

2/20/2013



**PRODUCT RELIABILITY REPORT  
FOR**

**MAX31865**

**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:

MAX31865

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:

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

NOTE: MTTF is frequently used interchangeably with MTBF.

The calculated failure rate for this device/process is:

**FAILURE RATE:**                      **MTTF (YRS):**                      **2820**                      **FITS:**                      **40.5**  
**DEVICE HOURS:**                      **22636011**                      **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: 3.7 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 SA Fab S45  
 Passivation: SiN/SiO2  
 Die Size: 137 x 120  
 Number of Transistors: 39837  
 Interconnect: Aluminum / 0.5% Copper  
 Gate Oxide Thickness: 140Å

**ESD HBM**

DESCRIPTION	DATE	CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
ESD SENSITIVITY	1231	<b>MAX31865</b>	ZJ381729AB- JESD22-A114 HBM 500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1231	<b>MAX31865</b>	ZJ381729AB- JESD22-A114 HBM 1000 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1231	<b>MAX31865</b>	ZJ381729AB- JESD22-A114 HBM 1500 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1231	<b>MAX31865</b>	ZJ381729AB- JESD22-A114 HBM 2000 VOLTS	1	PUL'S	5	0
ESD SENSITIVITY	1231	<b>MAX31865</b>	ZJ381729AB- JESD22-A114 HBM 2500 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	1231	<b>MAX31865</b>	ZJ381729AB- JESD78A, I-TEST 25C 100mA			6	0
LATCH-UP I	1231	<b>MAX31865</b>	ZJ381729AB- JESD78A, I-TEST 25C 250mA			6	0
LATCH-UP V	1231	<b>MAX31865</b>	ZJ381729AB- JESD78A, V-SUPPLY TEST 25C			6	0
<b>Total:</b>						<b>0</b>	

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**OPERATING LIFE**

DESCRIPTION	DATE CODE/PRODUCT/LOT	CONDITION	READPOIN	QTY	FAILS	FA#
HIGH TEMP OP LIFE	0943 MAX31190	WJ051035AB 125C, 3.6 VOLTS	192 HRS	45	0	
HIGH TEMP OP LIFE	1105 DS3920	ZJ163071AB 135C, 75V (V8)	192 HRS	77	0	
HIGH TEMP OP LIFE	1218 MAX31910	ZJ276928FA 135C, 36V (V8)	192 HRS	80	0	
HIGH TEMP OP LIFE	1231 <b>MAX31865</b>	ZJ381729AB- 125C, 3.7V (PSA)	192 HRS	80	0	
			<b>Total:</b>		<b>0</b>	

**FAILURE RATE:                    MTTF (YRS):                    2820                    FITS:                    40.5**  
**DEVICE HOURS:                    22636011                    FAILS:                    0**

Cumulative monitor data for the S4 Process results in a FIT Rate of 0.13 @ 25C and 2.31 55C (0.8 eV, 60% UCL).