

Features

- Loop Start Trunk Interface.
- 600Ω Input Impedance.
- 2-4Wire Conversion.
- Line state detection outputs.
 - Forward Loop.
 - Reverse Loop.
 - Ringing Voltage.
 - Service Out.
- Relay Driver.
- 15mA operation, allowing long line length capability.
- Meets FCC part 68 Leakage Current Requirements.

Applications

Interface to Central Office for:

- PABX
- Key Telephone Systems
- Channel Bank
- Voice Mail

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Ordering Information

MH88634BV-K 21 Pin SIL Package

0°C to 70°C

- Terminal Equipment
- Digital Loop Carrier
- Optical Multiplexer

Description

The Mitel MH88634BV-K Central Office Trunk Interface circuit provides a complete analog and signalling link between audio switching equipment and a Telephone Line. It has been designed specifically to meet the needs of the Korean market.

The device is available in a single in line package and has a small footprint area (4.75cm²) for high packing densities.

The device is fabricated as a thick film hybrid incorporating various technologies for optimum circuit design and very high reliability.

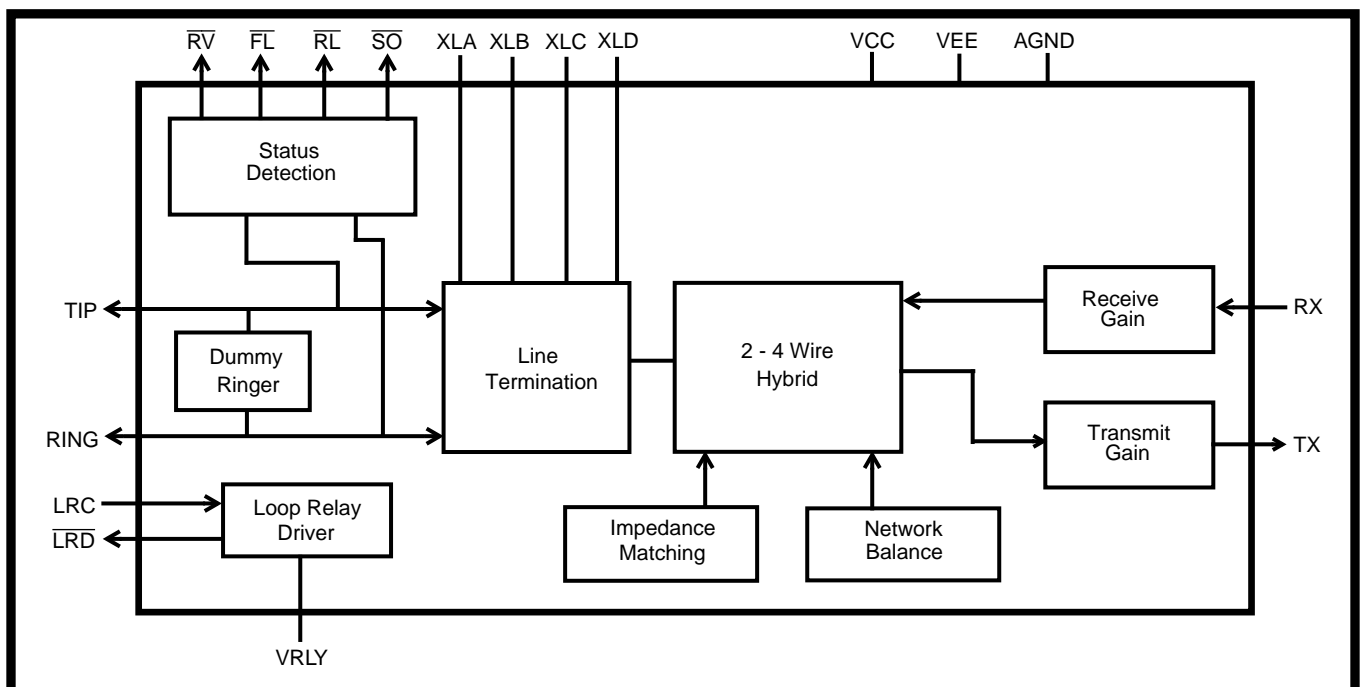


Figure 1 - Functional Block Diagram

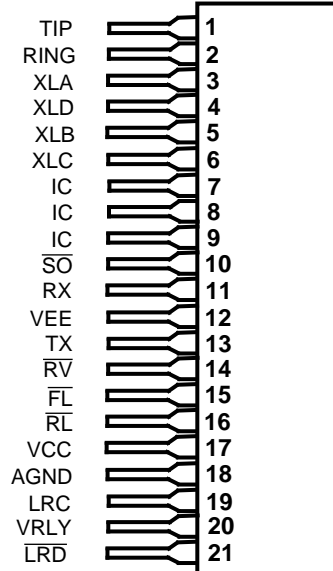


Figure 2 - Pin Connections

Pin Description

Pin #	Name	Description
1	TIP	Tip Lead. Connects to the "Tip" lead of a Telephone Line.
2	RING	Ring Lead. Connects to the "Ring" lead of a Telephone Line.
3	XLA	Loop Relay Contact A. Connects to XLB through the Loop relay (K1) contacts when the relay is activated.
4	XLD	Loop Relay Contact D. Connects to XLC through the loop relay (K1) contacts when the relay is activated.
5	XLB	Loop Relay Contact B. Connects to XLA through the loop relay (K1) contacts when the relay is activated.
6	XLC	Loop Relay Contact C. Connects to XLD through the loop relay (K1) contacts when the relay is activated.
7	IC	Internal Connection. No connection should be made to this pin.
8	IC	Internal Connection. No connection should be made to this pin.
9	IC	Internal Connection. No connection should be made to this pin.
10	\overline{SO}	Service Out Detect (Output). A logic 0 indicates that the Telephone Line is out of service.
11	RX	Receive (Input). 4-Wire ground (AGND) referenced analog input.
12	VEE	Negative Supply Voltage. -5V DC
13	TX	Transmit (Output). 4-Wire ground (AGND) referenced analog output.
14	\overline{RV}	Ring Voltage Detect (Output). A logic 0 indicates that ringing voltage is across the Tip and Ring leads.
15	\overline{FL}	Forward Loop Detect (Output). In the on-hook state, a logic 0 output indicates that forward loop battery is present. In the off-hook state, a logic 0 indicates that forward loop current is present.
16	\overline{RL}	Reverse Loop Detect (Output). In the on-hook state, a logic 0 output indicates that reverse loop battery is present. In the off-hook state, a logic 0 output indicates that reverse loop current is present.

Pin Description (continued)

17	VCC	Positive Supply Voltage. +5V DC
18	AGND	Analog Ground. 4-wire ground (AGND). Normally connected to system ground.
19	LRC	Loop Relay Control (Input). A logic 1 activates the Loop Relay Driver output ($\overline{\text{LRD}}$).
20	$\overline{\text{VRLY}}$	Relay Positive Supply Voltage. Typically +5V. Connects to the relay supply voltage.
21	$\overline{\text{LRD}}$	Loop Relay Drive (Output). Connects to the Loop Relay Coil. When LRC is at logic 1 an open collector output at $\overline{\text{LRD}}$ sinks current and energizes the relay.

Functional Description

The MH88634BV-K is a Central Office Interface Circuit (COIC). It is used to correctly terminate a Central Office 2-Wire telephone line. The device provides a signalling link and a 2-4 Wire line interface between the telephone line and subscriber equipment. The subscriber equipment can include Private Branch Exchanges (PBXs), Key Telephone Systems, Terminal Equipment, Digital Loop Carriers and Wireless Local Loops.

All descriptions assume that the device is connected as in the application circuit shown in Figure 3.

Isolation Barrier

The MH88634BV-K provides an isolation barrier which is designed to meet FCC Part 68 (November 1987) Leakage Current Requirements.

External Protection Circuit

An external Protection Circuit assists in preventing damage to the device and the subscriber equipment, due to over-voltage conditions. The type of protection required is dependant upon the application and regulatory standards. Further details should be obtained from the specific country's regulatory body. In Figure 3 the protection is shown in block form.

Line Termination

When LRC is at a logic 1, $\overline{\text{LRD}}$ will sink current which energizes the Loop Relay (K1), connecting XLA to XLB and XLC to XLD. This places a line termination across Tip and Ring. The device can be considered to be in an off-hook state and DC loop current will flow. The line termination consists of a DC resistance and an AC impedance. When LRC is at a logic 0, the line termination is removed from across Tip and Ring.

An internal Dummy Ringer is permanently connected across Tip and Ring which is a series AC load of (17k Ω +330nF). This represents a mechanical telephone ringer and allows ringing voltages to be sensed. This load can be considered negligible when the line has been terminated.

Depending on the Network Protocol being used the line termination can terminate an incoming call, seize the line for an outgoing call, or if applied and disconnected at the correct rate can be used to generate dial pulse signals.

The DC line termination circuitry provides the line with an active DC load termination which is equivalent to a DC resistance of upto 285 Ω , dependant upon the loop current.

Ringing Equivalent Number

The Ringing Equivalent Number (REN) is application specific. See the governing regulatory body specification for details.

Input Impedance

The input impedance (Z_{in}) is the AC impedance that the MH88634BV-K places across Tip and Ring to terminate the Telephone line. This is fixed at 600 Ω .

Network Balance Impedance

The MH88634BV-K's Network Balance Impedance is fixed at 600 Ω .

2-4 Wire Conversion

The device converts the balanced 2-Wire input, presented by the line at Tip and Ring, to a ground referenced signal at TX.

Conversely the device converts the ground referenced signal input at RX, to a balanced 2-Wire signal across Tip and Ring.

The 4-Wire side (TX and RX) can be interfaced to a filter/codec, such as the Mitel MT896X, for use in digital voice switched systems

During full duplex transmission, the signal at Tip and Ring consists of both the signal from the device to the line and the signal from the line to the device. The signal input at RX, being sent to the line, must not appear at the output TX. In order to prevent this, the device has an internal cancellation circuit. The measure of attenuation is Transhybrid Loss (THL).

Transmit and Receive Gain

The Transmit Gain of the device is the gain from the balanced signal across Tip and Ring to the ground referenced signal at TX. It is set at 0dB.

The Receive Gain of the device is the gain from the ground referenced signal at RX to the balanced signal across Tip and Ring. It is set at -2dB.

Supervision Features

Line Status Detection Outputs

The MH88634BV-K supervisory circuitry provides the signalling status outputs which are monitored by the system controller. The supervisory circuitry is capable of detecting: Ringing Voltage; Forward and Reverse loop battery; Forward and Reverse loop current; and Service Out.

- **Ringing Voltage Detect Output (\overline{RV})**

The \overline{RV} output provides a logic 0 when ringing voltage is detected across Tip and Ring. This detector includes a filter which ensures that the output toggles at the ringing cadence and not at the ringing frequency. Typically this output switches to a logic 0 after 50ms of applied ringing voltage and remains at a logic 0 for 50ms after ringing voltage is removed.

- **Forward Loop and Reverse Loop Detect Outputs (\overline{FL} & \overline{RL})**

The FL output provides a logic 0 when either forward loop battery or forward loop current is detected, that is the Ring pin voltage is negative with respect to Tip pin voltage.

The RL output provides a logic 0 when either reverse loop battery or reverse loop current is detected, that is the Tip pin voltage is negative with respect to Ring pin voltage.

- **Service Out Detect (\overline{SO})**

The \overline{SO} output will go to logic 0 if the loop current is between -5mA and its threshold. This indicates that the line has intentionally been taken "out of service" by the Central Office. \overline{SO} will go to logic 1 if the loop current is outside this range. \overline{FL} and \overline{RL} outputs will go low if the loop current is greater than 15mA.

Control Input

The MH88634BV-K accepts a control signal from the system controller at the Loop Relay Control input (LRC). This energises the relay drive output Loop Relay Drive (\overline{LRD}). The output is active low and has an internal clamp diode to VRLY.

The intended use of this relay driver is to add and remove the Line Termination from across Tip and Ring, as shown in Figure 3.

If this Control input and the Supervisory Features are used as indicated in Figure 3, Loop-Start Signalling can be implemented.

Mechanical Data

See Figure 8 for details of the mechanical specification.

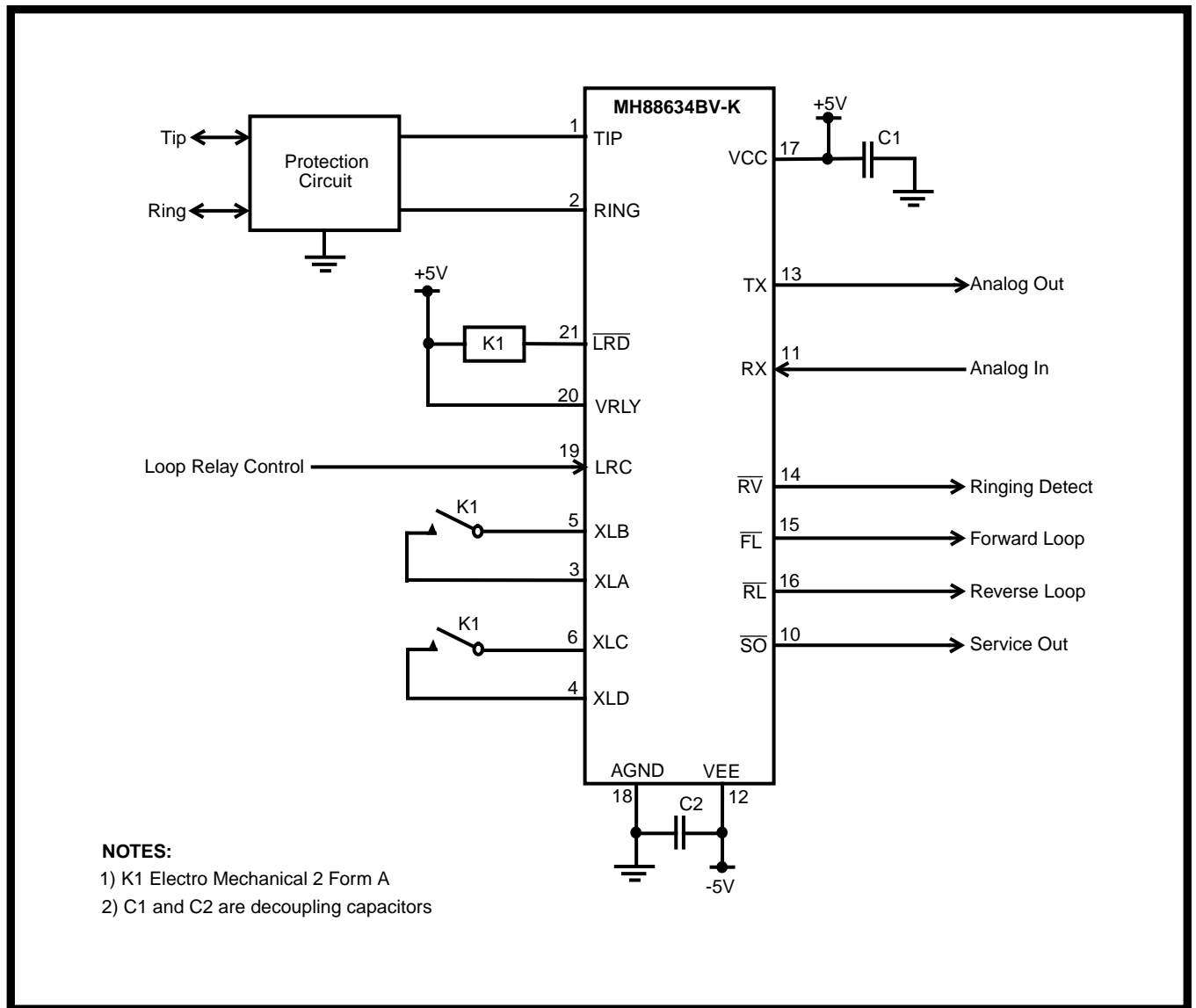


Figure 3 - Typical LS Application Circuit

Absolute Maximum Ratings*

	Parameter	Sym	Min	Max	Units	Comments
1	DC Supply Voltages	V_{CC}	-0.3	7	V	
		V_{EE}	0.3	-7	V	
2	DC Ring Relay Voltage	V_{RLY}	-0.3	18	V	
3	Storage Temperature	T_S	-55	+125	°C	
4	Ring Trip Current	I_{TRIP}		180	mArms	250ms 10% duty cycle or 500ms single shot

* Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

Recommended Operating Conditions

	Parameters	Symbol	Min	Typ [‡]	Max	Units
1	DC Supply Voltages	V_{CC}	4.75	5.0	5.25	V
		V_{EE}	-4.75	-5.0	-5.25	V
2	DC Ring Relay Voltage	V_{RLY}		5.0	15	V
3	Operating Temperature	T_{OP}	0	25	70	°C

‡ Typical figures are at 25°C with nominal 5V supplies and are for design aid only.

DC Electrical Characteristics[†]

		Characteristics	Sym	Min	Typ [‡]	Max	Units	Test Conditions
1		Supply Current	I_{CC}		5	13	mA	
			I_{EE}		2.5	13	mA	
2		Power Consumption	PC		37.5	137	mW	V_{BAT} not connected
3	\overline{FL} \overline{RL} \overline{SO} \overline{RV}	Low Level Output Voltage	V_{OL}			0.5	V	$I_{OL} = 4mA$ $I_{OH} = 0.4mA$
		High Level Output Voltage	V_{OH}	2.4			V	
4	\overline{LRD}	Sink Current, Relay to V_{CC} Clamp Diode Current	I_{OL}	100			mA	$V_{OL} = 0.35V$ not continuous, LRC=5V
			I_{CD}	150			mA	
5	LRC	Low Level Input Voltage	V_{IL}			0.8	V	
		High Level Input Voltage	V_{IH}	2.0			V	
6	LRC	High Level Input Current	I_{IH}			40	μA	$V_{IH} = 5.0V$
		Low Level Input Current	I_{IL}			40	μA	

† Electrical Characteristics are over recommended operating conditions unless otherwise stated.

‡ Typical figures are at 25°C with nominal 5V supplies and are for design aid only.

Loop Electrical Characteristics †

	Characteristics	Symbol	Min	Typ‡	Max	Units	Test Conditions
1	Ring Voltage	VR	40	90	130	V _{rms}	
2	Ring Frequency		16	20	33	Hz	
3	Operating Loop Current		15		70	mA	
4	Off-Hook DC Resistance			275	285	Ω	@ 20mA
5	Leakage Current (Tip-Ring to AGND)				7	mArms	@ 1000VAC
6	FL Threshold Tip-Ring (On-hook) Tip-Ring Current (Off-Hook)		12 10.5	16 12.5	21 15	VDC mA	LRC = 0V LRC = 5V
7	RL Threshold Tip-Ring (On-Hook) Tip-Ring Current (Off-Hook)		-12 -10.5	-16 -12.5	-21 -15	VDC mA	LRC = 0V LRC = 5V
8	SO Detect Threshold		-10.13	-11.5	-12.4	mA	V _{BAT} = -48V

† Electrical Characteristics are over recommended operating conditions unless otherwise stated.

‡ Typical figures are at 25°C with nominal 5V supplies and are for design aid only.

AC Electrical Characteristics†

	Characteristics	Symbol	Min	Typ‡	Max	Units	Test Conditions
1	2-wire Input Impedance	Zin		600		Ω	
2	Return Loss at 2-wire	RL	20	29		dB	Test Circuit as Fig 6 200-3400 Hz
3	Longitudinal to Metallic Balance		48			dB	Test Circuit as Fig 7 200-3400Hz
4	Transhybrid Loss	THL	20	27		dB	200-3400Hz
5	Gain, 2 wire to TX		-0.25	0	0.25	dB	Test Circuit as Fig 4 1000Hz
	Relative Gain		-0.3	0	0.3	dB	200-3400Hz
6	Gain, Rx to 2 wire		-2.25	-2	-1.75	dB	Test Circuit as Fig 5 1000Hz
	Relative Gain		-0.3	0	0.3	dB	200-3400Hz
7	Input impedance at RX			10		kΩ	
8	Output impedance at TX			5		Ω	
9	Signal Overload Level						% THD ≤ 5% @ 15mA
	at 2-wire		3.0			dBm	
	at TX		3.0			dBm	
10	Total Harmonic Distortion	THD					
	at 2-wire				1.0	%	Input 0.5V, 1kHz @ RX
	at TX				1.0	%	Input 0.5V, 1kHz @ Tip-Ring
11	Idle Channel Noise	NC					
	at 2-Wire			13	15.5	dBrnC	
	at TX			13	15.5	dBrnC	
12	Power Supply Rejection Ratio	PSRR					Ripple 0.1V, 1kHz
	at 2-wire and TX						
	V _{CC}		25	48		dB	
	V _{EE}		25	47		dB	
13	Common Mode Rejection	CMRR	48			dB	Test Circuit as Fig 7 200-3400Hz

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‡ Typical figures are at 25°C with nominal 5V supplies and are for design aid only.

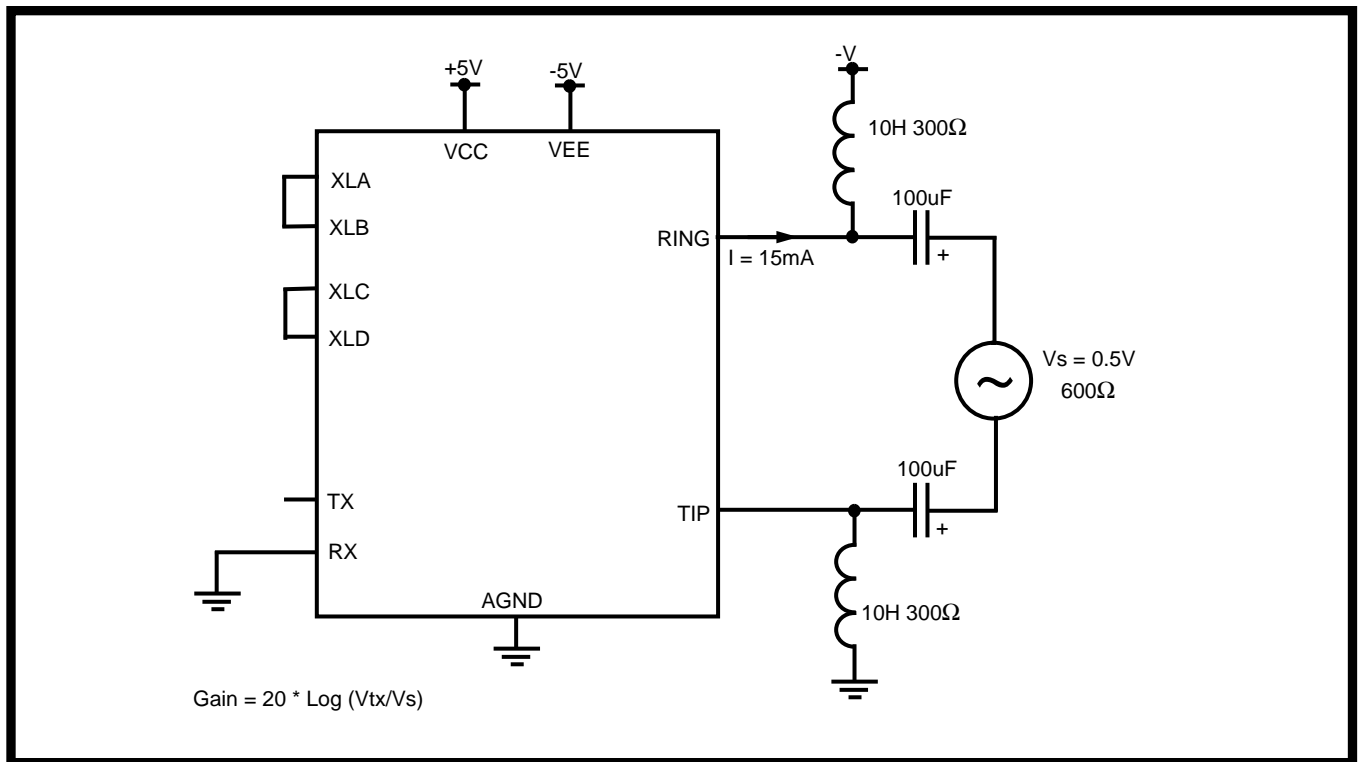


Figure 4 - 2-4 Wire Gain Test Circuit

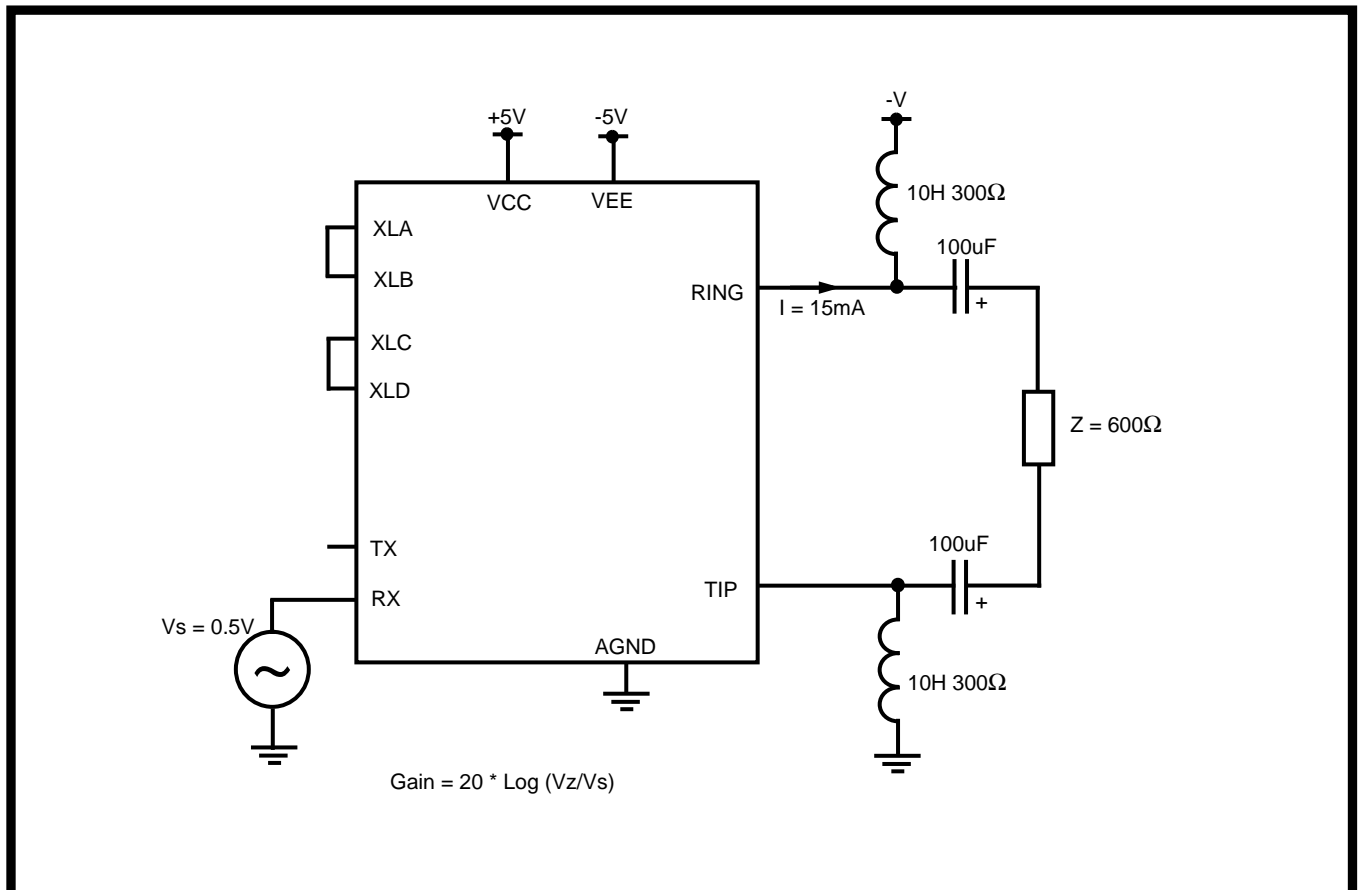


Figure 5 - 4-2 Wire Gain Test Circuit

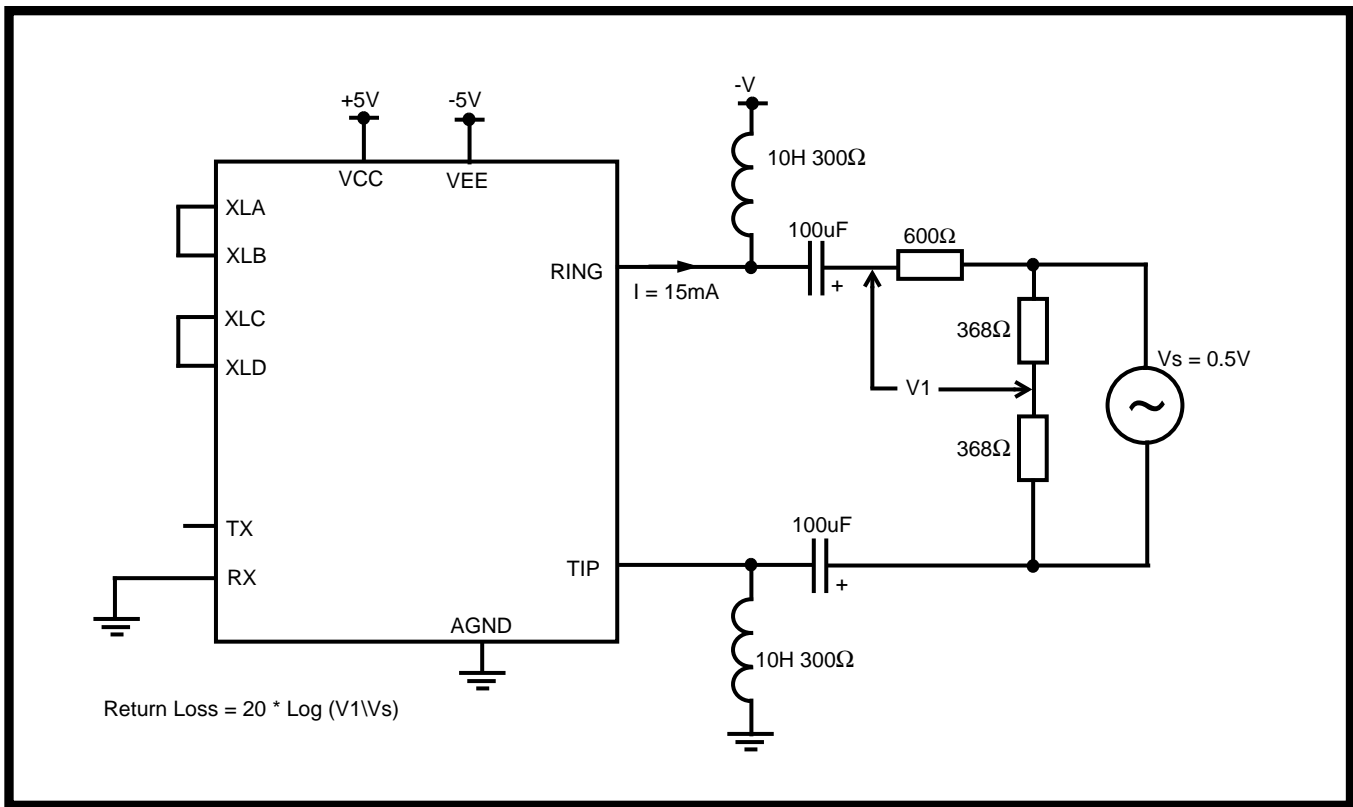


Figure 6 - Return Loss Test Circuit

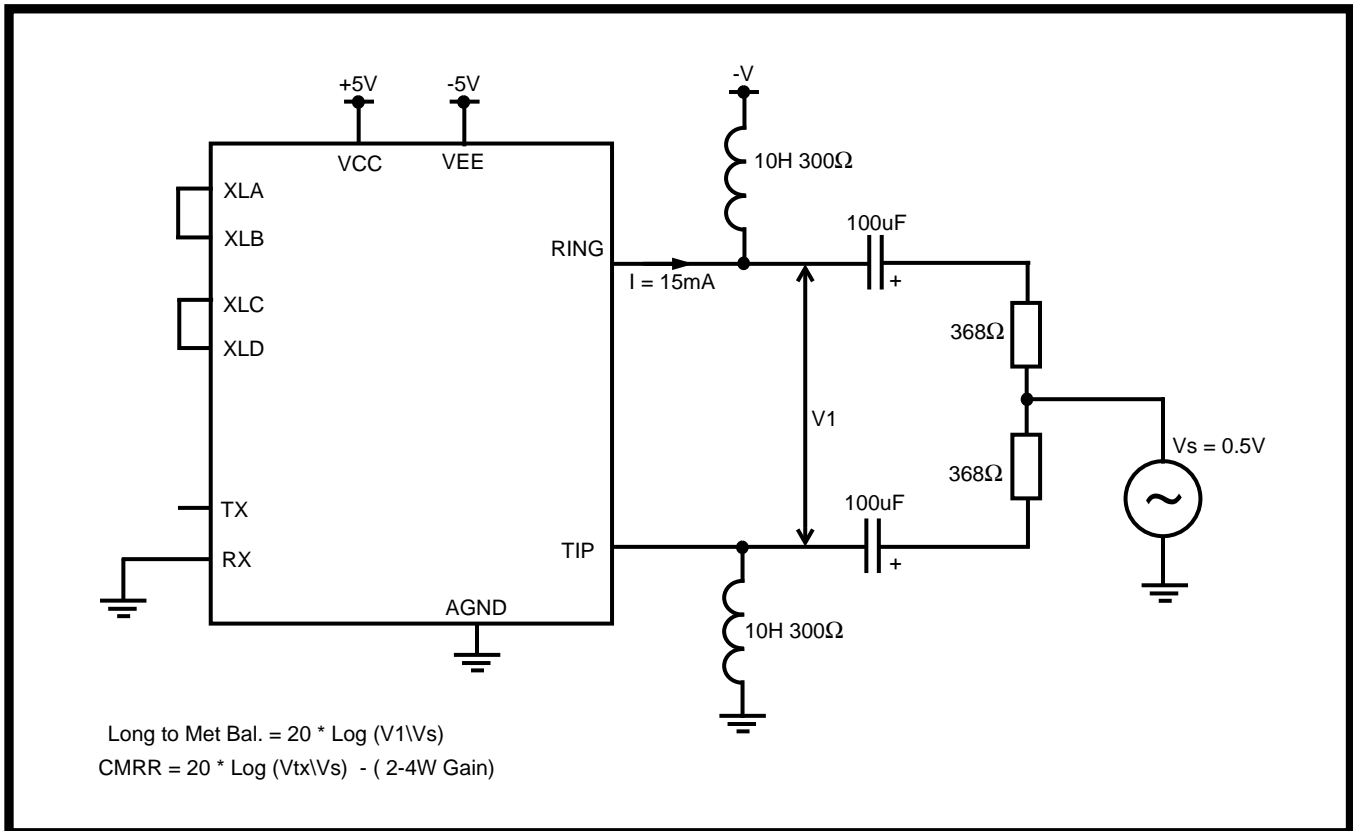


Figure 7 - Longitudinal to Metallic Balance and CMRR Test Circuit

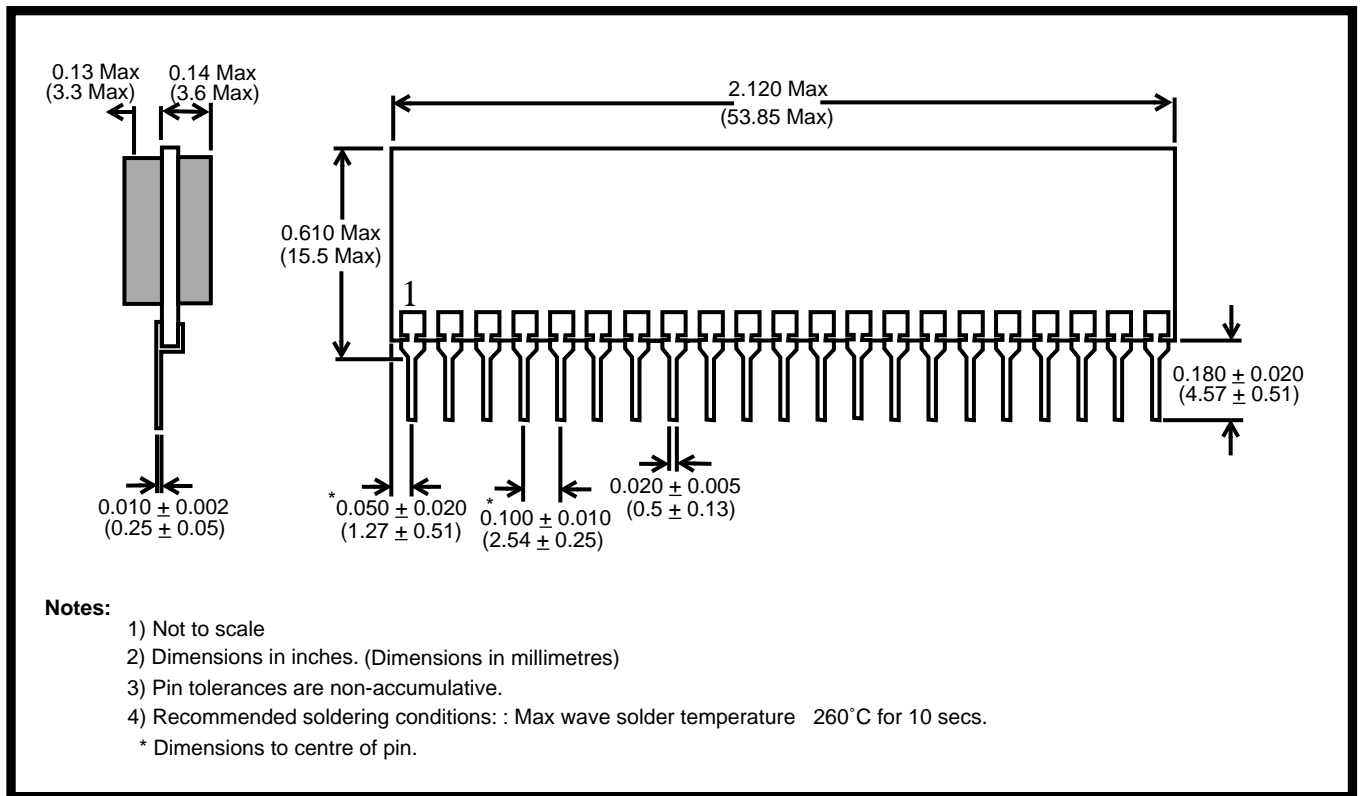


Figure 8 - Mechanical Data

Notes: