MAX16990/MAX16992 Evaluation Kits

General Description

The MAX16990/MAX16992 evaluation kits (EV kits) are fully assembled and tested PCBs that contain a 16W DC-DC converter for front-end preboost automotive applications. The devices integrate a low-side FET driver and current-mode control-loop circuitry for output-voltage regulation, making them ideal for automotive boost or SEPIC converters. The MAX16990 integrated driver switches at 400kHz, while the MAX16992 integrated driver switches at 2.2MHz using the default configuration. The MAX16990 can be synchronized with an external clock source within the 100kHz to 1MHz range, and the MAX16992 within the 1MHz to 2.5MHz range.

The EV kits operate from a DC supply voltage of 4.5V (3V in bootstrapped mode) up to 36V. The EV kits can withstand a 42V load-dump condition for up to 400ms. Each EV kit demonstrates the device features, such as dynamic adjustable output voltage, external clock synchronization, two-phase operation configurability, cycle-by-cycle current limit, hiccup mode, and thermal shutdown. The boost converter regulates 8V and can supply a current up to 2A. Each EV kit includes an external p-MOSFET (P1) that can be used to disconnect the boost output from the load in a fault condition. The EV kits also demonstrate a reference MAX16990 design for automotive applications.

Features

- 4.5V (3V in Bootstrapped Mode) Up to 36V Input Voltage Range
- 8V Up to 2A Output
- Demonstrates External Clock Synchronization
- Demonstrates SUP UVLO
- Demonstrates Cycle-by-Cycle Current Limit and Hiccup Mode
- Thermal-Shutdown Protection
- PGOOD Flag
- Demonstrates Dynamic Adjustable Output
- Switched Output Option
- Demonstrates Two Phases of Operation
- Proven PCB Layout and Thermal Design
- Fully Assembled and Tested

Quick Start

Required Equipment

- MAX16990 or MAX16992 EV kit
- 3V to 36V, 10A DC power supply
- Digital voltmeter (DVM)
- 2A load

Output Testing

Each EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supply until all connections are completed.**

1) Verify that a shunt is installed on pins 1-2 on jumper JU1 (device enabled).
2) Verify that a shunt is installed on jumper JU3 (FB internal reference).
3) Verify that a shunt is installed on pins 1-2 (normal mode) or 2-3 (bootstrapped mode) on jumper JU2.
4) Connect the power supply to the VBAT PCB pad and the power supply's ground to the PGND PCB pad.
5) Connect DVM across the VOUT and AGND test point.
6) Turn on the power supply and set it to 4.5V.
7) Measure the voltage from the VOUT PCB pad to AGND and verify that it is 8V.
8) Apply the 2A load on the VOUT or SWITCHED VOUT PCB pad.

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

19-6788; Rev 0; 9/13

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Detailed Description of Hardware

The MAX16990/MAX16992 EV kits are fully assembled and tested PCBs that contain a 16W DC-DC converter for front-end preboost automotive applications. The devices integrate a low-side FET driver and current-mode control-loop circuitry for output-voltage regulation, making them ideal for automotive boost or SEPIC converters. The MAX16990 integrated driver switches at 400kHz, while the MAX16992 integrated driver switches at 2.2MHz using the default configuration. The MAX16990 can be synchronized with an external clock source within the 100kHz to 1MHz range, and the MAX16992 within the 1MHz to 2.5MHz range.

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Enable

The EV kits feature an enable input that can be used to enable and disable the device and place it in shutdown mode. To enable the EV kits whenever power is applied to VIN and PGND, place the jumper on pins 1-2 on jumper JU1.

To enable the EV kit from an external enable signal, leave jumper JU1 disconnected. In this configuration, apply a logic signal on the ENABLE input pad on the EV kit. The enable (EN) input should not be left unconnected.

Refer to the EN pin description in the MAX16990/MAX16992 IC data sheet for additional information. See Table 1 for jumper JU1 settings.

Bootstrap Mode

For applications where the input voltage goes below 4.5V, use the device in bootstrapped mode, placing the jumper on pins 2-3 on JU2. In bootstrapped configuration, the device is supplied by the output of the boost regulator itself and does not trigger the UVLO, even if the input voltage goes down to 3V. See Table 2 for jumper JU2 settings.

Table 1. Enable (JU1)

SHUNT POSITION	EN PIN	EV KIT OPERATION
1-2*	Connected to SUP	Enabled
2-3	Connected to AGND	Disabled
Unconnected	Connected to an external controller	External controller enabled

**Default position.*

Table 2. Bootstrap Mode (JU2)

SHUNT POSITION	SUP PIN	EV KIT OPERATION
1-2*	Connected to SUP	Normal
2-3	Connected to VOUT	Bootstrapped

**Default position.*

Output-Voltage Adjustment

The output voltage of the device can be dynamically adjusted, feeding an analog voltage to the REFIN pin. The external voltage applied to the REFIN pin is used as FB reference. Remove jumper JU3 to apply an external voltage to the REFIN pin. With the JU3 jumper installed, REFIN is shorted to PVL and an internal 1V FB reference is used for loop regulation. See Table 3 for jumper JU3 settings.

External Clock Synchronization

The device can be synchronized using an external clock applied to the FSET/SYNC pin. A falling clock edge on FSET/SYNC turns on the external MOSFET by driving DRV high after a short delay. The MAX16990 can be synchronized with an external clock source within the 100kHz to 1MHz range, and the MAX16992 within the 1MHz to 2.5MHz range.

Two-Phase Configuration

To configure the device in two phases, use two EV kits and follow the instructions below:

Master EV kit:

1) Install R8 (1kΩ).

Slave EV kit:

1) Remove R2 and R1.
2) Remove C2, C3, and R5.
3) Install R11 (0Ω).

Make the following connections:

1) Connect the PGND PCB pad on the master to the PGND PCB pad on the slave.
2) Connect the AGND PCB pad on the master to the AGND PCB pad on the slave.
3) Connect the VBAT PCB pad on the master to the VBAT PCB pad on the slave.
4) Connect the VOUT PCB pad on the master to the VOUT PCB pad on the slave.
5) Connect the COMP PCB pin on the master to the COMP pin on the slave through a BNC cable.
6) Connect the SYNCO PCB pin on the master to the FSET/SYNC pin on the slave.

Table 3. Output-Voltage Adjustment (JU3)

SHUNT POSITION	REFIN PIN	EV KIT OPERATION
Installed	Connected to PVL	Internal 1V reference
Not Installed	Open	External voltage reference

**Default position.*

Component Lists

MAX16990 EV Kit

DESIGNATION	QTY	DESCRIPTION
AGND	1	Black test point
C1, C7	2	47µF ±10%, 16V X5R ceramic capacitors (1210) Murata GRM32ER61C476K
C2	1	0.068µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C683K
C3	1	150pF ±5%, 50V C0G ceramic capacitor (0603) Murata GRM1885C1H151J
C4	1	47µF, 50V aluminum electrolytic capacitor (SMD) Panasonic EEE-1HA470XP
C5, C11	2	1µF ±10%, 50V X7R ceramic capacitors (0805) Murata GRM21BR71H105K
C6	1	2.2µF ±10%, 10V X7R ceramic capacitor (0603) Murata GRM188R71A225K
C8	1	1000pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H102K
C9, C10	0	Not installed, ceramic capacitors (0603)
C12	1	0.1µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C104K
COMP	1	SMA female vertical-mount PCB Johnson 142-0701-201
D1	1	40V, 5A Schottky diode (SMC) ON Semi MBRS540T3G
D2	1	7.5A, 45V Schottky diode (D2PAK) ON Semi MBRB1545CTG
D4, D5	2	18V zener diodes (SOT523) Diodes Inc. BZX84C18T-7-F
EN, FB, FSET/SYNC, PGOOD, PVL, REFIN, SUP, SYNCO	8	Red test points
JU1, JU2	2	3-pin headers, 2.54mm Sullins PEC36SAAN
JU3	1	2-pin header, 2.54mm Sullins PEC36SAAN
L1	1	4.7µH, 6A inductor (7mm x 6.9mm) Würth 744311470
N1	1	60V, 10A n-channel MOSFET (SO8) Fairchild FDS5670
N2, N3	2	60V, 115mA, n-channel MOSFETs (SOT23) Fairchild 2N7002
P1	1	55V, 80A p-channel MOSFET (D2PAK) STMicroelectronics STB80PF55
R1	1	90.9kΩ ±1% resistor (0603)
R2	1	13kΩ ±1% resistor (0603)
R3	1	0.022Ω, 0.5W ±1% current-sense resistor (1812) Panasonic ERJ-L12KF22MU
R4	1	1kΩ ±1% resistor (0603)
R5	1	6.81kΩ ±1% resistor (0603)
R6	1	10kΩ ±5% resistor (0603)
R7	1	68.1kΩ ±1% resistor (0603)
R8, R11, R14, R15	0	Not installed, resistors (0603)
R9, R12	2	0Ω ±5% resistors (0603)
R10	1	4.7kΩ ±5% resistor (0603)
R13	1	1kΩ ±5% resistor (0603)
U1	0	Automotive current-mode boost controller (12 TQFN-EP*) Maxim MAX16990ATCE/V+
—	1	PCB: MAX16990 EVKIT

**EP = Exposed pad.*

Component Lists (continued)

MAX16992 EV Kit**

DESIGNATION	QTY	DESCRIPTION
C1, C8	0	Not installed, capacitors
C2	1	6200pF ±5%, 50V X7R ceramic capacitor (0603) AVX 06035C622JAT2A
C7	1	47µF ±10%, 16V X5R ceramic capacitor (1210) Murata GRM32ER61C476K
L1	1	0.47µH, 18A inductor (7mm x 6.9mm) Würth 744314047
R7	1	12.1kΩ ±1% resistor (0603)
U1	0	Automotive current-mode boost controller (12 TQFN-EP*) Maxim MAX16992ATCE/V+
—	1	PCB: MAX16990 EVKIT

**EP = Exposed pad.*

***Components not listed are the same as for the MAX16990 EV kit.*

Component Suppliers

SUPPLIER	WEBSITE
Diodes Incorporated	www.diodes.com
Murata Americas	www.murataamericas.com
ON Semiconductor	www.onsemi.com
Panasonic Corp.	www.panasonic.com
STMicroelectronics	www.us.st.com
Vishay	www.vishay.com
Würth Electronik GmbH & Co. KG	www.we-online.com

Note: *Indicate that you are using the MAX16990 or MAX16992 when contacting these component suppliers.*

MAX16990/MAX16992

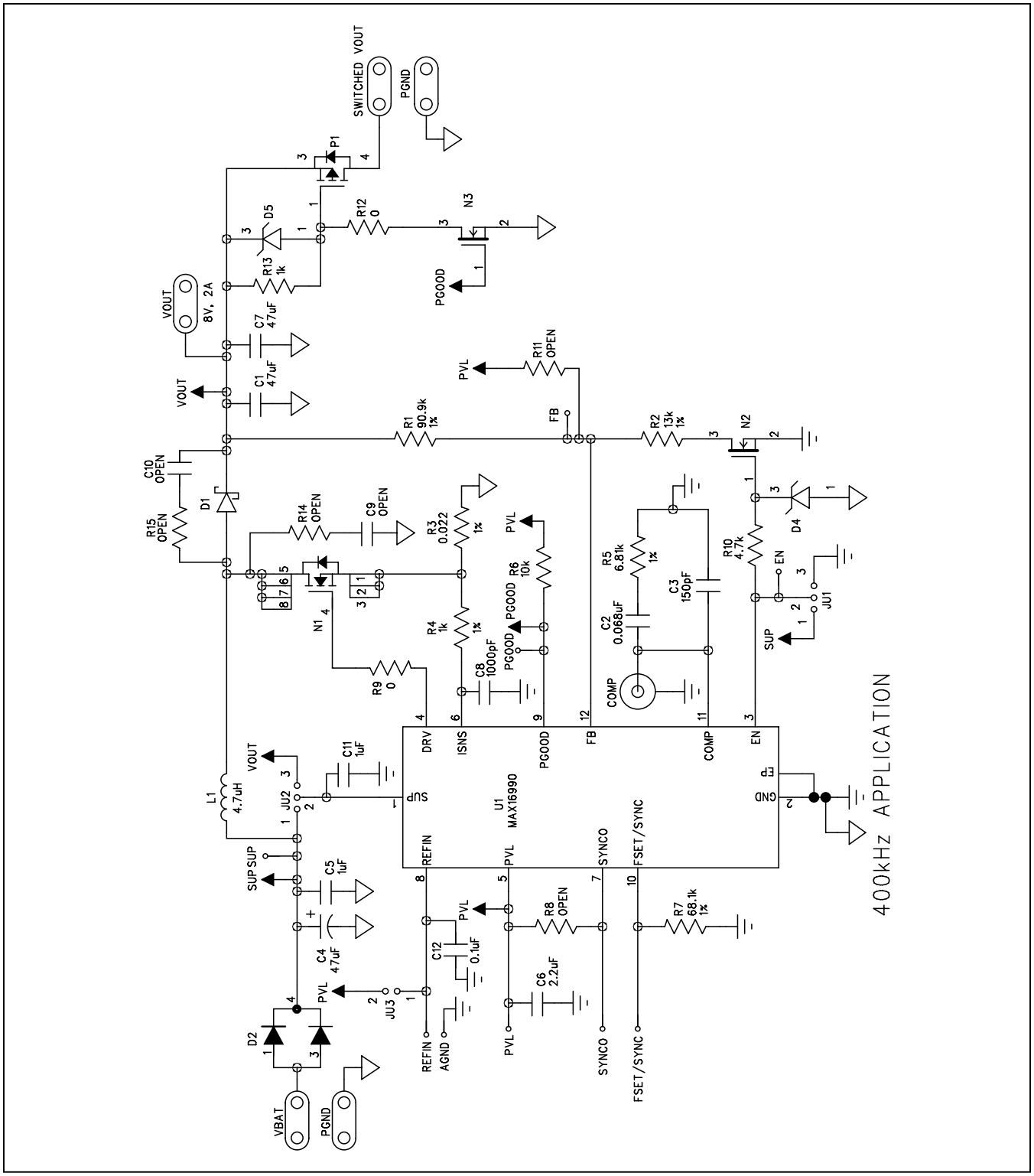

Figure 1. MAX16990 EV Kit Schematic

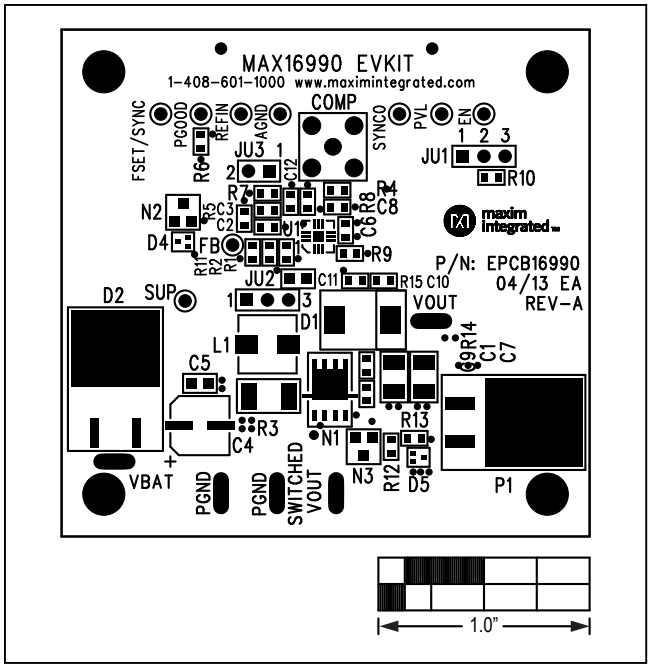

Figure 2. MAX16990 EV Kit Component Placement Guide—Component Side

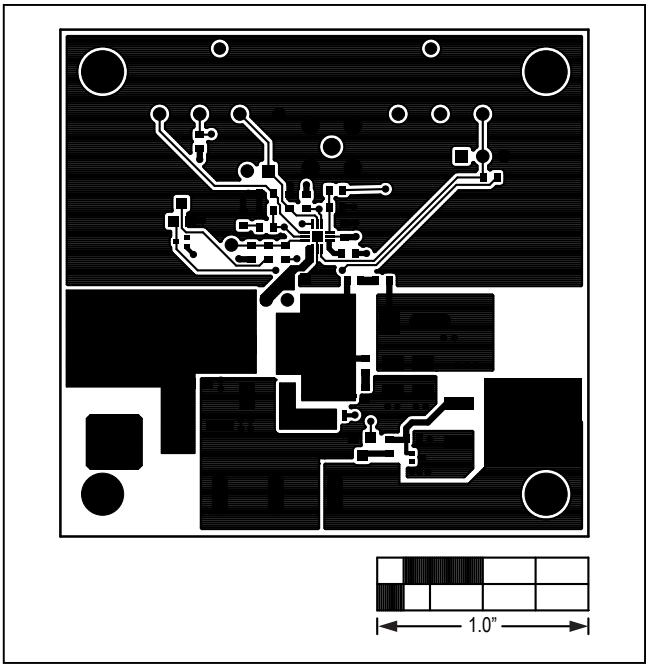

Figure 3. MAX16990 EV Kit PCB Layout—Component Side

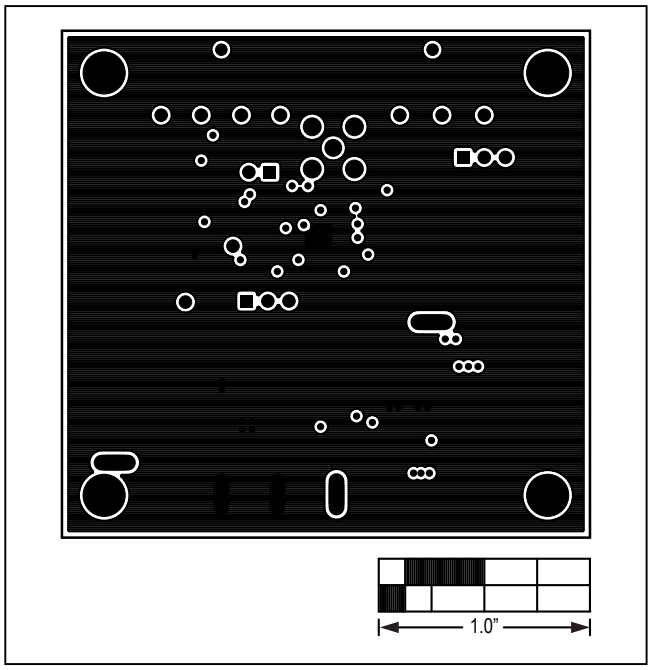

Figure 4. MAX16990 EV Kit PCB Layout—PGND Layer 2

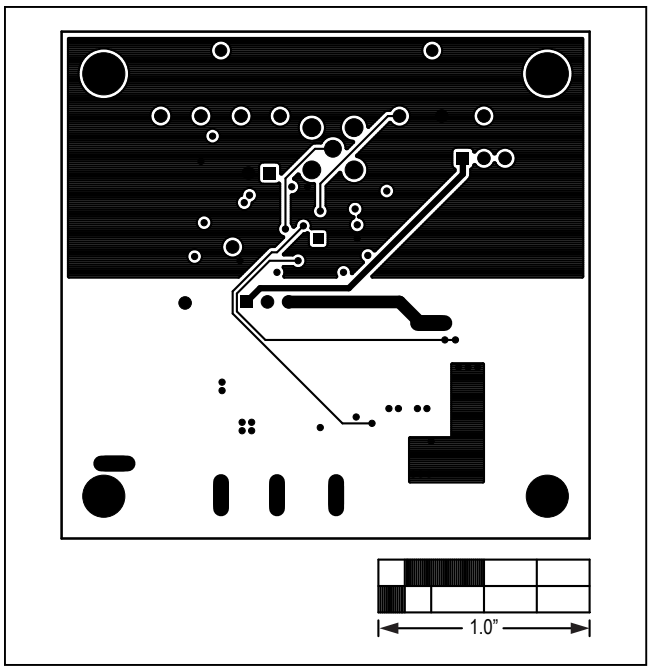

Figure 5. MAX16990 EV Kit PCB Layout—PVL Layer 3

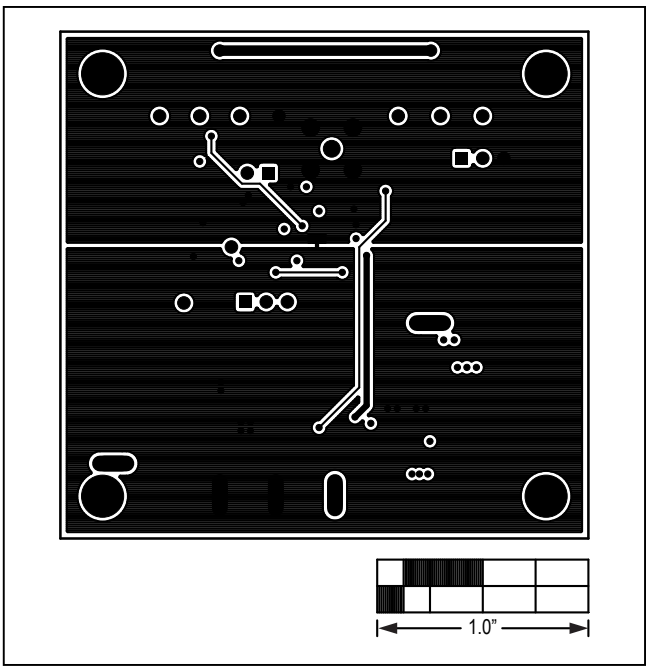

Figure 6. MAX16990 EV Kit PCB Layout—AGND and PGND Solder Side

Ordering Information

PART	TYPE
MAX16990EVKIT#	EV Kit
MAX16992EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/13	Initial release	—

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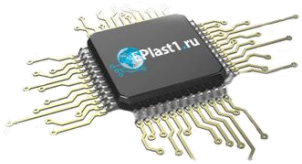
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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