



# CMOS Static RAM 16K (2K x 8-Bit)

**IDT6116SA  
IDT6116LA**

## Features

- ◆ **High-speed access and chip select times**
  - *Military: 20/25/35/45/55/70/90/120/150ns (max.)*
  - *Industrial: 20/25ns (max.)*
  - *Commercial: 15/20/25ns (max.)*
- ◆ **Low-power consumption**
- ◆ **Battery backup operation**
  - *2V data retention voltage (LA version only)*
- ◆ **Produced with advanced CMOS high-performance technology**
- ◆ **CMOS process virtually eliminates alpha particle soft-error rates**
- ◆ **Input and output directly TTL-compatible**
- ◆ **Static operation: no clocks or refresh required**
- ◆ **Available in ceramic 24-pin DIP, ceramic and plastic 24-pin Thin Dip and 24-pin SOIC**
- ◆ **Military product compliant to MIL-STD-883, Class B**

## Description

The IDT6116SA/LA is a 16,384-bit high-speed static RAM organized as 2K x 8. It is fabricated using 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 power 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 to 4  $\mu$ W operating off a 2V battery.

All inputs and outputs of the IDT6116SA/LA are TTL-compatible. Fully static asynchronous circuitry is used, requiring no clocks or refreshing for operation.

The IDT6116SA/LA is packaged in 24-pin 300mil plastic DIP, 24-pin 600mil and 300mil ceramic DIP, or 24-lead gull-wing SOIC providing high board-level packing densities.

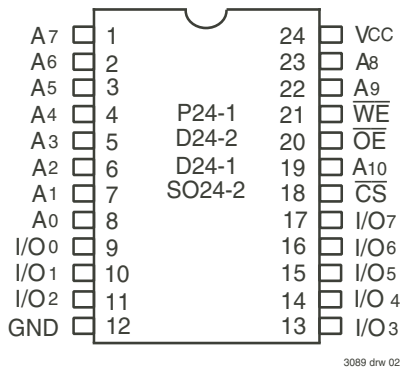
Military grade product is manufactured in compliance to MIL-STD-883, Class B, making it ideally suited to military temperature applications demanding the highest level of performance and reliability.

## Functional Block Diagram



FEBRUARY 2013

## Pin Configurations



DIP/SOIC  
Top View

## Pin Description

| Name            | Description       |
|-----------------|-------------------|
| A0 - A10        | Address Inputs    |
| I/O0 - I/O7     | Data Input/Output |
| $\overline{CS}$ | Chip Select       |
| $\overline{WE}$ | Write Enable      |
| $\overline{OE}$ | Output Enable     |
| Vcc             | Power             |
| GND             | Ground            |

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## Truth Table<sup>(1)</sup>

| Mode    | $\overline{CS}$ | $\overline{OE}$ | $\overline{WE}$ | I/O                 |
|---------|-----------------|-----------------|-----------------|---------------------|
| Standby | H               | X               | X               | High-Z              |
| Read    | L               | L               | H               | DATA <sub>OUT</sub> |
| Read    | L               | H               | H               | High-Z              |
| Write   | L               | X               | L               | DATA <sub>IN</sub>  |

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### NOTE:

- H = V<sub>IH</sub>, L = V<sub>IL</sub>, X = Don't Care.

## Capacitance (T<sub>A</sub> = +25°C, f = 1.0 MHz)

| Symbol          | Parameter <sup>(1)</sup> | Conditions            | Max. | Unit |
|-----------------|--------------------------|-----------------------|------|------|
| C <sub>IN</sub> | Input Capacitance        | V <sub>IN</sub> = 0V  | 8    | pF   |
| C <sub>VO</sub> | I/O Capacitance          | V <sub>OUT</sub> = 0V | 8    | pF   |

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### NOTE:

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

## Absolute Maximum Ratings<sup>(1)</sup>

| Symbol                           | Rating                               | Com'l.       | Mil.         | Unit |
|----------------------------------|--------------------------------------|--------------|--------------|------|
| V <sub>TERM</sub> <sup>(2)</sup> | Terminal Voltage with Respect to GND | -0.5 to +7.0 | -0.5 to +7.0 | V    |
| T <sub>A</sub>                   | Operating Temperature                | 0 to +70     | -55 to +125  | °C   |
| T <sub>BIAS</sub>                | Temperature Under Bias               | -55 to +125  | -65 to +135  | °C   |
| T <sub>STG</sub>                 | Storage Temperature                  | -55 to +125  | -65 to +150  | °C   |
| P <sub>T</sub>                   | Power Dissipation                    | 1.0          | 1.0          | W    |
| I <sub>OUT</sub>                 | DC Output Current                    | 50           | 50           | mA   |

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### 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<sub>TERM</sub> must not exceed V<sub>CC</sub> +0.5V.

### Recommended Operating Temperature and Supply Voltage

| Grade      | Ambient Temperature | GND | Vcc        |
|------------|---------------------|-----|------------|
| Military   | -55°C to +125°C     | 0V  | 5.0V ± 10% |
| Industrial | -40°C to +85°C      | 0V  | 5.0V ± 10% |
| Commercial | 0°C to +70°C        | 0V  | 5.0V ± 10% |

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### Recommended DC Operating Conditions

| Symbol          | Parameter          | Min.                | Typ. | Max.                  | Unit |
|-----------------|--------------------|---------------------|------|-----------------------|------|
| Vcc             | Supply Voltage     | 4.5                 | 5.0  | 5.5 <sup>(2)</sup>    | V    |
| GND             | Ground             | 0                   | 0    | 0                     | V    |
| V <sub>IH</sub> | Input High Voltage | 2.2                 | 3.5  | V <sub>cc</sub> + 0.5 | V    |
| V <sub>IL</sub> | Input Low Voltage  | -0.5 <sup>(1)</sup> | —    | 0.8                   | V    |

3089 tbl 06

**NOTES:**

- V<sub>IL</sub> (min.) = -3.0V for pulse width less than 20ns, once per cycle.
- V<sub>IN</sub> must not exceed V<sub>cc</sub> + 0.5V.

### DC Electrical Characteristics

(V<sub>cc</sub> = 5.0V ± 10%)

| Symbol          | Parameter              | Test Conditions   | IDT6116SA           |              | IDT6116LA   |             | 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.<br>COM'L & IND | —<br>10<br>5 | —<br>5<br>2 | —<br>5<br>2 | μA   |
| I <sub>LO</sub> | Output Leakage Current | V <sub>cc</sub> = Max., $\overline{CS} = V_{IH}$ ,<br>V <sub>OUT</sub> = GND to V <sub>cc</sub> | MIL.<br>COM'L & IND | —<br>10<br>5 | —<br>5<br>2 | —<br>5<br>2 | μA   |
| V <sub>OL</sub> | Output Low Voltage     | I <sub>OL</sub> = 8mA, V <sub>cc</sub> = Min.   |                     | —<br>0.4     | —<br>0.4    | —<br>0.4    | V    |
| V <sub>OH</sub> | Output High Voltage    | I <sub>OH</sub> = -4mA, V <sub>cc</sub> = Min.  |                     | 2.4<br>—     | 2.4<br>—    | —<br>—      | V    |

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### DC Electrical Characteristics<sup>(1)</sup>

(V<sub>cc</sub> = 5.0V ± 10%, V<sub>LC</sub> = 0.2V, V<sub>HC</sub> = V<sub>cc</sub> - 0.2V)

| 123Symbol | Parameter   | Power | 6116SA15      | 6116SA20<br>6116LA20 |     | 6116SA25<br>6116LA25 |     | Unit |
|-----------|---|-------|---------------|----------------------|-----|----------------------|-----|------|
|           |   |       | Com'l<br>Only | Com'l<br>& Ind       | Mil | Com'l<br>& Ind       | Mil |      |
| ICC1      | Operating Power Supply Current<br>CS ≤ V <sub>IL</sub> , Outputs Open<br>V <sub>cc</sub> = Max., f = 0  | SA    | 105           | 105                  | 130 | 100                  | 90  | mA   |
|           |   | LA    | —             | 95                   | 120 | 95                   | 85  |      |
| ICC2      | Dynamic Operating Current<br>CS ≤ V <sub>IL</sub> , Outputs Open<br>V <sub>cc</sub> = Max., f = f <sub>MAX</sub> <sup>(2)</sup>   | SA    | 150           | 130                  | 150 | 120                  | 135 | mA   |
|           |   | LA    | —             | 120                  | 140 | 110                  | 125 |      |
| ISB       | Standby Power Supply Current<br>(TTL Level)<br>CS ≥ V <sub>IH</sub> , Outputs Open<br>V <sub>cc</sub> = Max., f = f <sub>MAX</sub> <sup>(2)</sup>                                     | SA    | 40            | 40                   | 50  | 40                   | 45  | mA   |
|           |   | LA    | —             | 35                   | 45  | 35                   | 40  |      |
| ISB1      | Full Standby Power Supply Current<br>(CMOS Level)<br>CS ≥ V <sub>HC</sub> , V <sub>cc</sub> = Max.,<br>V <sub>IN</sub> ≤ V <sub>LC</sub> or V <sub>IN</sub> ≥ V <sub>HC</sub> , f = 0 | SA    | 2             | 2                    | 10  | 2                    | 10  | mA   |
|           |   | LA    | —             | 0.1                  | 0.9 | 0.1                  | 0.9 |      |

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**NOTES:**

- All values are maximum guaranteed values.
- f<sub>MAX</sub> = 1/trc, only address inputs are cycling at f<sub>MAX</sub>, f = 0 means address inputs are not changing.

## DC Electrical Characteristics<sup>(1)</sup> (continued)

(V<sub>CC</sub> = 5.0V ± 10%, V<sub>LC</sub> = 0.2V, V<sub>HC</sub> = V<sub>CC</sub> - 0.2V)

| Symbol | Parameter  | Power | 6116SA35<br>6116LA35 | 6116SA45<br>6116LA45 | 6116SA55<br>6116LA55 | 6116SA70<br>6116LA70 | 6116SA90<br>6116LA90 | 6116SA120<br>6116LA120 | 6116SA150<br>6116LA150 | Unit |
|--------|--|-------|----------------------|----------------------|----------------------|----------------------|----------------------|------------------------|------------------------|------|
|        |  |       | Mil Only             | Mil Only             | Mil Only             | Mil Only             | Mil Only             | Mil Only               | Mil Only               |      |
| ICC1   | Operating Power Supply Current, $\overline{CS} \leq V_{IL}$ , Outputs Open<br>V <sub>CC</sub> = Max., f = 0  | SA    | 90                   | 90                   | 90                   | 90                   | 90                   | 90                     | 90                     | mA   |
|        |  | LA    | 85                   | 85                   | 85                   | 85                   | 85                   | 85                     | 85                     |      |
| ICC2   | Dynamic Operating Current, $\overline{CS} \leq V_{IL}$ , Outputs Open<br>V <sub>CC</sub> = Max., f = f <sub>MAX</sub> <sup>(2)</sup>   | SA    | 115                  | 100                  | 100                  | 100                  | 100                  | 100                    | 90                     | mA   |
|        |  | LA    | 105                  | 95                   | 90                   | 90                   | 85                   | 85                     | 85                     |      |
| ISB    | Standby Power Supply Current (TTL Level)<br>$\overline{CS} \geq V_{IH}$ , Outputs Open<br>V <sub>CC</sub> = Max., f = f <sub>MAX</sub> <sup>(2)</sup>                                      | SA    | 35                   | 25                   | 25                   | 25                   | 25                   | 25                     | 25                     | mA   |
|        |  | LA    | 30                   | 20                   | 20                   | 20                   | 25                   | 15                     | 15                     |      |
| ISB1   | Full Standby Power Supply Current (CMOS Level), $\overline{CS} \geq V_{HC}$ ,<br>V <sub>CC</sub> = Max., V <sub>IN</sub> ≤ V <sub>LC</sub><br>or V <sub>IN</sub> ≥ V <sub>HC</sub> , f = 0 | SA    | 10                   | 10                   | 10                   | 10                   | 10                   | 10                     | 10                     | mA   |
|        |  | LA    | 0.9                  | 0.9                  | 0.9                  | 0.9                  | 0.9                  | 0.9                    | 0.9                    |      |

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### NOTES:

- All values are maximum guaranteed values.
- f<sub>MAX</sub> = 1/trc, only address inputs are toggling at f<sub>MAX</sub>, f = 0 means address inputs are not changing.

## 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 |      |
| VDR                             | V <sub>CC</sub> for Data Retention   | —   | 2.0                            | —  | —    | —                         | —    | V    |
| ICCDR                           | Data Retention Current               | MIL.<br>COM'L.  | —                              | 0.5                                      | 1.5  | 200                       | 300  | μA   |
|                                 |                                      |   | —                              | 0.5                                      | 1.5  | 20                        | 30   |      |
| t <sub>CDR</sub> <sup>(3)</sup> | 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              |   | t <sub>RC</sub> <sup>(2)</sup> | —  | —    | —                         | —    | ns   |
| I <sub>LIL</sub>                | Input Leakage Current                |   | —                              | —  | —    | 2                         | 2    | μA   |

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### NOTES:

- T<sub>A</sub> = + 25°C
- t<sub>RC</sub> = Read Cycle Time.
- This parameter is guaranteed by device characterization, but is not production tested.

### Low Vcc Data Retention Waveform



### 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 |

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Figure 1. AC Test Load



Figure 2. AC Test Load  
(for tOLZ, tCLZ, tOHZ, tWHZ, tCHZ & tOW)

\*Including scope and jig.

AC Electrical Characteristics (V<sub>CC</sub> = 5V ± 10%, All Temperature Ranges)

| Symbol                          | Parameter                          | 6116SA15 <sup>(1)</sup> |      | 6116SA20<br>6116LA20 |      | 6116SA25<br>6116LA25 |      | 6116SA35 <sup>(2)</sup><br>6116LA35 <sup>(2)</sup> |      | Unit |
|---------------------------------|------------------------------------|-------------------------|------|----------------------|------|----------------------|------|--|------|------|
|                                 |                                    | Min.                    | Max. | Min.                 | Max. | Min.                 | Max. | Min.   | Max. |      |
| <b>Read Cycle</b>               |                                    |                         |      |                      |      |                      |      |  |      |      |
| t <sub>RC</sub>                 | Read Cycle Time                    | 15                      | —    | 20                   | —    | 25                   | —    | 35   | —    | ns   |
| t <sub>AA</sub>                 | Address Access Time                | —                       | 15   | —                    | 19   | —                    | 25   | —  | 35   | ns   |
| t <sub>ACS</sub>                | Chip Select Access Time            | —                       | 15   | —                    | 20   | —                    | 25   | —  | 35   | ns   |
| t <sub>CLZ</sub> <sup>(3)</sup> | Chip Select to Output in Low-Z     | 5                       | —    | 5                    | —    | 5                    | —    | 5  | —    | ns   |
| t <sub>OE</sub>                 | Output Enable to Output Valid      | —                       | 10   | —                    | 10   | —                    | 13   | —  | 20   | ns   |
| t <sub>OLZ</sub> <sup>(3)</sup> | Output Enable to Output in Low-Z   | 0                       | —    | 0                    | —    | 5                    | —    | 5  | —    | ns   |
| t <sub>CHZ</sub> <sup>(3)</sup> | Chip Deselect to Output in High-Z  | —                       | 10   | —                    | 11   | —                    | 12   | —  | 15   | ns   |
| t <sub>OHZ</sub> <sup>(3)</sup> | Output Disable to Output in High-Z | —                       | 8    | —                    | 8    | —                    | 10   | —  | 13   | ns   |
| t <sub>OH</sub>                 | Output Hold from Address Change    | 5                       | —    | 5                    | —    | 5                    | —    | 5  | —    | ns   |
| t <sub>PU</sub> <sup>(3)</sup>  | Chip Select to Power Up Time       | 0                       | —    | 0                    | —    | 0                    | —    | 0  | —    | ns   |
| t <sub>PD</sub> <sup>(3)</sup>  | Chip Deselect to Power Down Time   | —                       | 15   | —                    | 20   | —                    | 25   | —  | 35   | ns   |

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AC Electrical Characteristics (V<sub>CC</sub> = 5V ± 10%, All Temperature Ranges) (continued)

| Symbol                          | Parameter                          | 6116SA45 <sup>(2)</sup><br>6116LA45 <sup>(2)</sup> |      | 6116SA55 <sup>(2)</sup><br>6116LA55 <sup>(2)</sup> |      | 6116SA70 <sup>(2)</sup><br>6116LA70 <sup>(2)</sup> |      | 6116SA90 <sup>(2)</sup><br>6116LA90 <sup>(2)</sup> |      | 6116SA120 <sup>(2)</sup><br>6116LA120 <sup>(2)</sup> |      | 6116SA150 <sup>(2)</sup><br>6116LA150 <sup>(2)</sup> |      | Unit |
|---------------------------------|------------------------------------|--|------|--|------|--|------|--|------|--|------|--|------|------|
|                                 |                                    | Min.   | Max. | Min.   | Max. | Min.   | Max. | Min.   | Max. | Min.   | Max. | Min.   | Max. |      |
| <b>Read Cycle</b>               |                                    |  |      |  |      |  |      |  |      |  |      |  |      |      |
| t <sub>RC</sub>                 | Read Cycle Time                    | 45   | —    | 55   | —    | 70   | —    | 90   | —    | 120  | —    | 150  | —    | ns   |
| t <sub>AA</sub>                 | Address Access Time                | —  | 45   | —  | 55   | —  | 70   | —  | 90   | —  | 120  | —  | 150  | ns   |
| t <sub>ACS</sub>                | Chip Select Access Time            | —  | 45   | —  | 50   | —  | 65   | —  | 90   | —  | 120  | —  | 150  | ns   |
| t <sub>CLZ</sub> <sup>(3)</sup> | Chip Select to Output in Low-Z     | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | ns   |
| t <sub>OE</sub>                 | Output Enable to Output Valid      | —  | 25   | —  | 40   | —  | 50   | —  | 60   | —  | 80   | —  | 100  | ns   |
| t <sub>OLZ</sub> <sup>(3)</sup> | Output Enable to Output in Low-Z   | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | ns   |
| t <sub>CHZ</sub> <sup>(3)</sup> | Chip Deselect to Output in High-Z  | —  | 20   | —  | 30   | —  | 35   | —  | 40   | —  | 40   | —  | 40   | ns   |
| t <sub>OHZ</sub> <sup>(3)</sup> | Output Disable to Output in High-Z | —  | 15   | —  | 30   | —  | 35   | —  | 40   | —  | 40   | —  | 40   | ns   |
| t <sub>OH</sub>                 | Output Hold from Address Change    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | ns   |

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NOTES:

- 0°C to +70°C temperature range only.
- 55°C to +125°C temperature range only.
- This parameter guaranteed with the AC Load (Figure 2) by device characterization, but is not production tested.

### Timing Waveform of Read Cycle No. 1<sup>(1,3)</sup>



### Timing Waveform of Read Cycle No. 2<sup>(1,2,4)</sup>



### Timing Waveform of Read Cycle No. 3<sup>(1,3,4)</sup>



**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.  $\overline{OE}$  is LOW.
5. Transition is measured  $\pm 500\text{mV}$  from steady state.

AC Electrical Characteristics ( $V_{CC} = 5V \pm 10\%$ , All Temperature Ranges)

| Symbol                           | Parameter                       | 6116SA15 <sup>(1)</sup> |      | 6116SA20<br>6116LA20 |      | 6116SA25<br>6116LA25 |      | 6116SA35 <sup>(2)</sup><br>6116LA35 <sup>(2)</sup> |      | Unit |
|----------------------------------|---------------------------------|-------------------------|------|----------------------|------|----------------------|------|--|------|------|
|                                  |                                 | Min.                    | Max. | Min.                 | Max. | Min.                 | Max. | Min.   | Max. |      |
| <b>Write Cycle</b>               |                                 |                         |      |                      |      |                      |      |  |      |      |
| t <sub>WC</sub>                  | Write Cycle Time                | 15                      | —    | 20                   | —    | 25                   | —    | 35   | —    | ns   |
| t <sub>CW</sub>                  | Chip Select to End-of-Write     | 13                      | —    | 15                   | —    | 17                   | —    | 25   | —    | ns   |
| t <sub>AW</sub>                  | Address Valid to End-of-Write   | 14                      | —    | 15                   | —    | 17                   | —    | 25   | —    | ns   |
| t <sub>AS</sub>                  | Address Set-up Time             | 0                       | —    | 0                    | —    | 0                    | —    | 0  | —    | ns   |
| t <sub>WP</sub>                  | Write Pulse Width               | 12                      | —    | 12                   | —    | 15                   | —    | 20   | —    | ns   |
| t <sub>WR</sub>                  | Write Recovery Time             | 0                       | —    | 0                    | —    | 0                    | —    | 0  | —    | ns   |
| t <sub>WHZ</sub> <sup>(3)</sup>  | Write to Output in High-Z       | —                       | 7    | —                    | 8    | —                    | 16   | —  | 20   | ns   |
| t <sub>DW</sub>                  | Data to Write Time Overlap      | 12                      | —    | 12                   | —    | 13                   | —    | 15   | —    | ns   |
| t <sub>DH</sub> <sup>(4)</sup>   | Data Hold from Write Time       | 0                       | —    | 0                    | —    | 0                    | —    | 0  | —    | ns   |
| t <sub>OW</sub> <sup>(3,4)</sup> | Output Active from End-of-Write | 0                       | —    | 0                    | —    | 0                    | —    | 0  | —    | ns   |

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AC Electrical Characteristics ( $V_{CC} = 5V \pm 10\%$ , All Temperature Ranges)(con't)

| Symbol                           | Parameter                       | 6116SA45 <sup>(2)</sup><br>6116LA45 <sup>(2)</sup> |      | 6116SA55 <sup>(2)</sup><br>6116LA55 <sup>(2)</sup> |      | 6116SA70 <sup>(2)</sup><br>6116LA70 <sup>(2)</sup> |      | 6116SA90 <sup>(2)</sup><br>6116LA90 <sup>(2)</sup> |      | 6116SA120 <sup>(2)</sup><br>6116LA120 <sup>(2)</sup> |      | 6116SA150 <sup>(2)</sup><br>6116LA150 <sup>(2)</sup> |      | Unit |
|----------------------------------|---------------------------------|--|------|--|------|--|------|--|------|--|------|--|------|------|
|                                  |                                 | Min.   | Max. | Min.   | Max. | Min.   | Max. | Min.   | Max. | Min.   | Max. | Min.   | Max. |      |
| <b>Write Cycle</b>               |                                 |  |      |  |      |  |      |  |      |  |      |  |      |      |
| t <sub>WC</sub>                  | Write Cycle Time                | 45   | —    | 55   | —    | 70   | —    | 90   | —    | 120  | —    | 150  | —    | ns   |
| t <sub>CW</sub>                  | Chip Select to End-of-Write     | 30   | —    | 40   | —    | 40   | —    | 55   | —    | 70   | —    | 90   | —    | ns   |
| t <sub>AW</sub>                  | Address Valid to End-of-Write   | 30   | —    | 45   | —    | 65   | —    | 80   | —    | 105  | —    | 120  | —    | ns   |
| t <sub>AS</sub>                  | Address Set-up Time             | 0  | —    | 5  | —    | 15   | —    | 15   | —    | 20   | —    | 20   | —    | ns   |
| t <sub>WP</sub>                  | Write Pulse Width               | 25   | —    | 40   | —    | 40   | —    | 55   | —    | 70   | —    | 90   | —    | ns   |
| t <sub>WR</sub>                  | Write Recovery Time             | 0  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 10   | —    | ns   |
| t <sub>WHZ</sub> <sup>(3)</sup>  | Write to Output in High-Z       | —  | 25   | —  | 30   | —  | 35   | —  | 40   | —  | 40   | —  | 40   | ns   |
| t <sub>DW</sub>                  | Data to Write Time Overlap      | 20   | —    | 25   | —    | 30   | —    | 30   | —    | 35   | —    | 40   | —    | ns   |
| t <sub>DH</sub> <sup>(4)</sup>   | Data Hold from Write Time       | 0  | —    | 5  | —    | 5  | —    | 5  | —    | 5  | —    | 10   | —    | ns   |
| t <sub>OW</sub> <sup>(3,4)</sup> | Output Active from End-of-Write | 0  | —    | 0  | —    | 0  | —    | 0  | —    | 0  | —    | 0  | —    | ns   |

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NOTES:

- 0°C to +70°C temperature range only.
- 55°C to +125°C temperature range only.
- This parameter guaranteed with AC Load (Figure 2) by device characterization, but is not production tested.
- The specification for t<sub>DH</sub> must be met by the device supplying write data to the RAM under all operation conditions. Although t<sub>DH</sub> and t<sub>OW</sub> values will vary over voltage and temperature, the actual t<sub>DH</sub> will always be smaller than the actual t<sub>OW</sub>.



Timing Waveform of Write Cycle No. 1 ( **$\overline{WE}$**  Controlled Timing)<sup>(1,2,5,7)</sup>



3089 drw 09

Timing Waveform of Write Cycle No. 2 ( **$\overline{CS}$**  Controlled Timing)<sup>(1,2,3,5,7)</sup>



3089 drw 10

NOTES:

1.  $\overline{WE}$  or  $\overline{CS}$  must be HIGH 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. During this period, the I/O pins are in the output state and the input signals must not be applied.
5. If the  $\overline{CS}$  LOW transition occurs simultaneously with or after the  $\overline{WE}$  LOW transition, the outputs remain in the high-impedance state.
6. Transition is measured  $\pm 500\text{mV}$  from steady state.
7.  $\overline{OE}$  is continuously HIGH. 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 is the specified  $t_{WP}$ . For a  $\overline{CS}$  controlled write cycle,  $\overline{OE}$  may be LOW with no degradation to  $t_{CW}$ .

### Ordering Information — Military



3089 drw 11

### Ordering Information — Commercial & Industrial



\*Available in commercial temperature range and standard power only.

3089 drw 12

## Datasheet Document History

|          |                 |  |
|----------|-----------------|--|
| 01/07/00 |                 | Updated to new format  |
|          | Pg. 1, 3, 4, 10 | Added Industrial Temperature range offerings   |
|          | Pg. 9, 10       | Separated ordering information into military, commercial, and industrial temperature range offerings   |
|          | Pg. 11          | Added Datasheet Document History   |
| 08/09/00 |                 | Not recommended for new designs  |
| 02/01/01 |                 | Removed "Not recommended for new designs"  |
| 12/30/03 | Pg. 3,10        | Corrected Industrial temp from -45C to -40C.   |
| 03/31/05 | Pg. 10          | Added "Restricted hazardous substance device" to ordering information.   |
| 11/15/06 | Pg. 3           | Changed power limits for commercial and industrial on speed grades 25ns and 35ns.  |
|          | Pg.4            | Changed power limits for commercial and industrial on speed grade 45ns. Refer to PCN SR-0602-02.   |
| 04/26/11 | Pg.1,2,3,4,6,10 | Updated "Restricted hazardous substance device" to "Green". Obsoleted 24-pin SOJ, 24-pin 600 mil and 35ns, 45ns for Industrial & Commercial.   |
| 05/01/13 | Pg. 1           | Description paragraph 4, package information. Changed text to read "The IDT6116SA/LA is packaged in 24-pin 300mil plastic DIP, 24-pin 600mil and 300mil ceramic DIP, or 24-lead gull-wing SOIC providing high board-level packing densities". Removed IDT in reference to fabrication. |
|          | Pg. 3           | Updated DC Elec Chars ( $V_{CC} = 5.0V \pm 10\%$ ) table by adding industrial to the Test Conditions.<br>Updated DC Elec Chars ( $V_{CC} = 5.0V \pm 10\%$ , $V_{LC} = 0.2V$ , $V_{HC} + V_{CC} - 0.2V$ ) table by removing the LA power for the 15ns speed.                            |
|          | Pg. 10          | Removed footnote "** Available in 300mil packaging only" from the Military ordering information.   |



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