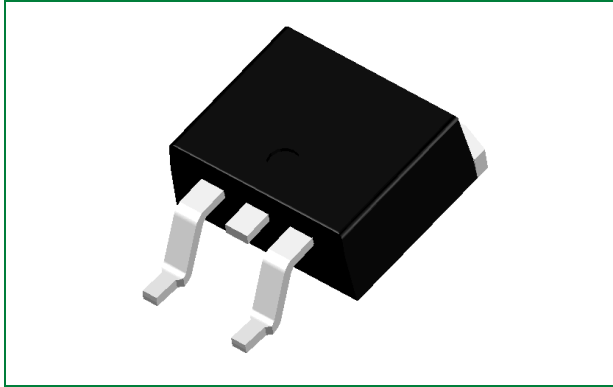


LGB8245T1

450 V, 20 A N-Channel Ignition IGBT



Product Summary

| Characteristic | Value | Unit |
|----------------|-------|------|
| V_{CES} | 450 | V |
| I_c | 20 | A |

Description

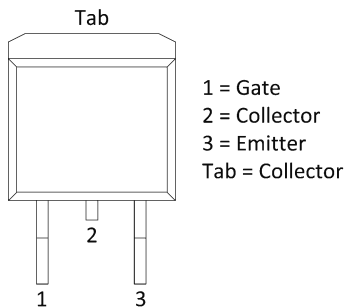
This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

Agency Approvals

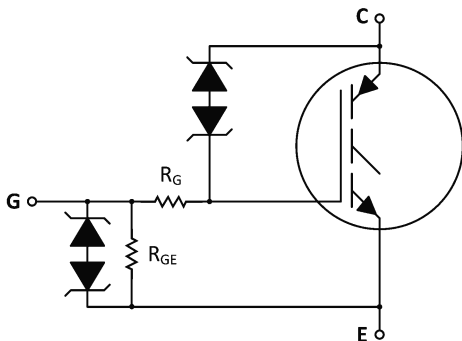
Environmental Approvals



Pinout Diagram



Functional Diagram



Features

- Ideal for Coil-on-Plug and Driver-on-Coil Applications
- D2PAK 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

Applications

- Ignition Systems

| | |
|---|---|
| 1. Maximum Ratings ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified) | 3 |
| 2. Unclamped Collector-to-Emitter Avalanche Characteristics | 3 |
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1. Maximum Ratings (T_J = 25 °C unless otherwise specified)

| Characteristic | Conditions | Symbol | Value | Unit |
|---|------------------------|-----------------------------------|-------------|-----------------|
| Collector-Emitter Voltage | - | V _{CES} | 500 | V |
| Gate Voltage | - | V _{CER} | 500 | V |
| Gate-Emitter Voltage | - | V _{GE} | ±15 | V |
| Collector Current – Continuous | T _C = 25 °C | I _C | 20 | A _{DC} |
| Collector Current – Pulsed | | | 50 | A _{AC} |
| Continuous Gate Current | - | I _G | 1.0 | mA |
| Transient Gate Current | t < 2 ms, f ≤ 100 Hz | | 20 | mA |
| ESD – Human Body Model | R = 1500 Ω, C = 100 pF | ESD | 8.0 | kV |
| ESD – Machine Model | R = 0 Ω, C = 200 pF | | 500 | V |
| Total Power Dissipation | T _C = 25 °C | P _D | 150 | W |
| | Derating for >25 °C | | 1.0 | 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} = 9.5 A, L = 3.5 mH, R _G = 1 kΩ, Starting T _C = 150 °C | E _{AS} | 158 | mJ |

Note: -55 °C ≤ T_J ≤ 150 °C

3. Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|---|------------------|-------|------|
| Thermal Resistance, Junction to Case | R _{θJC} | 1.0 | °C/W |
| Thermal Resistance, Junction to Ambient (D2PAK) ¹ | R _{θJA} | 62.5 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | T _L | 275 | °C |

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

4. 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 175 °C | 430 | 450 | 470 | V |
| | | I _C = 10 mA | | 450 | 475 | 500 | |
| Collector-Emitter Clamp Voltage ⁴ | BV _{CES} | I _C = 12 mA, L = 3.5 mH, R _G = 1 kΩ | T _J = -40 °C to 175 °C | 420 | 450 | 480 | V |
| Collector-Emitter Leakage Current | I _{CES} | V _{CE} = 15 V, V _{GE} = 0 V | T _J = 25 °C | - | 0.002 | 1.0 | μA |
| | | V _{CE} = 250 V, R _G = 1 kΩ | T _J = -40 °C to 175 °C | 0.5 | 2.0 | 100 | |
| Reverse Collector-Emitter Leakage Current | I _{ECS} | V _{CE} = -24 V | T _J = 25 °C | - | 0.4 | 1.0 | mA |
| | | | T _J = 175 °C | - | 20 | 35 | |
| | | | T _J = -40 °C | - | 0.04 | 0.2 | |
| Reverse Collector-Emitter Clamp Voltage | BV _{CES(R)} | I _C = -75 mA | T _J = 25 °C | 30 | 33 | 39 | V |
| | | | T _J = 175 °C | 31 | 35 | 40 | |
| | | | T _J = -40 °C | 30 | 31 | 37 | |
| Gate-Emitter Clamp Voltage | BV _{GES} | I _G = ±5.0 mA | T _J = -40 °C to 175 °C | 12 | 12.5 | 14 | V |
| Gate-Emitter Leakage Current | I _{GES} | V _{GE} = ±5.0 V | T _J = -40 °C to 175 °C | 200 | 316 | 350 | μA |
| Gate-Emitter Resistor | R _{GE} | - | T _J = -40 °C to 175 °C | 14.25 | 16 | 25 | kΩ |
| Gate Resistor | R _G | - | T _J = -40 °C to 175 °C | - | 70 | - | Ω |

5. Electrical Characteristics – On

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|--|--------------|--|--|-------|------|------|----------------------|
| | | | | Min | Typ | Max | |
| Gate Threshold Voltage | $V_{GE(th)}$ | $I_C = 1.0 \text{ mA}$, $V_{GE} = V_{CE}$ | $T_J = 25 \text{ }^\circ\text{C}$ | 1.5 | 1.8 | 2.1 | V |
| | | | $T_J = 175 \text{ }^\circ\text{C}$ | 0.7 | 1.0 | 1.3 | |
| | | | $T_J = -40 \text{ }^\circ\text{C}$ | 1.7 | 2.0 | 2.3 | |
| Threshold Temperature Coefficient (Negative) | - | - | - | 4.0 | 4.6 | 5.2 | mV/ $^\circ\text{C}$ |
| Collector-Emitter On-Voltage | $V_{CE(on)}$ | $I_C = 10 \text{ A}$, $V_{GE} = 3.7 \text{ V}$ | $T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$ | 0.8 | 1.11 | 1.97 | V |
| | | $I_C = 10 \text{ A}$, $V_{GE} = 4.0 \text{ V}$ | $T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$ | 0.8 | 1.10 | 1.85 | |
| | | $I_C = 15 \text{ A}$, $V_{GE} = 4.0 \text{ V}$ | $T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$ | 0.8 | 1.24 | 2.00 | |
| Forward Transconductance | gfs | $V_{CE} = 5.0 \text{ V}$, $I_C = 6.0 \text{ A}$ | $T_J = 25 \text{ }^\circ\text{C}$ | 10 | 19 | 25 | Mhos |

6. Dynamic Characteristics

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|----------------------|-----------|---|------------------------------------|-------|------|------|------|
| | | | | Min | Typ | Max | |
| Input Capacitance | C_{ISS} | $V_{CE} = 25 \text{ V}$, $f = 10 \text{ kHz}$ | $T_J = -25 \text{ }^\circ\text{C}$ | 1100 | 1400 | 1600 | pF |
| Output Capacitance | C_{OSS} | | | 50 | 65 | 80 | |
| Transfer Capacitance | C_{RSS} | | | 15 | 20 | 25 | |

7. Switching Characteristics

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|--|---------------|--|--|-------|-----|------|---------------|
| | | | | Min | Typ | Max | |
| Turn-on Delay Time (Resistive) 10% V_{GE} to 10% I_C | $t_{d(on)R}$ | $V_{CE} = 14 \text{ V}$, $V_{GE} = 5.0 \text{ V}$, $R_G = 1.0 \text{ k}\Omega$, $R_L = 1.0 \text{ }\Omega$ | $T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$ | 0.1 | 1.0 | 2.0 | μs |
| Rise Time (Resistive) 10% I_C to 90% I_C | t_R | | | 1.0 | 3.4 | 6.0 | |
| Turn-off Delay Time (Resistive) 90% V_{GE} to 90% I_C | $t_{d(off)R}$ | | | 2.0 | 4.5 | 8.0 | |
| Fall Time (Resistive) 90% I_C to 10% I_C | t_F | | | 3.0 | 8.0 | 12 | |
| Turn-off Delay Time (Inductive) 90% V_{GE} to 90% I_C | $t_{d(off)L}$ | $V_{CE} = BV_{CES}$, $L = 0.5 \text{ mH}$, $R_G = 1.0 \text{ k}\Omega$, $I_C = 10 \text{ A}$, $V_{GE} = 5.0 \text{ V}$ | $T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$ | 6.5 | 9.7 | 12.5 | μs |
| Fall Time (Inductive) 90% I_C to 10% I_C | t_{FL} | | | 6.0 | 8.3 | 11 | |

Note: Electrical Characteristics at temperature other than 25 °C, Dynamic and Switching characteristics are not subject to production testing. Not subject to production testing.

8. Figure Data

Figure 1. Self-Clamped Inductive Switching

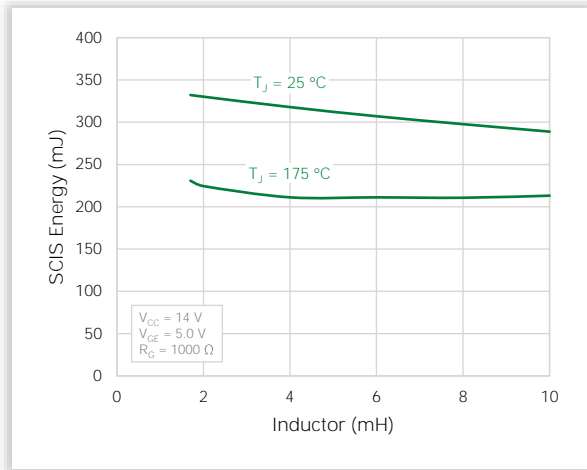


Figure 2. Open Secondary Avalanche Current vs. Temperature

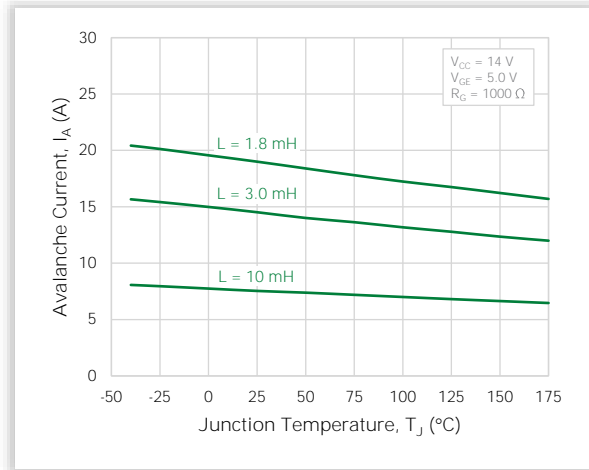


Figure 3. Collector-Emitter Voltage vs. Junction Temperature

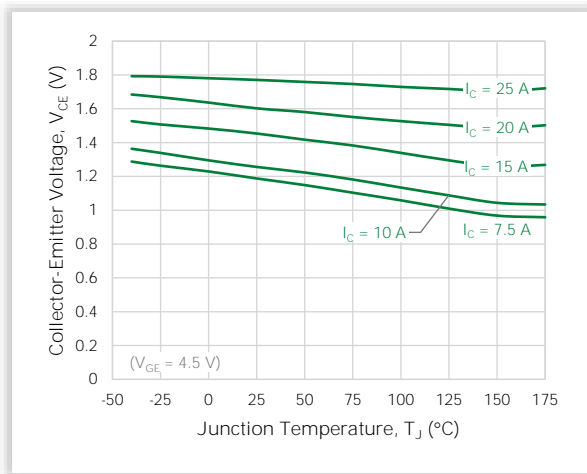
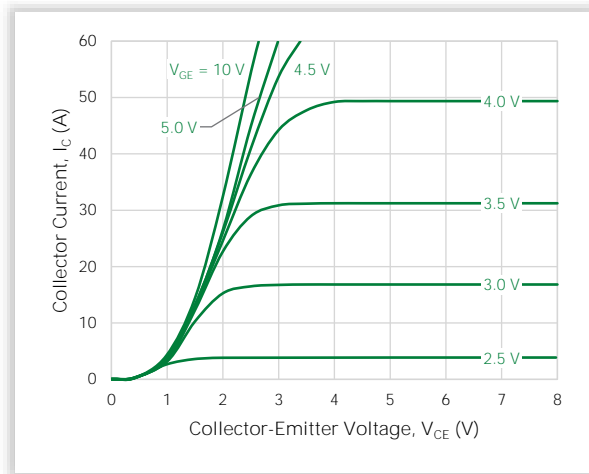
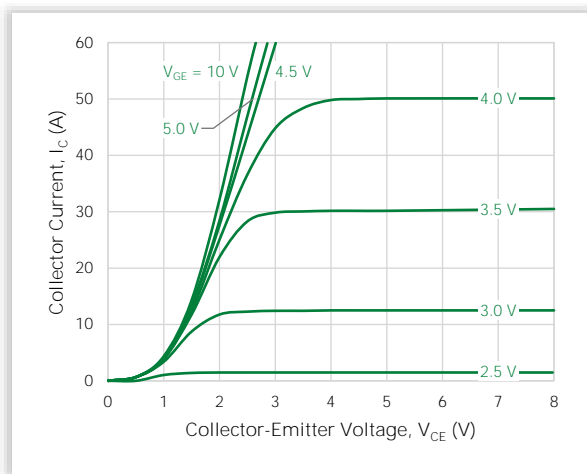
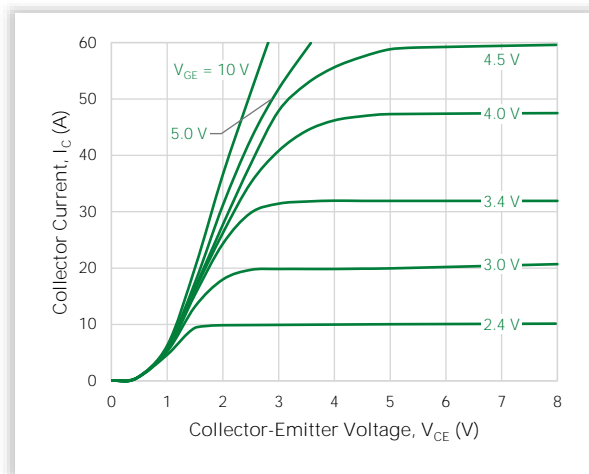

 Figure 4. Output Characteristics ($T_J = 25^\circ\text{C}$)

 Figure 5. Output Characteristics ($T_J = -40^\circ\text{C}$)

 Figure 6. Output Characteristics ($T_J = 175^\circ\text{C}$)


Figure 7. Transfer Characteristics

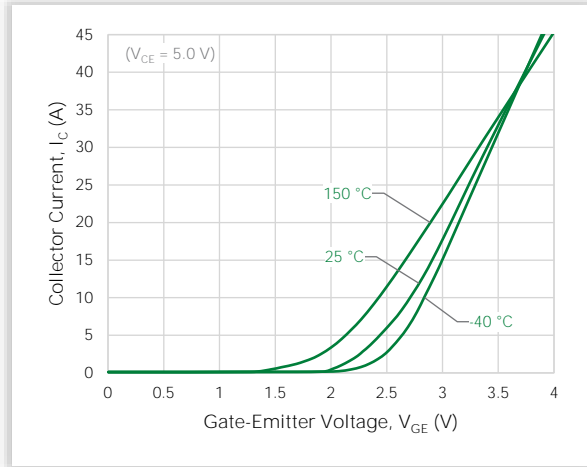


Figure 8. Collector-Emitter Leakage Current vs. Temperature

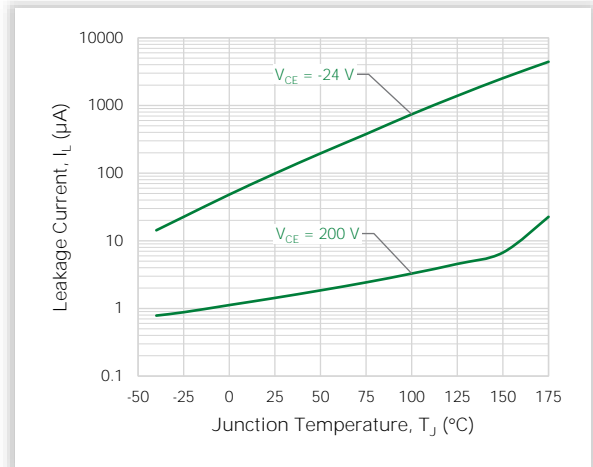


Figure 9. Gate Threshold Voltage vs. Temperature

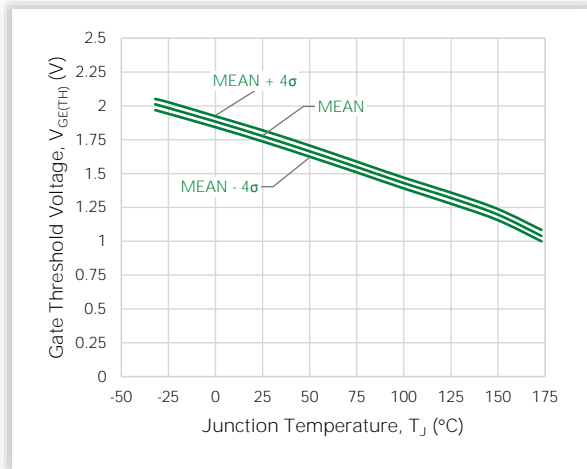


Figure 10. Capacitance Variance

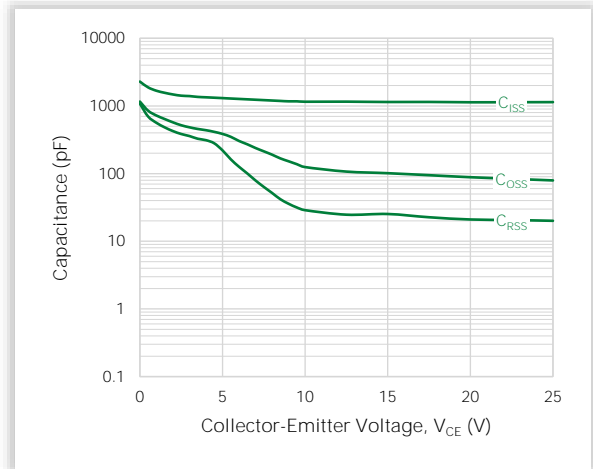


Figure 11. Resistive Switching Fall Time vs. Temperature

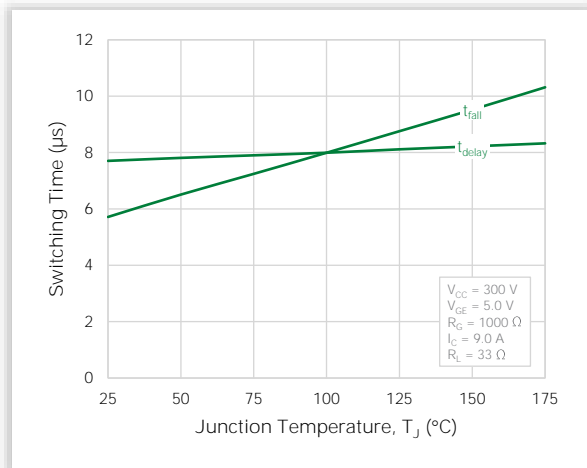


Figure 12. Inductive Switching Fall Time vs. Temperature

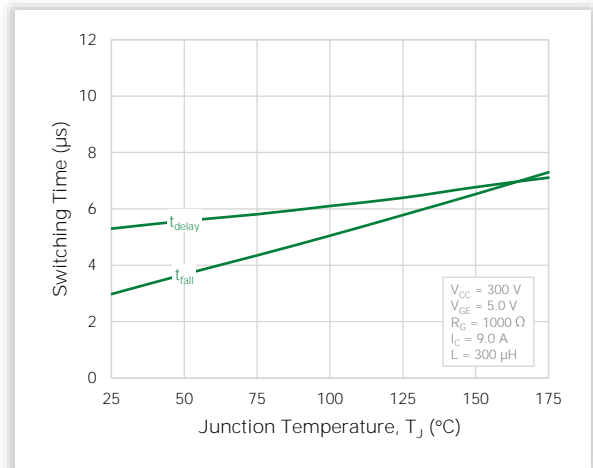


Figure 13. Minimum Pad Transient Thermal Resistance
(Non-normalized Junction-Ambient)

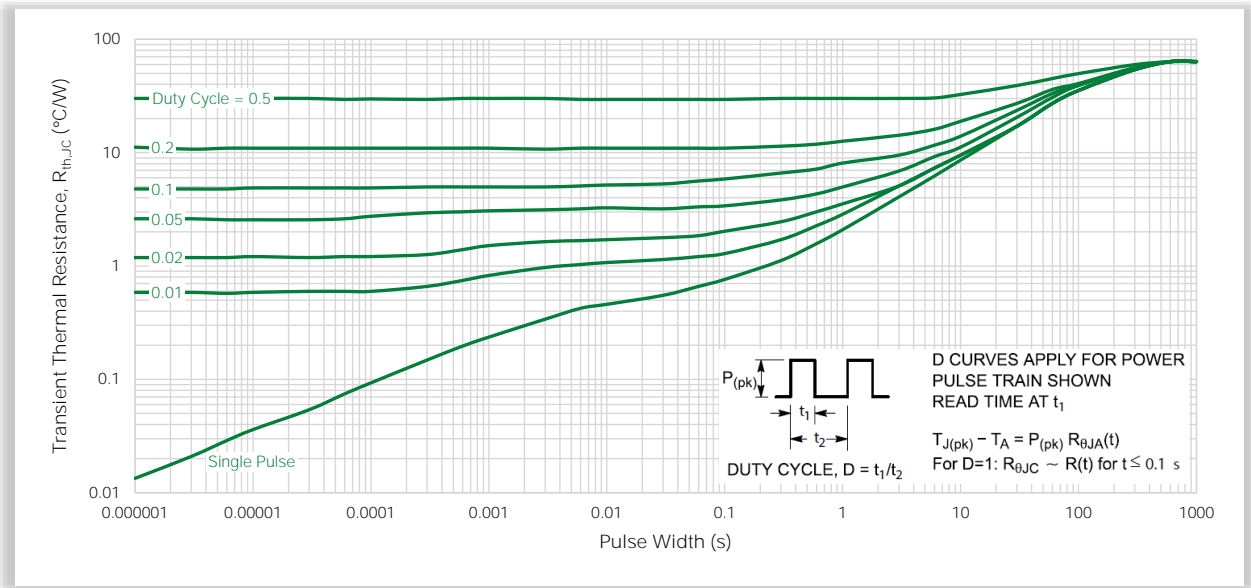
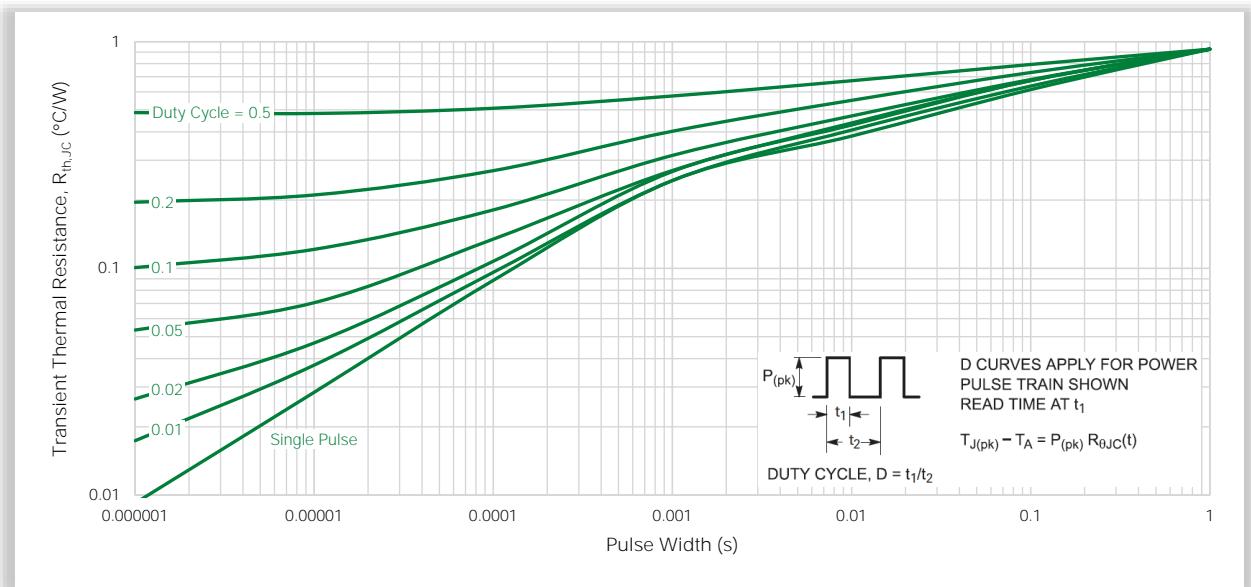
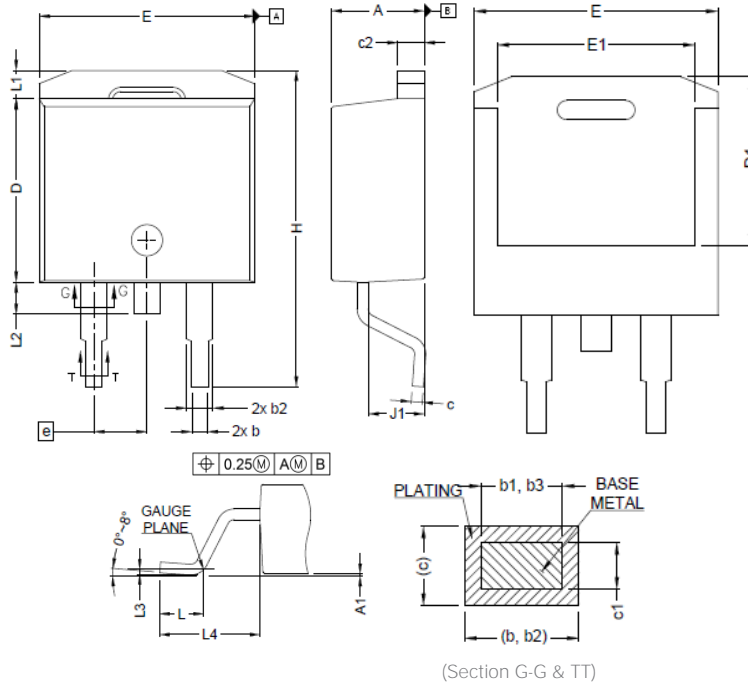


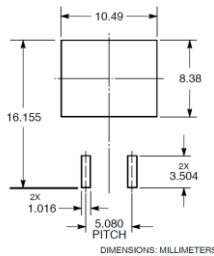
Figure 14. Best Case Transient Thermal Resistance
(Non-normalized Junction-Case mounted on cold plate)



9. Package Dimensions



Recommended Solder Pad Layout:

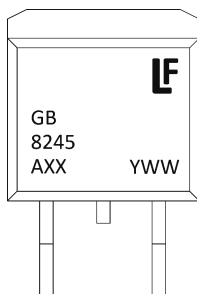


Notes:

1. Dimensioning & tolerancing conform to ASME Y14.5M-1994.
2. All dimensions are in millimeters. Angles are in degrees.
3. Heatsink side flash is max 0.8 mm.
4. Radius on terminal is optional

| Symbol | Millimeters | | |
|--------|-------------|-----|--------|
| | Min | Nom | Max |
| A | 4.360 | - | 4.560 |
| A1 | 0.000 | - | 0.250 |
| b | 0.700 | - | 0.900 |
| b1 | 0.510 | - | 0.890 |
| b2 | 1.200 | - | 1.460 |
| b3 | 1.170 | - | 1.370 |
| c | 0.380 | - | 0.694 |
| c1 | 0.380 | - | 0.534 |
| c2 | 1.190 | - | 1.340 |
| D | 8.600 | - | 9.000 |
| D1 | 6.900 | - | 7.500 |
| E | 10.150 | - | 10.550 |
| E1 | 8.100 | - | 8.700 |
| e | 2.540 BSC | | |
| H | 15.000 | - | 15.600 |
| L | 1.900 | - | 2.500 |
| L1 | - | - | 1.650 |
| L2 | - | - | 1.780 |
| L3 | 0.250 | | |
| L4 | 4.780 | - | 5.280 |
| J1 | 2.560 | - | 2.960 |

10. Part Numbering and Marking



GB8245 = Device Code
 A = Assembly Location
 XX = Lot Number
 Y = Year
 WW = Work Week

11. Packing Options

| Part Number | Package | Packing Mode | M.O.Q. |
|-------------|-----------------|--------------|--------|
| LGB8245TI | D2PAK (Pb-Free) | Tape & Reel | 800 |

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