# ABRIDGED DATA SHEET

*Click here for production status of specific part numbers.*

## MAX20098 Evaluation Kit

## Evaluates: MAX20098

## General Description

The MAX20098 evaluation kit (EV kit) provides a proven design to evaluate the MAX20098 automotive 2.2MHz synchronous step-down controller with 3.5µA $I_Q$. The EV kit PCB comes with a MAX20098ATEA/VY+ installed, as well as various test points and jumpers for evaluation. The EV kit output voltage is fixed and is easily configured with minimum component changes. The EV kit is designed to deliver up to 7A with input voltages from 3.5V to 36V and by switching at 400kHz/2.2MHz, but can be configured to deliver up to 20A. Output-voltage quality can be monitored by observing the PGOOD signal.

## Benefits and Features

- 3.5V to 36V Input Supply Range
- Output Voltage: 5V or 3.3V Fixed, or Adjustable from 1V Up to 10V
- Delivers Up to 20A Output Current
- Frequency-Synchronization Input
- Enable Input
- Voltage-Monitoring PGOOD Output
- Proven PCB Layout
- Fully Assembled and Tested

***Ordering Information* appears at end of data sheet.**

## Quick Start

### Required Equipment

- MAX20098 EV kit
- 3.5V to 36V, 7A power supply (capable of providing 7A at 3.5V input)
- Digital multimeter (DMM)
- Oscilloscope
- Electronic load capable of sinking 7A

### Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Verify that all jumpers are in their default positions, as shown in Table 1.
2) Connect the positive and negative terminals of the power supply to the SUP and GND1 test pads, respectively.
3) Set the power-supply voltage to 14V and current limit to 3A.
4) Turn on the power supply.
5) Verify that OUT is approximately 5V using the DMM.
6) Verify that the switching frequency is approximately 2.2MHz by monitoring inductor switching voltage with the oscilloscope.

### Additional Evaluation

7) Connect the positive and negative terminals of the electronic load to OUT and GND, respectively.
8) Set the electronic load to the desired current at or below 7A, or use an equivalent resistive load with an appropriate power rating.
9) Adjust current limit on the power supply as necessary.
10) Turn on the power supply and electronic load.
11) Verify that voltage across the VOUT and GND PCB pads is 5V ±1%.

*319-100056; Rev 4; 4/19*

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## Table 1. Default Jumper Settings

| JUMPER | DEFAULT SHUNT POSITION | FUNCTIONS |
|---|---|---|
| ENABLE | 1-2 | Buck enabled |
| SYNC | 1-2 | Forced-PWM mode |

## Detailed Description of Hardware

The MAX20098 EV kit provides a proven layout for the MAX20098 synchronous buck regulator IC. The IC accepts input voltages as high as 36V and delivers up to 20A. The EV kit can handle an input supply transient up to 42V. Various test points are included for evaluation.

### External Synchronization

The IC can operate in two modes: forced-PWM (FPWM) or skip mode. Skip mode has better efficiency for light-load conditions. When SYNC is pulled low, the IC operates in skip mode for light loads and PWM mode for larger loads. When SYNC is pulled high, the IC is forced to operate in PWM mode across all load conditions. SYNC can be used to synchronize with other supplies if a clock source is present. The IC is forced to operate in FPWM mode when SYNC is connected to a clock source.

### Buck Output Monitoring (PGOOD)

The EV kit provides a power-good output test point (PGOOD) to monitor the status of the buck output (OUT). PGOOD is low impedance when the output voltage is in regulation. PGOOD is high impedance when the output voltage drops below 7% (typ) of its nominal regulated voltage.

### BST Diode

The BST diode (D1) can be removed if operating in skip mode or at low switching frequency, 400kHz. Skip mode is set with a shunt position of 2-3 on the SYNC jumper.

### Evaluating the MAX20098

The IC is available in fixed 5V and 3.3V outputs. The EV kit comes installed with the 5V output version. To externally configure the output voltage, remove R1 and place appropriate resistors in positions R17 and R19. To optimize efficiency, refer to the MAX20098 IC data sheet.

### Evaluate 400kHz or 2.2MHz Operation

Order the MAX20098EVKIT# to evaluate 2.2MHz operation. Order the MAX20098LFEVKIT# to evaluate 400kHz operation. Table 2 lists different component selections for both 2.2MHz and 400kHz switching frequencies (the other components remain the same).

## Ordering Information

| PART | TYPE | $f_{SW}$ |
|---|---|---|
| MAX20098EVKIT# | EV Kit | 2.2MHz |
| MAX20098LFEVKIT# | EV Kit | 400kHz |

*#Denotes RoHS compliant.*

## MAX20098 EV Kit Bill of Materials

| REFERENCE DESIGNATOR | QTY | DESCRIPTION | MFG PART # |
|---|---|---|---|
| **COMPONENT LIST: $5V_{OUT}$, 2.2MHz SWITCHING FREQUENCY, UP TO 7A LOAD** | | | |
| C6 | 1 | 2.2µF±20% 50V Ceramic Capacitor (0805) | CGA4J3X7R1H225M125AE |
| C8 | 1 | 4700PF±5% 50V Ceramic Capacitor (0402) | CL05B472JB5NNNC |
| C9 | 1 | 4.7µF ±10% 50V X7R Ceramic Capacitor (1210) | GRM32ER71H475KA88K |
| C12 | 1 | 0.1µF ±10% 50V Ceramic Capacitor (0402) | GRM155R71H104KE14 |
| C16 | 1 | 2.2µF±10% 10V Ceramic Capacitor (0603) | CL10B225KP8NNN |
| C19 | 1 | 47µF ±10% 16V X6S Ceramic Capacitor (1210) | GRM32ER71A476KE15L |
| C20 | 1 | 47µF ±10% 16V X6S Ceramic Capacitor (1210) | GRM32ER71A476KE15L |
| D1 | 1 | Diode; SCH; Schottky Diode; SMT (SOT23-3); PIV = 30; IF = 0.2A | BAT54A |
| L1 | 1 | 1.2µH Inductor | XAL1060-122MEB |
| Q1, Q2 | 2 | N-Channel 40V Surface Mount 5-DFN, 8-SO Flat Lead (5x6) | NVMFS5C468NLT1G |
| R1, R2, R5, R7, R8 | 6 | 0Ω resistor (0402) | CRCW04020000Z0EDHP |
| R3 | 1 | 2.5Ω resisitor (0402) | — |
| R4 | 1 | 10kΩ resistor (0402) | RC0402FR-0710K |
| R10 | 1 | 0.01Ω resistor (1206) | PMR18EZPFU10L0 |
| R11 | 1 | 100kΩ resistor (0402) | TNPW0402100KBE |
| R12 | 1 | 12kΩ resistor (0402) | ERJ-2RKF1202 |
| R15 | 1 | 51.1kΩ resistor (0603) | ERJ-3EKF5112V |
| U1 | 1 | MAX20098ATEA/VY+ | — |
| — | 1 | PCB: MAX20098 EVKIT | — |
| **COMPONENT CHANGES FOR 400kHz SWITCHING FREQUENCY** | | | |
| D1 | DNI | Diode; SCH; Schottky Diode; SMT (SOT23-3) | BAT54A |
| L1 | 1 | 4.7µH Inductor | XAL1060-472MEB |
| R3 | 1 | 0Ω resistor (0402) | — |
| R12 | 1 | 66.5kΩ resistor (0402) | ERJ-2RKF6652X |
| R15 | 1 | 30.1kΩ resistor (0603) | PTN0603E3012BST1 |
| **Note:** R10 can be adjusted to change the output current limit. | | | |

## MAX20098 EV Kit Schematic