June 1999-2

Application Note:

INTRODUCTION

The XRD6480 family consists of the XRD6202, XRD6440, XRD64L40, XRD64L42 and the XRD64L80. VRTF (Top Reference Voltage Force) and VRBF (Bottom Reference Voltage Force) are located at the top and bottom of the reference resistor string. The voltages applied to VRTF and VRBF coarsely define the voltage range of the reference resistor ladder. (The exact voltage range of the reference resistor ladder is determined by the voltage difference between VRTS and VRBS) Proper setting of the VRTF and VRBF is therefore necessary to obtain the best dynamic range and the best performance of the ADC. VRTF can be set using either the internal voltage reference amplifier, or using an external amplifier. Likewise, VRBF can be connected to Analog Ground, or using an external amplifier.

Connection Using Internal Bandgap Voltage Reference Amplifier

VRTF can be set using the internal bandgap voltage reference amplifier, while VRBF is connected to analog ground. (Please see Figure 1.)

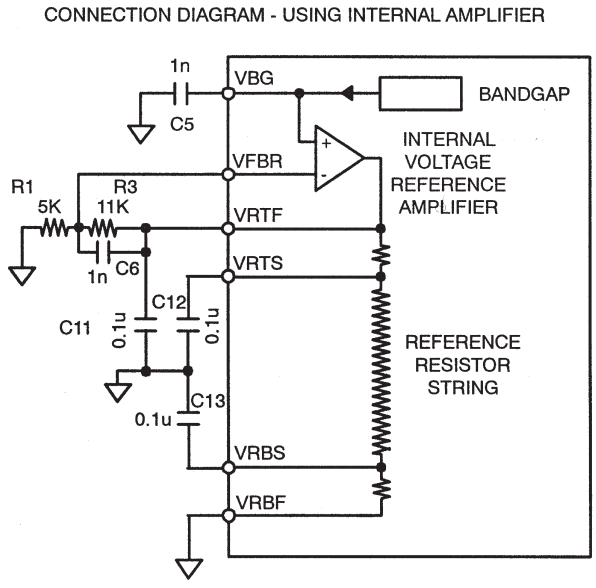

Figure 1. VRTF Connected to Internal Bandgap Voltage Reference Amplifier and VRBF Connected to Analog Ground

The value of VRTF in Figure 1, can be calculated using the transfer function:

$$VRTF = VBG\ (1 + R3/R1) = VBG\ (1 + 11K/5K) = 3.968V$$

where VBG is the bandgap voltage and is normally 1.24V. Please notice that VRTS and VRBS are bypassed to the Analog Ground using 0.1µF capacitors.

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Connection Using External Amplifiers

VRTF and VRBF can also be forced by using external amplifiers, with VRTS and VRBS used as feedbacks. (Please see Figure 2.)

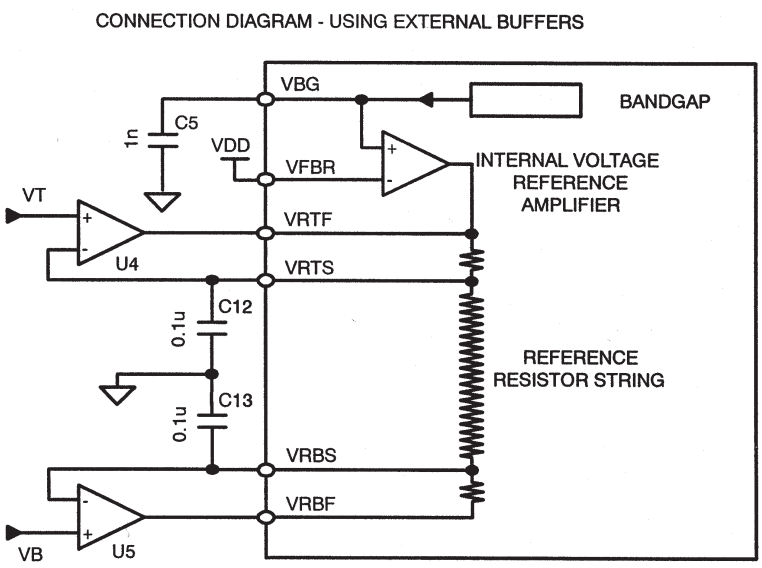

Figure 2. VRTF and VRBF Forced by External Amplifiers, VRTS and VRBS are Used as Feedbacks to External Amplifiers

When using the external amplifiers, the internal bandgap voltage reference amplifier must be disabled by connecting VFBR to VDD. External amplifiers chosen must be capable of driving the 500 ohm reference resistor ladder and remain stable. AD847 amplifiers are used in the XRD6440EVAL board. Lab experiments show the AD847 to oscillate when a large capacitive load is present. Therefore, C11 shown in Figure 1, was removed.

Comparison of The Two Configurations

Using the internal voltage reference (Figure 1) is simpler and more cost-effective than using external amplifiers. Theoretically, less noise will be injected into the system when using the internal voltage reference due to presence of less components. However, VRTS accuracy becomes a function of internal voltage reference variation and resistor (R1 and R3) tolerance.

When using external amplifiers (U4 and U5), VRTS and VRBS will track the values of VT and VB which come from external, low noise DC sources. The Force and Sense Configuration also eliminates the effect of stray capacitance and serial resistance in the reference resistor string between the force and sense pins. VRTS and VRBS can be set precisely in this configuration and gives the best dynamic range of the ADC.

Adding two external amplifiers will inevitably inject noise into the system. It also complicates the design process by requiring the engineer to choose and evaluate components.

A comparison summary of using the two configurations is shown below. Different users might choose one configuration over the other depend on their own concerns.

	Internal Bandgap	External Amplifiers
Component Cost	Low	High
VRTS Acuracy	Low	High
VRBS Value	Gound only	0 to 2.0 V
Engineering Work	Minimal	Extensive
System Noise	Theoretically lower	Theorectically higher

Table 1. Comparison of Using Internal Bandgap and Using External Amplifiers