

ENVISIONING • EMPOWERING • EXCELLING



**MxL7704**  
**Five Output Universal PMIC**  
EVB User Manual

## Revision History

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| Revision | Release Date | Change Description  |
|----------|--------------|---|
| 1A       | 2/28/18      | Initial Release   |
| 019UMR00 | 11/22/19     | Correct inductor count in MxL7704-X BOM. Update cover page. |

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# Introduction

The MxL7704 evaluation board provides a platform to evaluate the features and performance of the MxL7704. The MxL7704 is a five output Universal PMIC optimized for powering low power FPGAs, DSPs, and microprocessors from 5V inputs.

The MxL7704 power module and evaluation board come in two configurations which are summarized in Table 1.

Please refer to the [MxL7704 datasheet](#) for additional information about the MxL7704.

# Ordering Information

**Table 1: Evaluation Board Ordering Part Numbers<sup>(1)</sup>**

| PMIC          | Evaluation Board | Channel           | Output Voltage (V) | Switching Frequency (MHz) |
|---------------|------------------|-------------------|--------------------|---------------------------|
| MxL7704-AQB-T | MxL7704-A-EVB    | V <sub>OUT1</sub> | 3.3                | 1.5                       |
|               |                  | V <sub>OUT2</sub> | 1.8                |                           |
|               |                  | V <sub>OUT3</sub> | 1.35               |                           |
|               |                  | V <sub>OUT4</sub> | 1.2                |                           |
| MxL7704-XQB-T | MxL7704-X-EVB    | V <sub>OUT1</sub> | 3.3                | 1                         |
|               |                  | V <sub>OUT2</sub> | 1.8                |                           |
|               |                  | V <sub>OUT3</sub> | 1.35               |                           |
|               |                  | V <sub>OUT4</sub> | 0.85               |                           |

NOTE:

1. Refer to [www.exar.com/MxL7704](http://www.exar.com/MxL7704) for most up-to-date Ordering Information

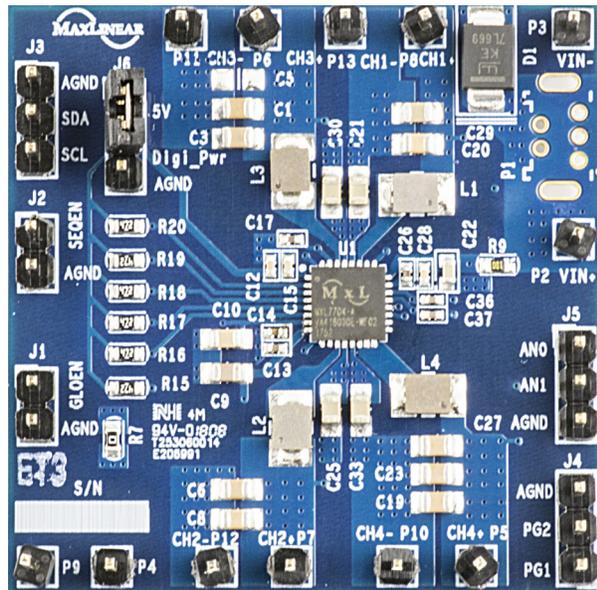


Figure 1: Top View of MxL7704-A-EVB

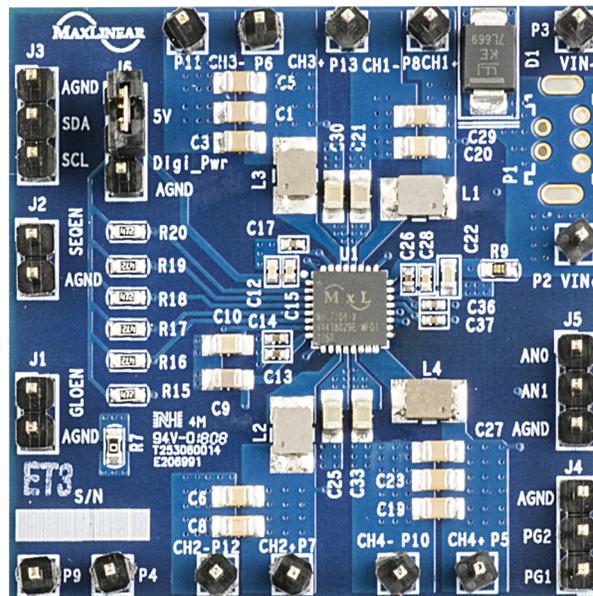


Figure 2: Top View of MxL7704-X-EVB

## Evaluation Board Overview

The block diagram shown in Figure 3 illustrates the connection points.

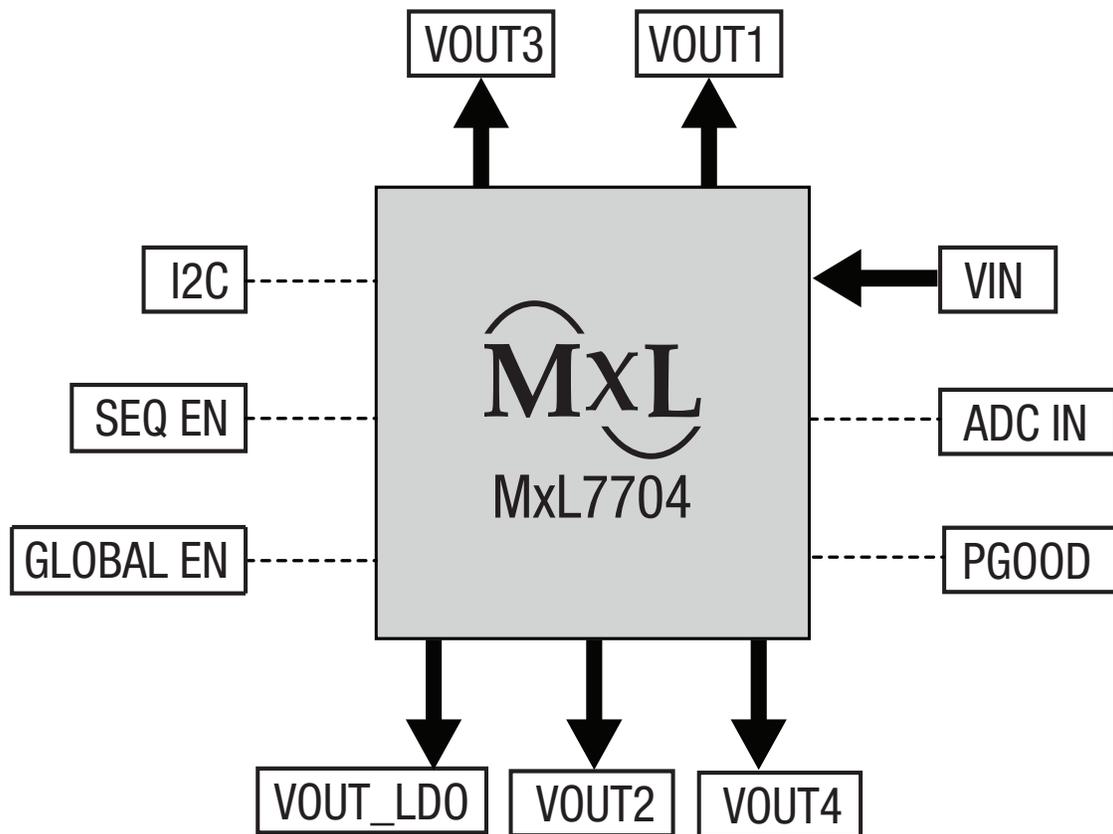


Figure 3: Block Diagram MxL7704 EVB

### System Set-Up

Jumpers are factory installed per Table 2 to configure the EVB for operation. Jumper and testing options are described in the next sections. Refer to the product data sheet for additional information.

**Table 2: Factory Settings**

| Jumper          | Factory Setting | Description                    |
|-----------------|-----------------|--------------------------------|
| Digi_Pwr to P5V | J6, Jumper 1-2  | Enables all pull-up resistors. |

## Powering Up the Evaluation Board

- Connect P2 (VIN+) and P3 (VIN-) to a 5V power supply. See Note A.
- Turn on the power supply. The EVB will power up and regulate the outputs as follows:
  - Channel 1: 3.3V
  - Channel 2: 1.8V
  - Channel 3: 1.35V
  - Channel 4: 1.2V (MXL7704-A-EVB) or 0.85V (MXL7704-X-EVB)
  - LDO: 3.3V

## Monitoring or Testing $V_{OUT}$

- The outputs may be left open or connected to an external load. A low impedance connection will provide the best load regulation.

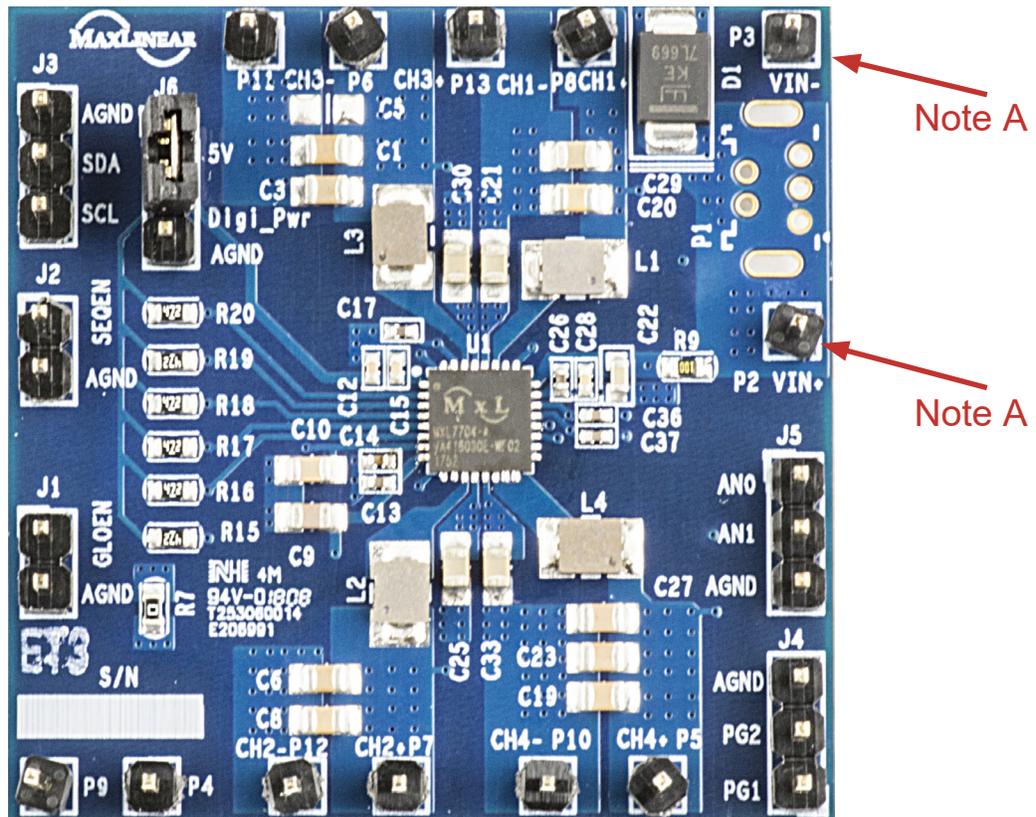
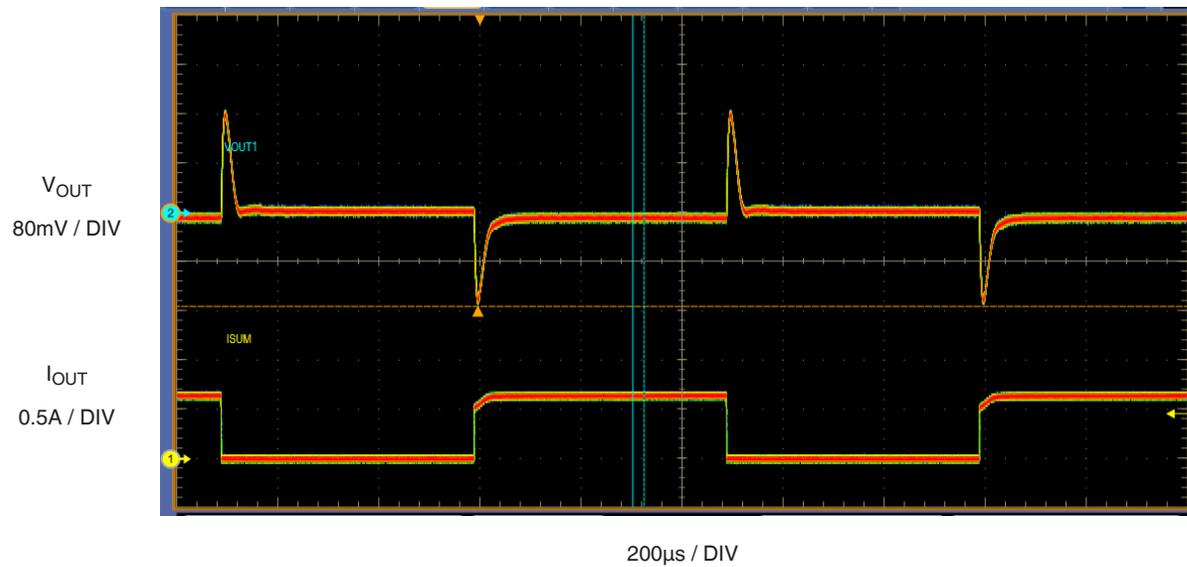


Figure 4:  $V_{IN}$  Connection

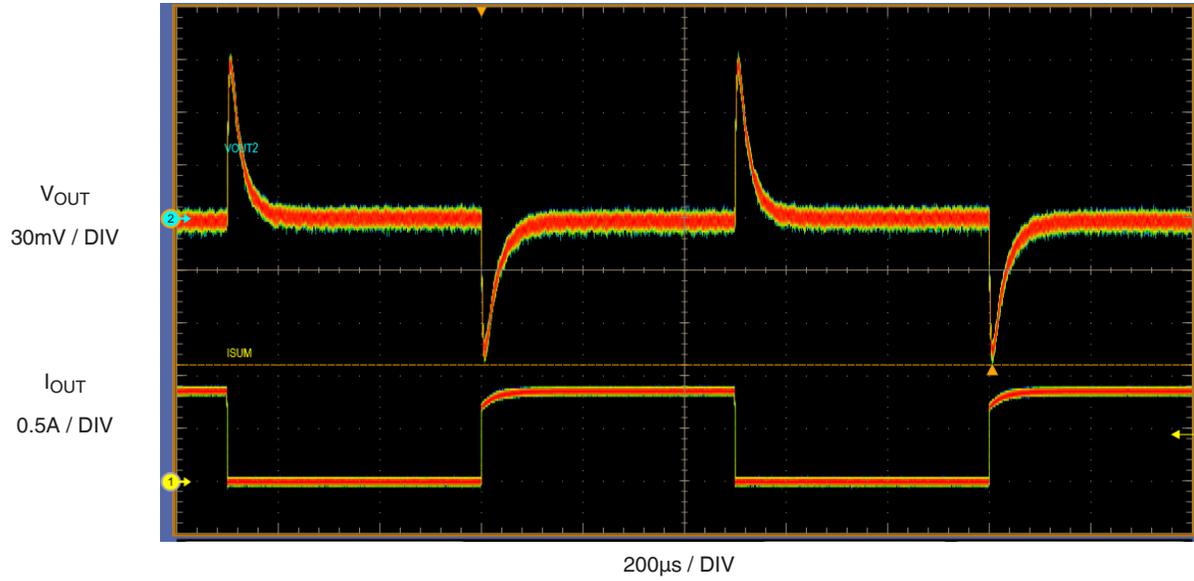
## Typical Output Transient Response

The following waveforms were captured on the MXL7704-A-EVB and MXL7704-X-EVB.



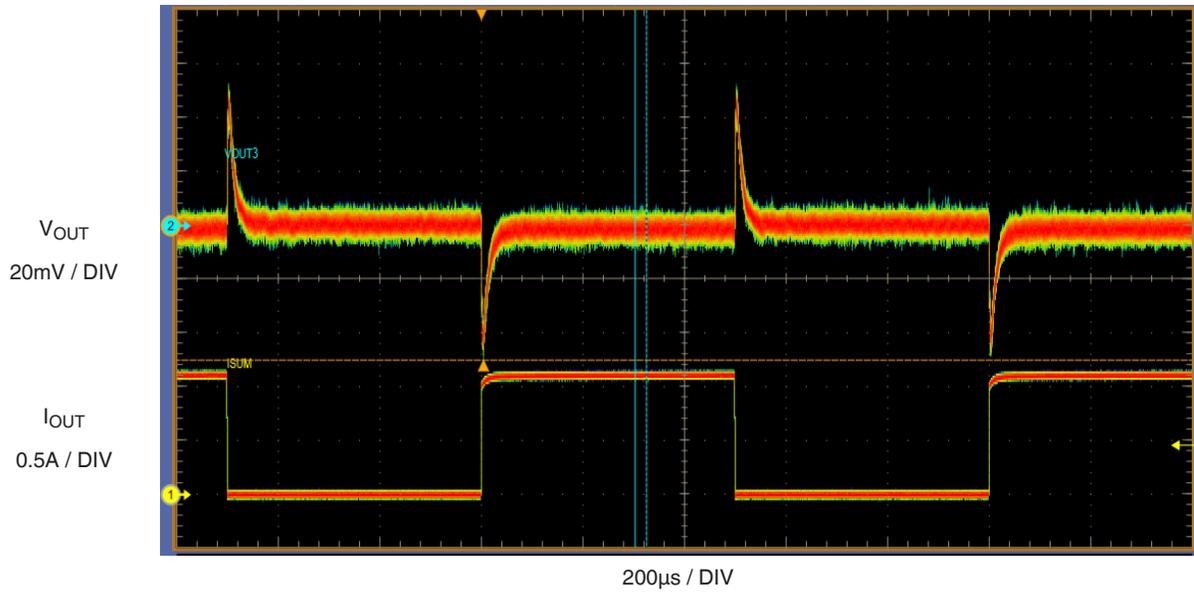
$V_{IN} = 5V$ ,  $V_{OUT} = 3.3V$  at  $1A/\mu s$  Load Step  
 $f = 1kHz$   
 $L_{OUT} = 2.2\mu H$   
 $C_{OUT} = 22\mu F$ , 6.3V X5R Ceramic  
 $C_{OUT} = 2 \times 10\mu F$ , 6.3V X5R Ceramic

Figure 5: 3.3V Output Transient Response on Channel 1



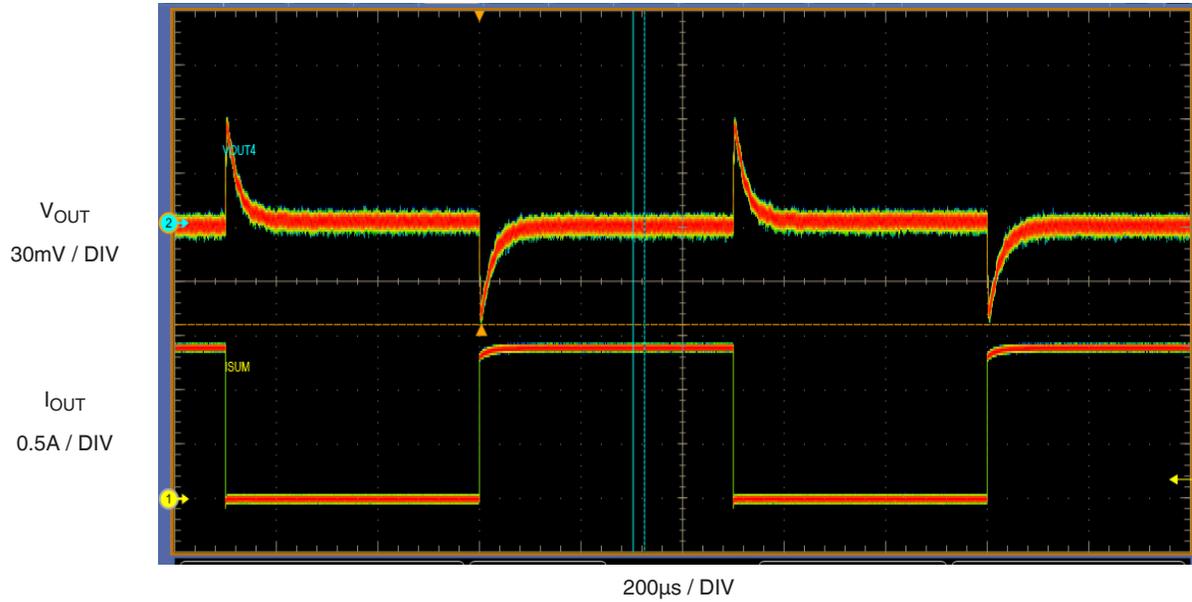
$V_{IN} = 5V$ ,  $V_{OUT} = 1.8V$  at  $1A/\mu s$  Load Step  
 $f = 1kHz$   
 $L_{OUT} = 1\mu H$   
 $C_{OUT} = 2 \times 22\mu F$ , 6.3V X5R Ceramic  
 $C_{OUT} = 10\mu F$ , 6.3V X5R Ceramic

Figure 6: 1.8V Output Transient Response on Channel 2



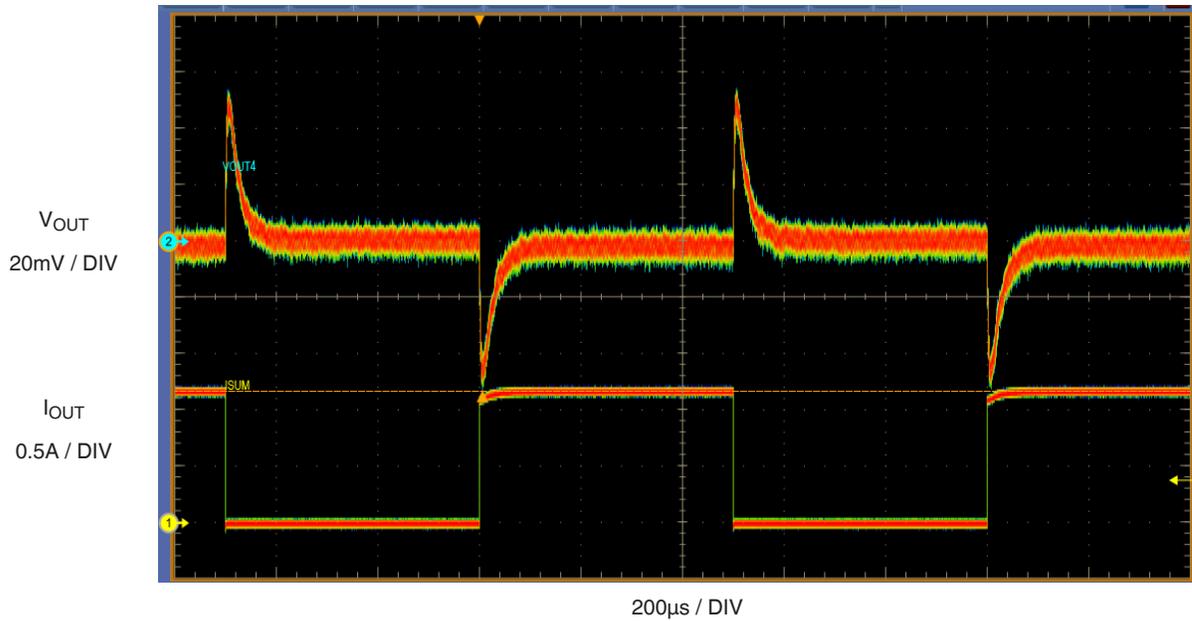
$V_{IN} = 5V$ ,  $V_{OUT} = 1.35V$  at  $1A/\mu s$  Load Step  
 $f = 1kHz$   
 $L_{OUT} = 0.47\mu H$   
 $C_{OUT} = 2 \times 22\mu F$ , 6.3V X5R Ceramic

Figure 7: 1.35V Output Transient Response on Channel 3



$V_{IN} = 5V$ ,  $V_{OUT} = 1.2V$  at  $10A/\mu s$  Load Step  
 $f = 1kHz$   
 $L_{OUT} = 0.47\mu H$   
 $C_{OUT} = 3 \times 47\mu F$ , 6.3V X5R Ceramic

Figure 8: MxL7704-AQB 1.2V Output Transient Response on Channel 4



$V_{IN} = 5V$ ,  $V_{OUT} = 0.85V$  at  $10A/\mu s$  Load Step  
 $f = 1kHz$   
 $L_{OUT} = 0.47\mu H$   
 $C_{OUT} = 5 \times 47\mu F$ , 6.3V X5R Ceramic

Figure 9: MxL7704-XQB 0.85V Output Transient Response on Channel 4

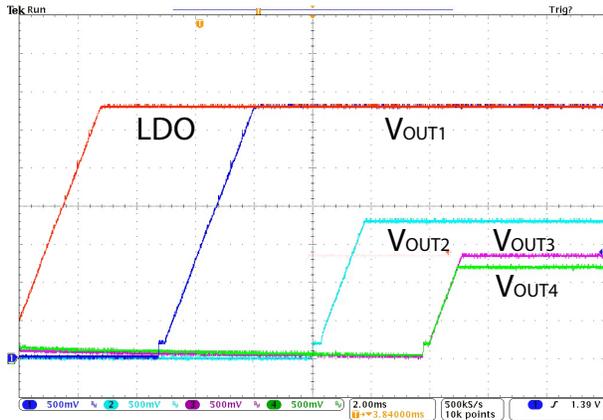


Figure 10: MxL7704-AQB Power-Up Sequencing

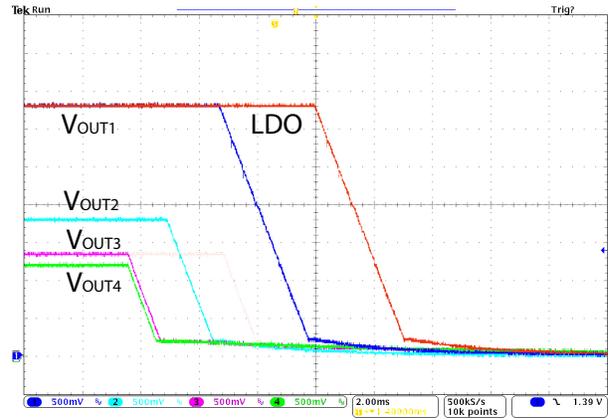


Figure 11: MxL7704-AQB Power-Down Sequencing

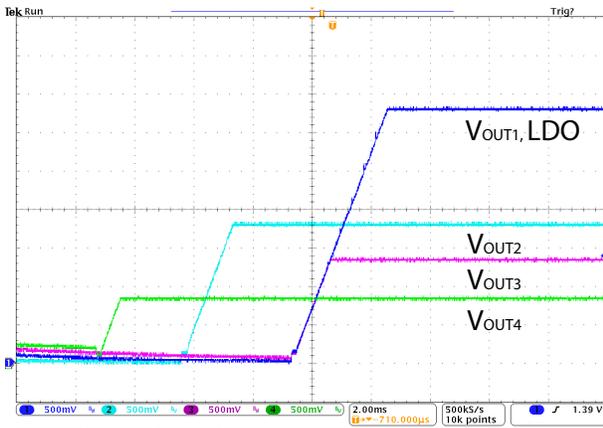


Figure 12: MxL7704-XQB Power-Up Sequencing

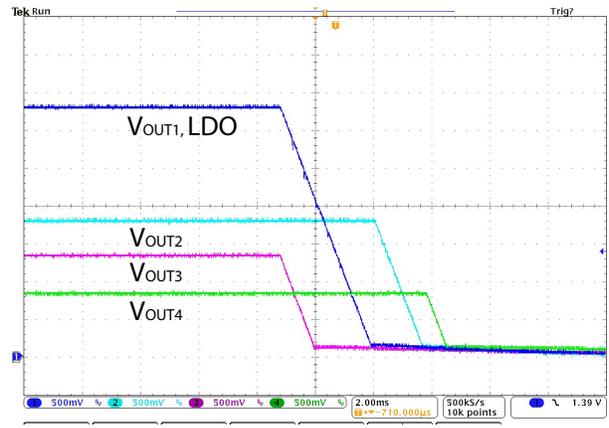
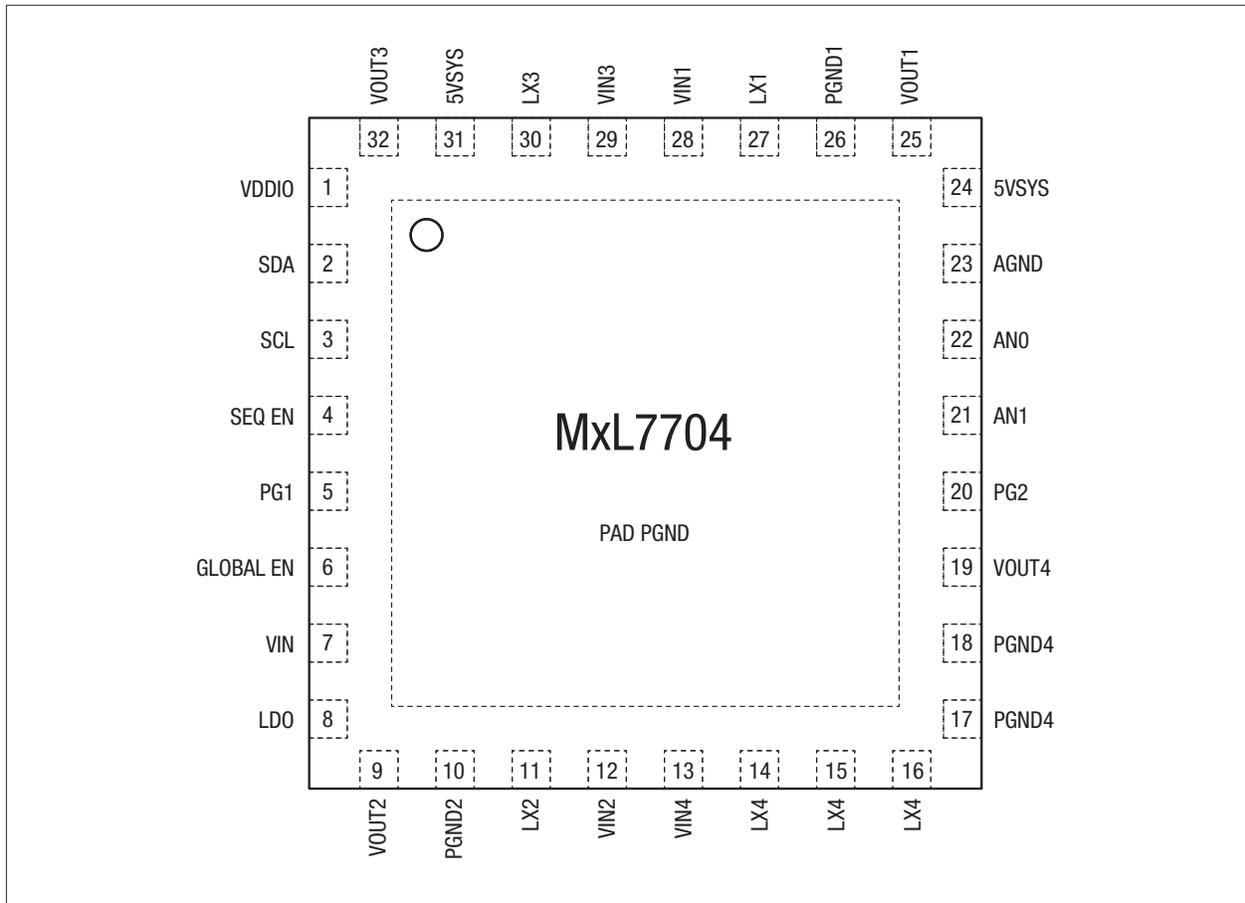


Figure 13: MxL7704-XQB Power-Down Sequencing

# Pin Configuration



Top View, 5mm x 5mm QFN-32

Figure 14: Pin Configuration

# MxL7704-A-EVB Schematic

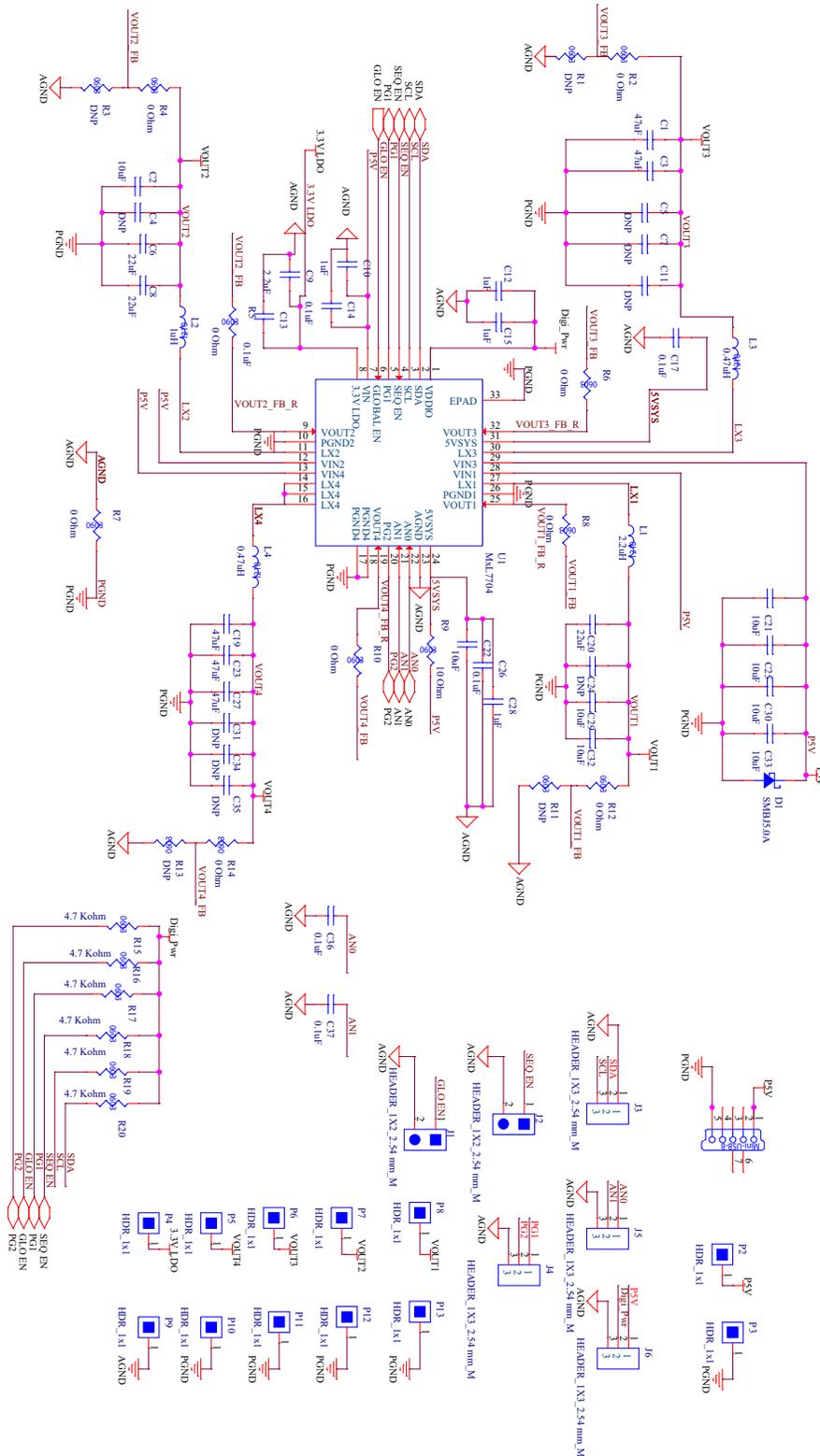


Figure 15: MxL7704-A-EVB Schematic

# MxL7704-X-EVB Schematic

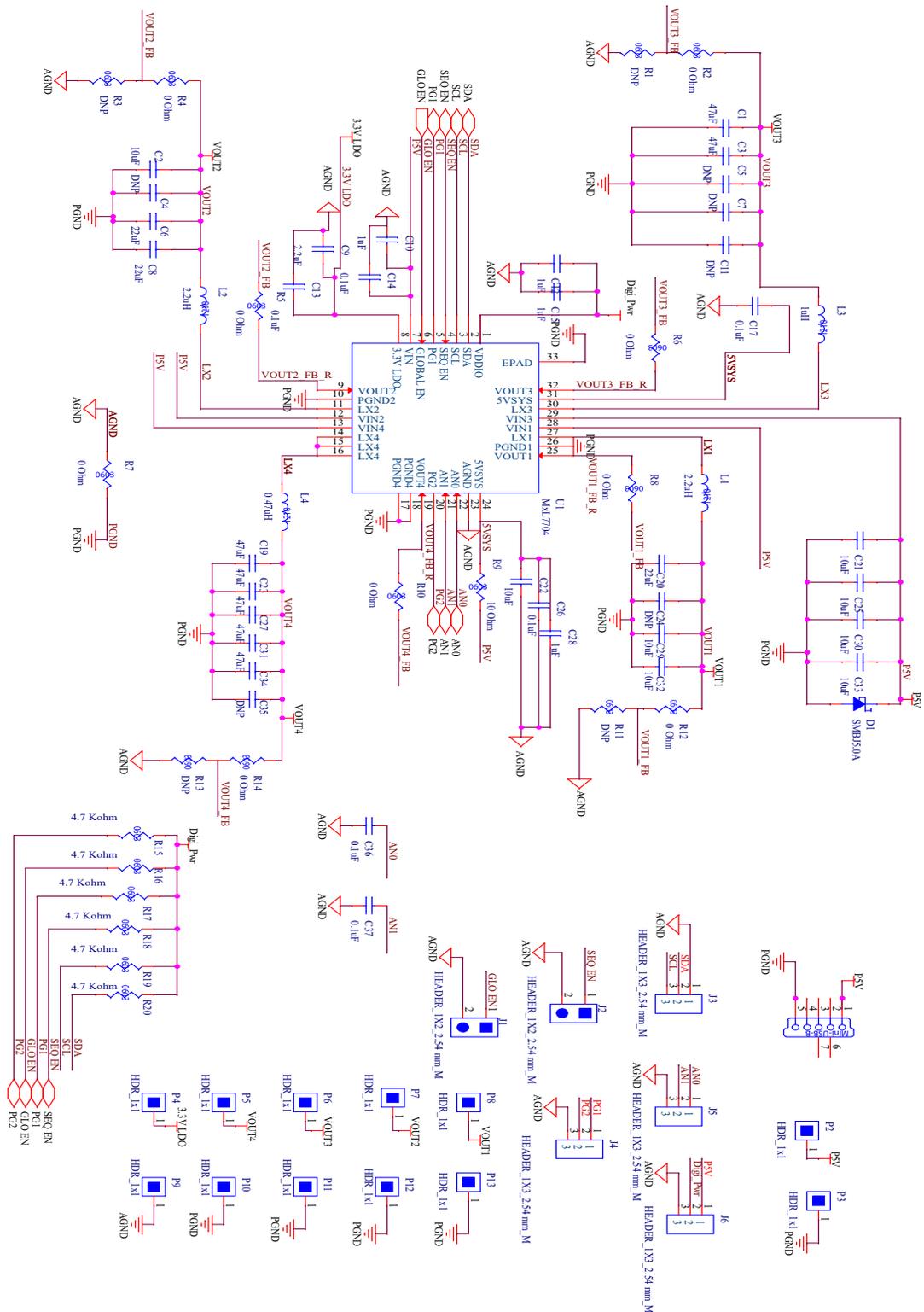


Figure 16: MxL7704-X-EVB Schematic

# MxL7704 EVB PCB Layers

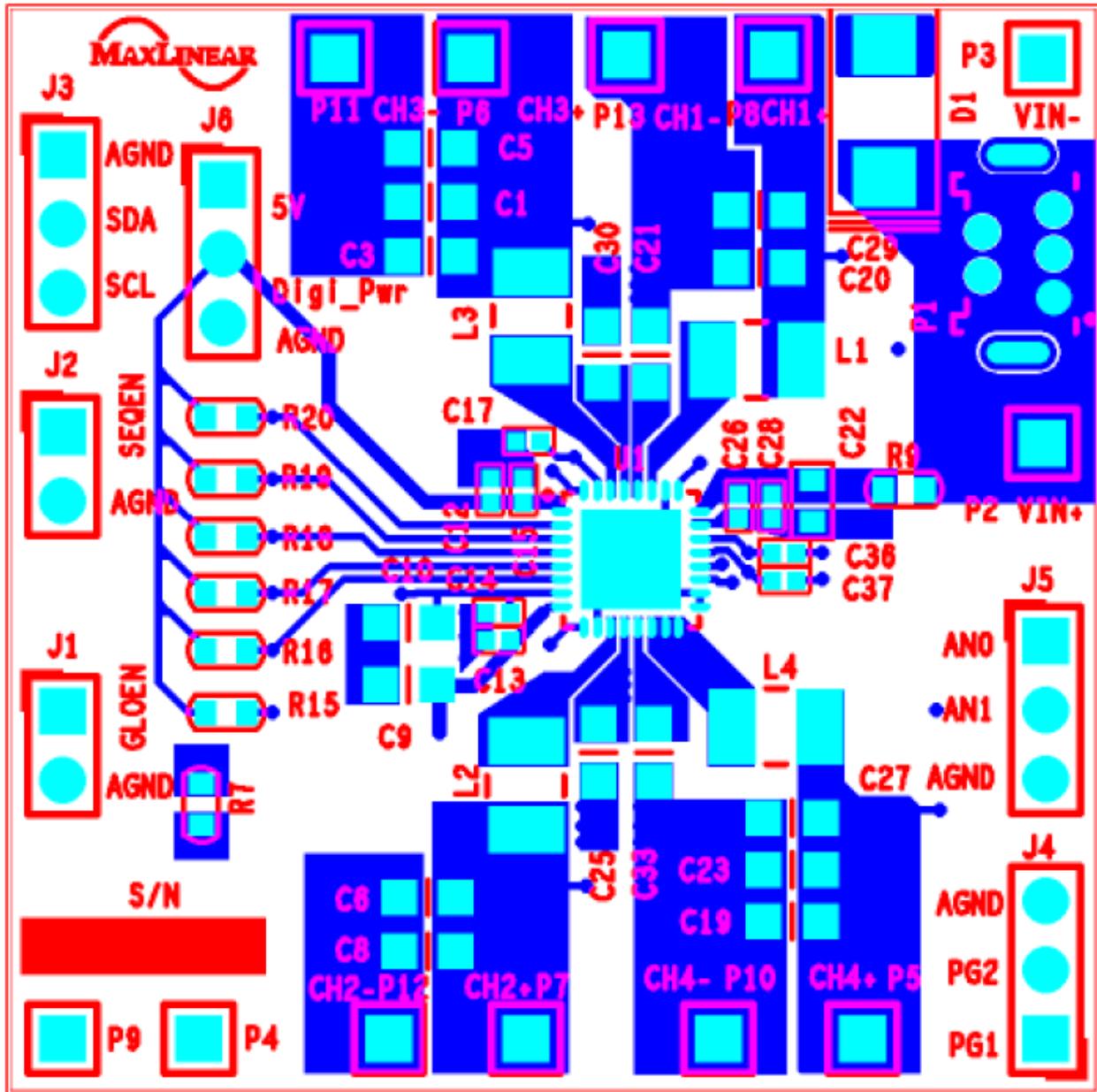


Figure 17: EVB PCB, Top View

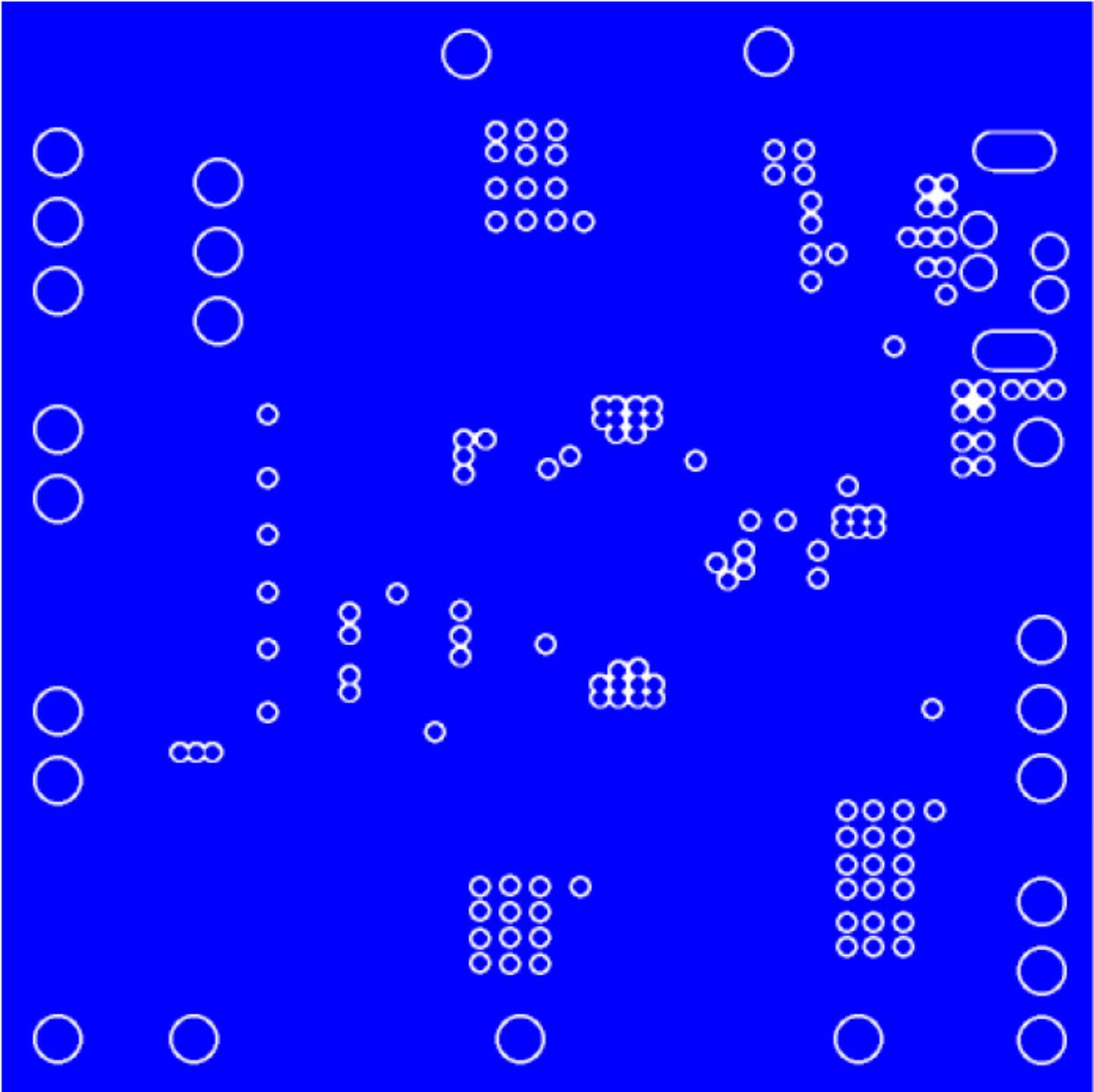


Figure 18: EVB PCB Layer 2, Ground Plane

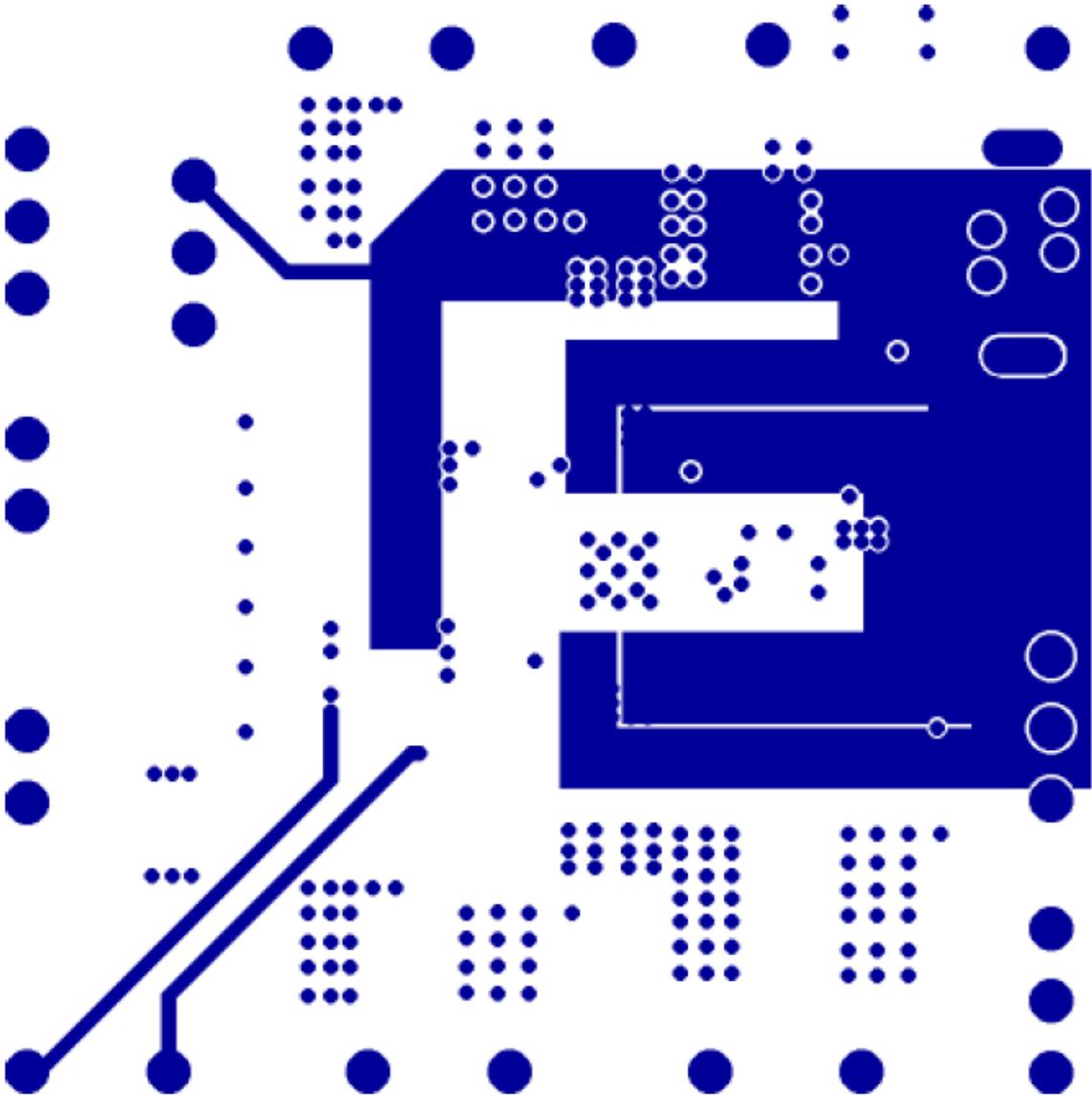


Figure 19: EVB PCB Layer 3, Signal Plane

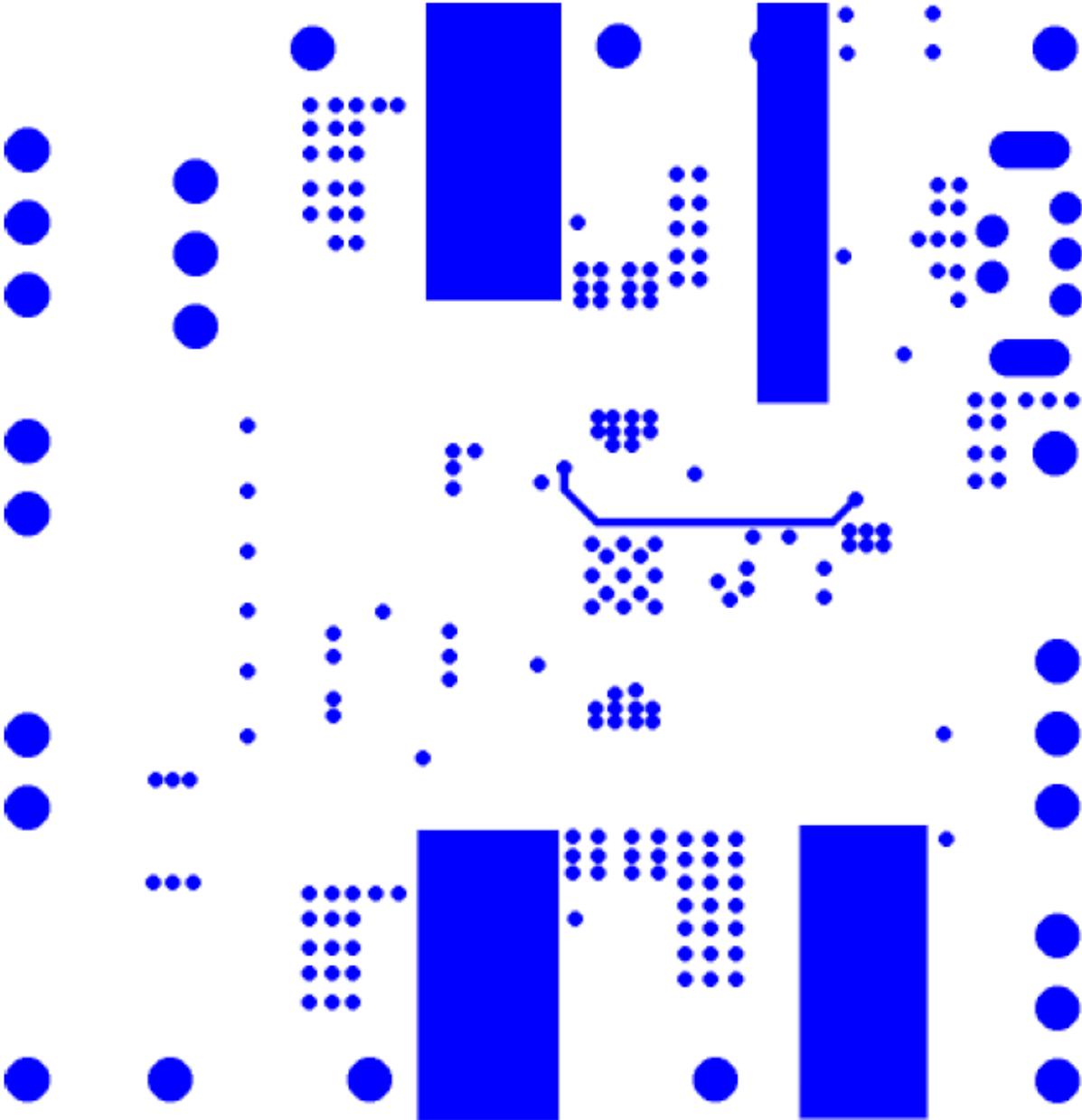


Figure 20: EVB PCB, Layer 4 Signal Plane

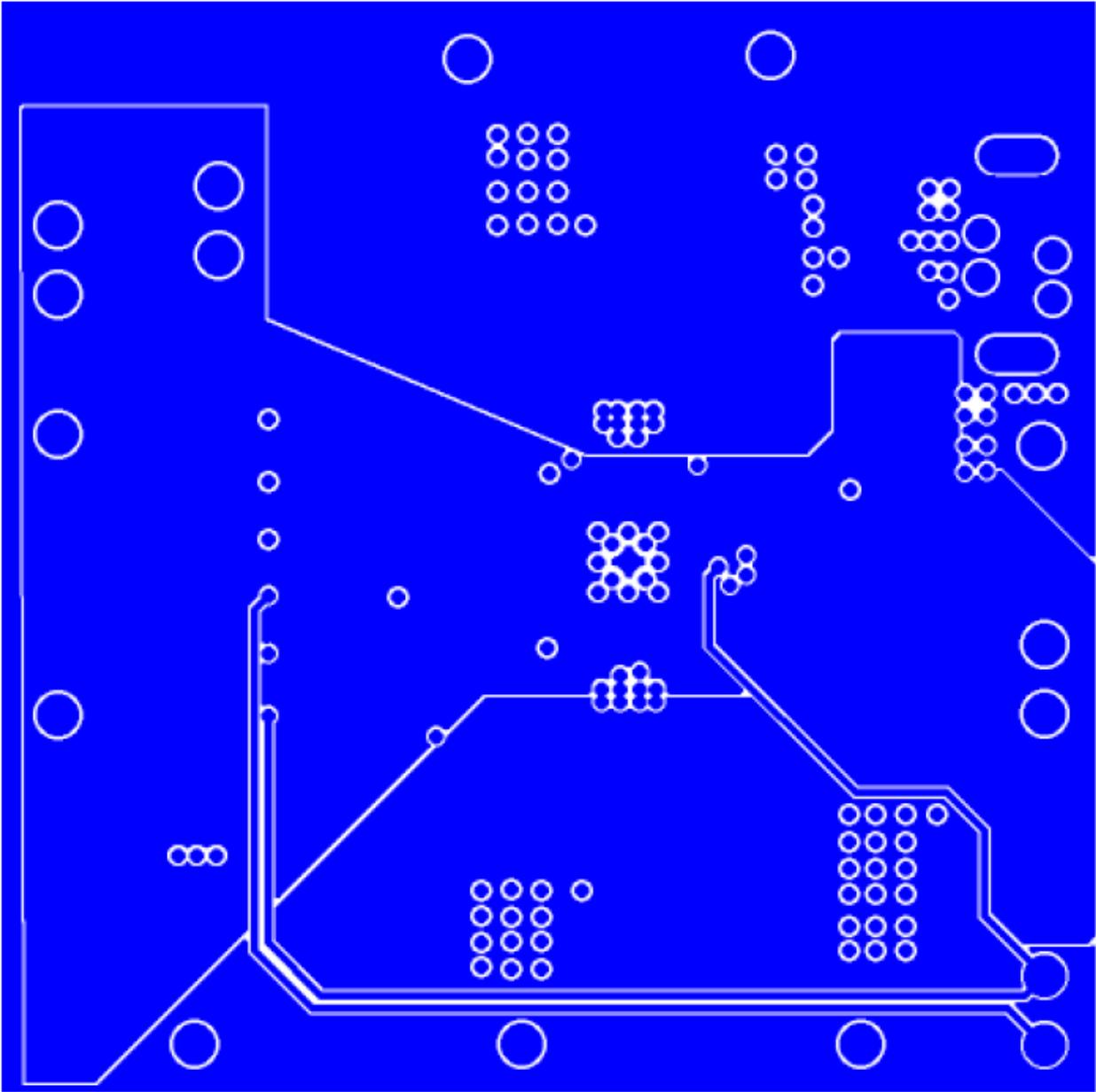


Figure 21: EVB PCB, Layer 5 Ground Planes

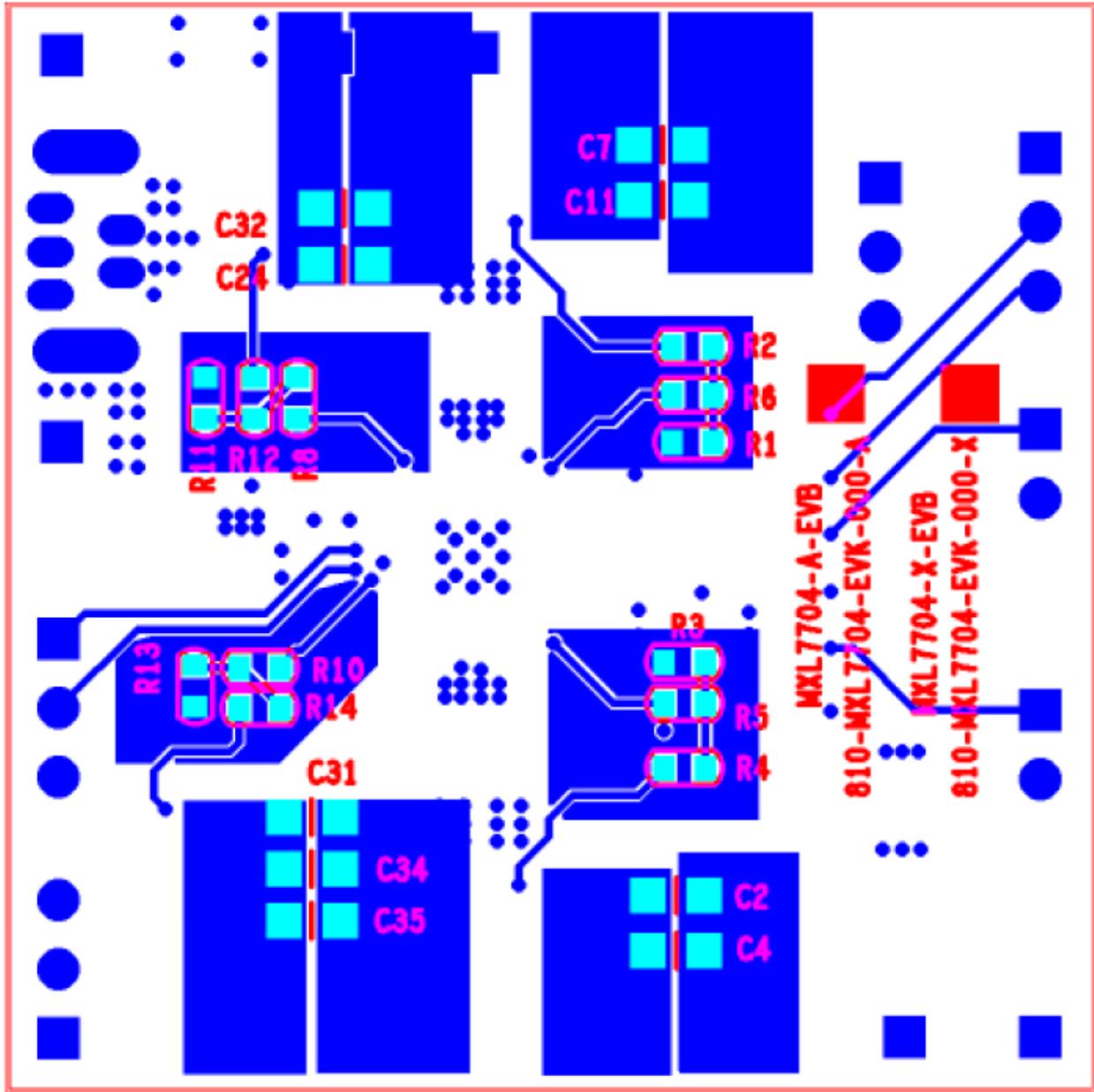


Figure 22: EVB PCB, Bottom View

# MxL7704 EVB Bill of Materials

**Table 3: MxL7704-A-EVB Bill of Materials**

| Item | Qty | Reference Designator                   | Manufacturer     | Part Number        | Package Size                 | Component   |
|------|-----|--|------------------|--------------------|------------------------------|---|
| 1    | 1   | PCB                                    | MaxLinear        |                    | PCB                          | MxL7704EVB Evaluation Board                       |
| 2    | 1   | U1                                     | MaxLinear        | MXL7704-AQB-T      | 5mm x 5mm x 0.9mm 32-pin QFN | MxL7704 Five Output Universal PMIC with 8-bit ADC |
| 3    | 5   | C1<br>C3<br>C19<br>C23<br>C27          | Murata           | GRM219R60J476ME44  | 0805                         | CAP CER 47UF 6.3V X5R                             |
| 4    | 3   | C2<br>C29<br>C32                       | Murata           | GRM21BR60J106ME19  | 0805                         | CAP CER 10UF 6.3V X5R                             |
| 5    | 1   | C4                                     | DNP              | Murata             | GRM21BR60J106ME19            | CAP CER 10UF 6.3V X5R                             |
| 6    | 6   | C5<br>C7<br>C11<br>C31<br>C34<br>C35   | DNP              | Murata             | GRM219R60J476ME44            | CAP CER 47UF 6.3V X5R                             |
| 7    | 3   | C6<br>C8<br>C20                        | Murata           | GRM21BR60J226ME39  | 0805                         | CAP CER 22UF 6.3V X5R                             |
| 8    | 1   | C9                                     | Murata           | GRM21BR60J225KA01  | 0805                         | CAP CER 2.2UF 6.3V X5R                            |
| 9    | 1   | C10                                    | Murata           | GRM219R61A105KA01  | 0805                         | CAP CER 1UF 10V X5R                               |
| 10   | 3   | C12<br>C15<br>C28                      | Murata           | GRM155R60J105KE19D | 0402                         | CAP CER 1UF 6.3V X5R                              |
| 11   | 6   | C13<br>C14<br>C17<br>C26<br>C36<br>C37 | Murata           | GRM155R61A104MA01  | 0402                         | CAP CER 0.1UF 10V X5R                             |
| 12   | 4   | C21<br>C25<br>C30<br>C33               | Murata           | GRM219R61A106ME47  | 0805                         | CAP CER 10UF 10V X5R                              |
| 13   | 1   | C22                                    | Murata           | GRM188R60J106ME47D | 1608[0603]                   | CAP CER 10UF 6.3V X5R                             |
| 14   | 1   | C24                                    | DNP              | Murata             | GRM21BR60J226ME39            | CAP CER 22UF 6.3V X5R                             |
| 15   | 1   | D1                                     | Littlefuse       | SMBJ5.0A           | SMBJ                         | Schottky Rectifier                                |
| 16   | 4   | J1<br>J2<br>J3<br>J6                   | Würth Elektronik | 61300311121        | 2.54mm                       | Header, 3-Pin                                     |
| 17   | 2   | J4<br>J5                               | Würth Elektronik | 61300311121        | 2.54mm                       | Header, 3-Pin                                     |
| 18   | 1   | L1                                     | Delta            | HMME32251E-2R2MSR  | HMME32251E<br>INDM3225X15M   | Inductor  |
| 19   | 1   | L2                                     | Delta            | HMME32251E-1R0MSR  | HMME32251E<br>INDM3225X15M   | Inductor  |
| 20   | 2   | L3<br>L4                               | Delta            | HMME32251E-R47MSR  | HMME32251E<br>INDM3225X15M   | Inductor  |

## MxL7704 EVB Bill of Materials (continued)

**Table 3: MxL7704-A-EVB Bill of Materials (continued)**

| Item | Qty | Reference Designator   | Manufacturer | Part Number      | Package Size  | Component   |   |
|------|-----|--|--------------|------------------|---------------|-------------|---|
| 21   | 1   | P1   | DNP          | Molex            | 5000750517    | Mini B      | USB Mini-B Receptacle, Right Angle, Thru-Hole |
| 22   | 12  | P2<br>P3<br>P4<br>P5<br>P6<br>P7<br>P8<br>P9<br>P10<br>P11<br>P12<br>P13 |              | Würth Elektronik | 7471287       | 0.32x0.10in | Blade connectors                              |
| 23   | 4   | R1<br>R3<br>R11<br>R13   | DNP          | Panasonic        | ERJ-PA3F1003V | ERA-0603    | Resistor                                      |
| 24   | 9   | R2<br>R4<br>R5<br>R6<br>R7<br>R8<br>R10<br>R12<br>R14                    |              | Panasonic        | ERJ-3GEY0R00V | ERA-0603    | Resistor                                      |
| 25   | 1   | R9   |              | Panasonic        | ERJ-3GEYJ100V | ERA-0603    | Resistor                                      |
| 26   | 6   | R15<br>R16<br>R17<br>R18<br>R19<br>R20                                   |              | Panasonic        | ERJ-3GEYJ472V | ERA-0603    | Resistor                                      |

**Table 4: MxL7704-X-EVB Bill of Materials**

| Item | Qty | Reference Designator                              | Manufacturer | Part Number | Package Size      | Component                    |   |
|------|-----|---|--------------|-------------|-------------------|------------------------------|---|
| 1    | 1   | PCB   |              | MaxLinear   |                   | PCB                          | MxL7704EVB Evaluation Board                       |
| 2    | 1   | U1  |              | MaxLinear   | MXL7704-XQB-T     | 5mm x 5mm x 0.9mm 32-pin QFN | MxL7704 Five Output Universal PMIC with 8-bit ADC |
| 3    | 5   | C1<br>C3<br>C5<br>C19<br>C23<br>C27<br>C31<br>C34 |              | Murata      | GRM219R60J476ME44 | 0805                         | CAP CER 47UF 6.3V X5R                             |
| 4    | 3   | C2<br>C29<br>C32                                  |              | Murata      | GRM21BR60J106ME19 | 0805                         | CAP CER 10UF 6.3V X5R                             |
| 5    | 1   | C4  | DNP          | Murata      | GRM21BR60J106ME19 | 0805                         | CAP CER 10UF 6.3V X5R                             |
| 6    | 6   | C6<br>C8<br>C20                                   |              | Murata      | GRM21BR60J226ME39 | 0805                         | CAP CER 22UF 6.3V X5R                             |

## MxL7704 EVB Bill of Materials (continued)

**Table 4: MxL7704-X-EVB Bill of Materials (continued)**

| Item | Qty | Reference Designator   | Manufacturer | Part Number      | Package Size        | Component                  |   |
|------|-----|--|--------------|------------------|---------------------|----------------------------|---|
| 7    | 3   | C7<br>C11<br>C35   | DNP          | Murata           | GRM219R60J476ME44   | 0805                       | CAP CER 47UF 6.3V X5R                         |
| 8    | 1   | C9   |              | Murata           | GRM21BR60J225KA01   | 0805                       | CAP CER 2.2UF 6.3V X5R                        |
| 9    | 1   | C10  |              | Murata           | GRM219R61A105KA01   | 0805                       | CAP CER 1UF 10V X5R                           |
| 10   | 3   | C12<br>C15<br>C28  |              | Murata           | GRM155R60J105KE19D  | 0402                       | CAP CER 1UF 6.3V X5R                          |
| 11   | 6   | C13<br>C14<br>C17<br>C26<br>C36<br>C37                                   |              | Murata           | GRM155R61A104MA01   | 0402                       | CAP CER 0.1UF 10V X5R                         |
| 12   | 4   | C21<br>C25<br>C30<br>C33   |              | Murata           | GRM219R61A106ME47   | 0805                       | CAP CER 10UF 10V X5R                          |
| 13   | 1   | C22  |              | Murata           | GRM188R60J106ME47D  | 1608[0603]                 | CAP CER 10UF 6.3V X5R                         |
| 14   | 1   | C24  | DNP          | Murata           | GRM21BR60J226ME39   | 0805                       | CAP CER 22UF 6.3V X5R                         |
| 15   | 1   | D1   |              | Littlefuse       | SMBJ5.0A            | SMBJ                       | Schottky Rectifier                            |
| 16   | 4   | J1<br>J2<br>J3<br>J6   |              | Würth Elektronik | 61300311121         | 2.54mm                     | Header, 3-Pin                                 |
| 17   | 2   | J4<br>J5   |              | Würth Elektronik | 61300311121         | 2.54mm                     | Header, 3-Pin                                 |
| 18   | 2   | L1<br>L2   |              | Delta            | HMME32251E-2R2MSR   | HMME32251E<br>INDM3225X15M | Inductor                                      |
| 19   | 1   | L3   |              | Delta            | HMME32251E-1R0MSR   | HMME32251E<br>INDM3225X15M | Inductor                                      |
| 20   | 1   | L4   |              | Delta            | HMME32251E-R47MSR   | HMME32251E<br>INDM3225X15M | Inductor                                      |
| 21   | 1   | P1   | DNP          | Molex            | Mini-USB 5000750517 | Mini B                     | USB Mini-B Receptacle, Right Angle, Thru-Hole |
| 22   | 12  | P2<br>P3<br>P4<br>P5<br>P6<br>P7<br>P8<br>P9<br>P10<br>P11<br>P12<br>P13 |              | Würth Elektronik | 7471287             | 0.32x0.10in                | Blade connectors                              |
| 23   | 4   | R1<br>R3<br>R11<br>R13   | DNP          | Panasonic        | ERJ-PA3F1003V       | ERA-0603                   | RES SMD 100K OHM 1% 1/4W                      |
| 24   | 9   | R2<br>R4<br>R5<br>R6<br>R7<br>R8<br>R10<br>R12<br>R14                    |              | Panasonic        | ERJ-3GEY0R00V       | ERA-0603                   | RES SMD 0 OHM JUMPER 1/10W                    |

## MxL7704 EVB Bill of Materials (continued)

**Table 4: MxL7704-X-EVB Bill of Materials (continued)**

| Item | Qty | Reference Designator                   | Manufacturer | Part Number   | Package Size | Component                 |
|------|-----|--|--------------|---------------|--------------|---------------------------|
| 25   | 1   | R9                                     | Panasonic    | ERJ-3GEYJ100V | ERA-0603     | RES SMD 10 OHM 5% 1/10W   |
| 26   | 6   | R15<br>R16<br>R17<br>R18<br>R19<br>R20 | Panasonic    | ERJ-3GEYJ472V | ERA-0603     | RES SMD 4.7K OHM 5% 1/10W |



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