

2-Mbit (128 K × 16) Static RAM

Features

- Pin-and function-compatible with CY7C1011CV33
- High speed
 □ t_{AA} = 10 ns
- Low active power
 □ I_{CC} = 90 mA @ 10 ns (Industrial)
- Low CMOS standby power
 □ I_{SB2} = 10 mA
- Data Retention at 2.0 V
- Automatic power-down when deselected
- Independent control of upper and lower bits
- Easy memory expansion with CE and OE features
- Available in Pb-free 44-pin TSOP II, and 48-ball VFBGA

Functional Description

The CY7C1011DV33^[1] is a high-performance CMOS Static RAM organized as 128 K words by 16 bits.

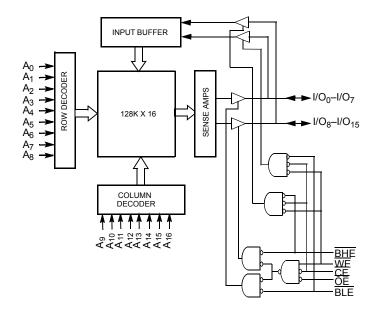
<u>Writing</u> to the device is <u>acc</u>omplished by taking Chip Enable (\overline{CE}) and Write Enable (\overline{WE}) inputs LOW. If Byte Low Enable (\overline{BLE}) is LOW, then data from I/O pins $(I/O_0$ through I/O₇), is written into the location specified <u>on the</u> address pins $(A_0$ through A_{16}). 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 $A_{16})$.

Reading from the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Output Enable ($\overline{\text{OE}}$) LOW while forcing the Write Enable ($\overline{\text{WE}}$) HIGH. If Byte Low Enable ($\overline{\text{BLE}}$) is LOW, then data from the memory location specified by the address pins will appear on I/O $_0$ to I/O $_7$. If Byte High Enable ($\overline{\text{BHE}}$) is LOW, then data from memory will appear on I/O $_8$ to I/O $_{15}$. See the truth table at the back of this data sheet for a complete description of read and write modes.

The input/output pins (I/O $_0$ through I/O $_{15}$) are placed in a high-impedance state when the device is deselected (CE HIGH), the outputs are disabled (OE HIGH), the BHE and BLE are disabled (BHE, BLE HIGH), or during a write operation (CE LOW, and WE LOW).

The CY7C1011DV33 is available in standard Pb-free 44-pin TSOP II with center power and ground pinout, as well as 48-ball very fine-pitch ball grid array (VFBGA) packages.

Logic Block Diagram



Note

1. For guidelines on SRAM system design, please refer to the "System Design Guidelines" Cypress application note, available on the internet at www.cypress.com

CY7C1011DV33



Contents

Selection Guide	3
Pin Configurations	3
Maximum Ratings	
Operating Range	4
DC Electrical Characteristics	
Capacitance	4
Thermal Resistance	
AC Test Loads and Waveforms	5
AC Switching Characteristics	
Data Retention Characteristics	
Data Retention Waveform	6
Switching Waveforms	
Read Cycle No. 1	7
Read Cycle No. 2 (OE Controlled)	
Write Cycle No. 1 (CF Controlled)	

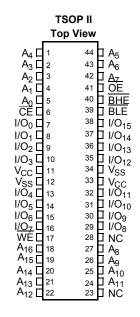
Write Cycle No. 3 (WE Controlled,	
OE HIGH During Write)	
Write Cycle No. 4 (WE Controlled, OE LOW)	9
Truth Table	10
Ordering Information	10
Ordering Code Definitions	10
Package Diagrams	
Acronyms	
Document Conventions	12
Units of Measure	
Document History	
Sales, Solutions, and Legal Information	
Worldwide Sales and Design Support	
Products	
PSoC Solutions	14

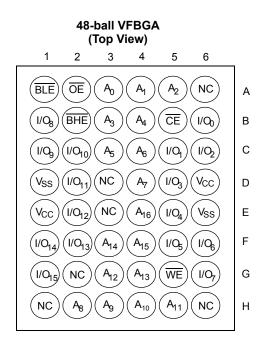


Selection Guide

	-10	Unit
Maximum Access Time	10	ns
Maximum Operating Current	90	mA
Maximum CMOS Standby Current	10	mA

Pin Configurations







Maximum Ratings

Exceeding maximum ratings may shorten the useful life of the device. User guidelines are not tested.

Storage temperature-65 °C to +150 °C Ambient temperature with Supply voltage on $\rm V_{CC}$ to relative $\rm GND^{[3]}.....-0.3~V$ to +4.6 $\rm V$

DC voltage applied to outputs in high Z $\rm State^{[3]}$ –0.3 V to $\rm V_{CC}$ + 0.3 V

DC input voltage $^{[3]}$ –0.3 V to V_{CC} + 0.3 V

Current into outputs (LOW)	20 mA
Static discharge voltage	> 2001 V
(per MIL-STD-883, method 3015)	
Latch-up current	> 200 mA

Operating Range

Range	Ambient Temperature	V _{cc}	
Industrial	–40 °C to +85 °C	$3.3~V\pm0.3~V$	

DC Electrical Characteristics

Over the Operating Range

Parameter	Decerintion	Test Conditions			Unit	
Parameter	Description	rest conditions		Min	Max	Oille
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 ^[2]			-0.3	0.8	V
I _{IX}	Input leakage current	nput leakage current $GND \le V_1 \le V_{CC}$				μА
I _{OZ}	Output leakage current	$GND \le V_{OUT} \le V_{CC}$, Output Disabled		-1	+1	μА
I _{CC}	V _{CC} operating supply current	V_{CC} = Max, f = f_{MAX} = $1/t_{RC}$	100 MHz	-	90	mA
			83 MHz	_	80	
			66 MHz	-	70	
			40 MHz	-	60	
I _{SB1}	Automatic CE Power-down Current — TTL Inputs	$ \begin{aligned} & \text{Max V}_{\text{CC}}, \overline{\text{CE}} \geq \text{V}_{\text{IH}}, \text{V}_{\text{IN}} \geq \text{V}_{\text{IH}} \text{ or } \text{V}_{\text{IN}} \leq \text{V}_{\text{IL}}, \\ & \text{f} = \text{f}_{\text{MAX}} \end{aligned} $		-	20	mA
I _{SB2}	Automatic CE Power-down Current — CMOS Inputs	Max V _{CC} , $\overline{CE} \ge V_{CC} - 0.3 \text{ V}$, V _{IN} ≥ V _{CC} - 0.3 V, or V _{IN} ≤ 0.3 V, f = 0		ı	10	mA

Capacitance^[3]

Parameter	ameter Description Test Conditions		Max	Unit
C _{IN}	Input capacitance	$T_A = 25 ^{\circ}\text{C}, f = 1 \text{MHz}, V_{CC} = 3.3 \text{V}$	8	pF
C _{OUT}	I/O capacitance		8	pF

Thermal Resistance[3]

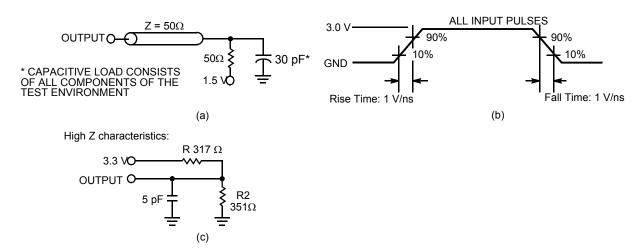
Parameter	Description	Test Conditions	TSOP II	VFBGA	Unit
Θ_{JA}		Still air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	50.66	27.89	°C/W
Θ _{JC}	Thermal Resistance (Junction to Case)		17.17	14.74	°C/W

- V_{IL} (min) = -2.0 V and V_{IH}(max) = V_{CC} + 2 V for pulse durations of less than 20 ns.
 Tested initially and after any design or process changes that may affect these parameters.

Document Number: 38-05609 Rev. *E Page 4 of 14



AC Test Loads and Waveforms[4]



AC Switching Characteristics

Over the Operating Range^[5]

Downwater	December 1	-	-10		
Parameter	Description	Min	Max	Unit	
Read Cycle					
t _{power} ^[6]	V _{CC} (typical) to the first access	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}	CE LOW to data valid	_	10	ns	
t _{DOE}	OE LOW to data valid	_	5	ns	
t _{LZOE}	OE LOW to low Z	0	_	ns	
t _{HZOE}	OE HIGH to high Z ^[7, 8]	_	5	ns	
t _{LZCE}	CE LOW to low Z ^[8]	3	_	ns	
t _{HZCE}	CE HIGH to high Z ^[7, 8]	_	5	ns	
t _{PU}	CE LOW to power-up	0	_	ns	
t _{PD}	CE HIGH to power-down	_	10	ns	
t _{DBE}	Byte enable to data valid	_	5	ns	
t _{LZBE}	Byte enable to low Z	0	_	ns	
t _{HZBE}	Byte disable to high Z	_	6	ns	

Notes

- AC characteristics (except high Z) are tested using the load conditions shown in (a). High Z characteristics are tested for all speeds using the test load shown in (c).
 Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V.
 tpower gives the minimum amount of time that the power supply should be at typical V_{CC} values until the first memory access is performed.
 thzoe, thze and thzwe are specified with a load capacitance of 5 pF as in part (d) of AC Test Loads. Transition is measured when the outputs enter a high impedance state.
- At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, t_{HZBE} is less than t_{LZBE}, and t_{HZWE} is less than t_{LZWE} for any given device.

Document Number: 38-05609 Rev. *E



AC Switching Characteristics

Over the Operating Range^[5] (continued)

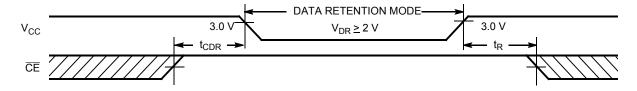
Parameter	Description	_	10	Unit			
	Description	Min	Max	- Onit			
Write Cycle ^[9, 10]							
t _{WC}	Write cycle time	10	_	ns			
t _{SCE}	CE LOW to write end	7	_	ns			
t _{AW}	Address set-up to write end	7	_	ns			
t _{HA}	Address hold from write end	0	_	ns			
t _{SA}	Address set-up to write start	0	_	ns			
t _{PWE}	WE pulse width	7	_	ns			
t _{SD}	Data set-up to write end	5	_	ns			
t _{HD}	Data hold from write end	0	_	ns			
t _{LZWE}	WE HIGH to low Z ^[12]	3	_	ns			
t _{HZWE}	WE LOW to high Z ^[11, 12]	_	5	ns			
t _{BW}	Byte enable to end of write	7	_	ns			

Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions ^[13]	Min	Max	Unit
V_{DR}	V _{CC} for data retention		2.0	_	V
I _{CCDR}	Data retention current	V V 00V 0E V 00V	_	10	mA
t _{CDR} ^[14]	Chip deselect to data retention time	$V_{CC} = V_{DR} = 2.0 \text{ V}, \overline{CE} \ge V_{CC} - 0.3 \text{ V}, V_{IN} \ge V_{CC} - 0.3 \text{ V}$	0	_	ns
t _R ^[15]	Operation recovery time	1 111 - 100 - 111 - 111 - 111	t _{RC}	=	ns

Data Retention Waveform



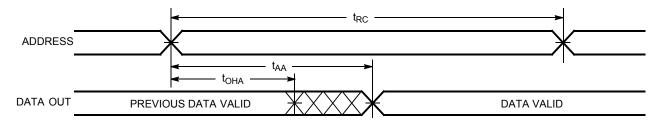
- 9. The internal write time of the memory is defined by the overlap of CE LOW, and WE LOW. CE and WE must be LOW to initiate a write, and the transition of either of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates
- 10. The minimum write cycle time for Write Cycle No. 4 (WE controlled, \overline{OE} LOW) is the sum of t_{HZWE} and t_{SD} .

 11. t_{HZOE} , t_{HZOE} , t_{HZDE} and t_{HZWE} are specified with a load capacitance of 5 pF as in part (d) of AC Test Loads. Transition is measured when the outputs enter a high impedance state.
- At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, t_{HZBE} is less than t_{LZBE}, and t_{HZWE} is less than t_{LZWE} for any given device.
- 13. No input may exceed $V_{\rm CC}$ + 0.3 V. 14. Tested initially and after any design or process changes that may affect these parameters.
- 15. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \ge 50$ μs or stable at $V_{CC(min.)} \ge 50$ μs.

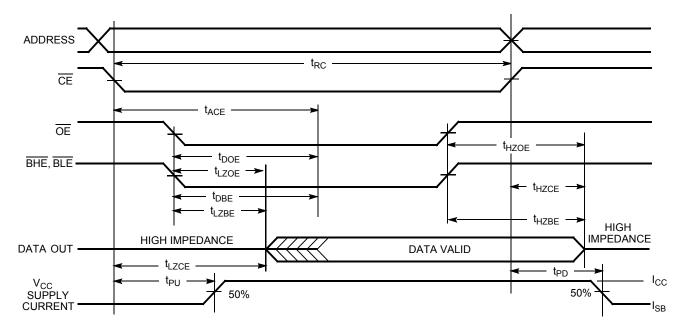


Switching Waveforms

Read Cycle No. 1[16, 17]



Read Cycle No. 2 ($\overline{\rm OE}$ Controlled)[17, 18]



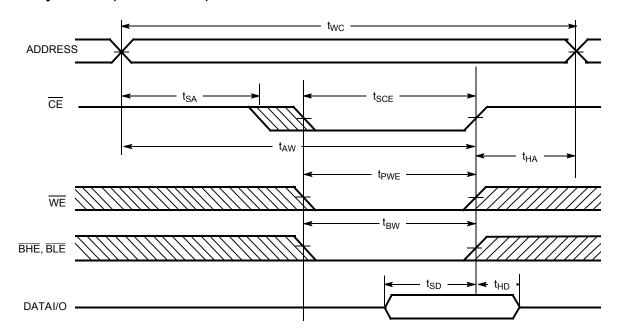
^{16. &}lt;u>Device</u> is continuously selected. <u>OE</u>, <u>CE</u>, <u>BHE</u> and/or <u>BHE</u> = V_{IL}. 17. <u>WE</u> is HIGH for read cycle.

^{18.} Address valid prior to or coincident with $\overline{\text{CE}}$ transition LOW.

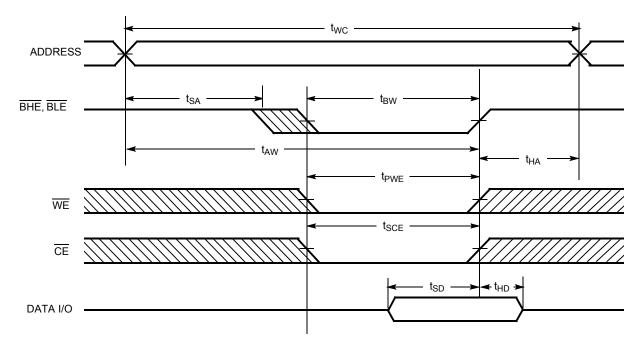


Switching Waveforms (continued)

Write Cycle No. 1 (CE Controlled)[19, 20]



Write Cycle No. 2 (BLE or BHE Controlled)

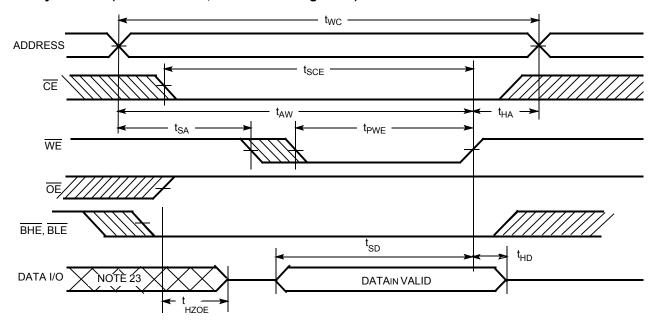


^{19.} Data I/O is high-impedance if \overline{OE} or \overline{BHE} and/or \overline{BLE} = V_{IH} .
20. If \overline{CE} goes HIGH simultaneously with \overline{WE} going HIGH, the output remains in a high-impedance state.

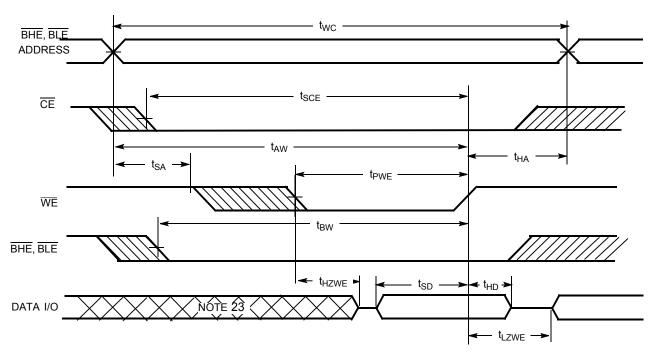


Switching Waveforms (continued)

Write Cycle No. 3 (WE Controlled, OE HIGH During Write)[21, 22]



Write Cycle No. 4 (WE Controlled, OE LOW)



- 21. Data I/O is high-impedance if \overline{OE} or \overline{BHE} and/or \overline{BLE} = V_{IH} .

 22. If \overline{CE} goes HIGH simultaneously with \overline{WE} going HIGH, the output remains in a high-impedance state.

 23. During this period the I/Os are in the output state and input signals should not be applied.



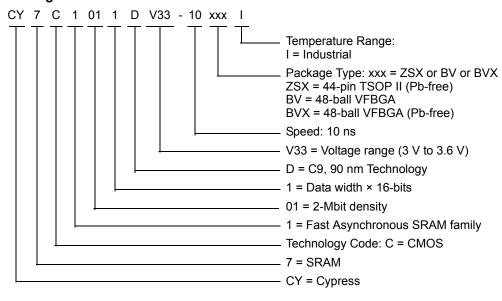
Truth Table

CE	OE	WE	BLE	BHE	I/O ₀ –I/O ₇	I/O ₈ –I/O ₁₅	Mode	Power
Н	X	Χ	Χ	Χ	High Z	High Z	Power-down	Standby (I _{SB})
L	L	Н	L	L	Data Out	Data Out	Read all bits	Active (I _{CC})
L	L	Н	L	Н	Data Out	High Z	Read lower bits only	Active (I _{CC})
L	L	Н	Н	L	High Z	Data Out	Read upper bits only	Active (I _{CC})
L	Х	L	L	L	Data In	Data In	Write all bits	Active (I _{CC})
L	Х	L	L	Н	Data In	High Z	Write lower bits only	Active (I _{CC})
L	Х	L	Н	L	High Z	Data In	Write upper bits only	Active (I _{CC})
L	Н	Н	Χ	Х	High Z	High Z	Selected, outputs disabled	Active (I _{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1011DV33-10ZSXI	51-85087	44-pin TSOP II (Pb-free)	Industrial
	CY7C1011DV33-10BVI	51-85150	48-ball VFBGA	
	CY7C1011DV33-10BVXI		48-ball VFBGA (Pb-free)	

Ordering Code Definitions



Please contact your local Cypress sales representative for availability of these parts



Package Diagrams

Figure 1. 44-pin TSOP II, 51-85087

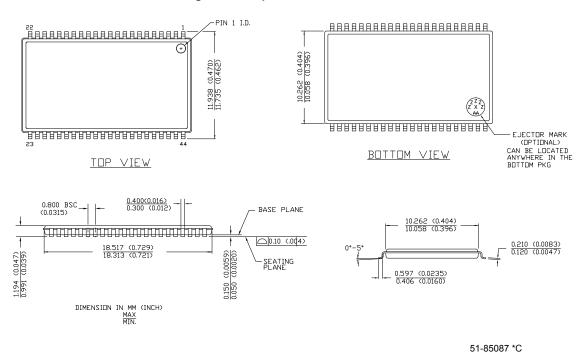
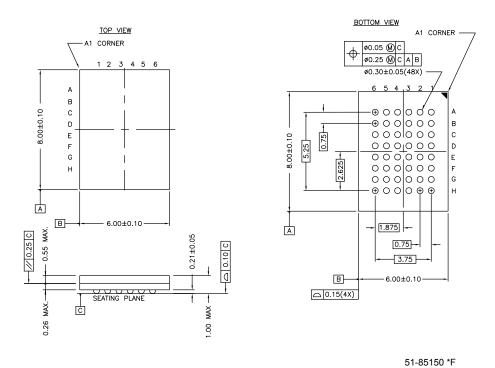


Figure 2. 48-ball VFBGA (6 × 8 × 1 mm), 51-85150



Document Number: 38-05609 Rev. *E



Acronyms

Acronym	Description		
CMOS	complementary metal oxide semiconductor		
CE	chip enable		
I/O	input/output		
OE	output enable		
SRAM	static random access memory		
TSOP	thin small-outline package		
TTL	transistor-transistor logic		
VFBGA	very fine-pitch ball grid array		
WE	write enable		

Document Conventions

Units of Measure

Symbol	Unit of Measure		
ns	nano seconds		
V	Volts		
μs	micro seconds		
μΑ	micro Amperes		
mA	milli Amperes		
MHz	Mega Hertz		
pF	pico Farad		
°C	degree Celcius		
W	Watts		
%	percent		

Page 12 of 14



Document History

	ocument Title: CY7C1011DV33 2-Mbit (128 K × 16) Static RAM ocument Number: 38-05609						
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change			
**	250650	See ECN	RKF	New Data Sheet			
*A	399070	See ECN	NXR	Changed from Advance to Preliminary Changed address of Cypress Semiconductor Corporation on Page# 1 from "3901 North First Street" to "198 Champion Court" Removed TQFP Package from product offering Removed –15 speed bin Corrected DC voltage limits in maximum ratings section from –0.5 to –0.3' and V _{CC} +0.5V to V _{CC} +0.3V Redefined I _{CC} values for Com'l and Ind'l temperature ranges I _{CC} (Com'l): Changed from 100, 80 and 70 mA to 90, 80 and 75 mA for 8, 10 and 12ns speed bins respectively I _{CC} (Ind'l): Changed from 80 and 70 mA to 90 and 85 mA for 10 and 12ns speed bins respectively Modified Note# 4 on AC Test Loads Added Static Discharge Voltage and latch-up current spec Added V _{IH(max}) spec in Note# 2 Changed reference voltage level for measurement of Hi-Z parameters from ±500 mV to ±200 mV Added Data Retention Characteristics Table and footnote on t _R Added Write Cycle (WE Controlled, OE HIGH During Write) Timing Diagram Changed package name for 44-pin TSOP II from Z to ZS Added 8 ns parts in the Ordering Information table Shaded Ordering Information Table			
*B	459073	See ECN	NXR	Converted Preliminary to Final. Removed –8 and –12 Speed bins Removed Commercial Operating Range from product offering. Changed the description of I _{IX} from "Input Load Current" to "Input Leakage Current" Updated the Thermal Resistance table. Changed t _{HZBE} from 5 ns to 6 ns. Updated footnote #7 on High-Z parameter measurement Added footnote #12. Updated the Ordering Information and replaced Package Name column with Package Diagram in the Ordering Information table.			
*C	480177	See ECN	VKN	Added -10BVI product ordering code in the Ordering Information table.			
*D	3059162	10/14/2010	PRAS	Added Ordering Code Definitions. Updated Package Diagrams.			
*E	3098812	12/01/2010	PRAS	Added Acronyms and Units of Measure. Minor edits and updated in new template.			



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Document Number: 38-05609 Rev. *E

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Page 14 of 14