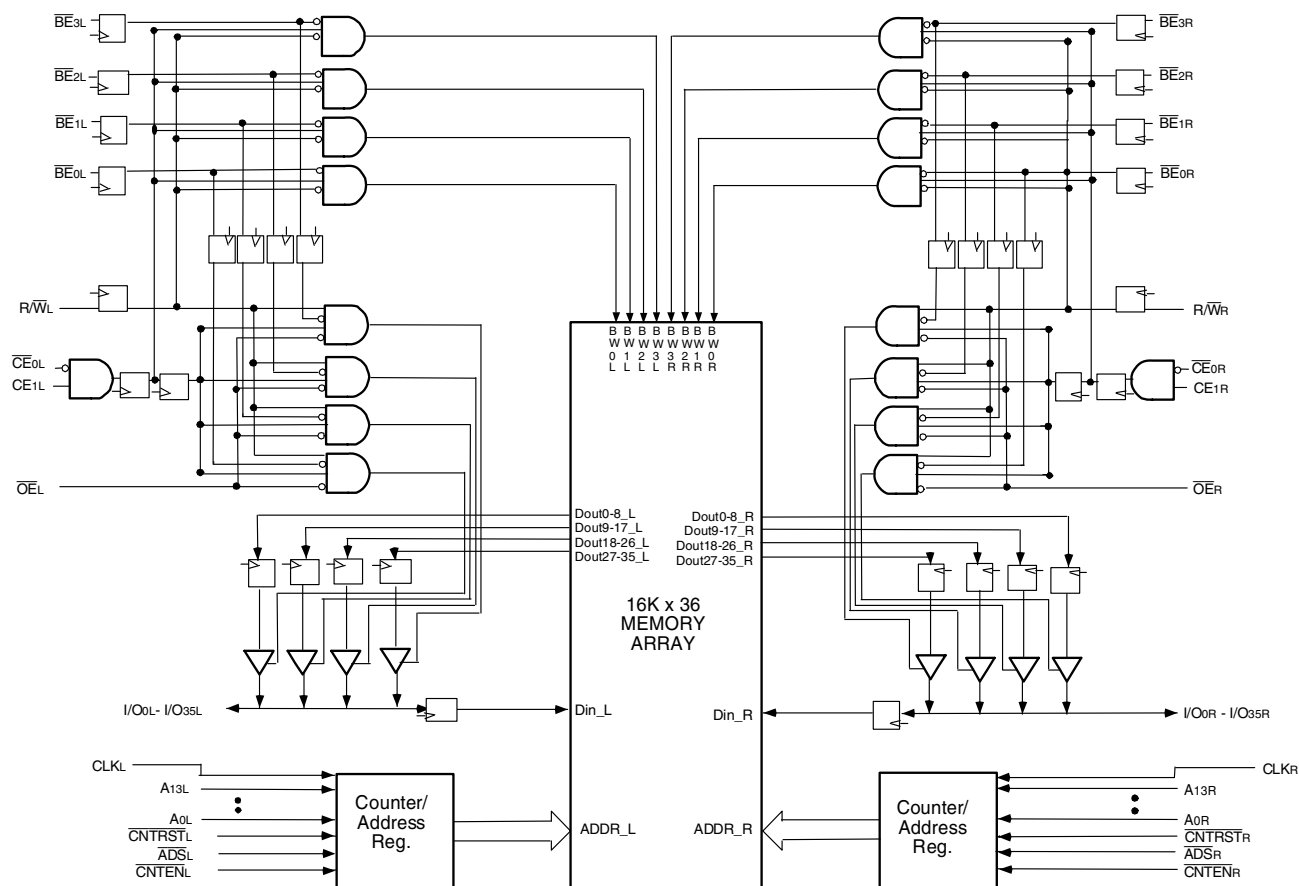


Features:

- ♦ True Dual-Port memory cells which allow simultaneous access of the same memory location
- ♦ High-speed clock to data access
 - Commercial: 4.2/5/6ns (max.)
 - Industrial: 5ns (max)
- ♦ Pipelined output mode
- ♦ Counter enable and reset features
- ♦ Dual chip enables allow for depth expansion without additional logic
- ♦ Full synchronous operation on both ports
 - 7.5ns cycle time, 133MHz operation (9.6 Gbps bandwidth)
 - Fast 4.2ns clock to data out
 - 1.8ns setup to clock and 0.7ns hold on all control, data, and address inputs @ 133MHz
- Data input, address, byte enable and control registers
- Self-timed write allows fast cycle time
- ♦ Separate byte controls for multiplexed bus and bus matching compatibility
- ♦ LVTTTL-compatible, single 3.3V (±150mV) power supply for core
- ♦ LVTTTL-compatible, selectable 3.3V (±150mV)/2.5V (±125mV) power supply for I/Os and control signals on each port
- ♦ Industrial temperature range (-40°C to +85°C) is available for selected speeds
- ♦ Available in a 208-pin Plastic Quad Flatpack (PQFP), 208-ball fine-pitch Ball Grid Array, and 256-pin Ball Grid Array
- ♦ Green parts available, see ordering instructions

Functional Block Diagram



4831 tbi 01

AUGUST 2019

Description:

The IDT70V3569 is a high-speed 16K x 36 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 IDT70V3569 has been optimized for applications having unidirectional or bidirectional data flow

in bursts. An automatic power down feature, controlled by $\overline{CE_0}$ and CE_1 , permits the on-chip circuitry of each port to enter a very low standby power mode.

The 70V3569 can support an operating voltage of either 3.3V or 2.5V on one or both ports, controllable by the OPT pins. The power supply for the core of the device (V_{DD}) remains at 3.3V.

Pin Configuration^(1,2,3,4)

A1 IO19L	A2 IO18L	A3 VSS	A4 NC	A5 NC	A6 NC	A7 A12L	A8 A8L	A9 $\overline{BE}_{1L}$	A10 VDD	A11 CLKL	A12 $\overline{CNTENL}$	A13 A4L	A14 A0L	A15 OPTL	A16 IO17L	A17 VSS
B1 IO20R	B2 VSS	B3 IO18R	B4 VSS	B5 NC	B6 A13L	B7 A9L	B8 $\overline{BE}_{2L}$	B9 $\overline{CE}_{0L}$	B10 VSS	B11 $\overline{ADSL}$	B12 A5L	B13 A1L	B14 VSS	B15 VDDQR	B16 IO16L	B17 IO15R
C1 VDDQL	C2 IO19R	C3 VDDQR	C4 VDD	C5 NC	C6 NC	C7 A10L	C8 $\overline{BE}_{3L}$	C9 CE_{1L}	C10 VSS	C11 $R/\overline{WL}$	C12 A6L	C13 A2L	C14 VDD	C15 IO16R	C16 IO15L	C17 VSS
D1 IO22L	D2 VSS	D3 IO21L	D4 IO20L	D5 NC	D6 A11L	D7 A7L	D8 $\overline{BE}_{0L}$	D9 VDD	D10 $\overline{OE}_L$	D11 $\overline{CNTRSTL}$	D12 A3L	D13 VDD	D14 IO17R	D15 VDDQL	D16 IO14L	D17 IO14R
E1 IO23L	E2 IO22R	E3 VDDQR	E4 IO21R	70V3569 BF208⁽⁵⁾ BFG208⁽⁵⁾ 208-Pin fpBGA Top View⁽⁶⁾									E14 IO12L	E15 IO13R	E16 VSS	E17 IO13L
F1 VDDQL	F2 IO23R	F3 IO24L	F4 VSS										F14 VSS	F15 IO12R	F16 IO11L	F17 VDDQR
G1 IO26L	G2 VSS	G3 IO25L	G4 IO24R										G14 IO9L	G15 VDDQL	G16 IO10L	G17 IO11R
H1 VDD	H2 IO26R	H3 VDDQR	H4 IO25R										H14 VDD	H15 IO9R	H16 VSS	H17 IO10R
J1 VDDQ	J2 VDD	J3 VSS	J4 VSS										J14 VSS	J15 VDD	J16 VSS	J17 VDDQR
K1 IO28R	K2 VSS	K3 IO27R	K4 VSS										K14 IO7R	K15 VDDQ	K16 IO8R	K17 VSS
L1 IO29R	L2 IO28L	L3 VDDQR	L4 IO27L										L14 IO6R	L15 IO7L	L16 VSS	L17 IO8L
M1 VDDQL	M2 IO29L	M3 IO30R	M4 VSS										M14 VSS	M15 IO6L	M16 IO5R	M17 VDDQR
N1 IO31L	N2 VSS	N3 IO31R	N4 IO30L										N14 IO3R	N15 VDDQL	N16 IO4R	N17 IO5L
P1 IO32R	P2 IO32L	P3 VDDQR	P4 IO35R	P5 NC	P6 NC	P7 A12R	P8 A8R	P9 $\overline{BE}_{1R}$	P10 VDD	P11 CLKR	P12 $\overline{CNTENR}$	P13 A4R	P14 IO2L	P15 IO3L	P16 VSS	P17 IO4L
R1 VSS	R2 IO33L	R3 IO34R	R4 NC	R5 NC	R6 A13R	R7 A9R	R8 $\overline{BE}_{2R}$	R9 $\overline{CE}_{0R}$	R10 VSS	R11 $\overline{ADSR}$	R12 A5R	R13 A1R	R14 VSS	R15 VDDQL	R16 IO1R	R17 VDDQR
T1 IO33R	T2 IO34L	T3 VDDQL	T4 VSS	T5 NC	T6 NC	T7 A10R	T8 $\overline{BE}_{3R}$	T9 CE_{1R}	T10 VSS	T11 $R/\overline{WR}$	T12 A6R	T13 A2R	T14 VSS	T15 IO0R	T16 VSS	T17 IO2R
U1 VSS	U2 IO35L	U3 VDD	U4 NC	U5 NC	U6 A11R	U7 A7R	U8 $\overline{BE}_{0R}$	U9 VDD	U10 $\overline{OE}_R$	U11 $\overline{CNTRSTR}$	U12 A3R	U13 A0R	U14 VDD	U15 OPTR	U16 IO0L	U17 IO1L

NOTES:

1. All V_{DD} pins must be connected to 3.3V power supply.
2. All V_{DDQ} pins must be connected to appropriate power supply: 3.3V if OPT pin for that port is set to V_{IH} (3.3V), and 2.5V if OPT pin for that port is set to V_{IL} (0V).
3. All V_{SS} pins must be connected to ground supply.
4. Package body is approximately 15mm x 15mm x 1.4mm, with 0.8mm ball pitch.
5. This package code is used to reference the package diagram.
6. This text does not indicate orientation of the actual part-marking.

4831 drw 02c

Pin Configuration^(1,2,3,4) (con't.)

70V3569
BC256⁽⁵⁾

256-Pin BGA
Top View⁽⁶⁾

A1 NC	A2 NC	A3 NC	A4 NC	A5 NC	A6 A11L	A7 A8L	A8 BE ₂ L	A9 CE ₁ L	A10 OE _L	A11 CNTEN _L	A12 A5L	A13 A2L	A14 A0L	A15 NC	A16 NC
B1 I/O ₁₈ L	B2 NC	B3 NC	B4 NC	B5 NC	B6 A12L	B7 A9L	B8 BE ₃ L	B9 CE ₀ L	B10 R/W _L	B11 CNTRST _L	B12 A4L	B13 A1L	B14 VDD	B15 I/O ₁₇ L	B16 NC
C1 I/O ₁₈ R	C2 I/O ₁₉ L	C3 VSS	C4 NC	C5 A13L	C6 A10L	C7 A7L	C8 BE ₁ L	C9 BE ₀ L	C10 CLK _L	C11 ADS _L	C12 A6L	C13 A3L	C14 OPT _L	C15 I/O ₁₇ R	C16 I/O ₁₆ L
D1 I/O ₂₀ R	D2 I/O ₁₉ R	D3 I/O ₂₀ L	D4 VDD	D5 VDDQL	D6 VDDQL	D7 VDDQR	D8 VDDQR	D9 VDDQL	D10 VDDQL	D11 VDDQR	D12 VDDQR	D13 VDD	D14 I/O ₁₅ R	D15 I/O ₁₅ L	D16 I/O ₁₆ R
E1 I/O ₂₁ R	E2 I/O ₂₁ L	E3 I/O ₂₂ L	E4 VDDQL	E5 VDD	E6 VDD	E7 VSS	E8 VSS	E9 VSS	E10 VSS	E11 VDD	E12 VDD	E13 VDDQR	E14 I/O ₁₃ L	E15 I/O ₁₄ L	E16 I/O ₁₄ R
F1 I/O ₂₃ L	F2 I/O ₂₂ R	F3 I/O ₂₃ R	F4 VDDQL	F5 VDD	F6 VSS	F7 VSS	F8 VSS	F9 VSS	F10 VSS	F11 VSS	F12 VDD	F13 VDDQR	F14 I/O ₁₂ R	F15 I/O ₁₃ R	F16 I/O ₁₂ L
G1 I/O ₂₄ R	G2 I/O ₂₄ L	G3 I/O ₂₅ L	G4 VDDQR	G5 VSS	G6 VSS	G7 VSS	G8 VSS	G9 VSS	G10 VSS	G11 VSS	G12 VSS	G13 VDDQL	G14 I/O ₁₀ L	G15 I/O ₁₁ L	G16 I/O ₁₁ R
H1 I/O ₂₆ L	H2 I/O ₂₅ R	H3 I/O ₂₆ R	H4 VDDQR	H5 VSS	H6 VSS	H7 VSS	H8 VSS	H9 VSS	H10 VSS	H11 VSS	H12 VSS	H13 VDDQL	H14 I/O ₉ R	H15 I/O ₉ L	H16 I/O ₁₀ R
J1 I/O ₂₇ L	J2 I/O ₂₈ R	J3 I/O ₂₇ R	J4 VDDQL	J5 VSS	J6 VSS	J7 VSS	J8 VSS	J9 VSS	J10 VSS	J11 VSS	J12 VSS	J13 VDDQR	J14 I/O ₈ R	J15 I/O ₇ R	J16 I/O ₈ L
K1 I/O ₂₉ R	K2 I/O ₂₉ L	K3 I/O ₂₈ L	K4 VDDQL	K5 VSS	K6 VSS	K7 VSS	K8 VSS	K9 VSS	K10 VSS	K11 VSS	K12 VSS	K13 VDDQR	K14 I/O ₆ R	K15 I/O ₆ L	K16 I/O ₇ L
L1 I/O ₃₀ L	L2 I/O ₃₁ R	L3 I/O ₃₀ R	L4 VDDQR	L5 VDD	L6 VSS	L7 VSS	L8 VSS	L9 VSS	L10 VSS	L11 VSS	L12 VDD	L13 VDDQL	L14 I/O ₅ L	L15 I/O ₄ R	L16 I/O ₅ R
M1 I/O ₃₂ R	M2 I/O ₃₂ L	M3 I/O ₃₁ L	M4 VDDQR	M5 VDD	M6 VDD	M7 VSS	M8 VSS	M9 VSS	M10 VSS	M11 VDD	M12 VDD	M13 VDDQL	M14 I/O ₃ R	M15 I/O ₃ L	M16 I/O ₄ L
N1 I/O ₃₃ L	N2 I/O ₃₄ R	N3 I/O ₃₃ R	N4 VDD	N5 VDDQR	N6 VDDQR	N7 VDDQL	N8 VDDQL	N9 VDDQR	N10 VDDQR	N11 VDDQL	N12 VDDQL	N13 VDD	N14 I/O ₂ L	N15 I/O ₁ R	N16 I/O ₂ R
P1 I/O ₃₅ R	P2 I/O ₃₄ L	P3 NC	P4 NC	P5 A13R	P6 A10R	P7 A7R	P8 BE ₁ R	P9 BE ₀ R	P10 CLK _R	P11 ADS _R	P12 A6R	P13 A3R	P14 I/O ₀ L	P15 I/O ₀ R	P16 I/O ₁ L
R1 I/O ₃₅ L	R2 NC	R3 NC	R4 NC	R5 NC	R6 A12R	R7 A9R	R8 BE ₃ R	R9 CE ₀ R	R10 R/W _R	R11 CNTRST _R	R12 A4R	R13 A1R	R14 OPT _R	R15 NC	R16 NC
T1 NC	T2 NC	T3 NC	T4 NC	T5 NC	T6 A11R	T7 A8R	T8 BE ₂ R	T9 CE ₁ R	T10 OE _R	T11 CNTEN _R	T12 A5R	T13 A2R	T14 A0R	T15 NC	T16 NC

4831 drw 02d

NOTES:

1. All VDD pins must be connected to 3.3V power supply.
2. All VDDQ pins must be connected to appropriate power supply: 3.3V if OPT pin for that port is set to VIH (3.3V), and 2.5V if OPT pin for that port is set to VIL (0V).
3. All VSS pins must be connected to ground supply.
4. Package body is approximately 17mm x 17mm x 1.4mm, with 1.0mm ball-pitch.
5. This package code is used to reference the package diagram.
6. This text does not indicate orientation of the actual part-marking.

4831 drw 02e

Pin Names

Left Port	Right Port	Names
$\overline{CE}_{0L}$, CE_{1L}	$\overline{CE}_{0R}$, CE_{1R}	Chip Enables
$R/\overline{WL}$	$R/\overline{WR}$	Read/Write Enable
$\overline{OE}_L$	$\overline{OE}_R$	Output Enable
A _{0L} - A _{13L}	A _{0R} - A _{13R}	Address
I/O _{0L} - I/O _{35L}	I/O _{0R} - I/O _{35R}	Data Input/Output
CLK _L	CLK _R	Clock
$\overline{ADS}_L$	$\overline{ADS}_R$	Address Strobe Enable
$\overline{CNTEN}_L$	$\overline{CNTEN}_R$	Counter Enable
$\overline{CNTRST}_L$	$\overline{CNTRST}_R$	Counter Reset
$\overline{BE}_{0L}$ - $\overline{BE}_{3L}$	$\overline{BE}_{0R}$ - $\overline{BE}_{3R}$	Byte Enables (9-bit bytes)
V _{DDQ} _L	V _{DDQ} _R	Power (I/O Bus) (3.3V or 2.5V) ⁽¹⁾
OPT _L	OPT _R	Option for selection V _{DDQ} ^(1,2)
V _{DD}		Power (3.3V) ⁽¹⁾
V _{SS}		Ground (0V)

NOTES:

- V_{DD}, OPT_x, and V_{DDQ}_x must be set to appropriate operating levels prior to applying inputs on the I/Os and controls for that port.
- OPT_x selects the operating voltage levels for the I/Os and controls on that port. If OPT_x is set to VIH (3.3V), then that port's I/Os and controls will operate at 3.3V levels and V_{DDQ}_x must be supplied at 3.3V. If OPT_x is set to VIL (0V), then that port's I/Os and controls will operate at 2.5V levels and V_{DDQ}_x must be supplied at 2.5V. The OPT pins are independent of one another—both ports can operate at 3.3V levels, both can operate at 2.5V levels, or either can operate at 3.3V with the other at 2.5V.

4831 tbl 01

Truth Table I—Read/Write and Enable Control^(1,2,3,4)

OE	CLK	$\overline{CE}_0$	CE ₁	$\overline{BE}_3$	$\overline{BE}_2$	$\overline{BE}_1$	$\overline{BE}_0$	R/ $\overline{W}$	Byte 3 I/O ₂₇₋₃₅	Byte 2 I/O ₁₈₋₂₆	Byte 1 I/O ₉₋₁₇	Byte 0 I/O ₀₋₈	MODE
X	↑	H	X	X	X	X	X	X	High-Z	High-Z	High-Z	High-Z	Deselected—Power Down
X	↑	X	L	X	X	X	X	X	High-Z	High-Z	High-Z	High-Z	Deselected—Power Down
X	↑	L	H	H	H	H	H	X	High-Z	High-Z	High-Z	High-Z	All Bytes Deselected
X	↑	L	H	H	H	H	L	L	High-Z	High-Z	High-Z	D _{IN}	Write to Byte 0 Only
X	↑	L	H	H	H	L	H	L	High-Z	High-Z	D _{IN}	High-Z	Write to Byte 1 Only
X	↑	L	H	H	L	H	H	L	High-Z	D _{IN}	High-Z	High-Z	Write to Byte 2 Only
X	↑	L	H	L	H	H	H	L	D _{IN}	High-Z	High-Z	High-Z	Write to Byte 3 Only
X	↑	L	H	H	H	L	L	L	High-Z	High-Z	D _{IN}	D _{IN}	Write to Lower 2 Bytes Only
X	↑	L	H	L	L	H	H	L	D _{IN}	D _{IN}	High-Z	High-Z	Write to Upper 2 bytes Only
X	↑	L	H	L	L	L	L	L	D _{IN}	D _{IN}	D _{IN}	D _{IN}	Write to All Bytes
L	↑	L	H	H	H	H	L	H	High-Z	High-Z	High-Z	D _{OUT}	Read Byte 0 Only
L	↑	L	H	H	H	L	H	H	High-Z	High-Z	D _{OUT}	High-Z	Read Byte 1 Only
L	↑	L	H	H	L	H	H	H	High-Z	D _{OUT}	High-Z	High-Z	Read Byte 2 Only
L	↑	L	H	L	H	H	H	H	D _{OUT}	High-Z	High-Z	High-Z	Read Byte 3 Only
L	↑	L	H	H	H	L	L	H	High-Z	High-Z	D _{OUT}	D _{OUT}	Read Lower 2 Bytes Only
L	↑	L	H	L	L	H	H	H	D _{OUT}	D _{OUT}	High-Z	High-Z	Read Upper 2 Bytes Only
L	↑	L	H	L	L	L	L	H	D _{OUT}	D _{OUT}	D _{OUT}	D _{OUT}	Read All Bytes
H	↑	L	H	L	L	L	L	X	High-Z	High-Z	High-Z	High-Z	Outputs Disabled

NOTES:

- "H" = V_{IH}, "L" = V_{IL}, "X" = Don't Care.
- $\overline{ADS}$, $\overline{CNTEN}$, $\overline{CNTRST}$ = X.
- OE is an asynchronous input signal.
- It is possible to read or write any combination of bytes during a given access. A few representative samples have been illustrated here.

4831 tbl 02

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

NOTES:

- "H" = V_{IH}, "L" = V_{IL}, "X" = Don't Care.
- Read and write operations are controlled by the appropriate setting of R_W, $\overline{CE_0}$, CE₁, $\overline{BEn}$ and $\overline{OE}$.
- Outputs are in Pipelined mode: the data out will be delayed by one cycle.
- $\overline{ADS}$ and $\overline{CNTRST}$ are independent of all other memory control signals including $\overline{CE_0}$, CE₁ and $\overline{BEn}$.
- The address counter advances if $\overline{CNTEN}$ = V_{IL} on the rising edge of CLK, regardless of all other memory control signals including $\overline{CE_0}$, CE₁, $\overline{BEn}$.

4831 tbl 03

Recommended Operating Temperature and Supply Voltage⁽¹⁾

Grade	Ambient Temperature	GND	V _{DD}
Commercial	0°C to +70°C	0V	3.3V ± 150mV
Industrial	-40°C to +85°C	0V	3.3V ± 150mV

4831 tbl 04

NOTES:

- Industrial temperature: for specific speeds, packages and powers contact your sales office.

Recommended DC Operating Conditions with V_{DDQ} at 2.5V

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{DD}	Core Supply Voltage	3.15	3.3	3.45	V
V _{DDQ}	I/O Supply Voltage ⁽³⁾	2.375	2.5	2.625	V
V _{SS}	Ground	0	0	0	V
V _{IH}	Input High Voltage ⁽³⁾ (Address & Control Inputs)	1.7	—	V _{DDQ} + 125mV ⁽²⁾	V
V _{IH}	Input High Voltage - I/O ⁽³⁾	1.7	—	V _{DDQ} + 125mV ⁽²⁾	V
V _{IL}	Input Low Voltage	-0.3 ⁽⁴⁾	—	0.7	V

4831 tbl 05a

NOTES:

- V_{IL} ≥ -1.5V for pulse width less than 10 ns.
- V_{TERM} must not exceed V_{DDQ} + 125mV.
- To select operation at 2.5V levels on the I/Os and controls of a given port, the OPT pin for that port must be set to V_{IL} (0V), and V_{DDQX} for that port must be supplied as indicated above.

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

4831 tbl 06

NOTES:

- 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.
- V_{TERM} must not exceed V_{DD} + 150mV for more than 25% of the cycle time or 4ns maximum, and is limited to ≤ 20mA for the period of V_{TERM} ≥ V_{DD} + 150mV.

Recommended DC Operating Conditions with V_{DDQ} at 3.3V

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{DD}	Core Supply Voltage	3.15	3.3	3.45	V
V _{DDQ}	I/O Supply Voltage ⁽³⁾	3.15	3.3	3.45	V
V _{SS}	Ground	0	0	0	V
V _{IH}	Input High Voltage (Address & Control Inputs) ⁽³⁾	2.0	—	V _{DDQ} + 150mV ⁽²⁾	V
V _{IH}	Input High Voltage - I/O ⁽³⁾	2.0	—	V _{DDQ} + 150mV ⁽²⁾	V
V _{IL}	Input Low Voltage	-0.3 ⁽⁴⁾	—	0.8	V

4831 tbl 05b

NOTES:

- V_{IL} ≥ -1.5V for pulse width less than 10 ns.
- V_{TERM} must not exceed V_{DDQ} + 150mV.
- To select operation at 3.3V levels on the I/Os and controls of a given port, the OPT pin for that port must be set to V_{IH} (3.3V), and V_{DDQX} for that port must be supplied as indicated above.

Capacitance⁽¹⁾

(T_A = +25°C, F = 1.0MHz) PQFP ONLY

Symbol	Parameter	Conditions ⁽²⁾	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 3dV	8	pF
C _{OUT} ⁽³⁾	Output Capacitance	V _{OUT} = 3dV	10.5	pF

4831 tbl 07

NOTES:

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

DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range (V_{DD} = 3.3V ± 150mV)

Symbol	Parameter	Test Conditions	70V3569S		Unit
			Min.	Max.	
I _{LI}	Input Leakage Current ⁽¹⁾	V _{DDQ} = Max., V _{IN} = 0V to V _{DDQ}	—	10	μA
I _{LO}	Output Leakage Current	$\overline{CE}_0 = V_{IH}$ or CE ₁ = V _{IL} , V _{OUT} = 0V to V _{DDQ}	—	10	μA
V _{OL} (3.3V)	Output Low Voltage ⁽²⁾	I _{OL} = +4mA, V _{DDQ} = Min.	—	0.4	V
V _{OH} (3.3V)	Output High Voltage ⁽²⁾	I _{OH} = -4mA, V _{DDQ} = Min.	2.4	—	V
V _{OL} (2.5V)	Output Low Voltage ⁽²⁾	I _{OL} = +2mA, V _{DDQ} = Min.	—	0.4	V
V _{OH} (2.5V)	Output High Voltage ⁽²⁾	I _{OH} = -2mA, V _{DDQ} = Min.	2.0	—	V

4831 tbl 08

NOTE:

- At V_{DD} ≤ -2.0V input leakages are undefined.
- V_{DDQ} is selectable (3.3V/2.5V) via OPT pins. Refer to p.4 for details.

DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range⁽³⁾ ($V_{DD} = 3.3V \pm 150mV$)

Symbol	Parameter	Test Condition	Version	70V3569S4 Com'l Only		70V3569S5 Com'l & Ind		70V3569S6 Com'l Only		Unit
				Typ. ⁽⁴⁾	Max.	Typ. ⁽⁴⁾	Max.	Typ. ⁽⁴⁾	Max.	
IDD	Dynamic Operating Current (Both Ports Active)	$\overline{CE}_L$ and $\overline{CE}_R = V_{IL}$, Outputs Disabled, $f = f_{MAX}^{(1)}$	COM'L S	375	460	285	360	245	310	mA
			IND S	—	—	285	415	245	360	
ISB1	Standby Current (Both Ports - TTL Level Inputs)	$\overline{CE}_L = \overline{CE}_R = V_{IH}$ $f = f_{MAX}^{(1)}$	COM'L S	145	190	105	145	95	125	mA
			IND S	—	—	105	175	95	150	
ISB2	Standby Current (One Port - TTL Level Inputs)	$\overline{CE}^{(5)}$ "A" = V_{IL} and $\overline{CE}^{(5)}$ "B" = V_{IH} , Active Port Outputs Disabled, $f = f_{MAX}^{(1)}$	COM'L S	265	325	190	260	175	225	mA
			IND S	—	—	190	300	175	260	
ISB3	Full Standby Current (Both Ports - CMOS Level Inputs)	Both Ports $\overline{CE}_L$ and $\overline{CE}_R \geq V_{DDQ} - 0.2V$, $V_{IN} \geq V_{DDQ} - 0.2V$ or $V_{IN} \leq 0.2V$, $f = 0^{(2)}$	COM'L S	6	15	6	15	6	15	mA
			IND S	—	—	6	30	6	30	
ISB4	Full Standby Current (One Port - CMOS Level Inputs)	$\overline{CE}^{(5)}$ "A" $\leq 0.2V$ and $\overline{CE}^{(5)}$ "B" $\geq V_{DDQ} - 0.2V$, $V_{IN} \geq V_{DDQ} - 0.2V$ or $V_{IN} \leq 0.2V$, Active Port, Outputs Disabled, $f = f_{MAX}^{(1)}$	COM'L S	265	325	180	260	170	225	mA
			IND S	—	—	180	300	170	260	

4831 tbl 09

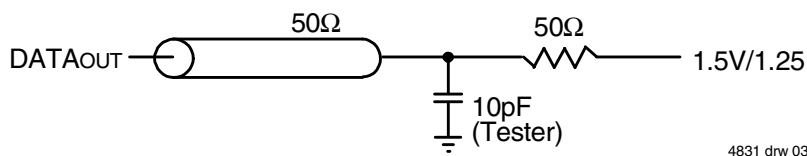
NOTES:

- At $f = f_{MAX}$, address and control lines (except Output Enable) are cycling at the maximum frequency clock cycle of $1/t_{cyc}$, 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".
- $V_{DD} = 3.3V$, $T_A = 25^\circ C$ for Typ, and are not production tested. $I_{DD} \text{ at } f=0 = 120mA$ (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 $CE_{1X} \geq V_{DDQ} - 0.2V$
 $\overline{CE}_X \geq V_{DDQ} - 0.2V$ means $\overline{CE}_{0X} \geq V_{DDQ} - 0.2V$ or $CE_{1X} \leq 0.2V$
"X" represents "L" for left port or "R" for right port.

AC Test Conditions

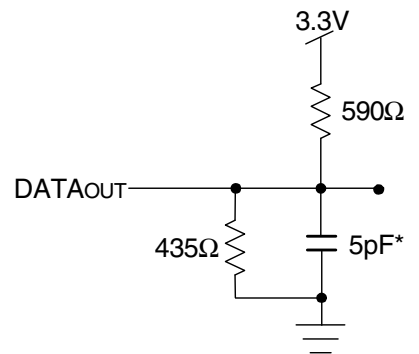
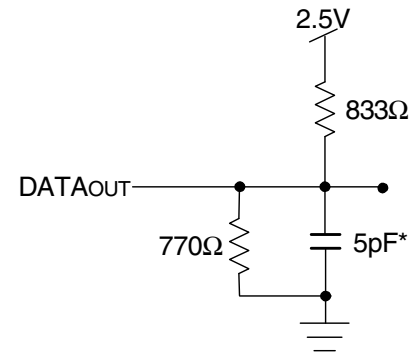
Input Pulse Levels (Address & Controls)	GND to 3.0V/GND to 2.35V
Input Pulse Levels (I/Os)	GND to 3.0V/GND to 2.35V
Input Rise/Fall Times	3ns
Input Timing Reference Levels	1.5V/1.25V
Output Reference Levels	1.5V/1.25V
Output Load	Figures 1, 2, and 3

4831 tbl 10



4831 drw 03

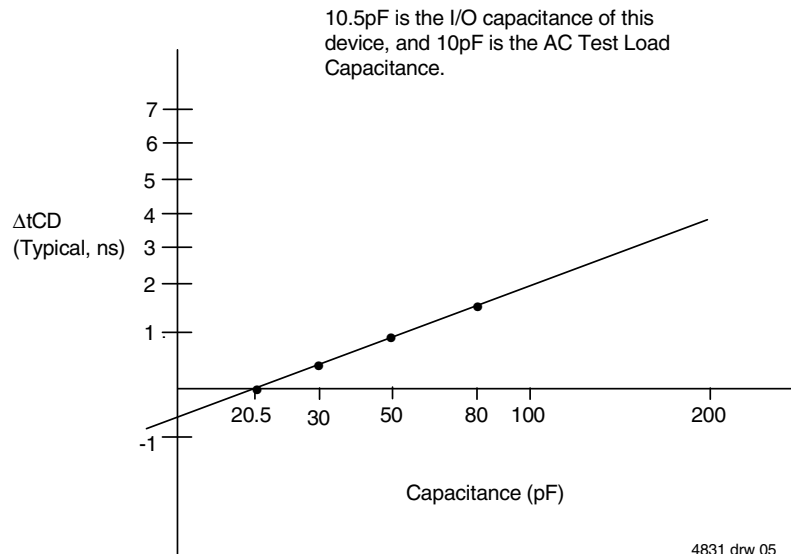
Figure 1. AC Output Test load.



4831 drw 04

Figure 2. Output Test Load
(For tckLZ, tckHZ, tolZ, and toHZ).

*Including scope and jig.



4831 drw 05

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

AC Electrical Characteristics Over the Operating Temperature Range (Read and Write Cycle Timing)^(1,2)

(V_{DD} = 3.3V ± 150mV, T_A = 0°C to +70°C)

Symbol	Parameter	70V3569S4 Com'I Only		70V3569S5 Com'I & Ind		70V3569S6 Com'I Only		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t _{CYC2}	Clock Cycle Time (Pipelined)	7.5	—	10	—	12	—	ns
t _{CH2}	Clock High Time (Pipelined)	3	—	4	—	5	—	ns
t _{CL2}	Clock Low Time (Pipelined)	3	—	4	—	5	—	ns
t _R	Clock Rise Time	—	3	—	3	—	3	ns
t _F	Clock Fall Time	—	3	—	3	—	3	ns
t _{SA}	Address Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HA}	Address Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{SC}	Chip Enable Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HC}	Chip Enable Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{SB}	Byte Enable Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HB}	Byte Enable Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{SW}	R/W Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HW}	R/W Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{SD}	Input Data Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HD}	Input Data Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{SAD}	$\overline{\text{ADS}}$ Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HAD}	$\overline{\text{ADS}}$ Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{SCN}	$\overline{\text{CNTEN}}$ Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HCN}	$\overline{\text{CNTEN}}$ Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{SRST}	$\overline{\text{CNTRST}}$ Setup Time	1.8	—	2.0	—	2.0	—	ns
t _{HRST}	$\overline{\text{CNTRST}}$ Hold Time	0.7	—	0.7	—	1.0	—	ns
t _{OE} ⁽¹⁾	Output Enable to Data Valid	—	4	—	5	—	6	ns
t _{OLZ}	Output Enable to Output Low-Z	0	—	0	—	0	—	ns
t _{OHZ}	Output Enable to Output High-Z	1	4	1	4.5	1	5	ns
t _{CD2}	Clock to Data Valid (Pipelined)	—	4.2	—	5	—	6	ns
t _{DC}	Data Output Hold After Clock High	1	—	1	—	1	—	ns
t _{CKHZ}	Clock High to Output High-Z	1	3	1	4.5	1.5	6	ns
t _{CKLZ}	Clock High to Output Low-Z	1	—	1	—	1	—	ns
Port-to-Port Delay								
t _{CO}	Clock-to-Clock Offset	6	—	8	—	10	—	ns

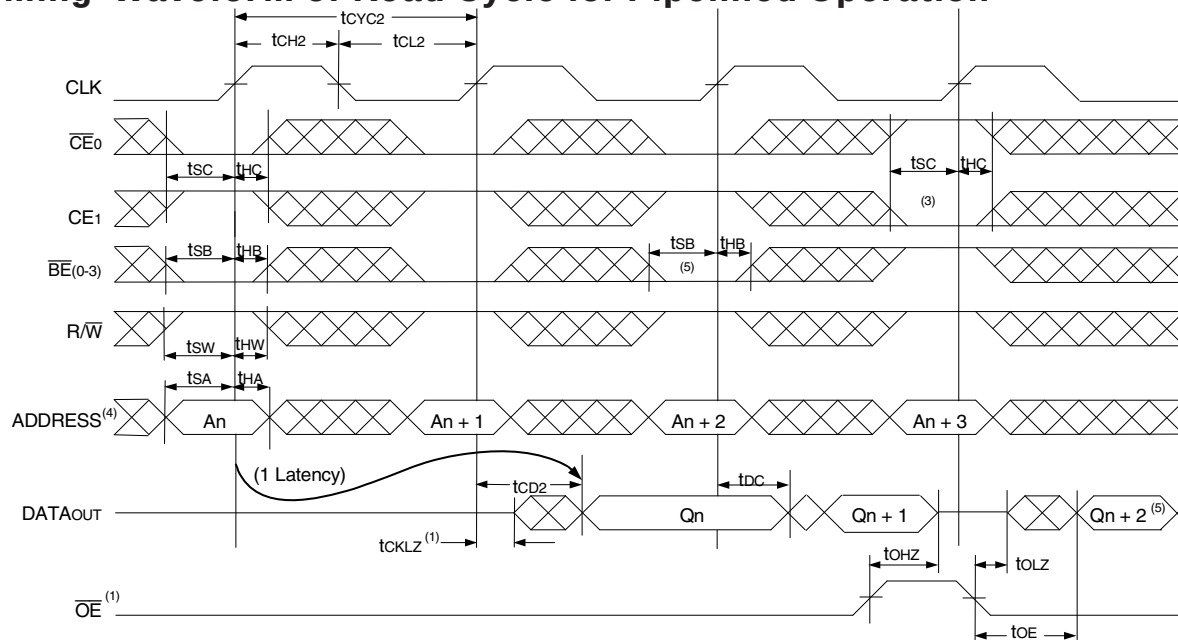
4831 tbl 11

NOTES:

1. All input signals are synchronous with respect to the clock except for the asynchronous Output Enable ($\overline{\text{OE}}$).

2. These values are valid for either level of V_{DDQ} (3.3V/2.5V). See page 4 for details on selecting the desired I/O voltage levels for each port.

Timing Waveform of Read Cycle for Pipelined Operation⁽²⁾

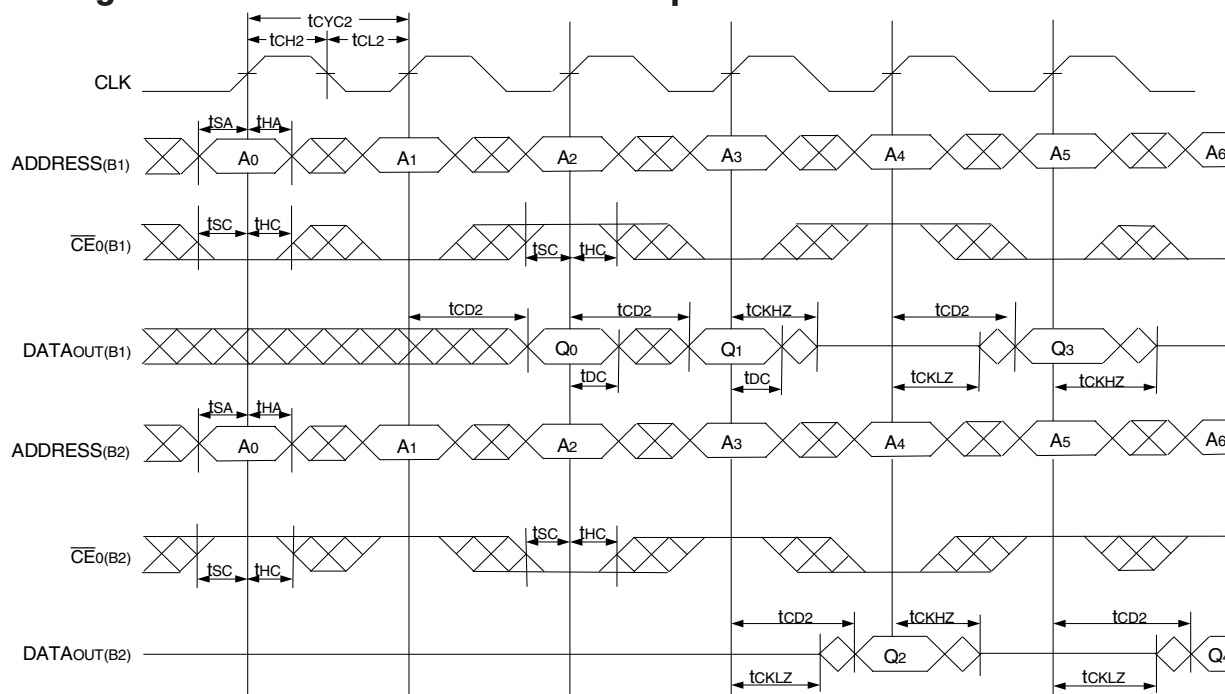


NOTES:

- $\overline{OE}$ is asynchronously controlled; all other inputs are synchronous to the rising clock edge.
- $\overline{ADS} = V_{IL}$, $\overline{CNTEN}$ and $\overline{CNTRST} = V_{IH}$.
- The output is disabled (High-Impedance state) by $\overline{CE}_0 = V_{IH}$, $\overline{CE}_1 = V_{IL}$, $\overline{BE}_n = V_{IH}$ following the next rising edge of the clock. Refer to Truth Table 1.
- 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.
- If $\overline{BE}_n$ was HIGH, then the appropriate Byte of DATAout for Q_{n+2} would be disabled (High-Impedance state).

4831 drw 06

Timing Waveform of a Multi-Device Pipelined Read^(1,2)

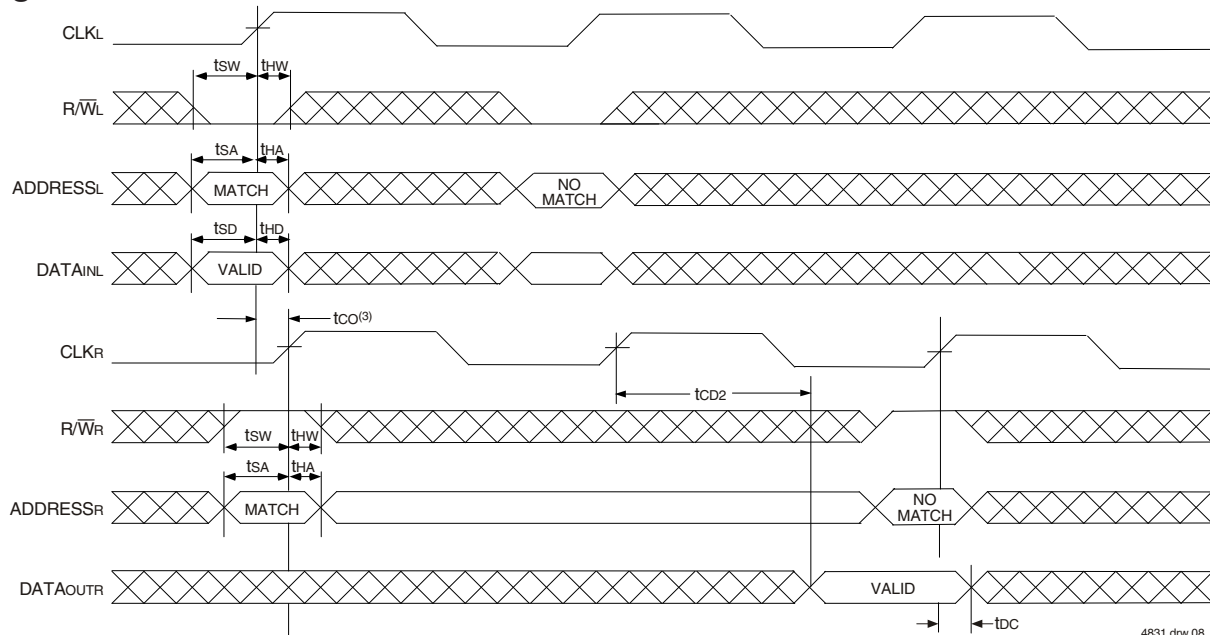


NOTES:

- B1 Represents Device #1; B2 Represents Device #2. Each Device consists of one IDT70V3569 for this waveform, and are setup for depth expansion in this example. ADDRESS(B1) = ADDRESS(B2) in this situation.
- $\overline{BE}_n$, $\overline{OE}$, and $\overline{ADS} = V_{IL}$; $\overline{CE}_{1(B1)}$, $\overline{CE}_{1(B2)}$, $R/\overline{W}$, $\overline{CNTEN}$, and $\overline{CNTRST} = V_{IH}$.

4831 drw 07

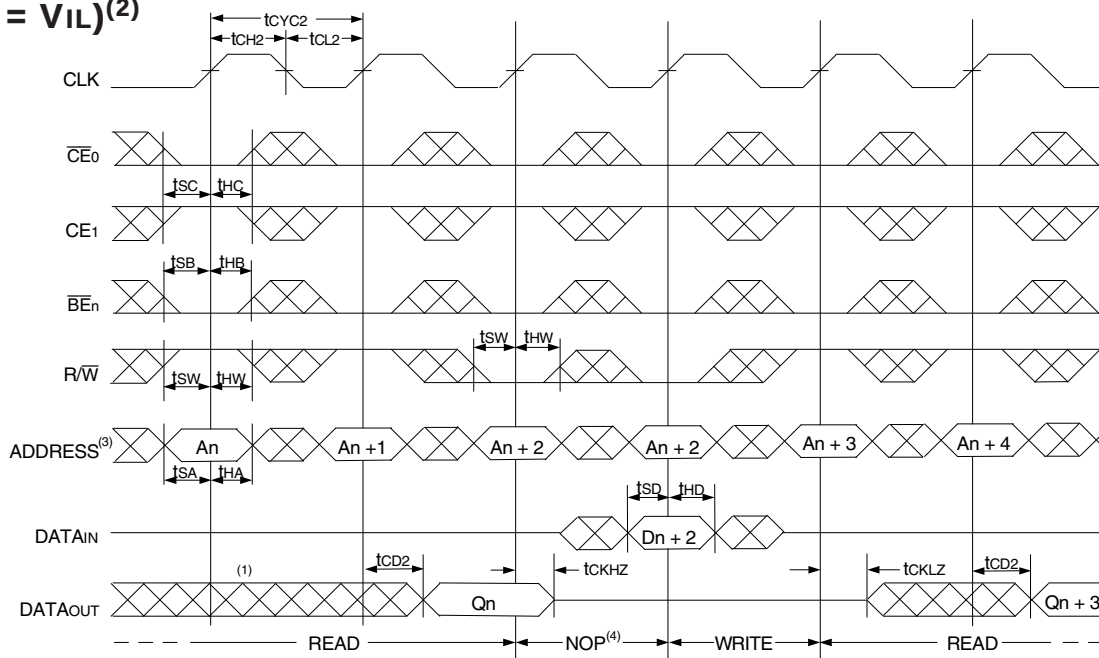
Timing Waveform of Left Port Write to Pipelined Right Port Read^(1,2)



NOTES:

1. $\overline{CE}_0$, $\overline{BE}_n$, and $\overline{ADS} = V_{IL}$; $\overline{CE}_1$, $\overline{CNTEN}$, and $\overline{CNTRST} = V_{IH}$.
2. $\overline{OE} = V_{IL}$ for the Right Port, which is being read from. $\overline{OE} = V_{IH}$ for the Left Port, which is being written to.
3. If $t_{co} \leq$ minimum specified, then data from right port read is not valid until following right port clock cycle (ie, time from write to valid read on opposite port will be $t_{co} + 2 t_{cyc2} + t_{cd2}$). If $t_{co} >$ minimum, then data from right port read is available on first right port clock cycle (ie, time from write to valid read on opposite port will be $t_{co} + t_{cyc} + t_{cd2}$).

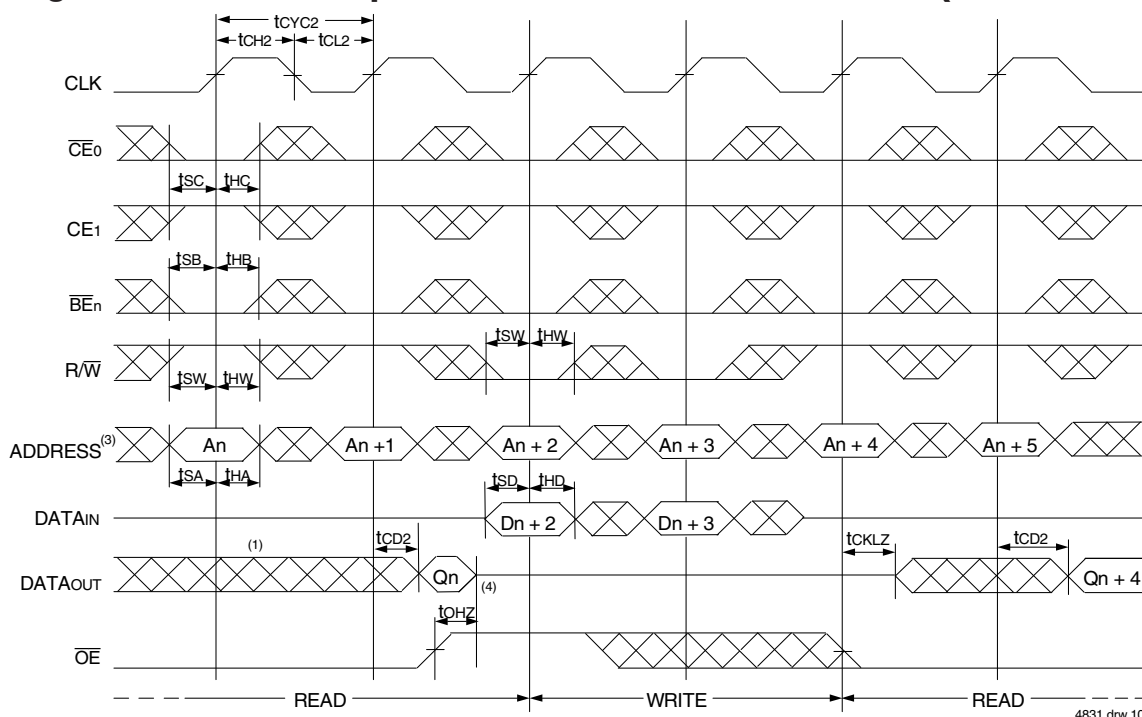
Timing Waveform of Pipelined Read-to-Write-to-Read ($\overline{OE} = V_{IL}$)⁽²⁾



NOTES:

1. Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
2. $\overline{CE}_0$, $\overline{BE}_n$, and $\overline{ADS} = V_{IL}$; $\overline{CE}_1$, $\overline{CNTEN}$, and $\overline{CNTRST} = V_{IH}$. "NOP" is "No Operation".
3. 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.
4. "NOP" is "No Operation." Data in memory at the selected address may be corrupted and should be rewritten to guarantee data integrity.

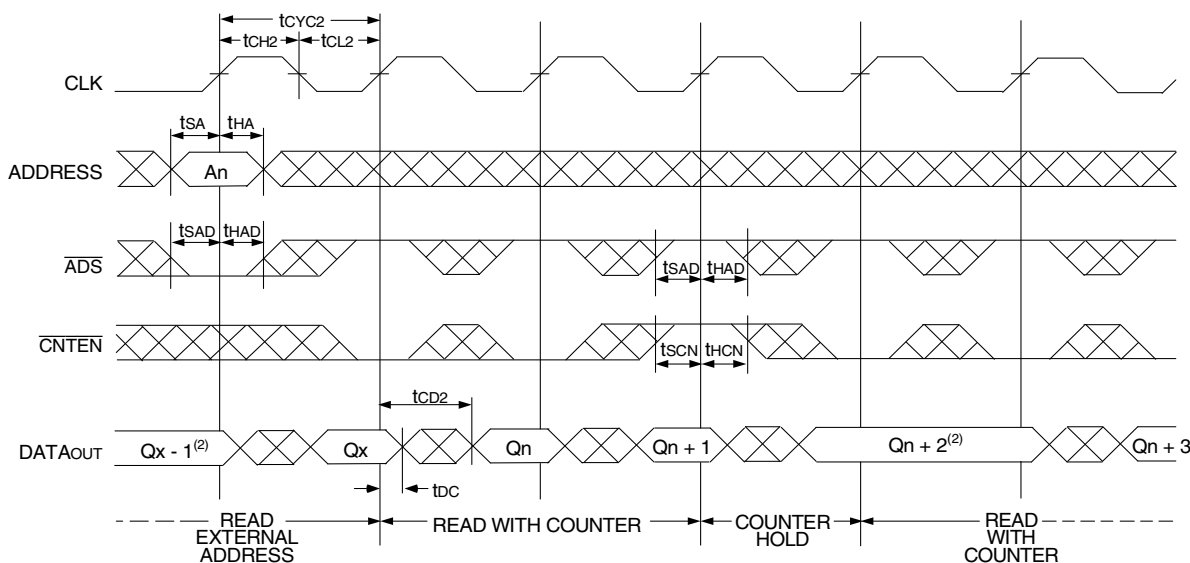
Timing Waveform of Pipelined Read-to-Write-to-Read ($\overline{OE}$ Controlled)⁽²⁾



NOTES:

1. Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
2. $\overline{CE_0}$, $\overline{BE_n}$, and $\overline{ADS} = V_{IL}$; $\overline{CE_1}$, $\overline{CNTEN}$, and $\overline{CNTRST} = V_{IH}$.
3. 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.
4. This timing does not meet requirements for fastest speed grade. This waveform indicates how logically it could be done if timing so allows.

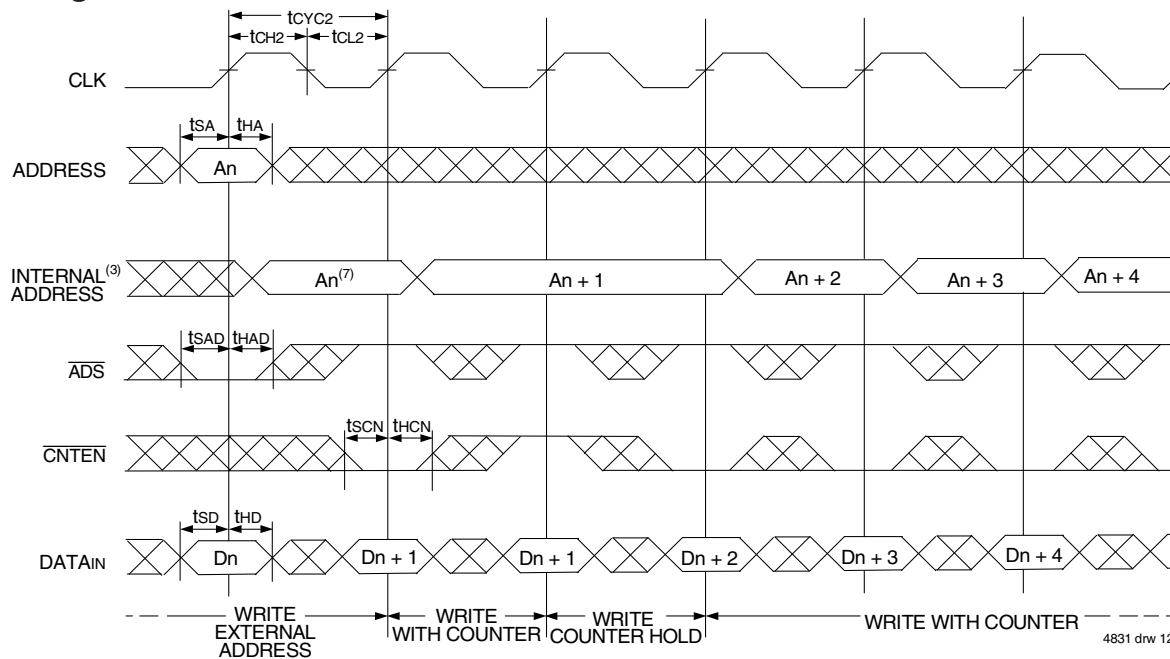
Timing Waveform of Pipelined Read with Address Counter Advance⁽¹⁾



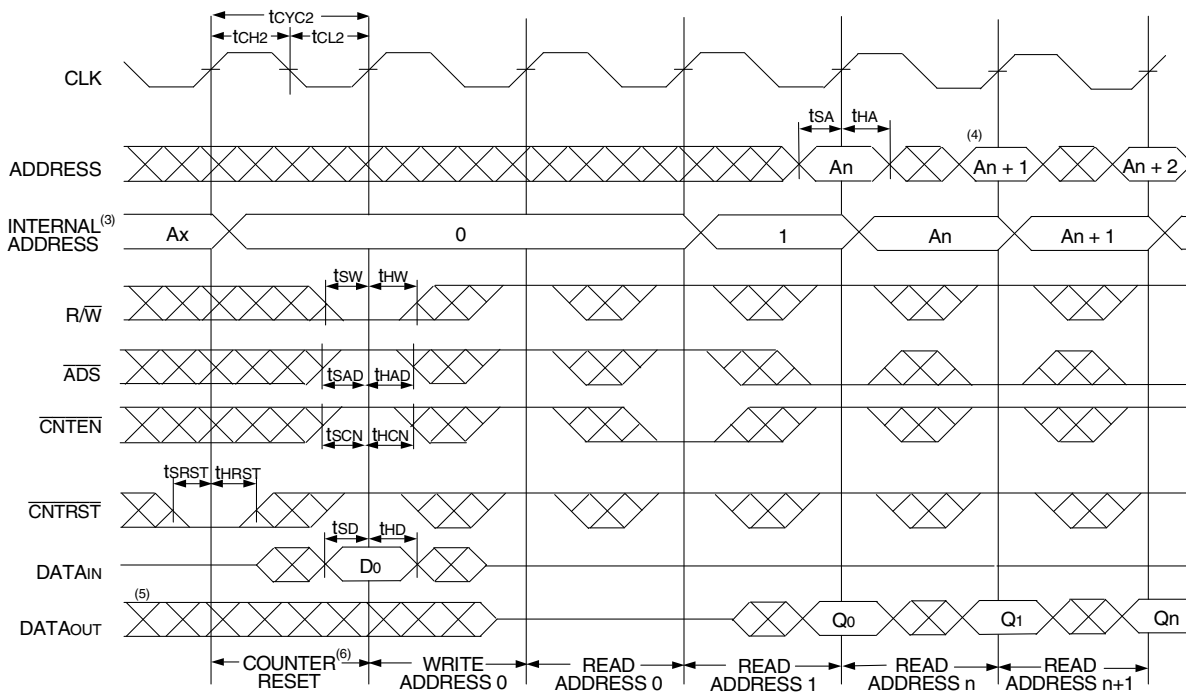
NOTES:

1. $\overline{CE_0}$, $\overline{OE}$, $\overline{BE_n} = V_{IL}$; $\overline{CE_1}$, $\overline{R/W}$, and $\overline{CNTRST} = V_{IH}$.
2. 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⁽¹⁾



Timing Waveform of Counter Reset⁽²⁾



NOTES:

1. $\overline{CE_0}$, $\overline{BE_n}$, and $R/\overline{W} = V_{IL}$; CE_1 and $\overline{CNTRST} = V_{IH}$.
2. $\overline{CE_0}$, $\overline{BE_n} = V_{IL}$; $CE_1 = V_{IH}$.
3. The "Internal Address" is equal to the "External Address" when $\overline{ADS} = V_{IL}$ and equals the counter output when $\overline{ADS} = V_{IH}$.
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. Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
6. No dead cycle exists during counter reset. A READ or WRITE cycle may be coincidental with the counter reset cycle: Addr 0 will be accessed. Extra cycles are shown here simply for clarification.
7. $CNTEN = V_{IL}$ 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 IDT70V3569 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 address counters 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 IDT70V3569s for depth expansion configurations. Two cycles are required with $\overline{CE_0}$ LOW and CE_1 HIGH to reactivate the outputs.

Depth and Width Expansion

The IDT70V3569 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 IDT70V3569 can also be used in applications requiring expanded width, as indicated in Figure 4. Through combining the control signals, the devices can be grouped as necessary to accommodate applications needing 72-bits or wider.

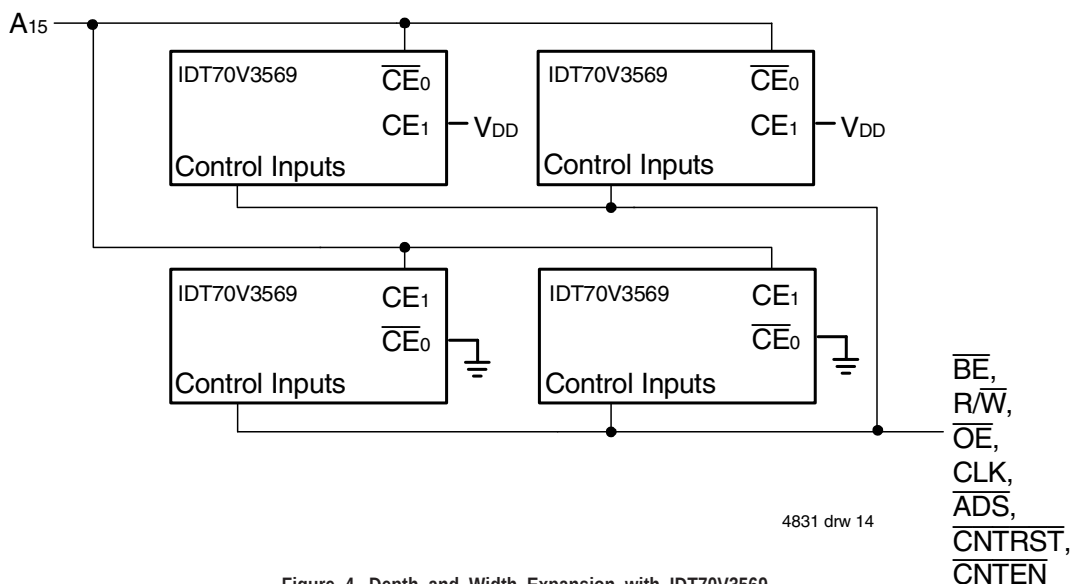
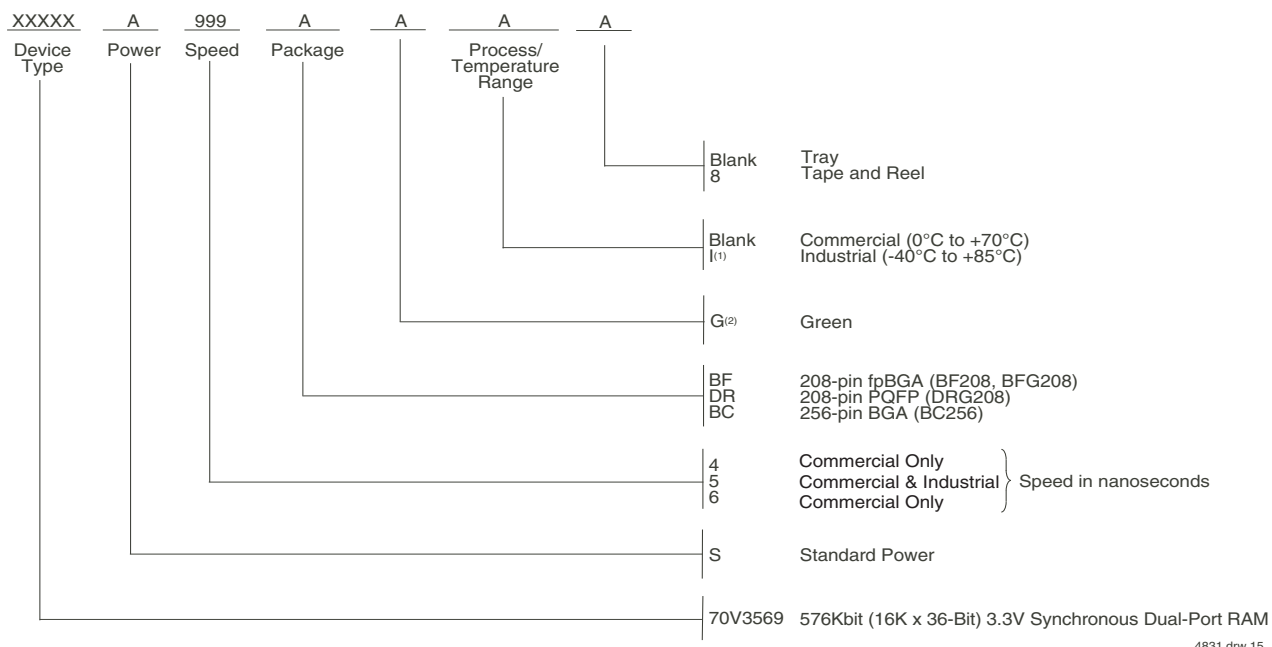


Figure 4. Depth and Width Expansion with IDT70V3569

Ordering Information



4831 drw 15

NOTES:

- Contact your local sales office for Industrial temp range in other speeds, packages and powers.
- Green parts available. For specific speeds, packages and powers contact your local sales office.

LEAD FINISH (SnPb) parts are Obsolete excluding BGA & fpBGA. Product Discontinuation Notice - PDN# SP-17-02
Note that information regarding recently obsoleted parts are included in this datasheet for customer convenience.

Orderable Part Information

Speed (ns)	Orderable Part ID	Pkg. Code	Pkg. Type	Temp. Grade
4	70V3569S4BC	BC256	CABGA	C
	70V3569S4BC8	BC256	CABGA	C
	70V3569S4BF	BF208	CABGA	C
	70V3569S4BF8	BF208	CABGA	C
	70V3569S4BFG	BFG208	CABGA	C
	70V3569S4BFG8	BFG208	CABGA	C
	70V3569S4DRG	DRG208	PQFP	C
5	70V3569S5BC	BC256	CABGA	C
	70V3569S5BC8	BC256	CABGA	C
	70V3569S5BCI	BC256	CABGA	I
	70V3569S5BCI8	BC256	CABGA	I
	70V3569S5BF	BF208	CABGA	C
	70V3569S5BF8	BF208	CABGA	C
	70V3569S5BFI	BF208	CABGA	I
	70V3569S5BFI8	BF208	CABGA	I
6	70V3569S6BC	BC256	CABGA	C
	70V3569S6BC8	BC256	CABGA	C
	70V3569S6BF	BF208	CABGA	C
	70V3569S6BF8	BF208	CABGA	C

Datasheet Document History

01/08/99:	Initial Public Release
03/12/99:	Added fpBGA package
04/28/99:	Fixed typo on page 10
06/08/99:	Changed drawing format
	Page 2 Changed package body dimensions
	Page 3 Fixed typo
06/15/99:	Page 5 Deleted note 6 for Table II
08/04/99:	Page 2 Fixed typographical error
	Page 6 Improved power number
10/14/99:	Upgraded speed to 133MHz, added 2.5V I/O capability
10/19/99:	Page 4 Corrected I/O numbers in Truth Table I
11/12/99:	Replaced IDT logo
04/10/00:	Added new BGA packages, added full 2.5V interface capability
01/12/01:	Page 6 Updated Truth Table II
	Increased storage temperature parameter
	Clarified TA Parameter
	Page 8 DC Electrical parameters—changed wording from "open" to "disabled"
	Removed note 7 on DC Electrical Characteristics table
	Removed Preliminary status
04/10/01:	Added Industrial Temperature Ranges and removed related notes
12/12/01:	Page 2, 3 & 4 Added date revision to pin configurations
	Page 6 Removed industrial temp footnote from table 04
	Page 8 & 10 Removed industrial temp for 6ns from DC & AC Electrical Characteristics
	Page 16 Removed industrial temp from 6ns in ordering information
	Added industrial temp footnote
	Page 1 & 17 Replaced TM logo with ® logo
03/23/05:	Page 1 Added green availability to features
	Page 16 Added green indicator to ordering information
	Page 1 & 17 Replaced old IDT TM with new IDT TM logo
02/08/06:	Page 5 Changed footnote 2 for Truth Table I from $\overline{\text{ADS}}$, $\overline{\text{CNTEN}}$, $\overline{\text{CNTRST}} = \text{V}_{\text{IH}}$ to $\overline{\text{ADS}}$, $\overline{\text{CNTEN}}$, $\overline{\text{CNTRST}} = \text{X}$
07/25/08:	Page 8 Corrected a typo in the DC Chars table
10/23/08:	Page 16 Removed "IDT" from orderable part number
10/08/14:	Page 16 Added Tape and Reel to the Ordering Information
02/15/18:	Product Discontinuation Notice - PDN# SP-17-02
	Last time buy expires June 15, 2018
08/21/19:	Page 2, 3 & 16 Updated package codes BF-208 to BF208, BFG208 and BC-256 to BC256
	Page 4 Rotated DRG208 PQFP pin configuration to accurately reflect pin 1 orientation
	Page 16 Added Orderable Part Information table

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