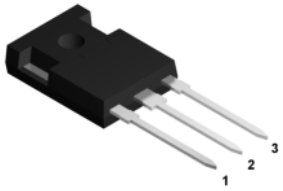
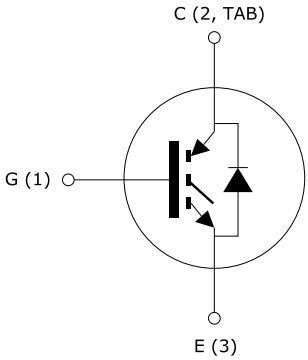
STGW30NC60VD

Datasheet

40 A, 600 V, fast IGBT with UltraFAST diode



TO-247 long leads



SC12850_DIODE_IGBT

Features

- High current capability
- High frequency operation up to 50 kHz
- Very soft ultra fast recovery antiparallel diode

Applications

- High frequency inverters, UPS
- Motor drive
- SMPS and PFC in both hard switch and resonant topologies

Description

This device uses the advanced PowerMESH process resulting in an excellent trade-off between switching performance and low on-state behavior.

Product status link
STGW30NC60VD

Product summary	
Order code	STGW30NC60VD
Marking	GW30NC60VD
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)	600	V
I_C(1)	Continuous collector current at T_C = 25 °C	80	A
	Continuous collector current at T_C = 100 °C	40	
I_{CL}(2)	Turn-off latching current	100	A
I_{CP}(3)	Pulsed collector current	150	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Diode RMS forward current at T_C = 25 °C	30	A
I_{FSM}	Surge not repetitive forward current, t_P = 10 ms sinusoidal	120	A
P_{TOT}	Total power dissipation at T_C = 25 °C	250	W
T_J	Operating junction temperature range	-55 to 150	°C
T_{STG}	Storage temperature range		°C

1. *Calculated according to the iterative formula:* $I_C(T_C) = \frac{T_{J(\max)} - T_C}{R_{thj-C} \times V_{CE(sat)}(\max)\left(T_{J(\max)}, I_C(T_C)\right)}$
2. *V_{clamp} = 80% V_{CES}, T_J =150 °C, R_G = 10 Ω, V_{GE} = 15 V.*
3. *Pulse width limited by maximum junction temperature and turn-off within RBSOA.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case IGBT	0.5	°C/W
	Thermal resistance, junction-to-case diode	1.5	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0 V, I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 20 A		1.8	2.5	V
		V_{GE} = 15 V, I_C = 40 A		2.1		
		V_{GE} = 15 V, I_C = 80 A, T_J= 100 °C		2.9		
		V_{GE} = 15 V, I_C = 20 A, T_J= 125 °C		1.7		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 600 V			10	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 125 °C (1)			1	mA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			±100	nA
g_{fs}	Forward transconductance	V_{CE} = 15 V, I_C = 20 A		15		S

1. *Specified by design, not tested in production.*

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	2200		pF
C_{oes}	Output capacitance		-	225		
C_{res}	Reverse transfer capacitance		-	50		
Q_g	Total gate charge	V_{CE} = 390 V, I_C = 20 A, V_{GE} = 15 V (see Figure 17. Gate charge test circuit)	-	100	140	nC
Q_{ge}	Gate-emitter charge		-	16		
Q_{gc}	Gate-collector charge		-	45		

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 20 A,	-	31	-	ns
t_r	Current rise time	R_G = 3.3 Ω, V_{GE} = 15 V	-	11	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	1600	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 20 A,	-	31	-	ns
t_r	Current rise time	R_G = 3.3 Ω, V_{GE} = 15 V, T_J = 125 °C	-	11.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	1500	-	A/µs
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 390 V, I_C = 20 A,	-	28	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 3.3 Ω, V_{GE} = 15 V	-	100	-	ns
t_f	Current fall time	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	75	-	ns
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 390 V, I_C = 20 A,	-	66	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 3.3 Ω, V_{GE} = 15 V, T_J = 125 °C	-	150	-	ns
t_f	Current fall time	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	130	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{CC} = 390 V, I_C = 20 A,	-	220	300	µJ
E_{off}(1)	Turn-off switching energy	R_G = 3.3 Ω, V_{GE} = 15 V	-	330	450	µJ
E_{ts}	Total switching energy	(see Figure 16. Test circuit for inductive load switching)	-	550	750	µJ
E_{on}	Turn-on switching energy	V_{CC} = 390 V, I_C = 20 A,	-	450		µJ
E_{off}(1)	Turn-off switching energy	R_G = 3.3 Ω, V_{GE} = 15 V, T_J = 125 °C	-	770		µJ
E_{ts}	Total switching energy	(see Figure 16. Test circuit for inductive load switching)	-	1220		µJ

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

Table 7. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	I_F = 20 A	-	1.8	2.3	V
		I_F = 20 A, T_J = 125 °C	-	1.4		V
t_{rr}	Reverse recovery time	I_F = 20 A, V_R = 40 V, T_J = 25 °C, di/dt =100 A/µs (see Figure 19. Diode reverse recovery waveform)	-	44		ns
Q_{rr}	Reverse recovery charge		-	66		nC
I_{rrm}	Reverse recovery current		-	3		A
t_{rr}	Reverse recovery time	I_F = 20 A, V_R = 40 V, T_J = 125 °C, di/dt =100 A/µs (see Figure 19. Diode reverse recovery waveform)	-	88		ns
Q_{rr}	Reverse recovery charge		-	237		nC
I_{rrm}	Reverse recovery current		-	5.4		A

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

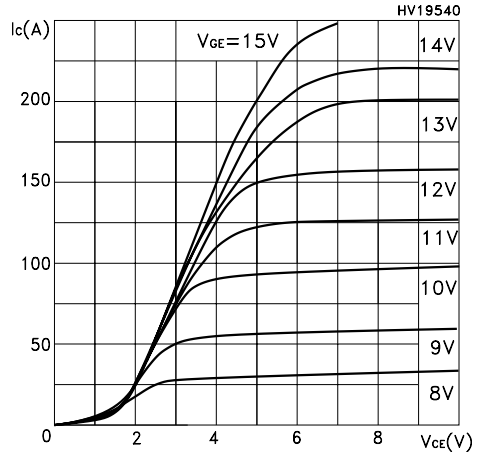


Figure 2. Transfer characteristics

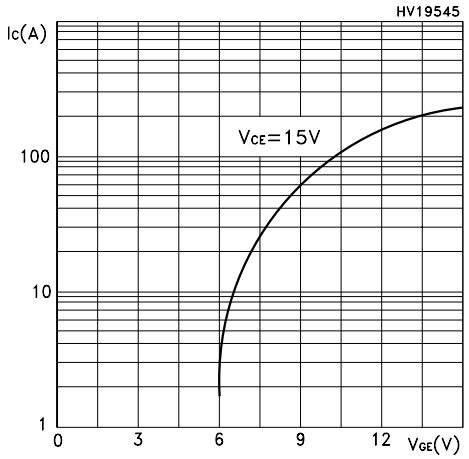


Figure 3. Transconductance

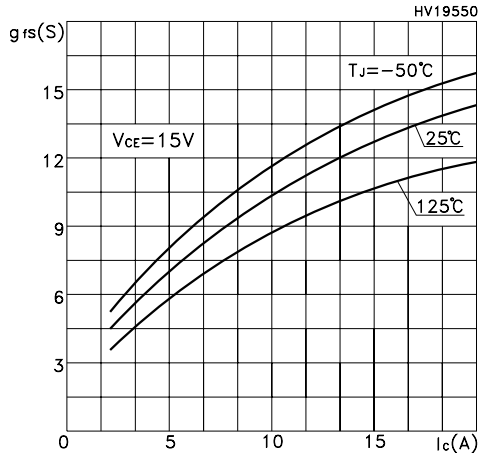


Figure 4. Collector-emitter on voltage vs temperature

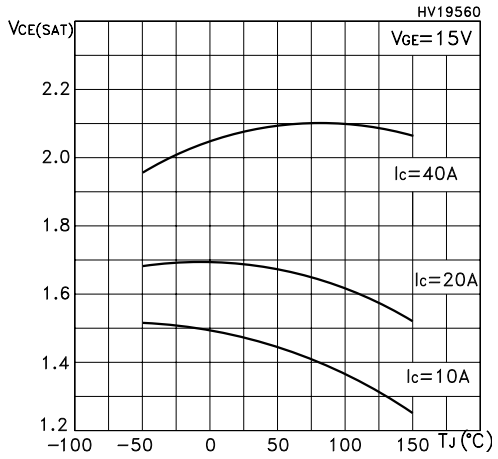


Figure 5. Gate charge vs gate-source voltage

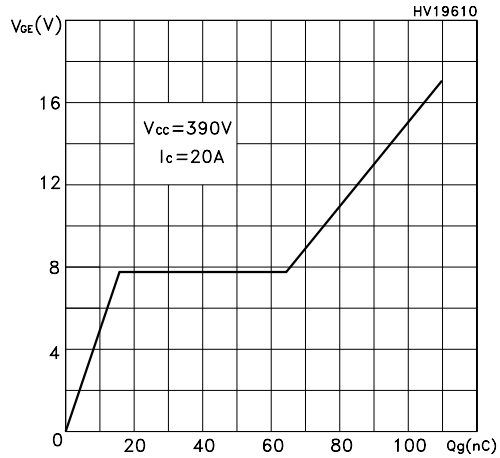


Figure 6. Capacitance variations

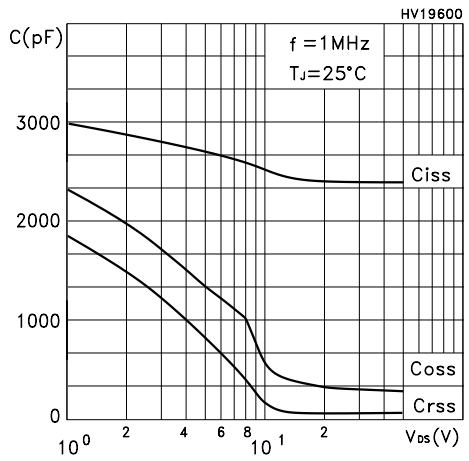


Figure 7. Normalized gate threshold voltage vs temperature

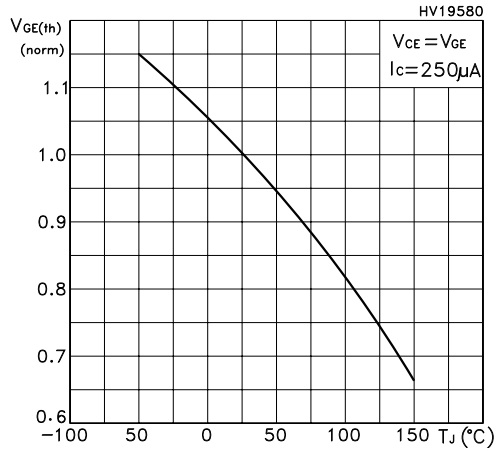


Figure 8. Collector-emitter on voltage vs collector current

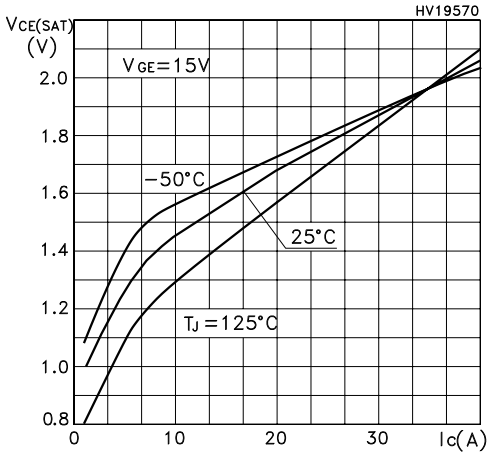


Figure 9. Normalized breakdown voltage vs temperature

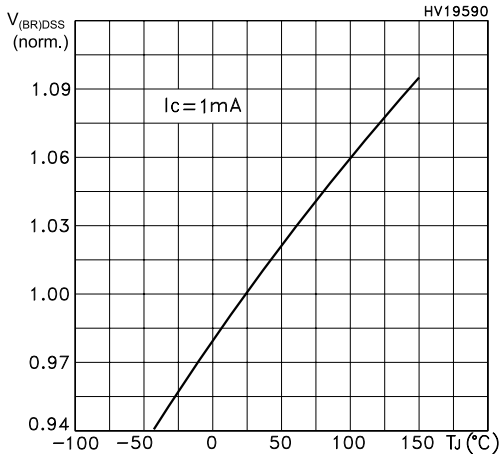


Figure 10. Switching energy vs temperature

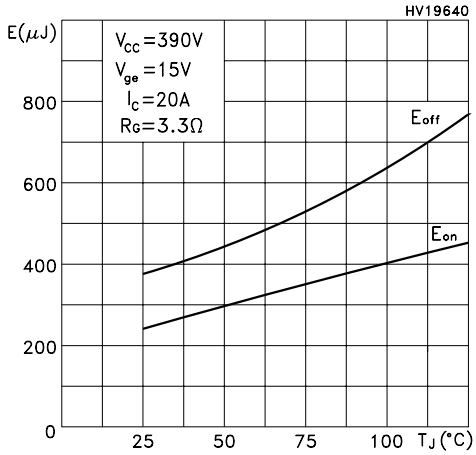


Figure 11. Switching energy vs gate resistance

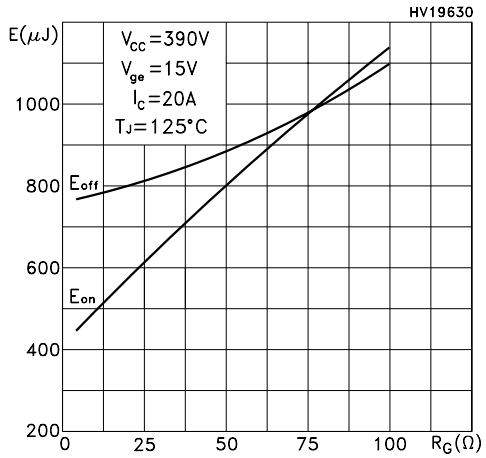


Figure 12. Switching energy vs collector current

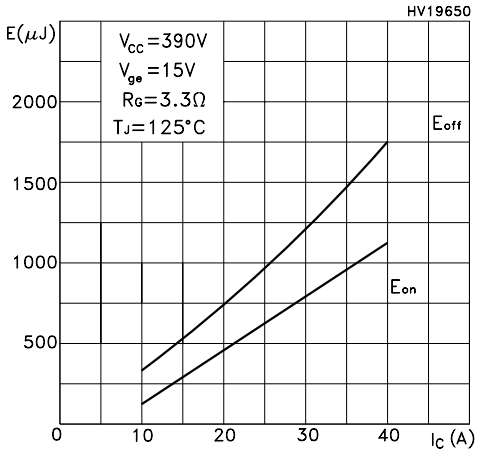


Figure 13. Turn-off SOA

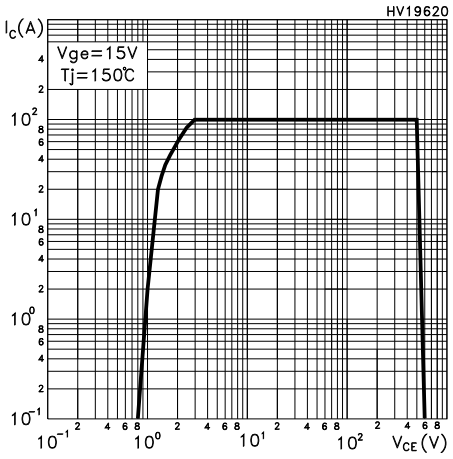


Figure 14. Thermal Impedance

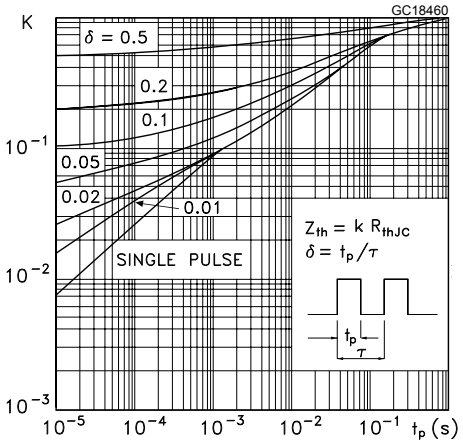
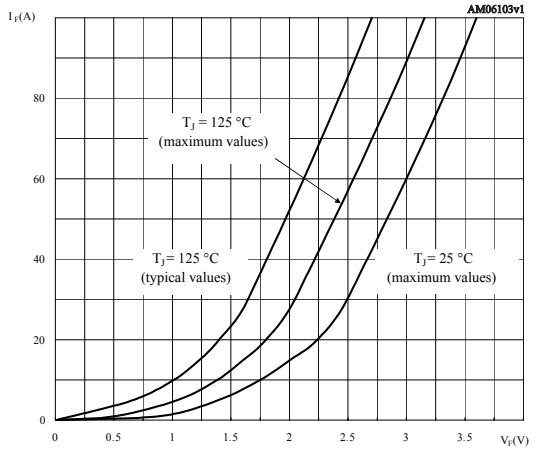


Figure 15. Emitter-collector diode characteristics



3 Test circuits

Figure 16. Test circuit for inductive load switching

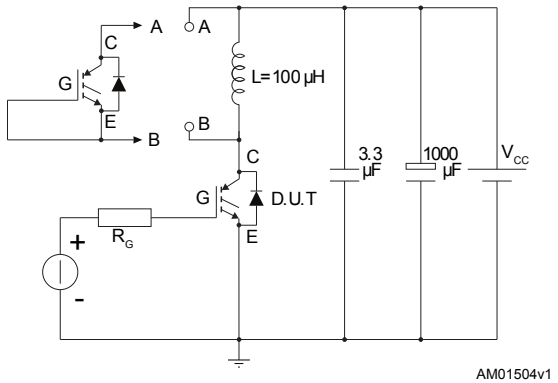


Figure 17. Gate charge test circuit

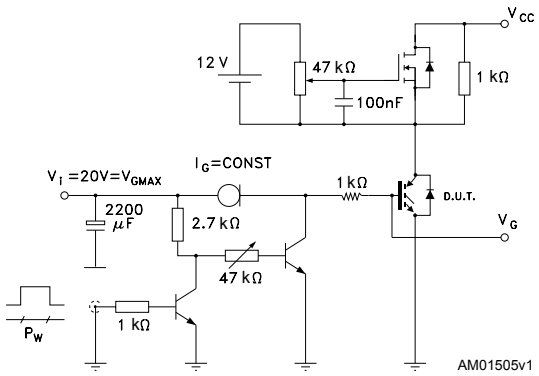


Figure 18. Switching waveform

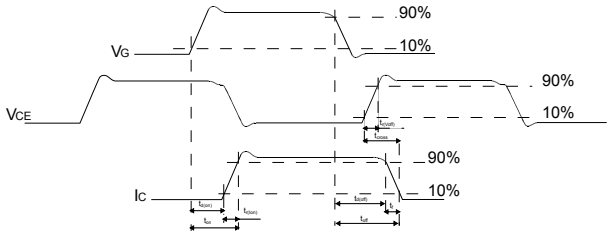
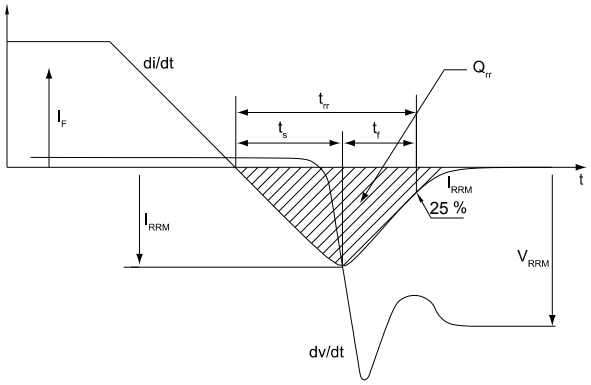


Figure 19. Diode reverse recovery waveform

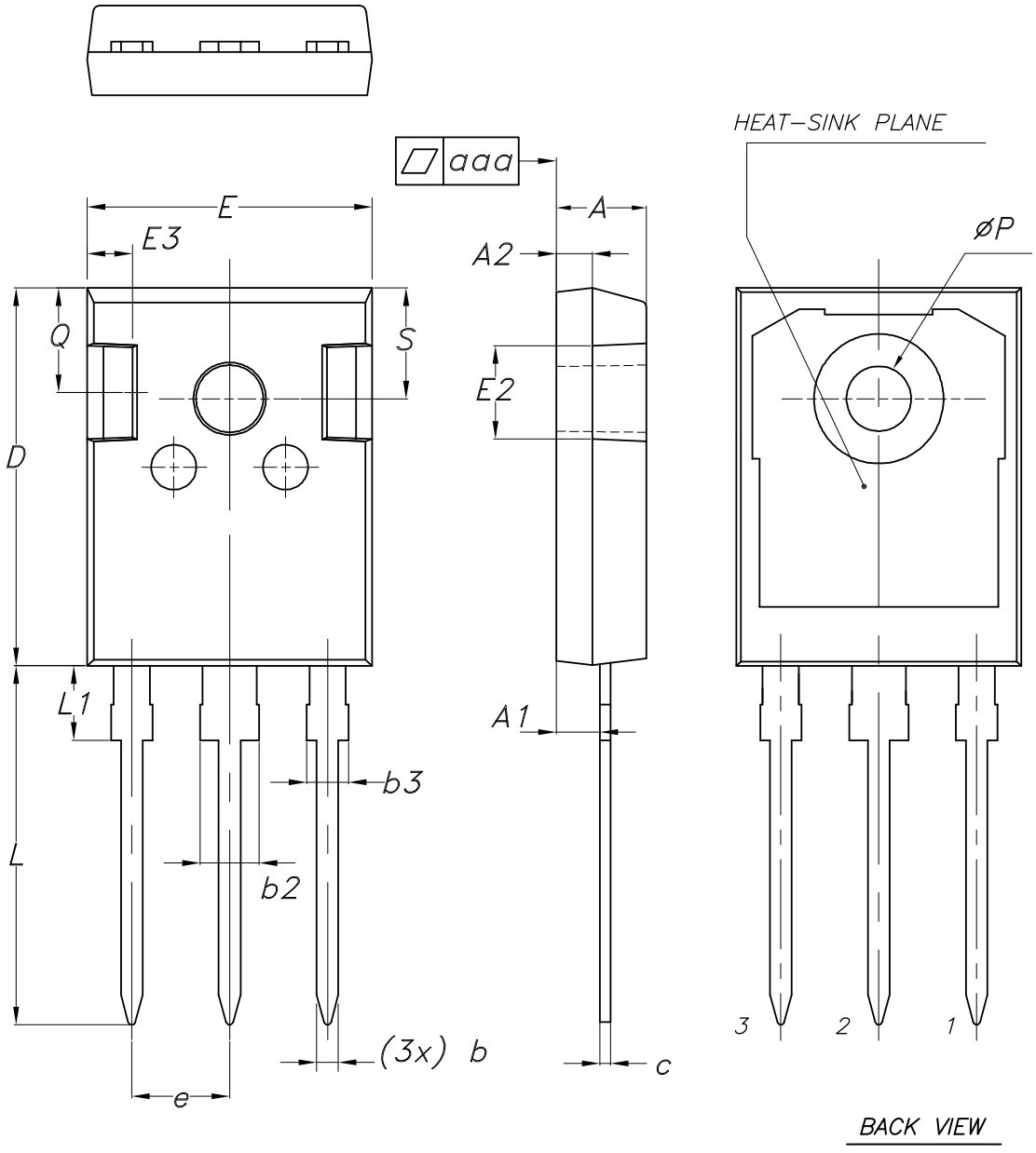


4 Package information

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 long leads package information

Figure 20. TO-247 long leads package outline



8463846_3

Table 8. **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 9. Document revision history

Date	Version	Changes
12-Feb-2007	1	First release.
19-Feb-2007	2	*Figure 6* has been updated
12-Mar-2010	3	Inserted IFSM parameter on *Table 2: Absolute maximum ratings*. Updated *Figure 16: Emitter-collector diode characteristics* and package mechanical data.
03-Jan-2011	4	Updated *Table 4: Static*, *Table 8: Collector-emitter diode* and *Figure 14: Thermal impedance*.
23-Feb-2011	5	Added T_L row *Table 2 on page 3*.
02-May-2022	6	Updated Section 4.1 TO-247 long leads package information. Minor text changes.

Contents

1 **Electrical ratings** 2

2 **Electrical characteristics** 3

2.1 Electrical characteristics (curves) 6

3 **Test circuits** 9

4 **Package information** 10

4.1 TO-247 long leads package information 10

Revision history 12

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. 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.

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 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.

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.

© 2022 STMicroelectronics – All rights reserved