Application Considerations for the Integrated Bias Control Circuits BCR400R and BCR400W

Application Note No. 014

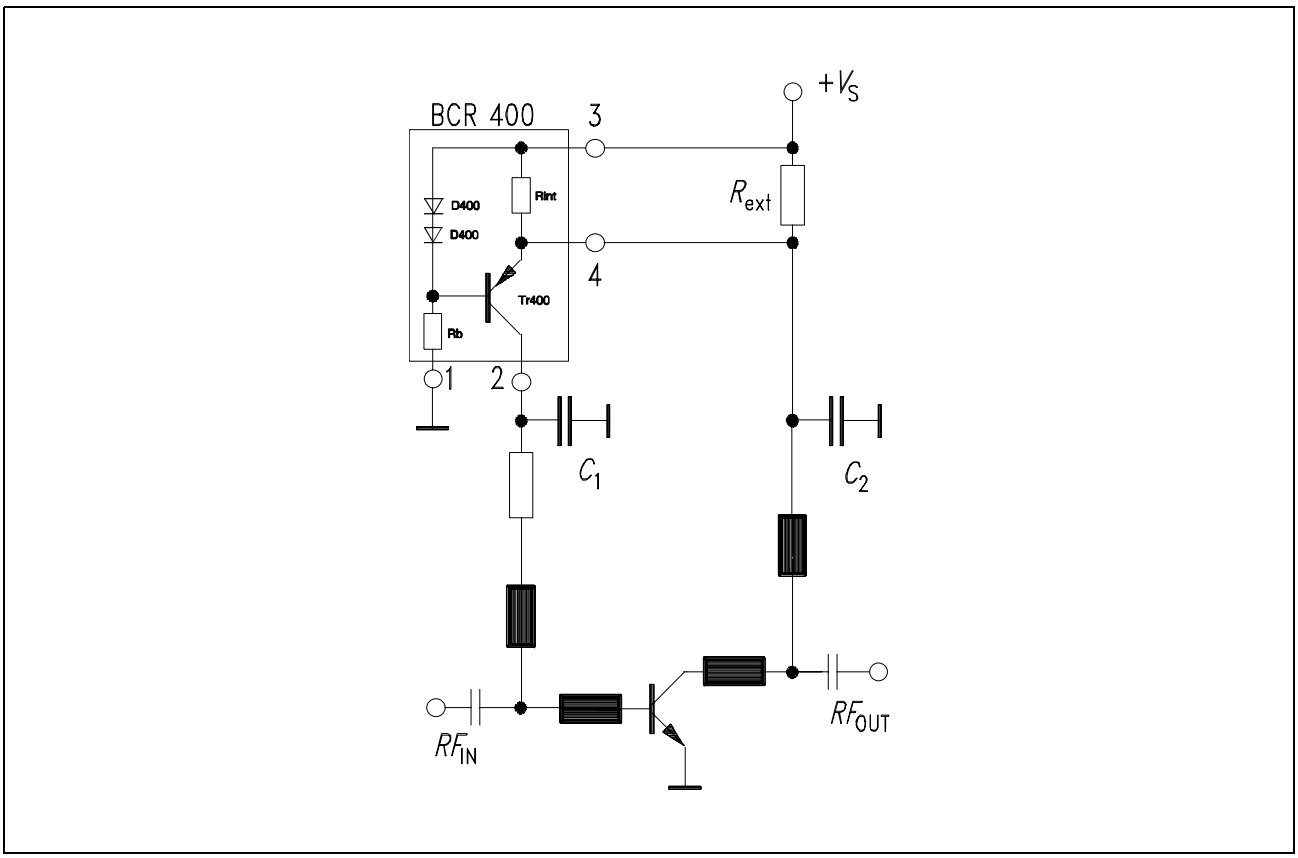


Figure 1 RF Transistor Controlled by BCR400

Operating Point

- BCR400 stabilizes the operating current (i.e. I_C or I_D), the collector (or drain) voltage depends on the supply voltage: $V_{CE} = V_S$ - 0.65 V
- The voltage drop of approximately 0.65 V on R_{ext} (i.e. between pins 3 and 4 of BCR400) is almost constant (R_{ext} = 0.65 V x I_C)
- In case a lower V_{CE} is really required (e.g. to prevent exceeding of maximum V_{CE} or V_{DS} ratings), an additional resistor $R = (V_S - V_{CE} - 0.65\ V) / I_C$ can be inserted either between pin 4 and collector (or drain) or in series to the supply voltage V_S, thus providing an additional voltage drop.

Stability

BCR400 stabilizes bias current of transistors in an active control loop. In order to avoid loop oscillation (hunting), time constants must be chosen adequately, i.e. C_1 >= 10 x C_2. It is strongly recommended that the entire DC circuit is analyzed and optimized for stability with one of the commercially available SPICE simulators.

Thermal considerations

The collector or drain current of a stabilized RF transistor does not directly affect BCR400, as it must only provide the base current (or gate bias current). Even as a stand-alone current source it is not possible to exceed P_{tot} (up to T_s = 115°C), if the maximum ratings of V_s and I_{contr} are adhered to (see data sheet).

Preliminary SPICE Parameters

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**********************************************************************
.MODEL DI400 D(
+        IS= 6.00E-15      N= 1.20E+00     RS= 5.0E+01
+        IBV= 1.00E-04   BV= 7.50E+01
+        M= 1.00E-01     CJO= 6.87E-13   EG= 1.11E+00
+        TT= 8.66E-09    VJ= 2.00E+00    XTI= 5.00E+00)
* one internal Diode of BCR400
**********************************************************************
.MODEL TR400 PNP(
+       BF= 3.00E+02     BR= 3.38E+00     CJC= 2.00E-12
+       CJE= 1.56E-11    CJS= 0.00E+00     EG= 1.11E+00     FC= 8.28E-01
+       IKF= 1.00E-02    IKR= 0.40E-02    IRB= 0.30E-06     IS= 0.30E-14
+       ISC= 2.00E-14    ISE= 0.50E-13    ITF= 0.50E-01
+       MJC= 3.49E-01    MJE= 4.18E-01    MJS= 3.30E-01     NC= 1.19E+00
+        NE= 1.83E+00     NF= 1.00E+00     NR= 1.00E+00    PTF= 0.00E+00
+        RB= 1.00E+02    RBM= 1.00E+01     RC= 5.00E+00     RE= 2.00E-01
+        TF= 6.05E-10     TR= 0.00E+00    VAF= 5.90E+01    VAR= 1.74E+01
+       VJC= 3.00E-01    VJE= 8.00E-01    VJS= 7.50E-01    VTF= 4.39E+00
+      XCJC= 1.00E+00    XTB= 0.00E+00    XTF= 5.81E+00    XTI= 1.50E+00)

**********************************************************************
* internal parallel resistance Rint= 6.5 kOhm
* Rb= 75 kOhm
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Revision History: 2000-07-27 DS0

Previous Version:

Page	Subjects (major changes since last revision)
	Document's layout has been changed: 2002-Aug.

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Edition 2000-07-27

Published by Infineon Technologies AG,
St.-Martin-Strasse 53,
81669 München, Germany

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