MOTOROLA
SEMICONDUCTOR TECHNICAL DATA

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Product Preview

Insulated Gate Bipolar Transistor

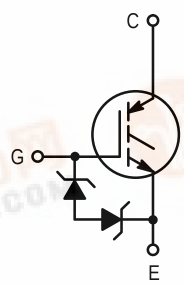
N–Channel Enhancement–Mode Silicon Gate

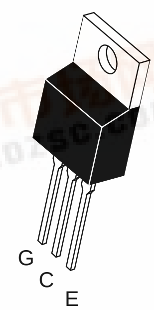
MGP15N60U

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

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 µJ/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





CASE 221A–09, Style 9
TO–220AB

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

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CES}	600	Vdc
Collector–Gate Voltage (R_{GE} = 1.0 MΩ)	V_{CGR}	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}	26 15 30	Adc Apk
Total Power Dissipation @ T_C = 25°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 — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.3 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.

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 = 4.0 Adc) (V_{GE} = 15 Vdc, I_C = 4.0 Adc, T_J = 125°C) (V_{GE} = 15 Vdc, I_C = 8.0 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 —	5.5 10	7.0 —	Vdc mV/°C
Forward Transconductance (V_{CE} = 10 Vdc, I_C = 8.0 Adc)	g_{fe}	—	7.0	—	Mhos

DYNAMIC CHARACTERISTICS

Characteristic		Symbol	Min	Typ	Max	Unit
Input Capacitance	(V_{CE} = 25 Vdc, V_{GE} = 0 Vdc, f = 1.0 MHz)	C_{ies}	—	806	—	pF
Output Capacitance		C_{oes}	—	78	—	
Transfer Capacitance		C_{res}	—	13	—	

SWITCHING CHARACTERISTICS (1)

Characteristic		Symbol	Min	Typ	Max	Unit
Turn–On Delay Time	(V_{CC} = 360 Vdc, I_C = 8.0 Adc, V_{GE} = 15 Vdc, L = 300 μH, R_G = 20 Ω, T_J = 25°C) Energy losses include “tail”	$t_{d(on)}$	—	35	—	ns
Rise Time		t_r	—	34	—	
Turn–Off Delay Time		$t_{d(off)}$	—	105	—	
Fall Time		t_f	—	200	—	
Turn–Off Switching Loss		E_{off}	—	250	—	μJ
Turn–On Delay Time	(V_{CC} = 360 Vdc, I_C = 8.0 Adc, V_{GE} = 15 Vdc, L = 300 μH, R_G = 20 Ω, T_J = 125°C) Energy losses include “tail”	$t_{d(on)}$	—	36	—	ns
Rise Time		t_r	—	39	—	
Turn–Off Delay Time		$t_{d(off)}$	—	206	—	
Fall Time		t_f	—	255	—	
Turn–Off Switching Loss		E_{off}	—	510	—	μJ
Gate Charge	(V_{CC} = 360 Vdc, I_C = 8.0 Adc, V_{GE} = 15 Vdc)	Q_T	—	39.2	—	nC
		Q_1	—	8.7	—	
		Q_2	—	17.4	—	

INTERNAL PACKAGE INDUCTANCE

Characteristic	Symbol	Min	Typ	Max	Unit
Internal Emitter Inductance (Measured from the emitter lead 0.25″ from package to emitter bond pad)	L_E	—	7.5	—	nH

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

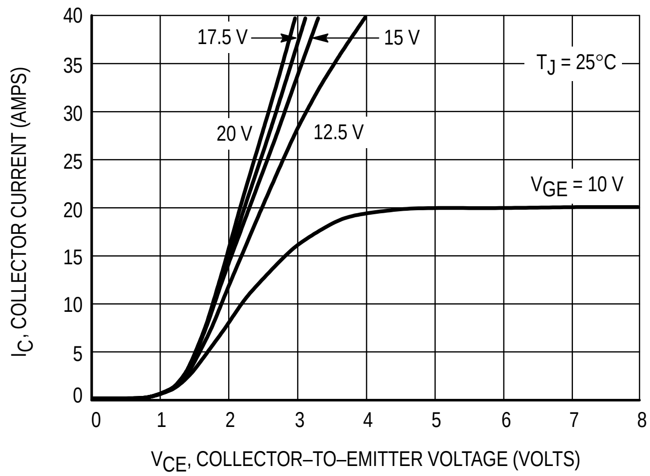


Figure 1. Output Characteristics

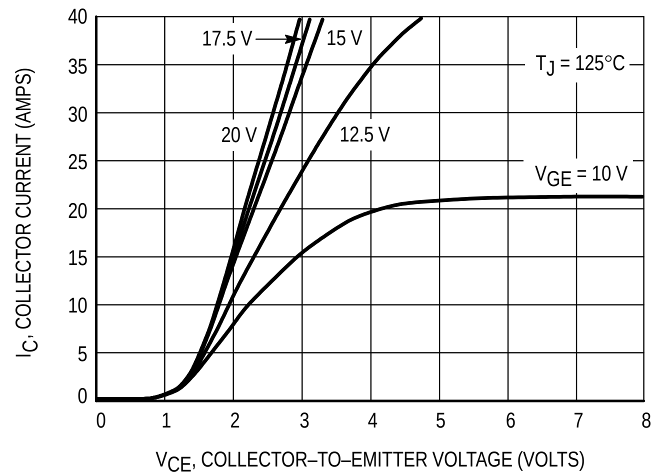


Figure 2. Output Characteristics

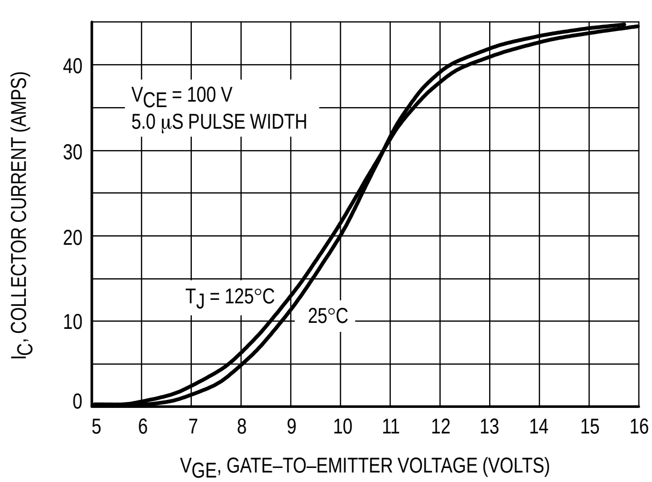


Figure 3. Transfer Characteristics

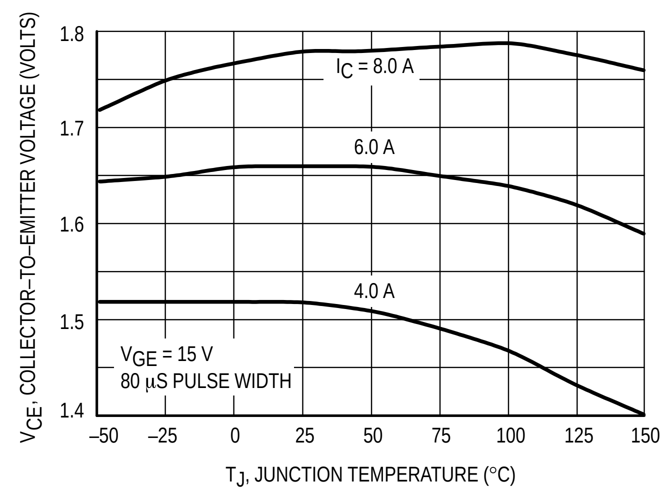


Figure 4. Collector–To–Emitter Saturation Voltage versus Junction Temperature

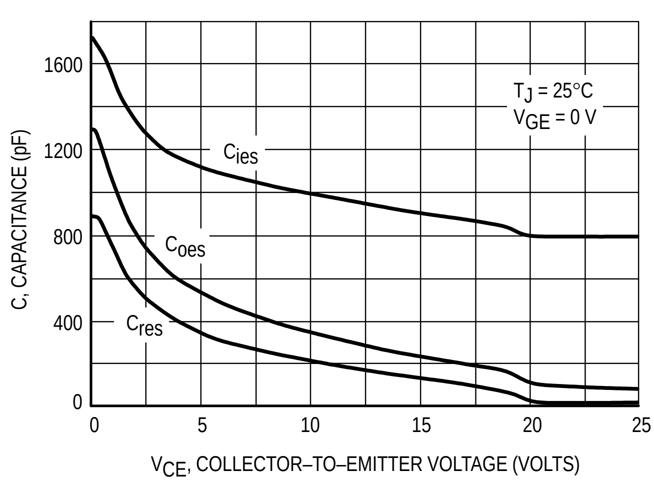


Figure 5. Capacitance Variation

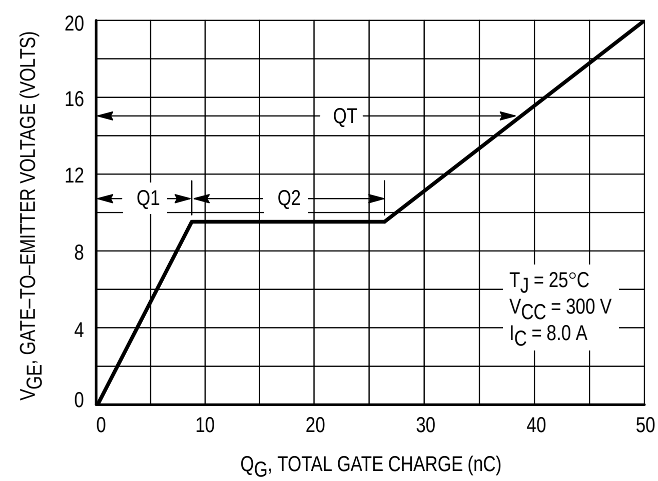


Figure 6. Gate–To–Emitter Voltage versus Total Charge

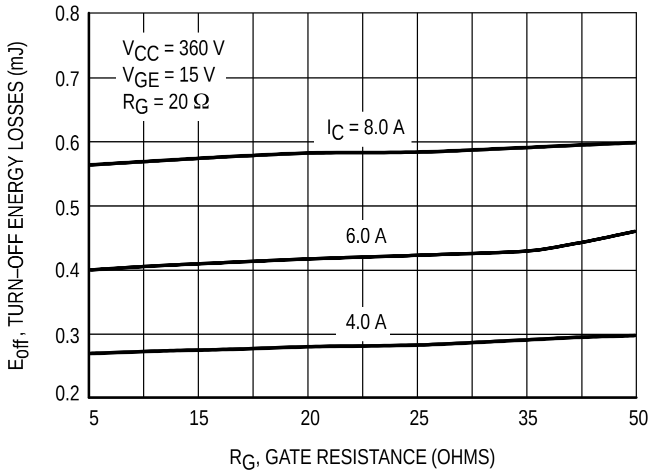


Figure 7. Turn–Off Losses versus Gate Resistance

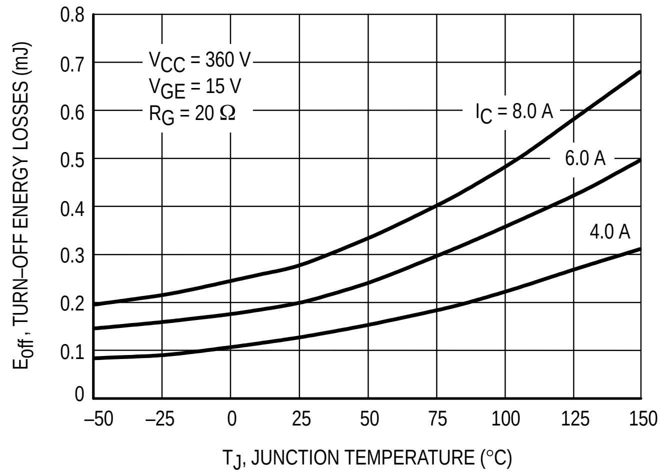


Figure 8. Turn–Off Losses versus Junction Temperature

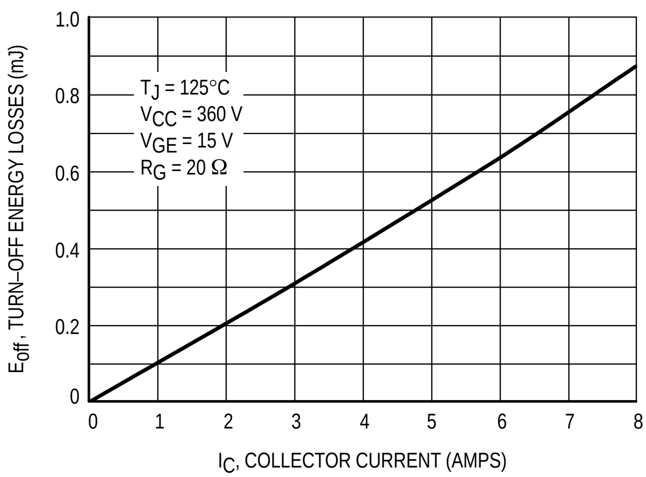


Figure 9. Turn–Off Losses versus Collector Current

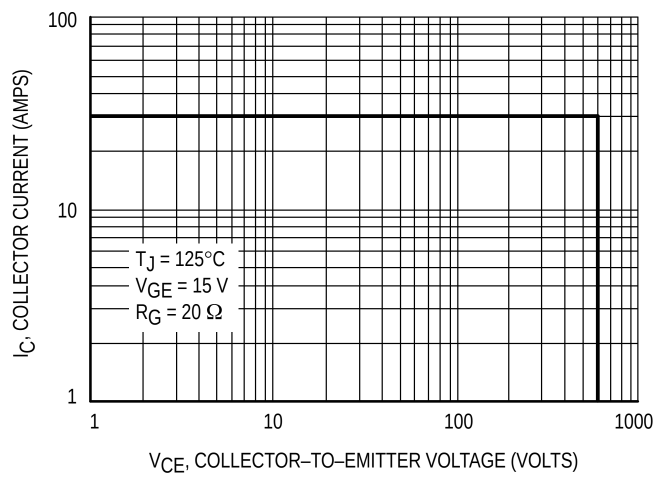
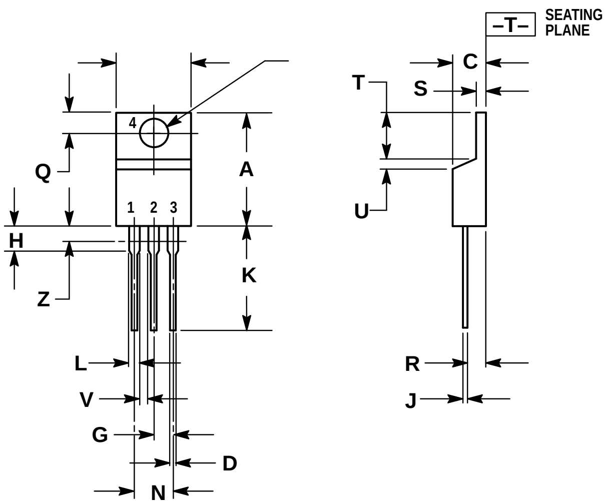


Figure 10. Reverse Biased Safe Operating Area

PACKAGE DIMENSIONS



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 MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

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

CASE 221A–09
ISSUE Z

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