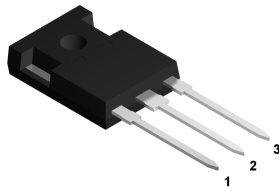
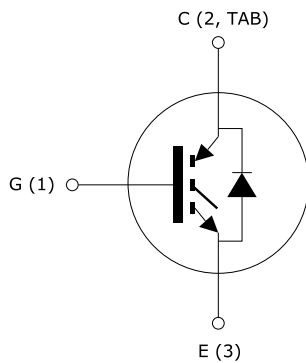


31 A, 600 V, fast IGBT with UltraFAST diode



TO-247 long leads



SC12850_DIODE_IGBT



Features

- Low on-voltage drop ($V_{CE(sat)}$)
- Very soft UltraFAST recovery anti-parallel diode

Applications

- High frequency motor drives
- 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

[STGWA19NC60HD](#)

Product summary

Order code	STGWA19NC60HD
Marking	GWA19NC60HD
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	52	A
	Continuous collector current at T _C = 100 °C	31	
I _{CL} ⁽²⁾	Turn-off latching current	40	A
I _{CP} ⁽³⁾	Pulsed collector current	60	A
V _{GE}	Gate-emitter voltage	±20	V
I _F	Diode RMS forward current at T _C = 25 °C	20	A
I _{FSM}	Surge not repetitive forward current, t _p = 10 ms sinusoidal	50	A
P _{TOT}	Total power dissipation at T _C = 25 °C	208	W
T _J	Operating junction temperature range	-55 to 150	°C
T _{STG}	Storage temperature range		°C

1. Calculated according to the iterative formula:
$$I_C(T_C) = \frac{T_{J(\max)} - T_C}{R_{thj-c} \times V_{CE(sat)(\max)}(T_{J(\max)}, I_C(T_C))}$$
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	0.6	°C/W
	Thermal resistance, junction-to-case diode	3	°C/W
R _{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

2 Electrical characteristics

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

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 12\text{ A}$		1.8	2.5	V
		$V_{GE} = 15\text{ V}, I_C = 15\text{ A}$		2		
		$V_{GE} = 15\text{ V}, I_C = 30\text{ A}, T_J = 100\text{ °C}$		2.5		
		$V_{GE} = 15\text{ V}, I_C = 12\text{ A}, T_J = 125\text{ °C}$		1.6		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3.75		5.75	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$			150	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ °C}^{(1)}$			1	mA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			± 100	nA
g_{fs}	Forward transconductance	$V_{CE} = 15\text{ V}, I_C = 12\text{ A}$		5		S

1. Specified by design, not tested in production.

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	1180	-	pF
C_{oes}	Output capacitance		-	130	-	
C_{res}	Reverse transfer capacitance		-	36	-	
Q_g	Total gate charge	$V_{CE} = 390\text{ V}, I_C = 12\text{ A}, V_{GE} = 15\text{ V}$ (see Figure 17. Gate charge test circuit)	-	53	-	nC
Q_{ge}	Gate-emitter charge		-	10	-	
Q_{gc}	Gate-collector charge		-	23	-	

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$,	-	25	-	ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	7	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	1600	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$,	-	24	-	ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	1400	-	A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$,	-	27	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	97	-	ns
t_f	Current fall time	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	73	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$,	-	58	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	144	-	ns
t_f	Current fall time	(see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform)	-	128	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$,	-	85	-	μ J
$E_{off}^{(1)}$	Turn-off switching energy	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	189	-	μ J
E_{ts}	Total switching energy	(see Figure 16. Test circuit for inductive load switching)	-	274	-	μ J
E_{on}	Turn-on switching energy	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$,	-	187	-	μ J
$E_{off}^{(1)}$	Turn-off switching energy	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	407	-	μ J
E_{ts}	Total switching energy	(see Figure 16. Test circuit for inductive load switching)	-	594	-	μ J

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 = 12 A	-	2.6	-	V		
		I _F = 12 A, T _J = 125 °C	-	2.1	-	V		
t _{rr}	Reverse recovery time	I _F = 12 A, V _R = 40 V, T _J = 25 °C, di/dt = 100 A/μs (see Figure 19. Diode reverse recovery waveform)	-	31	-	ns		
Q _{rr}	Reverse recovery charge		-	30	-	nC		
I _{rrm}	Reverse recovery current		-	2	-	A		
t _{rr}	Reverse recovery time	I _F = 12 A, V _R = 40 V, T _J = 125 °C, di/dt = 100 A/μs (see Figure 19. Diode reverse recovery waveform)	-	59	-	ns		
			Q _{rr}	Reverse recovery charge	-	102	-	nC
			I _{rrm}	Reverse recovery current	-	4	-	A

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

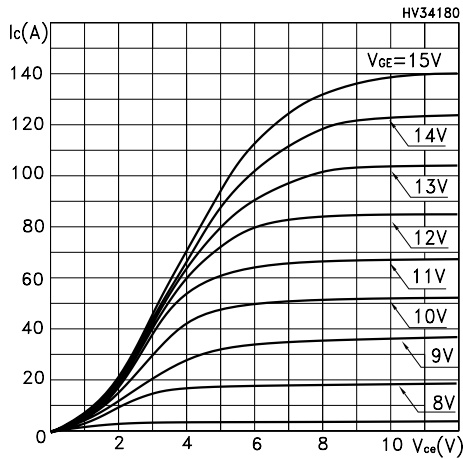


Figure 2. Transfer characteristics

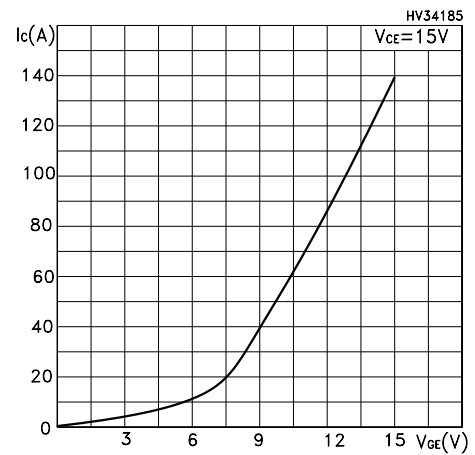


Figure 3. Transconductance

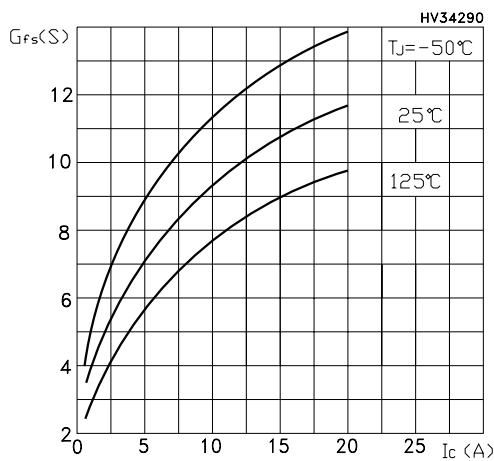


Figure 4. Collector-emitter on voltage vs temperature

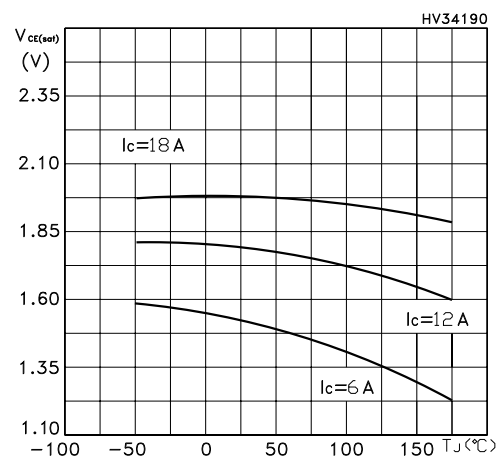


Figure 5. Gate charge vs gate-source voltage

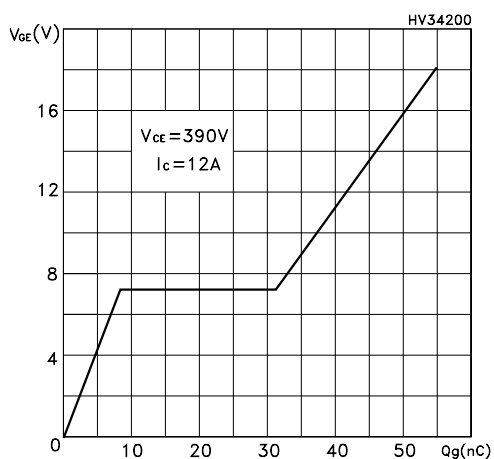


Figure 6. Capacitance variations

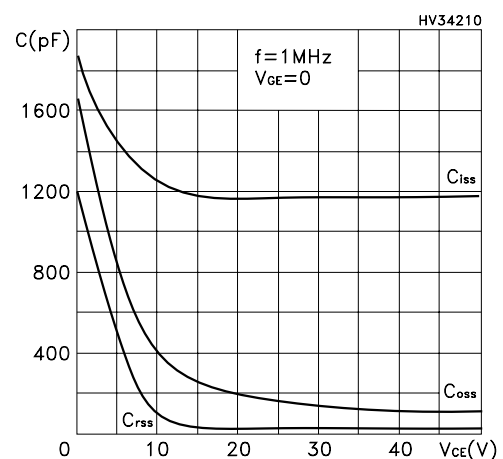


Figure 7. Normalized gate threshold voltage vs temperature

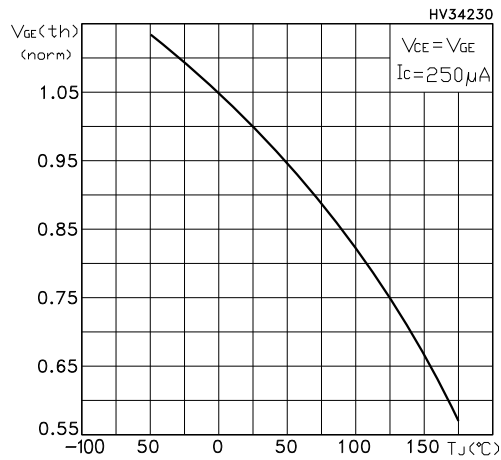


Figure 8. Collector-emitter on voltage vs collector current

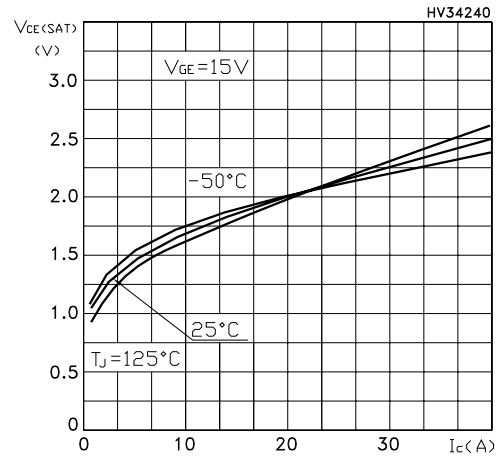


Figure 9. Normalized breakdown voltage vs temperature

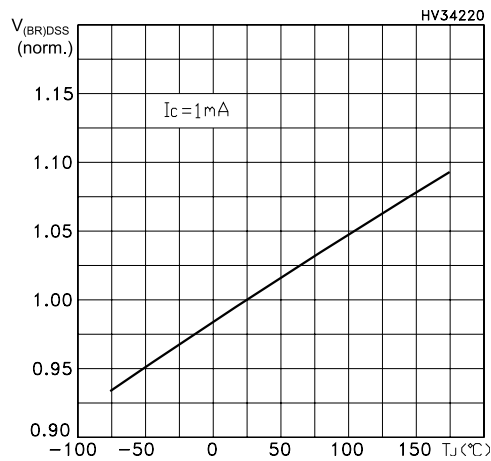


Figure 10. Switching energy vs temperature

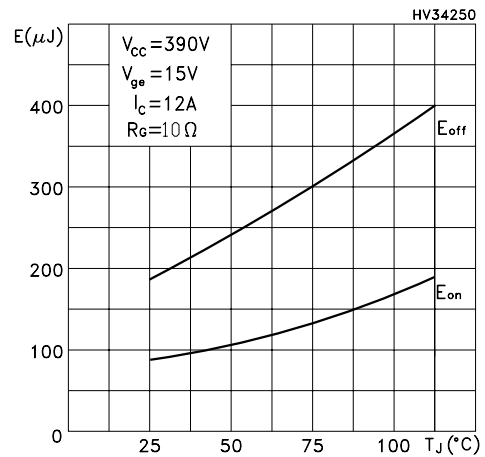


Figure 11. Switching energy vs gate resistance

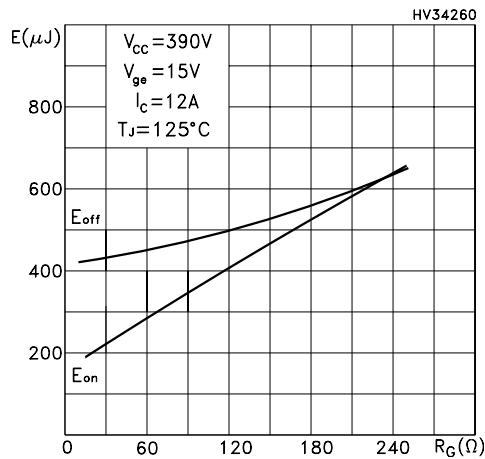


Figure 12. Switching energy vs collector current

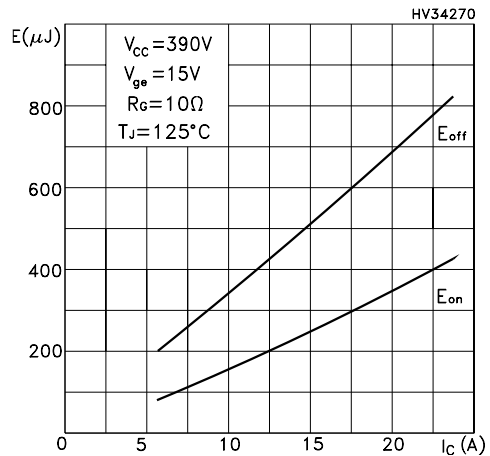


Figure 13. Turn-off SOA

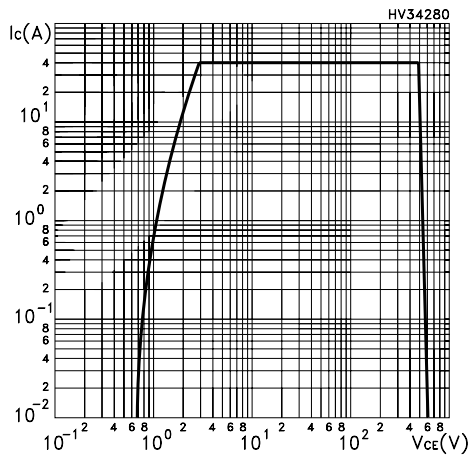


Figure 14. Thermal impedance

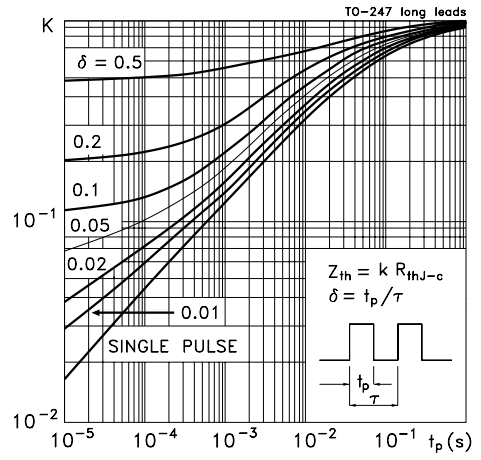
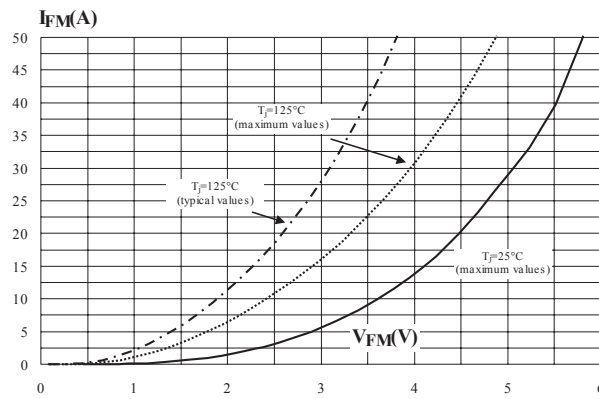
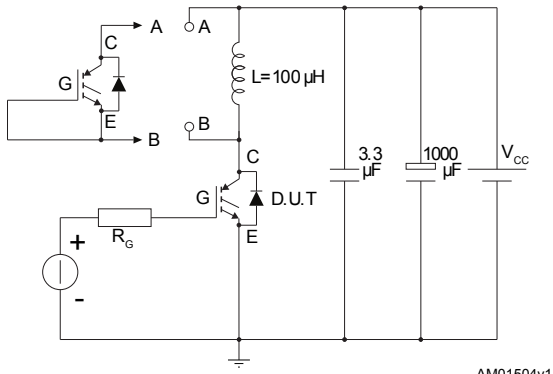
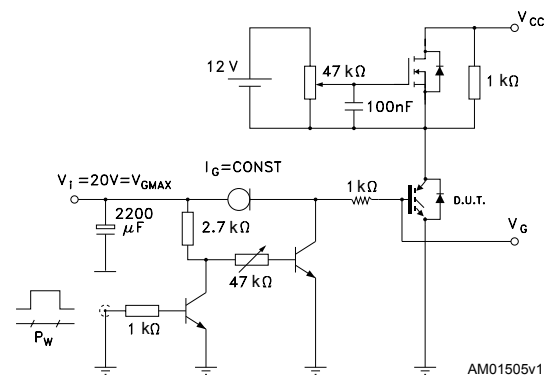
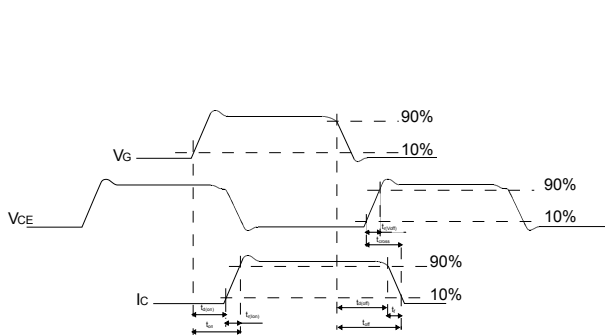
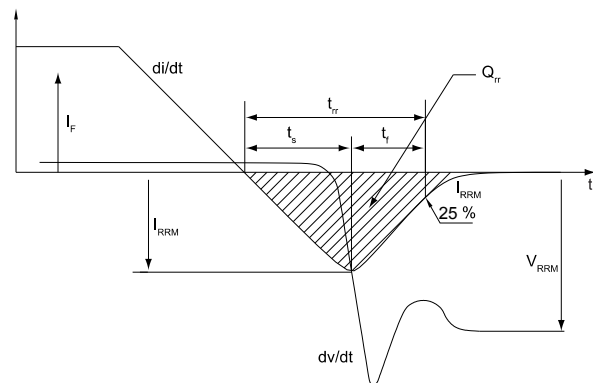


Figure 15. Forward voltage drop vs. forward current



3 Test circuits

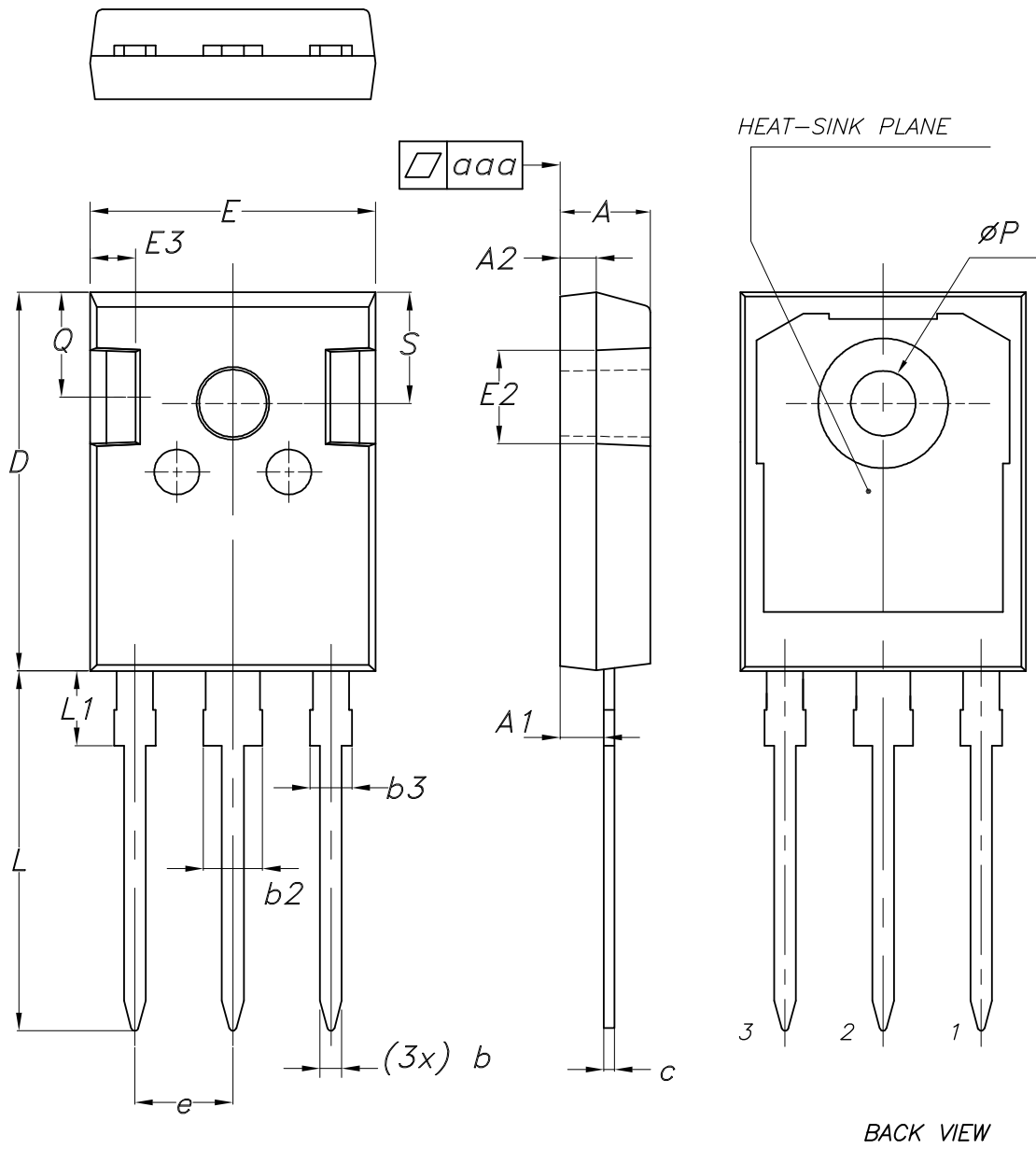
Figure 16. Test circuit for inductive load switching

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	Revision	Changes
14-Sep-2011	1	First release.
02-May-2022	2	Updated Section 4.1 TO-247 long leads package information Minor text changes.

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