

INTERNATIONAL RECTIFIER



2N681 & 2N5204 SERIES

25 and 35 Amp RMS SCRs

Major Ratings and Characteristics

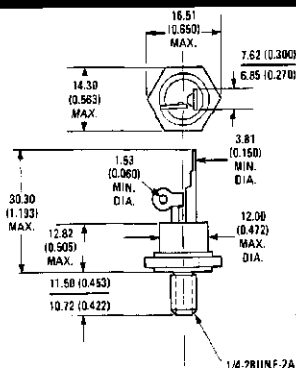
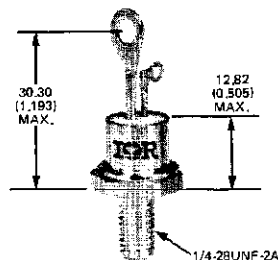
	2N681-92	2N5204-07	Units
I_T (RMS)	25	35	A
I_T (AV)	16*	22*	A
@ T_C	-65 to 85*	-40 to 40	°C
I_{TSM}			
@ 50 Hz	145	285	A
@ 60 Hz	150*	300*	
I_{2t}			A ² s
@ 50 Hz	103	410	
@ 60 Hz	94	375	
I_{GT}	40	40	mA
dv/dt	—	100*	V/ μ s
di/dt	75–100	100	A/ μ s
T_J	-65 to 125*	-40 to 125*	°C
V_{RRM}, V_{DRM} range	25–800	800–1200	V

*JEDEC registered value.

Description/Features

- General purpose stud mounted
- Broad forward and reverse voltage range — through 1200 volts
- Can be supplied to meet stringent military, aerospace and other high-reliability requirements

CASE STYLE AND DIMENSIONS



Conforms to JEDEC Outline TO-208AA (TO-48)
Dimensions in Millimeters and (Inches)

VOLTAGE RATINGS (Applied gate voltage zero or negative)

Part Numbers	V_{RRM}, V_{DRM} — Max. Repetitive Peak Reverse and Off-State Voltage (V)	V_{RSM} Max. Non Repetitive Peak Reverse Voltage $t_p \leq 5$ ms (V)
	$T_J = -65^\circ\text{C}$ to 125°C	$T_J = -65^\circ\text{C}$ to 125°C
2N681	25*	35*
2N682	60*	75*
2N683	100*	150*
2N686	200*	300*
2N687	300*	400*
2N688	400*	500*
2N689	500*	600*
2N690	600*	720*
2N691	700*	840*
2N692	800*	960*
	$T_J = -40^\circ\text{C}$ to 125°C	$T_J = -40^\circ\text{C}$ to 125°C
2N5204	600	720
2N5205	800	960
2N5206	1000	1200
2N5207	1200	1440

ELECTRICAL SPECIFICATIONS

	2N681-82	2N5204-07	Units	Conditions
ON-STATE				
$I_T(\text{RMS})$ Max. RMS on-state current	25	35	A	
$I_T(\text{AV})$ Max. average on-state current	16*	22*	A	
θ_{TC}	-65 to 65*	-40 to 40*	$^\circ\text{C}$	100% half sine wave conduction
I_{TSM} Max. peak one cycle, non-repetitive surge current	145 150* 170 180	285 300* 340 355	A	50 Hz half cycle sine wave on 6 ms rectangular pulse 60 Hz half cycle sine wave or 5 ms rectangular pulse 50 Hz half cycle sine wave or 6 ms rectangular pulse 60 Hz half cycle sine wave or 5 ms rectangular pulse Following any rated load condition, and with rated V_{RRM} applied following surge. Same conditions as above except with V_{RRM} applied following surge = 0.
I_{T2t} Max. I_{T2t} capability, for fusing	103 94	410 375	A^2s	$t = 10$ ms Rated V_{RRM} applied following surge, initial $T_J = 125^\circ\text{C}$ $t = 8.3$ ms
I_{T2t} Max. I_{T2t} capability, for individual device fusing	145 135	580 530	A^2s	$t = 10$ ms $V_{RRM} = 0$ following surge, initial $T_J = 125^\circ\text{C}$ $t = 8.3$ ms
$I_{T2\sqrt{t}}$ Max. $I_{T2\sqrt{t}}$ capability, for individual device fusing (1)	1450	5800	$A^2\sqrt{s}$	$t = 0.1$ to 10 ms initial $T_J \leq 125^\circ\text{C}$ V_{RRM} following surge = 0.
V_{TM} Max. peak on-state voltage	2*	2.3*	V	$T_J = 25^\circ\text{C}$, $I_T(\text{AV}) = 16\text{A}$ (60A peak) 2N681, $I_T(\text{AV}) = 22\text{A}$ (70A peak) 2N5204
I_H Max. holding current	20 @ 25°C †	200* @ -40°C	mA	Anode supply = 24V, initial $I_T = 1.0\text{A}$.
BLOCKING				
dV/dt Min. critical rate-of-rise of off-state voltage	100†	100*	$V/\mu s$	$T_J = 125^\circ\text{C}$. Exponential to 100% rated V_{DRM} $T_J = 125^\circ\text{C}$. Exponential to 67% rated V_{DRM} Gate open circuited.
	260†	250		

*JEDEC Registered value.

(1) I_{T2t} for time $t_X = I_{T2\sqrt{t}}^2 \cdot \sqrt{t_X}$.

† Typical

ELECTRICAL SPECIFICATIONS (Continued)

		2N681-92	2N5204-07	Units	Conditions	
BLOCKING (Continued)						
$I_{R(-)}$ & $I_{D(-)}$ V_{RRM} & $V_{DRM} =$	Max. reverse and off-state current	$I_{R(AV)}$ & $I_{D(AV)}$ (Average Values)	I_{RM} & I_{DM} (Peak Values)	mA $T_J = 125^{\circ}\text{C}$, gate open circuited.		
	5V					
	25 to 150V	6.5*	—			
	200 & 250V	8.0*	—			
	300V	5.0*	—			
	400V	4.0*	—			
	500V	3.0*	—			
	600V	2.5*	3.3*			
	700V	2.25*	—			
	800V	2.0*	2.5*			
	1000V	—	2.0*			
1200V	—	1.7*				
SWITCHING						
t_d	Typical delay time	1	1	μs	$T_C = 25^{\circ}\text{C}$, $V_{DM} = \text{rated } V_{DRM}$, $I_{TM} = 10\text{A}$ dc resistive circuit. Gate pulse: 10V, 40 Ω source, $t_p = 6\text{ }\mu\text{s}$, $t_r = 0.1\text{ }\mu\text{s}$.	
di/dt	Max. non-regenerative rate of rise of turned-on current $V_{DM} =$	25 to 600V	100	—	$\text{A}/\mu\text{s}$	$T_C = 125^{\circ}\text{C}$, $V_{DM} = \text{rated } V_{DRM}$, $I_{TM} = 2 \times di/dt$. Gate pulse: 20V, 15 Ω , $t_p = 6\text{ }\mu\text{s}$, $t_r = 0.1\text{ }\mu\text{s}$ max. Per JEDEC standard RS-397, 5.2.2.6.
		700 to 800V	75	—		
		—	—	100		
TRIGGERING						
P_{GM}	Max. peak gate power	5*	60*	W	$t_p \leq 5\text{ ms}$ for 2N681 series; $t_p \leq 500\text{ }\mu\text{s}$ for 2N5204 series.	
$P_{G(AV)}$	Max. average gate power	0.5*	0.5*	W		
I_{GM}	Max. peak positive gate current	2*	2	A		
$+V_{GM}$	Max. peak positive gate voltage	10*	—	V		
$-V_{GM}$	Max. peak negative gate voltage	5*	5*	V		
I_{GT}	Max. required DC gate current to trigger	80*	80*	mA	$T_C = \text{min. rated value}$. Max. required gate trigger current is the lowest value which will trigger all units with +6V anode-to-cathode.	
		40	40		$T_C = 25^{\circ}\text{C}$	
		18.5	20		$T_C = 125^{\circ}\text{C}$	
	Typical DC gate current to trigger	30	30		$T_C = 25^{\circ}\text{C}$ +6V anode-to-cathode	
V_{GT}	Max. required DC gate voltage to trigger	3*	3*	V	$T_C = -65^{\circ}\text{C}$. Max. required gate trigger voltage is the lowest value which will trigger all units with +6V anode-to-cathode.	
		2	2		$T_C = 25^{\circ}\text{C}$	
	Typical DC gate voltage to trigger	1.5	1.5		$T_C = 25^{\circ}\text{C}$ +6V anode-to-cathode	
V_{GD}	Max. DC gate voltage not to trigger	0.25*	0.25*	V	$T_C = 125^{\circ}\text{C}$. Max. gate voltage not to trigger is the maximum value which will not trigger any unit with rated V_{DRM} anode-to-cathode.	

THERMAL-MECHANICAL SPECIFICATIONS

		2N681-92	2N5204-07	Units	Conditions
T_J	Operating junction temperature range	-65° to 125°	-40° to 125°	°C	
T_{stg}	Storage temperature range	-65° to 125°	-40° to 125°	°C	
R_{thJC}	Max. internal thermal resistance, junction to case	1.5	1.5*	deg. C/W	DC operation
R_{thCS}	Thermal resistance, case to sink	0.35	0.35	deg. C/W	Mounting surface smooth, flat and greased.
Mounting torque to nut $\pm 10\%$		20.(27.5)		lbf · in.	Lubricated threads (non-lubricated threads).
		0.23.(32)		kgf · m	
		2.3(3.1)		N·m	
	to device	25		lbf · in.	Lubricated threads.
		0.28		kgf · m	
		2.8		N·m	
wt	Approximate weight	14(0.49)	14 (0.5)	g (oz.)	
	Case Style	TO-208AA (TO-48)			

*JEDEC Registered value.

2N681 Series

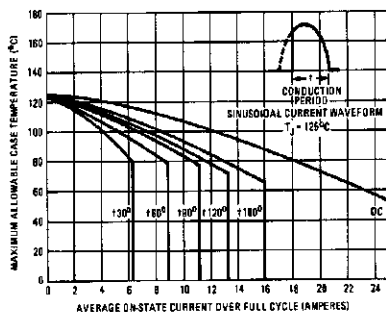


Fig. 1 — Maximum Allowable Case Temperature Vs. Average On-State Current, 2N681 Series

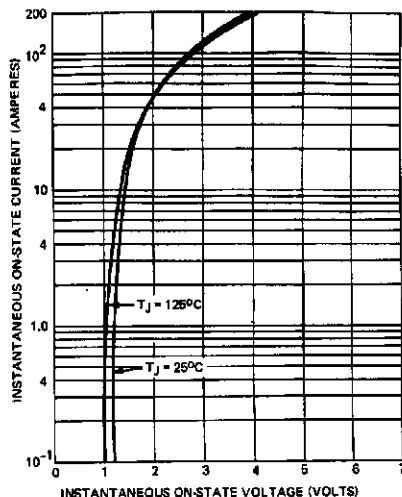


Fig. 2 — Maximum On-State Voltage Vs. Current, 2N681 Series

2N681 Series

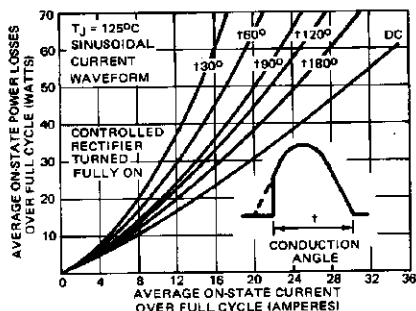


Fig. 3 — Maximum Low Level On-State Power Loss Vs. Current (Sinusoidal Current Waveform), 2N681 Series

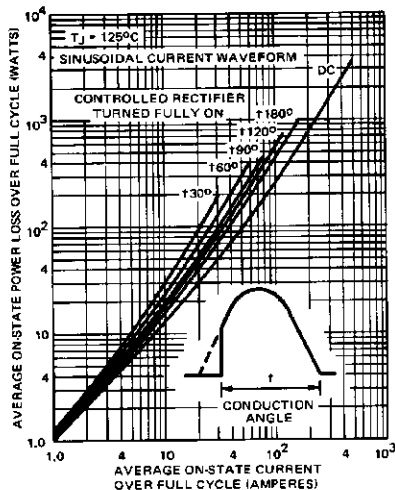


Fig. 4 — Maximum High Level On-State Power Loss Vs. Current (Sinusoidal Current Waveform), 2N681 Series

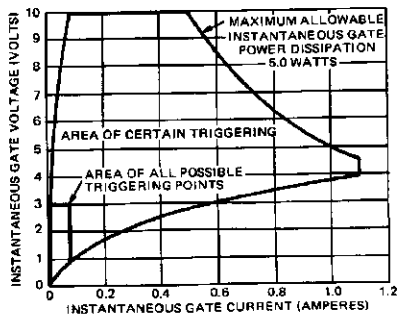


Fig. 5 — Gate Characteristics, 2N681 Series

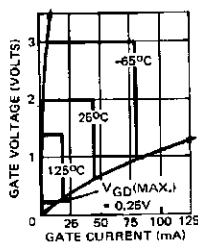


Fig. 5A — Area of All Possible Triggering Points Vs. Temperature, 2N681 Series

2N681 Series

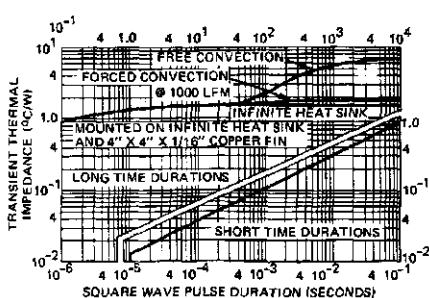


Fig. 6 — Maximum Transient Thermal Impedance, Junction to Case, Vs. Pulse Duration, 2N681 Series

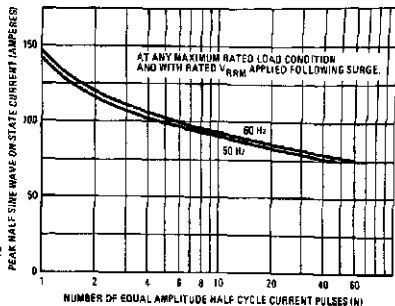


Fig. 7 — Maximum Non-Repetitive Surge Current, Vs. Number of Current Pulses, 2N681 Series

2N5204 Series

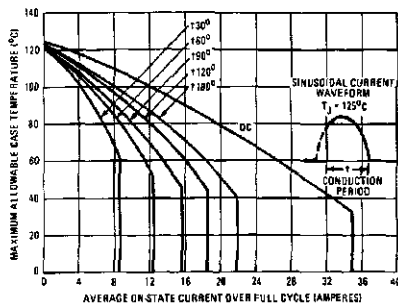


Fig. 8 — Maximum Allowable Case Temperature Vs. Average On-State Current (Sinusoidal Current Waveform), 2N5204 Series

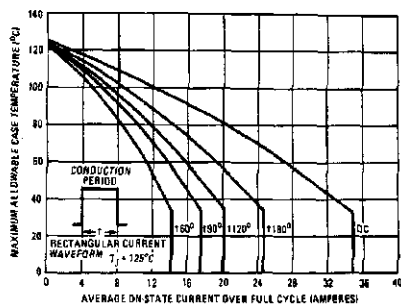


Fig. 9 — Maximum Allowable Case Temperature Vs. Average On-State Current (Rectangular Current Waveform), 2N5204 Series

2N5204 Series

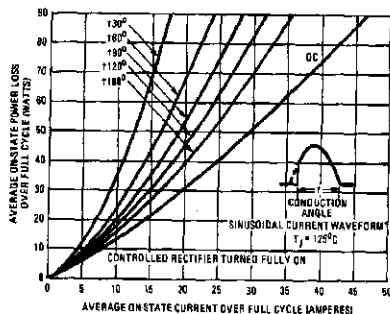


Fig. 10 - Maximum Low-Level On-State Power Loss Vs. Average On-State Current (Sinusoidal Current Waveform), 2N5204 Series

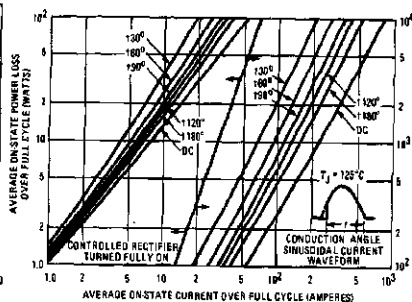


Fig. 11 - Maximum High-Level On-State Power Loss Vs. Average On-State Current (Sinusoidal Current Waveform), 2N5204 Series

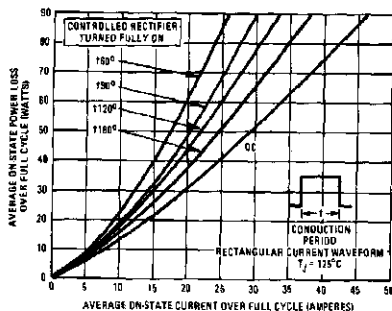


Fig. 12 - Maximum Low-Level On-State Power Loss Vs. Average On-State Current (Rectangular Current Waveform), 2N5204 Series

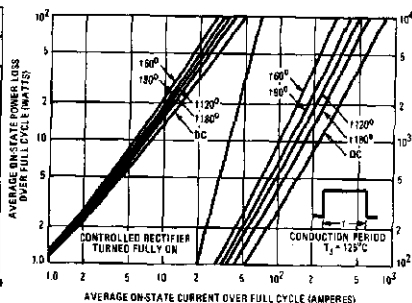


Fig. 13 - Maximum High-Level On-State Power Loss Vs. Average On-State Current (Rectangular Current Waveform), 2N5204 Series

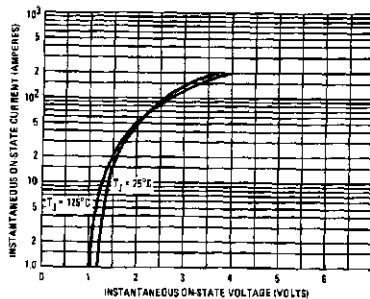


Fig. 14 - Maximum Instantaneous On-State Voltage Vs. Instantaneous On-State Current, 2N5204 Series

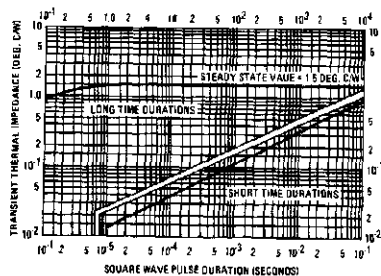


Fig. 15 - Maximum Transient Thermal Resistance, Junction to Case, Vs. Pulse Duration, 2N5204 Series