MH88520-1

German Subscriber Line Interface Circuit (SLIC)

Preliminary Information

ISSUE 4 April 1995

Features

- Differential to single ended conversion
- Transformerless 2-2 wire conversion
- Minimum installation space
- Off-Hook detection and $\overline{\text{LED}}$ indicator drive
- Relay drive output
- Battery and ringing feed to line
- Logic interface: $\overline{\text{MUTE}}$, $\overline{\text{SHK}}$, RRC
- Mute of incoming audio
- Dial pulse detection
- Voltage surge protection
- German complex input impedance

Applications

Line Interface for:

- Intercoms
- Key Systems
- PABX

Ordering Information

MH88520-1 20 Pin SIL Package

0°C to 70°C

Description

The Mitel MH88520-1 German Subscriber Line Interface Circuit provides a complete interface between the telephone line and a speech switch requiring only single bidirectional switch per crosspoint. The functions provided by the MH88520-1 include bidirectional differential to single ended conversion in the speech path, line battery feed, ringing feed and loop and dial pulse detection. The device is fabricated as a thick film hybrid in a 20-pin 'single-in-line' (SIL) package allowing optimum circuit board packing density and very high reliability.

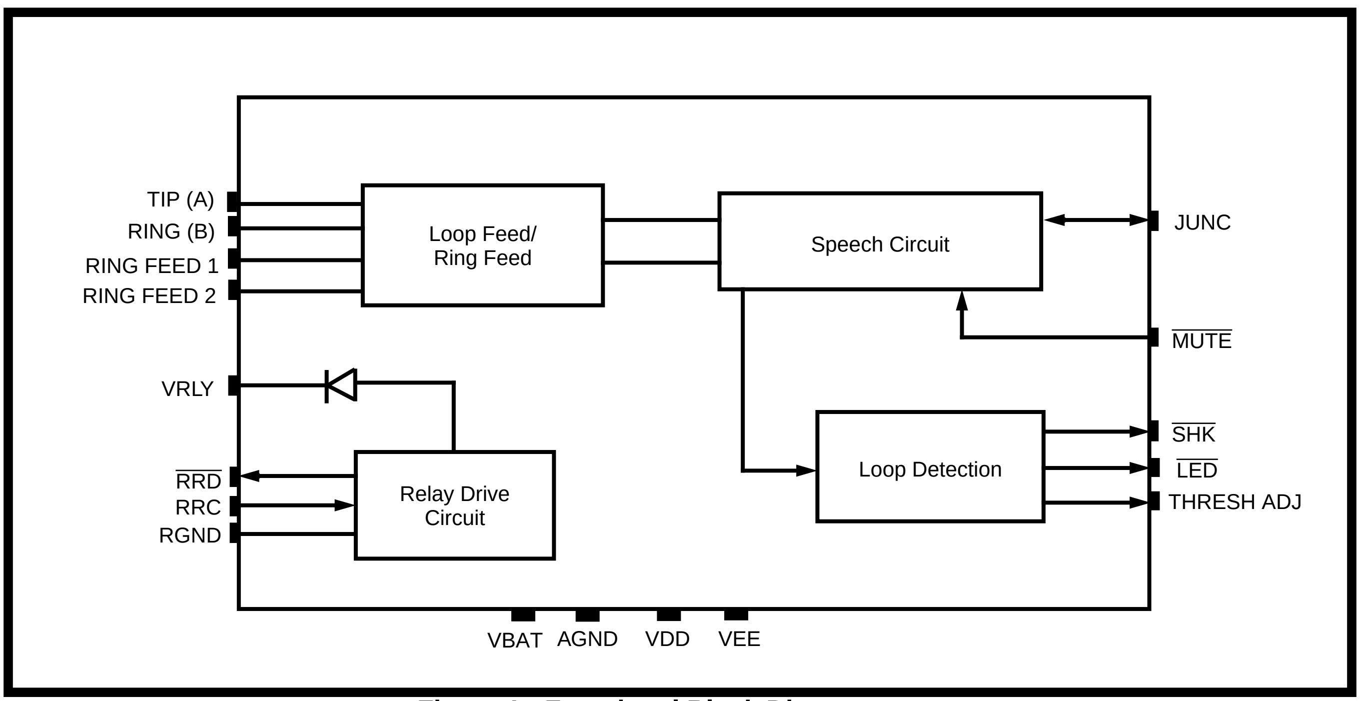


Figure 1 - Functional Block Diagram

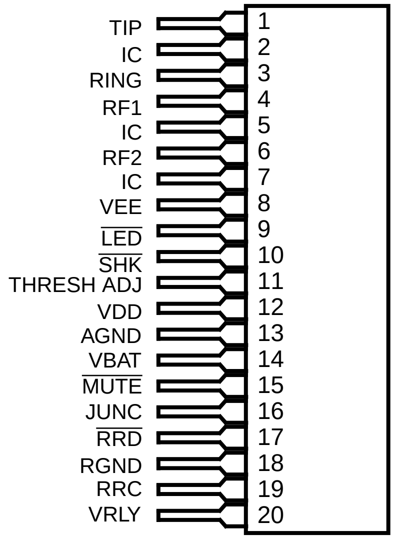


Figure 2 - Pin Connections

Pin Description

Pin #	Name	Description
1	TIP	**Tip Lead.** Connects to the “Tip” lead (A-wire) of the telephone line.
2	IC	**Internal Connection**. Leave open circuit**.**
3	RING	**Ring Lead.** Connects to the “Ring” lead (B-wire) of the telephone line.
4	RF1	**Ring Feed 1.** Connect to the Ring Relay contact. See Figure 5.
5	IC	**Internal Connection.** Leave open circuit.
6	RF2	**Ring Feed 2.** Connect to normally closed contact of Ring Relay. See Figure 5.
7	IC	**Internal Connection.** Leave open circuit.
8	V_{EE}	**Negative Power Supply Voltage**. Normally -5V.
9	$\overline{LED}$	**LED Drive (Output).** Drives an LED directly. A logic low indicates an off-hook condition.
10	$\overline{SHK}$	**Switch Hook Detect (Output).** A logic low indicates an off-hook and dial pulsing condition. Open collector output with 10kΩ internal pull up to V_{DD}.
11	THRESH ADJ	Allows adjustment of $\overline{SHK}$ detection threshold as shown in Figure 6.
12	V_{DD}	**Positive Power Supply Voltage**. Normally +5V. This provides current for both internal circuitry as well as the loop.
13	AGND	**Analog Ground.** Supply and Battery Ground.
14	V_{BAT}	**Battery Supply Voltage.** Normally -24V. This provides current to the loop.
15	$\overline{MUTE}$	**MUTE (Input)**. A logic low will mute signals coming from Tip-Ring to the JUNC pin.
16	JUNC	**JUNCTOR**. Ground (AGND) referenced transmit and receive speech path.
17	$\overline{RRD}$	**Ring Relay Drive (Output).** Connects to the ring relay coil. A logic low activates the relay.
18	RGND	**Relay Ground.** Return path for relay supply voltage. Normally connected to AGND.
19	RRC	**Ring Relay Control (Input)**. A logic high activates the Ring Relay Drive ($\overline{RRD}$) outputs.
20	VRLY	**Relay Positive Supply voltage**. Normally +5V. Connects to the relay coil and the relay supply voltage. An internal clamp diode from VRLY to GRND is provided.

Functional Description

The BORSH Functions

The MH88520-1 performs all of the Borsh functions of Battery Feed Overvoltage Protection, Ringing, Supervision and Hybrid (2-2 Wire).

Return Loss at Tip-Ring

To maximise return loss, the impedance at Tip-Ring should match the SLIC's impedance (220R + 820R // 115nF). However, the SLIC's input impedance is dependent on the JUNCTOR termination resistance. Therefore the JUNCTOR must be terminated with 754Ω.

Figure 3 illustrates a typical connection between two SLICs through two crosspoint switches. Optimum return loss occurs when the JUNCTOR is terminated with 754Ω. Since the JUNCTOR input/output impedances is 604Ω and the crosspoint switch resistances are 75Ω + 75Ω, this configuration gives optimum return loss as shown in Figure 4.

Hybrid

The 2-2 wire hybrid circuit converts the incoming balanced signal at Tip and Ring of the telephone line into a ground referenced output signal at JUNC of the SLIC, and converts the ground referenced input signal at JUNC of the SLIC into the non-balanced output signal at Tip-Ring of the telephone line.

Mute

A logic low at the $\overline{\text{MUTE}}$ input results in muted signals coming from Tip and Ring to the JUNC terminal while allowing signals from the JUNC terminal to Tip and Ring to be transmitted.

Overvoltage Protection

The MH88520-1 is protected from short term (1ms) (+250V) between Tip and Ring, Tip and Ground, and Ring and Ground. However, additional protection circuitry may be needed depending upon the requirements which must be met for the final equipment.

Loop Detection

The loop detection circuit determines whether a low enough path is across Tip and Ring to be recognised as an off-hook condition. (Threshold impedance = 5.4kΩ with no adjustment). This threshold level can be adjusted by the use of external resistors as shown in Figure 6. When an off-hook condition occurs the $\overline{\text{SHK}}$ and $\overline{\text{LED}}$ outputs toggle to a logic low level. These outputs also toggle during incoming dial pulses.

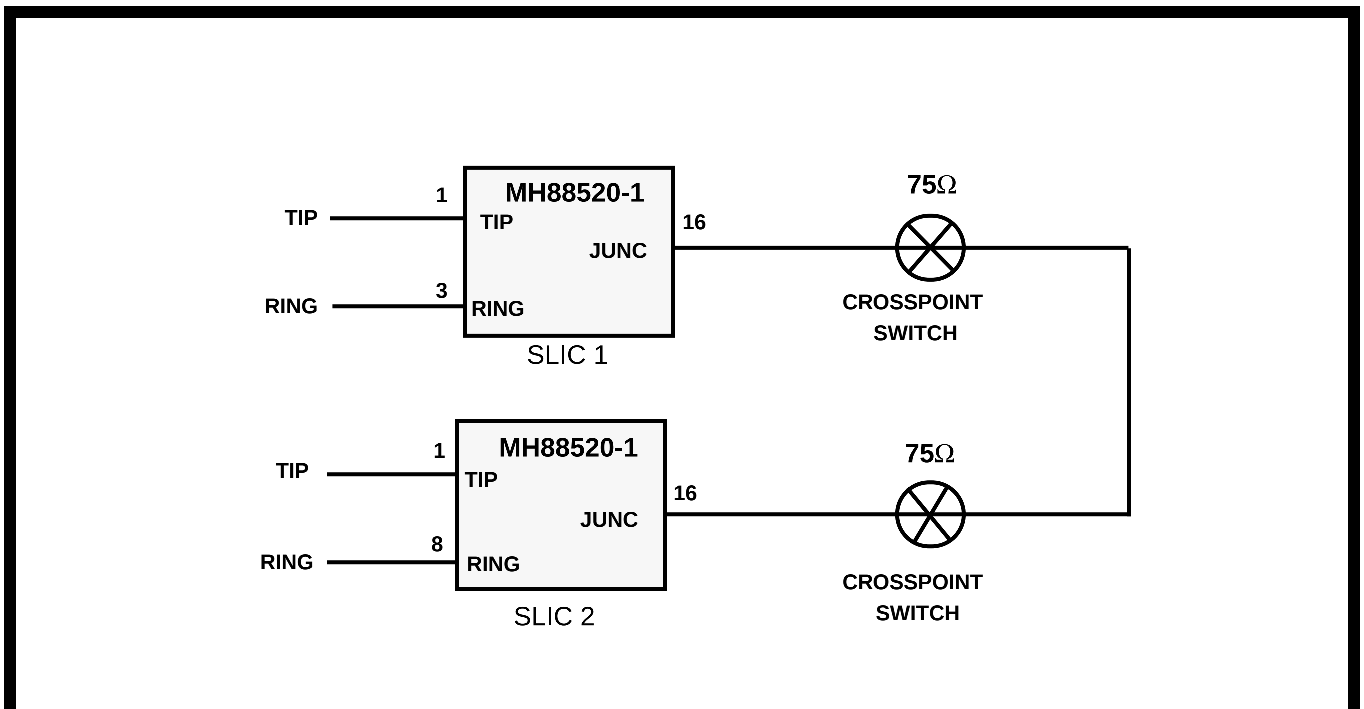


Figure 3 - SLIC Crosspoint Switch Connection

Ringing

The relay drive circuit switches ringing onto Ring Feed (Fig. 7). The diode is present to suppress voltage transients during relay switching caused by the inductive coils of the relay. Ringing voltage included ac ringing ($90V_{RMS}$ typically) and DC line feed voltage (-24V typically).

Line Feed/Ring Feed Circuit

The line feed circuit provides loop current and the ability to apply ringing onto Tip and Ring. The impedance from Ring Feed to GND is 600Ω dc (although for ac it is optimised for a German complex impedance) which gives the loop current as:

$$\frac{\text{Voltage at Ring Feed pin}}{\text{Telephone Impedance + 600}} \quad \text{Amps}$$

The positive supply for the line feed circuit is VDD though the loop current is determined from Ring Feed and GND.

Line Impedance

The MH88520-1's Tip-Ring (Zin) impedance is fixed at the German complex impedance. For correct SLIC impedance, JUNC must be appropriately terminated. **See AC Electrical Characteristics.**

Transmit and Receive Gain

Transmit Gain (JUNC to Tip-Ring) and Receive Gain (Tip-Ring to JUNC) are fixed (See AC Electrical Characteristics). For correct gain, the SLIC input impedance must match theline impedance and JUNC must be appropriately terminated.

Digital Applications

The 2-wire junctor output can be converted to a 4-wire circuit using the MH88524 (2-4 wire converter). This 4 wire circuit can be interfaced to a filter/codec to use in digital voice switched systems. Alternatively the MH88600/MH88612, digital ONS SLIC can be used.

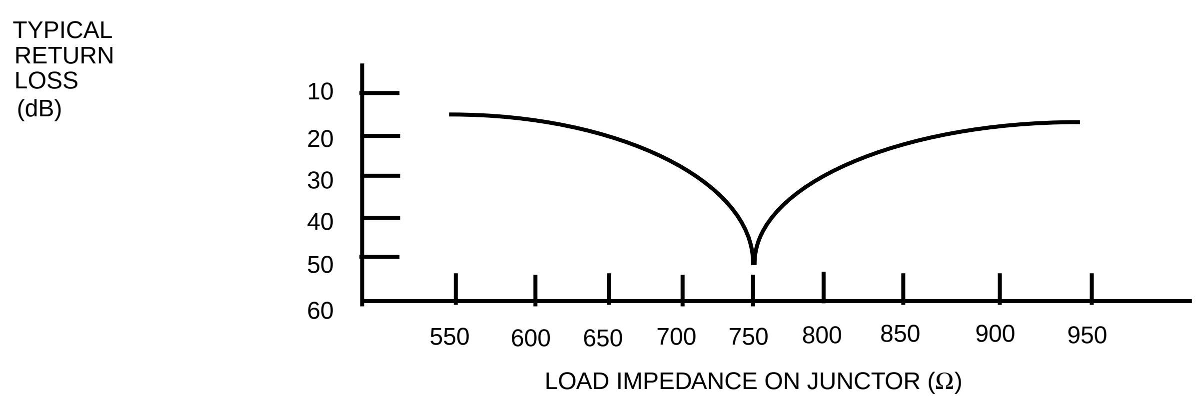


Figure 4 - Return Loss VS Junctor Load Impedance

Absolute Maximum Ratings†

	Parameter	Symbol	Min	Max	Units
1	Voltage Supplies Referenced to GND	V_{DD}	-0.3	+15	V
		V_{EE}	-15	0.3	V
		V_{Bat}	-35	0.3	V
2	Clamp Diode Breakdown Voltage-V_{Ref} to RGND	V_{RLY}		+32	V
3	Operating Temperature	T_{AMB}	0	+70	˚C
4	Storage Temperature	T_S	-55	+125	˚C
5	Power Dissipation	P_D		4	Watt

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

AC Electrical Characteristics†

Voltages are with respect to ground (V_{SS}), TA = 25˚C, unless otherwise stated.
Test conditions unless noted, V_{DD}=5V, V_{EE}=-5V, V_{Bat}=-24V).

	Characteristics	Sym	Min	Typ‡	Max	Units	Test Conditions
1	Junctor to Differential Output (tip-ring) Gain			-7.0	0	dB	1kHz, 0.5V source on pin 16. Note 2
2	Differential; Input (tip-ring) to Junctor Gain			0.0		dB	1kHz, 0.5V Source Applied on pins 1&3 Note 1, 2
3	On/Off Hook Detection Threshold Loop Current	I_{Thresh}	8.0	10	12	mA	Note 1
4	Transhybrid Loss			30		dB	Notes 1,2
5	Passband Frequency Response			±1.0		dB	Notes 1,2 200Hz - 3400Hz
6	Power Supply Rejection Ratio (@ Junctor) V_{BAT} / V_{DD} / V_{EE}	PSRR PSRR PSRR		30 40 40		dB dB dB	Notes 1,2. Ripple 0.1V 1kHz
7	Common Mode Rejection Ratio (Tip and Ring to Junctor)	CMRR		40		dB	Notes 1,2 1kHz, 0.5V
8	Longitudinal Balance		46	50		dB	Notes 1
9	Junctor Output Impedance	Z_{OJ}		604		Ω	
10	Return Loss at Tip, Ring		18	30		dB	1kHz Notes 1,2
11	Max. Signal Level				3	dB	Notes 1,2
12	Max. Ringing Voltage				105	V_{RMS}	
13	Max. Ringing Frequency			25	60	Hz	
14	Idle Channel Noise at T-R at Junctor	N_{TR} N_J		-80 -80	-70 -75	dBmp dBmp	Notes 1,2
15	Mute Attenuation			30		dB	Notes 1,2

† Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.
‡ Typical figures are at 25°C with nominal± 5V supplies and are for design aid only: not guaranteed and not subject to production testing.
Note 1: 754Ω connected between JUNCTOR (pin 16) and 0V.
Note 2: German Impedance connected between TIP (A) (pin 1) and RING (B) (pin 3).

DC Electrical Characteristics

		Characteristics	Sym	Min	Typ‡	Max	Units	Test Conditions
1	SUPPLY	Operating Supply Voltages	V_{DD} V_{EE} V_{Bat}	4.5 -5.5 -30	5 -5 -24	5.5 -4.5 -20	V V V	
2	SUPPLY	Operating Supply Currents	I_{DD} I_{EE} I_{Bat}		8 6 1		mA mA mA	On Hook
3	INPUTS	High Level Input Voltage $\overline{MUTE}$ RRC	 V_{IH} V_{IH}	 2.0 4.5			 V V	
4	INPUTS	Low Level Input Voltage $\overline{MUTE}$ RRC	 V_{IL} V_{IL}			 0.8 0.5	 V V	
5	INPUTS	High Level Input Current $\overline{MUTE}$ RRC	 I_{IH} I_{IH}			 -28 700	 μA μA	
6	INPUTS	Low Level Input Current $\overline{MUTE}$ RRC	 I_{IL} I_{IL}			 100 10	 μA μA	
7	OUTPUTS	Sink Current LED $\overline{RRD}$	 I_{LED} I_{RRD}	 65	 1.5 100	 200	 mA mA	 V_{RLY} = RRC= 5V RGND = 0V V_{RRD} < 1.5V
8	OUTPUTS	Relay to V_{DD} Diode Clamp Current	 I_{RLY}	 65	 100		 mA	 RRC=RGND=0V V_{RLY} = 5V V_{RRD} > 4.5V
9	OUTPUTS	High Level Output Voltage $\overline{SHK}$	V_{OH}	4.5	5	5.5	V	$\overline{LED}$ Unconnected
10	OUTPUTS	Low Level Output Voltage $\overline{SHK}$	V_{OL}	0	.01	0.7	V	$\overline{LED}$ Unconnected
11	OUTPUTS	Low Level Output Current	I_{OL}		4		μA	
12	OUTPUTS	Power Consumption	P_C				mW	400Ω Loop
13	OUTPUTS	Max. Operating loop	R_L R_L		600 900		Ω Ω	at 18mA, 24V at 18mA, 30V

‡ Typical figures are at 25°C with nominal± 5V supplies and are for design aid only: not guaranteed and not subject to production testing.

MH88520 Input Impedance

Variant	Country	Impedance
01	GERMANY	220Ω + 820Ω // 115nF

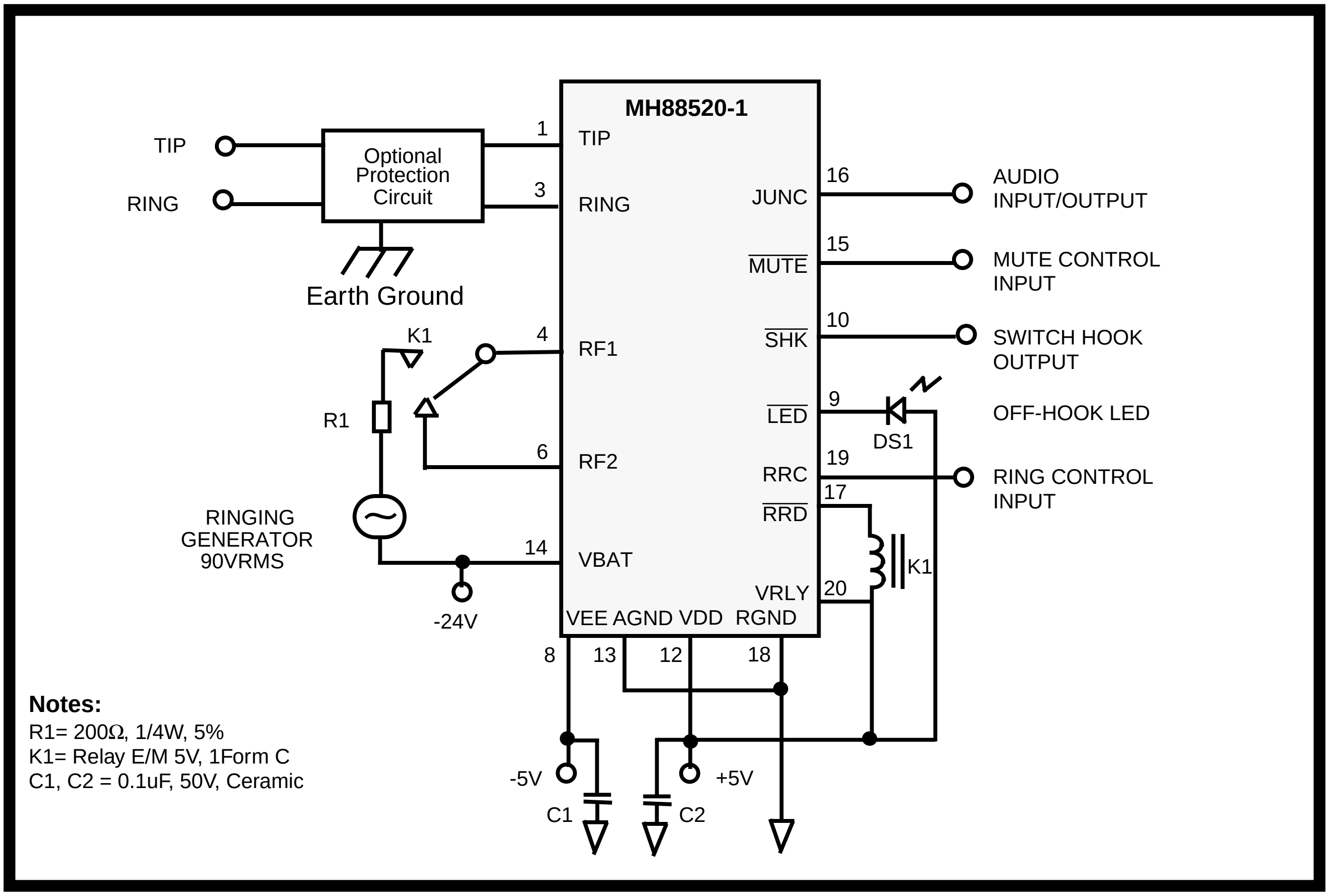


Figure 5 - Typical Application Circuit

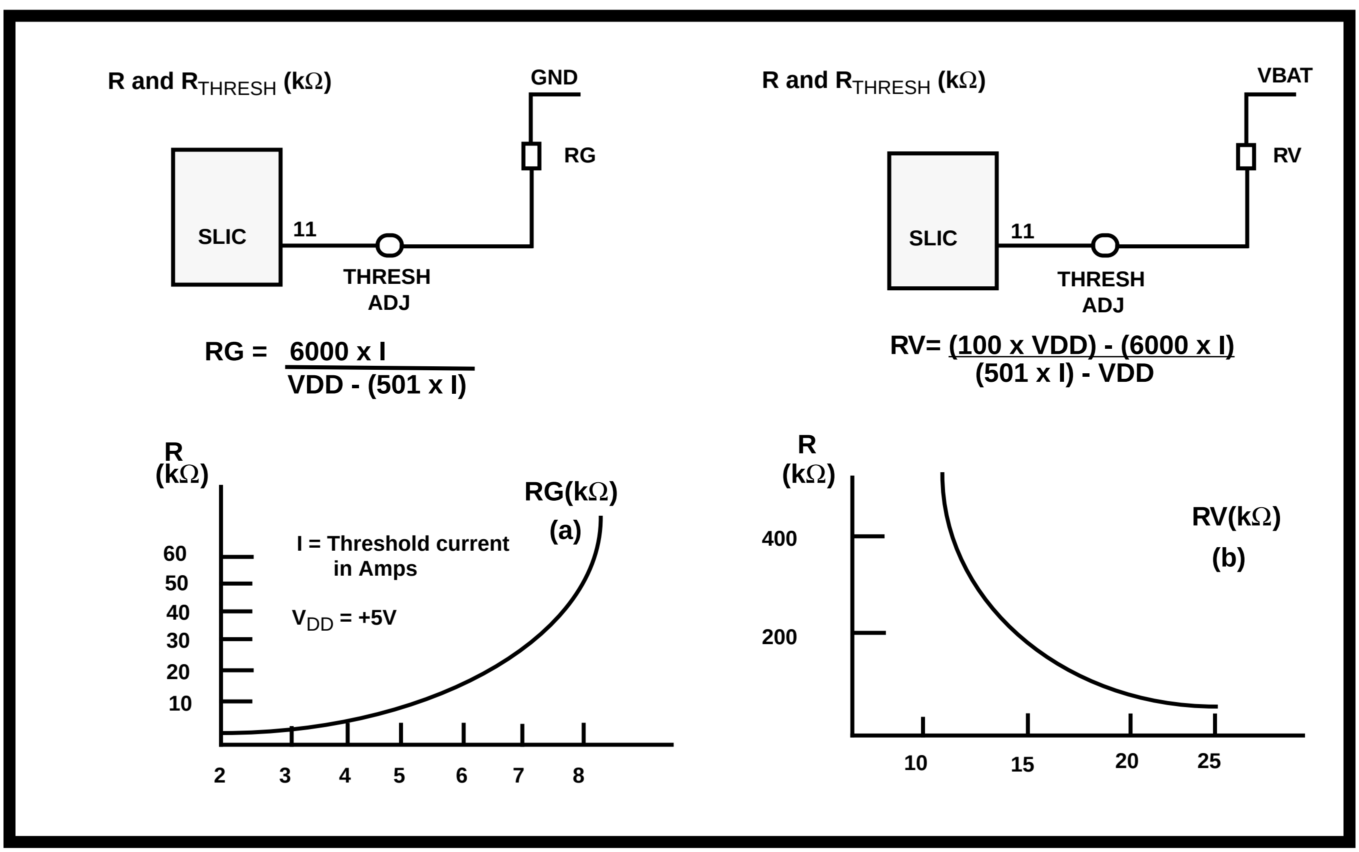


Figure 6 - Off-Hook Threshold Adjust

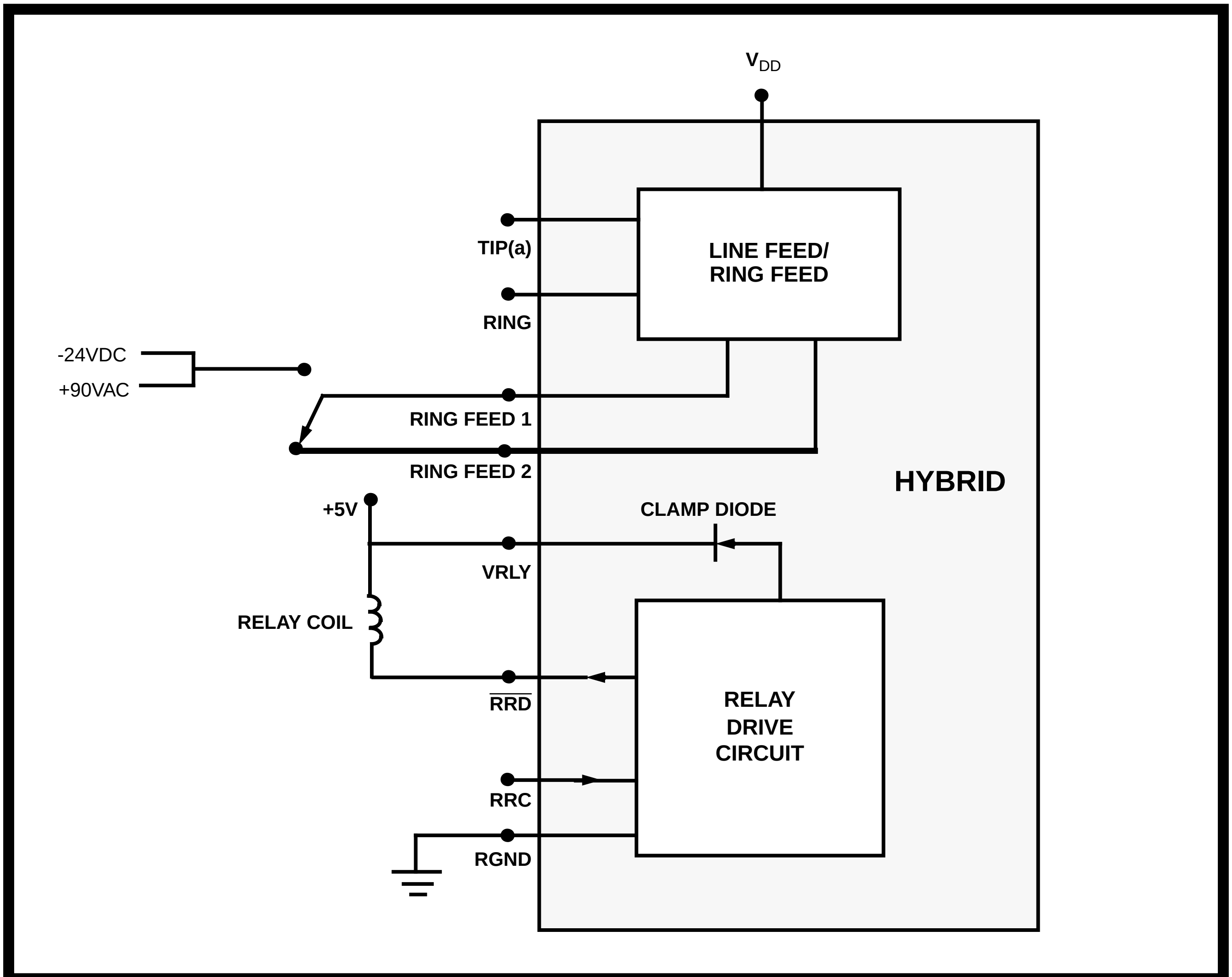


Figure 7 - Relay Drive Circuit

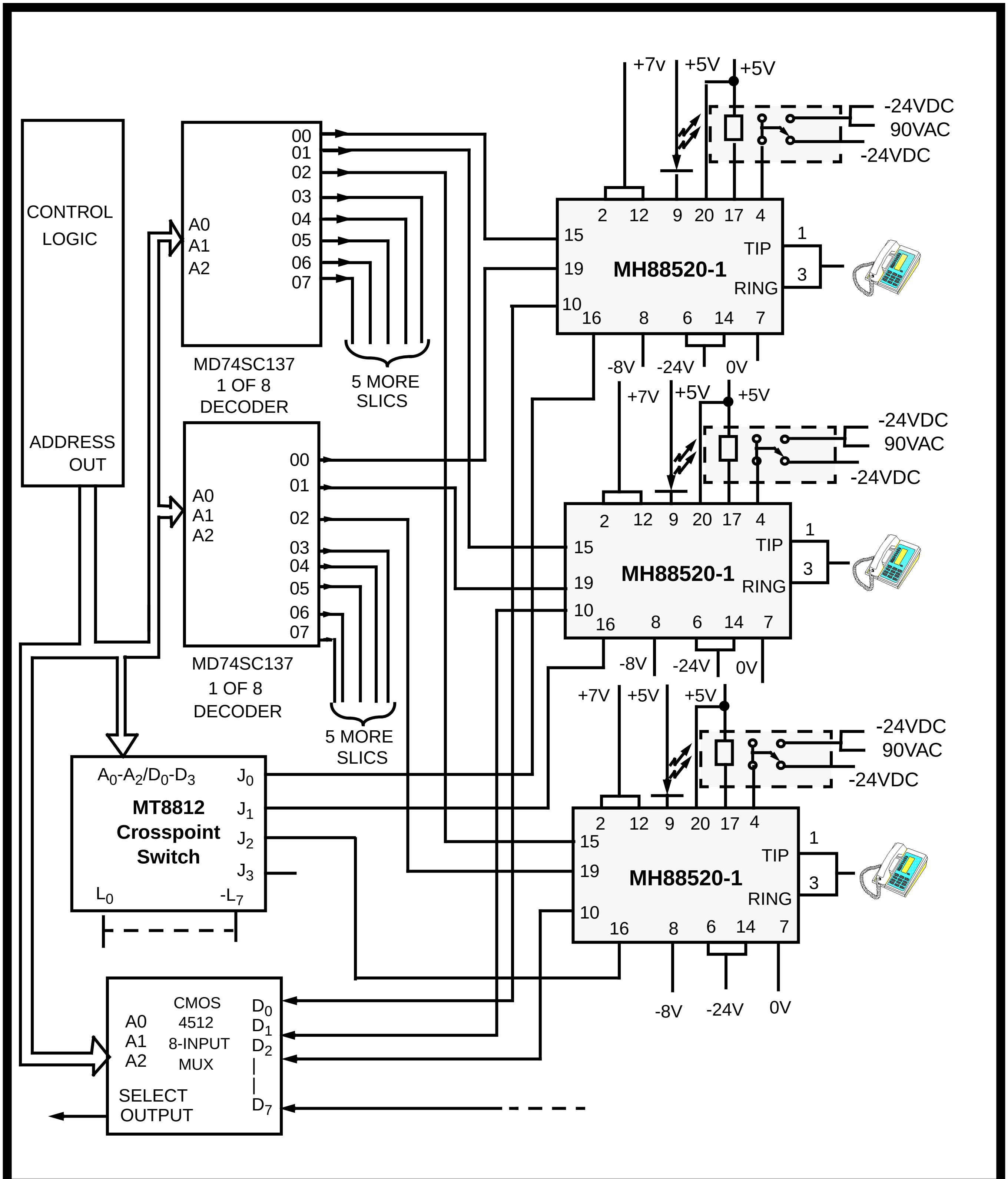
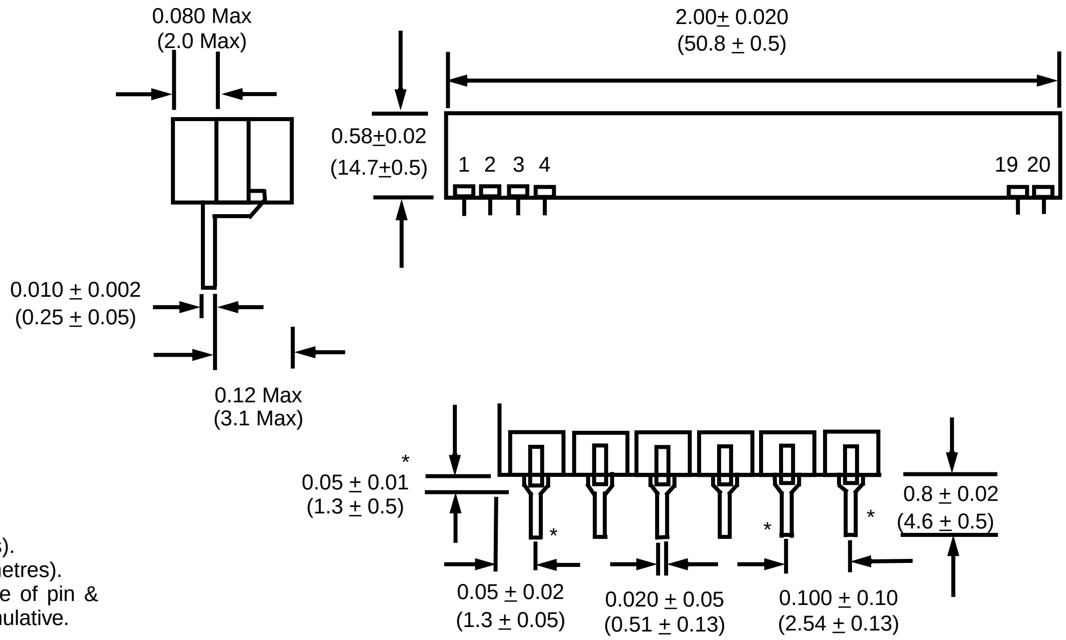


Figure 8 - PABX Typical Application

Side View



Notes:
1) Not to scale
2) Dimensions in inches).
3) (Dimensions in millimetres).
*Dimensions to centre of pin & tolerance non accumulative.

Figure 9 - Mechanical Data