

# **Application Bulletin**

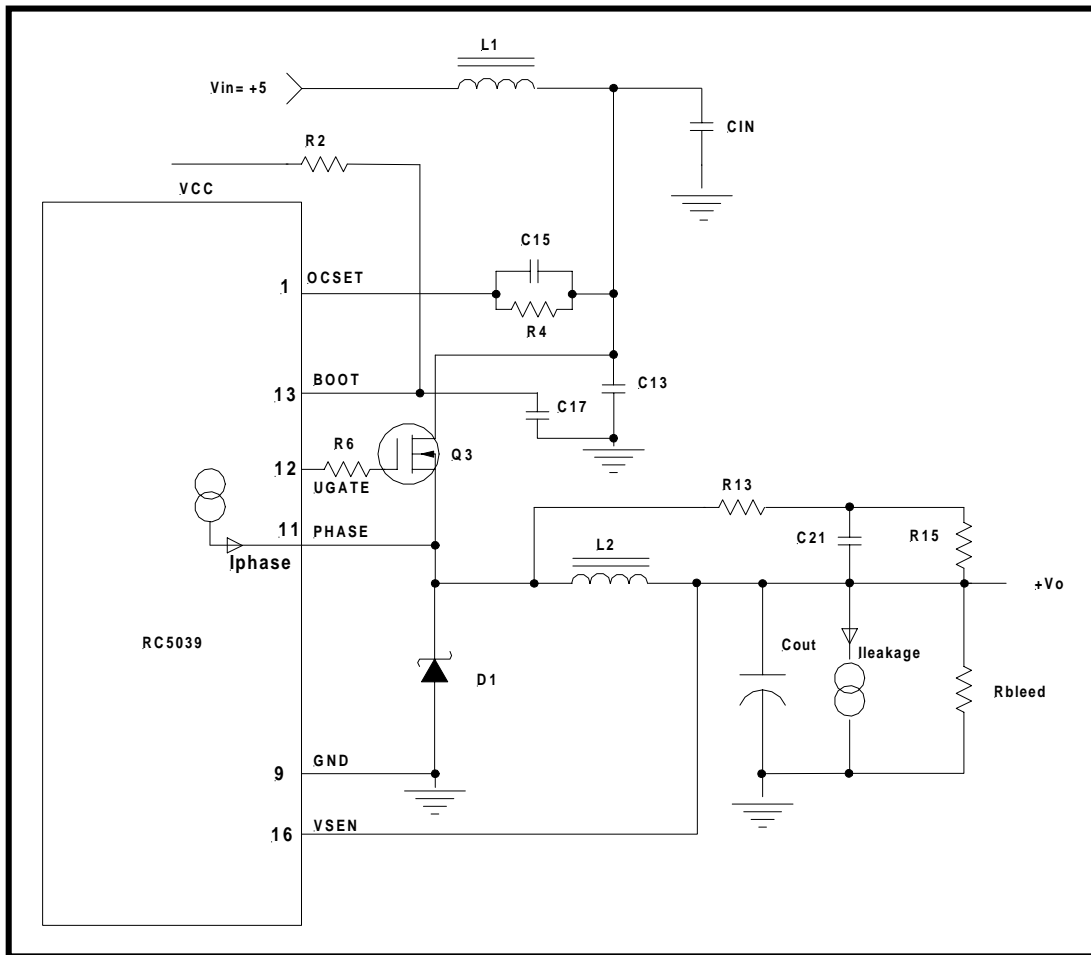
## **AB-22**

### **Output Voltage Drift in the RC5039 When Operated at No Load**

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**Abstract:**

Power supplies using Fairchild RC5039 controllers when operated at no load will develop an output voltage around 5V regardless of the VID code selection. This bulletin will show the reason for this and will suggest a simple solution. This issue should not present any problems in typical applications



**Fig. 1 RC5039 controller showing  $I_{\text{phase}}$ ,  $I_{\text{leakage}}$  and  $R_{\text{bleed}}$**

**The Problem**

Power supplies using Fairchild RC5039 controllers when operated at no load will develop an output voltage around 5V regardless of the VID code selection.

### **Cause of the Problem**

All electrolytic capacitors have a certain amount of leakage current when a DC voltage is applied across the terminals. Leakage current is usually insignificantly small compared to the power supply load current. When the power supply is operated under a no load condition, this very small current represents all the current drawn from the power supply. The internal circuit of RC5039 that is connected to the phase pin (pin 11) is referenced to the application circuit and sources about 1mA for proper operation ( $I_{\text{phase}}$ ). From Fig. 1 showing  $I_{\text{phase}}$  and  $I_{\text{leakage}}$ , it is clear that if  $I_{\text{leakage}}$  is smaller than  $I_{\text{phase}}$  the output capacitor  $C_{\text{out}}$  will charge till it reaches an equilibrium voltage around 5V which is dependent on the internal IC design.

### **Solution**

A small resistor  $R_{\text{bleed}}$  of about 2k $\Omega$  should provides a path for  $I_{\text{phase}}$  to ground and restores proper operation to the power supply.

### **Conclusion**

In a typical application the power supply should always be operated with the CPU present on the mother board since it is the CPU that provides the VID code for the power supply determining the output voltage required by the CPU. A 5V at the output while the CPU is missing does not constitute any danger to any part of the mother board provided that the CPU is not plugged in while the power is on.

### **Fixing the Root Cause**

Fairchild will provide a bleeder resistance internal to the controller in the next revision to be available soon.