



Integrated Device Technology, Inc.

## CMOS STATIC RAM 16K (16K x 1-BIT)

IDT6167SA  
IDT6167LA

### FEATURES:

- High-speed (equal access and cycle time)
  - Military: 15/20/25/35/45/55/70/85/100ns (max.)
  - Commercial: 15/20/25/35ns (max.)
- Low power consumption
- Battery backup operation — 2V data retention voltage (IDT6167LA only)
- Available in 20-pin Cerdip and Plastic DIP, and 20-pin SOJ
- Produced with advanced CMOS high-performance technology
- CMOS process virtually eliminates alpha particle soft-error rates
- Separate data input and output
- Military product compliant to MIL-STD-883, Class B

### DESCRIPTION:

The IDT6167 is a 16,384-bit high-speed static RAM organized as 16K x 1. The part is fabricated using IDT's high-performance, high reliability CMOS technology.

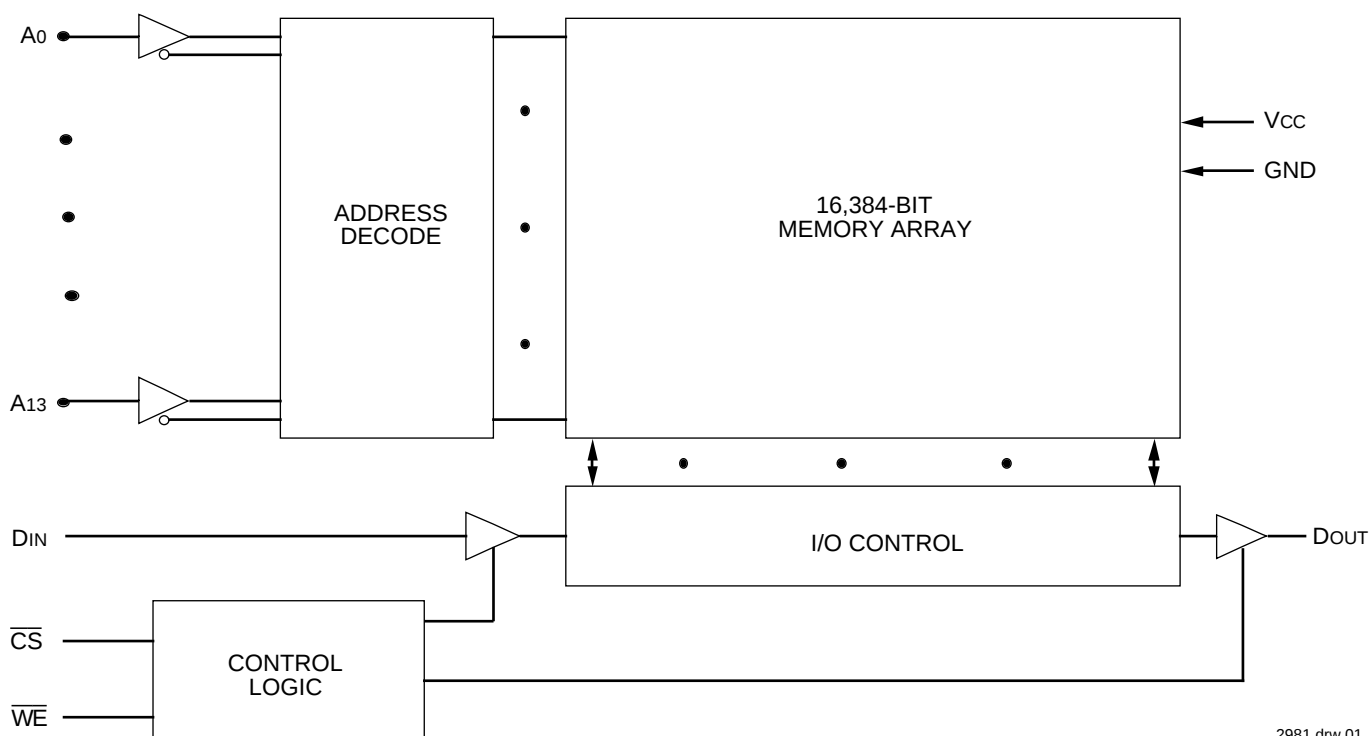
Access times as fast as 15ns are available. The circuit also offers a reduced power standby mode. When  $\overline{CS}$  goes HIGH, the circuit will automatically go to, and remain in, a standby mode as long as  $\overline{CS}$  remains HIGH. This capability provides significant system-level power and cooling savings. The low-power (LA) version also offers a battery backup data retention capability where the circuit typically consumes only 1 $\mu$ W operating off a 2V battery.

All inputs and the output of the IDT6167 are TTL-compatible and operate from a single 5V supply, thus simplifying system designs.

The IDT6167 is packaged in a space-saving 20-pin, 300 mil Plastic DIP or Cerdip, Plastic 20-pin SOJ, providing high board-level packing densities.

Military grade product is manufactured in compliance with the latest revision of MIL-STD-883, Class B, making it ideally suited to military temperature applications demanding the highest level of performance and reliability.

### FUNCTIONAL BLOCK DIAGRAM

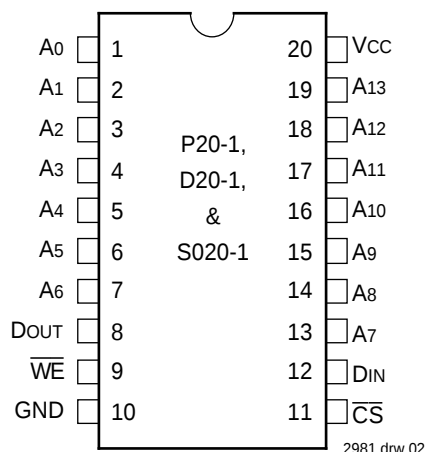


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### MILITARY AND COMMERCIAL TEMPERATURE RANGES

MARCH 1996

## PIN CONFIGURATIONS



DIP/SOJ  
TOP VIEW

## PIN DESCRIPTIONS

|                 |                |
|-----------------|----------------|
| A0–A13          | Address Inputs |
| $\overline{CS}$ | Chip Select    |
| $\overline{WE}$ | Write Enable   |
| VCC             | Power          |
| DIN             | DATAIN         |
| DOUT            | DATAOUT        |
| GND             | Ground         |

2981 tbl 01

## TRUTH TABLE (1)

| Mode    | $\overline{CS}$ | $\overline{WE}$ | Output  | Power   |
|---------|-----------------|-----------------|---------|---------|
| Standby | H               | X               | High-Z  | Standby |
| Read    | L               | H               | DATAOUT | Active  |
| Write   | L               | L               | High-Z  | Active  |

### NOTE:

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

2981 tbl 02

## RECOMMENDED OPERATING TEMPERATURE AND SUPPLY VOLTAGE

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

2981 tbl 06

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol | Rating                               | Com'l.       | Mil.         | Unit |
|--------|--------------------------------------|--------------|--------------|------|
| VTERM  | Terminal Voltage with Respect to GND | –0.5 to +7.0 | –0.5 to +7.0 | V    |
| TA     | Operating Temperature                | 0 to +70     | –55 to +125  | °C   |
| TBIAS  | Temperature Under Bias               | –55 to +125  | –65 to +135  | °C   |
| TSTG   | Storage Temperature                  | –55 to +125  | –65 to +150  | °C   |
| PT     | Power Dissipation                    | 1.0          | 1.0          | W    |
| IOUT   | DC Output Current                    | 50           | 50           | mA   |

### NOTE:

2981 tbl 03

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.

## CAPACITANCE (TA = +25°C, f = 1.0MHz)

| Symbol | Parameter <sup>(1)</sup> | Conditions | Max. | Unit |
|--------|--------------------------|------------|------|------|
| CIN    | Input Capacitance        | VIN = 0V   | 7    | pF   |
| COUT   | Output Capacitance       | VOUT = 0V  | 7    | pF   |

### NOTE:

2981 tbl 04

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

## 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    |
| V <sub>IH</sub> | Input High Voltage | 2.2                 | —    | 6.0  | V    |
| V <sub>IL</sub> | Input Low Voltage  | –0.5 <sup>(1)</sup> | —    | 0.8  | V    |

### NOTE:

2981 tbl 05

1. V<sub>IL</sub> (min.) = –3.0V for pulse width less than 20ns, once per cycle.

## DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

( $V_{CC} = 5.0V \pm 10\%$ ,  $V_{LC} = 0.2V$ ,  $V_{HC} = V_{CC} - 0.2V$ )

| Symbol | Parameter                                                                                                                                                                 | Power | 6167SA/LA15 |      | 6167SA/LA20 |      | 6167SA/LA25 |      | Unit |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------|------|-------------|------|-------------|------|------|
|        |                                                                                                                                                                           |       | Com'l.      | Mil. | Com'l.      | Mil. | Com'l.      | Mil. |      |
| ICC1   | Operating Power Supply Current<br>$\overline{CS} \leq V_{IL}$ , Outputs Open,<br>$V_{CC} = \text{Max.}$ , $f = 0^{(3)}$                                                   | SA    | 90          | 90   | 90          | 90   | 90          | 90   | mA   |
|        |                                                                                                                                                                           | LA    | 55          | 60   | 55          | 60   | 55          | 60   |      |
| ICC2   | Dynamic Operating Current<br>$\overline{CS} \leq V_{IL}$ , Outputs Open,<br>$V_{CC} = \text{Max.}$ , $f = f_{MAX}^{(3)}$                                                  | SA    | 120         | 130  | 100         | 110  | 100         | 100  | mA   |
|        |                                                                                                                                                                           | LA    | 100         | 110  | 80          | 85   | 70          | 75   |      |
| ISB    | Standby Power Supply Current<br>(TTL Level)<br>$\overline{CS} \geq V_{IH}$ , Outputs Open,<br>$V_{CC} = \text{Max.}$ , $f = f_{MAX}^{(3)}$                                | SA    | 50          | 50   | 35          | 35   | 35          | 35   | mA   |
|        |                                                                                                                                                                           | LA    | 35          | 35   | 30          | 30   | 25          | 25   |      |
| ISB1   | Full Standby Power Supply Current<br>(CMOS Level)<br>$\overline{CS} \geq V_{HC}$ , $V_{CC} = \text{Max.}$<br>$V_{IN} \geq V_{HC}$ or $V_{IN} \leq V_{LC}$ , $f = 0^{(3)}$ | SA    | 5           | 10   | 5           | 10   | 5           | 10   | mA   |
|        |                                                                                                                                                                           | LA    | 0.9         | 2    | 0.05        | 2    | 0.05        | 0.9  |      |

## DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup> (CONTINUED)

( $V_{CC} = 5.0V \pm 10\%$ ,  $V_{LC} = 0.2V$ ,  $V_{HC} = V_{CC} - 0.2V$ )

| Symbol | Parameter                                                                                                                                                                 | Power | 6167SA/LA35 |      | 6167SA/LA45 <sup>(2)</sup> |      | 6167SA/LA55 <sup>(2)</sup> |      | 6167SA/LA70 <sup>(2)</sup> |      | Unit |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------|------|----------------------------|------|----------------------------|------|----------------------------|------|------|
|        |                                                                                                                                                                           |       | Com'l.      | Mil. | Com'l.                     | Mil. | Com'l.                     | Mil. | Com'l.                     | Mil. |      |
| ICC1   | Operating Power Supply Current<br>$\overline{CS} \leq V_{IL}$ , Outputs Open,<br>$V_{CC} = \text{Max.}$ , $f = 0^{(3)}$                                                   | SA    | 90          | 90   | —                          | 90   | —                          | 90   | —                          | 90   | mA   |
|        |                                                                                                                                                                           | LA    | 55          | 60   | —                          | 60   | —                          | 60   | —                          | 60   |      |
| ICC2   | Dynamic Operating Current<br>$\overline{CS} \leq V_{IL}$ , Outputs Open,<br>$V_{CC} = \text{Max.}$ , $f = f_{MAX}^{(3)}$                                                  | SA    | 100         | 100  | —                          | 100  | —                          | 100  | —                          | 100  | mA   |
|        |                                                                                                                                                                           | LA    | 65          | 70   | —                          | 65   | —                          | 60   | —                          | 60   |      |
| ISB    | Standby Power Supply Current<br>(TTL Level)<br>$\overline{CS} \geq V_{IH}$ , Outputs Open,<br>$V_{CC} = \text{Max.}$ , $f = f_{MAX}^{(3)}$                                | SA    | 35          | 35   | —                          | 35   | —                          | 35   | —                          | 35   | mA   |
|        |                                                                                                                                                                           | LA    | 20          | 20   | —                          | 20   | —                          | 20   | —                          | 15   |      |
| ISB1   | Full Standby Power Supply Current<br>(CMOS Level)<br>$\overline{CS} \geq V_{HC}$ , $V_{CC} = \text{Max.}$<br>$V_{IN} \geq V_{HC}$ or $V_{IN} \leq V_{LC}$ , $f = 0^{(3)}$ | SA    | 5           | 10   | —                          | 10   | —                          | 10   | —                          | 10   | mA   |
|        |                                                                                                                                                                           | LA    | 0.05        | 0.9  | —                          | 0.9  | —                          | 0.9  | —                          | 0.9  |      |

### NOTES:

1. All values are maximum guaranteed values.
2.  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  temperature range only. Also available; 85ns and 100ns Military devices.
3.  $f_{MAX} = 1/\text{trc}$ , only address inputs cycling at  $f_{MAX}$ .  $f = 0$  means no Address inputs change.

2981 tbl 07

## DC ELECTRICAL CHARACTERISTICS

$V_{CC} = 5.0V \pm 10\%$

| Symbol          | Parameter              | Test Condition                                                                                           |       | IDT6167SA |      | IDT6167LA |      | Unit |
|-----------------|------------------------|----------------------------------------------------------------------------------------------------------|-------|-----------|------|-----------|------|------|
|                 |                        |                                                                                                          |       | Min.      | Max. | Min.      | Max. |      |
| I <sub>LI</sub> | Input Leakage Current  | V <sub>CC</sub> = Max.,<br>V <sub>IN</sub> = GND to V <sub>CC</sub>                                      | MIL   | —         | 10   | —         | 5    | μA   |
|                 |                        |                                                                                                          | COM'L | —         | 5    | —         | 2    |      |
| I <sub>LO</sub> | Output Leakage Current | V <sub>CC</sub> = Max., $\overline{CS}$ = V <sub>IH</sub> ,<br>V <sub>OUT</sub> = GND to V <sub>CC</sub> | MIL   | —         | 10   | —         | 5    | μA   |
|                 |                        |                                                                                                          | COM'L | —         | 5    | —         | 2    |      |
| V <sub>OL</sub> | Output Low Voltage     | I <sub>OL</sub> = 8mA, V <sub>CC</sub> = Min.                                                            |       | —         | 0.4  | —         | 0.4  | V    |
| V <sub>OH</sub> | Output High Voltage    | I <sub>OH</sub> = -4mA, V <sub>CC</sub> = Min.                                                           |       | 2.4       | —    | 2.4       | —    | V    |

2981 tbl 08

## DATA RETENTION CHARACTERISTICS OVER ALL TEMPERATURE RANGES

(LA Version Only) V<sub>LC</sub> = 0.2V, V<sub>HC</sub> = V<sub>CC</sub> - 0.2V

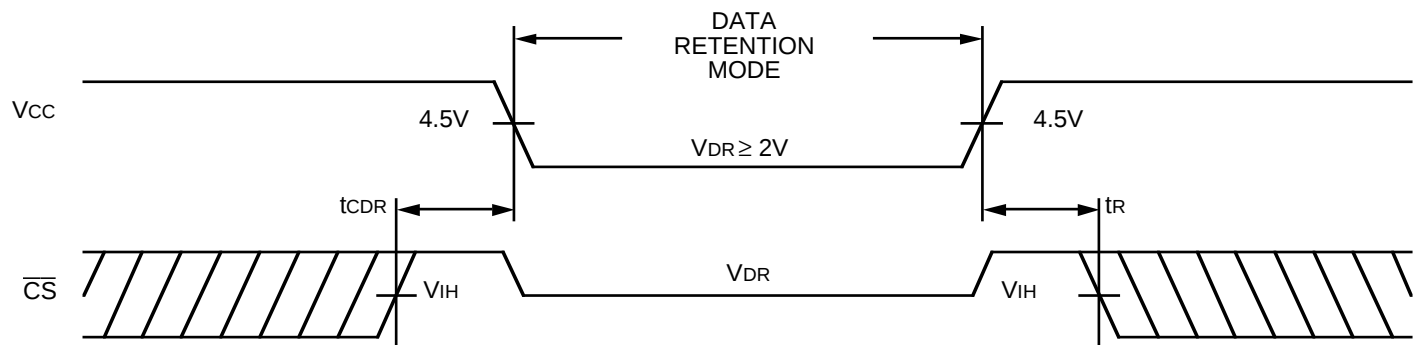
| Symbol                           | Parameter                            | Test Condition                                                                        | Min. | Typ. <sup>(1)</sup><br>V <sub>CC</sub> @ |      | Max.<br>V <sub>CC</sub> @ |      | Unit |
|----------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|------|------------------------------------------|------|---------------------------|------|------|
|                                  |                                      |                                                                                       |      | 2.0v                                     | 3.0V | 2.0V                      | 3.0V |      |
| V <sub>DR</sub>                  | V <sub>CC</sub> for Data Retention   | —                                                                                     | 2.0  | —                                        | —    | —                         | —    | V    |
| I <sub>CCDR</sub>                | Data Retention Current               | MIL.<br>COM'L.                                                                        | —    | 0.5                                      | 1.0  | 200                       | 300  | μA   |
|                                  |                                      |                                                                                       | —    | 0.5                                      | 1.0  | 20                        | 30   |      |
| t <sub>CDR</sub>                 | Chip Deselect to Data Retention Time | $\overline{CS} \geq V_{HC}$<br>V <sub>IN</sub> ≥ V <sub>HC</sub> or ≤ V <sub>LC</sub> | 0    | —                                        | —    | —                         | —    | ns   |
| t <sub>R</sub> <sup>(3)</sup>    | Operation Recovery Time              | trc <sup>(2)</sup>                                                                    | —    | —                                        | —    | —                         | —    | ns   |
| I <sub>LI</sub>   <sup>(3)</sup> | Input Leakage Current                | —                                                                                     | —    | —                                        | —    | 2                         | 2    | μA   |

### NOTES:

1. T<sub>A</sub> = +25°C.
2. trc = Read Cycle Time.
3. This parameter is guaranteed by device characterization, but is not production tested.

2981 tbl 09

## LOW V<sub>CC</sub> DATA RETENTION WAVEFORM



2981 drw 03

## 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                |
| AC Test Load                  | See Figures 1 and 2 |

2981 tbl 10

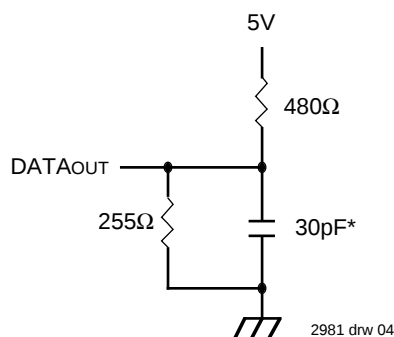


Figure 1. AC Test Load

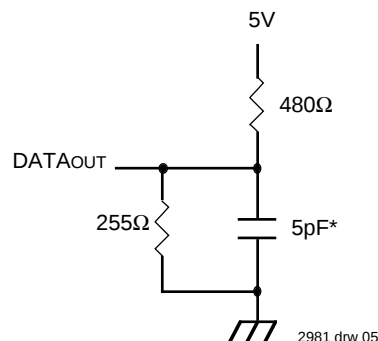


Figure 2. AC Test Load  
(for tCLZ, tCHZ, tWHZ and tOW)

\*Includes scope and jig.

## AC ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 5.0V ± 10%, All Temperature Ranges)

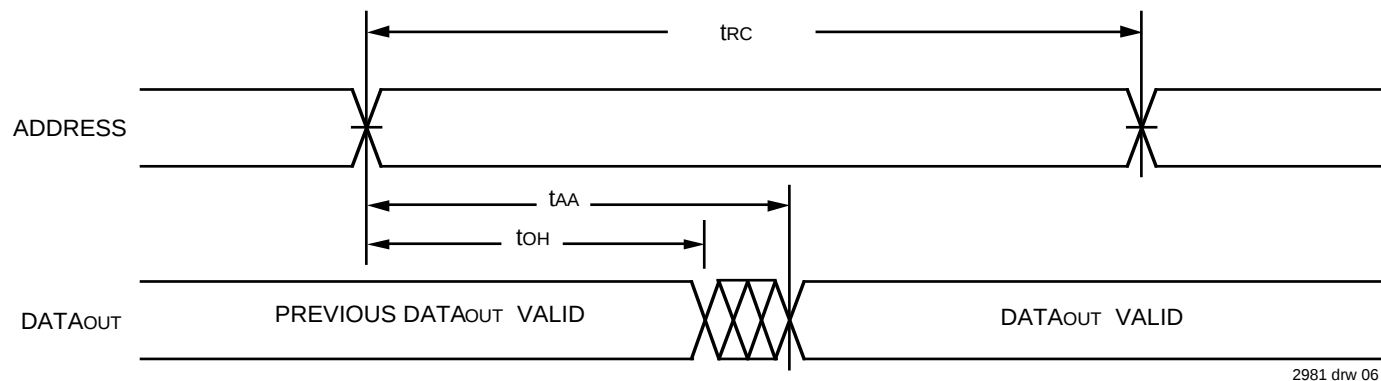
| Symbol              | Parameter                        | 6167SA15<br>6167LA15 |      | 6167SA20/25<br>6167LA20/25 |       | 6167SA35/45 <sup>(1)</sup><br>6167LA35/45 <sup>(1)</sup> |       | 6167SA55 <sup>(1)</sup> /70 <sup>(1)</sup><br>6167LA55 <sup>(1)</sup> /70 <sup>(1)</sup> |       | Unit |
|---------------------|----------------------------------|----------------------|------|----------------------------|-------|----------------------------------------------------------|-------|------------------------------------------------------------------------------------------|-------|------|
|                     |                                  | Min.                 | Max. | Min.                       | Max.  | Min.                                                     | Max.  | Min.                                                                                     | Max.  |      |
| Read Cycle          |                                  |                      |      |                            |       |                                                          |       |                                                                                          |       |      |
| tRC                 | Read Cycle Time                  | 15                   | —    | 20/25                      | —     | 35/45                                                    | —     | 55/70                                                                                    | —     | ns   |
| tAA                 | Address Access Time              | —                    | 15   | —                          | 20/25 | —                                                        | 35/45 | —                                                                                        | 55/70 | ns   |
| tACS                | Chip Select Access Time          | —                    | 15   | —                          | 20/25 | —                                                        | 35/45 | —                                                                                        | 55/70 | ns   |
| tCLZ <sup>(2)</sup> | Chip Deselect to Output in Low-Z | 3                    | —    | 5/5                        | —     | 5/5                                                      | —     | 5/5                                                                                      | —     | ns   |
| tCHZ <sup>(2)</sup> | Chip Select to Output in High-Z  | —                    | 10   | —                          | 10/10 | —                                                        | 15/30 | —                                                                                        | 40/40 | ns   |
| tOH                 | Output Hold from Address Change  | 3                    | —    | 5/5                        | —     | 5/5                                                      | —     | 5/5                                                                                      | —     | ns   |
| tPU <sup>(2)</sup>  | Chip Select to Power-Up Time     | 0                    | —    | 0/0                        | —     | 0/0                                                      | —     | 0/0                                                                                      | —     | ns   |
| tPD <sup>(2)</sup>  | Chip Deselect to Power-Down Time | —                    | 15   | —                          | 20/25 | —                                                        | 35/45 | —                                                                                        | 55/70 | ns   |
| Write Cycle         |                                  |                      |      |                            |       |                                                          |       |                                                                                          |       |      |
| tWC                 | Write Cycle Time                 | 15                   | —    | 20/20                      | —     | 30/45                                                    | —     | 55/70                                                                                    | —     | ns   |
| tcw                 | Chip Select to End-of-Write      | 15                   | —    | 15/20                      | —     | 30/40                                                    | —     | 45/55                                                                                    | —     | ns   |
| tAW                 | Address Valid to End-of-Write    | 15                   | —    | 15/20                      | —     | 30/40                                                    | —     | 45/55                                                                                    | —     | ns   |
| tAS                 | Address Set-up Time              | 0                    | —    | 0/0                        | —     | 0/0                                                      | —     | 0/0                                                                                      | —     | ns   |
| tWP                 | Write Pulse Width                | 13                   | —    | 15/20                      | —     | 30/30                                                    | —     | 35/40                                                                                    | —     | ns   |
| tWR                 | Write Recovery Time              | 0                    | —    | 0/0                        | —     | 0/0                                                      | —     | 0/0                                                                                      | —     | ns   |
| tdW                 | Data Valid to End-of-Write       | 10                   | —    | 12/15                      | —     | 17/20                                                    | —     | 25/30                                                                                    | —     | ns   |
| tdH                 | Data Hold Time                   | 0                    | —    | 0/0                        | —     | 0/0                                                      | —     | 0/0                                                                                      | —     | ns   |
| tWHZ <sup>(2)</sup> | Write Enable to Output in High-Z | —                    | 7    | —                          | 8/8   | —                                                        | 15/30 | —                                                                                        | 40/40 | ns   |
| tow <sup>(2)</sup>  | Output Active from End-of-Write  | 0                    | —    | 0/0                        | —     | 0/0                                                      | —     | 0/0                                                                                      | —     | ns   |

### NOTES:

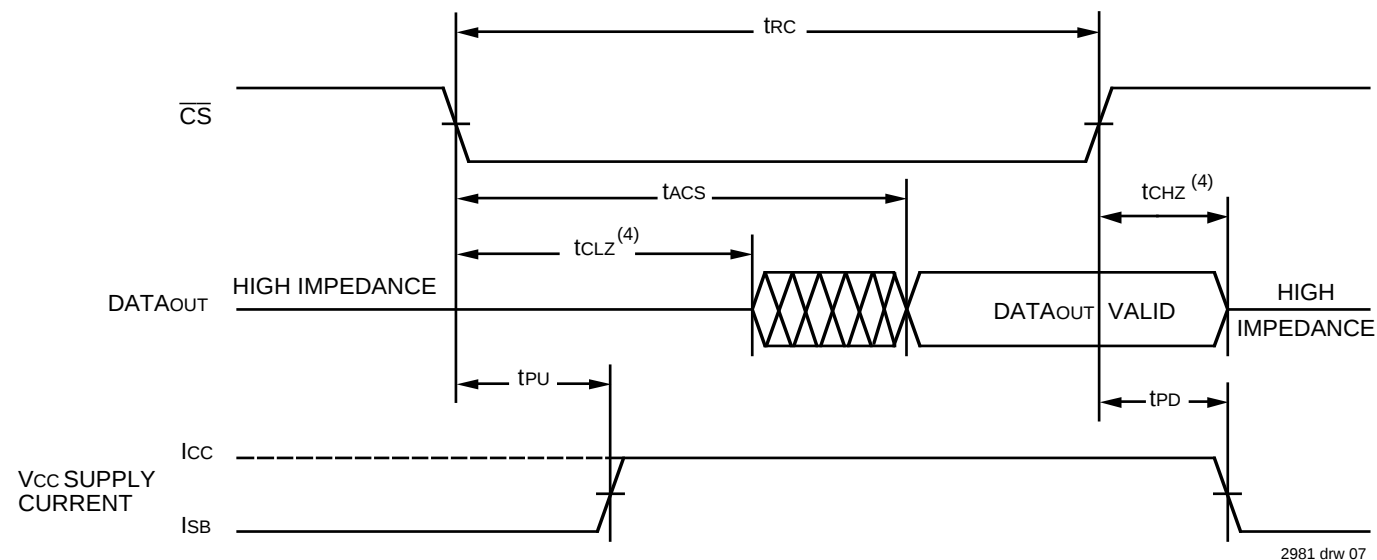
1. -55°C to +125°C temperature range only. Also available: 85ns and 100ns Military devices.
2. This parameter is guaranteed with AC Load (Figure 2) by device characterization, but is not production tested.

2981 tbl 11

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



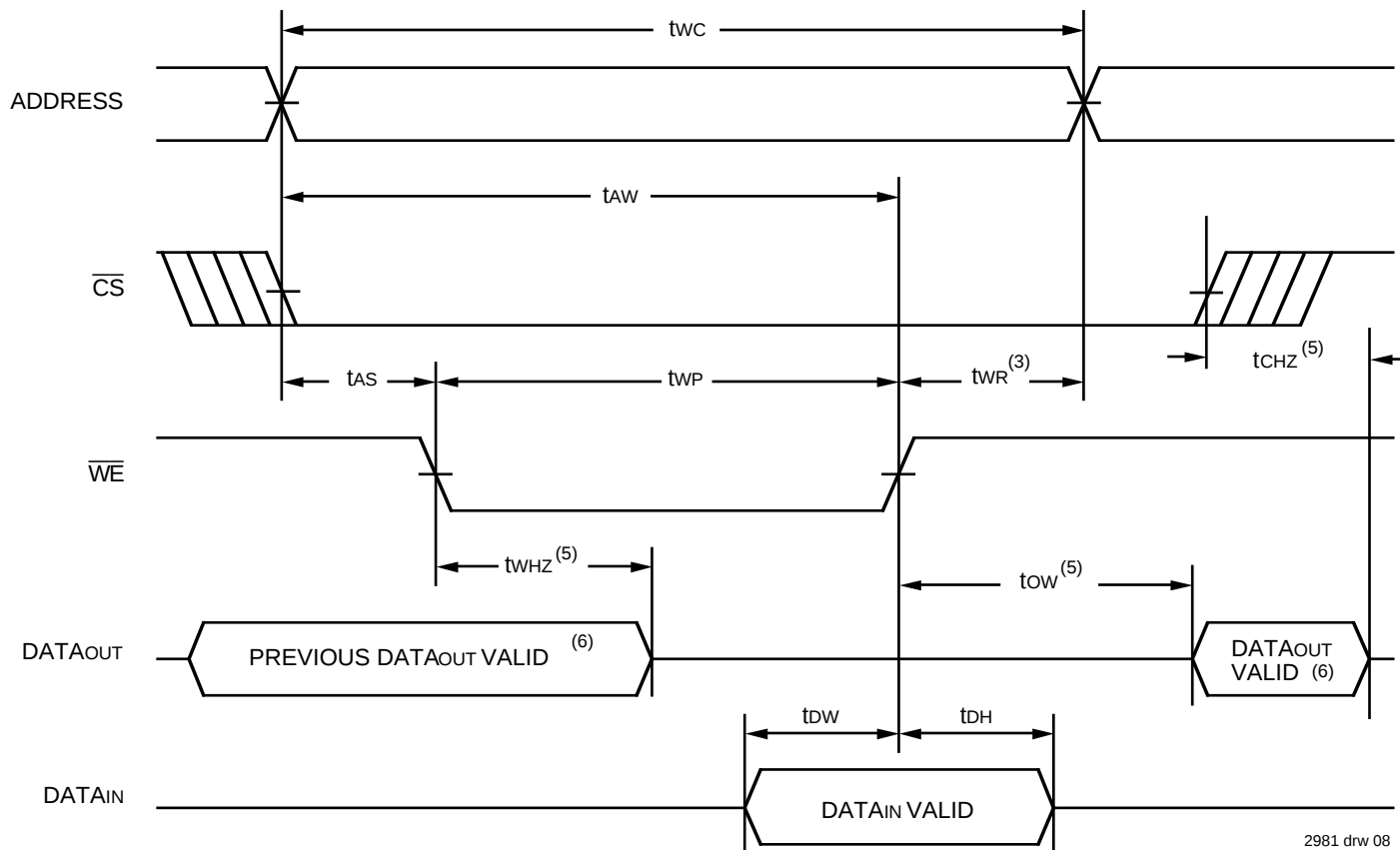
## TIMING WAVEFORM OF READ CYCLE NO. 2(1, 3)



### NOTES:

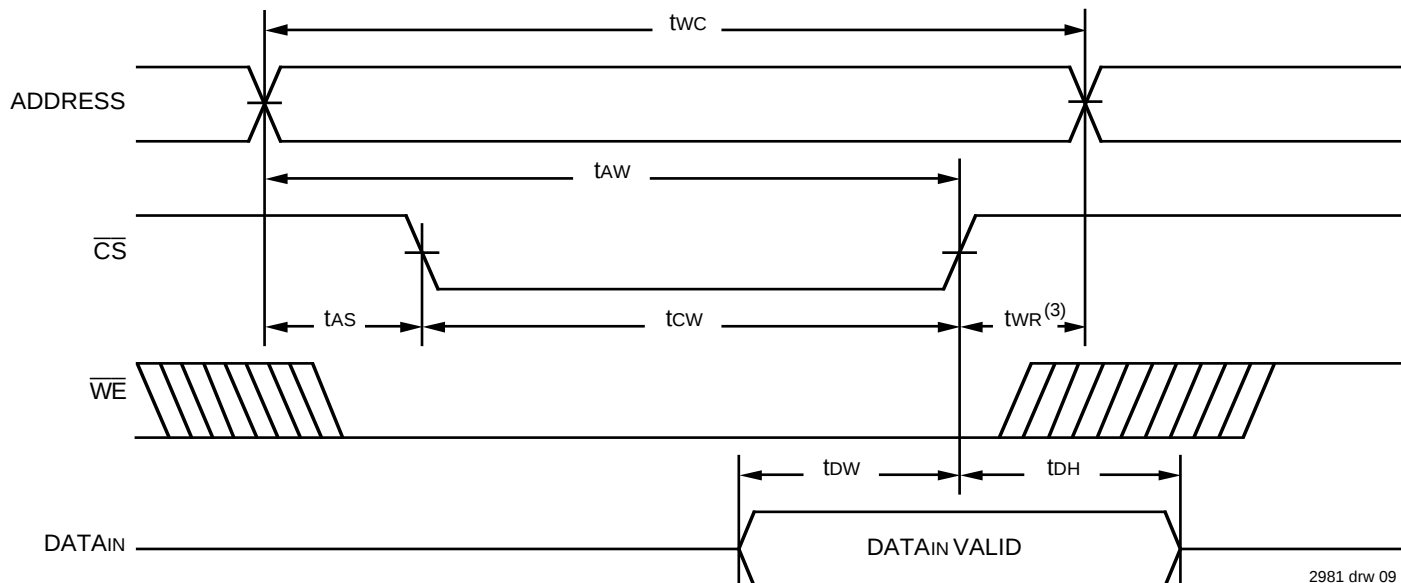
1.  $\overline{WE}$  is HIGH for Read cycle.
2. Device is continuously selected,  $\overline{CS}$  is LOW.
3. Address valid prior to or coincident with  $\overline{CS}$  transition LOW.
4. Transition is measured  $\pm 200\text{mV}$  from steady state.

## TIMING WAVEFORM OF WRITE CYCLE NO. 1, ( $\overline{WE}$ CONTROLLED TIMING)<sup>(1, 2, 4)</sup>



2981 drw 08

## TIMING WAVEFORM OF WRITE CYCLE NO. 2, ( $\overline{CS}$ CONTROLLED TIMING)<sup>(1, 2, 4)</sup>



2981 drw 09

### NOTES:

1.  $\overline{WE}$  or  $\overline{CS}$  must be inactive during all address transitions.
2. A write occurs during the overlap of a LOW  $\overline{CS}$  and a LOW  $\overline{WE}$ .
3.  $t_{WR}$  is measured from the earlier of  $\overline{CS}$  or  $\overline{WE}$  going HIGH to the end of the write cycle.
4. If the  $\overline{CS}$  low transition occurs simultaneously with or after the  $\overline{WE}$  LOW transition, the outputs remain in the high-impedance state.
5. Transition is measured  $\pm 200\text{mV}$  from steady state.
6. During this period, the I/O pins are in the output state and the input signals must not be applied.

ORDERING INFORMATION

|     |             |       |       |         |                               |                                                                                   |                      |
|-----|-------------|-------|-------|---------|-------------------------------|-----------------------------------------------------------------------------------|----------------------|
| IDT | 6167        | XX    | XXX   | XX      | X                             |                                                                                   |                      |
|     | Device Type | Power | Speed | Package | Process/<br>Temperature Range |                                                                                   |                      |
|     |             |       |       |         | Blank                         | Commercial (0°C to +70°C)                                                         |                      |
|     |             |       |       |         | B                             | Military (−55°C to +125°C)<br>Compliant to MIL-STD-883, Class B                   |                      |
|     |             |       |       |         | P                             | 300MIL Plastic DIP (P20−1)                                                        |                      |
|     |             |       |       |         | D                             | 300MIL Cerdip (D20−1)                                                             |                      |
|     |             |       |       |         | Y                             | 300MIL SOJ (SO20−1)                                                               |                      |
|     |             |       |       |         | 15                            | Military Only<br>Military Only<br>Military Only<br>Military Only<br>Military Only | Speed in nanoseconds |
|     |             |       |       |         | 20                            |                                                                                   |                      |
|     |             |       |       |         | 25                            |                                                                                   |                      |
|     |             |       |       |         | 35                            |                                                                                   |                      |
|     |             |       |       |         | 45                            |                                                                                   |                      |
|     |             |       |       |         | 55                            |                                                                                   |                      |
|     |             |       |       |         | 70                            |                                                                                   |                      |
|     |             |       |       |         | 85                            |                                                                                   |                      |
|     |             |       |       |         | 100                           |                                                                                   |                      |
|     |             |       |       |         | SA                            | Standard Power                                                                    |                      |
|     |             |       |       |         | LA                            | Low Power                                                                         |                      |

2981 drw 10



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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