19-4778; Rev 0a; 8/98

MAXIM

MAX668 Evaluation Kit

Evaluates: MAX668/MAX669

General Description

The MAX668 evaluation kit (EV kit) combines a constant-frequency, pulse-width-modulation (PWM) step-up controller with an external N-channel MOSFET and Schottky diode to provide a regulated output voltage. The EV kit accepts a +3V to V_{OUT} input and converts it to a +12V output for currents up to 1A, with greater than 90% conversion efficiency. The EV kit operates at 500kHz, allowing the use of small external components.

The MAX668 EV kit is a fully assembled and tested surface-mount circuit board. This EV kit can also be configured for the application circuits listed in the *EV Kit Application Circuit Capabilities* table. For input voltages below 3V and down to 1.8V, replace the MAX668 with a MAX669. The MAX669 must always operate in bootstrapped mode (JU2 shunt across pins 1 and 2).

Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX668EVKIT	0°C to +70°C	10 µMAX

Note: *To evaluate the MAX669, request a MAX669EUB free sample with the MAX668EVKIT.*

EV Kit Application Circuit Capabilities

$V_{IN(MIN)}$ (V)	V_{OUT} (V)	I_{OUT} (A)
1.8	12	0.4
1.8	24	0.1
2.5	12	0.65
3	5	3
3	12	1
3	36	0.02
12	24	0.5

Note: *Design information for these applications is included. The shaded row shows EV kit configuration as shipped.*

Features

- **+3V to V_{OUT} Input Range (as shipped)**
- **+12V or Adjustable Output Voltage**
- **Output Current Up to 1A**
- **N-Channel External MOSFET**
- **4µA IC Shutdown Current**
- **500kHz Switching Frequency**
- **Surface-Mount Components**
- **Fully Assembled and Tested**

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	68µF, 20V, low-ESR tantalum cap Sprague 593D686X0020E2W or AVX TPSE686M020R0150
C5	1	120µF, 20V, low-ESR tantalum cap Sprague 594D127X0020R2T
C2	1	0.1µF ceramic capacitor
C3	1	0.22µF ceramic capacitor
C4, C8	2	1µF ceramic capacitors
C7	1	220pF ceramic capacitor
C6	0	Not installed
D1	1	3A Schottky diode Hitachi HRF302A or Motorola MBRS340T3
L1	1	4.7µH power inductor Sumida CDRH104-4R7 (shielded), Coiltronics UP2B-4R7, or Coilcraft DO3316P-472
N1	1	N-channel MOSFET Fairchild FDS6680 or International Rectifier IRF7801
R1	1	0.020Ω, 1%, 1/2W resistor Dale WSL-2010-R020F or IRC LR2010-01-R020F
R2	1	218kΩ, 1% resistor
R3	1	24.9kΩ, 1% resistor
R4	1	100kΩ, 1% resistor
U1	1	MAX668EUB
JU1, JU2	2	3-pin headers
JU3	1	2-pin header
None	2	Shunts (JU1, JU2)
None	1	MAX668/MAX669 PC board
None	1	MAX668/MAX669 data sheet

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	803-946-0690	803-626-3123
CoilCraft	708-639-6400	708-639-1469
Coiltronics	561-241-7876	561-241-9339
Dale-Vishay	402-564-3131	402-563-6418
Fairchild	408-721-2181	408-721-1635
Hitachi	888-777-0384	650-244-7947
International Rectifier	310-322-3331	310-322-3332
IRC	512-992-7900	512-992-3377
Motorola	602-303-5454	602-994-6430
Siliconix	408-988-8000	408-970-3950
Sprague	603-224-1961	603-224-1430
Sumida	708-956-0666	708-956-0702
Vishay/Vitramon	203-268-6261	203-452-5670

Note: *Please indicate that you are using the MAX668 when contacting these component suppliers.*

Quick Start

The MAX668 EV kit is fully assembled and tested. Follow these steps to verify board operation. **Do not turn on the power supply until all connections are completed.**

1) Place the shunt on JU1 across pins 1 and 2. Verify that the shunt is across JU2 pins 2 and 3 (V_{CC} is tied to V_{IN}) and JU3 is open (LDO is open).
2) Connect a +5V supply to the V_{IN} pad. Connect ground to the GND pad.
3) Connect a voltmeter to the V_{OUT} pad.
4) Turn on the power supply and verify that the output voltage is 12V.

Detailed Description

The MAX668 EV kit provides a regulated +12V output voltage from an input source as low as +3V. It drives loads up to 1A with greater than 90% conversion efficiency. This EV kit is shipped configured in the non-bootstrapped mode (V_{CC} is tied to V_{IN}). However, there are several methods of connecting V_{CC} and LDO depending on the specific design including input and output voltage range, quiescent power dissipation, MOSFET selection, and load.

If the minimum input voltage is below +3.0V, use the MAX669 with V_{CC} bootstrapped from V_{OUT} (Table 1). In bootstrapped mode, if V_{OUT} is always less than +5.5V, then LDO may be shorted to V_{CC} to eliminate the dropout voltage of the LDO regulator. This increases the gate drive to the MOSFET, which lowers the MOSFET on-resistance but increases the MAX668 supply current due to gate-charge loss.

If V_{IN} is greater than +3.0V, the MAX668's V_{CC} can be powered from V_{IN}. This will decrease quiescent power dissipation, especially when V_{OUT} is large. If V_{IN} is always less than +5.5V, LDO may be shorted to V_{CC} to eliminate the dropout voltage of the LDO regulator. If V_{IN} is in the range of +3V to +4.5V, then the user may still want to bootstrap from V_{OUT} to increase gate drive to the MOSFET at the expense of power dissipation. If V_{IN} is always greater than +4.5V, the V_{CC} input should always be tied to V_{IN}, since bootstrapping from V_{OUT} will not increase the gate drive from LDO, but quiescent power dissipation will rise. Jumpers JU2 and JU3 control the V_{CC} and LDO inputs (see *MAX668/MAX669* data sheet).

Jumper Selection

The 3-pin header JU1 selects shutdown mode. Table 1 lists the selectable jumper options. The 3-pin header JU2 selects bootstrapped mode. Table 2 lists the selectable jumper options. For V_{CC} less than 5.5V, use the 2-pin header JU3 to short LDO to V_{CC}. This eliminates the internal linear regulator (LDO) dropout voltage. For the MAX668, this allows operation with input voltages down to 2.7V. Table 3 lists the selectable jumper options.

Other Output Voltages

The MAX668 EV kit can also be used to evaluate other output voltages. Refer to the *Output Voltage Selection* section in the MAX668 data sheet for instructions on selecting the feedback resistors R2 and R3. **For output voltages greater than 15V, replace C5 (20V) with a capacitor that has a higher voltage rating.**

In addition to the standard EV kit configuration of $3V_{IN}$ to $12V_{OUT}$ at 1A, the *EV Kit Application Circuit Capabilities* table listed several common Input/Output combinations. Table 4 lists the components recommended for these alternative circuits.

Table 1. Jumper JU1 Functions

SHUNT LOCATION	SYNC/$\overline{\text{SHDN}}$ PIN	MAX668 OUTPUT
1 and 2	Connected to V_{CC}	MAX668 enabled, V_{OUT} = 12V. MAX668 operates at internal frequency.
2 and 3	Connected to GND	Shutdown mode, $V_{OUT} = V_{IN}$ - diode
Not installed	Floating	MAX668 can be externally synchronized when the SYNC/$\overline{\text{SHDN}}$ pad is clocked.

Table 2. Jumper JU2 Functions

SHUNT LOCATION	V_{CC} PIN	MAX668 MODE
1 and 2	Connected to V_{OUT}	Bootstrapped mode
2 and 3	Connected to V_{IN}	Non-bootstrapped mode

Table 3. Jumper JU3 Functions

SHUNT LOCATION	LDO PIN
On	Connected to V_{CC}
Off	Open

Table 4. Components for Alternate Application Circuits

V_{IN} (MIN) (V)	V_{OUT} (V)	I_{OUT} (A)	MAXIM PART NO.	JU2 BOOT-STRAPPED vs. NON-BOOT-STRAPPED	L1 (µH)	R1 (mΩ)	R2 (kΩ)	R3 (kΩ)	R4 (kΩ)	D1	N1	C1	C5	C6
1.8	12	0.4	MAX669	1 & 2 Bootstrapped	4.7 Sumida CDRH104-4R7	20 Dale WSL-2010-R020F	218	24.9	100	Hitachi HRF302A	International Rectifier IRF7401	68µF 20V AVX TPSE686M020R0150	120µF 20V Sprague 594D127X0020R2T	Open
1.8	24	0.1	MAX669	1 & 2 Bootstrapped	1.0 Coilcraft D03316-102	15 Dale WSL-2010-R015F	454	24.9	200	Hitachi HRF302A	International Rectifier IRF7401	68µF 20V AVX TPSE686M020R0150	22µF 35V AVX TPSE226M035R0300	22µF 35V AVX TPSE226M035R0300
2.5	12	0.65	MAX669	1 & 2 Bootstrapped	4.7 Sumida CDRH104-4R7	20 Dale WSL-2010-R020F	218	24.9	100	Hitachi HRF302A	International Rectifier IRF7401	68µF 20V AVX TPSE686M020R0150	120µF 20V Sprague 594D127X0020R2T	Open
3	5	3	MAX668	1 & 2 Bootstrapped	4.7 Sumida CDRH127-4R7	15 Dale WSL-2512-R015F	75	24.9	100	Hitachi HRF502A	Fairchild FDS6680	330µF 10V Kemet T510X337M010	330µF 10V Kemet T510X337M010	330µF 10V Kemet T510X337M010
3	36	0.020	MAX668	2 & 3 Non-Bootstrapped	4.7 Sumida CD43-4R7	100 Dale WSL-1206-R100F	398	24.9	100	Central Semi-conductor CMPD914	Fairchild FDS5610	10µF 6.3V, X7R Taiyo Yuden JMK325BJ106MN	2.2µF 50V, X7R Kemet C1825C225MR0RAC	Open
12	24	0.5	MAX668	2 & 3 Non-Bootstrapped	22 Sumida CD73-220	50 Dale WSL-2010-R050F	453	24.9	100	Motorola MBRS140T3	Fairchild FDS6680	33µF 20V AVX TPSD336M020R0200	22µF 35V AVX TPSE226M035R0300	Open

Note: *This table lists components recommended for building other application circuits using the MAX668 EV kit.*

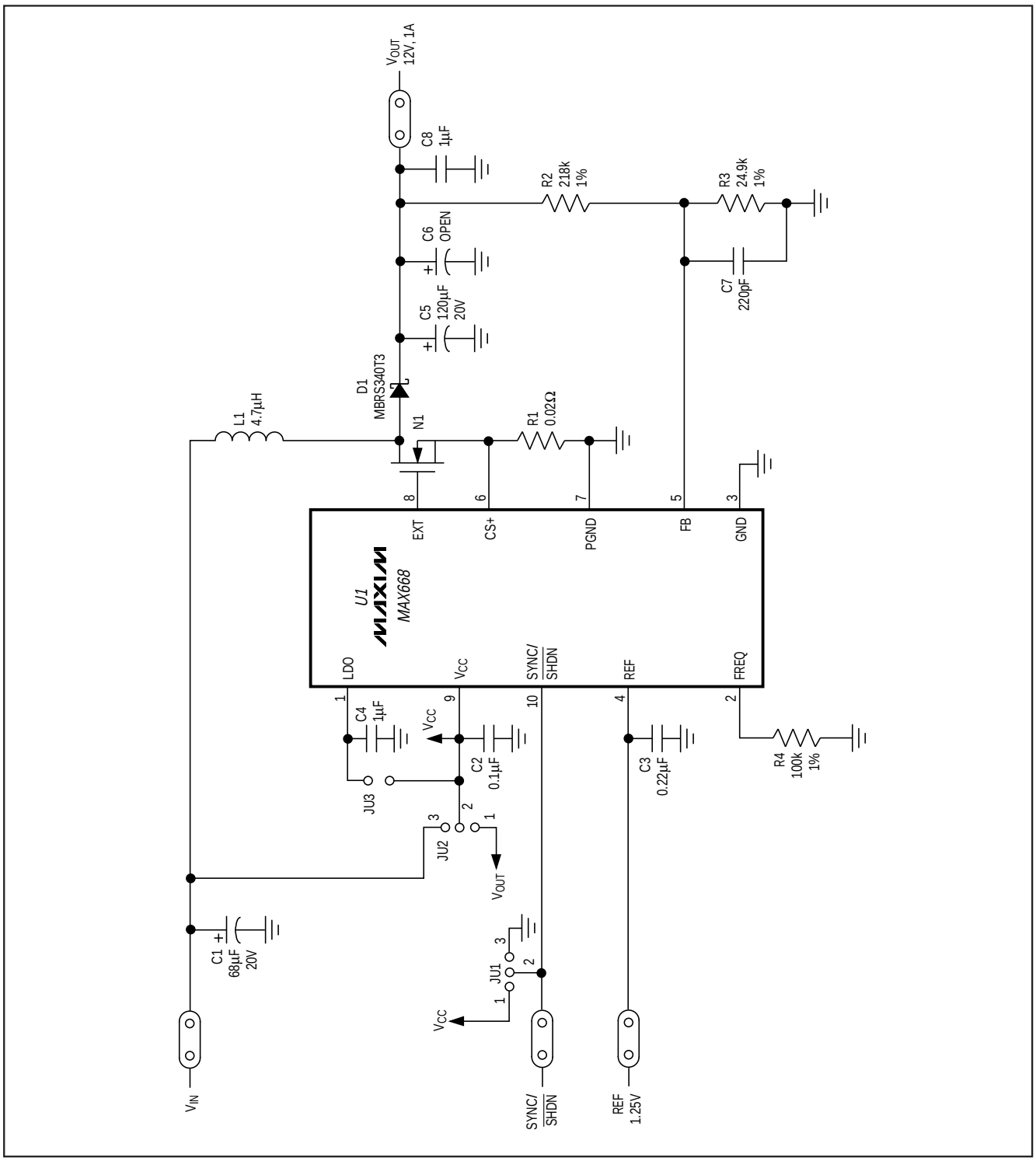

Figure 1. MAX668 EV Kit Schematic

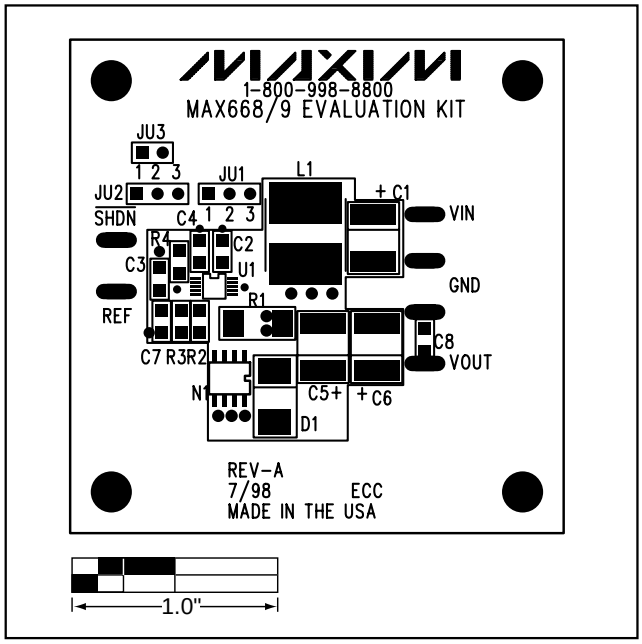

Figure 2. MAX668 EV Kit Component Placement Guide—Component Side

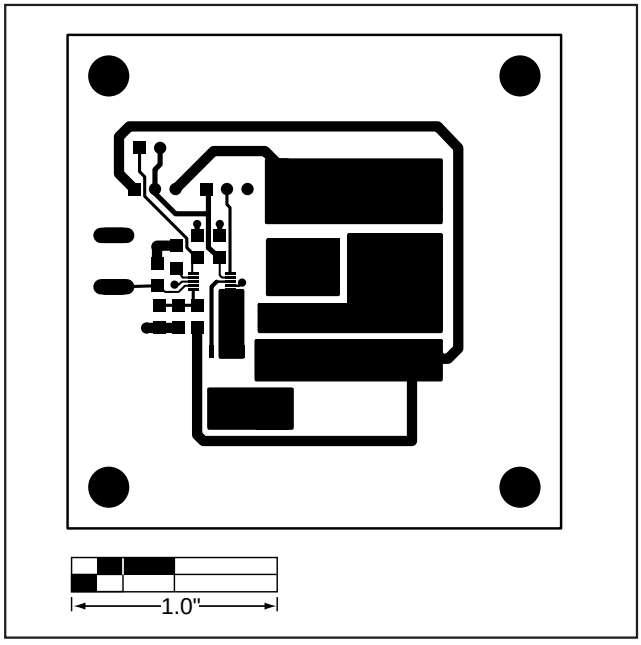

Figure 3. MAX668 EV Kit PC Board Layout—Component Side

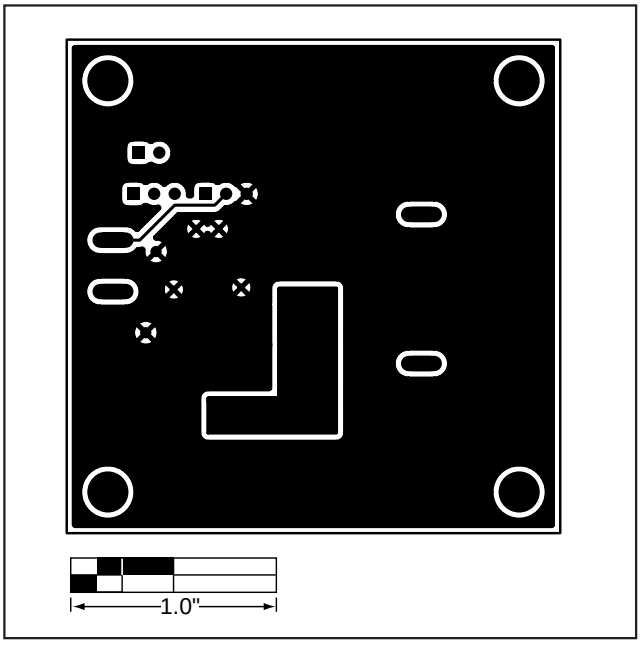

Figure 4. MAX668 EV Kit PC Board Layout—Solder Side

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