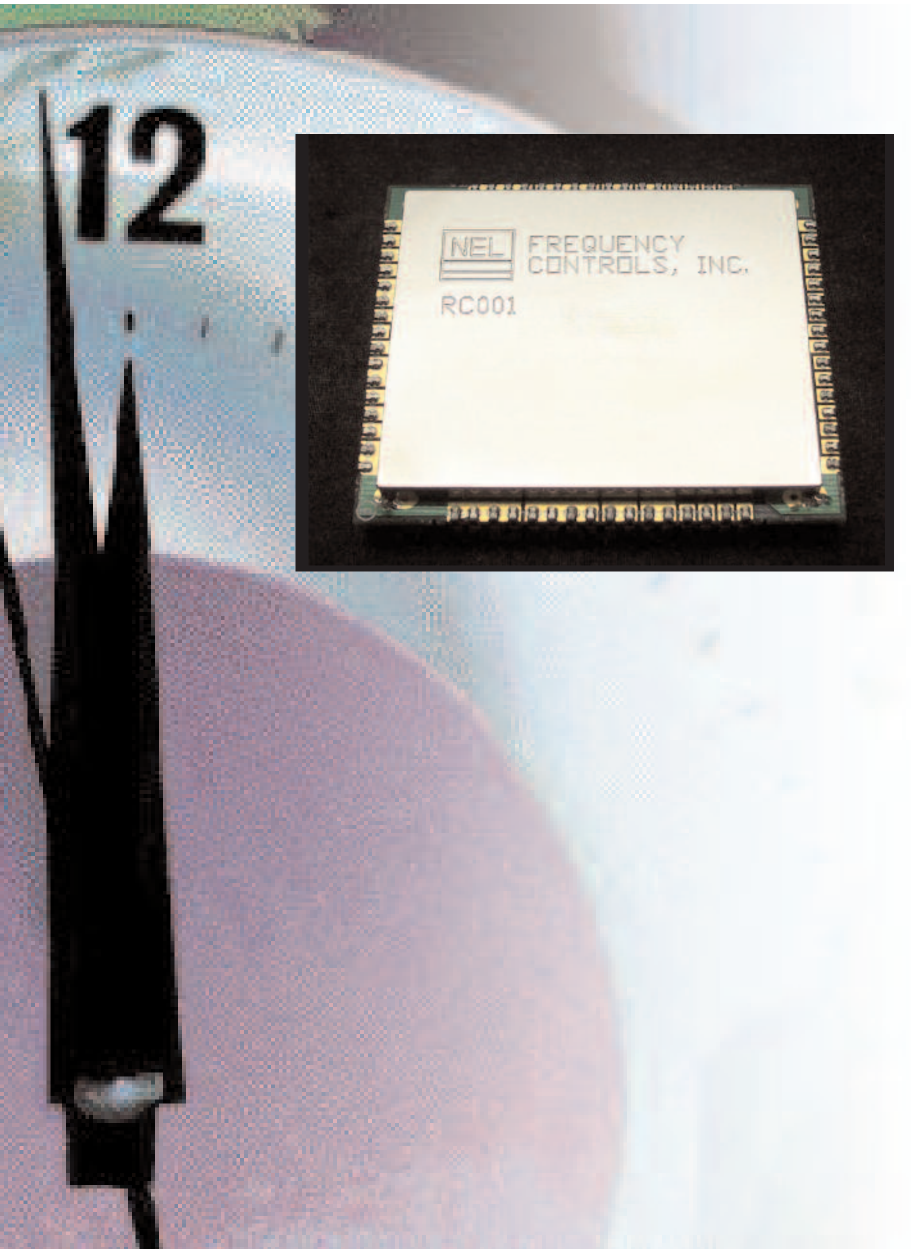
NEL FREQUENCY CONTROLS, INC.

Redundant Clock Module
RC001



Key Features/Benefits

- Detects if Primary Signal or Clock fails (either no output or off frequency)
- Switches to Secondary Signal or Clock within one frequency cycle, preventing system failure
- Ideal for Mission Critical Applications in Networking, Computers, and Storage

Contents

- RC001, Redundant Clock Module Specifications
- Design Note - “Monitor, Detect, Action”

Call today for Samples and Application Support 262-763-3591

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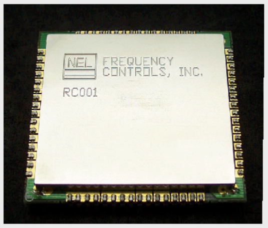
RC001



- **Clock Redundancy**
- **Zero Downtime**
- **HALT/HASS Verified**
- **Up to 250.000 MHz**

RC001 Redundant Clock Module
Positive ECL Compatible Differential Output

U.S. Patent 6,970,045 *Rev F*

Description

The Redundant Clock Module is intended to supply highly reliable fixed clock reference. This clock output is based on two clock references internal that are monitored and eliminated from use if they are not operating within tolerance. A slow transition between oscillator references during switching is controlled to assure no significant phase shift or runt pulses will affect the end user application. Osc. 0 Enable or Osc. 1 Enable is used to disable respective oscillator to verify switching functionality. The oscillator status outputs indicate if the respective oscillator is functioning properly or not.

Features

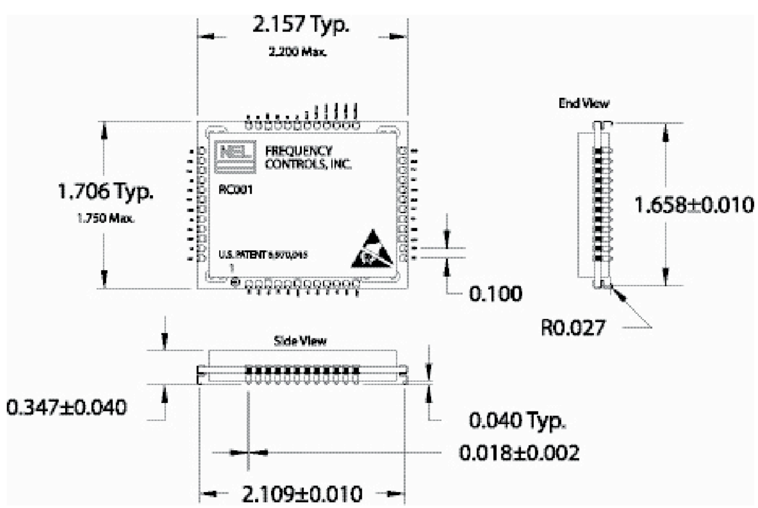
- HALT/HASS verified
- Frequency range: 20.000MHz to 250.000MHz
- User specified tolerance from ±100ppm
- Cover at electrical ground
- Will withstand SMD reflow temperatures of 253°C for 4 minutes maximum
- MECL compatible outputs
- High shock resistance, to 1000g
- Leaded package
- Ten low skew DPECL outputs

Electrical Connection

Pin	Connection	Pin	Connection	Pin	Connection
1	Q6	17	Vcc	33	/Q0
2	/Q6	18	Vcc	34	GND
3	Vcc	19	GND	35	Q1
4	Q7	20	GND	36	/Q1
5	/Q7	21	Vcc	37	Q2
6	GND	22	Vcc	38	/Q2
7	Q8	23	GND	39	Vcc
8	/Q8	24	GND	40	Q3
9	Vcc	25	/Osc 0 status	41	/Q3
10	Q9	26	Osc 0 status	42	Vcc
11	/Q9	27	/Osc 1 status	43	GND
12	GND	28	Osc 1 status	44	Q4
13	EN1	29	Osc select	45	/Q4
14	EN0	30	/Reset	46	GND
15	GND	31	Vcc	47	GND Q5
16	GND	32	Q0	48	GND /Q5

Note: Osc X status is logic low for pass and logic high for fail

Drawing Specifications



For the most up to date specifications on each NEL product, log on to our website—www.nelfc.com

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RC001 Redundant Clock Module
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Operating Conditions and Output Characteristics

Electrical Characteristics

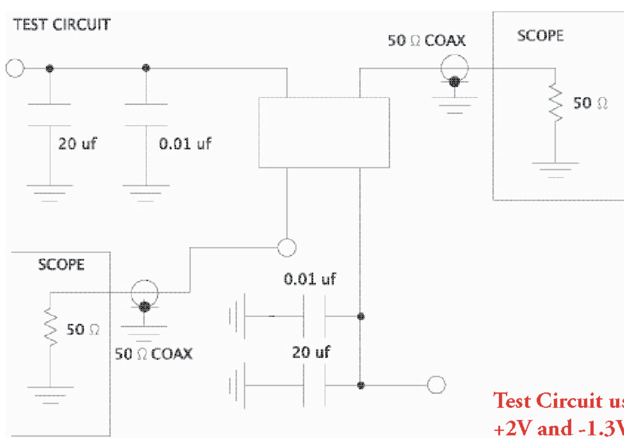
Parameter	Symbol	Conditions	Min	Typical	Max
Frequency	—	—	20.000 MHz	—	250.000 MHz
Duty Cycle	—	@V_{CC} -1.29	45/55%	—	55/45%
Logic 0	V_{OL}	—	V_{CC} -1.95 V	—	V_{CC} -1.60 V
Logic 1	V_{OH}	—	V_{CC} -1.15 V	—	V_{CC} -0.90 V
Rise & Fall Time	tr, tf	20-80% V_O	—	—	600 psec
Jitter, RMS	—	12 kHz to 20 MHz	—	—	5 psec
Frequency Stability	dF/F	User Specified	-100 ppm	—	+100 ppm
Output Skew	—	—	—	—	±30

General Characteristics

Parameter	Symbol	Conditions	Min	Typical	Max
Supply Voltage	V_{CC}	3.3V±10%	2.97 V	3.3 V	3.63 V
Supply Current[1]	I_{CC}	V_{CC} or Ground Current	0.0 mA	—	900 mA
Output Current	I_O	Low level Output Current	0.0 mA	—	±50.0 mA
Operating Temperature	T_A	—	-0°C	—	70°C
Storage Temperature	T_S	—	-55°C	—	125°C

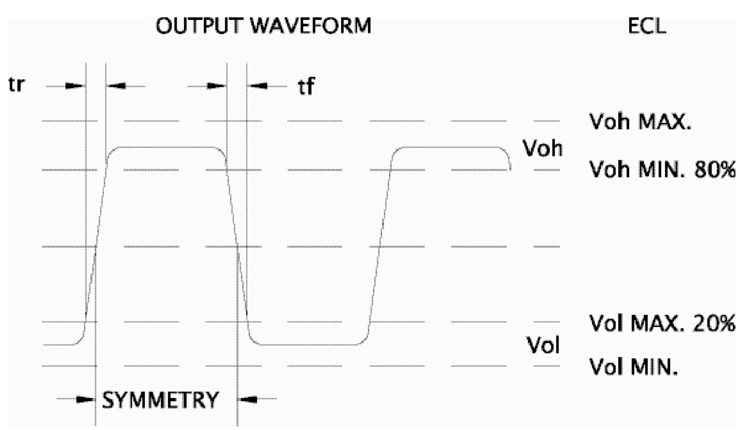
Footnote:
1) All outputs terminated by 50 ohm to V_{CC} -2V

Test Circuit



Test Circuit uses a split supply of +2V and -1.3V for ease of testing.

Output Waveform



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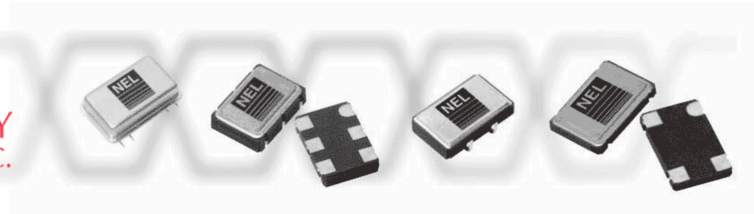


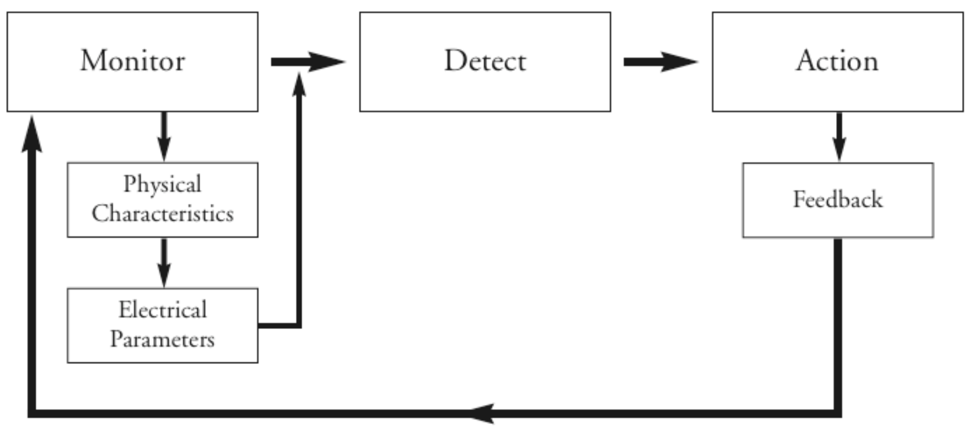
Monitor, Detect, Action
A Modules Solution for Mission Critical Applications

Problem

Many complex, high-speed, multifunction systems require an appropriate response to environmental or internal changes quickly. Correlation between the physical or environmental characteristics being monitored and the circuit parameters must be determined to generate an appropriate response.

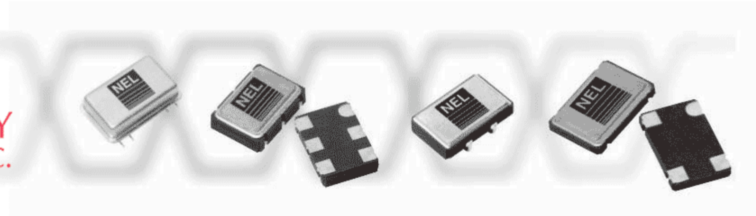
An appropriate response requires three actions to occur within a critical time frame. The system must first monitor the primary input signals for changes. Then the system must detect whether those changes exceed predetermined limits (limits can be variable depending on current conditions). Lastly, action must be taken. The action can be as simple as notifying the system or operator of the status through a signal or indicator. Alternatively, the action could consist of making intelligent decisions based on multiple detector information.

For Mission Critical applications high reliability components must be selected and their interactions must be carefully reviewed.



Possible Physical Characteristics:
- Speed
- Light intensity
- Frequency
- Sound
- Vibration
- Signal
- Position

Possible Actions:
- Change voltage
- Recognize device
- Change rotary position
- Change linear position
- Change motor speed
- Send indicator signal
- Light indicator



Monitor

To build a reliable application the first challenge is to determine which variables need to be watched for further processing later. Critical variables need to be determined and a suitable method for monitoring them must be implemented.

Possible Variables:

Frequency – The system could watch for the presence of a signal source such as if a clock fails and has no frequency output. On the other hand it could monitor for a frequency source to be out of tolerance. This can occur when an oscillator fails to start properly.

Current or Voltage – Monitoring a “hot swappable” device or component for current or voltage could help the system determine whether the item has been removed or is installed. If it is removed it will cease to draw current and it will begin again once it is replaced. The current or voltage levels could also be monitored to determine when lower or upper limits are met or exceeded.

Motor Speed – When a device starts, stops, slows down or speeds up could also be determined by the monitoring system. The system could determine when upper or lower limits for speed or acceleration are met or exceeded.

Position – Both rotational and linear position could be monitored. Rotational shaft positions can be determined for less than a 0º10' change in the angle. Linear position could also be determined using a conversion from rotational information.

Detect

The detection phase processes the information from the monitoring methods that have been selected. Detection would determine whether they pass, fail or meet other criteria that requires action.

Microcontrollers can serve many of these purposes today. But the signal must be in a digital form if it is not already. This can be done using an analog/digital conversion or analog comparitors. Analog comparitors detect analog limits using the reference voltage as a limit voltage for the application.

Action

Action must be taken once detection has been accomplished and it is determined that the inputs have met the necessary criteria. The required action could range from simply alerting the operator with an indicator light to making an intelligent decision based on multiple sources of information.

Defining the reaction to detection information is critical in creating a viable system. The system must also respond to the correct degree for different ranges of information.

Examples of Actions:

Reporting – Making the system or the operator aware of the conditions that have been detected is the simplest action. This might include simply setting a digital bit high or low to indicate a change or lighting an LED to indicate to an operator that the status has changed. A report to the system may also consist of a more complex digital signal.

Switching – The action could cause the system to switch to alternate or backup sources if a device fails or its condition changes. The system could also switch off the failed device or switch on another device.

Adjustments – If certain criteria are detected the system could make changes to any number of outputs including motor speed, rotational position, frequency or amplitude.

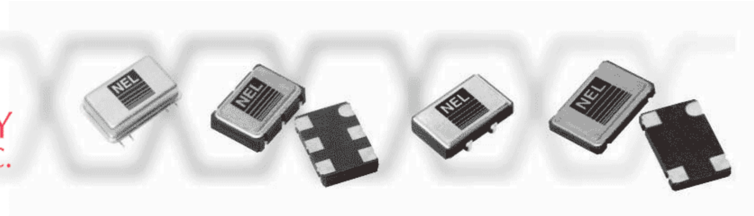
Why NEL Frequency Controls?

The module concept allows our engineers to develop plug and play devices for your applications. You will not have to worry about any engineering considerations for capturing inputs and configuring outputs and actions. You just let us know what the inputs and action thresholds are along with what actions need to be taken and we take care of the details.

We currently have a patent pending for the control loop sensing upon which “Monitor, Detect, Action” systems are built. Our engineers have vast experience with creating high reliability frequency control devices and motion control encoders. Our work in these areas has included numerous miniaturization and signal conditioning projects. This experience allows us to build mission critical control systems for almost any requirements.

Our past experience includes a range of monitor, detect, action and other applications:

- Mixed signal knowledge - We have worked with and interfaced between many different digital technologies, analog signals, RF signals, and microwave signals
- RF, analog and EMI filtering
- Noise source generation - generating noise sources for controlled noise injection



- Reliability Quality issues - HALT concepts, FIT rate calculations, long term aging affects, moisture levels and cleanliness/contamination issues
- Reliability Physics - Electronic component failure mechanisms
- Frequency domain and time domain relationships
- Control loops - phase locked loops, motor control loops, micro controller
- Encoder technologies - absolute and incremental, optical and hall affect, digital or analog outputs
- Redundancy concepts for mission critical applications
- Quartz crystal design and processing
- Oscillator design and manufacture
- Hybrid electronic packaging including hermetic seal, ceramic and glass to metal packaging.
- Signal integrity applications such as transmission lines, impedance matching, jitter issues and phase noise issues.
- Miniaturization – We commonly work with extremely small size components and creative packaging to miniaturize circuits. Some standard components we have worked with are bare IC DIE, thick film resistors to reduce overall size 0402 chip components. IC DIE stacking to save space is one example of our creative packaging solutions