Definition of FIT and MTBF

A failure rate λ is defined by the number of failures r during a specific test time t of n components:

$$\lambda = \frac{r}{n \cdot t}$$

The unit for failure rates is 1 fit (**f**ailures **i**n **t**ime) = $1*10^{-9}h^{-1}$, meaning one failure in 10^9 operation hours of the device.

A component specified with 100 fit is therefore expected to operate 10^7 hours.

Example: Testing 4000 components for 5000 hours with 2 failures in this time leads to a failure rate of

$$\lambda = \frac{2}{4000 * 5000h} = 1 \cdot 10^{-7} h^{-1} \qquad \text{or expressed in fit:}$$

$$= \frac{10^{-7}}{10^{-9} h^{-1}} fit = 100 \, fit$$

The failure rate or fit value is used to calculate the MTBF (**m**ean **t**ime **b**etween **f**ailures) of a complete equipment existing of i separate components with individual failure rates λ_i :

MTBF = $1 / \sum \lambda_i$

Example: An equipment is built of 50 components with 250 fit each, which adds up to a MTBF of 1 / (50×250fit) = 80.000 h. The equipment is operated 18 hours a day and 300 days a year under the specified operating conditions. The expected lifetime is therefore: 80.000 h / (300*18 h) = 14.8 years.

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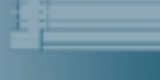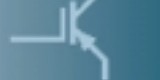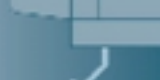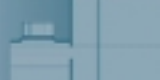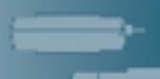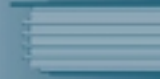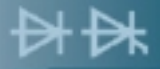
Together with the fit value, the operating conditions must be given. For eupec IGBT modules these conditions are: operation at 50% nominal voltage, 50% nominal current and Tamb = 40°C. Tracing back shipped modules, estimated accumulated operation hours and field returns for the last years, we could calculate the following tendency in the failure rates:

FIT-rates for Medium Power IGBT-modules
based on 5.364.102 modules in the field

FIT-rates for IHM / IHV-modules
based on 463.230 modules in the field