

Features

- Transformerless 2 W to 4 W conversion
- Controls battery feed to line
- Off-hook and dial pulse detection
- Ring ground over-current protection
- Programmable constant current feed
- -30 V to -72 V battery operation
- Relay and line driver electronics on board

Applications

- PABX/ONS/OPS
- Key Telephone Systems
- Integrated Access Devices
- SOHO and Home Gateway

Ordering Information

ZL49200MDC 38 Pin SIL Trays

-40°C to +85°C

Description

The Zarlink ZL49200 Dual SLIC hybrid provides an interface between a switching system and a subscriber loop with 600 Ω impedance. The functions provided by each SLIC include battery feed, 2 W to 4 W conversion, off-hook and dial pulse detection. All driver electronics are included on the hybrid in order to minimize the number of external components required by the user.

Loop Length determination table provided on page 9.

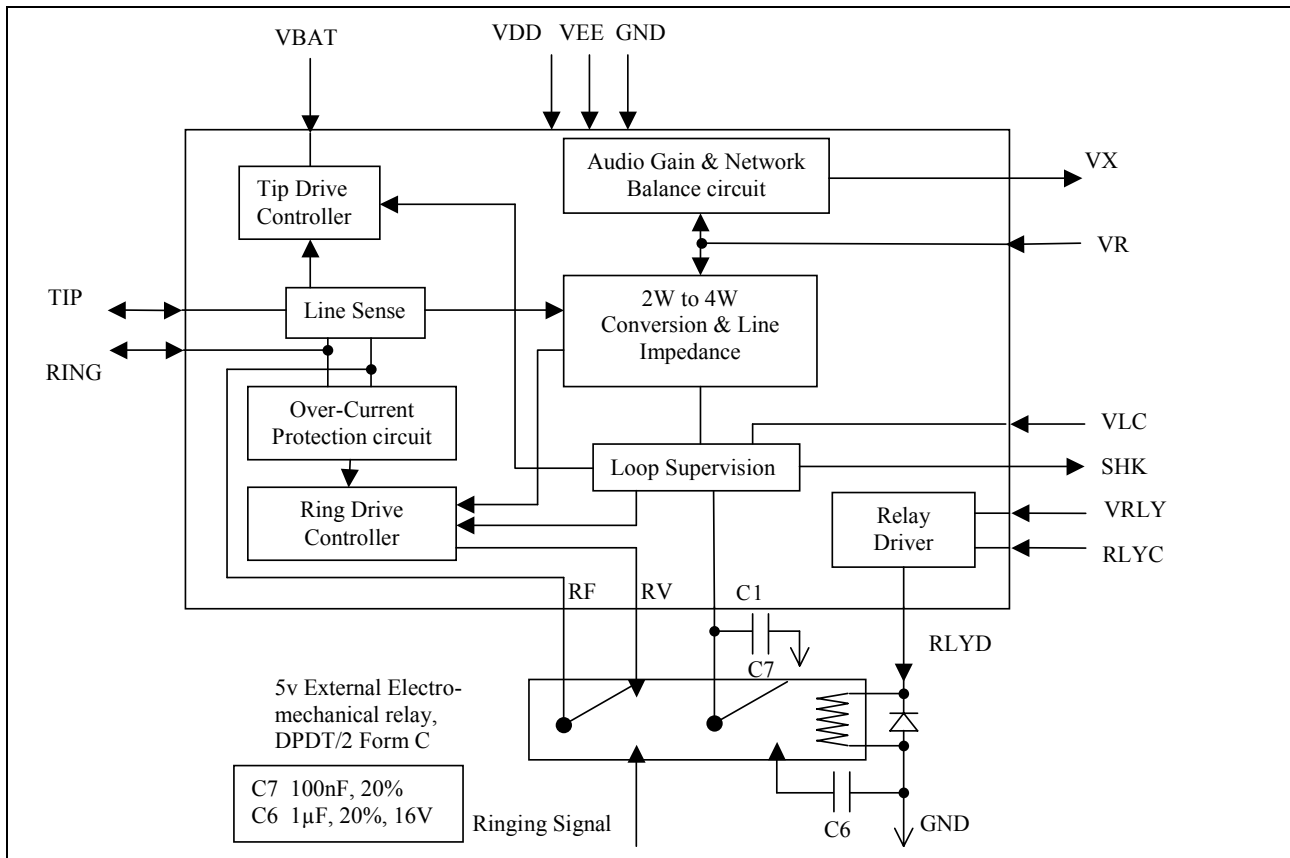
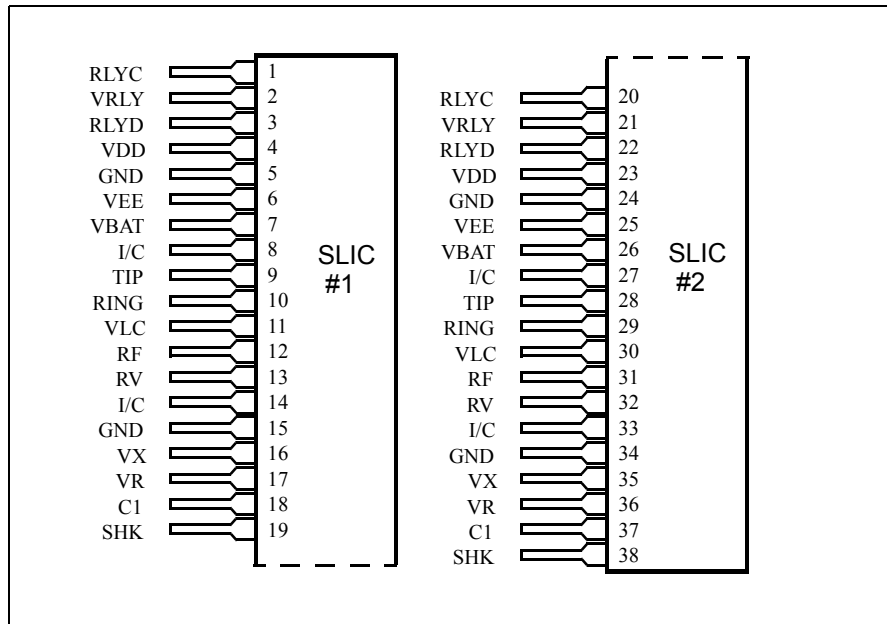


Figure 1 - Dual Channel SLIC Single Channel Schematic Diagram

Pin Diagram



Power Supply Pin Out

| Pin Out #1, #2 | Name | Description |
|-----------------|------|--|
| 4, 23 | VDD | Positive supply rail. +5 V |
| 5, 24 15, 34 | GND | Ground. Return path for +5 V and -5 V. This should also be connected back to the return path for the loop battery, Cap and relay drive ground RLYGND. |
| 6, 25 | VEE | Negative supply rail. -5 V |
| 7, 26 | VBAT | Battery Voltage for powering the line |
| 11, 30 | VLC | Reference Voltage (Input). This pin is used to set the subscribers loop constant current. Changing the input voltage sets the current to any desired value within the working limits. |
| 2, 21 | VRLY | Relay voltage source. Voltage source for relay driver. |

Analog I/O Pin Out

| Pin Out #1, #2 | Name | Description |
|----------------|------|--|
| 1, 20 | RLYC | Relay Control (Input). An active high on this pin will switch RLYD low. |
| 3, 22 | RLYD | Relay Voltage Output. Voltage source used to drive relay coil |
| 8, 27 | I/C | Internal Connection. |
| 9, 28 | TIP | Tip. Connects to the TIP lead of the telephone line. |
| 10, 29 | RING | Ring. Connects to the RING lead of the telephone line. |
| 12, 31 | RF | Ring Feed. Connects to the RING lead via the Ring feed resistor. |
| 13, 32 | RV | Ring Voltage and Audio Feed. Connects directly to Ring Feed via a relay. |
| 14, 33 | I/C | Internal Connection. |
| 16, 35 | VX | Transmit Audio (Output). This is the 4 W analog signal to the SLIC. |
| 17, 36 | VR | Receive Audio (Input). This is the 4 W analog signal to the SLIC. |
| 18, 37 | C1 | Filter capacitor for ring trip, capacitor connected between this pin and GND. |
| 19, 38 | SHK | Switch Hook (Output). This pin indicates the line state of the subscribers telephone. The output can also be used for dial pulse monitoring. SHK is high in off-hook state. |

Functional Description

The ZL49200 is the analog SLIC for use in a 4 Wire switched system. The SLIC performs all of the normal interface functions between the CODEC or switching system and the analog telephone line such as 2 W to 4 W conversion, constant current feed, switch hook indication, ringing and ring trip detection.

2 Wire to 4 Wire Conversion

The hybrid performs 2 wire to 4 wire conversion by taking the 4 wire signal from an analog switch or voice CODEC, a.c. coupled to VR and converting it to a 2 wire differential signal at tip and ring. The 2 wire signal applied to tip and ring by the telephone is converted to a 4 wire signal VX which is a.c. coupled to the input of the analog switch or voice CODEC.

Loop Supervision & Dial Pulse Detection

The Loop Supervision circuit monitors the state of the phone line and when the phone goes “Off Hook” the SHK pin goes high to indicate this state. This pin reverts to a low state when the phone goes back ‘On Hook” or if the loop resistance is too high for the circuit to continue to support a constant current feed.

The SHK output can also be monitored for dialing information when used in dial pulse system.

Ringling and Ring Trip Detection

Ringling is applied to the line by applying a logic low to the RLYC relay control pin. When an off hook condition is detected, SHK goes high and could be connected to RLYC input to remove ringling.

Constant Current Control

The ZL49200 could be programmed to provide constant current line feed between 18 mA to 26 mA by applying an appropriate DC voltage to VLC input. VLC can be set between 8.75 VDC and –1.25 VDC. The relationship is defined by the equation:

$$I_{Loop} = (V_{BAT} / 1.89 - VLC / 1.25) \pm 2 \text{ mA}$$

e.g. for VLC =0 V, VBAT = -48 V

$$I_{Loop} = 25 \text{ mA} \pm 2 \text{ mA}$$

Application Information

Most PBX applications will have line lengths less than 2 km

Most C.O.... applications will have line lengths up to 5 km

A single No 22 (AWG) cable is about 250 Ohms/km

A PBX operating loop (R_{LOOP}) or ONS will normally be below 1000 Ohms, (incl.... phone).

A C.O. operating loop (R_{LOOP}) or OPS could be up to 3000 Ohms (incl.... phone).

ONS therefore are normally short loops whilst OPS are normally long loops.

This affects the Battery Feed function of the SLIC.

There are various parameters that affect the battery feed requirements.

| | | |
|--------------------------|------------|--|
| Resistance of the line | R_L | Maximum limit that you must be capable handling |
| Resistance of the phone | R_P | Normally fixed for a particular country |
| Loop current | I_{LOOP} | Normally fixed for a particular country |
| Feed resistor value | R_F | Fixed in the SLIC design |
| Line driver voltage drop | V_{LD} | Fixed by the product, usually between 8 V to 10 V depending on V_{BAT} |
| Battery voltage | V_{BAT} | Fixed in the system |

If we wish to work out what is the maximum Line resistance we can handle we can use the following formulae:

$$R_L = \{[-V_{BAT} - V_{LD}] / I_{LOOP}\} - [R_P + 2R_F]$$

Typical values of $V_{LD} = 10V$, $I_{LOOP} = 15$ to $30mA$, $R_F = 50$ to 300 Ohms and $R_P = 300$ Ohms

If we set $V_{BAT} = -72V$, $I_{LOOP} = 18mA$, assume the phone is 300 Ohms and use a hybrid with $R_F = 220$ Ohms and $V_{LD} = 10V$ like the ZL49200 we get:

$$R_L = \{[-V_{BAT} - V_{LD}] / I_{LOOP}\} - [R_P + 2R_F]$$

$$R_L = \{[72V - 10V] / 18mA\} - [300R + 2 \times 220R]$$

Therefore $R_L = 2700$ Ohms (or $R_{LOOP} = 3000$ Ohms incl... phone)

Equivalent line length = $(R_L/2) / (250 \text{ ohm/km}) = 5.4km$

If we set $V_{BAT} = -48V$, $I_{LOOP} = 18mA$, assume the phone is 300 Ohms and use a hybrid with $R_F = 220$ Ohms and $V_{LD} = 10V$ like the ZL49200 we get:

$$R_L = \{[-V_{BAT} - V_{LD}] / I_{LOOP}\} - [R_P + 2R_F]$$

$$R_L = \{[48V - 10V] / 18mA\} - [300R + 2 \times 220R]$$

Therefore $R_L = 1371$ Ohms (or $R_{LOOP} = 1671$ Ohms incl... phone)

Equivalent line length = $(R_L/2) / (250 \text{ ohm/km}) = 2.7km$

If we set $V_{BAT} = -30V$, $I_{LOOP} = 18mA$, assume the phone is 300 Ohms and use a hybrid with $R_F = 220$ Ohms and $V_{LD} = 9V$ like the ZL49200 we get:

$$R_L = \{[-V_{BAT} - V_{LD}] / I_{LOOP}\} - [R_P + 2R_F]$$

$$R_L = \{[30V - 9V] / 18mA\} - [300R + 2 \times 220R]$$

Therefore $R_L = 420$ Ohms (or $R_{LOOP} = 720$ Ohms incl... phone)

Equivalent line length = $(R_L/2) / (250 \text{ ohm/km}) = 0.84\text{km}$.

It can be seen that the battery feed limits the line length that be supported.

Low battery voltages are therefore used in PBXs with short loops

High battery voltages are used where longer loops are encountered.

Operating loop (R_{LOOP}) Data (including phone)

As measured in lab.

| Loop current (mA) | VBAT = -30 V | VBAT= -48 V | VBAT = -72 V |
|-------------------|--------------|-------------|--------------|
| 18 mA | 750 Ohms | 1600 Ohms | 3100 Ohms |
| 20 mA | 610 Ohms | 1500 Ohms | 2700 Ohms |
| 22 mA | 490 Ohms | 1300 Ohms | 2400 Ohms |
| 24 mA | 390 Ohms | 1100 Ohms | 2100 Ohms |
| 26 mA | 310 Ohms | 1000 Ohms | 1900 Ohms |

The maximum subscriber loop is a function of loop current, VBAT, wire gauge and the DC resistance of the phone connected at the end of the subscriber loop. The following table will help to determine the optimum combination to achieve maximum subscriber loop in Kilo-feet and Kilo-meter.

Note: No 22 (AWG) copper wire is selected for the 'local loop' and is about 250 Ohms/Km.

| R_{LOOP} | RL (300 Ohms Phone) | | RL (600 Ohms Phone) | |
|-------------------------|----------------------------|-------------------------|----------------------------|-------------------------|
| | (Ohms) | Local loop (kft) | Local loop (km) | Local loop (kft) |
| 500 | 1.32 | 0.4 | | |
| 600 | 1.98 | 0.6 | | |
| 700 | 2.64 | 0.8 | 0.66 | 0.2 |
| 800 | 3.30 | 1.0 | 1.32 | 0.4 |
| 900 | 3.96 | 1.2 | 1.98 | 0.6 |
| 1000 | 4.62 | 1.4 | 2.64 | 0.8 |
| 1100 | 5.28 | 1.6 | 3.30 | 1.0 |
| 1200 | 5.94 | 1.8 | 3.96 | 1.2 |
| 1300 | 6.60 | 2.0 | 4.62 | 1.4 |
| 1400 | 7.26 | 2.2 | 5.28 | 1.6 |
| 1500 | 7.92 | 2.4 | 5.94 | 1.8 |
| 1600 | 8.58 | 2.6 | 6.60 | 2.0 |
| 1700 | 9.24 | 2.8 | 7.26 | 2.2 |
| 1800 | 9.90 | 3.0 | 7.92 | 2.4 |
| 1900 | 10.56 | 3.2 | 8.58 | 2.6 |
| 2000 | 11.22 | 3.4 | 9.24 | 2.8 |
| 2100 | 11.88 | 3.6 | 9.90 | 3.0 |
| 2200 | 12.54 | 3.8 | 10.56 | 3.2 |
| 2300 | 13.20 | 4.0 | 11.22 | 3.4 |
| 2400 | 13.86 | 4.2 | 11.88 | 3.6 |
| 2500 | 14.52 | 4.4 | 12.54 | 3.8 |
| 2600 | 15.18 | 4.6 | 13.2 | 4.0 |
| 2700 | 15.84 | 4.8 | 13.86 | 4.2 |
| 2800 | 16.50 | 5.0 | 14.52 | 4.4 |
| 2900 | 17.16 | 5.2 | 15.18 | 4.6 |
| 3000 | 17.82 | 5.4 | 15.84 | 4.8 |
| 3100 | 18.48 | 5.6 | 16.5 | 5.0 |

Recommended Operating Conditions

| | Parameter | Sym. | Min. | Typ.‡ | Max. | Units | Test Conditions |
|---|----------------------------------|--|----------------------|----------------------|----------------------|-------------|--|
| 1 | Operating Supply Voltages * | V _{DD} V _{EE} V _{BAT} | 4.75 -5.25 -72 | 5.00 -5.00 -48 | 5.25 -4.75 -30 | V V V | Note 1 |
| 2 | Ringling Voltage | Vring | 0 | 50 | 100 | V RMS | Note 2 |
| 3 | Voltage setting for Loop Current | V _{LC} | | 0 V | | V | I _{LOOP} = 25 mA, V _{BAT} = -48 V |
| 4 | Operating Temperature | To | -40 | +25 | +85 | °C | |

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

Note 1: Power up sequence must be in the following order – V_{DD}, V_{EE}, V_{BAT}.

Note 2: 16 to 68 Hz superimposed on a V_{BAT}.

DC Electrical Characteristics †

| | Characteristics | Sym. | Min. | Typ. | Max. | Units | Test Conditions |
|---|--|--|-------------|--------------|------|----------------|--|
| 1 | Supply Current per SLIC * | I _{DD} I _{EE} I _{BAT} | -8.5 | 5 -3 2 | 11 | mA mA mA | On Hook |
| 2 | Constant Current Line Feed | I _{LOOP} | 23 | 25 | 27 | mA | V _{LC} = 0 V V _{BAT} = -48 V |
| 3 | Programmable Loop Current Range | I _{LOOP} | 18 | | 26 | mA | With V _{LC} , +/- 2 mA accuracy |
| 4 | Operating Loop (Including telephone) | R _{LOOP} | 1600 750 | | | Ω Ω | I _{LOOP} = 18 mA V _{BAT} = -48 V I _{LOOP} = 18 mA V _{BAT} = -30 V |
| 5 | Off Hook Detection Threshold | SHK | | 20 | | mA | V _{LC} = 0 V V _{BAT} = -48 V See Note 3. I _{LOOP} = 25 mA |
| 6 | RLYC Input Low Voltage Input High Voltage | V _{il} V _{ih} | 2.0 | 0.4 | 0.7 | V V | I _{il} = 50 μA I _{ih} = +50 μA |
| 7 | SHK Output Low Voltage Output High Voltage | V _{ol} V _{oh} | 2.7 | | 0.4 | V V | I _{ol} = 8 mA I _{oh} = -0.4 mA |
| 8 | Dial Pulse Distortion ON OFF | | | +4 +4 | | ms ms | |

† Electrical Characteristics are over Recommended Operating Conditions unless otherwise stated.

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

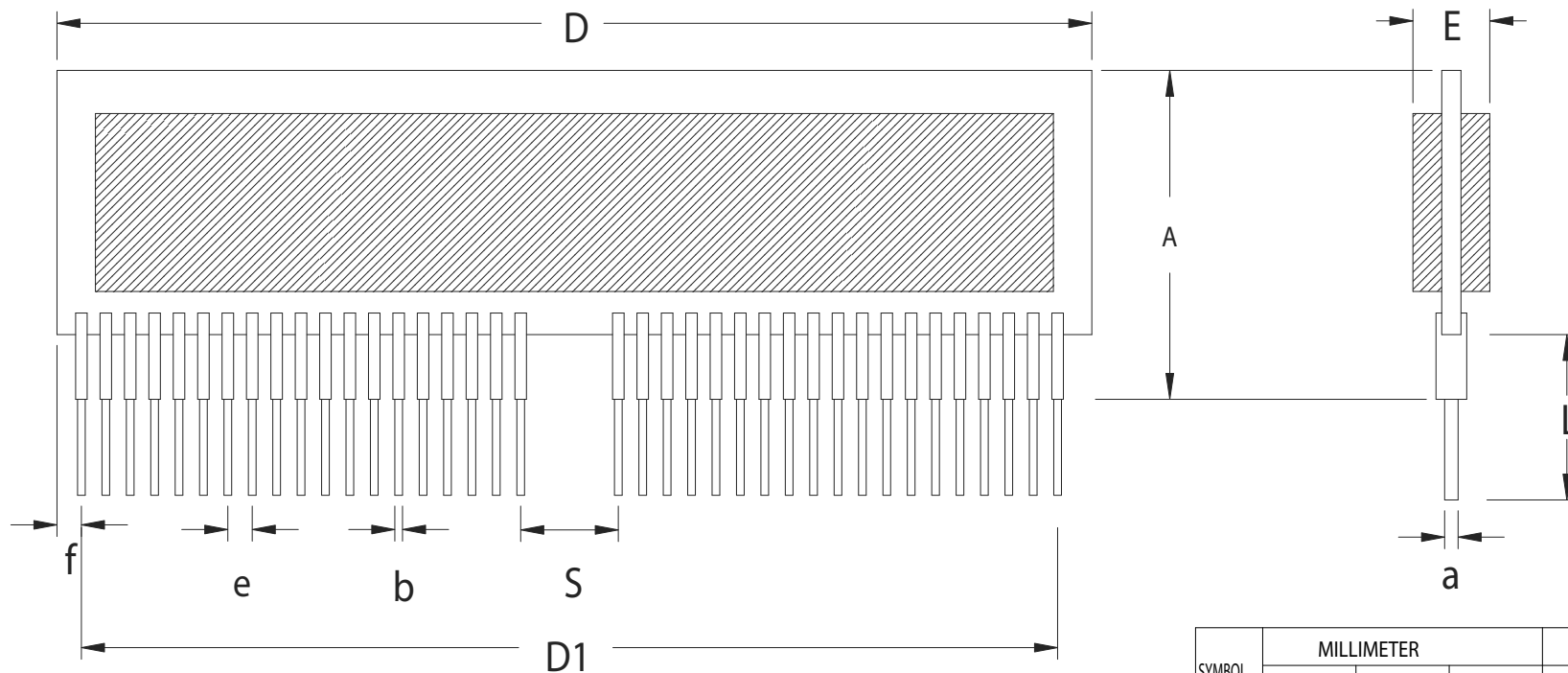
Note 3: Off hook detection is related to loop current.

AC Electrical Characteristics†

| | Characteristics | Sym. | Min. | Typ.‡ | Max. | Units | Test Conditions |
|----|--|------|----------------|----------------|------------|----------------|---|
| 1 | Ring Trip Detect Time | Tt | | 90 | 300 | ms | |
| 2 | Output Impedance at VX | | | 10 | | Ω | |
| 3 | Gain 4-2 @ 1 kHz | | -1.3 | -1 | -0.8 | dB | |
| 4 | Gain Relative to 1 kHz | | -0.5 | | 0.5 | dB | 300 Hz - 3400 Hz |
| 5 | Transhybrid Loss | THL | 20 18 | 25 20 | | dB | 300 Hz - 1000 Hz 1000 Hz – 3400 Hz |
| 6 | Gain 2-4 @ 1 kHz | | -1.3 | -1 | -0.8 | dB | |
| 7 | Gain Relative to 1 kHz | | -0.5 | | 0.5 | dB | 300 Hz to 3400 Hz |
| 8 | Return Loss at 2-Wire | RL | 20 | 30 | | dB | 300 Hz - 3400 Hz |
| 9 | Total Harmonic Distortion @ 2 W @ V X | THD | | 0.3 0.3 | 1.0 1.0 | % % | 3 dBm, 1 kHz @ 2 W 1 Vrms, 1 KHz @ 4 W |
| 10 | Common Mode Rejection 2 wire to Vx | CMR | 35 | 42 | | dB | Input 0.5 Vrms, 1 KHz |
| 11 | Longitudinal to Metallic Balance | LCL | 46 | 55 | | dB | 200 Hz to 3400 Hz |
| 13 | Idle Channel Noise @ 2 W @ VX | Nc | | 10 12 | 15 15 | dBmC dBmC | Cmessage Filter Cmessage Filter |
| 14 | Power Supply Rejection (2 W) Vdd Vee Vbat | PSRR | 20 20 20 | 23 23 23 | | dB dB dB | 0.1 Vp-p @ 1 kHz |
| 15 | Power Supply Rejection (Vx) Vdd Vee Vbat | PSRR | 20 20 20 | 23 23 23 | | dB dB dB | 0.1 Vp-p @ 1 kHz |

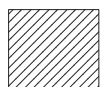
† Electrical Characteristics are over Recommended Operating Conditions unless otherwise stated.

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



Note:

1. Drawing not to scale.



2. Region containing SMT components.

| SYMBOL | MILLIMETER | | | INCH | | |
|--------|------------|-------|-------|-------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | --- | --- | 15.24 | --- | --- | 0.600 |
| D | --- | --- | 53.85 | --- | --- | 2.120 |
| D1 | 49.27 | 49.53 | 49.79 | 1.940 | 1.950 | 1.960 |
| E | --- | 4.58 | --- | --- | 0.180 | --- |
| a | --- | 0.25 | --- | --- | 0.010 | --- |
| b | 0.33 | 0.355 | 0.38 | 0.013 | 0.014 | 0.015 |
| L | 4.06 | 4.45 | 4.83 | 0.160 | 0.175 | 0.190 |
| e | 1.22 | 1.27 | 1.32 | 0.048 | 0.05 | 0.052 |
| f | --- | 1.27 | --- | --- | 0.050 | --- |
| S | --- | 3.81 | --- | --- | 0.150 | --- |
| n | 38 | | | 38 | | |

Drawing not to JEDEC Standard defined outline.

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| Package Outline for ZL49200 38 Lead SIL Hybrid (53.85x15.24)mm 1.27mm Pitch | |
| | 108998 |



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