



# STF8NM50N

N-channel 500 V, 0.73  $\Omega$ , 5 A MDmesh™II Power MOSFET  
in TO-220FP

## Features

Order codes	V <sub>DSS</sub> @T <sub>JMAX</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STF8NM50N	550 V	< 0.79 $\Omega$	5 A

- 100% avalanche tested
- Low input capacitances 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.

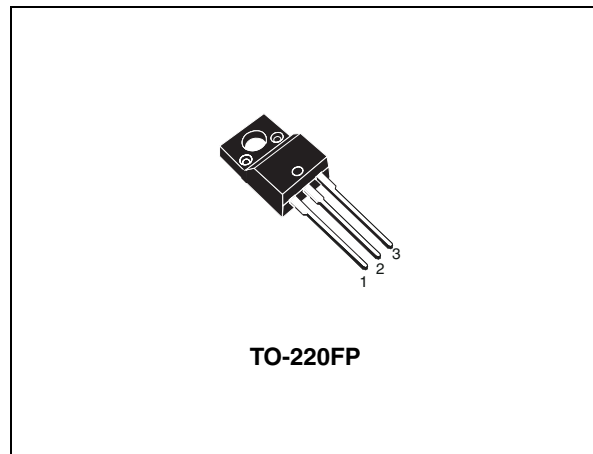


Figure 1. Internal schematic diagram

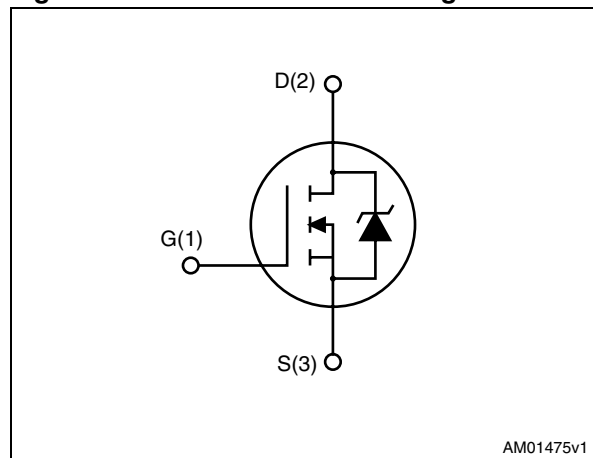


Table 1. Device summary

Order codes	Marking	Packages	Packaging
STF8NM50N	8NM50N	TO-220FP	Tube

# 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 $T_C = 25\text{ }^\circ\text{C}$	5 <sup>(1)</sup>	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	20	W
$dv/dt$ <sup>(2)</sup>	Peak diode recovery voltage slope	15	V/ns
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t = 1\text{ s}$ ; $T_C = 25\text{ }^\circ\text{C}$ )	2500	V
$T_{stg}$	Storage temperature	- 55 to 150	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	150	$^\circ\text{C}$

1. Limited by maximum junction temperature.

2.  $I_{SD} \leq 7\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{Peak} < V_{(BR)DSS}$ ,  $V_{DS} = 80\% V_{(BR)DSS}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	6.25	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	2	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	140	mJ

## 2 Electrical characteristics

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

**Table 5. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS} = 0$ )	$I_D = 1\text{ mA}$	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 ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$		0.73	0.79	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	364	-	pF
$C_{oss}$	Output capacitance			33		pF
$C_{rss}$	Reverse transfer capacitance			1.2		pF
$C_{oss(eq)}^{(1)}$	Equivalent output capacitance time related	$V_{DS} = 0\text{ to }50\text{ V}, V_{GS} = 0$	-	147.5	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz open drain}$	-	5.4	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 400\text{ V}, I_D = 5\text{ A},$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14</a> )	-	14	-	nC
$Q_{gs}$	Gate-source charge			3		nC
$Q_{gd}$	Gate-drain charge			7		nC

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

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 250\text{ V}, I_D = 5\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (see <a href="#">Figure 13</a> )	-	7	-	ns
$t_r$	Rise time			4.4		ns
$t_{d(off)}$	Turn-off-delay time			25		ns
$t_f$	Fall time			8.8		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		20	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5 \text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 5 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ (see <a href="#">Figure 18</a> )	-	187		ns
$Q_{rr}$	Reverse recovery charge			1.3		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			14		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 5 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ , $T_J = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 18</a> )	-	224		ns
$Q_{rr}$	Reverse recovery charge			1.5		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			13		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 2. Safe operating area

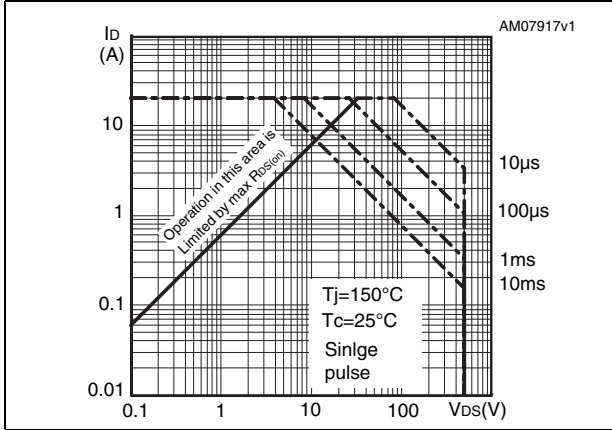


Figure 3. Thermal impedance

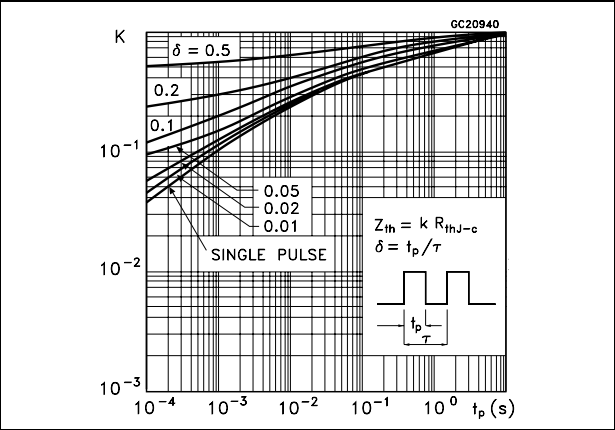


Figure 4. Output characteristics

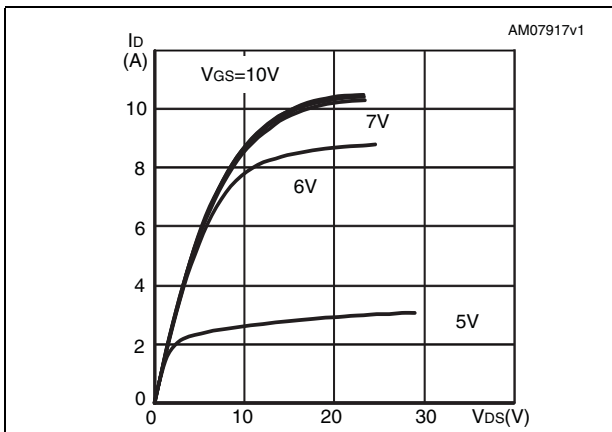


Figure 5. Transfer characteristics

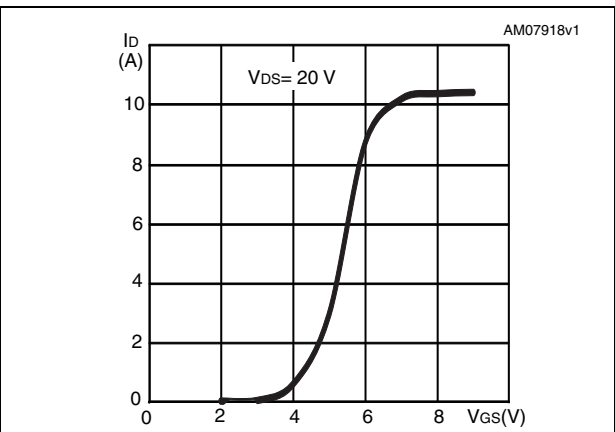


Figure 6. Static drain-source on resistance

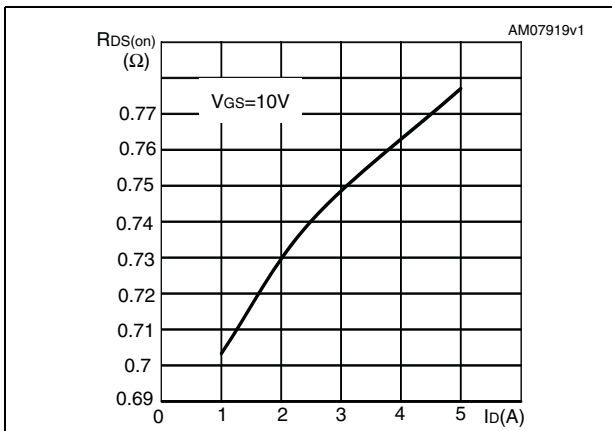


Figure 7. Gate charge vs gate-source voltage

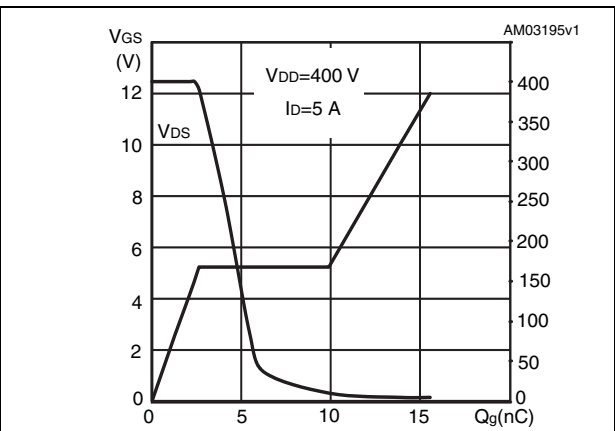


Figure 8. Capacitance variations

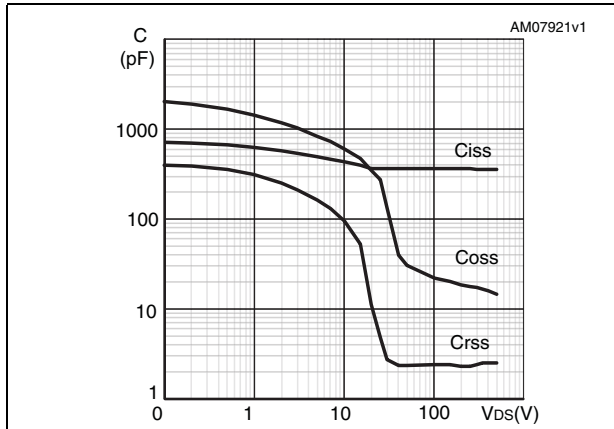


Figure 9. Output capacitance stored energy

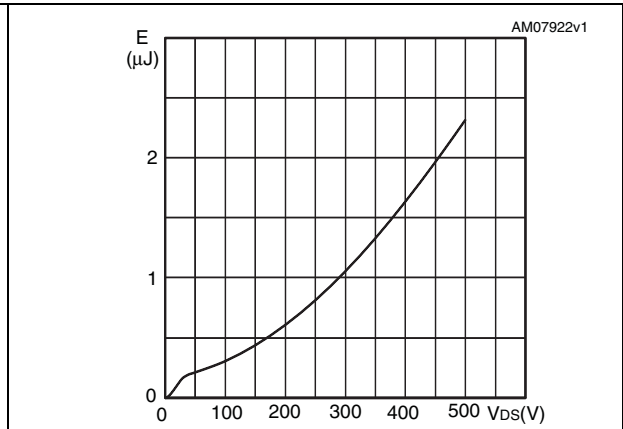


Figure 10. Normalized gate threshold voltage vs temperature

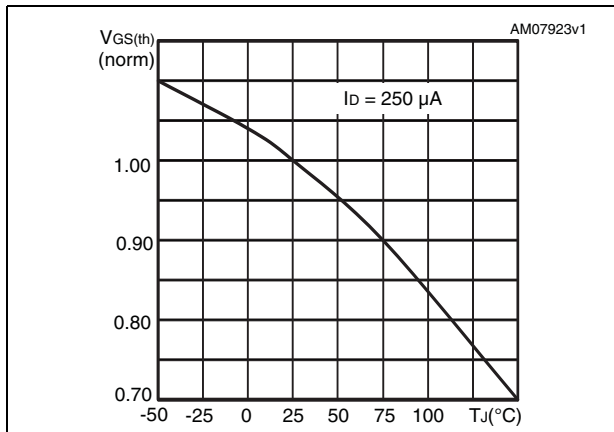


Figure 11. Normalized on resistance vs temperature

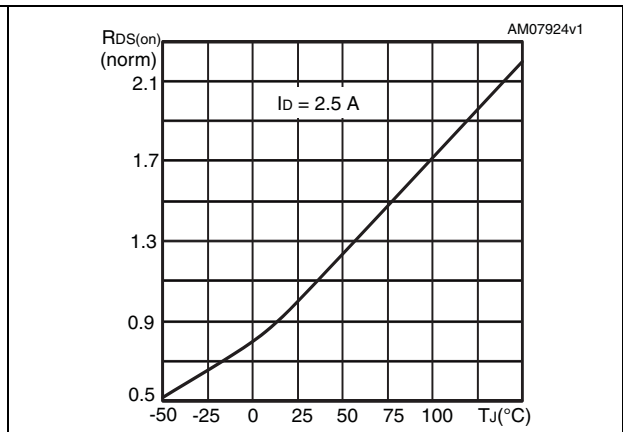
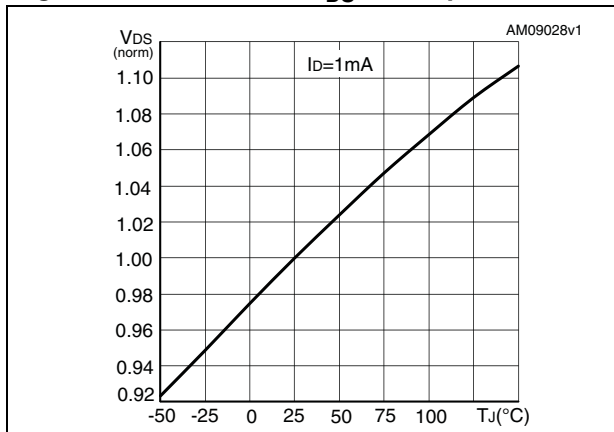
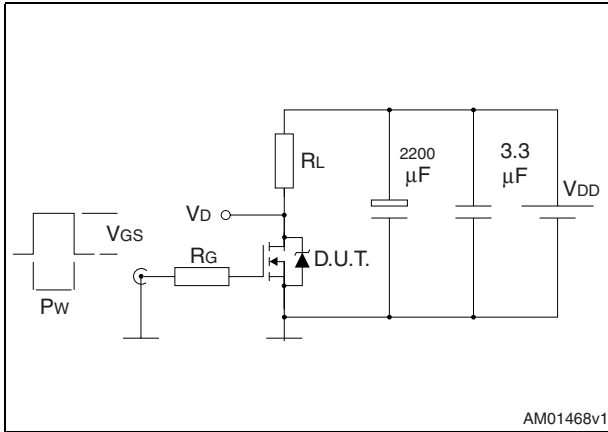


Figure 12. Normalized VDS vs temperature



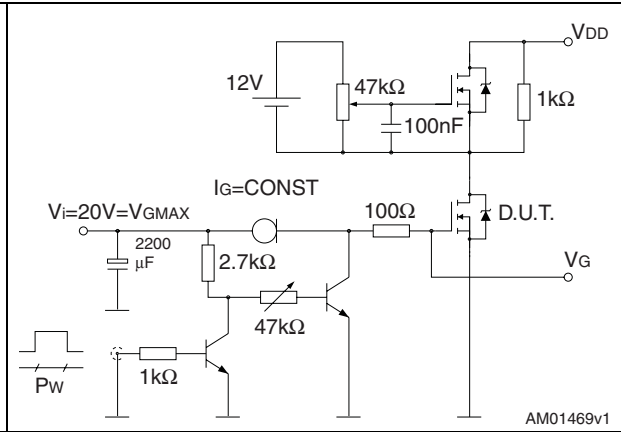
### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



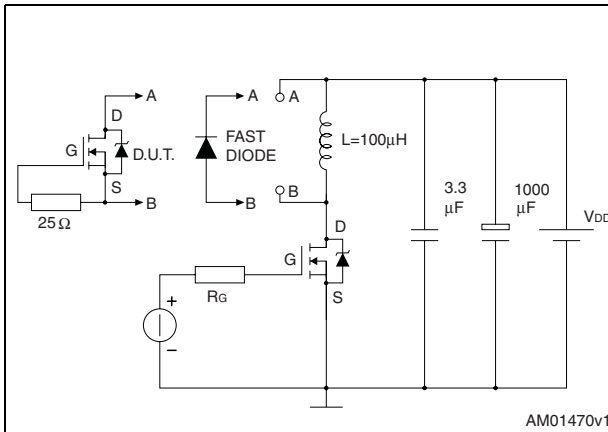
AM01468v1

**Figure 14. Gate charge test circuit**



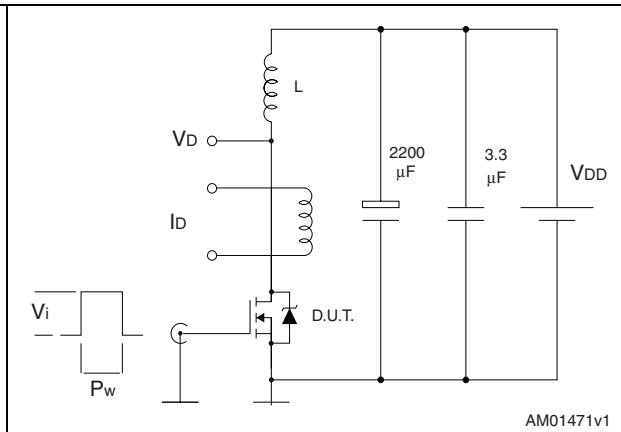
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**Figure 15. Test circuit for inductive load switching and diode recovery times**



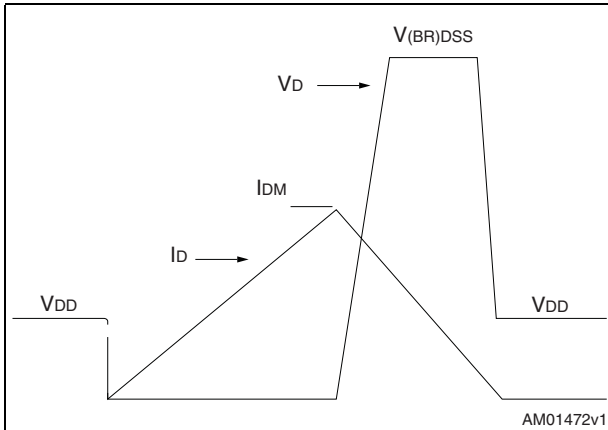
AM01470v1

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



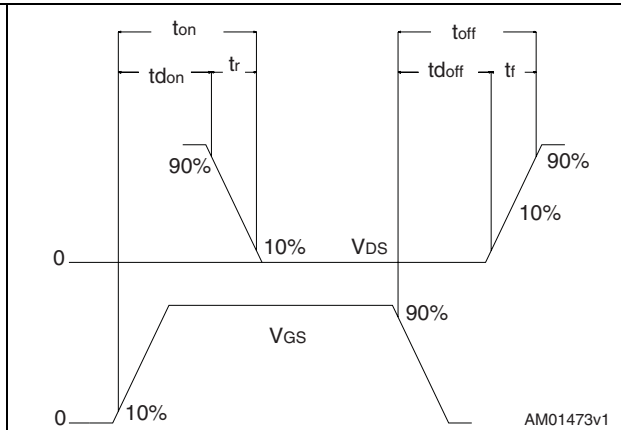
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



AM01473v1



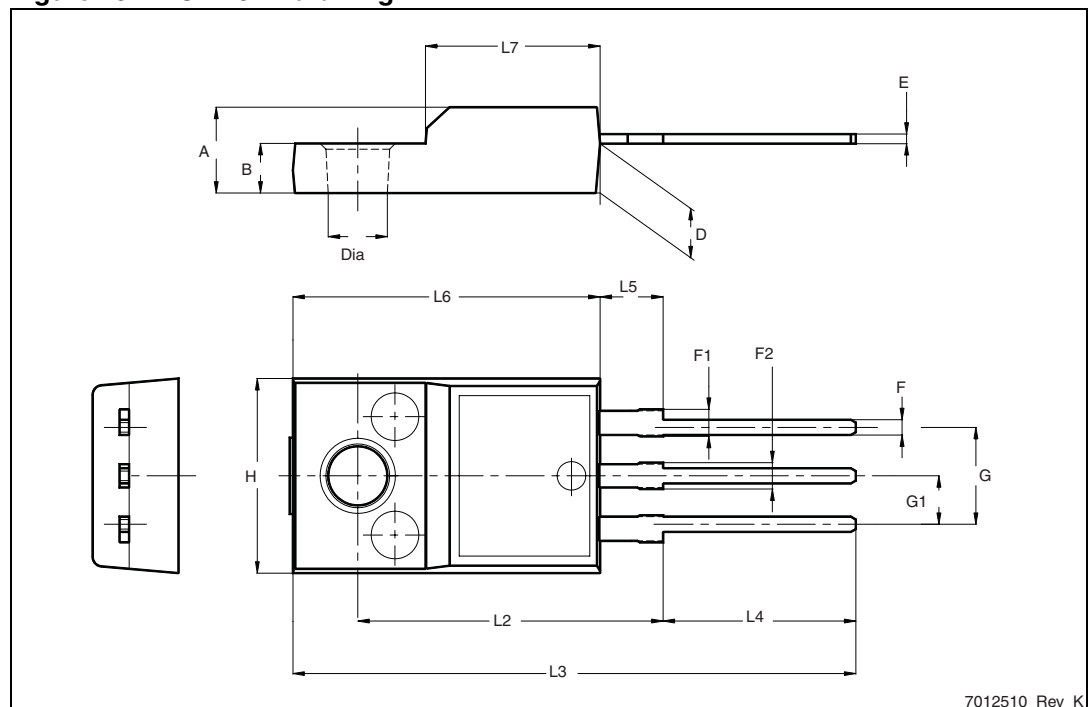
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 9. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 19. TO-220FP drawing



7012510\_Rev\_K

## 5 Revision history

Table 10. Document revision history

Date	Revision	Changes
17-Nov-2011	1	First release.
18-Nov-2011	2	Updated dv/dt in <a href="#">Table 2: Absolute maximum ratings</a> .

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