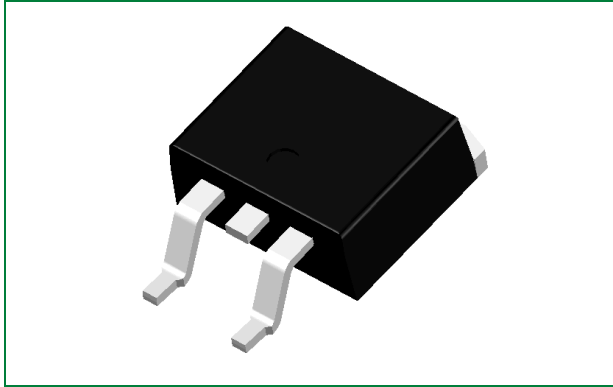


# LGB8207TH

## 365 V, 20 A N-Channel Ignition IGBT



### Product Summary

Characteristic	Value	Unit
$V_{CES}$	365	V
$I_c$	20	A

### Description

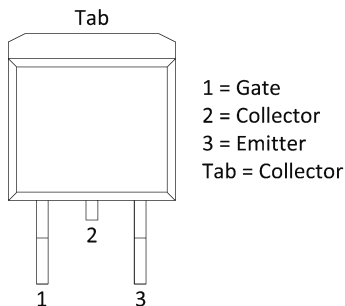
This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

### Agency Approvals

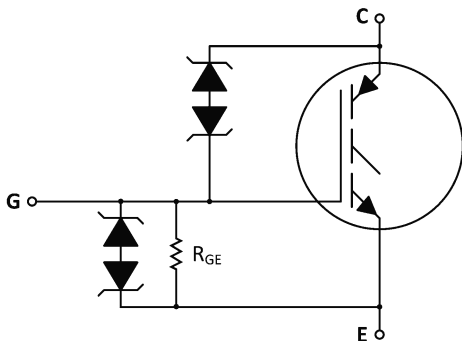
Environmental Approvals



### Pinout Diagram



### Functional Diagram



### Features

- Ideal for Coil-on-Plug and Driver-on-Coil Applications
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage Interfaces Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Minimum Avalanche Energy – 500 mJ
- Gate Resistor ( $R_G$ ) = 70  $\Omega$
- AEC-Q101 Qualified
- These are Pb-Free Devices

### Applications

- Ignition Systems

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## 1. Maximum Ratings ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristic	Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	-	$V_{CES}$	365	V
Gate-Emitter Voltage	-	$V_{GE}$	$\pm 15$	V
Collector Current – Continuous	$T_C = 25\text{ }^\circ\text{C}$	$I_C$	20	$A_{DC}$
Collector Current – Pulsed			50	$A_{AC}$
Continuous Gate Current	-	$I_G$	1.0	mA
Transient Gate Current	$t < 2\text{ ms}, f \leq 100\text{ Hz}$		20	mA
ESD – Charged-Device Model	-	ESD	2.0	kV
ESD – Human Body Model	$R = 1500\ \Omega, C = 100\text{ pF}$		8.0	kV
ESD – Machine Model	$R = 0\ \Omega, C = 200\text{ pF}$		500	V
Total Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	$P_D$	165	W
	Derating for $>25\text{ }^\circ\text{C}$		1.1	$\text{W}/^\circ\text{C}$
Operating and Storage Temperature Range	-	$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$

## 2. Unclamped Collector-to-Emitter Avalanche Characteristics

Characteristic	Symbol	Value	Unit
Single Pulse Collector-to-Emitter Avalanche Energy	$E_{AS}$	500	mJ
$V_{CC} = 50\text{ V}, V_{GE} = 5.0\text{ V}, P_{kL} = 16.5\text{ A}, L = 3.7\text{ mH}, R_G = 1\text{ k}\Omega$ , Starting $T_J = 25\text{ }^\circ\text{C}$			
$V_{CC} = 50\text{ V}, V_{GE} = 5.0\text{ V}, P_{kL} = 10\text{ A}, L = 6.1\text{ mH}, R_G = 1\text{ k}\Omega$ , Starting $T_J = 125\text{ }^\circ\text{C}$		306	
Reverse Avalanche Energy	$E_{AS(R)}$	2000	mJ
$V_{CC} = 100\text{ V}, V_{GE} = 20\text{ V}, P_{kL} = 25.8\text{ A}, L = 6.0\text{ mH}$ , Starting $T_J = 25\text{ }^\circ\text{C}$			

Note:  $-55\text{ }^\circ\text{C} \leq T_J \leq 150\text{ }^\circ\text{C}$

## 3. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.9	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient (D2PAK) <sup>1</sup>	$R_{\theta JA}$	50	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	$T_L$	275	$^\circ\text{C}$

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	$BV_{CES}$	$I_C = 2.0 \text{ mA}$	$T_J = -40 \text{ }^\circ\text{C to } 150 \text{ }^\circ\text{C}$	325	350	375	V
		$I_C = 10 \text{ mA}$		340	365	390	
Zero Gate Voltage Collector Current	$I_{CES}$	$V_{CE} = 24 \text{ V}, V_{GE} = 0 \text{ V}$	$T_J = 25 \text{ }^\circ\text{C}$	-	0.1	2.0	$\mu\text{A}$
			$T_J = 25 \text{ }^\circ\text{C}$	-	1.0	5	
		$V_{CE} = 250 \text{ V}, V_{GE} = 0 \text{ V}$	$T_J = 175 \text{ }^\circ\text{C}$	70	85	150	
			$T_J = -40 \text{ }^\circ\text{C}$	-	0.25	2.5	
Reverse Collector-Emitter Leakage Current	$I_{ECS}$	$V_{CE} = -24 \text{ V}$	$T_J = 25 \text{ }^\circ\text{C}$	0.10	0.25	0.85	mA
			$T_J = 175 \text{ }^\circ\text{C}$	20	25	40	
			$T_J = -40 \text{ }^\circ\text{C}$	-	0.03	0.3	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	$I_C = -75 \text{ mA}$	$T_J = 25 \text{ }^\circ\text{C}$	30	33	39	V
			$T_J = 175 \text{ }^\circ\text{C}$	30	36	42	
			$T_J = -40 \text{ }^\circ\text{C}$	29	32	35	
Gate-Emitter Clamp Voltage	$BV_{GES}$	$I_G = \pm 5.0 \text{ mA}$	$T_J = -40 \text{ }^\circ\text{C to } 175 \text{ }^\circ\text{C}$	12	13	14.5	V
Gate-Emitter Leakage Current	$I_{GES}$	$V_{GE} = \pm 10.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C to } 175 \text{ }^\circ\text{C}$	500	700	1000	$\mu\text{A}$
Gate-Emitter Resistor	$R_{GE}$	-	$T_J = -40 \text{ }^\circ\text{C to } 175 \text{ }^\circ\text{C}$	14.25	16	25	k $\Omega$
Gate Resistor	$R_G$	-	$T_J = -40 \text{ }^\circ\text{C to } 175 \text{ }^\circ\text{C}$	-	70	-	$\Omega$

## 5. Electrical Characteristics – On

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0 \text{ mA}, V_{GE} = V_{CE}$	$T_J = 25 \text{ }^\circ\text{C}$	1.2	1.5	2.0	V
			$T_J = 175 \text{ }^\circ\text{C}$	0.6	0.8	1.2	
			$T_J = -40 \text{ }^\circ\text{C}$	1.4	1.7	2.0	
Threshold Temperature Coefficient (Negative)	-	-	-	12	12	12	mV/ $^\circ\text{C}$
Collector-Emitter On-Voltage <sup>2</sup>	$V_{CE(on)}$	$I_C = 6.0 \text{ mA}, V_{GE} = 4.0 \text{ V}$	$T_J = 25 \text{ }^\circ\text{C}$	1.0	1.3	1.6	V
			$T_J = 175 \text{ }^\circ\text{C}$	0.8	1.1	1.4	
			$T_J = -40 \text{ }^\circ\text{C}$	1.15	1.4	1.75	
		$I_C = 10.0 \text{ mA}, V_{GE} = 4.5 \text{ V}$	$T_J = 25 \text{ }^\circ\text{C}$	-	0.62	1.0	
			$T_J = 25 \text{ }^\circ\text{C}$	1.1	1.5	1.7	
			$T_J = 175 \text{ }^\circ\text{C}$	1.0	1.3	1.6	
		$I_C = 8.0 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$	1.2	1.5	1.85	
			$T_J = 25 \text{ }^\circ\text{C}$	1.2	1.6	1.9	
			$T_J = 175 \text{ }^\circ\text{C}$	1.1	1.45	1.8	
		$I_C = 10 \text{ A}, V_{GE} = 3.7 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$	1.3	1.7	2.0	
			$T_J = 25 \text{ }^\circ\text{C}$	1.1	1.5	1.85	
			$T_J = 175 \text{ }^\circ\text{C}$	1.1	1.4	1.75	
		$I_C = 10 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$	1.35	1.7	2.1	
			$T_J = 25 \text{ }^\circ\text{C}$	1.2	1.5	1.8	
			$T_J = 175 \text{ }^\circ\text{C}$	1.1	1.4	1.7	
		$I_C = 10 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$	1.2	1.6	2.0	
			$T_J = 25 \text{ }^\circ\text{C}$	1.45	1.85	2.15	
			$T_J = 175 \text{ }^\circ\text{C}$	1.6	1.9	2.4	
		$I_C = 15 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$	1.5	1.9	2.25	
			$T_J = 25 \text{ }^\circ\text{C}$	1.6	2.1	2.6	
			$T_J = 175 \text{ }^\circ\text{C}$	2.0	2.4	3.1	
$I_C = 20 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$	1.6	2.1	2.5			
	$T_J = 25 \text{ }^\circ\text{C}$	-	15.8	-			
	$T_J = 175 \text{ }^\circ\text{C}$	-	15.8	-			
Forward Transconductance <sup>2</sup>	gfs	$V_{CE} = 5.0 \text{ V}, I_C = 6.0 \text{ A}$	$T_J = 25 \text{ }^\circ\text{C}$	-	15.8	-	Mhos

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

## 6. Dynamic Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Input Capacitance	$C_{ISS}$	$V_{CE} = 25 \text{ V}$ , $f = 10 \text{ kHz}$	$T_J = -25 \text{ }^\circ\text{C}$	750	810	900	pF
Output Capacitance	$C_{OSS}$			75	90	105	
Transfer Capacitance	$C_{RSS}$			4	7	12	

## 7. Switching Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Low Voltage							
Turn-on Delay Time (Resistive)	$t_{d(on)}$	$V_{CE} = 14 \text{ V}$ , $V_{GE} = 5.0 \text{ V}$ , $R_G = 1.0 \text{ k}\Omega$ , $R_L = 1.0 \Omega$	$T_J = 25 \text{ }^\circ\text{C}$	0.5	0.55	0.7	$\mu\text{s}$
Rise Time (Resistive)	$t_r$			2.0	2.32	2.7	
Turn-off Delay Time (Resistive)	$t_{d(off)}$			2.0	2.5	3.0	
Fall Time (Resistive)	$t_f$			8.0	10	13	
High Voltage							
Turn-on Delay Time (Resistive)	$t_{d(on)}$	$V_{CE} = 300 \text{ V}$ , $V_{GE} = 5.0 \text{ V}$ , $R_G = 1.0 \text{ k}\Omega$ , $R_L = 46 \Omega$	$T_J = 25 \text{ }^\circ\text{C}$	0.5	0.65	0.75	$\mu\text{s}$
Rise Time (Resistive)	$t_r$			0.7	1.8	2.0	
Turn-off Delay Time (Resistive)	$t_{d(off)}$			4.0	4.7	6.0	
Fall Time (Resistive)	$t_f$			6.0	10	15	

## 8. Figure Data

Figure 1. Typical Self Clamped Inductive Switching Performance (SCIS) @ 25 °C

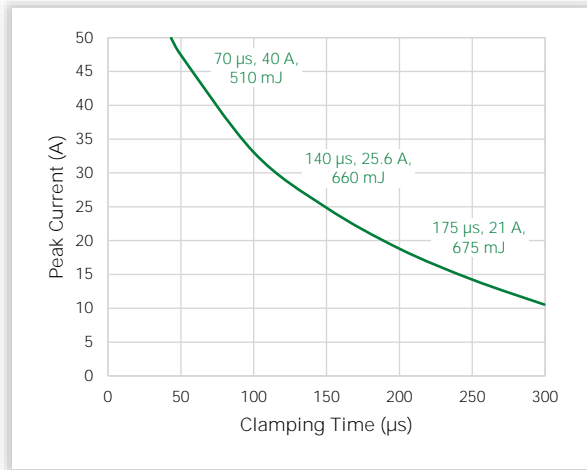


Figure 2. Typical Self Clamped Inductive Switching Performance (SCIS) @ 150 °C

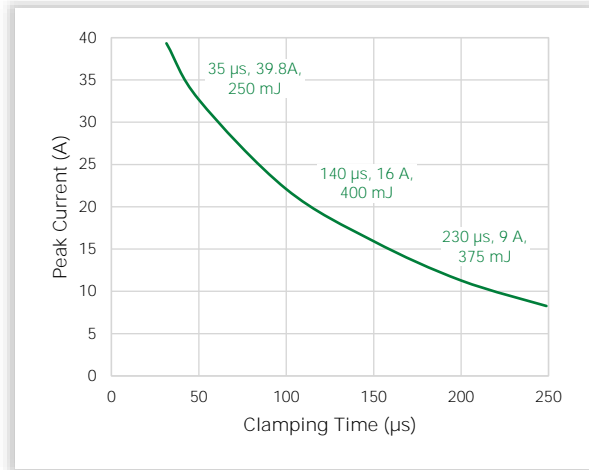


Figure 3. Collector-Emitter Voltage vs. Collector Current

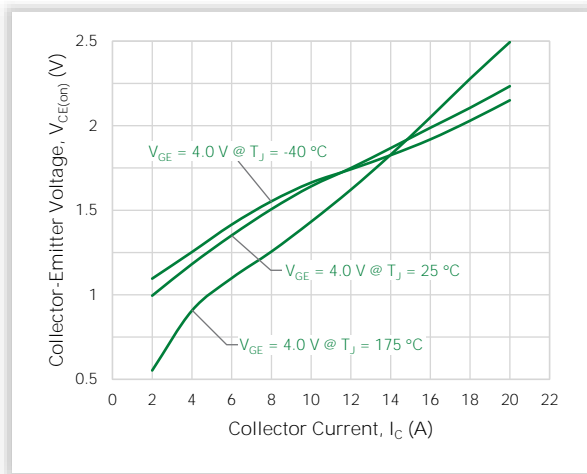


Figure 4. Collector-Emitter Voltage vs. Junction Temperature

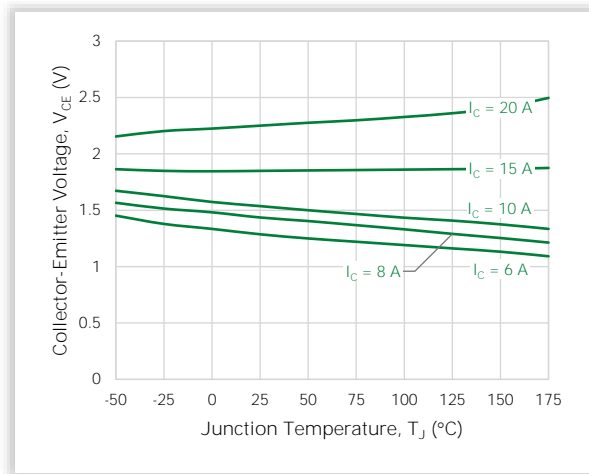


Figure 5. Output Characteristics (T<sub>J</sub> = 25 °C)

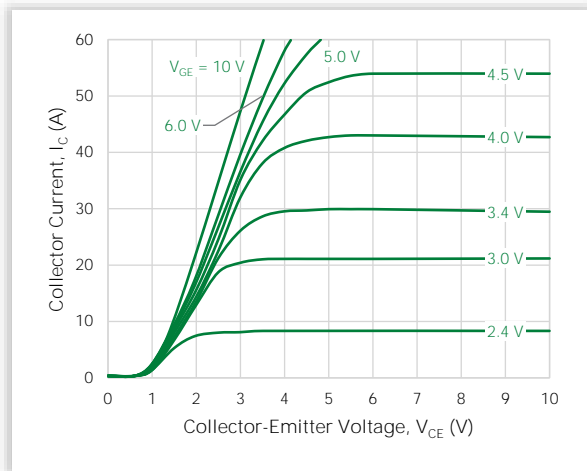


Figure 6. Output Characteristics (T<sub>J</sub> = -40 °C)

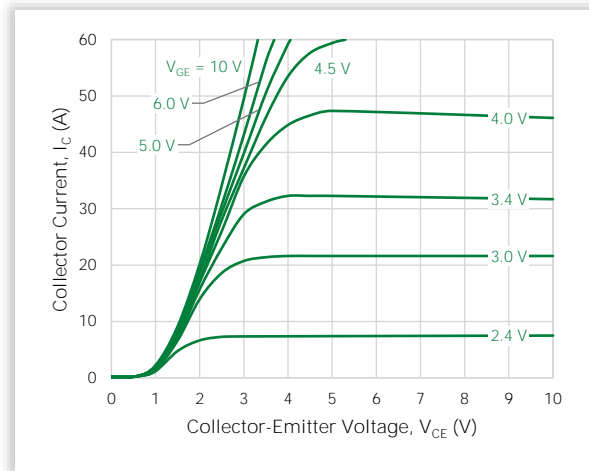


Figure 7. Output Characteristics ( $T_J = 150\text{ }^\circ\text{C}$ )

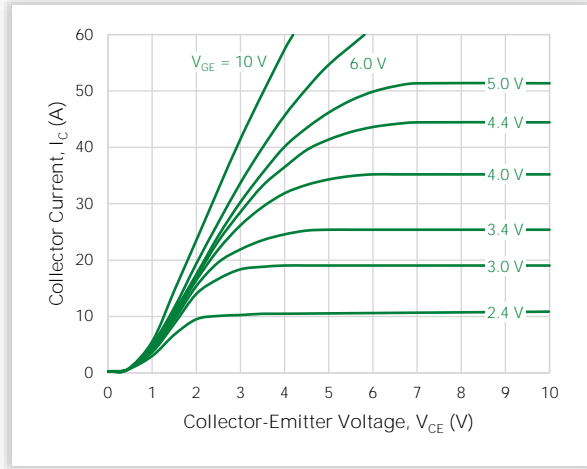


Figure 8. Transfer Characteristics

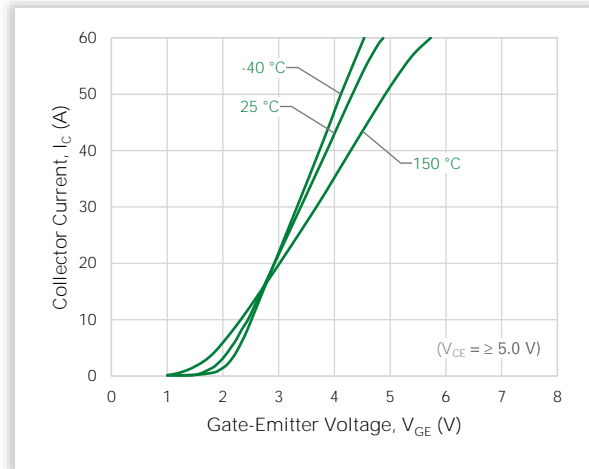


Figure 9. Collector-Emitter Leakage Current vs. Temperature

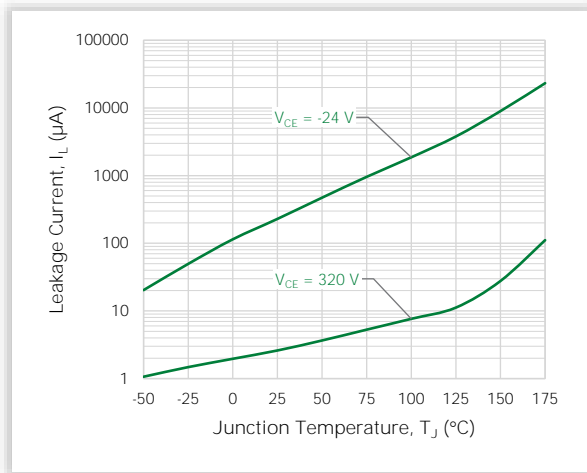


Figure 10. Gate Threshold Voltage vs. Temperature

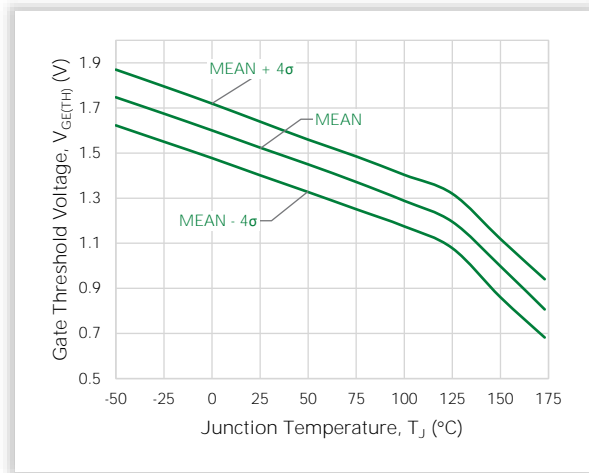


Figure 11. Capacitance Variance

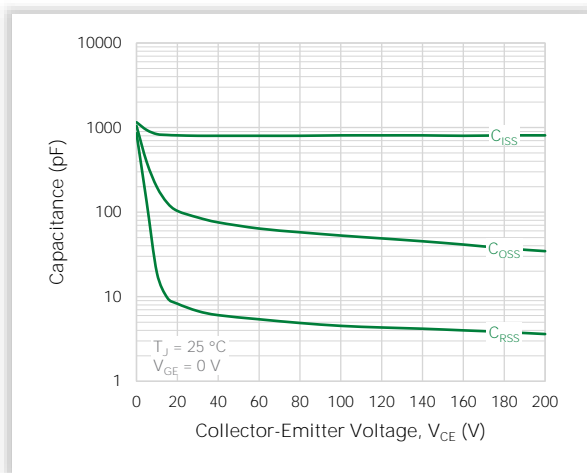


Figure 12. Resistive Switching Time Variation vs. Temperature

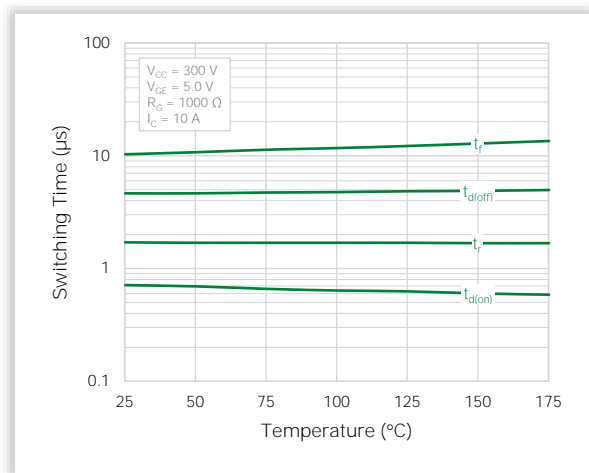




Figure 13. Inductive Switching Time Variation vs. Temperature

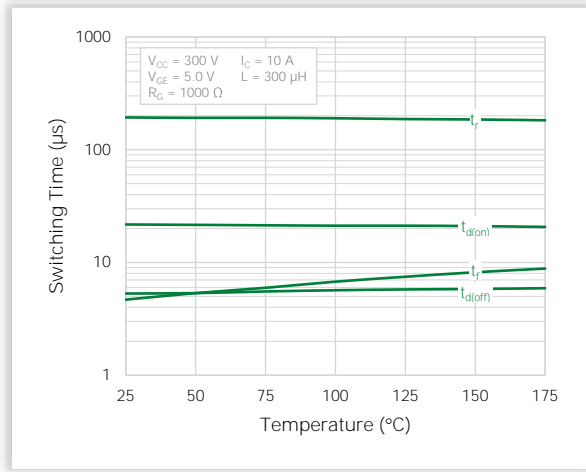


Figure 14. Forward Biased Safe Operating Area

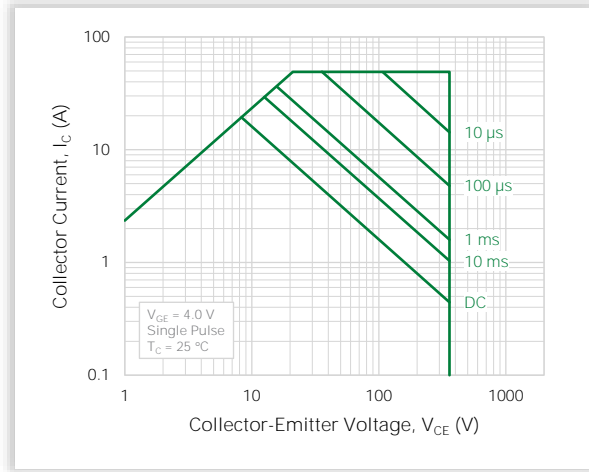
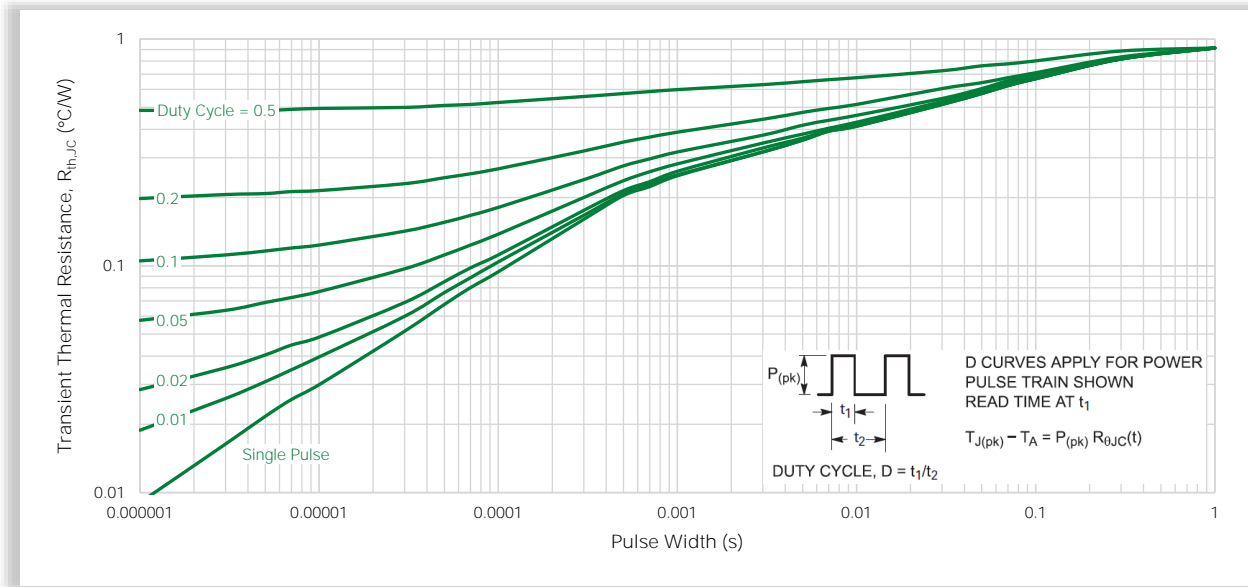
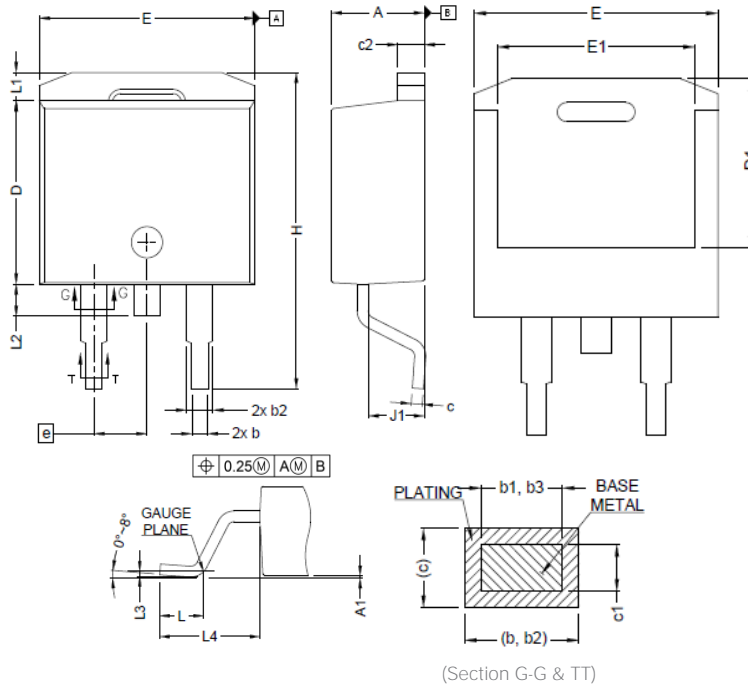


Figure 15. Best Case Transient Thermal Resistance

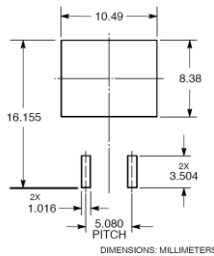
(Non-normalized Junction-Case mounted on cold plate)



## 9. Package Dimensions



Recommended Solder Pad Layout:

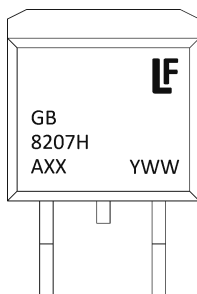


Notes:

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



GB8207	= Device Code
A	= Assembly Location
XX	= Lot Number
Y	= Year
WW	= Work Week
H	= Ballast Structure Design

## 11. Packing Options

Part Number	Package	Packing Mode	M.O.Q.
LGB8207TH	D2PAK (Pb-Free)	Tape & Reel	800

For additional information please visit [www.Littelfuse.com/powersemi](http://www.Littelfuse.com/powersemi)

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