

## FGD2N40L 400V N-Channel Logic Level IGBT

### Features

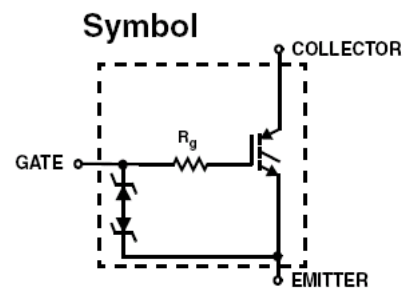
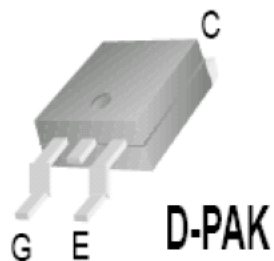
- $V_{CE(SAT)} = 1.6V @ I_C = 2.5A, V_{GE} = 2.4V$
- 6kV ESD Protected
- High Peak Current Density
- TO-252 (D-Pak)
- Low  $V_{GE(TH)}$

### Applications

- Small Engine Ignition Applications

### General Description

This N-Channel IGBT is a MOS gated, logic level device which has been especially tailored for small engine ignition applications. The gate is ESD protected with a zener diode.



**Device Maximum Ratings**  $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol     | Parameter   | Ratings    | Units            |
|------------|---|------------|------------------|
| $BV_{CES}$ | Collector to Emitter Breakdown Voltage                  | 400        | V                |
| $I_C$      | Collector Current Continuous(DC)                        | 7          | A                |
| $I_{CP}$   | Collector Current Pulsed(100 $\mu\text{s}$ )            | 29         | A                |
| $V_{GES}$  | Gate to Emitter Voltage Continuous(DC)                  | $\pm 8$    | V                |
| $V_{GEP}$  | Gate to Emitter Voltage Pulsed                          | $\pm 10$   | V                |
| $P_D$      | Power Dissipation Total $T_C = 25^\circ\text{C}$        | 29         | W                |
| $T_J$      | Operating Junction Temperature Range                    | -40 to 150 | $^\circ\text{C}$ |
| $T_{STG}$  | Storage Junction Temperature Range                      | -40 to 150 | $^\circ\text{C}$ |
| ESD        | Electrostatic Discharge Voltage at 100pF, 1500 $\Omega$ | 6          | kV               |

**Package Marking and Ordering Information**

| Device Marking | Device   | Package | Tape Width  | Quantity |
|----------------|----------|---------|-------------|----------|
| FGD2N40        | FGD2N40L | D-PAK   | 12mm / 16mm | 2500     |

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**Off Characteristics**

|            |  |  |                            |   |          |               |               |
|------------|--|--|----------------------------|---|----------|---------------|---------------|
| $BV_{CES}$ | Collector to Emitter Breakdown Voltage | $I_C = 1\text{mA}, V_{GE} = 0\text{V}$ | 400                        | - | -        | V             |               |
| $BV_{GES}$ | Gate-Emitter Breakdown Voltage         | $I_{GES} = \pm 1\text{mA}$             | $\pm 10$                   | - | -        | V             |               |
| $I_{CES}$  | Collector to Emitter leakage Current   | $V_{CE} = 320\text{V}$                 | $T_C = +25^\circ\text{C}$  | - | -        | 10            | $\mu\text{A}$ |
|            |  |  | $T_C = +125^\circ\text{C}$ | - | -        | 250           | $\mu\text{A}$ |
| $I_{GES}$  | Gate-Emitter Leakage Current           | $V_{GE} = \pm 8$                       | -                          | - | $\pm 10$ | $\mu\text{A}$ |               |

**On Characteristics**

|               |   |   |   |     |     |   |
|---------------|---|---|---|-----|-----|---|
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_C = 2.5\text{A}, V_{GE} = 2.4\text{V}(\text{NOTE1})$ | - | 1.3 | 1.6 | V |
|---------------|---|---|---|-----|-----|---|

**Dynamic Characteristics**

|              |                                   |  |      |      |     |      |
|--------------|-----------------------------------|--|------|------|-----|------|
| $Q_{G(ON)}$  | Gate Charge                       | $I_C = 2.5\text{A}, V_{CE} = 300\text{V}, V_{GE} = 10\text{V}$ | -    | 11   | -   | nC   |
| $V_{GEP}$    | Gate to Emitter Plateau Voltage   | $I_C = 2.5\text{A}, V_{CE} = 300\text{V}$                      | -    | 1.8  | -   | V    |
| $V_{GE(TH)}$ | Gate to Emitter Threshold Voltage | $I_C = 1.0\text{mA}, V_{CE} = V_{GE}$                          | 0.70 | 0.85 | 1.2 | V    |
| $C_{IES}$    | Input Capacitance                 | $V_{CE} = 10\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$     | -    | 357  | -   | pF   |
| $R_G$        | Internal Gate Series Resistance   |  |      | 300  |     | ohms |

**Switching Characteristics**

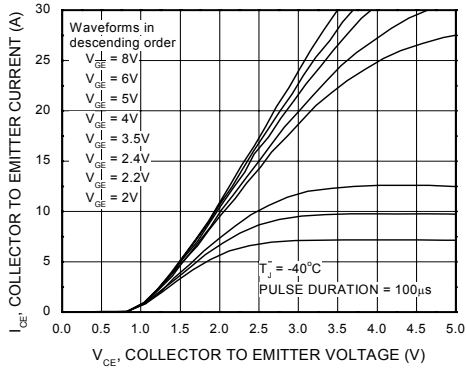
|               |                             |  |   |       |   |               |
|---------------|-----------------------------|--|---|-------|---|---------------|
| $t_{ON}$      | Turn-On Time                | $V_{CC} = 300\text{V}, I_C = 2.5\text{A}, V_{GE} = 4\text{V}, R_L = 120\Omega, R_G = 51\Omega, T_J = 25^\circ\text{C}$ | - | 0.142 | - | $\mu\text{s}$ |
| $t_{d(ON)I}$  | Current Turn-On Delay Time  |  | - | 0.047 | - | $\mu\text{s}$ |
| $t_{rI}$      | Current Rise Time           |  | - | 0.095 | - | $\mu\text{s}$ |
| $t_{OFF}$     | Turn-Off Time               |  | - | 2.152 | - | $\mu\text{s}$ |
| $t_{d(OFF)I}$ | Current Turn-Off Delay Time |  | - | 0.650 | - | $\mu\text{s}$ |
| $t_{fI}$      | Current Fall Time           |  | - | 1.529 | - | $\mu\text{s}$ |

**Thermal Characteristics**

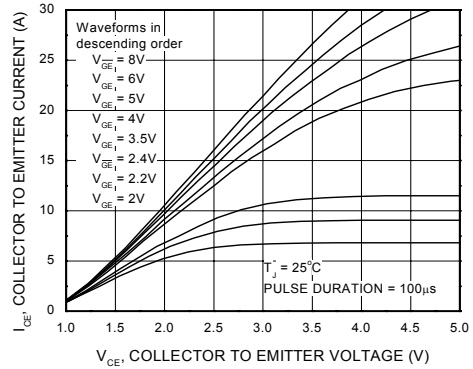
|                 |                                  |                |   |   |      |                    |
|-----------------|----------------------------------|----------------|---|---|------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction-Case | TO-252 (D-Pak) | - | - | 4.29 | $^\circ\text{C/W}$ |
|-----------------|----------------------------------|----------------|---|---|------|--------------------|

**Notes:**1: Pulse Duration = 100  $\mu\text{sec}$

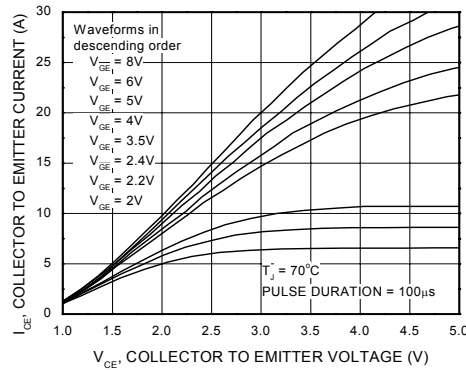
## Typical Performance Characteristics



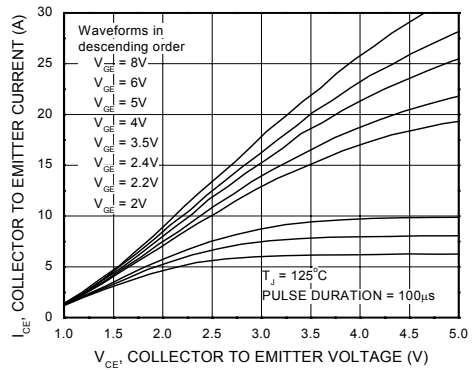
**Figure 1. Collector Current Vs. Collector to Emitter On-State Voltage**



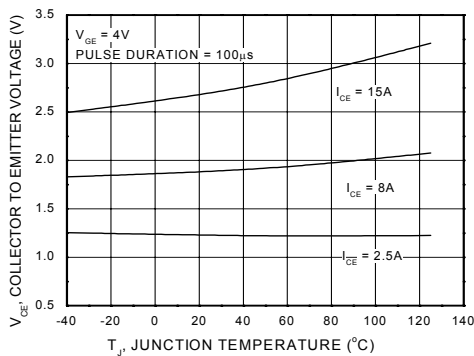
**Figure 2. Collector Current Vs. Collector to Emitter On-State Voltage**



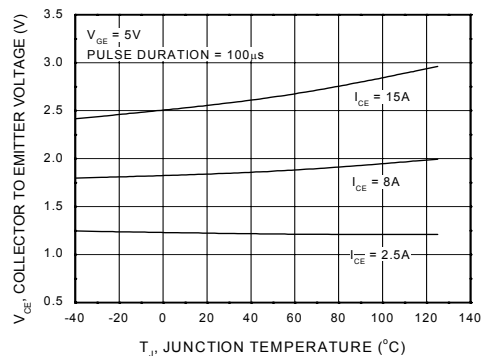
**Figure 3. Collector Current Vs. Collector to Emitter On-State Voltage**



**Figure 4. Collector Current Vs. Collector to Emitter On-State Voltage**

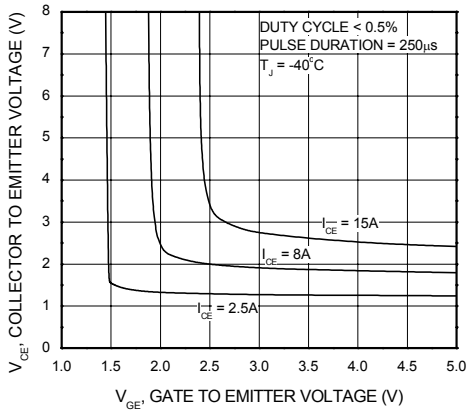


**Figure 5. Collector to Emitter Saturation Voltage Vs. Junction Temperature**

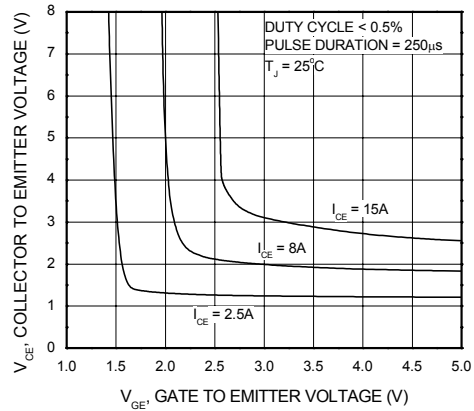


**Figure 6. Collector to Emitter Saturation Voltage Vs. Junction Temperature**

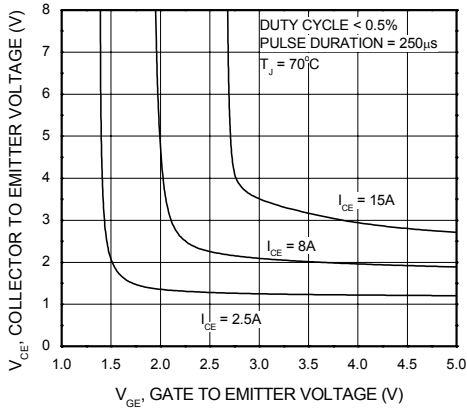
## Typical Performance Characteristics



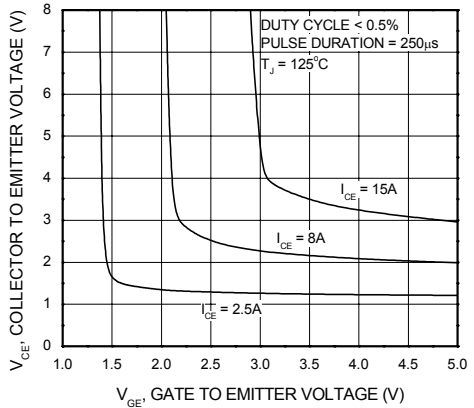
**Figure 7. Collector to Emitter On-State Voltage Vs. Gate to Emitter Voltage**



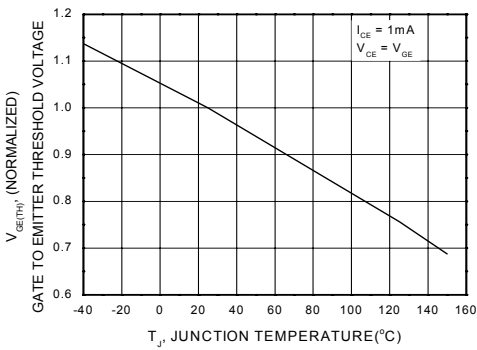
**Figure 8. Collector to Emitter On-State Voltage Vs. Gate to Emitter Voltage**



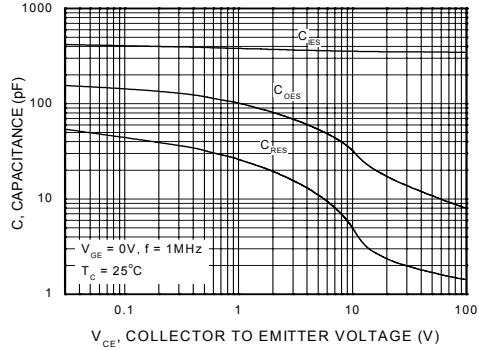
**Figure 9. Collector to Emitter On-State Voltage Vs. Gate to Emitter Voltage**



**Figure 10. Collector to Emitter On-State Voltage Vs. Gate to Emitter Voltage**



**Figure 11. Normalized Gate to Emitter Threshold Voltage Vs. Junction Temperature**



**Figure 12. Capacitance Vs. Collector to Emitter Voltage**

## Typical Performance Characteristics

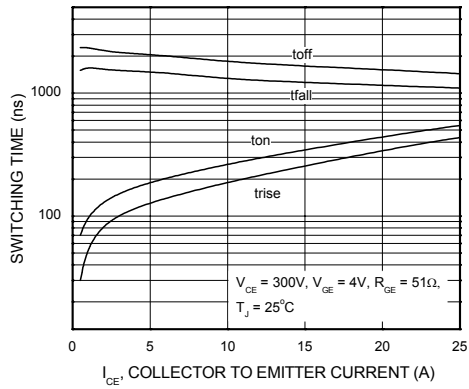


Figure 13. Switching Time Vs. Collector Current

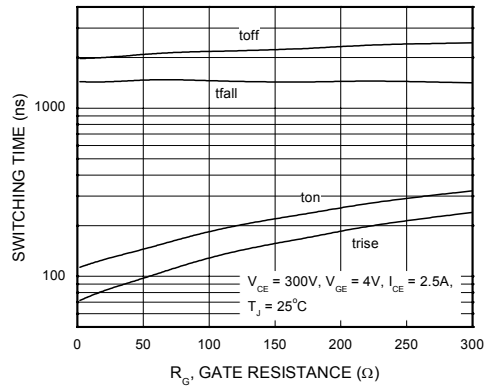


Figure 14. Switching Time Vs. Gate Resistance

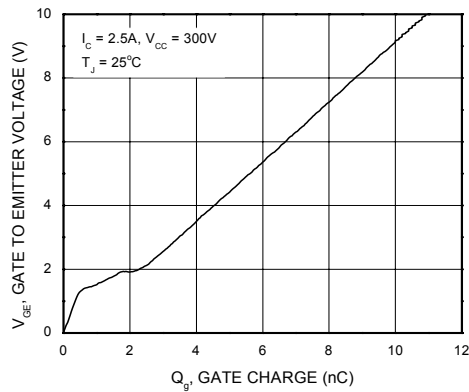


Figure 15. Gate Charge

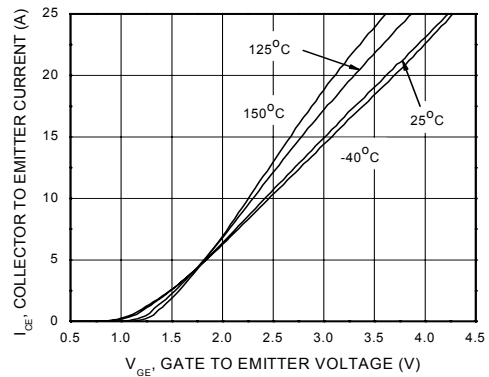


Figure 16. Transfer

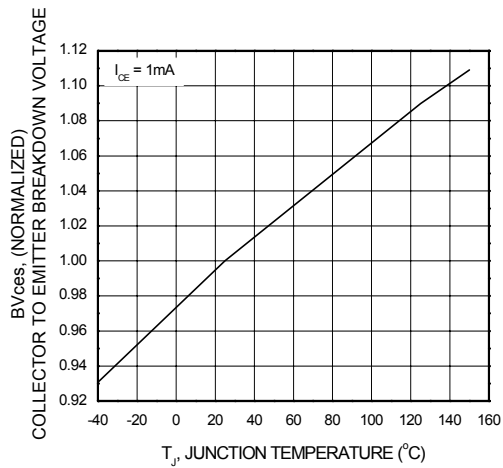


Figure 17. Normalized Collector to Emitter Breakdown Voltage Vs. Junction Temperature

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