

## 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 500 mA 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.

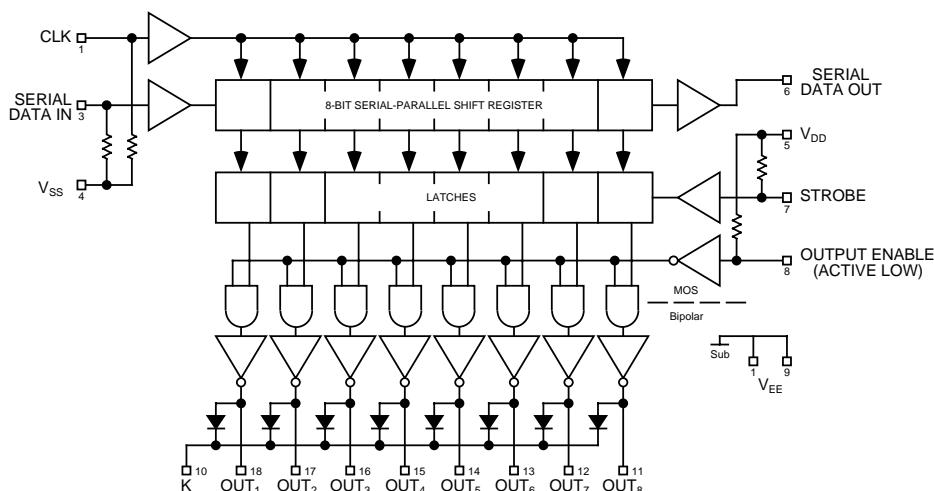
## Features

- 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

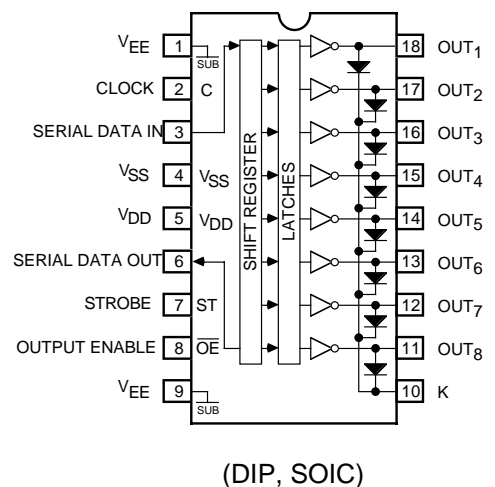
## Ordering Information

Part Number	Temperature Range	Package
MIC5841BN	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	18-Pin Plastic DIP
MIC5841BV	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	20-Pin PLCC
MIC5841BWM	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	18-Pin Wide SOIC
MIC5842BN	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	18-Pin Plastic DIP
MIC5842BV	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	20-Pin PLCC
MIC5842BWM	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	18-Pin Wide SOIC

## Functional Diagram

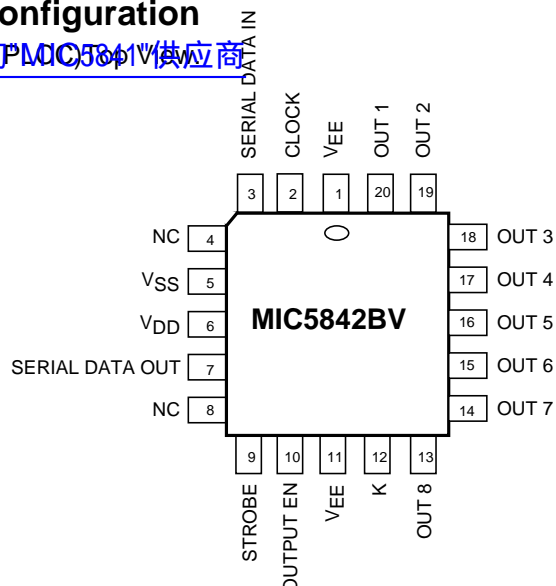


## Pin Configuration



## Pin Configuration

(20-Pin PDIP, 30-Pin VSSOP)



## Absolute Maximum Ratings (Note 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) (Note 1)	35V
(MIC5842)	50V
Logic Supply Voltage, $V_{DD}$	15V
$V_{DD}$ 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, $P_D$ (Note 2)	1.82W
Operating Temperature Range, $T_A$	-55°C to +85°C
Storage Temperature Range, $T_S$	-65°C to +150°C

Note 1: For Inductive load applications.

Note 2: Derate at the rate of 18.2mW/°C above  $T_A = 25^\circ C$  (Plastic DIP)

Note 3: CMOS devices have input-static protection but are susceptible to damage when exposed to extremely high static electrical charges.

## Electrical Characteristics at $T_A = 25^\circ C$ , $V_{DD} = 5V$ , $V_{SS} = V_{EE} = 0V$ (unless otherwise noted)

Characteristic	Symbol	Applicable Devices	Test Conditions	Limits		
				Min.	Max.	Unit
Output Leakage Current	$I_{CEX}$	MIC5841	$V_{OUT} = 50V$		50	$\mu A$
			$V_{OUT} = 50V, T_A = +70^\circ C$		100	
		MIC5842	$V_{OUT} = 80V$		50	
			$V_{OUT} = 80V, T_A = +70^\circ C$		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 Sustaining Voltage	$V_{CE(SUS)}$ (Note 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		
			$V_{DD} = 5.0V$ (See Note 4)	3.5		
Input Resistance	$R_{IN}$	Both	$V_{DD} = 12V$	50		$k\Omega$
			$V_{DD} = 10V$	50		
			$V_{DD} = 5.0V$	50		
Supply Current	$I_{DD(ON)}$	Both	All Drivers ON, $V_{DD} = 12V$		16	mA
			All Drivers ON, $V_{DD} = 10V$		14	
			All Drivers ON, $V_{DD} = 5.0V$		8.0	
	$I_{DD(OFF)}$	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	$\mu A$
		MIC5842	$V_R = 80V$		50	
Clamp Diode Forward Voltage	$V_F$	Both	$I_F = 350mA$		2.0	V

Note 4: Operation of these devices with standard TTL may require the use of appropriate pull-up resistors to insure an input logic HIGH.

Note 5: Not 100% tested. Guaranteed by design.

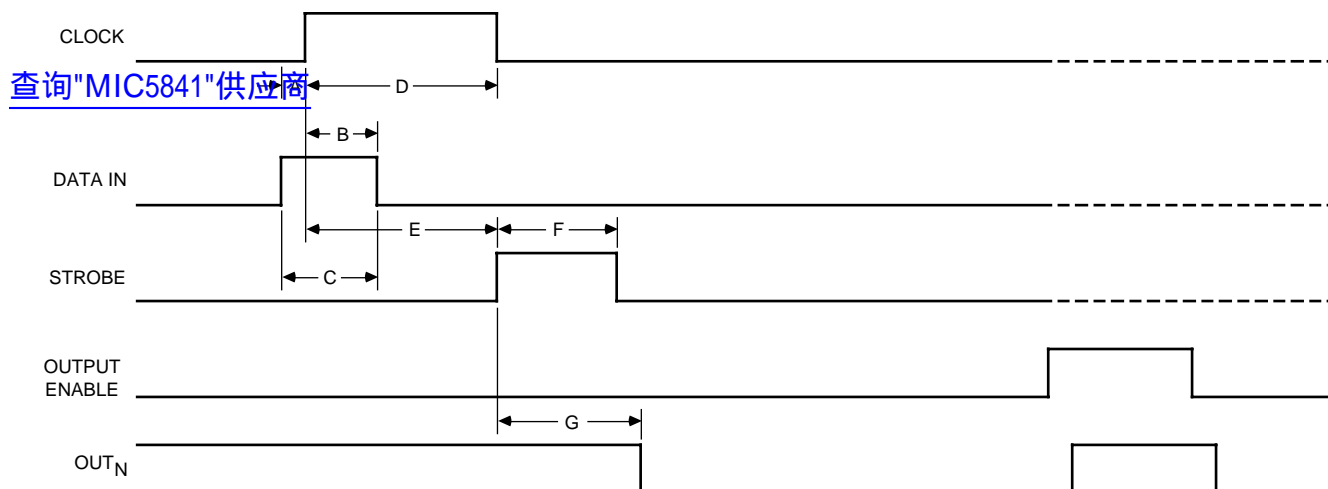
# Electrical Characteristics $T_A = -55^{\circ}\text{C}$ , $V_{DD} = 5\text{V}$ , $V_{SS} = V_{EE} = 0\text{V}$ (unless otherwise noted)

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

# Electrical Characteristics $T_A = +125^{\circ}\text{C}$ , $V_{DD} = 5\text{V}$ , $V_{SS} = V_{EE} = 0\text{V}$ (unless otherwise noted)

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



## Timing Conditions

( $T_A = 25^\circ\text{C}$  Logic Levels are  $V_{DD}$  and  $V_{SS}$ )

$V_{DD} = 5\text{V}$

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.

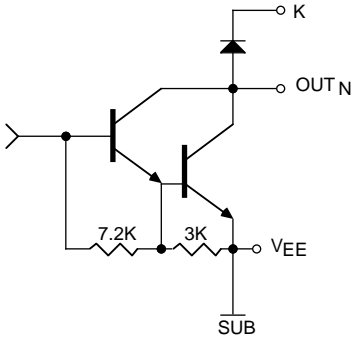
## MIC5840 Family Truth Table

Serial Data Input	Clock Input	Shift Register Contents					Serial Data Output	Strobe Input	Latch Contents					Output Enable	Output Contents				
		I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	.....	I <sub>8</sub>			I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	.....	I <sub>8</sub>		O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	.....	O <sub>8</sub>
H		H	R <sub>1</sub>	R <sub>2</sub>	.....	R <sub>7</sub>	R <sub>7</sub>												
L		L	R <sub>1</sub>	R <sub>2</sub>	.....	R <sub>7</sub>	R <sub>7</sub>												
X		R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	.....	R <sub>8</sub>	R <sub>8</sub>												
		X	X	X	.....	X	X	L	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	.....	R <sub>8</sub>						
		P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	.....	P <sub>8</sub>	P <sub>8</sub>	H	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	.....	P <sub>8</sub>	L	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	.....	P <sub>8</sub>
									X	X	X	.....	X	H	H	H	.....	H	

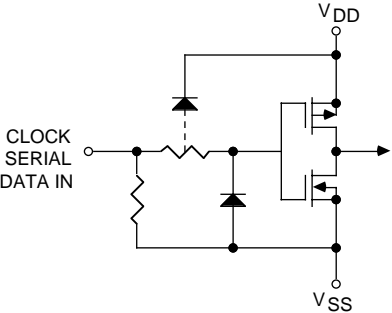
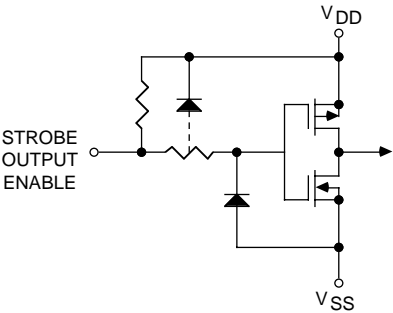
L = Low Logic Level  
H = High Logic Level  
X = Irrelevant  
P = Present State  
R = Previous State

Typical Output Driver

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Typical Input Circuits



Maximum Allowable Duty Cycle (Plastic DIP)

V<sub>DD</sub> = 5.0V

Number of Outputs ON (I <sub>OUT</sub> = 200mA V <sub>DD</sub> = 5.0V)	Max. Allowable Duty Cycle at Ambient Temperature of				
	25°C	40°C	50°C	60°C	70°C
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%

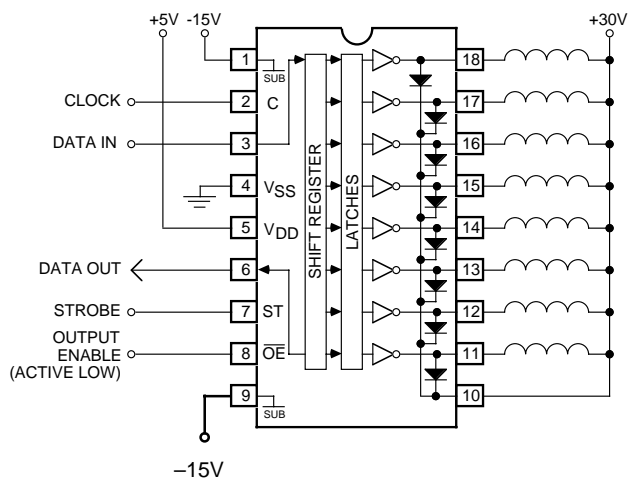
V<sub>DD</sub> = 12V

Number of Outputs ON (I <sub>OUT</sub> = 200mA V <sub>DD</sub> = 12V)	Max. Allowable Duty Cycle at Ambient Temperature of				
	25°C	40°C	50°C	60°C	70°C
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%

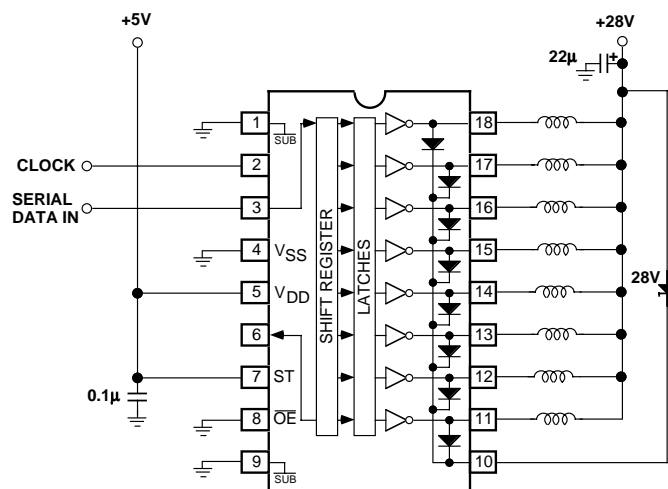
## Typical Applications

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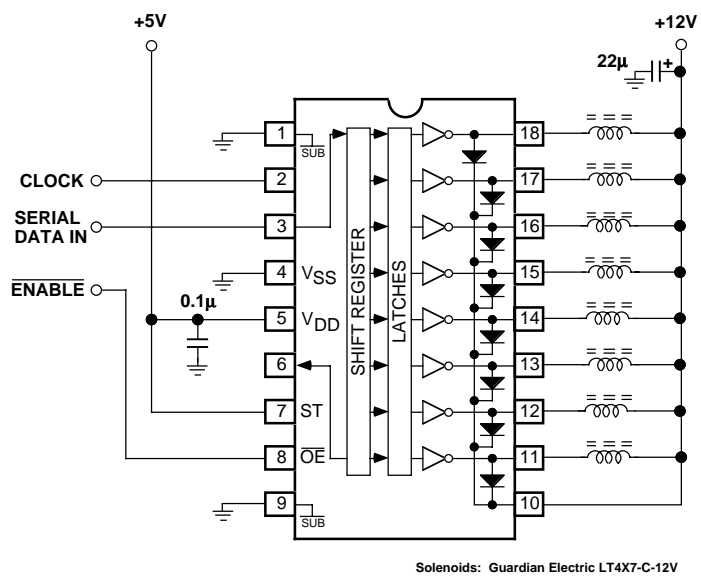
**Relay/Solenoid Driver  
MIC5842**



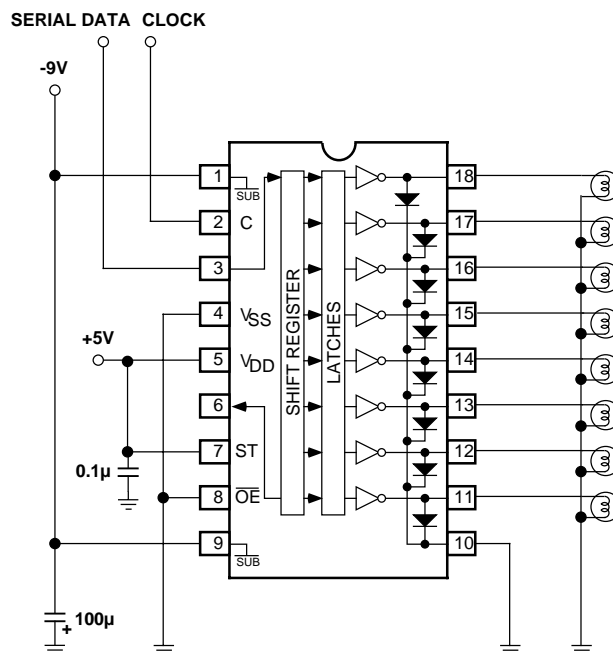
**MIC5841 Hammer Driver**



**MIC5841 Solenoid Driver with Output Enable**



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



Typical Applications, Continued

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MIC5842 Negative/Positive Supply PIN Diode Driver Transmit/Receive Switch

