

## ISL54059EVAL1Z Through ISL54064EVAL1Z

Evaluation Board

AN1369  
Rev 0.00  
February 3, 2009

### Description

The ISL54059EVAL1Z, ISL54060EVAL1Z, ISL54061EVAL1Z, ISL54062EVAL1Z, ISL54063EVAL1Z and ISL54064EVAL1Z evaluation board is designed to provide a quick and easy method for evaluating the ISL54059 through ISL54064 ICs.

The ISL54059 and ISL54062 ICs are a single supply Dual Single-Pole Double Throw (SPDT) analog switches while the ISL54060, ISL54061, ISL54063 and ISL54064 IC's are single supply Dual Single-Pole Single Throw (SPST) analog switches. All devices feature negative swing capability, sub- $\Omega$  ON-resistance, and low power dissipation. The ICs are designed for applications that require an analog switch that may see voltages below ground at the switch terminals, such as audio and video. The evaluation board is developed to evaluate the ISL540XX ICs, integrating many features for ease of use in examining the performance of the device under various operating conditions. To help understand the operation of the ISL540XX IC and the ISL540XXEVAL1Z evaluation board, it is recommended to study the evaluation board schematic found on page 4 of this document and the datasheet for the IC under evaluation.

The ICs are analog switches that are capable of swinging down to 6.5V below the positive supply rail. For example, if the supply is at +1.8V, the switch terminal analog operating range is from -4.3V to +1.8V. The ISL54062, ISL54063, and ISL54064 also integrate Click and Pop Elimination Circuitry to remove transient noises at the speaker during power ON/OFF of an audio system. The evaluation board contains standard RCA/BNC connectors and a single headphone jack to allow the user to easily interface with the IC to evaluate its functions, features, and performance.

This application note will guide the user through the process of configuring and using the evaluation board to evaluate the ISL540XX devices.

### Key Features

- RCA Audio Input/Output Jacks, Stereo Headphone Output Jack and BNC Connectors
- Convenient Test Points and Connections for Test Equipment
- Click and Pop Elimination Circuitry (ISL54062, ISL54063, and ISL54064)
- Manual or External Logic Input Control

### Picture of Evaluation Board (Top View)



FIGURE 1. ISL54059EVAL1Z THROUGH ISL54064EVAL1Z EVALUATION BOARD

### Board Architecture/Layout

#### Basic Layout of Evaluation Board

A picture of the evaluation board is located in Figure 1. The ISL540XX IC is located inside socket U1 located at the center of the evaluation board. The IC needs to be orientated inside the socket such that the pin 1 indicator on the IC is aligned with the pin 1 indicator dot inside the socket. The evaluation board integrates the necessary connections and components to interface with the ICs for ease of operation.

#### Power Supply

The ISL540XX IC requires a supply voltage in the range of +1.8V to +6.5V for proper operation. Banana jacks for  $V_{CC}$  (J1) and GND (J2) are located at the top of the board. The evaluation board contains a 10 $\mu$ F bulk capacitor and a 0.1 $\mu$ F high frequency decoupling capacitor at the supply lines.

#### Logic Control

The evaluation board contains two types of logic control to the digital logic inputs of the IC available to the user. The logic pins can be controlled either through manual or external operation. The logic control pins are manually toggled by the SPST switches mounted on the evaluation board (S1-S2). When the switch is in the up position (H), the associated logic pin is pulled to  $V_{CC}$  for logic HIGH. When the switch is in the down position (L), the associated logic pin is pulled to GND for logic LOW. For manual operation, the jumpers JP6-JP7 need to be in the 2-3 position.

For external control via a function generator or switched source, set the jumpers JP6-JP7 in the 1-2 position. This by-passes the SPST switches and routes the logic control to

the BNC connectors J13-J14 located on the bottom right side of the board.

Note: There are 500k $\Omega$  logic pull-down resistors on the INx control pins. In external control mode when the digital logic input lines are left in a floating state, these pull-down resistors bias the logic inputs to ground.

### Switch Terminals

The evaluation board contains components to interface with all six terminals of the Dual SPDT switch (four terminals for the SPST switches). The common (COM) terminals of the switch are located on the right side of the evaluation board. The Normally Open (NO) and Normally Closed (NC) terminals of the switch are located on the left side of the evaluation board. All switch terminals include both RCA jacks and BNC connectors. The COM terminals also include a headphone jack (HJ1) for connecting a stereo headphone or line level plug.

Note: There are 10k $\Omega$  pull-down resistors on the NCx and NOx pins of the evaluation board (R21, R22, R23, and R26). They will need to be depopulated if the user does not desire to have them.

Refer to Table 1 for a list of the connections on the ISL540XXEVAL1Z and the associated pin of the IC. The evaluation board also includes Test Points for convenient locations to probe specific pins on the IC.

**TABLE 1. BOARD COMPONENT TABLE**

DEVICE PIN	EVALUATION BOARD CONNECTION	TEST POINT	APPLICABLE IC
V <sub>CC</sub>	J1	TP1	All
GND	J2	TP2	All
IN1	S2, J13	TP8	All
IN2	S1, J14	TP9	All
NO1	J11, J12	TP7	ISL54059, ISL54060, ISL54062, ISL54063
NC1	J5, J6	TP4	ISL54059, ISL54061, ISL54062, ISL54064
COM1	J3, J4, HJ1	TP3	All
NO2	J15, J16	TP10	ISL54059, ISL54060, ISL54062, ISL54063
NC2	J7, J8	TP5	ISL54059, ISL54061, ISL54062, ISL54064
COM2	J9, J10, HJ1	TP6	All

Note: All switch terminals on the evaluation board have place holders that can have surface mounted components placed either in series with the switch path or shunted to ground. Jumpers on these components allow flexible configurations. Refer to the Evaluation Board Schematics located on page 4 for clarification.

### Power Supply

The DC power supply connected at banana jacks J1 (V<sub>CC</sub>) and J2 (GND) provides power to the evaluation board. The evaluation board requires a +1.8V to +6.5V DC power supply for proper operation. The power supply should be capable of delivering 100 $\mu$ A of current.

### Logic Control

The state of the ISL540XX IC is determined by the Truth Table as defined in their respective datasheet. When in manual operation mode, the logic being toggled by the SPST switches (S1-S2) will always drive the voltage of the logic pin to V<sub>CC</sub> for a HIGH and GND for a LOW. In external control mode, the voltages being driven by an external source must meet appropriate V<sub>IH</sub> and V<sub>IL</sub> levels as defined in the datasheet.

The control pins are 1.8V logic compatible up to a +3.3V supply, which allows for control via a standard  $\mu$ controller.  
Logic "0" (LOW) when  $\leq 0.5V$  (or floating)  
Logic "1" (HIGH) when  $\geq 1.4V$

When operating above +3.3V supply, refer to the datasheet for appropriate logic levels to drive the logic pins. It is always recommended to drive the logic pins to the positive supply rail (V<sub>CC</sub>) and GND to minimize power consumption.

### Logic States

#### INPUT SELECT (INX) PINS

If the INx Pins are logic "HIGH", then the NOx switches are turned ON and the NCx switches are turned OFF. If the INx Pins are logic "LOW", then the NCx switches are turned ON and the NCx switches are turned OFF.

#### CLICK AND POP OPERATION (ISL54062, ISL54063, ISL54064 ONLY)

Single supply audio sources are biased at a DC offset that generates transients during power ON/OFF of the audio source. This DC offset is coupled through a blocking capacitor that is need to remove the DC bias to the speaker, causing a transient voltage at the load. For example, when the source is OFF and suddenly turned ON with a DC offset, the capacitor will develop a voltage equal to the DC offset. This voltage gets discharged by the speaker causing a click and pop noise. The ISL54062, ISL54063, and ISL54064 ICs integrate circuitry to eliminate click and pop noises to the speaker.

For proper operation of Click and Pop elimination, the switch terminal that is being connected to the speaker should be connected through the integrated shunt resistor before

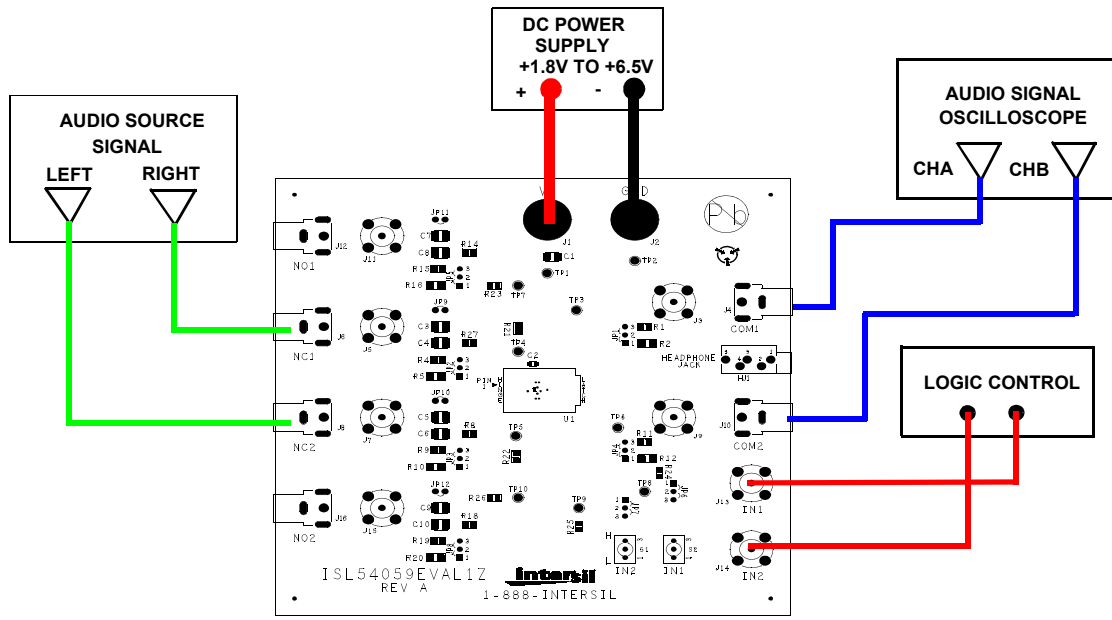


FIGURE 2. BASIC EVALUATION TEST SETUP BLOCK DIAGRAM

connecting to the load. This allows any transients generated by the source to be discharged through the shunt resistor first, eliminating any audible click and pop noises. With a typical DC blocking capacitor of 200 $\mu$ F and the shunt resistance having a typical value of 140 $\Omega$ , allowing a 250ms dead time in for discharging a transient will eliminate the click and pop noise.

### Applications

The ISL540XX ICs are designed to be a Dual SPDT or SPST switch for multiplexing or switching of signals that require low insertion loss, low power consumption, and negative voltage swing capability. Such applications include Audio/Video equipment, battery or portable devices and medical equipment. In addition, the Click and Pop Elimination Circuitry makes it ideal for portable audio such as MP3 players and cell phones.

### Using The Board (Refer to Figure 2)

#### Lab Equipment

The equipment, external supplies and signal sources needed to operate the board are listed below:

1. +1.8V to +6.5V DC Power Supply
2. Audio Signal Generator
3. Audio Signal Oscilloscope
4. Logic Control Generator and/or Pulse Generator

#### Initial Board Setup Procedure

1. Attach the evaluation board to the DC power supply at J1 ( $V_{CC}$ ) and J2 (GND). Positive terminal at J1 and negative terminal at J2. The supply should be capable of delivering +1.8V to +6.5V and 100 $\mu$ A of current.

2. Connect the Audio Source Signal to the NO $_x$  or NC $_x$  BNC inputs . The analog input voltage range can be from  $V_{CC}$ -6.5V up to  $V_{CC}$ .
3. Connect the Audio Signal Oscilloscope to the COM $_x$  BNC outputs .
4. Connect the Logic Control generator to the IN $_x$  logic inputs.

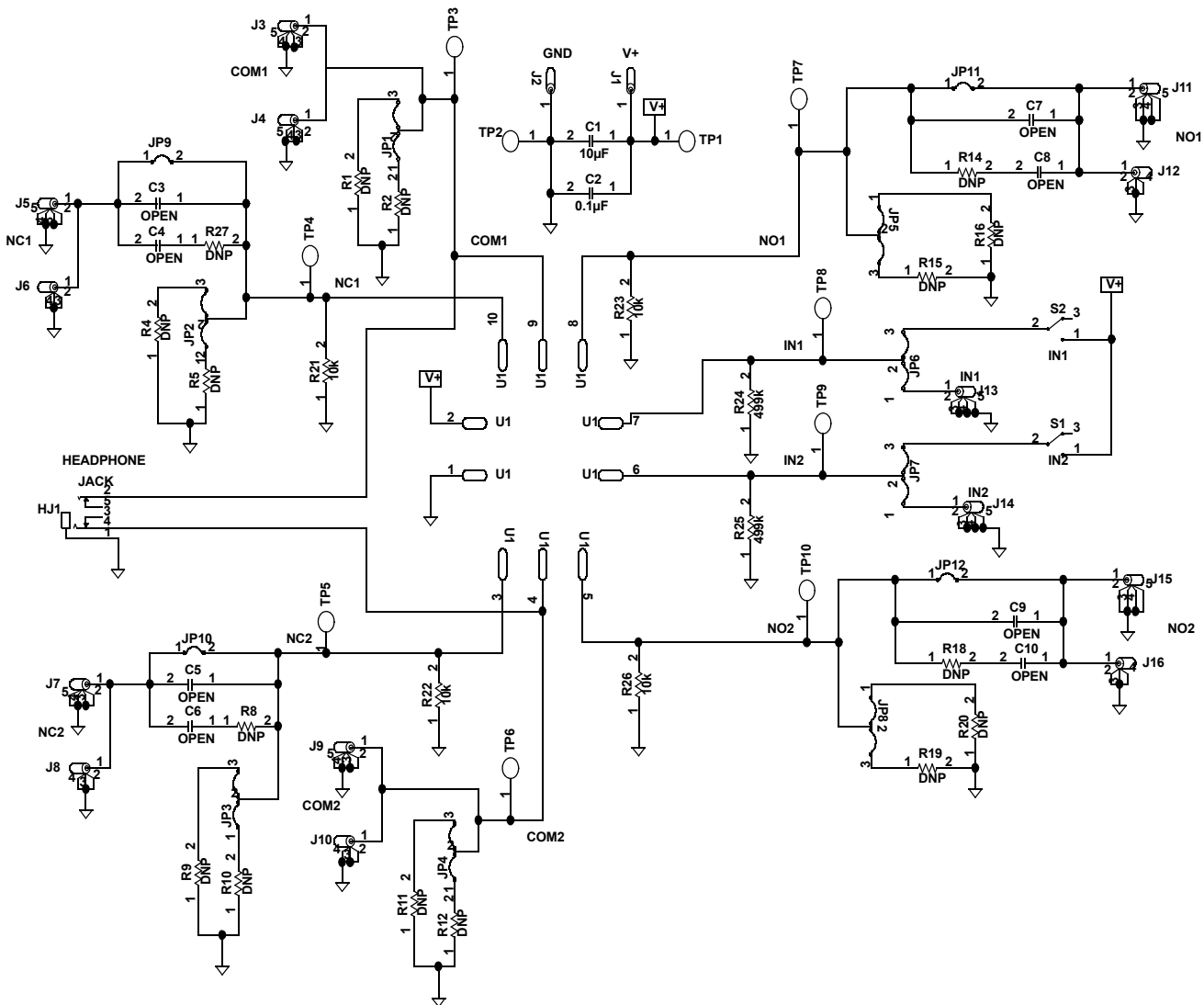
#### NC $_x$ Switches Active

1. Drive the IN $_x$  pins to logic "LOW".
2. The NC $_x$  switches are now connected to the COM $_x$  terminals (ISL54059, ISL54061, ISL54062, and ISL54064 only).
3. The NO $_x$  switches have shunt resistors on the terminals to ground (ISL54062 and ISL54063 only).

#### NO $_x$ Switches Active

1. Drive the IN $_x$  pins to logic "HIGH".
2. The NO $_x$  switches are now connected to the COM $_x$  terminals (ISL54059, ISL54060, ISL54062 and ISL54063 only).
3. The NC $_x$  switches have shunt resistors on the terminals to ground (ISL54062 and ISL54064 only).

### ISL54059EVAL1Z Through ISL54064EVAL1Z Evaluation Board Schematic



## Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.  
"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.  
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.  
Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.  
(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.  
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



### SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

**Renesas Electronics America Inc.**  
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.  
Tel: +1-408-432-8888, Fax: +1-408-434-5351

**Renesas Electronics Canada Limited**  
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3  
Tel: +1-905-237-2004

**Renesas Electronics Europe Limited**  
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.  
Tel: +44-1628-651-700, Fax: +44-1628-651-804

**Renesas Electronics Europe GmbH**  
Arcadiastrasse 10, 40472 Düsseldorf, Germany  
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

**Renesas Electronics (China) Co., Ltd.**  
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China  
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

**Renesas Electronics (Shanghai) Co., Ltd.**  
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China  
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

**Renesas Electronics Hong Kong Limited**  
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong  
Tel: +852-2265-6688, Fax: +852-2886-9022

**Renesas Electronics Taiwan Co., Ltd.**  
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan  
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

**Renesas Electronics Singapore Pte. Ltd.**  
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949  
Tel: +65-6213-0200, Fax: +65-6213-0300

**Renesas Electronics Malaysia Sdn.Bhd.**  
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia  
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

**Renesas Electronics India Pvt. Ltd.**  
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India  
Tel: +91-80-67208700, Fax: +91-80-67208777

**Renesas Electronics Korea Co., Ltd.**  
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea  
Tel: +82-2-558-3737, Fax: +82-2-558-5338