

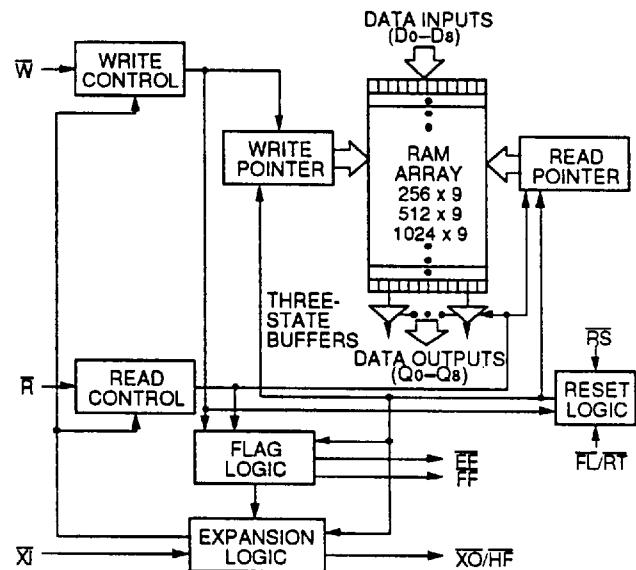
# 1024 x 9-Bit FIFO - Radiation Hardened 7202ERP

CMOS epi Parallel  
Cascadeable FIFO

## *For Space Applications*

SEI's 7202ERP (RP for RAD-PAK®) high speed FIFO microcircuit features a minimum 100kilorad (Si) total dose tolerance. Using SEI's radiation hardened RAD-PAK® packaging technology, the 7202ERP is fully equivalent to the commercial 7202

(IDT) and the CY7C424 (Cypress Semiconductor). The 7202ERP is a dual port memory that load and empty data on a first-in/first-out basis. This device uses Full and Empty flags to prevent data overflow and underflow and expansion logic to allow for unlimited expansion capability in both word size and depth. It also utilizes a 9-bit wide data array to allow for control and parity bits at the user's option. This feature is very beneficial in data communications applications where it is necessary to use a parity bit for transmission/reception error checking. Utilizing high-speed CMOS technology, the 7202ERP is designed for applications requiring asynchronous and simultaneous read/writes in multiprocessing and rate buffer applications. Capable of surviving space environments; the 7202ERP 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 100krad (Si) total dose survivability, mitigation of dose enhancement, and a high-rel die attachment. The 7202ERP 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.



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**7202ERP 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

**7202ERP 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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7202ERP 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> : ( $R^2 = W^2 / RS^2 = FL^2 / RT^2 = V_{IH}$ )	$I_{CC2}$		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:

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



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**7202ERP TIMING CHARACTERISTICS<sup>1</sup>**

PARAMETER	SYMBOL	MIN	MAX	UNIT
Shift Frequency 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$f_s$		25 28.5 33.3	ns
Read Cycle Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RC}$	40 35 30		ns
Data Access Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_A$		30 25 20	ns
Read Recovery Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RR}$	10 10 10		ns
Read Pulse Width <sup>2</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RPW}$	30 25 20		ns
Read LOW to Data Bus LOW <sup>3</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RLZ}$	5 5 5		ns
Write HIGH to Data Bus Low-Z <sup>3,4</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{WLZ}$	5 5 5		ns
Data Valid from Read HIGH 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{DV}$	5 5 5		ns
Read HIGH to Data Bus High-Z <sup>3</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RHZ}$		20 18 15	ns



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7202ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Write Cycle Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{WC}$	40 35 30		ns
Write Pulse Width <sup>2</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{WPW}$	30 25 20		ns
Write Recovery Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{WR}$	10 10 10		ns
Data Set-up Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{DS}$	18 15 12		ns
Data Hold Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{DH}$	0 0 0		ns
Reset Cycle Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RSC}$	40 35 30		ns
Reset Pulse Width <sup>2</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RS}$	30 25 20		ns
Reset Set-up Time <sup>3</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RSS}$	30 25 20		ns
Reset Recovery Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RSR}$	10 10 10		ns



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7202ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Retransmit Cycle Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RTC}$	40 35 30		ns
Retransmit Pulse Width <sup>2</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RT}$	30 25 20		ns
Retransmit Set-up Time <sup>3</sup> 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RTS}$	30 25 20		ns
Retransmit Recovery Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RSR}$	10 10 10		ns
Reset to EF\ LOW 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{EFL}$		40 35 30	ns
Reset to HF\ and FF\ HIGH 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{HFH}, t_{FFH}$		40 35 20	ns
Retransmit LOW to Flags Valid 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RTF}$		40 35 20	ns
Read LOW to EF\ LOW 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{REF}$		30 25 20	ns
Read HIGH to FF\ HIGH 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	$t_{RFF}$		30 25 20	ns



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7202ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Read Pulse Width after EF\ HIGH 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{RPE}$	30 25 20		ns
Write HIGH to EF\ HIGH 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{WEF}$		30 25 20	ns
Write LOW to FF\ LOW 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{WFF}$		30 25 20	ns
Write LOW to HF\ Flag LOW 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{WHF}$		40 35 30	ns
Read HIGH to HF\ Flag HIGH 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{RHF}$		40 35 30	ns
Write Pulse Width after FF\ HIGH 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{WPF}$	30 25 20		ns
Read/Write LOW to XO\ LOW 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{XOL}$		30 25 20	ns
Read/Write HIGH to XO\ HIGH 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{XOH}$		30 25 20	ns
XI\ Pulse Width <sup>2</sup> 7202ERPx-30 7202ERPx-25 7202ERPx-20	$t_{XI}$	30 25 20		ns



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**7202ERP TIMING CHARACTERISTICS<sup>1</sup> - (Continued)**

PARAMETER	SYMBOL	MIN	MAX	UNIT
X <sub>1</sub> Recovery Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	t <sub>xr</sub>	10 10 10		ns
X <sub>1</sub> Set-up Time 7202ERP <sub>x</sub> -30 7202ERP <sub>x</sub> -25 7202ERP <sub>x</sub> -20	t <sub>xs</sub>	10 10 10		ns

**Notes:**

1. V<sub>cc</sub> = +5 Volts; T<sub>A</sub> = +25 °C; use switching test circuit. 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 3.0 V 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.

**7202ERP 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:**

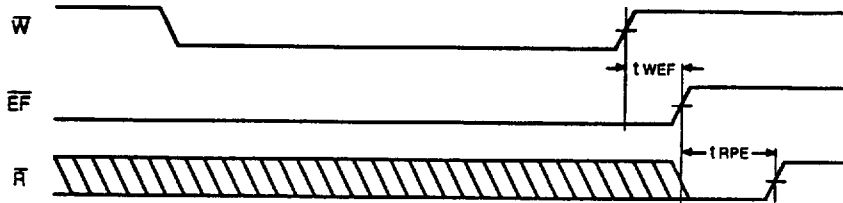
1/ For outline information, see Appendix A (Package Information - Outline Dimension)



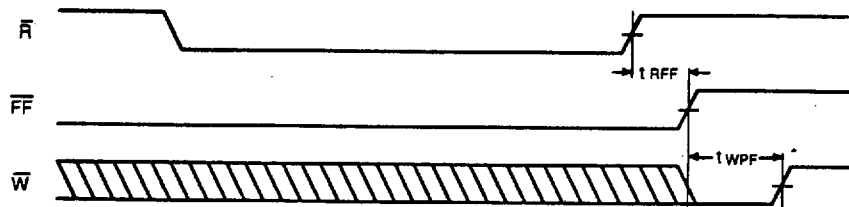
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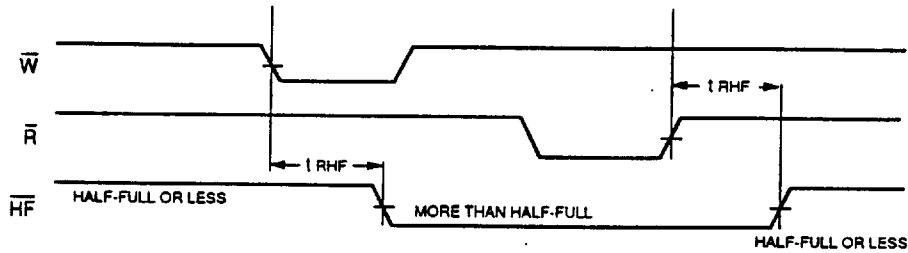
### Minimum Timing for an Empty Flag Coincident Read Pulse



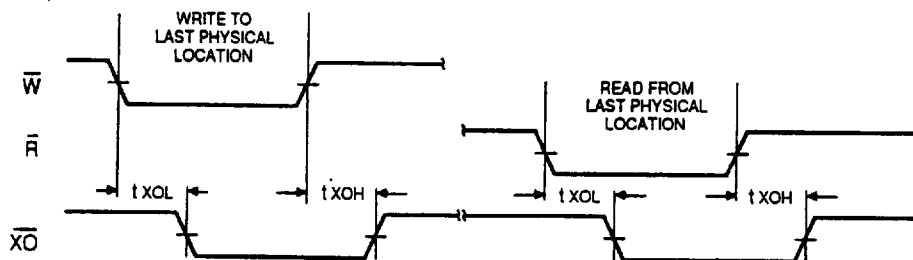
### Minimum Timing for a Full Flag Coincident Write Pulse



### Half-Full Flag Timing



### Expansion Out

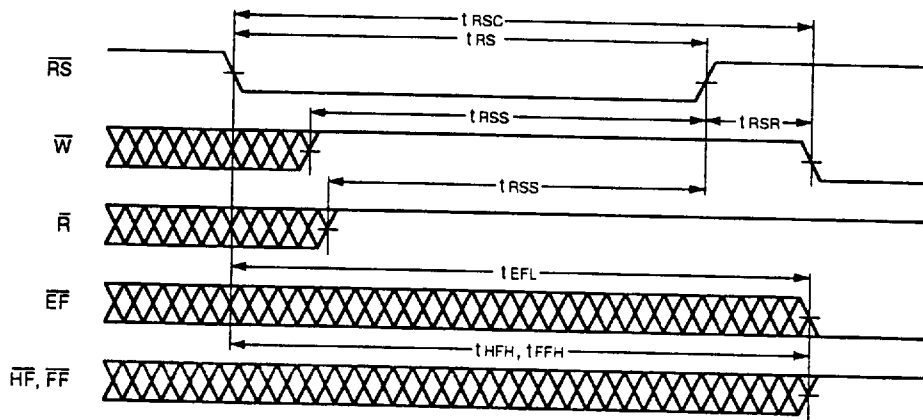


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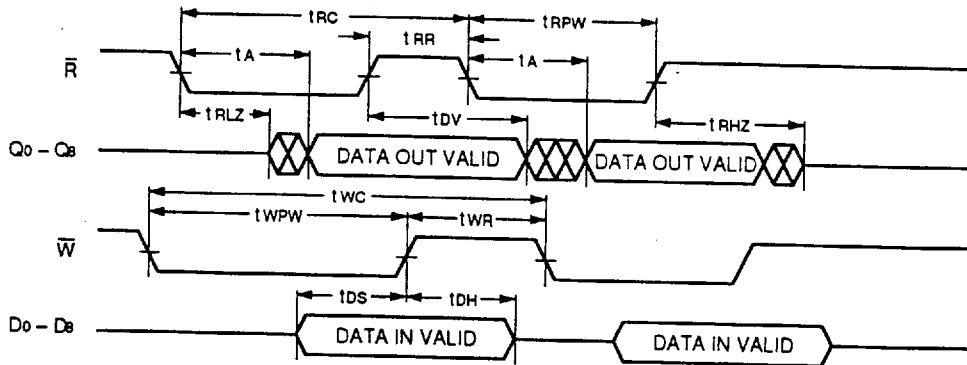
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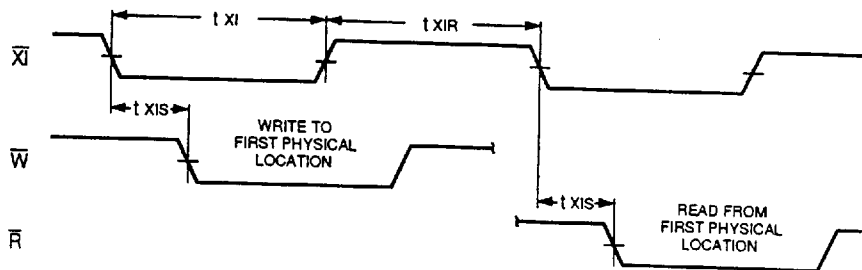
### Reset



### Asynchronous Write and Read Operation



### Expansion In

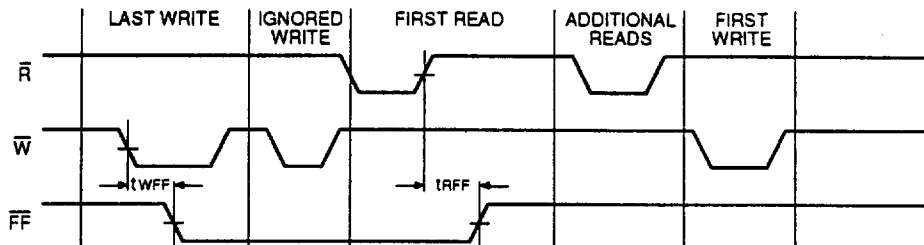


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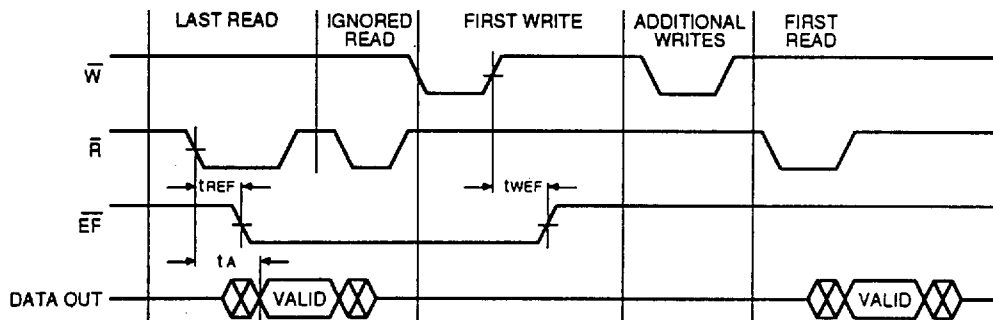
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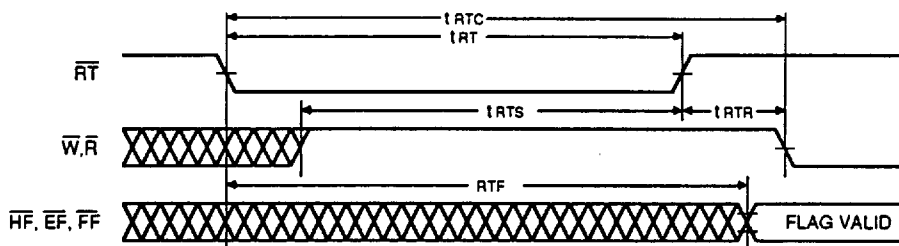
### Full Flag From Last Write to First Read



### Empty Flag From Last Read to First Write



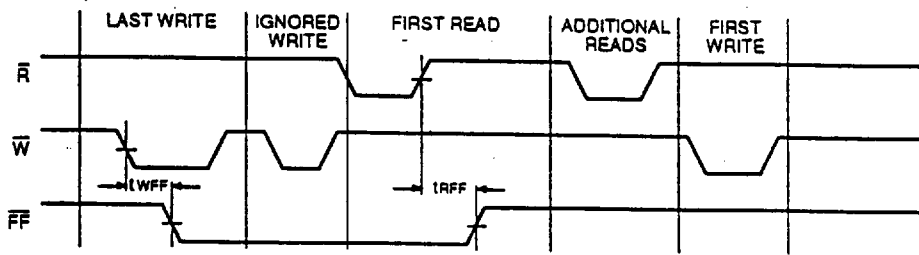
### Retransmit



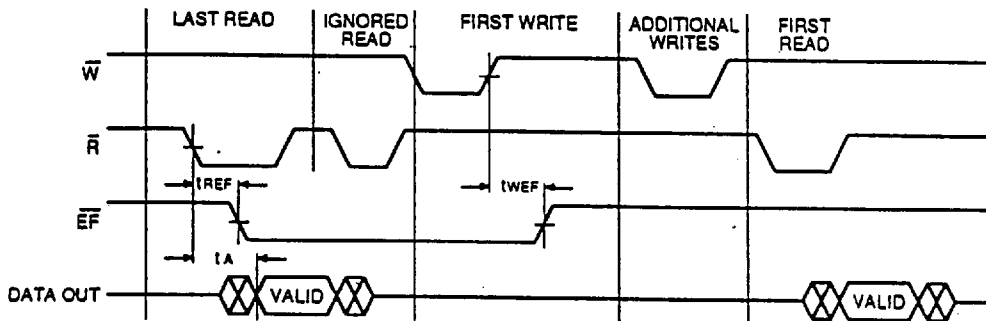
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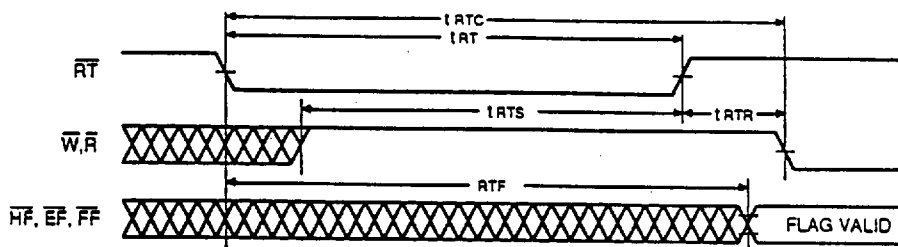
### Full Flag From Last Write to First Read



### Empty Flag From Last Read to First Write



### Retransmit



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## 7202ERP 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\	Read Enable
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	RS\	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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