3.3V CMOS Static RAM for Automotive Applications 4 Meg (256K x 16-Bit)

IDT71V416YS
IDT71V416YL

Features

- **256K x 16 advanced high-speed CMOS Static RAM**
- **JEDEC Center Power / GND pinout for reduced noise.**
- **Equal access and cycle times**
  - *Automotive: 12/15/20ns*
- **One Chip Select plus one Output Enable pin**
- **Bidirectional data inputs and outputs directly LVTTL-compatible**
- **Low power consumption via chip deselect**
- **Upper and Lower Byte Enable Pins**
- **Single 3.3V power supply**
- **Available in 44-pin, 400 mil plastic SOJ package and a 44-pin, 400 mil TSOP Type II package and a 48 ball grid array, 9mm x 9mm package.**

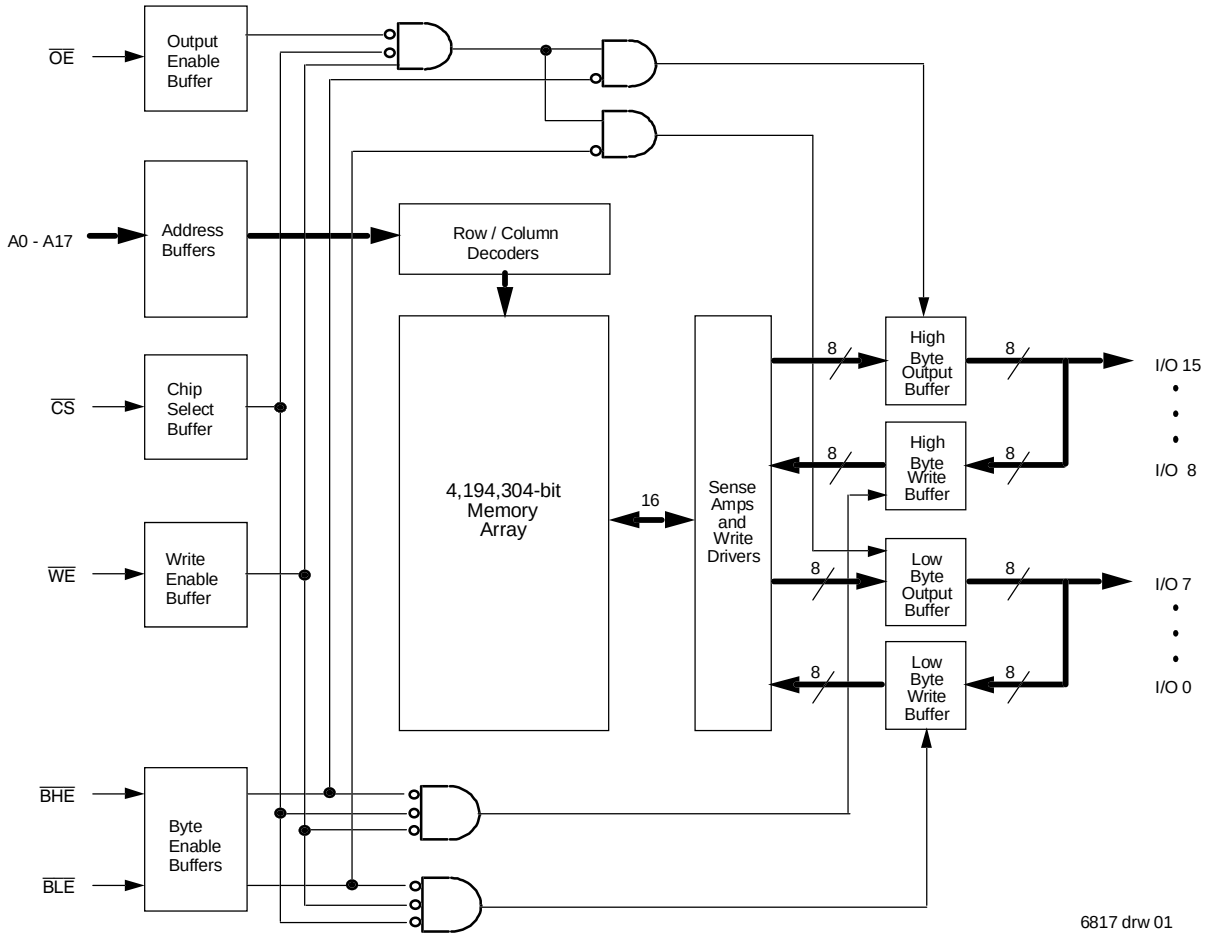
Description

The IDT71V416 is a 4,194,304-bit high-speed Static RAM organized as 256K x 16. It is fabricated using IDT's high-perfomance, high-reliability CMOS technology. This state-of-the-art technology, combined with innovative circuit design techniques, provides a cost-effective solution for high-speed memory needs and automotive applications.

The IDT71V416 has an output enable pin which operates as fast as 5ns, with address access times as fast as 10ns. All bidirectional inputs and outputs of the IDT71V416 are LVTTL-compatible and operation is from a single 3.3V supply. Fully static asynchronous circuitry is used, requiring no clocks or refresh for operation.

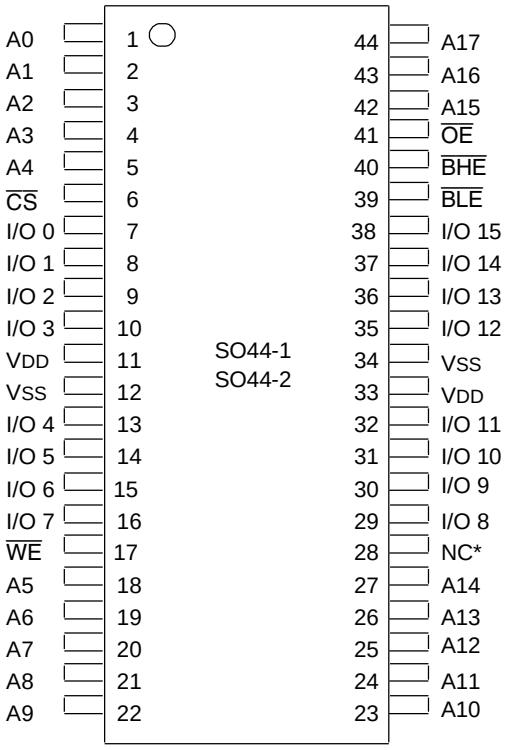
The IDT71V416 is packaged in a 44-pin, 400 mil Plastic SOJ and a 44-pin, 400 mil TSOP Type II package and a 48 ball grid array, 9mm x 9mm package.

Functional Block Diagram



DECEMBER 2004

Pin Configurations - SOJ/TSOP



6817 drw 02

*Pin 28 can either be a NC or connected to Vss

Top View

Pin Configurations - 48 BGA

	1	2	3	4	5	6
A	$\overline{BLE}$	$\overline{OE}$	A_0	A_1	A_2	NC
B	I/O_0	$\overline{BHE}$	A_3	A_4	$\overline{CS}$	I/O_8
C	I/O_1	I/O_2	A_5	A_6	I/O_{10}	I/O_9
D	V_{SS}	I/O_3	A_{17}	A_7	I/O_{11}	V_{DD}
E	V_{DD}	I/O_4	NC	A_{16}	I/O_{12}	V_{SS}
F	I/O_6	I/O_5	A_{14}	A_{15}	I/O_{13}	I/O_{14}
G	I/O_7	NC	A_{12}	A_{13}	$\overline{WE}$	I/O_{15}
H	NC	A_8	A_9	A_{10}	A_{11}	NC

6817 tbl 11

Pin Descriptions

A_0 - A_{17}	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}	3.3V Power	Pwr
V_{SS}	Ground	Gnd

6817 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:
1. H = V_{IH}, L = V_{IL}, X = Don't care.

6817 tbl 03

Absolute Maximum Ratings(1)

Symbol	Rating	Value	Unit
V_{DD}	Supply Voltage Relative to V_{SS}	-0.5 to +4.6	V
V_{IN}, V_{OUT}	Terminal Voltage Relative to V_{SS}	-0.5 to V_{DD}+0.5	V
T_{BIAS}	Temperature Under Bias	-55 to +125	°C
T_J	Junction Temperature Range	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_T	Power Dissipation	1	W
I_{OUT}	DC Output Current	50	mA

6817 tbl 04

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.

SOJ/TSOP Capacitance

(T_A = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 3dV	7	pF
$C_{I/O}$	I/O Capacitance	V_{OUT} = 3dV	8	pF

6817 tbl 02

48 BGA Capacitance

(T_A = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 3dV	6	pF
$C_{I/O}$	I/O Capacitance	V_{OUT} = 3dV	7	pF

6817 tbl 02b

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

Recommended Operating Temperature and Supply Voltage

Grade	Temperature	V_{SS}	V_{DD}
Automotive Grade 1	-40°C to +125°C	0V	See Below
Automotive Grade 2	-40°C to +105°C	0V	See Below
Automotive Grade 3	-40°C to +85°C	0V	See Below
Automotive Grade 4	0°C to +70°C	0V	See Below

6817 tbl 05

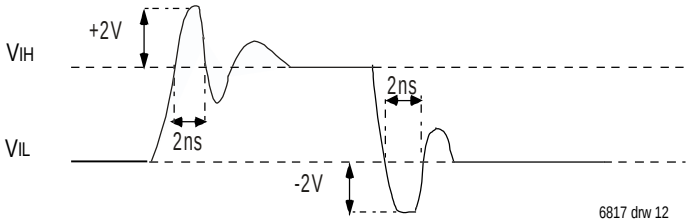
Recommended DC Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage	3.0	3.3	3.6	V
V_{SS}	Ground	0	0	0	V
V_{IH}	Input High Voltage	2.0	—	V_{DD}+0.3(1)	V
V_{IL}	Input Low Voltage	-0.3(1)	—	0.8	V

6817 tbl 06

NOTE:
1. Refer to maximum overshoot/undershoot diagram below. The measured voltage at device pin must not exceed half sinusoidal wave with 2V peak and half period of 2ns.

Maximum Overshoot/Undershoot



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DC Electrical Characteristics

(V_{DD} = Min. to Max., Automotive Temperature Ranges)

Symbol	Parameter	Test Conditions	Automotive Temperature Grade	IDT71V416 Min.	IDT71V416 Max.	Unit
$\|I_{LI}\|$	Input Leakage Current	V_{DD} = Max., V_{IN} = V_{SS} to V_{DD}	1 and 2	—	5	µA
			3 and 4	—	1	
$\|I_{LO}\|$	Output Leakage Current	V_{DD} = Max., $\overline{CS}$ = V_{IH}, V_{OUT} = V_{SS} to V_{DD}	1 and 2	—	5	µA
			3 and 4	—	1	
V_{OL}	Output Low Voltage	I_{OL} = 8mA, V_{DD} = Min.		—	0.4	V
V_{OH}	Output High Voltage	I_{OH} = -4mA, V_{DD} = Min.		2.4	—	V

6817 tbl 07

DC Electrical Characteristics(1, 2, 3)

(V_{DD} = Min. to Max., V_{LC} = 0.2V, V_{HC} = V_{DD} – 0.2V, Automotive Temperature Ranges)

Symbol	Parameter			71V416S/L12 Automotive Grade 1	71V416S/L12 Automotive Grade 2	71V416S/L12 Automotive Grade 3 and 4	71V416S/L15 Automotive Grade 1	71V416S/L15 Automotive Grade 2	71V416S/L15 Automotive Grade 3 and 4	71V416S/L20 Automotive Grade 1	71V416S/L20 Automotive Grade 2	71V416S/L20 Automotive Grade 3 and 4	Unit
I_{CC}	Dynamic Operating Current CS ≤ V_{LC}, Outputs Open, V_{DD} = Max., f = f_{MAX}(3)	S	Max.	130	120	110	125	115	105	120	110	100	mA
		L	Max.	120	110	100	115	105	95	110	100	90	
			Typ.(4)	85	85	85	80	80	80	80	80	80	
I_{SB}	Dynamic Standby Power Supply Current CS ≥ V_{HC}, Outputs Open, V_{DD} = Max., f = f_{MAX}(3)	S	Max.	65	65	65	55	55	50	50	50	50	mA
		L	Max.	50	50	45	45	45	40	40	40	40	
I_{SB1}	Full Standby Power Supply Current (static) CS ≥ V_{HC}, Outputs Open, V_{DD} = Max., f = 0(3)	S	Max.	20	20	20	20	20	20	20	20	20	mA
		L	Max.	10	10	10	10	10	10	10	10	10	

6817 tbl 8

NOTES:
1. All values are maximum guaranteed values.
2. All inputs switch between 0.2V (Low) and V_{DD} -0.2V (High).
3. f_{MAX} = 1/t_{RC} (all address inputs are cycling at f_{MAX}); f = 0 means no address input lines are changing.
4. Typical values are measured at 3.3V, 25°C and with equal read and write cycles. This parameter is guaranteed by device characterization but is not production tested.

AC Test Loads

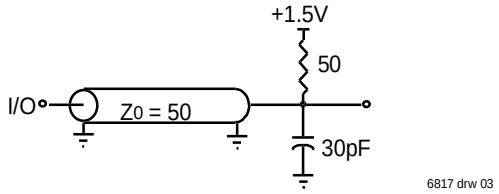
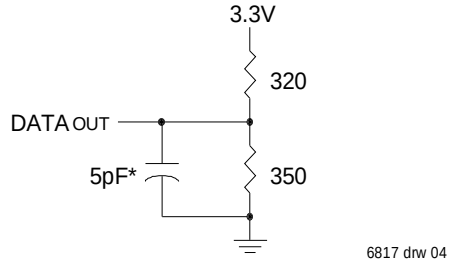


Figure 1. AC Test Load



*Including jig and scope capacitance.

Figure 2. AC Test Load
(for t_{CLZ}, t_{OLZ}, t_{CHZ}, t_{OHZ}, t_{OW}, and t_{WHZ})

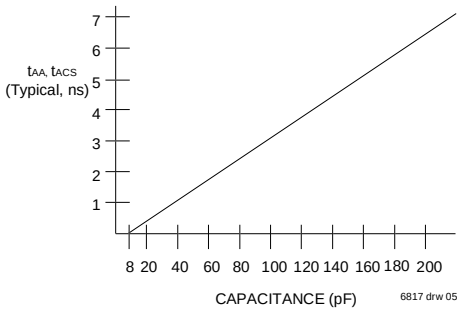


Figure 3. Output Capacitive Derating

AC Test Conditions

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

6817 tbl 09

AC Electrical Characteristics

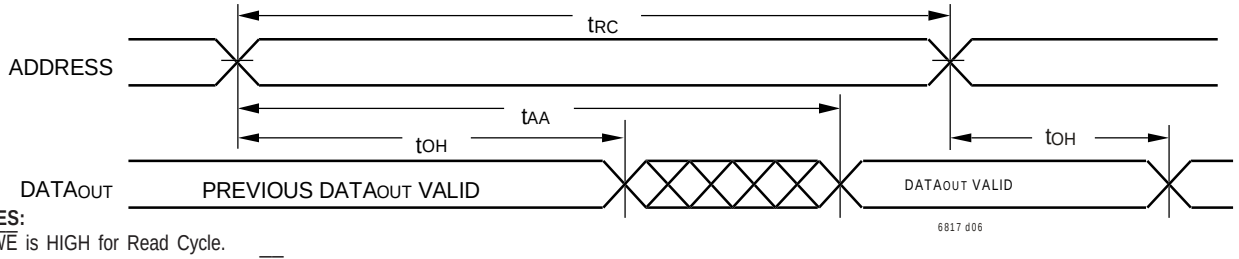
(V_{DD} = Min. to Max., Automotive Temperature Ranges)

Symbol	Parameter	71V416S/L12		71V416S/L15		71V416S/L20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE								
t_{RC}	Read Cycle Time	12	—	15	—	20	—	ns
t_{AA}	Address Access Time	—	12	—	15	—	20	ns
t_{ACS}	Chip Select Access Time	—	12	—	15	—	20	ns
t_{CLZ}(1,2)	Chip Select Low to Output in Low-Z	4	—	4	—	4	—	ns
t_{CHZ}(1,2)	Chip Select High to Output in High-Z	—	6	—	7	—	8	ns
t_{OE}	Output Enable Low to Output Valid	—	6	—	7	—	8	ns
t_{OLZ}(1,2)	Output Enable Low to Output in Low-Z	0	—	0	—	0	—	ns
t_{OHZ}(1,2)	Output Enable High to Output in High-Z	—	6	—	7	—	8	ns
t_{OH}	Output Hold from Address Change	4	—	4	—	4	—	ns
t_{BE}	Byte Enable Low to Output Valid	—	6	—	7	—	8	ns
t_{BLZ}(1,2)	Byte Enable Low to Output in Low-Z	0	—	0	—	0	—	ns
t_{BHZ}(1,2)	Byte Enable High to Output in High-Z	—	6	—	7	—	8	ns
t_{PU}(3)	Chip Select Low to Power Up	0	—	0	—	0	—	ns
t_{PD}(3)	Chip Select High to Power Down	—	12	—	15	—	20	ns
WRITE CYCLE								
t_{WC}	Write Cycle Time	12	—	15	—	20	—	ns
t_{AW}	Address Valid to End of Write	8	—	10	—	10	—	ns
t_{CW}	Chip Select Low to End of Write	8	—	10	—	10	—	ns
t_{BW}	Byte Enable Low to End of Write	8	—	10	—	10	—	ns
t_{AS}	Address Set-up Time	0	—	0	—	0	—	ns
t_{WR}	Address Hold from End of Write	0	—	0	—	0	—	ns
t_{WP}	Write Pulse Width	8	—	10	—	10	—	ns
t_{DW}	Data Valid to End of Write	6	—	7	—	8	—	ns
t_{DH}	Data Hold Time	0	—	0	—	0	—	ns
t_{OW}(1,2)	Write Enable High to Output in Low-Z	3	—	3	—	3	—	ns
t_{WHZ}(1,2)	Write Enable Low to Output in High-Z	—	7	—	7	—	8	ns

6817 tbl 10

NOTES:
1. At any given temperature and voltage condition, tCHZ is less than tCLZ, tOHZ is less than tOLZ, and tWHZ is less than tOW for any given device.
2. This parameter is guaranteed with the AC Load (Figure 2) by device characterization, but is not production tested.
3. This parameter is guaranteed by design and not production tested.

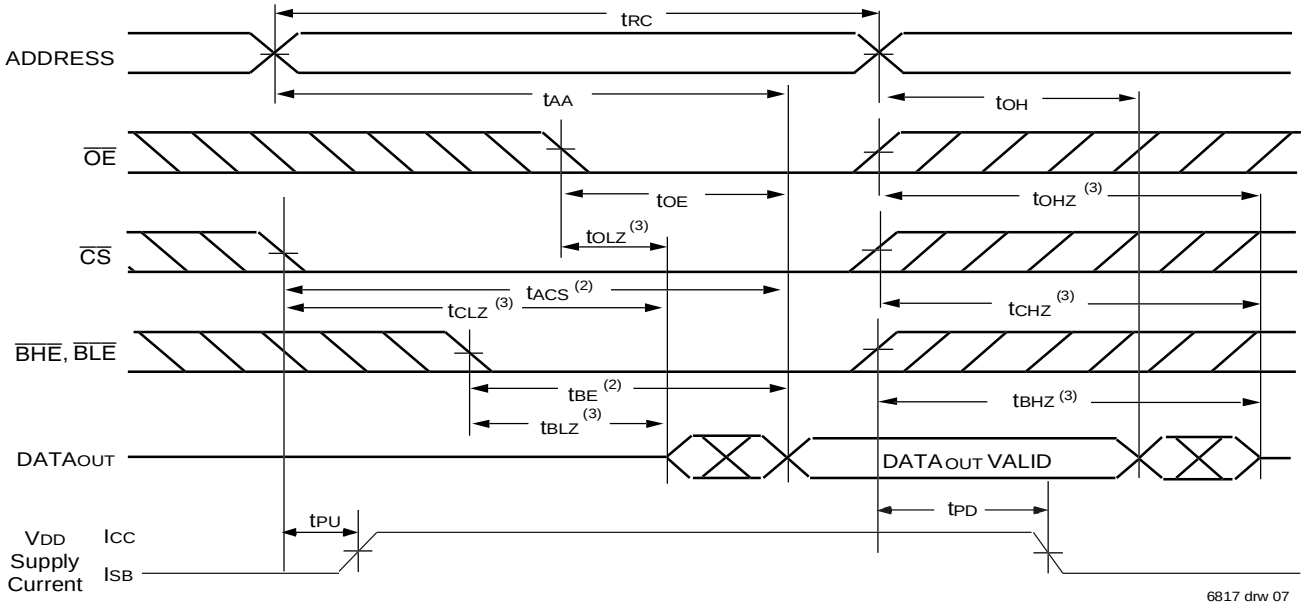
Timing Waveform of Read Cycle No. 1(1,2,3)



6817 d06

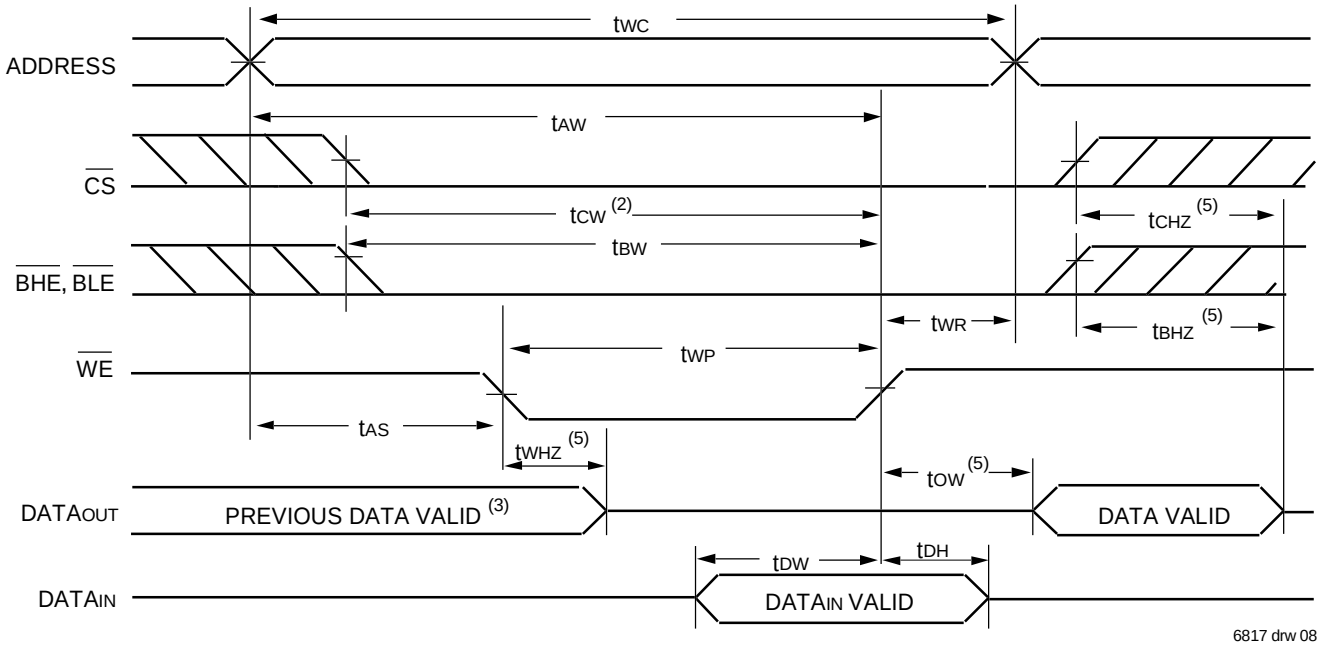
NOTES:
1. $\overline{WE}$ is HIGH for Read Cycle.
2. Device is continuously selected, $\overline{CS}$ is LOW.
3. $\overline{OE}$, $\overline{BHE}$, and $\overline{BLE}$ are LOW.

Timing Waveform of Read Cycle No. 2(1)



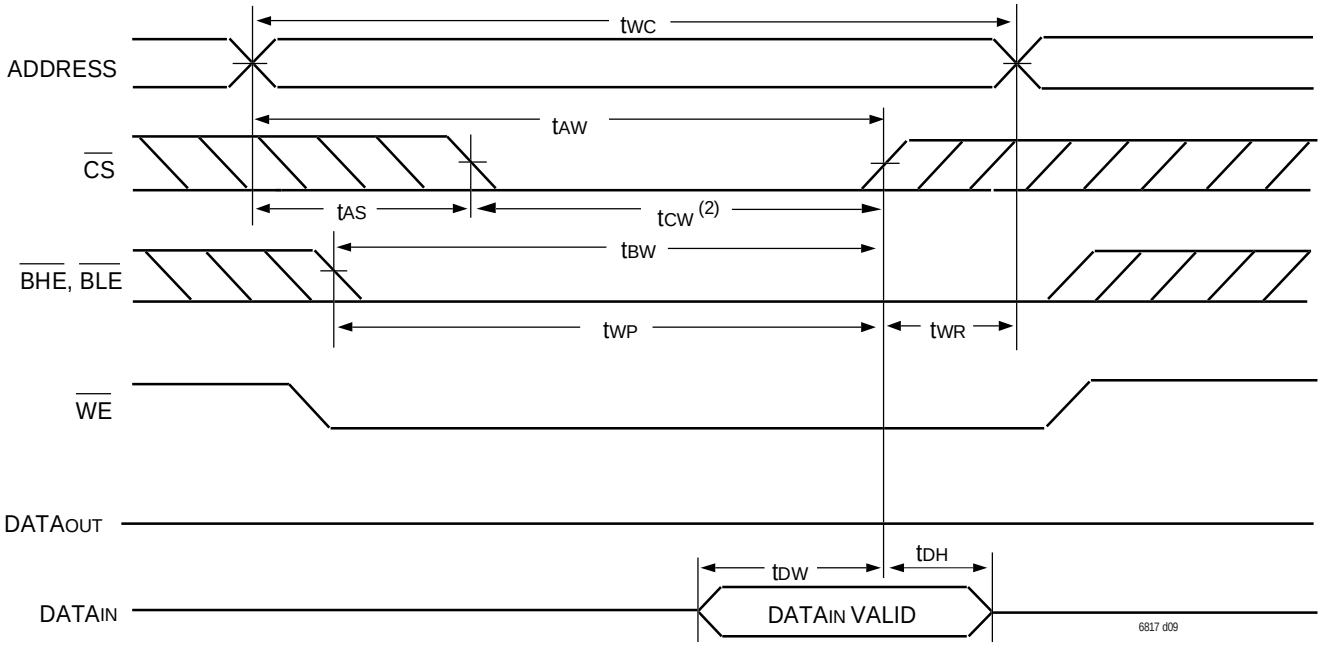
NOTES:
1. $\overline{WE}$ is HIGH for Read Cycle.
2. Address must be valid prior to or coincident with the later of $\overline{CS}$, $\overline{BHE}$, or $\overline{BLE}$ transition LOW; otherwise t_{AA} is the limiting parameter.
3. Transition is measured ±200mV from steady state.

Timing Waveform of Write Cycle No. 1 ($\overline{WE}$ Controlled Timing)(1,2,4)

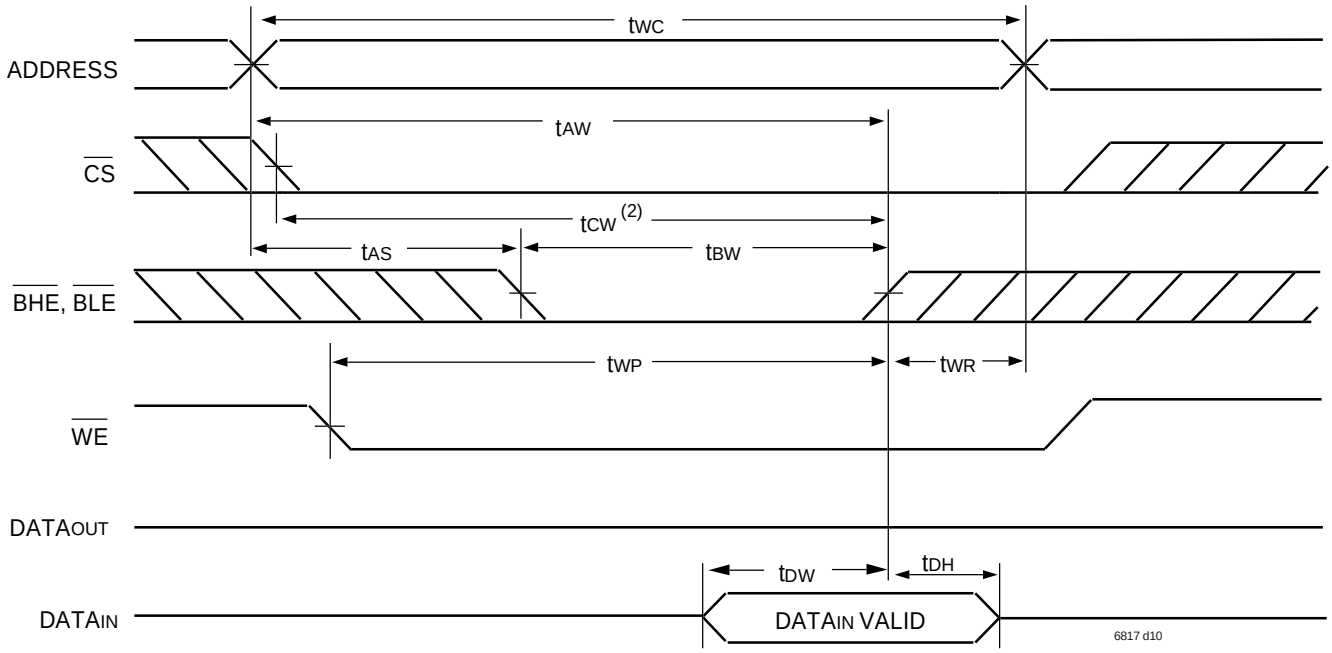


NOTES:
1. A write occurs during the overlap of a LOW $\overline{CS}$, LOW $\overline{BHE}$ or $\overline{BLE}$, and a LOW $\overline{WE}$.
2. $\overline{OE}$ is continuously HIGH. If during a $\overline{WE}$ controlled write cycle $\overline{OE}$ is LOW, t_{WP} must be greater than or equal to $t_{WHZ} + t_{DW}$ 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}.
3. During this period, I/O pins are in the output state, and input signals must not be applied.
4. 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.
5. Transition is measured ±200mV from steady state.

Timing Waveform of Write Cycle No. 2 ($\overline{CS}$ Controlled Timing)(1,3)

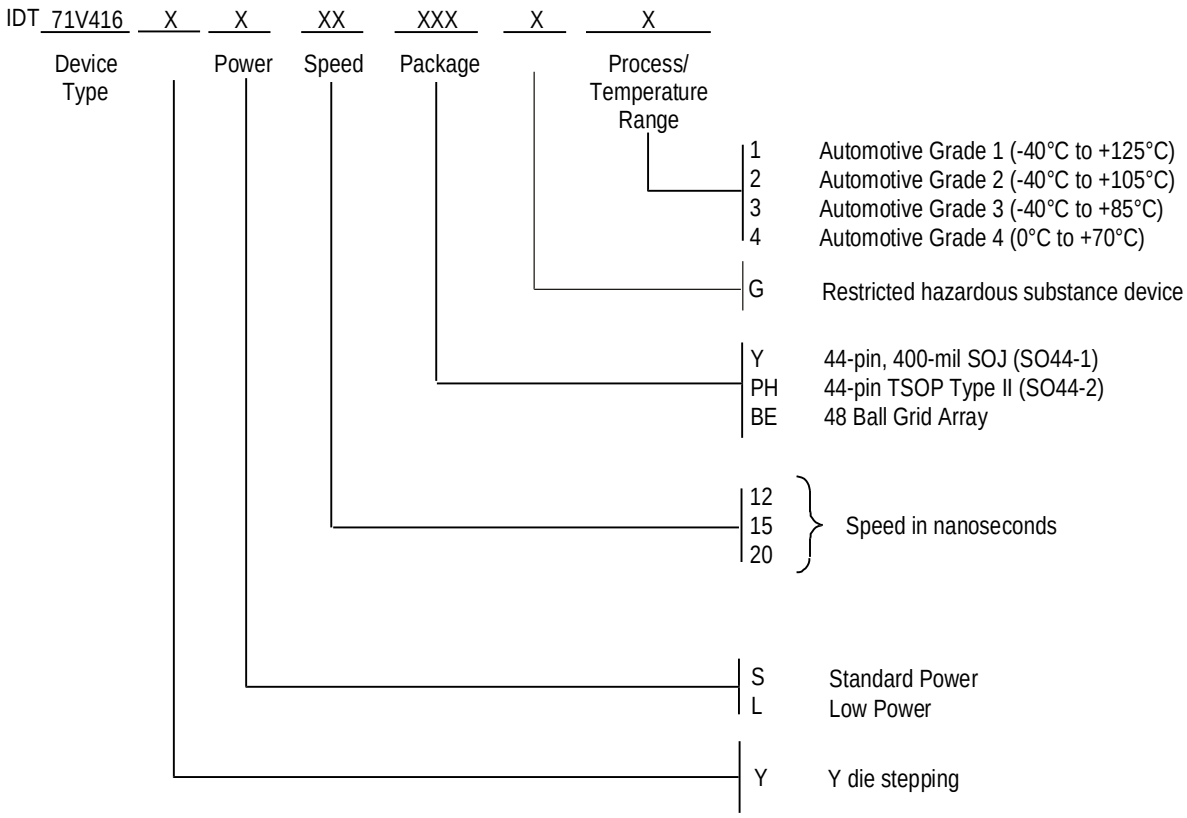


Timing Waveform of Write Cycle No. 3 ($\overline{BHE}$, $\overline{BLE}$ Controlled Timing)(1,3)



NOTES:
1. A write occurs during the overlap of a LOW $\overline{CS}$, LOW $\overline{BHE}$ or $\overline{BLE}$, and a LOW $\overline{WE}$.
2. During this period, I/O pins are in the output state, and input signals must not be applied.
3. 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.

Ordering Information



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Datasheet Document History

Rev	Date	Page	Description
0	12/17/04	p. 1-8	Released Automotive datasheet

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:
sramhelp@idt.com
800-544-7726