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Temperature Compensation for the EL4581 and EL4583

The EL4581 and EL4583 are sync separators with on-board filters. It has been found that over temperature, the propagation delay of composite sync varies due to this filter. For example, in the 25°C to 85°C range, the delay varies by about 20ns. The reason for this is that as temperature increases, the g_m of transistors in the filter stage drops, causing the filter bandwidth and delay to change. A solution for this is to introduce a PTAT (Proportional To Absolute Temperature) bias current for this stage, thus maintaining a constant g_m as temperature increases.

For the EL4581, the filter bias current is set by the resistor R_{SET} on pin 6. We replace this with a resistor and two diodes in series as shown in Figure 1. Since the diode voltage has a negative temperature coefficient, this would increase the bias current thru R_{SET} as temperature rises. Shown in Table 1 below are the propagation delays over temperature with and without compensation. With compensation, we achieved a threefold improvement over the uncompensated case.

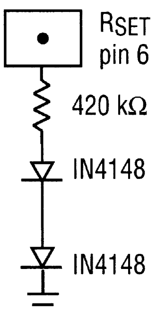

FIGURE 1. EL4581 COMPENSATION NETWORK

TABLE 1. PROPAGATION DELAYS FOR THE EL4581

TEMPERATURE (°C)	DELAY W/O COMP (ns)	DELAY WITH COMP (ns)
25	233	232
50	240	228
85	253	226

NOTE: Propagation delay is defined as the time from the rising edge of the input horizontal sync to the rising edge of the CSYNC output.

If we look more closely at the above results, however, we see that the circuit is over-compensating, causing the delay to decrease with temperature. The two diodes actually provided too much of a PTAT current, whereas a single diode does not create enough PTAT current. Thus, the ideal compensation would provide about one and a half diodes of temperature coefficient.

Shown in Figure 2 is a circuit which does the job; it is a V_{BE} multiplier with a multiplication factor of about 1.6. Measured on the scope, there is no perceivable delay variations in the 25°C to 85°C temperature range. Since the measurement accuracy is limited by the waveform jitter, the delay may have actually changed by 1ns to 2ns, but this should not present a problem for most applications.

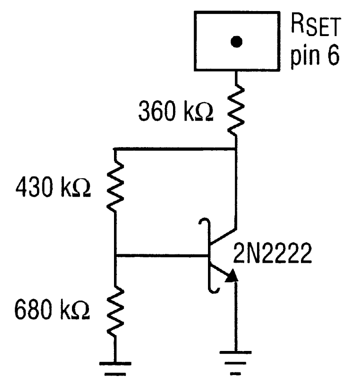

FIGURE 2. IMPROVED COMPENSATION NETWORK

For the EL4583, however, the filter bias current is not controlled by R_{SET}, but by the Filter Cutoff resistor RF on pin 1. Moreover, since there is only about 0.5V on this pin at room temperature, putting a diode in series with RF would not work in this case. A compensation network which circumvents this problem is shown in Figure 3. At room temperature, the voltage at node A would be about 0.7V due to the diode, and since node A is higher than node B, R_2 would inject a current into RF, thus requiring a smaller current from pin 1 than would otherwise. As temperature rises, the voltage at node A would decrease, such that R_2 would take current away from RF and requiring pin 1 to supply more current. We have thus achieved the desired PTAT effect on pin 1 with this arrangement, and the results using this network is shown in Table 2.

TABLE 2. PROPAGATION DELAYS FOR EL4583

TEMPERATURE (°C)	DELAY W/O COMP (ns)	DELAY WITH COMP (ns)
25	243	247
50	250	244
85	261	246

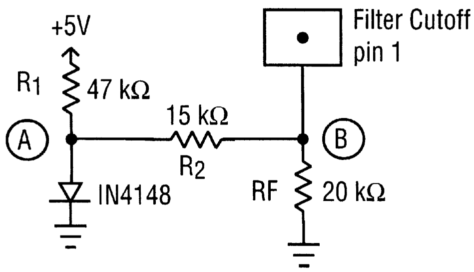

FIGURE 3. EL4583 COMPENSATION NETWORK

We can see that with these compensation schemes, we obtained a drastic reduction in propagation delay drifts over temperature. For comparison the delay drift of the LM1881 is also shown.

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