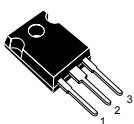
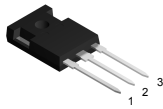


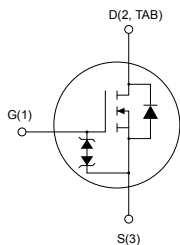
N-channel 600 V, 60 mΩ typ., 46 A MDmesh DM6 Power MOSFETs in a TO-247 and TO-247 long leads packages



TO-247



TO-247 long leads



AM01476v1_lab



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STW65N60DM6	600 V	71 mΩ	46 A
STWA65N60DM6			

- Fast-recovery body diode
- Lower $R_{DS(on)}$ 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_{rr}), recovery time (t_{rr}) and excellent improvement in $R_{DS(on)}$ 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.

Product status links

[STW65N60DM6](#)
[STWA65N60DM6](#)

Product summary

Order code	STW65N60DM6
Marking	65N60DM6
Package	TO-247
Packing	Tube
Order code	STWA65N60DM6
Marking	65N60DM6
Package	TO-247 long leads
Packing	Tube

1 Electrical ratings

Table 1. 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
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	29	
$I_{DM}^{(1)}$	Drain current (pulsed)	140	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	368	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	100	V/ns
$di/dt^{(2)}$	Peak diode recovery current slope	1000	A/ μs
$dv/dt^{(3)}$	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. $I_{SD} \leq 46\text{ A}$, $V_{DS}(\text{peak}) < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$.
3. $V_{DS} \leq 480\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.34	$^\circ\text{C/W}$
R_{thJA}	Thermal resistance, junction-to-ambient	50	$^\circ\text{C/W}$

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_J max)	6	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$; $V_{DD} = 50\text{ V}$)	900	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	600			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$, $T_C = 125\text{ °C}^{(1)}$			100	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$			± 5	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3.25	4.00	4.75	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 23\text{ A}$		60	71	$\text{m}\Omega$

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	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	2500	-	pF
C_{oss}	Output capacitance		-	125	-	pF
C_{rSS}	Reverse transfer capacitance		-	4	-	pF
$C_{oss\ eq}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}$, $V_{GS} = 0\text{ V}$	-	204	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	1.7	-	Ω
Q_g	Total gate charge	$V_{DD} = 480\text{ V}$, $I_D = 42\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 14. Test circuit for gate charge behavior)	-	65.2	-	nC
Q_{gs}	Gate-source charge		-	16.8	-	nC
Q_{gd}	Gate-drain charge		-	30.2	-	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_{DSS} .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 19\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	21	-	ns
t_r	Rise time		-	22	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	56	-	ns
t_f	Fall time		-	9	-	ns

Table 7. 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)		-		140	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 46\text{ A}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 38\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$,	-	116		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 60\text{ V}$	-	0.58		μC
I_{RRM}	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	10		A
t_{rr}	Reverse recovery time	$I_{SD} = 38\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$,	-	208		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	1.98		μC
I_{RRM}	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	19		A

1. Pulse width is limited by safe operating area.
2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics curves

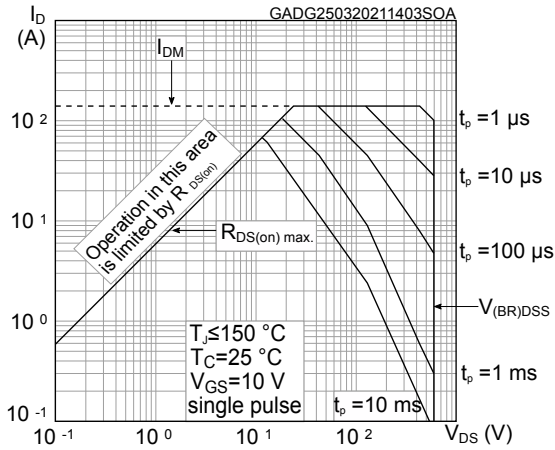
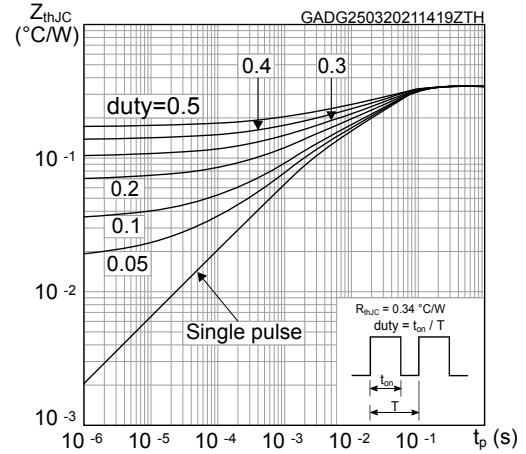
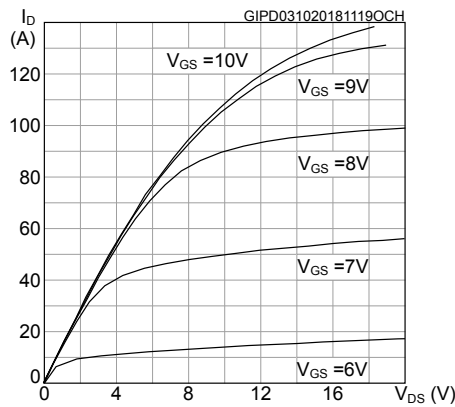
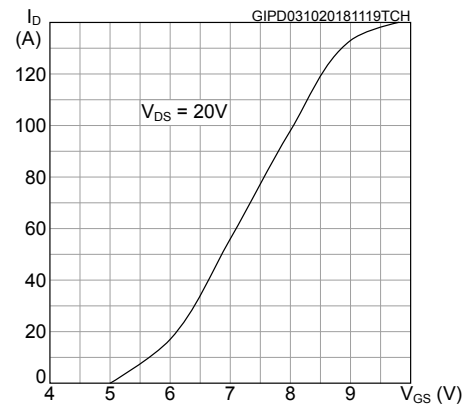
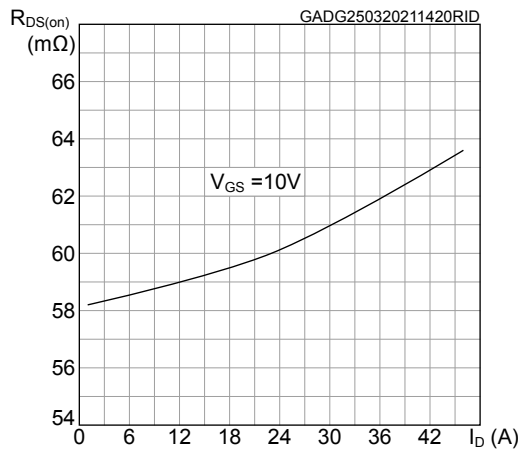
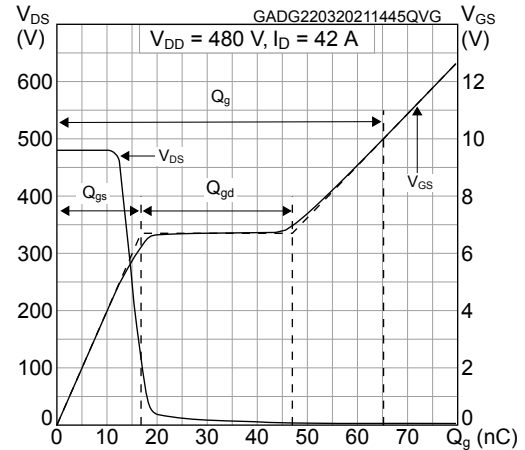
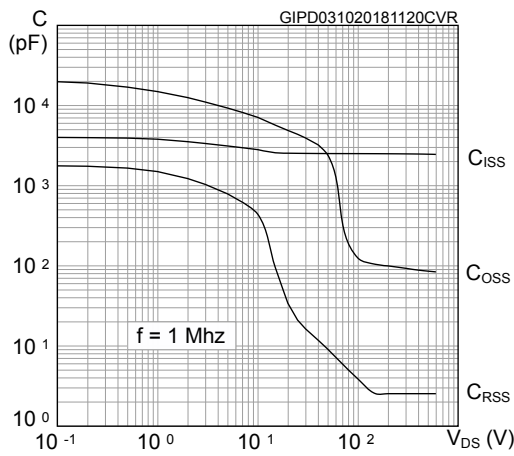
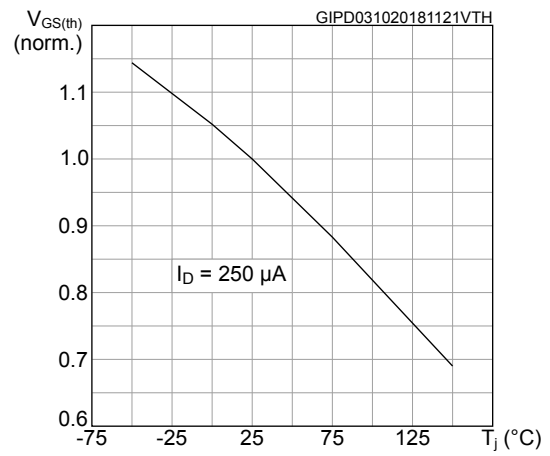
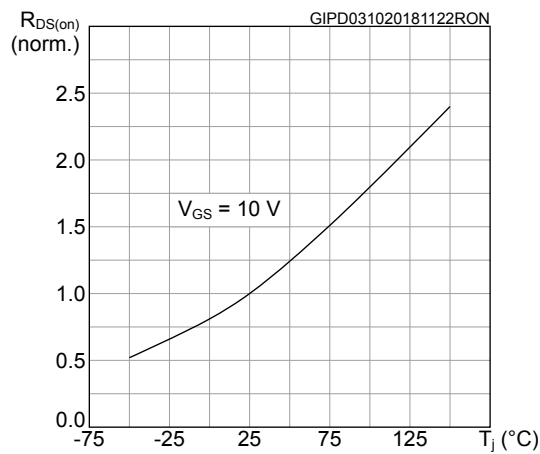
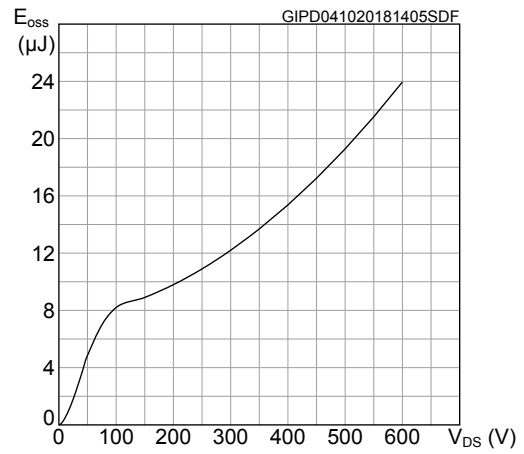
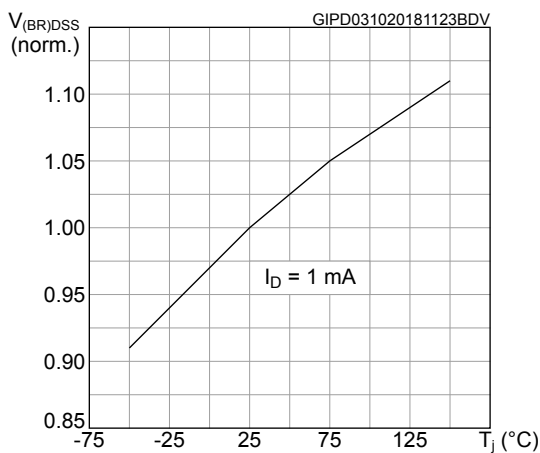
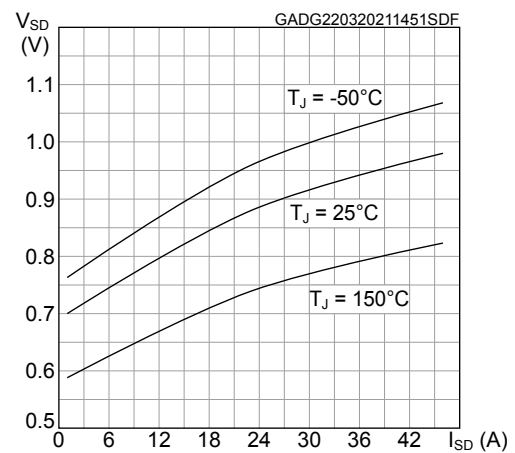
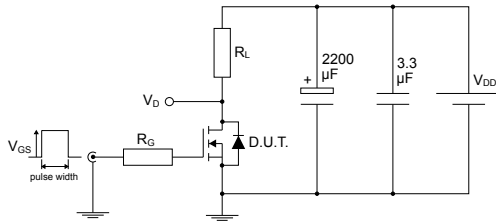
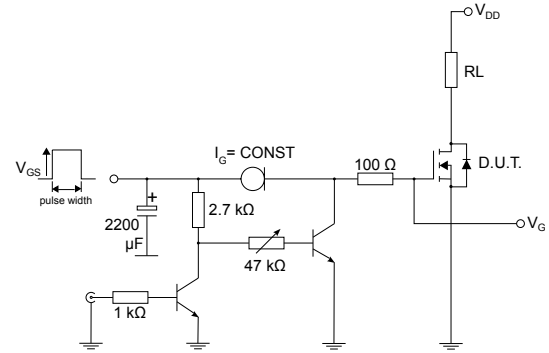
Figure 1. Safe operating area

Figure 2. Maximum transient thermal impedance

Figure 3. Typical output characteristics

Figure 4. Typical output characteristics

Figure 5. Typical drain-source on-resistance

Figure 6. Typical gate charge characteristics


Figure 7. Typical capacitance characteristics

Figure 8. Normalized gate threshold vs temperature

Figure 9. Normalized on resistance vs temperature

Figure 10. Typical output capacitance stored energy

Figure 11. Normalized breakdown voltage vs temperature

Figure 12. Typical reverse diode forward characteristics


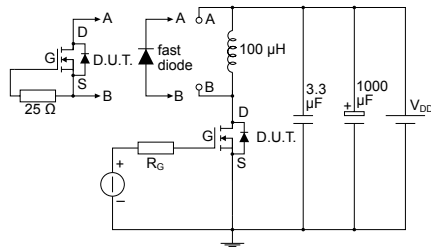
3 Test circuits

Figure 13. Test circuit for resistive load switching times


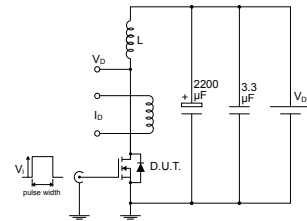
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Figure 14. Test circuit for gate charge behavior


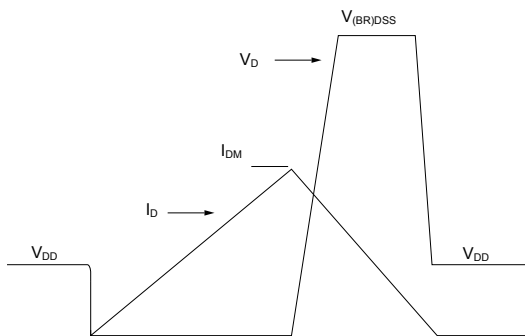
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Figure 15. Test circuit for inductive load switching and diode recovery times


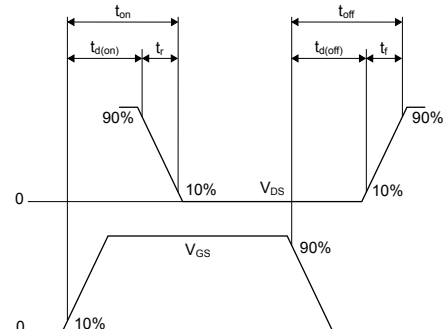
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Figure 16. Unclamped inductive load test circuit


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Figure 17. Unclamped inductive waveform


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Figure 18. Switching time waveform


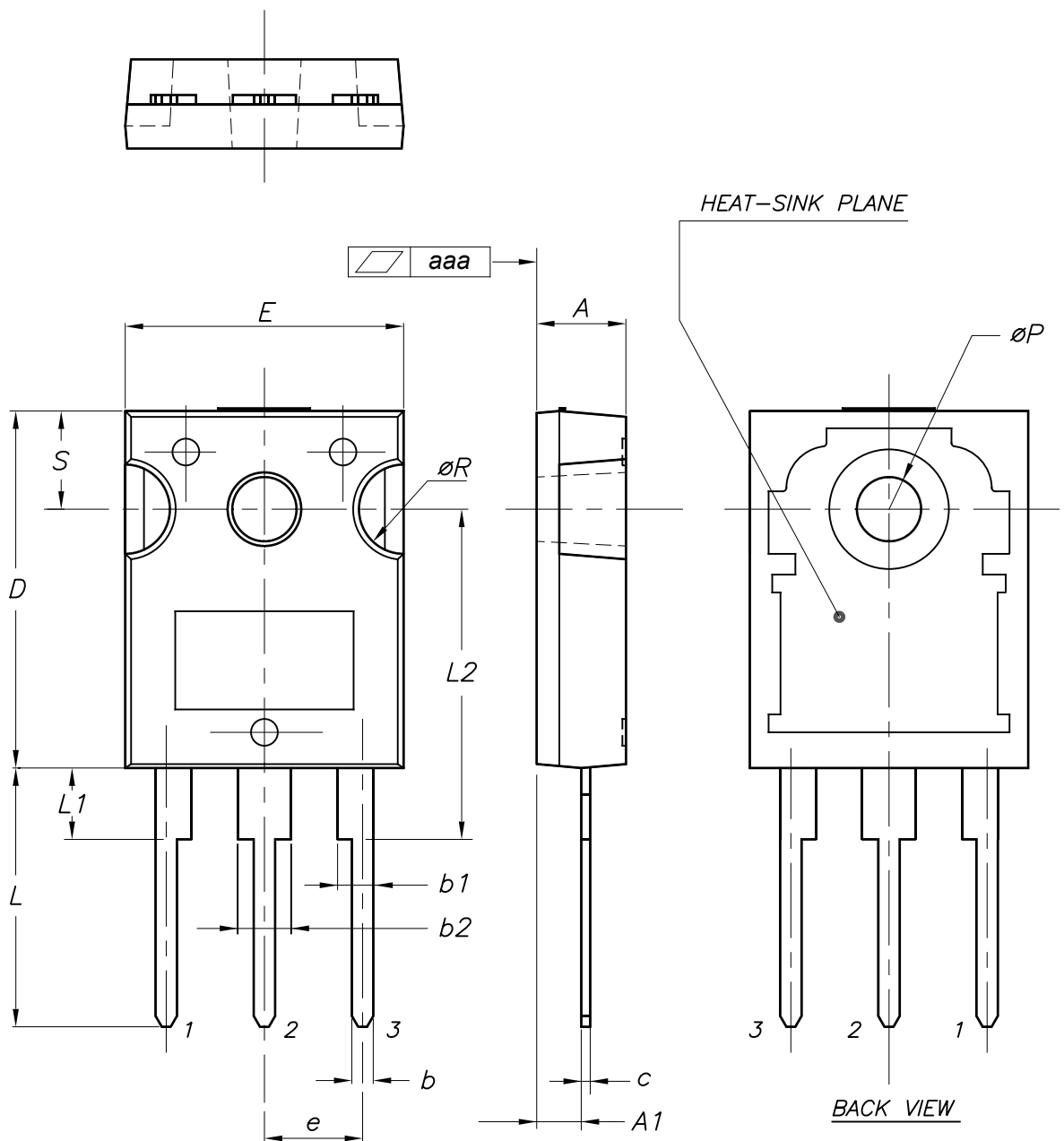
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4 Package information

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.

4.1 TO-247 package information

Figure 19. TO-247 package outline



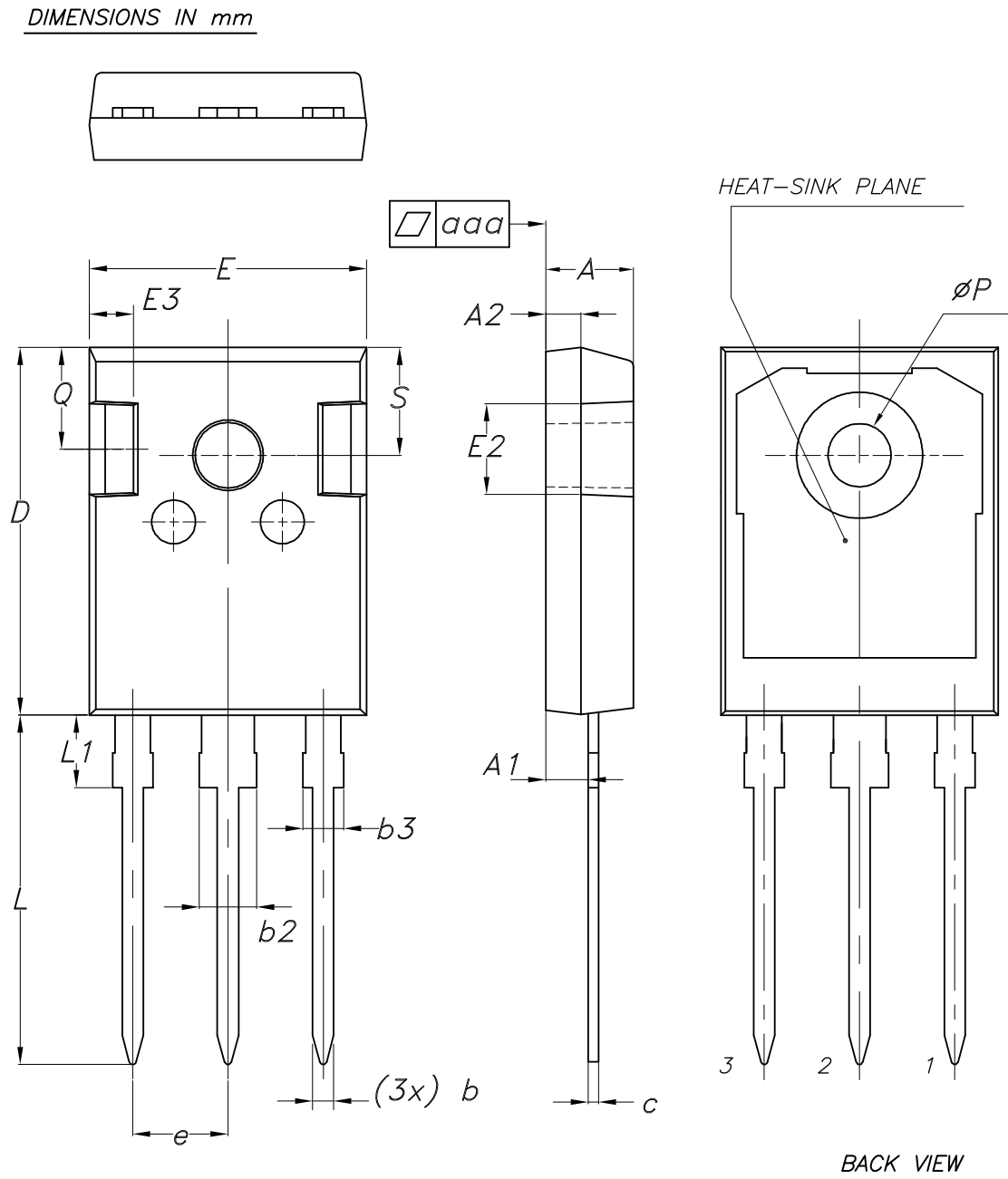
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Table 8. TO-247 package mechanical data

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
aaa		0.04	0.10

4.2 TO-247 long leads package information

Figure 20. TO-247 long leads package outline



8463846_3

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
aaa		0.04	0.10

Revision history

Table 10. Document revision history

Date	Version	Changes
02-Nov-2017	1	Initial release.
03-Oct-2018	2	Removed maturity status indication from cover page. The document status is production data. Updated title and features in cover page. Updated <i>Updated Section 1 Electrical ratings, Section 2 Electrical characteristics.</i> Added <i>Section 2.1 Electrical characteristics curves.</i> Minor text changes.
17-Jun-2020	3	Updated <i>Table 1. Absolute maximum ratings.</i>
31-Mar-2021	4	Updated <i>Table 1. Absolute maximum ratings, Table 2. Thermal data, Table 4. On/off states, Table 7. Source drain diode, Figure 1. Safe operating area, Figure 2. Maximum transient thermal impedance and Figure 6. Gate charge vs gate-source voltage.</i>
21-May-2021	5	Updated <i>Section 4.2 TO-247 long leads package information.</i> Minor text changes.

Contents

1	Electrical ratings	2
2	Electrical characteristics	3
2.1	Electrical characteristics curves	5
3	Test circuits	7
4	Package information	8
4.1	TO-247 package information	8
4.2	TO-247 long leads package information	10
	Revision history	12

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