

Snubber Circuits Test Result for the FRD Module Application

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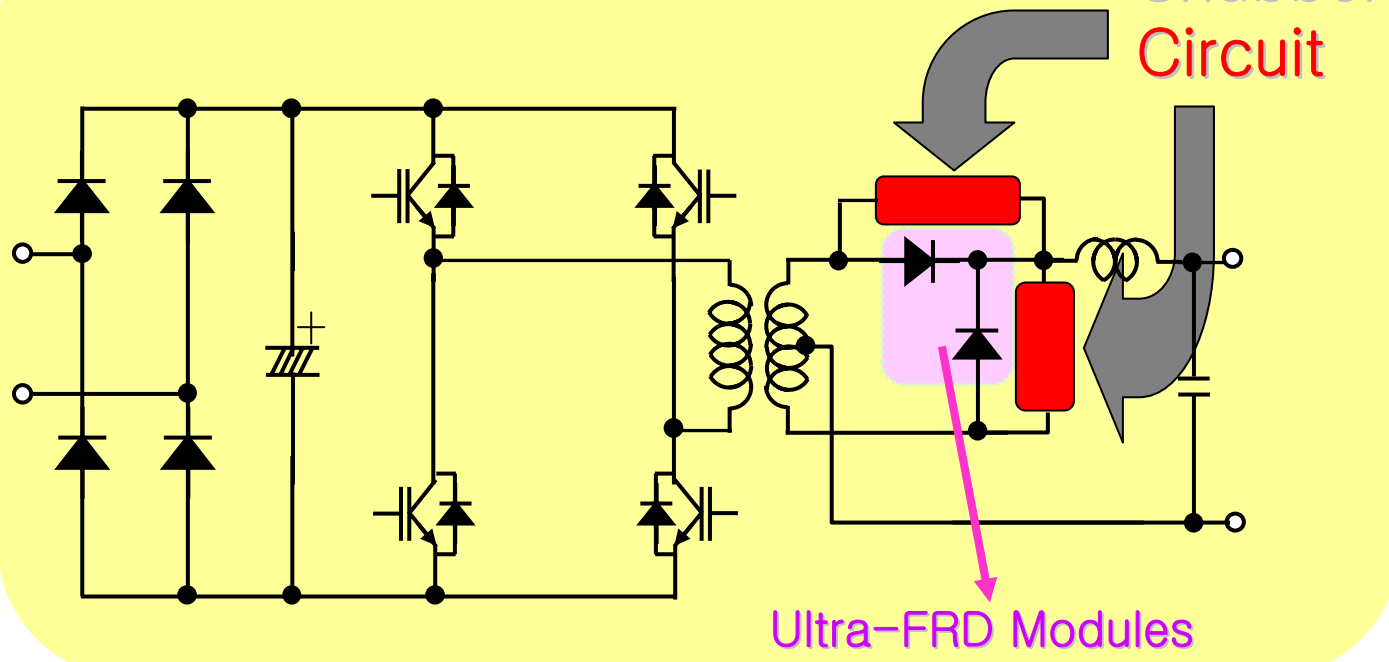
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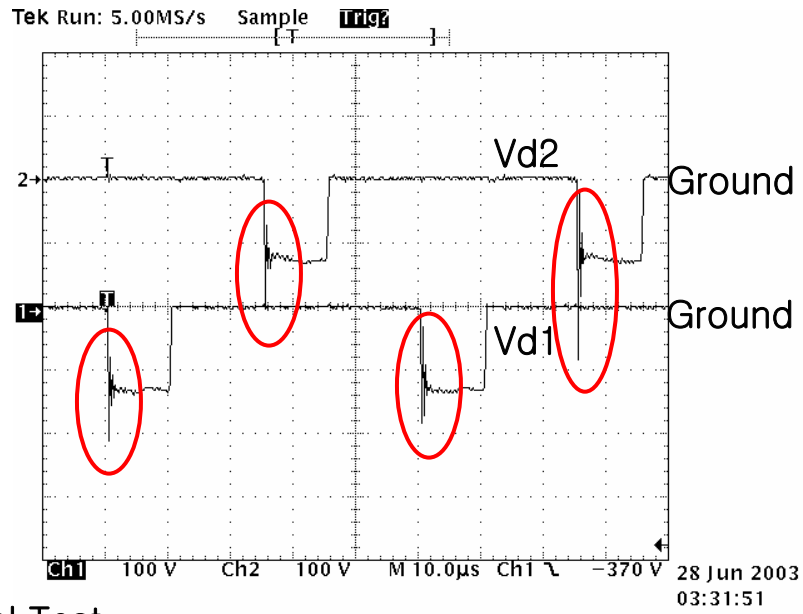
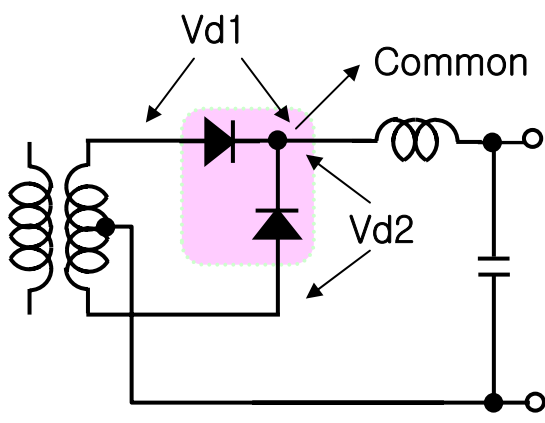
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1. Snubber test Circuits for FRD Module

Basic Topology of Welding Machine



2. Secondly part FRD Operating Waveform




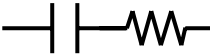


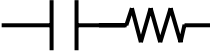


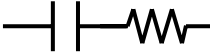
○ : Switching Noise Level Test

3. Vd1 Noise Signal Test Result

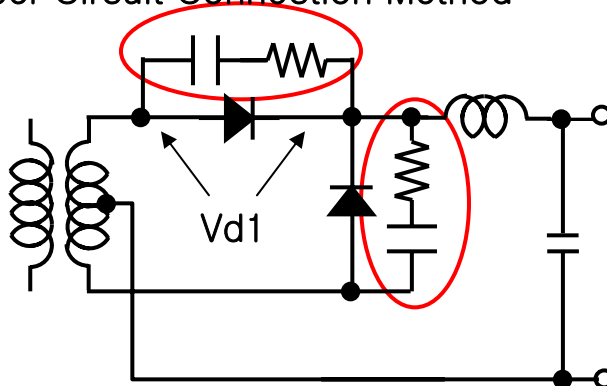
1) Common Condition

- Test Device : DWC2F100N040S
- Test System : 180A ARC Welding Machine(Made in Korea)
 - => Switching Frequency : 20Khz
 - => at Maximum Output Power
- Vd1 Noise Signal Monitoring

2) Test Result According to the Snubber Circuits

Test Condition(RC Snubber)	Circuits	Result
No Snubber(No Connection)		Too Bad
Only 472[1KV] Cap.		Bad
472[1KV] Cap. + 4.7Ohm [3W]		So so
Only 103[1KV] Cap.		Bad
103[1KV] Cap. + 4.7Ohm [3W]		Good
103[1KV] Cap. + 10Ohm [3W]		Very Good
Only 503[1KV] Cap.		Too Bad
503[1KV] Cap. + 4.7Ohm [5W]		Too Bad
503[1KV] Cap. + 10Ohm [5W]		Too Bad

3) RC Snubber Circuit Connection Method



4) Notices

- There is a possibility that there will be some difference in each system. In general, the snubber circuits can be selected and used by referring to the above test result.
- Recommended values
There is slight difference, according to each system; thus, the following values are recommended:

=> **The best snubber circuit value method:**

Series connection of 103 Cap. [1KV] * 10 Ω [3W]

=> Second method:

Series connection of 103 Cap. [1KV] * 4.7 Ω [3W]

=> Third method:

Series connection of 472 Cap. [1KV] * 10 Ω [3W]

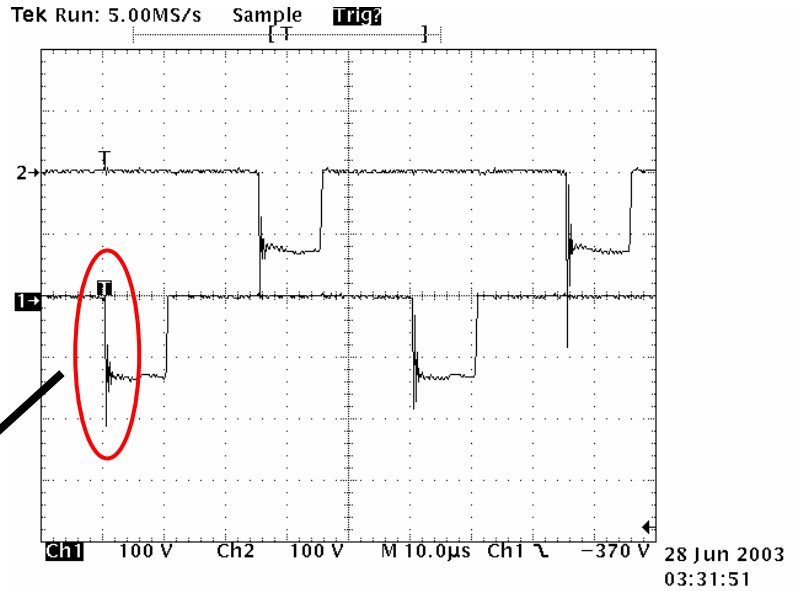
- In case of welding machines,
The application of the above snubber circuits is the circuits in which the maximum system power up to ~5KW is applied.
In other words, this can be expressed as the following formula,
$$P = 1/2 * C * V * V [W]$$

As indicated in the above formula, the heat dissipation characteristics are determined, according to capacitor value.
Thus, the more complex and excellent circuits than the above-mentioned snubber circuits should be applied and used in the system where more power is required.
- When applying the above-mentioned snubber circuit,
if R and C have a severe heating, a higher watt resistor should be used, or bulkier product should be selected and used with the same capacity in terms of a capacitor.

4. Vd1 Noise Signal Test Data

1) Vd1, Vd2 Operating Signal

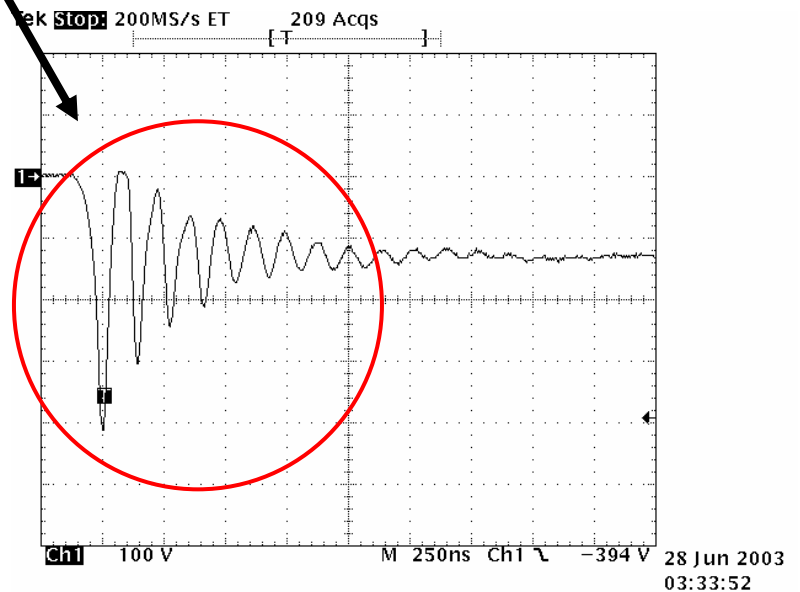
- 20Khz Switching



Scale up

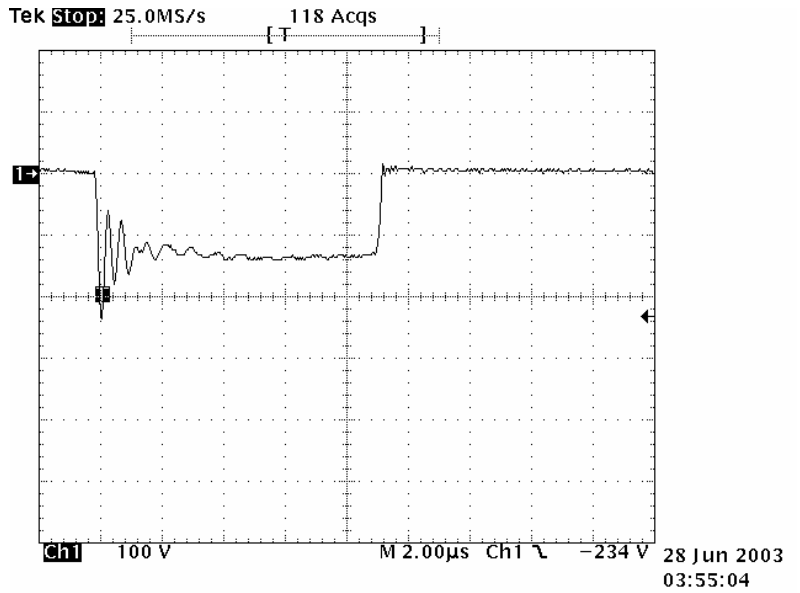
2) No Snubber

- Vd1 : -415Vp-p
- Over Vrrm Operation => Too High Noise



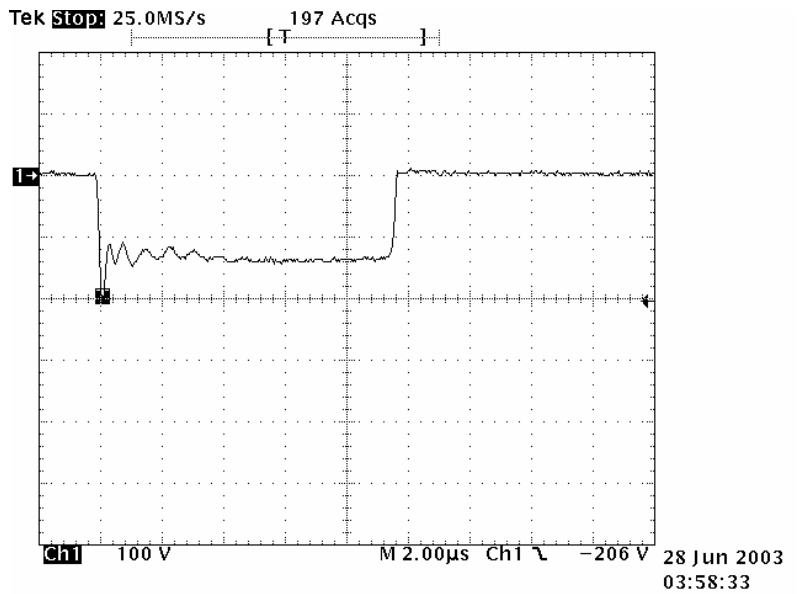
3) Only 472[1KV] Cap. Connection

- Vd1 : -234Vp-p



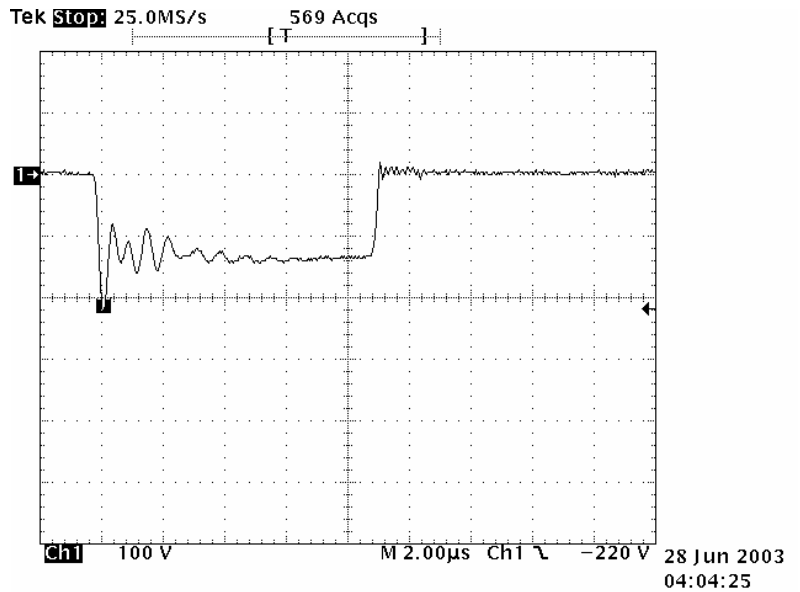
4) 472[1KV] Cap. + 4.7Ohm [3W] Series Connection

- Vd1 : -206Vp-p



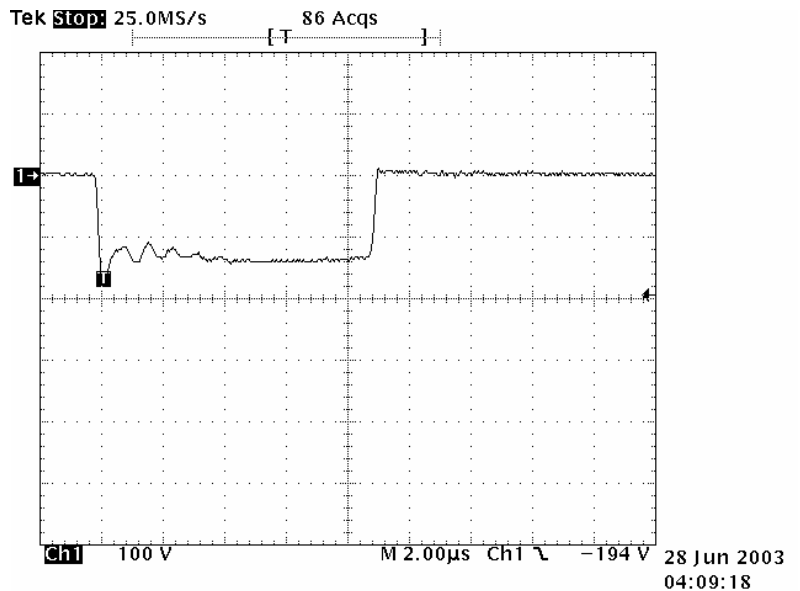
5) Only 103[1KV] Cap. Connection

- Vd1 : -220Vp-p



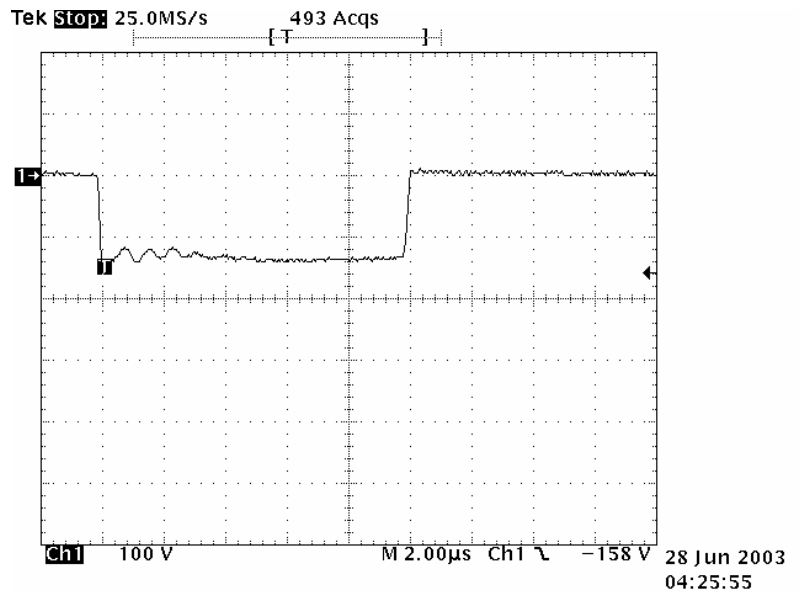
6) 103[1KV] Cap. + 4.7Ohm [3W] Series Connection

- Vd1 : -180Vp-p
- Good Method



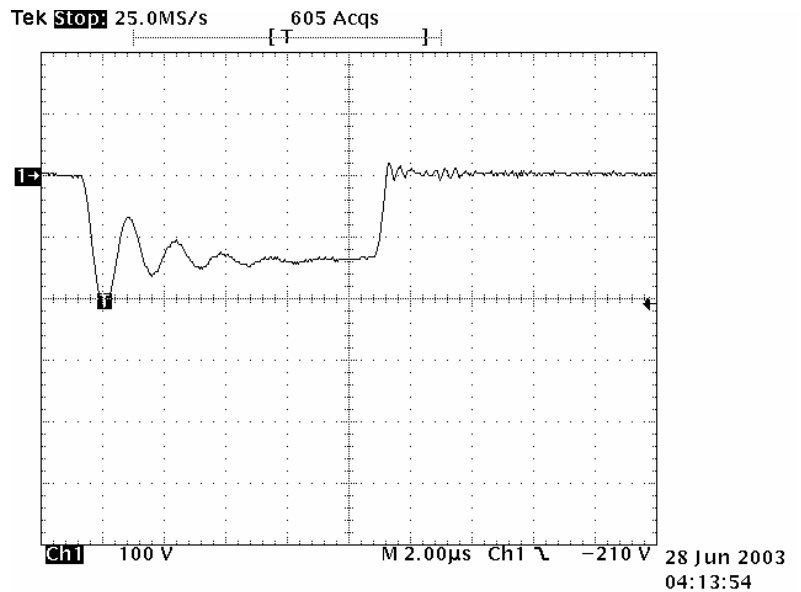
7) 103[1KV] Cap. + 100Ohm [3W] Series Connection

- Vd1 : -158Vp-p
- Very Good Method



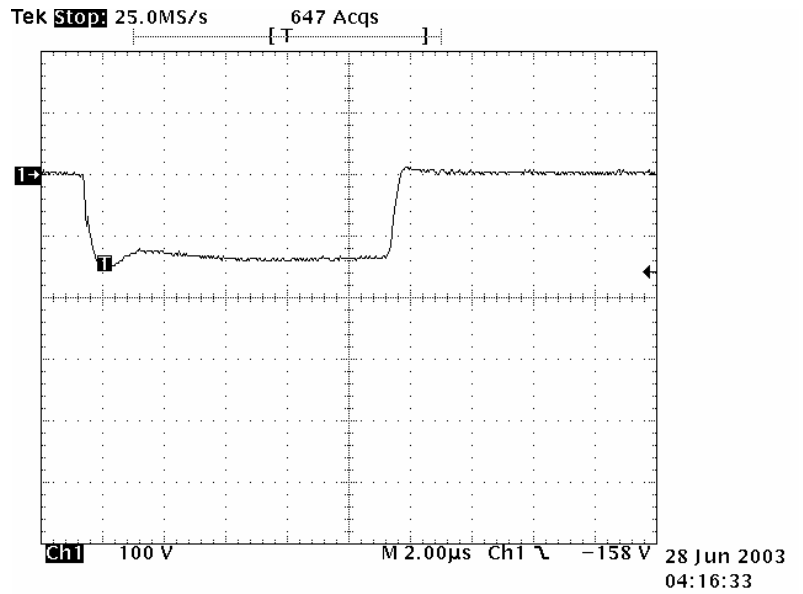
8) Only 503[1KV] Cap. Connection

- Vd1 : -210Vp-p
- Too bad



9) 503[1KV] Cap. + 4.7Ohm [5W] Series Connection

- Vd1 : -158Vp-p
- Too bad



10) 503[1KV] Cap. + 10Ohm [5W] Series Connection

- Vd1 : -148Vp-p
- too bad

