



STG3P3M25N60

3 Phase inverter IGBT - SEMITOP®3 module

PRELIMINARY DATA

General features

Type	V _{CES}	V _{CE(sat)} (Max) @ I _C =7A, T _s =25°C	I _C @80°C
STG3P3M25N60	600V	< 2.5V	25A

- N-channel very fast PowerMESH™ IGBT
- Lower on-voltage drop (V_{cesat})
- Lower C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode
- High frequency operation up to 70 KHz
- New generation products with tighter parameter distribution
- One screw mounting
- Compact design
- Semitop®3 is a trademark of Semikron

Description

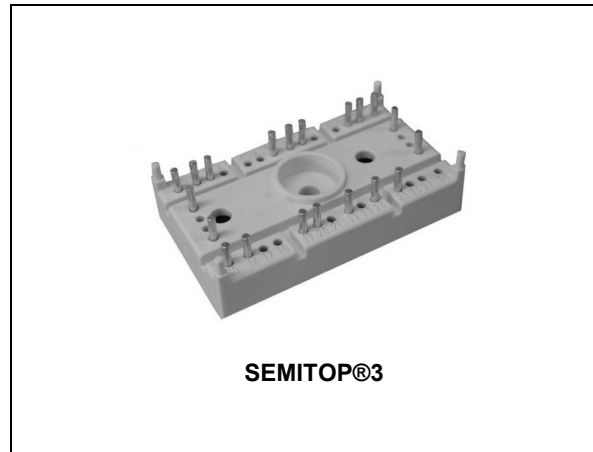
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBT, with outstanding performances.

Applications

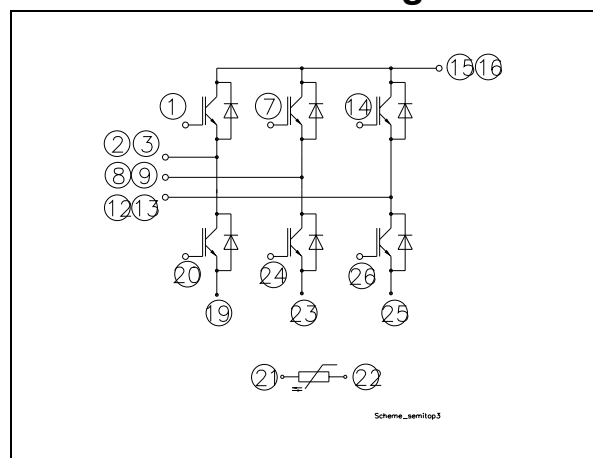
- High frequency inverters
- Motor drivers

Order codes

Sales Type	Marking	Package	Packaging
STG3P3M25N60	G3P3M25N60	SEMITOP®3	SEMIBOX



Internal schematic diagram



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1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GS} = 0$)	600	V
$I_C^{(1)}$	Collector current (continuous) at $T_s = 25^\circ\text{C}$	50	A
$I_C^{(1)}$	Collector current (continuous) at $T_s = 80^\circ\text{C}$	25	A
V_{GE}	Gate-emitter voltage	± 20	V
$I_{CM}^{(2)}$	$T_P < 1\text{ms}$; $T_s = 25^\circ\text{C}$	100	A
I_{CM}	$T_P < 1\text{ms}$; $T_s = 80^\circ\text{C}$	50	A
I_F	Diode RMS forward current at $T_s = 25^\circ\text{C}$	19	A
P_{TOT}	Total dissipation at $T_s = 25^\circ\text{C}$	96	W
V_{ISO}	Insulation withstand voltage A.C. ($t=1\text{min/sec}$; $T_s=25^\circ\text{C}$)	2500/3000	V
T_{stg}	Storage temperature	- 40 to 125	$^\circ\text{C}$
T_j	Operating junction temperature	- 40 to 150	$^\circ\text{C}$

1. Calculated value

2. Pulse width limited by max. junction temperature

Table 2. Thermal resistance (for single IGBT)

Symbol	Parameter	Value	Unit
$R_{th(j-s)}$	Thermal resistance junction-sink ⁽¹⁾ Max.	1.3	K/W

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

2 Electrical characteristics

($T_s=25^\circ\text{C}$ unless otherwise specified)

Table 3. IGBT-Inverter parameters

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-emitter breakdown voltage	$I_C = 1\text{mA}$, $V_{GE} = 0$	600			V
I_{CES}	Collector cut-off Current ($V_{GE} = 0$)	$V_{CE} = \text{Max rating}$, $t_s = 25^\circ\text{C}$ $V_{CE} = \text{max rating}$, $T_s = 125^\circ\text{C}$			10 1	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{V}$, $V_{CE} = 0$			± 100	nA
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\mu\text{A}$	3.75		5.75	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{V}$, $I_C = 20\text{A}$ $V_{GE} = 15\text{V}$, $I_C = 20\text{A}$, $T_s = 125^\circ\text{C}$		1.85 1.7	2.5	V V

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 15\text{V}$, $I_C = 20\text{A}$		15		S
C_{ies}	Input capacitance	$V_{CE} = 25\text{V}$, $f = 1\text{MHz}$, $V_{GE} = 0$		2200		pF
C_{oes}	Output capacitance			225		pF
C_{res}	Reverse transfer capacitance			50		pF
Q_g	Total gate charge	$V_{CE} = 390\text{V}$, $I_C = 20\text{A}$, $V_{GE} = 15\text{V}$, (see Figure 8)		100	140	nC
Q_{ge}	Gate-emitter charge			16		nC
Q_{gc}	Gate-collector charge			45		nC

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

Table 5. 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	$V_{CC} = 300V$, $I_C = 20A$ $R_G = 33\Omega$, $V_{GE} = \pm 15V$, $T_s = 25^\circ C$ (see Figure 9)		31 11 1600		ns ns A/ μs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	$V_{CC} = 300V$, $I_C = 20A$ $R_G = 33\Omega$, $V_{GE} = \pm 15V$, $T_s = 125^\circ C$ (see Figure 9)		31 11.5 1500		ns ns A/ μs
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	$V_{CC} = 300V$, $I_C = 20A$ $R_G = 33\Omega$, $V_{GE} = \pm 15V$, $T_s = 25^\circ C$ (see Figure 9)		28 100 75		ns ns ns
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	$V_{CC} = 300V$, $I_C = 20A$ $R_G = 33\Omega$, $V_{GE} = \pm 15V$, $T_s = 125^\circ C$ (see Figure 9)		66 150 130		ns ns ns

Table 6. 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	$V_{CC} = 300V$, $I_C = 20A$ $R_G = 33\Omega$, $V_{GE} = \pm 15V$, $T_s = 25^\circ C$ (see Figure 9)		220 330 550		μJ μJ μJ
$E_{on}^{(1)}$ $E_{off}^{(2)}$ E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	$V_{CC} = 300V$, $I_C = 20A$ $R_G = 33\Omega$, $V_{GE} = \pm 15V$, $T_s = 125^\circ C$ (see Figure 9)		450 770 1220		μJ μJ μJ

1. E_{on} is the turn-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-pak 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 7. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_f	Forward on-voltage	$I_f = 10A$ $I_f = 10A, T_s = 125^\circ C$		1.3 1.0	2.0	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	$I_f = 20A, V_R = 40V,$ $T_s = 25^\circ C, di/dt = 100 A/\mu s$ (see Figure 4)		44 32 66 3 0.375		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	$I_f = 20A, V_R = 40V,$ $T_s = 125^\circ C, di/dt = 100A/\mu s$ (see Figure 4)		88 56 237 5.4 0.57		ns ns nC A

Table 8. Temperature sensor

Symbol	Parameter	Condictions	Min.	Typ.	Max.	Unit
R_{ts}	Equivalent resistance	5%, $T_f = 25 (100)^\circ C$		5000 (493)		Ω

2.1 Typical characteristics (curves)

Figure 1. Output characteristics at $T_s=25^\circ\text{C}$

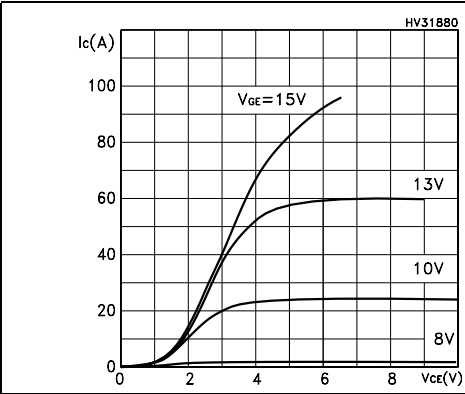


Figure 2. Output characteristics at $T_s=125^\circ\text{C}$

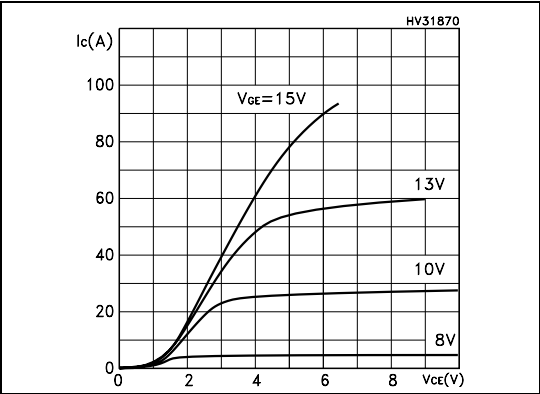


Figure 3. Capacitance variation

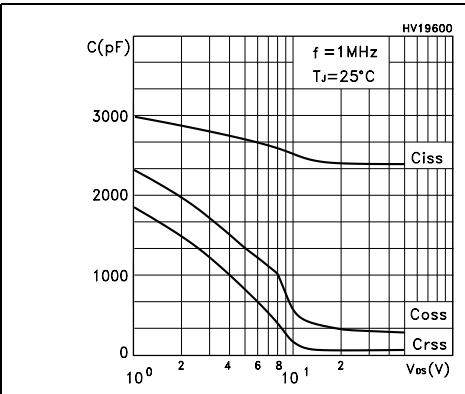


Figure 4. Gate charge vs gate-emitter voltage

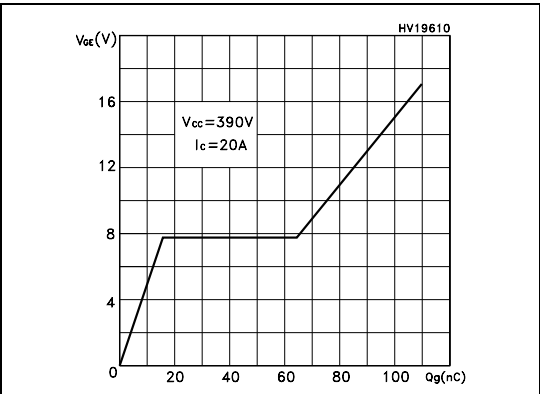


Figure 5. Total switching losses vs gate resistance

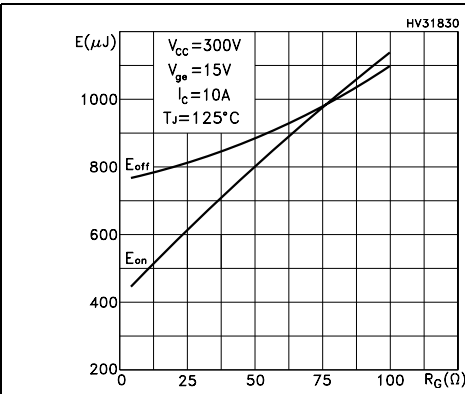
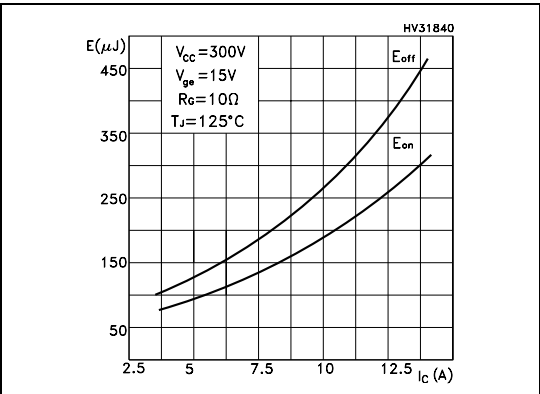


Figure 6. Total switching losses vs collector current



3 Test circuit

Figure 7. Test Circuit for Inductive Load Switching

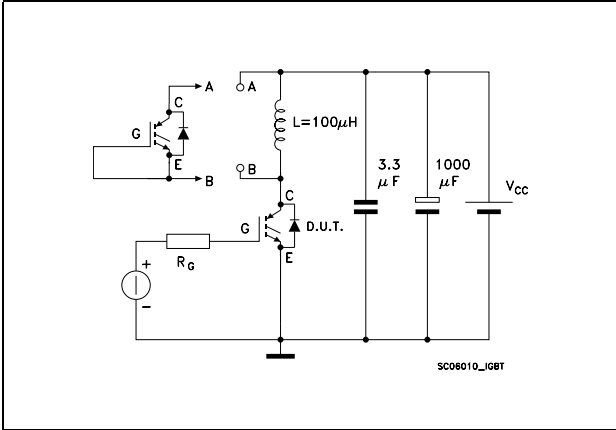


Figure 8. Gate charge test circuit

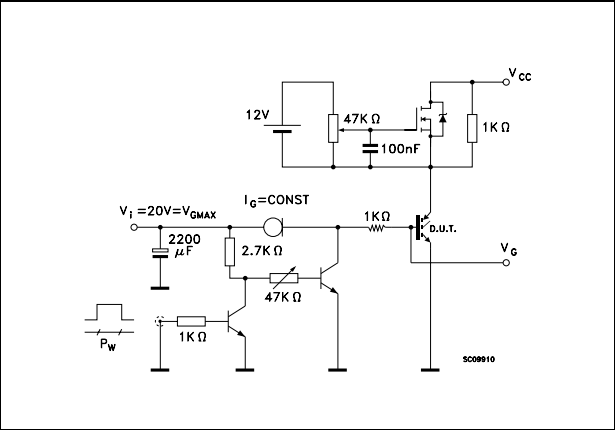


Figure 9. Switching Waveform

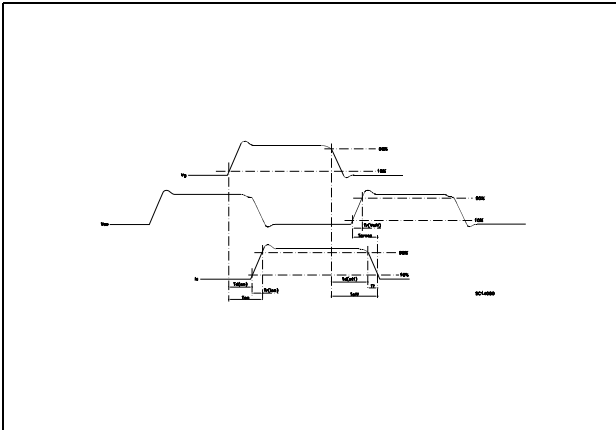
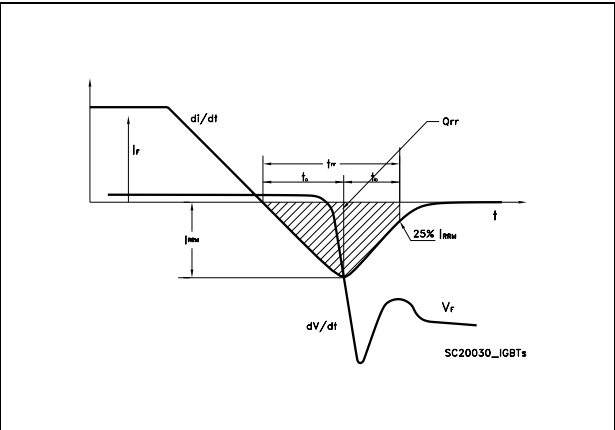


Figure 10. Diode Recovery Time Waveform

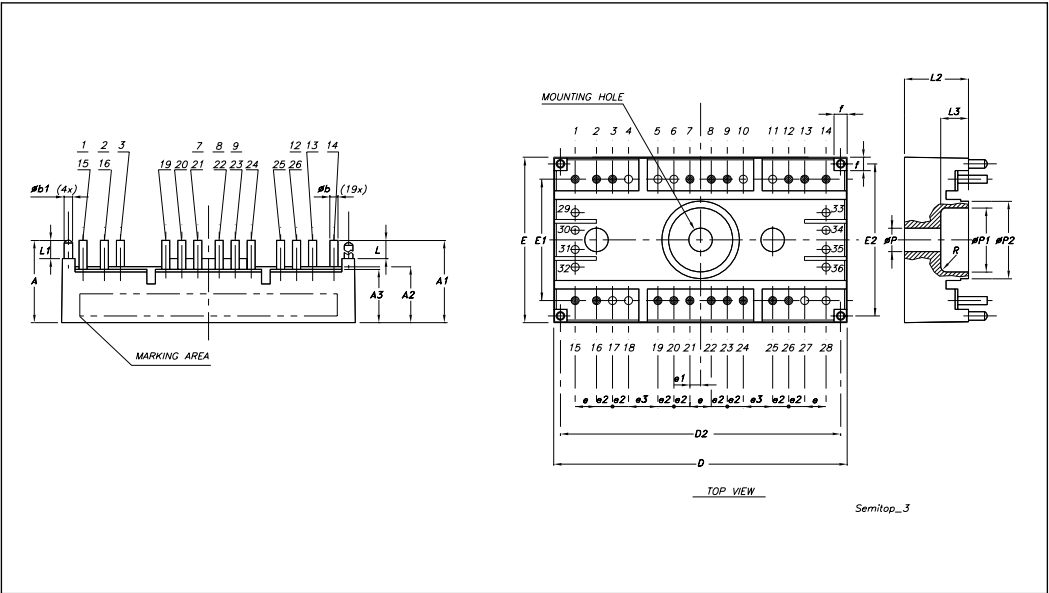


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

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 9. Revision history

Date	Revision	Changes
29-May-2006	1	Initial release.

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