# 一、IP名称: XRN011EFDCLKOSC\_LPMFA

# 1.测试总结

**8MHz:**EN\_LV=0🡪1, IOP\_SEL[1:0]=2’b00,FREQ\_SEL[4:0]=5’b00000, FREQ\_CTUNE[5:0]=**6’b100110**, FREQ\_FTUNE[5:0]=6’b100000, TEMPRATE[3:0]=**4’b1010**, 其他设置为默认值。

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **OSC 参数** | **测试条件** | **规格范围** | | | **测量范围** | | | **单位** | **结果** |
| **最小值** | **典型值** | **最大值** | **最小值** | **典型值** | **最大值** |  |  |
| 频率 | **调整前**  (NVNT) | 6 | 8 | 10 | 8.02 | - | 8.77 | MHz | 通过 |
| 调整后  (-40℃~125℃, LV~HV) | 7.6 | 8.00 | 8.4 | 7.70 | 8 | 8.037 | MHz | 通过 |
| 温度系数 | 调整后  (-40℃~125℃, LV~HV) | -5 |  | 5 | -3.74 | - | 0.46 | % | 通过 |
| VCCA\_OSC工作电流 | 调整后  (-40℃~125℃, LV~HV) | - | 18.00 | 22.00 | - | 13.28 | 16.86 | uA | 通过 |
| VDDL\_OSC工作电流 | 调整后  (-40℃~125℃, LV~HV) | - | 13.00 | 19.00 | - | 7.7 | 13.73 | uA | 通过 |
| Tsu | 调整后  (-40℃~125℃, LV~HV) | - | 6.88 | 13.14 | - | 6.07 | 8.23 | us | 通过 |
| Tostab | 调整后  (-40℃~125℃, LV~HV) | - | 12.13 | 18.04 | - | 9.88 | 12.87 | us | 通过 |
| 占空比 | 调整后  (-40℃~125℃, LV~HV) | 45 | 50 | 55 | 46.9 | 51.5 | 53.4 | % | 通过 |

**32MHz:**EN\_LV=0🡪1,IOP\_SEL[1:0]=2’b00,FREQ\_SEL[4:0]=5’b00111, FREQ\_CTUNE[5:0]=**6’b100110**, FREQ\_FTUNE[5:0]=6’b100000, TEMPRATE[3:0]=**4’b1100,** other set default.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **OSC 参数** | **测试条件** | **规格范围** | | | | | **测量范围** | | | | | **单位** | **结果** |
| **最小值** | | **典型值** | | **最大值** | **最小值** | | **典型值** | | **最大值** |  |  |
| 频率 | **调整前**  (NVNT) | 24 | 32 | | 40 | | 32.43 | - | | 34.53 | | MHz | 通过 |
| 调整后  (-40℃~125℃, LV~HV) | 30.4 | 32 | | 33.6 | | 30.74 | 31.96 | | 32.17 | | MHz | 通过 |
| 温度系数 | 调整后  (-40℃~125℃, LV~HV) | -5 |  | | 5 | | -3.95 | - | | 0.53 | | % | 通过 |
| VCCA\_OSC工作电流 | 调整后  (-40℃~125℃, LV~HV) | - | 48.00 | | 55.00 | | - | 43.6 | | 50.05 | | uA | 通过 |
| VDDL\_OSC工作电流 | 调整后  (-40℃~125℃, LV~HV) | - | 32.00 | | 38.00 | | - | 27.3 | | 32.84 | | uA | 通过 |
| Tsu | 调整后  (-40℃~125℃, LV~HV) | - | 2.75 | | 5.67 | | - | 2.01 | | 2.79 | | us | 通过 |
| Tostab | 调整后  (-40℃~125℃, LV~HV) | - | 4.26 | | 7.47 | | - | 5 | | 6.04 | | us | 通过 |
| 占空比 | 调整后  (-40℃~125℃, LV~HV) | 45 | 50 | | 55 | | 45.4 | 53.5 | | 54.9 | | % | 通过 |

**48MHz:**EN\_LV=0🡪1,IOP\_SEL[1:0]=2’b00,FREQ\_SEL[4:0]=5’b01111, FREQ\_CTUNE[5:0]=**6’b100110**, FREQ\_FTUNE[5:0]=6’b100000, TEMPRATE[3:0]=**4’b1010,** other set default.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **OSC 参数** | **测试条件** | **规格范围** | | | | | **测量范围** | | | | | **单位** | **结果** |
| **最小值** | | **典型值** | | **最大值** | **最小值** | | **典型值** | | **最大值** |  |  |
| 频率 | **调整前**  (NVNT) | 36 | 48 | | 60 | | 48.95 |  | | 50.92 | | MHz | 通过 |
| 调整后  (-20℃~85℃, LV~HV) | 45.6 | 48 | | 50.4 | | 46.85 | 48.01 | | 48.41 | | MHz | 通过 |
| 温度系数 | 调整后  (-20℃~85℃, LV~HV) |  |  | |  | | -2.40 |  | | 0.74 | | % | 通过 |
| VCCA\_OSC工作电流 | 调整后  (-20℃~85℃, LV~HV) | - | 70.00 | | 85.00 | | 60.11 | 67.69 | | 73.12 | | uA | 通过 |
| VDDL\_OSC工作电流 | 调整后  (-20℃~85℃, LV~HV) | - | 45.00 | | 60.00 | | 37.47 | 41.67 | | 47.60 | | uA | 通过 |
| Tsu | 调整后  (-20℃~85℃, LV~HV) | - | 3.79 | | 6.29 | | 1.44 | 1.72 | | 2.42 | | us | 通过 |
| Tostab | 调整后  (-20℃~85℃, LV~HV) | - | 2.38 | | 5.01 | | 2.28 | 2.60 | | 4.39 | | us | 通过 |
| 占空比 | 调整后  (-20℃~85℃, LV~HV) | 45 | 50 | | 55 | | 46.1 | 46.5 | | 53.12 | | % | 通过 |

**64MHz:**EN\_LV=0🡪1,IOP\_SEL[1:0]=2’b00,FREQ\_SEL[4:0]=5’b11111, FREQ\_CTUNE[5:0]=**6’b100110**, FREQ\_FTUNE[5:0]=6’b100000, TEMPRATE[3:0]=**4’b1100,** other set default.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **OSC 参数** | **测试条件** | **规格范围** | | | | | **测量范围** | | | | | **单位** | **结果** |
| **最小值** | | **典型值** | | **最大值** | **最小值** | | **典型值** | | **最大值** |  |  |
| 频率 | **调整前**  (NVNT) | 48 | 64 | | 80 | | 65.36 | - | | 68.7 | | MHz | 通过 |
| 调整后  (-40℃~125℃, LV~HV) | 60.8 | 64.00 | | 67.2 | | 60.84 | 64.11 | | 64.95 | | MHz | 通过 |
| 温度系数 | 调整后  (-40℃~125℃, LV~HV) | -5 | - | | 5 | | -4.93 | - | | 1.48 | | % | 通过 |
| VCCA\_OSC工作电流 | 调整后  (-40℃~125℃, LV~HV) | - | 100.0 | | 110.0 | | - | 94.4 | | 101.35 | | uA | 通过 |
| VDDL\_OSC工作电流 | 调整后  (-40℃~125℃, LV~HV) | - | 60.0 | | 70.0 | | - | 56.7 | | 64.8 | | uA | 通过 |
| Tsu | 调整后  (-40℃~125℃, LV~HV) | - | 2.16 | | 4.65 | | - | 1.53 | | 2.2 | | us | 通过 |
| Tostab | 调整后  (-40℃~125℃, LV~HV) | - | 3.23 | | 6.02 | | - | 3.76 | | 4.63 | | us | 通过 |
| 占空比 | 调整后  (-40℃~125℃, LV~HV) | 45 | 50 | | 55 | | 42.2 | 53.7 | | 58.1 | | % | FAIL |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| VCCA\_OSC漏电流 | (-40℃~125℃, LV~HV) | - | 2 | 50 | - | ＜10 | 30 | nA | 通过 |
| VDDL\_OSC漏电流 | (-40℃~125℃, LV~HV) | - | 30 | 3000 |  | 20 | 1310 | nA | 通过 |

注释:

**[1].典型选取的是TT11样本@NVNT的数据。**

# 2.测试报告一览表

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **项目** | | | **实例** | **是** | **否** |
| 1 | 代工厂名称 | | NEXCHIP | 是 |  |
| 2 | 工艺 | | NEXCHIP 110nm E-Flash低功耗工艺 | 是 |  |
| 3 | 核心供电电压&IO供电电压 | | 1.5V/3.3V | 是 |  |
| 4 | 金属堆叠选项 | | 1P5M | 是 |  |
| 5 | 参照 | 数据表 | XRN011EFDCLKOSC\_LPMFA\_V1P0\_数据手册\_V0.3 | 是 |  |
| 试验规格 | XRN011EFDCLKOSC\_LPMFA\_V1P0\_测试方案\_V0.1 | 是 |  |
| 6 | 样本编号和列表 | | 总共9个样品，  良率测试:9个样品  特性测试:9个样品 | 是 |  |
| 7 | 工艺角 | | TT SS and FF | 是 |  |
| 8 | 温度变量 | | -40℃, -20℃,25℃,85℃ 125℃ | 是 |  |
| 9 | 电压变量 | | VCCA\_OSC: 2.0V, 3.3V, 5.5V  VDDL\_OSC: 1.35V, 1.5V, 1.65V | 是 |  |
| 10 | 静电放电 | | **不需要静电放电测试** | 是 |  |
| 11 | 默认测试条件(设置) | | 1.5V/3.3V, 25℃ |  |  |

# 3.知识产权信息



## 功能描述

XRN011EFDCLKOSC \_ LPMFA是一款片内RC振荡器，输出可供选择的8兆赫兹/16兆赫兹/24兆赫兹/32兆赫兹/48兆赫兹/64兆赫兹时钟。它基于NEXCHIP 110nm E-Flash低功耗工艺，包含振荡器频率微调模块，可以用作高精度振荡器。片上RC振荡器广泛应用于单片机系统。

## 特征

* 振荡器输出频率:8兆赫兹/16兆赫兹/24兆赫兹/32兆赫兹/48兆赫兹/64兆赫兹
* 精度±0.15% 手动微调后 @25°C, 3.3V

精度±1.50% 微调后 @ -40℃~100℃, 3.3V

精度±2.00% 微调后 @ -40℃~125℃, 3.3V

精度±5.00% 微调后 @ -40℃~125℃, 2.0V~5.5V

精度±1.50% 微调后 @ -40℃~125℃, 2.0V~3.63V

* 基于NEXCHIP 110nm E-Flash 低功耗工艺，支持1P5M及以上
* 工作结温:-40℃~+25℃~+125℃
* 尺寸: 263\*228=59

# 4．测试信息

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **项目** | | **信息** | | | | | | **评价** |
| 1 | IP 名称 | XRN011EFDCLKOSC\_LPMFA\_V1P0 | | | | | |  |
| 2 | 工艺角 | TT SS and FF | | | | | |  |
| 3 | 样本编号和列表 | TT11/TT12/TT13/SS1/SS2/SS3/FF1/FF2/FF3 | | | | | |  |
| 4 | 测试条件 | 条件 | 温度(℃) | | VCCA  （V） | | VDDL  （V） |  |
| LVLT | -40 | | 2 | | 1.35 |
| NVLT | -40 | | 3.3 | | 1.5 |
| HVLT | -40 | | 5.5 | | 1.65 |
| LVMT | -20 | | 2 | | 1.35 |
| NVMT | -20 | | 3.3 | | 1.5 |
| HVMT | -20 | | 5.5 | | 1.65 |
| LVNT | 25 | | 2 | | 1.35 |
| NVNT | 25 | | 3.3 | | 1.5 |
| HVNT | 25 | | 5.5 | | 1.65 |
| LVST | 85 | | 2 | | 1.35 |
| NVST | 85 | | 3.3 | | 1.5 |
| HVST | 85 | | 5.5 | | 1.65 |
| LVHT | 125 | | 2 | | 1.35 |
| NVHT | 125 | | 3.3 | | 1.5 |
| HVHT | 125 | | 5.5 | | 1.65 |
| 5 | 测试项目 | 整形 | | | | | |  |
| 频率 | | | | | |
| 占空比 | | | | | |
| 工作电流 | | | | | |
| 掉电泄漏 | | | | | |
| 启动时间 | | | | | |
| 稳定时间 | | | | | |
| 6 | 测试仪器 | 测试项 | | 生产商 | | 型号& SN | |  |
| 电流表 | | GW | | GDM-82469 CN861218 | |
| 电流表 | | GW | | GDM-82469 CN861205 | |
| 示波器 | | Keysight | | DSA-X91604A | |
| 高低温热流仪 | |  | | TPO4310 | |
| 电源 | | GW | | GPD-3303S GES919004 | |
| 7 | 测试工程师 | FQR/ZT/YX | | | | | |  |
| 8 | 测试日期 | 2020-10-13~2020-10-16,  2021-03-10~2021-03-12,  2021-05-10~2021/06-10. | | | | | |  |

# 5.检测方法

## 5.1 测试框图

****图.5.1 测试框图

## 5.1 检测方法

根据《XRN011EFDCLKOSC\_LPMFA\_V1P0\_测试计划\_V0.1》，所有测试项均已检测。

# 6.测试结果

## 6.1 良率测试结果

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **良率测试结果** | | | | | | | | |
| **TT11** | **TT12** | **TT13** | **SS1** | **SS2** | **SS3** | **FF1** | **FF2** | **FF3** |
| **取决于目标频率** | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 |

图.6.28占空比@64MHz

# 7．测试数据

## 调前频率

**表 7‑1 调前频率 @NVNT**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| FREQ\_SEL[4:0] | **频率(MHz)** | | | | | | | | |
| **TT1** | **TT2** | **TT3** | **SS1** | **SS2** | **SS3** | **FF1** | **FF2** | **FF3** |
| 5’b00000 | 8.77 | 8.77 | 8.77 | 8.15 | 8.47 | 8.41 | 8.57 | 8.10 | 8.29 |
| 5’b00111 | 34.53 | 34.53 | 34.53 | 32.99 | 33.82 | 33.62 | 34.00 | 32.54 | 33.16 |
| 5’b 01111 | 49.38 | 49.65 | 50.11 | 49.68 | 50.81 | 50.47 | 50.92 | 48.95 | 49.85 |
| 5’b11111 | 68.7 | 68.7 | 68.7 | 66.53 | 67.98 | 67.57 | 68.23 | 65.42 | 66.66 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| FREQ\_SEL[4:0] | **精度 (%)** | | | | | | | | |
| **TT1** | **TT2** | **TT3** | **SS1** | **SS2** | **SS3** | **FF1** | **FF2** | **FF3** |
| 5’b00000 | 9.625 | 9.625 | 9.625 | 1.875 | 5.875 | 5.125 | 7.125 | 1.250 | 3.625 |
| 5’b00111 | 7.906 | 7.906 | 7.906 | 3.094 | 5.688 | 5.062 | 6.250 | 1.688 | 3.625 |
| 5’b 01111 | 2.875 | 3.438 | 4.396 | 3.500 | 5.854 | 5.146 | 6.083 | 1.979 | 3.854 |
| 5’b11111 | 7.344 | 7.344 | 7.344 | 3.953 | 6.219 | 5.578 | 6.609 | 2.219 | 4.156 |

## 调后频率

**表7-2 调后频率 @(-40℃~25℃~125℃) 条件下.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **TT11** | | | **TT12** | | | **TT13** | | |
| **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** |
| **LVLT** | 7.98 | 31.88 | 64.63 | 7.96 | 31.99 | 64.79 | 7.91 | 31.87 | 64.87 |
| **NVLT** | 7.97 | 31.76 | 63.77 | 7.95 | 31.87 | 64.05 | 7.91 | 31.78 | 63.95 |
| **HVLT** | 7.94 | 31.67 | 63.36 | 7.90 | 31.72 | 63.60 | 7.86 | 31.64 | 63.36 |
| **LVNT** | 8.02 | 32.06 | 64.74 | 8.02 | 32.13 | 64.50 | 8.01 | 32.11 | 64.69 |
| **NVNT** | 8.00 | 31.96 | 64.11 | 8.01 | 31.99 | 64.1 | 7.99 | 32.00 | 64.05 |
| **HVNT** | 7.98 | 31.83 | 63.65 | 7.96 | 31.78 | 63.53 | 7.94 | 31.81 | 63.45 |
| **LVHT** | 7.93 | 31.66 | 63.83 | 7.86 | 31.20 | 62.70 | 7.87 | 31.34 | 63.34 |
| **NVHT** | 7.91 | 31.54 | 63.35 | 7.84 | 31.14 | 62.24 | 7.86 | 31.26 | 62.69 |
| **HVHT** | 7.86 | 31.36 | 62.78 | 7.75 | 30.76 | 61.20 | 7.76 | 30.88 | 61.61 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **SS1** | | | **SS2** | | | **SS3** | | |
| **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** |
| **LVLT** | 7.92 | 31.87 | 64.49 | 7.97 | 32.02 | 64.95 | 7.94 | 31.97 | 64.91 |
| **NVLT** | 7.93 | 31.84 | 63.64 | 7.97 | 31.94 | 63.75 | 7.94 | 31.92 | 63.71 |
| **HVLT** | 7.89 | 31.64 | 63.02 | 7.93 | 31.76 | 63.15 | 7.90 | 31.92 | 63.15 |
| **LVNT** | 8.01 | 32.11 | 64.70 | 8.04 | 32.17 | 64.88 | 8.02 | 32.15 | 64.81 |
| **NVNT** | 8.00 | 31.99 | 64.05 | 8.01 | 32.02 | 64.02 | 8.00 | 31.98 | 64.00 |
| **HVNT** | 7.94 | 31.80 | 63.40 | 7.97 | 31.84 | 63.42 | 7.95 | 31.81 | 63.35 |
| **LVHT** | 7.80 | 31.03 | 62.53 | 7.81 | 31.13 | 62.56 | 7.83 | 31.21 | 62.62 |
| **NVHT** | 7.77 | 31.17 | 61.86 | 7.79 | 31.05 | 62.01 | 7.81 | 31.10 | 61.98 |
| **HVHT** | 7.70 | 31.19 | 60.96 | 7.72 | 30.77 | 61.05 | 7.74 | 30.83 | 61.11 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **FF1** | | | **FF2** | | | **FF3** | | |
| **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** |
| **LVLT** | 7.99 | 32.02 | 64.77 | 7.96 | 31.97 | 64.37 | 7.98 | 32.06 | 64.59 |
| **NVLT** | 7.97 | 31.90 | 63.71 | 7.95 | 31.88 | 63.60 | 7.96 | 31.95 | 63.64 |
| **HVLT** | 7.94 | 31.75 | 63.20 | 7.91 | 31.76 | 63.13 | 7.92 | 31.78 | 63.12 |
| **LVNT** | 8.03 | 32.12 | 64.71 | 8.02 | 32.12 | 64.53 | 8.02 | 32.14 | 64.53 |
| **NVNT** | 8.01 | 32.00 | 64.06 | 8.01 | 32.01 | 64.05 | 8.00 | 32.03 | 63.98 |
| **HVNT** | 7.97 | 31.82 | 63.44 | 7.96 | 31.86 | 63.46 | 7.95 | 31.85 | 63.33 |
| **LVHT** | 7.81 | 31.14 | 62.57 | 7.81 | 31.14 | 62.41 | 7.82 | 31.18 | 62.38 |
| **NVHT** | 7.79 | 31.05 | 61.97 | 7.79 | 31.05 | 61.90 | 7.80 | 31.10 | 61.81 |
| **HVHT** | 7.71 | 30.74 | 60.96 | 7.72 | 30.78 | 60.97 | 7.72 | 30.77 | 60.84 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **48MHZ@(-20℃~25℃~85℃)** | | | | | | | | |
| **TT1** | **TT2** | **TT3** | **SS1** | **SS2** | **SS3** | **FF1** | **FF2** | **FF3** |
| **LVLT** | 48.34 | 48.25 | 48.21 | 48.13 | 48.41 | 48.32 | 48.32 | 48.18 | 48.31 |
| **NVLT** | 48.07 | 48.01 | 47.96 | 47.90 | 48.08 | 48.02 | 48.06 | 48.12 | 48.05 |
| **HVLT** | 47.72 | 47.74 | 47.66 | 47.52 | 47.71 | 47.70 | 47.71 | 47.59 | 47.68 |
| **LVNT** | 48.21 | 48.23 | 48.2 | 48.22 | 48.33 | 48.27 | 48.24 | 48.14 | 48.25 |
| **NVNT** | 48.01 | 48.01 | 47.98 | 47.99 | 48.05 | 48.03 | 48.07 | 47.96 | 48.07 |
| **HVNT** | 47.63 | 47.72 | 47.63 | 47.62 | 47.67 | 47.70 | 47.72 | 47.62 | 47.69 |
| **LVHT** | 47.55 | 47.75 | 47.56 | 47.60 | 47.75 | 47.75 | 47.77 | 47.67 | 47.73 |
| **NVHT** | 47.36 | 47.55 | 47.37 | 47.45 | 47.55 | 47.55 | 47.59 | 47.51 | 47.58 |
| **HVHT** | 46.85 | 47.17 | 46.9 | 46.99 | 47.09 | 47.14 | 47.11 | 47.05 | 47.08 |

## 占空比

**表 7-4 占空比测试数据 @(-40℃~25℃~125℃) 条件下**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **占空比单位（%）** | | | | | | | | |
| **TT11** | | | **TT12** | | | **TT13** | | |
| **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** |
| **LVLT** | 52.0 | 54.0 | 53.8 | 51.5 | 53.5 | 52.8 | 52.7 | 53.5 | 52.9 |
| **NVLT** | 51.8 | 53.7 | 53.6 | 51.2 | 53.3 | 52.4 | 52.4 | 53.4 | 52.5 |
| **HVLT** | 51.6 | 53.3 | 53.5 | 50.9 | 52.6 | 52.2 | 52.1 | 53.1 | 52.2 |
| **LVNT** | 51.9 | 53.6 | 54.2 | 51.2 | 53.1 | 53.2 | 52.3 | 53.5 | 54.7 |
| **NVNT** | 51.5 | 53.5 | 53.7 | 50.9 | 52.8 | 53.0 | 51.9 | 53.2 | 53.9 |
| **HVNT** | 51.2 | 53.2 | 53.3 | 50.5 | 52.5 | 52.9 | 51.6 | 52.8 | 53.4 |
| **LVHT** | 51.3 | 54.2 | 53.2 | 50.5 | 50.8 | 52.3 | 51.3 | 52.9 | 52.5 |
| **NVHT** | 51.0 | 53.9 | 52.8 | 50.1 | 51.8 | 52.1 | 50.8 | 52.6 | 52.1 |
| **HVHT** | 50.6 | 53.1 | 52.2 | 49.5 | 52.3 | 51.9 | 50.4 | 52.1 | 52.0 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **占空比单位（%）** | | | | | | | | |
|  | **SS1** | | | **SS2** | | | **SS3** | | |
| **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** |
| **LVLT** | 51.3 | 53.1 | 58.1 | 51.4 | 52.4 | 56.6 | 51.9 | 53.1 | 56.7 |
| **NVLT** | 51.1 | 52.8 | 57.8 | 51.2 | 52.1 | 56.7 | 51.7 | 52.8 | 56.3 |
| **HVLT** | 50.9 | 52.5 | 57.3 | 51.0 | 51.8 | 55.7 | 51.5 | 52.3 | 55.9 |
| **LVNT** | 48.4 | 45.8 | 46.4 | 48.6 | 47.7 | 46.2 | 48.2 | 46.9 | 46.5 |
| **NVNT** | 48.6 | 46.3 | 47.8 | 48.9 | 47.9 | 46.7 | 48.4 | 46.9 | 46.6 |
| **HVNT** | 48.9 | 46.9 | 47.8 | 49.2 | 48.1 | 47.1 | 48.7 | 47.1 | 48.0 |
| **LVHT** | 48.4 | 48.9 | 49.2 | 48.9 | 50.4 | 48.2 | 48.7 | 47.9 | 45.7 |
| **NVHT** | 48.8 | 49.5 | 48.9 | 49.2 | 50.8 | 49.4 | 49.0 | 48.1 | 46.7 |
| **HVHT** | 49.1 | 50.0 | 49.4 | 49.6 | 50.6 | 49.6 | 49.4 | 48.3 | 46.9 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **占空比单位（%）** | | | | | | | | |
|  | **FF1** | | | **FF2** | | | **FF3** | | |
| **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** | **8MHZ** | **32MHZ** | **64MHZ** |
| **LVLT** | 53.4 | 53.7 | 56.7 | 53.4 | 53.7 | 56.7 | 53.4 | 53.7 | 56.7 |
| **NVLT** | 53.2 | 53.2 | 55.4 | 53.2 | 53.2 | 55.4 | 53.2 | 53.2 | 55.4 |
| **HVLT** | 52.9 | 25.8 | 55.3 | 52.9 | 25.8 | 55.3 | 52.9 | 25.8 | 55.3 |
| **LVNT** | 46.9 | 45.4 | 47.0 | 46.9 | 45.4 | 47.0 | 46.9 | 45.4 | 47.0 |
| **NVNT** | 47.2 | 45.9 | 47.9 | 47.2 | 45.9 | 47.9 | 47.2 | 45.9 | 47.9 |
| **HVNT** | 47.5 | 46.5 | 48.4 | 47.5 | 46.5 | 48.4 | 47.5 | 46.5 | 48.4 |
| **LVHT** | 47.7 | 47.3 | 46.2 | 47.7 | 47.3 | 46.2 | 47.7 | 47.3 | 46.2 |
| **NVHT** | 48.1 | 47.6 | 46.8 | 48.1 | 47.6 | 46.8 | 48.1 | 47.6 | 46.8 |
| **HVHT** | 48.5 | 47.8 | 47.6 | 48.5 | 47.8 | 47.6 | 48.5 | 47.8 | 47.6 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **48MHZ@(-20℃~25℃~85℃) 单位（%）** | | | | | | | | |
| **TT1** | **TT2** | **TT3** | **SS1** | **SS2** | **SS3** | **FF1** | **FF2** | **FF3** |
| **LVLT** | 46.1 | 51.9 | 47.7 | 50.40 | 50.23 | 49.71 | 47.42 | 50.50 | 49.85 |
| **NVLT** | 46.5 | 52.4 | 47.8 | 50.15 | 51.32 | 50.20 | 47.67 | 49.97 | 50.51 |
| **HVLT** | 47.5 | 52.9 | 47.8 | 50.72 | 50.53 | 50.44 | 49.66 | 49.88 | 50.10 |
| **LVNT** | 46.5 | 52.7 | 47.5 | 49.8 | 52.1 | 52.5 | 52.3 | 52.4 | 53.1 |
| **NVNT** | 46.5 | 52.3 | 47.6 | 48.5 | 51.8 | 52.7 | 52.5 | 51.8 | 53.1 |
| **HVNT** | 47.1 | 51.8 | 47.7 | 48.6 | 52.2 | 52.6 | 52.5 | 52.1 | 52.8 |
| **LVHT** | 47.5 | 52.4 | 48.2 | 50.7 | 50.2 | 49.9 | 50.4 | 49.8 | 49.7 |
| **NVHT** | 47.7 | 52 | 48.3 | 51.2 | 50.2 | 50.4 | 50.1 | 50.2 | 50.1 |
| **HVHT** | 47.7 | 51.5 | 48.4 | 50.5 | 50.6 | 50.6 | 50.4 | 50.8 | 50.3 |

## 工作电流

**表 7-6 工作电流测试数据 @8MHZ 和 (-40℃~25℃~125℃)条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **8MHz** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 14.10 | 6.10 | 14.49 | 6.30 | 14.81 | 6.21 | **uA** |
| **NVLT** | 14.80 | 7.20 | 15.30 | 7.49 | 15.70 | 7.46 | **uA** |
| **HVLT** | 15.90 | 8.90 | 16.45 | 9.26 | 16.86 | 9.31 | **uA** |
| **LVNT** | 13.10 | 6.30 | 13.50 | 6.60 | 13.80 | 6.60 | **uA** |
| **NVNT** | 13.28 | 7.70 | 13.70 | 8.20 | 14.00 | 8.20 | **uA** |
| **HVNT** | 14.30 | 9.80 | 14.70 | 10.50 | 15.00 | 10.60 | **uA** |
| **LVHT** | 10.20 | 7.60 | 10.76 | 8.37 | 10.98 | 8.30 | **uA** |
| **NVHT** | 10.40 | 9.60 | 11.06 | 10.35 | 11.20 | 10.42 | **uA** |
| **HVHT** | 11.20 | 12.50 | 11.78 | 13.63 | 11.94 | 13.73 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **8MHz** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 13.37 | 5.95 | 13.73 | 6.00 | 13.65 | 6.51 | **uA** |
| **NVLT** | 14.77 | 6.81 | 15.13 | 6.88 | 15.15 | 7.43 | **uA** |
| **HVLT** | 15.75 | 8.07 | 16.11 | 8.20 | 16.13 | 8.77 | **uA** |
| **LVNT** | 12.86 | 6.08 | 13.16 | 6.11 | 13.11 | 6.18 | **uA** |
| **NVNT** | 13.23 | 7.15 | 13.52 | 7.20 | 13.46 | 7.27 | **uA** |
| **HVNT** | 14.07 | 8.73 | 14.37 | 8.82 | 14.32 | 8.86 | **uA** |
| **LVHT** | 10.21 | 6.54 | 10.38 | 6.57 | 10.45 | 6.64 | **uA** |
| **NVHT** | 10.33 | 8.03 | 10.48 | 8.08 | 10.57 | 8.14 | **uA** |
| **HVHT** | 11.12 | 10.13 | 11.28 | 10.22 | 11.34 | 10.25 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **8MHz** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 14.61 | 6.59 | 14.02 | 6.57 | 14.41 | 6.08 | **uA** |
| **NVLT** | 14.96 | 7.74 | 14.37 | 7.72 | 14.76 | 7.19 | **uA** |
| **HVLT** | 16.09 | 9.49 | 15.50 | 9.49 | 15.88 | 8.92 | **uA** |
| **LVNT** | 13.11 | 6.34 | 12.65 | 6.34 | 12.94 | 6.31 | **uA** |
| **NVNT** | 13.25 | 7.74 | 12.77 | 7.74 | 13.07 | 7.73 | **uA** |
| **HVNT** | 14.27 | 9.79 | 13.79 | 9.79 | 14.09 | 9.84 | **uA** |
| **LVHT** | 10.17 | 7.14 | 9.90 | 7.19 | 10.07 | 7.21 | **uA** |
| **NVHT** | 10.30 | 9.06 | 10.05 | 9.09 | 10.20 | 9.16 | **uA** |
| **HVHT** | 11.23 | 11.72 | 10.96 | 11.74 | 11.13 | 11.87 | **uA** |

**表 7-8 工作电流测试数据 @32MHZ和 (-40℃~25℃~125℃) 条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **32MHz** | **TT11** | | **TT12** | | **TT13** | | **Unit** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 46.10 | 24.10 | 46.35 | 24.37 | 47.18 | 24.18 | **uA** |
| **NVLT** | 47.10 | 26.10 | 47.66 | 26.95 | 48.70 | 26.77 | **uA** |
| **HVLT** | 48.50 | 29.10 | 49.00 | 29.97 | 50.05 | 29.76 | **uA** |
| **LVNT** | 43.40 | 24.50 | 44.00 | 25.00 | 44.80 | 25.00 | **uA** |
| **NVNT** | 43.60 | 27.30 | 44.20 | 28.00 | 44.90 | 27.90 | **uA** |
| **HVNT** | 44.90 | 30.70 | 45.30 | 31.60 | 46.10 | 31.50 | **uA** |
| **LVHT** | 36.80 | 25.70 | 37.21 | 25.73 | 37.87 | 25.74 | **uA** |
| **NVHT** | 36.90 | 28.90 | 37.52 | 28.94 | 38.07 | 28.95 | **uA** |
| **HVHT** | 38.10 | 32.50 | 38.29 | 32.84 | 38.95 | 32.75 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **32MHz** | **SS1** | | **SS2** | | **SS3** | | **Unit** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 45.13 | 24.41 | 45.58 | 24.31 | 46.08 | 25.16 | **uA** |
| **NVLT** | 47.31 | 26.81 | 47.74 | 26.73 | 48.48 | 27.62 | **uA** |
| **HVLT** | 48.39 | 29.40 | 48.80 | 29.38 | 49.56 | 30.31 | **uA** |
| **LVNT** | 43.37 | 24.72 | 43.75 | 24.62 | 44.14 | 25.00 | **uA** |
| **NVNT** | 43.73 | 27.24 | 44.07 | 27.14 | 44.47 | 27.53 | **uA** |
| **HVNT** | 44.75 | 30.13 | 45.05 | 30.05 | 45.51 | 30.39 | **uA** |
| **LVHT** | 36.19 | 24.59 | 36.44 | 24.52 | 37.08 | 24.89 | **uA** |
| **NVHT** | 36.28 | 27.37 | 36.51 | 27.33 | 37.13 | 27.72 | **uA** |
| **HVHT** | 37.21 | 30.48 | 37.50 | 30.47 | 38.10 | 30.86 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **32MHz** | **FF1** | | **FF2** | | **FF3** | | **Unit** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 46.20 | 24.75 | 45.34 | 24.86 | 46.69 | 24.40 | **uA** |
| **NVLT** | 46.56 | 27.35 | 45.75 | 27.49 | 47.08 | 26.94 | **uA** |
| **HVLT** | 47.93 | 30.46 | 47.12 | 30.61 | 48.44 | 29.97 | **uA** |
| **LVNT** | 42.61 | 24.65 | 41.91 | 24.80 | 42.93 | 24.70 | **uA** |
| **NVNT** | 42.71 | 27.47 | 42.00 | 27.65 | 43.04 | 27.53 | **uA** |
| **HVNT** | 44.06 | 30.78 | 43.39 | 30.98 | 44.40 | 30.87 | **uA** |
| **LVHT** | 35.22 | 24.86 | 34.84 | 25.04 | 35.45 | 25.01 | **uA** |
| **NVHT** | 35.35 | 28.02 | 34.93 | 28.22 | 35.57 | 28.18 | **uA** |
| **HVHT** | 36.59 | 31.57 | 36.21 | 31.83 | 36.82 | 31.77 | **uA** |

**表 7-10 工作电流测试数据 @48MHZ 和 (-20℃~25℃~85℃) 条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **48MHz** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 70.11 | 37.47 | 70.19 | 38.00 | 71.24 | 37.73 | **uA** |
| **NVLT** | 70.65 | 41.02 | 70.63 | 41.72 | 71.84 | 41.38 | **uA** |
| **HVLT** | 71.87 | 44.96 | 71.89 | 45.95 | 73.12 | 45.52 | **uA** |
| **LVNT** | 67.56 | 37.90 | 67.78 | 38.41 | 68.85 | 38.12 | **uA** |
| **NVNT** | 67.69 | 41.67 | 67.88 | 42.32 | 69.01 | 42.00 | **uA** |
| **HVNT** | 68.86 | 45.76 | 69.11 | 46.73 | 70.23 | 46.33 | **uA** |
| **LVHT** | 62.56 | 38.13 | 63.53 | 38.90 | 63.63 | 38.64 | **uA** |
| **NVHT** | 62.57 | 42.11 | 63.60 | 43.07 | 63.66 | 42.83 | **uA** |
| **HVHT** | 63.65 | 46.36 | 64.96 | 47.60 | 64.83 | 47.35 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **48MHz** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 68.89 | 37.65 | 69.78 | 37.69 | 70.65 | 38.14 | **uA** |
| **NVLT** | 70.20 | 41.12 | 71.02 | 41.09 | 72.05 | 41.55 | **uA** |
| **HVLT** | 71.20 | 44.75 | 72.01 | 44.76 | 73.04 | 45.22 | **uA** |
| **LVNT** | 66.95 | 38.05 | 67.31 | 38.01 | 68.23 | 38.42 | **uA** |
| **NVNT** | 67.26 | 41.62 | 67.48 | 41.57 | 68.48 | 42.02 | **uA** |
| **HVNT** | 68.17 | 45.39 | 68.44 | 45.37 | 69.49 | 45.85 | **uA** |
| **LVHT** | 62.71 | 38.00 | 63.22 | 38.06 | 64.05 | 38.44 | **uA** |
| **NVHT** | 62.74 | 41.73 | 63.32 | 41.82 | 64.13 | 42.25 | **uA** |
| **HVHT** | 63.64 | 45.55 | 64.15 | 45.72 | 65.05 | 46.19 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **48MHz** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 68.69 | 37.49 | 67.41 | 37.51 | 68.96 | 37.54 | **uA** |
| **NVLT** | 68.82 | 41.12 | 67.58 | 41.17 | 69.11 | 41.18 | **uA** |
| **HVLT** | 70.18 | 45.22 | 69.00 | 45.39 | 70.47 | 45.30 | **uA** |
| **LVNT** | 65.26 | 37.85 | 64.15 | 37.88 | 65.53 | 37.87 | **uA** |
| **NVNT** | 65.29 | 41.72 | 64.23 | 41.78 | 65.60 | 41.71 | **uA** |
| **HVNT** | 66.70 | 45.94 | 65.60 | 46.06 | 66.92 | 45.95 | **uA** |
| **LVHT** | 60.97 | 38.04 | 60.11 | 38.14 | 61.09 | 38.11 | **uA** |
| **NVHT** | 60.96 | 42.10 | 60.22 | 42.19 | 61.12 | 42.13 | **uA** |
| **HVHT** | 62.26 | 46.42 | 61.54 | 46.54 | 62.38 | 46.42 | **uA** |

**表 7-11 工作电流测试数据 @64MHZ和 (-40℃~25℃~125℃) 条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **64MHz** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 97.70 | 50.90 | 96.30 | 50.21 | 97.67 | 50.03 | **uA** |
| **NVLT** | 98.20 | 55.10 | 98.64 | 54.36 | 100.32 | 54.06 | **uA** |
| **HVLT** | 99.60 | 59.80 | 99.86 | 58.97 | 101.35 | 58.64 | **uA** |
| **LVNT** | 94.80 | 52.00 | 94.70 | 52.40 | 96.20 | 52.40 | **uA** |
| **NVNT** | 94.40 | 56.70 | 94.60 | 57.40 | 95.80 | 57.30 | **uA** |
| **HVNT** | 95.70 | 61.80 | 95.80 | 62.70 | 96.90 | 62.60 | **uA** |
| **LVHT** | 86.90 | 54.00 | 85.74 | 52.11 | 87.52 | 52.53 | **uA** |
| **NVHT** | 86.60 | 59.40 | 85.45 | 57.27 | 86.93 | 57.49 | **uA** |
| **HVHT** | 87.50 | 64.80 | 85.60 | 62.51 | 87.20 | 62.48 | **uA** |
| **HVHT** | 90.91 | 61.50 | 90.07 | 63.85 | 91.24 | 63.43 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **64MHz** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 95.56 | 51.19 | 96.78 | 51.22 | 98.17 | 52.31 | **uA** |
| **NVLT** | 98.14 | 55.49 | 99.00 | 55.24 | 100.56 | 56.36 | **uA** |
| **HVLT** | 98.93 | 59.97 | 99.81 | 59.67 | 101.27 | 60.99 | **uA** |
| **LVNT** | 94.67 | 51.97 | 95.49 | 51.89 | 96.61 | 52.41 | **uA** |
| **NVNT** | 94.48 | 56.79 | 94.99 | 56.46 | 96.17 | 57.07 | **uA** |
| **HVNT** | 95.34 | 61.68 | 95.80 | 61.34 | 97.06 | 61.92 | **uA** |
| **LVHT** | 84.91 | 51.95 | 85.35 | 51.78 | 86.80 | 52.36 | **uA** |
| **NVHT** | 84.30 | 57.15 | 84.68 | 57.03 | 86.10 | 57.66 | **uA** |
| **HVHT** | 84.74 | 61.88 | 85.17 | 61.79 | 86.59 | 62.55 | **uA** |
| **HVHT** | 95.56 | 51.19 | 96.78 | 51.22 | 98.17 | 52.31 | **uA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **64MHz** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | 96.66 | 51.49 | 94.53 | 51.35 | 96.80 | 51.01 | **uA** |
| **NVLT** | 96.03 | 55.63 | 94.26 | 55.80 | 96.37 | 55.20 | **uA** |
| **HVLT** | 97.42 | 60.67 | 95.63 | 60.94 | 97.77 | 60.26 | **uA** |
| **LVNT** | 92.32 | 51.85 | 90.73 | 51.92 | 92.28 | 51.71 | **uA** |
| **NVNT** | 91.86 | 56.58 | 90.42 | 56.90 | 91.98 | 56.49 | **uA** |
| **HVNT** | 93.24 | 61.77 | 91.83 | 62.13 | 93.41 | 61.73 | **uA** |
| **LVHT** | 82.22 | 52.37 | 81.06 | 52.35 | 81.99 | 52.26 | **uA** |
| **NVHT** | 81.67 | 57.62 | 80.60 | 57.74 | 81.49 | 57.57 | **uA** |
| **HVHT** | 82.48 | 62.54 | 81.59 | 62.86 | 82.46 | 62.63 | **uA** |
| **HVHT** | 96.66 | 51.49 | 94.53 | 51.35 | 96.80 | 51.01 | **uA** |

## 掉电泄露

**表 7-13 掉电泄露测试数据 @ (-40℃~25℃~125℃) 条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PD** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **NVLT** | <10 | <10 | <10 | 10 | <10 | <10 | **nA** |
| **HVLT** | <10 | <10 | <10 | 20 | <10 | 10 | **nA** |
| **LVNT** | <10 | 20 | <10 | 60 | <10 | 40 | **nA** |
| **NVNT** | <10 | 20 | <10 | 80 | <10 | 50 | **nA** |
| **HVNT** | <10 | 30 | <10 | 90 | <10 | 60 | **nA** |
| **LVHT** | <10 | 540 | <10 | 1020 | <10 | 860 | **nA** |
| **NVHT** | <10 | 610 | <10 | 1140 | <10 | 960 | **nA** |
| **HVHT** | 10 | 680 | 10 | 1310 | 10 | 1070 | **nA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PD** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **NVLT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **HVLT** | <10 | 10 | <10 | 10 | 10 | 10 | **nA** |
| **LVNT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **NVNT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **HVNT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **LVHT** | <10 | 240 | <10 | 220 | <10 | 230 | **nA** |
| **NVHT** | <10 | 250 | <10 | 230 | <10 | 250 | **nA** |
| **HVHT** | 10 | 270 | <10 | 250 | <10 | 270 | **nA** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PD** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** | **IVCCA\_OSC** | **IVDDL\_OSC** |
| **LVLT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **NVLT** | <10 | <10 | <10 | <10 | <10 | <10 | **nA** |
| **HVLT** | 10 | 10 | 10 | 10 | 10 | 10 | **nA** |
| **LVNT** | <10 | <10 | <10 | 20 | <10 | 20 | **nA** |
| **NVNT** | <10 | <10 | <10 | 20 | <10 | 20 | **nA** |
| **HVNT** | <10 | <10 | <10 | 20 | <10 | 20 | **nA** |
| **LVHT** | 10 | 330 | 10 | 440 | 10 | 440 | **nA** |
| **NVHT** | 20 | 350 | 20 | 470 | 20 | 470 | **nA** |
| **HVHT** | 30 | 380 | 30 | 500 | 30 | 500 | **nA** |

## 启动时间和稳定时间

**表 7-15 启动时间、稳定时间测试数据 @ 8MHZ @ (-40℃~25℃~125℃) 条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **8MHz** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 5.82 | 9.25 | 5.80 | 9.41 | 5.98 | 10.88 | **us** |
| **NVLT** | 5.34 | 8.64 | 5.45 | 8.22 | 5.28 | 9.77 | **us** |
| **HVLT** | 5.09 | 7.70 | 5.22 | 8.06 | 5.15 | 8.64 | **us** |
| **LVNT** | 6.81 | 10.55 | 7.12 | 11.15 | 7.21 | 10.24 | **us** |
| **NVNT** | 6.07 | 9.88 | 6.34 | 10.06 | 6.42 | 9.03 | **us** |
| **HVNT** | 5.75 | 8.98 | 6.02 | 9.44 | 5.12 | 8.52 | **us** |
| **LVHT** | 6.25 | 11.42 | 6.23 | 10.88 | 6.56 | 10.42 | **us** |
| **NVHT** | 5.81 | 10.06 | 5.72 | 10.02 | 6.05 | 9.46 | **us** |
| **HVHT** | 5.42 | 9.25 | 5.36 | 10.24 | 5.67 | 9.04 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **8MHz** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 6.98 | 11.32 | 6.69 | 10.47 | 6.74 | 10.86 | **us** |
| **NVLT** | 6.06 | 10.68 | 5.80 | 9.60 | 5.90 | 9.73 | **us** |
| **HVLT** | 5.99 | 10.63 | 5.75 | 9.43 | 5.63 | 9.56 | **us** |
| **LVNT** | 8.23 | 12.87 | 7.74 | 12.29 | 7.95 | 12.60 | **us** |
| **NVNT** | 7.23 | 11.27 | 6.92 | 11.07 | 7.07 | 11.83 | **us** |
| **HVNT** | 6.94 | 10.07 | 6.60 | 10.91 | 6.77 | 11.70 | **us** |
| **LVHT** | 7.94 | 12.79 | 7.64 | 11.70 | 7.68 | 12.30 | **us** |
| **NVHT** | 7.12 | 12.15 | 6.81 | 11.59 | 6.98 | 11.23 | **us** |
| **HVHT** | 6.74 | 11.48 | 6.44 | 11.46 | 6.61 | 11.15 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **8MHz** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 5.30 | 9.34 | 5.31 | 9.43 | 5.19 | 9.51 | **us** |
| **NVLT** | 4.88 | 8.57 | 5.06 | 8.91 | 4.69 | 9.06 | **us** |
| **HVLT** | 4.70 | 8.52 | 4.74 | 8.72 | 4.59 | 8.96 | **us** |
| **LVNT** | 6.37 | 12.53 | 6.48 | 12.19 | 6.25 | 11.74 | **us** |
| **NVNT** | 5.80 | 11.72 | 5.97 | 11.92 | 5.67 | 11.17 | **us** |
| **HVNT** | 5.51 | 11.46 | 5.68 | 12.16 | 5.36 | 11.02 | **us** |
| **LVHT** | 5.47 | 12.11 | 5.56 | 11.67 | 5.26 | 12.17 | **us** |
| **NVHT** | 5.11 | 11.88 | 5.20 | 11.31 | 4.94 | 11.73 | **us** |
| **HVHT** | 4.78 | 11.62 | 4.89 | 11.19 | 4.64 | 11.80 | **us** |

**表 7-17 启动时间、稳定时间测试数据 @ 32MHZ @ (-40℃~25℃~125℃)条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **32MHz** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 2.31 | 5.86 | 2.37 | 5.51 | 2.39 | 5.11 | **us** |
| **NVLT** | 2.06 | 5.46 | 2.11 | 4.72 | 2.10 | 4.22 | **us** |
| **HVLT** | 1.94 | 5.06 | 2.01 | 4.46 | 2.03 | 3.95 | **us** |
| **LVNT** | 2.36 | 5.43 | 2.45 | 6.04 | 2.47 | 5.54 | **us** |
| **NVNT** | 2.01 | 5.00 | 2.10 | 5.56 | 2.12 | 5.03 | **us** |
| **HVNT** | 1.88 | 4.62 | 2.06 | 5.35 | 2.01 | 4.75 | **us** |
| **LVHT** | 2.49 | 5.43 | 2.37 | 4.98 | 2.40 | 5.60 | **us** |
| **NVHT** | 2.20 | 5.14 | 2.12 | 4.69 | 2.14 | 4.99 | **us** |
| **HVHT** | 2.09 | 5.03 | 2.03 | 4.39 | 2.05 | 4.55 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **32MHz** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSU** | **TSTB** | **TSTB** |
| **LVLT** | 2.63 | 4.70 | 2.57 | 4.60 | 2.59 | 4.90 | **us** |
| **NVLT** | 2.28 | 4.41 | 2.23 | 4.57 | 2.27 | 4.25 | **us** |
| **HVLT** | 2.15 | 4.19 | 2.10 | 4.36 | 2.15 | 4.15 | **us** |
| **LVNT** | 2.79 | 5.35 | 2.73 | 5.45 | 2.77 | 5.27 | **us** |
| **NVNT** | 2.33 | 5.14 | 2.29 | 4.80 | 2.32 | 4.90 | **us** |
| **HVNT** | 2.22 | 4.91 | 2.21 | 4.69 | 2.21 | 4.87 | **us** |
| **LVHT** | 2.78 | 5.27 | 2.72 | 5.18 | 2.79 | 5.20 | **us** |
| **NVHT** | 2.44 | 4.98 | 2.38 | 4.83 | 2.38 | 5.00 | **us** |
| **HVHT** | 2.34 | 4.88 | 2.28 | 4.95 | 2.30 | 4.98 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **32MHz** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSU** | **TSTB** | **TSU** |
| **LVLT** | 2.09 | 4.41 | 2.05 | 4.37 | 2.02 | 4.46 | **us** |
| **NVLT** | 1.92 | 4.15 | 1.89 | 4.20 | 1.84 | 4.27 | **us** |
| **HVLT** | 1.79 | 4.06 | 1.78 | 4.16 | 1.76 | 4.19 | **us** |
| **LVNT** | 2.17 | 5.21 | 2.17 | 5.49 | 2.11 | 5.27 | **us** |
| **NVNT** | 1.92 | 4.91 | 1.98 | 5.27 | 1.87 | 5.13 | **us** |
| **HVNT** | 1.83 | 4.73 | 1.82 | 5.09 | 1.78 | 5.04 | **us** |
| **LVHT** | 2.14 | 5.13 | 2.10 | 5.09 | 2.07 | 4.99 | **us** |
| **NVHT** | 1.93 | 4.71 | 1.91 | 4.93 | 1.89 | 4.94 | **us** |
| **HVHT** | 1.80 | 4.74 | 1.79 | 4.86 | 1.80 | 4.93 | **us** |

**表 7-19 启动时间、稳定时间测试数据 @48MHZ @ (-20℃~25℃~85℃) 条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **48MHz** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 1.83 | 3.77 | 1.88 | 3.80 | 2.00 | 3.50 | **us** |
| **NVLT** | 1.61 | 3.38 | 1.72 | 3.22 | 1.72 | 3.33 | **us** |
| **HVLT** | 1.50 | 3.11 | 1.55 | 3.12 | 1.61 | 3.22 | **us** |
| **LVNT** | 2.00 | 3.13 | 1.98 | 3.03 | 2.00 | 3.72 | **us** |
| **NVNT** | 1.72 | 2.60 | 1.68 | 2.85 | 1.72 | 3.36 | **us** |
| **HVNT** | 1.58 | 2.28 | 1.50 | 2.34 | 1.66 | 3.11 | **us** |
| **LVHT** | 2.05 | 4.27 | 2.00 | 4.11 | 2.04 | 3.62 | **us** |
| **NVHT** | 1.83 | 3.77 | 1.70 | 3.50 | 1.77 | 3.40 | **us** |
| **HVHT** | 1.61 | 3.62 | 1.60 | 3.38 | 1.60 | 3.20 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **48MHz** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 2.18 | 4.14 | 2.12 | 4.15 | 2.10 | 4.02 | **us** |
| **NVLT** | 1.90 | 3.97 | 1.86 | 3.83 | 1.86 | 3.76 | **us** |
| **HVLT** | 1.78 | 3.83 | 1.76 | 3.68 | 1.76 | 3.60 | **us** |
| **LVNT** | 2.34 | 4.28 | 2.30 | 4.35 | 2.42 | 4.24 | **us** |
| **NVNT** | 1.96 | 4.08 | 1.92 | 3.95 | 1.94 | 3.86 | **us** |
| **HVNT** | 1.84 | 3.96 | 1.84 | 3.78 | 1.84 | 3.80 | **us** |
| **LVHT** | 2.36 | 4.39 | 2.28 | 4.24 | 2.34 | 4.30 | **us** |
| **NVHT** | 2.02 | 4.06 | 1.96 | 3.70 | 2.02 | 4.02 | **us** |
| **HVHT** | 1.90 | 3.92 | 1.84 | 3.86 | 1.90 | 3.82 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **48MHz** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 1.74 | 3.66 | 1.76 | 3.96 | 1.72 | 3.70 | **us** |
| **NVLT** | 1.58 | 3.34 | 1.60 | 3.76 | 1.54 | 3.38 | **us** |
| **HVLT** | 1.48 | 3.08 | 1.44 | 3.44 | 1.44 | 3.02 | **us** |
| **LVNT** | 1.87 | 3.86 | 1.85 | 3.91 | 1.82 | 3.77 | **us** |
| **NVNT** | 1.61 | 3.43 | 1.60 | 3.53 | 1.58 | 3.46 | **us** |
| **HVNT** | 1.51 | 3.25 | 1.49 | 3.37 | 1.48 | 3.25 | **us** |
| **LVHT** | 1.84 | 3.75 | 1.80 | 3.67 | 1.80 | 3.74 | **us** |
| **NVHT** | 1.66 | 3.58 | 1.62 | 3.44 | 1.60 | 3.50 | **us** |
| **HVHT** | 1.56 | 3.42 | 1.52 | 3.28 | 1.52 | 3.34 | **us** |

**表 7-20 启动时间、稳定时间测试数据 @ 64MHZ @ (-40℃~25℃~125℃)条件下**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **64MHz** | **TT11** | | **TT12** | | **TT13** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 2.13 | 4.01 | 1.80 | 4.06 | 2.20 | 3.73 | **us** |
| **NVLT** | 1.91 | 3.64 | 1.54 | 3.67 | 1.53 | 3.35 | **us** |
| **HVLT** | 1.39 | 3.04 | 1.45 | 3.20 | 1.46 | 3.26 | **us** |
| **LVNT** | 1.82 | 4.36 | 1.72 | 4.63 | 1.90 | 4.44 | **us** |
| **NVNT** | 1.53 | 3.76 | 1.51 | 4.06 | 1.62 | 3.58 | **us** |
| **HVNT** | 1.42 | 3.44 | 1.42 | 3.64 | 1.57 | 3.27 | **us** |
| **LVHT** | 1.83 | 4.24 | 1.85 | 4.12 | 1.87 | 4.13 | **us** |
| **NVHT** | 1.61 | 4.00 | 1.64 | 3.98 | 1.65 | 3.66 | **us** |
| **HVHT** | 1.49 | 3.64 | 1.56 | 3.80 | 1.57 | 3.44 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **64MHz** | **SS1** | | **SS2** | | **SS3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 2.01 | 3.90 | 1.99 | 3.93 | 2.00 | 4.19 | **us** |
| **NVLT** | 1.70 | 3.61 | 1.65 | 3.72 | 1.67 | 3.77 | **us** |
| **HVLT** | 1.57 | 3.27 | 1.56 | 3.52 | 1.60 | 3.68 | **us** |
| **LVNT** | 2.11 | 3.71 | 2.04 | 4.22 | 2.10 | 3.82 | **us** |
| **NVNT** | 1.77 | 3.33 | 1.74 | 3.65 | 1.77 | 3.51 | **us** |
| **HVNT** | 1.66 | 3.23 | 1.68 | 3.42 | 1.70 | 3.46 | **us** |
| **LVHT** | 2.12 | 4.25 | 2.10 | 4.45 | 2.17 | 3.98 | **us** |
| **NVHT** | 1.88 | 4.01 | 1.84 | 3.63 | 1.84 | 3.76 | **us** |
| **HVHT** | 1.76 | 3.89 | 1.76 | 3.55 | 1.76 | 3.94 | **us** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **64MHz** | **FF1** | | **FF2** | | **FF3** | | **单位** |
| **TSU** | **TSTB** | **TSU** | **TSTB** | **TSU** | **TSTB** |
| **LVLT** | 1.60 | 3.82 | 1.59 | 3.75 | 1.56 | 3.60 | **us** |
| **NVLT** | 1.42 | 3.57 | 1.43 | 3.48 | 1.39 | 3.31 | **us** |
| **HVLT** | 1.34 | 3.49 | 1.33 | 3.48 | 1.31 | 3.30 | **us** |
| **LVNT** | 1.70 | 3.68 | 2.17 | 3.94 | 1.65 | 3.92 | **us** |
| **NVNT** | 1.48 | 3.41 | 1.91 | 3.82 | 1.45 | 3.77 | **us** |
| **HVNT** | 1.41 | 3.18 | 1.82 | 3.86 | 1.37 | 3.64 | **us** |
| **LVHT** | 1.70 | 3.77 | 1.68 | 3.81 | 1.64 | 3.90 | **us** |
| **NVHT** | 1.53 | 3.72 | 1.51 | 3.80 | 1.48 | 3.78 | **us** |
| **HVHT** | 1.44 | 3.65 | 1.43 | 3.83 | 1.42 | 3.88 | **us** |

**二、IP 名称: XRN011EFDPWRPOR\_TYLVA**

# 1.测试总结

VCC\_TYL=2.0V~5.0V,VDD\_TYL=1.35V~1.65V;TA=-40°C~125°C; 所有工艺角。

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **符号** | **条件** | **规格** | | | **测量@（-40℃~125℃）** | | | | |
| **最小值** | **典型值** | **最大值** | **最小值** | **典型值** | **最大值** | **单位** | **结果** |
| VPOR\_ON |  | 1.05 | 1.15 | 1.35 | 1.05 | 1.15 | 1.35 | V | Pass |
| VPOR\_OFF |  |  | 1.1 |  | 1 | 1.1 | 1.29 | V | Pass |
| Iq\_POR |  |  | 5 | 10 | 5.14 | 7 | 8.13 | uA | Pass |
| Tdly\_ON | REG\_POR\_LV[1:0] =2’b11 | - | 4 | - | 3.38 | 3.38 | 4.02 | mS | Pass |
| REG\_POR\_LV[1:0] =2’b10 | 0.98 | 2 | 2.5 | 1.66 | 1.72 | 2.06 | mS | Pass |
| REG\_POR\_LV[1:0] =2’b01 |  | 1 |  | 0.78 | 0.88 | 1.06 | mS | Pass |
| REG\_POR\_LV[1:0] =2’b00 |  | 0.5 |  | 0.3 | 0.46 | 0.58 | mS | Pass |

注释：典型值选取的是TT2常温常压的数据

# 一览表

表1-1 一览表

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **项目** | | | **实例** | **是** | **否** |
| 1 | 代工厂名称 | | NEXCHIP | 是 |  |
| 2 | 工艺 | | NEXCHIP110nm E-Flash低功耗 1P5M工艺 | 是 |  |
| 3 | 核心供电电压&IO供电电压 | | 1.5V | 是 |  |
| 4 | 金属堆叠选项 | | 1P5M | 是 |  |
| 6 | 参照 | 数据表 | XRN011EFDPWRPOR\_TYLVA\_V1P0\_数据手册\_V0.5 | 是 |  |
| 试验规格 | XRN011EFDPWRPOR\_TYLVA\_V1P0\_测试计划\_V0.1 | 是 |  |
| 7 | 样本编号和列表 | | 总共9个样品，  良率测试:9个样品  特性测试:9个样品 | 是 |  |
| 8 | 工艺角 | | TT FF and SS | 是 |  |
| 9 | 温度变量 | | -40℃, 25℃, 125℃ | 是 |  |
| 10 | 电压变量 | | VCC\_PMU: 1.35V，1.5V，1.65V | 是 |  |
| 11 | 静电放电 | | **不需要静电放电测试** |  | NA |

# IP 信息

## 描述

XRN011EFDPWRPOR\_TYLVA\_V1P0是典型电源内核电压上电复位(POR)和掉电复位(PDR)解决方案的IP版本。该版本基于NEXCHIP110nm E-Flash低功耗 1P5M工艺，上电复位的静态电流为7uA。

POR/PDR IP支持1V至1.65V的输入电压。该上电复位状态的典型延迟时间约为2毫秒。

下表显示了这些模块的简要功能。

* + - 输入电源电压范围为1V至1.65V
    - 正常模式下静态电流为7uA
    - 典型上电复位状态延迟时间为2毫秒
    - 工作结温:~+~+125℃-40°C25°C
    - 面积:129um\*105um
    - NEXCHIP110nm E-Flash低功耗 1P5M工艺 ，支持1P5M及以上工艺

# 测试信息

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **项目** | | **信息** | | | | | | **评价** |
| 1 | IP 名称 | NEXCHIP0.11um E-Flash低功耗工艺  典型电源内核电压上电复位 | | | | | |  |
| 2 | 工艺角 | TT,FF,SS | | | | | |  |
| 3 | 样本编号和列表 | TT2/TT5/TT7/FF4/FF7/FF8/SS4/SS5/SS6 | | | | | |  |
| 4 | 测试条件 | 条件 | 温度(℃) | | VCC  （V） | | VDD  （V） |  |
| LVLT | -40 | | 5.0 | | 1.35 |
| NVLT | -40 | | 5.0 | | 1.5 |
| HVLT | -40 | | 5.0 | | 1.65 |
| LVNT | 25 | | 5.0 | | 1.35 |
| NVNT | 25 | | 5.0 | | 1.5 |
| HVNT | 25 | | 5.0 | | 1.65 |
| LVHT | 125 | | 5.0 | | 1.35 |
| NVHT | 125 | | 5.0 | | 1.5 |
| HVHT | 125 | | 5.0 | | 1.65 |
| 5 | 测试项目 | 上电复位的阈值电压 | | | | | |  |
| 上电复位的静态电流 | | | | | |
| 上电复位的延迟时间 | | | | | |
| 掉电复位的阈值电压 | | | | | |
|  | | | | | |
|  | | | | | |
|  | | | | | |
| 6 | 测试仪器 | 测试项 | | 生产商 | | 型号& SN | |  |
| 电流表 | | Keysight | | 34461A | |
| 高低温热流仪 | |  | | TPO4310 | |
| 电源 | | GW | | 3303S | |
| 示波器 | | ZLG | | ZDS1104 | |
|  | |  | |  | |
| 7 | 测试工程师 | WZX/MHB | | | | | |  |
| 8 | 测试日期 | 2020-10-13~2020-10-16  2021-5-20~2021-6-18 | | | | | |  |

# 

# 测试方法

## 5.1 测试框图

****

## 5.2 测试方法

根据《XRN011EFDPWRPOR\_TYLVA\_V1P0\_测试计划\_V0.1》，所有测试项均已检测。

# 测试结果

## 良率测试结果

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **温度和输入电压条件** | **良率测试结果** | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **NVNT** | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 |

# 测试数据

## 7.1上电复位和掉电复位

* 表 7‑1 上电复位和掉电复位测试数据 @VDD\_POR=1.35V~1.65V

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | TT2 | | TT5 | | TT7 | |
| 温度 | V POR (V) | V PDR (V) | V POR (V) | V PDR (V) | V POR (V) | V PDR (V) |
| -40℃ | 1.15 | 1.10 | 1.15 | 1.10 | 1.05 | 1.00 |
| 25℃ | 1.25 | 1.15 | 1.20 | 1.15 | 1.10 | 1.05 |
| 125℃ | 1.30 | 1.25 | 1.35 | 1.25 | 1.30 | 1.20 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | FF4 | | FF7 | | FF8 | |
| 温度 | V POR (V) | V PDR (V) | V POR (V) | Temp (V) | V POR (V) | V PDR (V) |
| -40℃ | 1.16 | 1.1 | 1.14 | 1.1 | 1.13 | 1.06 |
| 25℃ | 1.20 | 1.15 | 1.19 | 1.14 | 1.11 | 1.08 |
| 125℃ | 1.31 | 1.23 | 1.3 | 1.24 | 1.32 | 1.24 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | SS4 | | SS5 | | SS6 | |
| 温度 | V POR (V) | V PDR (V) | V POR (V) | Temp (V) | V POR (V) | V PDR (V) |
| -40℃ | 1.17 | 1.10 | 1.17 | 1.17 | 1.10 | 1.08 |
| 25℃ | 1.23 | 1.17 | 1.22 | 1.21 | 1.14 | 1.13 |
| 125℃ | 1.31 | 1.30 | 1.33 | 1.28 | 1.28 | 1.21 |

## 7.2工作电流和延迟时间

* 表 7‑2-1 TT工作电流和延迟时间测试数据 @ I2C 配置: 3C 01 08 /3C 01 OC/3C 01 00 /3C 01 04 VDD\_POR=1.35v~1.65v VCC\_POR=2.0V~5.5V

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”10” | | | | | | |
|  | TT2 | | TT5 | | TT7 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| LVLT | 1.74 | 5.61 | 1.82 | 5.37 | 1.88 | 5.19 |
| NVLT | 1.70 | 6.13 | 1.78 | 5.88 | 1.84 | 5.69 |
| HVLT | 1.66 | 6.65 | 1.76 | 6.39 | 1.76 | 6.42 |
| LVNT | 1.76 | 6.17 | 1.86 | 5.89 | 1.90 | 5.86 |
| NVNT | 1.72 | 6.70 | 1.84 | 6.40 | 1.86 | 6.36 |
| HVNT | 1.70 | 7.20 | 1.80 | 6.90 | 1.84 | 6.85 |
| LVHT | 1.90 | 7.01 | 2.02 | 6.63 | 2.06 | 6.86 |
| NVHT | 1.86 | 7.62 | 1.96 | 7.24 | 2.00 | 7.44 |
| HVHT | 1.82 | 8.13 | 1.92 | 7.75 | 1.96 | 7.93 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”11” | | | | | | |
|  | TT2 | | TT5 | | TT6 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 3.38 | 6.7 | 3.60 | 6.40 | 3.66 | 6.36 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”00” | | | | | | |
|  | TT2 | | TT5 | | TT6 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 0.46 | 6.70 | 0.50 | 6.40 | 0.50 | 6.36 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”01” | | | | | | |
|  | TT2 | | TT5 | | TT6 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 0.88 | 6.70 | 0.94 | 6.40 | 0.96 | 6.36 |

* 表 7‑2-2 FF工作电流和延迟时间测试数据@ I2C 配置: 3C 01 08 /3C 01 OC/3C 01 00 /3C 01 04 VDD\_POR=1.35v~1.65v VCC\_POR=2.0V~5.5V

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”10” | | | | | | |
|  | FF4 | | FF7 | | FF8 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| LVLT | 1.69 | 5.14 | 2.32 | 5.57 | 1.8 | 5.46 |
| NVLT | 1.67 | 5.65 | 2.11 | 6.08 | 1.756 | 5.97 |
| HVLT | 1.64 | 6.53 | 1.97 | 6.61 | 1.72 | 6.51 |
| LVNT | 1.78 | 7.52 | 2.38 | 6.04 | 1.85 | 5.99 |
| NVNT | 1.9 | 6.13 | 2.11 | 6.56 | 1.80 | 6.04 |
| HVNT | 1.74 | 7.23 | 1.95 | 7.07 | 1.77 | 6.57 |
| LVHT | 2.01 | 6.83 | 2.86 | 6.77 | 2.01 | 6.75 |
| NVHT | 1.93 | 7.46 | 2.34 | 7.39 | 1.92 | 7.37 |
| HVHT | 1.90 | 7.99 | 2.16 | 7.903 | 1.89 | 7.89 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”11” | | | | | | |
|  | FF4 | | FF7 | | FF8 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 3.7 | 6.134 | 3.5 | 6.92 | 3.84 | 6.326 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”00” | | | | | | |
|  | FF4 | | FF7 | | FF8 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 0.54 | 6.129 | 0.3 | 6.92 | 0.48 | 6.327 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”01” | | | | | | |
|  | FF4 | | FF7 | | FF8 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 0.98 | 6.13 | 0.78 | 6.928 | 0.96 | 6.33 |

* 表 7‑2-3 FF工作电流和延迟时间测试数据@ I2C 配置: 3C 01 08 /3C 01 OC/3C 01 00 /3C 01 04 VDD\_POR=1.35v~1.65v VCC\_POR=2.0V~5.5V

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”10” | | | | | | |
|  | SS4 | | SS5 | | SS6 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| LVLT | 1.85 | 5.27 | 1.84 | 5.28 | 1.84 | 5.27 |
| NVLT | 1.8 | 5.76 | 1.74 | 5.72 | 1.8 | 5.68 |
| HVLT | 1.78 | 6.39 | 1.65 | 6.42 | 1.72 | 6.43 |
| LVNT | 1.82 | 5.98 | 1.88 | 5.99 | 1.9 | 5.66 |
| NVNT | 1.81 | 6.52 | 1.796 | 5.5 | 1.9 | 5.74 |
| HVNT | 1.82 | 6.91 | 1.77 | 7.03 | 1.82 | 8.04 |
| LVHT | 1.98 | 6.23 | 2.74 | 6.79 | 2.04 | 6.44 |
| NVHT | 1.92 | 6.83 | 1.98 | 7.4 | 1.96 | 7 |
| HVHT | 1.9 | 7.34 | 1.86 | 7.92 | 1.92 | 7.49 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”11” | | | | | | |
|  | SS4 | | SS5 | | SS6 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 4.02 | 5.435 | 3.96 | 5.5 | 3.76 | 5.74 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”00” | | | | | | |
|  | SS4 | | SS5 | | SS6 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 0.54 | 5.435 | 0.58 | 5.5 | 0.52 | 5.738 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG1[1:0]=’”01” | | | | | | |
|  | SS4 | | SS5 | | SS6 | |
| 温度 | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） | TST1（ms） | IQ POR（uA） |
| 25℃ | 1.06 | 5.438 | 1.06 | 5.5 | 0.96 | 5.742 |

**三、IP 名称: XRN011EFDPWRREF\_LP08A**

# 测试总结

VCC\_BGP=2.0V~5.5V,VDD=1.35V~1.65V,TA=-40℃，25℃，125℃ @所有工艺角

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **符号** | **条件** | **规格范围** | | | **测量范围** | | | **单位** | **结果** |
| **最小值** | **典型值** | **最大值** | **最小值** | **典型值** | **最大值** |  |  |
| VREF08L | VCC\_BGP=2V~5.5V  REG\_LPBGP\_LV[3:0]=1000 | 0.76 | 0.8 | 0.88 | 0.800 | 0.811 | 0.817 | V | 通过 |
| VCC\_BGP=3.6V~5.5V  VRANG\_SEL\_HV=”1”  REG\_LPBGP\_LV[3:0]=1000 | 0.76 | 0.8 | 0.88 | 0.793 | 0.810 | 0.814 | V | 通过 |
| VCC\_BGP=2V~3.8V  VRANG\_SEL\_HV=”0”  REG\_LPBGP\_LV[3:0]=1000 | 0.76 | 0.8 | 0.82 | 0.793 | 0.811 | 0.817 | V | 通过[3] |
| Iq | VCC\_BGP=2V~5.5V  REF\_LPBGP\_LV[4]=”1” | - | 480 | - | 17 | 561 | 1007 | nA | 通过[1] |
| VCC\_BGP=2V~5.5V  REF\_LPBGP\_LV[4]=”0” |  | 300 | - | 17 | 362 | 743 | nA | 通过[1] |
| Ipd | VCC\_BGP=2V~5.5V LPBGP\_EN\_HV=”0” | - | 8 | 300 | <10 | <10 | 72 | nA | 通过 |
| Tok | VCC\_BGP=2V~5.5V | - | 60 |  | 34 | 52 | 26561 | uS | 不合格[2] |

注意:

1, 测试时，LPBGP给LPLDO提供两路偏置电流（40nA\*2），LPLDO有一路160nA的偏置电流被引出测试，有一路160nA的电流提供给OSC；使得测试电流偏大（无法单独测试LPBGP的功耗）,上述表格中数据减去了这两部分电流(40nA\*2+160nA+160nA=400nA)的结果。

2, SS5和SS6在LVLT条件下，启动时间均超过20mS

3, SS4和SS5在LVLT条件下，输出电压偏低，低于0.55V



# 2.测试计划一览表

表1-1 一览表

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **项目** | | | **实例** | **是** | **否** |
| 1 | 代工厂名称 | | NEXCHIP | 是 |  |
| 2 | 工艺 | | 110nm E-flash低功耗工艺 | 是 |  |
| 3 | 核心供电电压&IO供电电压 | | 5V | 是 |  |
| 4 | 金属堆叠选项 | | 1P5M | 是 |  |
| 6 | 参照 | 数据表 | XRN011EFDPWRREF\_LP08A\_V1P0\_数据手册\_V0.5 | 是 |  |
| 试验规格 | XRN011EFDPWRREG\_LPHV15A\_测试计划\_V0.1 | 是 |  |
| 7 | 样本编号和列表 | | 总共9个样品，  良率测试:9个样品  特性测试:9个样品 | 是 |  |
| 8 | 工艺角 | | TT FF 和 SS | 是 |  |
| 9 | 温度变量 | | -40℃, 25℃, 85℃, 125℃ | 是 |  |
| 10 | 电压变量 | | VCC\_LDO: 2.0V,2.5V,5V,5.5V | 是 |  |
| 11 | 静电放电 | | HBM/MM/CDM/Latch up  4kV/200V/500V/200mA |  | NA |

# 3.IP 信息

## 3.1描述

XRN011EFDPWRREG\_LP08A是低功耗带隙的IP版本。其静态电流为400nA。IP的典型参考电压为0.8V，温度系数较低。

该IP适用于低功耗稳压器，有寄存器可以配置内核电压使用的特殊参考电压。

特征

* + - 输入电源电压范围为2V至5.5V
    - 典型静态电流:400纳安(带隙)
    - 带隙典型参考电压为0.8V
    - 限流功能
    - 基于NEXCHIP 0.11um E-Flash 低功耗1P5M工艺
    - 工作结温范围:-40℃~+25℃~+125℃
    - **尺寸:330微米\* 255微米(带隙)+367微米\* 401微米(LDO)**

## 3.2 测试芯片引脚描述

表 3-1 接口描述表

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **引脚名称** | **封装PAD** | **I/O** | **活跃程度** | **电源域** | **描述** |
| **电源/接地引脚** | | | | | |
| **VCC\_BGP** | **VCC\_LPBGP** | **PI** | **-** | **5V** | 输入电源  范围从2V~5.5V |
| **VDD15** | **VDD\_I2C** | **PI** | **-** | **1.5V** | 输入1.5V数字电源 |
| **AGND\_BGP**  **AGND\_LDO** | **AGND\_PMU** | **G** | **-** | **5V/1.5V** | 接地 |
| **VCC\_MLDO** | **VCC\_LPLDO** | **PI** | **-** | **5V** | LDO 5V输入电源；  其电压范围从2V到5.5V |
| **其它引脚** | | | | | |
| **VREF08L** | VBGP\_检测\_OUT | AO | - | 5V  （VCC\_BGP） | 0.8V输出参考电压；  缓冲器之后； |
| **IBP160N** | IBP160N\_LPBGP | AO | - | 5V  （VCC\_BGP） | 从PMOS输出2通道160nA偏置电流；  PTAT电流 |
| **V15\_MLDO** | V15\_LPLDO | PO | - | 1.5V  （VCC\_LPLDO） | LDO输出，也是内部反馈分频器网络和调节环路的反馈引脚。最大输出能力大于100毫安 |
| **LPBGP\_EN\_HV**  **LPLDO\_EN\_HV** | LPBGP\_LPLDO\_EN\_LV | I | 高 | 1.5V  （VDDI2C） | 使能信号 |
| |  |  | | --- | --- | | **REG0** | **IP EN名称** | | 8'h01 | GPIORXMFA | | 8'h02 | GPIORX32KA | | 8'h04 | XRN011EFDTSTCEL\_TYA | | 8'h08 | XRN011EFDCLKOSC\_LPMFB | | 8'h10 | XRN011EFDCLKPLL\_LPMFA | | 8'h20 | XRN011EFDPWRREG\_NCHQHV15A | | 8'h40 | AMP\_CORE | | 8'h80 | XRN011EFDPWRREG\_LPHV15A & XRN011EFDPWRREF\_LP08A | | | | | |
| **LPBGP\_OK\_HV**  **LPLDO\_OK\_HV** | IP\_OK\_OUT | O | - | 1.5V  （VDDI2C） | OK 信号 |
| |  |  | | --- | --- | | **REG23** | **IP OK 名称** | | 8'h01 | LPBGP\_OK\_LV | | 8'h02 | LPLDO\_OK\_LV | | 8'h04 | NCLDO\_OK\_LV | | 8'h08 | TRIM\_OSC\_DONE\_LV | | 8'h10 | CLK\_OSCTST\_LV | | | | | |
| **检测\_EN\_LV** | LPBGP\_检测\_EN\_LV | I | 高 | 1.5V  （VDDI2C | 检测 电路使能信号 |

表 3-2 寄存器描述表

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **引脚名称** | **REG** | **I/O** | **活跃程度** | **电源域** | **描述** |
| **REG\_LPBGP\_LV[4:0]** | REG2  [4:0] | I | - | 1.5V  (VDD\_I2C) | **REG\_LPBGP\_LV[4]**  用于配置LPBGP静态电流的寄存器  REG\_LPBGP\_LV[4]=1’b0🡪 典型静态电流 200Na  REG\_LPBGP\_LV[4]=1’b1🡪 典型静态电流 400Na  **REG\_LPBGP\_LV[3:0]**  调节VREF08L的电压  =REG\_LPBGP\_LV[4]=1’b0：  REG\_LPBPG\_LV[3:0]=4’b0000🡪  VREF08L=670Mv;  … …  **REG\_LPBGP\_LV[3:0]=4’b1000🡪**  **VREF08L =800mV;**  **… …**  REG\_LPBPG\_LV[3:0]=4’b1111🡪  VREF08L=905Mv;  每一级都是15Mv |
| **LPBGP\_VRANG\_SEL\_HV** | REG2[5] | I | - | 1.5V  (VDD\_I2C) | **当电源低于3.8V时，将其配置为“0”;**  **当电源高于3.8V时，将其配置为“1”;** |
| **REG\_MLDO\_LV**  **[7:0]** | REG3  [7:0] | I | - | 1.5V  (VDD\_I2C) | 控制LDO的寄存器  **REG\_MLDO\_LV[7]**  **使能电流限制功能:**  **REG\_MLDO\_LV[7]=”0”🡪 禁用电流限制(默认)**  REG\_MLDO\_LV[7]=”1”🡪 **使能电流限制**  **REG\_MLDO\_LV[6:5]**  用于配置MLDO静态电流的寄存器  REG\_MLDO\_LV[6:5]=2’b11 🡪  静态电流=6uA;  REG\_MLDO\_LV[6:5]=2’b10 🡪  静态电流 =2uA(默认);  REG\_MLDO\_LV[6:5]=2’b01 🡪  静态电流=1.5uA;  **REG\_MLDO\_LV[6:5]=2’b00 🡪**  **静态电流 =1.1uA(默认);**  **REG\_MLDO\_LV[4:0]**  **输出电压配置:**  REG\_MLDO\_LV[4:0]=5’b11111🡪  V15\_MLDO=1.875V  ……  **REG\_MLDO\_LV[4:0]=5’b10000🡪**  **V15\_MLDO=1.5V（默认）**  **……**  REG\_MLDO\_LV[4:0]=5’b000000🡪  V15\_MLDO=1.1V  每一级是 25mV |

# 4.测试信息

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 项目 | | 信息 | | | | | | **评价** |
| 1 | IP 名称 | NEXCHIP 0.11um E-Flash 低功耗工艺  低功耗带隙 | | | | | |  |
| 2 | 工艺角 | TT,SS,FF | | | | | |  |
| 3 | 样本编号和列表 | TT2/TT5/TT7/FF4/FF7/FF8/SS4/SS5/SS6 | | | | | |  |
| 4 | 测试条件 | 条件 | 温度(℃) | | VCC\_BGP  （V） | | VDD  （V） |  |
| LVLT | -40 | | 2 | | 1.35 |
| MVLT | -40 | | 3.3 | | 1.35 |
| NVLT | -40 | | 5 | | 1.5 |
| HVLT | -40 | | 5.5 | | 1.65 |
| LVLT | 25 | | 2 | | 1.35 |
| MVNT | 25 | | 3.3 | | 1.35 |
| NVNT | 25 | | 5 | | 1.5 |
| HVNT | 25 | | 5.5 | | 1.65 |
| LVNT | 125 | | 2 | | 1.35 |
| MVHT | 125 | | 3.3 | | 1.35 |
| NVHT | 125 | | 5 | | 1.5 |
| HVHT | 125 | | 5.5 | | 1.65 |
| 5 | 测试项目 | 参考电压(BGP) | | | | | |  |
| 工作电流(BGP) | | | | | |
| 掉电电流(BGP) | | | | | |
| 启动时间(BGP) | | | | | |
| 线性调节、负载调节和温度特性(BGP) | | | | | |
| 6 | 测试仪器 | 测试项 | | 生产商 | | 型号& SN | |  |
| 电流表 | | Keysight | | 34461A | |
| 电压表 | | Keysight | | 34461A 102 | |
| 高低温热流仪 | |  | | TPO4310 | |
| 电源 | | GW | | GPD-3303S | |
| 7 | 测试工程师 | ZT/MHB | | | | | |  |
| 8 | 测试日期 | 2020-10-13~2020-10-22  2021-5-20~2021-6-18 | | | | | |  |

# 5.测试方法

## 5.1 测试框图



图.5.1 测试框图

## 5.2测试方法

根据《XRN011EFDPWRREG\_LPHV15A\_V1P0\_检测Plan\_V0.1》，所有测试项均已检测。

# 6.测试数据

## 6.1参考电压

**表 7-1 ~7-3 参考电压测试数据 @BGP.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **REG\_LPBGP\_LV[4:0]** | **理论值(V)** | **VBGP\_检测\_OUT** | | | | | | | | |
| REG2[4:0] | **T2** | **T7** | **T5** | **F4** | **F7** | **F8** | **S4** | **S5** | **S6** |
|  | 11111 | 0.898 | 0.91 | 0.914 | 0.898 | 0.91 | 0.884 | 0.891 | 0.903 | 0.896 | 0.891 |
| 11110 |  | 0.896 | 0.899 | 0.884 | 0.895 | 0.871 | 0.877 | 0.889 | 0.882 | 0.877 |
| 11101 |  | 0.881 | 0.885 | 0.87 | 0.881 | 0.857 | 0.863 | 0.874 | 0.868 | 0.863 |
| 11100 |  | 0.867 | 0.871 | 0.856 | 0.866 | 0.843 | 0.849 | 0.86 | 0.854 | 0.849 |
| 11011 |  | 0.853 | 0.856 | 0.842 | 0.852 | 0.829 | 0.835 | 0.846 | 0.84 | 0.835 |
| 11010 |  | 0.838 | 0.842 | 0.828 | 0.838 | 0.815 | 0.821 | 0.832 | 0.826 | 0.821 |
| 11001 |  | 0.824 | 0.828 | 0.814 | 0.824 | 0.802 | 0.807 | 0.818 | 0.812 | 0.807 |
| 11000 | 0.801 | 0.81 | 0.814 | 0.8 | 0.809 | 0.788 | 0.794 | 0.804 | 0.798 | 0.793 |
| 10111 |  | 0.796 | 0.8 | 0.786 | 0.795 | 0.774 | 0.78 | 0.79 | 0.784 | 0.779 |
| 10110 |  | 0.781 | 0.785 | 0.772 | 0.78 | 0.76 | 0.766 | 0.775 | 0.77 | 0.765 |
| 10101 |  | 0.767 | 0.771 | 0.758 | 0.766 | 0.746 | 0.752 | 0.761 | 0.756 | 0.752 |
| 10100 |  | 0.753 | 0.757 | 0.744 | 0.752 | 0.732 | 0.738 | 0.747 | 0.742 | 0.737 |
| 10011 |  | 0.738 | 0.743 | 0.73 | 0.737 | 0.718 | 0.724 | 0.733 | 0.728 | 0.723 |
| 10010 |  | 0.724 | 0.728 | 0.716 | 0.723 | 0.705 | 0.71 | 0.719 | 0.714 | 0.709 |
| 10001 |  | 0.71 | 0.714 | 0.702 | 0.709 | 0.691 | 0.696 | 0.705 | 0.7 | 0.695 |
| 10000 | 0.687 | 0.696 | 0.7 | 0.688 | 0.694 | 0.677 | 0.682 | 0.691 | 0.686 | 0.681 |
| 01111 | 0.908 | 0.92 | 0.926 | 0.907 | 0.924 | 0.896 | 0.905 | 0.913 | 0.907 | 0.9 |
| 01110 |  | 0.904 | 0.91 | 0.891 | 0.909 | 0.881 | 0.89 | 0.897 | 0.892 | 0.885 |
| 01101 |  | 0.889 | 0.895 | 0.876 | 0.893 | 0.866 | 0.875 | 0.882 | 0.877 | 0.87 |
| 01100 |  | 0.873 | 0.88 | 0.862 | 0.877 | 0.851 | 0.859 | 0.867 | 0.861 | 0.854 |
| 01011 |  | 0.858 | 0.864 | 0.846 | 0.861 | 0.836 | 0.844 | 0.852 | 0.846 | 0.839 |
| 01010 |  | 0.842 | 0.848 | 0.831 | 0.846 | 0.821 | 0.829 | 0.836 | 0.832 | 0.824 |
| 01001 |  | 0.826 | 0.833 | 0.816 | 0.83 | 0.806 | 0.814 | 0.821 | 0.816 | 0.808 |
| 01000 | 0.8 | 0.811 | 0.817 | 0.8 | 0.815 | 0.791 | 0.798 | 0.805 | 0.8 | 0.793 |
| 00111 |  | 0.795 | 0.802 | 0.785 | 0.799 | 0.775 | 0.783 | 0.79 | 0.785 | 0.778 |
| 00110 |  | 0.78 | 0.787 | 0.769 | 0.783 | 0.761 | 0.768 | 0.774 | 0.77 | 0.763 |
| 00101 |  | 0.764 | 0.771 | 0.754 | 0.767 | 0.746 | 0.753 | 0.759 | 0.755 | 0.748 |
| 00100 |  | 0.749 | 0.755 | 0.739 | 0.752 | 0.73 | 0.737 | 0.745 | 0.739 | 0.732 |
| 00011 |  | 0.733 | 0.74 | 0.724 | 0.736 | 0.715 | 0.722 | 0.729 | 0.724 | 0.717 |
| 00010 |  | 0.718 | 0.724 | 0.708 | 0.721 | 0.7 | 0.707 | 0.713 | 0.708 | 0.702 |
| 00001 |  | 0.702 | 0.709 | 0.693 | 0.704 | 0.685 | 0.692 | 0.698 | 0.693 | 0.686 |
| 00000 | 0.679 | 0.686 | 0.693 | 0.677 | 0.689 | 0.67 | 0.676 | 0.682 | 0.679 | 0.671 |

## 6.2工作电流

**表 7-4~7-6工作电流测试数据 @BGP.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | T2 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 417 | 737 | 748 | 564 | 925 | 1003 |
| 3.3V | 433 | 752 | 765 | 586 | 948 | 1022 |
| 5V | 436 | 762 | 778 | 596 | 961 | 1046 |
| 5.5V | 441 | 771 | 797 | 601 | 968 | 1065 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | T5 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 430 | 558 | 732 | 578 | 750 | 983 |
| 3.3V | 440 | 565 | 746 | 595 | 764 | 1003 |
| 5V | 448 | 574 | 764 | 602 | 777 | 1025 |
| 5.5V | 451 | 580 | 784 | 606 | 785 | 1046 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | T7 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 432 | 546 | 744 | 574 | 734 | 993 |
| 3.3V | 445 | 555 | 761 | 594 | 747 | 1009 |
| 5V | 453 | 562 | 782 | 603 | 756 | 1027 |
| 5.5V | 457 | 569 | 797 | 607 | 763 | 1033 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | F4 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 469 | 564 | 1067 | 612 | 762 | 1326 |
| 3.3V | 477 | 573 | 1087 | 625 | 773 | 1350 |
| 5V | 482 | 580 | 1116 | 631 | 784 | 1380 |
| 5.5V | 483 | 588 | 1143 | 635 | 793 | 1407 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | F7 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 451 | 575 | 721 | 571 | 760 | 957 |
| 3.3V | 473 | 580 | 767 | 640 | 815 | 995 |
| 5V | 494 | 619 | 785 | 613 | 821 | 1040 |
| 5.5V | 502 | 630 | 810 | 621 | 826 | 1053 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | F8 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 409 | 542 | 739 | 556 | 736 | 1011 |
| 3.3V | 423 | 552 | 758 | 564 | 750 | 1025 |
| 5V | 427 | 559 | 756 | 578 | 762 | 1056 |
| 5.5V | 429 | 565 | 802 | 583 | 768 | 1066 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | S4 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 412 | 749 | 1025 | 417 | 935 | 1265 |
| 3.3V | 425 | 762 | 1040 | 571 | 952 | 1284 |
| 5V | 429 | 773 | 1051 | 579 | 964 | 1306 |
| 5.5V | 431 | 775 | 1064 | 583 | 972 | 1320 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | S5 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 411 | 740 | 987 | 422 | 921 | 1252 |
| 3.3V | 424 | 752 | 1007 | 547 | 942 | 1271 |
| 5V | 432 | 764 | 1026 | 575 | 952 | 1286 |
| 5.5V | 435 | 766 | 1043 | 583 | 958 | 1301 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| REG2[4] | Iq（uA）VCC\_LPBGP（典型200nA） | | | Iq（uA）VCC\_LPBGP（典型400nA） | | |
| REG2[4]=”0” | | | REG2[4]=”1” | | |
| VCC\_LPLDO | S6 | | | | | |
| -40℃ | 25℃ | 125℃ | -40℃ | 25℃ | 125℃ |
| 2V | 396 | 726 | 1003 | 540 | 915 | 1241 |
| 3.3V | 404 | 742 | 1017 | 551 | 934 | 1260 |
| 5V | 410 | 748 | 1026 | 559 | 943 | 1278 |
| 5.5V | 414 | 754 | 1036 | 563 | 949 | 1293 |

## 6.3 掉电电流

**表 7-13~7-15 掉电电流测试数据@BGP.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | T2 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | <10 |
| 3.3V | <10 | <10 | <10 |
| 5V | <10 | <10 | 12 |
| 5.5V | <10 | <10 | 14 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | T5 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | <10 |
| 3.3V | <10 | <10 | <10 |
| 5V | <10 | <10 | 13 |
| 5.5V | <10 | <10 | 16 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | T7 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | 7 |
| 3.3V | <10 | <10 | 8 |
| 5V | <10 | <10 | 10 |
| 5.5V | <10 | <10 | 10 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | F4 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | 17 |
| 3.3V | <10 | <10 | 23 |
| 5V | <10 | <10 | 38 |
| 5.5V | <10 | <10 | 42 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | F7 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | 21 |
| 3.3V | <10 | <10 | 64 |
| 5V | <10 | <10 | 72 |
| 5.5V | <10 | <10 | 70 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | F8 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | 15 |
| 3.3V | <10 | <10 | 21 |
| 5V | <10 | <10 | 28 |
| 5.5V | <10 | <10 | 28 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | S4 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | 11 |
| 3.3V | <10 | <10 | 14 |
| 5V | <10 | <10 | 18 |
| 5.5V | <10 | <10 | 20 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | S5 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | <10 |
| 3.3V | <10 | <10 | <10 |
| 5V | <10 | <10 | 11 |
| 5.5V | <10 | <10 | 14 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ipd（nA） VCC\_LPBGP | | |
| VCC\_LPBGP | S6 | | |
| -40℃ | 25℃ | 125℃ |
| 2V | <10 | <10 | <10 |
| 3.3V | <10 | <10 | <10 |
| 5V | <10 | <10 | 13 |
| 5.5V | <10 | <10 | 15 |

## 6.4 启动时间

**表 7-16~7-18 启动时间测试数据 @BGP&LDO 单位 (ms).**

|  |  |  |  |
| --- | --- | --- | --- |
| condition | -40℃ | 25℃ | 125℃ |
| FF4-2.0V | 151.92 | 81 | 49.6 |
| FF7-2.0V | 204.9 | 161.76 | 50 |
| FF8-2.0V | 94.38 | 96.76 | 46.4 |
| SS4-2.0V | 24390 | 816 | 104 |
| SS5-2.0V | 23094 | 668 | 93.5 |
| SS6-2.0V | 26561 | 860 | 108 |
| TT2-2.0V | 366 | 278 | 54 |
| TT5-2.0V | 398 | 119 | 72 |
| TT7-2.0V | 333 | 123 | 54 |
| FF4-3.3V | 65.52 | 48.6 | 34.8 |
| FF7-3.3V | 63.92 | 48.58 | 36.52 |
| FF8-3.3V | 69.32 | 49.64 | 35.3 |
| SS4-3.3V | 92 | 62 | 42 |
| SS5-3.3V | 83.64 | 60 | 42 |
| SS6-3.3V | 81.5 | 59.7 | 43 |
| TT2-3.3V | 110 | 232 | 34 |
| TT5-3.3V | 74 | 53 | 226 |
| TT7-3.3V | 73 | 50 | 36 |
| FF4-5.0V | 64.92 | 51 | 36.8 |
| FF7-5.0V | 66.92 | 50.88 | 41.24 |
| FF8-5.0V | 69.56 | 52.74 | 38.64 |
| SS4-5.0V | 70.36 | 52 | 40 |
| SS5-5.0V | 72.74 | 55 | 41.5 |
| SS6-5.0V | 72.5 | 56 | 42 |
| TT2-5.0V | 58 | 52 | 36 |
| TT5-5.0V | 70 | 56 | 160 |
| TT7-5.0V | 63 | 49 | 38 |
| FF4-5.5V | 66.92 | 53 | 37.4 |
| FF7-5.5V | 68.92 | 52.78 | 42.76 |
| FF8-5.5V | 72.12 | 54.88 | 42.24 |
| SS4-5.5V | 69.35 | 53 | 41 |
| SS5-5.5V | 72.38 | 51 | 42.5 |
| SS6-5.5V | 73.56 | 56.4 | 43 |
| TT2-5.5V | 60 | 48 | 38 |
| TT5-5.5V | 69 | 50 | 176 |
| TT7-5.5V | 64 | 50 | 39 |

## 6.5 线性调节和温度特性

**表 7-19~7-27 负载调节和温度特性试验数据 @BGP.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | -40℃ | 25℃ | 85℃ | 125℃ |
| T2-2.0V | 0.791 | 0.797 | 0.794 | 0.791 |
| T2-2.5V | 0.796 | 0.801 | 0.798 | 0.794 |
| T2-3.3V | 0.801 | 0.805 | 0.802 | 0.798 |
| T2-5.0V | 0.807 | 0.811 | 0.809 | 0.808 |
| T2-5.5V | 0.81 | 0.814 | 0.815 | 0.818 |
| T7-2.0V | 0.803 | 0.805 | 0.801 | 0.798 |
| T7-2.5V | 0.809 | 0.809 | 0.804 | 0.801 |
| T7-3.3V | 0.813 | 0.812 | 0.808 | 0.805 |
| T7-5.0V | 0.818 | 0.817 | 0.814 | 0.812 |
| T7-5.5V | 0.82 | 0.82 | 0.818 | 0.82 |
| T5-2.0V | 0.794 | 0.789 | 0.781 | 0.778 |
| T5-2.5V | 0.798 | 0.792 | 0.784 | 0.781 |
| T5-3.3V | 0.801 | 0.795 | 0.787 | 0.784 |
| T5-5.0V | 0.805 | 0.8 | 0.794 | 0.793 |
| T5-5.5V | 0.807 | 0.803 | 0.801 | 0.803 |
| F4-2.0V | 0.813 | 0.804 | 0.793 | 0.787 |
| F4-2.5V | 0.816 | 0.806 | 0.795 | 0.79 |
| F4-3.3V | 0.819 | 0.809 | 0.799 | 0.793 |
| F4-5.0V | 0.823 | 0.814 | 0.805 | 0.802 |
| F4-5.5V | 0.825 | 0.817 | 0.812 | 0.813 |
| F7-2.0V | 0.803 | 0.791 | 0.78 | 0.772 |
| F7-2.5V | 0.808 | 0.793 | 0.783 | 0.775 |
| F7-3.3V | 0.811 | 0.796 | 0.786 | 0.779 |
| F7-5.0V | 0.816 | 0.801 | 0.793 | 0.788 |
| F7-5.5V | 0.818 | 0.806 | 0.8 | 0.799 |
| F8-2.0V | 0.777 | 0.779 | 0.777 | 0.775 |
| F8-2.5V | 0.781 | 0.782 | 0.78 | 0.778 |
| F8-3.3V | 0.784 | 0.786 | 0.783 | 0.781 |
| F8-5.0V | 0.789 | 0.79 | 0.79 | 0.789 |
| F8-5.5V | 0.79 | 0.794 | 0.797 | 0.798 |
| S4-2.0V | 0.532 | 0.795 | 0.788 | 0.784 |
| S4-2.5V | 0.799 | 0.799 | 0.791 | 0.786 |
| S4-3.3V | 0.801 | 0.802 | 0.794 | 0.789 |
| S4-5.0V | 0.807 | 0.811 | 0.798 | 0.795 |
| S4-5.5V | 0.808 | 0.822 | 0.802 | 0.801 |
| S5-2.0V | 0.546 | 0.788 | 0.782 | 0.777 |
| S5-2.5V | 0.796 | 0.793 | 0.783 | 0.779 |
| S5-3.3V | 0.801 | 0.796 | 0.787 | 0.783 |
| S5-5.0V | 0.805 | 0.808 | 0.792 | 0.788 |
| S5-5.5V | 0.807 | 0.819 | 0.795 | 0.794 |
| S6-2.0V | 0.781 | 0.783 | 0.781 | 0.766 |
| S6-2.5V | 0.779 | 0.786 | 0.787 | 0.778 |
| S6-3.3V | 0.784 | 0.789 | 0.799 | 0.782 |
| S6-5.0V | 0.791 | 0.799 | 0.801 | 0.798 |
| S6-5.5V | 0.798 | 0.811 | 0.815 | 0.817 |

**四、IP 名称:XRN011EFDPWRREG\_NCHQHV15A**

# 1.测试总结

VCC\_NCLDO=2.0v~5.5v,VDD=1.35v~1.65v,TA=-40℃，25℃，125℃；@所有工艺角

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **符号** | **条件** | **规格** | | | **测量@（-40℃~125℃）** | | | | |
| **最小值** | **典型值** | **最大值** | **最小值** | **典型值** | **最大值** | **单位** | **结果** |
| V15\_LDO | VCC\_LDO=2.0V~5.5V | 1.100 | 1.5 | 1.900 | 1.09 | 1.505 | 1.799 | V | 通过 |
| IMAX\_LDO | VCC\_LDO =2.5V~5.5V | 300 | 450 | 500 | 305 | 460 | 560 | mA | 通过 |
| IMAX\_LDO | VCC\_LDO =2.0V~2.5V | 70 | 100 | 120 | 69 | 103 | 154 | mA | 通过 |
| Iq\_LDO | VCC\_LDO =2V~5.5V  IOPSEL\_LV[1:0]=1’b0  ILOADSEL\_LV[1:0]=3’b000  Iload=0mA | 8 | 13 | 18 | 4.202 | 12.97 | 18.98 | uA | 通过 |
| VCC\_LDO =2V~5.5V  IOPSEL\_LV[1:0]=1’b1  ILOADSEL\_LV[1:0]=3’b000  Iload=0mA | 230 | 440 | 620 | 81.36 | 434.94 | 613.375 | 通过 |
| Ipd\_LDO | VCC\_LDO =2.0V~5.5V  LDO\_EN\_LV=”0” | - | 10 | 1000 | <10 | <10 | 336 | nA | 通过 |
| VREG\_LOAD | VCC\_LDO=2V~5.5V  ILOAD=10mA~100mA | 0 | 15 | 150 | 0 | 13 | 150 | mV | 通过 |
| VREG\_LINE | ILOAD=100uA  VCC\_LDO=2V~5.5V | 5 | 10 | 35 | 2 | 8 | 23 | mV | 通过 |
| VRIPP\_LDO | Load changing from 10mA to 100mA or 100mA to 10mA,  transition time is 100ns  with 1nF | 120 | 130 | 200 | 104 | 116 | 196 | mV | 通过 |
| TOK\_LDO | VCCA\_LDO=2.0V~5.5V  IOPSEL\_LV=1’b0  CLDO=1nF | 1 | 20 | 250 | 1.01 | 2.8 | 840  [1] | uS | 不合格 |

注释：TYP选取的是TT2常温常压的数据

[1]: 在低温低压（2.0V，-40℃）条件下测得，并且测试结果包含BGP的启动时间。

# 2.一览表

表1-1 一览表

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **项目** | | | **实例** | **是** | **否** |
| 1 | 代工厂名称 | | NEXCHIP | 是 |  |
| 2 | 工艺 | | NEXCHIP110nm E-Flash低功耗 1P5M工艺 | 是 |  |
| 3 | 核心供电电压&IO供电电压 | | 1.5V | 是 |  |
| 4 | 金属堆叠选项 | | 1P5M | 是 |  |
| 6 | 参照 | 数据表 | XRN011EFDPWRREG\_NCHQHV15A \_V1P0  \_数据手册\_V0.7 | 是 |  |
| 试验规格 | XRN011EFDPWRREG\_NCHQHV15A \_V1P0  \_测试计划\_V0.1 | 是 |  |
| 7 | 样本编号和列表 | | 总共9个样品，  良率测试:9个样品  特性测试:9个样品 | 是 |  |
| 8 | 工艺角 | | TT FF 和 SS | 是 |  |
| 9 | 温度变量 | | -40℃, 25℃, 125℃ | 是 |  |
| 10 | 电压变量 | | 2.0V~5.5V | 是 |  |
| 11 | 静电放电 | | **不需要静电放电测试** |  | NA |

# 3.IP 信息

## 3.1描述

XRN011EFDPWRREG\_NCHQHV15A是低功耗和LDO(低压降稳压器)的IP版本。该版本基于 Nexchip 0.11umE-Flash低功耗1P5M工艺。

LDO IP支持2.0V到5.5V的输入电源电压。典型的输出电压为1.5V，可以软件设置为1.1V到1.8V。

* + - 输入电源电压范围为2.0V至5.5V
    - 典型的输出电压为1.5V，可以软件设置为1.1V到1.8V。
    - 支持无电容应用，具有高响应率
    - 最大输出电流能力:

150毫安(2.5V-5.5V输入电压范围)

* + - NEXCHIP110nm E-Flash低功耗 1P5M工艺
    - 工作结温: -40°C~+25°C~+125°C
    - 尺寸:368微米\* 311微米

# 4.测试信息

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **项目** | | **信息** | | | | | | **评价** |
| 1 | IP 名称 | NEXCHIP0.11um E-Flash低功耗工艺  无电容 5V🡪1.5V LDO | | | | | |  |
| 2 | 工艺角 | TT,FF,SS | | | | | |  |
| 3 | 样本编号和列表 | TT2/TT5/TT7/FF4/FF7/FF8/SS4/SS5/SS6 | | | | | |  |
| 4 | 测试条件 | 条件 | 温度(℃) | | VCC  （V） | | VDD  （V） |  |
| LVLT | -40 | | 2.0 | | 1.35 |
| NVLT | -40 | | 5.0 | | 1.5 |
| HVLT | -40 | | 5.5 | | 1.65 |
| LVNT | 25 | | 2.0 | | 1.35 |
| NVNT | 25 | | 5.0 | | 1.5 |
| HVNT | 25 | | 5.5 | | 1.65 |
| LVHT | 125 | | 2.0 | | 1.35 |
| NVHT | 125 | | 5.0 | | 1.5 |
| HVHT | 125 | | 5.5 | | 1.65 |
| 5 | 测试项目 | LDO输出电压范围 | | | | | |  |
| LDO目前的能力 | | | | | |
| LDO的断电电流 | | | | | |
| 负载调节 | | | | | |
| 线性调节 | | | | | |
| LDO输出的纹波电压 | | | | | |
|  | | | | | |
| 6 | 测试仪器 | 测试项 | | 生产商 | | 型号& SN | |  |
| 电流表 | | Keysight | | 102 | |
| 高低温热流仪 | |  | | TPO4310 | |
| 电源 | | GW | | GES919002 | |
| 示波器 | | ZLG | | ZDS1104 | |
| 电压表 | | Keysight | | 103 | |
| 7 | 测试工程师 | ZT/MHB | | | | | |  |
| 8 | 测试日期 | 2020-10-13~2020-10-16  2021-5-20~2021-6-18 | | | | | |  |

# 5.测试方法

## 5.1 测试框图



## 5.2 测试方法

根据《XRN011EFDPWRREG\_NCHQHV15A\_V1P0\_测试计划\_V0.1》所有测试项均已检测。

# 6.测试结果

## 6.1 良率测试结果

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品 |  | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **结果** | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 |

# 7.测试数据

## 7.1 调整

* 表 7‑1 调整测试结果@TT,FF,SS
* @I2C 配置: 3C 01 A0 3C 05 20~3A 00 VDD\_POR=1.5V,VCC\_POR=5.0V

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **REG5[7:0]** | **V15\_NCLDO** | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **8’h00** | 1.122 | 1.121 | 1.111 | 1.142 | 1.091 | 1.101 | 1.104 | 1.09 | 1.113 |
| **8’h01** | 1.147 | 1.146 | 1.136 | 1.167 | 1.115 | 1.125 | 1.128 | 1.115 | 1.138 |
| **8’h02** | 1.173 | 1.171 | 1.161 | 1.193 | 1.139 | 1.15 | 1.154 | 1.14 | 1.163 |
| **8’h03** | 1.198 | 1.196 | 1.188 | 1.218 | 1.1674 | 1.175 | 1.179 | 1.165 | 1.188 |
| **8’h04** | 1.224 | 1.221 | 1.213 | 1.243 | 1.189 | 1.199 | 1.204 | 1.19 | 1.213 |
| **8’h05** | 1.249 | 1.245 | 1.238 | 1.268 | 1.213 | 1.224 | 1.229 | 1.215 | 1.237 |
| **8’h06** | 1.275 | 1.271 | 1.264 | 1.294 | 1.238 | 1.249 | 1.254 | 1.241 | 1.263 |
| **8’h07** | 1.301 | 1.295 | 1.289 | 1.318 | 1.262 | 1.274 | 1.279 | 1.265 | 1.287 |
| **8’h08** | 1.326 | 1.32 | 1.314 | 1.344 | 1.287 | 1.299 | 1.304 | 1.29 | 1.312 |
| **8’h09** | 1.352 | 1.346 | 1.34 | 1.37 | 1.312 | 1.324 | 1.329 | 1.315 | 1.337 |
| **8’h0a** | 1.377 | 1.371 | 1.366 | 1.395 | 1.336 | 1.348 | 1.355 | 1.34 | 1.362 |
| **8’h0b** | 1.403 | 1.396 | 1.391 | 1.42 | 1.361 | 1.373 | 1.38 | 1.365 | 1.386 |
| **8’h0c** | 1.428 | 1.421 | 1.417 | 1.446 | 1.385 | 1.398 | 1.405 | 1.39 | 1.411 |
| **8’h0d** | 1.454 | 1.445 | 1.442 | 1.471 | 1.409 | 1.423 | 1.43 | 1.415 | 1.436 |
| **8’h0e** | 1.479 | 1.47 | 1.469 | 1.496 | 1.435 | 1.448 | 1.455 | 1.44 | 1.461 |
| **8’h10** | 1.505 | 1.495 | 1.493 | 1.546 | 1.483 | 1.497 | 1.502 | 1.489 | 1.51 |
| **8’h11** | 1.529 | 1.519 | 1.517 | 1.572 | 1.507 | 1.521 | 1.53 | 1.514 | 1.534 |
| **8’h12** | 1.555 | 1.544 | 1.542 | 1.597 | 1.532 | 1.546 | 1.554 | 1.539 | 1.559 |
| **8’h13** | 1.581 | 1.569 | 1.577 | 1.622 | 1.556 | 1.571 | 1.58 | 1.564 | 1.584 |
| **8’h14** | 1.606 | 1.594 | 1.603 | 1.648 | 1.581 | 1.595 | 1.606 | 1.589 | 1.609 |
| **8’h15** | 1.632 | 1.619 | 1.629 | 1.673 | 1.606 | 1.62 | 1.631 | 1.614 | 1.633 |
| **8’h16** | 1.657 | 1.643 | 1.654 | 1.698 | 1.63 | 1.645 | 1.656 | 1.639 | 1.658 |
| **8’h17** | 1.683 | 1.669 | 1.679 | 1.724 | 1.654 | 1.67 | 1.681 | 1.663 | 1.683 |
| **8’h18** | 1.708 | 1.694 | 1.706 | 1.749 | 1.68 | 1.695 | 1.706 | 1.689 | 1.708 |
| **8’h19** | 1.734 | 1.719 | 1.73 | 1.774 | 1.704 | 1.72 | 1.731 | 1.714 | 1.733 |
| **8’h1a** | 1.757 | 1.744 | 1.755 | 1.799 | 1.729 | 1.745 | 1.756 | 1.739 | 1.758 |

## 7.2 LDO静态电流

* 表 7‑2-1 TTSS FF LDO静态电流测试数据@I2C 配置: 3C 00 A0 3C 02 08 3C 05 10 00/3C 05 30 10

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **条件** | **Iq (REG5[7:0]=10)** | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **LVLT** | 8.538 | 9.027 | 7.113 | 9.732 | 6.822 | 7.054 | 8.172 | 8.644 | 4.202 |
| **NVLT** | 10.788 | 11.131 | 8.941 | 11.72 | 8.396 | 8.896 | 9.84 | 10.301 | 10.412 |
| **HVLT** | 11.558 | 11.932 | 9.636 | 12.615 | 9.495 | 9.46 | 10.5 | 11.036 | 11.099 |
| **LVNT** | 10.787 | 10.819 | 9.071 | 11.461 | 8.84 | 10.59 | 10.235 | 10.581 | 10.774 |
| **NVNT** | 12.971 | 12.827 | 10.974 | 13.442 | 10.93 | 12.9 | 12.063 | 12.695 | 12.893 |
| **HVNT** | 13.814 | 13.658 | 11.749 | 14.206 | 11.837 | 13.94 | 12.6698 | 13.56 | 13.779 |
| **LVHT** | 13.921 | 14.022 | 12.935 | 15.19 | 13.362 | 11.621 | 13.244 | 8.6 | 8.67 |
| **NVHT** | 16.428 | 16.568 | 15.425 | 17.81 | 16.234 | 13.9 | 16.144 | 16.63 | 16.83 |
| **HVHT** | 17.624 | 17.689 | 16.541 | 18.98 | 17.491 | 14.856 | 17.352 | 17.512 | 17.7 |
| **条件** | **Iq (REG5[7:0]=8’h30)** | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **LVLT** | 278.573 | 281.893 | 227.431 | 296.76 | 241.05 | 247.64 | 272.73 | 81.36 | 80.12 |
| **NVLT** | 343.925 | 344.616 | 274.841 | 348.2 | 288.61 | 291.32 | 306.52 | 319.51 | 328.14 |
| **HVLT** | 360.714 | 363.393 | 290.412 | 374.81 | 313.13 | 307.31 | 320.29 | 340.43 | 349.27 |
| **LVNT** | 359.44 | 354.319 | 303.964 | 373.516 | 324.12 | 366.72 | 330.196 | 333.354 | 342.845 |
| **NVNT** | 434.939 | 421.748 | 364.438 | 428.0941 | 379.41 | 432.19 | 407.412 | 415.851 | 435.164 |
| **HVNT** | 456.457 | 443.243 | 384.156 | 450.152 | 409.83 | 465.95 | 425.309 | 442.235 | 462.256 |
| **LVHT** | 485.297 | 475.925 | 439.922 | 511.8 | 497.69 | 413.41 | 452.24 | 273.94 | 269.48 |
| **NVHT** | 579.154 | 565.794 | 520.277 | 590.57 | 571.75 | 483.22 | 556.43 | 561.4 | 579.3 |
| **HVHT** | 613.375 | 599.652 | 552.631 | 624.84 | 600.95 | 512.92 | 599.18 | 587.01 | 604.2 |

## 

## 7.3 LDO关断电流

* LDO\_EN\_HV=”0” VDD\_POR=1.35V~1.65V VCC\_POR=2.0V~3.6V

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **条件** |  | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **LVLT** | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| **NVLT** | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| **HVLT** | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| **LVNT** | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| **NVNT** | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| **HVNT** | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| **LVHT** | 40 | 45 | 22 | 22 | 33 | 62 | 54 | 12 | 26 |
| **NVHT** | 84 | 119 | 48 | 253 | 31 | 233 | 297 | 45 | 210 |
| **HVHT** | 93 | 140 | 58 | 304 | 92 | 267 | 336 | 50 | 257 |

## 7.4 LDO电流容量 (IMAX\_LDO)

* I2C 配置:3C 00 A0 3C 05 30 00 VDD\_POR=1.35V~1.65V VCC\_POR=2.0V~5.5V

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Condition** |  | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **LVLT** | 110 | 126 | 120 | 141 | 88 | 90 | 154 | 133.5 | 153.2 |
| **NVLT** | 509 | 438 | 500 | 419 | 200 | 217 | 396 | 318.7 | 414.7 |
| **HVLT** | 515 | 439 | 502 | 460 | 162 | 220 | 419 | 373 | 339 |
| **LVNT** | 109 | 103 | 110 | 106 | 92 | 84 | 88 | 87 | 87 |
| **NVNT** | 460 | 366 | 442 | 411 | 201 | 276 | 447 | 433 | 443 |
| **HVNT** | 467 | 372 | 448 | 423 | 176 | 214 | 437 | 427 | 436 |
| **LVHT** | 75 | 84 | 80 | 80 | 83 | 76 | 69.9 | 69.9 | 68.8 |
| **NVHT** | 319 | 356 | 358 | 221 | 218 | 205 | 276 | 250 | 253 |
| **HVHT** | 323 | 361 | 364 | 223 | 221 | 209 | 443 | 250 | 220 |

## 7.5 负载调节

* 2C 配置:3C 00 A0 3C 05 30 00 VDD\_POR=1.35V~1.65V VCC\_POR=2.0V~5.5V

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| VCC\_NCLDO | VCC\_NCLDO(mA) | | | | |
| TT2 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.496 | 1.495 | 1.484 | 1.483 | 1.432 |
| NVLT | 1.527 | 1.527 | 1.517 | 1.515 | 1.505 |
| HVLT | 1.532 | 1.532 | 1.523 | 1.52 | 1.51 |
| LVNT | 1.508 | 1.507 | 1.493 | 1.491 | 1.431 |
| NVNT | 1.536 | 1.534 | 1.521 | 1.518 | 1.504 |
| HVNT | 1.543 | 1.541 | 1.529 | 1.525 | 1.511 |
| LVHT | 1.494 | 1.491 | 1.47 | 1.463 | 1.316 |
| NVHT | 1.529 | 1.526 | 1.503 | 1.499 | 1.478 |
| HVHT | 1.55 | 1.546 | 1.523 | 1.519 | 1.498 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| VCC\_NCLDO | VCC\_NCLDO(mA) | | | | |
| TT5 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.486 | 1.485 | 1.477 | 1.471 | 1.447 |
| NVLT | 1.508 | 1.507 | 1.498 | 1.496 | 1.483 |
| HVLT | 1.514 | 1.514 | 1.5 | 1.498 | 1.485 |
| LVNT | 1.499 | 1.483 | 1.466 | 1.466 | 1.418 |
| NVNT | 1.513 | 1.503 | 1.489 | 1.486 | 1.471 |
| HVNT | 1.521 | 1.511 | 1.494 | 1.492 | 1.479 |
| LVHT | 1.46 | 1.457 | 1.434 | 1.427 | 1.298 |
| NVHT | 1.492 | 1.488 | 1.466 | 1.462 | 1.44 |
| HVHT | 1.512 | 1.508 | 1.486 | 1.482 | 1.462 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| VCC\_NCLDO | VCC\_NCLDO(mA) | | | | |
| TT7 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.509 | 1.506 | 1.495 | 1.492 | 1.461 |
| NVLT | 1.533 | 1.533 | 1.522 | 1.52 | 1.508 |
| HVLT | 1.537 | 1.536 | 1.525 | 1.524 | 1.514 |
| LVNT | 1.51 | 1.503 | 1.494 | 1.493 | 1.436 |
| NVNT | 1.534 | 1.532 | 1.517 | 1.514 | 1.498 |
| HVNT | 1.541 | 1.539 | 1.524 | 1.521 | 1.504 |
| LVHT | 1.488 | 1.485 | 1.462 | 1.456 | 1.306 |
| NVHT | 1.52 | 1.516 | 1.493 | 1.488 | 1.467 |
| HVHT | 1.541 | 1.536 | 1.513 | 1.509 | 1.487 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| VCC\_NCLDO | VCC\_NCLDO(mA) | | | | |
| FF4 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.517 | 1.516 | 1.501 | 1.496 | 1.442 |
| NVLT | 1.545 | 1.544 | 1.528 | 1.524 | 1.495 |
| HVLT | 1.562 | 1.561 | 1.544 | 1.541 | 1.495 |
| LVNT | 1.506 | 1.505 | 1.492 | 1.489 | 1.375 |
| NVNT | 1.529 | 1.527 | 1.512 | 1.509 | 1.492 |
| HVNT | 1.535 | 1.533 | 1.518 | 1.515 | 1.498 |
| LVHT | 1.488 | 1.485 | 1.455 | 1.447 | 1.153 |
| NVHT | 1.52 | 1.516 | 1.487 | 1.481 | 1.451 |
| HVHT | 1.553 | 1.536 | 1.506 | 1.5 | 1.47 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| V15\_NCLDO | VCC\_NCLDO(mA) | | | | |
| FF7 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.499 | 1.496 | 1.469 | 1.462 | 0.62 |
| NVLT | 1.531 | 1.528 | 1.498 | 1.491 | 1.454 |
| HVLT | 1.55 | 1.54 | 1.512 | 1.503 | 1.461 |
| LVNT | 1.492 | 1.489 | 1.459 | 1.451 | 1.288 |
| NVNT | 1.528 | 1.526 | 1.488 | 1.479 | 1.431 |
| HVNT | 1.557 | 1.555 | 1.518 | 1.51 | 1.467 |
| LVHT | 1.455 | 1.451 | 1.423 | 1.414 | 1.139 |
| NVHT | 1.49 | 1.486 | 1.458 | 1.452 | 1.421 |
| HVHT | 1.523 | 1.507 | 1.478 | 1.472 | 1.443 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| V15\_NCLDO | VCC\_NCLDO(mA) | | | | |
| FF8 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.466 | 1.462 | 1.436 | 1.429 | 0.831 |
| NVLT | 1.495 | 1.492 | 1.466 | 1.462 | 1.43 |
| HVLT | 1.517 | 1.511 | 1.486 | 1.478 | 1.446 |
| LVNT | 1.469 | 1.468 | 1.446 | 1.44 | 0.296 |
| NVNT | 1.505 | 1.503 | 1.482 | 1.476 | 1.449 |
| HVNT | 1.54 | 1.533 | 1.511 | 1.506 | 1.48 |
| LVHT | 1.46 | 1.458 | 1.427 | 1.419 | 0.287 |
| NVHT | 1.518 | 1.514 | 1.485 | 1.478 | 1.442 |
| HVHT | 1.574 | 1.564 | 1.534 | 1.527 | 1.493 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| V15\_NCLDO | VCC\_NCLDO(mA) | | | | |
| SS4 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.466 | 1.462 | 1.436 | 1.429 | 0.831 |
| NVLT | 1.495 | 1.492 | 1.466 | 1.462 | 1.43 |
| HVLT | 1.517 | 1.511 | 1.486 | 1.478 | 1.446 |
| LVNT | 1.469 | 1.468 | 1.446 | 1.44 | 0.296 |
| NVNT | 1.505 | 1.503 | 1.482 | 1.476 | 1.449 |
| HVNT | 1.54 | 1.533 | 1.511 | 1.506 | 1.48 |
| LVHT | 1.46 | 1.458 | 1.427 | 1.419 | 0.287 |
| NVHT | 1.518 | 1.514 | 1.485 | 1.478 | 1.442 |
| HVHT | 1.574 | 1.564 | 1.534 | 1.527 | 1.493 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| V15\_NCLDO | VCC\_NCLDO(mA) | | | | |
| SS5 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.466 | 1.462 | 1.436 | 1.429 | 0.831 |
| NVLT | 1.495 | 1.492 | 1.466 | 1.462 | 1.43 |
| HVLT | 1.517 | 1.511 | 1.486 | 1.478 | 1.446 |
| LVNT | 1.469 | 1.468 | 1.446 | 1.44 | 1.217 |
| NVNT | 1.505 | 1.503 | 1.482 | 1.476 | 1.449 |
| HVNT | 1.54 | 1.533 | 1.511 | 1.506 | 1.48 |
| LVHT | 1.46 | 1.458 | 1.427 | 1.419 | 0.54 |
| NVHT | 1.518 | 1.514 | 1.485 | 1.478 | 1.442 |
| HVHT | 1.574 | 1.564 | 1.534 | 1.527 | 1.493 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| V15\_NCLDO | VCC\_NCLDO(mA) | | | | |
| SS6 | 0.01 | 1 | 40 | 50 | 100 |
| LVLT | 1.463 | 1.463 | 1.445 | 1.443 | 1.418 |
| NVLT | 1.492 | 1.4888 | 1.474 | 1.47 | 1.453 |
| HVLT | 1.514 | 1.502 | 1.486 | 1.483 | 1.467 |
| LVNT | 1.473 | 1.471 | 1.456 | 1.451 | 1.151 |
| NVNT | 1.505 | 1.503 | 1.49 | 1.488 | 1.472 |
| HVNT | 1.531 | 1.524 | 1.51 | 1.508 | 1.494 |
| LVHT | 1.465 | 1.463 | 1.429 | 1.414 | 0.538 |
| NVHT | 1.491 | 1.488 | 1.461 | 1.455 | 1.425 |
| HVHT | 1.508 | 1.497 | 1.47 | 1.463 | 1.434 |

## 7.6 线性调节

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2.0V | 5.0V | 5.5V |
| T2\_-40℃ | 1.432 | 1.505 | 1.51 |
| T2\_25℃ | 1.431 | 1.504 | 1.511 |
| T2\_125℃ | 1.316 | 1.478 | 1.498 |
| T7\_-40℃ | 1.461 | 1.508 | 1.514 |
| T7\_25℃ | 1.436 | 1.498 | 1.504 |
| T7\_125℃ | 1.306 | 1.467 | 1.487 |
| T5\_-40℃ | 1.447 | 1.483 | 1.485 |
| T5\_25℃ | 1.418 | 1.471 | 1.479 |
| T5\_125℃ | 1.298 | 1.44 | 1.462 |
| S4\_-40℃ | 1.451 | 1.477 | 1.49 |
| S4\_25℃ | 1.224 | 1.49 | 1.51 |
| S4\_125℃ | 0.506 | 1.458 | 1.498 |
| S5\_-40℃ | 1.435 | 1.469 | 1.488 |
| S5\_25℃ | 1.217 | 1.471 | 1.494 |
| S5\_125℃ | 0.54 | 1.442 | 1.493 |
| S6\_-40℃ | 1.418 | 1.453 | 1.467 |
| S6\_25℃ | 1.151 | 1.472 | 1.494 |
| S6\_125℃ | 0.538 | 1.425 | 1.434 |
| F4\_-40℃ | 1.442 | 1.495 | 1.495 |
| F4\_25℃ | 1.375 | 1.492 | 1.498 |
| F4\_125℃ | 1.153 | 1.451 | 1.47 |
| F7\_-40℃ | 1.368 | 1.454 | 1.461 |
| F7\_25℃ | 1.288 | 1.431 | 1.467 |
| F7\_125℃ | 1.139 | 1.421 | 1.443 |
| F8\_-40℃ | 1.331 | 1.43 | 1.446 |
| F8\_25℃ | 1.269 | 1.449 | 1.48 |
| F8\_125℃ | 1.227 | 1.442 | 1.493 |

## 7.7 TOK\_LDO

* 配置:3C 00 A0 3C 05 30 00 3C 17 04 VDD\_POR=1.35V~1.65V VCC\_POR=2.0V~5.5V

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Condition** | **TOK\_LDO（uS）** | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **LVLT** | 220 | 251 | 232 | 92 | 154 | 87.18 | 444 | 360 | 840 |
| **NVLT** | 1.28 | 1.5 | 1.49 | 1.5 | 1.58 | 1.48 | 1.88 | 3.4 | 2.98 |
| **HVLT** | 1.68 | 1.44 | 2.74 | 1.84 | 1.38 | 2.32 | 1.6 | 1.6 | 1.62 |
| **LVNT** | 65.9 | 89 | 75.5 | 38.8 | 41.62 | 36.96 | 766 | 66.5 | 67.5 |
| **NVNT** | 2.8 | 2.28 | 3.1 | 3.08 | 2.06 | 3.02 | 3.8 | 3.92 | 3.3 |
| **HVNT** | 2.2 | 1.86 | 2.4 | 2.52 | 1.98 | 2.58 | 1.8 | 3.04 | 2.74 |
| **LVHT** | 58 | 60 | 62 | 22.4 | 16.5 | 21.7 | 59.6 | 70.8 | 68 |
| **NVHT** | 1.42 | 1.64 | 1.51 | 1.58 | 1.82 | 1.56 | 3.88 | 3.68 | 3.9 |
| **HVHT** | 1.01 | 1.08 | 1.1 | 1.16 | 1.4 | 1.18 | 1.8 | 2.52 | 2.06 |

## 7.8 LDO输出的负载纹波电压

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **条件** | **10mA-100mA（mV）** | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **NVLT** | 148 | 128 | 144 | 118 | 31 | 35 | 107 | 129 | 133 |
| **NVNT** | 116 | 104 | 128 | 108 | 134 | 31 | 79 | 91 | 122 |
| **NVHT** | 120 | 103 | 120 | 100 | 131 | 32 | 78 | 86 | 120 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **条件** | **100mA-10mA（mV）** | | | | | | | | |
| **TT2** | **TT5** | **TT7** | **FF4** | **FF7** | **FF8** | **SS4** | **SS5** | **SS6** |
| **NVLT** | 196 | 156 | 196 | 168 | 87 | 92 | 232 | 224 | 221 |
| **NVNT** | 108 | 116 | 120 | 92 | 104 | 90 | 90 | 91 | 96 |
| **NVHT** | 109 | 108 | 112 | 88 | 102 | 90 | 100 | 95 | 91 |

**五、、IP 名称: XRN011EFDMCUPAD\_HVA**

# 1.测试总结

* **GPIOXC32KA\_50\_5T\_XR(Cload=12p)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **符号** | **参数** | **规格** | | | **测量值** | | | | **单位** | **结果[1]** |
| **最小值** | **典型值** | **最大值** | **最小值** | **典型值** | | **最大值** |
|  | 启动时间 | - | 1000 | - | - | 225.9 | - | | ms | 通过[2] |
|  | 稳定时间 | - | 2000 | - | - | 516.1 | - | | ms | 通过 [3] |
| DC | 占空比 | 45 | - | 55 |  | 46.1 | 48.31 | | % | 通过**[4]** |
|  | 操作电流 | - | 180 | - | - | 70 | 580 | | nA | 通过 |
|  | 掉电电流 | - | 2 | - | - | ＜10 | 70 | | nA | 通过 |

* **GPIOXCMFA\_50\_5T\_XR（24M）(Cload=12p)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **符号** | **参数** | **规格** | | | **测量值** | | | **单位** | **结果** |
| **最小值** | **典型值** | **最大值** | **最小值** | **典型值** | **最大值** |
|  | 启动时间 | - | 1000 | - | - | 383.8 | 1001.1 | us | 通过 |
|  | 稳定时间 | - | 2000 | - | - | 667.8 | 1477.6 | us | 通过 |
| DC | 占空比 | 45 | - | 55 | 40.8 | 47.7 | 52.8 | % | 条件通过**[5]** |
|  | 操作电流 | - | 120 | - |  | 104.1 | 250.87 | uA | 通过 |
|  | 掉电电流 | - | 3 | - |  | ＜10 | 80 | nA | 通过 |

# 2．测试计划一览表

表1-1 一览表

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **项目** | | | **实例** | **是** | **否** |
| 1 | 代工厂名称 | | NEXCHIP | 是 |  |
| 2 | 工艺 | | NEXCHIP 110nm 嵌入式Flash 低功耗工艺 | 是 |  |
| 3 | 核心供电电压&IO供电电压 | | 1.35V~1.65V(核心供电)  /2.0V~5.5V(IO供电) | 是 |  |
| 4 | 金属堆叠选项 | | 1P5M | 是 |  |
| 6 | 参照 | 数据表 | XRN011EFDMCUPAD\_HVA\_V1P0\_数据手册\_V0.2 | 是 |  |
| 试验规格 | XRC417\_CHIP\_ESD\_测试计划\_V0.2 | 是 |  |
| 7 | 样本编号和列表 | | 总共9个样品，  良率测试:9个样品  特性测试:9个样品 | 是 |  |
| 8 | 工艺角 | | TT SS and FF | 是 |  |
| 9 | 温度变量 | | -40℃, 25℃, 125℃ | 是 |  |
| 11 | 静电放电 | |  |  | NA |

# 3.IP 信息

## 3.1描述

基于NEXCHIP 110nm 嵌入式Flash低功耗工艺，本资料书提供了 I/O库的一般技术信息和特性。

该I/O库可以轻松支持1.5V核心电压断电，以及不同电压域之间的电压转换。常见的GPIO不仅包含数字功能单元，还包含模拟输入/输出单元。

## 3.2特点

* 可以使用3.3V电源
* 支持1.5V核心电压断电，获得超低漏电
* 所有的GPIO都支持PAD的电压高于输入输出功率
* 基于NEXCHIP 110nm 嵌入式Flash低功耗工艺，支持1P5M及以上工艺
* 帮助客户降低成本的DUP结构
* 标准输入/输出大小为73微米\* 134微米
* 内置通电控制功能
* 32.768千赫晶体驱动器的功耗低于180纳安
* 24MHz晶体驱动器的功耗低于120纳安
* 静电放电规格如下
* HBM …………………………………4千伏
* MM……………………………………200伏
* CDM…………………………………750伏
* 闩锁效应……………………………200毫安

# 4.测试信息

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **项目** | | **信息** | | | | | | **评价** |
| 1 | IP 名称 | XRN011EFDMCUPAD\_HVA\_V1P0 | | | | | |  |
| 2 | 工艺角 | TT SS 和 FF | | | | | |  |
| 3 | 样本编号和列表 | TT11/TT12/TT13/SS1/SS2/SS3/FF1/FF2/FF3 | | | | | |  |
| 4 | 测试条件 | 条件 | 温度  (℃) | | VCCA  （V） | | VDDL  （V） |  |
| LVLT | -40 | | 2 | | 1.35 |
| NVLT | -40 | | 3.3 | | 1.5 |
| HVLT | -40 | | 5.5 | | 1.65 |
| LVNT | 25 | | 2 | | 1.35 |
| NVNT | 25 | | 3.3 | | 1.5 |
| HVNT | 25 | | 5.5 | | 1.65 |
| LVHT | 125 | | 2 | | 1.35 |
| NVHT | 125 | | 3.3 | | 1.5 |
| HVHT | 125 | | 5.5 | | 1.65 |
| 5 | 测试项目 | 启动时间 | | | | | |  |
| 稳定时间 | | | | | |
| 占空比 | | | | | |
| 工作电流 | | | | | |
| 掉电泄露 | | | | | |
| 6 | 测试仪器 | 测试项 | | 生产商 | | 型号 & SN | |  |
| 电流表 | | GW | | GDM-82469 CN861218 | |
| 电流表 | | GW | | GDM-82469 CN861205 | |
| 示波器 | | Keysight | | DSA-X91604A | |
| 高低温热流仪 | |  | | TPO4310 | |
| 电源 | | GW | | GPD-3303S GES919004 | |
| 温度试验箱 | |  | | 17080894 | |
| 7 | 测试工程师 | FQR/YX | | | | | |  |
| 8 | 测试日期 | 2020-10-13~2020-10-19  2021-05-20~2021-06-16 | | | | | |  |

# 5.测试方法

## 5.1 测试框图

****图.5.1 测试框图

## 5.2 测试方法

根据《XRN011EFDMCUPAD\_HVA\_V1P0\_测试计划\_V0.1》，所有测试项均已检测。

# 6.测试结果

## 6.1 良率测试结果

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **样品** | **良率测试结果** | | | | | | | | |
| **TT11** | **TT12** | **TT13** | **SS1** | **SS2** | **SS3** | **FF1** | **FF2** | **FF3** |
| **结果** | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 | 通过 |

# 7.测试数据

## 7.1 GPIOXC32KA\_50\_5T\_XR 检测

* **表 7‑1 测试数据**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 项目 | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| TSU (ms) | TT11 | 334.7 | 240.8 | 216.4 | 282.7 | 225.9 | 204.9 | 316.7 | 395.8 | 198.2 |
| TT12 | 289.4 | 210.4 | 205.8 | 266.8 | 236.4 | 224.8 | 352.7 | 315.7 | 251.5 |
| TT13 | 341.3 | 205.5 | 198.2 | 264.7 | 221.5 | 211.6 | 434.7 | 344.5 | 237.1 |
| TSTB (ms) | TT11 | 537.2 | 449.5 | 456.8 | 523.6 | 500.1 | 445.7 | 876.5 | 946.6 | 806.4 |
| TT12 | 499.3 | 474.6 | 428.0 | 543.3 | 516.1 | 433.3 | 966.6 | 866.8 | 778.4 |
| TT13 | 516.8 | 486.5 | 468.5 | 525.3 | 496.2 | 458.0 | 1070.5 | 996.4 | 866.8 |
| 频率 (kHz) | TT11 | 32.75 | 32.75 | 32.75 | 32.76 | 32.77 | 32.77 | 32.75 | 32.75 | 32.75 |
| TT12 | 32.76 | 32.75 | 32.76 | 32.76 | 32.77 | 32.77 | 32.76 | 32.76 | 32.76 |
| TT13 | 32.76 | 32.76 | 32.76 | 32.77 | 32.77 | 32.77 | 32.75 | 32.75 | 32.75 |
| 占空比 (%) | TT11 | 44 | 42.9 | 43.7 | 45.9 | 46.1 | 47.2 | 47.7 | 47.8 | 47.8 |
| TT12 | 44.3 | 43.9 | 42.9 | 46.3 | 46.2 | 46.1 | 46.8 | 46.6 | 46.7 |
| TT13 | 45.1 | 45.5 | 42.1 | 47.4 | 47 | 46.7 | 47.6 | 47.4 | 47.3 |
| IVDDH32K (nA) | TT11 | <10 | <10 | <10 | <10 | <10 | <10 | 170 | 170 | 210 |
| TT12 | <10 | <10 | <10 | <10 | <10 | <10 | 170 | 170 | 210 |
| TT13 | <10 | <10 | <10 | <10 | <10 | <10 | 150 | 150 | 170 |
| IVDDAON32K (nA) | TT11 | 40 | 60 | 90 | 40 | 70 | 100 | 90 | 120 | 150 |
| TT12 | 40 | 50 | 100 | 40 | 70 | 100 | 110 | 130 | 180 |
| TT13 | 40 | 60 | 100 | 40 | 60 | 100 | 100 | 120 | 200 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 项目 | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| TSU (ms) | SS1 | 180.2 | 148.2 | 1240.7 | 241.9 | 200.0 | 165.4 | 355.6 | 286.4 | 172.8 |
| SS2 | 190.2 | 187.7 | 5953.1 | 285.6 | 235.8 | 154.3 | 508.4 | 429.4 | 202.3 |
| SS3 | 202.5 | 481.5 | 429.6 | 274.5 | 198.3 | 160.5 | 412.4 | 355.6 | 177.8 |
| TSTB (ms) | SS1 | 740.7 | 686.4 | 1897.3 | 760.5 | 680.2 | 674.1 | 1009.9 | 921.0 | 781.5 |
| SS2 | 718.5 | 725.9 | 6847.8 | 893.8 | 869.1 | 780.2 | 1093.6 | 1017.1 | 688.7 |
| SS3 | 723.5 | 993.8 | 985.2 | 839.5 | 727.4 | 718.6 | 949.4 | 885.2 | 781.5 |
| 频率 (kHz) | SS1 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.76 | 32.76 | 32.76 |
| SS2 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.75 | 32.75 | 32.75 |
| SS3 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.75 | 32.75 | 32.75 |
| 占空比 (%) | SS1 | 47.20 | 47.70 | 46.80 | 48.04 | 47.77 | 47.50 | 47.80 | 47.80 | 47.70 |
| SS2 | 47.00 | 46.50 | 45.40 | 46.90 | 46.69 | 46.08 | 45.30 | 45.40 | 45.50 |
| SS3 | 47.60 | 48.10 | 48.00 | 48.31 | 48.12 | 47.91 | 46.30 | 46.33 | 46.30 |
| IVDDH32K (nA) | SS1 | <10 | 100 | 140 | 100 | 110 | 140 | 150 | 150 | 180 |
| SS2 | <10 | <10 | <10 | <10 | <10 | <10 | 290 | 300 | 350 |
| SS3 | <10 | 110 | 150 | 100 | 110 | 150 | 310 | 320 | 360 |
| IVDDAON32K (nA) | SS1 | 30 | 50 | 80 | 30 | 50 | 80 | 60 | 80 | 100 |
| SS2 | 30 | 50 | 80 | 30 | 50 | 80 | 60 | 90 | 120 |
| SS3 | 30 | 50 | 80 | 30 | 50 | 80 | 70 | 90 | 120 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 项目 | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| TSU (ms) | FF1 |  | 异常 |  | 475.0 | 433.0 | 381.1 | 480.3 | 322.2 | 175.3 |
| FF2 | 249.4 | 143.2 | 197.6 | 242.9 | 198.4 | 163.8 | 424.7 | 382.7 | 217.3 |
| FF3 | 202.4 | 177.8 | 449.4 | 202.0 | 194.1 | 151.4 | 461.7 | 358.1 | 222.3 |
| TSTB (ms) | FF1 |  | 异常 |  | 984.0 | 884.2 | 903.3 | 959.3 | 660.5 | 528.4 |
| FF2 | 856.8 | 708.7 | 824.7 | 791.0 | 778.7 | 726.8 | 984.0 | 889.8 | 795.7 |
| FF3 | 738.2 | 679.0 | 948.1 | 744.1 | 682.4 | 671.1 | 1074.1 | 925.9 | 809.9 |
| 频率 (kHz) | FF1 |  | 异常 |  | 32.77 | 32.77 | 32.77 | 32.76 | 32.76 | 32.76 |
| FF2 | 32.76 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.75 | 32.75 | 32.75 |
| FF3 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.77 | 32.75 | 32.75 | 32.75 |
| 占空比 (%) | FF1 |  | 异常 |  | 30.2 | 30.1 | 30.4 | 38.7 | 38.6 | 39.4 |
| FF2 | 47.3 | 47.6 | 47.2 | 47.0 | 47.5 | 47.4 | 46.0 | 45.9 | 45.8 |
| FF3 | 47.8 | 47.0 | 45.7 | 47.8 | 48.0 | 47.7 | 46.9 | 46.8 | 46.6 |
| IVDDH32K (nA) | FF1 |  | 异常 |  | 70 | 80 | 110 | 150 | 160 | 180 |
| FF2 | <10 | 100 | 140 | 100 | 110 | 140 | 320 | 340 | 420 |
| FF3 | <10 | <10 | <10 | 90 | 110 | 120 | 320 | 340 | 420 |
| IVDDAON32K (nA) | FF1 |  | 异常 |  | 40 | 60 | 90 | 70 | 100 | 120 |
| FF2 | 40 | 60 | 100 | 40 | 70 | 100 | 100 | 130 | 160 |
| FF3 | 40 | 70 | 110 | 40 | 70 | 100 | 90 | 120 | 150 |

**注释：**

**红色部分为实际测试值，研发建议采用后仿值给客户。**

**黄色部分为FF1在低温测试过程中输出不稳定(时有时无),无法进行测试。**

* **表 7‑2 IPD测试数据**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IPD | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| IVDDH32K  (nA) | TT11 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 20 |
| TT12 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| TT13 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| IVDDAON32K  (nA) | TT11 | <10 | <10 | <10 | <10 | <10 | <10 | 20 | 30 | 30 |
| TT12 | <10 | <10 | <10 | <10 | <10 | <10 | 30 | 50 | 60 |
| TT13 | <10 | <10 | <10 | <10 | <10 | <10 | 20 | 30 | 40 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IPD | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| IVDDH32K  (nA) | SS1 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| SS2 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| SS3 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| IVDDAON32K  (nA) | SS1 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 10 | 10 |
| SS2 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 10 | 10 |
| SS3 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 10 | 10 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IPD | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| IVDDH32K  (nA) | FF1 |  | 异常 |  | <10 | <10 | <10 | 20 | 20 | 30 |
| FF2 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 20 | 40 |
| FF3 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 20 | 30 |
| IVDDAON32K  (nA) | FF1 |  | 异常 |  | <10 | <10 | <10 | 30 | 20 | 20 |
| FF2 | <10 | <10 | <10 | <10 | <10 | <10 | 30 | 30 | 30 |
| FF3 | <10 | <10 | <10 | <10 | <10 | <10 | 20 | 20 | 20 |

## 7.2 GPIOXCMFA\_50\_5T\_XR 检测

* **表 7‑3 测试数据**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 项目 | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| TSU (us) | TT11 | 551.11 | 328.89 | 440.62 | 581.36 | 383.83 | 309.75 | 828.3 | 606.05 | 988.77 |
| TT12 | 589.64 | 396.17 | 464.07 | 660.08 | 426.75 | 259.58 | 865.31 | 556.67 | 1001.1 |
| TT13 | 569.01 | 204.81 | 426.35 | 554.2 | 357.9 | 239.14 | 764.32 | 445.56 | 939.38 |
| TSTB (us) | TT11 | 508.52 | 673.33 | 925.8 | 865.31 | 667.78 | 643.09 | 1012.6 | 804.6 | 1356.8 |
| TT12 | 904.2 | 717.16 | 982.59 | 897.26 | 697.12 | 455.64 | 1164.8 | 986.5 | 1246.9 |
| TT13 | 886.4 | 632.4 | 986.5 | 1010 | 702.35 | 603.58 | 992.47 | 754.2 | 1235.3 |
| 频率 (MHz) | TT11 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| TT12 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| TT13 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| 占空比 (%) | TT11 | 43.4 | 48.6 | 52 | 43 | 47.7 | 49.2 | 41 | 50 | 51.7 |
| TT12 | 43 | 50.9 | 48.6 | 42.1 | 47.5 | 49.2 | 41.1 | 49.6 | 52.5 |
| TT13 | 44.1 | 50.9 | 49.7 | 42.4 | 48 | 49.3 | 41.8 | 49.4 | 52.8 |
| IVDDH\_TXALMF (uA) | TT11 | 62.81 | 74.86 | 94.37 | 73.7 | 90.2 | 117.45 | 120 | 140 | 201 |
| TT12 | 64.21 | 74.54 | 92.86 | 72.24 | 87.19 | 113.29 | 109 | 144 | 195 |
| TT13 | 52.8 | 60.93 | 76.34 | 63.38 | 76.2 | 100 | 101 | 128 | 180 |
| IVDD\_TXALMF (uA) | TT11 | 8.03 | 12.1 | 18.11 | 9.41 | 13.88 | 19.88 | 10.9 | 16.8 | 23.5 |
| TT12 | 8.56 | 13.07 | 19.58 | 10.17 | 15.07 | 21.54 | 12.8 | 18.1 | 24.6 |
| TT13 | 8.45 | 13.01 | 19.69 | 10.11 | 15.1 | 21.76 | 12.8 | 17.9 | 25.1 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 项目 | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| TSU (us) | SS1 | 690.1 | 401.2 | 216.1 | 774.5 | 485.6 | 239.5 | 876.6 | 550.6 | 296.3 |
| SS2 | 488.9 | 301.2 | 413.3 | 448.3 | 277.3 | 66.7 | 318.5 | 234.6 | 138.3 |
| SS3 | 634.5 | 234.6 | 21.1 | 692.1 | 432.8 | 210.6 | 704.5 | 439.0 | 262.5 |
| TSTB (us) | SS1 | 955.5 | 919.8 | 1386.4 | 1160.5 | 914.8 | 1477.6 | 1297.6 | 950.7 | 955.5 |
| SS2 | 777.8 | 停振 | 981.6 | 757.8 | 875.3 | 856.8 | 723.5 | 654.9 | 777.8 |
| SS3 | 728.4 | 停振 | 1037.8 | 951.4 | 895.8 | 1290.9 | 969.9 | 984.7 | 728.4 |
| 频率 (MHz) | SS1 | 24.01 | 24.01 | 24.00 | 24.02 | 24.02 | 24.01 | 23.98 | 24.01 | 24.01 |
| SS2 | 24.00 | 24.00 | 24.00 | 24.01 | 24.03 | 24.02 | 24.01 | 24.01 | 24.01 |
| SS3 | 24.00 | 24.00 | 24.00 | 24.03 | 24.01 | 24.02 | 24.00 | 24.01 | 24.01 |
| 占空比 (%) | SS1 | 42.8 | 52.1 | 52.6 | 41.9 | 46.4 | 48.9 | 40.8 | 50.0 | 52.1 |
| SS2 | 43.2 | 51.8 | 52.6 | 41.6 | 46.4 | 49.5 | 48.0 | 50.4 | 52.1 |
| SS3 | 44.3 | 51.1 | 51.7 | 41.0 | 46.0 | 49.2 | 48.4 | 49.8 | 51.9 |
| IVDDH\_TXALMF (uA) | SS1 | 58.8 | 72.3 | 91.8 | 63.2 | 78.3 | 105.3 | 84.4 | 119.8 | 164.6 |
| SS2 | 74.6 | 93.7 | 119.4 | 84.8 | 103.7 | 133.6 | 111.8 | 155.3 | 206.4 |
| SS3 | 56.5 | 68.3 | 87.0 | 62.3 | 75.3 | 101.6 | 90.0 | 125.9 | 170.5 |
| IVDD\_TXALMF (uA) | SS1 | 6.9 | 10.1 | 15.5 | 8.0 | 11.8 | 17.4 | 10.0 | 14.2 | 19.6 |
| SS2 | 7.0 | 10.4 | 16.0 | 8.2 | 12.1 | 17.8 | 10.3 | 14.6 | 20.2 |
| SS3 | 7.0 | 10.3 | 16.0 | 8.2 | 12.1 | 17.8 | 10.3 | 14.6 | 20.2 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 项目 | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| TSU (us) | FF1 | 521.0 | 298.8 | 163.0 | 624.2 | 364.9 | 192.1 | 624.7 | 533.3 | 442.0 |
| FF2 | 543.2 | 308.6 | 160.5 | 562.5 | 346.4 | 163.7 | 693.8 | 493.8 | 423.5 |
| FF3 | 548.1 | 279.0 | 143.2 | 578.5 | 353.8 | 158.8 | 672.8 | 549.3 | 432.1 |
| TSTB (us) | FF1 | 1022.2 | 740.7 | 750.6 | 994.6 | 889.6 | 871.1 | 1155.6 | 1017.3 | 1259.2 |
| FF2 | 1037.0 | 919.8 | 停振 | 945.2 | 877.3 | 729.1 | 1022.2 | 921.0 | 停振 |
| FF3 | 1029.6 | 713.7 | 停振 | 930.4 | 864.9 | 773.6 | 1172.8 | 1055.5 | 停振 |
| 频率 (MHz) | FF1 | 24.01 | 24.00 | 24.00 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 |
| FF2 | 24.00 | 24.01 | 24.01 | 24.02 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 |
| FF3 | 24.01 | 24.00 | 24.00 | 24.01 | 24.02 | 24.01 | 24.01 | 24.01 | 24.01 |
| 占空比 (%) | FF1 | 44.9 | 50.3 | 49.2 | 43.1 | 47.3 | 49.0 | 45.7 | 50.8 | 52.5 |
| FF2 | 48.7 | 50.6 | 51.6 | 43.7 | 47.3 | 49.2 | 47.9 | 49.9 | 51.0 |
| FF3 | 49.2 | 50.7 | 51.6 | 45.5 | 47.9 | 49.7 | 47.6 | 50.8 | 51.4 |
| IVDDH\_TXALMF (uA) | FF1 | 59.9 | 74.6 | 101.2 | 59.0 | 79.0 | 109.6 | 103.8 | 141.6 | 189.9 |
| FF2 | 55.2 | 69.2 | 93.8 | 66.1 | 87.8 | 120.8 | 111.8 | 149.8 | 200.8 |
| FF3 | 46.0 | 61.4 | 88.9 | 53.9 | 76.8 | 111.8 | 95.4 | 134.2 | 185.2 |
| IVDD\_TXALMF (uA) | FF1 | 8.1 | 12.7 | 19.6 | 9.6 | 14.6 | 21.3 | 12.0 | 17.1 | 23.6 |
| FF2 | 8.0 | 12.6 | 19.7 | 9.6 | 14.5 | 21.3 | 11.9 | 17.0 | 23.6 |
| FF3 | 8.4 | 13.2 | 20.7 | 10.1 | 15.2 | 22.3 | 12.5 | 17.8 | 24.5 |

* **表 7‑4IPD检测数据**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IPD | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| IVDDH32K  (nA) | TT11 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 20 |
| TT12 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 20 |
| TT13 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| IVDDAON32K  (nA) | TT11 | <10 | <10 | <10 | <10 | <10 | <10 | 30 | 40 | 40 |
| TT12 | <10 | <10 | <10 | <10 | <10 | <10 | 40 | 50 | 60 |
| TT13 | <10 | <10 | <10 | <10 | <10 | <10 | 40 | 60 | 60 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IPD | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| IVDDH32K  (nA) | SS1 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| SS2 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| SS3 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| IVDDAON32K  (nA) | SS1 | <10 | <10 | <10 | <10 | <10 | <10 | 20 | 20 | 20 |
| SS2 | <10 | <10 | <10 | <10 | <10 | <10 | 20 | 20 | 20 |
| SS3 | <10 | <10 | <10 | <10 | <10 | <10 | 20 | 20 | 20 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IPD | 倒角 | LVLT | NVLT | HVLT | LVNT | NVNT | HVNT | LVHT | NVHT | HVHT |
| IVDDH32K  (nA) | FF1 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 20 |
| FF2 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 30 |
| FF3 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 | 20 |
| IVDDAON32K  (nA) | FF1 | <10 | <10 | <10 | <10 | <10 | <10 | 30 | 30 | 30 |
| FF2 | <10 | <10 | <10 | <10 | <10 | <10 | 30 | 30 | 20 |
| FF3 | <10 | <10 | <10 | <10 | <10 | <10 | 40 | 40 | 30 |

**Note：**

**黄色部分为:在HVLT/HVHT条件下,测试过程中有停振现象, 无法进行稳定时间的测试。**

**重要提示:**

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