

NGB18N40ACLB

Ignition IGBT 18 Amps, 400 Volts N-Channel 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.

Features

- Ideal for Coil-on-Plug Applications
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- New Design Increases Unclamped Inductive Switching (UIS) Energy Per Area
- Low Threshold Voltage to Interface Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Integrated Gate-Emitter Resistor (R_{GE})
- Emitter Ballasting for Short-Circuit Capability
- These are Pb-Free Devices

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	430	V_{DC}
Collector-Gate Voltage	V_{CER}	430	V_{DC}
Gate-Emitter Voltage	V_{GE}	18	V_{DC}
Collector Current-Continuous @ $T_C = 25^\circ\text{C}$ - Pulsed	I_C	18 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	115 0.77	W W/ $^\circ\text{C}$
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

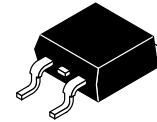
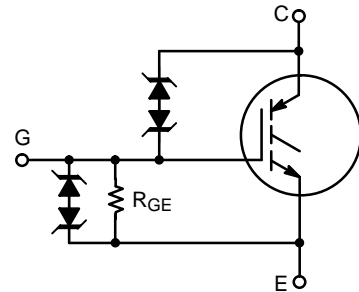


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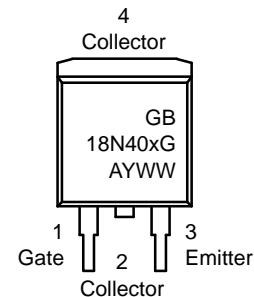
18 AMPS, 400 VOLTS

$V_{CE(on)} \leq 2.0 \text{ V @}$
 $I_C = 10 \text{ A}, V_{GE} \geq 4.5 \text{ V}$



**D²PAK
CASE 418B
STYLE 4**

MARKING DIAGRAM



GB18N40x = Device Code
x = A
A = Assembly Location
Y = Year
WW = Work Week
G = Pb-Free Package

ORDERING INFORMATION

Device	Package	Shipping [†]
NGB18N40ACLBT4G	D ² PAK (Pb-Free)	800/Tape & Reel

NGB18N40ACLB

UNCLAMPED COLLECTOR-TO-EMITTER AVALANCHE CHARACTERISTICS ($-55^{\circ} \leq T_J \leq 175^{\circ}C$)

Characteristic	Symbol	Value	Unit
Single Pulse Collector-to-Emitter Avalanche Energy $V_{CC} = 50\text{ V}$, $V_{GE} = 5.0\text{ V}$, $Pk\ I_L = 21.1\text{ A}$, $L = 1.8\text{ mH}$, Starting $T_J = 25^{\circ}C$ $V_{CC} = 50\text{ V}$, $V_{GE} = 5.0\text{ V}$, $Pk\ I_L = 18.3\text{ A}$, $L = 1.8\text{ mH}$, Starting $T_J = 125^{\circ}C$	E_{AS}	400 300	mJ
Reverse Avalanche Energy $V_{CC} = 100\text{ V}$, $V_{GE} = 20\text{ V}$, $Pk\ I_L = 25.8\text{ A}$, $L = 6.0\text{ mH}$, Starting $T_J = 25^{\circ}C$	$E_{AS(R)}$	2000	mJ

MAXIMUM SHORT-CIRCUIT TIMES ($-55^{\circ}C \leq T_J \leq 150^{\circ}C$)

Characteristic	Symbol	Value	Unit
Short Circuit Withstand Time 1 (See Figure 17, 3 Pulses with 10 ms Period)	t_{sc1}	750	μs
Short Circuit Withstand Time 2 (See Figure 18, 3 Pulses with 10 ms Period)	t_{sc2}	5.0	ms

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.3	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient D ² PAK (Note 1)	$R_{\theta JA}$	50	$^{\circ}C/W$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	275	$^{\circ}C$

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Clamp Voltage	BV_{CES}	$I_C = 2.0\text{ mA}$	$T_J = -40^{\circ}C$ to $150^{\circ}C$	380	395	420	V
		$I_C = 10\text{ mA}$	$T_J = -40^{\circ}C$ to $150^{\circ}C$	390	405	430	
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 350\text{ V}$, $V_{GE} = 0\text{ V}$	$T_J = 25^{\circ}C$	-	2.0	20	μA
			$T_J = 150^{\circ}C$	-	10	40*	
			$T_J = -40^{\circ}C$	-	1.0	10	
Reverse Collector-Emitter Leakage Current	I_{ECS}	$V_{CE} = -24\text{ V}$	$T_J = 25^{\circ}C$	-	0.7	2.0	mA
			$T_J = 150^{\circ}C$	-	12	25*	
			$T_J = -40^{\circ}C$	-	0.1	1.0	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	$I_C = -75\text{ mA}$	$T_J = 25^{\circ}C$	27	33	37	V
			$T_J = 150^{\circ}C$	30	36	40	
			$T_J = -40^{\circ}C$	25	32	35	
Gate-Emitter Clamp Voltage	BV_{GES}	$I_G = 5.0\text{ mA}$	$T_J = -40^{\circ}C$ to $150^{\circ}C$	11	13	15	V
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = 10\text{ V}$	$T_J = -40^{\circ}C$ to $150^{\circ}C$	384	640	100 0	μA
Gate Emitter Resistor	R_{GE}	-	$T_J = -40^{\circ}C$ to $150^{\circ}C$	10	16	26	k Ω

ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0\text{ mA}$, $V_{GE} = V_{CE}$	$T_J = 25^{\circ}C$	1.1	1.4	1.9	V
			$T_J = 150^{\circ}C$	0.75	1.0	1.4	
			$T_J = -40^{\circ}C$	1.2	1.6	2.1*	
Threshold Temperature Coefficient (Negative)	-	-	-	-	3.4	-	mV/ $^{\circ}C$

*Maximum Value of Characteristic across Temperature Range.

- When surface mounted to an FR4 board using the minimum recommended pad size.
- Pulse Test: Pulse Width $\leq 300\ \mu s$, Duty Cycle $\leq 2\%$.

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ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 2)							
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	1.4	1.6	V
			$T_J = 150^\circ\text{C}$	0.9	1.3	1.6	
			$T_J = -40^\circ\text{C}$	1.1	1.45	1.7*	
		$I_C = 8.0 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.3	1.6	1.9*	
			$T_J = 150^\circ\text{C}$	1.2	1.55	1.8	
			$T_J = -40^\circ\text{C}$	1.4	1.6	1.9*	
		$I_C = 10 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.4	1.8	2.05	
			$T_J = 150^\circ\text{C}$	1.5	1.8	2.0	
			$T_J = -40^\circ\text{C}$	1.4	1.8	2.1*	
		$I_C = 15 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.6	1.9	2.2	
			$T_J = 150^\circ\text{C}$	1.7	2.1	2.3*	
			$T_J = -40^\circ\text{C}$	1.6	1.8	2.2	
		$I_C = 10 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = 25^\circ\text{C}$	1.3	1.8	2.0*	
			$T_J = 150^\circ\text{C}$	1.3	1.75	2.0*	
			$T_J = -40^\circ\text{C}$	1.4	1.8	2.0*	
Forward Transconductance	gfs	$V_{CE} = 5.0 \text{ V}, I_C = 6.0 \text{ A}$	$T_J = -40^\circ\text{C to } 150^\circ\text{C}$	8.0	14	25	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	C_{ISS}	$V_{CC} = 25 \text{ V}, V_{GE} = 0 \text{ V}$ $f = 1.0 \text{ MHz}$	$T_J = -40^\circ\text{C to } 150^\circ\text{C}$	400	800	100	pF
Output Capacitance	C_{OSS}			50	75	100	
Transfer Capacitance	C_{RSS}			4.0	7.0	10	

SWITCHING CHARACTERISTICS

Turn-Off Delay Time (Resistive)	$t_{d(off)}$	$V_{CC} = 300 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 46 \Omega,$	$T_J = 25^\circ\text{C}$	-	4.0	10	μs
Fall Time (Resistive)	t_f	$V_{CC} = 300 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 46 \Omega,$	$T_J = 25^\circ\text{C}$	-	9.0	15	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 10 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \Omega$	$T_J = 25^\circ\text{C}$	-	0.7	4.0	μs
Rise Time	t_r	$V_{CC} = 10 \text{ V}, I_C = 6.5 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \Omega$	$T_J = 25^\circ\text{C}$	-	4.5	7.0	

*Maximum Value of Characteristic across Temperature Range.

- When surface mounted to an FR4 board using the minimum recommended pad size.
- Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$.

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TYPICAL ELECTRICAL CHARACTERISTICS

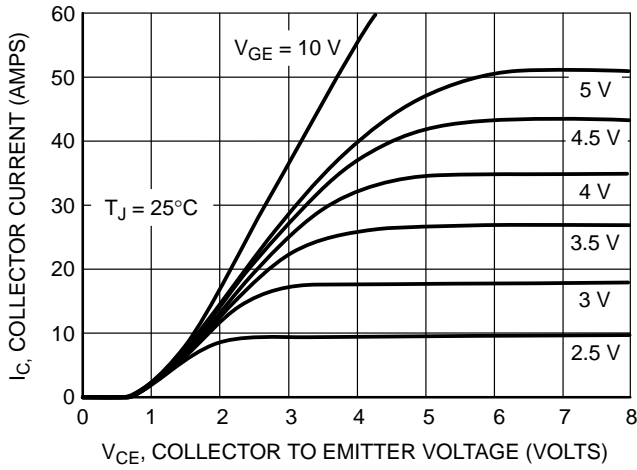


Figure 1. Output Characteristics

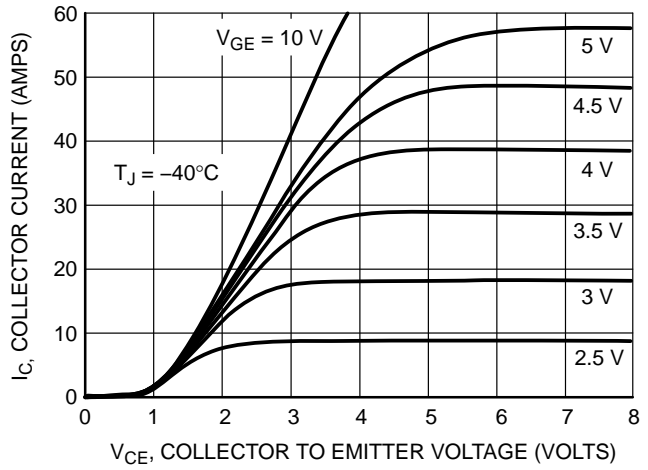


Figure 2. Output Characteristics

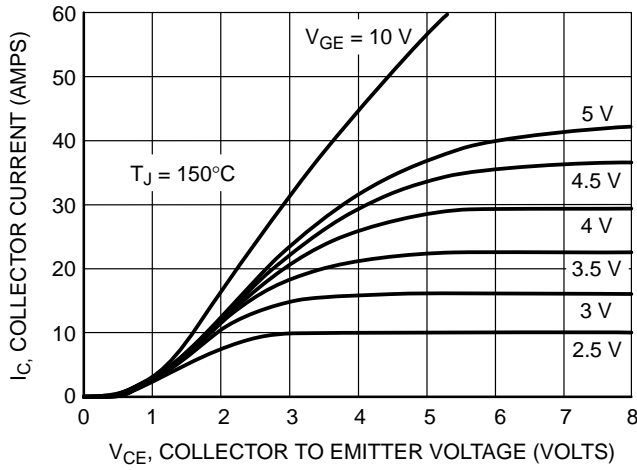


Figure 3. Output Characteristics

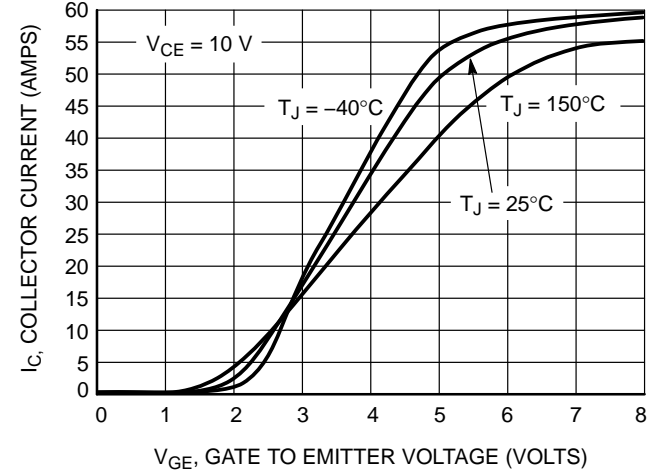


Figure 4. Transfer Characteristics

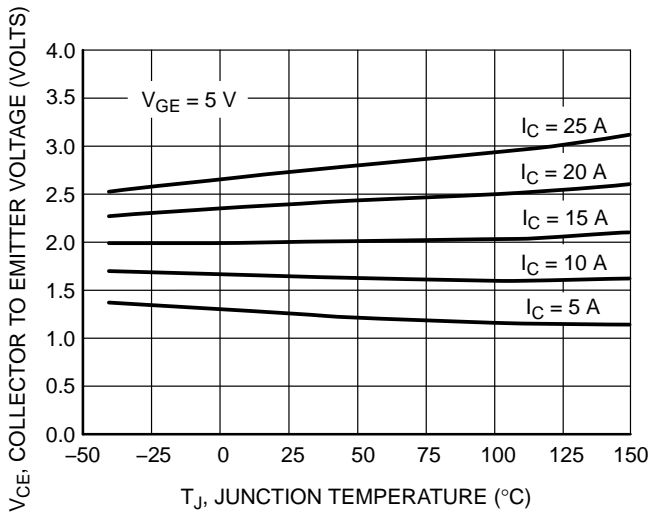


Figure 5. Collector-to-Emitter Saturation Voltage versus Junction Temperature

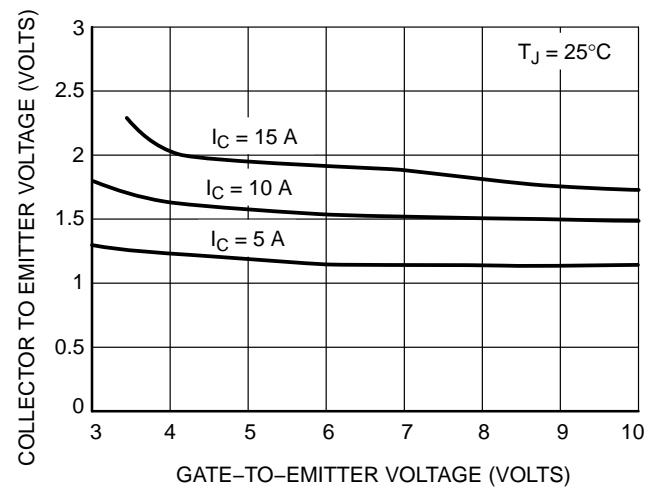


Figure 6. Collector-to-Emitter Voltage versus Gate-to-Emitter Voltage

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TYPICAL ELECTRICAL CHARACTERISTICS

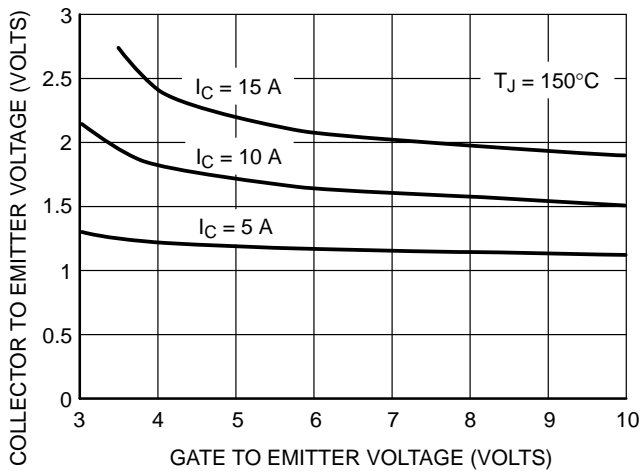


Figure 7. Collector-to-Emitter Voltage versus Gate-to-Emitter Voltage

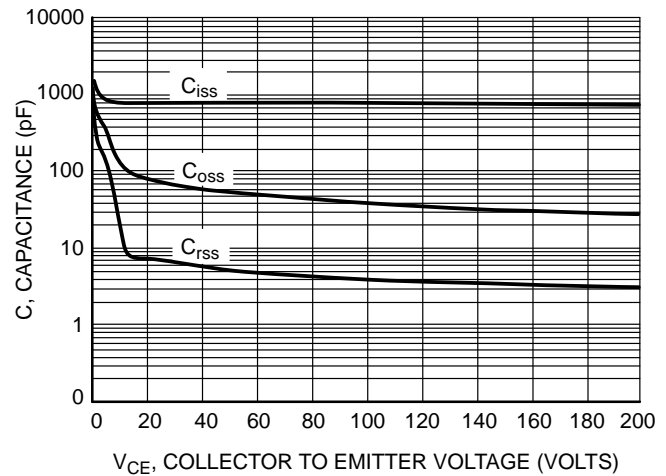


Figure 8. Capacitance Variation

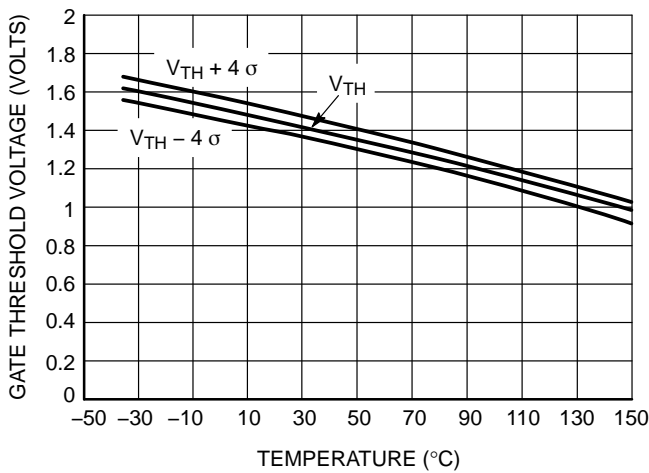


Figure 9. Gate Threshold Voltage versus Temperature

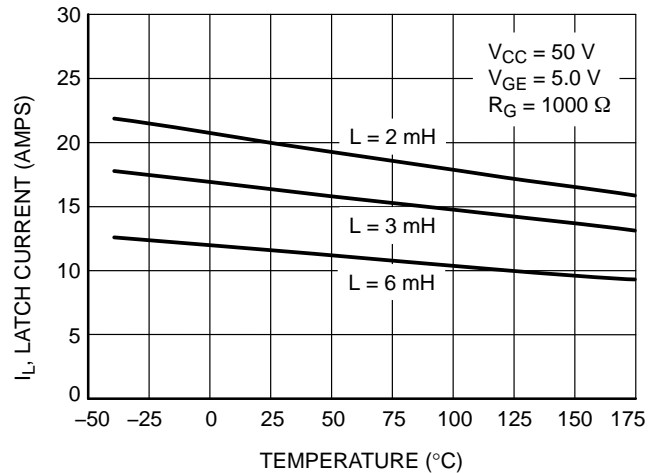


Figure 10. Minimum Open Secondary Latch Current versus Temperature

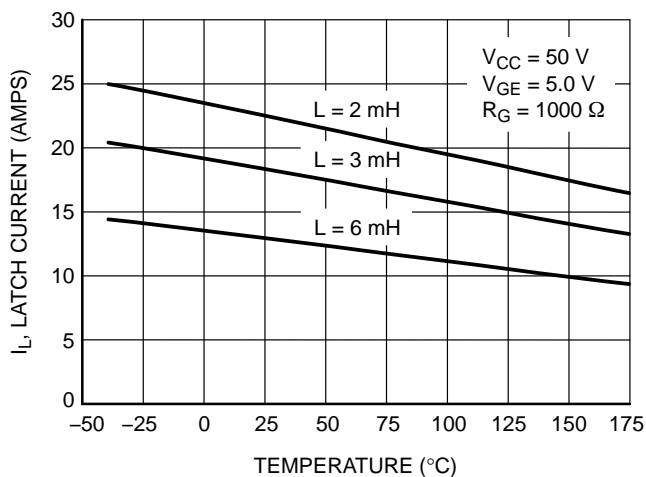


Figure 11. Typical Open Secondary Latch Current versus Temperature

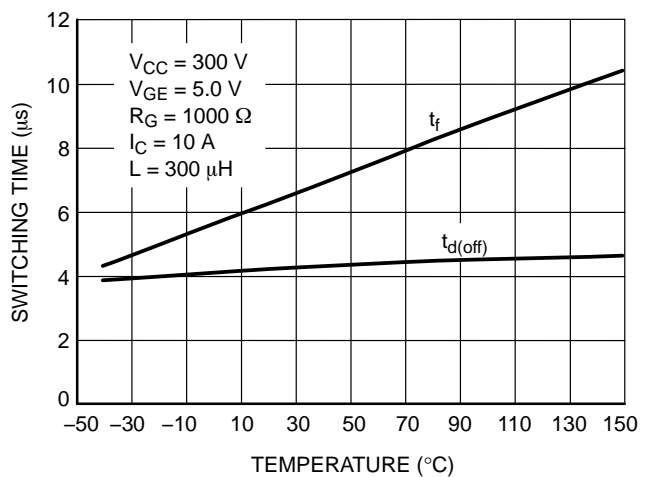


Figure 12. Inductive Switching Fall Time versus Temperature

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TYPICAL ELECTRICAL CHARACTERISTICS

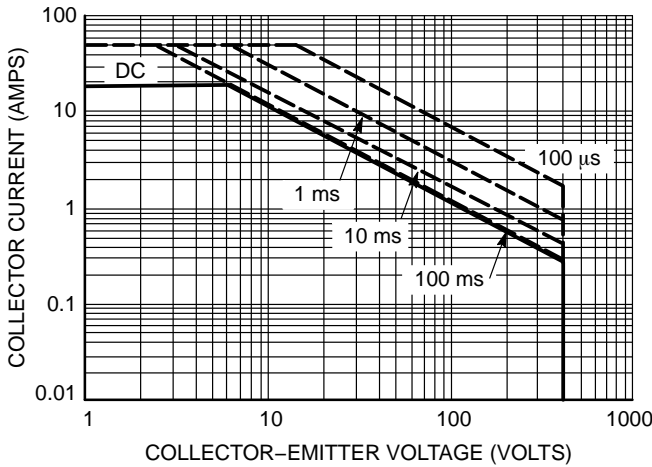


Figure 13. Single Pulse Safe Operating Area (Mounted on an Infinite Heatsink at $T_A = 25^\circ\text{C}$)

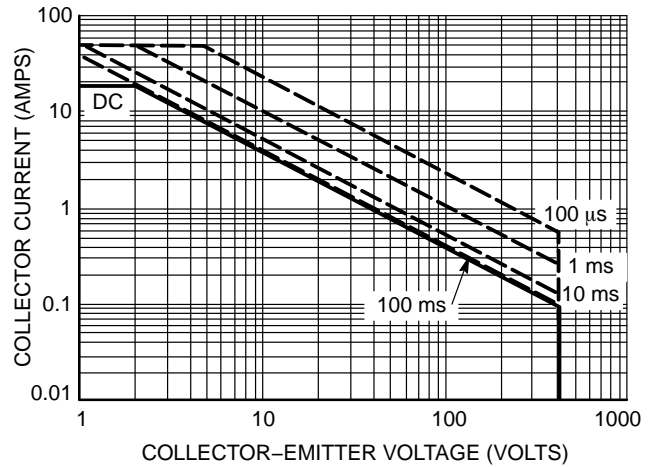


Figure 14. Single Pulse Safe Operating Area (Mounted on an Infinite Heatsink at $T_A = 125^\circ\text{C}$)

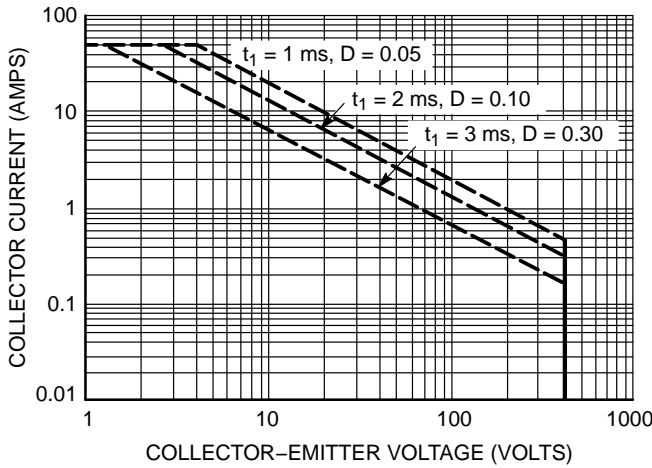


Figure 15. Pulse Train Safe Operating Area (Mounted on an Infinite Heatsink at $T_C = 25^\circ\text{C}$)

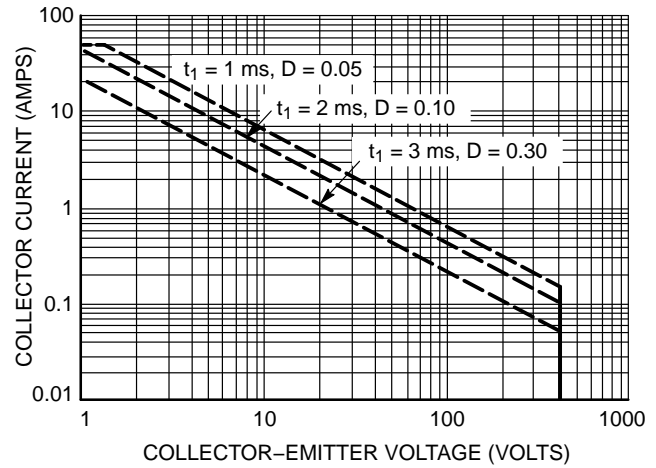


Figure 16. Pulse Train Safe Operating Area (Mounted on an Infinite Heatsink at $T_C = 125^\circ\text{C}$)

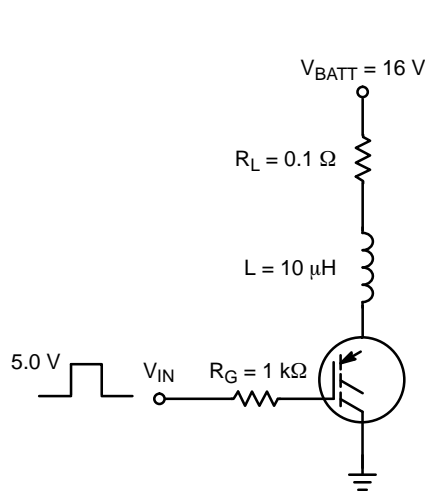


Figure 17. Circuit Configuration for Short Circuit Test #1

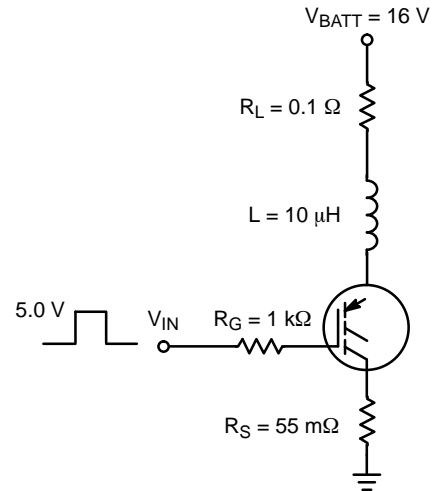


Figure 18. Circuit Configuration for Short Circuit Test #2

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TYPICAL ELECTRICAL CHARACTERISTICS

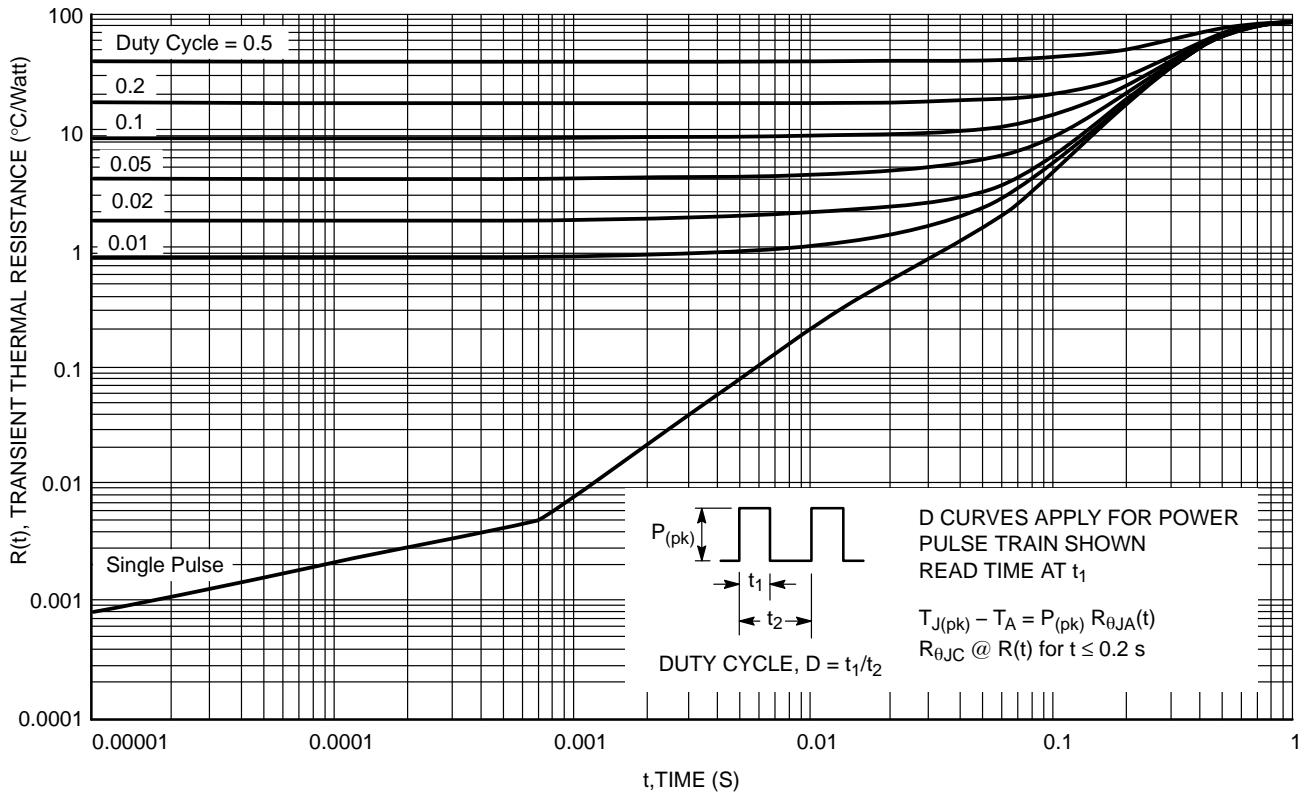
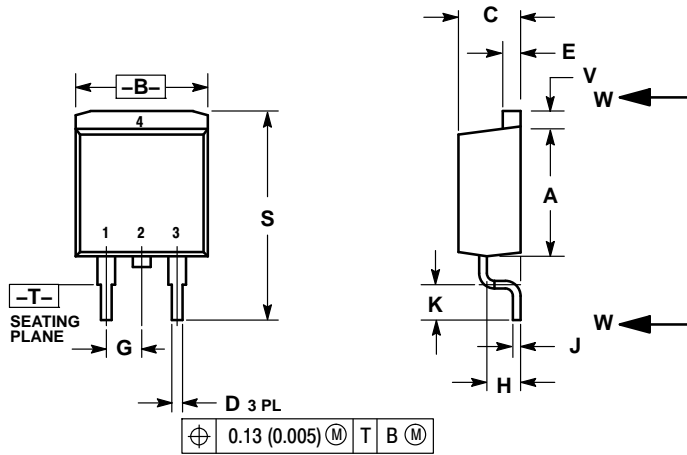


Figure 19. Transient Thermal Resistance (Non-normalized Junction-to-Ambient mounted on minimum pad area)

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PACKAGE DIMENSIONS

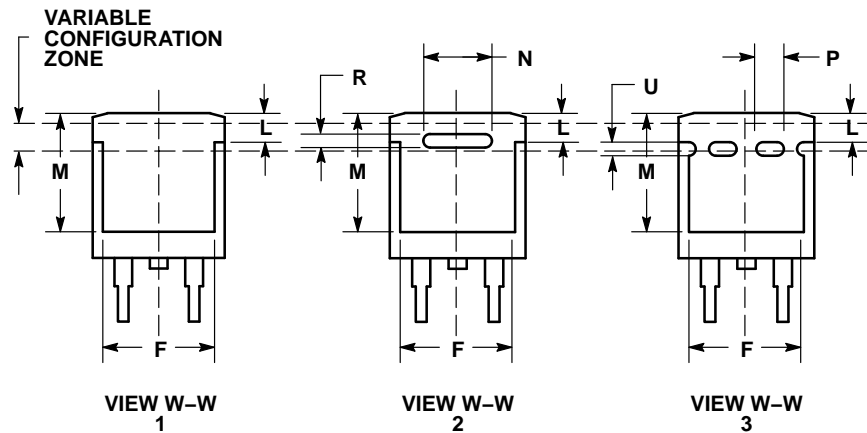
D²PAK 3
CASE 418B-04
ISSUE L



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

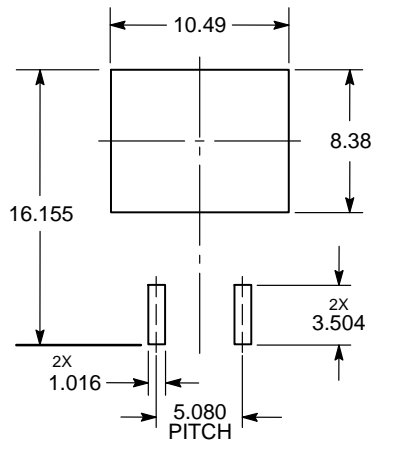
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100	BSC	2.54	BSC
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	1.83
M	0.280	0.320	7.11	8.13
N	0.197	REF	5.00	REF
P	0.079	REF	2.00	REF
R	0.039	REF	0.99	REF
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

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

NGB18N40ACLB

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