Designer's™ Data Sheet

Insulated Gate Bipolar Transistor with Anti-Parallel Diode

N-Channel Enhancement-Mode Silicon Gate

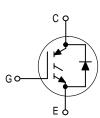
This Insulated Gate Bipolar Transistor (IGBT) is co-packaged with a soft recovery ultra-fast rectifier and uses an advanced termination scheme to provide an enhanced and reliable high voltage-blocking capability. Short circuit rated IGBT's are specifically suited for applications requiring a guaranteed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

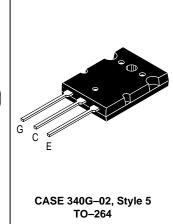
- Industry Standard High Power TO-264 Package (TO-3PBL)
- High Speed E_{off}: 60 μJ per Amp typical at 125°C
- High Short Circuit Capability 10 μs minimum
- Soft Recovery Free Wheeling Diode is included in the package
- Robust High Voltage Termination
- Robust RBSOA

MGY30N60D

Motorola Preferred Device

IGBT & DIODE IN TO-264 30 A @ 90°C 50 A @ 25°C 600 VOLTS SHORT CIRCUIT RATED





MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	VCES	600	Vdc
Collector–Gate Voltage (R _{GE} = 1.0 MΩ)	VCGR	600	Vdc
Gate–Emitter Voltage — Continuous	V _{GE}	±20	Vdc
Collector Current — Continuous @ T _C = 25°C — Continuous @ T _C = 90°C — Repetitive Pulsed Current (1)	I _{C25} I _{C90} I _{CM}	50 30 100	Adc Apk
Total Power Dissipation @ T _C = 25°C Derate above 25°C	PD	202 1.61	Watts W/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-55 to 150	°C
Short Circuit Withstand Time (V _{CC} = 360 Vdc, V _{GE} = 15 Vdc, T _J = 25°C, R _G = 20 Ω)	t _{SC}	10	μS
Thermal Resistance — Junction to Case – IGBT — Junction to Case – Diode — Junction to Ambient	R _θ JC R _θ JC R _θ JA	0.62 1.41 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)		

⁽¹⁾ Pulse width is limited by maximum junction temperature.

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.

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



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Cha	Symbol	Min	Тур	Max	Unit		
OFF CHARACTERISTICS							
Collector-to-Emitter Breakdown Vo	BVCES	000			Vdc		
(VGE = 0 Vdc, I _C = 250 µAdc) Temperature Coefficient (Positive		600 —	870	_	mV/°C		
Zero Gate Voltage Collector Currer (VCE = 600 Vdc, VGE = 0 Vdc)	nt	ICES			100	μAdc	
(VCE = 600 Vdc, VGE = 0 Vdc, T		_	_	2500			
Gate-Body Leakage Current (VGE	= \pm 20 Vdc, V _{CE} = 0 Vdc)	IGES	_	_	250	nAdc	
ON CHARACTERISTICS (1)							
Collector-to-Emitter On-State Voltage		VCE(on)		0.00		Vdc	
(V _{GE} = 15 Vdc, I _C = 15 Adc) (V _{GE} = 15 Vdc, I _C = 15 Adc, T _J	(VGE = 15 Vdc, IC = 15 Adc)			2.20 2.10	2.90 —		
(VGE = 15 Vdc, IC = 30 Adc)		–	2.60	3.45			
Gate Threshold Voltage		VGE(th)				Vdc	
(V _{CE} = V _{GE} , I _C = 1 mAdc) Threshold Temperature Coefficient (Negative)			4.0	6.0 10	8.0	mV/°C	
Forward Transconductance (VCE =		Ot -	 	15		Mhos	
	10 vac, IC = 30 Auc)	9fe		13		IVIIIOS	
DYNAMIC CHARACTERISTICS Input Capacitance		C _{ies}	Ι	4280	Γ_	pF	
Output Capacitance	$(V_{CE} = 25 \text{ Vdc}, V_{GE} = 0 \text{ Vdc},$	C _{oes}		225		P'	
Transfer Capacitance	f = 1.0 MHz)	C _{res}	 	19	_		
SWITCHING CHARACTERISTICS (1)	9162					
Turn-On Delay Time	·,	t _{d(on)}	Γ_	76	I _	ns	
Rise Time		t _r	 	80	_		
Turn-Off Delay Time	(V _{CC} = 360 Vdc, I _C = 30 Adc,	t _d (off)	 	348	_		
Fall Time	V _{GE} = 15 Vdc, L = 300 μH	t _f	 	188	_		
Turn-Off Switching Loss	$R_G = 20 \Omega$, $T_J = 25^{\circ}C$) Energy losses include "tail"	E _{off}	_	0.98	1.28	mJ	
Turn-On Switching Loss		Eon	_	2.00	_		
Total Switching Loss		E _{ts}	_	2.98	_		
Turn-On Delay Time		t _{d(on)}	_	73	_	ns	
Rise Time		t _r	_	95	_		
Turn-Off Delay Time	$(V_{CC} = 360 \text{ Vdc}, I_{C} = 30 \text{ Adc},$	t _d (off)	_	394	_		
Fall Time	V_{GE} = 15 Vdc, L = 300 μH R_{G} = 20 Ω , T_{J} = 125°C)	tf	_	418	_		
Turn-Off Switching Loss	Energy losses include "tail"	E _{off}	_	1.90	_	mJ	
Turn-On Switching Loss		Eon	_	3.10	_		
Total Switching Loss		E _{ts}	_	5.00	_		
Gate Charge		QT	_	150	_	nC	
	$V_{CC} = 360 \text{ Vdc}, I_{C} = 30 \text{ Adc},$ $V_{GE} = 15 \text{ Vdc})$	Q ₁	_	30	_	1	
	- GE - 10 140)	Q ₂	_	45	_	1	
DIODE CHARACTERISTICS							
Diode Forward Voltage Drop	VFEC				Vdc		
(I _{EC} = 15 Adc) (I _{EC} = 15 Adc, T _J = 125°C)			_	1.30 1.10	1.80		

(1) Pulse Test: Pulse Width \leq 300 μ s, Duty Cycle \leq 2%.

(continued)

ELECTRICAL CHARACTERISTICS — continued (T_J = 25°C unless otherwise noted)

Cha	Symbol	Min	Тур	Max	Unit			
DIODE CHARACTERISTICS — continued								
Reverse Recovery Time		t _{rr}	_	153	_	ns		
	$(I_F = 30 \text{ Adc}, V_R = 360 \text{ Vdc},$	ta	_	82	_			
	dI _F /dt = 200 A/μs)	t _b	_	71	_			
Reverse Recovery Stored Charge		Q _{RR}	_	2.3	_	μC		
Reverse Recovery Time		t _{rr}	_	208	_	ns		
	$(I_F = 30 \text{ Adc}, V_R = 360 \text{ Vdc},$	ta	_	117	_			
	$dI_F/dt = 200 \text{ A/}\mu\text{s}, T_J = 125^{\circ}\text{C}$	t _b	_	91	_			
Reverse Recovery Stored Charge		Q _{RR}	_	3.8	_	μC		
INTERNAL PACKAGE INDUCTANCE								
Internal Emitter Inductance (Measured from the emitter lead 0.25" from package to emitter bond pad)		LE	_	13	_	nH		

TYPICAL ELECTRICAL CHARACTERISTICS

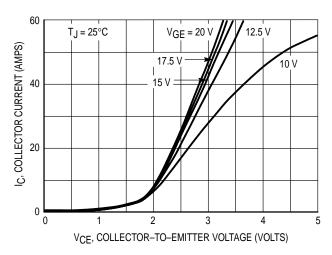


Figure 1. Output Characteristics, T_J = 25°C

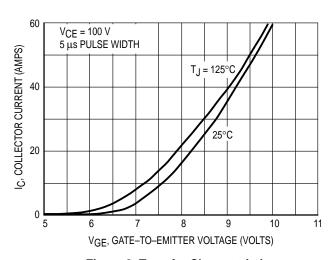


Figure 3. Transfer Characteristics

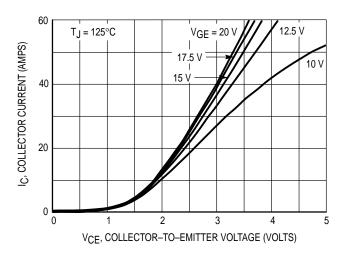


Figure 2. Output Characteristics, T_J = 125°C

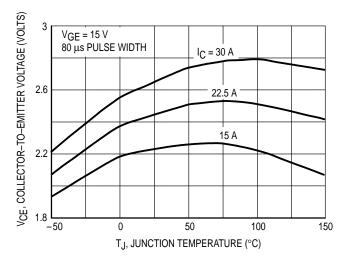


Figure 4. Collector–to–Emitter Saturation Voltage versus Junction Temperature

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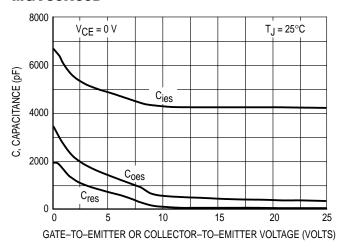


Figure 5. Capacitance Variation

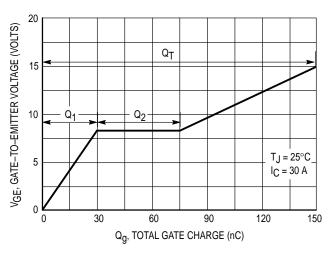


Figure 6. Gate-to-Emitter Voltage versus
Total Charge

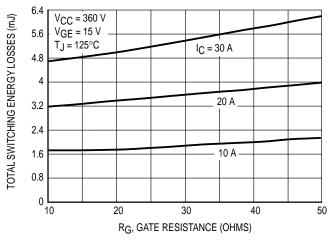


Figure 7. Total Switching Losses versus
Gate Resistance

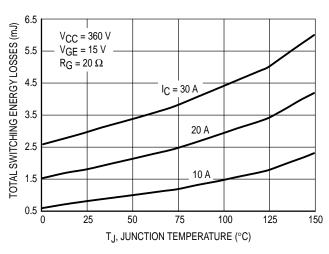


Figure 8. Total Switching Losses versus Junction Temperature

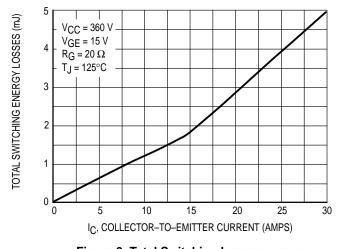


Figure 9. Total Switching Losses versus Collector-to-Emitter Current

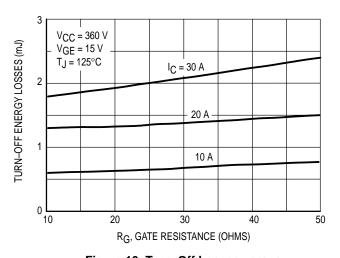
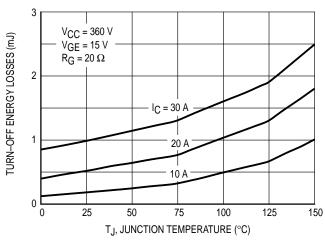


Figure 10. Turn-Off Losses versus
Gate Resistance



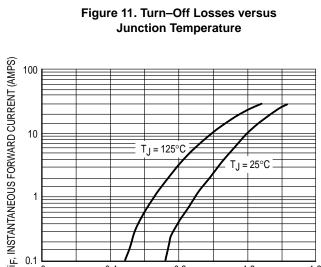


Figure 13. Typical Diode Forward Drop versus Instantaneous Forward Current

V_{FM}, FORWARD VOLTAGE DROP (VOLTS)

1.2

0.4

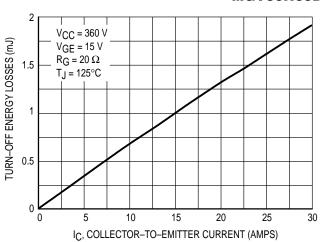


Figure 12. Turn-Off Losses versus Collector-to-Emitter Current

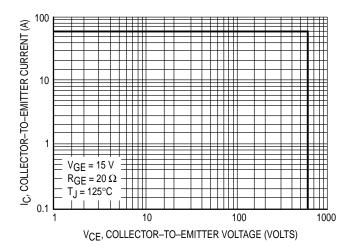
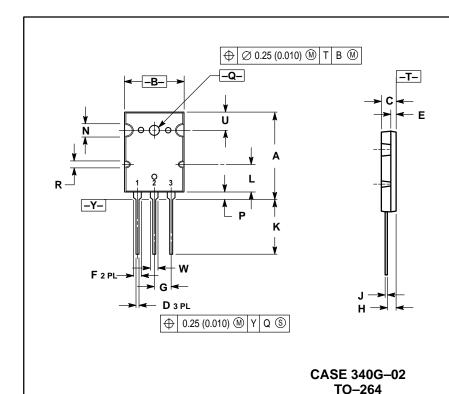


Figure 14. Reverse Biased Safe Operating Area

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
E	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
Р	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 2. COLLECTOR

3. EMITTER

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