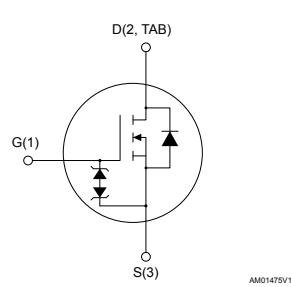
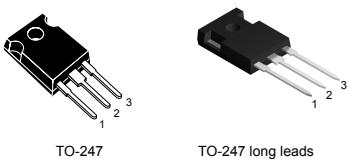


N-channel 650 V, 36 mΩ typ., 68 A MDmesh™ DM6 Power MOSFETs in TO-247 and TO-247 long leads packages

### Features



#### Product status link

[STW70N65DM6](#)
[STWA70N65DM6](#)

#### Product summary

<b>Order code</b>	<b>STW70N65DM6</b>
<b>Marking</b>	70N65DM6
<b>Package</b>	TO-247
<b>Packing</b>	Tube
<b>Order code</b>	<b>STWA70N65DM6</b>
<b>Marking</b>	70N65DM6
<b>Package</b>	TO-247 long leads
<b>Packing</b>	Tube

### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STW70N65DM6	650 V	40 mΩ	68 A
STWA70N65DM6			

- Fast-recovery body diode
- Lower R<sub>DS(on)</sub> per area vs previous generation
- Low gate charge, input capacitance and resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

### Applications

- Switching applications

### Description

These high-voltage N-channel Power MOSFETs are part of the MDmesh DM6 fast-recovery diode series. Compared with the previous MDmesh fast generation, DM6 combines very low recovery charge (Q<sub>rr</sub>), recovery time (t<sub>rr</sub>) and excellent improvement in R<sub>DS(on)</sub> per area with one of the most effective switching behaviors available in the market for the most demanding high-efficiency bridge topologies and ZVS phase-shift converters.

<a href="#">Product status link</a>
<a href="#">STW70N65DM6</a>
<a href="#">STWA70N65DM6</a>

<b>Order code</b>	<b>STW70N65DM6</b>
<b>Marking</b>	70N65DM6
<b>Package</b>	TO-247
<b>Packing</b>	Tube
<b>Order code</b>	<b>STWA70N65DM6</b>
<b>Marking</b>	70N65DM6
<b>Package</b>	TO-247 long leads
<b>Packing</b>	Tube

## 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	68	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	43	A
$I_D$ <sup>(1)</sup>	Drain current (pulsed)	260	A
$P_{TOT}$	Total power dissipation at $T_C = 25^\circ\text{C}$	450	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	50	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	100	V/ns
$T_{STG}$	Storage temperature range	-55 to 150	$^\circ\text{C}$
$T_J$	Operating junction temperature range		$^\circ\text{C}$

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 68$  A,  $di/dt \leq 900$  A/ $\mu$ s;  $V_{DS}(\text{peak}) < V_{(BR)DSS}$ ,  $V_{DD} = 400$  V
3.  $V_{DS} \leq 520$  V

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.28	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	50	$^\circ\text{C}/\text{W}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive ( $t_p$ limited by $T_j$ max)	8	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$ , $I_D = I_{AR}$ ; $V_{DD} = 50$ V)	1.8	J

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{GS} = 0 \text{ V}, I_D = 1 \text{ mA}$	650			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{GS} = 0 \text{ V}, V_{DS} = 650 \text{ V}$			10	$\mu\text{A}$
		$V_{GS} = 0 \text{ V}, V_{DS} = 650 \text{ V}, T_C = 125^\circ\text{C}$ <sup>(1)</sup>			100	
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 25 \text{ V}$			$\pm 5$	$\mu\text{A}$
$V_{GS(\text{th})}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	3.25	4	4.75	V
$R_{\text{DS(on)}}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 34 \text{ A}$		36	40	$\text{m}\Omega$

1. Defined by design, not subject to production test.

**Table 5. Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0 \text{ V}$	-	4900	-	$\text{pF}$
$C_{oss}$	Output capacitance		-	280	-	
$C_{rss}$	Reverse transfer capacitance		-	3	-	
$C_{oss\ eq}^{(\text{t})}$	Equivalent output capacitance	$V_{DS} = 0$ to $520 \text{ V}, V_{GS} = 0 \text{ V}$	-	859	-	
$R_G$	Intrinsic gate resistance	$f = 1 \text{ MHz}, I_D = 0 \text{ A}$	-	2.3	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 520 \text{ V}, I_D = 68 \text{ A}, V_{GS} = 0$ to $10 \text{ V}$ (see Figure 14)	-	125	-	$\text{nC}$
$Q_{gs}$	Gate-source charge		-	33	-	
$Q_{gd}$	Gate-drain charge		-	56	-	

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%  $V_{DSS}$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 325 \text{ V}, I_D = 34 \text{ A}, R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (see Figure 13 and Figure 18)	-	30.4	-	ns
$t_r$	Rise time		-	52	-	ns
$t_{d(off)}$	Turn-off delay time		-	107	-	ns
$t_f$	Fall time		-	10.8	-	ns

**Table 7. Source drain diode**

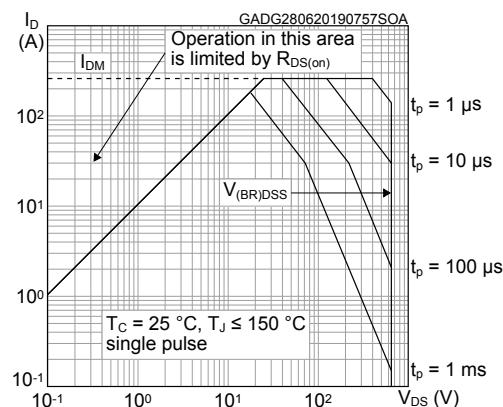
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		68	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		260	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 68 \text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 68 \text{ A}, dI/dt = 100 \text{ A}/\mu\text{s}, V_{DD} = 60 \text{ V}, (\text{see Figure 15})$	-	17	-	ns
$Q_{rr}$	Reverse recovery charge		-	1.08	-	$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	12.7	-	A
$t_{rr}$	Reverse recovery time		-	308	-	ns
$Q_{rr}$	Reverse recovery charge	$I_{SD} = 68 \text{ A}, dI/dt = 100 \text{ A}/\mu\text{s}, V_{DD} = 60 \text{ V}, T_J = 150 \text{ }^\circ\text{C}$ (see Figure 15)	-	4.16	-	$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	27	-	A

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

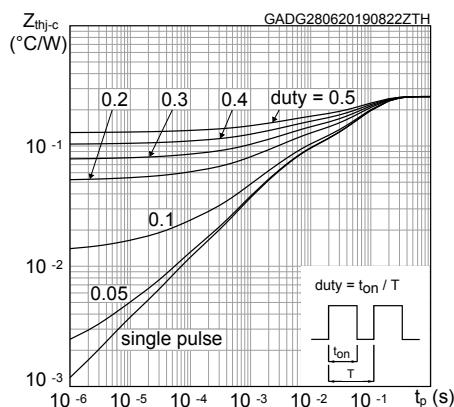
## 2.1

### Electrical characteristics (curves)

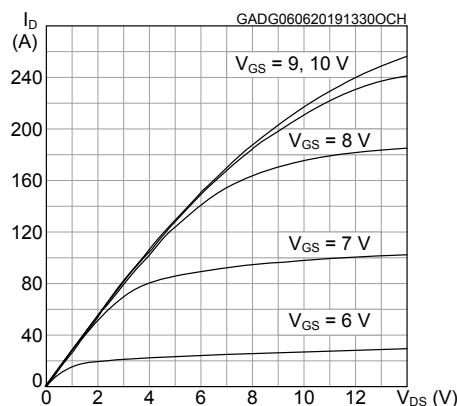
**Figure 1. Safe operating area**



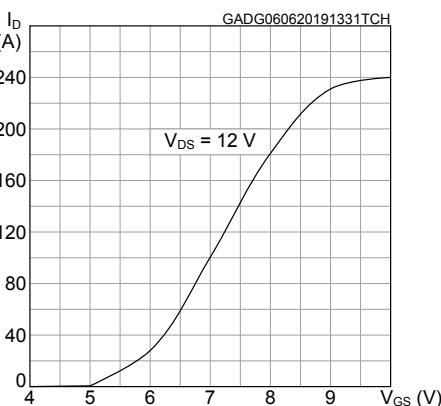
**Figure 2. Transient thermal impedance**



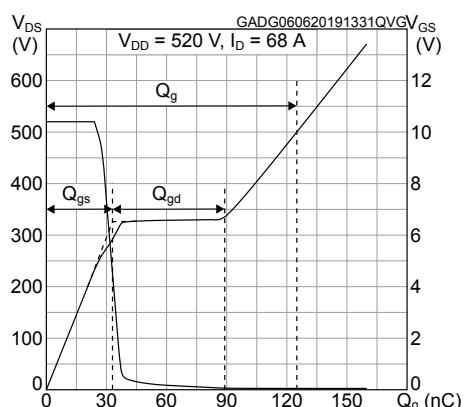
**Figure 3. Output characteristics**



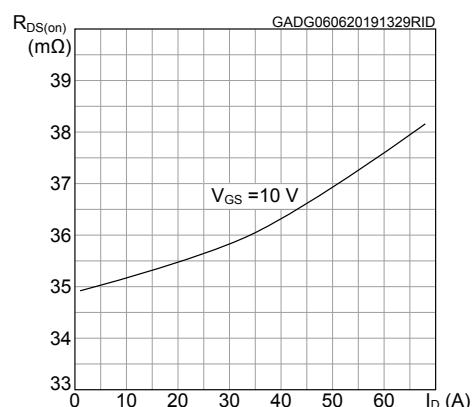
**Figure 4. Transfer characteristics**

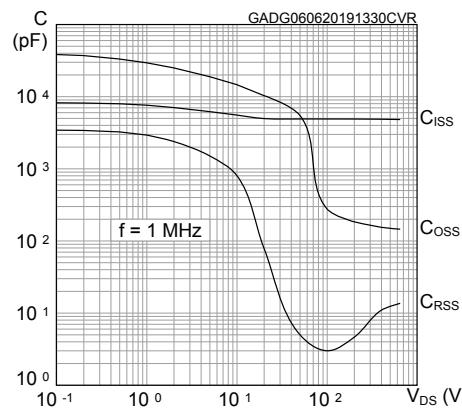
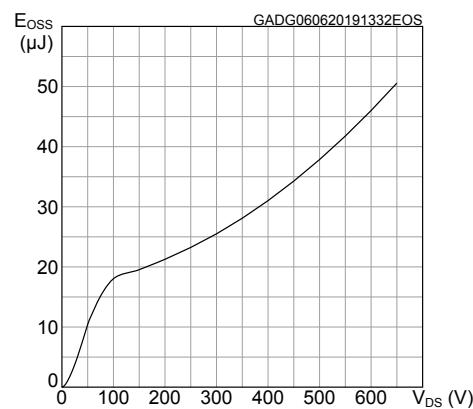
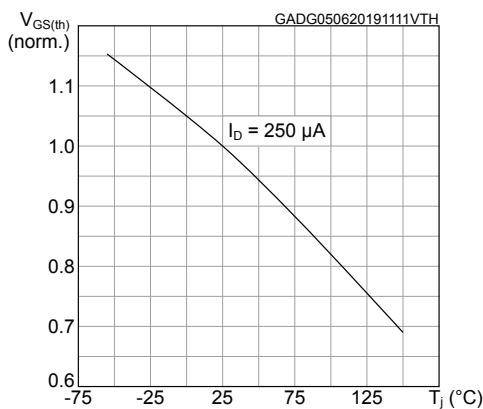
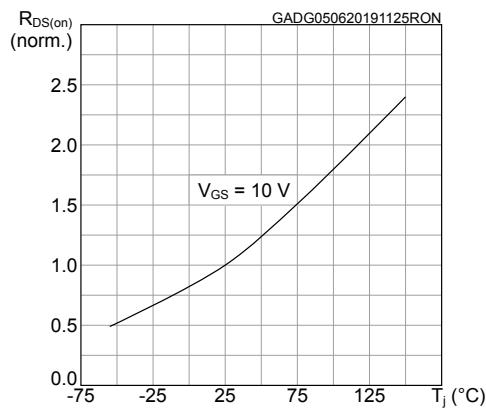
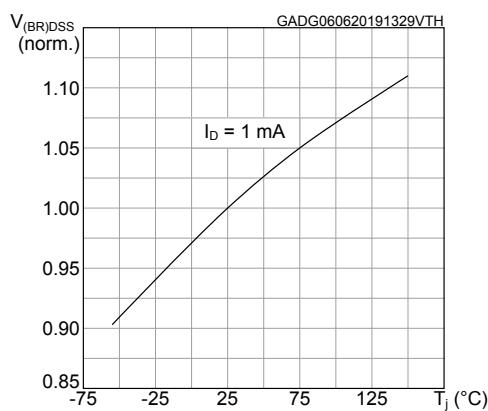
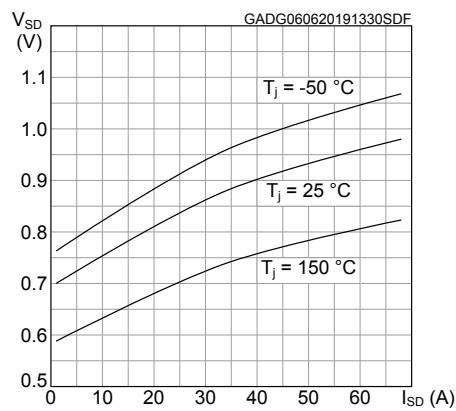


**Figure 5. Gate charge**



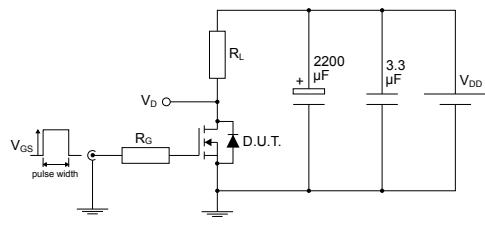
**Figure 6. Static drain-source on-resistance**



**Figure 7. Capacitance variations**

**Figure 8.  $C_{OSS}$  stored energy vs.  $V_{DS}$** 

**Figure 9. Normalized gate threshold voltage vs. temperature**

**Figure 10. Normalized on-resistance vs. temperature**

**Figure 11. Normalized  $V_{(BR)DSS}$  vs. temperature**

**Figure 12. Source-drain diode forward characteristics**


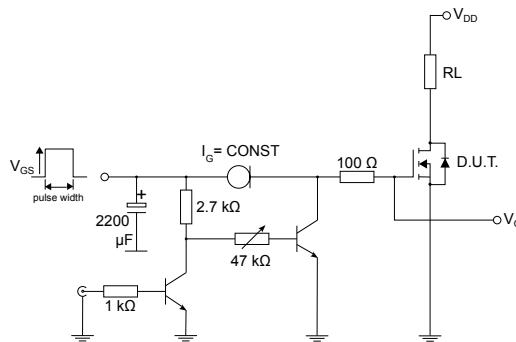
### 3 Test circuits

**Figure 13.** Test circuit for resistive load switching times



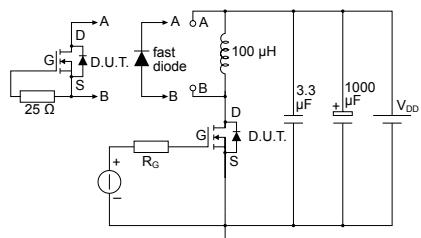
AM01468v1

**Figure 14.** Test circuit for gate charge behavior



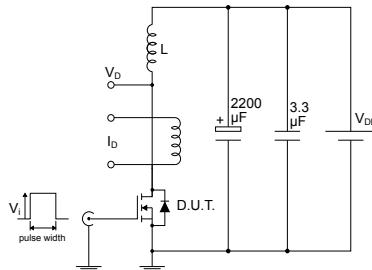
AM01469v10

**Figure 15.** Test circuit for inductive load switching and diode recovery times



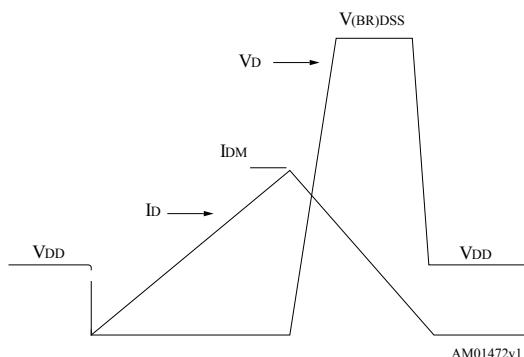
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**Figure 16.** Unclamped inductive load test circuit



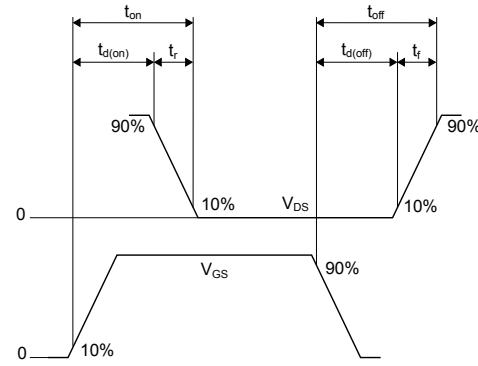
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**Figure 17.** Unclamped inductive waveform



AM01472v1

**Figure 18.** Switching time waveform



AM01473v1

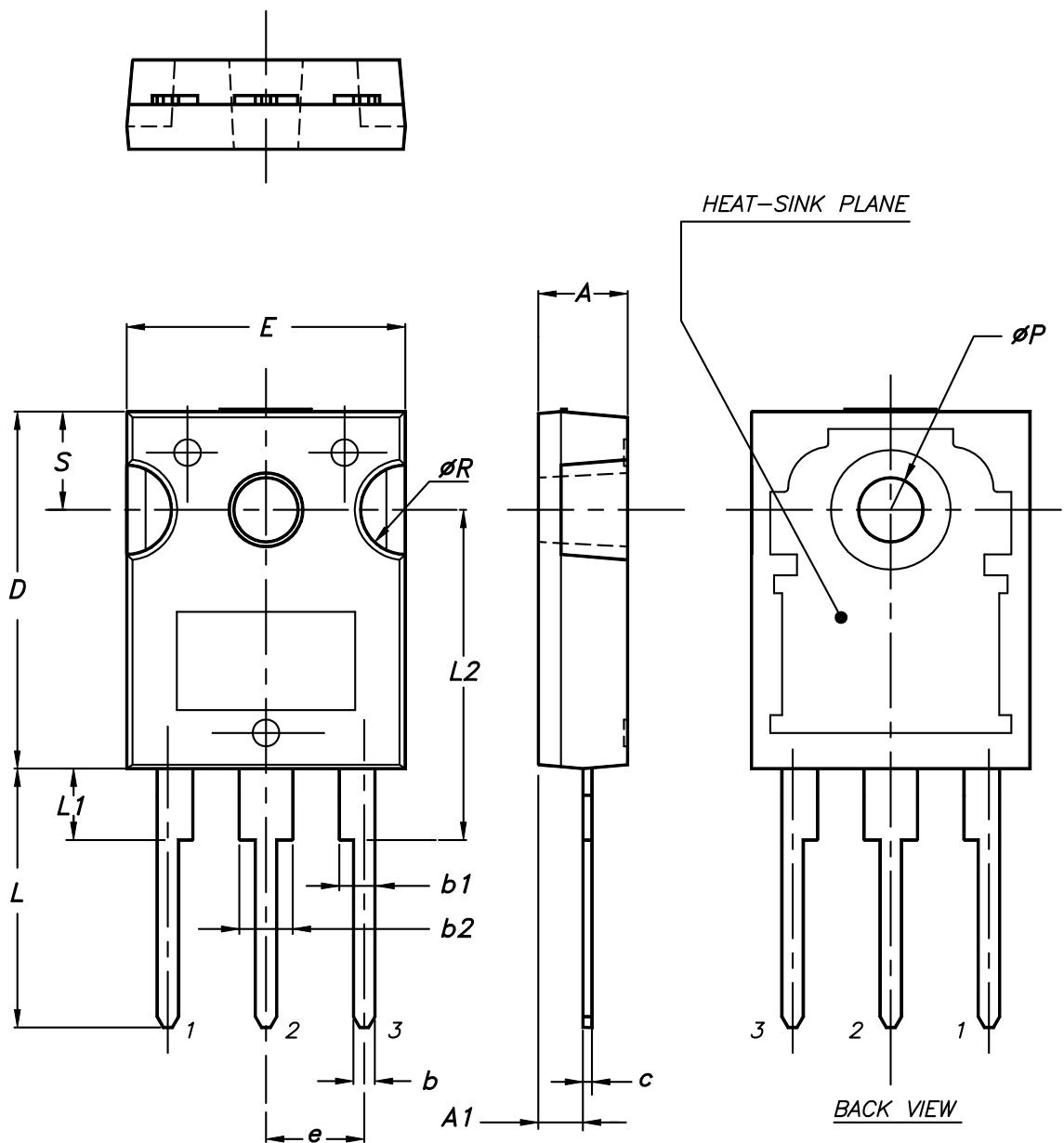
**4****Package information**

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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](http://www.st.com). ECOPACK is an ST trademark.

## 4.1 TO-247 package information

Figure 19. TO-247 package outline



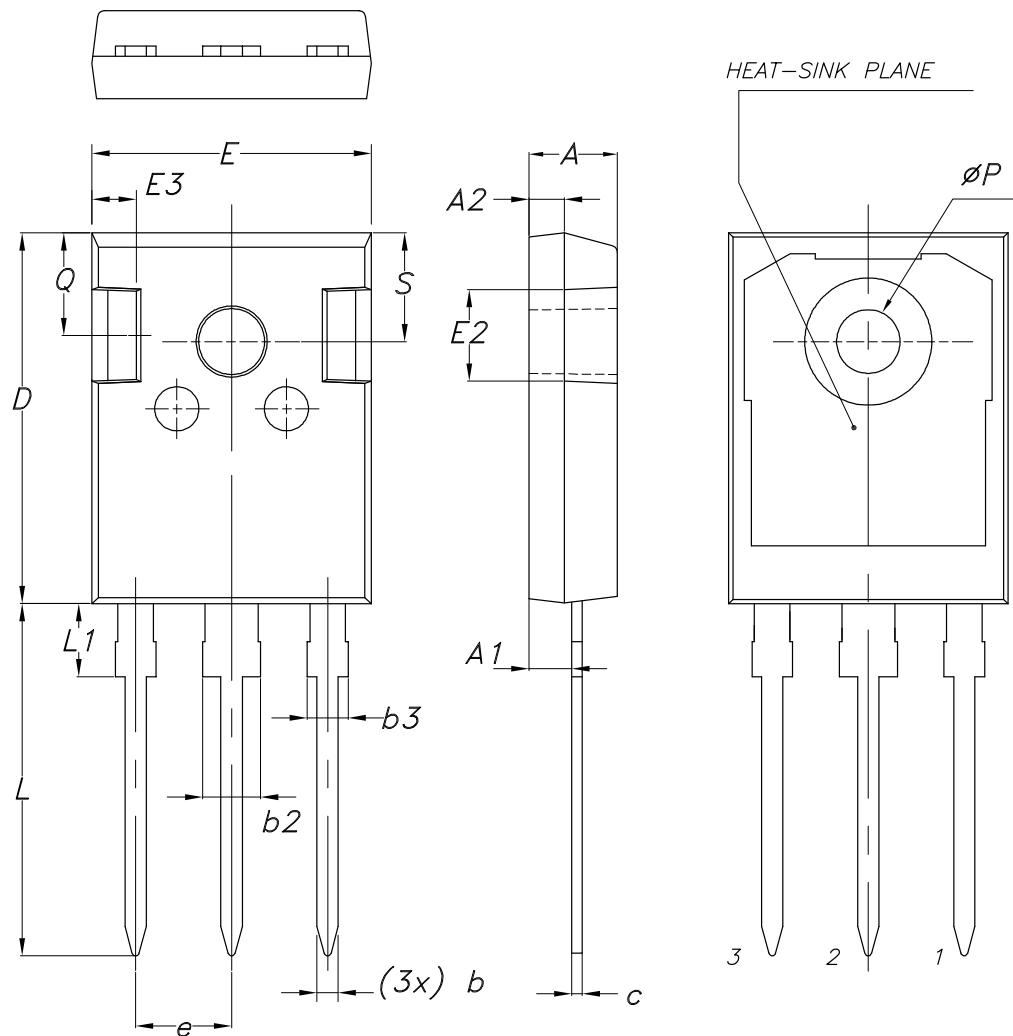
0075325\_9

**Table 8.** TO-247 package 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

## 4.2 TO-247 long leads package information

**Figure 20.** TO-247 long leads package outline



8463846\_2\_F

**Table 9. TO-247 long leads package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16		1.26
b2			3.25
b3			2.25
c	0.59		0.66
D	20.90	21.00	21.10
E	15.70	15.80	15.90
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1			4.30
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25

## Revision history

**Table 10. Document revision history**

Date	Version	Changes
06-Dec-2017	1	Initial release.
09-Jul-2019	2	Update <a href="#">Table 1</a> , <a href="#">Table 3</a> , <a href="#">Table 4</a> , <a href="#">Table 5</a> , <a href="#">Table 6</a> and <a href="#">Table 7</a> . Added <a href="#">Section 2.1</a> Update <a href="#">Figure 14</a> .

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