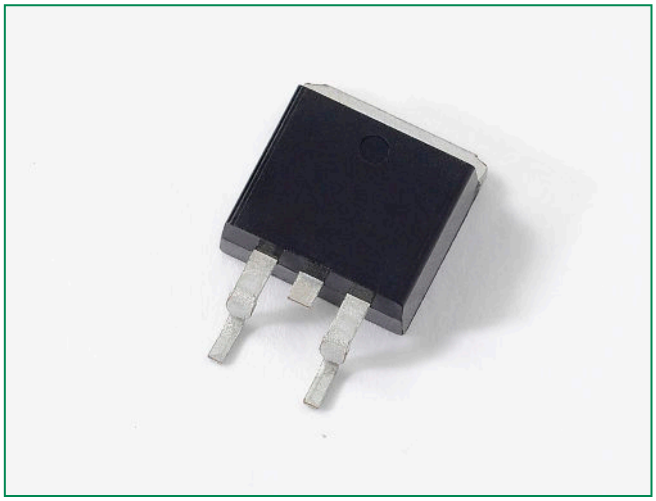
NGB8204AN - 18 A, 400 V, N-Channel Ignition IGBT, D²PAK



18 Amps, 400 Volts
$V_{CE}(on) \leq 2.0$ V @
I_C = 10A, $V_{GE} \geq 4.5$ V

Maximum Ratings (T_J = 25°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°C − Pulsed	I_C	18 50	A_{DC} A_{AC}
ESD (Human Body Model) R = 1500 Ω, C = 100 pF	ESD	8.0	kV
ESD (Machine Model) R = 0 Ω, C = 200 pF	ESD	800	V
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	115 0.77	Watts W/°C
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to +175	°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.

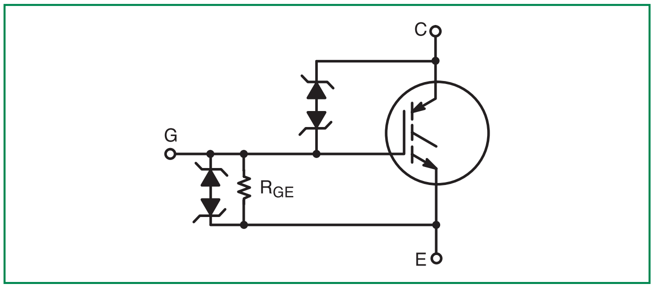
Description

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

Functional Diagram



Additional Information

Datasheet | Resources | Samples

Unclamped Collector–To–Emitter Avalanche Characteristics (–55°≤T_J≤175°C)

Rating	Symbol	Value	Unit
Single Pulse Collector–to–Emitter Avalanche Energy			
V_{CC} = 50 V, V_{GE} = 5.0 V, P_k I_L = 21.1 A, L = 1.8 mH, Starting T_J = 25°C	E_{AS}	400	mJ
V_{CC} = 50 V, V_{GE} = 5.0 V, P_k I_L = 18.3 A, L = 1.8 mH, Starting T_J = 125°C		400	
Reverse Avalanche Energy			
V_{CC} = 100 V, V_{GE} = 20 V, P_k I_L = 25.8 A, L = 6.0 mH, Starting T_J = 25°C	$E_{AS(R)}$	2000	mJ

Maximum Short-Circuit Times (–55°C ≤ TJ ≤ 150°C)

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

Thermal Characteristics

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{θJC}$	1.3	°C/W
Thermal Resistance, Junction to Ambient D²PAK (Note 1)	$R_{θJA}$	50	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 5 seconds	T_L	275	°C

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

Electrical Characteristics - OFF

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Collector−Emitter Clamp Voltage	BV_{CES}	I_C = 2.0 mA	T_J = −40°C to 150°C	370	395	420	V_{DC}
		I_C = 10 mA	T_J = −40°C to 150°C	390	415	440	
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 200V V_{GE} = 0 V	T_J = 25°C	–	2.0	10	μA_{DC}
			T_J = 150°C	–	10	40*	
			T_J = -40°C	–	1.0	10	
Reverse Collector−Emitter Clamp Voltage	$B_{VCES(R}$	I_C = −75 mA	T_J = 25°C	27	33	37	V_{DC}
			T_J = 150°C	30	36	40	
			T_J = −40°C	25	32	35	
Reverse Collector−Emitter Leakage Current	$I_{CES(R)}$	V_{CE} = −24 V	T_J = 25°C	–	0.7	1.0	mA
			T_J = 150°C	–	12	25*	
			T_J = −40°C	–	0.1	1.0	
Gate−Emitter Clamp Voltage	BV_{GES}	I_G = 5.0 mA	T_J = −40°C to 150°C	11	13	15	V_{DC}
Gate−Emitter Leakage Current	I_{GES}	V_{GE} = 10 V	T_J = −40°C to 150°C	384	640	700	μA_{DC}
Gate Emitter Resistor	R_{GE}	–	T_J = −40°C to 150°C	10	16	26	kΩ

Electrical Characteristics - ON (Note 3)

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Gate Threshold Voltage	$V_{GE(th)}$	I_C = 1.0 mA, $V_{GE} = V_{CE}$	T_J = 25°C	1.1	1.4	1.9	V_{DC}
			T_J = 150°C	0.75	1.0	1.4	
			T_J = −40°C	1.2	1.6	2.1*	
Threshold Temperature Coefficient (Negative)	–	–	–	–	3.4	–	mV/°C
Collector−to−Emitter On−Voltage	$V_{CE\ (on)}$	I_C = 6.0 A, V_{GE} = 4.0 V	T_J = 25°C	1.0	1.4	1.6	V_{DC}
			T_J = 150°C	0.9	1.3	1.6	
			T_J = −40°C	1.1	1.45	1.7*	
		I_C = 8.0 A, V_{GE} = 4.0 V	T_J = 25°C	1.3	1.6	1.9*	
			T_J = 150°C	1.2	1.55	1.8	
			T_J = −40°C	1.4	1.6	1.9*	
		I_C = 10 A, V_{GE} = 4.0 V	T_J = 25°C	1.4	1.8	2.0	
			T_J = 150°C	1.5	1.8	2.0	
			T_J = −40°C	1.4	1.8	2.1*	
		I_C = 15 A, V_{GE} = 4.0 V	T_J = 25°C	1.8	2.2	2.5	
			T_J = 150°C	2.0	2.4	2.6*	
			T_J = −40°C	1.7	2.1	2.5	
		I_C = 10 A, V_{GE} = 4.5 V	T_J = 25°C	1.3	1.8	2.0*	
			T_J = 150°C	1.3	1.75	2.0*	
			T_J = −40°C	1.4	1.8	2.0*	
Forward Transconductance	gfs	V_{CE} = 5.0 V, I_C = 6.0 A	T_J = −40°C to 150°C	8.0	14	25	Mhos

*Maximum Value of Characteristic across Temperature Range.

3. Pulse Test: Pulse Width ≤ 300 µS, Duty Cycle ≤ 2%.

Dynamic Characteristics

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Input Capacitance	C_{ISS}	V_{CC} = 25 V, V_{GE} = 0 V, f = 1.0 MHz	T_J = −40°C to 150°C	400	800	1000	pF
Output Capacitance	C_{OSS}			50	75	100	
Transfer Capacitance	C_{RSS}			4.0	7.0	10	

Switching Characteristics

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Turn−Off Delay Time (Resistive)	$t_{d\ (off)}$	V_{CC} = 300 V, I_C = 6.5 A, R_G = 1.0 kΩ, R_L = 46 Ω	T_J = 25°C	–	4.0	10	μSec
Fall Time (Resistive)	t_f		T_J = 25°C	–	9.0	15	
Turn−On Delay Time	$t_{d\ (on)}$	V_{CC} = 10 V, I_C = 6.5 A, R_G = 1.0 kΩ, R_L = 1.5 Ω,	T_J = 25°C	–	0.7	4.0	
Rise Time	t_r		T_J = 25°C	–	4.5	7.0	

Ratings and Characteristic Curves

Figure 1. Output Characteristics

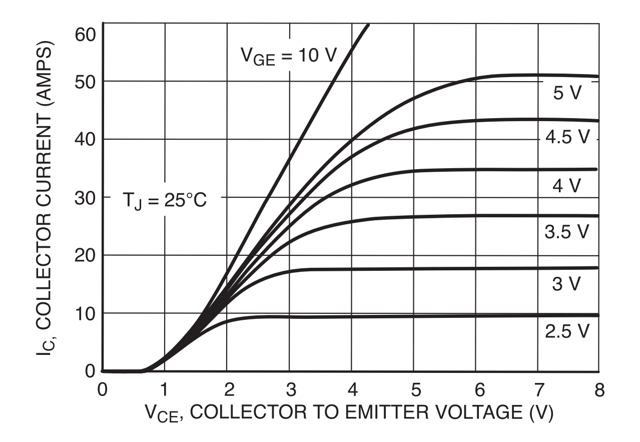


Figure 2. Output Characteristics

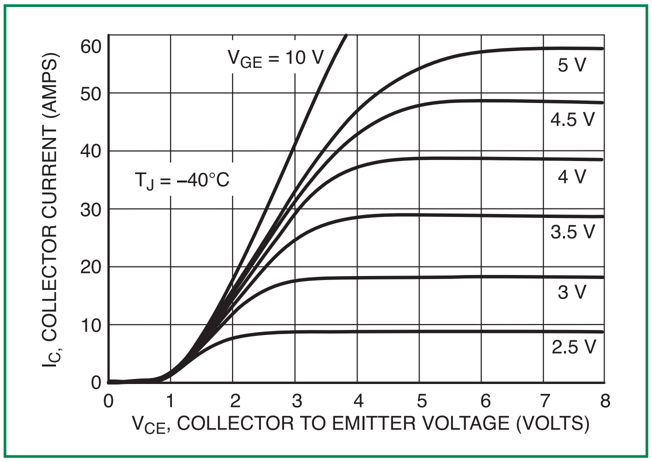


Figure 3. Output Characteristics

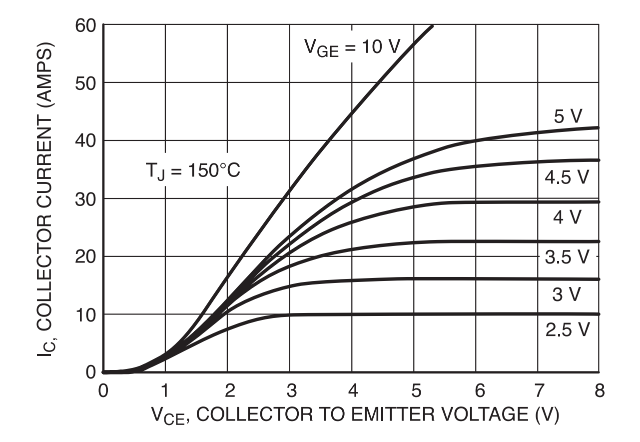
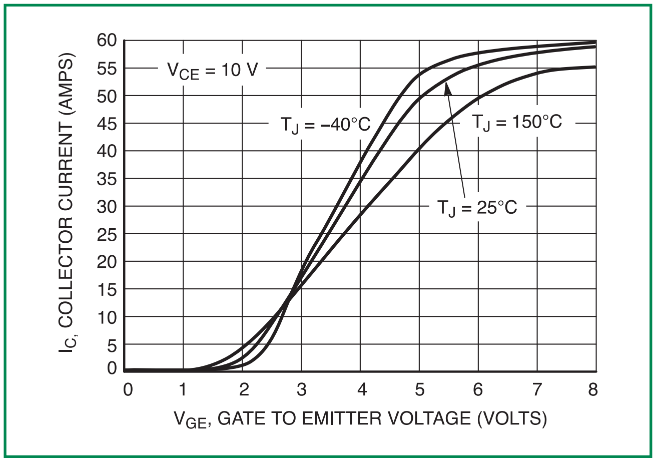


Figure 4. Transfer Characteristics



Ratings and Characteristic Curves

Figure 5. Collector–to–Emitter Saturation Voltage vs Junction Temperature

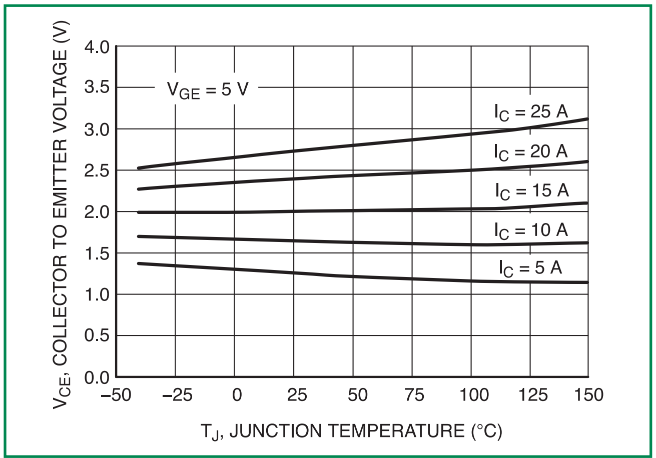


Figure 6. Collector–to–Emitter Voltage vs Gate–to–Emitter Voltage

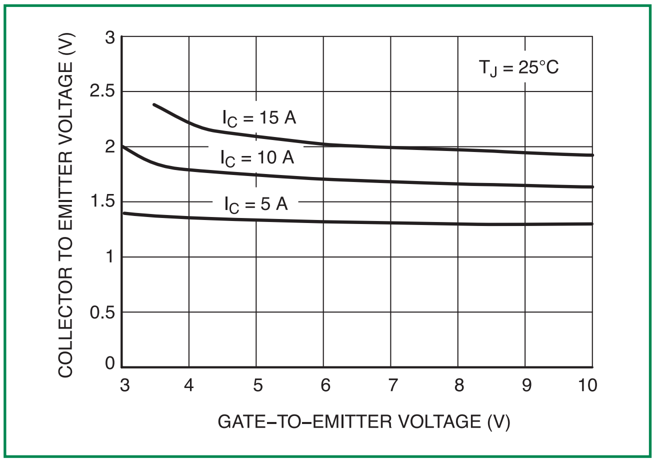


Figure 7. Collector–to–Emitter Voltage vs Gate–to–Emitter Voltage

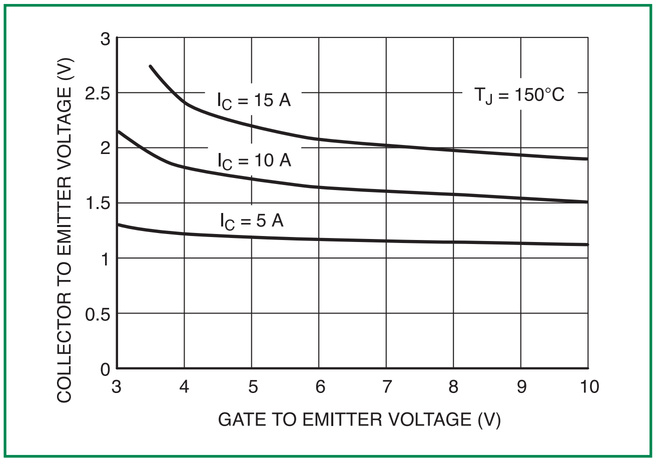


Figure 8. Capacitance Variation

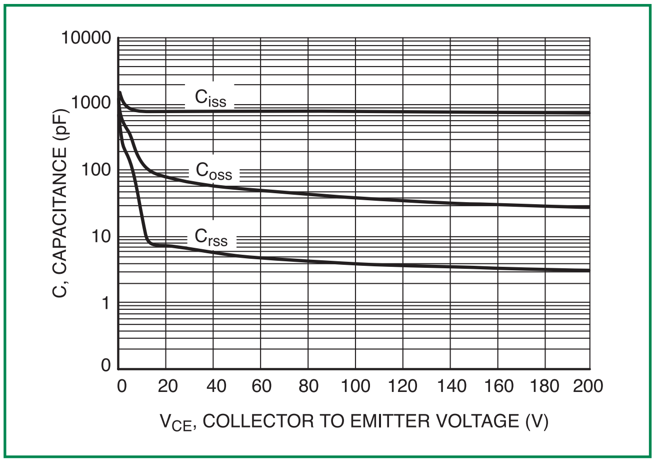


Figure 9. Gate Threshold Voltage versus Temperature

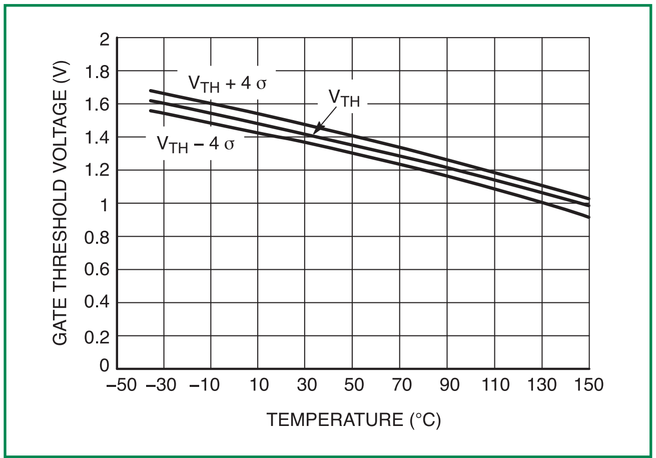


Figure 10. Minimum Open Secondary Latch Current vs. Temperature

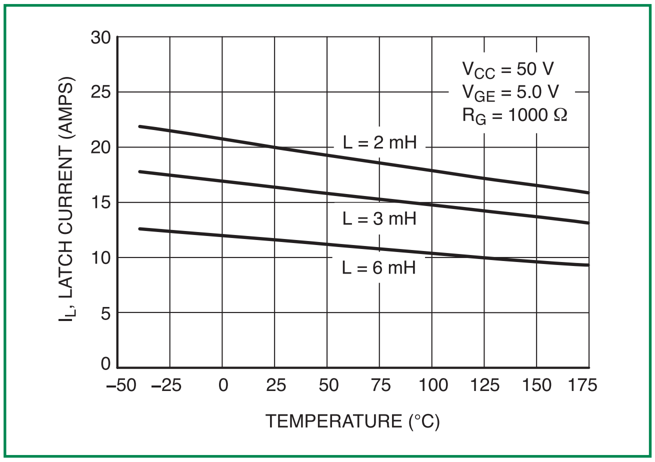


Figure 11. Typical Open Secondary Latch Current vs. Temperature

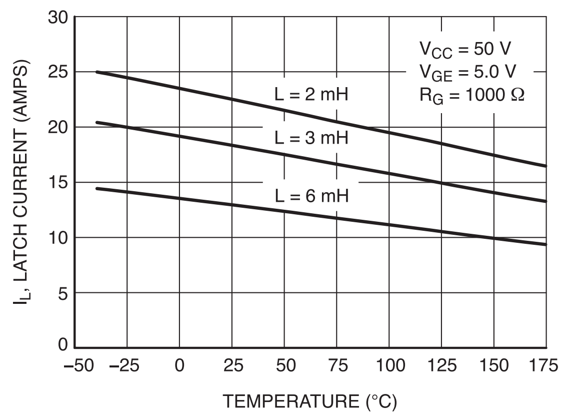


Figure 12. Inductive Switching Fall Time vs. Temperature

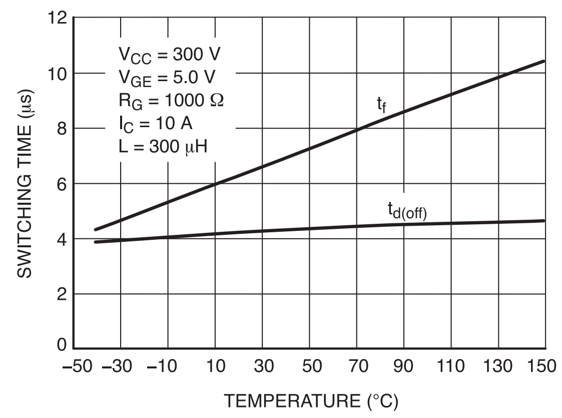


Figure 13. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at T_A = 25°C)

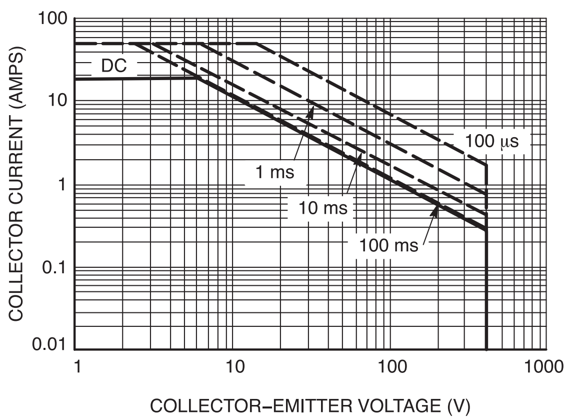


Figure 14. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at T_A = 125°C)

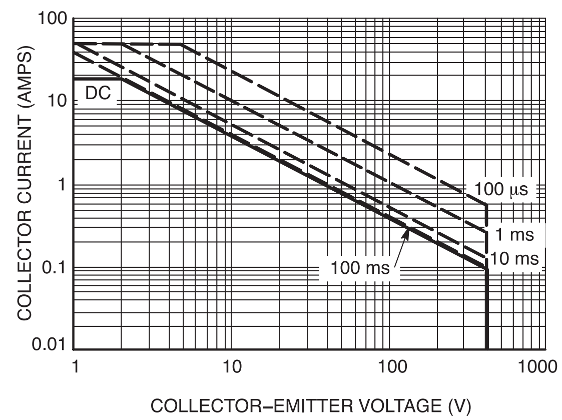


Figure 15. Pulse Train Safe Operating Area
(Mounted on an Infinite Heatsink at T_C = 25°C)

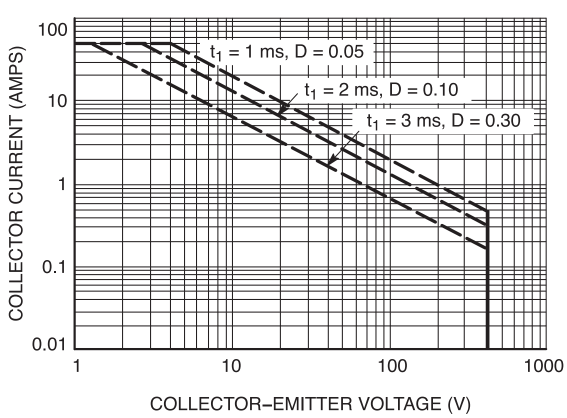


Figure 15. Pulse Train Safe Operating Area
(Mounted on an Infinite Heatsink at T_C = 125°C)

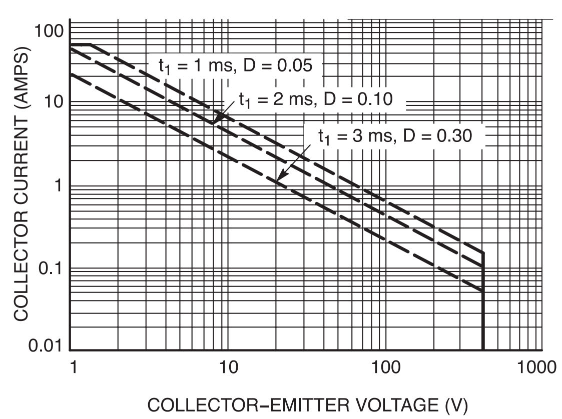


Figure 17. Circuit Configuration for Short Circuit Test #1

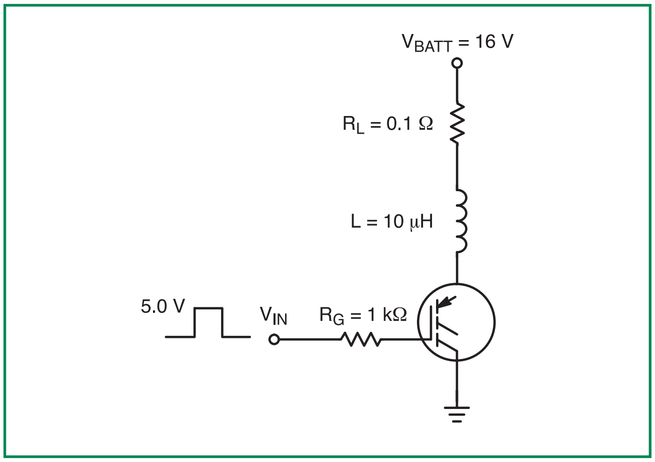


Figure 18. Circuit Configuration for Short Circuit Test #2

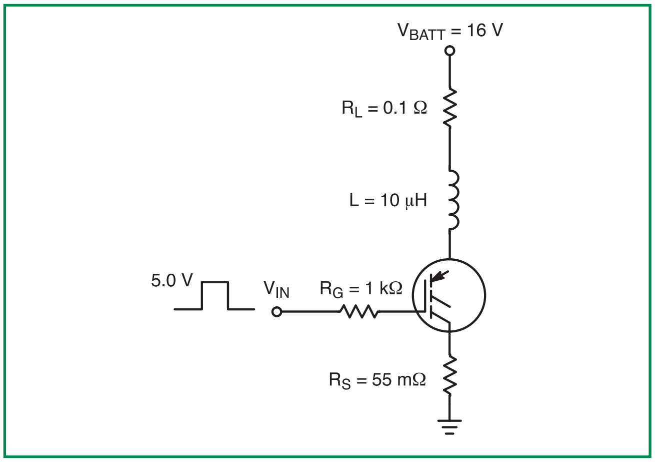
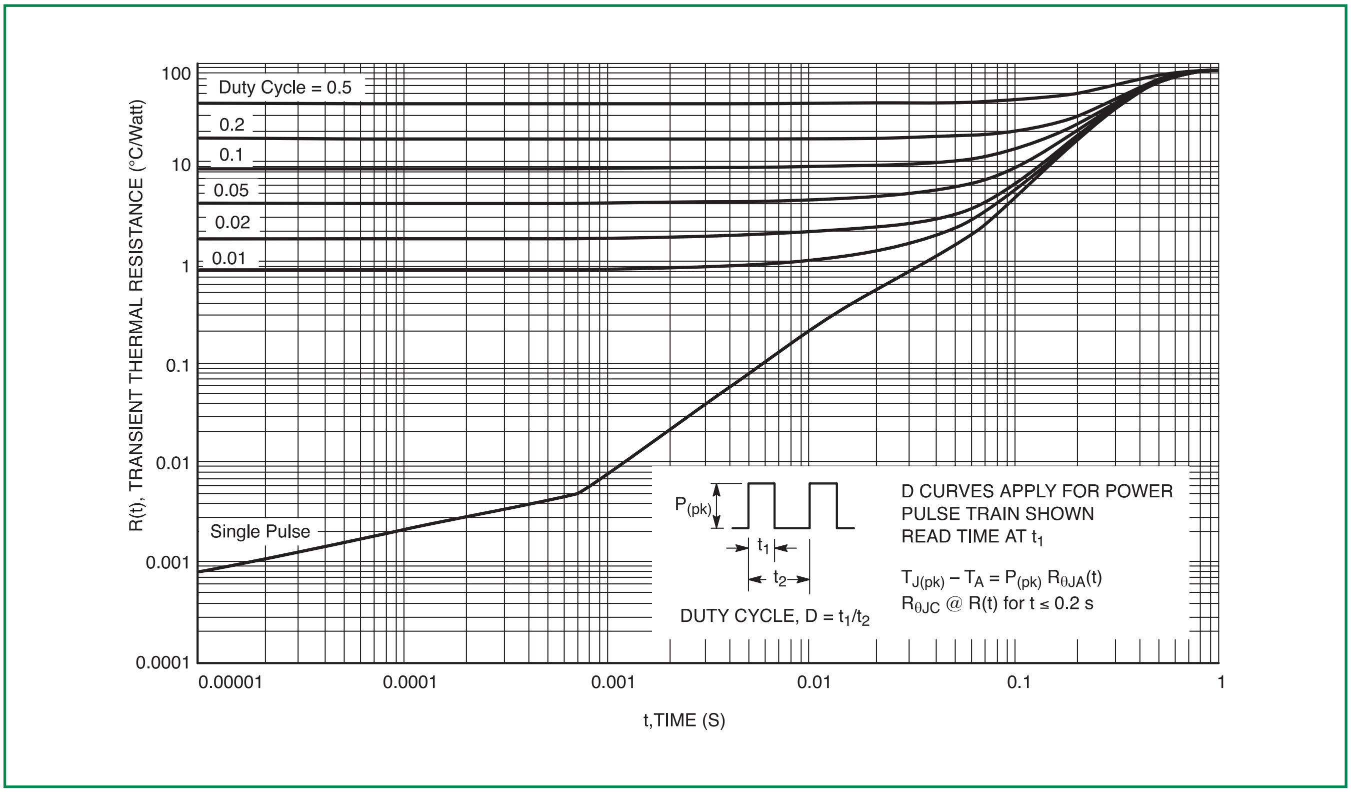
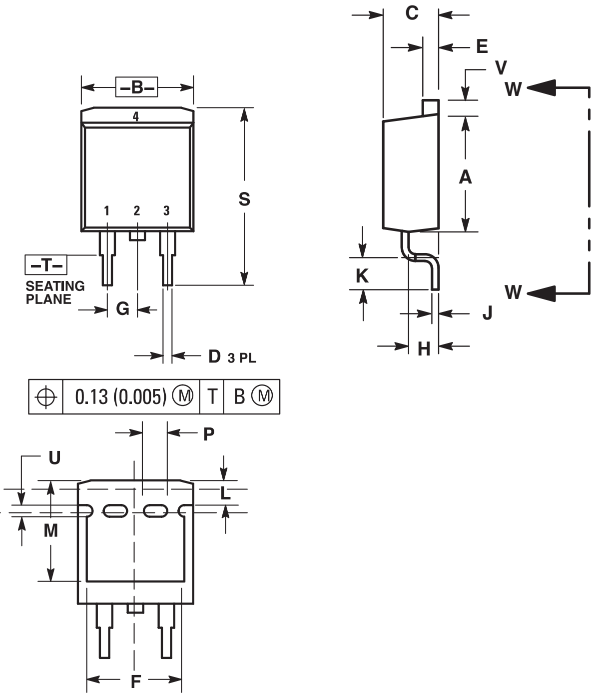


Figure 19. Transient Thermal Resistance (Non–normalized Junction–to–Ambient mounted on minimum pad area)



Dimensions



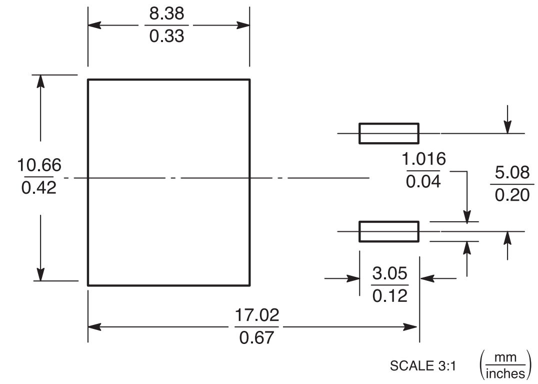
VIEW W–W

10.66
0.42

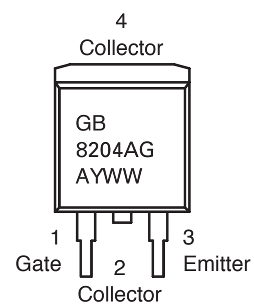
Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	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

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.

Soldering Footrpint



Part Marking System



GB8204x= Device Code

A= Assembly Location
Y= Year
WW = Work Week
G= Pb–Free Package

ORDERING INFORMATION

Device	Package	Shipping†
NGB8204ANT4G	D^2PAK (Pb–Free)	800 / Tape & Reel

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