

8/27/2014



**PRODUCT RELIABILITY REPORT
FOR**

MAX21002

Maxim Integrated

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

Approved by:

**Sokhom Chum
SMTS, Reliability Engineering**

Conclusion:

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

MAX21002

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 10⁻⁵ 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:

$$\text{MTTF} = 1/\text{Fr}$$

NOTE: MTTF is frequently used interchangeably with MTBF.

The calculated failure rate for this device/process is:

FAILURE RATE: **MTTF (YRS):** **50199** **FITS:** **2.3**
DEVICE HOURS: **402928537** **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: Maxim EPSON Fab S18C 3V & 5V CMOS, 4 metals
 Passivation: SiN / SiO2
 Die Size: 76 x 108
 Number of Transistors: 485284
 Interconnect: Aluminum / 0.5% Copper
 Gate Oxide Thickness: 140Å

ESD HBM

DESCRIPTION	DATE	CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
ESD SENSITIVITY	1249	MAX21000	Z112Z006BA- JESD22-A114 HBM 500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1249	MAX21000	Z112Z006BA- JESD22-A114 HBM 1000 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1249	MAX21000	Z112Z006BA- JESD22-A114 HBM 1500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1249	MAX21000	Z112Z006BA- JESD22-A114 HBM 2000 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1249	MAX21000	Z112Z006BA- JESD22-A114 HBM 2500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1303	MAX21000	Z113Z005BA- JESD22-A114 HBM 500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1303	MAX21000	Z113Z005BA- JESD22-A114 HBM 1000 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1303	MAX21000	Z113Z005BA- JESD22-A114 HBM 1500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1303	MAX21000	Z113Z005BA- JESD22-A114 HBM 2000 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1303	MAX21000	Z113Z005BA- JESD22-A114 HBM 2500 VOLTS	1	PUL'S	5	0
Total:						0	

LATCH-UP

DESCRIPTION	DATE	CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
LATCH-UP I	1249	MAX21000	ZI12Z006BA- JESD78A, I-TEST 25C 100mA		6	0	
LATCH-UP I	1249	MAX21000	ZI12Z006BA- JESD78A, I-TEST 25C 250mA		6	0	
LATCH-UP V	1249	MAX21000	ZI12Z006BA- JESD78A, V-SUPPLY TEST 25C		6	0	
LATCH-UP I	1303	MAX21000	ZI13Z005BA- JESD78A, I-TEST 25C 100mA		6	0	
LATCH-UP I	1303	MAX21000	ZI13Z005BA- JESD78A, I-TEST 25C 250mA		6	0	
LATCH-UP V	1303	MAX21000	ZI13Z005BA- JESD78A, V-SUPPLY TEST 25C		6	0	
LATCH-UP I	1304	MAX21000	ZI13Z003BA- JESD78A, I-TEST 85C 100mA		6	0	
LATCH-UP I	1304	MAX21000	ZI13Z003BA- JESD78A, I-TEST 85C 250mA		6	0	
LATCH-UP V	1304	MAX21000	ZI13Z003BA- JESD78A, V-SUPPLY TEST 85C		6	0	
Total:						0	

OPERATING LIFE

DESCRIPTION	DATE	CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
HIGH TEMP OP LIFE	1003	MAX17042	QJ000200DA 125C, 5.5 VOLTS	192 HRS	45	0	
HIGH TEMP OP LIFE	1018	DS28E10	QH000900A 125C, 3.6 VOLTS	192 HRS	45	0	
HIGH TEMP OP LIFE	1134	MAX17048	ZJ213800AB 125C, 5.0 VOLTS	192 HRS	77	0	
HIGH TEMP OP LIFE	1240	MAX31790	ZX330900AB 125C, 5.5 VOLTS	192 HRS	80	0	
HIGH TEMP OP LIFE	1244	DS2483	ZJ330302AE 125C, 5.25 VOLTS	1000 HRS	45	0	
HIGH TEMP OP LIFE	1249	MAX21000	ZI12Z006BA- 125C, 3.6 VOLTS	1000 HRS	80	0	
HIGH TEMP OP LIFE	1302	MAX17048	ZJ386023AB 125C, 5.0 VOLTS	192 HRS	77	0	
HIGH TEMP OP LIFE	1303	MAX21000	ZI13Z005BA- 125C, 3.6 VOLTS	1000 HRS	80	0	
HIGH TEMP OP LIFE	1304	MAX21000	ZI13Z003BA- 125C, 3.6 VOLTS	1000 HRS	80	0	
HIGH TEMP OP LIFE	1312	MAX31790	ZX330900AC 125C, 5.5 VOLTS	1000 HRS	80	0	
Total:						0	

FAILURE RATE: MTTF (YRS): 50199 FITS: 2.3
DEVICE HOURS: 402928537 FAILS: 0

Cumulative monitor data for the S18 Process results in a FIT Rate of 0.05 @ 25C and 0.93 @ 55C (0.8 eV, 60% UCL).

MAX21002 is built with the identical die of MAX21000.