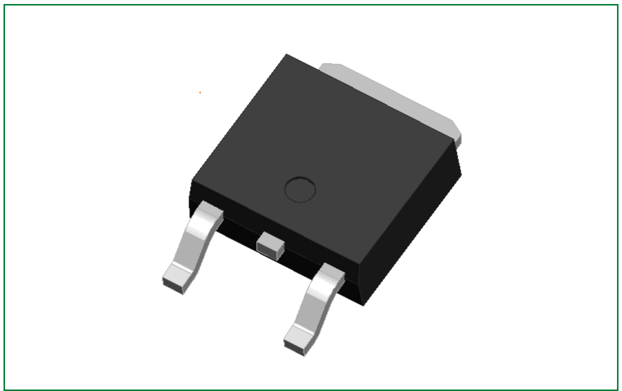
LGD8201ATI
400 V, 20 A N-Channel Ignition IGBT



Product Summary

Characteristic	Value	Unit
V_{CES}	400	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.

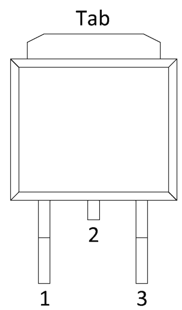
Agency Approvals

Environmental Approvals
Pb

Features

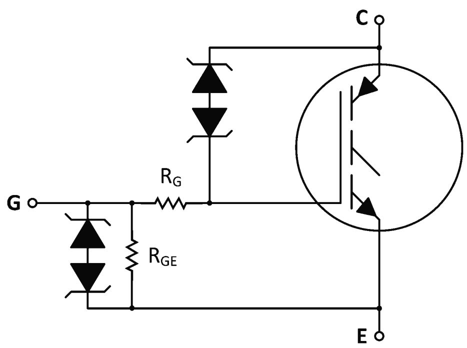
- Ideal for Coil−on−Plug and Driver−on−Coil Applications
- DPAK Package Offers Smaller Footprint for Increased Board Space
- Gate−Emitter ESD Protection
- Temperature Compensated Gate−Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage Interfaces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

Pinout Diagram



1 = Gate
2 = Collector
3 = Emitter
Tab = Collector

Functional Diagram



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

Characteristic	Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	-	V_{CES}	440	V
Collector-Gate Voltage	-	V_{CER}	440	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 – Charged Device Model	-	ESD	2.0	kV
ESD – Human Body Model	R = 1500 Ω, C = 100 pF		8.0	kV
ESD – Machine Model	R = 0 Ω,C = 200 pF		500	V
Total Power Dissipation	T_C = 25 °C	P_D	125	W
	Derating for > 25 °C		0.83	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 = 16.7 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 25 °C	E_{AS}	250	mJ
V_{CC} = 50 V, V_{GE} = 5.0 V, P_kI_L = 14.9 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 150 °C		200	
V_{CC} = 50 V, V_{GE} = 5.0 V, P_kI_L = 14.1 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 175 °C		180	
Reverse Avalanche Energy			
V_{CC} = 100 V, V_{GE} = 20 V, P_kI_L = 25.8 A, L = 6.0 mH, Starting T_J = 25 °C	$E_{AS(R)}$	2000	mJ

3. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.2	°C/W
Thermal Resistance, Junction to Ambient (DPAK)[1]	$R_{\theta JA}$	95	°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	370	395	420	V
		I_C = 10 mA		390	415	440	
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 15 V, V_{GE} = 0 V	T_J = 25 °C	-	0.1	1.0	µA
		V_{CE} = 200 V, V_{GE} = 0 V	T_J = 25 °C	0.5	1.5	10	
			T_J = 175 °C	1.0	25	100[2]	
			T_J = -40 °C	0.4	0.8	5.0	
Reverse Collector-Emitter Leakage Current	$I_{CES(R)}$	V_{CE} = -24 V	T_J = 25 °C	0.05	0.2	1.0	mA
			T_J = 175 °C	1.0	8.5	25	
			T_J = -40 °C	0.005	0.025	0.2	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	I_C = -75 mA	T_J = 25 °C	30	35	39	V
			T_J = 175 °C	35	39	45[2]	
			T_J = -40 °C	30	33	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	300	350[2]	µA
Gate Resistor	R_G	-	T_J = -40 °C to 175 °C	-	70	-	Ω
Gate-Emitter Resistor	R_{GE}	-	T_J = -40 °C to 175 °C	14.25	16	25	kΩ

Footnote 2: Maximum value of characteristic across temperature range

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[2]	
Threshold Temperature Coefficient (Negative)	-	-	-	4.0	4.6	5.2	mV/°C
Collector-Emitter On-Voltage[3]	$V_{CE(on)}$	I_C = 6.5 A, V_{GE} = 3.7 V	T_J = 25 °C	0.85	1.03	1.35	V
			T_J = 175 °C	0.7	0.9	1.15	
			T_J = -40 °C	0.9	1.11	1.4	
		I_C = 9.0 A, V_{GE} = 3.9 V	T_J = 25 °C	0.9	1.11	1.45	
			T_J = 175 °C	0.8	1.01	1.25	
			T_J = -40 °C	1.0	1.18	1.5	
		I_C = 7.5 A, V_{GE} = 4.5 V	T_J = 25 °C	0.85	1.15	1.4	
			T_J = 175 °C	0.7	0.95	1.2	
			T_J = -40 °C	1.0	1.3	1.6[2]	
		I_C = 10 A, V_{GE} = 4.5 V	T_J = 25 °C	1.0	1.3	1.6	
			T_J = 175 °C	0.8	1.05	1.4	
			T_J = -40 °C	1.1	1.4	1.7[2]	
		I_C = 15 A, V_{GE} = 4.5 V	T_J = 25 °C	1.15	1.45	1.7	
			T_J = 175 °C	1.0	1.3	1.55	
			T_J = -40 °C	1.25	1.55	1.8[2]	
		I_C = 20 A, V_{GE} = 4.5 V	T_J = 25 °C	1.1	1.4	1.9	
			T_J = 175 °C	1.2	1.5	1.8	
			T_J = -40 °C	1.3	1.42	2.0	
Forward Transconductance	gfs	V_{CS} = 5.0 V, I_C = 6.0 A	T_J = 25 °C	10	18	25	Mhos

Footnote 2: Maximum value of characteristic across temperature range

Footnote 3: Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%

6. Dynamic Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Input Capacitance	C_{ISS}	V_{CC} = 25 V, f = 10 kHz	T_J = 25 °C	1100	1300	1500	pF
Output Capacitance	C_{OSS}			70	80	90	
Transfer Capacitance	C_{RSS}			18	20	22	

7. Switching Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Turn-off Delay Time (Resistive)	$t_{d(off)}$	V_{CC} = 300 V, I_C = 9.0 A, R_G = 1.0 kΩ, R_L = 33 Ω, V_{GE} = 5.0 Ω	T_J = 25 °C	6.0	8.0	10	µs
			T_J = 175 °C	6.0	8.0	10	
Fall Time (Resistive)	t_f		T_J = 25 °C	4.0	6.0	8.0	µs
			T_J = 175 °C	8.0	10.5	14	
Turn-off Delay Time (Inductive)	$t_{d(off)}$	V_{CC} = 300 V, I_C = 9.0 A, R_G = 1.0 kΩ, L = 300 µH, V_{GE} = 5.0 Ω	T_J = 25 °C	3.0	5.0	7.0	µs
			T_J = 175 °C	5.0	7.0	9.0	
Fall Time (Inductive)	t_f		T_J = 25 °C	1.5	3.0	4.5	µs
			T_J = 175 °C	5.0	7.0	10	
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 14 V, I_C = 9.0 A, R_G = 1.0 kΩ, R_L = 1.5 Ω, V_{GE} = 5.0 V	T_J = 25 °C	1.0	1.5	2.0	µs
			T_J = 175 °C	1.0	1.5	2.0	
Rise Time	t_r		T_J = 25 °C	4.0	6.0	8.0	µs
			T_J = 175 °C	3.0	5.0	7.0	

8. Figure Data

Figure 1. Self-Clamped Inductive Switching

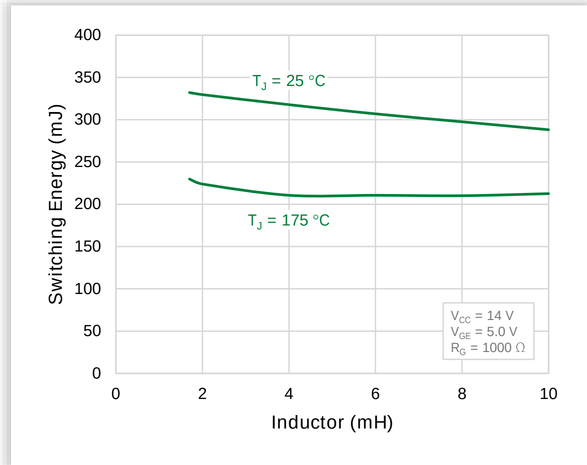


Figure 2. Open Secondary Avalanche Current vs. Temperature

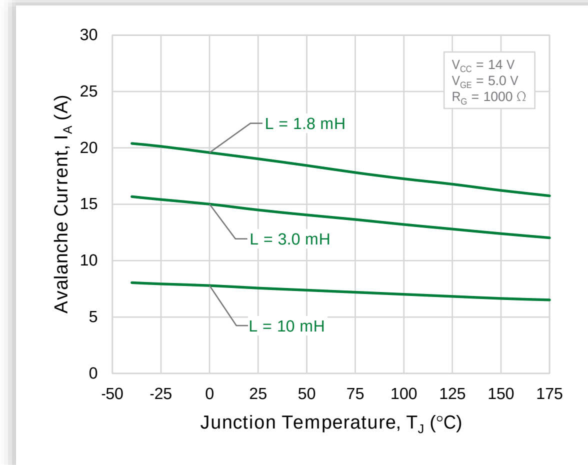


Figure 3. Collector-Emitter Voltage vs. Junction Temperature

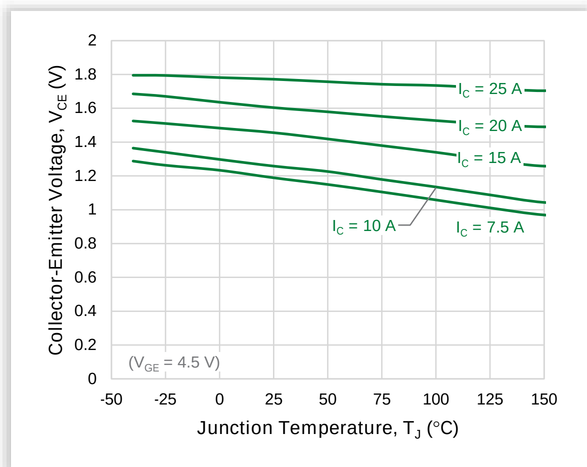


Figure 4. Output Characteristics (T_J = 175 °C)

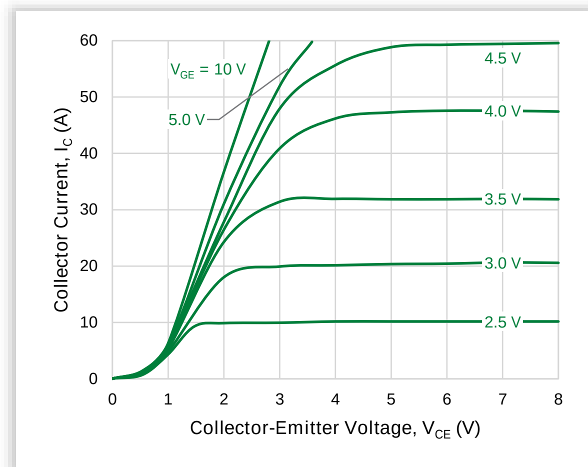


Figure 5. Output Characteristics (T_J = 25 °C)

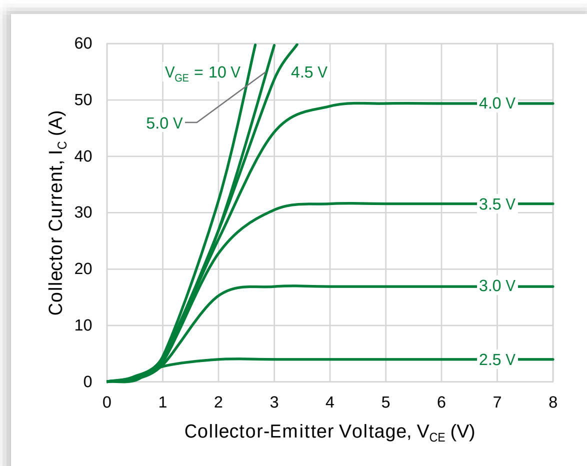


Figure 6. Output Characteristics (T_J = -40 °C)

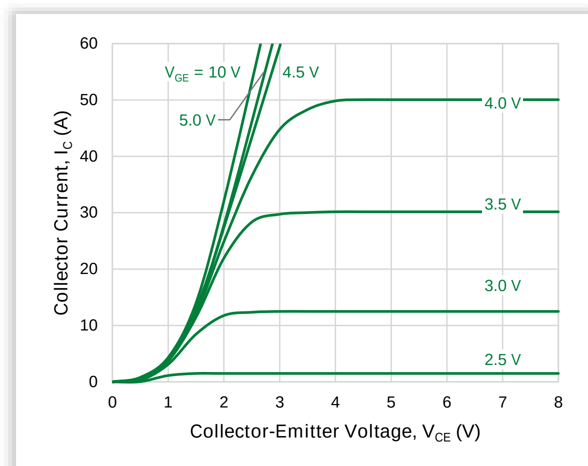


Figure 7. Transfer Characteristics

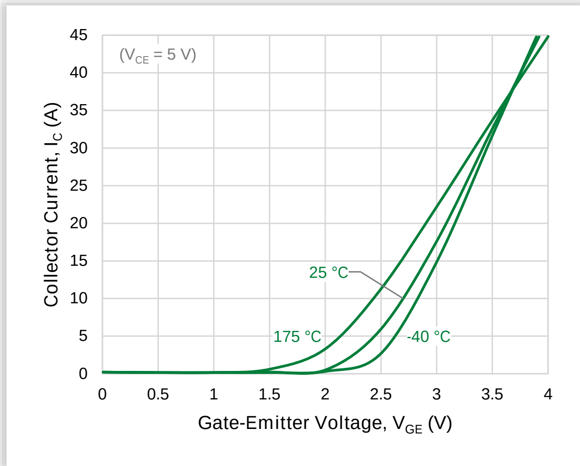


Figure 8. Collector-Emitter Leakage Current vs. Temperature

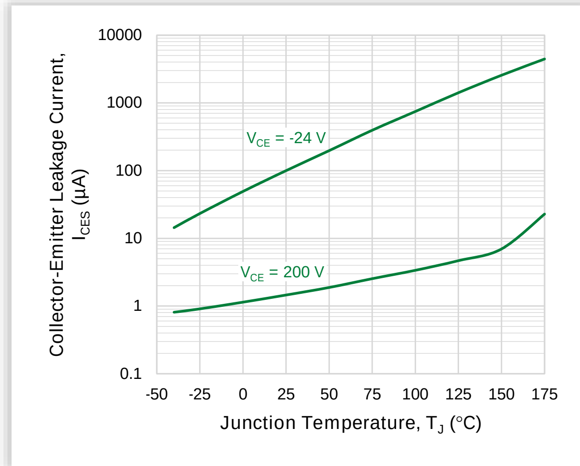


Figure 9. Gate Threshold Voltage vs. Temperature

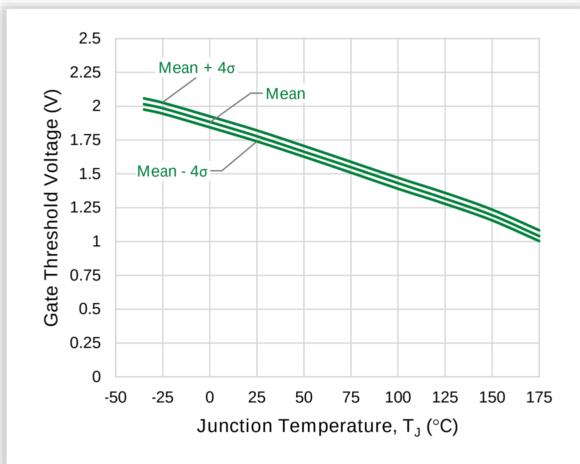


Figure 10. Capacitance Variance

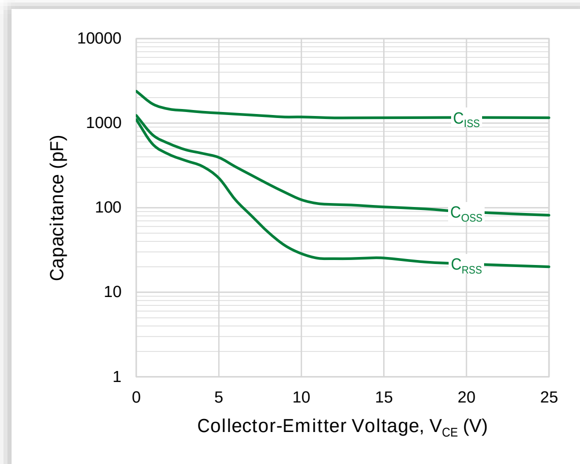


Figure 11. Resistive Switching Fall Time vs. Temperature

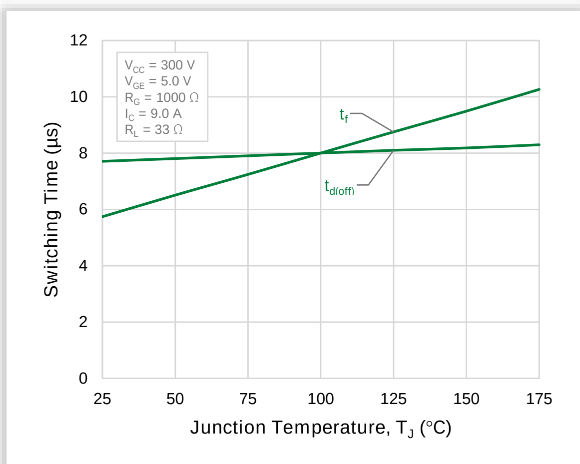


Figure 12. Inductive Switching Fall Time vs. Temperature

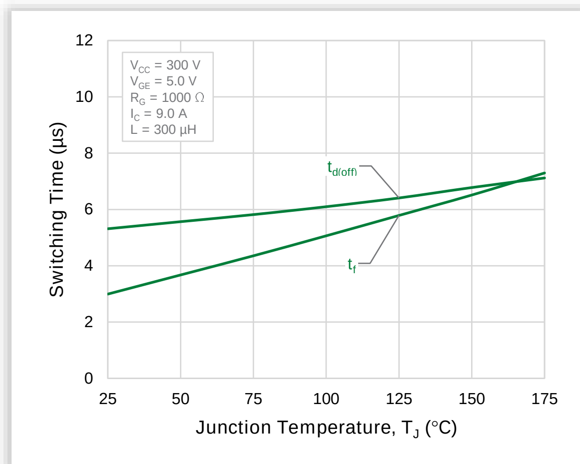


Figure 13. Minimum Pad Transient Thermal Resistance

(Non-normalized Junction-Ambient)

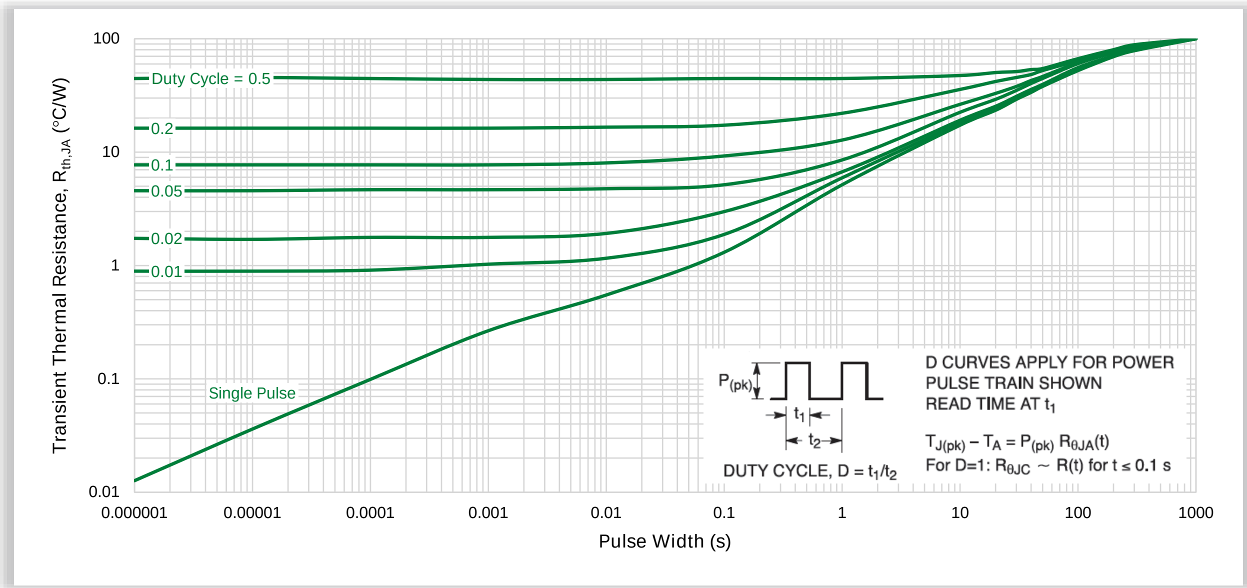
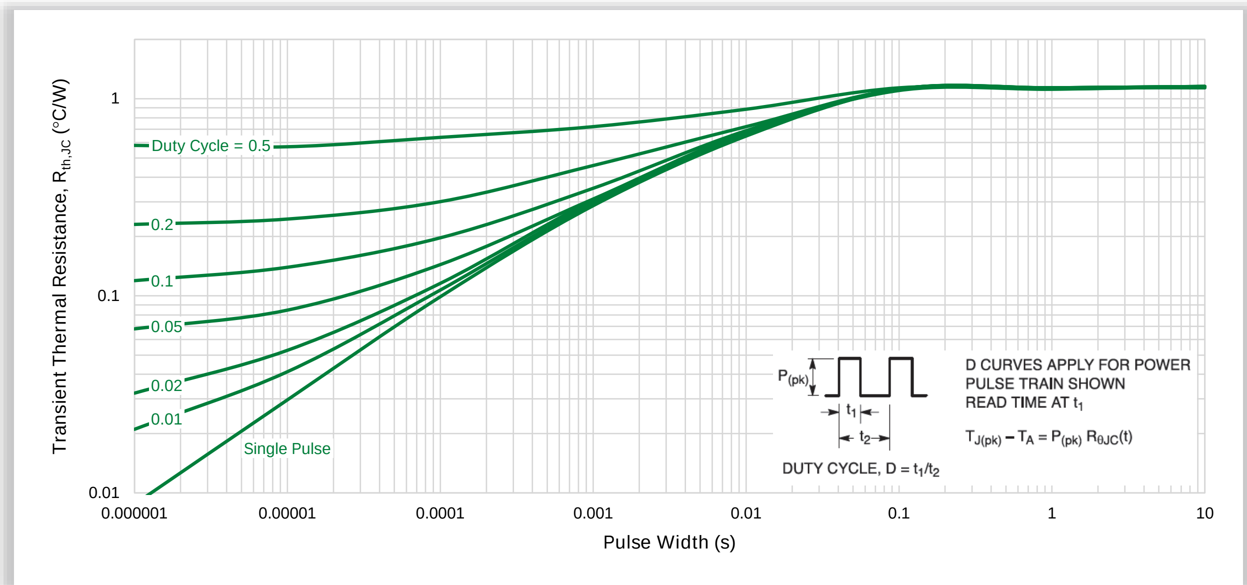
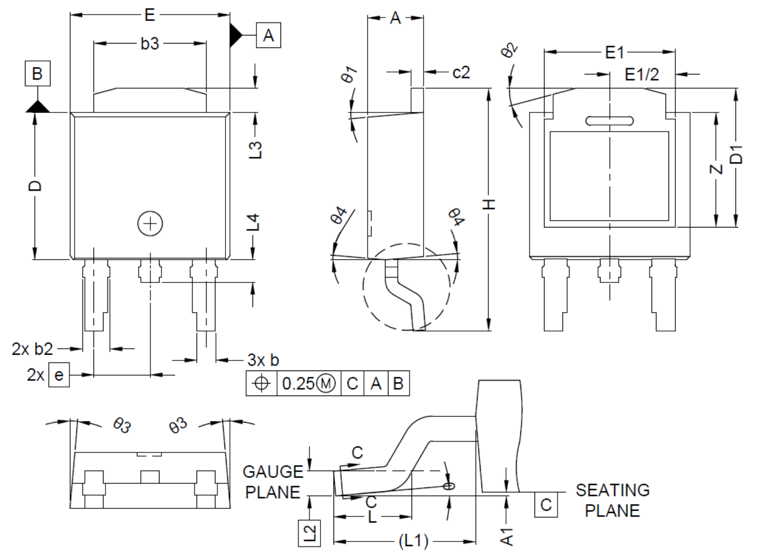


Figure 14. Best Case Transient Thermal Resistance

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

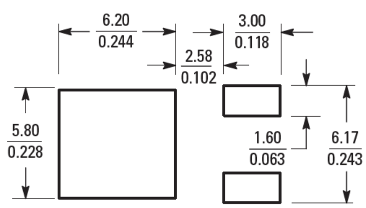


9. Package Dimensions



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°

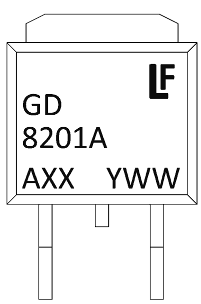
Recommended Solder Pad Layout:



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.

10. Part Numbering and Marking



GD8201A	= Device Code
A	= Assembly Location
XX	= Lot Number
Y	= Year
WW	= Work Week

11. Packing Options

Part Number	Package	Packing Mode	M.O.Q.
LGD8201ATI	DPAK (Pb-Free)	Tape & Reel	2500

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