Simple Circuit Uses FET To Protect Car's Video Driver From Overvoltage

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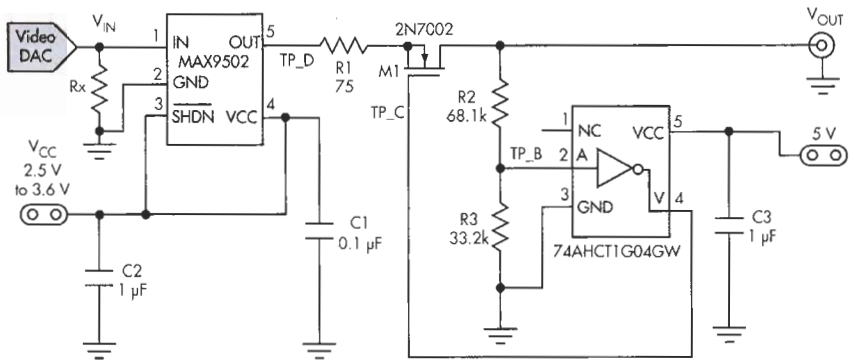
In a typical automotive video application, the video digital-to-analog converter (DAC)—from a rear camera or DVD player, for example—is followed by a low-pass reconstruction filter and an amplifier that transmits a video signal to the LCD. This amplifier, and all such similar automotive circuits, must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

A simple circuit employing an inverter and a FET can provide this protection against shorts to the battery *(Fig. 1)*. The MAX9502 video filter amplifier used in this example eliminates the requirement for the passive low-pass LC reconstruction filter. In most applications, the video DAC has a ground-referenced current output, and the value of Rx (75 to 300 Ω, depending on characteristics of the video DAC) sets the video amplitude at 1 V p-p.

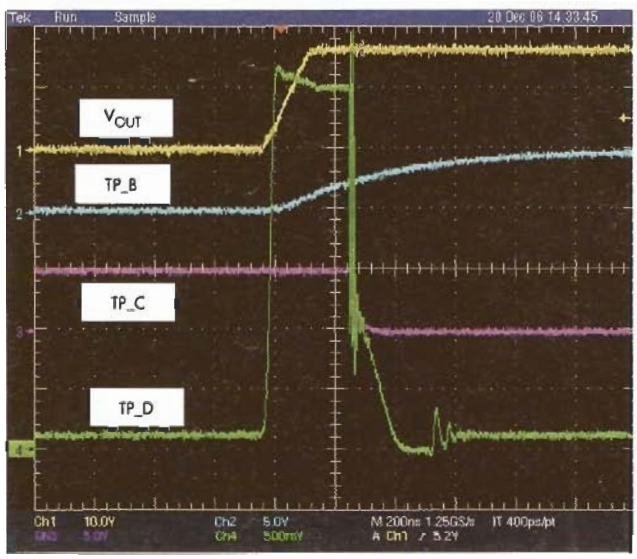
When the circuit's output voltage (V_{OUT}) exceeds 7 V, the output of the inverter (74AHCT1G04GW) goes low and turns off transistor M1, thus protecting the MAX9502 by isolating its output. When V_{OUT} drops below 7 V, the inverter output goes high, allowing M1 to turn on and re-establish the video channel.

Figure 2 shows the circuit's transient response. As V_{OUT} rises from 0 to 16 V, 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 3.3 V. Since this ON period is very short, the MAX9502 isn't damaged and the power supply connected to its V_{CC} pin is unaffected.

The table shows the overall video performance with a 75-Ω termination resistor (Rx), as measured with a Tektronix VM700 video test set. Performance is good, and the transistor has a negligible effect on the video quality.



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



2. The transient-response waveforms for the circuit illustrate how it operates.

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Video Performance

dG	0.51%
dP	0.7°
Luminance nonlinearity	0.3%
K-2T	0.7%
Gain flatness (100 kHz to 5 MHz)	0.5 dB
Group delay	15 ns