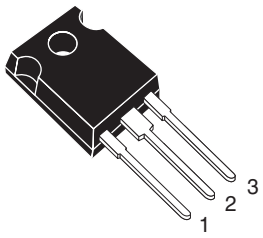
STGW60V65DF

650 V, 60 A very high speed trench gate field-stop IGBT

Datasheet – preliminary data

Features

- Maximum junction temperature : T_J = 175 °C
- Very high speed switching
- Negligible tail current
- Low saturation voltage: $V_{CE(sat)}$ = 1.9 V (typ.) @ I_C = 60 A
- Tight parameters distribution
- Safe paralleling
- Low thermal resistance
- Very fast soft recovery antiparallel diode
- Lead free package

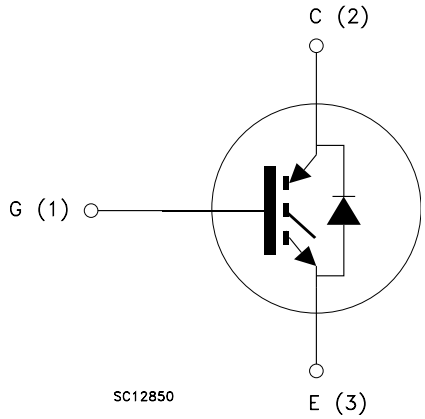


TO-247

Applications

- Photovoltaic inverters
- Uninterruptible power supply
- Welding
- Power factor correction
- Very high frequency converters

Figure 1. Internal schematic diagram



Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. The device is part of the "V" series of IGBTs, which represent an optimum compromise between conduction and switching losses to maximize the efficiency of very high frequency converters. Furthermore, a 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
STGW60V65DF	GW60V65DF	TO-247	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 °C	120	A
I_C	Continuous collector current at T_C = 100 °C	60	A
I_{CP} (1)	Pulsed collector current	240	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Continuous forward current at T_C = 25 °C	60	A
I_F	Continuous forward current at T_C = 100 °C	30	A
I_{FP} (1)	Pulsed forward current	240	A
P_{TOT}	Total dissipation at T_C = 25 °C	428	W
T_{STG}	Storage temperature range	- 55 to 175	°C
T_J	Operating junction temperature		

1. 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	0.35	°C/W
R_{thJC}	Thermal resistance junction-case diode	1.38	°C/W
R_{thJA}	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 = 2 mA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 60 A		1.9		V
		V_{GE} = 15 V, I_C = 60 A T_J = 125 °C		2.2		
		V_{GE} = 15 V, I_C = 60 A T_J = 175 °C		2.35		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA		6.0		V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 650 V			25	µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ± 20 V			250	nA

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	-	7080 220 135	-	pF pF pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 60 A, V_{GE} = 15 V	-	215	-	nC
Q_{ge}	Gate-emitter charge		-	TBD	-	nC
Q_{gc}	Gate-collector charge		-	TBD	-	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_{CE} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V	-	TBD TBD TBD	-	ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CE} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V T_J = 175 °C	-	TBD TBD TBD	-	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_{CE} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V	-	TBD TBD TBD	-	ns ns ns
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CE} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V T_J = 175 °C	-	TBD TBD TBD	-	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_{CE} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V	-	TBD 0.75 TBD	-	mJ mJ mJ
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CE} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V T_J = 175 °C	-	TBD 1.1 TBD	-	mJ mJ mJ

1. Energy losses include reverse recovery of the diode.
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 = 175°C	-	1.7 1.25	-	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 30 A, V_R = 400 V, R_G = 5 Ω	-	TBD TBD TBD	-	ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 30 A, V_R = 400 V, R_G = 5 Ω T_J = 175 °C	-	TBD TBD TBD	-	ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

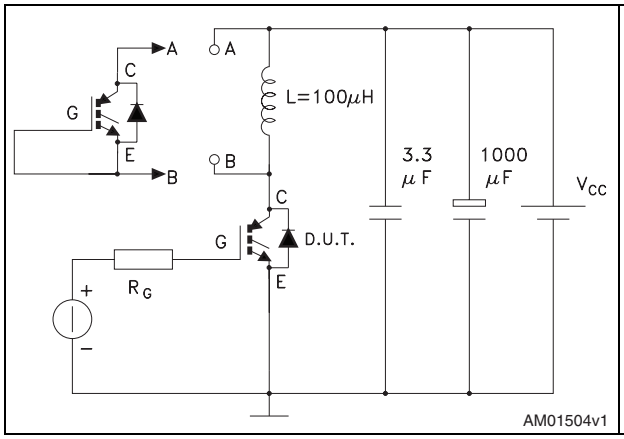


Figure 3. Gate charge test circuit

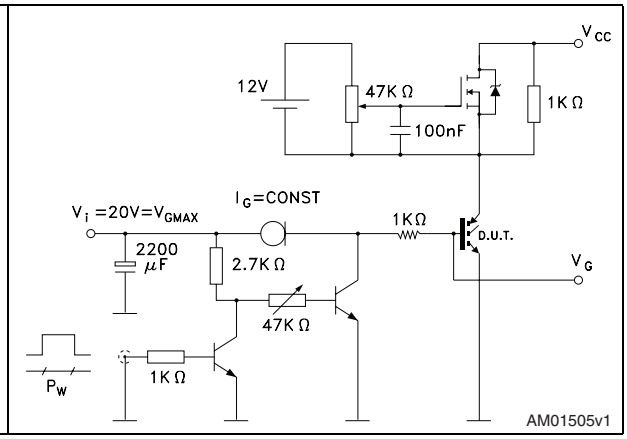


Figure 4. Switching waveform

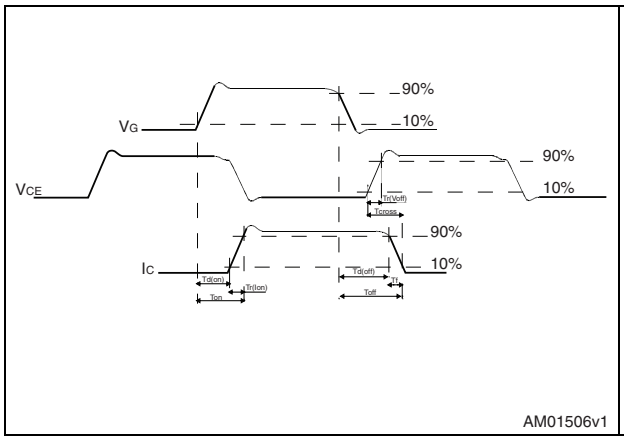
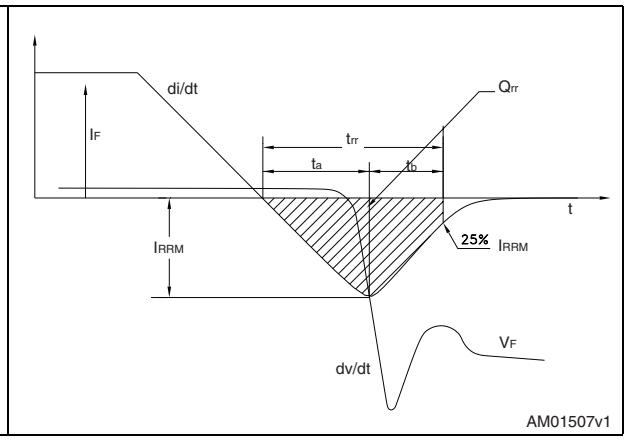


Figure 5. Diode recovery time waveform



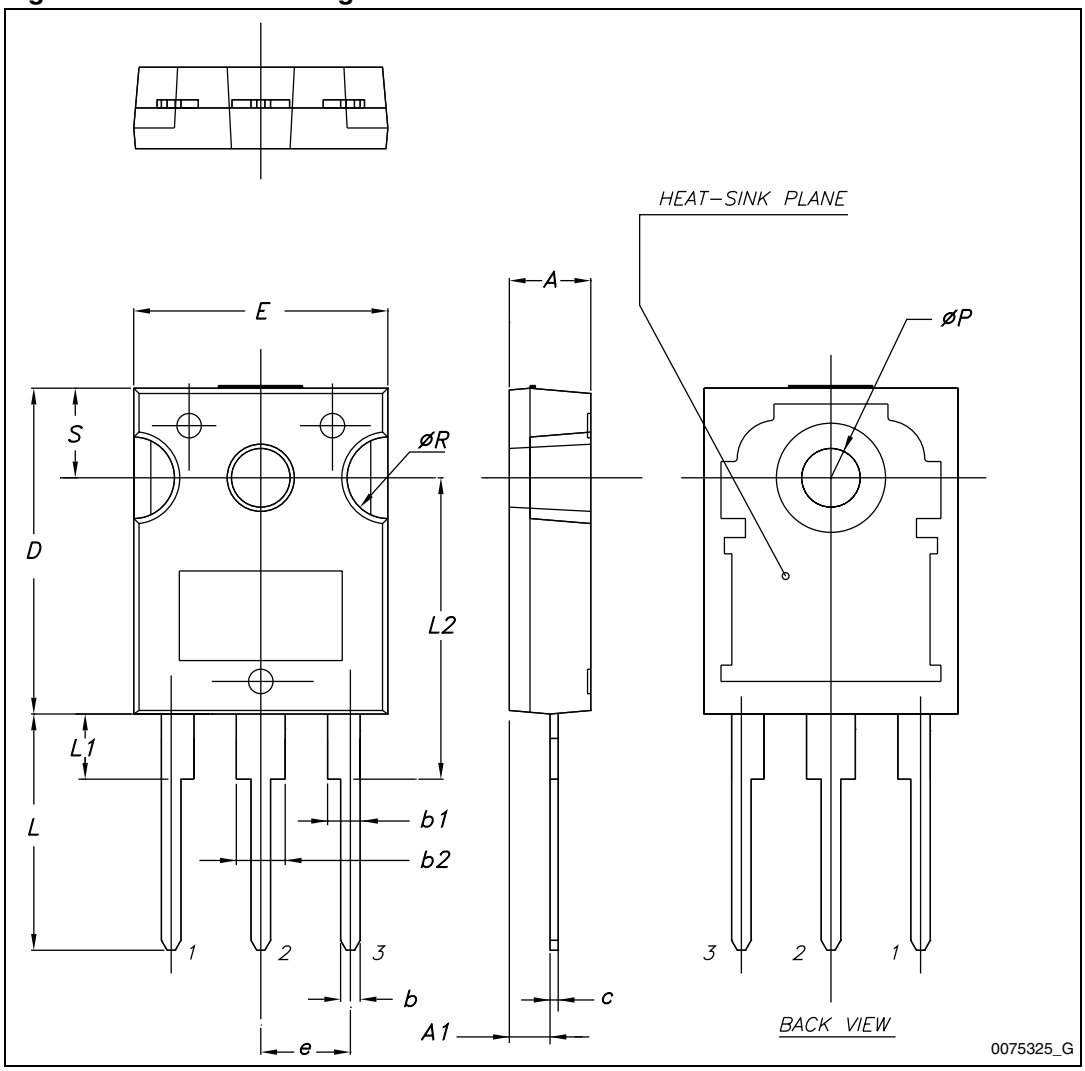
4 Package mechanical data

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 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	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

Figure 6. TO-247 drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
20-Sep-2012	1	Initial release.

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