

Designer's™ Data Sheet

Insulated Gate Bipolar Transistor

N-Channel Enhancement-Mode Silicon Gate

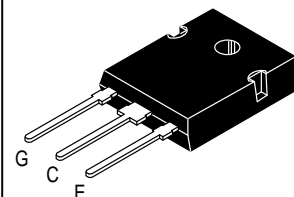
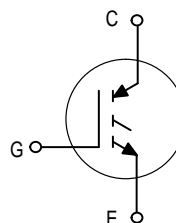
MGW30N60

Motorola Preferred Device

IGBT IN TO-247
30 A @ 90°C
50 A @ 25°C
600 VOLTS
SHORT CIRCUIT RATED

This Insulated Gate Bipolar Transistor (IGBT) 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.

- Industry Standard High Power TO-247 Package with Isolated Mounting Hole
- High Speed E_{off} : 60 μ s per Amp typical at 125°C
- High Short Circuit Capability – 10 μ s minimum
- Robust High Voltage Termination
- Robust RBSOA



CASE 340F-03, Style 4
TO-247AE

MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	600	Vdc
Collector-Gate Voltage ($R_{GE} = 1.0 \text{ M}\Omega$)	V_{CGR}	600	Vdc
Gate-Emitter Voltage — Continuous	V_{GE}	± 20	Vdc
Collector Current — Continuous @ $T_C = 25^\circ\text{C}$ — Continuous @ $T_C = 90^\circ\text{C}$ — Repetitive Pulsed Current (1)	I_{C25} I_{C90} I_{CM}	50 30 100	Adc Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	202 1.61	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to 150	°C
Short Circuit Withstand Time ($V_{CC} = 360 \text{ Vdc}$, $V_{GE} = 15 \text{ Vdc}$, $T_J = 25^\circ\text{C}$, $R_G = 20 \Omega$)	t_{sc}	10	μ s
Thermal Resistance — Junction to Case – IGBT — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	0.62 45	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	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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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-to-Emitter Breakdown Voltage (V _{GE} = 0 Vdc, I _C = 250 μAdc) Temperature Coefficient (Positive)	BV _{CES}	600 —	— 870	— —	Vdc mV/°C
Emitter-to-Collector Breakdown Voltage (V _{GE} = 0 Vdc, I _{EC} = 100 mAdc)	BV _{ECS}	25	—	—	Vdc
Zero Gate Voltage Collector Current (V _{CE} = 600 Vdc, V _{GE} = 0 Vdc) (V _{CE} = 600 Vdc, V _{GE} = 0 Vdc, T _J = 125°C)	I _{CES}	— —	— —	100 2500	μAdc
Gate-Body Leakage Current (V _{GE} = ± 20 Vdc, V _{CE} = 0 Vdc)	I _{GES}	—	—	250	nAdc

ON CHARACTERISTICS (1)

Collector-to-Emitter On-State Voltage (V _{GE} = 15 Vdc, I _C = 15 Adc) (V _{GE} = 15 Vdc, I _C = 15 Adc, T _J = 125°C) (V _{GE} = 15 Vdc, I _C = 30 Adc)	V _{CE(on)}	— — —	2.20 2.10 2.60	2.90 — 3.45	Vdc
Gate Threshold Voltage (V _{CE} = V _{GE} , I _C = 1 mAdc) Threshold Temperature Coefficient (Negative)	V _{GE(th)}	4.0 —	6.0 10	8.0 —	Vdc mV/°C
Forward Transconductance (V _{CE} = 10 Vdc, I _C = 30 Adc)	g _{fe}	—	15	—	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{CE} = 25 Vdc, V _{GE} = 0 Vdc, f = 1.0 MHz)	C _{ies}	—	4280	—	pF
Output Capacitance		C _{oes}	—	275	—	
Transfer Capacitance		C _{res}	—	19	—	

SWITCHING CHARACTERISTICS (1)

Turn-On Delay Time	(V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc, L = 300 μH R _G = 20 Ω, T _J = 25°C) Energy losses include "tail"	t _{d(on)}	—	76	—	ns
Rise Time		t _r	—	80	—	
Turn-Off Delay Time		t _{d(off)}	—	348	—	
Fall Time		t _f	—	188	—	
Turn-Off Switching Loss		E _{off}	—	0.98	1.28	
Turn-On Delay Time	(V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc, L = 300 μH R _G = 20 Ω, T _J = 125°C) Energy losses include "tail"	t _{d(on)}	—	73	—	ns
Rise Time		t _r	—	95	—	
Turn-Off Delay Time		t _{d(off)}	—	394	—	
Fall Time		t _f	—	418	—	
Turn-Off Switching Loss		E _{off}	—	1.90	—	
Gate Charge	(V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc)	Q _T	—	150	—	nC
		Q ₁	—	30	—	
		Q ₂	—	45	—	

INTERNAL PACKAGE INDUCTANCE

Internal Emitter Inductance (Measured from the emitter lead 0.25" from package to emitter bond pad)	L _E	—	13	—	nH
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(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

TYPICAL ELECTRICAL CHARACTERISTICS

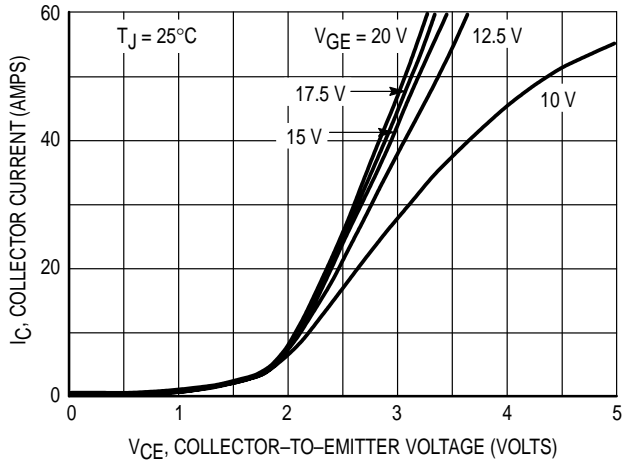


Figure 1. Output Characteristics, $T_J = 25^\circ\text{C}$

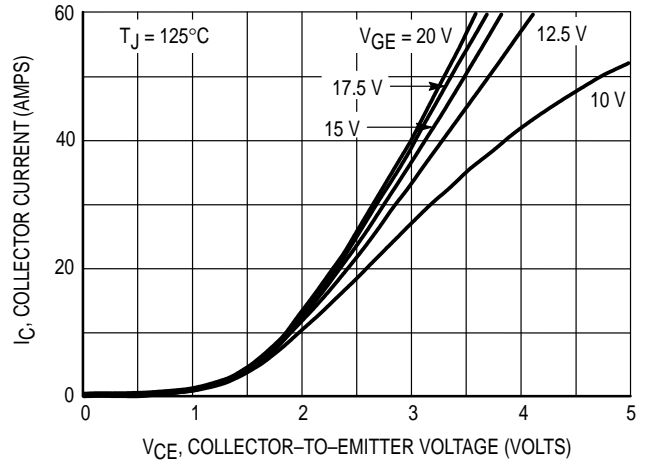


Figure 2. Output Characteristics, $T_J = 125^\circ\text{C}$

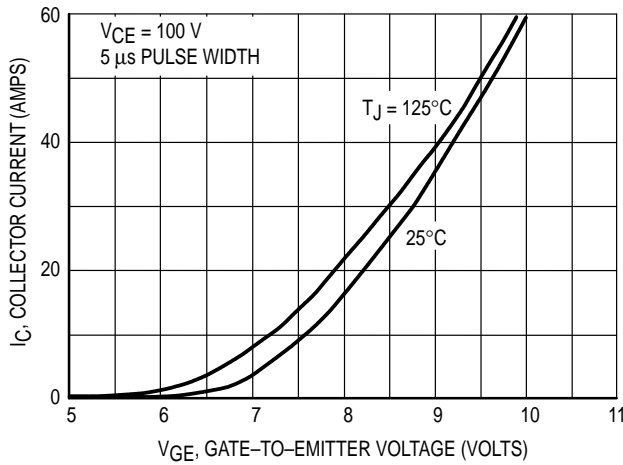


Figure 3. Transfer Characteristics

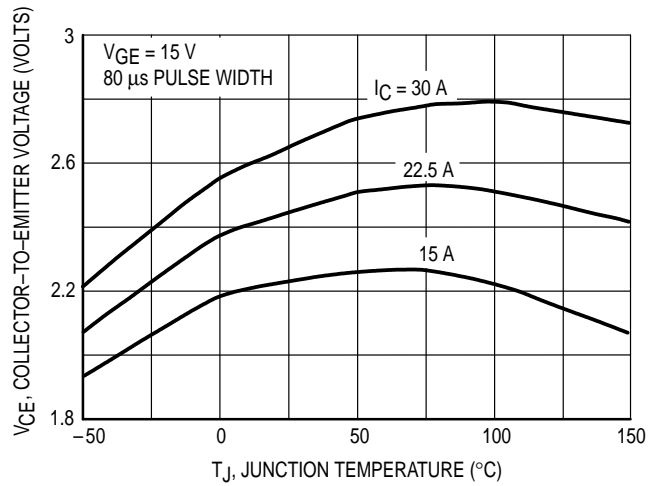


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

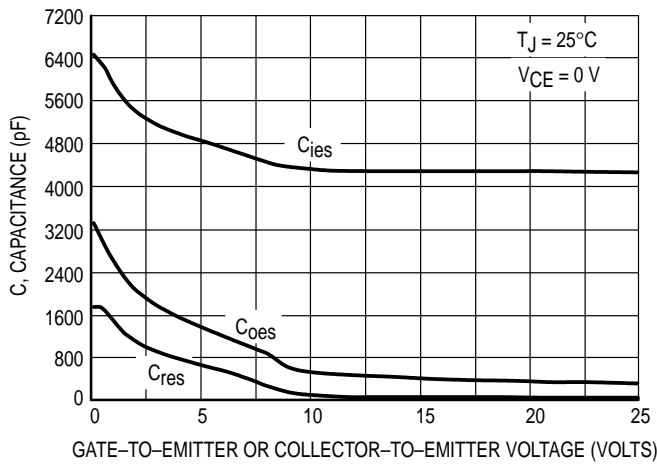


Figure 5. Capacitance Variation

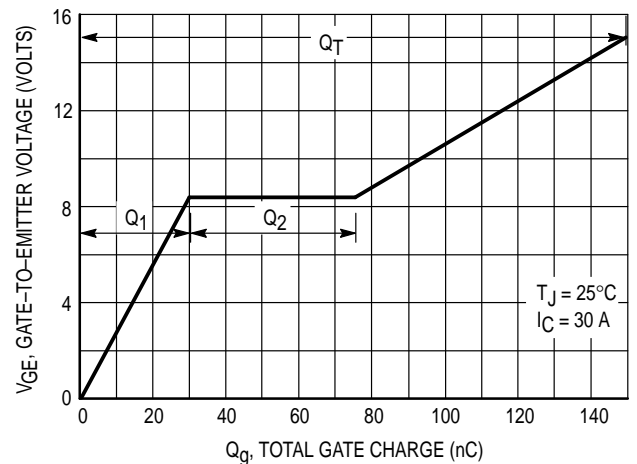


Figure 6. Gate-to-Emitter Voltage versus Total Charge

MGW30N60

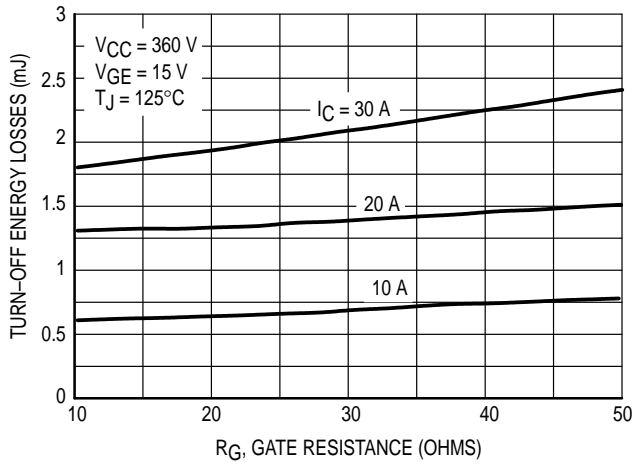


Figure 7. Turn-Off Losses versus Gate Resistance

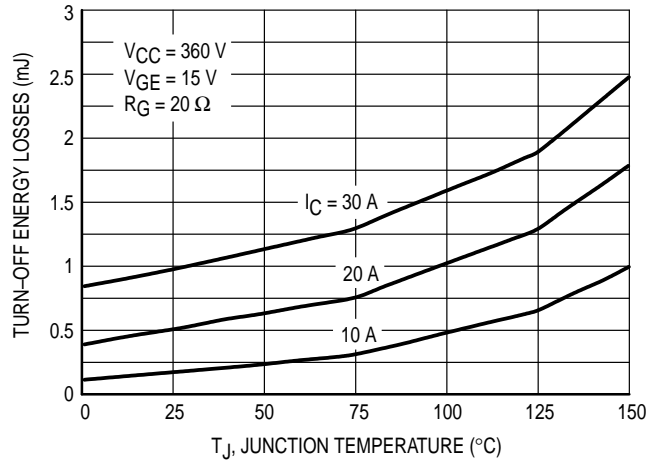


Figure 8. Turn-Off Losses versus Junction Temperature

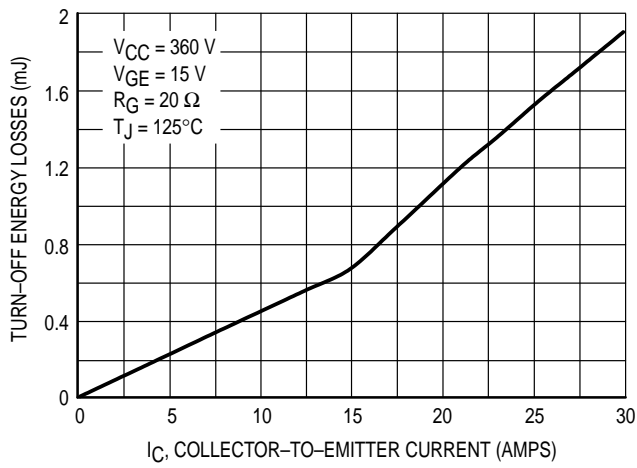


Figure 9. Turn-Off Losses versus Collector-to-Emitter Current

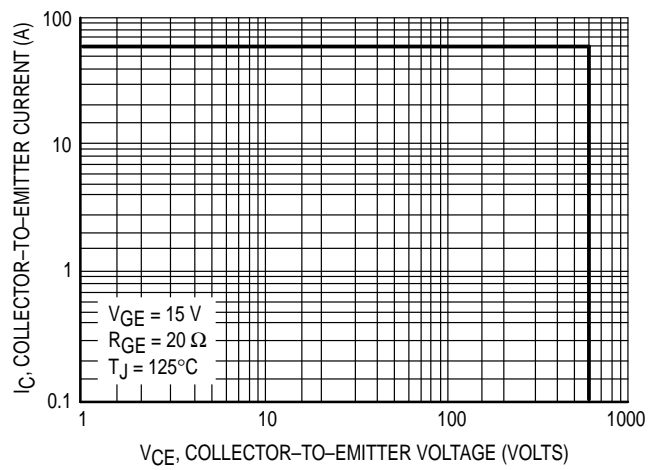
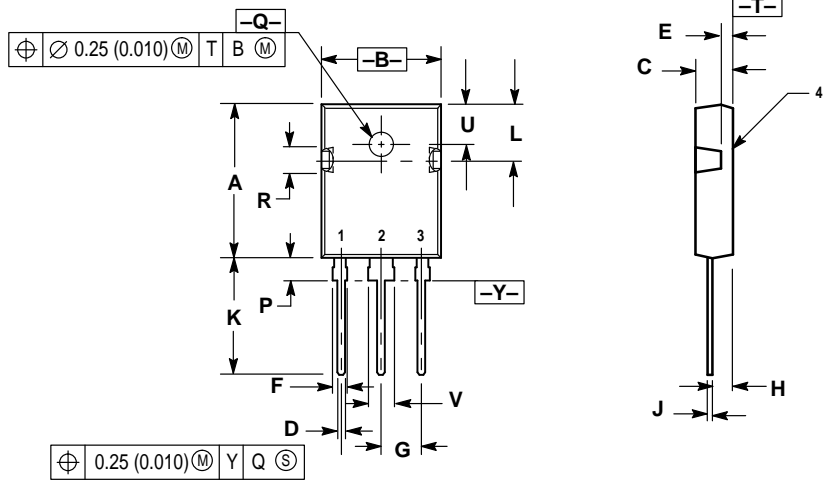


Figure 10. Reverse Biased Safe Operating Area

PACKAGE DIMENSIONS




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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.40	20.90	0.803	0.823
B	15.44	15.95	0.608	0.628
C	4.70	5.21	0.185	0.205
D	1.09	1.30	0.043	0.051
E	1.50	1.63	0.059	0.064
F	1.80	2.18	0.071	0.086
G	5.45 BSC		0.215 BSC	
H	2.56	2.87	0.101	0.113
J	0.48	0.68	0.019	0.027
K	15.57	16.08	0.613	0.633
L	7.26	7.50	0.286	0.295
P	3.10	3.38	0.122	0.133
Q	3.50	3.70	0.138	0.145
R	3.30	3.80	0.130	0.150
U	5.30 BSC		0.209 BSC	
V	3.05	3.40	0.120	0.134

STYLE 4:
 PIN 1. GATE
 2. COLLECTOR
 3. EMITTER
 4. COLLECTOR

CASE 340F-03
 TO-247AE
 ISSUE E

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