# Application Considerations for the Integrated Bias Control Circuits BCR400R and BCR400W

**Application Note No. 014**

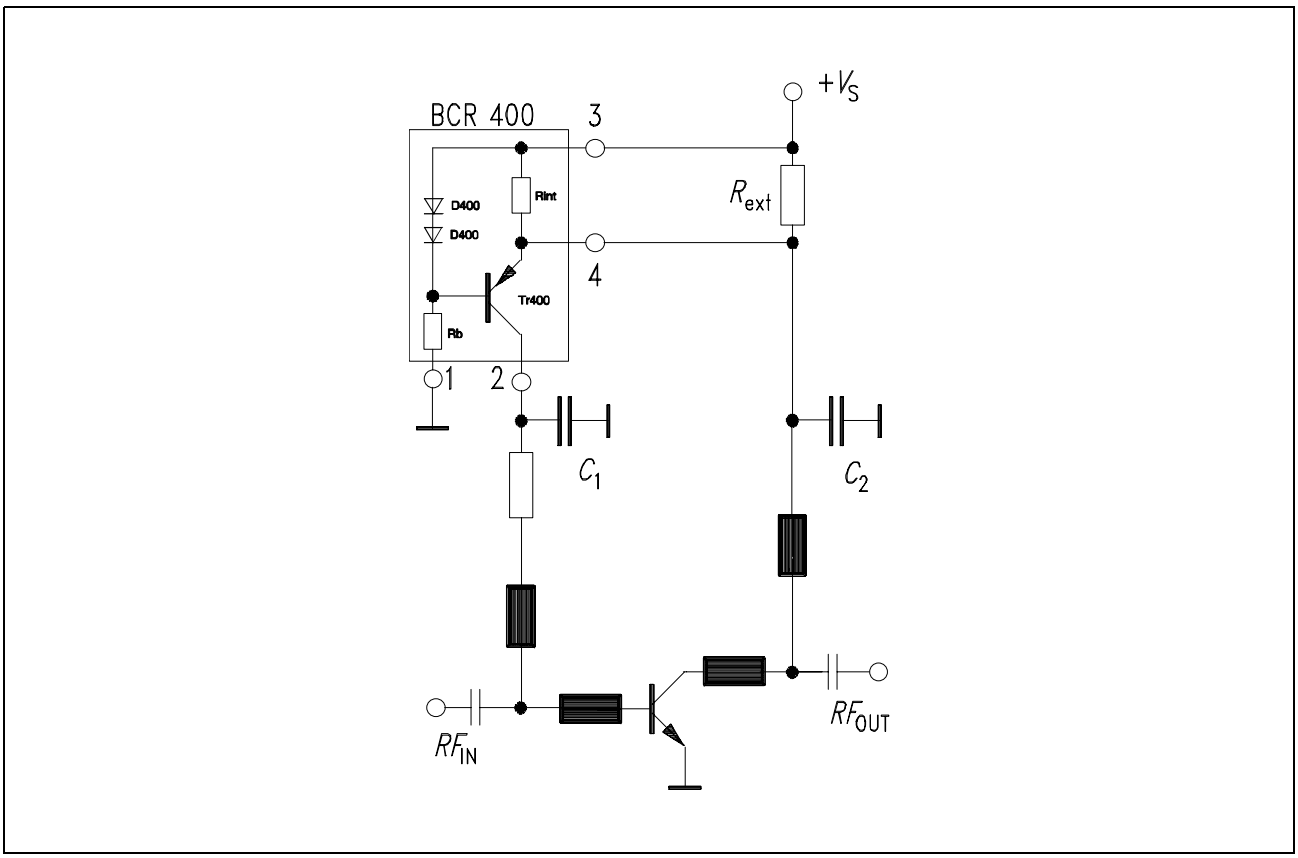


**Figure 1 RF Transistor Controlled by BCR400**

## 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

```
**********************************************************************
.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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```

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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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