MH88434-P

Data Access Arrangement

Preliminary Information

ISSUE 2 March 1997

Features

- FAX and Modem interface (V.34/V.34+)
- Externally programmable line impedance
- Isolation conforms to FCC/DOC requirements
- Transformerless 2-4 Wire conversion
- Integral Loop Switch
- Dial Pulse and DTMF operation
- Accomodates external monitor phone
- Line state detection outputs:
- -loop current/ringing outputs
- Single +5V operation, low on-hook power (25mW)
- Full duplex voice and data transmission
- On-Hook reception from the line

Applications

Interface to Central Office or PABX line for:

- Modem
- FAX / Answering machine
- Electronic point of sale
- Security system
- Telemetry

Ordering Information

MH88434-P	26 Pin DIL Package
MH88434-PS	26 Pin SM Package

0°C to 70°C

Description

The Mitel MH88434 Data Access Arrangement (D.A.A.) provides a complete interface between audio or data transmission equipment and a telephone line. All functions are integrated into a single thick film hybrid module which provides high voltage isolation, very high reliability and optimum circuit design, needing a minimum of external components.

The impedance is externally programmable to allow various country line impedance requirements to be met.

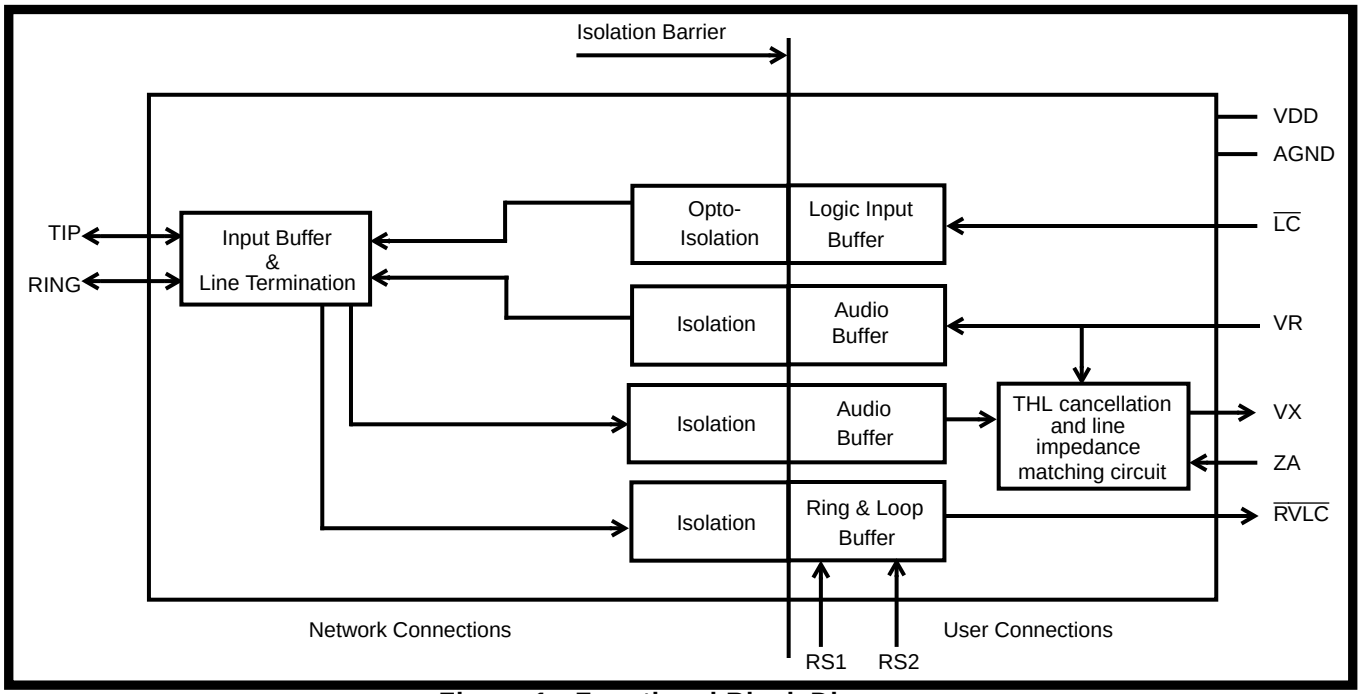


Figure 1 - Functional Block Diagram

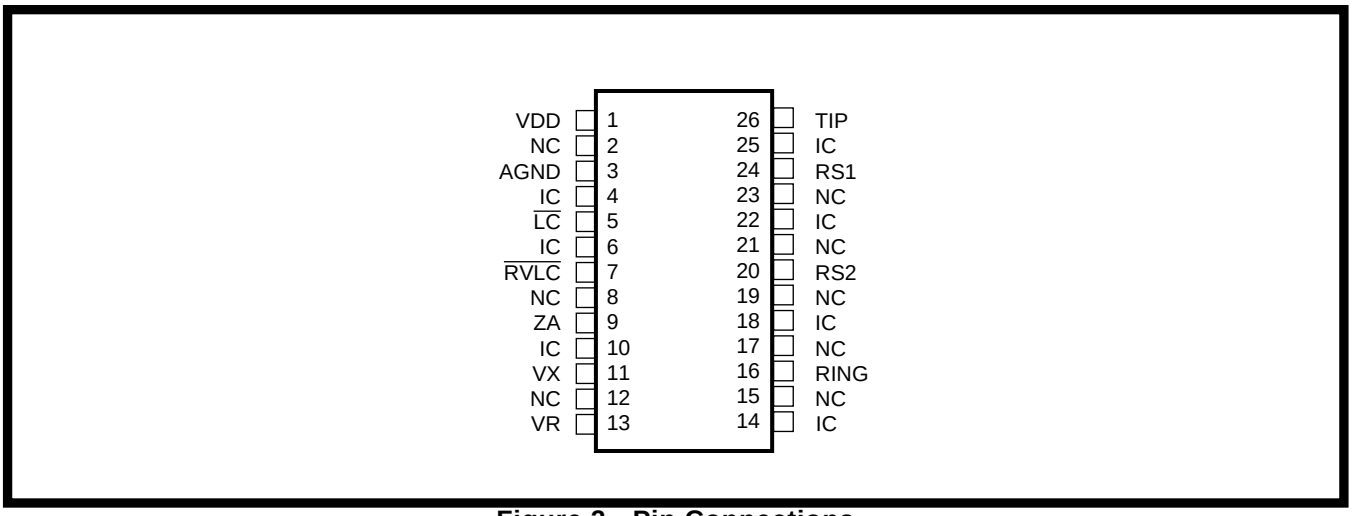


Figure 2 - Pin Connections

Pin Description

Pin #	Name	Description
1	VDD	**Positive Supply Voltage.** +5V.
2, 8	NC	**No Connection.** No pin is fitted.
3	AGND	**Analog Ground.** 4-Wire Ground. Normally connected to System Ground.
4, 6	IC	**Internal Connection.** No connection should be made to this pin. This pin is cropped short.
5	$\overline{LC}$	**Loop Control (Input).** A logic 0 activates internal circuitry which provides a line termination across Tip and Ring. Used for seizing the line and dial pulsing.
7	$\overline{RVLC}$	**Ringing Voltage and Current Detect (Output).** Indicates the status of loop current and ringing voltage.
9	ZA	**External Impedance.** Connects impedance matching components from this pin to ground.
10	IC	**Internal Connection.** No connection should be made to this pin. This pin is cropped short.
11	VX	**Transmit (Output).** Analog output to modem/fax chip set.
12, 15, 17	NC	**No Connection.** No pin is fitted.
13	VR	**Receive (Input).** Analog input from modem/fax chip set.
14	IC	**Internal Connection.** No connection should be made to this pin. This pin is cropped short.
16	RING	**Ring Lead**. Connects to the "Ring" lead of a telephone line.
18, 22,25	IC	**Internal Connection.** No connection should be made to this pin. This pin is cropped short.
19, 21, 23	NC	**No Connection.** No pin is fitted.
20	RS2	**Ringing Sensitivity.** Connects to RS1 via an external link.
24	RS1	**Ringing Sensitivity.** Connects to RS2 via an external link.
26	TIP	**Tip Lead.** Connects to the "tip" lead of a telephone line.

Functional Description

The device is a Data Access Arrangement (D.A.A.). It is used to correctly terminate a 2-Wire telephone line. It provides a signalling link and a 2-4 Wire line interface between an analog loop and subscriber data transmission equipment, such as Modems, Facsimiles (Fax's), Remote Meters, Electronic Point of Sale equipment and Answering Machines.

Isolation

The device provides isolation capable of meeting North American requirements - FCC Part 68.304, DOC CS03 2.2.

External Protection Circuit

An External Protection Circuit assists in preventing damage to the device and the subscriber equipment, due to over-voltage conditions. See Figure 3.

Line Termination

When Loop Control ($\overline{LC}$) is at a logic 0, a line termination is applied across Tip and Ring. The device can be considered off-hook and DC loop current will flow. The line termination consists of both a DC line termination and an AC input impedance. It is used to terminate an incoming call, seize the line for an outgoing call, or if it is applied and disconnected at the required rate, can be used to generate dial pulses. The DC termination resembles approximately 300Ω resistance, which is loop current dependant. The AC input impedance should be set by the user to match the line impedance.

Input Impedance

The MH88434 has a programmable input impedance set by fitting external components between the ZA pin and AGND.

$$\text{Input impedance } Zin = \frac{Zext + Zint}{10}$$

Where Zext = external network connected between ZA and AGND and Zint = 1.3kΩ (internal resistance).

Although the input impedance is programmable to meet any particular requirement, some countries have additional regulations relating to isolation or DC line termination, that the MH88434 will not meet i.e. this device has been designed primarily for North American and Asian applications.

Ringing Voltage Detection

The sensitivity of the ringing voltage detection circuitry can be adjusted by applying an external resistor between the RS1 and RS2 pins. With a short circuit, the threshold sensitivity is ~10Vrms (300kΩ gives ~20Vrms and 620kΩ gives ~30Vrms).

Monitor Phone and Dummy Ringer

An external monitor phone or dummy ringer circuit can be connected across Tip and Ring as shown in Figure 3.

The monitor phone is used in an application such as answering machines.

A Dummy Ringer is an AC load which represents a telephone's mechanical ringer.

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 VX, as required by modem/fax chip sets.

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

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 VR, being sent to the line, must not appear at the output VX. In order to prevent this, the device has an internal cancellation circuit, the measure of this attenuation is Transhybrid Loss (THL).

The Transmit (VX) and Receive (VR) signals are ground referenced (AGND), and biased to 2.5V.

The MH88434 has the ability to transmit analog signals from Tip and Ring through to VX when on-hook. This can be used when receiving caller line identification information.

Transmit Gain

The Transmit Gain of the MH88434 is the gain from the differential signal across Tip and Ring to the ground referenced signal at VX. The internal Transmit Gain of the device is fixed as shown in the AC Electrical Characteristics table. For the correct gain, the Input Impedance of the MH88434, must match the specified line impedance.

By adding an external potential divider to VX, it is possible to reduce the overall gain in the application. The output impedance of VX is approximately 10Ω and the minimum resistance from VX to ground should be 2kΩ. For example: If R3 = R4 = 2kΩ, in Figure 3, the overall gain would reduce by 6.0dB.

Receive Gain

The Receive Gain of the MH88434 is the gain from the ground referenced signal at VR to the differential signal across Tip and Ring. The internal Receive Gain of the device is fixed as shown in the AC Electrical Characteristics table. For the correct gain, the Input Impedance of the MH88434 must match the specified line impedance.

The input impedance to ground of VR is 47kΩ and this can be used with an external series resistor to form a potential divider and reduce the overall gain in the application.

Example: If R5 = 100kΩ, in Figure 3, the overall gain would reduce by 3.0dB.

Supervisory Features

The device is capable of monitoring the line conditions across Tip and Ring, this is shown in Figure 3. The Ringing Voltage / Loop Current detect pin ($\overline{RVLC}$), indicates the status of the device. The $\overline{RVLC}$ output is at logic 0 when loop current flows, indicating that the MH88434 is in an off hook state.

$\overline{RVLC}$ will also go low if a parallel monitor phone goes off-hook. Therefore line conditions can be determined with the $\overline{LC}$ and the $\overline{RVLC}$ pins.

When the device is generating dial pulses, the $\overline{RVLC}$ pin outputs a TTL pulse at the same rate. $\overline{RVLC}$ output will also pulse if a monitor phone is used to dial.

An AC ringing voltage across Tip and Ring will cause $\overline{RVLC}$ to output a TTL pulse at double the ringing frequency, with an envelope determined by the ringing cadence.

Mechanical Data

See Figures 10, 11 and 12 for details of the mechanical specification.

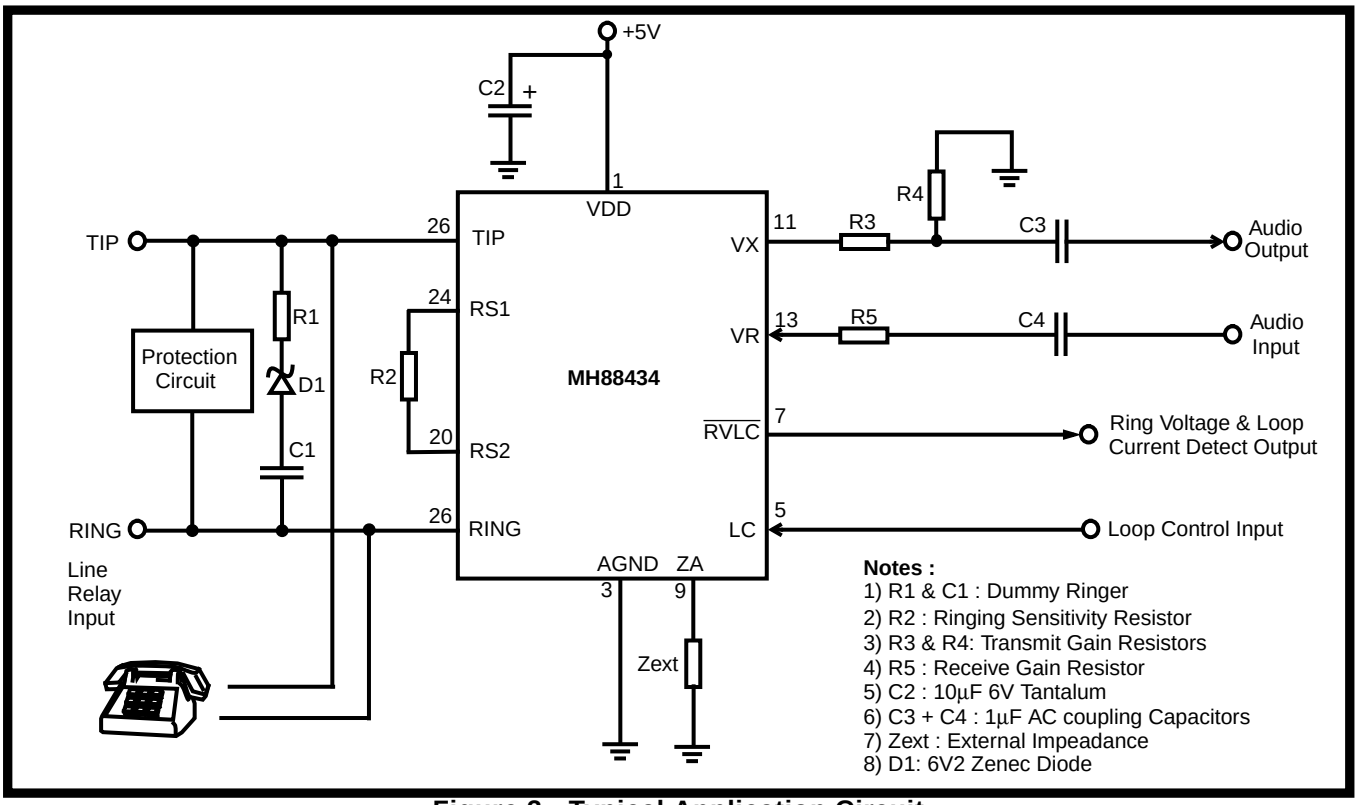


Figure 3 - Typical Application Circuit

Absolute Maximum Ratings* - All voltages are with respect to AGND unless otherwise specified.

	Parameter	Sym	Min	Max	Units	Comments
1	DC Supply Voltage	V_{DD}	-0.3	6	V	
2	Storage Temperature	T_S	-55	+125	˚C	
3	DC Loop Voltage	V_{BAT}	-110	+110	V	
4	Ringing Voltage	V_R		120	Vrms	
5	Loop Current	I_{Loop}		90	mA	
6	Ring Trip Current	I_{TRIP}		180	mA_{rms}	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

	Parameter	Sym	Min	Typ‡	Max	Units	Test Conditions
1	DC Supply Voltages	V_{DD}	4.75	5.0	5.25	V	
2	Operating Temperatures	T_{OP}	0	25	70	˚C	
3	RingingVoltage	V_R		75	90	Vrms	

‡ Typical figures are at 25˚C with nominal +5V supply and are for design aid only

Loop Electrical Characteristics †

	Characteristics	Sym	Min	Typ‡	Max	Units	Test Conditions
1	Ringing Voltage No Detect Detect	VR	 14		 7	 Vrms Vrms	Externally Adjustable
2	Ringing Frequency		15		68	Hz	
3	Operating Loop Current		15		80	mA	
4	Off-Hook DC Voltage		 2.4 3.1	 4.5 5.5 6.5	 6.0 6.0 7.8	 V V V	Test circuit as Fig 4 I_{Loop}=15mA I_{Loop}=20mA I_{Loop}=26mA
5	Leakage Current (Tip or Ring to AGND)				10 7	µA mA	100V DC 1000V AC
6	Leakage Current on-hook (Tip to Ring)			5.2	10	µA	V_{BAT} = -50V
7	Dial Pulse Distortion ON OFF		0 0	+2 +2	+4 +4	ms ms	
8	Loop Condition Detect Threshold Off-Hook		 4		 20	 V	

† 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.
*Note 1: Refer to EIA/TIA 464 section 4.1.1.4.4

DC Electrical Characteristics †

		Characteristics	Sym	Min	Typ‡	Max	Units	Test Conditions
1		Supply Current	I_{DD}		5	8	mA	V_{DD} = 5.0V, On-hook
2	$\overline{RVLC}$	Low Level Output Voltage High Level Output Voltage	V_{OL} V_{OH}	 2.4		0.4	V V	I_{OL} = 4mA I_{OH} = 0.4mA
3	$\overline{LC}$	Low Level Input Voltage High Level Input Voltage Low Level Input Current High Level Input Current	V_{IL} V_{IH} I_{IL} I_{IH}	 2.0 	 0 100	0.8 10 150	V V µA µA	 V_{IL} = 0.0V V_{IH} = 5.0V

† 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	Sym	Min	Typ‡	Max	Units	Test Conditions
1	Input Impedance VR			47k		Ω	
2	Output Impedance at VX			10		Ω	
3	Receive Gain (VR to 2-Wire)		-0.5	0	0.5	dB	Test circuit as Fig 6 Input 0.5V at 1kHz
4	Frequency Response Gain (relative to Gain @ 1kHz)		-0.3 -0.3	0 0	0.3 0.3	dB dB	300Hz 3400Hz
5	Signal Output Overload Level at 2-Wire at VX			 0 3	 0.1 3.5	 dBm dBm	THD ≤ 5% @ 1kHz I_{Loop} = 25 to 75mA
6	Signal/Noise & Distortion at 2-Wire at VX	SINAD		 69 64		 dB dB	1kHz 0dBm I_{Loop} = 25 to 75mA 300-3400Hz
7	Power Supply Rejection Ratio at 2-Wire at VX	PSRR	 24 24	 34 34		 dB dB	Ripple 0.1Vrms 1kHz on V_{DD}
8	Transhybrid Loss	THL	18	38		dB	Test circuit as Fig 6 Input -3.5dBm, 200-3400Hz at V_R
9	2-Wire Input Impedance	Zin		Note 3		Ω	@1kHz
10	Return Loss at 2-Wire (Reference 600Ω)	RL	 18 20 18	 24.5 40 38		 dB dB dB	Test circuit as Fig 7 200-500Hz 500-2500Hz 2500-3200Hz
11	Longitudinal to Metallic Balance Metallic to Longitudinal Balance		 46 46 60 40	 62 59 69 64		 dB dB dB dB	Test circuit as Fig 8 200-1000Hz 1000-3000Hz Test circuit as Fig 9 200-1000Hz 1000-4000Hz

AC Electrical Characteristics † (continued)

	Characteristics	Sym	Min	Typ‡	Max	Units	Test Conditions
12	Idle Channel Noise	Nc					
	at 2-Wire			7.6	20	dBrnC	Cmess filter
	at VX			9.6	20	dBrnC	
	at 2-Wire			80		dBm	300-3400Hz filter
	at VX			80		dBm	
13	Transmit Gain (2-Wire to VX)						Test circuit as Fig 5
	Off-Hook		-0.5	0	0.5	dB	Input 0.5V @ 1kHz
	On-Hook			0		dB	$\overline{LC}$ @ V_{DD}
14	Frequency Response Gain (relative to Gain @ 1kHz)		-0.3	0	0.3	dB	300Hz
			-0.3	0	0.3	dB	3400Hz
15	Intermodulation Distortion products at VX and 2W	IMD		75		dB	I_{Loop} 25-75mA F1 = 1kHz at -6dBm F2 = 800Hz at -6dBm Total signal power = -3dBm
16	Distortion VX due to near end echo (300Hz - 3400Hz bandwidth)			82		dB	I_{Loop} 25-75mA F1 = 1kHz at -6dBm F2 = 800Hz at -6dBm Total signal power = -3dBm

† Electrical Characteristics are over Recommended Operating Conditions unless otherwise stated.
‡ Typical figures are at 25°C with nominal +5V and are for design aid only.
*Note 1: All of the above test conditions use a test source impedance which matches the device's impedance.
*Note 2: dBm is referenced to 600Ω unless otherwise stated.
*Note 3: Zin = $\frac{Zext + 1k3}{10}$ ZA has 1k3 fitted internally, this must be added to the external resistor when calculating Zext e.g. 4k7 external and 1k3 internal = 6k0 which gives Zin = 600Ω.

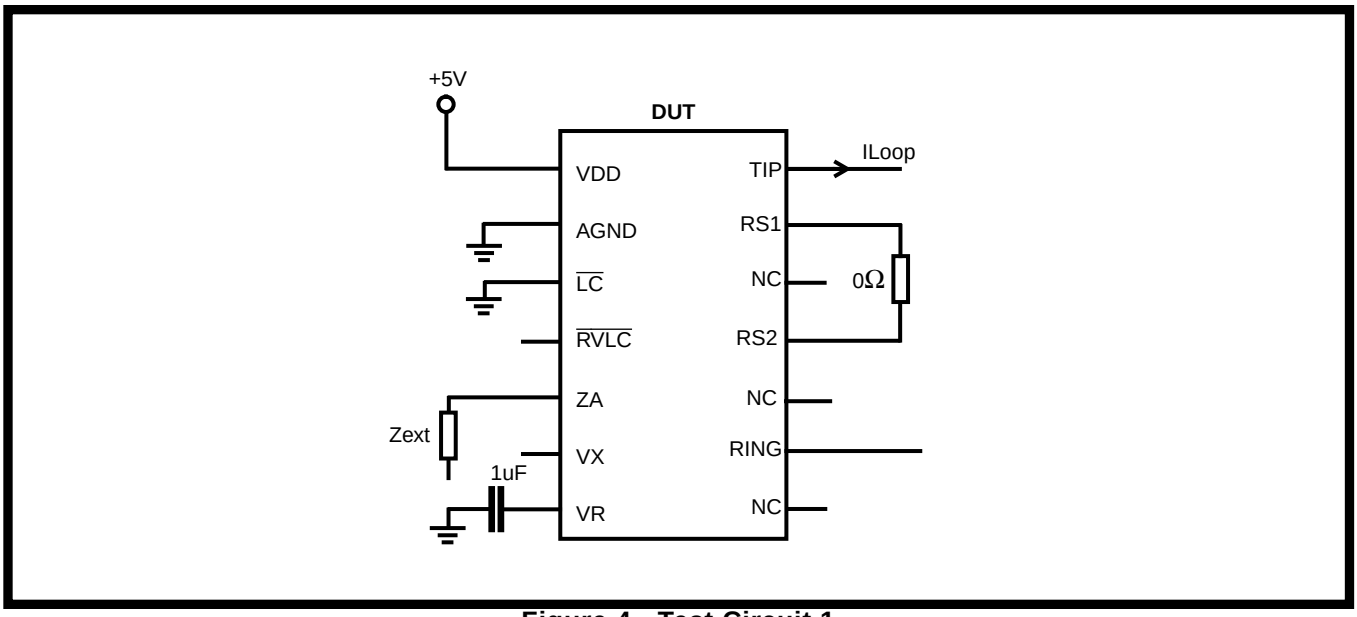


Figure 4 - Test Circuit 1

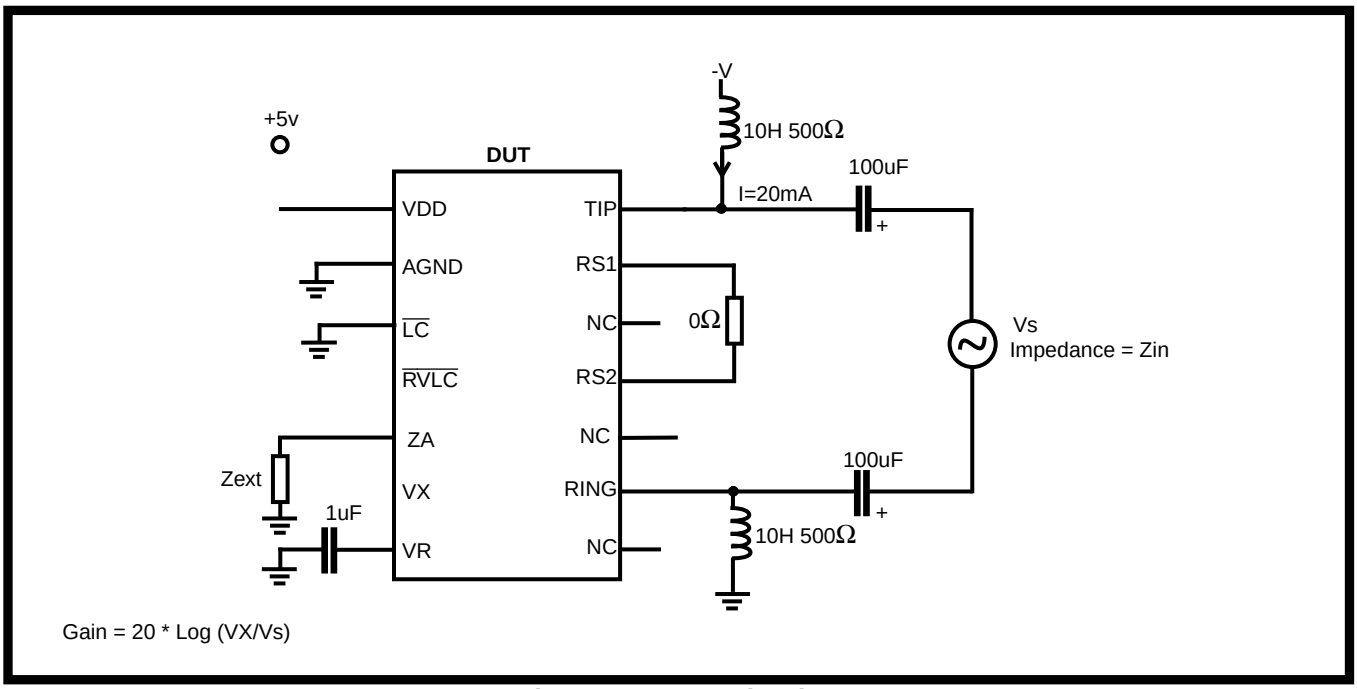


Figure 5 - Test Circuit 2

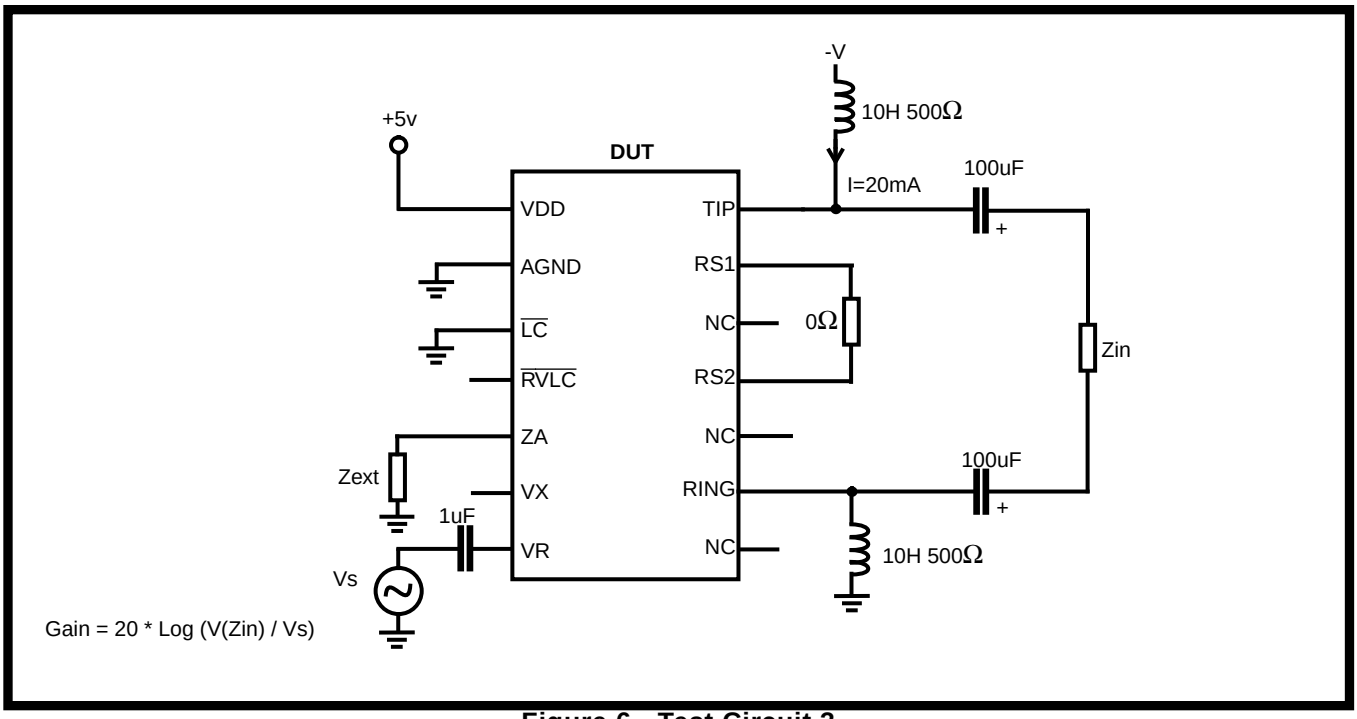


Figure 6 - Test Circuit 3

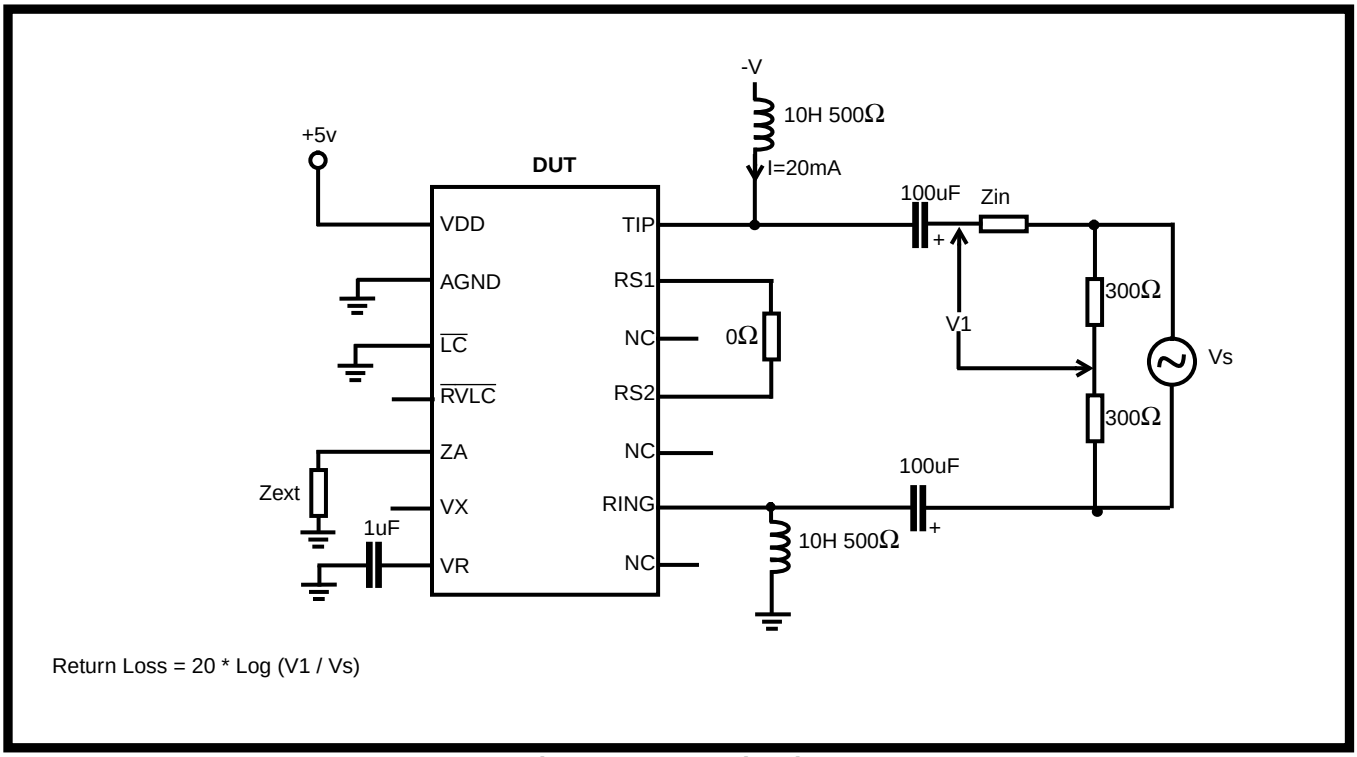
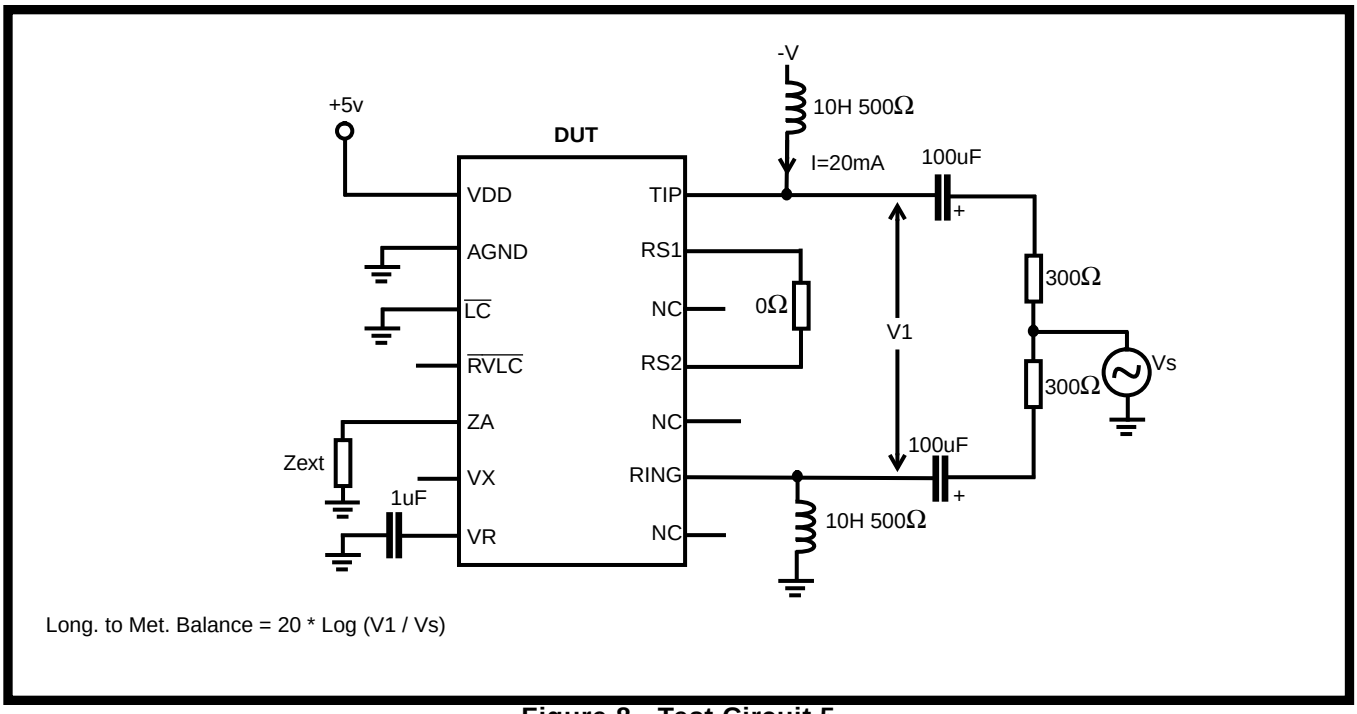
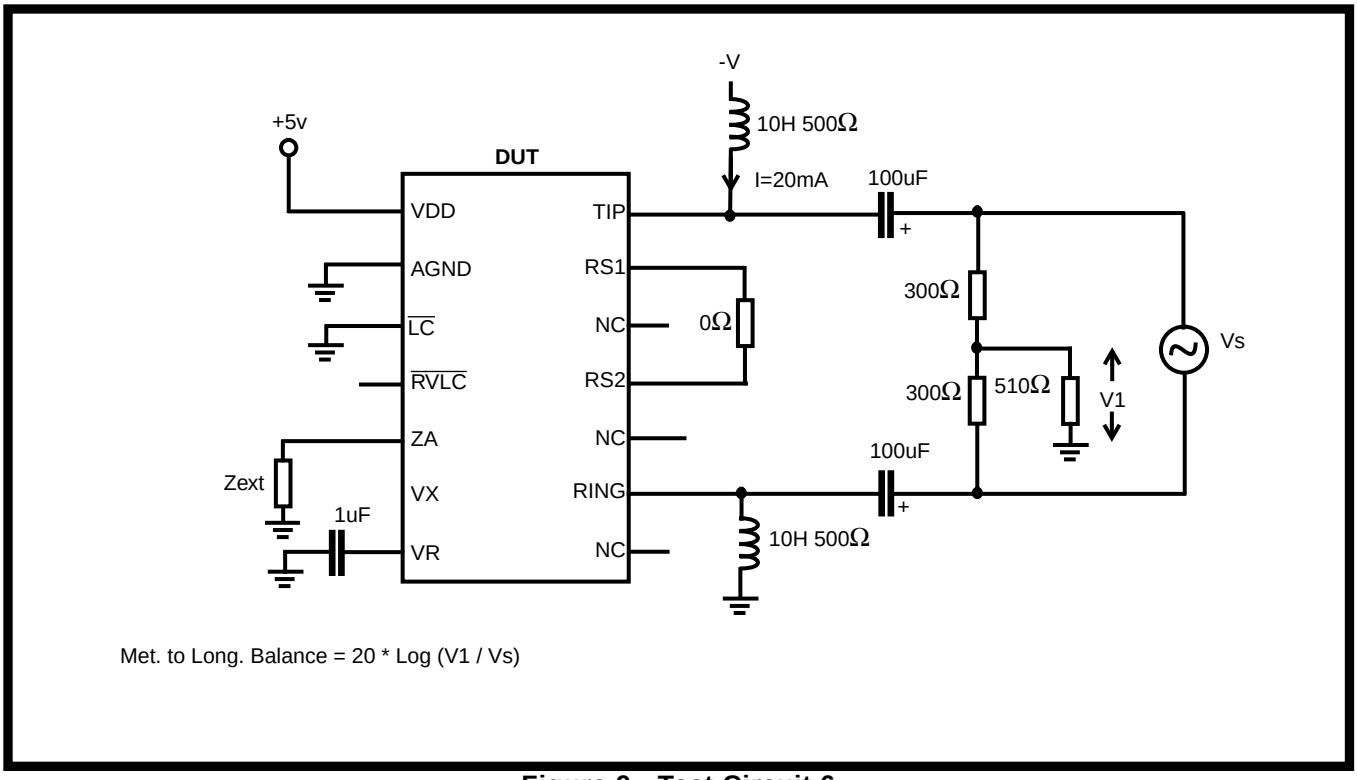


Figure 7 - Test Circuit 4



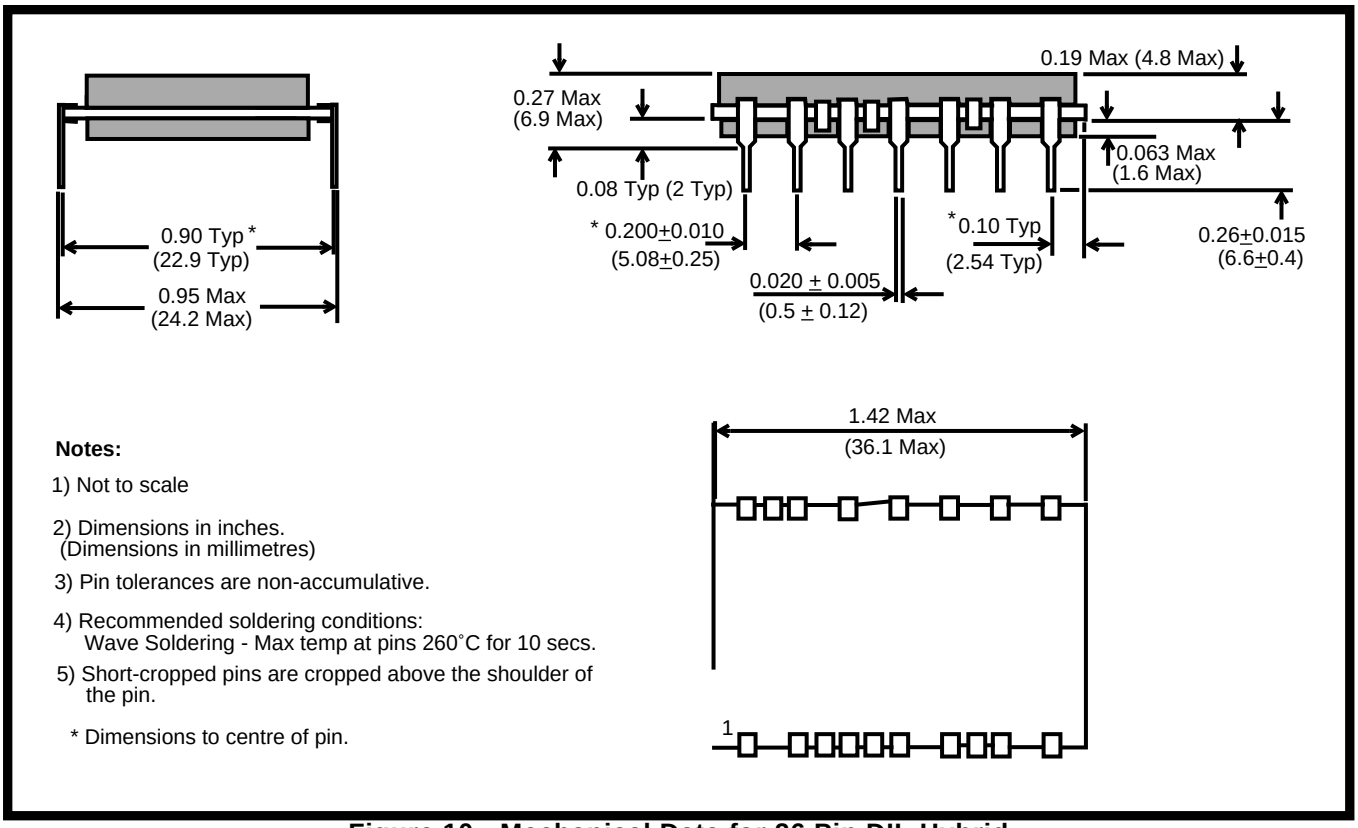
Long. to Met. Balance = 20 * Log (V1 / Vs)

Figure 8 - Test Circuit 5



Met. to Long. Balance = 20 * Log (V1 / Vs)

Figure 9 - Test Circuit 6



Notes:

1) Not to scale

2) Dimensions in inches.
(Dimensions in millimetres)

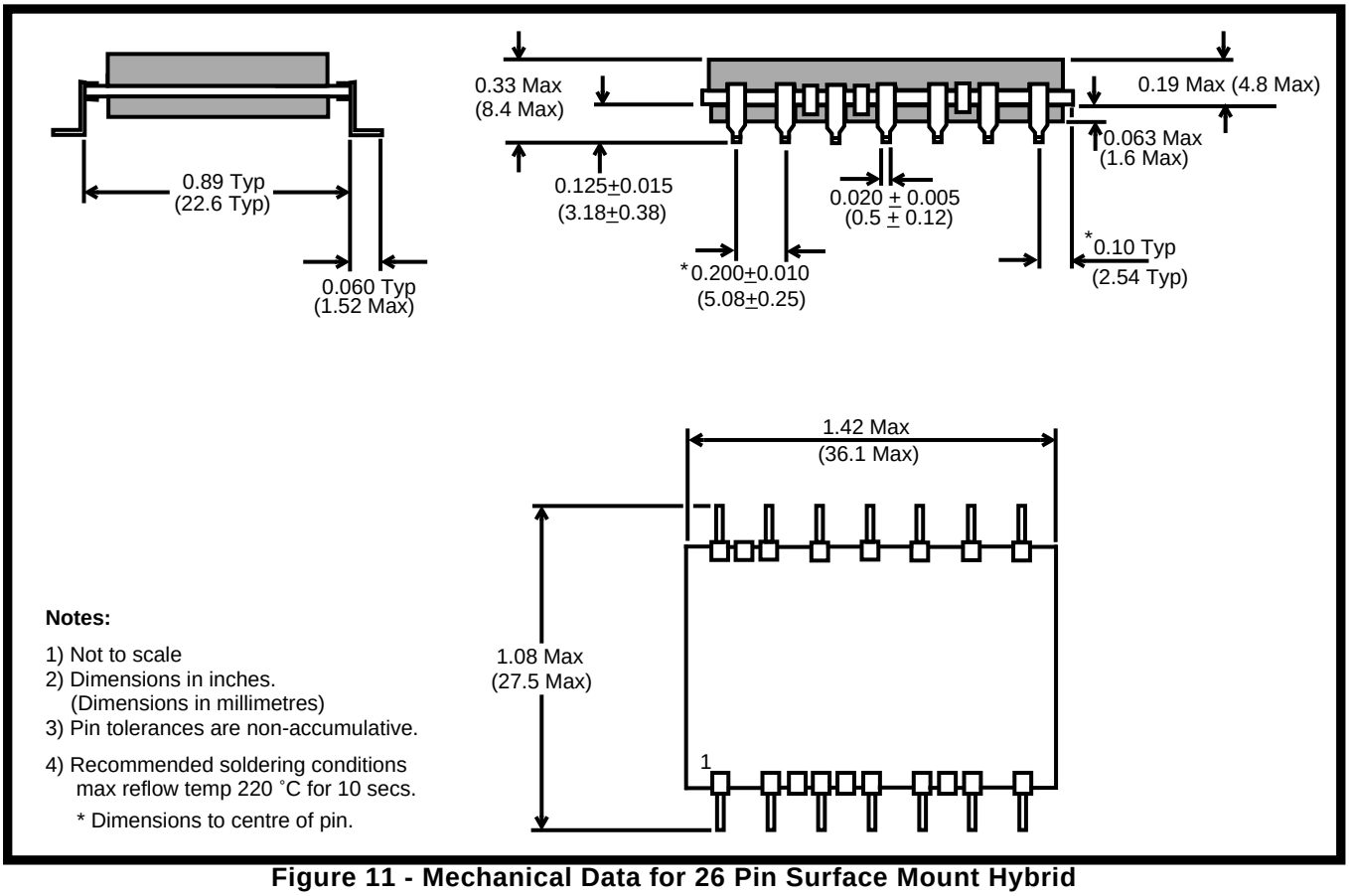
3) Pin tolerances are non-accumulative.

4) Recommended soldering conditions:
Wave Soldering - Max temp at pins 260˚C for 10 secs.

5) Short-cropped pins are cropped above the shoulder of the pin.

* Dimensions to centre of pin.

Figure 10 - Mechanical Data for 26 Pin DIL Hybrid



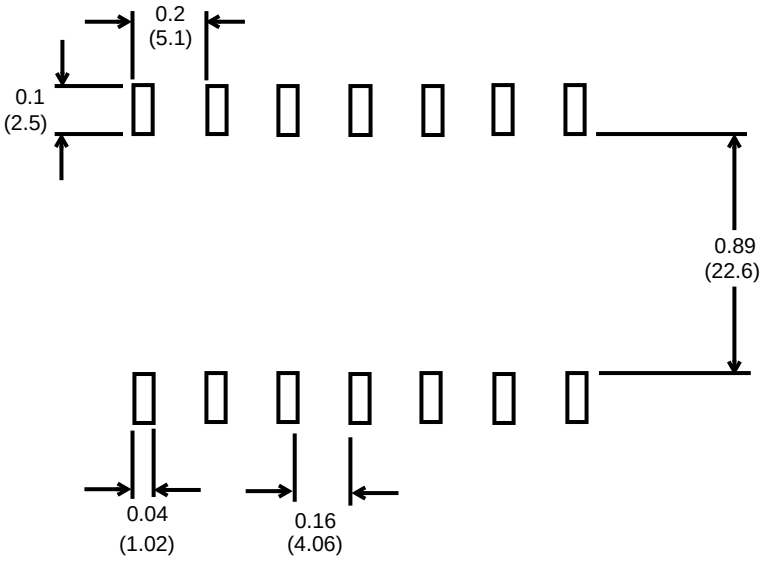
Notes:

1) Not to scale
2) Dimensions in inches.
(Dimensions in millimetres)
3) Pin tolerances are non-accumulative.

4) Recommended soldering conditions
max reflow temp 220 ˚C for 10 secs.

* Dimensions to centre of pin.

Figure 11 - Mechanical Data for 26 Pin Surface Mount Hybrid



Notes:
1) Not to scale
2) Dimensions in inches.
(Dimensions in millimetres)
3) All dimensions are Typical.

Figure 12 - Recommended Footprint for 26 Pin Surface Mount Hybrid