

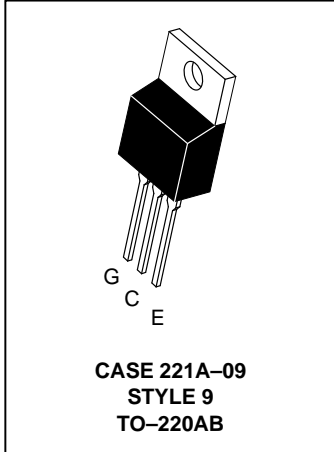
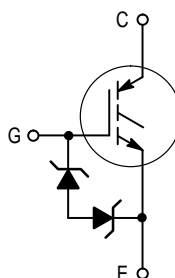
Designer's™ Data Sheet
Insulated Gate Bipolar Transistor
N-Channel Enhancement-Mode Silicon Gate

MGP20N60U

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
20 A @ 90°C
31 A @ 25°C
600 VOLTS
VERY LOW
ON-VOLTAGE

- Industry Standard TO-220 Package
- High Speed E_{off} : 63 μ J/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



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}	± 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 62	Adc Apc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	112 0.89	Watts $W/^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$
Thermal Resistance — Junction to Case – IGBT — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.12 65	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	260	$^\circ\text{C}$
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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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 = 25 μAdc) Temperature Coefficient (Positive)	V _{(BR)CES}	600 —	— 870	— —	Vdc mV/°C
Emitter-to-Collector Breakdown Voltage (V _{GE} = 0 Vdc, I _{EC} = 100 mAdc)	V _{(BR)ECS}	15	—	—	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}	— —	— —	10 200	μAdc
Gate-Body Leakage Current (V _{GE} = ± 20 Vdc, V _{CE} = 0 Vdc)	I _{GES}	—	—	50	μAdc

ON CHARACTERISTICS (1)

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

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{CE} = 25 Vdc, V _{GE} = 0 Vdc, f = 1.0 MHz)	C _{ies}	—	1060	—	pF
Output Capacitance		C _{oes}	—	99	—	
Transfer Capacitance		C _{res}	—	15	—	

SWITCHING CHARACTERISTICS (1)

Turn-On Delay Time	(V _{CC} = 360 Vdc, I _C = 10 Adc, V _{GE} = 15 Vdc, L = 300 μH, R _G = 20 Ω) Energy losses include "tail"	t _{d(on)}	—	43	—	ns
Rise Time		t _r	—	45	—	
Turn-Off Delay Time		t _{d(off)}	—	144	—	
Fall Time		t _f	—	175	—	
Turn-Off Switching Loss		E _{off}	—	340	—	
Turn-On Delay Time	(V _{CC} = 360 Vdc, I _C = 10 Adc, V _{GE} = 15 Vdc, L = 300 μH, R _G = 20 Ω, T _J = 125°C) Energy losses include "tail"	t _{d(on)}	—	43	—	ns
Rise Time		t _r	—	56	—	
Turn-Off Delay Time		t _{d(off)}	—	235	—	
Fall Time		t _f	—	220	—	
Turn-Off Switching Loss		E _{off}	—	625	—	
Gate Charge	(V _{CC} = 360 Vdc, I _C = 10 Adc, V _{GE} = 15 Vdc)	Q _T	—	57	—	nC
		Q ₁	—	12	—	
		Q ₂	—	25	—	

INTERNAL PACKAGE INDUCTANCE

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

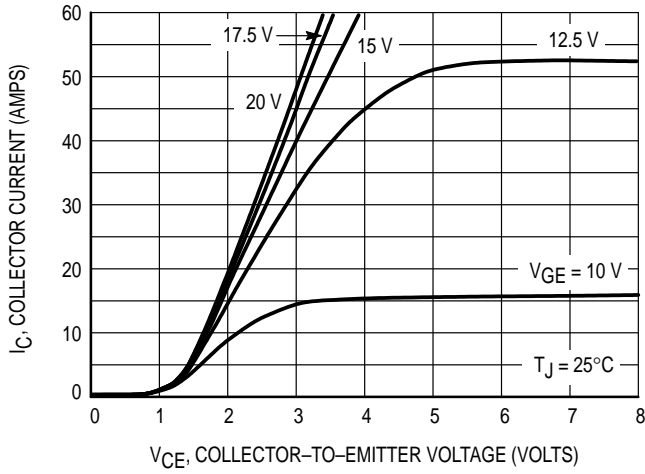


Figure 1. Output Characteristics

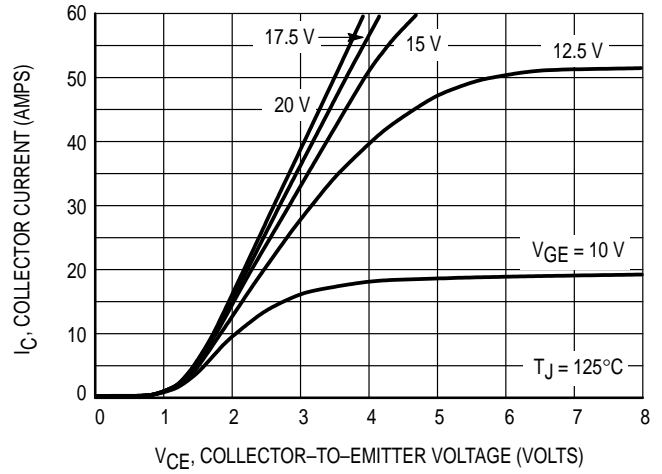


Figure 2. Output Characteristics

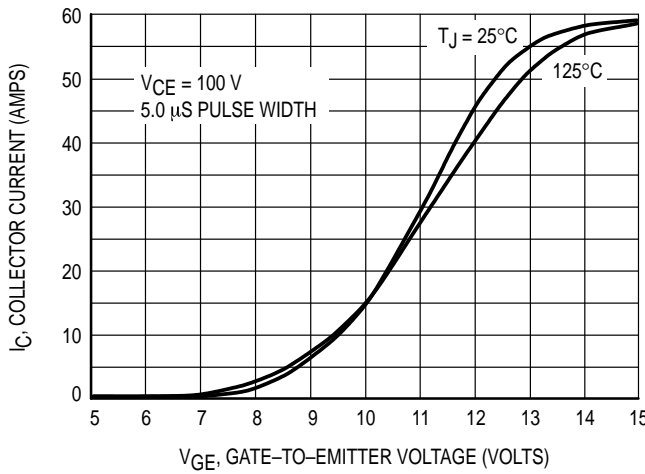


Figure 3. Transfer Characteristics

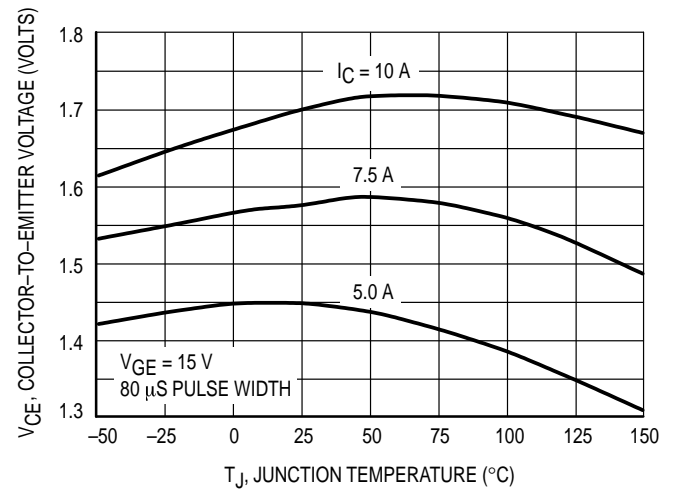


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

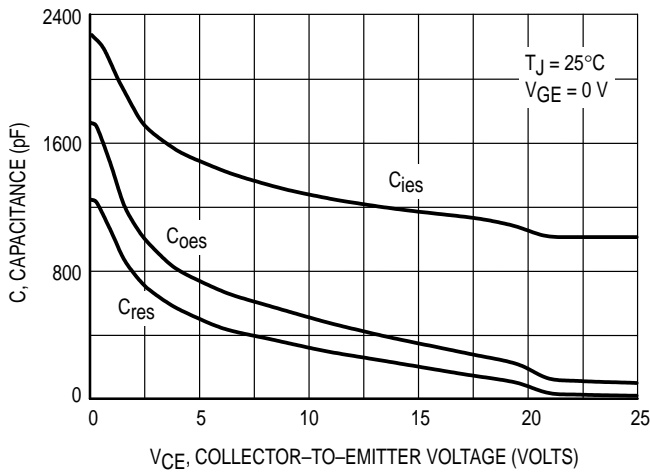


Figure 5. Capacitance Variation

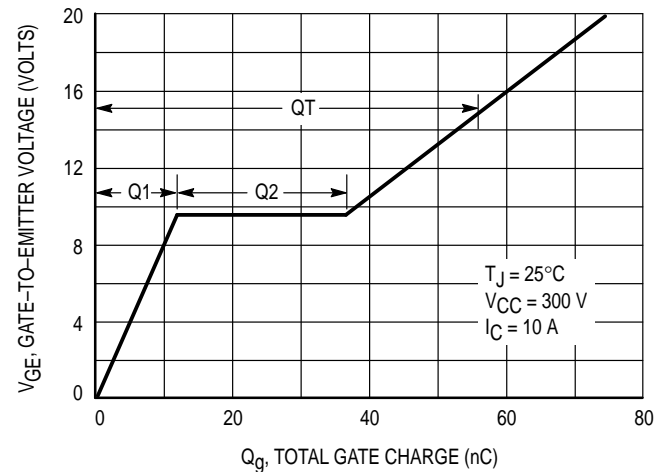


Figure 6. Gate-to-Emitter Voltage versus Total Charge

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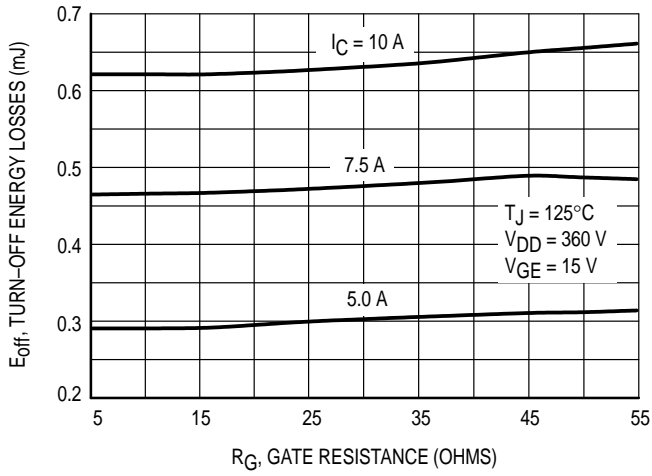


Figure 7. Turn-Off Energy Losses versus Gate Resistance

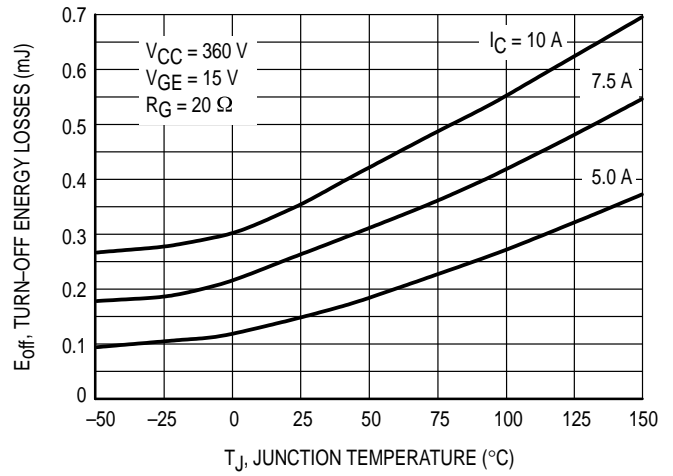


Figure 8. Turn-Off Energy Losses versus Junction Temperature

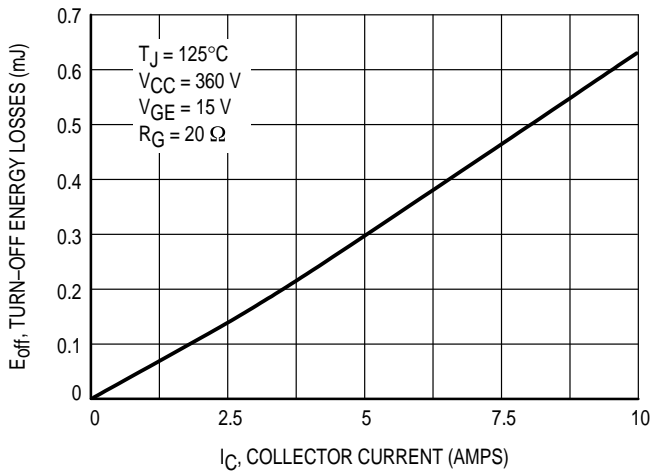


Figure 9. Turn-Off Energy Losses versus Collector Current

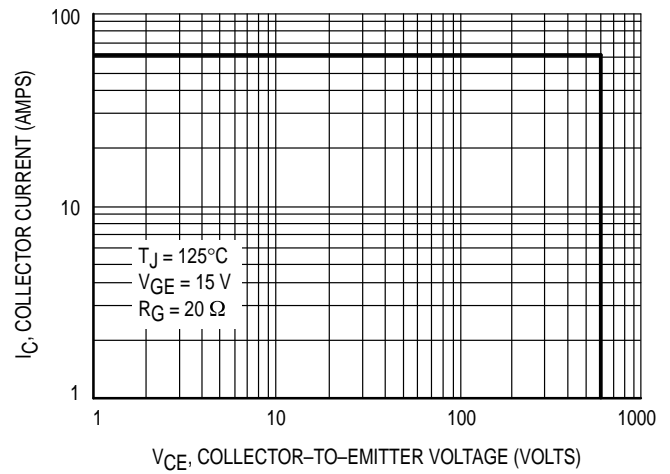
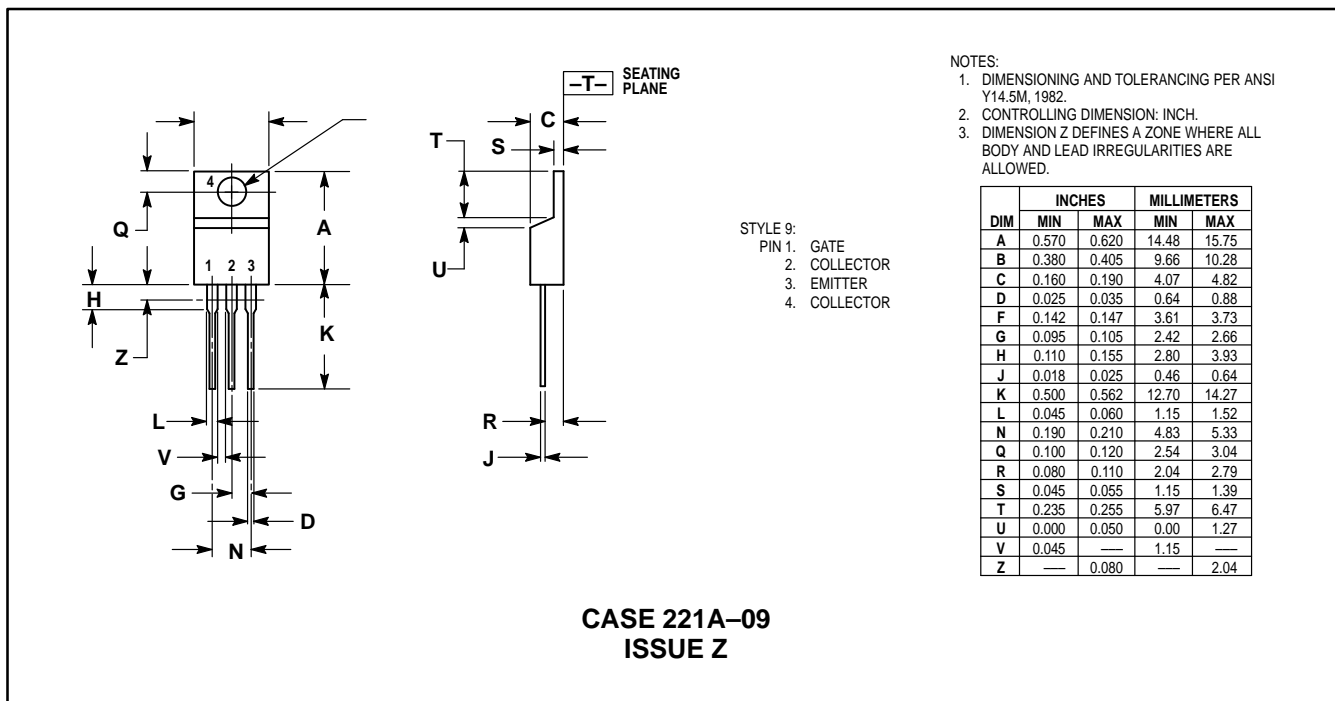


Figure 10. Reverse Biased Safe Operating Area

PACKAGE DIMENSIONS



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