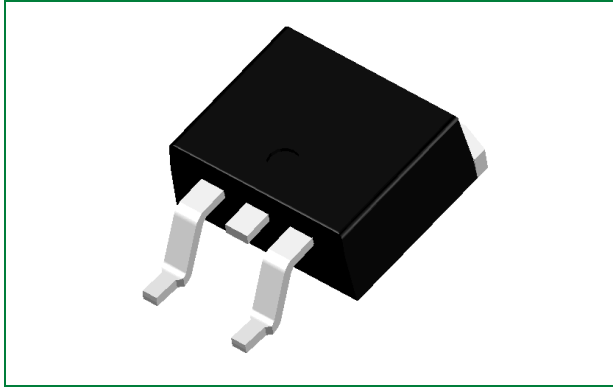


LGB8204ATH 400 V, 18 A N-Channel Ignition IGBT

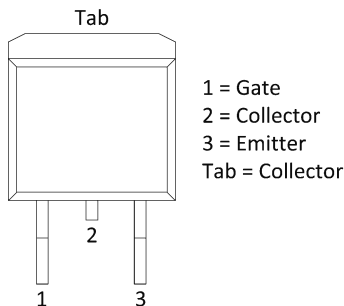


Agency Approvals

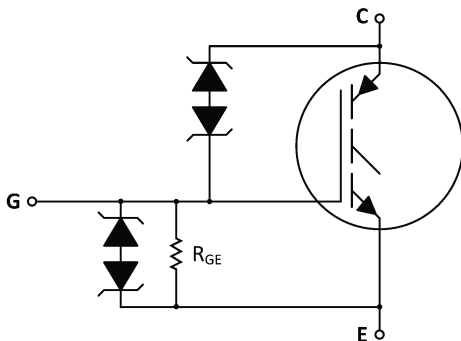
Environmental Approvals



Pinout Diagram



Functional Diagram



Product Summary

Characteristic	Value	Unit
V_{CES}	400	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.

Features

- Ideal for Coil-on-Plug Applications
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- New Design Increases Unclamped Inductive Switching (UIS) Energy Per Area
- Low Threshold Voltage Interfaces Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Integrated Gate-Emitter Resistor (R_{GE})
- AEC-Q101 Qualified
- These are Pb-Free Devices
- Emitter Ballasting for Short-Circuit Capability

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

Characteristic	Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	-	V_{CES}	430	V_{DC}
Collector-Gate Voltage	-	V_{CER}	430	V_{DC}
Gate-Emitter Voltage	-	V_{GE}	18	V_{DC}
Collector Current – Continuous	$T_C = 25^\circ\text{C}$	I_C	18	A_{DC}
Collector Current – Pulsed			50	A_{AC}
ESD – Human Body Model	$R = 1500\ \Omega$, $C = 100\ \text{pF}$	ESD	8.0	kV
ESD – Machine Model	$R = 0\ \Omega$, $C = 200\ \text{pF}$		800	V
Total Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	115	W
	Derating for $> 25^\circ\text{C}$		0.77	$\text{W}/^\circ\text{C}$
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			
V _{CC} = 50 V, V _{GE} = 5.0 V, P _{kL} = 21.1 A, L = 1.8 mH, Starting T _J = 25 °C	E _{AS}	400	mJ
V _{CC} = 50 V, V _{GE} = 5.0 V, P _{kL} = 18.3 A, L = 1.8 mH, Starting T _J = 125 °C		300	
Reverse Avalanche Energy			
V _{CC} = 100 V, V _{GE} = 20 V, P _{kL} = 25.8 A, L = 6.0 mH, Starting T _J = 25 °C	E _{AS(R)}	2000	mJ

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

3. Maximum Short-Circuit Times

Characteristic	Symbol	Value	Unit
Short Circuit Withstand Time 1 ¹	$t_{sc,1}$	750	μs
Short Circuit Withstand Time 2 ²	$t_{sc,2}$	5.0	ms

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

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	$R_{\theta JC}$	1.3	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient (D2PAK) ³	$R_{\theta JA}$	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 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}	$I_C = 2.0 \text{ mA}$	$T_J = -40^\circ\text{C to } 150^\circ\text{C}$	380	395	420	V_{DC}
		$I_C = 10 \text{ mA}$		390	405	430	
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 200 \text{ V}, V_{GE} = 0 \text{ V}$	$T_J = 25^\circ\text{C}$	-	2.0	10	μA_{DC}
			$T_J = 150^\circ\text{C}$	-	10	40 ⁴	
			$T_J = -40^\circ\text{C}$	-	1.0	10	
Reverse Collector-Emitter Leakage Current	I_{ECS}	$V_{CE} = -24 \text{ V}$	$T_J = 25^\circ\text{C}$	-	0.7	1.0	mA
			$T_J = 150^\circ\text{C}$	-	12	25 ⁴	
			$T_J = -40^\circ\text{C}$	-	0.1	1.0	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	$I_C = -75 \text{ mA}$	$T_J = 25^\circ\text{C}$	27	33	37	V_{DC}
			$T_J = 150^\circ\text{C}$	30	36	40	
			$T_J = -40^\circ\text{C}$	25	32	35	
Gate-Emitter Clamp Voltage	BV_{GES}	$I_G = 5.0 \text{ mA}$	$T_J = -40^\circ\text{C to } 150^\circ\text{C}$	11	13	15	V_{DC}
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = 10 \text{ V}$	$T_J = -40^\circ\text{C to } 150^\circ\text{C}$	384	640	700	μA_{DC}
Gate-Emitter Resistor	R_{GE}	-	$T_J = -40^\circ\text{C to } 150^\circ\text{C}$	10	16	26	k Ω

Footnote 4: Maximum value of characteristic across temperature range

6. Electrical Characteristics – On

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0 \text{ mA}, V_{GE} = V_{CE}$	$T_J = 25^\circ\text{C}$	1.1	1.4	1.9	V_{DC}
			$T_J = 150^\circ\text{C}$	0.75	1.0	1.4	
			$T_J = -40^\circ\text{C}$	1.2	1.6	2.1 ⁴	
Threshold Temperature Coefficient (Negative)	-	-	-	-	3.4	-	mV/ $^\circ\text{C}$
Collector-Emitter On-Voltage ⁵	$V_{CE(on)}$	$I_C = 6.0 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.0	1.4	1.6	V_{DC}
			$T_J = 150^\circ\text{C}$	0.9	1.3	1.6	
			$T_J = -40^\circ\text{C}$	1.1	1.45	1.7 ⁴	
		$I_C = 8.0 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.3	1.6	1.9 ⁴	
			$T_J = 150^\circ\text{C}$	1.2	1.55	1.8	
			$T_J = -40^\circ\text{C}$	1.4	1.6	1.9 ⁴	
		$I_C = 10 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.4	1.8	2.0	
			$T_J = 150^\circ\text{C}$	1.5	1.8	2.0	
			$T_J = -40^\circ\text{C}$	1.4	1.8	2.1 ⁴	
		$I_C = 15 \text{ A}, V_{GE} = 4.0 \text{ V}$	$T_J = 25^\circ\text{C}$	1.8	2.2	2.5	
			$T_J = 150^\circ\text{C}$	2.0	2.4	2.6	
			$T_J = -40^\circ\text{C}$	1.7	2.1	2.5	
		$I_C = 10 \text{ A}, V_{GE} = 4.5 \text{ V}$	$T_J = 25^\circ\text{C}$	1.3	1.8	2.0 ⁴	
			$T_J = 150^\circ\text{C}$	1.3	1.75	2.0 ⁴	
			$T_J = -40^\circ\text{C}$	1.4	1.8	2.0 ⁴	
Forward Transconductance ⁵	gfs	$V_{CS} = 5.0 \text{ V}, I_C = 6.0 \text{ A}$	$T_J = -40^\circ\text{C to } 150^\circ\text{C}$	8.0	14	25	Mhos

Footnote 4: Maximum value of characteristic across temperature range

Footnote 5: Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$

7. Dynamic Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Input Capacitance	C_{iss}	$V_{CC} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 1.0 \text{ MHz}$	$T_J = -40 \text{ }^{\circ}\text{C to } 150 \text{ }^{\circ}\text{C}$	400	800	1000	pF
Output Capacitance	C_{oss}			50	75	100	
Transfer Capacitance	C_{rss}			4.0	7.0	10	

8. Switching Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Turn-off Delay Time (Resistive)	$t_{d(off)}$	$V_{CC} = 300 \text{ V}, I_C = 6.5 \text{ A}, R_G = 1.0 \text{ k}\Omega, R_L = 46 \text{ }\Omega$	$T_J = 25 \text{ }^{\circ}\text{C}$	-	4.0	10	μs
Fall Time (Resistive)	t_f			-	9.0	15	
Turn-on Delay Time	$t_{d(on)}$	$V_{CC} = 10 \text{ V}, I_C = 6.5 \text{ A}, R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \text{ }\Omega$	$T_J = 25 \text{ }^{\circ}\text{C}$	-	0.7	4.0	μs
Rise Time	t_r			-	4.5	7.0	

9. Figure Data

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

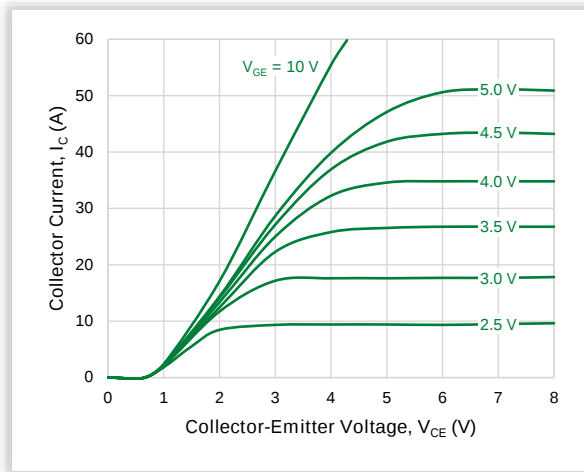


Figure 2. Output Characteristics ($T_J = -40^\circ\text{C}$)

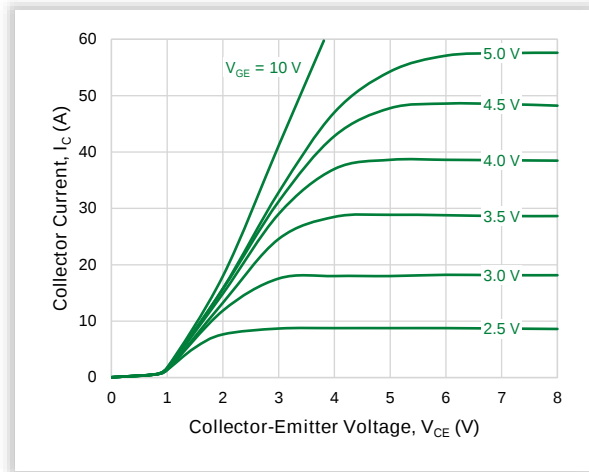


Figure 3. Output Characteristics ($T_J = 150^\circ\text{C}$)

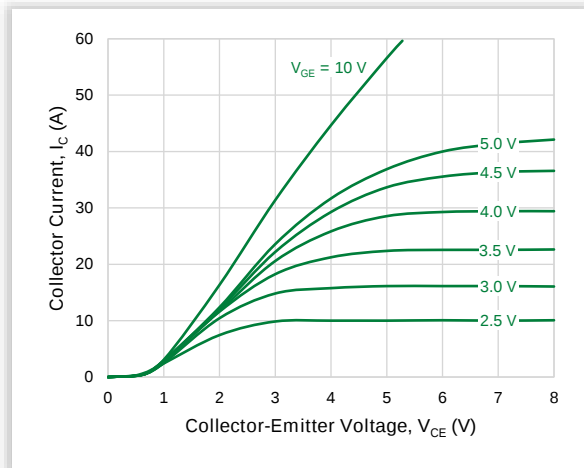


Figure 4. Transfer Characteristics

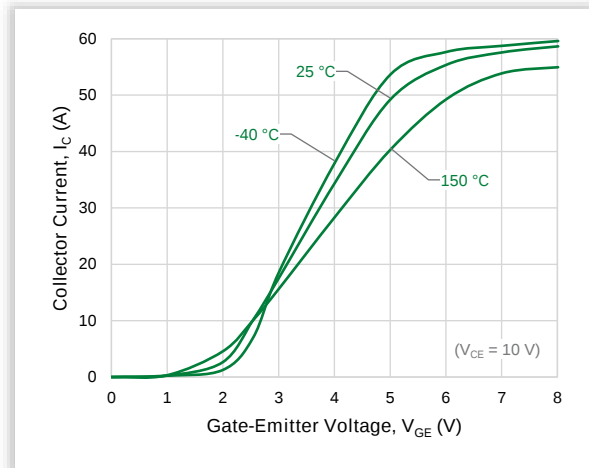


Figure 5. Collector-Emitter Saturation Voltage vs. Junction Temperature

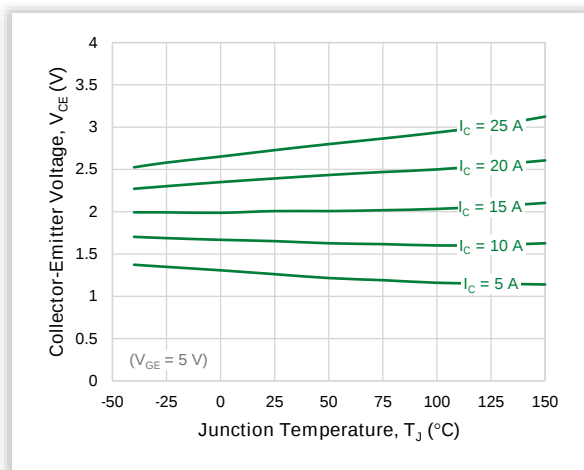


Figure 6. Collector-Emitter Voltage vs. Gate-Emitter Voltage ($T_J = 25^\circ\text{C}$)

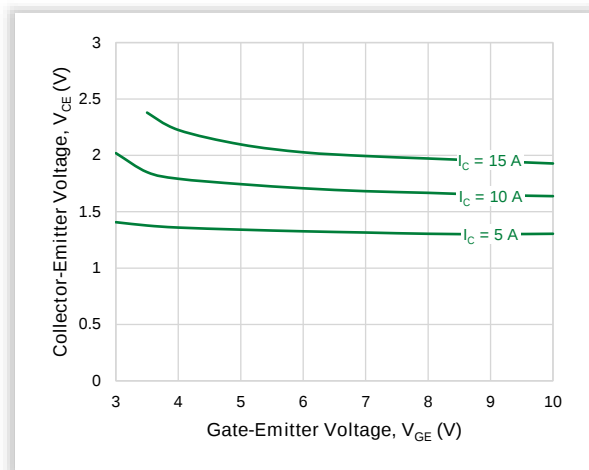


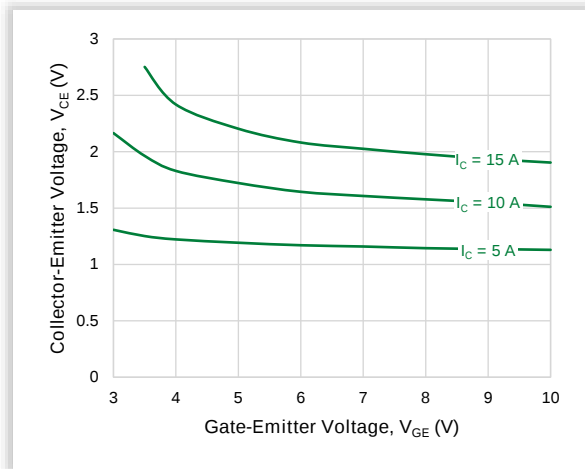
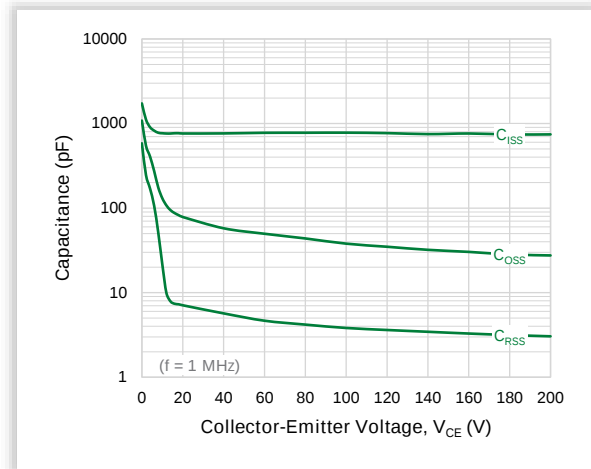
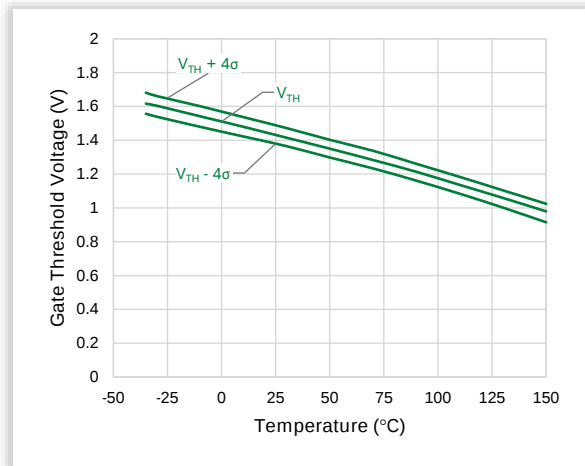
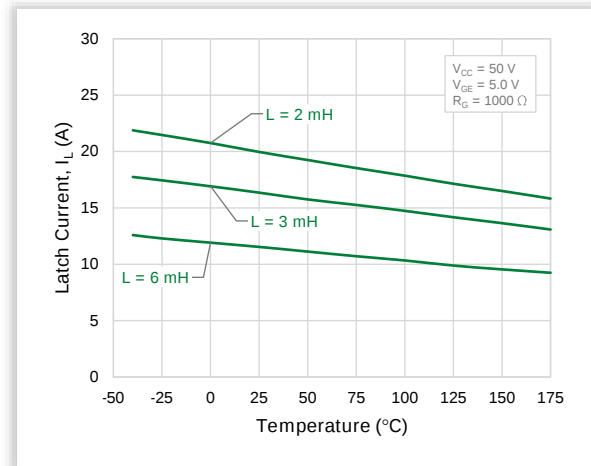
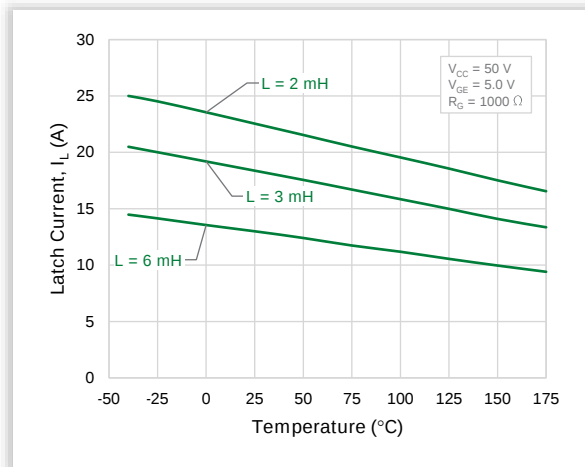
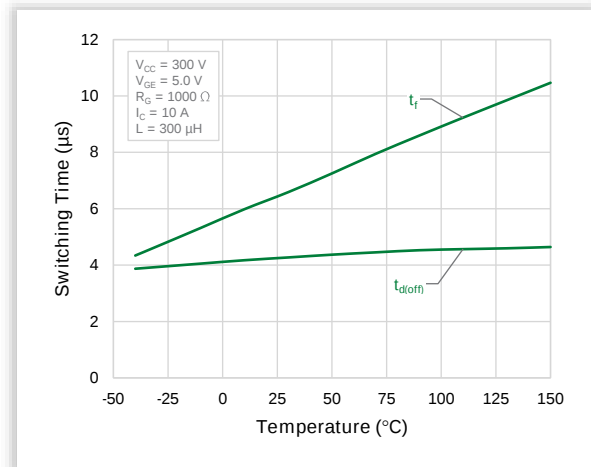
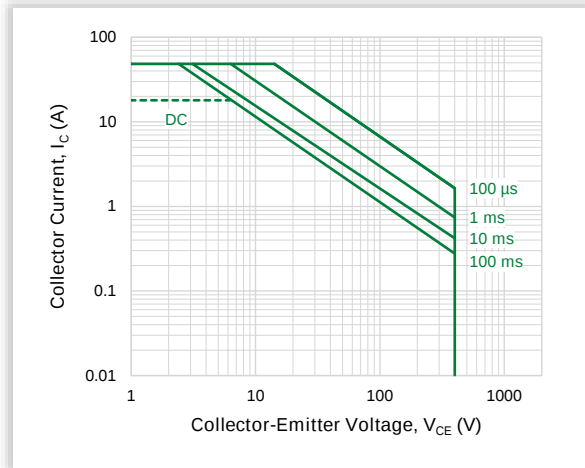
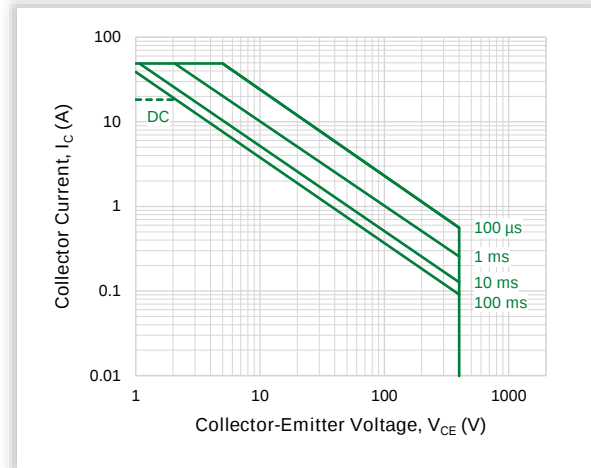
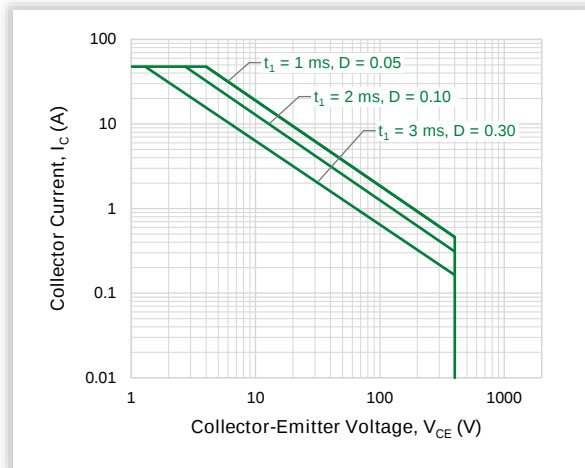
Figure 7. Collector-Emitter Voltage vs. Gate-Emitter Voltage
 ($T_J = 150^\circ\text{C}$)

Figure 8. Capacitance Variation

Figure 9. Gate Threshold Voltage vs. Temperature

Figure 10. Minimum Open Secondary Latch Current vs. Temperature

Figure 11. Typical Open Secondary Latch Current vs. Temperature

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

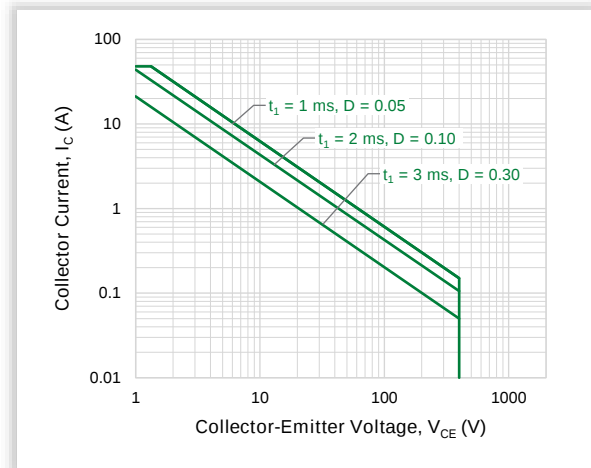
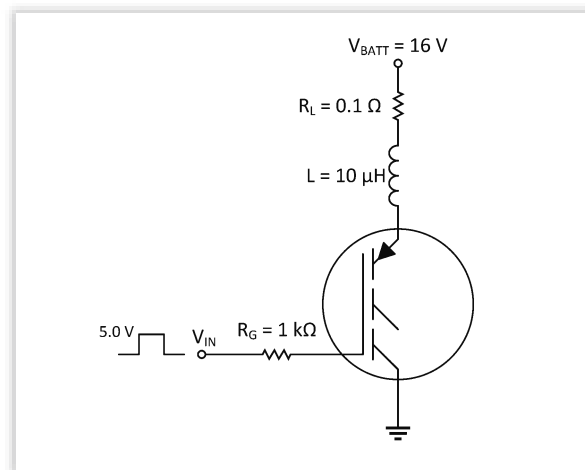
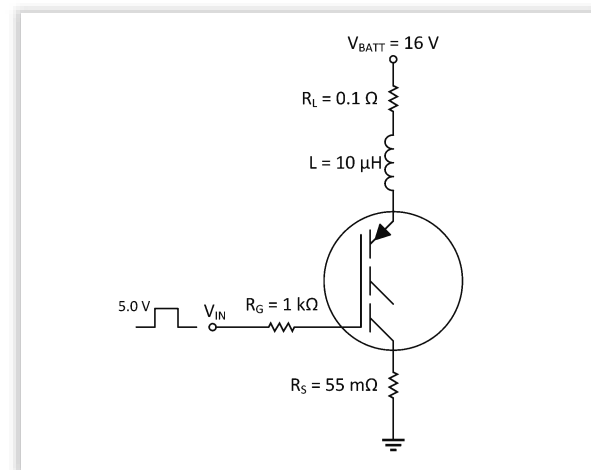
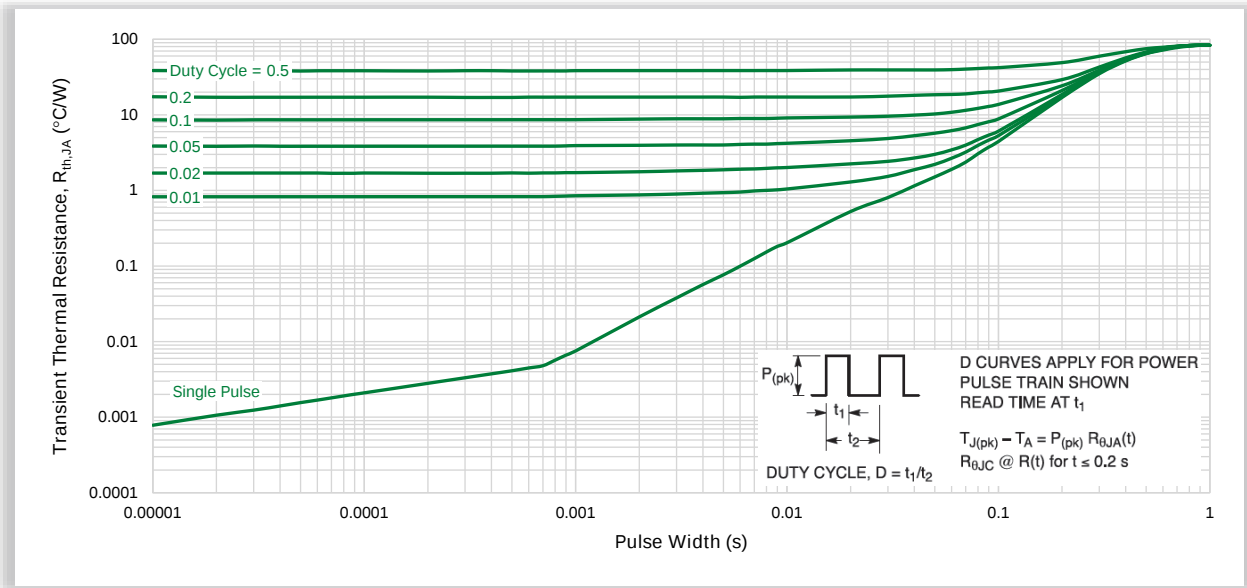
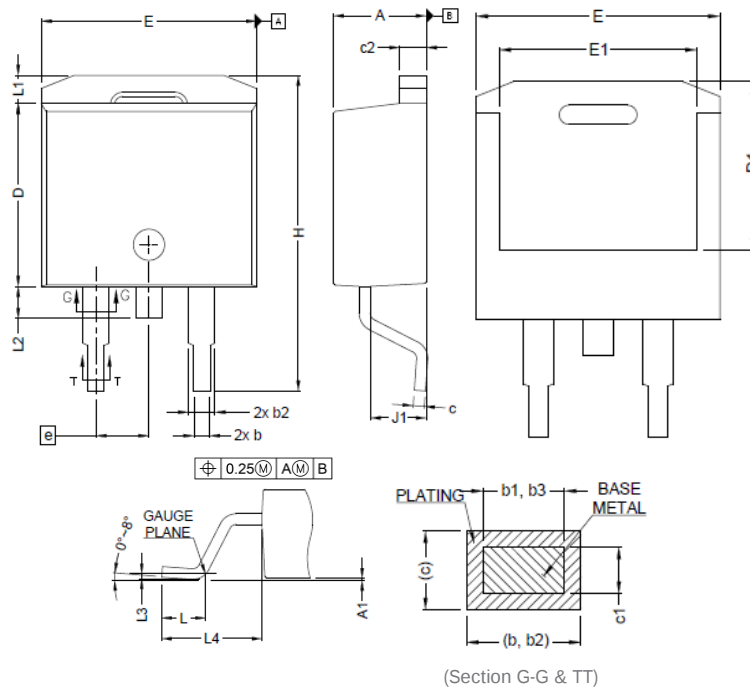
 (Mounted on an Infinite Heatsink at $T_A = 125^\circ\text{C}$)

Figure 17. Circuit Configuration for Short Circuit Test 1

Figure 18. Circuit Configuration for Short Circuit Test 2


Figure 19. Transient Thermal Resistance

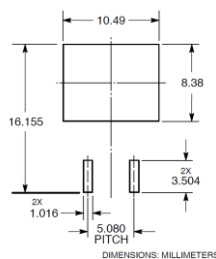
(Non-normalized Junction-Ambient mounted on minimum pad area)



10. Package Dimensions



Recommended Solder Pad Layout:

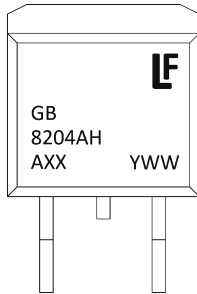


Notes:

1. Dimensioning & 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

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

11. Part Numbering and Marking



GB8204x = 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.
LGB8204ATH	D2PAK (Pb-Free)	Tape & Reel	800

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

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