FAIRCHILD

SEMICONDUCTOR ™

July 1997
Revised April 1999

74VCX16839

Low Voltage 20-Bit Selectable Register/Buffer with 3.6V Tolerant Inputs and Outputs

General Description

The VCX16839 contains twenty non-inverting selectable buffered or registered paths. The device can be configured to operate in a registered, or flow through buffer mode by utilizing the register enable (REGE) and Clock (CP) signals. The device operates in a 20-bit word wide mode. All outputs can be placed into 3-STATE through use of the $\overline{OE}$ pin. These devices are ideally suited for buffered or registered 168 pin and 200 pin SDRAM DIMM memory modules.

The 74VCX16839 is designed for low voltage (1.65V to 3.6V) V_{CC} applications with I/O compatibility up to 3.6V.

The 74VCX16839 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining low CMOS power dissipation.

Features

- Compatible with PC100 and PC133 DIMM module specifications
- 1.65V–3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD} (CP to O_n)

    3.2 ns max for 3.0V to 3.6V V_{CC}

    4.4 ns max for 2.3V to 2.7V V_{CC}

    8.8 ns max for 1.65V to 1.95V V_{CC}

- Power-off high impedance inputs and outputs
- Supports live insertion and withdrawal (Note 1)
- Static Drive (I_{OH}/I_{OL})

    ±24 mA @ 3.0V V_{CC}

    ±18 mA @ 2.3V V_{CC}

    ±6 mA @ 1.65V V_{CC}

- Uses patented noise/EMI reduction circuitry
- Latch-up performance exceeds 300 mA
- ESD performance:

    Human body model > 2000V

    Machine model > 200V

Note 1: To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pull-up resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

Ordering Code:

Order Number	Package Number	Package Descriptions
74VCX16839MTD	MTD56	56-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.
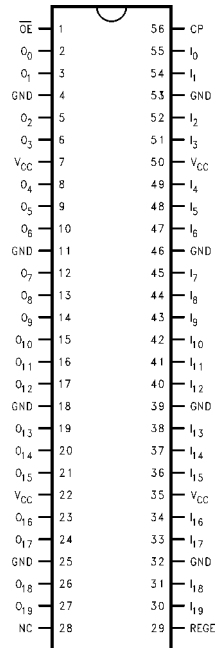
Logic Symbol
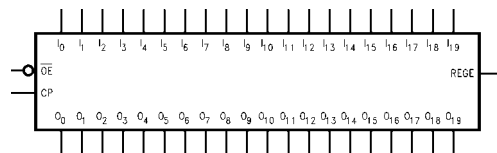
Pin Descriptions

Pin Names	Description
$\overline{OE}$	Output Enable Input (Active LOW)
I_0–I_{19}	Inputs
O_0–O_{19}	Outputs
CP	Clock Pulse Input
REGE	Register Enable Input

Connection Diagram

$\overline{OE}$	1		56	CP
O_0	2		55	I_0
O_1	3		54	I_1
GND	4		53	GND
O_2	5		52	I_2
O_3	6		51	I_3
V_{CC}	7		50	V_{CC}
O_4	8		49	I_4
O_5	9		48	I_5
O_6	10		47	I_6
GND	11		46	GND
O_7	12		45	I_7
O_8	13		44	I_8
O_9	14		43	I_9
O_{10}	15		42	I_{10}
O_{11}	16		41	I_{11}
O_{12}	17		40	I_{12}
GND	18		39	GND
O_{13}	19		38	I_{13}
O_{14}	20		37	I_{14}
O_{15}	21		36	I_{15}
V_{CC}	22		35	V_{CC}
O_{16}	23		34	I_{16}
O_{17}	24		33	I_{17}
GND	25		32	GND
O_{18}	26		31	I_{18}
O_{19}	27		30	I_{19}
NC	28		29	REGE

Truth Table

Inputs				Outputs
CP	REGE	I_n	$\overline{OE}$	O_n
↑	H	H	L	H
↑	H	L	L	L
X	L	H	L	H
X	L	L	L	L
X	X	X	H	Z

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial (HIGH or LOW, inputs may not float)
Z = High Impedance

Functional Description

The 74VCX16839 consists of twenty selectable non-invert-ing buffers or registers with word wide controls. Mode func-tionality is selected through operation of the CP and REGE pin as shown by the truth table. When REGE is held at a logic "1" the device operates as a 20-bit register. Data is transferred from I_n to O_n on the rising edge of the CP pin. When the REGE pin is held at a logic "0" the device oper-ates in a flow through mode and data propagates directly from the I_n to the O_n outputs. All outputs can be 3-stated by holding the $\overline{OE}$ pin at a logic "1."

Logic Diagram
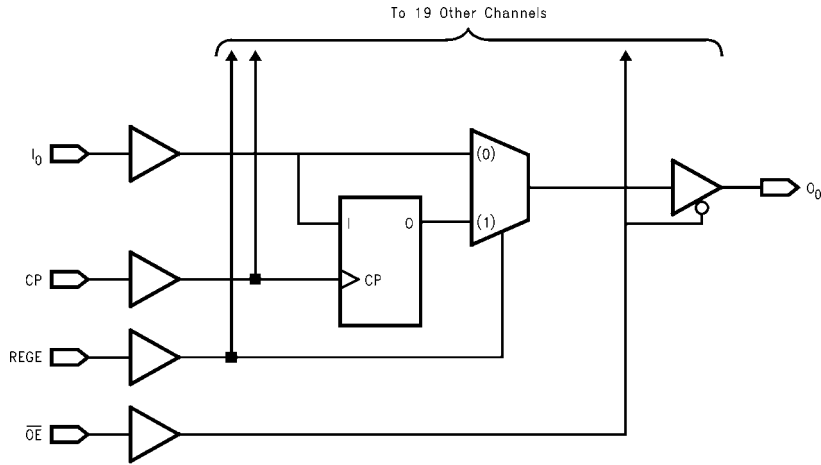
Absolute Maximum Ratings(Note 2)

Supply Voltage (V_CC)	−0.5V to +4.6V
DC Input Voltage (V_I)	−0.5V to +4.6V
Output Voltage (V_O)	
Outputs 3-STATE	−0.5V to +4.6V
Outputs Active (Note 3)	−0.5V to V_CC +0.5V
DC Input Diode Current (I_IK) V_I < 0V	−50 mA
DC Output Diode Current (I_OK)	
V_O < 0V	−50 mA
V_O > V_CC	+50 mA
DC Output Source/Sink Current	
(I_OH/I_OL)	±50 mA
DC V_CC or GND Current per	
Supply Pin (I_CC or GND)	±100 mA
Storage Temperature Range (T_STG)	−65°C to +150°C

Recommended Operating Conditions (Note 4)

Power Supply	
Operating	1.65V to 3.6V
Data Retention Only	1.2V to 3.6V
Input Voltage	−0.3V to +3.6V
Output Voltage (V_O)	
Output in Active States	0V to V_CC
Output in "OFF" State	0.0V to 3.6V
Output Current in I_OH/I_OL	
V_CC = 3.0V to 3.6V	±24 mA
V_CC = 2.3V to 2.7V	±18 mA
V_CC = 1.65V to 2.3V	±6 mA
Free Air Operating Temperature (T_A)	−40°C to +85°C
Minimum Input Edge Rate (Δt/ΔV)	
V_IN = 0.8V to 2.0V, V_CC = 3.0V	10 ns/V

Note 2: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 3: I_O Absolute Maximum Rating must be observed.

Note 4: Floating or unused inputs must be held HIGH or LOW.

DC Electrical Characteristics (2.7V < V_CC ≤ 3.6V)

Symbol	Parameter	Conditions	V_CC (V)	Min	Max	Units
V_IH	HIGH Level Input Voltage		2.7 – 3.6	2.0		V
V_IL	LOW Level Input Voltage		2.7 – 3.6		0.8	V
V_OH	HIGH Level Output Voltage	I_OH = −100 μA	2.7 – 3.6	V_CC − 0.2		V
		I_OH = −12 mA	2.7	2.2		V
		I_OH = −18 mA	3.0	2.4		V
		I_OH = −24 mA	3.0	2.2		V
V_OL	LOW Level Output Voltage	I_OL = 100 μA	2.7 – 3.6		0.2	V
		I_OL = 12 mA	2.7		0.4	V
		I_OL = 18 mA	3.0		0.4	V
		I_OL = 24 mA	3.0		0.55	V
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	2.7 – 3.6		±5.0	μA
I_OZ	3-STATE Output Leakage	0 ≤ V_O ≤ 3.6V V_I = V_IH or V_IL	2.7 – 3.6		±10	μA
I_OFF	Power-OFF Leakage Current	0 ≤ (V_I, V_O) ≤ 3.6V	0		10	μA
I_CC	Quiescent Supply Current	V_I = V_CC or GND	2.7 – 3.6		20	μA
		V_CC ≤ (V_I, V_O) ≤ 3.6V (Note 5)	2.7 – 3.6		±20	μA
ΔI_CC	Increase in I_CC per Input	V_IH = V_CC −0.6V	2.7 – 3.6		750	μA

Note 5: Outputs disabled or 3-STATE only.

DC Electrical Characteristics (2.3V ≤ V$_{CC}$ ≤ 2.7V)

Symbol	Parameter	Conditions	V$_{CC}$ (V)	Min	Max	Units
V$_{IH}$	HIGH Level Input Voltage		2.3 – 2.7	1.6		V
V$_{IL}$	LOW Level Input Voltage		2.3 – 2.7		0.7	V
V$_{OH}$	HIGH Level Output Voltage	I$_{OH}$ = −100 μA	2.3 – 2.7	V$_{CC}$ – 0.2		V
		I$_{OH}$ = −6 mA	2.3	2.0		V
		I$_{OH}$ = −12 mA	2.3	1.8		V
		I$_{OH}$ = −18 mA	2.3	1.7		V
V$_{OL}$	LOW Level Output Voltage	I$_{OL}$ = 100 μA	2.3 – 2.7		0.2	V
		I$_{OL}$ = 12 mA	2.3		0.4	V
		I$_{OL}$ = 18 mA	2.3		0.6	V
I$_I$	Input Leakage Current	0 ≤ V$_I$ ≤ 3.6V	2.3 – 2.7		±5.0	μA
I$_{OZ}$	3-STATE Output Leakage	0 ≤ V$_O$ ≤ 3.6V V$_I$ = V$_{IH}$ or V$_{IL}$	2.3 – 2.7		±10	μA
I$_{OFF}$	Power-OFF Leakage Current	0 ≤ (V$_I$, V$_O$) ≤ 3.6V	0		10	μA
I$_{CC}$	Quiescent Supply Current	V$_I$ = V$_{CC}$ or GND	2.3 – 2.7		20	μA
		V$_{CC}$ ≤ (V$_I$, V$_O$) ≤ 3.6V (Note 6)	2.3 – 2.7		±20	μA

Note 6: Outputs disabled or 3-STATE only.

DC Electrical Characteristics (1.65V ≤ V$_{CC}$ < 2.3V)

Symbol	Parameter	Conditions	V$_{CC}$ (V)	Min	Max	Units
V$_{IH}$	HIGH Level Input Voltage		1.65 - 2.3	0.65 × V$_{CC}$		V
V$_{IL}$	LOW Level Input Voltage		1.65 - 2.3		0.35 × V$_{CC}$	V
V$_{OH}$	HIGH Level Output Voltage	I$_{OH}$ = −100 μA	1.65 - 2.3	V$_{CC}$ – 0.2		V
		I$_{OH}$ = −6 mA	1.65	1.4		V
V$_{OL}$	LOW Level Output Voltage	I$_{OL}$ = 100 μA	1.65 - 2.3		0.2	V
		I$_{OL}$ = 6 mA	1.65		0.3	V
I$_I$	Input Leakage Current	0 ≤ V$_I$ ≤ 3.6V	1.65 - 2.3		±5.0	μA
I$_{OZ}$	3-STATE Output Leakage	0 ≤ V$_O$ ≤ 3.6V V$_I$ = V$_{IH}$ or V$_{IL}$	1.65 - 2.3		±10	μA
I$_{OFF}$	Power-OFF Leakage Current	0 ≤ (V$_I$, V$_O$) ≤ 3.6V	0		10	μA
I$_{CC}$	Quiescent Supply Current	V$_I$ = V$_{CC}$ or GND	1.65 - 2.3		20	μA
		V$_{CC}$ ≤ (V$_I$, V$_O$) ≤ 3.6V (Note 7)	1.65 - 2.3		±20	μA

Note 7: Outputs disabled or 3-STATE only.

AC Electrical Characteristics VCX16839 (Note 8)

Symbol	Parameter	$T_A = -40°C$ to $+85°C$, $C_L = 30$ pF, $R_L = 500\Omega$						Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 1.8V \pm 0.15V$		
		Min	Max	Min	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	250		200		100		MHz
t_{PHL} t_{PLH}	Prop Delay I_n to O_n (REGE = 0)	0.8	2.5	1.0	3.5	1.5	7.0	ns
t_{PHL} t_{PLH}	Prop Delay CP to O_n (REGE = 1)	0.8	3.2	1.0	4.4	1.5	8.8	ns
t_{PHL}, t_{PLH}	Prop Delay REGE to O_n	0.8	4.0	1.0	5.0	1.5	9.8	ns
t_{PZL}, t_{PZH}	Output Enable Time	0.8	3.8	1.0	4.9	1.5	9.8	ns
t_{PLZ}, t_{PHZ}	Output Disable Time	0.8	3.7	1.0	4.2	1.5	7.6	ns
t_S	Setup Time	1.0		1.0		2.5		ns
t_H	Hold Time	0.7		0.7		1.0		ns
t_W	Pulse Width	1.5		1.5		4.0		ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 9)		0.5		0.5		0.75	ns

Note 8: For $C_L = 50$ pF, add approximately 300 ps to the AC maximum specification.

Note 9: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}).

Extended AC Electrical Characteristics (Note 10)

Symbol	Parameter	$T_A = -0°C$ to $+85°C$, $R_L = 500\Omega$ $V_{CC} = 3.3V \pm 0.3V$		Units
		$C_L = 50$ pF		
		Min	Max	
t_{PHL}, t_{PLH}	Prop Delay I_n to O_n (REGE = 0)	1.0	2.8	ns
t_{PHL}, t_{PLH}	Prop Delay CP to O_n (REGE = 1)	1.4	3.5	ns
t_{PHL}, t_{PLH}	Prop Delay REGE to O_n	1.0	4.3	ns
t_{PZL}, t_{PZH}	Output Enable Time	1.0	4.1	ns
t_{PLZ}, t_{PHZ}	Output Disable Time	1.0	4.0	ns
t_S	Setup Time	1.0		ns
t_H	Hold Time	0.7		ns

Note 10: This parameter is guaranteed by characterization but not tested.

Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = +25°C$ Typical	Units
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	$C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$	1.8	0.25	V
			2.5	0.6	
			3.3	0.8	
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	$C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$	1.8	−0.25	V
			2.5	−0.6	
			3.3	−0.8	
V_{OHV}	Quiet Output Dynamic Valley V_{OH}	$C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$	1.8	1.5	V
			2.5	1.9	
			3.3	2.2	

Capacitance

Symbol	Parameter	Conditions	$T_A = +25°C$ Typical	Units
C_{IN}	Input Capacitance	$V_{CC} = 1.8V$, 2.5V or 3.3V, $V_I = 0V$ or V_{CC}	6	pF
C_{OUT}	Output Capacitance	$V_I = 0V$ or V_{CC}, $V_{CC} = 1.8V$, 2.5V or 3.3V	7	pF
C_{PD}	Power Dissipation Capacitance	$V_I = 0V$ or V_{CC}, f = 10 MHz, $V_{CC} = 1.8V$, 2.5V or 3.3V	20	pF

AC Loading and Waveforms
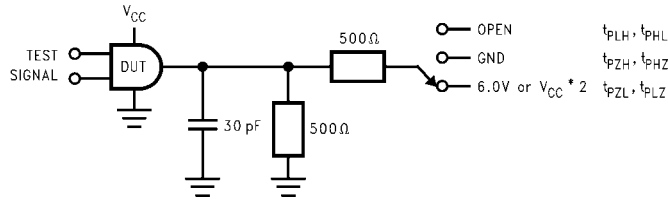
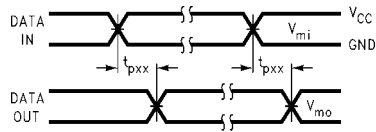| TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V at $V_{CC} = 3.3 \pm 0.3V$; V_{CC} x 2 at $V_{CC} = 2.5 \pm 0.2V$; $1.8V \pm 0.15V$
t_{PZH}, t_{PHZ}	GND

FIGURE 1. AC Test Circuit

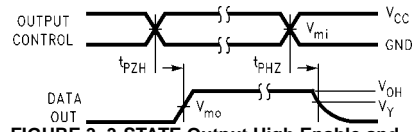**FIGURE 2. Waveform for Inverting and Non-Inverting Functions**

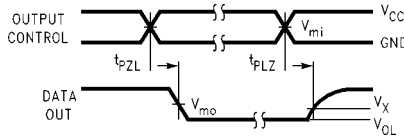**FIGURE 3. 3-STATE Output High Enable and Disable Times for Low Voltage Logic**

FIGURE 4. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic
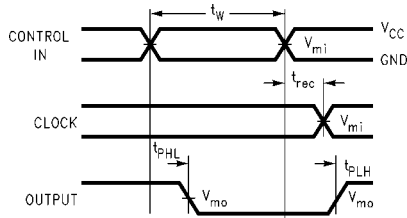
FIGURE 5. Propagation Delay, Pulse Width and t_{rec} Waveforms
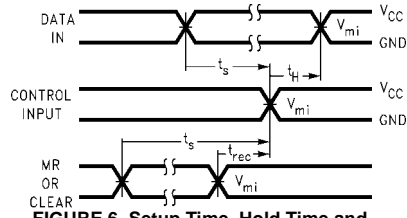
FIGURE 6. Setup Time, Hold Time and Recovery Time for Low Voltage Logic

Symbol	V_{CC}		
	3.3V $\pm$ 0.3V	**2.5V $\pm$ 0.2V**	**1.8V $\pm$ 0.15V**
V_{mi}	1.5V	$V_{CC}/2$	$V_{CC}/2$
V_{mo}	1.5V	$V_{CC}/2$	$V_{CC}/2$
V_X	$V_{OL} +0.3V$	$V_{OL} +0.15V$	$V_{OL} +0.15V$
V_Y	$V_{OH} -0.3V$	$V_{OH} -0.15V$	$V_{OH} -0.15V$

Physical Dimensions inches (millimeters) unless otherwise noted
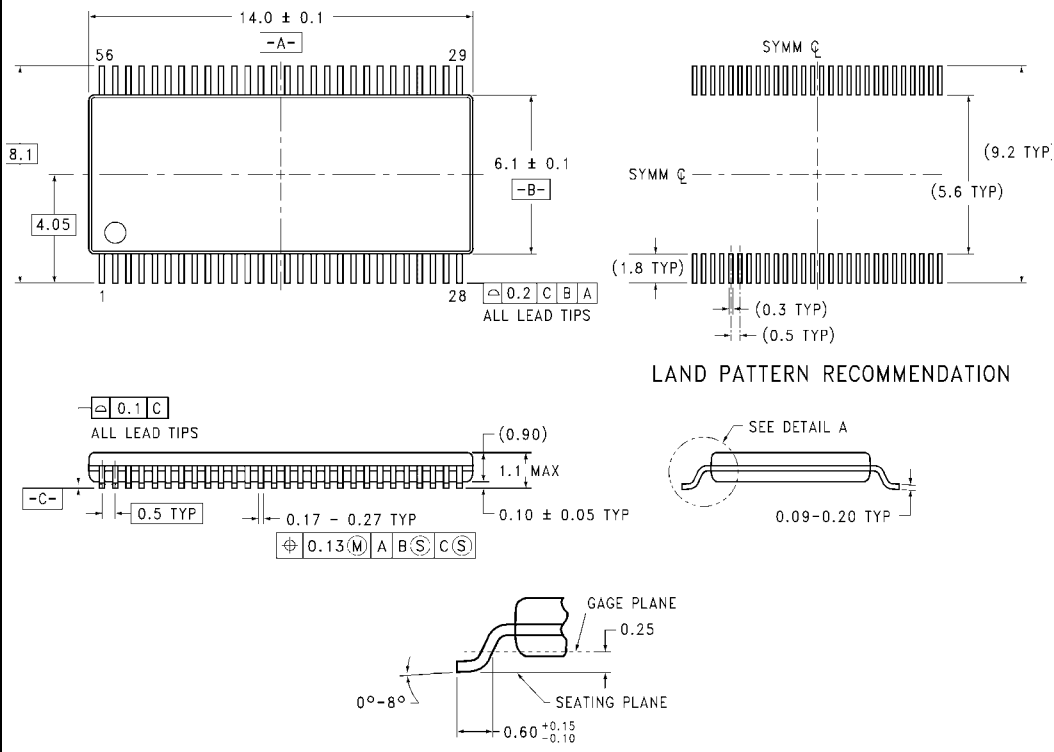
56-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
Package Number MTD56

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