

8.9 RING COUNTERS

A ring counter may be considered as a circuit that sequentially transfers voltage from one load to the next, when a number of loads are connected in parallel from a common supply. Transfer along the string proceeds always in the same direction, and each transfer is initiated by pulsing a common input line. The ring counter is an extremely useful tool in digital applications, and SCR ring counters in particular excel in low speed applications that require high voltage, high current or both.

8.9.1 Cathode Coupled Ring Counter

As an example a ten stage SCR ring counter can function as a decade counter with direct lamp or glowtube (Nixie)[®] readout. The circuit of Figure 8.21 is a three stage cathode coupled ring counter, suitable for driving high voltage loads up to 50 mA. Additional stages may be added as required. Assume SCR₁ is conducting load current, and SCR₂ and SCR₃ are both blocking. Capacitors C₂ and C₁ charge to the supply voltage through R₃/R_{L2} and R₁/R_{L3} respectively, while capacitors C₅ and C₆ charge through R_{L2} and R_{L3}. Because SCR₁ is conducting, C₂ and C₄ cannot charge. When a shift pulse arrives at the shift line only SCR₂ can be triggered, since its gate steering diode CR₂ is the only diode not reverse biased by a pre-charged capacitor. In any ring counter only the SCR following the conducting SCR will trigger. As SCR₂ turns on, capacitor C₅ is connected across R₄, which drives the common cathode line momentarily to the supply voltage, reverse biasing SCR₁ and forcing it to turn off. When the next shift pulse arrives, SCR₃ turns on and SCR₂ turns off and so on. The advan-

tage of the cathode coupled ring counter is that undistorted square waves free from commutation transients appear across each load. Its major disadvantage is that relatively large value commutating capacitors (C_4 , C_5 , C_6) are required with consequent limitations on circuit speed.

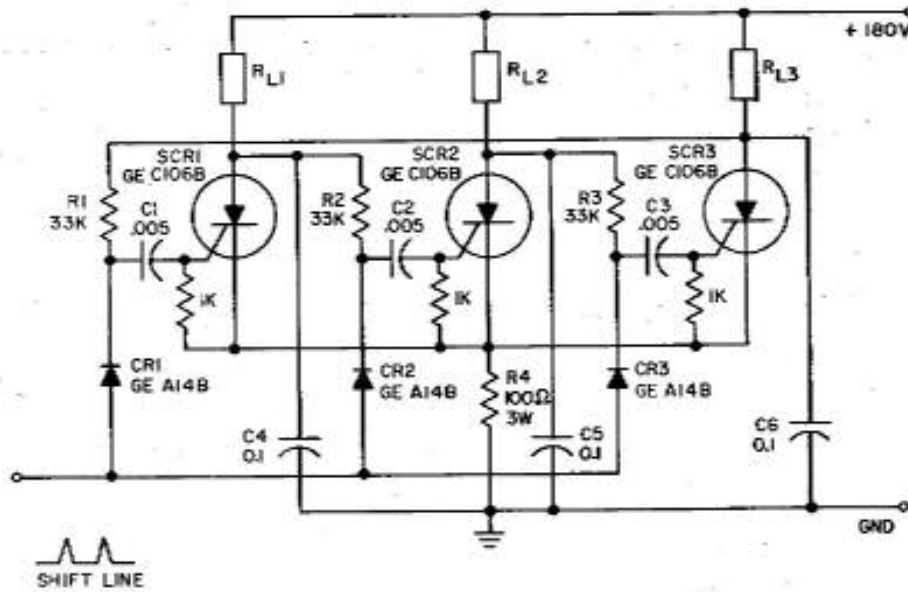


FIGURE 8.21 CATHODE COUPLED RING COUNTER

8.9.2 Anode Coupled Ring Counter

In applications where commutation transients can be tolerated and/or higher speed operation is required (lamp driving circuits for instance), the ring counter circuit can be modified as follows:

1. Remove resistor R_4 , and ground the common cathode line.
2. Remove C_4 , C_5 , and C_6 .
3. Connect a $.005 \mu f$ capacitor between each pair of SCR anodes.

Figure 8.22 shows the modified circuit being used to drive a #6844A Nixie Decade Readout Tube.⁵

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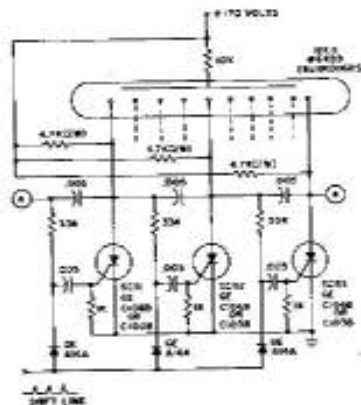


FIGURE 8.22 ANODE COUPLED RING COUNTER (DECADE READOUT)