LVDT signal conditioner

5521

FEATURES
- Low distortion
- Single supply 5V to 20V, or dual supply ± 2.5V to ± 10V
- Oscillator frequency 1kHz to 20kHz
- Capable of ratiometric operation
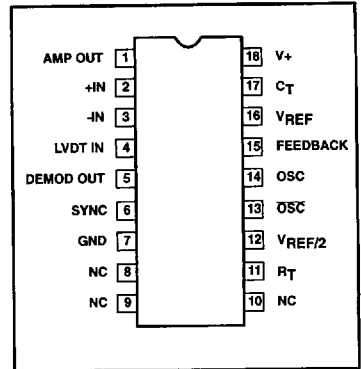- Low power consumption (182mV typ)

APPLICATIONS
- LVDT signal conditioning
- RVDT signal conditioning
- LPDT signal conditioning
- Bridge circuits

DESCRIPTION
The 5521 is a signal conditioning circuit for use with Linear Variable Differential Transformers (LDVTs) and Rotary Variable Differential Transformers (RVDTs). The chip includes a low distortion, amplitude-stable sine wave oscillator with programmable frequency to drive the primary of the LVDT/RVDT, a synchronous demodulator to convert the LVDT/RVDT output amplitude and phase to position information, and an output amplifier to provide amplification and filtering of the demodulated signal.
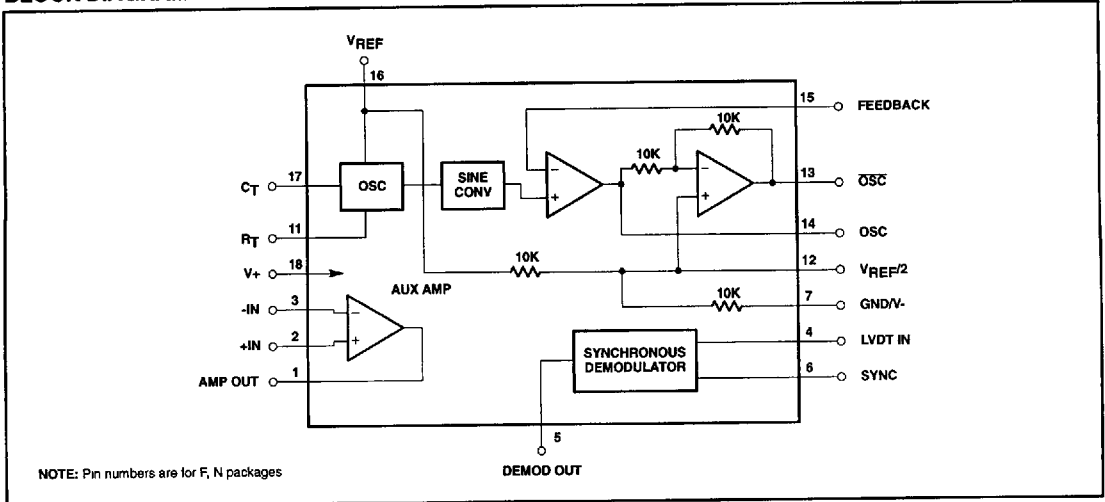
PIN CONFIGURATION

Pin		Pin
AMP OUT	1	18 V+
+IN	2	17 C$_T$
-IN	3	16 V$_{REF}$
LVDT IN	4	15 FEEDBACK
DEMOD OUT	5	14 OSC
SYNC	6	13 $\overline{OSC}$
GND	7	12 V$_{REF}$/2
NC	8	11 R$_T$
NC	9	10 NC

ORDERING INFORMATION

DESCRIPTION	ORDER CODE	PACKAGE DESIGNATOR*
18-Pin Ceramic DIP	5521/BVA	GDIP1-T18

* MIL-STD 1835 or Appendix A of 1995 Military Data Handbook

BLOCK DIAGRAM

NOTE: Pin numbers are for F, N packages

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PIN DEFINITIONS

PIN NO.	SYMBOL	DEFINITION
1	Amp Out	Auxiliary Amplifier Output.
2	+ IN	Auxiliary Amplifier non-inverting input.
3	- IN	Auxiliary Amplifier inverting input.
4	LVDT IN	Input to Synchronous Demodulator from the LVDT/RVDT secondary.
5	DEMOD OUT	Pulsating DC output from the Synchronous Demodulator output. This voltage should be filtered before use.
6	SYNC	Synchronizing input for the Synchronizing Demodulator. This input should be connected to the OSC or $\overline{OSC}$ output. Sync is referenced to $V_{REF}/2$.
7	GND	Device return. Should be connected to system ground or to the negative supply.
8	NC	No internal connection.
9	NC	No internal connection.
10	NC	No internal connection.
11	R_T	Oscillator frequency-determining resistor. A temperature stable $18k\Omega$ resistor should be connected between this pin and pin 7.
12	$V_{REF}/2$	A high impedance source of one half the potential applied to V_{REF} (pin 16). The LVDT/RVDT secondary return should be to this point. A bypass capacitor with low impedance at the oscillator frequency should also be connected between this pin and ground.
13	$\overline{OSC}$	Oscillator sinewave output that is 180° out of phase with the OSC signal at pin 14. The LVDT/RVDT primary is usually connected between OSC and $\overline{OSC}$ pins.
14	OSC	Oscillator sinewave output. The LVDT/RVDT primaries are usually connected between OSC and $\overline{OSC}$ pins.
15	FEEDBACK	Usually connected to the OSC (pin 14) output for unity gain, a resistor between this pin and OSC, and one between this pin and ground can provide for a change in the oscillator output pin amplitudes.
16	V_{REF}	Reference voltage input for the oscillator and sine converter. This voltage MUST be stable and must not exceed +V supply voltage.
17	C_T	Oscillator frequency-determining capacitor. The capacitor connected between this pin and ground should be a temperature-stable type.
18	+V	Positive supply connection.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING[1]	UNIT
V_{CC}	Supply voltage	+20	V
V+/V-	Split supply voltage	±10	V
T_{STG}	Storage temperature range	-65 to +150	°C
P_D	Power dissipation	840	mW

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DC ELECTRICAL CHARACTERISTICS

$V+ = V_{REF} = 10V$, $R_T = 18k\Omega$, $C_T = 0.047\mu F$, Frequency $\approx$ 1kHz, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	$T_{amb} = +25°C$			$T_{amb} = -55°C, +125°C$			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_T	Supply current			12.9	18			18	mA
I_{REF}	Reference current			5.3	8			8	mA
V_{REF}	Reference voltage range		5		V+	5		V+	V
P_D	Power dissipation			182	260			260	mW
Oscillator Section									
V_{OSC}	Oscillator output	$R_L = 10k$		$\dfrac{V_{REF}}{8.8}$					V_{RMS}
D_{IST}	Sineware distortion	No load		1.5					%
V_{OSC}	Initial amplitude error			0.4					%
$\Delta V_{OSC}/\Delta T$	Temperature coeff. of amplitude						0.005		%/°C
f_O	Init. accuracy of oscillator freq.[4]			0.9	5.0				%
$\Delta f_O/\Delta T$	Temperature coeff. of frequency[2]						0.05		%/°C
$\Delta f/\Delta V$	Voltage coeff. of frequency			3.3					%/ $V(V_{REF})$
R_L	Min OSC ($\overline{OSC}$) Load[3]		300	170		300			Ω
Demodulator Section									
EL	Linearity error[4]	$5V_{P-P}$ input		0.05	0.1			0.1	%FS
$V_{I\ (MAX)}$	Maximum demodulator input			$\dfrac{V_{REF}}{2}$			$\dfrac{V_{REF}}{2}$		V_{P-P}
V_{IO}	Demodulator offset voltage			1.4	5.0			5.0	mV
$\Delta V_{IO}/\Delta T$	Demodulator offset voltage drift[4]							25	$\mu V/°C$
I_{IB}	Demodulator input current			234	500			500	nA
$\Delta V_R/2$	$V_R/2$ accuracy			0.1	1.0			1.0	%
Auxiliary Output Amplifier									
V_{IO}	Input offset voltage			0.5	5.0			5.0	mV
$\Delta V_{IO}/\Delta T$	Input offset voltage drift[4]							25	$\mu V/°C$
I_{IB}	Input bias current			210	500			500	nA
I_{IO}	Input offset current			9	50			50	nA
A_V	Gain		100	385		100			V/mV
SR	Slew rate			1.3					V/μs
GBW	Unity gain bandwidth product	$A_V = 1$		1.6					MHz
V_O	Output voltage swing	$R_L = 10k$	7	8.2		7			V
I_{SC}	Output short circuit current to ground or to V_{CC}			42	100				mA

NOTES:
1. Operation beyond the limit of this table may impair the useful life of the device.
2. This is temperature coefficient of frequency for the device only. It is assumed that C_T and R_T are fixed in value and C_T leakage is fixed over the operating temperature range.
3. Minimum lead impedence for which distortion is guaranteed to be less than 5%.
4. This parameter is guaranteed, but not tested.

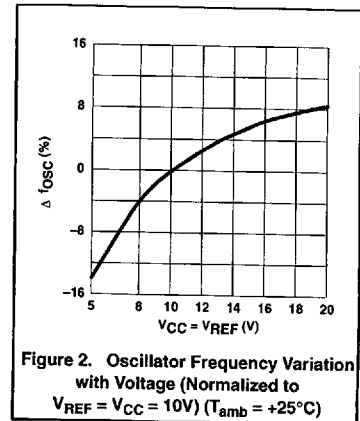7110826 0085327 567
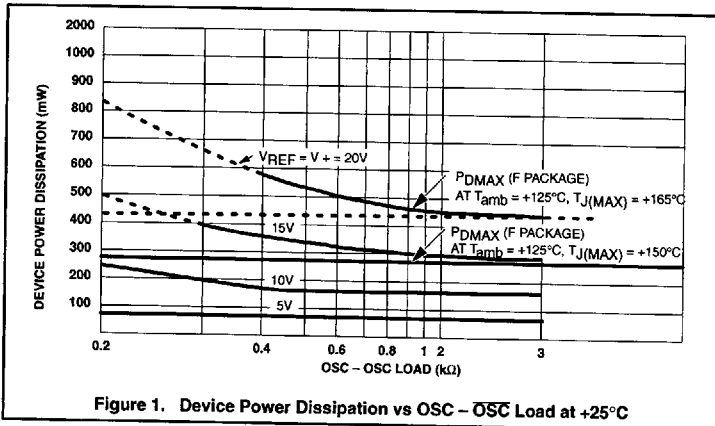
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DEFINITION OF TERMS

TERM	DEFINITION
Oscillator Output	RMS value of the AC voltage available at the oscillator output pin. This output is referenced to $V_{REF/2}$ and is a function of V_{REF}.
Sine Wave Distortion	The Total Harmonic Distortion (THD) of the oscillator output with no load. This is not a critical specification in LVDT/RVDT systems. This figure could be 15% or more without affecting system performance.
Initial Amplitude Error	A measure of the interchangeability of 5521 parts, *not* a characteristic of any one part. It is the degree to which the oscillator output of a number of 5521 samples will vary from the median of that sample.
Initial Accuracy of Oscillator Frequency	Another measure of the interchangeability of individual 5521 parts. This is the degree to which the oscillator frequency of a number of 5521 samples will vary from the median of that sample with a given timing capacitor
Tempco of Oscillator Amplitude	A measure of how the oscillator amplitude varies with ambient temperature as that temperature deviates from a 25°C ambient.
Tempco of Oscillator Frequency	A measure of how the oscillator frequency varies with ambient temperature as that temperature deviates from a 25°C ambient.
Voltage Coefficient of Oscillator Frequency	The degree to which the oscillator frequency will vary as the reference voltage (V_{REF}) deviates from +10V.
Min OSC ($\overline{OSC}$) Load	Minimum load impedance for which distortion is guaranteed to be less than 5%.
Linearity Error	The degree to which the DC output of the demodulator/amplifier combination matches a change in the AC signal at the demodulator input. It is measured as the worst case nonlinearity from a straight line drawn between positive and negative fullscale end points.
Maximum Demodulator Input	The maximum signal that can be applied to the demodulator input without exceeding the specified linearity error.

APPLICATION INFORMATION

$$\text{OSC frequency} = \frac{V_{REF} - 1.3V}{V_{REF}(R_T + 1.5k)C_T}$$

Figure 1. Device Power Dissipation vs OSC – $\overline{OSC}$ Load at +25°C

Figure 2. Oscillator Frequency Variation with Voltage (Normalized to $V_{REF} = V_{CC} = 10V$) ($T_{amb} = +25°C$)

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Figure 3. I_{REF} and I_{CC} vs Voltage
(T_{amb} = +25°C)

Figure 4. I_{REF} and I_{CC} vs Temperature
(V_{REF} = V_{CC} = 10V)

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