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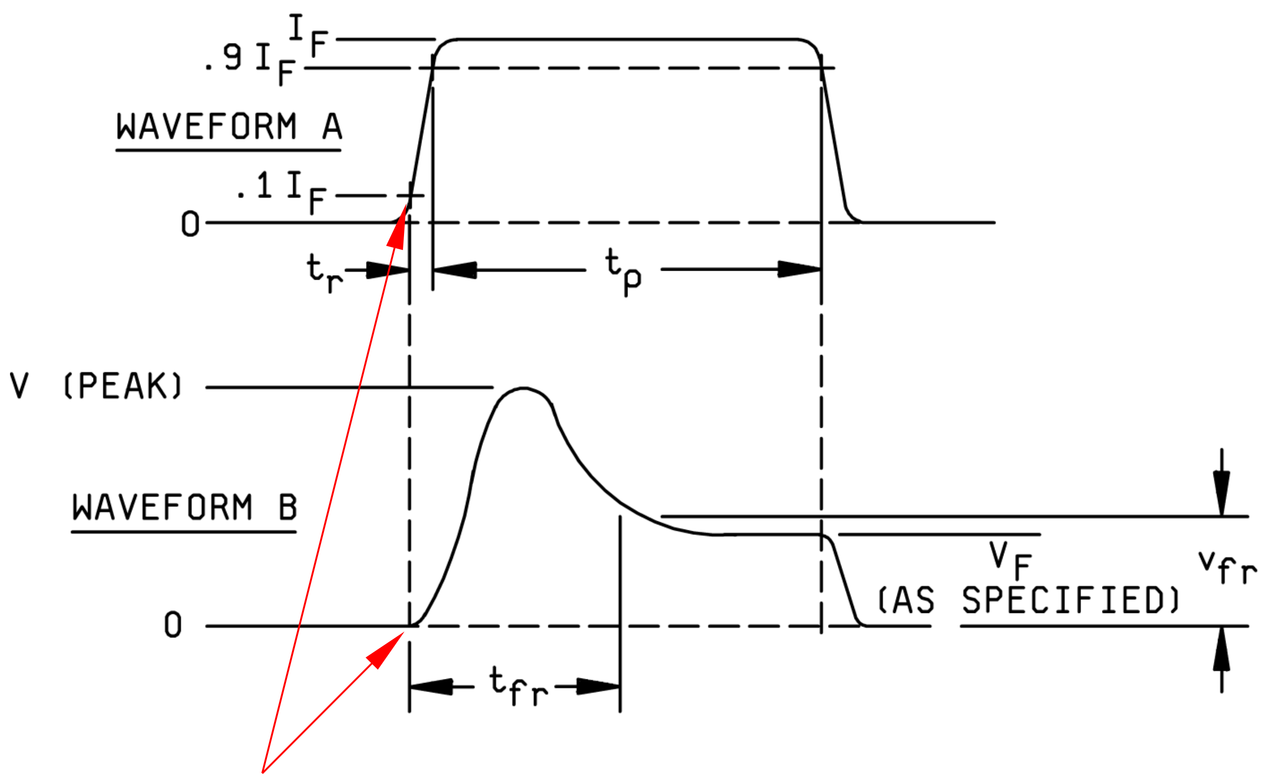
SUGGESTIONS FOR IMPROVING MIL-STD-750 METHOD 4026.3

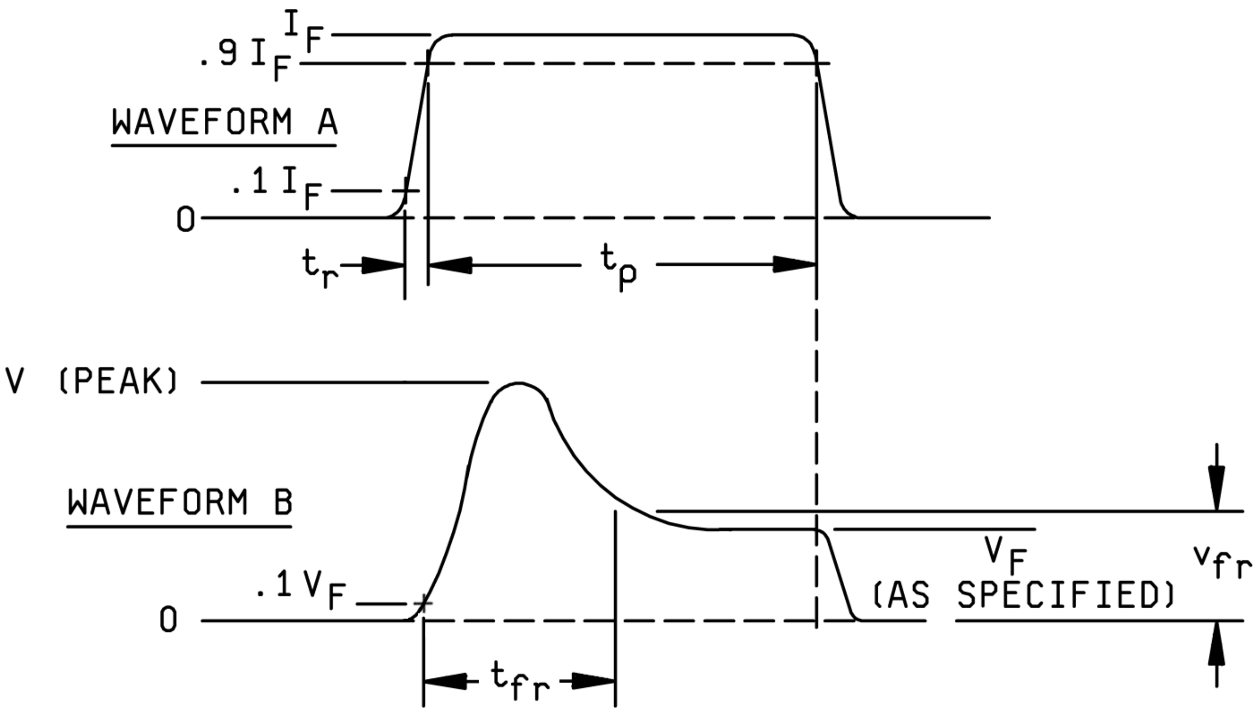
MAJOR CONCERN: GIVE tfr A CLEARER, MORE MEASURABLE DEFINITION



The above figure is ambiguous – it shows t_{fr} as the time between 0.1 I_F and V = V_{fr}, *AND* as the time between V=0 and V=V_{fr}. The latter definition agrees with the text, which says t_{fr} is "measured from the time forward voltage becomes positive to the time that forward voltage recovers to a specified vfr".

Unfortunately, it is impossible to measure the "time forward voltage becomes positive" repeatably. Does this mean 1 uV? 1 mV? 10 mV? Also, this definition makes the measurement highly sensitive to noise and any minor variations in the exact shape of the rising slope (caused, for example, by repositioning a cable). In practice, this results in variations of several nanoseconds, which is problematic for fast devices.

I would suggest measuring t_{fr} between V = 0.1 Vf (or 0.1 Vfr) and V = Vfr, as shown in the next figure:



This is much easier to measure reliably with automated equipment than the existing definition.

Since this gives a slightly smaller value of t_{fr}, all devices that passed tests based on the old definition would also pass based on the new definition.

MINOR CONCERN: RESPONSE DETECTOR INPUT IMPEDANCE

Method 4026.3 currently calls for Z ≥ 100 RF. For a diode tested at RF = 0.7V / 100 mA, this gives Z ≥ 700 Ohms. For a diode tested at RF = 0.7V / 1 A, this gives Z ≥ 70 Ohms.

In practice, it is convenient to use Z = 500 Ohms, consisting of a 450 Ohm resistor in series with the 50 Ohm input impedance of an oscilloscope. This provides a 10:1 attenuation ratio, which is convenient for quick calculations.

Also, using higher values of Z with a 50 Ohm oscilloscope results in higher attenuation ratios, which is undesirable due to the small signal levels. For instance, a V_F = 0.7V is attenuated to 70 mV in a 10:1 system. Measuring signals much smaller than that on most oscilloscopes becomes difficult, since DC offsets and noise in common oscilloscopes can amount to several mV or more.

In practice, 500 Ohms is sufficiently high to not affect the measurement, and sufficiently low to not over-attenuate the signal.

I would suggest changing the requirement to Z ≥ 500 Ohms.

This should not affect measured t_{FR} / V_{FR} values in any significant way.

MINOR CONCERN: GENERATOR RESISTANCE

Method 4026.3 currently calls for RS ≥ 20 RF (RF = VF/IF at specified IF). For a diode tested at RF = 0.7V / 100 mA, this gives Z ≥ 140 Ohms. For a diode tested at RF = 0.7V / 1 A, this gives Z ≥ 14 Ohms.

In practice, it is convenient to use a pulse generator with a 50 Ohm output impedance, and install 50 Ohms on the test jig in series with the diode under test, with 50 Ohm coaxial cabling between the pulser and the test jig. This terminates the cabling at both ends, absorbing reflections.

This gives RS = 50 Ohms + 50 Ohms = 100 Ohms, which is lower than the currently-required 140 Ohm value for 100 mA devices.

I would suggest changing the requirement to:

RS ≥ 10 RF

or

RS ≥ 100 Ohms

This should not affect measured t_{FR} / V_{FR} values in any significant way.

– Dr. Michael J. Chudobiak
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