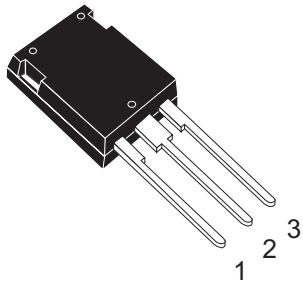
STY130NF20D

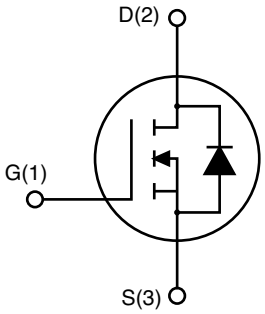
N-channel 200 V, 0.01 Ω typ., 130 A STripFET™ II with fast recovery diode Power MOSFET in a Max247 package

Datasheet - production data



Max247

Figure 1. Internal schematic diagram



AM01475v1

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

Contents

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 °C	130	A
I_D	Drain current (continuous) at T_C=100 °C	82	A
I_{DM} (1)	Drain current (pulsed)	520	A
P_{TOT}	Total dissipation at T_C = 25 °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	°C

1. Pulse width limited by T_{jmax}
2. Starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V
3. I_{SD} ≤ 130 A, di/dt ≤ 1000 A/µs, peak V_{DS} ≤ $V_{(BR)DSS}$

Table 3. Thermal resistance

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

2 Electrical characteristics

(T_{CASE} = 25 °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 mA	200			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS} = 200 V			10	µA
		V_{GS} = 0, V_{DS} =200 V, T_C=125 °C			100	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0, V_{GS} = ± 20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on- resistance	V_{GS}= 10 V, I_D= 65 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 V, f=1 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} = o to 160	-	1525	-	pF
$C_{o(er)}$(2)	Equivalent capacitance energy related		-	1139	-	pF
R_G	Intrinsic gate resistance	f=1 MHz, I_D=0	-	1.4	-	Ω
Q_g	Total gate charge	V_{DD}=160 V, I_D = 130 A V_{GS}= 10 V *(see Figure 16)*	-	338	-	nC
Q_{gs}	Gate-source charge		-	47	-	nC
Q_{gd}	Gate-drain charge		-	183	-	nC

1. $C_{o(er)}$ 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}
2. $C_{o(tr)}$ 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 V, I_D= 65 A, R_G= 4.7 Ω, V_{GS} =10 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 A, V_{GS}=0	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 130 A, di/dt = 100 A/µs, V_{DD}= 100 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 A, di/dt = 100 A/µs, V_{DD}= 100 V, Tj=150 °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=300µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

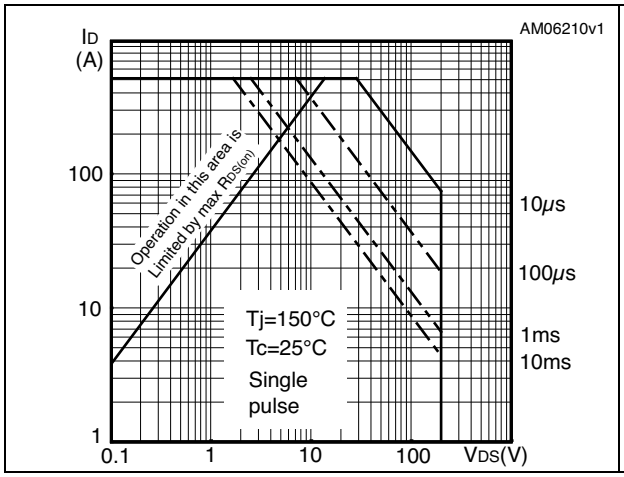


Figure 3. Thermal impedance

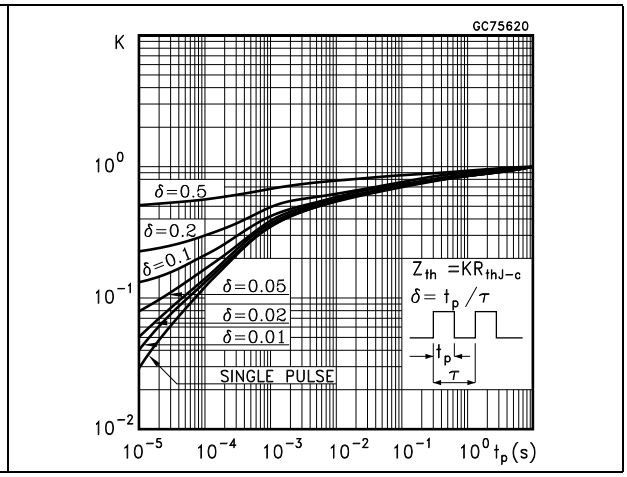


Figure 4. Output characteristics

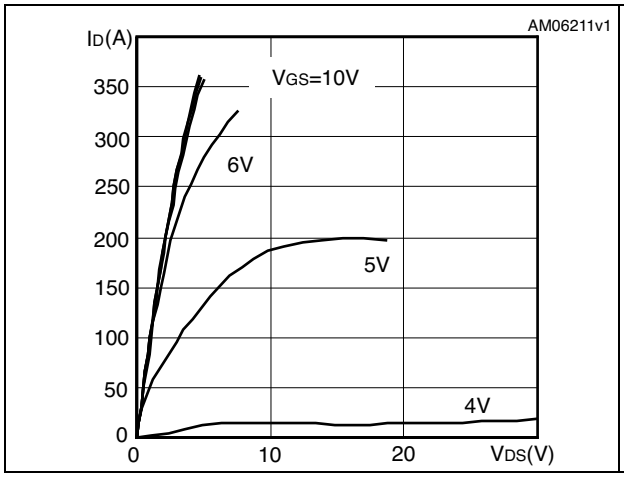


Figure 5. Transfer characteristics

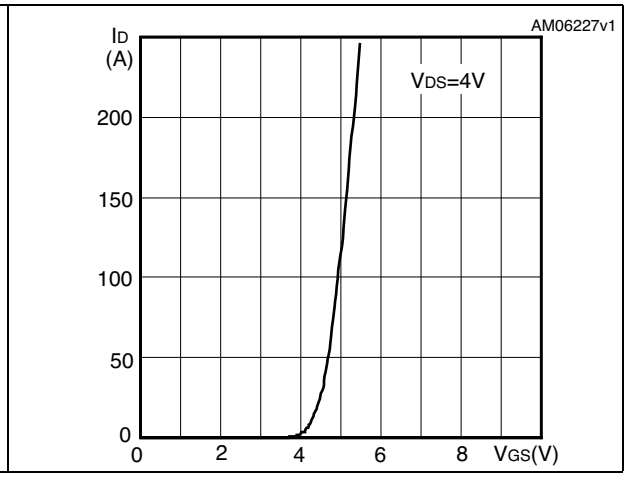


Figure 6. Gate charge vs gate-source voltage

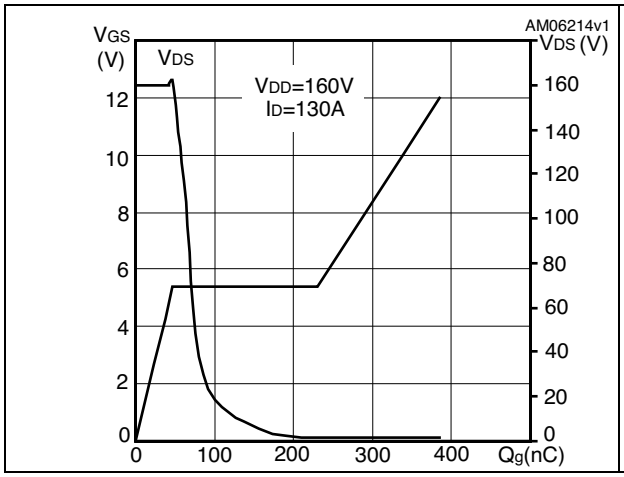


Figure 7. Static drain-source on-resistance

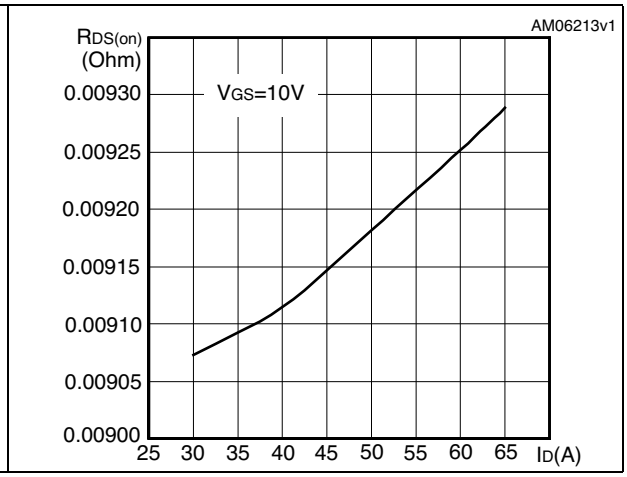


Figure 8. Capacitance variations

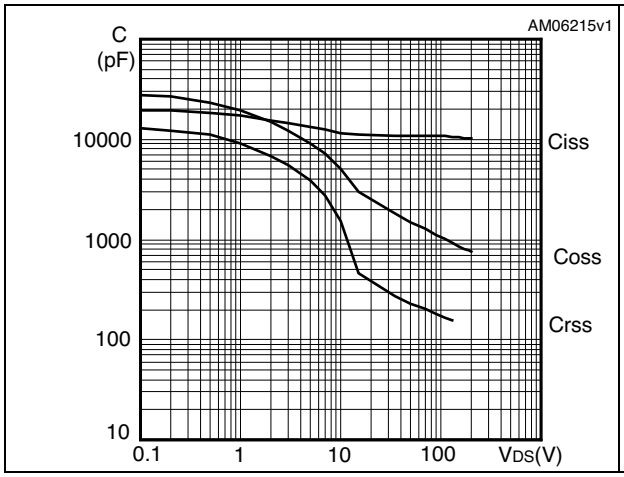


Figure 9. Output capacitance stored energy

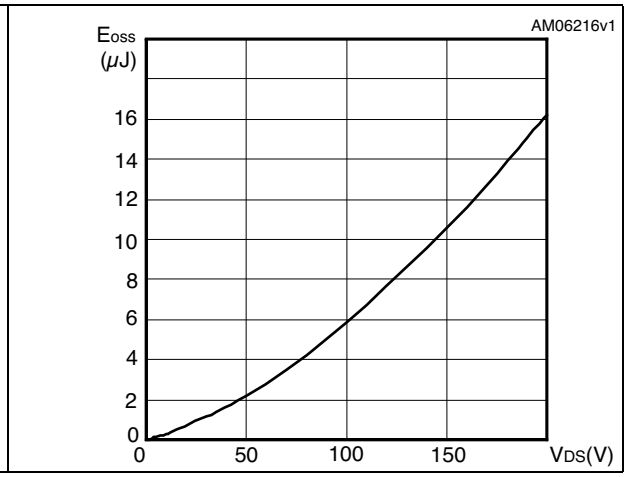


Figure 10. Normalized gate threshold voltage vs temperature

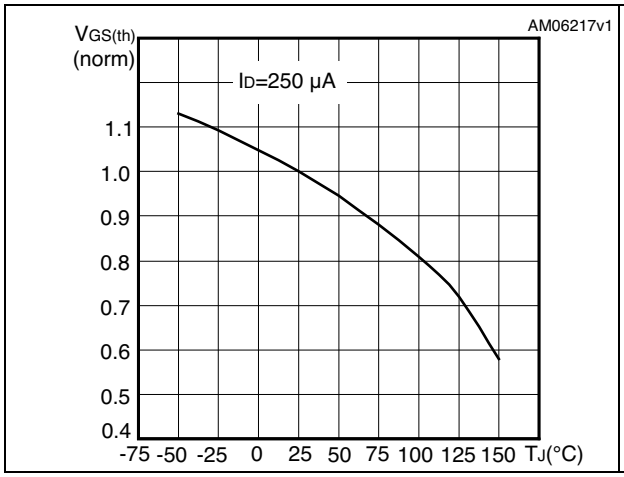


Figure 11. Normalized on-resistance vs temperature

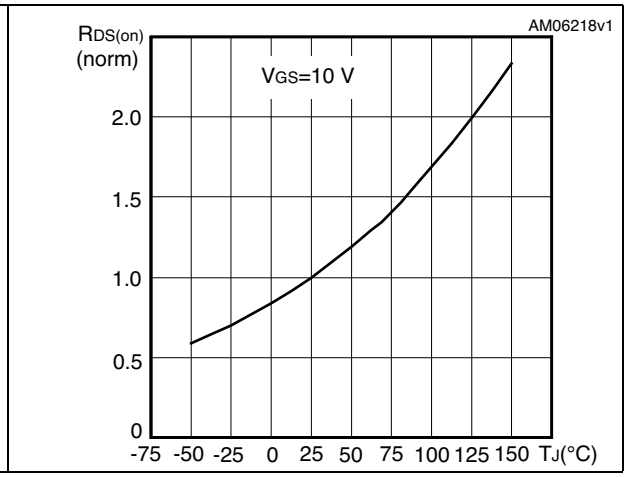


Figure 12. Source-drain diode forward characteristics

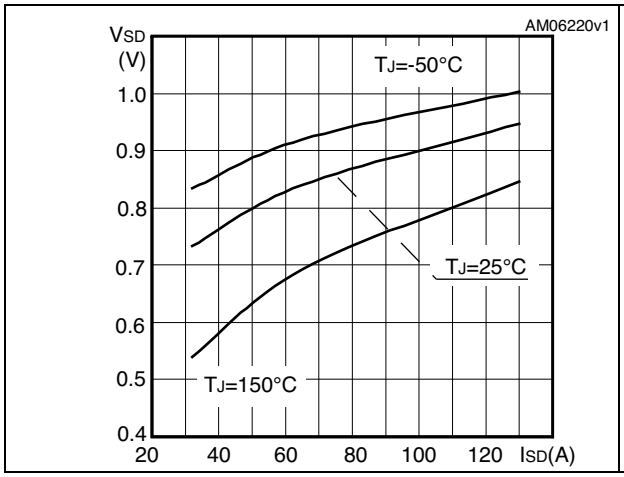


Figure 13. Normalized $V_{(BR)DSS}$ vs temperature

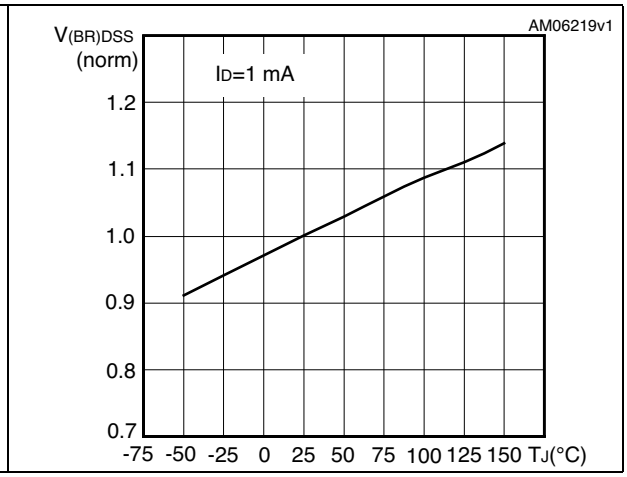
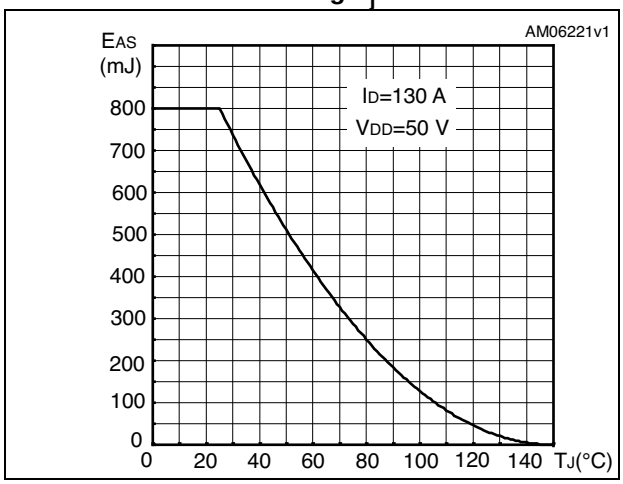


Figure 14. Maximum avalanche energy vs starting T_j



3 Test circuit

Figure 15. Switching times test circuit for resistive load

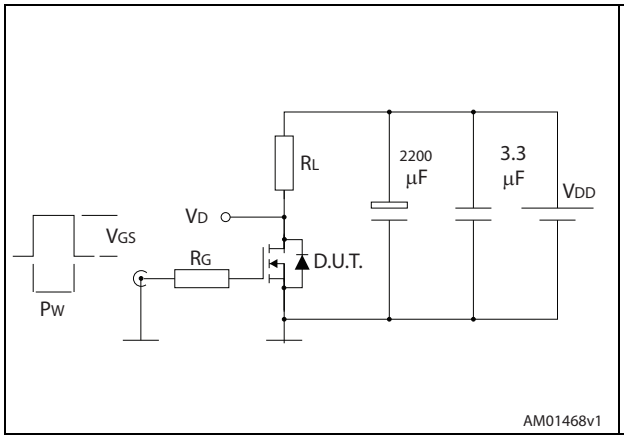


Figure 16. Gate charge test circuit

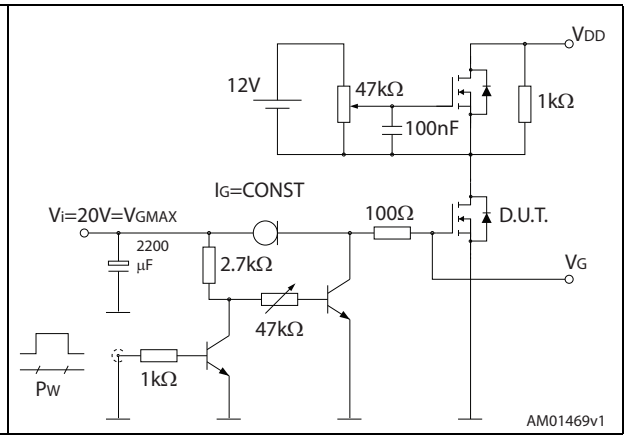


Figure 17. Test circuit for inductive load switching and diode recovery times

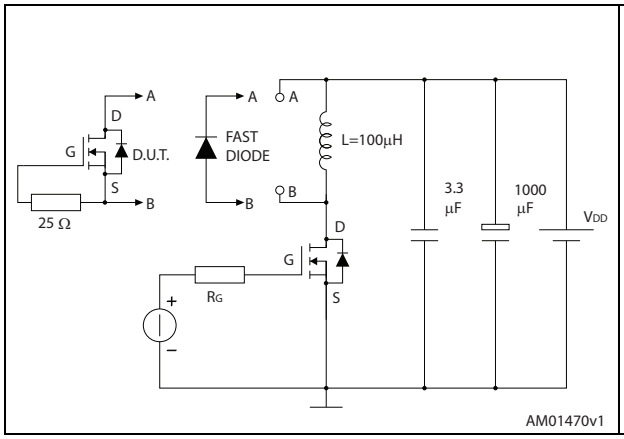


Figure 18. Unclamped inductive load test circuit

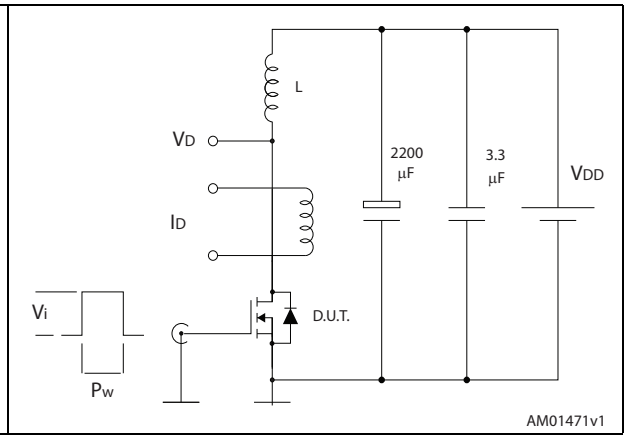


Figure 19. Unclamped inductive waveform

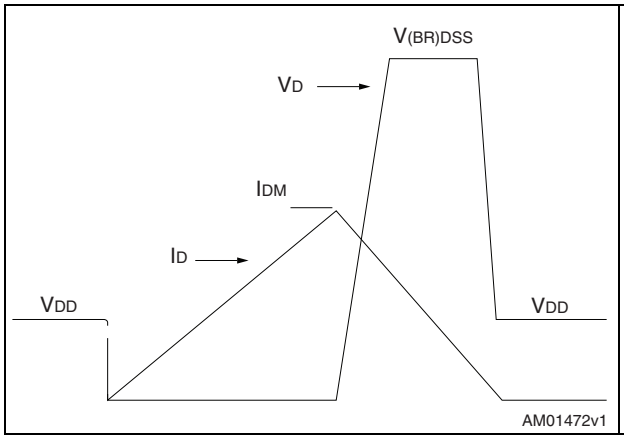
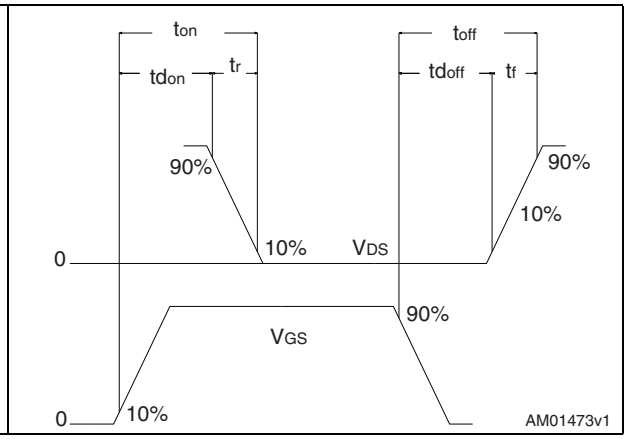


Figure 20. Switching time waveform



4 Package mechanical data

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*.
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Figure 21. Max247 drawing

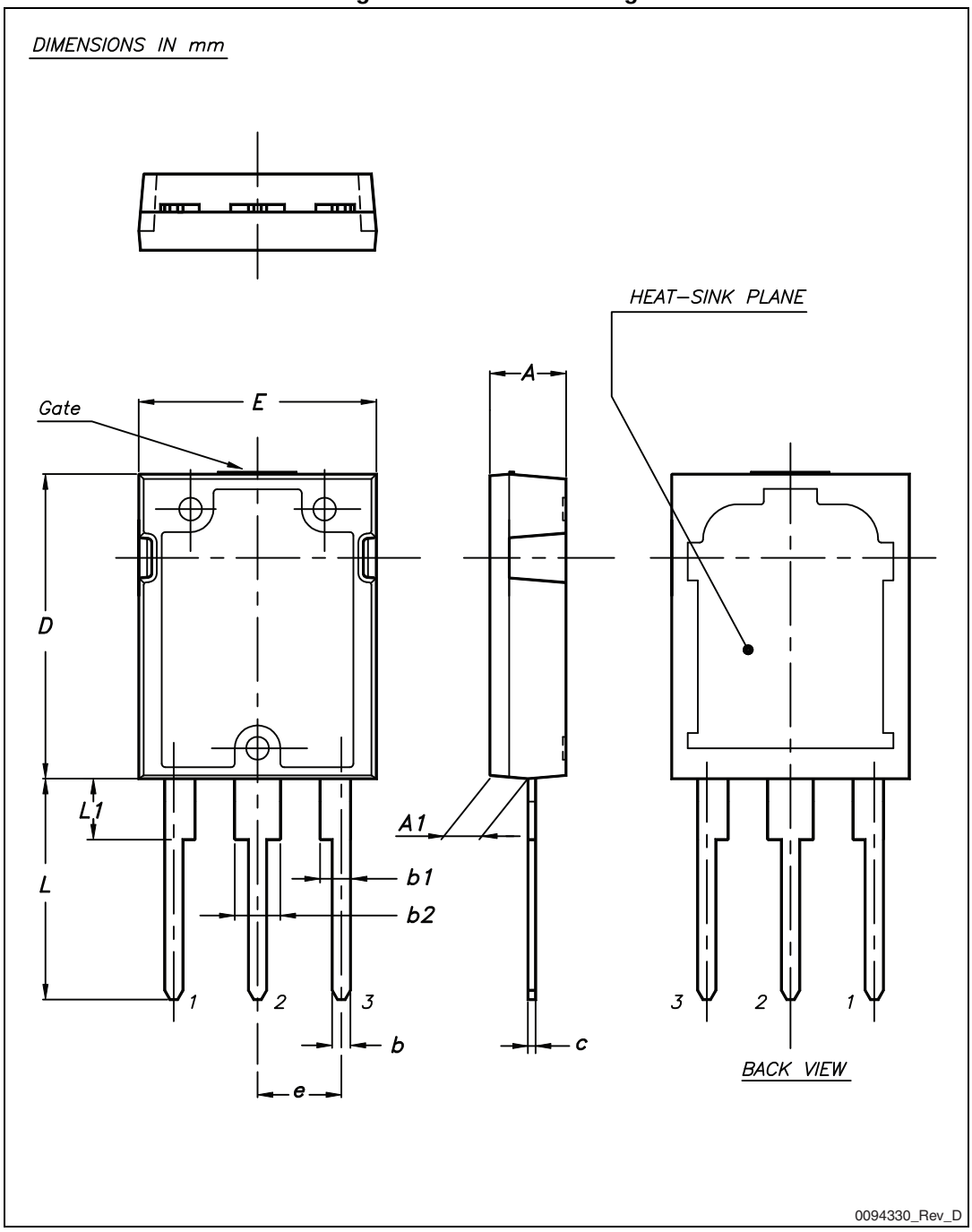

Table 8. Max247 mechanical data

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	– Modified: title – Modified: *Figure 5*, *6*, *10*, *11* and *13* – Minor text changes in the cover page.

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