

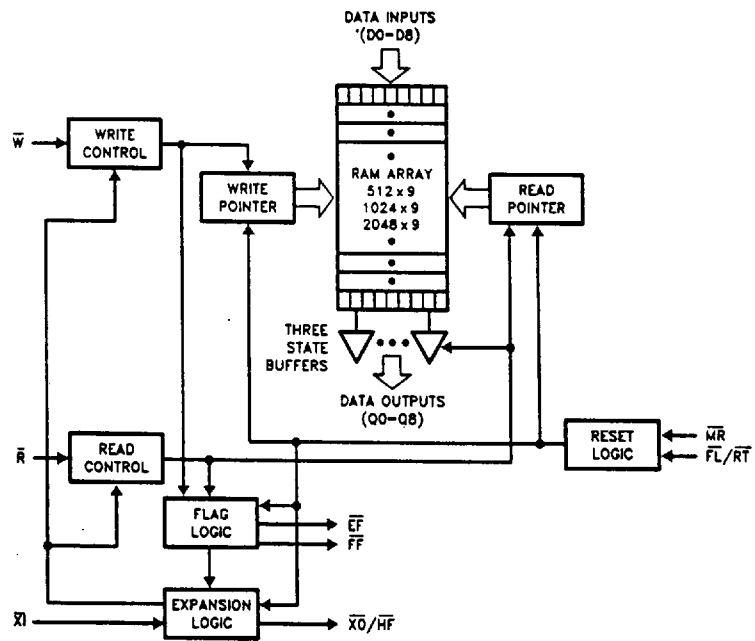
# 2048 x 9-Bit FIFO - Radiation Hardened 7203ERP

CMOS epi Parallel  
Cascadeable FIFO

*For Space  
Applications*

SEI's 7203ERP (RP for RAD-PAK®) high speed FIFO microcircuit features a minimum 100 kilorad (Si) total dose tolerance. Using SEI's radiation hardened RAD-PAK® packaging technology, the 7203ERP is fully

equivalent to the commercial 7203 (IDT) and the CY7C429 (Cypress Semiconductor). It is organized such that the data is read in the same sequential order that it was written. Full and Empty flags are provided to prevent over-run and under-run. Three additional pins are also provided to facilitate unlimited expansion in width, depth, or both. The depth expansion technique steers the control signals from one device to another in parallel, thus eliminating the serial addition of propagation delays so that throughput is not reduced. Data is steered in a similar manner. Capable of surviving space environments, the 7203ERP is ideal for satellite, spacecraft, and space probe missions. The RAD-PAK® technology incorporates radiation shielding in the microcircuit package. It eliminates box shielding while providing lifetime in orbit. It has a 100 krad (Si) total dose survivability, mitigation of dose enhancement, and a high-rel die attachment. The 7203ERP features the same system performance and architecture as the commercial counterparts and is manufactured on an epitaxial substrate to enhance single event latchup performance. It is available in Class S packaging and screening.

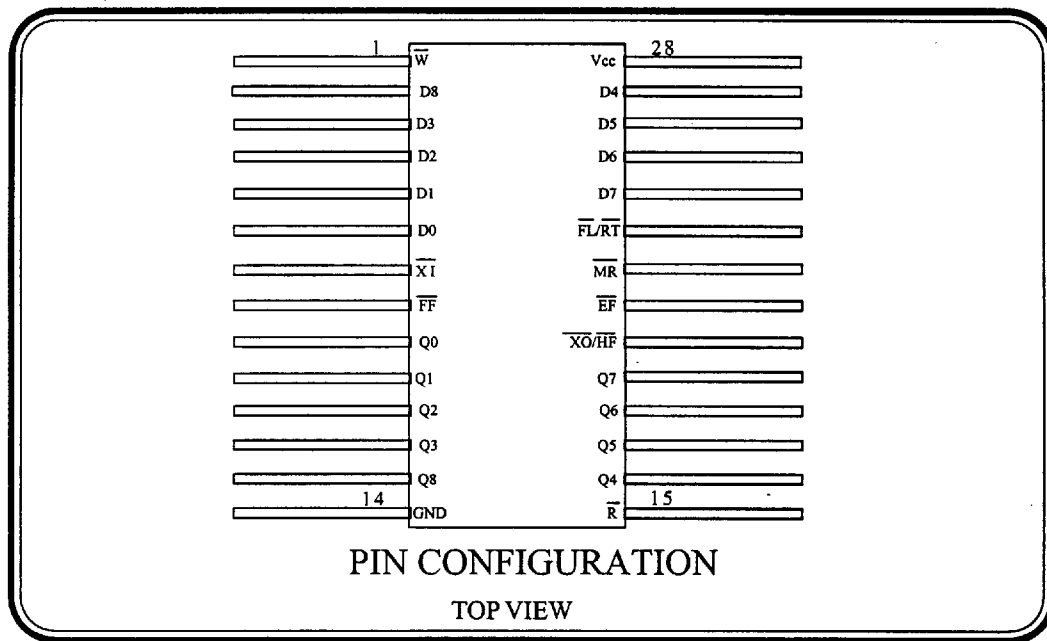


SPACE  
ELECTRONICS  
INCORPORATED

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# Radiation Hardened 7203ERP

CMOS 28 Pin  
Cascadeable FIFO



## Features

- 2048 x 9-bit Organization
- Pin Compatible with IDT7203/ CY7C429
- RAD-PAK® Radiation Hardened  
Against Natural Space Radiation
- Epitaxial substrate for improved SEL performance (40 MeV/mg cm<sup>2</sup>)
- Total Dose Hardness >100 krad (Si)
- Package:
  - 28 Pin RAD-PAK® flat pack (410 mils x 720 mils)
  - Weight – 5.2 grams
  - 28 Pin RAD-PAK® DIP (410 mils x 720 mils)
  - Weight-5.2 grams
- Fast Propagation Time (Max access time):
  - 30 ns : 7203ERPx-30
  - 25 ns : 7203ERPx-25
  - 20 ns : 7203ERPx-20
- Asynchronous read/ write
- High Speed CMOS epi Technology
  - Half full flag in standalone
  - Empty and full flags
  - Three state outputs, TTL compatible
  - High speed 33.3 MHz read/ write independent of depth/ width
  - Retransmit in standalone
  - Low operating power, Icc (max) = 147 mA
- Screening per TM 5004
- QCI per TM5005

Specifications and design are subject to change without notice.



Aug. 1994

For Further Information Contact:

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**7203ERP ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	MIN	MAX	UNITS
Positive Supply Voltage	$V_{CC}$	-0.5	7.0	V
DC Voltage to Outputs (During High-z State)		-0.5	7.0	V
Output Current into Outputs (Low)			20	mA
DC Input Voltage	$V_{IN}$	-0.5	7.0	V
Power Dissipation	$P_d$		1000	mW
Storage Temperature Range	$T_s$	-65	+150	°C
Operating Temperature Range	$T_A$	-55	+125	°C

**7203ERP RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	MIN	MAX	UNITS
Positive Supply Voltage	$V_{dd}$	4.5	5.5	V
High Level Input Voltage	$V_{IH}$	2.2		V
Low Level Input Voltage	$V_{IL}$		0.8	V
Case Operating Temperature Range	$T_C$	-55	+125	°C



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7203ERP DC ELECTRICAL CHARACTERISTICS<sup>1</sup>

PARAMETER	SYMBOL	MIN	MAX	UNITS
Input Low Voltage	$V_{IL}$		0.8	V
Input High Voltage	$V_{IH}$	2.2		V
Output Low Voltage $V_{CC} = 4.5\text{ V}$ , $V_{IN} = V_{IL}/V_{IH}$ , $I_{OL} = 8\text{ mA}$	$V_{OL}$		0.4	V
Output High Voltage $V_{CC} = 4.5\text{ V}$ , $V_{IN} = V_{IL}/V_{IH}$ , $I_{OL} = -2\text{ mA}$	$V_{OH}$	2.4		V
Input Low Current, $V_{IN} = 0\text{ V}$ , $V_{CC} = \text{Max}$	$I_{IL}$	-10	10	$\mu\text{A}$
Input High Current, $V_{IN} = 5.5\text{ V}$ , $V_{CC} = \text{Max}$	$I_{IH}$	-10	10	$\mu\text{A}$
Output Leakage Current, $V_{IN} = 5.5\text{ V}/0\text{ V}$ , $V_{CC} = \text{Max}$	$I_{OZ}$	-10	10	$\mu\text{A}$
Active Power Supply Current <sup>2</sup>	$I_{CC1}$		147	mA
Standby Supply Current <sup>2</sup> , ( $R = W = RS = FLVRT = V_{IH}$ )	$I_{CC2}$		12	mA
Power Down Current <sup>2</sup> , All Input = $V_{CC} - 0.2\text{ V}$	$I_{CC3}$		2	mA
Input Capacitance <sup>3</sup>	$C_{IN}$		11	pF
Output Capacitance <sup>3</sup>	$C_{OUT}$		15	pF

Notes:

1.  $V_{CC} = 5 + 5\%$  volts;  $T_A = -55$  to  $+125\text{ }^\circ\text{C}$ .
2. All measurements are made with outputs open (only capacitive loading).
3. Guaranteed by design,  $f = 1\text{ MHz}$ .



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**7203ERP TIMING CHARACTERISTICS<sup>1</sup>**

PARAMETER	SYMBOL	MIN	MAX	UNIT
Shift Frequency 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$f_s$		25 28.5 33.3	ns
Read Cycle Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RC}$	40 35 30		ns
Data Access Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_A$		30 25 20	ns
Read Recovery Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RR}$	10 10 10		ns
Read Pulse Width <sup>2</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RPW}$	30 25 20		ns
Read LOW to Data Bus LOW <sup>3</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RLZ}$	5 5 5		ns
Write HIGH to Data Bus Low-Z <sup>3,4</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{WLZ}$	5 5 5		ns
Data Valid from Read HIGH 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{DV}$	5 5 5		ns
Read HIGH to Data Bus High-Z <sup>3</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RHZ}$		20 18 15	ns



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7203ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Write Cycle Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{wc}$	40 35 30		ns
Write Pulse Width <sup>2</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{wpw}$	30 25 20		ns
Write Recovery Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{wr}$	10 10 10		ns
Data Set-up Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{ds}$	18 15 12		ns
Data Hold Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{dh}$	0 0 0		ns
Reset Cycle Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{rsc}$	40 35 30		ns
Reset Pulse Width <sup>2</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{rs}$	30 25 20		ns
Reset Set-up Time <sup>3</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{rss}$	30 25 20		ns
Reset Recovery Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{rsr}$	10 10 10		ns



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7203ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Retransmit Cycle Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RTC}$	40 35 30		ns
Retransmit Pulse Width <sup>2</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RT}$	30 25 20		ns
Retransmit Set-up Time <sup>3</sup> 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RTS}$	30 25 20		ns
Retransmit Recovery Time 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RSR}$	10 10 10		ns
Reset to EF\ LOW 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{EFL}$		40 35 30	ns
Reset to HF\ and FF\ HIGH 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{HFH}^{\dagger} t_{FFH}$		40 35 20	ns
Retransmit LOW to Flags Valid 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RTF}$		40 35 20	ns
Read LOW to EF\ LOW 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{REF}$		30 25 20	ns
Read HIGH to FF\ HIGH 7203ERP <sub>x</sub> -30 7203ERP <sub>x</sub> -25 7203ERP <sub>x</sub> -20	$t_{RFF}$		30 25 20	ns



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7203ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Read Pulse Width after EF\ HIGH 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{RPE}$	30 25 20		ns
Write HIGH to EF\ HIGH 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{WEF}$		30 25 20	ns
Write LOW to FF\ LOW 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{WFF}$		30 25 20	ns
Write LOW to HF\ Flag LOW 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{WHF}$		40 35 30	ns
Read HIGH to HF\ Flag HIGH 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{RHF}$		40 35 30	ns
Write Pulse Width after FF\ HIGH 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{WPF}$	30 25 20		ns
Read/Write LOW to XO\ LOW 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{XOL}$		30 25 20	ns
Read/Write HIGH to XO\ HIGH 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{XOH}$		30 25 20	ns
XI\ Pulse Width <sup>2</sup> 7203ERPx-30 7203ERPx-25 7203ERPx-20	$t_{XI}$	30 25 20		ns



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**7203ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)**

PARAMETER	SYMBOL	MIN	MAX	UNIT
XI\ Recovery Time	$t_{XIR}$			ns
7203ERP <sub>x</sub> -30		10		
7203ERP <sub>x</sub> -25		10		
7203ERP <sub>x</sub> -20		10		
XI\ Set-up Time	$t_{XIS}$			ns
7203ERP <sub>x</sub> -30		10		
7203ERP <sub>x</sub> -25		10		
7203ERP <sub>x</sub> -20		10		

Notes:

1. AC tests are performed with input rise and fall times of 5 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0V and the output load circuit, unless otherwise specified.
2. Pulse widths less than minimum are not allowed.
3. Guaranteed by design, not tested.
4. Only applies to read data flow-through mode.

**7203ERP Package Ordering Guide**

Package Style	Case Outline	1/	Description
D	D-28		28 Pin Dual In Line Package
F	F-28		28 Pin Flat Package

Note:

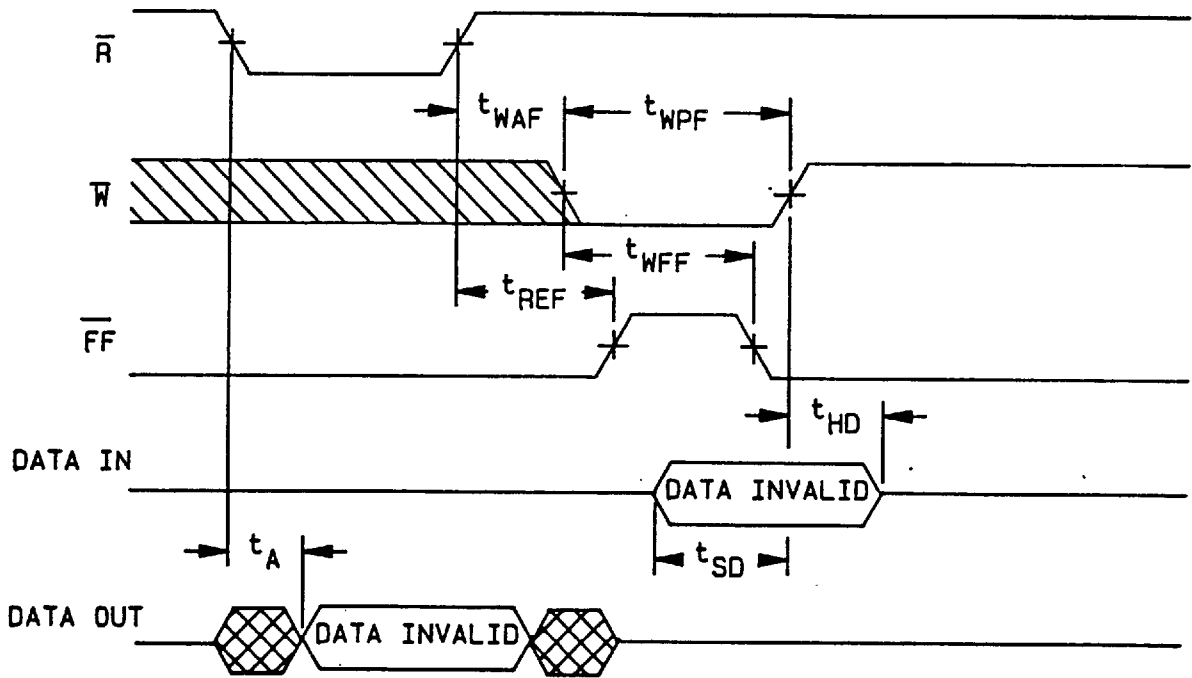
- 1/ For outline information, see Appendix A (Package Information - Outline Dimension)



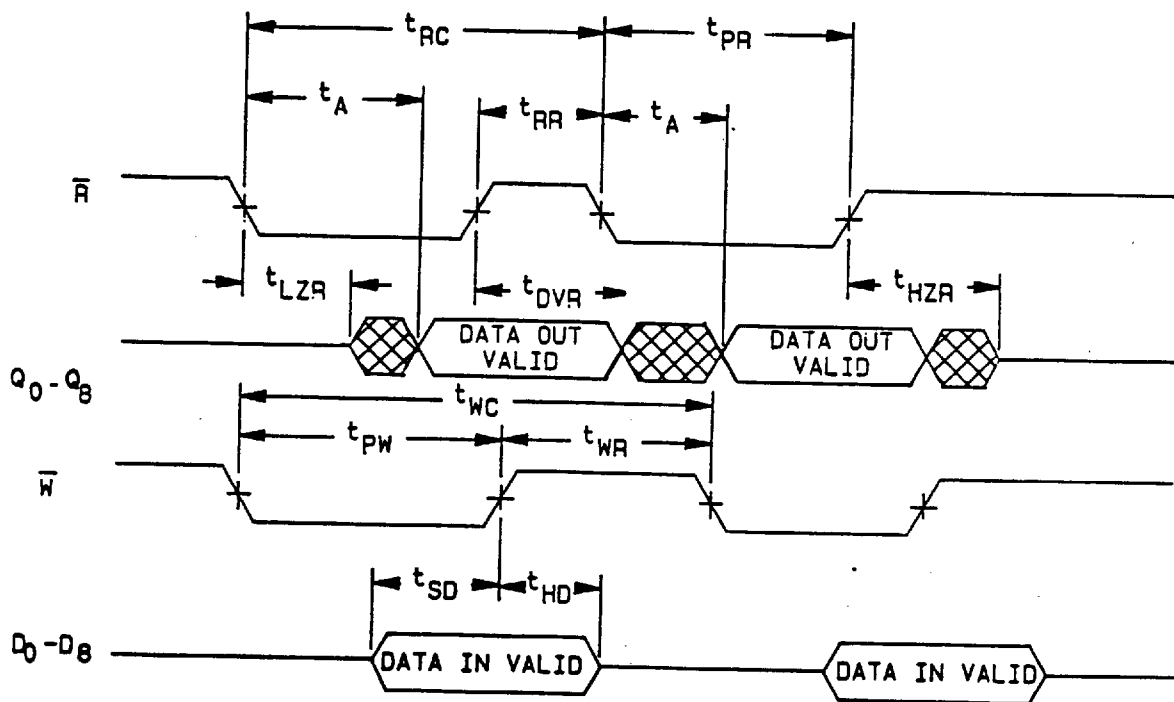
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### Full Flag and Write Bubble - through Mode Timing Diagram



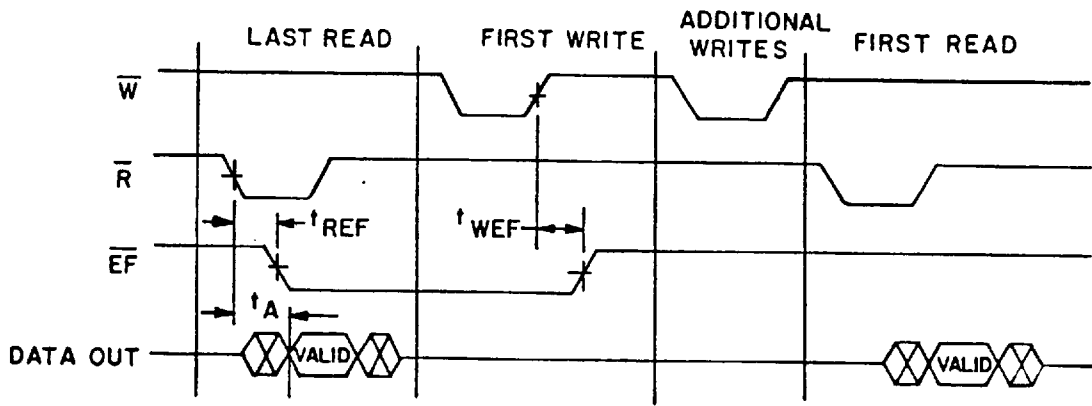
### Asynchronous Read and Write Timing Diagram



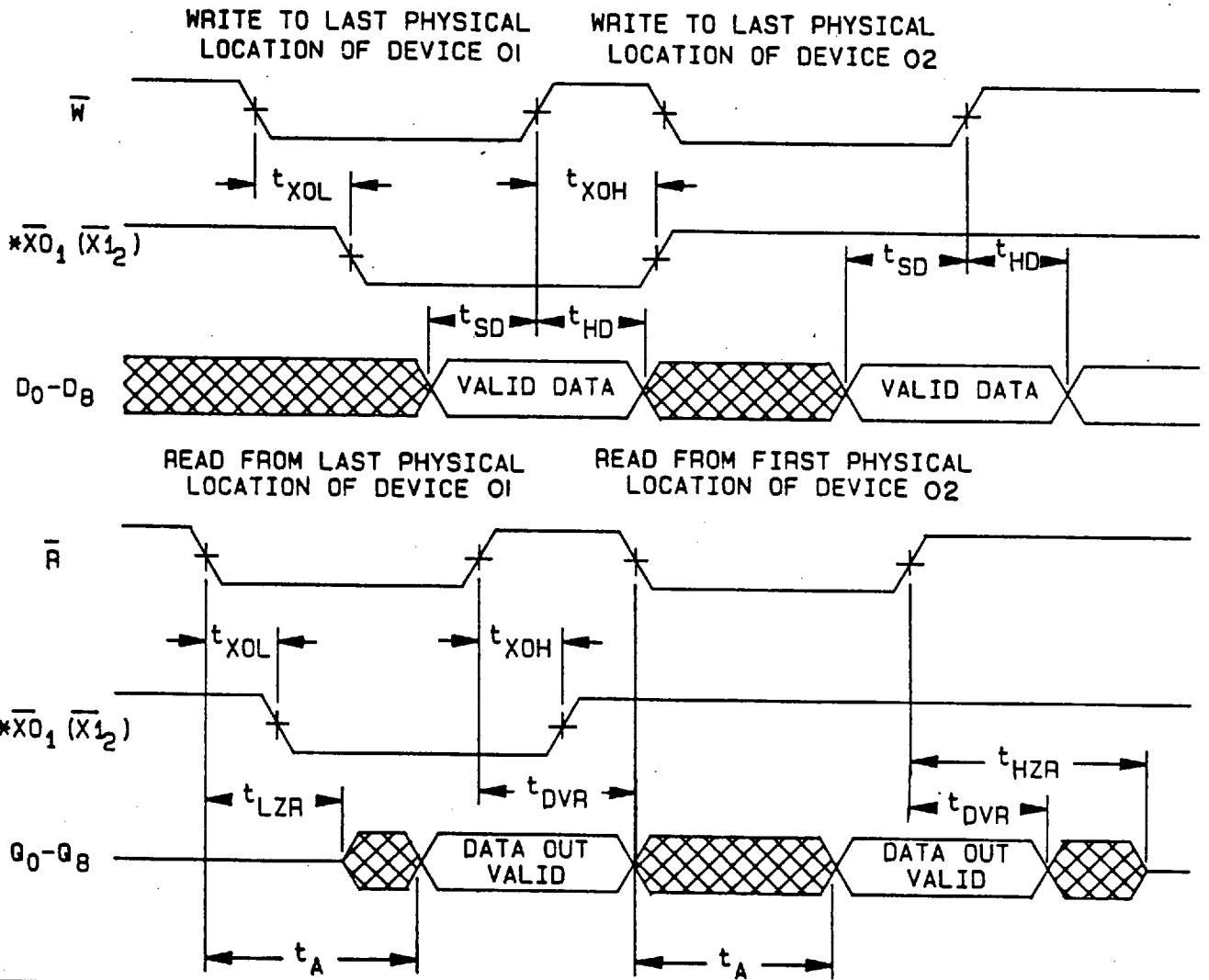
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**Last Read to First Write Empty Flag Timing Diagram**



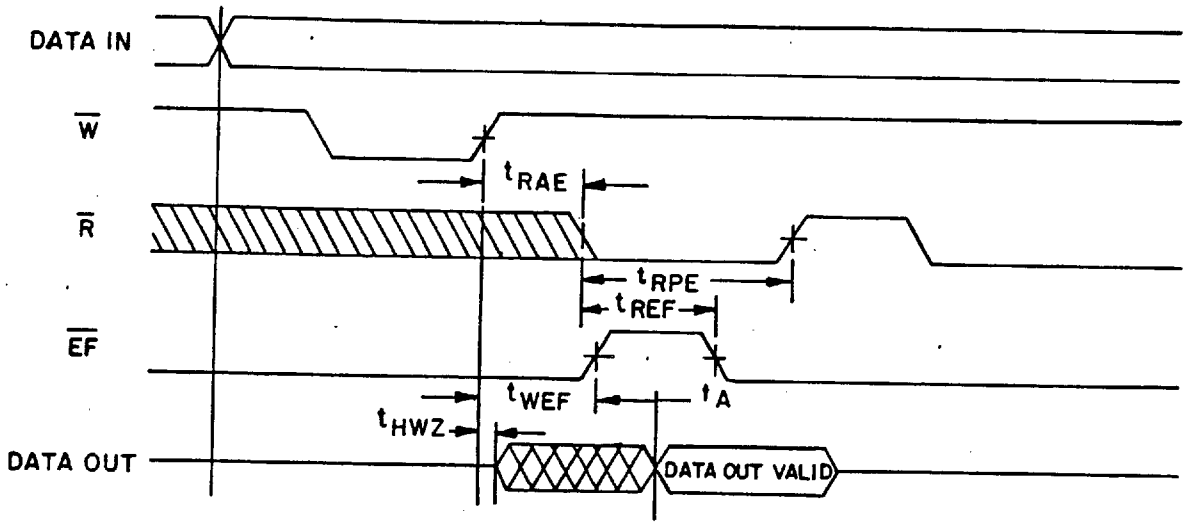
**Expansion Timing Diagrams**



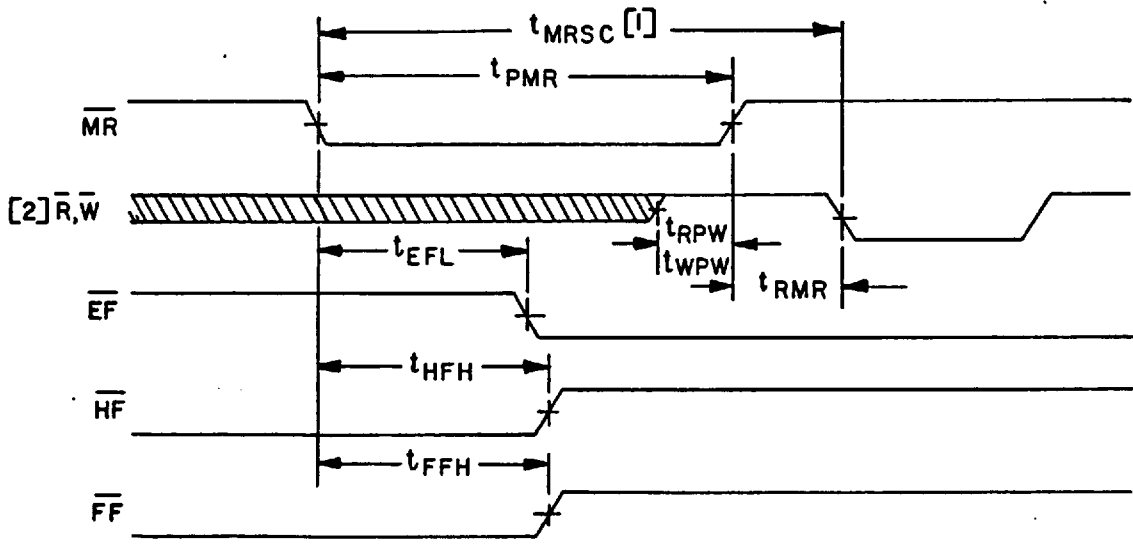
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**Empty Flag and Read Bubble - through Mode Timing Diagram**



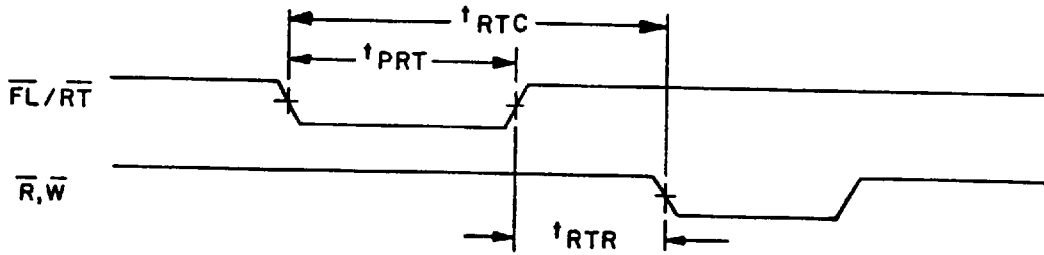
**Master Reset Timing Diagram**



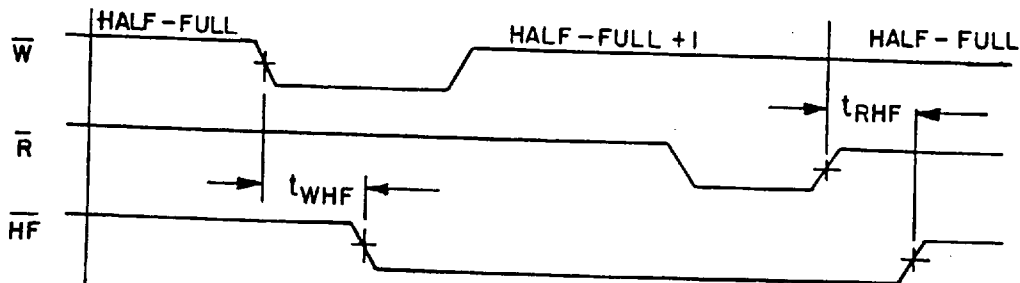
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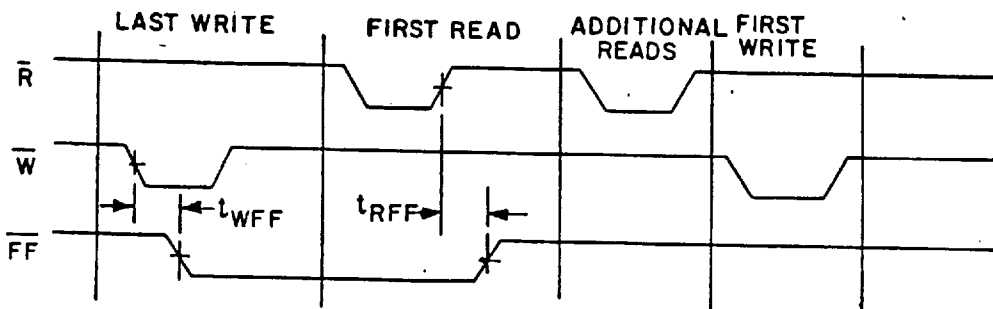
### Retransmit Timing Diagram



### Half - full Flag Timing Diagram



### Last Write to First Read Full Flag Timing Diagram



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## 7203ERP PINOUT DESCRIPTION

PIN	SIGNAL	DESCRIPTION
1	W\	Write Enable
2	D8	Data Input
3	D3	Data Input
4	D2	Data Input
5	D1	Data Input
6	D0	Data Input
7	XI\	Expansion In
8	FF\	Full Flag
9	Q0	Data Output
10	Q1	Data Output
11	Q2	Data Output
12	Q3	Data Output
13	Q8	Data Output
14	GND	Ground
15	R\	Reset
16	Q4	Data Output
17	Q5	Data Output
18	Q6	Data Output
19	Q7	Data Output
20	XO\HF\	Expansion Out/ Half-Full Flag
21	EF\	Empty Flag
22	MR\	Master Reset
23	FL\RT\	First Load/ Retransmit
24	D7	Data Input
25	D6	Data Input
26	D5	Data Input
27	D4	Data Input
28	Vcc	Power Supply



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