MIC5841/5842

8-Bit Serial-Input Latched Drivers

General Description

Using BiCMOS technology, the MIC5841/5842 integrated circuits were fabricated to be used in a wide variety of peripheral power driver applications. The devices each have an eight-bit CMOS shift register, CMOS control circuitry, eight CMOS data latches, and eight bipolar current-sink Darlington output drivers.

These two devices differ only in maximum voltage ratings. The MIC5842 offers premium performance with a minimum output breakdown voltage rating of 80V (50V sustaining). The drivers can be operated with a split supply where the negative supply is down to –20V.

The 500mA outputs, with integral transient-suppression diodes, are suitable for use with lamps, relays, solenoids and other inductive loads.

These devices have improved speed characteristics. With a 5V logic supply, they will typically operate faster than 5 MHz. With a 12V supply, significantly higher speeds are obtained. The CMOS inputs are compatible with standard CMOS, PMOS, and NMOS logic levels. TTL or DTL circuits may require the use of appropriate pull-up resistors. By using the serial data output, the drivers can be cascaded for interface applications requiring additional drive lines.

The MIC5840 family is available in DIP, PLCC, and SOIC packages. Because of limitations on package power dissipation, the simultaneous operation of all drivers at maximum rated current might require a reduction in duty cycle. A copper-alloy lead frame provides for maximum package power dissipation.

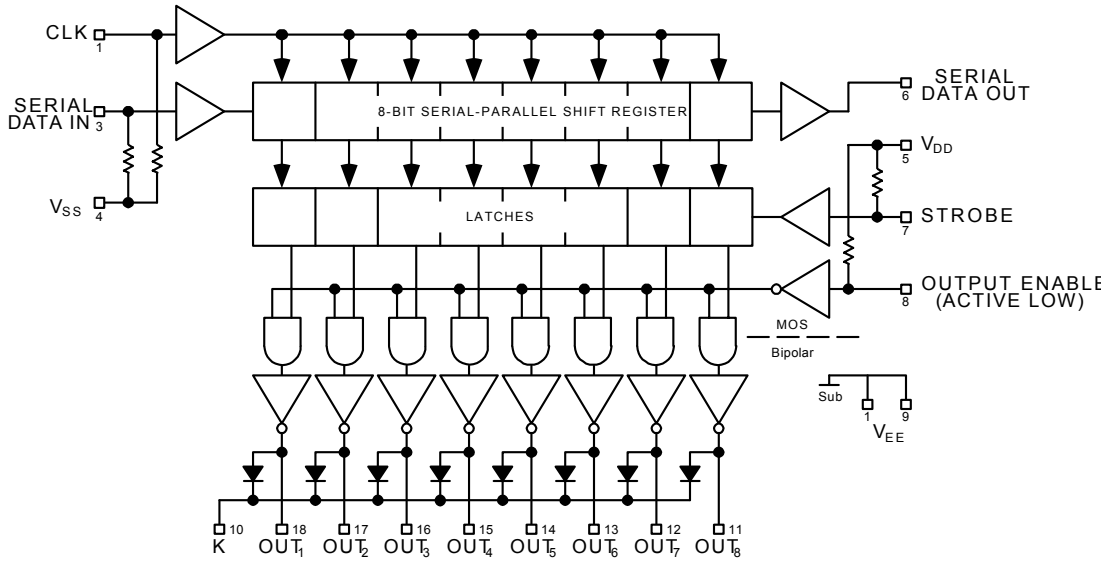
Features

- 3.3 MHz Minimum Data-Input Rate
- CMOS, PMOS, NMOS, TTL Compatible
- Internal Pull-Up/Pull-Down Resistors
- Low-Power CMOS Logic and Latches
- High-Voltage Current-Sink Outputs
- Output Transient-Protection Diodes
- Single or Split Supply Operation

Ordering Information

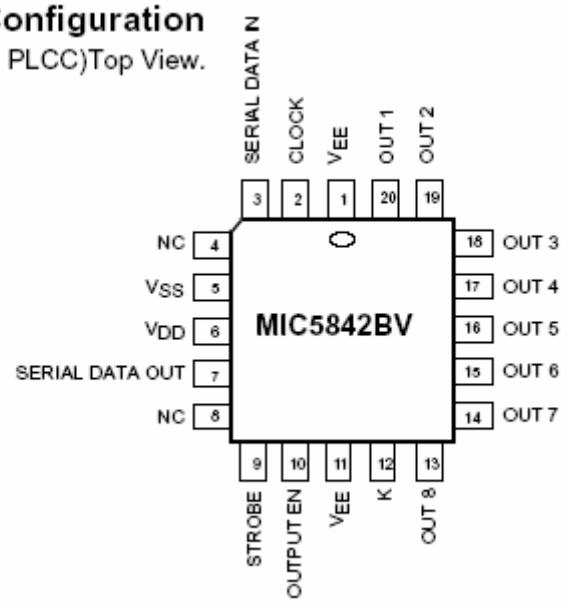
Part Number		Temperature Range	Package
Standard	**Pb-Free**		
MIC5841BN	MIC5841YN	–40ºC to +85ºC	18-Pin Plastic DIP
MIC5841BV	MIC5841YV	–40ºC to +85ºC	20-Pin PLCC
MIC5841BWM	MIC5841YWM	–40ºC to +85ºC	18-Pin Wide SOIC
MIC5842BN	MIC5842YN	–40ºC to +85ºC	18-Pin Plastic DIP
MIC5842BV	MIC5842YV	–40ºC to +85ºC	20-Pin PLCC
MIC5842BWM	MIC5842YWM	–40ºC to +85ºC	18-Pin Wide SOIC

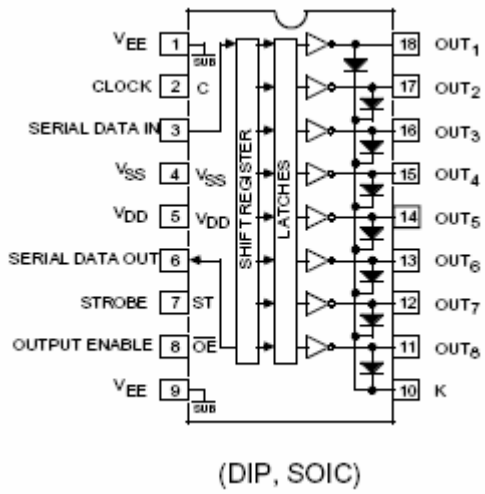
Functional Diagram



Pin Configuration

(20-Pin PLCC)Top View.





(DIP, SOIC)

Absolute Maximum Ratings[1,2,3]

At 25°C Free-Air Temperature and V_{SS} 0V
Output Voltage, V_{CE} (MIC5841) 50V
(MIC5842) 80V
Output Voltage, $V_{CE(SUS)}$ (MIC5841)[1] 35V
(MIC5842) 50V
Logic Supply Voltage, V_{DD} 15V
VDD with Reference to V_{EE} 25V

Emitter Supply Voltage, V_{EE} ..... –20V
Input Voltage Range, V_{IN} ..... –0.3V to V_{DD} + 0.3V
Continuous Output Current, I_{OUT} 500mA
Package Power Dissipation, P_D[2] 1.82W
Operating Temperature Range, T_A ..... –55°C to +85°C
Storage Temperature Range, T_S ..... –65°C to +150°C

Electrical Characteristics

At T_A = 25°C V_{DD} = 5V, V_{SS} = V_{EE} = 0V (unless otherwise noted)

Characteristic	Symbol	Applicable Devices	Test Conditions	Limits		
				Min	Max	Unit
Output Leakage Current	I_{CEX}	MIC5841	V_{OUT} = 50V		50	µA
			V_{OUT} = 50V, T_A = +70ºC		100	
		MIC5842	V_{OUT} = 80V		50	
			V_{OUT} = 80V, T_A = +70ºC		100	
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	Both	I_{OUT} = 100mA		1.1	V
			I_{OUT} = 200mA		1.3	
			I_{OUT} = 350mA, V_{DD} = 7.0V		1.6	
Collector-Emitter Saturation Voltage	$V_{CE(SUS)}$[5]	MIC5841	I_{OUT} = 350mA, L = 2mH	35		V
		MIC5842	I_{OUT} = 350mA, L = 2mH	50		
Input Voltage	$V_{IN(0)}$	Both			0.8	V
	$V_{IN(1)}$	Both	V_{DD} = 12V	10.5		
			V_{DD} = 10V	8.5		
			V_{DD} = 5.0V(4)	3.5		
Input Resistance	R_{IN}	Both	V_{DD} = 12V	50		kΩ
			V_{DD} = 10V	50		
			V_{DD} = 5.0V	50		
Supply Current	$IDD_{(ON)}$	Both	All Drivers ON, V_{DD} = 12V		16	1.6
			All Drivers ON, V_{DD} = 10V		14	
			All Drivers ON, V_{DD} = 5.0V		8.0	
	$IDD_{(OFF)}$	Both	All Drivers OFF, V_{DD} = 12V		2.9	
			All Drivers OFF, V_{DD} = 10V		2.5	
			All Drivers OFF, V_{DD} = 5.0V		1.6	
Clamp Diode Leakage Current	I_R	MIC5841	V_R = 50V		50	µA
		MIC5842	V_R = 80V		50	
Clamp Diode Forward Voltage	V_F	Both	I_F = 350mA		2.0	V

Electrical Characteristics

At T_A = –55°C V_{DD} = 5V, V_{SS} = V_{EE} = 0V (unless otherwise noted)

Characteristic	Symbol	Test Conditions	Limits		
			Min	Max	Unit
Output Leakage Current	I_{CEX}	V_{OUT} = 80V		50	µA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_{OUT} = 100mA		1.3	V
		I_{OUT} = 200mA		1.5	
		I_{OUT} = 350mA, V_{DD} = 7.0V		1.8	
Input Voltage	$V_{IN(0)}$			0.8	V
	$V_{IN(1)}$	V_{DD} = 12V	10.5		
		V_{DD} = 5.0V	3.5		
Input Resistance	R_{IN}	V_{DD} = 12V	35		kΩ
		V_{DD} = 10V	35		
		V_{DD} = 5.0V	35		
Supply Current	$I_{DD(ON)}$	All Drivers ON, V_{DD} = 12V		16	mA
		All Drivers ON, V_{DD} = 10V		14	
		All Drivers ON, V_{DD} = 5.0V		10	
	$I_{DD(OFF)}$	All Drivers OFF, V_{DD} = 12V		3.5	
		All Drivers OFF, V_{DD} = 5.0V		2.0	

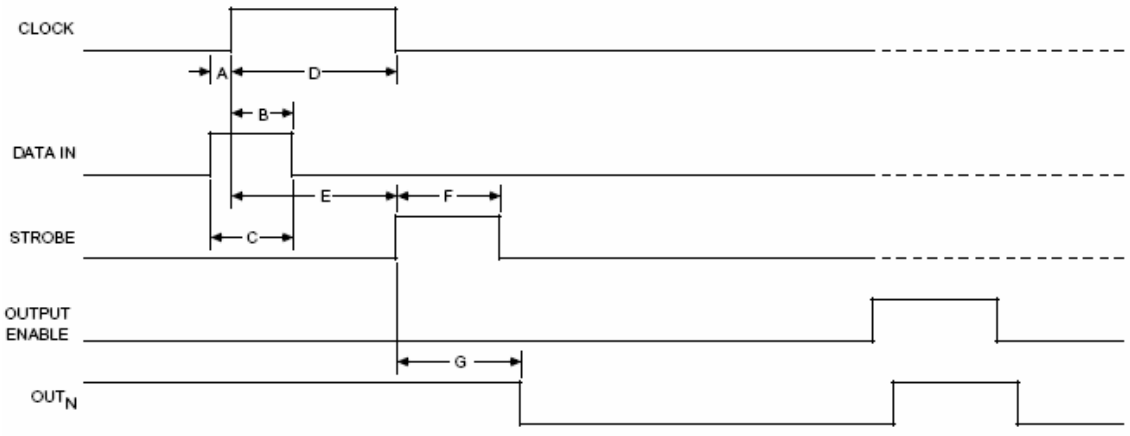
Electrical Characteristics

At T_A = +125°C V_{DD} = 5V, V_{SS} = V_{EE} = 0V (unless otherwise noted)

Characteristic	Symbol	Test Conditions	Limits		
			Min	Max	Unit
Output Leakage Current	I_{CEX}	V_{OUT} = 80V		500	µA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_{OUT} = 100mA		1.3	V
		I_{OUT} = 200mA		1.5	
		I_{OUT} = 350mA, V_{DD} = 7.0V		1.8	
Input Voltage	$V_{IN(0)}$			0.8	V
	$V_{IN(1)}$	V_{DD} = 12V	10.5		
		V_{DD} = 5.0V	3.5		
Input Resistance	R_{IN}	V_{DD} = 12V	50		kΩ
		V_{DD} = 10V	50		
		V_{DD} = 5.0V	50		
Supply Current	$I_{DD(ON)}$	All Drivers ON, V_{DD} = 12V		16	mA
		All Drivers ON, V_{DD} = 10V		14	
		All Drivers ON, V_{DD} = 5.0V		8	
	$I_{DD(OFF)}$	All Drivers OFF, V_{DD} = 12V		2.9	
		All Drivers OFF, V_{DD} = 5.0V		2.1.6	
Clamp Diode Leakage Current	I_R	MIC5841A V_R = 50V		1.6	µA
		MIC5842A V_R = 80V		100	

Notes:

1. For Inductive load applications.
2. Derate at the rate of 18.2mW/°C above TA = 25°C (Plastic DIP)
3. CMOS devices have input-static protection but are susceptible to damage when exposed to extremely high static electrical charges.
4. Operation of these devices with standard TTL may require the use of appropriate pull-up resistors to insure an input logic HIGH.
5. Not 100% tested. Guaranteed by design.



Timing Conditions

(TA = 25°C Logic Levels are V_{DD} and V_{SS}) V_{DD} = 5V

A. Minimum Data Active Time Before Clock Pulse (Data Set-Up Time)..... 75 ns
B. Minimum Data Active Time After Clock Pulse (Data Hold Time) ..... 75 ns
C. Minimum Data Pulse Width ..... 150 ns
D. Minimum Clock Pulse Width..... 150 ns
E. Minimum Time Between Clock Activation and Strobe ..... 300 ns
F. Minimum Strobe Pulse Width..... 100 ns
G. Typical Time Between Strobe Activation and Output Transition..... 500 ns

SERIAL DATA present at the input is transferred to the shift register on the logic "0" to logic "1" transition of the CLOCK input pulse. On succeeding CLOCK pulses, the registers shift data information towards the SERIAL DATA OUTPUT. The SERIAL DATA must appear at the input prior to the rising edge of the CLOCK input waveform.

Information present at any register is transferred to its respective latch when the STROBE is high (serial-to-parallel conversion). The latches will continue to accept new data as long as the STROBE is held high. Applications where the latches are bypassed (STROBE tied high) will require that the ENABLE input be high during serial data entry.

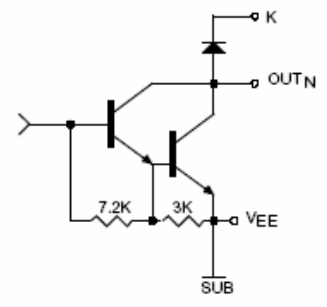
When the ENABLE input is high, all of the output buffers are disabled (OFF) without affecting information stored in the latches or shift register. With the ENABLE input low, the outputs are controlled by the state of the latches.

MIC5840 Family Truth Table

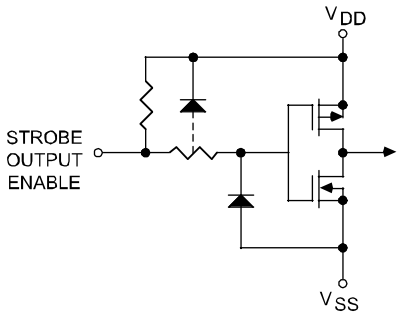
Serial Data Input	Clock Input	Shift Register Contents					Serial Data Output	Strobe Input	Latch Contents					Output Enable	Output Contents				
		I_1	I_2	I_3	…	I_8			I_1	I_2	I_3	…	I_8		I_1	I_2	I_3	…	I_8
H		H	R1	R2	…	R7	R7												
L		L	R1	R2	…	R7	R7												
X		R1	R2	R3	…	R8	R8												
		X	X	X	…	X	X	L	R1	R2	R3	…	R8						
		P1	P2	P3	…	P8	P8	H	P1	P2	P3	…	P8	L	P1	P2	P3	…	P8
									X	X	X	…	X	H	H	H	H	…	H

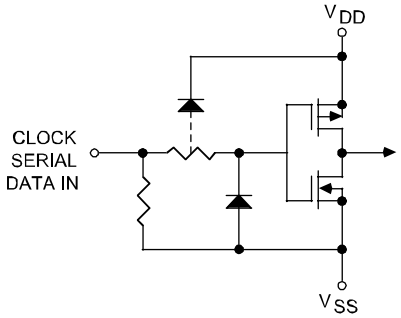
L = Low Logic Level
H = High Logic Level
X = Irrelevant
P = Present State
R = Previous State

Typical Output Driver



Typical Input Circuits





Maximum Allowable Duty Cycle (Plastic DIP)

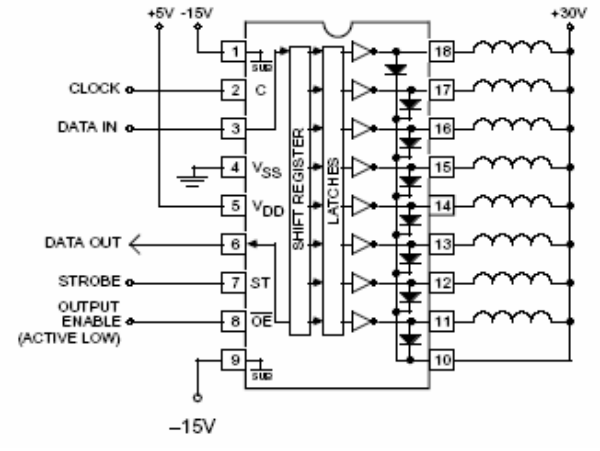
V_{DD} = 5.0V

Number of Outputs ON (I_{OUT} = 200mA V_{DD} = 5.0V)	Max. Allowable Duty Cycle at Ambient Temperature of				
	25ºC	40ºC	50ºC	60ºC	70ºC
8	85%	72%	64%	55%	46%
7	97%	82%	73%	63%	53%
6	100%	96%	85%	73%	62%
5	100%	100%	100%	88%	75%
4	100%	100%	100%	100%	93%
3	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%
1	100%	100%	100%	100%	100%

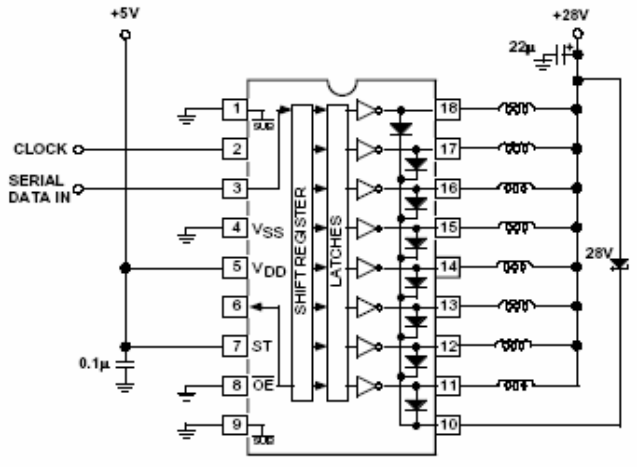
V_{DD} = 12V

Number of Outputs ON (I_{OUT} = 200mA V_{DD} = 12V)	Max. Allowable Duty Cycle at Ambient Temperature of				
	25ºC	40ºC	50ºC	60ºC	70ºC
8	80%	68%	60%	52%	44%
7	91%	77%	68%	59%	50%
6	100%	90%	79%	69%	58%
5	100%	100%	95%	82%	69%
4	100%	100%	100%	100%	86%
3	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%
1	100%	100%	100%	100%	100%

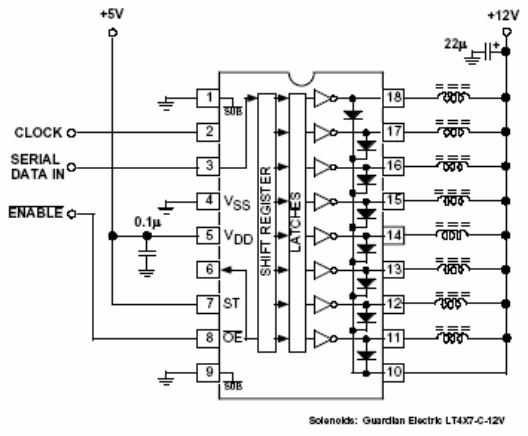
Typical Applications



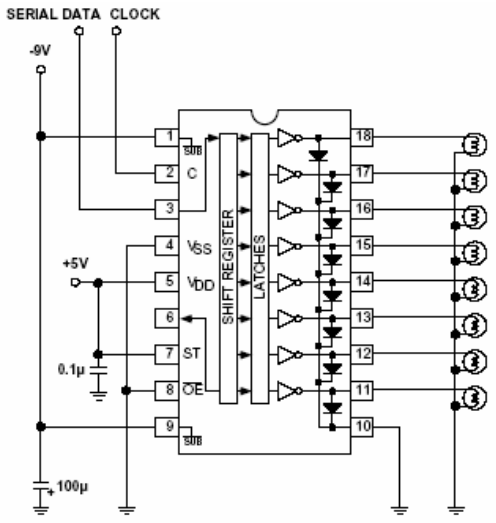
Relay/Solenoid Driver MIC5842



MIC5841 Hammer Driver

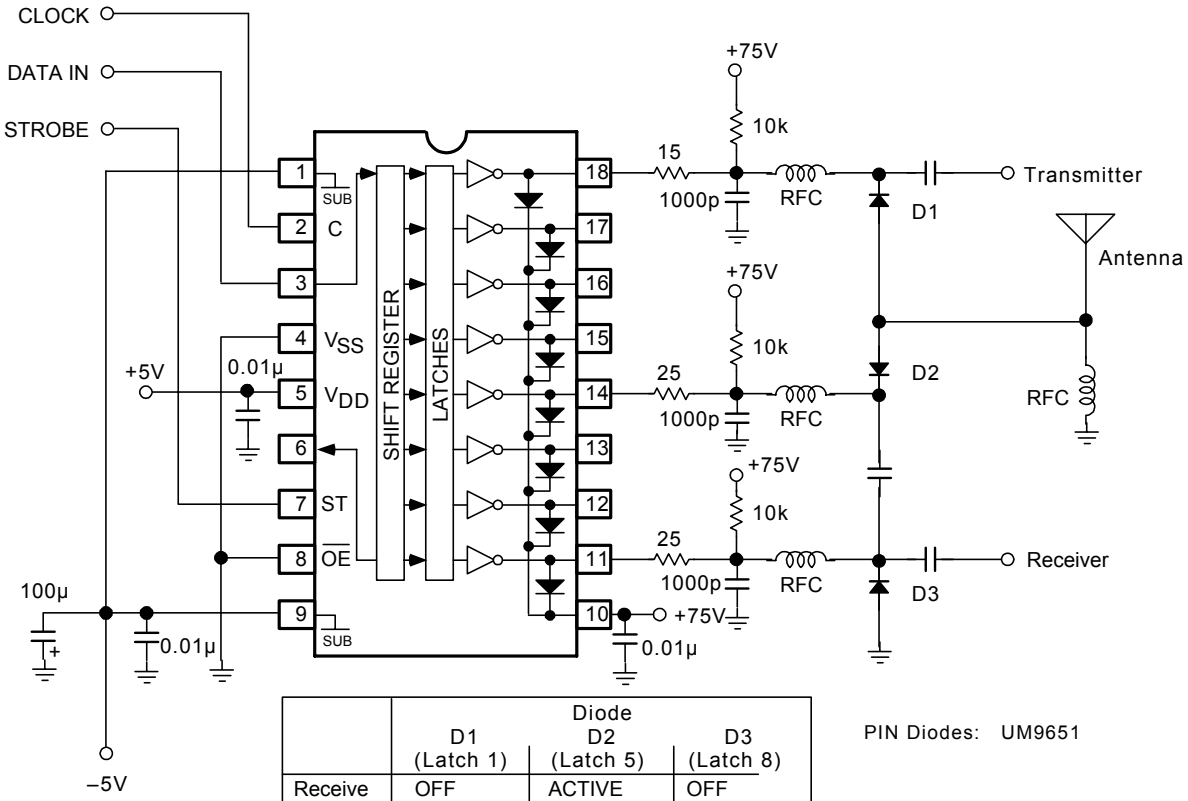


MIC5841 Solenoid Driver with Output Enable



MIC5841 Level Shifting Lamp Driver with Darlington Emitters Tied to a Negative Supply

Typical Applications, Continued



	Diode D1 (Latch 1)	D2 (Latch 5)	D3 (Latch 8)
Receive	OFF	ACTIVE	OFF
Transmit	ACTIVE	OFF	ACTIVE

PIN Diodes: UM9651

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