

Low Noise Single-Ended to Differential Amplifier  
 SAR ADC Driver

## DESCRIPTION

Demonstration Circuit 1538A supports the LT6350, a Low Noise Single Ended to Differential Amplifier / SAR ADC Driver. The LT6350 contains an un-dedicated open-loop “Opamp1”, and a dedicated inverting “Opamp2” in a gain of -1. Opamp1 has Rail to Rail inputs and output. Opamp2 has a Rail to Rail output. See Figure 1.

**Design files for this circuit board are available. Call the LTC factory.**

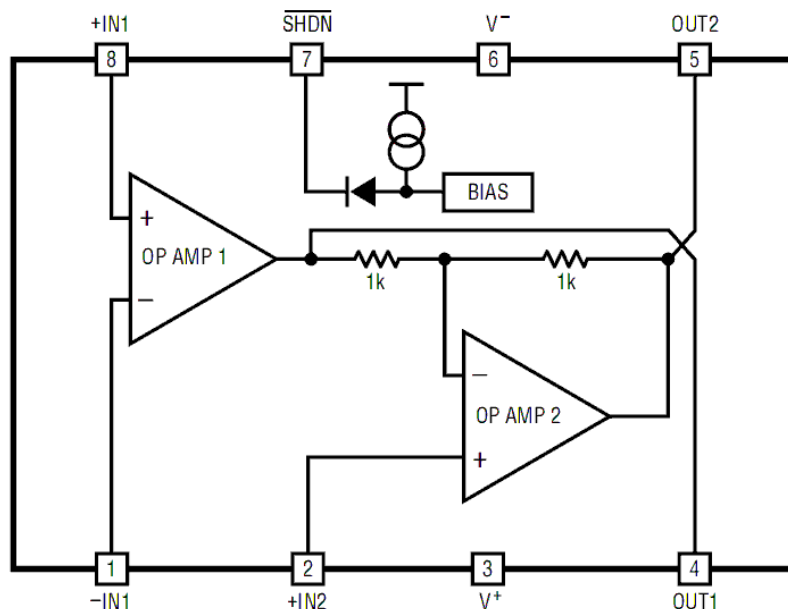
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## PERFORMANCE SUMMARY

 Specifications are typical at  $T_A = 25^\circ\text{C}$ ,  $V_S = \pm 5\text{V}$ 

SYMBOL	PARAMETER	CONDITIONS, COMMENTS	TYP	UNITS
$V_S$	Supply Voltage Range	Single Supply	2.7V to 12V	V
		Split Supply	+/-1.35V to +/-6V	V
$V_{cm}$	Input Voltage Range	Op Amp 1	Rail to Rail	V
		Op Amp 2	$V_{S-} + 1.5\text{V}$ to $V_{S+} - 0.1\text{V}$	V
BW	-3dB Bandwidth	Small signal, differential output	33	MHz
$V_{out}$	Output Voltage Swing	Each output, to either rail, no load	55	mV
$I_{CC}$	Supply Current	$V_S = \pm 5\text{V}$	4.8	mA

Figure 1. LT6350 Block Diagram . Opamp1 is an undedicated low noise opamp. Opamp2 is a dedicated inverter.



## OPERATING PRINCIPLES

Conversion of single ended signals to differential is a basic function. It may be desired for improved transmission characteristics over twisted pair, or for driving SAR ADCs which prefer differential inputs. The LT6350 makes the single-ended to conversion easy by providing

an already connected internal inverter, Opamp2. In the simplest configuration, with Opamp1 in a gain of 1, the conversion to differential causes an effective gain of 2 overall.

## QUICK START PROCEDURE

Demonstration circuit 1538 is shipped with the jumpers set for Single Supply, DC coupled operation, with Opamp1 configured in a gain of 1 (OUT1 shorted to -IN1). As the intended application is for single ended inputs, only one input BNC connector is installed (J1) and this is the excitation path for Opamp1's non-inverting input +IN1. To support Opamp1 in inverting or other applications, a footprint for another BNC was included (J3) for user installation.

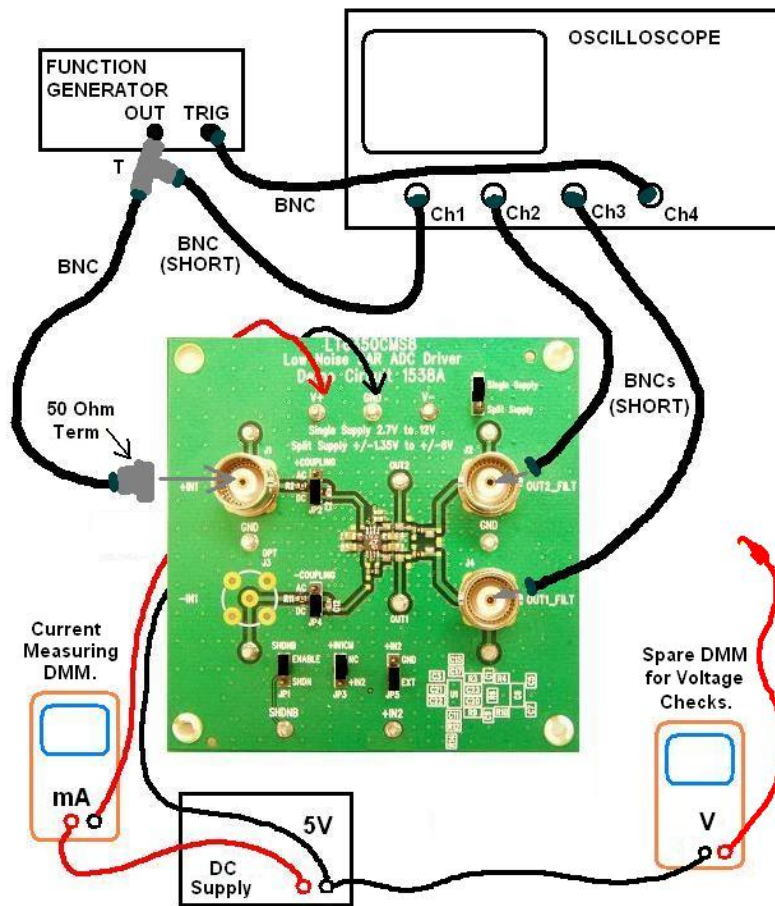


Figure 2. Proper Connections for Single Supply Operation (DMMs optional). The function generator should be set up to operate around a positive 2V DC offset. For split supply operation, set JP6 to "Split Supply" and connect a negative supply to the V- turret.

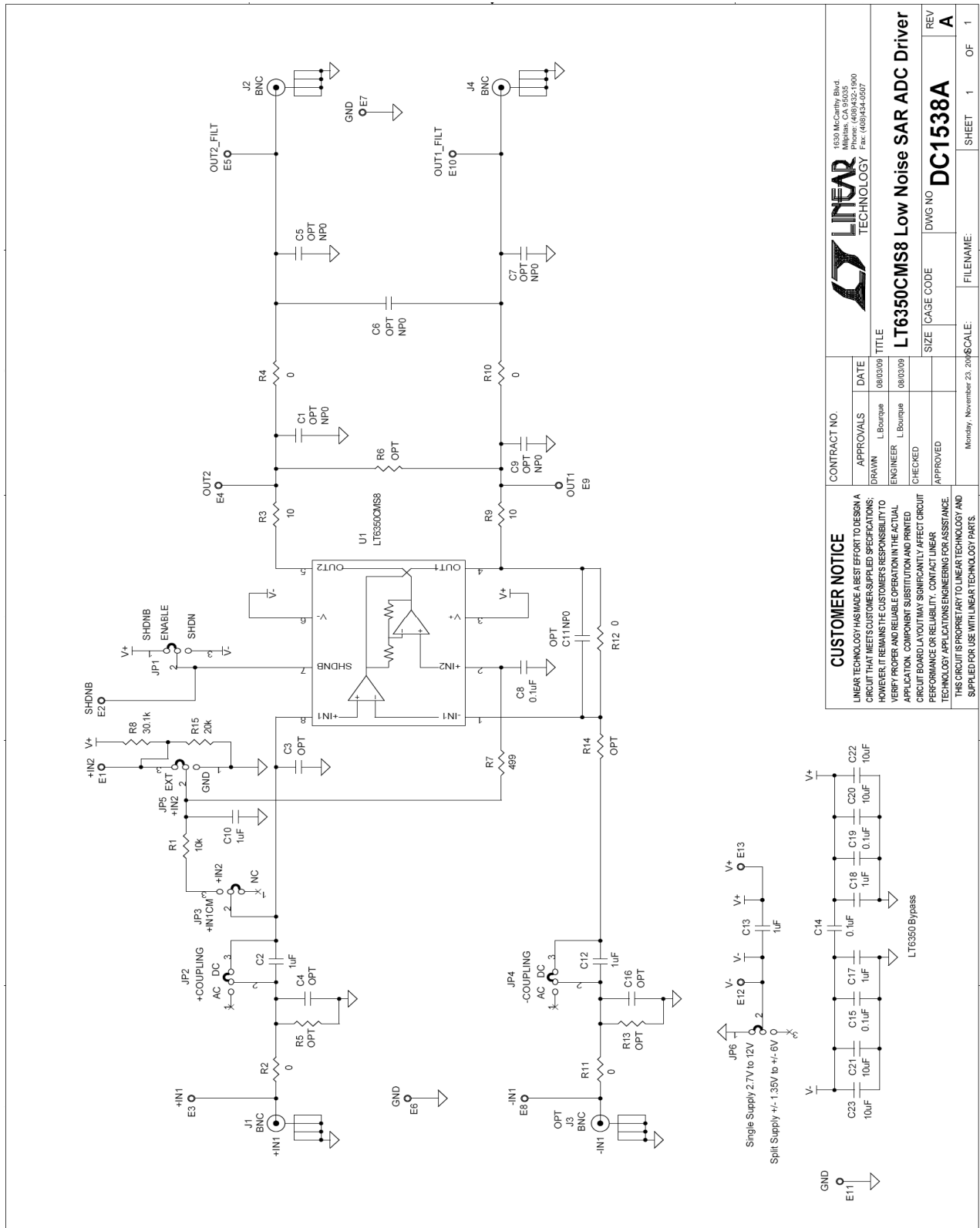


Figure 3. Circuit Schematic

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CONTRACT NO.	APPROVALS	DATE	TITLE
	DRAWN: L. Bourque	08/02/06	LT6350CMS8 Low Noise SAR ADC Driver
	ENGINEER: L. Bourque	08/02/06	REV A
	CHECKED:		SIZE: CASE CODE
	APPROVED:		DWG NO: DC1538A
		Monday, November 23, 2004	SCALE: SHEET 1 OF 1
FILENAME:			

**CUSTOMER NOTICE**

LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS THE CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

Item	Qty	Ref - Des	Part Description	Manufacturer, Part #
<b>REQUIRED CIRCUIT COMPONENTS:</b>				
1	6	C2,C10,C12,C13,C17,C18	CAP., X7R, 1uF, 16V, 10% 0603	AVX, 0603YC105KAT2A
2	4	C8,C14,C15,C19	CAP., X7R, 0.1uF, 25V, 10% 0603	AVX, 06033C104KAT2A
3	4	C20,C21,C22,C23	CAP., X5R,10uF, 16V, 10% 0805	MURATA,GRM21BR61C106KE15L
4	1	R1	RES., CHIP, 10K, 1/10W, 1% 0603	VISHAY, CRCW060310K0FKEA
5	5	R2,R4,R10,R11,R12	RES., CHIP, 0, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
6	2	R3,R9	RES., CHIP, 10, 1/10W, 1% 0603	VISHAY, CRCW060310R0FKEA
7	1	R7	RES., CHIP, 499, 1/10W, 1% 0603	VISHAY, CRCW0603499RFKEA
8	1	R8	RES., CHIP, 30.1K, 1/10W, 1% 0603	VISHAY, CRCW060330K1FKEA
9	1	R15	RES., CHIP, 20K, 1/10W, 1% 0603	VISHAY, CRCW060320K0FKEA
10	1	U1	Low Noise SAR ADC Driver	Linear Tech., LT6350CMS8#TRPBF
<b>ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:</b>				
1	5	C1,C5,C7,C9,C11 (opt.)	CAP., 0603, NP0	
2	1	C3 (opt.)	CAP., 0603	
3	3	C4,C6,C16 (opt.)	CAP., 1206, NP0	
4	2	R5,R13 (opt.)	RES., 1206	
5	2	R6,R14 (opt.)	RES., 0603	
<b>HARDWARE</b>				
1	13	E1-E13	TESTPOINT, TURRET, .065" pbf	MILL-MAX, 2308-2-00-80-00-00-07-0
2	4	J1,J2,J3,J4	CONN, BNC, 5 PINS	CONNEX, 112404
3	6	JP1,JP2,JP3,JP4,JP5,JP6	HEADER, 3PINS, 2mm	SAMTEC, TMM-103-02-L-S
4	6	JP1,JP2,JP3,JP4,JP5,JP6	SHUNT, 2MM CENTER	SAMTEC, 2SN-BK-G
5	4	MH1,MH2,MH3,MH4	STAND-OFF, NYLON 0.25"	KEYSTONE, 8831(SNAP ON)

Figure 4. Bill of Materials