

R.F. Research Australia

Instrumentation Phase Detector

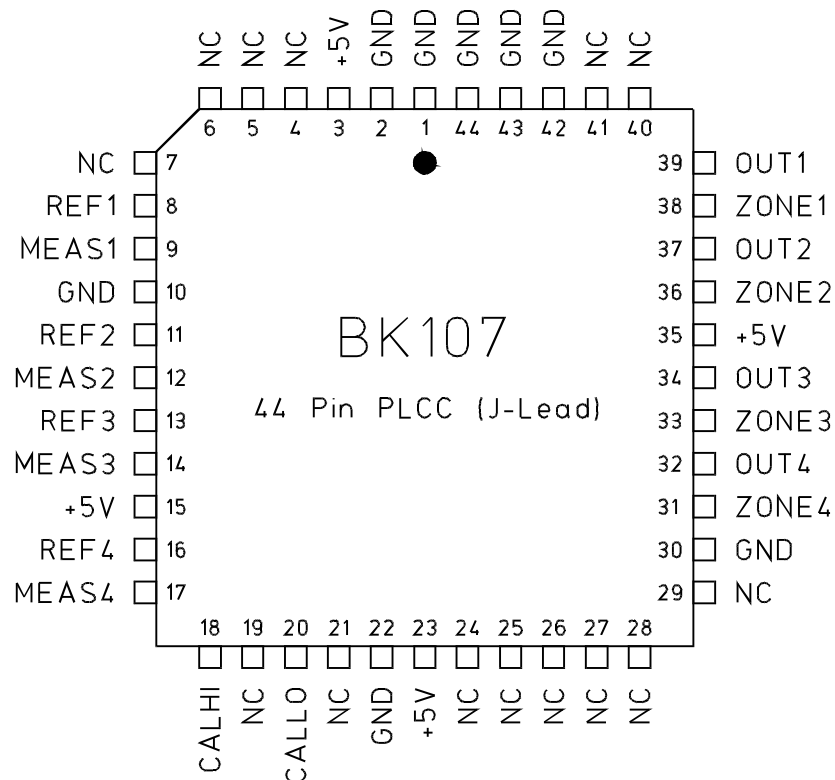
[www. rf. ozi . nu](http://www.rf.ozinfo.net)

ERRATA

- 1.) E-Mail address has changed to: info@rf.ozl.nu
- 2.) Web address has changed to: <http://www.rf.ozl.nu>

BK107Quad, Instrumentation
Phase DetectorDATA SHEET
JUN. 1998**Features.**

- Designed for Vector Measurement applications.
- 1440 (360 x 4) degrees phase detection range.
- 90 MHz Maximum operating frequency.
- 15mA output sink current guaranteed.
- TTL or HCMOS compatible.
- 44 pin PLCC (J - Lead) package.

Pin - Outs.**Figure 1.****R.F. Research Australia**

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General Description.

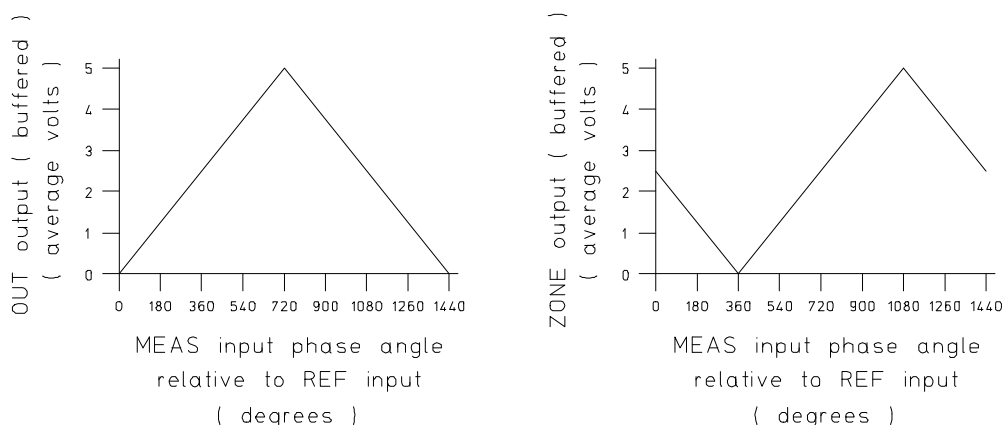
The BK107 is a quad, Instrumentation Phase Detector designed primarily for Vector Measurement applications.

As the measured phase angle (MEAS input) increases relative to the reference phase angle (REF input), the average output voltage (OUT output) increases until the phase angle reaches 720 degrees. Any further increase in phase angle causes the the average output voltage to decrease until the phase angle reaches 1440 degrees (which is 0 degrees because the average output voltage is back to where it started). Therefore, the phase detector has a positive gain from 0 to 720 degrees and a negative gain from 720 to 1440 degrees.

To overcome the problem of not knowing which zone the output voltage corresponds to (ie. 0 to 720 or 720 to 1440 degrees), the ZONE output is provided. If the ZONE output's average voltage is below the voltage that corresponds to halfway between a logic High & Low, the zone is 0 to 720 degrees. If the ZONE output's average voltage is above the voltage that corresponds to halfway between a logic High & Low, the zone is 720 to 1440 degrees.

In applications requiring accurate phase measurements, the OUT & ZONE outputs should be buffered using a 74HCT541 buffer IC or similar device.

Calibration inputs are also provided so that the circuitry following the BK107 and buffer (eg. A to D converters and microcomputers) know the precise High voltage and the precise Low voltage for each output.

**Figure 2.****R.F. Research Australia**

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**Block
Diagram.**

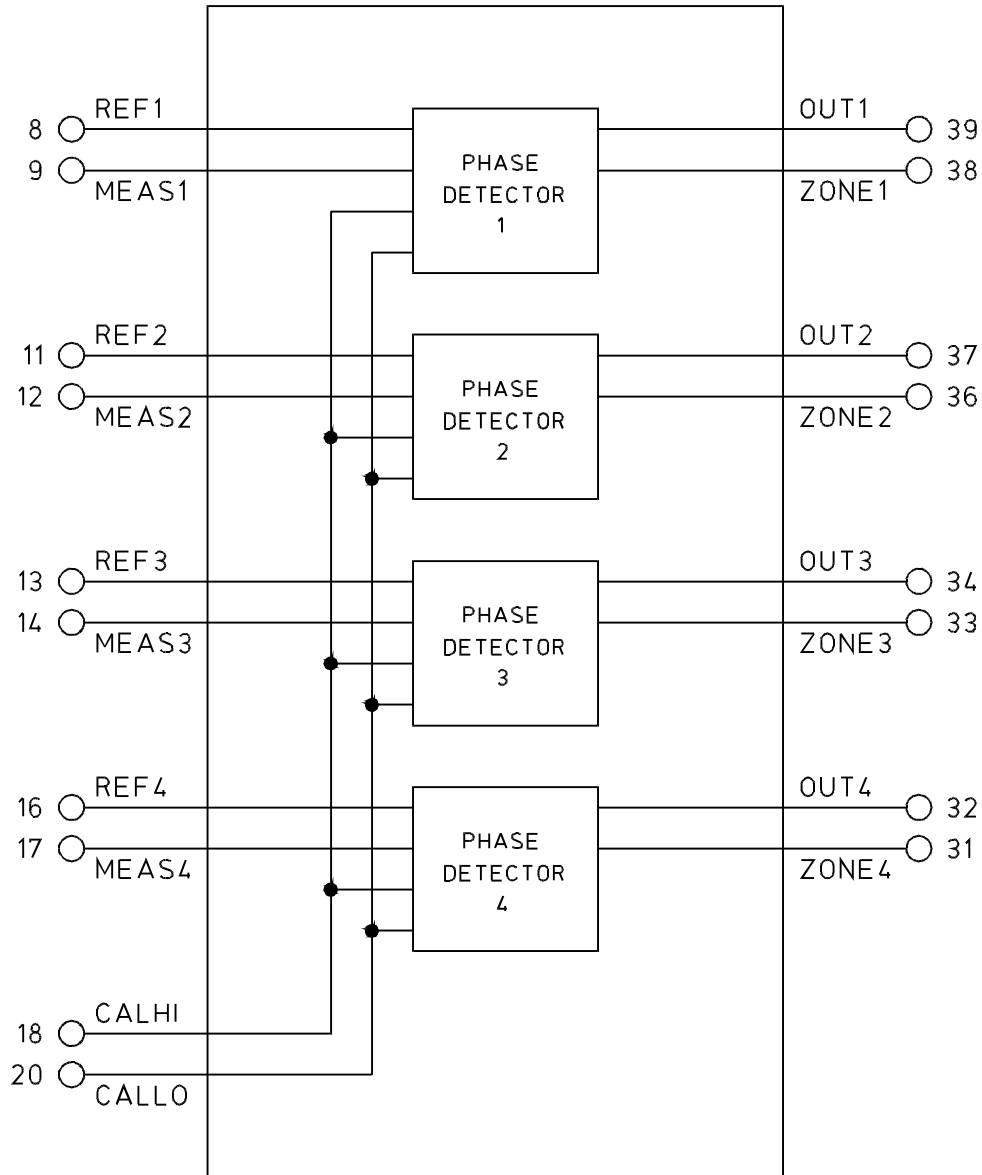
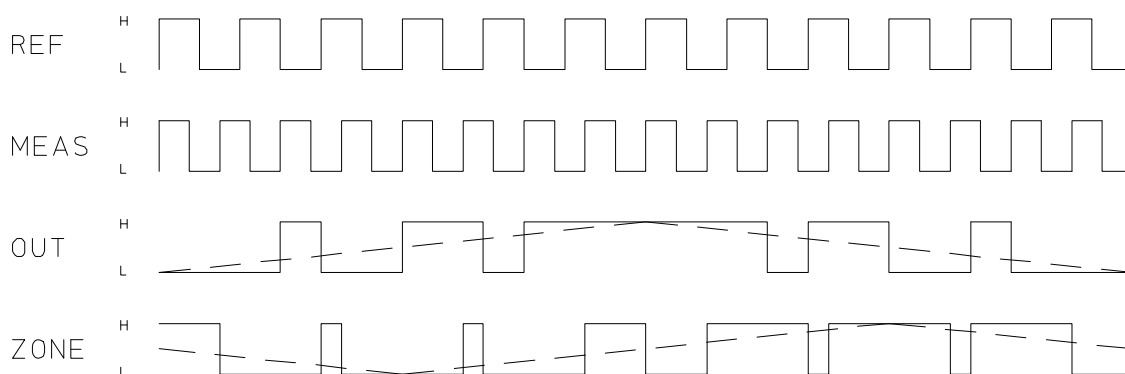


Figure 3.

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Typical Waveforms.

Figure 4 (below) shows the typical output vs. input waveforms. This is a crude example because the Phase Angle of the MEAS input increases by 360 degrees every 3 reference cycles (this was necessary to show the waveforms for a full 1440 degrees phase change on one page).



Note : Dotted line shows average output.

Figure 4.

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Pin Descriptions.

REFn	Reference input. Rising edge triggered.
MEASn	Measure input. Rising edge triggered. The phase angle of this signal (relative to the signal on the REF input) determines the average voltage on the OUT and ZONE outputs.
CALHI	Forces all outputs (OUT and ZONE) to a High voltage (for instrument calibration).
CALLO	Forces all outputs (OUT and ZONE) to a Low voltage (for instrument calibration).
OUTn	Phase Detector Output.
ZONEn	Zone Output. Indicates which zone is being measured (0-720 or 720-1440 degrees). See General Description for more information.
+5V	+5V D.C. SUPPLY pin. ALL +5V PINS (4 total) MUST BE CONNECTED TO THE +5V POWER RAIL.
GND	Ground Pin. ALL GND PINS (8 total) MUST BE CONNECTED TO THE GROUND POWER RAIL.
NC	Not connected. ALL NC PINS (14 total) MUST BE LEFT UNCONNECTED AT ALL TIMES.

Note : "n" refers to phase detector 1,2,3 or 4.

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Specifications.

Absolute Maximum Ratings *Notes (1), (2)*

Parameter	Condition	Min.	Max.	Unit
Supply voltage		-2.0	7.0	V
Input voltage	when supply = 5V	-0.3	5.3	V
Output voltage	when supply = 5V	-0.3	5.3	V
Output Current		-25	25	mA
Power dissipation			1.5	W
Junction Temp.		-65	150	deg.C

Recommended Operating Conditions *Note (1)*

Parameter	Condition	Min.	Max.	Unit
Supply voltage		4.75	5.25	V
Input voltage	when supply = 5V	0	5	V
Output voltage	when supply = 5V	0	5	V
Ambient Temp.		0	70	deg.C

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Specifications Continued.

DC Operating Conditions *Notes (3), (4)*

Parameter	Condition	Min.	Typ.	Max.	Unit
Input voltage	HIGH (logic 1)	2.0		5.0	V
Input voltage	LOW (logic 0)	0		0.8	V
Output voltage	HIGH, I out= -36 μ A	3.6	4.0		V
Output voltage	HIGH, I out= -5mA	2.4	3.4		V
Output voltage	LOW, I out= 15mA		0.18	0.45	V
Input leakage	HIGH or LOW	-10		10	μ A
Supply current	Quiescent		41		mA
Supply current	Note (5)		72		mA

AC Operating Conditions *Note (3)*

Parameter	Condition	Min.	Max.	Unit
Input rise time	Note (8)		40	ns
Input fall time	Note (8)		40	ns
Input frequency			90	MHz

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- Notes.**
- (1) Inputs & outputs may undershoot to -2V & overshoot to 7V for periods less than 20ns.
 - (2) Exposure to Absolute Maximum Ratings for extended periods may cause permanent damage to the device. For reliable operation the device must be used in accordance with the Operating Conditions (Recommended, DC & AC).
 - (3) Min. & Max. Operating Conditions are applicable for a supply voltage of 5V +/- 5% and an ambient temperature range of 0 to 70 degrees C.
 - (4) Typ. operating conditions are applicable for a supply voltage of 5V and an ambient temperature of 23 degrees C and may vary from one device to another.
 - (5) Measured with a 24 MHz signal applied to all REF & ZONE inputs.
 - (6) All currents and voltages listed in this data sheet are DC. All voltages are with respect to GND. "Supply voltage" is the voltage applied to the +5V pins.
 - (7) This device must not be used in applications where its failure may cause personal injury or loss of life.
 - (8) Inputs may become unstable if the input voltage remains between guaranteed logic levels (outside DC operating conditions) for periods greater than 40ns.
 - (9) Information in this data sheet and device specifications may change without prior notice. Errors and omissions expected.

Ordering Information.

Part No.	Features
BK107	Quad, 90MHz fMAX

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Power Supply Connections & Decoupling.

Figure 1 shows the recommended power supply & decoupling circuitry for the BK107.

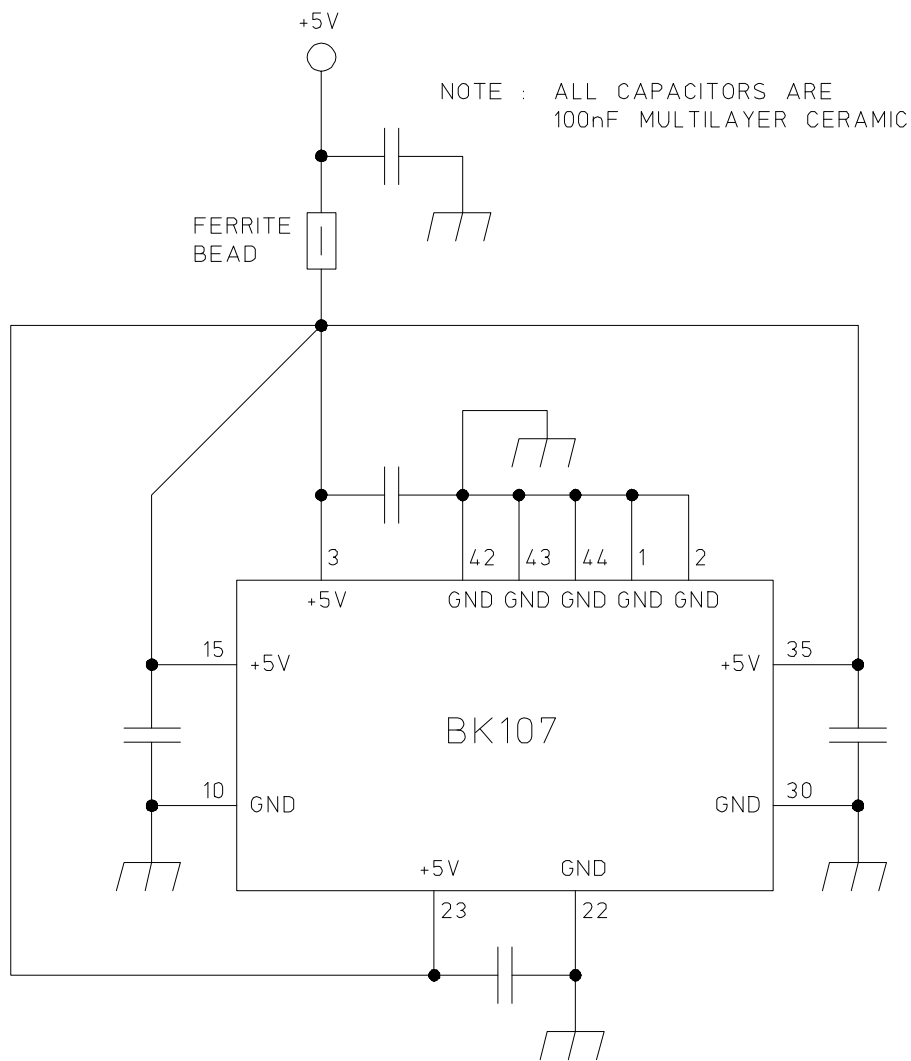


Figure 1.

Output Buffering.

Figure 2 shows the recommended Output Buffer circuitry for applications requiring accurate phase measurements. When input frequencies are above 50MHz, use a 74ACT541 instead of the 74HCT541 to reduce propagation delays.

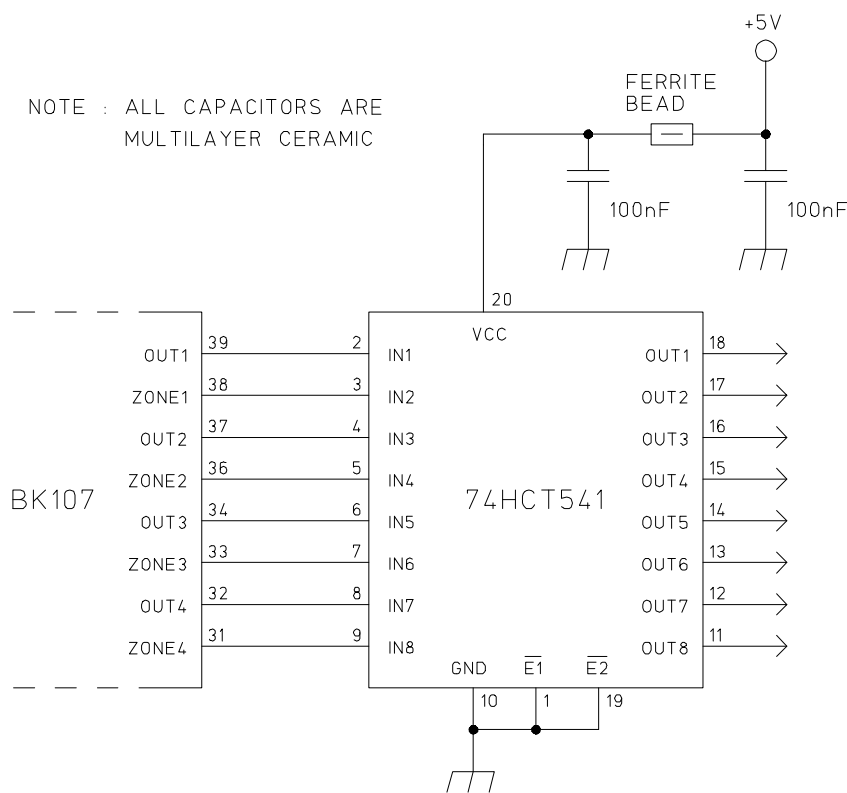


Figure 2.

Note : The information in these application notes may change without prior notice. Errors and omissions expected.