



# STGP20NB37LZ

## N-CHANNEL CLAMPED 20A TO-220 INTERNALLY CLAMPED PowerMESH™ IGBT

PRELIMINARY DATA

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGP20NB37LZ	CLAMPED	< 2.0 V	20 A

- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE

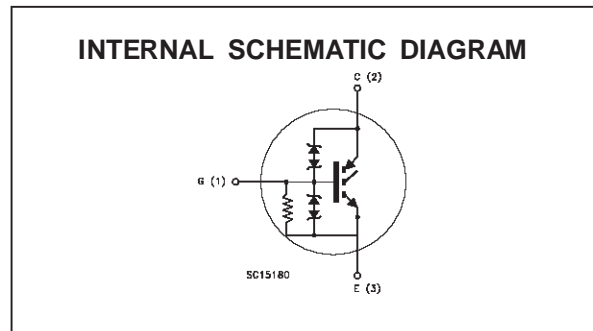
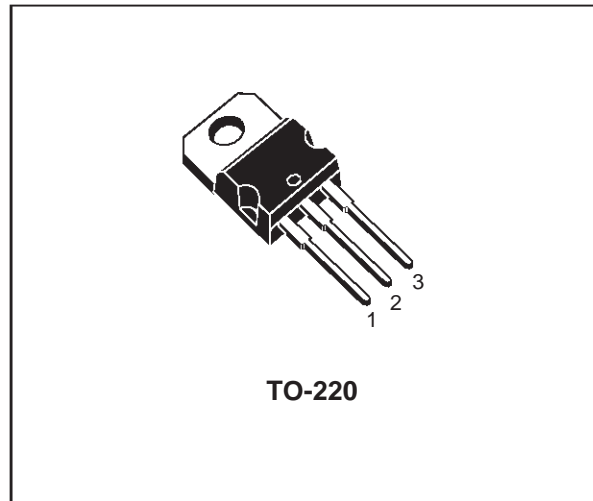
### DESCRIPTION

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

The built in collector-gate zener exhibits a very precise active clamping while the gate-emitter zener supplies an ESD protection.

### APPLICATIONS

- AUTOMOTIVE IGNITION



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	CLAMPED	V
V <sub>ECR</sub>	Reverse Battery Protection	20	V
V <sub>GE</sub>	Gate-Emitter Voltage	CLAMPED	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 25 °C	40	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 100 °C	30	A
I <sub>CM</sub> (●)	Collector Current (pulsed)	80	A
E <sub>AS</sub>	Single Pulse Energy T <sub>c</sub> = 25 °C	700	mJ
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	150	W
	Derating Factor	1	W/°C
E <sub>SD</sub>	ESD (Human Body Model)	4	KV
T <sub>stg</sub>	Storage Temperature	-65 to 175	°C
T <sub>j</sub>	Max. Operating Junction Temperature	175	°C

(●) Pulse width limited by safe operating area

## STGP20NB37LZ

### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	62.5	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	0.2	°C/W

### ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV <sub>(CES)</sub>	Clamped Voltage	I <sub>C</sub> = 2mA V <sub>GE</sub> = 0 T <sub>C</sub> = - 40°C	380	405	430	V
		I <sub>C</sub> = 2mA V <sub>GE</sub> = 0 T <sub>C</sub> = 25°C	375	400	425	V
		I <sub>C</sub> = 2mA V <sub>GE</sub> = 0 T <sub>C</sub> = 150°C	370	395	420	V
BV <sub>(ECR)</sub>	Emitter Collector Break-down Voltage	I <sub>C</sub> = 75 mA T <sub>C</sub> = 25°C	20	28		V
BV <sub>GE</sub>	Gate Emitter Break-down Voltage	I <sub>G</sub> = ± 2 mA	12	14	16	V
I <sub>CES</sub>	Collector cut-off Current (V <sub>GE</sub> = 0)	V <sub>CE</sub> = 15 V V <sub>GE</sub> = 0 T <sub>C</sub> = 150 °C			10	μA
		V <sub>CE</sub> = 200 V V <sub>GE</sub> = 0 T <sub>C</sub> = 150 °C			100	μA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 10 V V <sub>CE</sub> = 0	± 300	± 660	± 1000	μA
R <sub>GE</sub>	Gate Emitter Resistance		10	15	30	KΩ

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 250μA T <sub>C</sub> = - 40°C	1.2			V
		V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 250μA T <sub>C</sub> = 25°C	1.0	1.4	2	V
		V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 250μA T <sub>C</sub> = 150°C	0.6			V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 4.5 V I <sub>C</sub> = 10 A T <sub>C</sub> = 25°C		1.1	1.8	V
		V <sub>GE</sub> = 4.5 V I <sub>C</sub> = 10 A T <sub>C</sub> = 150 °C		1.0	1.7	V
		V <sub>GE</sub> = 4.5 V I <sub>C</sub> = 20 A T <sub>C</sub> = 25°C		1.35	2.0	V
		V <sub>GE</sub> = 4.5 V I <sub>C</sub> = 20 A T <sub>C</sub> = 150 °C		1.25	2.0	V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V I <sub>C</sub> = 20 A		35		S
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25 V f = 1 MHz V <sub>GE</sub> = 0		2300		pF
C <sub>oes</sub>	Output Capacitance			165		pF
C <sub>res</sub>	Reverse Transfer Capacitance			28		pF
Q <sub>G</sub>	Gate Charge	V <sub>CE</sub> = 280 V I <sub>C</sub> = 20 A V <sub>GE</sub> = 5 V		51		nC

**FUNCTIONAL CHARACTERISTICS**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
II	Latching Current	$V_{CLAMP} = 250\text{ V}$ $R_{G\text{OFF}} = 1\text{ K}\Omega$	80			A
U.I.S.	Functional Test Open Secondary Coil	$R_{G\text{OFF}}=1\text{ K}\Omega$ L =3 mH $T_C = 25\text{ }^\circ\text{C}$	21.6	26		A
		$R_{G\text{OFF}}=1\text{ K}\Omega$ L =3 mH $T_C = 150\text{ }^\circ\text{C}$	15	18		A

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(\text{on})}$	Delay Time	$V_{CC} = 250\text{ V}$		2.3		$\mu\text{s}$
$t_r$	Rise Time	$V_{GE} = 4.5\text{ V}$ $R_G = 1\text{ K}\Omega$		0.6		$\mu\text{s}$
$(di/dt)_{\text{on}}$	Turn-on Current Slope	$V_{CC} = 250\text{ V}$ $R_G = 1\text{ K}\Omega$		550		A/ $\mu\text{s}$
$E_{\text{on}}$	Turn-on Switching Losses	$V_{CC}=250\text{ V}$ $I_C =20\text{ A}$ $T_C = 25\text{ }^\circ\text{C}$		8.8		mJ
		$R_G =1\text{ K}\Omega$ $V_{GE} =4.5\text{ V}$ $T_C = 150\text{ }^\circ\text{C}$		9.2		mJ

**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 250\text{ V}$		4.8		$\mu\text{s}$
$t_r(V_{\text{off}})$	Off Voltage Rise Time	$R_{GE} = 1\text{ K}\Omega$		2.6		$\mu\text{s}$
$t_f$	Fall Time	$V_{GE} = 4.5\text{ V}$		2.0		$\mu\text{s}$
$t_{d(\text{off})}$	Off Voltage Delay Time			11.5		$\mu\text{s}$
$E_{\text{off}}^{(**)}$	Turn-off Switching Loss			11.8		mJ
$t_c$	Cross-Over Time	$V_{CC} = 250\text{ V}$		7.8		$\mu\text{s}$
$t_r(V_{\text{off}})$	Off Voltage Rise Time	$R_{GE} = 1\text{ K}\Omega$		3.5		$\mu\text{s}$
$t_f$	Fall Time	$T_C = 150\text{ }^\circ\text{C}$		3.9		$\mu\text{s}$
$t_{d(\text{off})}$	Off Voltage Delay Time			12.0		$\mu\text{s}$
$E_{\text{off}}^{(**)}$	Turn-off Switching Loss			17.8		mJ

(\*) Pulse width limited by safe operating area (\*) Pulsed: Pulse duration = 300 ms, duty cycle 1.5 % (\*\*)Losses Include Also The Tail (jedec Standardization)

Fig. 1: Unclamped Inductive Load Test Circuit

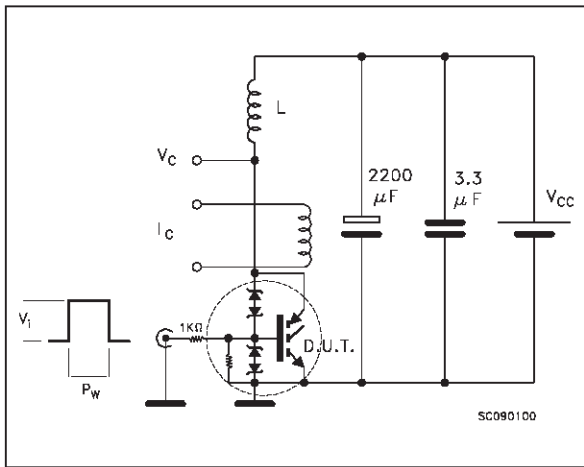


Fig. 2: Unclamped Inductive Waveform

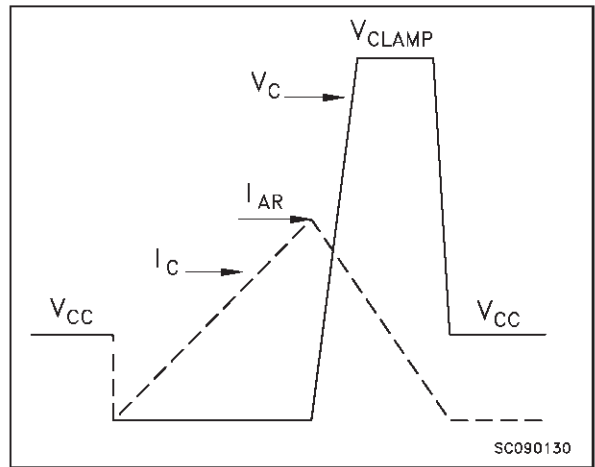


Fig. 3: Switching Times Test Circuits For Resistive Load

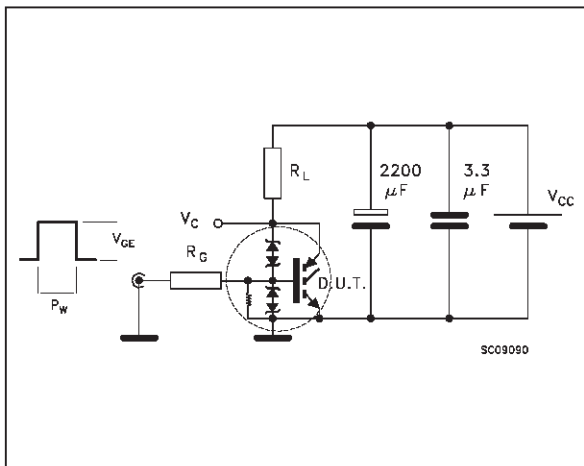


Fig. 4: Gate Charge test Circuit

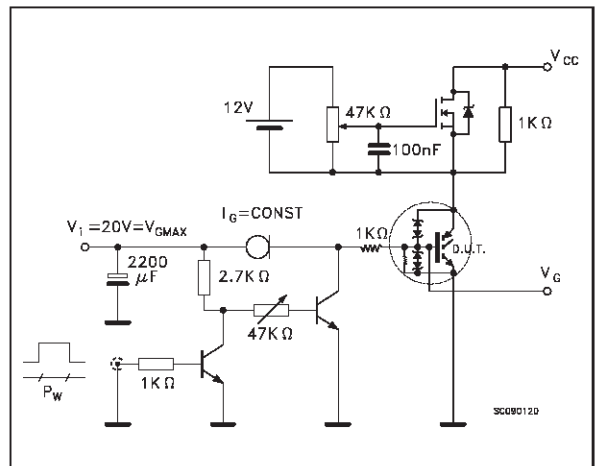
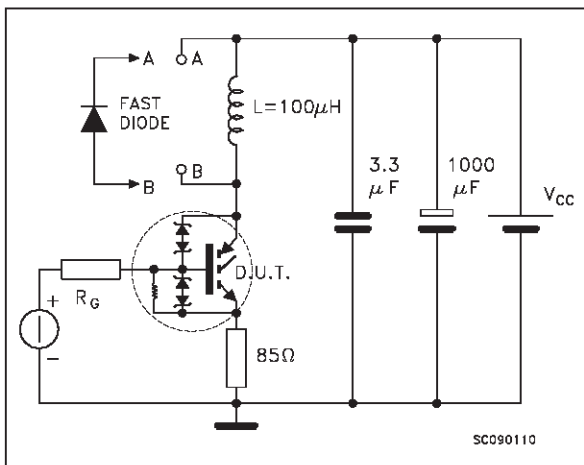
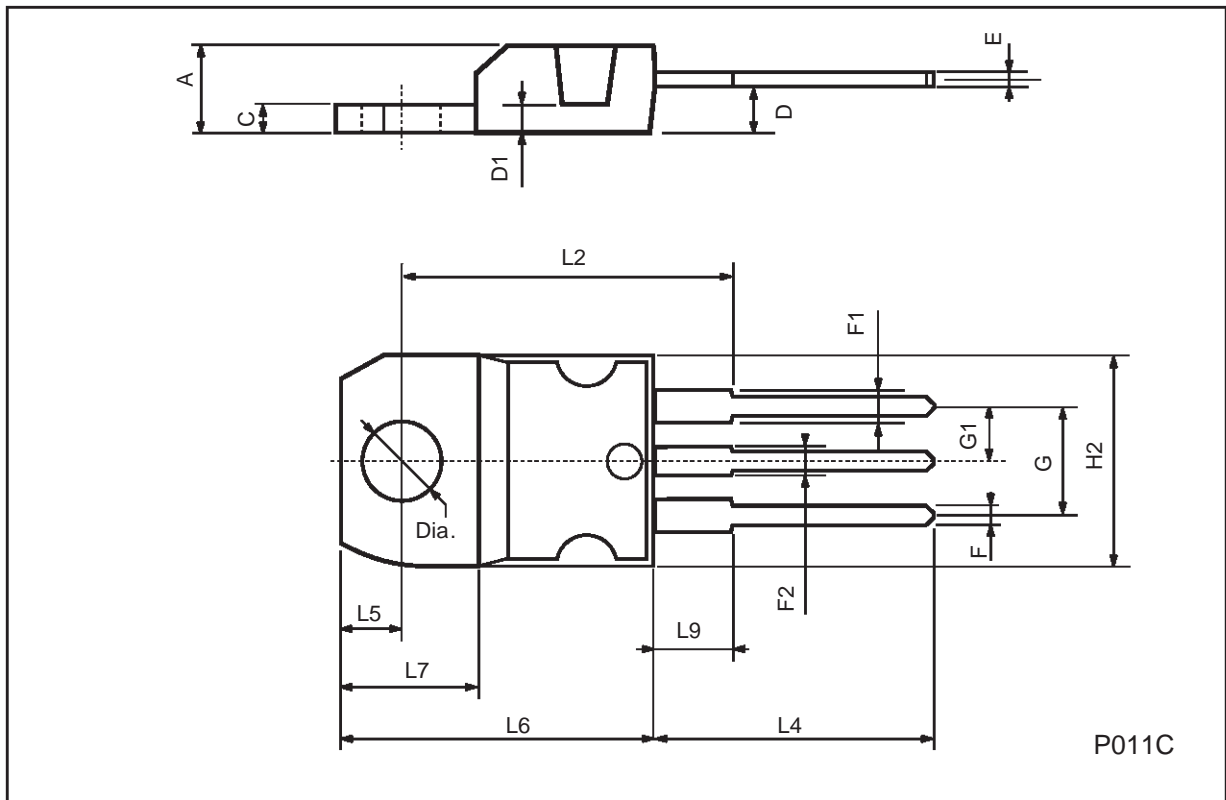


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



**TO-220 MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



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