



# High-Speed CMOS 64Kx4 SRAM with Output Enable

QS86446

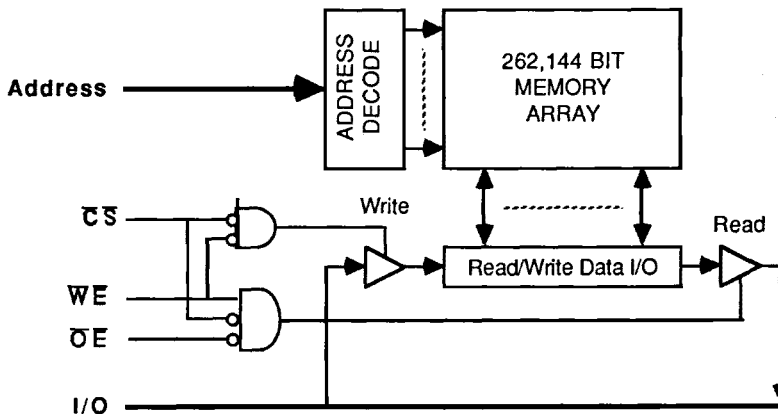
## FEATURES/BENEFITS

- High Speed Access and Cycle times
- 12ns/15ns Commercial
- 15ns/20ns Military
- TTL compatible I/O
- Low power, high-speed QCMOS™ technology
- Military product compliant to MIL-STD-883, Class B
- 6-Transistor cell for high reliability
- Ideal for reliable, dense memory systems
- Available in 28-pin, 300-mil DIP & SOJ
- JEDEC standard pinout
- Low Standby current

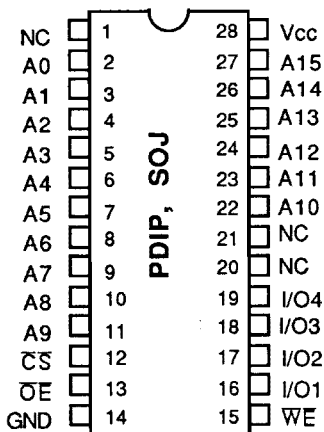
## DESCRIPTION

The QS86446 is a high-speed 256K SRAM organized as 64Kx4 with an output enable. It is manufactured in a high-performance CMOS process, and it based on a 6-transistor cell design for high reliability of data retention. The high-speed access times of the QS86446 make it useful in cache data RAM, cache tag RAMs, high-speed scratchpad memories, look-up tables, pipelined DSP and bit-slice systems. Low operating power and excellent latch-up and ESD protection are provided.

## FUNCTIONAL BLOCK DIAGRAM



**PIN CONFIGURATIONS**



**ALL PINS TOP VIEW**

\* For LCC pinout contact factory

**PIN DESCRIPTION**

Pin Name	I/O	Function
A	I	Address
I/O1 - I/O4	I/O	Data
CS	I	Chip Select
WE	I	Write Enable
OE	I	Output enable

**FUNCTION TABLE**

CS	WE	I/O	Power	Function
H	X	High Z	Standby	Deselect
L	H	Data Out	Active	Read
L	L	Data In	Active	Write

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage to Ground..... -0.5V to +7.0V  
 DC Output Voltage  $V_O$  ..... -0.5V to  $V_{CC} + 0.5V$   
 DC Input Voltage  $V_I$  ..... -0.5V to  $V_{CC} + 0.5V$   
 AC Input Voltage (for a pulse width  $\leq 20$  ns)..... -3.0V  
 DC Output Current Max. sink current/pin..... 50 mA  
 DC Output Current Max. source current/pin..... 30 mA  
 $T_{BIAS}$  Temperature Under Bias, COM..... -65° to +125°C  
 $T_{STG}$  Storage Temperature, COM..... -65° to +125°C  
 $T_{BIAS}$  Temperature Under Bias, MIL..... -65° to +135°C  
 $T_{STG}$  Storage Temperature, MIL..... -65° to +155°C

Note: Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to the maximum ratings for extended periods may affect reliability.



**CAPACITANCE**

$T_a = +25^\circ\text{C}$ ,  $f = 1$  MHz

Name	Description	Conditions	Typ	Max	Unit
Cin	Input Capacitance	$V_{in} = 0$ V PDIP Pkg.	3	6	pF
Cin	Input Capacitance	$V_{in} = 0$ V SOJ Pkg.	2.5	5	pF
Cout	Output Capacitance	$V_{out} = 0$ V PDIP Pkg.		7	pF
Cout	Output Capacitance	$V_{out} = 0$ V SOJ Pkg.		7	pF

Note: Capacitance is measured at characterization but not tested at final production.

**DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE**

Commercial TA = 0° C to 70°C, Vcc = 5.0V±10% Military TA = -55°C to 125° C, Vcc = 5.0V±10%

Symbol	Parameter	Test Conditions	Commercial		Military		Unit
			Min	Max	Min	Max	
Vih	Input HIGH Voltage	Logic High for All Inputs	2.2	6.0	2.2	6.0	Volts
Vil	Input LOW Voltage (1)	Logic Low for All Inputs		0.8		0.8	
Voh	Output HIGH Voltage	Ioh = -4 mA, Vcc = MIN	2.4		2.4		
Vol	Output LOW Voltage	Iol = 8 mA, Vcc = MIN		0.4		0.4	
Ii	Input Leakage	Vcc = MAX, Vin = GND to Vcc		5		10	µA
Io	Output Leakage	Vcc = MAX, Vout = GND to Vcc		5		10	

**Notes:**

1. Transient inputs with Vil not more negative than -3.0 volts are permitted for pulse widths < 20 ns.

**POWER SUPPLY CHARACTERISTICS**

Commercial TA = 0° C to 70°C, Vcc = 5.0V±10% Military TA = -55°C to 125° C, Vcc = 5.0V±10%  
 Vlc = 0.2 V, Vhc = Vcc - 0.2V At f = 0, no input lines switch; At f = f MAX, RAM is cycling at 1 / t RC.  
 For 12ns, Vcc=5.0V±5%

Symbol	Parameter	-12		-15		-20		Unit
		C	C	M	M	M	M	
Icc	Dynamic Operating Current, Vcc = MAX Outputs open CS ≤ Vil, f = f MAX	170	165	175	165			mA
I <sub>sb</sub>	TTL Standby Current, Vcc = MAX Outputs open CS ≥ Vih, f = f MAX	90	90	100	100			
I <sub>sb1</sub>	Full Standby Current, Vcc = MAX Outputs open CS ≥ Vhc, f = 0 Vin ≤ Vlc or Vin ≥ Vhc	15	15	20	20			

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE**

Commercial TA = 0° C to 70°C, Vcc = 5.0V±10% Military TA = -55°C to 125° C, Vcc = 5.0V±10%  
 See Read Timing Diagrams. All values in nanoseconds unless otherwise noted

Symbol	Parameter	-12 (3)		-15(3)		-20	
		Min	Max	Min	Max	Min	Max
<b>READ CYCLE</b>							
t RC	Read Cycle Time (1)	12	-	15	-	19	-
t AA	Address Access Time	-	12	-	15	-	19
t ACS	Chip Select Access Time	-	12	-	15	-	19
t OH	Output Hold from Address Change	2	-	2	-	3	-
tCLZ	Chip Select to Output in Low Z (2)	2	-	2	-	2	-
tCHZ	Chip Select to Output in High Z (2)	-	5	-	7	-	8
t PU	Chip Select to Power Up Time (2)	0	-	0	-	0	-
t PD	Chip Select to Power Down Time (2)	-	12	-	15	-	19
tOE	Output Enable to Data Valid	-	6	-	6	-	8
tOLZ	Output Enable to Output in Low-Z (2)	2	-	2	-	2	-
tOHZ	Output Enable to Output in High-Z (2)	-	4	-	5	-	7

Notes:

- 1) See Test Circuit and Waveforms. Minimums guaranteed but not tested.
- 2) This parameter is guaranteed by design but not tested.
- 3) For Vcc±5%. Commercial Only

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## QS86446

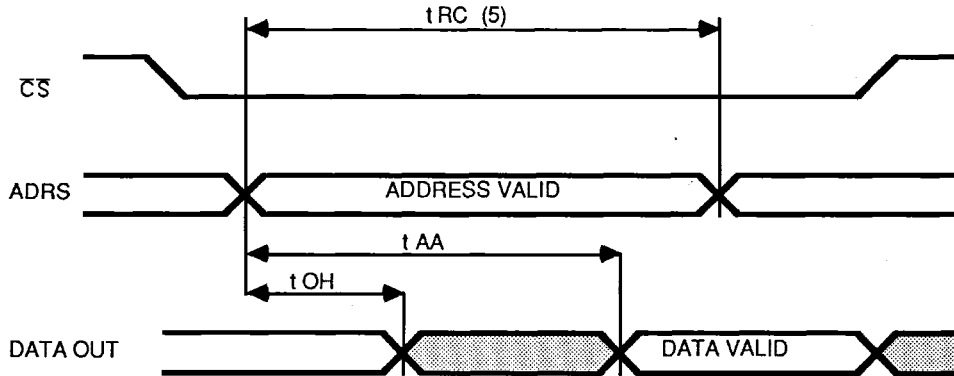
Commercial TA = 0° C to 70°C, Vcc = 5.0V±10% Military TA = -55°C to 125° C, Vcc = 5.0V±10%  
See Write Timing Diagrams. All values in nanoseconds unless otherwise noted

Symbol	Parameter	-12(3)		-15(3)		-20	
		Min	Max	Min	Max	Min	Max
<b>WRITE CYCLE</b>							
t WC	Write Cycle Time (1)	12	-	15	-	19	-
t CW	Chip Select Valid to End of Write	10	-	13	-	17	-
t AW	Address Valid to End of Write	10	-	13	-	17	-
t AS	Address Setup Time	0	-	0	-	0	-
t WP	Write Pulse width	10	-	12	-	16	-
t WR	Write Recovery Time	0	-	0	-	0	-
t DW	Data Valid to End of Write	6	-	8	-	10	-
t DH	Data Hold Time	0	-	0	-	0	-
t WZ	Write Enable to Output in High Z (2)	-	5	-	6	-	7
t OW	Output Active from End of Write(2)	2	-	2	-	2	-

**Notes:**

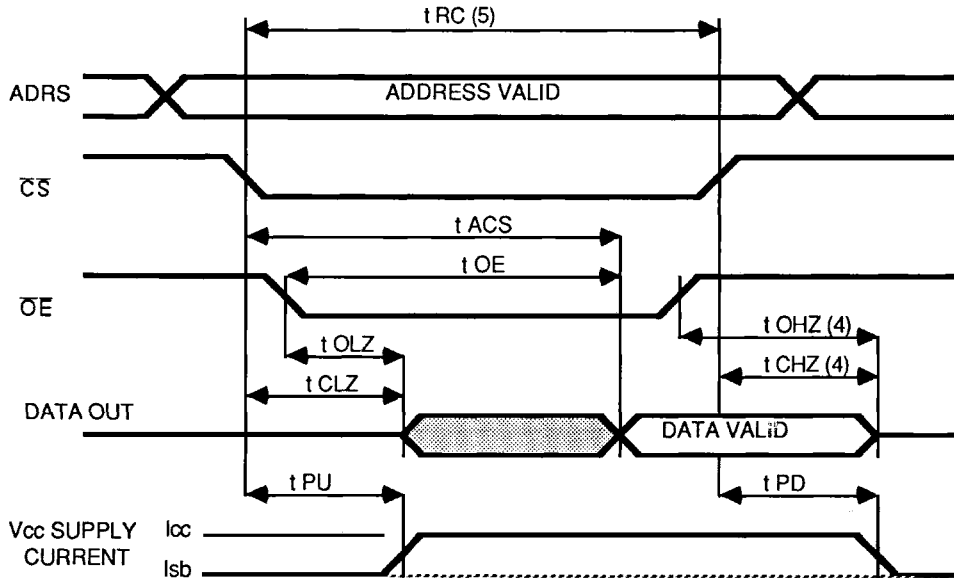
- 1) See Test Circuit and Waveforms. Minimums guaranteed but not tested.
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**TIMING WAVEFORMS - READ CYCLE NO. 1 (1,2)**



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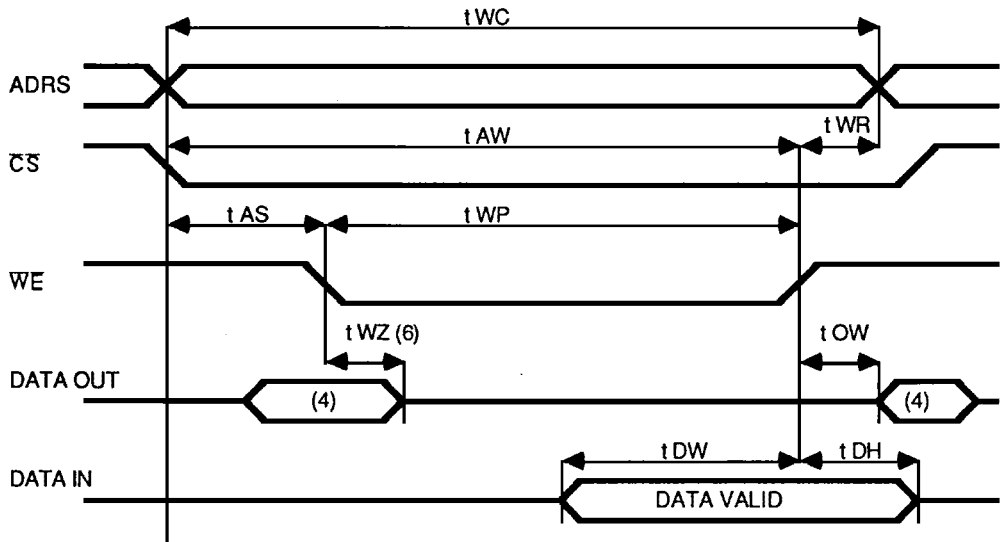
**TIMING WAVEFORMS - READ CYCLE NO. 2 (1,3)**



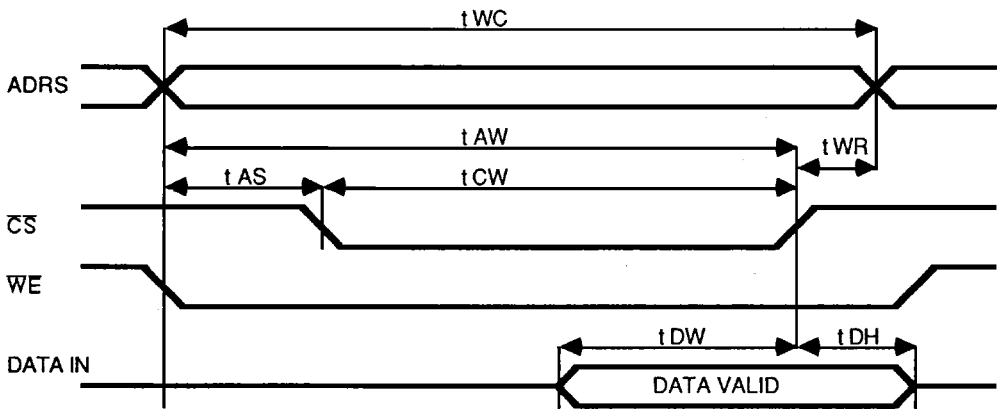
**Notes:**

1. WE is high for Read cycle.
2. CS is low for Read cycle #1.
3. Address is valid to or coincident with CS transition time for Read Cycle #2.
4. Transition to Hi-Z is measured  $\pm 200$  mV change from the prior steady state voltage.
5. All read timings are referenced from the last valid address to the first transitioning address.

**TIMING WAVEFORMS-WRITE CYCLE No. 1 (1,2,3 WE controlled timing)**



**TIMING WAVEFORMS-WRITE CYCLE No. 2 (1,2,3,5 CS controlled timing)**



**Notes:**

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