

# Product Reliability Data

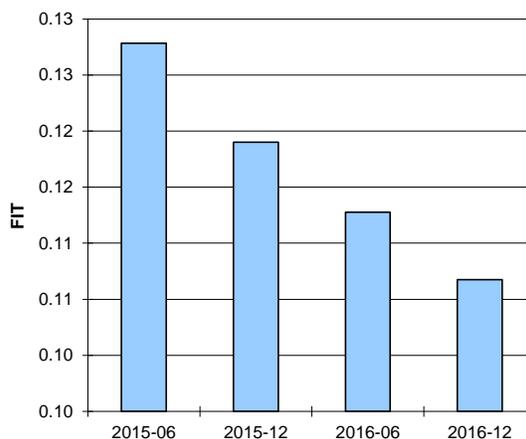
10 December 2018

Sales Name: IPP90R1K2C3  
 SP-Number: SP000683096  
 ISPN-Number: IPP90R1K2C3  
 Package: PG-TO220-3

## AFR – Average Failure Rate

upper limit of the average failure rate in time for a given confidence level, based on technology data

| Timeframe                        | 2015-06       | 2015-12       | 2016-06       | 2016-12       |
|----------------------------------|---------------|---------------|---------------|---------------|
| <b>cumulated values</b>          |               |               |               |               |
| tested devices                   | 131619        | 141461        | 150705        | 158826        |
| device hours @ stress conditions | 136187883     | 146407215     | 154855676     | 164167971     |
| failed devices                   | 5             | 5             | 5             | 5             |
| FIT Value                        | 0.13          | 0.12          | 0.11          | 0.11          |
| MTTF [h] Value                   | 7,822,434,668 | 8,403,000,179 | 8,868,912,154 | 9,368,267,001 |



Confidence Level: 60%  
 Activation Energy: 0,7 eV  
 Ambient Temperature: 55°C

Notes: 70% rated BVDSS

**Please note:** Average Failure Rate is shown as upper limit and represents the status of the respective reporting period. High failure rate may be caused by limited number of devices tested.

The calculation Method is based on JEDEC JESD85 (chapter 3.1). This standard can be used for further reference and details.

The stress duration must be scaled with the acceleration factor AF for obtaining the simulated operation time. AF depends on the use and stress conditions of the product:

$$AF = \exp\left(\frac{E_A}{k_B} \times \left(\frac{1}{T_{juse}} - \frac{1}{T_{jstress}}\right)\right)$$

Where  $E_A$  is the activation energy, typically 0.7 eV -- used value is noted below the table above  
 $k_B$  Boltzmann constant  
 $T_{juse}, T_{jstress}$  junction temperature at use and stress conditions  
 $t_{operation} = t_{stress} \times AF$

The average failure rate is described as follow:

$$AFR = \frac{X^2(P_A, 2(r+1))/2}{n \times \Delta t \times AF} \times 10^9 FIT$$

Where  $X^2(P_A, 2(r+1))/2$  s the chi-square distribution  
 $\Delta t$  is the stress duration between 168h and 1000h (or more)  
 $r$  is the number failures that happened in the time  
 $P_A$  is the confidence level (given in number between 0 and 1)  
 $n$  is the number of stressed parts

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