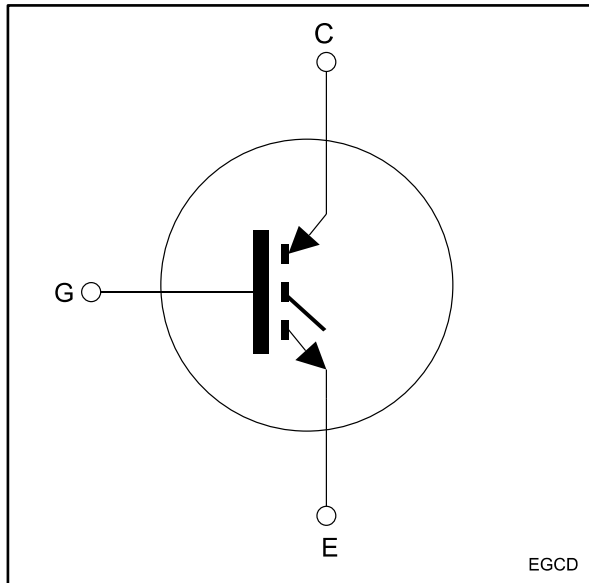


650 V, 50 A trench gate field-stop M series low-loss IGBT die in D7 packing

Datasheet - production data



Features

- 6 μ s of short-circuit withstand time
- Low $V_{CE(sat)} = 1.65$ V (typ.) @ $I_C = 50$ A
- Positive $V_{CE(sat)}$ temperature coefficient
- Tight parameter distribution
- Maximum junction temperature: $T_J = 175$ °C

Applications

- Motor control
- Industrial drives
- UPS
- Solar
- General purpose inverter

Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the M series IGBTs, which represent an optimal balance between inverter system performance and efficiency where low-loss and short-circuit functionality are essential. Furthermore, the positive $V_{CE(sat)}$ temperature coefficient and tight parameter distribution result in safer paralleling operation.

Table 1: Device summary

Order code	V_{CE}	I_C	Die size	Packing
STG50M65F2D7	650 V	50 A	5.5 x 5.0 mm ²	D7

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1 Mechanical parameters

Table 2: Mechanical parameters

Symbol		Value	Unit
Die size including scribe line		5.50 x 5.00	mm ²
Wafer size		200	mm
Maximum possible dice per wafer		940	dice
Die thickness		70	μm
Front side passivation		Silicone nitride	
Emitter pad size including gate pad (x2)		4.83 x 2.03	mm ²
Gate pad size		0.82 x 1.22	mm ²
Front side metallization	composition	AlCu	
	thickness	4.5	μm
Back side metallization	composition	Al/Ti/NiV/Ag	
	thickness	0.65	μm
Die bond		Electrically conductive glue or soft solder	
Recommended wire bonding		≤500	μm

2 Electrical ratings

2.1 Absolute maximum ratings

Table 3: Absolute maximum ratings ($T_J = 25\text{ °C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	
V_{CES}	Collector-emitter voltage ($V_{GE} = 0\text{ V}$)	650	V	
V_{GE}	Gate-emitter voltage	± 20	V	
$I_{CN}^{(1)}$	Continuous collector current at $T = 100\text{ °C}$	50	A	
$I_{CP}^{(1)(2)}$	Pulsed collector current	150	A	
$t_{sc}^{(3)}$	Short -circuit withstand time	$V_{CC} = 400\text{ V}$, $V_{GE} = 13\text{ V}$, $V_{CE(peak)} \leq 650\text{ V}$, $T_{Jstart} \leq 150\text{ °C}$	10	μs
		$V_{CC} = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $V_{CE(peak)} \leq 650\text{ V}$, $T_{Jstart} \leq 150\text{ °C}$	6	μs
T_J	Operating junction temperature range	-55 to 175	$^{\circ}\text{C}$	

Notes:

(1) Nominal collector current for die packaged in ST discrete solution. Current level depends on the assembly thermal properties and is limited by maximum junction temperature.

(2) Pulse width is limited by maximum junction temperature.

(3) Not tested at chip level, verified by design/characterization.

2.2 Electrical characteristics

Table 4: Static characteristics (tested on wafer unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$I_C = 250\text{ }\mu\text{A}$, $V_{GE} = 0\text{ V}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 15\text{ A}$			1.5	V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	5	6	7	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 650\text{ V}$			25	μA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 250	μA

Table 5: Electrical characteristics (not tested at chip level, verified by design/characterization)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$	-	1.65	2.10	V
		$V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$, $T_J = 175\text{ °C}$	-	2.1		V
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	4200		pF
C_{oes}	Output capacitance		-	252		pF
C_{res}	Reverse transfer capacitance		-	88		pF
Q_g	Total gate charge	$V_{CC} = 520\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$	-	150		nC

Table 6: Switching characteristics on inductive load

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 400\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 6.8\ \Omega$	-	42	-	ns
t_r	Current rise time		-	21	-	ns
$t_{d(off)}$	Turn-off-delay time		-	130	-	ns
t_f	Current fall time		-	104	-	ns
$E_{off}^{(1)}$	Turn-off switching energy		-	1.57	-	mJ
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 400\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 6.8\ \Omega$, $T_J = 175\text{ }^\circ\text{C}$	-	42	-	ns
t_r	Current rise time		-	24	-	ns
$t_{d(off)}$	Turn-off-delay time		-	131	-	ns
t_f	Current fall time		-	184	-	ns
$E_{off}^{(1)}$	Turn-off switching energy		-	2.22	-	mJ

Notes:

⁽¹⁾Including the tail of the collector current.



The aforementioned values are not tested at chip level and are strongly dependent on the package/module design and the mounting technology. Refer to STGWA50M65DF2 datasheet for further information.

3 Die layout

Figure 1: Die drawing (dimensions are in mm)

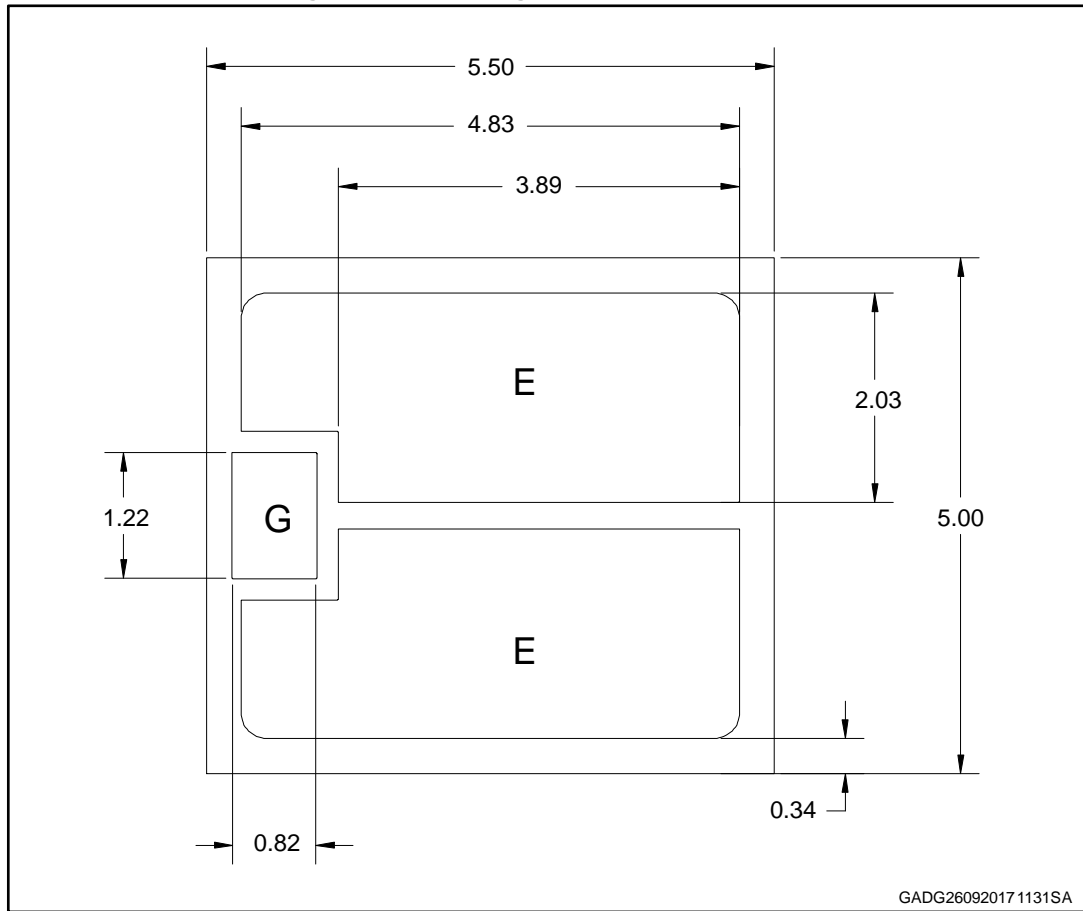
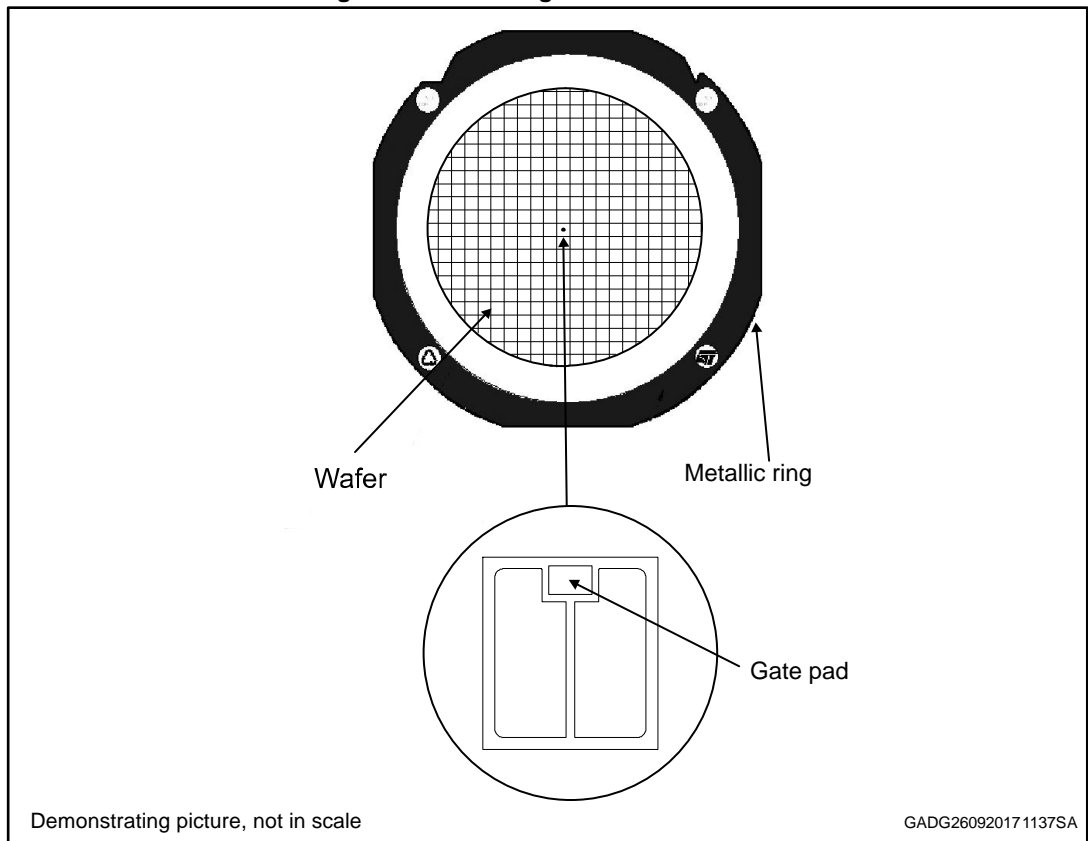


Table 7: Die delivery

Package option	Test condition	Details
D7	Wafer (8 inches) tested, inked, cut on sticky foil on 10.8" (276 mm) ring (see Figure 2: "D7 drawing and die orientation")	Wafer (8 inches) is held by ring protected by two carton shells, inside a plastic envelope sealed under vacuum. Maximum number of wafers for each package is 5, weight is about 3.7 Kg.

Figure 2: D7 drawing and die orientation



4 Additional information

4.1 Additional testing and screening

For customers requiring product supplied as known good die (KGD) or requiring specific die level testing (i.e. for dynamic and switching characterization), please contact the local ST sales office.

If KGD is requested, the shipping delivery is D8.

4.2 Shipping

Several shipping options are offered, consult the local ST sales office for availability:

- Die on film sticky foil - suffix on sales type D7
- Carrier tape - suffix on sales type D8

4.3 Handling

- Products must be handled only at ESD safe workstations. Standard ESD precautions and safe work environments are as defined in MIL-HDBK-263.
- Products must be handled only in a class 1000 or better-designated clean room environment.
- Singular die are not to be handled with tweezers. A vacuum wand with a non-metallic ESD protected tip should be used.

4.4 Wafer/die storage

Once the packaging is opened, the wafer must be stored in a dry, inert atmosphere, such as nitrogen.

Optimum temperature for storage is 18 °C \pm 2 °C with as few variations as possible to avoid parasitic polymerization of the adhesive. Sawn wafers must be processed within 12 weeks after receipt by customer.

After the customer opens the package, the customer is responsible for the products.

5 Revision history

Table 8: Document revision history

Date	Revision	Changes
26-Sep-2017	1	Initial release

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