NGD8201N

Ignition IGBT

20 A, 400 V, N−Channel DPAK

This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Overvoltage 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 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 for Interfacing 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})

Applications

- Ignition Systems

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

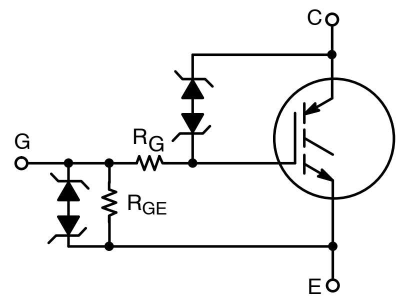
Rating	Symbol	Value	Unit
Collector−Emitter Voltage	V_{CES}	440	V
Collector−Gate Voltage	V_{CER}	440	V
Gate−Emitter Voltage	V_{GE}	± 15	V
Collector Current−Continuous @ T_C = 25°C − Pulsed	I_C	20 50	A_{DC} A_{AC}
Continuous Gate Current	I_G	1.0	mA
Transient Gate Current (t ≤ 2 ms, f ≤ 100 Hz)	I_G	20	mA
ESD (Charged−Device Model)	ESD	2.0	kV
ESD (Human Body Model) R = 1500 Ω, C = 100 pF	ESD	8.0	kV
ESD (Machine Model) R = 0 Ω, C = 200 pF	ESD	500	V
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	125 0.83	W W/°C
Operating & Storage Temperature Range	T_J, T_{stg}	−55 to +175	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

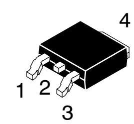
ON Semiconductor®

http://onsemi.com

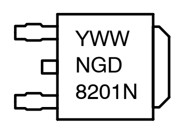
20 Amps
400 Volts
$V_{CE(on)}$ = 1.3 V @
I_C = 10 A, V_{GE} ≥ 4.5 V



MARKING DIAGRAM



DPAK
CASE 369C
STYLE 7



NGD8201N = Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
NGD8201NT4	DPAK	2500 / Tape & Reel

†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.

UNCLAMPED COLLECTOR−TO−EMITTER AVALANCHE CHARACTERISTICS ($-55° \le T_J \le 175°C$)

Characteristic	Symbol	Value	Unit
Single Pulse Collector−to−Emitter Avalanche Energy	E_{AS}		mJ
V_{CC} = 50 V, V_{GE} = 5.0 V, Pk I_L = 16.7 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 25°C		250	
V_{CC} = 50 V, V_{GE} = 5.0 V, Pk I_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, Pk I_L = 14.1 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 175°C		180	
Reverse Avalanche Energy	$E_{AS(R)}$		mJ
V_{CC} = 100 V, V_{GE} = 20 V, Pk I_L = 25.8 A, L = 6.0 mH, Starting T_J = 25°C		2000	

THERMAL CHARACTERISTICS

Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	1.2	°C/W
Thermal Resistance, Junction−to−Ambient (Note 1)	$R_{\theta JA}$	95	°C/W
Maximum Temperature for Soldering Purposes, 1/8″ from case for 5 seconds (Note 2)	T_L	275	°C

1. When surface mounted to an FR4 board using the minimum recommended pad size.
2. For further details, see Soldering and Mounting Techniques Reference Manual: SOLDERRM/D.

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
OFF CHARACTERISTICS							
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	T_J = −40°C to 175°C	390	415	440	
Zero Gate Voltage Collector Current	I_{CES}	V_{GE} = 0 V, V_{CE} = 15 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	μA
			T_J = 175°C	1.0	25	100*	
			T_J = −40°C	0.4	0.8	5.0	
Reverse Collector−Emitter Clamp Voltage	$B_{VCES(R)}$	I_C = −75 mA	T_J = 25°C	30	35	39	V
			T_J = 175°C	35	39	45*	
			T_J = −40°C	30	33	37	
Reverse Collector−Emitter Leakage Current	$I_{CES(R)}$	V_{CE} = −24 V	T_J = 25°C	0.05	0.1	0.5	mA
			T_J = 175°C	1.0	5.0	10*	
			T_J = −40°C	0.005	0.01	0.1	
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*	μA
Gate Resistor (Optional)	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
ON CHARACTERISTICS (Note 4)							
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*	
Threshold Temperature Coefficient (Negative)				4.0	4.6	5.2	mV/°C

*Maximum Value of Characteristic across Temperature Range.
3. Pulse Test: Pulse Width ≤ 300 μS, Duty Cycle ≤ 2%.

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 4)							
Collector−to−Emitter On−Voltage	$V_{CE(on)}$	I_C = 6.5 A, V_{GE} = 3.7 V	T_J = 25°C	0.95	1.15	1.35	V
			T_J = 175°C	0.7	0.95	1.15	
			T_J = −40°C	1.0	1.3	1.40	
		I_C = 9.0 A, V_{GE} = 3.9 V	T_J = 25°C	0.95	1.25	1.45	
			T_J = 175°C	0.8	1.05	1.25	
			T_J = −40°C	1.1	1.4	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*	
		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*	
		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*	
		I_C = 20 A, V_{GE} = 4.5 V	T_J = 25°C	1.3	1.6	1.9	
			T_J = 175°C	1.2	1.5	1.8	
			T_J = −40°C	1.4	1.75	2.0*	
Forward Transconductance	gfs	I_C = 6.0 A, V_{CE} = 5.0 V	T_J = 25°C	10	18	25	Mhos
DYNAMIC CHARACTERISTICS							
Input Capacitance	C_{ISS}	f = 10 kHz, V_{CE} = 25 V	T_J = 25°C	1100	1300	1500	pF
Output Capacitance	C_{OSS}			70	80	90	
Transfer Capacitance	C_{RSS}			18	20	22	
SWITCHING CHARACTERISTICS							
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 V	T_J = 25°C	6.0	8.0	10	μSec
			T_J = 175°C	6.0	8.0	10	
Fall Time (Resistive)	t_f		T_J = 25°C	4.0	6.0	8.0	
			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 V	T_J = 25°C	3.0	5.0	7.0	
			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	
			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	
			T_J = 175°C	1.0	1.5	2.0	
Rise Time	t_r		T_J = 25°C	4.0	6.0	8.0	
			T_J = 175°C	3.0	5.0	7.0	

*Maximum Value of Characteristic across Temperature Range.
4. Pulse Test: Pulse Width ≤ 300 μS, Duty Cycle ≤ 2%.

TYPICAL ELECTRICAL CHARACTERISTICS

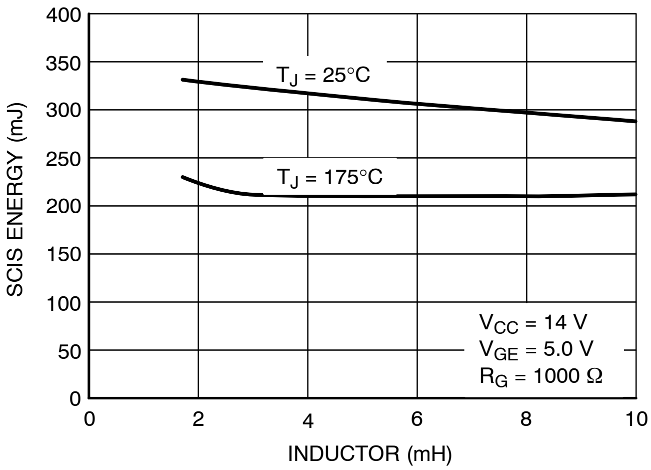


Figure 1. Self Clamped Inductive Switching

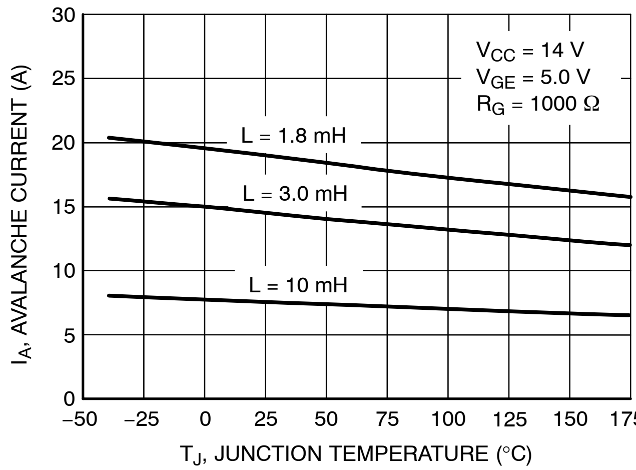


Figure 2. Open Secondary Avalanche Current vs. Temperature

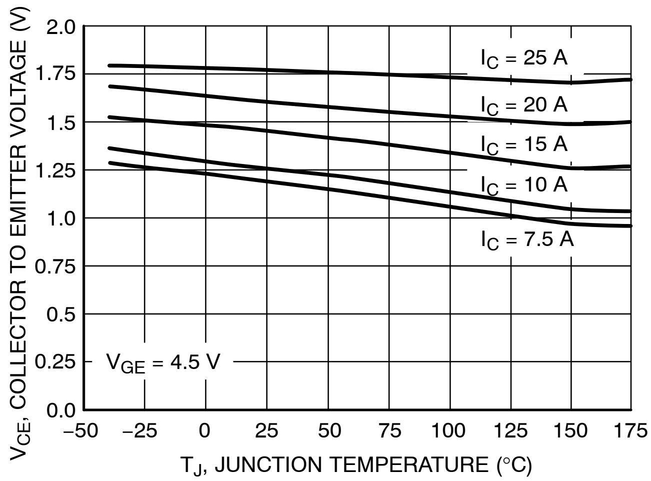


Figure 3. Collector−to−Emitter Voltage vs. Junction Temperature

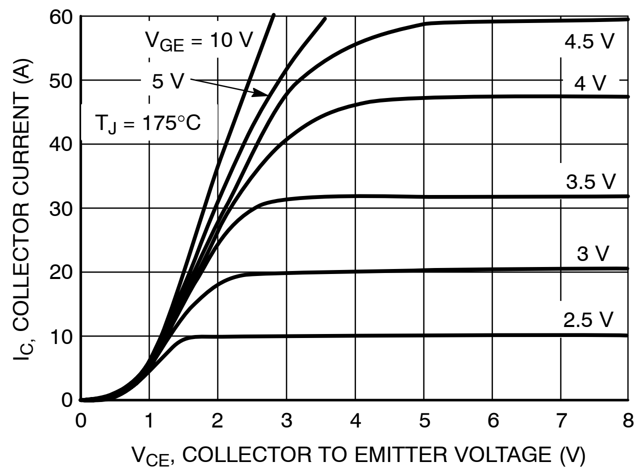


Figure 4. Collector Current vs. Collector−to−Emitter Voltage

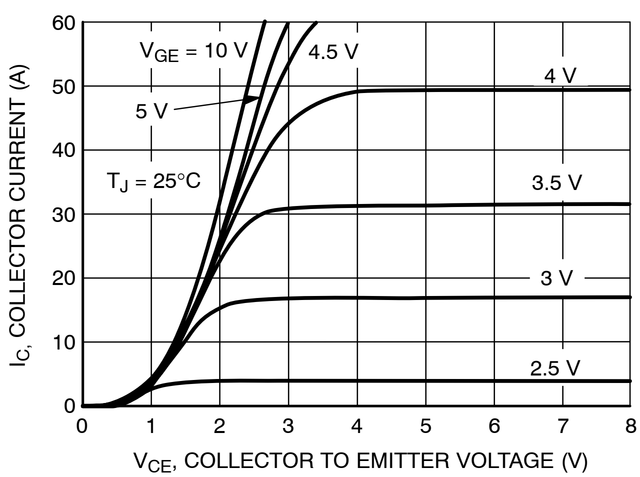


Figure 5. Collector Current vs. Collector−to−Emitter Voltage

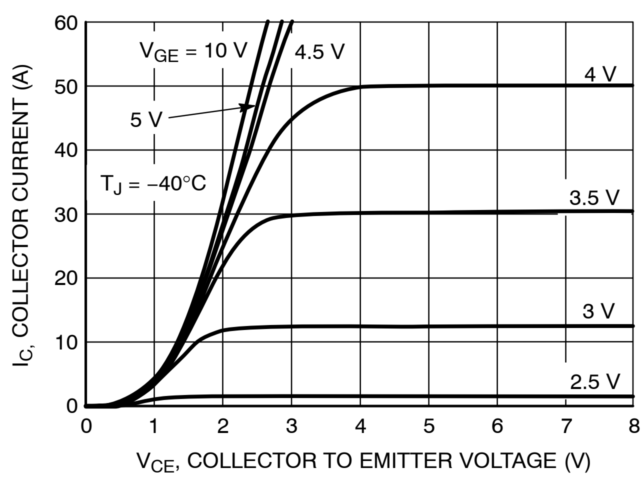


Figure 6. Collector Current vs. Collector−to−Emitter Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

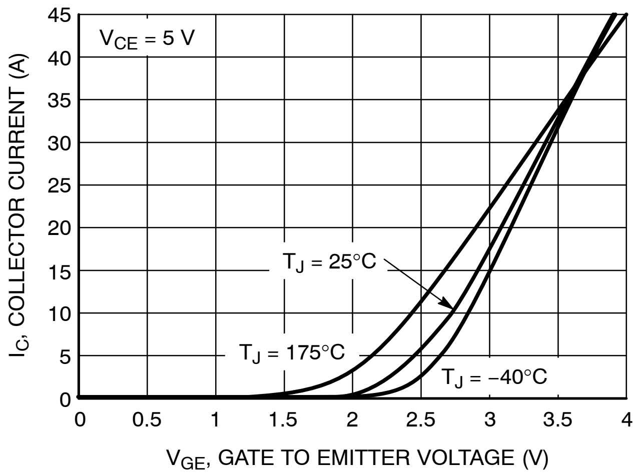


Figure 7. Transfer Characteristics

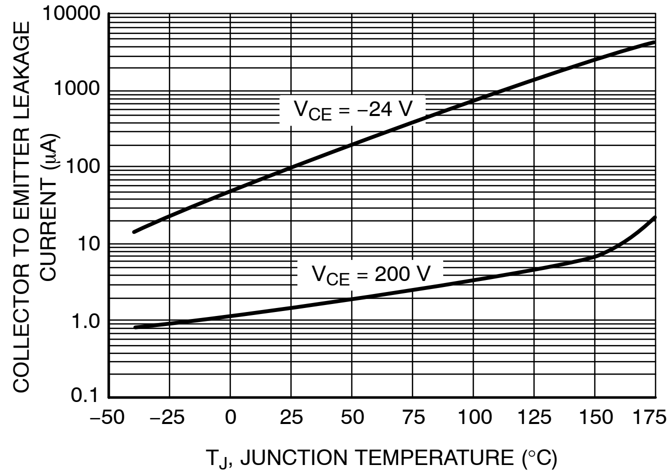


Figure 8. Collector−to−Emitter Leakage Current vs. Temperature

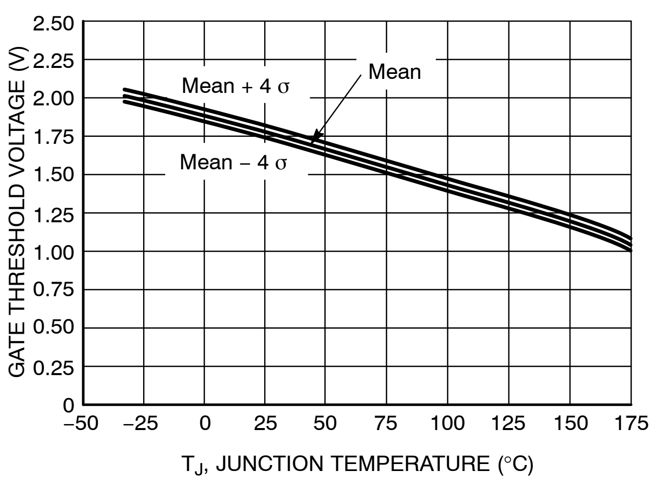


Figure 9. Gate Threshold Voltage vs. Temperature

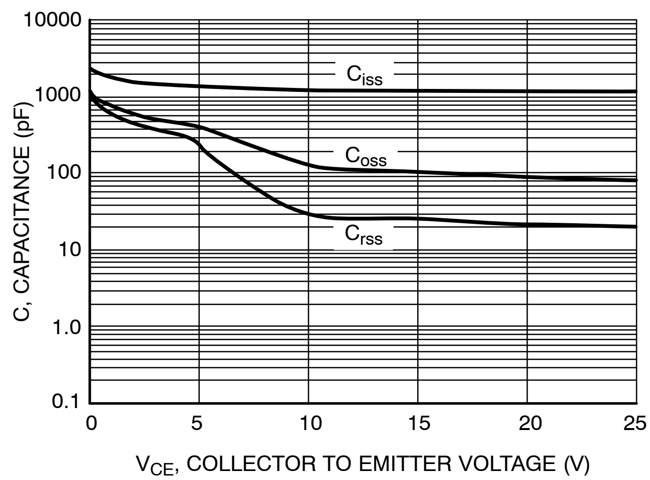


Figure 10. Capacitance vs. Collector−to−Emitter Voltage

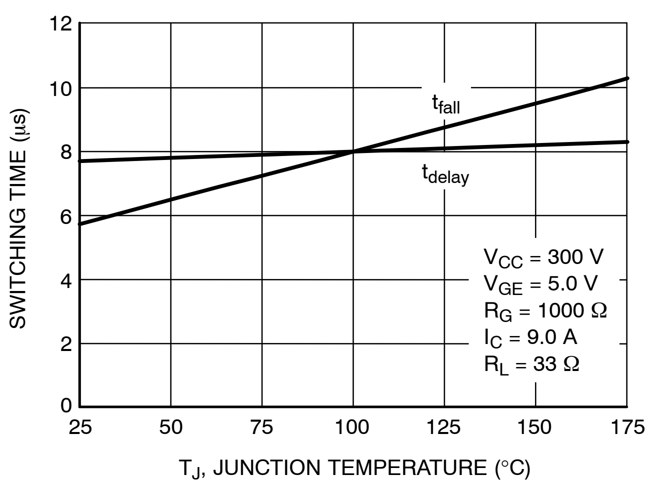


Figure 11. Resistive Switching Fall Time vs. Temperature

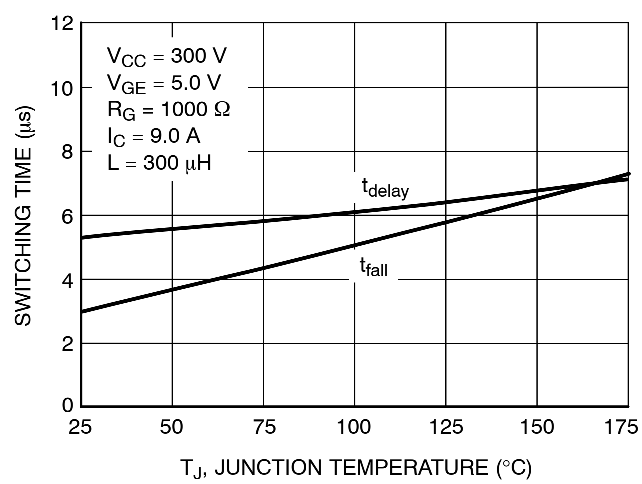


Figure 12. Inductive Switching Fall Time vs. Temperature

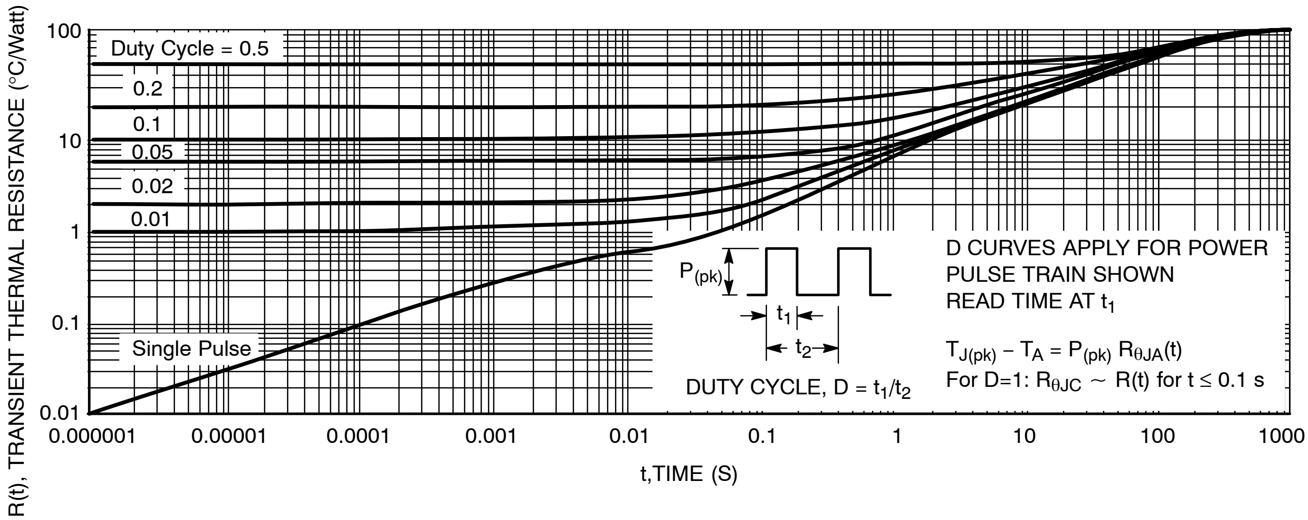


Figure 13. Minimum Pad Transient Thermal Resistance (Non−normalized Junction−to−Ambient)

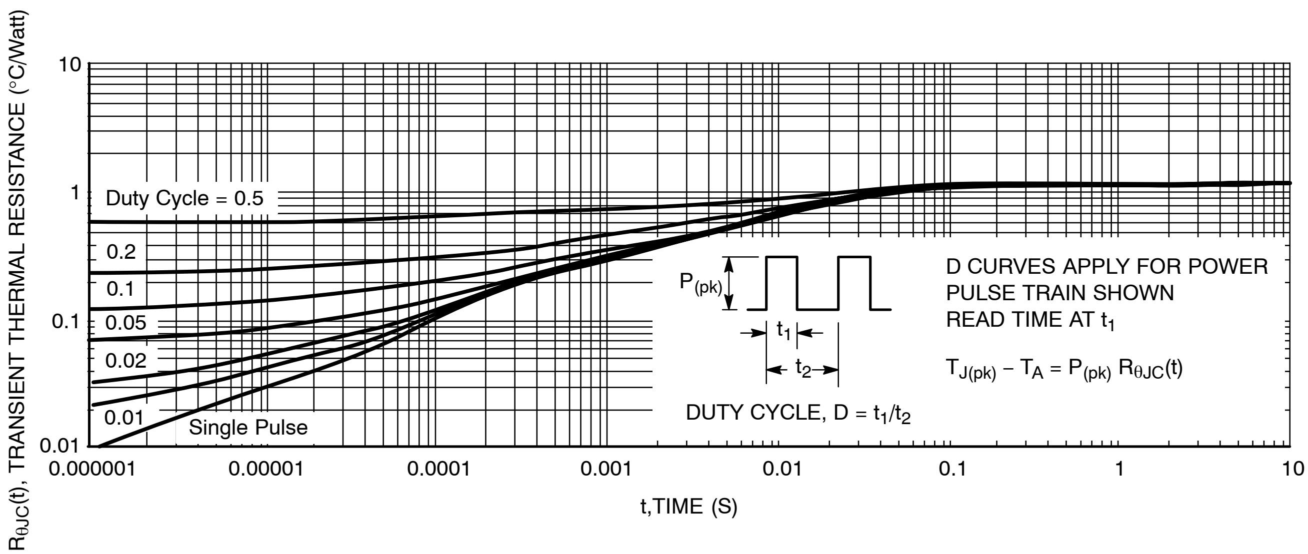
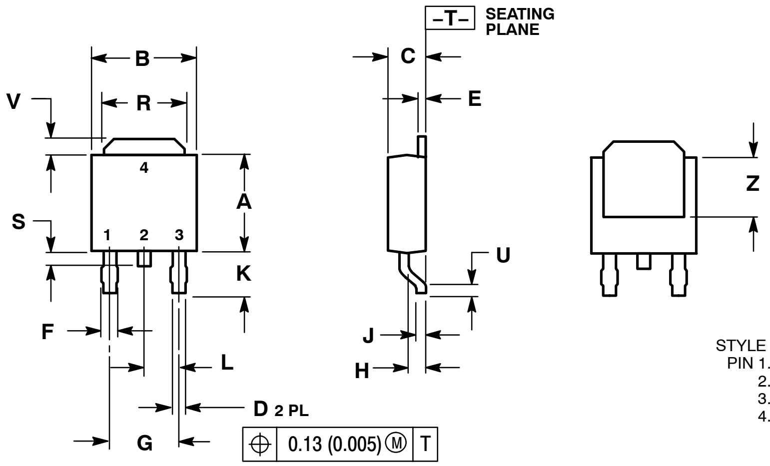


Figure 14. Best Case Transient Thermal Resistance (Non−normalized Junction−to−Case Mounted on Cold Plate)

PACKAGE DIMENSIONS

DPAK
CASE 369C−01
ISSUE O

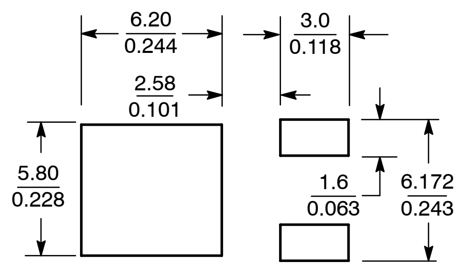


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.025	0.040	0.63	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

SOLDERING FOOTPRINT



SCALE 3:1 (mm / inches)

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.