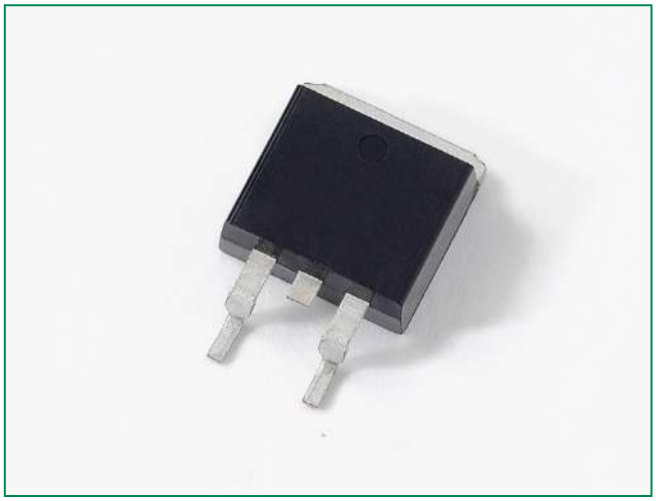
NGB8245N - 20 A, 450 V, N-Channel Ignition IGBT, D²PAK



20 Amps, 450 Volts
VCE(on) ≤ 1.24 V @
IC = 15 A, VGE ≥ 4.0

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

Rating	Symbol	Value	Unit
Collector−Emitter Voltage	V_{CES}	500	V
Gate Voltage	V_{CER}	500	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 (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	150 1.0	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.

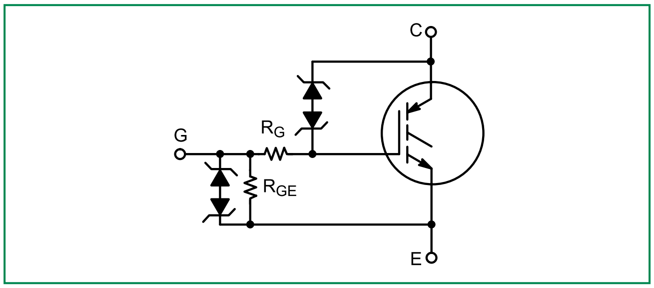
Features

- Ideal for Coil−on−Plug and Driver−on−Coil Applications
- D²PAK Package Offers Smaller Footprint for Increased Board Space
- Gate−Emitter ESD Protection
- Temperature Compensated Gate−Collector Voltage Clamp Limits Stress Applied to Load
- Low Threshold Voltage for Interfacing Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- This is a Pb−Free Device

Applications

- Ignition Systems

Functional Diagram



Additional Information

Datasheet | Resources | Samples

Unclamped Collector–To–Emitter Avalanche Characteristics

Rating	Symbol	Value	Unit
Single Pulse Collector–to–Emitter Avalanche Energy V_{CC} = 50 V, V_{GE} = 5.0 V, Pk I_L = 9.5 A, R_G = 1 kΩ, L = 3.5 mH, Starting T_C = 150°C	E_{AS}	158	mJ

Thermal Characteristics

Rating	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.0	°C/W
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	62.5	°C/W
Maximum Lead 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 - OFF Characteristics (Note 3)

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Collector−Emitter Clamp Voltage	BV_{CES}	I_C = 2.0 mA	T_J = −40°C to 175°C	430	450	470	V
		IC = 10 mA	T_J = −40°C to 175°C	450	475	500	
		IC = 12 A, L = 3.5 mH, R_G = 1 kΩ (Note 4)	T_J = −40°C to 175°C	420	450	480	
Collector−Emitter Leakage Current	I_{CES}	V_{CE} = 15 V V_{GE} = 0 V	T_J = 25°C	–	0.002	1.0	μA
		V_{CE} = 250V R_G = 1kΩ	T_J = −40°C to 175°C	0.5	2.0	100	
Reverse Collector−Emitter Clamp Voltage	$B_{VCES\ (R)}$	IC = −75 mA	T_J = 25°C	30	33	39	V
			T_J = 175°C	31	35	40	
			T_J = −40°C	30	31	37	
Reverse Collector−Emitter Leakage Current	$I_{CES(R)}$	V_{CE} = −24 V	T_J = 25°C	–	0.4	1.0	mA
			T_J = 175°C	–	20	35	
			T_J = −40°C	–	0.04	0.2	
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	316	350	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

Electrical Characteristics - ON Characteristics (Note 3)

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Gate Threshold Voltage	$VGE_{(th)}$	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
Collector−to−Emitter On−Voltage	$VG_{(on)}$	V_{GE} = 3.7 V, I_C = 10 A	T_J = −40°C to 175°C	0.8	1.11	1.97	V
		V_{GE} = 4.0 V, I_C = 10 A	T_J = −40°C to 175°C	0.8	1.10	1.85	
		V_{GE} = 4.0 V, I_C = 15 A	T_J = −40°C to 175°C	0.8	1.24	2.00	
Forward Transconductance	gfs	V_{CE} = 5.0 V, I_C = 6.0 A	T_J = 25°C	10	19	25	Mhos

Dynamic Characteristics (Note 3)

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Input Capacitance	C_{ISS}	V_{CE} = 25 V f = 10 MHz	T_J = 25°C	1100	1400	1600	pF
Output Capacitance	C_{OSS}			50	65	80	
Transfer Capacitance	C_{RSS}			15	20	25	

Switching Characteristics (Note 3)

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
Turn–On Delay Time (Resistive) 10% V_{GE} to 10% I_C	$t_{d\,(on)R}$	V_{CC} = 14 V, R_L = 1.0 Ω, V_{GE} = 5.0 V, R_G = 1.0 kΩ	T_J = −40°C to 175°C	0.1	1.0	2.0	μS
Rise Time (Resistive) 10% I_C to 90% I_C	t_{rR}		T_J = −40°C to 175°C	1.0	3.4	6.0	
Turn–Off Delay Time (Resistive) 90% V_{GE} to 90% I_C	$t_{d\,(off)R}$		T_J = −40°C to 175°C	2.0	4.5	8.0	
Fall Time (Resistive) 90% I_C to 10% I_C	t_{fR}		T_J = −40°C to 175°C	3.0	8.0	12	
Turn–Off Delay Time (Inductive) 90% V_{GE} to 90% I_C	$t_{d(off)L}$	V_{CE} = BV_{CES}, L = 0.5mH, R_G = 1.0 kΩ, I_C = 10 A, V_{GE} = 5.0 V	T_J = −40°C to 175°C	6.5	9.7	12.5	
Fall Time (Inductive) 90% I_C to 10% I_C	t_{fL}		T_J = −40°C to 175°C	6.0	8.3	11	

3. Electrical Characteristics at temperature other than 25ºC, Dynamic and Switching characteristics are not subject to production testing.
4. Not subject to production testing.

Ratings and Characteristic Curves

Figure 1. Self Clamped Inductive Switching

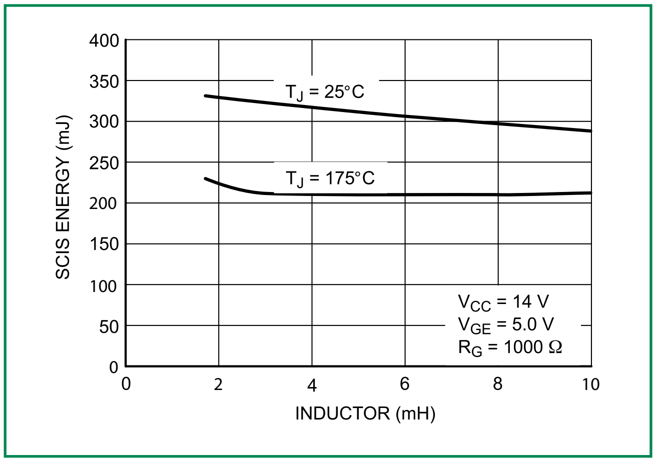


Figure 2. Open Secondary Avalanche Current vs. Temperature

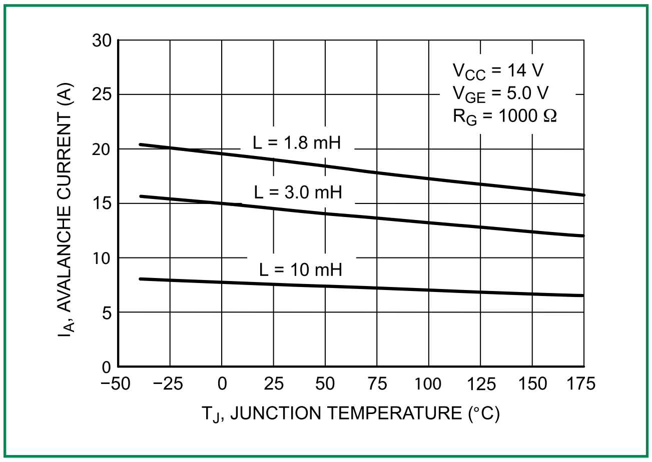


Figure 3. Collector–to–Emitter Voltage vs. Junction Temperature

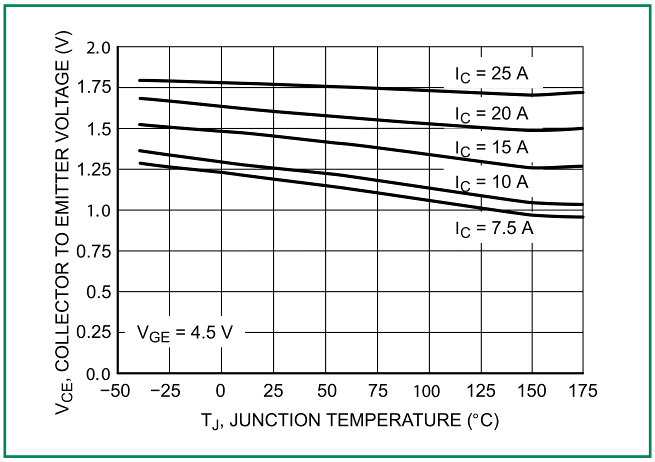


Figure 4. Collector Current vs. Collector–to–Emitter Voltage

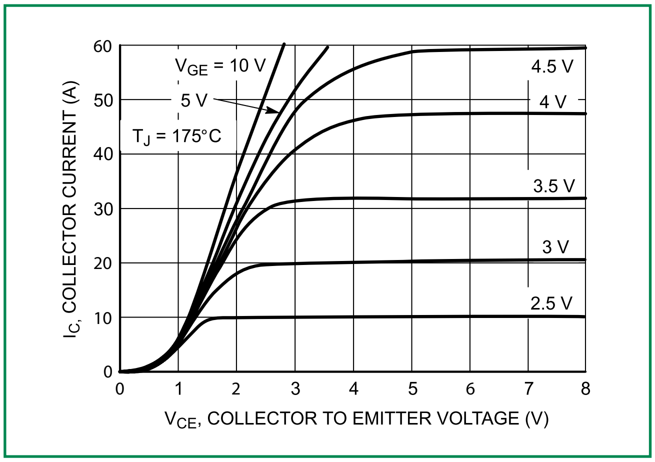


Figure 5. Collector Current vs. Collector–to–Emitter Voltage

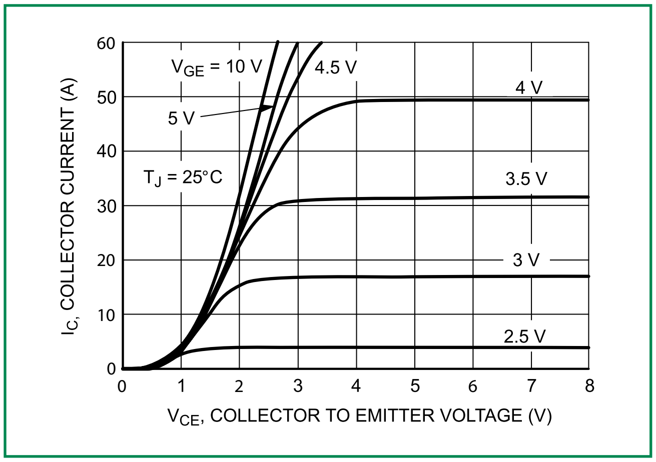


Figure 6. Collector Current vs. Collector–to–Emitter Voltage

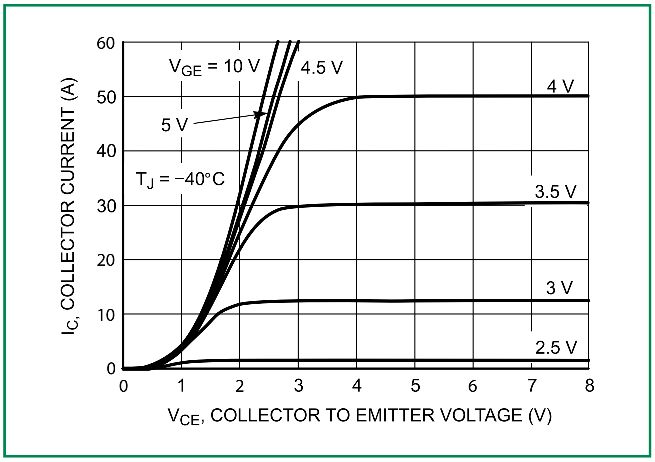


Figure 7. . Transfer Characteristics

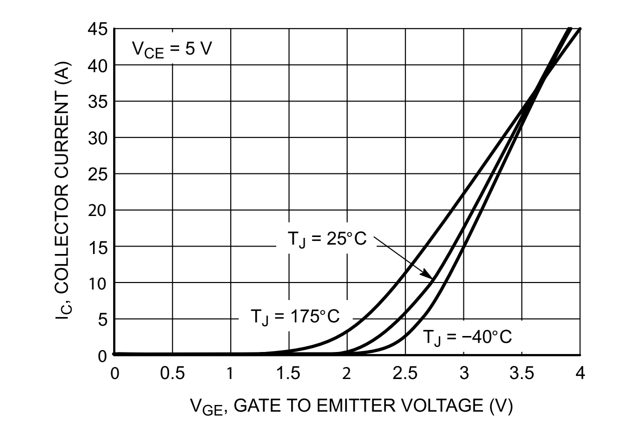


Figure 8. Collector−to−Emitter Leakage Current vs. Temperature

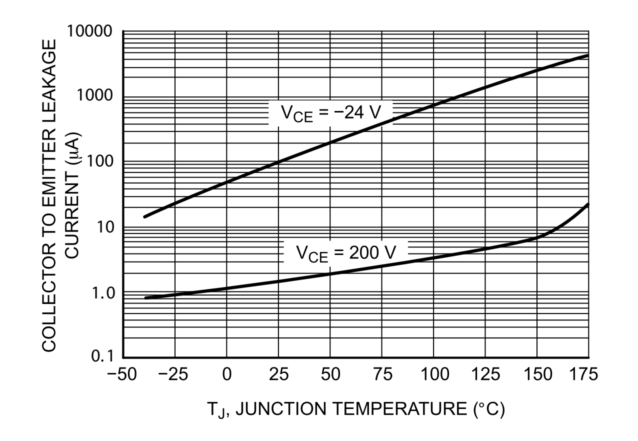


Figure 9. Gate Threshold Voltage vs. Temperature

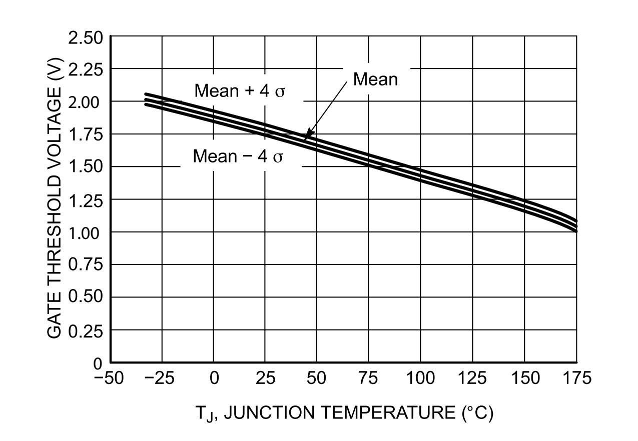


Figure 10. Capacitance vs. Collector−to−Emitter Voltage

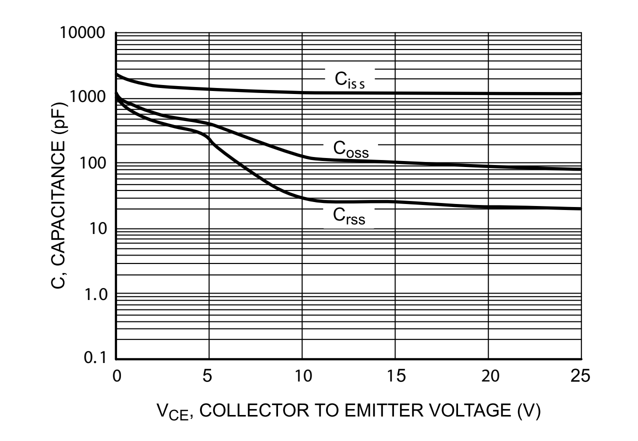


Figure 11. Resistive Switching Fall Time vs. Temperature

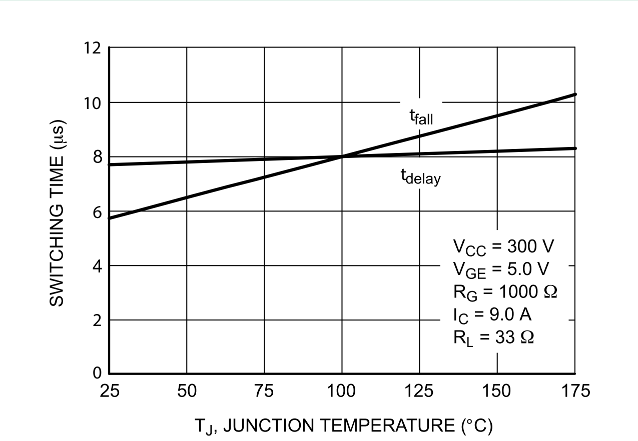


Figure 12. Inductive Switching Fall Time vs. Temperature

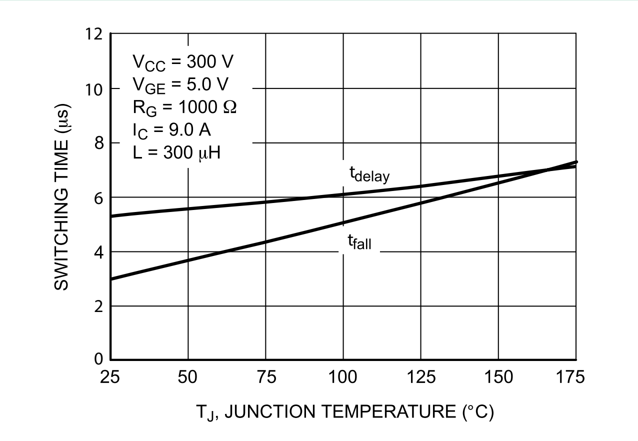


Figure 13. Minimum Pad Transient Thermal Resistance (Non−normalized Junction−to−Ambient)

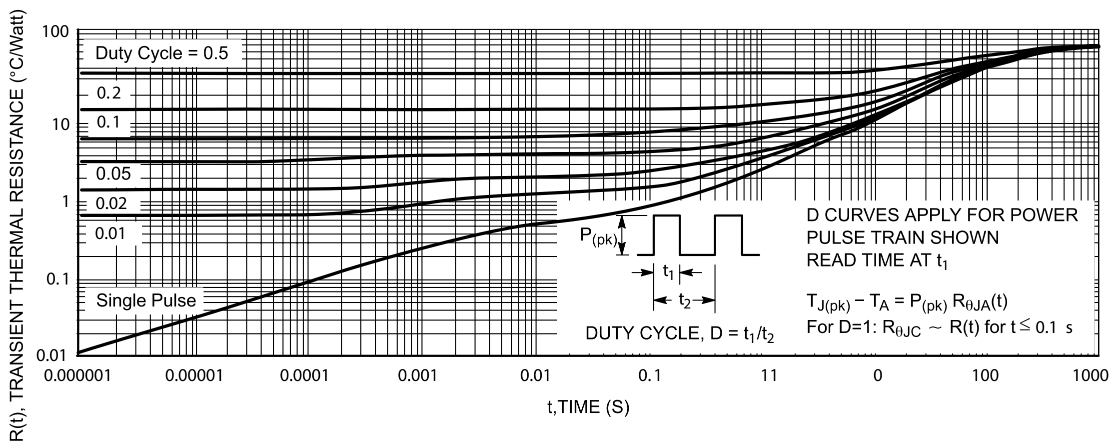
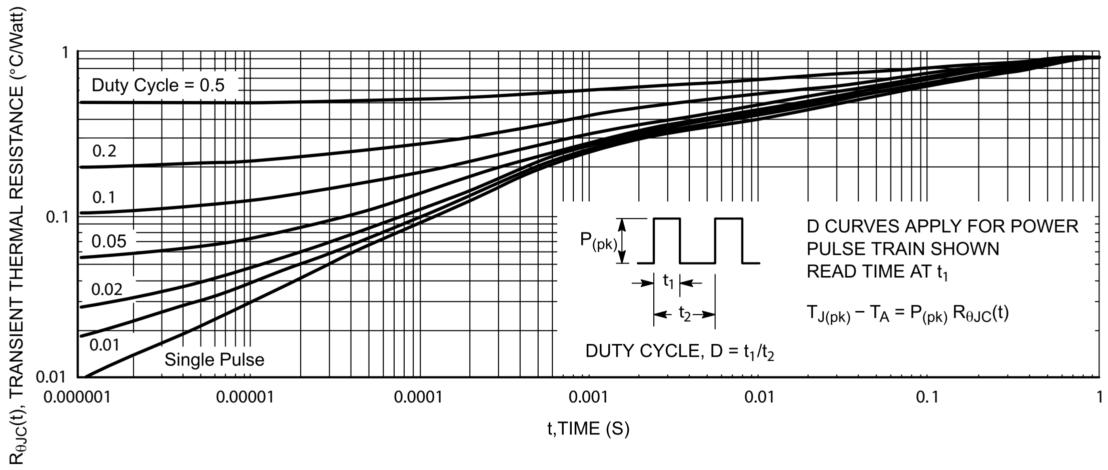
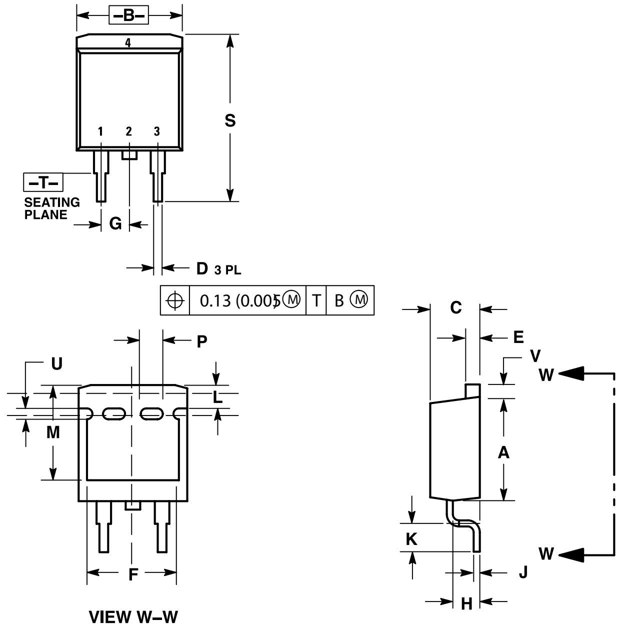


Figure 14. Best Case Transient Thermal Resistance (Non−normalized Junction−to−Case Mounted on Cold Plate)



Dimensions

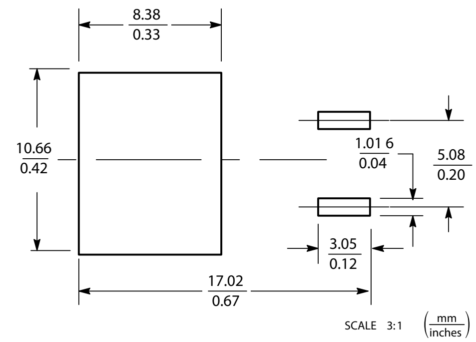


Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	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

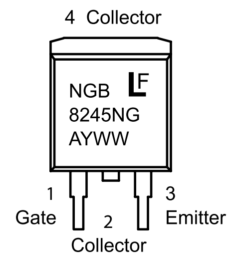
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 418B–01 THRU 418B–03 OBSOLETE, NEW STANDARD 418B–04.

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

Soldering Footrpint



Part Marking System



NGB8245N = Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping
NGB8245NT4G	D²PAK (Pb−Free)	800 / Tape & Reel