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MAX16712 Evaluation Kit

Evaluates: MAX16712

General Description

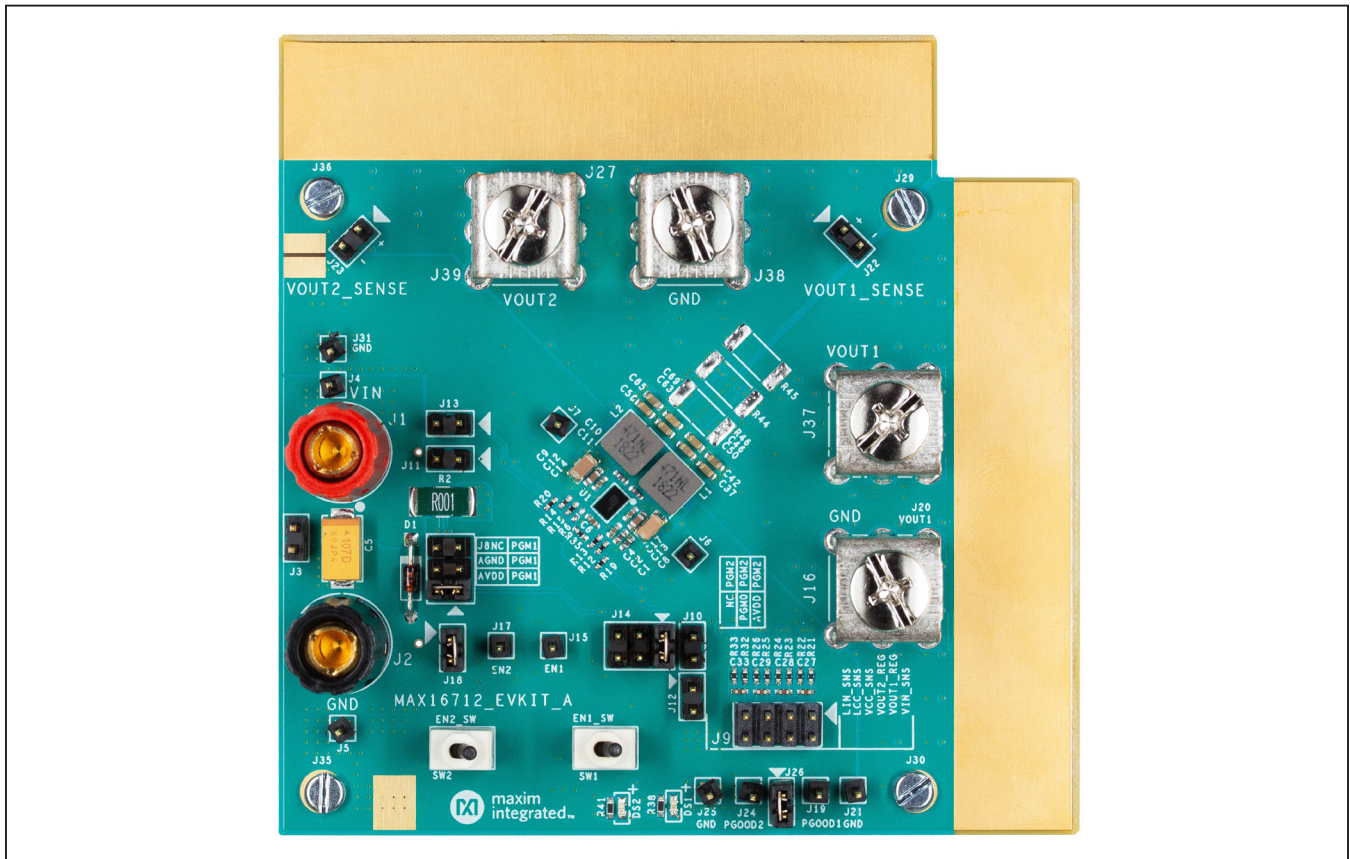
The MAX16712 evaluation kit (EV kit) is a reference platform designed for the evaluation of MAX16712, a dual-output, fully integrated, highly efficient, step-down DC-DC switching regulator IC. This EV kit can deliver up to 6A load per output. The two outputs can be connected as a single-output, dual-phase regulator that supports up to 12A load current. The EV kit comprises a fully assembled and tested PCB implementation of the MAX16712. Jumper pins, test points, and input/output connectors are included for flexibility and convenience in a wide range of applications.

Features

- 2.7V to 16V Input Voltage Range
- 0.5V to 5.8V Output Voltage Range
- High Efficiency and Power Density
- Low Component Count
- Dual-output or Single-output Dual-Phase Operation
- Optimized Performance
- Proven PCB Layout
- Fully Assembled and Tested

[Ordering Information](#) appears at end of data sheet.

MAX16712 EV Kit Board



Quick Start

Required Equipment

- MAX16712 EV kit
- 2.7V to 16V power supply
- 0A to 12A load
- Oscilloscope, probes, voltmeter
- MAX16712 EV kit data sheet
- MAX16712 product data sheet

Procedure

The EV kit is fully assembled and tested. EV kit is preset with MAX16712 dual-output operation with 1V on rail 1 and 1.2V on rail 2. Follow the steps below to verify board operation.

For dual output operation:

- 1) Connect a powered-off 2.7V to 16V input supply, then connect to J1 (positive terminal) and J2 (negative terminal). Although not required, connect supply sense leads to J3 for best accuracy .
- 2) Connect the load to edge connector J20 for rail 1 or J27 for rail 2 (positive on top, negative on bottom).
- 3) Screw connectors are available for VOUT1 and VOUT2.
- 4) Connect the VOUT scope probe/voltmeter to J22 for rail 1 or J23 for rail 2.
- 5) Filtered VOUT for best accuracy can be pick on J9 (See schematic).
- 6) Turn on power supply.
- 7) Position the SW1 or SW2 toggle switch to enable the IC.
- 8) Verify the two output are set to their nominal value (1V for VOUT1, 1.2V for VOUT2).

For dual phase operation (interleaved two phases buck, double the output current. 12A max output current)

- To enable the dual phase operation, remove R14 for rail 2 sense line and install 0Ω in R6 to pull SNSP2 to AVDD.
- When configured to dual-phase operation, only the control loop for rail 1 works, and the control loop for rail 2 is bypassed. EN1 and PGOOD1 are used in dual-phase operation mode to enable the device and

indicate power-good status. EN2 and PGOOD2 can be disconnected.

- Install a 0Ω resistor for R44-R45-R46 to short the outputs of the two rails.
- Use the same inductor for LX1 and LX2 or replace with a two-phase couple inductor.
- Repeat the above steps described for the dual-output operation.

Detailed Description of Hardware

Operation

The MAX16712 IC is a monolithic, dual-output, high-frequency step-down switching regulator with internal bias LDO, optimized for applications requiring small size and high-efficiency. Detailed product and application information is provided in the MAX16712 IC data sheet.

Output Enable (OE)

OE is used to enable/disable the output voltage. For dual output operation, rail 1 output voltage is enabled/disabled by SW1. Rail 2 output voltage is enabled/disabled by SW2. For dual-phase operation, EN1 is used, and EN2 can be disconnected.

Output-Voltage Selection

The MAX16712 EV kit is set up to initially boot up to an output voltage of 1V of rail 1 and 1.2V of rail 2. The device has internal and fixed 0.5V reference voltage. To achieve output voltage, a voltage-divider is placed in the feedback path:

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R_{FB1}}{R_{FB2}} \right)$$

where:

VOUT = Output voltage

VREF = 0.5V fixed reference voltage

RFB₁ = Top divider resistor

RFB₂ = Bottom divider resistor

Soft-Start

When VDDH and EN are above their rising thresholds, soft-start begins and switching is enabled. The soft-start ramp time is 3ms. The device supports smooth startup with output pre-biased.

PGM0 Resistor Value (Switching Frequency and Scenario Selection)

On the PGM0 pin, a resistor is present. On this EV kit board, R11 is 2.87kΩ. Set the value of this resistor properly to set the switching frequency for the two regulators and the control loop gain.

For this EV kit, the switching frequency is set to 1000kHz for both rails, and control scenario A” is selected. Refer to the Switching Frequency and Scenario Selection table and the Pre-defined Scenario table on the MAX16712 product data sheet for further details.

PGM1 and PGM2 (OCP Protection)

The PGM1 and PGM2 pins are connected to J8 and J14. When shorting these pins at AVDD, AGND, or leaving them open, it is possible to select three different over current protection (OCP) thresholds according to the PGM1 POCP Selection for Output 1 table and the PGM2 POCP Selection for Output 2 table on the IC data sheet document. For PGM1, select OCP option for rail 1. For PGM2, select OCP option for rail 2.

Status Monitoring

Whenever the part is actively regulating, and the output voltage is within the power-good window, the PGOOD pin

is high. In all other conditions, including enabled but in a fault state, the PGOOD pin is pulled low. Refer to the MAX16712 IC data sheet for more details.

Input-Voltage Monitoring

The input supply can be monitored on J4 for VDDH and J5 for GND.

Switching-Voltage Monitoring

The switching waveform can be monitored on J6 for LX1 and J7 for LX2.

Output-Voltage Monitoring

J22 and J23 monitor the output voltage of rail 1 and rail 2, respectively. Do not use these test points for loading.

Efficiency Testing

The J9 pin connector provides convenient access to input supply and output sense points filtered out for a low noise measurement.

Measure input and output currents with 0.1% lab shunts.

For increased accuracy, perform a test by running the same current through both shunts to measure and calibrate shunt mismatch.

Ordering Information

PART	TYPE
MAX16712EVKIT#	EV Kit

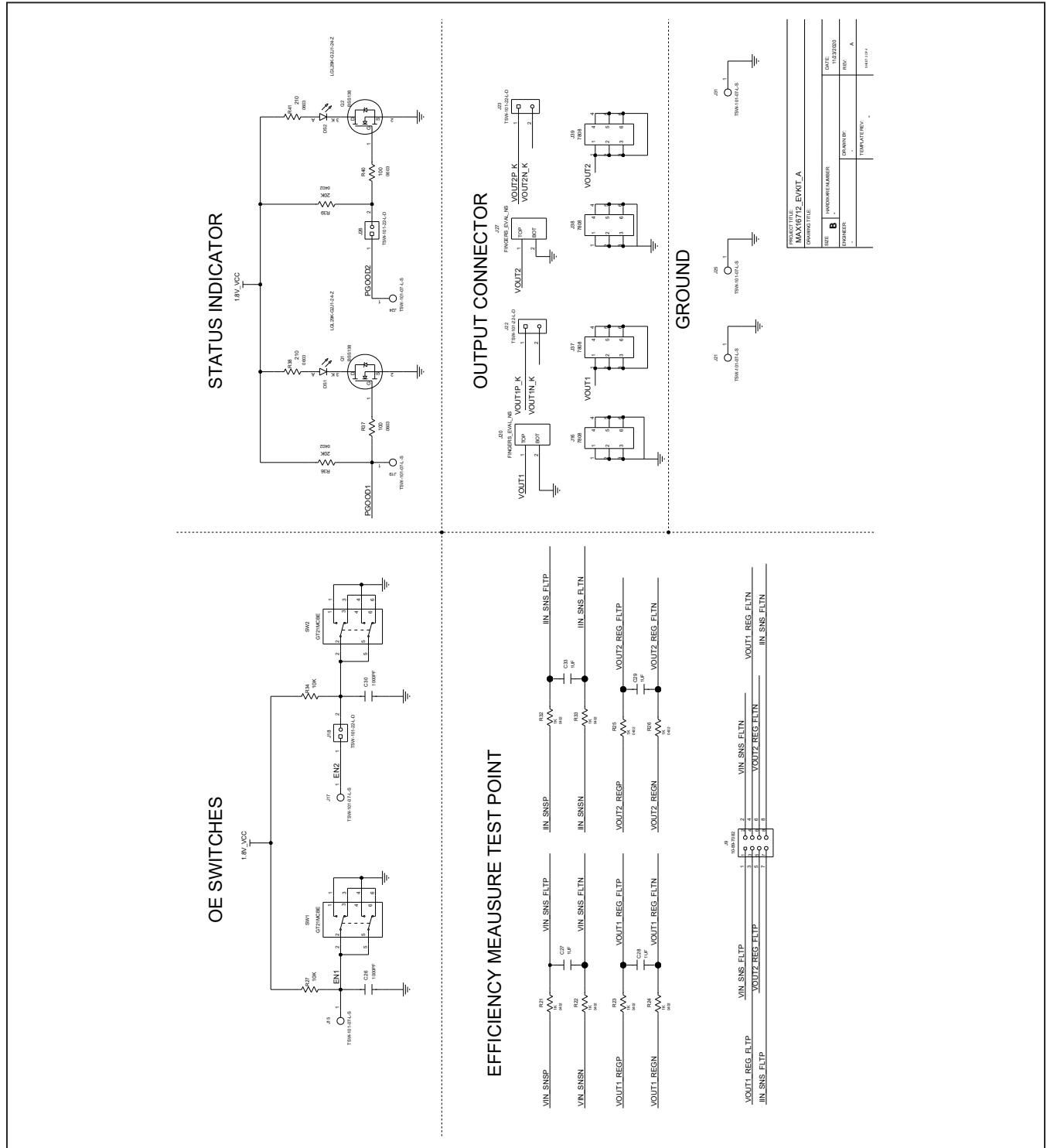
MAX16712 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1, C2	-	2	C1005X7S0J225K050BC; GRM155C70J225KE11	TDK;MURATA	2.2UF	CAP: SMT (0402); 2.2UF; 10%; 6.3V; X7S; CERAMIC	
2	C3, C5	-	2	TPSD107K020R0085	AVX	100UF	CAP: SMT (7343); 100UF; 10%; 20V; TANTALUM	
3	C4, C14, C17	-	3	GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB	MURATA;TDK; TAIYO YUDEN;TDK	0.1UF	CAP: SMT (0402); 0.1UF; 10%; 25V; X7R; CERAMIC	
4	C6, C27-C29, C33	-	5	GRM155C81E105KE11	MURATA	1UF	CAP: SMT (0402); 1UF; 10%; 25V; X6S; CERAMIC	
5	C7, C53	-	2	CL31X226KAHN3N; GRM31CC81E226KE11	SAMSUNG;MURATA	22UF	CAP: SMT (1206); 22UF; 10%; 25V; X6S; CERAMIC	
6	C8, C9	-	2	GRM31CR71E106KA12; CL31B106KAHNNN	MURATA;SAMSUNG ELECTRONICS	10UF	CAP: SMT (1206); 10UF; 10%; 25V; X7R; CERAMIC	
7	C10, C11	-	2	JMK105B7224KV	TAIYO YUDEN	0.22UF	CAP: SMT (0402); 0.22UF; 10%; 6.3V; X7R; CERAMIC	
8	C12, C13	-	2	C1608X7R1V105K080AC	TDK	1UF	CAP: SMT (0603); 1UF; 10%; 35V; X7R; CERAMIC	
9	C24, C25	-	2	C0402C103K3RAC; GRM155R71E103KA01; C1005X7R1E103K050BB	KEMET;MURATA;TDK	0.01UF	CAP: SMT (0402); 0.01UF; 10%; 25V; X7R; CERAMIC;	
10	C26, C30	-	2	C0402C102K5GAC	KEMET	1000PF	CAP: SMT (0402); 1000PF; 10%; 50V; C0G; CERAMIC	
11	C37, C39, C42, C46, C48-C52, C56, C58, C60, C63, C65, C69, C70	-	16	GRM188C80J226ME15	MURATA	22UF	CAP: SMT (0603); 22UF; 20%; 6.3V; X6S; CERAMIC	
12	C40, C54	-	2	T491X477K010AT	KEMET	470UF	CAP: SMT (7343); 470UF; 10%; 10V; TANTALUM	
13	D1	-	1	1N5250B	FAIRCHILD SEMICONDUCTOR	20V	DIODE, ZENER, DO-35, Pd=0.5W, Vz=20V@Iz=6.2mA	
14	DS1, DS2	-	2	LGL29K-G2J1-24-Z	OSRAM	LGL29K-G2J1-24-Z	DIODE; LED; SMARTLED; GREEN; SMT; PIV=1.7V; IF=0.02A	
15	J1	-	1	3750-2	POMONA ELECTRONICS	3750-2	CONNECTOR; FEMALE; SMT; COLOR RED; STANDARD BINDING POST; STRAIGHT; 1PIN	
16	J2	-	1	3750-0	POMONA ELECTRONICS	3750-0	CONNECTOR; FEMALE; SMT; COLOR BLACK; STANDARD BINDING POST; STRAIGHT; 1PIN	
17	J3, J10-J13, J18, J22, J23, J26	-	9	TSW-101-22-L-D	SAMTEC	TSW-101-22-L-D	CONNECTOR; MALE; THROUGH HOLE; .025IN SQ POST HEADER; STRAIGHT; 2PINS	
18	J4-J7, J15, J17, J19, J21, J24, J25, J31	-	11	TSW-101-07-L-S	SAMTEC	TSW-101-07-L-S	CONNECTOR; MALE; THROUGH HOLE; TSW SERIES; STRAIGHT; 1PIN	
19	J8, J14	-	2	TSW-103-07-L-D	SAMTEC	TSW-103-07-L-D	CONNECTOR; MALE; THROUGH HOLE; THROUGH HOLE 0.025 POST HEADER; STRAIGHT; 8PINS	
20	J9	-	1	10-89-7082	MOLEX	10-89-7082	CONNECTOR, TH, MALE, SALES ASSY-HIGH TEMP DUAL ROW WAFER WITH BREAK-OFF OPTION, 8PINS, STR	
21	J16, J37-J39	-	4	7808	KEYSTONE	7808	TERMINAL; BODY LENGTH=0.67IN; BODY WIDTH=0.47IN; HEIGHT=0.45IN; SCRW; BRASS	
22	J29, J30, J35, J36	-	4	29301	GENERIC PART	N/A	MACHINE SCREW; SLOTTED; PAN; M2.5; 6MM; STEEL; ZINC PLATE	
23	J29, J30, J35, J36	-	4	24427	GENERIC PART	N/A	STANDOFF; FEMALE-THREADED; HEX; M2.5; 20MM; ALUMINUM	
24	L1, L2	-	2	PA5003.471NLT	PULSE	0.47UH	INDUCTOR; SMT; COMPOSITE; 0.47UH; 20%; 18.4A	

MAX16712 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
25	Q1, Q2	-	2	BSS138	ON SEMICONDUCTOR	BSS138	TRAN; LOGIC LEVEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR; NCH; SOT-23; PD-(0.36W); I-(0.22A); V-(50V); -55 DEGC TO +150 DEGC	
26	R1	-	1	CRCW04024R70FK	VISHAY DALE	4.7	RES; SMT (0402); 4.7; 1%; +/-100PPM/DEGC; 0.0630W	
27	R2	-	1	CSR2512C0R001F	RIEDON INC.	0.001	RES; SMT (2512); 0.001; 1%; +/-50PPM/DEGC; 3W	
28	R11	-	1	CR0402-16W-2871F; CRCW04022K87	VENKEL LTD.;VISHAY DALE	2.87K	RES; SMT (0402); 2.87K; 1%; +/-100PPM/DEGC; 0.0630W	
29	R12, R13, R15	-	3	CRCW04023K01FK	VISHAY DALE	3.01K	RES; SMT (0402); 3.01K; 1%; +/-100PPM/DEGC; 0.0630W	
30	R14	-	1	CRCW04024K22FK	VISHAY DALE	4.22K	RES; SMT (0402); 4.22K; 1%; +/-100PPM/DEGC; 0.0630W	
31	R19, R20	-	2	CRCW040210R0FK; 9C04021A10R0FL	VISHAY DALE;YAGEO	10	RES; SMT (0402); 10; 1%; +/-100PPM/DEGC; 0.0630W	
32	R21-R26, R32, R33	-	8	ERJ-2RKF1001	PANASONIC	1K	RES; SMT (0402); 1K; 1%; +/-100PPM/DEGC; 0.1000W	
33	R27, R34	-	2	ERJ-2RKF1002	PANASONIC	10K	RES; SMT (0402); 10K; 1%; +/-100PPM/DEGC; 0.1000W	
34	R35	-	1	ERJ-2GE0R00	PANASONIC	0	RES; SMT (0402); 0; JUMPER; JUMPER; 0.1000W	
35	R36, R39	-	2	CRCW040220K0FK	VISHAY DALE	20K	RES; SMT (0402); 20K; 1%; +/-100PPM/DEGC; 0.0630W	
36	R37, R40	-	2	CRCW0603100RFK; ERJ-3EKF1000; RC0603FR-07100RL	VISHAY DALE;PANASONIC	100	RES; SMT (0603); 100; 1%; +/-100PPM/DEGC; 0.1000W	
37	R38, R41	-	2	ERJ-3EKF2100	PANASONIC	210	RES; SMT (0603); 210; 1%; +/-100PPM/DEGC; 0.1000W	
38	SU1, SU3-SU5	-	4	S1100-B;SX1100-B; STC02SYAN	KYCON;KYCON;SULLINS ELECTRONICS CORP.	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT;PHOSPHOR BRONZE CONTACT=GOLD PLATED	
39	SW1, SW2	-	2	GT21MCBE	C&K COMPONENTS	GT21MCBE	SWITCH; DPDT; THROUGH HOLE; 20V; 0.4VA; GT SERIES; SEALED ULTRAMINIATURE TOGGLE SWITCH; RCOIL= 0.05 OHM; RINSULATION=10G OHM; C&K COMPONENTS	
40	U1	-	1	MAX16712	MAXIM	MAX16712	EVKIT PART - IC; MAX16712; PACKAGE OUTLINE NUMBER: 21-100392; PACKAGE CODE: W282D3Z+1; WLP28	
41	PCB	-	1	MAX16712	MAXIM	PCB	PCB:MAX16712	
42	R44-R46	DNI	3	CRCW25120000ZS	VISHAY DALE	0	RES; SMT (2512); 0; 1%; JUMPER; 1W	
43	C36, C38, C41, C43, C55, C57, C59, C62	DNP	0	GRM21BR61A476ME15	MURATA	47UF	CAP; SMT (0805); 47UF; 20%; 10V; X5R; CERAMIC	
44	C44, C45, C67, C68	DNP	0	GRM188C80J226ME15	MURATA	22UF	CAP; SMT (0603); 22UF; 20%; 6.3V; X6S; CERAMIC	
45	C47, C61	DNP	0	GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB	MURATA;TDK; TAIYO YUDEN;TDK	0.1UF	CAP; SMT (0402); 0.1UF; 10%; 25V; X7R; CERAMIC	
46	R6	DNP	0	RC0402FR-070RL	YAGEO	0	RES; SMT (0402); 0; 1%; JUMPER; 0.0630W	
47	R54, R55	DNP	0	ERJ-P06F1000	PANASONIC	100	RES; SMT (0805); 100; 1%; +/-100PPM/DEGC; 0.5000W	
TOTAL			123					

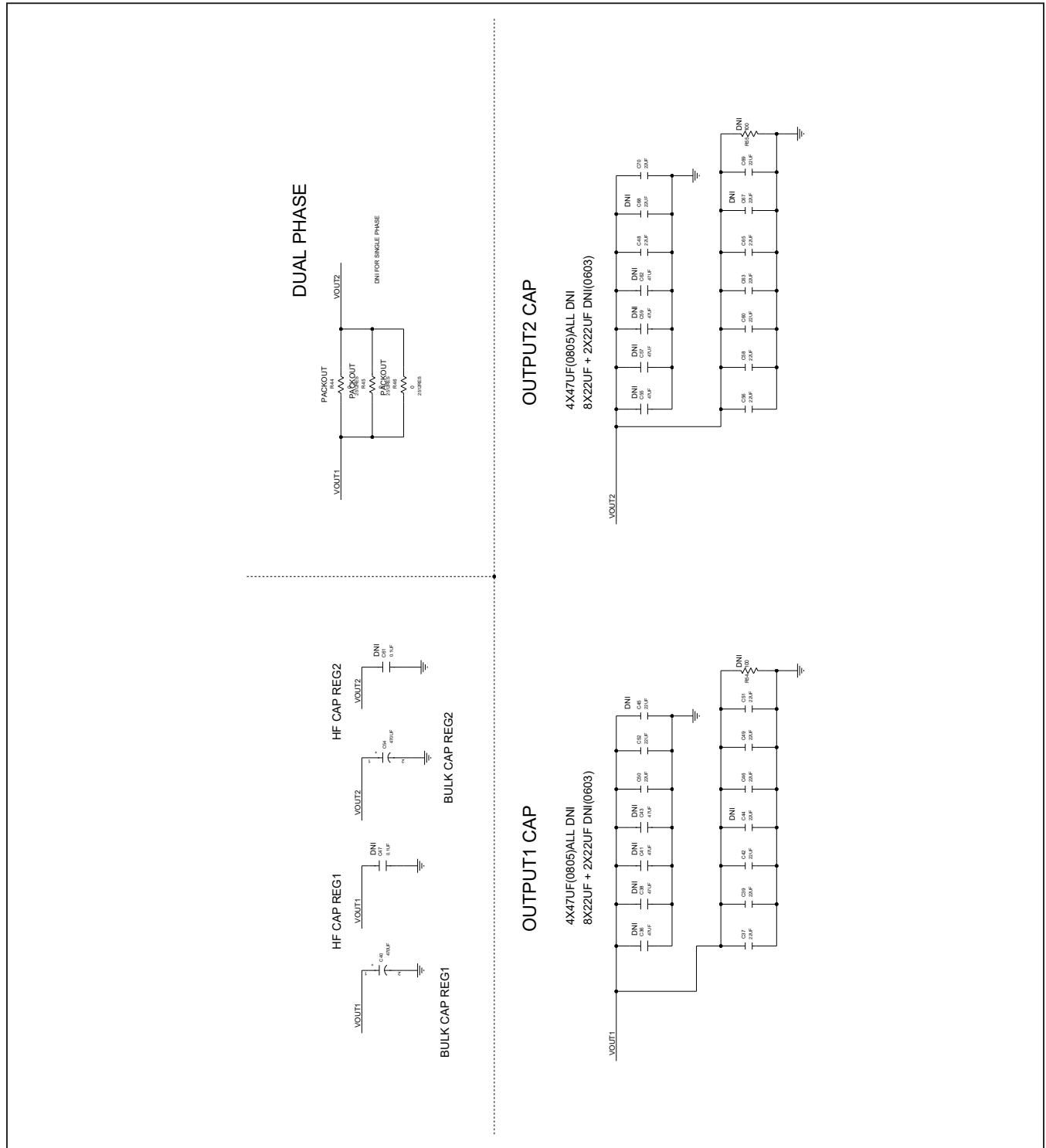
MAX16712 EV Kit Schematic (continued)



MAXIM INTEGRATED	
MAX16712 EVKIT A	
REV. A	
DATE	ISSUE
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DESIGNED BY	DESIGNED BY
REV. A	1
TESTED BY	TESTED BY
REV. A	1

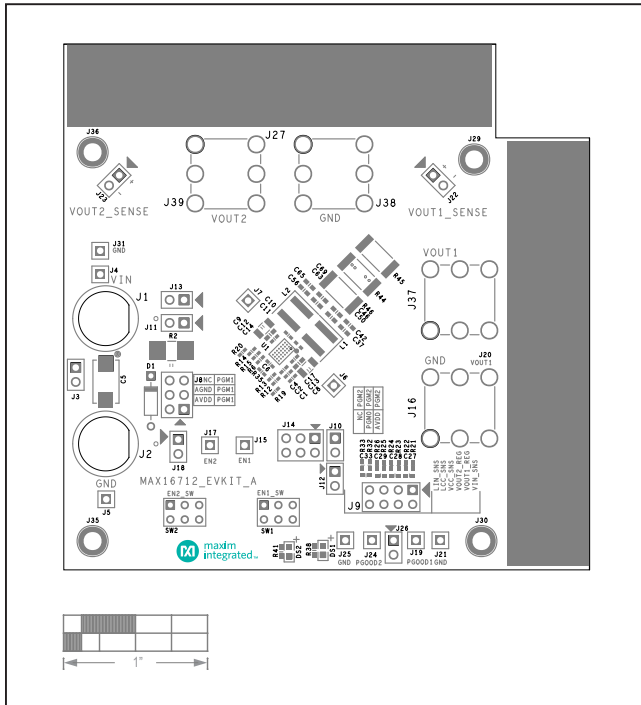
MAX16712 EV Kit Schematic (2 of 3)

MAX16712 EV Kit Schematic (continued)

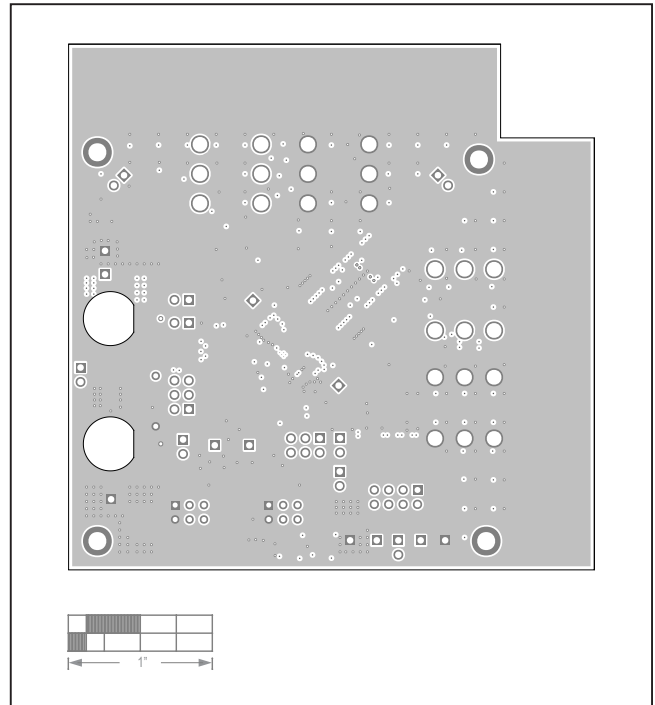


MAX16712 EV Kit Schematic (3 of 3)

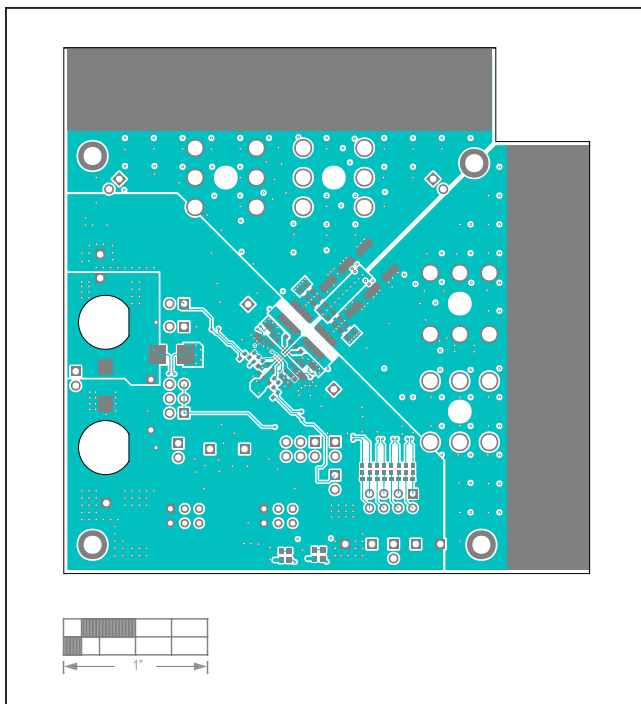
MAX16712 EV Kit Layout



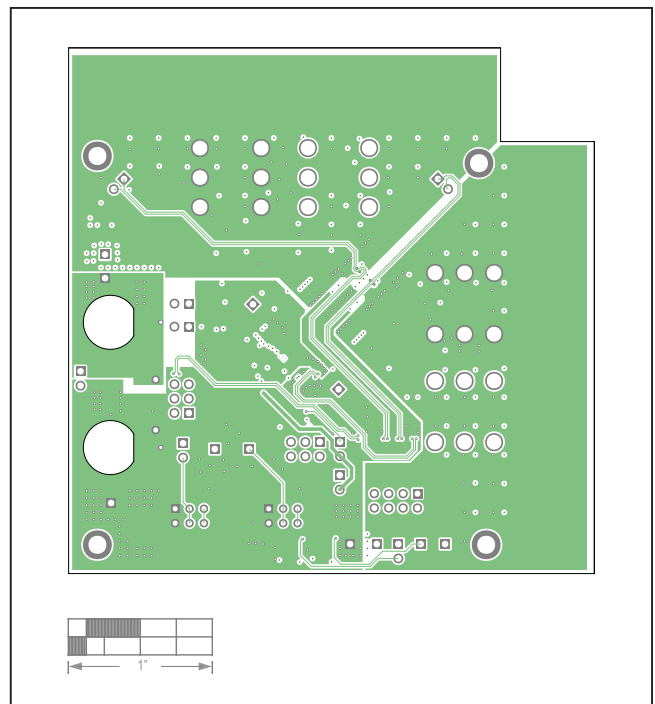
MAX16712 EV Kit PCB—Silk Top



MAX16712 EV Kit PCB—Layer 2

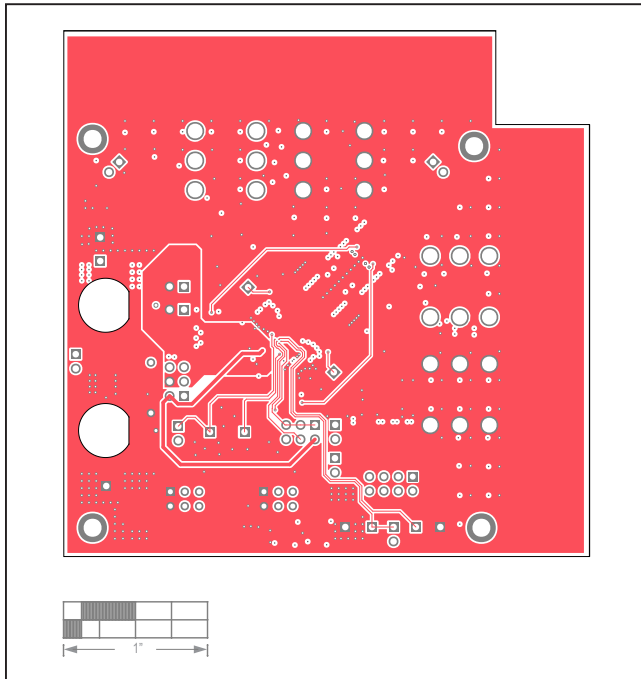


MAX16712 EV Kit PCB—Top

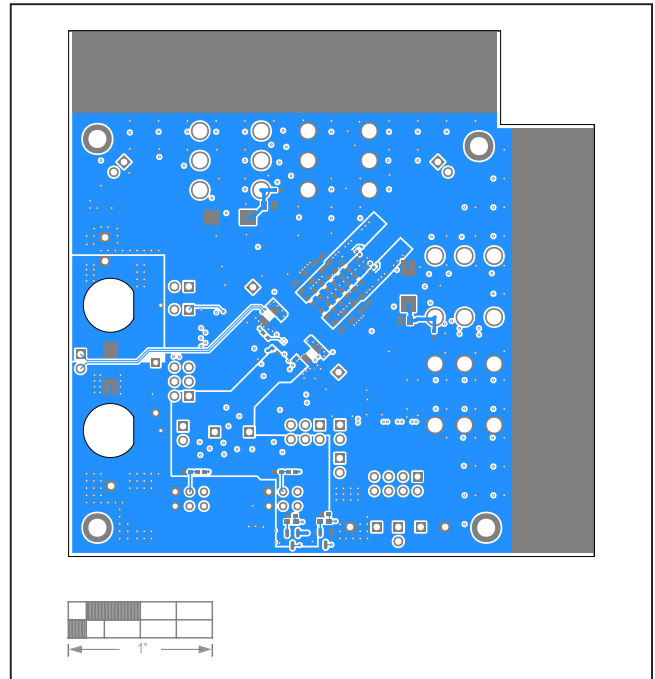


MAX16712 EV Kit PCB—Layer 3

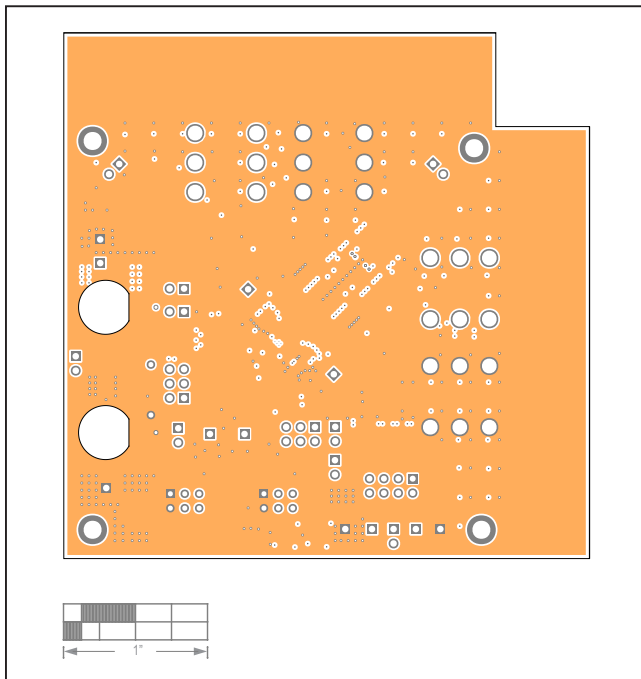
MAX16712 EV Kit Layout (continued)



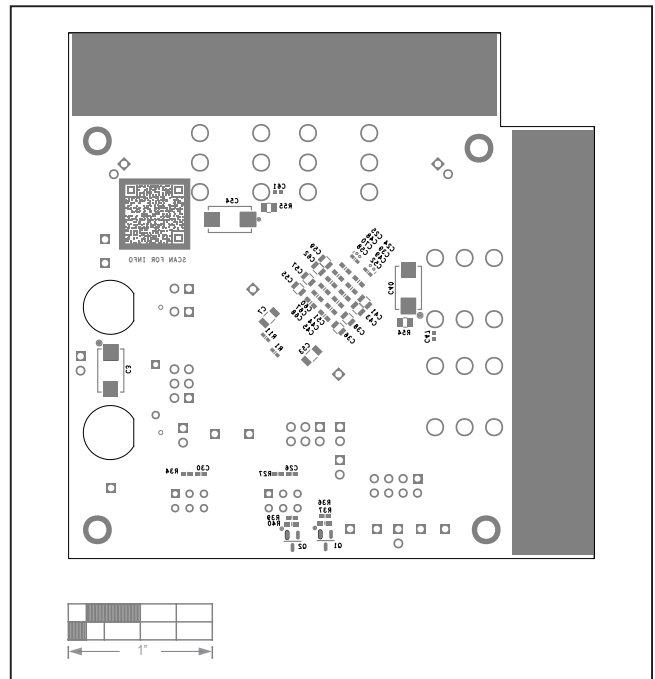
MAX16712 EV Kit PCB—Layer 4



MAX16712 EV Kit PCB—Bottom



MAX16712 EV Kit PCB—Layer 5



MAX16712 EV Kit PCB—Silk Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/21	Initial release	—

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