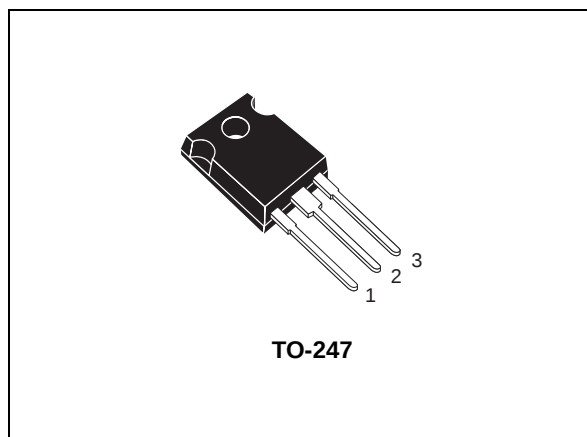


Automotive-grade N-channel 650 V, 0.041 Ω typ., 46 A MDmesh™ M5 Power MOSFET in a TO-247 package

Datasheet - production data



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.

Figure 1. Internal schematic diagram

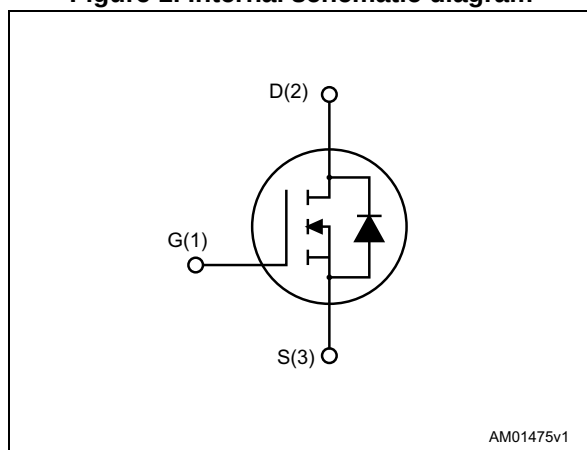


Table 1. Device summary

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 $T_C = 25\text{ }^{\circ}\text{C}$	46	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	26	A
$I_{DM}^{(1)}$	Drain current (pulsed)	184	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	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	$^{\circ}\text{C}$
T_j	Max. operating junction temperature	150	$^{\circ}\text{C}$

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

Table 3. Thermal data

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

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 $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	1400	mJ

2 Electrical characteristics

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

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 650\text{ V}$			1	μA
		$V_{GS} = 0, V_{DS} = 650\text{ V}, T_C = 125\text{ }^{\circ}\text{C}$			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 25\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 23\text{ A}$		0.041	0.049	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{GS} = 0, V_{DS} = 100\text{ V}, f = 1\text{ MHz},$	-	6420	-	pF
C_{oss}	Output capacitance		-	170	-	pF
C_{rss}	Reverse transfer capacitance		-	11	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{GS} = 0, V_{DS} = 0\text{ to }520\text{ V}$	-	536	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	146	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}, I_D = 0$	-	1.2	-	Ω
Q_g	Total gate charge	$V_{DD} = 520\text{ V}, I_D = 23\text{ A}, V_{GS} = 10\text{ V}$ (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	$V_{DD} = 400\text{ V}$, $I_D = 30\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (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	$V_{GS} = 0$, $I_{SD} = 46\text{ A}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 46\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see Figure 17)	-	448		ns
Q_{rr}	Reverse recovery charge		-	10		μC
I_{RRM}	Reverse recovery current		-	43		A
t_{rr}	Reverse recovery time	$I_{SD} = 46\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (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

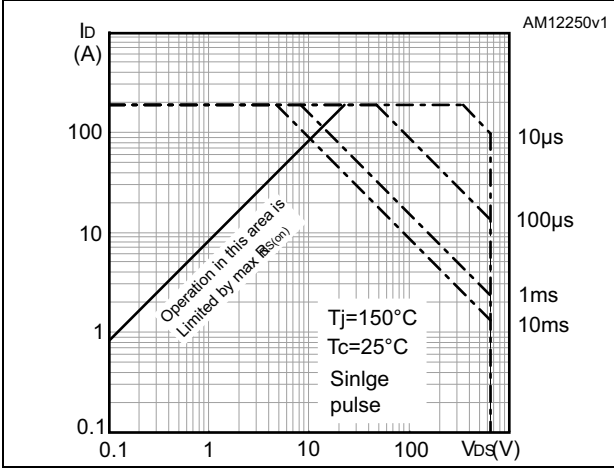


Figure 3. Thermal impedance

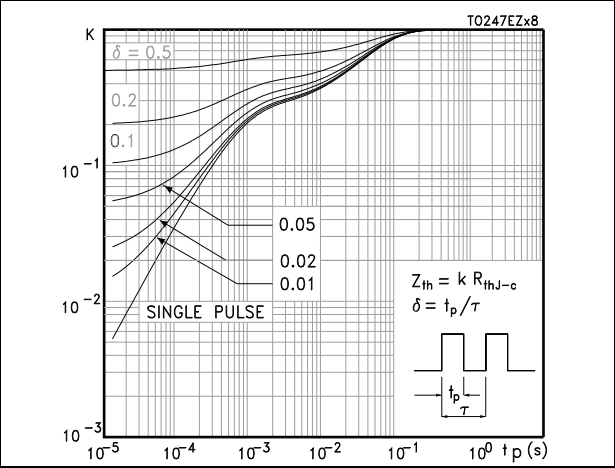


Figure 4. Output characteristics

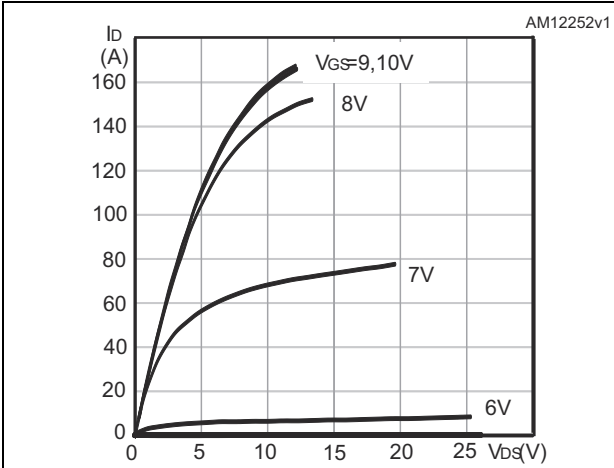


Figure 5. Transfer characteristics

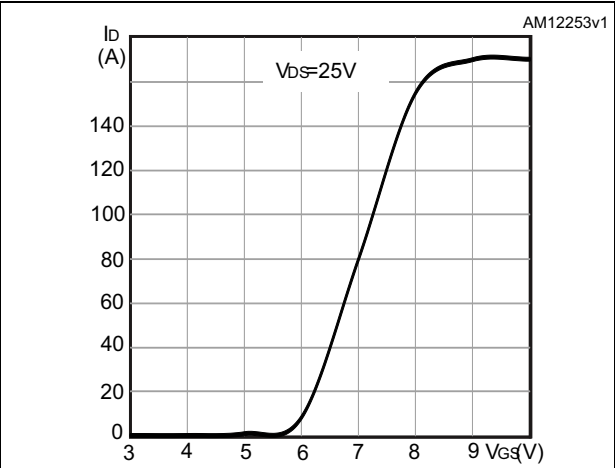


Figure 6. Gate charge vs gate-source voltage

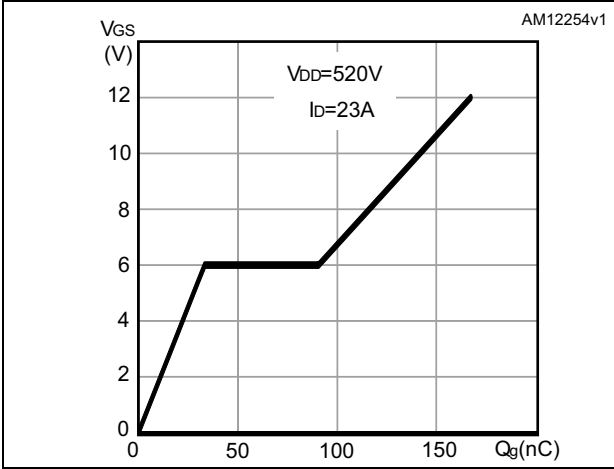


Figure 7. Static drain-source on-resistance

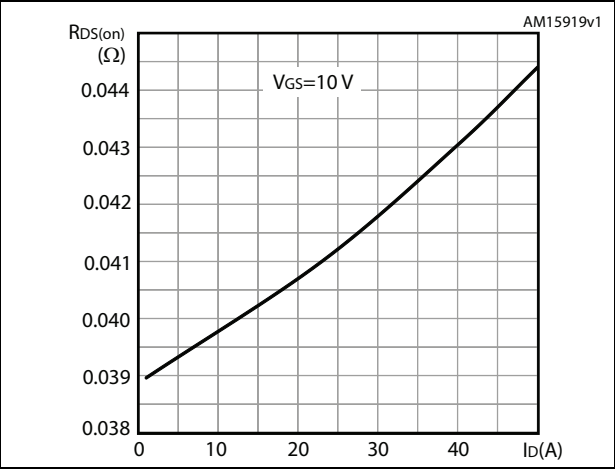


Figure 8. Capacitance variations

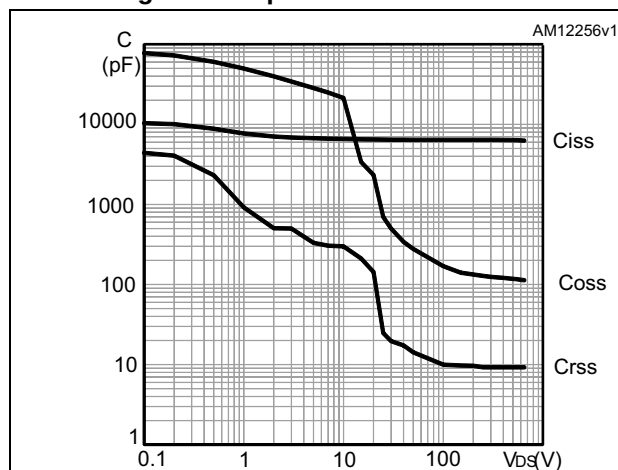


Figure 9. Output capacitance stored energy

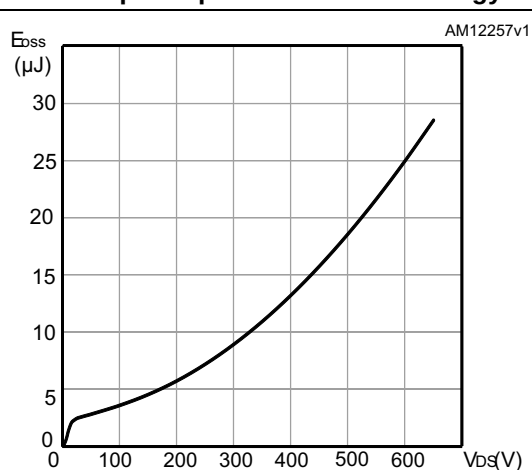


Figure 10. Normalized gate threshold voltage vs temperature

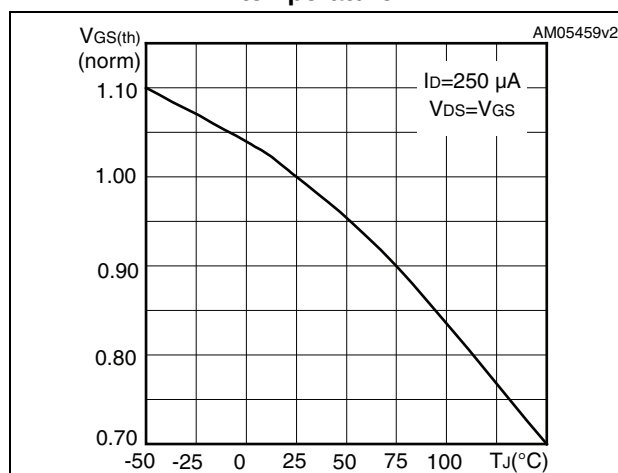


Figure 11. Normalized on-resistance vs temperature

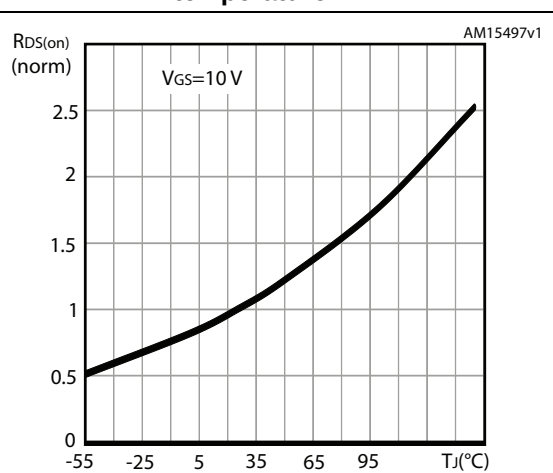


Figure 12. Source-drain diode forward characteristics

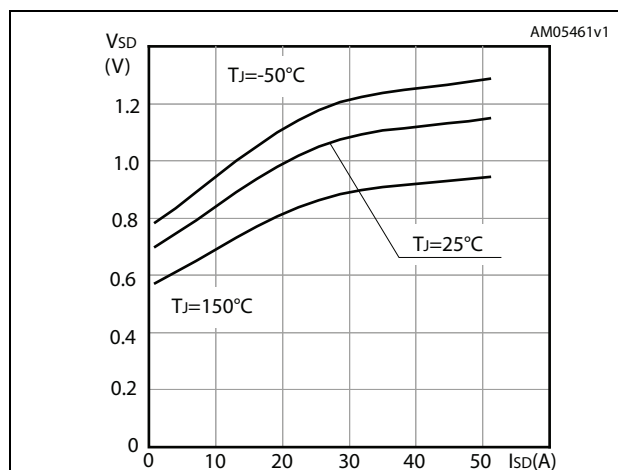
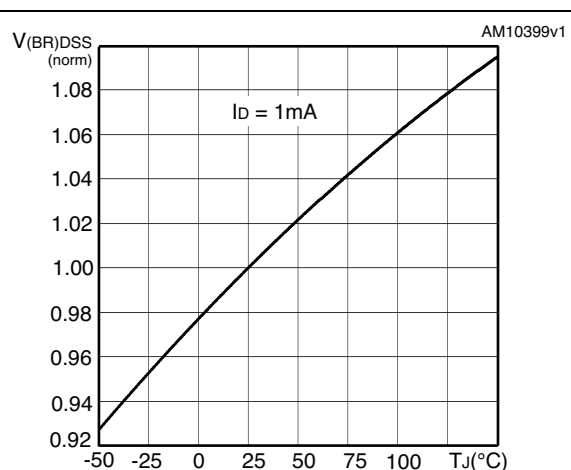
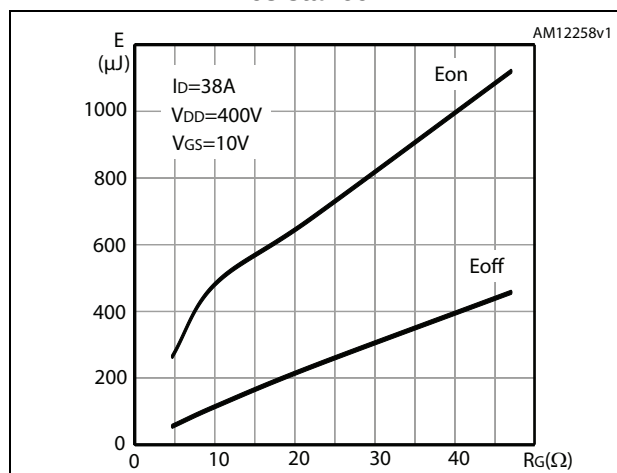
Figure 13. Normalized $V_{(BR)DSS}$ vs temperature

Figure 14. Switching losses vs gate resistance⁽¹⁾



1. E_{on} including reverse recovery of a SiC diode

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

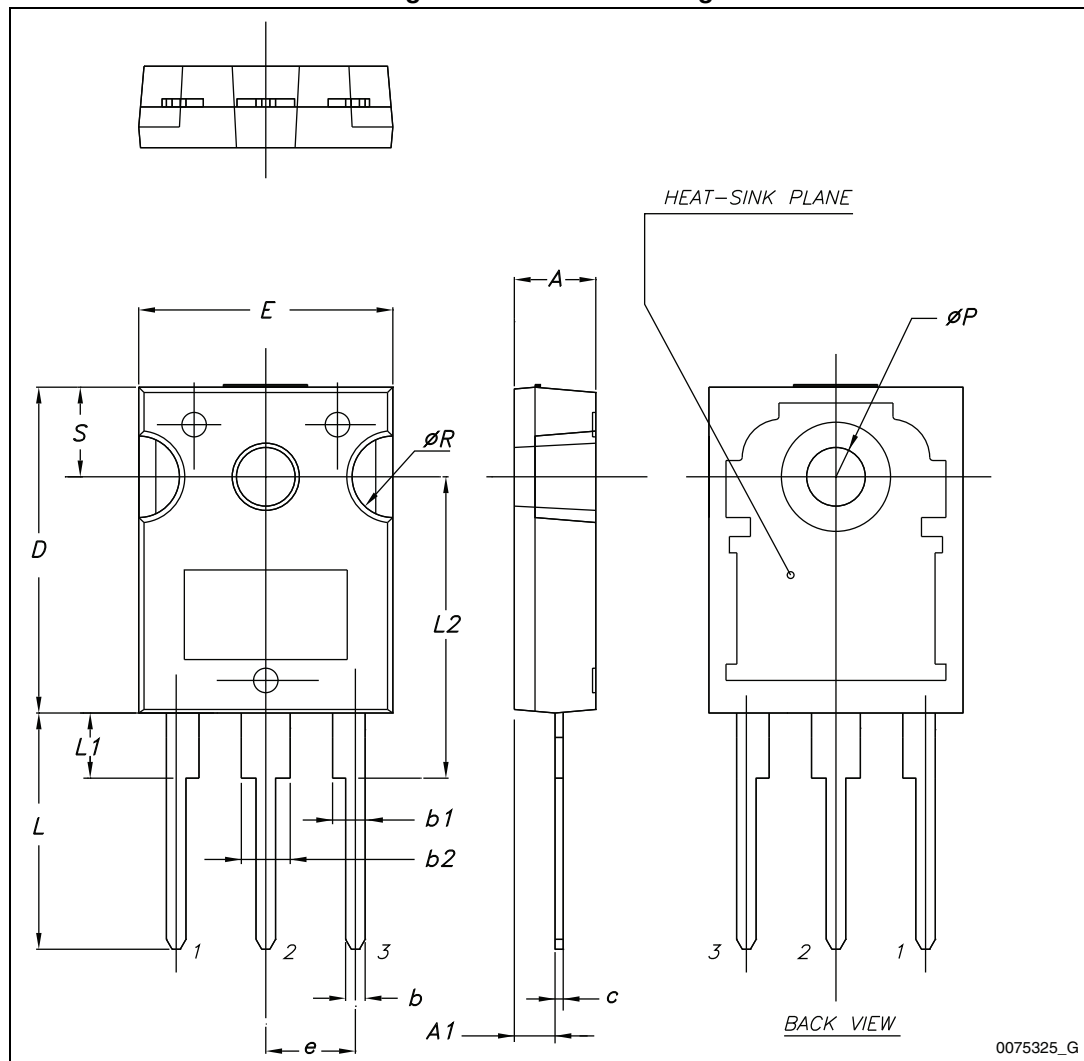


Table 9. TO-247 mechanical data

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	
ØP	3.55		3.65
ØR	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 $t_{f(l)}$ in Table 7 – Minor text changes

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