STGW50HF60SD

60 A, 600 V, very low drop IGBT with soft and fast recovery diode

Features

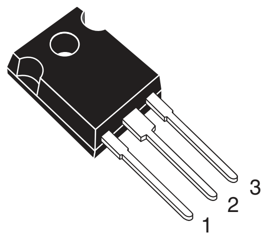
- Very low on-state voltage drop
- Low switching off
- High current capability
- Very soft ultra fast recovery antiparallel diode

Application

- PV inverter
- UPS

Description

STGW50HF60SD is a very low drop IGBT based on new advanced planar technology, showing extremely low on-state voltage and limited turn-off losses. The overall performance makes this IGBT ideal in low frequency switches of mixed frequency topologies for PF ≤1.



TO-247

Figure 1. Internal schematic diagram

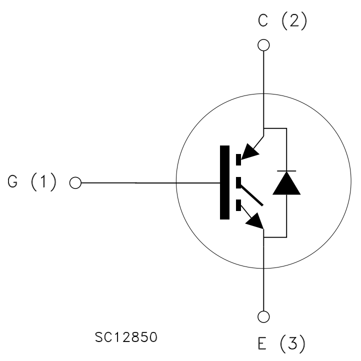


Table 1. Device summary

Order code	Marking	Package	Packaging
STGW50HF60SD	GW50HF60SD	TO-247	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600	V
I_C (1)	Continuous collector current at T_C = 25 °C	110	A
I_C (1)	Continuous collector current at T_C = 100 °C	60	A
I_{CL} (2)	Turn-off latching current	60	A
I_{CP} (3)	Pulsed collector current	130	A
V_{GE}	Gate-emitter voltage	±20	V
P_{TOT}	Total dissipation at T_C = 25 °C	284	W
I_F	Diode RMS forward current at T_C = 25 °C	30	A
I_{FSM}	Surge non repetitive forward current t_p = 10 ms sinusoidal	120	A
T_j	Operating junction temperature	- 55 to 150	°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. Vclamp = 80% of 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 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case IGBT	0.44	°C/W
$R_{thj-case}$	Thermal resistance junction-case diode	1.25	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

(T_J=25°C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 30 A V_{GE}= 15 V, I_C= 30 A, T_J =125 °C		1.15 1.05	1.45	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	3.5		5.7	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} =600 V V_{CE} =600 V, T_J=125 °C			50 500	µA µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} =± 20 V			± 100	nA
g_{fs}	Forward transconductance	V_{CE} = 15 V, I_C= 30 A		25		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}=0	-	4300 400 100	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 480 V, I_C= 30 A,V_{GE}=15 V	-	200 27 90	-	nC nC nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 15)*	-	50 20 1280	-	ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 15)*	-	47 22 1100	-	ns ns A/µs
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 15)*	-	370 220 465	-	ns ns ns
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 15)*	-	700 250 800	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 15)*	-	0.25 4.2 4.45	-	mJ mJ mJ
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 15)*	-	0.45 7.8 8.25	-	mJ mJ mJ

1. Eon is the turn-on losses when a typical diode is used in the test circuit in *Figure 15*. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs and diode are at the same temperature (25°C and 125°C).
2. Turn-off losses include also the tail of the collector current.

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	I_F = 30 A I_F = 30 A, T_J = 125 °C	-	2.8 1.8	-	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 30 A, V_R = 50 V, di/dt = 100 A/µs *(see Figure 18)*	-	67 140 4	-	ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 30 A, V_R = 50 V, T_J = 125 °C, di/dt = 100 A/µs *(see Figure 18)*	-	103 390 7	-	ns nC A

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

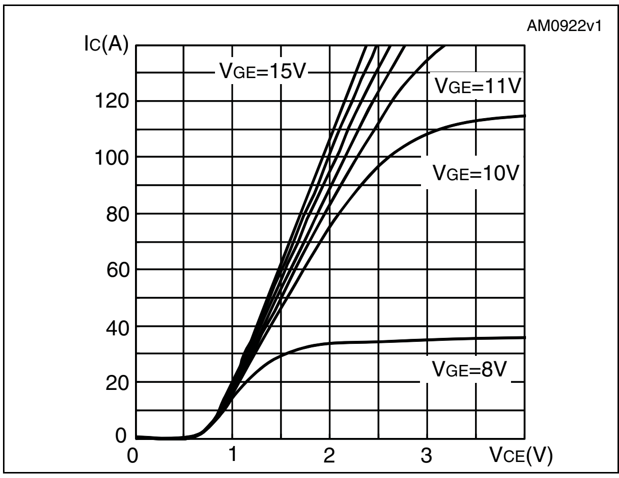


Figure 3. Transfer characteristics

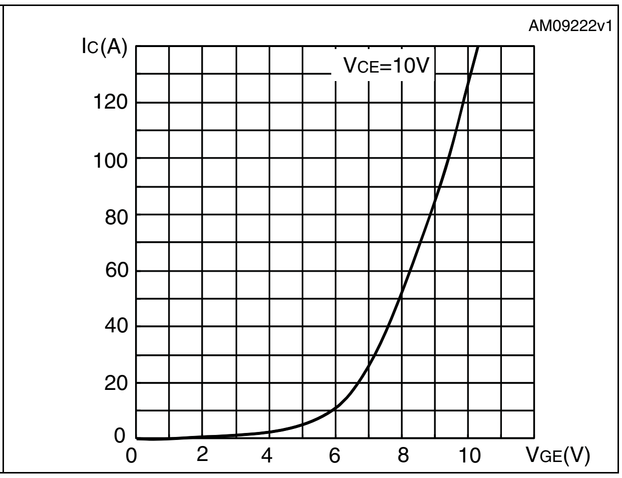


Figure 4. Collector-emitter on voltage vs temperature

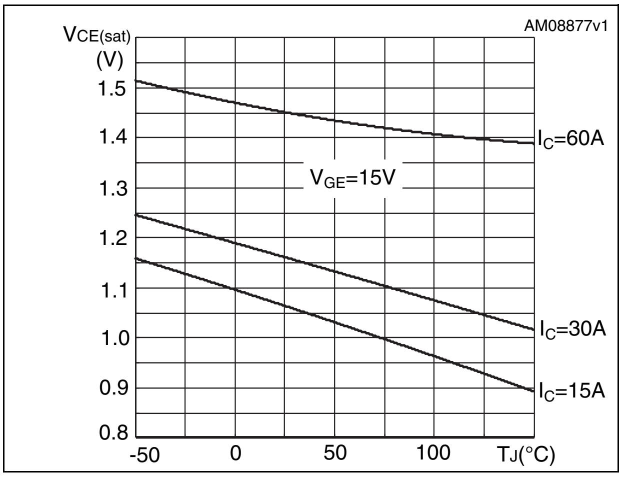


Figure 5. Collector-emitter on voltage vs collector current

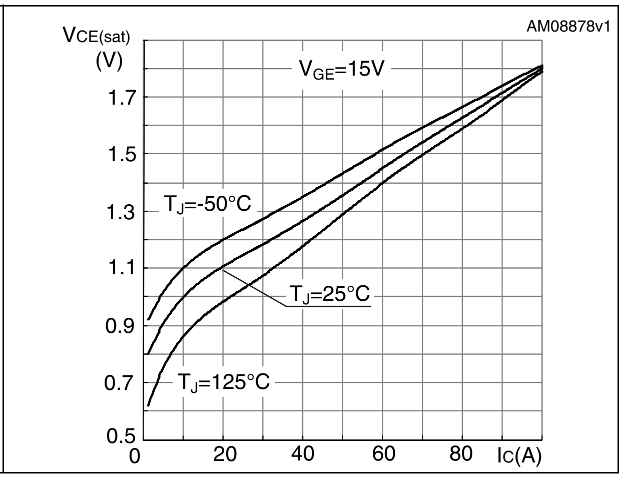


Figure 6. Breakdown voltage vs temperature

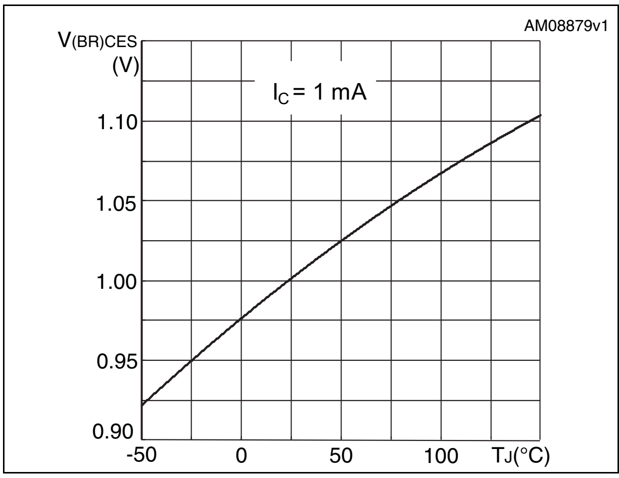


Figure 7. Gate threshold voltage vs temperature

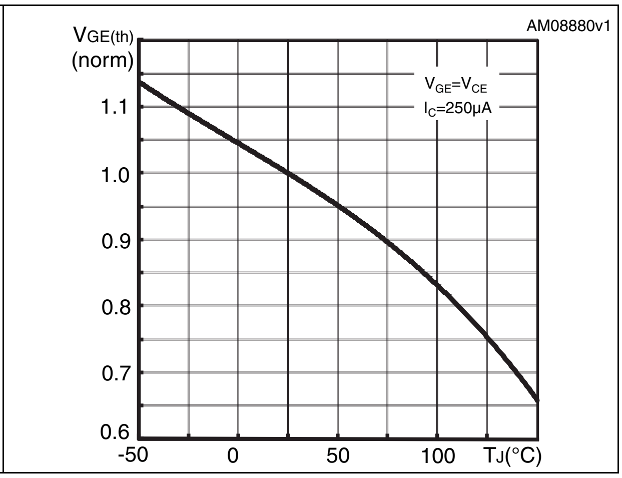


Figure 8. Gate charge vs gate-emitter voltage

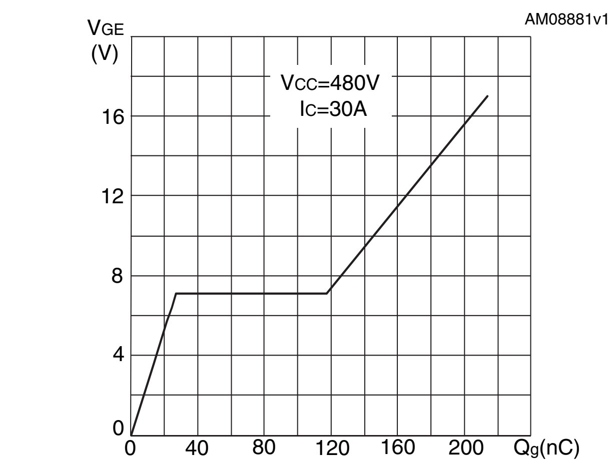


Figure 9. Capacitance variations

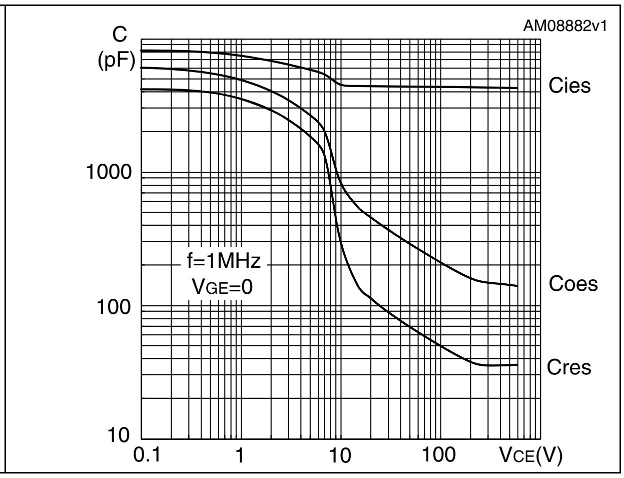


Figure 10. Switching losses vs collector current

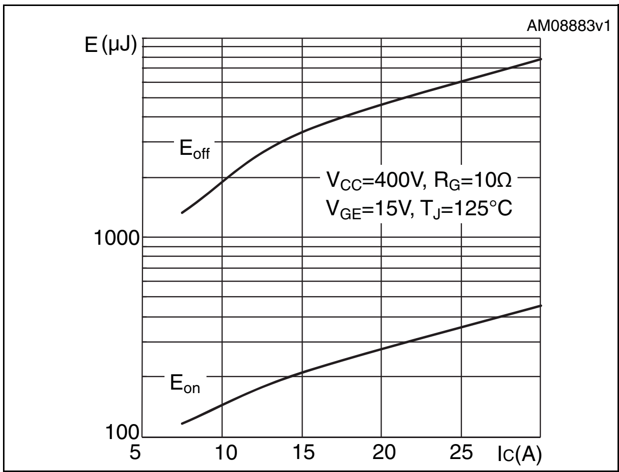


Figure 11. Switching losses vs gate resistance

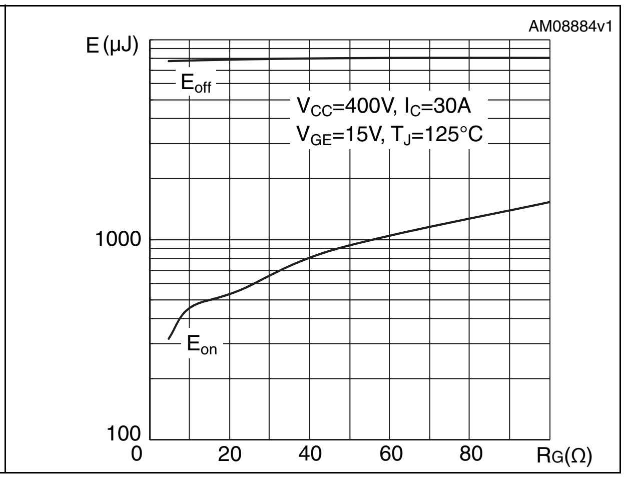


Figure 12. Switching losses vs temperature

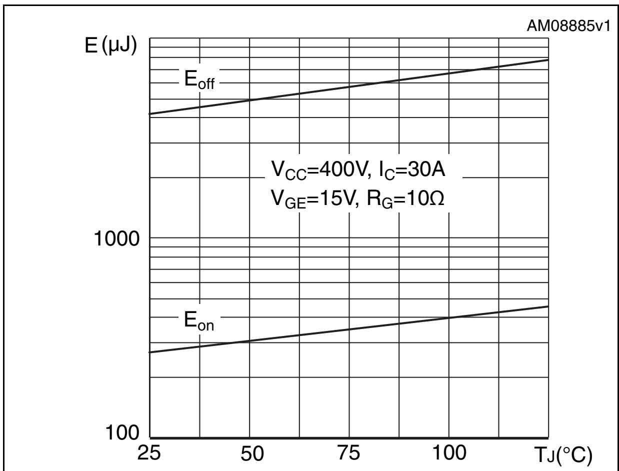


Figure 13. Turn-off SOA

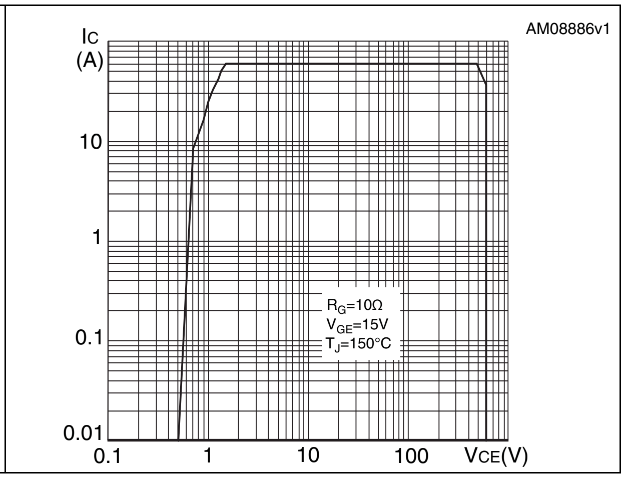
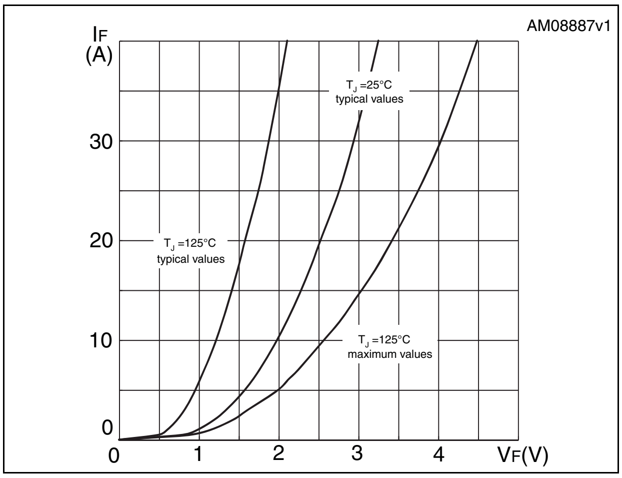


Figure 14. Emitter-collector diode characteristics



3 Test circuits

Figure 15. Test circuit for inductive load switching

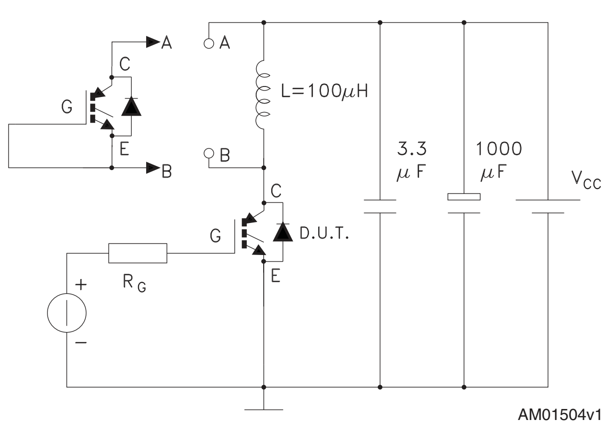


Figure 16. Gate charge test circuit

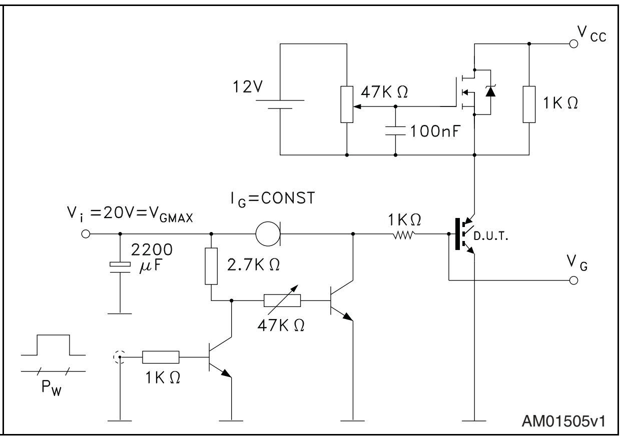


Figure 17. Switching waveform

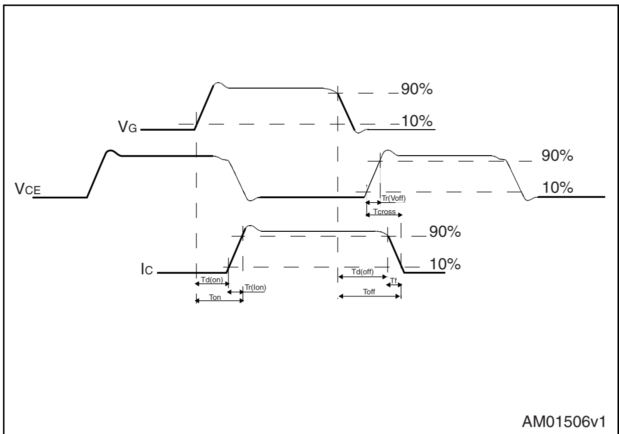
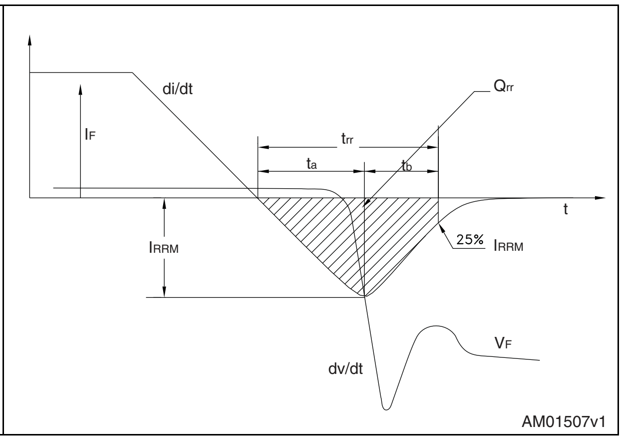


Figure 18. Diode recovery time waveform



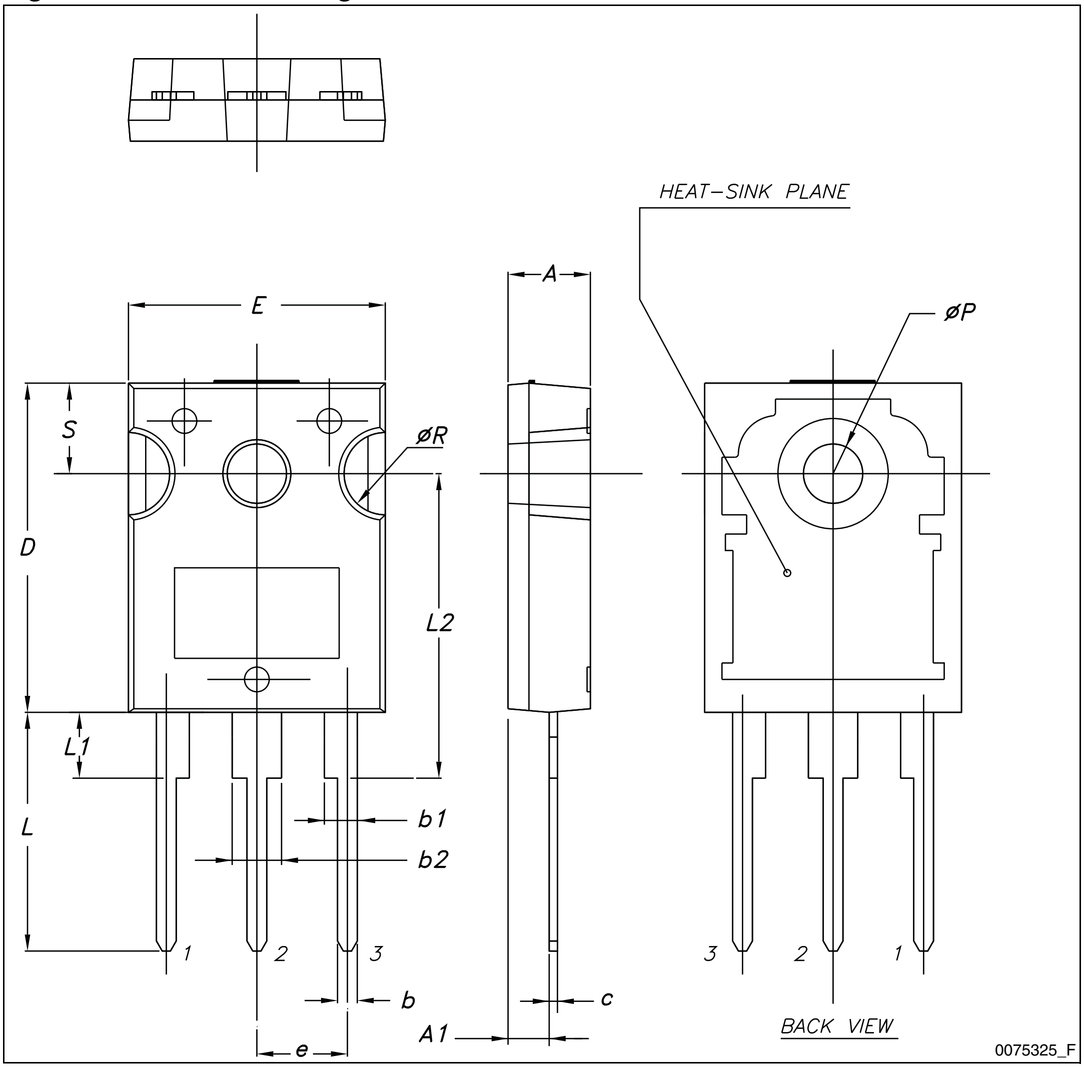
4 Package mechanical data

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.

Table 9. TO-247 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		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S		5.50	

Figure 19. TO-247 drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
15-Jan-2010	1	Initial release.
21-Dec-2010	2	Document status promoted to datasheet.