

# Qualification and Reliability Report

 Series:                   E5M                  

Qualification Tests				
Test	Method/Condition	Test	Pass	Fail
Aging	Biased, 100μW typical, Temperature = 85°C, Duration = 30 days	100	100	0
Autoclave	JESD22-A102, 121°C, 100% RH, 15 PSIG, 96 hours	100	100	0
ESD Susceptibility	MIL-STD-883, Method 3015, Class 1, HBM = 1,500V	10	10	0
Flammability	UL94-V0	10	10	0
Hermeticity – Fine Leak	MIL-STD-883, Method 1014, Condition A	100	100	0
Hermeticity – Gross Leak	MIL-STD-883, Method 1014, Condition C	100	100	0
High Temperature Operating Life	MIL-STD-883, Method 1005, Condition B, Biased, 125°C, 1,000 hours	100	100	0
High Temperature Storage	MIL-STD-883, Method 1008, Condition C, 125°C, 168 hours	100	100	0
Highly Accelerated Temperature and Humidity Stress Test	JESD22-A110, Biased, 130°C, 85% RH, 96 hours	100	100	0
Lead Integrity	MIL-STD-883, Method 2004	25	25	0
Mechanical Dimensions	Per Datasheet	25	25	0
Mechanical Shock	MIL-STD-202, Method 213, Condition C, 100G's, 6msec, ½ sine	100	100	0
Moisture Sensitivity Level	J-STD-020, MSL = 1	100	100	0
Resistance to Soldering Heat	MIL-STD-202, Method 210, Condition K	100	100	0
Resistance to Solvents	MIL-STD-202, Method 215	100	100	0
Solderability	MIL-STD-883, Method 2003	100	100	0
Temperature Cycle	MIL-STD-883, Method 1010, Condition B, -55°C to +125°C, 10 cycles	100	100	0
Vibration	MIL-STD-883, Method 2007, Condition A, 20G's	100	100	0

Reliability Tests				
Test	Method/Condition	Test	Pass	Fail
Vibration	MIL-STD-883, Method 2007, 20 G's	8,215	8,215	0
Mechanical Shock	MIL-STD-883, Method 2002, Condition B, 1,500G's, 0.5msec, ½ sine	8,215	8,215	0
Temperature Cycle	MIL-STD-883, Method 1010, Condition B, -55°C to +125°C, 10 cycles	8,215	8,215	0
Aging	Biased, 100μW typical, Temperature = 85°C, Duration = 720 hours	8,215	8,215	0

Reliability Data		
Characteristic	Constant	Value
Number of Units	<i>N</i>	8,215
Hours Tested	<i>t</i>	720
Activation Voltage	<i>Ea</i>	0.4eV
Boltzmann's Constant	<i>k</i>	8.62 x 10 <sup>-5</sup>
Aging Temperature	<i>T1</i>	85°C
Ambient Temperature	<i>T2</i>	25°C
Confidence Level	$\chi^2_{(CL, 2 \text{ dof})}$	90%

Reliability Calculations	
Parameter	Value
Failures in Time (FIT)	29 units / 1 x 10 <sup>9</sup> Hours
Mean Time To Failure (MTTF)	34,925,000 hours / Failure

$$FIT = \frac{(\chi^2 / 2) \cdot 1,000,000,000}{\sum \left[ f_i \cdot t_i \cdot e^{\frac{Ea}{k} \left( \frac{1}{T1+273} - \frac{1}{T2+273} \right)} \right] + \left[ N \cdot t \cdot e^{\frac{Ea}{k} \left( \frac{1}{T1+273} - \frac{1}{T2+273} \right)} \right]}$$

$$MTTF = 1,000,000,000 / FIT$$