



STY130NF20D

N-channel 200 V, 0.01 Ω , 130 A, Max247
low gate charge STripFET™ II Power MOSFET

Features

Type	V _{DSS}	R _{DS(on) max}	I _D	P _W
STY130NF20D	200 V	< 0.012 Ω	130 A	450 W

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

Application

- Switching applications

Description

This series of Power MOSFETs manufactured using STMicroelectronics' unique STripFET™ process is specifically designed to minimize input capacitance and gate charge. It is therefore suitable as the primary switch in advanced high-efficiency isolated DC-DC converters.

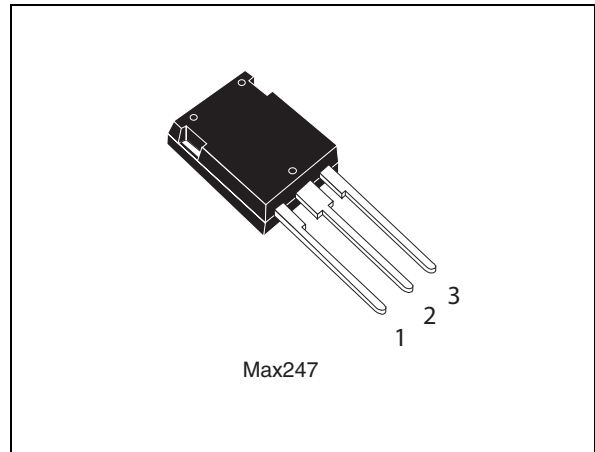


Figure 1. Internal schematic diagram

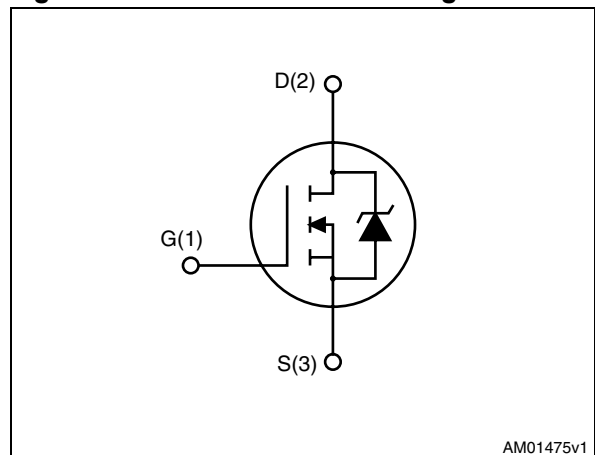


Table 1. Device summary

Order code	Marking	Package	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
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	450	W
I_{AR}	Avalanche current, repetitive or not repetitive ⁽²⁾	130	A
E_{AS}	Single pulse avalanche energy ⁽³⁾	800	mJ
$dv/dt^{(4)}$	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 safe operating area
2. Pulse width limited by T_{jmax}
3. Strating $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$
4. $I_{SD} \leq 130\text{ A}$, $di/dt \leq 1000\text{ A}/\mu\text{s}$, 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	$^\circ\text{C}/\text{W}$
T_L	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

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	$I_D = 1\text{ mA}$, $V_{GS} = 0$	200			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{max rating}$, $V_{DS} = \text{max rating @ } 125\text{ °C}$			10 100	μA 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	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	11100	-	pF
C_{oss}	Output capacitance			2190		
C_{rss}	Reverse transfer capacitance			334		
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ to }160$, $V_{GS} = 0$	-	1525	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related			1139		
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	1.4	-	Ω
Q_g	Total gate charge	$V_{DD} = 160\text{ V}$, $I_D = 130\text{ A}$ $V_{GS} = 10\text{ V}$ (see Figure 16)	-	338	-	nC
Q_{gs}	Gate-source charge			47		
Q_{gd}	Gate-drain charge			183		

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

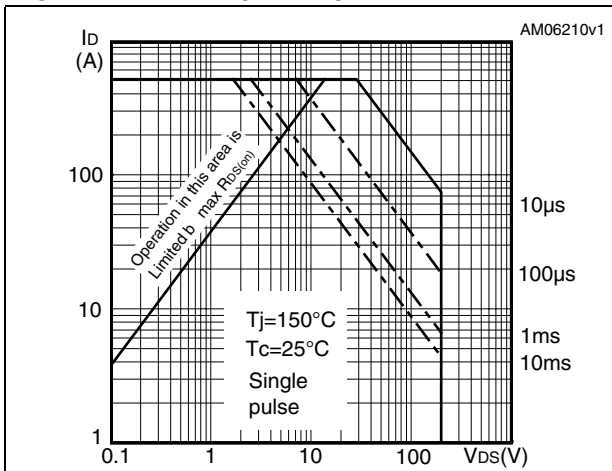


Figure 3. Thermal impedance

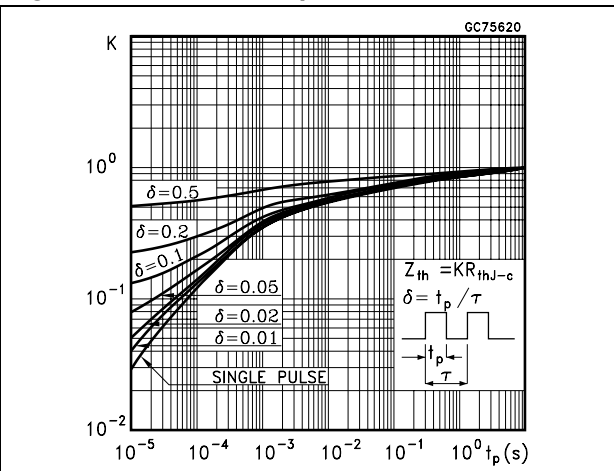


Figure 4. Output characteristics

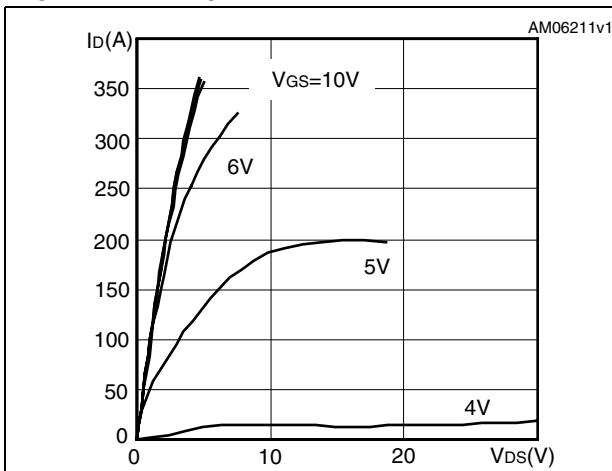


Figure 5. Transfer characteristics

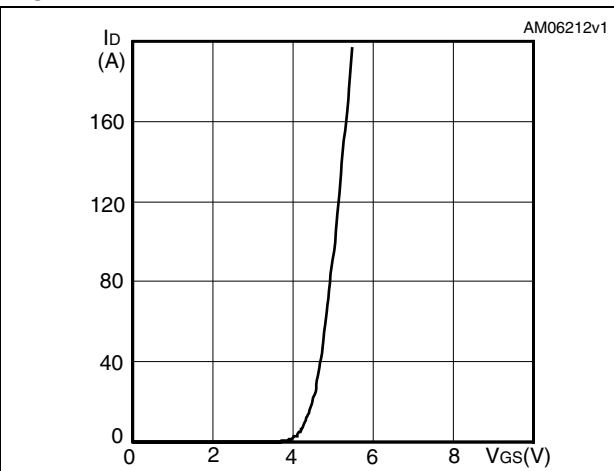


Figure 6. Gate charge vs gate-source voltage

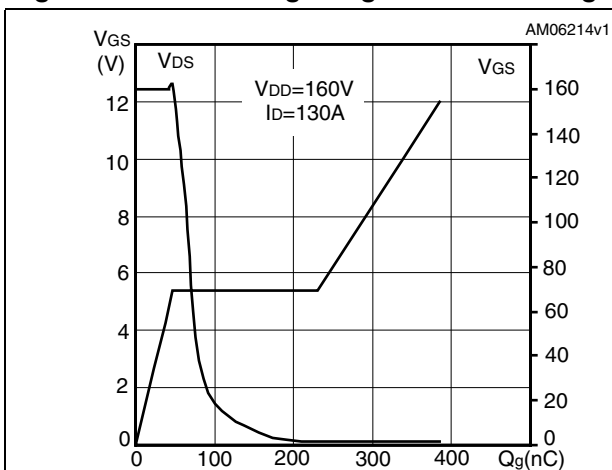


Figure 7. Static drain-source on resistance

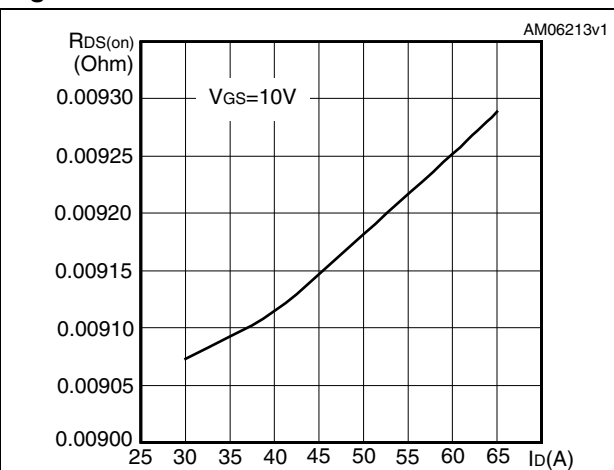


Figure 8. Capacitance variations

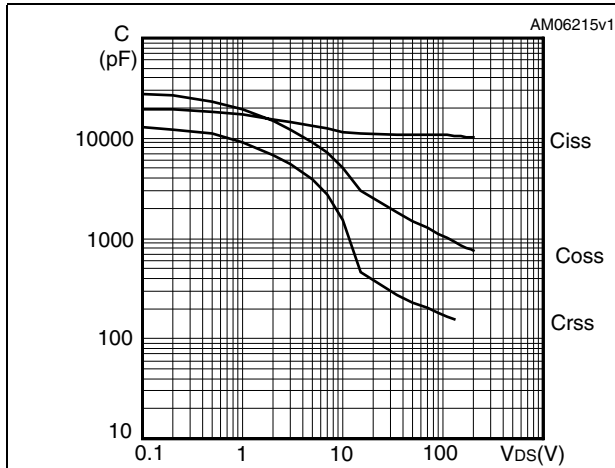


Figure 9. Output capacitance stored energy

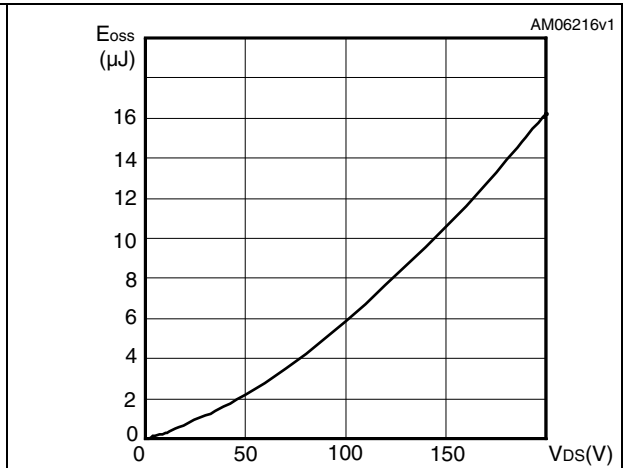


Figure 10. Normalized gate threshold voltage vs temperature

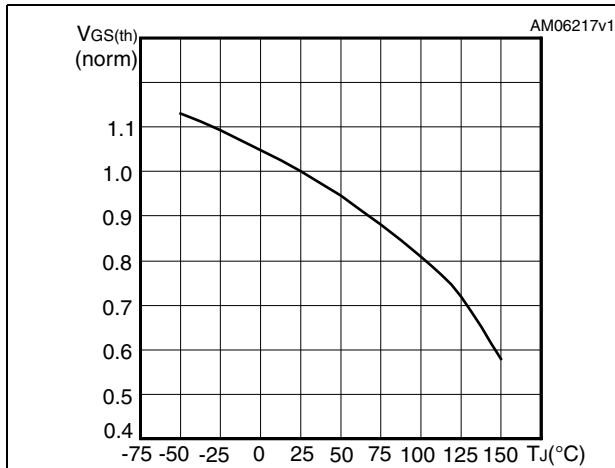


Figure 11. Normalized on resistance vs temperature

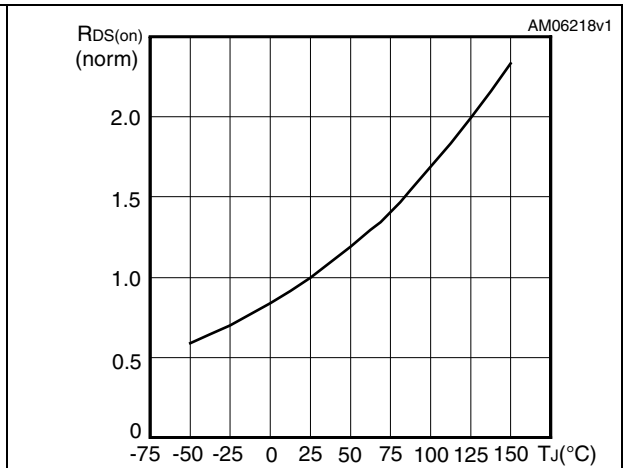


Figure 12. Source-drain diode forward characteristics

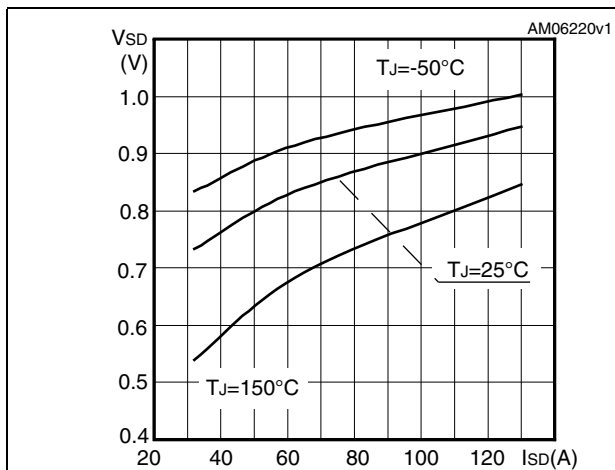


Figure 13. Normalized B_VDSS vs temperature

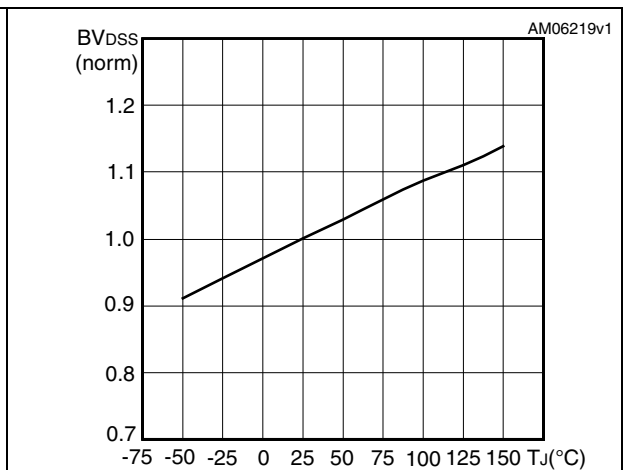
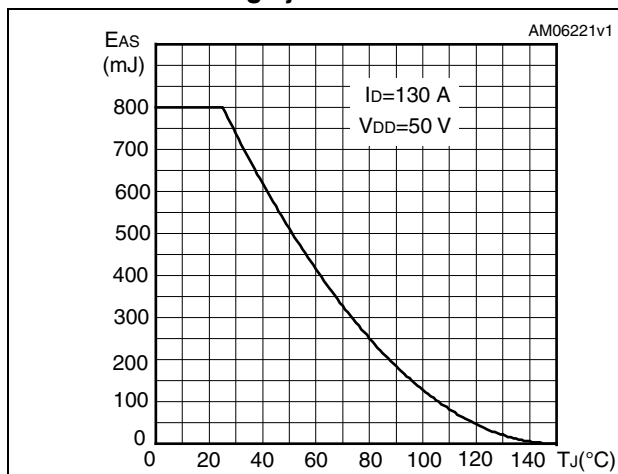


Figure 14. Maximum avalanche energy vs starting Tj



3 Test circuit

Figure 15. Switching times test circuit for resistive load

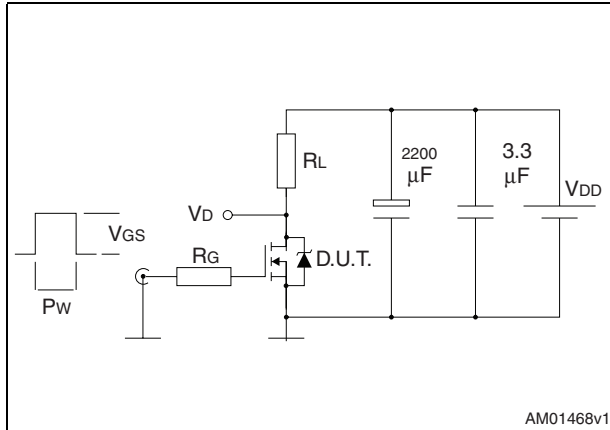


Figure 16. Gate charge test circuit

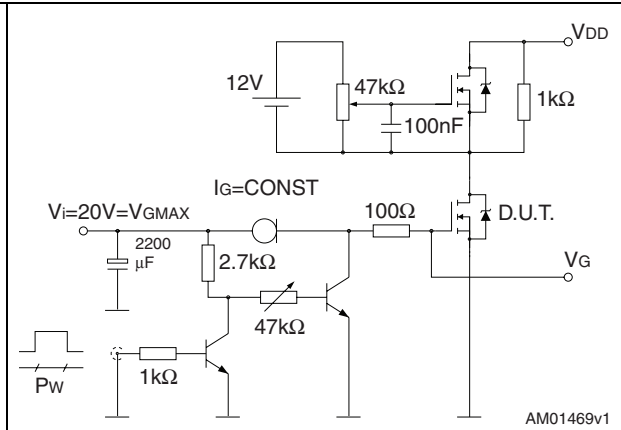


Figure 17. Test circuit for inductive load switching and diode recovery times

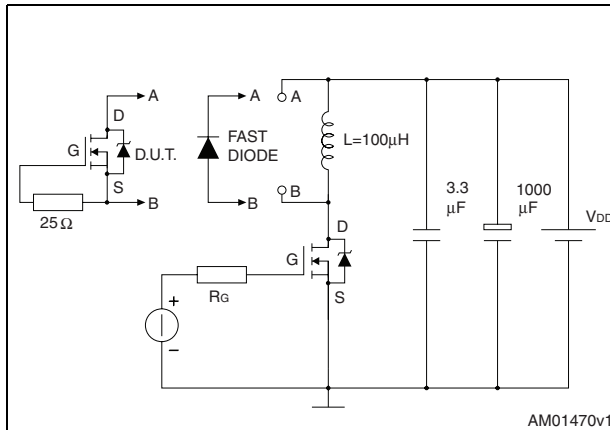


Figure 18. Unclamped inductive load test circuit

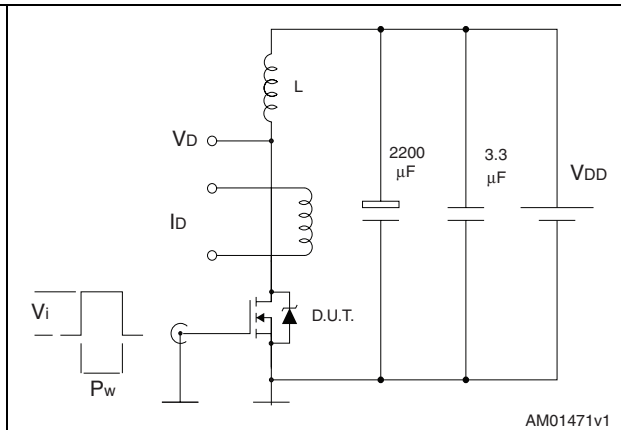


Figure 19. Unclamped inductive waveform

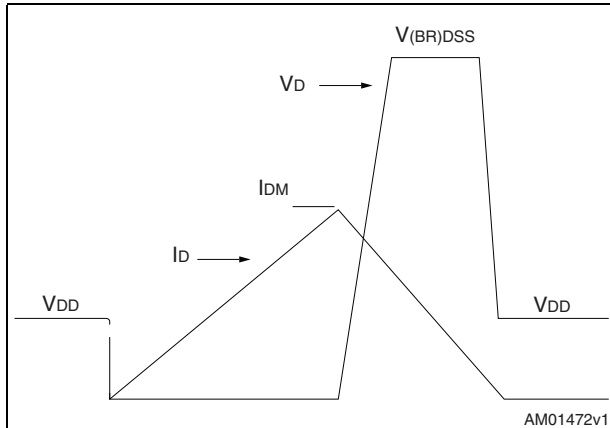
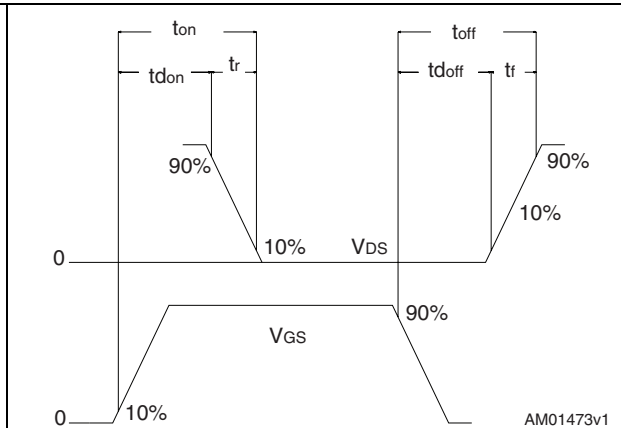


Figure 20. Switching time waveform



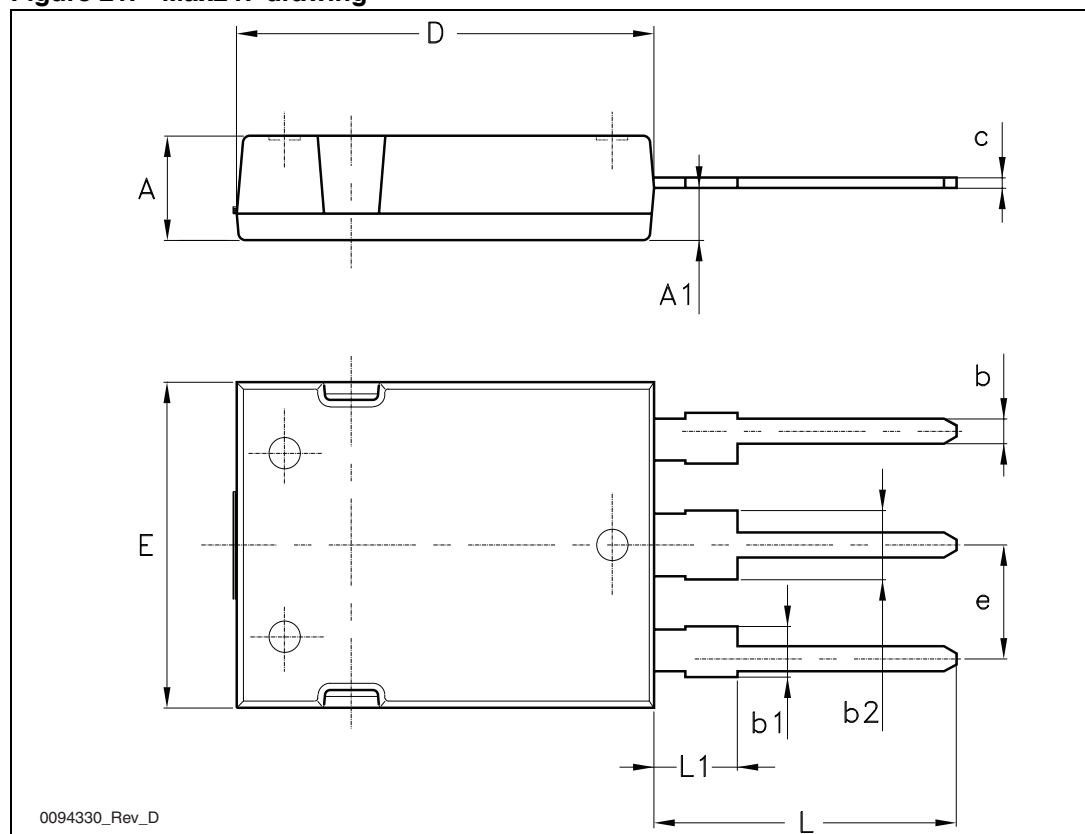
4 Package mechanical data

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. ECOPACK[®] is an ST trademark.

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

Figure 21. Max247 drawing



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.

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