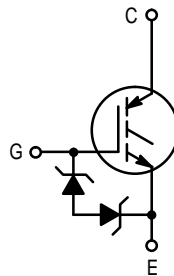


*Product Preview*

**Insulated Gate Bipolar Transistor**  
**N-Channel Enhancement-Mode Silicon Gate**

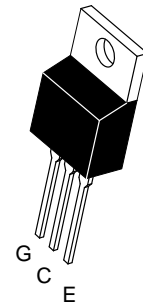
This Insulated Gate Bipolar Transistor (IGBT) uses an advanced termination scheme to provide an enhanced and reliable high voltage-blocking capability. It also provides fast switching characteristics and results in efficient operation at high frequencies.

- Industry Standard TO-220 Package
- High Speed  $E_{off}$ : 67  $\mu$ s/A typical at 125°C
- Low On-Voltage – 1.7 V typical at 10 A, 125°C
- Robust High Voltage Termination
- ESD Protection Gate-Emitter Zener Diodes



**MGP20N60U**

**IGBT IN TO-220**  
**20 A @ 90°C**  
**31 A @ 25°C**  
**600 VOLTS**  
**VERY LOW**  
**ON-VOLTAGE**



**CASE 221A-09, Style 9**  
**TO-220AB**

**MAXIMUM RATINGS** ( $T_J = 25^\circ\text{C}$  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	$V_{GE}$	$\pm 20$	Vdc
Collector Current — Continuous @ $T_C = 25^\circ\text{C}$ — Continuous @ $T_C = 90^\circ\text{C}$ — Repetitive Pulsed Current (1)	$I_{C25}$ $I_{C90}$ $I_{CM}$	31 20 40	Adc Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	$P_D$	142 0.89	Watts W/°C
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to 150	°C
Thermal Resistance — Junction to Case – IGBT — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.12 65	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	$T_L$	200	°C
Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.13 N•m)		

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

This document contains information on a new product. Specifications and information herein are subject to change without notice.

# MGP20N60U

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-to-Emitter Breakdown Voltage (V <sub>GE</sub> = 0 Vdc, I <sub>C</sub> = 25 μAdc) Temperature Coefficient (Positive)	V <sub>(BR)CES</sub>	600 —	— 870	— —	Vdc mV/°C
Emitter-to-Collector Breakdown Voltage (V <sub>GE</sub> = 0 Vdc, I <sub>EC</sub> = 100 mAdc)	V <sub>(BR)ECS</sub>	15	—	—	Vdc
Zero Gate Voltage Collector Current (V <sub>CE</sub> = 600 Vdc, V <sub>GE</sub> = 0 Vdc) (V <sub>CE</sub> = 600 Vdc, V <sub>GE</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>CES</sub>	— —	— —	10 200	μAdc
Gate-Body Leakage Current (V <sub>GE</sub> = ± 20 Vdc, V <sub>CE</sub> = 0 Vdc)	I <sub>GES</sub>	—	—	50	μAdc

## ON CHARACTERISTICS (1)

Collector-to-Emitter On-State Voltage (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 5.0 Adc) (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 5.0 Adc, T <sub>J</sub> = 125°C) (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 10 Adc, T <sub>J</sub> = 125°C)	V <sub>CE(on)</sub>	— — —	1.4 1.3 1.7	1.7 — 2.0	Vdc
Gate Threshold Voltage (V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1.0 mAdc) Threshold Temperature Coefficient (Negative)	V <sub>GE(th)</sub>	3.0 —	5.0 10	7.0 —	Vdc mV/°C
Forward Transconductance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 10 Adc)	g <sub>fe</sub>	—	7.0	—	Mhos

## DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>CE</sub> = 25 Vdc, V <sub>GE</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>ies</sub>	—	1060	—	pF
Output Capacitance		C <sub>oes</sub>	—	99	—	
Transfer Capacitance		C <sub>res</sub>	—	15	—	

## SWITCHING CHARACTERISTICS (1)

Turn-On Delay Time	(V <sub>CC</sub> = 360 Vdc, I <sub>C</sub> = 10 Adc, V <sub>GE</sub> = 15 Vdc, L = 300 μH, R <sub>G</sub> = 20 Ω, T <sub>J</sub> = 25°C) Energy losses include "tail"	t <sub>d(on)</sub>	—	43	—	ns
Rise Time		t <sub>r</sub>	—	45	—	
Turn-Off Delay Time		t <sub>d(off)</sub>	—	144	—	
Fall Time		t <sub>f</sub>	—	175	—	
Turn-Off Switching Loss		E <sub>off</sub>	—	340	—	
Turn-On Delay Time	(V <sub>CC</sub> = 360 Vdc, I <sub>C</sub> = 10 Adc, V <sub>GE</sub> = 15 Vdc, L = 300 μH, R <sub>G</sub> = 20 Ω, T <sub>J</sub> = 125°C) Energy losses include "tail"	t <sub>d(on)</sub>	—	43	—	ns
Rise Time		t <sub>r</sub>	—	56	—	
Turn-Off Delay Time		t <sub>d(off)</sub>	—	235	—	
Fall Time		t <sub>f</sub>	—	220	—	
Turn-Off Switching Loss		E <sub>off</sub>	—	625	—	
Gate Charge	(V <sub>CC</sub> = 360 Vdc, I <sub>C</sub> = 10 Adc, V <sub>GE</sub> = 15 Vdc)	Q <sub>T</sub>	—	57	—	nC
		Q <sub>1</sub>	—	12	—	
		Q <sub>2</sub>	—	25	—	

## INTERNAL PACKAGE INDUCTANCE

Internal Emitter Inductance (Measured from the emitter lead 0.25" from package to emitter bond pad)	L <sub>E</sub>	—	7.5	—	nH
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(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

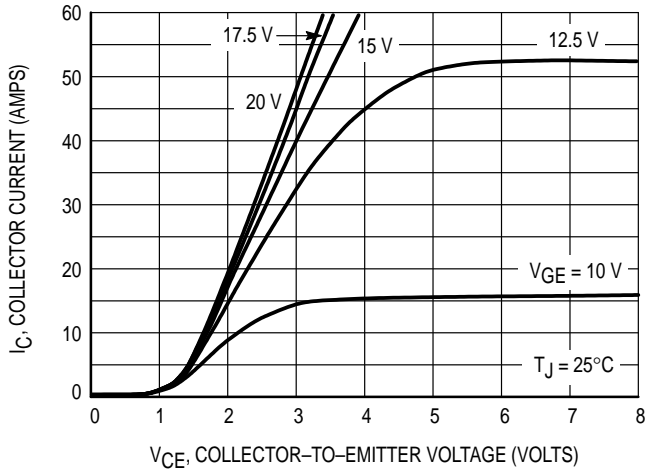


Figure 1. Output Characteristics

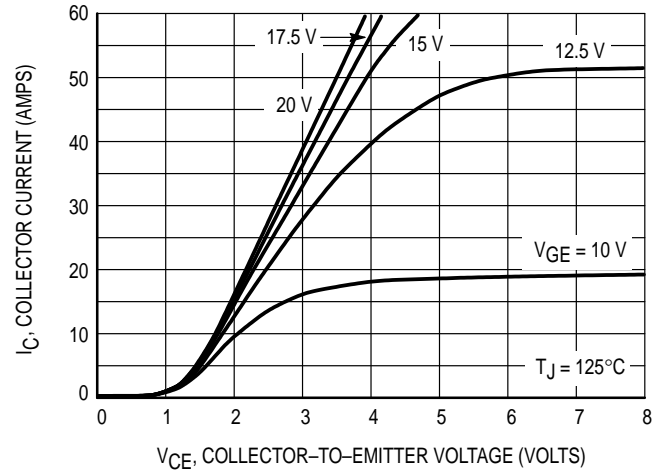


Figure 2. Output Characteristics

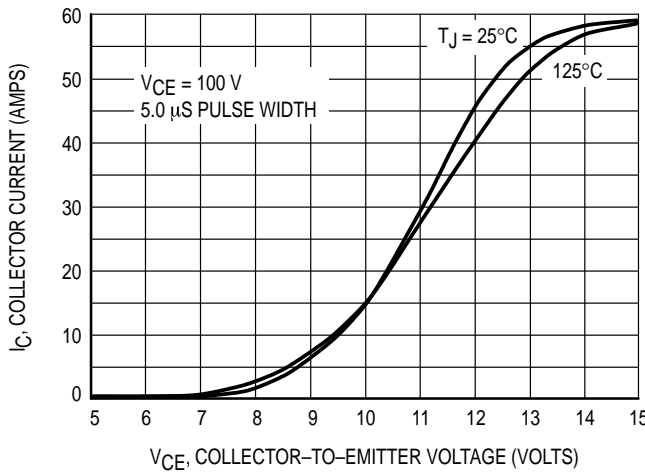


Figure 3. Transfer Characteristics

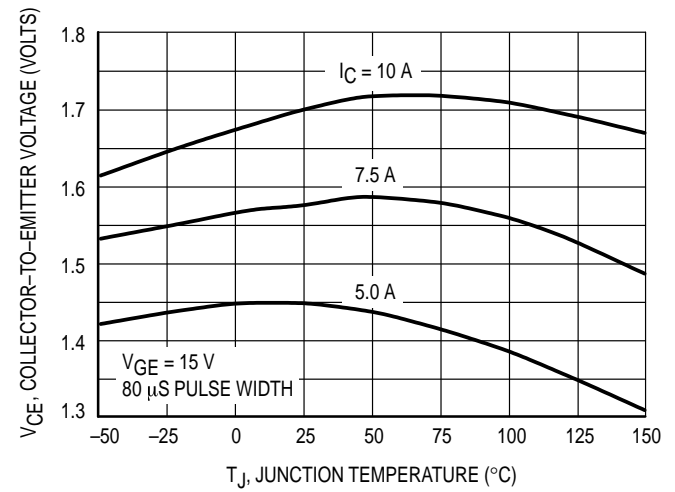


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

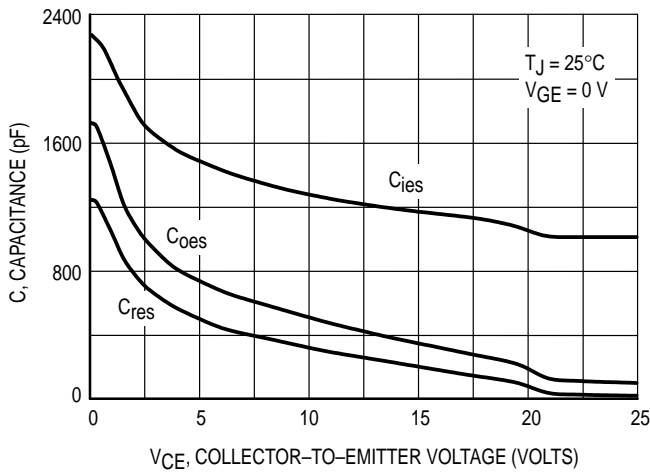


Figure 5. Capacitance Variation

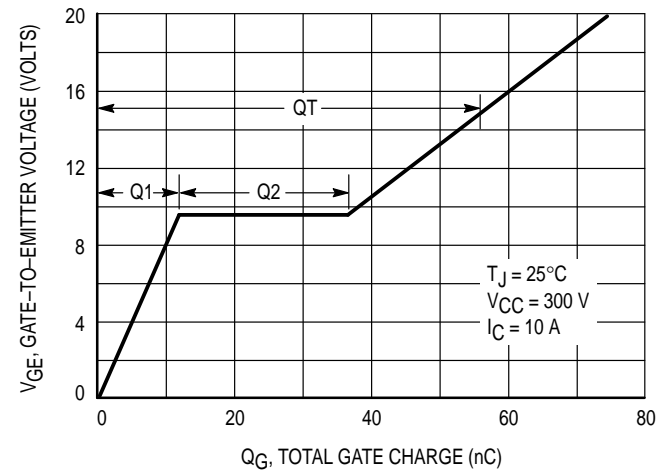
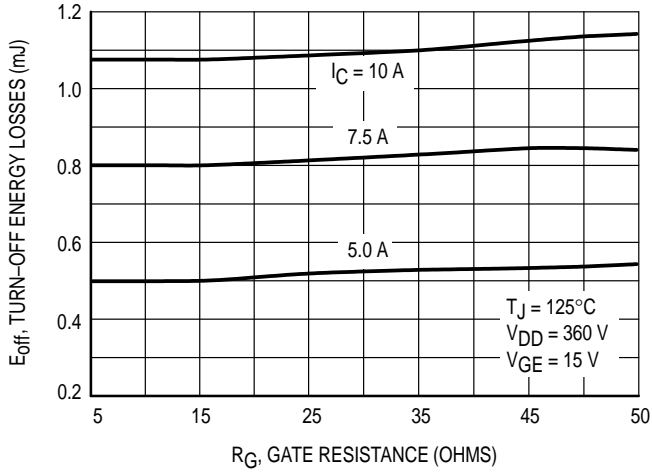
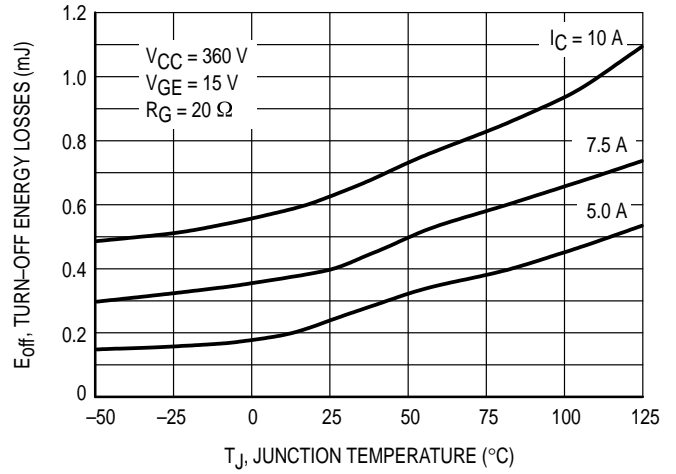


Figure 6. Gate-to-Emitter Voltage versus Total Charge

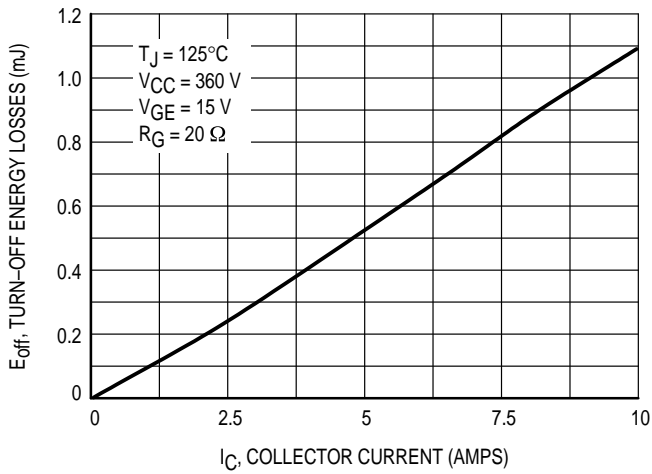
# MGP20N60U



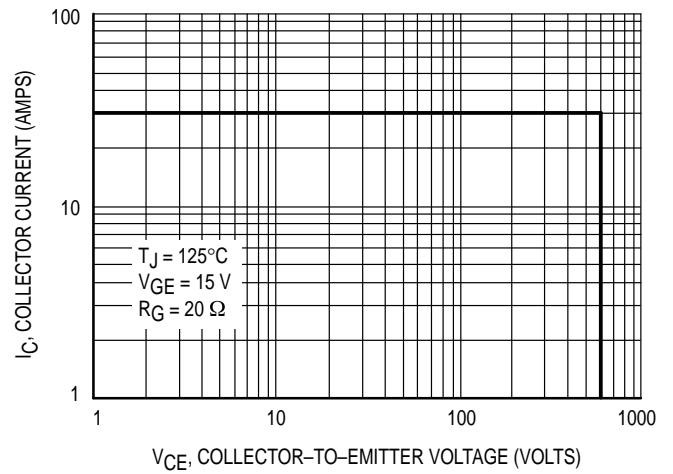
**Figure 7. Turn-Off Losses versus Gate Resistance**



**Figure 8. Turn-Off Losses versus Junction Temperature**

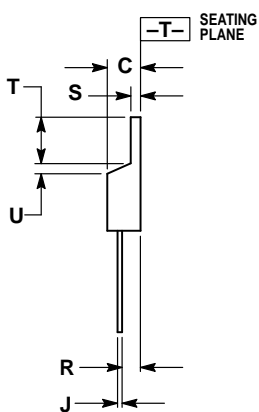
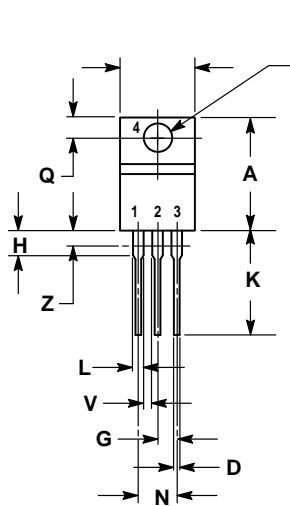


**Figure 9. Turn-Off Losses versus Collector Current**



**Figure 10. Reverse Biased Safe Operating Area**

PACKAGE DIMENSIONS




STYLE 9:  
 PIN 1. GATE  
 2. COLLECTOR  
 3. EMITTER  
 4. COLLECTOR

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

CASE 221A-09  
 ISSUE Z

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