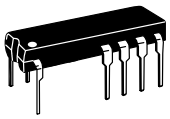
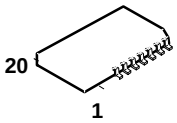
CS8190

Precision Air-Core Tach/Speedo Driver with Return to Zero

The CS8190 is specifically designed for use with air−core meter movements. The IC provides all the functions necessary for an analog tachometer or speedometer. The CS8190 takes a speed sensor input and generates sine and cosine related output signals to differentially drive an air−core meter.

Many enhancements have been added over industry standard tachometer drivers such as the CS289 or LM1819. The output utilizes differential drivers which eliminates the need for a zener reference and offers more torque. The device withstands 60 V transients which decreases the protection circuitry required. The device is also more precise than existing devices allowing for fewer trims and for use in a speedometer.





PDIP−16
NF SUFFIX
CASE 648

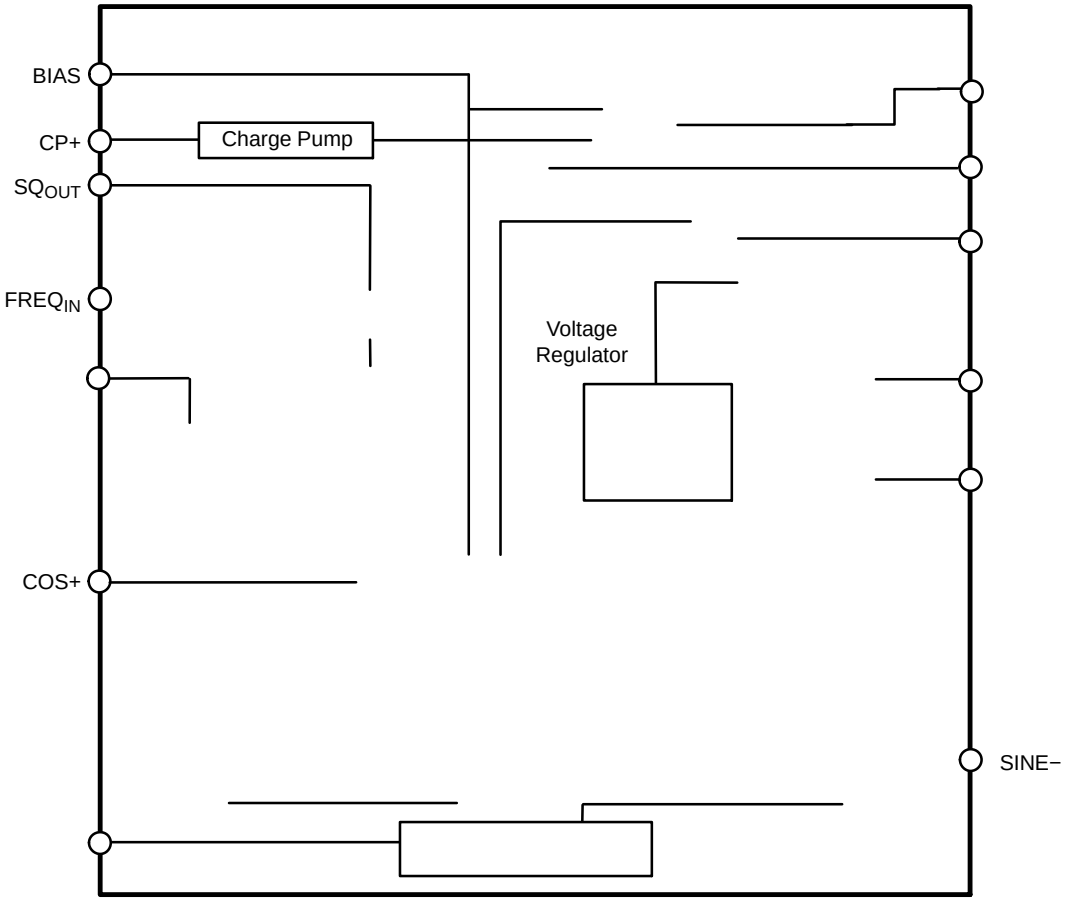
PDIP−16

SO−20W

A = Assembly Location
WL = Wafer Lot

Features

- Direct Sensor Input
- High Output Torque
- Low Pointer Flutter
- High Input Impedance
- Overvoltage Protection
- Return to Zero
- Internally Fused Leads in PDIP−16 and SO−20W Packages
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant


BIAS
CP+
Charge Pump
SQOUT
FREQIN
Voltage
Regulator
COS+
SINE−

ELECTRICAL CHARACTERISTICS ($-40°C \le T_A \le 85°C$, $8.5\ V \le V_{CC} \le 15\ V$, unless otherwise specified.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
SUPPLY VOLTAGE SECTION					
I_{CC} Supply Current	V_{CC} = 16 V, −40°C, No Load	−	50	125	mA
V_{CC} Normal Operation Range	−	8.5	13.1	16	V
INPUT COMPARATOR SECTION					
Positive Input Threshold	−	1.0	2.0	3.0	V
Input Hysteresis	−	200	500	−	mV
Input Bias Current (Note 3)	$0\ V \le V_{IN} \le 8.0\ V$	−	−10	−80	μA
Input Frequency Range	−	0	−	20	kHz
Input Voltage Range	in series with 1.0 kΩ	−1.0	−	V_{CC}	V
Output V_{SAT} (SQ_{OUT})	I_{CC} = 10 mA	−	0.15	0.40	

TYPICAL PERFORMANCE CHARACTERISTICS

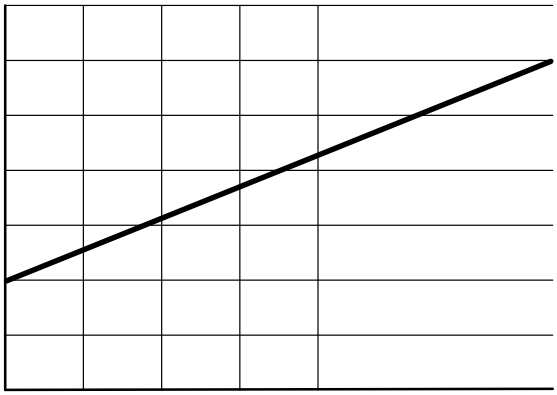


Table 1. Function Generator Output Nominal Angle vs. Ideal Angle (After Calibrating at 270°)

Ideal θ Degrees	Nominal θ Degrees	Ideal θ Degrees	Nominal θ Degrees	Ideal θ Degrees	Nominal θ Degrees	Ideal θ Degrees	Nominal θ Degrees	Ideal θ Degrees	Nominal θ Degrees	Ideal θ Degrees	Nominal θ Degrees
0	0	17	17.98	34	33.04	75	74.00	160	159.14	245	244.63
1	1.09	18	18.96	35	34.00	80	79.16	165	164.00	250	249.14
2	2.19	19	19.92	36	35.00	85	84.53	170	169.16	255	254.00
3	3.29	20	20.86	37	36.04	90	90.00	175	174.33	260	259.16
4	4.38	21	21.79	38	37.11	95	95.47	180	180.00	265	264.53
5	5.47	22	22.71	39	38.21	100	100.84	185	185.47	270	270.00
6	6.56	23	23.61	40	39.32	105	106.00	190	190.84	275	275.47
7	7.64	24	24.50	41	40.45	110	110.86	195	196.00	280	280.84
8	8.72	25	25.37	42	41.59	115	115.37	200	200.86	285	286.00
9	9.78	26	26.23	43	42.73	120	119.56	205	205.37	290	290.86
10	10.84	27	27.07	44	43.88	125	124.00	210	209.56	295	295.37
11	11.90	28	27.79	45	45.00	130	129.32	215	214.00	300	299.21
12	12.94	29	28.73	50	50.68	135	135.00	220	219.32	305	303.02
13	13.97	30	29.56	55	56.00	140	140.68	225	225.00		
14	14.99	31	30.39	60	60.44	145	146.00	230	230.58		
15	16.00	32	31.24	65	64.63	150	150.44	235	236.00		
16	17.00	33	32.12	70	69.14	155	154.63	240	240.44		

Note: Temperature, voltage and nonlinearity not included.

CIRCUIT DESCRIPTION and APPLICATION NOTES

The CS8190 is specifically designed for use with air−core meter movements. It includes an input comparator for sensing an input signal from an ignition pulse or speed sensor, a charge pump for frequency to voltage conversion, a bandgap voltage regulator for stable operation, and a function generator with sine and cosine amplifiers to differentially drive the meter coils.

From the partial schematic of Figure 7, the input signal is applied to the $FREQ_{IN}$ lead, this is the input to a high impedance comparator with a typical positive input threshold of 2.0 V and typical hysteresis of 0.5 V. The output of the comparator, SQ_{OUT}, is applied to the charge pump input CP+ through an external capacitor C_{CP}. When the input signal changes state, C_{CP} is charged or discharged through R3 and R4. The charge accumulated on C_{CP} is mirrored to C4 by the Norton Amplifier circuit comprising of Q1, Q2 and Q3. The charge pump output voltage, F/V_{OUT}, ranges from 2.0 V to 6.3 V depending on the input signal frequency and the gain of the charge pump according to the formula:

$$F/V_{OUT} = 2.0\ V + 2.0 \times FREQ \times C_{CP} \times R_T \times (V_{REG} - 0.7\ V)$$

R_T is a potentiometer used to adjust the gain of the F/V output stage and give the correct meter deflection. The F/V output voltage is applied to the function generator which generates the sine and cosine output voltages. The output ges. ThiTD-.008 92.6929 140.20applied rter used to adjust the7c46()TjETq59.301 147.572 23.8 2to the function generator Ts 0 0 8 2-.295

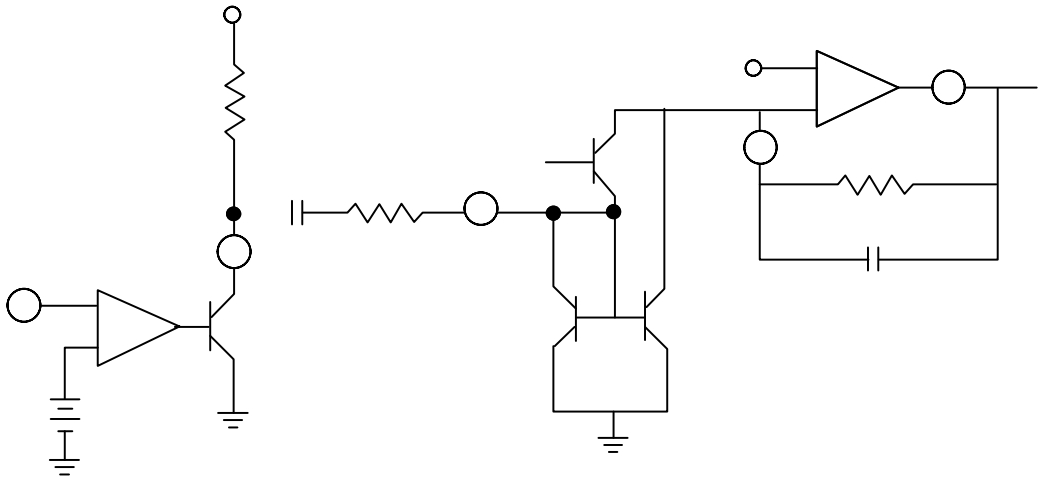
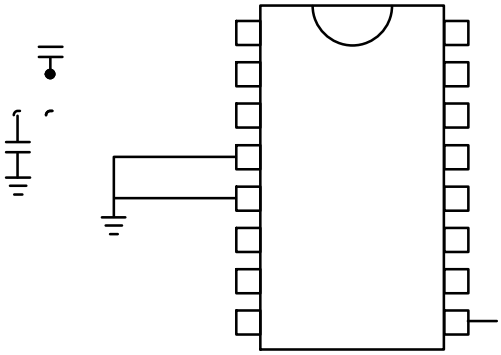
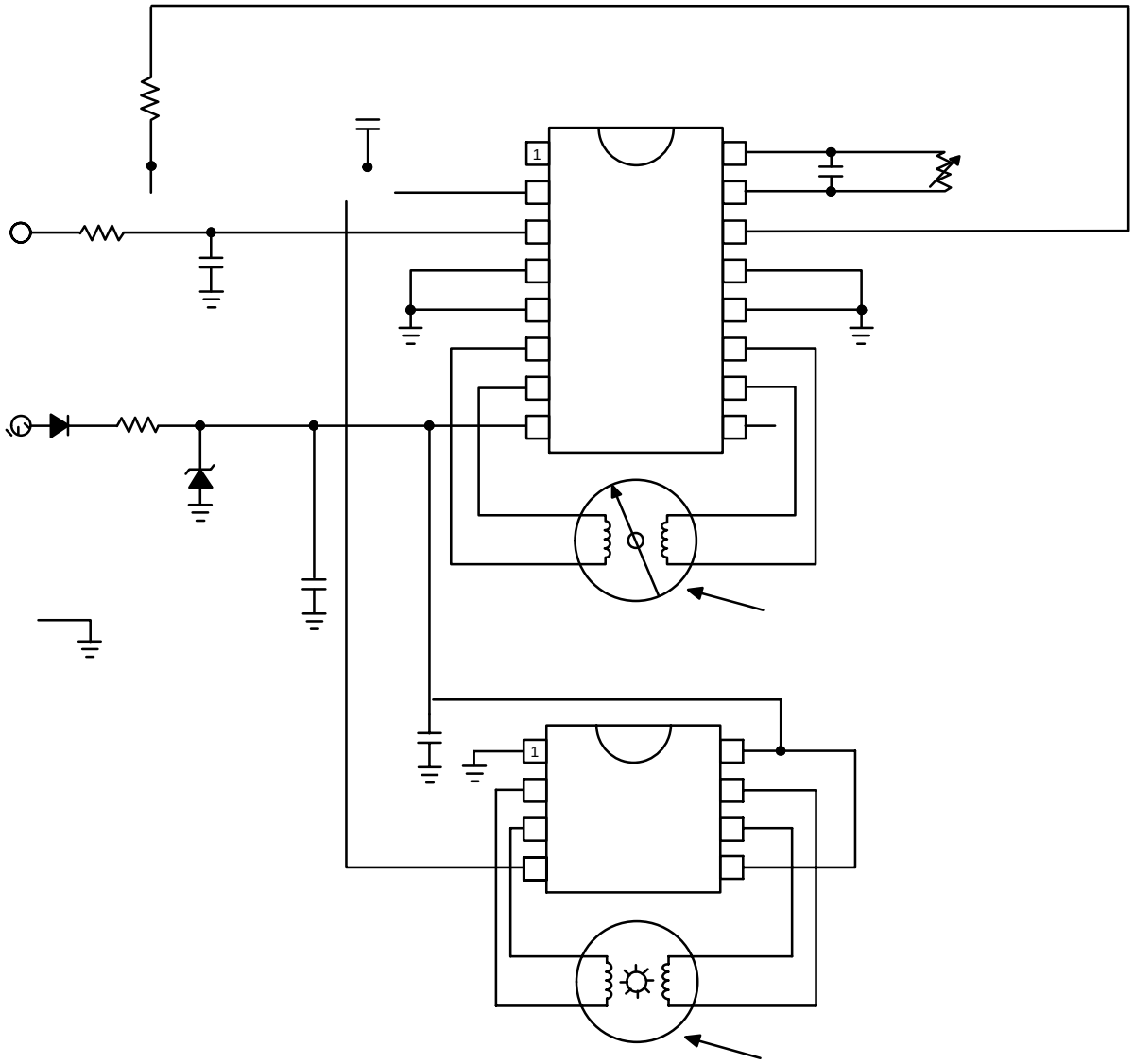


Figure 7. Partial Schematic of Input and Charge Pump

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In some cases a designer may wish to use the CS8190 only as a driver for an air−core meter having performed the F/V conversion elsewhere in the circuit.

Figure 11 shows how to drive the CS8190 with a DC voltage ranging from 2.0 V to 6.0 V. This is accomplished by forcing a voltage on the F/V_{OUT} lead. The alternative scheme shown in Figure 12 uses an external op amp as a buffer and operates over an input voltage range of 0 V to 4.0 V.

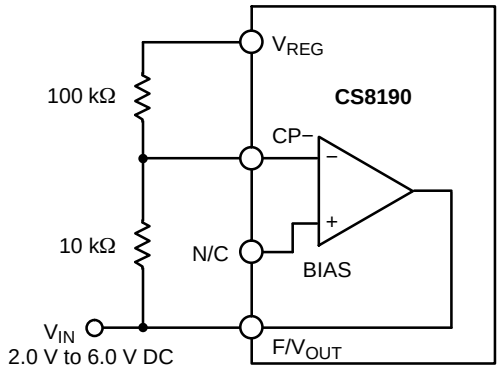


Figure 11. Driving the CS8190 from an External DC Voltage

Figures 11 and 12 are not temperature compensated.

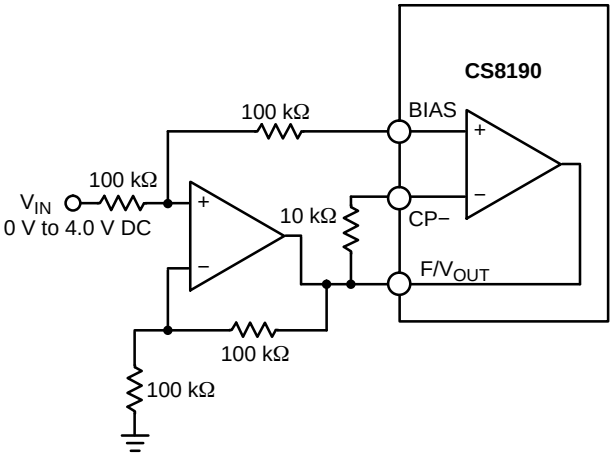


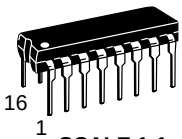
Figure 12. Driving the CS8190 from an External DC Voltage Using an Op Amp Buffer

PACKAGE THERMAL DATA

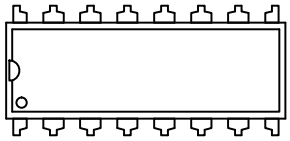
Parameter		PDIP−16	SO−20W	Unit
$R_{\theta JC}$	Typical	15	9	°C/W
$R_{\theta JA}$				

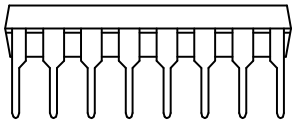
PDIP−16
CASE 648−08
ISSUE V

DATE 22 APR 2015



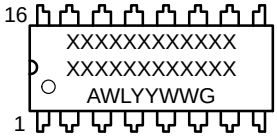
SCALE 1:1





STYLE 1:

GENERIC
MARKING DIAGRAM*



XXXXX	= Specific Device Code
A	= Assembly Location
WL	= Wafer Lot
YY	= Year
WW	= Work Week
G	= Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

SOIC−20 WB
CASE 751D−05
ISSUE H

DATE 22 APR 2015