

4855452 INTERNATIONAL RECTIFIER

55C 04823 D

Data Sheet No. PD-3.082

INTERNATIONAL RECTIFIER **IR**  
T-25-17

**2N1792, 2N1805, 2N1909,  
2N2023 SERIES  
110 Amp RMS SCRs**

Major Ratings and Characteristics

	2N1792 thru 2N1804	2N1805 thru 2N1807	2N1909 thru 2N1916 2N1805 thru 2N2030	Units
I <sub>T</sub> (RMS)	110	110	110	A
I <sub>T</sub> (AV) @ T <sub>C</sub>	70*	70*	70*	A
I <sub>TSM</sub> @ 50 Hz @ 60 Hz	955 1,000*	955 1,000*	955 1,000*	A
I <sup>2</sup> t @ 50 Hz @ 60 Hz	4,550 4,150	4,550 4,150	4,550 4,150	A <sup>2</sup> s
I <sub>GT</sub>	70	70	70	mA
dv/dt	200	200	50	V/μs
di/dt	100	100	100	A/μs
T <sub>J</sub>	-65° to 125°	-40° to 125°	-65° to 150°	°C
V <sub>RRM</sub> , V <sub>DRM</sub> range	50* to 1,200*	25* to 840*	25* to 400*	V

\*JEDEC registered values

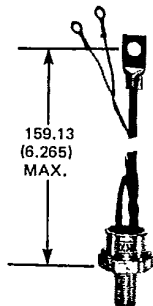
Description/Features

- For general purpose phase control applications
- Forward and reverse voltage ratings up to 1200V
- High temperature series
- High surge rating
- Standard 1/2" - 20 stud
- Can be supplied as JAN and JAN-TX devices in accordance with MIL-S-19500/203 or MIL-S-19500/204.

\*JEDEC registered values.

**A**

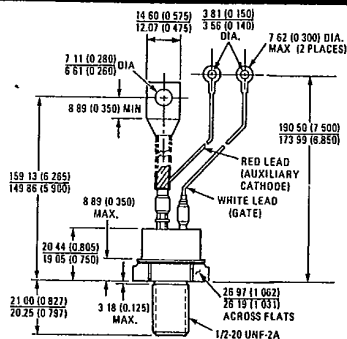
CASE STYLE AND DIMENSIONS



159.13  
(6.265)  
MAX.

Case style (ceramic) A-11  
furnished when part is  
rated 1000V or higher.  
A-13 (glass) for parts  
below 1000V.

JAN and/or JAN/TX  
types available.



Refer to Page A-34  
for flag terminal  
Case Style

All Dimensions in  
Millimeters and (Inches)

IR Case Style A-13  
Conforms to JEDEC Outline TO-209AC (TO-94)

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VOLTAGE RATINGS (Applied gate voltage zero or negative)

Part Numbers			$V_{RRM}$ - Max. Repetitive Peak Reverse Voltage (V)	$V_{DRM}$ - Max. Repetitive Peak Off-State Voltage (V) (1)	$V_{RSM}$ - Max. Non-Repetitive Peak Reverse Voltage $t_p < 5$ ms (V)
TO-208AD Case	TO-209AC Case	TO-209AC Case	$T_J = -40^\circ\text{C}$ to $125^\circ\text{C}$	$T_J = -40^\circ\text{C}$ to $125^\circ\text{C}$	$T_J = 25^\circ\text{C}$ to $125^\circ\text{C}$
—	2N1809	2N2023	25*	25*	35*
2N1792	2N1910	2N2024	50*	50*	70*
2N1793	2N1911	2N2025	100*	100*	150*
2N1794	2N1912	2N2026	150*	150*	225*
2N1795	2N1913	2N2027	200*	200*	300*
2N1796	2N1914	2N2028	250*	250*	350*
2N1797	2N1915	2N2029	300*	300*	400*
2N1798	2N1916	2N2030	400*	400*	500*
2N1799	2N1805	—	600*	500*	625*
2N1800	2N1806	—	720*	600*	750*
2N1801	2N1807	—	840*	700*	880*
2N1802	—	—	960*	800*	1000*
2N1803	—	—	1080*	900*	1130*
2N1804	—	—	1200*	1000*	1250*

ELECTRICAL SPECIFICATIONS

	2N1792 to 2N1804	2N1909-16 2N1805-07	2N2023-30	Units	Conditions	
ON-STATE						
$I_T(\text{RMS})$	Max. RMS on-state current	110	110	110	A	
$I_T(\text{AV})$	Max. average on-state current @ Max. $T_C =$	70*	70*	70*	A	
		65*	62*	85*	$^\circ\text{C}$	
$I_{TSM}$	Max. peak one cycle, non-repetitive surge current	955	955	955	A	50 Hz half cycle sine wave or 6 ms rectangular pulse following any rated load condition, and with rated $V_{RRM}$ applied following surge. SCR turned fully on.
		1000*	1000*	1000*		
		1150	1150	1150	A	50 Hz half cycle sine wave or 6 ms rectangular pulse Same conditions as above except with $V_{RRM}$ applied following surge = 0.
		1200	1200	1200		
$I^2t$	Max. $I^2t$ capability, for fusing	4550	4550	4550	$\text{A}^2\text{s}$	$t = 10$ ms Rated $V_{RRM}$ applied following surge, $t = 8.3$ ms Initial $T_J = \text{max. rated}$
		4150	4150	4150		
$I^2t$	Max. $I^2t$ capability, for individual device fusing	6450	6450	6450	$\text{A}^2\text{s}$	$t = 10$ ms $V_{RRM} = 0$ following surge, $t = 8.3$ ms Initial $T_J = \text{max. rated}$
		5900	5900	5900		
$I^2\sqrt{t}$	Max. $I^2\sqrt{t}$ capability, for individual device fusing (2)	64 500	64 500	64 500	$\text{A}^2\sqrt{\text{s}}$	$t = 0.1$ to $10$ ms, $V_{RRM}$ following surge = 0, initial $T_J = \text{max. rated}$
$V_{TM}$	Max. peak on-state voltage	1.85*	1.85*	1.9*	V	$T_J = 25^\circ\text{C}$ , $I_T(\text{AV}) = 70\text{A}$ (220A peak)
		2.0*	—	—		$T_J = 25^\circ\text{C}$ , $I_T(\text{AV}) = 70\text{A}$ (220A peak) 2N1803 & 2N1804 only
$I_H$	Typical holding current.	20	20	20	mA	$T_C = 25^\circ\text{C}$ , anode supply = 22V, initial $I_T = 2\text{A}$ .

\*JEDEC registered values.  
 (1) Units may be broken over non-repetitively without damage if  $di/dt$  does not exceed  $20 \text{ A}/\mu\text{s}$ .  
 (2)  $I^2t$  for time  $t_x = I^2\sqrt{t} \sqrt{t_x}$ .

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ELECTRICAL SPECIFICATIONS (Continued)

	2N1792 to 2N1804	2N1809-16 2N1805-07	2N2023-30	Units	Conditions
<b>BLOCKING</b>					
dv/dt	Min. critical rate-of-rise of off-state voltage	200	200	50	V/ $\mu$ s $T_J = 125^\circ\text{C}$ Exponential to 100% rated $V_{DRM}$ . Gate open circuit. $T_J = 150^\circ\text{C}$ for 2N2023-30.
$I_{R(AV)}$ & $I_{D(AV)}$	Max. average reverse and off-state current $V_{RRM}$ & $V_{DRM}$				At rated $V_{RRM}$ , $V_{DRM}$ , $T_J = \text{max. rated}$ , gate open circuited.
	= 25V to 150V	6.5*	6.5*	6.5*	
	= 200V	6.0*	6.5*	6.0*	
	= 250V	5.5*	5.5*	5.5*	
	= 300V	5.0*	5.0*	5.0*	
	= 400V	4.0*	4.0*	4.0*	
	= 500V to 600V	3.3* <sup>①</sup>	3.3* <sup>①</sup>	—	
	= 700V to 800V	3.0* <sup>①</sup>	3.0* <sup>①</sup>	—	
	= 800V to 1200V	2.7* <sup>①</sup>	—	—	
<b>SWITCHING</b>					
$t_d$	Typical delay time	1	1	1	$T_C = 25^\circ\text{C}$ , $V_{DM} = \text{rated } V_{DRM}$ , $I_{TM} = 50\text{A}$ dc resistive circuit. Gate pulse: 10V, 25 $\Omega$ source, $t_p = 6\mu\text{s}$ , $t_r = 0.1\mu\text{s}$
$t_r$	Typical rise time	1.5	1.5	1.5	
$t_q$	Typical turn-off time	40	40	40 (70 @ 150°C)	$T_C = 125^\circ\text{C}$ , $I_{TM} = 50\text{A}$ , commutating di/dt = -5 A/ $\mu$ s, min. $V_R$ during turn-off interval = 50V, dv/dt = 20 V/ $\mu$ s linear to rated $V_{DRM}$ .
di/dt	Max. non-repetitive rate-of-rise of turned-on current $V_{DRM}$				$T_C = 125^\circ\text{C}$ , $V_{DM} = \text{rated } V_{DRM}$ $I_{TM} = (2 \times \text{rated di/dt}) \text{ A}$ Gate pulse: 20V, 15 $\Omega$ , $t_p \geq 6\mu\text{s}$ , $t_r = 0.1\mu\text{s}$ Per JEDEC Standard RS-297, 5.2.2.6.
	= 25V to 600V	100	100	100	
	= 700V to 1200V	75	75	75	
<b>TRIGGERING</b>					
$P_{GM}$	Max. peak gate power	5*	5*	5*	W $t_p = 5\text{ ms max.}$
$P_{G(AV)}$	Max. average gate power	0.5*	0.5*	0.5*	W
$+I_{GM}$	Max. peak positive gate current	2*	2*	2*	A
$+V_{GM}$	Max. peak positive gate voltage	10*	10*	10*	V
$-V_{GM}$	Max. peak negative gate voltage	5*	5*	5*	V
$I_{GT}$	Max. required DC gate current to trigger	130* ①	130*	150* @ -65°C	mA $T_C = -40^\circ\text{C}$ . Max. required gate trigger current is the lowest value which will trigger all units with +6V anode-to-cathode. $T_C = 25^\circ\text{C}$ $T_C = 125^\circ\text{C}$ $T_C = 150^\circ\text{C}$
		70* ①	70	70	
		40* ①	40	—	
		—	—	35	
	Typical DC gate current to trigger	35	35	35	$T_C = 25^\circ\text{C}$ +6V anode-to-cathode

\*JEDEC registered values.

①  $V_{RRM}$  20% greater than  $V_{DRM}$ .

① For 2N1803, 1804:  $I_{GT} = 200\text{ mA} @ -40^\circ\text{C}$ ; 110mA @ 25°C; 50 mA @ 125°C.



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ELECTRICAL SPECIFICATIONS (Continued)

	2N1792 to 2N1804	2N1909-16 2N1805-07	2N2023-30	Units	Conditions		
TRIGGERING (Cont.)							
V <sub>GT</sub>	Max. required DC gate voltage to trigger	—	—	3*	V	T <sub>C</sub> = -65°C. Max. required gate trigger voltage is the lowest value which will trigger all units with +6V anode-to-cathode.	
		3*	3*	—			T <sub>C</sub> = -40°C
		2.5	2.5	2.0			T <sub>C</sub> = 25°C
	Typical DC gate voltage to trigger	1.2	1.2	1.2		T <sub>C</sub> = 25°C +6V anode-to-cathode	
V <sub>GD</sub>	Max. DC gate voltage not to trigger	0.25*	0.25*	0.25* @ 150°C	V	T <sub>C</sub> = 125°C. Max. gate voltage not to trigger is the maximum value which will not trigger any unit with rated V <sub>DRM</sub> anode-to-cathode.	

THERMAL-MECHANICAL SPECIFICATIONS

T <sub>J</sub>	Operating junction temperature range	-65* to 125*	-40* to 125*	-65* to 150*	°C	
T <sub>stg</sub>	Storage temperature range	-40* to 150*	-40* to 125*	-65* to 150*	°C	
R <sub>thJC</sub>	Max. internal thermal resistance, junction-to-case	0.4* ⑥	0.4*	0.4*	deg. C/W	DC operation
R <sub>thCS</sub>	Thermal resistance, case-to-sink	0.1	0.1	0.1	deg. C/W	Mounting surface smooth, flat and greased.
T	Mounting torque	Min.	14.5 (125)		N·m	Non-lubricated threads
		Max.	17 (150)		(lb·f·in)	
	Max. torque on screw in flagterminal	1.4 (12)	—	—	N·m (lb·f·in)	Non-lubricated threads TO-208AD (TO-83) only
wt	Approximate weight	100 (3.5)			g (oz)	
Case style		2N1805-07; 2N1909-16; 2N2023-30; TO-209AC (TO-94) (A-13)			JEDEC	
		2N1792-1804; TO-208AD (TO-83) (A-14)			JEDEC	

\*JEDEC registered values.  
⑥ 2N1803, 2N1804: R<sub>thJC</sub> = 0.35 deg. C/W.

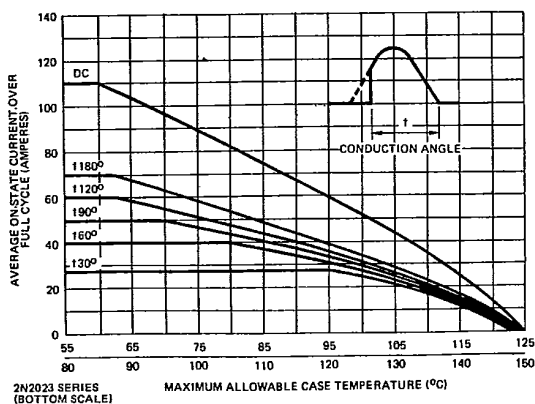


Fig. 1 — On-State Current Vs. Case Temperature (Sinusoidal Current Waveform, 50 to 400 Hz)

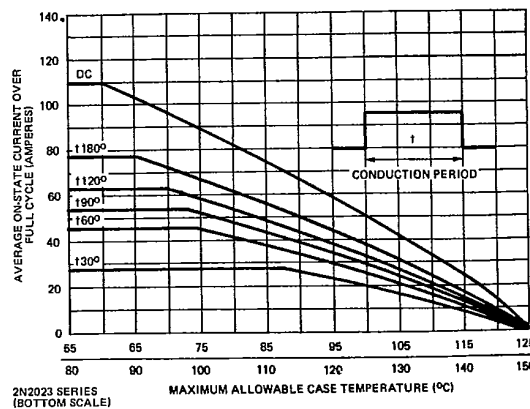


Fig. 2 — On-State Current Vs. Case Temperature (Rectangular Current Waveform, 50 to 400 Hz)

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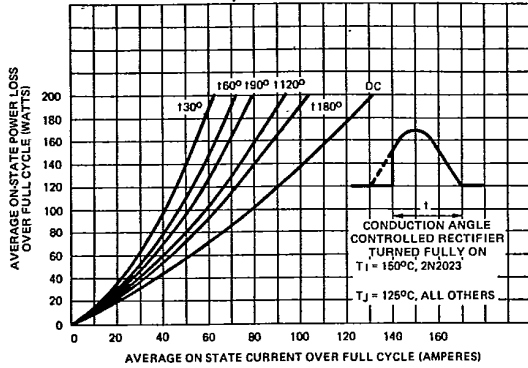


Fig. 3 - Maximum Low-Level On-State Power Loss Vs. Current (Sinusoidal Current Waveform)

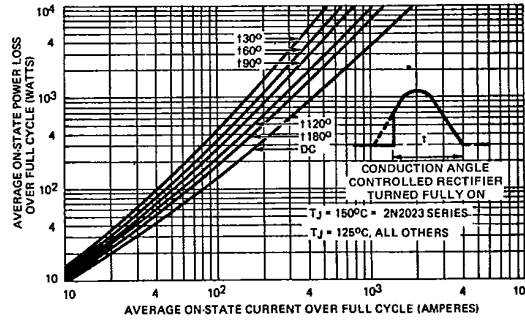


Fig. 4 - Maximum High-Level On-State Power Loss Vs. Current (Sinusoidal Current Waveform)

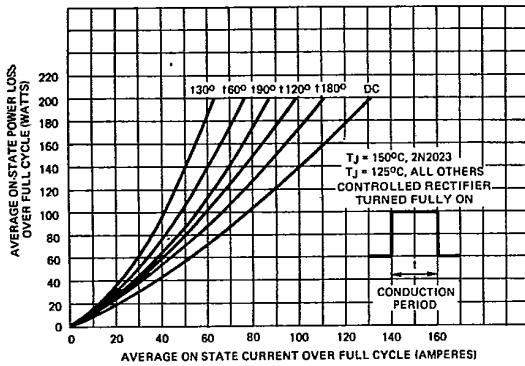


Fig. 5 - Maximum Low-Level On-State Power Loss Vs. Current (Rectangular Current Waveform)

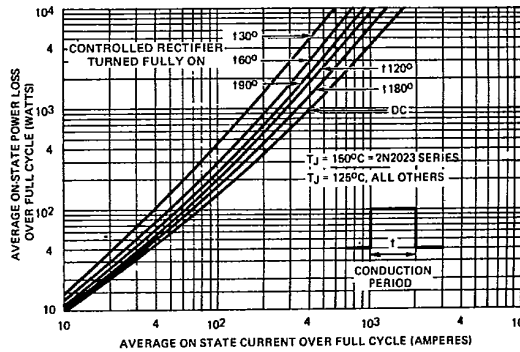


Fig. 6 - Maximum High-Level On-State Power Loss Vs. Current (Rectangular Current Waveform)

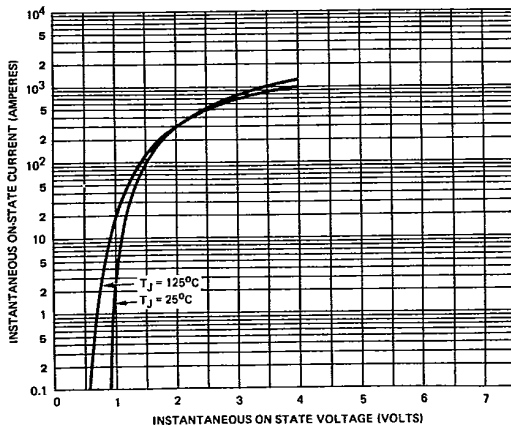


Fig. 7 - Maximum Instantaneous On-State Voltage Vs. Current (2N1792, 2N1805 and 2N1909 Series)

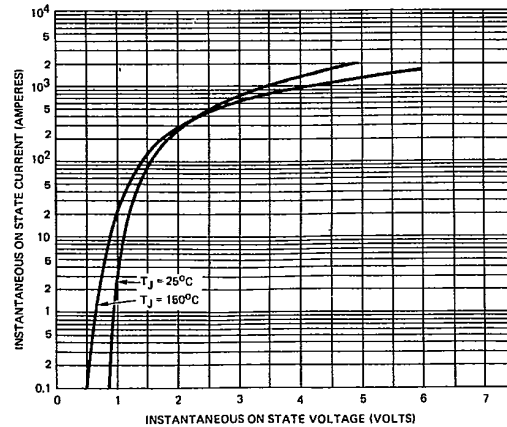


Fig. 8 - Maximum Instantaneous On-State Voltage Vs. Current (2N2023 Series)

A

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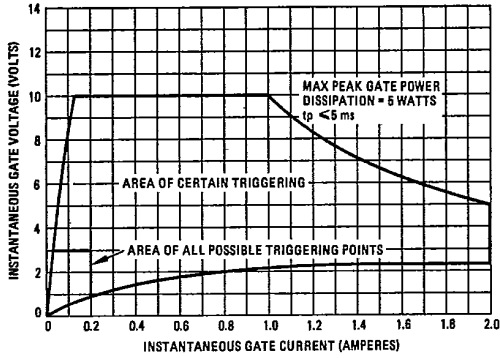


Fig. 9 - Gate Characteristics

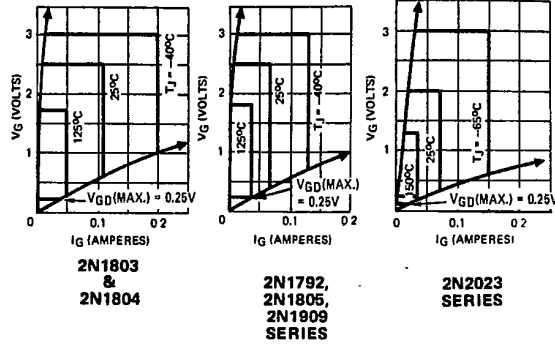


Fig. 9A - Areas of All Possible Triggering Points Vs. Junction Temperature

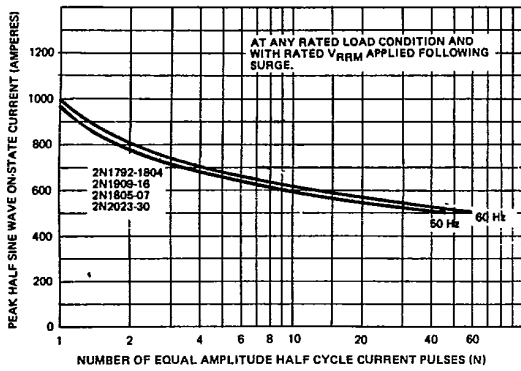


Fig. 10 - Maximum Non-Repetitive Surge Current Vs. Number of Current Pulses

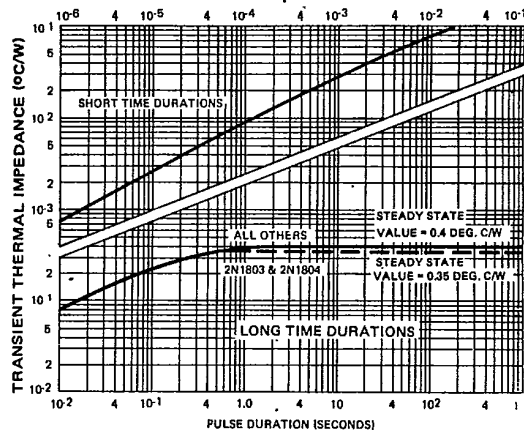
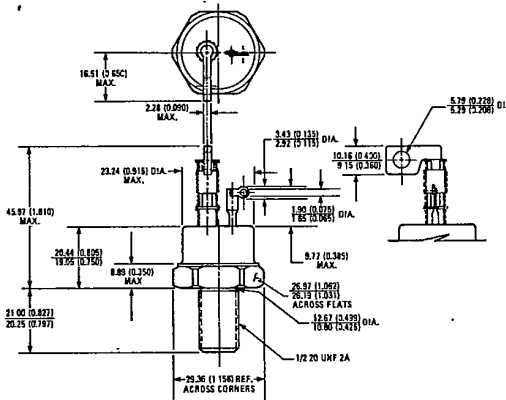


Fig. 11 - Transient Thermal Impedance, Junction to Case, Vs. Pulse Duration



IR Case Style A-14  
 Conforms to JEDEC Outline TO-208AD (TO-83)  
 All Dimensions in Millimeters and (Inches)