

## ISL85033CRSHEVAL1Z

Wide VIN Current Sharing Standard Buck Regulator With 6A Output Current

AN1605  
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### Description

The ISL85033CRSHEVAL1Z kit is intended for use by individuals with requirements for Point-of-Load applications sourcing from 4.5V to 28V. The ISL85033CRSHEVAL1Z evaluation board is used to demonstrate the performance of the ISL85033 wide VIN standard buck regulator with 6A output current.

The ISL85033 is offered in a 4mmx4mm 28 Ld TQFN package with 1mm maximum height. The complete converter occupies 6.25cm<sup>2</sup> area.

### Key Features

- Wide Input Voltage Range from 4.5V to 28V
- Adjustable Output Voltage with Continuous Output Current up to 6A
- Current Mode Control
- Adjustable Switching Frequency from 300kHz to 2MHz
- Power-Good Detection
- External Soft-start Time
- Overcurrent and Hiccup Mode Short Circuit Protection, Thermal Overload Protection, UVLO
- Boot Undervoltage Detection
- Channels are Out-of-phase, Reducing Voltage Ripple and Component Size

### Recommended Equipment

The following materials are recommended to perform testing:

- 0V to 30V Power Supply with at least 7A source current capability or 5V battery
- Electronic Loads capable of sinking current up to 7A
- Digital Multimeters (DMMs)
- 100MHz quad-trace oscilloscope
- Signal generator

### Quick Setup Guide

1. Ensure that the circuit is correctly connected to the supply and loads prior to applying any power.
2. Connect the bias supply to VIN1, the plus terminal to VIN1 and the negative return to GND2.
3. Verify that the position is ON for S1 and S2.
4. Turn on the power supply.
5. Verify the output voltage is 5V for V<sub>OUT</sub>.

### Evaluating the Other Output Voltage

The ISL85033CRSHEVAL1Z kit output is preset to 5V; however, output voltages can be adjusted from 0.8V to 5V. The output voltage programming resistor, R3, will depend on the desired output voltage of the regulator. The value for the feedback resistor is typically between 0Ω and 42.3kΩ as shown in Equation 1.

$$R3 = R2 \left( \frac{V_{OUT}}{V_{FB}} - 1 \right) \quad (\text{EQ. 1})$$

If the output voltage desired is 0.8V, then R3 is shorted. The value for R2 is typically between 1k and 10k. Please note that if V<sub>OUT</sub> is less than 2.5V, the switching frequency and compensation must be changed for 300kHz operation due to minimum on-time limitation. Please refer to the data sheet for further information ([FN6676](#)).

### Frequency Control

ISL85033 has an FS pin that controls the frequency of operation. Programmable frequency allows for optimization between efficiency and external component size. Default switching frequency is 500kHz when FS is tied to VCC (R9 = 0). By removing R9 and connecting R10 to GND, the switching frequency could be changed from 300kHz (R10 = 383k) to 2MHz (R10 = 40.2k). Please refer to the data sheet ([FN6676](#)) for calculating the value of R10. Do not leave this pin floating.

### Disabling/enabling Function

The ISL85033 evaluation board contains S1, S2 switches that need to be tied together in current sharing in order to enable or disable both of the channels, thus allowing low quiescent current state. Table 1 details this function.

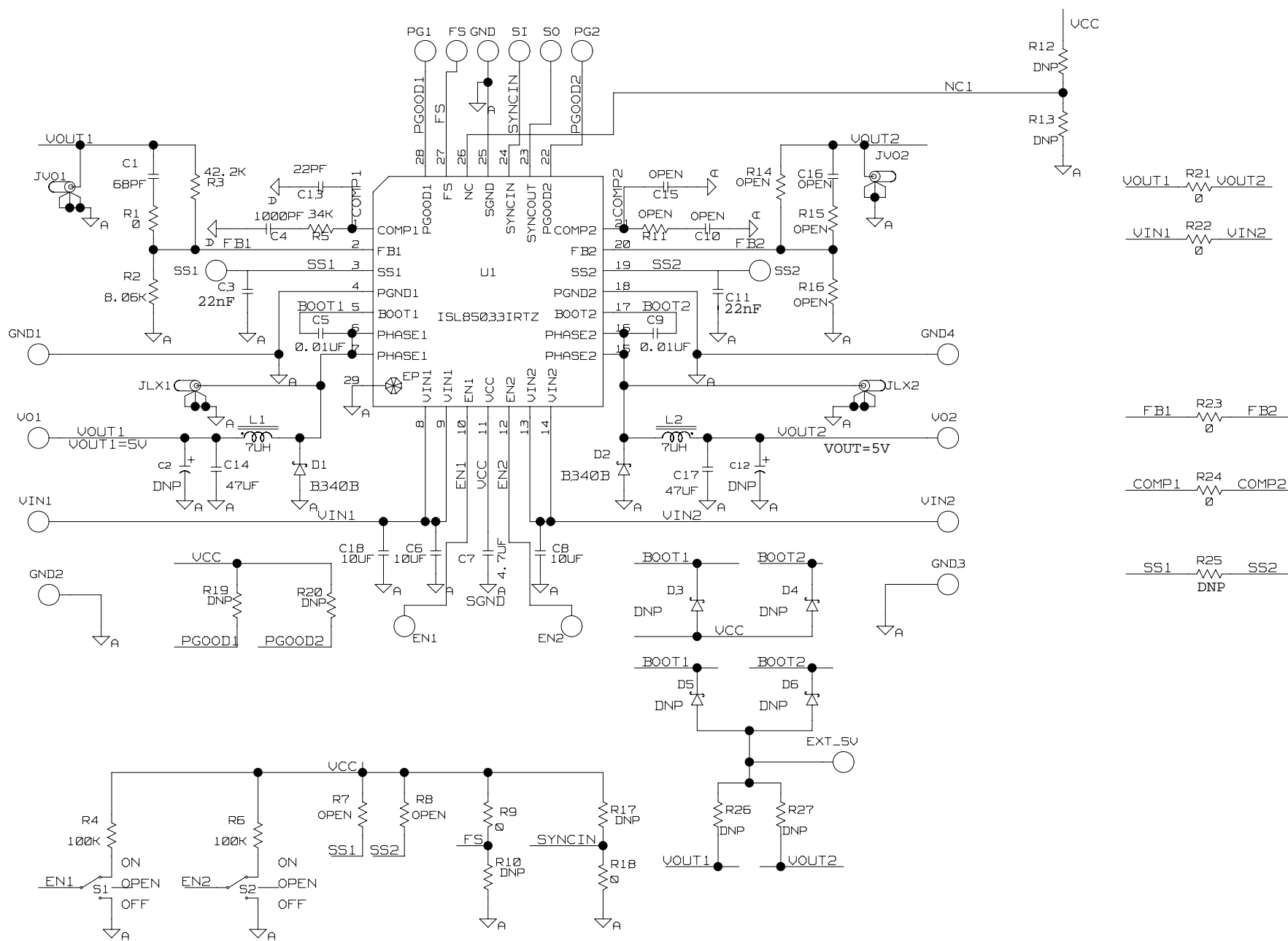
TABLE 1. SWITCH SETTINGS

| S1  | S2  | ON/OFF CONTROL           |
|-----|-----|--------------------------|
| ON  | ON  | Enable V <sub>OUT</sub>  |
| OFF | OFF | Disable V <sub>OUT</sub> |

### SYNC Control

The ISL85033 evaluation board has an SI pin that allows external synchronization frequency to be applied. Default board configuration has R18 = 0 to GND, which defaults to the internal selected switching frequency. Removing R18 allows the synchronization to be external between 600kHz to 4MHz. Do not leave this pin floating.

## ISL85033CRSHEVAL1Z Schematic



ISL85033CRSHEVAL1Z

TABLE 2. BILL OF MATERIALS

| PART NUMBER           | QTY | UNITS | REFERENCE DESIGNATOR   | DESCRIPTION                                     | MANUFACTURER | MANUFACTURER PART     |
|-----------------------|-----|-------|------------------------|---|--------------|-----------------------|
| ISL85033EVAL1ZREVBPCB | 1   | ea    | SEE LABEL-RENAME BOARD | PWB-PCB, ISL85033EVAL1Z, REVB, ROHS             | TBD          | ISL85033EVAL1ZREVBPCB |
| EEE-FK1V101P-T        | 0   | ea    | DNP (C2,C12)           | CAP, SMD, 8X10.2, 100µF, 35V, 20%, AL.EL., ROHS | PANASONIC    | EEE-FK1V101P          |
| GMK325BJ106KN-T       | 2   | ea    | C6,C8                  | CAP, SMD, 1210, 10µF, 35V, 10%, X5R, ROHS       | TAIYO YUDEN  | GMK325BJ106KN-T       |
| H1044-00220-50V5-T    | 1   | ea    | C13                    | CAP, SMD, 0402, 22pF, 50V, 5%, NPO, ROHS        | MURATA       | GRM36COG220J050AQ     |
|                       |     |       |                        |   | PANASONIC    | ECU-E1H220JCQ         |
|                       |     |       |                        |   | SAMSUNG      | CL05C220JBNC          |
| H1044-00680-50V10-T   | 1   | ea    | C1                     | CAP, SMD, 0402, 68pf, 50V, 10%, X7R, ROHS       | MURATA       | GRM36COG680K050AQ     |
|                       |     |       |                        |   | PANASONIC    | ECJ-OEC1H680J         |
|                       |     |       |                        |   | VENKEL       | C0402COG500-680KNE    |
| H1045-00102-50V5-T    | 1   | ea    | C4                     | CAP, SMD, 0603, 1000pF, 50V, 5%, COG, ROHS      | MURATA       | GRM1885C1H102JA01D    |
|                       |     |       |                        |   | VENKEL       | C0603COG500-102JNE    |
|                       |     |       |                        |   | PANASONIC    | ECJ-1VC1H102J         |
|                       |     |       |                        |   | TDK          | C1608C0G1H102J        |
|                       |     |       |                        |   | AVX          | 06035A102JAT2A        |
|                       |     |       |                        |   | KEMET        | C0603C102J5GACTU      |
| H1045-00103-50V10-T   | 2   | ea    | C5, C9                 | CAP, SMD, 0603, 0.01µF, 50V, 10%, X7R, ROHS     | TAIYO YUDEN  | UMK107CG102JZ-T       |
|                       |     |       |                        |   | MURATA       | GRM39X7R103K050       |
|                       |     |       |                        |   | AVX          | 06035C103KAT2A        |
| H1045-00473-50V10-T   | 1   | ea    | C3, C11                | CAP, SMD, 0603, 22nF, 50V, 10%, X7R, ROHS       | VENKEL       | C0603X74500-103KNE    |
|                       |     |       |                        |   | PANASONIC    | ECJ-1VB1H473K         |
|                       |     |       |                        |   |              |                       |
| H1045-00475-6R3V10-T  | 1   | ea    | C7                     | CAP, SMD, 0603, 4.7µF, 6.3V, 10%, X5R, ROHS     | VENKEL       | C0603X5R6R3-475KNE    |
|                       |     |       |                        |   | TDK          | C1608X5R0J475K        |
|                       |     |       |                        |   | PANASONIC    | ECJ-1VB0J475K         |
|                       |     |       |                        |   | MURATA       | GRM188R60J475KE19D    |
|                       |     |       |                        |   | KEMET        | C0603C475K9PACTU      |
|                       |     |       |                        |   | TAIYO YUDEN  | JMK107BJ475KA-T       |
| H1045-DNP             | 0   | ea    | C10, C15, C16          | CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS          |              |                       |
| H1082-00106-50V10-T   | 1   | ea    | C18                    | CAP, SMD, 1210, 10µF, 50V, 10%, X5R, ROHS       | TAIYO YUDEN  | UMK325BJ106KM-T       |

TABLE 2. BILL OF MATERIALS (Continued)

| PART NUMBER          | QTY | UNITS | REFERENCE DESIGNATOR                   | DESCRIPTION  | MANUFACTURER | MANUFACTURER PART  |
|----------------------|-----|-------|--|--|--------------|--------------------|
| H1082-00476-16V20-T  | 2   | ea    | C14, C17                               | CAP, SMD, 1210, 47 $\mu$ F, 16V, 20%, X5R, ROHS          | TDK          | C3225X5R1C476M     |
|                      |     |       |  |  | PANASONIC    | ECJ-4YB1C476M      |
|                      |     |       |  |  | MURATA       | GRM32ER61C476ME15L |
|                      |     |       |  |  | TAIYO YUDEN  | EMK325BJ476MM-T    |
|                      |     |       |  |  | KEMET        | C1210C476M4PACTU   |
|                      |     |       |  |  | VENKEL       | C1210X5R160-476MNE |
| SQL004               | 2   | ea    | L1, L2                                 | COIL-PWR INDUCTOR, SMD, 10mm, 7 $\mu$ H, 25%, 4.8A, ROHS | FALCO        | SQL004             |
| 131-4353-00          | 4   | ea    | JLX1, JLX2, JV01, JV02                 | CONN-SCOPE PROBE TEST PT, COMPACT, PCB MNT, ROHS         | TEKTRONIX    | 131-4353-00        |
| 1514-2               | 8   | ea    | VO1, VO2, GND1-GND4, VIN1, VIN2        | CONN-TURRET, TERMINAL POST, TH, ROHS                     | KEYSTONE     | 1514-2             |
| 5002                 | 11  | ea    | a) FS, SI, SO, EN1, EN2, GND, PG1, PG2 | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS              | KEYSTONE     | 5002               |
| 5002                 | 0   | ea    | b) SS1, SS2, EXT_5V                    | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS              | KEYSTONE     | 5002               |
| B340B-13-F-T         | 2   | ea    | D1, D2                                 | DIODE-SCHOTTKY, SMD, SMB, 2P, 40V, 3A, ROHS              | DIODES INC.  | B340B-13-F         |
| ISL85033IRTZ         | 1   | ea    | U1                                     | IC-3A DUAL STD REGULATOR, 28P, TQFN, 4x4, ROHS           | INTERSIL     | ISL85033IRTZ       |
| H2505-DNP            | 0   | ea    | R10, R17, R19, R20, R26, R27           | RESISTOR, SMD, 0603, 0.1%, MF, DNP-PLACE HOLDER          |              |                    |
| H2510-04222-1/16W1-T | 1   | ea    | R3                                     | RES,SMD, 0402, 42.2k, 1/16W, 1%, TF, ROHS                | PANASONIC    | ERJ-2RKF4222X      |
|                      |     |       |  |  | VENKEL       | CR0402-16W-4222FT  |
| H2510-08061-1/16W1-T | 1   | ea    | R2                                     | RES, SMD, 0402, 8.06k, 1/16W, 1%, TF, ROHS               | VENKEL       | CR0402-16W-8061FT  |
|                      |     |       |  |  | PANASONIC    | ERJ-2RKF8061X      |
|                      |     |       |  |  | ROHM         | MCR01MZPF8061      |
|                      |     |       |  |  | YAGEO        | RC0402FR-078K06L   |
|                      |     |       |  |  | VISHAY/DALE  | CRCW04028K06FKED   |
| H2510-DNP            | 0   | ea    | R7, R8, R14, R16                       | RES, SMD, 0402, DNP, DNP, DNP, TF, ROHS                  |              |                    |
| H2511-00R00-1/10W-T  | 1   | ea    | R25                                    | RES, SMD, 0603, DNP                                      | VENKEL       | CR0603-10W-000T    |
|                      |     |       |  |  | ROHM         | MCR03EZPJ000       |

TABLE 2. BILL OF MATERIALS (Continued)

| PART NUMBER          | QTY | UNITS | REFERENCE DESIGNATOR              | DESCRIPTION   | MANUFACTURER   | MANUFACTURER PART  |
|----------------------|-----|-------|-----------------------------------|---|----------------|--------------------|
| H2511-00R00-1/10W-T  | 6   | ea    | R1, R9, R18, R23, R24             | RES, SMD, 0603, 0Ω, 1/10W, TF, ROHS                         | VENKEL         | CR0603-10W-000T    |
|                      |     |       |                                   |   | ROHM           | MCR03EZPJ000       |
|                      |     |       |                                   |   | PANASONIC      | ERJ-3GEY0R00V      |
|                      |     |       |                                   |   | YAGEO          | RC0603JR-070RL     |
|                      |     |       |                                   |   | VISHAY/DALE    | CRCW06030000Z0EA   |
| H2511-01004-1/10W1-T | 2   | ea    | R4, R6                            | RES, SMD, 0603, 1M, 1/10W, 1%, TF, ROHS                     | PANASONIC      | ERJ-3EKF1004V      |
|                      |     |       |                                   |   | VENKEL         | CR0603-10W-1004FT  |
|                      |     |       |                                   |   | YAGEO          | RC0603FR-071ML     |
|                      |     |       |                                   |   | ROHM           | MCR03EZPFX1004     |
|                      |     |       |                                   |   | KOA            | RK73H1JTTD1004F    |
|                      |     |       |                                   |   | VISHAY/DALE    | CRCW06031M00FKEA   |
| H2511-03402-1/10W1-T | 1   | ea    | R5                                | RES, SMD, 0603, 34k, 1/10W, 1%, TF, ROHS                    | VENKEL         | CR0603-10W-3402FT  |
|                      |     |       |                                   |   | PANASONIC      | ERJ-3EKF3402V      |
|                      |     |       |                                   |   | YAGEO          | RC0603FR-0734KL    |
|                      |     |       |                                   |   | VISHAY/DALE    | CRCW060334K0FKEA   |
|                      |     |       |                                   |   | ROHM           | MCR03EZPFX3402     |
| H2511-DNP            | 0   | ea    | R11, R12, R13, R15                | RES, SMD, 0603, DNP-PLACE HOLDER, ROHS                      |                |                    |
| H2514-00R00-1/4W-T   | 2   | ea    | R21, R22                          | RES, SMD, 1210, 0Ω, 1/4W, TF, ROHS                          | VENKEL         | CR1210-4W-000      |
| GT13MCBE             | 2   | ea    | S1, S2                            | SWITCH-TOGGLE, THRU-HOLE, 5PIN, SPDT, 3POS, ON-OFF-ON, ROHS | C&K COMPONENTS | GT13MCBE           |
| SJ-5003-BLACK        | 4   | ea    | Bottom four corners               | BUMPONS, 0.44" W x 0.20" H, DOMETOP, BLACK                  | 3M             | SJ-5003SPBL        |
| 5X8-STATIC-BAG       | 1   | ea    | Place assy in bag                 | BAG, STATIC, 5X8, ZIPLOC, ROHS                              | INTERSIL       | 212403-013         |
| DNP                  | 0   | ea    | D3-D6                             | DO NOT POPULATE OR PURCHASE                                 |                |                    |
| LABEL-RENAME BOARD   | 1   | ea    | RENAME PCB TO: ISL85033CRSHEVAL1Z | LABEL, TO RENAME BOARD                                      | INTERSIL       | LABEL-RENAME BOARD |
| LABEL-SERIAL NUMBER  | 1   | ea    |                                   | LABEL, FOR SERIAL NUMBER AND BOM REV #                      |                |                    |

## ISL85033CRSHEVAL1Z Board Layout

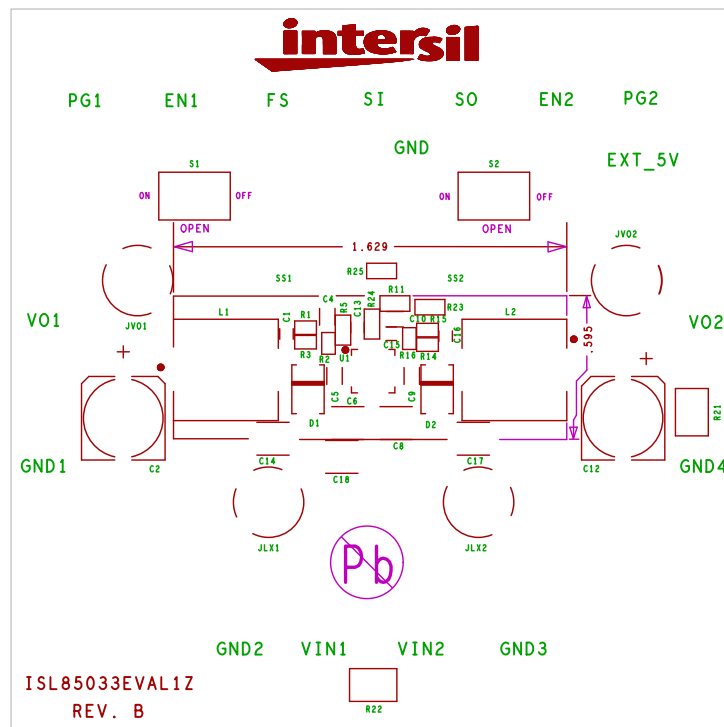


FIGURE 1. TOP LAYER COMPONENTS

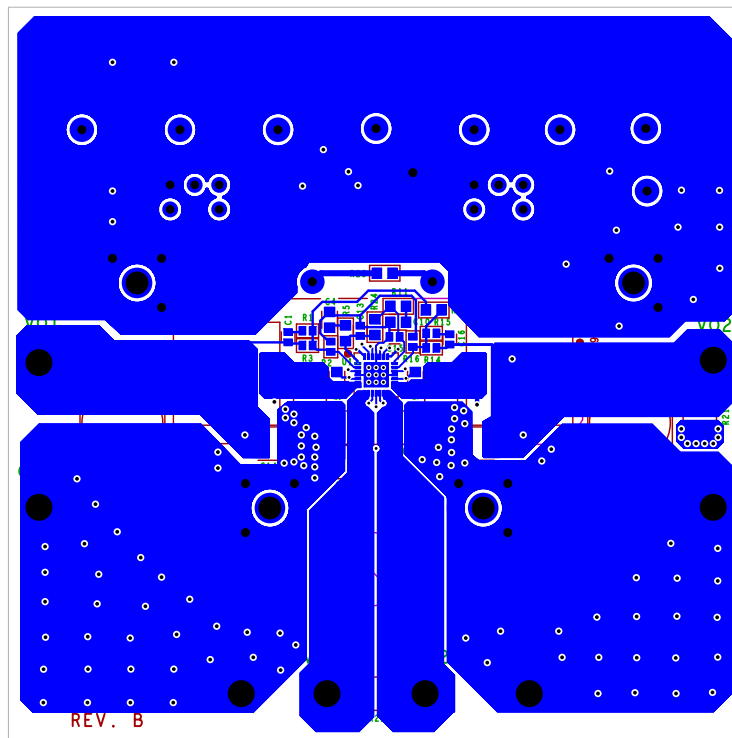


FIGURE 2. TOP LAYER ETCH

## ISL85033CRSHEVAL1Z Board Layout (Continued)

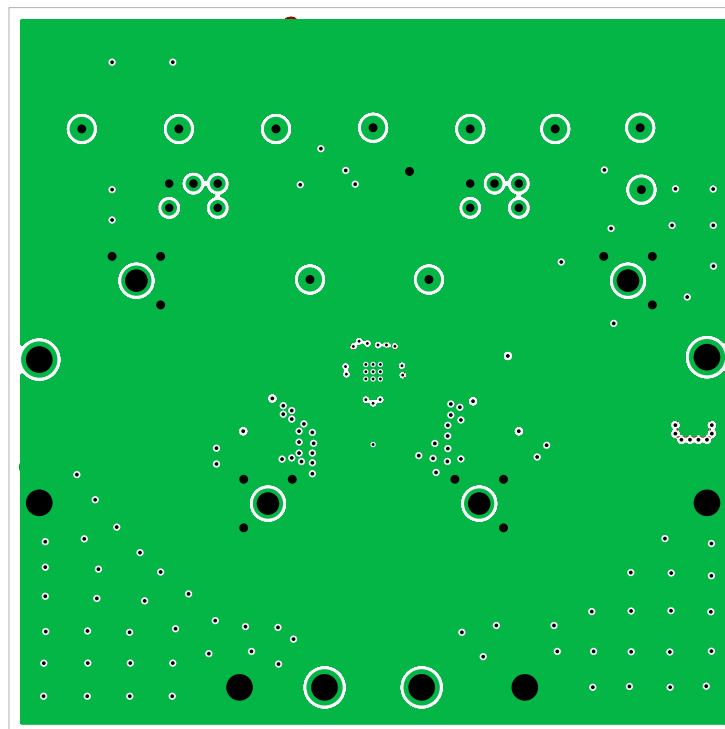


FIGURE 3. SECOND LAYER ETCH

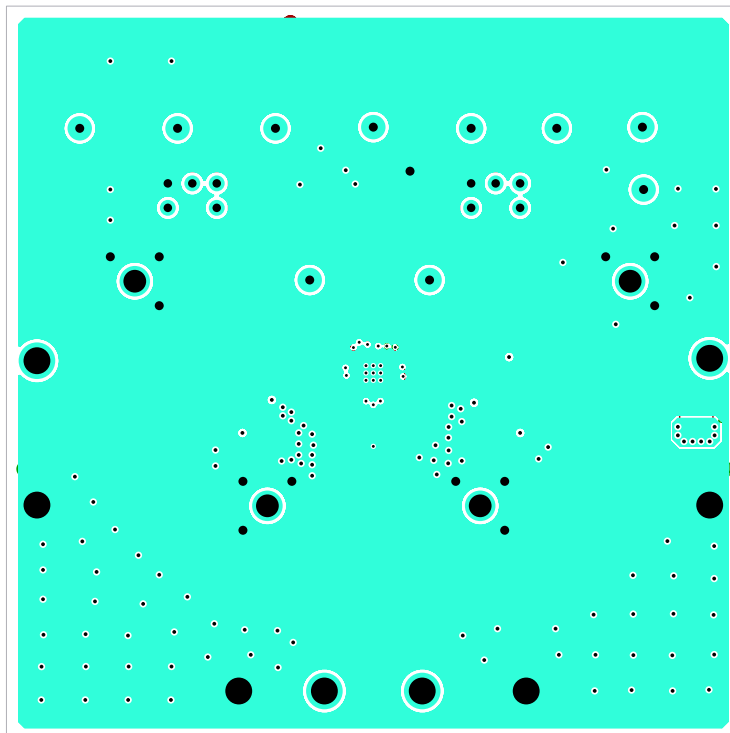


FIGURE 4. THIRD LAYER ETCH





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