

RELIABILITY REPORT
FOR

DS21Q50, Rev C1, 100 LQFP, 14x14x1.4mm

Dallas Semiconductor

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Conclusion:

The following qualification successfully meets the quality and reliability standards required of all Dallas Semiconductor products and processes:

DS21Q50, Rev C1, 100 LQFP, 14x14x1.4mm

Device Description:

A description of the device used in this qualification can be found in the product data sheet. You can find the product data sheet at http://dbserv.maxim-ic.com/l_datasheet3.cfm.

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/assembly is:

FAILURE RATE:	MTTF (YRS):	37380	FITS:	3.1
	DEVICE HOURS:	318120	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: 5.5 Volts**

The reliability data follows. At the start of this data is the device information. This is a description of the device for this report. Following this is the assembly information. This section includes a description of the assembly vehicle used to generate this reliability data for both qualifications and monitors. The next section is the detailed reliability data for each stress found in the qualification / monitor. If there are additional assemblies used as part of this report, a description of each will follow which includes the respective reliability data for that assembly. The reliability data section includes the latest data available.

Device Information:

Device: DS21Q50
 Process: 2P, 2M, 0.6um, GOI, ZTC P1R, P2Cap,Pd,LowVts, WJ BPS
 Passivation: Laser/TEOS Ox - Pass/Nit - Gen.LaserPrb
 Die Size: 409 x 407
 Number of Transistors: 300000
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness: 150 Å

Assembly Information:

Qualification Vehicle: DS21Q50
 Assembly Site: ATP (Amkor, PI)
 Pin Count: 100
 Package Type: LQFP
 Body Size: 14x14x1.4
 Mold Compound: Sumitomo 7320CR
 Lead Frame: Stamped Copper CDA194
 Lead Finish: SnPb Plate
 Die Attach: JM2500AN Ag Polymer
 Bond Wire / Size: Au / 1.2 mil
 Theta JA:
 Theta JC:
 Flammability: UL 94-V0
 Moisture Sensitivity (JEDEC J-STD20A) Level 4
 Date Code Range: 0027 to 0418

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ESD SENSITIVITY	0219	EOS/ESD S5.1 HBM 500 VOLTS	2 PUL'S	3	0	

ESD SENSITIVITY	0219	EOS/ESD S5.1 HBM 1000 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0219	EOS/ESD S5.1 HBM 2000 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0219	EOS/ESD S5.1 HBM 4000 VOLTS	1	PUL'S	3	1	No FA
ESD SENSITIVITY	0219	EOS/ESD S5.1 HBM 8000 VOLTS	1	PUL'S	3	3	No FA
LATCH-UP	0219	JESD78, I-TEST 125C			3	0	
LATCH-UP	0219	JESD78, Vsupply TEST 125C			3	0	
ESD SENSITIVITY	0418	EOS/ESD S5.1 HBM 500 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0418	EOS/ESD S5.1 HBM 1000 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0418	EOS/ESD S5.1 HBM 2000 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0418	EOS/ESD S5.1 HBM 4000 VOLTS	1	PUL'S	3	3	No FA
ESD SENSITIVITY	0418	EOS/ESD S5.1 HBM 8000 VOLTS	1	PUL'S	3	3	No FA
LATCH-UP	0418	JESD78, I-TEST 125C			6	0	
LATCH-UP	0418	JESD78, Vsupply TEST 125C			6	0	
Total:						10	

MOISTURE SENSITIVITY LEVEL 3

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ULTRASOUND	0027		J-STD-020		8	0	
STORAGE LIFE			125C	24 HRS	8		
MOISTURE SOAK			30C/60% R.H.	240 HRS	8		
CONVECTION REFLOW			235C +5/-0C	3 PASS	8	0	
EXTERNAL VISUAL			MIL-STD-883-2009		8	0	
PRECONDITION U/S			J-STD-020		8	0	
ULTRASOUND	0121		J-STD-020		22	0	
STORAGE LIFE			125C	24 HRS	22		
MOISTURE SOAK			30C/60% R.H.	192 HRS	22		
CONVECTION REFLOW			235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
ULTRASOUND	0122		J-STD-020		22	0	
STORAGE LIFE			125C	24 HRS	22		
MOISTURE SOAK			30C/60% R.H.	192 HRS	22		
CONVECTION REFLOW			235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
ULTRASOUND	0122		J-STD-020		22	0	
STORAGE LIFE			125C	24 HRS	22		
MOISTURE SOAK			30C/60% R.H.	192 HRS	22		
CONVECTION REFLOW			235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
ULTRASOUND	0122		J-STD-020		22	0	
STORAGE LIFE			125C	24 HRS	22		
MOISTURE SOAK			30C/60% R.H.	192 HRS	22		

CONVECTION REFLOW	0122	235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0	
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0126	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		
MOISTURE SOAK		30C/60% R.H.	192	HRS	22		
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0	
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0219	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		
MOISTURE SOAK		30C/60% R.H.	192	HRS	22		
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0	
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0237	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		
MOISTURE SOAK		30C/60% R.H.	192	HRS	22		
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0	
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0305	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		
MOISTURE SOAK		30C/60% R.H.	192	HRS	22		
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	1	CRACK
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0305	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		
MOISTURE SOAK		30C/60% R.H.	192	HRS	22		
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0	
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0309	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		
MOISTURE SOAK		30C/60% R.H.	192	HRS	22		
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0	
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0313	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		
MOISTURE SOAK		30C/60% R.H.	192	HRS	22		
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0	
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0	
PRECONDITION U/S		J-STD-020			22	0	
ULTRASOUND	0330	J-STD-020			22	0	
STORAGE LIFE		125C	24	HRS	22		

MOISTURE SOAK	0330	30C/60% R.H.	192	HRS	22	
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0
PRECONDITION U/S		J-STD-020			22	0
ULTRASOUND	0332	J-STD-020			22	0
STORAGE LIFE		125C	24	HRS	22	
MOISTURE SOAK		30C/60% R.H.	192	HRS	22	
CONVECTION REFLOW		235C +5/-0C	3	PASS	22	0
EXTERNAL VISUAL		J-STD-020, 6.1a			22	0
PRECONDITION U/S		J-STD-020			22	0
Total:						1

OPERATING LIFE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
INFANT LIFE	0027		125C, 5.0 VOLTS	48 HRS	315	0	
HIGH VOLTAGE LIFE	0027		125C, 5.0 VOLTS	1000 HRS	149	0	
HIGH VOLTAGE LIFE	0219		125C, 5.0 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0418		125C, 5.0 VOLTS	1000 HRS	77	0	
Total:						0	

PACKAGE TESTS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
SOLDERABILITY (Sn/Pb)	0027		MIL-STD-883-2003		3	0	
X-RAY	0027		MIL-STD-883-2012 : TOP & SIDE VIEW		6	0	
PHYSICAL DIMENSIONS			MIL-STD-883-2016		6	0	
MARK PERMANENCY			MIL-STD-883-2015		6	0	
LEAD INTEGRITY			MIL-STD-883-2004 : COND B2		6	0	
Total:						0	

PRECONDITIONING

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
CONVECTION REFLOW	0121		235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
CONVECTION REFLOW	0122		235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
CONVECTION REFLOW	0122		235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
CONVECTION REFLOW	0122		235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
CONVECTION REFLOW	0126		235C +5/-0C	3 PASS	22	0	
EXTERNAL VISUAL			J-STD-020, 6.1a		22	0	
PRECONDITION U/S			J-STD-020		22	0	
Total:						0	

PRECONDITIONING LEVEL 3

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
STORAGE LIFE	0027		125C	24 HRS	317		
MOISTURE SOAK			30C/60% R.H.	240 HRS	317		
CONVECTION REFLOW			235C +5/-0C	3 PASS	317	0	
				Total:		0	

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0027		-55C TO 125C	1000 CYS	76	0	
				Total:		0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HAST, NO BIAS	0027		130C, 85% R.H.	200 HRS	90	0	
				Total:		0	

FAILURE RATE: **MTTF (YRS):** **37380** **FITS:** **3.1**
 DEVICE HOURS: **318120** **FAILS:** **0**