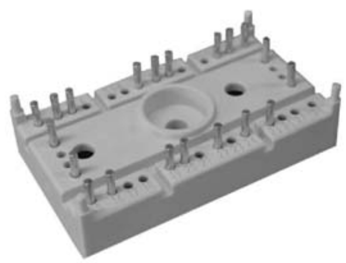
STG3P3M25N60

3 phase inverter
IGBT - SEMITOP®3 module

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
- High frequency operation up to 70 kHz
- One screw mounting
- Compact design
- Semitop®3 is a trademark of Semikron



SEMITOP®3

Applications

- High frequency inverters
- Motor drivers

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.

Figure 1. Internal schematic diagram

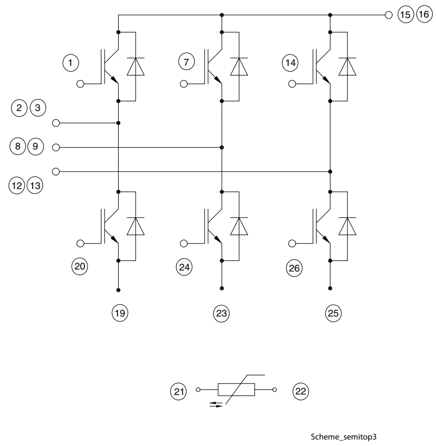


Table 1. Device summary

Order code	Marking	Package	Packaging
STG3P3M25N60	G3P3M25N60	SEMITOP®3	Semibox

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600	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_{CM}(2)	Collector current (pulsed, t_p < 1 ms) T_s=25 °C	100	A
I_{CM} (2)	Collector current (pulsed, t_p < 1 ms) T_s=80 °C	50	A
I_F	Diode RMS forward current at T_s = 25 °C	19	A
P_{TOT}	Total dissipation at T_s = 25 °C	96	W
V_{ISO}	Insulation withstand voltage A.C. (t=1 min/sec; T_s= 25 °C)	2500/3000	V
T_{stg}	Storage temperature	– 40 to 125	°C
T_j	Operating junction temperature	– 40 to 150	°C

1. Calculated value
2. Pulse width limited by max. junction temperature

Table 3. 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 °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	600			V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE}= 600 V V_{CE}= 600 V, T_s= 125 °C			10 1	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= 250 µA	3.75		5.75	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		1.85 1.7	2.5	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		15		S
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0		2200 225 50		pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 390 V, I_C = 20 A, V_{GE} = 15 V, (see Figure 9)		100 16 45	140	nC nC nC

1. Pulsed: pulse duration=300µs, 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} = 300 V, I_C = 20 A R_G= 3.3 Ω , V_{GE}= ±15 V, (see Figure 10)		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} = 300 V, I_C = 20 A R_G= 3.3 Ω , V_{GE}= ±15 V, T_s=125°C (see Figure 10)		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} = 300 V, I_C = 20 A R_G= 3.3 Ω , V_{GE}= ±15 V, (see Figure 10)		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} = 300 V, I_C = 20 A R_G= 3.3 Ω , V_{GE}= ±15 V, T_s=125 °C (see Figure 10)		66 150 130		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} = 300 V, I_C = 20 A R_G= 3.3 Ω, V_{GE}= ±15 V, (see Figure 10)		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} = 300 V, I_C = 20 A R_G= 3.3 Ω, V_{GE}= ±15 V, T_s= 125 °C (see Figure 10)		450 770 1220		µJ µJ µJ

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 = 10 A I_F = 10 A, T_s = 125 °C		1.3 1.0	2.0	V V
t_{rr}	Reverse recovery time	I_F = 20 A ,V_R = 40 V, di/dt = 100 A/µs		44		ns
t_a				32		ns
Q_{rr}	Reverse recovery charge			66		nC
I_{rrm}	Reverse recovery current			3		A
S	Softness factor of the diode			0.375		
t_{rr}	Reverse recovery time	I_F = 20 A ,V_R = 40 V, di/dt = 100 A/µs, T_s = 125 °C		88		ns
t_a				56		ns
Q_{rr}	Reverse recovery charge			237		nC
I_{rrm}	Reverse recovery current			5.4		A
S	Softness factor of the diode			0.57		

Table 9. Temperature sensor

Symbol	Parameter	conditions	Min.	Typ.	Max.	Unit
R_{ts}	Equivalent resistance	5%, T_r = 25 (100) °C		5000 (493)		Ω

2.1 Typical characteristics (curves)

Figure 2. Output characteristics at T_s = 25 °C

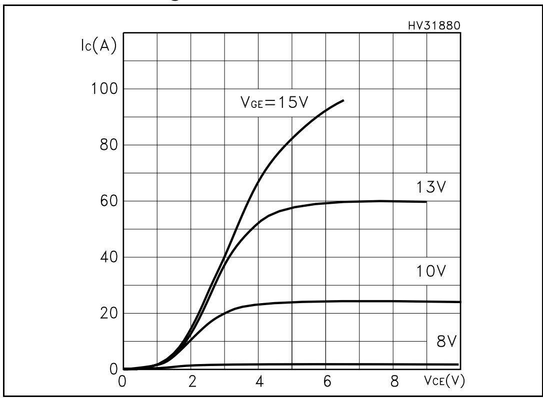


Figure 3. Output characteristics at T_s = 125 °C

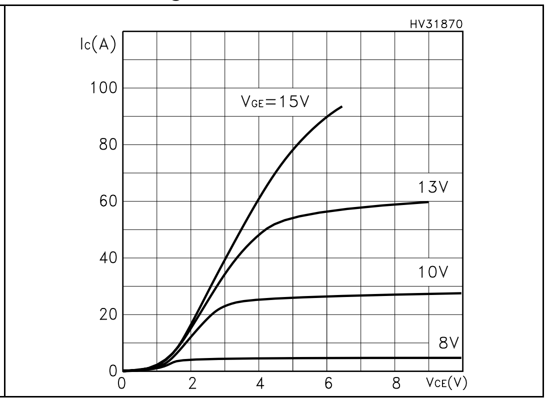


Figure 4. Capacitance variation

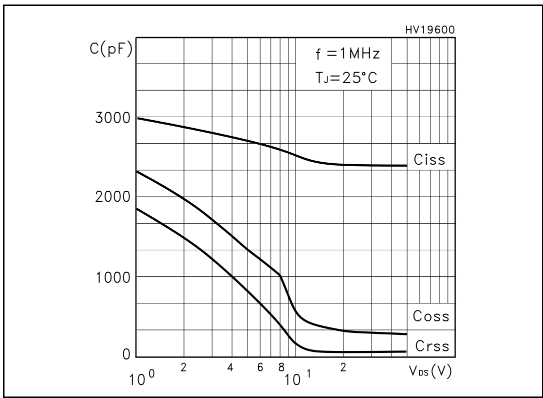


Figure 5. Gate charge vs gate-emitter voltage

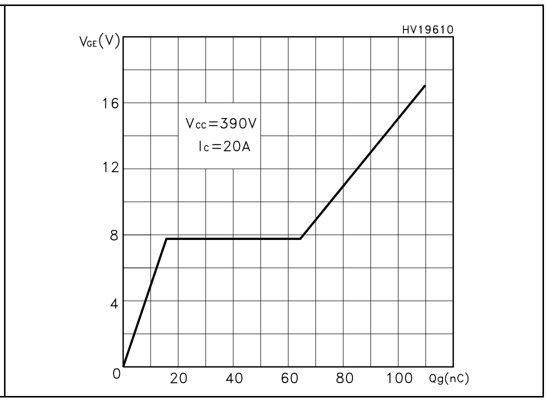


Figure 6. Total switching losses vs gate resistance

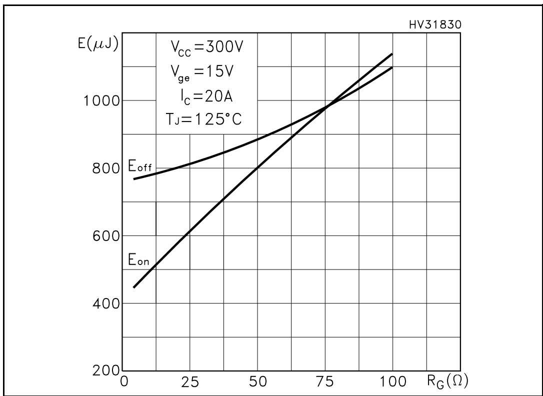
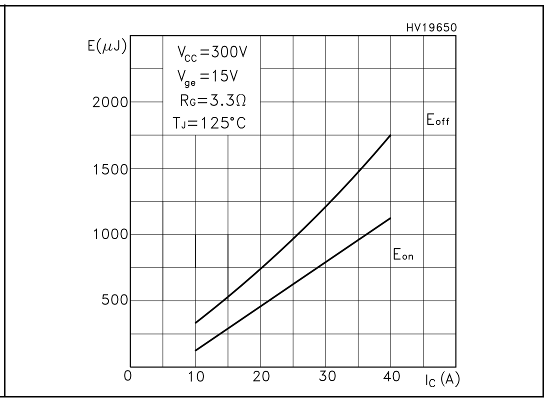


Figure 7. Total switching losses vs collector current



3 Test circuits

Figure 8. Test circuit for inductive load switching

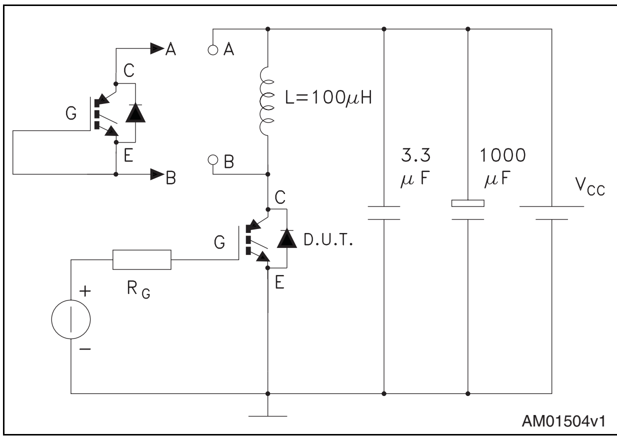


Figure 9. Gate charge test circuit

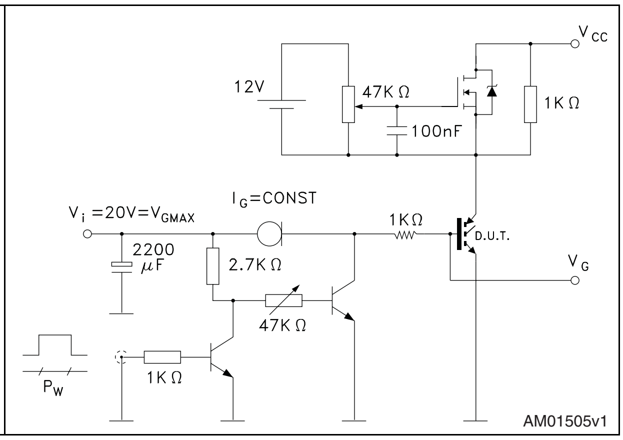


Figure 10. Switching waveform

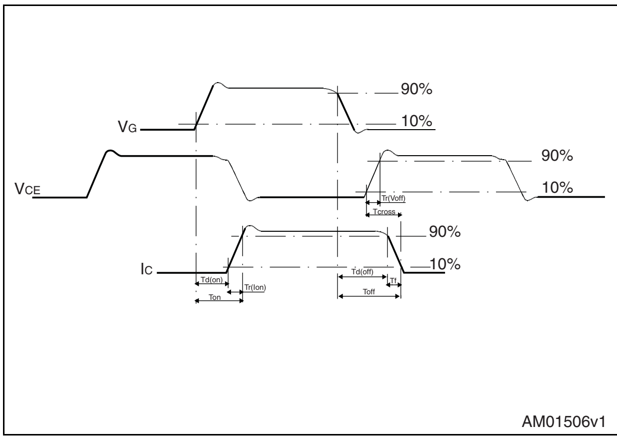
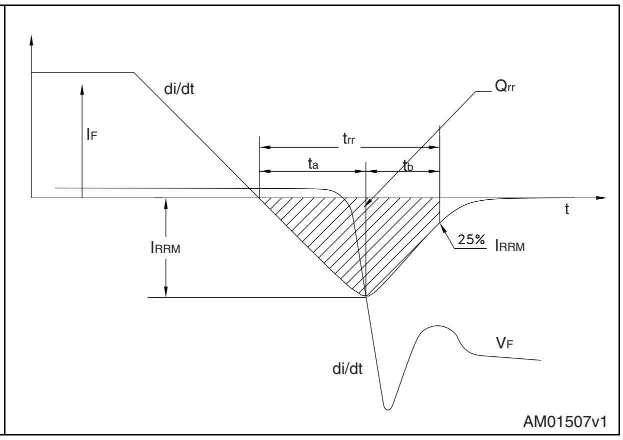


Figure 11. Diode recovery time waveform

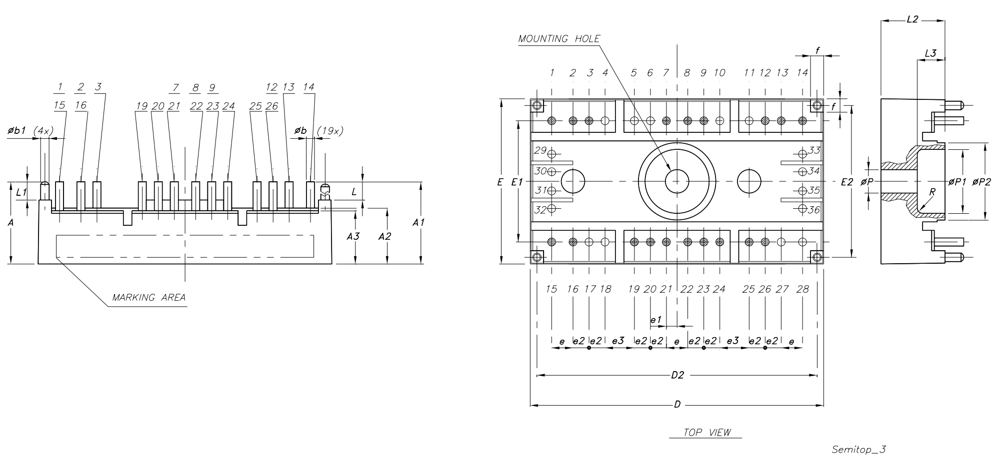


4 Package mechanical data

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 10. Revision history

Date	Revision	Changes
29-May-2006	1	Initial release
02-Oct-2008	2	– Updated *Figure 6* and *Figure 7* – Document status promoted from preliminary data to datasheet.