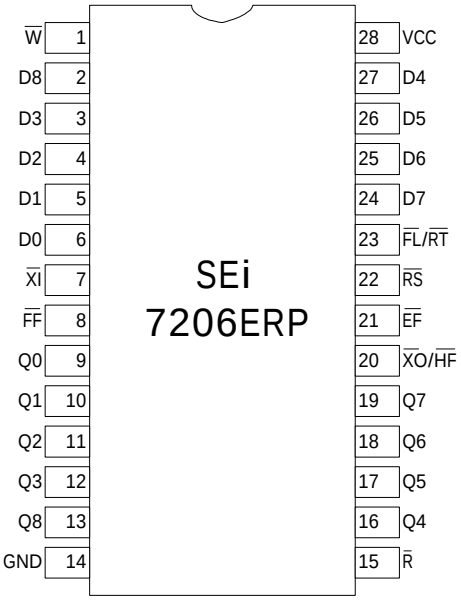
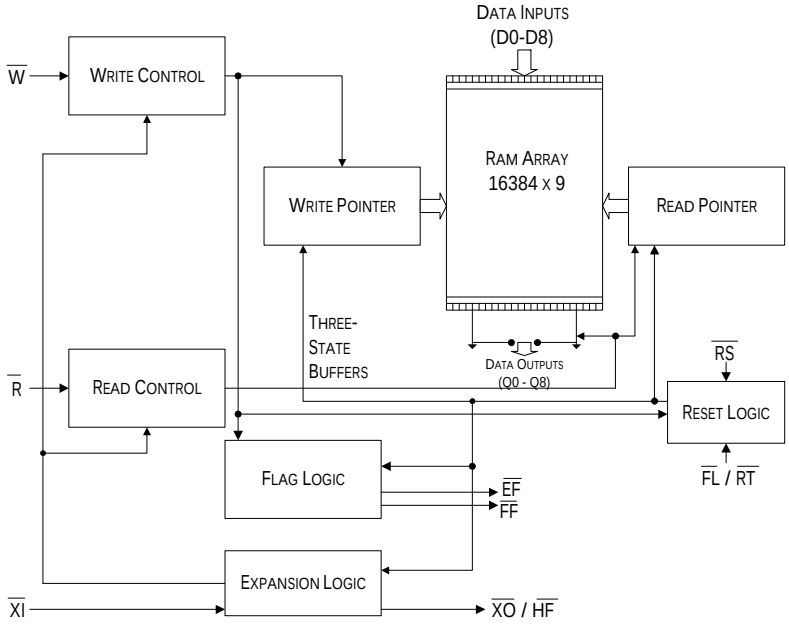
PRELIMINARY

SPACE ELECTRONICS INC.
SPACE PRODUCTS

HIGH-SPEED EPI-CMOS 16384 X 9-BIT PARALLEL FIFO

7206ERP





FEATURES:

- 16384 x 9-bit organization
- RAD-PAK® radiation-hardened against natural space radiation
- Manufactured on an epitaxial substrate for improved SEL performance
  - SEL_{TH}: no latchup > 100 MeV/mg/cm^2
- A total dose hardness > 100 krad (Si); dependent upon orbit
- Asynchronous Read/Write operation
- A high speed CMOS epi technology
- Retransmit capability
- Propagation time (max access time):
  -10 ns: 7206ERPx-10
  -12 ns: 7206ERPx-12
  -15 ns: 7206ERPx-15
  -20 ns: 7206ERPx-20
  -30 ns: 7206ERPx-30
  -40 ns: 7206ERPx-40
  -50 ns: 7206ERPx-50
- Status flag: empty, half-full, full fast
- Fully expandable in both word depth and width
- Bi-directional applications
- Low power
- Battery back-up operation
- TTL compatible

DESCRIPTION:

Space Electronics' 7206ERP (RP for RAD-PAK®) high speed FIFO microcircuit features a minimum 100 kilorad (Si) total dose tolerance; dependent upon orbit. 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 overflow and underflow. The expansion logic allows unlimited expansion capability in work size and depth with no timing penalties. Twin address pointers automatically generate internal read and write addresses, and automatically increment with the write and read pin. The 7206ERP 9-bits wide data are used in data communications applications where a parity bit for error checking is necessary. The retransmit capability allows the read pointer to be reset to its initial position without affecting the write pointer. The RAD-PAK® technology incorporates radiation shielding in the microcircuit package. It eliminates box shielding while providing required lifetime performing in orbit. The 7206ERP features the same system performance and architecture as the commercial counterparts and is manufactured on an epitaxial substrate to enhance single event latchup performance. Capable of surviving in space environments, the 7206ERP is ideal for satellite, spacecraft, and space probe missions. This product is available with packaging and screening up to Class S.

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TABLE 1. 7206ERP PINOUT DESCRIPTION

NUMBER	NAMES	DESCRIPTION
1	$\overline{W}$	Write Enable
2 - 6	D8, D3-D0	Inputs
7	$\overline{XI}$	Expansion In
8	$\overline{FF}$	Full Flag
9 - 13	Q0 - Q3, Q8	Outputs
14	GND	Ground
15	$\overline{R}$	Read Enable
16 - 19	Q4 - Q7	Outputs
20	$\overline{XO}/\overline{HF}$	Expansion Out/Half Full Flag
21	$\overline{EF}$	Empty Flag
22	$\overline{RS}$	Reset
23	FL/$\overline{RT}$	First Load/Retransmit
24 - 27	D7 - D4	Inputs
28	V_{CC}	Power Supply

TABLE 2. 7206ERP ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Positive Supply Voltage	V_{CC}	-0.3	7.0	V
Input or Output Voltage	V_{IN}	GND - 0.3	V_{CC} + 0.3	V
Storage Temperature Range	T_S	-65	+150	˚C
Operating Temperature Range	T_A	-55	+125	˚C

TABLE 3. 7206ERP RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Positive Supply Voltage	V_{CC}	4.5	5.5	V
High Level Input Voltage	V_{IH}	2.2	--	V
Low Level Voltage	V_{IL}	--	0.8	V
Operating Temperature Range	T_C	-55	+125	˚C

TABLE 4. 7206ERP DC ELECTRICAL CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNIT
Operating Supply Current	I_{CCOP}			mA
7206ERPx-10		--	170	
7206ERPx-12		--	170	
7206ERPx-15		--	165	
7206ERPx-20		--	160	
7206ERPx-30		--	150	
7206ERPx-40		--	140	
7206ERPx-50		--	130	
Standby Supply Current ($\overline{R} = \overline{W} = \overline{FL}/\overline{VRT} = V_{IH}$)	I_{CCSB}	--	1.5	mA
Power Down Current (All Input = V_{CC})	I_{CCPD}	--	4	mA
Input Leakage Current ($0.4V \le V_{IN} \le V_{CC}$)	I_{LI}	--	$\pm$1	µA
Output Leakage Current ($\overline{R} = V_{IH}$, $0.4V \le V_{OUT} \le V_{CC}$)	I_{LO}	--	$\pm$10	µA
Input Low Voltage[2]	V_{IL}	--	0.8	V
Input High Voltage[2]	V_{IH}	2.2	--	V
Output Low Voltage (V_{CC} min, I_{OL} = 8mA)	V_{OL}	--	0.4	V
Output High Voltage (V_{CC} min, I_{OH} = -2mA)	V_{OH}	2.4	--	V
Input Capacitance [3]	C_{IN}	--	8	pF
Output Capacitance [3]	C_{OUT}	--	8	pF

1. V_{CC} = 5V ± 5%, T_A = -55 to +125 °C.
2. V_{IH} max = V_{CC} + 0.3V. V_{IL} min = -0.3V or -1.0V pulse width 50ns.
3. This parameter is sampled and not 100% tested. T_A = 25°C; F = 1MHz.

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Read Cycle				
Read Cycle Time	t_{RC}			ns
7206ERPx-10		20	--	
7206ERPx-12		20	--	
7206ERPx-15		25	--	
7206ERPx-20		30	--	
7206ERPx-30		40	--	
7206ERPx-40		50	--	
7206ERPx-50		60	--	
Access Time	t_A			ns
7206ERPx-10		--	12	
7206ERPx-12		--	12	
7206ERPx-15		--	15	
7206ERPx-20		--	20	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Read Recovery Time	t_{RR}			ns
7206ERPx-10		8	--	
7206ERPx-12		8	--	
7206ERPx-15		10	--	
7206ERPx-20		10	--	
7206ERPx-30		10	--	
7206ERPx-40		10	--	
7206ERPx-50		10	--	
Read Pulse Width [2]	t_{RPW}			ns
7206ERPx-10 [5]		10	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	
Read Low to Data Low-Z [3]	t_{RLZ}			ns
7206ERPx-10		0	--	
7206ERPx-12		0	--	
7206ERPx-15		0	--	
7206ERPx-20		0	--	
7206ERPx-30		0	--	
7206ERPx-40		0	--	
7206ERPx-50		0	--	

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Write HIGH to Data Low-Z [3,4]	t_{WLZ}			ns
7206ERPx-10		3	--	
7206ERPx-12		3	--	
7206ERPx-15		3	--	
7206ERPx-20		3	--	
7206ERPx-30		3	--	
7206ERPx-40		3	--	
7206ERPx-50		3	--	
Data Valid from Read High	t_{DV}			ns
7206ERPx-10		5	--	
7206ERPx-12		5	--	
7206ERPx-15		5	--	
7206ERPx-20		5	--	
7206ERPx-30		5	--	
7206ERPx-40		5	--	
7206ERPx-50		5	--	
Read High to Data Bus High-Z [3]	t_{RHZ}			ns
7206ERPx-10		--	15	
7206ERPx-12		--	12	
7206ERPx-15		--	15	
7206ERPx-20		--	15	
7206ERPx-30		--	15	
7206ERPx-40		--	15	
7206ERPx-50		--	15	
Write Cycle				
Write Cycle Time	t_{WC}			ns
7206ERPx-10		17	--	
7206ERPx-12		17	--	
7206ERPx-15		25	--	
7206ERPx-20		30	--	
7206ERPx-30		40	--	
7206ERPx-40		50	--	
7206ERPx-50		60	--	
Write Pulse Width [2]	t_{WPW}			ns
7206ERPx-10 [5]		10	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Write Recovery Time	t_{WR}			ns
7206ERPx-10		8	--	
7206ERPx-12		8	--	
7206ERPx-15		10	--	
7206ERPx-20		10	--	
7206ERPx-30		10	--	
7206ERPx-40		10	--	
7206ERPx-50		10	--	
Data Set-up Time	t_{DS}			ns
7206ERPx-10		7	--	
7206ERPx-12		7	--	
7206ERPx-15		9	--	
7206ERPx-20		12	--	
7206ERPx-30		18	--	
7206ERPx-40		24	--	
7206ERPx-50		27	--	
Data Hold Time	t_{DH}			ns
7206ERPx-10		0	--	
7206ERPx-12		0	--	
7206ERPx-15		0	--	
7206ERPx-20		0	--	
7206ERPx-30		0	--	
7206ERPx-40		0	--	
7206ERPx-50		0	--	
Reset Cycle				
Reset Cycle Time	t_{RSC}			ns
7206ERPx-10		20	--	
7206ERPx-12		20	--	
7206ERPx-15		25	--	
7206ERPx-20		30	--	
7206ERPx-30		40	--	
7206ERPx-40		50	--	
7206ERPx-50		60	--	
Reset Pulse Width [2]	t_{RS}			ns
7206ERPx-10		12	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Reset Set-up TIme	t_{RSS}			ns
7206ERPx-10		20	--	
7206ERPx-12		20	--	
7206ERPx-15		25	--	
7206ERPx-20		30	--	
7206ERPx-30		40	--	
7206ERPx-40		50	--	
7206ERPx-50		60	--	
Reset Recovery Time	t_{RSR}			ns
7206ERPx-10		8	--	
7206ERPx-12		8	--	
7206ERPx-15		10	--	
7206ERPx-20		10	--	
7206ERPx-30		10	--	
7206ERPx-40		10	--	
7206ERPx-50		10	--	
Retransmit Cycle				
Retransmit Cycle Time	t_{RTC}			ns
7206ERPx-10		22	--	
7206ERPx-12		22	--	
7206ERPx-15		25	--	
7206ERPx-20		30	--	
7206ERPx-30		40	--	
7206ERPx-40		50	--	
7206ERPx-50		60	--	
Retransmit Pulse Width [2]	t_{RT}			ns
7206ERPx-10		12	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	
Retransmit Set-up Time [3]	t_{RTS}			ns
7206ERPx-10		12	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Retransmit Recovery Time	t_{RTR}			ns
7206ERPx-10		10	--	
7206ERPx-12		10	--	
7206ERPx-15		10	--	
7206ERPx-20		10	--	
7206ERPx-30		10	--	
7206ERPx-40		10	--	
7206ERPx-50		10	--	
Flags				
Reset to $\overline{EF}$ Low	t_{EFL}			ns
7206ERPx-10		--	20	
7206ERPx-12		--	20	
7206ERPx-15		--	25	
7206ERPx-20		--	30	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Reset to $\overline{HF}$/$\overline{FF}$ High	t_{HFH}, t_{FFH}			ns
7206ERPx-10		--	20	
7206ERPx-12		--	20	
7206ERPx-15		--	25	
7206ERPx-20		--	30	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Read Low to $\overline{EF}$ Low	t_{REF}			ns
7206ERPx-10		--	13	
7206ERPx-12		--	13	
7206ERPx-15		--	15	
7206ERPx-20		--	20	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Read High to $\overline{FF}$ High	t_{RFF}			ns
7206ERPx-10		--	15	
7206ERPx-12		--	15	
7206ERPx-15		--	17	
7206ERPx-20		--	20	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Read Pulse Width after $\overline{EF}$ High	t_{RPE}			ns
7206ERPx-10		12	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	
Write High to $\overline{EF}$ High	t_{WEF}			ns
7206ERPx-10		--	13	
7206ERPx-12		--	13	
7206ERPx-15		--	15	
7206ERPx-20		--	20	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Write Low to $\overline{FF}$ Low	t_{WFF}			ns
7206ERPx-10		--	15	
7206ERPx-12		--	15	
7206ERPx-15		--	17	
7206ERPx-20		--	20	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Write Low to $\overline{HF}$ Flag Low	t_{WHF}			ns
7206ERPx-10		--	22	
7206ERPx-12		--	22	
7206ERPx-15		--	25	
7206ERPx-20		--	30	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Read High to $\overline{HF}$ Flag High	t_{RHF}			ns
7206ERPx-10		--	22	
7206ERPx-12		--	22	
7206ERPx-15		--	25	
7206ERPx-20		--	30	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Read Pulse Width after FF High	t_{WPF}			ns
7206ERPx-10		12	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	
Read/Write LOW to XO LOW	t_{XOL}			ns
7206ERPx-10		--	12	
7206ERPx-12		--	12	
7206ERPx-15		--	15	
7206ERPx-20		--	20	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
Read/Write LOW to XO HIGH	t_{XOH}			ns
7206ERPx-10		--	12	
7206ERPx-12		--	12	
7206ERPx-15		--	15	
7206ERPx-20		--	20	
7206ERPx-30		--	30	
7206ERPx-40		--	40	
7206ERPx-50		--	50	
XI Pulse Width	t_{XI}			ns
7206ERPx-10		12	--	
7206ERPx-12		12	--	
7206ERPx-15		15	--	
7206ERPx-20		20	--	
7206ERPx-30		30	--	
7206ERPx-40		40	--	
7206ERPx-50		50	--	
XI Recovery Time	t_{XIR}			ns
7206ERPx-10		8	--	
7206ERPx-12		8	--	
7206ERPx-15		10	--	
7206ERPx-20		10	--	
7206ERPx-30		10	--	
7206ERPx-40		10	--	
7206ERPx-50		10	--	

TABLE 5. 7206ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
XI Set-up Time	t_{XIS}			ns
7206ERPx-10		8	--	
7206ERPx-12		8	--	
7206ERPx-15		10	--	
7206ERPx-20		10	--	
7206ERPx-30		10	--	
7206ERPx-40		10	--	
7206ERPx-50		10	--	

1. V_{CC} = +5 V, T_A = +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 3.0V and the output load circuit, unless otherwise specified.
2. Pulse widths less than minimum value are not allowed.
3. Values guaranteed by design, not currently tested.
4. Only applies to read data flow-through mode.
5. For t_{RPW} (Pulse Read Width) and t_{WPW} (Write Pulse Width) 10 ns applies over temperature range -20 °C to +85 °C.

FIGURE 1. RESET

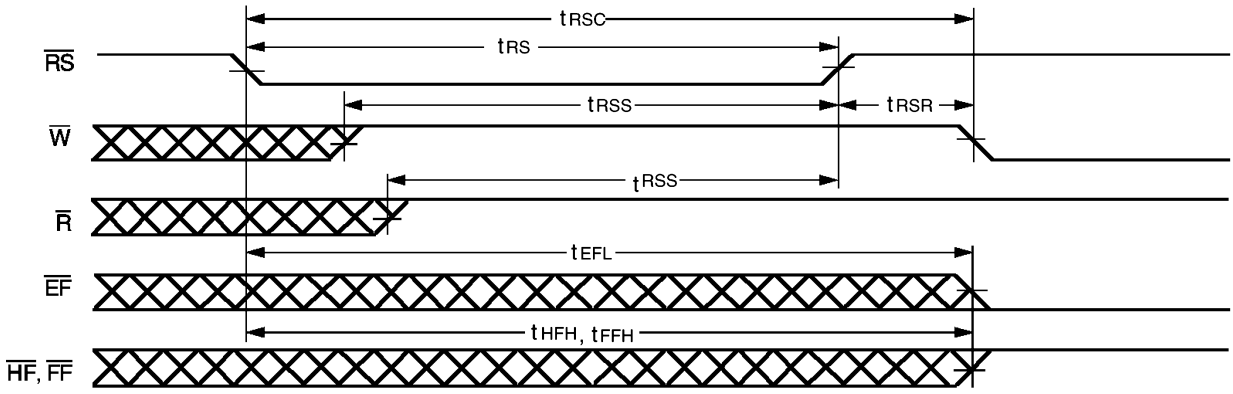


FIGURE 2. ASYNCHRONOUS WRITE AND READ OPERATION

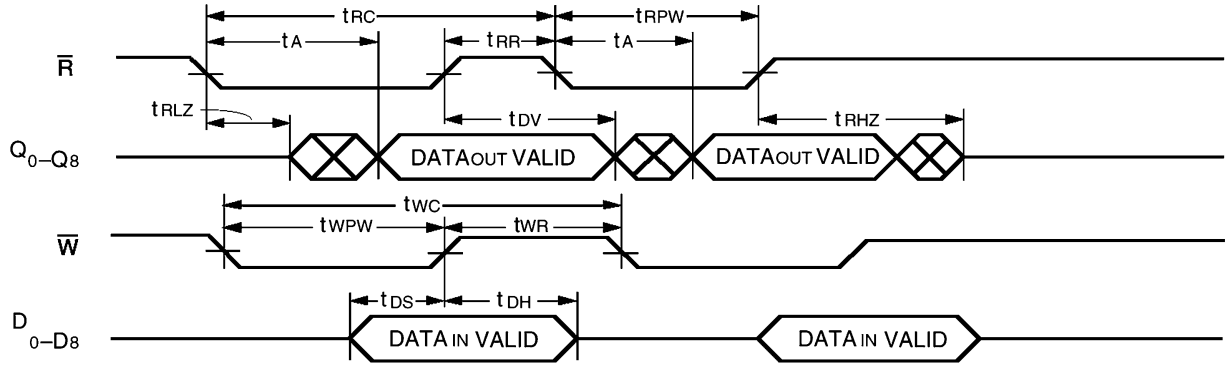


FIGURE 3. FULL FLAG TIMING FROM LAST WRITE TO FIRST READ

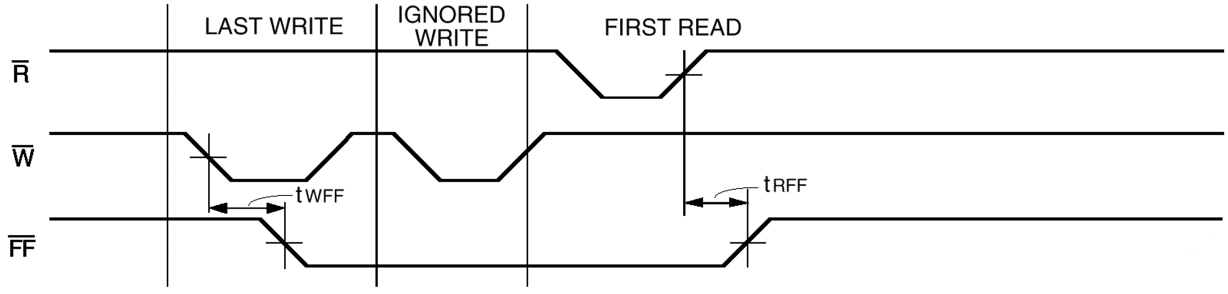


FIGURE 4. EMPTY FLAG TIMING FROM LAST READ TO FIRST WRITE

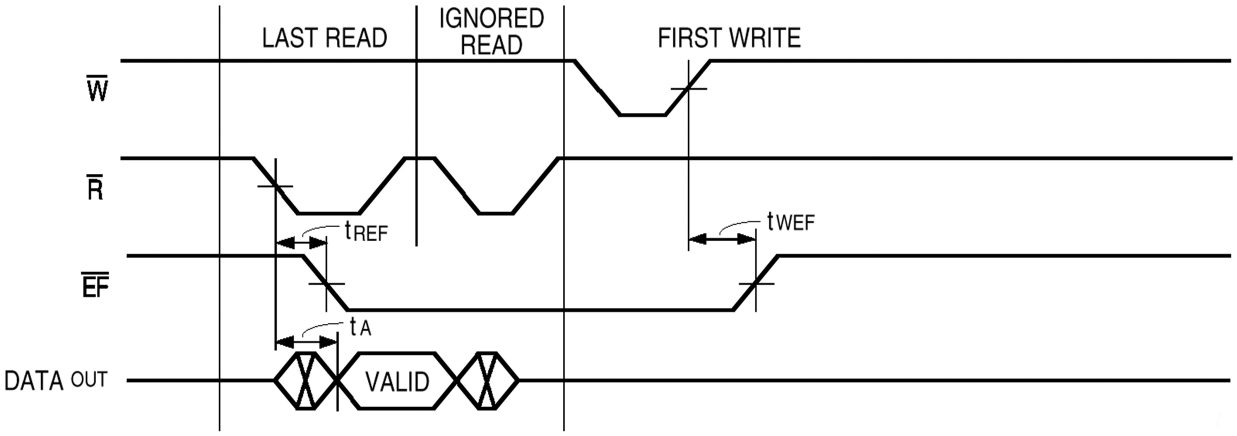
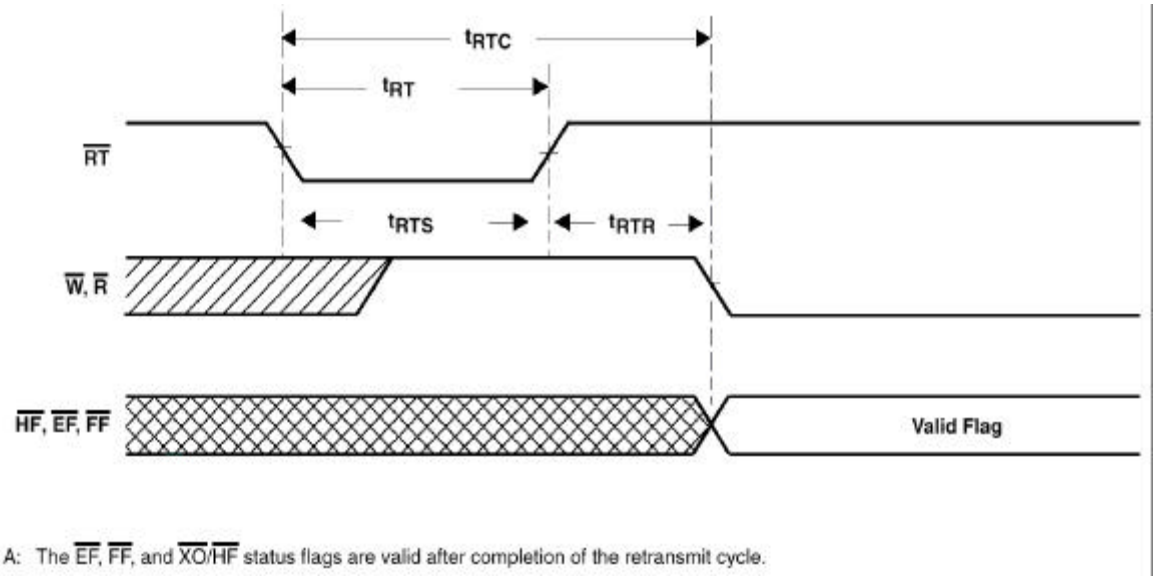


FIGURE 5. RETRANSMIT



NOTE A: The EF, FF, and XO/HF status flags are valid after completion of the retransmit cycle.

FIGURE 6. EMPTY FLAG TIMING

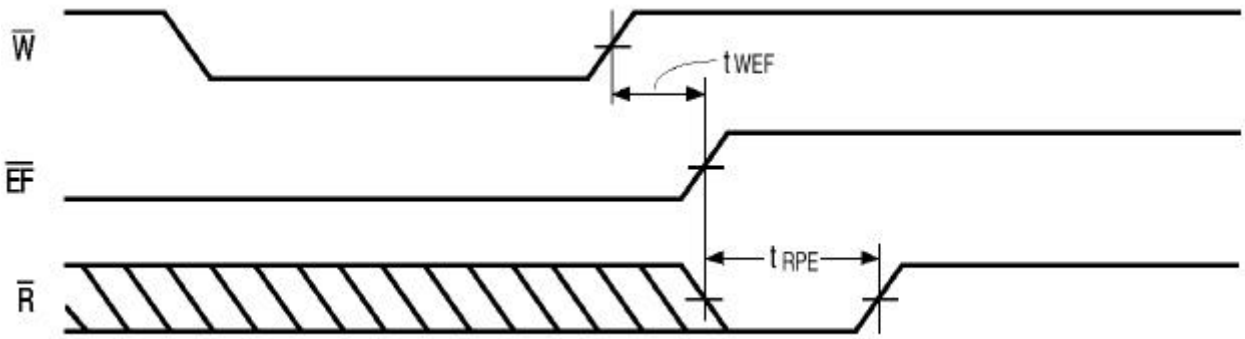


FIGURE 7. FULL FLAG TIMING

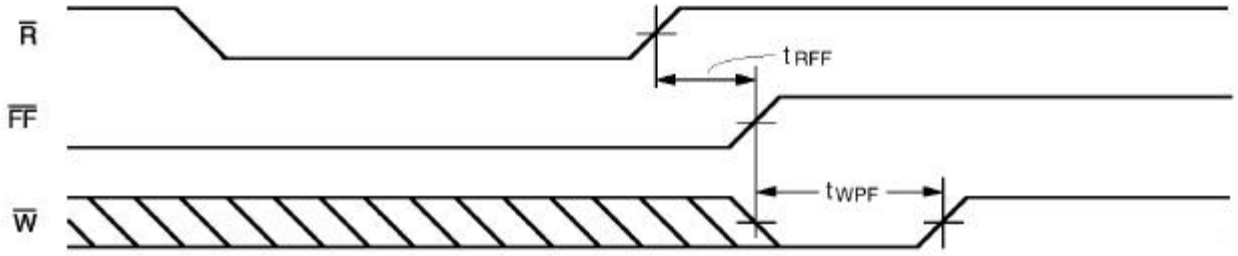


FIGURE 8. HALF-FULL FLAG TIMING

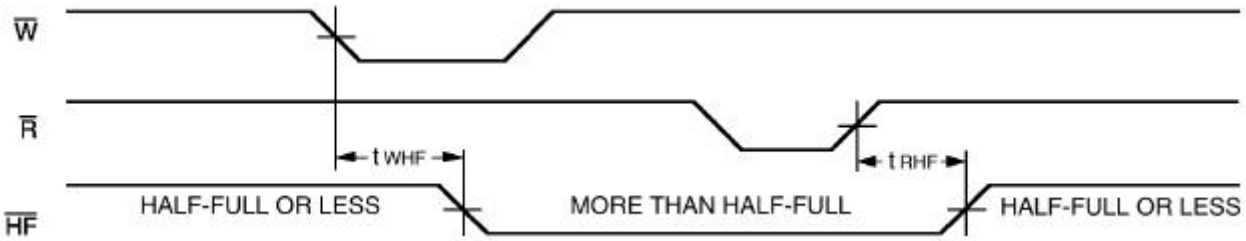


FIGURE 9. EXPANSION OUT

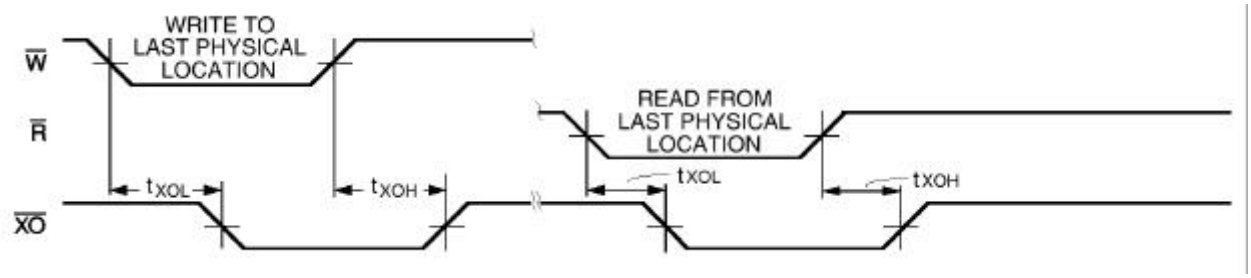


FIGURE 10. EXPANSION IN

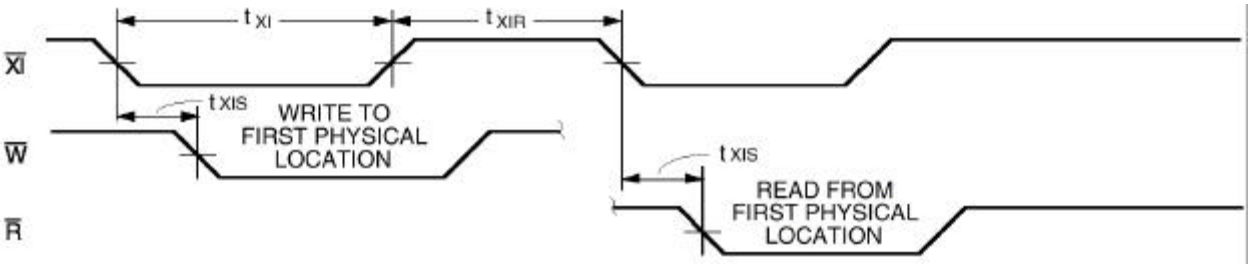


FIGURE 11. READ DATA FLOW FOR THROUGH MODE

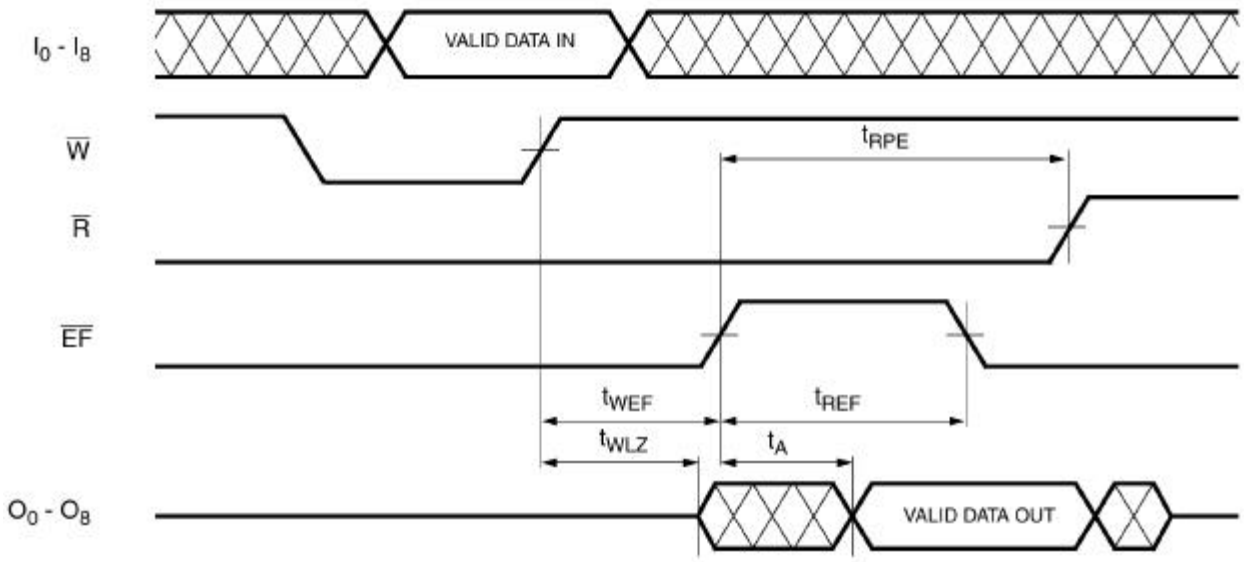


FIGURE 12. WRITE DATA FLOW FOR THROUGH MODE