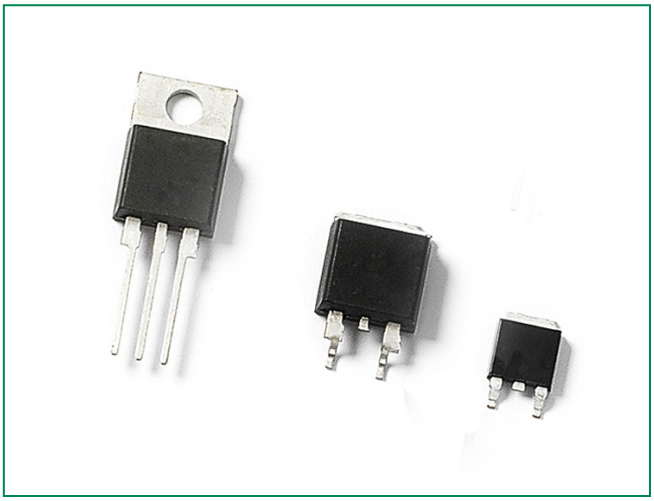
NGD15N41ACL, NGB15N41ACL, NGP15N41ACL - 15 A, 410 V, N-Channel Ignition IGBT, DPAK, D2PAK and TO-220



15 Amps, 410 Volts
VCE(on) ≤ 2.1 V @
IC = 10 A, VGE ≥ 4.5 V

Maximum Ratings (T_J = 25°C unless otherwise noted)

Rating	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 – Pulsed	I_C	15 50	A_{DC} 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	ESD	800	V
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	107 0.71	W W/°C
Operating and Storage Temperature Range	T_J, T_{stg}	–55 to +175	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

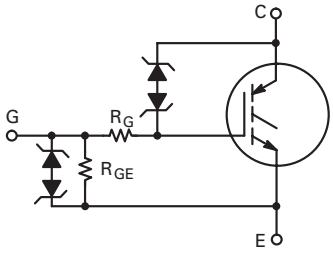
Description

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 to Interface 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})
- These are Pb–Free Devices

Functional Diagram



Additional Information

Datasheet | Resources | Samples

© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Unclamped Collector–To–Emitter Avalanche Characteristics (–55° ≤ T_J ≤ 175°C)

Rating	Symbol	Value	Unit
Single Pulse Collector–to–Emitter Avalanche Energy V_{CC} = 50 V, V_{GE} = 5.0 V, P_k I_L = 16.6 A, L = 1.8 mH, Starting T_C = 25°C V_{CC} = 50 V, V_{GE} = 5.0 V, P_k I_L = 15 A, L = 1.8 mH, Starting T_C = 125°C	E_{AS}	250 200	mJ

Thermal Characteristics

Rating		Symbol	Value	Unit
Thermal Resistance, Junction to Case		$R_{\theta JC}$	1.4	°C/W
Thermal Resistance, Junction to Ambient (Note 1)	DPAK (Note 1)	$R_{\theta JA}$	100	
	D^2PAK (Note 1)		50	
	TO–220		62.5	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds		T_L	275	°C

Electrical Characteristics - OFF

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Collector–Emitter Clamp Voltage	B_{VCES}	I_C = 2.0 mA	T_J = –40°C to 150°C	380	410	440	V_{DC}
		I_C = 10 mA	T_J = –40°C to 150°C	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*	
			T_J = –40°C	–	1.0	10	
Reverse Collector–Emitter Leakage Current	I_{CES}	V_{CE} = –24 V	T_J = 25°C	–	0.7	2.0	mA
			T_J = 150°C	–	12	25*	
			T_J = –40°C	–	0.1	1.0	
Reverse Collector–Emitter Leakage Current	$B_{VCES(R)}$	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_G	–	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
Gate Emitter Resistor	R_{GE}	–	T_J = –40°C to 150°C	14.25	16	25	kΩ

1. When surface mounted to an FR4 board using the minimum recommended pad size.

© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Electrical Characteristics - ON (Note 3)

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
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*	
Threshold Temperature Coefficient (Negative)	–	–	–	–	3.4	–	mV/°C
Collector−to−Emitter On−Voltage	$V_{CE\ (on)}$	V_{GE} = 4.0 V, I_C = 6.0 A	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*	
		V_{GE} = 4.0 V, I_C = 8.0 A	T_J = 25°C	1.3	1.8	2.0*	
			T_J = 150°C	1.2	1.7	1.9	
			T_J = −40°C	1.4	1.8	2.0*	
		V_{GE} = 4.0 V, I_C = 10 A	T_J = 25°C	1.4	2.0	2.2	
			T_J = 150°C	1.5	2.0	2.3*	
			T_J = −40°C	1.4	2.0	2.2	
		V_{GE} = 4.5 V, I_C = 10 A	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*	
Forward Transconductance	gfs	V_{CE} = 5.0 V, I_C = 6.0 A	T_J = −40°C to 150°C	8	15	25	Mhos

Dynamic Characteristics

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Input Capacitance	C_{ISS}	V_{CE} = 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	

© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Switching Characteristics

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Turn–On Delay Time (Inductive)	$t_{d\ (off)}$	V_{CC} = 300 V, I_C = 6.5 A, R_G = 1.0 kΩ, L = 300 µH	T_J = 25°C	–	4.0	10	µSec
			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	
			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	
			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	
			T_J = 150°C	–	12	15	
Turn–Off Delay Time (Inductive)	$t_{d(on)}$	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	
			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	
			T_J = 150°C	–	5.0	7.0	

*Maximum Value of Characteristic across Temperature Range.

3. Pulse Test: Pulse Width ≤ 300 µS, Duty Cycle ≤ 2%.

Ratings and Characteristic Curves

Figure 1. Output Characteristics

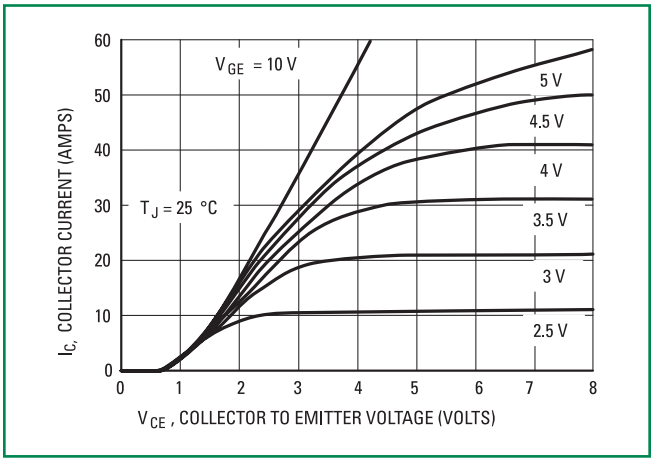
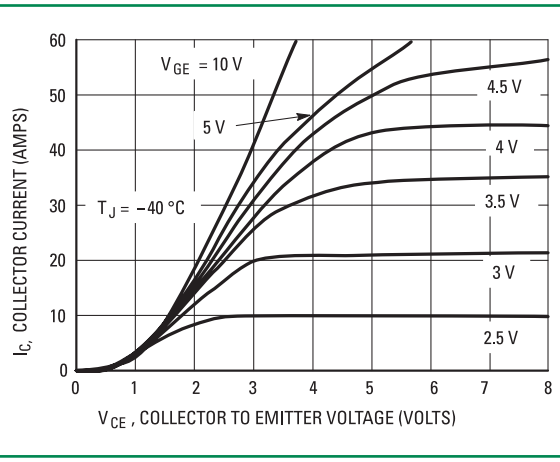


Figure 2. Output Characteristics



© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Figure 3. Output Characteristics

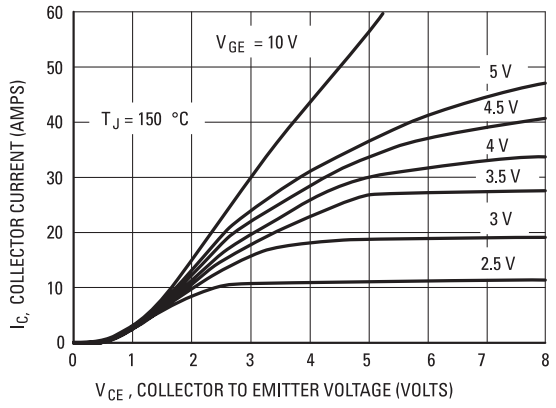


Figure 4. Transfer Characteristics

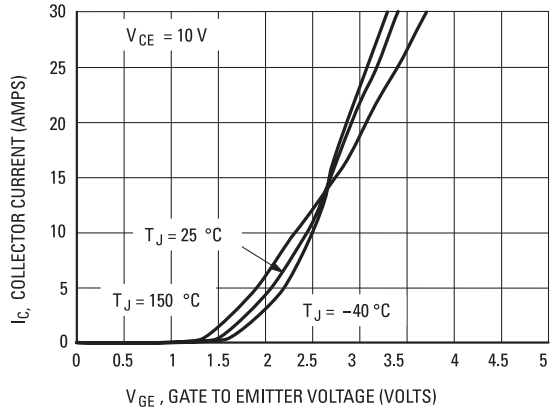


Figure 5. Collector–to–Emitter Saturation Voltage vs. Junction Temp

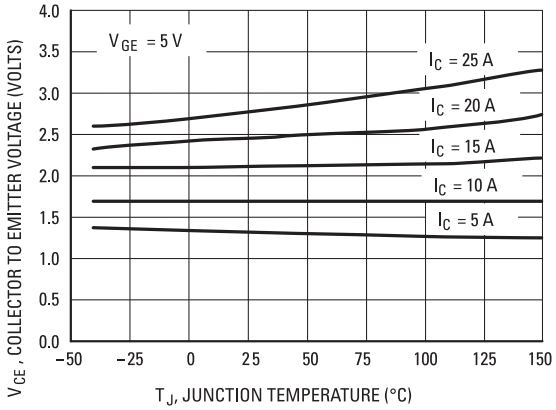


Figure 6. Collector–to–Emitter Voltage vs Gate–to–Emitter Voltage

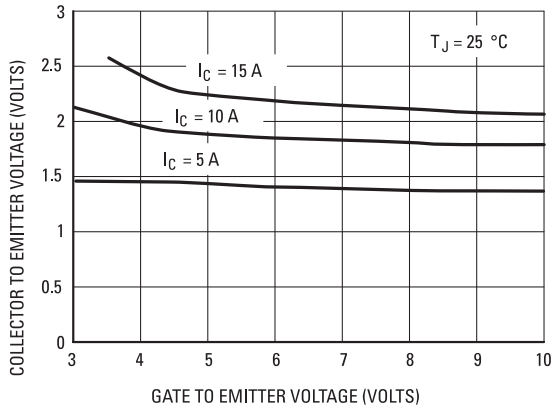


Figure 7. Collector–to–Emitter Voltage vs Gate–to–Emitter Voltage

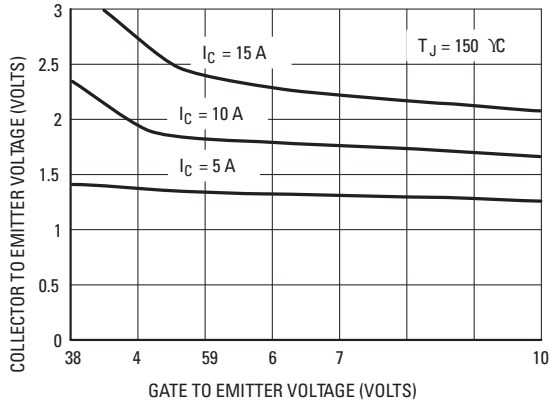
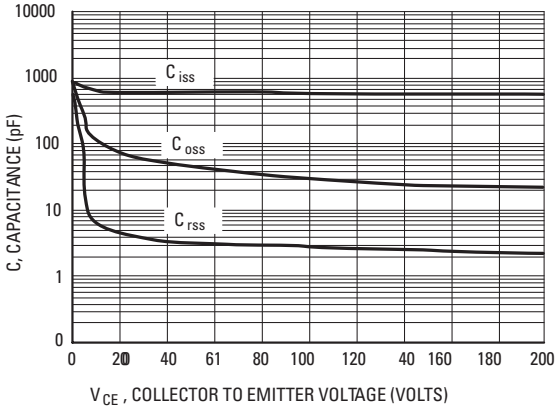


Figure 8. Capacitance Variation



© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.

Figure 9. Gate Threshold Voltage vs. Temperature

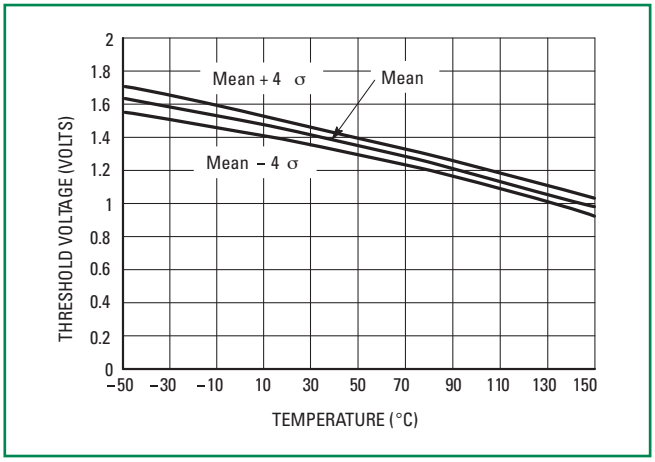


Figure 10. Minimal Open Secondary Latch Current vs Temperature

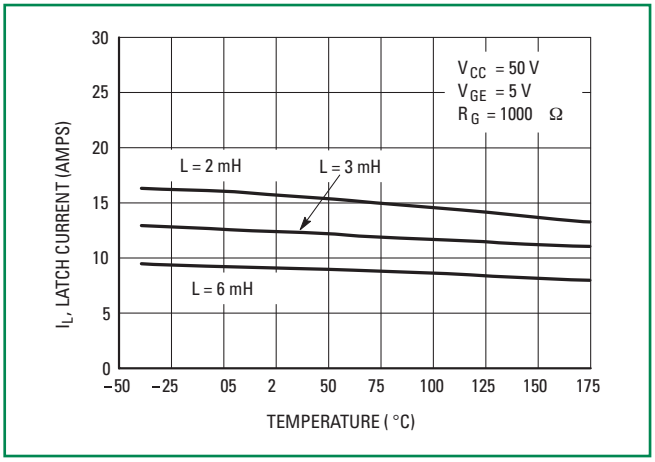


Figure 11. Typical Open Secondary Latch Current vs Temperature

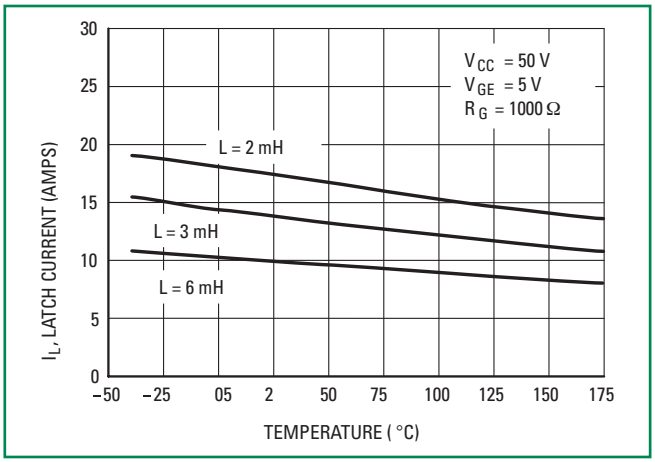
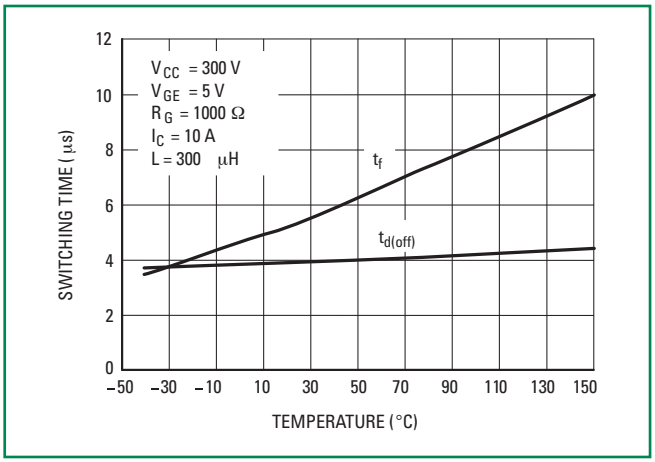


Figure 12. Inductive Switching Fall Time vs. Temperature



© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Figure 13. Transient Thermal Resistance (Non–normalized Junction–to–Ambient mounted on fixture in Figure 14)

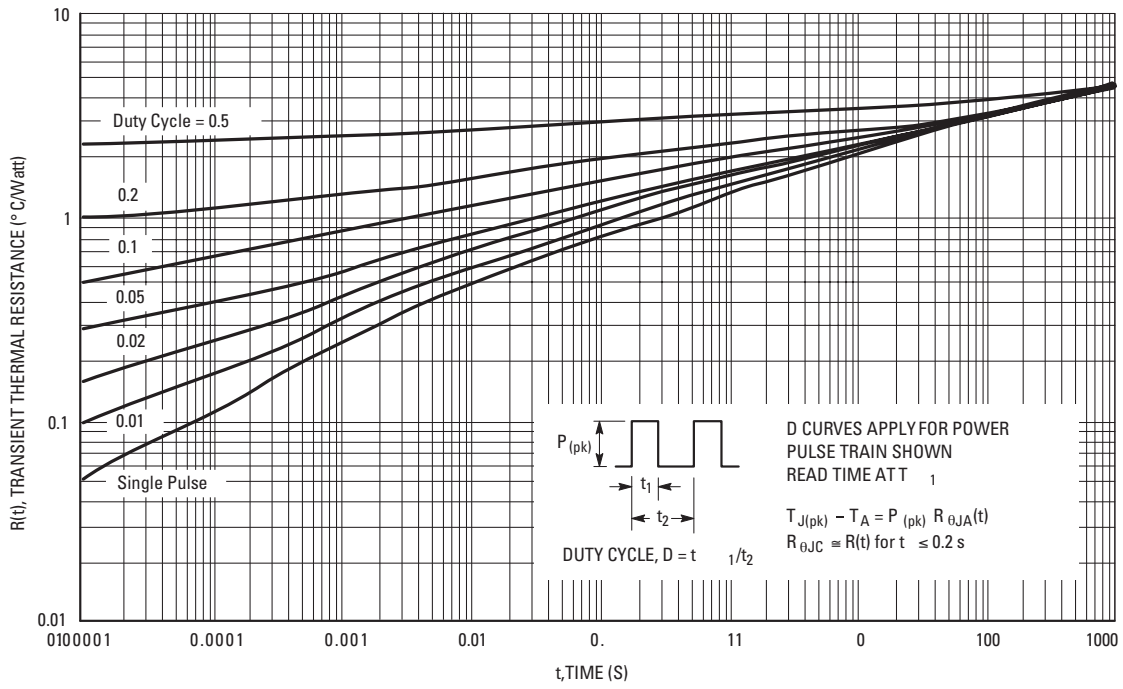
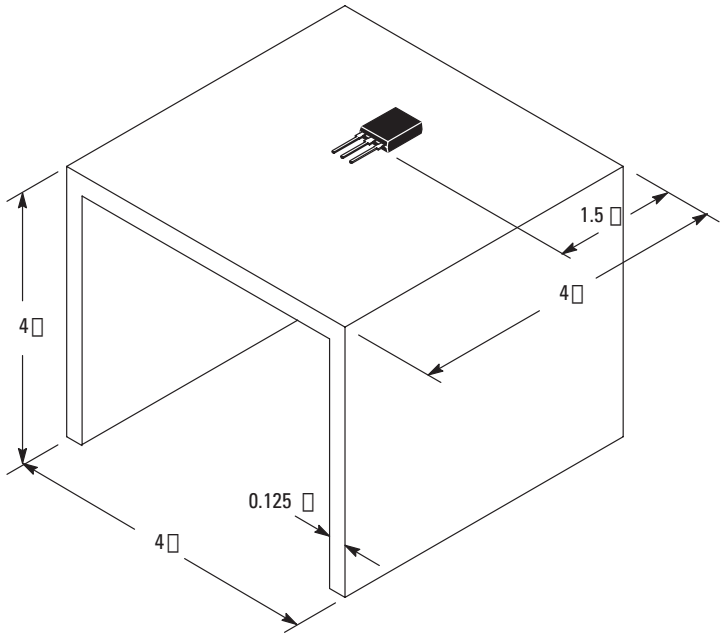


Figure 14. Test Fixture for Transient Thermal Curve (48 square inches of 1/8<?> thick aluminum)



© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Figure 15. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at T_A = 25°C)

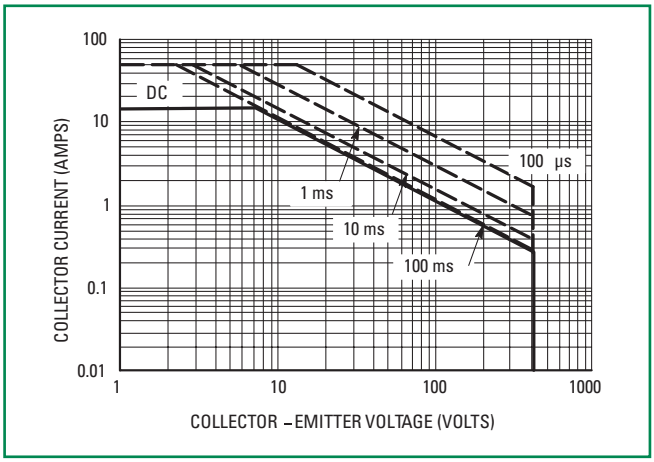


Figure 16. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at T_A = 125°C)

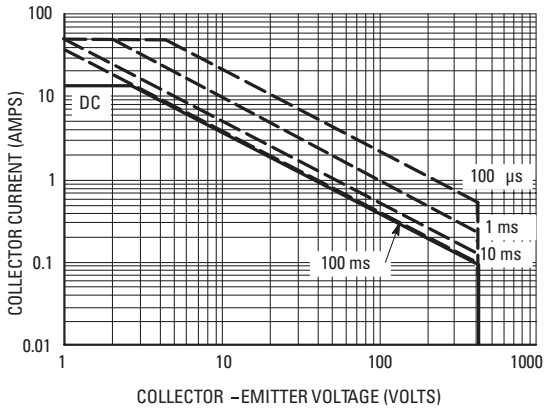


Figure 17. Pulse Train Safe Operating Area
(Mounted on an Infinite Heatsink at T_C = 25°C)

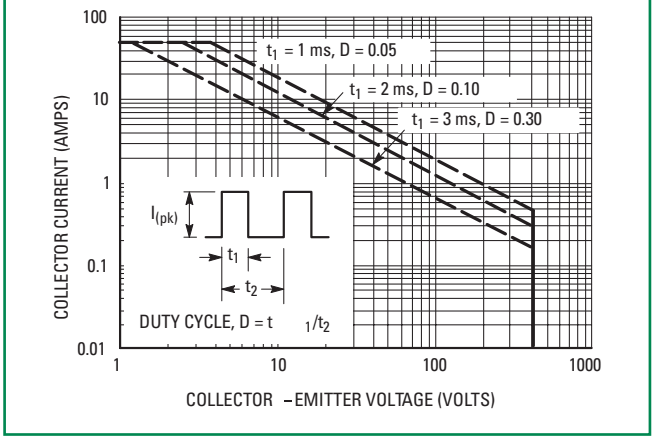
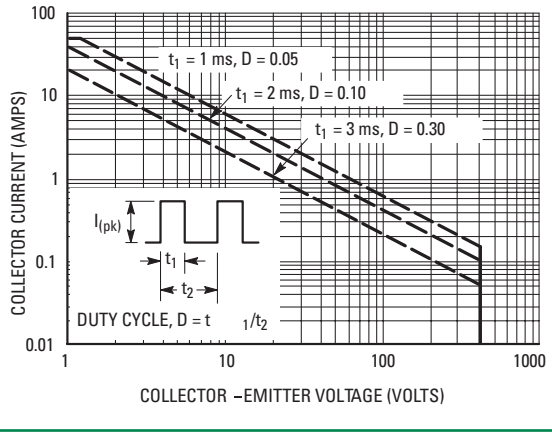


Figure 18. Pulse Train Safe Operating Area
(Mounted on an Infinite Heatsink at T_C = 125°C)

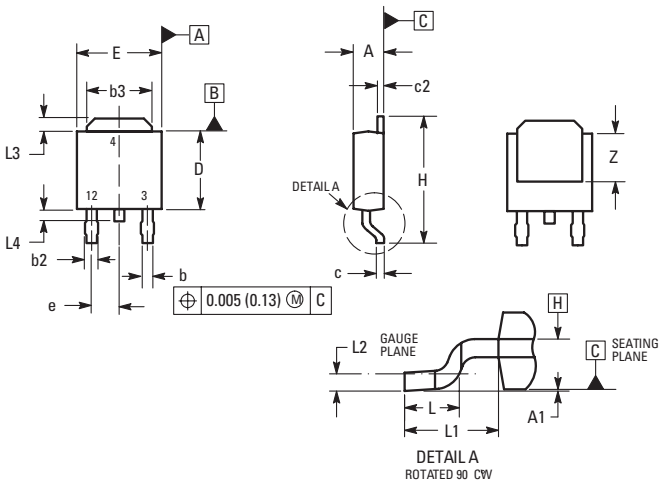


© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Ignition IGBT

Surface Mount > 410V > NGx15N41

Dimensions

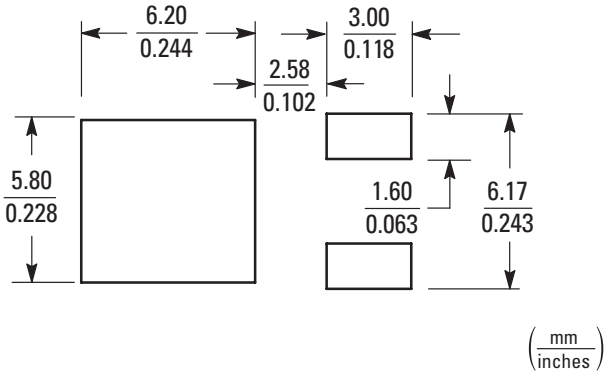


Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.030	0.045	0.76	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090 BSC		2.29 BSC	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.108 REF		2.74 REF	
L2	0.020 BSC		0.51 BSC	
L3	0.035	0.050	0.89	1.27
L4	---	0.040	---	1.01
Z	0.155	---	3.93	---

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSION: INCHES.CONTROLLING
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DI- MENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

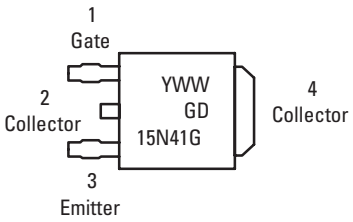
Soldering Footprint



Part Marking System

A= Assembly Location
Y= Year
WW = Work Week
G= Pb –Free Device

DPAK
CASE 369C
STYLE 7

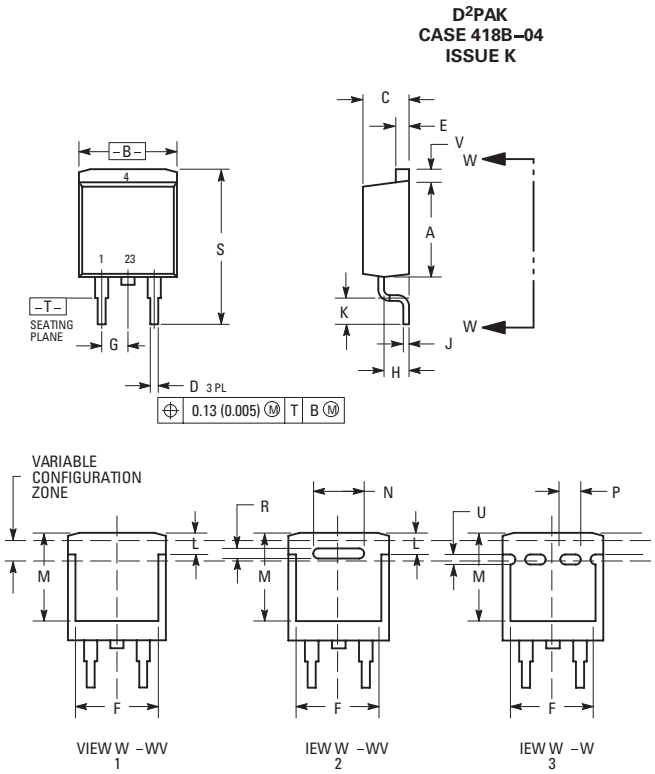


© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Ignition IGBT

Surface Mount > 410V > NGx15N41

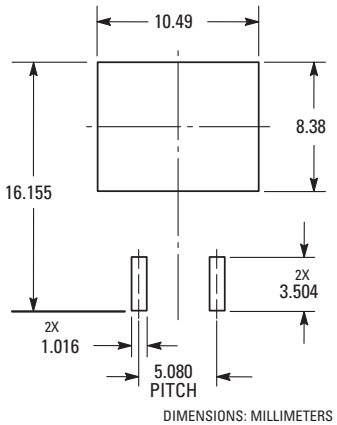
Dimensions



Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	1.83
M	0.280	0.320	7.11	8.13
N	0.197 REF		5.00 REF	
P	0.079 REF		2.00 REF	
R	0.039 REF		0.99 REF	
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

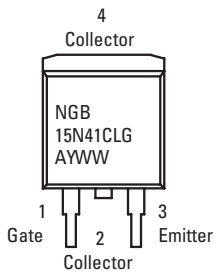
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 418B–01 THRU 418B–03 OBSOLETE, NEW STANDARD 418B–04.

Soldering Footrpint



Part Marking System

A= Assembly Location
Y= Year
WW = Work Week
G= Pb –Free Device

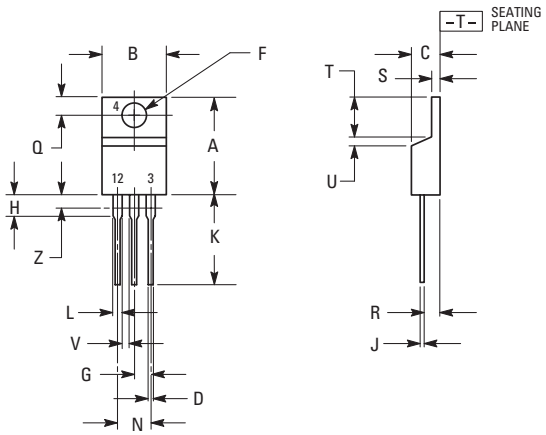


D²PAK
CASE 418B
STYLE 4

© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18

Dimensions

TO–220
CASE 221A–09
ISSUE AF



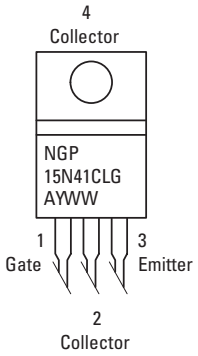
Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.014	0.025	0.36	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

Part Marking System

A= Assembly Location
Y= Year
WW = Work Week
G= Pb –Free Device

TO–220AB
CASE 221A
STYLE 9



ORDERING INFORMATION

Device	Package	Shipping†
NGD15N41ACLT4G	DPAK (Pb–Free)	2500 / Tape & Reel
NGB15N41ACLT4G	D²PAK (Pb–Free)	800 / Tape & Reel
NGP15N41ACLG	TO-220 (Pb–Free)	50 Units / Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at: www.littelfuse.com/disclaimer-electronics.

© 2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revised: 02/15/18