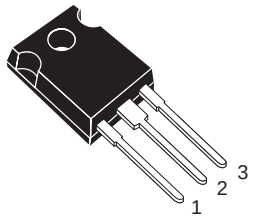
STW62N65M5

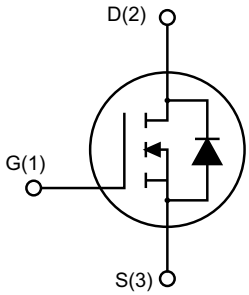
Automotive-grade N-channel 650 V, 0.041 Ω typ., 46 A MDmesh™ M5 Power MOSFET in a TO-247 package

Datasheet - production data



TO-247

Figure 1. Internal schematic diagram



Features

Order code	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max	I_D
STW62N65M5	710 V	0.049 Ω	46 A

- Designed for automotive applications and AEC-Q101 qualified
- Extremely low $R_{DS(on)}$
- Low gate charge and input capacitance
- Excellent switching performance
- 100% avalanche tested

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET based on MDmesh™ M5 innovative vertical process technology combined with the well-known PowerMESH™ horizontal layout. The resulting product offers extremely low on-resistance, making it particularly suitable for applications requiring high power and superior efficiency.

Table 1. Device summary

Order code	Marking	Package	Packaging
STW62N65M5	62N65M5	TO-247	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at T_C = 25 °C	46	A
I_D	Drain current (continuous) at T_C = 100 °C	26	A
I_{DM} (1)	Drain current (pulsed)	184	A
P_{TOT}	Total dissipation at T_C = 25 °C	330	W
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
dv/dt (3)	MOSFET dv/dt ruggedness	50	V/ns
T_{stg}	Storage temperature	- 55 to 150	°C
T_j	Max. operating junction temperature	150	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 46$ A, di/dt ≤ 200 A/µs; $V_{DS\ peak} < V_{(BR)DSS}$, V_{DD}=400 V
3. $V_{DS} \leq 520$ V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.38	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	50	°C/W

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	12	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	1400	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 5. 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	650			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS} = 650 V			1	µA
		V_{GS} = 0, V_{DS} = 650 V, T_C=125 °C			100	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	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 23 A		0.041	0.049	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0, V_{DS} = 100 V, f = 1 MHz,	-	6420	-	pF
C_{oss}	Output capacitance		-	170	-	pF
C_{rss}	Reverse transfer capacitance		-	11	-	pF
$C_{o(tr)}$(1)	Equivalent capacitance time related	V_{GS} = 0, V_{DS} = 0 to 520 V	-	536	-	pF
$C_{o(er)}$(2)	Equivalent capacitance energy related		-	146	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0	-	1.2	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 23 A, V_{GS} = 10 V (see *Figure 16*)	-	142	-	nC
Q_{gs}	Gate-source charge		-	34	-	nC
Q_{gd}	Gate-drain charge		-	58	-	nC

1. Time related is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}
2. Energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(V)}$	Voltage delay time	V_{DD} = 400 V, I_D = 30 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 17* and *Figure 20*)	-	101	-	ns
$t_{r(V)}$	Voltage rise time		-	11	-	ns
$t_{c(off)}$	Crossing time		-	14	-	ns
$t_{f(i)}$	Current fall time		-	8	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		46	A
I_{SDM} (1)	Source-drain current (pulsed)				184	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0, I_{SD} = 46 A	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 46 A, di/dt = 100 A/µs V_{DD} = 100 V (see *Figure 17*)	-	448		ns
Q_{rr}	Reverse recovery charge		-	10		µC
I_{RRM}	Reverse recovery current		-	43		A
t_{rr}	Reverse recovery time	I_{SD} = 46 A, di/dt = 100 A/µs V_{DD} = 100 V, T_j = 150 °C (see *Figure 17*)	-	548		ns
Q_{rr}	Reverse recovery charge		-	14		µC
I_{RRM}	Reverse recovery current		-	51		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

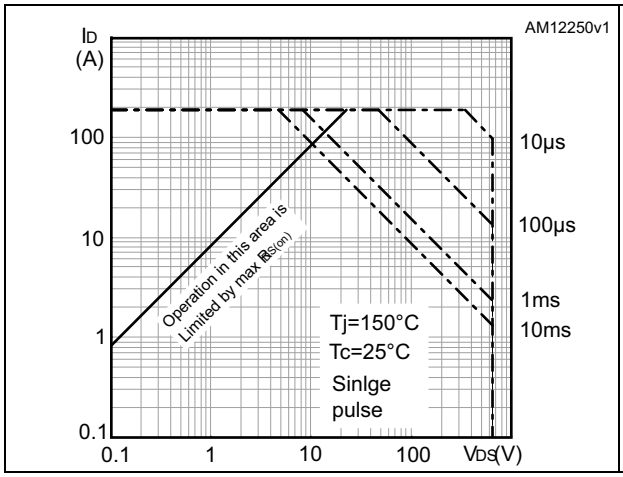


Figure 3. Thermal impedance

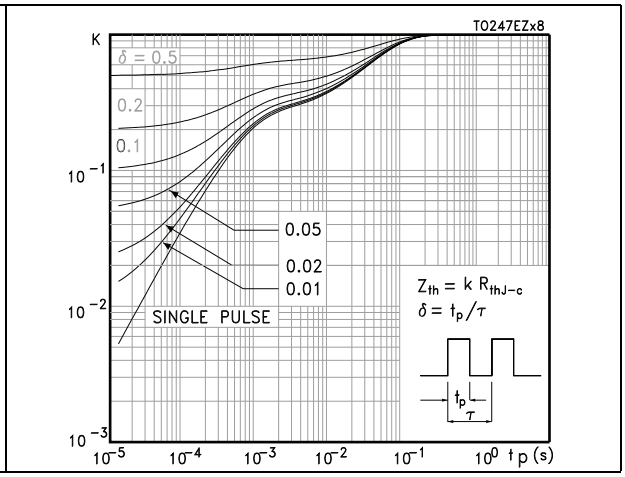


Figure 4. Output characteristics

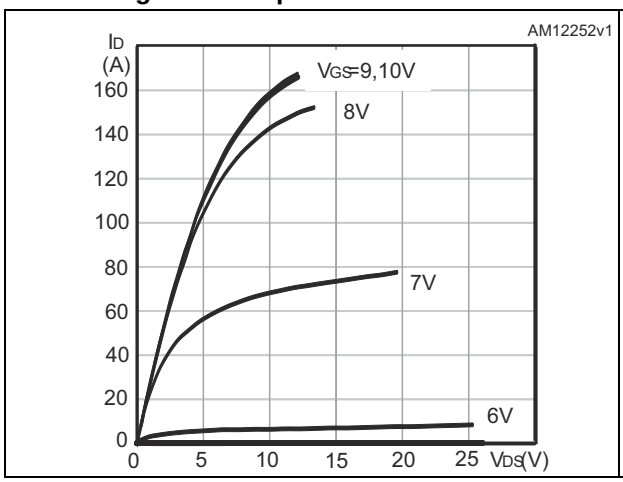


Figure 5. Transfer characteristics

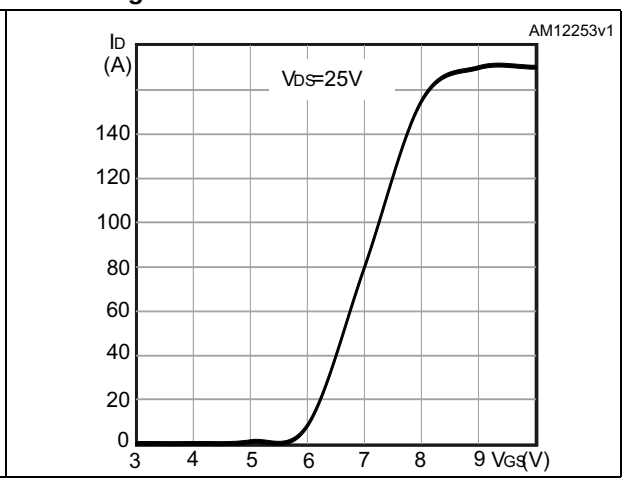


Figure 6. Gate charge vs gate-source voltage

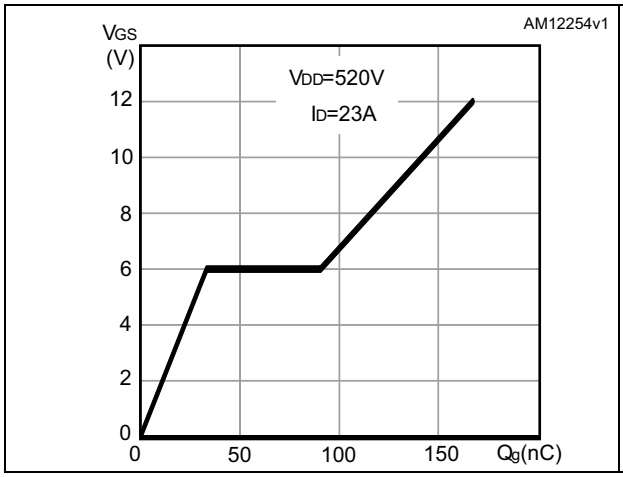


Figure 7. Static drain-source on-resistance

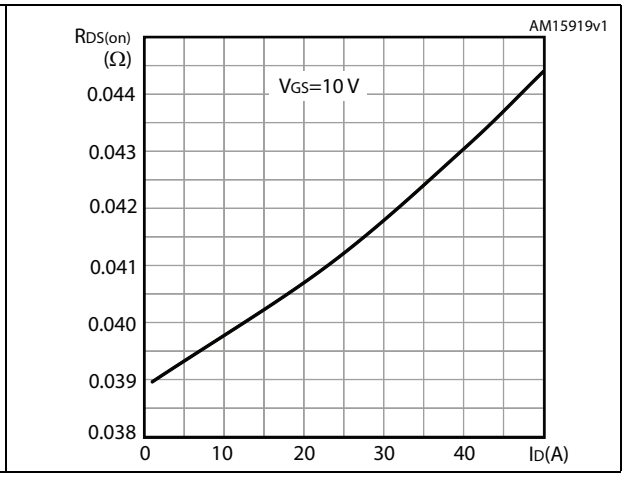


Figure 8. Capacitance variations

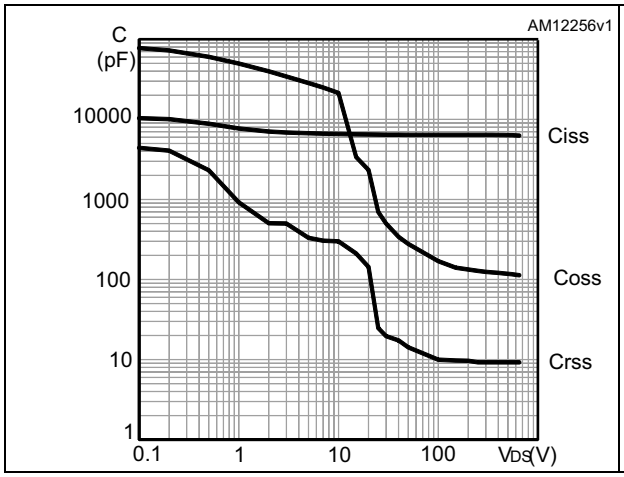


Figure 9. Output capacitance stored energy

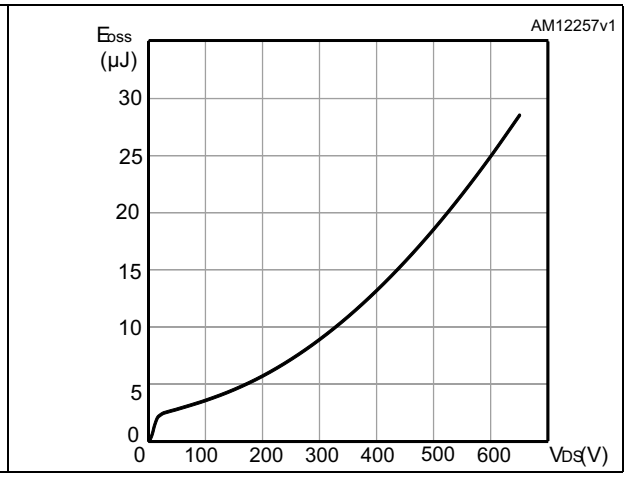


Figure 10. Normalized gate threshold voltage vs temperature

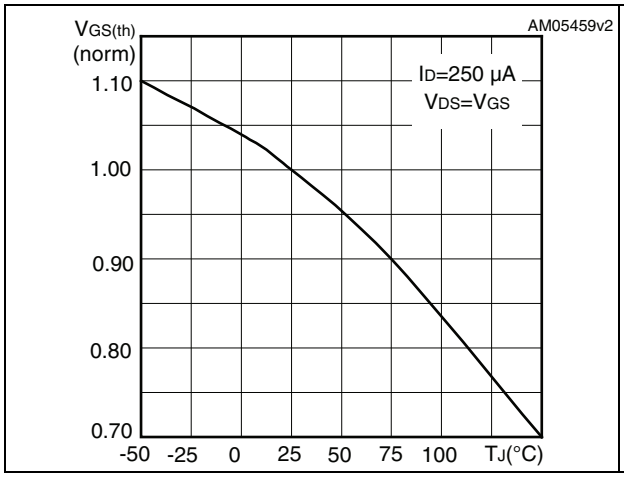


Figure 11. Normalized on-resistance vs temperature

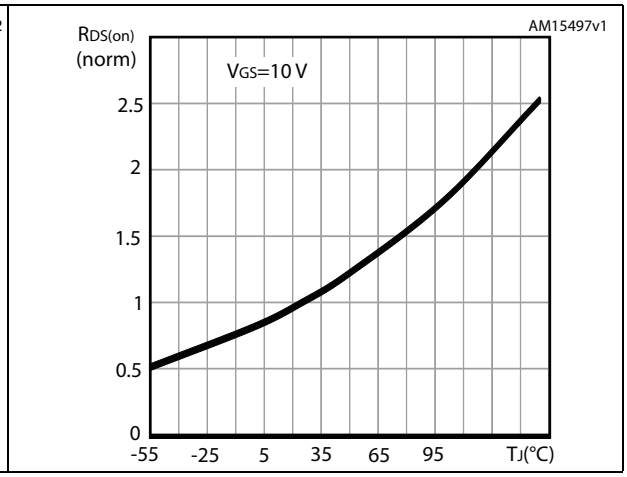


Figure 12. Source-drain diode forward characteristics

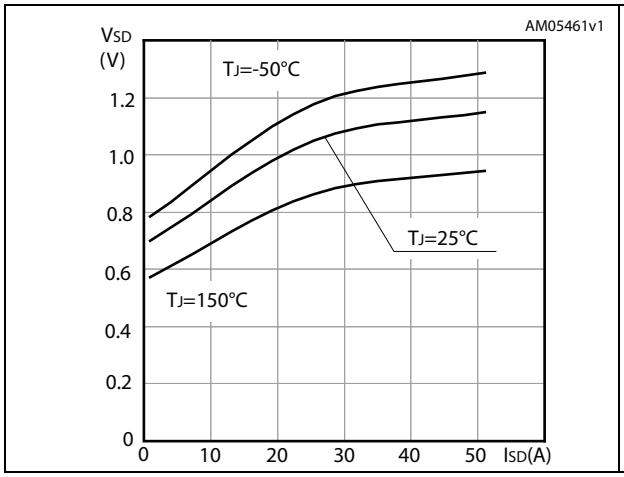


Figure 13. Normalized $V_{(BR)DSS}$ vs temperature

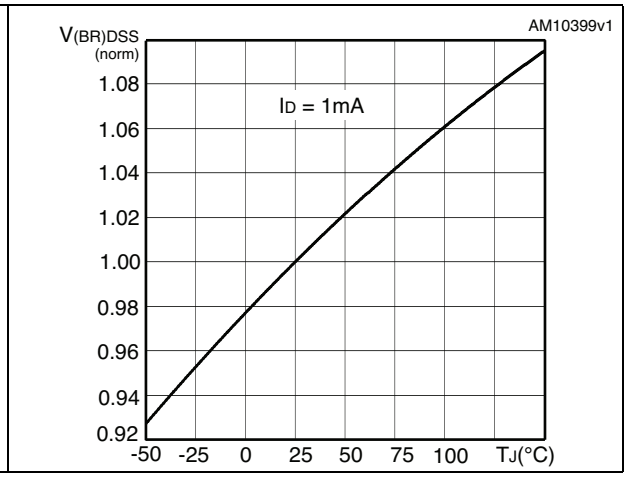
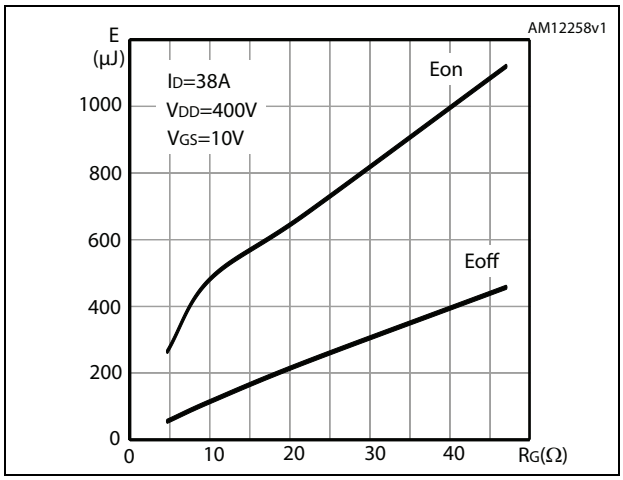


Figure 14. Switching losses vs gate resistance(1)



1. Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 15. Switching times test circuit for resistive load

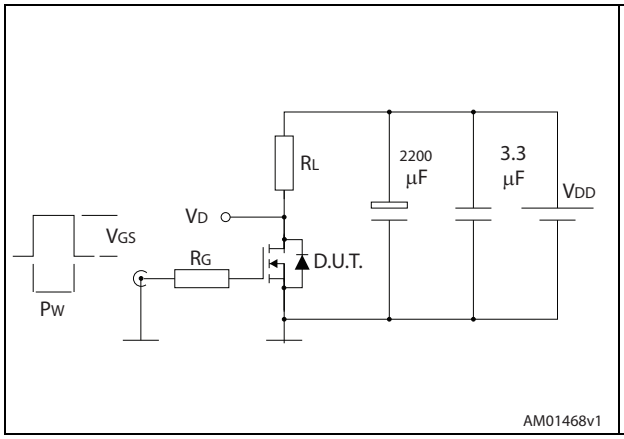


Figure 16. Gate charge test circuit

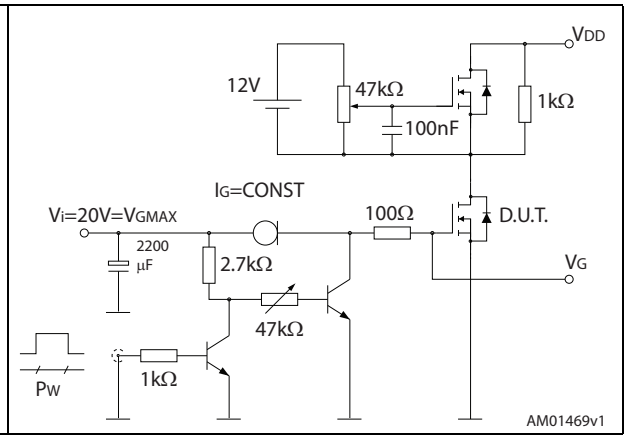


Figure 17. Test circuit for inductive load switching and diode recovery times

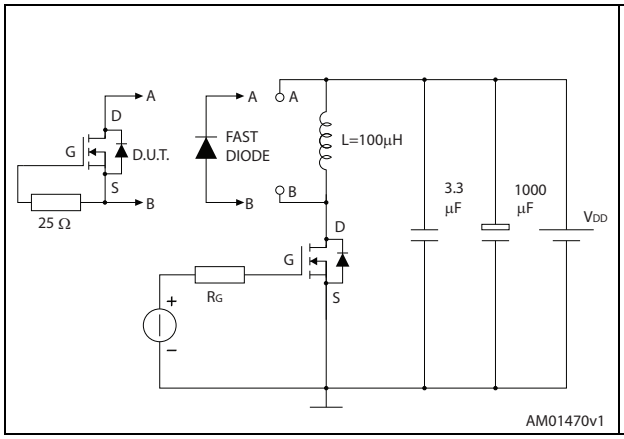


Figure 18. Unclamped inductive load test circuit

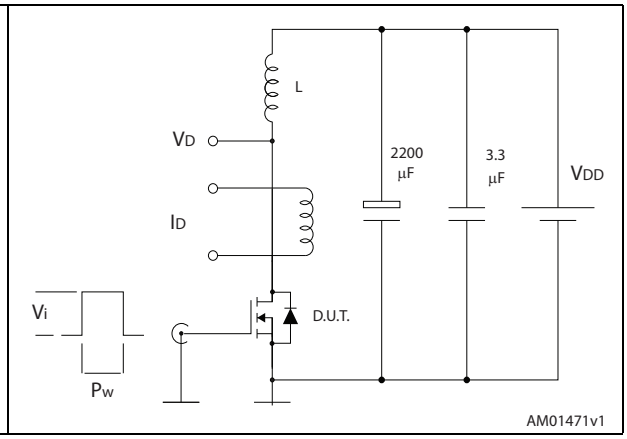


Figure 19. Unclamped inductive waveform

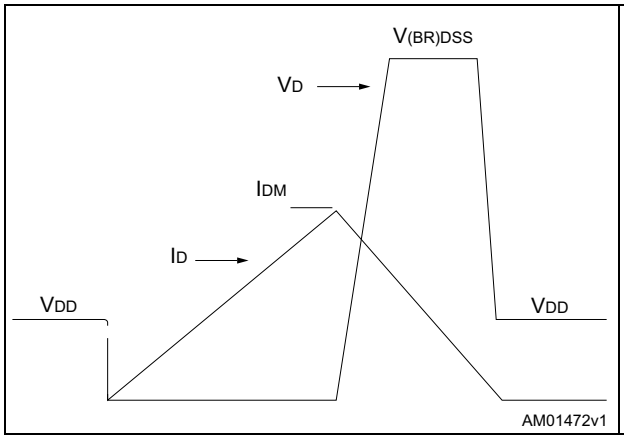
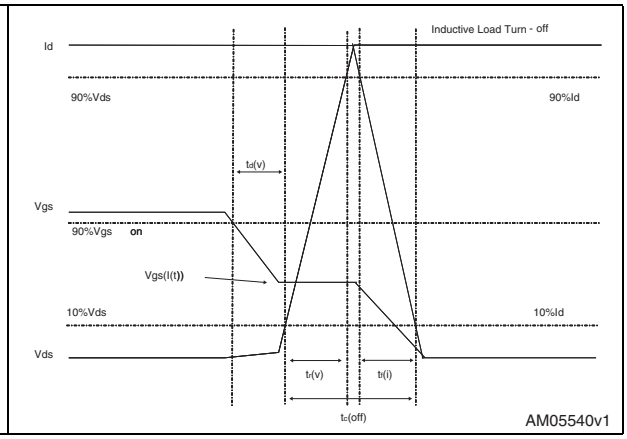


Figure 20. Switching time waveform



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.

Figure 21. TO-247 drawing

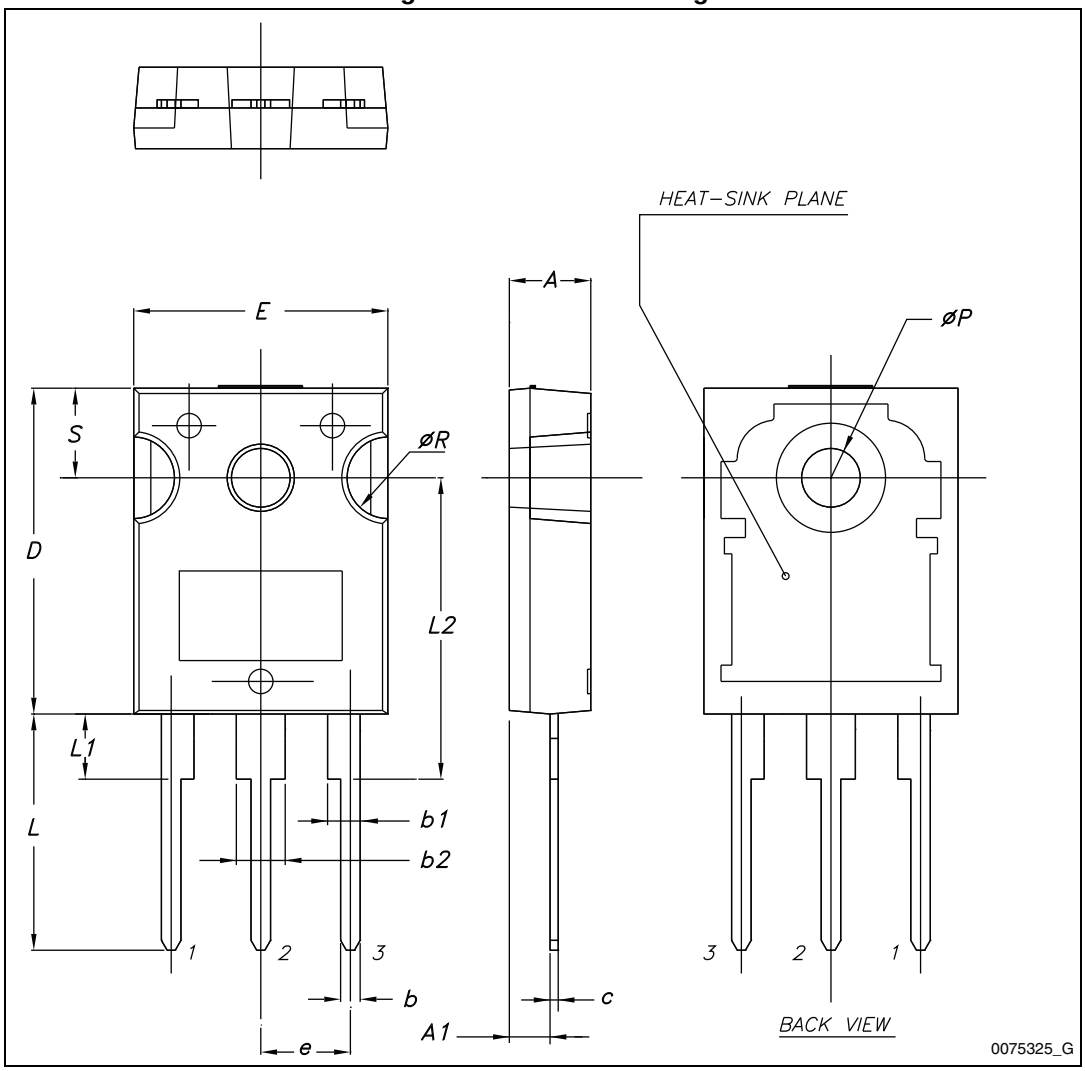


Table 9. TO-247 mechanical data

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

5 Revision history

Table 10. Document revision history

Date	Revision	Changes
19-Jun-2013	1	First release.
23-May-2014	2	– Modified: *Features* in cover page – Minor text changes
25-Jul-2014	3	– Modified: note *2* in *Table 2* – Modified: symbol, parameters, $t_{c(off)}$ and $t_{f(i)}$ in *Table 7* – Minor text changes