

Advanced Information

SMARTDISCRETES™

Internally Clamped, N-Channel IGBT

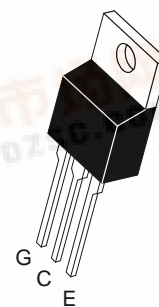
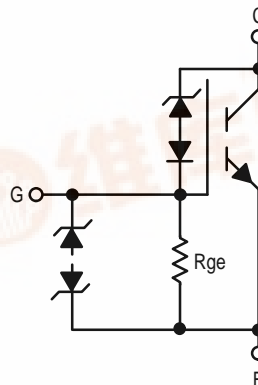
MGP20N35CL

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–Drain 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



**20 AMPERES
VOLTAGE CLAMPED
N–CHANNEL IGBT
V_{ce(on)} = 1.8 VOLTS
350 VOLTS (CLAMPED)**



CASE 221A–06, Style 9
TO–220AB

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

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

THERMAL CHARACTERISTICS

Thermal Resistance — Junction to Case – (TO–220) — Junction to Ambient	R _{θJC} R _{θJA}	1.0 62.5	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T _L	275	°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 _J = 25°C @ Starting T _J = 150°C	E _{AS}	550 150	mJ
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This document contains information on a new product. Specifications and information herein are subject to change without notice.

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ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-to-Emitter Breakdown Voltage ($I_{\text{Clamp}} = 10\text{ mA}$, $T_J = -40$ to 150°C)	BV_{CES}	320	350	380	Vdc
Zero Gate Voltage Collector Current ($V_{\text{CE}} = 250\text{ V}$, $V_{\text{GE}} = 0\text{ V}$, $T_J = 125^\circ\text{C}$) ($V_{\text{CE}} = 15\text{ V}$, $V_{\text{GE}} = 0\text{ V}$, $T_J = 125^\circ\text{C}$)	I_{CES}	— —	— —	1.0 200	mA μA
Resistance Gate-Emitter ($T_J = -40$ to 150°C)	R_{GE}	10k	16k	30k	Ω
Gate-Emitter Breakdown Voltage ($I_G = 2\text{ mA}$)	BV_{GES}	11	13	15	$\pm\text{ V}$
Collector-Emitter Reverse Leakage ($V_{\text{CE}} = -15\text{ V}$, $T_J = -40$ to 150°C)	I_{CES}	—	8	100	mA
Collector-Emitter Reversed Breakdown Voltage ($I_E = 75\text{ mA}$)	BV_{CER}	26	40	120	V

ON CHARACTERISTICS (1)

Gate Threshold Voltage ($V_{\text{CE}} = V_{\text{GE}}$, $I_C = 1\text{ mA}$) ($V_{\text{CE}} = V_{\text{GE}}$, $I_C = 1\text{ mA}$, $T_J = 150^\circ\text{C}$)	$V_{\text{GE(th)}}$	1.0 0.75	1.7 —	2.4 1.8	V
Collector-Emitter On-Voltage ($V_{\text{GE}} = 5\text{ V}$, $I_C = 5\text{ A}$) ($V_{\text{GE}} = 5\text{ V}$, $I_C = 10\text{ A}$) ($V_{\text{GE}} = 5\text{ V}$, $I_C = 10\text{ A dc}$, $T_J = 150^\circ\text{C}$)	$V_{\text{CE(on)}}$	— — —	1.1 1.4 1.4	1.4 1.9 1.8	V
Forward Transconductance ($V_{\text{CE}} > 50\text{ V}$, $I_C = 10\text{ A}$)	g_{fs}	10	16	—	S

DYNAMIC CHARACTERISTICS

Input Capacitance	$(V_{\text{CE}} = 25\text{ Vdc}$, $V_{\text{GE}} = 0\text{ Vdc}$, $f = 1.0\text{ MHz}$)	C_{iss}	—	2800	—	pF
Output Capacitance		C_{oss}	—	200	—	
Transfer Capacitance		C_{rss}	—	25	—	

SWITCHING CHARACTERISTICS (1)

Total Gate Charge	$(V_{\text{CC}} = 280\text{ V}$, $I_C = 20\text{ A}$, $V_{\text{GE}} = 5\text{ V}$)	Q_g	—	45	80	nC
Gate-Emitter Charge		Q_{gs}	—	8.0	—	
Gate-Collector Charge		Q_{gd}	—	20	—	
Turn-Off Delay Time	$(V_{\text{CC}} = 320\text{ V}$, $I_C = 20\text{ A}$, $L = 200\text{ }\mu\text{H}$, $R_G = 1\text{ K}\Omega$)	$t_{\text{d(off)}}$	—	TBD	TBD	μs
Fall Time		t_f	—	TBD	TBD	
Turn-On Delay Time	$(V_{\text{CC}} = 14\text{ V}$, $I_C = 20\text{ A}$, $L = 200\text{ }\mu\text{H}$, $R_G = 1\text{ K}\Omega$)	$t_{\text{d(on)}}$	—	TBD	TBD	μs
Rise Time		t_r	—	TBD	TBD	

(1) Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.

TYPICAL ELECTRICAL CHARACTERISTICS

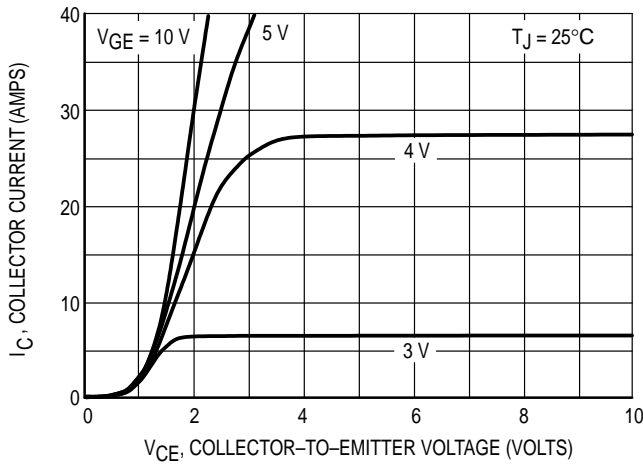


Figure 1. Output Characteristics, $T_J = 25^\circ\text{C}$

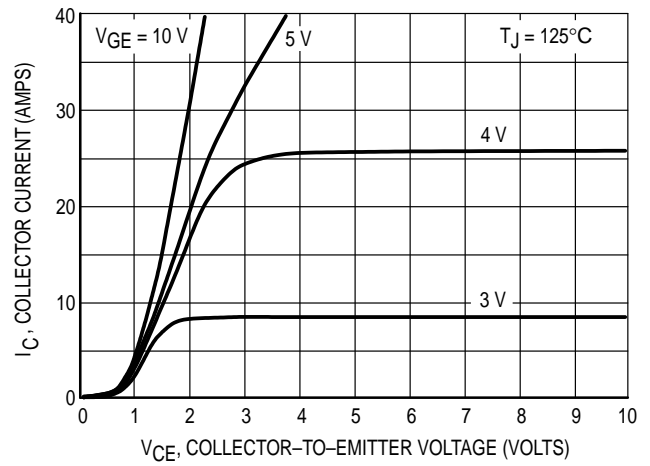


Figure 2. Output Characteristics, $T_J = 125^\circ\text{C}$

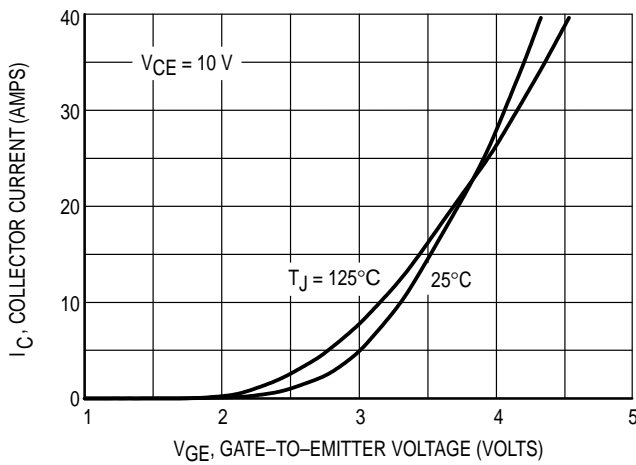


Figure 3. Transfer Characteristics

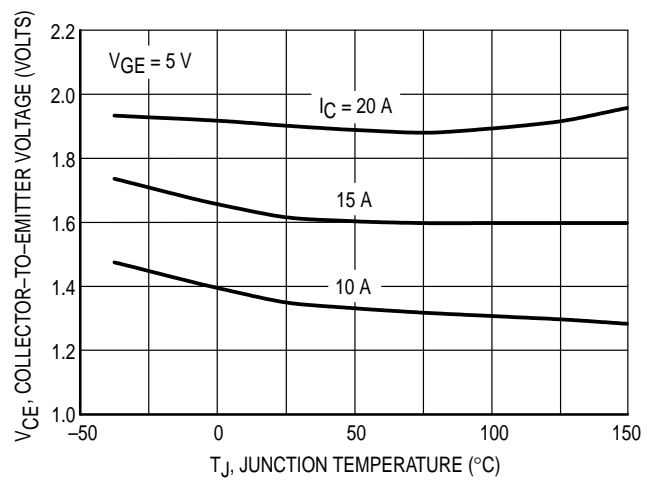


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

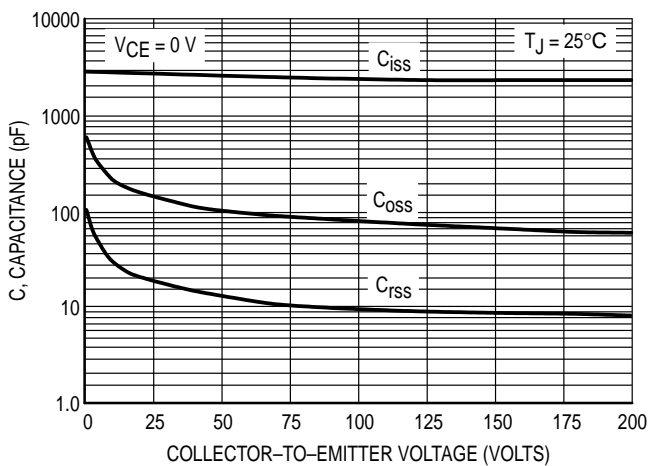


Figure 5. Capacitance Variation

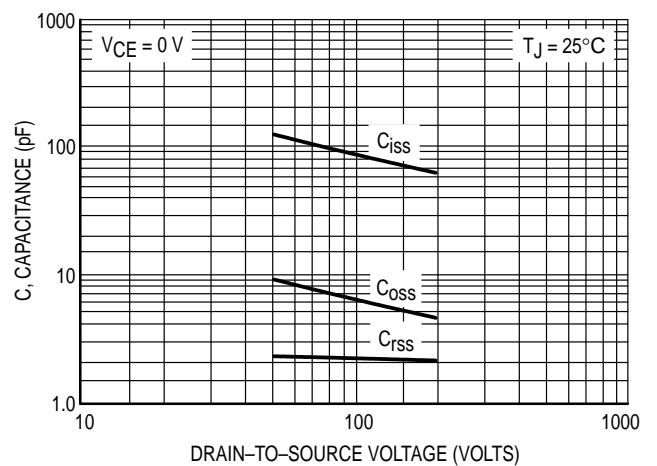


Figure 6. High Voltage Capacitance Variation

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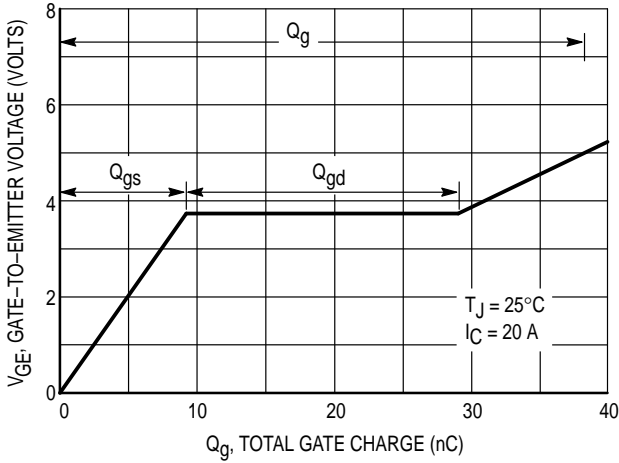


Figure 7. Gate-to-Emitter and Collector-to-Emitter Voltage vs Total Charge

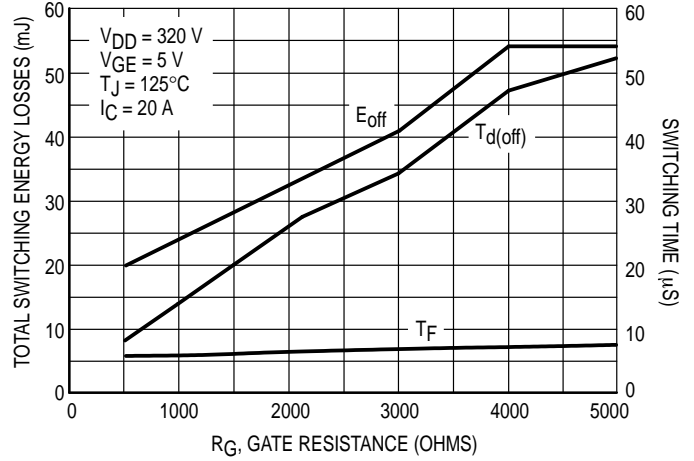


Figure 8. Total Switching Losses versus Gate Resistance

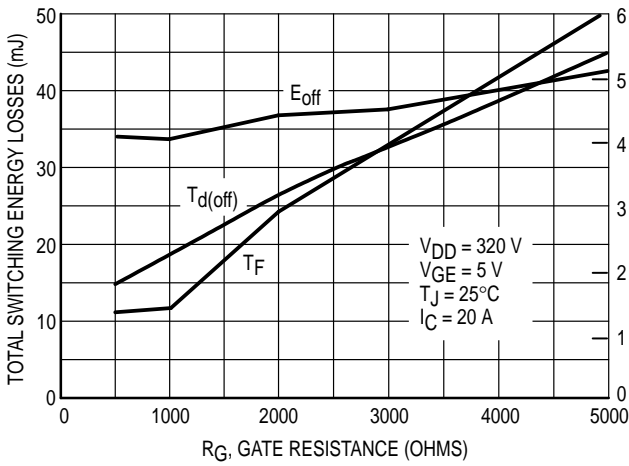


Figure 9. Total Switching Losses versus Gate Resistance

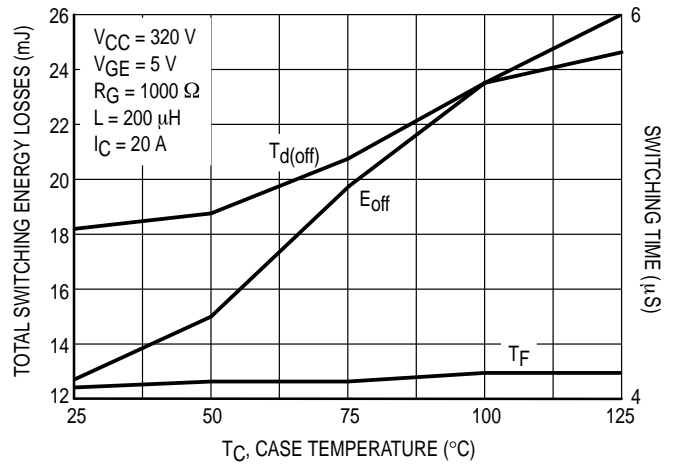


Figure 10. Total Switching Losses versus Case Temperature

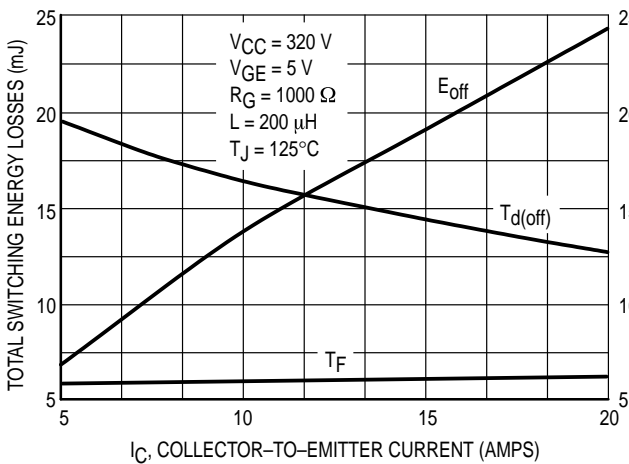


Figure 11. Total Switching Losses versus Collector Current

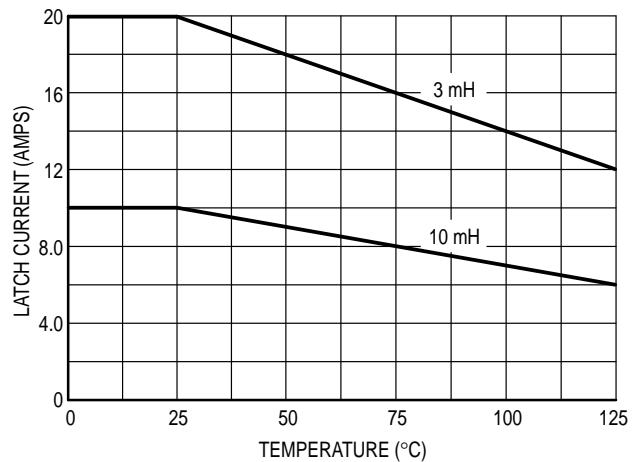


Figure 12. Latch Current versus Temperature

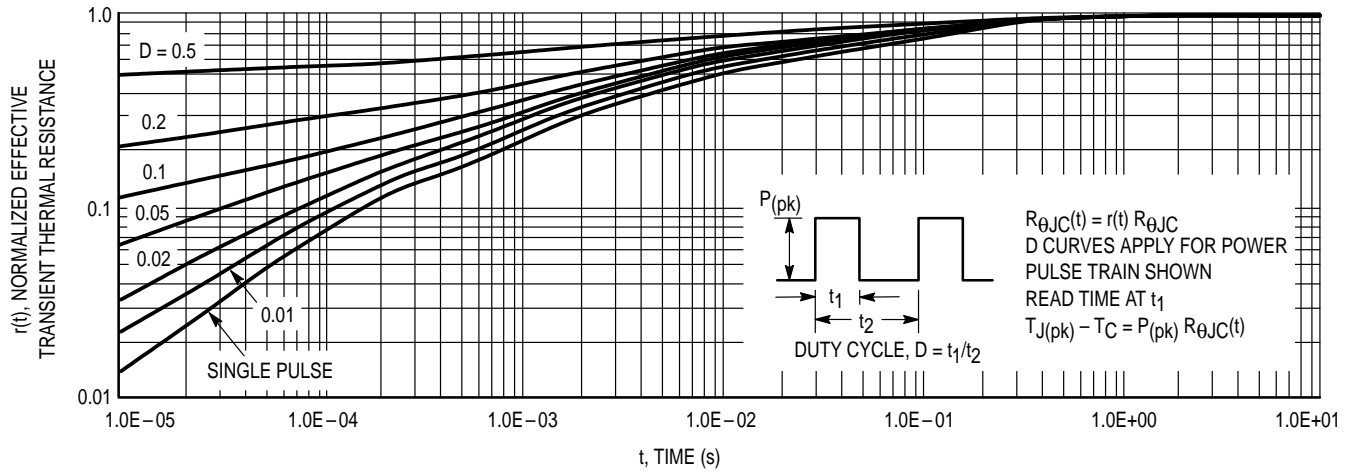


Figure 13. Thermal Response

PACKAGE DIMENSIONS


SEATING PLANE
 STYLE 9:
 PIN 1. GATE
 PIN 2. COLLECTOR
 PIN 3. EMITTER
 PIN 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-06
 (TO-220AB)
 ISSUE Y**

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