

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 ² s
	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 ² t capability for fusing	I ² t	t = 10 ms	Rated V _{RRM} applied following surge, initial T _J = 125 °C	103	410	A ² s
		t = 8.3 ms		94	375	
Maximum I ² t 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 √t capability for individual device fusing	I ² √t ⁽²⁾	t = 0.1 ms to 10 ms, initial T _J < 125 °C V _{RRM} applied following surge = 0		1450	5800	A ² √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	dl/dt	$T_C = 125\text{ }^{\circ}\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 2 \times dl/dt$, gate pulse = 20 V, 15 Ω , $t_p = 6\text{ }\mu\text{s}$, $t_r = 0.1\text{ }\mu\text{s}$ maximum Per JEDEC standard RS-397, 5.2.2.6	100	-	A/ μs
		$V_{DM} = 700\text{ V to } 800\text{ V}$	75	-	
		$T_C = 125\text{ }^{\circ}\text{C}$, $V_{DM} = 600\text{ V}$, $I_{TM} = 200\text{ A}$ at 400 Hz maximum, gate pulse = 20 V, 15 Ω , $t_p = 6\text{ }\mu\text{s}$, $t_r = 0.1\text{ }\mu\text{s}$ maximum Per JEDEC standard RS-397, 5.2.2.6	-	100	
Typical delay time	t_d	$T_C = 25\text{ }^{\circ}\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 10\text{ A}$ DC resistive circuit, gate pulse = 10 V, 40 Ω source, $t_p = 6\text{ }\mu\text{s}$, $t_r = 0.1\text{ }\mu\text{s}$	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 V _{RRM} , V _{DRM} = 500 V V _{RRM} , V _{DRM} = 600 V V _{RRM} , V _{DRM} = 700 V V _{RRM} , V _{DRM} = 800 V V _{RRM} , V _{DRM} = 1000 V V _{RRM} , V _{DRM} = 1200 V	I _{DRM} , I _{RRM}	T _J = 125 °C	3.5	-	mA
				3.5	-	
				2.5	3.3	
				2.2	-	
				2	2.5	
				-	2	
				-	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}	$t_p < 5\text{ ms}$ for 2N681 series; $t_p < 500\text{ }\mu\text{s}$ 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}	$T_C = \text{min. rated value}$ 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
		$T_C = 25\text{ }^{\circ}\text{C}$	40	40	
		$T_C = 125\text{ }^{\circ}\text{C}$	18.5	20	
Typical DC gate current to trigger		$T_C = 25\text{ }^{\circ}\text{C}$, + 6 V anode to cathode	30	30	
Maximum required DC gate voltage to trigger	V_{GT}	$T_C = -65\text{ }^{\circ}\text{C}$ 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
		$T_C = 25\text{ }^{\circ}\text{C}$	2	2	
Typical DC gate voltage to trigger		$T_C = 25\text{ }^{\circ}\text{C}$, + 6 V anode to cathode	1.5	1.5	
Maximum DC gate voltage not to trigger	V_{GD}	$T_C = 125\text{ }^{\circ}\text{C}$ 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
	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

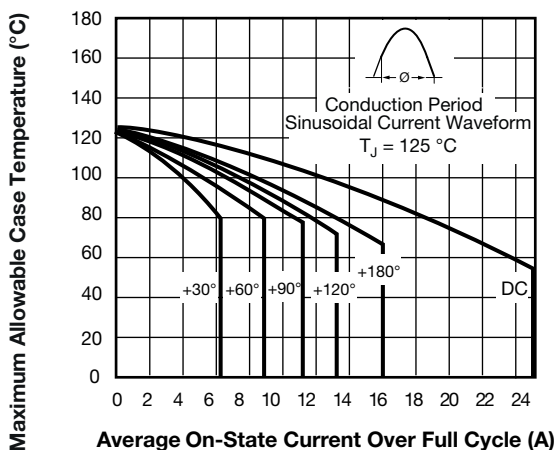


Fig. 1 - Maximum Allowable Case Temperature vs. Average On-State Current, 2N681 Series

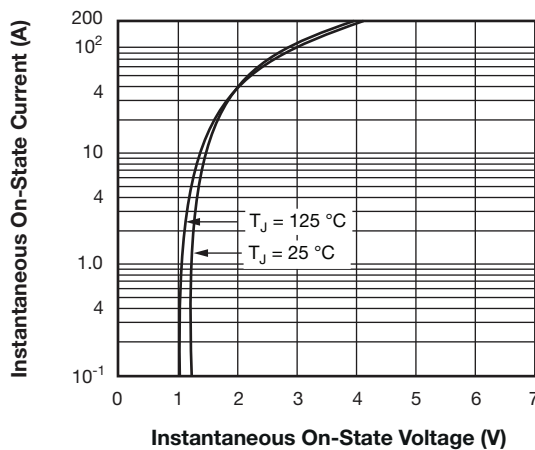
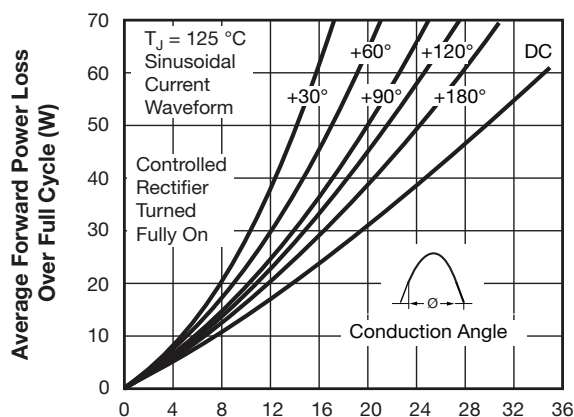
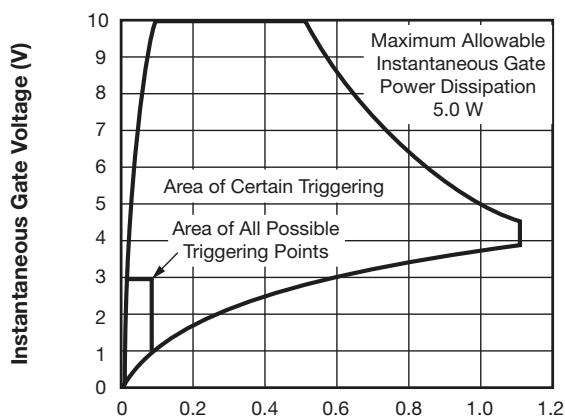


Fig. 2 - Maximum On-State Voltage vs. Current, 2N681 Series



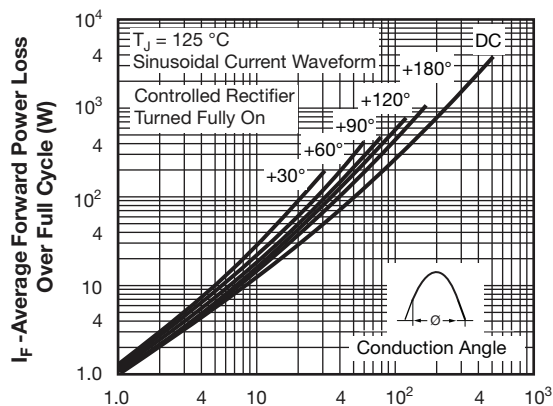
Average On-State Current Over Full Cycle (A)

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



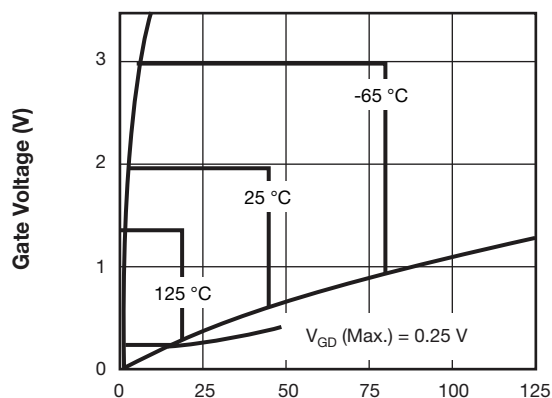
Instantaneous Gate Current (A)

Fig. 5 - Gate Characteristics, 2N681 Series



Average On-State Current Over Full Cycle (A)

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



Gate Current (mA)

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

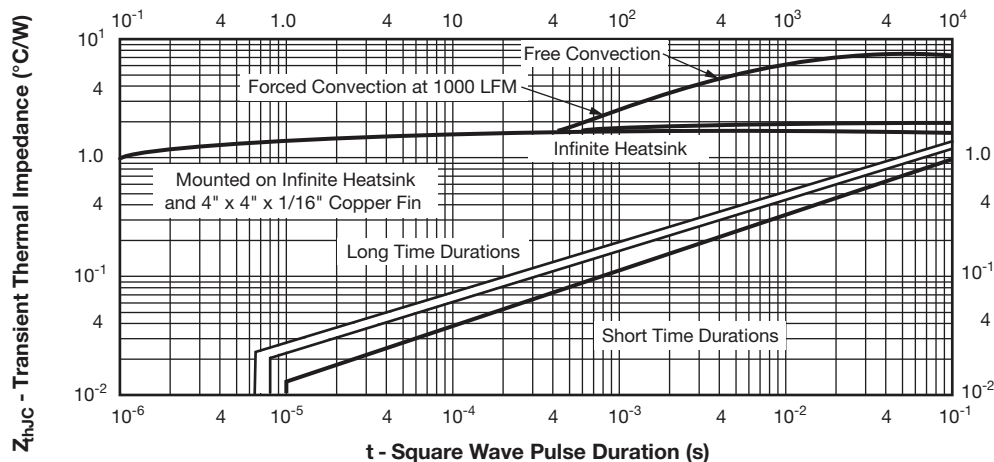


Fig. 6 - Maximum Transient Thermal Impedance, Junction to Case, vs. Pulse Duration, 2N681 Series

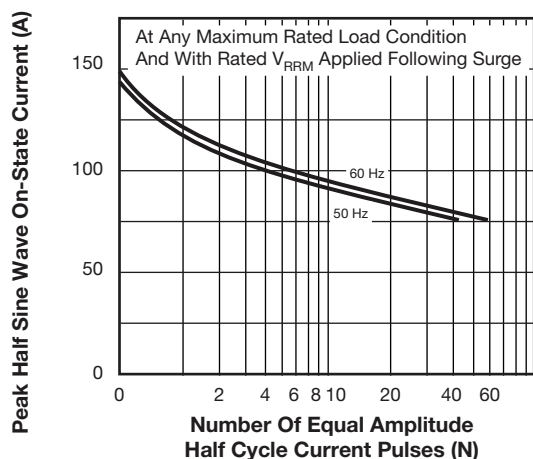


Fig. 7 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 2N681 Series

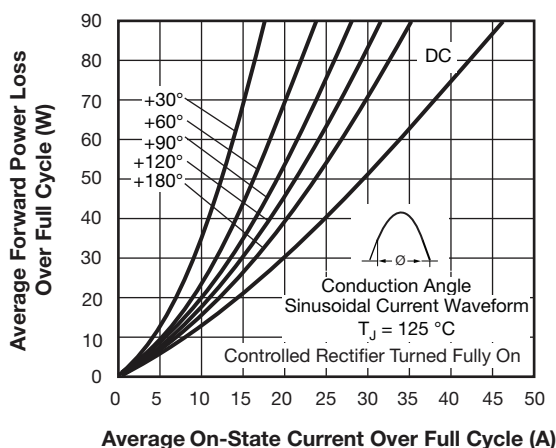


Fig. 10 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

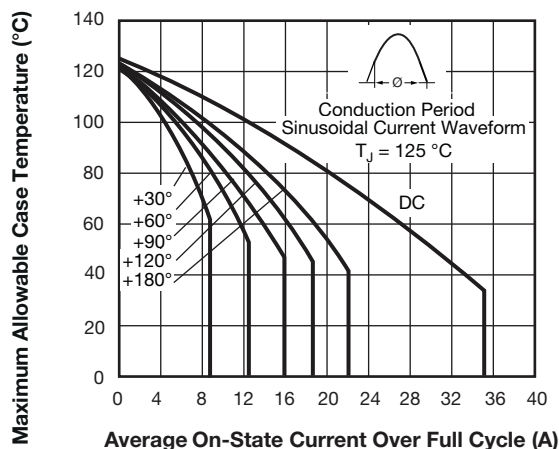


Fig. 8 - Maximum Allowable Case Temperature vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

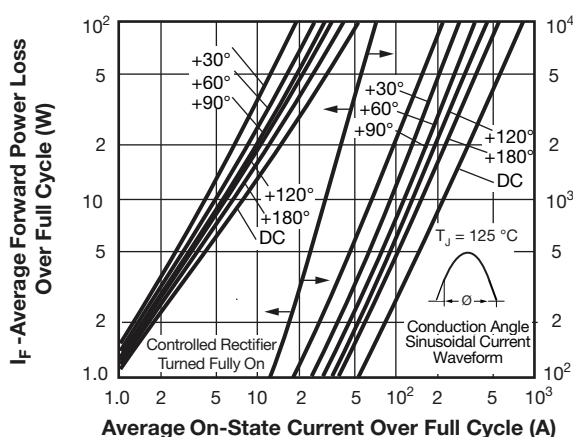


Fig. 11 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

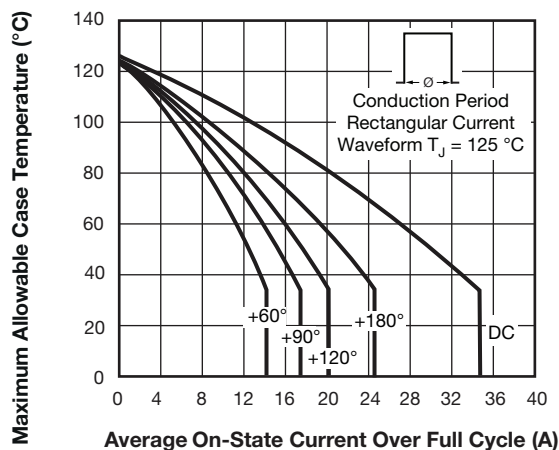


Fig. 9 - Maximum Allowable Case Temperature vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

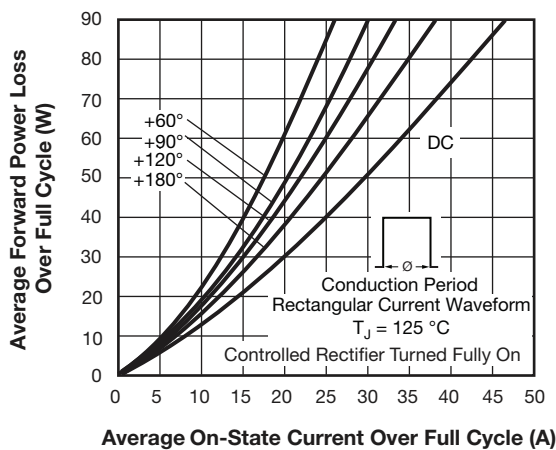


Fig. 12 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

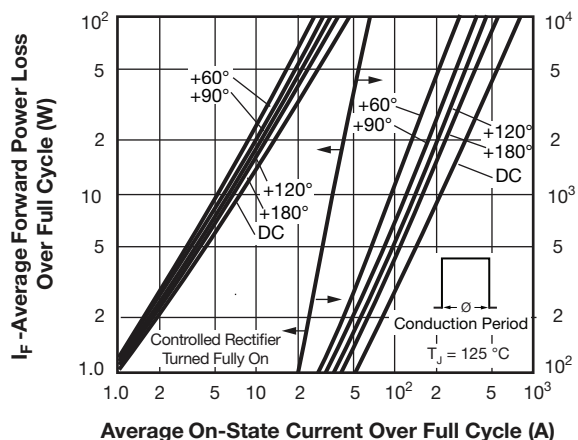


Fig. 13 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

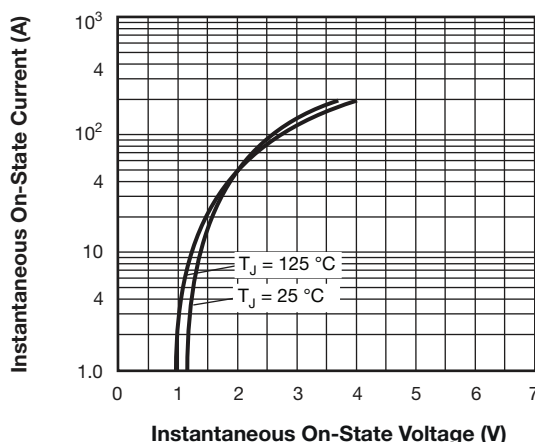


Fig. 14 - Maximum Instantaneous On-State Voltage vs. Instantaneous On-State Current, 2N5205 Series

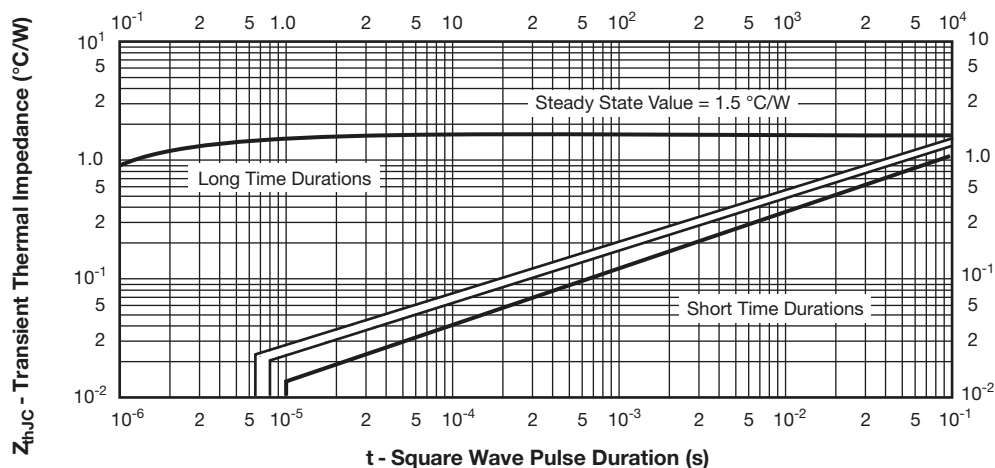


Fig. 15 - Maximum Transient Thermal Resistance, Junction to Case vs. Pulse Duration, 2N5205 Series

LINKS TO RELATED DOCUMENTS

Dimensions

www.vishay.com/doc?95333



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