

NGB8206N

Ignition IGBT

20 A, 350 V, 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 and Driver-on-Coil Applications
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage for Interfacing Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Optional Gate Resistor (R_G) and Gate-Emitter Resistor (R_{GE})

Applications

- Ignition Systems

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

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	390	V
Collector-Gate Voltage	V_{CER}	390	V
Gate-Emitter Voltage	V_{GE}	± 15	V
Collector Current-Continuous @ $T_C = 25^\circ\text{C}$ - Pulsed	I_C	20 50	A_{DC} A_{AC}
Continuous Gate Current	I_G	1.0	mA
Transient Gate Current ($t \leq 2$ ms, $f \leq 100$ Hz)	I_G	20	mA
ESD (Charged-Device Model)	ESD	2.0	kV
ESD (Human Body Model) $R = 1500 \Omega$, $C = 100$ pF	ESD	8.0	kV
ESD (Machine Model) $R = 0 \Omega$, $C = 200$ pF	ESD	500	V
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	150 1.0	W W/ $^\circ\text{C}$
Operating & Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$



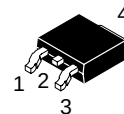
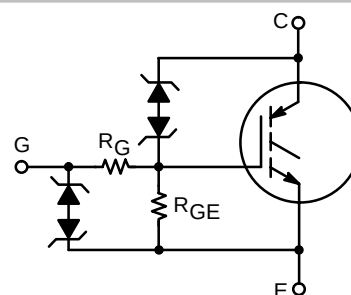
ON Semiconductor®

<http://onsemi.com>

20 AMPS

350 VOLTS

$V_{CE(on)} = 1.3 \text{ V @}$
 $I_C = 10 \text{ A, } V_{GE} \geq 4.5 \text{ V}$



D²PAK
CASE 418B
STYLE 4

MARKING DIAGRAM



NGB8206N = Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping [†]
NGB8206NT4	D ² PAK	800 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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

Characteristic	Symbol	Value	Unit
Single Pulse Collector-to-Emitter Avalanche Energy $V_{CC} = 50\text{ V}$, $V_{GE} = 5.0\text{ V}$, $Pk\ I_L = 16.7\text{ A}$, $L = 1.8\text{ mH}$, $R_g = 1\text{ k}\Omega$ Starting $T_J = 25^{\circ}\text{C}$ $V_{CC} = 50\text{ V}$, $V_{GE} = 5.0\text{ V}$, $Pk\ I_L = 14.9\text{ A}$, $L = 1.8\text{ mH}$, $R_g = 1\text{ k}\Omega$ Starting $T_J = 150^{\circ}\text{C}$ $V_{CC} = 50\text{ V}$, $V_{GE} = 5.0\text{ V}$, $Pk\ I_L = 14.1\text{ A}$, $L = 1.8\text{ mH}$, $R_g = 1\text{ k}\Omega$ Starting $T_J = 175^{\circ}\text{C}$	E_{AS}	250 200 180	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 $T_J = 25^{\circ}\text{C}$	$E_{AS(R)}$	2000	mJ

THERMAL CHARACTERISTICS

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.0	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	62.5	$^{\circ}\text{C/W}$
Maximum Temperature for Soldering Purposes, 0.125 in from case for 5 seconds (Note 2)	T_L	275	$^{\circ}\text{C}$

- When surface mounted to an FR4 board using the minimum recommended pad size.
- For further details, see Soldering and Mounting Techniques Reference Manual: SOLDERM/D.

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Clamp Voltage	BV_{CES}	$I_C = 2.0\text{ mA}$	$T_J = -40^{\circ}\text{C to } 175^{\circ}\text{C}$	325	350	375	V
		$I_C = 10\text{ mA}$	$T_J = -40^{\circ}\text{C to } 175^{\circ}\text{C}$	340	365	390	
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 15\text{ V}$, $V_{GE} = 0\text{ V}$	$T_J = 25^{\circ}\text{C}$		0.1	1.0	μA
			$T_J = 175^{\circ}\text{C}$	0.5	1.5	10	
		$V_{CE} = 175\text{ V}$, $V_{GE} = 0\text{ V}$	$T_J = 175^{\circ}\text{C}$	1.0	25	100*	
			$T_J = -40^{\circ}\text{C}$	0.4	0.8	5.0	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	$I_C = -75\text{ mA}$	$T_J = 25^{\circ}\text{C}$	30	35	39	V
			$T_J = 175^{\circ}\text{C}$	35	39	45*	
			$T_J = -40^{\circ}\text{C}$	30	33	37	
Reverse Collector-Emitter Leakage Current	$I_{CES(R)}$	$V_{CE} = -24\text{ V}$	$T_J = 25^{\circ}\text{C}$	0.05	0.25	0.5	mA
			$T_J = 175^{\circ}\text{C}$	1.0	12.5	25	
			$T_J = -40^{\circ}\text{C}$	0.005	0.03	0.25	
Gate-Emitter Clamp Voltage	BV_{GES}	$I_G = \pm 5.0\text{ mA}$	$T_J = -40^{\circ}\text{C to } 175^{\circ}\text{C}$	12	12.5	14	V
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 5.0\text{ V}$	$T_J = -40^{\circ}\text{C to } 175^{\circ}\text{C}$	200	300	350*	μA
Gate Resistor (Optional)	R_G		$T_J = -40^{\circ}\text{C to } 175^{\circ}\text{C}$		70		Ω
Gate Emitter Resistor	R_{GE}		$T_J = -40^{\circ}\text{C to } 175^{\circ}\text{C}$	14.25	16	25	$\text{k}\Omega$

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0\text{ mA}$, $V_{GE} = V_{CE}$	$T_J = 25^{\circ}\text{C}$	1.5	1.8	2.1	V
			$T_J = 175^{\circ}\text{C}$	0.7	1.0	1.3	
			$T_J = -40^{\circ}\text{C}$	1.7	2.0	2.3*	
Threshold Temperature Coefficient (Negative)				3.8	4.6	6.0	mV/ $^{\circ}\text{C}$

- Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.
- *Maximum Value of Characteristic across Temperature Range.

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 3)							
Collector-to-Emitter On-Voltage	$V_{CE(on)}$	$I_C = 6.5 \text{ A}, V_{GE} = 3.7 \text{ V}$	$T_J = 25^\circ\text{C}$	0.95	1.15	1.35	V
			$T_J = 175^\circ\text{C}$	0.70	0.95	1.15	
			$T_J = -40^\circ\text{C}$	1.0	1.30	1.40	
		$I_C = 9.0 \text{ A}, V_{GE} = 3.9 \text{ V}$	$T_J = 25^\circ\text{C}$	0.95	1.25	1.45	
			$T_J = 175^\circ\text{C}$	0.8	1.05	1.25	
			$T_J = -40^\circ\text{C}$	1.1	1.4	1.50	
		$I_C = 7.5 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = 25^\circ\text{C}$	0.85	1.15	1.4	
			$T_J = 175^\circ\text{C}$	0.7	0.95	1.2	
			$T_J = -40^\circ\text{C}$	1.0	1.3	1.6*	
		$I_C = 10 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = 25^\circ\text{C}$	1.0	1.3	1.6	
			$T_J = 175^\circ\text{C}$	0.8	1.05	1.4	
			$T_J = -40^\circ\text{C}$	1.1	1.4	1.7*	
		$I_C = 15 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = 25^\circ\text{C}$	1.15	1.45	1.7	
			$T_J = 175^\circ\text{C}$	1.0	1.3	1.55	
			$T_J = -40^\circ\text{C}$	1.25	1.55	1.8*	
		$I_C = 20 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = 25^\circ\text{C}$	1.3	1.6	1.9	
			$T_J = 175^\circ\text{C}$	1.2	1.5	1.8	
			$T_J = -40^\circ\text{C}$	1.4	1.75	2.0*	
Forward Transconductance	gfs	$I_C = 6.0 \text{ A}, V_{CE} = 5.0 \text{ V}$	$T_J = 25^\circ\text{C}$	10	18	25	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	C_{ISS}	$f = 10 \text{ kHz}, V_{CE} = 25 \text{ V}$	$T_J = 25^\circ\text{C}$	1100	1300	1500	pF
Output Capacitance	C_{OSS}			70	80	90	
Transfer Capacitance	C_{RSS}			18	20	22	

SWITCHING CHARACTERISTICS

Turn-Off Delay Time (Resistive)	$t_{d(off)}$	$V_{CC} = 300 \text{ V}, I_C = 9.0 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 33 \Omega$ $V_{GE} = 5 \text{ V}$	$T_J = 25^\circ\text{C}$	6.0	8.0	10	μSec
Fall Time (Resistive)	t_f		$T_J = 175^\circ\text{C}$	6.0	8.0	10	
			$T_J = 25^\circ\text{C}$	4.0	6.0	8.0	
			$T_J = 175^\circ\text{C}$	8.0	10.5	14	
Turn-Off Delay Time (Inductive)	$t_{d(off)}$	$V_{CC} = 300 \text{ V}, I_C = 9.0 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, L = 300 \mu\text{H}$ $V_{GE} = 5 \text{ V}$	$T_J = 25^\circ\text{C}$	3.0	5.0	7.0	
Fall Time (Inductive)	t_f		$T_J = 175^\circ\text{C}$	5.0	7.0	9.0	
			$T_J = 25^\circ\text{C}$	1.5	3.0	4.5	
			$T_J = 175^\circ\text{C}$	5.0	7.0	10	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 14 \text{ V}, I_C = 9.0 \text{ A}$ $R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \Omega$ $V_{GE} = 5 \text{ V}$	$T_J = 25^\circ\text{C}$	1.0	1.5	2.0	
Rise Time	t_r		$T_J = 175^\circ\text{C}$	1.0	1.5	2.0	
			$T_J = 25^\circ\text{C}$	4.0	6.0	8.0	
			$T_J = 175^\circ\text{C}$	3.0	5.0	7.0	

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

*Maximum Value of Characteristic across Temperature Range.

TYPICAL ELECTRICAL CHARACTERISTICS

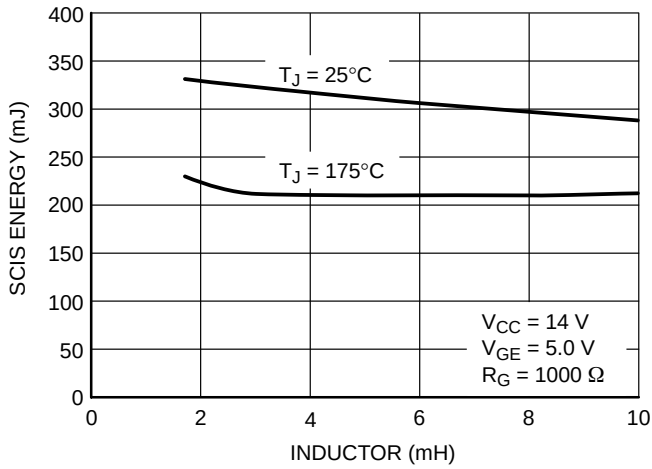


Figure 1. Self Clamped Inductive Switching

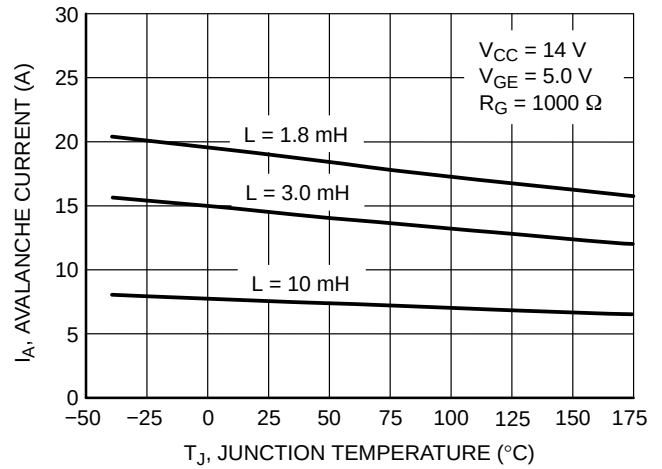


Figure 2. Open Secondary Avalanche Current vs. Temperature

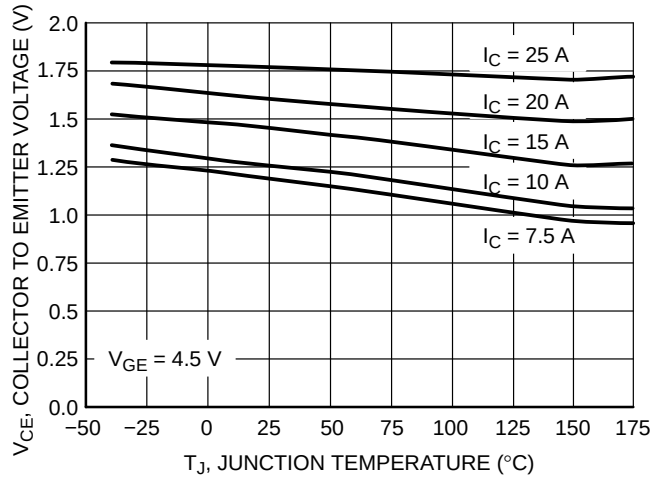


Figure 3. Collector-to-Emitter Voltage vs. Junction Temperature

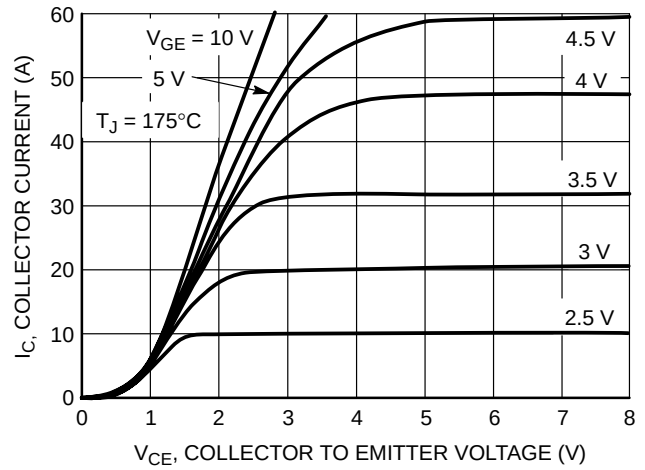


Figure 4. Collector Current vs. Collector-to-Emitter Voltage

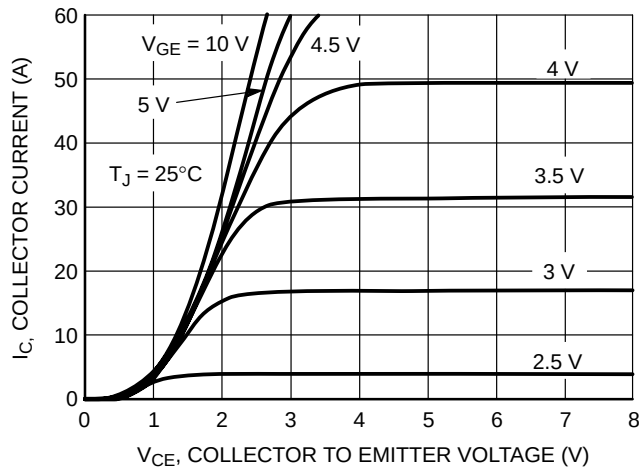


Figure 5. Collector Current vs. Collector-to-Emitter Voltage

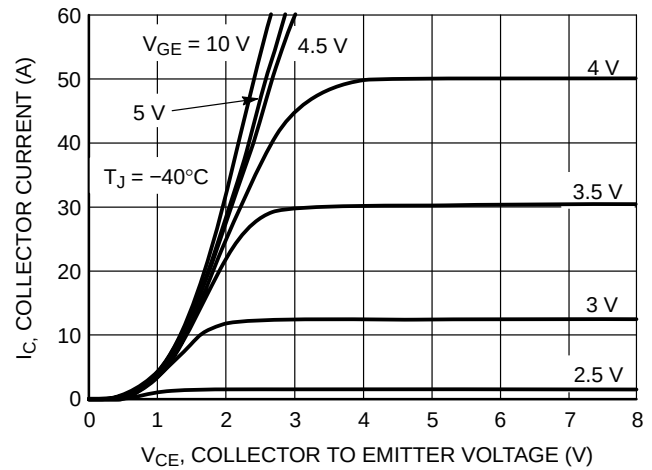


Figure 6. Collector Current vs. Collector-to-Emitter Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

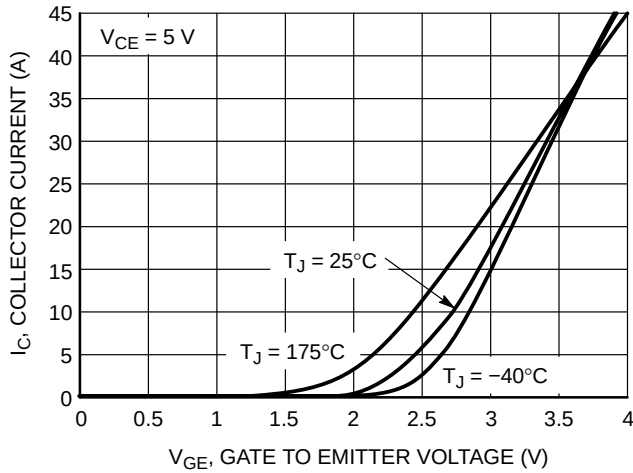


Figure 7. Transfer Characteristics

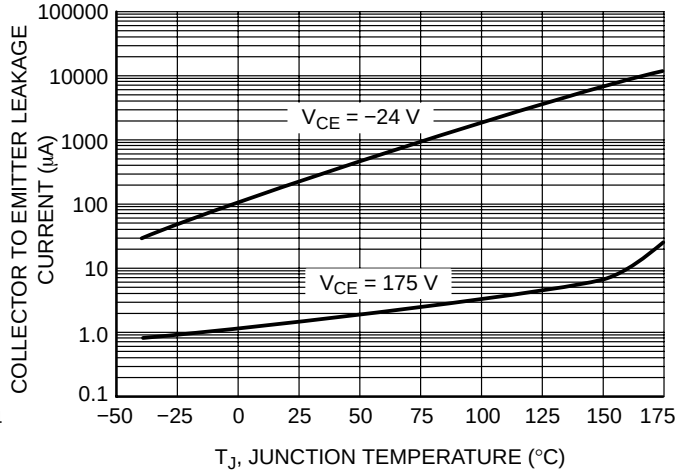


Figure 8. Collector-to-Emitter Leakage Current vs. Temperature

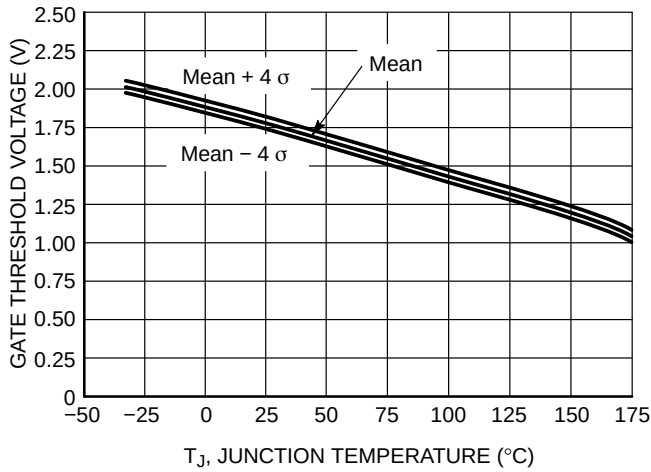


Figure 9. Gate Threshold Voltage vs. Temperature

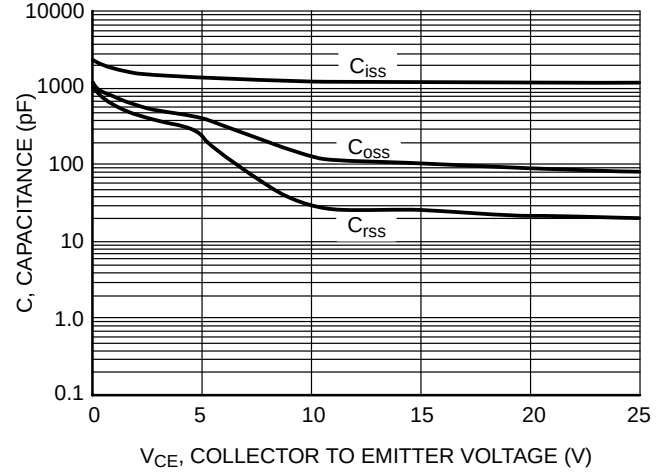


Figure 10. Capacitance vs. Collector-to-Emitter Voltage

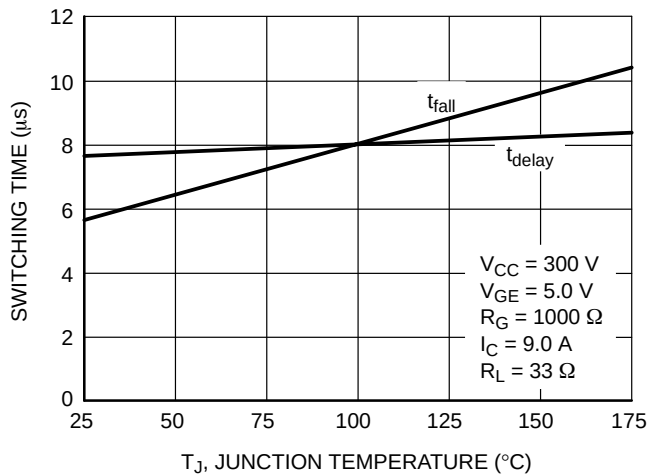


Figure 11. Resistive Switching Fall Time vs. Temperature

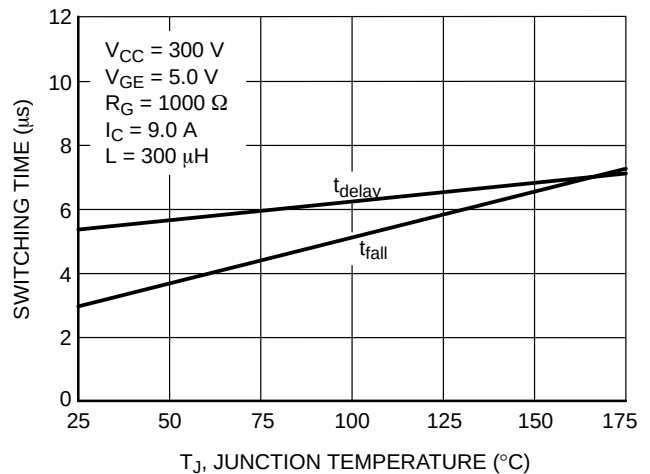
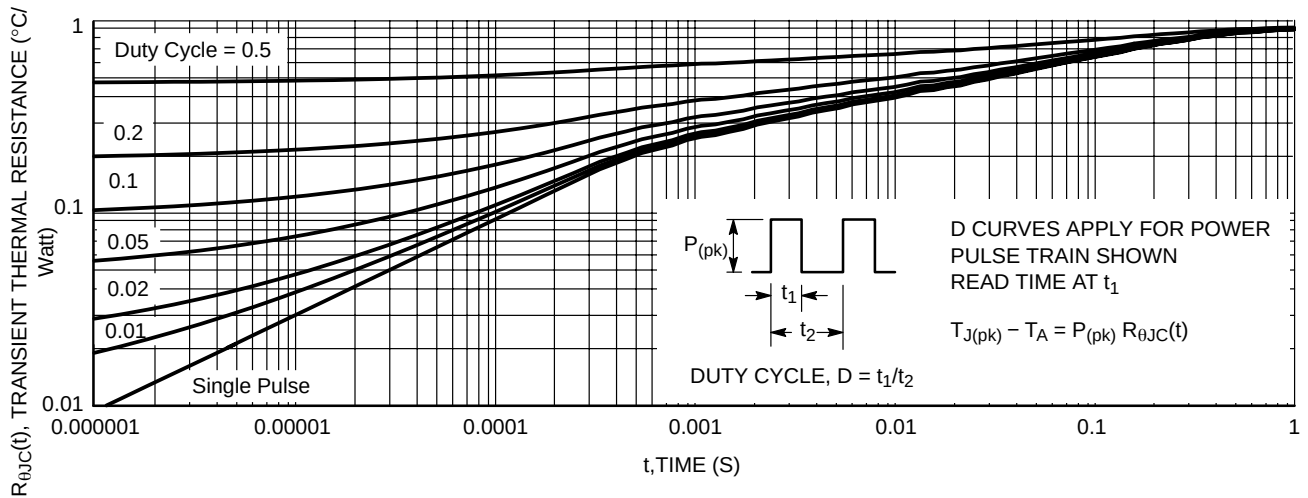


Figure 12. Inductive Switching Fall Time vs. Temperature

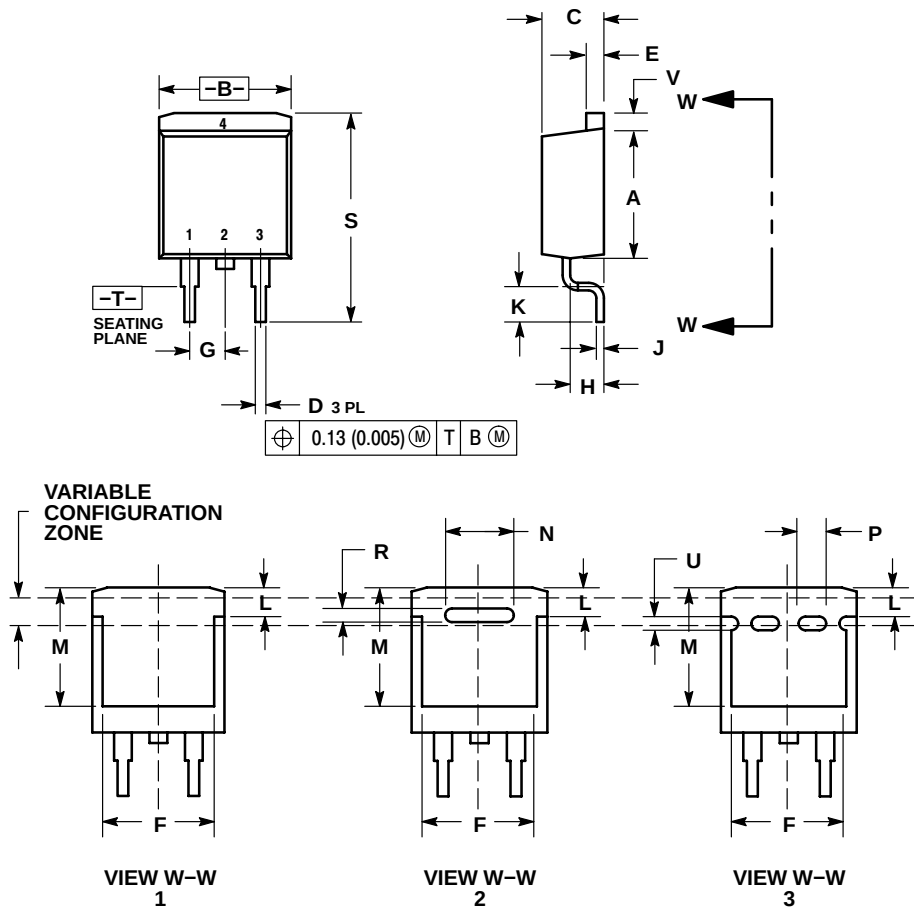


**Figure 13. Best Case Transient Thermal Resistance
(Non-normalized Junction-to-Case Mounted on Cold Plate)**

NGB8206N

PACKAGE DIMENSIONS

D²PAK CASE 418B-04 ISSUE H



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
- COLLECTOR
- EMITTER
- COLLECTOR

SOLDERING FOOTPRINT

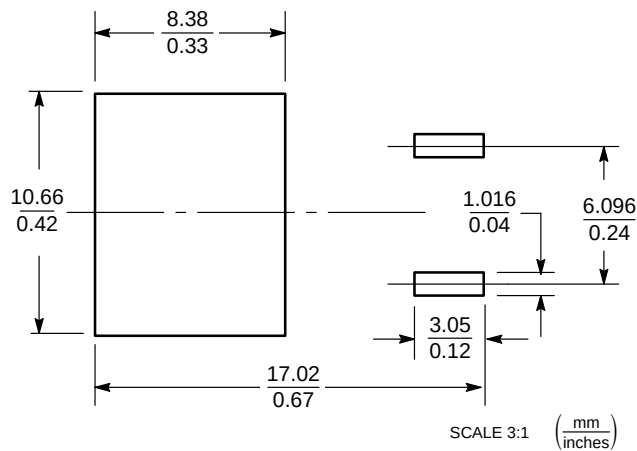


Figure 14. D²PAK

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