

MGP19N35CL, MGB19N35CL

Preferred Device

Ignition IGBT 19 Amps, 350 Volts N-Channel TO-220 and D²PAK

This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

- Ideal for IGBT-On-Coil or Distributorless Ignition System Applications
- High Pulsed Current Capability up to 50 A
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage to Interface Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- Optional Gate Resistor (R_G)

MAXIMUM RATINGS ($-55^{\circ}\text{C} \leq T_J \leq 175^{\circ}\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	380	V_{DC}
Collector-Gate Voltage	V_{CER}	380	V_{DC}
Gate-Emitter Voltage	V_{GE}	22	V_{DC}
Collector Current – Continuous @ $T_C = 25^{\circ}\text{C}$ – Pulsed	I_C	19 50	A_{DC} A_{AC}
ESD (Human Body Model) $R = 1500 \Omega$, $C = 100 \text{ pF}$	ESD	8.0	kV
ESD (Machine Model) $R = 0 \Omega$, $C = 200 \text{ pF}$	ESD	800	V
Total Power Dissipation @ $T_C = 25^{\circ}\text{C}$ Derate above 25°C	P_D	165 1.1	Watts $\text{W}/^{\circ}\text{C}$
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 175	$^{\circ}\text{C}$

UNCLAMPED COLLECTOR-TO-EMITTER AVALANCHE

CHARACTERISTICS ($-55^{\circ}\text{C} \leq T_J \leq 175^{\circ}\text{C}$)

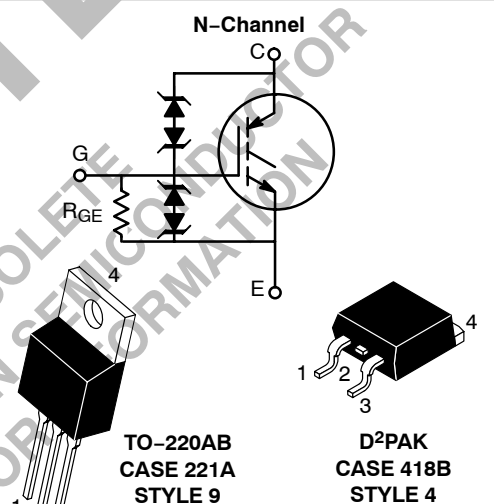
Characteristic	Symbol	Value	Unit
Single Pulse Collector-to-Emitter Avalanche Energy $V_{CC} = 50 \text{ V}$, $V_{GE} = 5.0 \text{ V}$, $\text{Pk } I_L = 22.4 \text{ A}$, $L = 2.0 \text{ mH}$, Starting $T_J = 25^{\circ}\text{C}$	E_{AS}	500	mJ
$V_{CC} = 50 \text{ V}$, $V_{GE} = 5.0 \text{ V}$, $\text{Pk } I_L = 17.4 \text{ A}$, $L = 2.0 \text{ mH}$, Starting $T_J = 150^{\circ}\text{C}$		300	
Reverse Avalanche Energy $V_{CC} = 100 \text{ V}$, $V_{GE} = 20 \text{ V}$, $L = 3.0 \text{ mH}$, $\text{Pk } I_L = 25.8 \text{ A}$, Starting $T_J = 25^{\circ}\text{C}$	$E_{AS(R)}$	1000	mJ



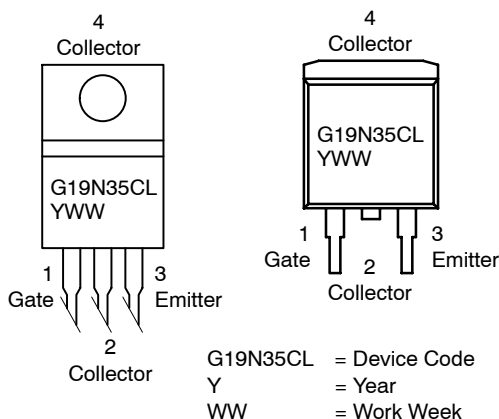
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**19 AMPERES
350 VOLTS (Clamped)
 $V_{CE(on)} @ 10 \text{ A} = 1.8 \text{ V Max}$**



MARKING DIAGRAMS & PIN ASSIGNMENTS



ORDERING INFORMATION

Device	Package	Shipping
MGP19N35CL	TO-220	50 Units/Rail
MGB19N35CLT4	D2PAK	800 Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.9	$^{\circ}\text{C/W}$
Thermal Resistance, Junction to Ambient	TO-220 $R_{\theta JA}$	62.5	
	D ² PAK (Note 1.) $R_{\theta JA}$	50	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	275	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Clamp Voltage	BV_{CES}	$I_C = 2.0 \text{ mA}$	$T_J = -40^{\circ}\text{C to } 150^{\circ}\text{C}$	320	350	380	V_{DC}
		$I_C = 10 \text{ mA}$	$T_J = -40^{\circ}\text{C to } 150^{\circ}\text{C}$	330	360	380	
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 300 \text{ V},$ $V_{GE} = 0 \text{ V}$	$T_J = 25^{\circ}\text{C}$	–	1.5	20	μA_{DC}
			$T_J = 150^{\circ}\text{C}$	–	15	40*	
			$T_J = -40^{\circ}\text{C}$	–	0.7	1.5	
Reverse Collector-Emitter Leakage Current	I_{ECS}	$V_{CE} = -24 \text{ V}$	$T_J = 25^{\circ}\text{C}$	–	0.35	1.0	mA
			$T_J = 150^{\circ}\text{C}$	–	10	20*	
			$T_J = -40^{\circ}\text{C}$	–	0.05	0.5	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	$I_C = -75 \text{ mA}$	$T_J = 25^{\circ}\text{C}$	25	33	50	V_{DC}
			$T_J = 150^{\circ}\text{C}$	25	36	50	
			$T_J = -40^{\circ}\text{C}$	25	30	50	
Gate-Emitter Clamp Voltage	BV_{GES}	$I_G = 5.0 \text{ mA}$	$T_J = -40^{\circ}\text{C to } 150^{\circ}\text{C}$	17	20	22	V_{DC}
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = 10 \text{ V}$	$T_J = -40^{\circ}\text{C to } 150^{\circ}\text{C}$	384	500	1000	μA_{DC}
Gate Resistor (Optional)	R_G	–	$T_J = -40^{\circ}\text{C to } 150^{\circ}\text{C}$	–	70	–	Ω
Gate Emitter Resistor	R_{GE}	–	$T_J = -40^{\circ}\text{C to } 150^{\circ}\text{C}$	10	20	26	k Ω

ON CHARACTERISTICS (Note 2.)

Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0 \text{ mA},$ $V_{GE} = V_{CE}$	$T_J = 25^{\circ}\text{C}$	1.4	1.7	2.0	V_{DC}
			$T_J = 150^{\circ}\text{C}$	0.75	1.1	1.4	
			$T_J = -40^{\circ}\text{C}$	1.6	1.9	2.1*	
Threshold Temperature Coefficient (Negative)	–	–	–	–	4.4	–	mV/ $^{\circ}\text{C}$

1. When surface mounted to an FR4 board using the minimum recommended pad size.

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

*Maximum Value of Characteristic across Temperature Range.

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ELECTRICAL CHARACTERISTICS (continued)

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
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ON CHARACTERISTICS (continued) (Note 3.)

Collector-to-Emitter On-Voltage	$V_{CE(on)}$	$I_C = 6.0 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.0	1.25	1.6	V_{DC}
			$T_J = 150^\circ\text{C}$	0.8	1.05	1.4	
			$T_J = -40^\circ\text{C}$	1.15	1.4	1.75*	
		$I_C = 10 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.2	1.5	1.8	
			$T_J = 150^\circ\text{C}$	1.0	1.3	1.6	
			$T_J = -40^\circ\text{C}$	1.3	1.6	1.9*	
		$I_C = 15 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.5	1.75	2.1	
			$T_J = 150^\circ\text{C}$	1.35	1.65	1.95	
			$T_J = -40^\circ\text{C}$	1.5	1.8	2.1*	
		$I_C = 20 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.7	2.0	2.3	
			$T_J = 150^\circ\text{C}$	1.6	1.9	2.2	
			$T_J = -40^\circ\text{C}$	1.7	2.0	2.3*	
		$I_C = 25 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	2.0	2.25	2.6	
			$T_J = 150^\circ\text{C}$	2.0	2.3	2.7*	
			$T_J = -40^\circ\text{C}$	2.0	2.2	2.6	
Collector-to-Emitter On-Voltage	$V_{CE(on)}$	$I_C = 10 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = 150^\circ\text{C}$	-	1.3	1.8	V_{DC}
Forward Transconductance	gfs	$V_{CE} = 5.0 \text{ V}, I_C = 6.0 \text{ A}$	$T_J = -40^\circ\text{C}$ to 150°C	8.0	15	25	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	C_{ISS}	$V_{CC} = 25 \text{ V}, V_{GE} = 0 \text{ V}$ $f = 1.0 \text{ MHz}$	$T_J = -40^\circ\text{C}$ to 150°C	-	1500	1800	pF
Output Capacitance	C_{OSS}			-	130	160	
Transfer Capacitance	C_{RSS}			-	6.0	8.0	

SWITCHING CHARACTERISTICS (Note 3.)

Turn-Off Delay Time (Inductive)	$t_{d(off)}$	$V_{CC} = 300 \text{ V}, I_C = 10 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, L = 300 \mu\text{H}$	$T_J = 25^\circ\text{C}$	-	5.0	10	μSec
			$T_J = 150^\circ\text{C}$	-	6.0	10	
Fall Time (Inductive)	t_f	$V_{CC} = 300 \text{ V}, I_C = 10 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, L = 300 \mu\text{H}$	$T_J = 25^\circ\text{C}$	-	6.0	10	
			$T_J = 150^\circ\text{C}$	-	11	15*	
Turn-Off Delay Time (Resistive)	$t_{d(off)}$	$V_{CC} = 300 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 46 \Omega$	$T_J = 25^\circ\text{C}$	-	6.0	10	μSec
			$T_J = 150^\circ\text{C}$	-	7.0	10	
Fall Time (Resistive)	t_f	$V_{CC} = 300 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 46 \Omega$	$T_J = 25^\circ\text{C}$	-	12	20	
			$T_J = 150^\circ\text{C}$	-	18	22*	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 10 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \Omega$	$T_J = 25^\circ\text{C}$	-	1.5	2.0	μSec
			$T_J = 150^\circ\text{C}$	-	1.5	2.0	
Rise Time	t_r	$V_{CC} = 10 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \Omega$	$T_J = 25^\circ\text{C}$	-	4.0	6.0	
			$T_J = 150^\circ\text{C}$	-	5.0	6.0	

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

*Maximum Value of Characteristic across Temperature Range.

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TYPICAL ELECTRICAL CHARACTERISTICS (unless otherwise noted)

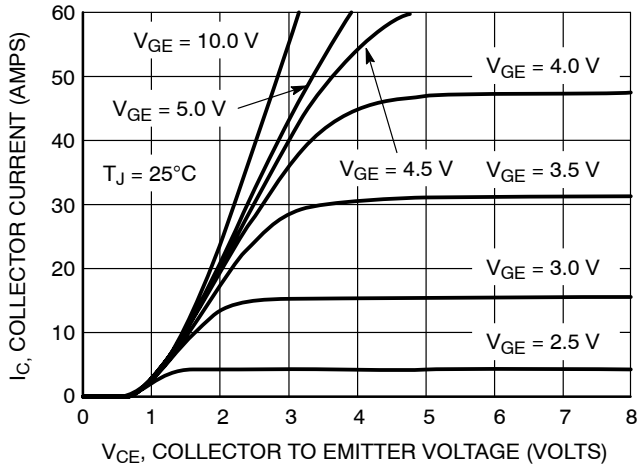


Figure 1. Output Characteristics

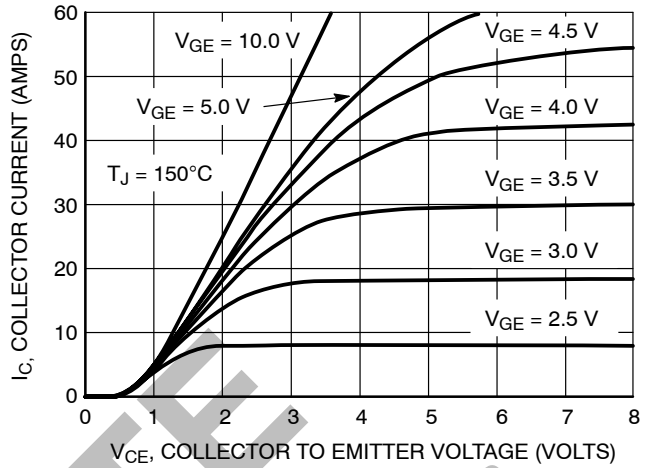


Figure 2. Output Characteristics

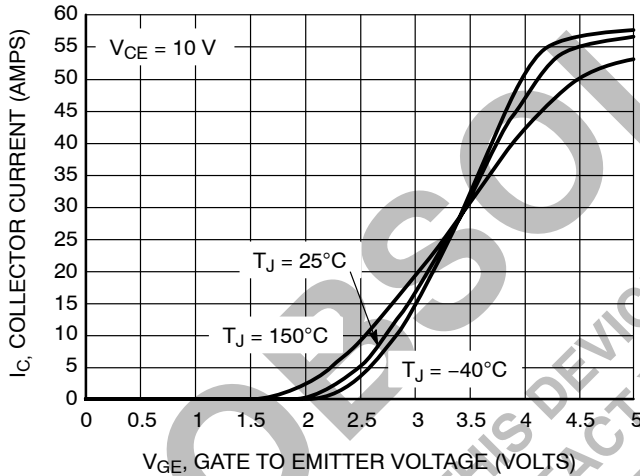


Figure 3. Transfer Characteristics

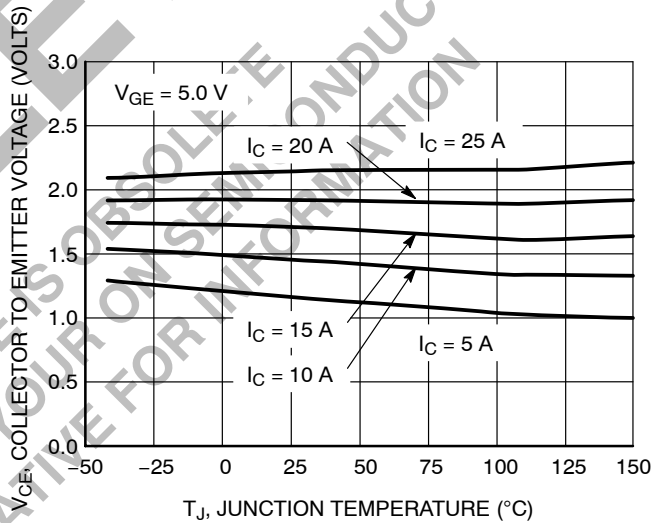


Figure 4. Collector-to-Emitter Saturation Voltage vs. Junction Temperature

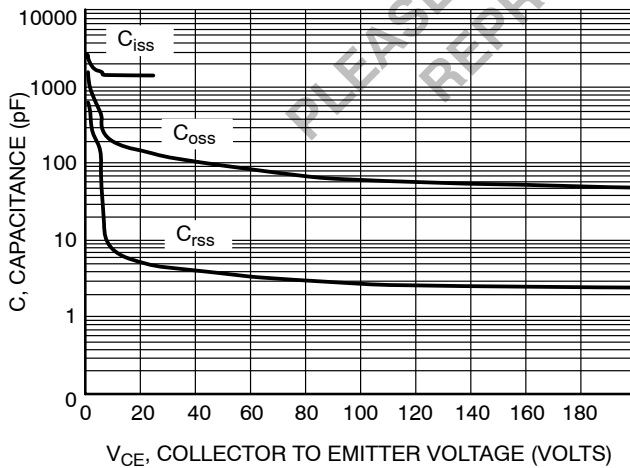


Figure 5. Capacitance Variation

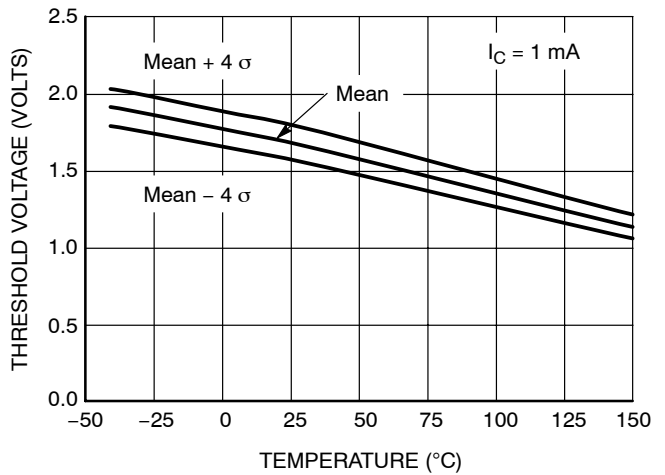


Figure 6. Threshold Voltage vs. Temperature

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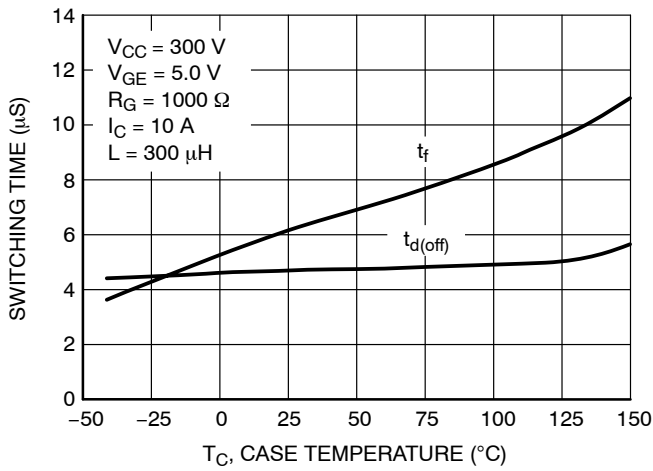


Figure 7. Switching Speed vs. Case Temperature

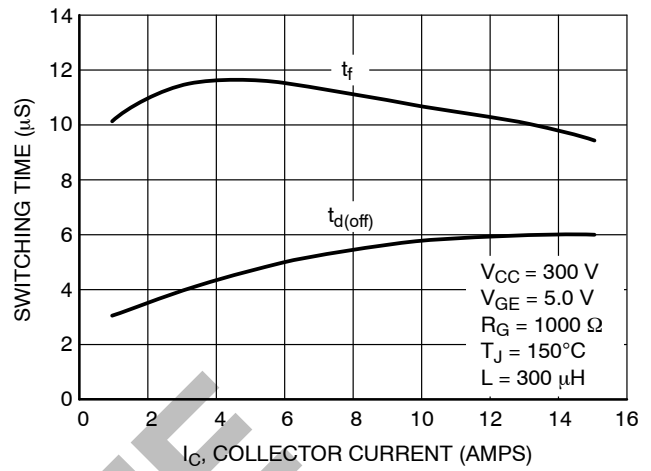


Figure 8. Switching Speed vs. Collector Current

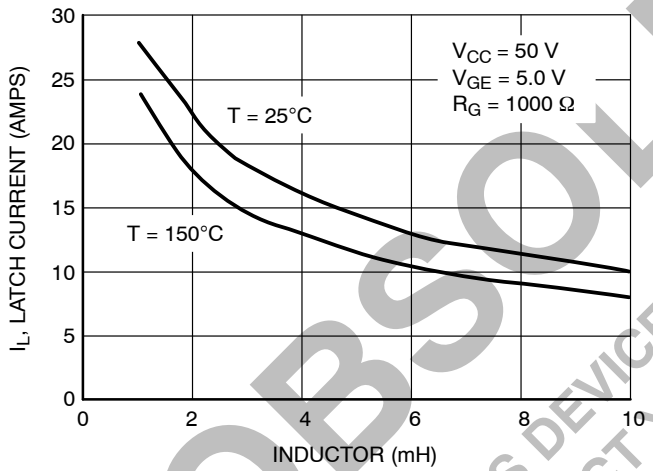


Figure 9. Minimum Open Secondary Latch Current vs. Inductor

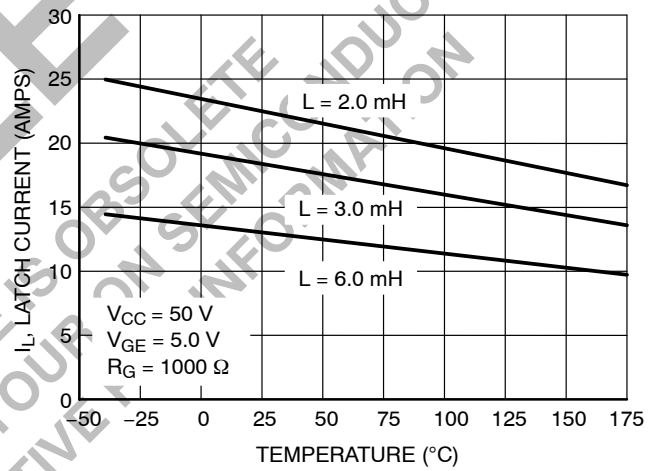


Figure 10. Minimum Open Secondary Latch Current vs. Temperature

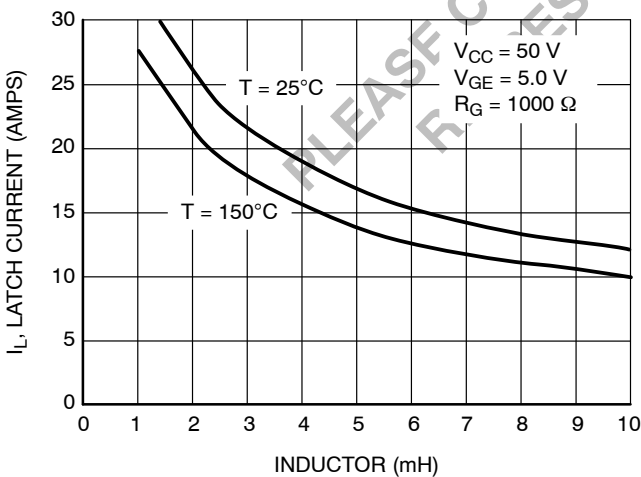


Figure 11. Typical Open Secondary Latch vs. Inductor

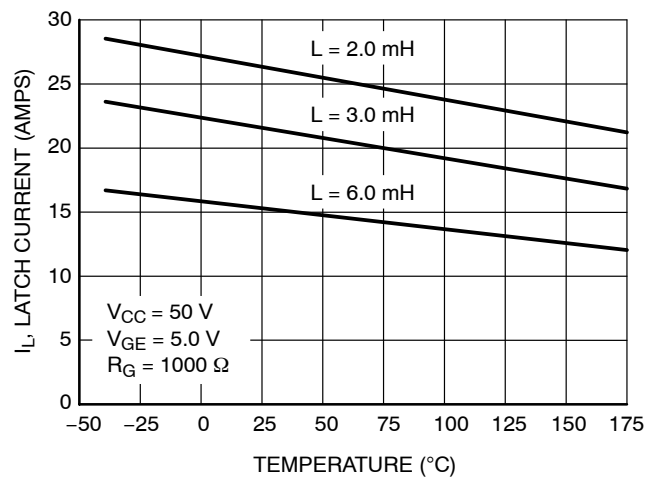


Figure 12. Typical Open Secondary Latch vs. Temperature

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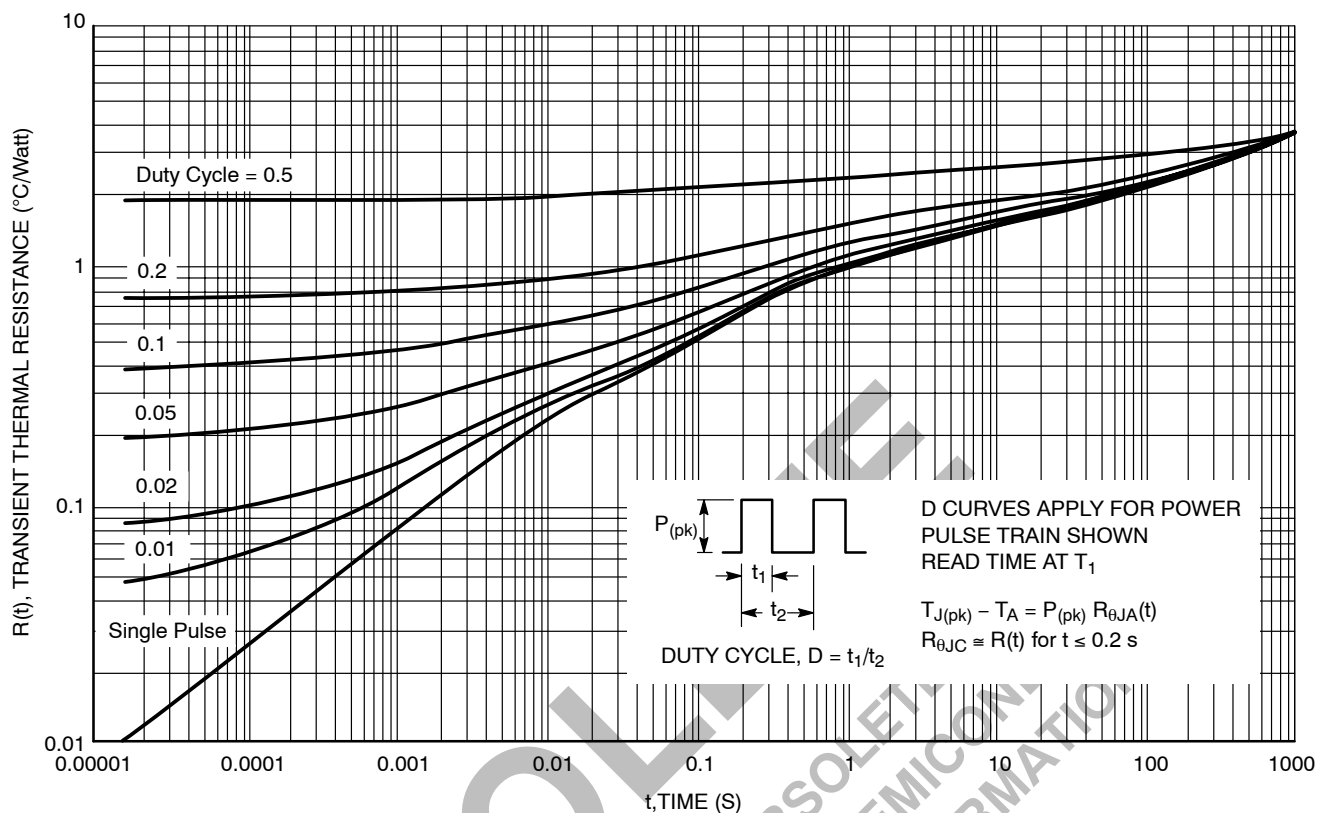


Figure 13. Transient Thermal Resistance
(Non-normalized Junction-to-Ambient mounted on
fixture in Figure 14)

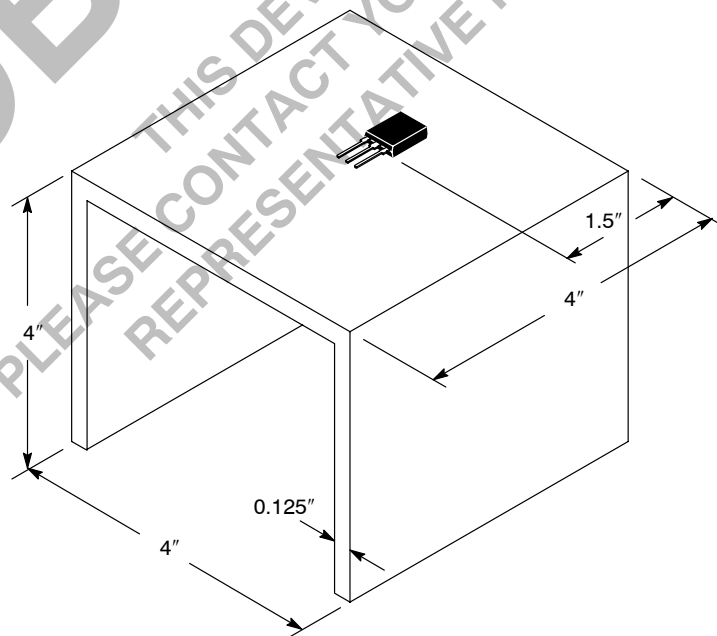


Figure 14. Test Fixture for Transient Thermal Curve
(48 square inches of 1/8" thick aluminum)

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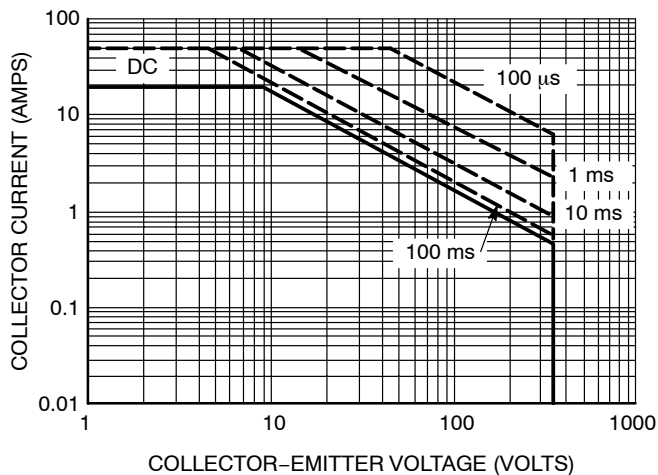


Figure 15. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at $T_C = 25^\circ\text{C}$)

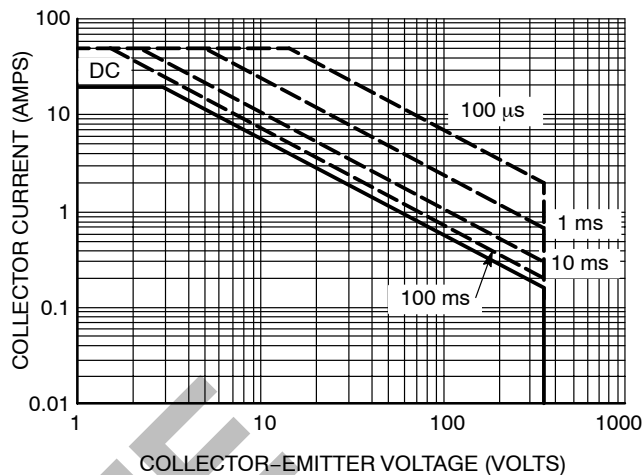


Figure 16. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at $T_C = 125^\circ\text{C}$)

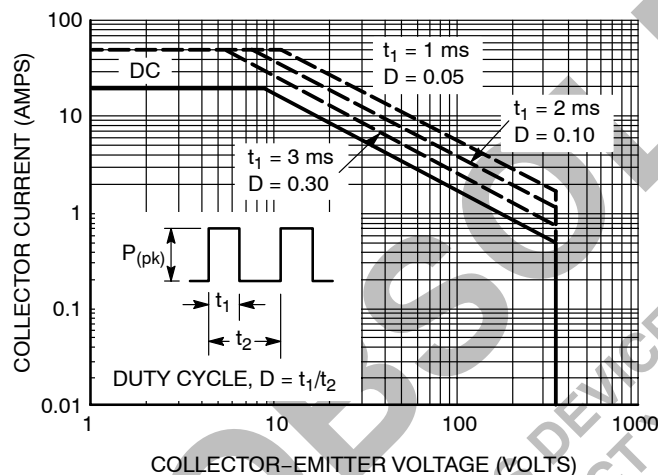


Figure 17. Pulse Train Safe Operating Area
(Mounted on an Infinite Heatsink at $T_C = 25^\circ\text{C}$)

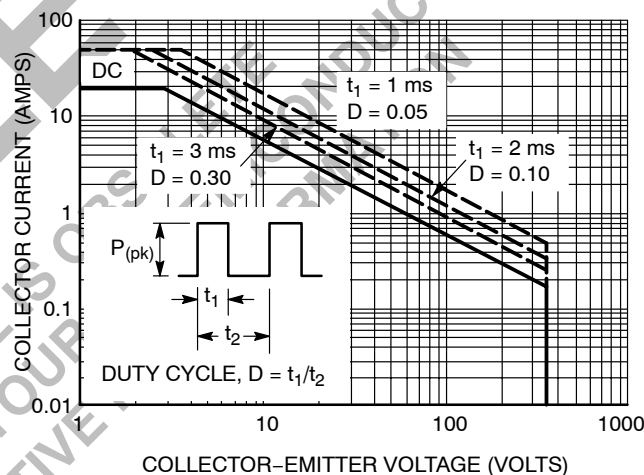


Figure 18. Pulse Train Safe Operating Area
(Mounted on an Infinite Heatsink at $T_C = 125^\circ\text{C}$)

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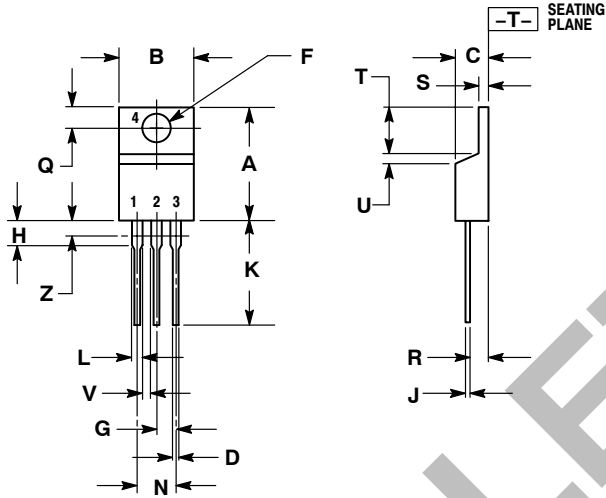
PACKAGE DIMENSIONS

TO-220 THREE-LEAD

TO-220AB

CASE 221A-09

ISSUE AA



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	4.88	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

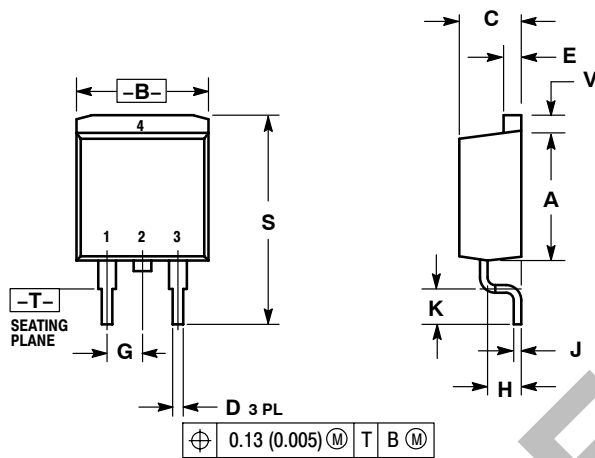
STYLE 9:

- PIN 1: GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

MGP19N35CL, MGB19N35CL

PACKAGE DIMENSIONS

D²PAK
CASE 418B-03
ISSUE D



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

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

Notes

OBSOLETE
THIS DEVICE IS OBSOLETE
PLEASE CONTACT YOUR ON SEMICONDUCTOR
REPRESENTATIVE FOR INFORMATION

Notes

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