EVM User's Guide: TPS7H3014EVM

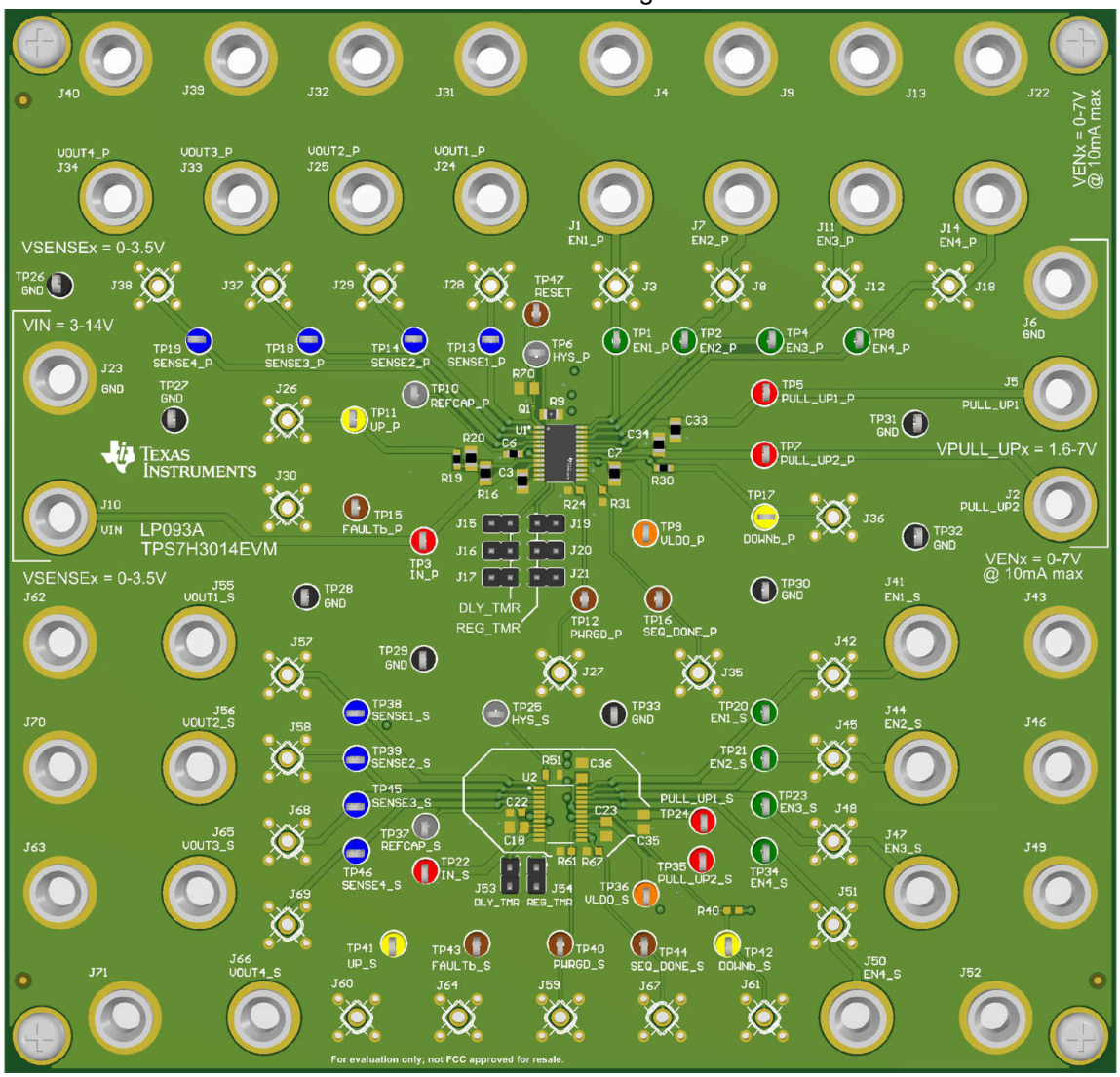
TPS7H3014EVM Evaluation Module (EVM)

Description

The TPS7H3014EVM demonstrates the operation of a single TPS7H3014-SEP sequencer. The board provides footprints that can be populated with additional components to allow for testing of customized configurations, such as daisy-chained sequencers.

Features

- Flexible configuration options, including single-device and daisy-chained device circuits.
- Customizable delay timers, sense thresholds, sense hysteresis, and sequence up/down thresholds.
- Footprints for optional external system reset signal.



EVM Board

1 Evaluation Module Overview

1.1 Introduction

The TPS7H3014EVM is the Evaluation Module (EVM) for the plastic package option of the TPS7H3014 and provides a platform to electrically evaluate its features. This user's guide provides details about the EVM, including the configuration, schematics, and BOM.

The EVM is designed to provide flexibility in configuring the device under different conditions, through footprints for external components and multiple connection options for monitored external rails and enable signal outputs. By default, the device on the EVM is configured as shown in TPS7H3014EVM Default Configuration and Default EVM Schematic. To configure the device in a different configuration, please refer to the TPS7H3014 data sheet to calculate the values of the passives around the device that needs to be changed.

1.2 Kit Contents

- EVM board (1)
- EVM Kit User Guide (1)

1.3 Specification

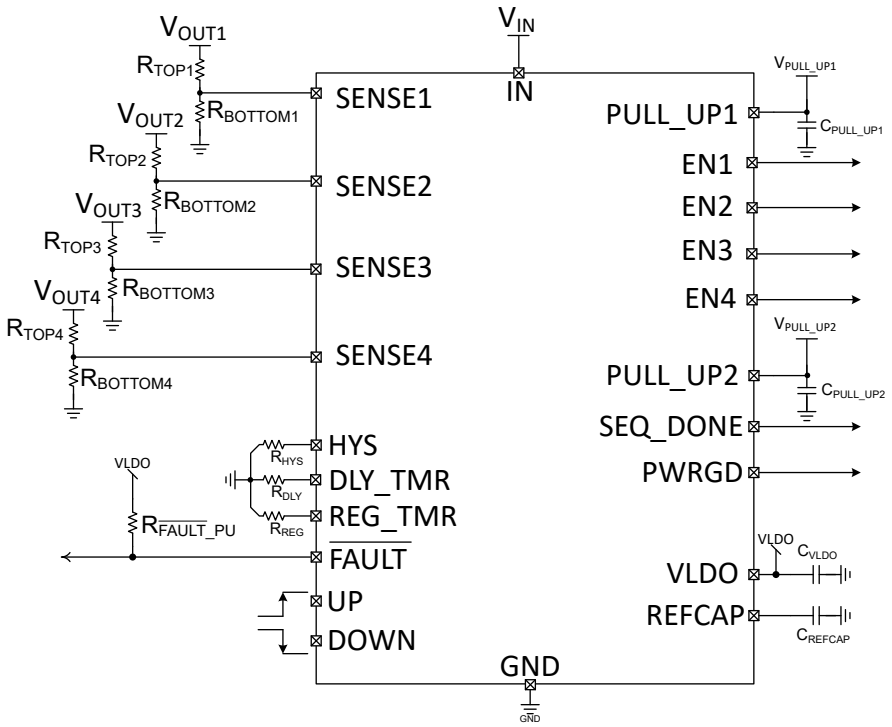


Figure 1-1. Default Configuration Simplified Schematic

Table 1-1. Default EVM Configuration

Specification	Value	Description
Input Voltage VIN	12V	Falls within the recommended device input voltage range of 3V to 14V.
Sequence Up Threshold	10.2V	VIN rising threshold that initiates sequence UP. Set by: R16 = 10 kΩ R20 = 620 Ω
Sequence Down Threshold	6V	VIN falling threshold that initiates sequence DOWN. Set by: R29 = 10 kΩ R34 = 909 Ω

Table 1-1. Default EVM Configuration (continued)

Specification	Value	Description
PULL_UP1 Voltage	1.8V	Voltage used by all ENx outputs. Falls within the recommended device input voltage range of 1.6V to 7V.
PULL_UP2 Voltage	1.8V	Voltage used by SEQ_DONE and PWRGD outputs. Falls within the recommended device input voltage range of 1.6V to 7V.
VOUT1 VON Threshold	1.64V (91 % of 1.8V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R21 = 60.4 kΩ R25 = 34.8 kΩ
VOUT1 VOFF Threshold	0.19V (11 % of 1.8V)	
VOUT2 VON Threshold	1.34 V (90 % of 1.5V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R22 = 49.9 kΩ R26 = 40.2 kΩ
VOUT2 VOFF Threshold	0.15 V (10 % of 1.5V)	
VOUT3 VON Threshold	0.72 V (90 % of 0.8V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R32 = 26.7 kΩ R35 = 130 kΩ
VOUT3 VOFF Threshold	0.08 V (10 % of 0.8V)	
VOUT4 VON Threshold	0.79 V (90 % of 0.88V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R33 = 29.4 kΩ R36 = 90.9 kΩ
VOUT4 VOFF Threshold	0.09 V (10 % of 0.88V)	
ENx Delay Time tDLY_TMR	12.35 ms	Programmable time delay between when the condition for an ENx signal to transition is met and when the signal actually transitions. Set by: R11 = 619 kΩ J16 shunted
SENSEx Regulation Timer tREG_TMR	12.35 ms	Programmable timer that sets the amount of time SENSEx is allowed to reach the regulation threshold voltage (VTH_SENSEx, typically 599mV). If VTH_SENSEx is not reached before the timer expires, the device will sequence down. Set by: R14 = 619 kΩ J20 shunted

1.3.1 Alternate Board Configurations

The TPS7H3014EVM board provides footprints that can be populated with components for testing a "daisy-chain" configuration of 2 TPS7H3014-SEP sequencers. The configuration is used to increase the number of monitored SENSEx inputs and ENx outputs that can be used for sequencing.

The figure below shows an example of how this configuration can be set up. This dual-device configuration has the same specifications as the table in the previous section which described the default single-device EVM configuration. Also, the following specifications for the additional SENSEx rails and timer settings of the secondary device are provided.

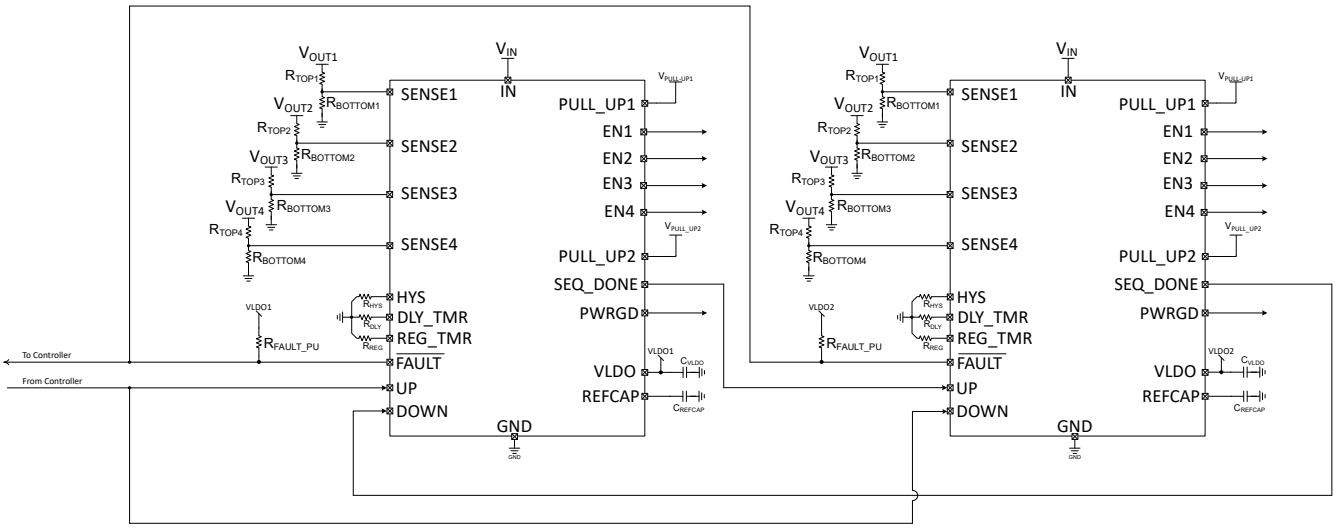


Figure 1-2. Daisy-Chain Configuration Example

Table 1-2. Secondary Device Configuration

Specification	Value	Description
VOUT1 VON Threshold VON1_S	1.34V (90 % of 1.5V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R57 = 49.9kΩ R59 = 40.2kΩ
VOUT1 VOFF Threshold VOFF1_S	0.15V (10 % of 1.5V)	
VOUT2 VON Threshold VON2_S	0.85V (85% of 1V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R58 = 14.5kΩ R60 = 34.8kΩ
VOUT2 VOFF Threshold VOFF2_S	0.50V (50 % of 1V)	
Secondary VOUT3 VON Threshold VON3_S	1.08V (90 % of 1.2V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R65 = 40.2kΩ R68 = 49.9kΩ
Secondary VOUT3 VOFF Threshold VOFF3_S	0.12V (10% of 1.2V)	
VOUT4 VON Threshold VON4_S	1.16V (97 % of 1.2V)	Rising and falling voltage thresholds where the monitored VOUT rail is considered ON or OFF, respectively. Set by: R66 = 1kΩ R69 = 1.07kΩ
VOUT4 VOFF Threshold VOFF4_S	1.14 (95 % of 1.2V)	
ENx Delay Time tDLY_TMR	0.25ms	Programmable time delay between when the condition for an ENx signal to transition is met and when the signal actually transitions. Set by: R52 = 10kΩ J53 shunted

Table 1-2. Secondary Device Configuration (continued)

Specification	Value	Description
SENSEx Regulation Timer tREG_TMR	0.25ms	Programmable timer that sets the amount of time SENSEx is allowed to reach the regulation threshold voltage (VTH_SENSEx, typically 599mV). If VTH_SENSEx is not reached before the timer expires, the device sequences down. Set by: R53 = 10kΩ J54 shunted

1.4 Device Information

The TPS7H3014-SEP is an integrated, 3V to 14V, four-channel radiation-tolerant power supply sequencer. Channel count can be expanded by connecting multiple devices in a daisy-chain configuration. The device has active high sequence UP and DOWN inputs. Additionally, the SEQ_DONE, PWRGD, and FAULT outputs of the device provide information about the sequence, power, and internally-generated fault status of the monitored power tree to increase system-level reliability. An accurate 599mV ± 1 % SENSEx threshold voltage and a 24µA ± 3 % hysteresis current allow the user to set programmable rise and fall thresholds for the voltage rails monitored by the sequencer. The rise/fall delay time of all ENx outputs is globally programmed via a single resistor on the DLY_TMR pin, or by floating the pin to result in the shortest possible delay time. Similarly, the time the device allows for the SENSEx voltage to pass the ON threshold can be globally programmed via a single resistor on the REG_TMR pin, or by floating the pin to allow infinite time for the SENSEx voltage to pass the on threshold.

2 Hardware

2.1 Power Requirements

The TPS7H3014EVM board requires 3 power rails (VIN, VPULL_UP1, and VPULL_UP2) to be externally provided by power supplies. These can be separate or shared as long as the voltage ranges of each are respected. The test results shown in this user guide were performed with 1 power supply used for VIN and 1 power supply shared by VPULL_UP1 and VPULL_UP2.

- 3V ≤ VIN ≤ 14V
- 1.6V ≤ VPULL_UPx ≤ 7V

2.2 Important Usage Notes

The TPS7H3014EVM board is configured so that the ENx signals are tied by a 0Ω resistor to their respective SENSEx signal. This configuration is purely for simplicity of testing device features and behavior when external voltages are not available to be sensed by the SENSEx pins. If external voltages are applied to the VOUTx jumpers, the 0Ω resistors tying ENx to VOUTx must be removed.

Because the board is configured with ENx tied to VOUTx, the user should make sure VPULL_UP1 is low enough that VSENSEx does not reach the channel-disabling voltage threshold (VTURN_OFF). If the user intends to disable channels, it is recommended to do so by using R3, R4 and R5 to tie the SENSEx nodes to VLDO or another stable voltage rail.

It is important to calculate the expected maximum SENSEx voltage both before and after the SENSEx hysteresis current has been added, since the hysteresis current increases the voltage at the SENSEx node.

If VSENSEx is lower than the channel-disabling threshold before the SENSEx hysteresis current is added, but above the threshold after the hysteresis current is added, then the channel(s) experience Enable-Disable behavior. This state is not desirable or recommended and users should make sure that the channels are either fully enabled or disabled.

2.3 Connector Descriptions

<table>
<tr><th colspan="3">Primary Device</th><th colspan="3">Secondary Device</th></tr>
<tr><th>Designator</th><th colspan="2">Function</th><th>Designator</th><th colspan="2">Function</th></tr>
<tr><td>J10</td><td rowspan="2">VIN_P</td><td>Power input connector for VIN of the primary device.</td><td>R42</td><td rowspan="2">VIN_S</td><td>0 Ohm resistor for tying VIN of the primary and secondary devices.</td></tr>
<tr><td>TP3</td><td>Test point</td><td>TP22</td><td>Test point</td></tr>
<tr><td>J5</td><td rowspan="2">PULL_UP1_P</td><td>Power input connector for PULL_UP1 of the primary device.</td><td>R41</td><td rowspan="2">PULL_UP1_S</td><td>0 Ohm resistor for tying PULL_UP1 of the primary and secondary devices.</td></tr>
<tr><td>TP5</td><td>Test point</td><td>TP24</td><td>Test point</td></tr>
<tr><td>J2</td><td rowspan="2">PULL_UP2_P</td><td>Power input connector for PULL_UP2 of the primary device.</td><td>R38</td><td rowspan="2">PULL_UP2_S</td><td>0 Ohm resistor for tying PULL_UP2 of the primary and secondary devices.</td></tr>
<tr><td>TP7</td><td>Test point</td><td>TP35</td><td>Test point</td></tr>
<tr><td>J6, J23</td><td rowspan="2">GND</td><td>Power input connector for GND of the primary device.</td><td colspan="3" rowspan="2">GND power connections are shared between primary and secondary devices.</td></tr>
<tr><td>TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33</td><td>Test point</td></tr>
</table>

Primary Device			Secondary Device		
Designator	**Function**		**Designator**	**Function**	
J24	VOUT1_P	Input connector for an external VOUT rail to be monitored by SENSE1 of the primary device.	J55	VOUT1_S	Input connector for an external VOUT rail to be monitored by SENSE1 of the secondary device.
J31	GND		J62	GND	
J28	SENSE1_P	Probe test point	J57	SENSE1_S	
TP13		Test point	TP38		Test point
J25	VOUT2_P	Input connector for an external VOUT rail to be monitored by SENSE2 of the primary device.	J56	VOUT2_S	Input connector for an external VOUT rail to be monitored by SENSE2 of the secondary device.
J32	GND		J63	GND	
J29	SENSE2_P	Probe test point	J58	SENSE2_S	Probe test point
TP14		Test point	TP39		Test point
J33	VOUT3_P	Input connector for an external VOUT rail to be monitored by SENSE3 of the primary device.	J65	VOUT3_S	Input connector for an external VOUT rail to be monitored by SENSE3 of the secondary device.
J39	GND		J70	GND	
J37	SENSE3_P	Probe test point	J68	SENSE3_S	Probe test point
TP18		Test point	TP45		Test point
J34	VOUT4_P	Input connector for an external VOUT rail to be monitored by SENSE4 of the primary device.	J66	VOUT4_S	Input connector for an external VOUT rail to be monitored by SENSE4 of the secondary device.
J40	GND		J71	GND	
J38	SENSE4_P	Probe test point	J69	SENSE4_S	Probe test point
TP19		Test point	TP46		Test point
TP1	EN1_P	Test point	TP20	EN1_S	Test point
J3		Probe test point	J42		Probe test point
J1		Output connector for EN1 of the primary device.	J41		Output connector for EN1 of the secondary device.
J4	GND		J43	GND	
TP2	EN2_P	Test point	TP21	EN2_S	Test point
J8		Probe test point	J45		Probe test point
J7		Output connector for EN2 of the primary device.	J44		Output connector for EN2 of the secondary device.
J9	GND		J46	GND	
TP4	EN3_P	Test point	TP23	EN3_S	Test point
J12		Probe test point	J48		Probe test point
J11		Output connector for EN3 of the primary device.	J47		Output connector for EN3 of the secondary device.
J13	GND		J49	GND	
TP8	EN4_P	Test point	TP34	EN4_S	Test point
J18		Probe test point	J51		Probe test point
J14		Output connector for EN4 of the primary device.	J50		Output connector for EN4 of the secondary device.
J22	GND		J52	GND	

Primary Device			Secondary Device		
Designator	**Function**		**Designator**	**Function**	
J15, J16, J17	DLY_TMR_P	Shunt for DLY_TMR resistor configuration of the primary device.	J53	DLY_TMR_S	Shunt for DLY_TMR resistor configuration of the secondary device.
J19, J20, J21	REG_TMR_P	Shunt for REG_TMR resistor configuration of the primary device.	J54	REG_TMR_S	Shunt for REG_TMR resistor configuration of the secondary device.
TP11	UP_P	Test point	TP41	UP_S	Test point
J26		Probe test point	J60		Probe test point
TP17	DOWNb_P	Test point	TP42	DOWNb_S	Test point
J36		Probe test point	J61		Probe test point
TP6	HYS_P	Test point	TP25	HYS_S	Test point
TP15	FAULTb_P	Test point	TP43	FAULTb_S	Test point
J30		Probe test point	J64		Probe test point
TP16	SEQ_DONE_P	Test point	TP44	SEQ_DONE_S	Test point
J35		Probe test point	J67		Probe test point
TP12	PWRGD_P	Test point	TP40	PWRGD_S	Test point
J27		Probe test point	J59		Probe test point
TP9	VLDO_P	Test point	TP36	VLDO_S	Test point
TP10	REFCAP_P	Test point	TP37	REFCAP_S	Test point
TP47	RESET	Test point	External RESET will apply to both the primary and secondary device.		

3 Implementation Results

Test results are shown below for the following features:

1. Sequence UP and DOWN thresholds
2. ENx Delay Time
3. SENSEx Regulation Timer
4. Disabling Channels
5. External System RESET

3.1 Default Configuration Results

The following tests were performed using the TPS7H3014EVM in the default configuration with VIN=12V and PULL_UP1=PULL_UP2=1.8V or 3.3V (indicated by voltage seen on the ENx, PWRGD, SEQ_DONE, and FAULT signals). All UP and DOWN sequences were initiated by raising or lowering VIN, as shown in the first two tests, unless stated otherwise.

3.2 Sequence UP and DOWN Thresholds

VIN>10.2V initiates sequence UP. EN1 goes HIGH after DLY_TMR (12.35ms) expires.

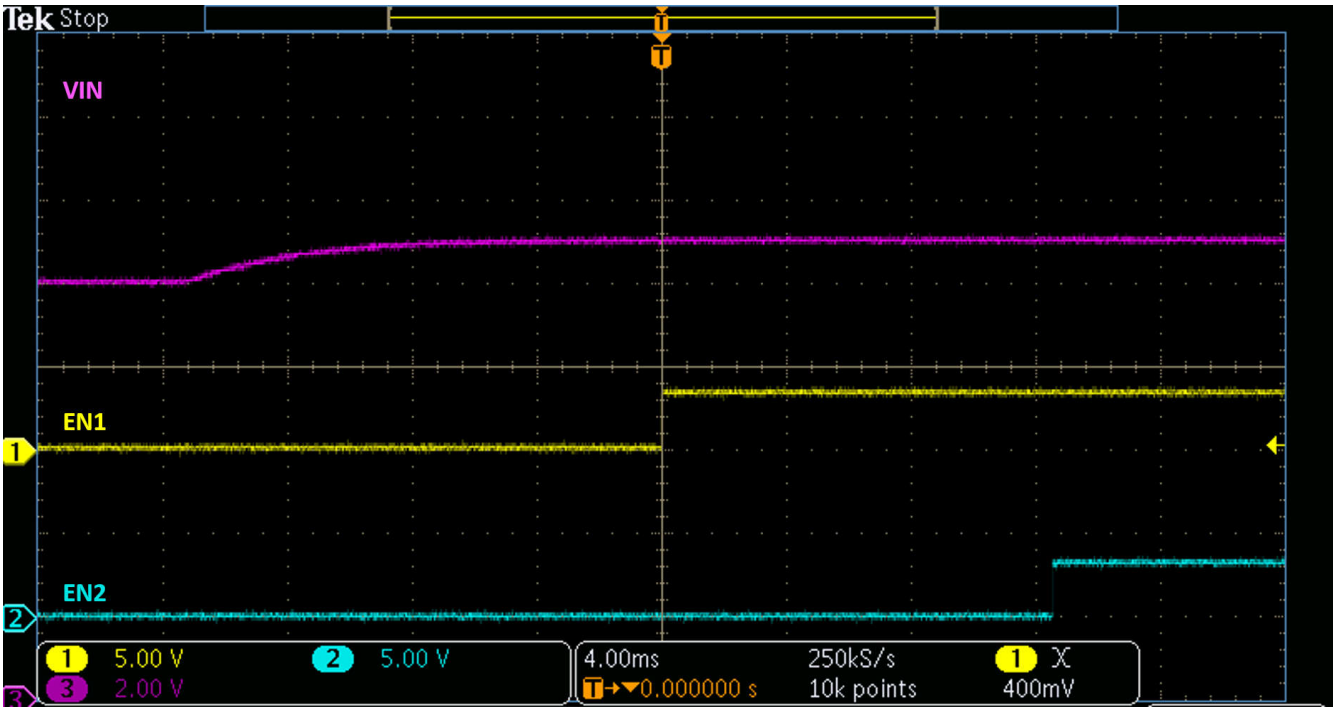


Figure 3-1. VIN Rising, Initiate Sequence UP

VIN<6V initiates sequence DOWN. EN2 goes LOW after DLY_TMR (12.35ms) expires.

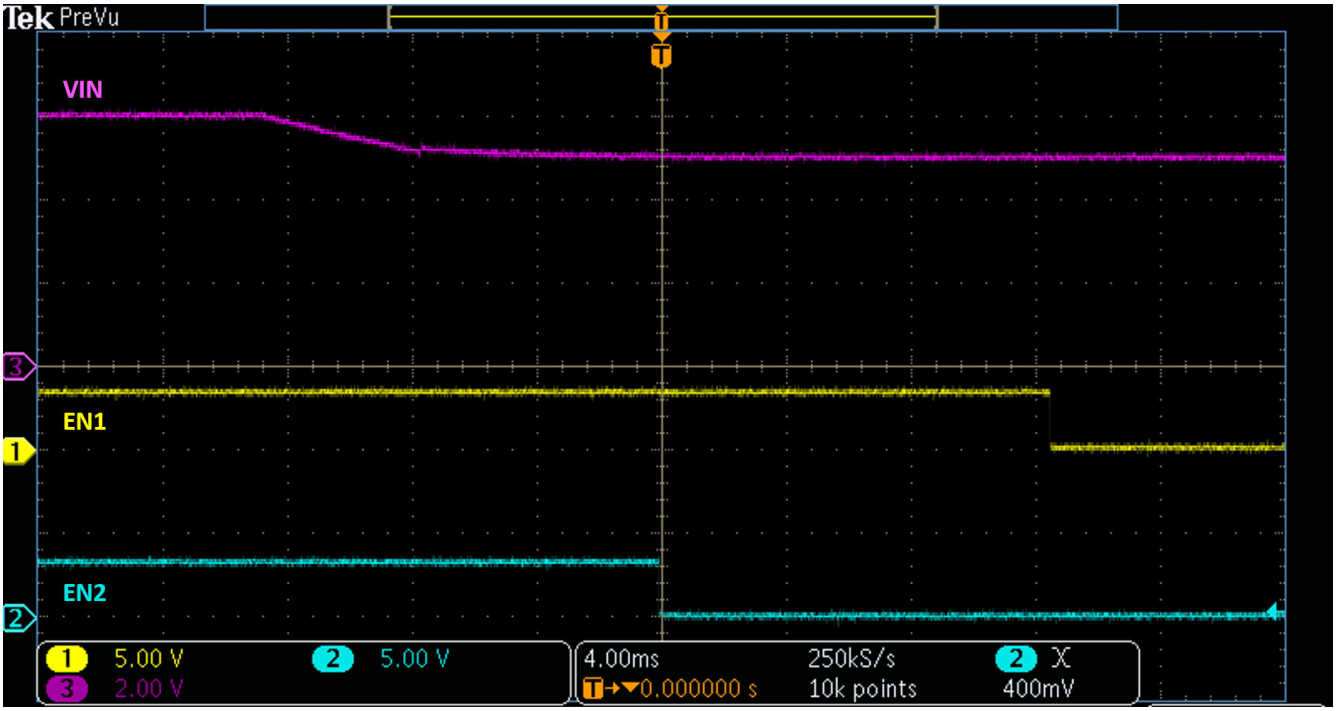


Figure 3-2. VIN Falling, Initiate Sequence DOWN

3.3 Delay Timer

The shunt and resistor used on the DLY_TMR pin set the delay time that occurs between when the condition for an ENx signal to transition HIGH or LOW is met and when the ENx signal transitions.

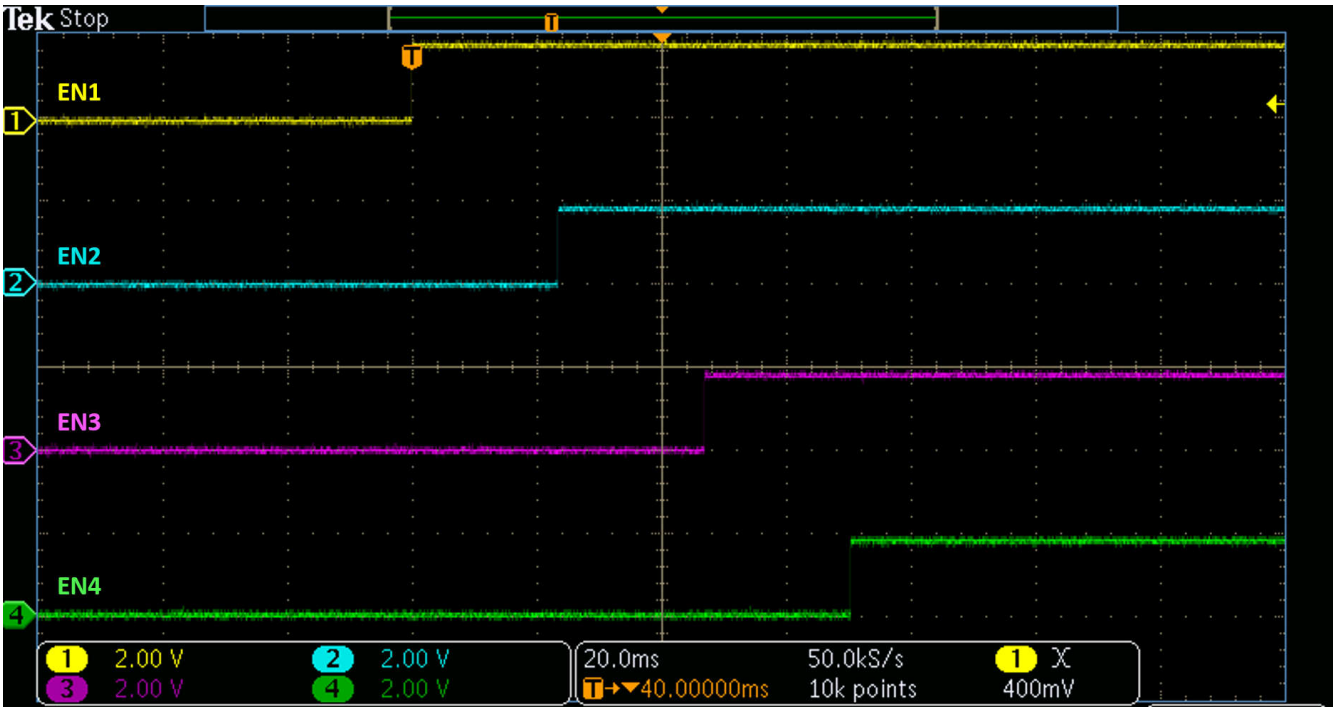


Figure 3-3. Sequence UP, 23ms Delay

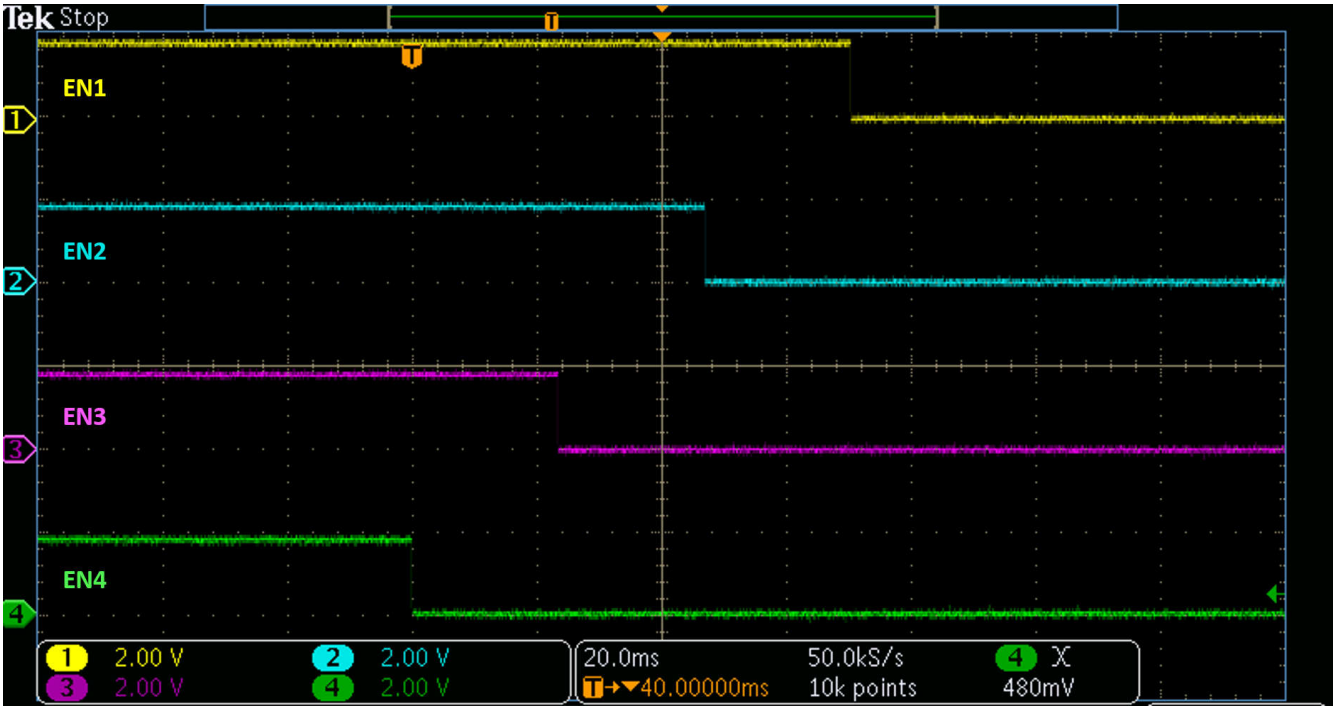


Figure 3-4. Sequence DOWN, 23ms Delay

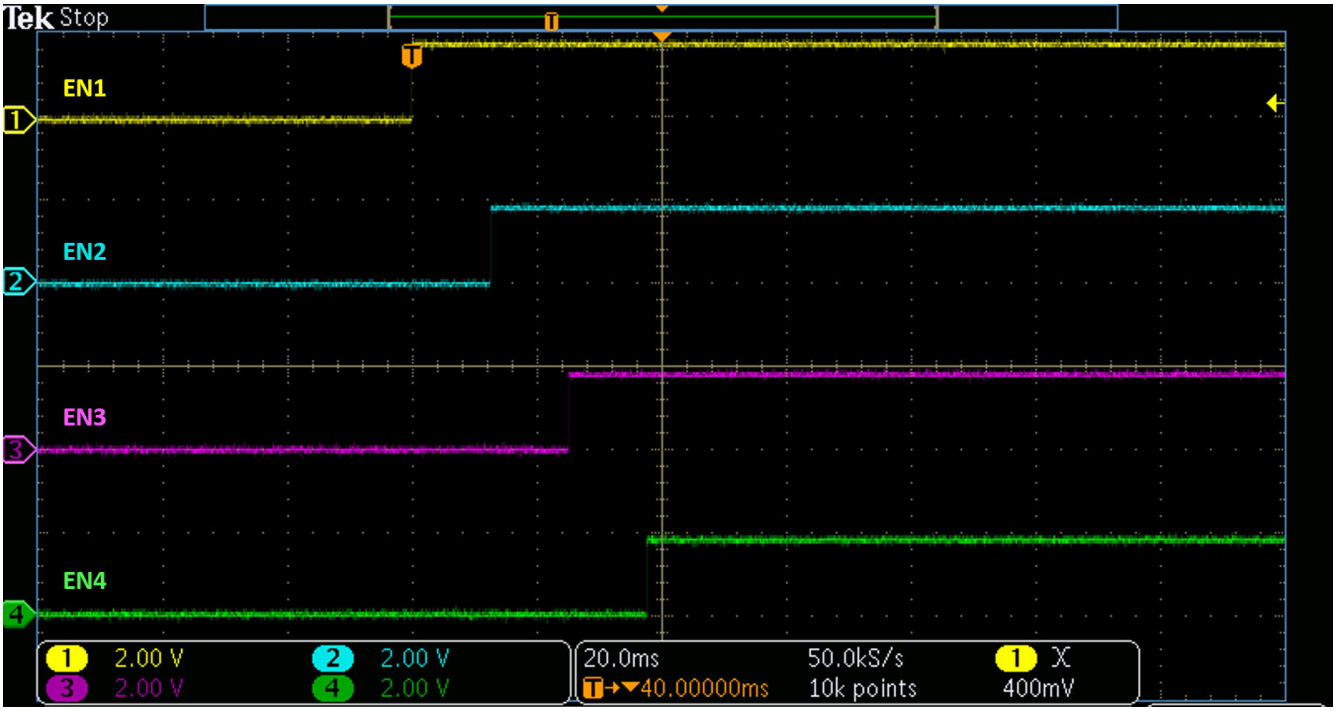


Figure 3-5. Sequence UP, 12ms Delay

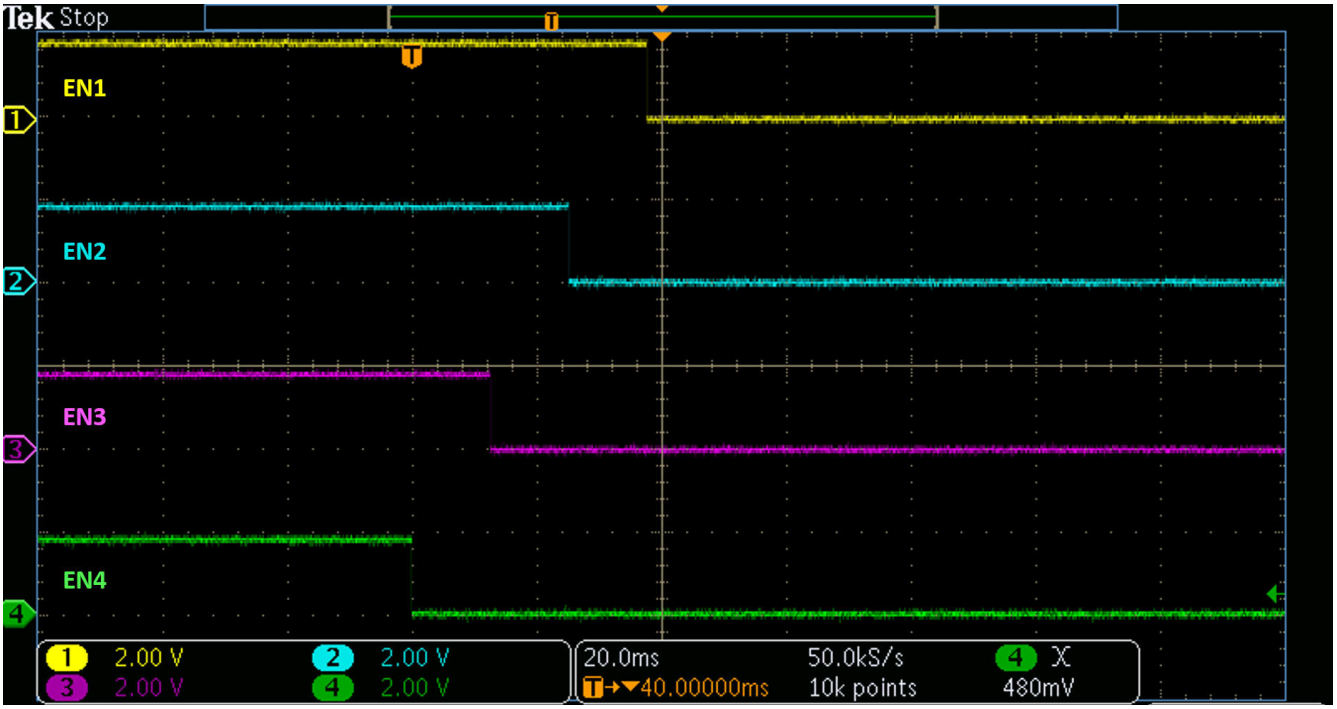


Figure 3-6. Sequence DOWN, 12ms Delay

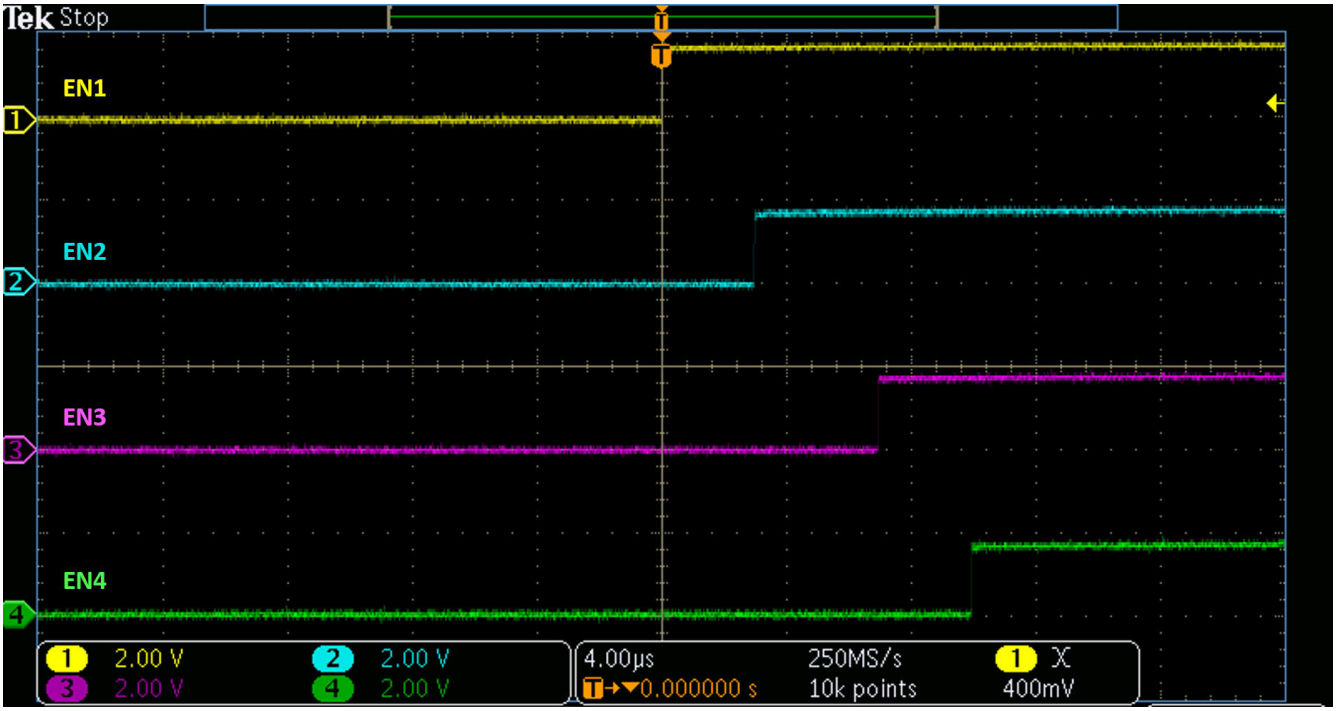


Figure 3-7. Sequence UP, DLY_TMR Floating

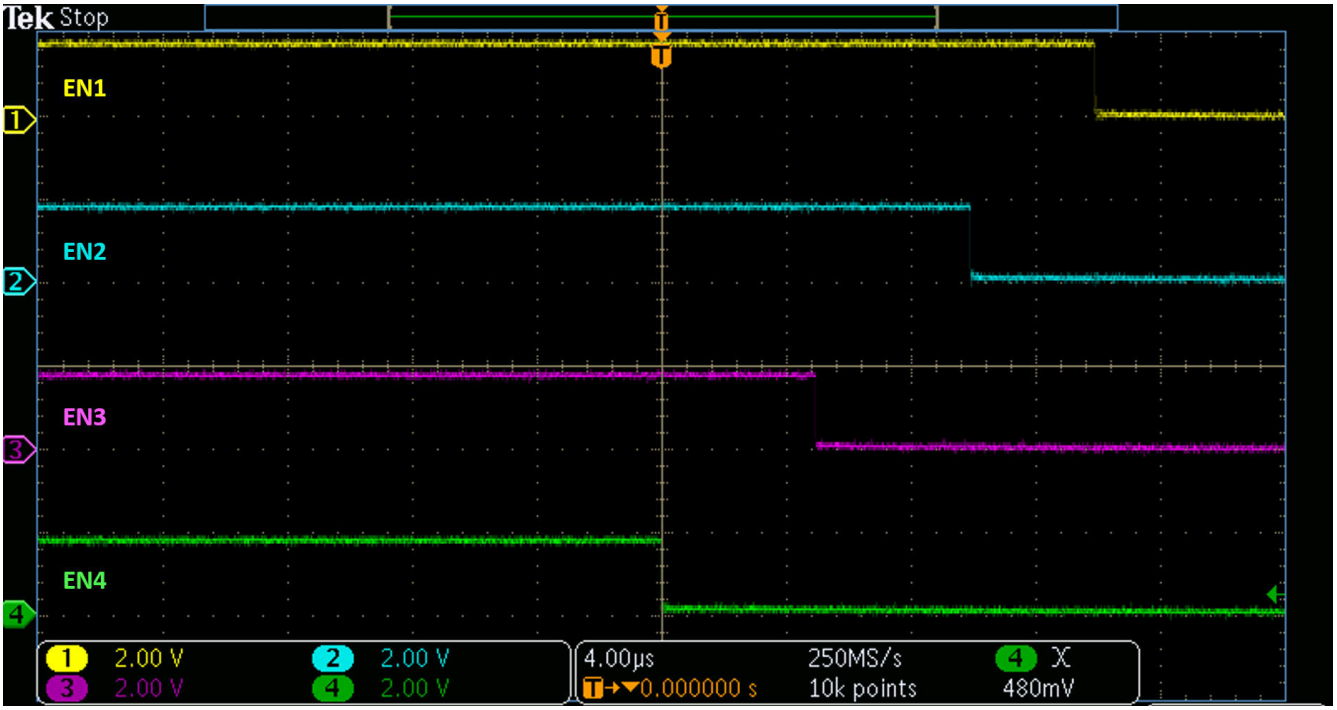


Figure 3-8. Sequence DOWN, DLY_TMR Floating

3.4 Regulation Timer

In the following tests, SENSE3 is tied to GND to prevent reaching the VON3 threshold before the Regulation Timer expires. Sequence DOWN is initiated automatically by the device when REG_TMR expires. This time is set by the jumper and resistor used on the REG_TMR pin. If REG_TMR is floating, the Regulation Timer does not expire, and the device waits indefinitely for a condition that changes the state.

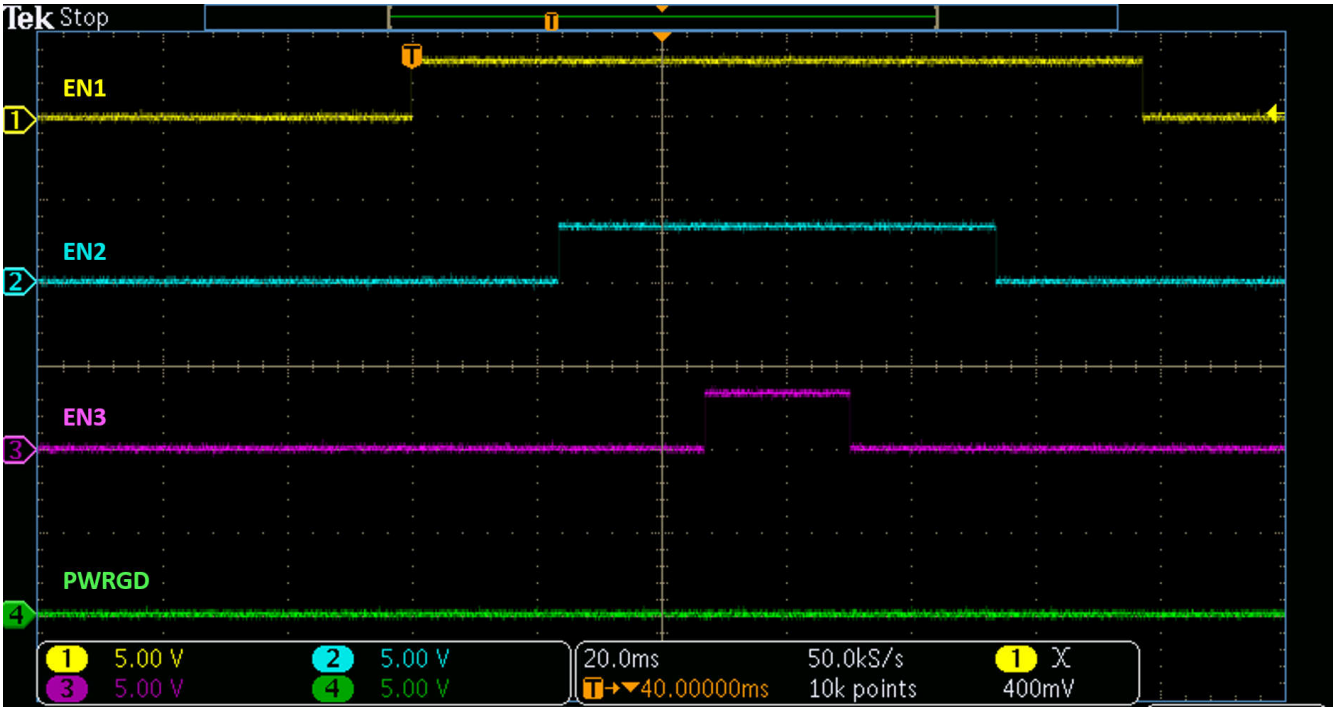


Figure 3-9. Regulation Timer Expiration, 23ms

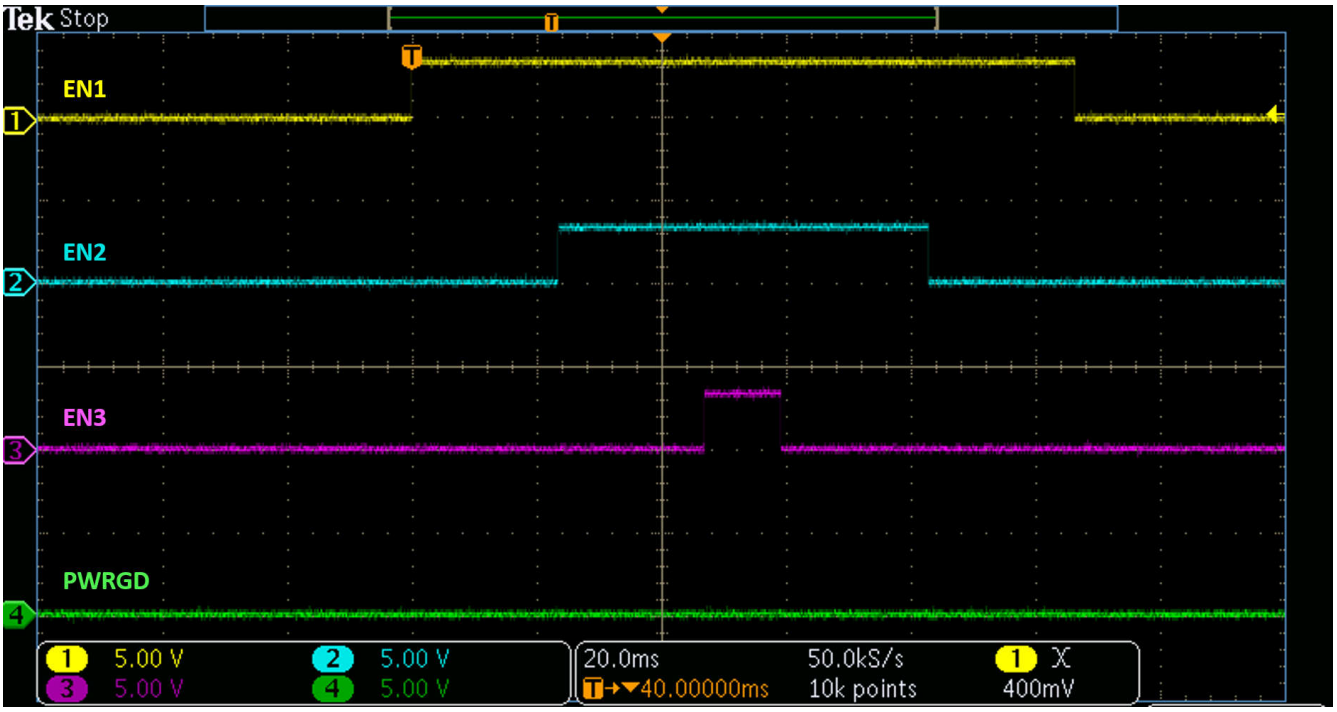


Figure 3-10. Regulation Timer Expiration, 12ms

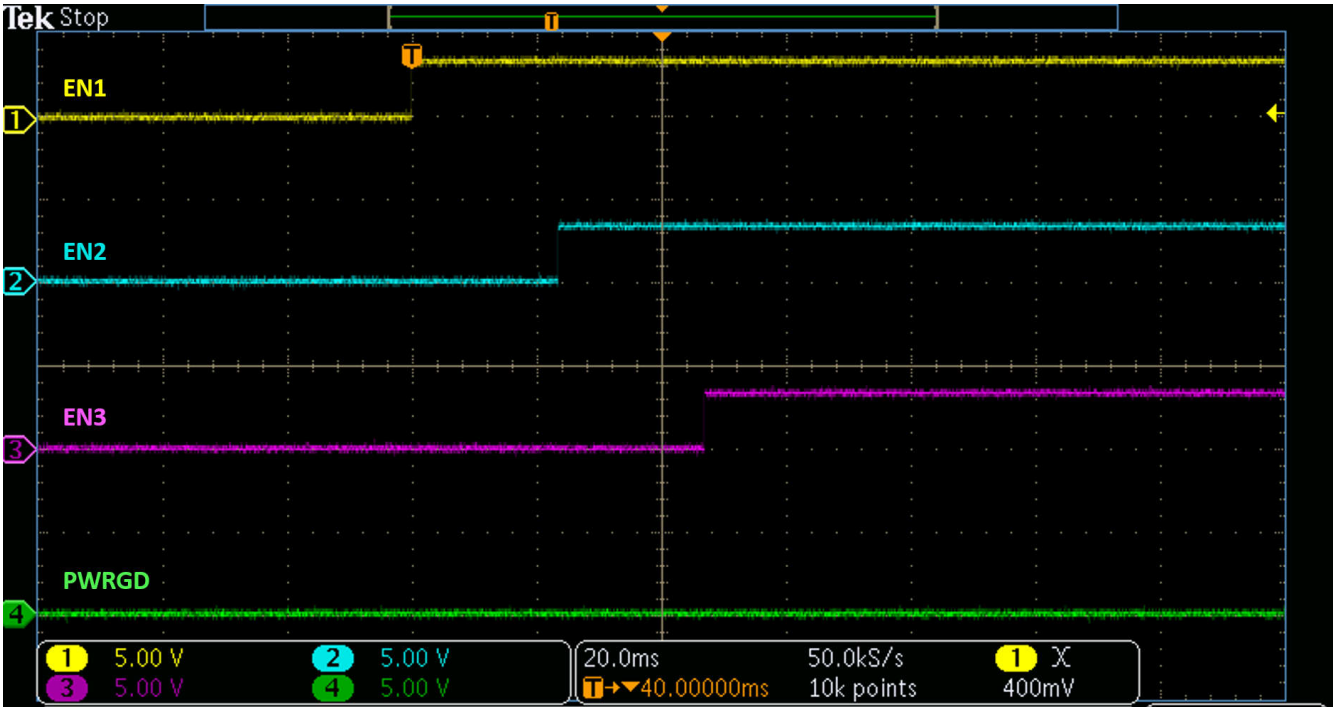


Figure 3-11. Sequence UP, REG_TMR Floating

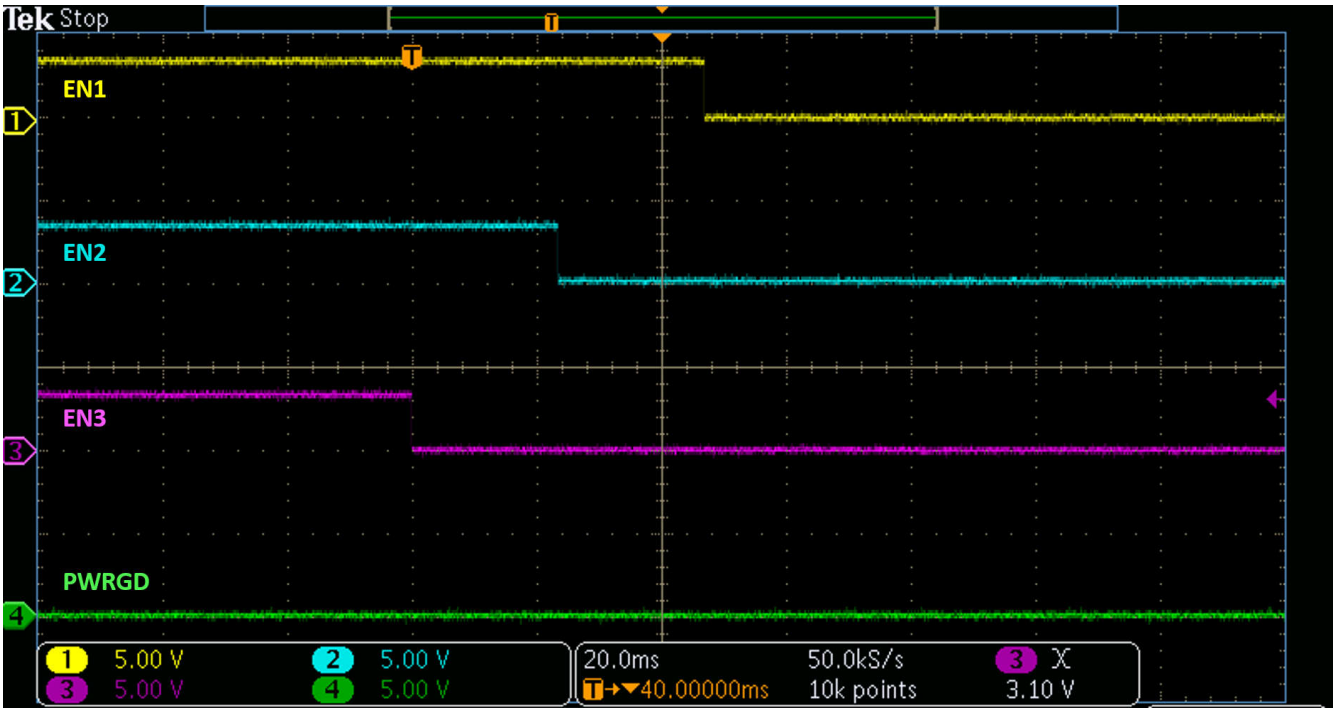


Figure 3-12. Sequence DOWN, REG_TMR Floating

3.5 Disabled Channels

The following tests were performed with SENSE3 and SENSE4 tied to 3.3V to disable channels 3 and 4.

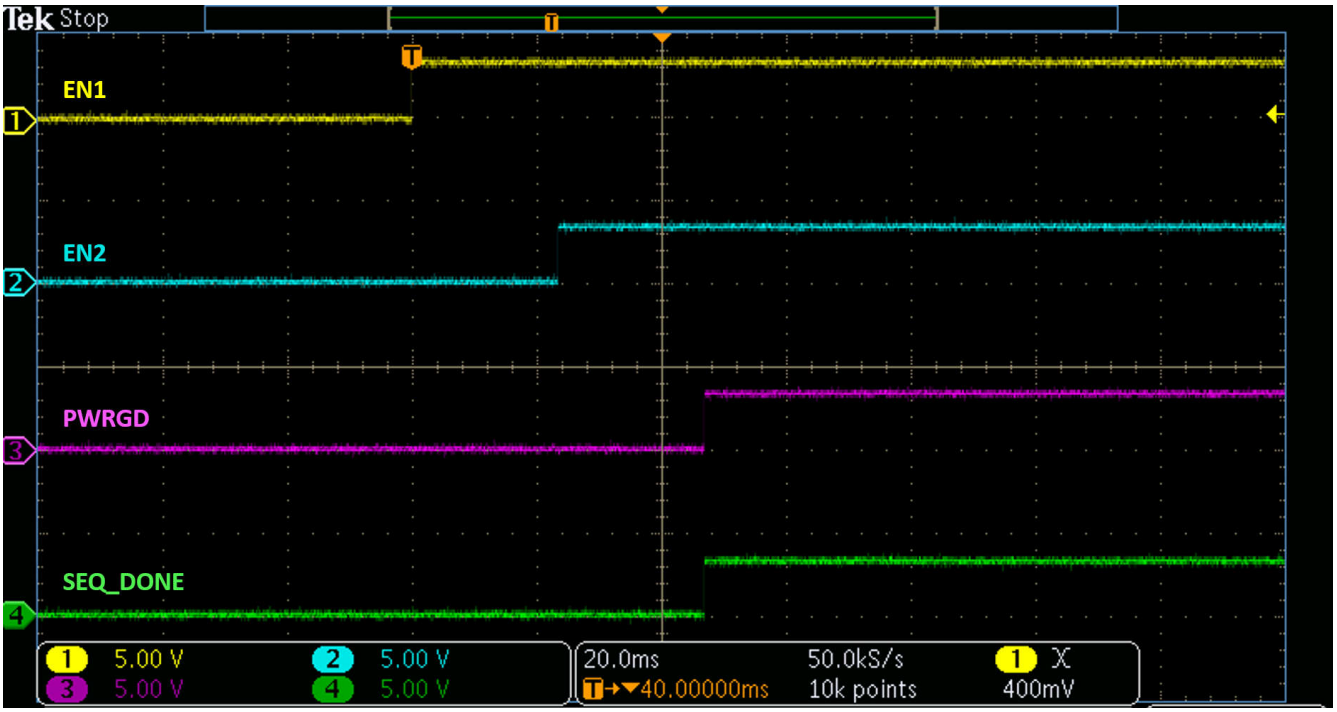


Figure 3-13. Sequence UP, CH3-4 Disabled

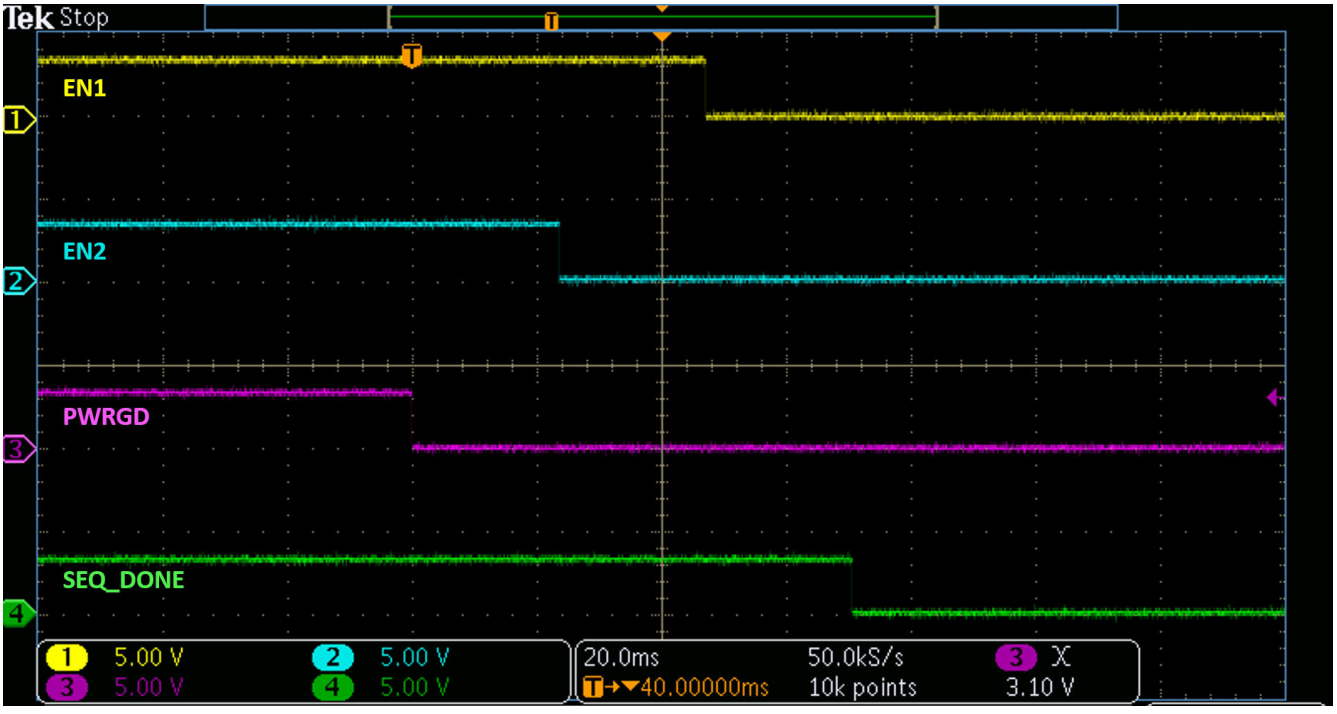


Figure 3-14. Sequence DOWN, CH3-4 Disabled

3.6 Externally Induced System RESET

The following test was performed using a FET to ground the SENSE1 pin to induce a FAULT. This can be done if an external system RESET signal is desired by the user. CH3 and CH4 were disabled during this test for convenience of displaying the results. Applying 3.3V to the gate of the FET circuitry shown in the "Optional External Reset" section of the EVM Schematic induces the external RESET. If used, it is recommended to choose a FET with low leakage to minimize the error it introduces to the SENSEx ON and OFF thresholds.

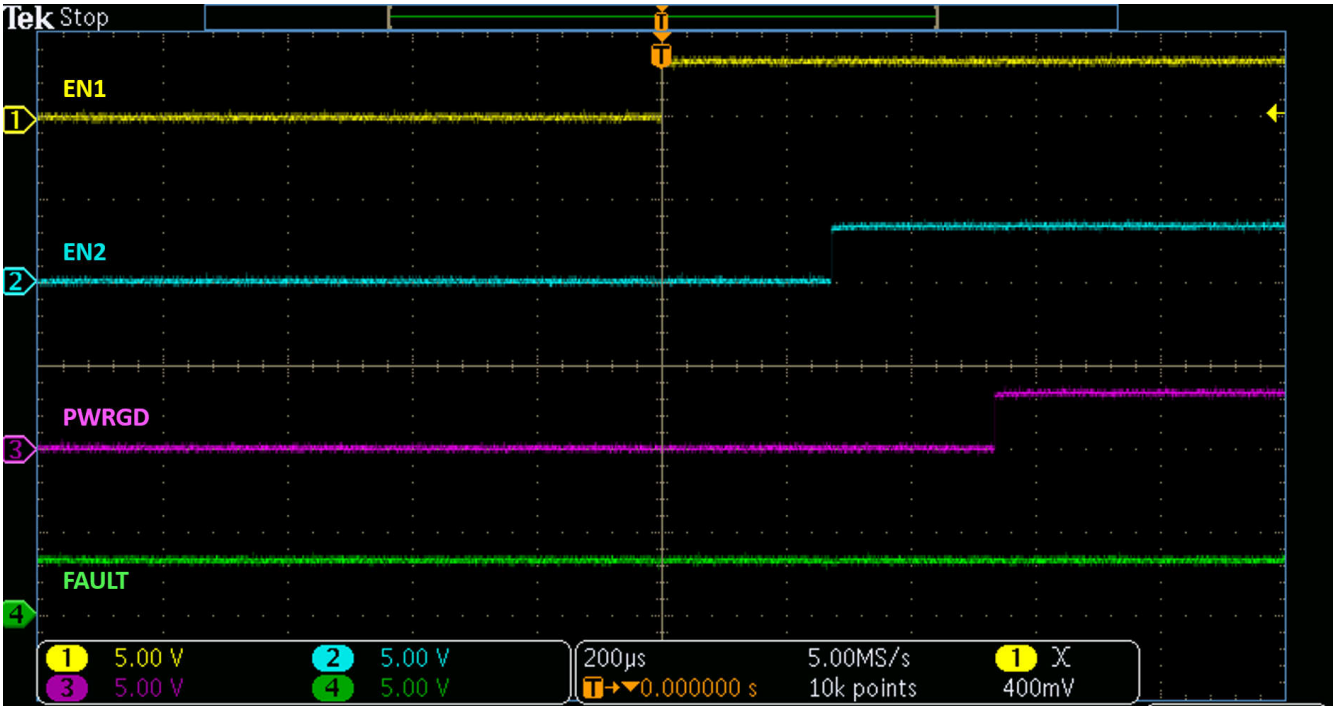


Figure 3-15. Sequence UP

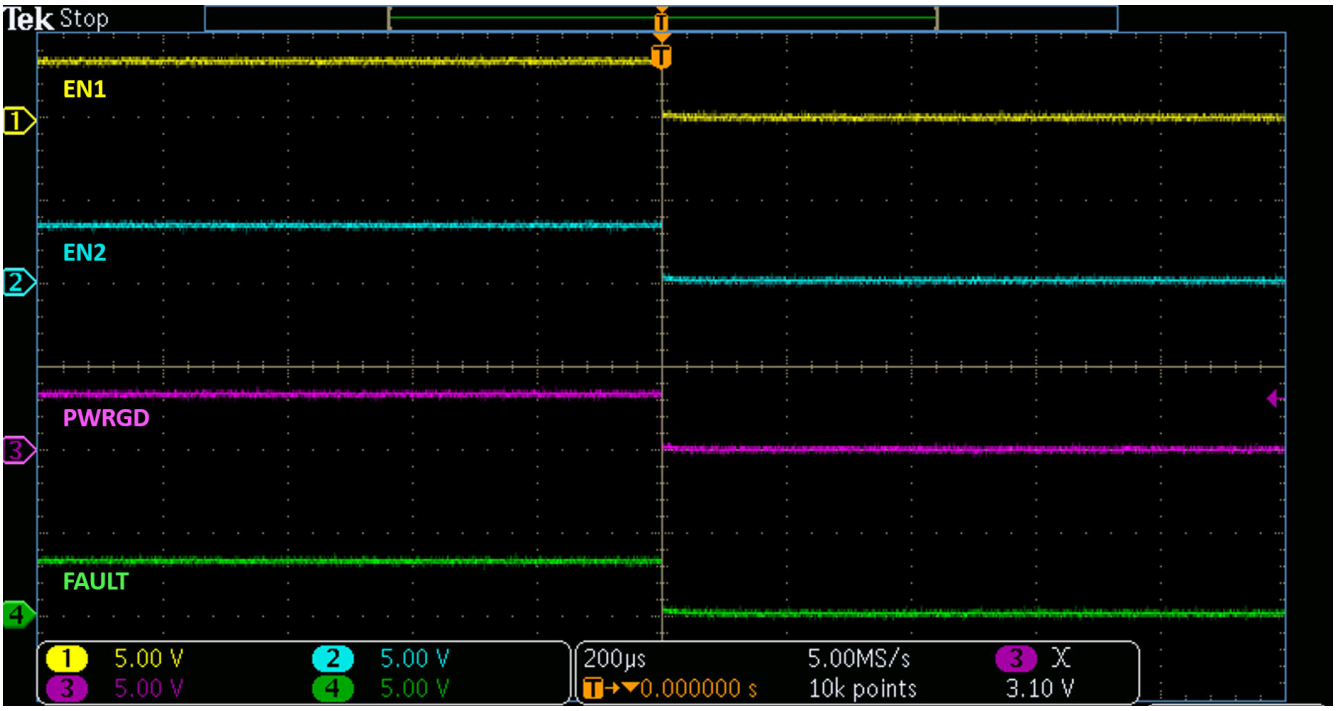
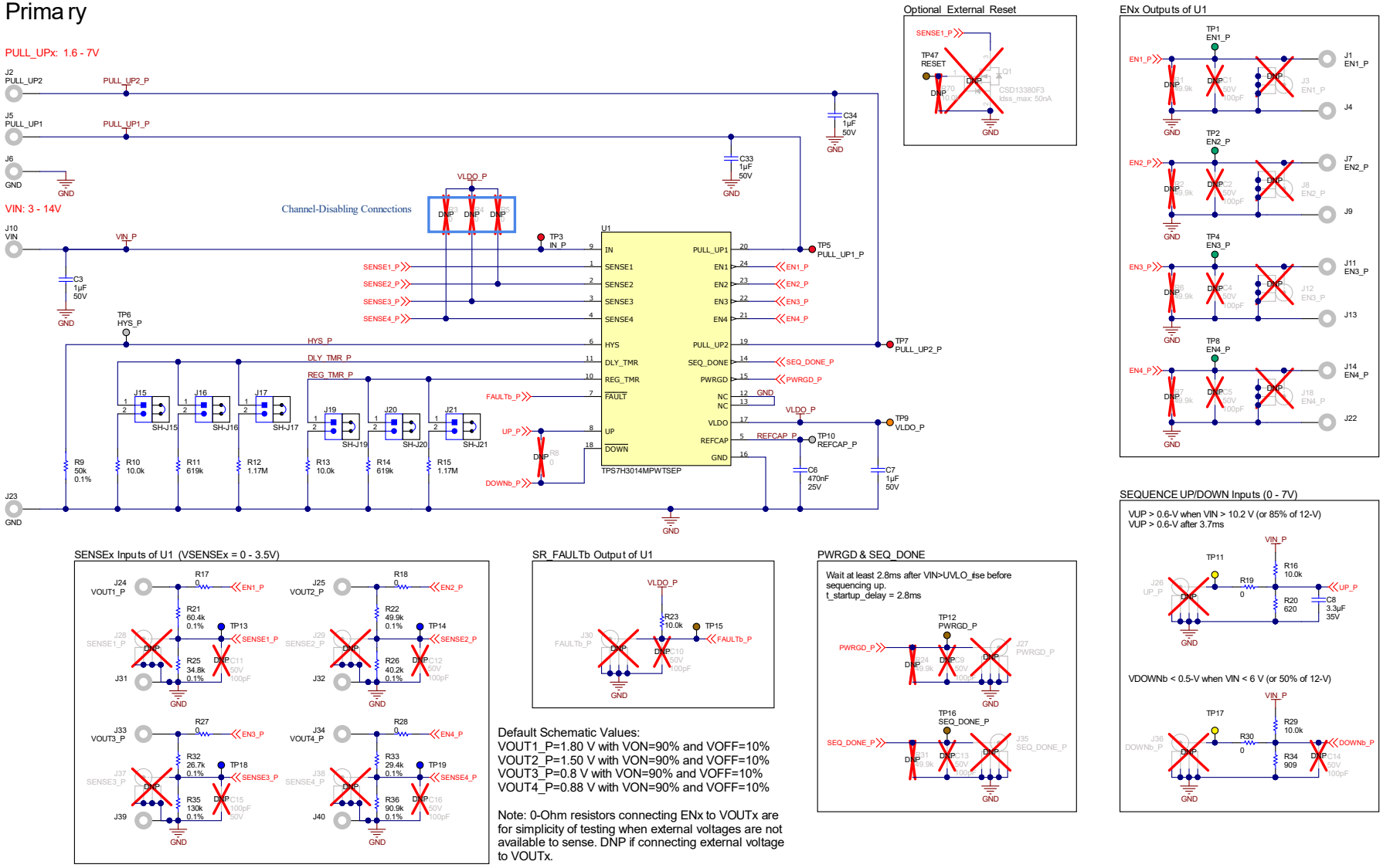


Figure 3-16. External System RESET

4 Hardware Design Files

4.1 Schematic

Primary



Default Schematic Values:
VOUT1_P=1.80 V with VON=90% and VOFF=10%
VOUT2_P=1.50 V with VON=90% and VOFF=10%
VOUT3_P=0.8 V with VON=90% and VOFF=10%
VOUT4_P=0.88 V with VON=90% and VOFF=10%

Note: 0-Ohm resistors connecting ENx to VOUTx are for simplicity of testing when external voltages are not available to sense. DNP if connecting external voltage to VOUTx.

Secondary

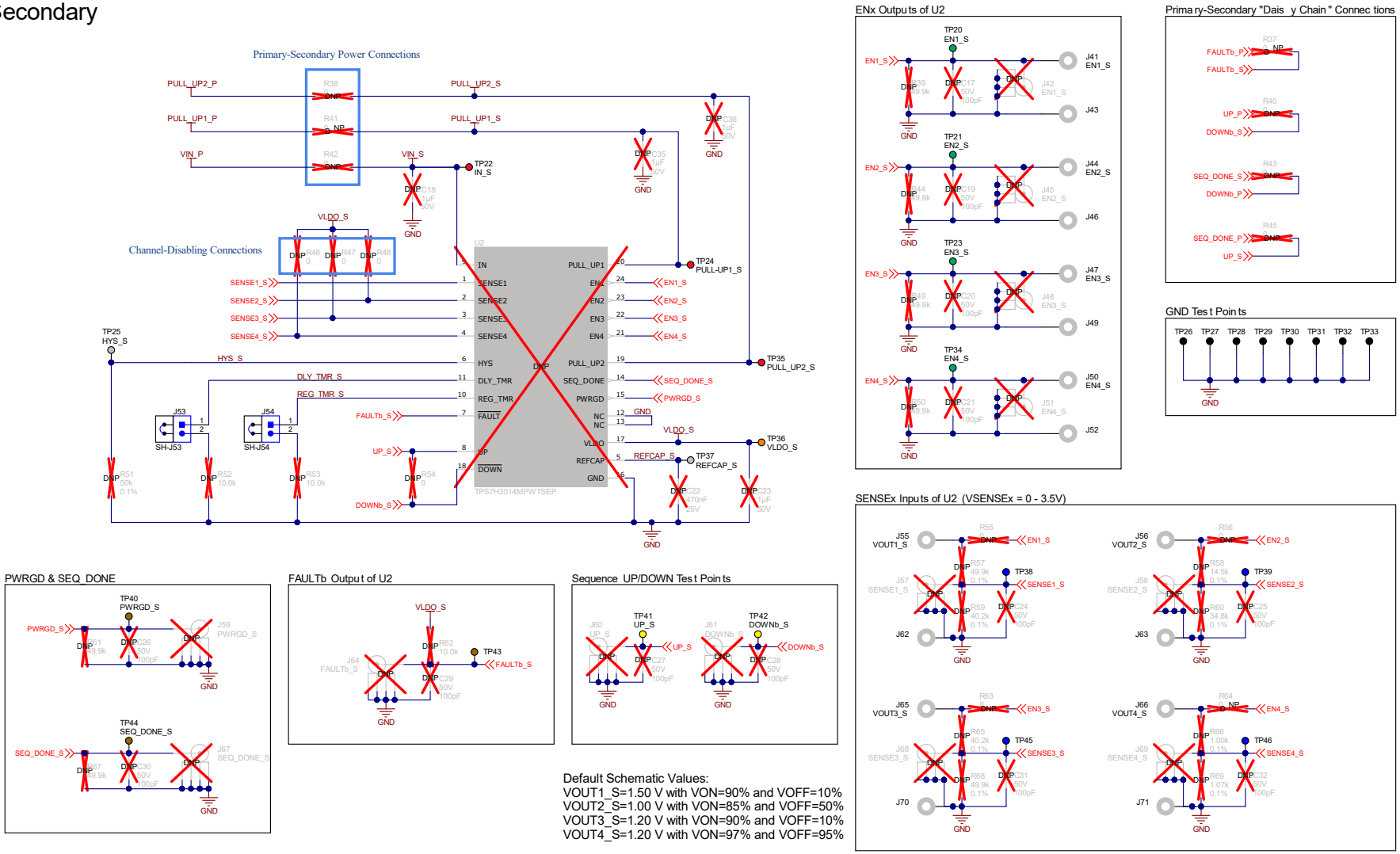


Figure 4-1. Default EVM Schematic

4.2 PCB Layout

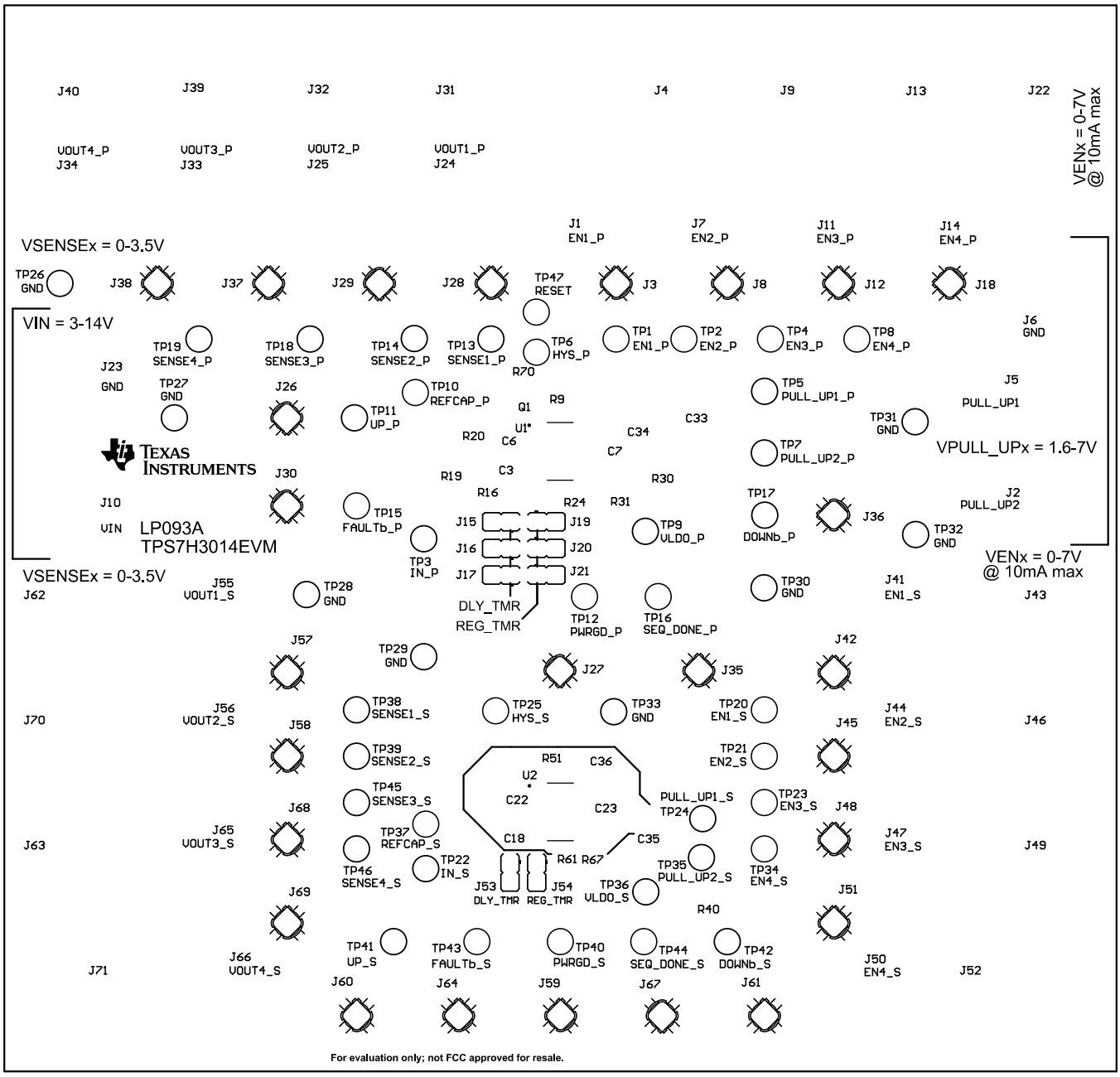


Figure 4-2. Top Overlay

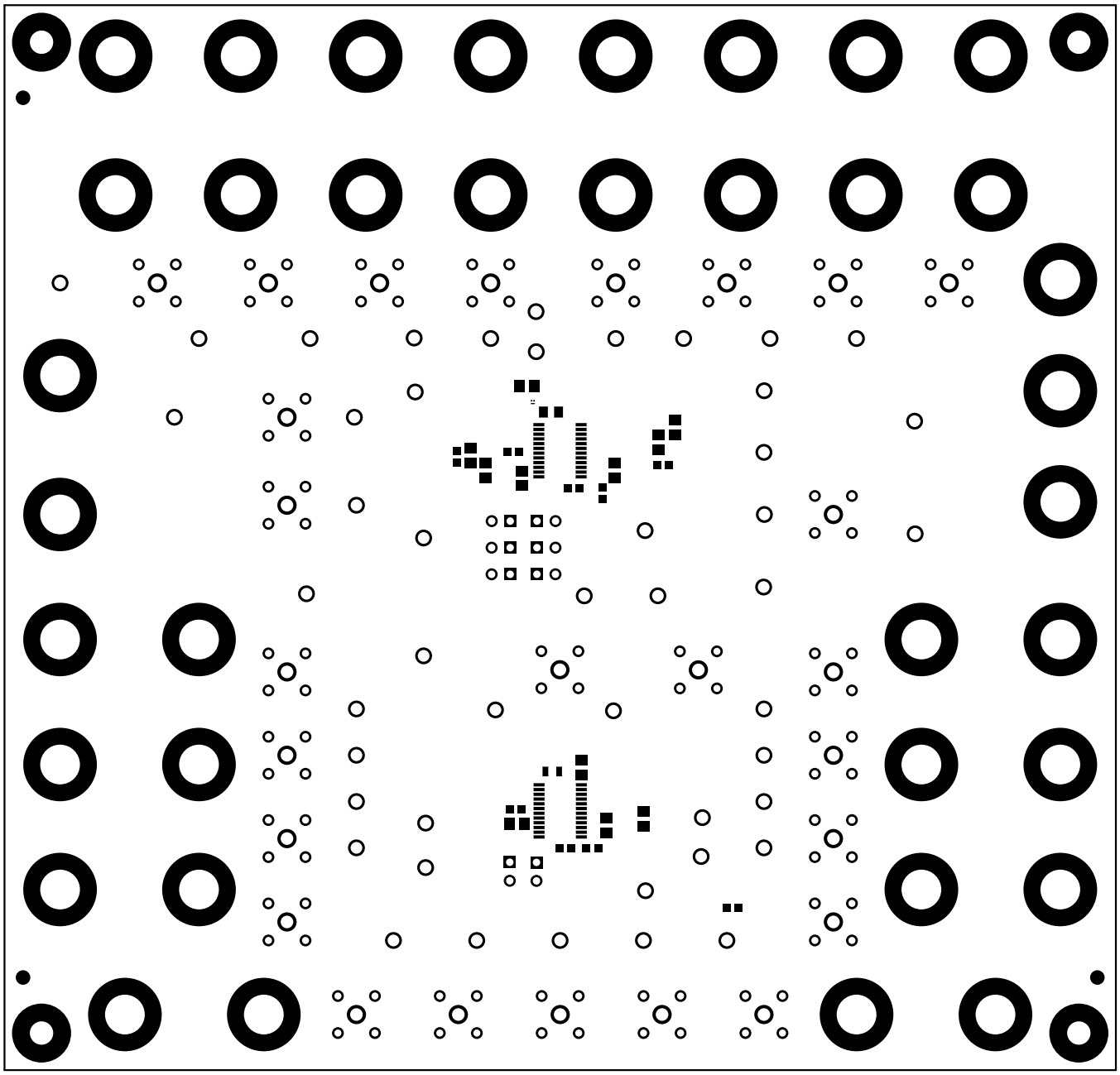


Figure 4-3. Top Solder Mask

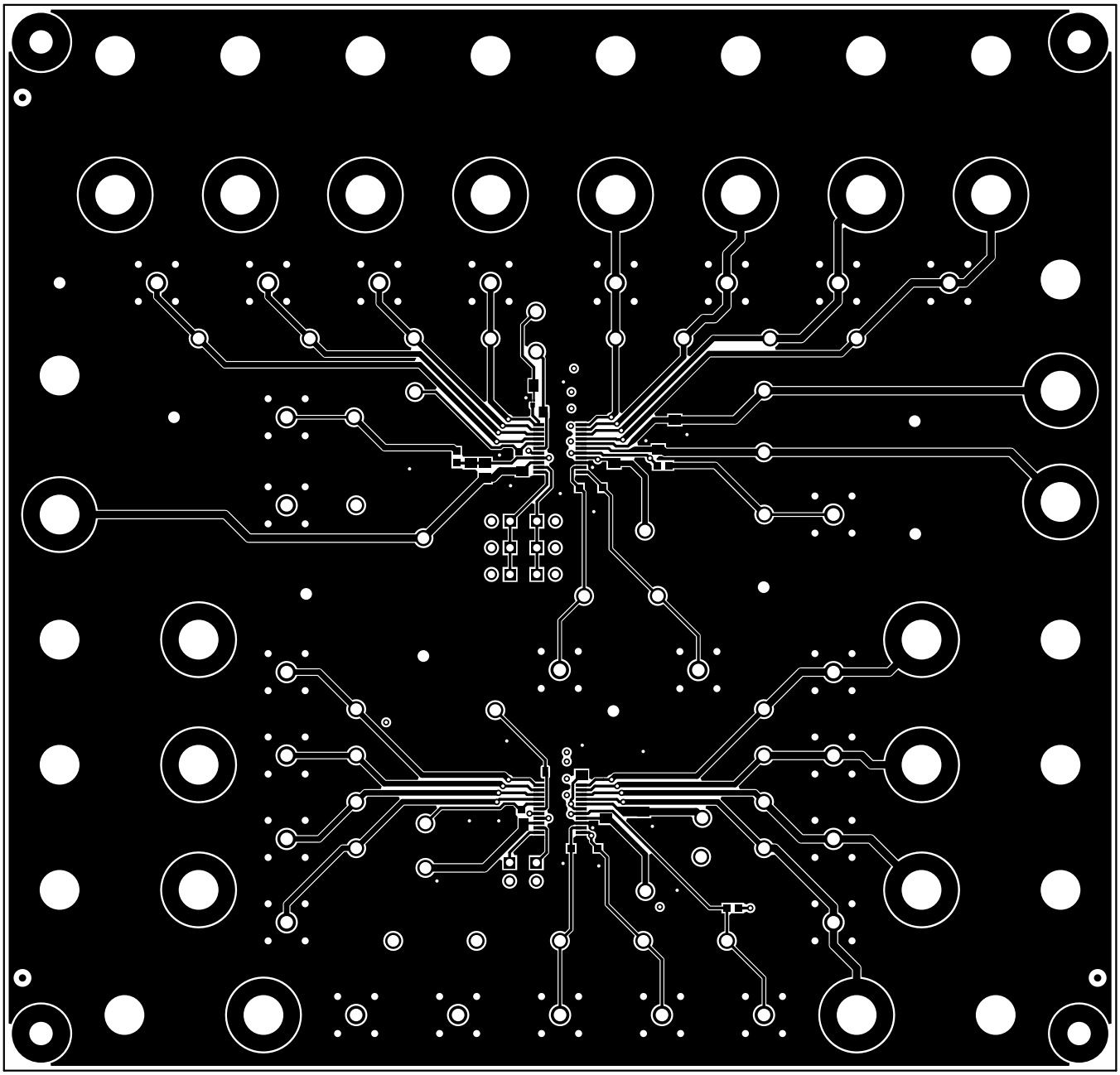


Figure 4-4. Layer 1 (Top)

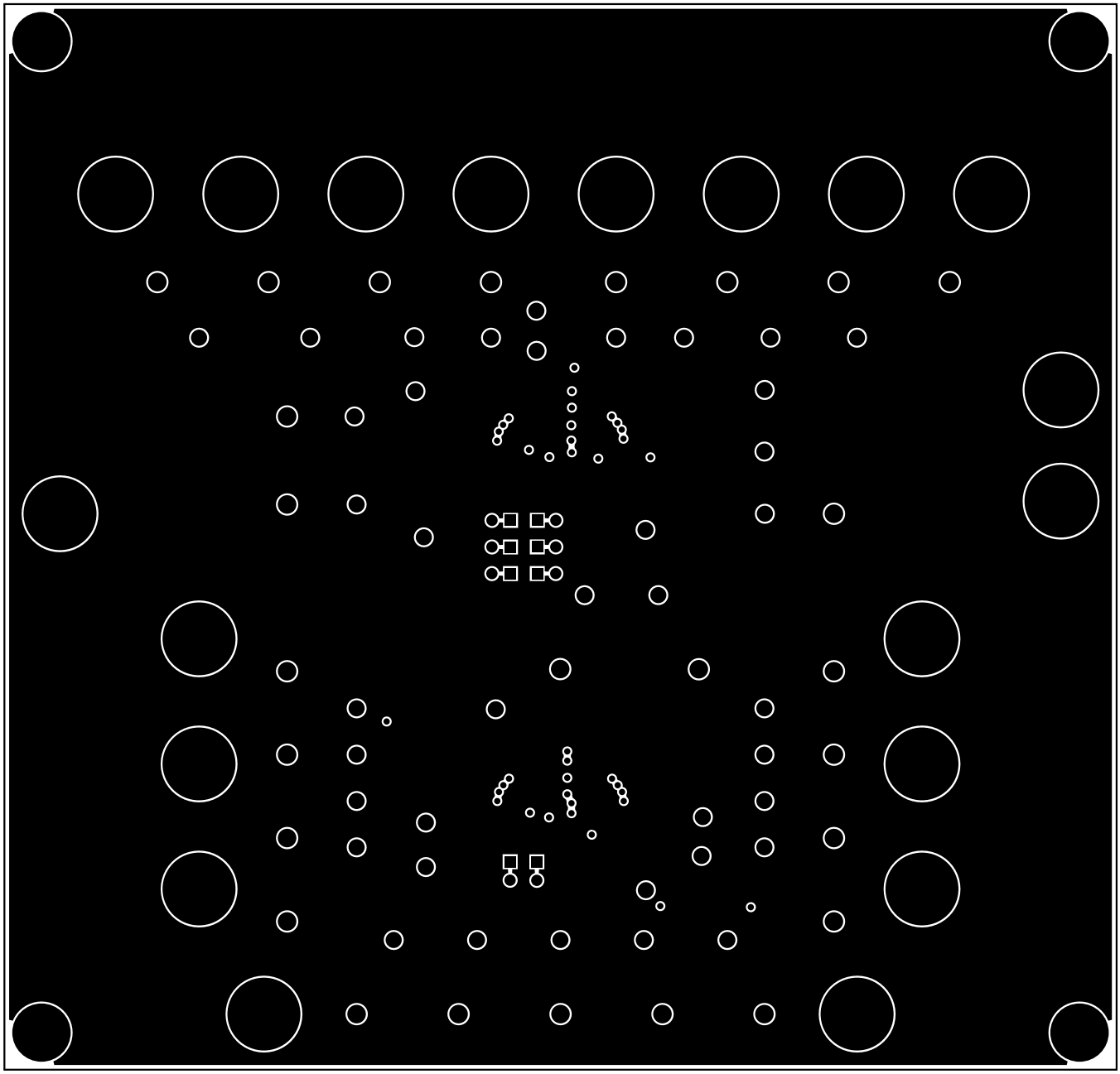


Figure 4-5. Layer 2

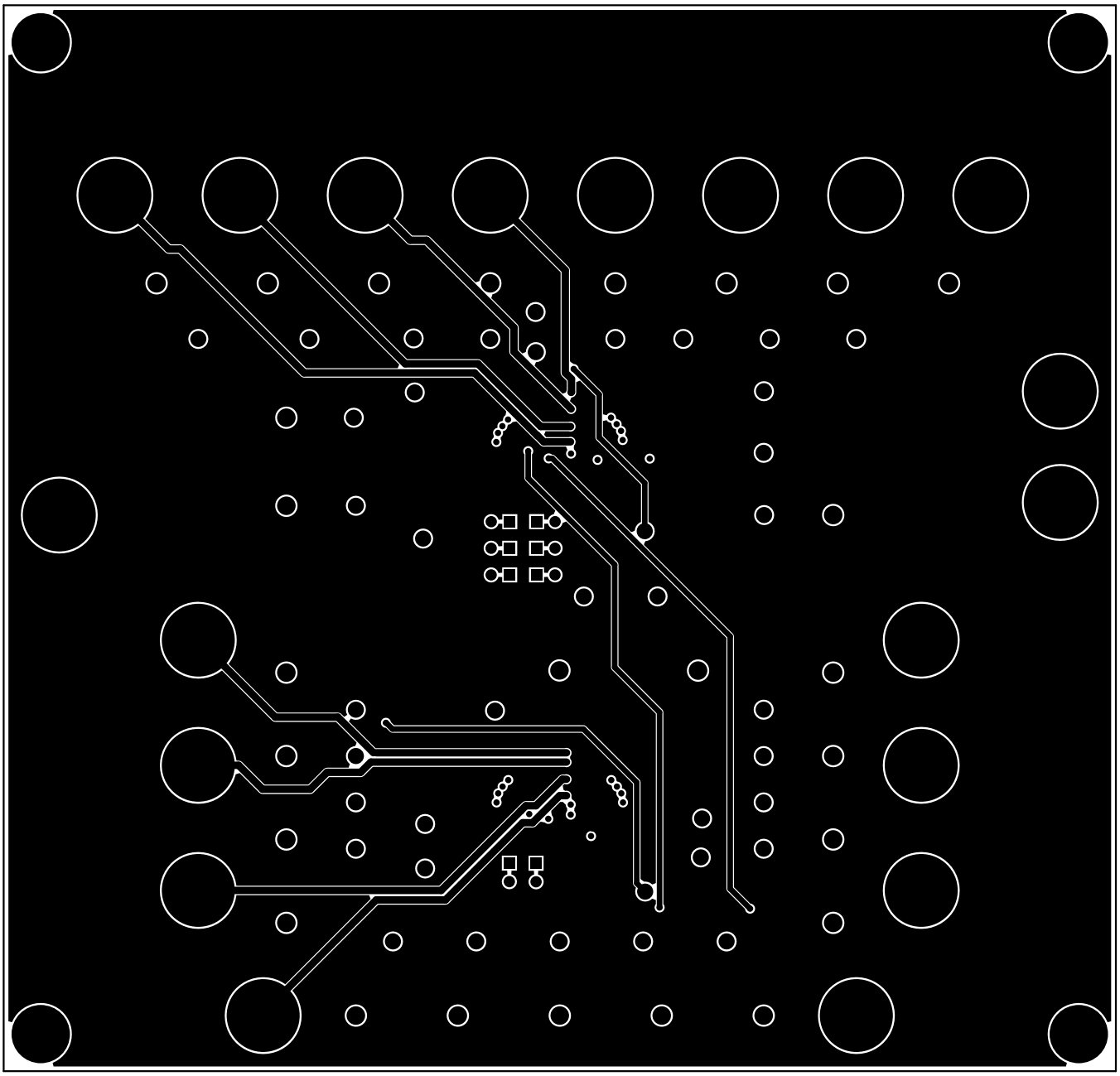


Figure 4-6. Layer 3

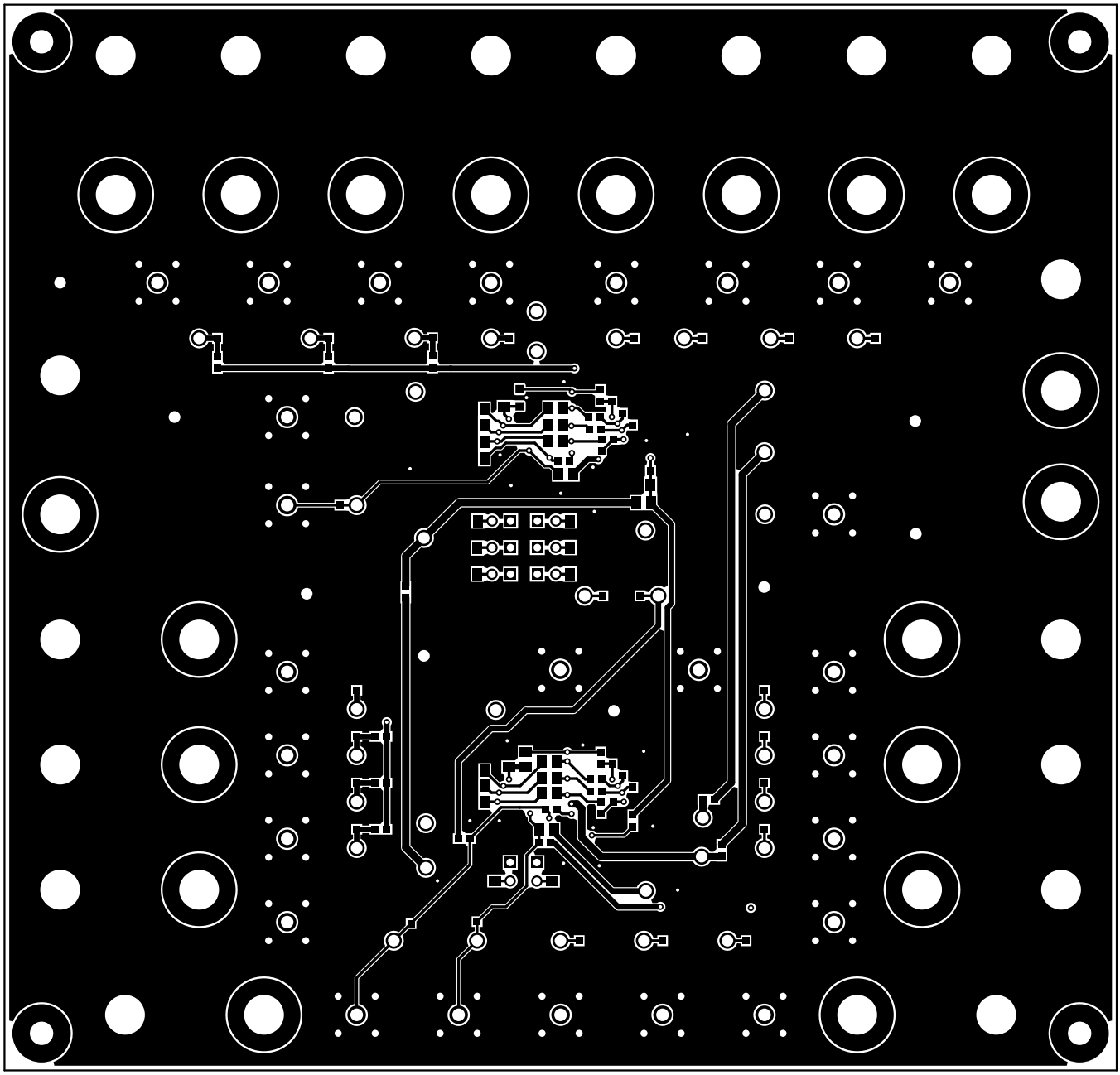


Figure 4-7. Layer 4 (Bottom)

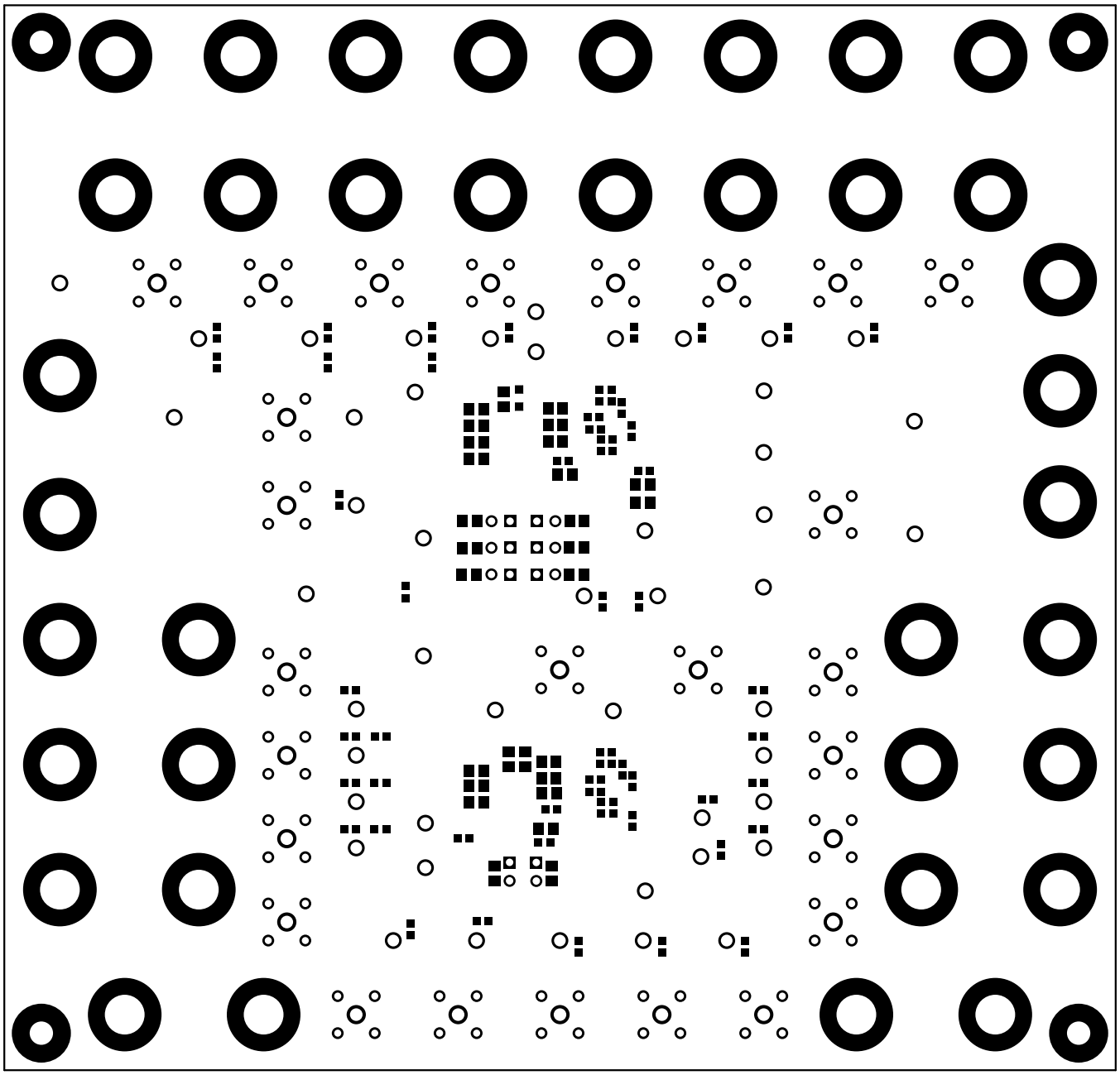


Figure 4-8. Bottom Solder Mask

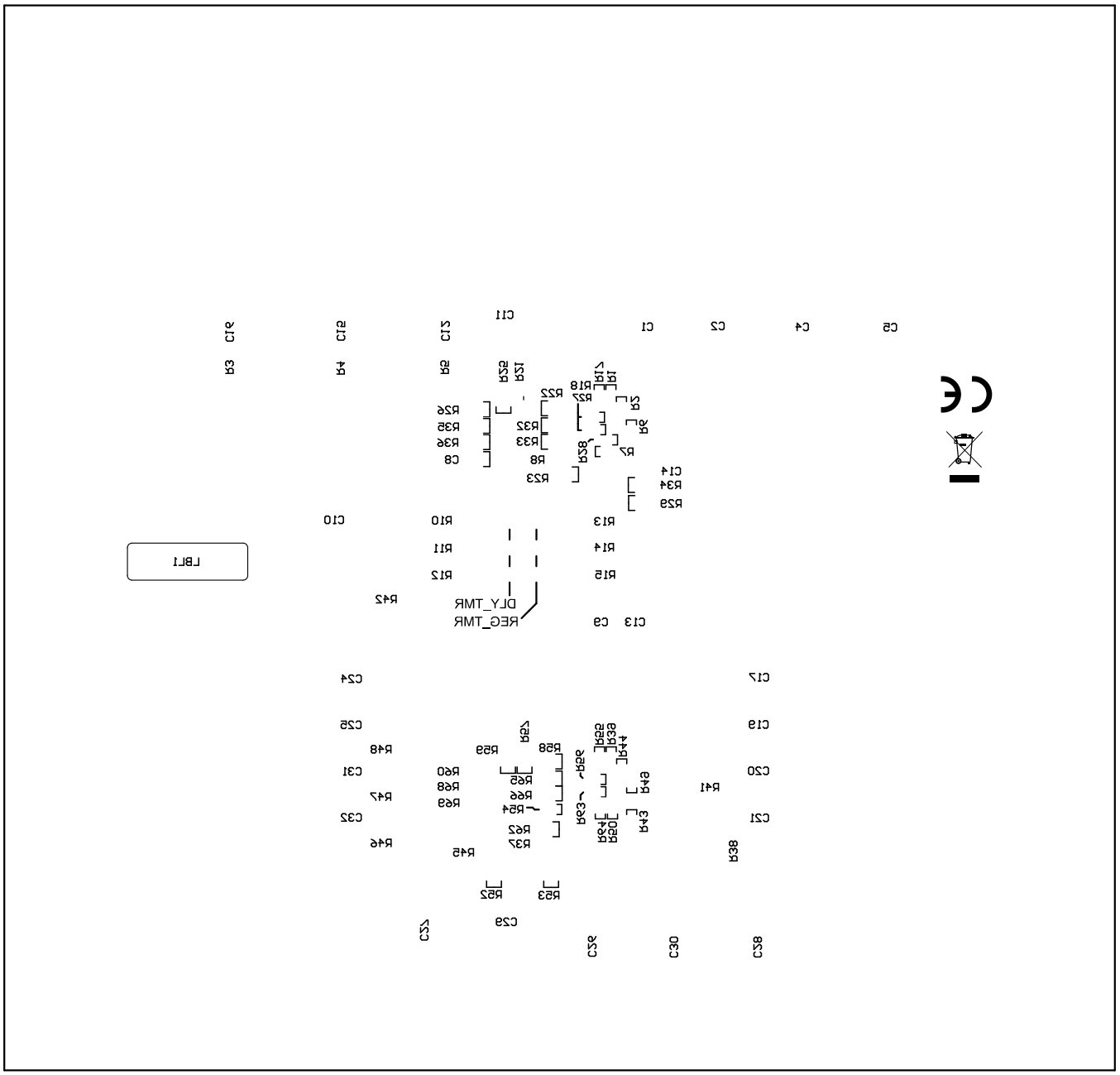


Figure 4-9. Bottom Overlay

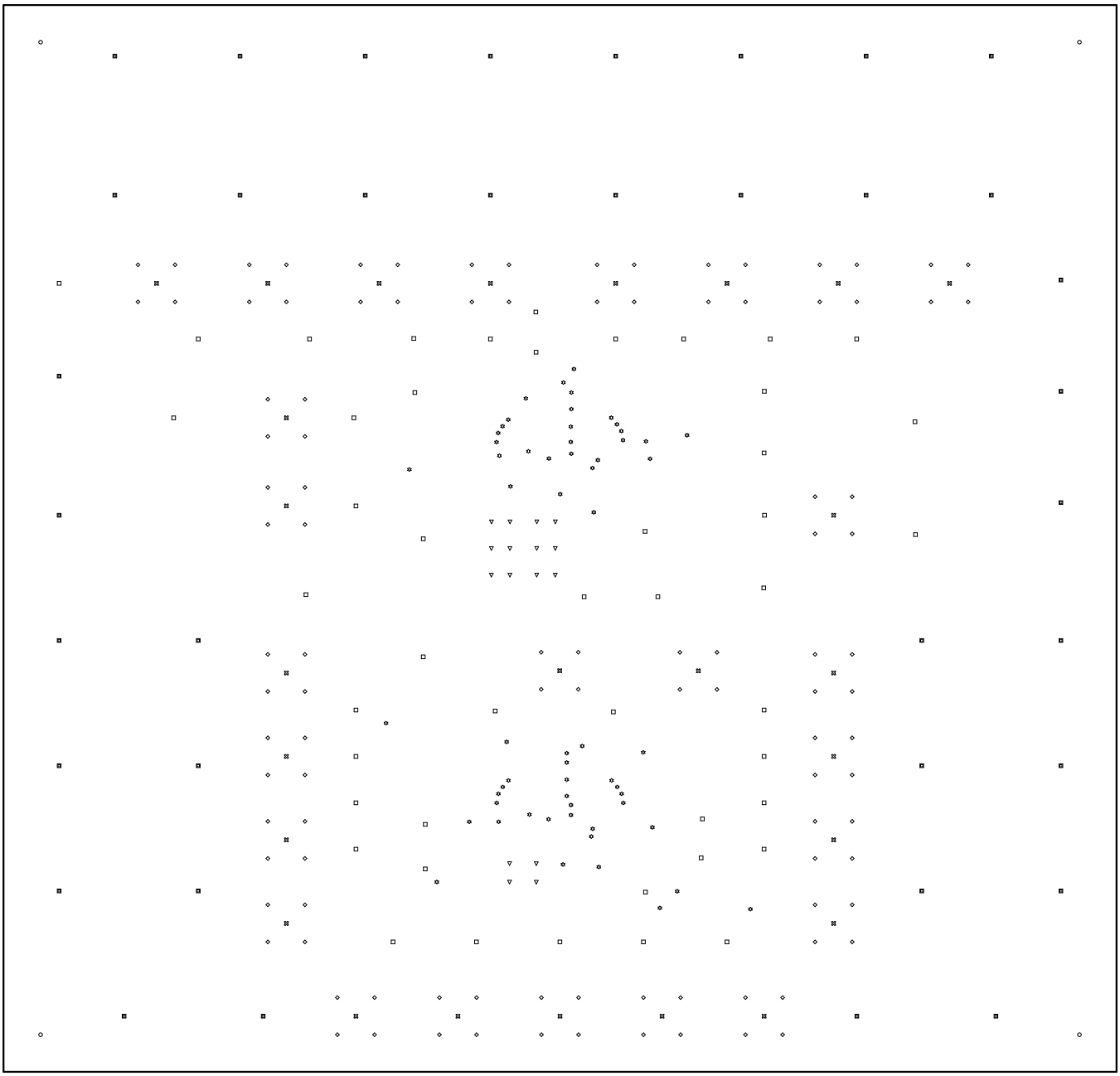


Figure 4-10. Drill Drawing

4.3 Bill of Materials (BOM)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
C3, C7, C33, C34	4	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X7R, 0805	0805	08055C105KAT2A	AVX
C6	1	0.47uF	CAP, CERM, 0.47 uF, 25 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71E474KA64D	MuRata
C8	1	3.3uF	CAP, CERM, 3.3 uF, 35 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805	CGA4J1X7R1V335K125AC	TDK
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2, J4, J5, J6, J7, J9, J10, J11, J13, J14, J22, J23, J24, J25, J31, J32, J33, J34, J39, J40, J41, J43, J44, J46, J47, J49, J50, J52, J55, J56, J62, J63, J65, J66, J70, J71	37		Standard Banana Jack, Uninsulated, 5.5mm	Keystone_575-4	575-4	Keystone
J15, J16, J17, J19, J20, J21, J53, J54	8		Header, 50mil, 2x1, Gold, TH	2x1 Header	GRPB021VWVN-RC	Sullins Connector Solutions
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady
R9	1	50k	50 kOhms ±0.1% 0.2W, 1/5W Chip Resistor 0805 (2012 Metric) Anti-Sulfur, Moisture Resistant, Non-Inductive Thin Film	0805	PTN0805E5002BST1	Vishay
R10, R13, R16, R29	4	10.0k	RES, 10.0 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD0710KL	Yageo America
R11, R14	2	619k	RES, 619 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD07619KL	Yageo America
R12, R15	2	1.17Meg	RES, 1.17 M, 0.1%, 0.125 W, 0805	0805	RT0805BRD071M17L	Yageo America
R17, R18, R19, R27, R28, R30	6	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R20	1	620	RES, 620, 0.1%, 0.125 W, 0805	0805	RG2012P-621-B-T5	Susumu Co Ltd
R21	1	60.4k	Res Thin Film 0805 60.4K Ohm 0.1% 0.125W(1/8W) ±25ppm/C Pad SMD Automotive T/R	0805	ERA-6AEB6042V	Panasonic Electronic Components
R22	1	49.9k	RES, 49.9 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD0749K9L	Yageo America

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
R23	1	10.0k	RES, 10.0 k, 0.1%, 0.2 W, AEC-Q200 Grade 0, 0805	0805	MCU0805MD1002BP100	Vishay/Beyschlag
R25	1	34.8k	RES, 34.8 k, 0.1%, 0.125 W, 0805	0805	RG2012P-3482-B-T5	Susumu Co Ltd
R26	1	40.2k	Res Thin Film 0805 40.2K Ohm 0.1% 1/8W ±25ppm/°C Molded SMD SMD Punched Carrier T/R	0805	ERA-6AEB4022V	Panasonic Electronic Components
R32	1	26.7k	RES, 26.7 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD0726K7L	Yageo America
R33	1	29.4k	RES, 29.4 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD0729K4L	Yageo America
R34	1	909	RES, 909, 0.1%, 0.125 W, 0805	0805	RT0805BRD07909RL	Yageo America
R35	1	130k	RES, 130 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD07130KL	Yageo America
R36	1	90.9k	RES, 90.9 k, 0.1%, 0.125 W, 0805	0805	RG2012P-9092-B-T5	Susumu Co Ltd
SH-J15, SH-J16, SH-J17, SH-J19, SH-J20, SH-J21, SH-J53, SH-J54	8		CONN SHUNT 1.27MM BLACK		M50-1900005	Harwin
TP1, TP2, TP4, TP8, TP20, TP21, TP23, TP34	8		Test Point, Multipurpose, Green, TH	Multipurpose Testpoint	5126	Keystone Electronics
TP3, TP5, TP7, TP22, TP24, TP35	6		Test Point, Multipurpose, Red, TH	Multipurpose Testpoint	5010	Keystone Electronics
TP6, TP10, TP25, TP37	4		Test Point, Multipurpose, Grey, TH	Multipurpose Testpoint	5128	Keystone Electronics
TP9, TP36	2		Test Point, Multipurpose, Orange, TH	Multipurpose Testpoint	5013	Keystone Electronics
TP11, TP17, TP41, TP42	4		Test Point, Multipurpose, Yellow, TH	Multipurpose Testpoint	5014	Keystone Electronics
TP12, TP15, TP16, TP40, TP43, TP44, TP47	7		Test Point, Multipurpose, Brown, TH	Multipurpose Testpoint	5125	Keystone Electronics
TP13, TP14, TP18, TP19, TP38, TP39, TP45, TP46	8		Test Point, Multipurpose, Blue, TH	Multipurpose Testpoint	5127	Keystone Electronics
TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33	8		Test Point, Multipurpose, Black, TH	Multipurpose Testpoint	5011	Keystone Electronics
U1	1		Radiation-Tolerant, 14-V, 4-Channel Sequencer	TSSOP-24	TPS7H3014MPWTSEP	Texas Instruments
C1, C2, C4, C5, C9, C10, C11, C12, C13, C14, C15, C16, C17, C19, C20, C21, C24, C25, C26, C27, C28, C29, C30, C31, C32	0	100pF	CAP, CERM, 100 pF, 50 V,+/- 1%, C0G/NP0, 0603	0603	C0603C101F5GACTU	Kemet

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
C18, C23, C35, C36	0	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X7R, 0805	0805	08055C105KAT2A	AVX
C22	0	0.47uF	CAP, CERM, 0.47 uF, 25 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71E474KA64D	MuRata
J3, J8, J12, J18, J26, J27, J28, J29, J30, J35, J36, J37, J38, J42, J45, J48, J51, J57, J58, J59, J60, J61, J64, J67, J68, J69	0		Compact Probe Tip Circuit Board Test Points, TH, 25 per	TH Scope Probe	131-5031-00	Tektronix
Q1	0	12V	MOSFET, N-CH, 12 V, 3.6 A, YJM0003A (PICOSTAR-3)	YJM0003A	CSD13380F3	Texas Instruments
R1, R2, R6, R7, R24, R31, R39, R44, R49, R50, R61, R67	0	49.9k	RES, 49.9 k, 1%, 0.1 W, 0603	0603	RC0603FR-0749K9L	Yageo
R3, R4, R5, R8, R37, R38, R40, R41, R42, R43, R45, R46, R47, R48, R54, R55, R56, R63, R64	0	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R51	0	50k	50 kOhms ±0.1% 0.2W, 1/5W Chip Resistor 0805 (2012 Metric) Anti-Sulfur, Moisture Resistant, Non-Inductive Thin Film	0805	PTN0805E5002BST1	Vishay
R52, R53	0	10.0k	RES, 10.0 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD0710KL	Yageo America
R57, R68	0	49.9k	RES, 49.9 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD0749K9L	Yageo America
R58	0	14.5k	RES, 14.5 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD0714K5L	Yageo America
R59	0	40.2k	Res Thin Film 0805 40.2K Ohm 0.1% 1/8W ±25ppm/°C Molded SMD SMD Punched Carrier T/R	0805	ERA-6AEB4022V	Panasonic Electronic Components
R60	0	34.8k	RES, 34.8 k, 0.1%, 0.125 W, 0805	0805	RG2012P-3482-B-T5	Susumu Co Ltd
R62, R70	0	10.0k	RES, 10.0 k, 0.1%, 0.2 W, AEC-Q200 Grade 0, 0805	0805	MCU0805MD1002BP100	Vishay/Beyschlag
R65	0	40.2k	RES, 40.2 k, 0.1%, 0.125 W, 0805	0805	RG2012P-4022-B-T5	Susumu Co Ltd
R66	0	1.00k	RES, 1.00 k, 0.1%, 0.25 W, 0805	0805	RP73PF2A1K0BTDF	TE Connectivity
R69	0	1.07k	RES, 1.07 k, 0.1%, 0.125 W, 0805	0805	RT0805BRD071K07L	Yageo America
U2	0		Radiation-Tolerant, 14-V, 4-Channel Sequencer	TSSOP-24	TPS7H3014MPWTSEP	Texas Instruments

5 Compliance Information

5.1 Compliance and Certifications

- Texas Instruments, TPS7H3014EVM EU RoHS Declaration of Conformity (DoC)

6 Related Documentation

- Texas Instruments, Standard Terms for Evaluation Modules

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

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