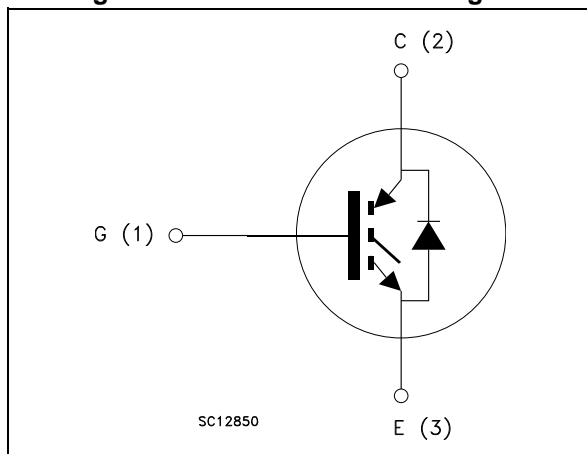


Figure 1. Internal schematic diagram



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 ⁽¹⁾	A
I_C	Continuous collector current at $T_C = 100\text{ °C}$	60	A
I_{CP} ⁽²⁾	Pulsed collector current	240	A
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Continuous forward current at $T_C = 25\text{ °C}$	80 ⁽¹⁾	A
I_F	Continuous forward current at $T_C = 100\text{ °C}$	60	A
I_{FP} ⁽²⁾	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	μA
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 Figure 3	-	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 Figure 2	-	TBD		ns
t_r	Current rise time		-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	TBD		A/ μ 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 Figure 2	-	TBD		ns
t_r	Current rise time		-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	TBD		A/ μ 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 Figure 2	-	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/ μ s
E_{rr}	Reverse recovery energy		-	TBD	-	μ 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 Figure 2	-	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/ μ s
E_{rr}	Reverse recovery energy		-	TBD	-	μ J

3 Test circuits

Figure 2. Test circuit for inductive load switching

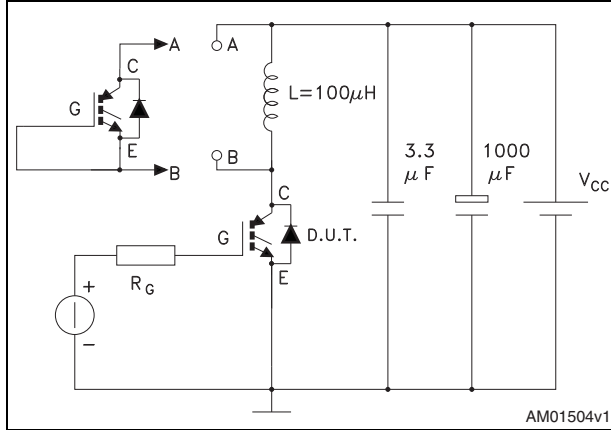


Figure 3. Gate charge test circuit

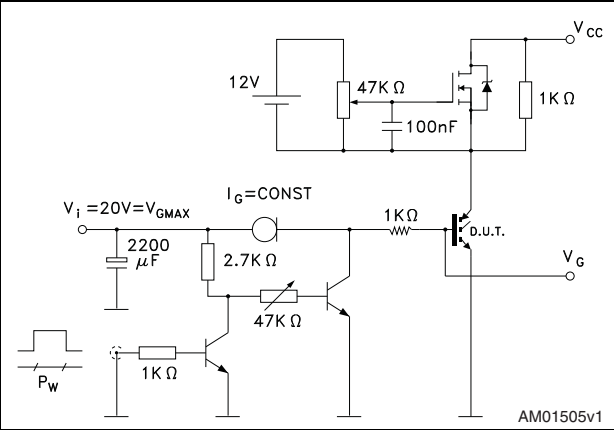


Figure 4. Switching waveform

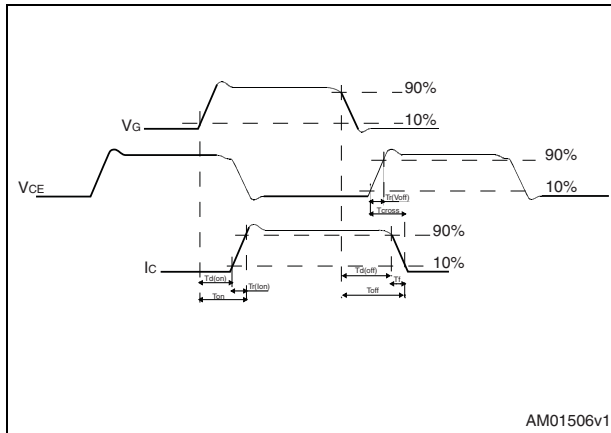
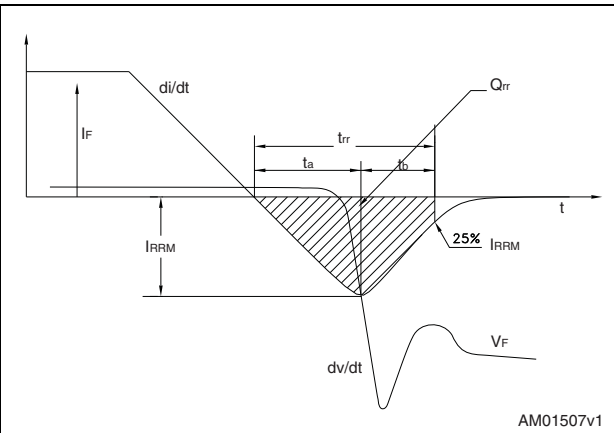


Figure 5. Diode recovery time waveform



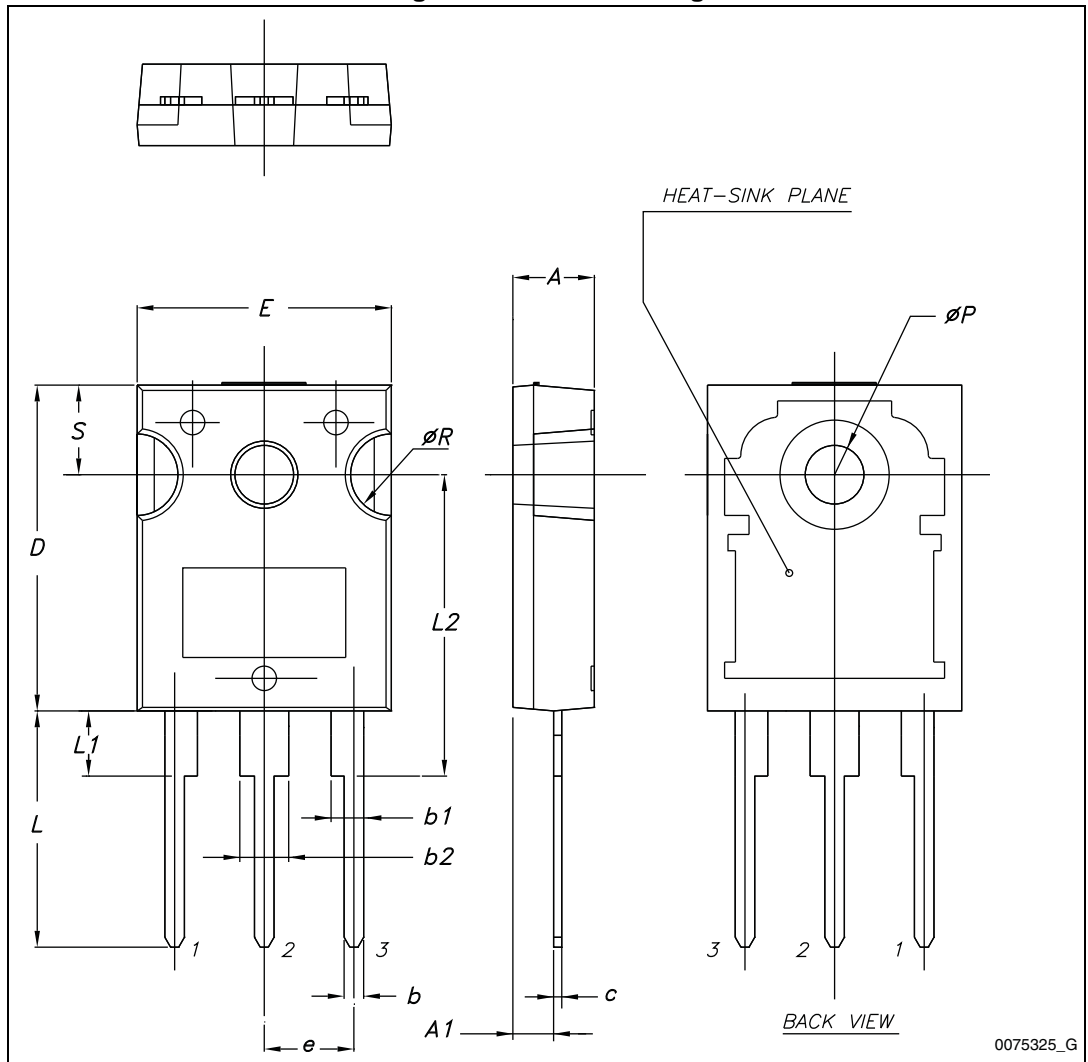
4 Package mechanical data

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 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

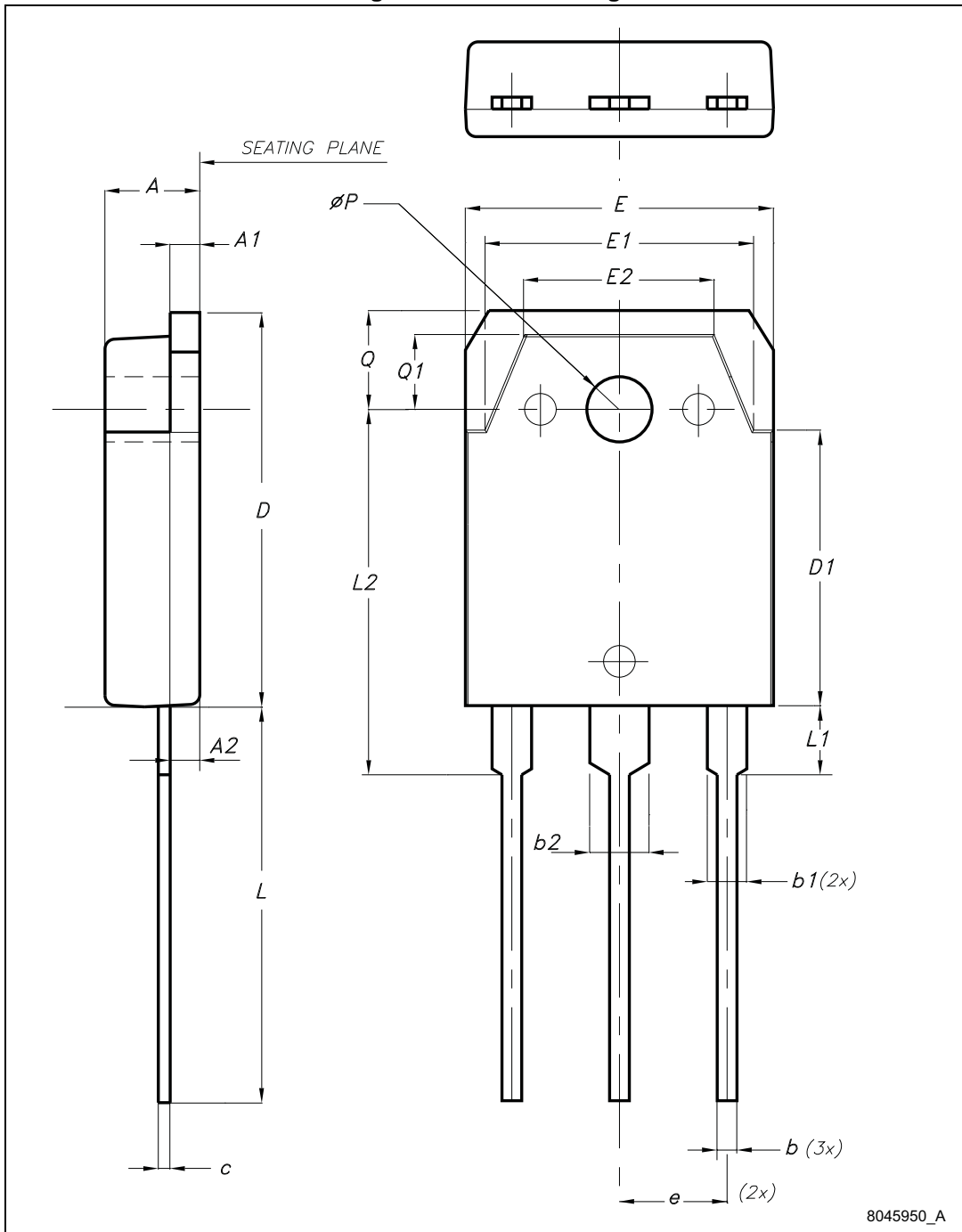


0075325_G

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



8045950_A

5 Revision history

Table 10. Document revision history

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

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