



STW26NM60N-H

N-channel 600 V, 0.135 Ω , 20 A TO-247
MDmesh™ II Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STW26NM60N-H	600 V	< 0.165 Ω	20 A

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

Application

- Switching applications

Description

This series of devices implements second generation MDmesh™ technology. This revolutionary Power MOSFET associates a new 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.

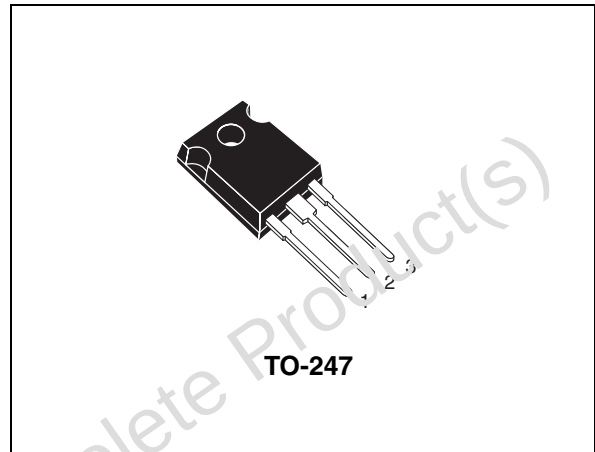


Figure 1. Internal schematic diagram

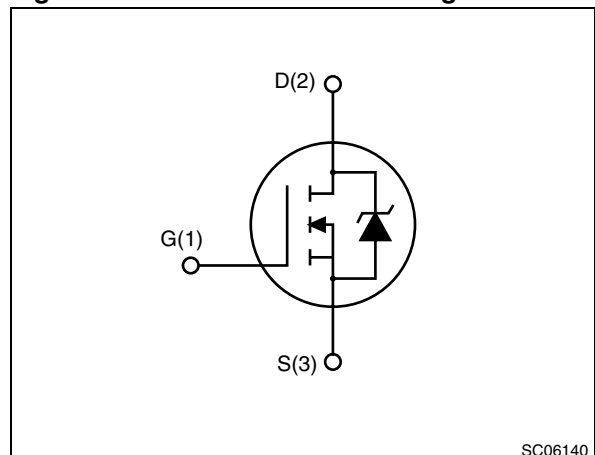


Table 1. Device summary

Order codes	Marking	Package	Packaging
STW26NM60N-H	26NM60N	TO-247	Tube

Note: The device meets ECOPACK® standards, an environmentally-friendly grade of products commonly referred to as “halogen-free”. See [Section 4: Package mechanical data](#)

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Obsolete Product(s) - Obsolete Product(s)



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	600	V
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	20	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	12.6	A
$I_{DM}^{(1)}$	Drain current (pulsed)	80	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	140	W
	Derating factor	1.12	
$dv/dt^{(2)}$	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. $I_{SD} \leq 20\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DD} \leq 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.89	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^{\circ}\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300	$^{\circ}\text{C}$

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	8.5	A
E_{AS}	Single pulse avalanche energy (starting $T_j=25\text{ }^{\circ}\text{C}$, $I_D=I_{AS}$, $V_{DD}=50\text{ V}$)	610	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	600			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, @ $125\text{ }^{\circ}\text{C}$			1 10	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			1	μA
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}$, $I_D = 10\text{ A}$		0.135	0.165	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	1800	-	pF
C_{oss}	Output capacitance			115		pF
C_{rss}	Reverse transfer capacitance			1.1		pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0$, $V_{DS} = 0\text{ to }480\text{ V}$	-	310	-	pF
Q_g	Total gate charge	$V_{DD} = 480\text{ V}$, $I_D = 20\text{ A}$, $V_{GS} = 10\text{ V}$, (see Figure 15)	-	60	-	nC
Q_{gs}	Gate-source charge			8.5		nC
Q_{gd}	Gate-drain charge			30		nC
R_g	Gate input resistance	$f = 1\text{ MHz}$ Gate DC Bias = 0 Test signal level = 20 mV open drain	-	2.8	-	Ω

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	$V_{DD} = 300\text{ V}$, $I_D = 10\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14)	-	13	-	ns
t_r	Rise time			25		ns
$t_{d(off)}$	Turn-off delay time			85		ns
t_f	Fall time			50		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		20	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				30	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 20\text{ A}$, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 16)	-	370		ns
Q_{rr}	Reverse recovery charge			5.8		μC
I_{RRM}	Reverse recovery current			31.6		A
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 16)	-	450		ns
Q_{rr}	Reverse recovery charge			7.5		μC
I_{RRM}	Reverse recovery current			32.5		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 for TO-247

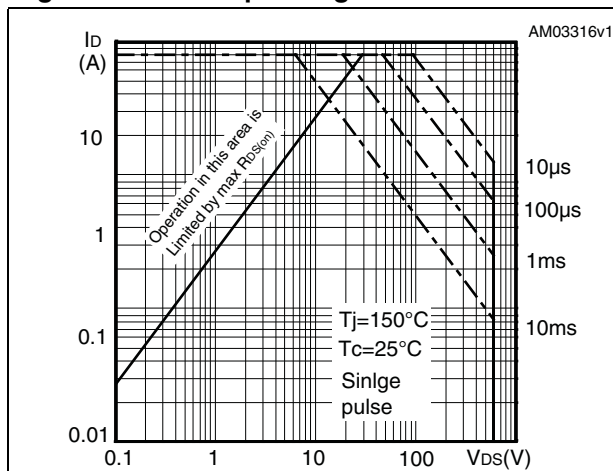


Figure 3. Thermal impedance for TO-247

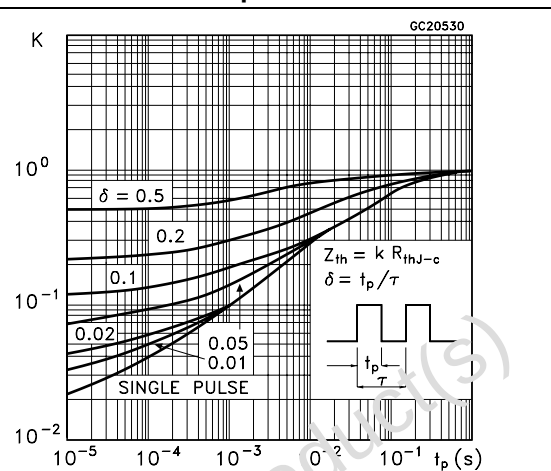


Figure 4. Output characteristics

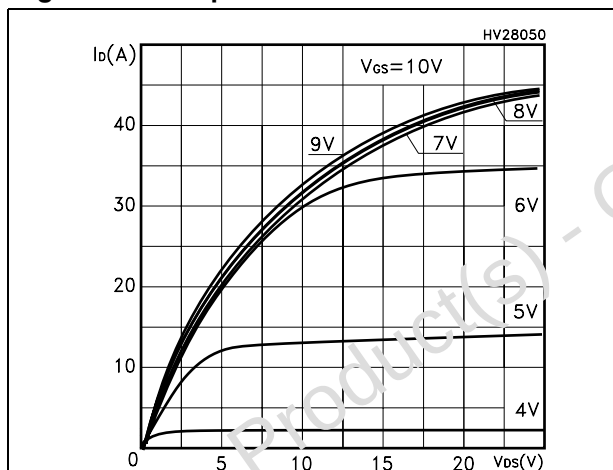


Figure 5. Transfer characteristics

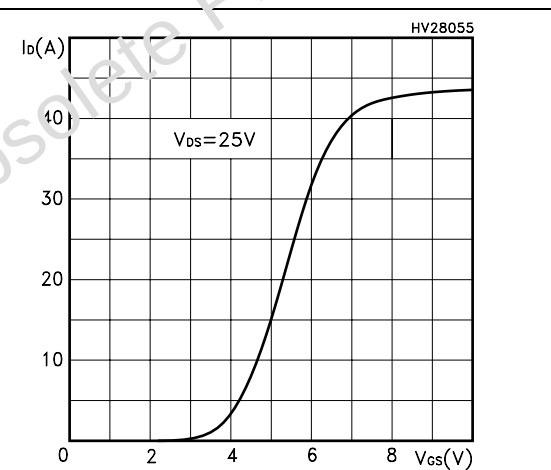


Figure 6. Transconductance

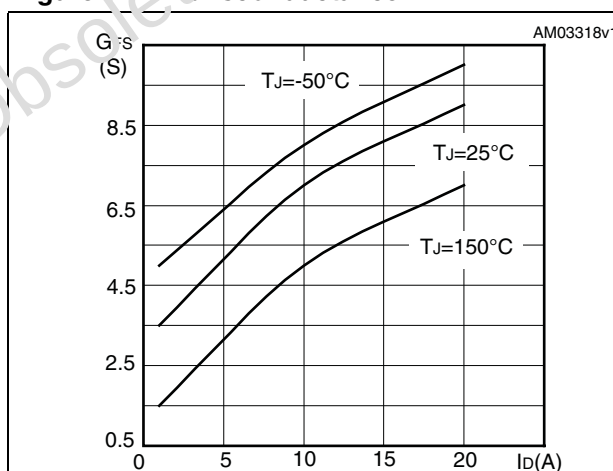


Figure 7. Static drain-source on resistance

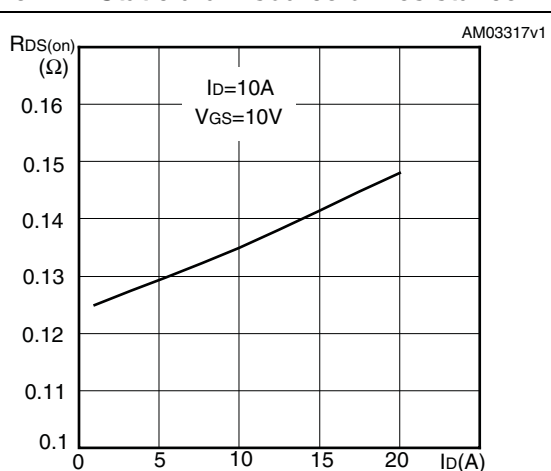
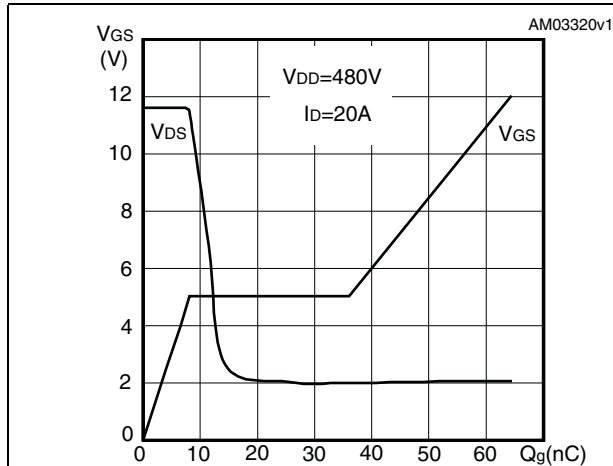
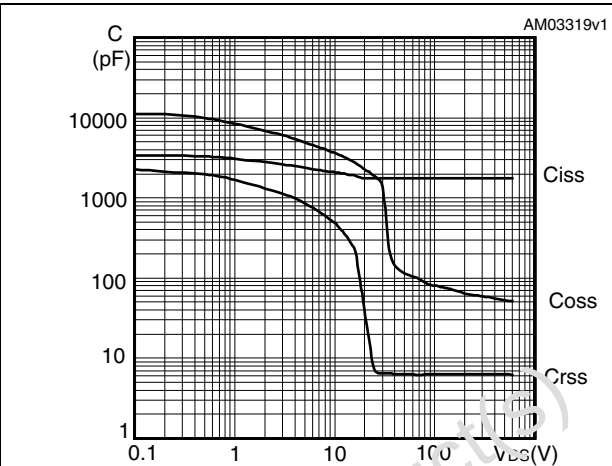
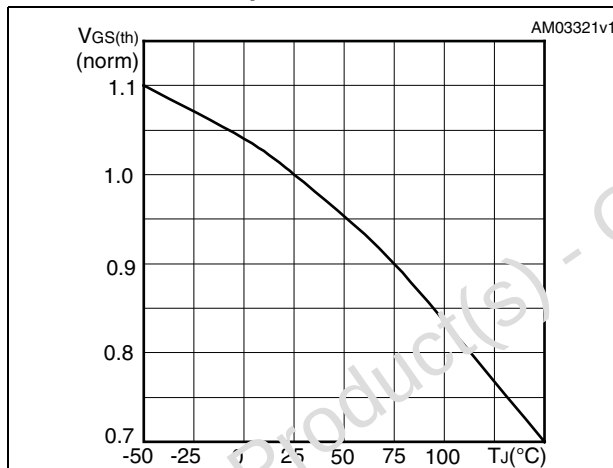
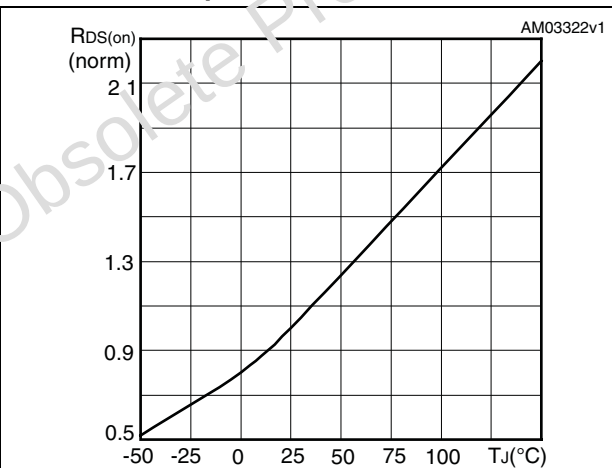
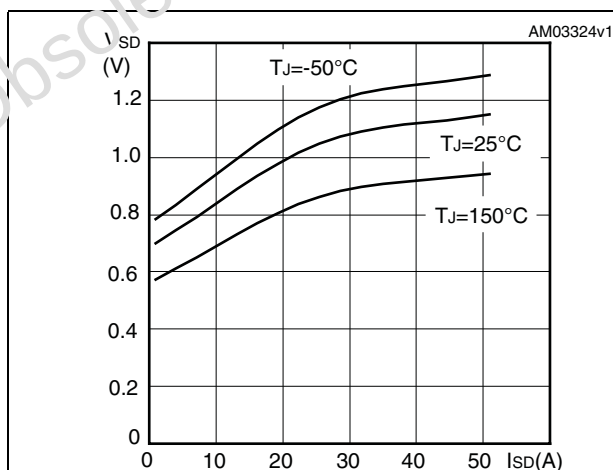
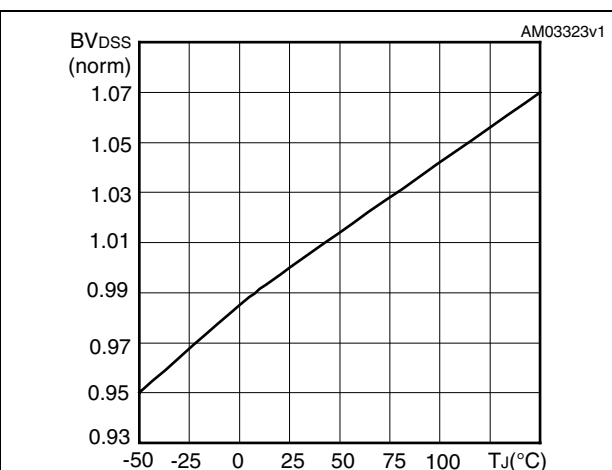


Figure 8. Gate charge vs gate-source voltage**Figure 9. Capacitance variations****Figure 10. Normalized gate threshold voltage vs temperature****Figure 11. Normalized on resistance vs temperature****Figure 12. Source-drain diode forward characteristics****Figure 13. Normalized BVDS vs temperature**

3 Test circuits

Figure 14. Switching times test circuit for resistive load

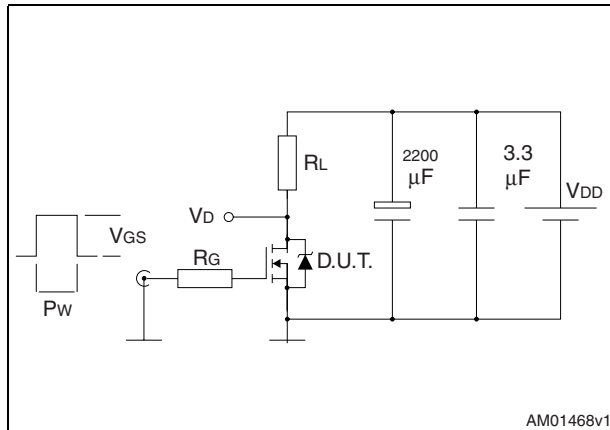


Figure 15. Gate charge test circuit

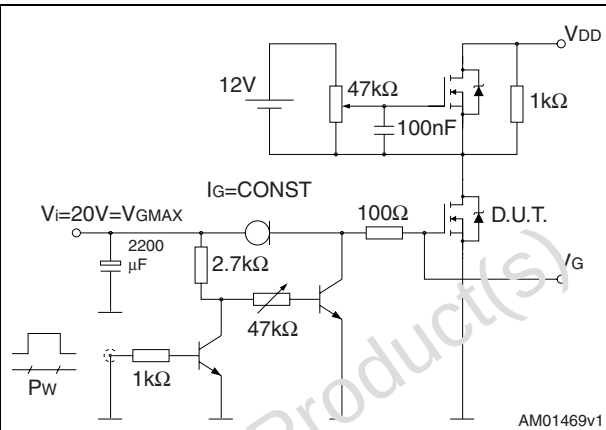


Figure 16. Test circuit for inductive load switching and diode recovery times

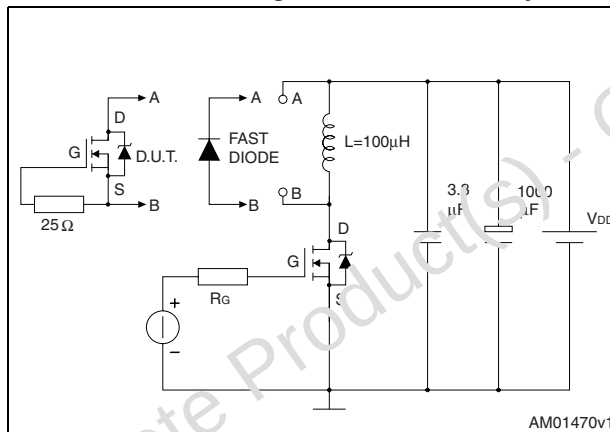


Figure 17. Unclamped inductive load test circuit

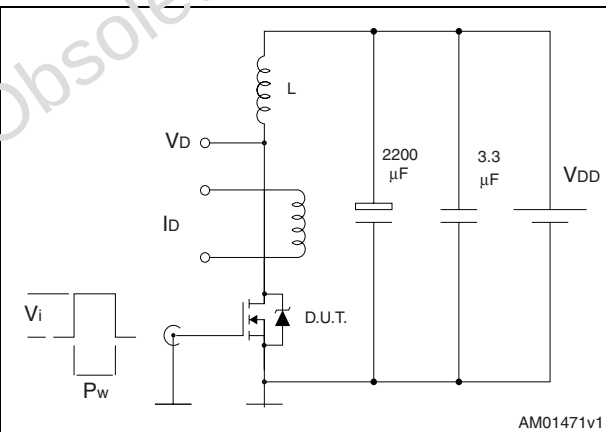


Figure 18. Unclamped inductive waveform

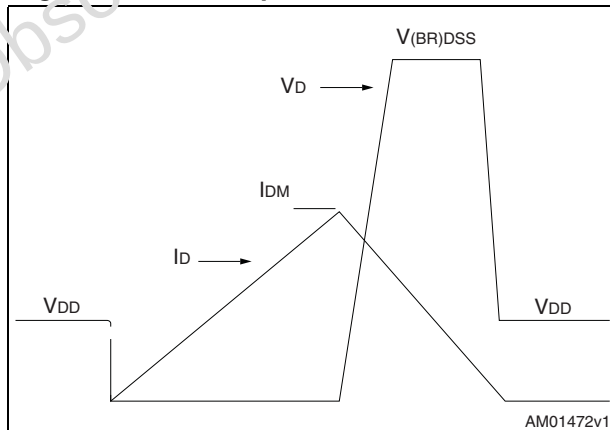
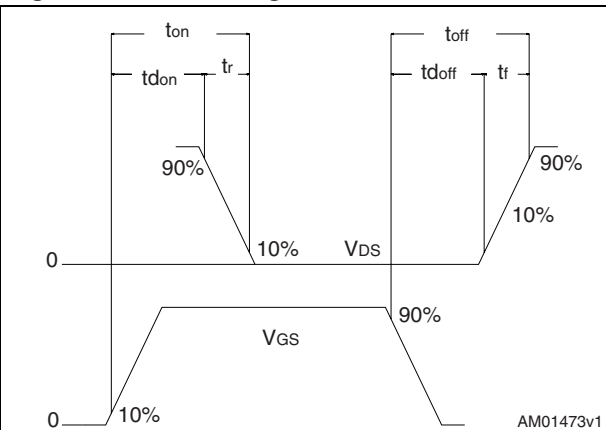


Figure 19. Switching time waveform



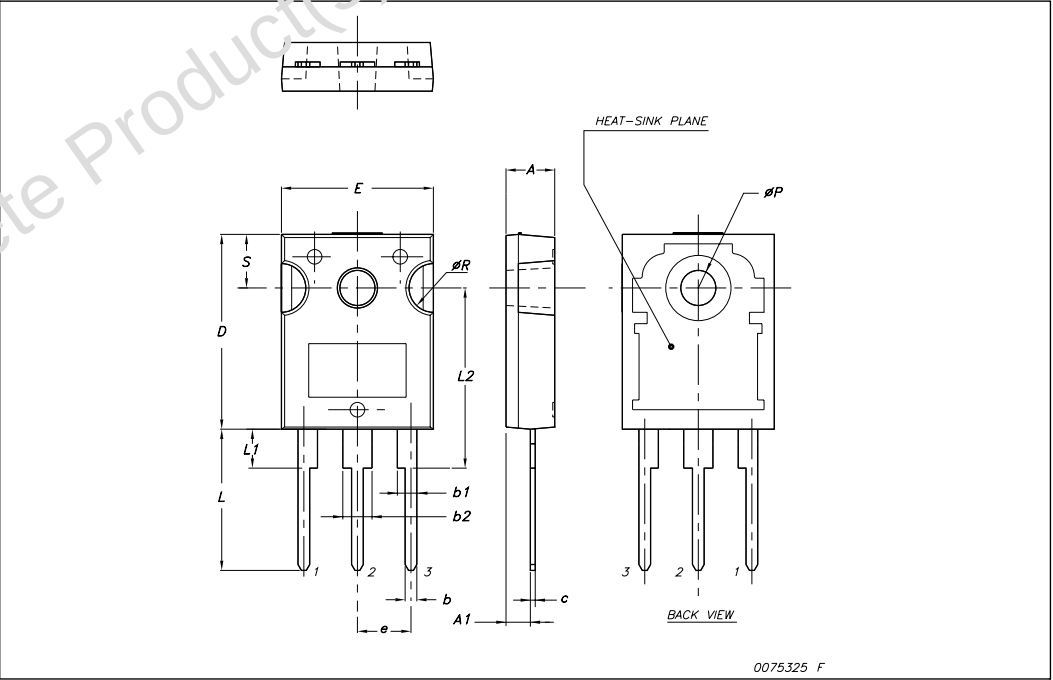
4 Package mechanical data

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.

Obsolete Product(s) - Obsolete Product(s)

TO-247 Mechanical data

Dim.	mm.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
06-Oct-2009	1	First release

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