

NGD8209N

Ignition IGBT 12 A, 410 V N-Channel DPAK

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 motorbike ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

Features

- Ideal for Coil-on-Plug Applications
- DPAK Package Offers Smaller Footprint and Increased Board Space
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Low Saturation Voltage
- High Pulsed Current Capability
- These are Pb-Free Devices

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|-----------------------------------|----------------|------------------------------------|
| Collector-Emitter Voltage | V _{CES} | 445 | V _{DC} |
| Collector-Gate Voltage | V _{CER} | 445 | V _{DC} |
| Gate-Emitter Voltage | V _{GE} | 15 | V _{DC} |
| Collector Current-Continuous @ T _C = 25°C - Pulsed | I _C | 12 30 | 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 | 94 0.63 | Watts W/°C |
| Operating and Storage Temperature Range | T _J , T _{stg} | -55 to +175 | °C |

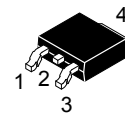
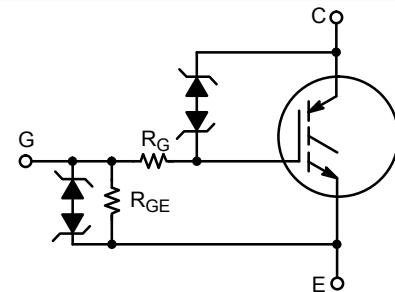
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



Expertise Applied | Answers Delivered

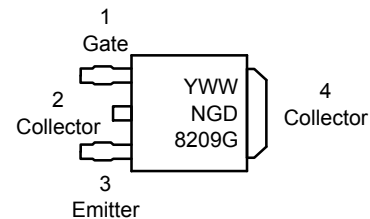
Littelfuse.com

12 AMPS
410 VOLTS
V_{CE(on)} ≤ 2.0 V @
I_C = 6.0 A, V_{GE} ≥ 4.0 V



**DPAK
CASE 369C
STYLE 7**

MARKING DIAGRAM



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

ORDERING INFORMATION

| Device | Package | Shipping† |
|-------------|-------------------|--------------------|
| NGD8209NT4G | DPAK (Pb-Free) | 2500 / Tape & Reel |

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UNCLAMPED COLLECTOR-TO-EMITTER AVALANCHE CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|----------|-------|------|
| Single Pulse Collector-to-Emitter Avalanche Energy $V_{CC} = 50\text{ V}$, $V_{GE} = 5.0\text{ V}$, $\text{Pk } I_L = 7.4\text{ A}$, $L = 10\text{ mH}$, Starting $T_J = 25^\circ\text{C}$ | E_{AS} | 274 | mJ |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|-----------------|-------|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.6 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Ambient (Note 1) | $R_{\theta JA}$ | 105 | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | T_L | 275 | $^\circ\text{C}$ |

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

ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|----------------|--------|-----------------|-------------|-----|-----|-----|------|
|----------------|--------|-----------------|-------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | | |
|---|---------------|--|--|-----|------|------|--------------------|
| Collector-Emitter Clamp Voltage | BV_{CES} | $I_C = 2.0\text{ mA}$ | $T_J = -40^\circ\text{C}$ to 150°C | 380 | 410 | 435 | V_{DC} |
| | | $I_C = 10\text{ mA}$ | $T_J = -40^\circ\text{C}$ to 150°C | 390 | 420 | 445 | |
| Zero Gate Voltage Collector Current | I_{CES} | $V_{CE} = 350\text{ V}$, $V_{GE} = 0\text{ V}$ | $T_J = 25^\circ\text{C}$ | - | 1.0 | 25 | μA_{DC} |
| | | | $T_J = 150^\circ\text{C}$ | - | 9.0 | 50 | |
| | | | $T_J = -40^\circ\text{C}$ | - | 0.5 | 15 | |
| Reverse Collector-Emitter Leakage Current | I_{ECS} | $V_{CE} = -24\text{ V}$ | $T_J = 25^\circ\text{C}$ | - | 0.5 | 1.0 | mA |
| | | | $T_J = 150^\circ\text{C}$ | - | 10 | 30 | |
| | | | $T_J = -40^\circ\text{C}$ | - | 0.05 | 0.5 | |
| Reverse Collector-Emitter Clamp Voltage | $BV_{CES(R)}$ | $I_C = -75\text{ mA}$ | $T_J = 25^\circ\text{C}$ | 26 | 33 | 38 | V_{DC} |
| | | | $T_J = 150^\circ\text{C}$ | 29 | 36 | 41 | |
| | | | $T_J = -40^\circ\text{C}$ | 24 | 32 | 36 | |
| Gate-Emitter Clamp Voltage | BV_{GES} | $I_G = 5.0\text{ mA}$ | $T_J = -40^\circ\text{C}$ to 150°C | 10 | 13 | 16 | V_{DC} |
| Gate-Emitter Leakage Current | I_{GES} | $V_{GE} = 10\text{ V}$ | $T_J = -40^\circ\text{C}$ to 150°C | 380 | 635 | 1000 | μA_{DC} |
| Gate Resistor | R_G | - | $T_J = -40^\circ\text{C}$ to 150°C | - | 70 | - | Ω |
| Gate Emitter Resistor | R_{GE} | - | $T_J = -40^\circ\text{C}$ to 150°C | 10 | 16 | 26 | k Ω |

ON CHARACTERISTICS (Note 2)

| | | | | | | | |
|--|--------------|--|---------------------------|-----|------|-----|----------------------|
| Gate Threshold Voltage | $V_{GE(th)}$ | $I_C = 1.0\text{ mA}$, $V_{GE} = V_{CE}$ | $T_J = 25^\circ\text{C}$ | 1.0 | 1.42 | 2.0 | V_{DC} |
| | | | $T_J = 150^\circ\text{C}$ | 0.7 | 0.95 | 1.5 | |
| | | | $T_J = -40^\circ\text{C}$ | 1.1 | 1.62 | 2.2 | |
| Threshold Temperature Coefficient (Negative) | - | - | - | - | 3.5 | - | mV/ $^\circ\text{C}$ |

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

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ELECTRICAL CHARACTERISTICS (continued)

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|--|--------------|---|---|------|------|------|----------|
| ON CHARACTERISTICS (continued) (Note 3) | | | | | | | |
| Collector-to-Emitter On-Voltage | $V_{CE(on)}$ | $I_C = 6.0 \text{ A}$, $V_{GE} = 4.0 \text{ V}$ | $T_J = 25^\circ\text{C}$ | 0.8 | 1.45 | 2.0 | V_{DC} |
| | | | $T_J = 150^\circ\text{C}$ | 0.85 | 1.44 | 1.85 | |
| | | | $T_J = -40^\circ\text{C}$ | 1.0 | 1.5 | 1.95 | |
| | | $I_C = 10 \text{ A}$, $V_{GE} = 4.5 \text{ V}$ | $T_J = 25^\circ\text{C}$ | 1.1 | 1.79 | 2.3 | |
| | | | $T_J = 150^\circ\text{C}$ | 1.2 | 1.9 | 2.2 | |
| | | | $T_J = -40^\circ\text{C}$ | 1.3 | 1.77 | 2.2 | |
| Forward Transconductance | gfs | $V_{CE} = 5.0 \text{ V}$, $I_C = 6.0 \text{ A}$ | $T_J = -40^\circ\text{C}$ to 150°C | 5.0 | 14 | 30 | Mhos |

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

TYPICAL CHARACTERISTICS

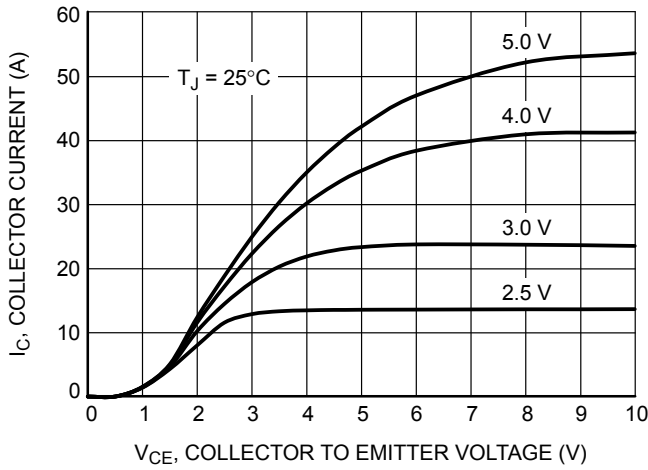


Figure 1. Output Characteristics

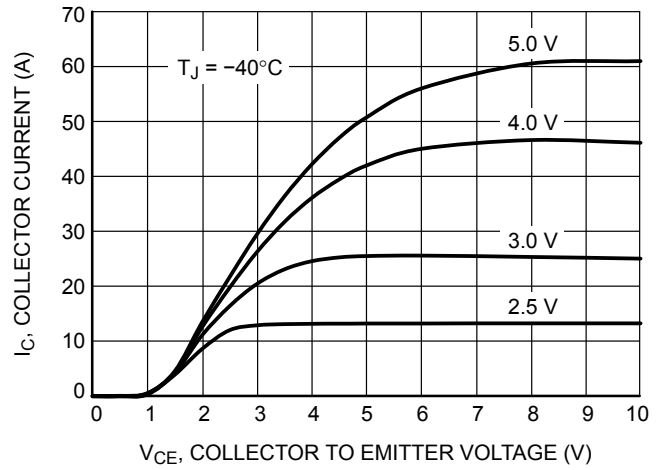


Figure 2. Output Characteristics

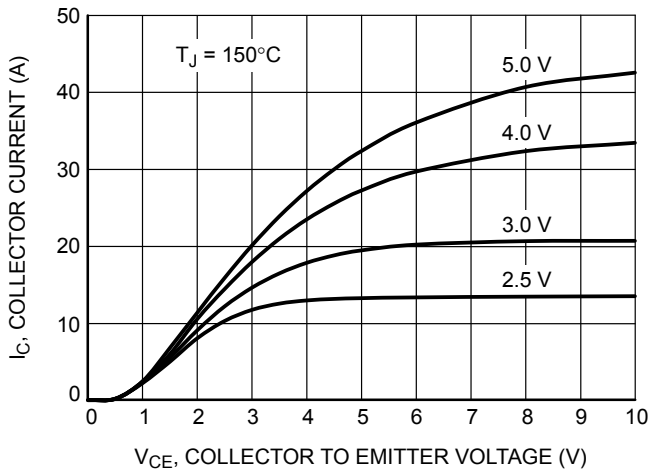


Figure 3. Output Characteristics

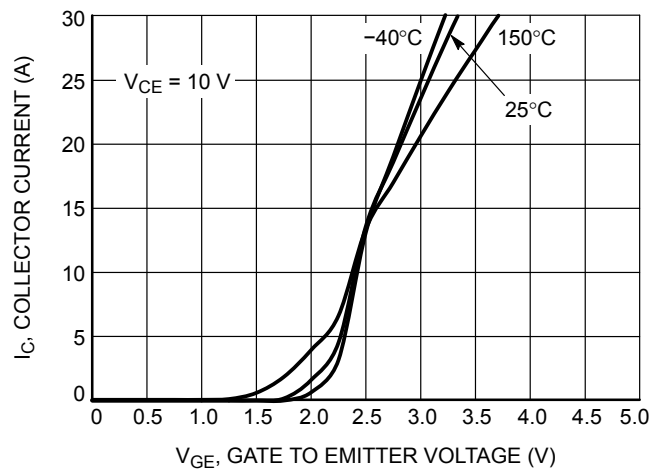


Figure 4. Transfer Characteristics

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TYPICAL CHARACTERISTICS

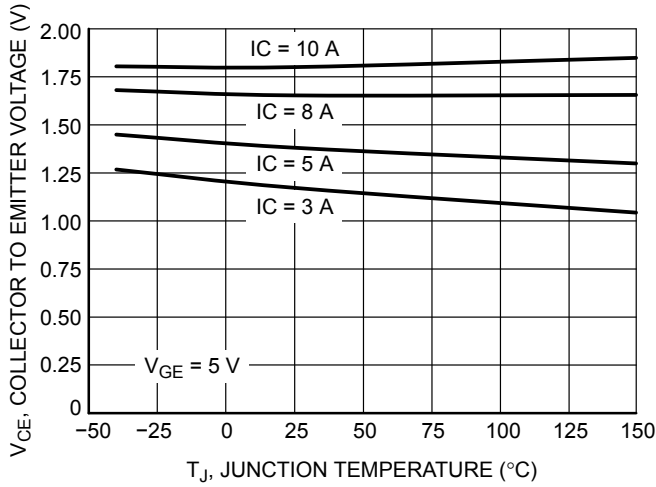


Figure 5. Collector-to-Emitter Saturation Voltage vs. Junction Temperature

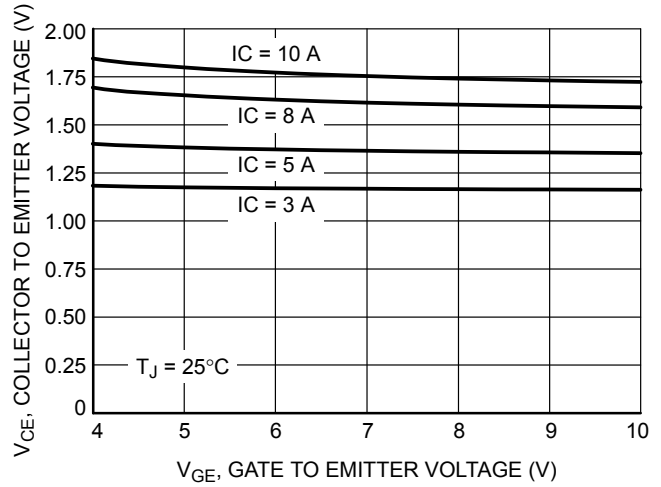


Figure 6. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

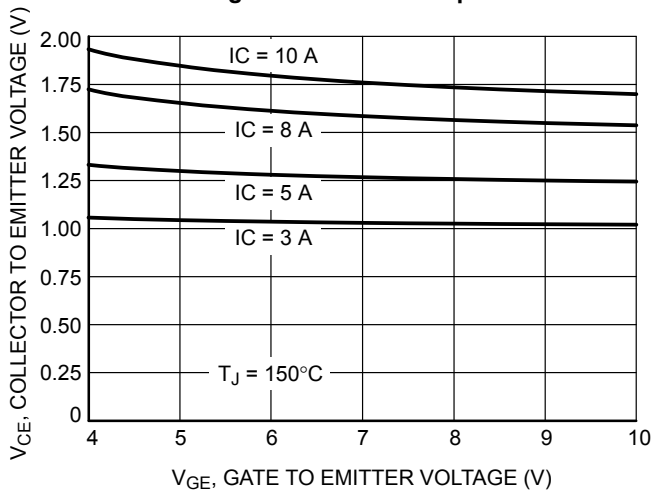


Figure 7. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

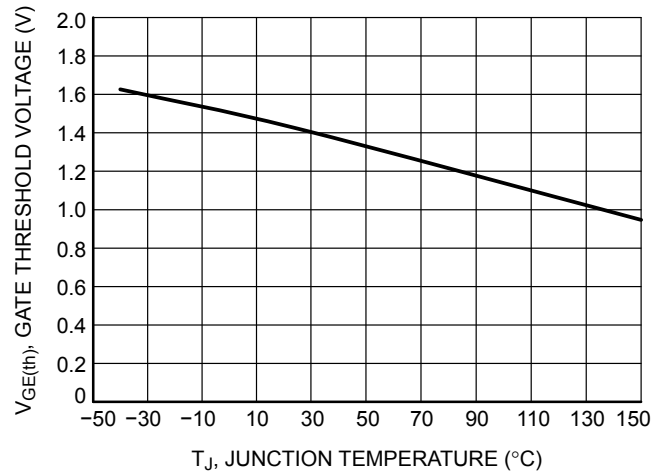
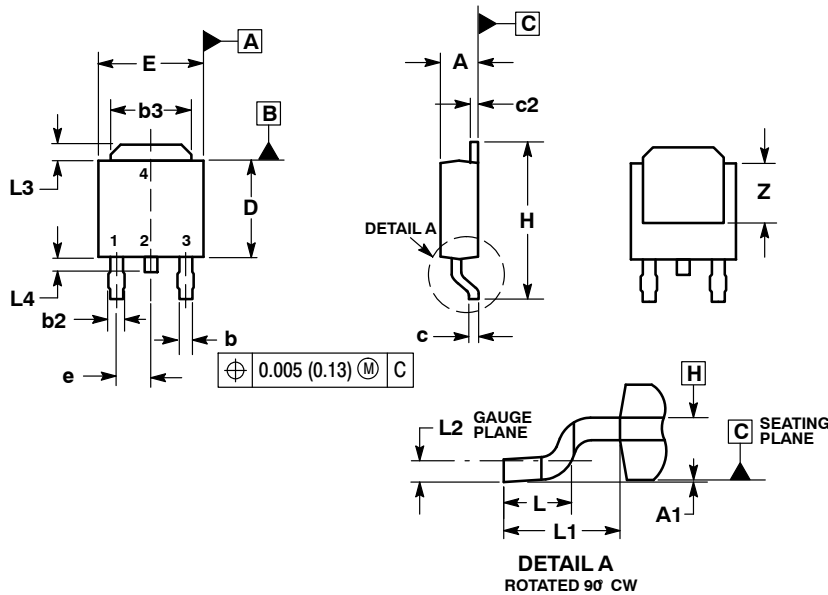


Figure 8. Gate Threshold Voltage vs. Junction Temperature

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PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE) CASE 369C ISSUE D

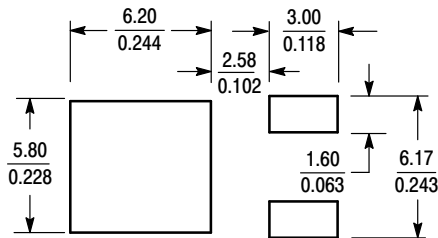


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.086 | 0.094 | 2.18 | 2.38 |
| A1 | 0.000 | 0.005 | 0.00 | 0.13 |
| b | 0.025 | 0.035 | 0.63 | 0.89 |
| b2 | 0.030 | 0.045 | 0.76 | 1.14 |
| b3 | 0.180 | 0.215 | 4.57 | 5.46 |
| c | 0.018 | 0.024 | 0.46 | 0.61 |
| c2 | 0.018 | 0.024 | 0.46 | 0.61 |
| D | 0.235 | 0.245 | 5.97 | 6.22 |
| E | 0.250 | 0.265 | 6.35 | 6.73 |
| e | 0.090 BSC | | 2.29 BSC | |
| H | 0.370 | 0.410 | 9.40 | 10.41 |
| L | 0.055 | 0.070 | 1.40 | 1.78 |
| L1 | 0.108 REF | | 2.74 REF | |
| L2 | 0.020 BSC | | 0.51 BSC | |
| L3 | 0.035 | 0.050 | 0.89 | 1.27 |
| L4 | --- | 0.040 | --- | 1.01 |
| Z | 0.155 | --- | 3.93 | --- |

SOLDERING FOOTPRINT*



SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

STYLE 7:

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

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