

4855452 INTERNATIONAL RECTIFIER

55C 04829 D

Data Sheet No. PD-3.083

INTERNATIONAL RECTIFIER **IR**

T-25-17

# 2N3091 SERIES

## 110 Amp RMS SCRs

**A**

**Major Ratings and Characteristics**

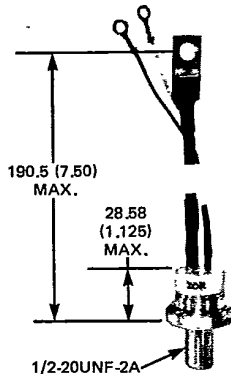
|                          | 2N3091-98   | Units      |
|--------------------------|-------------|------------|
| $I_T(RMS)$               | 110         | A          |
| $I_T(AV)$                | 70*         | A          |
| @ Max. $T_C$             | 62*         | °C         |
| $I_{TSM}$                | @ 50 Hz     | 855        |
|                          | @ 60 Hz     | 1000*      |
| $I^2t$                   | @ 50 Hz     | 4550       |
|                          | @ 60 Hz     | 4150       |
| $I_{GT}$                 | 110         | mA         |
| $dv/dt$                  | 20*         | V/ $\mu$ s |
| $di/dt$                  | 300         | A/ $\mu$ s |
| $T_J$                    | -40 to 125  | °C         |
| $V_{RRM}, V_{DRM}$ range | 600 to 1300 | V          |

\*JEDEC registered values.

**Description/Features**

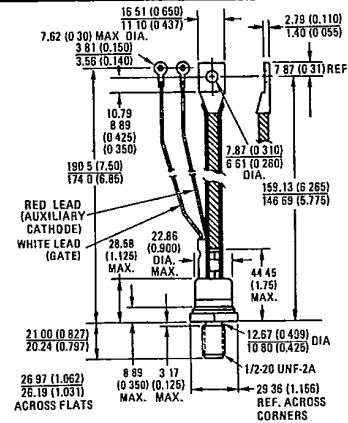
- Bulk Avalanche
- Can be supplied as JAN devices in accordance with MIL-S-19500/280A
- Forward and reverse ratings from 600 – 1300 volts.

**CASE STYLE AND DIMENSIONS**



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.



IR Case Style A-11  
Conforms to JEDEC Outline TO-209AC (TO-94)  
All Dimensions in Millimetres and (Inches)

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VOLTAGE RATINGS (Applied gate voltage zero or negative)

| Part Number ① | $V_{RRM} - V_{DRM}$<br>Max. Repetitive Peak Reverse and Off-State<br>Voltage<br>(V) ② | $V_{(BR)R}$<br>Min. Reverse Avalanche Voltage |
|---------------|---|---|
|               | $T_J = -40^\circ\text{C to } 125^\circ\text{C}$                                       | $T_J = 25^\circ\text{C}$                      |
| 2N3091        | 600*  | 700*  |
| 2N3092        | 700*  | 800*  |
| 2N3093        | 800*  | 900*  |
| 2N3094        | 900*  | 1000*   |
| 2N3095        | 1000*   | 1100*   |
| 2N3096        | 1100*   | 1200*   |
| 2N3097        | 1200*   | 1300*   |
| 2N3098        | 1300*   | 1400*   |

ELECTRICAL SPECIFICATIONS

|   | 2N3091-98 | Units            | Conditions   |
|---|-----------|------------------|--|
| <b>ON-STATE</b>   |           |                  |  |
| $I_T(\text{RMS})$ Max. RMS on-state current                                 | 110       | A                |  |
| $I_T(\text{AV})$ Max. average on-state current @ Max. $T_C =$               | 70*       | A                | 180° half sine wave conduction   |
|   | 62*       | °C               |  |
| $I_{TSM}$ Max. peak one cycle, non-repetitive surge current                 | 955       | A                | 50 Hz half cycle sine wave or 6 ms rectangular pulse<br>Following any rated load condition, and with rated $V_{RRM}$ applied following surge. SCR turned fully on. |
|   | 1000*     |                  |  |
|   | 1150      | A                | 50 Hz half cycle sine wave or 6 ms rectangular pulse<br>Same conditions as above except with $V_{RRM}$ applied following surge = 0.                                |
|   | 1200      |                  |  |
| $i^2t$ Max. $i^2t$ capability, for fusing                                   | 4550      | $A^2s$           | t = 10 ms<br>t = 8.3 ms<br>Rated $V_{RRM}$ applied following surge, initial $T_J = 125^\circ\text{C}$  |
|   | 4150      |                  |  |
| $i^2t$ Max. $i^2t$ capability, for individual device fusing                 | 6450      | $A^2s$           | t = 10 ms<br>t = 8.3 ms<br>$V_{RRM} = 0$ following surge, initial $T_J = 125^\circ\text{C}$  |
|   | 5900      |                  |  |
| $i^2\sqrt{t}$ Max. $i^2\sqrt{t}$ capability, for individual device fusing ③ | 64 500    | $A^2\sqrt{s}$    | $V_{RRM}$ following surge = 0. Initial $T_J \leq 125^\circ\text{C}$<br>t = 0.1 to 10ms.  |
| $V_{TM}$ Max. peak on-state voltage   | 1.85*     | V                | $T_J = 25^\circ\text{C}$ , $I_T(\text{AV}) = 70\text{A}$ (220A peak)   |
| $I_H$ Max. holding current  | 500       | mA               | $T_C = 25^\circ\text{C}$ , anode supply = 22V, initial $I_T = 3\text{A}$ .   |
| <b>BLOCKING</b>   |           |                  |  |
| $dv/dt$ Min. critical rate of rise of off-state voltage                     | 20*       | V/ $\mu\text{s}$ | $T_J = 125^\circ\text{C}$ . Exponential to 100% rated $V_{DRM}$ ; gate open circuited  |
| $I_{RM}$ & $I_{DM}$ Max. peak reverse and off-state current 300V - 600V     | 5*        | mA               | Max. rated $T_J$ , rated $V_{RRM}$ , gate open circuited.  |

① Meets MIL-S-19500/280A when ordered as JAN2N - - -

② Units may be broken over without damage if  $di/dt$  does not exceed 20 A/ $\mu\text{s}$ .

③  $i^2t$  for time  $t_x = i^2\sqrt{t} \sqrt{t_x}$

\* JEDEC registered values.

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ELECTRICAL SPECIFICATIONS (Continued)

|                   |  | 2N3901-98 | Units            | Conditions  |
|-------------------|--|-----------|------------------|---|
| <b>SWITCHING</b>  |  |           |                  |   |
| $t_d$             | Typical delay time   | 1         |                  | $T_C = 25^\circ\text{C}$ , rated $V_{DRM}$  |
| $t_r$             | Typical rise time  | 1         | $\mu\text{s}$    | $I_{TM} = 50\text{A}$ resistive circuit, Gate pulse: 10V, 25 $\Omega$ , $t_0 = 6\mu\text{s}$  |
| $t_q$             | Typical turn-off time  | 50        | $\mu\text{s}$    | $T_C = 125^\circ\text{C}$ , $I_{TM} = 50\text{A}$ , $di/dt = 5\text{A}/\mu\text{s}$ , $V_R = 50\text{V}$ , reapplied $dv/dt = 20\text{V}/\mu\text{s}$ linear to rated $V_{DRM}$ , Gate bias: 0V, 100 $\Omega$ .   |
| $di/dt$           | Max. non-repetitive rate of rise of turned-on current = $V_{RRM}$<br>= 500V to 600V<br>= 700V to 1000V<br>= 1100V to 1400V | 300       | A/ $\mu\text{s}$ | $T_C = 125^\circ\text{C}$ , $V_{VDM} = \text{rated } V_{DRM}$ . $I_{TM} = (2 \times di/dt)$ or $(2 \times \text{rated } I_T(AV))\text{A}$ (whichever is the greater), Gate pulse: 20V, 15 $\Omega$ , $t_p = 6\mu\text{s}$ , $t_r = 0.1\mu\text{s}$ . Per JEDEC standard RS397, 5.2.2.6. |
|                   |  | 225       |                  |   |
|                   |  | 150       |                  |   |
| <b>TRIGGERING</b> |  |           |                  |   |
| $P_{GM}$          | Max. peak gate power   | 5*        | W                | $t_p \leq 5\text{ ms max.}$   |
| $P_{G(AV)}$       | Max. average gate power  | 0.5*      | W                |   |
| $+I_{GM}$         | Max. peak positive gate current  | 2         | A                |   |
| $+V_{GM}$         | Max. peak positive gate voltage  | 20*       | V                |   |
| $-V_{GM}$         | Max. peak negative gate voltage  | 5*        | V                |   |
| $I_{GT}$          | Max. required DC gate current to trigger   | 200*      | mA               | $T_C = -40^\circ\text{C}$ . Max. required gate trigger voltage is the lowest value which will trigger all units with +6V anode-to-cathode.  |
|                   |  | 110       | mA               | $T_C = 25^\circ\text{C}$  |
|                   |  | 50        | mA               | $T_C = 125^\circ\text{C}$   |
|                   |  | 25        | mA               | $T_C = 25^\circ\text{C}$ +6V anode-to-cathode   |
| $V_{GT}$          | Max. required DC gate voltage to trigger   | 3*        | V                | $T_C = -40^\circ\text{C}$ . Max. required gate trigger voltage is the lowest value which will trigger all units with +6V anode-to-cathode.  |
|                   |  | 2.5       | V                | $T_C = 25^\circ\text{C}$  |
|                   |  | 1         | V                | $T_C = 25^\circ\text{C}$ +6V anode-to-cathode   |
| $V_{GD}$          | Max. DC gate voltage not to trigger  | 0.20*     | 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

|            |  | 2N3901-98                                      | Units            | Conditions                                  |                        |
|------------|--|--|------------------|---|------------------------|
| $T_J$      | Operating junction temperature range               | -40* to 125*                                   | $^\circ\text{C}$ |   |                        |
| $T_{stg}$  | Storage temperature range                          | -40* to 125*                                   | $^\circ\text{C}$ |   |                        |
| $R_{thJC}$ | Max. internal thermal resistance, junction to case | 0.4*   | K/W              | DC operation                                |                        |
| $R_{thCS}$ | Thermal resistance, case to sink                   | 0.1  | K/W              | Mounting surface smooth, flat and greased.  |                        |
| T          | Mounting torque                                    | Min.   | 14.5 (125)       | N m<br>(lbf-in)                             | Non-lubricated threads |
|            |  | Max.   | 17.0 (150)       |   |                        |
|            | Max. torque on screw in flag terminal              | 1.4 (12)                                       | N m<br>(lbf-in)  | Non-lubricated threads. TO-208AD case only. |                        |
| wt         | Approximate weight                                 | 100 (3.5)                                      | g (oz)           |   |                        |
| Case Style |  | TO-209AC<br>(TO-94)<br>(IR case<br>Style A-11) |                  | JEDEC                                       |                        |

\*JEDEC registered values.

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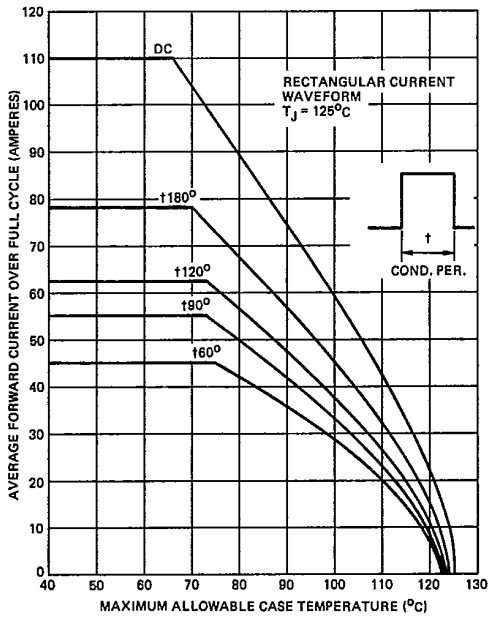


Fig. 1 - Average On-State Current Vs. Maximum Allowable Case Temperature (Sinusoidal Current Waveform, 50 to 400 Hz)

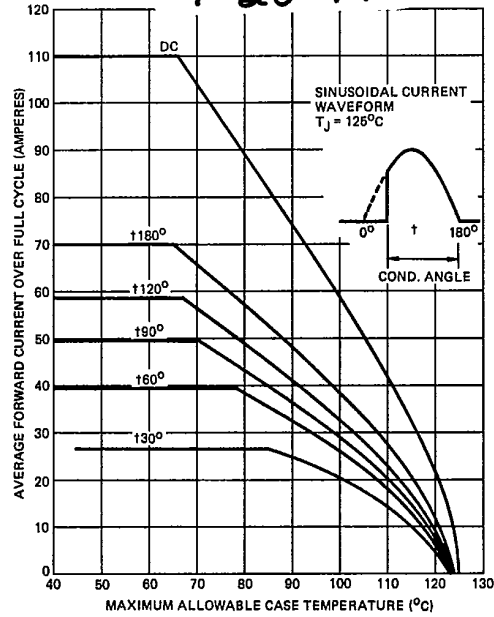


Fig. 2 - Average On-State Current Vs. Maximum Allowable Case Temperature (Rectangular Current Waveform, 50 to 400 Hz)

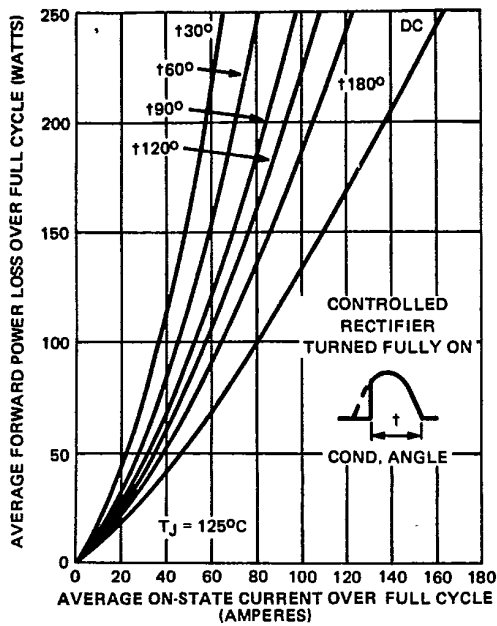


Fig. 3 - Maximum Low Level On-State Power Loss Vs. On-State Current (Sinusoidal Current Waveform)

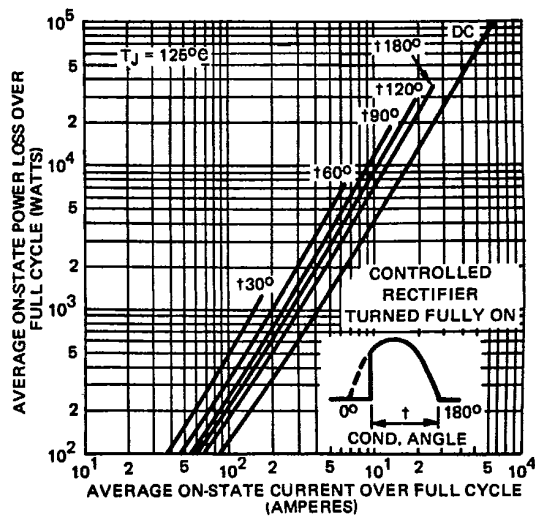


Fig. 4 - Maximum High Level On-State Power Loss Vs. On-State Current (Sinusoidal Current Waveform)

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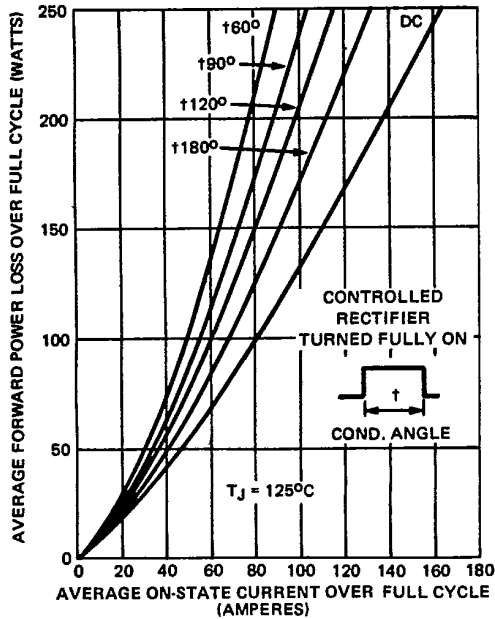


Fig. 5 - Maximum Low Level On-State Power Loss Vs. On-State Current (Rectangular Current Waveform)

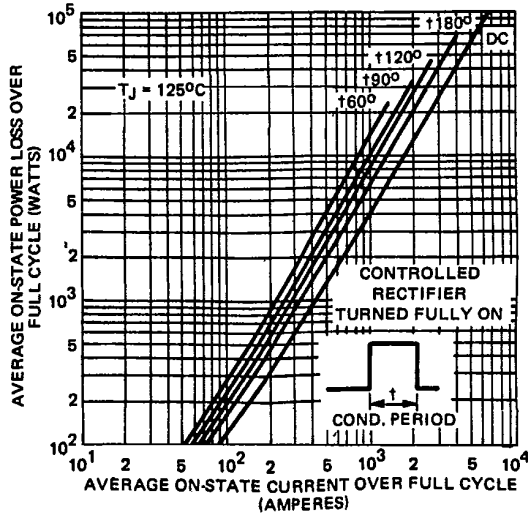


Fig. 6 - Maximum High Level On-State Power Loss Vs. On-State Current (Rectangular Current Waveform)

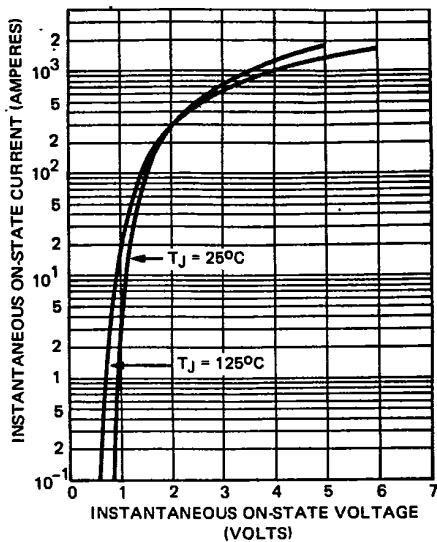


Fig. 7 - Maximum Instantaneous On-State Voltage Vs. Instantaneous On-State Current

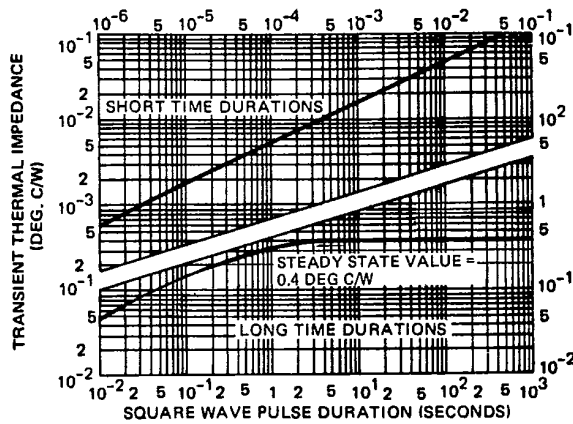


Fig. 8 - Maximum Transient Thermal Impedance, Junction to Case Vs. Pulse Duration

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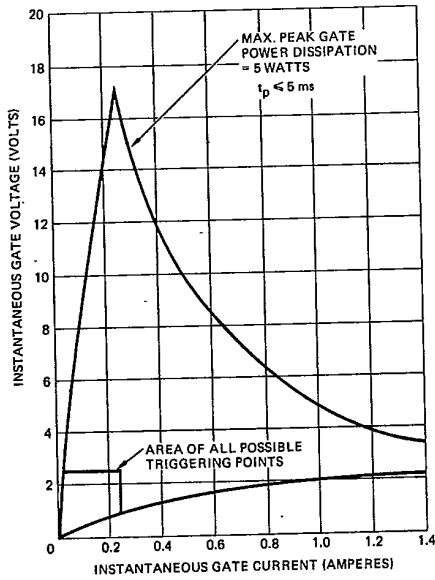


Fig. 9 - Gate Characteristics

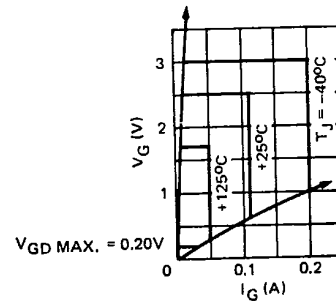


Fig. 9a - Area of All Possible Triggering Points

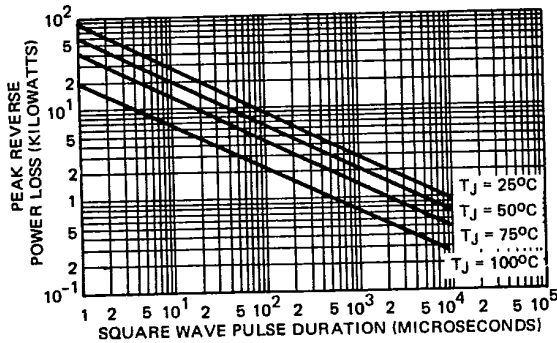


Fig. 10 - Maximum Allowable Reverse Power Dissipation Vs. Pulse Duration

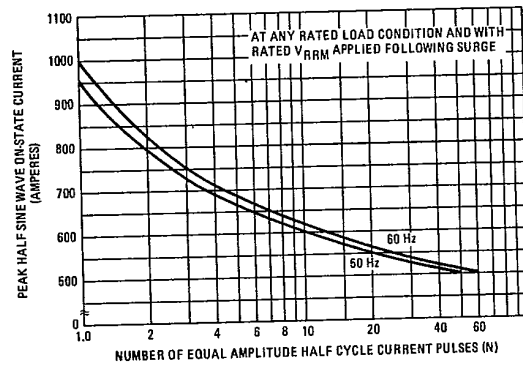


Fig. 11 - Maximum Non-Repetitive Surge Current Vs. Number of Current Pulses