MACRONIX
INTERNATIONAL CO., LTD.

Quality & Reliability Quarterly Report

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1. Quality/Reliability monitoring test items and conditions:

Test Item	Test Method	Test Conditions	Typical Sample Size (units)
QV (Quality Validation)	JESD86	Per datasheet, at high/room/cold temperatures	All samples
ELFR (Early Life Failure Rate)	JESD22-A108 and JESD74	125 °C, Vcc(max), 48 hrs	2000
NVCE (Non-Volatile Memory Cycling Endurance)	JESD47 JESD22-A117 AEC-Q100-005D (For Automotive Product)	Half samples at 25 °C, half samples at max operating Temperature, 1K/10K/100K Program/Erase cycles. For flash products only.	77 Automotive Product: Sum of sample size for HTDR, LTDR, and HTOL
LTDR (NVM Low Temperature Retention and Read Disturb)	JESD47 JESD22-A117 AEC-Q100-005D (For Automotive Product)	25 °C, Vcc(max), 168hrs/500hrs. For flash products only.	38
HTDR (High Temperature Data Retention)	JESD47 JESD22-A117 AEC-Q100-005D (For Automotive Product)	125 °C, 10hrs/100hrs or equivalent stress time per lifetime model. For flash products only.	39
HTOL (High Temperature Operating Life)	JESD22-A108 JESD85 AEC-Q100-005D (For Automotive Product)	125 °C, Vcc(max), 168hrs/500hrs/1000hrs (For Automotive Product with P/E cycle pre-conditioning)	77 Automotive Product:77
HTSL (High Temperature Storage Life)	JESD22-A103	150 °C, 168hrs/500hrs/1000hrs	77
PC (Pre-conditioning)	JESD22-A113	TCT(-65 °C to 150 °C) 10 cycles, IR reflow 3 cycles, HTSL 125 °C 24hrs, 30 °C/60%RH 192hrs (MSL 3)	All SMD samples before TCT, PCT, HAST
TCT (Temperature Cycle Test)	JESD22-A104	-65°C⟵⟶150°C (condition C), 200/500 cycles	77
PCT (Pressure Cooker Test)	JESD22-A102	121 °C, 100%RH, 2 atm, 96hrs	77
HAST (Highly Accelerated Temperature and Humidity Stress Test)	JESD22-A110	130°C, 85% RH, 33.3 psia, Vcc(max), 96hrs	77
ESD (Electro-Static Discharge)	JS-001-2012 (HBM) JS-002-2014 (CDM)	NTD: 1000V or till failure HBM: 500~2000V or till failure CDM : 750 or till failure Optional test in response to specific customer	3

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2. Flash Quarterly reliability monitor results:

2-1. Quality Validation & Early Life Failure Rate :

Tech.	EPN Code	QV		ELFR	
		SS	Reject	SS	Reject
0.15 µm	MX29F400C	4000	0	2000	0
0.13 µm	MX29LV160D	2000	0	2000	0
0.11 µm	MX25L12845E	4000	0	4000	0
	MX25L3206E	2000	0	2000	0
	MX25U1635E	2000	0	2000	0
	MX29GL256E	1800	0	*2	*2
	MX25L3206E	1200	0	*2	*2
75 nm	MX25L12835F	6000	0	4000	0
	MX25L12835F	4000	0	4000	0
	MX25R8035F	6000	0	4000	0
	MX25R8035F	6000	0	6000	0
	MX30LF1G08AA	2000	0	2000	0
	MX29GL128F	1800	0	*2	*2
55 nm	MX25L25645G	6000	0	4000	0
	MX25L25645G	1800	0	*2	*2
	MX25U51245G	600	0	*2	*2
36 nm	MX30LF1G18AC	4000	0	4000	0
	MX30LF4G18AC	1200	0	*2	*2

*2 : No ELFR test, the samples are only used for QV and NVCE test.

2-2. Non-Volatile Memory Cycling Endurance Test :

Tech.	EPN Code	NVCE@25°C		NVCE@85°C	
		SS	Reject	SS	Reject
0.15 µm	MX29F400C	154	0	77	0
0.13 µm	MX29LV160D	38	0	39	0
0.11 µm	MX25L12845E	76	0	78	0
	MX25L3206E	38	0	39	0
	MX25U1635E	38	0	39	0
75 nm	MX25L12835F	76	0	78	0
	MX25L12835F	76	0	78	0
	MX25R8035F	76	0	78	0
	MX25R8035F	114	0	117	0
	MX30LF1G08AA	38	0	39	0
55 nm	MX25L25645G	76	0	78	0
36 nm	MX30LF1G18AC	76	0	78	0

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2-3. Data Retention Test :

Tech.	EPN Code	LTDR@25°C 500hrs		HTDR@125°C 100hrs	
		SS	Reject	SS	Reject
0.13 µm	MX29LV160D	38	0	39	0
0.11 µm	MX25L12845E	38	0	39	0
	MX25L3206E	38	0	39	0
	MX25U1635E	38	0	39	0
75 nm	MX25L12835F	76	0	78	0
	MX25L12835F	38	0	39	0
	MX25R8035F	76	0	78	0
	MX25R8035F	38	0	117	0
	MX30LF1G08AA	38	0	39	0
55 nm	MX25L25645G	76	0	78	0
36 nm	MX30LF1G18AC	76	0	78	0

2-4. Non-Volatile Memory Program/ Erase Endurance, Data Retention and Operation Life Test (For Automotive Product)

a. High Temperature

Tech.	EPN Code	NVCE@105°C		HTDR@150°C 500hrs		HTOL@125°C 1000hrs	
		SS	Reject	SS	Reject	SS	Reject
0.11 µm	MX29GL256E	348	0	78	0	154	0
	MX25L3206E	232	0	39	0	77	0
75 nm	MX29GL128F	348	0	78	0	154	0
55 nm	MX25L25645G	232	0	39	0	77	0
	MX25U51245G	*1	*1	*1	*1	*1	*1

Tech.	EPN Code	NVCE@105°C		HTDR@150°C 100hrs		HTOL@125°C 1000hrs	
		SS	Reject	SS	Reject	SS	Reject
36 nm	MX30LF4G18AC	232	0	78	0	77	0

b. Low Temperature

Tech.	EPN Code	NVCE@25°C		LTDR@25°C 1000hrs	
		SS	Reject	SS	Reject
0.11 µm	MX29GL256E	114	0	76	0
	MX25L3206E	76	0	38	0
75 nm	MX29GL128F	114	0	76	0
55 nm	MX25L25645G	76	0	38	0
	MX25U51245G	*1	*1	*1	*1
36 nm	MX30LF4G18AC	76	0	76	0

*1: Means the test is "on going". The results will be updated next quarter.

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2-5. High Temperature Operating Life and High Temperature Storage Life Test:

Tech.	EPN Code	HTOL 1000hrs		HTSL 1000hrs	
		SS	Reject	SS	Reject
0.15 µm	MX29F400C	7	0	77	0
0.13 µm	MX29LV160D	77	0	77	0
0.11 µm	MX25L12845E	77	0	77	0
	MX25L3206E	77	0	77	0
	MX25U1635E	77	0	77	0
75 nm	MX25L12835F	154	0	154	0
	MX25L12835F	77	0	77	0
	MX25R8035F	77	0	154	0
	MX25R8035F	77	0	77	0
	MX30LF1G08AA	77	0	77	0
55 nm	MX25L25645G	154	0	154	0
36 nm	MX30LF1G18AC	154	0	154	0

2-6. Pre-Condition Test / Pressure Cooker Test / Temperature Cycling Test / Highly Accelerated Temperature and Humidity Stress Test:

Tech.	EPN Code	PC		TCT 500cycles		PCT 96hrs		HAST 96hrs	
		SS	Reject	SS	Reject	SS	Reject	SS	Reject
0.15 µm	MX29F400C	231	0	77	0	77	0	77	0
0.13 µm	MX29LV160D	231	0	77	0	77	0	77	0
0.11 µm	MX25L12845E	462	0	154	0	154	0	154	0
	MX25L3206E	231	0	77	0	77	0	77	0
	MX25U1635E	231	0	77	0	77	0	77	0
75 nm	MX25L12835F	462	0	154	0	154	0	154	0
	MX25L12835F	462	0	154	0	154	0	154	0
	MX25R8035F	462	0	154	0	154	0	154	0
	MX25R8035F	693	0	231	0	231	0	231	0
	MX30LF1G08AA	231	0	77	0	77	0	77	0
55 nm	MX25L25645G	693	0	154	0	231	0	231	0
36 nm	MX30LF1G18AC	462	0	154	0	154	0	154	0

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3. XtraROM Quarterly reliability monitor results:

3-1. Quality Validation & Early Life Failure Rate:

Tech.	EPN Code	QV		ELFR	
		SS	Reject	SS	Reject
65 nm	MX23J4GC0TC	770	0	770	0
45 nm	MX23J16GL0TC	2000	0	2000	0

3-2. High Temperature Operating Life and High Temperature Storage Life Test:

Tech.	EPN Code	HTOL 1000hrs		HTSL 1000hrs	
		SS	Reject	SS	Reject
65 nm	MX23J4GC0TC	77	0	77	0
45 nm	MX23J16GL0TC	77	0	77	0

3-3. Pre-Condition Test / Pressure Cooker Test / Temperature Cycling Test / Highly Accelerated Temperature and Humidity Stress Test:

Tech.	EPN Code	PC		TCT 500cycles		PCT 96hrs		HAST 96hrs	
		SS	Reject	SS	Reject	SS	Reject	SS	Reject
65 nm	MX23J4GC0TC	231	0	77	0	77	0	77	0
45 nm	MX23J16GL0TC	231	0	77	0	77	0	77	0

3-4. Electrostatic Discharge Sensitivity Test:

Tech.	EPN Code	Mode	Classification	SS	Reject
65 nm	MX23J4GC0TC	HBM	2.0 KV	6	0
			2.5 KV	6	0
			3.0 KV	6	0
		CDM	0.75 KV	6	0
		NTD	1.0 KV	24	0
45 nm	MX23J16GL0TC	HBM	2.0 KV	3	0
			2.5 KV	3	0
		CDM	0.75 KV	6	0
		NTD	1.0 KV	9	0

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