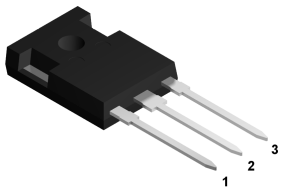
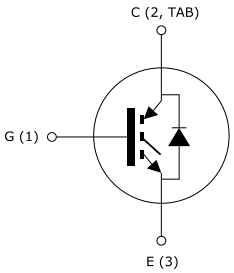
GWA40MS120DLAG

Datasheet

Automotive-grade trench gate field-stop, 1200 V, 40 A, low-loss MS series IGBT and ultra-low reverse losses in a TO-247 long leads package



TO-247 long leads



Features

- AEC-Q101 qualified
- 8 µs of short-circuit withstand time at V_{CC} = 800 V, V_{GE} = 15 V, T_J (start) = 175 °C
- $V_{CE(sat)}$ = 1.95 V (typ.) @ I_C = 40 A
- Tight parameter distribution
- Positive $V_{CE(sat)}$ temperature coefficient
- Low thermal resistance
- Ultra low conduction losses
- Ultra-low reverse losses

Applications

- On board charger (OBC)

Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the MS series IGBTs. This series represents an evolution of the low-loss M series. The diode has very low conduction losses and very low reverse losses. These features make it ideal for battery chargers.

Product status link
GWA40MS120DLAG

Product summary	
Order code	GWA40MS120DLAG
Marking	G40MS120DLAG
Package	TO-247 long leads
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	1200	V
I_C	Continuous collector current at T_C = 25 °C	90	A
	Continuous collector current at T_C = 100 °C	65	
I_{CP} (1)	Pulsed collector current	120	A
V_{GE}	Gate-emitter voltage	±30	V
I_F	Continuous forward current at T_C = 25 °C	120	A
	Continuous forward current at T_C = 100 °C	74	
I_{FP} (1)	Pulse forward current	120	A
P_{TOT}	Total power dissipation at T_C = 25 °C	536	W
T_{stg}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range	-55 to 175	°C

1. *Pulse width is limited by maximum junction temperature.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case, IGBT	0.28	°C/W
	Thermal resistance, junction-to-case, diode	0.61	
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

2 Electrical characteristics

T_C = 25 °C unless otherwise specified.

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0 V, I_C = 2 mA	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 40 A		1.95	2.30	V
		V_{GE} = 15 V, I_C = 40 A, T_J = 125 °C		2.25		
		V_{GE} = 15 V, I_C = 40 A, T_J = 175 °C		2.35		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 2 mA	5	6	7	V
V_F	Forward on-voltage	I_F = 40 A		1.13	1.21	V
		I_F = 40 A, T_J = 125 °C		1.05		
		I_F = 40 A, T_J = 175 °C		1.03		
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 1200 V			25	µA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			250	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	2700	-	pF
C_{oes}	Output capacitance		-	185	-	pF
C_{res}	Reverse transfer capacitance		-	101	-	pF
Q_g	Total gate charge	V_{CC} = 960 V, I_C = 40 A, V_{GE} = 0 to 15 V (see Figure 17. Gate charge test circuit)	-	147	-	nC
Q_{ge}	Gate-emitter charge		-	24	-	nC
Q_{gc}	Gate-collector charge		-	79.5	-	nC

Table 5. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	V_{CC} = 600 V, I_C = 40 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 16. Test circuit for inductive load switching)		140	-	ns
t_f	Current fall time			135	-	ns
E_{off} (1)	Turn-off switching energy			3.3	-	mJ
$t_{d(off)}$	Turn-off delay time	V_{CC} = 600 V, I_C = 40 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 175 °C (see Figure 16. Test circuit for inductive load switching)		150	-	ns
t_f	Current fall time			240	-	ns
E_{off} (1)	Turn-off switching energy			5.2	-	mJ
t_{sc}	Short-circuit withstand time	V_{CE} = 800 V, V_{GE} = 15 V, T_J (start) = 175 °C	8		-	µs

1. *Including the tail of the collector current.*

2.1 Electrical characteristics (curves)

Figure 1. Power dissipation vs case temperature

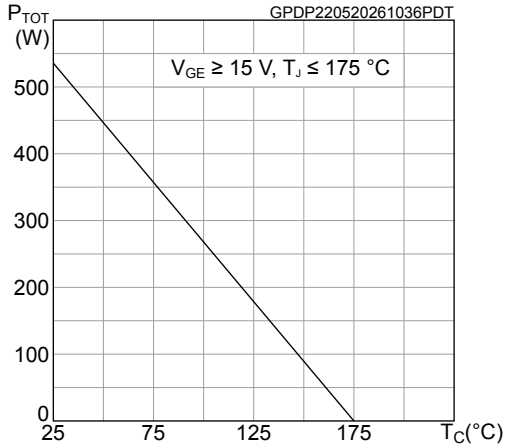


Figure 2. Collector current vs case temperature

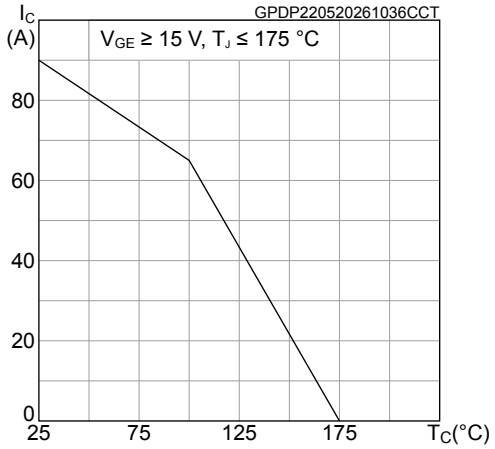


Figure 3. Output characteristics (T_J = 25 °C)

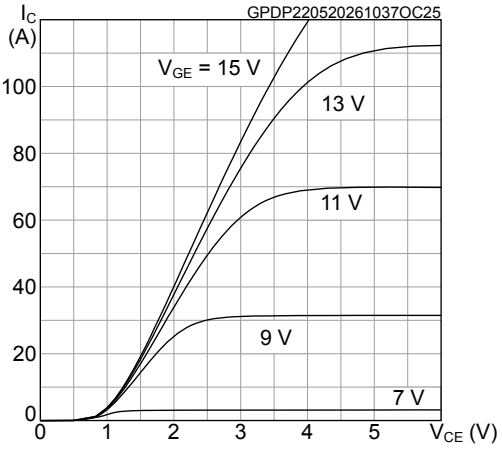


Figure 4. Output characteristics (T_J = 175 °C)

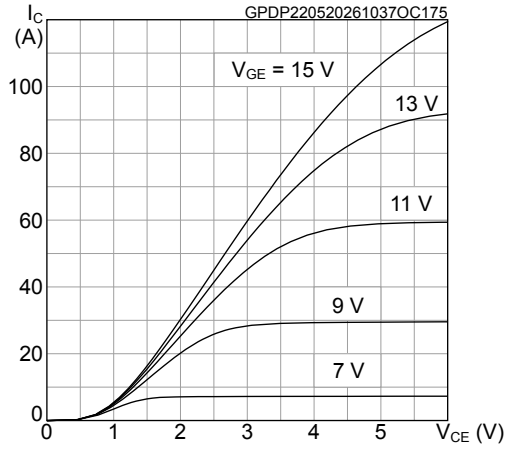


Figure 5. $V_{CE(sat)}$ vs junction temperature

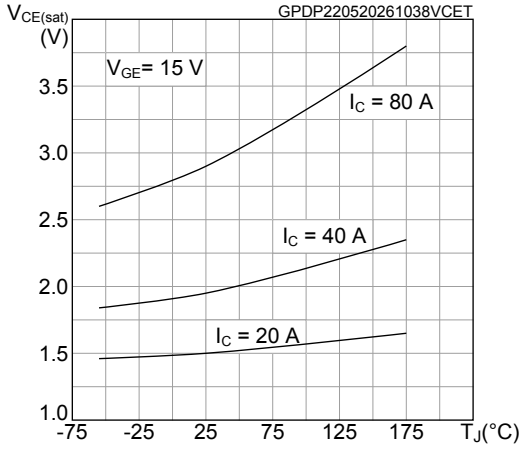


Figure 6. $V_{CE(sat)}$ vs collector current

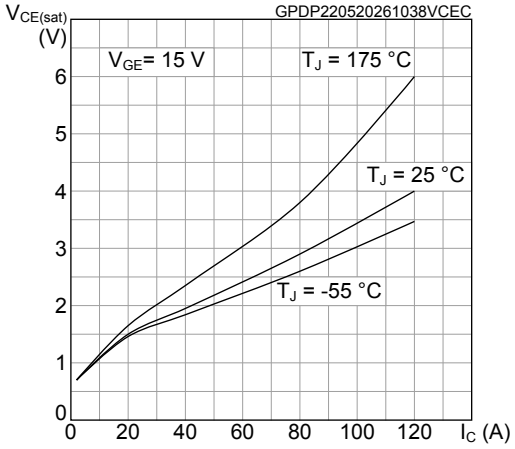


Figure 7. Forward bias safe operating area

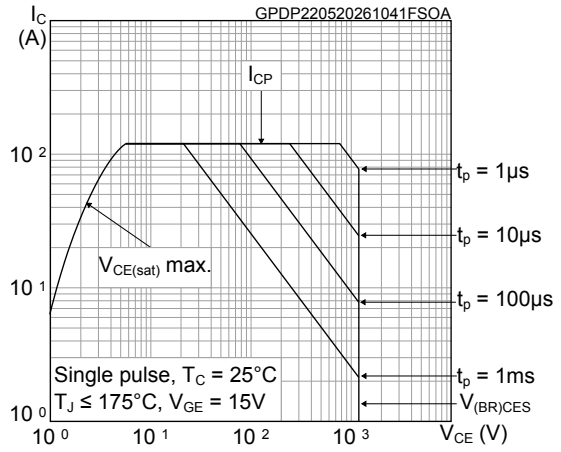


Figure 8. Transfer characteristics

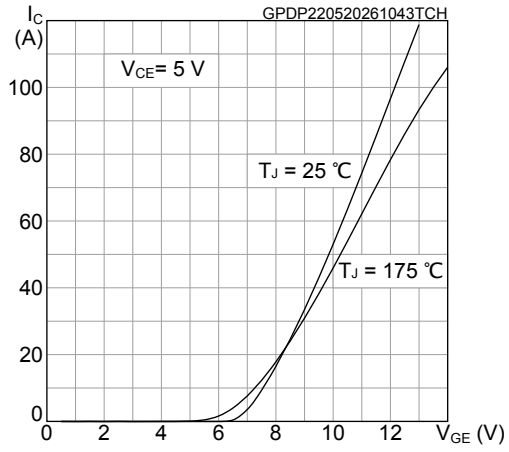


Figure 9. Diode V_F vs forward current

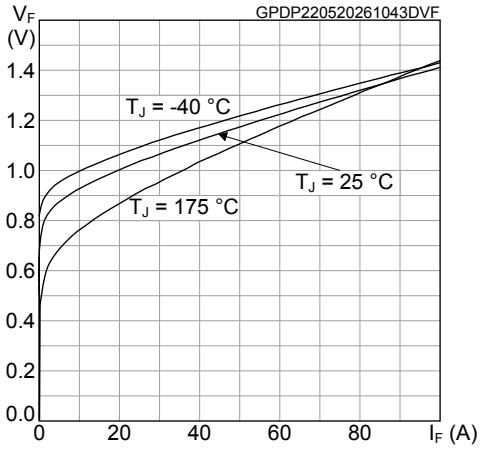


Figure 10. Normalized $V_{GE(th)}$ vs junction temperature

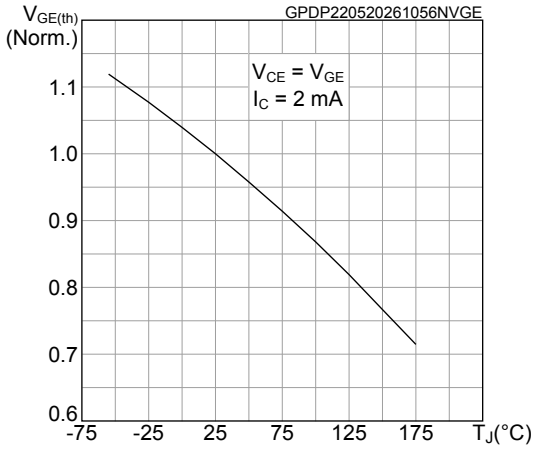


Figure 11. Normalized $V_{(BR)CES}$ vs junction temperature

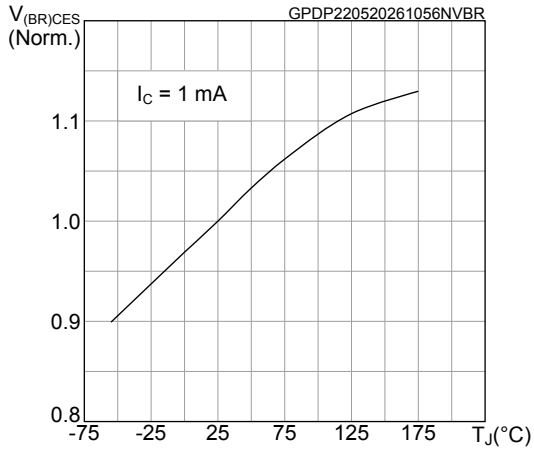


Figure 12. Capacitance variations

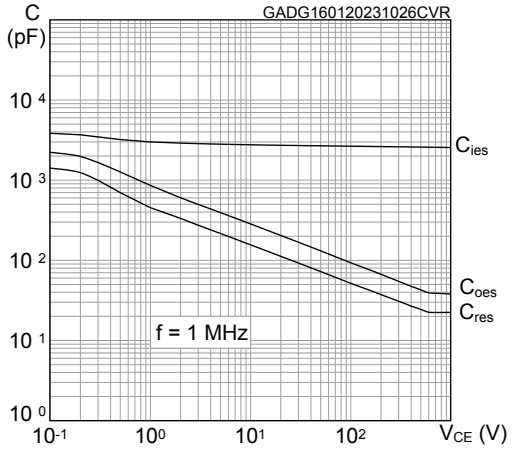


Figure 13. Gate charge vs gate-emitter voltage

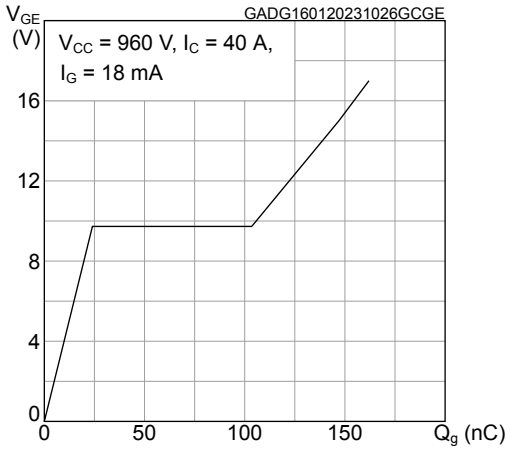


Figure 14. IGBT maximum transient thermal impedance

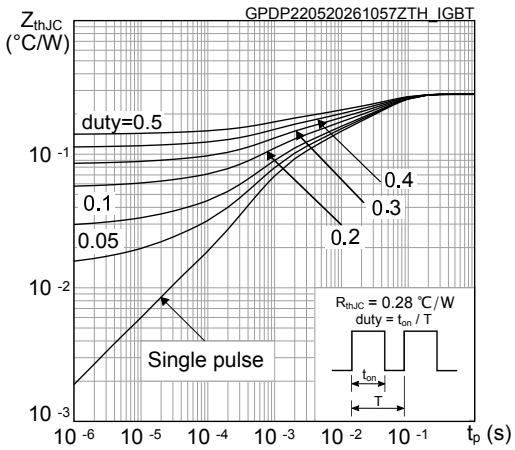
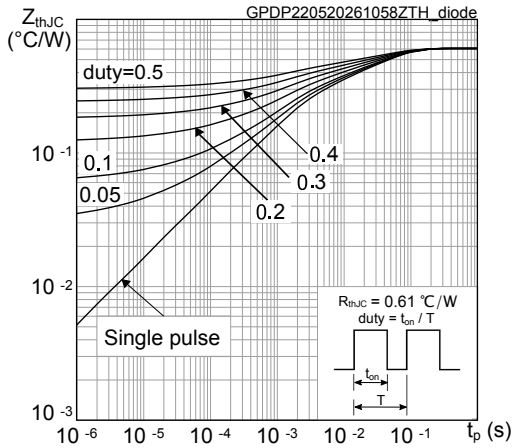


Figure 15. Diode maximum transient thermal impedance



3 Test circuits

Figure 16. Test circuit for inductive load switching

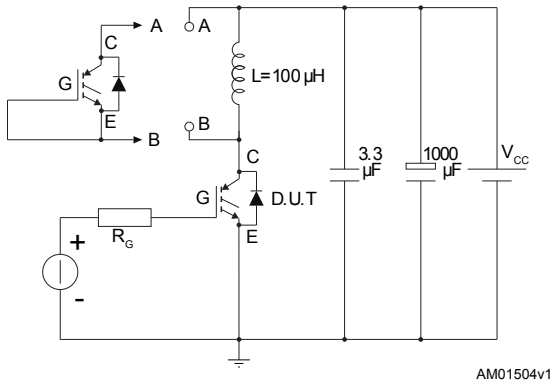


Figure 17. Gate charge test circuit

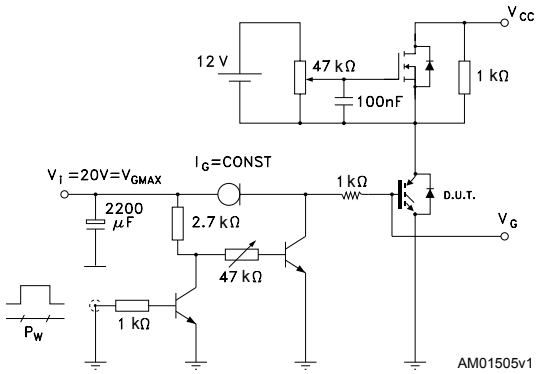


Figure 18. Switching waveform

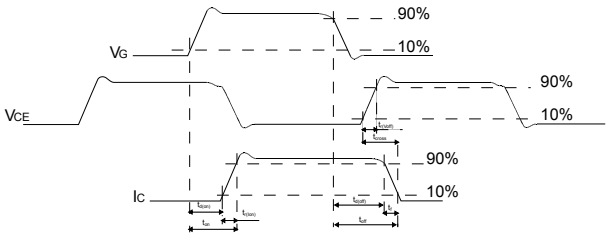
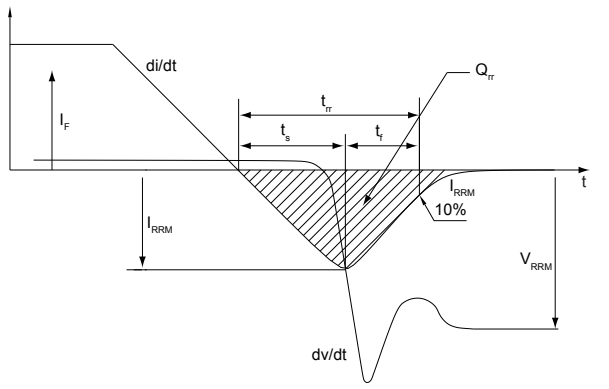


Figure 19. Diode reverse recovery waveform



4 Package information

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 long leads package information

Figure 20. TO-247 long leads package outline

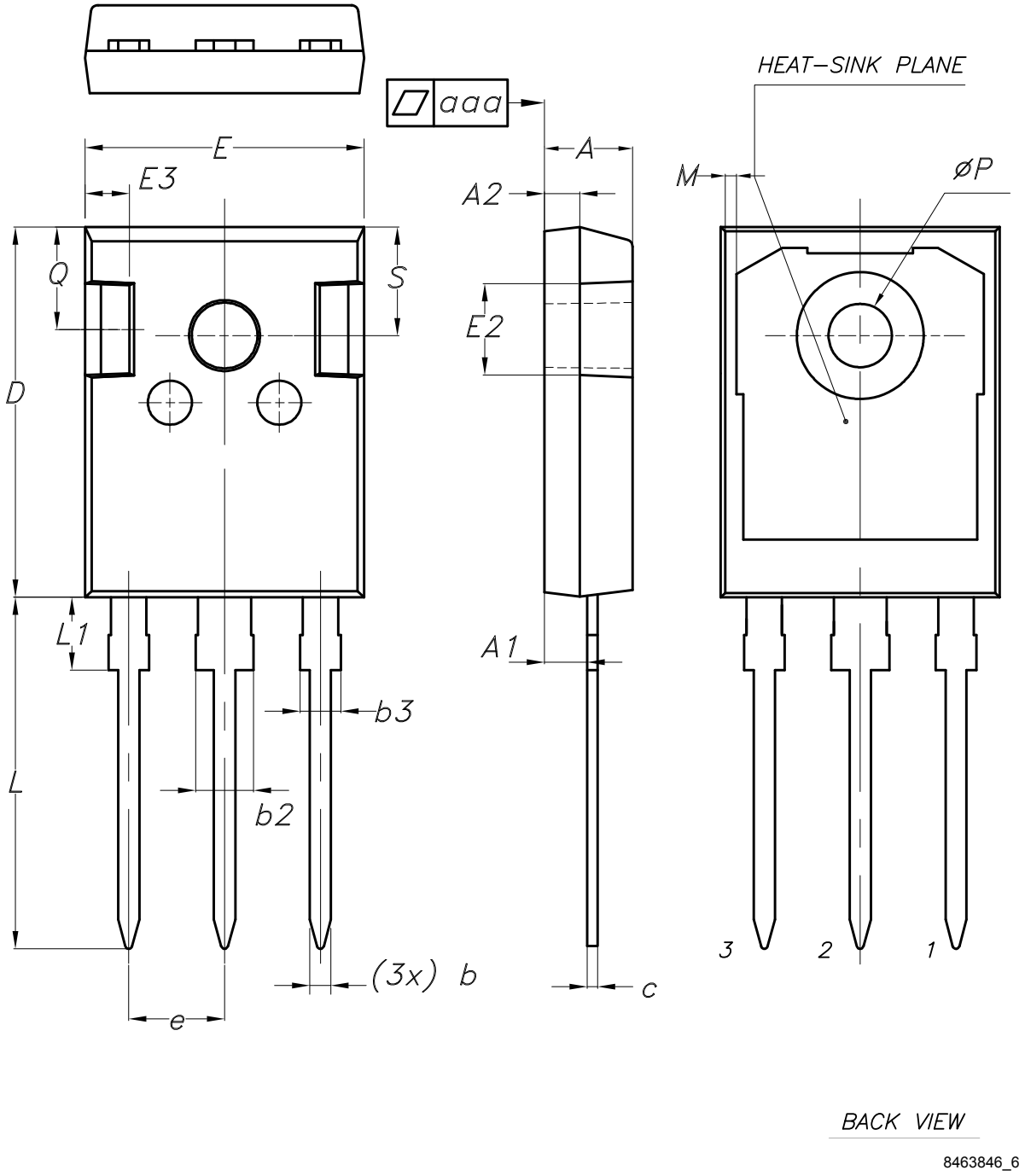


Table 6. **TO-247 long leads package mechanical data**

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
M	0.35		0.95
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 7. **Document revision history**

Date	Revision	Changes
25-May-2026	1	First release.

Contents

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice.

In the event of any conflict between the provisions of this document and the provisions of any contractual arrangement in force between the purchasers and ST, the provisions of such contractual arrangement shall prevail.

The purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

The purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of the purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

If the purchasers identify an ST product that meets their functional and performance requirements but that is not designated for the purchasers' market segment, the purchasers shall contact ST for more information.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.