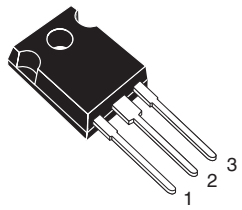
STW19NM60N

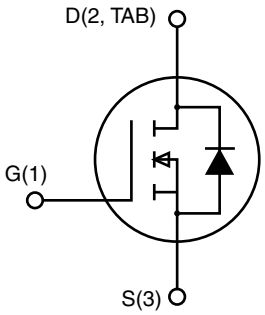
Automotive-grade N-channel 600 V, 0.26 Ω typ., 13 A MDmesh™ II Power MOSFET in a TO-247 package

Datasheet - production data



TO-247

Figure 1. Internal schematic diagram



Features

Order code	V_{DS} ($@T_{jmax}$)	$R_{DS(on)}$ max.	I_D	P_{TOT}
STW19NM60N	650 V	0.285 Ω	13 A	110 W

- Designed for automotive applications and AEC-Q101 qualified
- 100% avalanche tested
- Low input capacitance 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.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STW19NM60N	19NM60N	TO-247	Tube

This is information on a product in full production. www.st.com

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2 Electrical characteristics 4

2.1 Electrical characteristics (curves) 6

3 Test circuits 8

4 Package mechanical data 9

5 Revision history 12

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate- source voltage	± 25	
I_D	Drain current (continuous) at T_C = 25 °C	13	A
I_D	Drain current (continuous) at T_C = 100 °C	8.2	A
I_{DM} (1)	Drain current (pulsed)	52	A
P_{TOT}	Total dissipation at T_C = 25 °C	110	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	4	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	350	mJ
dv/dt(2)	Peak diode recovery voltage slope	15	V/ns
T_J	Operating junction temperature	-55 to 150	°C
T_{stg}	Storage temperature		°C

1. Pulse width limited by safe operating area.
2. I_{SD} ≤ 13 A, di/dt ≤ 400 A/µs, V_{DD} ≤ 80 % $V_{(BR)DSS}$, $V_{DS(peak)}$ ≤ $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.14	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-amb max	50	°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	I_D = 1 mA, V_{GS}= 0	600			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 600 V			1	µA
		V_{DS} = 600 V, T_J=125 °C			10	µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±25 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=6.5 A		0.260	0.285	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f =1 MHz, V_{GS} = 0	-	1000	-	pF
C_{oss}	Output capacitance		-	60	-	pF
C_{rss}	Reverse transfer capacitance		-	3	-	pF
$C_{oss\ eq.}$ (1)	Output equivalent capacitance	V_{DS} = 0, to 480 V, V_{GS}=0	-	225	-	pF
R_g	Intrinsic resistance	f=1 MHz open drain	-	3.5	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 13 A V_{GS} = 10 V *(see Figure 15)*	-	35	-	nC
Q_{gs}	Gate-source charge		-	6	-	nC
Q_{gd}	Gate-drain charge		-	20	-	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_{DS}.

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 6.5 A, R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 14)*	-	12	-	ns
t_r	Rise time		-	15	-	ns
$t_{d(off)}$	Turn-off delay time		-	55	-	ns
t_f	Fall time		-	25	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		13	A
I_{SDM} (1)	Source-drain current (pulsed)		-		52	A
V_{SD} (2)	Forward on voltage	I_{SD} = 13 A, V_{GS}=0	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} =13 A, di/dt =100 A/µs, V_{DD} = 60 V *(see Figure 16)*	-	300		ns
Q_{rr}	Reverse recovery charge		-	4.0		µC
I_{RRM}	Reverse recovery current		-	25		A
t_{rr}	Reverse recovery time	V_{DD} = 60 V di/dt =100 A/µs, I_{SD} = 13 A Tj = 150°C *(see Figure 16)*	-	360		ns
Q_{rr}	Reverse recovery charge		-	4.5		µC
I_{RRM}	Reverse recovery current		-	25		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

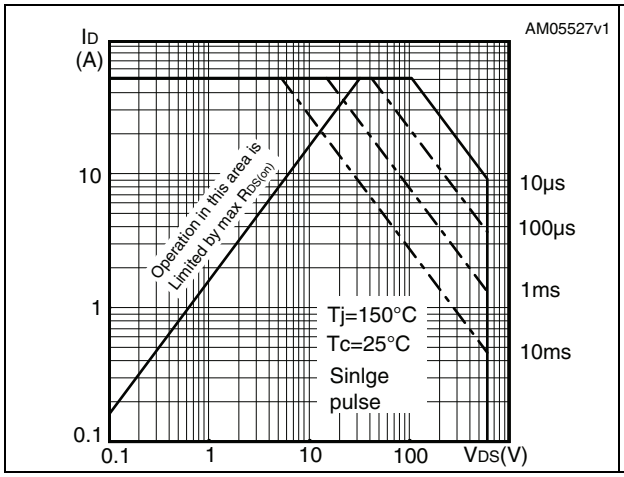


Figure 3. Thermal impedance

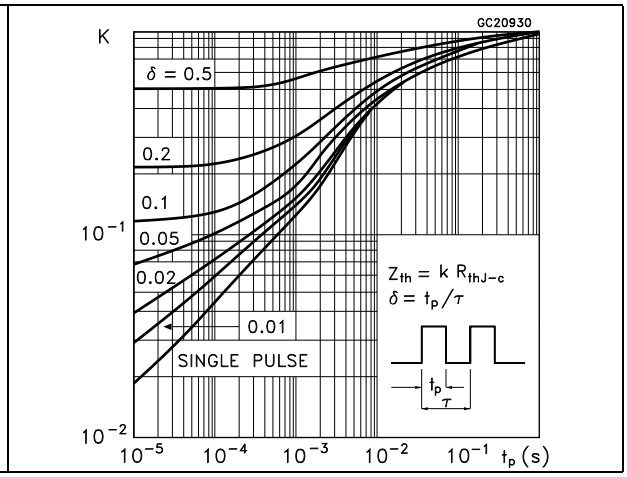


Figure 4. Output characteristics

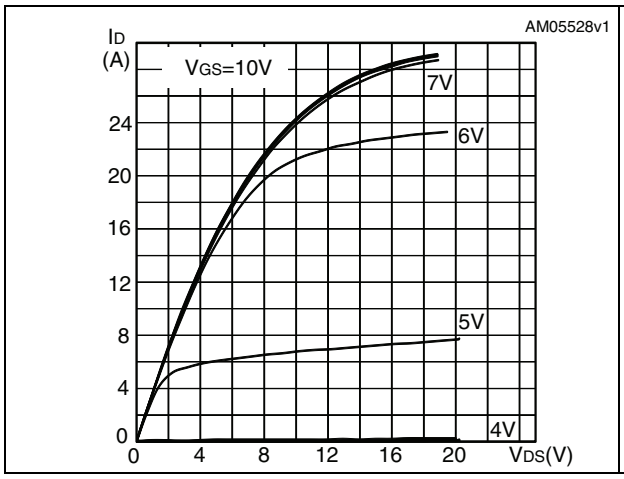


Figure 5. Transfer characteristics

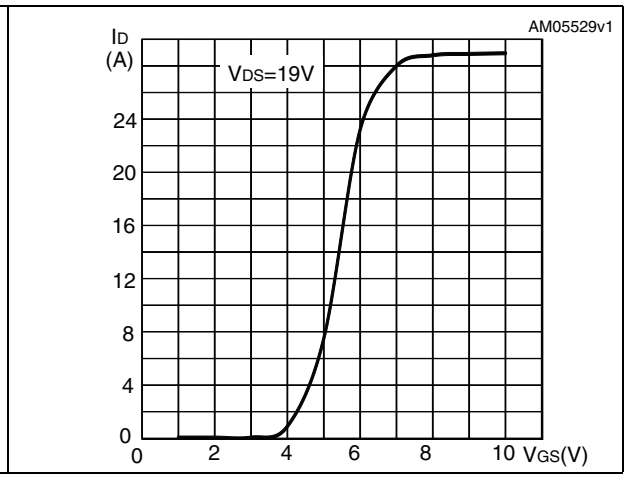


Figure 6. Static drain-source on-resistance

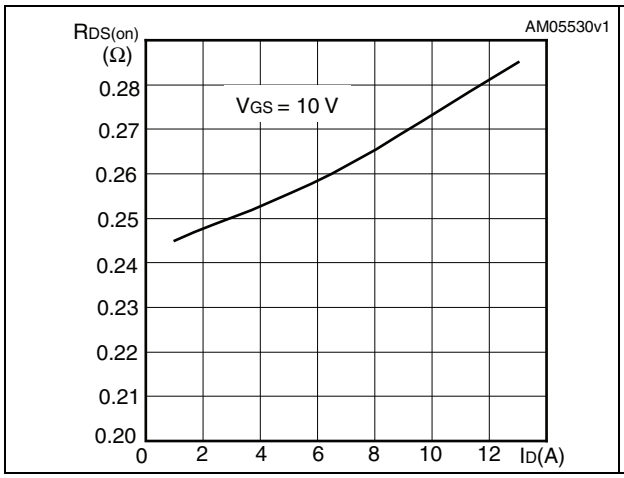


Figure 7. Gate charge vs gate-source voltage

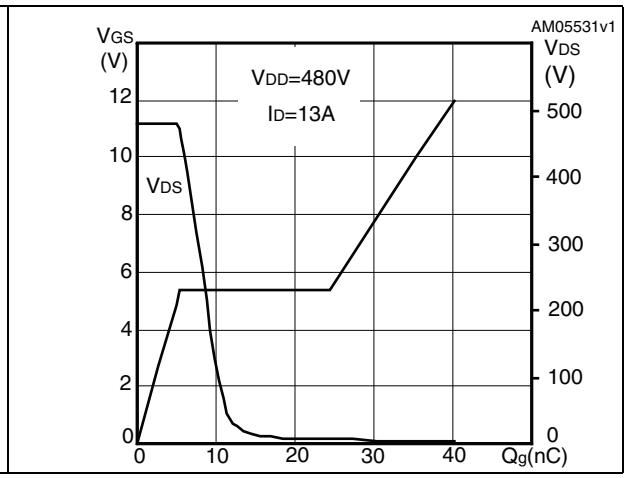


Figure 8. Capacitance variations

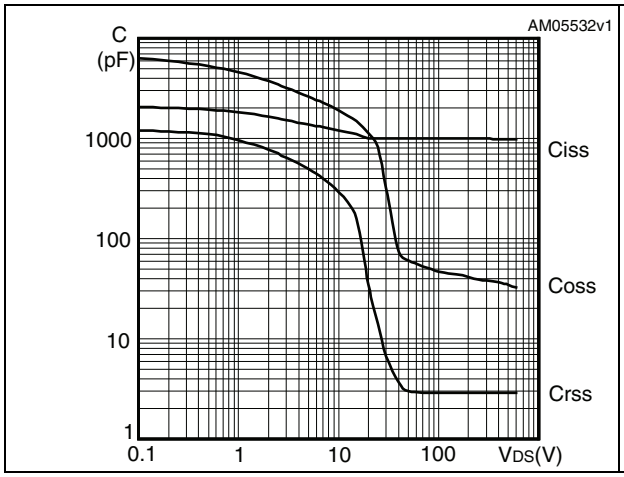


Figure 9. Output capacitance stored energy

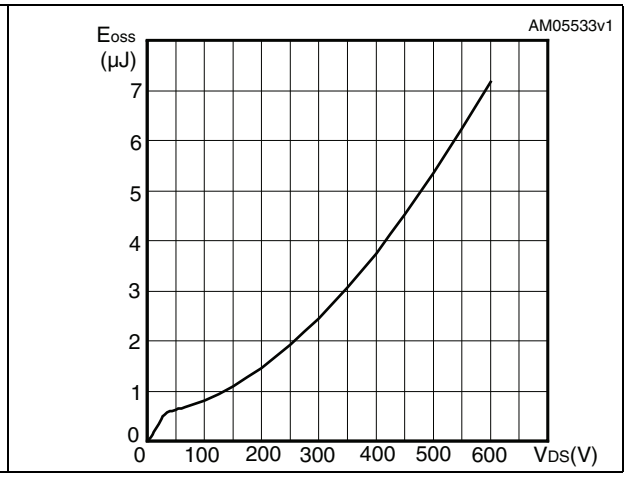


Figure 10. Normalized gate threshold voltage vs temperature

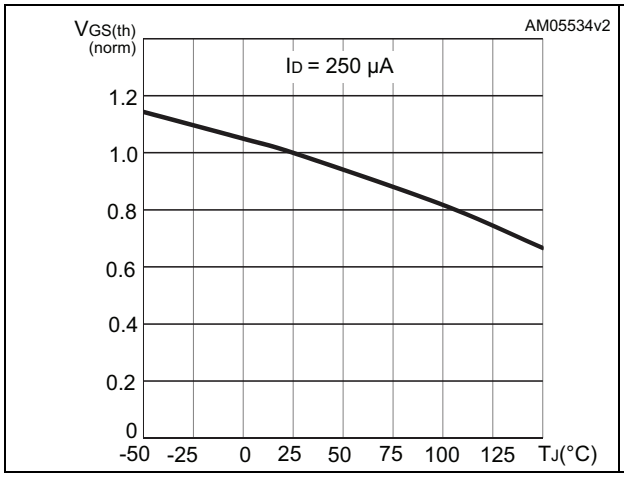


Figure 11. Normalized on-resistance vs temperature

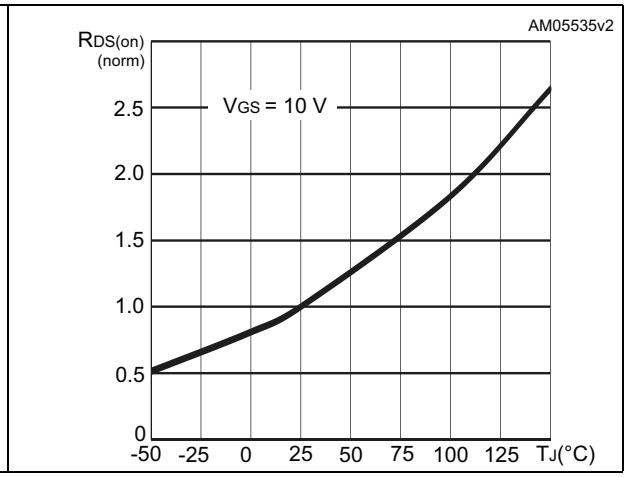


Figure 12. Normalized V_{DS} vs temperature

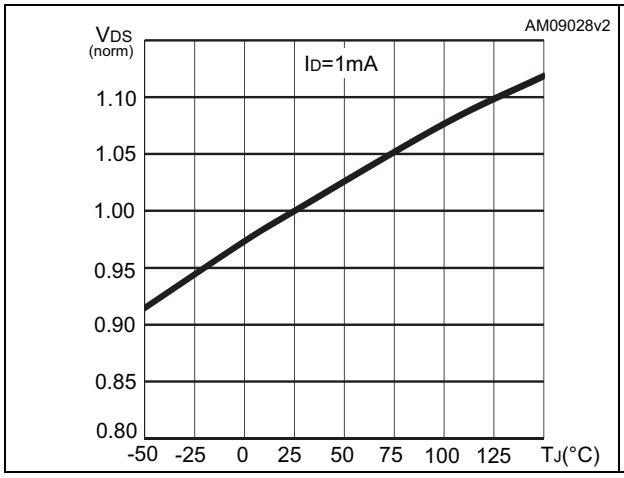
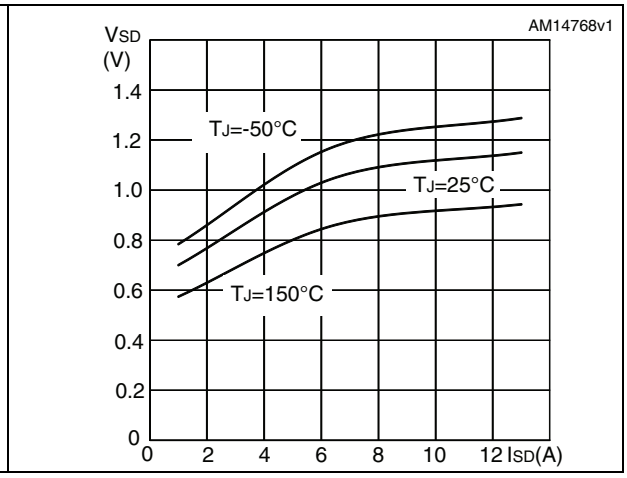


Figure 13. Source-drain diode forward vs temperature



3 Test circuits

Figure 14. Switching times test circuit for resistive load

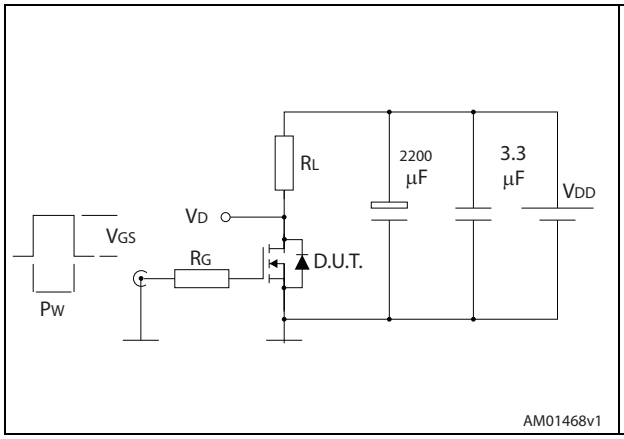


Figure 15. Gate charge test circuit

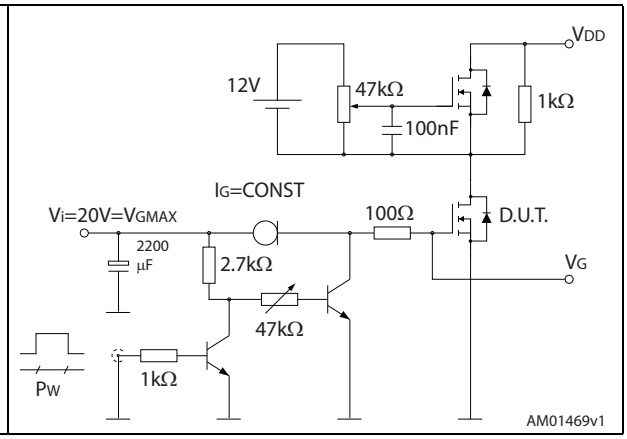


Figure 16. Test circuit for inductive load switching and diode recovery times

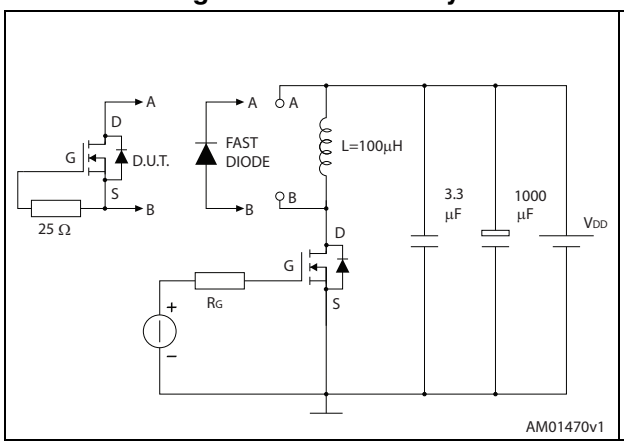


Figure 17. Unclamped inductive load test circuit

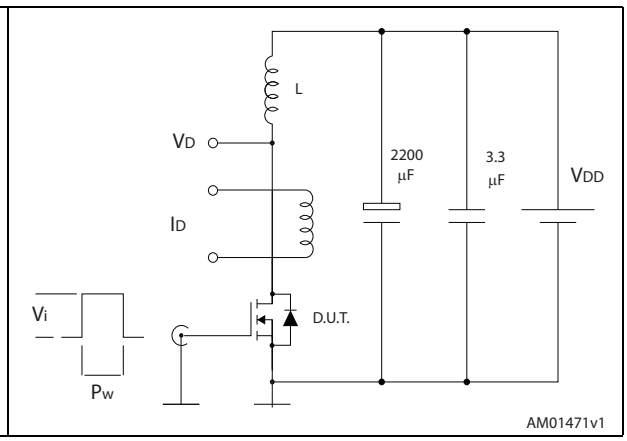


Figure 18. Unclamped inductive waveform

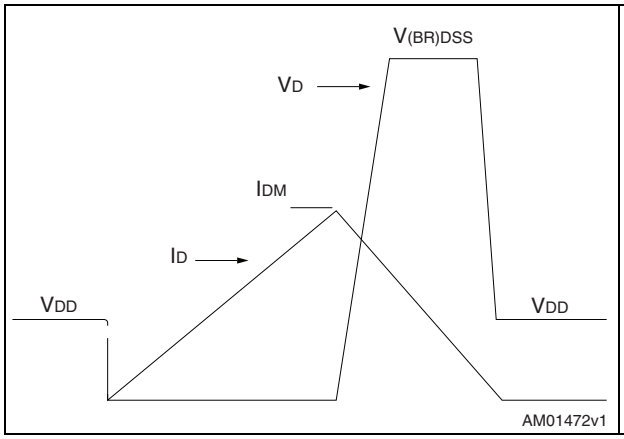
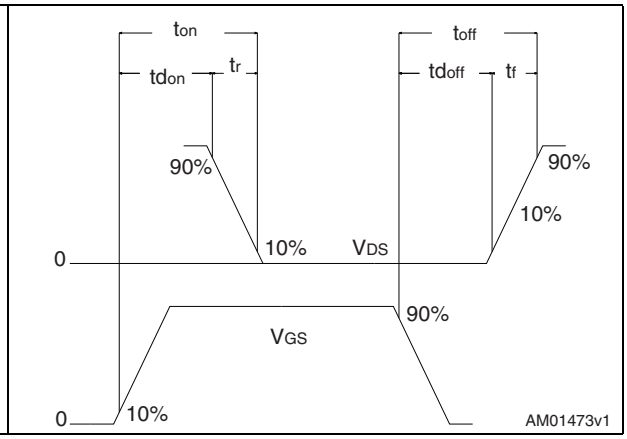


Figure 19. Switching time waveform



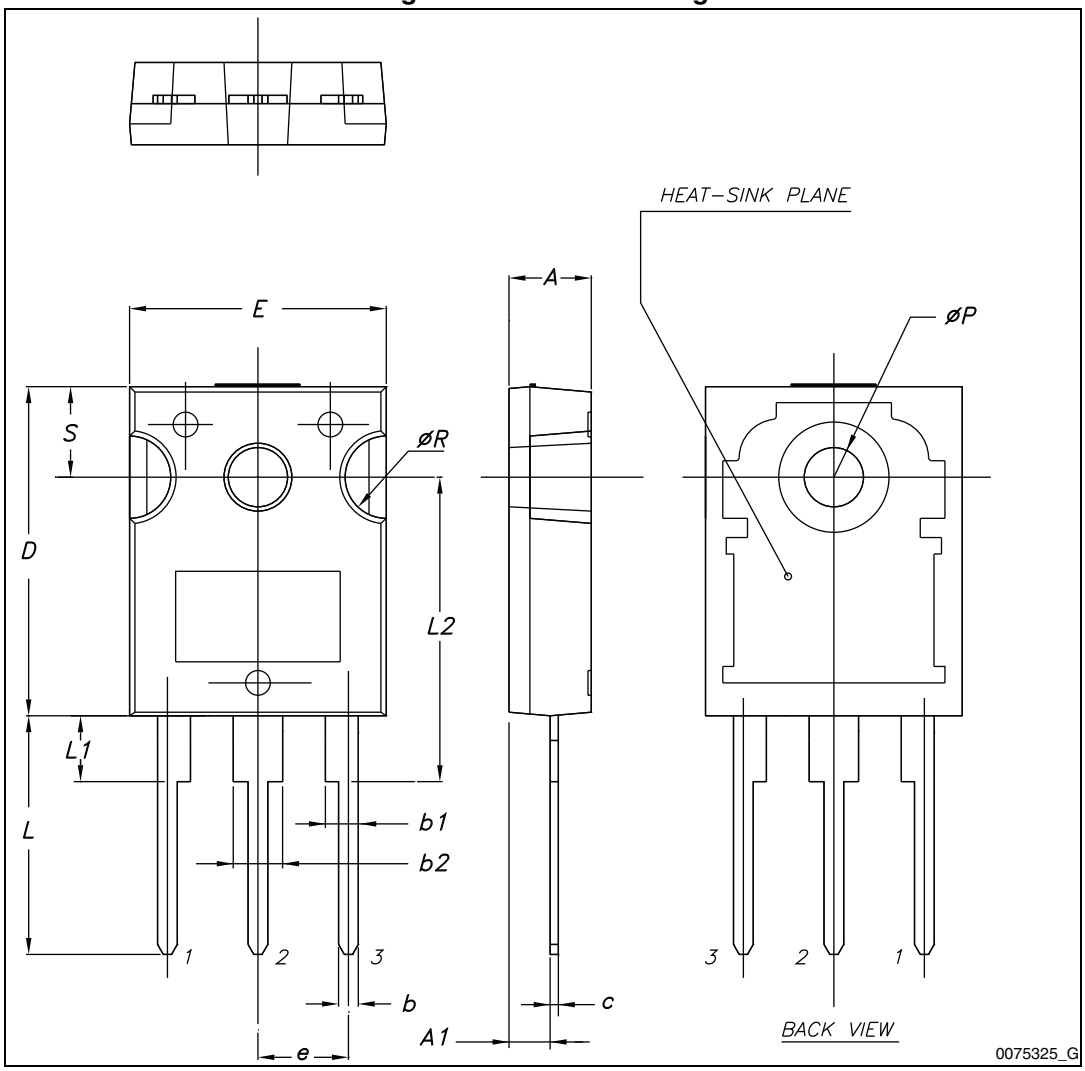
4 Package mechanical data

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.

Table 8. 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	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

Figure 20. TO-247 drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
21-Mar-2013	1	Initial release.
24-Oct-2013	2	– Modified: title, features and applications – Minor text changes

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