

Contents

1      **Electrical ratings** ..... 3

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
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	68	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	43	A
$I_{DM}^{(1)}$	Drain current (pulsed)	272	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	450	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		

1. Pulse width limited by safe operating area.

2.  $I_{SD} \leq 68\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ;  $V_{DS\text{ peak}} < V_{(BR)DSS}$ ;  $V_{DD} = 400\text{ V}$ .

3.  $V_{DS} \leq 480\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.28	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	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 $T_{jmax}$ )	10	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25^{\circ}\text{C}$ , $I_D = 10\text{ A}$ ; $V_{DD} = 50$ )	1500	mJ

## 2 Electrical characteristics

( $T_C = 25\text{ °C}$  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 ( $V_{GS} = 0$ )	$V_{DS} = 600\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 600\text{ V}$ , $T_C = 125\text{ °C}$			100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	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	$V_{GS} = 10\text{ V}$ , $I_D = 34\text{ A}$		0.030	0.040	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	5200	-	pF
$C_{oss}$	Output capacitance		-	250	-	pF
$C_{rss}$	Reverse transfer capacitance		-	5	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}$ , $V_{GS} = 0$	-	395	-	pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_D = 0$	-	3.3	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 68\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> )	-	118	-	nC
$Q_{gs}$	Gate-source charge		-	25	-	nC
$Q_{gd}$	Gate-drain charge		-	47	-	nC

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%  $V_{DSS}$

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 34\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14</a> and <a href="#">Figure 19</a> )	-	32	-	ns
$t_r$	Rise time		-	17	-	ns
$t_{d(off)}$	Turn-off-delay time		-	155	-	ns
$t_f$	Fall time		-	9	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		68	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		272	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 68\text{ A}$ , $V_{GS} = 0$	-	0.98	1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 68\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see <a href="#">Figure 18</a> )	-	520		ns
$Q_{rr}$	Reverse recovery charge		-	12		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	45		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 68\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 18</a> )	-	680		ns
$Q_{rr}$	Reverse recovery charge		-	18		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	50		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

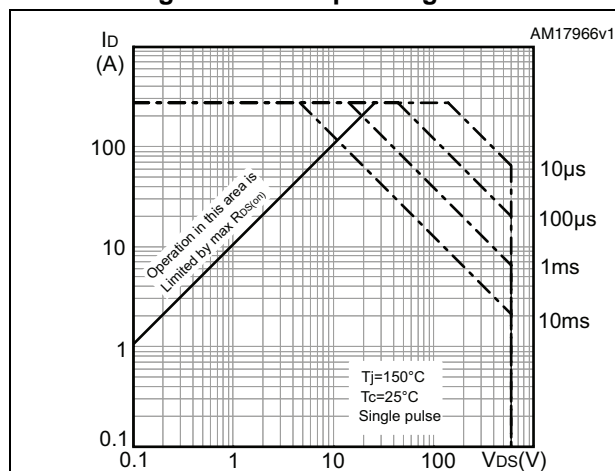


Figure 3. Thermal impedance

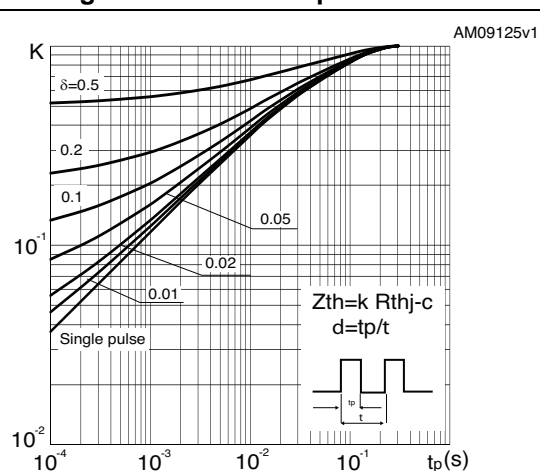


Figure 4. Output characteristics

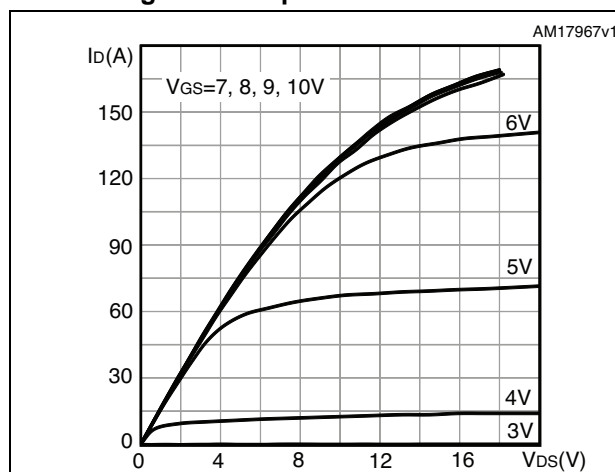


Figure 5. Transfer characteristics

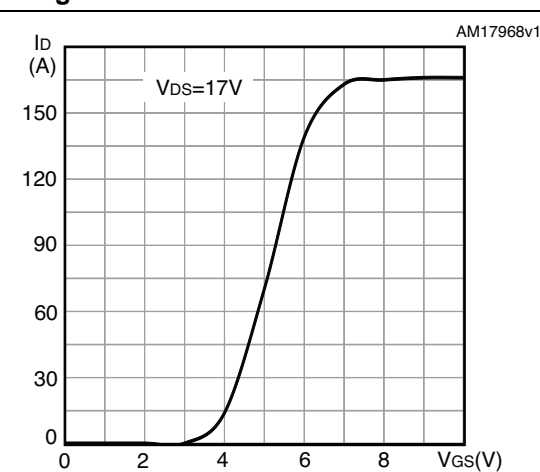


Figure 6. Gate charge vs gate-source voltage

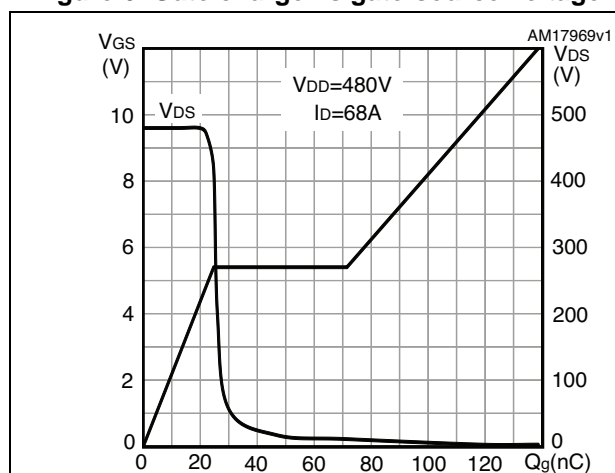


Figure 7. Static drain-source on-resistance

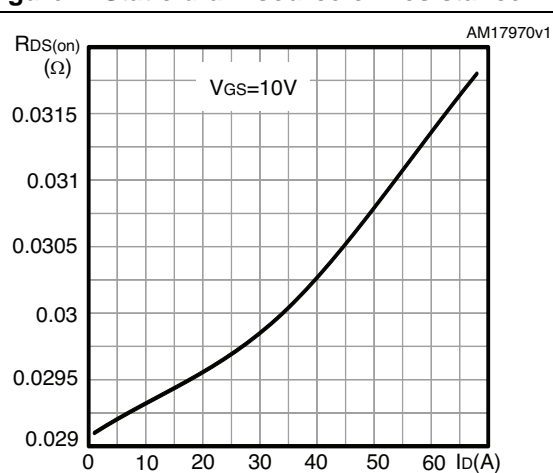


Figure 8. Capacitance variations

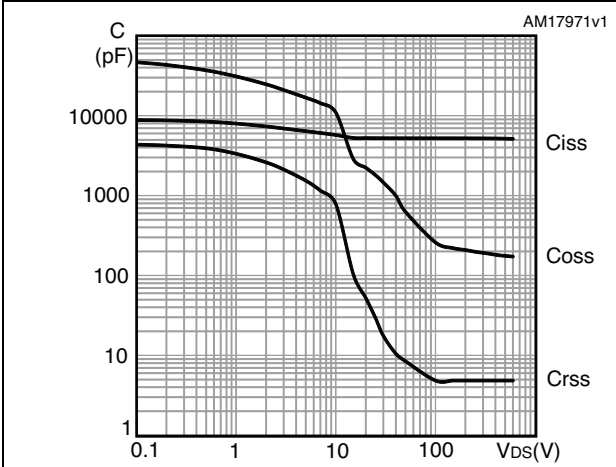


Figure 9. Output capacitance stored energy

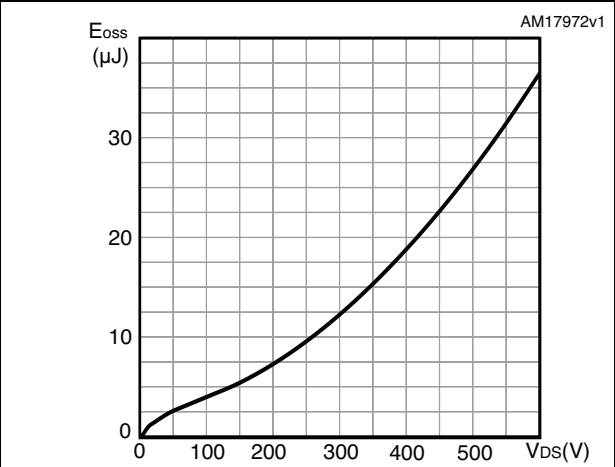


Figure 10. Normalized gate threshold voltage vs temperature

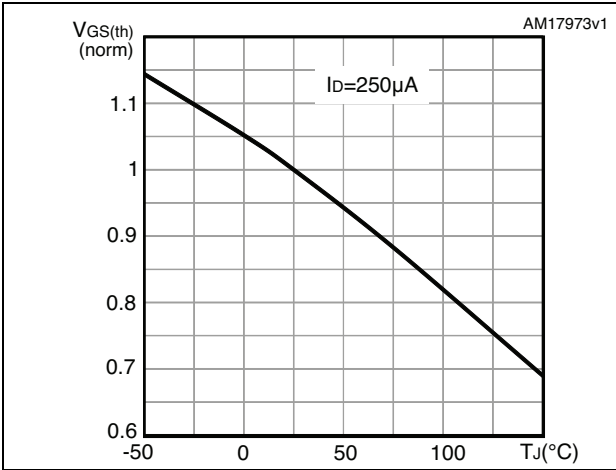


Figure 11. Normalized on-resistance vs temperature

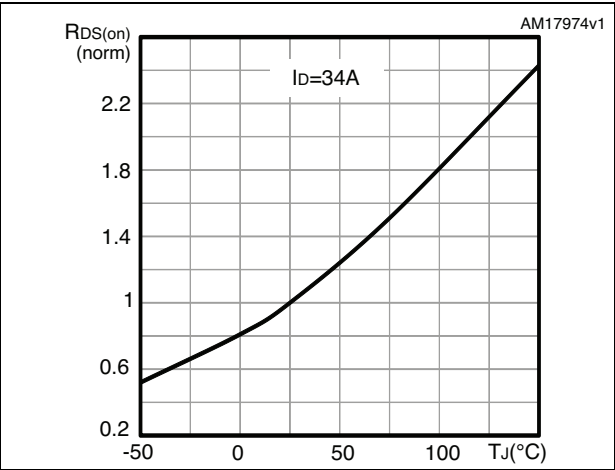


Figure 12. Normalized  $V_{DS}$  vs temperature

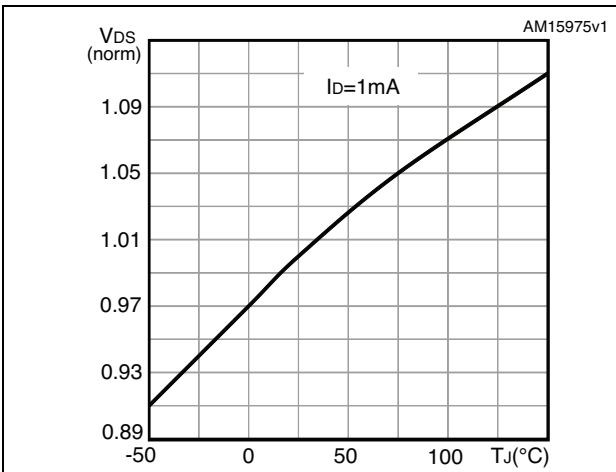
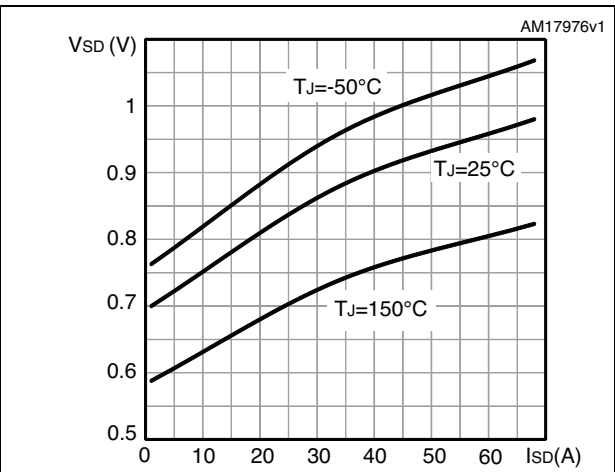


Figure 13. Source-drain diode forward characteristics



### 3 Test circuits

Figure 14. Switching times test circuit for resistive load

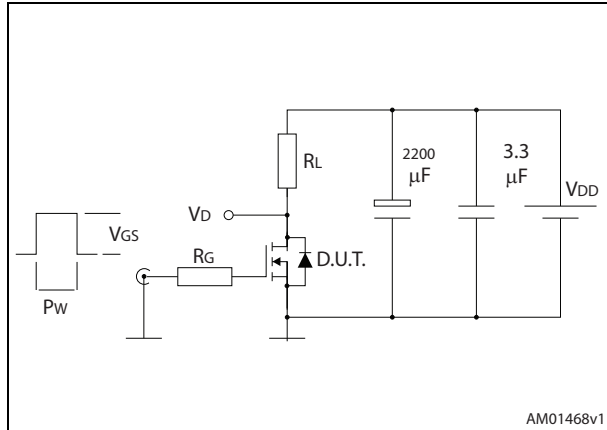


Figure 15. Gate charge test circuit

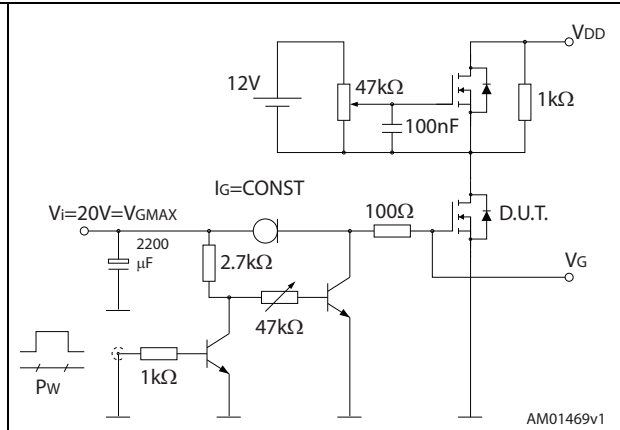


Figure 16. Test circuit for inductive load switching and diode recovery times

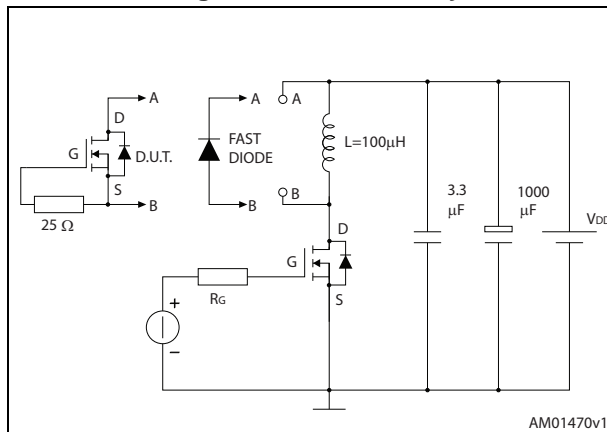


Figure 17. Unclamped inductive load test circuit

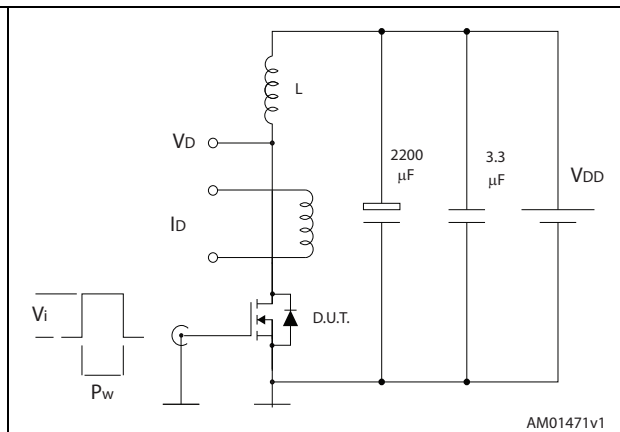


Figure 18. Unclamped inductive waveform

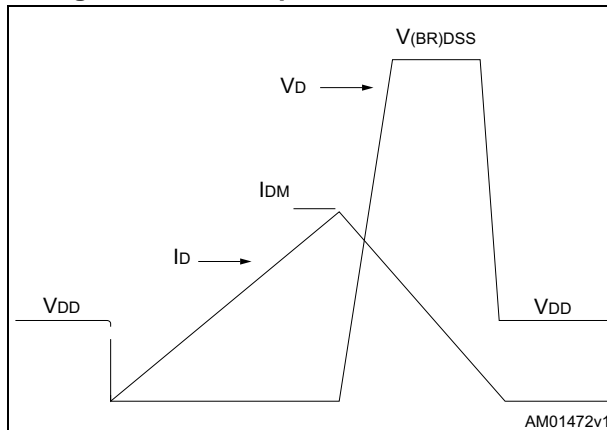
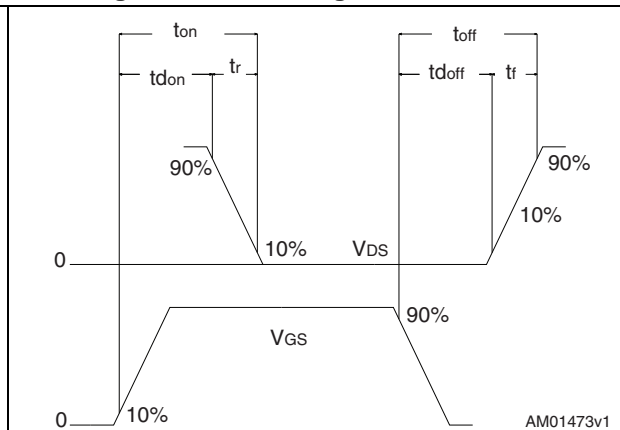


Figure 19. Switching time waveform



## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.



Figure 20. TO-247 drawing

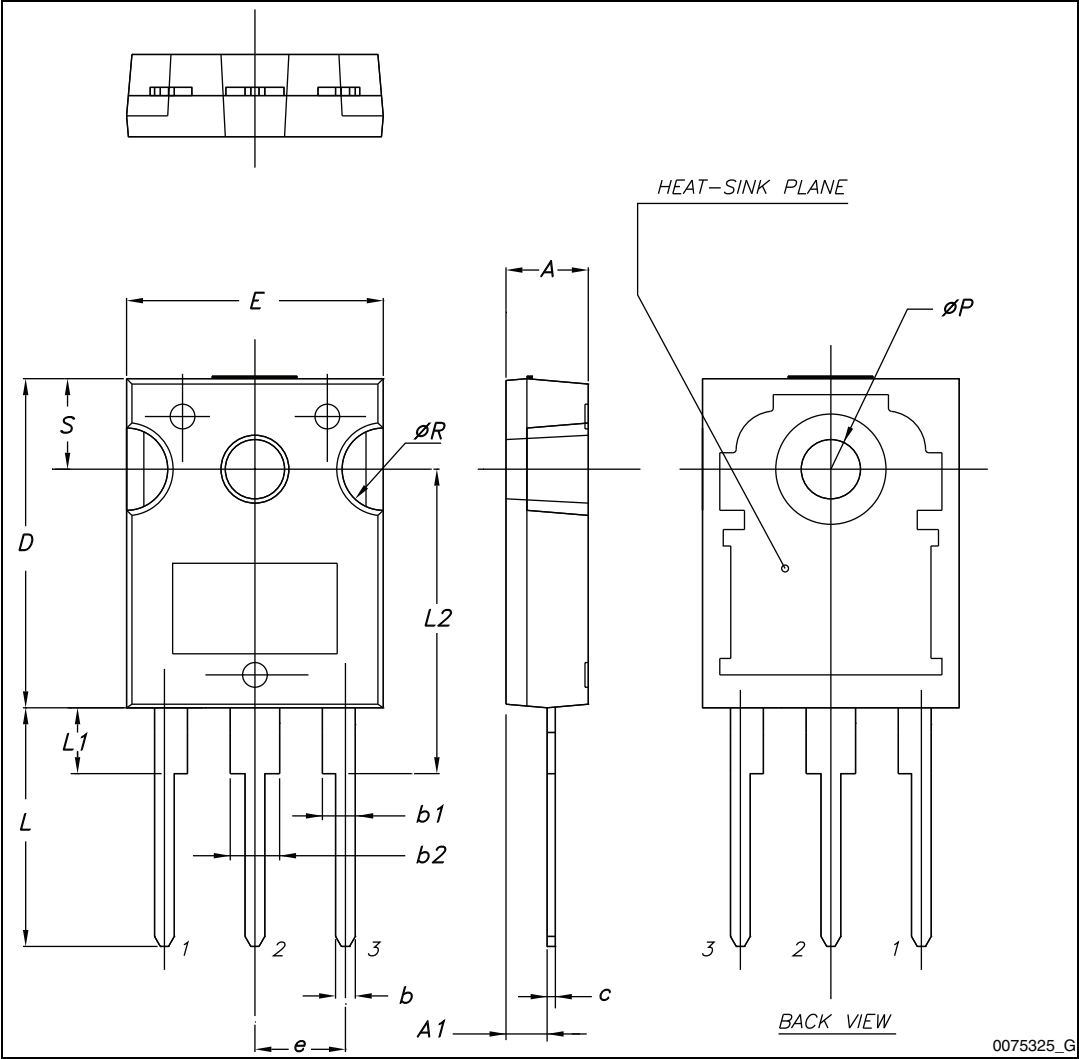


Table 9. TO-247 mechanical data

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
28-Feb-2013	1	First release.
13-Mar-2013	2	– Minor text changes – Modified: test condition in <a href="#">Table 7</a>
12-Dec-2013	3	– Modified: title – Modified: <a href="#">Table 4</a> , $R_{DS(on)}$ typical value in <a href="#">Table 5</a> , the entire typical values in <a href="#">Table 6</a> , <a href="#">7</a> and <a href="#">8</a> – Updated: <a href="#">Section 3: Test circuits</a> – Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a> – Minor text changes
01-Sep-2014	4	– Updated values in <a href="#">Table 4</a> – Updated description and features in cover page – Minor text changes

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