

PRELIMINARY QUALIFICATION INFORMATION for NEW FABRICATION FACILITIES for EPROM

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The Product Change Notice MPG/NV/6008 was issued recently to announce the transfer of EPROM production to a new wafer fabrication plant in Phoenix, USA. This is a very modern plant processing 8" wafers in technologies down to 0.35 micron.

The EPROM technology running in this plant uses two processes: E5-U35 which is an 0.8 micron process that has been upgraded by 35%, and the E6-DM which is a new 0.6 micron, double metal process. A test vehicle product was chosen for the qualification of each of these processes:

- The 8Mb M27C801 EPROM for the E5-U35 process

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- The 4Mb M27C4001 EPROM for the E6-DM process

The qualification has taken into account three aspects: the intrinsic fabrication facility quality, the characterisation and electrical stability of the products compared to the previous fabrication facility and the reliability tests performed on test lots.

INTRINSIC FABRICATION FACILITY QUALITY

A well accepted and formalised quality index to compare wafer fabrication plants is the "average defectivity per square centimeter per mask level". This defectivity is derived from the electrical wafer testing yields by applying simple statisatical models. The results for the D0 index show that up at the end of March 1997 the defectivity of the new Phoenix, USA fabrication facility was 10% better than the previously used facility in Agrate, Italy. This is an expected result for this more modern plant.

Fabrication Facility	Parameter	Previous Year 1996	Jan. 1997	Feb. 1997	Mar. 1997
Phoenix, USA.	D0 Total	0.025	0.027	0.032	0.030
8" wafers	D0 Top Ten Runners	0.025	0.027	0.032	0.030
Agrate, Italy. 6" wafers	Do Total	0.0331	0.043	0.0379	0.0327
6" wafers	D0 Top Ten Runers	0.0273	0.027	0.0262	0.0261

Table 1. Defectivity D0 (Defects/cm²/Mask level)

RELIABILITY

The process architecture of the products, the process controls, equipment, chemicals and photoresist were unchanged, leading to the expectation of excellent reliability results. In accordance with ST Standard Operating Procedures both test vehicles have been submitted to intensive reliability tests with the very positive result that no defects have currently been found.

The reliability tests and results are in Tables 2 to 5.

CHARACTERISTICS AND STABILITY OF ELECTRICAL PARAMETERS

Reflecting the overall stability of the products' design, a comparison of the main electrical characteristics of both test vehicles in the worst case conditions of supply voltage and/or temperature, does not show any significant variations from the previous fabrication facility.

The results are shown in Tables 6 to 9.

A complete Qualification Report will be published. For more information please contact your nearest SGS-THOMSON Sales Office.

QN111 - QUALITY NOTE

Sub-	Test Procedure	MIL-STD-883	Test Conditions	Results			Note
group		Procedure		Lots Samp. Lots Samp. 3 228 228 228 3 108 108 108 3 108 108 3 300 300 300 3 300 300 2 103	Fail		
1	Operating Life Test	1005	140°C, V _{CC} = 7V, – 168 hrs – 500 hrs – 1000 hrs – 2000 hrs	3	228 228	0 0 0 0	
2	Operating Life Test	1005	-40°C, V _{CC} = 7V, - 168 hrs - 500 hrs - 1000 hrs - 2000 hrs	3	108 108	0 0 0 0	
3	Retention Bake	1008	250°C, – 168 hrs – 500 hrs – 1000 hrs – 2000 hrs	3	300 300	0 0 0 0	
4	Temperature Cycling	1010	–65 to 140°C, – 100 cycles – 500 cycles – 1000 cycles	2	103 103 103	000	

Table 2. M27C4001 UV EPROM version, FDIP32W package, E6-DM Process, Phoenix USA

Table 3. M27C4001 OTP EPROM version, PLCC32 package, E6-DM Process, Phoenix USA

Sub-	Test Procedure	MIL-STD-883	Test Conditions		Results		Note
group	1001110004410	Procedure		Lots Samp. Fail 3 $\begin{array}{c} 170\\ 170\\ 170\\ 170\\ 170\end{array}$ 0 3 $\begin{array}{c} 185\\ 185\\ 185\\ 185\\ 185\\ 185\end{array}$ 0 4 3 $\begin{array}{c} 180\\ 180\\ 180\end{array}$ 0			
1	Operating Life Test	1005	140°C, V _{CC} = 7V, – 168 hrs – 500 hrs – 1000 hrs – 2000 hrs	3	170 170	0	
2	Retention Bake	1008	150°C, – 168 hrs – 500 hrs – 1000 hrs – 2000 hrs	3	185 185	0	
3	Temperature, Humidity, Bias	CECC 90,000	85°C, RH = 85%, V _{CC} = 5.5V, – 168 hrs – 500 hrs – 1000 hrs	3		-	
4	Temperature Cycling	1010	–65 to 150°C, – 100 cycles – 500 cycles	3	180 180	0 0	
5	Pressure Pot		121°C, 2 Atm, – 96 hrs – 168 hrs – 240 hrs	3	180 180 180	0 0 0	

Sub-	Test Procedure	MIL-STD-883	Test Conditions	Results		esults	
group		Procedure		$\begin{tabular}{ c c c c } \hline $$ Results$ \\ \hline $$ Lots$ $$ Samp. $$ Fail $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$$	Note		
1	Operating Life Test	1005	140°C, V _{CC} = 7V, – 168 hrs – 500 hrs – 1000 hrs – 2000 hrs	5	420 420	0 0	
2	Operating Life Test	1005	-40°C, V _{CC} = 7V, - 168 hrs - 500 hrs - 1000 hrs - 2000 hrs	2	57 57	0 0	
3	Retention Bake	1008	250°C, – 168 hrs – 500 hrs – 1000 hrs – 2000 hrs	6	508	0	

Table 4.	M27C801 l	UV EPROM version	, FDIP32W package	e. E5-U35 Process	. Phoenix USA

Table 5. M27C801 OTP EPROM version, PLCC32 package, E5-U35 Process, Phoenix USAFormal Product Qualification on-going on further lots

Sub-	Test Procedure	MIL-STD-883	Test Conditions	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Note	
group		Procedure			Samp.	Fail	
1	Operating Life Test	1005	140°C, V _{CC} = 7V, – 168 hrs – 500 hrs – 1000 hrs	1	70	0 0 0	
2	Retention Bake	1008	150°C, – 168 hrs – 500 hrs – 1000 hrs	1	70	0 0 0	
3	Temperature, Humidity, Bias	CECC 90,000	85°C, RH = 85%, V _{CC} = 5.5V, – 168 hrs – 500 hrs – 1000 hrs	1	60	0 0 0	
4	Temperature Cycling	1010	–65 to 150°C, – 100 cycles – 500 cycles – 1000 cycles	1	60		
5	Pressure Pot		121°C, 2 Atm, – 96 hrs – 168 hrs – 240 hrs – 336 hrs	1		-	



Symbol	Parameter	Test Condition	Measurement	Fabricatio	on Facility	Data	Unit
Symbol	Farameter	Test Condition	Measurement	Agrate, Italy	Phoenix, USA	Sheet	Unit
			Min	13	10		
I _{CC2}	Supply Current	\overline{E} > V _{CC} – 0.2V, V _{CC} = 5.5V,	Avg	13	11		μA
.002	(Standby) CMOS	$T_A = 0^{\circ}C$	Max	14	12	100	<i>p</i>
			Std Deviation	0	0.4		
		=	Min	0.31	0.28		
Icc1	Supply Current	$\overline{E} = V_{IH},$ $V_{CC} = 5.5V,$	Avg	0.32	0.28		mA
	(Standby) TTL	$T_A = 0^{\circ}C$	Max	0.33	0.28	1	
			Std Deviation	0	0		
		$\overline{E} = V_{IL}, \overline{G} = V_{IL},$	Min	10.3	9.1		
Icc	Supply Current	$I_{OUT} = 0mA$,	Avg	10.5	9.2		mA
	Supply Surrent	$V_{CC} = 5.5V,$ $T_A = 0^{\circ}C,$ Static	Max	10.9	9.4	_	
		$T_A = 0$ 0, 0 and	Std Deviation	0.2	0.1		
		$\overline{E} = V_{IL}, \overline{G} = V_{IL},$	Min	13.0	11.8		
		$I_{OUT} = 0mA$,	Avg	13.2	12.0		_
Icc	Supply Current	V _{CC} = 5.5V, T _A = 0°C,	Max	13.4	12.2	30	mA
		f = 5MHz	Std Deviation	0.1	0.14		
			Min	-0.50	-3.00		
	Program Current	$V_{PP} = V_{CC} =$	Avg	-0.20	-1.06		μA 10
IPP	I _{PP} Program Current	5.5V, T _A = 0°C	Max	0.20	0.40	10	
			Std Deviation	0.20	0.91	10	
			Min	1.20	1.22		
., .	Input Low Voltage	but Low Voltage $V_{CC} = 4.5V,$ $T_A = 70^{\circ}C$	Avg	1.22	1.24		V
VIL			Max	1.24	1.26	0.8	
			Std Deviation	0.01	0.01	0.0	
			Min	1.50	1.52	2	
N/	land the line \alterna	V _{CC} = 5.5V,	Avg	1.53	1.55		
Vih	Input High Voltage	$T_A = 0^{\circ}C$	Max	1.54	1.56		V
			Std Deviation	0.01	0.01		
			Min	4.30	4.24	2.4	
	Output High	$I_{OH} = -400 \mu A$,	Avg	4.30	4.25	2.1	
Vон	Voltage TTL	V _{CC} = 4.5V, T _A = 70°C	Max	4.30	4.25		V
			Std Deviation	0	0.01		
			Min	0.16	0.14		
V	Output Low	$I_{OL} = 2.1 \text{mA},$	Avg	0.16	0.15		v
V _{OL}	Voltage	V _{CC} = 4.5V, T _A = 70°C	Max	0.16	0.15	0.4	v
			Std Deviation	0	0	011	
			Min	2.80	2.55	4.5	
V _{CC}	Committee Vielteene	$T_A = 0^{\circ}C$,	Avg	2.90	2.72		
(min)	Supply Voltage	function	Max	3.60	2.95		V
			Std Deviation	0.2	0.11		
			Min	7.50	7.50		
Vcc	Supply Valters	T _A = 70°C,	Avg	7.50	7.50		
(max)	Supply Voltage	function	Max	7.50	7.50	5.5	V
			Std Deviation	0	0	0.0	1

Table 6. M27C4001 E6-DM Process, Phoenix USA - Read Mode DC Characteristics

Sym-	Alt	Parameter	Test Condition	Measurement	Fabricatio	on Facility	Data	Unit
bol		Farameter	Test condition	Weasurement	Agrate, Italy	Phoenix, USA	Sheet	Onic
			$\overline{E} = V_{IL}$,	Min	48	50		
t _{AVQV}	t _{ACC} Address Valid to Output Valid		$\frac{\underline{\mathbf{G}}}{\mathbf{G}} = V_{\mathrm{IL}},$ $V_{\mathrm{CC}} = 5.5 \mathrm{V},$	Avg	48	51		ns
			$T_A = 0^{\circ}C$	Max	50	53	70	
				Std Deviation	1	1		
			Ē = Vıı.	Min	55	58		
t _{AVQV}	t _{ACC}	Address Valid to Output Valid	$\frac{\overline{E}}{G} = V_{IL},$ $G = V_{IL},$ $V_{CC} = 4.5V,$	Avg	57	61		ns
			$T_A = 70^{\circ}C$	Max	60	65	70	
				Std Deviation	2	2		
				Min	48	48		
t _{ELQV}	Chip Enable t _{CE} Low to Output	ow to Output $V_{CC} = 5.5V$,	Avg	49	49		ns	
		Valid	$T_A = 0^{\circ}C$	Max	50	50	70	
				Std Deviation	1	1		
			_	Min	55	58		
t _{ELQV}	t _{CE}	Chip Enable Low to Output	$\overline{G} = V_{IL},$ $V_{CC} = 4.5V,$	Avg	58	60		ns
		Valid	$T_A = 70^{\circ}C$	Max	60	63	70	
				Std Deviation	1	2		
			=	Min	25	23		
t _{GLQV}	t _{OE}	Output Enable Low to Output	$\overline{E} = V_{IL},$ $V_{CC} = 5.5V,$	Avg	25	23		ns
		Valid	$T_A = 0^{\circ}C$	Max	25	23	35	
				Std Deviation	0	0		
			=	Min	28	25		
t _{GLQV}	toE	Output Enable Low to Output	$\overline{E} = V_{IL}, \\ V_{CC} = 4.5V,$	Avg	28	28		ns
		Valid	$T_A = 70^{\circ}C$	Max	28	33	35	
				Std Deviation	0	2		

Table 7. M27C4001 E6-DM Process, Phoenix USA - Read Mode AC Characteristics

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Symbol	Parameter	Test Condition	Measurement	Fabricatio	on Facility	Data	Unit
Symbol	Farameter	Test Condition	Measurement	Agrate, Italy	Phoenix, USA	Sheet	Unit
			Min	10	10		
I _{CC2}	Supply Current	$\overline{E} > V_{CC} - 0.2V,$ $V_{CC} = 5.5V,$	Avg	13	13		μA
.002	(Standby) CMOS	$T_A = 0^{\circ}C$	Max	18	16	100	μ.,
			Std Deviation	2	2		
		=	Min	0.33	0.32		
Icc1	Supply Current	$\overline{E} = V_{IH},$ $V_{CC} = 5.5V,$	Avg	0.32	0.31		mA
	(Standby) TTL	$T_A = 0^{\circ}C$	Max	0.33	0.31	1	
			Std Deviation	0	0		
	Ē=	$\overline{E} = V_{IL}, \overline{G} = V_{IL},$	Min	9.1	8.6		
Icc	Supply Current	$I_{OUT} = 0mA$,	Avg	9.2	8.9		mA
icc	Supply Surrent	$V_{CC} = 5.5V$, $T_A = 0^{\circ}C$, Static	Max	9.4	9.1	_	
		$T_A = 0.0$, Otatio	Std Deviation	0.1	0.13		
		$\overline{E} = V_{IL}, \overline{G} = V_{IL},$	Min	14.4	14.0		
	Cummbe Course of	$I_{OUT} = 0mA$,	Avg	14.6	14.2		
Icc	Supply Current	V _{CC} = 5.5V, T _A = 0°C,	Max	14.8	14.5	30	mA
		f = 5MHz	Std Deviation	0.1	0.1		1
			Min	0.00	0.00		
		$V_{PP} = V_{CC} =$	Avg	0.00	0.00		μΑ
IPP	I _{PP} Program Current	5.5V, T _A = 0°C	Max	0.00	0.00	10	
			Std Deviation	0.00	0.00	10	-
			Min	1.10	1.10		
		t Low Voltage $V_{CC} = 4.5V,$ $T_A = 70^{\circ}C$	Avg	1.10	1.10		-
VIL	Input Low Voltage		Max	1.10	1.12	0.8	V
			Std Deviation	0.01	0.01	0.0	
			Min	1.58	1.58	2	
		V _{CC} = 5.5V,	Avg	1.59	1.60	2	
Vih	Input High Voltage	put High Voltage $T_A = 0^{\circ}C$	Max	1.60	1.62		V
			Std Deviation	0.01	0.02		
			Min	4.06	4.04	2.4	
	Output High	$I_{OH} = -400 \mu A,$		4.06	4.04	2.4	
Vон	Voltage TTL	V _{CC} = 4.5V, T _A = 70°C	Avg Max	4.06	4.05		V
			Std Deviation	0	0.01		
			Min	0.10	0.10		
.,	Output Low	$I_{OL} = 2.1 mA$,	Avg	0.10	0.10		.,
V _{OL}	Voltage	V _{CC} = 4.5V, T _A = 70°C	Max	0.11	0.11	0.4	V
		14 - 70 0	Std Deviation	0.11	0.11	0.4	
						4.5	
V _{CC}		$T_A = 0^{\circ}C$,	Min	2.50	2.90	4.0	
(min)	Supply Voltage	function	Avg Max	2.60	2.75 2.65		V
			Max Std Doviation	2.75			
			Std Deviation	0.08	0.08		
Vcc		T _A = 70°C,	Min	7.50	7.50		
(max)	Supply Voltage	function	Avg	7.50	7.50	FF	V
(max)			Max	7.50	7.50	5.5	4

Table 8. M27C801 E5-U35 Process, Phoenix USA - Read Mode DC Characteristics

Sym-	Alt	Parameter	Test Condition	Measurement	Fabricatio	on Facility	Data	Unit	
bol	~"	Farameter	Test Condition	weasurement	Agrate, Italy	Phoenix, USA	Sheet	Onit	
			$\overline{\underline{E}} = V_{IL},$	Min	68	65			
t _{AVQV}	VQV t _{ACC} Address Valid to Output Valid			$\frac{L}{G} = V_{IL},$ $V_{CC} = 5.5V,$	Avg	68	67		ns
			$T_A = 0^{\circ}C$	Max	70	70	90		
				Std Deviation	1	1			
			$\overline{F} = V_{H}$	Min	83	83			
t _{AVQV}	t _{ACC}	Address Valid to Output Valid	$\frac{\overline{E}}{G} = V_{IL},$ $G = V_{IL},$ $V_{CC} = 4.5V,$	Avg	84	86		ns	
			$T_A = 70^{\circ}C$	Max	85	90	90		
				Std Deviation	1	2			
			=	Min	68	65			
t _{ELQV}	Chip Enable		$\overline{G} = V_{IL},$ $V_{CC} = 5.5V,$	Avg	68	67		ns	
		Valid	$T_A = 0^{\circ}C$	Max	70	70	90		
				Std Deviation	1	1			
				Min	83	83			
t _{ELQV}	t _{CE}	Chip Enable Low to Output	$\overline{G} = V_{IL},$ $V_{CC} = 4.5V,$	Avg	84	86		ns	
		Valid	$T_A = 70^{\circ}C$	Max	85	90	90		
				Std Deviation	1	2			
			=	Min	25	25			
t _{GLQV}	t _{OE}	Output Enable Low to Output	$\overline{E} = V_{IL},$ $V_{CC} = 5.5V,$	Avg	25	25		ns	
		Valid	$T_A = 0^{\circ}C$	Max	25	25	45		
				Std Deviation	0	0			
			=	Min	33	33			
t _{GLQV}	toE	Output Enable Low to Output	$\overline{E} = V_{IL}, \\ V_{CC} = 4.5V,$	Avg	33	33		ns	
		Valid	$T_A = 70^{\circ}C$	Max	33	35	45		
				Std Deviation	0	1			

Table 9. M27C801 E6-DM Process, Phoenix USA - Read Mode AC Characteristics

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