

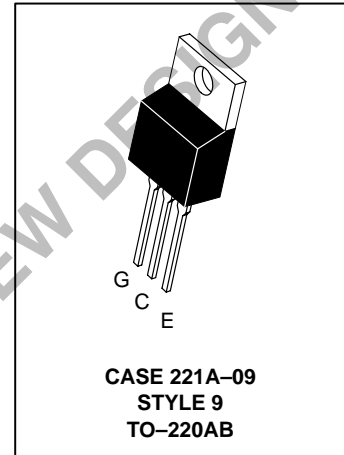
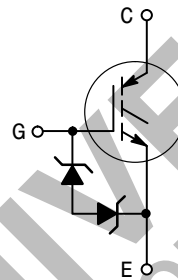
*Designer's™ Data Sheet*  
**Insulated Gate Bipolar Transistor**  
**N-Channel Enhancement-Mode Silicon Gate**

**MGP15N60U**

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

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

- Industry Standard TO-220 Package
- High Speed  $E_{off}$ : 63  $\mu$ J/A typical at 125°C
- Low On-Voltage – 1.7 V typical at 8.0 A, 125°C
- Robust High Voltage Termination
- ESD Protection Gate-Emitter Zener Diodes



**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 @ $T_C = 25^\circ\text{C}$	$I_{C25}$	26	Adc
— Continuous @ $T_C = 90^\circ\text{C}$	$I_{C90}$	15	
— Repetitive Pulsed Current (1)	$I_{CM}$	52	Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	$P_D$	96 0.77	Watts W/°C
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to 150	°C
Thermal Resistance — Junction to Case – IGBT	$R_{\theta JC}$	1.3	°C/W
— Junction to Ambient	$R_{\theta JA}$	65	
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. 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.

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# MGP15N60U

## 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> = 4.0 Adc) (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 4.0 Adc, T <sub>J</sub> = 125°C) (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 8.0 Adc)	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 —	5.5 10	7.0 —	Vdc mV/°C
Forward Transconductance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 8.0 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>	—	806	—	pF
Output Capacitance		C <sub>oes</sub>	—	78	—	
Transfer Capacitance		C <sub>res</sub>	—	13	—	

## SWITCHING CHARACTERISTICS (1)

Turn-On Delay Time	(V <sub>CC</sub> = 360 Vdc, I <sub>C</sub> = 8.0 Adc, V <sub>GE</sub> = 15 Vdc, L = 300 μH, R <sub>G</sub> = 20 Ω) Energy losses include "tail"	t <sub>d(on)</sub>	—	35	—	ns
Rise Time		t <sub>r</sub>	—	34	—	
Turn-Off Delay Time		t <sub>d(off)</sub>	—	105	—	
Fall Time		t <sub>f</sub>	—	200	—	
Turn-Off Switching Loss		E <sub>off</sub>	—	250	—	
Turn-On Delay Time	(V <sub>CC</sub> = 360 Vdc, I <sub>C</sub> = 8.0 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>	—	36	—	ns
Rise Time		t <sub>r</sub>	—	39	—	
Turn-Off Delay Time		t <sub>d(off)</sub>	—	206	—	
Fall Time		t <sub>f</sub>	—	255	—	
Turn-Off Switching Loss		E <sub>off</sub>	—	510	—	
Gate Charge	(V <sub>CC</sub> = 360 Vdc, I <sub>C</sub> = 8.0 Adc, V <sub>GE</sub> = 15 Vdc)	Q <sub>T</sub>	—	39.2	—	nC
		Q <sub>1</sub>	—	8.7	—	
		Q <sub>2</sub>	—	17.4	—	

## 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%.

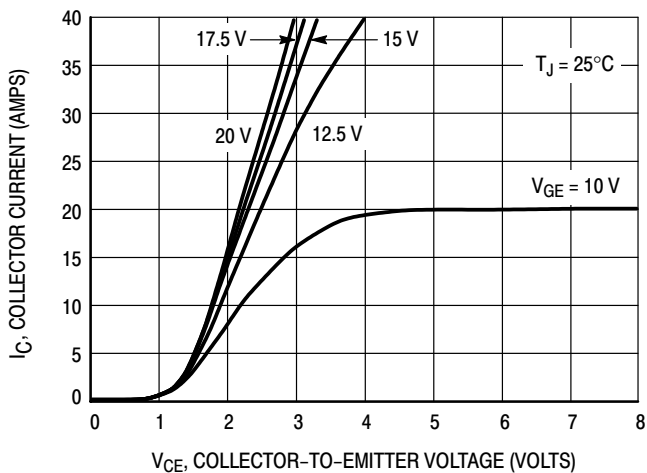


Figure 1. Output Characteristics

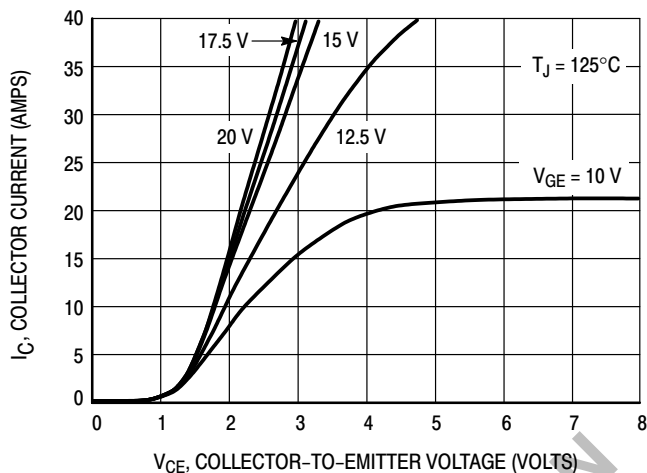


Figure 2. Output Characteristics

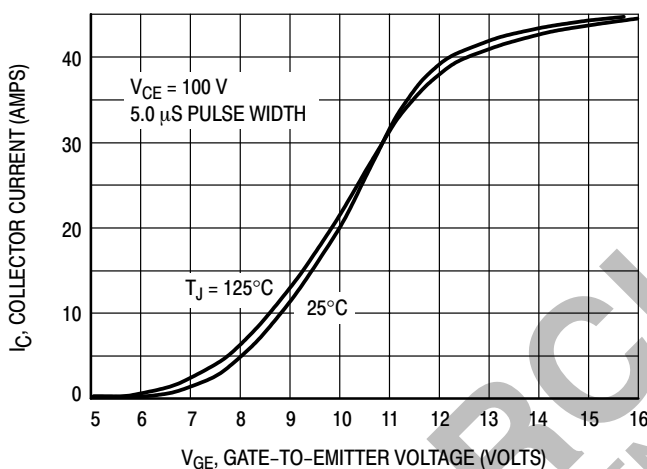


Figure 3. Transfer Characteristics

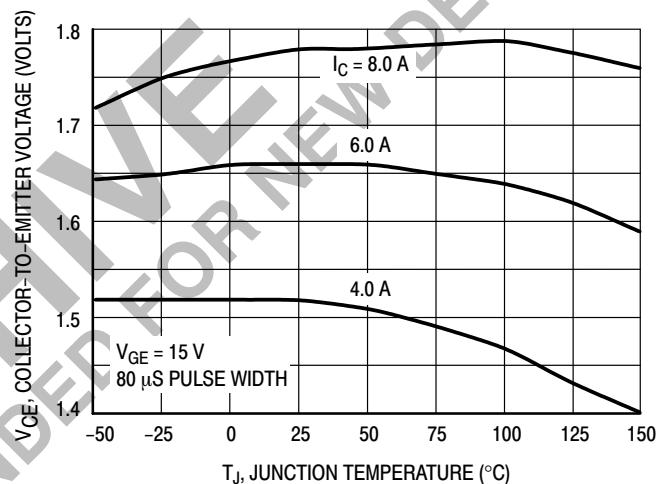


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

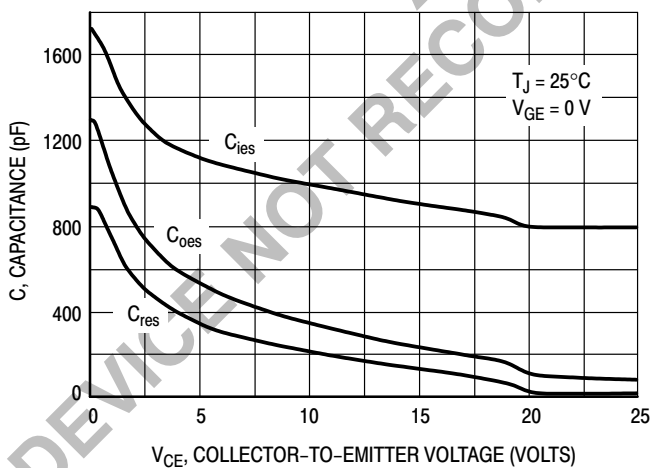


Figure 5. Capacitance Variation

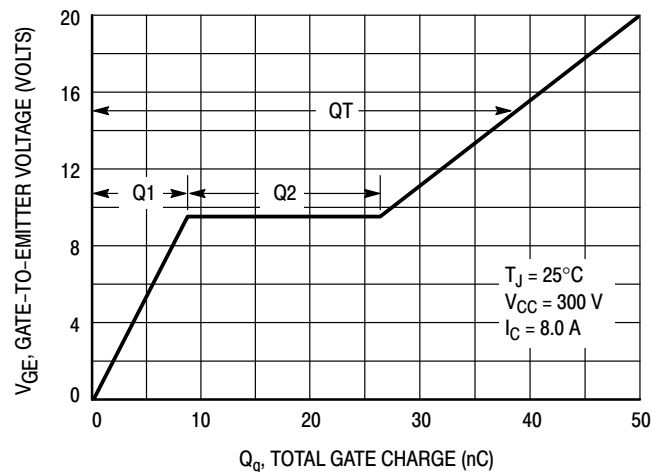


Figure 6. Gate-to-Emitter Voltage versus Total Charge

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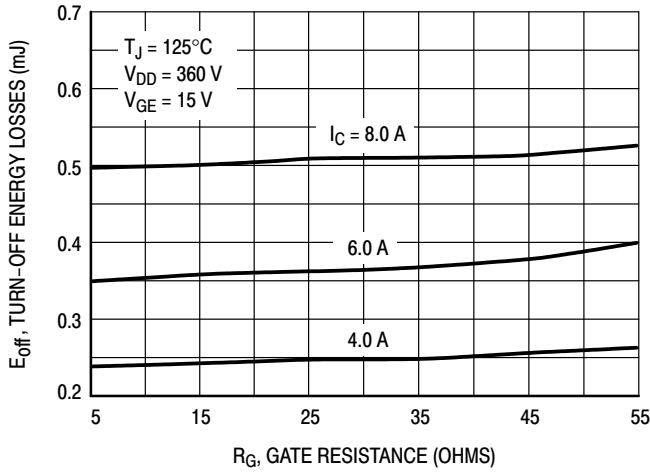


Figure 7. Turn-Off Energy Losses versus Gate Resistance

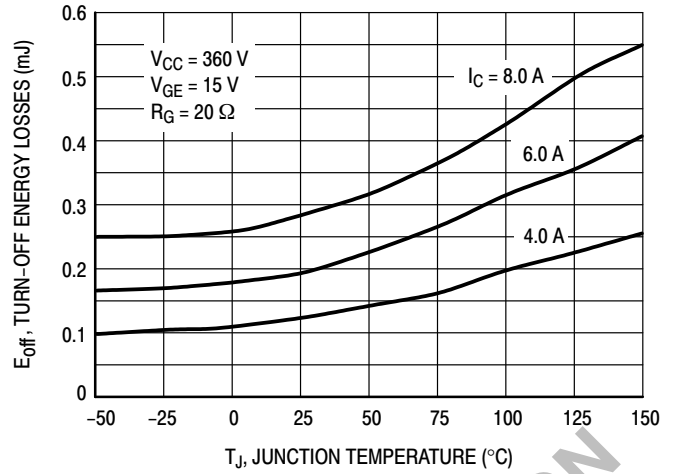


Figure 8. Turn-Off Energy Losses versus Junction Temperature

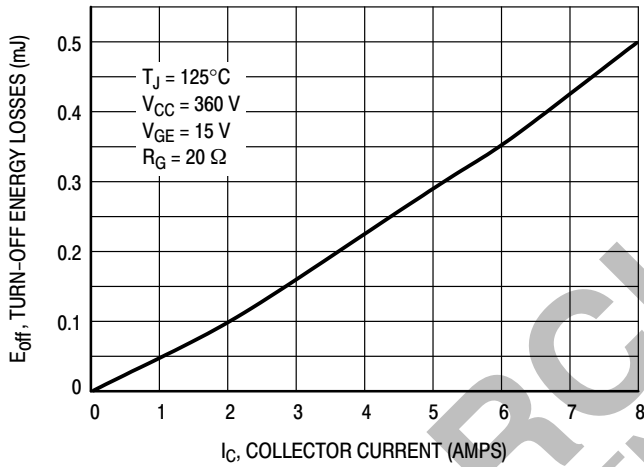


Figure 9. Turn-Off Energy Losses versus Collector Current

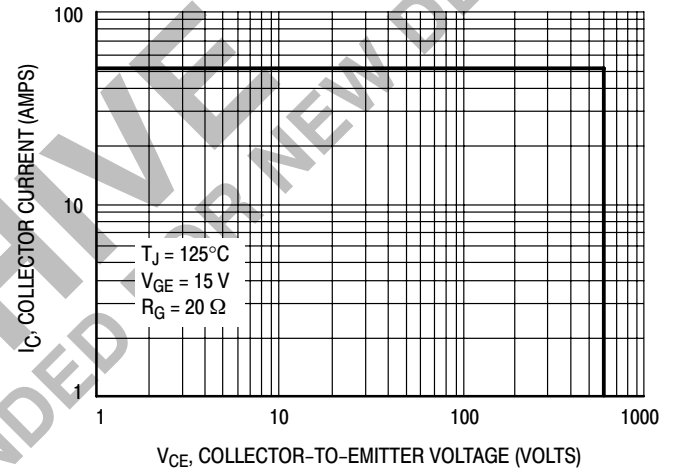
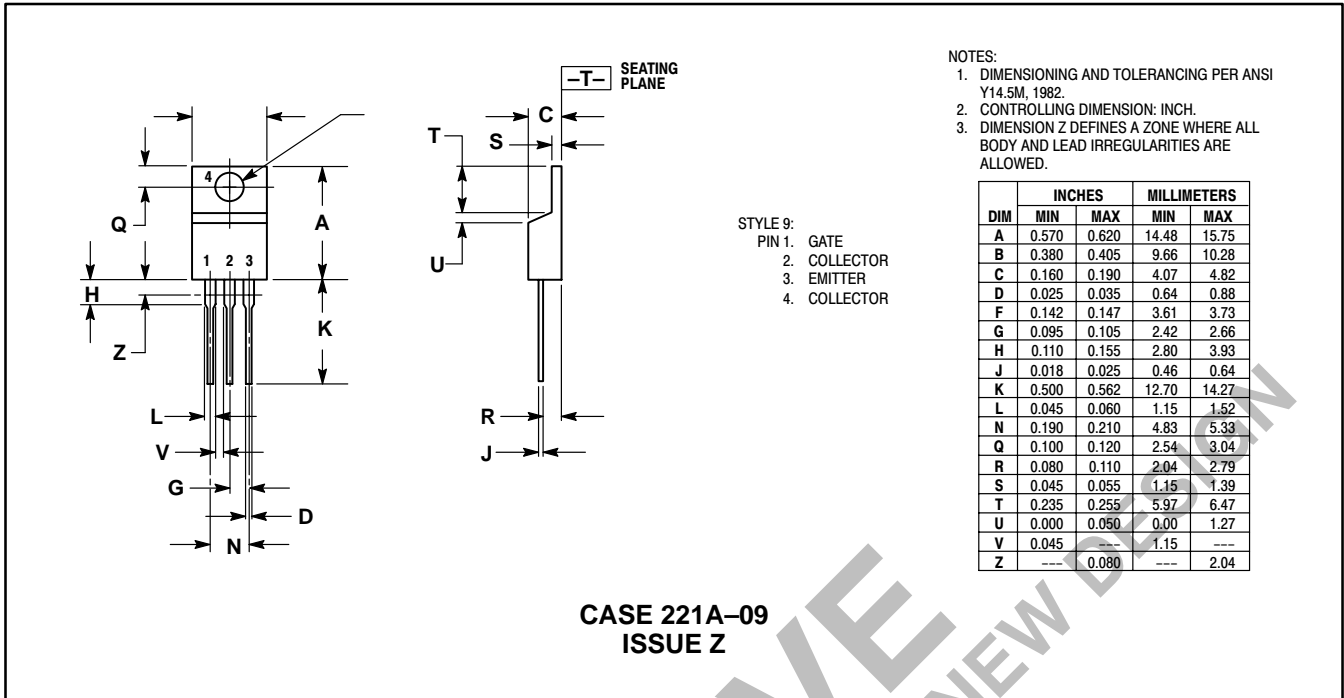



Figure 10. Reverse Biased Safe Operating Area

PACKAGE DIMENSIONS



ARCHIVE  
 DEVICE NOT RECOMMENDED FOR NEW DESIGN

ARCHIVE  
RECOMMENDED FOR NEW DESIGN

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