CY7C1061DV33

16-Mbit (1M × 16) Static RAM

Features

- High speed
  - t_{AA} = 10 ns
- Low active power
  - I_{CC} = 175 mA at 100 MHz
- Low CMOS standby power
  - I_{SB2} = 25 mA
- Operating voltages of 3.3 ± 0.3 V
- 2.0 V data retention
- Automatic power down when deselected
- TTL compatible inputs and outputs
- Easy memory expansion with $\overline{CE}_1$ and CE_2 features
- Available in Pb-free 54-pin TSOP II and 48-ball VFBGA packages
- Offered in single CE and dual CE options

Functional Description

The CY7C1061DV33 is a high performance CMOS Static RAM organized as 1,048,576 words by 16 bits.

To write to the device, take Chip Enables ($\overline{CE}_1$ LOW and CE_2 HIGH) and Write Enable ($\overline{WE}$) input LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address pins (A_0 through A_{19}). If Byte High Enable ($\overline{BHE}$) is LOW, then data from I/O pins (I/O_8 through I/O_{15}) is written into the location specified on the address pins (A_0 through A_{19}).

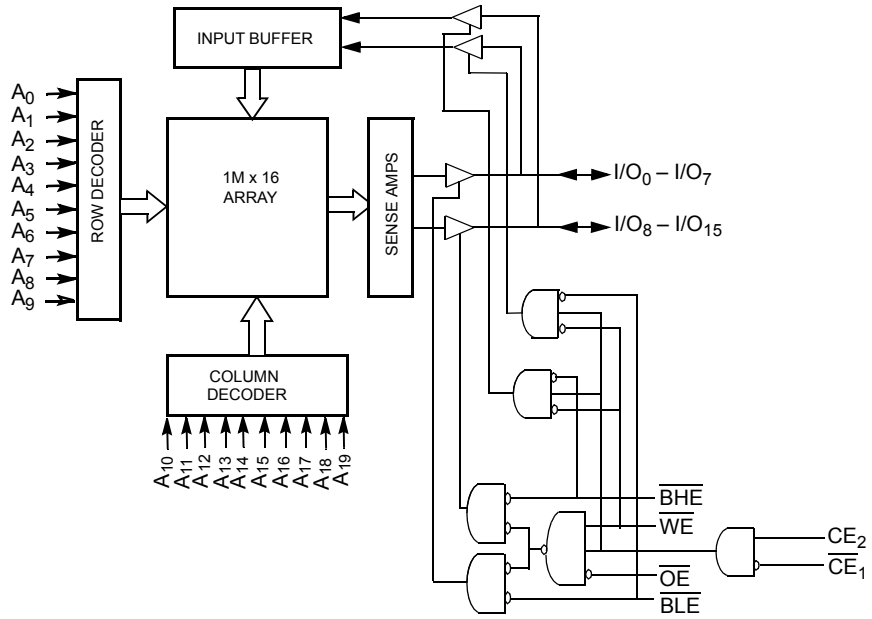
To read from the device, take Chip Enables ($\overline{CE}_1$ LOW and CE_2 HIGH) and Output Enable ($\overline{OE}$) LOW while forcing the Write Enable ($\overline{WE}$) HIGH. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from the memory location specified by the address pins appears on I/O_0 to I/O_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory appears on I/O_8 to I/O_{15}. See Truth Table on page 12 for a complete description of Read and Write modes.

The input or output pins (I/O_0 through I/O_{15}) are placed in a high impedance state when the device is deselected ($\overline{CE}_1$ HIGH/CE_2 LOW), the outputs are disabled ($\overline{OE}$ HIGH), the $\overline{BHE}$ and $\overline{BLE}$ are disabled ($\overline{BHE}$, $\overline{BLE}$ HIGH), or during a write operation ($\overline{CE}_1$ LOW, CE_2 HIGH, and $\overline{WE}$ LOW).

The CY7C1061DV33 is available in a 54-pin TSOP II package with center power and ground (revolutionary) pinout, and 48-ball VFBGA packages.

For a complete list of related documentation, click here.

Logic Block Diagram



Contents

Selection Guide

Description	-10	Unit
Maximum access time	10	ns
Maximum operating current	175	mA
Maximum CMOS standby current	25	mA

Pin Configurations

Figure 1. 48-ball VFBGA (8 × 9.5 × 1 mm) Dual Chip Enable (-BVXI) pinout (Top View) [1, 2]

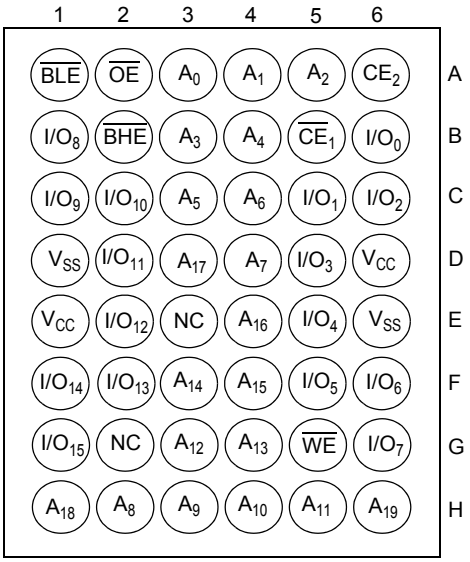
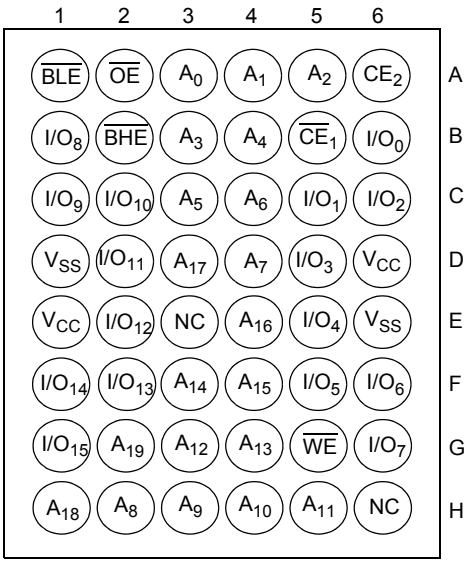


Figure 2. 48-ball VFBGA (8 × 9.5 × 1 mm) Dual Chip Enable (-BVJXI) pinout (Top View) [1, 2]



Notes
1. NC pins are not connected on the die.
2. In BVXI package, ball H6 is MSB address A19 and ball G2 is NC; in BVJXI package, ball H6 is NC and ball G2 is MSB address A19.

Pin Configurations (continued)

Figure 3. 48-ball VFBGA (8 × 9.5 × 1 mm) Single Chip Enable (-BV1XI) pinout (Top View) [3, 4]

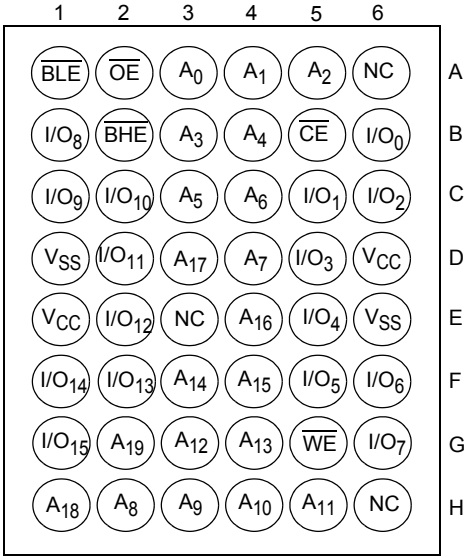
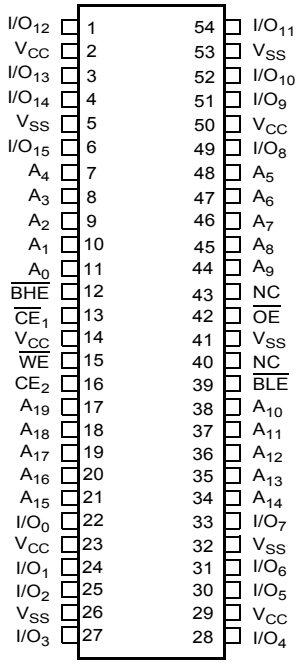


Figure 4. 54-pin TSOP II (22.4 × 11.84 × 1.0 mm) pinout (Top View) [3]



Notes
3. NC pins are not connected on the die.
4. In BV1XI package, ball A6 is NC, ball H6 is NC and ball G2 is MSB address A19. BV1XI package has only single Chip Enable ($\overline{CE}$).

Maximum Ratings

Exceeding maximum ratings may impair the useful life of the device. These user guidelines are not tested.

Storage Temperature ..... –65 °C to +150 °C

Ambient Temperature with Power Applied ..... –55 °C to +125 °C

Supply Voltage on V_{CC} relative to GND [5] .....–0.5 V to +4.6 V

DC Voltage Applied to Outputs in High Z State [5] ..... –0.5 V to V_{CC} + 0.5 V

DC Input Voltage [5] ..... –0.5 V to V_{CC} + 0.5 V

Current into Outputs (LOW) ..... 20 mA

Static Discharge Voltage (MIL-STD-883, Method 3015) ..... >2001 V

Latch Up Current ..... >200 mA

Operating Range

Range	Ambient Temperature	V_{CC}
Industrial	–40 °C to +85 °C	3.3 V ± 0.3 V

DC Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	-10		Unit
			Min	Max	
V_{OH}	Output HIGH voltage	V_{CC} = Min, I_{OH} = –4.0 mA	2.4	–	V
V_{OL}	Output LOW voltage	V_{CC} = Min, I_{OL} = 8.0 mA	–	0.4	V
V_{IH}	Input HIGH voltage	–	2.0	V_{CC} + 0.3	V
V_{IL}	Input LOW voltage [5]	–	–0.3	0.8	V
I_{IX}	Input leakage current	GND ≤ V_I ≤ V_{CC}	–1	+1	µA
I_{OZ}	Output leakage current	GND ≤ V_{OUT} ≤ V_{CC}, Output disabled	–1	+1	µA
I_{CC}	V_{CC} operating supply current	V_{CC} = Max, f = f_{MAX} = 1/t_{RC}, I_{OUT} = 0 mA, CMOS levels	–	175	mA
I_{SB1}	Automatic CE power down current – TTL inputs	Max V_{CC}, $\overline{CE}_1$ ≥ V_{IH}, CE_2 ≤ V_{IL}, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}	–	30	mA
I_{SB2}	Automatic CE power down current – CMOS inputs	Max V_{CC}, $\overline{CE}_1$ ≥ V_{CC} – 0.3 V, CE_2 ≤ 0.3 V, V_{IN} ≥ V_{CC} – 0.3 V, or V_{IN} ≤ 0.3 V, f = 0	–	25	mA

Note

5. $V_{IL(min)}$ = –2.0 V and $V_{IH(max)}$ = V_{CC} + 2 V for pulse durations of less than 20 ns.

Capacitance

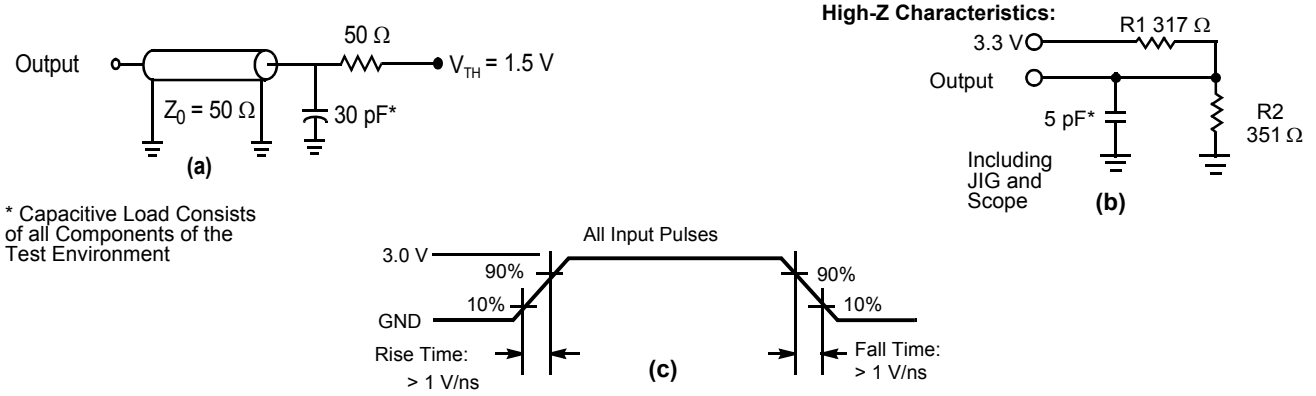
Parameter [6]	Description	Test Conditions	54-pin TSOP II	48-ball VFBGA	Unit
C_{IN}	Input capacitance	T_A = 25 °C, f = 1 MHz, V_{CC} = 3.3 V	6	8	pF
C_{OUT}	I/O capacitance		8	10	pF

Thermal Resistance

Parameter [6]	Description	Test Conditions	54-pin TSOP II	48-ball VFBGA	Unit
Θ_{JA}	Thermal resistance (junction to ambient)	Still air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	76.15	28.37	°C/W
Θ_{JC}	Thermal resistance (junction to case)		14.15	5.79	°C/W

AC Test Loads and Waveforms

Figure 5. AC Test Loads and Waveforms [7]



Notes
6. Tested initially and after any design or process changes that may affect these parameters.
7. Valid SRAM operation does not occur until the power supplies have reached the minimum operating V_{DD} (3.0 V). 100 µs (t_{power}) after reaching the minimum operating V_{DD}, normal SRAM operation begins including reduction in V_{DD} to the data retention (V_{CCDR}, 2.0 V) voltage.

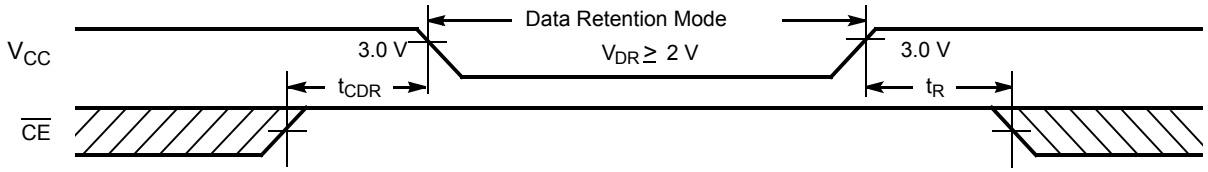
Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions	Min	Max	Unit
V_{DR}	V_{CC} for data retention	–	2	–	V
I_{CCDR}	Data retention current	V_{CC} = 2 V, $\overline{CE}_1 \geq V_{CC} - 0.2$ V, $CE_2 \leq 0.2$ V, $V_{IN} \geq V_{CC} - 0.2$ V or $V_{IN} \leq 0.2$ V	–	25	mA
t_{CDR} [8]	Chip deselect to data retention time	–	0	–	ns
t_R [9]	Operation recovery time	–	t_{RC}	–	ns

Data Retention Waveform

Figure 6. Data Retention Waveform [10]



Notes

8. Tested initially and after any design or process changes that may affect these parameters.
9. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 50$ µs or stable at $V_{CC(min.)} \geq 50$ µs.
10. For all packages except -BV1XI, $\overline{CE}$ is the logical combination of $\overline{CE}_1$ and CE_2. When $\overline{CE}_1$ is LOW and CE_2 is HIGH, $\overline{CE}$ is LOW; when $\overline{CE}_1$ is HIGH or CE_2 is LOW, $\overline{CE}$ is HIGH. For -BV1XI package, $\overline{CE}$ refers to CE.

AC Switching Characteristics

Over the Operating Range

Parameter [11]	Description	-10		Unit
		Min	Max	
Read Cycle				
t_{power}	V_{CC}(typical) to the first access [12]	100	–	µs
t_{RC}	Read cycle time	10	–	ns
t_{AA}	Address to data valid	–	10	ns
t_{OHA}	Data hold from address change	3	–	ns
t_{ACE}	$\overline{CE}_1$ LOW/CE_2 HIGH to data valid	–	10	ns
t_{DOE}	$\overline{OE}$ LOW to data valid	–	5	ns
t_{LZOE}	$\overline{OE}$ LOW to low Z [13]	1	–	ns
t_{HZOE}	$\overline{OE}$ HIGH to high Z [13]	–	5	ns
t_{LZCE}	$\overline{CE}_1$ LOW/CE_2 HIGH to low Z [13]	3	–	ns
t_{HZCE}	$\overline{CE}_1$ HIGH/CE_2 LOW to high Z [13]	–	5	ns
t_{PU}	$\overline{CE}_1$ LOW/CE_2 HIGH to power-up [14]	0	–	ns
t_{PD}	$\overline{CE}_1$ HIGH/CE_2 LOW to power-down [14]	–	10	ns
t_{DBE}	Byte enable to data valid	–	5	ns
t_{LZBE}	Byte enable to low Z	1	–	ns
t_{HZBE}	Byte disable to high Z	–	5	ns
Write Cycle [15, 16]				
t_{WC}	Write cycle time	10	–	ns
t_{SCE}	$\overline{CE}_1$ LOW/CE_2 HIGH to write end	7	–	ns
t_{AW}	Address setup to write end	7	–	ns
t_{HA}	Address hold from write end	0	–	ns
t_{SA}	Address setup to write start	0	–	ns
t_{PWE}	$\overline{WE}$ pulse width	7	–	ns
t_{SD}	Data setup to write end	5.5	–	ns
t_{HD}	Data hold from write end	0	–	ns
t_{LZWE}	$\overline{WE}$ HIGH to low Z [13]	3	–	ns
t_{HZWE}	$\overline{WE}$ LOW to high Z [13]	–	5	ns
t_{BW}	Byte Enable to End of Write	7	–	ns

Notes

11. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, and input pulse levels of 0 to 3.0 V. Test conditions for the read cycle use output loading shown in part (a) of Figure 5 on page 6, unless specified otherwise.
12. t_{POWER} gives the minimum amount of time that the power supply is at typical V_{CC} values until the first memory access is performed.
13. t_{HZOE}, t_{HZCE}, t_{HZWE}, t_{HZBE}, t_{LZOE}, t_{LZCE}, t_{LZWE}, and t_{LZBE} are specified with a load capacitance of 5 pF as in (b) of Figure 5 on page 6. Transition is measured ±200 mV from steady state voltage.
14. These parameters are guaranteed by design and are not tested.
15. The internal write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}_1$ = V_{IL}, and CE_2 = V_{IH}. Chip enables must be active and $\overline{WE}$ and byte enables must be LOW to initiate a write, and the transition of any of these signals can terminate. The input data setup and hold timing should be referenced to the edge of the signal that terminates the write.
16. The minimum write cycle time for Write Cycle No. 2 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

Switching Waveforms

Figure 7. Read Cycle No. 1 (Address Transition Controlled) [17, 18]

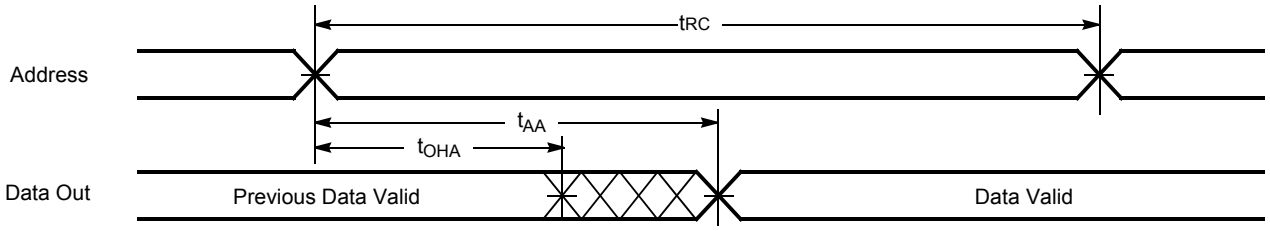
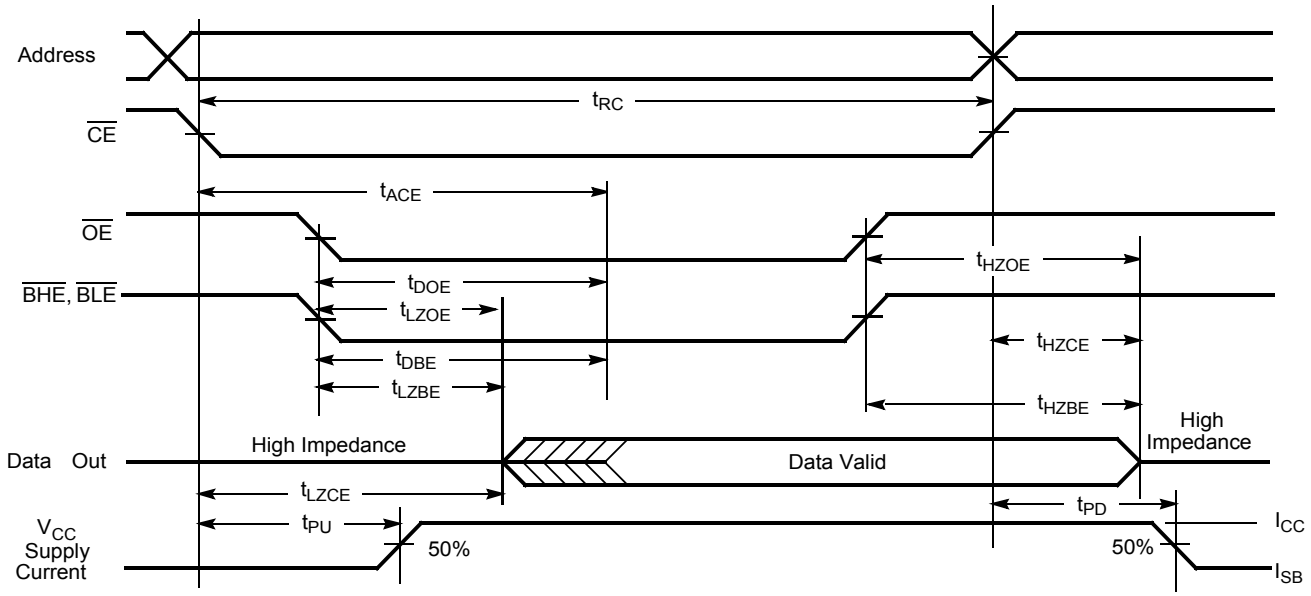


Figure 8. Read Cycle No. 2 ($\overline{OE}$ Controlled) [18, 19, 20]



Notes
17. The device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}, $\overline{BHE}$, $\overline{BLE}$ or both = V_{IL}.
18. $\overline{WE}$ is HIGH for read cycle.
19. For all packages except -BV1XI, $\overline{CE}$ is the logical combination of $\overline{CE}_1$ and CE_2. When $\overline{CE}_1$ is LOW and CE_2 is HIGH, $\overline{CE}$ is LOW; when $\overline{CE}_1$ is HIGH or CE_2 is LOW, $\overline{CE}$ is HIGH. For -BV1XI package, $\overline{CE}$ refers to $\overline{CE}$.
20. Address valid before or similar to $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Figure 9. Write Cycle No. 1 ($\overline{CE}$ Controlled) [21, 22, 23]

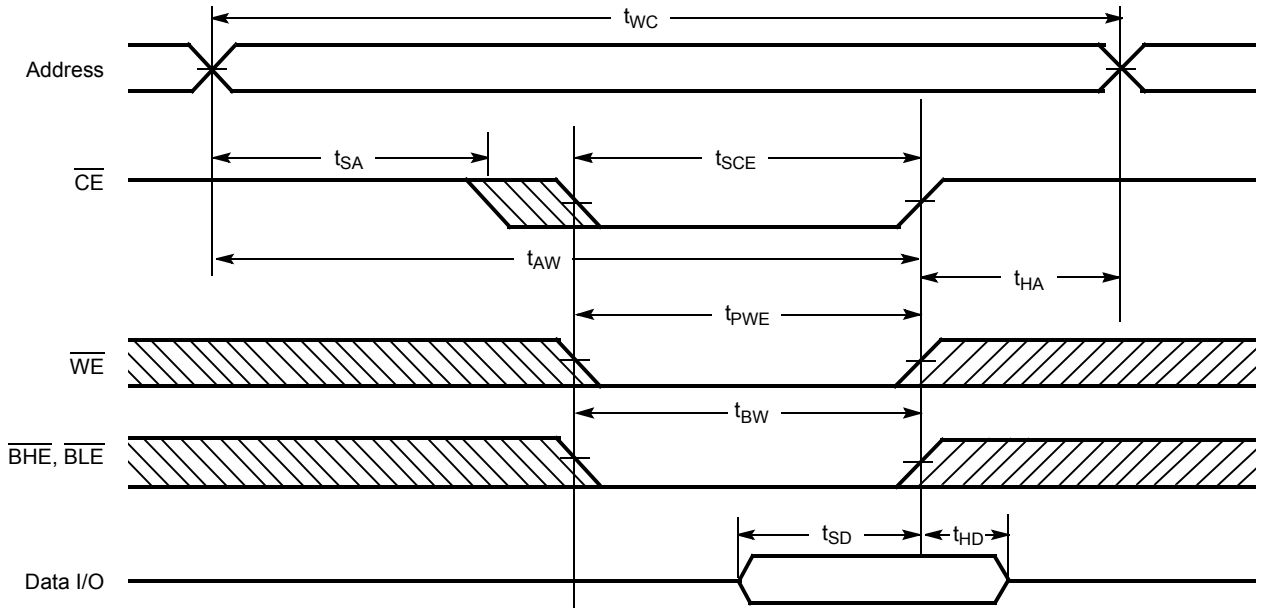
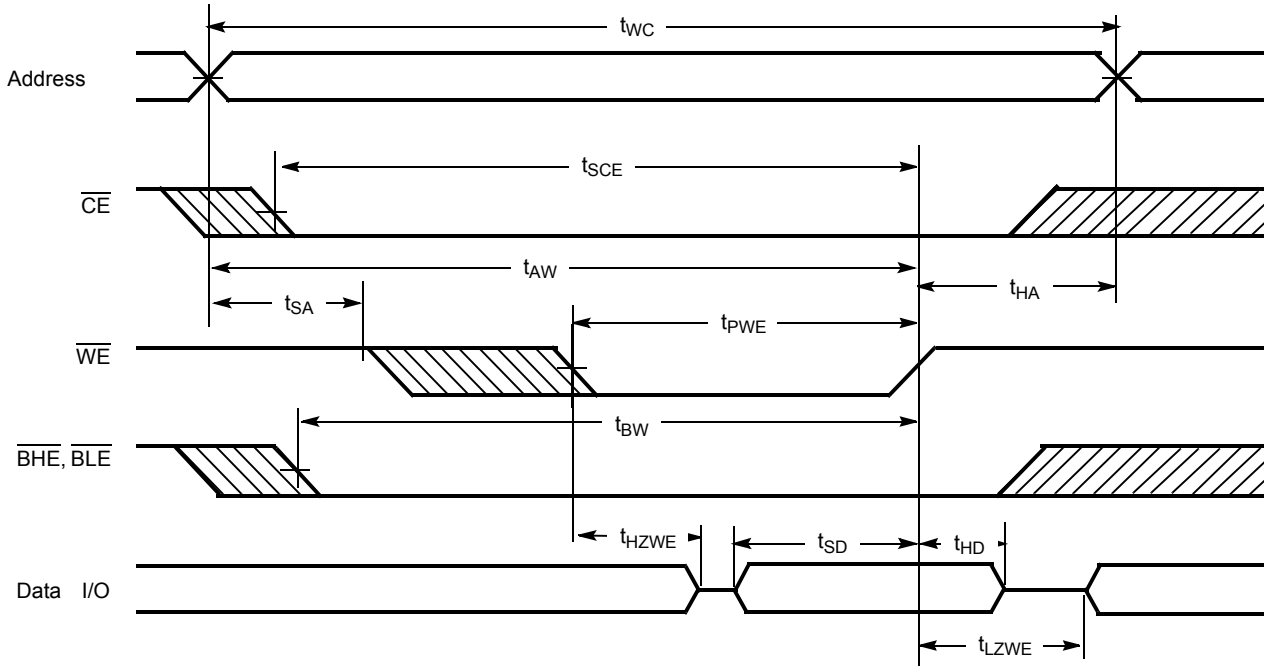


Figure 10. Write Cycle No. 2 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) [21, 22, 23, 24]

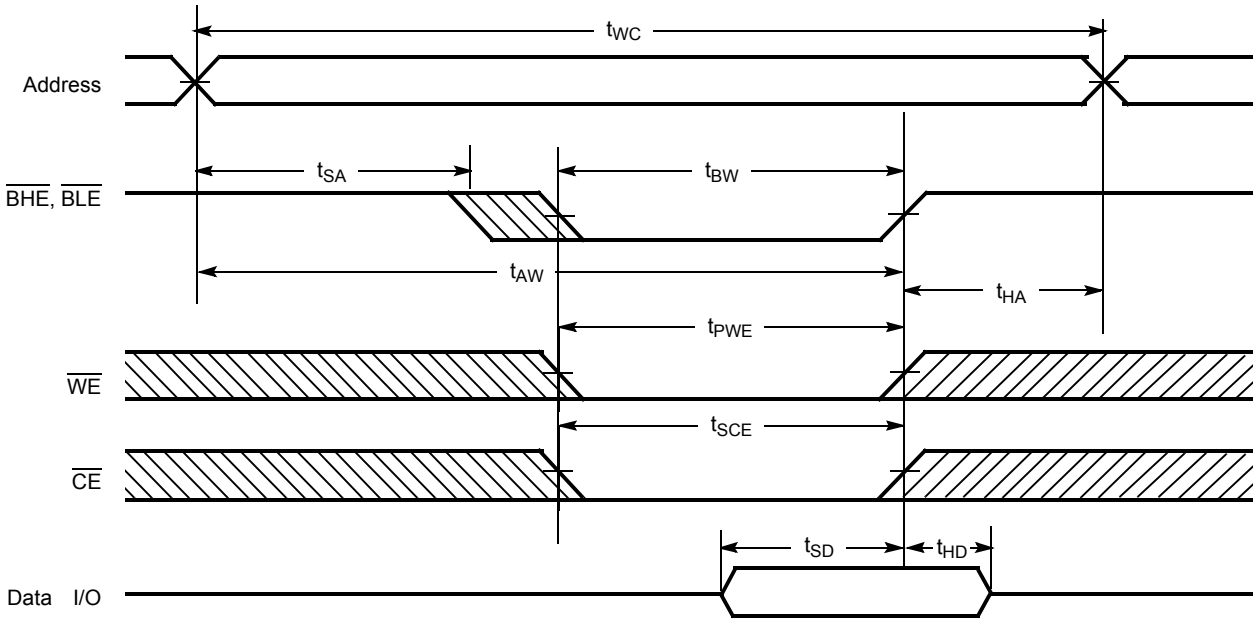


Notes

21. For all packages except -BV1XI, $\overline{CE}$ is the logical combination of $\overline{CE_1}$ and CE_2. When $\overline{CE_1}$ is LOW and CE_2 is HIGH, $\overline{CE}$ is LOW; when $\overline{CE_1}$ is HIGH or CE_2 is LOW, $\overline{CE}$ is HIGH. For -BV1XI package, $\overline{CE}$ refers to $\overline{CE}$.
22. Data I/O is high impedance if $\overline{OE}$, $\overline{BHE}$, and/or $\overline{BLE}$ = V_{IH}.
23. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ going HIGH, the output remains in a high-impedance state.
24. The minimum write cycle time is the sum of t_{HZWE} and t_{SD}.

Switching Waveforms (continued)

Figure 11. Write Cycle No. 3 ($\overline{BLE}$ or $\overline{BHE}$ Controlled) [25]



Note

25. For all packages except -BV1XI, $\overline{CE}$ is the logical combination of $\overline{CE_1}$ and CE_2. When $\overline{CE_1}$ is LOW and CE_2 is HIGH, $\overline{CE}$ is LOW; when $\overline{CE_1}$ is HIGH or CE_2 is LOW, $\overline{CE}$ is HIGH. For -BV1XI package, $\overline{CE}$ refers to $\overline{CE}$.

Truth Table

For all packages except -BV1XI

$\overline{CE_1}$	CE_2	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O_0–I/O_7	I/O_8–I/O_{15}	Mode	Power
H	X	X	X	X	X	High Z	High Z	Power down	Standby (I_{SB})
X	L	X	X	X	X	High Z	High Z	Power down	Standby (I_{SB})
L	H	L	H	L	L	Data out	Data out	Read all bits	Active (I_{CC})
L	H	L	H	L	H	Data out	High Z	Read lower bits only	Active (I_{CC})
L	H	L	H	H	L	High Z	Data out	Read upper bits only	Active (I_{CC})
L	H	X	L	L	L	Data in	Data in	Write all bits	Active (I_{CC})
L	H	X	L	L	H	Data in	High Z	Write lower bits only	Active (I_{CC})
L	H	X	L	H	L	High Z	Data in	Write upper bits only	Active (I_{CC})
L	H	H	H	X	X	High Z	High Z	Selected, outputs disabled	Active (I_{CC})

Truth Table

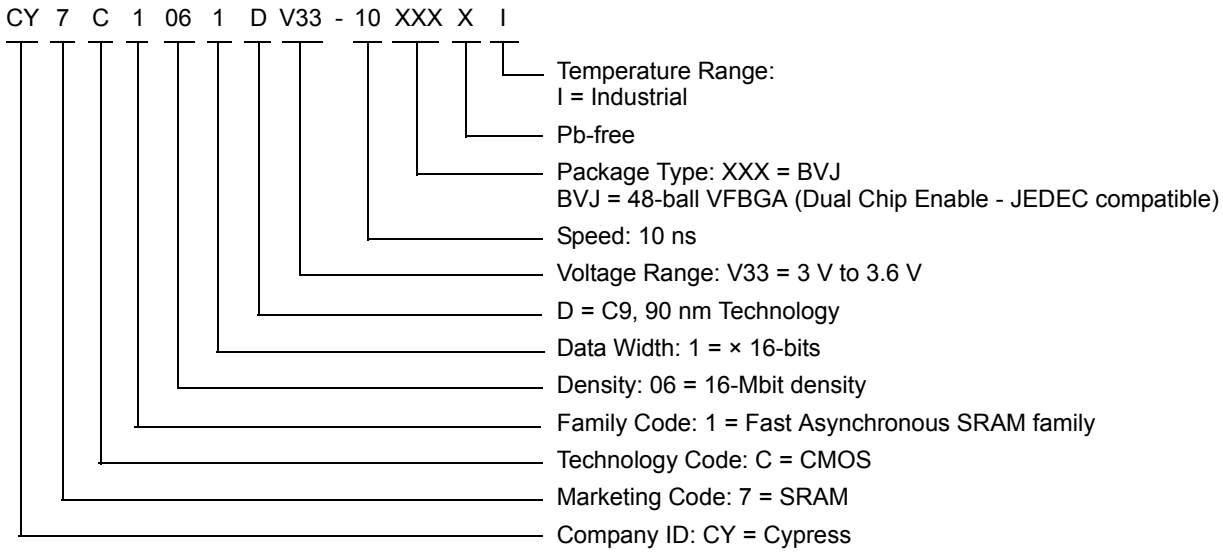
For -BV1XI package only

$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O_0–I/O_7	I/O_8–I/O_{15}	Mode	Power
H	X	X	X	X	High Z	High Z	Power down	Standby (I_{SB})
L	L	H	L	L	Data out	Data out	Read all bits	Active (I_{CC})
L	L	H	L	H	Data out	High Z	Read lower bits only	Active (I_{CC})
L	L	H	H	L	High Z	Data out	Read upper bits only	Active (I_{CC})
L	X	L	L	L	Data in	Data in	Write all bits	Active (I_{CC})
L	X	L	L	H	Data in	High Z	Write lower bits only	Active (I_{CC})
L	X	L	H	L	High Z	Data in	Write upper bits only	Active (I_{CC})
L	H	H	X	X	High Z	High Z	Selected, outputs disabled	Active (I_{CC})

Ordering Information

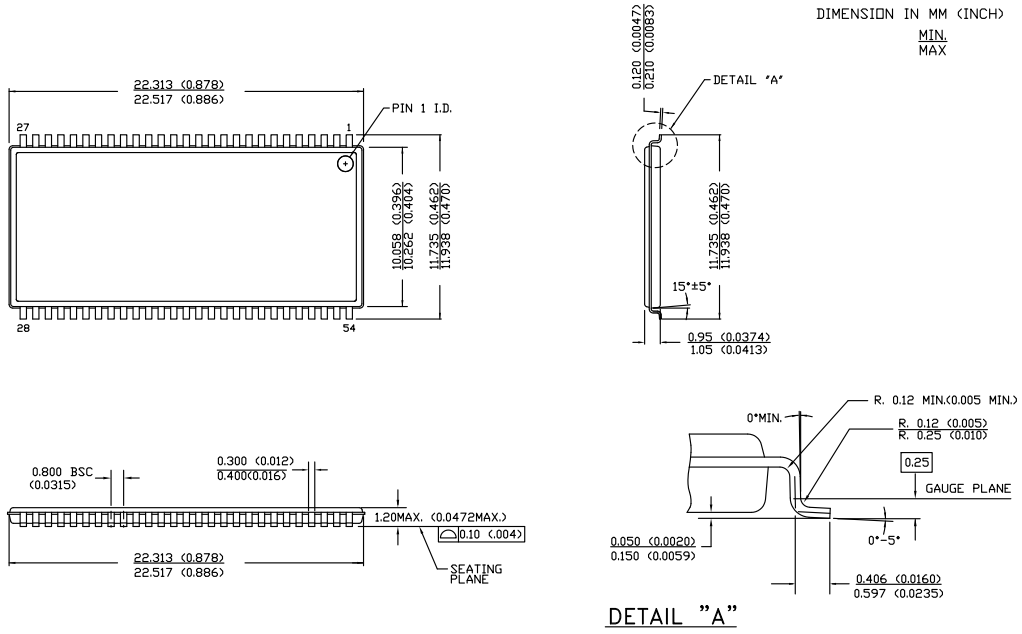
Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1061DV33-10BVJXI	51-85178	48-ball VFBGA (8 × 9.5 × 1 mm) (Pb-free) (Dual Chip Enable - JEDEC compatible)	Industrial

Ordering Code Definitions



Package Diagrams

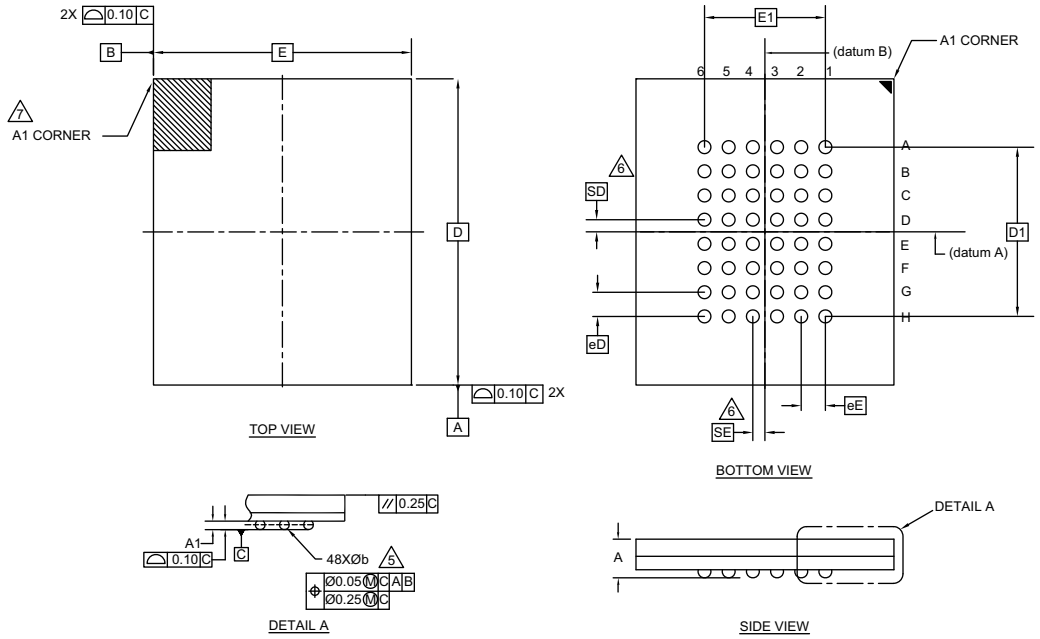
Figure 12. 54-pin TSOP II (22.4 × 11.84 × 1.0 mm) Z54-II Package Outline, 51-85160



51-85160 *E

Package Diagrams (continued)

Figure 13. 48-ball VFBGA (8 × 9.5 × 1.0 mm) VCG048/BZ48B Package Outline, 51-85178



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.16	0.21	0.26
D	9.50 BSC		
E	8.00 BSC		
D1	5.25 BSC		
E1	3.75 BSC		
MD	8		
ME	6		
N	48		
∅ b	0.25	0.30	0.35
eD	0.75 BSC		
eE	0.75 BSC		
SD	0.38		
SE	0.38		

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. SOLDER BALL POSITION DESIGNATION PER JEP95, SECTION 3, SPP-020.
3. "e" REPRESENTS THE SOLDER BALL GRID PITCH.
4. SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.
   SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.
   N IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.
5. DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
6. "SD" AND "SE" ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.
   WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW, "SD" OR "SE" = 0.
   WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, "SD" = eD/2 AND "SE" = eE/2.
7. A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK METALIZED MARK, INDENTATION OR OTHER MEANS.
8. "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED SOLDER BALLS.

51-85178 *D

Acronyms

Acronym	Description
$\overline{BHE}$	Byte High Enable
$\overline{BLE}$	Byte Low Enable
$\overline{CE}$	Chip Enable
CMOS	Complementary Metal Oxide Semiconductor
I/O	Input/Output
$\overline{OE}$	Output Enable
SRAM	Static Random Access Memory
TSOP	Thin Small Outline Package
TTL	Transistor-Transistor Logic
VFBGA	Very Fine-Pitch Ball Grid Array
$\overline{WE}$	Write Enable

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
µA	microampere
µs	microsecond
mA	milliampere
mm	millimeter
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

Document History Page

Document Title: CY7C1061DV33, 16-Mbit (1M × 16) Static RAM Document Number: 38-05476				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	201560	SWI	See ECN	Advance data sheet for C9 IPP
*A	233748	RKF	See ECN	Updated AC and DC parameters as per EROS (Specification Number 01-02165). Updated Ordering Information (Added Pb-free devices).
*B	469420	NXR	See ECN	Changed status from Advance Information to Preliminary. Updated Document Title (Corrected typo). Removed 8 ns and 12 ns speed bins related information in all instances across the document. Removed Commercial Temperature Range related information in all instances across the document. Updated Selection Guide: Changed value of “Maximum Operating Current” corresponding to 10 ns speed bin from 176 mA to 125 mA. Changed value of “Maximum CMOS Standby Current” corresponding to 10 ns speed bin from 40 mA to 25 mA. Updated Pin Configurations: Changed ball 2G of FBGA and pin 40 of TSOP II from DNU to NC. Updated Maximum Ratings: Included details corresponding to “Static Discharge Voltage” and “Latch-Up Current”. Updated DC Electrical Characteristics: Updated Note 5 (Specified the Overshoot specification). Changed maximum value of I_{CC} parameter corresponding to 10 ns speed bin from 176 mA to 125 mA Changed maximum value of I_{SB1} parameter corresponding to 10 ns speed bin from 70 mA to 30 mA. Changed maximum value of I_{SB2} parameter corresponding to 10 ns speed bin from 40 mA to 25 mA. Updated Ordering Information.
*C	499604	NXR	See ECN	Updated Pin Configurations: Added Note 1 and referred the same note in Pin Configurations. Updated DC Electrical Characteristics: Updated details in “Test Condition” column corresponding to I_{CC} parameter. Updated Package Diagrams: Updated figure corresponding to 48-ball FBGA Package (Removed spec 51-85150 *D and added spec 51-85178 **).
*D	1462583	VKN / AESA	See ECN	Changed status from Preliminary to Final. Updated Selection Guide: Changed value of “Maximum Operating Current” from 125 mA to 175 mA corresponding to 10 ns speed bin. Updated DC Electrical Characteristics: Changed maximum value of I_{CC} parameter from 125 mA to 175 mA corresponding to 10 ns speed bin. Updated Thermal Resistance: Replaced TBD with values for all packages.
*E	2704415	VKN / PYRS	05/11/09	Included 48-ball FBGA Dual Chip Enable - JEDEC compatible package related information in all instances across the document. Updated Pin Configurations: Added Note 2 and referred the same note in Figure 1 and Figure 2.
*F	3109102	AJU	12/13/2010	Added Ordering Code Definitions under Ordering Information. Updated Package Diagrams.

Document History Page (continued)

Document Title: CY7C1061DV33, 16-Mbit (1M × 16) Static RAM Document Number: 38-05476				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
*G	3126531	PRAS	01/03/2011	Added 48-ball VFBGA Single Chip Enable package related information in all instances across the document. Updated Ordering Information. Added Acronyms.
*H	3414708	TAVA	10/19/2011	Updated Features. Updated DC Electrical Characteristics. Updated Switching Waveforms. Updated Package Diagrams. Added Units of Measure. Updated to new template.
*I	4574311	TAVA	11/19/2014	Updated Functional Description: Added “For a complete list of related documentation, click here.” at the end. Updated Package Diagrams: spec 51-85160 – Changed revision from *C to *E. spec 51-85178 – Changed revision from *A to *C.
*J	4990813	NILE	10/27/2015	Updated Thermal Resistance: Changed value of Θ_{JA} parameter corresponding to 54-pin TSOP II package from 24.18 °C/W to 76.15 °C/W. Changed value of Θ_{JC} parameter corresponding to 54-pin TSOP II package from 5.40 °C/W to 14.15 °C/W. Updated Switching Waveforms: Added Note 24 and referred the same note in Figure 10. Updated to new template. Completing Sunset Review.
*K	5529600	VINI	11/22/2016	Updated Ordering Information: Updated part numbers. Updated Package Diagrams: spec 51-85178 – Changed revision from *C to *D. Updated to new template. Completing Sunset Review.

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