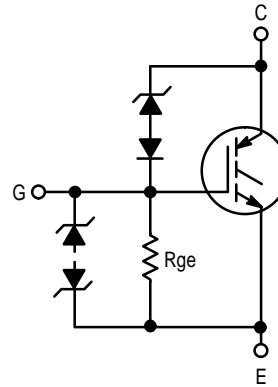


*Advanced Information*  
**SMARTDISCRETES™**  
**Internally Clamped, N-Channel IGBT**

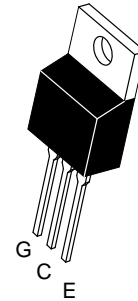
This Logic Level Insulated Gate Bipolar Transistor (IGBT) features Gate–Emitter ESD protection, Gate–Collector overvoltage protection from SMARTDISCRETES™ monolithic circuitry for usage as an **Ignition Coil Driver**.

- Temperature Compensated Gate–Collector Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage to Interface Power Loads to Logic or Microprocessors
- Low Saturation Voltage
- High Pulsed Current Capability



**MGP20N40CL**

**20 AMPERES  
VOLTAGE CLAMPED  
N-CHANNEL IGBT  
V<sub>CE(on)</sub> = 1.8 VOLTS  
400 VOLTS (CLAMPED)**



**CASE 221A-09  
STYLE 9  
TO-220AB**

**MAXIMUM RATINGS** (T<sub>J</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V <sub>CES</sub>	CLAMPED	V <sub>dc</sub>
Collector–Gate Voltage	V <sub>CGR</sub>	CLAMPED	V <sub>dc</sub>
Gate–Emitter Voltage	V <sub>GE</sub>	CLAMPED	V <sub>dc</sub>
Collector Current — Continuous @ T <sub>C</sub> = 25°C	I <sub>C</sub>	20	A <sub>dc</sub>
Reversed Collector Current – pulse width < 100 μs	I <sub>CR</sub>	12	A <sub>pk</sub>
Total Power Dissipation @ T <sub>C</sub> = 25°C (TO-220)	P <sub>D</sub>	150	Watts
Electrostatic Voltage — Gate–Emitter	ESD	3.5	kV
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	–55 to 175	°C

**THERMAL CHARACTERISTICS**

Thermal Resistance — Junction to Case – (TO-220) — Junction to Ambient	R <sub>θJC</sub> R <sub>θJA</sub>	1.0 62.5	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T <sub>L</sub>	260	°C
Mounting Torque, 6–32 or M3 screw	10 lbf•in (1.13 N•m)		

**UNCLAMPED INDUCTIVE SWITCHING CHARACTERISTICS**

Single Pulse Collector–Emitter Avalanche Energy @ Starting T <sub>J</sub> = 25°C @ Starting T <sub>J</sub> = 150°C	E <sub>AS</sub>	550 150	mJ
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SMARTDISCRETES is a trademark of Motorola, Inc.

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

# MGP20N40CL

## 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 (I <sub>Clamp</sub> = 10 mA, T <sub>J</sub> = -40 to 150°C)	V <sub>(BR)CES</sub>	370	405	430	V <sub>dc</sub>
Zero Gate Voltage Collector Current (V <sub>CE</sub> = 350 V, V <sub>GE</sub> = 0 V, T <sub>J</sub> = 150°C) (V <sub>CE</sub> = 15 V, V <sub>GE</sub> = 0 V, T <sub>J</sub> = 150°C)	I <sub>CES</sub>	— —	— —	500 100	μA
Resistance Gate-Emitter (T <sub>J</sub> = -40 to 150°C)	R <sub>GE</sub>	10k	16k	30k	Ω
Gate-Emitter Breakdown Voltage (I <sub>G</sub> = 2 mA)	V <sub>(BR)GES</sub>	11	13	15	± V
Collector-Emitter Reverse Leakage (V <sub>CE</sub> = -15 V, T <sub>J</sub> = 150°C)	I <sub>ECS</sub>	—	—	50	mA
Collector-Emitter Reversed Breakdown Voltage (I <sub>E</sub> = 75 mA)	V <sub>(BR)ECS</sub>	26	40	120	V

## ON CHARACTERISTICS (1)

Gate Threshold Voltage (V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1 mA) (V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1 mA, T <sub>J</sub> = 150°C)	V <sub>GE(th)</sub>	1.0 0.75	1.7 —	2.2 1.8	V
Collector-Emitter On-Voltage (V <sub>GE</sub> = 5 V, I <sub>C</sub> = 5 A) (V <sub>GE</sub> = 5 V, I <sub>C</sub> = 10 A) (V <sub>GE</sub> = 5 V, I <sub>C</sub> = 10 A <sub>dc</sub> , T <sub>J</sub> = 150°C)	V <sub>CE(on)</sub>	— — —	1.1 1.4 1.4	1.4 1.9 1.8	V
Forward Transconductance (V <sub>CE</sub> > 5.0 V, I <sub>C</sub> = 10 A)	g <sub>fe</sub>	10	18	—	S

## DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>CE</sub> = 25 V <sub>dc</sub> , V <sub>GE</sub> = 0 V <sub>dc</sub> , f = 1.0 MHz)	C <sub>ies</sub>	—	2800	—	pF
Output Capacitance		C <sub>oes</sub>	—	200	—	
Transfer Capacitance		C <sub>res</sub>	—	25	—	

## SWITCHING CHARACTERISTICS (1)

Total Gate Charge	(V <sub>CC</sub> = 280 V, I <sub>C</sub> = 20 A, V <sub>GE</sub> = 5 V)	Q <sub>g</sub>	—	45	80	nC
Gate-Emitter Charge		Q <sub>ge</sub>	—	8.0	—	
Gate-Collector Charge		Q <sub>gc</sub>	—	20	—	
Turn-Off Delay Time	(V <sub>CC</sub> = 320 V, I <sub>C</sub> = 20 A, L = 200 μH, R <sub>G</sub> = 1 KΩ)	t <sub>d(off)</sub>	—	14	—	μs
Fall Time		t <sub>f</sub>	—	4.0	—	
Turn-On Delay Time	(V <sub>CC</sub> = 14 V, I <sub>C</sub> = 20 A, L = 200 μH, R <sub>G</sub> = 1 KΩ)	t <sub>d(on)</sub>	—	2.0	—	μs
Rise Time		t <sub>r</sub>	—	6.0	—	

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

TYPICAL ELECTRICAL CHARACTERISTICS

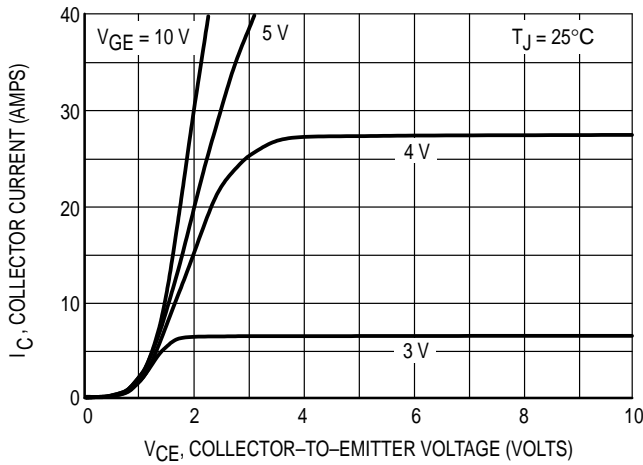


Figure 1. Output Characteristics

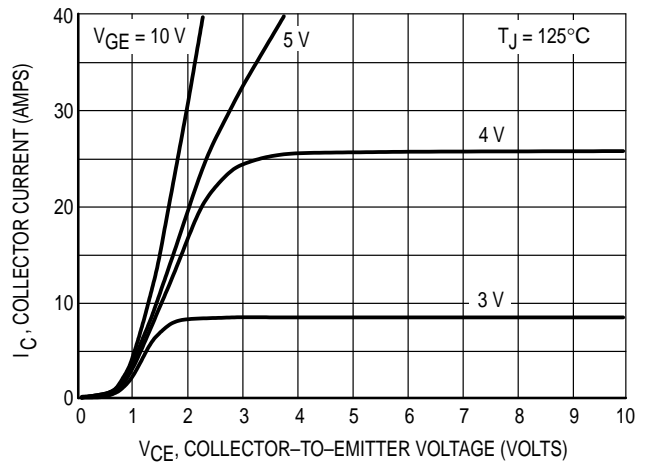


Figure 2. Output Characteristics

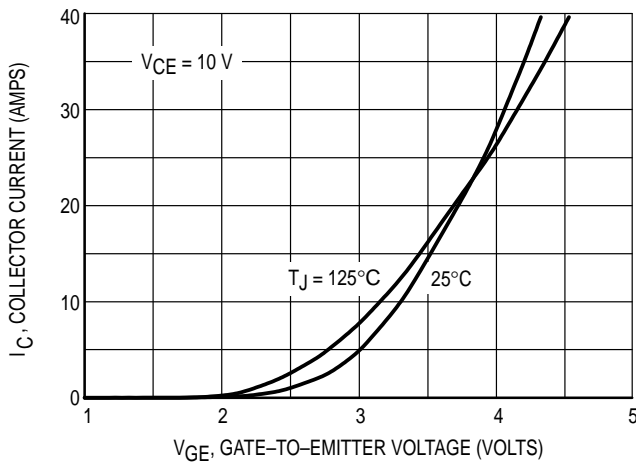


Figure 3. Transfer Characteristics

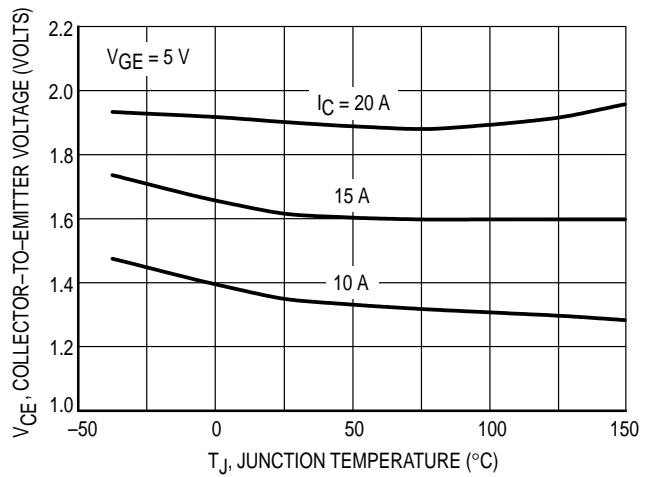


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

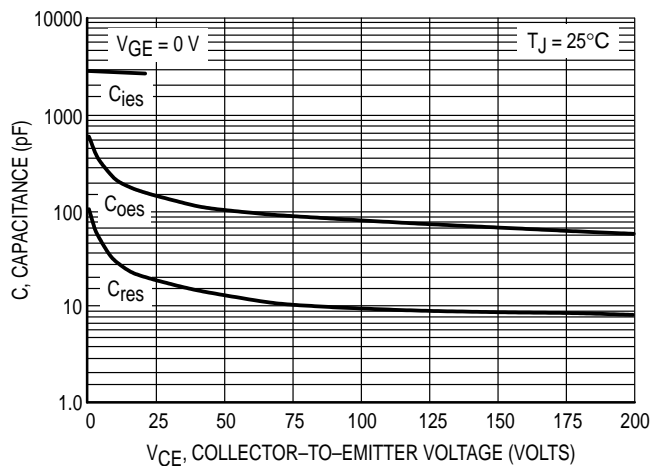
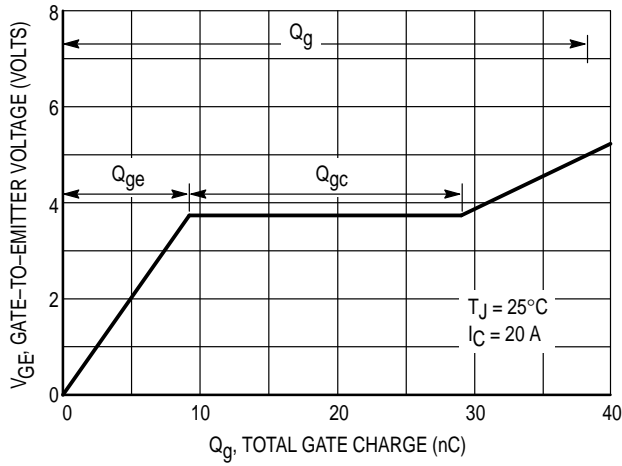
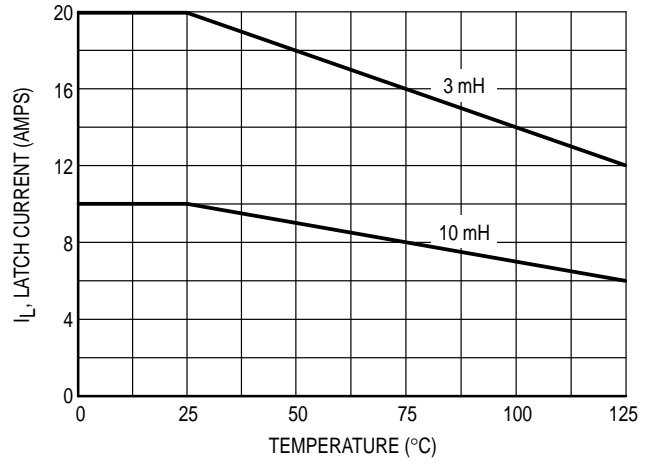


Figure 5. Capacitance Variation

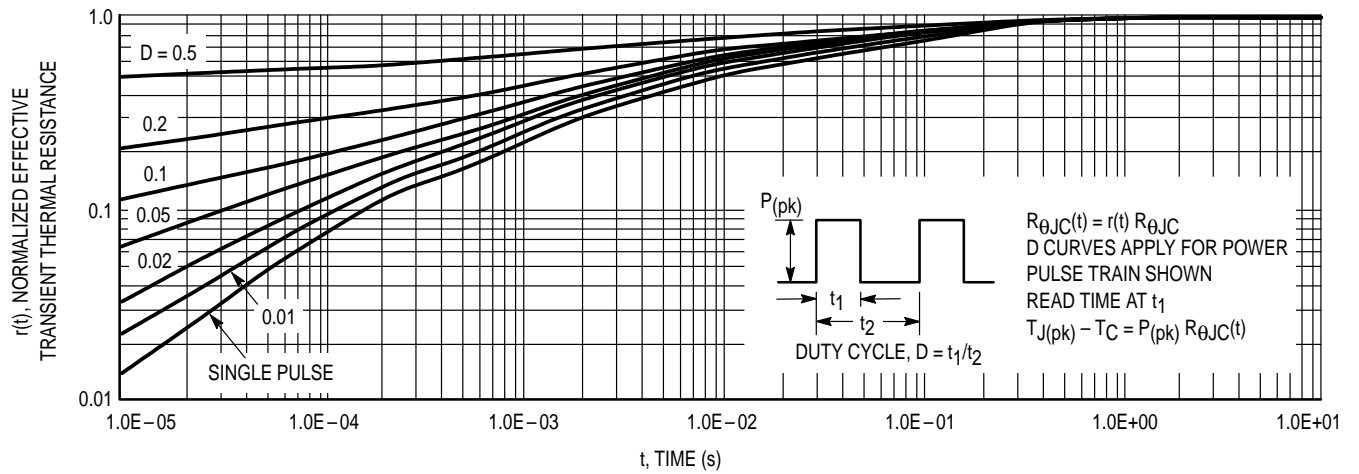
# MGP20N40CL



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

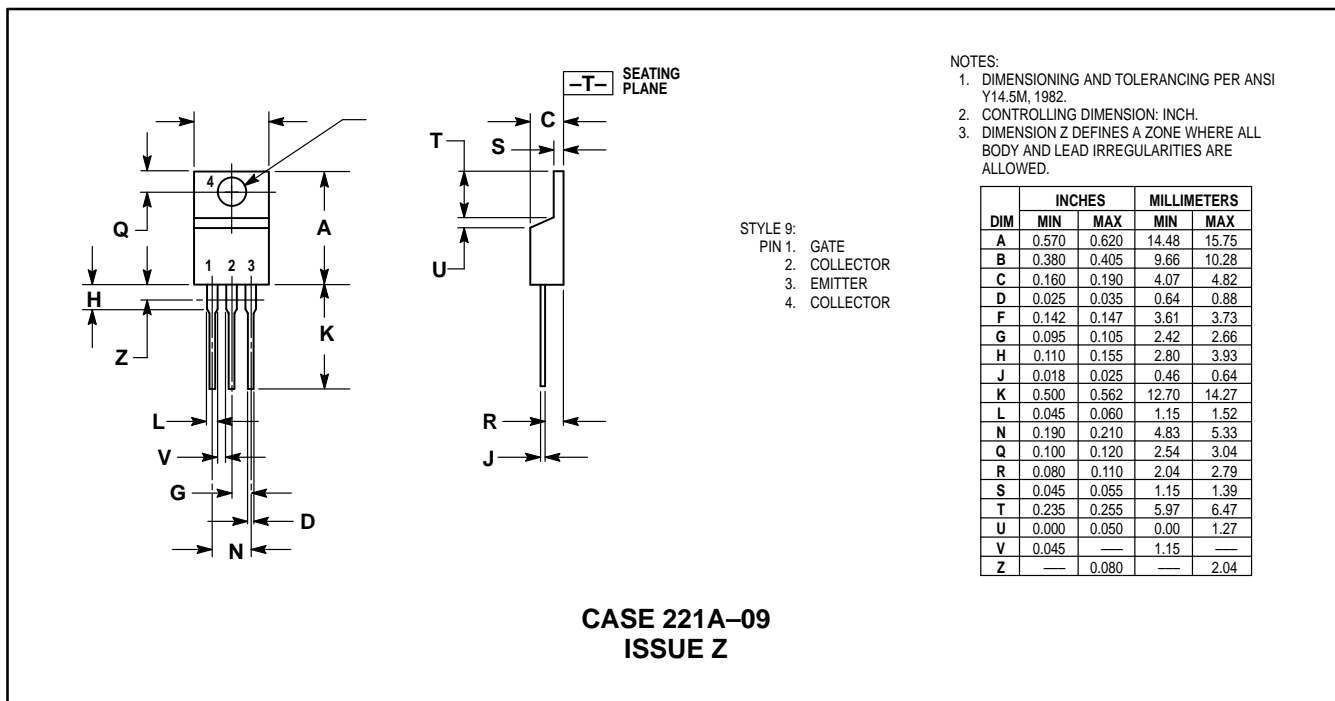


**Figure 7. Latch Current versus Temperature**



**Figure 8. Thermal Response**

PACKAGE DIMENSIONS



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