MAX4990 Evaluation Kit

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor Corp.	631-435-1110	www.centralsemi.com
Murata Mfg. Co., Ltd.	770-436-1300	www.murata.com
TDK Corp.	847-803-6100	www.component.tdk.com
TOKO America, Inc.	847-297-0070	www.tokoam.com

Note: *Indicate that you are using the MAX4990 when contacting these component suppliers.*

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- MAX4990 EV kit
- A user-supplied electroluminescent (EL) lamp
- 5V DC power supply
- Oscilloscope to monitor VA and VB

Procedure

The MAX4990 EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Verify that all jumpers (JU1–JU8) are in their default positions, as shown in Table 1.
2) Connect the VA and VB alligator clip leads to the EL lamp. **Note: Under some conditions, the VA/VB output may be as high as 250V_{P-P}.**
3) Connect the oscilloscope to VA and VB. With math function, monitor VA-VB waveform.
4) Connect the 5V DC power supply between the VDD and GND pins.
5) Switch on the 5V power supply. Verify that the EL lamp illuminates.

Table 1. MAX4990 EV Kit Jumper Descriptions (JU1–JU8)

JUMPER	SIGNAL	SHUNT POSITION	FUNCTION
JU1	SLEW	1-2*	Set by R2
		2-3	Adjustable by VR1
JU2	EN	1-2*	EN = logic-high: normal operation
		Open	EN = logic-low: shutdown
JU3	DIM	1-2	Adjustable by VR2
		2-3*	Set by R4
JU4	EL	1-2	Adjustable by VR3
		Open*	Set by C2
JU5	SW	1-2	Adjustable by VC1
		Open*	Set by C3
JU6	VDD2	1-2*	Power supplied to U2 by VDD Note: VDD must be ≤ 5V
		Open	U1 must be powered independently
JU7	VDD1	1-2*	Power supplied to U1 by VDD Note: VDD must be ≤ 5V
		Open	U2 must be powered independently
JU8	VBATT	1-2*	VDD and VBATT connected together Note: VBATT must be ≤ 5V
		Open	VBATT supplies L1 independent of VDD

**Default position.*

Detailed Description of Hardware

The MAX4990 EV kit provides a proven layout for the MAX4990. Component selection, adjustment range, and typical operation values for a typical EL panel (1.5in x 2.5in area, nominal 15nF load capacitance) are described in the sections that follow.

Slew Rate (R_{SLEW})

Slew rate is set by the resistance on the SLEW pin (see Table 2). Many other adjustments depend upon the slew rate setting as a reference. The equation is:

$$\text{Slew Rate}\left(\frac{V}{100\mu s}\right) = \frac{11.25}{R_{SLEW}}(M\Omega)$$

The VR1 + R1 resistance can be adjusted to a specific value before applying power, by connecting an ohmmeter between JU1 pin 3 and GND. After adjusting VR1 to the desired value, disconnect the ohmmeter, install the JU1 shunt, and finally, apply power to the EV kit.

Output Voltage (R_{DIM}, R_{SLEW})

The output voltage control interacts with the slew rate control (see Table 3). Peak-to-peak output voltage is set by the ratio of the resistances on the DIM and SLEW pins:

$$V_{P\_P} = 200 \times \frac{R_{DIM}}{R_{SLEW}}, \text{ subject to the constraint } 70V \leq V_{P\_P} \leq 250V$$

The VR2 resistance can be adjusted to a specific value before applying power, by connecting an ohmmeter between JU3 pin 1 and GND. After adjusting VR2 to the desired value, disconnect the ohmmeter, install the JU3 shunt, and finally, apply power to the EV kit.

Table 2. Slew Rate Configuration

JU1 SHUNT POSITION	VR1 TRIMMER	R_{SLEW} (MΩ)	SLEW RATE (V/100µs)
1-2	—	R2 = 0.374	30
2-3	25% CW	VR1 + R1 = 0.560	20
	50% CW	VR1 + R1 = 0.997	12

CW = Clockwise. Approximate trimmer values provided for initial guidance only.

Table 3. Output Voltage Configuration

JU1 SHUNT POSITION	VR1 TRIMMER	R_{SLEW} (MΩ)	JU3 SHUNT POSITION	VR2 TRIMMER	R_{DIM} (MΩ)	V_{P-P} (V)
1-2	—	R2 = 0.374	2-3	—	R4 = 0.374	200
			1-2	7% CW	VR2 = 0.152	90
				13% CW	VR2 = 0.272	150
				19% CW	VR2 = 0.386	200
2-3	25% CW	VR1 + R1 = 0.560	2-3	—	R4 = 0.374	144
			1-2	10% CW	VR2 = 0.211	80
				25% CW	VR2 = 0.496	182
				36% CW	VR2 = 0.729	242
	50% CW	VR1 + R1 = 0.997	2-3	—	R4 = 0.374	86
			1-2	19% CW	VR2 = 0.383	86
				35% CW	VR2 = 0.700	150
				70% CW	VR2 = 1.398	260

CW = Clockwise. Approximate trimmer values provided for initial guidance only.

Soft-Start (R_{DIM}, C_{DIM})

Subject to the constraint that $R_{DIM}/R_{SLEW} \leq 1.3$, the gradual turn-on/turn-off time is set by R_{DIM} and C_{DIM} (see Table 4) by the equations:

$$t_{ON} = 2.6 \times R_{DIM} \times C_{DIM}$$
$$t_{OFF} = 1.2 \times R_{DIM} \times C_{DIM}$$

Lamp Output Frequency (R_{SLEW}, C_{EL})

Lamp output frequency can be set by an external capacitor, C_{EL} (see Table 5):

$$f_{EL} = \frac{0.0817}{R_{SLEW} \times C_{EL}}$$

Table 4. Soft-Start Configuration

C_{DIM} (µF)	JU3 SHUNT POSITION	VR2 TRIMMER	R_{DIM} (MΩ)	t_{ON} (S)	t_{OFF} (S)
C1 = 1.0	2-3	—	R4 = 0.374	0.972	0.449
	1-2	7% CW	VR2 = 0.152	0.395	0.182
		10% CW	VR2 = 0.211	0.549	0.253
		18% CW	VR2 = 0.374	0.972	0.449
		25% CW	VR2 = 0.496	1.290	0.595
		35% CW	VR2 = 0.700	1.820	0.840
		50% CW	VR2 = 1.000	2.600	1.200
		70% CW	VR2 = 1.398	3.635	1.678

CW = Clockwise. Approximate trimmer values provided for initial guidance only.

Table 5. Lamp Output Frequency When JU4 = Open (Internal f_{EL})

C_{EL} (pF)	JU1 SHUNT POSITION	VR1 TRIMMER	R_{SLEW} (MΩ)	f_{EL} (Hz)
C2 = 560	1-2	—	R2 = 0.374	390
	2-3	25% CW	VR1 + R1 = 0.560	260
		50% CW	VR1 + R1 = 0.997	150
C2 = 1000	1-2	—	R2 = 0.374	218
	2-3	25% CW	VR1 + R1 = 0.560	146
		50% CW	VR1 + R1 = 0.997	82

CW = Clockwise. Approximate trimmer values provided for initial guidance only.

Lamp Output Frequency (External f_{EL} Signal)

When the f_{EL} pin is driven by an external clock, the lamp frequency is $f_{EL}/4$. The EV kit uses an ICM7556 dual CMOS timer (U2) to generate a 50% duty-cycle square wave. The VR3 value can be adjusted while power is applied (see Table 6).

Boost Converter Frequency (R_{SLEW}, C_{SW})

ICM7556 square-wave frequency f_{EL} = 1/(1.4 x R x C). The boost converter switching frequency can be set by an external capacitor, C_{SW} (see Table 7).

$$f_{SW} = \frac{3.61}{R_{SLEW} \times C_{SW}}$$

Boost Converter Frequency (External f_{SW} Signal)

Boost converter switching frequency can be driven by an external clock. The EV kit uses an ICM7556 dual CMOS timer (U2) to generate a 90% duty-cycle square-wave pulse. The C_{SW} value can be adjusted while power is applied (see Table 8).

Table 6. Lamp Output Frequency When JU4 = Pins 1-2 (External f_{EL})

ICM7556 TIMING CAPACITOR (pF)	VR3 TRIMMER	ICM7556 TIMING RESISTORS (kΩ)	f_{EL} FROM ICM7556 (kHz)	LAMP FREQUENCY = $f_{EL}/4$ (Hz)
C7 = 15000	0% CW	VR3 + R5 = 513.3	0.0927	23
	50% CW	VR3 + R5 = 263.3	0.180	45
	100% CW	VR3 + R5 = 13.3	3.58	895

CW = Clockwise. Approximate trimmer values provided for initial guidance only.

Table 7. Boost Converter Frequency When JU5 = Open (Internal f_{SW})

C_{SW} (pF)	JU1 SHUNT POSITION	VR1 TRIMMER	R_{SLEW} (MΩ)	f_{SW} (kHz)
C3 = 68	1-2	—	R2 = 0.374	142
	2-3	25% CW	VR1 + R1 = 0.560	95
		50% CW	VR1 + R1 = 0.997	53

CW = Clockwise. Approximate trimmer values provided for initial guidance only.

Table 8. Boost Converter Frequency When JU5 = Pins 1-2 (External f_{SW})

VC1 TRIMMER	ICM7556 TIMING CAPACITOR (pF)	f_{SW} = ICM7556 SQUARE WAVE = 1.44/((R7 + 2 x R6) x (VC1)) (kHz)
Minimum: 0°	VC1 = 7 + 25	112
Center: 90° or 270°	VC1 = 30 + 25	60
Maximum: 180°	(50 ≤ VC1 ≤ 100) + 25	33

Note: *f_{SW} square wave has fixed duty cycle = (R6 + R7)/(R7 + 2 x R6) = 90%. Approximate trimmer values provided for initial guidance only.*

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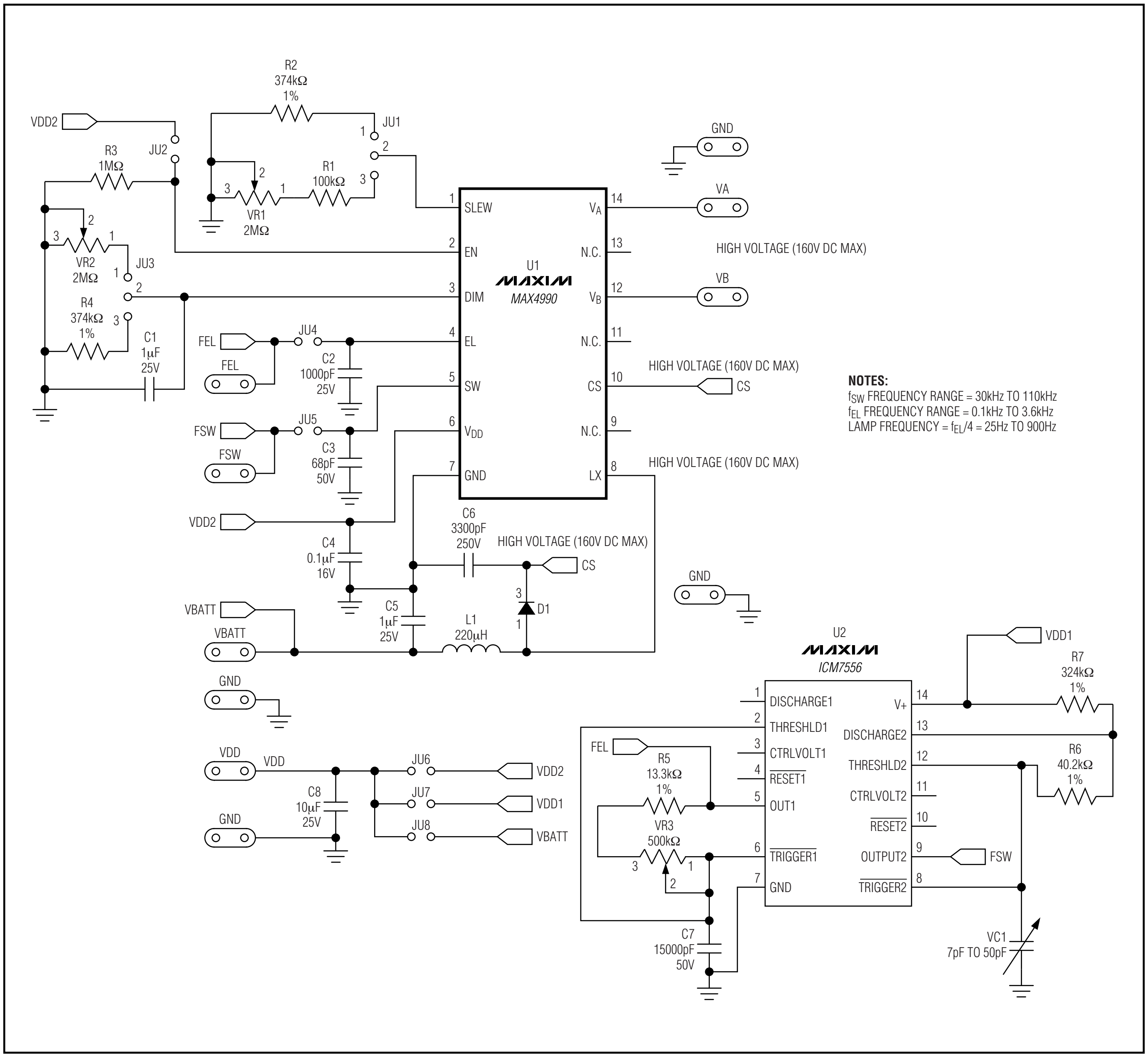

Figure 1. MAX4990 EV Kit Schematic

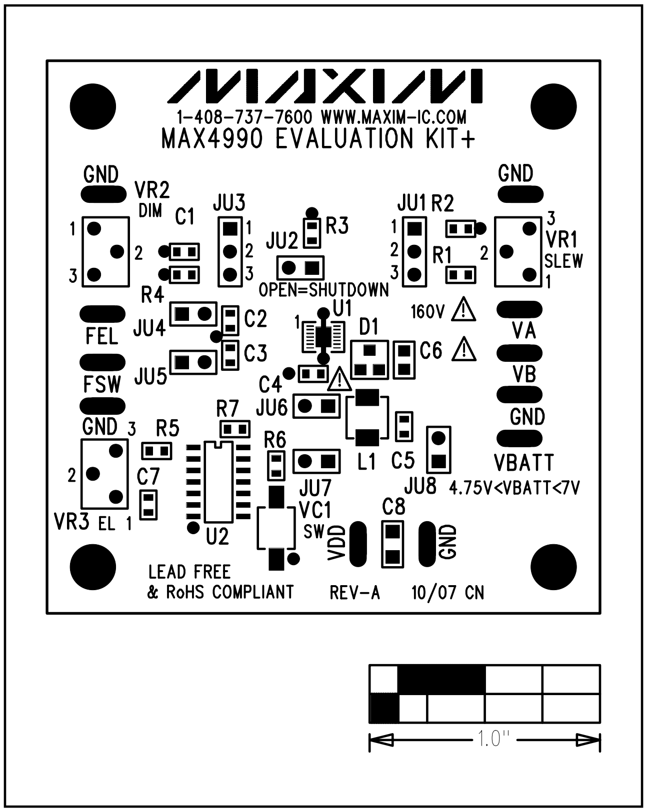

Figure 2. MAX4990 EV Kit Component Placement Guide—Component Side

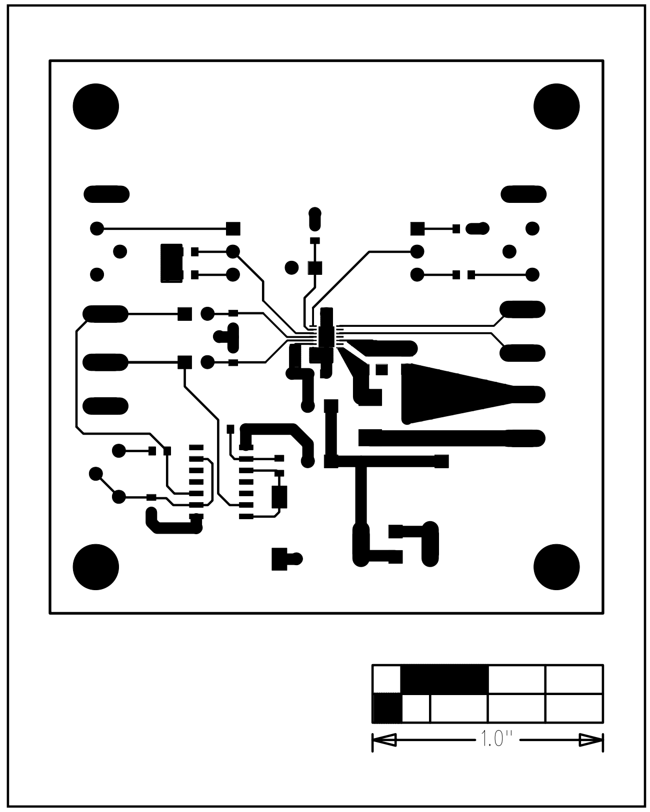

Figure 3. MAX4990 EV Kit PCB Layout—Component Side

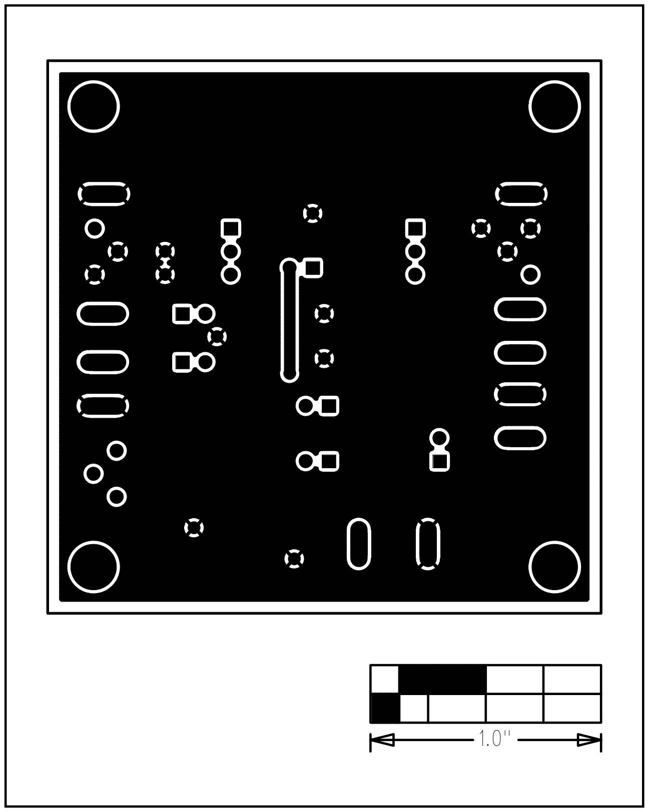

Figure 4. MAX4990 EV Kit PCB Layout—Solder Side