MH88612B
Subscriber Line Interface Circuit (SLIC)

Data Sheet

Features

August 2006

- 600 Ω line impedance
- Transformerless 2-wire to 4-wire conversion
- Battery and ringing feed to line
- Off-hook and dial pulse detection.
- Ring ground over-current protection
- Adjustable constant current feed.
- Relay driver
- Power Denial
- Wide Operating Range

Applications

Line interface for:

- PABX
- Intercoms
- Key Telephone Systems
- Control Systems

Ordering Information		
MH88612BV-21	20 Pin SIL*	Boxed
*Pb Free Matte Tin		
0°C to 70°C		

Description

The SLIC provides a complete interface between a switching system and a subscriber loop. Functions provided include battery feed and ringing feed to the subscriber line, 2-Wire to 4-Wire hybrid interfacing, constant current feed and dial pulse detection. The device is fabricated using thick film hybrid technology in a 20-pin single in-line package.

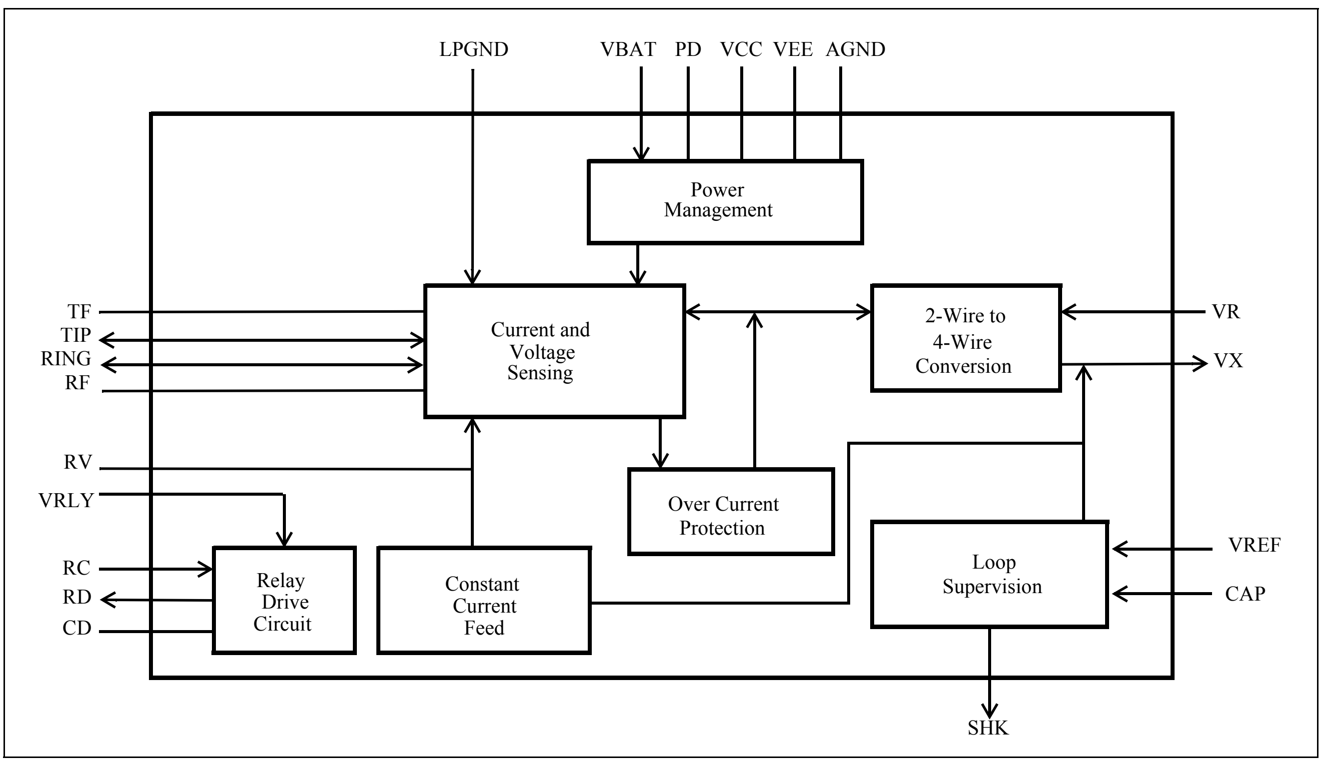


Figure 1 - Functional Block Diagram

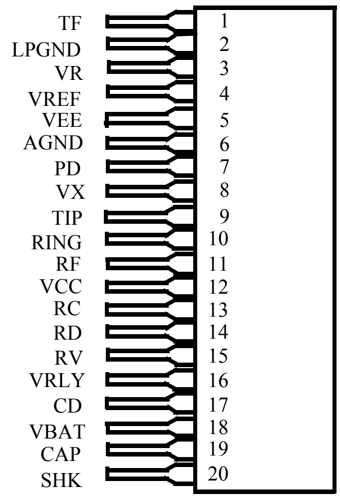


Figure 2 - Pin Connections

Pin Description

Pin #	Name	Description
1	TF	**Tip Feed.** Connects to external diode for protection
2	LPGND	**Loop Ground**. Is the system ground reference with respect to $V_{BAT.}$ Normally connected to AGND.
3	VR	**Voice Receive (input)** is the 4 wire analog signal to the device.
4	VREF	**Voltage Reference (Input)** Constant current feed can be adjusted by the input voltage on V_{REF}. This pin can also be grounded for normal 25 mA loop current.
5	VEE	**Negative Power Supply Voltage (-5 V).**
6	AGND	**Analog Ground (0V).**
7	PD	**Power Denial (Input)**. A logic high will isolate the battery voltage to Tip/Ring.
8	VX	**Voice Transmit (Output)** is the 4-wire analog signal from the device.
9	TIP	Connects to the “Tip” lead of the telephone line.
10	RING	Connects to the “Ring” lead of the telephone line.
11	RF	**Ring Feed (Input)** is normally connected to Ring relay for negative battery feed voltage and ringing voltage input.
12	VCC	**Positive Power Supply Voltage (+5 V).**
13	RC	**Relay Control (Input)**. Active high.
14	RD	Open collector sinks current when RC is at logic high.
15	RV	**Ring Feed Voltage** connects to pin 11 (RF) through a normally closed relay.
16	VRLY	**Relay voltage Supply (+5 V).**
17	CD	**Clamping Diode**. Connects to AGND
18	VBAT	**Negative Battery Feed Supply Voltage (-48 V).**
19	CAP	Connects external capacitor to ground for ring trip.
20	SHK	**Switch Hook Detect (Output).** Active high.

Functional Description

The SLIC performs a transformerless 2-wire to 4-wire conversion of the analog signal. The 2-wire circuit is the balanced line going to the subscriber loop, while the 4-wire circuit is the audio signal going to and from devices such as the voice codec or switching circuit. The SLIC also provides a switch hook (SHK) status output which goes high when the telephone is set off-hook.

Constant Current Feed

The SLIC employs a complex feedback circuit to supply a constant feed current to the line. This is done by sensing the sum of the voltages across the internal feed resistors and comparing it to an input reference voltage (V_{REF}) that determines the constant feed current. If V_{REF} (pin 4) is externally grounded, the constant current is set at 25 mA. For a constant current setting between 18 mA and 30 mA, V_{REF}can be set between 8.75 Vdc and -6.35 Vdc. The relationship is defined by the equation:

$$ILOOP = \left(\frac{V_{BAT}}{1.89} - \frac{V_{REF}}{1.25}\right) mA\ (\pm 2\ mA)$$

Switch Hook Detection

When the DC current exceeds an internal threshold level, the switch hook (SHK) will go high. If the loop resistance is so high that V_{BAT} can no longer supply the required amount of loop current as determined by constant current supply circuit, the output of the switch hook (SHK) will go low to indicate that the loop resistance is too high and the line is on hook.

Ringing And Ring Trip Detection

In Figure 3 a ringing signal (e.g., 90 Vrms and -48Vdc) is applied to the line by disconnecting pin 15 (RV) from pin 11(RF), and connecting the ringing voltage at pin 11 (RF) by use of the relay K1.

The SLIC can detect an off-hook condition during ringing but there is a large AC component which must be filtered out to give a true off-hook condition at SHK.

A 1.0 μF capacitor connected from pin 19 (CAP) to ground will provide adequate attenuation when ringing is applied. Once an off-hook condition has been detected a logic low should be applied to pin 13 (RC) which will deactivate the relay (K1) to disconnect the ringing voltage from pin 11 and reconnect to pin 15. At that time the SLIC will revert to constant current feed operation.

For applications requiring Dial Pulse Detection the Capacitor connection to ground should be controlled such that the capacitor is only connected during ringing.

During off-hook conditions (closed loop), the capacitor should be switched out. This can be performed using a transistor, relay or system drive output of a codec. Applying AGND to the Ring Trip Filter Control pin as shown in Figure 4 will switch in the filter, whilst removing AGND, (with the switch in a tri-state condition), will switch out the filter.

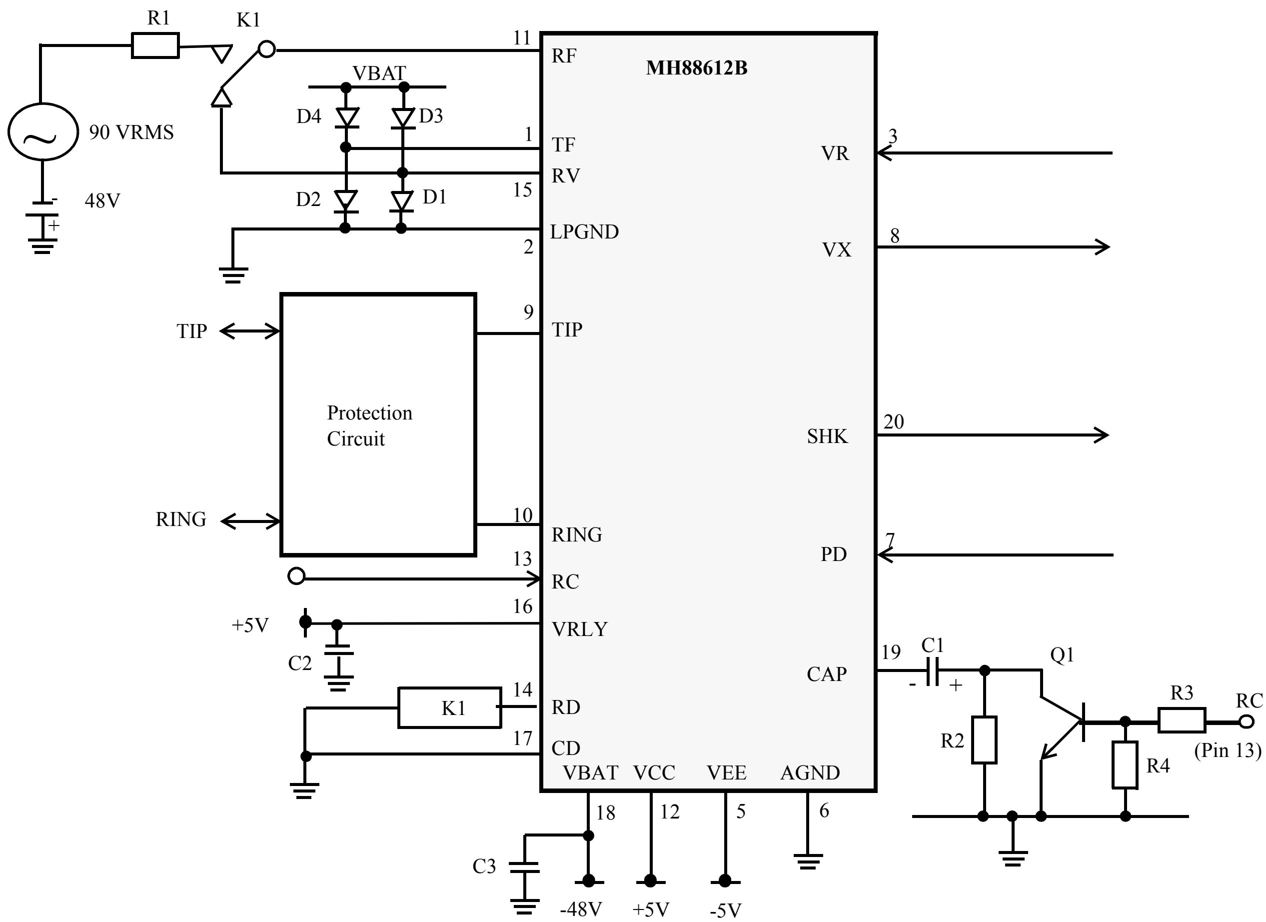
For applications using DTMF signalling, the capacitor can be permanently connected to ground.

Current Limit

The Tip or Ring of the telephone line may accidentally be shorted to ground. In such a case, current will only flow through the feed resistor. This high current will be sensed and reduced by the current limit circuit to a lower value to protect the internal circuitry.

Power Denial

The power denial function is a feature of the MH88612B which allows for powering down of the subscriber loop. A logic high voltage applied to the power denial input effectively removes the battery voltage from the loop driver circuitry. The resulting I_{LOOP} is negligible and power consumption is minimized. The power denial function is useful for disabling a loop which may have a ground fault.



Components List

R1	200Ω ± 10%, 1/4W
R2	470kΩ ± 5%, 1/4W
R3, R4	10kΩ ± 5%, 1/4W
C1	1.0µf, ± 10%, 25V electrolytic capacitor
C2, C3	0.1µf ± 20%, 50V ceramic de-coupling capacitors
D1, D2, D3, D4	Diode rectifier 200V, 1A, IN4003
Q1	General Purpose switching transistor
K1	Relay E/M, 5V or 6V 1Form C

Protection Circuit - depending on the application the Protection Circuit may need to provide over-voltage and/or over-current protection. In certain circumstances no protection will be required.

Figure 3 - Application Circuit

Absolute Maximum Ratings*

	Parameter	Symbol	Min.	Max.	Units
1	DC Supply Voltage LPGND = AGND	V_{CC} V_{EE} V_{BAT} V_{RLY} V_{REF}	-0.3 -15 -80 -0.3 -60	+15 +0.3 +0.3 +40 +15	V V V V V
2	Storage Temperature	T_S	-40	100	°C
3	Package Power Dissipation	PD		2	W

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

Recommended Operating Conditions

	Characteristics	Sym.	Min.	Typ.‡	Max.	Units	Test Conditions
1	Operating Supply Voltage	V_{CC} V_{EE} V_{REF} V_{BAT} V_{RLY}	4.75 -5.25 -60 	5.0 -5.0 0 -48 5	5.25 -4.75 -27 	V V V V V	Adjustable
2	Storage Temperature	T_S	-40	100	°C	2	Storage Temperature
3		T_o	0		70	°C	

‡ Typical figures are at 25°C with nominal supply voltages and are for design aid only

DC Electrical Characteristics† **-** Voltages are with respect to GNDA unless otherwise stated.

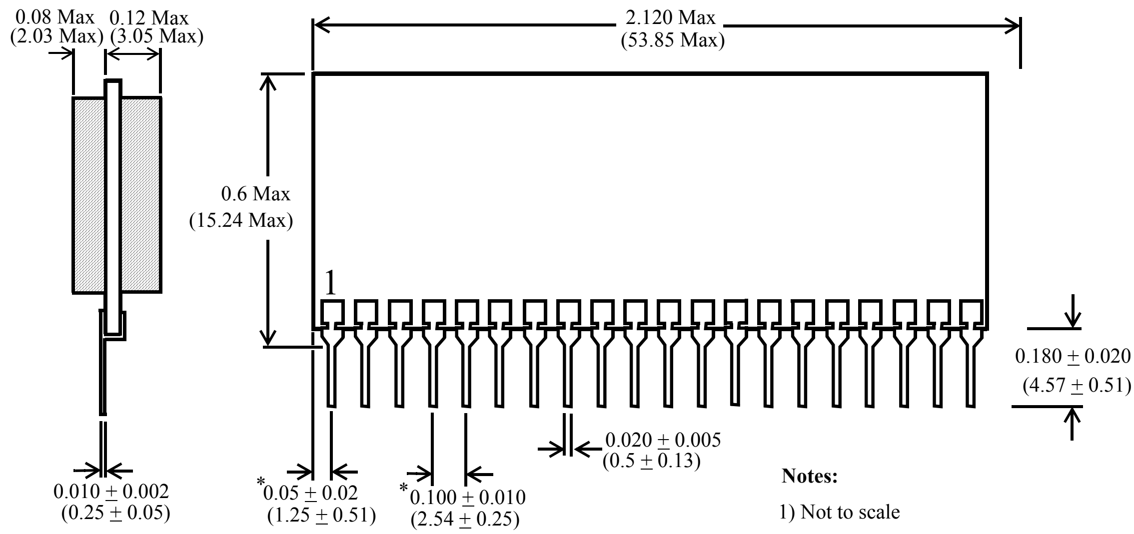
	Characteristics	Sym.	Min.	Typ.‡	Max.	Units	Test Conditions
1	Supply Current V_{CC} V_{EE} V_{BAT}	 I_{CC} I_{EE} I_{BAT}		 6.6 -3.8 150 2	 500	 mA mA µA mA	PD = Logic High PD = Logic Low, Idle
2	Power Consumption	P_C		160 1600		mW mW	Standby V_{BAT} = -48V Active (Off Hook)
3	Constant Current Line Feed	I_{Loop}	23	25	27	mA	V_{REF} = AGND, V_{BAT} = -48V
4	Adjustable Loop Current Range	I_{Loop}	18		30	mA	Adjustable with Ext. V_{REF} input, V_{BAT} = -48V
5	Operating Loop Resistance	RLoop			1200	Ω	V_{BAT} = -48V @ I_{LOOP} = 18mA, R_{LOOP} includes telephone set
6	Ring Ground Over-Current protection				40 50	mA mA	I_{LOOP} = 25mA V_{BAT} = 48V I_{LOOP} = 30mA V_{BAT} = 48V
7	Off-Hook Detect Output Low Voltage (On-hook) Output High Voltage (Off-hook)	 V_{OL} V_{OH}	 2.7		 0.4	 V V	Active high logic
8	Off-Hook Detect Output Low Current (On-hook) Output High Current. (Off-hook)	 I_{OL} I_{OH}			 8 -200	 mA µA	
9	RC, PD Control Input Input Low Volt (no activation) Input High Volt (activation)	 V_{IL} V_{IH}	 2.0		 0.7	 V V	Active high logic LSTTL compatible
10	RC, PD control Input Input Low Current (no activation) Input high current (activation)	 I_{IL} I_{IH}			 50 0.5	 µA mA	
11	PD Control Input Input Low Current Input High Current	 I_{IL} I_{IH}			 0.5 0.3	 mA mA	

† DC Electrical Characteristics are over recommended operating supply voltages.
‡ 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	Ringing Voltage (rms)	V_{RING}	17		90 25	V_{rms} Hz	Superimposed on V_{BAT} = -48V
2	Ringer Equivalence Number	REN			3		
3	Ring Trip Detect time			200		ms	Cap = 1uF
4	Input AC Impedance 2-wire	Zin		600		Ω	
5	Input Impedance at V_R			100		kΩ	
6	Output Impedance at Vx			10		Ω	
7	Gain 2-wire to Vx Gain relative to Gain @ 1kHz		-1.3 -0.15	-1.0	-0.7 +0.15	dB	Input 3dBm, 1kHz across Tip and Ring 300-3400 Hz
8	Gain VR to 2-wire Gain relative to Gain @ 1kHz		-1.3 -0.15	-1.0	-0.7 +0.15	dB dB	Input 1.0 Vrms 1kHz at V_R Z_{Load} = 600Ω 300 - 3400 Hz
9	2-wire Return Loss over 300-3400Hz	RL	20	30		dB	Input 0.5 Vrms , 1kHz across Tip and Ring, Z_{Load} = 600Ω
10	Transhybrid Loss	THL	20	30		dB	Input 0.5 Vrms, 1kHz at V_R Z_{Load}= 600Ω
11	Longitudinal to Metallic Balance over 300-3400 Hz		50	55		dB	Input 0.5 Vrms
12	Total Harmonic Distortion at VX at Tip and Ring	THD		0.1 0.1	1.0 1.0	% %	Input 3dBm, 1 kHz across Tip and Ring, Input 1.0 Vrms 1kHz at V_R
13	Common Mode Rejection Ratio 2-wire to Vx	CMRR	40	50		dB	Input 0.5Vrms, 1kHz
14	Idle channel Noise	Nc			14	dBrnC	C @ & VX Message
15	Power supply rejection ratio VCC VEE VBAT	PSRR	 26 26 26			 dB dB dB	1 V_{PP} ripple, 1kHz on VCC/V_{EE}/V_{BAT},measure at VX and across Tip & Ring

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



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: 260°C for 10 secs.

* Dimensions to centre of pin.

Figure 4 - Mechanical Data

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