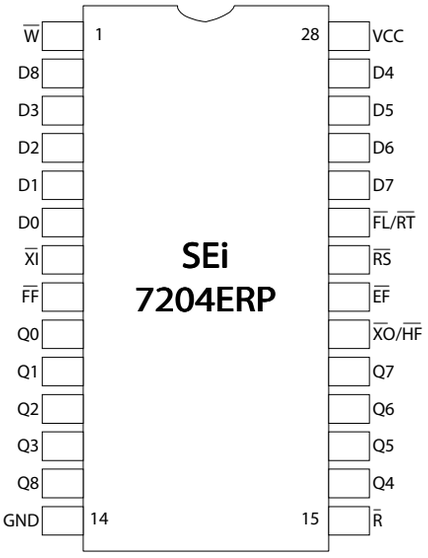
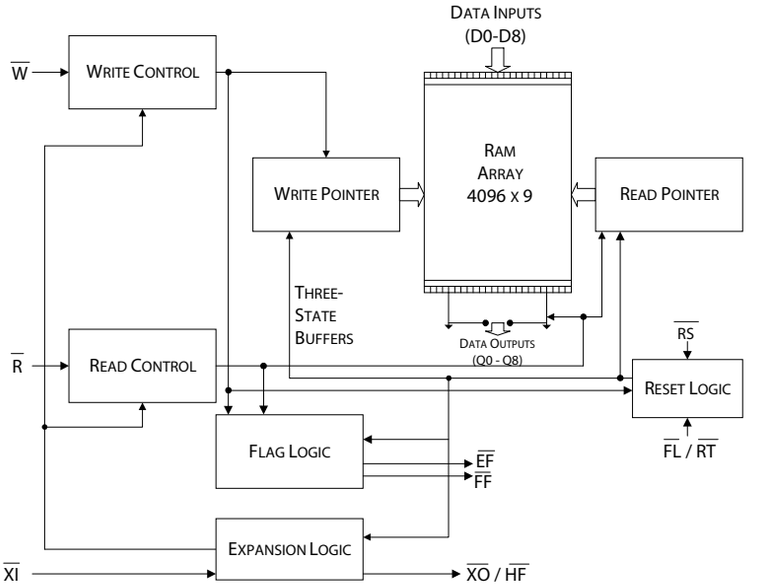
HIGH-SPEED EPI-CMOS 4096 X 9-BIT PARALLEL FIFO

7204ERP





FEATURES:

- 4096 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
- Package:
  -28 pin RAD-PAK® flat pack
- Asynchronous read/write operation
- A high speed CMOS Epi Technology
- Retransmit capability
- Propagation Time (max access time):
  -30ns: 7204ERPx-30
  -40ns: 7204ERPx-40
  -50ns: 7204ERPx-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' 7204ERP (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 7204ERP 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 in orbit. The 7204ERP 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 7204ERP is ideal for satellite, spacecraft, and space probe missions. This product is available with packaging and screening up to Class S.

(619) 452-4167 - Fax: (619) 452-5499 - www.spaceelectronics.com

7204ERP 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	$\overline{FL}/\overline{RT}$	First Load/Retransmit
24 - 27	D7 - D4	Inputs
28	V_{CC}	Power Supply

7204ERP ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNITS
Supply Voltage (V_{CC} - GND)	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

7204ERP RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	MAX	UNITS
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

7204ERP DC ELECTRICAL CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
Operating Supply Current 7204ERPx-30 7204ERPx-40 7204ERPx-50	I_{CCOP}	 -- -- --	 140 135 125	mA
Standby Supply Current ($\overline{R} = \overline{W} = \overline{FL}/\overline{RT} = V_{IH}$) 7204ERPx-30 7204ERPx-40 7204ERPx-50	I_{CCSB}	 -- -- --	 1.5 1.5 1.5	mA
Power Down Current All input = V_{CC} - 0.2V 7204ERPx-30 7204ERPx-40 7204ERPx-50	I_{CCPD}	 -- -- --	 2 2 2	mA
Input Leakage Current $0.4V < V_{IN} < V_{CC}$	I_{LI}	--	±1	uA
Output Leakage Current $\overline{R} = V_{IH}$, $0.4V < V_{OUT} < V_{CC}$	I_{LO}	--	±10	uA
Input Low Voltage	V_{IL}	--	0.8	V
Input High Voltage	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 2/	C_{IN}	--	8	pF
Output Capacitance 2/	C_{OUT}	--	8	pF

NOTE:
1/ $V_{CC} = 5 \pm 5\%$ volts; T_A = -55 to +125 °C.
2/ F = 1MHz.
3/ V_{IH} max = V_{CC} + 0.3V. V_{IL} min = -0.3V or -1V pulse width 50ns.

7204ERP TIMING CHARACTERISTICS [1]

PARAMETER	SYMBOL	MIN	MAX	UNITS
READ CYCLE				
Read Cycle Time 7204ERPx-30 7204ERPx-40 7204ERPx-50	t_{RC}	 40 50 65	 -- -- --	ns
Access Time 7204ERPx-30 7204ERPx-40 7204ERPx-50	t_A	 -- -- --	 30 40 50	ns
Read Recovery Time 7204ERPx-30 7204ERPx-40 7204ERPx-50	t_{RR}	 10 10 15	 -- -- --	ns

7204ERP TIMING CHARACTERISTICS [1] (cont)

PARAMETER	SYMBOL	MIN	MAX	UNITS
Read Pulse Width 2/				
7204ERPx-30	t_{RPW}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	
Read Low to Data Low 3/				
7204ERPx-30	t_{RLZ}	5	--	ns
7204ERPx-40		5	--	
7204ERPx-50		10	--	
Write HIGH to Data Low-Z 3/ 4/				
7204ERPx-30	t_{WLZ}	10	--	ns
7204ERPx-40		10	--	
7204ERPx-50		15	--	
Data Valid from Read High				
7204ERPx-30	t_{DV}	5	--	ns
7204ERPx-40		5	--	
7204ERPx-50		5	--	
Read High to Data Bus High-Z 3/				
7204ERPx-30	t_{RHZ}	--	20	ns
7204ERPx-40		--	25	
7204ERPx-50		--	30	
WRITE CYCLE				
Write Cycle Time				
7204ERPx-30	t_{WC}	40	--	ns
7204ERPx-40		50	--	
7204ERPx-50		65	--	
Write Pulse Width 2/				
7204ERPx-30	t_{WPW}	30	--	ns
7204ERPx-40		40	----	
7204ERPx-50		50		
Write Recovery Time				
7204ERPx-30	t_{WR}	10	--	ns
7204ERPx-40		10	--	
7204ERPx-50		15	--	
Data Set-up Time				
7204ERPx-30	t_{DS}	18	--	ns
7204ERPx-40		20	--	
7204ERPx-50		30	--	
Data Hold Time				
7204ERPx-30	t_{DH}	0	--	ns
7204ERPx-40		0	--	
7204ERPx-50		0	--	

7204ERP TIMING CHARACTERISTICS [1] (cont)

PARAMETER	SYMBOL	MIN	MAX	UNITS
RESET CYCLE				
Reset Cycle Time				
7204ERPx-30	t_{RSC}	40	--	ns
7204ERPx-40		50	--	
7204ERPx-50		65	--	
Reset Pulse Width 2/				
7204ERPx-30	t_{RS}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	
Reset Set-up Time 3/				
7204ERPx-30	t_{RSS}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	
Reset Recovery Time				
7204ERPx-30	t_{RSR}	10	--	ns
7204ERPx-40		10	--	
7204ERPx-50		15	--	
RETRANSMIT CYCLE				
Retransmit Cycle Time				
7204ERPx-30	t_{RTC}	40	--	ns
7204ERPx-40		50	--	
7204ERPx-50		65	--	
Retransmit Pulse Width 2/				
7204ERPx-30	t_{RT}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	
Retransmit Set-up Time 3/				
7204ERPx-30	t_{RTS}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	
Retransmit Recovery Time				
7204ERPx-30	t_{RSR}	10	--	ns
7204ERPx-40		10	--	
7204ERPx-50		15	--	
FLAGS				
Reset to $\overline{EF}$ Low				
7204ERPx-30	t_{EFL}	--	40	ns
7204ERPx-40		--	50	
7204ERPx-50		--	60	

7204ERP TIMING CHARACTERISTICS [1] (cont)

PARAMETER	SYMBOL	MIN	MAX	UNITS
Reset to $\overline{HF}$ and $\overline{FF}$ High				
7204ERPx-30	t_{HFH}, t_{FFH}	--	40	ns
7204ERPx-40		--	50	
7204ERPx-50		--	60	
Read Low to $\overline{EF}$ Low				
7204ERPx-30	t_{REF}	--	30	ns
7204ERPx-40		--	30	
7204ERPx-50		--	45	
Read High to $\overline{FF}$ High				
7204ERPx-30	t_{RFF}	--	30	ns
7204ERPx-40		--	35	
7204ERPx-50		--	45	
Read Pulse Width after $\overline{EF}$ High				
7204ERPx-30	t_{RPE}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	
Write High to $\overline{EF}$ High				
7204ERPx-30	t_{WEF}	--	30	ns
7204ERPx-40		--	35	
7204ERPx-50		--	45	
Write Low to $\overline{FF}$ Low				
7204ERPx-30	t_{WFF}	--	30	ns
7204ERPx-40		--	35	
7204ERPx-50		--	45	
Write Low to $\overline{HF}$ Flag Low				
7204ERPx-30	t_{WHF}	--	40	ns
7204ERPx-40		--	50	
7204ERPx-50		--	60	
Read High to $\overline{HF}$ Flag High				
7204ERPx-30	t_{RHF}	--	40	ns
7204ERPx-40		--	50	
7204ERPx-50		--	60	
Read Pulse Width after $\overline{FF}$ High				
7204ERPx-30	t_{WPF}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	

7204ERP TIMING CHARACTERISTICS [1] (cont)

PARAMETER	SYMBOL	MIN	MAX	UNITS
Read/Write LOW to $\overline{XO}$ LOW				
7204ERPx-30	t_{XOL}	--	30	ns
7204ERPx-40		--	40	
7204ERPx-50		--	50	
Read/Write HIGH to $\overline{XO}$ HIGH				
7204ERPx-30	t_{XOH}	--	30	ns
7204ERPx-40		--	40	
7204ERPx-50		--	50	
$\overline{XI}$ Pulse Width 2/				
7204ERPx-30	t_{XI}	30	--	ns
7204ERPx-40		40	--	
7204ERPx-50		50	--	
$\overline{XI}$ Recovery Time				
7204ERPx-30	t_{XIR}	10	--	ns
7204ERPx-40		10	--	
7204ERPx-50		10	--	
$\overline{XI}$ Set-up Time				
7204ERPx-30	t_{XIS}	10	--	ns
7204ERPx-40		10	--	
7204ERPx-50		15	--	

NOTE:

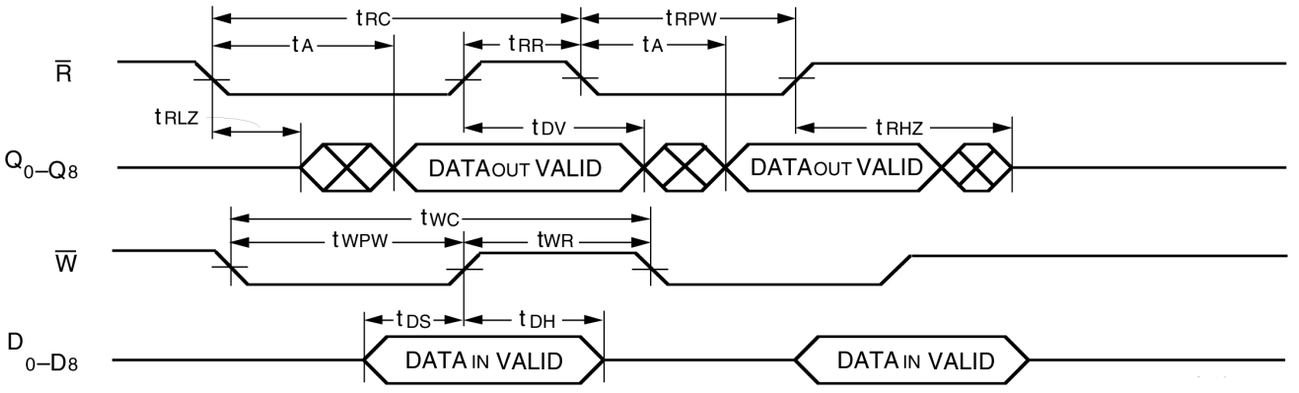
1/ $V_{CC} = +5V$:$T_A = +25\ ^oC$; use switching test circuit. AC tests are performed with input rise and fall times of 5ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V and the output load circuit, unless otherwise specified.

2/ Pulse widths less than minimum value are not allowed.

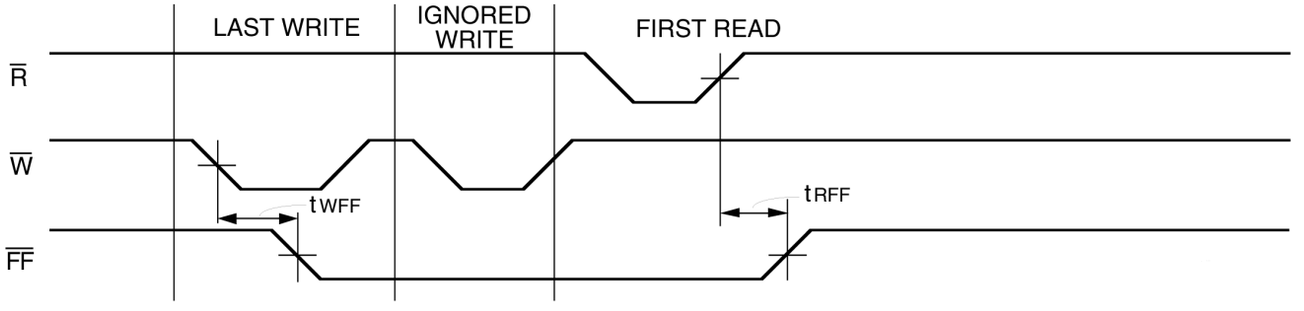
3/ Values guaranteed by design, not currently tested.

4/ Only applies to read data flow-through mode.

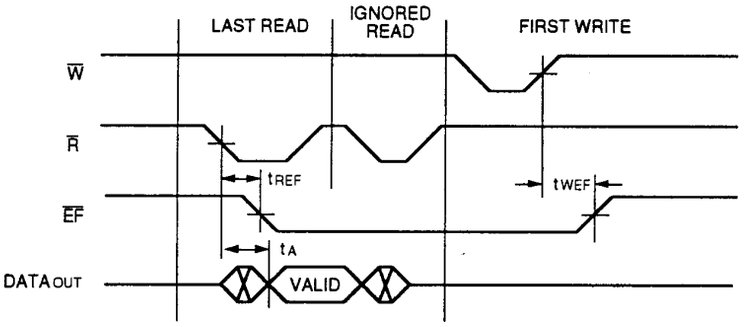
Asynchronous Write and Read Operation



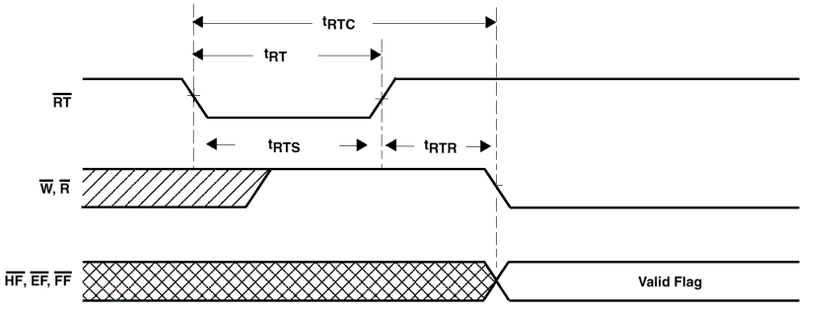
Full FlagTiming From Last Write to First Read



Empty Flag Timing from Last Read to First Write

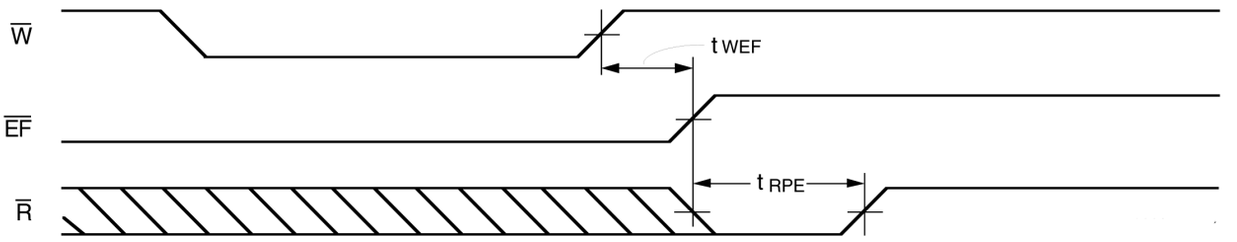


RETRANSMIT

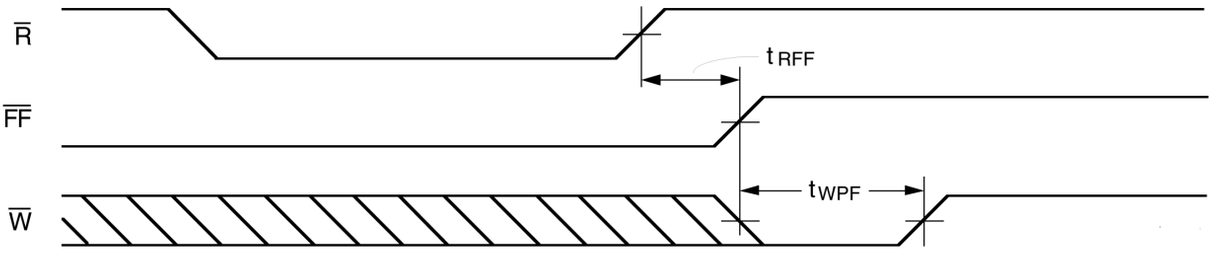


NOTE A: The EF, FF, and XO/HF status flags are valid after completion of the retransmit cycle.

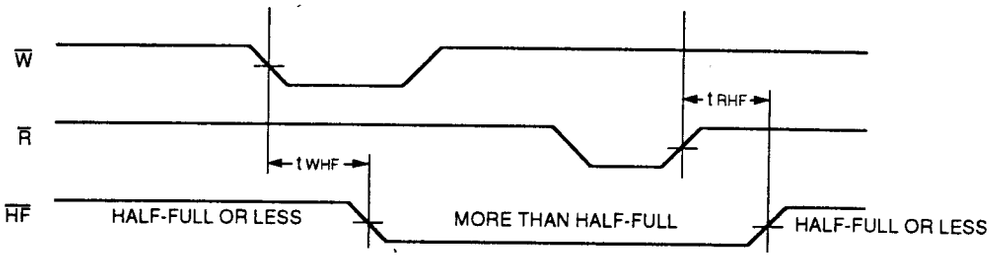
Empty Flag Timing



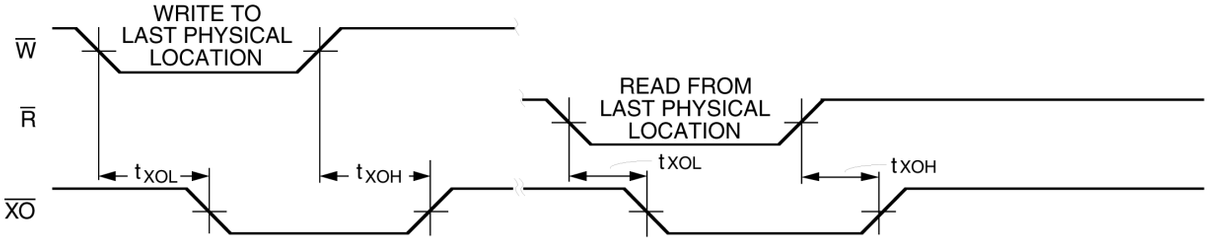
Full Flag Timing



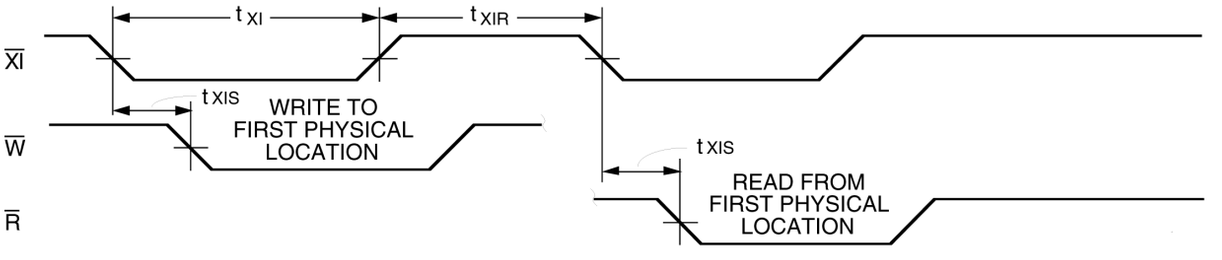
Half-Full Flag Timing

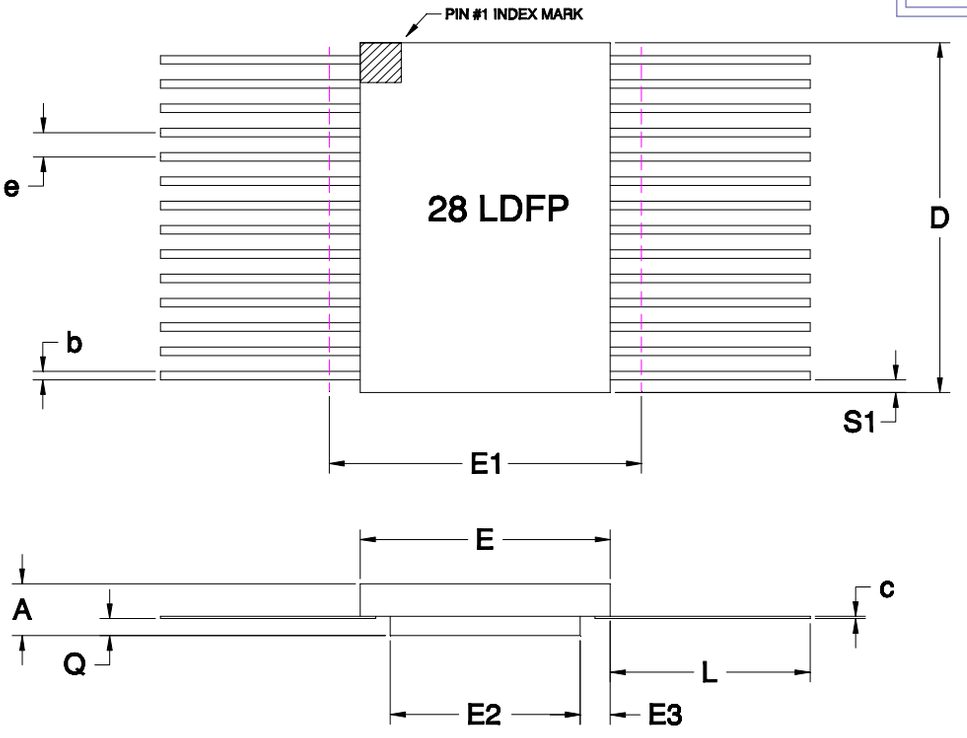


Expansion Out



Expansion In



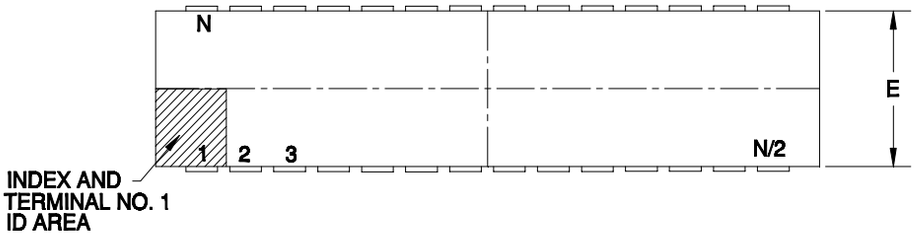


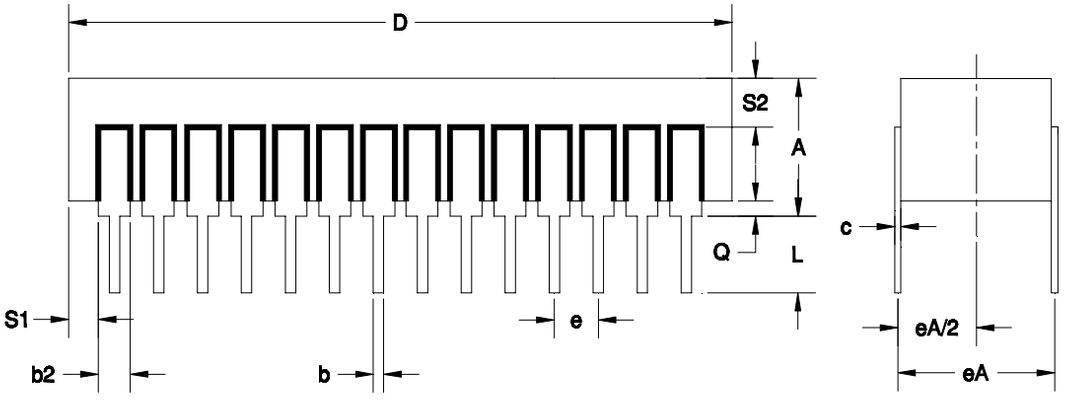
28 PIN RAD-PAK® FLAT PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	0.090	0.109	0.143
b	0.015	0.017	0.022
c	0.004	0.005	0.009
D	---	0.720	0.740
E	0.380	0.410	0.420
E1	---	---	0.440
E2	0.180	0.280	---
E3	0.030	0.065	---
e	0.050 BSC		
L	0.390	0.400	0.410
Q	0.021	0.035	0.045
S1	0.000	0.027	---
N	28		

F28-01

NOTE: ALL DIMENSIONS IN INCHES.





28 PIN RAD-PAK® DUAL IN-LINE PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	---	0.177	0.225
b	0.014	0.018	0.026
b2	0.045	0.050	0.065
c	0.008	0.010	0.018
D	---	1.400	1.485
E	0.510	0.595	0.620
eA	0.600 BSC		
eA/2	0.300 BSC		
e	0.100 BSC		
L	0.140	0.150	0.160
Q	0.015	0.040	0.060
S1	0.005	0.025	---
S2	0.005	---	---
N	28		

D28-03

NOTE: ALL DIMENSIONS IN INCHES.