

# **International Rectifier**

**RELIABILITY REPORT 0209**

**DO5 PACKAGE DIODES**

**GENERATION II**

**QUALIFICATION REPORT**

**International Rectifier Corporation Italy  
RELIABILITY LABORATORY**

# INTERNATIONAL RECTIFIER

## CONTENTS

### Section

- |          |   |
|----------|---|
| <b>1</b> | <b>Introduction and Purpose:</b>  |
| <b>2</b> | <b>Issue:</b>   |
| <b>3</b> | <b>Process Description:</b>   |
| <b>4</b> | <b>Executive Summary:</b>   |
| <b>5</b> | <b>Environmental Stress Test Plan:</b>  |
| <b>6</b> | <b>Criteria for Qualification:</b>  |
| <b>7</b> | <b>Summary of Environmental Stress Test Results on 95PF(R)120 and<br/>50PF(R)120:</b> |

---

F.Giacosa  
Reliability Engineer

---

G. Masini  
Reliability & F/A Manager

# INTERNATIONAL RECTIFIER

## 1. Introduction and Purpose:

The purpose of this qualification program is to produce test data and relevant information to confirm that the new DO5 plastic diode assembled using glass passivated chip, meet the requirements for Market Introduction and IR internal Reliability Standards.

The test vehicle are 95PF(R)120 and 50PF(R)120.

The data and report are generated by IRCI Reliability Laboratory.

## 2. Issue:

The results collected in this report are sufficient to release a Final Qualification Approval of above mentioned devices.

The Final Qualification Approval is justified by environmental testing, presented in this report, which ensures that the product under consideration fulfil the requirements for Market Introduction and IRCI's reliability requirements.

**The Final Qualification is released for** part number under mentioned:

**All plastic DO5 series**

## 3. Process Description:

The product family under consideration uses glass passivated chip and plastic ring box.

## 4. Executive Summary:

Environmental testing was performed using 3 lots of wafers diffused in three different time. Each diffusion lot was assembled in 95PF(R)120, and 50PF(R)120 in three different times.

Environmental testing included: High Temperature Reverse Bias (HTRB), Temperature Cycling Test (T/C), Moisture Resistance Test (85/85) and Power Cycling Test (P/C).

## 5. Environmental Stress Test Plan:

Part Number	Stress	Test Conditions	Sample Size/Lot	Lots No	Read-out Intervals
95PF(R)120	HTRB	$V_{RR} = 1200 V_{pk}$ @ $T_j = 125^{\circ}C$ 1000 hours	10	3	0, 24, 168, 500, 1000 hours
95PF(R)120	T/C	$-40^{\circ}C / 125^{\circ}C$ $t_{cycle} = 60'$ 200 cycles	10	3	0, 50, 100, 200 cycles
95PF(R)120	85/85	RH = 85% ; $T = 85^{\circ}C$ 1000 hours	10	3	0, 168, 500, 1000 hours
95PF(R)120	P/C	? $T_j = 100^{\circ}C$ $t_{cycle} = 60'$ 200 cycles	10	1	0, 2500, 5000, 10000 cycles
50PF(R)120	HTRB	$V_{RR} = 1200 V_{pk}$ @ $T_j = 125^{\circ}C$ 1000 hours	10	3	0, 24, 168, 500, 1000 hours
50PF(R)120	T/C	$-40^{\circ}C / 125^{\circ}C$ $t_{cycle} = 60'$ 200 cycles	10	3	0, 50, 100, 200 cycles
50PF(R)120	85/85	RH = 85% ; $T = 85^{\circ}C$			

# INTERNATIONAL RECTIFIER

		1000 hours	10	3	0, 168, 500, 1000 hours
--	--	------------	----	---	-------------------------

## 6. Criteria for qualification:

Devices are expected to perform with maximum one failure on these stresses.

## 7. Summary of Environmental Stress Test Results:

- 7.1 High Temperature Reverse Bias (HTRB)
- 7.2 Temperature Cycling Test (T/C)
- 7.3 Moisture Resistance Test (85/85)
- 7.4 Power Cycling Test (P/C)

### 7.1 HIGH TEMPERATURE REVERSE BIAS (HTRB)

**Test conditions :**

Temperature  $T_j = 125\text{ }^\circ\text{C}$   
 Bias  $V_{RR} = 1200\text{ V}_{pk} = 100\% V_{RR\text{ max}}$

**Test Completed after**

1000 hours

**Measured parameter**

**Failure Criteria**

$V_F @ I_{F\text{ max}}, T_{\text{room}}$

Upper Bulletin Limit (UBL)

$I_{rr} @ V_{rr\text{ max}}, T_{j\text{ max}}$

UBL or increase 4 times versus initial values

Part Number	Assy Lot Number	Sample Size	No. of Test Failures @ hours				Total Devices Failed	
			0	24	168	500	1000	

## INTERNATIONAL RECTIFIER

95PF120	A	10	0	0	0	0	0	<b>0</b>
95PF120	B	10	0	0	0	0	0	<b>0</b>
95PF120	C	10	0	0	0	0	0	<b>0</b>
95PFR120	A	10	0	0	0	0	0	<b>0</b>
95PFR120	B	10	0	0	0	0	0	<b>0</b>
95PFR120	C	10	0	0	0	0	0	<b>0</b>
50PF120	A	10	0	0	0	0	0	<b>0</b>
50PF120	B	10	0	0	0	0	0	<b>0</b>
50PF120	C	10	0	0	0	0	0	<b>0</b>
50PFR120	A	10	0	0	0	0	0	<b>0</b>
50PFR120	B	10	0	0	0	0	0	<b>0</b>
50PFR120	C	10	0	0	0	0	0	<b>0</b>

The results collected show zero failures to the reliability limits.

# INTERNATIONAL RECTIFIER

## 7.2 TEMPERATURE CYCLING TEST (T/C)

**Test conditions :**

Temperature: -40°C / 125°C  
Time: 30' each chamber

**Test Completed after**

200 cycles

**Measured parameter**

**Failure Criteria**

$V_F @ I_{F \max}, T_{\text{room}}$

UBL or increase more than 10% versus initial values.

$I_{rr} @ V_{rr \max}, T_{j \max}$

UBL

Part Number	Assy Lot Number	Sample Size	No. of Test Failures @ cycles				Total Devices Failed
			0	50	100	200	
95PF120	A	10	0	0	0	0	<b>0</b>
95PF120	B	10	0	0	0	0	<b>0</b>
95PF120	C	10	0	0	0	0	<b>0</b>
95PFR120	A	10	0	0	0	0	<b>0</b>
95PFR120	B	10	0	0	0	0	<b>0</b>
95PFR120	C	10	0	0	0	0	<b>0</b>
50PF120	A	10	0	0	0	0	<b>0</b>
50PF120	B		0	0	0	0	<b>0</b>
50PF120	C	10	0	0	0	0	<b>0</b>
50PFR120	A	10	0	0	0	0	<b>0</b>
50PFR120	B	10	0	0	0	0	<b>0</b>
50PFR120	C	10	0	0	0	0	<b>0</b>

The results collected show zero failures to the reliability limits.

# INTERNATIONAL RECTIFIER

## 7.3 MOISTURE RESISTANCE TEST (85/85)

**Test conditions :**

Temperature      T = 85 °C  
 Humidity            RH = 85%

**Test Completed after**

1000 hours

**Measured parameter**

**Failure Criteria**

$V_F @ I_{F \max}, T_{\text{room}}$

UBL

$I_{rr} @ V_{rr \max}, T_{j \max}$

UBL

Part Number	Assy Lot Number	Sample Size	No. of Test Failures @ hours					Total Devices Failed
			0	24	168	500	1000	
95PF120	A	10	0	0	0	0	0	<b>0</b>
95PF120	B	10	0	0	0	0	0	<b>0</b>
95PF120	C	10	0	0	0	0	0	<b>0</b>
95PFR120	A	10	0	0	0	0	0	<b>0</b>
95PFR120	B	10	0	0	0	0	0	<b>0</b>
95PFR120	C	10	0	0	0	0	0	<b>0</b>
50PF120	A	10	0	0	0	0	0	<b>0</b>
50PF120	B		0	0	0	0	0	<b>0</b>
50PF120	C	10	0	0	0	0	0	<b>0</b>
50PFR120	A	10	0	0	0	0	0	<b>0</b>
50PFR120	B	10	0	0	0	0	0	<b>0</b>
50PFR120	C	10	0	0	0	0	0	<b>0</b>

The results collected show zero failures to the reliability limits.

# INTERNATIONAL RECTIFIER

## 7.4 POWER CYCLING TEST (P/C)

**Test conditions :**

Temperature      ?  $T_j = 80\text{ }^\circ\text{C}$   
 Time                 $t_{on} = t_{off} = 2'$   
 Current:             $I_{AV} = 27\text{ A}$

**Test Completed after**

10000 cycles

**Measured parameter**

**Failure Criteria**

$V_F @ I_{F\text{ max}}, T_{\text{room}}$

UBL or increase more than 10% versus initial values

$I_{rr} @ V_{rr\text{ max}}, T_{j\text{ max}}$

UBL

Part Number	Assy Lot Number	Sample Size	No. of Test Failures @ cycles				Total Devices Failed
			0	2500	5000	10000	
95PF120	A	10	0	0	0	0	<b>0</b>
95PFR120	A	10	0	0	0	0	<b>0</b>

The results collected show zero failures to the reliability limits.