CMOS Static RAM 16K (16K x 1-Bit)

IDT6167SA
IDT6167LA
OBSOLETE PART

Features

- **High-speed (equal access and cycle time)**
  - *Military: 25/35/45/55/70/85/100ns (max.)*
  - *Commercial: 15/20/25ns (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.

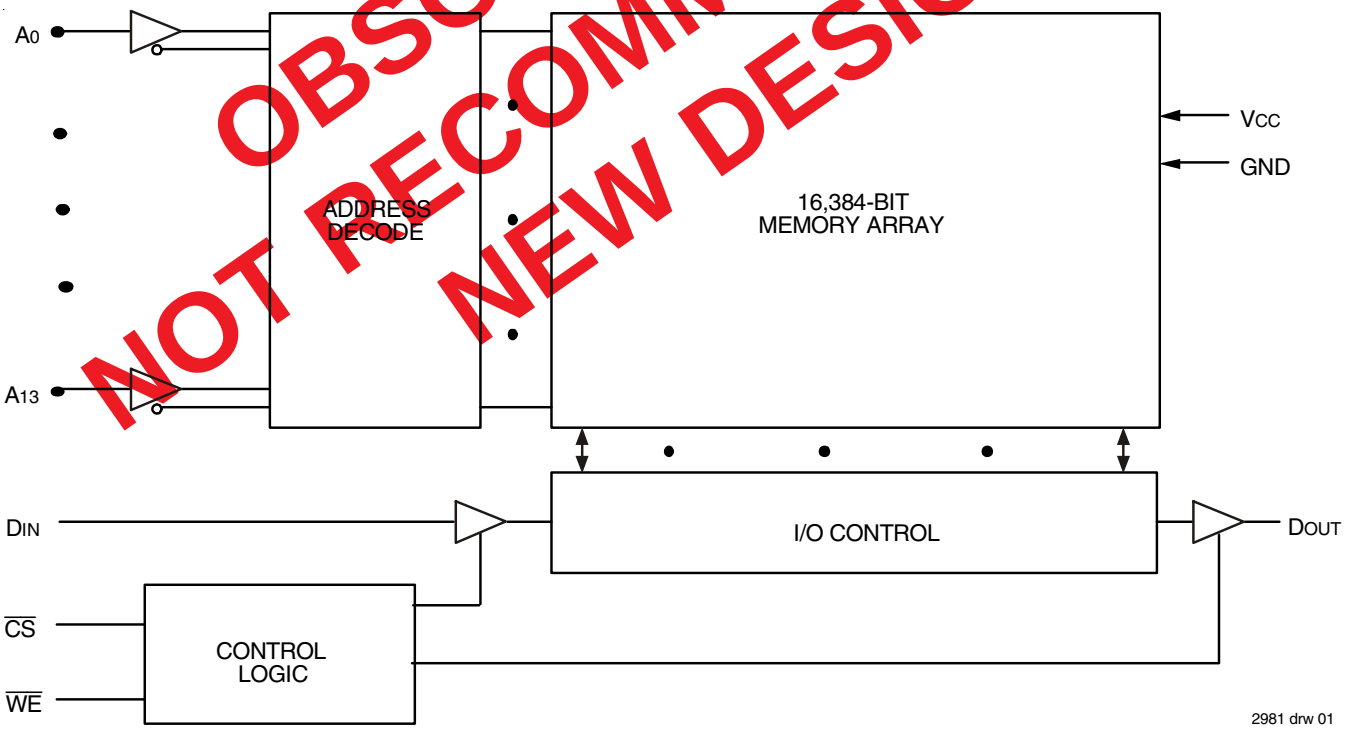
Access times as fast as 15ns are available. The circuit also offers a reduced power standby mode. When $\overline{CS}$ goes HIGH, the circuit will automatically go to, and remain in, a standby mode as long as $\overline{CS}$ remains HIGH. This capability provides significant system-level power and cooling savings. The low-power (LA) version also offers a battery backup data retention capability where the circuit typically consumes only 1µW 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 and a Plastic 20-pin providing high board-level packing densities.

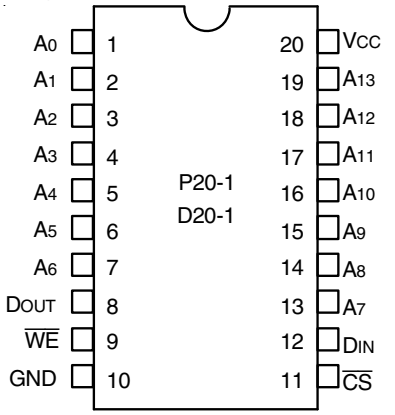
Military grade product is manufactured in compliance with the latest revision of MIL-STD-883, Class B, making it ideally suited to military temperature applications demanding the highest level of performance and reliability.

Functional Block Diagram



FEBRUARY 2001

Pin Configurations



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DIP
Top View

Pin Descriptions

Name	Description
A_0 - A_{13}	Address Inputs
$\overline{CS}$	Chip Select
$\overline{WE}$	Write Enable
V_{CC}	Power
D_{IN}	$DATA_{IN}$
D_{OUT}	$DATA_{OUT}$
GND	Ground

2981 tbl 01

Truth Table(1)

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

2981 tbl 02

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

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(1)

Symbol	Rating	Com'l.	Mil.	Unit
V_{TERM}	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
T_A	Operating Temperature	0 to +70	-55 to +125	°C
T_{BIAS}	Temperature Under Bias	-55 to +125	-65 to +135	°C
T_{STG}	Storage Temperature	-55 to +125	-65 to +150	°C
P_T	Power Dissipation	1.0	1.0	W
I_{OUT}	DC Output Current	50	50	mA

2981 tbl 03

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.

Capacitance (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	7	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	7	pF

2981 tbl 04

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

Recommended DC Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage	4.5	5.0	5.5	V
GND	Ground	0	0	0	V
V_{IH}	Input High Voltage	2.2	—	6.0	V
V_{IL}	Input Low Voltage	-0.5(1)	—	0.8	V

2981 tbl 05

NOTE:
1. V_{IL} (min.) = –3.0V for pulse width less than 20ns, once per cycle.

DC Electrical Characteristics(1)

(V_{CC} = 5.0V ± 10%, V_{LC} = 0.2V, V_{HC} = V_{CC} – 0.2V)

Symbol	Parameter	Power	6167SA/LA15 Com'l.	6167SA/LA20 Com'l.	6167SA/LA25 Com'l.	6167SA/LA25 Mil.	Unit
I_{CC1}	Operating Power Supply Current $\overline{CS} \leq V_{IL}$, Outputs Open V_{CC} = Max., f = 0(3)	SA	90	90	90	90	mA
		LA	55	55	55	60	
I_{CC2}	Dynamic Operating Current $\overline{CS} \leq V_{IL}$, Outputs Open V_{CC} = Max., f = f_{MAX}(3)	SA	120	100	100	100	mA
		LA	100	80	70	75	
I_{SB}	Standby Power Supply Current (TTL Level) $\overline{CS} \geq V_{IH}$, Outputs Open V_{CC} = Max., f = f_{MAX}(3)	SA	50	35	35	35	mA
		LA	35	30	25	25	
I_{SB1}	Full Standby Power Supply Current (CMOS Level) $\overline{CS} \geq V_{HC}$, V_{CC} = Max., $V_{IN} \geq V_{HC}$ or $V_{IN} \leq V_{LC}$, f = 0(3)	SA	5	5	5	10	mA
		LA	0.9	0.05	0.05	0.9	

2981 tbl 07

DC Electrical Characteristics(1) (con't.)

(V_{CC} = 5.0V ± 10%, V_{LC} = 0.2V, V_{HC} = V_{CC} – 0.2V)

Symbol	Parameter	Power	6167SA/LA35(2) Mil.	6167SA/LA45(2) Mil.	6167SA/LA55(2) Mil.	6167SA/LA70(2) Mil.	Unit
I_{CC1}	Operating Power Supply Current $\overline{CS} \leq V_{IL}$, Outputs Open V_{CC} = Max., f = 0(3)	SA	90	90	90	90	mA
		LA	60	60	60	60	
I_{CC2}	Dynamic Operating Current $\overline{CS} \leq V_{IL}$, Outputs Open V_{CC} = Max., f = f_{MAX}(3)	SA	100	100	100	100	mA
		LA	70	65	60	60	
I_{SB}	Standby Power Supply Current (TTL Level) $\overline{CS} \geq V_{IH}$, Outputs Open V_{CC} = Max., f = f_{MAX}(3)	SA	35	35	35	35	mA
		LA	20	20	20	15	
I_{SB1}	Full Standby Power Supply Current (CMOS Level) $\overline{CS} \geq V_{HC}$, V_{CC} = Max., $V_{IN} \geq V_{HC}$ or $V_{IN} \leq V_{LC}$, f = 0(3)	SA	10	10	10	10	mA
		LA	0.9	0.9	0.9	0.9	

2981 tbl 08

NOTES:

1. All values are maximum guaranteed values.
2. –55°C to +125°C temperature range only. Also available; 85ns and 100ns Military devices.
3. f_{MAX} = 1/t_{RC}, only address inputs cycling at f_{MAX}. f = 0 means no address inputs change.

DC Electrical Characteristics

(V_{CC} = 5.0V ± 10%)

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

2981 tbl 09

Data Retention Characteristics Over All Temperature Ranges

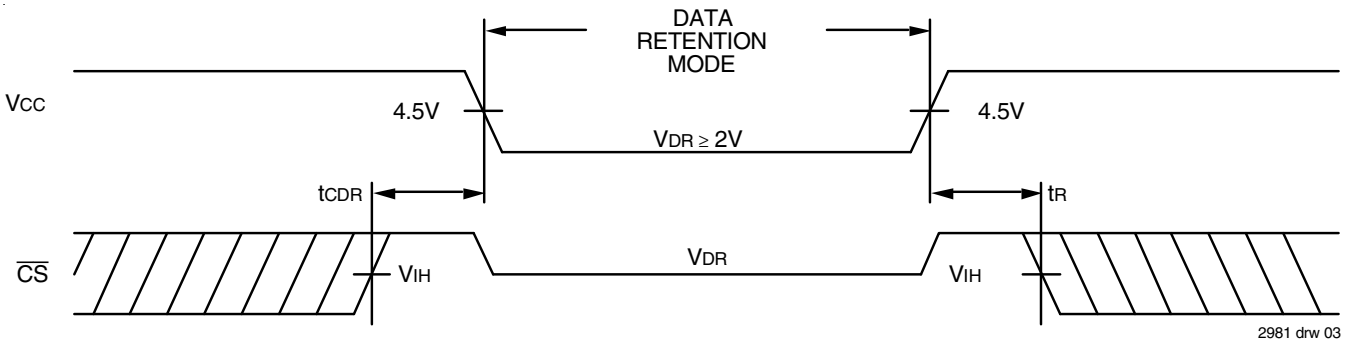
(LA Version Only) (V_{LC} = 0.2V, V_{HC} = V_{CC} – 0.2V)

Symbol	Parameter	Test Condition		Min.	Typ.[1] Vcc @ 2.0V	Typ.[1] Vcc @ 3.0V	Max. Vcc @ 2.0V	Max. Vcc @ 3.0V	Unit
V_{DR}	V_{CC} for Data Retention	—		2.0	—	—	—	—	V
I_{CCDR}	Data Retention Current	$\overline{CS} \geq V_{HC}$ $V_{IN} \geq V_{HC}$ or $\leq V_{LC}$	MIL. COM'L.	— —	0.5 0.5	1.0 1.0	200 20	300 30	µA
t_{CDR}	Chip Deselect to Data Retention Time			0	—	—	—	—	ns
t_R[3]	Operation Recovery Time			t_{RC}[2]	—	—	—	—	ns
$\|I_{LI}\|$[3]	Input Leakage Current			—	—	—	2	2	µA

2981 tbl 10

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.

Low V_{CC} Data Retention Waveform



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AC Test Conditions

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

2981 tbl 11

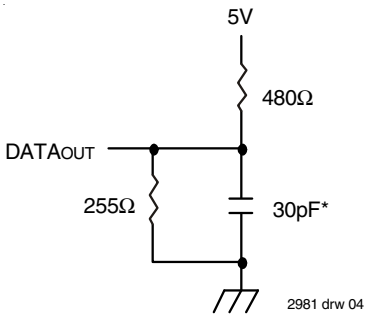

Figure 1. AC Test Load

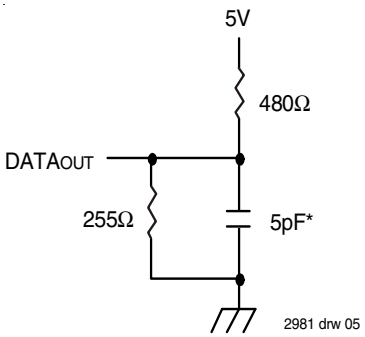

Figure 2. AC Test Load (for t_{CLZ}, t_{CHZ}, t_{WHZ} and t_{OW})

*Includes scope and jig.

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

Symbol	Parameter	6167SA15[3]		6167SA20[3]/25 6167LA20[3]/25		6167SA35[1]/45[1] 6167LA35[1]/45[1]		6167SA55[1]/70[1] 6167LA55[1]/70[1]		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle										
t_{RC}	Read Cycle Time	15	—	20/25	—	35/45	—	55/70	—	ns
t_{AA}	Address Access Time	—	15	—	20/25	—	35/45	—	55/70	ns
t_{ACS}	Chip Select Access Time	—	15	—	20/25	—	35/45	—	55/70	ns
t_{CLZ}[2]	Chip Deselect to Output in Low-Z	3	—	5/5	—	5/5	—	5/5	—	ns
t_{CHZ}[2]	Chip Select to Output in High-Z	—	10	—	10/10	—	15/30	—	40/40	ns
t_{OH}	Output Hold from Address Change	3	—	5/5	—	5/5	—	5/5	—	ns
t_{PU}[2]	Chip Select to Power-Up Time	0	—	0/0	—	0/0	—	0/0	—	ns
t_{PD}[2]	Chip Deselect to Power-Down Time	—	15	—	20/25	—	35/45	—	55/70	ns
Write Cycle										
t_{WC}	Write Cycle Time	15	—	20/20	—	30/45	—	55/70	—	ns
t_{CW}	Chip Select to End-of-Write	15	—	15/20	—	30/40	—	45/55	—	ns
t_{AW}	Address Valid to End-of-Write	15	—	15/20	—	30/40	—	45/55	—	ns
t_{AS}	Address Set-up Time	0	—	0/0	—	0/0	—	0/0	—	ns
t_{WP}	Write Pulse Width	13	—	15/20	—	30/30	—	35/40	—	ns
t_{WR}	Write Recovery Time	0	—	0/0	—	0/0	—	0/0	—	ns
t_{DW}	Data Valid to End-of-Write	10	—	12/15	—	17/20	—	25/30	—	ns
t_{DH}	Data Hold Time	0	—	0/0	—	0/0	—	0/0	—	ns
t_{WHZ}[2]	Write Enable to Output in High-Z	—	7	—	8/8	—	15/30	—	40/40	ns
t_{OW}[2]	Output Active from End-of-Write	0	—	0/0	—	0/0	—	0/0	—	ns

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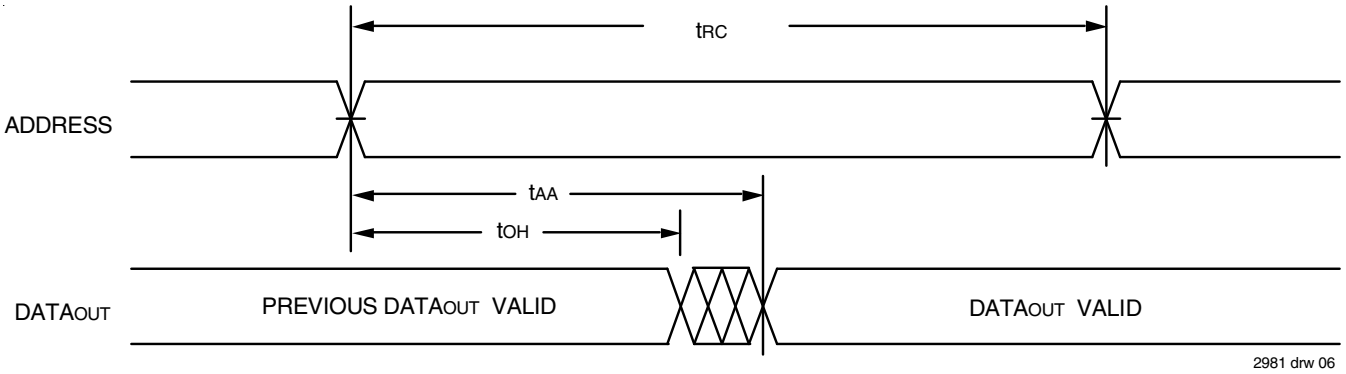
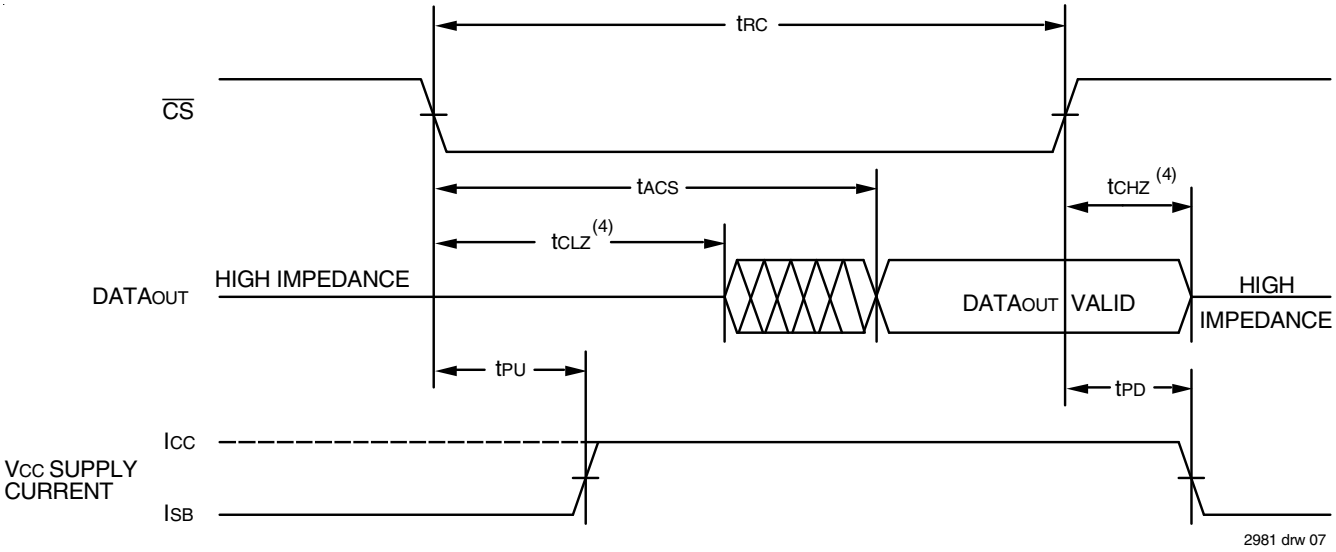
NOTES:
1. –55°C to +125°C temperature range only. Also available: 85ns and 100ns Military devices.
2. This parameter is guaranteed with AC Load (Figure 2) by device characterization, but is not production tested.
3. 0°C to +70°C temperature range only.

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

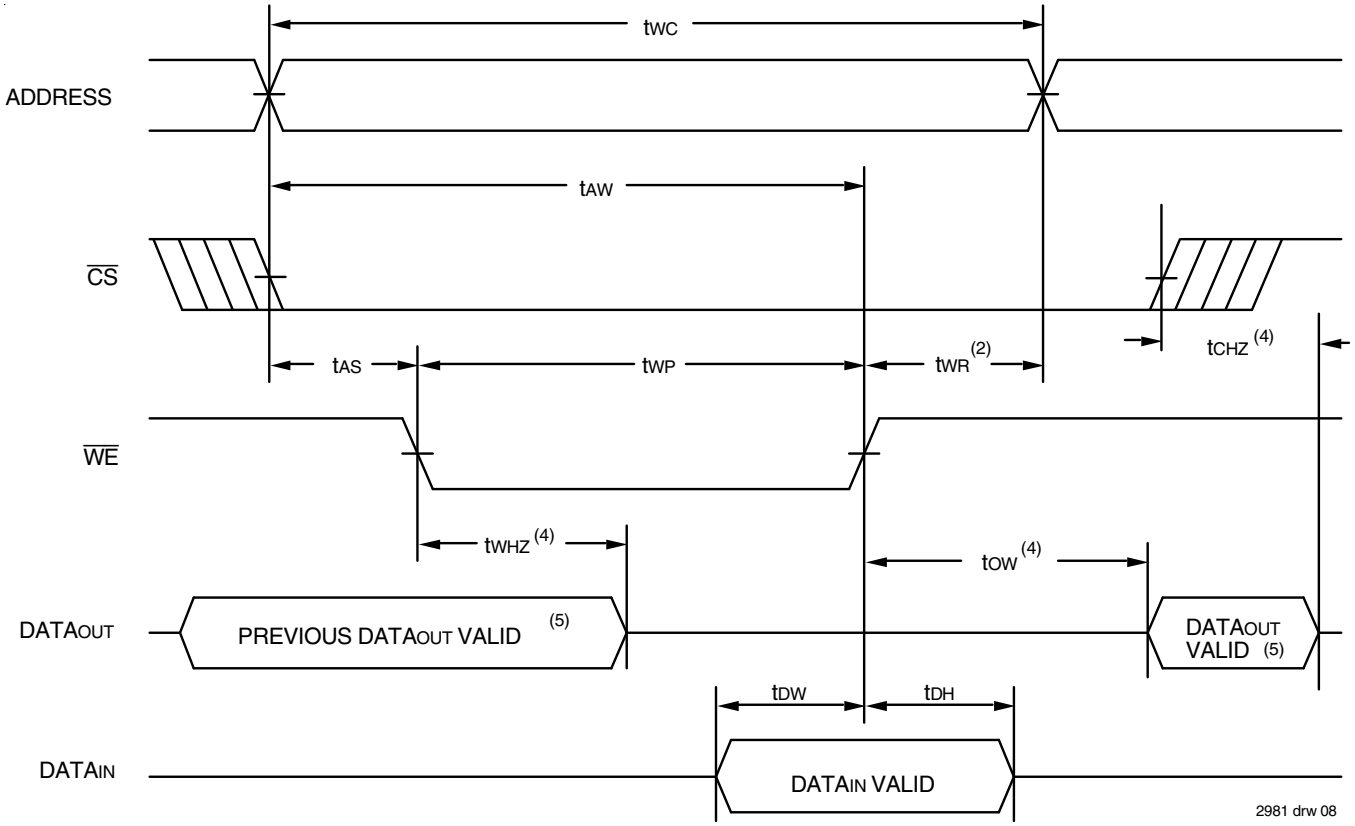


Timing Waveform of Read Cycle No. 2(1, 3)

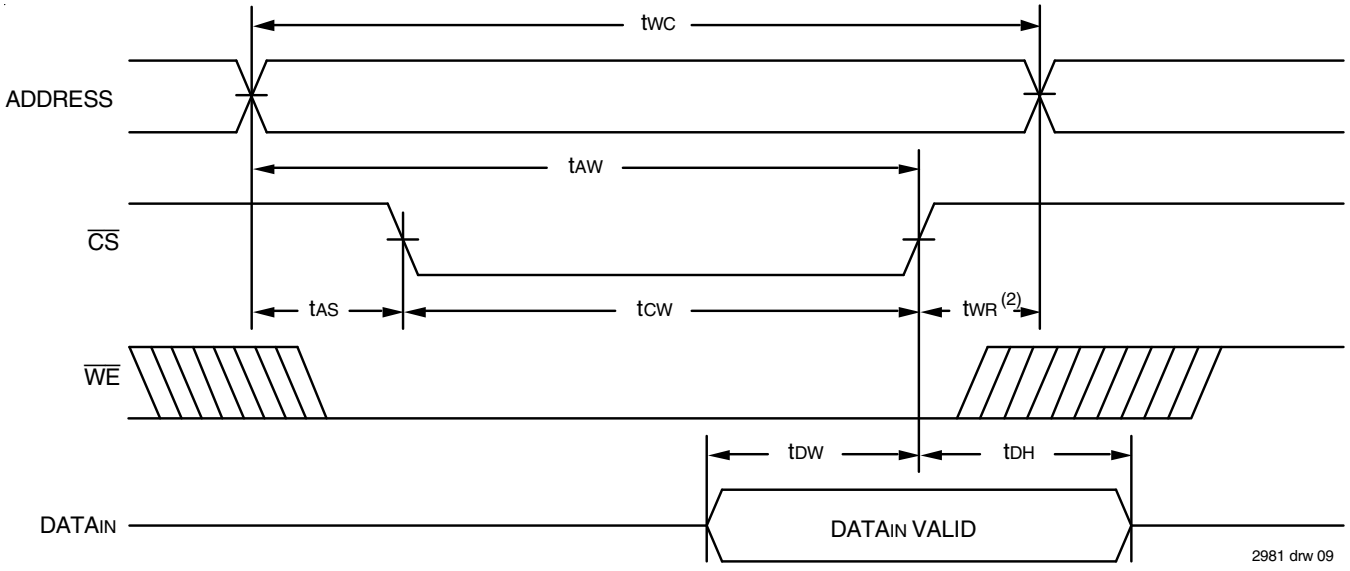


NOTES:
1. $\overline{WE}$ is HIGH for Read cycle.
2. Device is continuously selected, $\overline{CS}$ is LOW.
3. Address valid prior to or coincedent with $\overline{CS}$ transition LOW.
4. Transition is measured ±200mV from steady state.

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

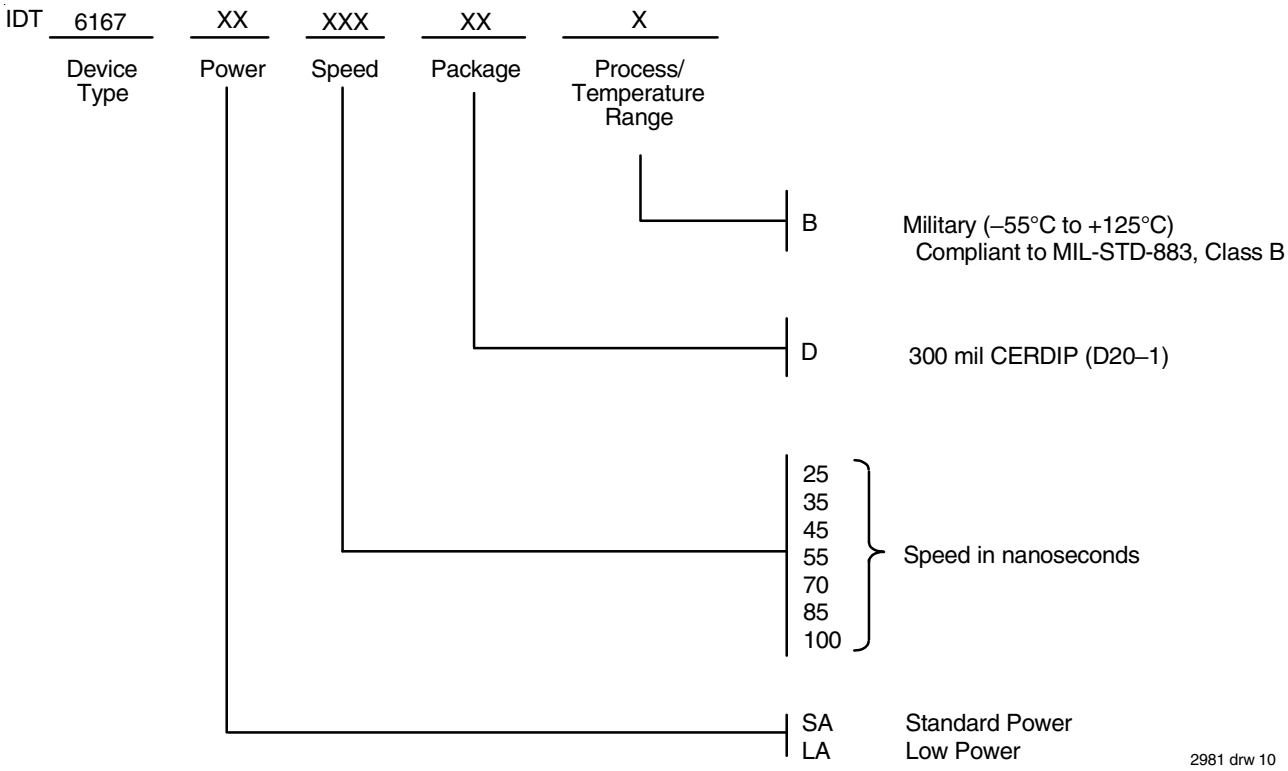


Timing Waveform of Write Cycle No. 2 ($\overline{CS}$ Controlled Timing)(1,3)



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

Ordering Information -- Military



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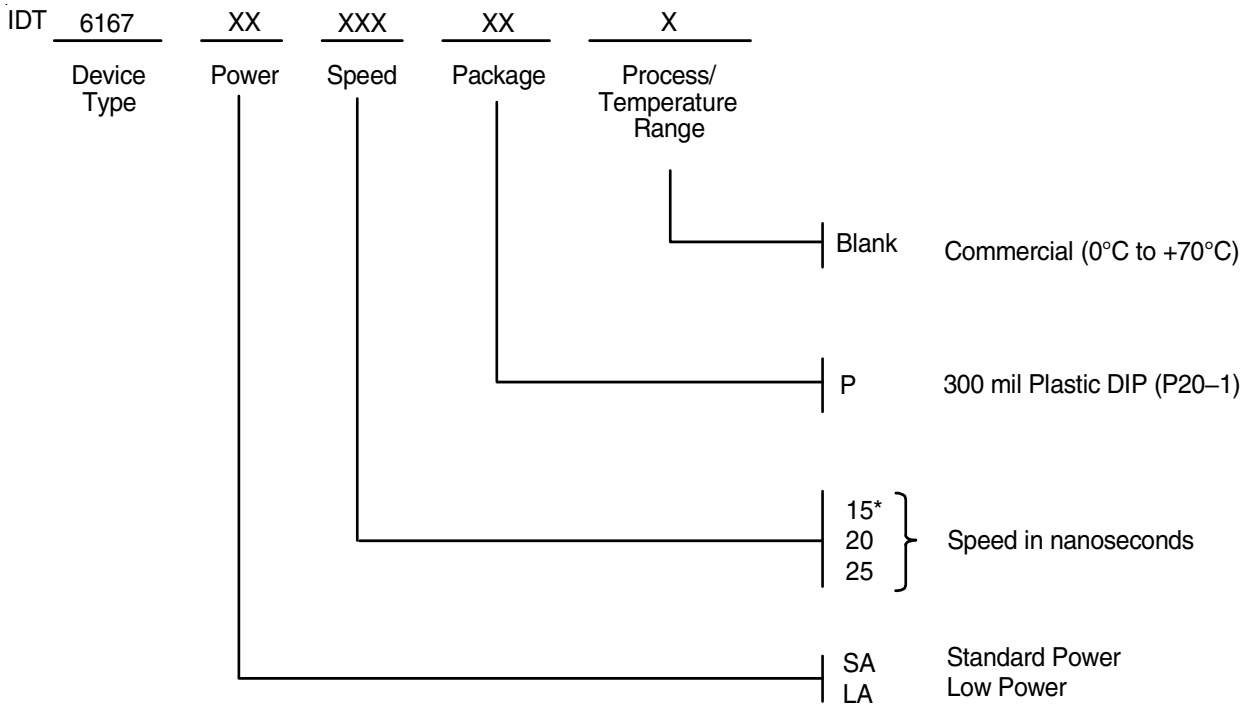
Ordering Information -- Commerical



* Available in standard power only.

2981 drw 10A

Datasheet Document History

1/13/00		Updated to new format
	Pg. 7	Removed Note 1 from Write Cycle No. 1 and No. 2 drawings; renumbered notes and footnotes
	Pg. 8	Added Datasheet Document History
1/26/00	Pg. 1-3, 5, 8	Removed speed offering 15ns and 20ns for military and 35ns for commercial temperature range.
	Pg. 1, 2, 8	Removed SOJ package offering.
	Pg. 9	Updated Datasheet History
08/09/00		Not recommended for new designs
02/01/01		Removed "Not recommended for new designs"
02/01/07		PDN-SR-07-01 issued. See IDT.com for PDN specifics
08/07/14		6167SA/LA Datasheet changed to Obsolete Status

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