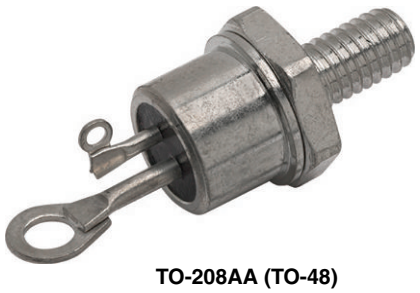
Phase Control Thyristor RMS SCRs, 25 A, 35 A



TO-208AA (TO-48)

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

PRODUCT SUMMARY	
$I_{T(AV)}$	16 A, 22 A
$I_{T(RMS)}$	25 A, 35 A
V_{DRM}/V_{RRM}	25 V to 1200 V
V_{TM}	2.3 V
I_{GT}	60 mA
T_J	-40 °C to 125 °C
Package	TO-208AA (TO-48)
Diode variation	Single SCR

MAJOR RATINGS AND CHARACTERISTICS				
PARAMETER	TEST CONDITIONS	2N681-92	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-2N685	200	300	
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

ON-STATE CONDUCTION						
PARAMETER	SYMBOL	TEST CONDITIONS		2N681-92	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		2N681-92	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		2N681-92	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		2N681-92	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**	**2N681-92**	**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
	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-208AA (TO-48)		

Note

(1) JEDEC registered value

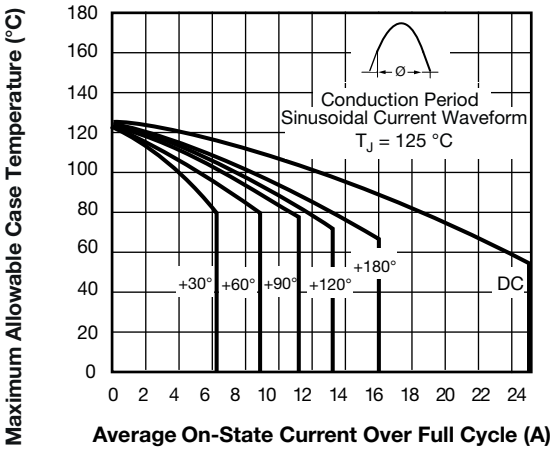


Fig. 1 - Maximum Allowable Case Temperature vs. Average On-State Current, 2N681 Series

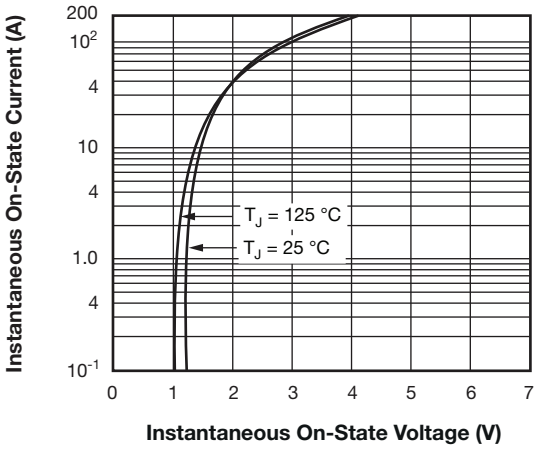


Fig. 2 - Maximum On-State Voltage vs. Current, 2N681 Series

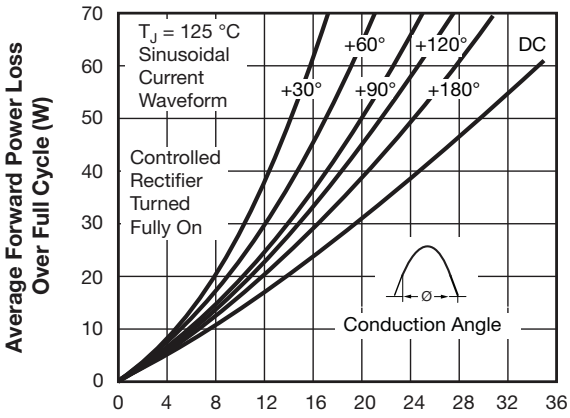


Fig. 3 - Maximum Low Level On-State Power Loss vs. Current (Sinusoidal Current Waveform), 2N681 Series

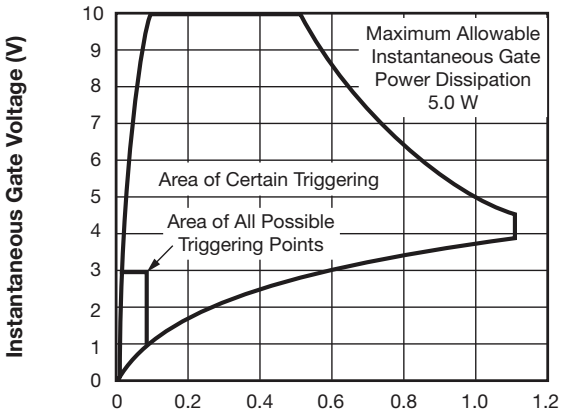


Fig. 5 - Gate Characteristics, 2N681 Series

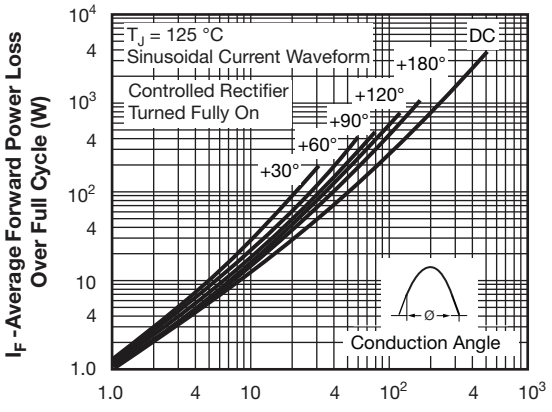


Fig. 4 - Maximum High Level On-State Power Loss vs. Current (Sinusoidal Current Waveform), 2N681 Series

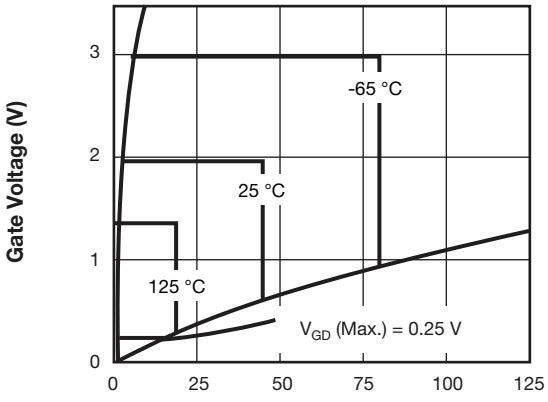


Fig. 5a - Area of All Possible Triggering Points vs. Temperature, 2N681 Series

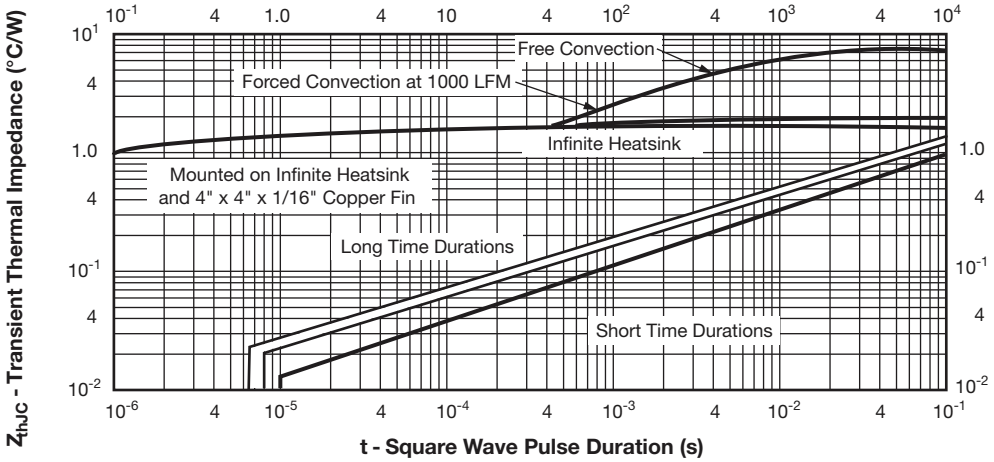


Fig. 6 - Maximum Transient Thermal Impedance, Junction to Case, vs. Pulse Duration, 2N681 Series

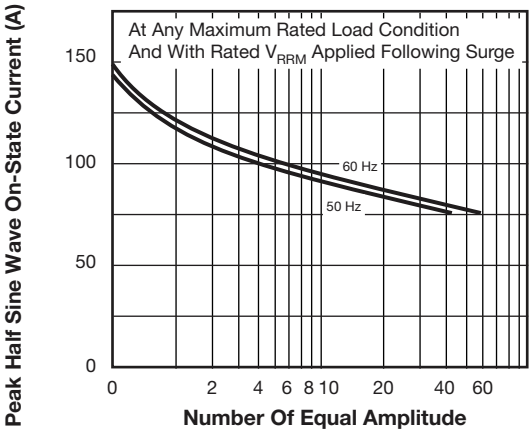


Fig. 7 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 2N681 Series

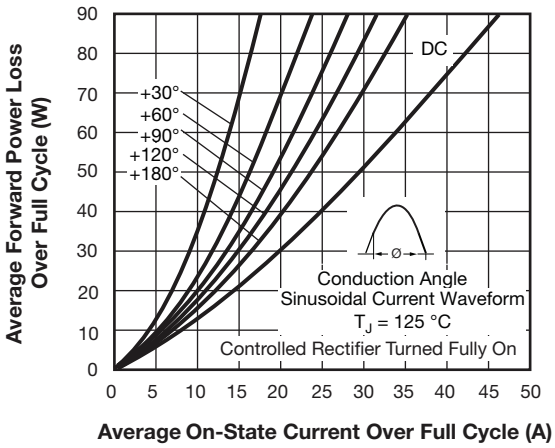


Fig. 10 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

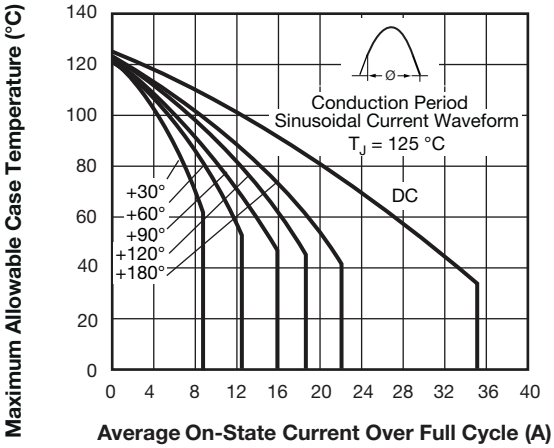


Fig. 8 - Maximum Allowable Case Temperature vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

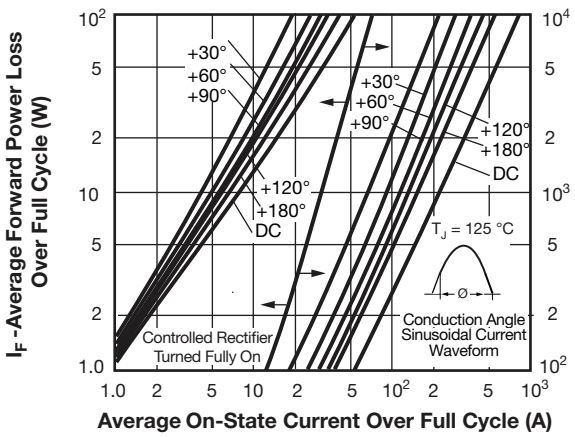


Fig. 11 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

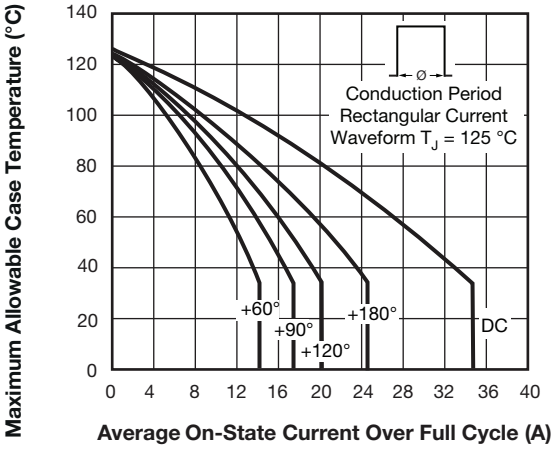


Fig. 9 - Maximum Allowable Case Temperature vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

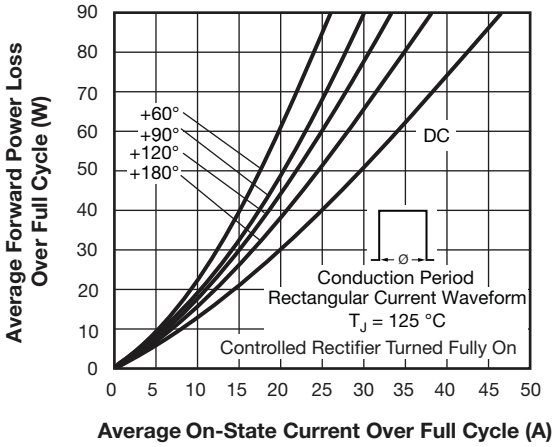


Fig. 12 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

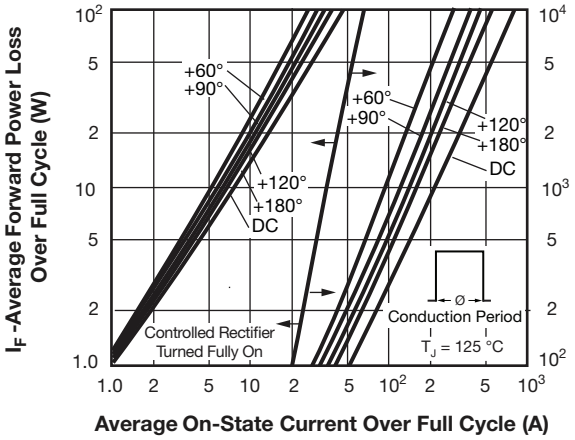


Fig. 13 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

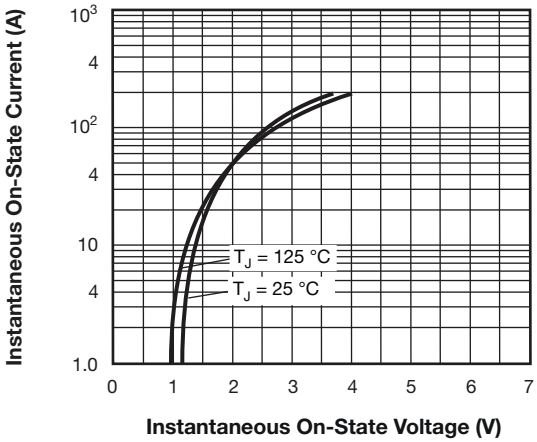


Fig. 14 - Maximum Instantaneous On-State Voltage vs. Instantaneous On-State Current, 2N5205 Series

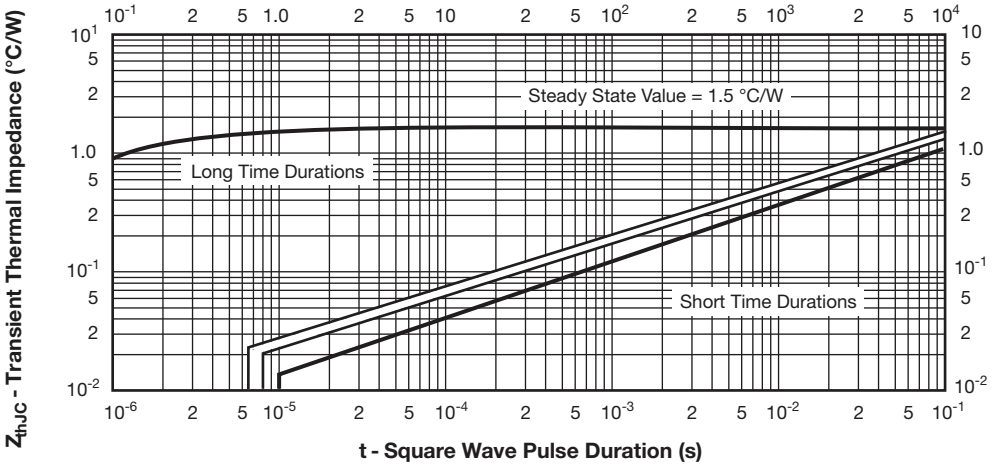


Fig. 15 - Maximum Transient Thermal Resistance, Junction to Case vs. Pulse Duration, 2N5205 Series

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

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.