

## DAT-31R5A/31A/15R5A Series Evaluation Boards Operation to $V_{DD}=5.2V$ **AN-70-006**

### 1. Background:

Mini-Circuits DAT series of 50 ohm Digital Step Attenuators support a wide variety of configurations including attenuation range, step size and operating power supply voltages. Table 1 shows the models, their operating Voltages and associated Evaluation Boards

**Table 1 DAT Series Models, their Operating Voltages and associated Evaluation Boards**

31.5 dB Models	31dB Models	15.5 dB Models	$V_{DD}(V)$ Spec	$V_{SS}(V)$ Spec	Evaluation Board P/N
DAT-31R5-SP+	DAT-31-SP+	DAT-15R5-SP+	+ 2.7 to +3.3	N/A	TB-334
DAT-31R5-SN+	DAT-31-SN+	DAT-15R5-SN+	+ 2.7 to +3.3	-2.7 to -3.3V	TB-342
DAT-31R5-PP+	DAT-31-PP+	DAT-15R5-PP+	+ 2.7 to +3.3	N/A	TB-339
DAT-31R5-PN+	DAT-31-PN+	DAT-15R5-PN+	+ 2.7 to +3.3	-2.7 to -3.3V	TB-340

Mini-Circuits is updating the above models with a new series of DAT Attenuators (Table 2). These models ("A" Suffix) are form-fit functional equivalents. The specified operating supply voltage ranges are nearly identical.

**Table 2 Updated DAT Models ("A" Series) , their Operating Voltages and associated Evaluation Boards**

31.5 dB Models	31dB Models	15.5 dB Models	$V_{DD}(V)$ Spec	$V_{SS}(V)$ Spec	Evaluation Board P/N
DAT-31R5A-SP+	DAT-31A-SP+	DAT-15R5A-SP+	+ 2.3 to +3.6	N/A	TB-334
DAT-31R5A-SN+	DAT-31A-SN+	DAT-15R5A-SN+	+ 2.7 to +3.6	-3.2 to -3.6V	TB-342
DAT-31R5A-PP+	DAT-31A-PP+	DAT-15R5A-PP+	+ 2.3 to +3.6	N/A	TB-339
DAT-31R5A-PN+	DAT-31A-PN+	DAT-15R5A-PN+	+ 2.7 to +3.6	-3.2 to -3.6V	TB-340

The "A" series models are released to the market using the existing Evaluation Boards which are designed to operate over the specified  $V_{DD}$  of up to 3.6V.

HOWEVER: The "A" series is capable of operation over a wider voltage range of  $V_{DD}$ , as high as +5.2V.

This Application Note describes the application circuit and provides detailed instructions to configure the existing Evaluation Boards, as shown below, to operate over the extended voltage range (up to +5.2V).

NOTE: Mini-Circuits uses Schmitt Triggers on the Evaluation Boards in order to ensure proper control signals level to the DUT and to filter external noise. For example if a user uses the PC LPT to control the DATs (provides 5 volts level), we need to ensure that the levels will not exceed 3.6 volts max and this is done with the Schmitt Trigger:

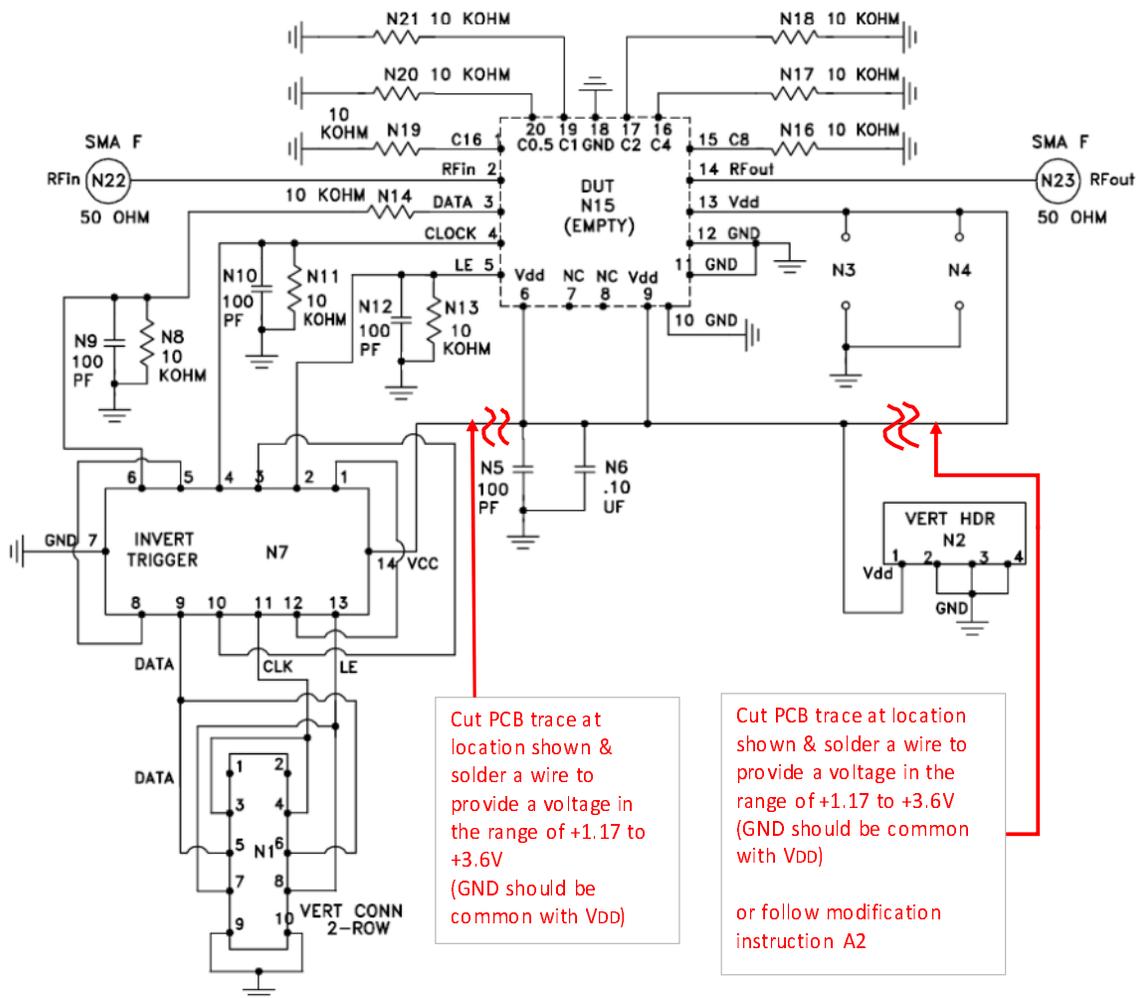
- a) N7 on TB-334
- b) N19 on TB-342
- c) N3, N4 & N23 on TB-339 & TB-340.

Mini-Circuits will be releasing updated Evaluation Boards which will operate over the entire voltage range, up to 5.2V. These Evaluation Boards will be available from February 2015.

## 2. TB-334 Evaluation Board Modification to operate with VDD from 3.6V to +5.2V (Models: DAT-31R5A-SP+, DAT-31A-SP+, DAT-15R5A-SP+)

Modifications:

- A) Limit DC voltage on Pin 13 of DUT (N15) to +3.6V max as follows:
  - A1) Cut PCB trace going to Pin 13 as shown below & apply a separate DC voltage in the range of +1.17 to +3.6V or
  - A2) Place a resistive voltage divider from Pin 1 of N2 to Pin 13 of DUT to limit the voltage to +3.6V (eg: for Vdd=+5V use 178kΩ in series and 365kΩ in shunt)
- B) Cut PCB trace going to Pin +14 of N7 & apply a separate DC Voltage to Pin 14 in the range of +1.17 to +3.6V



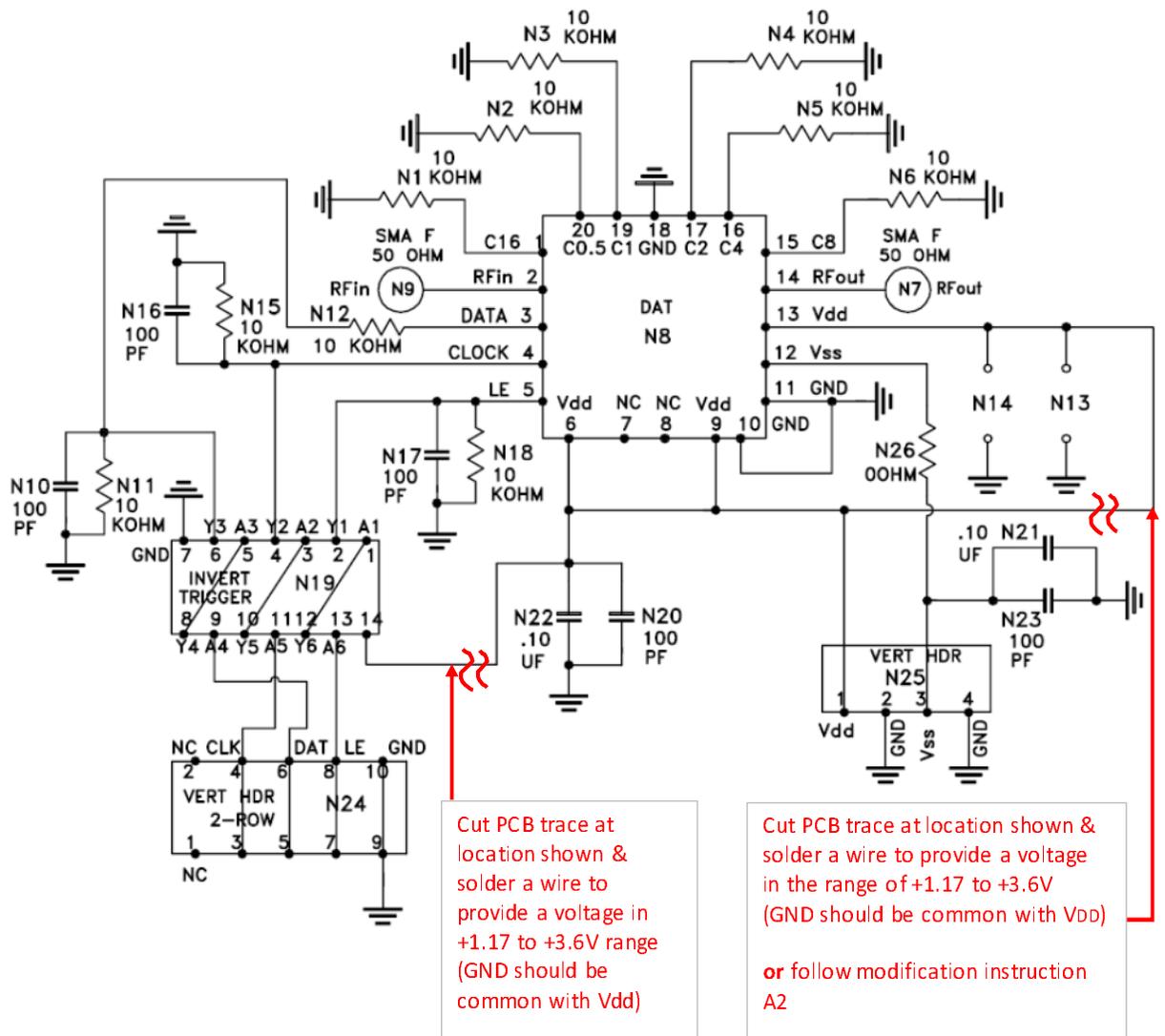
### 3. TB-342 Evaluation Board Modification to operate with VDD from 3.6V to +5.2V (Models: DAT-31R5A-SN+, DAT-31A-SN+, DAT-15R5A-SN+)

Modifications:

A) Limit DC voltage on Pin 13 of DAT(N8) to +3.6V max as follows:

- A1) Cut PCB trace going to Pin 13 as shown below & apply a separate DC voltage in the range of +1.17 to +3.6V or
- A2) Place a resistive voltage divider from Pin 1 of N25 to Pin 13 of DUT to limit the voltage to +3.6V (eg: for Vdd=+5V use 178kΩ in series and 365kΩ in shunt)

B) Cut PCB trace going to Pin 14 of N19 & apply a separate DC Voltage to Pin 14 in the range of +1.17 to +3.6V

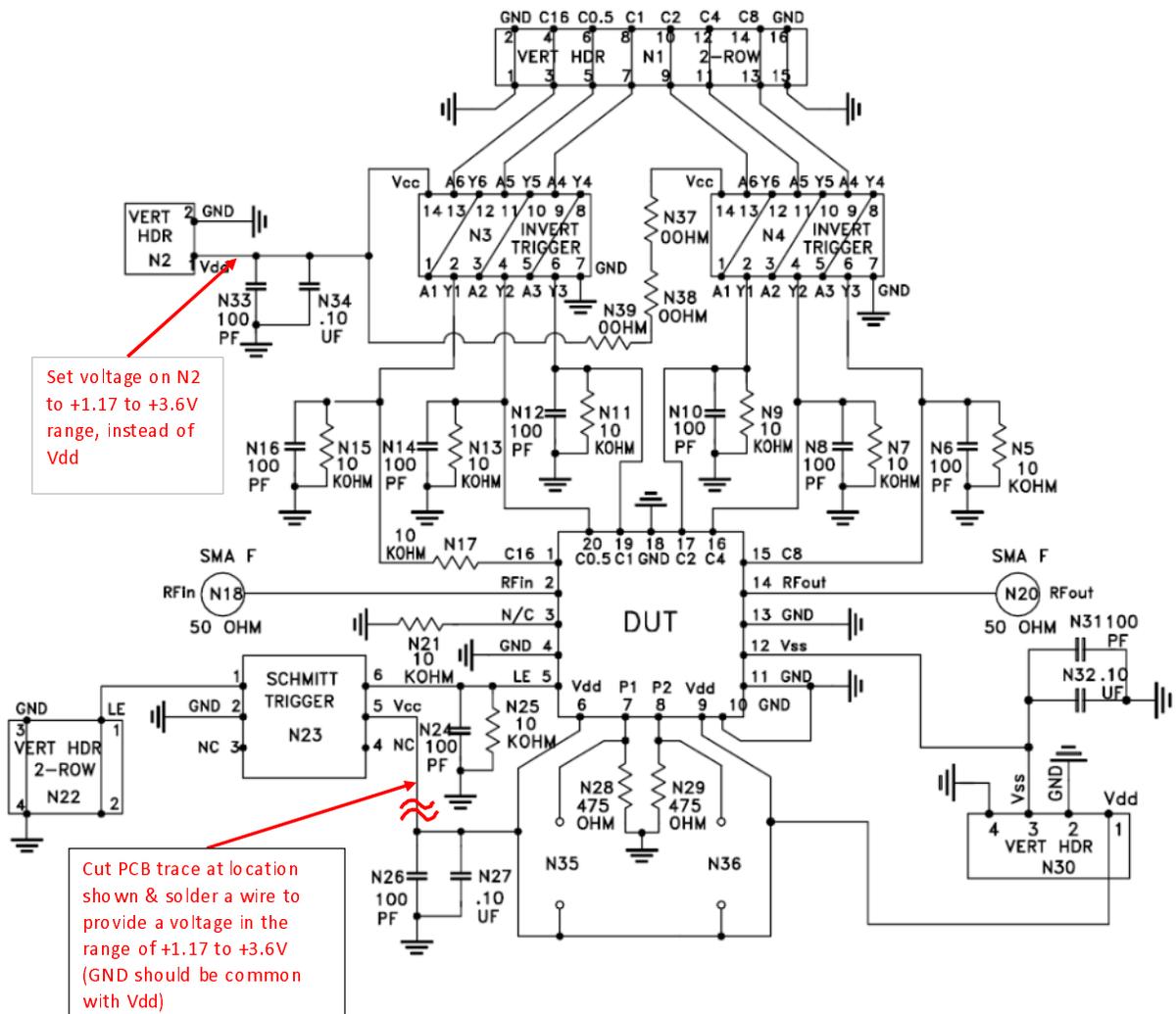




## 5. TB-340 Evaluation Board Modification to operate with VDD from 3.6V to +5.2V (Models: DAT-31R5A-PN+, DAT-31A-PN+, DAT-15R5A-PN+)

### Modifications:

- Set DC voltage at pin 1 of connector N2, +1.17 to +3.6V max.
- Cut PCB trace going to Pin 5 of N23 & apply a separate DC Voltage to Pin 5 in the range of +1.17 to +3.6V



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