

11/11/2015



**PRODUCT RELIABILITY REPORT  
FOR**

**MAX78615+PPM**

**Maxim Integrated**

**14460 Maxim Dr.  
Dallas, TX 75244**

**Approved by:**

**Don Lipps  
Manager, Reliability Engineering**

**Conclusion:**

The following qualification successfully meets the quality and reliability standards required of all Maxim Integrated products:

MAX78615+PPM

In addition, Maxim Integrated's continuous reliability monitor program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards. The current status of the reliability monitor program can be viewed at <http://www.maximintegrated.com/qa/reliability/monitor>.

**Device Description:**

A description of this device can be found in the product data sheet. You can find the product data sheet at <http://www.maximintegrated.com/search/parts.mvp>.

**Reliability Derating:**

The Arrhenius model will be used to determine the acceleration factor for failure mechanisms that are temperature accelerated.

$$AfT = \exp((Ea/k) * (1/Tu - 1/Ts)) = tu/ts$$

AfT = Acceleration factor due to Temperature  
tu = Time at use temperature (e.g. 55°C)  
ts = Time at stress temperature (e.g. 125°C)  
k = Boltzmann's Constant (8.617 x 10<sup>-5</sup> eV/°K)  
Tu = Temperature at Use (°K)  
Ts = Temperature at Stress (°K)  
Ea = Activation Energy (e.g. 0.7 ev)

The activation energy of the failure mechanism is derived from either internal studies or industry accepted standards, or activation energy of 0.7ev will be used whenever actual failure mechanisms or their activation energies are unknown. All deratings will be done from the stress ambient temperature to the use ambient temperature.

An exponential model will be used to determine the acceleration factor for failure mechanisms, which are voltage accelerated.

$$AfV = \exp(B * (Vs - Vu))$$

AfV = Acceleration factor due to Voltage  
Vs = Stress Voltage (e.g. 7.0 volts)  
Vu = Maximum Operating Voltage (e.g. 5.5 volts)  
B = Constant related to failure mechanism type (e.g. 1.0, 2.4, 2.7, etc.)

The Constant, B, related to the failure mechanism is derived from either internal studies or industry accepted standards, or a B of 1.0 will be used whenever actual failure mechanisms or their B are unknown. All deratings will be done from the stress voltage to the maximum operating voltage. Failure rate data from the operating life test is reported using a Chi-Squared statistical model at the 60% or 90% confidence level (Cf).

The failure rate, Fr, is related to the acceleration during life test by:

$$Fr = X / (ts * AfV * AfT * N * 2)$$

X = Chi-Sq statistical upper limit  
N = Life test sample size

Failure Rates are reported in FITs (Failures in Time) or MTTF (Mean Time To Failure). The FIT rate is related to MTTF by:

$$MTTF = 1/Fr$$

NOTE: MTTF is frequently used interchangeably with MTBF.

The calculated failure rate for this device/process is:

**FAILURE RATE:**                      **MTTF (YRS):**      **342667**      **FITS:**              **0.3**  
**DEVICE HOURS:** **2750486575**      **FAILS:**              **0**

Only data from Operating Life or similar stresses are used for this calculation.

The parameters used to calculate this failure rate are as follows:

**Cf: 60%**              **Ea: 0.7**              **B: 0**              **Tu: 25 °C**              **Vu: 3.6 Volts**

The reliability data follows. At the start of this data is the device information. The next section is the detailed reliability data for each stress. The reliability data section includes the latest data available and may contain some generic data. **Bold** Product Number denotes specific product data.

**Device Information:**

Process: TSMC 0.25um, Mixed signal, Embedded flash, General Purpose, Double poly Quad metal, 2.5V/3.3V  
 Passivation: SiO/SiN = 1000nm/700nm  
 Die Size: 88 x 86  
 Number of Transistors: 200000  
 Interconnect: Aluminum / 0.5% Copper

**ESD CDM**

DESCRIPTION	DATE CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-C101 CDM 250 VOLTS	3 PUL'S	5	0	
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-C101 CDM 500 VOLTS	3 PUL'S	5	0	
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-C101 CDM 750 VOLTS	3 PUL'S	5	0	
<b>Total:</b>					<b>0</b>	

**ESD HBM**

DESCRIPTION	DATE CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-A114 HBM 500 VOLTS	1 PUL'S	5	0	
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-A114 HBM 1000 VOLTS	1 PUL'S	5	0	
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-A114 HBM 1500 VOLTS	1 PUL'S	5	0	
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-A114 HBM 2000 VOLTS	1 PUL'S	5	0	
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-A114 HBM 2500 VOLTS	1 PUL'S	5	0	
ESD SENSITIVITY	1235 <b>MAX78615</b> ZJ123499AC	JESD22-A114 HBM 3000 VOLTS	1 PUL'S	5	0	

ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A114 HBM 3500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A114 HBM 4000 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A114 HBM 4500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A114 HBM 5000 VOLTS	1	PUL'S	5	0
<b>Total:</b>							<b>0</b>	

#### ESD MM

DESCRIPTION	DATE	CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A115 MM 150 VOLTS	1	PUL'S	5 0
ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A115 MM 200 VOLTS	1	PUL'S	5 0
ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A115 MM 250 VOLTS	1	PUL'S	5 0
ESD SENSITIVITY	1235	MAX78615	ZJ123499AC	JESD22-A115 MM 300 VOLTS	1	PUL'S	5 0
<b>Total:</b>							<b>0</b>

#### LATCH-UP

DESCRIPTION	DATE	CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
LATCH-UP I	1235	MAX78615	ZJ123499AC	JESD78A, I-TEST 25C 100mA		6	0
LATCH-UP I	1235	MAX78615	ZJ123499AC	JESD78A, I-TEST 25C 250mA		6	0
LATCH-UP V	1235	MAX78615	ZJ123499AC	JESD78A, V-SUPPLY TEST 25C		6	0
<b>Total:</b>							<b>0</b>

#### OPERATING LIFE

DESCRIPTION	DATE	CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
HIGH TEMP OP LIFE	0222	78M6613	26728	125C, 3.6 VOLTS	1000 HRS	76	0
HIGH TEMP OP LIFE	1026	71M6103	26803	125C, 3.3 VOLTS	500 HRS	200	0
HIGH TEMP OP LIFE	1042	71M6543	QB112428AE	125C, 3.3 VOLTS	500 HRS	100	0
HIGH TEMP OP LIFE	1052	71M6543G	445AN	125C, 3.6 VOLTS	192 HRS	77	0
HIGH TEMP OP LIFE	1118	78M6631	GW110677A	125C, 5.0 VOLTS	1000 HRS	1690	0
HIGH TEMP OP LIFE	1131	71M6543	GW112093A	125C, 3.5 VOLTS	500 HRS	77	0
HIGH TEMP OP LIFE	1131	71M6543	GW112093A	125C, 3.6 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	1131	71M6543	GW112093A	125C, 3.5 VOLTS	500 HRS	77	0
HIGH TEMP OP LIFE	1131	71M6543	GW112093A	125C, 3.6 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	1132	71M6543	GW112093A	125C, 3.5 VOLTS	500 HRS	77	0
HIGH TEMP OP LIFE	1132	71M6543	GW112093A	125C, 3.6 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	1209	78M6611	QX128420AB	125C, 3.6 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	1209	78M6611	QX128420A	125C, 3.6 VOLTS	1000 HRS	77	0

HIGH TEMP OP LIFE	1209	78M6611	QX128420A	125C, 3.6 VOLTS	1000	HRS	77	0
HIGH TEMP OP LIFE	1219	78M6610	ZJ123342BC	125C, 3.6 VOLTS	192	HRS	80	0
HIGH TEMP OP LIFE	1235	<b>MAX78615</b>	ZJ123499AC	125C, 3.6 VOLTS	192	HRS	80	0
HIGH TEMP OP LIFE	1236	71M6542FT	Z4133579DA	125C, 3.6 VOLTS	192	HRS	80	0
HIGH TEMP OP LIFE	1250	MAX78700	ZJ133523ED	125C, 3.6 VOLTS	192	HRS	80	0

**Total:** 0

**FAILURE RATE:**                    **MTTF (YRS):**        **342667**        **FITS:**            **0.3**  
**DEVICE HOURS:** **2750486575**    **FAILS:**            **0**

MAX78615+PPM is built with the identical die of MAX78615