

Evaluates: MAX20804

General Description

The MAX20804 evaluation kit (EV kit) is a reference platform designed for the evaluation of the MAX20804, a compact, low-cost, fully integrated, highly efficient, step-down DC-DC switching regulator IC. The IC is in a 14-pin, 3.0mm x 2.5mm FC2QFN package. This EV kit can deliver up to 4A load current. For more information, refer to the MAX20804 IC data sheet.

The EV kit comprises a fully assembled and tested PCB implementation of the MAX20804. The jumper pins, test points, and input/output connectors are included to provide a flexible and convenient use in a wide range of applications.

Benefits and Features

- 2.7V to 16V Input Voltage Range
- 0.5V to 5.8V Output Voltage Range
- 500kHz to 3.0MHz Switching Frequency Range
- High Efficiency and Power Density
- Low Component Count
- Optimized Performance
- Proven PCB Layout
- Fully Assembled and Tested

Quick Start

Required Equipment

- MAX20804 EV kit
- 2.7V to 16V power supply
- 0 to 4A load
- Digital voltmeters
- Oscilloscope and probes

Procedure

The MAX20804 EV kit is fully assembled and tested. Use the following steps to verify board operation.

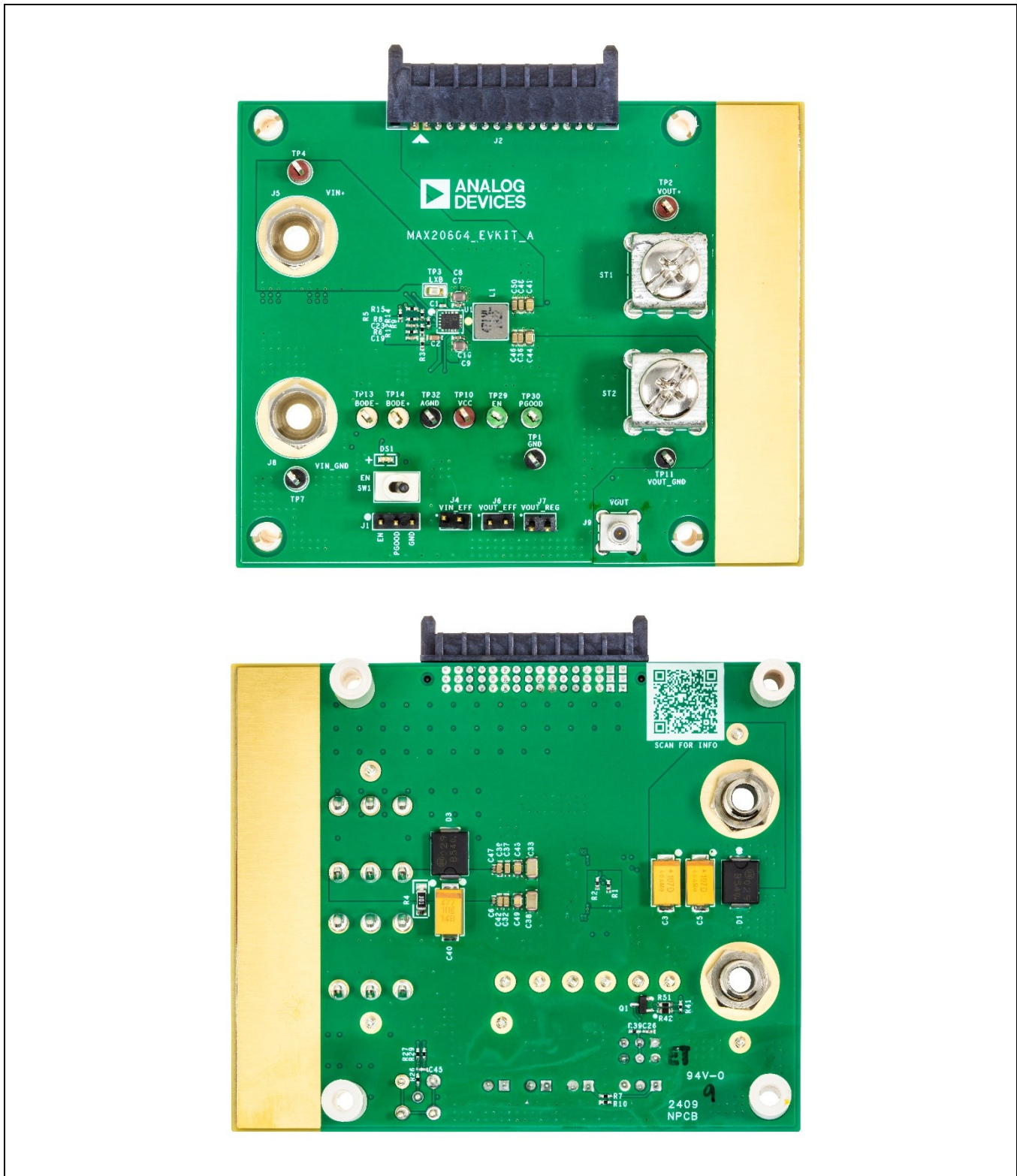
1. Position the SW1 toggle switch to disable the IC.
2. Connect a powered-off 2.7V to 16V input supply to J5 (positive terminal) and J8 (negative terminal) to the bias input V_{IN} (VDDH). Verify that the input polarity is correct before proceeding to the next step.
3. Connect the electronic load to the outputs of the PCB to the screw terminals ST1 (V_{OUT}) and ST2 (GND) or to the edge connector. Verify that the output polarity is correct before proceeding to the next step.
4. Connect the oscilloscope or multimeter probes to TP2 (V_{OUT}) and TP11 (GND) to measure the output voltage at the loading point.
5. Turn on the 2.7V to 16V input power supply.
6. Position the SW1 toggle switch towards the “EN” silkscreen to enable the IC.
7. Enable the electronic load to the desired level, if applicable.
8. Observe that $V_{OUT} = 1V$ (the EV kit’s default configuration).

Notes:

- For accurate efficiency measurements, use pin header J4 for V_{IN} measurement and J6 for V_{OUT} measurement.
- For accurate V_{OUT} regulation measurement across the full load range, use J7 or J9 for V_{OUT} sensing measurement.
- For low-noise V_{OUT} ripple measurement, probe across capacitor C47.

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

MAX20804 EV Kit Board Photos



Operation

The MAX20804 IC is a monolithic, high-frequency, step-down switching regulator optimized for applications that require a small size, low noise, and high efficiency. For detailed product and application information, refer to the MAX20804 IC data sheet.

Output Enable (OE)

The OE is used to enable/disable the IC by toggling SW1. When OE is enabled, the IC starts switching and the output voltage is regulated. Likewise, when OE is disabled, the IC stops switching and the output discharges.

Output-Voltage Selection

The MAX20804 EV kit is configured to initially boot up to an output voltage of 1V. The device has a fixed 0.5V reference voltage, and the output voltage is configured by placing a voltage divider in the feedback path.

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

where:

V_{OUT} = Output voltage

V_{REF} = 0.5V fixed reference voltage

R_{FB1} = Top divider resistor

R_{FB2} = Bottom divider resistor

Soft-Start

When V_{IN} and EN are above their rising thresholds, soft-start begins and switching is enabled. The soft-start ramp time is 3ms. The device also supports smooth startup with output prebiased.

Switching Frequency

The switching frequency is programmable—parameters and PGM0 are used to select the switching frequency. For the MAX20804 EV kit, the switching frequency is set to 1000kHz. For more information, refer to the *PGM0 Switching Frequency, AMS, and DCM Selections* table (Table 1) in the MAX20804 IC data sheet.

Pin-Strap Programmability

The MAX20804 EV kit provides an option to configure the part for the desired application using PGMx resistor values. For details, refer to *PGM0 Switching Frequency, AMS, and DCM Selections* table (Table 1) and the *PGM1 Configurations for OUTPUT* table (Table 2) in the MAX20804 IC data sheet. Appropriate values of the resistors R1 and R2 can be used for the desired application and protection.

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. For more information, refer to the MAX20804 IC data sheet.

Input-Voltage Monitoring

Monitor the input supply on TP4 for V_{IN} and TP7 for GND.

Switching-Voltage Monitoring

Use TP3 to monitor the switching LX waveform.

Output-Voltage Monitoring

Several V_{OUT} test points on the EV kit can be used for various testing setups. The output voltage-sense point can be monitored on pin header J7 or SMB connector J9. The output voltage at the load terminals can be monitored on TP2 (output terminal) and TP11 (ground terminal).

Note: These test points should not be used for loading.

Efficiency Testing

The J4 pin header test point is provided to measure V_{IN} , and the J6 pin header test point to measure V_{OUT} during efficiency measurement.

Bode Plot

A 10Ω resistor is installed between the V_{OUT} sense point and SNSP pin to measure the Bode plot. The TP13 and TP14 test points are provided on the board on either side of the 10Ω resistor for small signal injection and the ability to measure the Bode plot for V_{OUT} .

Ordering Information

PART	TYPE
MAX20804EVKIT#	EV Kit

#Denotes RoHS-compliant.

MAX20804 EV Kit Bill of Materials

ITEM	REF_DES	DNI/ DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	C1	—	1	C0402X5R100-224KNP; GRM155R61A224KE19; 0402ZD224KAT2A	MURATA; VENKEL; AVX	0.22UF	CAP; SMT (0402); 0.22UF; 10%; 10V; X5R; CERAMIC
2	C2	—	1	C1608X5R1E475K080AC; GRM188R61E475KE11	TDK; MURATA	4.7UF	CAP; SMT (0603); 4.7UF; 10%; 25V; X5R; CERAMIC
3	C3, C5	—	2	TPSD107K020R0085	AVX	100UF	CAP; SMT (7343); 100UF; 10%; 20V; TANTALUM
4	C6, C47	—	2	GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB	MURATA; TDK; TAIYO YUDEN; TDK	0.1UF	CAP; SMT (0402); 0.1UF; 10%; 25V; X7R; CERAMIC
5	C7, C16	—	2	GRM155R71E104ME14	MURATA	0.1UF	CAP; SMT (0402); 0.1UF; 20%; 25V; X7R; CERAMIC
6	C8, C9	—	2	GRM21BC71E106KE11	MURATA	10UF	CAP; SMT (0805); 10UF; 10%; 25V; X7S; CERAMIC
7	C26	—	1	C0402C102K5GAC	KEMET	1000PF	CAP; SMT (0402); 1000PF; 10%; 50V; C0G; CERAMIC
8	C32, C36, C37, C39, C42, C46, C48, C50	—	8	GRM188C80J226ME15	MURATA	22UF	CAP; SMT (0603); 22UF; 20%; 6.3V; X6S; CERAMIC
9	C45	—	1	C0402C101J5GAC; NMC0402NPO101J; CC0402JRNPO9BN101; GRM1555C1H101JA01; C1005C0G1H101J050BA	KEMET; NIC COMPONENTS CORP.; YAGEO PHICOMP; MURATA; TDK	100PF	CAP; SMT (0402); 100PF; 5%; 50V; C0G; CERAMIC
10	D1, D3	—	2	MBRS540T3G	ON SEMICONDUCTOR	MBRS540T3	DIODE; SCH; SURFACE MOUNT SCHOTTKY POWER RECTIFIER; SMC; PIV=40V; IF=5A
11	DS1	—	1	LGL29K-G2J1-24-Z	OSRAM	LGL29K- G2J1-24-Z	DIODE; LED; SMARTLED; GREEN; SMT; PIV=1.7V; IF=0.02A
12	J1	—	1	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; - 65 DEGC TO +125 DEGC
13	J2	—	1	UPS-08-01-01-L-RA	SAMTEC	UPS-08-01- 01-L-RA	CONNECTOR; FEMALE; THROUGH HOLE; DUAL LEAF POWER HEADER;

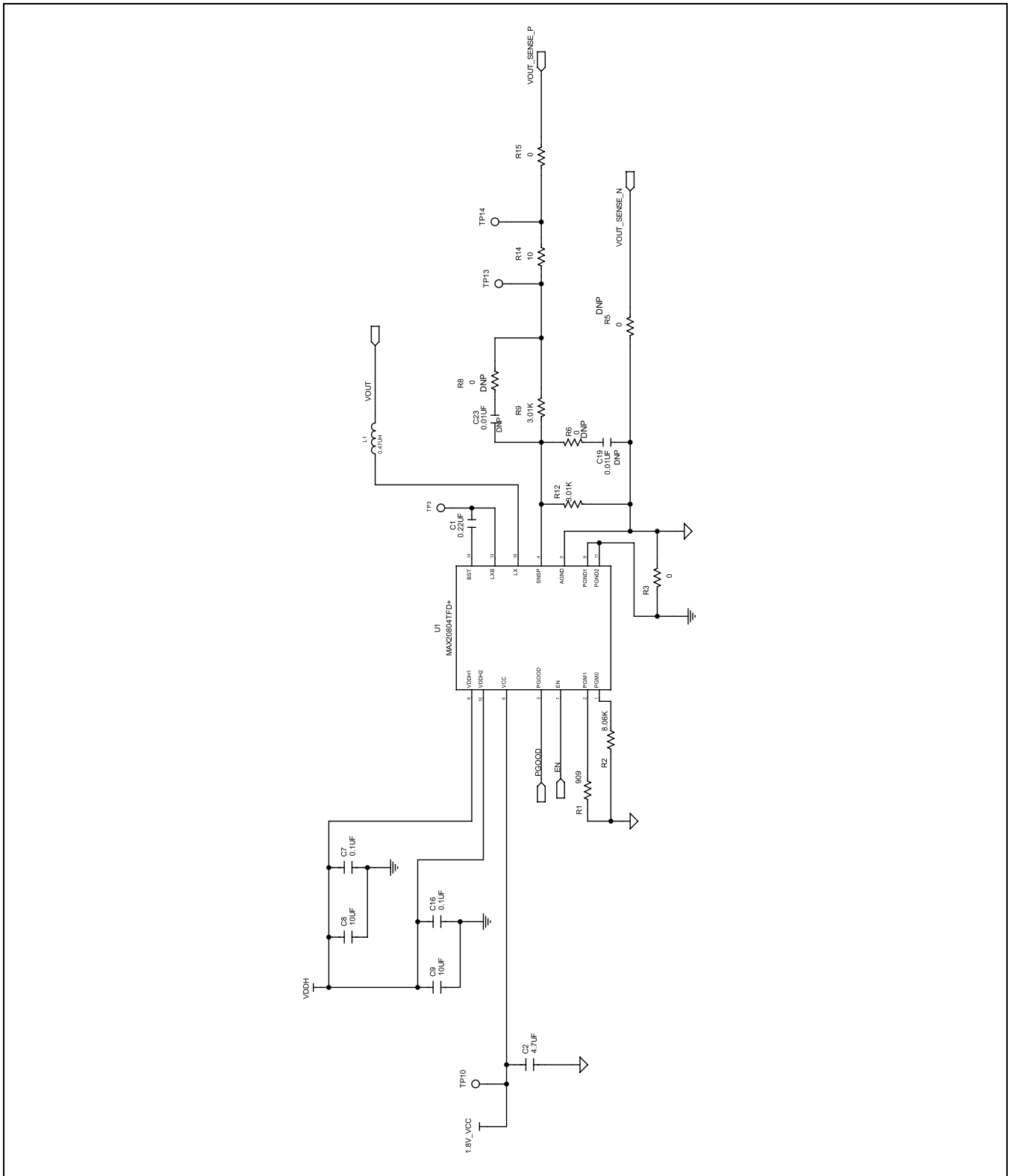
ITEM	REF_DES	DNI/ DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
							RIGHT ANGLE; 8PINS
14	J4, J6, J7	—	3	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; - 65 DEGC TO +125 DEGC
15	J5, J8	—	2	6095	KEYSTONE	6095	CONNECTOR; FEMALE; PANELMOUNT; NON- INSULATED RECESSED HEAD BANANA JACK; STRAIGHT THROUGH; 1PIN
16	J9	—	1	131-3701-266	JOHNSON COMPONENTS	131-3701-266	CONNECTOR; MALE; THROUGH HOLE; SMB JACK VERTICAL PCB MOUNT; STRAIGHT; 5PINS
17	L1	—	1	PA5003.471NLT	PULSE	0.47UH	INDUCTOR; SMT; COMPOSITE; 0.47UH; 20%; 18.4A
18	MH1-MH4	—	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON
19	Q1	—	1	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
20	R1	—	1	CR0402-16W-9090FT	VENKEL LTD.	909	RES; SMT (0402); 909; 1%; +/- 100PPM/DEGC; 0.0630W
21	R2	—	1	ERJ-2RKF8061	PANASONIC	8.06K	RES; SMT (0402); 8.06K; 1%; +/- 100PPM/DEGC; 0.1000W
22	R3, R15	—	2	RC0402JR-070RL; CR0402-16W-000RJT	YAGEO PHYCOMP; VENKEL LTD.	0	RES; SMT (0402); 0; 5%; JUMPER; 0.0630W
23	R9, R12	—	2	CRCW04023K01FK	VISHAY DALE	3.01K	RES; SMT (0402); 3.01K; 1%; +/-

ITEM	REF_DES	DNI/ DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
							100PPM/DEGC; 0.0630W
24	R14	—	1	9C04021A10R0FL	YAGEO	10	RES; SMT (0402); 10; 1%; +/- 100PPM/DEGC; 0.0630W
25	R26	—	1	CRCW040249R9FKEDHP	VISHAY DRALORIC	49.9	RES; SMT (0402); 49.9; 1%; +/- 100PPM/DEGC; 0.2000W
26	R39	—	1	ERJ-2RKF1002	PANASONIC	10K	RES; SMT (0402); 10K; 1%; +/- 100PPM/DEGC; 0.1000W
27	R41	—	1	CRCW040220K0FK	VISHAY DALE	20K	RES; SMT (0402); 20K; 1%; +/- 100PPM/DEGC; 0.0630W
28	R42	—	1	RC0603FR-07100RL; CR0603-FX-1000ELF	YAGEO; BOURNS	100	RES; SMT (0603); 100; 1%; +/- 100PPM/DEGC; 0.1000W
29	R51	—	1	ERJ-3EKF2100	PANASONIC	210	RES; SMT (0603); 210; 1%; +/- 100PPM/DEGK; 0.1000W
30	ST1, ST2	—	2	7808	KEYSTONE	7808	TERMINAL; BODY LENGTH=0.67IN; BODY WIDTH=0.47IN; HEIGHT=0.45IN; SCRW; BRASS
31	SW1	—	1	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
32	TP1, TP7, TP11, TP32	—	4	5011	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
33	TP2, TP4, TP10	—	3	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD

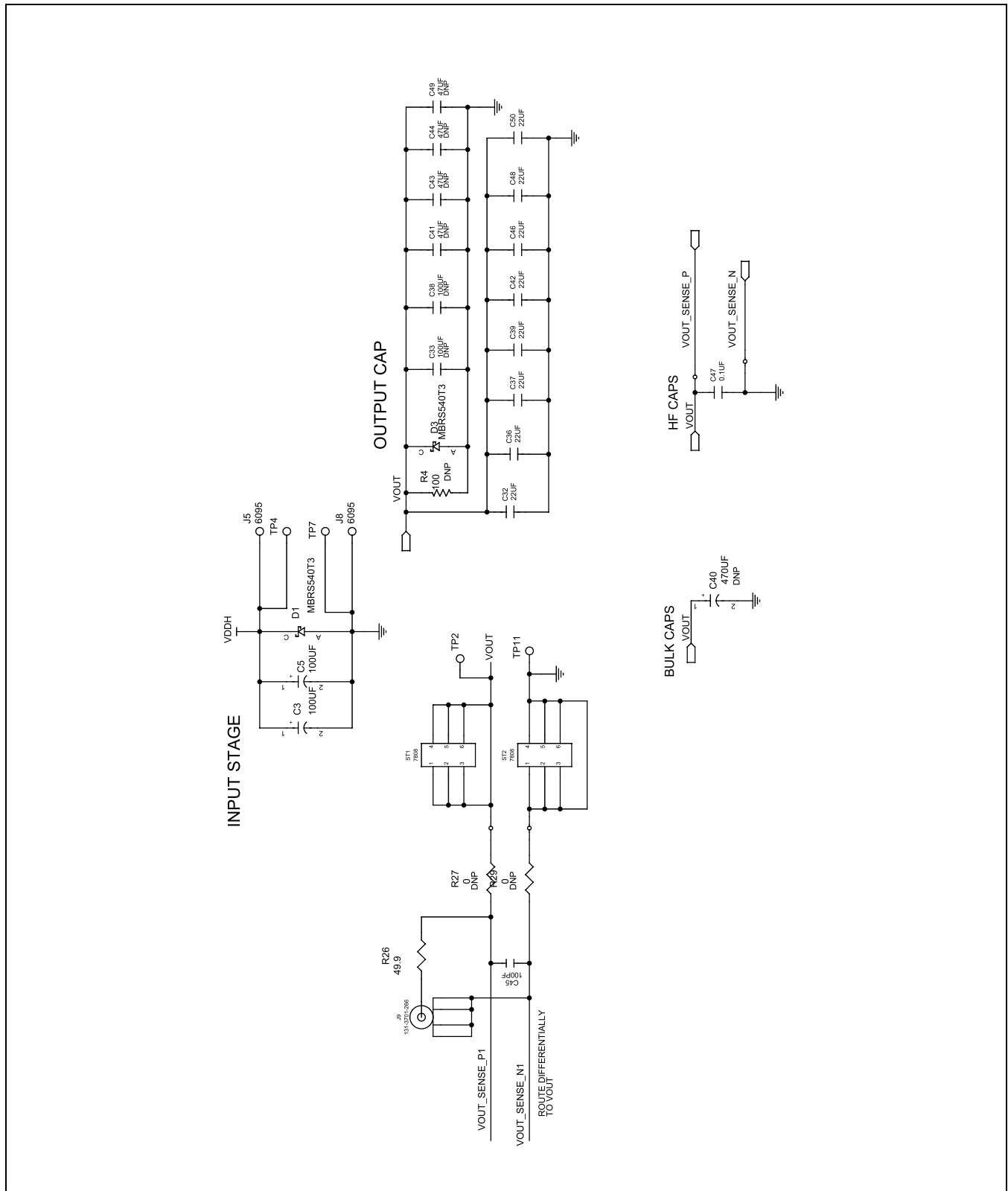
ITEM	REF_DES	DNI/ DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
							HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;
34	TP3	—	1	USE FOR COLD TEST: 5015	KEYSTONE	N/A	TEST POINT; SMT; PIN LENGTH=0.135IN; PIN WIDTH=0.07IN; PIN HEIGHT=0.06IN; SILVER; PHOSPHOR BRONZE WITH SILVER PLATE CONTACT
35	TP13, TP14	—	2	5012	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
36	TP29, TP30	—	2	5126	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; GREEN; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
37	U1	—	1	MAX20804	ANALOG DEVICES	MAX20804	EVKIT PART - IC; 4A; 3MHZ; 2.7V TO 16V; STEP-DOWN SWITCHING REGULATOR; FC2QFN14
38	PCB	—	1	MAX20804	ANALOG DEVICES	PCB	PCB:MAX20804
39	C19, C23	DNP	2	C0402C103J3RAC	KEMET	0.01UF	CAP; SMT (0402); 0.01UF; 5%; 25V; X7R; CERAMIC
40	C33, C38	DNP	2	GRM31CD80J107ME39	MURATA	100UF	CAP; SMT (1206); 100UF; 20%; 6.3V; X6T; CERAMIC
41	C40	DNP	1	T491X477K010AT	KEMET	470UF	CAP; SMT (7343); 470UF; 10%; 10V; TANTALUM
42	C41, C43, C44, C49	DNP	4	C0805C476M9PAC; GRM21BR60J476ME15	KEMET; MURATA	47UF	CAP; SMT (0805); 47UF; 20%; 6.3V; X5R; CERAMIC
43	R4	DNP	1	ERJ-P08J101	PANASONIC	100	RES; SMT (1206); 100; 5%; +/- 200PPM/DEGC; 0.6600W

ITEM	REF_DES	DNI/ DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
44	R5, R6, R8	DNP	3	RC0402JR-070RL; CR0402-16W-000RJT	YAGEO PHYCOMP; VENKEL LTD.	0	RES; SMT (0402); 0; 5%; JUMPER; 0.0630W
45	R7	DNP	1	CR0402-16W-3013FT; CRCW0402301KFK	VENKEL LTD.; VISHAY DALE	301K	RES; SMT (0402); 301K; 1%; +/- 100PPM/DEGC; 0.0630W
46	R10	DNP	1	CRCW0402100KFK; RC0402FR-07100KL	VISHAY; YAGEO	100K	RES; SMT (0402); 100K; 1%; +/- 100PPM/DEGC; 0.0630W
47	R27, R29	DNP	2	CRCW04020000Z0EDHP; RCS04020000Z0	VISHAY DRALORIC; VISHAY DALE	0	RES; SMT (0402); 0; JUMPER; JUMPER; 0.2000W

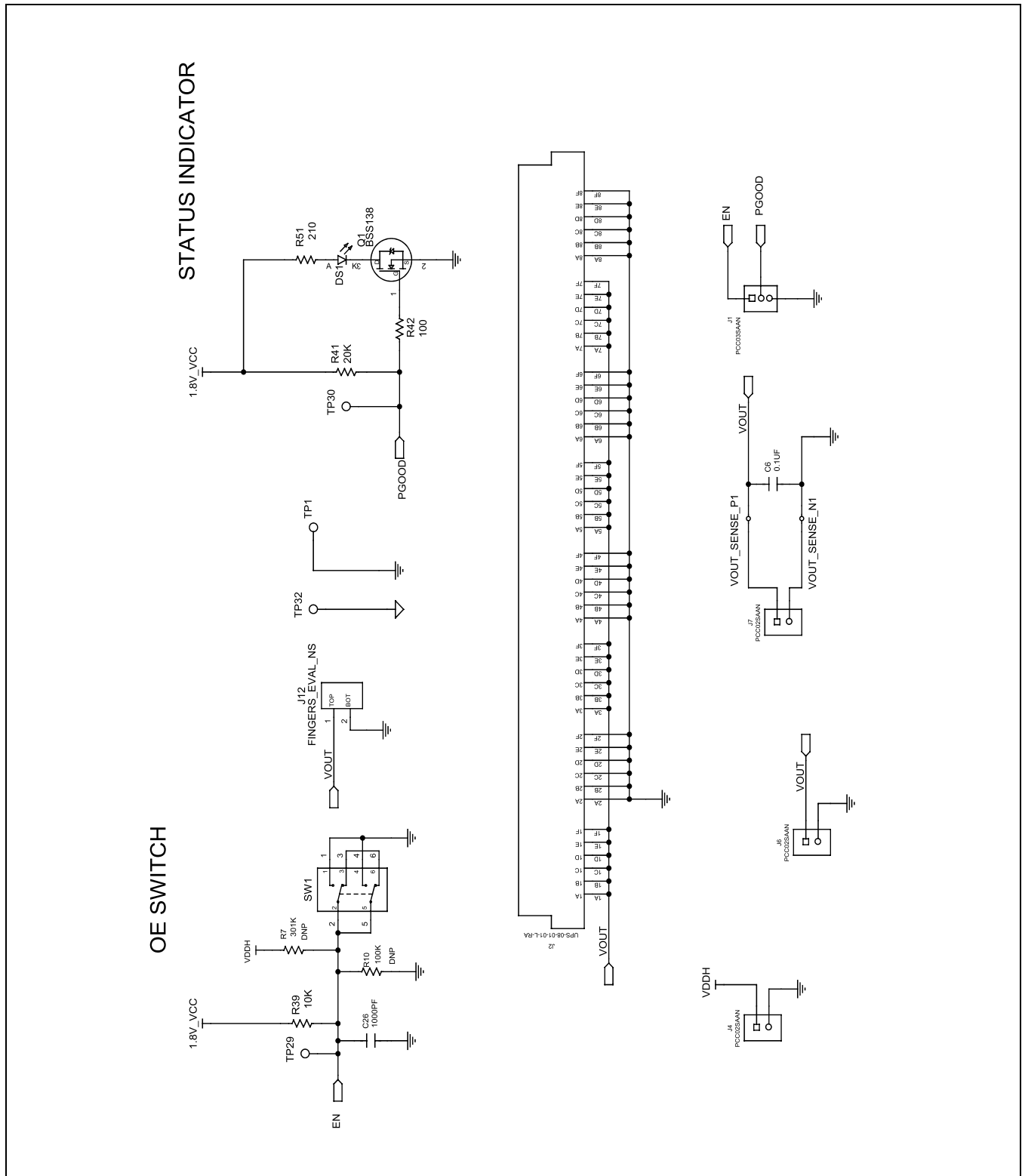
MAX20804 EV Kit Schematics



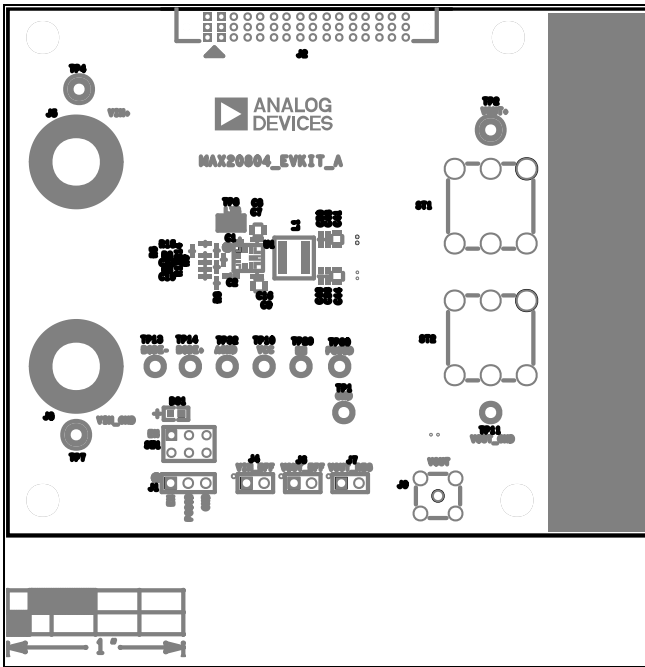
MAX20804 EV Kit Schematics (continued)



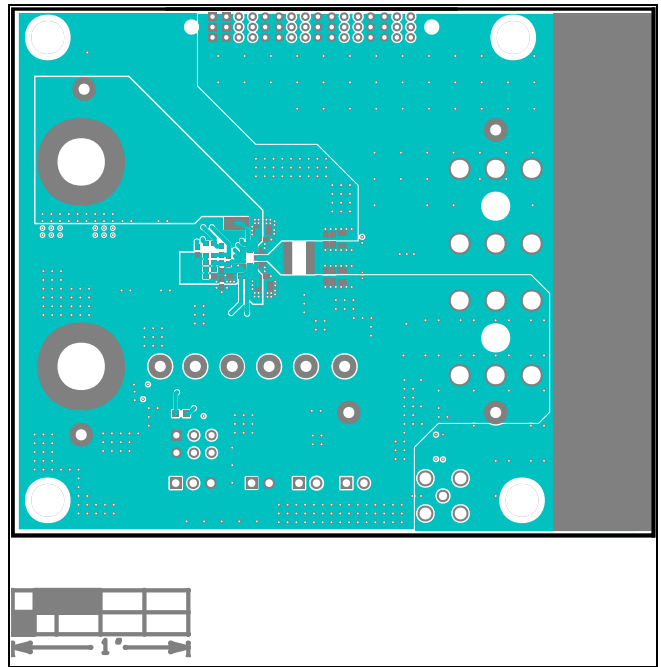
MAX20804 EV Kit Schematics (continued)



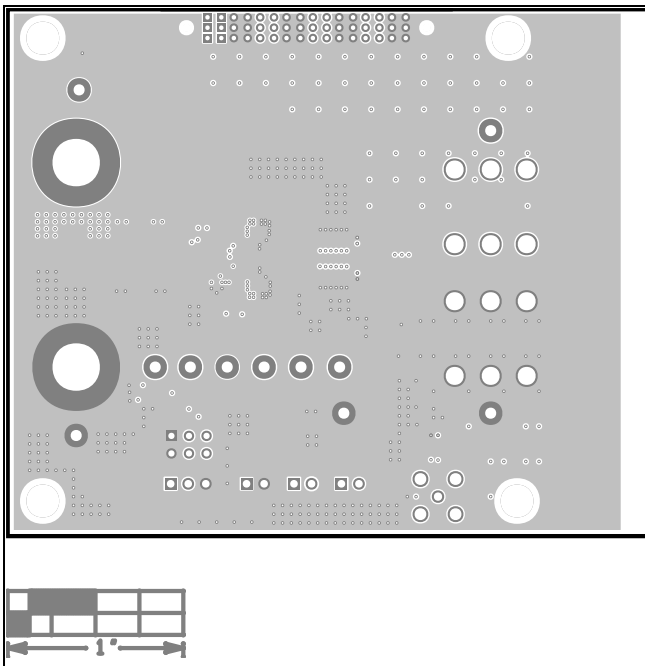
MAX20804 EV Kit PCB Layouts



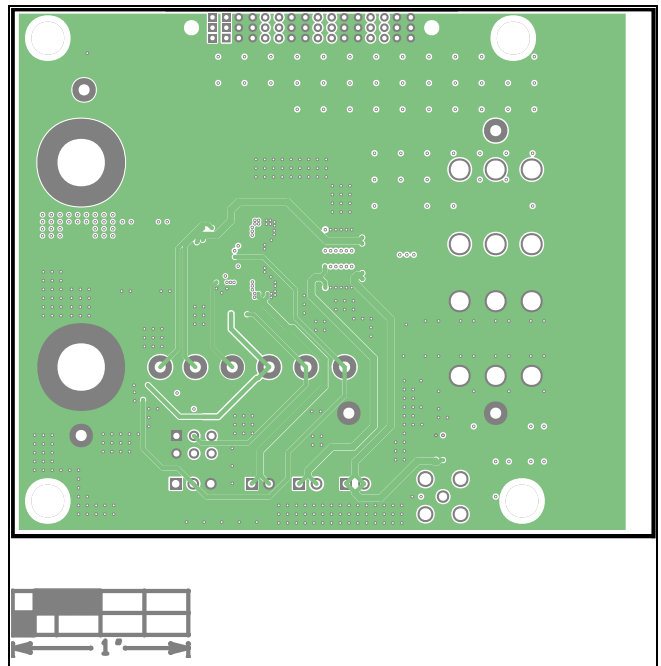
MAX20804 EV Kit Component Placement Guide—Top Silkscreen



MAX20804 EV Kit PCB Layout—Top

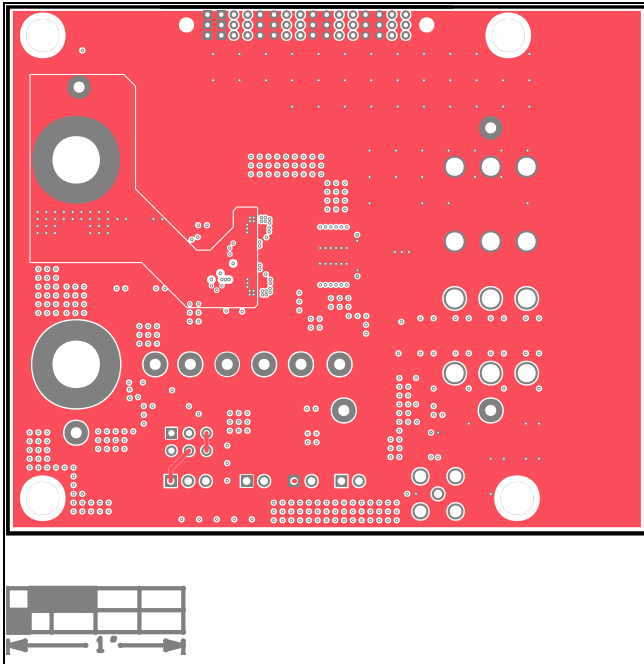


MAX20804 EV Kit PCB Layout—Layer 2

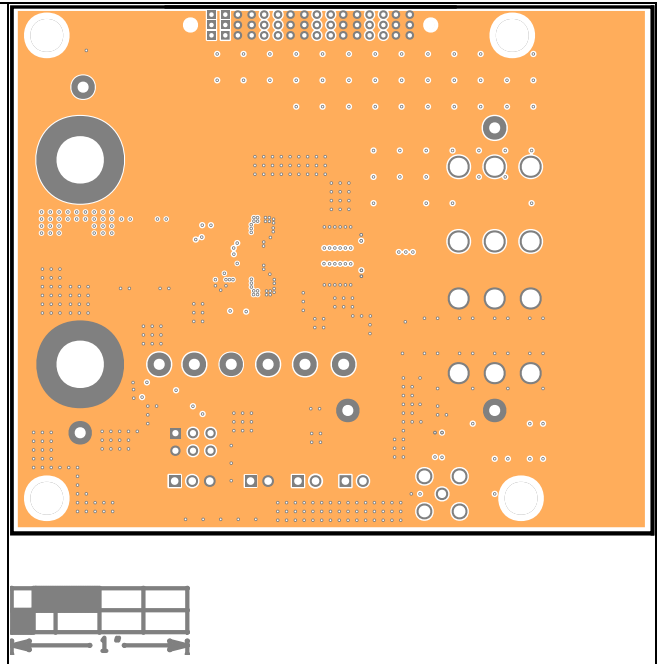


MAX20804 EV Kit PCB Layout—Layer 3

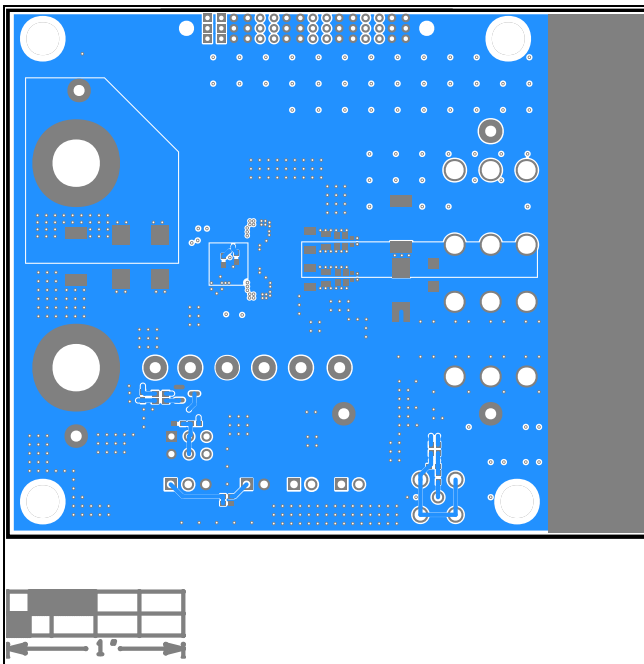
MAX20804 EV Kit PCB Layouts (continued)



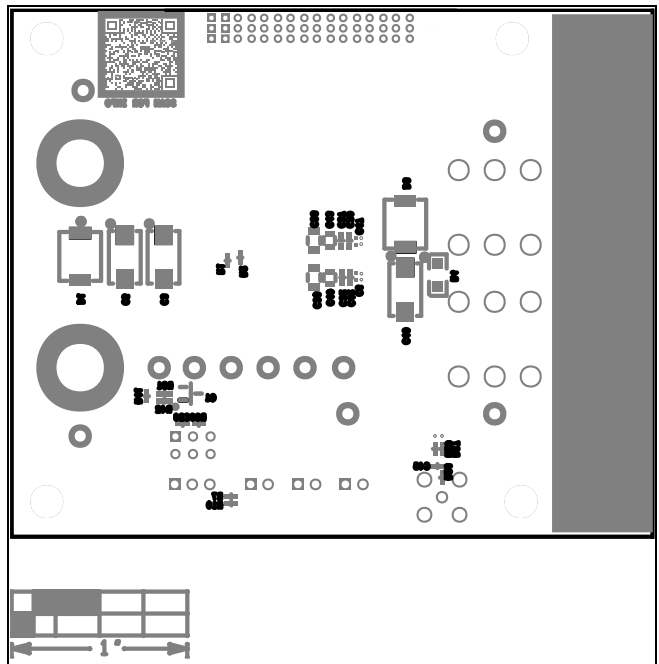
MAX20804 EV Kit PCB Layout—Layer 4



MAX20804 EV Kit PCB Layout—Layer 5



MAX20804 EV Kit PCB Layout—Bottom



MAX20804 EV Kit Component Placement Guide—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/25	Initial release	—

Notes

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