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APPLICATION NOTE 4516

Simple Circuit Protects Automotive Video Drivers from Overvoltage

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Abstract: This circuit protects automotive video amplifiers from accidental exposure to the car's battery voltage (16V maximum), by sensing voltage faults and quickly opening the connection between amplifier and battery.

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In a typical automotive video application, the video DAC (from a rear camera or DVD player, for example) is followed by a lowpass reconstruction filter and an amplifier that transmits a video signal to the LCD display. This amplifier and all such similar automotive circuits must be protected from direct connection to the car's battery voltage. Since car-battery voltages range from 12V to 16V, the minimum protection required is 16V.

The simple circuit of **Figure 1** protects the output of a video filter amplifier (**MAX9502**) against shorts to the battery. The MAX9502 saves component cost and board space by eliminating the passive lowpass LC reconstruction filter that is otherwise required following the video DAC. In most applications the video DAC has a ground-referenced current output, and the Rx value (75Ω to 300Ω, depending on characteristics of the video DAC) sets the video amplitude at 1V_{P-P}.

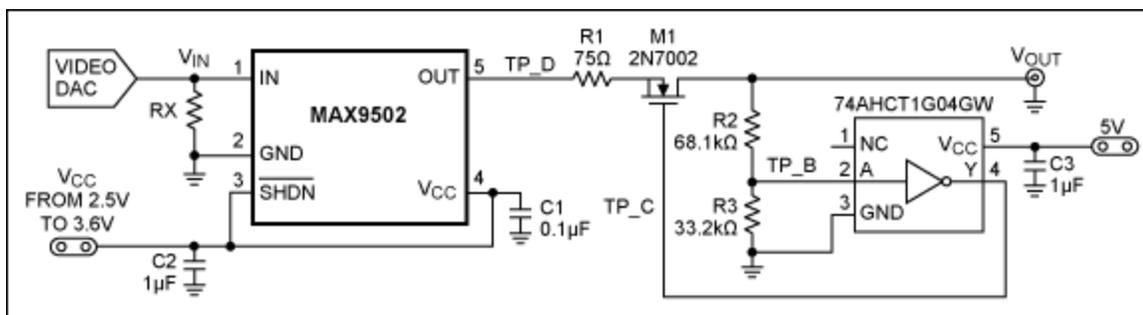


Figure 1. This circuit automatically protects the video driver (MAX9502) from overvoltage at V_{OUT} by turning off the transistor M1.

When the circuit's output voltage (V_{OUT}) exceeds 7V, the inverter output goes low and turns off transistor M1, thereby protecting the MAX9502 by isolating its output. When V_{OUT} returns below 7V, the

inverter output goes high, allowing M1 to turn on and re-establish the video channel.

Figure 2 shows the transient response of the circuit in Figure 1. As the voltage at V_{OUT} rises from 0V to 16V, transistor M1 remains on until TP_C goes low. The ESD-protection diode, connected internally from V_{CC} to the MAX9502 output, turns on during this period and clamps the output (TP_D) to about 3.3V. Since this ON period is very short, the MAX9502 is not damaged and the power supply connected to its V_{CC} pin is not affected.

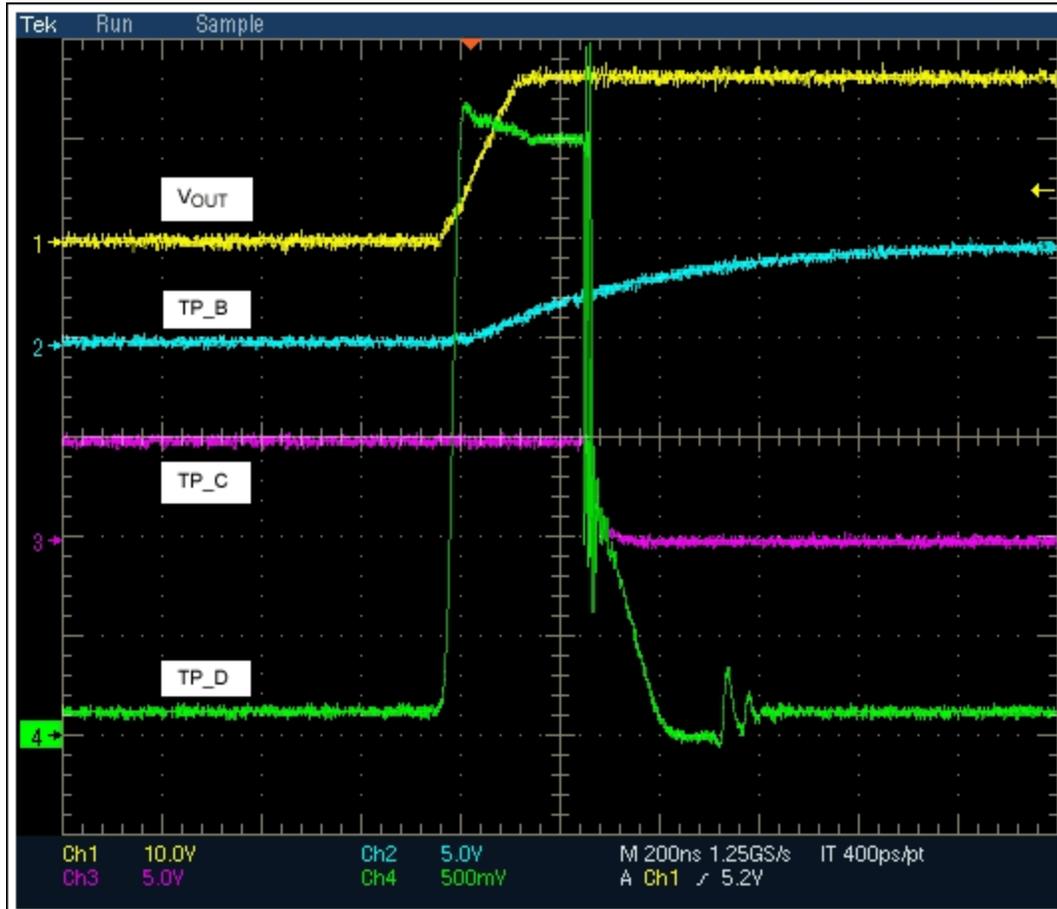


Figure 2. Transient-response waveform for the Figure 1 circuit.

Table 1 shows the overall video performance with a 75Ω termination resistor in place (Rx), as taken with a Tektronix VM700 video measurement set. Performance is good, and the transistor (M1) has a negligible effect on the video quality.

Table 1. Video Performance

dG (%)	dP (°)	Luminance Nonlinearity (%)	K-2T (%)	Gain (dB) from 100kHz to 5MHz	Group Delay (nS)
0.51	0.7	0.3	0.7	0.5	15

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