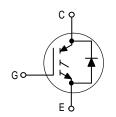
# Designer's™ Data Sheet

# Insulated Gate Bipolar Transistor with Anti-Parallel Diode

## N-Channel Enhancement-Mode Silicon Gate

This Insulated Gate Bipolar Transistor (IGBT) is co-packaged with a soft recovery ultra-fast rectifier and uses an advanced termination scheme to provide an enhanced and reliable high voltage blocking capability. Short circuit rated IGBT's are specifically suited for applications requiring a guaranteed short circuit withstand time such as Motor Control Drives. Fast switching characteristics result in efficient operation at high frequencies. Co-packaged IGBT's save space, reduce assembly time and cost.

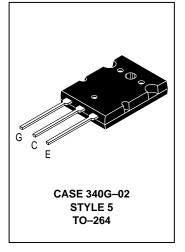
- Industry Standard High Power TO-264 Package (TO-3PBL)
- High Speed E<sub>off</sub>: 216 μJ/A typical at 125°C
- High Short Circuit Capability 10 μs minimum
- · Soft Recovery Free Wheeling Diode is included in the package
- Robust High Voltage Termination
- Robust RBSOA



# **MGY25N120D**

Motorola Preferred Device

IGBT & DIODE IN TO-264 25 A @ 90°C 38 A @ 25°C 1200 VOLTS SHORT CIRCUIT RATED



#### MAXIMUM RATINGS (T<sub>.J</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	VCES	1200	Vdc
Collector–Gate Voltage (R <sub>GE</sub> = 1.0 MΩ)	VCGR	1200	Vdc
Gate-Emitter Voltage — Continuous	V <sub>GE</sub>	±20	Vdc
Collector Current — Continuous @ T <sub>C</sub> = 25°C — Continuous @ T <sub>C</sub> = 90°C — Repetitive Pulsed Current (1)	IC25 IC90 ICM	38 25 76	Adc Apk
Total Power Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	PD	212 1.69	Watts W/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to 150	°C
Short Circuit Withstand Time ( $V_{CC}$ = 720 Vdc, $V_{GE}$ = 15 Vdc, $T_J$ = 125°C, $R_G$ = 20 $\Omega$ )	t <sub>SC</sub>	10	μS
Thermal Resistance — Junction to Case – IGBT — Junction to Case – Diode — Junction to Ambient	R <sub>θ</sub> JC R <sub>θ</sub> JC R <sub>θ</sub> JA	0.6 0.9 35	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	TL	260	°C
Mounting Torque, 6–32 or M3 screw 10 lbf•in (1.13 N•m			

<sup>(1)</sup> Pulse width is limited by maximum junction temperature. Repetitive rating.

**Designer's Data for "Worst Case" Conditions** — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

Designer's is a trademark of Motorola, Inc.

Preferred devices are Motorola recommended choices for future use and best overall value.

REV 2



## MGY25N120D

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(	Symbol	Min	Тур	Max	Unit	
OFF CHARACTERISTICS						
Collector-to-Emitter Breakdown	Noltage	V(BR)CES	1200			Vdc
(VGE = 0 Vdc, I <sub>C</sub> = 25 μAdc) Temperature Coefficient (Posi		1200 —	960	_	mV/°C	
Zero Gate Voltage Collector Cui		ICES			100	μAdc
(VCE = 1200 Vdc, VGE = 0 V (VCE = 1200 Vdc, VGE = 0 V			_	_	2500	
Gate–Body Leakage Current (V	IGES	_	_	250	nAdc	
ON CHARACTERISTICS (1)						
Collector-to-Emitter On-State	S .	VCE(on)		0.07		Vdc
$(V_{GE} = 15 \text{ Vdc}, I_{C} = 12.5 \text{ Add})$ $(V_{GE} = 15 \text{ Vdc}, I_{C} = 12.5 \text{ Add})$			_	2.37 2.15	3.24	
$(V_{GE} = 15 \text{ Vdc}, I_{C} = 25 \text{ Adc})$	., 3		–	2.98	4.19	
Gate Threshold Voltage		V <sub>GE(th)</sub>				Vdc
(V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1.0 mAdc) Threshold Temperature Coeff	icient (Negative)		4.0	6.0 10	8.0	mV/°C
Forward Transconductance (VC		9fe	<u> </u>	12	<u> </u>	Mhos
DYNAMIC CHARACTERISTICS	E = 10 vac, 1C = 20 Ado)	yie yie		12		WIIIOS
Input Capacitance		C <sub>ies</sub>	Ι_	1859	Ι_	pF
Output Capacitance	$(V_{CE} = 25 \text{ Vdc}, V_{GE} = 0 \text{ Vdc},$	C <sub>oes</sub>		198		ļ .
Transfer Capacitance	f = 1.0 MHz)	C <sub>res</sub>		30		1
SWITCHING CHARACTERISTIC	S (4)	ores		00		
Turn-On Delay Time		t <sub>d(on)</sub>	l _	91	l _	ns
Rise Time		t <sub>r</sub>	<u> </u>	124	<u> </u>	1.0
Turn-Off Delay Time	(V <sub>CC</sub> = 720 Vdc, I <sub>C</sub> = 25 Adc,			196		-
Fall Time	V <sub>GE</sub> = 15 Vdc, L = 300 μH	t <sub>d</sub> (off)	<u> </u>	310		1
Turn-Off Switching Loss	$R_G = 20 \Omega$ ) Energy losses include "tail"	E <sub>off</sub>		2.44	4.69	mJ
Turn–On Switching Loss	— Energy losses include tail			3.14	5.22	1113
Total Switching Loss	_	E <sub>on</sub>		5.58	9.91	-
		E <sub>ts</sub>	_			
Turn-On Delay Time		td(on)		88	_	ns
Rise Time		t <sub>r</sub>	_	126		
Turn-Off Delay Time	(V <sub>CC</sub> = 720 Vdc, I <sub>C</sub> = 25 Adc, V <sub>GE</sub> = 15 Vdc, L = 300 μH	td(off)	_	236	_	1
Fall Time	$R_G = 20 \Omega, T_J = 125^{\circ}C$	t <sub>f</sub>	_	640		
Turn-Off Switching Loss	Energy losses include "tail"	E <sub>off</sub>	_	5.40	_	mJ
Turn–On Switching Loss	_	E <sub>on</sub>	_	5.03	_	
Total Switching Loss		E <sub>ts</sub>	_	10.43	_	
Gate Charge	(V <sub>CC</sub> = 720 Vdc, I <sub>C</sub> = 25 Adc,	QT	_	62	_	nC
	VGE = 15 Vdc, IC = 25 Adc,	Q <sub>1</sub>	_	22	_	]
		Q <sub>2</sub>	_	25	_	
DIODE CHARACTERISTICS						
Diode Forward Voltage Drop		VFEC		2 00	2.50	Vdc
(I <sub>EC</sub> = 12.5 Adc) (I <sub>EC</sub> = 12.5 Adc, T <sub>J</sub> = 125°C)			_	2.89 1.75	3.50 —	
(I <sub>EC</sub> = 25 Adc)			-	3.65	4.45	

Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

(continued)

### ELECTRICAL CHARACTERISTICS — continued (T<sub>J</sub> = 25°C unless otherwise noted)

Cha	Symbol	Min	Тур	Max	Unit		
DIODE CHARACTERISTICS — continued							
Reverse Recovery Time		t <sub>rr</sub>	_	114	_	ns	
	(I <sub>F</sub> = 25 Adc, V <sub>R</sub> = 720 Vdc, dI <sub>F</sub> /dt = 150 A/μs)	ta	_	71	_		
		t <sub>b</sub>	_	43	_		
Reverse Recovery Stored Charge		Q <sub>RR</sub>	_	0.65	_	μС	
Reverse Recovery Time		t <sub>rr</sub>	_	226	_	ns	
	$(I_F = 25 \text{ Adc}, V_R = 720 \text{ Vdc},$	ta	_	165	_		
	dl <sub>F</sub> /dt = 150 A/μs, T <sub>J</sub> = 125°C)	t <sub>b</sub>	_	61	_		
Reverse Recovery Stored Charge		Q <sub>RR</sub>	_	1.90	_	μС	
INTERNAL PACKAGE INDUCTANCE							
Internal Emitter Inductance (Measured from the emitter lead 0	LE	_	13	_	nΗ		

### TYPICAL ELECTRICAL CHARACTERISTICS

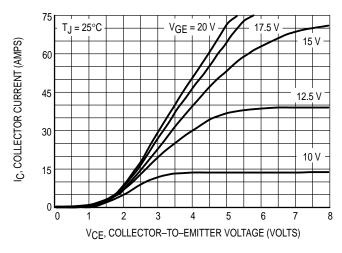


Figure 1. Output Characteristics

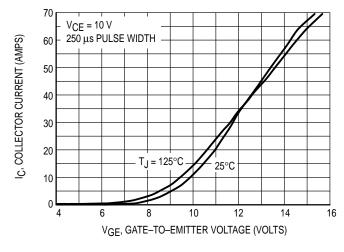


Figure 3. Transfer Characteristics

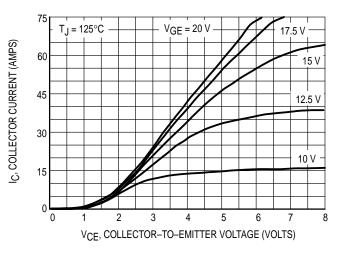


Figure 2. Output Characteristics

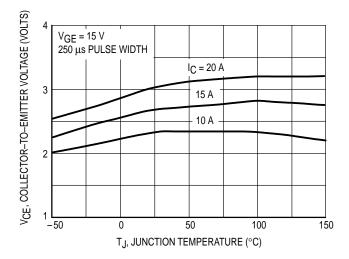


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

#### **MGY25N120D**

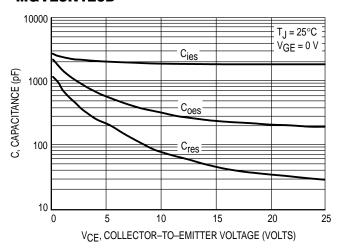


Figure 5. Capacitance Variation

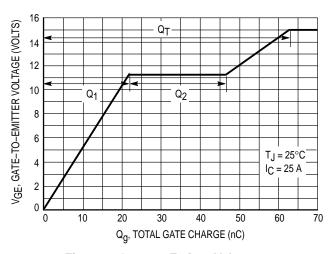


Figure 6. Gate-to-Emitter Voltage versus
Total Charge

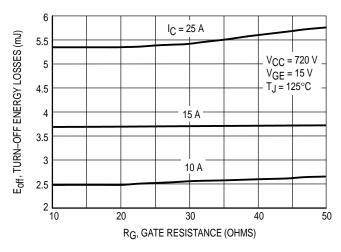


Figure 7. Turn-Off Losses versus
Gate Resistance

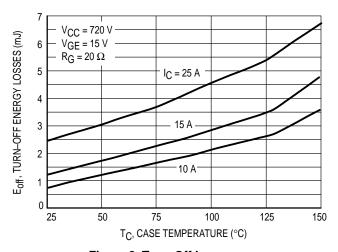


Figure 8. Turn-Off Losses versus
Case Temperature

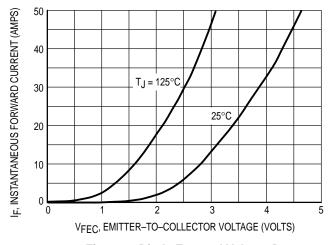


Figure 9. Diode Forward Voltage Drop

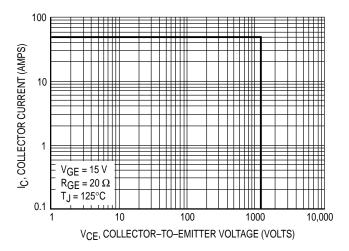


Figure 10. Reverse Biased Safe Operating Area

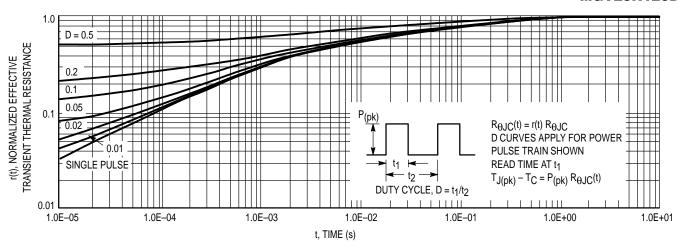
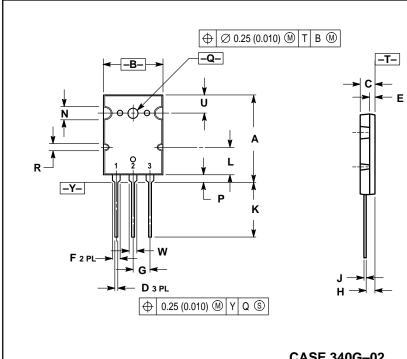


Figure 11. Thermal Response

#### PACKAGE DIMENSIONS



#### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- 2. CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		INCHES		
DIM	MIN	MAX	MIN	MAX	
Α	2.8	2.9	1.102	1.142	
В	19.3	20.3	0.760	0.800	
С	4.7	5.3	0.185	0.209	
D	0.93	1.48	0.037	0.058	
Е	1.9	2.1	0.075	0.083	
F	2.2	2.4	0.087	0.102	
G	5.45	BSC	0.215 BSC		
Н	2.6	3.0	0.102	0.118	
J	0.43	0.78	0.017	0.031	
K	17.6	18.8	0.693	0.740	
L	11.0	11.4	0.433	0.449	
N	3.95	4.75	0.156	0.187	
P	2.2	2.6	0.087	0.102	
Q	3.1	3.5	0.122	0.137	
R	2.15	2.35	0.085	0.093	
U	6.1	6.5	0.240	0.256	
W	2.8	3.2	0.110	0.125	

STYLE 5: PIN 1. GATE

COLLECTOR 2. **EMITTER** 

CASE 340G-02 TO-264 **ISSUE F** 

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