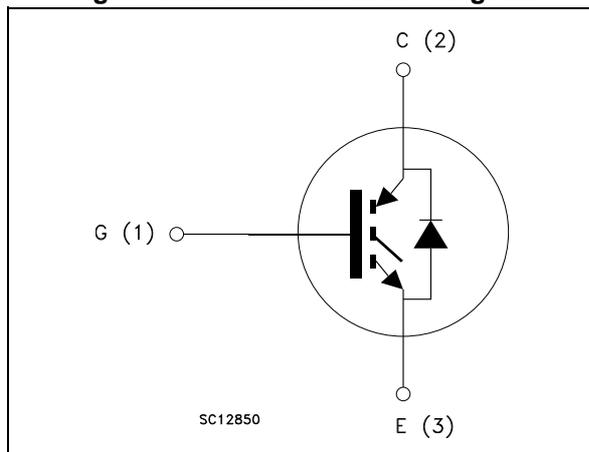


Figure 1. Internal schematic diagram



### Features

- Maximum junction temperature:  $T_J = 175\text{ }^\circ\text{C}$
- High speed switching series
- Minimized tail current
- Very low saturation voltage:  $V_{CE(sat)} = 1.65\text{ V}$  (typ.) @  $I_C = 60\text{ A}$
- Tight parameters distribution
- Safe paralleling
- Low thermal resistance
- Very fast soft recovery antiparallel diode
- Lead free package

### Applications

- Photovoltaic inverters
- High frequency converters

### Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. The device is part of the improved "H" series of IGBTs, which represent an optimum compromise between conduction and switching losses to maximize the efficiency of high frequency converters. Furthermore, a slightly positive  $V_{CE(sat)}$  temperature coefficient and very tight parameter distribution result in safer paralleling operation.

Table 1. Device summary

Order code	Marking	Package	Packaging
STGW60H65DFB	GW60H65DFB	TO-247	Tube
STGWT60H65DFB	GWT60H65DFB	TO-3P	Tube

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0$ )	650	V
$I_C$	Continuous collector current at $T_C = 25\text{ °C}$	80 <sup>(1)</sup>	A
$I_C$	Continuous collector current at $T_C = 100\text{ °C}$	60	A
$I_{CP}$ <sup>(2)</sup>	Pulsed collector current	240	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$I_F$	Continuous forward current at $T_C = 25\text{ °C}$	80 <sup>(1)</sup>	A
$I_F$	Continuous forward current at $T_C = 100\text{ °C}$	60	A
$I_{FP}$ <sup>(2)</sup>	Pulsed forward current	240	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	375	W
$T_{STG}$	Storage temperature range	- 55 to 150	°C
$T_J$	Operating junction temperature	- 40 to 175	°C

1. Current level is limited by bond wires
2. Pulse width limited by maximum junction temperature and turn-off within RBSOA

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case IGBT	0.4	°C/W
$R_{thJC}$	Thermal resistance junction-case diode	1.14	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	50	°C/W

## 2 Electrical characteristics

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

**Table 4. Static characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ( $V_{GE} = 0$ )	$I_C = 2\text{ mA}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 60\text{ A}$		1.65		V
		$V_{GE} = 15\text{ V}, I_C = 60\text{ A}$ $T_J = 125\text{ °C}$		1.8		
		$V_{GE} = 15\text{ V}, I_C = 60\text{ A}$ $T_J = 175\text{ °C}$		1.9		
$V_F$	Forward on-voltage	$I_F = 60\text{ A}$		2	TBD	V
		$I_F = 60\text{ A}, T_J = 125\text{ °C}$		1.7		V
		$I_F = 60\text{ A}, T_J = 175\text{ °C}$		1.6		V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$		6.0		V
$I_{CES}$	Collector cut-off current ( $V_{GE} = 0$ )	$V_{CE} = 650\text{ V}$			25	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{ V}$			250	nA

**Table 5. Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz},$ $V_{GE} = 0$	-	7900	-	pF
$C_{oes}$	Output capacitance		-	TBD	-	pF
$C_{res}$	Reverse transfer capacitance		-	TBD	-	pF
$Q_g$	Total gate charge	$V_{CC} = 520\text{ V}, I_C = 60\text{ A},$ $V_{GE} = 15\text{ V},$ see <a href="#">Figure 3</a>	-	340	-	nC
$Q_{ge}$	Gate-emitter charge		-	TBD	-	nC
$Q_{gc}$	Gate-collector charge		-	TBD	-	nC

**Table 6. IGBT switching characteristics (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$ , $I_C = 60\text{ A}$ , $R_G = 5\ \Omega$ , $V_{GE} = 15\text{ V}$ , see <a href="#">Figure 2</a>	-	TBD		ns
$t_r$	Current rise time		-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	TBD		A/ $\mu$ s
$t_{d(off)}$	Turn-off delay time			TBD		ns
$t_f$	Current fall time		-	TBD	-	ns
$E_{on}^{(1)}$	Turn-on switching losses		-	0.8	-	mJ
$E_{off}^{(2)}$	Turn-off switching losses		-	0.65	-	mJ
$E_{ts}$	Total switching losses	-	1.45	-	mJ	
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$ , $I_C = 60\text{ A}$ , $R_G = 5\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$ , see <a href="#">Figure 2</a>	-	TBD		ns
$t_r$	Current rise time		-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	TBD		A/ $\mu$ s
$t_{d(off)}$	Turn-off delay time			TBD		ns
$t_f$	Current fall time		-	TBD	-	ns
$E_{on}^{(1)}$	Turn-on switching losses		-	1.6	-	mJ
$E_{off}^{(2)}$	Turn-off switching losses		-	1.25	-	mJ
$E_{ts}$	Total switching losses	-	2.85	-	mJ	

1. Energy losses include reverse recovery of the diode.
2. Turn-off losses include also the tail of the collector current.

**Table 7. Diode switching characteristics (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$I_F = 60\text{ A}$ , $V_R = 400\text{ V}$ , $R_G = 5\ \Omega$ , $V_{GE} = 15\text{ V}$ , see <a href="#">Figure 2</a>	-	TBD	-	ns
$Q_{rr}$	Reverse recovery charge		-	TBD	-	nC
$I_{rrm}$	Reverse recovery current		-	TBD	-	A
$dl_{rr}/dt$	Peak rate of fall of reverse recovery current during $t_b$		-	TBD	-	A/ $\mu$ s
$E_{rr}$	Reverse recovery energy		-	TBD	-	$\mu$ J
$t_{rr}$	Reverse recovery time	$I_F = 60\text{ A}$ , $V_R = 400\text{ V}$ , $R_G = 5\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$ , see <a href="#">Figure 2</a>	-	TBD	-	ns
$Q_{rr}$	Reverse recovery charge		-	TBD	-	nC
$I_{rrm}$	Reverse recovery current		-	TBD	-	A
$dl_{rr}/dt$	Peak rate of fall of reverse recovery current during $t_b$		-	TBD	-	A/ $\mu$ s
$E_{rr}$	Reverse recovery energy		-	TBD	-	$\mu$ J



## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

**Table 8. 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	5.30	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

Figure 6. TO-247 drawing

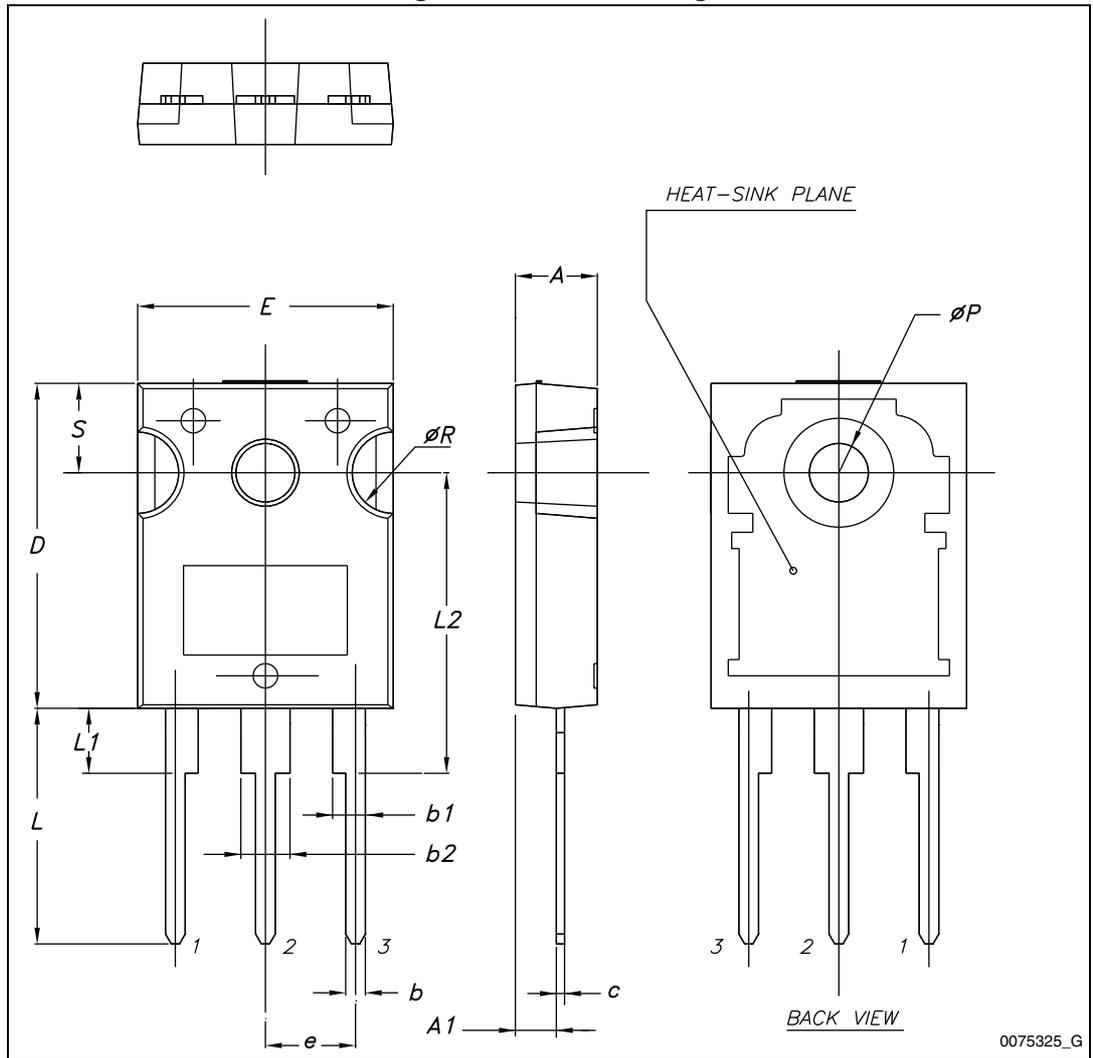
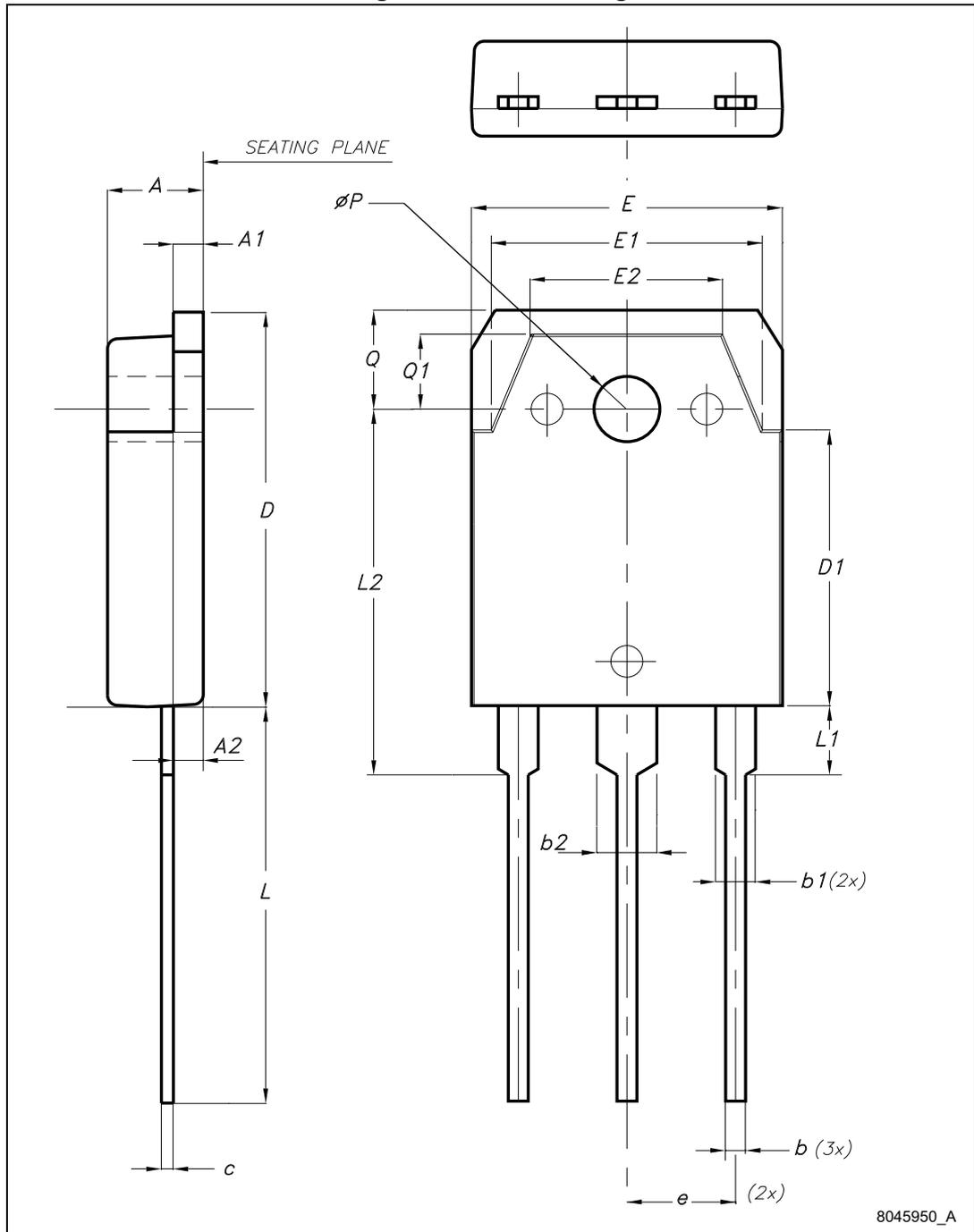


Table 9. TO-3P mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.60		5
A1	1.45	1.50	1.65
A2	1.20	1.40	1.60
b	0.80	1	1.20
b1	1.80		2.20
b2	2.80		3.20
c	0.55	0.60	0.75
D	19.70	19.90	20.10
D1		13.90	
E	15.40		15.80
E1		13.60	
E2		9.60	
e	5.15	5.45	5.75
L	19.50	20	20.50
L1		3.50	
L2	18.20	18.40	18.60
øP	3.10		3.30
Q		5	
Q1		3.80	

Figure 7. TO-3P drawing



## 5 Revision history

Table 10. Document revision history

Date	Revision	Changes
12-Mar-2013	1	Initial release.

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