

N-channel 1500 V, 1.6 Ω typ., 7 A MDmesh™ K5 Power MOSFET in a TO-247 package

Datasheet - production data

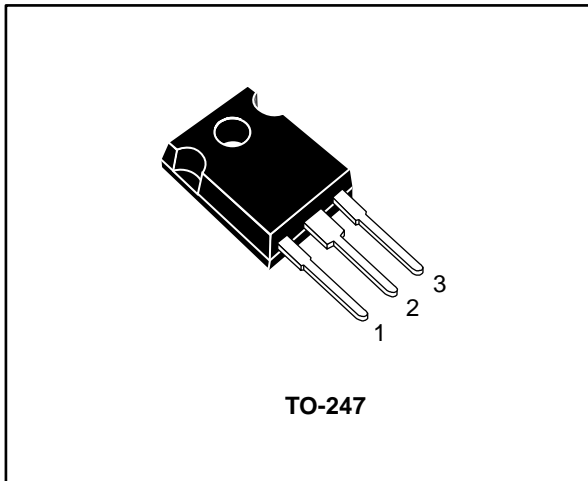
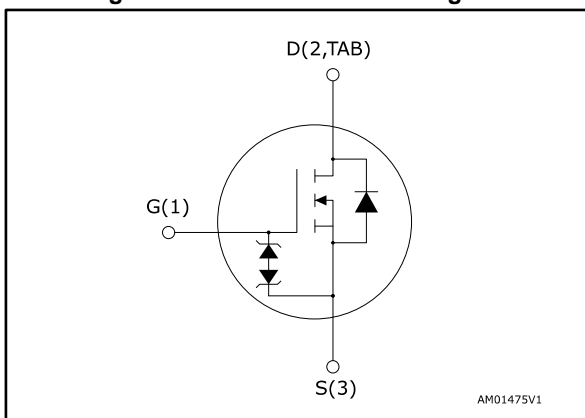


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STW12N150K5	1500 V	1.9 Ω	7 A	250 W

- Industry's lowest R_{DS(on)} * area
- Industry's best figure of merit (FoM)
- Ultra low gate charge
- 100% avalanche tested
- Zener-protected

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.

Table 1: Device summary

Order code	Marking	Package	Packing
STW12N150K5	12N150K5	TO-247	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current at $T_C = 25\text{ }^\circ\text{C}$	7	A
I_D	Drain current at $T_C = 100\text{ }^\circ\text{C}$	4	A
$I_{DM}^{(1)}$	Drain current (pulsed)	28	A
P_{TOT}	Total 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_j	Operating junction temperature	- 55 to 150	$^\circ\text{C}$
T_{stg}	Storage temperature		

Notes:

⁽¹⁾Pulse width limited by safe operating area

⁽²⁾ $I_{SD} \leq 7\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{Peak} \leq V_{(BR)DSS}$

⁽³⁾ $V_{DS} \leq 1200\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.5	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-amb	50	$^\circ\text{C}/\text{W}$

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Max current during repetitive or single pulse avalanche	2	A
E_{AS}	Single pulse avalanche energy	900	mJ

2 Electrical characteristics

($T_{CASE} = 25\text{ °C}$ unless otherwise specified)

Table 5: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	1500			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 1500\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 1500\text{ V}$, $T_C = 125\text{ °C}$			50	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0$, $V_{GS} = \pm 20\text{ V}$			± 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	$V_{GS} = 10\text{ V}$, $I_D = 3.5\text{ A}$		1.6	1.9	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{GS} = 0\text{ V}$, $V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$	-	1360	-	pF
C_{oss}	Output capacitance		-	80	-	pF
C_{rss}	Reverse transfer capacitance		-	0.7	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ V to }1200\text{ V}$, $V_{GS} = 0\text{ V}$	-	82	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	32	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	3	-	Ω
Q_g	Total gate charge	$V_{DD} = 1200\text{ V}$, $I_D = 7\text{ A}$ $V_{GS} = 10\text{ V}$ (see Figure 16: "Gate charge test circuit")	-	47	-	nC
Q_{gs}	Gate-source charge		-	8	-	nC
Q_{gd}	Gate-drain charge		-	32	-	nC

Notes:

⁽¹⁾ Time related is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when VDS increases from 0 to 80% VDSS.

⁽²⁾ Energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when VDS increases from 0 to 80% VDSS.

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 750 \text{ V}$, $I_D = 3.5 \text{ A}$, $R_G = 4.7 \Omega$ $V_{GS} = 10 \text{ V}$ (see Figure 18: "Unclamped inductive load test circuit")	-	25	-	ns
t_r	Rise time		-	8	-	ns
$t_{d(off)}$	Turn-off delay time		-	90	-	ns
t_f	Fall time		-	37	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		7	A
I_{SDM}	Source-drain current (pulsed)		-		28	A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 7 \text{ A}$, $V_{GS} = 0 \text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 7 \text{ A}$, $V_{DD} = 60 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$, (see Figure 17: "Test circuit for inductive load switching and diode recovery times")	-	302		ns
Q_{rr}	Reverse recovery charge		-	3.71		μC
I_{RRM}	Reverse recovery current		-	24.6		A
t_{rr}	Reverse recovery time	$I_{SD} = 7 \text{ A}$, $V_{DD} = 60 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 17: "Test circuit for inductive load switching and diode recovery times")	-	432		ns
Q_{rr}	Reverse recovery charge		-	4.71		μC
I_{RRM}	Reverse recovery current		-	21.8		A

Notes:

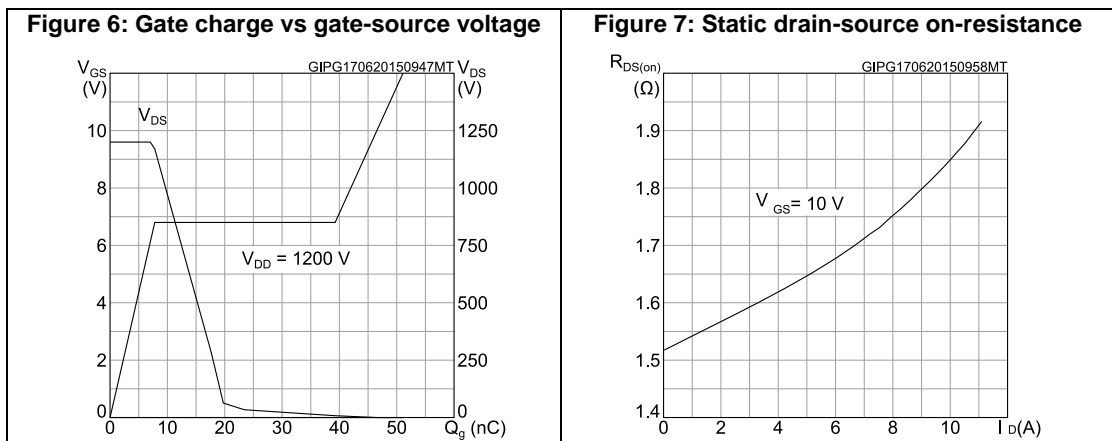
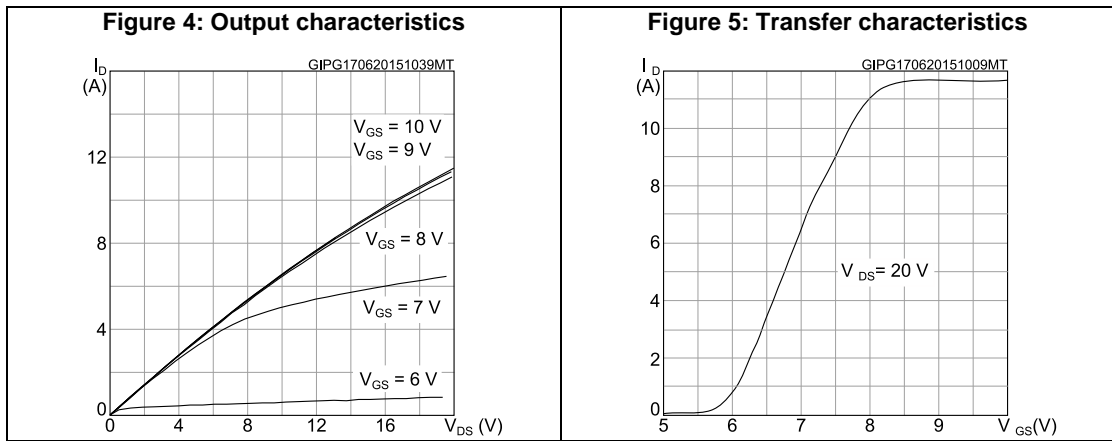
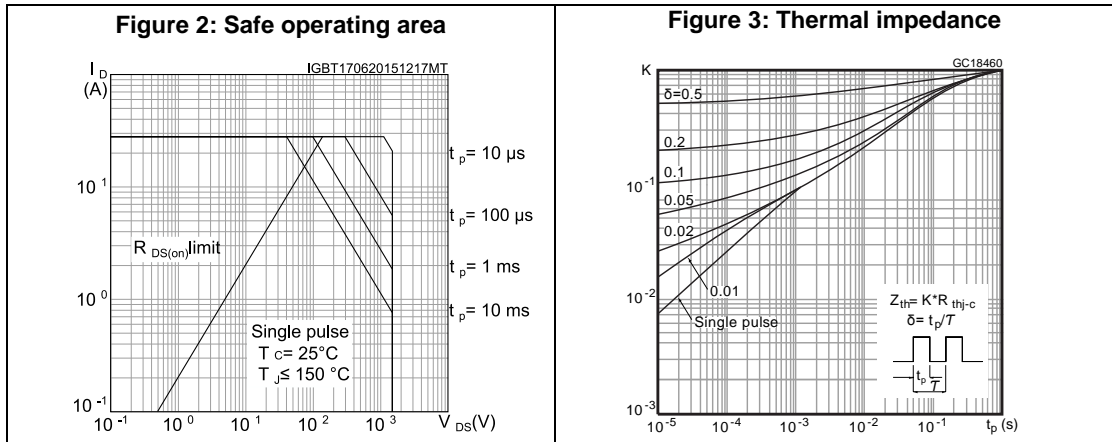
⁽¹⁾Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Table 9: Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	$I_{GS} = \pm 1 \text{ mA}$, $I_D = 0 \text{ A}$	30		-	V

The built-in back-to-back Zener diodes have been specifically designed to enhance the ESD capability of the device. The Zener voltage is appropriate for efficient and cost-effective intervention to protect the device integrity. These integrated Zener diodes thus eliminate the need for external components.

2.1 Electrical characteristics (curves)



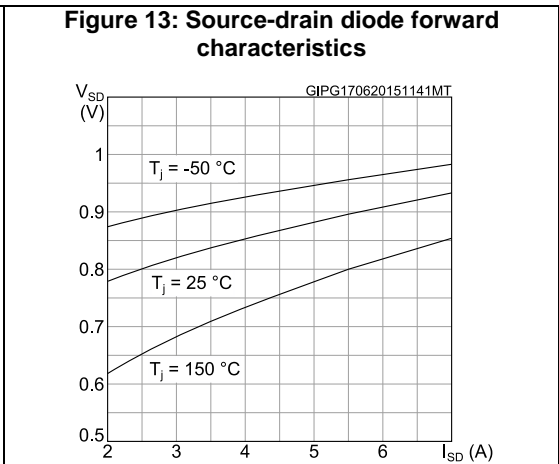
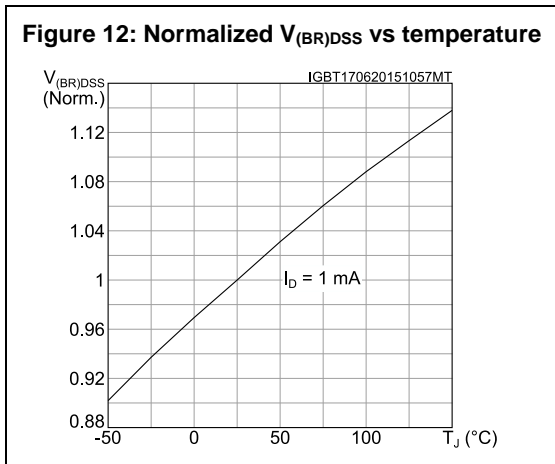
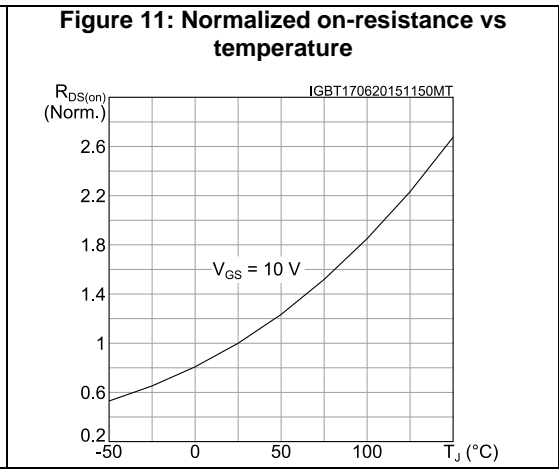
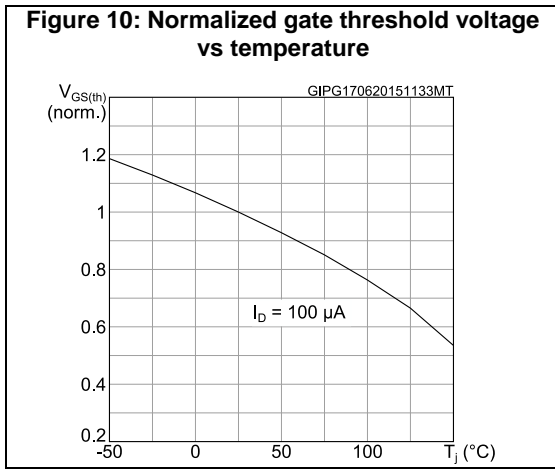
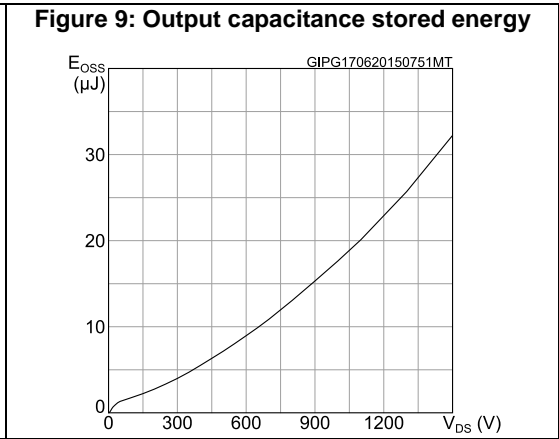
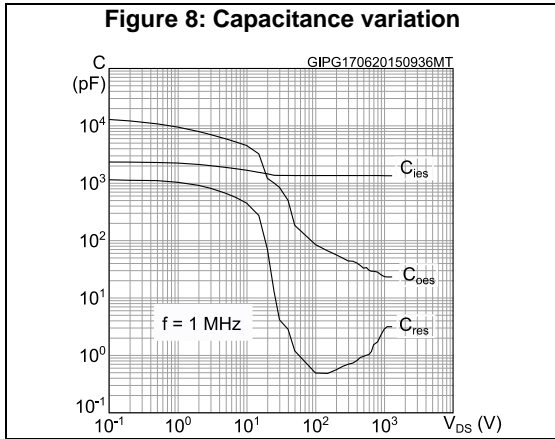
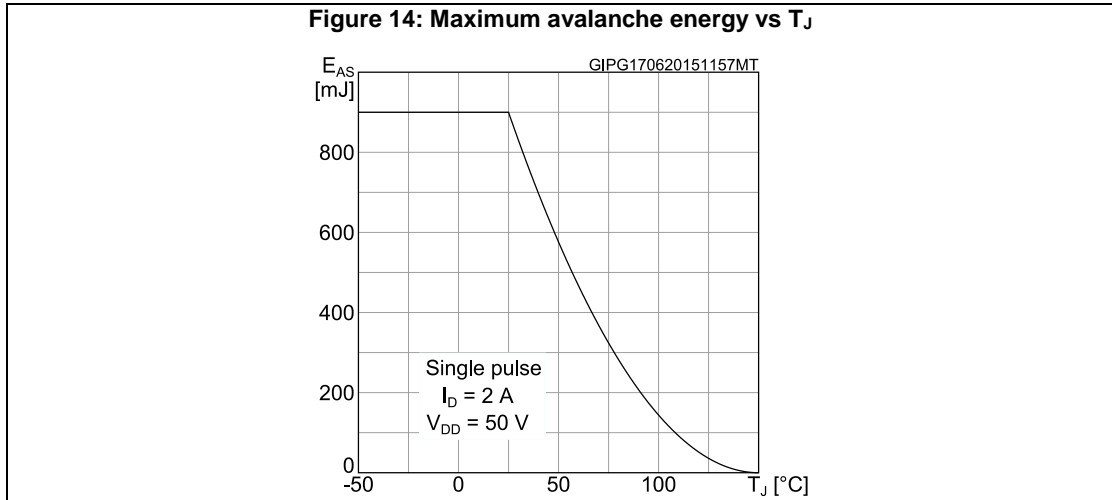
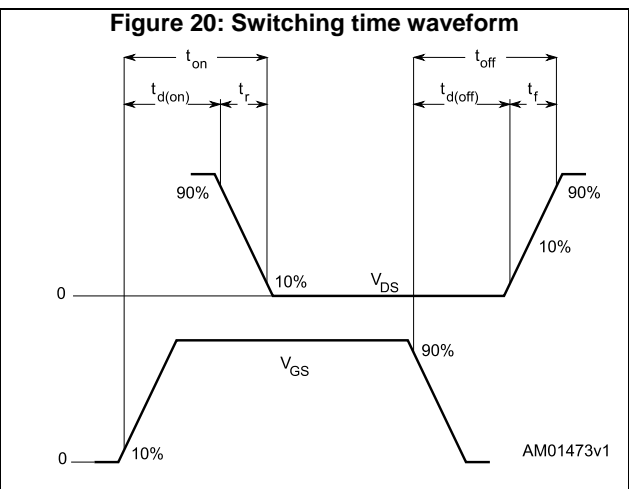
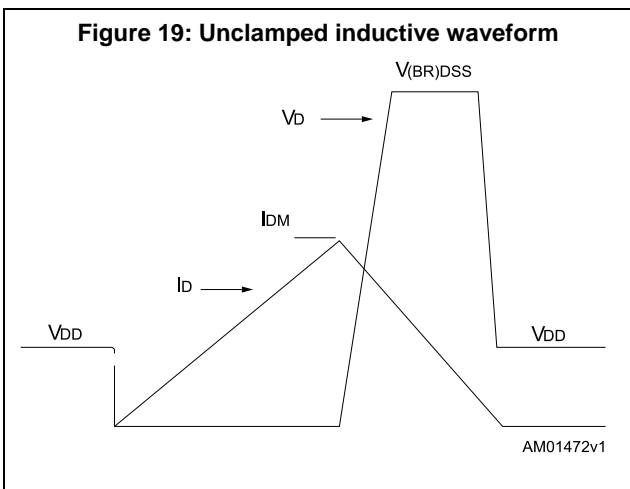
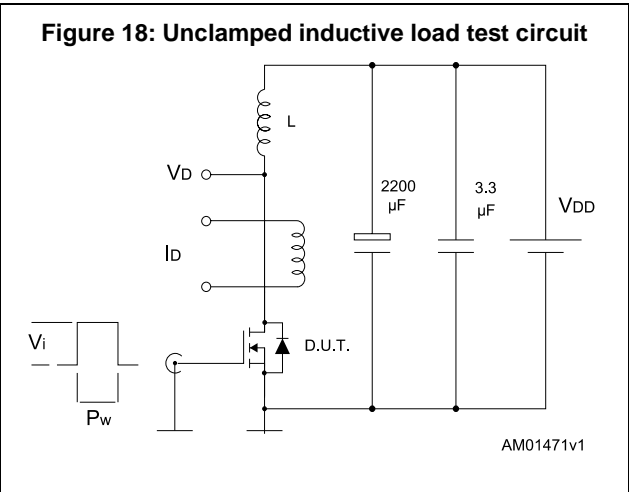
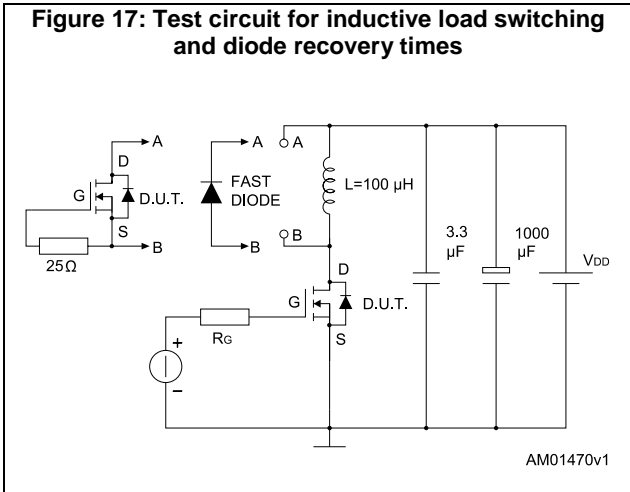
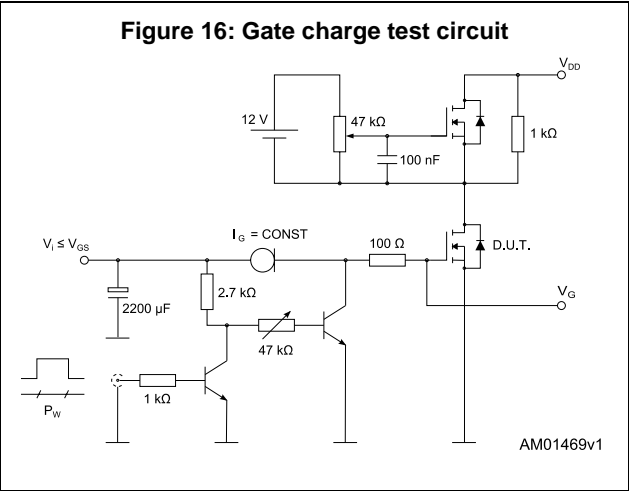
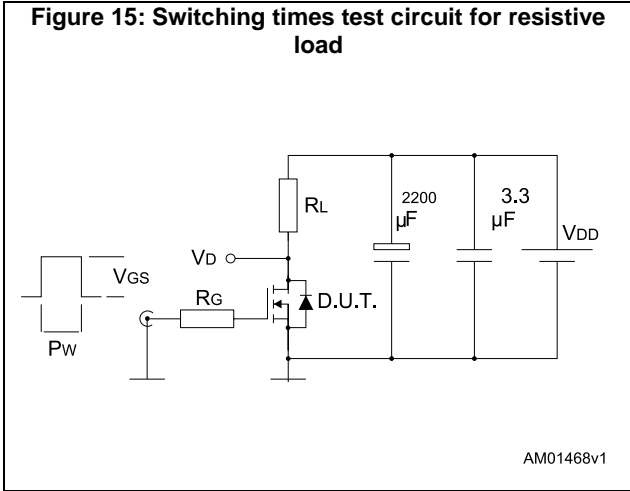


Figure 14: Maximum avalanche energy vs T_J



3 Test circuits



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 TO-247 package information

Figure 21: TO-247 package outline

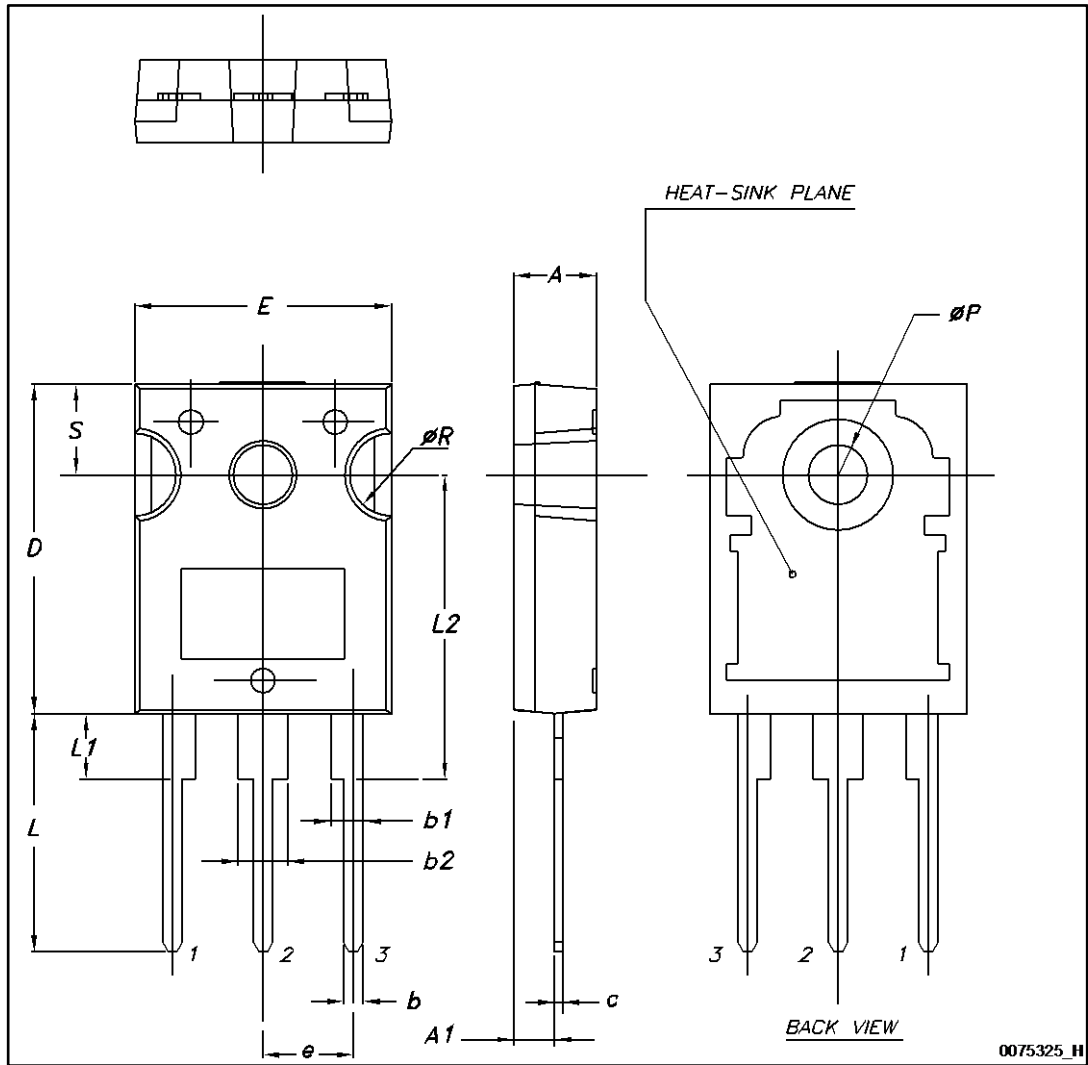


Table 10: TO-247 package mechanical data

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

5 Revision history

Table 11: Document revision history

Date	Revision	Changes
11-May-2015	1	First release.
30-Jun-2015	2	Updated title and features in cover page. Updated <i>Section 4: "Electrical ratings"</i> , <i>Section 5: "Electrical characteristics"</i> . Added <i>Section 5.1: "Electrical characteristics (curves)"</i> . Minor text changes.
07-Jul-2015	3	Updated <i>Section 5.1: "Electrical characteristics (curves)"</i> . Minor text changes.

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