

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

TYPICAL APPLICATIONS

- Can be supplied to meet stringent military, aerospace and other high reliability requirements

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 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-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	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	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	103	410	A^2s
		$t = 8.3$ ms	94	375	
Maximum I^2t capability for individual device fusing	I^2t	$t = 10$ ms	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	dI/dt	$T_C = 125\text{ }^{\circ}\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 2 \times dI/dt$, 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	2N681-92	2N5205-07	UNITS
Minimum critical rate of rise of off-state voltage	dV/dt	$T_J = 125\text{ }^{\circ}\text{C}$, exponential to 100 % rated V_{DRM}	100 (typical)	100 ⁽¹⁾	V/ μs
		$T_J = 125\text{ }^{\circ}\text{C}$, exponential to 67 % rated V_{DRM}	250 (typical)	250	
Maximum reverse leakage current	I_{DRM} , I_{RRM}	$T_J = 125\text{ }^{\circ}\text{C}$	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	2N681-92	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	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)		

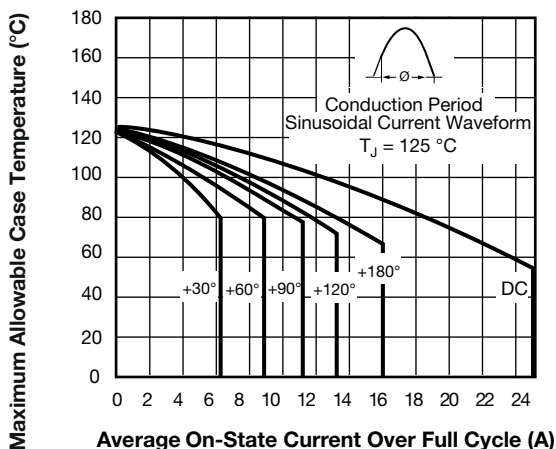
Note
⁽¹⁾ JEDEC registered value


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

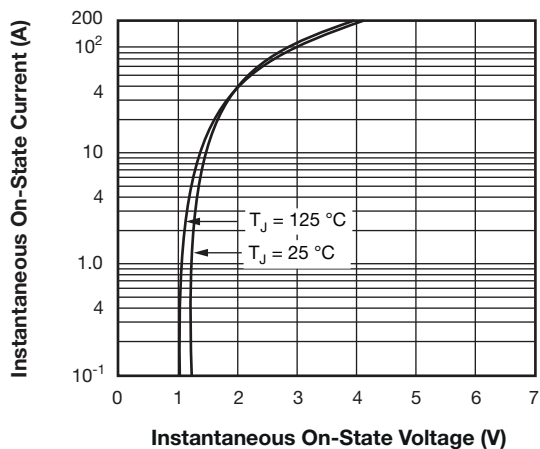
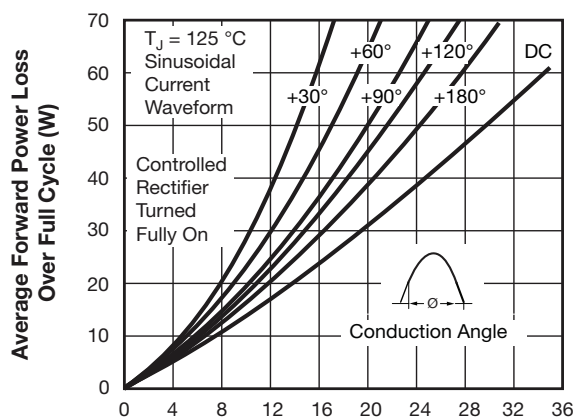
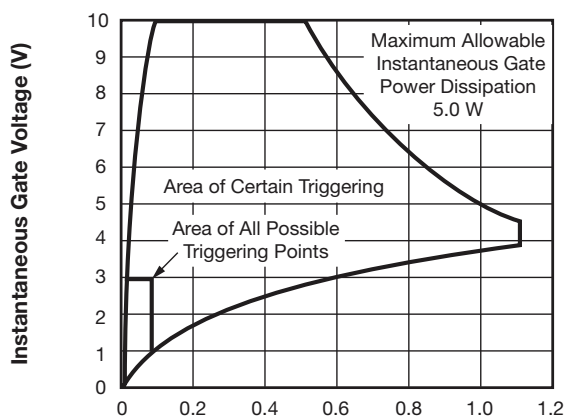


Fig. 2 - Maximum On-State Voltage vs. Current, 2N681 Series



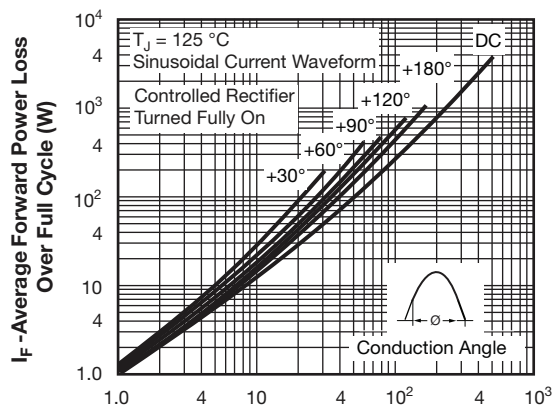
Average On-State Current Over Full Cycle (A)

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



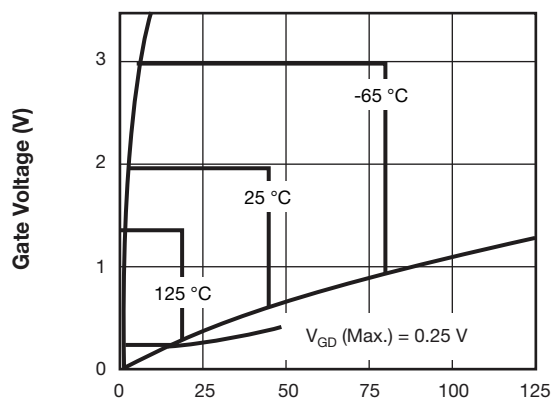
Instantaneous Gate Current (A)

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

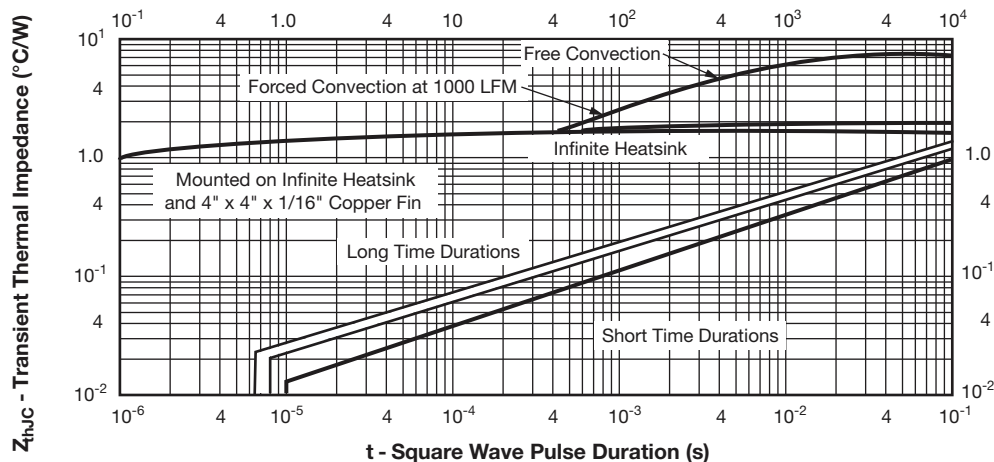


Fig. 6 - Maximum Transient Thermal Impedance, Junction to Case, vs. Pulse Duration, 2N681 Series

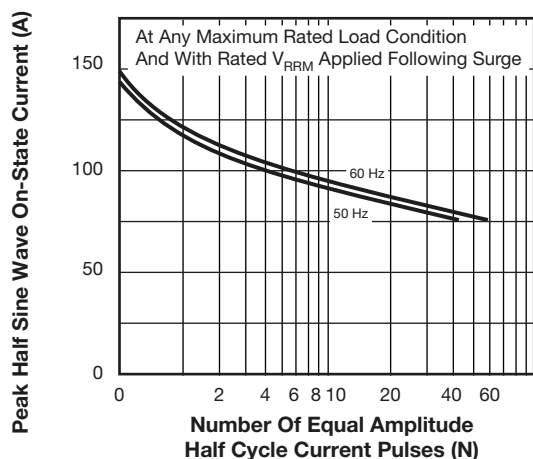


Fig. 7 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 2N681 Series

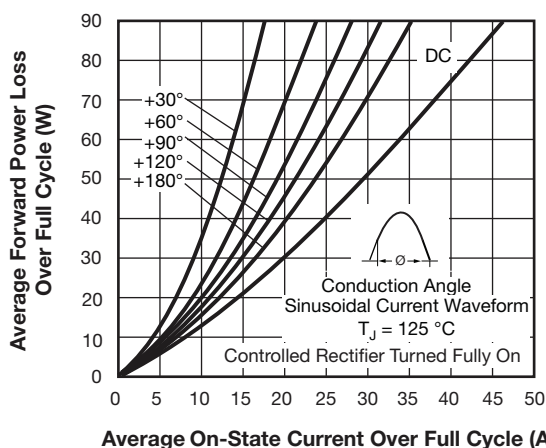


Fig. 10 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

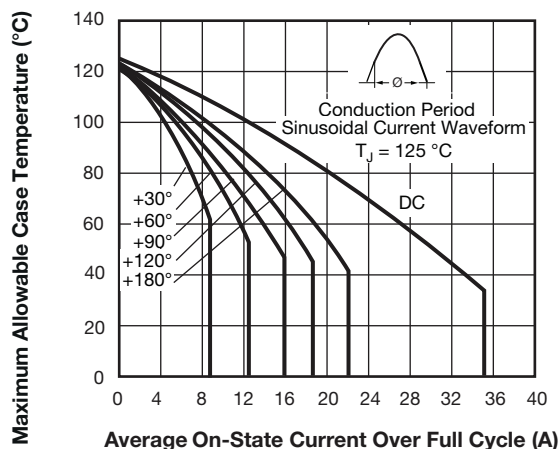


Fig. 8 - Maximum Allowable Case Temperature vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

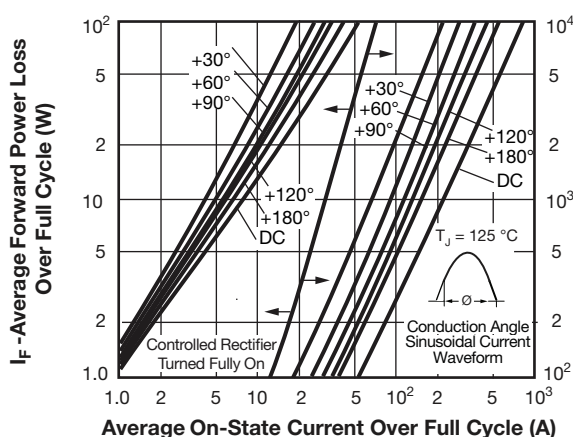


Fig. 11 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

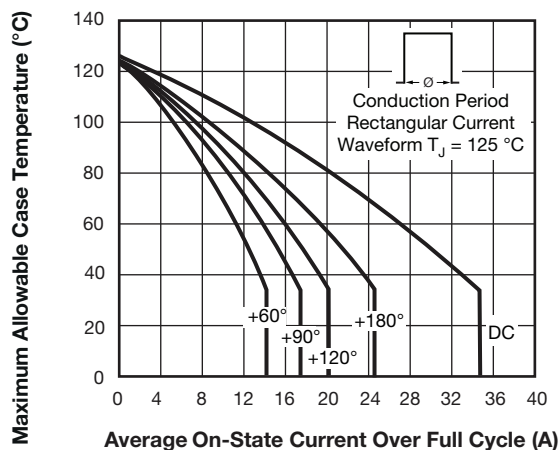


Fig. 9 - Maximum Allowable Case Temperature vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

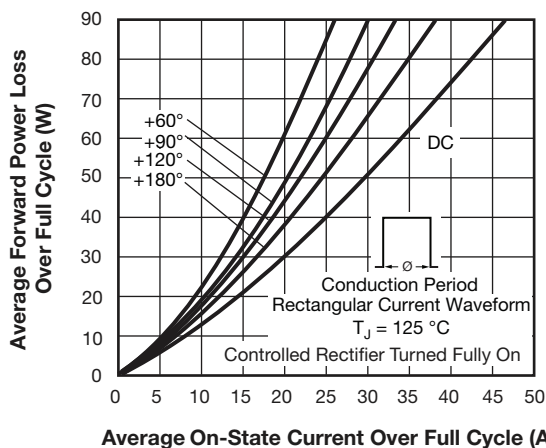


Fig. 12 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

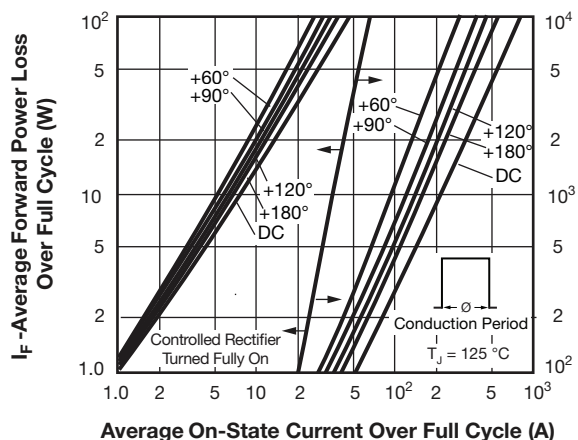


Fig. 13 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

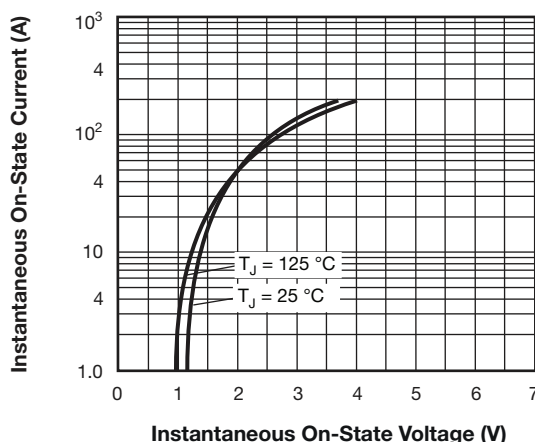


Fig. 14 - Maximum Instantaneous On-State Voltage vs. Instantaneous On-State Current, 2N5205 Series

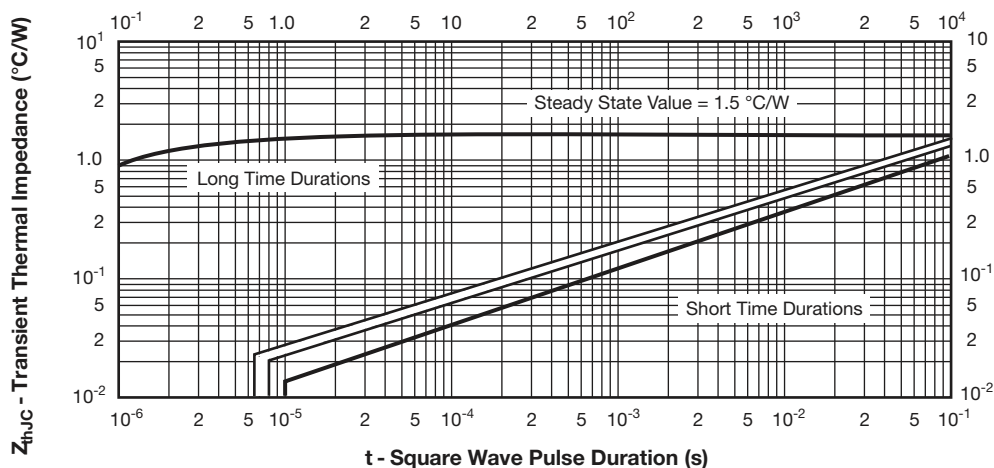


Fig. 15 - Maximum Transient Thermal Resistance, Junction to Case vs. Pulse Duration, 2N5205 Series

LINKS TO RELATED DOCUMENTS

Dimensions

www.vishay.com/doc?95333



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