



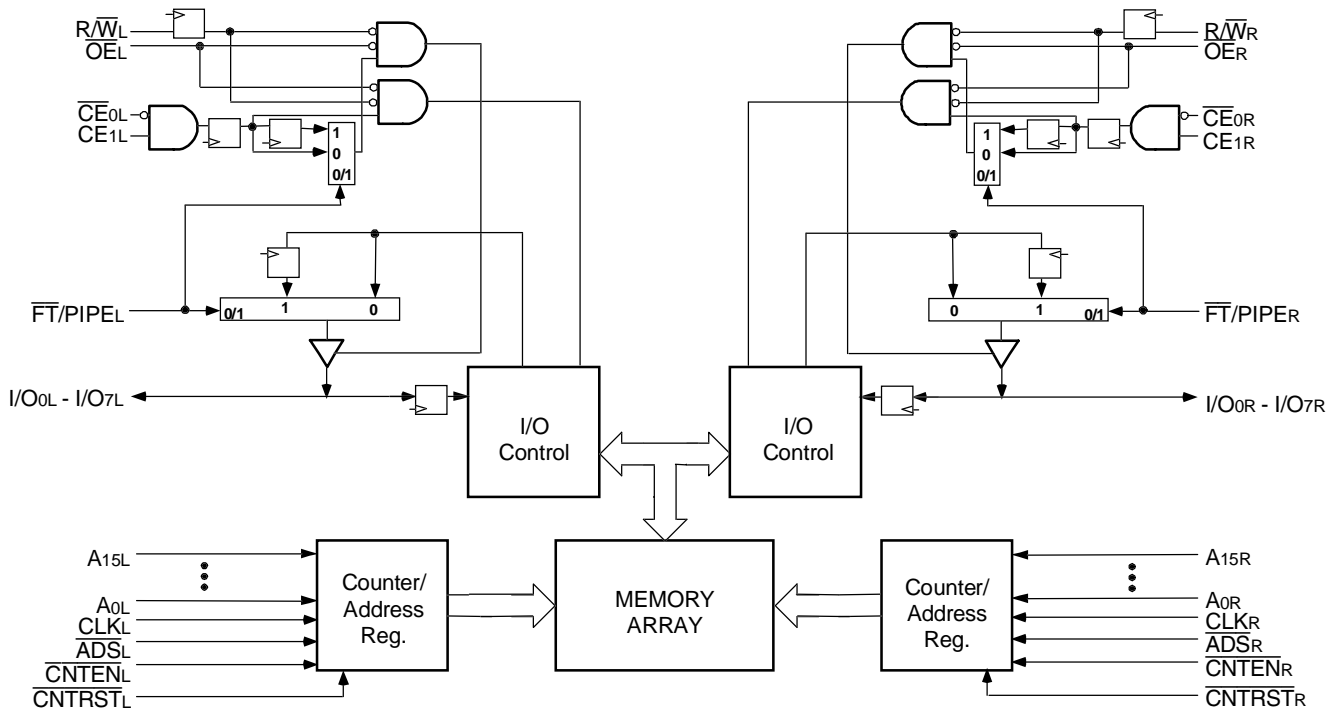
HIGH-SPEED 3.3V 64K x 8 SYNCHRONOUS DUAL-PORT STATIC RAM

IDT70V9089S/L

Features:

- ♦ True Dual-Ported memory cells which allow simultaneous access of the same memory location
- ♦ High-speed clock to data access
 - Commercial: 9/12/15ns (max.)
- ♦ Low-power operation
 - IDT70V9089S
Active: 429mW (typ.)
Standby: 3.3mW (typ.)
 - IDT70V9089L
Active: 429mW (typ.)
Standby: 660mW (typ.)
- ♦ Flow-Through or Pipelined output mode on either port via the FT/PIPE pin
- ♦ Counter enable and reset features
- ♦ Dual chip enables allow for depth expansion without additional logic
- ♦ Full synchronous operation on both ports
 - 4ns setup to clock and 1ns hold on all control, data, and address inputs
 - Data input, address, and control registers
 - Fast 9ns clock to data out in the Pipelined output mode
 - Self-timed write allows fast cycle time
 - 15ns cycle time, 66MHz operation in the Pipelined output mode
- ♦ LVTTTL-compatible, single 3.3V ($\pm 0.3V$) power supply
- ♦ Industrial temperature range ($-40^{\circ}C$ to $+85^{\circ}C$) is available for selected speeds
- ♦ Available in a 100 pin Thin Quad Flatpack (TQFP) package

Functional Block Diagram



3750 drw 01

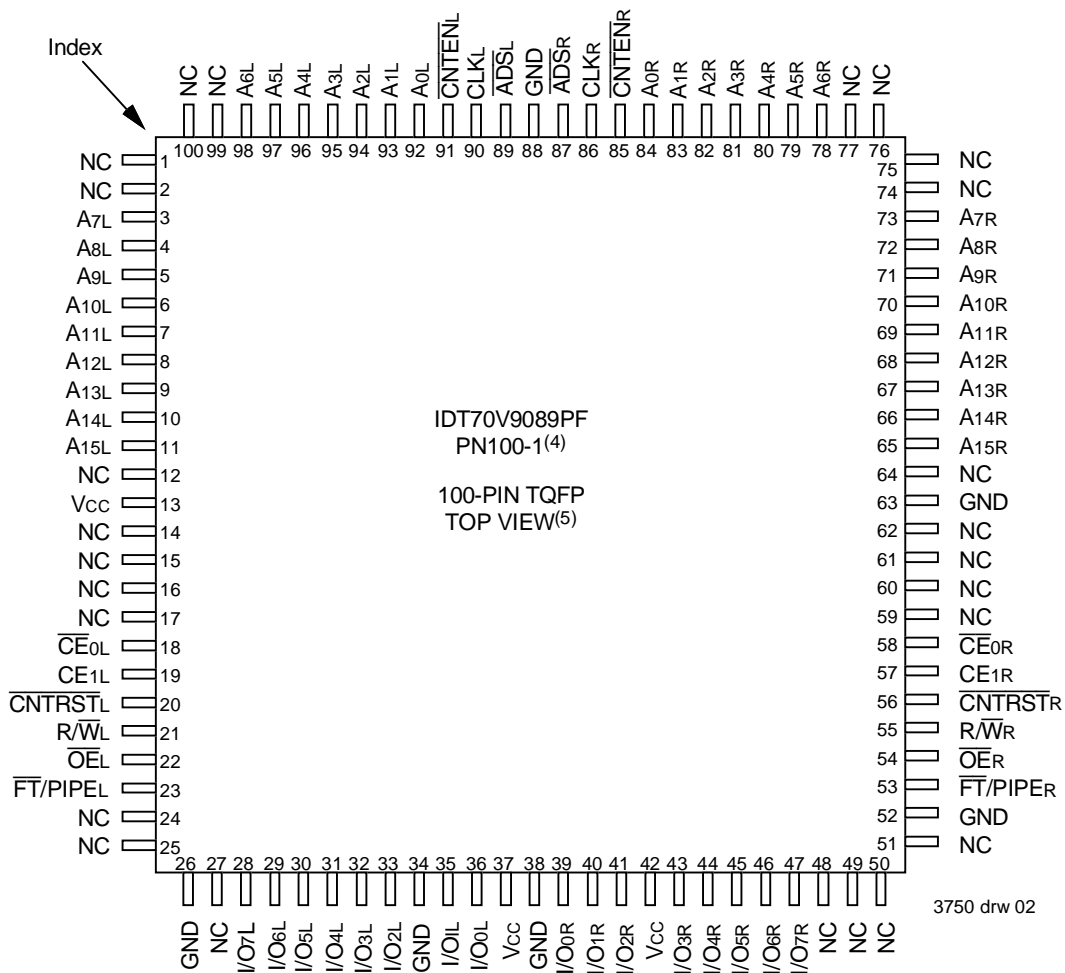
JANUARY 2001

Description:

The IDT70V9089 is a high-speed 64K x 8 bit synchronous Dual-Port RAM. The memory array utilizes Dual-Port memory cells to allow simultaneous access of any address from both ports. Registers on control, data, and address inputs provide minimal setup and hold times. The timing latitude provided by this approach allows systems to be designed with very short cycle times.

With an input data register, the IDT70V9089 has been optimized for applications having unidirectional or bidirectional data flow in bursts. An automatic power down feature, controlled by CE0 and CE1, permits the on-chip circuitry of each port to enter a very low standby power mode. Fabricated using IDT's CMOS high-performance technology, these devices typically operate on only 429mW of power.

Pin Configurations^(1,2,3)



NOTES:

1. All Vcc pins must be connected to power supply.
2. All GND pins must be connected to ground.
3. Package body is approximately 14mm x 14mm x 1.4mm.
4. This package code is used to reference the package diagram.
5. This text does not indicate orientation of the actual part-marking.

Pin Names

Left Port	Right Port	Names
\overline{CE}_{0L} , CE _{1L}	\overline{CE}_{0R} , CE _{1R}	Chip Enables
R/\overline{W}_L	R/\overline{W}_R	Read/Write Enable
\overline{OE}_L	\overline{OE}_R	Output Enable
A _{0L} - A _{15L}	A _{0R} - A _{15R}	Address
I/O _{0L} - I/O _{7L}	I/O _{0R} - I/O _{7R}	Data Input/Output
CLK _L	CLK _R	Clock
\overline{ADS}_L	\overline{ADS}_R	Address Strobe
\overline{CNTEN}_L	\overline{CNTEN}_R	Counter Enable
\overline{CNTRST}_L	\overline{CNTRST}_R	Counter Reset
$\overline{FT}/\overline{PIPEL}$	$\overline{FT}/\overline{PIPER}$	Flow-Through/Pipeline
VCC		Power
GND		Ground

3750 tbl 01

Truth Table I—Read/Write and Enable Control^(1,2,3)

\overline{OE}	CLK	\overline{CE}_0	CE ₁	R/ \overline{W}	I/O ₀₋₇	Mode
X	↑	H	X	X	High-Z	Deselected
X	↑	X	L	X	High-Z	Deselected
X	↑	L	H	L	D _{IN}	Write
L	↑	L	H	H	D _{OUT}	Read
H	X	L	H	X	High-Z	Outputs Disabled

3750 tbl 02

NOTES:

- "H" = V_{IH}, "L" = V_{IL}, "X" = Don't Care.
- \overline{ADS} , \overline{CNTEN} , \overline{CNTRST} = X.
- \overline{OE} is an asynchronous input signal.

Truth Table II—Address Counter Control^(1,2)

Address	Previous Address	Addr Used	CLK ⁽⁶⁾	\overline{ADS}	\overline{CNTEN}	\overline{CNTRST}	I/O ⁽³⁾	MODE
X	X	0	↑	X	X	L ⁽⁴⁾	D _{IO} (0)	Counter Reset to Address 0
A _n	X	A _n	↑	L ⁽⁴⁾	X	H	D _{IO} (n)	External Address Used
A _n	A _p	A _p	↑	H	H	H	D _{IO} (p)	External Address Blocked—Counter disabled (A _p reused)
X	A _p	A _p + 1	↑	H	L ⁽⁵⁾	H	D _{IO} (p+1)	Counter Enabled—Internal Address generation

3750 tbl 03

NOTES:

- "H" = V_{IH}, "L" = V_{IL}, "X" = Don't Care.
- \overline{CE}_0 and \overline{OE} = V_{IL}; CE₁ and R/ \overline{W} = V_{IH}.
- Outputs configured in Flow-Through Output mode; if outputs are in Pipelined mode the data out will be delayed by one cycle.
- \overline{ADS} is independent of all other signals including \overline{CE}_0 and CE₁.
- The address counter advances if \overline{CNTEN} = V_{IL} on the rising edge of CLK, regardless of all other signals including \overline{CE}_0 and CE₁.

Recommended Operating Temperature and Supply Voltage^(1,2)

Grade	Ambient Temperature	GND	V _{CC}
Commercial	0°C to +70°C	0V	3.3V ± 0.3V
Industrial	-40°C to +85°C	0V	3.3V ± 0.3V

3750 tbl 04

NOTES:

1. This is the parameter T_A. This is the "instant on" case temperature.
2. Industrial temperature: for specific speeds, packages and powers contact your sales office.

Recommended DC Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{CC}	Supply Voltage	3.0	3.3	3.6	V
GND	Ground	0	0	0	V
V _{IH}	Input High Voltage	2.2	—	V _{CC} + 0.3V ⁽¹⁾	V
V _{IL}	Input Low Voltage	-0.3 ⁽²⁾	—	0.8	V

3750 tbl 05

NOTES:

1. V_{TERM} must not exceed V_{CC} + 0.3V.
2. V_{IL} ≥ -1.5V for pulse width less than 10ns.

Absolute Maximum Ratings⁽¹⁾

Symbol	Rating	Commercial & Industrial	Unit
V _{TERM} ⁽²⁾	Terminal Voltage with Respect to GND	-0.5 to +4.6	V
T _{BIAS}	Temperature Under Bias	-55 to +125	°C
T _{STG}	Storage Temperature	-65 to +150	°C
I _{OUT}	DC Output Current	50	mA

3750 tbl 06

NOTES:

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. V_{TERM} must not exceed V_{CC} + 0.3V for more than 25% of the cycle time or 10ns maximum, and is limited to ≤ 20mA for the period of V_{TERM} ≥ V_{CC} + 0.3V.

Capacitance (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions ⁽²⁾	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 3dV	9	pF
C _{OUT} ⁽³⁾	Output Capacitance	V _{OUT} = 3dV	10	pF

3750 tbl 07

NOTES:

1. These parameters are determined by device characterization, but are not production tested.
2. 3dV references the interpolated capacitance when the input and output switch from 0V to 3V or from 3V to 0V.
3. C_{OUT} also references C_{I/O}.

DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range ($V_{CC} = 3.3V \pm 0.3V$)

Symbol	Parameter	Test Conditions	70V9089S		70V9089L		Unit
			Min.	Max.	Min.	Max.	
$ I_{II} $	Input Leakage Current ⁽¹⁾	$V_{CC} = 3.3V, V_{IN} = 0V \text{ to } V_{CC}$	—	10	—	5	μA
$ I_{LO} $	Output Leakage Current	$\overline{CE}_0 = V_{IH} \text{ or } CE_1 = V_{IL}, V_{OUT} = 0V \text{ to } V_{CC}$	—	10	—	5	μA
V_{OL}	Output Low Voltage	$I_{OL} = +4mA$	—	0.4	—	0.4	V
V_{OH}	Output High Voltage	$I_{OH} = -4mA$	2.4	—	2.4	—	V

NOTE:

- At $V_{CC} \leq 2.0V$ input leakages are undefined.

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DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range^(6,7) ($V_{CC} = 3.3V \pm 0.3V$)

Symbol	Parameter	Test Condition	Version	70V9089X9 Com'l Only		70V9089X12 Com'l Only		70V9089X15 Com'l Only		Unit	
				Typ. ⁽⁴⁾	Max.	Typ. ⁽⁴⁾	Max.	Typ. ⁽⁴⁾	Max.		
I_{CC}	Dynamic Operating Current (Both Ports Active)	$\overline{CE}_L \text{ and } \overline{CE}_R = V_{IL}$ Outputs Disabled $f = f_{MAX}^{(1)}$	COM'L	S	180	260	150	240	130	220	mA
				L	180	225	150	205	130	185	
ISB1	Standby Current (Both Ports - TTL Level Inputs)	$\overline{CE}_L \text{ and } \overline{CE}_R = V_{IH}$ $f = f_{MAX}^{(1)}$	COM'L	S	50	75	40	65	30	55	mA
				L	50	65	40	50	30	35	
ISB2	Standby Current (One Port - TTL Level Inputs)	$\overline{CE}_A^* = V_{IL} \text{ and } \overline{CE}_B^* = V_{IH}^{(3)}$ Active Port Outputs Disabled, $f = f_{MAX}^{(1)}$	COM'L	S	110	170	100	160	90	150	mA
				L	110	150	100	140	90	130	
ISB3	Full Standby Current (Both Ports - CMOS Level Inputs)	Both Ports \overline{CE}_R and $\overline{CE}_L \geq V_{CC} - 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V, f = 0^{(2)}$	COM'L	S	1.0	5	1.0	5	1.0	5	mA
				L	0.4	3	0.4	3	0.4	3	
ISB4	Full Standby Current (One Port - CMOS Level Inputs)	$\overline{CE}_A^* \leq 0.2V$ and $\overline{CE}_B^* \geq V_{CC} - 0.2V^{(5)}$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$, Active Port Outputs Disabled, $f = f_{MAX}^{(1)}$	COM'L	S	100	160	90	150	80	140	mA
				L	100	140	90	130	80	120	
			IND	S	—	—	—	—	—	—	
				L	—	—	—	—	—	—	

NOTES:

- At $f = f_{MAX}$, address and control lines (except Output Enable) are cycling at the maximum frequency clock cycle of $1/t_{cvc}$, using "AC TEST CONDITIONS" at input levels of GND to 3V.
- $f = 0$ means no address, clock, or control lines change. Applies only to input at CMOS level standby.
- Port "A" may be either left or right port. Port "B" is the opposite from port "A".
- $V_{CC} = 3.3V, T_A = 25^\circ C$ for Typ, and are not production tested. $I_{CC DC}(f=0) = 90mA$ (Typ).
- $\overline{CE}_X = V_{IL}$ means $\overline{CE}_{0X} = V_{IL}$ and $CE_{1X} = V_{IH}$
 $\overline{CE}_X = V_{IH}$ means $\overline{CE}_{0X} = V_{IH}$ or $CE_{1X} = V_{IL}$
 $\overline{CE}_X \leq 0.2V$ means $\overline{CE}_{0X} \leq 0.2V$ and $CE_{1X} \geq V_{CC} - 0.2V$
 $\overline{CE}_X \geq V_{CC} - 0.2V$ means $\overline{CE}_{0X} \geq V_{CC} - 0.2V$ or $CE_{1X} \leq 0.2V$
 "X" represents "L" for left port or "R" for right port.
- "X" in part number indicates power rating (S or L).
- Industrial temperature: for specific speeds, packages and powers contact your sales office.

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AC Test Conditions

Input Pulse Levels	GND to 3.0V
Input Rise/Fall Times	3ns Max.
Input Timing Reference Levels	1.5V
Output Reference Levels	1.5V
Output Load	Figures 1,2 and 3

3750 tbl 10

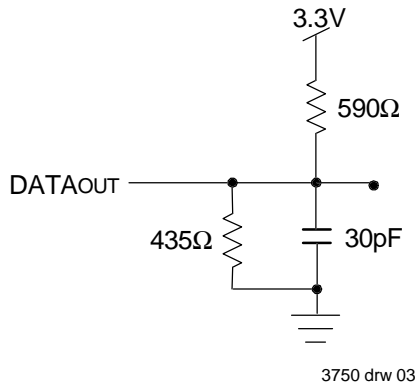


Figure 1. AC Output Test load.

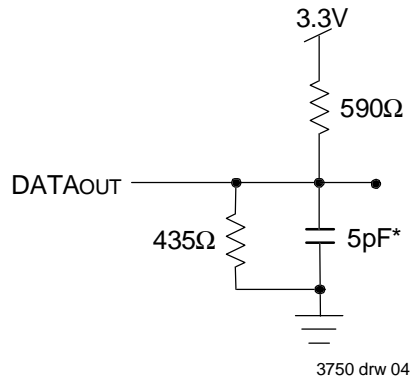


Figure 2. Output Test Load
(For t_{CKLZ}, t_{CKHZ}, t_{OLZ}, and t_{OHZ}).
*Including scope and jig.

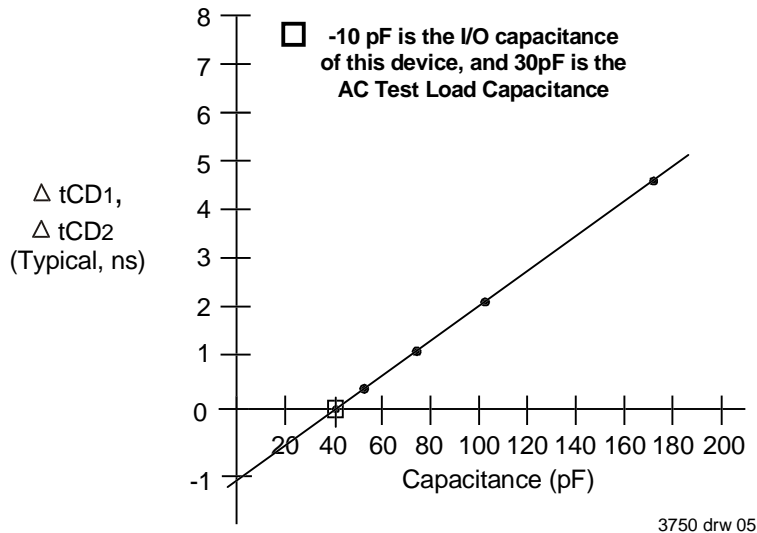


Figure 3. Typical Output Derating (Lumped Capacitive Load).

AC Electrical Characteristics Over the Operating Temperature Range (Read and Write Cycle Timing)^(3,4,5) ($V_{CC} = 3.3V \pm 0.3$, $T_A = 0^{\circ}C$ to $+70^{\circ}C$)

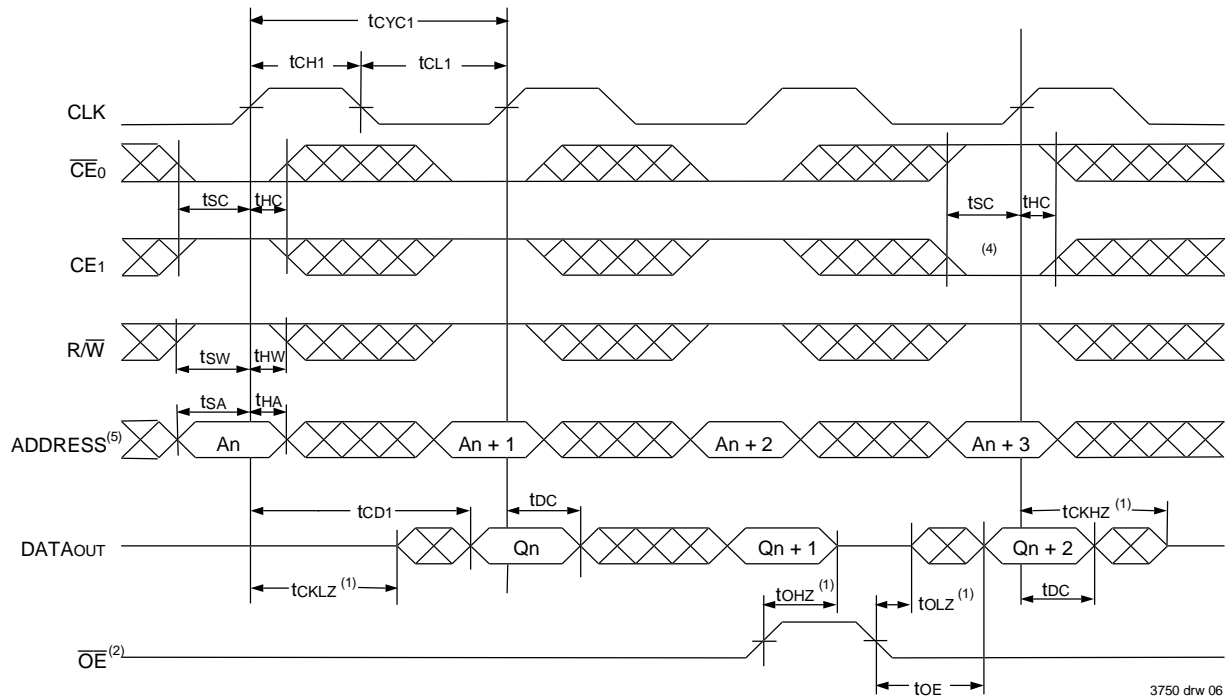
Symbol	Parameter	70V9089X9 Com1 Only		70V9089X12 Com1 Only		70V9089X15 Com1 Only		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t _{CYC1}	Clock Cycle Time (Flow-Through) ⁽²⁾	25	—	30	—	35	—	ns
t _{CYC2}	Clock Cycle Time (Pipelined) ⁽²⁾	15	—	20	—	25	—	ns
t _{CH1}	Clock High Time (Flow-Through) ⁽²⁾	12	—	12	—	12	—	ns
t _{CL1}	Clock Low Time (Flow-Through) ⁽²⁾	12	—	12	—	12	—	ns
t _{CH2}	Clock High Time (Pipelined) ⁽²⁾	6	—	8	—	10	—	ns
t _{CL2}	Clock Low Time (Pipelined) ⁽²⁾	6	—	8	—	10	—	ns
t _R	Clock Rise Time	—	3	—	3	—	3	ns
t _F	Clock Fall Time	—	3	—	3	—	3	ns
t _{SA}	Address Setup Time	4	—	4	—	4	—	ns
t _{HA}	Address Hold Time	1	—	1	—	1	—	ns
t _{SC}	Chip Enable Setup Time	4	—	4	—	4	—	ns
t _{HC}	Chip Enable Hold Time	1	—	1	—	1	—	ns
t _{SW}	R \bar{W} Setup Time	4	—	4	—	4	—	ns
t _{HW}	R \bar{W} Hold Time	1	—	1	—	1	—	ns
t _{SD}	Input Data Setup Time	4	—	4	—	4	—	ns
t _{HD}	Input Data Hold Time	1	—	1	—	1	—	ns
t _{SAD}	\overline{ADS} Setup Time	4	—	4	—	4	—	ns
t _{HAD}	\overline{ADS} Hold Time	1	—	1	—	1	—	ns
t _{SCN}	\overline{CNTEN} Setup Time	4	—	4	—	4	—	ns
t _{HCN}	\overline{CNTEN} Hold Time	1	—	1	—	1	—	ns
t _{SRST}	\overline{CNTRST} Setup Time	4	—	4	—	4	—	ns
t _{HRST}	\overline{CNTRST} Hold Time	1	—	1	—	1	—	ns
t _{OE}	Output Enable to Data Valid	—	12	—	12	—	15	ns
t _{OLZ}	Output Enable to Output Low-Z ⁽¹⁾	2	—	2	—	2	—	ns
t _{OHZ}	Output Enable to Output High-Z ⁽¹⁾	1	7	1	7	1	7	ns
t _{CD1}	Clock to Data Valid (Flow-Through) ⁽²⁾	—	20	—	25	—	30	ns
t _{CD2}	Clock to Data Valid (Pipelined) ⁽²⁾	—	9	—	12	—	15	ns
t _{DC}	Data Output Hold After Clock High	2	—	2	—	2	—	ns
t _{CKHZ}	Clock High to Output High-Z ⁽¹⁾	2	9	2	9	2	9	ns
t _{CKLZ}	Clock High to Output Low-Z ⁽¹⁾	2	—	2	—	2	—	ns
Port-to-Port Delay								
t _{CWDD}	Write Port Clock High to Read Data Delay	—	35	—	40	—	50	ns
t _{CCS}	Clock-to-Clock Setup Time	—	15	—	15	—	20	ns

NOTES:

3750 tbl 11

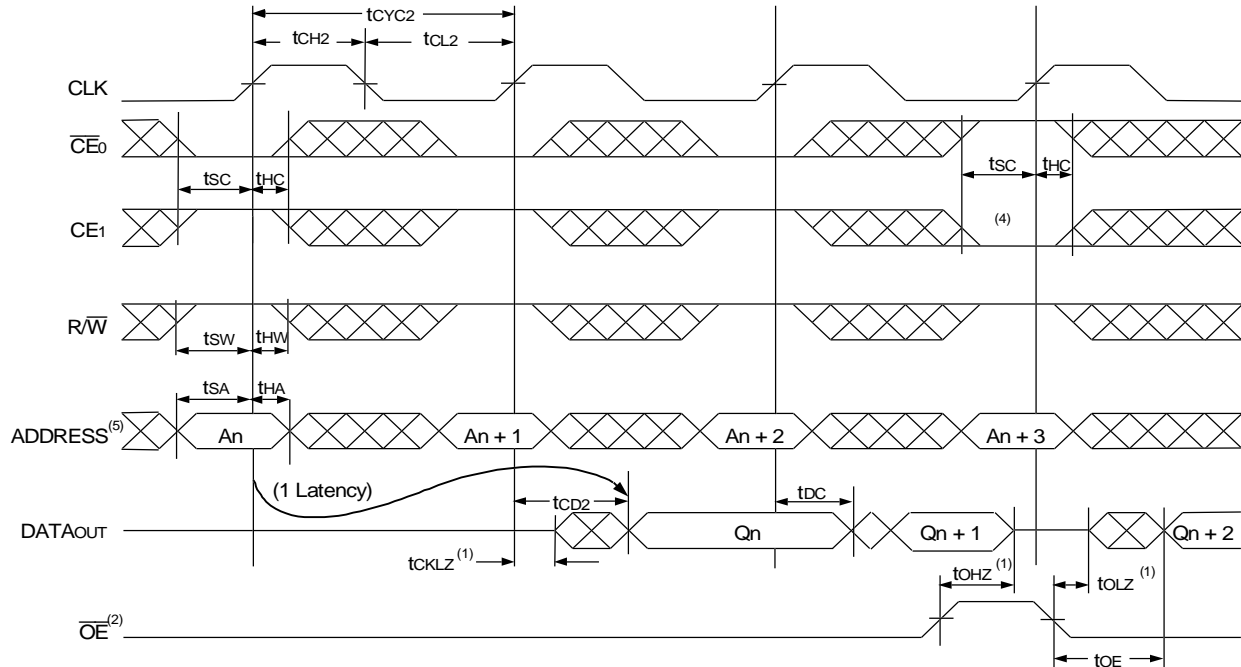
- Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2). This parameter is guaranteed by device characterization, but is not production tested.
- The Pipelined output parameters (t_{CYC2}, t_{CD2}) apply to either or both left and right ports when $\overline{FT}/PIPE = V_{IH}$. Flow-through parameters (t_{CYC1}, t_{CD1}) apply when $\overline{FT}/PIPE = V_{IL}$ for that port.
- All input signals are synchronous with respect to the clock except for the asynchronous Output Enable (\overline{OE}) and $\overline{FT}/PIPE$. $\overline{FT}/PIPE$ should be treated as a DC signal, i.e. steady state during operation.
- 'X' in part number indicates power rating (S or L).
- Industrial temperature: for specific speeds, packages and powers contact your sales office.

Timing Waveform of Read Cycle for Flow-Through Output (FT/PIPE"x" = V_{IL})(3,6)



3750 drw 06

Timing Waveform of Read Cycle for Pipelined Output (FT/PIPE"x" = V_{IH})(3,6)

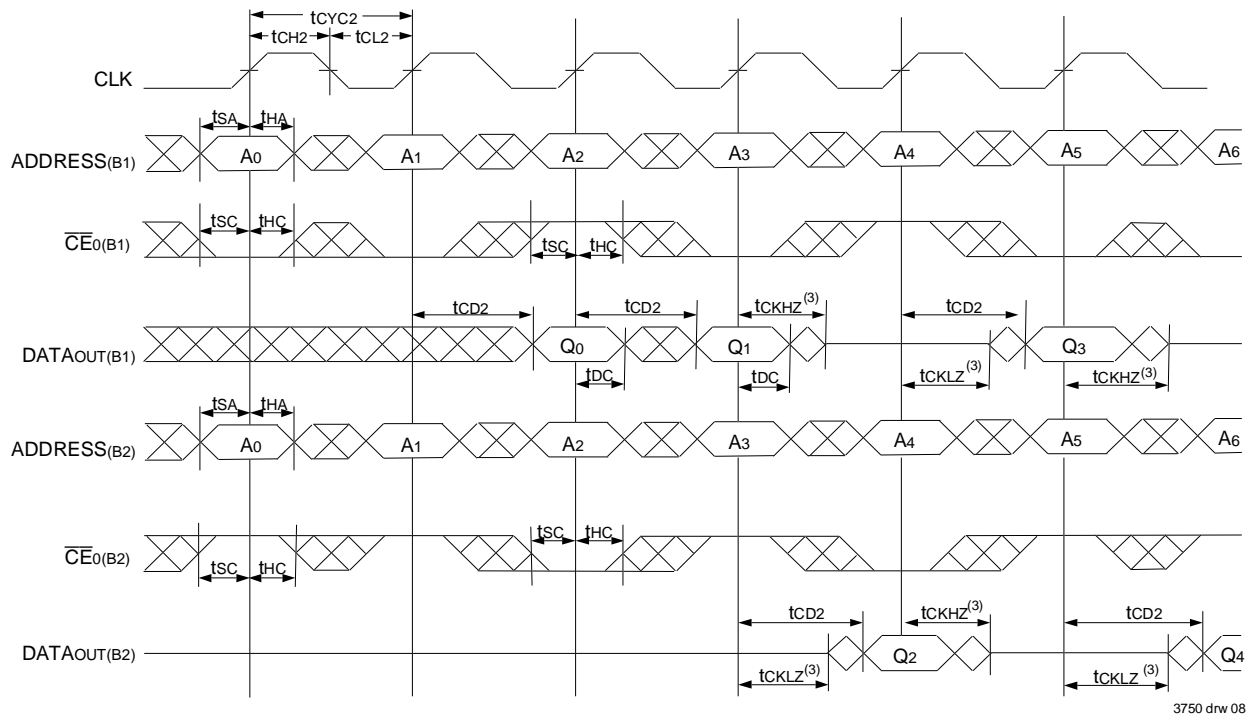


3750 drw 07

NOTES:

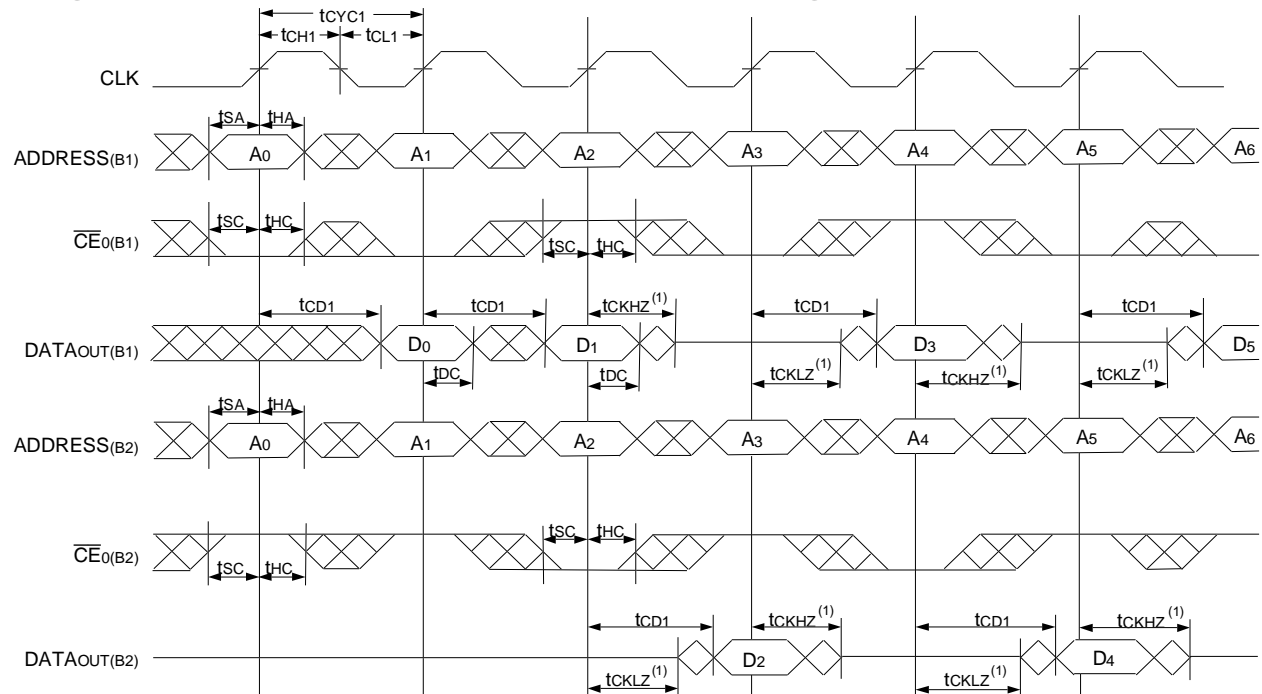
1. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2).
2. OE is asynchronously controlled; all other inputs are synchronous to the rising clock edge.
3. ADS = V_{IL}, CNTEN and CNTRST = V_{IH}.
4. The output is disabled (High-impedance state) by CE0 = V_{IH} or CE1 = V_{IL} following the next rising edge of clock. Refer to Truth Table 1.
5. Addresses do not have to be accessed sequentially since ADS = V_{IL} constantly loads the address on the rising edge of the CLK; numbers are for reference use only.
6. "x" denotes Left or Right port. The diagram is with respect to that port.

Timing Waveform of a Bank Select Pipelined Read^(1,2)



3750 drw 08

Timing Waveform of a Bank Select Flow-Through Read⁽⁶⁾

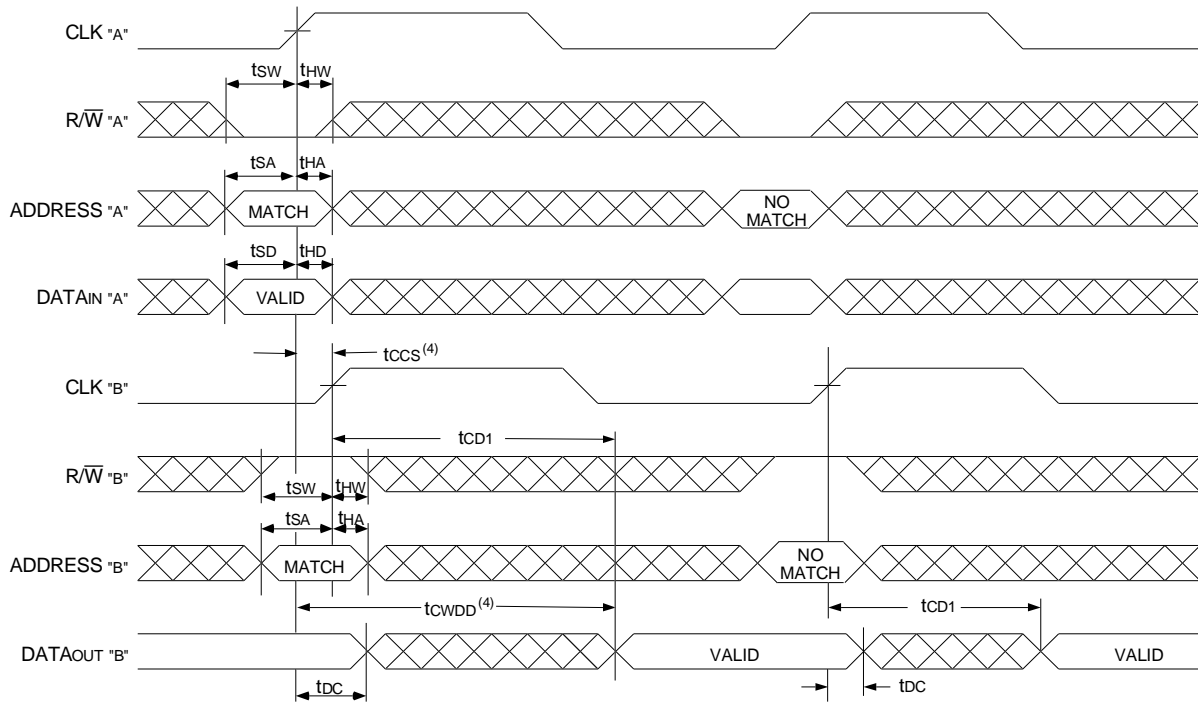


3750 drw 08a

NOTES:

1. B1 Represents Bank #1; B2 Represents Bank #2. Each Bank consists of one IDT70V9089 for this waveform, and are setup for depth expansion in this example. ADDRESS(B1) = ADDRESS(B2) in this situation.
2. OE and ADS = V_{IL}; CE1(B1), CE1(B2), RW, CNTEN, and CNTRST = V_{IH}.
3. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2).
4. CE0 and ADS = V_{IL}; CE1, CNTEN, and CNTRST = V_{IH}.
5. OE = V_{IL} for the Right Port, which is being read from. OE = V_{IH} for the Left Port, which is being written to.
6. If $t_{CCS} \leq$ maximum specified, then data from right port READ is not valid until the maximum specified for t_{CWD} . If $t_{CCS} >$ maximum specified, then data from right port READ is not valid until $t_{CCS} + t_{CWD}$. t_{CWD} does not apply in this case.

Timing Waveform Port-to-Port Flow-Through Read(1,2,3,5)

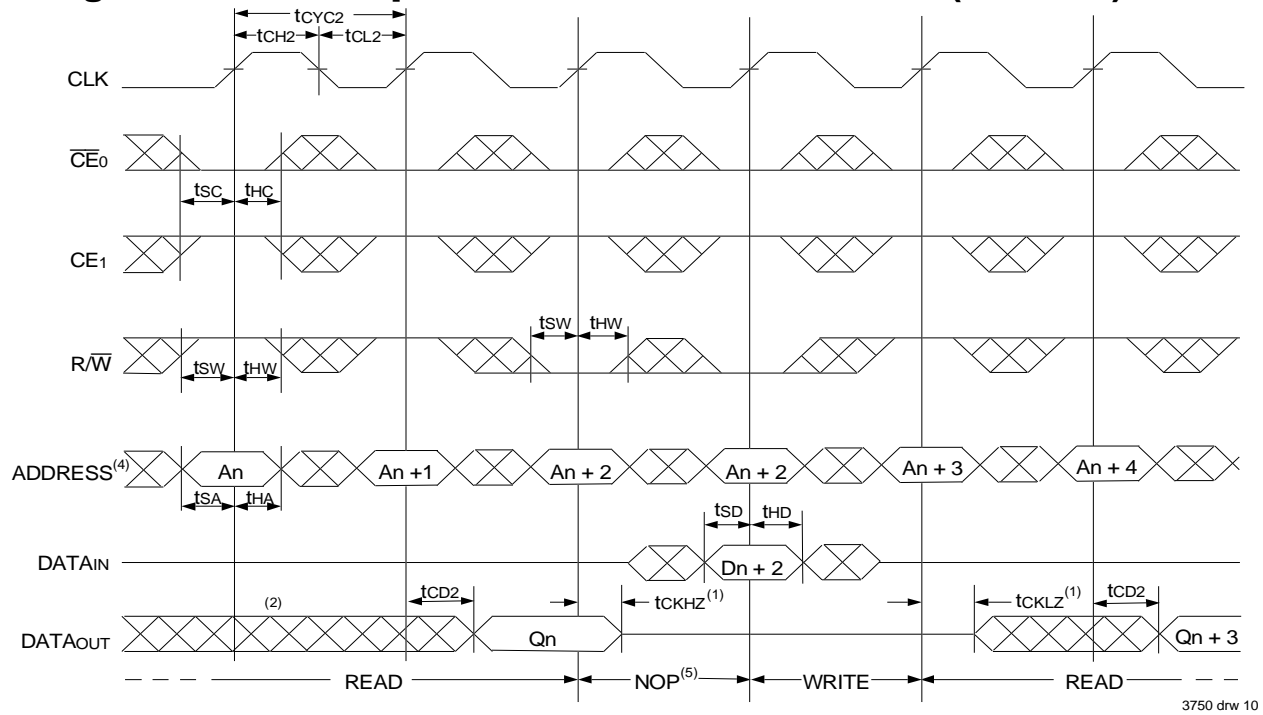


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NOTES:

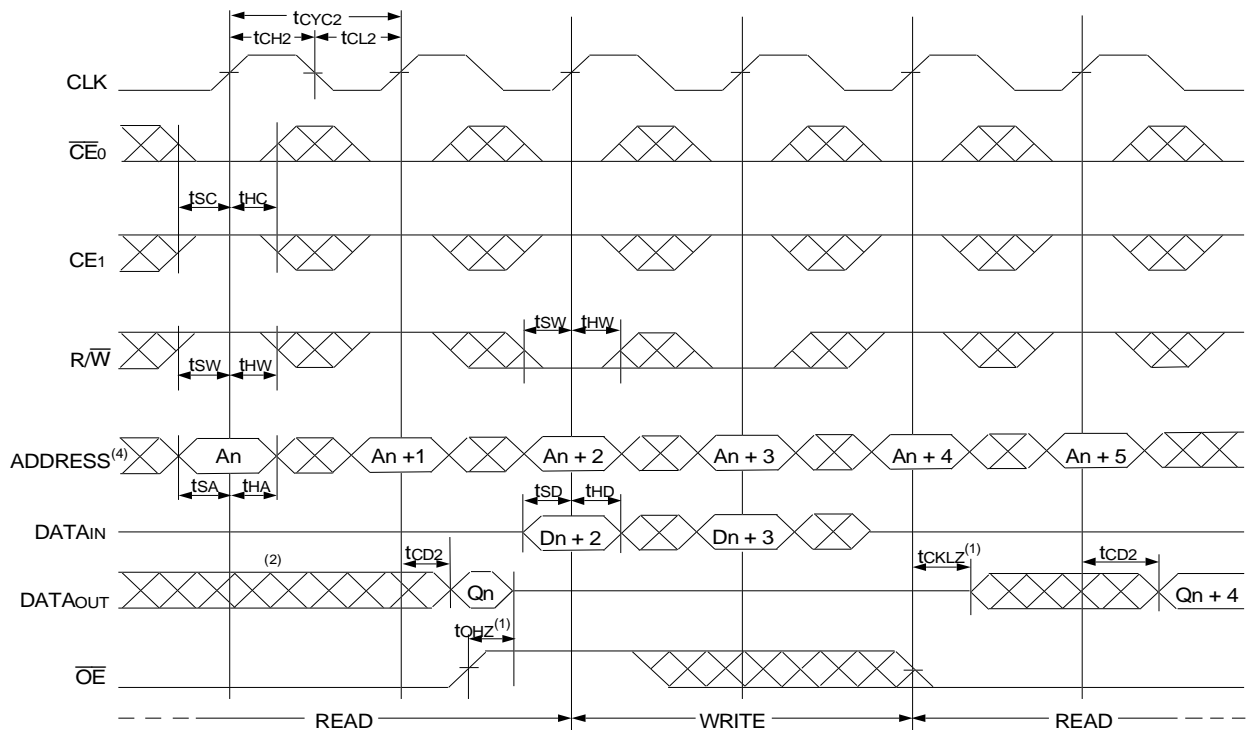
1. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2).
2. \overline{CE}_0 and $\overline{ADS} = V_{IL}$; CE_1 , \overline{CNTEN} , and $\overline{CNRST} = V_{IH}$.
3. $\overline{OE} = V_{IL}$ for the Port "B", which is being read from. $\overline{OE} = V_{IH}$ for the Port "A", which is being written to.
4. If $t_{CCS} \leq$ maximum specified, then data from right port READ is not valid until the maximum specified for t_{cWDD} .
If $t_{CCS} >$ maximum specified, then data from right port READ is not valid until $t_{CCS} + t_{CD1}$. t_{cWDD} does not apply in this case.
5. All timing is the same for both left and right ports. Port "A" may be either left or right port. Port "B" is the opposite of Port "A".

Timing Waveform of Pipelined Read-to-Write-to-Read ($\overline{OE} = V_{IL}$)⁽³⁾



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Timing Waveform of Pipelined Read-to-Write-to-Read (\overline{OE} Controlled)⁽³⁾

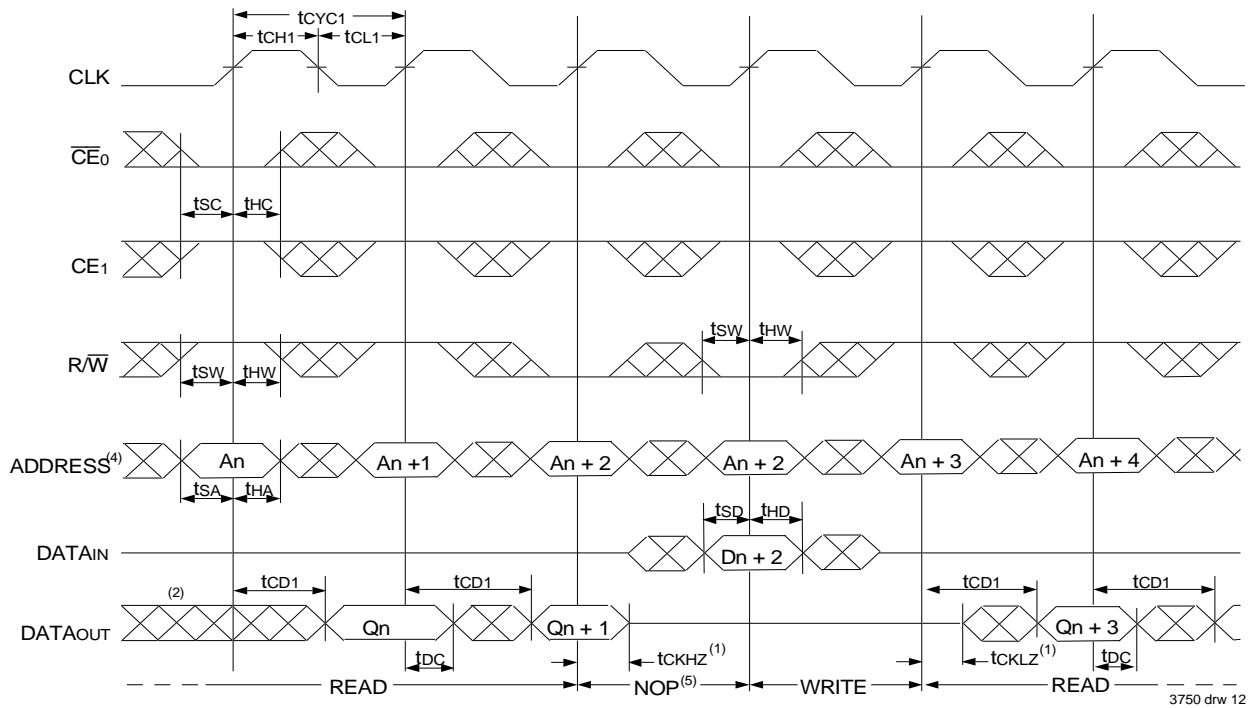


3750 drw 11

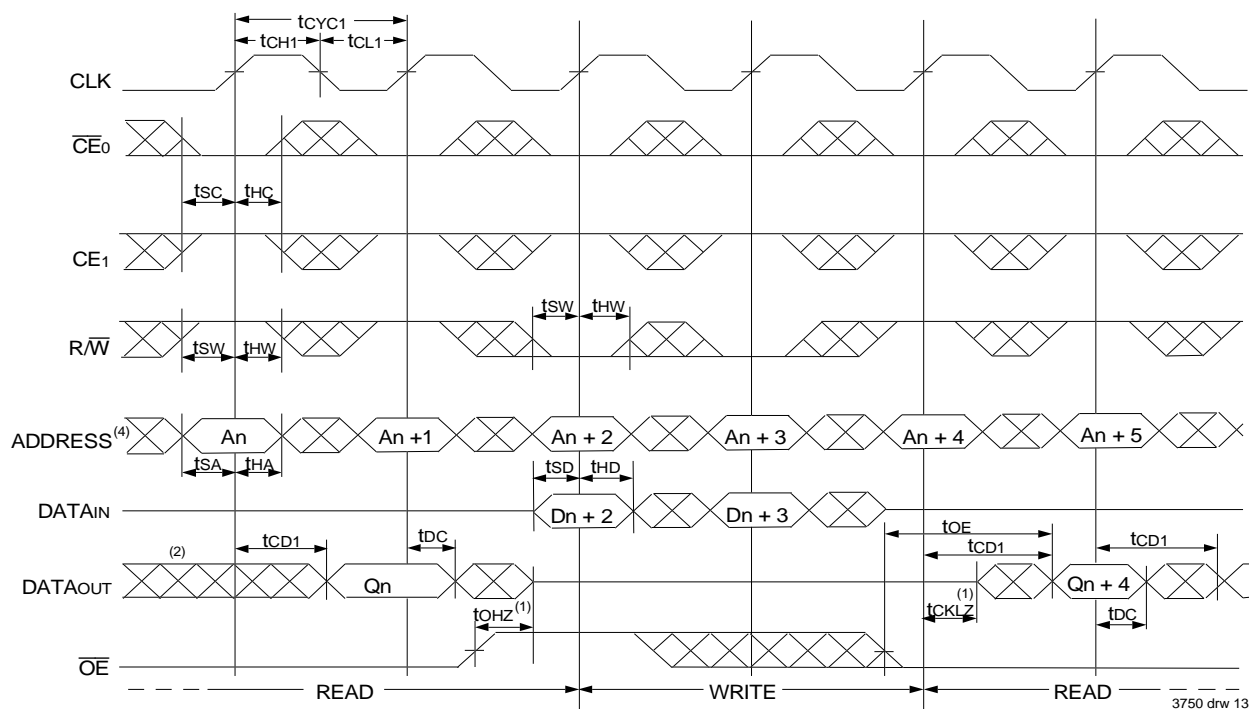
NOTES:

1. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2).
2. Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
3. \overline{CE}_0 and $\overline{ADS} = V_{IL}$; \overline{CE}_1 , \overline{CNTEN} , and $\overline{CNTRST} = V_{IH}$.
4. Addresses do not have to be accessed sequentially since $\overline{ADS} = V_{IL}$ constantly loads the address on the rising edge of the CLK; numbers are for reference use only.
5. "NOP" is "No Operation." Data in memory at the selected address may be corrupted and should be re-written to guarantee data integrity.

Timing Waveform of Flow-Through Read-to-Write-to-Read ($\overline{OE} = V_{IL}$)⁽³⁾



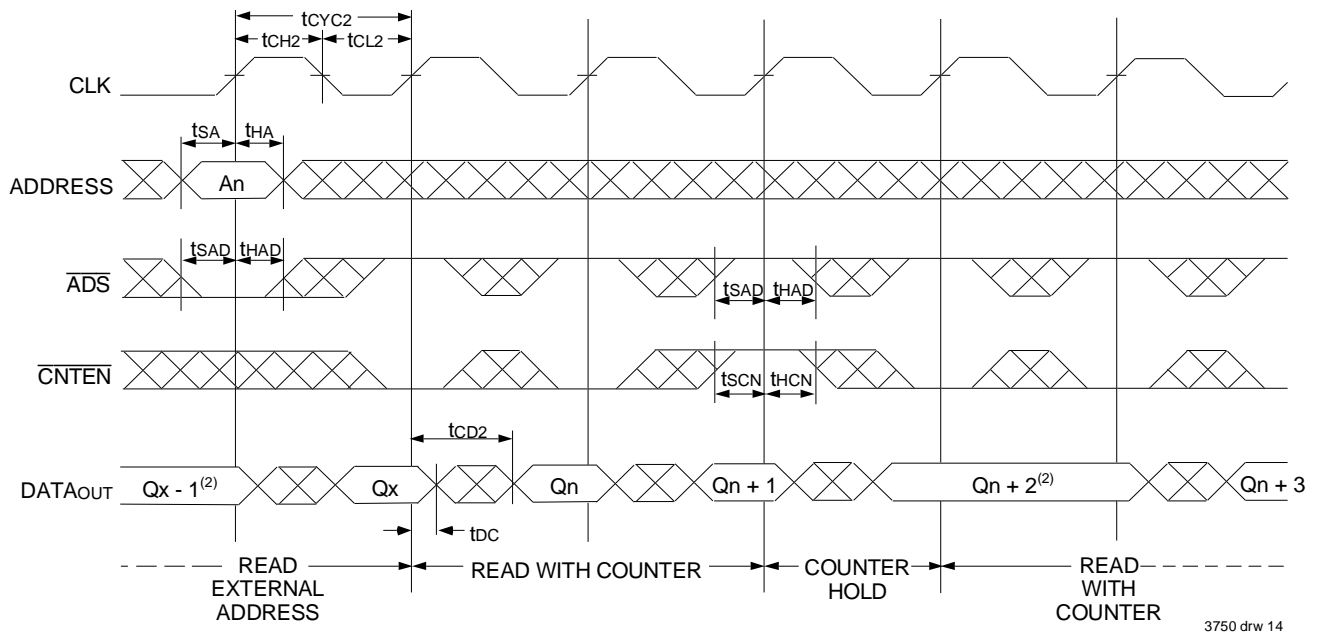
Timing Waveform of Flow-Through Read-to-Write-to-Read (\overline{OE} Controlled)⁽³⁾



NOTES:

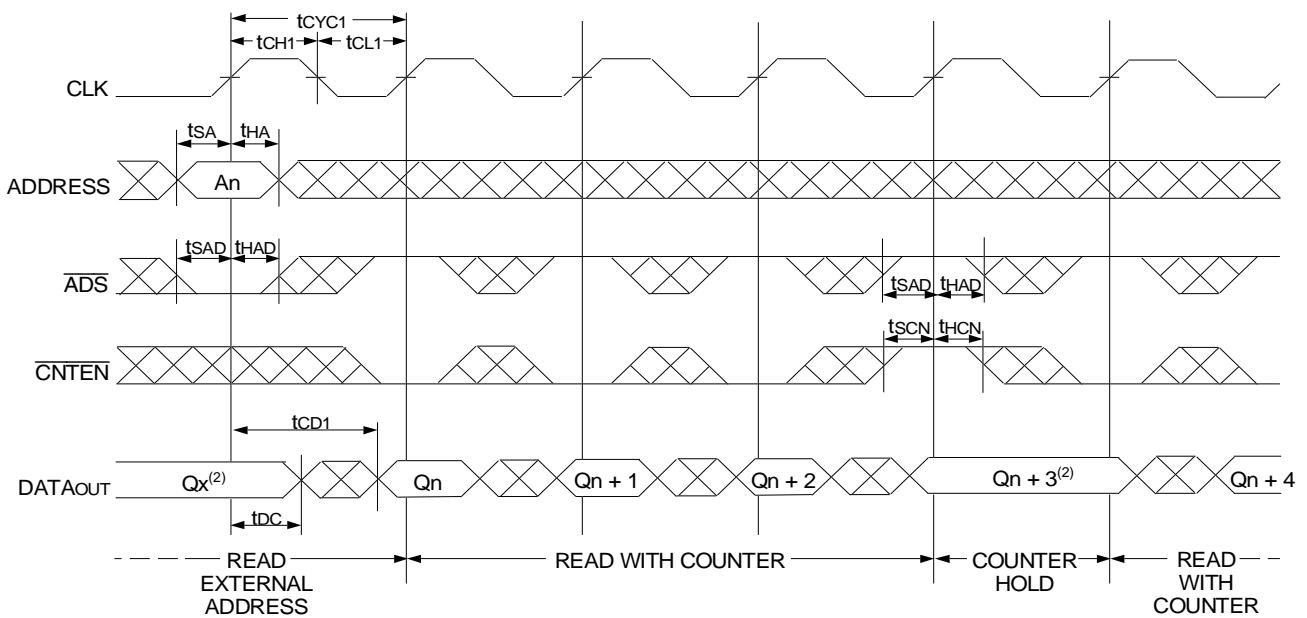
1. Transition is measured 0mV from Low or High-impedance voltage with the Output Test Load (Figure 2).
2. Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
3. $\overline{CE0}$ and $\overline{ADS} = V_{IL}$; $\overline{CE1}$, \overline{CNTEN} , and $\overline{CNTRST} = V_{IH}$.
4. Addresses do not have to be accessed sequentially since $\overline{ADS} = V_{IL}$ constantly loads the address on the rising edge of the CLK; numbers are for reference use only.
5. "NOP" is "No Operation." Data in memory at the selected address may be corrupted and should be re-written to guarantee data integrity.

Timing Waveform of Pipelined Read with Address Counter Advance⁽¹⁾



3750 drw 14

Timing Waveform of Flow-Through Counter Read with Address Counter Advance⁽¹⁾

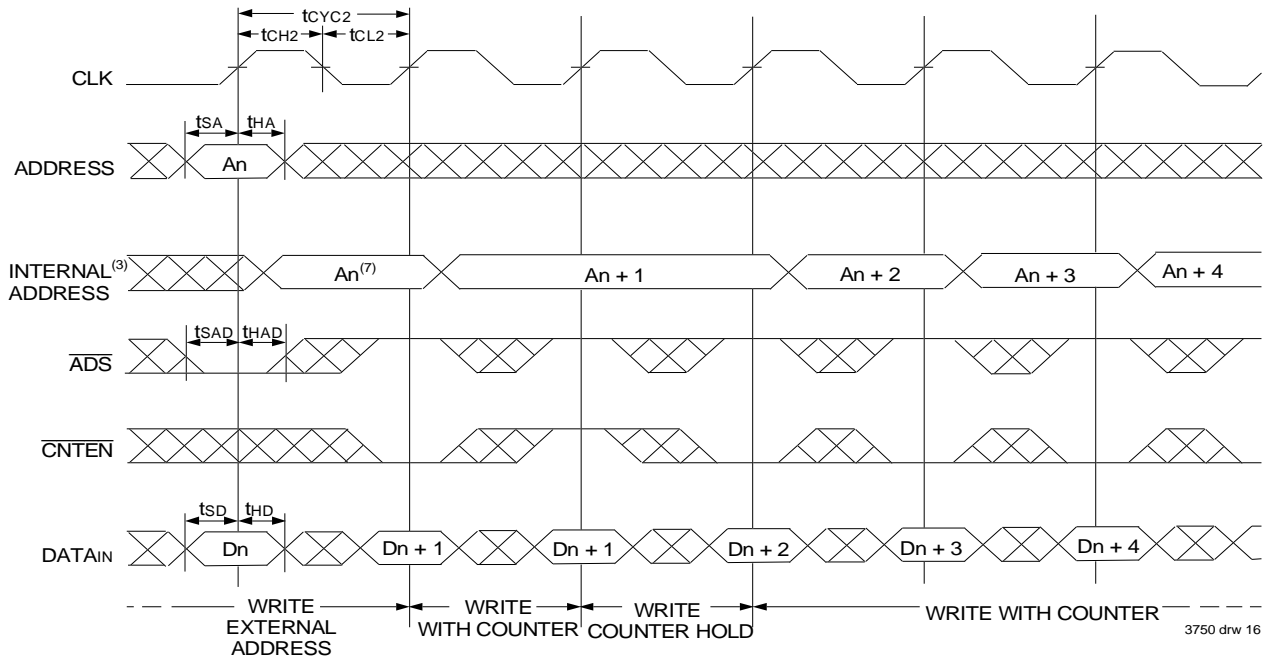


3750 drw 15

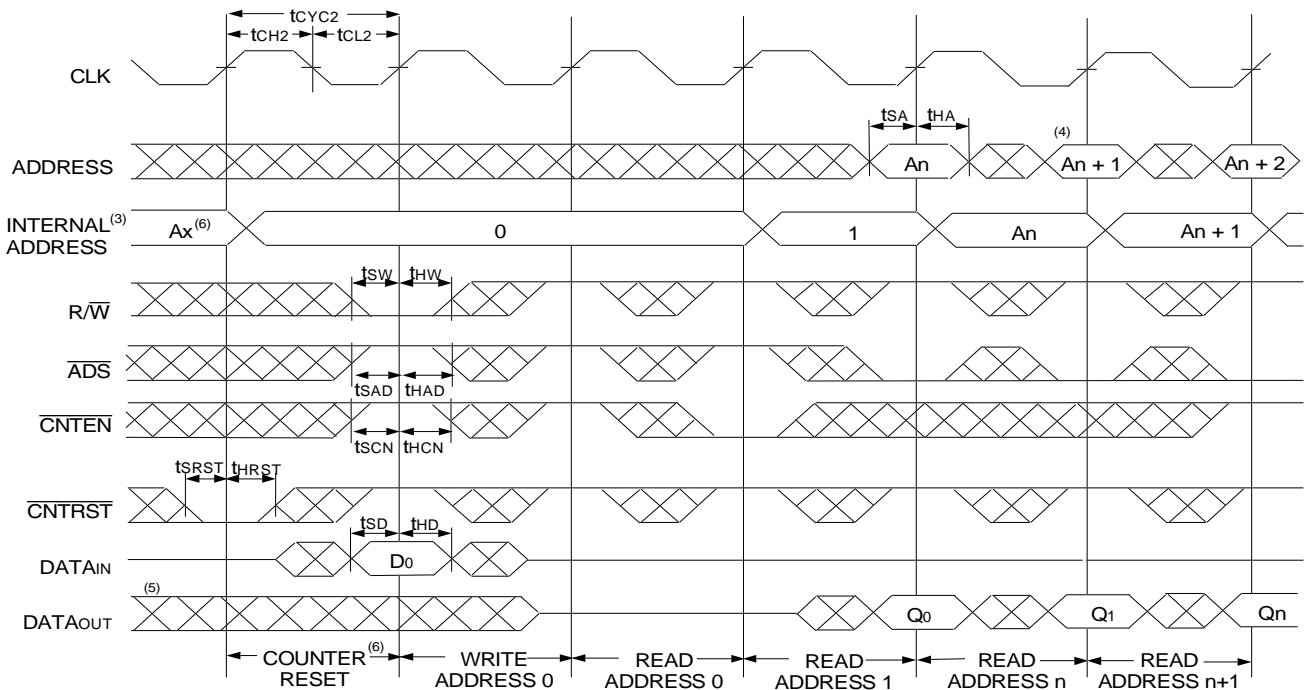
NOTES:

- $\overline{CE0}$ and $\overline{OE} = V_{IL}$; $CE1$, R/\overline{W} , and $\overline{CNTRST} = V_{IH}$.
- If there is no address change via $\overline{ADS} = V_{IL}$ (loading a new address) or $\overline{CNTEN} = V_{IL}$ (advancing the address), i.e. $\overline{ADS} = V_{IH}$ and $\overline{CNTEN} = V_{IH}$, then the data output remains constant for subsequent clocks.

Timing Waveform of Write with Address Counter Advance (Flow-Through or Pipelined Outputs)⁽¹⁾



Timing Waveform of Counter Reset (Pipelined Outputs)⁽²⁾



NOTES:

- \overline{CE}_0 and $\overline{R/W} = V_{IL}$; \overline{CE}_1 and $\overline{CNTRST} = V_{IH}$.
- $\overline{CE}_0 = V_{IL}$; $\overline{CE}_1 = V_{IH}$.
- The "Internal Address" is equal to the "External Address" when $\overline{ADS} = V_{IL}$ and equals the counter output when $\overline{ADS} = V_{IH}$.
- Addresses do not have to be accessed sequentially since $\overline{ADS} = V_{IL}$ constantly loads the address on the rising edge of the CLK; numbers are for reference use only.
- Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
- No dead cycle exists during counter reset. A READ or WRITE cycle may be coincidental with the counter reset. \overline{ADDR}_0 will be accessed. Extra cycles are shown here simply for clarification.
- $\overline{CNTEN} = V_{IL}$ advances Internal Address from 'An' to 'An +1'. The transition shown indicates the time required for the counter to advance. The 'An +1' address is written to during this cycle.

Functional Description

The IDT70V9089 provides a true synchronous Dual-Port Static RAM interface. Registered inputs provide minimal set-up and hold times on address, data, and all critical control inputs. All internal registers are clocked on the rising edge of the clock signal, however, the self-timed internal write pulse is independent of the LOW to HIGH transition of the clock signal.

An asynchronous output enable is provided to ease asynchronous bus interfacing. Counter enable inputs are also provided to stall the operation of the counter registers for fast interleaved memory applications.

A HIGH on $\overline{CE_0}$ or a LOW on CE_1 for one clock cycle will power down the internal circuitry to reduce static power consumption. Multiple chip enables allow easier banking of multiple IDT70V9089's for depth expansion configurations. When the Pipelined output mode is enabled, two cycles are required with $\overline{CE_0}$ LOW and CE_1 HIGH to re-activate the outputs.

Depth and Width Expansion

The IDT70V9089 features dual chip enables (refer to Truth Table I) in order to facilitate rapid and simple depth expansion with no requirements for external logic. Figure 4 illustrates how to control the various chip enables in order to expand two devices in depth.

The IDT70V9089 can also be used in applications requiring expanded width, as indicated in Figure 4. Since the banks are allocated at the discretion of the user, the external controller can be set up to drive the input signals for the various devices as required to allow for 16-bit or wider applications.

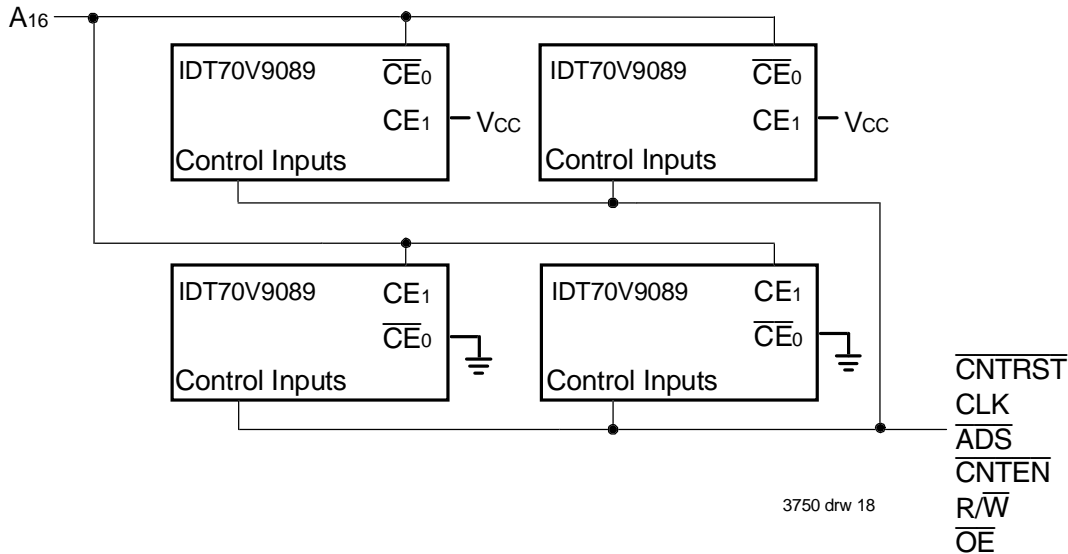
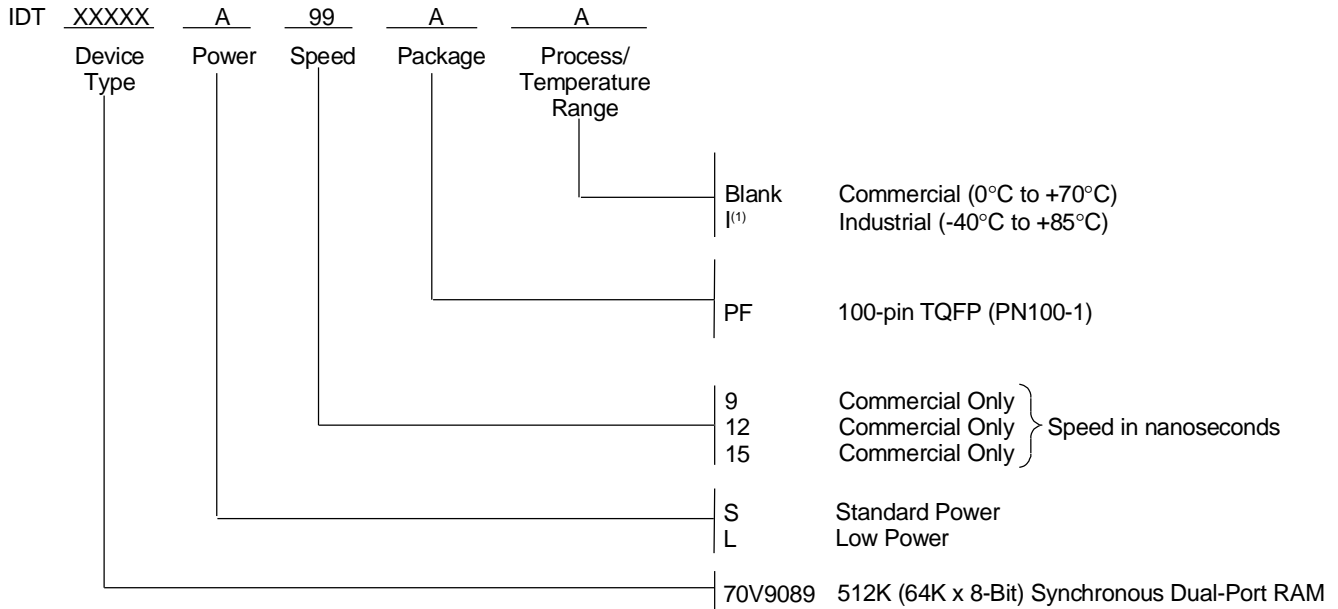


Figure 4. Depth and Width Expansion with IDT70V9089

Ordering Information



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NOTE:

1. Industrial temperature range is available.
 For specific speeds, packages and powers contact your sales office.

Ordering Information for Flow-through Devices

Old Flow-through Part	New Combined Part
70V908S/L25	70V9089S/L12
70V908S/L30	70V9089S/L15

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Datasheet Document History

- 1/18/99: Initiated datasheet document history
Converted to new format
Cosmetic and typographical corrections
Added additional notes to pin configurations
Page 14 Added Depth and Width Expansion section.
- 6/11/99: Page 3 Deleted note 6 for Table II
- 11/12/99: Replaced IDT logo
- 3/31/00: Combined Pipelined 70V9089 family and Flow-through 70V908 family offerings into one data sheet
Changed $\pm 200\text{mV}$ in waveform notes to 0mV
Added corresponding part chart with ordering information
- 1/10/01: Page 3 Changed information in Truth Table II
Page 4 Increased storage temperature parameters
Clarified T_A parameter
Page 5 DC Electrical parameters—changed wording from "open" to "disabled"
Removed Preliminary Status



CORPORATE HEADQUARTERS
2975 Stender Way
Santa Clara, CA 95054

for SALES:
800-345-7015 or 408-727-6116
fax: 408-492-8674
www.idt.com

for Tech Support:
831-754-4613
DualPortHelp@idt.com

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