

## N-channel 950 V, 1 $\Omega$ typ., 6 A MDmesh™ K5 Power MOSFET in a H<sup>2</sup>PAK-2 package

Datasheet - production data

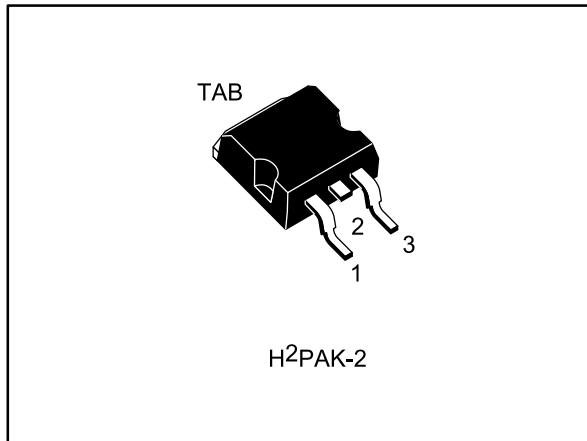
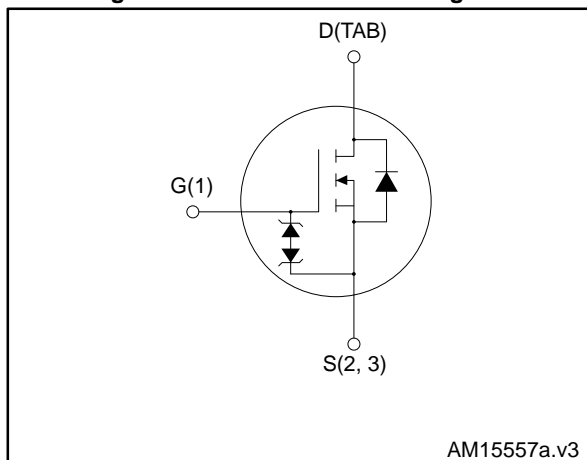


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STH6N95K5-2	950 V	1.25 $\Omega$	6 A	110 W

- Industry's lowest R<sub>DS(on)</sub> x 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	Packaging
STH6N95K5-2	6N95K5	H <sup>2</sup> PAK-2	Tape and reel

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>GS</sub>	Gate-source voltage	± 30	V
I <sub>D</sub>	Drain current at T <sub>C</sub> = 25 °C	6	A
I <sub>D</sub>	Drain current at T <sub>C</sub> = 100 °C	3.8	A
I <sub>DM</sub> <sup>(1)</sup>	Drain current (pulsed)	24	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	110	W
I <sub>AR</sub> <sup>(2)</sup>	Max current during repetitive or single pulse avalanche	3	A
E <sub>AS</sub> <sup>(3)</sup>	Single pulse avalanche energy	90	mJ
dv/dt <sup>(4)</sup>	Peak diode recovery voltage slope	4.5	V/ns
dv/dt <sup>(5)</sup>	MOSFET dv/dt ruggedness	50	V/ns
T <sub>j</sub>	Operating junction temperature	- 55 to 150	°C
T <sub>stg</sub>	Storage temperature		

**Notes:**

- (1)Pulse width limited by safe operating area.
- (2)Pulse width limited by T<sub>jmax</sub>.
- (3)Starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = I<sub>AS</sub>, V<sub>DD</sub> = 50 V.
- (4)|I<sub>SD</sub> ≤ 6 A, di/dt ≤ 100 A/μs, V<sub>DS(peak)</sub> ≤ V<sub>(BR)DSS</sub>.
- (5)V<sub>DS</sub> ≤ 760 V.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case max	1.14	°C/W
R <sub>thj-pcb</sub> <sup>(1)</sup>	Thermal resistance junction-pcb max	30	

**Notes:**

- (1)When mounted on 1 inch<sup>2</sup> FR-4 board, 2 oz Cu.

## 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	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	950			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 950\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 950\text{ V}$ , $T_C = 125\text{ °C}$			50	$\mu\text{A}$
$I_{GSS}$	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	$V_{CS} = 10\text{ V}$ , $I_D = 3\text{ A}$		1	1.25	$\Omega$

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0\text{ V}$ , $V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$	-	450	-	pF
$C_{oss}$	Output capacitance		-	30	-	
$C_{oss}$	Output capacitance		-	1.6	-	
$C_{o(tr)}^{(1)}$	Equivalent capacitance, time-related	$V_{GS} = 0\text{ V}$ , $V_{DS} = 0\text{ to }760\text{ V}$	-	45	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance, energy-related		-	19	-	
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	7	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 760\text{ V}$ , $I_D = 6\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 16: "Gate charge test circuit"</a> )	-	13	-	nC
$Q_{gs}$	Gate-source charge		-	3	-	
$Q_{gd}$	Gate-drain charge		-	7	-	

**Notes:**

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

(2)Energy-related is defined as a constant equivalent capacitance giving the same stored energy as  $C_{oss}$  when  $V_{DS}$  increases 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	$V_{DD} = 475\text{ V}$ , $I_D = 3\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$	-	12	-	ns
$t_r$	Rise time		-	12	-	ns
$t_{d(off)}$	Turn-off-delay time		-	33	-	ns
$t_f$	Fall time		-	21	-	ns

**Table 7: Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		6	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		24	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 6\text{ A}, V_{GS} = 0$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 6\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$	-	372		ns
$Q_{rr}$	Reverse recovery charge		-	4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	22		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 6\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}, T_j = 150\text{ }^\circ\text{C}$	-	522		ns
$Q_{rr}$	Reverse recovery charge		-	5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	20		A

**Notes:**

(1)Pulse width limited by safe operating area

(2)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

**Table 8: Gate-source Zener diode**

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

The built-in back-to-back Zener diodes have specifically been designed to enhance the device's ESD capability. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

## 2.1 Electrical characteristics (curves)

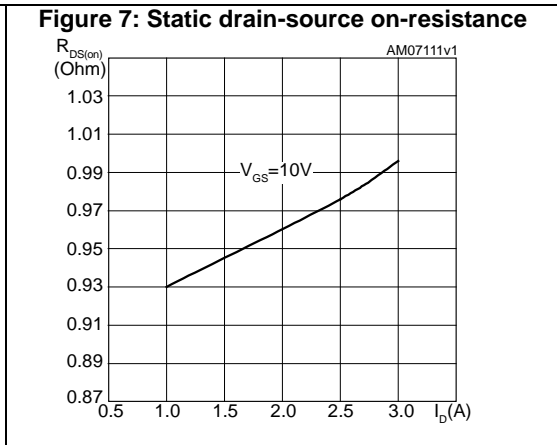
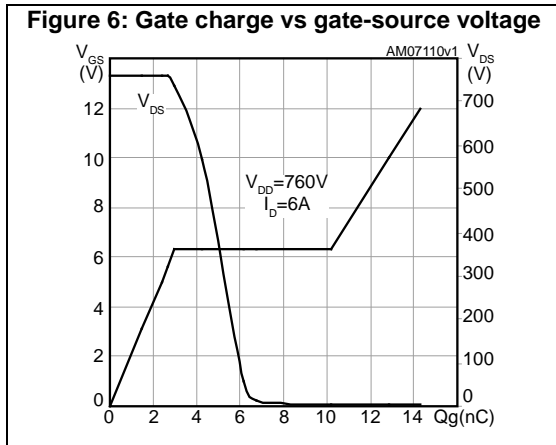
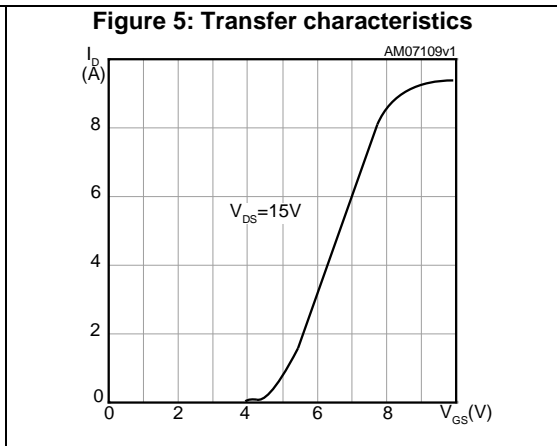
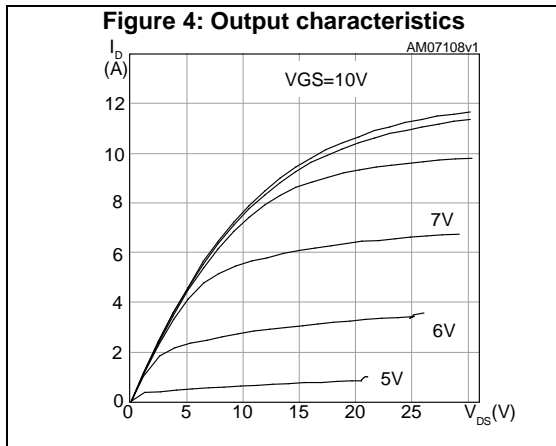
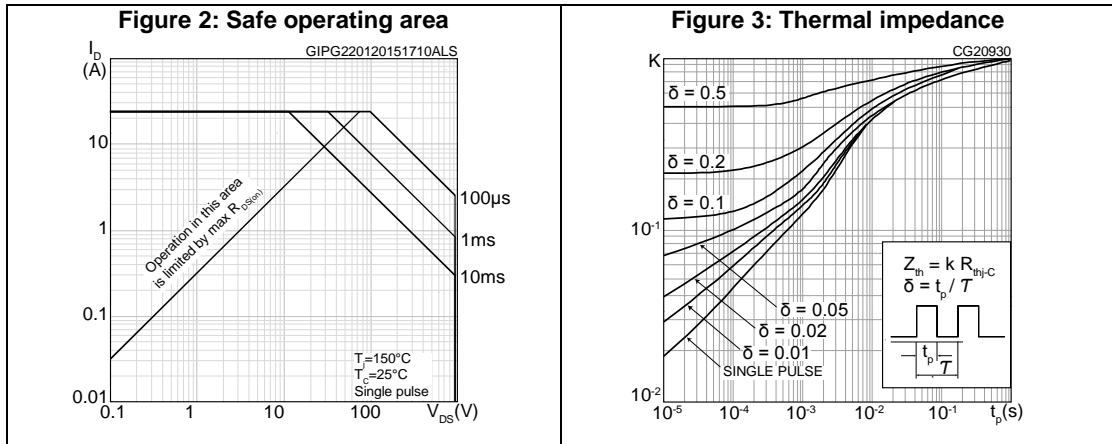


Figure 8: Capacitance variations

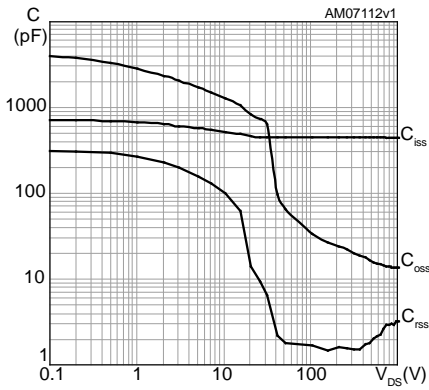


Figure 9: Output capacitance stored energy

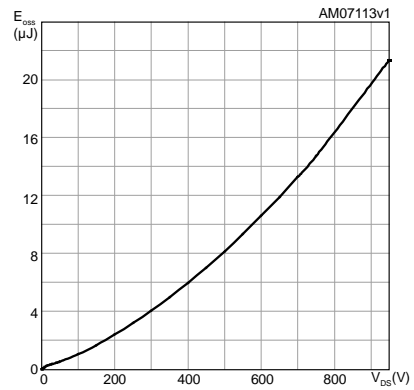


Figure 10: Normalized gate threshold voltage vs temperature

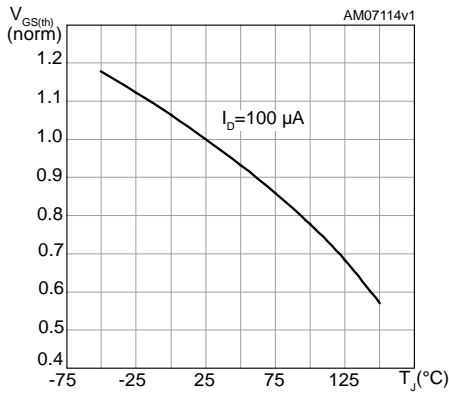


Figure 11: Normalized on-resistance vs temperature

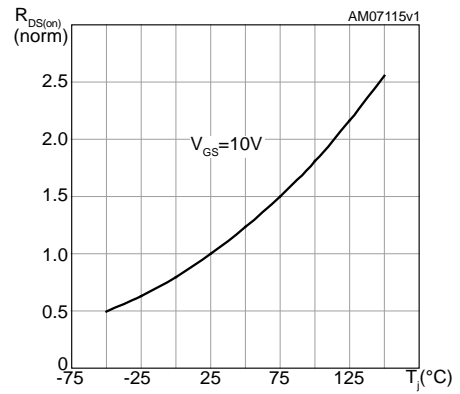


Figure 12: Source-drain diode forward characteristics

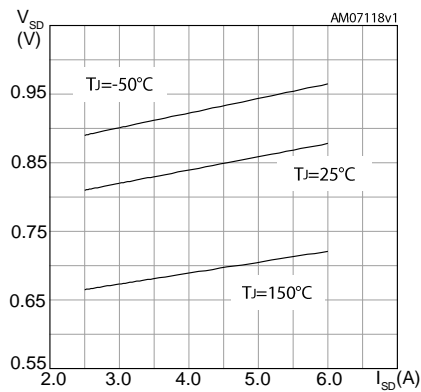


Figure 13: Normalized V(BR)DSS vs temperature

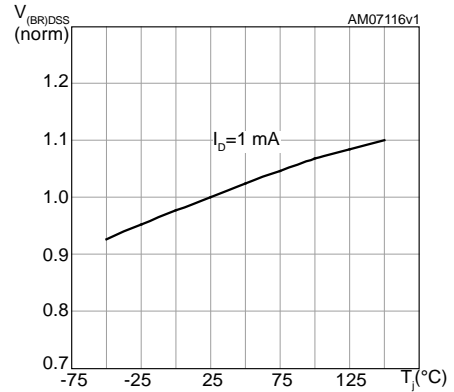
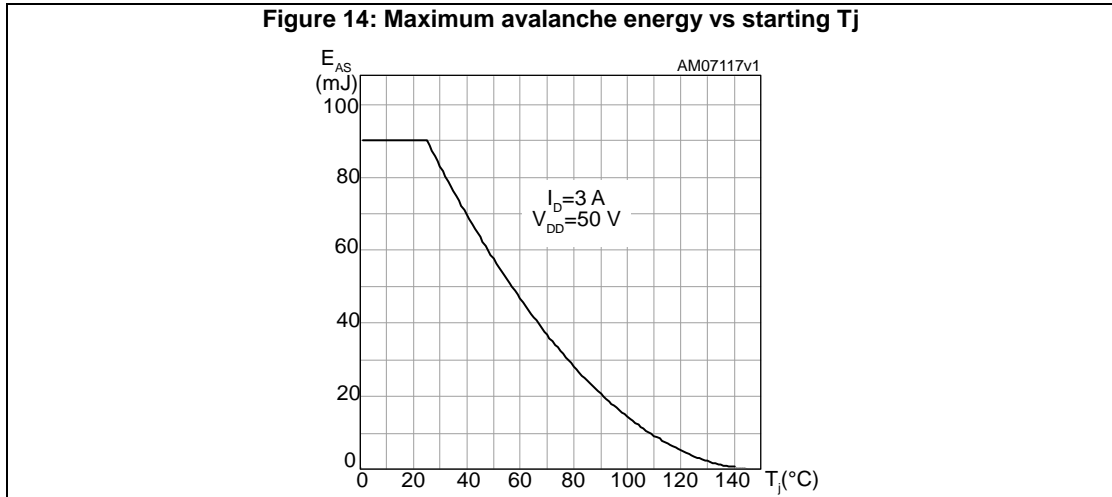
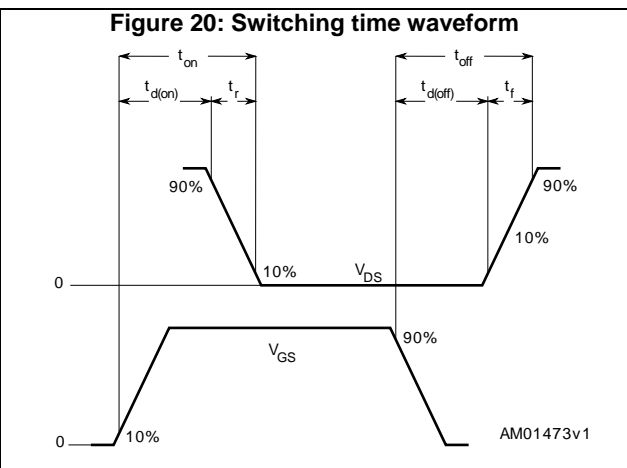
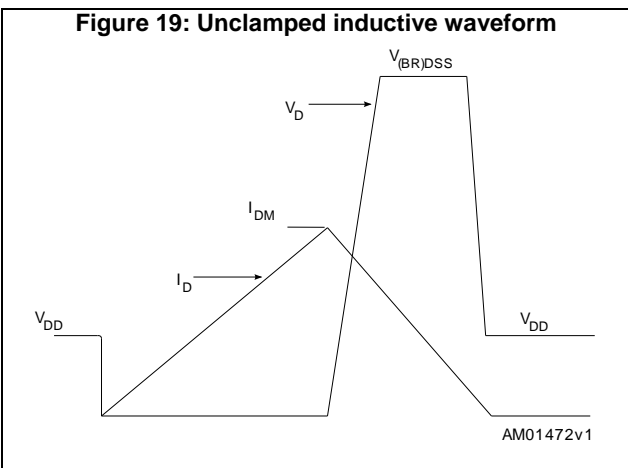
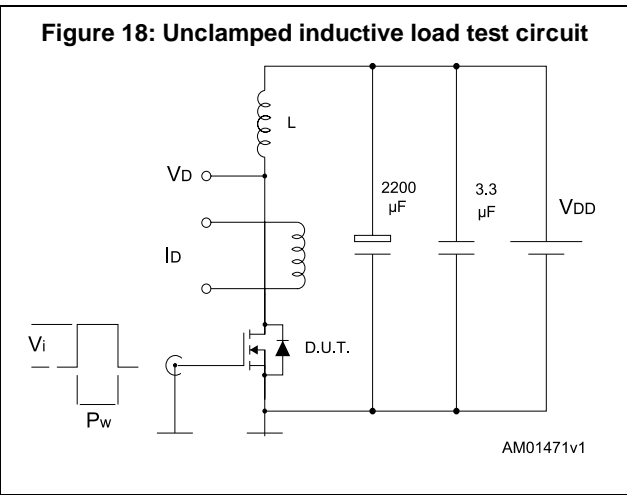
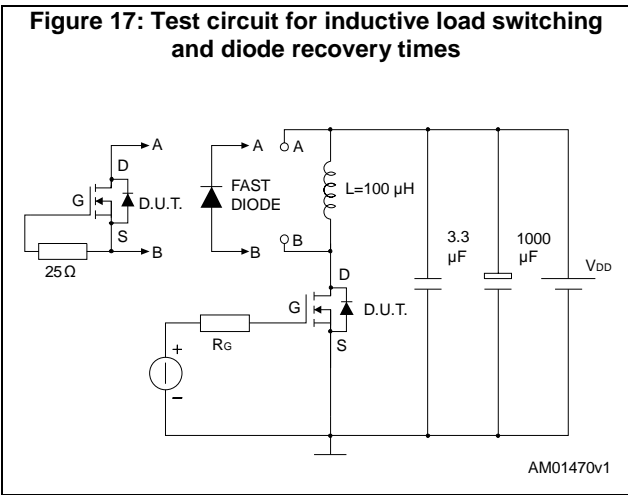
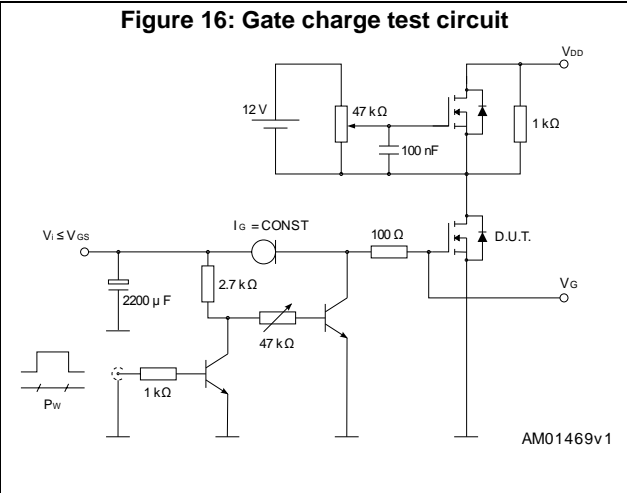
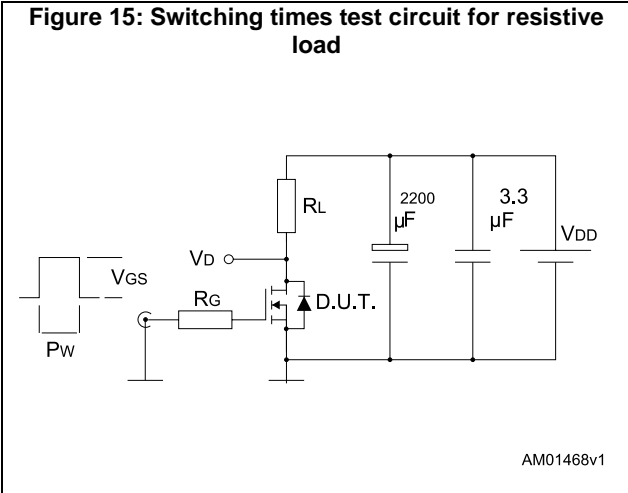


Figure 14: Maximum avalanche energy vs starting Tj





### 3 Test circuits



## 4 Package mechanical data

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 Package mechanical data

Figure 21: H<sup>2</sup>PAK-2 outline

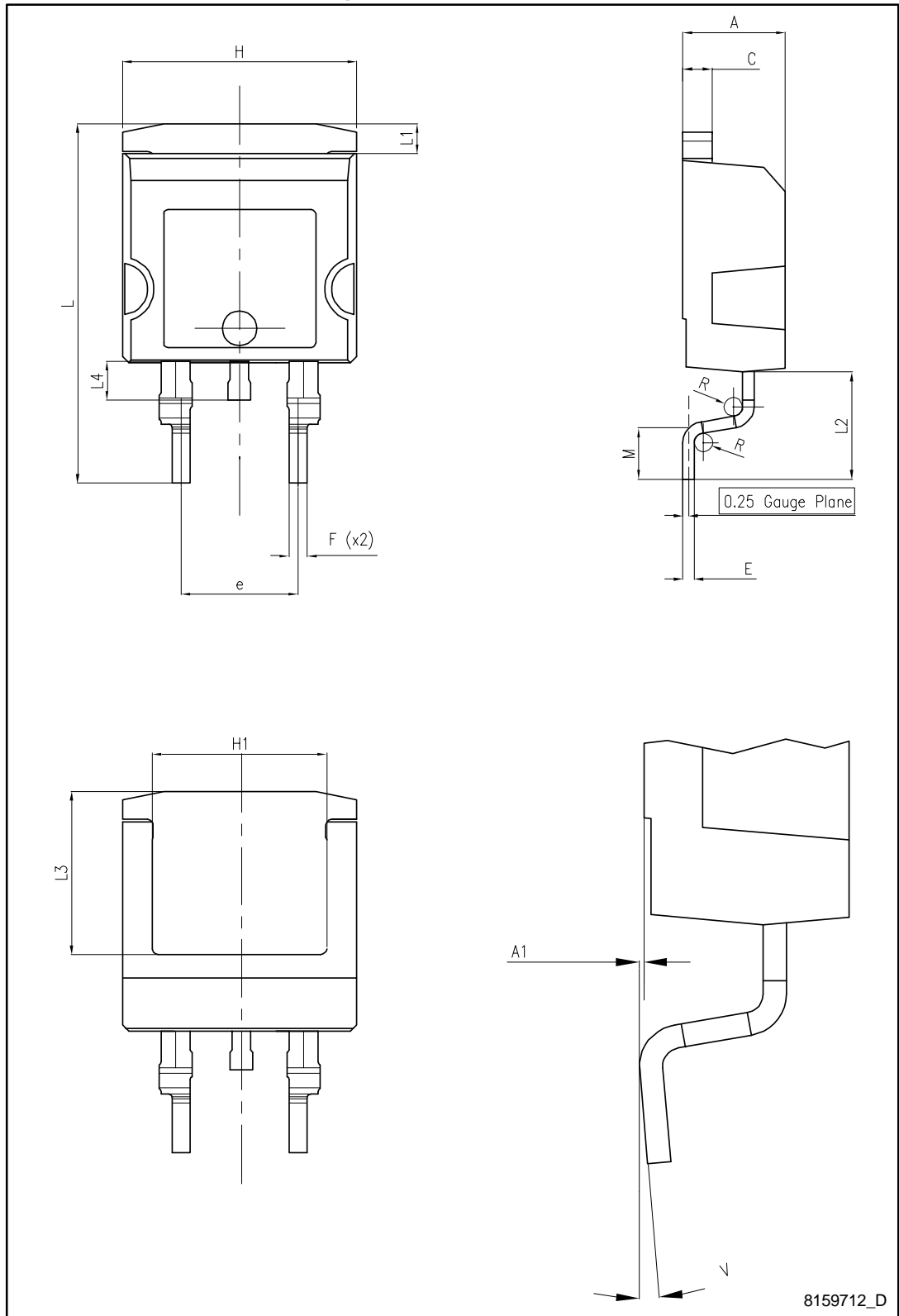
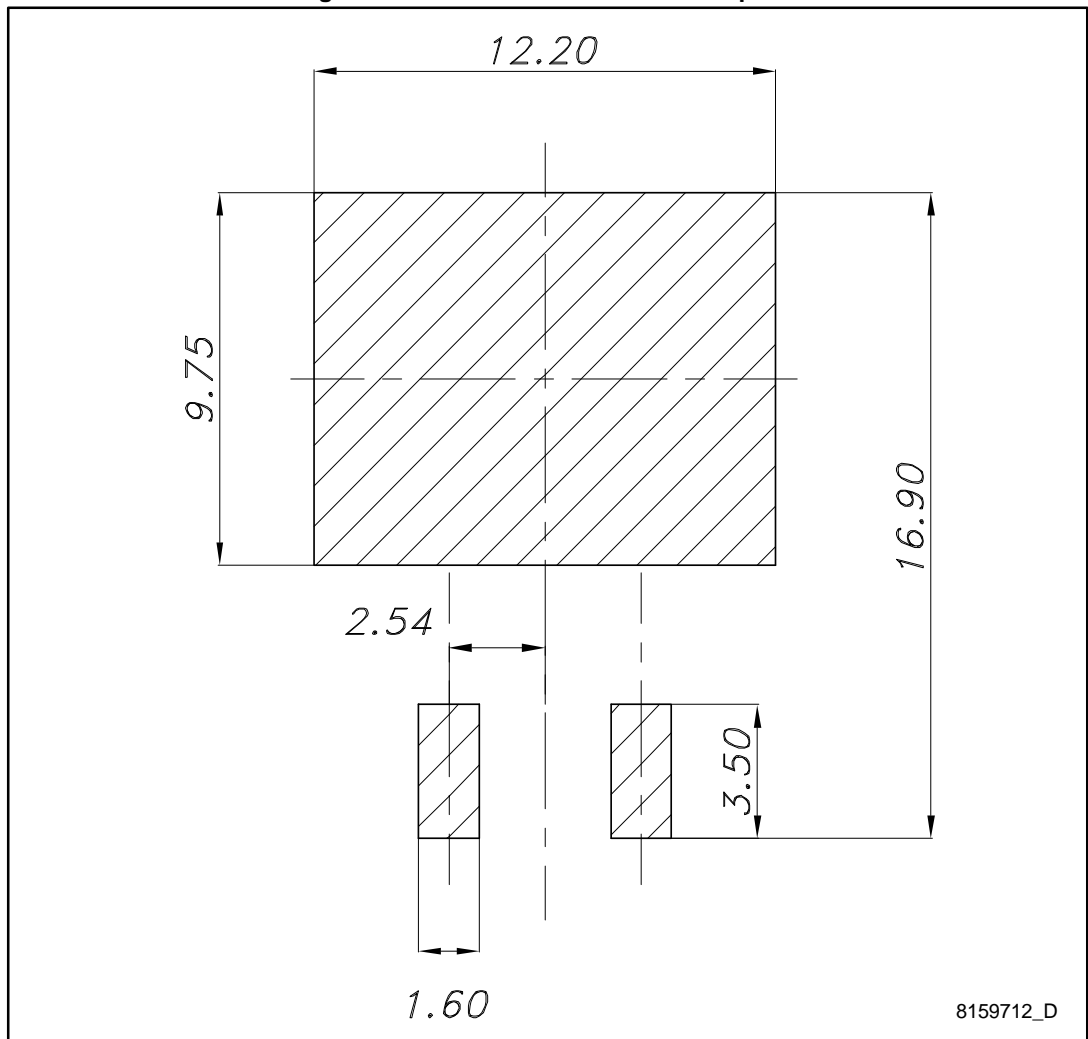


Table 9: H<sup>2</sup>PAK-2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
H	10.00		10.40
H1	7.40		7.80
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.5		1.7
M	2.6		2.9
R	0.20		0.60
V	0°		8°

Figure 22: H<sup>2</sup>PAK-2 recommended footprint



8159712\_D



Figure 24: Reel outline

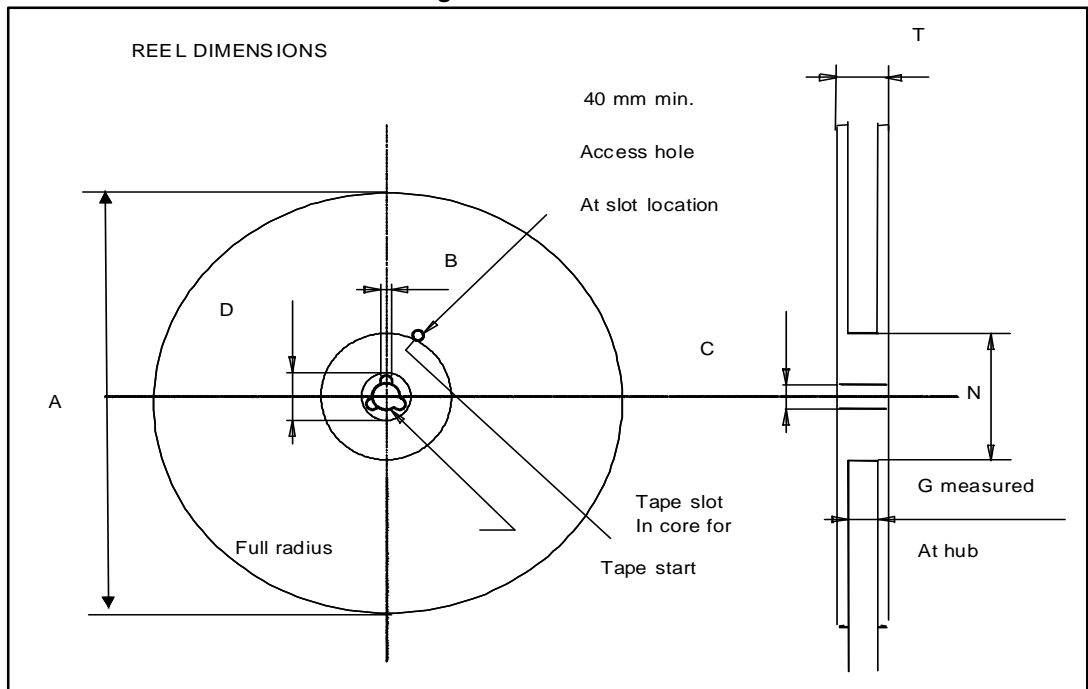


Table 10: Tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

## 6 Revision history

Table 11: Document revision history

Date	Revision	Changes
23-Jan-2015	1	First release.
04-Feb-2015	2	Updated <a href="#">Section 2: "Electrical characteristics"</a>
12-Mar-2015	3	Document status changed from preliminary to production data.



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