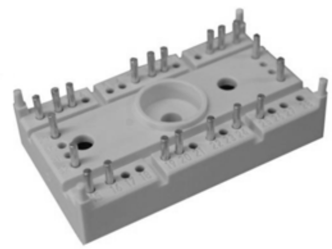
STG3P3M25K120

Tri-phase inverter
IGBT - SEMITOP®3 module

Preliminary data

Features

- Low on-voltage drop ($V_{CE(sat)}$)
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode
- Frequency operation up to 40 kHz
- New generation products with tighter parameter distribution
- One screw mounting
- Compact design
- Semitop®3 is a trademark of Semikron
- Short-circuit rugged



SEMITOP®3

Applications

- Inverters
- Motor drive

Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBT, with outstanding performance.

Figure 1. Internal schematic diagram

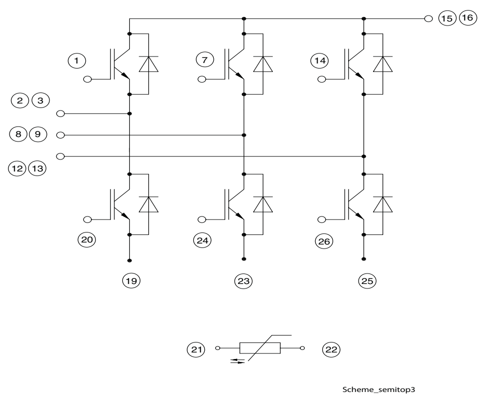


Table 1. Device summary

Order code	Marking	Package	Packaging
STG3P3M25K120	G3P3M25K120	SEMITOP®3	Semibox

This is preliminary information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	1200	V
I_C (1)	Collector current (continuous) at T_s = 25°C	50	A
I_C (1)	Collector current (continuous) at T_s = 80°C	25	A
V_{GE}	Gate-emitter voltage	±20	V
I_{CL} (2)	Turn-off latching current	100	A
I_{CP} (3)	Pulsed collector current	100	A
I_F	Diode RMS forward current at T_s = 25°C	30	A
I_{FSM}	Surge non repetitive forward current t_p = 10 ms sinusoidal	100	A
P_{TOT}	Total dissipation at T_s = 25°C	104	W
V_{ISO}	Insulation withstand voltage A.C. (t=1min/sec; Ts=25°C)	2500/3000	V
t_{scw}	Short circuit withstand time V_{CE} = 0.5 $V_{(BR)CES}$, T_j = 125 °C, R_G = 10 Ω, V_{GE} = 15 V	4.5	µs
T_{stg}	Storage temperature	– 40 to 125	°C
T_j	Operating junction temperature	– 40 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. V_{clamp} = 80% of V_{CES}, T_j =150 °C, R_G=10 Ω, V_{GE}= 15 V
3. Pulse width limited by max. junction temperature

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{th(j-s)}$	Thermal resistance junction-sink(1) IGBT	1.2	°C/W
	Thermal resistance junction-sink diode	1.8	

1. Calculated value with conductive grease applied and maximum mounting torque equal to 2 Nm

2 Electrical characteristics

(T_s= 25 °C unless otherwise specified)

Table 4. IGBT-inverter parameters

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE}= 0)	I_C= 1 mA	1200			V
I_{CES}	Collector cut-off Current (V_{GE} = 0)	V_{CE}= 1200 V V_{CE}= 1200 V, T_s= 125°C			500 10	µA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE}= ±20 V			±100	nA
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 1 mA	4.5		6.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 20 A V_{GE}= 15 V, I_C= 20 A, T_s=125 °C		3.1 3.0	3.85	V V

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{CE} = 15 V, I_C= 20 A	-	20	-	S
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0	-	2520 170 33	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 760 V, I_C = 20 A, V_{GE} = 15 V *Figure 3*	-	105 21 56	-	nC nC nC

1. Pulsed: pulse duration= 300 µs, duty cycle 1.5%

Table 6. Switching on/off

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} = 760 V, I_C = 20 A R_G= 10 Ω, V_{GE}= ±15 V, *Figure 4*	-	36 22 840	-	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} = 760 V, I_C = 20 A R_G= 10 Ω, V_{GE}= ±15 V, T_s=125 °C, *Figure 4*	-	35 22 760	-	ns ns A/µs

Table 6. Switching on/off (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 760 V, I_C = 20 A R_G= 10 Ω, V_{GE}= ±15 V, *Figure 4*	-	70 251 260	-	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} = 760 V, I_C = 20 A R_G= 10 Ω, V_{GE}= ±15 V, T_s=125 °C, *Figure 4*	-	140 324 432	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}(1) E_{off}(2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 760 V, I_C = 20 A R_G= 10 Ω, V_{GE}= ±15 V, *Figure 4*	-	2.4 4.3 6.7	-	mJ mJ mJ
E_{on}(1) E_{off}(2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 760 V, I_C = 20 A R_G= 10 Ω, V_{GE}= ±15 V, T_s=125 °C, *Figure 4*	-	3.9 5.8 9.7	-	mJ mJ mJ

1. Eon is the tun-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pak diode, the co-pack diode is used as external diode. IGBTs & 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 = 20 A I_F = 20 A, T_s = 125 °C	-	2.0 1.5	2.5	V V
t_{rr} t_a Q_{rr} I_{rrm} S	Reverse recovery time Reverse recovery charge Reverse recovery current Softness factor of the diode	I_F = 20 A,V_R = 27 V, di/dt = 100 A/µs *Figure 4*	-	84 TBD 235 5.6 TBD		ns ns nC A
t_{rr} t_a Q_{rr} I_{rrm} S	Reverse Recovery Time Reverse recovery charge Reverse recovery current Softness factor of the diode	I_F = 20 A,V_R = 27 V, T_s =125 °C, di/dt = 100 A/µs *Figure 4*	-	152 TBD 722 9 TBD		ns ns nC A

Table 9. NTC thermistor

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
R_{25}	Resistance	T_C = 25 °C		5		kΩ
R_{100}	Resistance	T_C =100 °C		493		Ω
B	B-constant	T_C = 25°C / 85°C		3420		K
T	Operating temperature		-40		125	°C

Equation 1: resistance variation vs temperature

$$R(T) = R_{25} \cdot e^{B\left(\frac{1}{T} - \frac{1}{298k}\right)}$$

3 Test circuits

Figure 2. Test circuit for inductive load switching

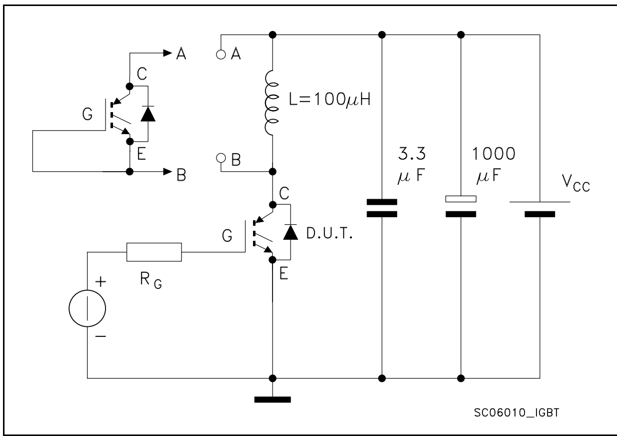


Figure 3. Gate charge test circuit

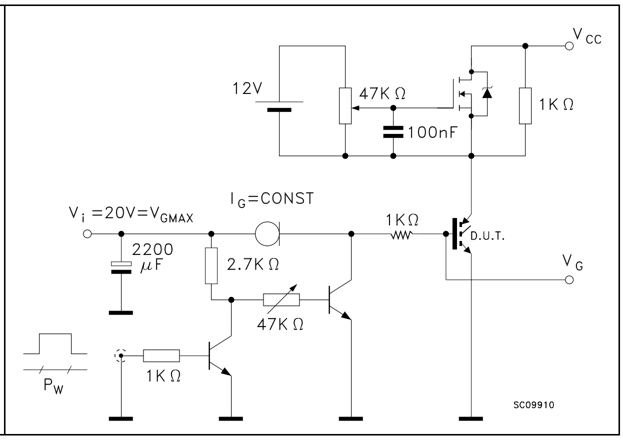


Figure 4. Switching waveform

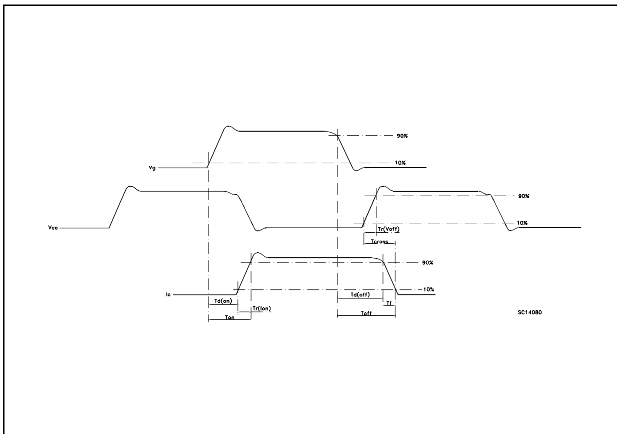
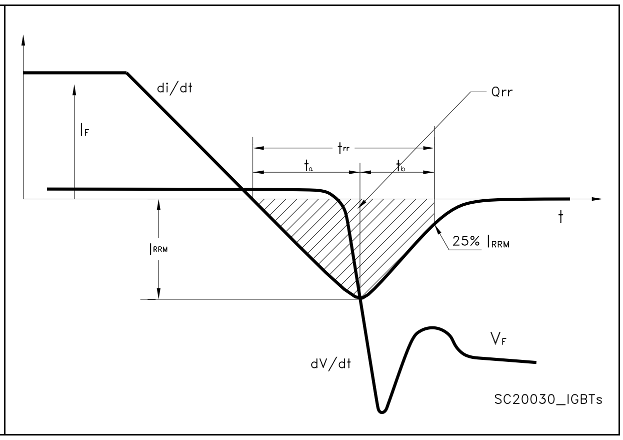


Figure 5. Diode recovery time waveform

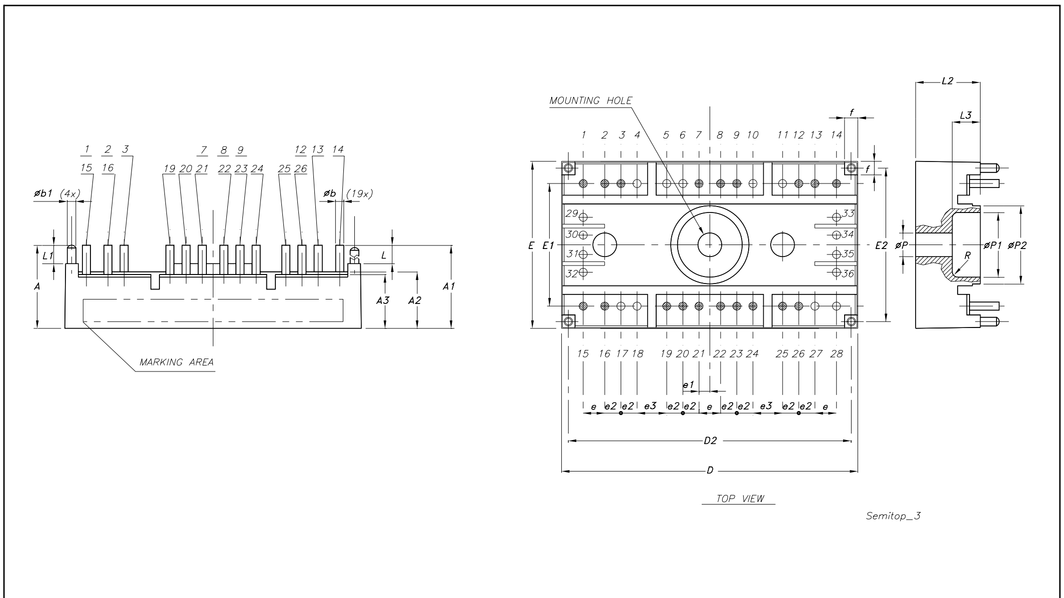


4 Package mechanical data

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.

SEMITOP®3 mechanical data

Dim	mm		
	Min	Typ	Max
A	15.30	15.50	15.70
A1	15.23	15.43	15.63
A2		10.50	
A3		10	
øb		1.50	
øb1		1.60	
D	54.70	55	55.30
D2		52.50	
E	30.70	31	31.30
E1	22.55	22.75	23
E2		28.50	
e	3.90	4	4.10
e1		2	
e2	2.90	3	3.10
e3	5.40	5.50	5.60
f		2.50	
L		3.43	
L1		3.50	
L2	11.80	12	12.20
L3		5.20	
øP	4.30	4.40	4.50
øP1		12	
øp2		14.50	
R		1	
SEMITOP®3 is a trademark of SEMIKRON			



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
23-Jun-2009	1	Initial release.

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