

Mean time before failure rate

The 786 series offers the longest MTBF rate in the industry providing continuous cost savings and reliable performance for 25 years.



MTBF

Mean time between failures (MTBF) represents the average expected time that will elapse between failures of like units under like conditions. Purchasers should consider MTBF of sensors before buying them. Accelerometers with a low (short) MTBF result in higher costs due to the manpower required for troubleshooting, replacement of faulty accelerometers and lost data associated with the more frequent failures.

Total hybrid failure rate (λ_p)

The Department of Defense developed a calculation to be used for electronic systems and circuits. Military Handbook MIL-HDBK-217 provides guidance for computing the MTBF for hermetically sealed electronic circuits.

The 786A is sealed to a leak rate of 1×10^{-8} cc/sec and is considered to be truly hermetically sealed. An analysis of failures indicates that the hybrid circuit board and connections are the only parts to fail due to normal environmental exposure. The piezoelectric sensing element does not play a significant role in failures.

$$\lambda_p = [\sum N_c \lambda_c] (1 + 0.2 \pi_E) \pi_F \pi_Q \pi_L \text{ failures per 1,000,000 hours}$$

Where

N_c = number of each particular component

λ_c = failure rate of each particular component

π_E = environmental factor

π_F = hybrid function factor

π_Q = quality (screening) factor

π_L = longevity (experience) factor

N is determined from the part or connection count, all other factors are determined through reference to MIL-HDBK-217 for the particular component or element.

Components for 786 series sensors

N components/elements	60° C	120° C
48 connections	0.018122	0.018122
4 plated through holes	0.000041	0.000041
1 crystal	0.0058	0.0058
1 bipolar transistor	0.00029	0.000773
1 FET	0.0135	0.0324
3 diodes	0.00731	0.027655
3 capacitors	0.16082	0.13992
5 resistors	0.00363	0.00594
Individual $N_c \lambda_c$	0.064775	0.230651

Calculated total hybrid failure rate of 786A

$$\begin{aligned} \text{Total hybrid failure rate at } 60^\circ \text{ C} \\ \lambda_p &= [0.064775] 70.18 \\ &= 4.5459 \text{ per 106 hrs} \\ &= 219,978 \text{ hours MTBF (25 years)} \end{aligned}$$

$$\begin{aligned} \text{Total hybrid failure rate at } 120^\circ \text{ C} \\ \lambda_p &= [0.230651] 70.18 \\ &= 16.187087 \text{ per 106 hrs} \\ &= 61,778 \text{ hours MTBF (7 years)} \end{aligned}$$

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