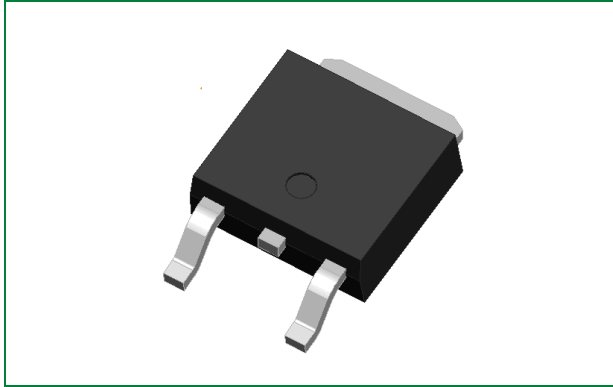


LGD18N45TH

450 V, 18 A N-Channel Ignition IGBT



Product Summary

| Characteristic | Value | Unit |
|----------------|-------|------|
| V_{CES} | 450 | V |
| I_c | 18 | A |

Description

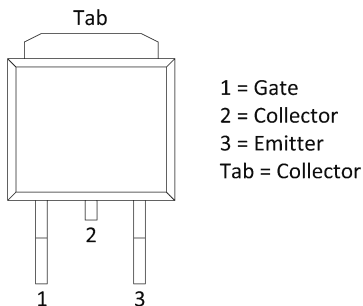
This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

Agency Approvals

Environmental Approvals



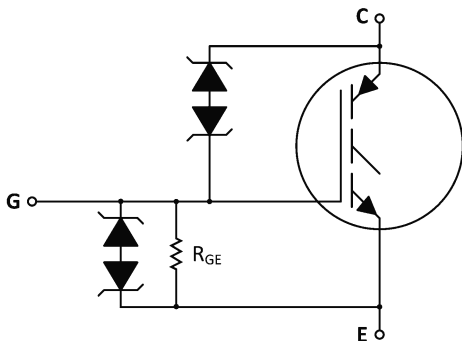
Pinout Diagram



Features

- Ideal for Coil-on-Plug Applications
- DPAK Package Offers Smaller Footprint for Increased Board Space
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Low Threshold Voltage Interfaces Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- AEC-Q101 Qualified
- These are Pb-Free Devices
- Emitter Ballasting for Short-Circuit Capability

Functional Diagram



| | |
|---|----|
| 1. Maximum Ratings ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified) | 3 |
| 2. Unclamped Collector-to-Emitter Avalanche Characteristics | 3 |
| 3. Maximum Short-Circuit Times | 3 |
| 4. Thermal Characteristics | 3 |
| 5. Electrical Characteristics – Off | 4 |
| 6. Electrical Characteristics – On | 4 |
| 7. Dynamic Characteristics | 4 |
| 8. Switching Characteristics | 5 |
| 9. Figure Data | 6 |
| 10. Package Dimensions | 9 |
| 11. Part Numbering and Marking | 10 |
| 12. Packing Options | 10 |

1. Maximum Ratings (T_J = 25 °C unless otherwise specified)

| Characteristic | Conditions | Symbol | Value | Unit |
|---|------------------------|-----------------------------------|-------------|-----------------|
| Collector-Emitter Voltage | - | V _{CEs} | 500 | V _{DC} |
| Gate-Gate Voltage | - | V _{CER} | 500 | V _{DC} |
| Gate-Emitter Voltage | - | V _{GE} | 18 | V _{DC} |
| Collector Current – Continuous | T _C = 25 °C | I _C | 18 | A _{DC} |
| Collector Current – Pulsed | | | 50 | 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 | | 400 | V |
| Total Power Dissipation | T _C = 25 °C | P _D | 115 | W |
| | Derating for > 25 °C | | 0.77 | W/°C |
| Operating and Storage Temperature Range | - | T _J , T _{stg} | -55 to +175 | °C |

2. Unclamped Collector-to-Emitter Avalanche Characteristics

| Characteristic | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Single Pulse Collector-to-Emitter Avalanche Energy | | | |
| V _{CC} = 50 V, V _{GE} = 5.0 V, P _{kL} = 26.0 A, L = 1.0 mH, Starting T _J = 25 °C | E _{AS} | 338 | mJ |
| V _{CC} = 50 V, V _{GE} = 5.0 V, P _{kL} = 10.0 A, L = 8.4 mH, Starting T _J = 25 °C | | 420 | |
| V _{CC} = 50 V, V _{GE} = 5.0 V, P _{kL} = 15.4 A, L = 2.0 mH, Starting T _J = 150 °C | | 237 | |
| V _{CC} = 50 V, V _{GE} = 5.0 V, P _{kL} = 5.7 A, L = 15.2 mH, Starting T _J = 150 °C | | 247 | |

3. Maximum Short-Circuit Times

| Characteristic | Symbol | Value | Unit |
|---|---------------------|-------|------|
| Short Circuit Withstand Time 1 (T _A = 105 °C) ¹ | t _{sc,1-1} | 1000 | μs |
| Short Circuit Withstand Time 1 (T _A = 150 °C) ¹ | t _{sc,1-2} | 800 | μs |
| Short Circuit Withstand Time 2 (T _A = 105 °C) ² | t _{sc,2-1} | 5.0 | ms |
| Short Circuit Withstand Time 2 (T _A = 150 °C) ² | t _{sc,2-2} | 1.0 | ms |

Footnote 1: See Figure 17, 3 pulses with 10 ms period

Footnote 2: See Figure 18, 3 pulses with 10 ms period

4. Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|---|------------------|-------|------|
| Thermal Resistance, Junction to Case | R _{θJC} | 1.3 | °C/W |
| Thermal Resistance, Junction to Ambient (DPAK) ³ | R _{θJA} | 95 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | T _L | 275 | °C |

Footnote 3: When surface mounted to an FR4 board using the minimum recommended pad size

5. Electrical Characteristics – Off

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|---|----------------------|--|-----------------------------------|-------|-----|-----|------------------|
| | | | | Min | Typ | Max | |
| Collector-Emitter Clamp Voltage | BV _{CES} | I _C = 2.0 mA | T _J = -40 °C to 150 °C | 430 | 455 | 470 | V _{DC} |
| | | I _C = 10 mA | | 440 | 475 | 500 | |
| Zero Gate Voltage Collector Current | I _{CES} | V _{CE} = 15 V, V _{GE} = 0 V | T _J = 25 °C | - | - | 2.0 | μA _{DC} |
| | | | T _J = 150 °C | - | 0.5 | 20 | |
| | | V _{CE} = 350 V, V _{GE} = 0 V | T _J = 150 °C | - | 75 | 250 | |
| | | | T _J = -40 °C | - | 0.2 | 10 | |
| Reverse Collector-Emitter Leakage Current | I _{ECS} | 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 | |
| Reverse Collector-Emitter Clamp Voltage | BV _{CES(R)} | I _C = -75 mA | T _J = 25 °C | 24 | 27 | 30 | V _{DC} |
| | | | T _J = 150 °C | 26 | 29 | 33 | |
| | | | T _J = -40 °C | 23 | 26 | 29 | |
| 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 | 590 | 700 | μA _{DC} |
| Gate-Emitter Resistor | R _{GE} | - | T _J = -40 °C to 150 °C | 10 | 16 | 26 | kΩ |
| Gate Resistor | R _G | - | T _J = -40 °C to 150 °C | - | 70 | - | Ω |

6. Electrical Characteristics – On

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|--|---------------------|---|-----------------------------------|-------|------|------|-----------------|
| | | | | Min | Typ | Max | |
| Gate Threshold Voltage | V _{GE(th)} | I _C = 1.0 mA, V _{GE} = V _{CE} | T _J = 25 °C | 1.1 | 1.56 | 1.9 | V _{DC} |
| | | | T _J = 150 °C | 0.75 | 1.08 | 1.4 | |
| | | | T _J = -40 °C | 1.2 | 1.75 | 2.1 | |
| Threshold Temperature Coefficient (Negative) | - | - | - | - | 3.5 | - | mV/°C |
| Collector-Emitter On-Voltage | V _{CE(on)} | I _C = 7.0 A, V _{GE} = 4.5 V | T _J = -40 °C to 150 °C | 1.10 | 1.84 | 2.30 | V _{DC} |
| | | I _C = 7.0 A, V _{GE} = 4.0 V | T _J = -40 °C to 150 °C | 1.15 | 1.89 | 2.35 | |
| | | I _C = 7.0 A, V _{GE} = 3.7 V | T _J = -40 °C to 150 °C | 1.20 | 1.93 | 2.50 | |
| | | I _C = 10 A, V _{GE} = 4.5 V | T _J = -40 °C to 150 °C | 1.45 | 2.07 | 2.65 | |
| | | I _C = 10 A, V _{GE} = 4.0 V | T _J = -40 °C to 150 °C | 1.50 | 2.13 | 2.80 | |
| | | I _C = 10 A, V _{GE} = 3.7 V | T _J = -40 °C to 150 °C | 1.55 | 2.19 | 2.85 | |
| | | I _C = 10 mA, V _{GE} = 4.5 V | T _J = -40 °C to 150 °C | - | 0.65 | 1.00 | |
| Forward Transconductance | g _{fs} | V _{CS} = 5.0 V, I _C = 6.0 A | T _J = -40 °C to 150 °C | 6.0 | 14 | 25 | Mhos |

7. Dynamic Characteristics

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|----------------------|------------------|---|-----------------------------------|-------|-----|------|------|
| | | | | Min | Typ | Max | |
| Input Capacitance | C _{ISS} | V _{CC} = 25 V, V _{GE} = 0 V, f = 1.0 MHz | T _J = -40 °C to 150 °C | 400 | 780 | 1000 | pF |
| Output Capacitance | C _{OSS} | | | 50 | 72 | 100 | |
| Transfer Capacitance | C _{RSS} | | | 4 | 6 | 10 | |

8. Switching Characteristics

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|---------------------|--------------|--|----------------------------------|-------|------|-----|---------------|
| | | | | Min | Typ | Max | |
| Turn-off Delay Time | $t_{d(off)}$ | $V_{CC} = 300\text{ V}, V_{GE} = 0\text{ V}, R_G = 1.0\text{ k}\Omega, R_L = 46\ \Omega$ | $T_J = 25\text{ }^\circ\text{C}$ | 1.0 | 2.9 | 12 | μs |
| Fall Time | t_f | $V_{CC} = 300\text{ V}, V_{GE} = 5\text{ V}, R_G = 1.0\text{ k}\Omega, R_L = 46\ \Omega$ | | 1.0 | 2.5 | 7.0 | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC} = 14\text{ V}, V_{GE} = 5\text{ V}, R_G = 1.0\text{ k}\Omega, R_L = 1\ \Omega$ | $T_J = 25\text{ }^\circ\text{C}$ | 0.1 | 0.42 | 1.4 | μs |
| Rise Time | t_r | $V_{CC} = 14\text{ V}, V_{GE} = 5\text{ V}, R_G = 1.0\text{ k}\Omega, R_L = 1\ \Omega$ | | 1.0 | 2.5 | 9.0 | |

9. Figure Data

Figure 1. Output Characteristics ($T_J = 25\text{ }^\circ\text{C}$)

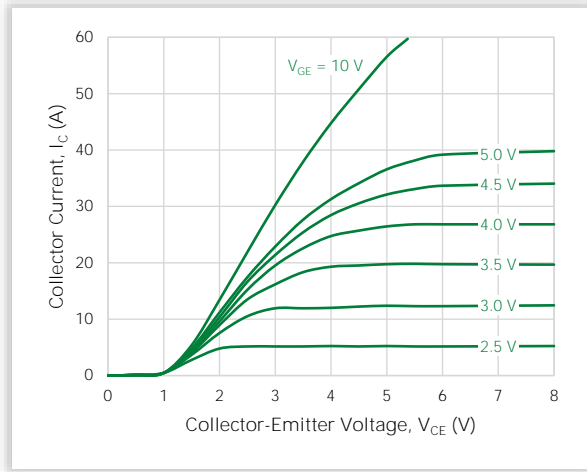


Figure 2. Output Characteristics ($T_J = -40\text{ }^\circ\text{C}$)

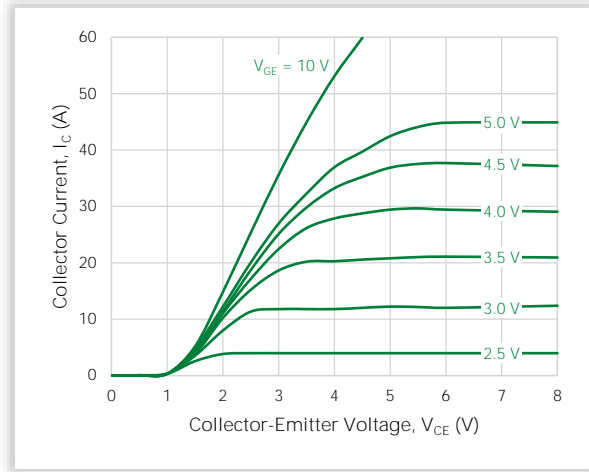


Figure 3. Output Characteristics ($T_J = 150\text{ }^\circ\text{C}$)

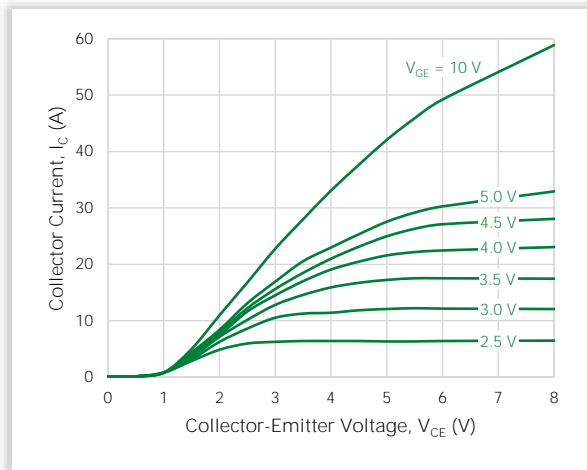


Figure 4. Transfer Characteristics

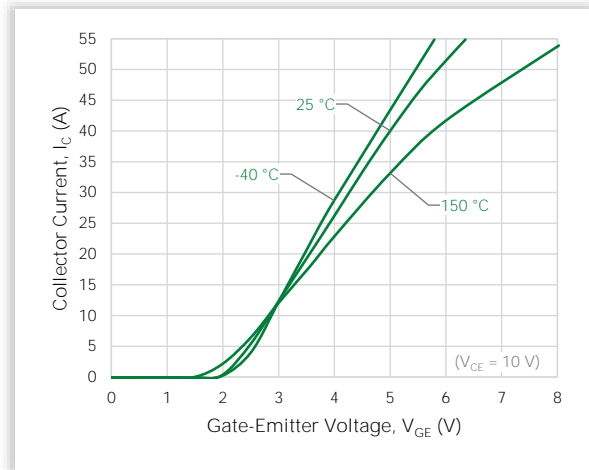


Figure 5. Collector-Emitter Saturation Voltage vs. Junction Temperature

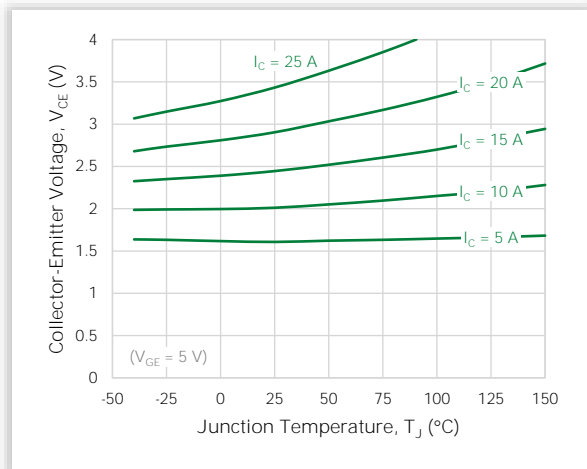


Figure 6. Collector-Emitter Voltage vs. Gate-Emitter Voltage ($T_J = 25\text{ }^\circ\text{C}$)

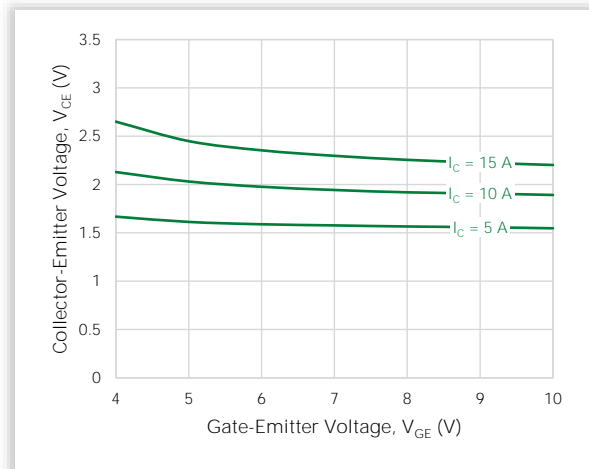


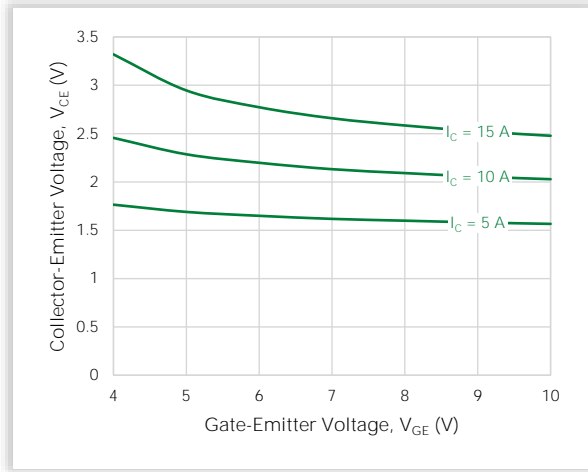
Figure 7. Collector-Emitter Voltage vs. Gate-Emitter Voltage ($T_J = 150\text{ }^\circ\text{C}$)


Figure 8. Capacitance Variation

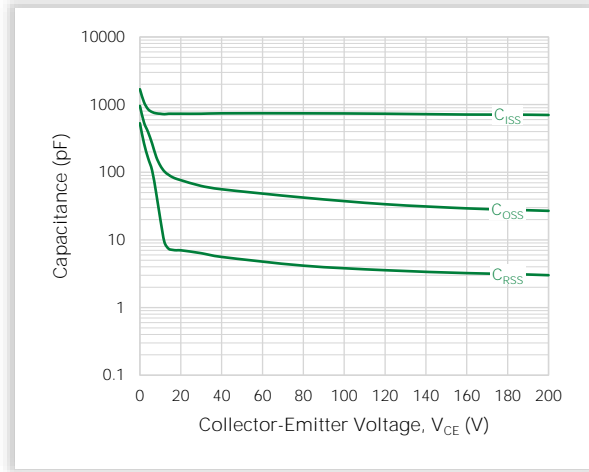


Figure 9. Gate Threshold Voltage vs. Temperature

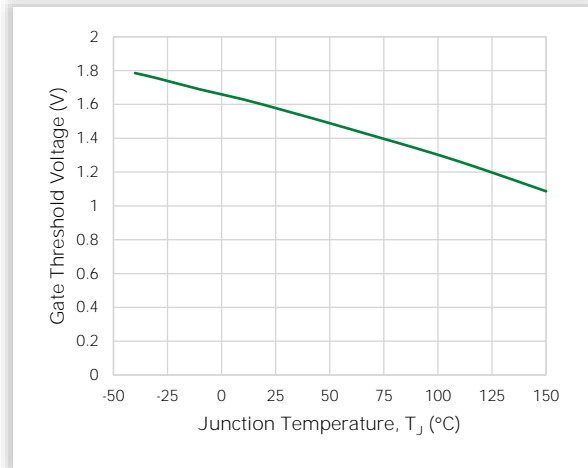


Figure 10. Minimum Open Secondary Latch Current vs. Inductance

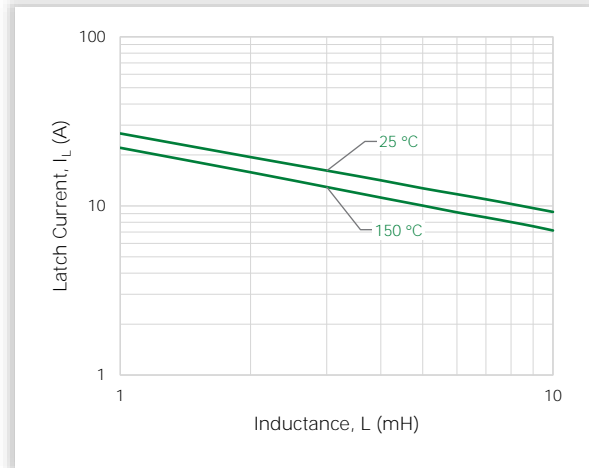


Figure 11. Typical Open Secondary Latch Current vs. Inductance

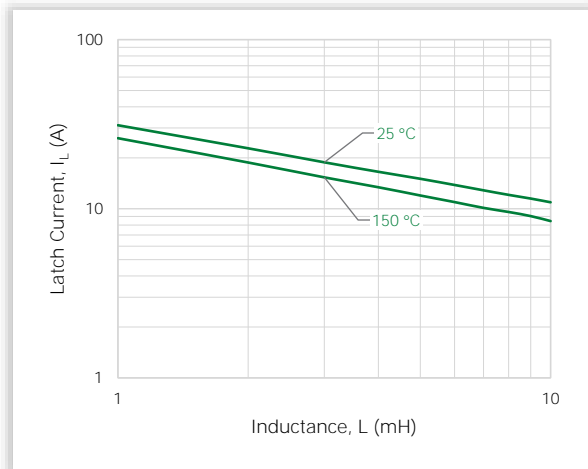


Figure 12. Inductive Switching Fall Time vs. Temperature

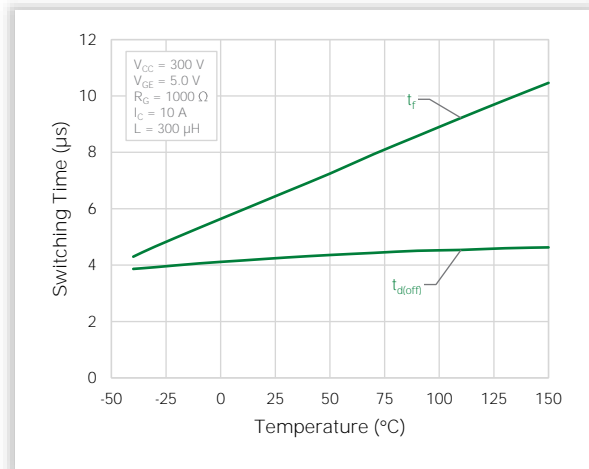


Figure 13. Single Pulse Safe Operating Area
 (Mounted on an Infinite Heatsink at $T_A = 25^\circ\text{C}$)

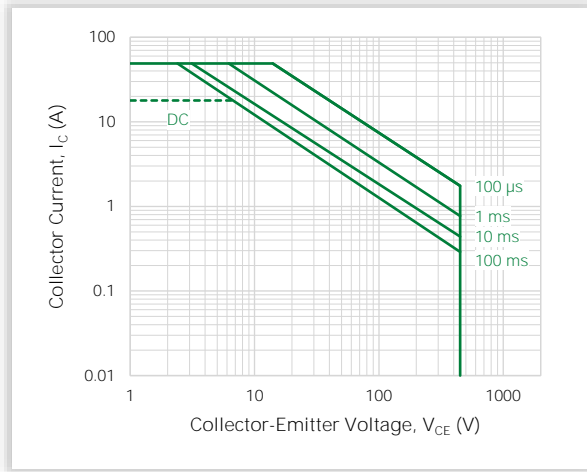


Figure 14. Single Pulse Safe Operating Area
 (Mounted on an Infinite Heatsink at $T_A = 125^\circ\text{C}$)

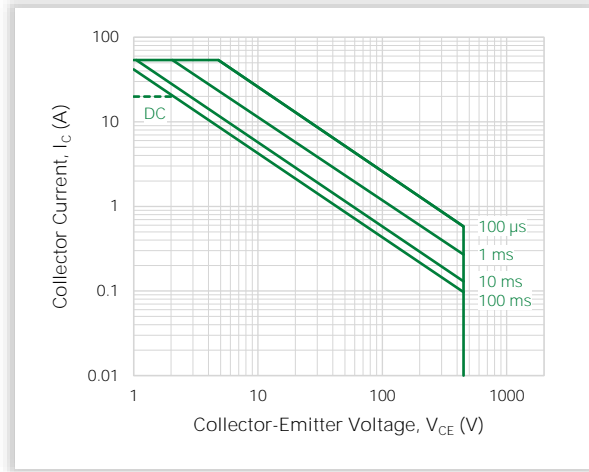


Figure 15. Pulse Train Safe Operating Area
 (Mounted on an Infinite Heatsink at $T_A = 25^\circ\text{C}$)

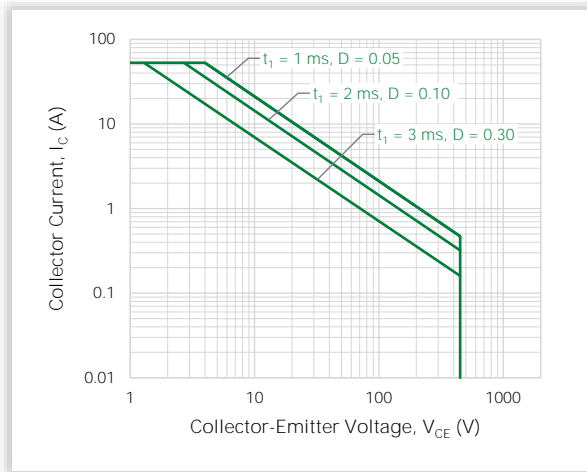


Figure 16. Pulse Train Safe Operating Area
 (Mounted on an Infinite Heatsink at $T_A = 125^\circ\text{C}$)

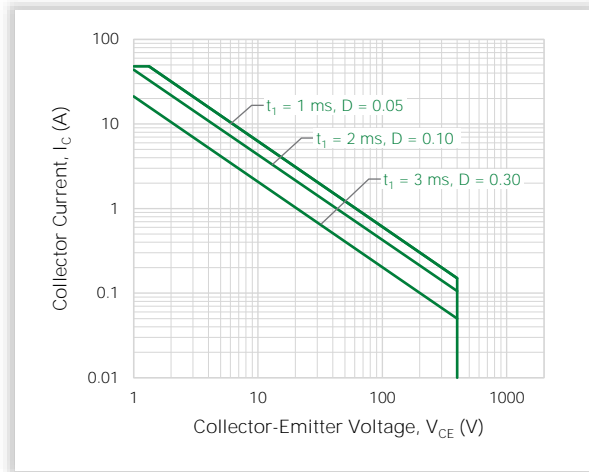


Figure 17. Circuit Configuration for Short Circuit Test 1

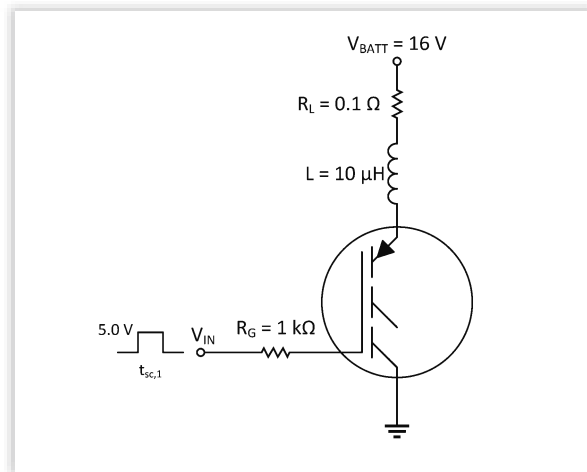


Figure 18. Circuit Configuration for Short Circuit Test 2

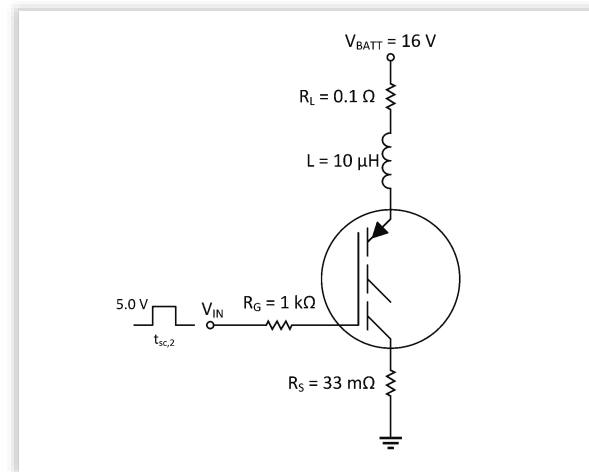
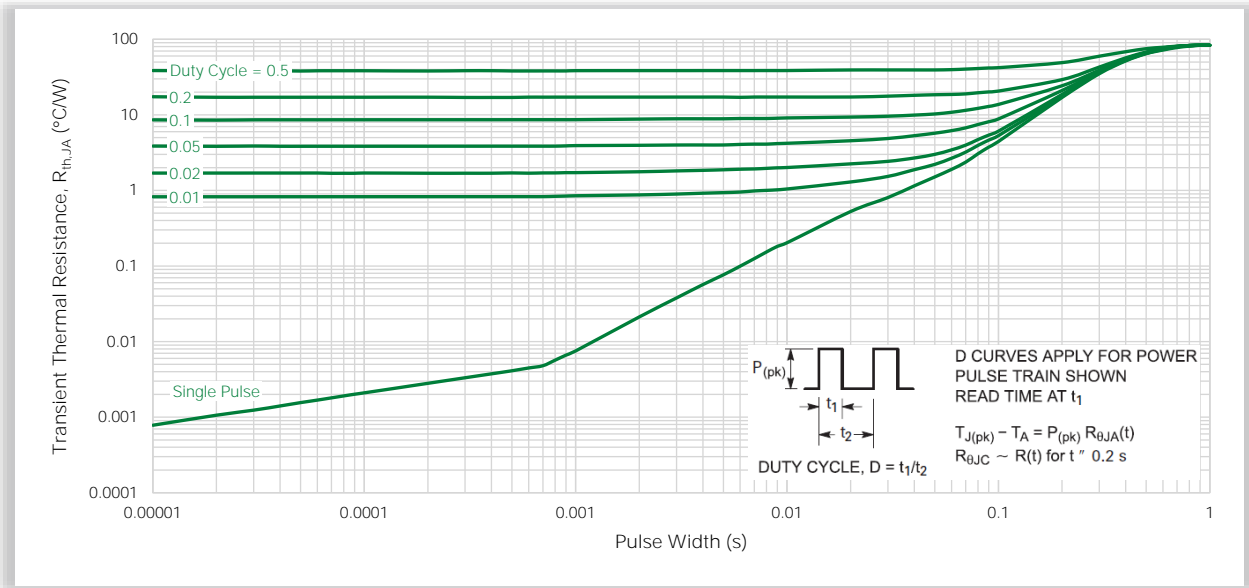
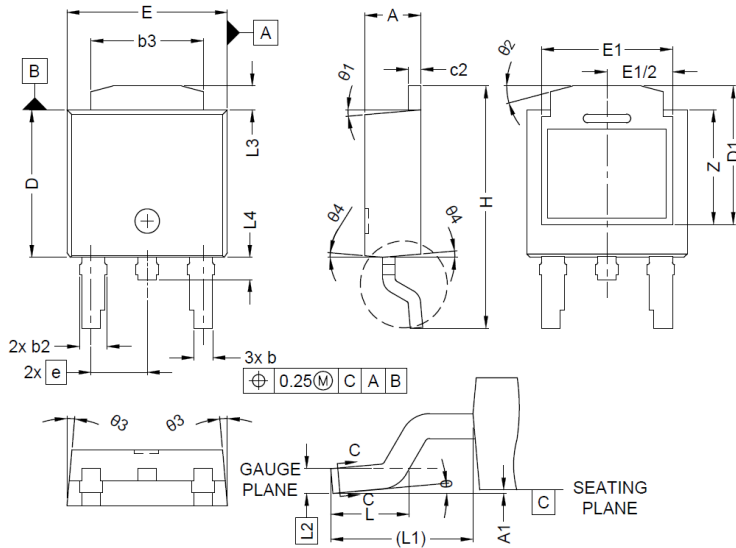


Figure 19. Transient Thermal Resistance

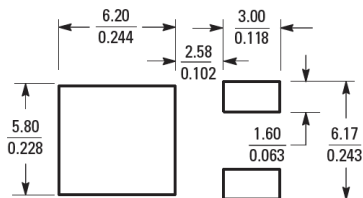
(Non-normalized Junction-Ambient mounted on minimum pad area)



10. Package Dimensions



Recommended Solder Pad Layout:

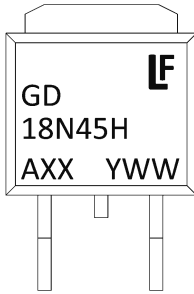


Notes:

1. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. HEAT SINK SIDE FLASH IS MAX. 0.8mm.
4. RADIUS ON TERMINAL IS OPTIONAL.

| Symbol | Millimeters | | |
|--------|-------------|-----|-------|
| | Min | Nom | Max |
| A | 2.18 | - | 2.38 |
| A1 | 0.00 | - | 0.13 |
| b | 0.63 | - | 0.89 |
| b2 | 0.72 | - | 1.14 |
| b3 | 4.57 | - | 5.46 |
| c | 0.46 | - | 0.61 |
| c2 | 0.46 | - | 0.61 |
| D | 5.97 | - | 6.22 |
| D1 | 5.45 | - | 5.85 |
| E | 6.35 | - | 6.73 |
| E1 | 5.14 | - | 5.54 |
| e | 2.29 BSC | | |
| H | 9.40 | - | 10.41 |
| L | 1.40 | - | 1.78 |
| L1 | 2.90 REF | | |
| L2 | 0.51 BSC | | |
| L3 | 0.89 | - | 1.27 |
| L4 | - | - | 1.01 |
| Z | 3.93 | - | - |
| θ | 0° | - | 10° |
| θ1 | 0° | - | 10° |
| θ2 | 10° | - | 20° |
| θ3 | 0° | - | 10° |
| θ4 | 0° | - | 10° |

11. Part Numbering and Marking



GD18N45H = Device Code
 A = Assembly Location
 XX = Lot Number
 Y = Year
 WW = Work Week
 H = Ballast Structure Design

12. Packing Options

| Part Number | Package | Packing Mode | M.O.Q. |
|-------------|----------------|--------------|--------|
| LGD18N45TH | DPAK (Pb-Free) | Tape & Reel | 2500 |

For additional information please visit www.Littelfuse.com/powersemi

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