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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



N-channel 200 V, 0.01 Ω typ., 130 A STripFET™ II with fast recovery diode Power MOSFET in a Max247 package

Datasheet - production data

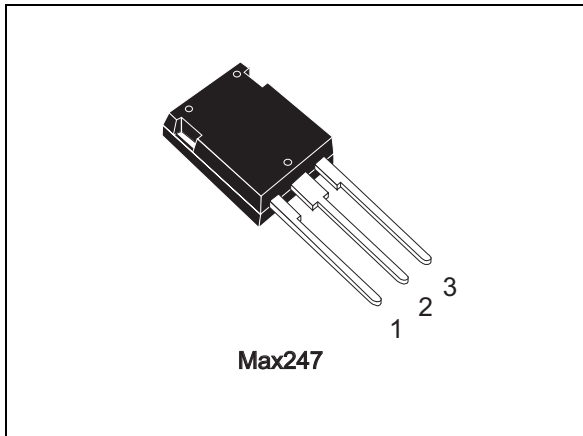
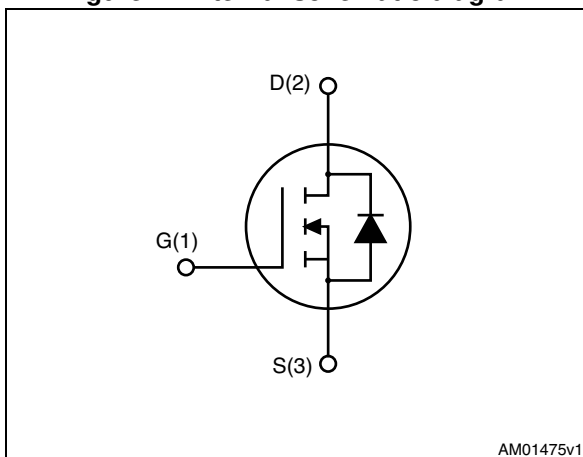


Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)max.}$	I_D	P_{TOT}
STY130NF20D	200 V	0.012 Ω	130 A	450 W

- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

Applications

- Switching applications

Description

This Power MOSFET is produced using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. The device offers extremely fast switching performance thanks to the intrinsic fast body diode, making the device ideal for hard switching topologies.

Table 1. Device summary

Order code	Marking	Packages	Packaging
STY130NF20D	130NF20D	Max247	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	130	A
I_D	Drain current (continuous) at $T_C=100\text{ }^\circ\text{C}$	82	A
$I_{DM}^{(1)}$	Drain current (pulsed)	520	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	450	W
$I_{AR}^{(1)}$	Avalanche current, repetitive or not repetitive	130	A
E_{AS}	Single pulse avalanche energy ⁽²⁾	800	mJ
$dv/dt^{(3)}$	Peak diode recovery voltage slope	25	V/ns
T_J T_{stg}	Operating junction temperature Storage temperature	- 55 to 150	$^\circ\text{C}$

1. Pulse width limited by T_{jmax}
2. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$
3. $I_{SD} \leq 130\text{ A}$, $di/dt \leq 1000\text{ A}/\mu\text{s}$, peak $V_{DS} \leq V_{(BR)DSS}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.28	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	30	$^\circ\text{C}/\text{W}$

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 1\text{ mA}$	200			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 200\text{ V}$			10	μA
		$V_{GS} = 0, V_{DS} = 200\text{ V}, T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$			± 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	$V_{GS} = 10\text{ V}, I_D = 65\text{ A}$		0.01	0.012	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz},$	-	11100	-	pF
C_{oss}	Output capacitance		-	2190	-	pF
C_{rss}	Reverse transfer capacitance		-	334	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{GS} = 0, V_{DS} = 0\text{ to }160$	-	1525	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	1139	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}, I_D = 0$	-	1.4	-	Ω
Q_g	Total gate charge	$V_{DD} = 160\text{ V}, I_D = 130\text{ A}$	-	338	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$	-	47	-	nC
Q_{gd}	Gate-drain charge	(see Figure 16)	-	183	-	nC

- $C_{o(er)}$ 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}
- $C_{o(tr)}$ 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}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 100\text{ V}$, $I_D = 65\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 15)	-	232	-	ns
t_r	Rise time		-	218	-	ns
$t_{d(off)}$	Turn-off delay time		-	283	-	ns
t_f	Fall time		-	250	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		130	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		520	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 130\text{ A}$, $V_{GS} = 0$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 130\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$	-	190		ns
Q_{rr}	Reverse recovery charge		-	1.4		μC
I_{RRM}	Reverse recovery current		-	14		A
t_{rr}	Reverse recovery time	$I_{SD} = 130\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	257		ns
Q_{rr}	Reverse recovery charge		-	2.4		μC
I_{RRM}	Reverse recovery current		-	18		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

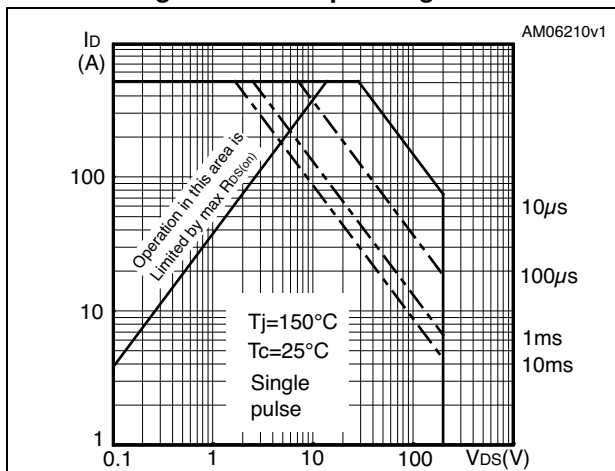


Figure 3. Thermal impedance

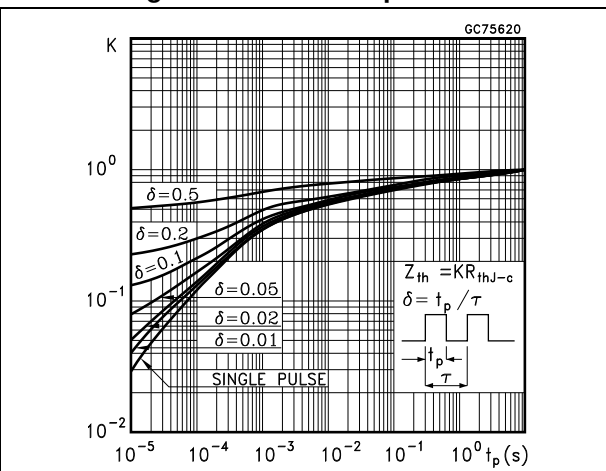


Figure 4. Output characteristics

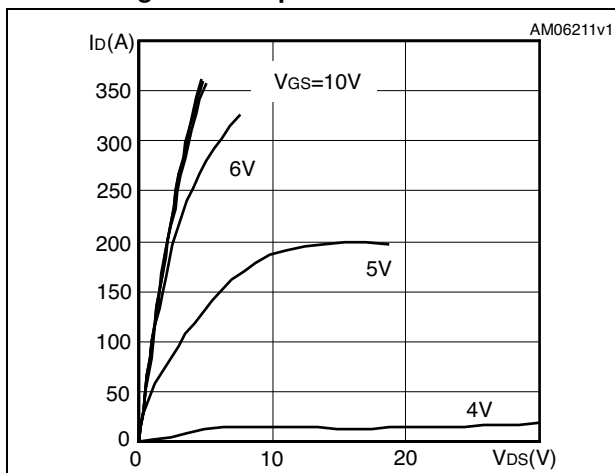


Figure 5. Transfer characteristics

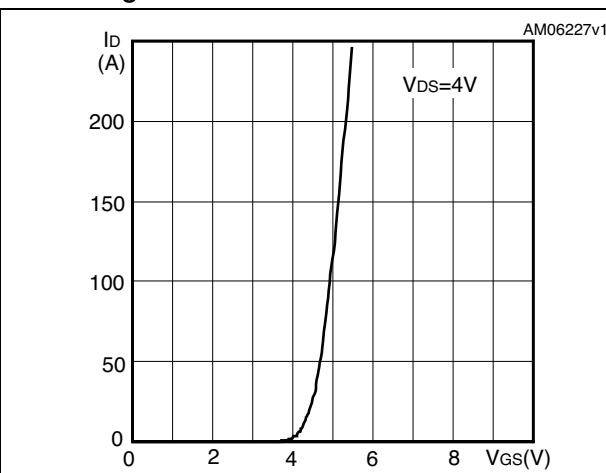


Figure 6. Gate charge vs gate-source voltage

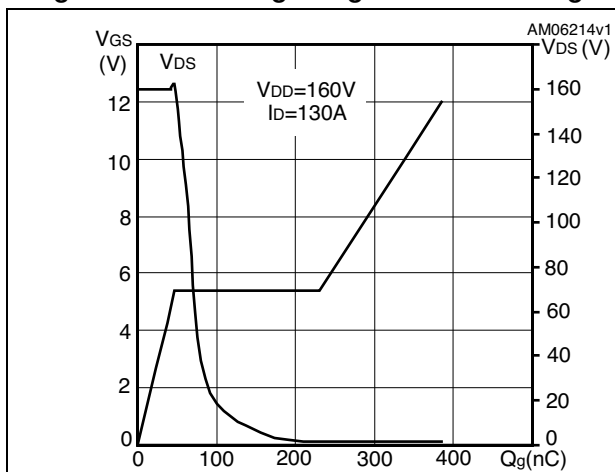


Figure 7. Static drain-source on-resistance

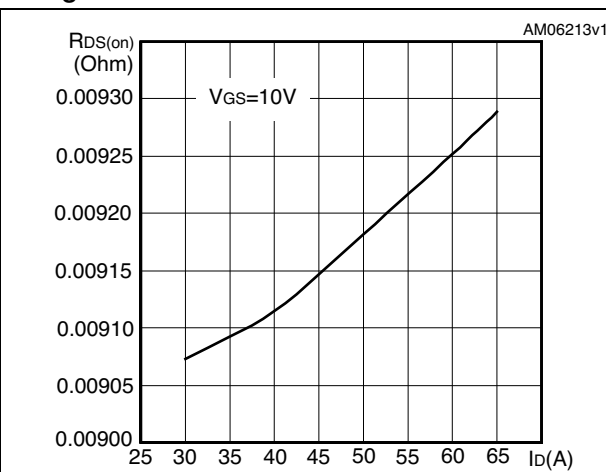


Figure 8. Capacitance variations

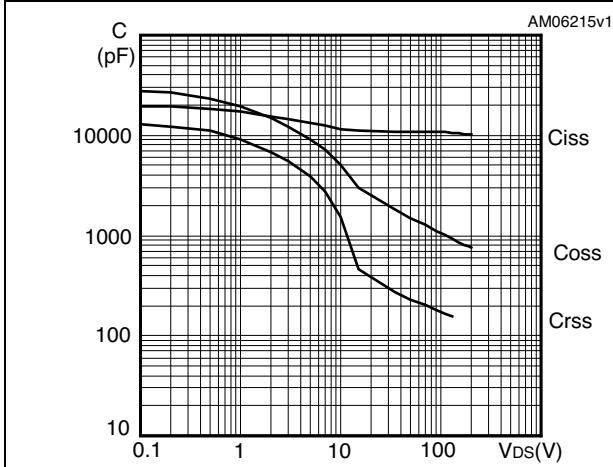


Figure 9. Output capacitance stored energy

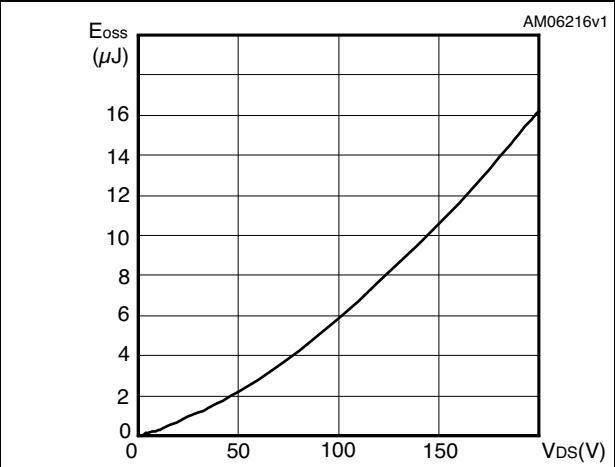


Figure 10. Normalized gate threshold voltage vs temperature

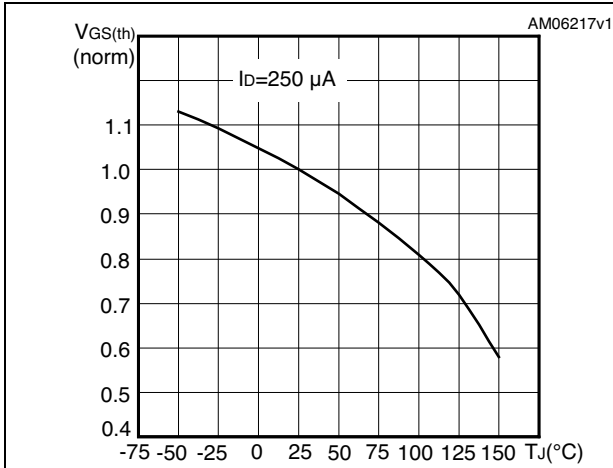


Figure 11. Normalized on-resistance vs temperature

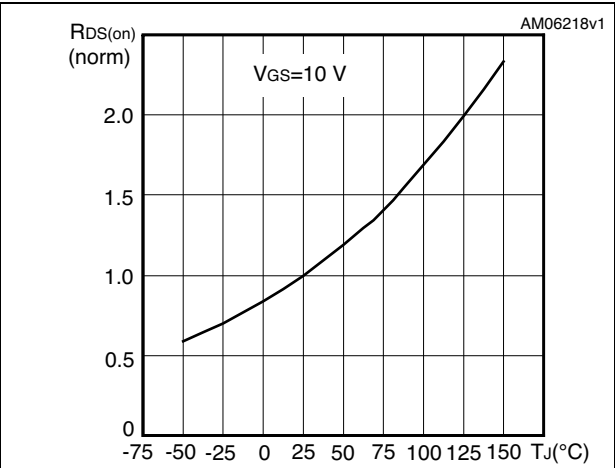


Figure 12. Source-drain diode forward characteristics

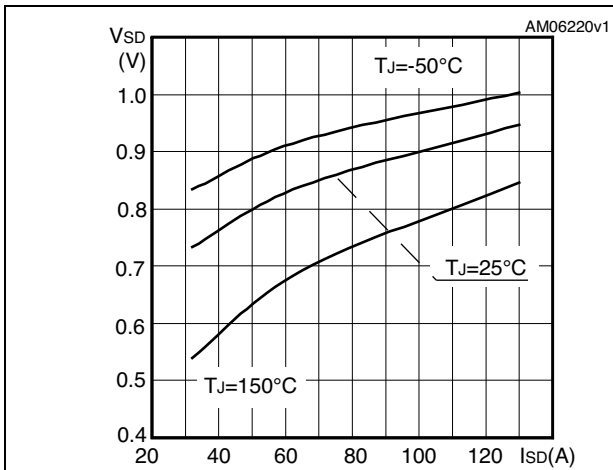


Figure 13. Normalized V(BR)DSS vs temperature

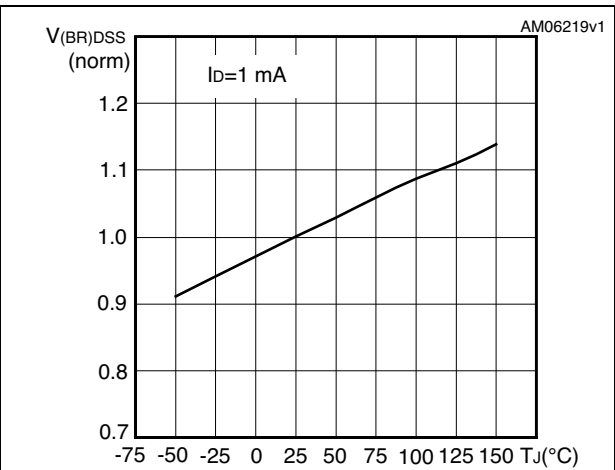
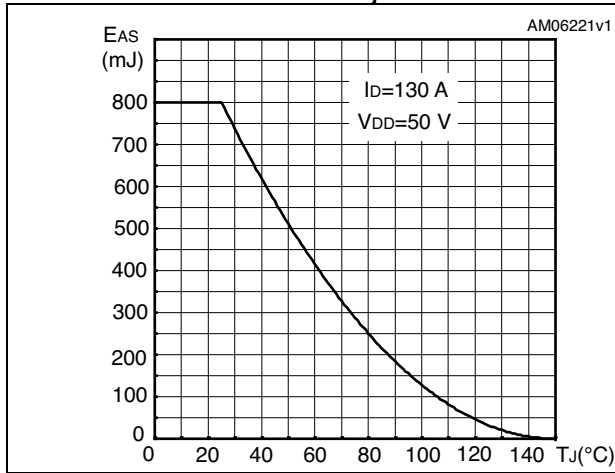


Figure 14. Maximum avalanche energy vs starting T_j



3 Test circuit

Figure 15. Switching times test circuit for resistive load

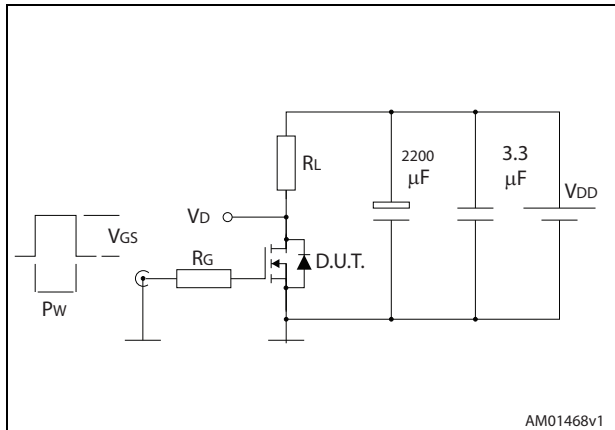


Figure 16. Gate charge test circuit

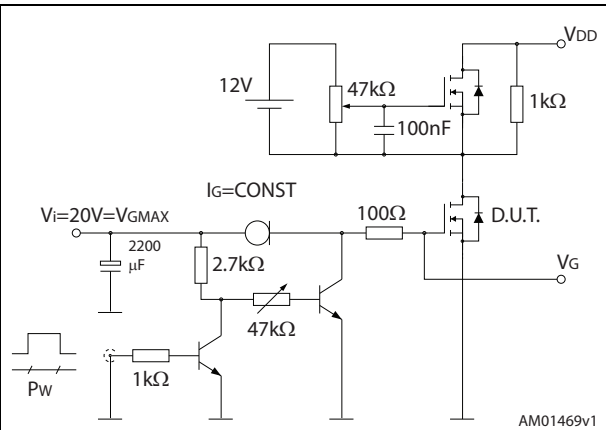


Figure 17. Test circuit for inductive load switching and diode recovery times

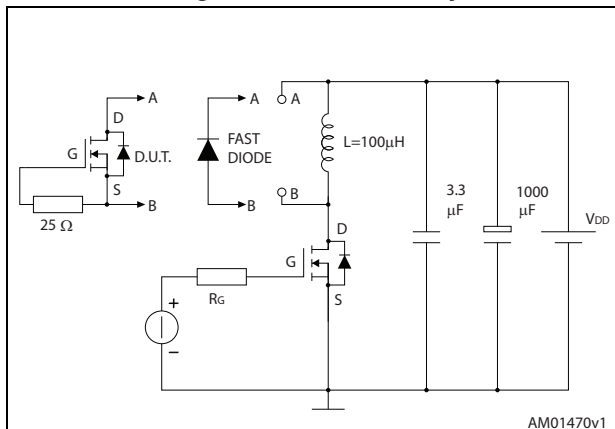


Figure 18. Unclamped inductive load test circuit

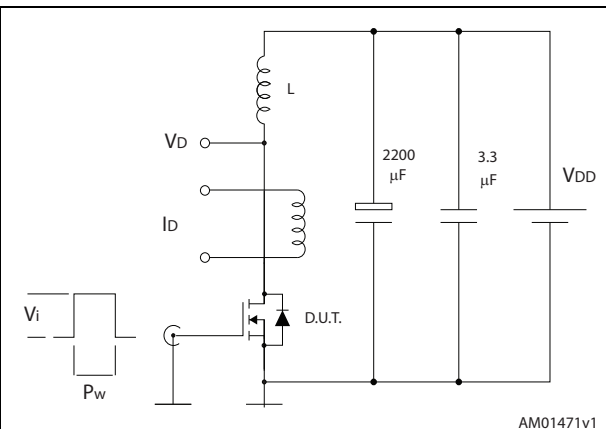


Figure 19. Unclamped inductive waveform

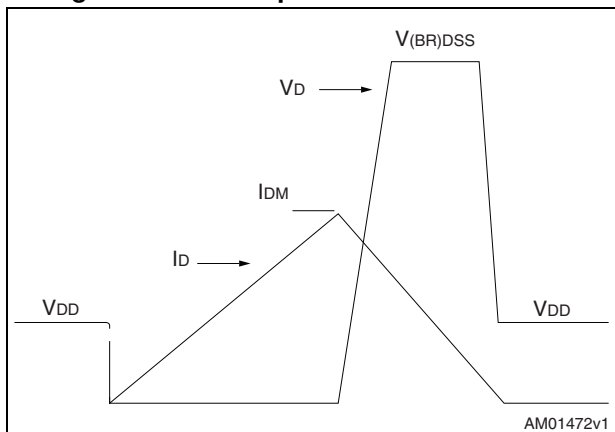
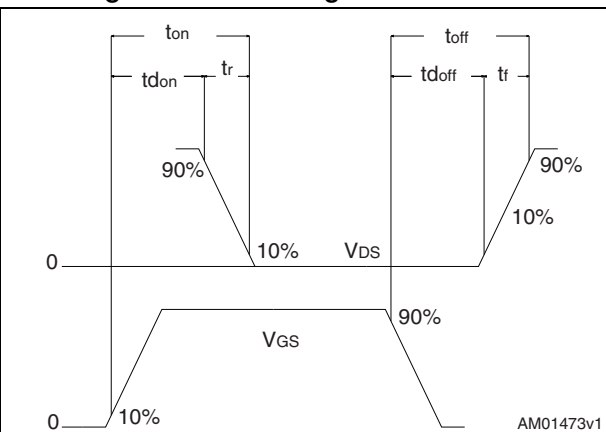


Figure 20. Switching time waveform



4 Package mechanical data

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Figure 21. Max247 drawing

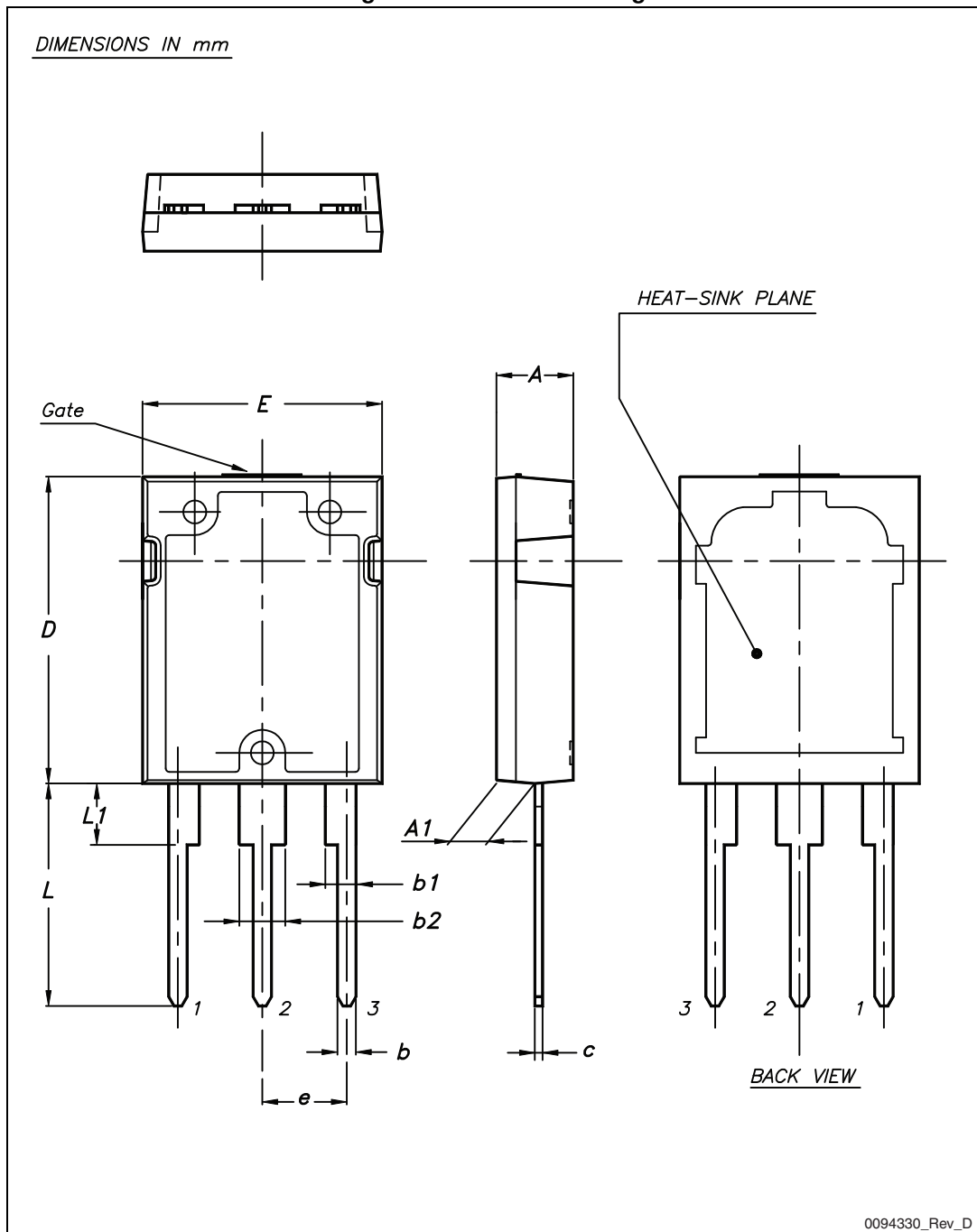


Table 8. Max247 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.70		5.30
A1	2.20		2.60
b	1.00		1.40
b1	2.00		2.40
b2	3.00		3.40
c	0.40		0.80
D	19.70		20.30
e	5.35		5.55
E	15.30		15.90
L	14.20		15.20
L1	3.70		4.30

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
27-Jan-2009	1	First release
29-Oct-2009	2	Some values have been updated in Table 4 , Table 5 , Table 6 and Table 7
11-Jan-2010	3	Document status promoted from preliminary data to datasheet.
16-May-2014	4	<ul style="list-style-type: none">– Modified: title– Modified: Figure 5, 6, 10, 11 and 13– Minor text changes in the cover page.

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