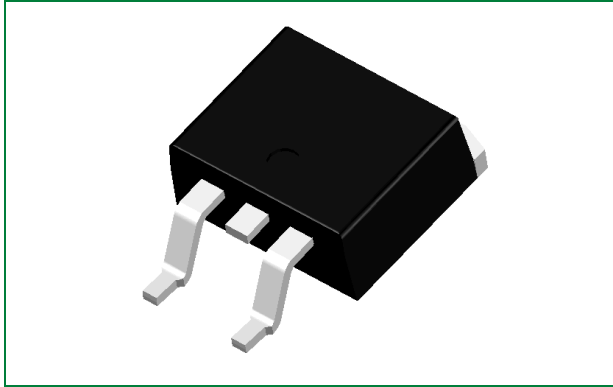


LGB8245T1

450 V, 20 A N-Channel Ignition IGBT



Product Summary

Characteristic	Value	Unit
V_{CES}	450	V
I_c	20	A

Description

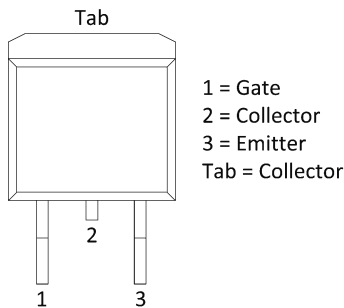
This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

Agency Approvals

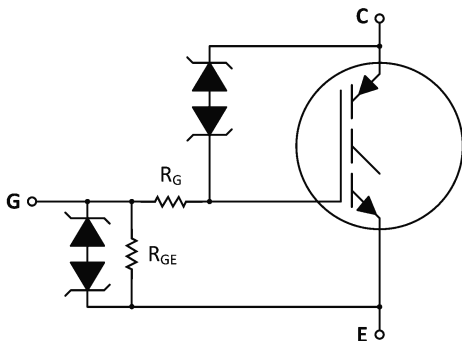
Environmental Approvals



Pinout Diagram



Functional Diagram



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 Interfaces Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- AEC-Q101 Qualified
- These are Pb-Free Devices

Applications

- Ignition Systems

1. Maximum Ratings ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)	3
2. Unclamped Collector-to-Emitter Avalanche Characteristics	3
3. Thermal Characteristics	3
4. Electrical Characteristics – Off	3
5. Electrical Characteristics – On	4
6. Dynamic Characteristics	4
7. Switching Characteristics	4
8. Figure Data	5
9. Package Dimensions	8
10. Part Numbering and Marking	8
11. Packing Options	8

1. Maximum Ratings ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristic	Conditions	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	$T_C = 25\text{ }^\circ\text{C}$	I_C	20	A_{DC}
Collector Current – Pulsed			50	A_{AC}
Continuous Gate Current	-	I_G	1.0	mA
Transient Gate Current	$t < 2\text{ ms}, f \leq 100\text{ Hz}$		20	mA
ESD – Human Body Model	$R = 1500\ \Omega, C = 100\text{ pF}$	ESD	8.0	kV
ESD – Machine Model	$R = 0\ \Omega, C = 200\text{ pF}$		500	V
Total Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	P_D	150	W
	Derating for $>25\text{ }^\circ\text{C}$		1.0	W/ $^\circ\text{C}$
Operating and Storage Temperature Range	-	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$

2. Unclamped Collector-to-Emitter Avalanche Characteristics

Characteristic	Symbol	Value	Unit
Single Pulse Collector-to-Emitter Avalanche Energy			
$V_{CC} = 50\text{ V}, V_{GE} = 5.0\text{ V}, P_{kL} = 9.5\text{ A}, L = 3.5\text{ mH}, R_G = 1\text{ k}\Omega$, Starting $T_C = 150\text{ }^\circ\text{C}$	E_{AS}	158	mJ

Note: $-55\text{ }^\circ\text{C} \leq T_J \leq 150\text{ }^\circ\text{C}$

3. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient (D2PAK) ¹	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	275	$^\circ\text{C}$

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}	$I_C = 2.0\text{ mA}$	$T_J = -40\text{ }^\circ\text{C}$ to $175\text{ }^\circ\text{C}$	430	450	470	V
		$I_C = 10\text{ mA}$		450	475	500	
Collector-Emitter Clamp Voltage ⁴	BV_{CES}	$I_C = 12\text{ mA}, L = 3.5\text{ mH}, R_G = 1\text{ k}\Omega$	$T_J = -40\text{ }^\circ\text{C}$ to $175\text{ }^\circ\text{C}$	420	450	480	V
Collector-Emitter Leakage Current	I_{CES}	$V_{CE} = 15\text{ V}, V_{GE} = 0\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	0.002	1.0	μA
		$V_{CE} = 250\text{ V}, R_G = 1\text{ k}\Omega$	$T_J = -40\text{ }^\circ\text{C}$ to $175\text{ }^\circ\text{C}$	0.5	2.0	100	
Reverse Collector-Emitter Leakage Current	I_{ECS}	$V_{CE} = -24\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	0.4	1.0	mA
			$T_J = 175\text{ }^\circ\text{C}$	-	20	35	
			$T_J = -40\text{ }^\circ\text{C}$	-	0.04	0.2	
Reverse Collector-Emitter Clamp Voltage	$BV_{CES(R)}$	$I_C = -75\text{ mA}$	$T_J = 25\text{ }^\circ\text{C}$	30	33	39	V
			$T_J = 175\text{ }^\circ\text{C}$	31	35	40	
			$T_J = -40\text{ }^\circ\text{C}$	30	31	37	
Gate-Emitter Clamp Voltage	BV_{GES}	$I_G = \pm 5.0\text{ mA}$	$T_J = -40\text{ }^\circ\text{C}$ to $175\text{ }^\circ\text{C}$	12	12.5	14	V
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 5.0\text{ V}$	$T_J = -40\text{ }^\circ\text{C}$ to $175\text{ }^\circ\text{C}$	200	316	350	μA
Gate-Emitter Resistor	R_{GE}	-	$T_J = -40\text{ }^\circ\text{C}$ to $175\text{ }^\circ\text{C}$	14.25	16	25	k Ω
Gate Resistor	R_G	-	$T_J = -40\text{ }^\circ\text{C}$ to $175\text{ }^\circ\text{C}$	-	70	-	Ω

5. Electrical Characteristics – On

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0 \text{ mA}$, $V_{GE} = V_{CE}$	$T_J = 25 \text{ }^\circ\text{C}$	1.5	1.8	2.1	V
			$T_J = 175 \text{ }^\circ\text{C}$	0.7	1.0	1.3	
			$T_J = -40 \text{ }^\circ\text{C}$	1.7	2.0	2.3	
Threshold Temperature Coefficient (Negative)	-	-	-	4.0	4.6	5.2	mV/ $^\circ\text{C}$
Collector-Emitter On-Voltage	$V_{CE(on)}$	$I_C = 10 \text{ A}$, $V_{GE} = 3.7 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.8	1.11	1.97	V
		$I_C = 10 \text{ A}$, $V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.8	1.10	1.85	
		$I_C = 15 \text{ A}$, $V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.8	1.24	2.00	
Forward Transconductance	gfs	$V_{CE} = 5.0 \text{ V}$, $I_C = 6.0 \text{ A}$	$T_J = 25 \text{ }^\circ\text{C}$	10	19	25	Mhos

6. Dynamic Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Input Capacitance	C_{ISS}	$V_{CE} = 25 \text{ V}$, $f = 10 \text{ kHz}$	$T_J = -25 \text{ }^\circ\text{C}$	1100	1400	1600	pF
Output Capacitance	C_{OSS}			50	65	80	
Transfer Capacitance	C_{RSS}			15	20	25	

7. Switching Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Turn-on Delay Time (Resistive) 10% V_{GE} to 10% I_C	$t_{d(on)R}$	$V_{CE} = 14 \text{ V}$, $V_{GE} = 5.0 \text{ V}$, $R_G = 1.0 \text{ k}\Omega$, $R_L = 1.0 \text{ }\Omega$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.1	1.0	2.0	μs
Rise Time (Resistive) 10% I_C to 90% I_C	t_{rR}			1.0	3.4	6.0	
Turn-off Delay Time (Resistive) 90% V_{GE} to 90% I_C	$t_{d(off)R}$			2.0	4.5	8.0	
Fall Time (Resistive) 90% I_C to 10% I_C	t_{fR}			3.0	8.0	12	
Turn-off Delay Time (Inductive) 90% V_{GE} to 90% I_C	$t_{d(off)L}$	$V_{CE} = BV_{CES}$, $L = 0.5 \text{ mH}$, $R_G = 1.0 \text{ k}\Omega$, $I_C = 10 \text{ A}$, $V_{GE} = 5.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	6.5	9.7	12.5	μs
Fall Time (Inductive) 90% I_C to 10% I_C	t_{fL}			6.0	8.3	11	

Note: Electrical Characteristics at temperature other than 25 °C, Dynamic and Switching characteristics are not subject to production testing. Not subject to production testing.

8. Figure Data

Figure 1. Self-Clamped Inductive Switching

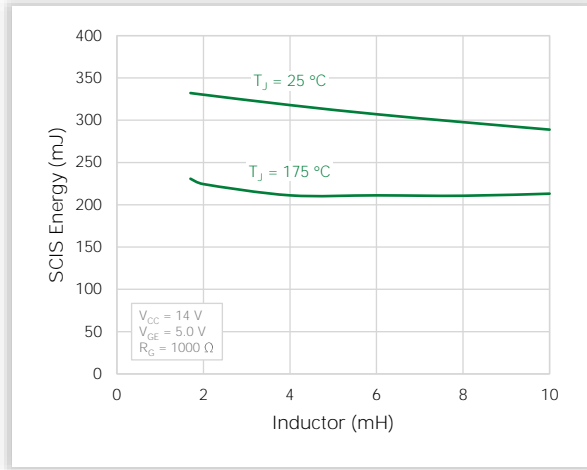


Figure 2. Open Secondary Avalanche Current vs. Temperature

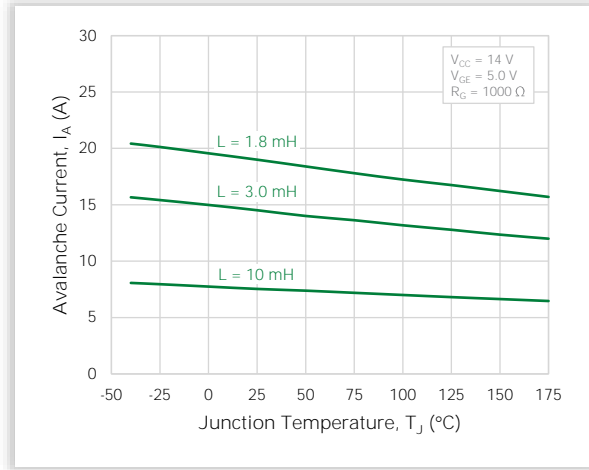


Figure 3. Collector-Emitter Voltage vs. Junction Temperature

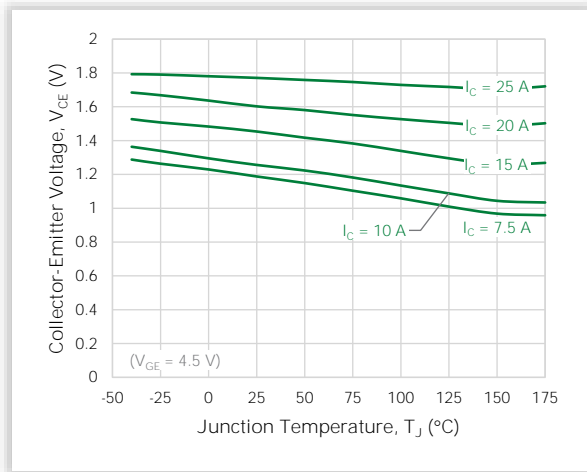
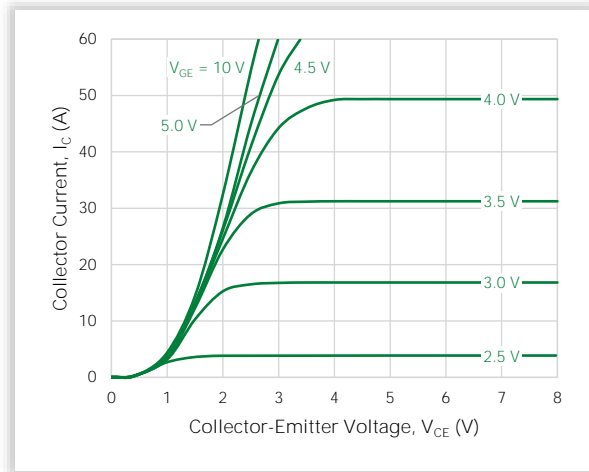
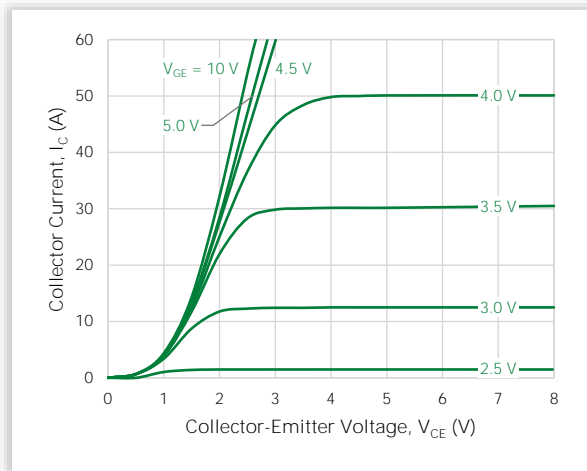
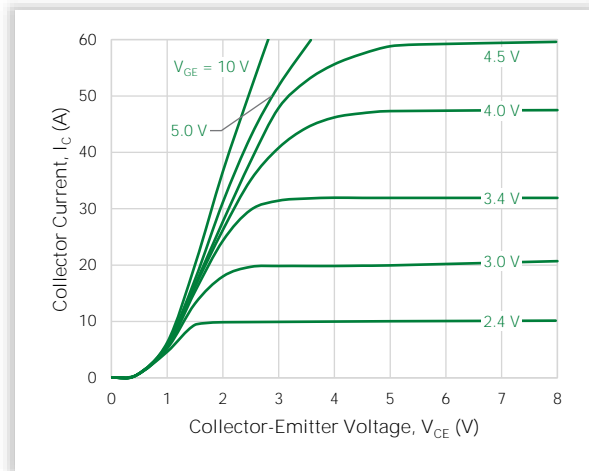

 Figure 4. Output Characteristics (T_J = 25 °C)

 Figure 5. Output Characteristics (T_J = -40 °C)

 Figure 6. Output Characteristics (T_J = 175 °C)


Figure 7. Transfer Characteristics

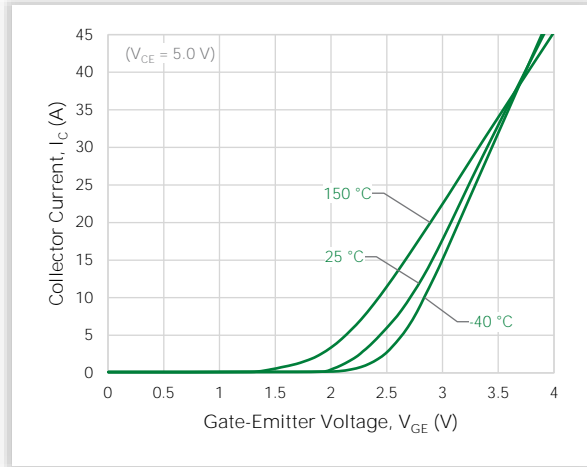


Figure 8. Collector-Emitter Leakage Current vs. Temperature

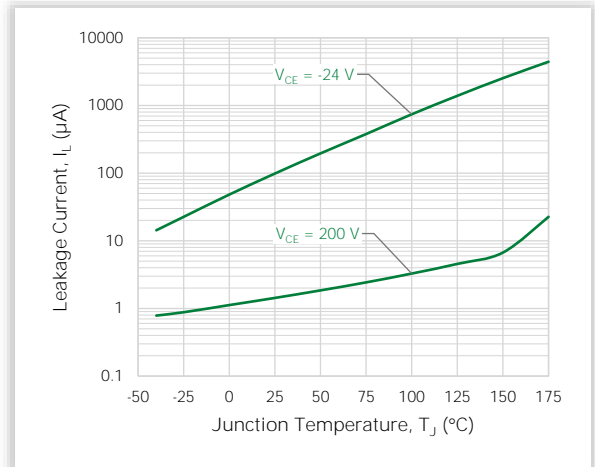


Figure 9. Gate Threshold Voltage vs. Temperature

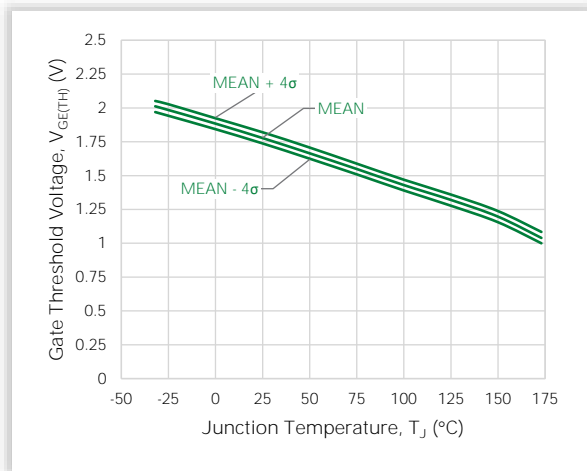


Figure 10. Capacitance Variance

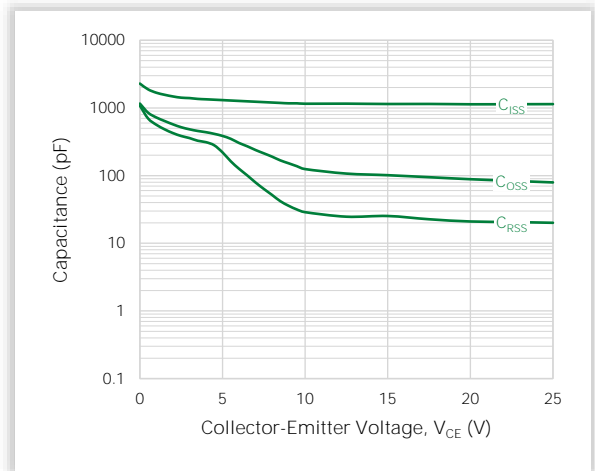


Figure 11. Resistive Switching Fall Time vs. Temperature

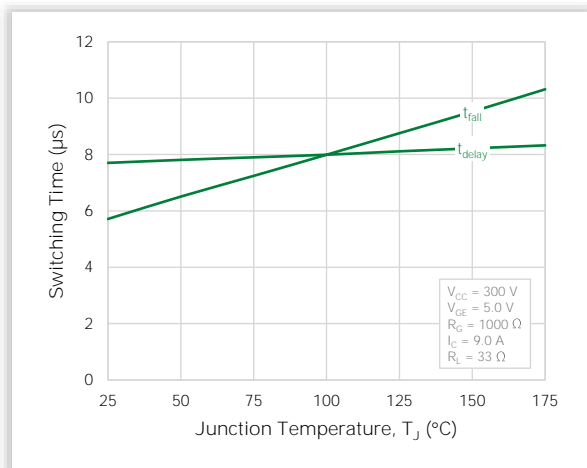


Figure 12. Inductive Switching Fall Time vs. Temperature

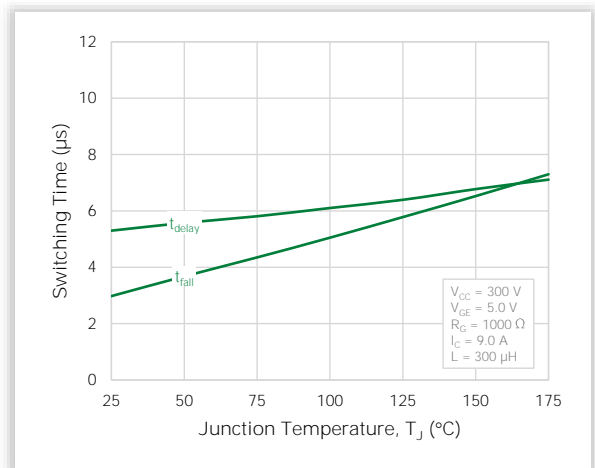


Figure 13. Minimum Pad Transient Thermal Resistance

(Non-normalized Junction-Ambient)

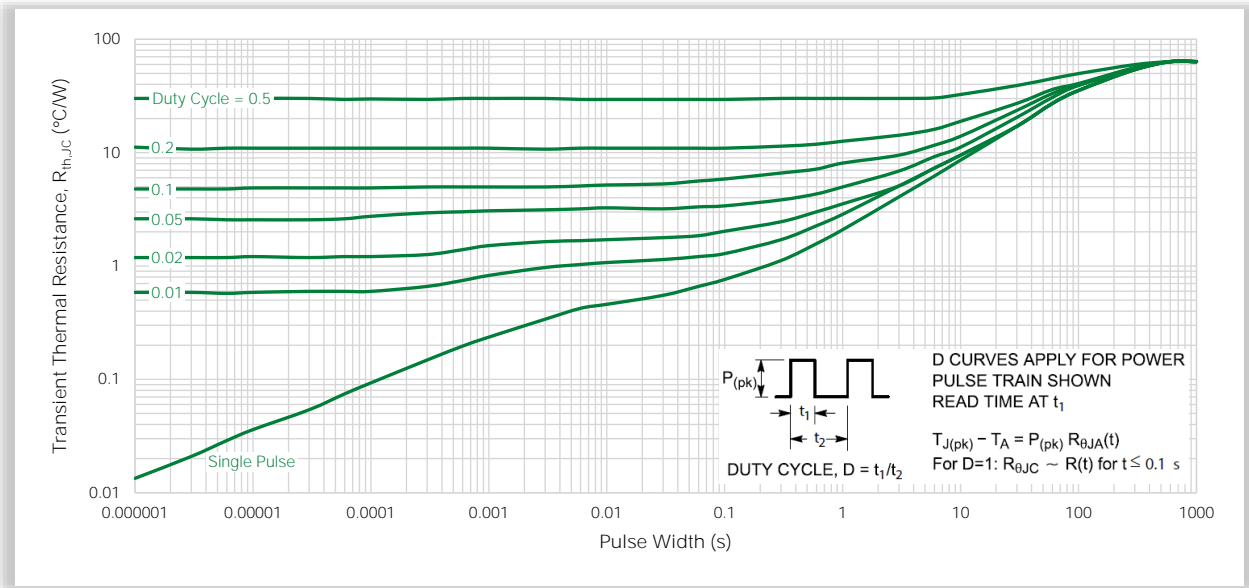


Figure 14. Best Case Transient Thermal Resistance

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

