

## N-channel 500 V, 0.40 $\Omega$ typ., 8.5 A MDmesh™ II Power MOSFET in a DPAK package

Datasheet - production data

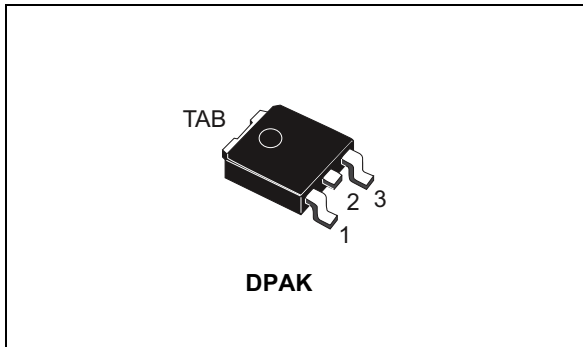
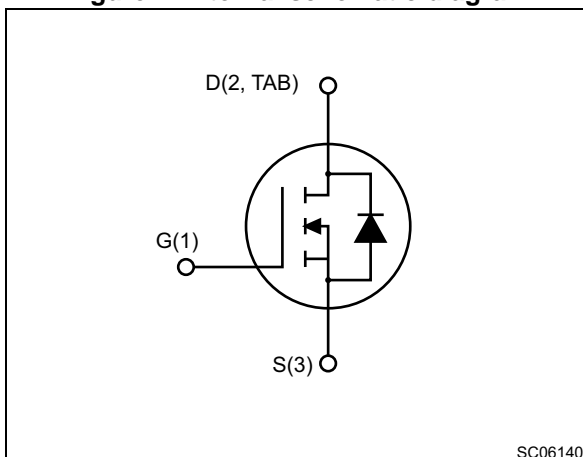


Figure 1. Internal schematic diagram



### Features

Order code	$V_{DS} @ T_J \text{ max}$	$R_{DS(on)} \text{ max}$	$I_D$
STD11NM50N	550 V	0.47 $\Omega$	8.5 A

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

Table 1. Device summary

Order code	Marking	Package	Packaging
STD11NM50N	11NM50N	DPAK	Tape and reel

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	500	V
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	8.5	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	6	A
$I_{DM}^{(1)}$	Drain current (pulsed)	34	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	70	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$T_{stg}$	Storage temperature	- 55 to 150	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area .
2.  $I_{SD} \leq 8.5\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DSpeak} \leq V_{(BR)DSS}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.79	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max <sup>(1)</sup>	50	$^\circ\text{C}/\text{W}$

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

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{jmax}$ )	3	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J=25\text{ }^\circ\text{C}$ , $I_D=I_{AR}$ , $V_{DD}=50\text{ V}$ )	150	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	$I_D = 1\text{ mA}, V_{GS} = 0$	500			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 500\text{ V}$ $V_{DS} = 500\text{ V}, T_C = 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$			$\pm 100$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 4.5\text{ A}$		0.40	0.47	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	547	-	pF
$C_{oss}$	Output capacitance		-	42	-	pF
$C_{riss}$	Reverse transfer capacitance		-	2	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0, V_{DS} = 0\text{ to }400\text{ V}$	-	210	-	pF
$Q_g$	Total gate charge	$V_{DD} = 400\text{ V}, I_D = 8.5\text{ A},$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14</a> )	-	19	-	nC
$Q_{gs}$	Gate-source charge		-	3.7	-	nC
$Q_{gd}$	Gate-drain charge		-	10	-	nC
$R_G$	Gate input resistance	$f = 1\text{ MHz}, I_D = 0$	-	5.8	-	$\Omega$

1.  $C_{oss\text{ eq.}}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DS}$

Table 7. Switching times

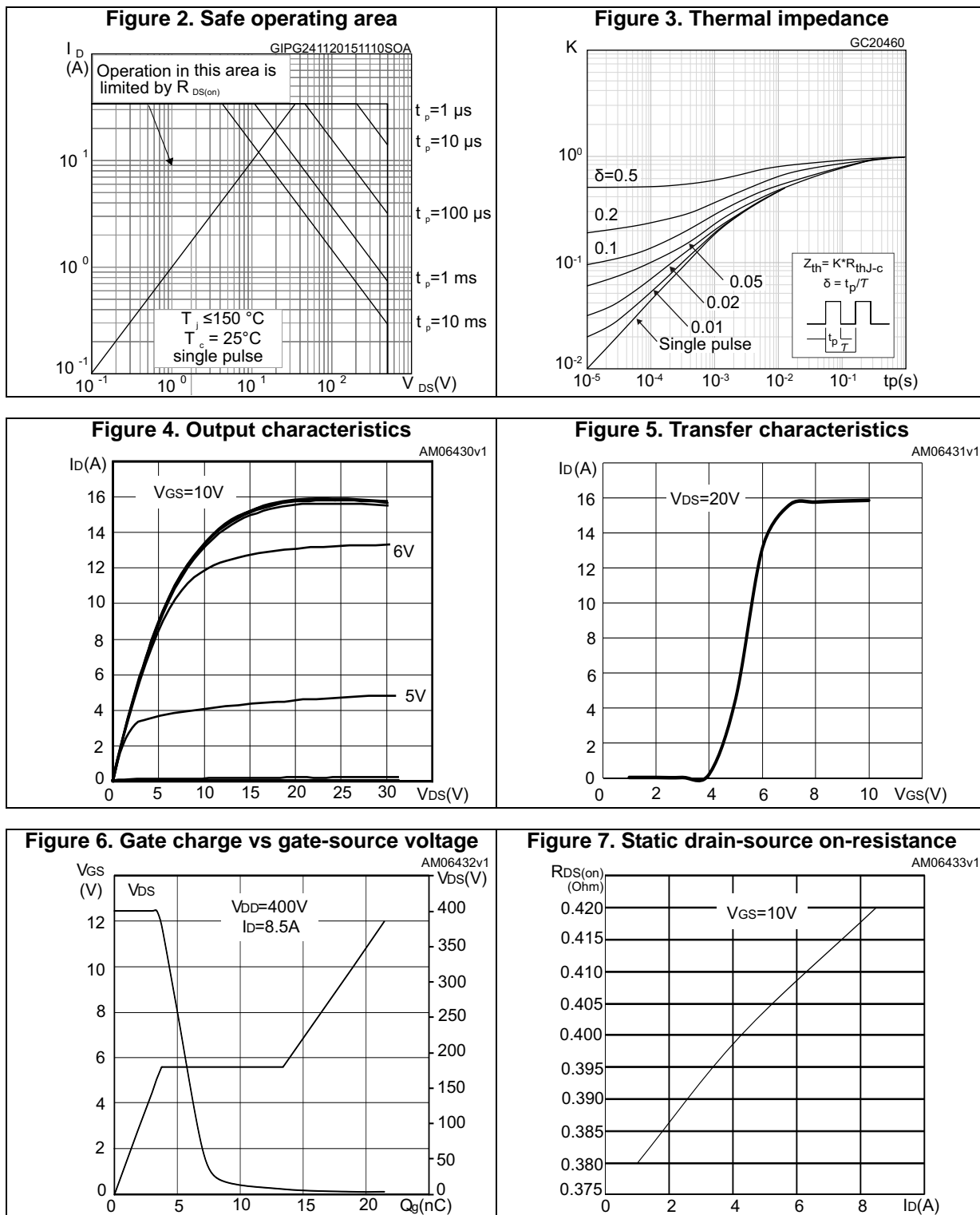
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 250\text{ V}$ , $I_D = 4.25\text{ A}$ $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> and <a href="#">Figure 18</a> )	-	8	-	ns
$t_r$	Rise time		-	10	-	ns
$t_{d(off)}$	Turn-off delay time		-	33	-	ns
$t_f$	Fall time		-	10	-	ns

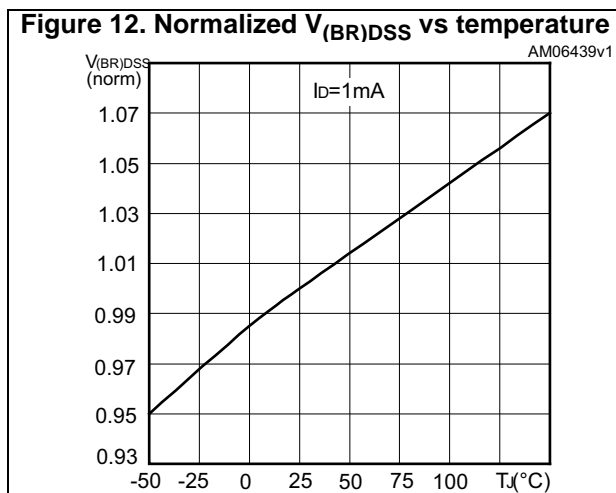
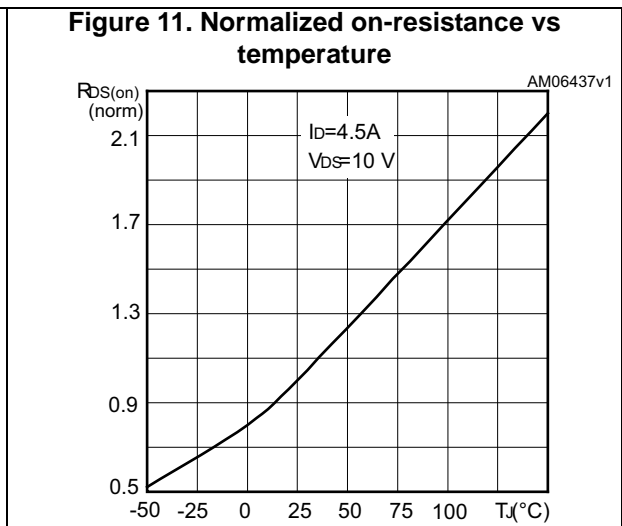
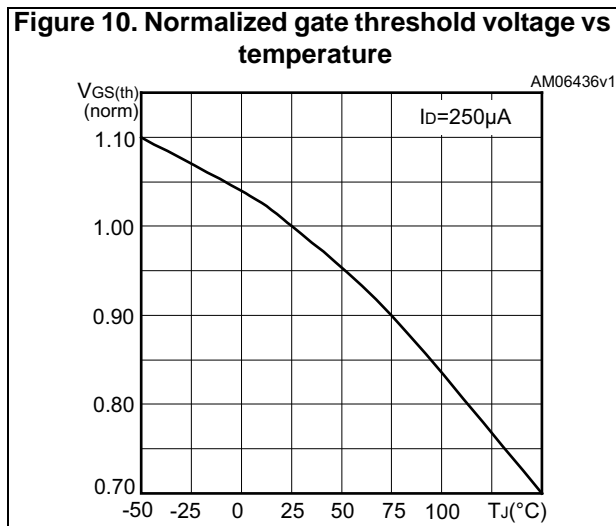
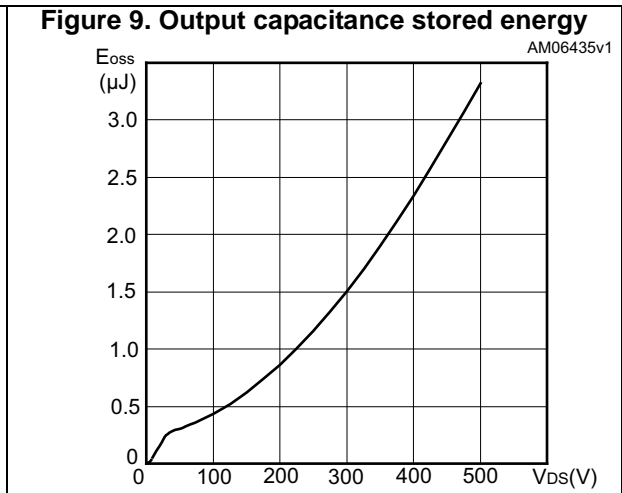
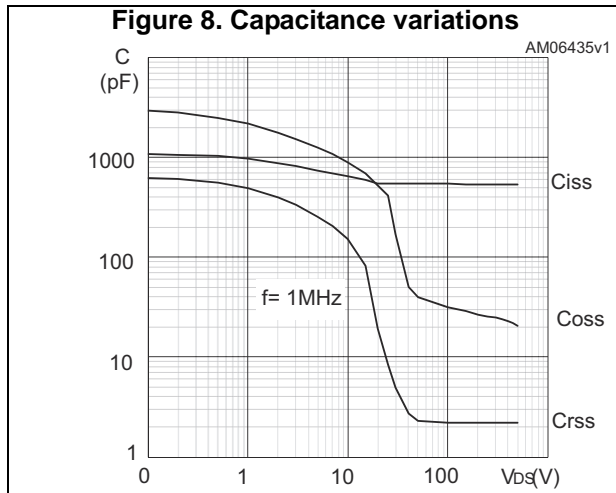
Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		8.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				34	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 8.5\text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 8.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	230		ns
$Q_{rr}$	Reverse recovery charge		-	2.1		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	$V_{DD} = 60\text{ V}$ (see <a href="#">Figure 15</a> )	-	18		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 8.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	275		ns
$Q_{rr}$	Reverse recovery charge		-	2.5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	$V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 15</a> )	-	18		A

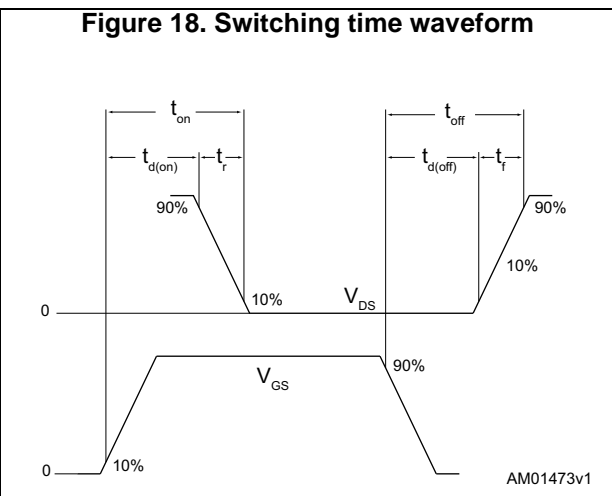
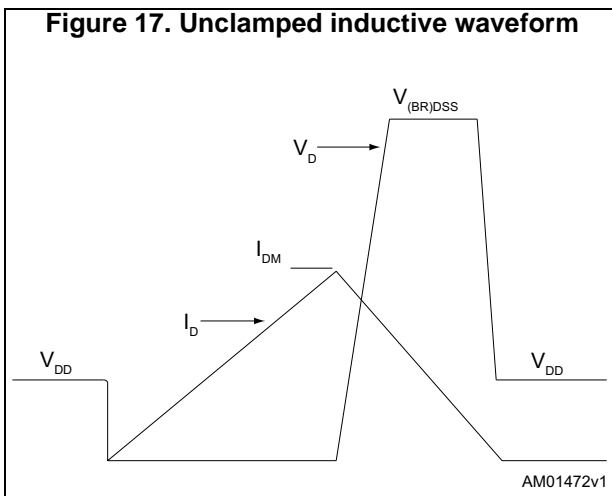
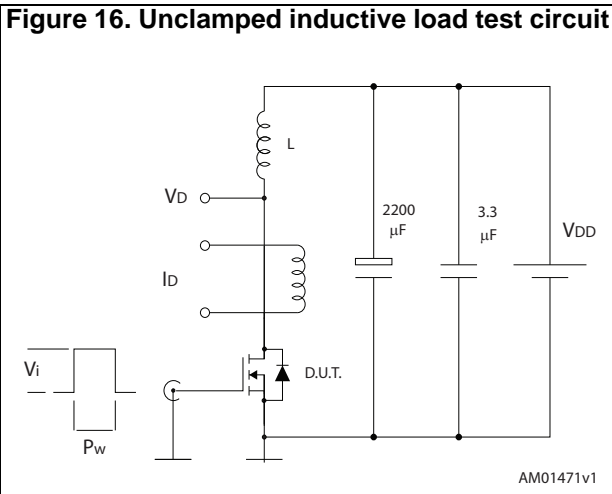
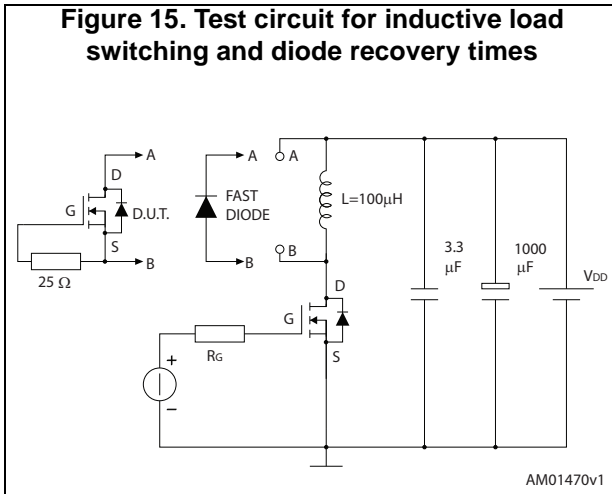
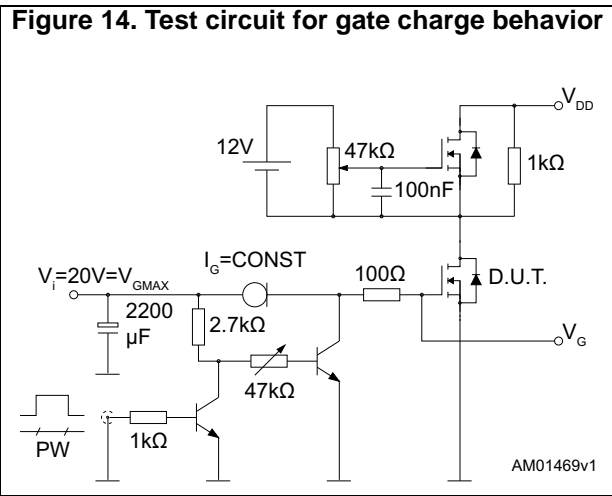
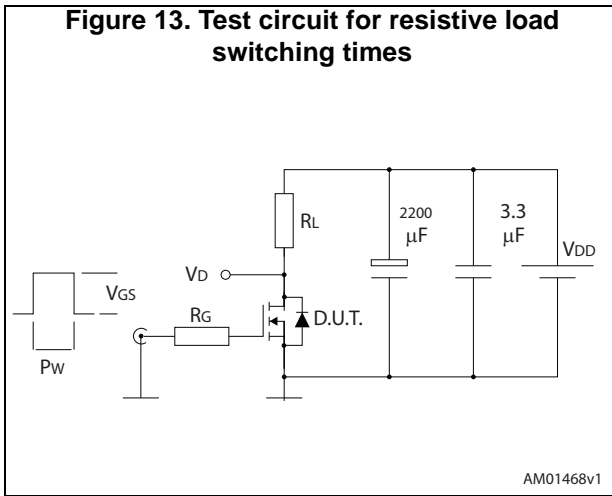
1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)





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

### 4.1 DPAK type A package information

Figure 19. DPAK (TO-252) type A package outline

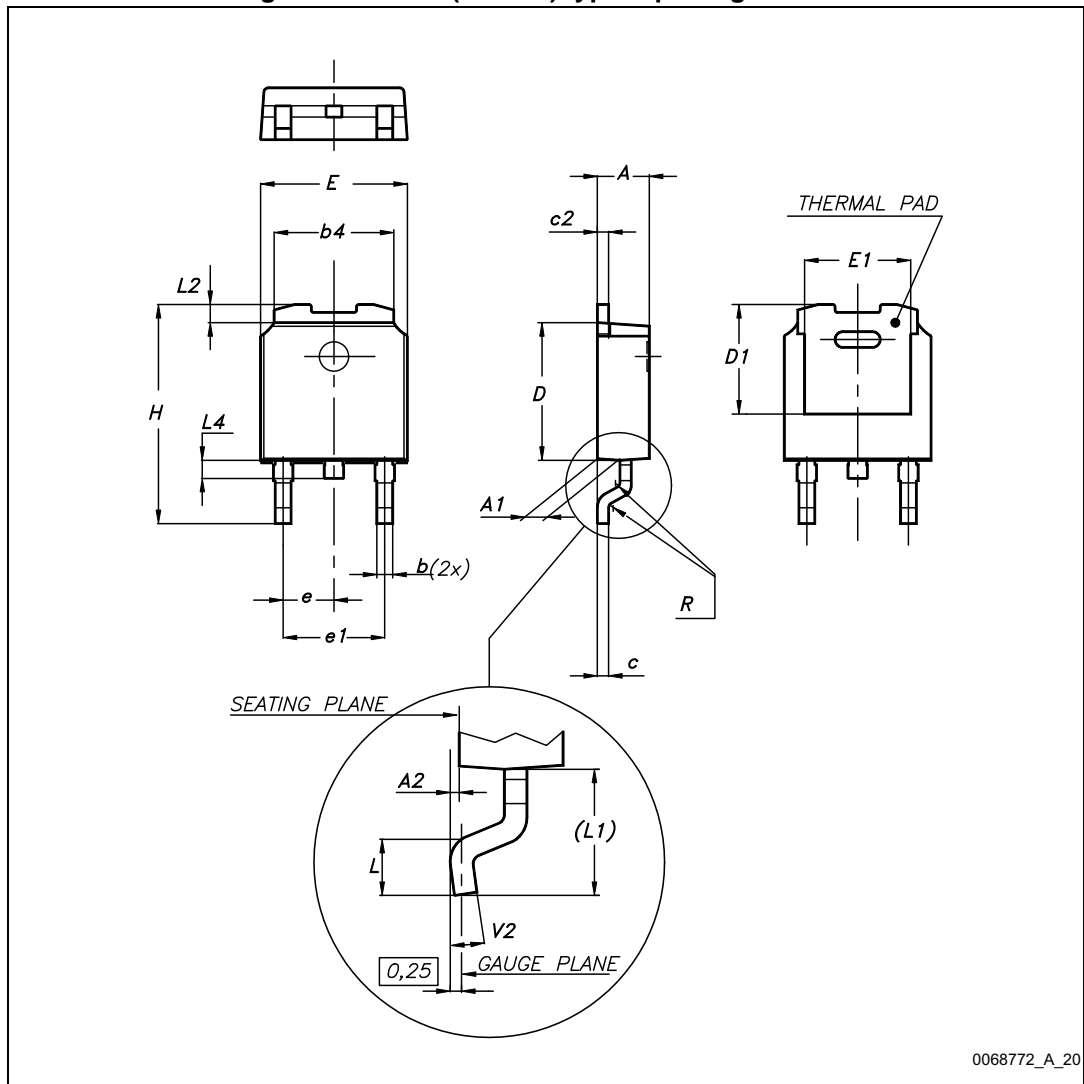


Table 9. DPAK (TO-252) type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

### 4.2 DPAK type E package information

Figure 20. DPAK (TO-252) type E outline

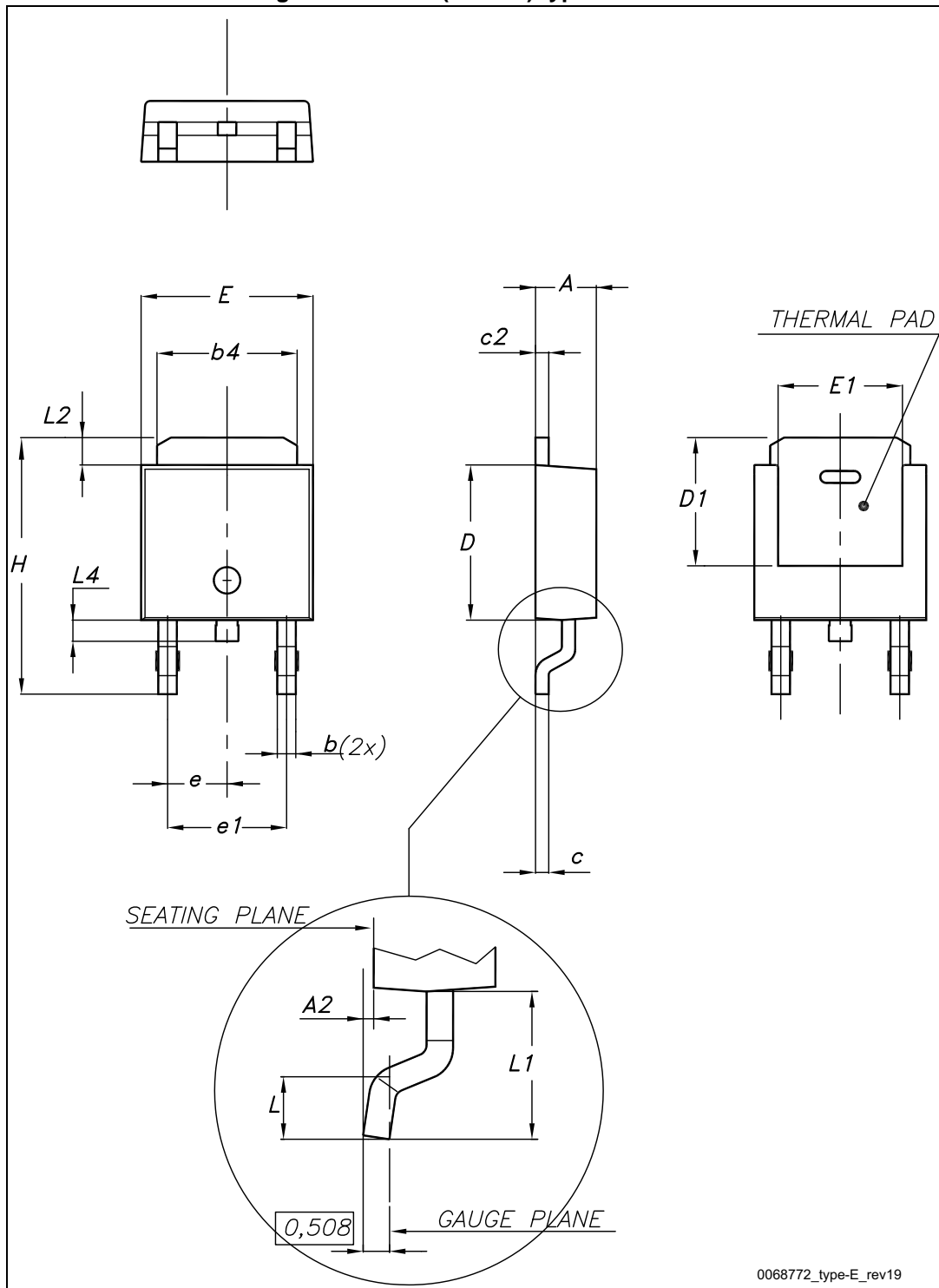
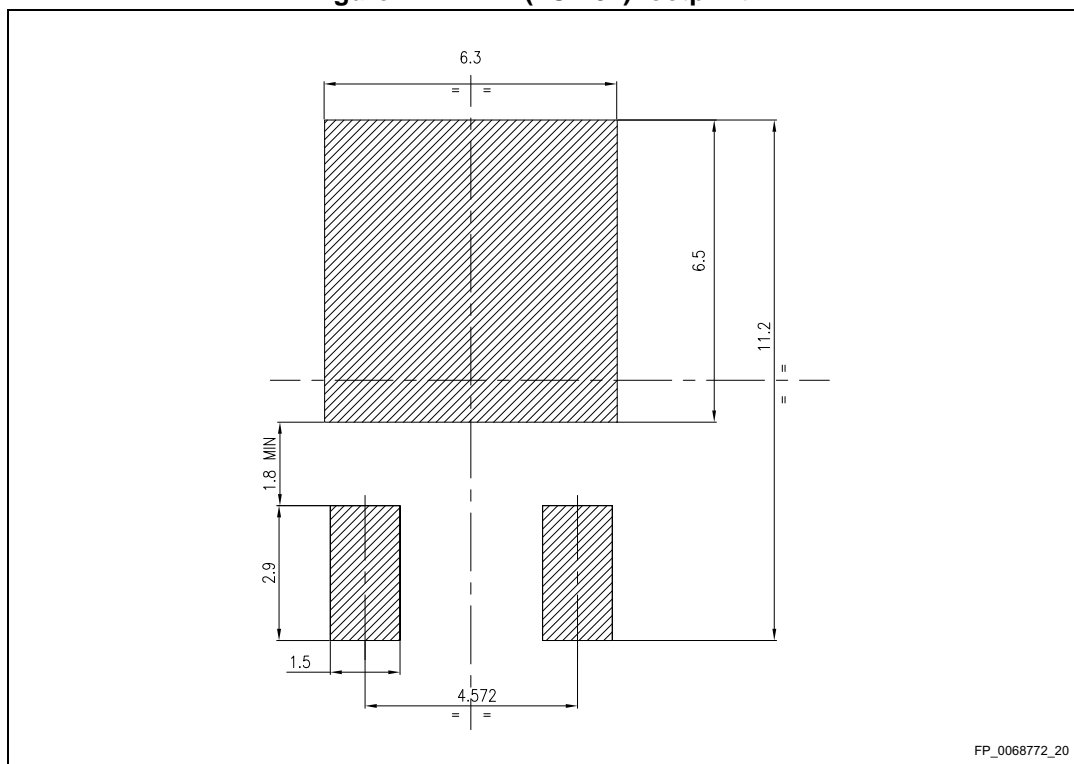


Table 10. DPAK (TO-252) type E mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.18		2.39
A2			0.13
b	0.65		0.884
b4	4.95		5.46
c	0.46		0.61
c2	0.46		0.60
D	5.97		6.22
D1	5.21		
E	6.35		6.73
E1	4.32		
e		2.286	
e1		4.572	
H	9.94		10.34
L	1.50		1.78
L1		2.74	
L2	0.89		1.27
L4			1.02

Figure 21. DPAK (TO-252) footprint (a)



a. All dimensions are in millimeters

## 5 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
25-Nov-2015	1	First release. Part number previously included in datasheet DocID17156

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