December 2005

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.

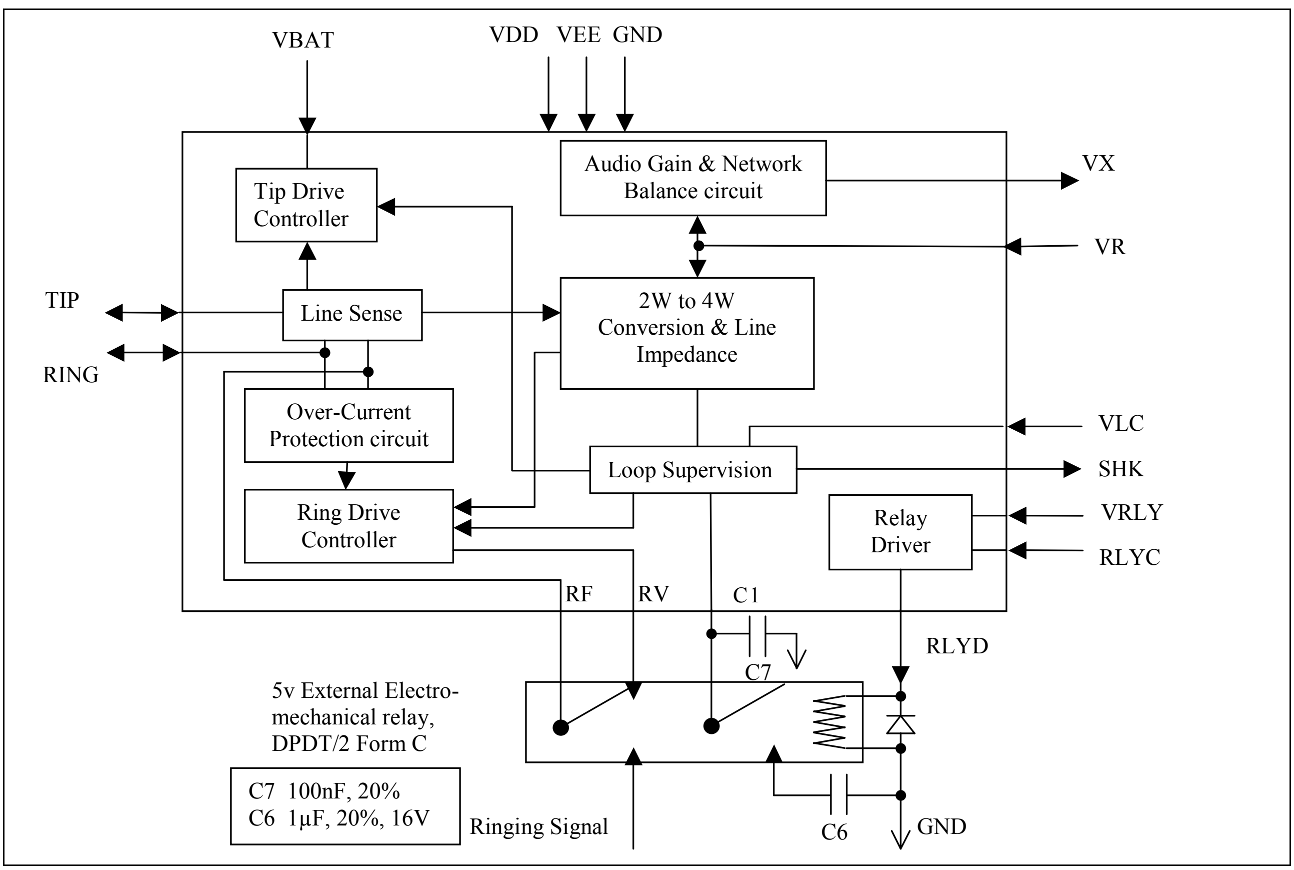
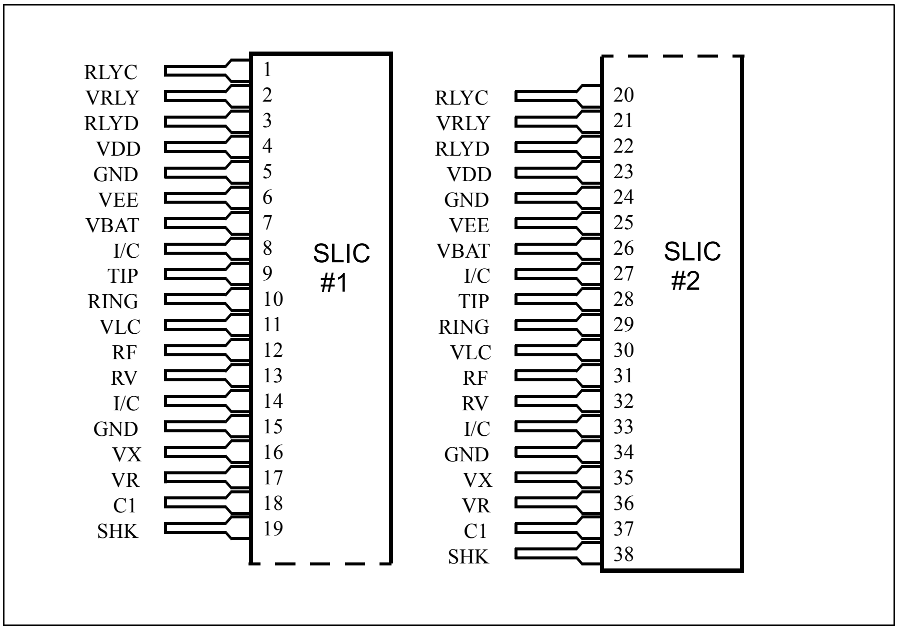


Figure 1 - Dual Channel SLIC Single Channel Schematic Diagram

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.

Ringing and Ring Trip Detection

Ringing 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 ringing.

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:

ILoop = (VBAT / 1.89 – VLC / 1.25) +/- 2 mA
e.g. for VLC =0 V, VBAT = -48 V
ILoop = 25 mA +/- 2 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:

$$R_L = \{[-V_{BAT} - V_{LD}] / I_{LOOP}\} - [R_P + 2R_F]$$
$$R_L = \{[72V - 10V)] / 18mA\} - [300R + 2x220R]$$

Therefore R_L = 2700 Ohms (or R_{LOOP} = 3000 Ohms incl... phone)
Equivalent line length = (RL/2) / (250 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:

$$R_L = \{[-V_{BAT} - V_{LD}] / I_{LOOP}\} - [R_P + 2R_F]\}$$
$$R_L = \{ [48V - 10V] / 18mA\} - [300R + 2x220R]$$

Therefore R_L = 1371 Ohms (or R_{LOOP} =1671 Ohms incl... phone)
Equivalent line length = (RL/2) / (250 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:

$R_L = \{[-V_{BAT} - V_{LD}] / I_{LOOP}\} - [R_P + 2R_F]\}$
$R_L = \{[30V - 9V] / 18mA\} - [300R + 2x220R]$

Therefore R_L = 420 Ohms (or R_{LOOP} =720 Ohms incl... phone)
Equivalent line length = (RL/2) / (250 ohm/km) = 0.84km.

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)	Local loop (km)
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	Ringing 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 – Vdd, Vee, Vbat.

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	 Vil Vih	 2.0	 0.4 	 0.7 	 V V	Iil = 50 µA Iih = +50 µA
7	SHK Output Low Voltage Output High Voltage	 Vol Voh	 2.7		 0.4 	 V V	Lol = 8 mA Loh = -0.4 mA
8	Dial Pulse Distortion ON OFF			+4 +4		ms ms	

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

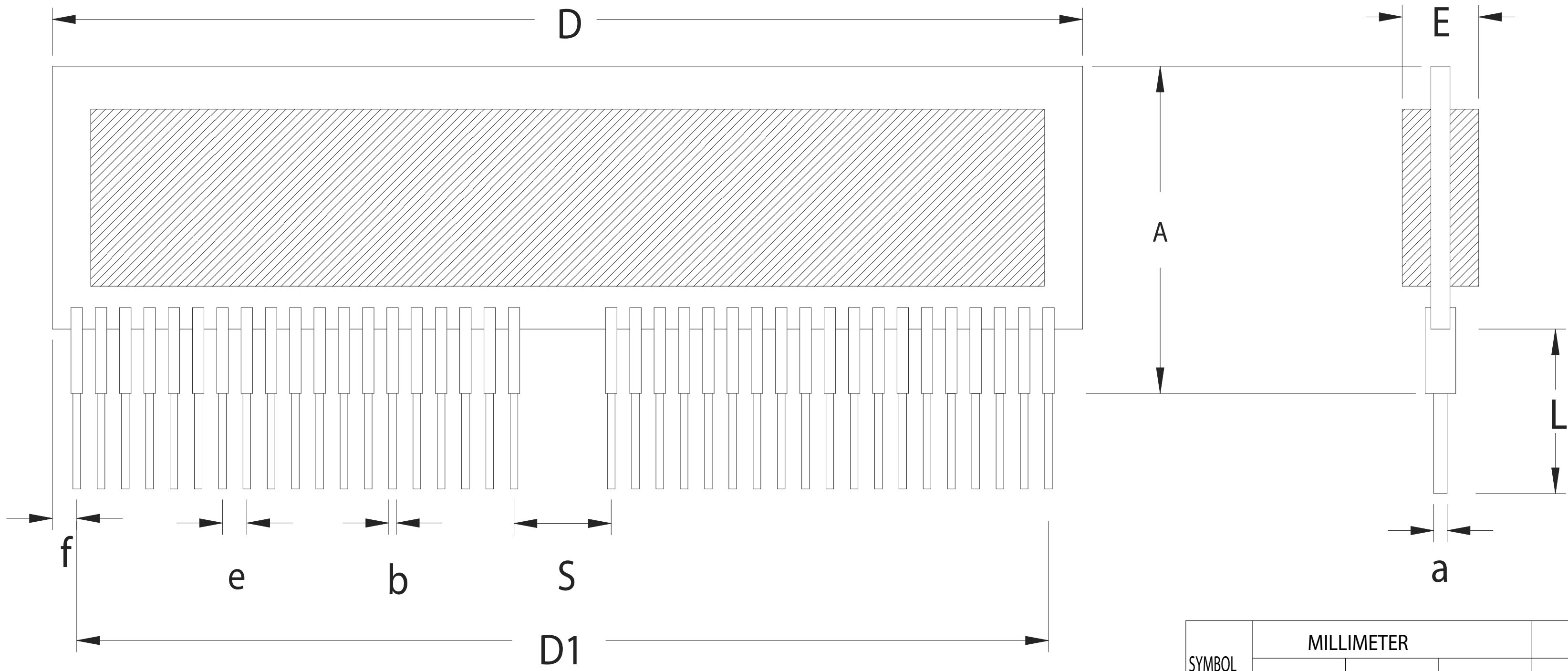
‡ Typical figures are at 25°C with nominal +5 V and are for design aid only.

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	 dBrnC dBrnC	 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.

ISSUE	1			
ACN				
DATE	17-Dec-2004			
APPRD.				

ZARLINK SEMICONDUCTOR

Previous package codes

N/A

Package Code MD

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

108998

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