

**GENERAL DESCRIPTION**

The XR75100 is a synchronous step-down controller for point-of load supplies up to 20A. A wide 5.5V to 40V input voltage range allows for single supply operation from industry standard 12V, 18V, and 24V DC and AC rails.

With a proprietary emulated current mode Constant On-Time (COT) control scheme, the XR75100 provides extremely fast line and load transient response using ceramic output capacitors. It requires no loop compensation hence simplifying circuit implementation and reducing overall component count. The control loop also provides exceptional load and line regulation and maintains constant operating frequency. A selectable power saving mode allows the user to operate in discontinuous mode (DCM) at light current loads thereby significantly increasing the converter efficiency.

A host of protection features, including over-current, over-temperature, short-circuit and UVLO, help achieve safe operation under abnormal operating conditions.

The XR75100 is available in RoHS compliant, green/halogen free space-saving 16-pin 3x3 QFN package.

**EVALUATION BOARD MANUAL**



**FEATURES**

- **20A Capable Step Down Controller**
  - Wide 5.5V to 40V Input Voltage Range
  - Integrated high Current 2A/3A Drivers
  - 0.6V to 30V Adjustable Output Voltage
- **Proprietary Constant On-Time Control**
  - No Loop Compensation Required
  - Ceramic Output Cap. Stable operation
  - Programmable 200ns-2µs On-Time
  - Constant 100kHz-800kHz Frequency
  - Selectable CCM or CCM/DCM Operation

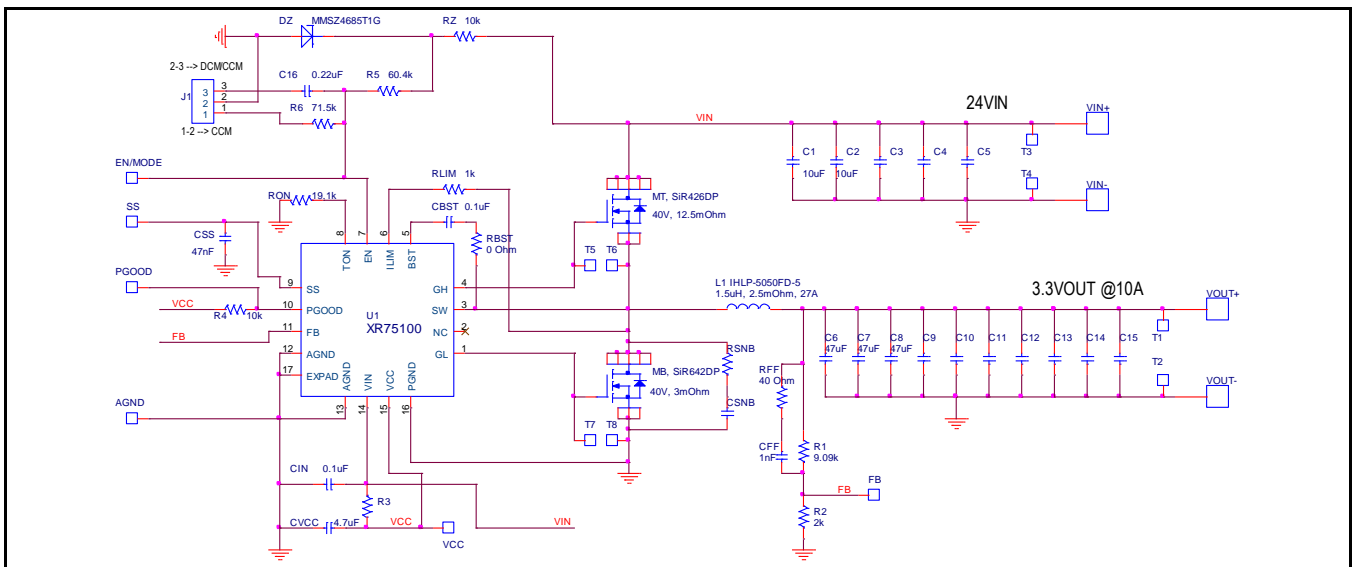


Fig. 1: XR75100 Evaluation Board Schematics

**PIN ASSIGNMENT**

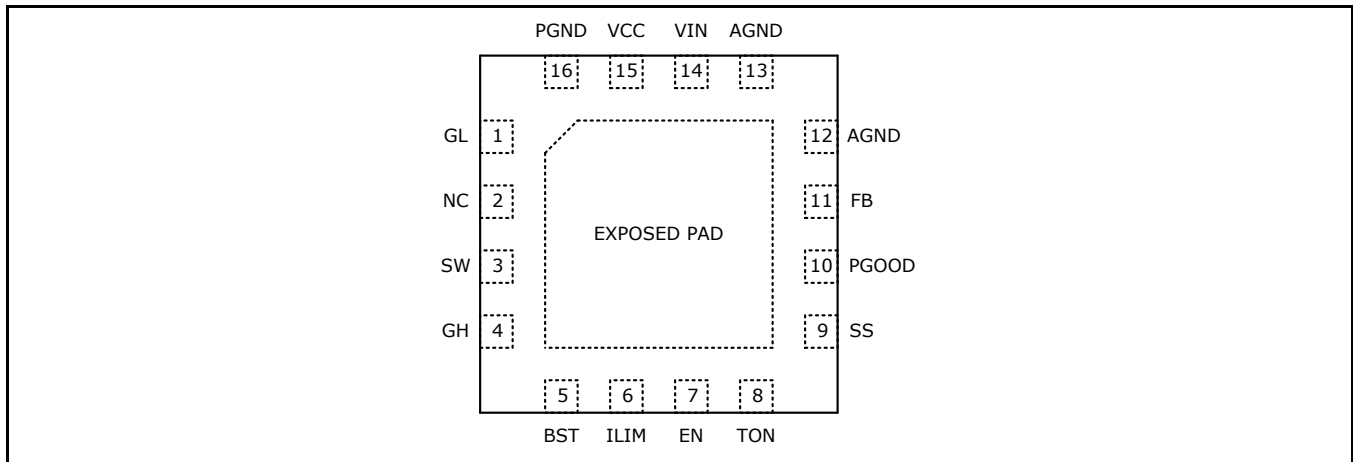


Fig. 2: XR75100 Pin Assignment

**PIN DESCRIPTION**

| Name        | Pin Number | Description  |
|-------------|------------|--|
| GL          | 1          | Driver output for Low-side N-channel synchronous MOSFET.   |
| NC          | 2          | Internally not connected. Leave this pin floating.   |
| SW          | 3          | Lower supply rail for high-side gate driver GH. Connect this pin to the junction between the two external N-channel MOSFETs.   |
| GH          | 4          | Driver output for high-side N-channel switching MOSFET.  |
| BST         | 5          | High-side driver supply pin. Connect a 0.1uF bootstrap capacitor between BST and SW.   |
| ILIM        | 6          | Over-current protection programming. Connect with a resistor to the Drain of the low-side MOSFET.  |
| EN/MODE     | 7          | Precision enable pin. Pulling this pin above 1.9V will turn the IC on and it will operate in Forced CCM. If the voltage is raised above 3.0V then the IC will operate in DCM or CCM depending on load. |
| TON         | 8          | Constant on-time programming pin. Connect with a resistor to AGND.   |
| SS          | 9          | Soft-Start pin. Connect an external capacitor between SS and AGND to program the soft-start rate based on the 10uA internal source current.  |
| PGOOD       | 10         | Power-good output. This open-drain output is pulled low when $V_{OUT}$ is outside the regulation.  |
| FB          | 11         | Feedback input to feedback comparator. Connect with a set of resistors to $V_{OUT}$ and GND in order to program $V_{OUT}$ .  |
| AGND        | 12, 13     | Analog ground. Control circuitry of the IC is referenced to this pin.  |
| VIN         | 14         | IC supply input. Provides power to internal LDO.   |
| VCC         | 15         | The output of LDO. For operation using a 5V rail, VCC should be shorted to VIN.  |
| PGND        | 16         | Ground for low side driver   |
| Exposed Pad |            | Thermal pad for heat dissipation. Connect to AGND with a short trace.  |

**ORDERING INFORMATION**

Refer to XR75100's datasheet and/or [www.exar.com](http://www.exar.com) for exact and up to date ordering information.



A New Direction in Mixed-Signal

**XR75100**

## **40V Synchronous Step Down COT Controller**

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### **USING THE EVALUATION BOARD**

#### **POWERING UP**

Connect the VIN+/VIN- with short/thick leads to power supply. Use test pins T3 and T4 to monitor VIN+ and VIN- respectively. Connect VOUT+/VOUT- with short/thick leads to electronic load. Use test pins T1 and T2 to monitor VOUT+ and VOUT- respectively. Apply 24V using the power supply. The XR75100EVB should power up and regulate the output at 3.3V. The Evaluation Board is rated at 10A. Overcurrent protection will trigger at about 16A.

#### **JUMPER J1**

If the jumper is set to CCM position, the converter will operate in 'Forced CCM'.

If the jumper is set to DCM/CCM position, the converter will operate at DCM or CCM, depending on load. Transition from DCM to CCM is at approximately 3A.

#### **INPUT VOLTAGE RANGE**

MOSFETs used in this evaluation board have a 40V rating. Therefore switching voltage transients limit the maximum VIN to 30V. In order to operate at VIN up to 40V, higher voltage MOSFETs have to be used. For example 60V rated SiR664DP and SiR662DP can be used for MT and MB respectively.

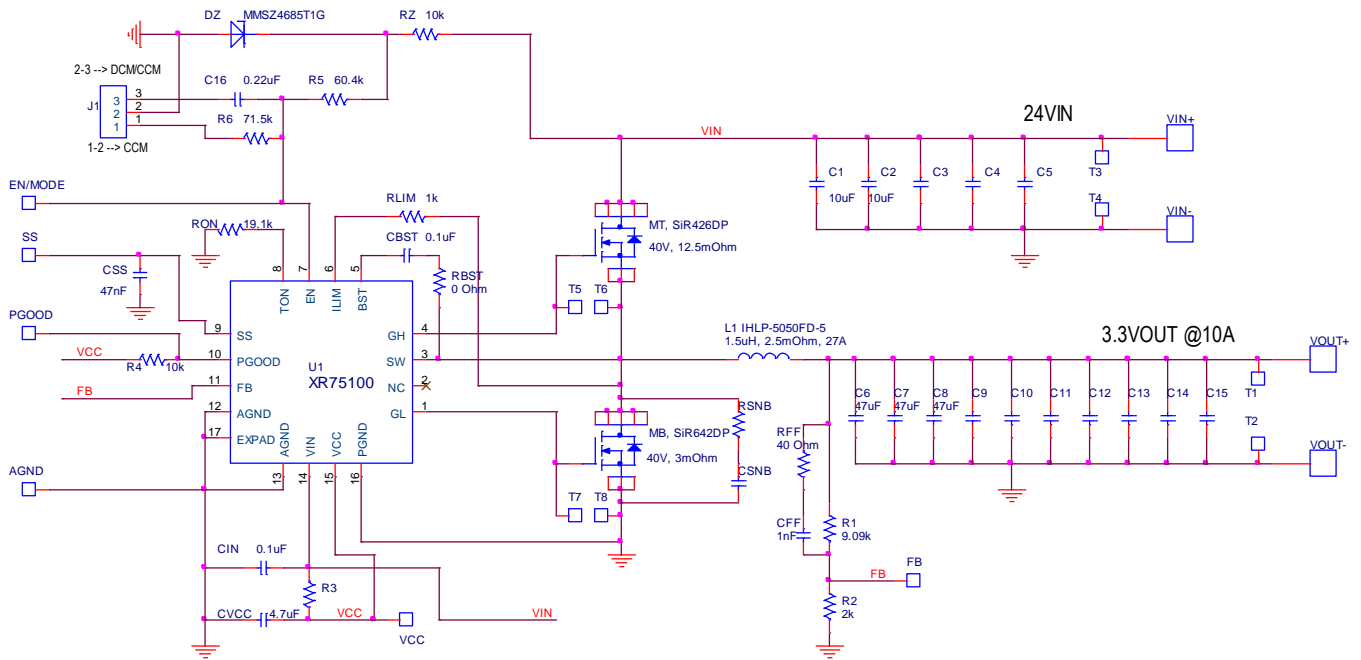


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XR75100

40V Synchronous Step Down COT Controller

### EVALUATION BOARD SCHEMATICS



**BILL OF MATERIAL**

| Reference Designator                             | Qty. | Manufacturer     | Manufacturer Part Number | Size        | Component                            |
|--|------|------------------|--------------------------|-------------|--------------------------------------|
| PCB  | 1    | Exar             | X75100EVB                |             | XR75100 Evaluation kit               |
| U1   | 1    | Exar             | XR75100EL-F              | QFN-16      | Constant On-Time Buck controller     |
| MT   | 1    | VISHAY-DALE      | SIR426DP                 | Power SO-8  | N-Ch. 40V, 30A, 12.5mOhm MOSFET      |
| MB   | 1    | VISHAY-DALE      | SIR642DP                 | Power SO-8  | N-Ch. 40V, 60A, 3.0mOhm, MOSFET      |
| DZ   | 1    | ON SEMI          | MMSZ4685T1G              | SOD-123     | Diode Zener 3.6V, 500MW,             |
| L1   | 1    | VISHAY-DALE      | IHLP5050FDER1R5M01       | 13.2x12.9mm | Shielded inductor, 1.5uH, 2.5mΩ, 27A |
| C1,C2  | 2    | MURATA           | GRM32ER71H106KA12L       | 1210        | CERAMIC CAP., 10uF, 50V, X7R, 10%    |
| C6,C7,C8   | 3    | MURATA           | GRM32ER71A476KE15L       | 1210        | CERAMIC CAP., 47uF, 10V, X7R, 10%    |
| CBST   | 1    | MURATA           | GRM188R71C105KA12D       | 0603        | CERAMIC CAP., 1uF, 16V, X7R, 10%     |
| CFF  | 1    | MURATA           | GRM188R71H102KA01D       | 0603        | CERAMIC CAP., 1000pF, 50V, X7R, 10%  |
| CIN,C16  | 2    | MURATA           | GRM188R71H104KA93D       | 0603        | CERAMIC CAP., 0.1uF, 50V, X7R, 10%   |
| CVCC   | 1    | MURATA           | GRM21BR71C475KA73L       | 0805        | CERAMIC CAP., 4.7uF, 16V, X7R, 10%   |
| CSS  | 1    | MURATA           | GRM188R71H473KA61D       | 0603        | CERAMIC CER, 47nF, 50V, X7R, 10%     |
| Csnub  | 0    | DONT POPULATE    | ...                      | ...         | ...                                  |
| R1   | 1    | PANASONIC        | ERJ-3EKF9091V            | 0603        | Resistor 9.09k, 1/10W, 1%, SMD       |
| R2   | 1    | PANASONIC        | ERJ-3EKF2001V            | 0603        | Resistor 2K Ohm, 1/10W, 1%, SMD      |
| R4,RZ  | 2    | PANASONIC        | ERJ-3EKF1002V            | 0603        | Resistor 10.0K Ohm, 1/10W, 1%, SMD   |
| RFF  | 1    | PANASONIC        | ERJ-3EKF40R2V            | 0603        | Resistor 40.2 Ohm, 1/10W, 1%, SMD    |
| RBST   | 1    | PANASONIC        | ERJ-3GEY0R00V            | 0603        | Resistor 0Ω, Jumper SMD              |
| R5   | 1    | PANASONIC        | ERJ-3EKF1333V            | 0603        | Resistor 133K Ohm, 1/10W, 1%, SMD    |
| R3   | 0    | DONT POPULATE    | ---                      | ---         | ---                                  |
| R6   | 1    | PANASONIC        | ERJ-3EKF1333V            | 0603        | Resistor 158K Ohm, 1/10W, 1%, SMD    |
| RLIM   | 1    | PANASONIC        | ERJ-3EKF1001V            | 0603        | Resistor 1.0K Ohm, 1/10W, 1%, SMD    |
| RON  | 1    | PANASONIC        | ERJ-3EKF1912V            | 0603        | Resistor 19.1K Ohm, 1/10W, 1%, SMD   |
| Rsnub  | 0    | DONT POPULATE    |                          |             |                                      |
| J1   | 1    | Würth Elektronik | 61300311121              |             | 3-PIN CONNECTOR                      |
| VIN+, VIN-, VOUT+, VOUT-                         | 4    | Würth Elektronik | 7471287                  | 0.32X0,10in | Mounting Tab                         |
| T7/T8  | 1    | Würth Elektronik | 61300211121              |             | DUAL TEST POINT                      |
| T1, T2, T3,T4,<br>EN/MODE,SS,PGOOD,<br>AGND, VCC | 9    | Würth Elektronik | 61300111121              |             | SINGLE Test Point Post               |

EVALUATION BOARD LAYOUT

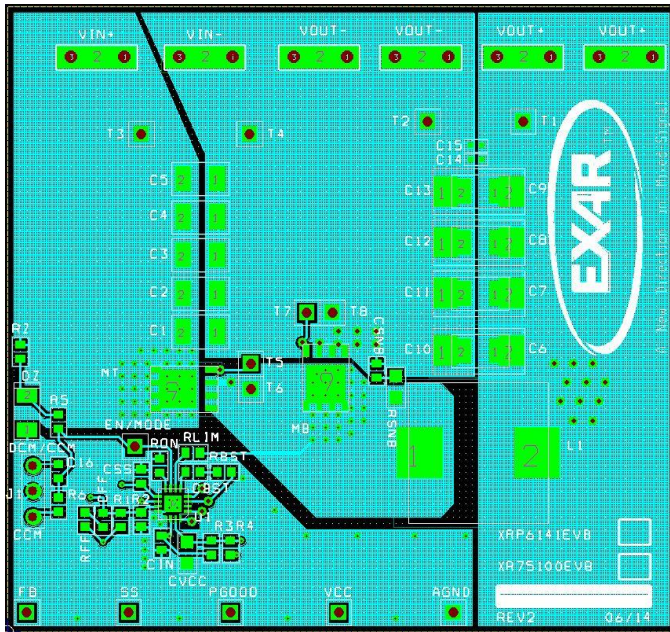


Fig. 3: Component Placement – Top Side

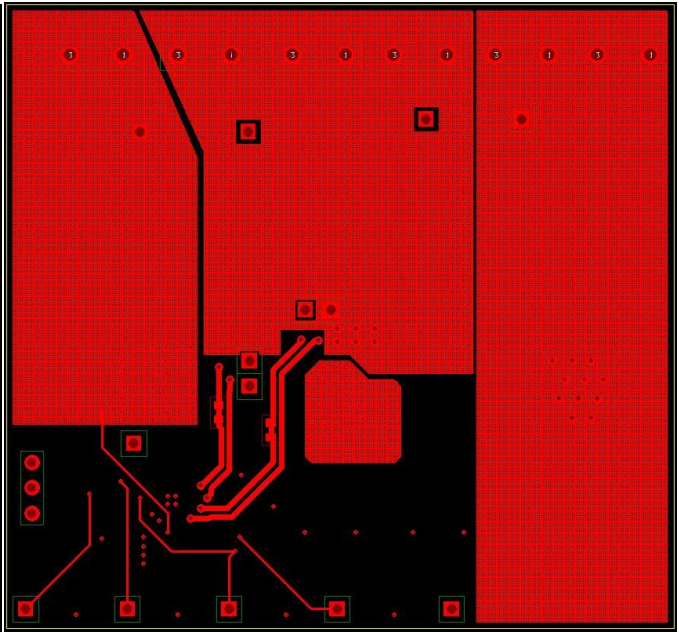


Fig. 4: Bottom Side

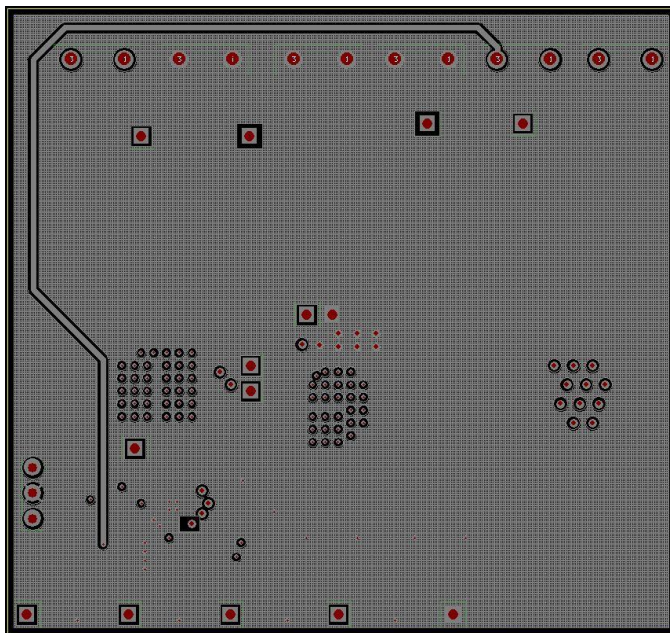


Fig. 5: Layer 2

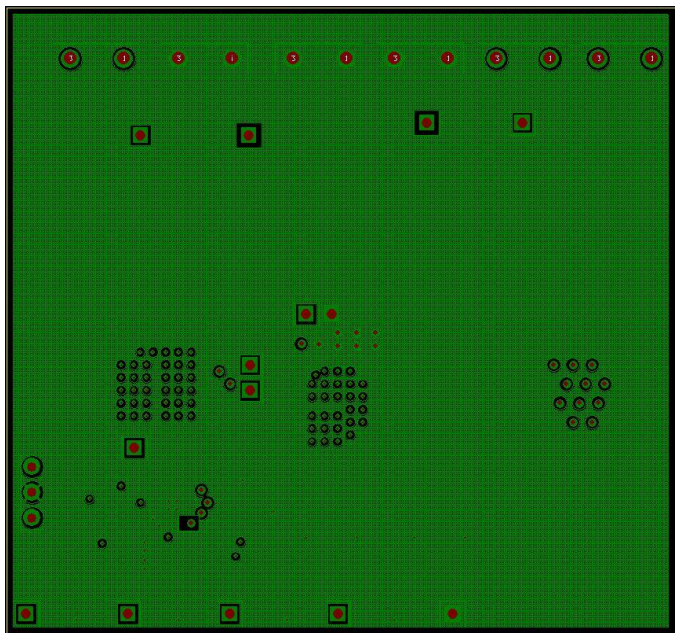


Fig. 6: Layer 3