



# MAX15031 Evaluation Kit

## General Description

The MAX15031 evaluation kit (EV kit) demonstrates the MAX15031 APD biasing pulse-width modulation (PWM) step-up DC-DC converter with an internal power switch, current monitor, and adjustable current limiting. The step-up converter switches at 400kHz. The EV kit operates from a DC supply voltage of 2.9V to 5.5V and is configured to deliver approximately 70V and 0 to 4mA of current at the output. The output voltage can be configured from  $V_{IN} + 1V$  to 76V by replacing a resistor or adjusting the CNTRL voltage. The EV kit demonstrates the MAX15031 APD fast current-limit, undervoltage lockout (UVLO), and thermal shutdown features.

The actual converter circuit's PCB footprint is 8mm x 18mm as required in BPON (broadband passive optical network) and GPON (gigabit passive optical network) applications and demonstrates the MAX15031's small, 16-pin TQFN package with exposed pad. The EV kit also features an APD input load simulator circuit for current monitoring and step-response measurements.

**WARNING: Voltages exceeding 42V may exist on the VOUT, APD, MOUT, and PGND PCB pads.**

## Features

- ◆ Tiny 8mm x 18mm Circuit Footprint
- ◆ 2.9V to 5.5V Wide Supply Voltage Range
- ◆ 70V Output Voltage (Approximate)
- ◆ 0 to 4mA Output Current
- ◆ Demonstrates APD Fast Current Limit
- ◆ Demonstrates Undervoltage Lockout
- ◆ Demonstrates Thermal Shutdown Feature
- ◆ MOUT Output Overvoltage Protection Through Clamping Circuit
- ◆ Lead(Pb)-Free and RoHS Compliant
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TYPE
MAX15031EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	1 $\mu$ F $\pm$ 10%, 10V X5R ceramic capacitor (0402) Murata GRM155R61A105K
C2	1	0.01 $\mu$ F $\pm$ 10%, 25V X7R ceramic capacitor (0402) Murata GRM155R71E103K
C3, C8	2	0.1 $\mu$ F $\pm$ 10%, 16V X7R ceramic capacitors (0402) Murata GRM155R71C104K
C4, C5	2	0.1 $\mu$ F $\pm$ 10%, 100V X7R ceramic capacitors (0805) AVX 08051C104KAT
C6	1	0.01 $\mu$ F $\pm$ 10%, 100V X7R ceramic capacitor (0805) Murata GRM21BR72A103K
C7	0	Not installed, ceramic capacitor (0402)
C9	1	10 $\mu$ F $\pm$ 10%, 10V X5R ceramic capacitor (0805) Murata GRM219R61A106K
D1	1	100V, 150mA Schottky diode (SOD123) Diodes, Inc. BAT46W-7-F (Top Mark: L6)
JU1	1	2-pin header

DESIGNATION	QTY	DESCRIPTION
JU2	1	3-pin header
L1	1	4.7 $\mu$ H, 1.5A inductor Coilcraft ME3220-472MLB
N1	1	100V 1.5A n-channel MOSFET (SOT23) Vishay Si2328DS-T1-E3 (Top Mark: CHV)
R1	1	348k $\Omega$ $\pm$ 1% resistor (0603)
R2	1	6.34k $\Omega$ $\pm$ 1% resistor (0402)
R3, R6	2	10k $\Omega$ $\pm$ 1% resistors (0402)
R5	1	2.87k $\Omega$ $\pm$ 1% resistor (0402)
R7	1	10k $\Omega$ $\pm$ 1% resistor (0805)
R8	1	10k $\Omega$ $\pm$ 1% resistor (1206)
R9	1	2k $\Omega$ $\pm$ 1% resistor (0805)
R10	1	100 $\Omega$ $\pm$ 1% resistor (0402)
TP1, TP2, TP4	3	PC mini red test points
TP3, TP6	2	PC mini black test points
TP5	1	PC mini yellow test point
U1	1	APD boost converter (16 TQFN-EP*) Maxim MAX15031ATE+
—	2	Shunts (JU1, JU2)
—	1	PCB: MAX15031 Evaluation Kit+

\*EP = Exposed pad.



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## Component Suppliers

SUPPLIER	PHONE	WEBSITE
AVX Corporation	843-946-0238	www.avxcorp.com
Coilcraft, Inc.	847-639-6400	www.coilcraft.com
Diodes, Inc.	805-446-4800	www.diodes.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Vishay	402-563-6866	www.vishay.com

**Note:** Indicate that you are using the MAX15031 when contacting these component suppliers.

## Quick Start

### Required Equipment

Before beginning, the following equipment is needed:

- MAX15031 EV kit
- 2.9V to 5.5V, 1A DC power supply
- 0 to 5mA adjustable load rated for at least 76V
- Digital multimeter (DMM)

**WARNING: Voltages exceeding 42V may exist on the VOUT, APD, MOUT, and PGND PCB pads.**

### Procedure

The MAX15031 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 jumper JU1 (70V output).
- 2) Verify that a shunt is installed on pins 1-2 of jumper JU2 (enabled).
- 3) Connect the adjustable load to the APD and the SGND pads.
- 4) Connect the power supply to the VIN pad and the power-supply ground to the PGND pad.
- 5) Connect the DMM across the APD and SGND PCB pads.
- 6) Turn on the power supply and set it to 3.3V.
- 7) Verify that the DMM reads approximately 70V.

## Detailed Description of Hardware

The MAX15031 evaluation kit (EV kit) demonstrates the MAX15031 in a small, 16-pin TQFN package with internal power switch, current monitor, and adjustable

current-limiting circuit features. The circuit's PWM step-up DC-DC converter is designed for APD biasing, switches at 400kHz, and is configured to deliver approximately 70V and 0 to 4mA of current to the APD output. The output voltage can be reconfigured from VIN + 1V to 76V by replacing resistor R1 or adjusting the CNTRL voltage. The EV kit demonstrates the MAX15031's APD fast current-limit, undervoltage lock-out (UVLO), and thermal shutdown features.

The converter circuit's PCB footprint is 8mm x 18mm. The EV kit operates from a DC supply voltage of 2.9V to 5.5V and provides up to 4mA at the APD output. The EV kit's APD load simulator circuit is used for current monitoring and step-response measurements. The circuit is comprised of MOSFET N1, resistors R7, R8, R9, and test points TP1, TP2, and TP3 (SGND). Test point TP4 provides access to the MAX15031 BIAS signal. **Voltages exceeding 42V may exist on TP4.** Additionally, bulk capacitor C9 is provided in case long connecting cables are used to power the EV kit during lab evaluation. Capacitor C9 is not required in a typical design.

### $\overline{SHDN}$ and Enable

The MAX15031 EV kit features a jumper to enable and disable U1. Jumper JU2 will disable the EV kit when the shunt is installed on pins 2-3. Installing the shunt on pins 1-2 enables the EV kit. Refer to the *Shutdown (SHDN)* section in the MAX15031 IC data sheet for information. See Table 1 for jumper JU2 settings.

**Table 1.  $\overline{SHDN}$  and Enable (Jumper JU2)**

SHUNT POSITION	$\overline{SHDN}$ PIN	EV KIT OPERATION
1-2	Connected to VIN	Enabled
2-3	Connected to SGND	Disabled

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Evaluates: MAX15031

## Output-Voltage Programmability

The MAX15031 EV kit features a jumper to set the VOUT/APD voltage programmability. The output voltage (VOUT/APD) is programmed by connecting an external reference voltage source to the CNTRL and SGND PCB pads. Remove the shunt at jumper JU1 to use the programmability feature and apply a reference voltage < 1.25V to the CNTRL pad. When the voltage applied to the CNTRL pad is > 1.5V, the MAX15031 internal reference is used. See Table 2 for jumper JU1 settings.

**Table 2. Output-Voltage Programming (Jumper JU1)**

SHUNT POSITION	CNTRL PIN	OUTPUT-VOLTAGE PROGRAMMING
Installed	Connected to VIN	Fixed output voltage: Internal reference voltage used
Not installed	Connected to external reference	Programmable output voltage: Apply an external reference voltage (< 1.25V) at CNTRL PCB pad
Not installed	Connected to external reference	Fixed output voltage: Apply an external reference voltage (> 1.5V*) at CNTRL PCB pad; internal reference voltage used

\*Apply a voltage exceeding 1.5V to use the MAX15031 internal reference. The voltage should be in the range of 1.5V to VIN voltage. Refer to the *Adjusting the Boost Converter Output Voltage (FB/CNTRL)* section in the MAX15031 IC data sheet for information.

The output voltage at VOUT is set by resistors R1 and R2 to 70V when jumper JU1 is installed. To reconfigure the output for a different voltage (VIN + 1V to 76V), select a new surface-mount 0603 resistor for R1. Refer to the *Setting the Output Voltage* section in the MAX15031 IC data sheet for selecting the R1 value.

## Current-Monitor Output (MOUT) and APD Load Simulator

The MOUT PCB pad provides a current-monitor output that sources a current 1/10th the APD current. An RC network comprised of resistor R3 and capacitor C7 provide a filter to the MOUT signal. Capacitor C7 is not required in a typical design.

Additionally, resistors R8 and R9 set the APD load simulator circuit's current for current-monitor step-response measurements. Apply a 0 to 11V square-wave signal to the APD\_DRV pad to simulate a 0 to 4mA load. Use test points TP1 or TP2 to measure the APD load current and TP3 as the SGND. Refer to the *Monitor Current Limit (RLIM)* section in the MAX15031 IC data sheet for additional information on the MOUT features.

## Clamp Input (CLAMP)

The CLAMP input PCB pad is used for voltage clamping the MOUT pin. Capacitor C6 provides filtering to the clamp voltage signal. The MAX15031 EV kit is capable of clamping MOUT voltages between 0.6V to 76V (typ). To clamp MOUT in the range of 0.6V to 4.3V, apply a voltage between 0 and 3.7V (typ) to the CLAMP and SGND PCB pads. Refer to the *Clamping the Monitor Output Voltage (CLAMP)* section in the MAX15031 IC data sheet for additional information on the CLAMP features.

## Fast Current-Limit Threshold and ILIM Output

Resistor R5 sets the MAX15031 APD fast current-limit threshold to 4.3mA. To reconfigure the circuit for another current-limit threshold, replace resistor R5 and use the following equation to calculate a new value for the desired current:

$$R5(k\Omega) = \frac{10 \times 1.245V}{I_{LIMIT}(mA)}$$

where  $I_{LIMIT}$  is the desired DC load current in milliamps.

The  $\overline{ILIM}$  open-drain signal is available at the  $\overline{ILIM}$  PCB pad. Resistor R6 pulls up the  $\overline{ILIM}$  pin to VIN; when low, the MAX15031 is in current limit. To interface with a microcontroller, connect to the  $\overline{ILIM}$  PCB and SGND pads. Refer to the *Monitor Current Limit (RLIM)* section in the MAX15031 IC data sheet for additional information on the  $\overline{ILIM}$  feature.

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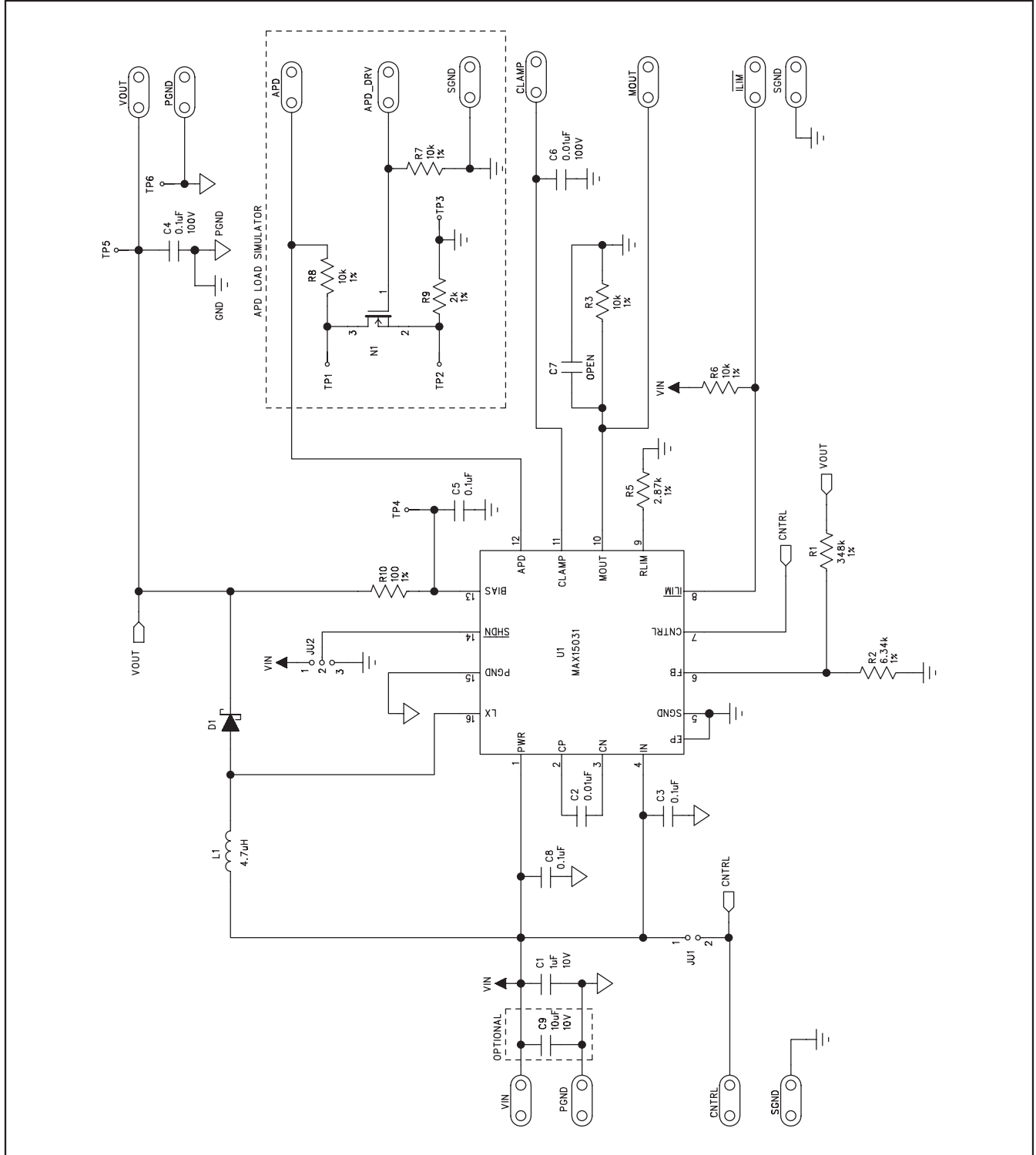


Figure 1. MAX15031 EV Kit Schematic