Integrated Device Technology, Inc.

LOW POWER 2V CMOS SRAM 1 MEG (64K x 16-BIT)

ADVANCE INFORMATION
IDT71T016

FEATURES:

- 64K x 16 Organization
- Wide Operating Voltage Range: 1.8 to 2.7V
- Speed Grades: 150ns, 200ns
- Low Operating Power: 20mA (max)
- Low Standby Power: 5µA (max)
- Low-Voltage Data Retention: 1.5V (min)
- Available in a 44-pin TSOP package

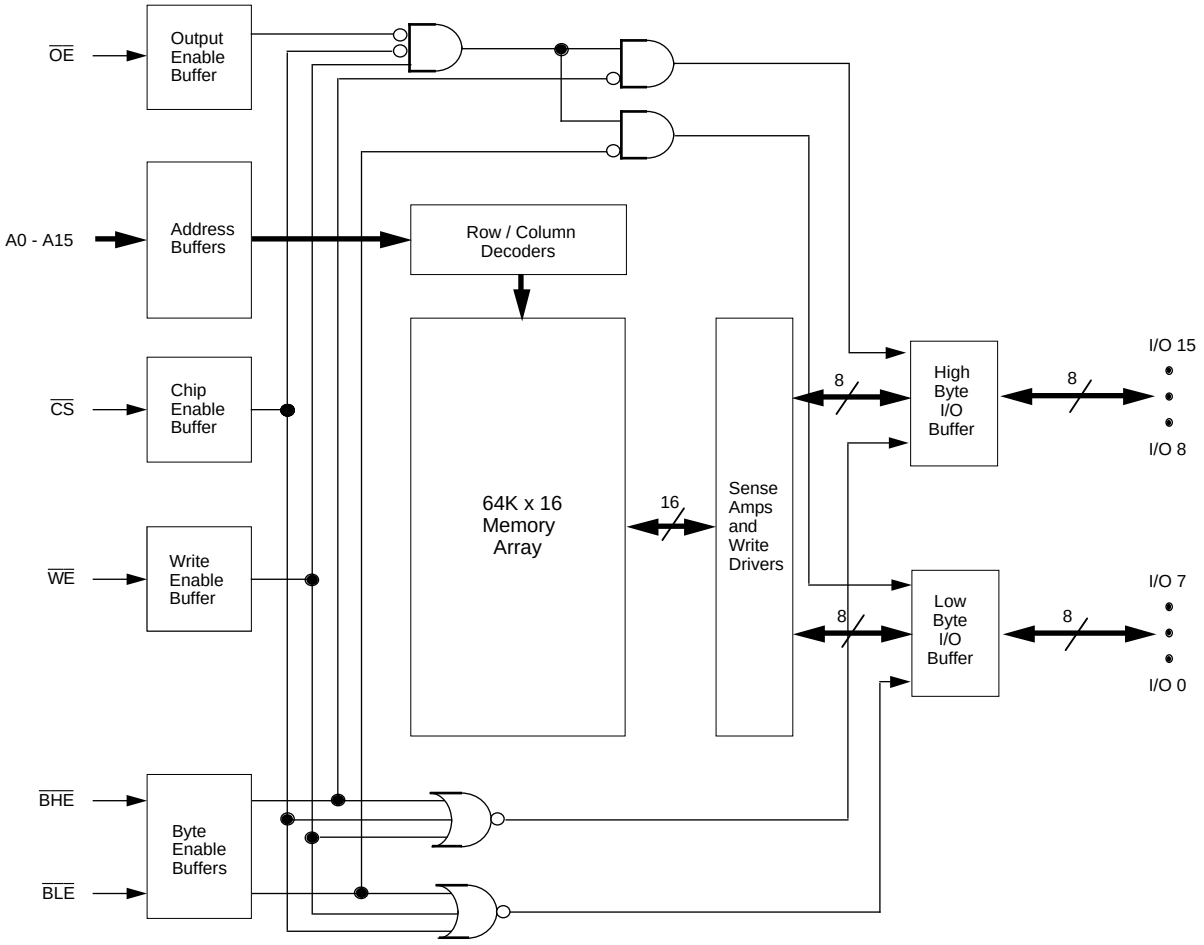
DESCRIPTION:

The IDT71T016 is a 1,048,576-bit very low-power Static RAM organized as 64K x 16. It is fabricated using IDT's high-reliability CMOS technology. This state-of-the-art technology, combined with innovative circuit design techniques, provides a cost-effective solution for low-power memory needs. It uses a 6-transistor memory cell.

Operation is from a single extended-range 2.5V supply. This extended supply range makes the device ideally suited for unregulated battery-powered applications. Fully static asynchronous circuitry is used, requiring no clocks or refresh for operation.

The IDT71T016 is packaged in a JEDEC standard 44-pin TSOP Type II.

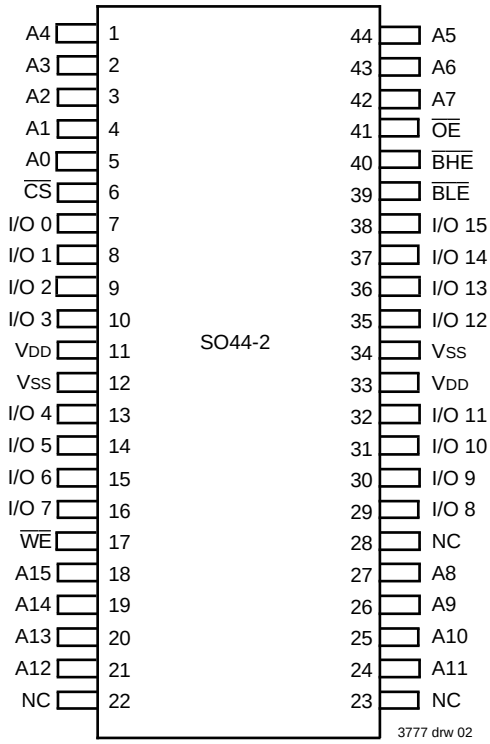
FUNCTIONAL BLOCK DIAGRAM



The IDT logo is a registered trademark of Integrated Device Technology, Inc.

3777 drw 01

PIN CONFIGURATIONS



TSOP
TOP VIEW

CAPACITANCE

(T_A = +25°C, f = 1.0MHz)

Symbol	Parameter[1]	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 1dV	6	pF
$C_{I/O}$	I/O Capacitance	V_{OUT} = 1dV	7	pF

NOTE: 3777 tbl 06

1. This parameter is guaranteed by device characterization, but not production tested.

PIN DESCRIPTIONS

A_0 – A_{15}	Address Inputs	Input
$\overline{CS}$	Chip Select	Input
$\overline{WE}$	Write Enable	Input
$\overline{OE}$	Output Enable	Input
$\overline{BHE}$	High Byte Enable	Input
$\overline{BLE}$	Low Byte Enable	Input
I/O_0 - I/O_{15}	Data Input/Output	I/O
V_{DD}	Power	Pwr
V_{SS}	Ground	Gnd

3777 tbl 01

TRUTH TABLE[1]

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O_0-I/O_7	I/O_8-I/O_{15}	Function
H	X	X	X	X	High-Z	High-Z	Deselected - Standby
L	L	H	L	H	$DATA_{OUT}$	High-Z	Low Byte Read
L	L	H	H	L	High-Z	$DATA_{OUT}$	High Byte Read
L	L	H	L	L	$DATA_{OUT}$	$DATA_{OUT}$	Word Read
L	X	L	L	L	$DATA_{IN}$	$DATA_{IN}$	Word Write
L	X	L	L	H	$DATA_{IN}$	High-Z	Low Byte Write
L	X	L	H	L	High-Z	$DATA_{IN}$	High Byte Write
L	H	H	X	X	High-Z	High-Z	Outputs Disabled
L	X	X	H	H	High-Z	High-Z	Outputs Disabled

NOTE: 3777 tbl 02

1.H = V_{IH}, L = V_{IL}, X = Don't care.

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Rating	Com'l. and Ind'l.	Unit
V_{TERM}(2)	Terminal Voltage with Respect to V_{SS}	–0.5 to +3.6	V
V_{TERM}(3)	Terminal Voltage with Respect to V_{SS}	–0.5 to V_{DD} + 0.5	V
T_{BIAS}	Temperature Under Bias	–55 to +125	°C
T_{STG}	Storage Temperature	–55 to +125	°C
P_T	Power Dissipation	1.0	W
I_{OUT}	DC Output Current	20	mA

3777 tbl 03

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_{DD} terminals only.
3. Input, Output,and I/O terminals; 3.6V maximum.

RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

Grade	Temperature	Vss	V_{DD}
Commercial	0°C to +70°C	0V	1.8V to 2.7V
Industrial	-40°C to +85°C	0V	1.8V to 2.7V

3777 tbl 04

RECOMMENDED DC OPERATING CONDITIONS

Symbol	Parameter	Min.	Max.	Unit
V_{DD}	Supply Voltage	1.8	2.7	V
V_{SS}	Ground	0	0	V
V_{IH}	Input High Voltage	V_{DD} x 0.7	V_{DD} + 0.3(1)	V
V_{IL}	Input Low Voltage	–0.3(2)	V_{DD} x 0.3	V

3777 tbl 05

NOTE:
1. V_{IH} (max.) = V_{DD} + 1.5V for pulse width less than 5ns, once per cycle.
1. V_{IL} (min.) = –1.5V for pulse width less than 5ns, once per cycle.

DC ELECTRICAL CHARACTERISTICS

V_{DD} = 1.8V to 2.7V, Commercial and Industrial Temperature Ranges

Symbol	Parameter	Test Conditions		Min.	Max.	Unit
$\|I_{LI}\|$	Input Leakage Current	V_{DD} = Max., V_{IN} = V_{SS} to V_{DD}		—	1	µA
$\|I_{LO}\|$	Output Leakage Current	V_{DD} = Max., $\overline{CS}$ = V_{IH}, V_{OUT} = V_{SS} to V_{DD}		—	1	µA
V_{OH}	Output High Voltage	V_{DD} = 1.8 to 2.7V	I_{OH} = –0.3mA	V_{DD} - 0.2	—	V
		V_{DD} = 2.3V	I_{OH} = –2.0mA	1.7	—	
V_{OL}	Output Low Voltage	V_{DD} = 1.8 to 2.7V	I_{OL} = 0.3mA	—	0.2	V
		V_{DD} = 2.3V	I_{OL} = 2mA	—	0.4	

3777 tbl 07

DC ELECTRICAL CHARACTERISTICS(1, 2)

V_{DD} = 1.8 to 2.7V, V_{LC} = 0.2V, V_{HC} = V_{DD}–0.2V, Commercial and Industrial Temperature Ranges

Symbol	Parameter	Test Conditions		Typ.(5)	Max.	Unit
I_{CC2}	Dynamic Operating Current	$\overline{CS}$ = V_{LC}, Outputs Open,	-70 ns	—	20	mA
		V_{DD} = 2.7V, f = f_{MAX}(3)	-100 ns	—	17	
I_{CC}	Static Operating Current	$\overline{CS}$ = V_{LC}, Outputs Open, $\overline{WE}$ = V_{HC}, V_{DD} = 2.7V, f = 0(4)		—	8	mA
I_{SB1}	Standby Supply Current	$\overline{CS}$ = V_{HC}, Outputs Open, V_{DD} = 2.7V	-40 to 85°C	—	10	µA
			0 to 70°C	—	5	
			40°C	—	2	
			25°C	—	1	

3771 tbl 08

NOTES:
1. All values are maximum guaranteed values.
2. Input low and high voltage levels are 0.2V and V_{DD}-0.2V respectively for all tests.
3. f_{MAX} = 1/t_{RC} (all address inputs are cycling at f_{MAX}).
4. f = 0 means no address input lines are changing .
5. Typical conditions are V_{DD} = 2.0V and specified temperature.

DATA RETENTION CHARACTERISTICS OVER ALL TEMPERATURE RANGES

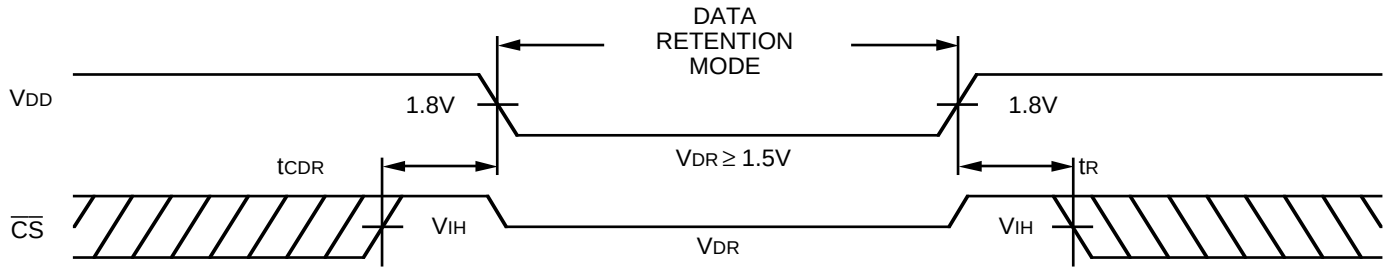
(V_{LC} = 0.2V, V_{HC} = V_{DD} - 0.2V)

Symbol	Parameter	Test Condition	Min.	Typ. [1]	Max.	Unit
V_{DR}	V_{CC} for Data Retention	—	1.5	—	—	V
I_{CCDR}	Data Retention Current	$\overline{CS} \geq V_{HC}$	—	<1	5	µA
t_{CDR}[3]	Chip Deselect to Data Retention Time		0	—	—	ns
t_R[3]	Operation Recovery Time		t_{RC}[2]	—	—	ns

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

3777 tbl 09

LOW V_{DD} DATA RETENTION WAVEFORM



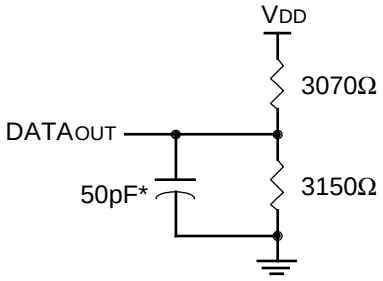
3777 drw 05

AC TEST CONDITIONS

Input Pulse Levels	GND to V_{DD}
Input Rise/Fall Times	3ns
Input Timing Reference Levels	V_{DD} x 0.5
Output Reference Levels	V_{DD} x 0.5
AC Test Load	See Figure 1

3777 tbl 09

AC TEST LOAD



3777 drw 04

*Including jig and scope capacitance.

Figure 1. AC Test Load

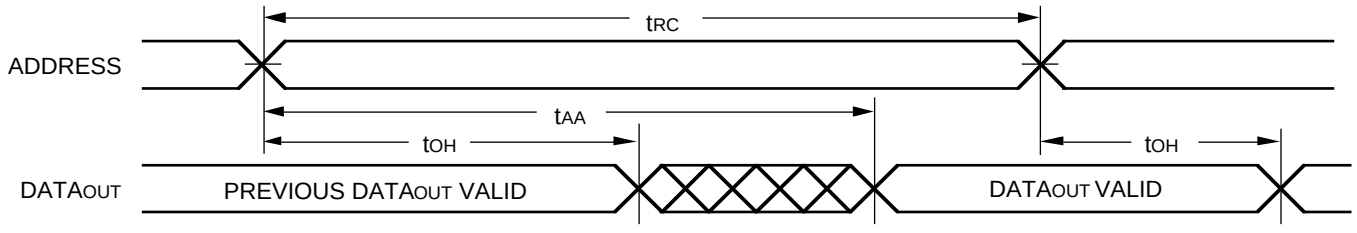
AC ELECTRICAL CHARACTERISTICS (V_{DD} = 1.8 to 2.7V, All Temperature Ranges)

Symbol	Parameter	71T016L150		71T016L200		Units
		Min.	Max.	Min.	Max.	
Read Cycle						
t_{RC}	Read Cycle Time	150	—	200	—	ns
t_{AA}	Address Access Time	—	150	—	200	ns
t_{ACS}	Chip Select Access Time	—	150	—	200	ns
t_{CLZ}(1)	Chip Select Low to Output in Low-Z	20	—	20	—	ns
t_{CHZ}(1)	Chip Select High to Output in High-Z	—	30	—	40	ns
t_{OE}	Output Enable Low to Output Valid	—	75	—	100	ns
t_{OLZ}(1)	Output Enable Low to Output in Low-Z	20	—	20	—	ns
t_{OHZ}(1)	Output Enable High to Output in High-Z	—	30	—	40	ns
t_{OH}	Output Hold from Address Change	15	—	15	—	ns
t_{BE}	Byte Enable Low to Output Valid	—	75	—	100	ns
t_{BLZ}(1)	Byte Enable Low to Output in Low-Z	20	—	20	—	ns
t_{BHZ}(1)	Byte Enable High to Output in High-Z	—	30	—	40	ns
Write Cycle						
t_{WC}	Write Cycle Time	150	—	200	—	ns
t_{AW}	Address Valid to End of Write	120	—	160	—	ns
t_{CW}	Chip Select Low to End of Write	120	—	160	—	ns
t_{BW}	Byte Enable Low to End of Write	120	—	160	—	ns
t_{AS}	Address Set-up Time	0	—	0	—	ns
t_{WR}	Address Hold from End of Write	0	—	0	—	ns
t_{WP}	Write Pulse Width	100	—	140	—	ns
t_{DW}	Data Valid to End of Write	60	—	80	—	ns
t_{DH}	Data Hold Time	0	—	0	—	ns
t_{OW}(1)	Write Enable High to Output in Low-Z	5	—	5	—	ns
t_{WHZ}(1)	Write Enable Low to Output in High-Z	—	40	—	50	ns

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

3777 tbl 10

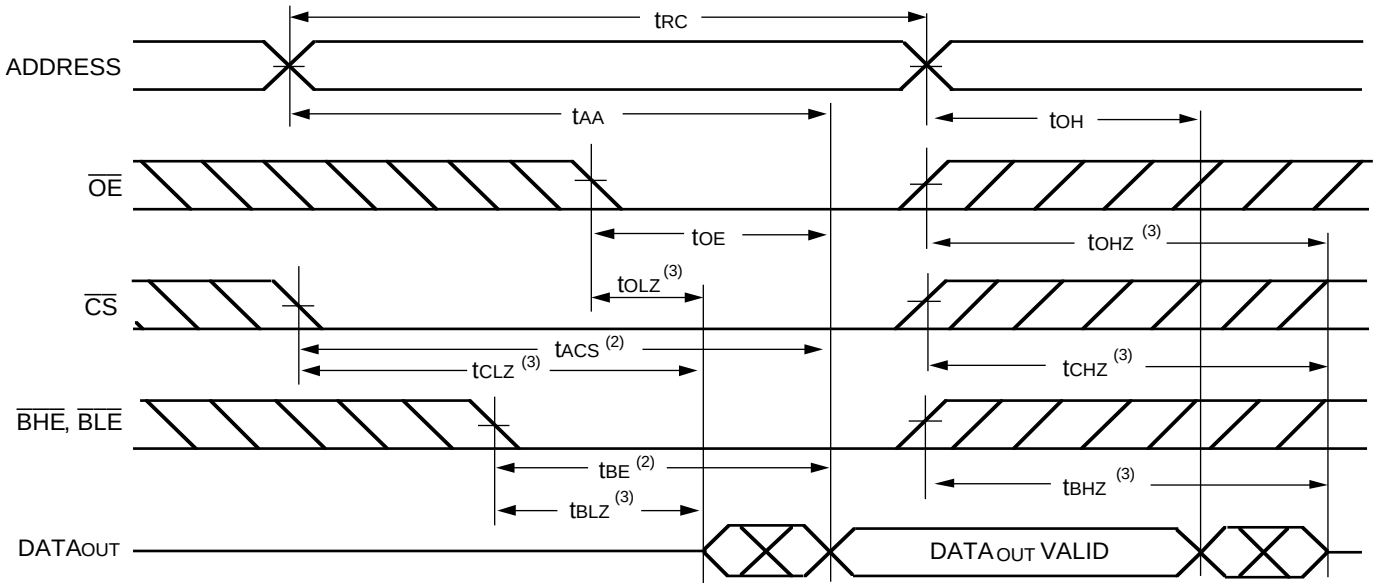
TIMING WAVEFORM OF READ CYCLE NO. 1(1,2,3)



3777 drw 06

NOTES:
1. $\overline{WE}$ is HIGH for Read Cycle.
2. Device is continuously selected, $\overline{CS}$ is LOW.
3. $\overline{OE}$, $\overline{BHE}$, and $\overline{BLE}$ are LOW.

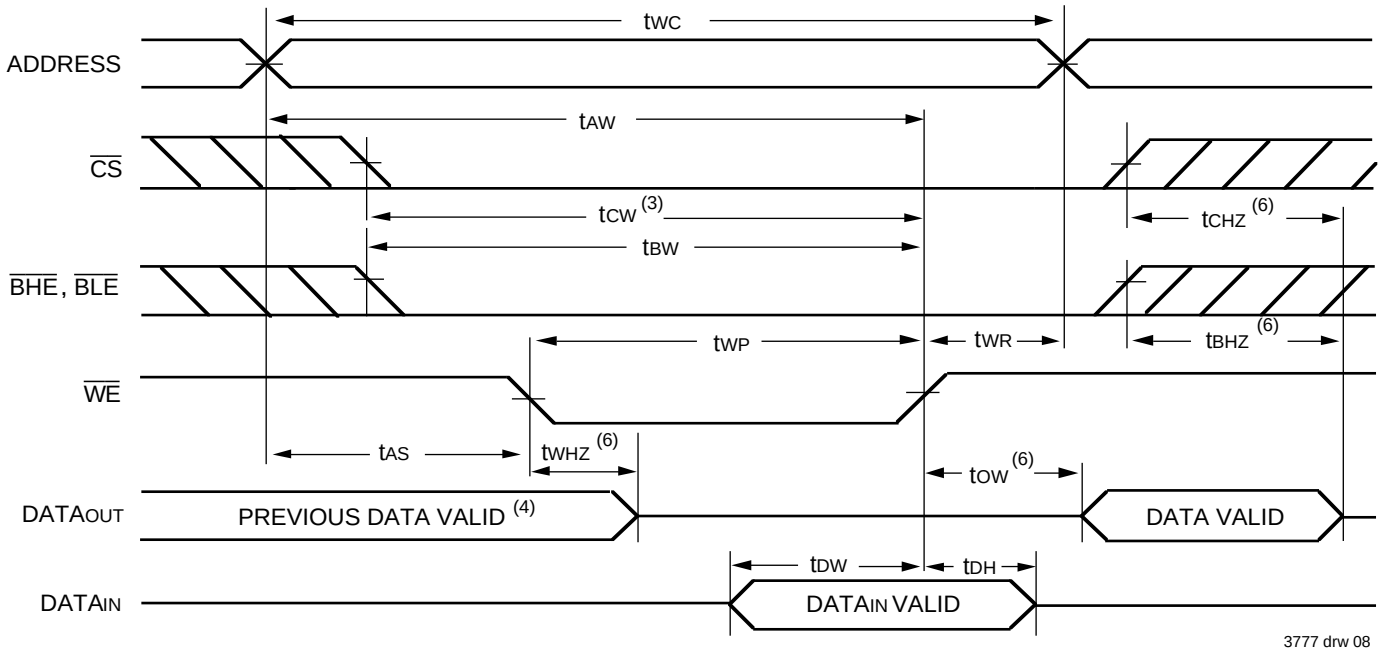
TIMING WAVEFORM OF READ CYCLE NO. 2(1)



3777 drw 07

NOTES:
1. $\overline{WE}$ is HIGH for Read Cycle.
2. Address must be valid prior to or coincident with the later of $\overline{CS}$, $\overline{BHE}$, or $\overline{BLE}$ transition LOW; otherwise t_{AA} is the limiting parameter.
3. Transition is measured ±200mV from steady state.

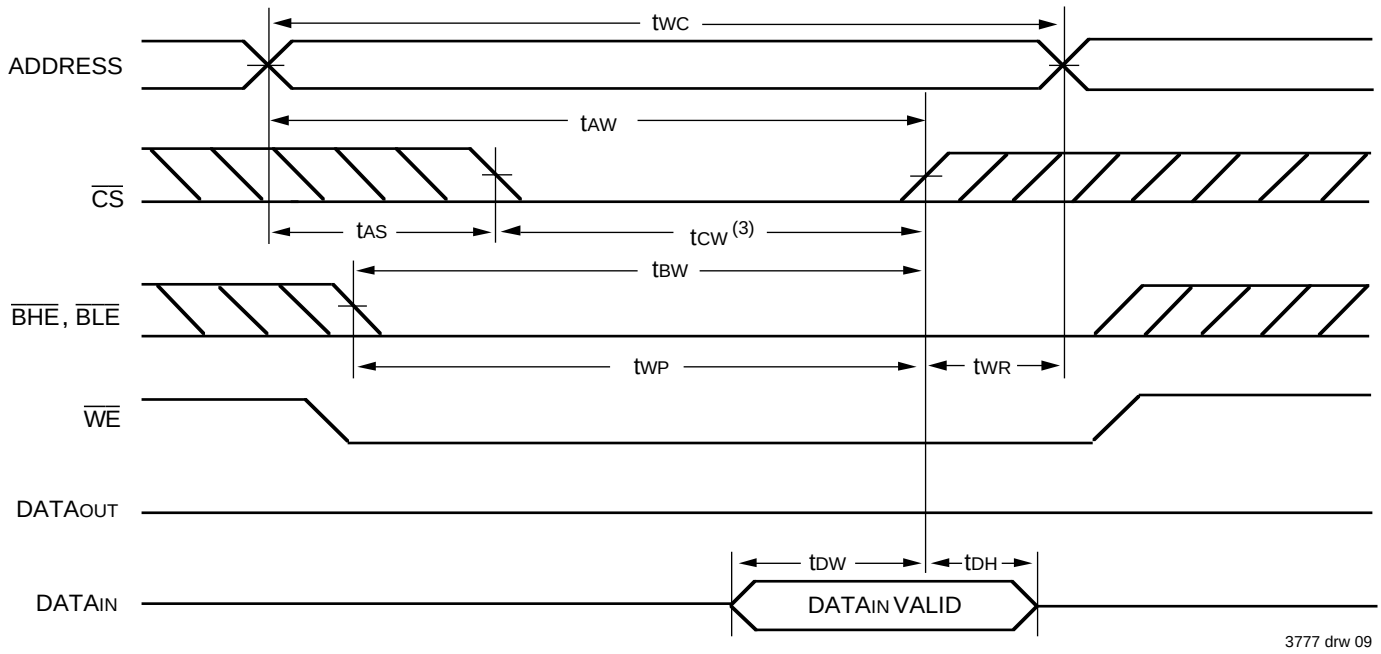
TIMING WAVEFORM OF WRITE CYCLE NO. 1 ($\overline{WE}$ CONTROLLED TIMING)(1,2,3,5)



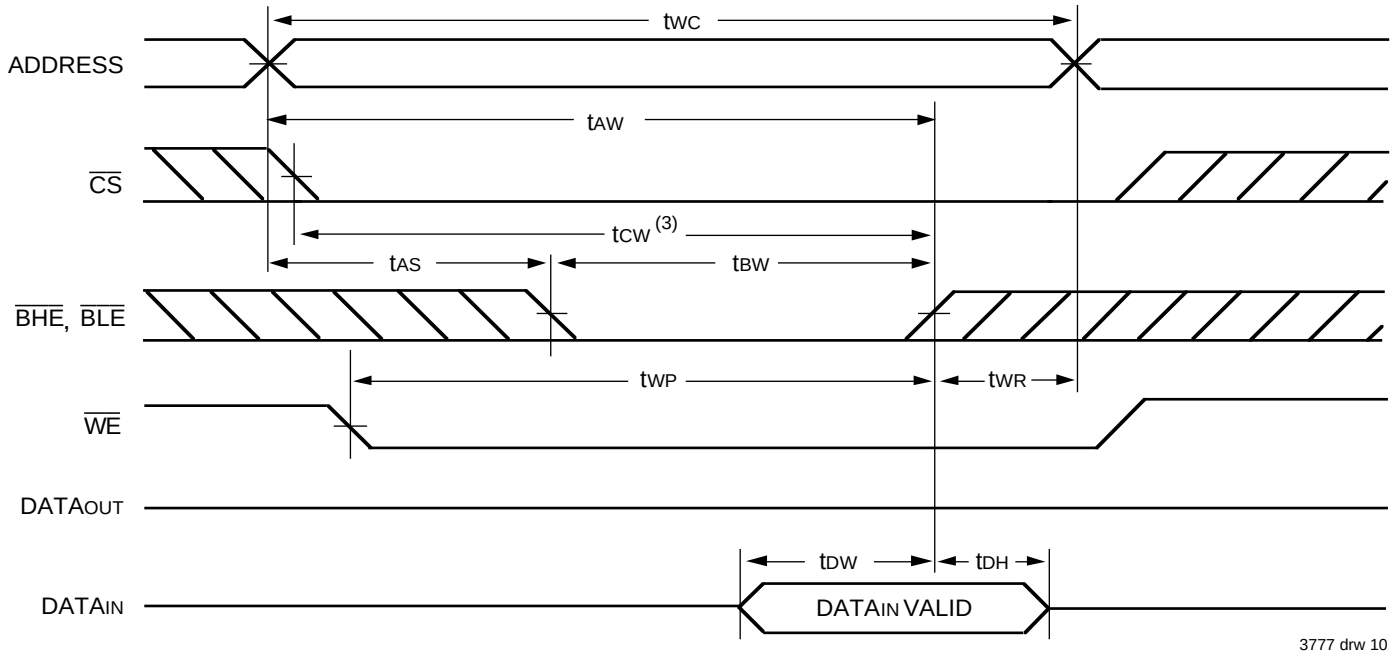
3777 drw 08

NOTES:
1. $\overline{WE}$ or ($\overline{BHE}$ and $\overline{BLE}$) or $\overline{CS}$ must be HIGH during all address transitions.
2. A write occurs during the overlap of a LOW $\overline{CS}$, LOW $\overline{BHE}$ or $\overline{BLE}$, and a LOW $\overline{WE}$.
3. $\overline{OE}$ is continuously HIGH. If during a $\overline{WE}$ controlled write cycle $\overline{OE}$ is LOW, t_{WP} must be greater than or equal to $t_{WHZ} + t_{DW}$ 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 minimum write pulse is as short as the specified t_{WP}.
4. During this period, I/O pins are in the output state, and input signals must not be applied.
5. If the $\overline{CS}$ LOW or $\overline{BHE}$ and $\overline{BLE}$ LOW transition occurs simultaneously with or after the $\overline{WE}$ LOW transition, the outputs remain in a high-impedance state.
6. Transition is measured ±200mV from steady state.

TIMING WAVEFORM OF WRITE CYCLE NO. 2 ($\overline{CS}$ CONTROLLED TIMING)(1,2,5)

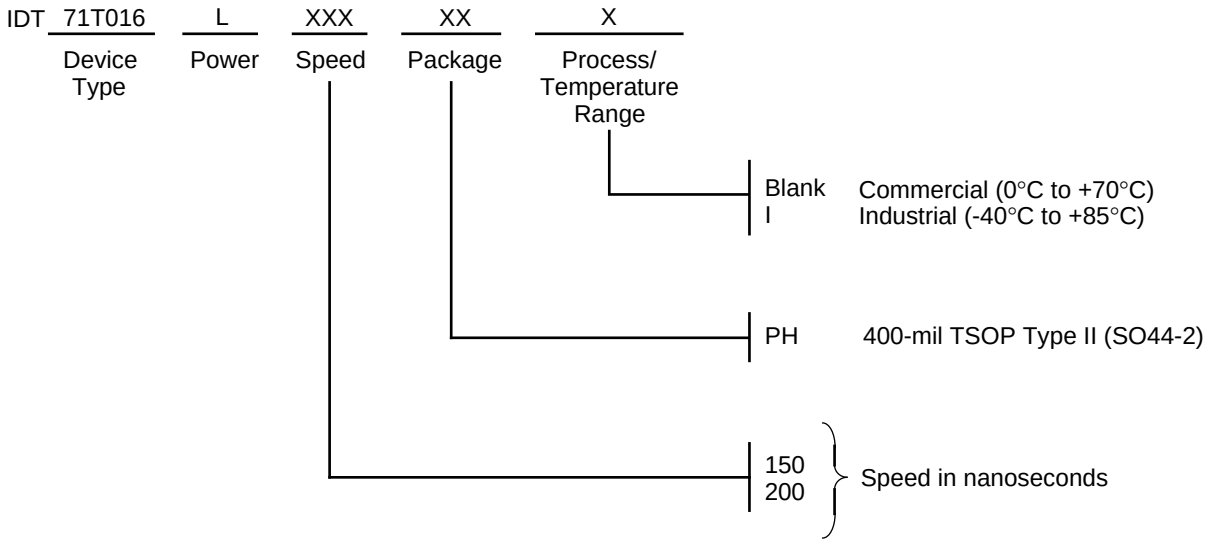


TIMING WAVEFORM OF WRITE CYCLE NO. 3 ($\overline{BHE}$, $\overline{BLE}$ CONTROLLED TIMING)(1,2,5)



NOTES:
1. $\overline{WE}$ or ($\overline{BHE}$ and $\overline{BLE}$) or $\overline{CS}$ must be HIGH during all address transitions.
2. A write occurs during the overlap of a LOW $\overline{CS}$, LOW $\overline{BHE}$ or $\overline{BLE}$, and a LOW $\overline{WE}$.
3. $\overline{OE}$ is continuously HIGH. If during a $\overline{WE}$ controlled write cycle $\overline{OE}$ is LOW, t_{WP} must be greater than or equal to $t_{WHZ} + t_{DW}$ 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 minimum write pulse is as short as the specified t_{WP}.
4. During this period, I/O pins are in the output state, and input signals must not be applied.
5. If the $\overline{CS}$ LOW or $\overline{BHE}$ and $\overline{BLE}$ LOW transition occurs simultaneously with or after the $\overline{WE}$ LOW transition, the outputs remain in a high-impedance state.
6. Transition is measured ±200mV from steady state.

ORDERING INFORMATION



3777 drw 11