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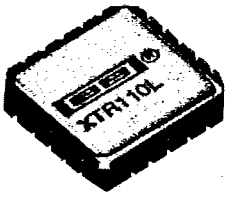
BURR-BROWN®



XTR110L

LCC Precision Voltage-To-Current CONVERTER/TRANSMITTER

FEATURES

- 4mA TO 20mA TRANSMITTER
- SELECTABLE INPUT/OUTPUT RANGES; 0V to +5V, 0V to +10V Inputs: 0mA to 20mA, 5mA to 25mA Outputs: Other Ranges
- 0.005% MAX NONLINEARITY, 14-BIT
- PRECISION +10V REFERENCE OUTPUT
- SINGLE SUPPLY OPERATION
- CURRENT SOURCING TO COMMON
- WIDE SUPPLY RANGE, 13.5V TO 40V
- HERMETIC 20-PIN LEADLESS CHIP CARRIER

APPLICATIONS

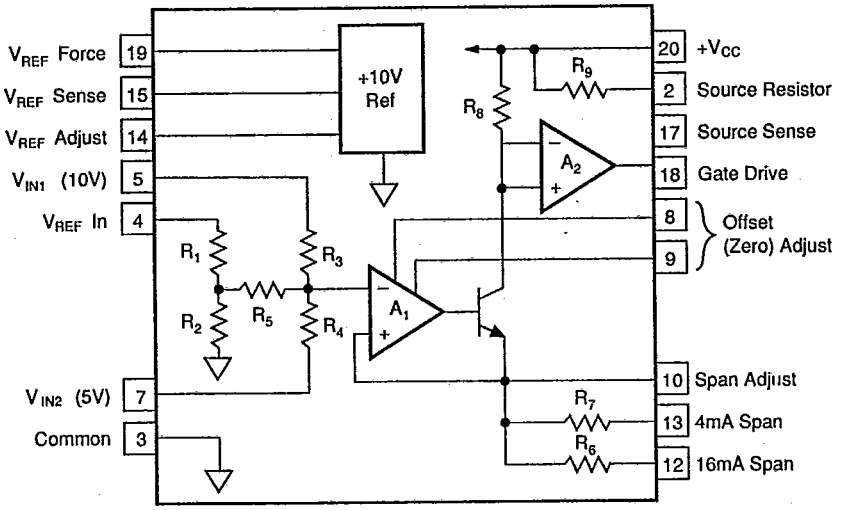
- INDUSTRIAL PROCESS CONTROL
- PRESSURE/TEMPERATURE TRANSMITTERS
- CURRENT-MODE BRIDGE EXCITATION
- GROUNDED TRANSDUCER CIRCUITS
- CURRENT SOURCE REFERENCE FOR DATA ACQUISITION
- PROGRAMMABLE CURRENT SOURCE FOR TEST EQUIPMENT
- AUTOMATED MANUFACTURING
- POWER PLANT/ENERGY SYSTEM MONITORING

DESCRIPTION

The XTR110L is a monolithic precision voltage-to-current converter. It can convert standard 0V to +10V or 0V to +5V inputs into 4mA to 20mA, or 5mA to 25mA outputs. The required external MOS transistor keeps heat outside the XTR110L package to optimize performance under all output conditions.

A precision +10V reference output can drive 10mA. An external transistor can be added for more current, e.g. 33mA for 300Ω bridges.

The XTR110L is a key data acquisition component, designed for high noise immunity current-mode transmission. It is also ideal as a precision programmable current source for transducer circuits and test equipment.



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SPECIFICATIONS

ELECTRICAL

At T_A = +25°C and V_{CC} = +24V and R_L = 250Ω† unless otherwise noted.

PARAMETER	CONDITIONS	XTR110AL MIN	XTR110AL TYP	XTR110AL MAX	XTR110BL MIN	XTR110BL TYP	XTR110BL MAX	UNITS
TRANSMITTER								
Transfer Function			$I_O = 10\,[(V_{REF\,IN}/16) + (V_{IN1}/4) + (V_{IN2}/2)]/R_{SPAN}$					
Input Range: V_{IN1}[1]	Specified Performance	0		+10	*		*	V
V_{IN2}	Specified Performance	0		+5	*		*	V
Current, I_O	Specified Performance[2]	4		20	*		*	mA
	Derated Performance[2]	0		40	*		*	mA
Nonlinearity	16mA/20mA Span[3]		0.01	0.025		0.002	0.005	% of Span
Offset Current, I_{OS}	I_O = 4mA[2]							
Initial	[2]		0.2	0.4		0.02	0.1	% of Span
vs Temp	[2]		0.0003	0.005		*	0.003	% of Span/°C
vs Supply, V_{CC}	[2]		0.0005	0.005		*	*	% of Span/V
Span Error	I_O = 20mA							
Initial	[2]		0.3	0.6		0.05	0.2	% of Span
vs Temp	[2]		0.0025	0.005		0.0009	0.003	% of Span/°C
vs Supply, V_{CC}	[2]		0.003	0.005		*	*	% of Span/V
Output Resistance	From Drain of FET (Q_{EXT})[4]		10×10^9			*		Ω
Input Resistance	V_{IN1}		27			*		kΩ
	V_{IN2}		22			*		kΩ
	$V_{REF\,IN}$		19			*		kΩ
Dynamic Response								
Settling Time	To 0.1% of Span		15			*		µs
	To 0.01% of Span		20			*		µs
Slew Rate			1.3			*		mA/µs
VOLTAGE REFERENCE								
Output Voltage		+9.95	+10	+10.05	+9.98	*	+10.02	V
vs Temp			35	50		15	30	ppm/°C
vs Supply, V_{CC}	Line Regulation		0.0002	0.005		*	*	%/V
vs Output Current	Load Regulation		0.0005	0.01		*	*	%/mA
vs Time			100			*		ppm/1k hrs
Trim Range[5]		–0.100		+0.25	*		*	V
Output Current[6]	Specified Performance	10			*			mA
POWER SUPPLY								
Input Voltage, V_{CC}		+13.5		+40	*		*	V
Quiescent Current	Excluding I_O		3	4.5		*	*	mA
TEMPERATURE RANGE								
Specification: AL, BL		–40		+85	*		*	°C
Operating: AL, BL		–55		+125	*		*	°C

*Specification same as AL grade.
†Specifications apply to the range of R_L shown in Typical Performance Curves.
NOTES: (1) Unit may be damaged. See "Input Voltage Range" on page 4. (2) Including internal reference. (3) Span is the change in output current resulting from a full-scale change in input voltage. (4) Within compliance range limited by ($+V_{CC}$ –2V) $+V_{DS}$ required for linear operation of the FET. (5) For V_{REF} adjustment circuit see Figure 1. (6) For extended I_{REF} drive circuit see Figure 2.

ORDERING INFORMATION

XTR110 X L

Basic Model Number

Performance Grade Code
A, B: –40°C to +85°C

Package Code
L: 20-Pin Leadless Chip Carrier

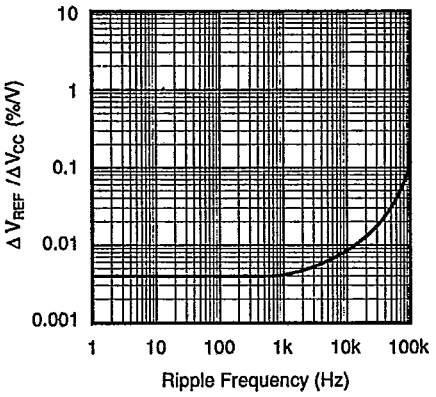
ABSOLUTE MAXIMUM RATINGS

Power Supply, $+V_{CC}$ 40V
Input Voltage, V_{IN1}, V_{IN2}, $V_{REF\,IN}$ ..... $+V_{CC}$
Storage Temperature Range ..... –55°C to +125°C
Output Short-Circuit Duration,
Gate Drive and V_{REF} Force ..... Continuous to common and $+V_{CC}$
Output Current Using Internal 50Ω Resistor 40mA

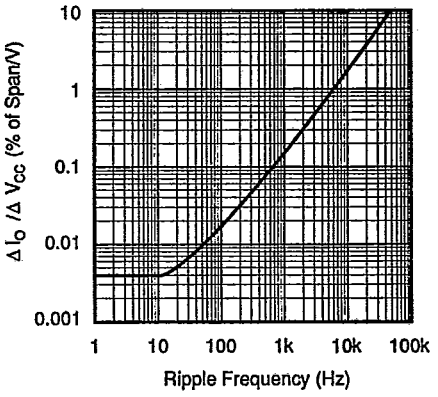
TYPICAL PERFORMANCE CURVE

T_A = 25°C, $\pm V_{CC}$ = 15VDC, R_L = 250Ω unless otherwise stated.

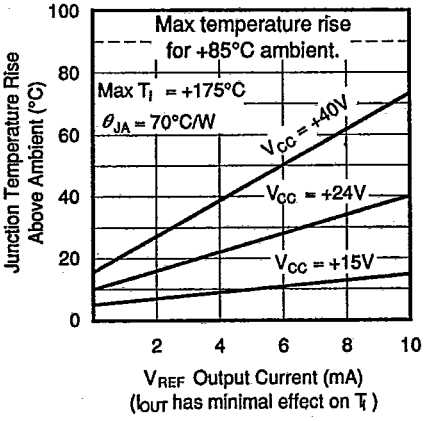
V_{REF} LINE REGULATION vs FREQUENCY



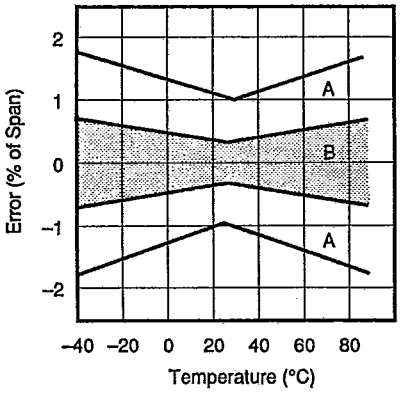
I_O POWER SUPPLY REJECTION vs FREQUENCY



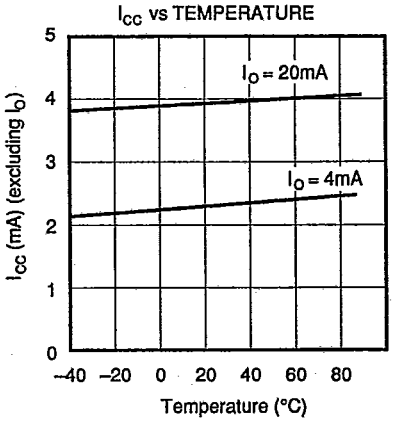
JUNCTION TEMPERATURE RISE vs V_{REF} OUTPUT CURRENT



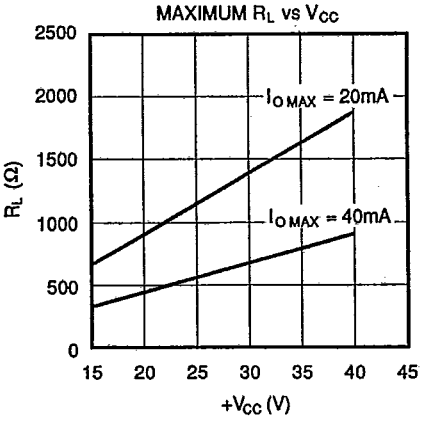
TOTAL OUTPUT ERROR vs TEMPERATURE



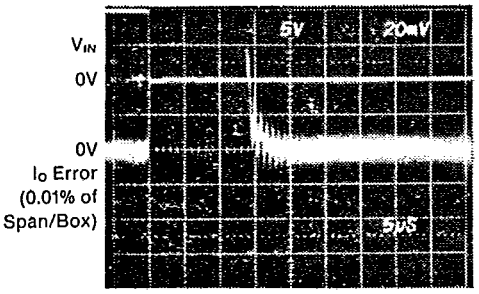
I_{CC} vs TEMPERATURE



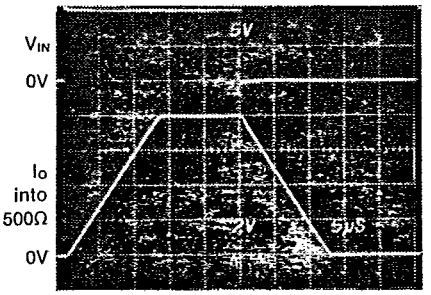
MAXIMUM R_L vs V_{CC}



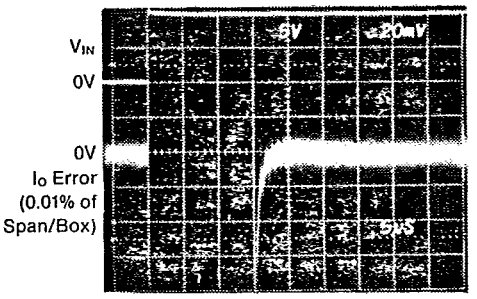
SETTLING TIME WITH NEG V_{IN} STEP



PULSE RESPONSE



SETTLING TIME WITH POS V_{IN} STEP



APPLICATIONS INFORMATION

For applications circuits and other information refer to PDS-555.

INPUT VOLTAGE RANGE

The XTR110L can be damaged if the inputs are taken below pin 3 (COMMON). Under carefully controlled conditions, the input can be allowed to go below system ground. To determine the allowable range for the input, use the following equation:

$$(V_{REF\,IN}/16) + (V_{IN1}/4) + (V_{IN2}/2) = 0$$

For example, assume that the standard configuration of Figure 3 is being used. In this case, $V_{REF\,IN}$ = 10V and V_{IN2} = 0V. The equation now becomes:

$$(10/16) + (V_{IN1}/4) + (0/2) = 0$$

Rearranging gives:

$$V_{IN1} = -2.5V$$

which is the maximum negative voltage that the input can be taken to. Note, however, that this applies only as long as there is 10V at $V_{REF\,IN}$. If, for example, the supply for the XTR110L is interrupted, the 10V will no longer be generated and any negative input at V_{IN1} could damage the unit.

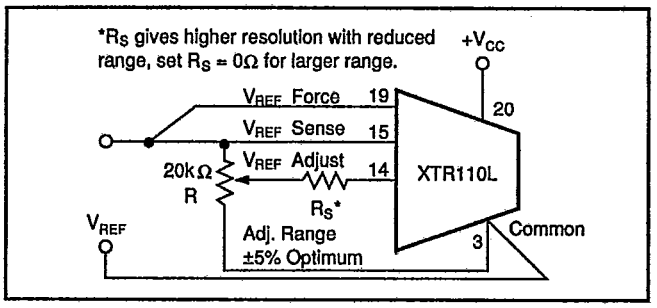


FIGURE 1. Optional Adjustment of Reference Voltage.

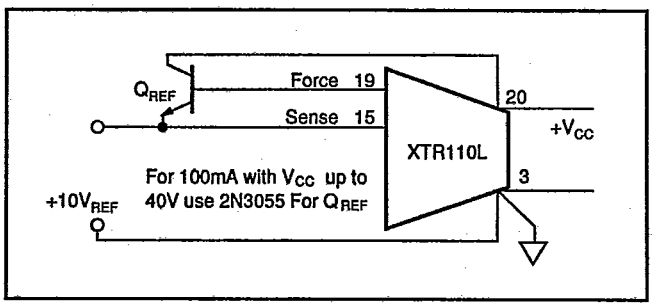
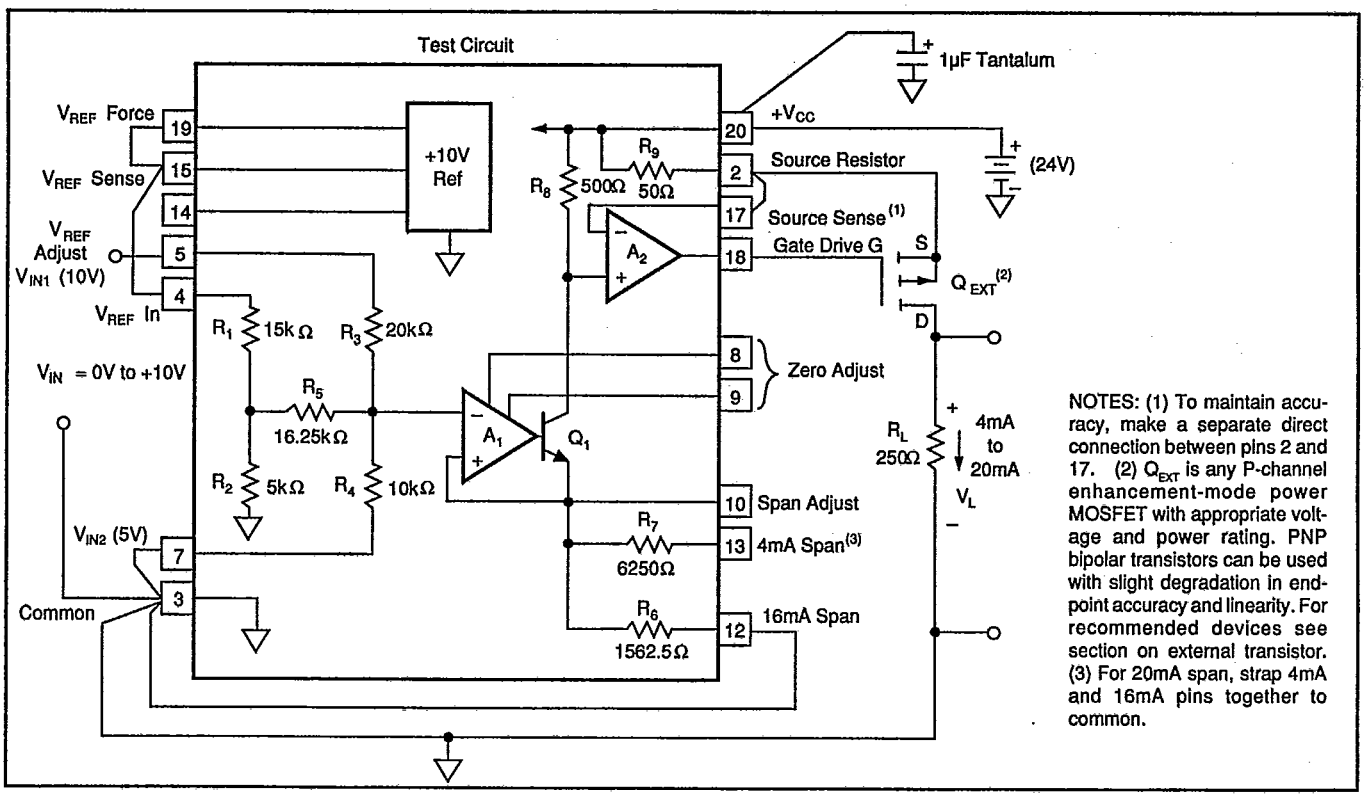


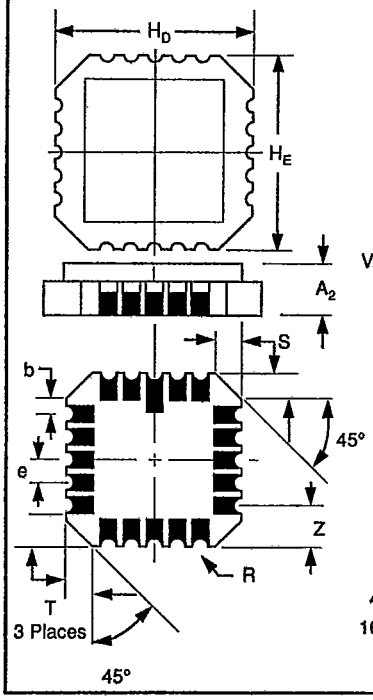
FIGURE 2. Extended Reference Current Drive.

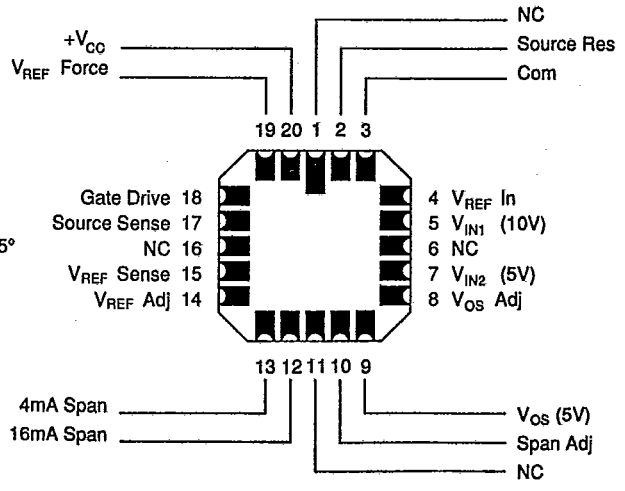


NOTES: (1) To maintain accuracy, make a separate direct connection between pins 2 and 17. (2) Q_{EXT} is any P-channel enhancement-mode power MOSFET with appropriate voltage and power rating. PNP bipolar transistors can be used with slight degradation in endpoint accuracy and linearity. For recommended devices see section on external transistor. (3) For 20mA span, strap 4mA and 16mA pins together to common.

FIGURE 3. Block Diagram of the XTR110L in Basic Connection: 0V to +10V In, 4mA to 20mA Out.

Ceramic LCC-20 Package





	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
H_D	.345	.360	8.76	9.14
H_E	.345	.360	8.76	9.14
A_2	.064	.100	1.63	2.54
b	.022	.028	0.56	0.71
e	.050 BASIC		1.27 BASIC	
R	.008R TYP		0.20R TYP	
S	.020 TYP		0.508 TYP	
T	.040 TYP		1.016 TYP	
Z	.075 TYP		1.91 TYP	