QuickRing™ External (Box-to-Box) Cable Initialization

National Semiconductor
Application Note 944
June 1994

In the externally-cabled environment there is no common reset signal that QuickRing chips may use to mark the start of the initialization process. In addition, a method is needed for selecting one node as the ring clock source and as the initializer (node 0). These functions are accomplished with the addition of one TTL signal in the QuickRing cables. This signal, $\overline{\text{INIT}}$ is connected to the upstream connector via pin 13, and attaches to pin 1 of the downstream connector.

$\overline{\text{UpINIT}}$ and NOTZERO must appear in a software-readable register, and two signals, DRIVE_INIT and $\overline{\text{RESET}}$_INIT must be settable by software via a control register that is *cleared at power up*. Under software control $\overline{\text{DnINIT}}$ may be forced high (when $\overline{\text{RESET}}$_INIT is true), forced low (when $\overline{\text{RESET}}$_INIT is false and DRIVE_INIT is true), or it may follow the state of the input signal $\overline{\text{UpINIT}}$ (when $\overline{\text{RESET}}$_INIT and DRIVE_INIT are both false).

The theory goes like this. Each node in the external ring randomly volunteers to become the clock source and node 0 by pulling $\overline{\text{DnINIT}}$ low for an instant. If it sees the signal return at $\overline{\text{UpINIT}}$ really fast, then there is a whole and complete ring, and that node *is indeed* the clock source and node 0. Otherwise, the node waits a long time before volunteering again. The first node to see its own $\overline{\text{INIT}}$ signal wins, and all those that just forwarded the signal are NOTZERO. (*Really fast* is on the order of 10 μs. *A long time* is something more than 10 ms.)

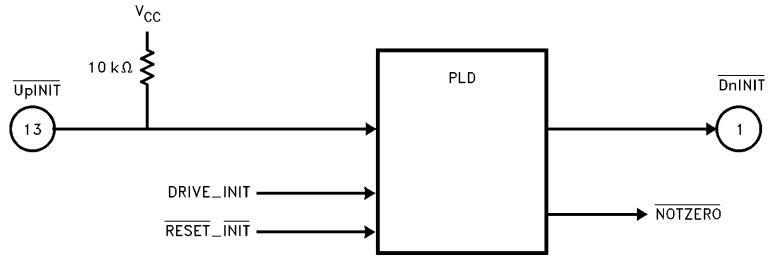
If you wish, you can drive the NODE0 and CLKSRC pins directly with $\overline{\text{NOTZERO}}$. Make sure that you have a reasonable clock signal applied to RGCLK of the QR0001 chip.

The last step is for the *new node 0* to release $\overline{\text{DnINIT}}$. Node 0 should leave it asserted for some pseudo-random time greater than, say, 100 ms, then assert $\overline{\text{RESET}}$_INIT until it detects $\overline{\text{UpINIT}}$ unasserted again. All nodes will see the release of $\overline{\text{UpINIT}}$. The reset signal applied to QR0001 (which should have been asserted throughout the procedure) may be released at any time after $\overline{\text{UpINIT}}$ is detected high. Once all nodes have done this, the ring is initialized and ready to operate.

Instigating the $\overline{\text{INIT}}$ Procedure in an Already-Initialized Ring

Let us suppose that an abort has occurred on the ring. How does a node go about repeating the initialization process to get started again?

To repeat the process, a node should both wish to reinitialize the ring and be willing to become the new CLKSRC an Node 0. The process is simply to assert $\overline{\text{DnINIT}}$ again, just as described above. The asserting node expects to win. To increase the odds that the winner is unique, after the detection of abort a node should wait a pseudo-random time delay before asserting $\overline{\text{DnINIT}}$, so that the probability is small that another node will have done the same thing at the same time.



TL/F/12046–1

$\overline{\text{DnINIT}}$ = !$\overline{\text{RESET}}$_INIT & (DRIVE_INIT + $\overline{\text{UpINIT}}$);
$\overline{\text{NOTZERO}}$ = !$\overline{\text{RESET}}$_INIT & (!DRIVE_INIT & $\overline{\text{UpINIT}}$ + $\overline{\text{NOTZERO}}$);

QuickRing™ is a trademark of Apple Computer, Inc.

RRD-B30M75/Printed in U. S. A.

National Semiconductor Corporation
2900 Semiconductor Drive
P.O. Box 58090
Santa Clara, CA 95052-8090
Tel: 1(800) 272-9959
TWX: (910) 339-9240

National Semiconductor GmbH
Livry-Gargan-Str. 10
D-82256 Fürstenfeldbruck
Germany
Tel: (81-41) 35-0
Telex: 527649
Fax: (81-41) 35-1

National Semiconductor Japan Ltd.
Sumitomo Chemical
Engineering Center
Bldg. 7F
1-7-1, Nakase, Mihama-Ku
Chiba-City,
Ciba Prefecture 261
Tel: (043) 299-2300
Fax: (043) 299-2500

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductores Do Brazil Ltda.
Rue Deputado Lacorda Franco
120-3A
Sao Paulo-SP
Brazil 05418-000
Tel: (55-11) 212-5066
Telex: 391-1131931 NSBR BR
Fax: (55-11) 212-1181

National Semiconductor (Australia) Pty, Ltd.
Building 16
Business Park Drive
Monash Business Park
Nottinghill, Melbourne
Victoria 3168 Australia
Tel: (3) 558-9999
Fax: (3) 558-9998