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

## Revision History

**2006-11-23, Rev. 2.0**

**Previous Version:** 2000-07-27

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1 Application Considerations for the Integrated Bias Control Circuit BCR400W

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. $C_1 \pm 10 \times C_2$. 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 parameter

********************************************************************************
.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
********************************************************************************

Figure 2  SPICE parameters