

FACTORS AFFECTING THE FAILURE RATES OF PARTS

GENERAL

The following tables give the factors affecting the failure rates of electrical/electronic parts. As given in MIL-HDBK-217 and other reliability prediction standards, the part failure rate is a function of several factors, normally designated as " π " factors. For example, the part failure rate λ_p for fixed resistors is given by,

$$\lambda_p = \lambda_b (\pi_E \pi_R \pi_Q)$$

where,

λ_b = Base Failure Rate (a function of temperature and stress)

π_E = Environmental Factor

π_R = Resistance Factor

π_Q = Quality Factor.

Table 1 gives a brief overview of the major π factors affecting failure rates. Due to a lack of statistically significant data, reliability prediction methodologies do not consider all possible electrical parameters that can affect failure rate. For example, transient conditions are not taken into account for most part types.

FAILURE RATE FACTORS UNIQUE TO DIFFERENT DEVICES

In addition to Table 1, many other factors affect failure rates. Further, the failure rate factors can depend on component style. For example, higher resistance values result in higher failure rates. The same is true for capacitance values in capacitors,

Table 1. Factors Affecting Failure Rates

Device Type	Temperature	Environment	Quality Level	Stress Ratio
Resistors	X	X	X	Power
Capacitors	X	X	X	Voltage
Semiconductors	X	X	X	Power
Microcircuits	X	X	X	Power and Current
Relays	X	X	X	Current and Load Type ¹
Connectors	X	X	X	Contact Current
Switches	X	X	X	Voltage, Current and Load Type
Inductors	X	X	X	Current

¹ Load type can be resistive, inductive, or lamp.

except styles CV, PC, CT, and CG. Further exceptions are given in Table 2 for resistors and Table 3 for relays, switches, and connectors.

Table 2. Factors Affecting Failure Rates Unique to Resistors

Resistor Type	Resistance Value	Number of Taps on Potentiometer	Voltage Factor	Construction	Number of Resistors in Use
Fixed	X				
Variable	X	X	X		
Variable, Style RP and RZ	X	X	X	X	
Resistor Network					X

Table 3. Factors Affecting Failure Rates of Relays, Switches, and Connectors

Device Type	Number of Contacts	Time Rate of Actuation	Contact Load	Construction and Application
Relays	X	X	X	X
Switches	X	X	X	
Connectors	X	X		X