ISL5586EVAL Evaluation Board User's Guide

Data Sheet | March 2001 | AN9918

Introduction

The ISL5586 evaluation board provides a complete evaluation system for the ISL5586 family of ringing SLICs. The receive and transmit ports of the ISL5586 are designed with differential interfaces. This implementation provides noise immunity and signal level compatibility with 3.3V CODECs. The ringing interface of the ISL5586 is DC coupled and has been implemented differentially. The interface allows both AC and DC control of the balanced waveform.

The evaluation board comes complete with a differential input driver. The differential input driver can be used to drive both the receive inputs of the ISL5586 or provide a differential ringing signal to ring the phone using a single ended input source. Also included on the evaluation board is a differential receive circuit to monitor the SLIC's differential transmit signal.

Voltage ratings for external components have been selected based on 100V device operation, therefore compatibility to lower voltage versions is guaranteed.

Getting Started

Your evaluation kit should contain this user's guide and the following hardware.

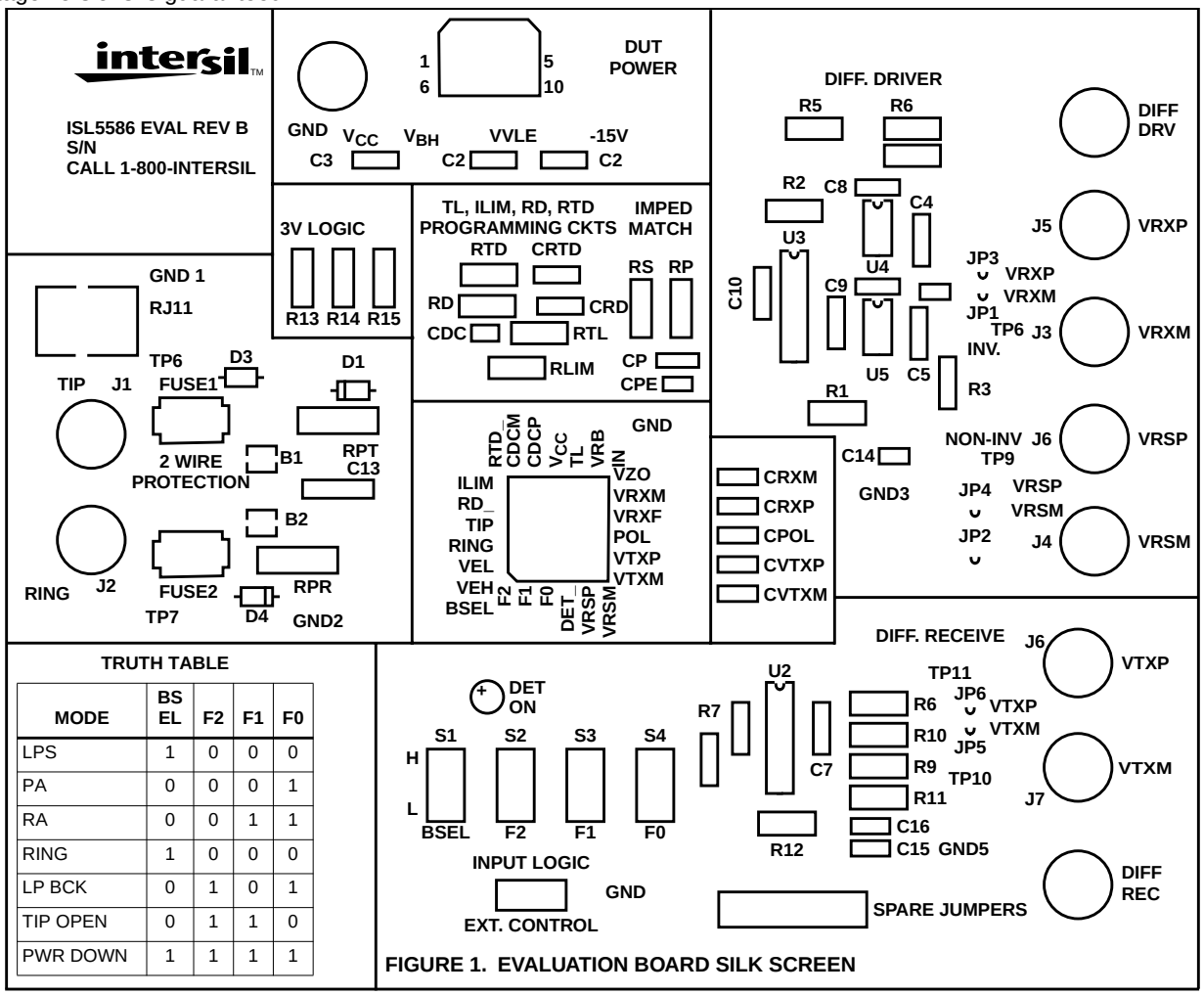
1. One ISL5586 evaluation board.
2. At least one ISL5586 device sample, already in board.
3. One PLCC extraction tool.
4. One power cable assembly with multi colored conductors.
5. Four jumpers.

The evaluation board should have the same appearance as the silk screen shown in Figure 1.

Applying Power to the Evaluation Board

Here are a few safeguards with power sequencing until you are accustomed to using the high voltages required by the devices.

1. Limit the current on all power supplies to 100mA.
2. Turn on the power supplies after the power cables are attached to the evaluation boards.



TRUTH TABLE

MODE	BSEL	F2	F1	F0
LPS	1	0	0	0
PA	0	0	0	1
RA	0	0	1	1
RING	1	0	0	0
LP BCK	0	1	0	1
TIP OPEN	0	1	1	0
PWR DOWN	1	1	1	1

FIGURE 1. EVALUATION BOARD SILK SCREEN

Evaluation Board Functional Description

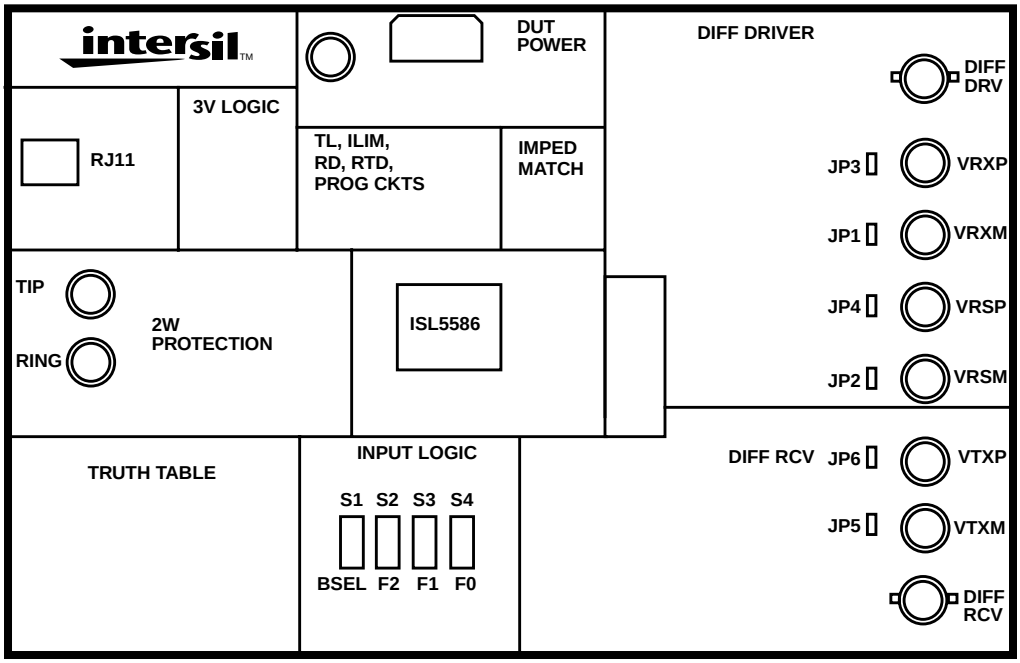


FIGURE 2. EVALUATION BOARD FUNCTIONAL DIAGRAM

Evaluation Board Jumper Definitions

JUMPER	DESCRIPTION
JP1	Connects the output of the differential driver to the VRXM pin of the ISL5586 for 4 wire to 2 wire communication.
JP2	Connects the output of the differential driver to the VRSM pin of the ISL5586 to ring the phone.
JP3	Connects the output of the differential driver to the VRXP pin of the ISL5586 for 4 wire to 2 wire communication.
JP4	Connects the output of the differential driver to the VRSP pin of the ISL5586 to ring the phone.
JP5	Connects the input of the differential receiver to the VTXM pin of the ISL5586 for 2 wire to 4 wire communication.
JP6	Connects the output of the differential driver to the VTXP pin of the ISL5586 for 2 wire to 4 wire communication.

Test Points

Each connector interface to the evaluation board has a test point (reference Table 5 for test point descriptions). All test points are DC coupled and should be guarded against ground shorts. High impedance test inputs, such as oscilloscopes or DVMs, should be used to monitor these points. Unused BNC connections also provide convenient test point access.

Toggle Switches

The four toggle switches, S1 thru S4, interface directly to the ISL5586 device. Positioning any switch towards the top of the board is a logic “1”. Positioning any switch towards the bottom of the board is a logic “0”. All switches are labeled with the control signal name of the ISL5586 device.

The battery select signal BSEL, selects the high battery when set to logic high. The operating modes for the ISL5586 device are provided in Table 1.

TABLE 1. ISL5586 OPERATING MODES

OPERATING MODE	F2	F1	F0
Low Power Standby	0	0	0
Forward Active	0	0	1
Unused	0	1	0
Reverse Active	0	1	1
Ringing	1	0	0
Forward Loop Back (Note)	1	0	1
Tip Open	1	1	0
Power Denial	1	1	1

NOTE: The ISL5586 device should always operate from low battery voltage when using the Forward Loop Back mode.

Refer to the device electrical data sheet for detailed descriptions regarding each operating mode according to the device under evaluation.

Basic Operation Configuration

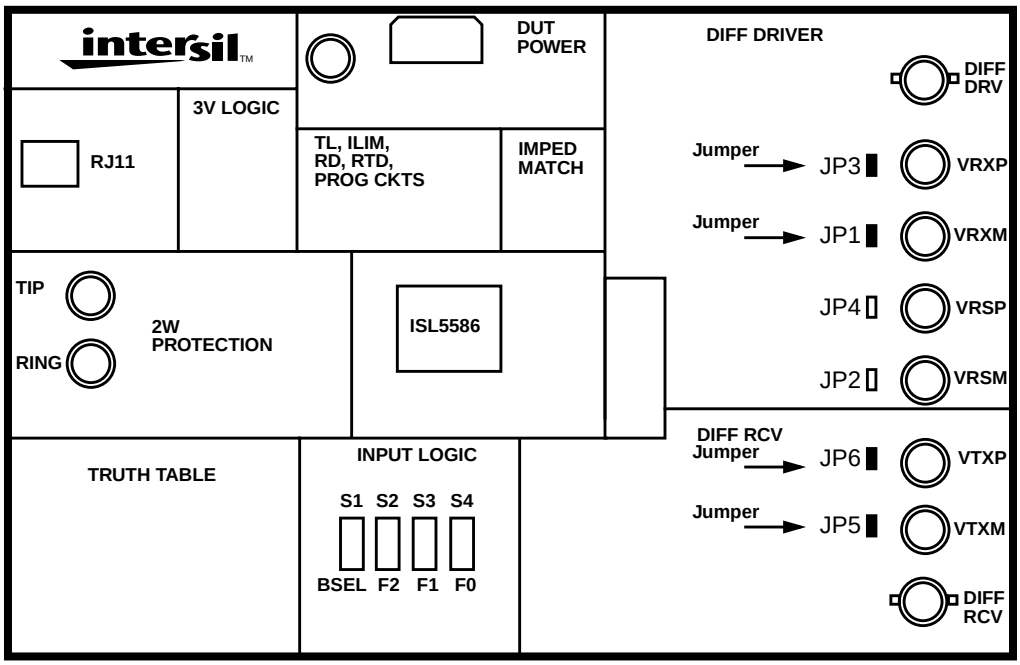


FIGURE 3. BASIC OPERATION CONNECTION AND JUMPERS

Description

The ISL5586 Evaluation Board is equipped to handle differential input signals from a CODEC in both the receive and transmit directions. The board is also equipped to enable a differential ringing signal to drive the phones through the ISL5586. This is accomplished by removing all jumpers from the board and applying the input signals using the banana jacks located on the right side of the board. The following section will discuss setting up the evaluation board for the basic operation. Setting up the evaluation board to ring the phone will be the topic of the next section.

The ISL5586 Evaluation Board is equipped with a differential driver to enable the user to drive the ISL5586 with standard lab equipment. Figure 3 shows the connection of the jumpers to enable basic operation of the ISL5586 using standard single ended lab equipment.

Power Supply Connections

Power should be applied to the evaluation board using the primary power cable located at the top of the board. Prior to applying power, the voltage setting of each supply should be verified. The power supplies should be turned off while mating the primary power cable to the evaluation board.

Jumper Settings

Reference Figure 3 for the placement of the jumpers to enable basic operation of the ISL5586.

Measurement Capability

Nearly all AC and DC parameters of the device can be measured using this configuration. The device has been socketed to allow easy measurements of more than a single device. An extraction tool has been included with the evaluation kit and should be used to remove the device from the socket. The typical device measurements are listed below.

1. Power supply current per operation mode.
2. Tip and Ring DC voltages per operation mod.
3. On hook AC gains G_{42}, G_{24} and G_{44}.
4. Off hook AC gains G_{42}, G_{24} and G_{44}.
5. Other AC parameters such as longitudinal balance.

$\overline{\text{DET}}$ LED

DET should light when: A DC current path exists from Tip to Ring (switch hook); Ring Trip has occurred during ringing or, during forward loop back testing.

Socket Removal

The surface mount socket for the ISL5586 device has the same solder foot print as the PLCC package. Therefore, the socket may be removed for more extensive characterization.

Basic Operation Configuration Typical Measurements

TABLE 2. SUPPLY CURRENTS (MILLI AMPS) - ON HOOK (V_{BL} = -24V, V_{BH} =-100V)

OPERATING MODE	F2, F1, F0	BSEL	ICC (Note)	IBH	IBL
Low Power Standby	0, 0, 0	1	23.2	0.65	0
Forward Active	0, 0, 1	0	25	0	2.5
Unused	0, 1, 0	N/A	N/A	N/A	N/A
Reverse Active	0, 1, 1	0	25	0	2.5
Ringing	1, 0, 0	1	27.4	2.2	1.5
Forward Loop Back	1, 0, 1	0	30.3	0	23
Tip Open	1, 1, 0	1	23.4	0.6	0.1
Power Denial	1, 1, 1	x	23.4	0	0.22

NOTE: The current ICC includes the current flowing through the $\overline{DET}$ LED biasing network (20ma).

TABLE 3. TIP AND RING VOLTAGES (VOLTS) - ON HOOK

OPERATING MODE	F2, F1, F0	BSEL	TIP	RING
Low Power Standby	0, 0, 0	1	-0.75	-52
Forward Active	0, 0, 1	0	-4.0	-19
Unused	0, 1, 0	N/A	N/A	N/A
Reverse Active	0, 1, 1	0	-19	-4
Ringing	1, 0, 0	1	$V_{BH}/2$	$V_{BH}/2$
Forward Loop Back	1, 0, 1	0	-4	-19
Tip Open	1, 1, 0	1	Float	-52
Power Denial	1, 1, 1	x	Float	Float

TABLE 4. AC GAINS (dB), OFF HOOK, 600Ω TERMINATION - FORWARD AND REVERSE ACTIVE ONLY

OPERATING MODE	F2, F1, F0	BSEL	G_{42}	G_{24}	G_{44}
Forward Active	0, 0, 1	0	2.92	-1.58	1.33
Reverse Active	0, 1, 1	0	2.92	-1.58	1.33
AC Gain Equations	G_{42}	G_{24}	G_{44}		
	$G_{42} = -2.82\left(\frac{Z_L}{Z_O + 2R_P + Z_L}\right)$	$G_{24} = -2\left(\frac{Z_O}{Z_O + 2R_P + Z_L}\right)$	$G_{44} = -2.82\left(\frac{Z_O}{Z_O + 2R_P + Z_L}\right)$		

Ringing Configuration

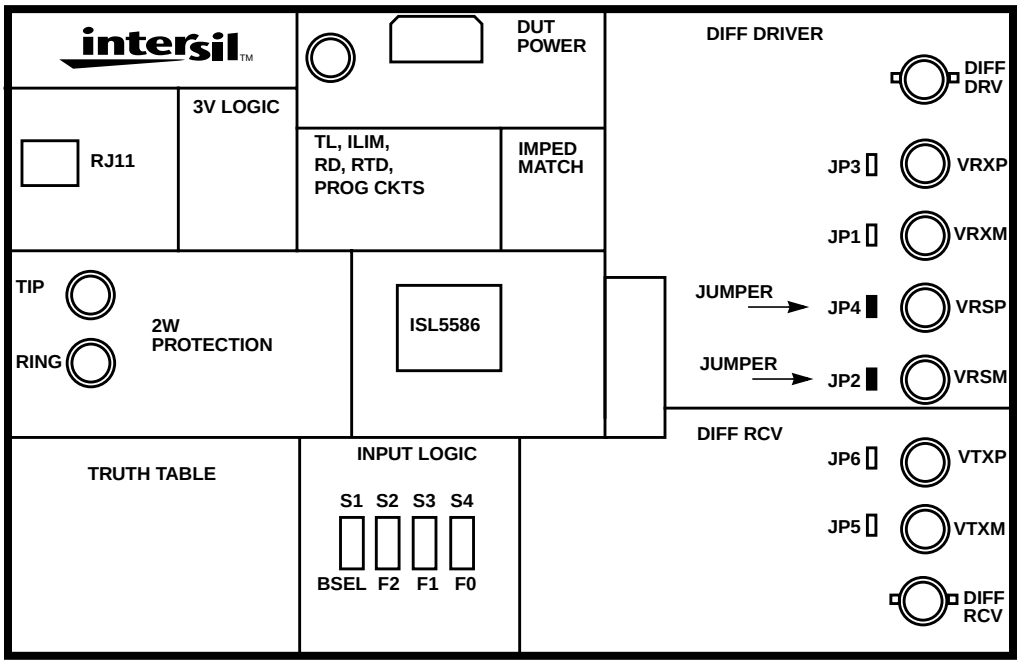


FIGURE 4. RINGING CONNECTION AND JUMPERS

Description

The evaluation board is equipped to enable a differential ringing signal using the VRSP and VRSM inputs located on the right side of the board. If a differential ringing source is not available, ringing the phone with standard lab equipment is achieved by using the differential drive circuit. Figure 4 shows the connection of the jumpers to ring the phone with a standard signal generator. The input impedance of the Driver circuit is 50Ω and the gain is set to 0.5V/V such that a $1V_{RMS}$ single ended input will produce a $1V_{RMS}$ differential output.

Power Supply Connections

Power should be applied to the evaluation board using the primary power cable located at the top of the board. Prior to applying power, the voltage setting of each supply should be verified. The power supplies should be turned off while mating the primary power cable to the evaluation board.

Jumper Settings

Reference Figure 4 for the placement of the jumpers to enable ringing of the phone.

Overview of Ringing

The Ringing mode (F2 = 1, F1 = 0, F0 = 0) provides linear amplification to support a variety of ringing waveforms. A programmable ring trip function provides loop supervision and auto disconnect upon ring trip. The device is designed to operate from the high battery during this mode.

The ISL5586 provides linear amplification to the differential signal applied to the ringing inputs VRSP and VRSM. The differential ringing gain of the device is 100V/V.

The voltage gain from the differential ringing input to the Tip output is 50V/V. The voltage gain from the differential ringing input to the Ring output is also 50V/V. The equations for the Tip and Ring outputs during ringing are given in EQ. 1 and EQ. 2.

$$V_T = \frac{V_{BH}}{2} + (50 \times V_{DIF}) \quad \text{(EQ. 1)}$$

$$V_R = \frac{V_{BH}}{2} - (50 \times V_{DIF}) \quad \text{(EQ. 2)}$$

When the differential input signal is zero, the Tip and Ring amplifier outputs are centered at half battery. The device provides auto centering for easy implementation of sinusoidal ringing. Both AC and DC control of the Tip and Ring outputs are available during ringing. This feature allows for DC offsets as part of the ringing waveform.

Ringing Input Terminals

The Ringing input is enabled only during the ringing mode, therefore, a free running oscillator may be connected at all times.

When operating from a battery of -100V, each amplifier, Tip and Ring, will swing a maximum of 95Vp-p. Hence the maximum differential signal swing between VRSP and VRSM to achieve full scale ringing is approximately 1.9Vp-p

The following VRS input voltages are recommended for maximum ringing capability at the given battery voltage.

V_{BH} = -100V, VRS = 0.672V_{RMS}.

V_{BH} = -85V, VRS = 0.565V_{RMS}.

V_{BH} = -75V, VRS = 0.495V_{RMS}.

Forward Loop Back Configuration

Description

The Forward Loop Back mode (F2 = 1, F1 = 0, F0 = 1) provides test capability for the SLIC. An internal signal path is enabled allowing for both DC and AC verification by the connection of an internal 600Ω resistor across Tip and Ring. This internal terminating resistor has a tolerance of ±10% at room temperature. The device is intended to operate from only the low battery during this mode. When the Forward Loop Back mode is initiated, an internal switch connects a 600Ω load across the outputs of the Tip and Ring amplifiers as shown in Figure 6.

DC Verification

When the internal signal path is provided, DC current will flow from Tip to Ring. The DC current will force $\overline{DET}$ low, indicating the presence of loop current. In addition to verifying device functionality, toggling the logic output verifies the interface to the system controller

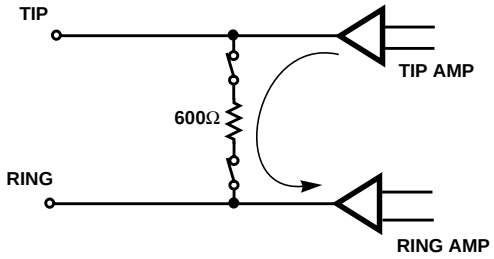


FIGURE 5. FORWARD LOOP BACK SIGNAL FLOW

Power Supply Connections

Power should be applied to the evaluation board using the primary power cable located at the top of the board. Prior to applying power, the voltage setting of each supply should be verified. The power supplies should be turned off while mating the primary power cable to the evaluation board.

Jumper Setting

Reference Figure 5 for the placement of the jumpers to enable Forward Loopback operation of the ISL5586.

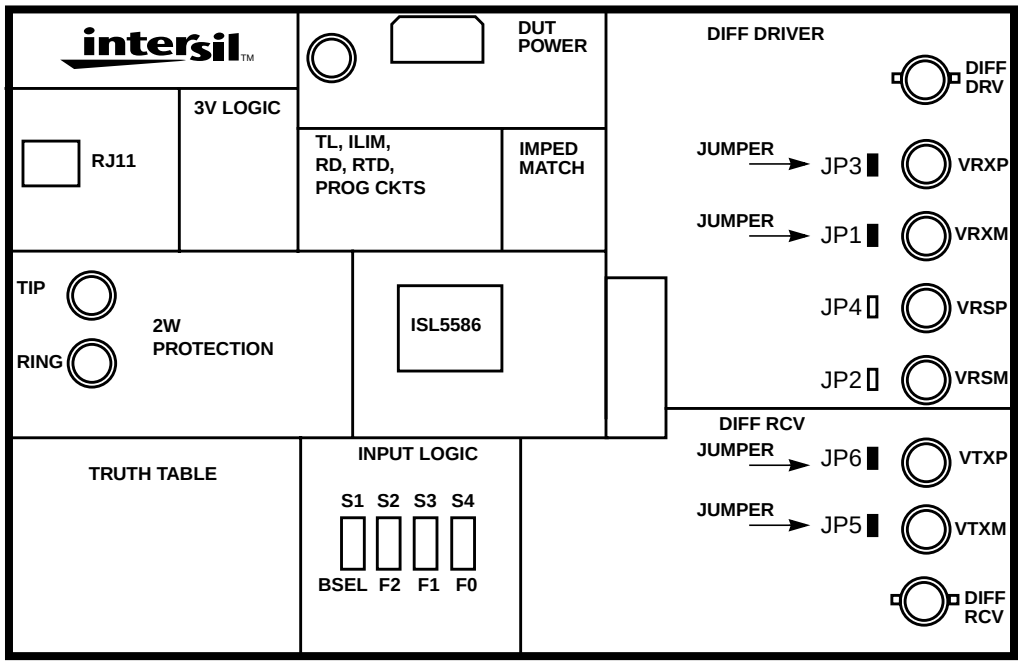
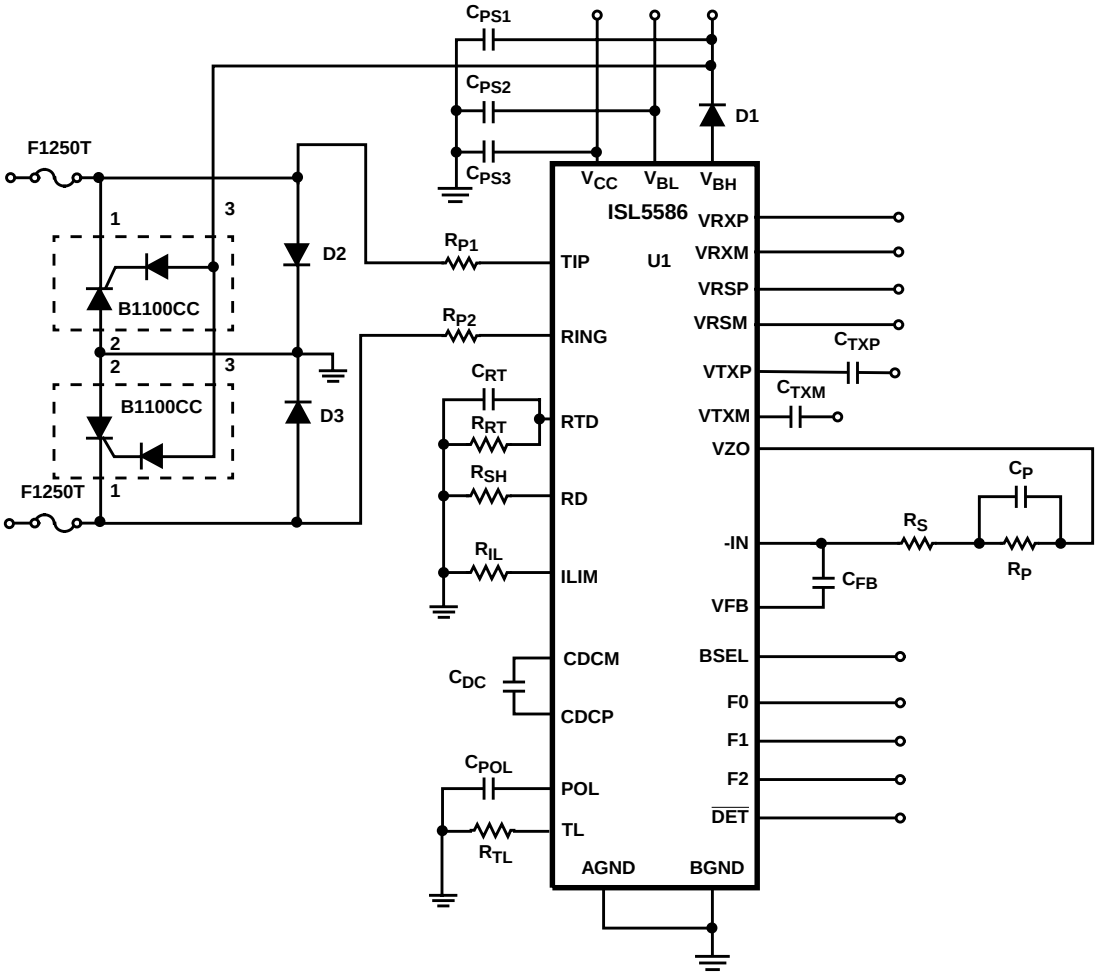


FIGURE 6. FORWARD LOOP BACK CONNECTION AND JUMPERS

TABLE 5. EVALUATION BOARD TEST POINTS DESCRIPTIONS

CONNECTOR	DESCRIPTION
T1	Connects to the Tip pin of the ISL5586. (The Tip pin is the Tip Power Amplifier Output).
T3, TP2	Connects to the V_{BL} pin of the ISL5586 and the external V_{BL} supply connection.
T4	Connects to the V_{BH} pin of the ISL5586 and the anode of D1.
TP1	External V_{BH} supply connection and the cathode of D1.
T5	Connects to the Battery Select pin of the ISL5586. (The BSEL pin Selects between high and low battery).
T6	Connects to the F2 pin of the ISL5586. (The F2 pin is a TTL Mode Control Input - MSB).
T7	Connects to the F1 pin of the ISL5586. (The F1 pin is a TTL Mode Control Input).
T8	Connects to the F0 pin of the ISL5586. (The F0 pin is a TTL Mode Control Input - LSB).
T9	Connects to the $\overline{DET}$ of the ISL5586. (The $\overline{DET}$ pin will either detect switch hook or ring trip based upon operating state).
T10	Connects to the VRSP pin of the ISL5586. (The VRSP pin is the Non-inverting Ringing Signal Input).
T11	Connects to the VRSM pin of the ISL5586. (The VRSM pin is the Inverting Ringing Signal Input).
T12	Connects to the VTXP pin of the ISL5586. (The VTXP pin is the positive Transmit Output Voltage).
T13	Connects to the VTXM pin of the ISL5586. (The VTXP pin is the negative Transmit Output Voltage).
T15	Connects to the POL pin of the ISL5586. (An external capacitor on this pin sets the polarity reversal time).
T16	Connects to the VRXP pin of the ISL5586. (The VRXP pin is the Non-inverting Analog Receive Voltage).
T17	Connects to the VRXM pin of the ISL5586. (The VRXM pin is the Inverting Analog Receive Voltage).
T18	Connects to the VZO pin of the ISL5586. (The VZO pin is the connection terminal for the impedance matching resistor).
T19	Connects to the -IN pin of the ISL5586. (The -IN pin is the connection terminal for high pass filter and impedance matching).
T20	Connects to the VFB pin of the ISL5586. (The VFB pin is the connection terminal for high pass filter and impedance matching).
T21	Connects to the TL pin of the ISL5586. (The TL pin is the Transient Current Limit Programming Resistor connection terminal).
T22,TP3	Connects to the V_{CC} pin of the ISL5586 and the external V_{CC} supply connection.
T23	Connects to the CDCP pin of the ISL5586. (The VCDCP pin is the DC Biasing Filter Capacitor - Positive terminal)..
T24	Connects to the CDCM pin of the ISL5586. (The VCDCM pin is the DC Biasing Filter Capacitor - Negative terminal).
T25	Connects to the RTD pin of the ISL5586. (The RTD pin is the Ring Trip Filter Network connection terminal).
T26	Connects to the ILIM pin of the ISL5586. (The ILIM pin is the Loop Current Limit programming resistor connection terminal).
T27	Connects to the RD pin of the ISL5586. (The RD pin is the Switch Hook Detection threshold programming connection terminal).
T28	Connects to the Ring pin of the ISL5586. (The Ring pin is the Ring Power Amplifier Output).
TP4	Connects to the -15V supply connection.
TP5	Connects to the +15V supply connection.
TP6	Connects to the Tip output of the eval board downstream from the protection resistor and fuse.
TP7	Connects to the Ring output of the eval board downstream from the protection resistor and fuse.
TP8	Connects to the inverting output of the differential driver circuit.
TP9	Connects to the non-inverting output of the differential driver circuit.
TP10, TP11	Connects to the inputs of the differential receive circuit.



NOTE: CPS1 should be located as close as possible to the B1100CC to minimize turn on time. Less than 2 inches is recommended.

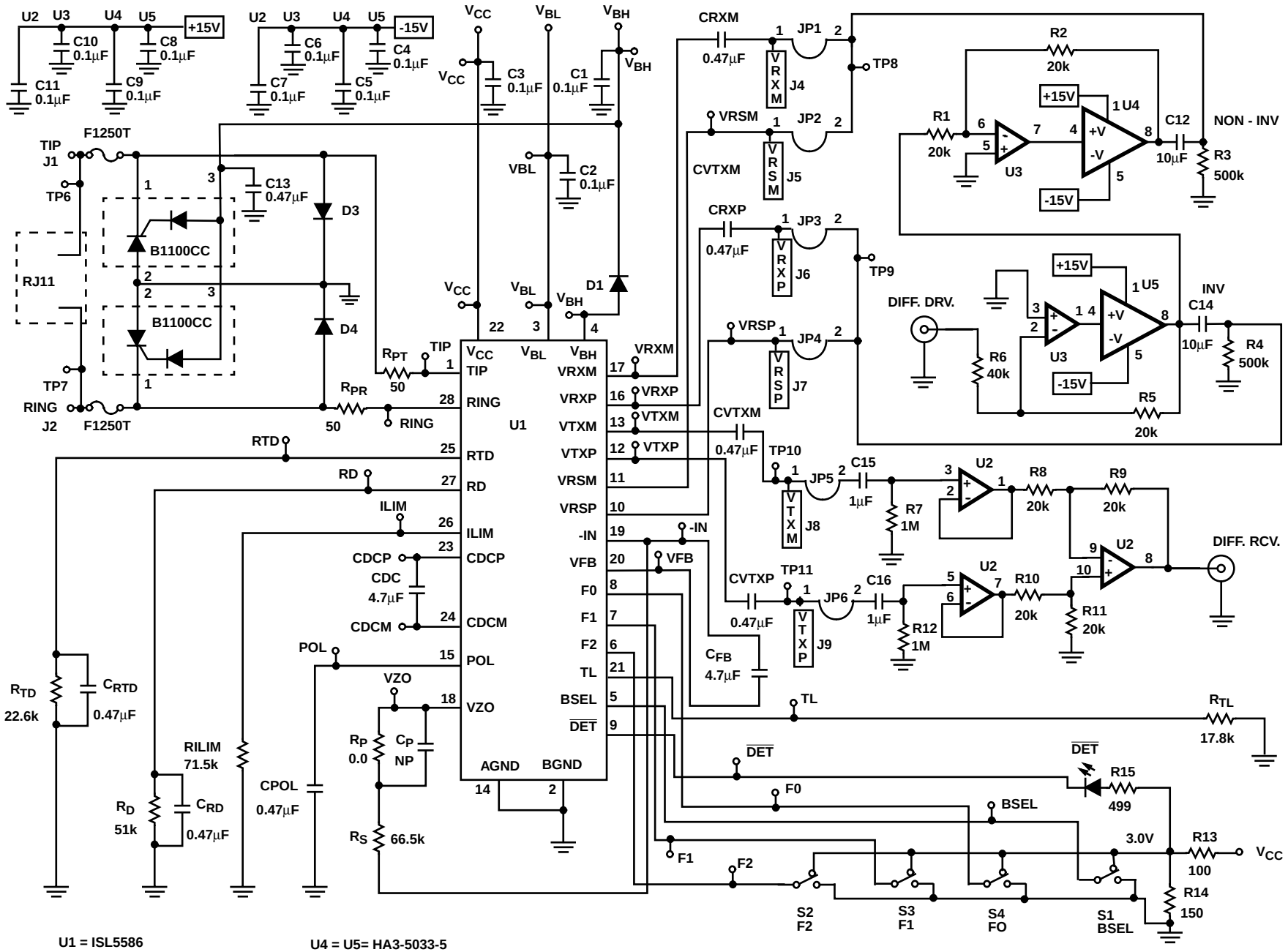
FIGURE 7. ISL5586 BASIC APPLICATION CIRCUIT

Basic Application Circuit Component List

COMPONENT	VALUE	TOLERANCE	RATING	COMPONENT	VALUE	TOLERANCE	RATING
U1 - Ringing SLIC	ISL5586	N/A	N/A	C_{DC}	4.7µF	20%	10V
R_{RT}	22.1kΩ	1%	0.1W	C_{FB}	1.0µF	20%	10V
R_{SH}	40kΩ	1%	0.1W	C_{PS1}	0.47µF	20%	>100V
R_{IL}	71.5kΩ	1%	0.1W	C_{PS2}, C_{PS3}	0.1µF	20%	100V
R_S	66.5kΩ	1%	0.1W	D_1	1N400X type with breakdown > 100V.		
R_{TL}	17.8kΩ	1%	0.1W	D_2, D_3	1N4935 type.		
R_P	0Ω	N/A	N/A	R_{P1}, R_{P2} = 50Ω, 0.5W, matched to 0.1Ω.	Protection resistor values are application dependent and will be determined by protection requirements. Standard applications will use ≥ 50Ω per side.		
C_P	Open	N/A	N/A				
C_{RT}, C_{RS}, C_{SH}, C_{TXP}, C_{TXM}, C_{POL}	0.47µF	20%	10V				

Design Parameters: Ring Trip Threshold = $90mA_{PEAK}$. Switch Hook Threshold = 12mA, Loop Current Limit = 24.6mA, Transient current limit: I_{SOURCE} = 100mA, I_{SINK} = 120mA, Synthesize Device Impedance = 66.5KΩ/133.3 = 500Ω, with 51Ω protection resistors, impedance across Tip and Ring terminals = 603Ω.

Evaluation Board Schematic



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