Si3038MDC-EVB

International MC'97 Reference Design

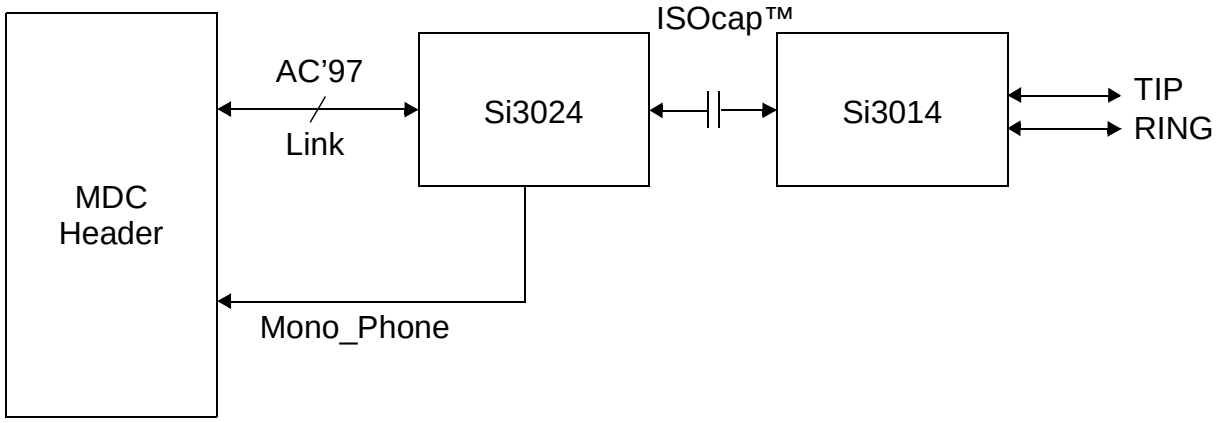
Description

The Si3038 is an integrated direct access arrangement (DAA) chipset that is available in two 16-pin small outline integrated circuit (SOIC) packages. The AC'97 interface is implemented on Si3024, and the phone-line interface is implemented on Si3014. Additionally, the Si3038 is available in two 16-pin thin shrink small outline packages (TSSOPs). The Si3038-MDC modem reference design is a direct application of the Si3024's AC'97 Rev 2.1 compliant interface. The reference design is based on Intel's Mobile Audio/Modem Daughter Card (MDC) Specification Rev 1.0.

Features

- AC'97 Rev 2.x modem codec
- Primary/secondary operating modes
- "3.3/5 V" and "3.3 V Only" operation

Functional Block Diagram



Si3038MDC-EVB Reference Design

Configurations

The Si3038MDC-EVB can be configured for primary or secondary codec mode.

Primary/Secondary Operation

The Si3038MDC-EVB's default configuration is secondary codec mode.

In order to set the Si3038MDC-EVB to a different mode, the component population configurations below should be applied to the MDC:

Table 1. Si3038 Primary/Secondary Configuration

	R28	R29	R30	R32	R33	R53	Q5
Force Primary	1	0	0	0	0	0	0
Force Secondary Line 1	1	1	0	0	0	0	0
Use PRI_DN for codec select	1	0	0	1	0	0	1
Use PRI_DN# for codec select	1	0	0	0	1	0	0

Notes: 1 = installed; 0 = not installed. See "Bill of Materials" on page 5 for component values.

EMI Suppression and Safety Protection Component Placement

C24, C25, L1, L2, FB1, FB2, and RV1 comprise the section of the DAA applications circuit responsible for emissions suppression, safety, and immunity.

Optionally, R61, R62, C38 and C39 may also be installed. See Appendix B of the Si3038 data sheet revision 2.0 or later for a more extensive discussion on the function of R61, R62, C38 and C39.

Per the MDC Specification, all of these components should be located on the same PCB as the RJ11. This is discussed in the MDC Specification Rev 1.0 in Section 7: MDC Design Rules. In practice, most laptop manufacturers do not make provisions for these components on the same PCB as the RJ11. So they have typically been placed on the MDC board itself. This is not an optimal architecture from an emissions perspective, but is the most commonly implemented approach. The revision 2.2 Si3038 MDC-EVB implements these components on the MDC itself to match the most commonly implemented laptop architecture in the market. The MDC designer must fully understand the requirements of the customer's laptop architecture and implement an MDC that is both compliant to relevant emissions, safety, and telecom specifications and meets the customer's requirements.

SOIC and TSSOP Packaging Options

The revision 2.2 Si3038 MDC-EVB utilizes an SOIC for the Si3024 and a TSSOP for the Si3014. This configuration is optimal for this particular layout. Designers implementing their own MDC design should weigh the benefits and trade-offs of cost, board space, and extended temperature operation in order to determine the optimal approach for their particular situation. Both devices are available in SOIC or TSSOP packages. Extended temperature (0–90 °C ambient) operation may also be available upon request. Consult Silicon Laboratories sales or marketing personnel to determine availability, lead time, and pricing for these options.

Alternative Isolation Capacitors

The revision 2.2 Si3038 MDC-EVB utilizes Y2-class capacitors in a 2220 package for the isolation capacitors (C1, C4, C24, C25). Other package and safety rating options are available from vendors such as Panasonic, Johanson Dielectrics, Murata, Kyocera, and Novacap. To be compliant to the Nordic Exclusions of CTR21, which are required by Sweden, Denmark, Norway, and Finland, certain construction and testing requirements must be met. Consult with your safety and homologation experts to ensure that the capacitors you have chosen have the proper safety certifications.

Thermal Considerations

Additional copper heat sink area has been added to the revision 2.2 Si3038 MDC-EVB design to ensure that the Q4 junction temperature remains within data sheet limits under normal operating conditions. In environments that may exceed 70 °C ambient, it may be necessary to use a Q4 transistor from a different vendor, and increase the amount of copper heat sink area.

Consult AN21 “Thermal Considerations for Applications Using the Si3034, Si3038, and Si3044” for more details.

For environments with a high ambient temperature, care must be taken to ensure that all the components on the MDC design remain within their operational limits as specified by their respective data sheets. Silicon Laboratories' applications support is available to assist with temperature calculations and measurements.

(Front View) **(Rear View)**

Figure 1. Si3038MDC-EVB (Actual Size)

Si3038 Primary/Secondary configuration

	R28	R29	R30	R32	R33	R53	Q5
Force Primary	1	0	0	0	0	0	0
Force Secondary Line 1	1	1	0	0	0	0	0
Use PRI_DN for codec select	1	0	0	1	0	0	1
Use PRI_DN# for codec select	1	0	0	0	1	0	0

1 = installed
0 = not installed
See Bill of Materials for Component Values

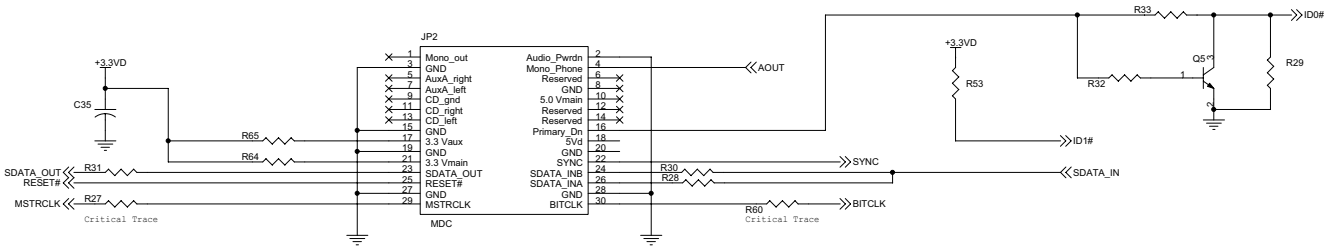
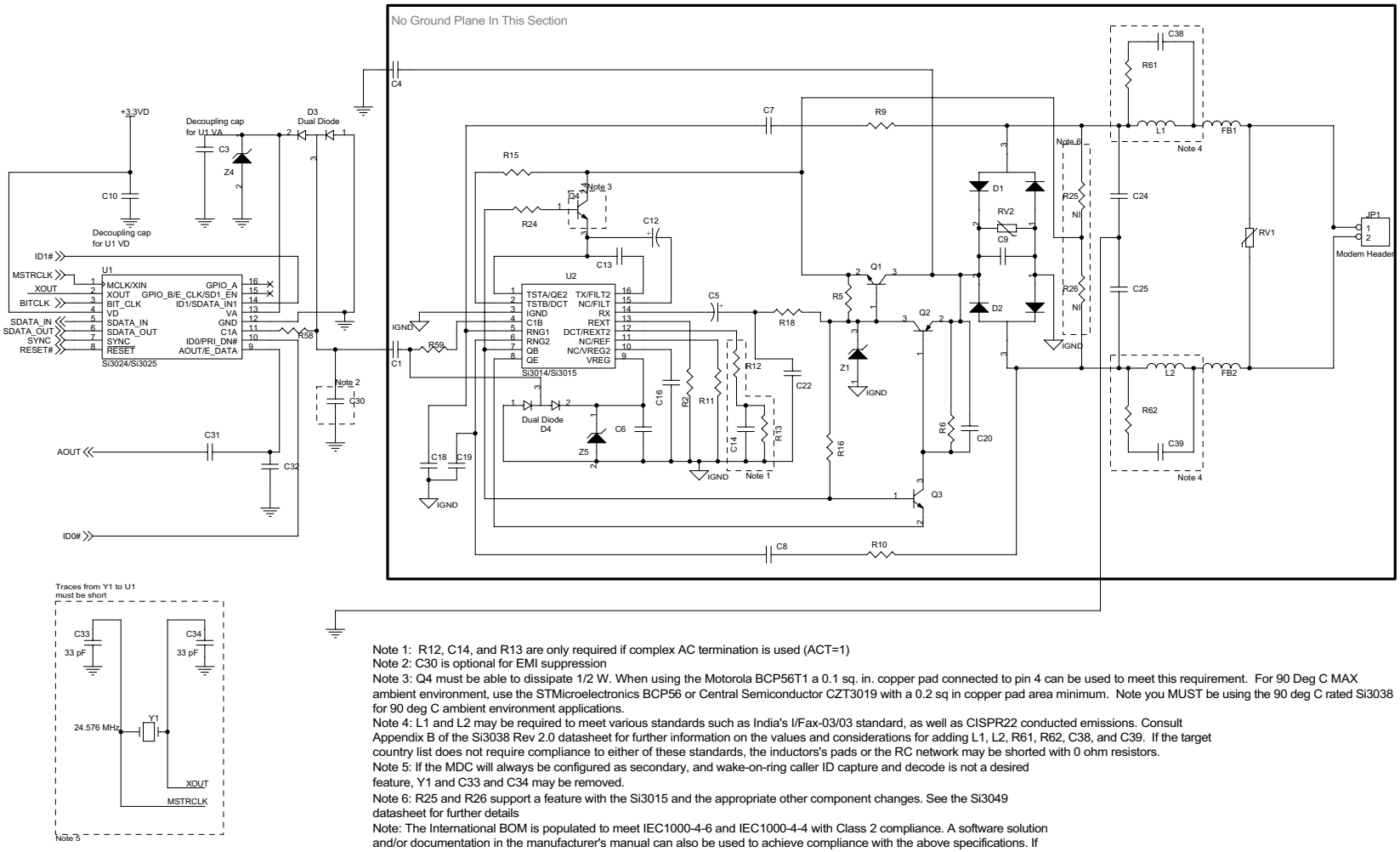


Figure 2. Si3038MDC-EVB Schematic (MDC Connector)



Note 1: R12, C14, and R13 are only required if complex AC termination is used (ACT=1)
Note 2: C30 is optional for EMI suppression
Note 3: Q4 must be able to dissipate 1/2 W. When using the Motorola BCP56T1 a 0.1 sq. in. copper pad connected to pin 4 can be used to meet this requirement. For 90 Deg C MAX ambient environment, use the STMicroelectronics BCP56 or Central Semiconductor CZT3019 with a 0.2 sq in copper pad area minimum. Note you MUST be using the 90 deg C rated Si3038 for 90 deg C ambient environment applications.
Note 4: L1 and L2 may be required to meet various standards such as India's I/Fax-03/03 standard, as well as CISPR22 conducted emissions. Consult Appendix B of the Si3038 Rev 2.0 datasheet for further information on the values and considerations for adding L1, L2, R61, R62, C38, and C39. If the target country list does not require compliance to either of these standards, the inductors's pads or the RC network may be shorted with 0 ohm resistors.
Note 5: If the MDC will always be configured as secondary, and wake-on-ring caller ID capture and decode is not a desired feature, Y1 and C33 and C34 may be removed.
Note 6: R25 and R26 support a feature with the Si3015 and the appropriate other component changes. See the Si3049 datasheet for further details
Note: The International BOM is populated to meet IEC1000-4-6 and IEC1000-4-4 with Class 2 compliance. A software solution and/or documentation in the manufacturer's manual can also be used to achieve compliance with the above specifications. If the latter is used, C22 is not installed.

Figure 3. Si3038MDC-EVB Schematic (Si3038)

Bill of Materials

Reference	Value	Dielectric	Tolerance	Rating	Part Number	Manufacturer	PCB Footprint
C4,C1	150 pF	X7R	±20%	Y2-CLASS	GHM3045X7R151K-GC	Murata	2220
C3	0.22 uF	X7R	±20%	25 V	C0805X7R250-224-MNE	Venkel	0805
C5	0.1 uF	Tant/Elec	±20%	50 V	TA050TCM104-KAR	Venkel	Case A
C6,C10,C16,C31	0.1 uF	X7R	±10%	16 V	C0603X7R160-104KNE	Venkel	0603
C8,C7	560 pF	X7R	±10%	250 V	C0805X7R251-561KNE	Venkel	0805
C9	10 nF	X7R	±20%	250 V	C0805X7R251-103KNE	Venkel	0805
C12	0.22 uF	Tant	±10%	35 V	TA035TCM224-KAL	Venkel	Case A
C13	0.47 uF	X7R	±10%	25 V	C0805X7R250-474KNE	Venkel	0805
C14	0.68 uF	X7R/Tant	±10%	16 V	1206YC684KATMA	AVX	1206
C18,C19	3.9 nF	X7R	±10%	16 V	C0603X7R160-392KNE	Venkel	0603
C20	0.01 uF	X7R	±10%	16 V	C0603X7R160-103KNE	Venkel	0603
C22	1800 pF	X7R	±10%	50 V	C0603X7R500-182KNE	Venkel	0603
C24	1000pF	X7R	±10%	Y2-CLASS	GHM3045X7R102K-GC	Murata	2220
C25	1000pF	Y2-CLASS	±10%	3 kV	GHM3045X7R102K-GC	Murata	2220
C32	2200 pF	X7R	±10%	16 V	C0603X7R160-222KNE	Venkel	0603
C33,C34	33 pF	NPO	±1%	50 V	C0603NPO500-330FNE	Venkel	0603
C35	10 uF	Tant	±10%	10 V	TA010TCM106KAR	Venkel	EIA Size A
C38,C39	33 pF	X7R	±10%	50 V	C0805X7R500330-MNE	Venkel	0805
D2,D1	Dual Diode		300 V	225 mA	CMPD2004S	Central Semiconductor	SOT-23
D3,D4	Dual Diode				BAV99	On Semiconductor	SOT23
FB1,FB2	Ferrite Bead				BLM31A601S	Murata	1206
JP1	Modem Header				FI-S2P-HF	JAE	Single 1.25mm SMT 2 pin header
JP2	MDC				3-179396-0	AMP	Dual 0.8mm SMT 30 pin header
L2,L1	150 uH				SD12-151	Cooper Technologies	
Q3,Q1	NPN			300 V	MMBTA42LT1	Motorola	SOT-23
Q2	PNP			300 V	MMBTA92LT1	Motorola	SOT-23
Q4	NPN			80 V	BCP56T1	Motorola	SOT-223
Q5	NPN			40 V	MMBT2222ALT1	Motorola	SOT-23
RV1	SiDactor		100 A	275 V	P3100SB	Teccor	DO-214AA
R2	402		±1%	1/8 W	CR0805-8W-4020FT	Venkel	0805
R5	36 k		±5%	1/16 W	CR0603-16W-363JT	Venkel	0603
R6	120 k		±5%	1/16 W	CR0603-16W-124JT	Venkel	0603
R10,R9	56 k		±5%	1/10 W	CR0805-10W-563JT	Venkel	0805
R11	10 k		±1%	1/16 W	CR0603-16W-1002FT	Venkel	0603
R12	78.7		±1%	1/16 W	CR0603-16W-78R7FT	Venkel	0603
R13	215		±1%	1/16 W	CR0603-16W-2150FT	Venkel	0603
R15	1.62 k		±1%	1 W	CR2010-1W-1621 F T	Venkel	2010
R16	1.62 k		±1%	1 W	CR2010-1W-1621 F T	Venkel	2010
R18	2.2 k		±5%	1/10 W	CR0805-10W-222JT	Venkel	0805
R24	150		±5%	1/16 W	CR0603-16W-151JT	Venkel	0603
R30,R31	0			1/16 W	CR0603-16W-000F	Venkel	0603
R32	750k		±5%	1/16 W	CR0603-16W-750F	Venkel	0603
R58,R59	10		±5%	1/8 W	CR0805-8W-10R2JT	Venkel	0805
R60,R65	0		±5%	1/16 W	CR0603-16W-000F	Venkel	0603
R61,R62	680		±10%	1/10 W	CR0805-10W-681JT	Venkel	0805
R63	0		±1%	1/8 W	CR1206-8W-000F	Venkel	1206
U1	Si3024-KS				Si3024-KS	Silicon Labs	16SOIC
U2	Si3014-KT				Si3014-KT	Silicon Labs	16TSSOP
Y1	24.576 MHz		50 ppm	18 pF Load	ABL2-24.576MHz-FI	Abracon	HC-49/US
Z1	Zener Diode			43 V	BZX84C43	Vishay	SOT-23
Z4,Z5	Zener Diode			5.6 V	MMSZ5232B	Diodes Inc.	SOD123

Miscellaneous Components - Not Installed

C30	10 pF	NPO	±10%	16 V	C0603NPO500-100KNE	Venkel	0603
F1	Fuse				4361.25	Littlefuse	
R26,R25	10 M		±5%	1/10 W	RC73L2A 10M OHM JT	SMEC	0805
RV2	MOV			270 V	ERZVF2T271	Panasonic	
R53	10 k		±5%	1/10 W	CR0603-16W-103F	Venkel	0603
R27,R28,R29,R33, R64	0		±5%	1/16 W	CR0603-16W-000F	Venkel	0603

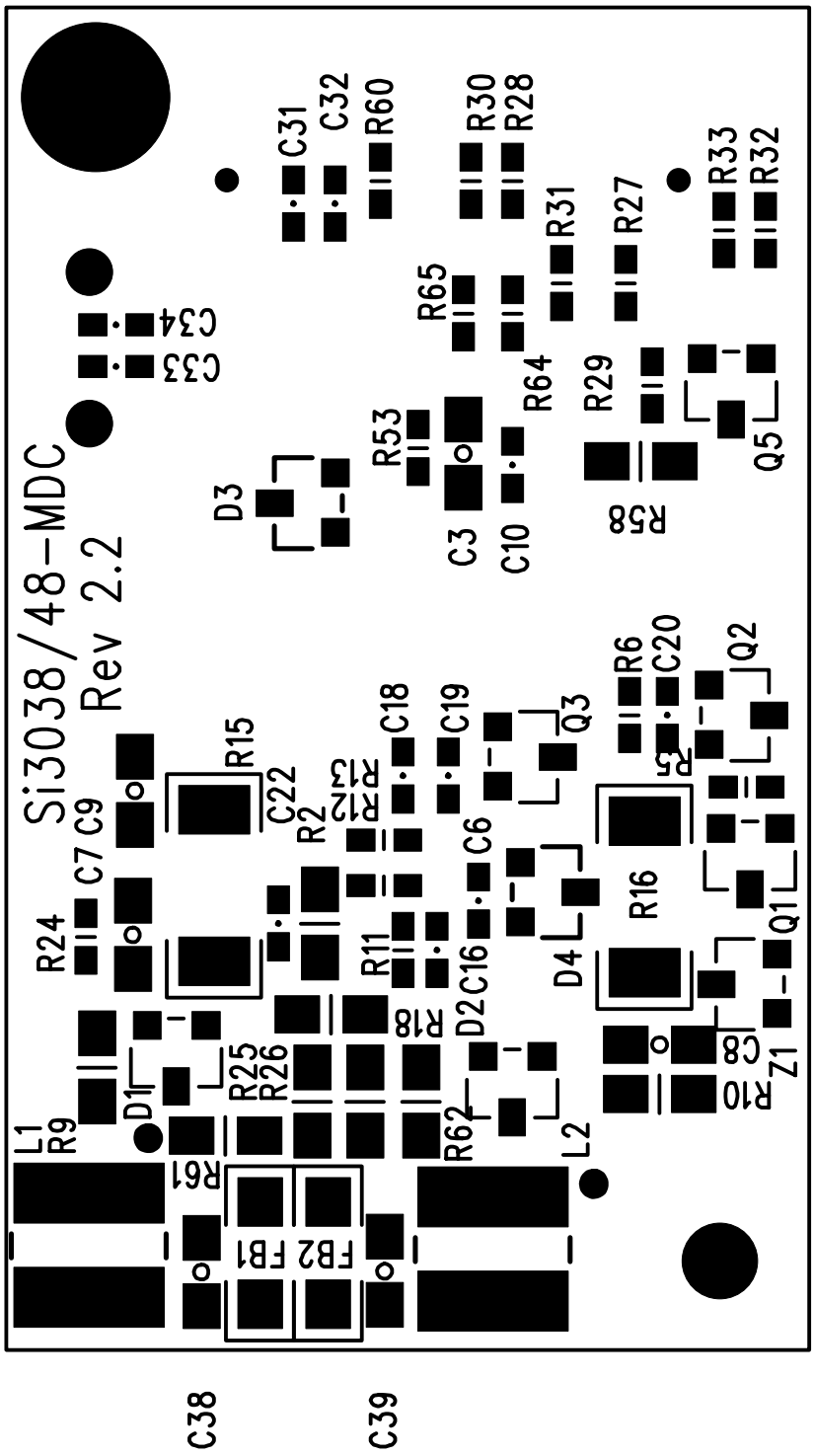


Figure 4. Si3038MDC-EVB Silkscreen

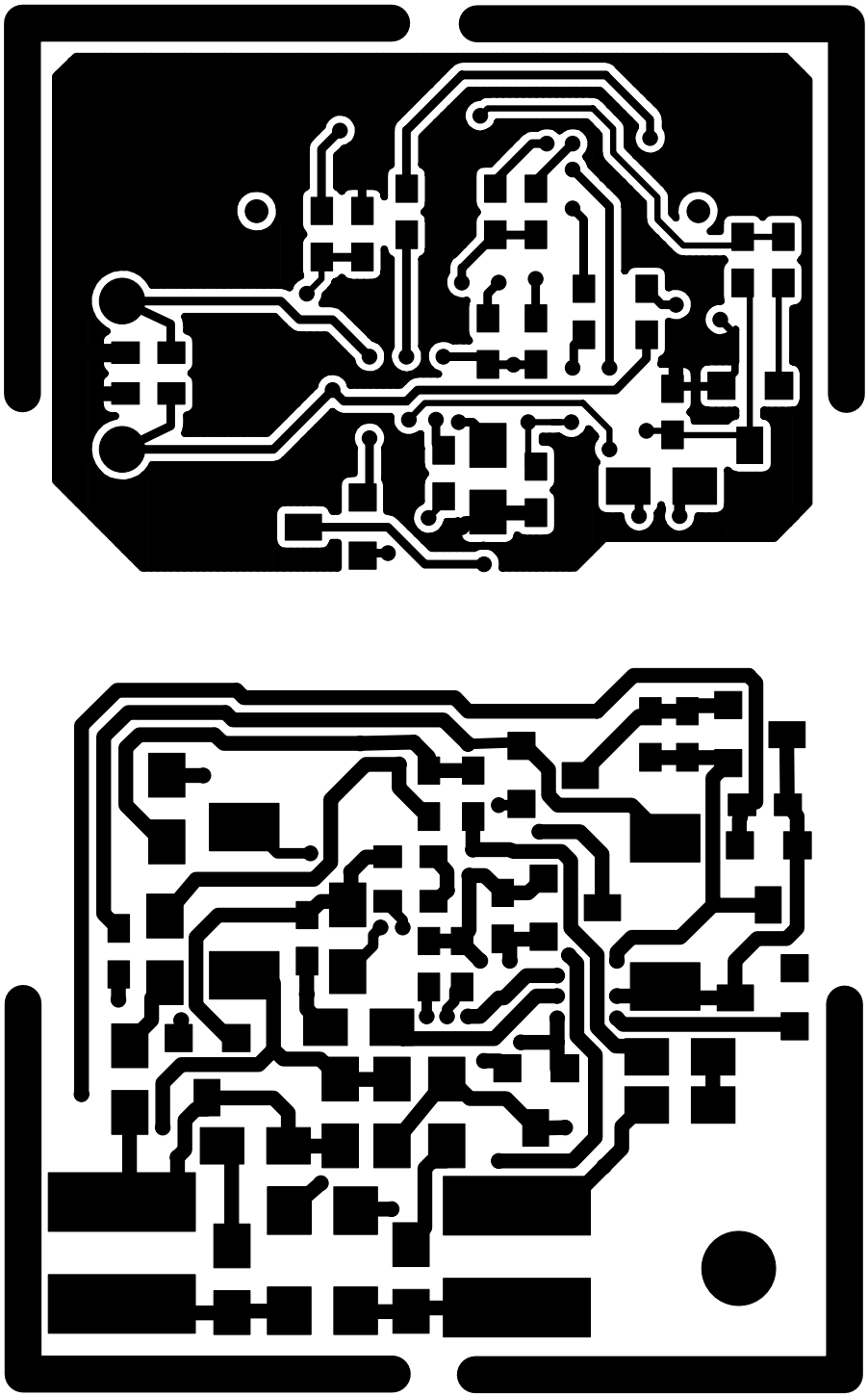


Figure 5. Si3038MDC-EVB Component Side

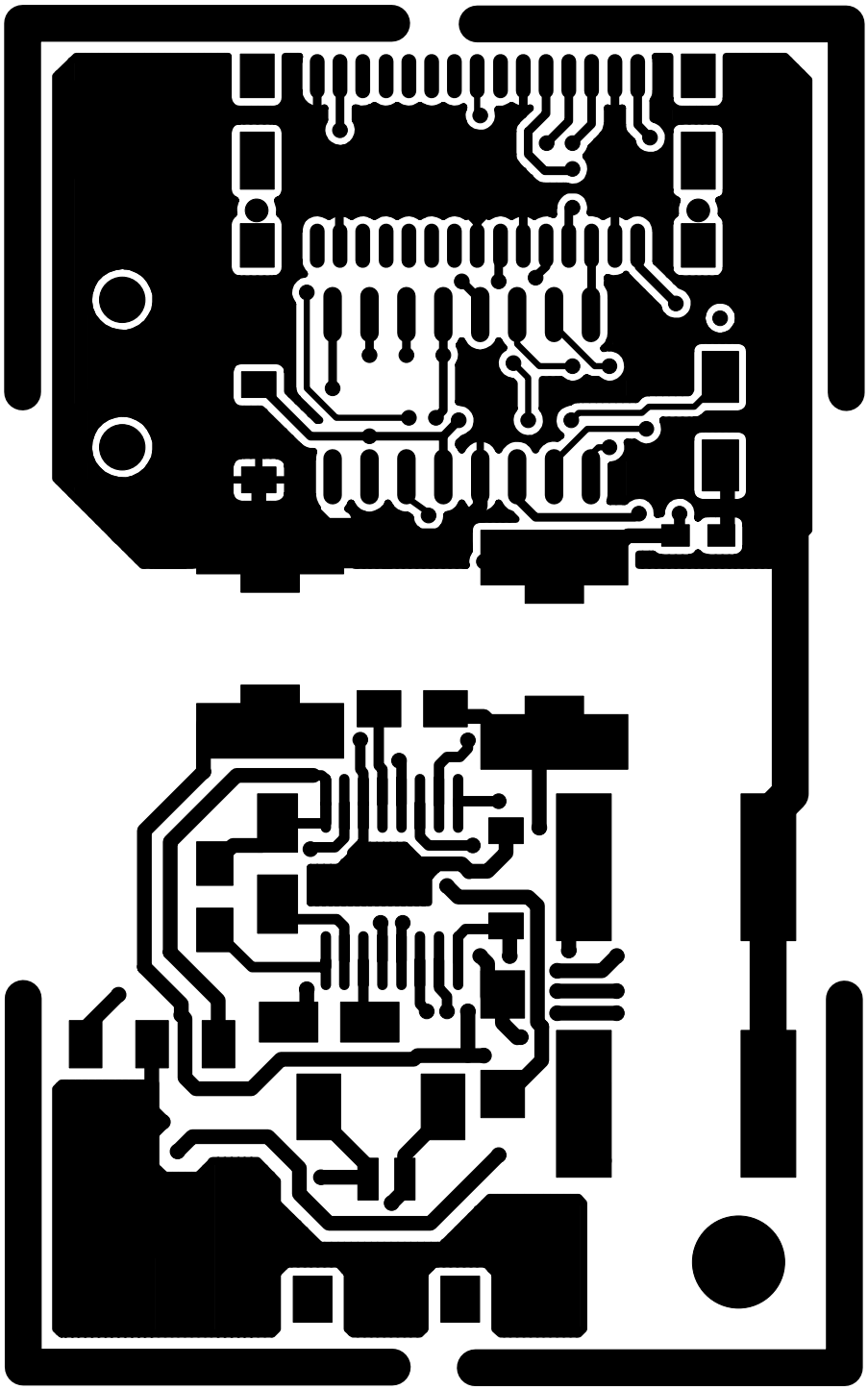


Figure 6. Si3038MDC-EVB Solder Side

Ordering Guide

Evaluation Board	Region	Description
Si3036MR-EVB	North America/ Japan	Modem Riser Card for the Intel Audio Modem Riser (AMR) Card interface.
Si3038MR-EVB	International	Modem Riser Card for the Intel Audio Modem Riser (AMR) Card interface.
Si3038MDC-EVB	International	Modem daughter card for the Intel Mobile Daughter Card (MDC) interface.

Document Change List

Revision 2.2 to Revision 2.3

- "Bill of Materials" on page 5
  - Changed C13 value from 0.22 µF to 0.47 µF.

NOTES:

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