19-0361; Rev 0; 12/94

MAXIM

MAX445 Evaluation Kit

Evaluates: MAX445

General Description

The MAX445 video CRT display driver evaluation kit (EV kit) contains all the circuitry needed to evaluate the high-speed, high-voltage MAX445 while driving a capacitive element simulating a CRT cathode.

BNC jacks are provided for inputs VIN+, VIN-, and BLANK. BLANK is a TTL input used to turn off the output current, independent of signal input. Gain (contrast) and offset adjustments for the output are made via two on-board potentiometers.

The MAX445's output configuration is open collector. A suitable load resistor is provided for proper circuit operation. An oscilloscope probe connector is included for monitoring the output signal.

The EV kit incorporates a heatsink for the MAX445, to help maintain the junction temperature within the recommended range.

Features

- **50V Output Swing**
- **50Ω Differential Inputs**
- **Optimized Output Impedance Matching Network**
- **Gain and Offset Adjustments**
- **TTL-Level Blank Input**
- **Fully Assembled and Tested**

Ordering Information

PART	TEMPERATURE	BOARD TYPE
MAX445EVKIT-DIP	+25°C	Through Hole

Component List

DESIGNATION	QTY	DESCRIPTION
U1	1	Maxim MAX445CPG
B1, B2, B3	3	Ferrite beads (SMT) Fair-Rite Products 2743019447
C1	1	15pF, 50V ceramic capacitor
C5	1	22µF, 100V electrolytic capacitor Nichicon UVX2A220MPA
C2, C3, C4, C6, C7, C9, C10	7	0.1µF, 25V ceramic capacitors
C8	1	0.1µF, 100V ceramic capacitor
C11	1	1.0pF, 50V ceramic capacitor
C12	1	3.0pF, 100V ceramic capacitor
VIN+, VIN-, BLANK	3	50Ω, BNC-jack PC mount
OUTPUT	1	Scope-probe jack Specialty Connector 33JR135-1
L1	1	22nH inductor CoilCraft 1008CS-220XKB
L2	1	220nH inductor CoilCraft 1008CS-221XKB
L3	1	39nH inductor CoilCraft 1008CS-390XKB
R1, R2	2	5kΩ potentiometers

DESIGNATION	QTY	DESCRIPTION
R3	1	15Ω, 5% resistor
R4, R5	2	51Ω, 5% resistors
R6	1	510Ω, 5% resistor
R7	1	200Ω, 5%, 10W noninductive resistor Dale FP10
R9	1	100Ω, 5%, 0.25W resistor Dale CRCW 1210101J
D1	1	100V, 1A Schottky diode Motorola MBRS1100T3, International Rectifier 10BQ100, or Central Semiconductor CMR1U-01
D2, D3	2	30V, 1A Schottky diodes Motorola MBRS130T3, International Rectifier 10BQ040, or Central Semiconductor CMSH1-40
D4	1	200V, 100mA switching diode Central Semiconductor CMPD2003, or Motorola BAS21LT1
None	24	Socket pins Berg 75315-001 *(Not recommended for production)*
None	1	Heatsink
None	1	MAX445 data sheet

Component Suppliers

SUPPLIER	PHONE	FAX
Capacitors		
Murata Erie	(800) 831-9172 (814) 237-1431	(814) 238-0490
Vishay/Vitramon	(203) 268-6261	(203) 452-5670
Inductors		
CoilCraft	(708) 639-6400	(708) 639-1469
Diodes		
Central Semiconductor	(516) 435-1110	(516) 435-1824
Motorola	(602) 244-5303	(602) 244-4015
Nihon	(805) 867-2555	(805) 867-2556
Resistors		
Dale/Vishay	(402) 371-0800	(402) 644-4206
Ferrite Beads		
Fair-Rite Products	(914) 895-2055	(914) 895-2629
Socket Pins		
Berg Electronics	(717) 938-7247	(717) 938-7604

Required Test Equipment

Input Signal:

- Pulse generator capable of delivering a 0V to +1V pulse, with less than 1ns rise time and less than 5% overshoot.

Measurement Equipment (see *Recommended Probe* section):

- Oscilloscope with a 500MHz minimum bandwidth.
- 100x, 5kΩ, 1.5pF, 0.5W oscilloscope probe. Tektronix P6057, P6156 (with option 25) recommended.

Quick Start

The MAX445 EV kit is fully assembled and tested. The circuit has been factory calibrated for the MAX445 installed on the board. Take the following steps to verify board operation. **Do not turn on the power supply(ies) until all connections are completed.**

1) The MAX445 EV kit requires supply voltages of +10.0V (80mA), -10.5V (100mA), and +75V (300mA). Connect the power supplies to the +10V, -10.5V, and +75V pads. Connect grounds to the GND pad.
2) Turn on the power supplies.
3) Use a 50Ω cable to connect the signal generator to the BNC jack marked VIN+. Adjust the input pulse amplitude within the 0mV to +700mV range.
4) Calibrate the scope probe using the input signal.
5) Monitor the output using a recommended oscilloscope probe connected to the jack marked OUTPUT.
6) If a new MAX445 is installed on the board, recalibrate the EV kit. See the *Calibration Procedure* section for instructions.

Detailed Description

Calibration Procedure

To ensure proper and optimum performance of the EV kit, it is advisable to recalibrate the EV kit if a new MAX445 is installed on the board (see the *Test Equipment* section).

1) With the MAX445 removed from the EV kit, adjust the +10V, -10.5V, and +75V supplies.
2) Adjust and apply a 0V to +700mV square wave to the VIN+ input jack.
3) Turn off the power supplies and insert the new MAX445. Reattach the heatsink to the MAX445 and board.
4) Turn on the power supplies. Use the potentiometer labeled CONTRAST (R2) to adjust the device's gain. Set the output signal to approximately 10Vp-p.
5) Use the potentiometer labeled OFFSET (R1) to adjust the device's offset to the desired "Black Level." Normally, the black level is set to several volts below V_{AA} (+75V).
6) Adjust gain (contrast) control to give the desired output voltage swing. Maximum input signal amplitude for video inputs is normally 700mV. With the V_{AA} supply set at +75V, 50Vp-p output waveforms can be generated.
7) Check for balanced rise and fall times at the output. With a proper input signal (t_r < 1ns), the output rise and fall times should be equal and balanced. If an extremely long rise or fall time is observed, reduce the device's gain (contrast) and adjust the output offset level to balance rise and fall times. Repeat steps 5 and 6 as necessary to optimize the output. The V_{AA} supply may also need adjustment.

Differential Inputs

The BNC connectors labeled Vin+ and Vin- are differential video inputs designed for a 0V to +1V, DC-coupled signal into VIN+ with respect to VIN-. Each input is terminated with a 50Ω resistor at the MAX445 input pins.

Recommended Probe

The oscilloscope probe recommended for measuring performance of the MAX445 is an integral part of the total capacitive load at the output. Most probes will not

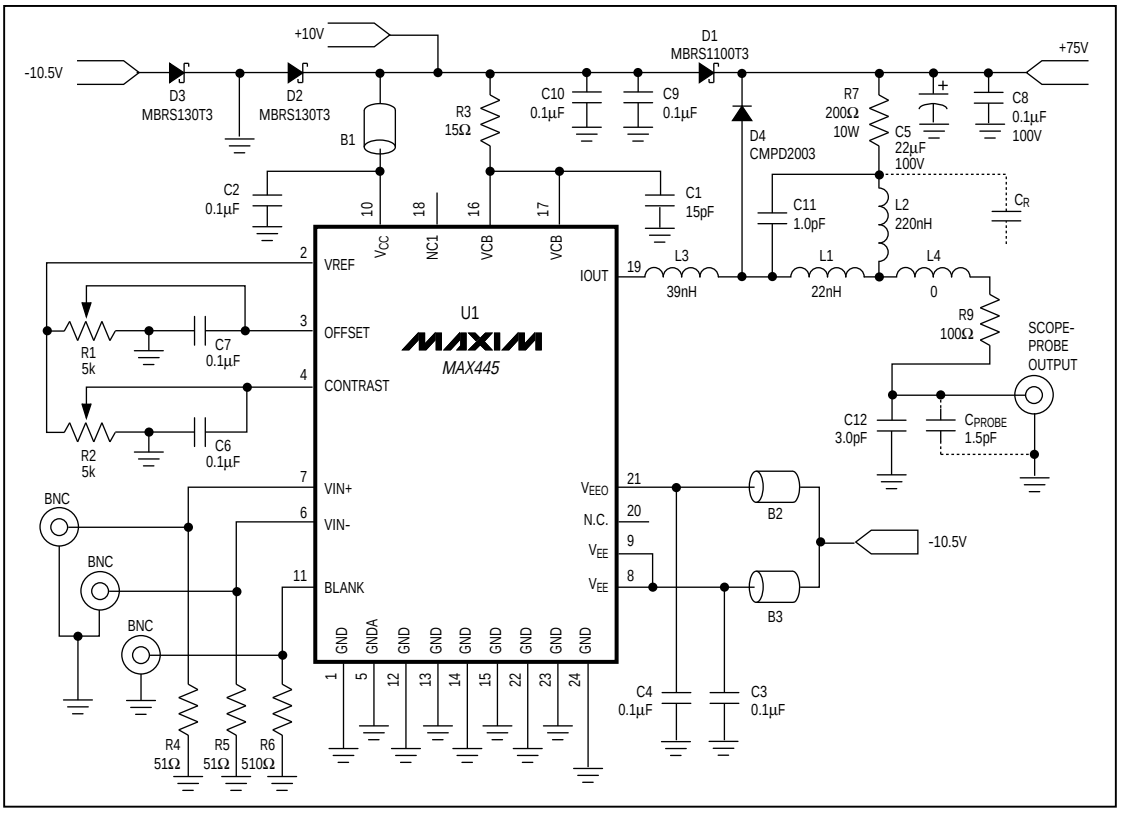

Figure 1. MAX445 EV Kit Schematic Diagram

provide the low capacitance and high bandwidths needed for optimum circuit performance. The Tektronix P6057, P6156 (with option 25), or equivalent probes are well suited for this application. These are 100x, 5kΩ, 0.5W probes with less than 1.5pF of capacitance.

Blank Input

The BNC jack labeled BLANK is a TTL-level input terminated at the MAX445 with a 510Ω resistor. Asserting BLANK (TTL high) will disable the input signal and allow the output to rise to the V_{AA} supply independent of offset control.

Offset and Gain Adjustments

Offset and gain (contrast) are easily adjusted using potentiometers R1 and R2, respectively, which are biased by the MAX445's internal 5.5V reference.

Output Loading

The total capacitive load incorporates the capacitance of the probe, the board, the arc protection diode, and the external capacitor. The recommended oscilloscope probe (P6057) represents approximately 1.5pF of the total load, and the PC board and metal signal traces add another 1.5pF. The arc protection diode contributes about 2pF. Finally, C12 (located across the scope-probe connector) accounts for 3pF. These four factors combine for a total capacitive load of approximately 8pF.

The 200Ω load resistor (R7) is a 10W low-inductance power resistor. It represents an inductive load of approximately 100nH to the output circuitry, and its leads add inductance at approximately 25nH per inch.

Output Impedance Matching Network

The MAX445 EV kit is configured with an impedance matching network to extend system bandwidth. This

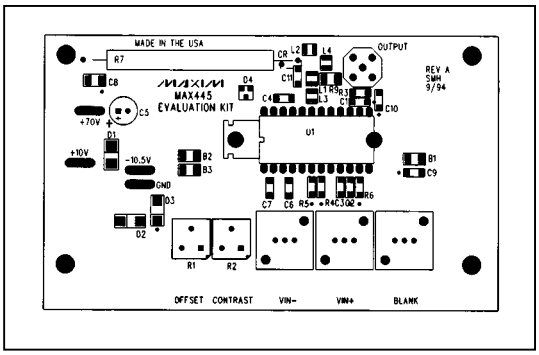

Figure 2. MAX445 EV Kit Component Placement Guide—Component Side

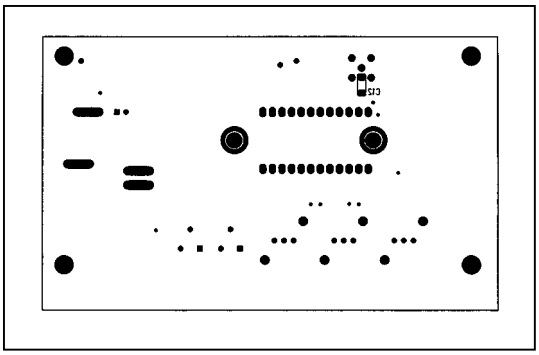

Figure 3. MAX445 EV Kit Component Placement Guide—Solder Side

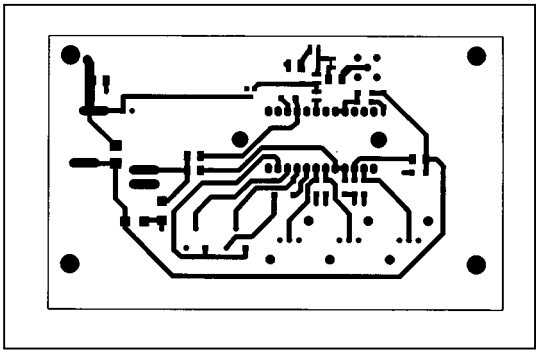

Figure 4. MAX445 EV Kit PC Board Layout—Component Side

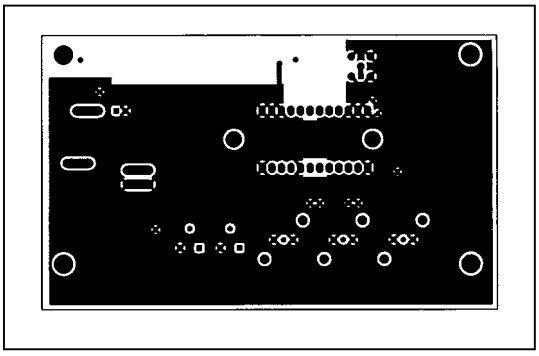

Figure 5. MAX445 EV Kit PC Board Layout—Solder Side

network is designed for a total capacitive load of 8pF, a 200Ω load resistor (R7), and a series arc protection resistor (R9). In an actual application, some components of the output network (such as L3 and L4) would be partially composed of the circuit board and wire interconnects.

If the total load capacitance of 8pF is altered by more than ±10%, the load resistor (R7), series arc protection resistor (R9), and impedance matching network may require modification.

Capacitor C_R may also be needed to improve step response. Further details of the matching network, including the sizing of C_R, are discussed in the *Impedance Matching Network* section of the MAX445 data sheet.

Heatsink and Cooling

The MAX445 dissipates large amounts of power. A specially designed heatsink is attached to the MAX445 and the EV kit board to facilitate cooling at room temperature. Additional forced air cooling will be required at elevated ambient temperatures in order to maintain proper junction temperatures. Forced air cooling is required for load resistor R7 when there is a large output voltage swing.

CRT Arc Protection Diode

The MAX445's output must be protected from electrostatic discharge ("arcs") when driving a CRT. D4, a low-capacitance diode that clamps the MAX445 output to the V_{AA} supply, is included to simulate an actual application.