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# SSI 73M376
## Integrated Line Interface

**Preliminary Data**

January 1993

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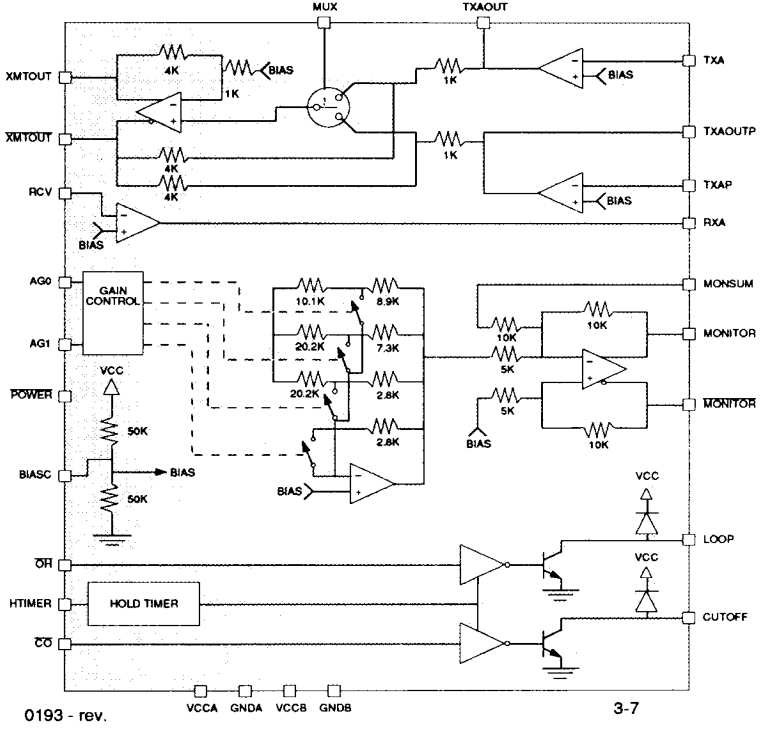
## DESCRIPTION

The SSI 73M376 K-Series Integrated Line Interface Unit(LIU) enables the modem to make direct connections to the Public SwitchedTelephone Network. This single chip data access arrangement integrates all external active (line side) components required in K-Series modem designs. The SSI 73M376 operates from a single 5 volt supply ideally suited for low power portable applications. Along with the transmit and receive function, it provides transmit and receive amplifiers, programmable audio monitor, and relay drivers. In the transmit path it has provision for level programmable gain path as well as a normal gain path which can be switched via a TTL input. The 73M376 comes in a 28-lead PLCC package.

## FEATURES

- **One-Chip data access arrangement**
- **Compatible with all SSI K-Series Modem Products**
- **On-board receive and transmit paths. Transmit has level protected programmability**
- **On-board differential speaker driver with four step variable gain**
- **On-board relay driver with power conserving hold state**
- **Low power (85 mW) with power down mode (25 mW) when on-hook**
- **Operates from a single +5V supply**

## BLOCK DIAGRAM

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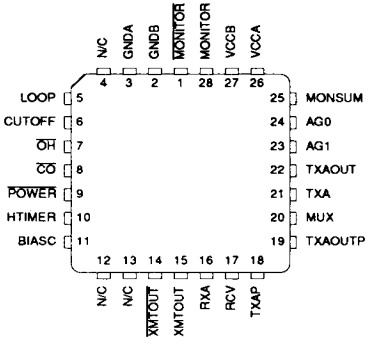
## PIN DIAGRAM




CAUTION: Use handling procedures necessary for a static sensitive component.

## FUNCTIONAL DESCRIPTION

The transmit output uses a differential drive to allow undistorted signals to be sent with a single 5 volt supply. Each output supplies half the drive signal to the transformer thus increasing the available output amplitude by 100%. Two dedicated transmit op-amps are supplied with the outputs and minus inputs brought out so that external resistors and capacitors can be connected facilitating gain setting and filtering. The TTL input, MUX, switches the output of the op-amps to the differential driver. If the MUX input is pulled high, or left floating, the TXA op-amp is selected. If the MUX input is pulled low the TXAP op-amp is selected.

The receive input, RCV, is the minus input of a dedicated op-amp where external resistors and capacitors can be connected facilitating gain setting and filtering. The bias, or plus, input for all the dedicated op-amps are connected to a VCC/2 bias point which allows for maximum swing between the supply rails. The VCC/2 bias point is brought out to an external pin, BIASC, where a compensation capacitor can be connected for power supply noise filtering.

The audio monitor gain stage has the RXA output as its input and has four gain settings; off or squelch, low, medium, and high. The output of the gain cell is fed to a summer where a signal can be summed in through the MONSUM pin. The audio amp differential output can drive an 8Ω speaker with up to 400 mW rms of power. A capacitor needs to be in series with the speaker so no DC current will flow.

On board relay drivers can directly drive the loop and cutoff relays. The TTL input $\overline{OH}$ (Off Hook) controls the loop relay driver. The TTL input $\overline{CO}$ (Cut Off) controls the cutoff relay driver. A timer, which uses an external timing capacitor connected to the HTIMER pin, is available to set a delay after relay energizing before the driver will go into its hold state. A negative transition on $\overline{OH}$ or $\overline{CO}$ starts the timer. When the timer has expired, both relay drivers will go into the hold state. While the timer is timing the relay drivers are in their full energizing state. If $\overline{OH}$ is low and $\overline{CO}$ goes low before the timer expires, or vice versa, then the timer will reset and start timing again.

The TTL input $\overline{POWER}$ controls the power down state. When $\overline{POWER}$ is low the part is powered up and when it is high, it is in its power down state.

## PIN DESCRIPTION

| NAME | TYPE | DESCRIPTION |
|---|---|---|
| VCCA | I | Analog power supply input. |
| VCCB | I | Digital power supply input. |
| GNDA | I | Analog ground pin. |
| GNDB | I | Digital ground pin. |
| TXA | I | Negative input to transmit op-amp selected when MUX = 1. |
| TXAOUT | O | Transmit amplifier output. |
| TXAP | I | Negative input to alternate transmit op-amp input selected when MUX = 0. |
| TXAOUTP | O | Level programmed transmit amplifier output. |
| MUX | I | Transmit amplifier mux control (TTL). 1 selects TXA source<br>0 slects TXAP source |
| XMTOUT | O | Transmit output. |
| $\overline{XMTOUT}$ | O | Transmit output (inverted). |
| RCV | I | Negative input to receive amplifier. |
| RXA | O | Receive amplifier output. |
| MONITOR | O | Positive audio amplified output. |
| $\overline{MONITOR}$ | O | Negative audio amplified output. |

## PIN DESCRIPTION (continued)

| NAME | TYPE | DESCRIPTION |
|---|---|---|
| MONSUM | I | Monitor summing input slected when AG1 and AG0 = 0 |
| AG0 | I | Bit1 (TTL) input to set audio gain. |
| AG1 | I | Bit2 (TTL) input to set audio gain. |
| BIASC | I | VCC/2 bias compensation point. |
| $\overline{OH}$ | I | Off hook TTL compatible input. Controls the loop relay |
| $\overline{CO}$ | I | Cut off TTL compatible input. Controls the cutoff relay. |
| HTIMER | I | Relay hold timing control pin connect to GND if not used. |
| LOOP | O | Loop relay drive output. |
| CUTOFF | O | Cutoff relay drive output. |
| $\overline{POWER}$ | I | Power Down TTL compatible input. Controls power down mode. Low level powers up 73M376. |

## ELECTRICAL SPECIFICATIONS

### ABSOULUTE MAXIMUM RATINGS

Operation above absolute maximum ratings may permanently damage the device.

| PARAMETER | RATING | UNIT |
|---|---|---|
| VCC Supply Voltage | 7 | V |
| Storage Temperature | -65 to 150 | °C |
| Soldering Temperature (10 sec.) | 300 | °C |

### RECOMMENDED OPERATING CONDITIONS

Unless otherwise specified 4.50V < Vcc < 5.50V and 0°C < T(ambient) < 70°C. Currents flowing into the chip are positive. Current maximums are currents with the highest absolute value.

| PARAMETER | CONDITIONS | MIN | NOM | MAX | UNITS |
|---|---|---|---|---|---|
| VCC SUPPLY VOLTAGE | | | | | |
| +5V | $\overline{POWER}$ low<br>Outputs unloaded | | | 17.0 | mA |
| +5V | $\overline{POWER}$ high | | | 5.0 | mA |
| Junction Temperature | Relay drivers in hold state driving maximum current. MONITOR, $\overline{MONITOR}$ driving 8Ω speaker to max rms power | | | 135 | °C |

**DIGITAL PINS**
(TTL compatible inputs: AG0, AG1, $\overline{OH}$, $\overline{CO}$, MUX, $\overline{POWER}$ pins)

| PARAMETER | CONDITIONS | MIN | NOM | MAX | UNITS |
|---|---|---|---|---|---|
| Input low voltage | (VIL) | -0.3 | | 0.8 | V |
| Input high voltage | (VOH) | 2.0 | | VCC+0.3 | V |
| Input low current | VIL = 0.4 V | 0.0 | | -0.4 | mA |
| Input high current | VIH = 2.4 V | | | 100 | µA |

**TRANSMIT AND RECEIVE SECTION**

| | | | | | |
|---|---|---|---|---|---|
| Transmit Gain Single ended into Differential | $\frac{(XMTOUT - \overline{XMTOUT})}{TXAOUT}$ MUX=High | 11.5 | | 12.5 | dB |
| Transmit Gain Single ended into Differential | $\frac{(XMTOUT - \overline{XMTOUT})}{TXAOUTP}$ MUX=Low | 11.5 | | 12.5 | dB |
| XMTOUT, $\overline{XMTOUT}$ Differential Output Impedance | | | | 30 | Ω |
| Transmit THD | 7V p-p differential From TXA or TXAP to XMTOUT-$\overline{XMTOUT}$ with Op-Amp gain=0dB @ 1 kHz Zload = 600 Ω speaker driver off | | | -72 | dB |
| Max. Capacitive differential load XMTOUT, $\overline{XMTOUT}$ | | | | 300 | pF |
| RCV, TXA, TXAP input impedance | | | 1 | | MΩ |
| RCV, TXA, TXAP input offset voltage | RCV - VCC/2<br>TXA - VCC/2<br>TXAP - VCC/2 | | 10 | | mV |
| RCV, TXA, TXAP input bias current | Vin = VCC/2 | | | 500 | nA |
| Receive THD | From receive Op-Amp input to RXA with Op-Amp gain=8dB 4 kHz speaker driver off | | | -72 | dB |
| Max. Capacitive load, TXAOUT, TXAOUTP, RXA | | | | 150 | pF |
| Transmit and Receive Op-Amps Unity Gain Bandwidth | | | 500 | | kHz |
| BIASC impedance $V_{BIASC}$=VCC/2 | | 18K | | | Ω |

**MONITOR OUTPUT CIRCUIT**
(All of the measurements are made with an 8Ω load, tied from MONITOR to $\overline{\text{MONITOR}}$, AC coupled through a 20 µF capacitor.)

| PARAMETER | CONDITIONS | MIN | NOM | MAX | UNITS |
|---|---|---|---|---|---|
| Gain | From RXA to Monitor outputs (MONITOR-$\overline{\text{MONITOR}}$)/RXA AG0=Low, AG1=Low | | | -60 | dB |
| | AG0=High, AG1=Low | 11 | | 15 | dB |
| | AG0=Low, AG1=High | 18 | | 23 | dB |
| | AG0=High, AG1=High | 27 | | 31 | dB |
| Max Output Swing | THD < -20 dB MONITOR-$\overline{\text{MONITOR}}$ | 3.5 | | | Vpp |
| MONSUM gain | $\frac{\text{MONITOR} - \overline{\text{MONITOR}}}{\text{MONSUM}}$ | 22 | 25 | 26 | dB |
| Max input at MONSUM | | | | 3.5 | Vpp |
| MONITOR output offset | MONITOR-$\overline{\text{MONITOR}}$ AG0=Low, AG1=Low | | 5 | | mV |
| MONITOR output offset | MONITOR-$\overline{\text{MONITOR}}$ AG0=High, AG1=High | | 180 | | mV |
| MONSUM input impedance | | 8K | | | Ω |

**RELAY DRIVER OUTPUTS**

| | | | | | |
|---|---|---|---|---|---|
| Peak pull in current | -25 °C < T(ambient) < 85 °C at Vol=0.8 V | 35 | | | mA |
| Hold voltage | After hold timer has timed out | 25% | | 40% | Vcc |
| Hold voltage delay | t=CHTIMER • 750K for 0.01 µF<CHTIMER<0.47 µF | | | ±45 | % |

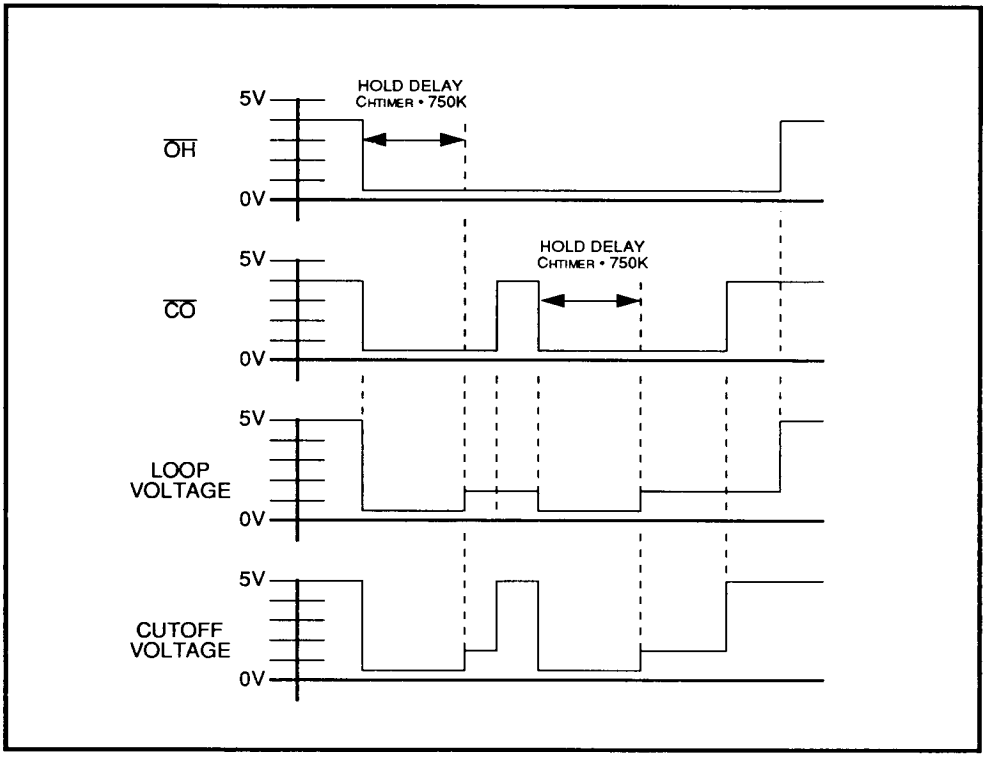



**FIGURE 1: Relay Hold and Power Down Timing Diagrams**

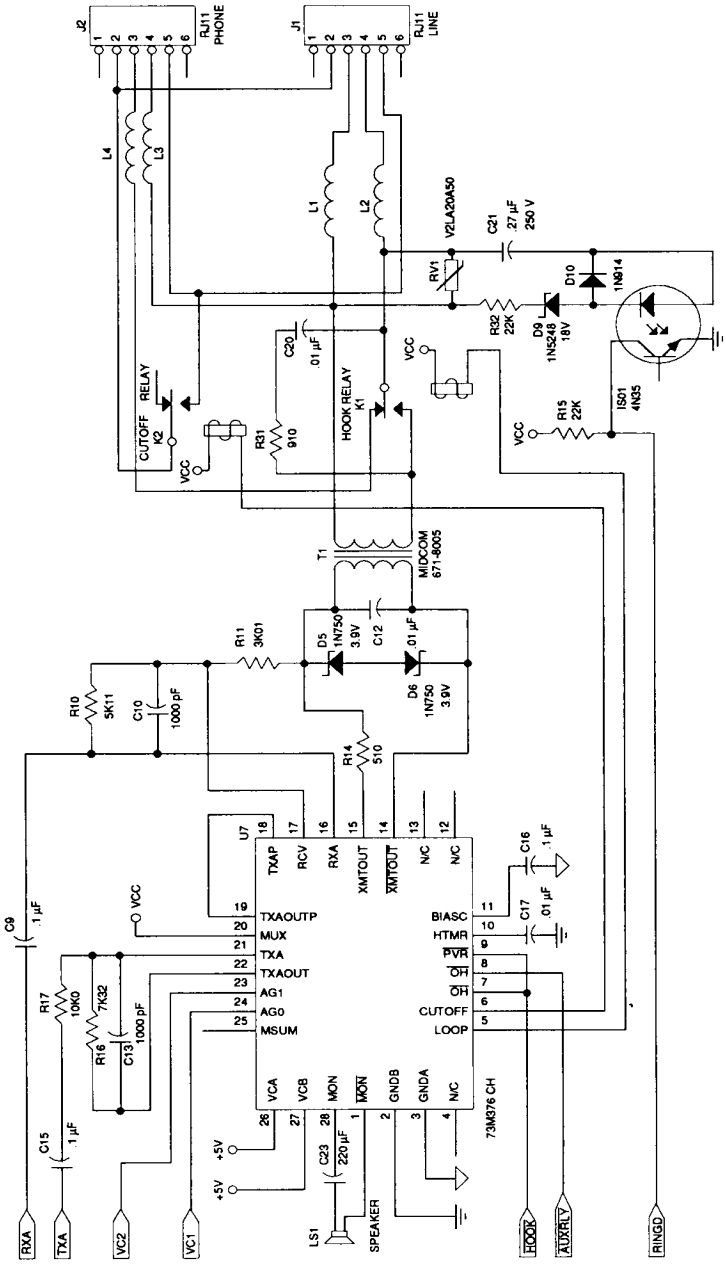
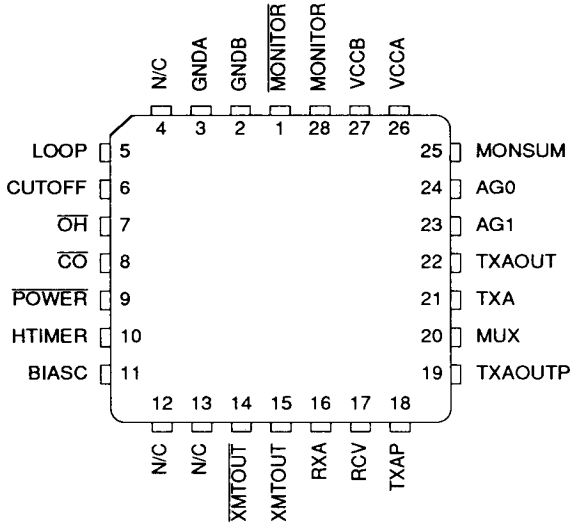



FIGURE 2: SSI 73M376 Based DAA Circuit

## PACKAGE PIN DESIGNATIONS

(Top View)




**28-Pin PLCC**

## ORDERING INFORMATION

| PART DESCRIPTION | ORDER NO. | PKG. MARK |
|---|---|---|
| SSI 73M376 28-Pin PLCC | 73M376-CH | 73M376-CH |

**Preliminary Data:** Indicates a product not completely released to production. The specifications are based on preliminary evaluations and are not guaranteed. Small quantities are available, and Silicon Systems should be consulted for current information.



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