

Application Note



**Reliability
Failure Mode Effects
and
Predicted Failure Rate
Analysis
for the
ACT 8500 64-Channel
Multiplexer Module**

RESULTS AND SUMMARY

The following Failure Mode Effects Analysis (FMEA) for the 64-CHANNEL MULTIPLEXER MODULE was analyzed in accordance with MIL-STD-1629, Task 101. As a result it was determined that a failure to any of the multiplexer's enable logic lines would cause that particular 16-Channel MUX to fail and consequently render the module inoperable. For the remaining failures which are concentrated within the device's transorb suppression circuitry, an (open) failure to either half of the Zener diode would render the device as unprotected against a input transient voltage, however the device multiplex function is not affected. A (short) however to either half of the Zener diode would render that input inoperable. These (4) Transorb failures (two zeners per line and two failures (Open/Short) as a result, have been classified as Category III (Marginal). Since each multiplex device is identical in function and mode of failure, only one device is documented for brevity in accordance with ACT8500 data sheet block diagram.

APPLICABLE DOCUMENTS

| | |
|------------------|---|
| MIL-Handbook-217 | Reliability Predictions of Electronic Equipment |
| MIL-STD-756 | Reliability Modeling and Prediction |
| MIL-STD 1629 | Procedures for Performing a Failure mode Effects and Criticality Analysis |

INTRODUCTION

This report presents a Failure Mode Effects Analysis study for the purpose of identifying from a functional failure effect level, those events or failures that can be a potential system failure. Characteristically a failure for the purposes of this report is defined as any failure which results in the degradation of system performance

The guidelines which set the conditional aspects for the failure analysis is based on that there are no multiple occurrences of failures and that all input signals and functions to the multiplexer are fault free.

SEVERITY CODE TABLE

SEVERITY CLASSES

The basis of the FMEA and its determination of failure (SEVERITY) is taken from MIL-STD-1629 and is presented as follows:

CATEGORY I

CATASTROPHIC: A failure which results in the loss of module function and renders the system inoperable.

CATEGORY II

CRITICAL: A failure which results in partial loss of module function.

CATEGORY III

MARGINAL: A failure which results in degraded operation.

CATEGORY IV

MINOR: A failure which has no effect or minimal performance impact.

DISCUSSION

Classification of failures is paramount when defining the severity or criticality of a potential problem. This FMEA utilizes the severity classification as outlined in Task 101 of MIL-STD-1629 and delineated in a modified table above. A failure with a Category I or Catastrophic in nature, for purposes of this analysis is defined as loss of or causing an unusable functional output

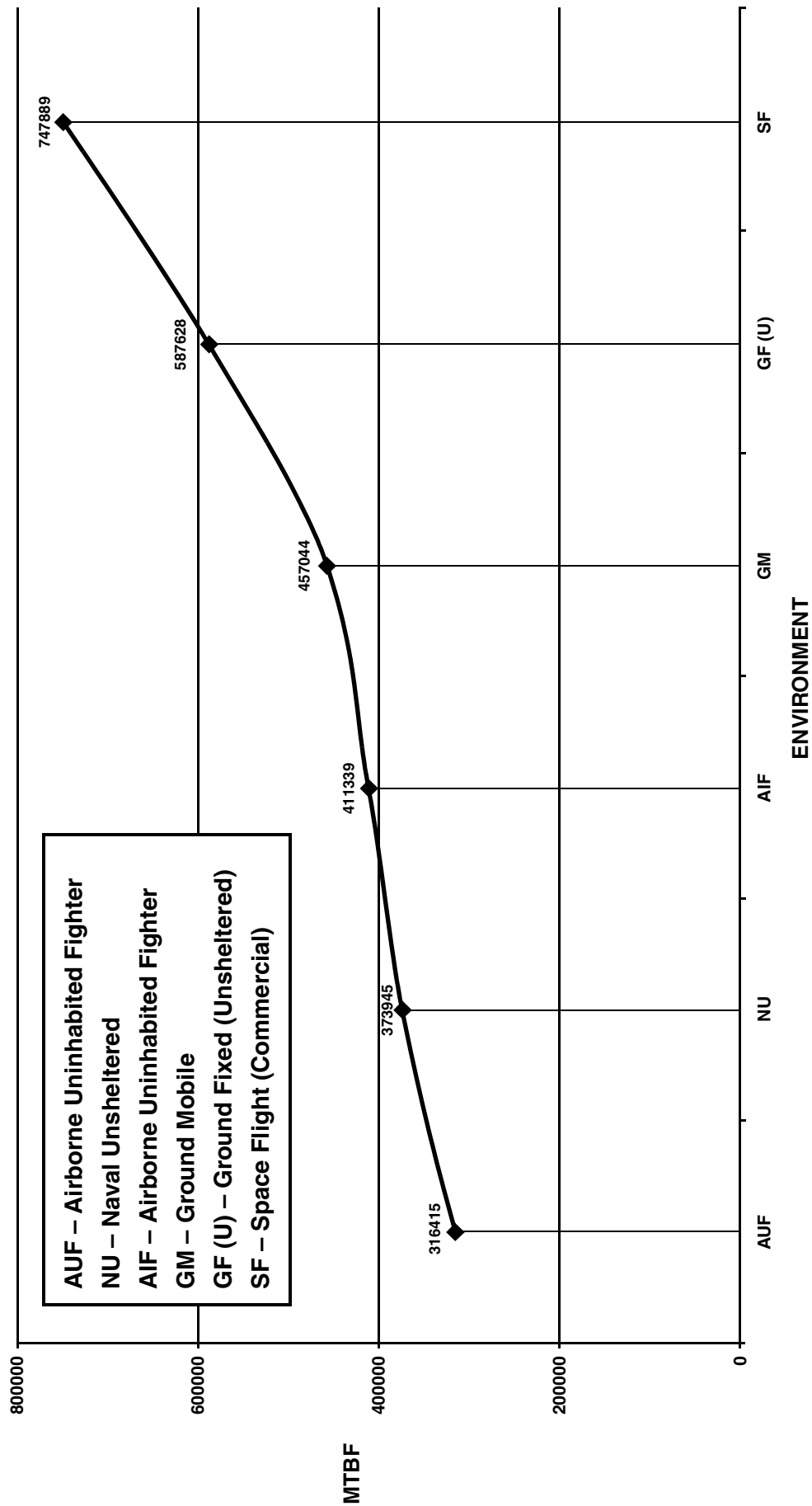
It is therefore recognized that in the absence of a Built-in-Test or the installation of back-up components, any functional failure as described in this report is considered significant.

Although a failure to the MUX enabling logic would cause a failure, the predicted failure rate for the device is significantly low enough (MTBF = 747,890hrs) which would enable the device to meet all of its required specifications. As a further consideration, the failure rate predicted values were conservatively modeled using a 50°C ambient with a 10°C heat rise in a Space Flight environment.

See Figure 1 for multiple reliability MTBF's for MUX performance under different environments.

See Table I – Failure mode effects analysis (FEMA) herein.

ACT8500 Mean Time Between Failures @ +50°C Operating Temperature



AUF – Airborne Uninhabited Fighter
 NU – Naval Unsheltered
 AIF – Airborne Uninhabited Fighter
 GM – Ground Mobile
 GF (U) – Ground Fixed (Unsheltered)
 SF – Space Flight (Commercial)

Figure 1

FAILURE MODE EFFECTS ANALYSIS (FEMA) ACT8500 MULTIPLEXER MODULE

Relex Software Report

Part Number 8500-S
Date 6/10/02
Environment SF, SC - Space Flight
Temperature 50 deg.C

Description ACT8500 64CHANNEL
File Name 85kmux.rpj

| Item Description | Function | Failure Mode | End Effect | Failure Mode Ratio | Failure Rate f/10 ⁶ hrs |
|--------------------------------------|---|----------------------------|--|--------------------|------------------------------------|
| Transorb A Zener Die | Protects each MUX line against high voltage transient | Open | loss of high voltage protection for each MUX line-device function not affected | 50.00 | 0.003867 |
| Transorb A Zener Die | Protects each MUX line against high voltage transient | Shorted | loss of input channel | 50.00 | 0.003867 |
| Transorb B Zener Die | Protects each MUX line against high voltage transient | Open | loss of high voltage protection for each MUX line-device function not affected | 50.00 | 0.003867 |
| Transorb B Zener Die | Protects each MUX line against high voltage transient | Shorted | loss of input channel | 50.00 | 0.003867 |
| 16 Channel Analog Multiplexer Die | Provides addressable Multiplexed outputs on each multiplexed line | MUX logic components open | loss of individual line output or signal | 50.00 | 0.057214 |
| 16 Channel Analog Multiplexer Die | Provides addressable Multiplexed outputs on each multiplexed line | MUX logic components short | loss of individual line output or signal | 50.00 | 0.057214 |
| External addressable MUX enable line | Sets logic GATE within MUX chip to enable digital address lines | MUX logic components open | loss of entire 16 MUX lines | 50.00 | 0.000527 |
| External addressable MUX enable line | Sets logic GATE within MUX chip to enable digital address lines | MUX logic components short | loss of entire 16 MUX lines | 50.00 | 0.000527 |

Table I

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused