Low Noise, Low Distortion Sine Wave Generator for Testing ADC Demo Boards

DESCRIPTION

Demonstration circuit 1858A is a low noise, low distortion sine wave generator designed to be used in conjunction with Linear Technology 16-bit and 18-bit ADC demo boards.

Functionally, this board uses a Wien bridge oscillator that has been level shifted to match the input range of 0V to 5V 16-bit and 18-bit Linear Technology ADC demo boards. The default oscillator output level is 0.5V to 4.5V. The output frequency is 2kHz. The output level and frequency can be adjusted by changing a few resistors and capacitors. For additional frequencies and output levels see Tables 1 and 2. For a detailed description of this oscillator see AN132. The DC1858A has 5V and ±12V outputs that can be used to provide power for the ADC demo board under test and the DC1216A low jitter clock source if required. The DC1858A combined with the DC1216A, an ADC demo board and a high speed USB controller (DC718 or DC890) form a complete ADC evaluation system when used with LTC's PScope™ software.

Design files for this circuit board are available at http://www.linear.com/demo

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BOARD PHOTO

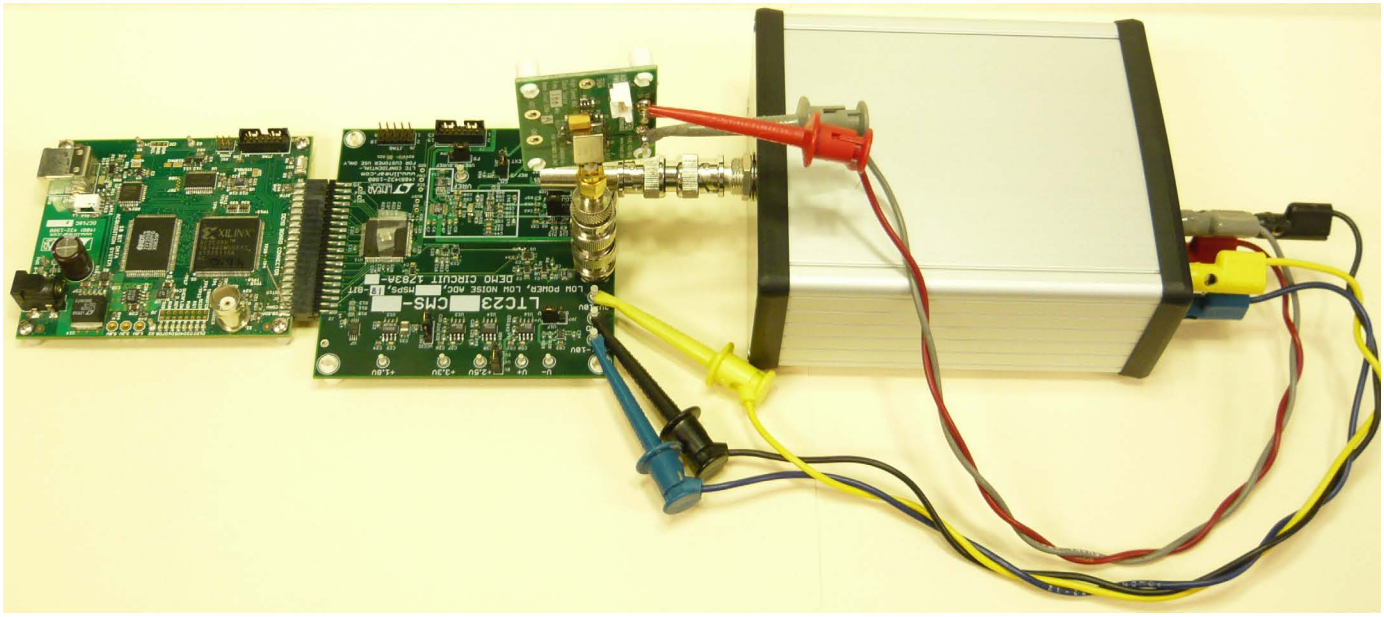


Figure 1. DC1858A Typical Connection Diagram

QUICK START PROCEDURE

Use the connection diagram of Figure 1. Connect the ADC demo board to a DC718 or DC890 USB high speed data collection board (DC718 or DC890 will be determined by the ADC demo board being tested). Then, connect the DC718 or DC890 to a host PC with a standard USB A/B cable. Apply ±12V from the DC1858A power outputs (see Figure 2) to the plus or ±terminals of the ADC demo board as required. Connect the SINE OUT (see Figure 3) of the DC1858A to the analog input of the ADC demo board. (The SINE OUT output is designed to drive a high impedance input. Do not use this to drive 50Ω inputs.) Connect a low jitter clock to the clock input of the demo board. DC1858A has a 5V output supply available to power the DC1216A low jitter clock source if desired. (See Figure 1 for connection diagram. A twisted pair or shielded cable from the DC1858A to the DC1216A power pins is recommended to minimize interference from the AC adapter.) Plug in the provided AC adapter.

Download and run the PScope software from www.linear.com/designtools/software.

Complete software documentation is available from the Help menu. Updates can be downloaded from the Tools menu. Check for updates periodically as new features may be added.

The PScope software should recognize the ADC demo board and configure itself automatically.

Set the sample rate in Msps to what is appropriate for the ADC used. The sample size should be set to 32768 for 16-bit ADCs or 131072 for 18-bit ADCs and above. If synchronous sampling is not used set the window to BIkmn-Harris 92dB, otherwise select None. Sample rate, sample size and window are located in the right hand center section of the PScope window.

Click the Collect button to begin acquiring data. The Collect button then changes to Pause, which can be clicked to stop data acquisition. F1 should read approximately 2kHz and F1 amplitude should read approximately –1dBFS. To get the best SNR performance it is recommended to turn on power averaging. The power averaging (MAVG) button is located at the top of the PScope window. Remember that to calculate the true SNR, the F1 amplitude has to be added back to the SNR that PScope displays.

IF THE OSCILLATOR DOESN'T START

Use the supplied non-conductive screwdriver to adjust the potentiometer through the opening in the box until a steady 2kHz sine wave with an amplitude of approximately 4.5V_{P-P} is observed. The oscillator has three states, normal oscillation, oscillation with modulated amplitude, and no oscillation. It takes only a small change in the potentiometer to go through all three states so adjust the potentiometer slowly.



Figure 2. DC1858A Rear Panel



Figure 3. DC1858A Front Panel

QUICK START PROCEDURE

Table 1. Amplitude and Offset Options for DC1858A (SNR and THD Taken at f_{OSC} = 2kHz)

ADC FS Range (V)	R22 (kΩ)	R18 (kΩ)	C11 (µF)	Sine Out (V_{P-P})	Offset (V)	SNR (dB)*	THD (dB)*
0 to 2.5	14	36.5	0.47	2.25	1.25	100	–119
0.5 to 4.5	22.6	12.1	0.47	3.6	2.5	103	–121
0 to 4.096	23.2	17.4	0.47	3.7	2.048	103	–121
0 to 5	28	12.1	0.47	4.5	2.5	104	–118
±2.5	28	∞	0.47	4.5	0	104	–119
±5	56.2	∞	0.47	9	0	107	–117
±10	118	∞	0.1	18	0	100	–107

*SNR and THD measurements made with Stanford Research Model SR1 Audio Analyzer.

Table 2. Frequency Options for DC1858A (SNR and THD Taken at SINE OUT = 4.5V_{P-P}, Offset = 2.5V)

f_{OSC} (kHz)	R1 = R8 (kΩ)	C10 (µF)	C11 (µF)	SNR (dB)*	THD (dB)*
2	7.87	0.0068	0.47	104	–118
5	3.16	0.0022	0.22	102	–112
10	1.58	0.0012	0.1	102	–112
20	0.787	0.00068	0.047	101	–117

Use 1% metal film resistors and mylar or silver mica capacitors when making modifications, to maintain the low noise, low distortion performance of this demo board.

*SNR and THD measurements made with Stanford Research Model SR1 Audio Analyzer.

QUICK START PROCEDURE

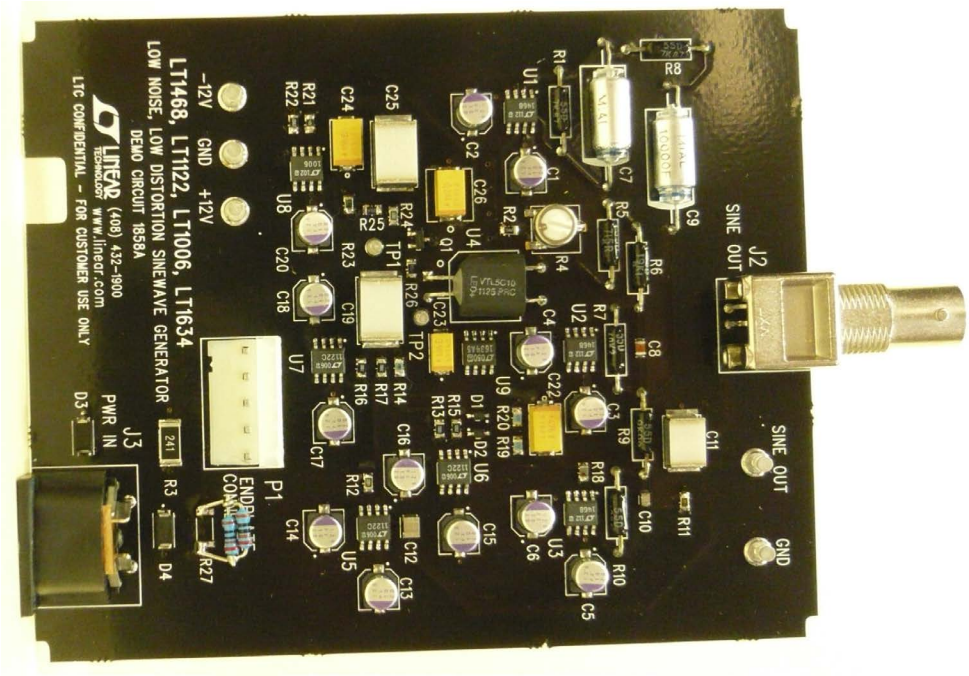


Figure 4. DC1858A PC Board

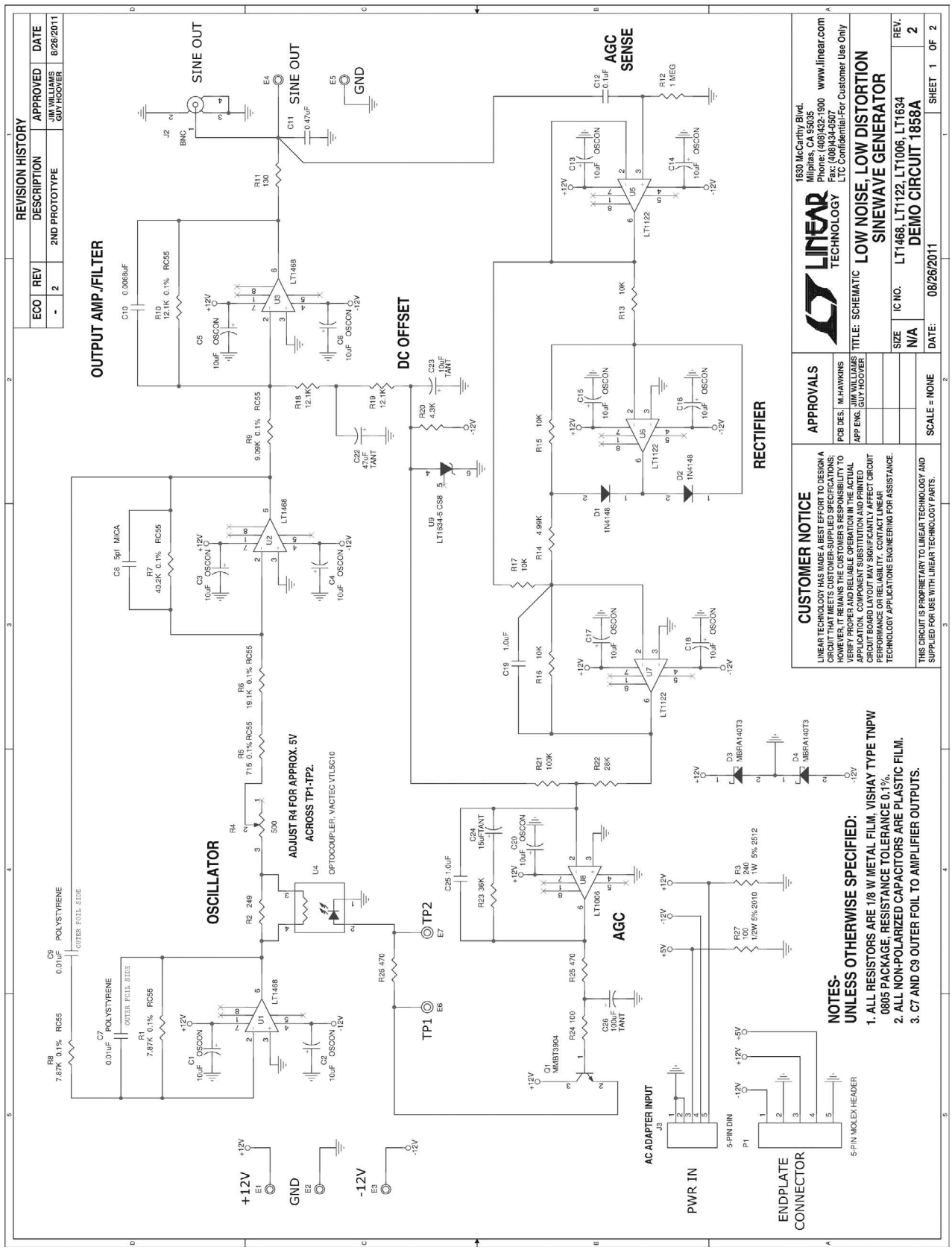
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	13	C1 TO C6, C13 TO C18, C20	CAP, OSCON, 10µF 20V 20% SMT	SANYO, 20SVPA10M
2	2	C7, C9	CAP, POLYSTYRENE, 0.01µF, 33V 1% AXIAL LEAD	CENTRALAB, 14OMFD33V-J
3	1	C8	CAP, MICA CHIP, 5pF, 100V ±0.5PF 0805	CDE, MC08CA050D-F
4	1	C10	CAP, PPS FILM, 0.0068µF, 16V 5% 0805	PANASONIC, ECHU1C682JX5
5	1	C11	CAP, PLASTIC FILM, 0.47µF, 100V 10% 3022	PANASONIC, ECWU1474KCV
6	1	C12	CAP, PLASTIC FILM, 0.1µF, 16V 5% 1210	PANASONIC, ECHU1C104JX5
7	2	C19, C25	CAP, PLASTIC FILM, 1.0µF, 100V 10% 3925	PANASONIC, ECWU1105KCV
8	1	C22	CAP, TANT, 47µF 35V 20% 7343	KEMET, T495X476K035ATE300/AVX, TAJE476M035RNJ
9	1	C23	CAP, TANT, 10µF 25V 10% 6032	AVX, TAJC106K025RNJ
10	1	C24	CAP, TANT, 15µF 25V 10% 7343	AVX, TAJD156K025RNJ
11	1	C26	CAP, TANT, 100µF 20V 20% 7361	AVX, TPSE107M020R0200/TPSV107M020R0085
12	2	D1, D2	DIODE, SMALL SIGNAL, SOD323	DIODES INC, 1N4148WS-7-F
13	2	D3, D4	DIODE, SCHOTTKY, 40V 1A SMA	ON SEMI, MBRA140T3G
14	5	E1, E2, E3, E4, E5	TESTPOINT, TURRET, 0.094, PBF	MILL MAX, 2501-2-00-80-00-00-07-0
15	2	E6, E7	TEST POINT, TURRET, 0.061	MILL MAX, 2308-2-00-80-00-00-07-0
16	1	J1	CONN RCPT HOUSING 5POS 3.96MM	MOLEX, 09-50-1051
17	1	J2	CON, BNC 50Ω, JACK, RIGHT ANGLE PCB MOUNT	MOLEX, 731385033
18	1	J3	CONNECTOR, 5-PIN DIN, RIGHT ANGLE PCB, 180 DEG	CUI, SDS-50J
19	1	J4	CONN, JACK BANANA INSUL NYLON VIOLET	EMERSON NETWORK, 108-0912-001
20	1	J5	CONN, JACK BANANA INSUL NYLON BLACK	EMERSON NETWORK, 108-0903-001
21	1	J6	CONN, JACK BANANA INSUL NYLON YELLOW	EMERSON NETWORK, 108-0907-001
22	1	J7	CONN, JACK BANANA INSUL NYLON RED	EMERSON NETWORK, 108-0902-001
23	1	P1	HEADER, 5 PIN, 0.156, LOCKING	MOLEX, 09-65-2058
24	1	Q1	TRANS, GP, 40V, 200mA, SOT-23	ON SEMI, MMBT3904LT1G
25	2	R1, R8	RES, METAL FILM, 7.87k, 1/4W, 0.1% RC55	IRC, RC55LF-D-7K87-B-B
26	1	R2	RES, METAL FILM, 249Ω, 1/8W, 0.1% 0805	VISHAY, TNPW0805249RBEEA
27	1	R3	RES, CHIP, 240Ω, 1W, 5% 2512	PANASONIC, ERJ-1TYJ241U
28	1	R4	TRIMPOT, SEALED, 500Ω, CERMET, SMT	BOURNS, 3361P-1-501GLF rl
29	1	R5	RES, METAL FILM, 715Ω, 1/4W, 0.1% RC55	IRC, RC55LF-D-715R-B-B
30	1	R6	RES, METAL FILM, 19.1k, 1/4W, 0.1% RC55	IRC, RC55LF-D-19K1-B-B
31	1	R7	RES, METAL FILM, 40.2k, 1/4W, 0.1% RC55	IRC, RC55LF-D-40K2-B-B
32	1	R9	RES, METAL FILM, 9.09k, 1/4W, 0.1% RC55	IRC, RC55LF-D-9K09-B-B
33	1	R10	RES, METAL FILM, 12.1k, 1/4W, 0.1% RC55	IRC, RC55LF-D-12K1-B-B
34	1	R11	RES, METAL FILM, 130Ω, 1/8W, 0.1% 0805	VISHAY, TNPW0805130RBEEA
35	1	R12	RES, METAL FILM, 1M, 1/8W, 0.1% 0805	VISHAY, TNPW08051M00BEEA
36	4	R13, R15 TO R17	RES, METAL FILM, 10k, 1/8W, 0.1% 0805	VISHAY, TNPW080510K0BEEA
37	1	R14	RES, METAL FILM, 4.99k, 1/8W, 0.1% 0805	VISHAY, TNPW08054K99BEEA
38	2	R18, R19	RES, METAL FILM, 12.1k, 1/8W, 0.1% 0805	VISHAY, TNPW080512K1BEEA

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
39	1	R20	RES, METAL FILM, 4.3k, 1/8W, 0.1% 0805	PANASONIC, ERA-6AEB432V
40	1	R21	RES, METAL FILM, 100k, 1/8W, 0.1% 0805	VISHAY, TNPW0805100KBEEA
41	1	R22	RES, METAL FILM, 28k, 1/8W, 0.1% 0805	VISHAY, TNPW080528K0BEEA
42	1	R23	RES, METAL FILM, 36k, 1/8W, 0.1% 0805	VISHAY, TNPW080536K0BEEA
43	1	R24	RES, METAL FILM, 100Ω, 1/8W, 0.1% 0805	VISHAY, TNPW0805100RBEEA
44	2	R25, R26	RES, METAL FILM, 470Ω, 1/8W, 0.1% 0805	VISHAY, TNPW0805470RBEEA
45	1	R27	RES, CHIP, 100Ω, 0.5W, 5% 2010	ROHM, MCR50JZHJ101/VISHAY, CRCW2010100RJNEA
46	3	U1, U2, U3	IC, OP-AMP, 90MHz, SO-8	LINEAR TECHNOLOGY, LT1468CS8#PBF
47	1	U4	OPTOCOUPLER, ANALOG, AXIAL	VACTEC, VTL5C10
48	3	U5, U6, U7	IC, OP-AMP, JFET, SO-8	LINEAR TECHNOLOGY, LT1122CS8#PBF
49	1	U8	IC, OP-AMP, PRECISION, SO-8	LINEAR TECHNOLOGY, LT1006CS8#PBF
50	1	U9	IC, MICROPOWER REFERENCE, 5V, SOIC	LINEAR TECHNOLOGY, LT1634ACS8-5#PBF
51	5		TERMINAL, 18-24 AWG CRIMP FEMALE TIN, BAG	MOLEX, 08-70-1030
52	1		BOX, ALUM. 4.72 x 4.06 x 2.09" BL/NAT	HAMMOND, 1455N1201
53	2		SCREWS, THREAD-FORMING PHILLIPS PANHEAD, M2 x 0.4mm x 6mm LENGTH	GRAINGER, ITEM #1PU17
54	1		ALIGNMENT TOOL	PHILMORE, # 63-8608
55	1		AC ADAPTOR POWER SUPPLY W/ PSE MARKING AND 5 PIN 180 DEG DIN CONNECTOR OUTPUT	ETA-USA, DTA27-3X-W-5

SCHEMATIC DIAGRAM



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