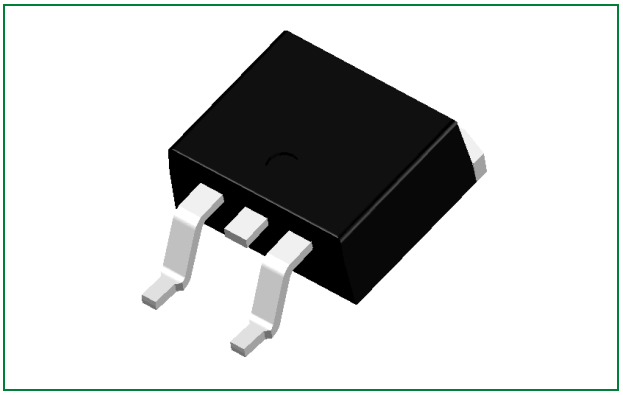
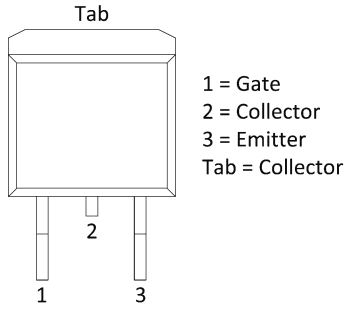
# LGB8245TI
## 450 V, 20 A N-Channel Ignition IGBT



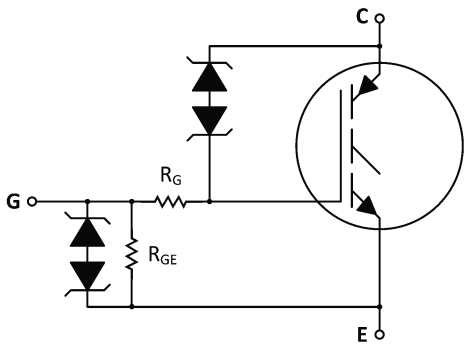
## Agency Approvals

| Environmental Approvals |
|---|
| Pb |

## Pinout Diagram




## Functional Diagram




## 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.

## 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 °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, $P_kI_L$ = 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 | $R_{\theta JC}$ | 1.0 | °C/W |
| Thermal Resistance, Junction to Ambient (D2PAK)[1] | $R_{\theta JA}$ | 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 mA, $V_{GE}$ = $V_{CE}$ | $T_J$ = 25 °C | 1.5 | 1.8 | 2.1 | V |
| | | | $T_J$ = 175 °C | 0.7 | 1.0 | 1.3 | |
| | | | $T_J$ = -40 °C | 1.7 | 2.0 | 2.3 | |
| Threshold Temperature Coefficient (Negative) | - | - | - | 4.0 | 4.6 | 5.2 | mV/°C |
| Collector-Emitter On-Voltage | $V_{CE(on)}$ | $I_C$ = 10 A, $V_{GE}$ = 3.7 V | $T_J$ = -40 °C to 175 °C | 0.8 | 1.11 | 1.97 | V |
| | | $I_C$ = 10 A, $V_{GE}$ = 4.0 V | $T_J$ = -40 °C to 175 °C | 0.8 | 1.10 | 1.85 | |
| | | $I_C$ = 15 A, $V_{GE}$ = 4.0 V | $T_J$ = -40 °C to 175 °C | 0.8 | 1.24 | 2.00 | |
| Forward Transconductance | gfs | $V_{CE}$ = 5.0 V, $I_C$ = 6.0 A | $T_J$ = 25 °C | 10 | 19 | 25 | Mhos |

## 6. Dynamic Characteristics

| Characteristic | Symbol | Conditions | Temperature | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| Input Capacitance | $C_{ISS}$ | $V_{CE}$ = 25 V, f = 10 kHz | $T_J$ = -25 °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 V, $V_{GE}$ = 5.0 V, $R_G$ = 1.0 kΩ, $R_L$ = 1.0 Ω | $T_J$ = -40 °C to 175 °C | 0.1 | 1.0 | 2.0 | µs |
| Rise Time (Resistive) 10% $I_C$ to 90% $I_C$ | $t_{rR}$ | | | 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% $I_C$ | $t_{fR}$ | | | 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 mH, $R_G$ = 1.0 kΩ, $I_C$ = 10 A, $V_{GE}$ = 5.0 V | $T_J$ = -40 °C to 175 °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

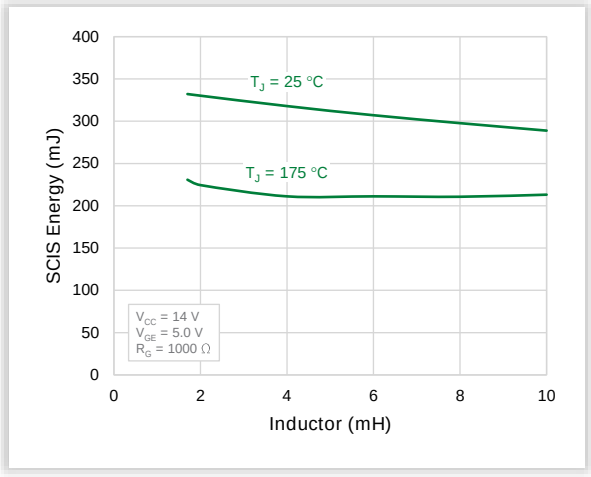



Figure 2. Open Secondary Avalanche Current vs. Temperature

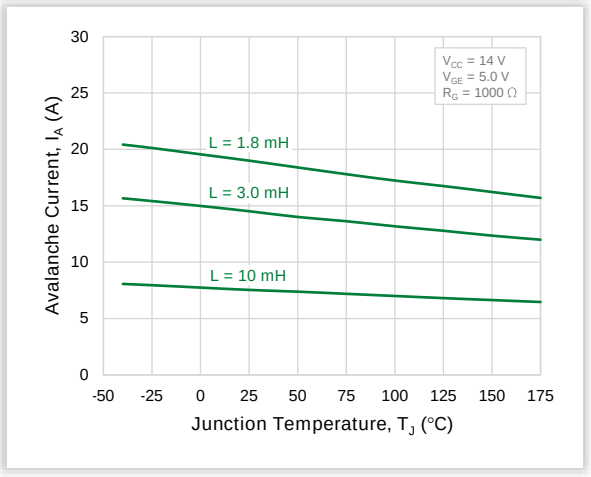



Figure 3. Collector-Emitter Voltage vs. Junction Temperature

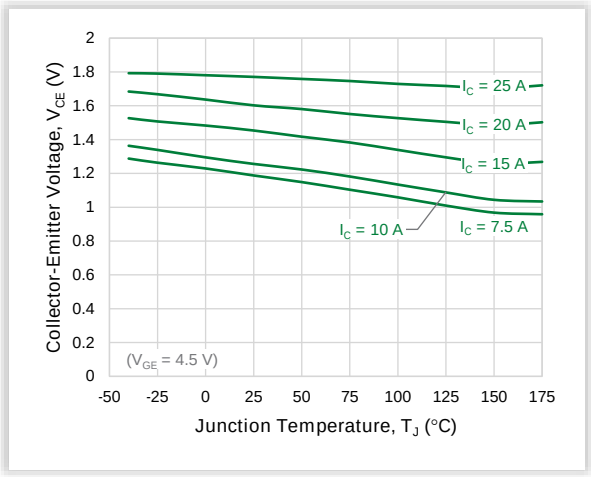



Figure 4. Output Characteristics ($T_J$ = 25 °C)

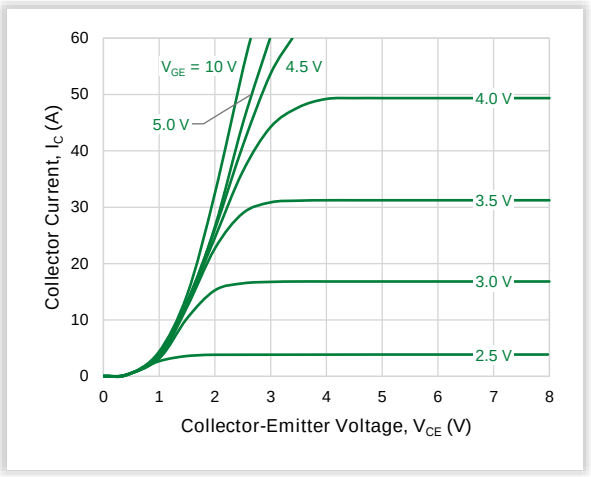



Figure 5. Output Characteristics ($T_J$ = -40 °C)

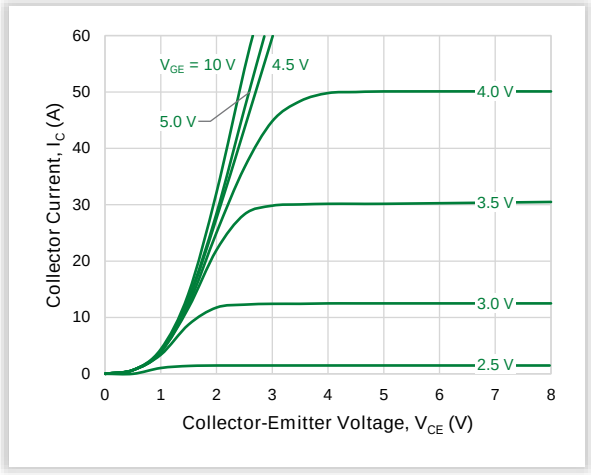



Figure 6. Output Characteristics ($T_J$ = 175 °C)

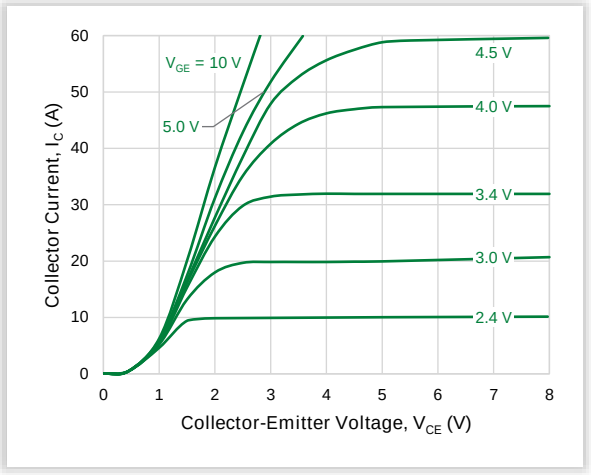


Figure 7. Transfer Characteristics

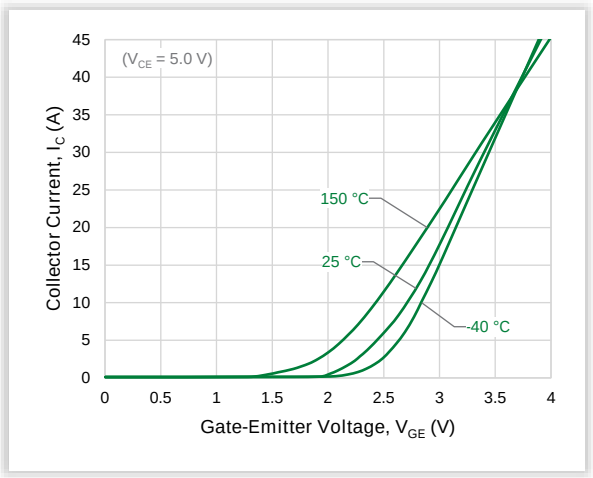



Figure 8. Collector-Emitter Leakage Current vs. Temperature

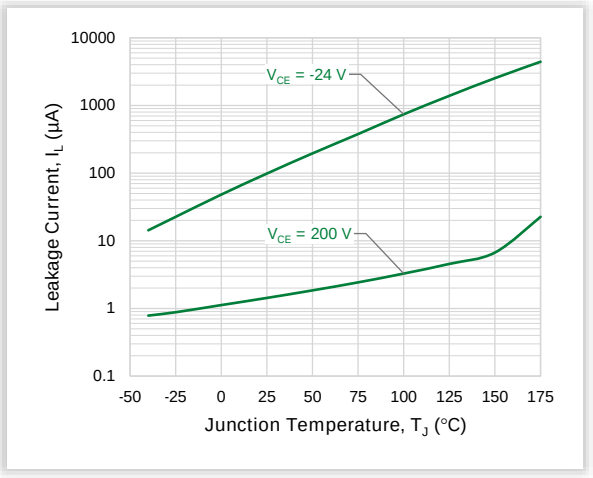



Figure 9. Gate Threshold Voltage vs. Temperature

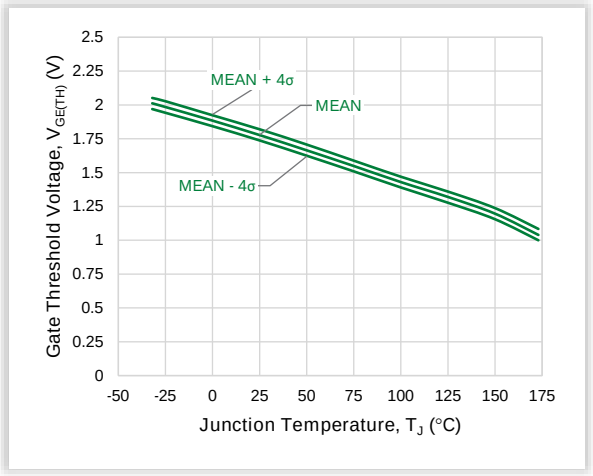



Figure 10. Capacitance Variance

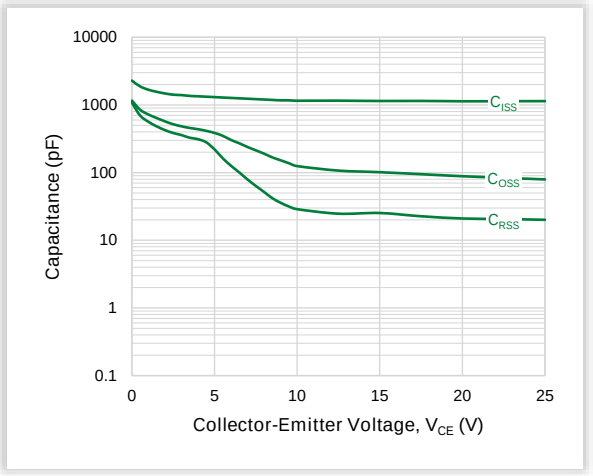



Figure 11. Resistive Switching Fall Time vs. Temperature

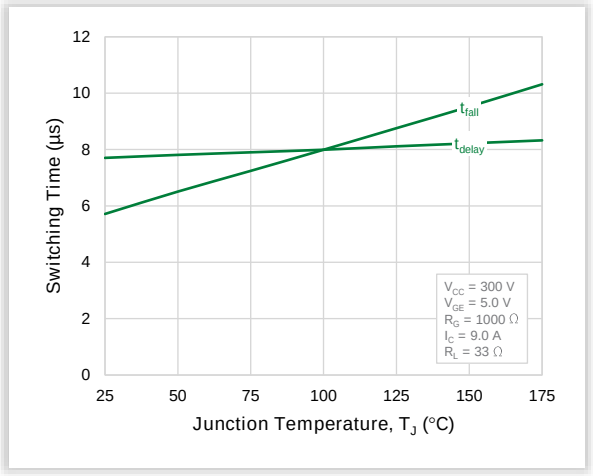



Figure 12. Inductive Switching Fall Time vs. Temperature

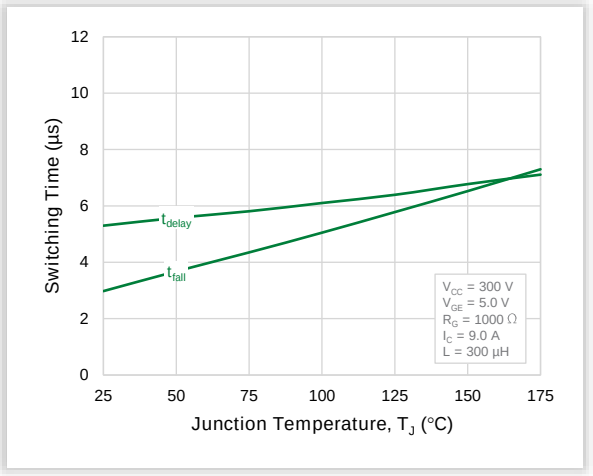


Figure 13. Minimum Pad Transient Thermal Resistance

(Non-normalized Junction-Ambient)

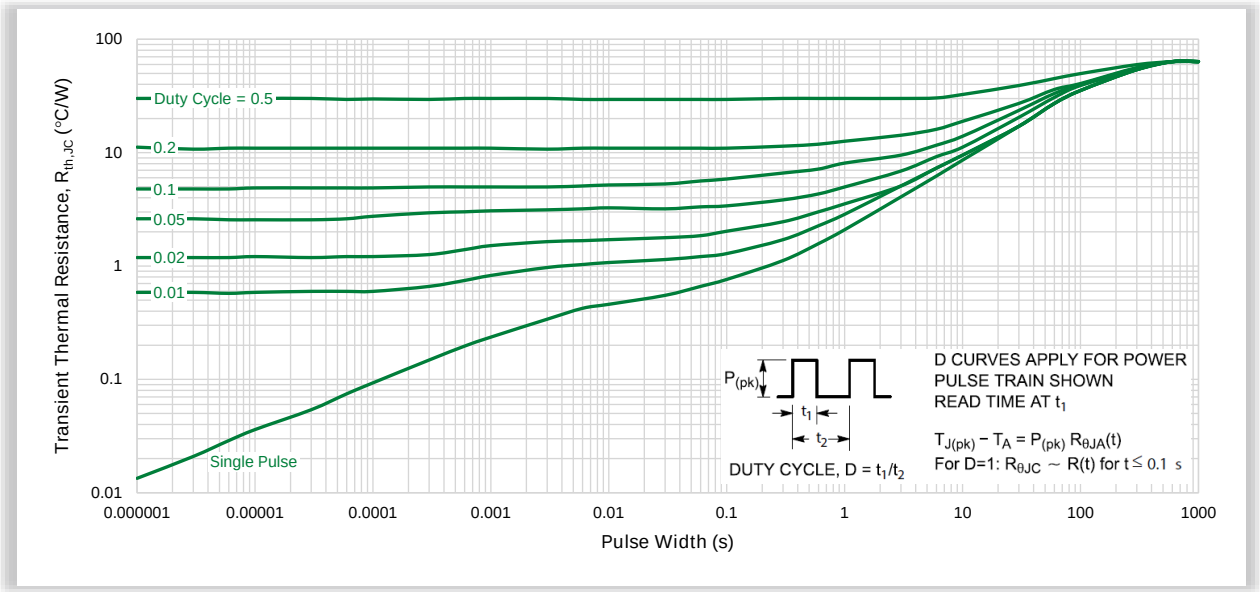
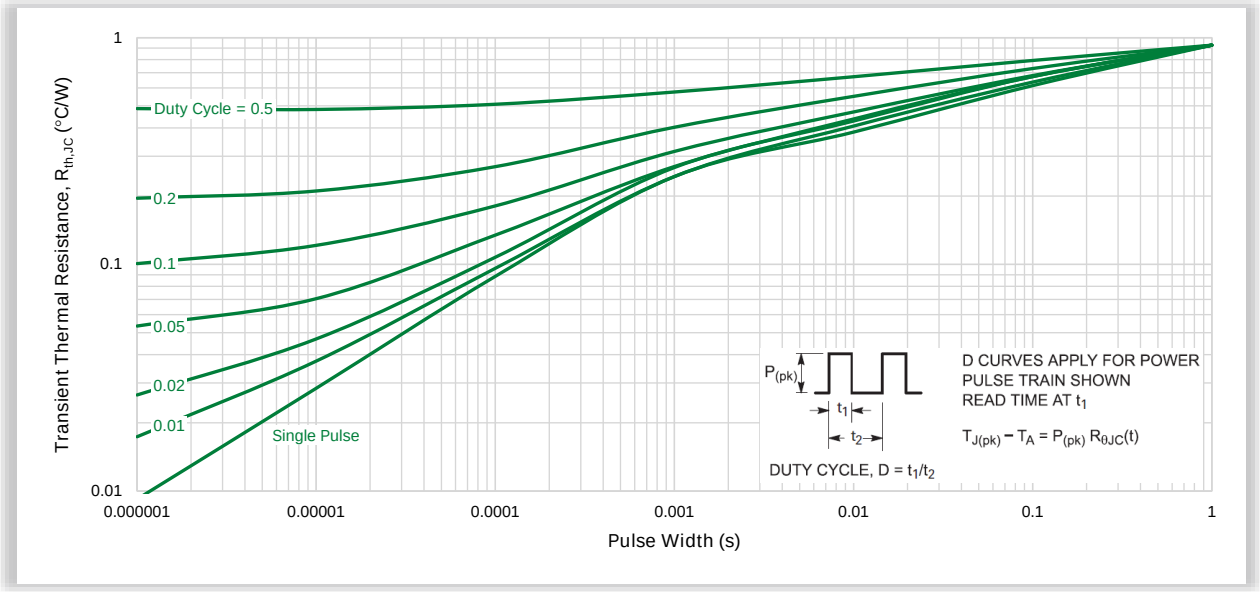
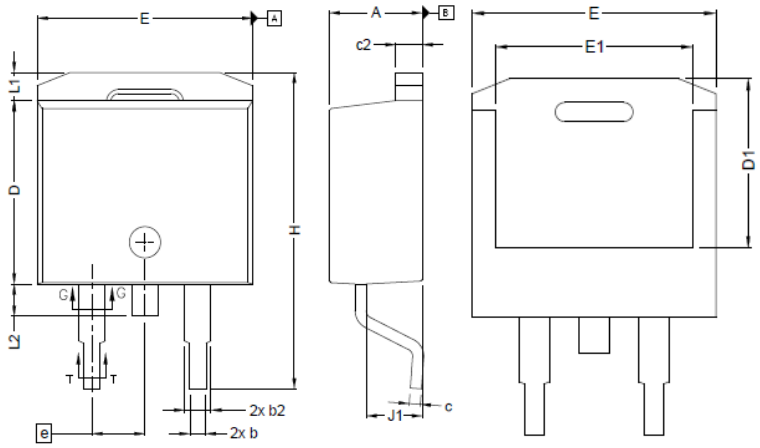


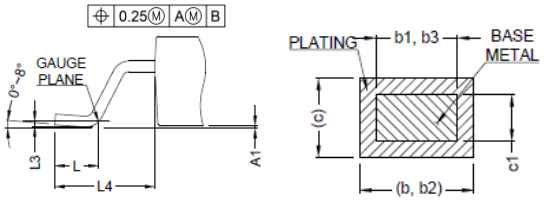

Figure 14. Best Case Transient Thermal Resistance

(Non-normalized Junction-Case mounted on cold plate)



## 9. Package Dimensions

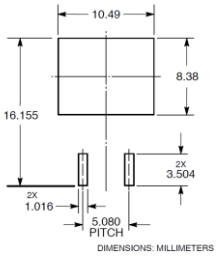



(Section G-G & TT)

| 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 |

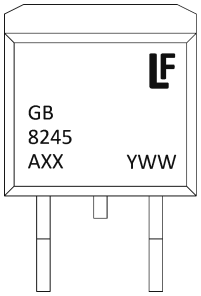
Recommended Solder Pad Layout:




Notes:

1. Dimensioning & tolerancing confirm 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

## 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 |

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