Data Sheet No. PD-2.032D

T-03-21

INTERNATIONAL RECTIFIER IOR

50HQ, 1N6097 & 98 SERIES

50 and 60 Amp Schottky Power Rectifiers

Major Ratings and Characteristics

Characteristic	50HQ	1N6097-98	Units
$I_{F(AV)}$			
@ 180° Rectangular	60	55.5	A
@ 180° Half Sine Wave	54	50*	A
I_{FSM}			
@ 50 Hz	765		A
@ 60 Hz	800	800*	A
I^2t			
@ 50 Hz	2900		A^2s
@ 60 Hz	2650		A^2s
$I^2\sqrt{t}$	41,000		$A^2\sqrt{s}$
V_{RWM} (1)	20 to 45	30* & 40*	V
C_t @ -5V	2900	7000*†	pF
T_J	-65 to 150	-65* to 125*	°C

*JEDEC Registered Value (1) $V_{RWM} = V_{RRM}$ for 1N6097 & 98.
†$V_R = 1V$

Description/Features

The 50HQ Schottky rectifier series is designed to operate at maximum rated junction temperature with no voltage derating. In addition to improved performance characteristics, these rugged devices feature guard ring construction to protect against reverse energy transients. Additionally, the 50HQ series offers a 20% safety margin for a pulse over the working peak reverse voltage rating to protect against voltage transients.

Applications for the 50HQ Schottky rectifiers include both existing and new switching power supply designs.

- Ultra fast switching.
- Extremely low V_F.
- Excellent parameter stability over temperature 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-203AB (DO-5) package.
- Can be supplied to meet stringent military, aerospace and other high-reliability requirements.

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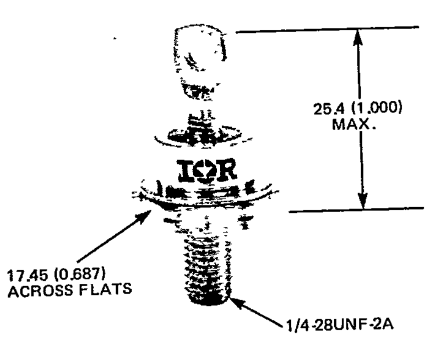
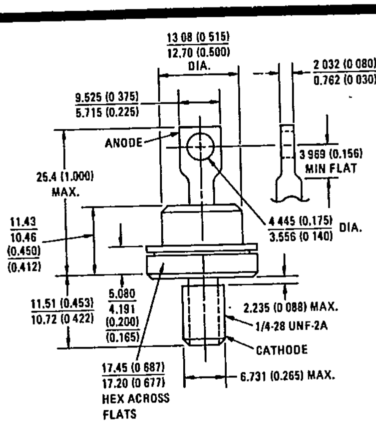
CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)
Dimensions in Millimeters and (Inches)

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VOLTAGE RATINGS

Part Numbers		V_{RWM} – Max. Working Peak Reverse Voltage (V) ① ④	V_{RRM} – Max. Repetitive Peak Reverse Voltage (V) tp = 200 ns Max. ② ⑤ ⑥	V_R – Max. DC Reverse Voltage (V) ③
50HQ020	–	20	24	20
50HQ030	1N6097	30*	36*	30*
50HQ035	–	35	42	35
50HQ040	1N6098	40*	48*	40*
50HQ045	–	45	54	45

ELECTRICAL SPECIFICATIONS

		50HQ	1N6097 & 98	Units	Conditions
$I_{F(AV)}$	Max. average forward current	60	55.5	A	180° conduction @ T_C = –65 to 96°C for 50HQ, T_C = –65 to 74°C for 1N6097-98, rectangular waveform
		54	50*	A	180° conduction @ T_C = –65 to 93°C for 50HQ, T_C = –65 to 70°C for 1N6097-98, sinusoidal waveform
I_{FSM}	Max. peak one cycle, non-repetitive surge current	765	765	A	50 Hz half sine wave, or 6 ms rectangular pulse, following any rated load condition and with rated V_{RWM} applied following surge. ④
		800	800*	A	60 Hz half sine wave, or 5 ms rectangular pulse, following any rated load condition and with rated V_{RWM} applied following surge. ④
		910	910	A	50 Hz: V_{RWM} following surge = 0, initial T_J = 150°C for 50HQ, initial T_J = 125°C for 1N6097-98 ④
		950	950	A	60 Hz
I^2t	Max. I^2t capability for fusing	2900	2900	A^2s	t = 10 ms: Rated V_{RWM} applied following surge, initial T_J = 150°C for 50HQ, initial T_J = 125°C for 1N6097 ④
		2650	2650	A^2s	t = 8.3 ms
I^2t	Max. I^2t capability for individual device fusing	4100	4100	A^2s	t = 10 ms: V_{RWM} following surge = 0, initial T_J = 150°C for 50HQ, initial T_J = 125°C for 1N6097 & 98.
		3750	3750	A^2s	t = 8.3 ms
$I^2\sqrt{t}$	Max. $I^2\sqrt{t}$ for individual device fusing ⑦	41,000	41,000	$A^2\sqrt{s}$	t = 0.1 to 10 ms, initial T_J = 150°C for 50HQ and 125°C for 1N6097 & 98. V_{RWM} following surge = 0.
V_{FM}	Max. peak forward voltage	0.50	0.60*	V	T_J = 25°C, I_{FM} = 35A. For 1N6097 & 98: I_{FM} = 10A
		0.48	–	V	T_J = 25°C, I_{FM} = 30A.
		0.52	–	V	T_J = 25°C, I_{FM} = 40A.
		0.59	0.68	V	T_J = 25°C, I_{FM} = 60A.
		0.77		V	T_J = 25°C, rated $I_{F(AV)}$ (120A peak), 180° rectangular waveform
		0.65	0.86*	V	For 50HQ: T_J = 150°C, rated $I_{F(AV)}$ (120A peak), 180° rectangular waveform. For 1N6097 & 98: T_C = 70°C, rated $I_{F(AV)}$ (160A peak), 180° half sine wave.
I_{RM}	Max. peak reverse current	50	75	mA	T_J = 25°C, Max. rated V_{RWM} ④
		200	250*	mA	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. 17 for test circuit
C_t	Max. capacitance	2900	7000*	pF	T_C = 25°C, V_R = 5 Vdc for 50HQ, V_R = 1 Vdc for 1N6097 & 98. 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

* JEDEC registered Valves

① T_C = -65°C to 141°C, 180° conduction for 50HQ and T_C = -65°C* to 122°C* for 1N6097 & 98

② T_C = 0°C to 141°C, 180° conduction for 50HQ and T_C = -65°C* to 122°C* for 1N6097 & 98

③ T_C = -65°C to 120°C for 50HQ and T_C = -65°C* to 115°C* for 1N6097 & 98

④ V_{RWM} = V_{RRM} for 1N6097 & 98

⑤ V_{RRM} = V_{RSM} for 1N6097 & 98

⑥ Applicable to 50HQ only.

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

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THERMAL-MECHANICAL SPECIFICATIONS

T_J	Max. operating junction temperature range	-65 to 150	-65* to 125*	°C	
T_{stg}	Max. storage temperature range	-65 to 150	-65* to 125*	°C	
R_{thJC}	Max. thermal resistance, junction-to-case	1.0*		deg C/W	DC Operation
R_{thCS}	Max. thermal resistance, case-to-sink	0.25		deg C/W	Mounting surface flat, smooth, and greased
T	Mounting torque Min.	2.26 (20)		N • m	Non-lubricated threads
	Max.	3.39 (30)		(lbf • in)	
wt	Approximate weight	15.6 (0.55)		g (oz.)	
	Case Style	DO-203AB (DO-5)			

*JEDEC registered value.

1N6097 & 98 Series

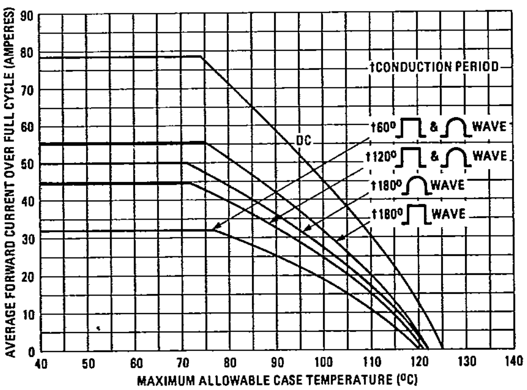

Fig. 1 — Average Forward Current Vs. Case Temperature

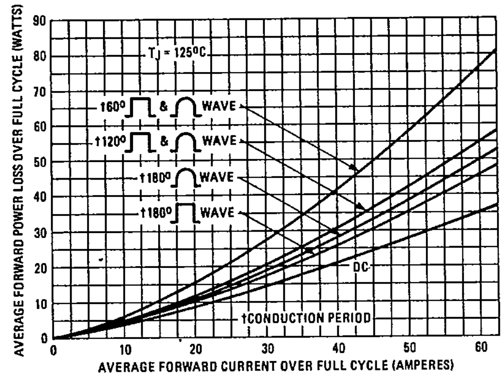

Fig. 2 — Maximum Average Forward Power Loss Vs. Average Forward Current

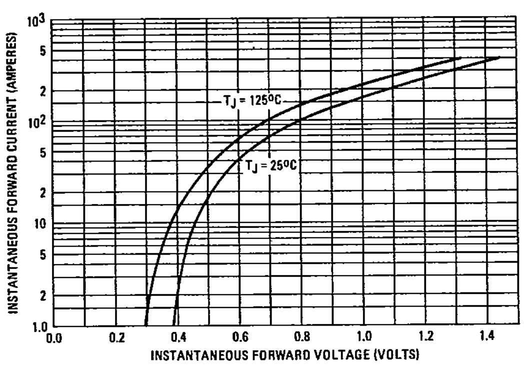

Fig. 3 — Maximum Forward Voltage Vs. Forward Current

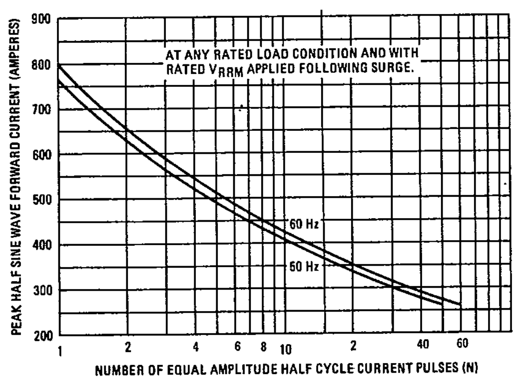

Fig. 4 — Maximum Non-Repetitive Surge Current Vs. Number of Cycles

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1N6097 & 98 Series

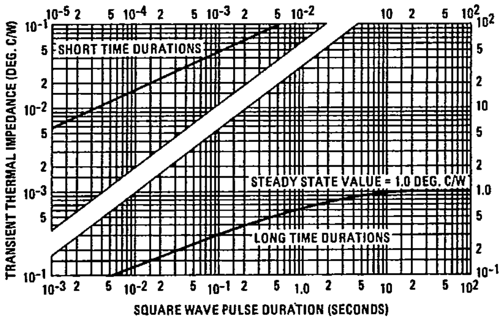

Fig. 5 — Maximum Transient Thermal Impedance, Junction-to-Case, Vs. Pulse Duration

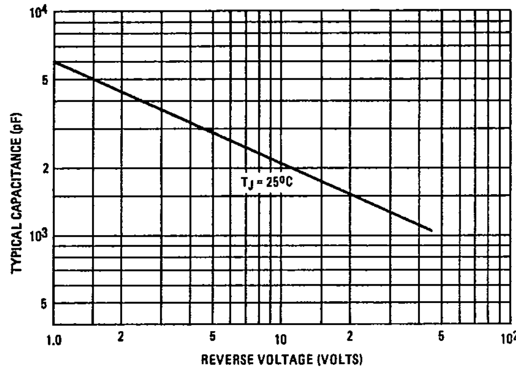

Fig. 6 — Typical Capacitance Vs. Reverse Voltage

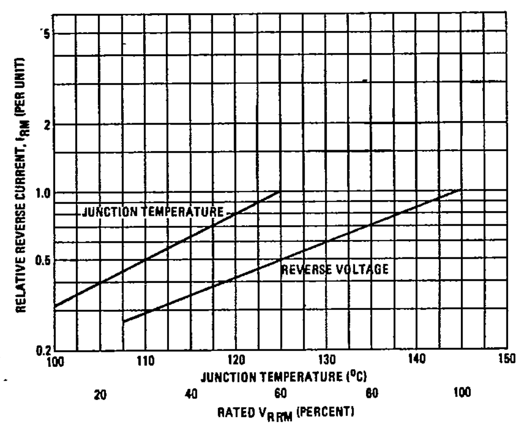

Fig. 7 — Typical Variation of Reverse Current Vs. Junction Temperature and Reverse Voltage

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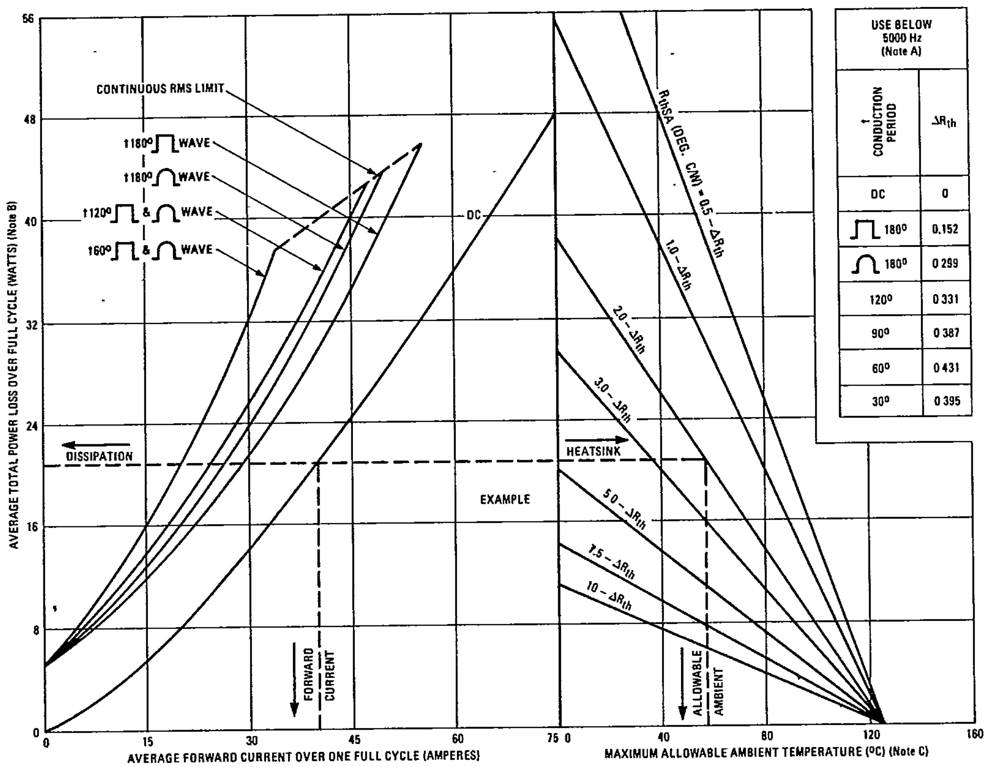

USE BELOW 5000 Hz (Note A)	
† CONDUCTION PERIOD	ΔR_{th}
DC	0
⎍ 180°	0.152
⌒ 180°	0.299
120°	0.331
90°	0.387
60°	0.431
30°	0.395

Fig. 8 — Thermal Nomogram

Notes: A. Maximum allowable heatsink thermal resistance, R_{thSA}, equals the graph value minus the ΔR_{th} factor which allows for instantaneous T_J excursion. At frequencies above 5000 Hz, ΔR_{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 25 deg C/W.

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50HQ Series

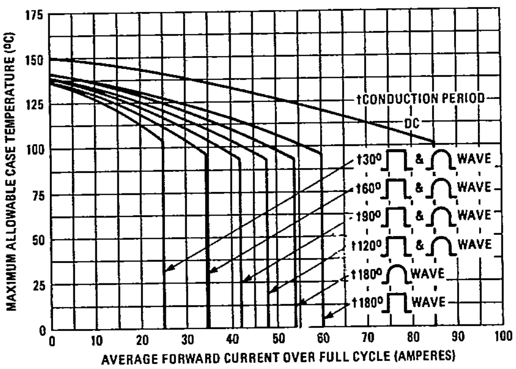

Fig. 9 – Average Forward Current Vs. Case Temperature

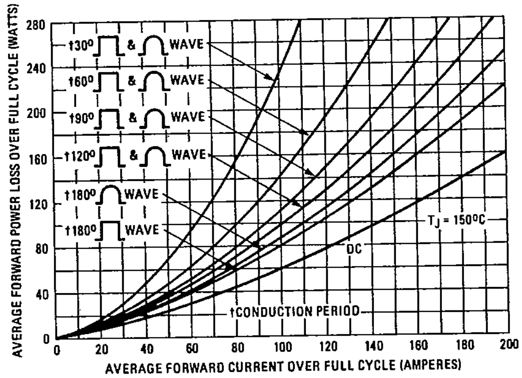

Fig. 10 – Maximum Average Forward Power Loss Vs. Average Forward Current

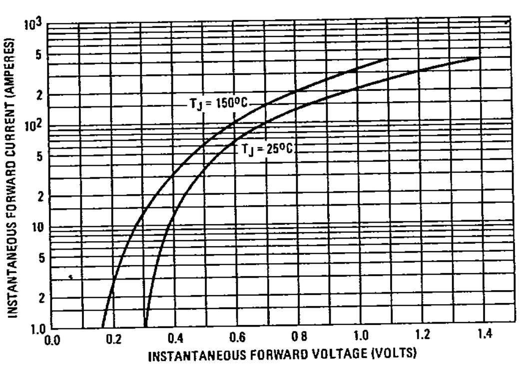

Fig. 11 – Maximum Forward Voltage Vs. Forward Current

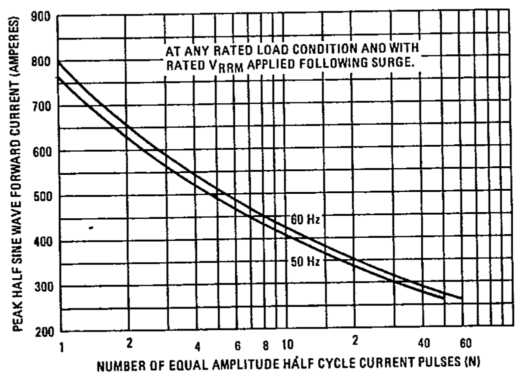

Fig. 12 – Maximum Non-Repetitive Surge Current Vs. Number of Cycles

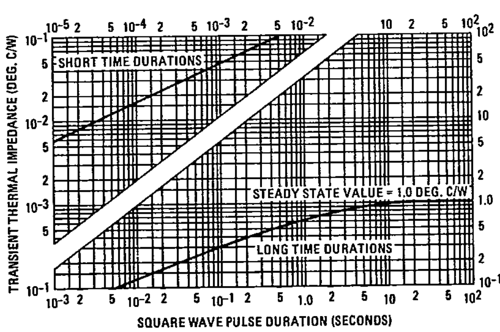

Fig. 13 – Maximum Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

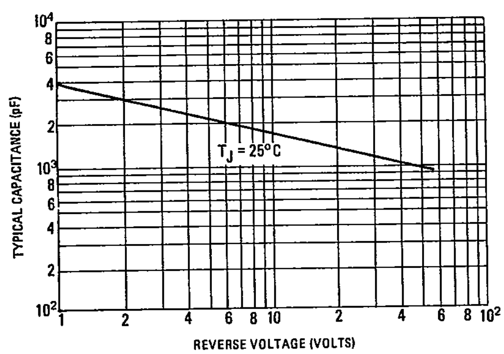

Fig. 14 – Typical Capacitance Vs. Reverse Voltage

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50HQ Series

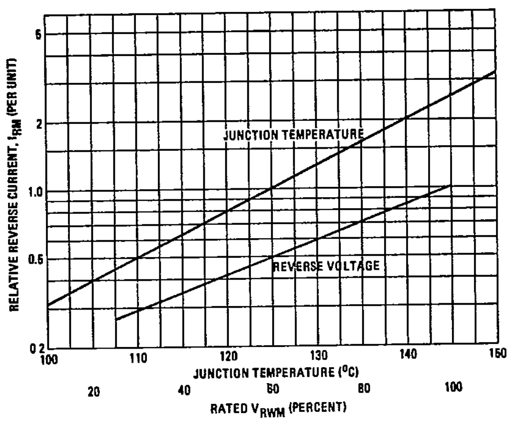
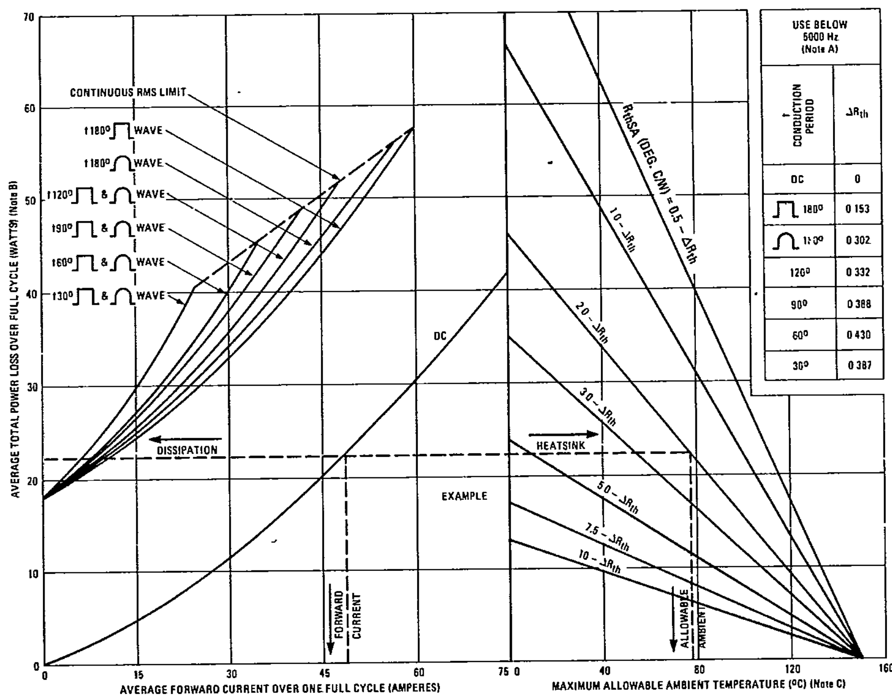


Fig. 15 — Typical Variation of Reverse Current Vs. Junction Temperature and Reverse Voltage



USE BELOW 5000 Hz (Note A)

CONDUCTION PERIOD	ΔR_{th}
DC	0
180° (rectangular)	0.153
180° (sine)	0.302
120°	0.332
90°	0.388
60°	0.430
30°	0.387

Fig. 16 Thermal Nomogram

Notes: A. Maximum allowable heatsink thermal resistance, R_{thSA}, equals the graph value minus the ΔR_{th} factor which allows for instantaneous T_J excursion. At frequencies above 5000 Hz, ΔR_{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} = 0.25 deg. C/W.

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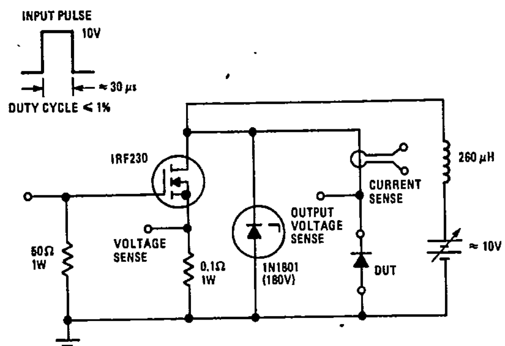

Fig. 17 — I_{RRM} Test Circuit