JEDEC STANDARD

Method for Repetitive Inductive Load Avalanche Switching

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JEDEC SOLID STATE TECHNOLOGY ASSOCIATION

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METHOD FOR REPETITIVE INDUCTIVE LOAD AVALANCHE SWITCHING

(From Council Ballot JCB-91-51 formulated under the cognizance of JC-25 Committee on Transistors)

1. PURPOSE

The purpose of this test method is to determine the repetitive inductive avalanche switching capability of power devices.

2. SCOPE

This method is intended as an endurance test for any power switching device designed and specified with repetitive avalanche capability.

3. CIRCUITY

The basic circuit is shown in Figure 1. The circuit shall be designed so that all stray reactances are held to a minimum. The inductor, L shall be of a fast response type.

4. DEFINITIONS

The following terms and symbols apply to this test method:

T_J	-	Junction temperature
$T_{J(max)}$	-	The maximum specified junction temperature
$R_{\theta JC}$	-	Thermal resistance from the junction to the case
L	-	Load inductance per DUT
E_{AR}	-	Repetitive avalanche energy, minimum
I_{AR}	-	Peak repetitive avalanche current, maximum
Eon	-	On state energy
f	-	frequency

T_C	-	Case temperature
P_D	-	Power dissipation of device
$V_{(BR)}$	-	Breakdown or avalanche voltage of device
V_{DD}	-	Power supply voltage
DUT	-	Device under test
R_S	-	Stray circuit resistance
t_{av}	-	Time in avalanche

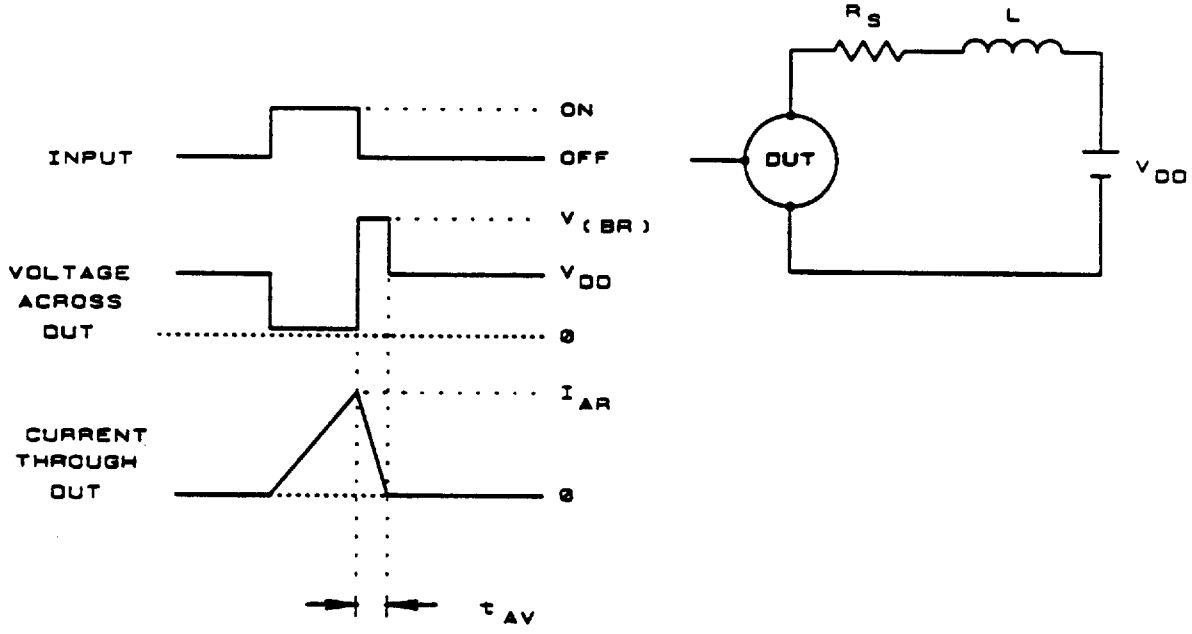

Figure 1
Basic Circuit

5. METHOD

(a) The DUT must be screened prior to avalanche and meet all specified parameters.

(b) The energy delivered to the DUT can be calculated as follows:

(1) $$E_{AR} = \frac{L * I_{AR}2 * V_{(BR)}}{2\,[V_{(BR)} - V_{DD}]}$$

NOTE: $R_S = 0$, where $V_{(BR)} = LI_{AR}2/t_{av}$

(2) $$E_{AR} = V_{BR} * I_{AR}(L/R_S)1n[I_{AR} * R_S/(V_{BR}-V_{DD})+1]$$

NOTE: $R_s = 0$

(c) The actual energy delivered to the DUT can vary depending on the real value of R_S. Since this resistance is test circuit dependant, the actual energy delivered must be verified by observing waveforms of the voltage across the DUT and current through the DUT waveforms (Refer to Figure 1). Record the $V_{(BR)}$, I_{AR} and t_{av}.

(3) $E_{AR} = (1/2)\ (V_{BR} * I_{AR} * t_{AV})$. (per Figure 1)

If this empirically derived value is not greater than or equal to the specified minimum E_{AR} value the circuit must be compensated until it is.

(d) T_j during the test must be held constant to T_j(max) +0 - 10°C, based on the case temperature of the DUT and $R_{\theta JC}$ or the junction temperature sensitive parameter. The power dissipated in the DUT equal to the sum of the on energy and the avalanche energy multiplied by the frequency. The E_{on} in most cases can be neglected.

(4) So: $P_D = F * (E_{AR}+E_{on})$

(5) $T_J = P_D * R_{\theta JC} + T_C$

The case temperature of the DUT will be measured at a specified reference point under the heat source. It is also possible to measure the temperature of the heat sink at a specified reference point provided that an accurate value of the thermal resistance case-to-heat-sink-reference-point is known. The measured junction temperature based on measurements of a temperature sensitive parameter may also be substituted for the junction temperature calculated from case temperature.

(e) The DUT will be avalanched for a specified minimum number of pulses at specified conditions. Upon completion the specified device parameters will be tested.

6. SPECIFICATION

The following parameters must be specified:

E_{AR}	=	Repetitive avalanche energy (joules)
I_{AR}	=	Repetitive avalanche current (amperes)
T_J	=	T_J(max) +0 -10°C
t_{av}	=	min, max
f	=	Frequency (hertz), minimum
N	=	Minimum number of pulses
V_{DD}	-	Power supply voltage

7. CRITERIA

The DUT must be within all specified parameter limits at the completion of the test. As a minimum $V_{(BR)} \geq$ rated breakdown voltage at applicable leakage currents.


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