



AEC-Q100 Qualification Report

Product Series: CA-IS322X-Q1

Report Version: V1.1

Reference Doc.: AEC-Q100-REV-H

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1. Overview

Reliability testing of microelectronic products is a risk mitigation process designed to ensure the service life of device in customer applications. Semiconductor wafer manufacturing process and package-level reliability can be assessed in a variety of ways and may include accelerated environmental test conditions. Chipanalog evaluates manufacturability of the device to verify a robust silicon and assembly flow to ensure continuity of supply to customers. Chipanalog qualifies new devices, significant changes, and product families based on AEC-Q100.

2. Part Number List

Package Type	Part Number
SOIC16-WB(W)	CA-IS3221BW-Q1/CA-IS3221CW-Q1 /CA-IS3222BW-Q1/CA-IS3222CW-Q1
SOIC14-WB(K)	CA-IS3221BK-Q1/CA-IS3221CK-Q1/CA-IS3222BK-Q1/CA-IS3222CK-Q1
SOIC16-NB(N)	CA-IS3221BN-Q1/CA-IS3221CN-Q1/ CA-IS3222BN-Q1/CA-IS3222CN-Q1

Note: AECQ-100 provides the guideline for the use of generic data to accelerate and streamline the qualification process. Products sharing the same major product, process and materials elements may be categorized in a product qualification family.

3. Production Information

3.1. Wafer information

Fab site	SMIC
Wafer	SHENNONG, NVWA
Fab Process	18BCD

3.2. Package information

Assembly site	UNIMOS	UNIMOS	JCET
FT site	UNIMOS	UNIMOS	JCET
Package	SOIC16-WB(W)	SOIC14-WB(K)	SOIC16-NB(N)
Lead Frame	Cu	Cu	Cu
Bond wire	25um Au	25um Au	25um Au
MSL level	MSL3	MSL3	MSL3
Operation Temp.	Grade 1(-40°C - 125°C)	Grade 1(-40°C - 125°C)	Grade 1(-40°C - 125°C)

4. Reliability Qualification Plan

Test Group A-Accelerated Environment Stress Tests					
Group	Item	Refer.	Test condition	QTY	Remark
A1	PC	J-STD-020 JESD22-A113	Test @ Rm, SMD only, Moisture Preconditioning before THB/BHAST, AC/UHAST, TC, and PTC stress, MSL = 3, Peak Reflow Temp = 260°C	240 pcs*3 lots	
A2	BHAST	JESD22-A110	BHAST: 130°C, 85% RH, V _{cc1} = 18V, V _{cc2} = 25V, 96 hrs (Test @ Rm/Hot)	80 pcs*3 lots	
A3	UHAST	JESD22-A101	UHAST: 130°C, 85% RH, 96 hrs (Test @ Rm)	80 pcs*3 lots	
A4	TC	JESD22-A104	-65°C-150°C, 500 cycles (Test @ Hot)	80 pcs*3 lots	
A5	PTC	JESD22-A105	-40°C-125°C, 1000 cycles (Test @ Rm/Hot)	NA	
A6	HTSL	JESD22-A103	T _a = 150°C, 1000 hrs (Test @ Rm/Hot)	45 pcs*1 lot	
Test Group B-Accelerated Lifetime Simulation Tests					
Group	Item	Refer.	Test condition	QTY	Remark
B1	HTOL	JESD22-A108	T _a = 135°C, V _{cc1} = 18V, V _{cc2} = 30V, 1000 hrs (Test @ Rm/Cold/Hot)	77 pcs*3 lots	
B2	ELFR	AEC-Q100-008	T _a = 135°C, V _{cc1} = 18V, V _{cc2} = 30V, 48 hrs (Test @ Rm/Hot)	800 pcs*3 lots	
B3	EDR	AEC-Q100-005	Test @ Rm/Hot	NA	
Group C-Package Assembly Integrity Tests					
Group	Item	Refer.	Test condition	QTY	Remark
C1	WBS	AEC-Q100-001 AEC-Q003	Cpk > 1.67, Each bonder used, T0 samples	30 bonds from 5 pcs	
C1	WBS	AEC-Q100-001 AEC-Q003	0 fails, Each bonder used, post-TC samples	30 bonds from 5 pcs	
C2	WBP	MIL-STD883 AEC-Q003	Cpk > 1.67, Each bonder used, T0 samples	30 bonds from 5 pcs	
C2	WBP	MIL-STD883 AEC-Q003	0 fails, Each bonder used, post-TC samples	30 bonds from 5 pcs	
C3	SD	JESD22-B102 JSTD-002D	> 95% coverage, 8hr steam aging prior to testing	15 pcs*1 lot	
C4	PD	JESD22-B100 JESD22-B108 AEC-Q003	Cpk > 1.67	10 pcs*3 lots	
C5	SBS	AEC-Q100-010 AEC-Q003	Cpk > 1.67, 5 balls from min. of 10 devices	NA	

C6	LI	JESD22 B105	10 leads from each of 5 devices	NA	
Test Group D–Die Fabrication Reliability Tests					
Group	Item	Refer.	Test condition	QTY	Remark
D1	EM	JESD61	---	---	Done by Fab
D2	TDDB	JESD35	---	---	Done by Fab
D3	HCI	JESD60 & 28	---	---	Done by Fab
D4	NBTI	JESD90	---	---	Done by Fab
D5	SM	JESD61, 87, & 202	---	---	Done by Fab
Group E-Electrical Verification Tests					
Group	Item	Refer.	Test condition	QTY	Remark
E1	TEST	per datasheet	Pre and Post Stress Electrical Test	all	
E2	HBM	AEC Q100-002	$\pm 500V, \pm 1KV, \pm 2KV, \pm 4KV$ (Test @ Rm/Hot)	3 pcs*1 lot	
E3	CDM	AEC-Q100-011	$\pm 250V, \pm 500V, \pm 750V, \pm 2KV$ (Test @ Rm/Hot)	3 pcs*1 lot	
E4	LU	AEC-Q100-004	125°C, I-trigger $\pm 200mA$ (Test @ Rm/Hot)	6 pcs*1 lot	
E9	EMC	SAE J1752/3	Electromagnetic Compatibility (Radiated Emissions)	1 pcs*1 lot	
E10	SC	AEC-Q100-012	/	NA	
E11	SER	JESD89-1/-2/-3	/	NA	
E12	LF	AEC-Q005	/	2 pcs*3 lots	

Note: Group E5, E6, E7 and Group F are not reliability related items. Group G are not applicable to non-hermetic packaged devices.

5. Reliability Test Results

Test Group A-Accelerated Environment Stress Test (SOIC16-WB &SOIC14-WB)					
Group	Item	Test Condition	QTY	Lot NO.	Result
A1	PC	Test @ Rm, SMD only, Moisture Preconditioning before BHAST, UHAST, TC stress, MSL = 3, Peak Reflow Temp = 260°C	240 pcs*3 lots	SUQ12306A	Pass
				SUQ12306B	Pass
				2310D	Pass
A2	BHAST	130°C, 85% RH, 96 hrs, $V_{cc1}= 18V$, $V_{cc2}= 25V$	80 pcs*3 lots	SUQ12306A	Pass
				SUQ12306B	Pass
				2310D	Pass
A3	UHAST	130°C, 85% RH, 96 hrs	80 pcs*3 lots	SUQ12306A	Pass
				SUQ12306B	Pass
				2310D	Pass
A4	TC	-65°C-150°C, 500 cycles	80 pcs*3 lots	SUQ12306A	Pass
				SUQ12306B	Pass
				2310D	Pass
A6	HTSL	$T_a = 150^\circ C$, 1000 hrs	45 pcs*1 lot	SUQ12306A	Pass
Test Group A-Accelerated Environment Stress Test (SOIC16-NB)					
Group	Item	Test Condition	QTY	Lot NO.	Result
A1	PC	Test @ Rm, SMD only, Moisture Preconditioning before BHAST, UHAST, TC stress, MSL = 3, Peak Reflow Temp = 260°C	240 pcs*3 lots	2317A	Pass
				2318A	Pass
				2319A	Pass
A2	BHAST	130°C, 85% RH, 96 hrs, $V_{cc1}= 18V$, $V_{cc2}= 25V$	80 pcs*3 lots	2317A	Pass
				2318A	Pass
				2319A	Pass
A3	UHAST	130°C, 85% RH, 96 hrs	80 pcs*3 lots	2317A	Pass
				2318A	Pass
				2319A	Pass
A4	TC	-65°C-150°C, 500 cycles	80 pcs*3 lots	2317A	Pass
				2318A	Pass
				2319A	Pass
A6	HTSL	$T_a = 150^\circ C$, 1000 hrs	45 pcs*1 lot	2317A	Pass
Test Group B-Accelerated Lifetime Simulation Tests					
Group	Item	Test Condition	QTY	Lot NO.	Result
B1	HTOL	$T_a = 135^\circ C$, 1000 hrs, $V_{cc1}= 18V$, $V_{cc2}= 30V$, input f = 1kHz	77 pcs*3 lots	SUQ12306A	Pass
				SUQ12306B	Pass
				2310D	Pass

	HTOL- Robust	$T_a = 135^{\circ}\text{C}$, 2000 hrs, $V_{cc1} = 18\text{V}$, $V_{cc2} = 30\text{V}$, input $f = 1\text{kHz}$	77 pcs*1 lot	SUQ12306B	Pass
B2	ELFR	$T_a = 135^{\circ}\text{C}$, 1000 hrs, $V_{cc1} = 18\text{V}$, $V_{cc2} = 30\text{V}$, input $f = 1\text{kHz}$	800 pcs*3 lots	SUQ12306A	Pass
				SUQ12306B	Pass
				2310D	Pass

Group C–Package Assembly Integrity Tests (SOIC16-WB &SOIC14-WB)

Group	Item	Test Condition	QTY	Lot NO.	Result
C1	WBS	Cpk > 1.67, Each bonder used, T0 samples	30 bonds from 5 pcs	SUQ12306A	Pass
C1	WBS	0 fails, Each bonder used, post-TC samples	30 bonds from 5 pcs	SUQ12306A	Pass
C2	WBP	Cpk > 1.67, each bonder used, T0 samples	30 bonds from 5 pcs	SUQ12306A	Pass
C2	WBP	0 fails, Each bonder used, post-TC samples	30 bonds from 5 pcs	SUQ12306A	Pass
C3	SD	>95% coverage, 8 hrs steam aging prior to testing	15 pcs*1 lot	SUQ12306A	Pass
C4	PD	Cpk > 1.67	10 pcs*3 lots	SUQ12306A	Pass
				SUQ12306B	Pass
				2310D	Pass

Group C–Package Assembly Integrity Tests (SOIC16-NB)

Group	Item	Test Condition	QTY	Lot NO.	Result
C1	WBS	Cpk > 1.67, Each bonder used, T0 samples	30 bonds from 5 pcs	2317A	Pass
C1	WBS	0 fails, Each bonder used, post-TC samples	30 bonds from 5 pcs	2317A	Pass
C2	WBP	Cpk > 1.67, each bonder used, T0 samples	30 bonds from 5 pcs	2317A	Pass
C2	WBP	0 fails, Each bonder used, post-TC samples	30 bonds from 5 pcs	2317A	Pass
C3	SD	>95% coverage, 8 hrs steam aging prior to testing	15 pcs*1 lot	2317A	Pass
C4	PD	Cpk > 1.67	10 pcs*3 lots	2317A	Pass
				2318A	Pass
				2319A	Pass

TEST GROUP D–Die Fabrication Reliability Tests

Group	Item	Test Condition	ADDITIONAL REQUIREMENTS
D1	EM	---	The Die Fabrication Reliability Tests are carried out by every fabrication site. The data, test method, calculations and internal criteria are available to the customer upon request.
D2	TDDDB	---	
D3	HCI	---	
D4	NBTI	---	
D5	SM	---	

Group E-Electrical Verification Tests					
Group	Item	Test Condition	QTY	Lot NO.	Result
E1	TEST	Pre and Post Stress Electrical Test	all	all	Pass
E2	HBM	± 500V, ± 1KV, ± 2KV, ± 4KV (Test @ Rm/Hot)	3 pcs*1 lot	2310D	3A
E3	CDM	± 250V, ± 500V, ± 750V, ± 2KV (Test @ Rm/Hot)	3 pcs*1 lot	2310D	C3
E4	LU	125°C, I-trigger ± 200mA (Test @ Rm/Hot)t	6 pcs*1 lot	2310D	Class II A
E9	EMC	Electromagnetic Compatibility (Radiated Emissions)	1 pcs*1 lot	2310D	See appendix 1
E12	LF	SOIC16-WB & SOIC14-WB	Refer to UNIMOS SOP8 Tin Whisker report		
		SOIC16-NB	Refer to JCET SOP8 Tin Whisker report		

6. MTBF&FIT

Supporting Data (Ea = 0.7 eV, Confidence Level = 60%)							MTBF (hrs)	FIT
Test Temp.	Test Voltage	Duration	QTY	Fail QTY	Operation Temp.	Operation Voltage	5.94E7	16.84
135°C	18V/30V	1000 hrs	154	0	55°C	18V/25V		
135°C	18V/30V	48 hrs	2400	0	55°C	18V/25V		
135°C	18V/30V	2000 hrs	77	0	55°C	18V/25V		

Note: The FIT data is generated based on Arrhenius model and voltage acceleration model.

7. Conclusion

CA-IS322X-Q1 series products are qualified according to AEC-Q100 standard.

Disclaimer

This information is provided to assist customers in design and development. It could change for technology innovation without notice.

The devices are shipped after passing final test. Customers are responsible to conduct sufficient engineering and additional qualification testing to determine whether a device is suitable for use in their applications.

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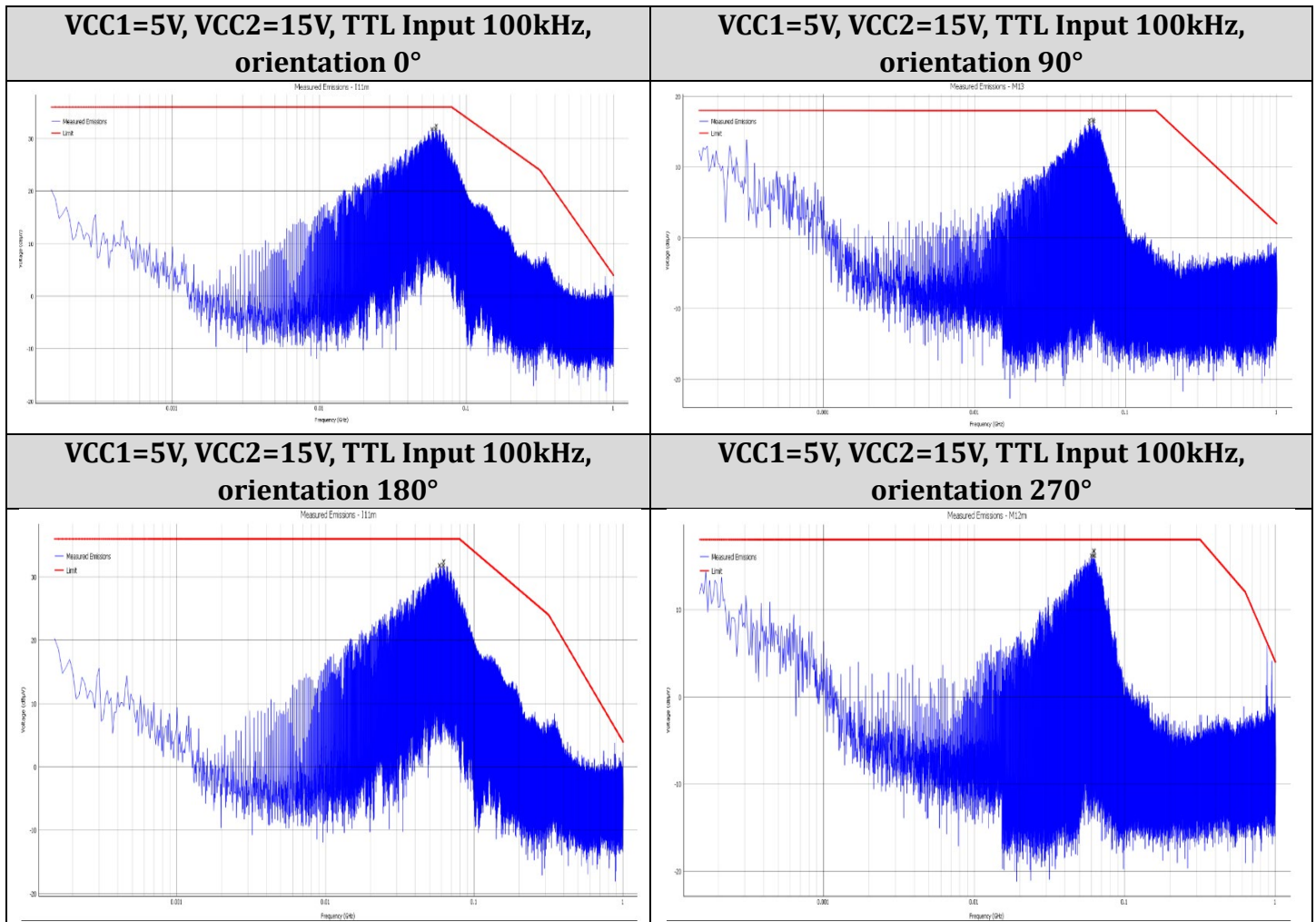
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Revision History


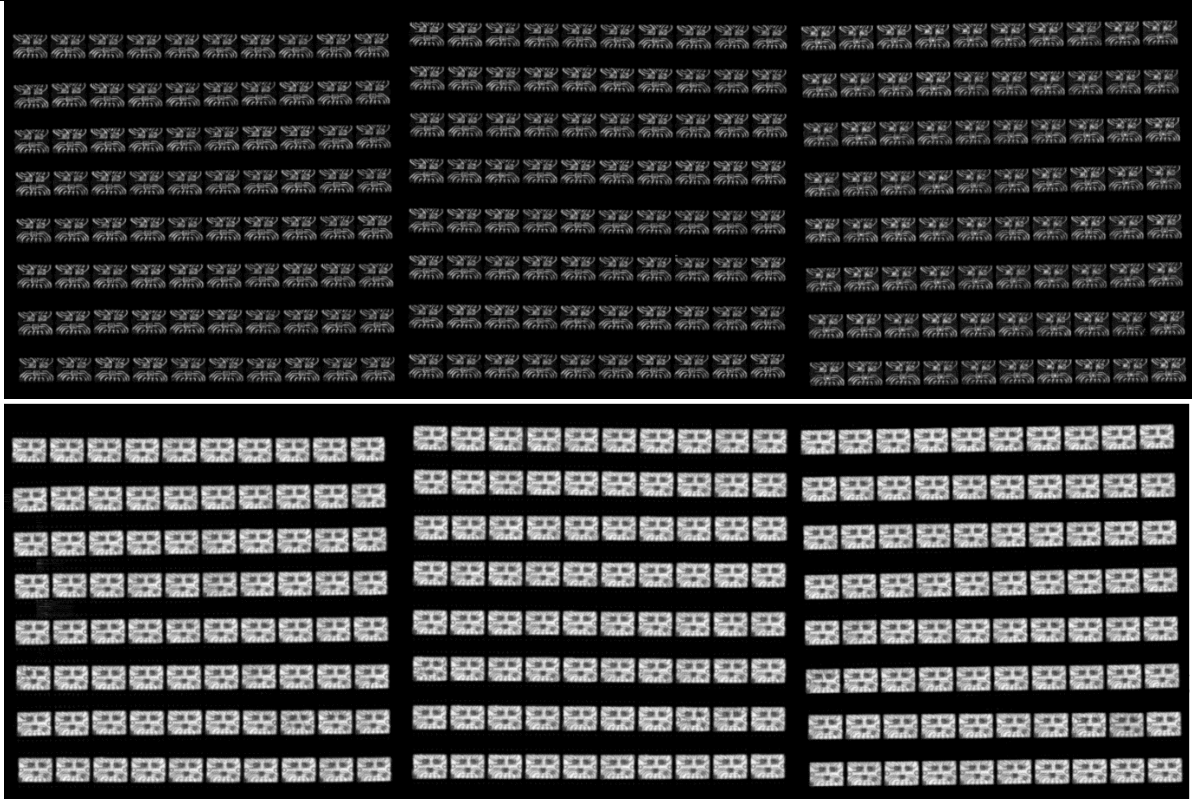
Revision	Change Log	Date
V1.0	Initial release	Jul. 2023
V1.1	1. Add SOIC16-NB package 2. MTBF&FIT update due to HTOL duration extension	Nov. 2023

Appendix 1: EMC Test Results

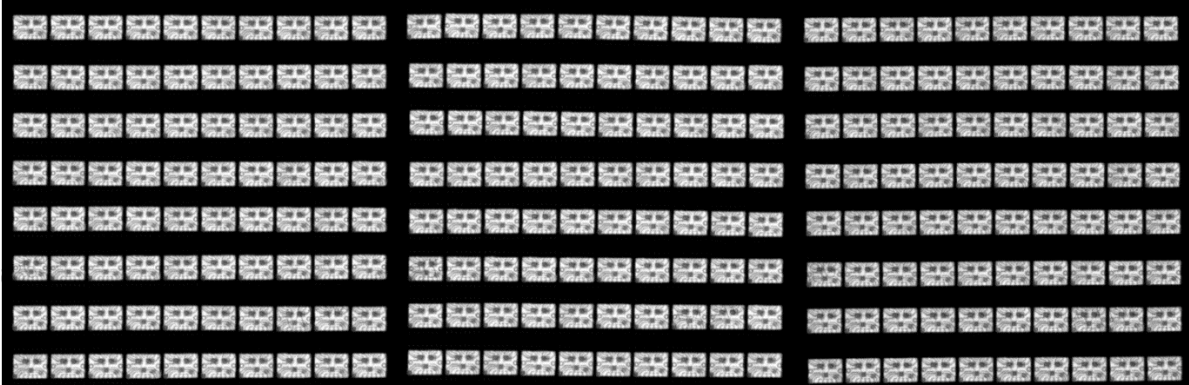


Appendix 2: SAT Test Results

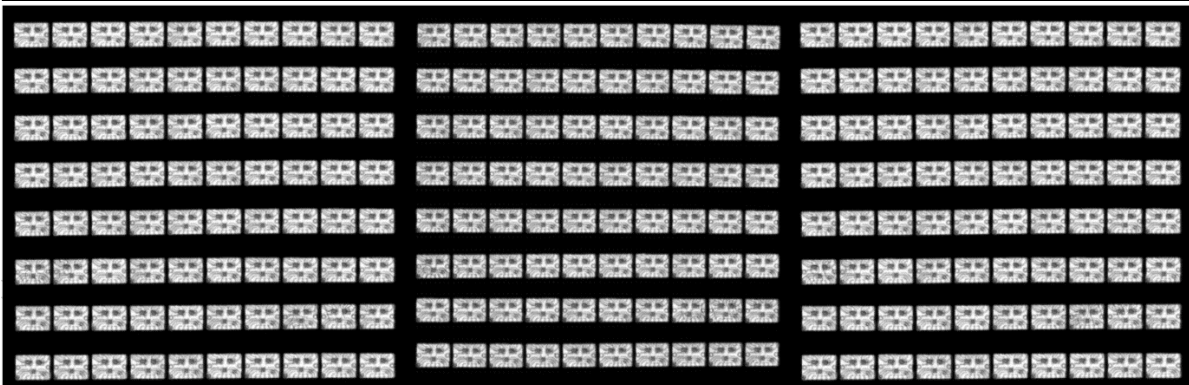
1. SOIC16-WB(W) Package

<p>Lot 1 pre-MSL</p>	
<p>Lot 1 post-MSL</p>	

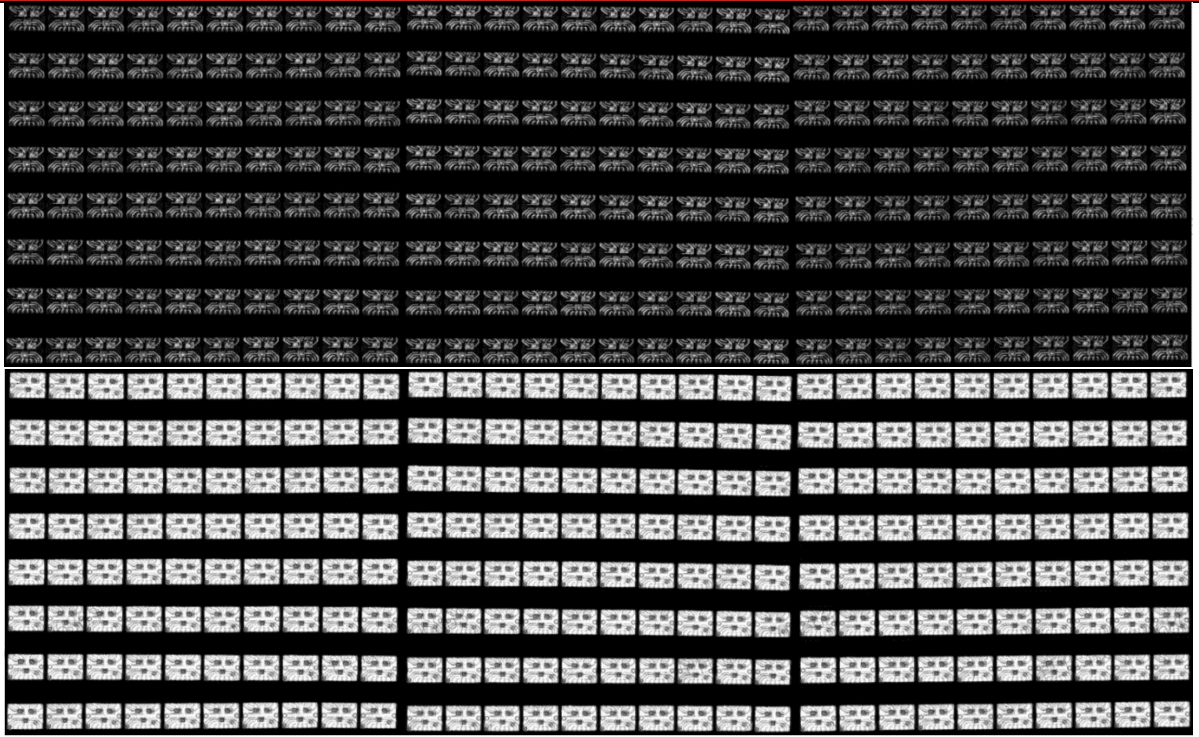
Lot 2
pre-MSL



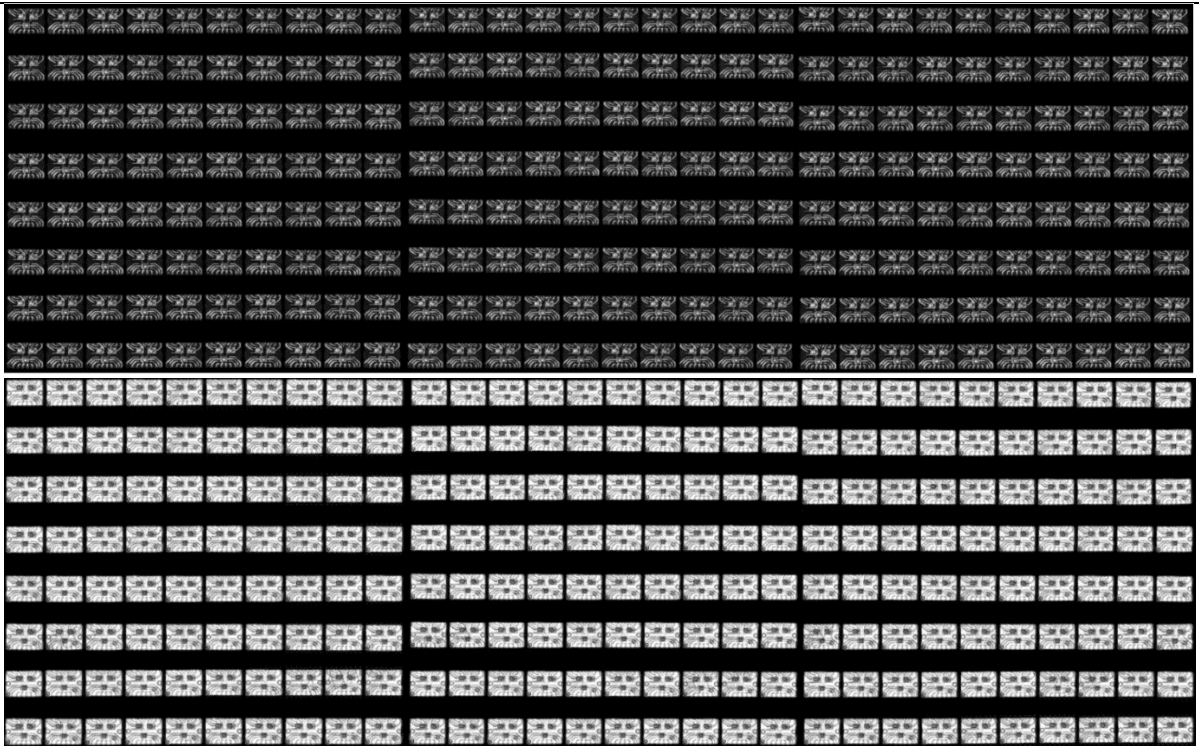
Lot 2
post-MSL



**Lot 3
pre-MSL**



**Lot 3
post-MSL**



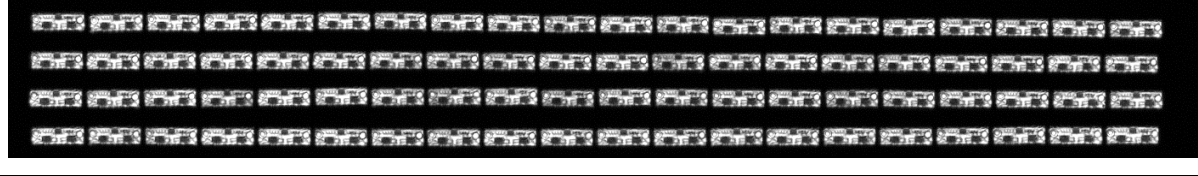


2. SOIC16-NB(N) Package

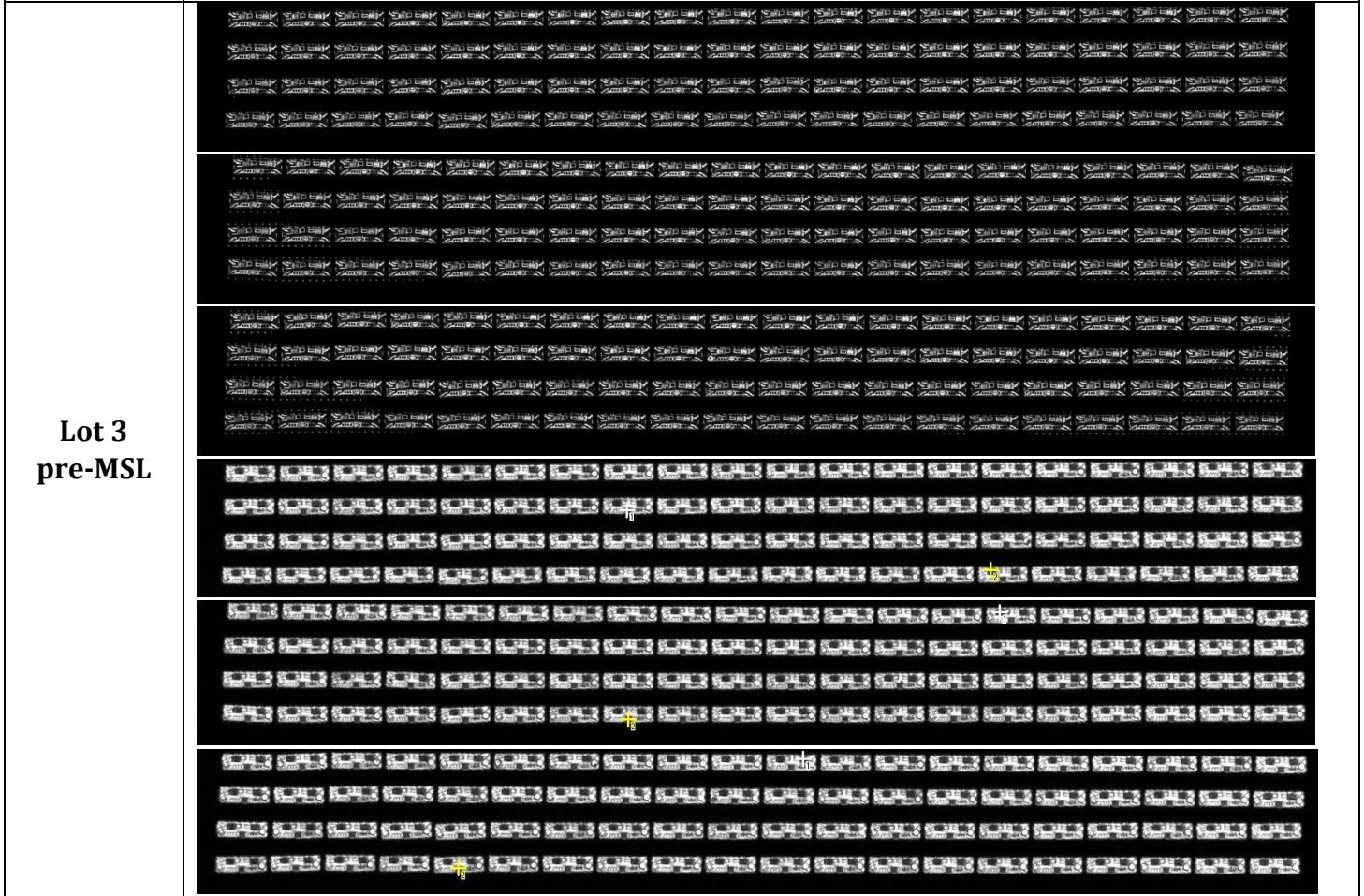
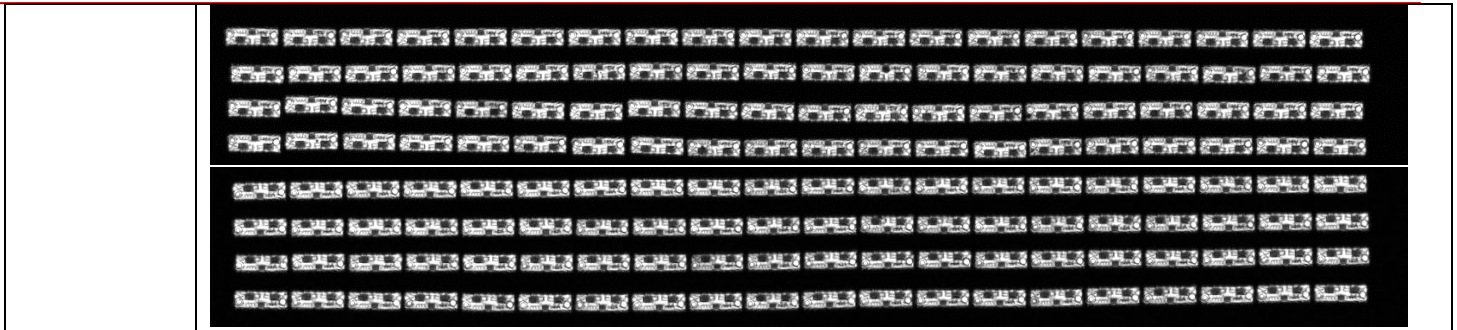
Lot 1
pre-MSL

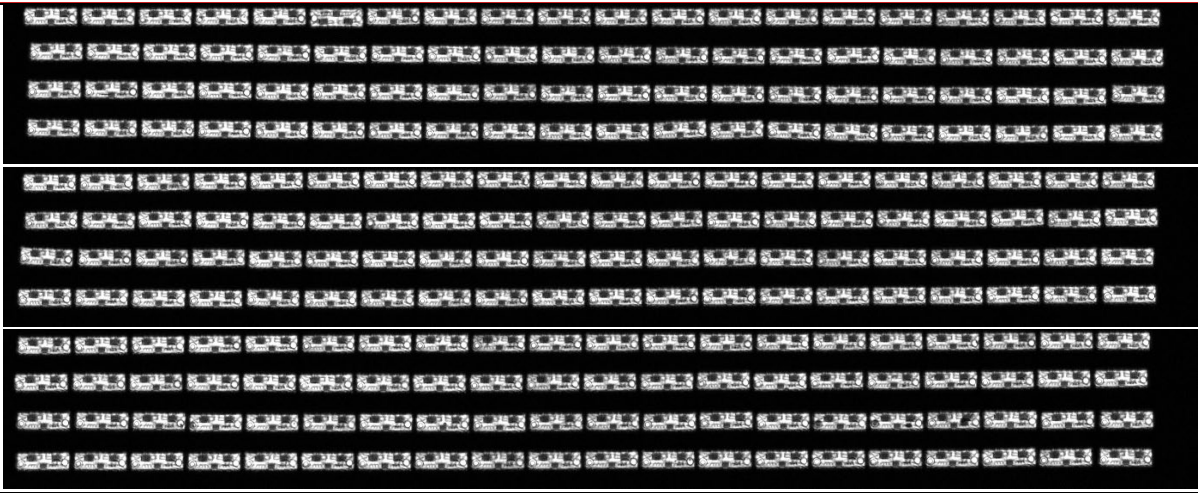


Lot 1
post-MSL



	
<p>Lot 2 pre-MSL</p>	
<p>Lot 2 post-MSL</p>	



	
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