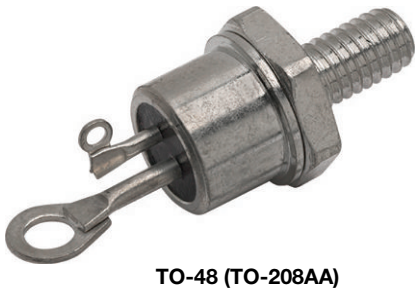
Phase Control Thyristor RMS SCRs, 25 A, 35 A



TO-48 (TO-208AA)

FEATURES

- General purpose stud mounted
- Broad forward and reverse voltage range - through 1200 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	16 A, 22 A
$I_{T(RMS)}$	25 A, 35 A
V_{DRM}/V_{RRM}	25 V, 50 V, 100 V, 150 V, 200 V, 250 V, 300 V, 400 V, 500 V, 600 V, 700 V, 800 V, 1000 V 1200 V
V_{TM}	2.3 V
I_{GT}	60 mA
T_J	-40 °C to +125 °C
Package	TO-48 (TO-208AA)
Circuit configuration	Single SCR

MAJOR RATINGS AND CHARACTERISTICS				
PARAMETER	TEST CONDITIONS	VALUES 2N681-92	VALUES 2N5205-07	UNITS
$I_{T(AV)}$		16 (1)	22 (1)	A
	T_C	-65 to +65 (1)	-40 to +40	°C
$I_{T(RMS)}$		25	35	A
I_{TSM}	50 Hz	145	285	A
	60 Hz	150 (1)	300 (1)	
I^2t	50 Hz	103	410	A^2s
	60 Hz	94	375	
I_{GT}		40	40	mA
dV/dt		-	100 (1)	V/µs
dI/dt		75 to 100	100	A/µs
V_{DRM}	Range	25 to 800	600 to 1200	V
V_{RRM}	Range	25 to 800	600 to 1200	V
T_J		-65 to +125 (1)	-40 to +125 (1)	°C

Note

(1) JEDEC® registered value

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS (APPLIED GATE VOLTAGE ZERO OR NEGATIVE)			
TYPE NUMBER	V_{RRM}/V_{DRM}, MAXIMUM REPETITIVE PEAK REVERSE AND OFF-STATE VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE (t_p < 5 ms) V	T_J
VS-2N681	25	35	-65 °C to +125 °C
VS-2N682	50	75	
VS-2N683	100	150	
VS-2N684	150	200	
VS-2N685	200	300	
VS-2N686	250	350	
VS-2N687	300	400	
VS-2N688	400	500	
VS-2N689	500	600	
VS-2N690	600	720	
VS-2N691	700	840	
VS-2N692	800	960	
VS-2N5205	800	960	-40 °C to +125 °C
VS-2N5206	1000	1200	
VS-2N5207	1200	1440	

Note

- JEDEC registered values

ABSOLUTE MAXIMUM RATINGS						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES 2N681-92	VALUES 2N5205-07	UNITS
Maximum average on-state current at case temperature	$I_{T(AV)}$	180° half sine wave conduction		16 (1)	22 (1)	A
				-65 to +65 (1)	-40 to +40 (1)	°C
Maximum RMS on-state current	$I_{T(RMS)}$			25	35	A
Maximum peak, one-cycle non-repetitive surge current	I_{TSM}	50 Hz half cycle sine wave or 6 ms rectangular pulse	Following any rated load condition, and with rated V_{RRM} applied following surge	145	285	A
		60 Hz half cycle sine wave or 5 ms rectangular pulse		150 (1)	300 (1)	
		50 Hz half cycle sine wave or 6 ms rectangular pulse	Same conditions as above except with V_{RRM} applied following surge = 0	170	340	
		60 Hz half cycle sine wave or 5 ms rectangular pulse		180	355	
Maximum I^2t capability for fusing	I^2t	t = 10 ms	Rated V_{RRM} applied following surge, initial T_J = 125 °C	103	410	A^2s
		t = 8.3 ms		94	375	
Maximum I^2t capability for individual device fusing		t = 10 ms	V_{RRM} = 0 following surge, initial T_J = 125 °C	145	580	
		t = 8.3 ms		135	530	
Maximum $I^2\sqrt{t}$ capability for individual device fusing	$I^2\sqrt{t}$ (2)	t = 0.1 ms to 10 ms, initial T_J < 125 °C V_{RRM} applied following surge = 0		1450	5800	$A^2\sqrt{s}$
Maximum peak on-state voltage	V_{TM}	T_J = 25 °C, $I_{T(AV)}$ = 16 A (50 A peak) 2N681, $I_{T(AV)}$ = 22 A (70 A peak) 2N5204		2 (1)	2.3 (1)	V
Maximum holding current	I_H	Anode supply 24 V, initial I_T = 1.0 A		20 at 25 °C (typical)	200 (1) at -40 °C	mA

Notes

(1) JEDEC registered value

(2) I^2t for time $t_x = I^2\sqrt{t} \cdot \sqrt{t_x}$

SWITCHING

PARAMETER		SYMBOL	TEST CONDITIONS	VALUES 2N681-92	VALUES 2N5205-07	UNITS
Maximum non-repetitive rate of rise of turned-on current	V_{DM} = 25 V to 600 V	dI/dt	T_C = 125 °C, V_{DM} = Rated V_{DRM}, I_{TM} = 2 x dI/dt, gate pulse = 20 V, 15 Ω, t_p = 6 µs, t_r = 0.1 µs maximum Per JEDEC standard RS-397, 5.2.2.6	100	-	A/µs
	V_{DM} = 700 V to 800 V			75	-	
			T_C = 125 °C, V_{DM} = 600 V, I_{TM} = 200 A at 400 Hz maximum, gate pulse = 20 V, 15 Ω, t_p = 6 µs, t_r = 0.1 µs maximum Per JEDEC standard RS-397, 5.2.2.6	-	100	
Typical delay time		t_d	T_C = 25 °C, V_{DM} = Rated V_{DRM}, I_{TM} = 10 A DC resistive circuit, gate pulse = 10 V, 40 Ω source, t_p = 6 µs, t_r = 0.1 µs	1	1	µs

BLOCKING

PARAMETER		SYMBOL	TEST CONDITIONS		VALUES 2N681-92	VALUES 2N5205-07	UNITS
Minimum critical rate of rise of off-state voltage		dV/dt	T_J = 125 °C, exponential to 100 % rated V_{DRM}	Gate open circuited	100 (typical)	100 (1)	V/µs
			T_J = 125 °C, exponential to 67 % rated V_{DRM}		250 (typical)	250	
Maximum reverse leakage current	V_{RRM}, V_{DRM} = 400 V	I_{DRM}, I_{RRM}	T_J = 125 °C		3.5	-	mA
	V_{RRM}, V_{DRM} = 500 V				3.5	-	
	V_{RRM}, V_{DRM} = 600 V				2.5	3.3	
	V_{RRM}, V_{DRM} = 700 V				2.2	-	
	V_{RRM}, V_{DRM} = 800 V				2	2.5	
	V_{RRM}, V_{DRM} = 1000 V				-	2	
	V_{RRM}, V_{DRM} = 1200 V				-	1.7	

Note
(1) JEDEC registered value

TRIGGERING

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES 2N681-92	VALUES 2N5205-07	UNITS
Maximum peak gate power	P_{GM}	t_p < 5 ms for 2N681 series; t_p < 500 µs for 2N5204 series		5 (1)	60 (1)	W
Maximum average gate power	$P_{G(AV)}$			0.5 (1)	0.5 (1)	
Maximum peak positive gate current	$+I_{GM}$			2 (1)	2	A
Maximum peak positive gate voltage	$+V_{GM}$			10 (1)	-	V
Maximum peak negative gate voltage	$-V_{GM}$			5 (1)	5 (1)	
Maximum required DC gate current to trigger	I_{GT}	T_C = min. rated value	Maximum required gate trigger current is the lowest value which will trigger all units with + 6 V anode to cathode	80 (1)	80 (1)	mA
		T_C = 25 °C		40	40	
		T_C = 125 °C		18.5	20	
Typical DC gate current to trigger		T_C = 25 °C, + 6 V anode to cathode		30	30	
Maximum required DC gate voltage to trigger	V_{GT}	T_C = -65 °C	Maximum required gate trigger voltage is the lowest value which will trigger all units with + 6 V anode to cathode	3 (1)	3 (1)	V
		T_C = 25 °C		2	2	
Typical DC gate voltage to trigger		T_C = 25 °C, + 6 V anode to cathode		1.5	1.5	
Maximum DC gate voltage not to trigger	V_{GD}	T_C = 125 °C	Maximum gate voltage not to trigger is the maximum value which will not trigger any unit with rated V_{DRM} anode to cathode	0.25 (1)	0.25 (1)	V

Note
(1) JEDEC registered value

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES 2N681-92**	**VALUES 2N5205-07**	**UNITS**
Operating junction and storage temperature range	T_J, T_{Stg}		-65 to 125 (1)	-40 to 125 (1)	°C
Maximum internal thermal resistance, junction to case	R_{thJC}	DC operation	1.5	1.5 (1)	°C/W
Typical thermal resistance, case to sink	R_{thCS}	Mounting surface, smooth, flat and greased	0.35	0.35	
Mounting torque ± 10 % — to nut		Lubricated threads (Non-lubricated threads)	20 (27.5)		lbf · in
			0.23 (0.32)		kgf · cm
			2.3 (3.1)		N · m
Mounting torque ± 10 % — to device		Lubricated threads	25		lbf · in
			0.29		kgf · cm
			2.8		N · m
Approximate weight			14	14	g
			0.49	0.5	oz.
Case style			TO-48 (TO-208AA)		

Note

(1) JEDEC registered value

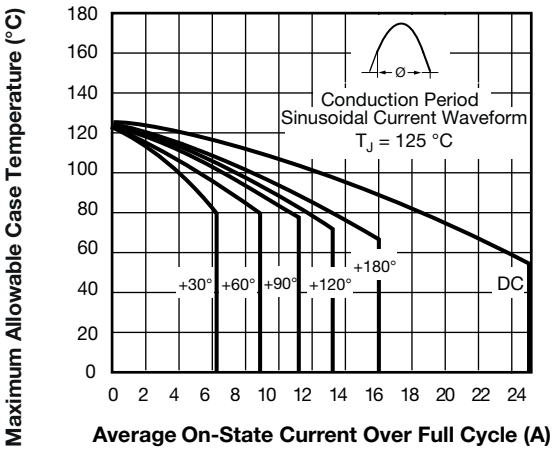


Fig. 1 - Maximum Allowable Case Temperature vs. Average On-State Current, 2N681 Series

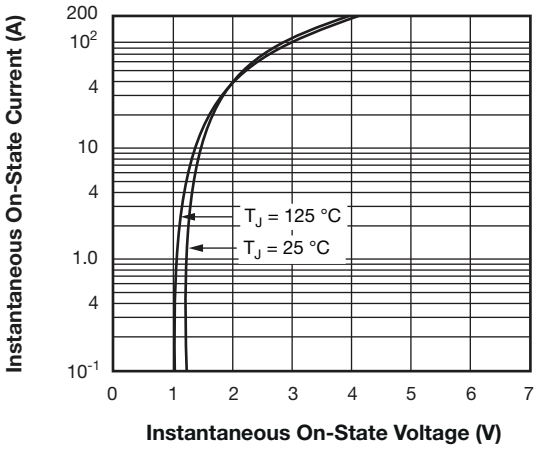


Fig. 2 - Maximum On-State Voltage vs. Current, 2N681 Series

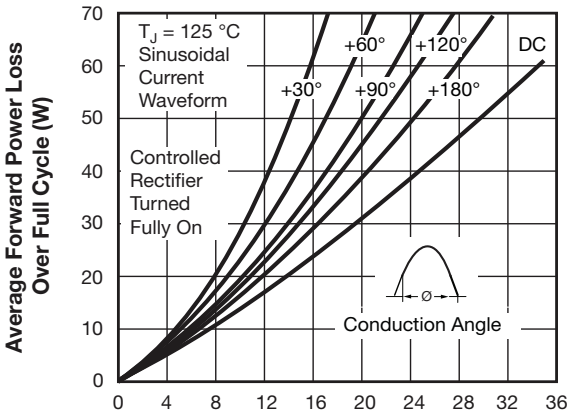


Fig. 3 - Maximum Low Level On-State Power Loss vs. Current (Sinusoidal Current Waveform), 2N681 Series

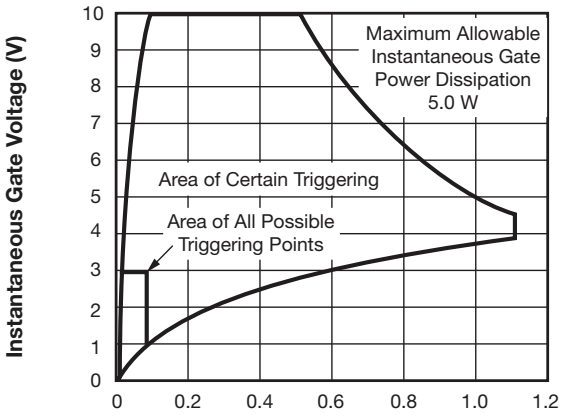


Fig. 5 - Gate Characteristics, 2N681 Series

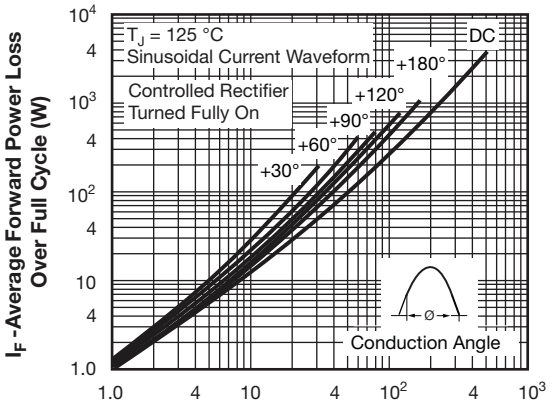


Fig. 4 - Maximum High Level On-State Power Loss vs. Current (Sinusoidal Current Waveform), 2N681 Series

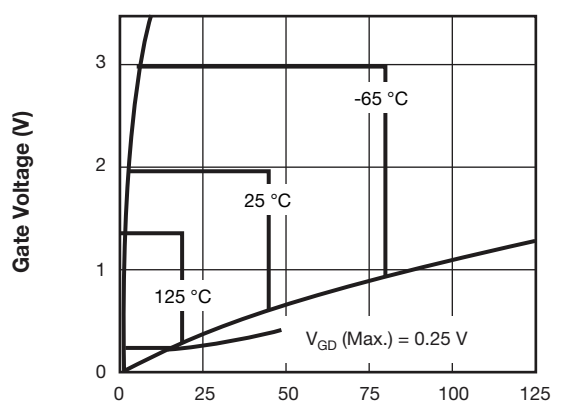


Fig. 5a - Area of All Possible Triggering Points vs. Temperature, 2N681 Series

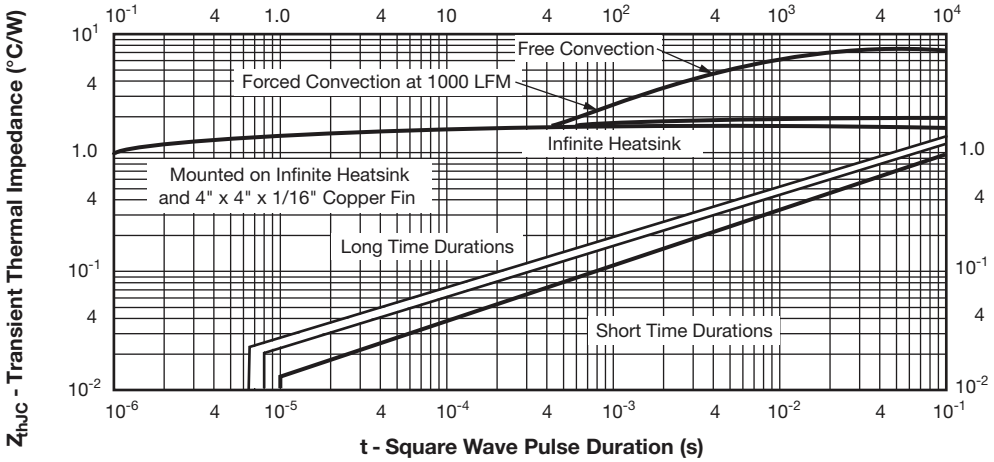


Fig. 6 - Maximum Transient Thermal Impedance, Junction to Case, vs. Pulse Duration, 2N681 Series

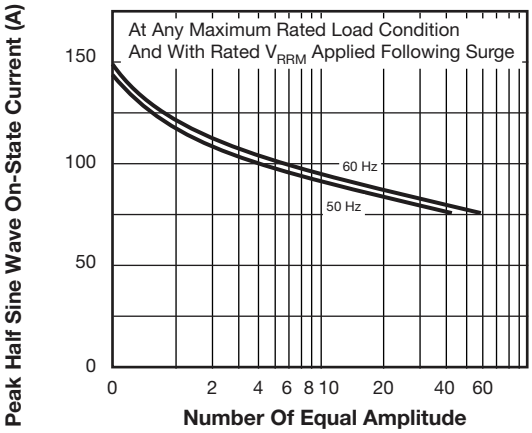


Fig. 7 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 2N681 Series

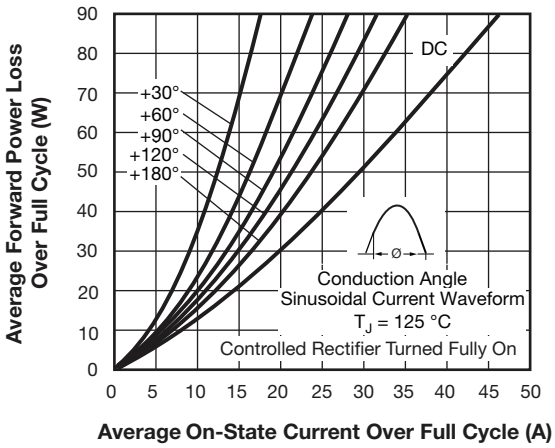


Fig. 10 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

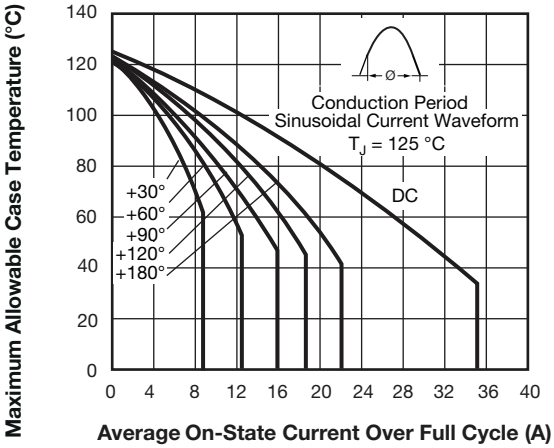


Fig. 8 - Maximum Allowable Case Temperature vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

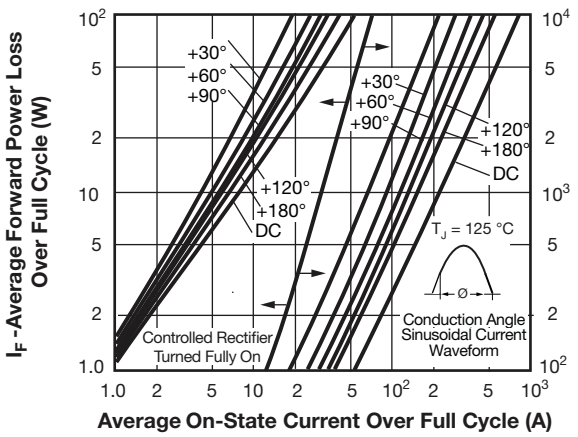


Fig. 11 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

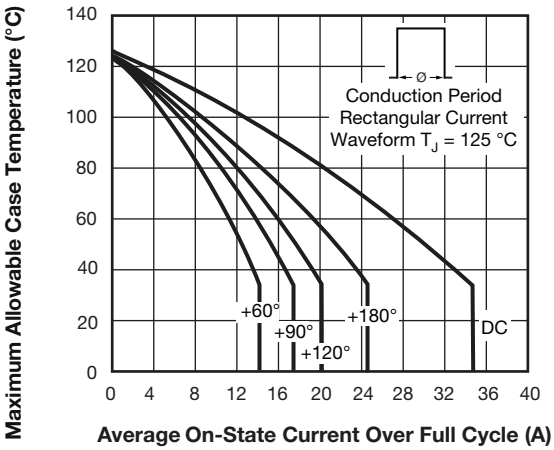


Fig. 9 - Maximum Allowable Case Temperature vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

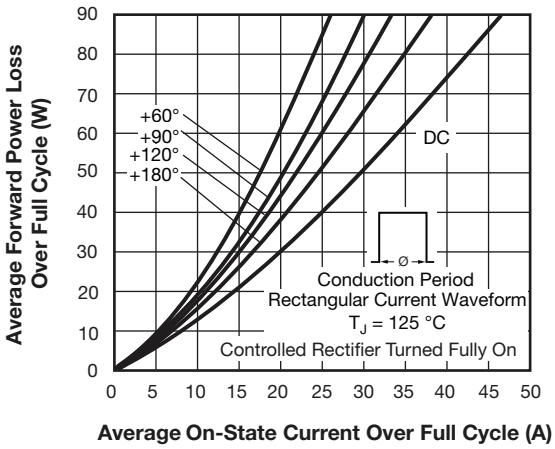


Fig. 12 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

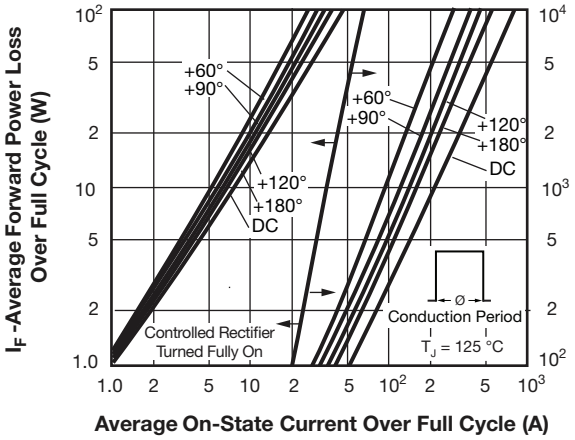


Fig. 13 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

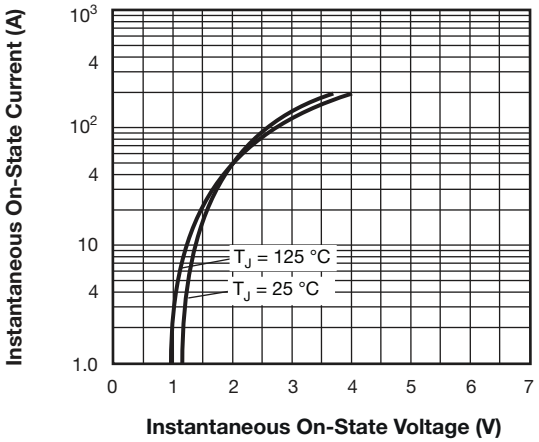


Fig. 14 - Maximum Instantaneous On-State Voltage vs. Instantaneous On-State Current, 2N5205 Series

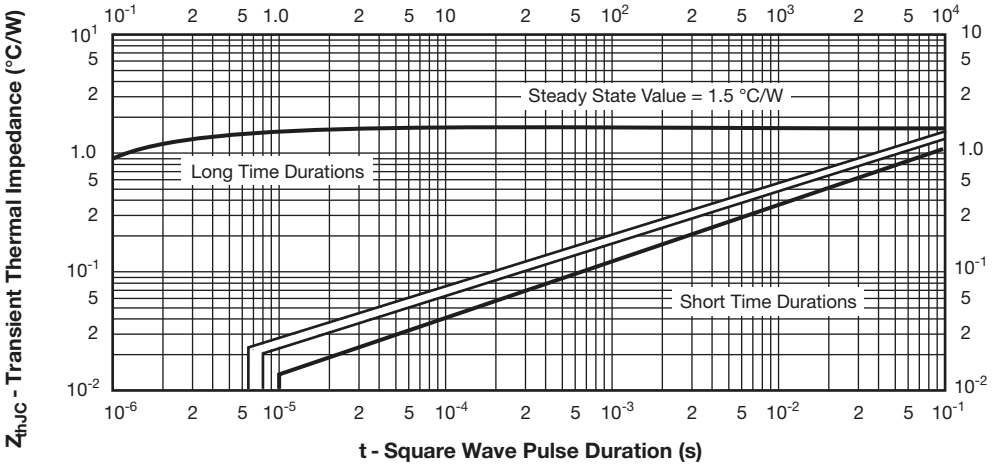


Fig. 15 - Maximum Transient Thermal Resistance, Junction to Case vs. Pulse Duration, 2N5205 Series

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95333

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