Ignition IGBT

20 A, 365 V, N-Channel D²PAK

This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Overvoltage 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
- Minimum Avalanche Energy 500 mJ
- Gate Resistor (R_G) = 70 Ω
- These are Pb-Free Devices

Applications

• Ignition Systems

MAXIMUM RATINGS (T, = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CES}	365	V
Gate-Emitter Voltage	V _{GE}	±15	V
Collector Current–Continuous @ T _C = 25°C – Pulsed	I _C	20 50	A _{DC} A _{AC}
Continuous Gate Current	IG	1.0	mA
Transient Gate Current (t \leq 2 ms, f \leq 100 Hz)	IG	20	mA
ESD (Charged-Device Model)	ESD	2.0	kV
ESD (Human Body Model) R = 1500 Ω , C = 100 pF	ESD	8.0	kV
ESD (Machine Model) R = 0 Ω , C = 200 pF	ESD	500	V
Total Power Dissipation @ T _C = 25°C Derate above 25°C (Note 1)	P _D	165 1.1	W W/°C
Operating & Storage Temperature Range	T _J , T _{stg}	–55 to +175	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

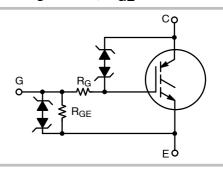
1. Assuming infinite heatsink Case-to-Ambient



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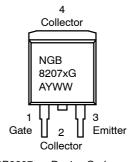
http://onsemi.com

20 AMPS, 365 VOLTS $V_{CE(on)} = 1.5 \text{ V Typ } @$ $I_C = 10 \text{ A}, V_{GE} \ge 4.5 \text{ V}$





MARKING DIAGRAM



NGB8207x = Device Codex = N or B

A = Assembly Location

Y = Year
WW = Work Week
G = Pb-Free Package

ORDERING INFORMATION

Device	Package	Shipping [†]
NGB8207NT4G	D ² PAK (Pb-Free)	800 / Tape & Reel
NGB8207BNT4G	D ² PAK (Pb-Free)	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.

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UNCLAMPED COLLECTOR-TO-EMITTER AVALANCHE CHARACTERISTICS ($-55^{\circ} \le T_{J} \le 175^{\circ}C$)

Characteristic	Symbol	Value	Unit
Single Pulse Collector–to–Emitter Avalanche Energy $V_{CC}=50~V,~V_{GE}=10~V,~Pk~I_L=16.5~A,~L=3.7~mH,~R_g=1~k\Omega~Starting~T_J=25^{\circ}C~V_{CC}=50~V,~V_{GE}=10~V,~Pk~I_L=10~A,~L=6.1~mH,~R_g=1~k\Omega~Starting~T_J=125^{\circ}C$	E _{AS}	500 306	mJ
Reverse Avalanche Energy V_{CC} = 100 V, V_{GE} = 20 V, Pk I _L = 25.8 A, L = 6.0 mH, Starting T _J = 25°C	E _{AS(R)}	2000	mJ

THERMAL CHARACTERISTICS

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.9	°C/W
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	50	°C/W
Maximum Temperature for Soldering Purposes, 0.125 in from case for 5 seconds (Note 3)	TL	275	°C

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

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Тур	Max	Unit
OFF CHARACTERISTICS	•						
Collector-Emitter Clamp Voltage	BV _{CES}	I _C = 2.0 mA	$T_{J} = -40^{\circ}\text{C to } 175^{\circ}\text{C}$	325	350	375	V
		I _C = 10 mA	$T_{J} = -40^{\circ}\text{C} \text{ to } 175^{\circ}\text{C}$	340	365	390	
Zero Gate Voltage Collector Current	I _{CES}	V _{CE} = 24 V V _{GE} = 0 V	T _J = 25°C		0.1	2.0	μΑ
			T _J = 25°C	-	1.0	5	
		$V_{CE} = 250 \text{ V}$ $V_{GE} = 0 \text{ V}$	T _J = 175°C	70	85	150	
		I GE 5 1	T _J = −40°C	_	0.25	2.5	
Reverse Collector-Emitter Clamp Voltage	B _{VCES(R)}		T _J = 25°C	30	33	39	V
		$I_C = -75 \text{ mA}$	T _J = 175°C	30	36	42	
			T _J = -40°C	29	32	35	
Reverse Collector-Emitter Leakage Current	I _{CES(R)}		T _J = 25°C	0.10	0.25	0.85	mA
		V _{CE} = -24 V	T _J = 175°C	20	25	40	
			T _J = −40°C	_	0.03	0.3	
Gate-Emitter Clamp Voltage	BV _{GES}	$I_G = \pm 5.0 \text{ mA}$	$T_J = -40^{\circ}\text{C} \text{ to } 175^{\circ}\text{C}$	12	13	14.5	V
Gate-Emitter Leakage Current	I _{GES}	V _{GE} = ±10 V	$T_J = -40^{\circ}\text{C} \text{ to } 175^{\circ}\text{C}$	500	700	1000	μΑ
Gate Resistor	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	kΩ
ON CHARACTERISTICS (Note 4)	-			-	-	-	-
Cata Throphold Valtage	1/		T 25°C	4.0	15	2.0	\/

Gate Threshold Voltage	V _{GE(th)}		T _J = 25°C	1.2	1.5	2.0	V
		I _C = 1.0 mA V _{GE} = V _{CE}	T _J = 175°C	0.6	0.8	1.2	
		GE OE	$T_J = -40^{\circ}C$	1.4	1.7	2.0	
Threshold Temperature Coefficient (Negative)				12	12	12	mV/°C
Collector-to-Emitter On-Voltage	V _{CE(on)}		T _J = 25°C	1.0	1.3	1.6	V
		$I_{C} = 6.0 \text{ A}$ $V_{GE} = 4.0 \text{ V}$	T _J = 175°C	0.8	1.1	1.4	
		GL	$T_J = -40^{\circ}C$	1.15	1.4	1.75	
		I _C = 10 mA V _{GE} = 4.5 V	T _J = 25°C	-	0.62	1.0	

^{*}Maximum Value of Characteristic across Temperature Range.

^{4.} Pulse Test: Pulse Width \leq 300 μ S, Duty Cycle \leq 2%.

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Тур	Max	Unit
ON CHARACTERISTICS (Note 4)	•	•					
Collector-to-Emitter On-Voltage V _{CE(on)}		T _J = 25°C	1.1	1.5	1.7	V	
		I _C = 8.0 A V _{GE} = 4.0 V	T _J = 175°C	1.0	1.3	1.6	
		I GE	$T_J = -40^{\circ}C$	1.2	1.5	1.85	
			T _J = 25°C	1.2	1.6	1.9	
		I _C = 10 A V _{GE} = 3.7 V	T _J = 175°C	1.1	1.45	1.8	
		VGE - 0.7 V	$T_J = -40^{\circ}C$	1.3	1.7	2.0	
			T _J = 25°C	1.1	1.5	1.85	
		I _C = 10 A V _{GE} = 4.0 V	T _J = 175°C	1.1	1.4	1.75	
		VGE = 4.0 V	$T_J = -40^{\circ}C$	1.35	1.7	2.1	
			T _J = 25°C	1.2	1.5	1.8	
		I _C = 10 A V _{GE} = 4.5 V	T _J = 175°C	1.1	1.4	1.7	
		VGE - 4.5 V	T _J = −40°C	1.2	1.6	2.0	
			T _J = 25°C	1.45	1.85	2.15	
		I _C = 15 A V _{GE} = 4.0 V	T _J = 175°C	1.6	1.9	2.4	
		VGE = 4.0 V	T _J = -40°C	1.5	1.9	2.25	
			T _J = 25°C	1.6	2.1	2.6	
		I _C = 20 A V _{GE} = 4.0 V	T _J = 175°C	2.0	2.4	3.1	
		V _{GE} = 4.0 V	T _J = -40°C	1.6	2.1	2.5	
Forward Transconductance	gfs	I _C = 6.0 A V _{CE} = 5.0 V	T _J = 25°C	-	15.8	-	Mhos
DYNAMIC CHARACTERISTICS	•						
Input Capacitance	C _{ISS}			750	810	900	pF
Output Capacitance	C _{OSS}	f = 10 kHz T _J = 25°C	75	90	105		
Transfer Capacitance	C _{RSS}	V _{CE} = 25 V	., _5 5	4	7	12	1
SWITCHING CHARACTERISTICS	I.	1		1			1
Turn-On Delay Time (Resistive) Low Voltage	t _{d(on)}	V _{CE} = 14 V R _L = 1.0 Ω	T _J = 25°C	0.5	0.55	0.7	μSec
Rise Time (Resistive) Low Voltage	t _r	$V_{GE} = 5.0 \text{ V}$ $R_{G} = 1000 \Omega$	T _J = 25°C	2.0	2.32	2.7	
Turn-Off Delay Time (Resistive) Low Voltage	t _{d(off)}	V _{CE} = 14 V R _L = 1.0 Ω	T _J = 25°C	2.0	2.5	3.0	
Fall Time (Resistive) Low Voltage	t _f	$V_{GE} = 5.0 \text{ V}$ $R_{G} = 1000 \Omega$	T _J = 25°C	8.0	10	13	
Turn-On Delay Time (Resistive) High Voltage	t _{d(on)}	V _{CE} = 300 V R _L = 46 Ω	T _J = 25°C	0.5	0.65	0.75	
Rise Time (Resistive) High Voltage	t _r	$V_{GE} = 5.0 \text{ V}$ $R_{G} = 1000 \Omega$	T _J = 25°C	0.7	1.8	2.0	
Turn-Off Delay Time (Resistive) High Voltage	t _{d(off)}	$V_{CE} = 300 \text{ V}$ $R_L = 46 \Omega$	T _J = 25°C	4.0	4.7	6.0	
Fall Time (Resistive) High Voltage	t _f	$V_{GE} = 5.0 \text{ V}$ $R_G = 1000 \Omega$	T _J = 25°C	6.0	10	15	

^{*}Maximum Value of Characteristic across Temperature Range.

^{4.} Pulse Test: Pulse Width \leq 300 μ S, Duty Cycle \leq 2%.

TYPICAL ELECTRICAL CHARACTERISTICS

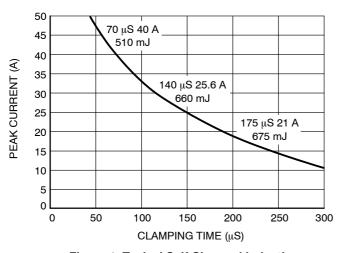


Figure 1. Typical Self Clamped Inductive Switching Performance (SCIS) @ 25°C

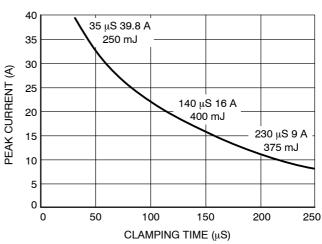


Figure 2. Typical Self Clamped Inductive Switching Performance (SCIS) @ 150°C

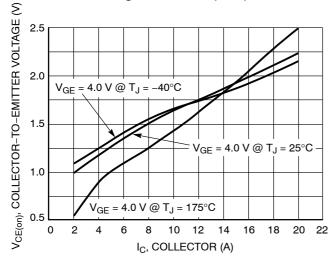


Figure 3. Collector-to-Emitter Voltage vs.
Collector Current

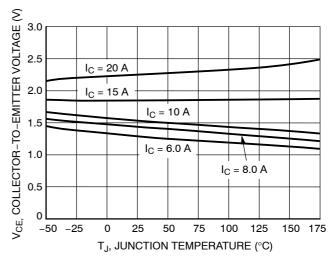


Figure 4. Collector-to-Emitter Voltage vs. Junction Temperature

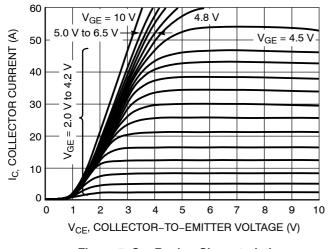


Figure 5. On–Region Characteristics @ T_J = 25°C

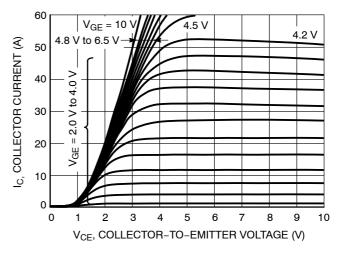
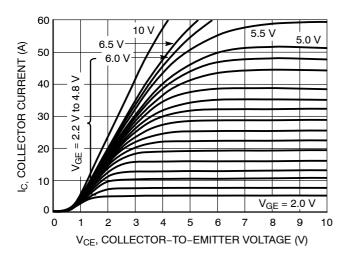


Figure 6. On–Region Characteristics $@T_J = -40^{\circ}C$

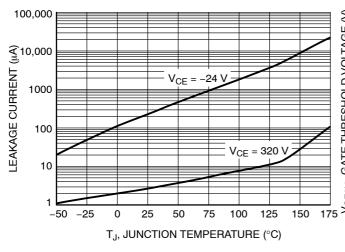
TYPICAL ELECTRICAL CHARACTERISTICS



 $V_{CE} \ge 5.0 \text{ V}$ V_{CE}

Figure 7. On–Region Characteristics @ T_J = 175°C

Figure 8. Transfer Characteristics



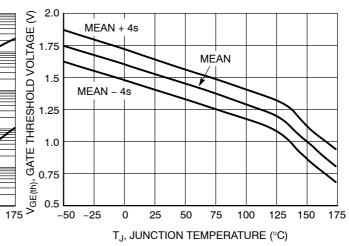
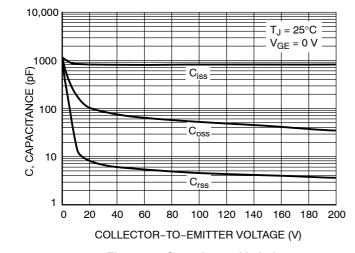


Figure 9. Collector-to-Emitter Leakage Current vs. Temperature

Figure 10. Gate Threshold Voltage vs. Temperature



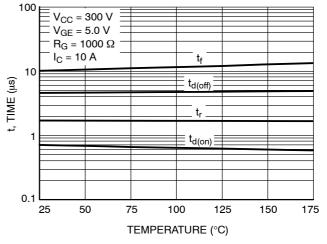


Figure 11. Capacitance Variation

Figure 12. Resistive Switching Time Variation vs. Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

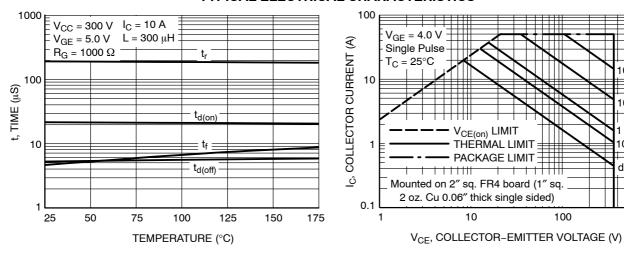


Figure 13. Inductive Switching Time Variation vs. Temperature

Figure 14. Forward Biased Safe Operating Area

10 μs

100 μs

ms

10 ms≢

dc | | | |

1000

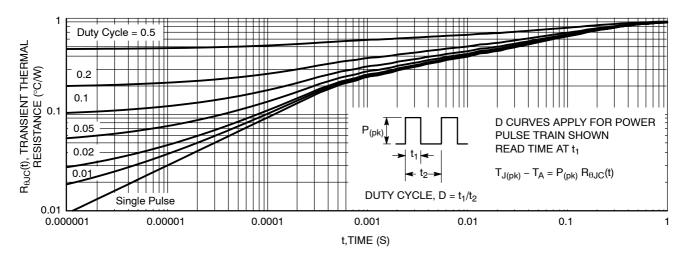
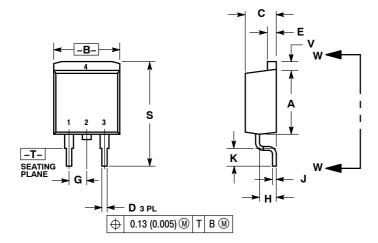


Figure 15. Best Case Transient Thermal Resistance (Non-normalized Junction-to-Case Mounted on Cold Plate)

PACKAGE DIMENSIONS

D²PAK 3 CASE 418B-04 **ISSUE J**



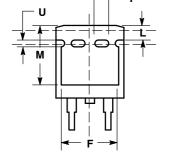
NOTES:

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

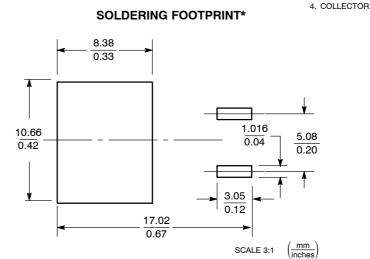
	INC	HES	MILLIN	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.340	0.380	8.64	9.65
В	0.380	0.405	9.65	10.29
С	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
Е	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100	BSC	2.54	BSC
Н	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	1.83
М	0.280	0.320	7.11	8.13
N	0.197	REF	5.00	REF
P	0.079	0.079 REF		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



VIEW W-W



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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 APT40GP60B2DQ2G
 APT40GP90B2DQ2G
 APT50GN120B2G
 APT50GT60BRG

 APT64GA90B2D30
 APT70GR120J
 NGTB10N60FG
 NGTB30N60L2WG
 NGTG25N120FL2WG
 IGP30N60H3XKSA1
 STGB15H60DF

 STGFW20V60DF
 STGFW40V60DF
 STGFW40V60F
 STGWA25H120DF2
 FGB3236_F085
 APT25GN120BG
 APT25GR120S

 APT30GN60BDQ2G
 APT30GN60BG
 APT30GS60BRDQ2G
 APT30N60BC6
 APT35GP120JDQ2
 APT36GA60B

 APT45GR65B2DU30
 APT50GP60B2DQ2G
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 APT70GR65B2SCD30
 GT50JR22(STA1ES)
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 STGB10H60DF
 STGB20V60F
 STGB40V60F
 STGFW80V60F
 IGW40N120H3FKSA1

 RJH60D7BDPQ-E0#T2
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