ISL72813SEHEV1Z

Evaluation Board User Guide

UG096
Rev 1.00
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Description

The ISL72813SEHEV1Z evaluation board was designed to provide a quick and easy method for evaluating the ISL72813SEH, 32-channel driver circuit IC. This device is a unique IC. To use this evaluation board properly requires a thorough knowledge of the operation of the IC. Refer to the ISL72813SEH datasheet for an understanding of the functions and features of the device.

The Intersil ISL72813SEH device is a radiation hardened, high-voltage, high-current 32-channel driver circuit with an integrated decoder for driving and selecting between a bank of relays in space applications. It is fabricated using Intersil's proprietary PR40 silicon-on-insulator process technology to mitigate single-event effects. This device integrates 32 current drivers that feature high-voltage, common-emitter and open-collector outputs with a 42V breakdown voltage and peak current rating of 600mA.

Specifications

The evaluation board has been configured and optimized for the following conditions:

- V_{CC} = 5V
- V_{EE} = -34V
- Collector output (Cx) load to GND of ≥58Ω (≤600mA)
- Board temperature: +25°C

Key Features

- Toggle switches for easy control of logic pins
- LED circuitry for quick functional testing
- Convenient test points and connections for test equipment
- MCU interface connector for control of logic
- Banana jacks for power and ground connections

Related Literature

- For a full list of related documents, visit our website
  - ISL72813SEH Datasheet

Ordering Information

PART NUMBER	DESCRIPTION
ISL72813SEHEV1Z	ISL72813SEH evaluation board

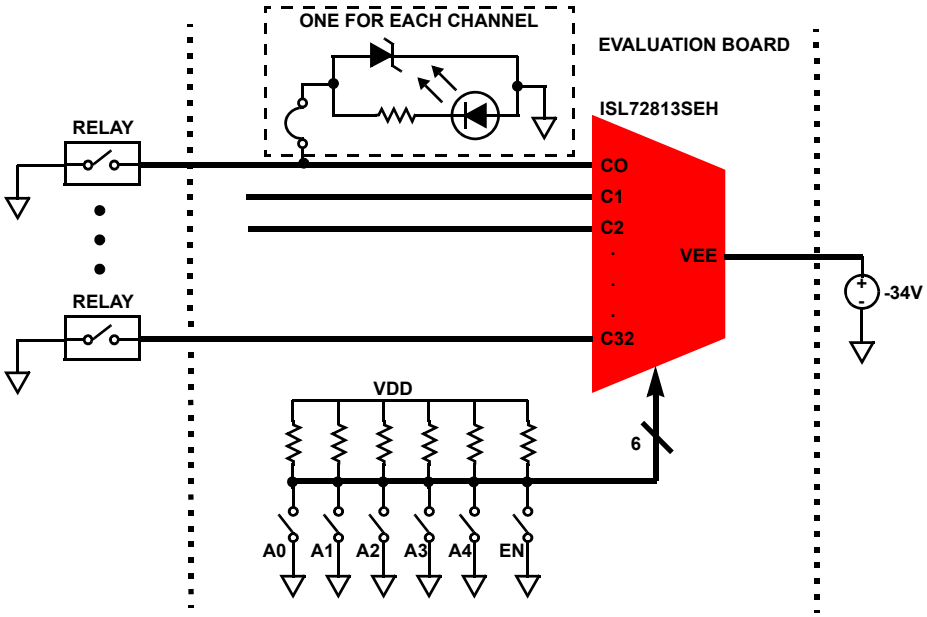

FIGURE 1. ISL72813SEHEV1Z BLOCK DIAGRAM

Quick Start

1. Verify that jumpers J0 - J31 are installed on the board. This connects the LED circuitry to each of the driver channels.
2. Put all of the toggle switches (SW0 A0, SW1 A1, SW2 A2, SW3 A3, SW4 A4, and SW5 EN) in the down position. This connects the A0 - A4, and EN logic pins of the IC to ground.
3. Apply $5V_{DC}$ at the VCC banana jack.
4. Apply $-30V_{DC}$ at the VEE banana jack.
5. Move the SW5 EN toggle switch to the up position (EN = VCC) to enable the current driver. The LED for the C0 channel will light up indicating channel C0 is ON.
6. Move the SW0 A0 toggle switch to the up position. The LED for the C1 channel will light up indicating that channel C1 is ON.
7. Adjust the toggle switches to cycle through the various 32 driver channels by changing the logic at the A0 - A4 pins per the truth table on page 5 of the ISL72813SEH datasheet.

Introduction

The ISL72813SEHEV1Z evaluation board is designed to provide a quick and easy method for evaluating the ISL72813SEH radiation hardened 32-channel current driver IC.

A picture of the evaluation board for ISL782813SEHEV1Z is shown in Figure 3 on page 6. The ISL72813SEHL/PROTO 44 Ld CLCC IC is soldered onto the evaluation board. It is located in the center of the board and is designated as U1.

The Intersil ISL72813SEH device has 32 current driver channels. It was specifically designed to drive the coils of a bank of relay circuits. Only one channel is active at a time. A channel is selected by the logic level applied at the A0 - A4 logic pins. It has an enable pin (EN) that can deactivate all the channels when it is driven LOW. A channel can drive a relay coil that requires up to 530mA of current. The part was designed to operate in the harsh environment of space.

This user guide will guide the user through the process of configuring and using the evaluation board to evaluate the ISL72813SEH device.

Functional Description

The ISL72813SEHEV1Z evaluation board provides a simple platform to demonstrate the features and evaluate the performance of the ISL72813SEH IC. It provides easy access to the pins of the ISL72813SEH IC and convenient connectors/test points for connecting test equipment. The schematic, bill of materials, and top silkscreen for the board are available on pages 9 through 11.

Figures 13 through 15 show performance data taken using the ISL72813SEHEV1Z evaluation board and basic lab equipment.

The sections that follow will discuss using the evaluation board.

Basic Layout of Evaluation Board

The basic layout of the evaluation board is as follows: Refer to Figure 3 on page 6 or the actual ISL72813SEHEV1Z evaluation board.

Located in the center of the board is the IS72813SEHL/PROTO driver circuit IC (U1). The evaluation board has a Pin 1 dot, to show how the IC should be oriented onto the evaluation board. The IC Pin 1 indicator lead needs to be aligned with the evaluation board Pin 1 dot indicator. The board comes with the IC soldered onto the board.

Power for the IC is located at the left side of the board through banana jacks labeled VEE, GND, and VCC. A negative DC voltage source of -10V to -34V must be connected between VEE and GND to power the common emitter of the current channels. A DC voltage source of 3V to 5.5V must be connected between VCC and GND to power the logic decoder and the level shifter of the part.

Access to the 32 collector driver channels is through the C0 - C31 silver turret posts. The relay load or resistor simulating the relay load would be connected at theses pins. Each pin in parallel to the turret post has an LED and resistor that can be connected through a jumper to check the functionality of the device. With jumpers J0 thru J31 installed the LED circuitry will be connected to the C0 thru C31 open collectors of the part and when a channel is active (turned ON), the LED will light up.

Control of the logic pins A0 - A4 and the EN pin is by the toggle switches labeled SW0 A0, SW1 A1, SW2 A2, SW3 A3, SW4 A4, and SW5 EN located at the middle left side of the evaluation board. In addition to the switches, the logic can be controlled through the 24 pin right angle header connector labeled “MCU INTERFACE”. When using this connector, the toggle switches should be switched into the up position. Finally, the logic can be controlled by connecting the user’s logic drivers at the PA0 (A0), PA1 (A1), PA2 (A2), PA3 (A3), PA4 (A4), and PEN (EN) turret pins. When driving these pins, the toggle switches need to be in the up position. These turret pins can also be used to monitor the voltage levels at the logic pins with a voltmeter or oscilloscope.

Refer to the board schematic (Figure 5 on page 8) for the reference designators of the jumpers, resistors, and connectors associated with each I/O.

VCC Power Supply

The ISL72813SEH device requires a VCC DC voltage supply in the range of 3.0V to 5.5V for proper operation. The VCC powers the logic circuitry of the IC.

The VCC power supply is connected at banana jacks VCC and GND. The power supply should be capable of delivering 100mA of current.

VEE Power Supply

The ISL72813SEH device requires a negative VEE DC voltage supply in the range of -5V to -34V. The VEE voltage is connected to the common emitter of the 32 current drivers.

The power supply is connected at banana jacks VEE and GND. The power supply should be capable of delivering 1A of current.

Logic Control

The ISL72813SEH IC has six logic control input pins; A0 - A4 (Pins 19 - 23) and EN (Pin 25).

The Logic 1 V_{IH} level for the logic pins is from 2.0V to VCC. The Logic 0 V_{IL} level is from 0.8V to 0V. The V_{CC} voltage can be 3.0V to 5.5V.

The A0 - A4 digital input pins select between the 32 current driver circuit channels per the truth table on page 5 of the ISL72813SEH datasheet. The selected channel is activated when the EN pin is HIGH (Logic 1).

The EN digital input enables and disables the current driver channels. When EN = LOW (Logic 0) all channels are deactivated (OFF). When EN = HIGH (Logic 1) then the channel selected by the logic levels at A0 - A4 is activated (ON).

Test Points

The board has various test points for ease of connecting probes to make measurements. The test points available are described in Table 1.

TABLE 1. TEST POINTS

DESIGNATOR	DESCRIPTION
PG1 - PG4	Ground test point
PA0	A0 logic input test point
PA1	A1 logic input test point
PA2	A2 logic input test point
PA3	A3 logic input test point
PA4	A4 logic input test point
PEN	EN logic input test point
PC0 - PC31	Open collector output test points

TABLE 2. BOARD COMPONENT DEFINITIONS

DESIGNATOR	DESCRIPTION
U1	ISL72813SEHL/PROTO CLCC IC
VCC	VCC power supply connection ($5V_{DC}$)
GND	Ground connection
VEE	Common emitter supply connection ($-34V_{DC}$)
SW0 A0	Toggle switch for logic input A0
SW1 A1	Toggle switch for logic input A1
SW2 A2	Toggle switch for logic input A2
SW3 A3	Toggle switch for logic input A3
SW4 A4	Toggle switch for logic input A4
SW5 EN	Toggle switch for logic input EN
C0 - C31	Open collector outputs load connections or test points
LED0 - LED31	LEDs for quick functional testing of the ISL72813SEH IC
R0 - R31	Load resistor for the LEDs
D0 - D31	Schottky diode across the LED circuitry to clamp positive transients during switching between channels
J0 - J31	Jumpers to connect LED circuitry to the open collector channel

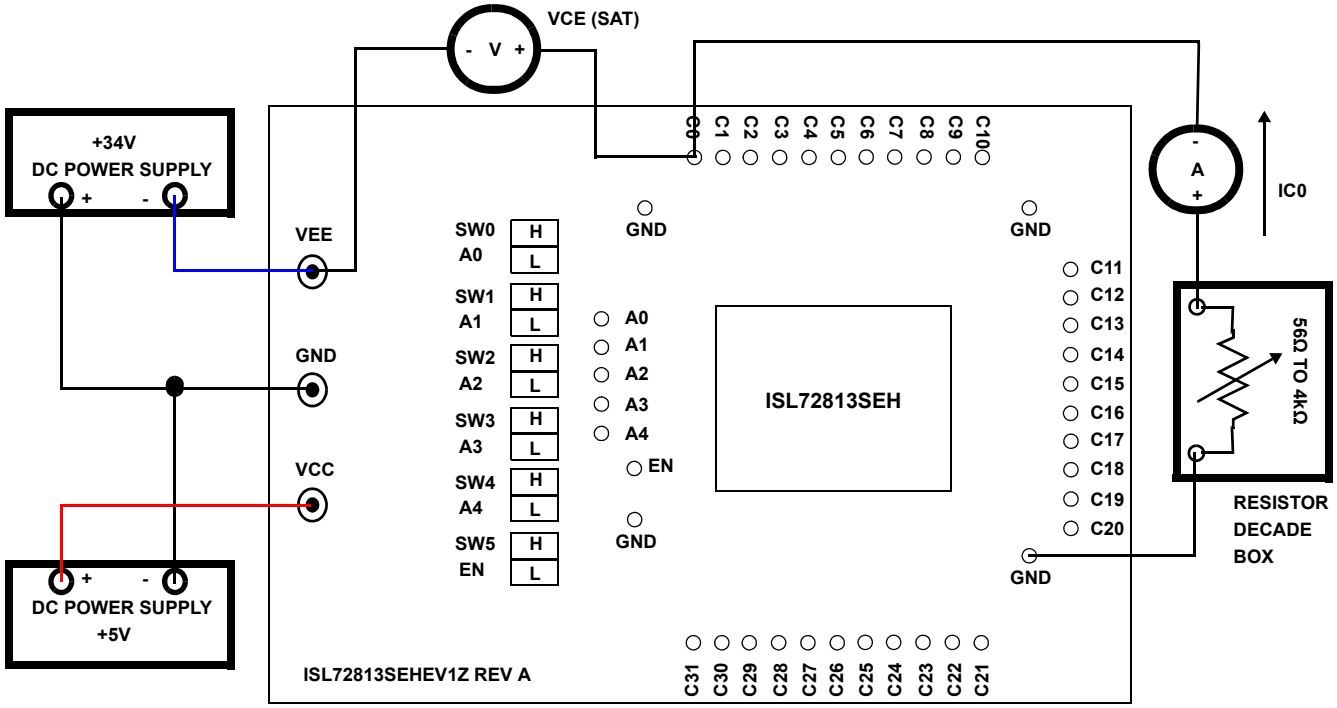

FIGURE 2. BASIC EVALUATION TEST SETUP BLOCK DIAGRAM (MEASURING VCE (SAT) vs ICx)

Using the Board to Measure VCE (SAT) vs IVEE of Channel C0

Refer to Figure 2.

Lab Equipment

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

1. DC power supply (3V to 5.5V).
2. DC power supply (-10V to -34V) capable of sinking 1A.
3. Resistor decade box or keysight B2902A precision source/measurement unit or equivalent.

Initial Board Setup Procedure

1. Remove the J0 jumper to disconnect the LED circuitry from the C0 channel.
2. Put the SW0 A0, SW1 A1, SW2 A2, SW3 A3, SW4 A4, and SW5 EN toggle switches in the “L” down position. With the SW5 EN in the “L” position all channels will be disabled (OFF).
3. Attach the $5V_{DC}$ power supply to the banana jacks labeled VCC and GND as shown in Figure 2. Positive terminal at VCC and negative terminal at GND. The supply should be capable of delivering 3V to 5.5V and 100mA of current. Set the supply voltage to 5V.
4. Attach the $34V_{DC}$ power supply to the banana jacks labeled VEE and GND as shown in Figure 2. Negative terminal at VEE and Positive terminal at GND. The supply should be capable of -10V to -34V and sinking 1A of current. Set the supply voltage to 34V.
5. Connect the resistor decade box and ammeter (A) to the C0 pin on the evaluation board as shown in Figure 2. One end of the decade box resistor should be connected to the C0 pin through the ammeter to measure the IC0 current. The other end of the resistor to the ground pin on the evaluation board. Set the decade box resistance to 165Ω.
6. Connect a voltmeter (V) between the C0 pin and VEE banana jack as shown in Figure 2. The voltmeter will measure the VCE (SAT) voltage.

VCE (SAT) Measurements for Channel C0

1. Configure the board as described in “Initial Board Setup Procedure”.
2. Put the SW5 EN toggle switch in the “H” up position to enable the IC. The IC0 current should read approximately 200mA and the VCE (SAT) voltage should read around 0.89V.
3. Change the decade box resistance to 94Ω. The IC0 current should read approximately 349mA and the VCE (SAT) voltage should read around 1.01V.
4. Change the decade box resistance to 65Ω. The IC0 current should read approximately 499mA and the VCE (SAT) voltage should read around 1.13V.
5. Change the decade box resistance to 61Ω. The IC0 current should read approximately 532mA and the VCE (SAT) voltage should read around 1.16V.

Measuring VCE (SAT) on Other Channels

1. Configure the board as described in "Initial Board Setup Procedure" on page 4.
2. Ensure that SW5 EN toggle switch is in the "L" down position to disable the IC.
3. Move the ammeter and decade box to the new Cx channel that the user wants to test. Move the voltmeter to measure the voltage from the new Cx channel to VEE. Remove the Jx jumper from that channel. Configure the SW0 A0 - SW4 A4 toggle switches to the appropriate logic levels to select the new Cx channel. Refer to the truth table on page 5 of the ISL72813SEH datasheet.
   For example, if the user wants to perform the measurement on the C26 channel, connect the ammeter/decade box at the C26 pin on the evaluation board. Connect the voltmeter across the C26 pin and VEE. Remove jumper J26 to disconnect its LED circuitry. Set the toggle switches SW0 A0 = "L", SW1 A1 = "H", SW2 A2 = "L", SW3 A3 = "H", and SW4 A4 = "H".
4. Repeat steps 2 - 5 in "VCE (SAT) Measurements for Channel C0" on page 4 for the new Cx channel.
5. Note: The performance curves shown in Figure 13 on page 17 was taken using the evaluation board and a Keysight B2902A precision source/measurement unit.
   Test conditions:
   a. The B2902A unit was set to measure and graph VCE (SAT) vs ICX as the user sweeps the ICX in 10mA increments from 0mA to 600mA.
   b. V_{CC} = 5V, V_{EE} = -34V, EN = V_{CC}, A0 - A4 = Set to have the Cx channel ON.
   c. Channels CH0, CH8, CH16, CH24, and CH31 were measured. The plots in Figure 13 are the average of these channels.

ISL72813SEHEV1Z Evaluation Board

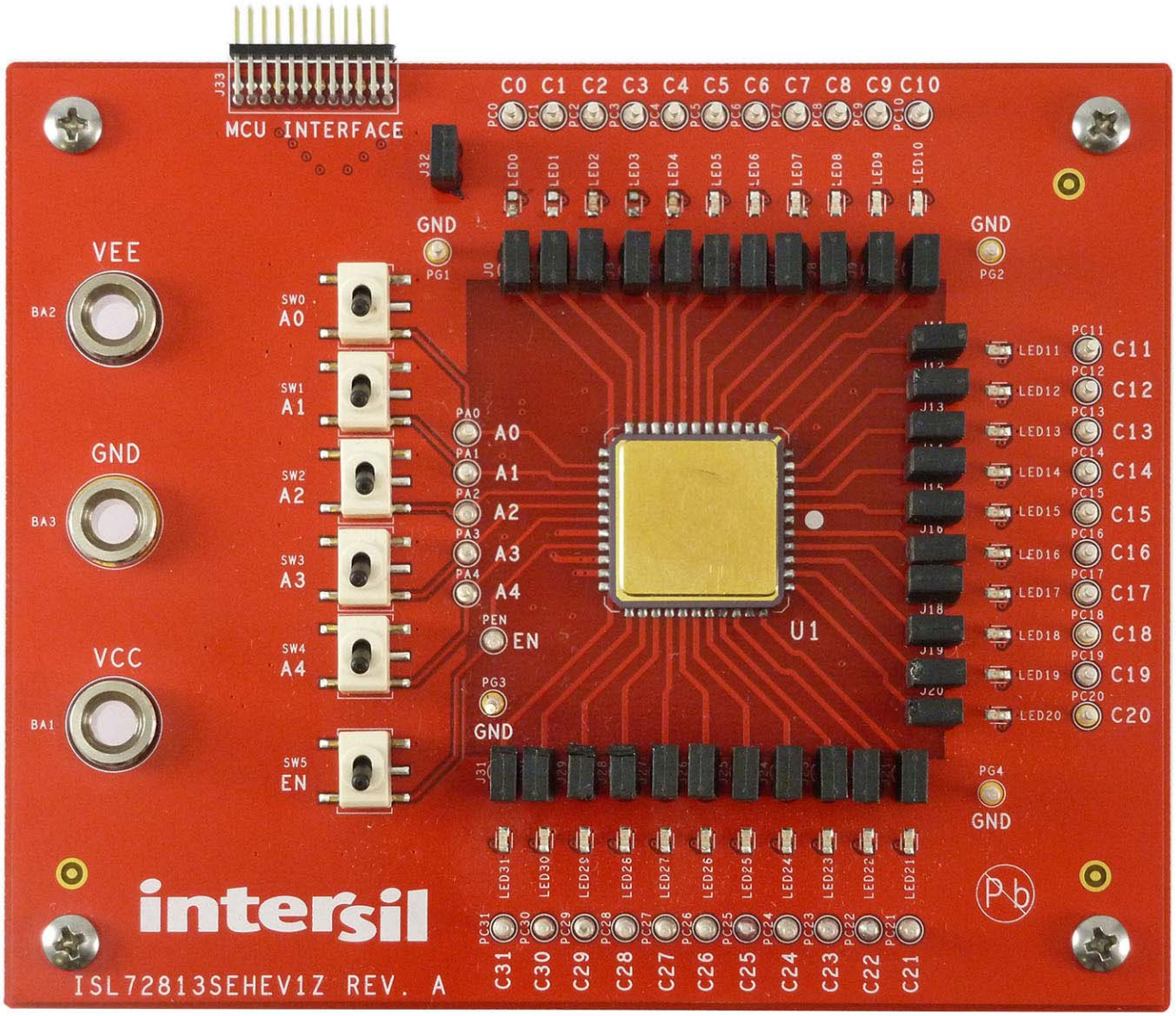

FIGURE 3. ISL72813SEHEV1Z EVALUATION BOARD (TOP VIEW)

ISL72813SEHEV1Z Evaluation Board (Continued)

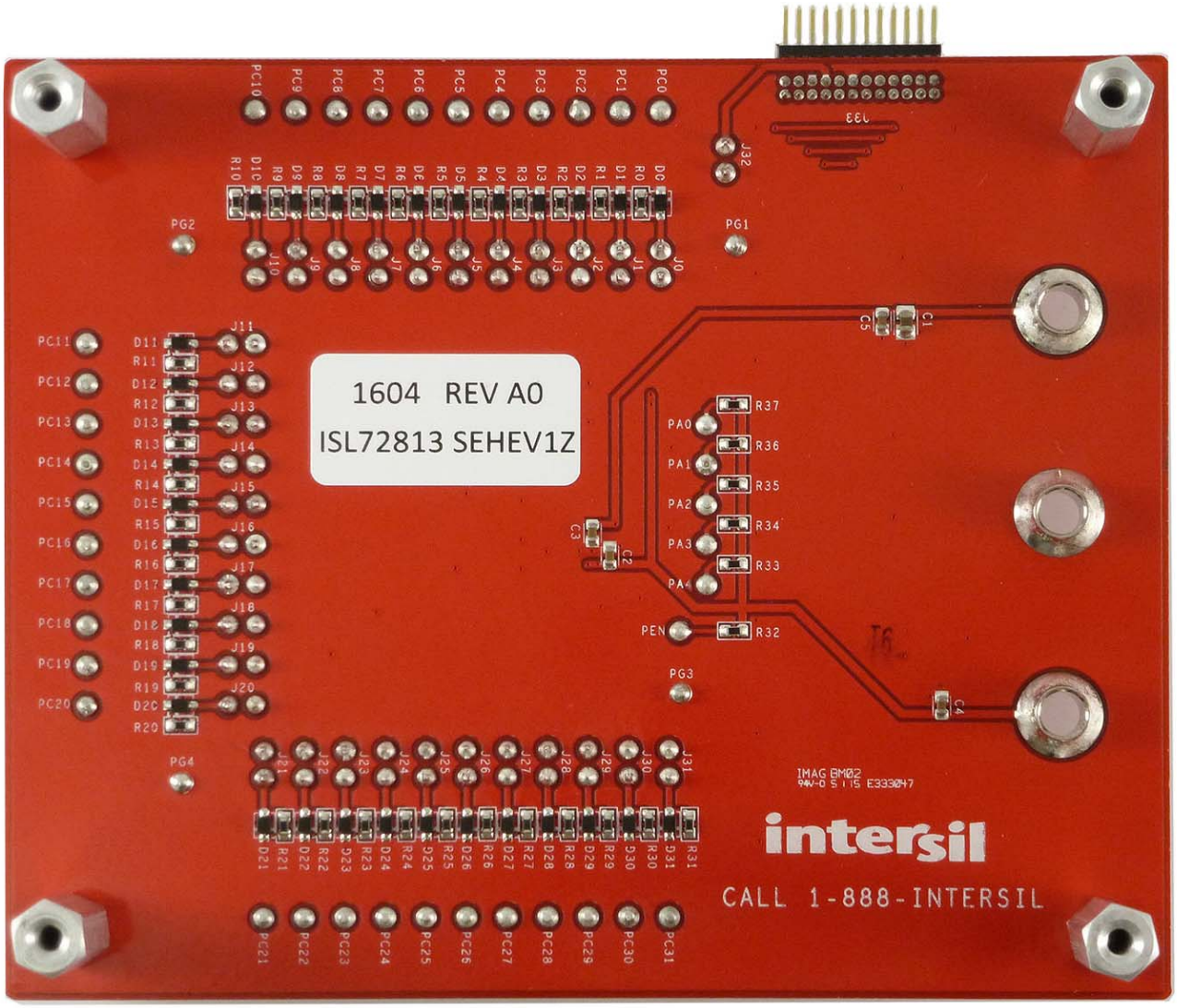

FIGURE 4. ISL72813SEHEV1Z EVALUATION BOARD (BOTTOM VIEW)

ISL72813SEHEV1Z Circuit Schematic

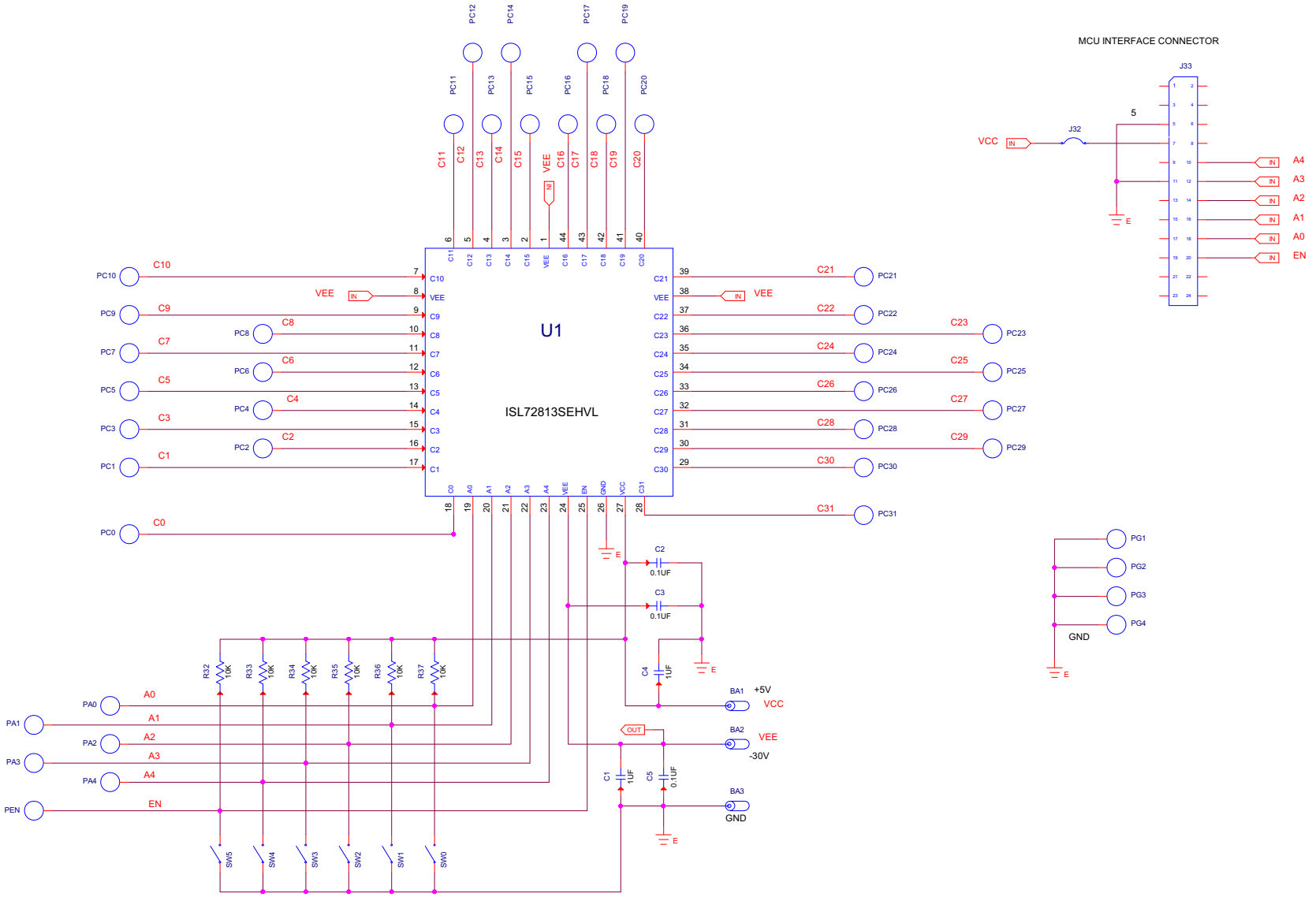

FIGURE 5. SCHEMATIC PAGE 1

ISL72813SEHEV1Z Circuit Schematic (Continued)

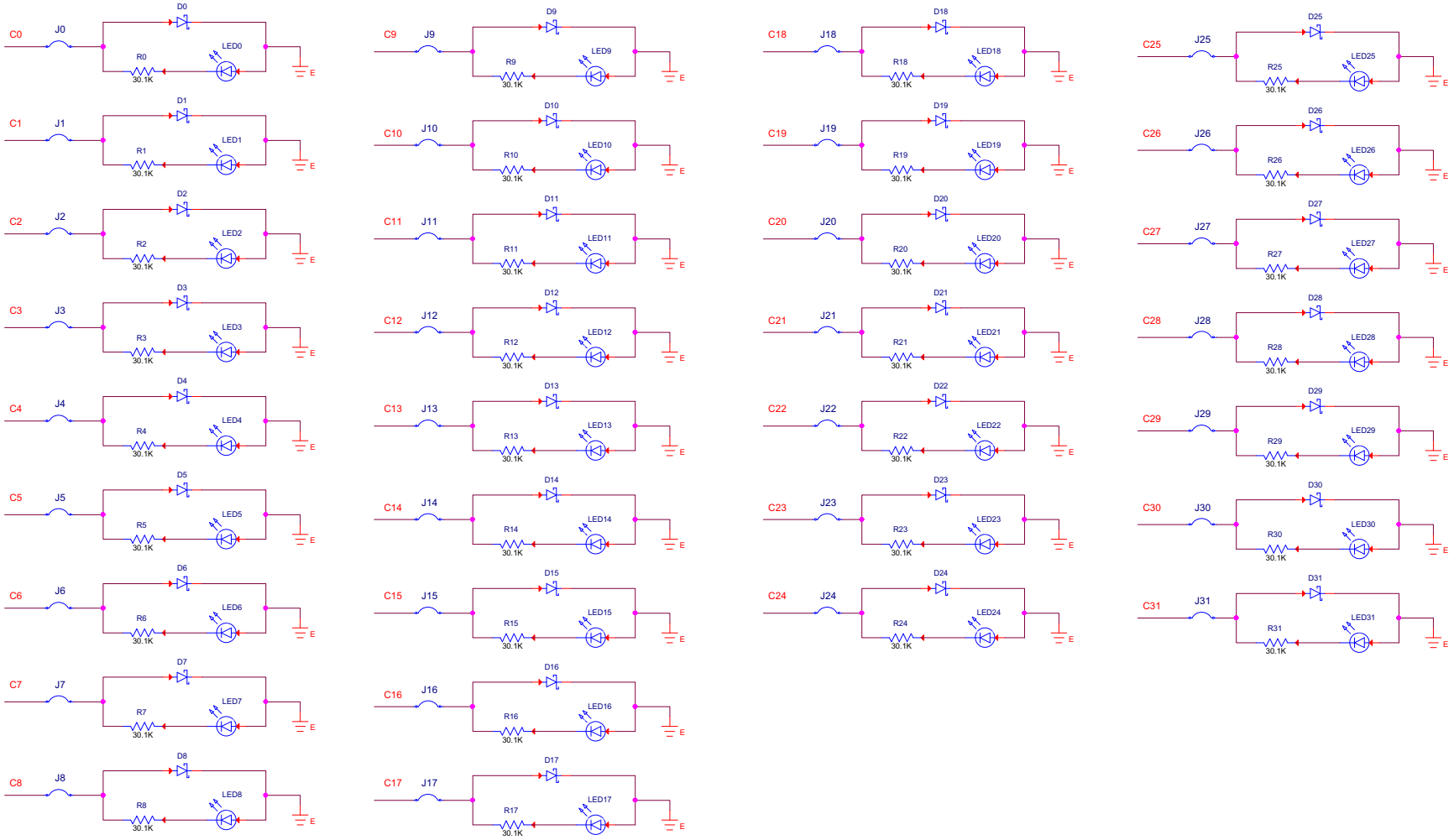

FIGURE 6. SCHEMATIC PAGE 2

ISL72813SEHEV1Z Bill of Materials

QTY	UNITS	REFERENCE DESIGNATOR	DESCRIPTION	MFR	MANUFACTURER PART NUMBER
42	ea.	PA0 - PA4, PC0-PC31, PEN, PG1-PG4	Silver Solder Terminal Turret, 0.08 Pad, 0.040 Thole	MILL-MAX	2108-2-00-44-00-07-0
1	ea.	C4	CAP, Multilayer, 0603, 1µF, 10V, 10%, CAP_0603	MURATA	GRM188R71A105KA61D
1	ea.	C1	CAP, Ceramic, 0803, 1µF, 50V, 10%, CAP_0805	MURATA	GRM21BR71H105KA12L
3	ea.	C2, C3, C5	CAP, Multilayer, 0603, 0.1µF, 50V, 10%, CAP_0603	GENERIC	H1045-00104-50V10
3	ea.	BA1 - BA3	CONN; CON_BAN_575, Solder Mount Banana Plug	KEYSTONE	575-4
6	ea.	SW0 - SW5	SPST - GT13MSCKE - C&K - SPST OFF-ON SM (2 Switch Positions), Ultra Miniature Toggle Switch	C&K	GT12MSCBETR
6	ea.	R32 - R37	Thick Film Chip Resistor, 10kΩ, 1/10W, 1%, 0603, RES_0603	GENERIC	H2511-01002-1/10W1
32	ea.	R0 - R31	Thick Film Chip Resistor, 30.1kΩ, 1/16W, 1%, 0603, RES_0603	GENERIC	H2511-03012-1/16W1
33	ea.	J0 - J32	Two Pin Jumper, Thole, Jumper-1	GENERIC	JUMPER2-100
32	ea.	LED0 - LED31	SMD, LED_LX_L29K_0603, SMT 0603, GREEN, 1.7V, 2mA, 570nm, 3.9MCD	OSRAM	LG L29K-G2J1-24-Z-T
32	ea.	D0 - D31	Schottky Barrier Rectifier Diode, SMD2, SOD23, 0.5A	DIODES	B0540WS
1	ea.	J33	PTH2X12A, CON_HDR_3X12_50_RA, Male, 24 PIN (2 ROWS X 12 POS at 0.05 IN), Right Angle Header Connector	HARWIN	M50-3901242
1	ea.	U1	32-Channel Driver Circuit with Integrated Decoder	INTERSIL	ISL72813SEHL/PROTO

Board Layout

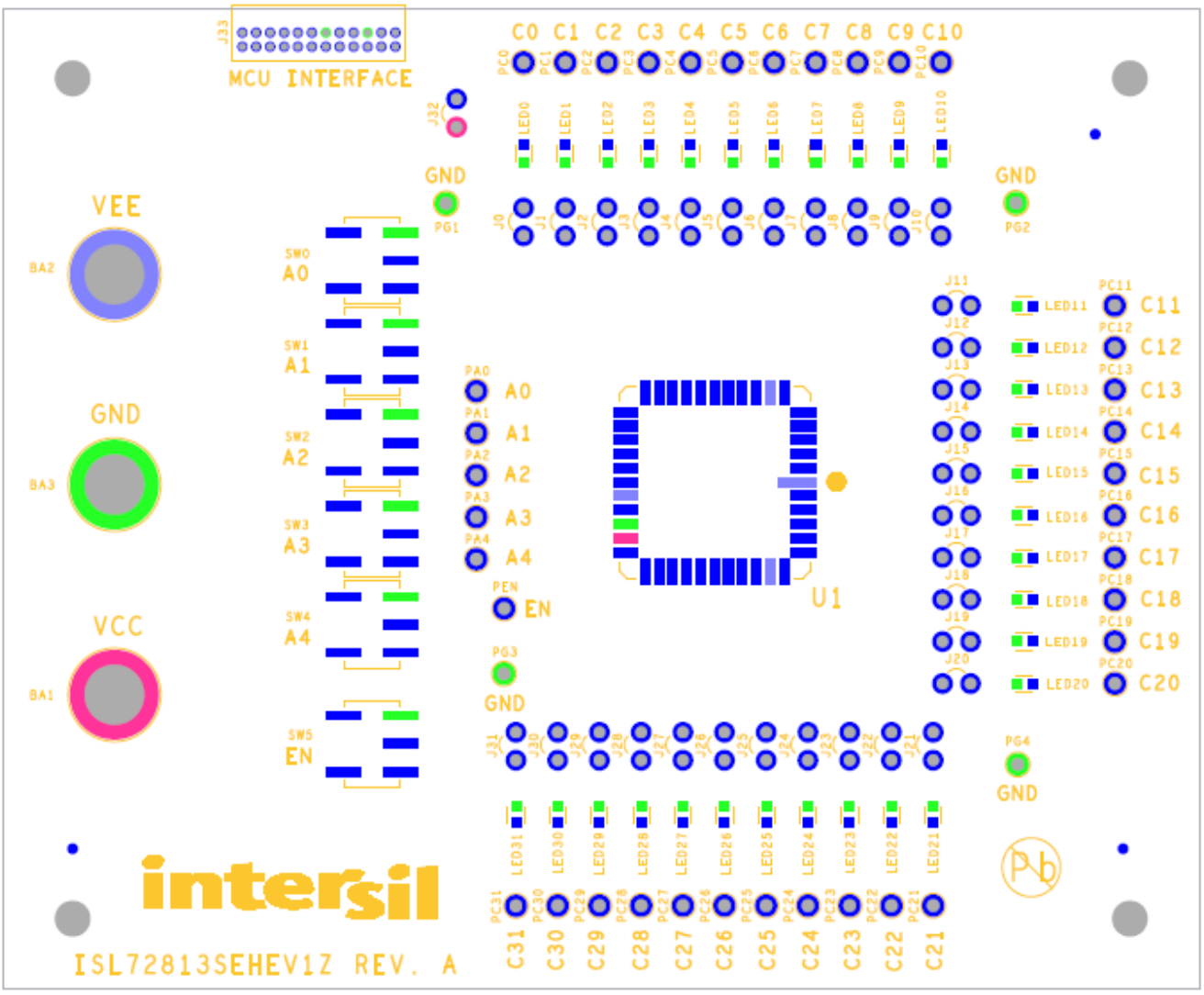

FIGURE 7. SILKSCREEN TOP

Board Layout (Continued)

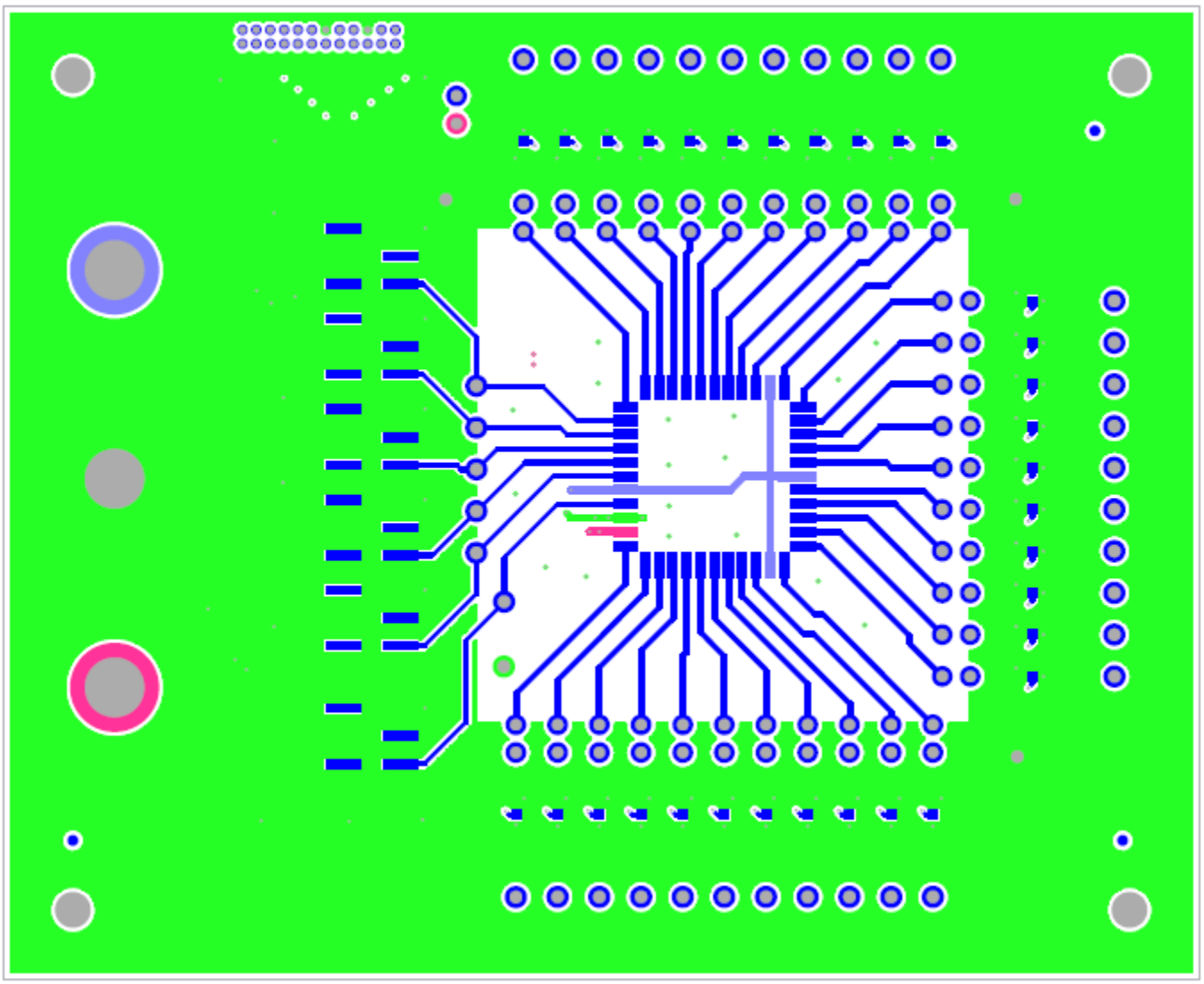

FIGURE 8. TOP LAYER COMPONENT SIDE

Board Layout (Continued)

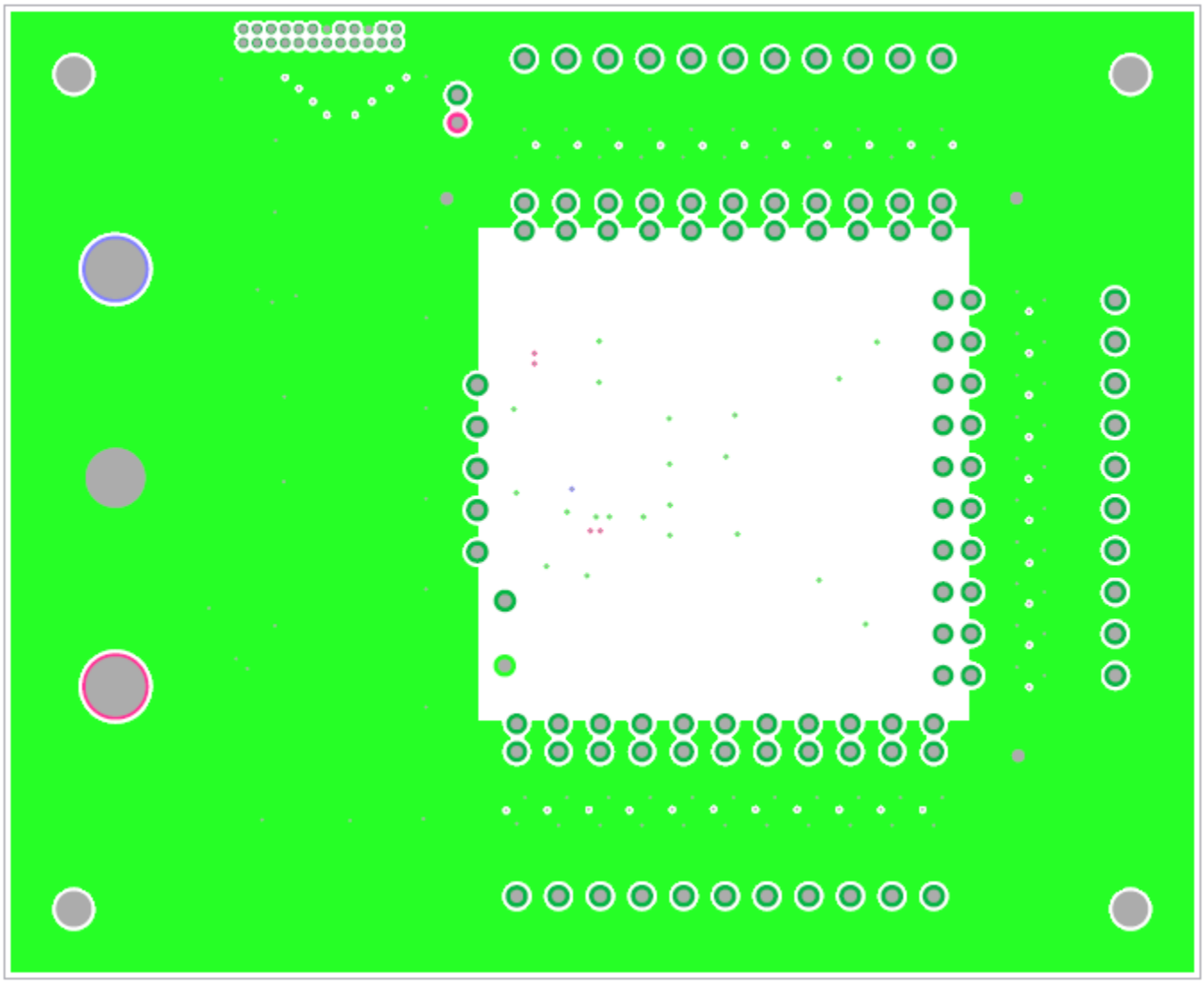

FIGURE 9. LAYER 2

Board Layout (Continued)

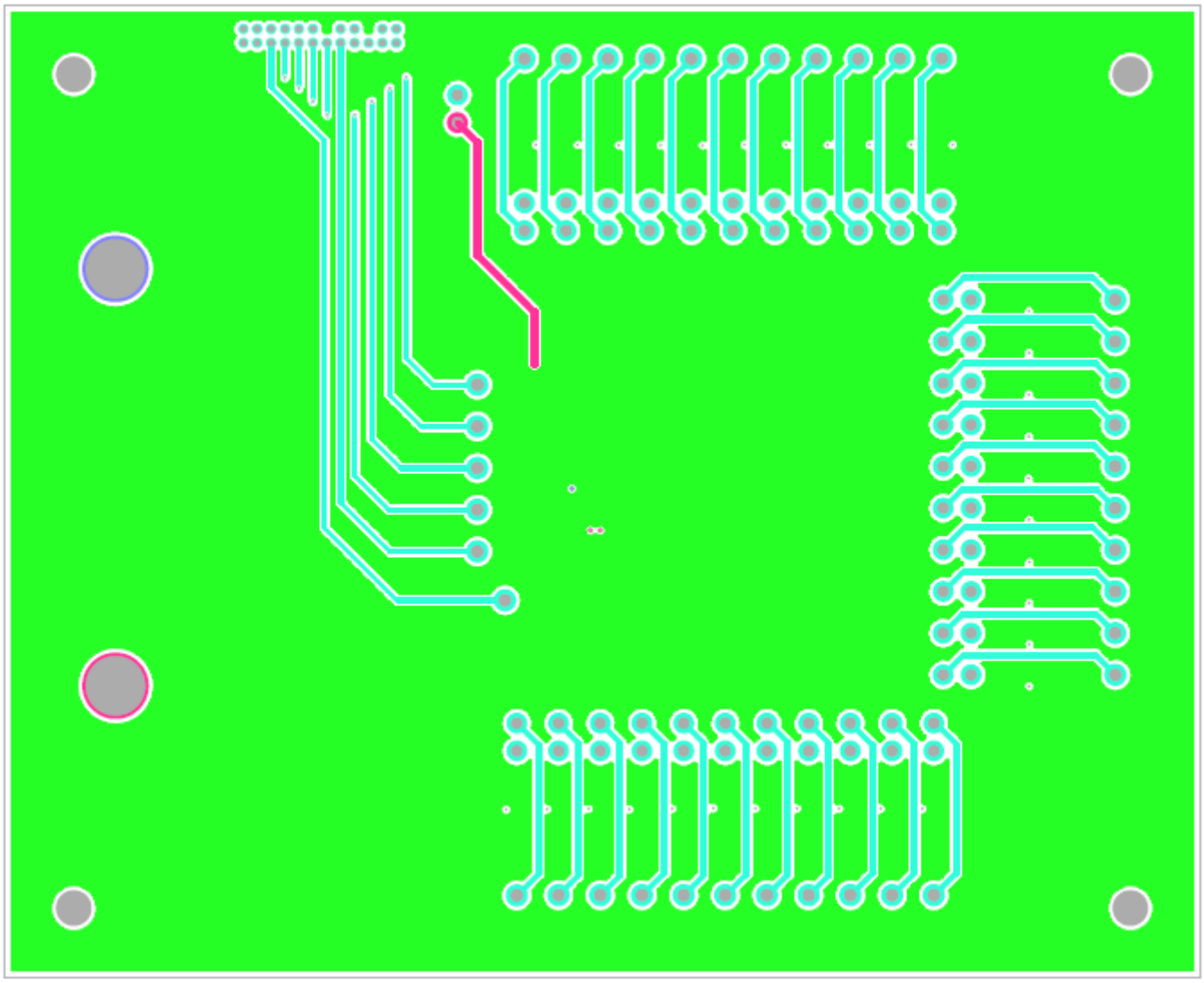

FIGURE 10. LAYER 3

Board Layout (Continued)

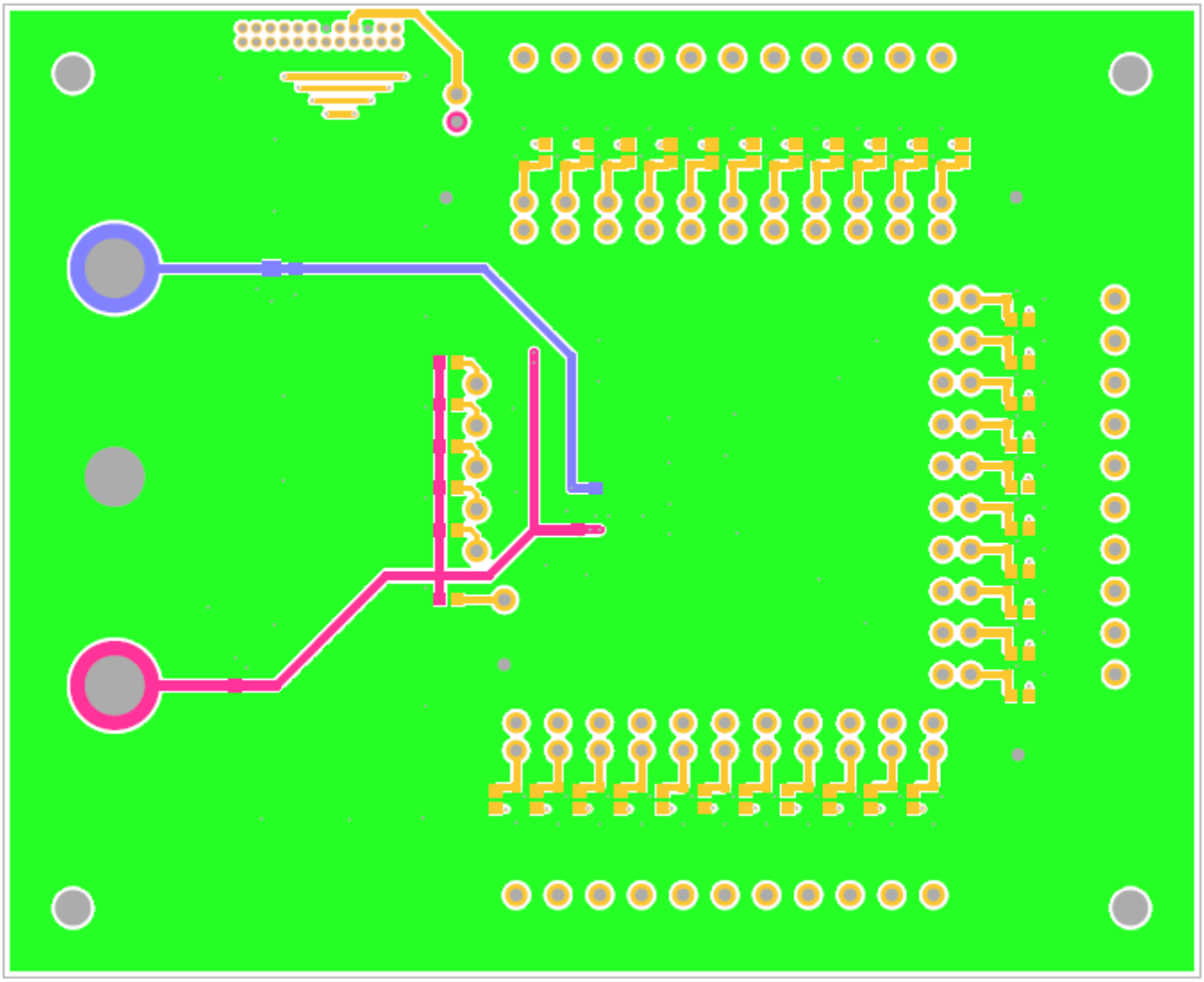

FIGURE 11. BOTTOM LAYER SOLDER SIDE

Board Layout (Continued)

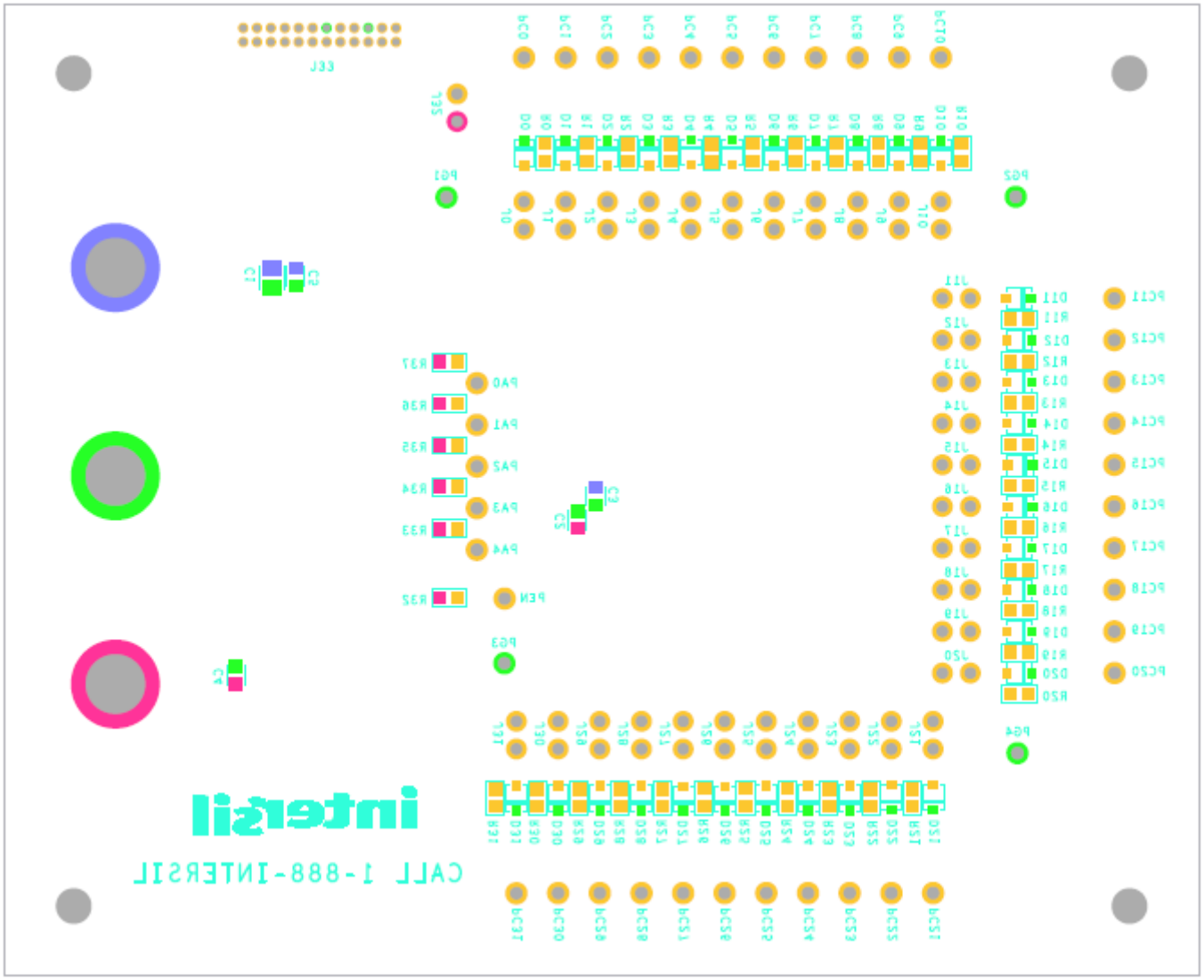

FIGURE 12. SILKSCREEN BOTTOM

Typical Performance Curves

Unless noted: V_{CC} = 3.3V, D = 125kHz, Square Wave, 0 to V_{CC}, 50% Duty Cycle, $t_r = t_f \leq 6ns$, $T_A = +25°C$

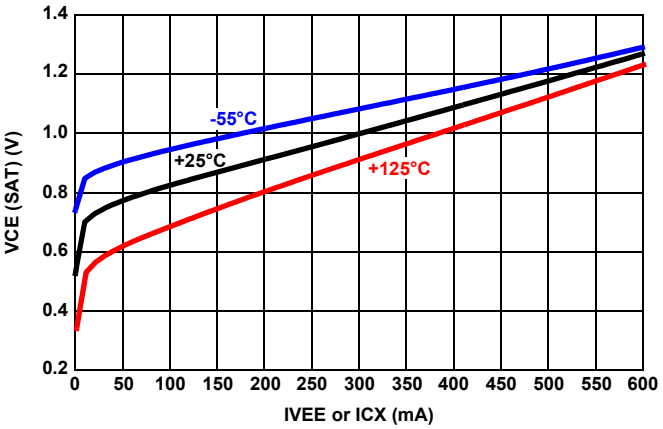

FIGURE 13. VCE (SAT) vs ICX vs TEMPERATURE

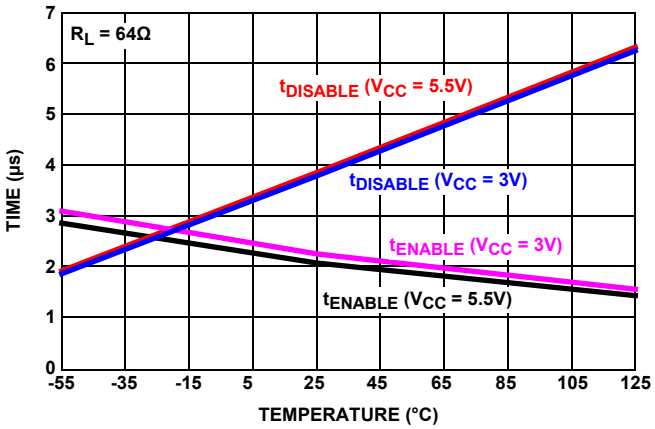

FIGURE 14. $t_{ENABLE}/t_{DISABLE}$ vs V_{CC} vs TEMPERATURE

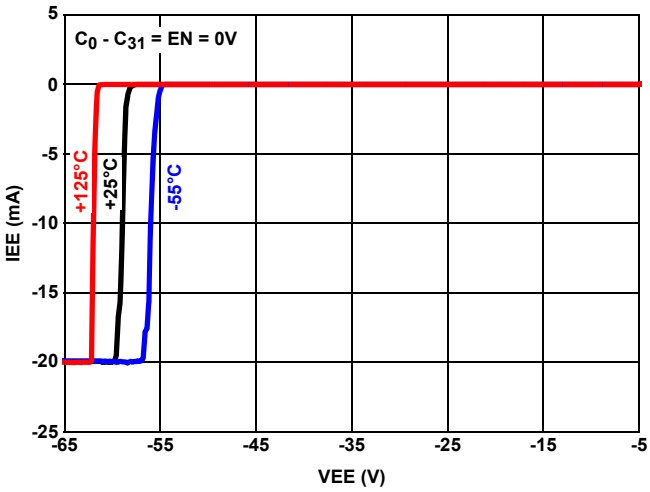

FIGURE 15. IEE vs VEE vs TEMPERATURE

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