Data Sheet No. PD-2.033C

INTERNATIONAL RECTIFIER IOR

T-03-19

# 20FQ, 1N6095 & 96 SERIES

## 27.5 and 30 Amp Schottky Power Rectifiers

### Major Ratings and Characteristics

| Characteristic | 20FQ | 1N6095 & 96 | Units |
|---|---|---|---|
| $I_{F(AV)}$ @ 180° Rectangular | 30 | 27.5 | A |
| @ 180° Half Sine Wave | 27 | 25* | |
| $I_{FSM}$ @ 50 Hz | 645 | 380 | A |
| @ 60 Hz | 675 | 400* | |
| $I^2t$ @ 50 Hz | 2,100 | 730 | $A^2s$ |
| @ 60 Hz | 1,900 | 665 | |
| $I^2\sqrt{t}$ | 29,500 | 10,500 | $A^2\sqrt{s}$ |
| $V_{RWM}$ ① | 20 to 45 | 30* & 40* | V |
| $C_t$ @ -5V | 2,000 | 6,000*† | pF |
| $T_J$ | -65 to 150 | -65* to 125* | °C |

*JEDEC registered value. ① $V_{RWM} = V_{RRM}$ for 1N6095 & 96
†$V_R$ = 1V.

### Description/Features

The 20FQ and the 1N6095-96 Schottky rectifier series are both designed to operate at maximum rated junction temperature without any voltage derating. In addition to improved performance characteristics, the 20FQ series offers a 20% safety margin for repetitive short pulses over the working peak reverse voltage rating to protect against voltage transients. Both series are provided with guard ring construction to protect against reverse energy transients.

Applications for the 20FQ and 1N6095-96 Schottky rectifiers include both existing and new switching power supply designs.

- Extremely low $V_F$
- Excellent parameter stability over the operating range
- No derating on reverse voltage to maximum operating temperature
- A guaranteed non-repetitive peak reverse voltage capability which is 20% above $V_{RWM}$ to protect against voltage transients
- Industry-preferred DO-203AA (DO-4) package
- Can be supplied to meet stringent military, aerospace and other high-reliability requirements.

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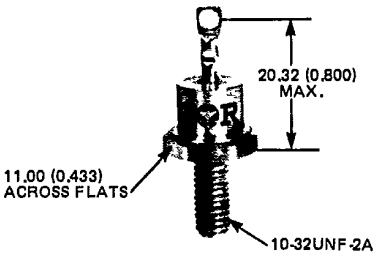
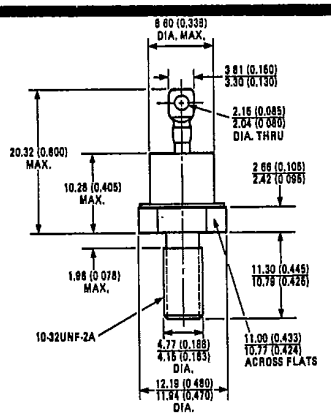
### CASE STYLE AND DIMENSIONS




Conforms to JEDEC Outline DO-203AA (DO-4)
All Dimensions in Millimeters and (Inches)

## VOLTAGE RATINGS

| Part Numbers | | $V_{RWM}$ – Max. Working Peak Reverse Voltage ① ④ (V) | $V_{RRM}$ – Max. Repetitive Peak Reverse Voltage ① ⑤ (V) ($t_p$ = 200 ns max.) ⑥ | $V_R$ – Max. Direct Reverse Voltage ③ (V) |
|---|---|---|---|---|
| 20FQ020 | – | 20 | 24 | 20 |
| 20FQ030 | 1N6095 | 30* | 36* | 30* |
| 20FQ035 | – | 35 | 42 | 35 |
| 20FQ040 | 1N6096 | 40* | 48* | 40* |
| 20FQ045 | – | 45 | 54 | 45 |

## ELECTRICAL SPECIFICATIONS

| | | 20FQ | 1N6095 & 96 | Units | Conditions |
|---|---|---|---|---|---|
| $I_{F(AV)}$ | Max. average forward current | 30 | 27.5 | A | 180° conduction @ $T_C$ = –65°C to 92°C (20FQ); –65°C to 71.5°C (1N6095 & 96). Rectangular waveform |
| | | 27 | 25* | | 180° conduction @ $T_C$ = –65°C to 91°C (20FQ); –65°C to 70°C (1N6095 & 96). Sinusoidal waveform |
| $I_{FSM}$ | Max. peak one cycle non-repetitive surge current | 645 | – | A | 50 Hz supply — Half cycle, sine wave or 6 ms rectangular pulse, following any rated load condition, and with rated $V_{RWM}$ applied following surge. ④ |
| | | – | 380 | | |
| | | 675 | – | | 60 Hz supply — Half cycle, sine wave or 5 ms rectangular pulse, following any rated load condition, and with rated $V_{RWM}$ applied following surge. ④ |
| | | – | 400* | | |
| | | 765 | 455 | | 50 Hz supply — Initial $T_J$ = 150°C (20FQ), 125°C (1N6095 & 96). |
| | | 805 | 475 | | 60 Hz supply — $V_{RWM}$ = 0 following surge. ④ |
| $I^2t$ | Max. $I^2t$ for fusing | 2100 | 730 | $A^2s$ | t = 10 ms — Initial $T_J$ = 150°C (20FQ), 125°C (1N6095 & 96). |
| | | 1900 | 665 | | t = 8.3 ms — Rated $V_{RWM}$ applied following surge. ④ |
| | Max. $I^2t$ for individual device fusing | 2950 | 1050 | $A^2s$ | t = 10 ms — Initial $T_J$ = 150°C (for 20FQ), 125°C (for 1N6095 & 96). $V_{RWM}$ applied following surge = 0. |
| | | 2700 | 940 | | t = 8.3 ms |
| $I^2\sqrt{t}$ | Max. $I^2\sqrt{t}$ for individual device fusing ⑦ | 29,500 | 10,500 | $A^2\sqrt{s}$ | t = 0.1 to 10 ms. Initial $T_J$ = 150°C for 20FQ and 125°C for 1N6095 & 96. $V_{RWM}$ applied following surge = 0. |
| $V_{FM}$ | Max. peak forward voltage | – | 0.60* | V | $T_C$ = 25°C, $I_{FM}$ = 5A |
| | | 0.53 | 0.64 | | $T_J$ = 25°C, $I_{FM}$ = 30A |
| | | 0.68 | – | | $T_J$ = 25°C — Rated $I_{F(AV)}$ 180° conduction (20FQ: Rectangular waveform, 60A peak; 1N6095 & 96: Half sine wave, 80A peak) |
| | | – | 0.86* | | $T_C$ = 70°C |
| | | 0.65 | – | | $T_J$ = 150°C |
| $I_{RM}$ | Max. peak reverse current | 55 | 60 | mA | $T_J$ = 25°C — Max. rated $V_{RWM}$ ④ |
| | | 180 | 250* | | $T_J$ = 125°C |
| $I_{RRM}$ | Max. repetitive peak reverse current | 2.0 | 2.0 | A | $T_C$ = 25°C, f = 1 kHz, see fig. 16 for test circuit |
| $C_t$ | Max. capacitance | 2000 | 6000* | pF | $T_C$ = 25°C, $V_R$ = 5 Vdc (20FQ); 1V (1N6095 & 96) Test signal in the range of 100 kHz to 1 MHz |
| dv/dt | Max. rate of reverse voltage application | 1000 | 1000 | V/μs | $T_C$ = 25°C, $V_{RM}$ = Rated $V_{RWM}$ ④ |

## THERMAL-MECHANICAL SPECIFICATIONS

| | | | | | |
|---|---|---|---|---|---|
| $T_J$ | Operating junction temperature range | –65 to 150 | –65* to 125* | °C | |
| $T_{stg}$ | Storage temperature range | –65 to 150 | –65* to 125* | °C | |
| $R_{thJC}$ | Max. thermal resistance, junction-to-case | 2.0* | | deg C/W | |
| $R_{thCS}$ | Max. thermal resistance, case-to-sink | 0.50 | | deg C/W | Mounting surface flat, smooth and greased |
| T | Mounting torque Min. | 1.35 (12) | | Nm (lbf in) | Non-lubricated threads |
| | Max. | 1.70 (15) | | | |
| wt | Approximate weight | 5.7 (0.2) | | g (oz) | |
| | Case style | DO-203AA (DO-4) | | | JEDEC |

① $T_C$ = –65°C to 136°C (20FQ), to 120°C* (1N6095 & 96), 180° conduction.

② $T_C$ = 0°C to 136°C (20FQ), to 120°C* (1N6095 & 96), 180° conduction.

③ $T_C$ = –65°C to 99°C (20FQ), to 105°C* (1N6095 & 96)

④ $V_{RWM}$ = $V_{RRM}$ for 1N6095 & 96

⑤ $V_{RRM}$ = $V_{RSM}$ for 1N6095 & 96

⑥ Applicable to 20FQ only.

⑦ $I^2t$ for time $t_x$ = $I^2\sqrt{t} \cdot \sqrt{t_x}$.

## 20FQ Series

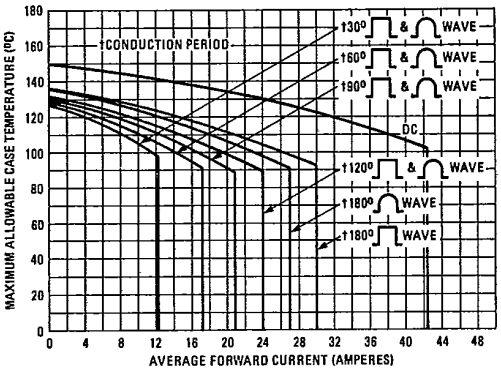



Fig. 1 – Average Forward Current Vs. Case Temperature

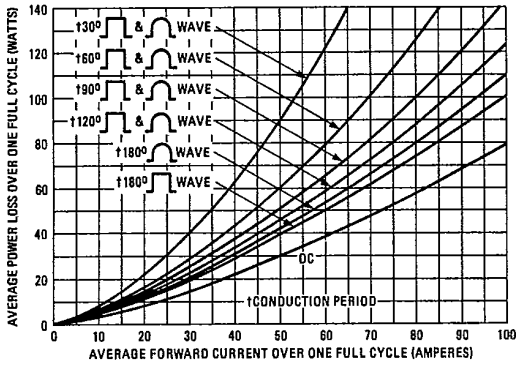



Fig. 2 – Maximum Average Forward Power Loss Vs. Average Forward Current

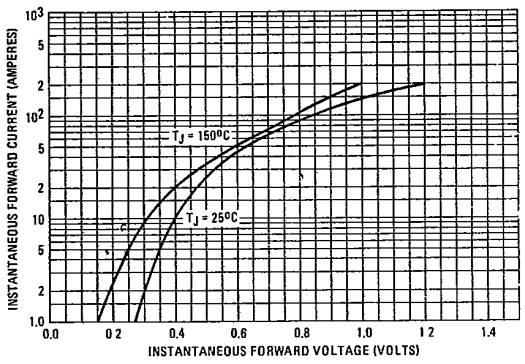



Fig. 3 – Maximum Forward Voltage Vs. Forward Current

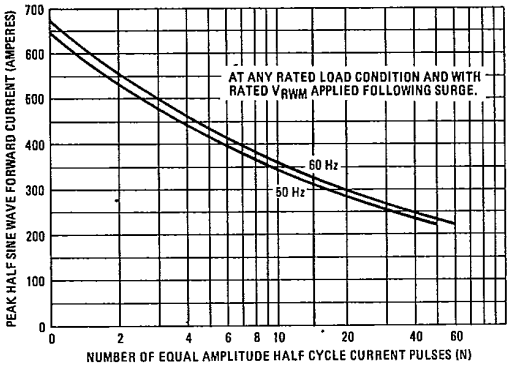



Fig. 4 – Maximum Non-Repetitive Surge Current Vs. Number of Cycles

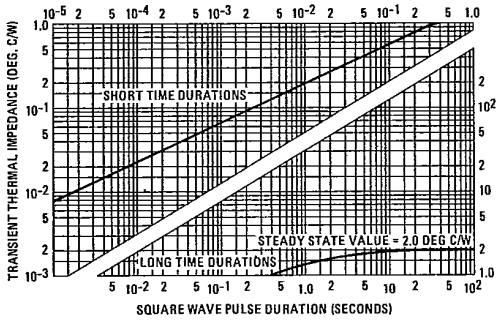



Fig. 5 – Maximum Transient Thermal Impedance, Junction-to-Case, Vs. Pulse Duration

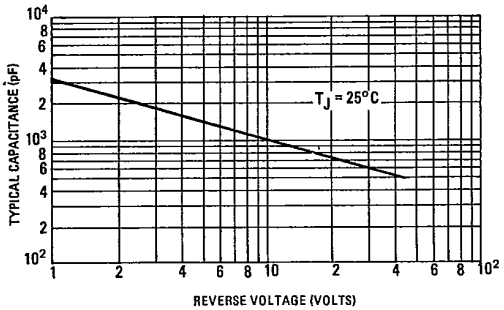



Fig. 6 – Typical Capacitance Vs. Reverse Voltage

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20FQ Series

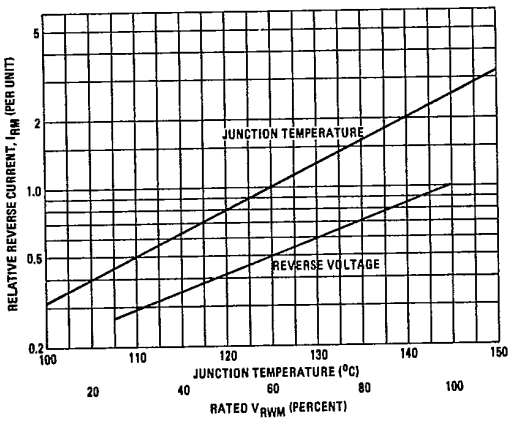


**Fig. 7 – Typical Variation of Reverse Current Vs. Junction Temperature and Reverse Voltage**

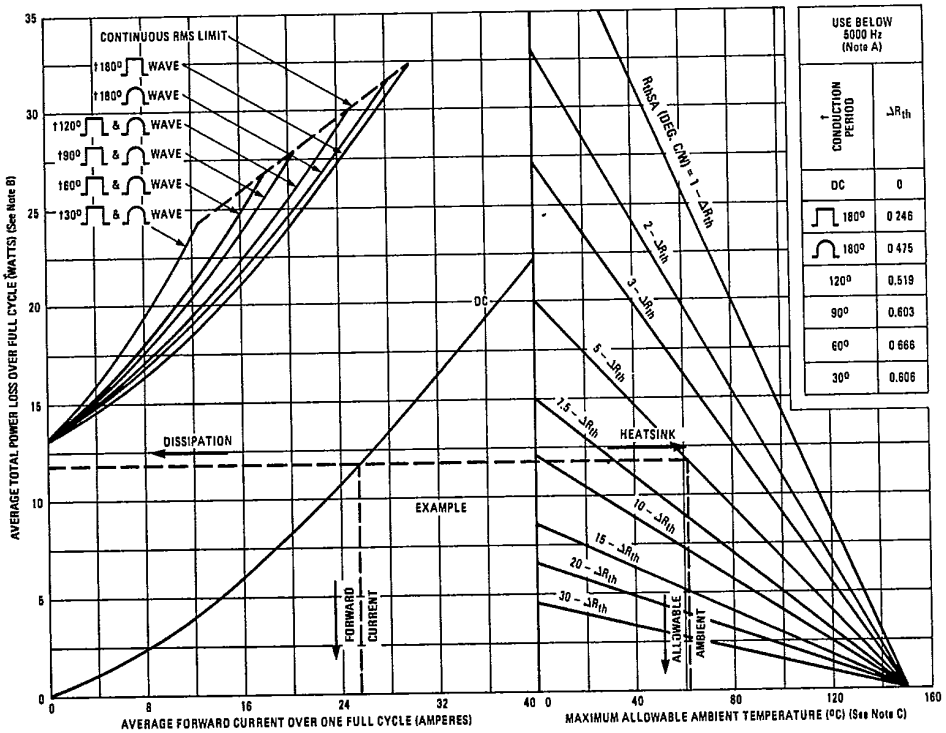


**Fig. 8 – Thermal Nomogram**

NOTES:
A. Maximum allowable heatsink thermal resistance, $R_{thSA}$, equals the graph value minus the $\Delta R_{th}$ factor which allows for instantaneous $T_J$ excursion. At frequencies above 5000 Hz, $\Delta R_{th}$ becomes essentially zero and can be ignored.
B. The total power dissipation curves assume the worst case reverse conditions of halfwave (180°) rectangular reverse voltage, full rated $V_R$, and $T_J$ = 150°C. Lower reverse power losses allow higher operating ambient, smaller heatsinks or larger operating safety margin.
C. Caution: Data assumes that the rectifier is mounted with thermally conductive grease to achieve $R_{thCS}$ = 0.50 deg. C/W.

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1N6095 & 96 Series

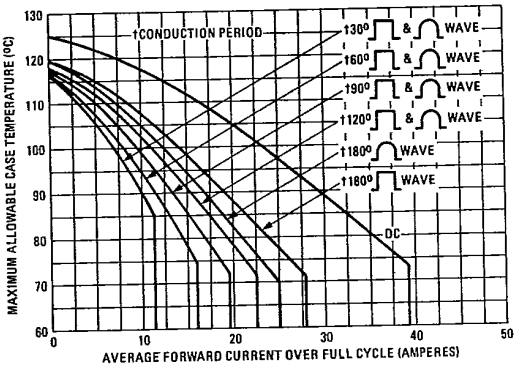


Fig. 9 – Average Forward Current Vs. Case Temperature

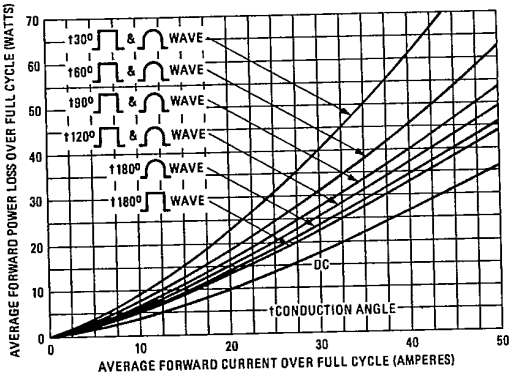


Fig. 10 – Maximum Average Forward Power Loss Vs. Average Forward Current

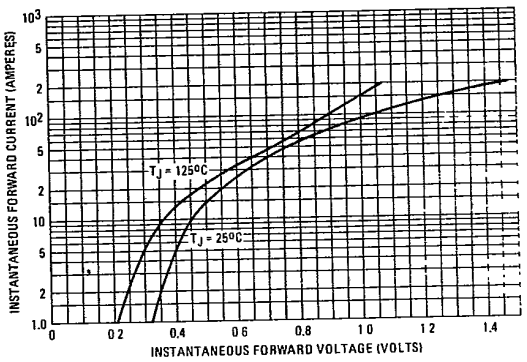


Fig. 11 – Maximum Forward Voltage Vs. Forward Current

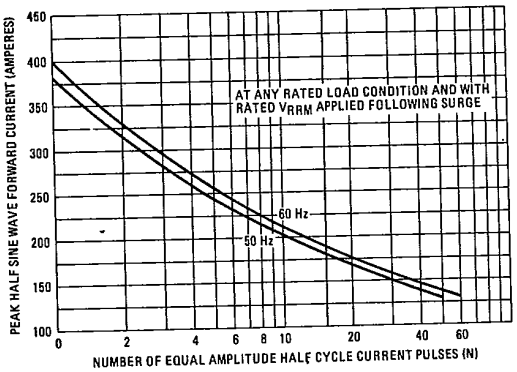


Fig. 12 – Maximum Non-Repetitive Surge Current Vs. Number of Cycles

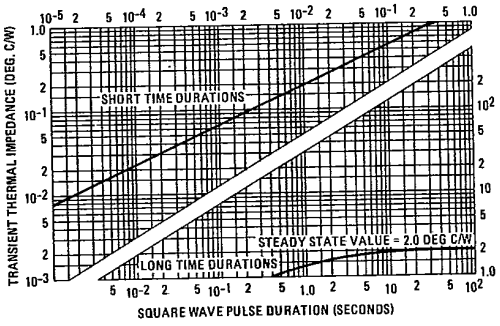


Fig. 13 – Maximum Transient Thermal Impedance, Junction-to-Case, Vs. Pulse Duration

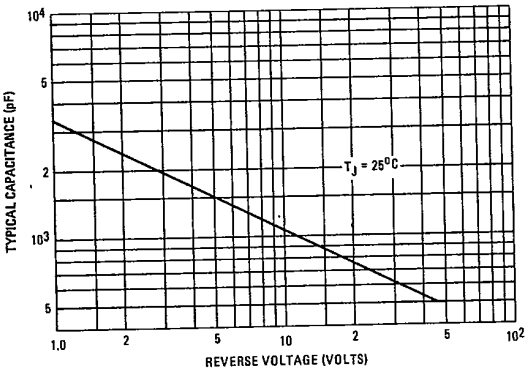


Fig. 14 – Typical Capacitance Vs. Reverse Voltage

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1N6095 & 6 Series

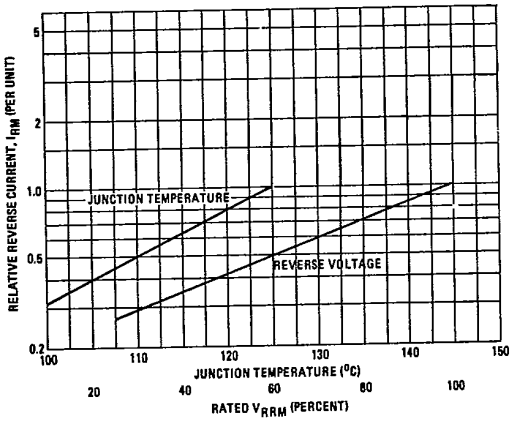



Fig. 15 – Typical Variation of Reverse Current Vs. Junction Temperature and Reverse Voltage

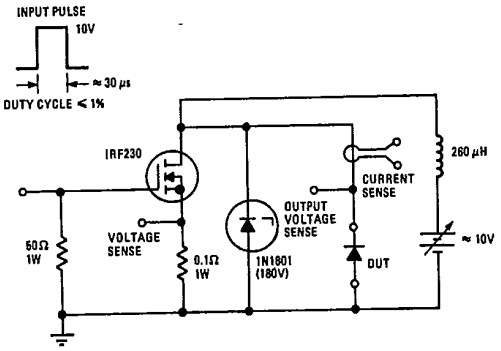
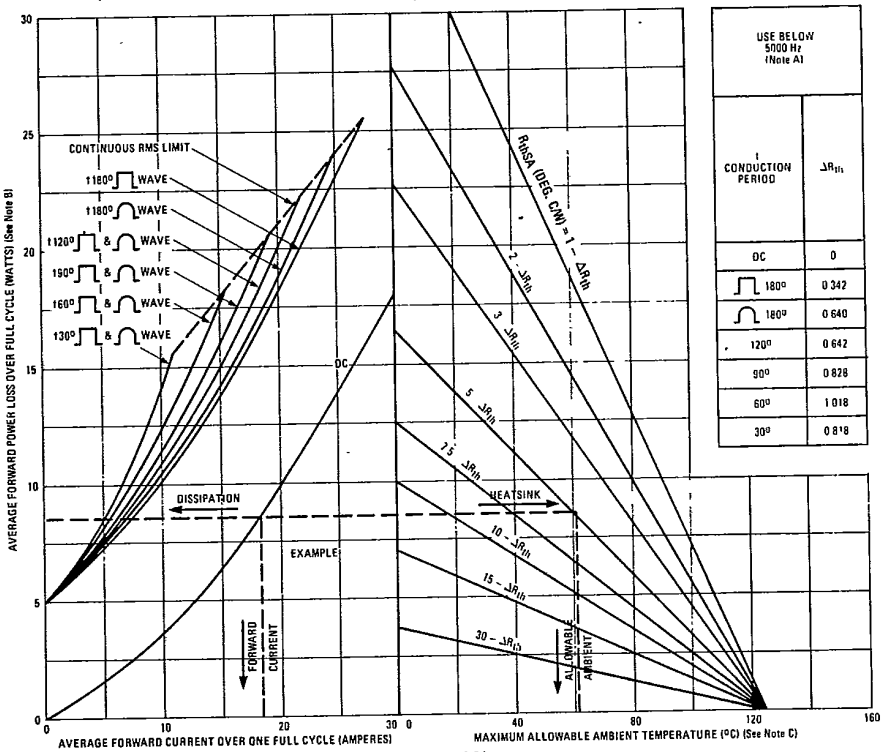



Fig. 16 – $I_{RRM}$ Test Circuit




| USE BELOW 5000 Hz (Note A) | |
|---|---|
| t CONDUCTION PERIOD | $\Delta R_{th}$ |
| DC | 0 |
| 180° | 0.342 |
| 180° | 0.640 |
| 120° | 0.642 |
| 90° | 0.828 |
| 60° | 1.018 |
| 30° | 0.818 |

Fig. 17 – Thermal Nomogram

Notes: A. Maximum allowable heatsink thermal resistance, $R_{thSA}$, equals the graph value minus the $\Delta R_{th}$ factor which allows for instantaneous $T_J$ excursion. At frequencies above 5000 Hz, $\Delta R_{th}$ becomes essentially zero and can be ignored.

B. The total power dissipation curves assume the worst case reverse conditions of halfwave (180°) rectangular reverse voltage, full rated $V_R$, and $T_J$ = 125°C. Lower reverse power losses allow higher operating ambient, smaller heatsinks or larger operating safety margin.

C. Caution. Data assumes that the rectifier is mounted with thermally conductive grease to achieve $R_{thCS}$ = 0.50 deg C/W