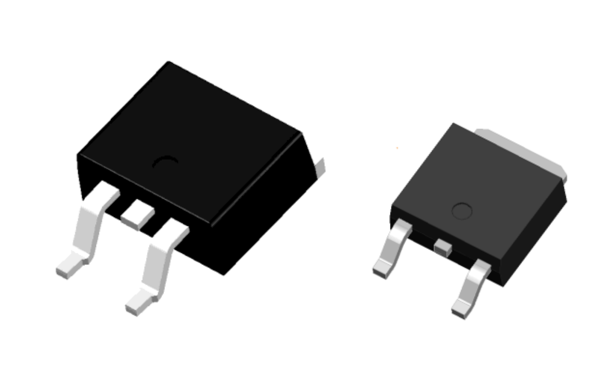
Datasheet

LGB15N41ATI, LGD15N41ATI
410 V, 15 A N-Channel Ignition IGBT



Product Summary

Characteristic	Value	Unit
V_{CES}	410	V
I_C	15	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.

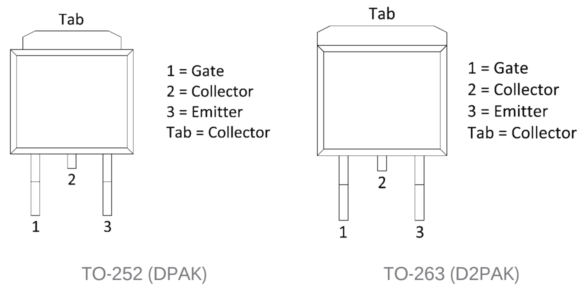
Features

- Ideal for Coil−on−Plug Applications
- DPAK Package Offers Smaller Footprint and Increased Board Space
- 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
- Optional Gate Resistor (R_G) and Gate−Emitter Resistor (R_{GE})
- AEC-Q101 Qualified
- These are Pb−Free Devices

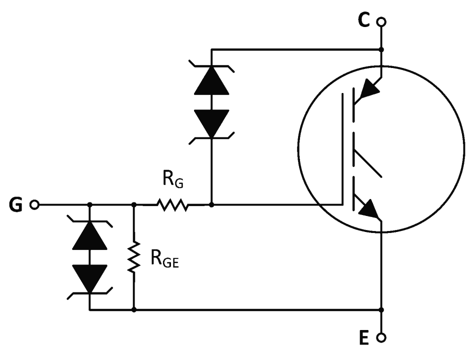
Agency Approvals

Environmental Approvals
Pb

Pinout Diagram



Functional Diagram



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

Characteristic	Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	-	V_{CES}	440	V_{DC}
Collector-Gate Voltage	-	V_{CER}	440	V_{DC}
Gate-Emitter Voltage	-	V_{GE}	15	V_{DC}
Collector Current – Continuous	T_C = 25 °C	I_C	15	A_{DC}
Collector Current – Pulsed			50	A_{AC}
ESD – Human Body Model	R = 1500 Ω, C = 100 pF	ESD	8.0	kV
ESD – Machine Model	R = 0 Ω,C = 200 pF		800	V
Total Power Dissipation	T_C = 25 °C	P_D	107	W
	Derating for > 25 °C		0.71	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 = 16.6 A, L = 1.8 mH, Starting T_C = 25 °C	E_{AS}	250	mJ
V_{CC} = 50 V, V_{GE} = 5.0 V, P_kI_L = 15.0 A, L = 1.8 mH, Starting T_C = 125 °C		200	

Note: -55 °C ≤ T_J ≤ 150 °C

3. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.4	°C/W
Thermal Resistance, Junction to Ambient (DPAK)[1]	$R_{\theta JA}$	100	°C/W
Thermal Resistance, Junction to Ambient (D2PAK)[1]	$R_{\theta JA}$	50	°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 150 °C	380	410	440	V_{DC}
		I_C = 10 mA		380	410	440	
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 350 V, V_{GE} = 0 V	T_J = 25 °C	-	2.0	20	μA_{DC}
			T_J = 150 °C	-	10	40[2]	
			T_J = -40 °C	-	1.0	10	
Reverse Collector-Emitter Leakage Current	I_{ECS}	V_{CE} = -24 V	T_J = 25 °C	-	0.7	2.0	mA
			T_J = 150 °C	-	12	25[2]	
			T_J = -40 °C	-	0.1	1.0	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	I_C = -75 mA	T_J = 25 °C	27	33	37	V_{DC}
			T_J = 150 °C	30	36	40	
			T_J = -40 °C	25	31	35	
Gate-Emitter Clamp Voltage	BV_{GES}	I_G = 5.0 mA	T_J = -40 °C to 150 °C	11	13	15	V_{DC}
Gate-Emitter Leakage Current	I_{GES}	V_{GE} = ±10 V	T_J = -40 °C to 150 °C	384	640	1000	μA_{DC}
Gate Resistor	R_{GE}	-	T_J = -40 °C to 150 °C	-	70	-	Ω
Gate-Emitter Resistor	R_{GE}	-	T_J = -40 °C to 150 °C	10	16	26	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	1.1	1.4	1.9	V_{DC}
			T_J = 150 °C	0.75	1.0	1.4	
			T_J = -40 °C	1.2	1.6	2.1[2]	
Threshold Temperature Coefficient (Negative)	-	-	-	-	3.4	-	mV/°C
Collector-Emitter On-Voltage[3]	$V_{CE(on)}$	I_C = 6.0 A, V_{GE} = 4.0 V	T_J = 25 °C	1.0	1.6	1.8	V_{DC}
			T_J = 150 °C	0.9	1.5	1.8	
			T_J = -40 °C	1.1	1.65	1.9[2]	
		I_C = 8.0 A, V_{GE} = 4.0 V	T_J = 25 °C	1.3	1.8	2.0[2]	
			T_J = 150 °C	1.2	1.7	1.9	
			T_J = -40 °C	1.4	1.8	2.0[2]	
		I_C = 10 A, V_{GE} = 4.0 V	T_J = 25 °C	1.4	2.0	2.2	
			T_J = 150 °C	1.5	2.0	2.3[2]	
			T_J = -40 °C	1.4	2.0	2.2	
		I_C = 10 A, V_{GE} = 4.5 V	T_J = 25 °C	1.3	1.9	2.1	
			T_J = 150 °C	1.3	1.9	2.1	
			T_J = -40 °C	1.4	1.95	2.1[2]	
Forward Transconductance[5]	gfs	V_{CS} = 5.0 V, I_C = 6.0 A	T_J = -40 °C to 150 °C	8.0	15	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, V_{GE} = 0 V, f = 1.0 MHz	T_J = -40 °C to 150 °C	400	650	1000	pF
Output Capacitance	C_{OSS}			30	55	100	
Transfer Capacitance	C_{RSS}			3.0	4.5	8.0	

7. Switching Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Turn-on Delay Time (Inductive)	$t_{d(on)}$	V_{CC} = 300 V, I_C = 6.5 A, R_G = 1.0 kΩ, L = 300 µH	T_J = 25 °C	-	4.0	10	µs
			T_J = 150 °C	-	4.5	10	
Fall Time (Inductive)	t_f	V_{CC} = 300 V, I_C = 6.5 A, R_G = 1.0 kΩ, L = 300 µH	T_J = 25 °C	-	6.0	12	µs
			T_J = 150 °C	-	10	12	
Turn-off Delay Time (Resistive)	$t_{d(off)}$	V_{CC} = 300 V, I_C = 6.5 A, R_G = 1.0 kΩ, R_L = 46 Ω	T_J = 25 °C	-	3.0	10	µs
			T_J = 150 °C	-	3.5	10	
Fall Time (Resistive)	t_f	V_{CC} = 300 V, I_C = 6.5 A, R_G = 1.0 kΩ, R_L = 46 Ω	T_J = 25 °C	-	8.0	15	µs
			T_J = 150 °C	-	12	15	
Turn-off Delay Time (Inductive)	$t_{d(off)}$	V_{CC} = 10 V, I_C = 6.5 A, R_G = 1.0 kΩ, R_L = 1.5 Ω	T_J = 25 °C	-	0.7	4.0	µs
			T_J = 150 °C	-	0.7	4.0	
Rise Time	t_r	V_{CC} = 10 V, I_C = 6.5 A, R_G = 1.0 kΩ, R_L = 1.5 Ω	T_J = 25 °C	-	4.0	7.0	µs
			T_J = 150 °C	-	5.0	7.0	

8. Figure Data

Figure 1. Output Characteristics (T_J = 25 °C)

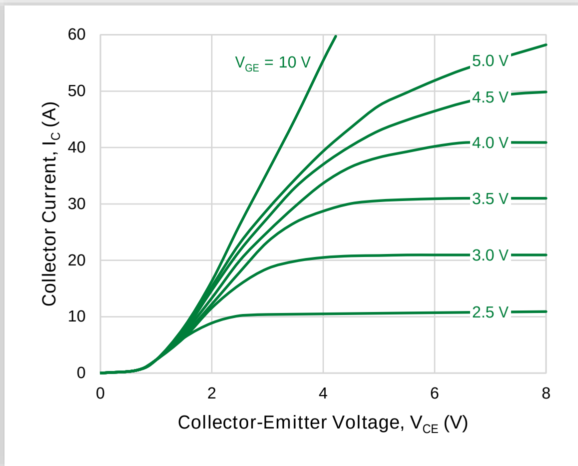


Figure 2. Output Characteristics (T_J = -40 °C)

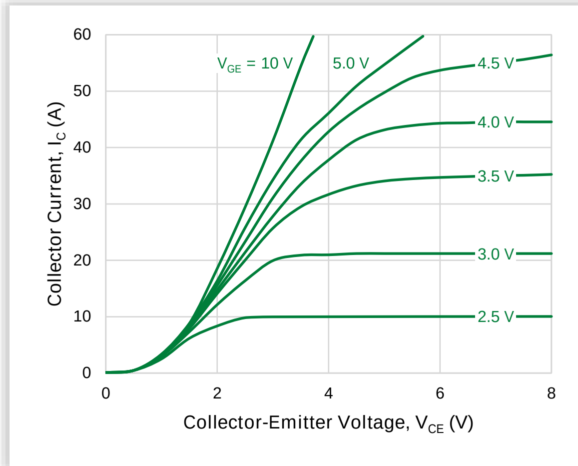


Figure 3. Output Characteristics (T_J = 150 °C)

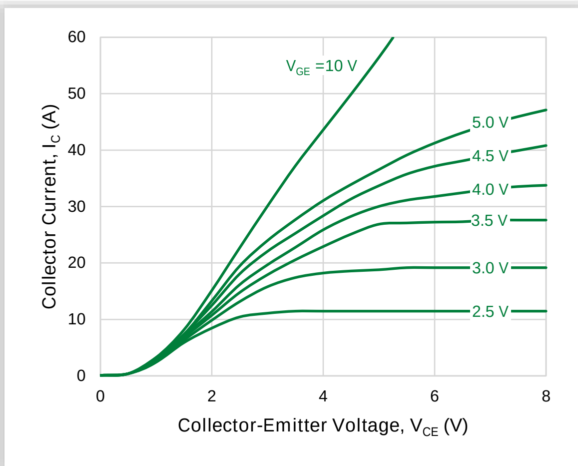


Figure 4. Transfer Characteristics

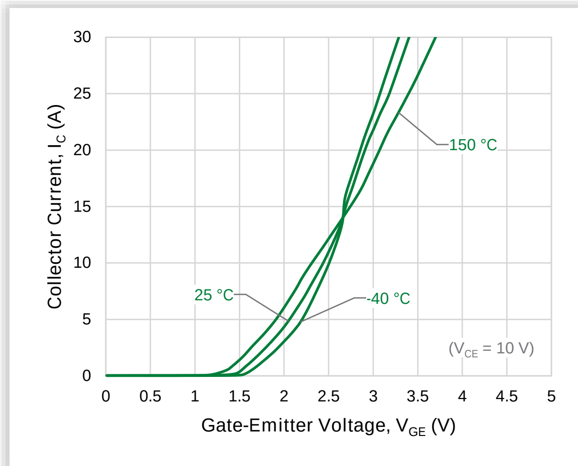


Figure 5. Collector-Emitter Saturation Voltage vs. Junction Temperature

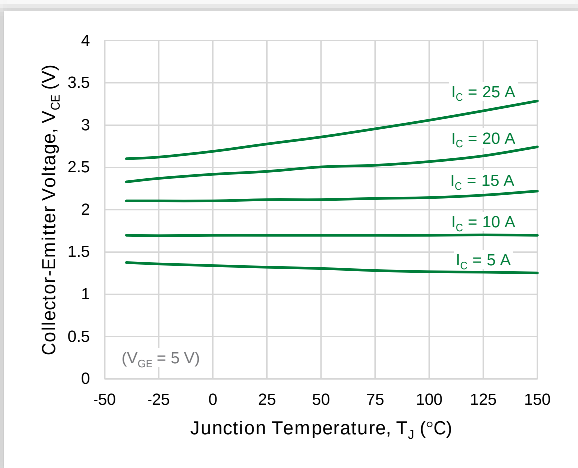


Figure 6. Collector-Emitter Voltage vs. Gate-Emitter Voltage (T_J = 25 °C)

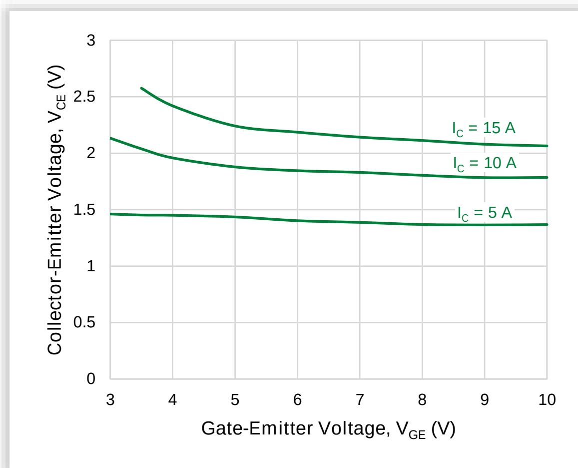


Figure 7. Collector-Emitter Voltage vs. Gate-Emitter Voltage (T_J = 150 °C)

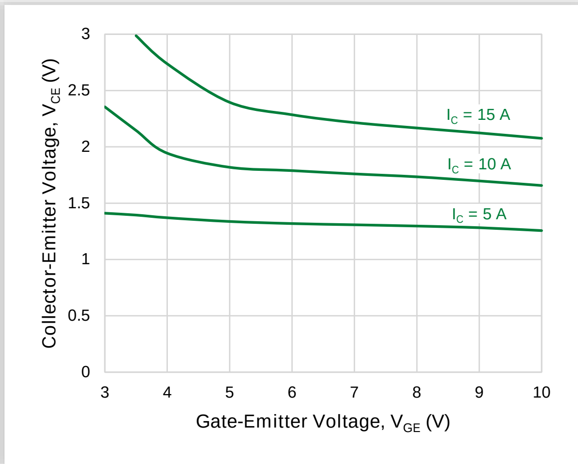


Figure 8. Capacitance Variation

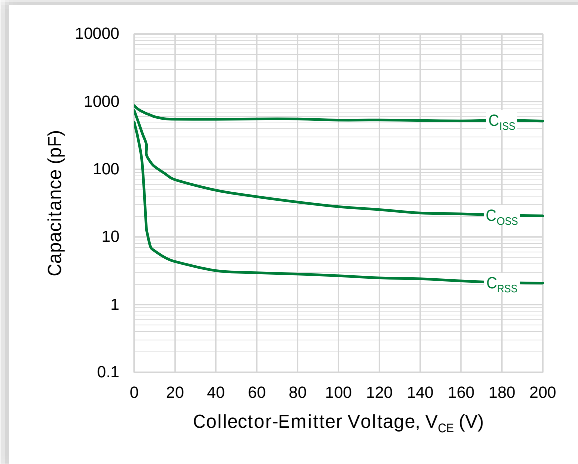


Figure 9. Gate Threshold Voltage vs. Temperature

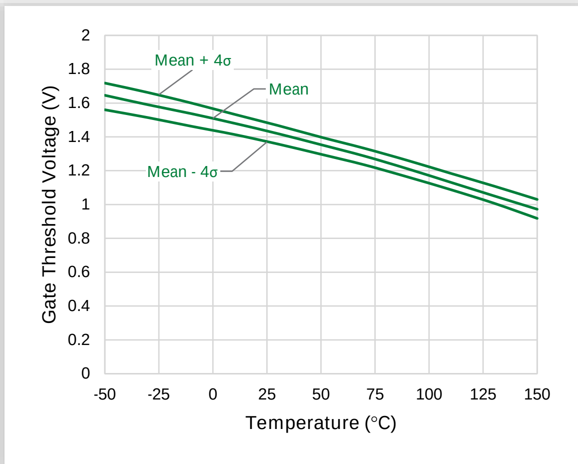


Figure 10. Minimum Open Secondary Latch Current vs. Temperature

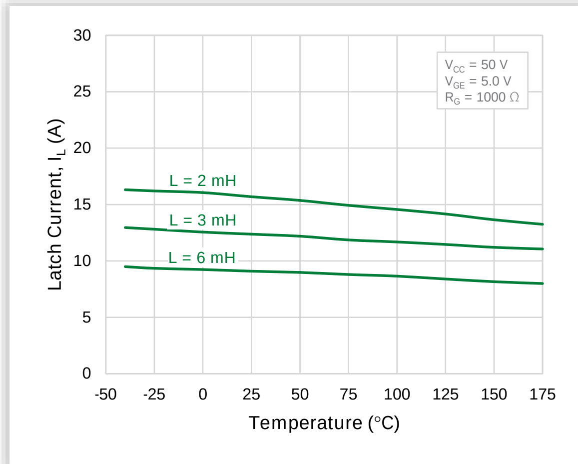


Figure 11. Typical Open Secondary Latch Current vs. Temperature

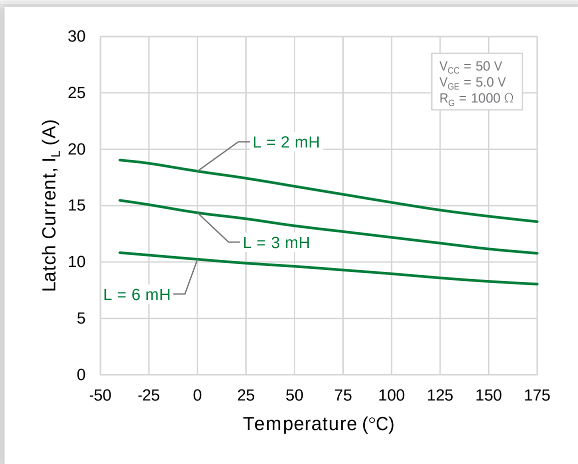


Figure 12. Inductive Switching Fall Time vs. Temperature

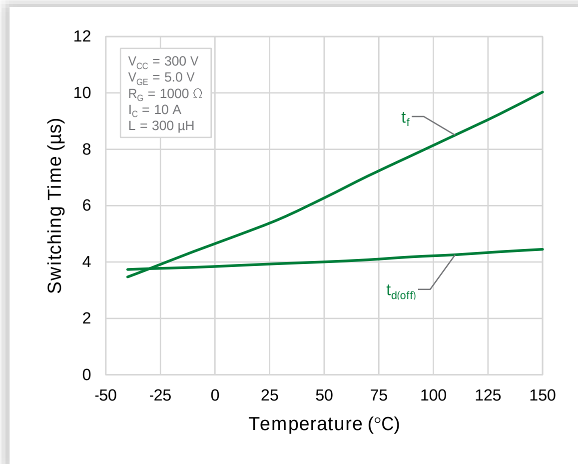


Figure 13. Transient Thermal Resistance

(Non–normalized Junction–to–Ambient mounted on fixture in Figure 14)

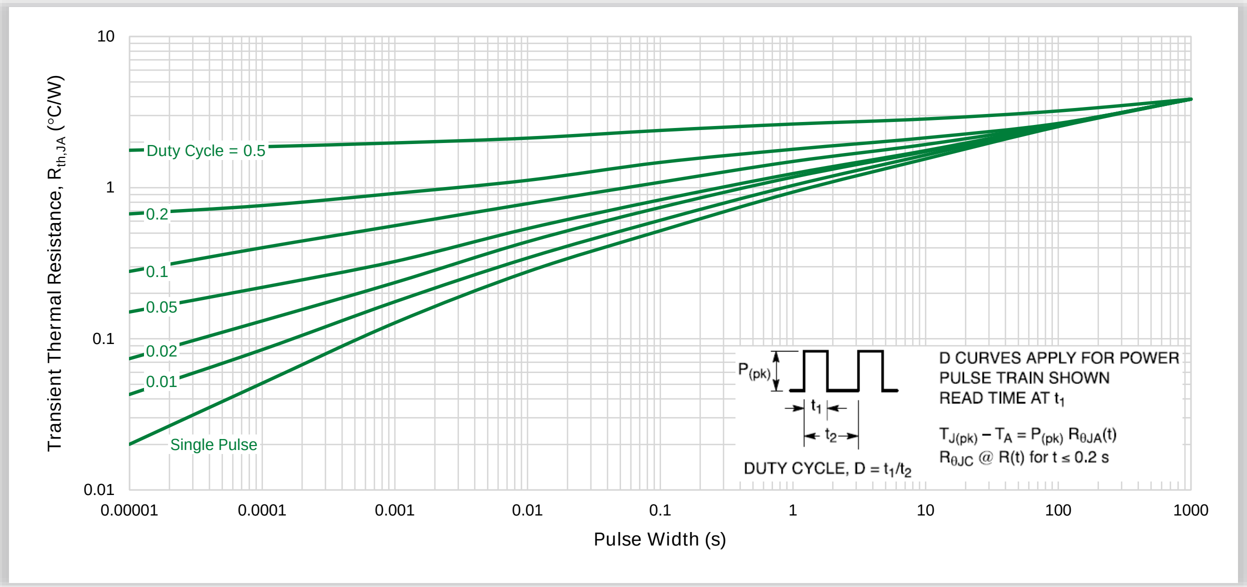


Figure 14. Test Fixture for Transient Thermal Curve

(48 square inches of 1/8″ thick aluminum)

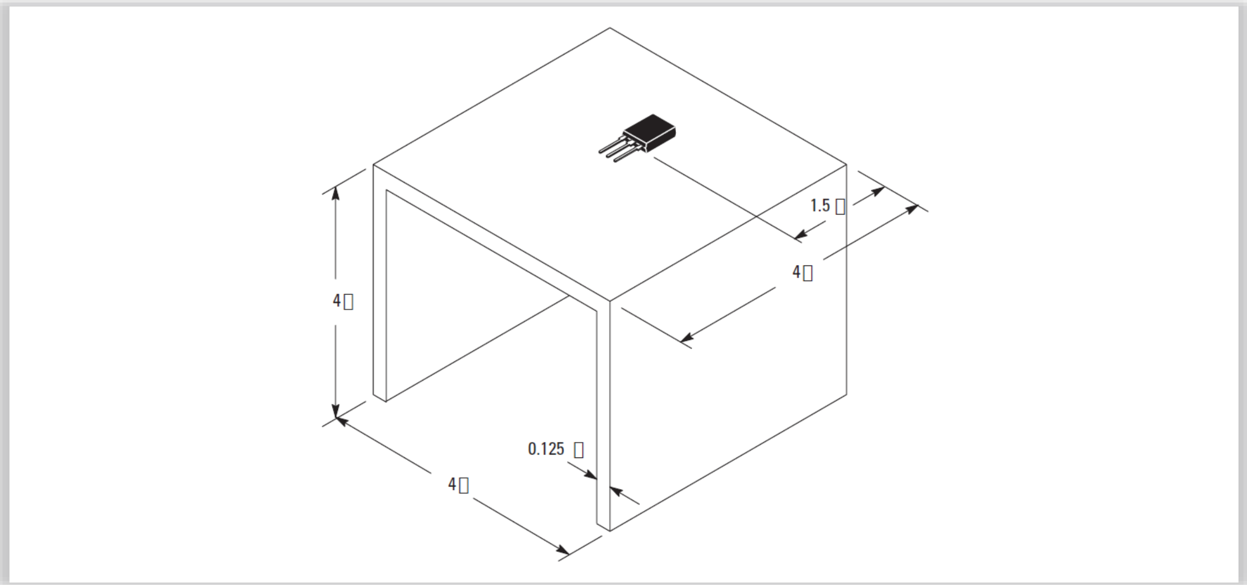


Figure 15. Single Pulse Safe Operating Area

(Mounted on an Infinite Heatsink at T_A = 25 °C)

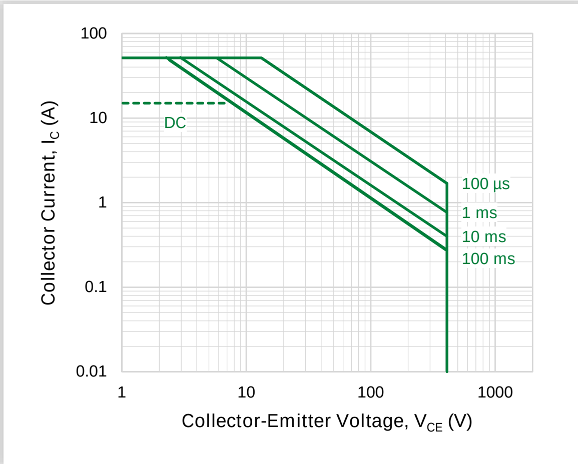


Figure 16. Single Pulse Safe Operating Area

(Mounted on an Infinite Heatsink at T_A = 125 °C)

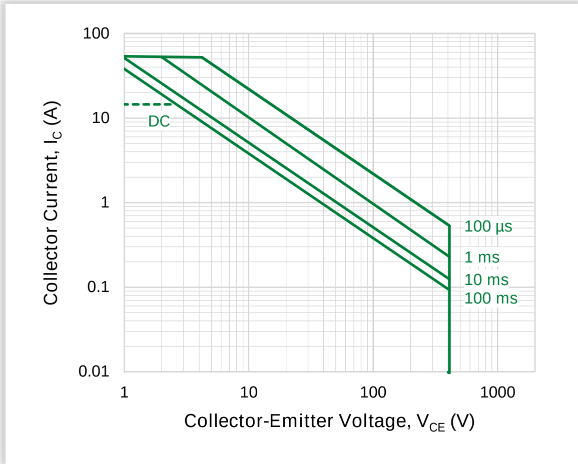


Figure 17. Pulse Train Safe Operating Area

(Mounted on an Infinite Heatsink at T_A = 25 °C)

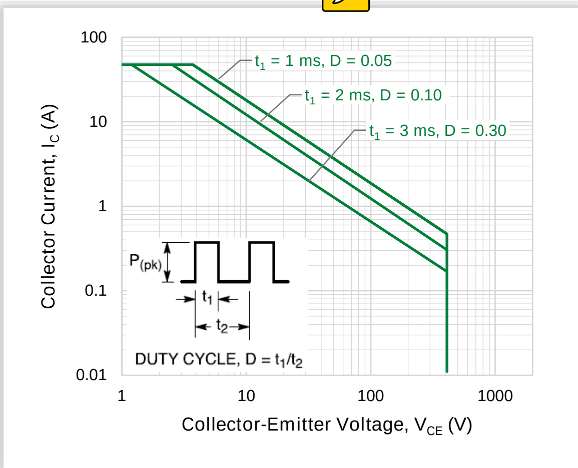
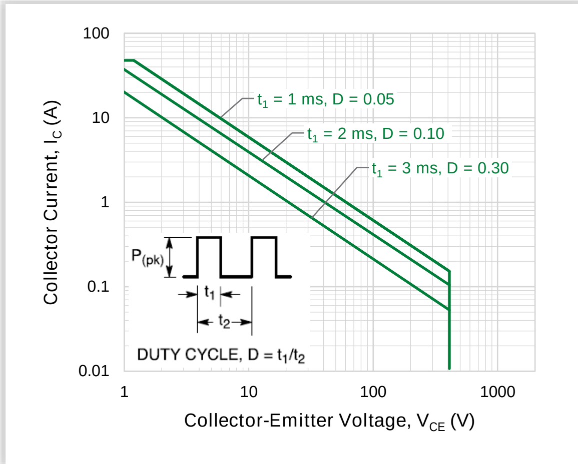


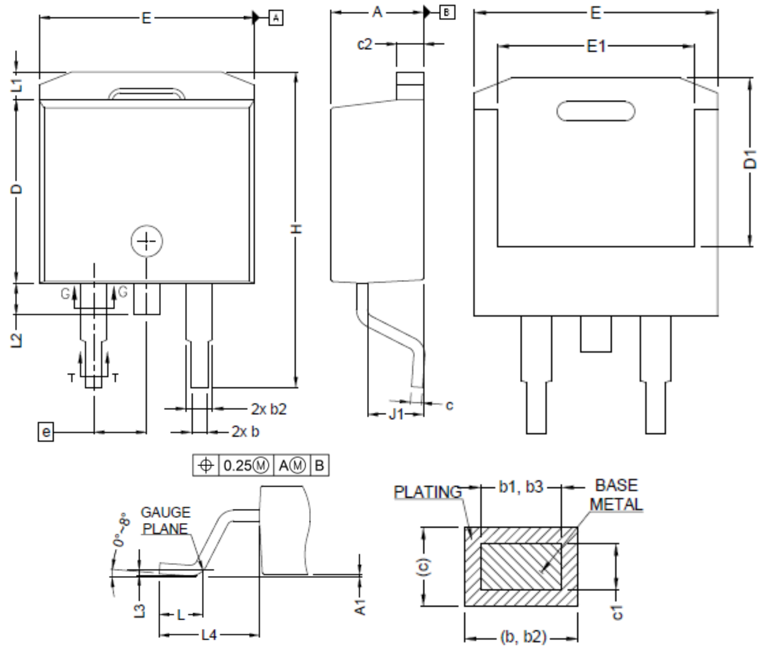
Figure 18. Pulse Train Safe Operating Area

(Mounted on an Infinite Heatsink at T_A = 125 °C)



9. Package Dimensions

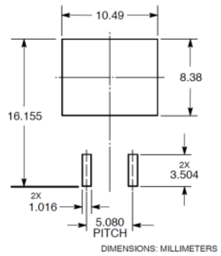
9.1. TO-252 (DPAK)



(Section G-G & T-T)

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

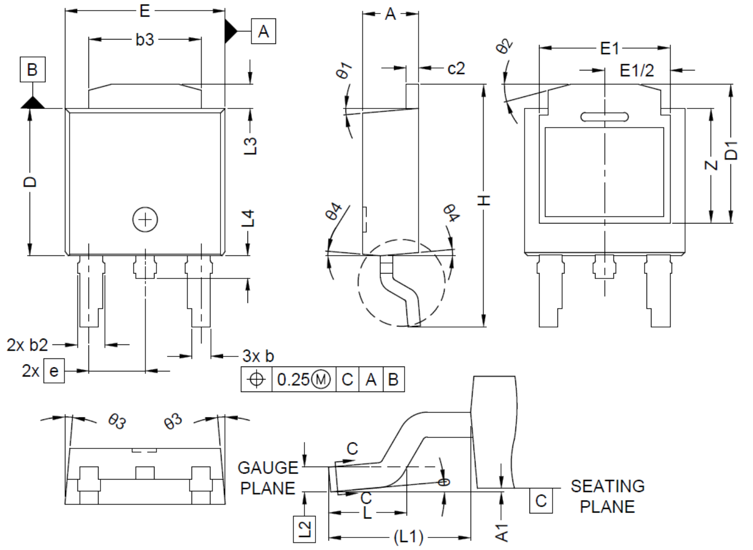
Recommended Solder Pad Layout:



Notes:

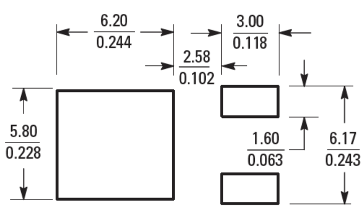
1. Dimensioning & tolerancing confirm to ASME Y14.5M-1994.
2. All dimensions are in millimeters. Angles are in degrees.
3. Heatsink side flash is max 0.8 mm.
4. Radius on terminal is optional

TO-263 (D2PAK)



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:

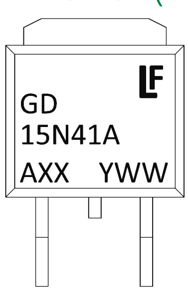


Notes:

5. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
6. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
7. HEAT SINK SIDE FLASH IS MAX. 0.8mm .
8. RADIUS ON TERMINAL IS OPTIONAL.

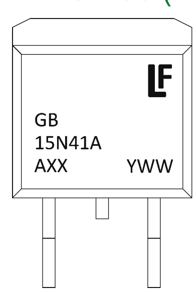
10. Part Numbering and Marking

10.1. TO-252 (DPAK)



GD15N41A = Device Code
A = Assembly Location
XX = Lot Number
Y = Year
WW = Work Week

10.2. TO-263 (D2PAK)



GB15N41A = Device Code
A = Assembly Location
XX = Lot Number
Y = Year
WW = Work Week

11. Packing Options

Part Number	Package	Packing Mode	M.O.Q.
LGD15N41ATI	DPAK (Pb-Free)	Tape & Reel	2500
LGB15N41ATI	D2PAK (Pb-Free)	Tape & Reel	800

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