure 7. Typical capacitance characteristics**

**Figure 8. Normalized gate threshold vs temperature**

**Figure 9. Normalized on-resistance vs temperature**

**Figure 10. Normalized breakdown voltage vs temperature**

**Figure 11. Typical output capacitance stored energy**

**Figure 12. Typical reverse diode forward characteristics**


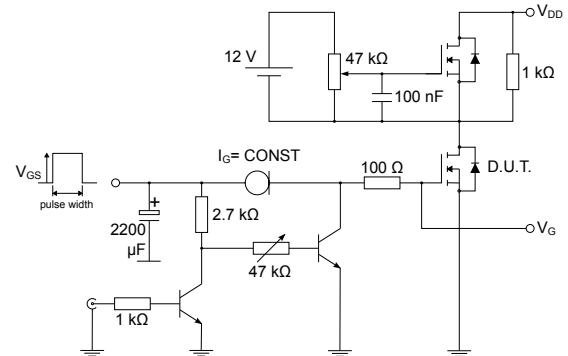
**Figure 13. Maximum avalanche energy vs temperature**



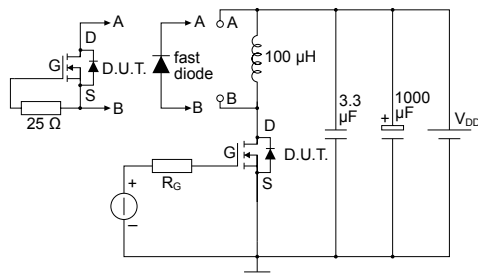
### 3 Test circuits

**Figure 14. Test circuit for resistive load switching times**


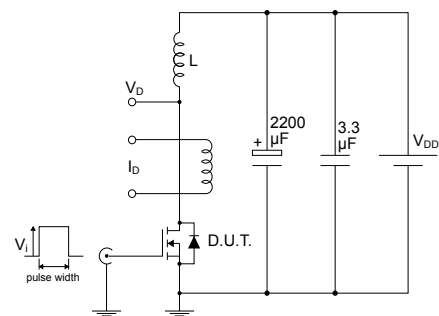
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**Figure 15. Test circuit for gate charge behavior**


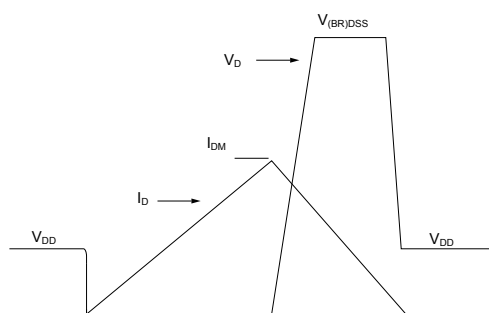
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**Figure 16. Test circuit for inductive load switching and diode recovery times**


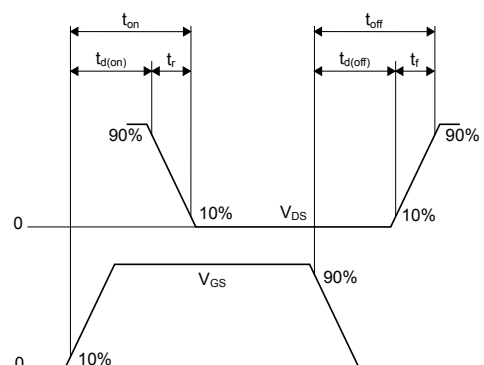
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**Figure 17. Unclamped inductive load test circuit**


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**Figure 18. Unclamped inductive waveform**


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**Figure 19. Switching time waveform**


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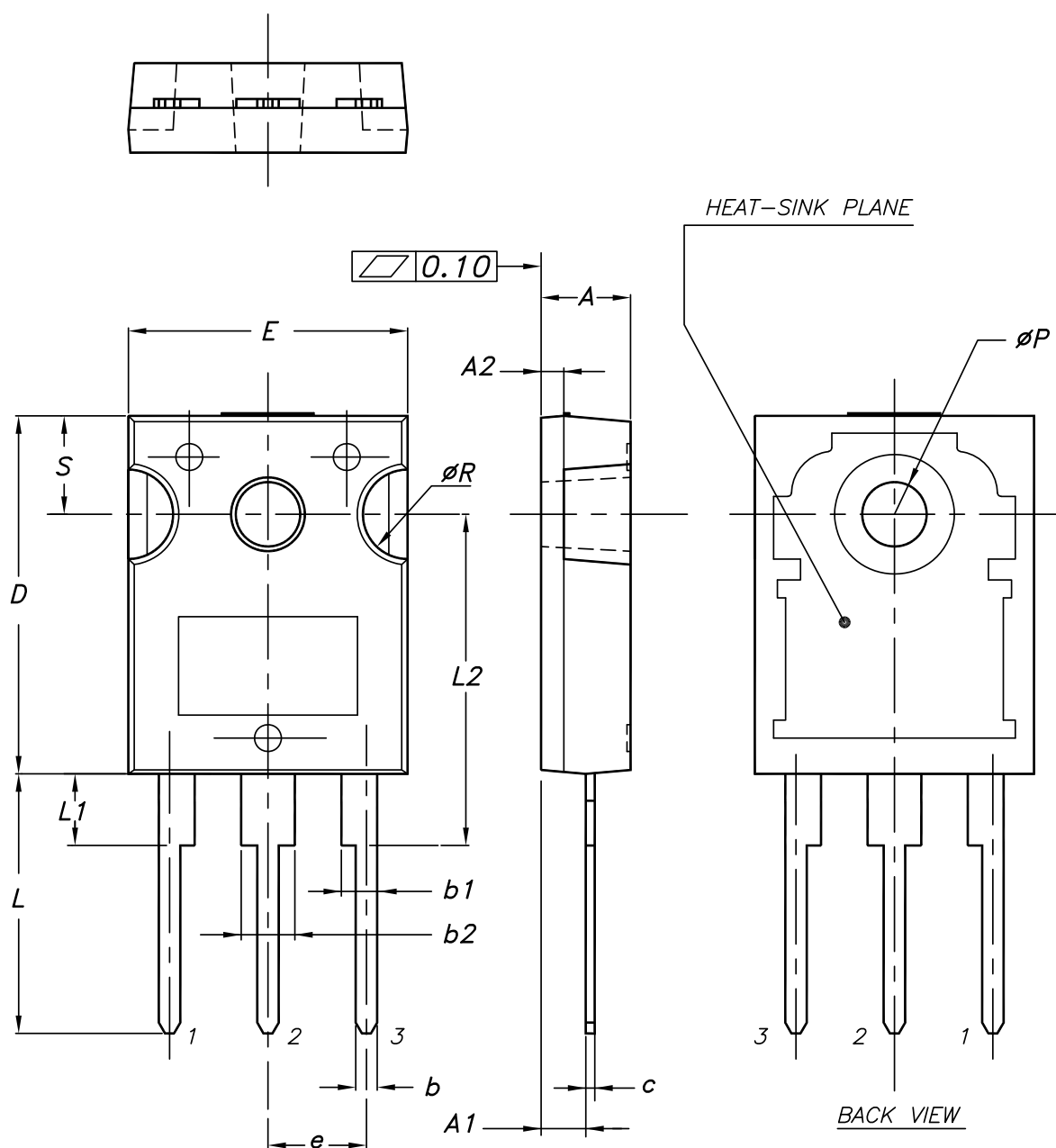


## 4 Package information

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 20. TO-247 package outline



0075325\_11

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

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
A2		1.27	
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

## Revision history

**Table 9. Document revision history**

Date	Version	Changes
11-May-2015	1	First release.
30-Jun-2015	2	Updated title and features in cover page. Updated Section 4: "Electrical ratings", Section 5: "Electrical characteristics". Added Section 5.1: "Electrical characteristics (curves)" . Minor text changes.
07-Jul-2015	3	Updated Section 5.1: "Electrical characteristics (curves)". Minor text changes.
19-Dec-2025	4	Updated <a href="#">Section 4.1: TO-247 package information</a> . Minor text changes.

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