



3.3V CMOS 8-BIT REGISTER WITH CLOCK ENABLE AND 5 VOLT TOLERANT I/O

IDT74LVC377A

FEATURES:

- 0.5 MICRON CMOS Technology
- ESD > 2000V per MIL-STD-883, Method 3015;
> 200V using machine model (C = 200pF, R = 0)
- 1.27mm pitch SOIC, 0.65mm pitch SSOP,
0.635mm pitch QSOP, 0.65mm pitch TSSOP packages
- Extended commercial range of – 40°C to +85°C
- V_{CC} = 3.3V ±0.3V, Normal Range
- V_{CC} = 2.3V to 3.6V, Extended Range
- CMOS power levels (0.4μW typ. static)
- Rail-to-Rail output swing for increased noise margin
- All inputs, outputs and I/O are 5 Volt tolerant
- Supports hot insertion

Drive Features for LVC377A:

- High Output Drivers: ±24mA
- Reduced system switching noise

DESCRIPTION:

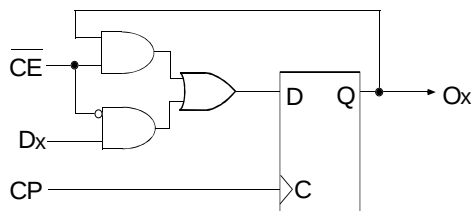
This 8-bit register with clock enable is built using advanced dual metal CMOS technology. This high-speed, low power device is an 8-bit register with a buffered common clock, buffered output drive, and synchronous clock enable, that is ideal for driving high capacitance loads such as memory address and data buses.

All pins can be driven from either 3.3V or 5V devices. This feature allows the use of these devices as translators in a mixed 3.3V/5V supply system.

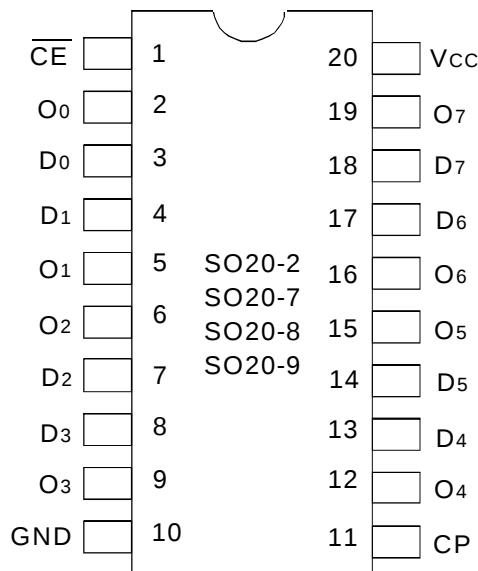
APPLICATIONS:

- 5V and 3.3V mixed voltage systems
- Data communication and telecommunication systems

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



PIN DESCRIPTION

Pin Names	Description
$\overline{CE}$	Clock Enable Input (Active LOW)
CP	Clock Input
Ox	Data Outputs
Dx	Data Inputs

FUNCTION TABLE (1)

Inputs			Internal Q Value	Outputs Ox	Function
$\overline{CE}$	CP	Dx			
H	↑	X	NC	NC	Hold Value
L	↑	L	L	L	Load Input Data
L	↑	H	H	H	

NOTE:

1. H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
↑ = LOW-to-HIGH Transition

EXTENDED COMMERCIAL TEMPERATURE RANGE

OCTOBER 1999

ABSOLUTE MAXIMUM RATINGS ⁽¹⁾

Symbol	Description	Max.	Unit
V _{TERM} ⁽²⁾	Terminal Voltage with Respect to GND	– 0.5 to +6.5	V
V _{TERM} ⁽³⁾	Terminal Voltage with Respect to GND	– 0.5 to +6.5	V
T _{STG}	Storage Temperature	– 65 to +150	°C
I _{OUT}	DC Output Current	– 50 to +50	mA
I _{IK} I _{OK}	Continuous Clamp Current, V _I < 0 or V _O < 0	– 50	mA
I _{CC} I _{SS}	Continuous Current through each V _{CC} or GND	±100	mA

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NOTES:

- 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.
- V_{CC} terminals.
- All terminals except V_{CC}.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	4.5	6	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	5.5	8	pF
C _{I/O}	I/O Port Capacitance	V _{IN} = 0V	6.5	8	pF

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NOTE:

- As applicable to the device type.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: T_A = – 40°C To +85°C

Symbol	Parameter	Test Conditions		Min.	Typ. ⁽¹⁾	Max.	Unit
V _{IH}	Input HIGH Voltage Level	V _{CC} = 2.3V to 2.7V		1.7	—	—	V
		V _{CC} = 2.7V to 3.6V		2	—	—	
V _{IL}	Input LOW Voltage Level	V _{CC} = 2.3V to 2.7V		—	—	0.7	V
		V _{CC} = 2.7V to 3.6V		—	—	0.8	
I _{IH} I _{IL}	Input Leakage Current	V _{CC} = 3.6V	V _I = 0 to 5.5V	—	—	±5	μA
I _{OZH} I _{OZL}	High Impedance Output Current (3-State Output pins)	V _{CC} = 3.6V	V _O = 0 to 5.5V	—	—	±10	μA
I _{OFF}	Input/Output Power Off Leakage	V _{CC} = 0V, V _{IN} or V _O ≤ 5.5V		—	—	±50	μA
V _{IK}	Clamp Diode Voltage	V _{CC} = 2.3V, I _{IN} = – 18mA		—	– 0.7	– 1.2	V
V _H	Input Hysteresis	V _{CC} = 3.3V		—	100	—	mV
I _{CCL} I _{CCH} I _{CCZ}	Quiescent Power Supply Current	V _{CC} = 3.6V	V _{IN} = GND or V _{CC}	—	—	10	μA
			3.6 ≤ V _{IN} ≤ 5.5V ⁽²⁾	—	—	10	
ΔI _{CC}	Quiescent Power Supply Current Variation	One input at V _{CC} - 0.6V, other inputs at V _{CC} or GND		—	—	500	μA

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NOTES:

- Typical values are at V_{CC} = 3.3V, +25°C ambient.
- This applies in the disabled state only.

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Max.	Unit
VOH	Output HIGH Voltage	VCC = 2.3V to 3.6V	IOH = – 0.1mA	VCC – 0.2	—	V
		VCC = 2.3V	IOH = – 6mA	2	—	
		VCC = 2.3V	IOH = – 12mA	1.7	—	
		VCC = 2.7V		2.2	—	
		VCC = 3.0V		2.4	—	
		VCC = 3.0V	IOH = – 24mA	2.2	—	
VOL	Output LOW Voltage	VCC = 2.3V to 3.6V	IOL = 0.1mA	—	0.2	V
		VCC = 2.3V	IOL = 6mA	—	0.4	
			IOL = 12mA	—	0.7	
		VCC = 2.7V	IOL = 12mA	—	0.4	
		VCC = 3.0V	IOL = 24mA	—	0.55	

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NOTE:

1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate VCC range. TA = – 40°C to +85°C.

OPERATING CHARACTERISTICS, VCC = 3.3V ± 0.3V, TA = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
CPD	Power Dissipation Capacitance per transceiver Outputs enabled	CL = 0pF, f = 10Mhz		pF
CPD	Power Dissipation Capacitance per transceiver Outputs disabled			pF

SWITCHING CHARACTERISTICS ⁽¹⁾

Symbol	Parameter	VCC = 2.7V		VCC = 3.3V±0.3V		Unit
		Min.	Max.	Min.	Max.	
tPLH tPHL	Propagation Delay CP to OX	1.5	9.5	1	8.5	ns
tSU	Data Setup Time, Dx to CP	2.5	—	2.5	—	ns
tH	Data Hold Time, Dx to CP	1.5	—	1.5	—	ns
tSU	Clock Enable Data Setup Time, $\overline{\text{CE}}$ to CP	3	—	3	—	ns
tH	Clock Enable Data Hold Time, $\overline{\text{CE}}$ to CP	1.5	—	1.5	—	ns
tw	CLK Pulse Width HIGH or LOW	3.3	—	3.3	—	ns
tsk(o)	Output Skew ⁽²⁾	—	—	—	500	ps

NOTES:

1. See test circuits and waveforms. TA = – 40°C to + 85°C.
2. Skew between any two outputs of the same package and switching in the same direction.

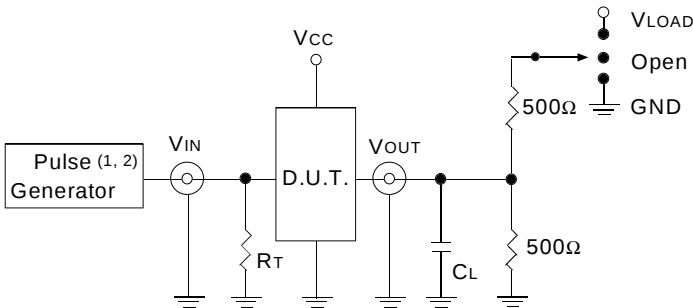
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	V _{CC} (1) = 3.3V ± 0.3V	V _{CC} (1) = 2.7V	V _{CC} (2) = 2.5V ± 0.2V	Unit
V _{LOAD}	6	6	2 x V _{CC}	V
V _{IH}	2.7	2.7	V _{CC}	V
V _T	1.5	1.5	V _{CC} / 2	V
V _{LZ}	300	300	150	mV
V _{HZ}	300	300	150	mV
C _L	50	50	30	pF

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TEST CIRCUITS FOR ALL OUTPUTS



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DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTES:

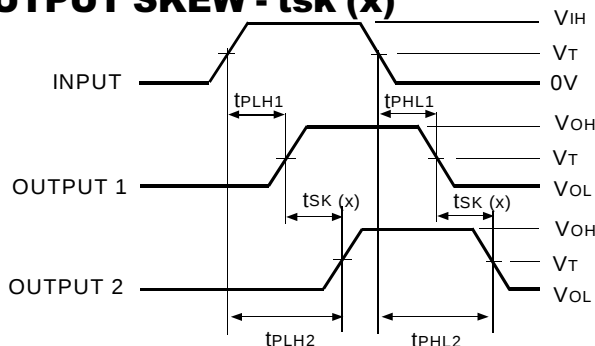
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2ns; t_R ≤ 2ns.

SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	V _{LOAD}
Disable High Enable High	GND
All Other tests	Open

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OUTPUT SKEW - t_{SK}(x)



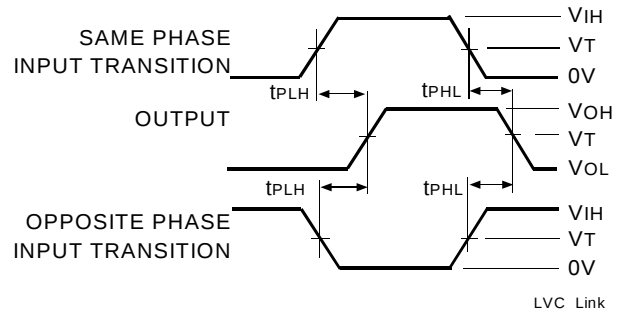
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

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NOTES:

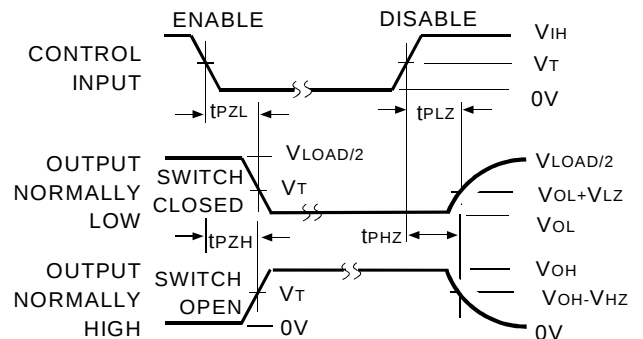
1. For t_{SK}(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

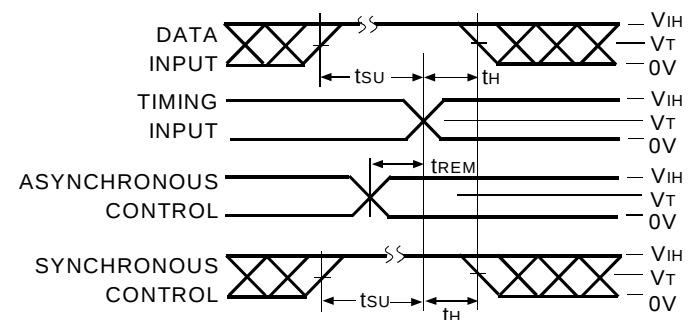


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NOTE:

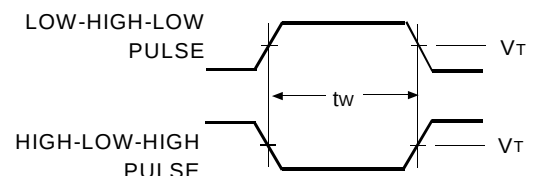
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

SET-UP, HOLD, AND RELEASE TIMES



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PULSE WIDTH



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ORDERING INFORMATION

IDT	XX	LVC	X	XXXX	XX	
	Temp. Range		Bus-Hold	Device Type	Package	
					SO	Small Outline IC (gull wing) (SO20-2)
					PY	Shrink Small Outline Package (SO20-7)
					Q	Quarter Size Small Outline Package (SO20-8)
					PG	Thin Shrink Small Outline Package (SO20-9)
					377A	8-bit Register with Clock Enable, $\pm 24\text{mA}$
					Blank	No Bus-hold
					74	-40°C to +85°C



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