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IEEE Standard for Low-Power Pulse Transformers

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IEEE Standard for Low-Power Pulse Transformers

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IEEE Magnetics Society**

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Foreword

(This foreword is not part of IEEE Std 390-1975, Standard for Low-Power Pulse Transformers.)

The purpose of this standard is to provide a common ground of understanding between electronic system engineers and pulse transformer design engineers.

It pertains to low-power pulse transformers for use in electronic equipment.

It does not include computer-type (square-loop) pulse transformers, which depend upon the use of square-loop core material for operation. Those transformers, often referred to as "switching" or "square-loop" types, are covered in IEEE Std 272-1970, Standard for Computer-Type (Square-Loop) Pulse Transformers.

High-power pulse transformers will be covered in a related standard.

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IEEE Standard for Low-Power Pulse Transformers

1. Scope

This standard pertains to small low-power pulse transformers for use in electronic equipment, transmitting peak power of 300 W or less and average power of 5 W or less with a peak working voltage of 1000 V or less.

These transformers are required to transform unipolar or bipolar pulses of voltage or current within specified tolerances of amplitude and time when operated between specified impedances.

This standard is not intended to include low-power "switching" type pulse transformers which are covered in IEEE Std 272-1970, Standard for Computer-Type (Square-Loop) Pulse Transformers. These transformers depend upon the use of "square-loop" core material for operation, have "memory" capability, and normally transmit only bipolar pulses unless provision is made for core flux reset. This standard is not intended to include transformers for power conversion applications. Those transformers will be covered in a related standard.

Whenever numerical values are indicated they may be considered as recommended values. Section 2 contains definitions of terms pertaining primarily to functional testing of low-power pulse transformers, and Section 5 contains equivalent circuits and definitions of associated terms. Section 6 describes preferred transformer test methods and the appendix contains alternate test methods.

1.1 Typical Transformer Types to Which This Publication Applies. This publication applies to these transformer types: impedance matching, interstage coupling, current sensing, and blocking oscillator transformers.

1.2 Related Transformer Standards

1.2.1 IEEE Std 272-1970, Standard for Computer-Type (Square-Loop) Pulse Transformers.

1.2.2 IEEE Std 111-1971, Standard for Low-Power Wide-Band Transformers.

1.2.3 IEEE Std 264-1968 (ANSI C16.41-1972), Standard for High-Power Wide-Band Transformers.

1.2.4 IEEE Std 266-1969, Test Procedure for the Evaluation of Insulation Systems for Electronics Power Transformers.

2. Definitions

Electrical terms used in this publication shall be in accordance with those given in the IEEE Std 100-1972 (ANSI C42.100-1972), IEEE Standard Dictionary of Electrical and Electronics Terms. In addition, other terms are defined below:

2.1 peak working voltage. The maximum instantaneous voltage stress that may appear under operation across the insulation being considered, including abnormal and transient conditions.

2.2 input pulse shape. Current pulse or source voltage pulse applied through associated impedance. The shape of the input pulse is described by a current- or voltage-time relationship and is defined with the aid of Fig 1 in accordance with the following definitions:

NOTE: (A) designates a general amplitude quantity which may be current (I) or voltage (V).

2.2.1 pulse amplitude (A_M). That quantity determined by the intersection of a line passing through the points on the leading edge where the instantaneous value reaches 10 percent and 90 percent of (A_M) and a straight line which is the best least-squares fit to the pulse in the pulse-top region. (Usually this is fitted visually rather than numerically.) For pulses deviating greatly from the ideal trapezoidal pulse shape, a number of successive approximations may be necessary to determine A_M .

NOTE: The pulse amplitude (A_M) may be arrived at by applying the following procedure. Step 1: Visually or numerically determine the best straight line fit to the pulse in the pulse-top region and extend this straight line into

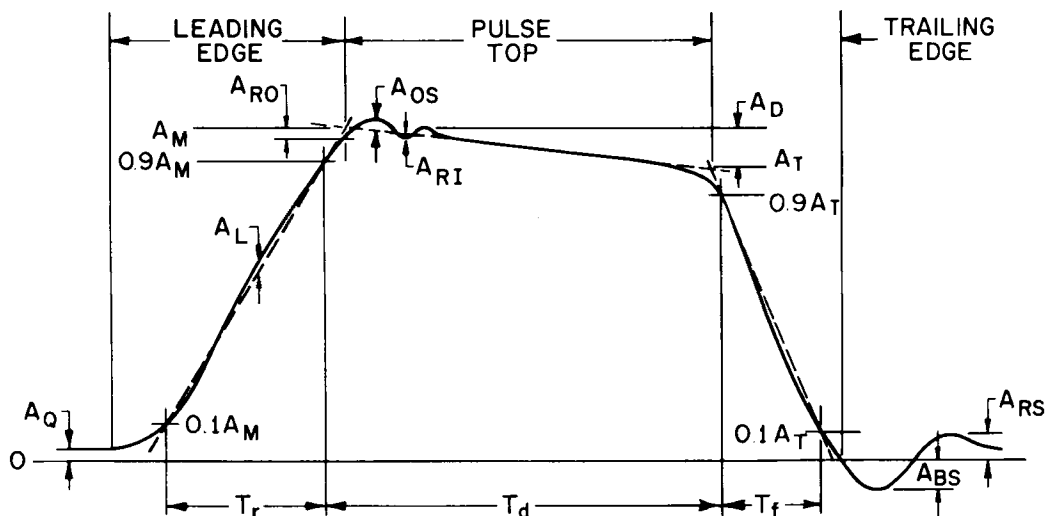


Fig 1
Input Pulse Shape

the leading-edge region. Step 2: An initial estimate of A_M is the first intersection of the pulse (in the late leading-edge or early pulse-top regions) with the straight line fitted to the pulse top. Step 3: Using the estimate of A_M calculate $0.1 A_M$ and $0.9 A_M$ and draw a straight line through these two points of the pulse-leading edge. Step 4: The intersection of the leading-edge straight line and the pulse-top straight line gives an improved estimate of A_M . Step 5: Repeat steps 3 and 4, until the estimate of A_M does not change. The converged estimate is the pulse amplitude A_M .

2.2.2 rise time (first transition duration) (T_r). The time interval of the leading edge between the instants at which the instantaneous value first reaches the specified lower and upper limits of 10 percent and 90 percent of A_M . Limits other than 10 percent and 90 percent may be specified in special cases.

2.2.3 pulse duration (90 percent) (T_d). The time interval between the instants at which the instantaneous value reaches 90 percent of A_M on the leading edge and 90 percent of A_T on the trailing edge.

NOTES: (1) Often the input pulse tilt (droop) is only a few percent, and in those cases pulse duration may be considered as the time interval between the first and last instants at which the instantaneous value reaches 90 percent of A_M . (2) Pulse duration may be specified at a value other than 90 percent of A_M and A_T in special cases.

2.2.4 fall time (last transition duration) (T_f). The time interval of the pulse trailing edge between the instants at which the instantaneous value first reaches specified upper and lower limits of 90 percent and 10 percent of A_T .

2.2.5 trailing edge (last transition) amplitude (A_T). That quantity determined by the

intersection of a line passing through the points on the trailing edge where the instantaneous value reaches 90 percent and 10 percent of A_T , and the straight-line segment fitted to the top of the pulse in determining A_M .

2.2.6 tilt (droop) (A_D). The difference between A_M and A_T . It is expressed in amplitude units or in percent of A_M .

2.2.7 overshoot (first transition overshoot) (A_{OS}). The amount by which the first maximum occurring in the pulse top region exceeds the straightline segment fitted to the top of the pulse in determining A_M . It is expressed in amplitude units or in percent of A_M .

2.2.8 backswing (last transition overshoot) (A_{BS}). The maximum amount by which the instantaneous pulse value is below the zero axis in the region following the fall time. It is expressed in amplitude units or in percent of A_M .

2.2.9 return swing (last transition ringing) (A_{RS}). The maximum amount by which the instantaneous pulse value is above the zero axis in the region following the backswing. It is expressed in amplitude units or in percent of A_M .

2.2.10 roll off (rounding after first transition) (A_{RO}). The amount by which the instantaneous pulse value is less than A_M at the point in time of the intersection of straight-line segments used to determine A_M . It is expressed in amplitude units or in percent of A_M .