



Integrated Device Technology, Inc.

CMOS STATIC RAM 64K (8K x 8-BIT) RESETTABLE RAM

**IDT7165S
IDT7165L**
**NOT RECOMMENDED
FOR NEW DESIGNS (1)**

FEATURES:

- High-speed asynchronous RAM clear on Pin 1 (clears all RAM bits to 0, reset cycle time = 2 x tAA)
- High-speed address access time
 - Military: 35/45/55ns (max.)
 - Commercial: 30/35/45ns (max.)
- High-speed chip select ($\overline{CS1}$) time
 - Military: 20/25/30 (max.)
 - Commercial: 15/20/25ns (max.)
- Low-power operation
 - IDT7165S
 - Active: 300mW (typ.)
 - Standby: 100 μ W (typ.)
 - IDT7165L
 - Active: 250mW (typ.)
 - Standby: 30 μ W (typ.)
- Battery backup operation — 2V data retention voltage (IDT7165L only)
- Produced with CEMOS™ high-performance technology
- Single 5V(+10%) power supply
- Input and output directly TTL-compatible
- Standard 28-pin, 600 mil DIP, 300 mil DIP, 28-pin SOIC, 32-pin LCC and PLCC
- Military product is compliant to MIL-STD-883, Class B

DESCRIPTION:

The IDT7165 is a high-speed 65,536-bit static RAM, organized 8K x 8, with reset function. The RESET pin provides a single RAM clear control which clears all words in the internal RAM to zero when activated. This allows the memory bits for all locations to be cleared at power-on or system reset, or for a fast clear to be available to graphics, histogramming and other designs where a byte-by-byte RAM clear would cause noticeable system speed degradation.

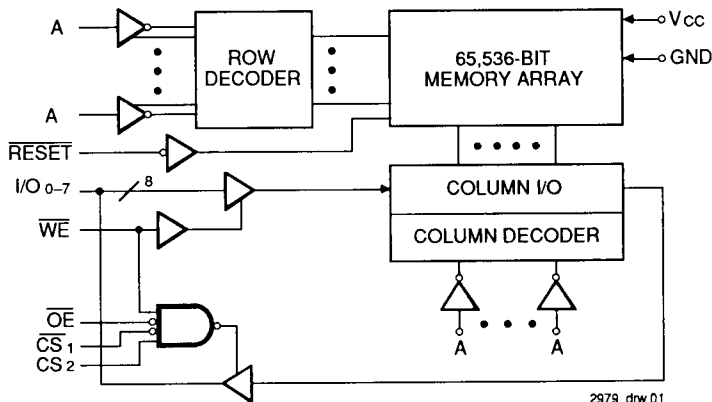
This product is fabricated using IDT's high-performance, high-reliability CEMOS technology. Address access time of 20ns and chip select ($\overline{CS1}$) time of 15ns are available with maximum power consumption of only 770mW. This circuit also offers a reduced power standby mode. When CS2 goes low, the circuit will automatically go to and remain in a low-power standby mode. In the full standby mode, the low-power device typically consumes less than 30 μ W. The low-power (L) version also offers a battery backup data retention capability where the circuit typically consumes only 10 μ W operating from a 2V battery.

The IDT7165 is packaged in a 28-pin 300 or 600 mil DIP, 28-pin gull-wing SOIC, and 32-pin LCC and PLCC, providing high board level densities.

Military grade product is manufactured in compliance with the latest revision of MIL-STD-883, Class B, making it ideally suited to the military temperature applications which require instant destruction of sensitive RAM data and demand the highest level of performance and reliability.

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FUNCTIONAL BLOCK DIAGRAM



NOTE:

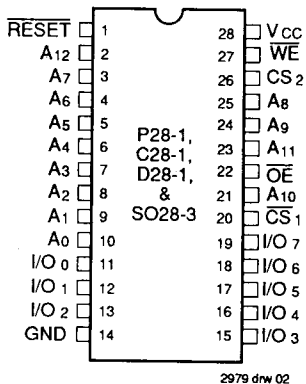
1. Not recommended for new designs. Contact marketing.

CEMOS is a trademark of Integrated Device Technology, Inc.

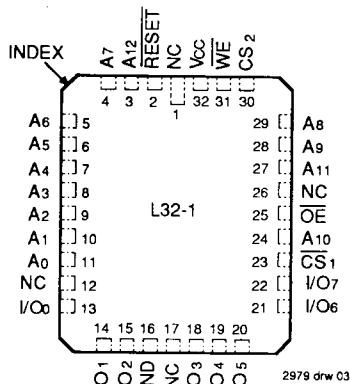
MILITARY AND COMMERCIAL TEMPERATURE RANGES

DECEMBER 1990

PIN CONFIGURATIONS



**DIP/SOIC
TOP VIEW**



**LCC/PLCC
TOP VIEW**

TRUTH TABLE ($V_{CC} = 0.2V$, $V_{HC} = V_{CC} - 0.2V$)^(1,2)

WE	CS ₁	CS ₂	OE	RESET	I/O	Function
X	X	X	X	L	—	Reset all bits to low
X	H	X	X	H	Z	Deselect chip
X	X	L	X	H	Z	Deselect power down ⁽¹⁾
X	V _{HC}	X	X	H	Z	Deselect chip
X	X	V _{LC}	X	V _{HC}	Z	CMOS deselect power down ⁽¹⁾
H	L	H	H	H	Z	Output disable
H	L	H	L	H	DOUT	Read
L	L	H	X	H	DIN	Write

NOTE:
1. CS₂ will power down CS₁, but CS₁ will not power down CS₂.
2. H = V_{IH}, L = V_{IL}, X = don't care.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Rating	Com'l.	Mil.	Unit
V _{TERM}	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
T _A	Operating Temperature	0 to +70	-55 to +125	°C
T _{BIAS}	Temperature Under Bias	-55 to +125	-65 to +135	°C
T _{STG}	Storage Temperature	-55 to +125	-65 to +150	°C
P _T	Power Dissipation	1.0	1.0	W
I _{OUT}	DC Output Current	50	50	mA

NOTE:
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.

PIN DESCRIPTIONS

A ₀ -12	Address
I/O ₀ -7	Data Input/Output
CS ₁ , CS ₂	Chip Select
RESET	Memory Reset
WE	Write Enable
OE	Output Enable
GND	Ground
V _{cc}	Power

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CAPACITANCE ($T_A = +25^\circ C$, $f = 1.0MHz$)

Symbol	Parameter ⁽¹⁾	Conditions	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	8	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	8	pF

NOTE:
1. This parameter is determined by device characterization, but is not production tested.

RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

Grade	Ambient Temperature	GND	Vcc
Military	-55°C to +125°C	0V	5V ± 10%
Commercial	0°C to +70°C	0V	5V ± 10%

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RECOMMENDED DC OPERATING CONDITIONS

Symbol	Parameter	Min.	Typ.	Max.	Unit
Vcc	Supply Voltage	4.5	5.0	5.5	V
GND	Supply Voltage	0	0	0	V
VIH	Input High Voltage	2.2	—	6.0	V
VIHR	RESET Input Voltage	2.5	—	6.0	V
VIL	Input Low Voltage	-0.5 ⁽¹⁾	—	0.8	V

NOTE:

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1. VIL (min.) = -3.0V for pulse width less than 20ns.

DC ELECTRICAL CHARACTERISTICS^(1, 2)

(VCC = 5.0V ± 10%, V_{LC} = 0.2V, V_{HC} = VCC - 0.2V)

Symbol	Parameter	Power	7165S30		7165S/L35		7165S/L45		7165S/L55		Unit
			Com'l.	Mil.	Com'l.	Mil.	Com'l.	Mil.	Com'l.	Mil.	
ICC1	Operating Power Supply Current CS ₁ = V _{IL} , CS ₂ = V _{IH} Outputs Open, Vcc = Max., f = 0	S	110	—	110	125	110	125	110	125	mA
		L	—	—	90	—	90	110	90	110	
ICC2	Dynamic Operating Current CS ₁ = V _{IL} , CS ₂ = V _{IH} Outputs Open, Vcc = Max., f = f _{MAX}	S	160	—	150	160	150	160	150	160	mA
		L	—	—	130	—	120	130	115	125	
ISB	Standby Power Supply Current (TTL Level) f = f _{MAX} CS ₁ ≥ V _{IH} , CS ₂ ≤ V _{IL} , RESET ≥ V _{IH} Outputs Open, Vcc = Max.	S	20	—	20	20	20	20	20	20	mA
		L	—	—	3	—	3	5	3	5	
ISB1	Full Standby Power Supply Current (CMOS Level) f = 0 CS ₂ ≤ V _{LC} and RESET ≥ V _{HC} Vcc = Max., V _{IN} ≥ V _{HC} or V _{IN} ≤ V _{LC}	S	15	—	15	20	15	20	15	20	mA
		L	—	—	0.2	—	0.2	1.0	0.2	1.0	

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NOTES:

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- All values are maximum guaranteed values.
- At f = f_{MAX} address and data are cycling at maximum frequency of read cycles f = 1/TRC. f = 0 means no inputs change.

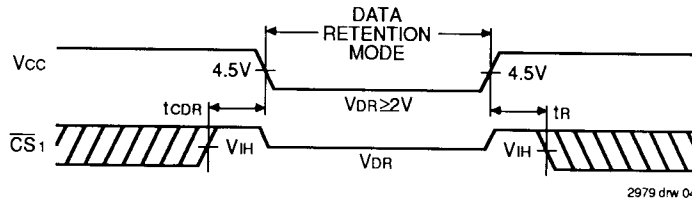
DC ELECTRICAL CHARACTERISTICS

VCC = 5.0V ± 10%

Symbol	Parameter	Test Condition	IDT7165S		IDT7165L		Unit	
			Min.	Max.	Min.	Max.		
I _{LI}	Input Leakage Current	Vcc = Max., V _{IN} = GND to Vcc	MIL.	—	10	—	5	μA
			COM'L.	—	5	—	2	
I _{LO}	Output Leakage Current	Vcc = Max., CS = V _{IH} , V _{OUT} = GND to Vcc	MIL.	—	10	—	5	μA
			COM'L.	—	5	—	2	
VOL	Output Low Voltage	IoL = 10mA, Vcc = Min.	—	0.5	—	0.5	V	
		IoL = 8mA, Vcc = Min.	—	0.4	—	0.4		
VOH	Output High Voltage	IoL = -4mA, Vcc = Min.	2.4	—	2.4	—	V	

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LOW V_{CC} DATA RETENTION WAVEFORM



DATA RETENTION CHARACTERISTICS OVER ALL TEMPERATURE RANGES

(L Version Only) V_{LC} = 0.2V, V_{HC} = V_{CC} - 0.2V

Symbol	Parameter	Test Condition	Min.	Typ. ⁽¹⁾ V _{CC} @		Max. V _{CC} @		Unit
				2.0v	3.0V	2.0V	3.0V	
V _{DR}	V _{CC} for Data Retention	—	2.0	—	—	—	—	V
I _{CCDR}	Data Retention Current	MIL. COM'L.	—	10	15	200	300	μA
t _{CDR} ⁽³⁾	Chip Deselect to Data Retention Time		CS ₂ ≤ V _{LC} , CS ₁ ≥ V _{HC} RESET ≥ V _{HC}	0	—	—	—	—
t _R ⁽³⁾	Operation Recovery Time		t _{RC} ⁽²⁾	—	—	—	—	ns
I _{LI} ⁽³⁾	Input Leakage Current		—	—	—	2	2	μA

NOTES:

1. T_A = +25°C.
2. t_{RC} = Read Cycle Time.
3. This parameter is guaranteed, but not tested.

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AC TEST CONDITIONS

Input Pulse Levels	GND to 3.0V
Input Rise/Fall Times	5ns
Input Timing Reference Levels	1.5V
Output Reference Levels	1.5V
Output Load	See Figures 1 and 2

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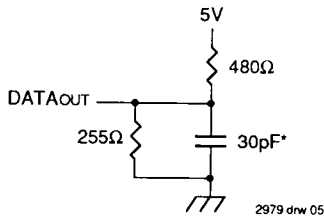


Figure 1. Output Load

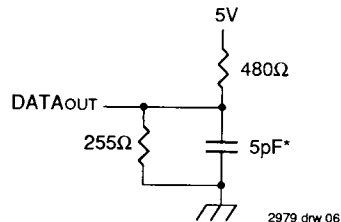


Figure 2. Output Load
(for t_{CLZ1, 2}, t_{OLZ}, t_{CHZ1, 2}, t_{OHZ}, t_{OW}, t_{WHZ})

*Includes scope and jig.

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 5.0V ± 10%, All Temperature Ranges)

Symbol	Parameter	7165S30 ⁽¹⁾		7165S35 7165L35 ⁽¹⁾		7165S45 7165L45		7165S55 ⁽³⁾ 7165L55 ⁽³⁾		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
		Read Cycle								
t _{RC}	Read Cycle Time	30	—	35	—	45	—	55	—	ns
t _{AA}	Address Access Time	—	30	—	35	—	45	—	55	ns
t _{ACS1}	Chip Select-1 Access Time ⁽²⁾	—	15	—	20	—	25	—	30	ns
t _{ACS2}	Chip Select-2 Access Time ⁽²⁾	—	35	—	40	—	45	—	55	ns
t _{CLZ1}	Chip Select-1 to Output in Low Z ⁽⁴⁾	0	—	0	—	0	—	0	—	ns
t _{CLZ2}	Chip Select-2 to Output in Low Z ⁽⁴⁾	5	—	5	—	5	—	5	—	ns
t _{OE}	Output Enable to Output Valid	—	15	—	20	—	25	—	30	ns
t _{OLZ}	Output Enable to Output in Low Z ⁽⁴⁾	3	—	3	—	3	—	3	—	ns
t _{CHZ1}	Chip Select-1 to Output in High Z ⁽⁴⁾	—	13	—	15	—	20	—	25	ns
t _{CHZ2}	Chip Select-2 to Output in High Z ⁽⁴⁾	—	13	—	15	—	20	—	25	ns
t _{OHZ}	Output Disable to Output in High Z ⁽⁴⁾	—	14	—	15	—	20	—	25	ns
t _{OH}	Output Hold from Address Change	5	—	5	—	5	—	5	—	ns
t _{PU}	Chip Select to Power Up Time ⁽⁴⁾	0	—	0	—	0	—	0	—	ns
t _{PD}	Chip Select to Power Down Time ⁽⁴⁾	—	30	—	35	—	45	—	55	ns
Write Cycle										
t _{WC}	Write Cycle Time	30	—	35	—	45	—	55	—	ns
t _{CW1}	Chip Select-1 to End of Write (\overline{CS}_1)	20	—	20	—	25	—	30	—	ns
t _{CW2}	Chip Select-2 to End of Write (CS ₂)	22	—	25	—	33	—	50	—	ns
t _{AW}	Address Valid to End of Write	22	—	25	—	33	—	50	—	ns
t _{AS}	Address Set-up Time	0	—	0	—	0	—	0	—	ns
t _{WP}	Write Pulse Width	23	—	25	—	25	—	50	—	ns
t _{WR1}	Write Recovery Time (\overline{CS}_1 , WE)	0	—	0	—	0	—	0	—	ns
t _{WR2}	Write Recovery Time (CS ₂)	5	—	5	—	5	—	5	—	ns
t _{WHZ}	Write Enable to Output in High Z ⁽⁴⁾	—	12	—	14	—	18	—	25	ns
t _{DW}	Data to Write Time Overlap	13	—	15	—	20	—	25	—	ns
t _{DH1}	Data Hold from Write Time (\overline{CS}_1)	3	—	3	—	3	—	3	—	ns
t _{DH2}	Data Hold from Write Time (CS ₂)	5	—	5	—	5	—	5	—	ns
t _{OW}	Output Active from End of Write ⁽⁴⁾	5	—	5	—	5	—	5	—	ns

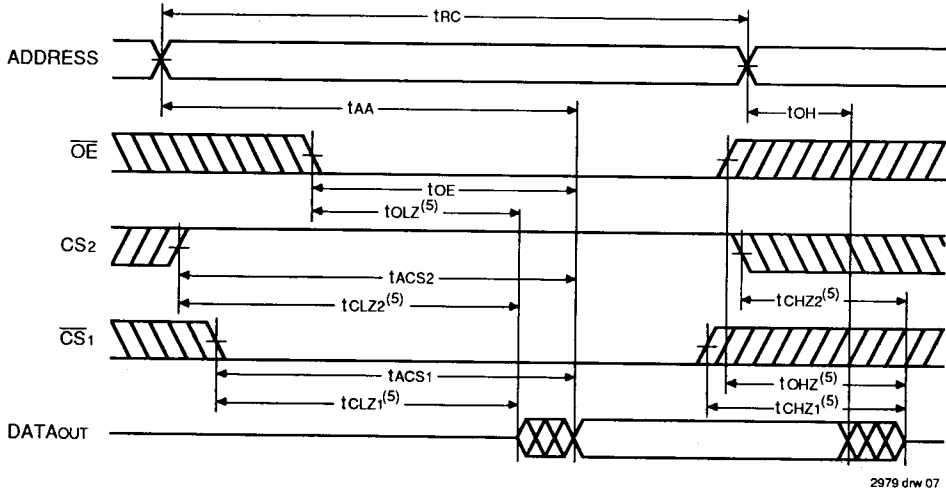
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NOTES:

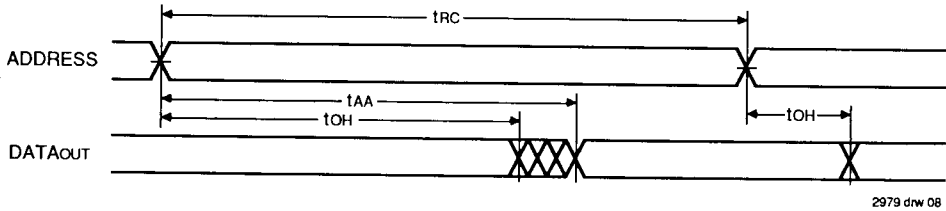
- 0° to +70°C temperature range only.
- Both chip selects must be active for the device to be selected.
- 55°C to +125°C temperature range only.
- This parameter is guaranteed, but not tested.

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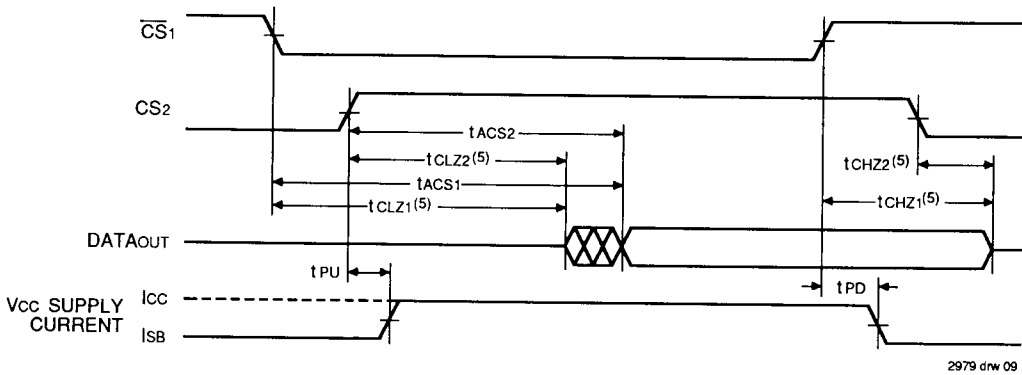
TIMING WAVEFORM OF READ CYCLE NO. 1⁽¹⁾



TIMING WAVEFORM OF READ CYCLE NO. 2^(1, 2, 4)



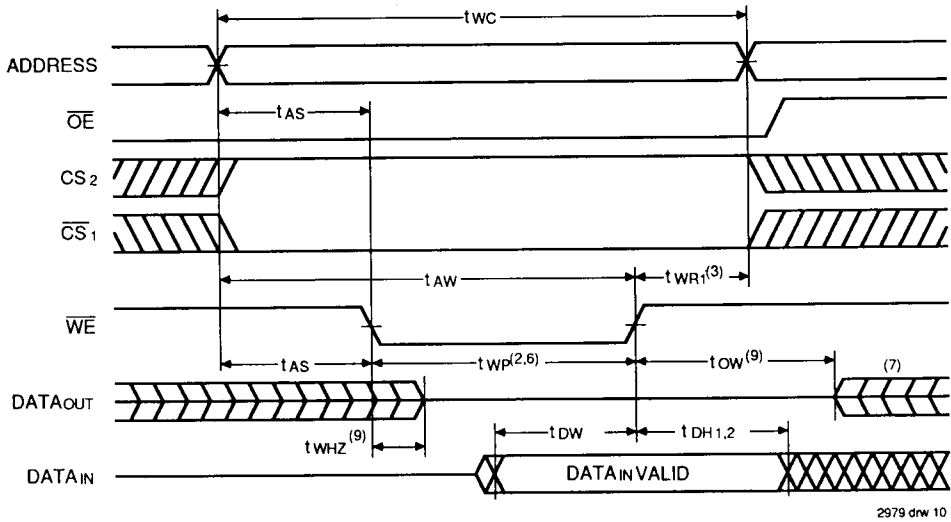
TIMING WAVEFORM OF READ CYCLE NO. 3^(1, 3, 4)



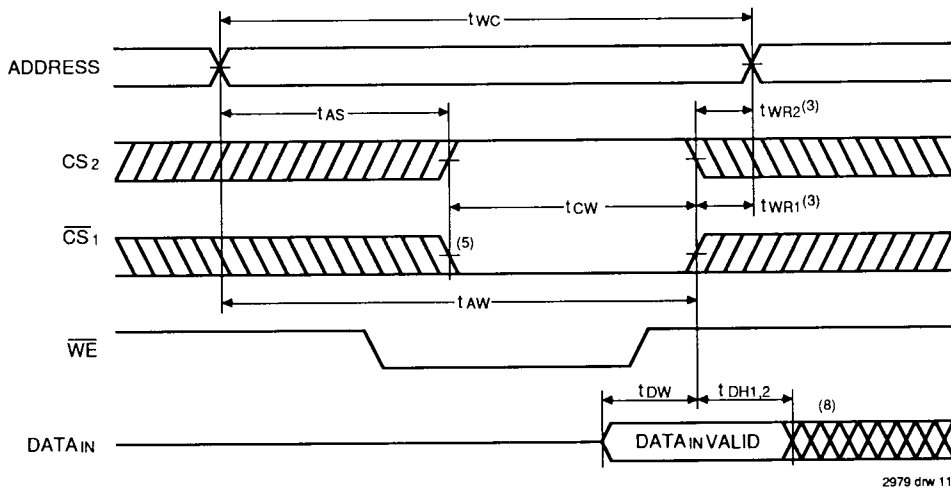
NOTES:

1. \overline{WE} is high for read cycle.
2. Device is continuously selected, $\overline{CS1} = V_{IL}$, $CS2 = V_{IH}$.
3. Address valid prior to or coincident with $\overline{CS1}$ transition low and $CS2$ transition high.
4. $\overline{OE} = V_{IL}$.
5. Transition is measured $\pm 200mV$ from steady state.

TIMING WAVEFORM OF WRITE CYCLE NO. 1 (\overline{WE} CONTROLLED TIMING)⁽¹⁾



TIMING WAVEFORM OF WRITE CYCLE NO. 2 (\overline{CS} CONTROLLED TIMING)⁽¹⁾



NOTES:

1. \overline{WE} , $\overline{CS_1}$ or CS_2 must be inactive during all address transitions.
2. A write occurs during the overlap (t_{WP}) of a low \overline{WE} , a low $\overline{CS_1}$ and a high CS_2 .
3. $t_{WR1,2}$ is measured from the earlier of $\overline{CS_1}$ or \overline{WE} going high or CS_2 going low to the end of the write cycle.
4. During this period, I/O pins are in the output state so that the input signals of opposite phase to the outputs must not be applied.
5. If the $\overline{CS_1}$ low transition or CS_2 high transition occurs simultaneously with or after the \overline{WE} low transition, the outputs remain in a high impedance state.
6. If \overline{OE} is low during a \overline{WE} controlled write cycle, the write pulse width must be the larger of t_{WP} or ($t_{WHZ} + t_{DW}$) to allow the I/O drivers to turn off and data to be placed on the bus for the required t_{DW} . If \overline{OE} is high during a \overline{WE} controlled write cycle, this requirement does not apply and the write pulse can be as short as the specified t_{WP} .
7. $DATA_{OUT}$ is the same phase of write data of this write cycle.
8. If $\overline{CS_1}$ is low and CS_2 is high during this period, I/O pins are in the output state. Data input signals of opposite phase to the outputs must not be applied to them.
9. Transition is measured $\pm 200mV$ from steady state.

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AC ELECTRICAL CHARACTERISTICS ($V_{CC} = 5.0V \pm 10\%$, All Temperature Ranges)

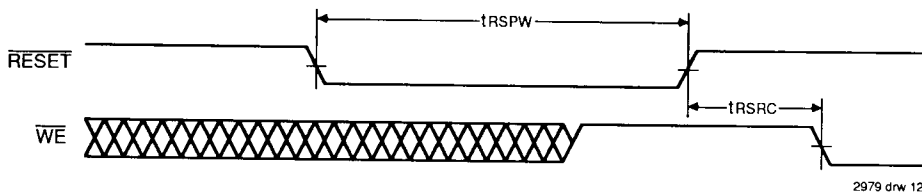
Symbol	Parameter	7165S30 ⁽¹⁾		7165S35 7165L35 ⁽¹⁾		7165S45 7165L45		7165S55 ⁽³⁾ 7165L55 ⁽³⁾		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle										
tRSPW	Reset Pulse Width ⁽²⁾	55	—	65	—	80	—	100	—	ns
tRSRC	Reset High to \overline{WE} Low	5	—	5	—	10	—	10	—	ns

NOTES:

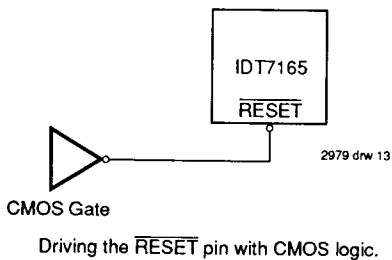
- 0° to +70°C temperature range only.
- Recommended duty cycle = 10% maximum.
- 55°C to +125°C temperature range only.

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RESET TIMING

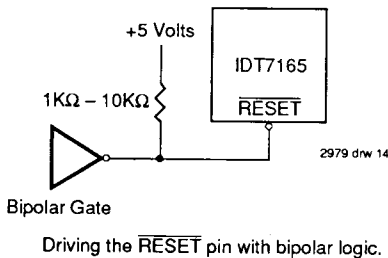


2979 drw 12



2979 drw 13

Driving the \overline{RESET} pin with CMOS logic.

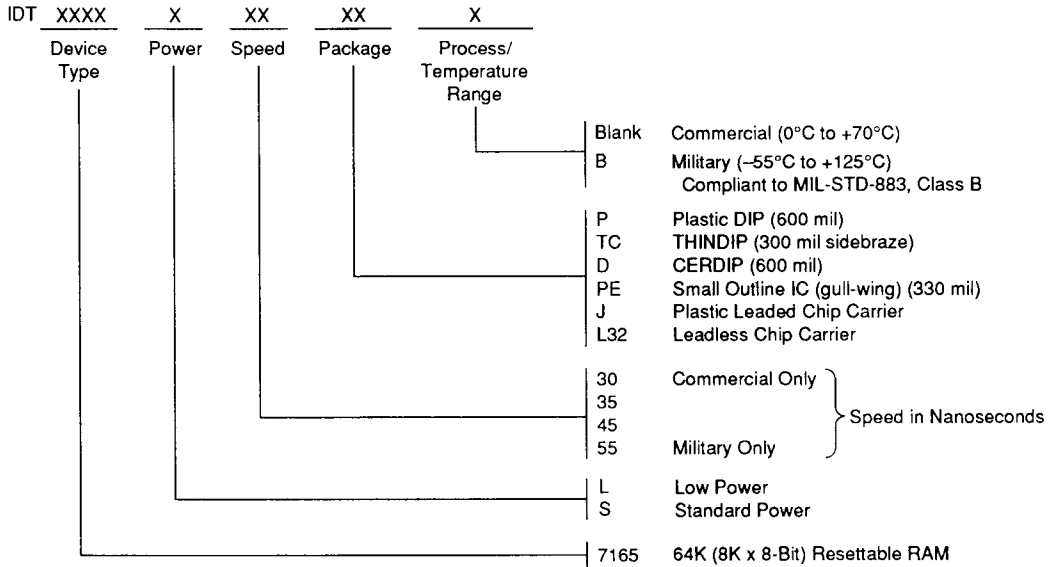


2979 drw 14

Driving the \overline{RESET} pin with bipolar logic.

Figure 3.

ORDERING INFORMATION



2979 drw 15