TWO PHASE HALL EFFECT LATCH WITH FG OUTPUT AH211

General Description

The AH211 is an integrated Hall sensor with output driver and frequency generator designed for electronic commutation of brush-less DC motor applications. The device includes an on-chip Hall sensor for magnetic sensing, an amplifier that amplifies the Hall voltage, a Schmitt trigger to provide switching hysteresis for noise rejection, a temperature compensation circuit to compensate the temperature drift of Hall sensitivity, two complementary open-collector drivers for sinking large load current. It also includes an internal band-gap regulator which is used to provide bias voltage for internal circuits.

Place the device in a variable magnetic field, while the magnetic flux density is larger than threshold BOP, DO will be turned on (low) and DOB (and FG) will be turned off (high). This output state is held till the magnetic flux density reversal falls below BRP causing DO to be turned off (high) and DOB (and FG) turned on (low).

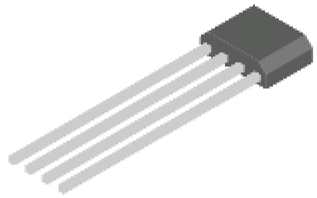
AH211 is available in TO-94 (SIP-4L) package.

Features

- On-Chip Hall Sensor
- 3.5V to 16V Supply Voltage
- 400mA (avg) Output Sink Current
- -20^{o}C to 85^{o}C Operating Temperature
- Built-in FG Output
- Low Profile TO-94 (SIP-4L) Package
- ESD Rating: 300V (Machine Model)

Applications

- Dual-Coil Brushless DC Motor
- Dual-Coil Brushless DC Fan
- Revolution Counting
- Speed Measurement



TO-94

Figure 1. Package Type of AH211

Pin Configuration

Z4 Package
(TO-94)

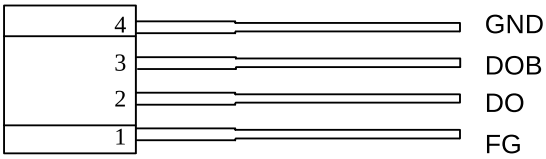


Figure 2. Pin Configuration of AH211 (Front View)

Pin Description

Pin Number	Pin Name	Function
1	FG	Frequency Generation
2	DO	Output 1
3	DOB	Output 2
4	GND	Ground

Functional Block Diagram

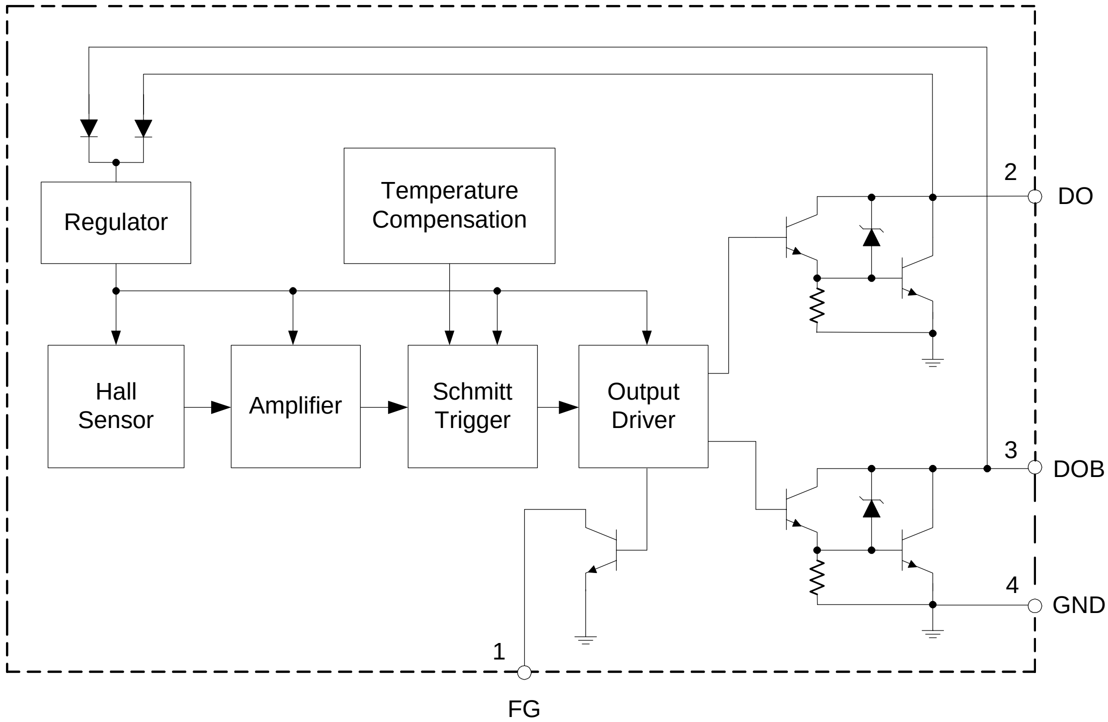


Figure 3. Functional Block Diagram of AH211

Ordering Information

AH211 □ - □ □

Circuit Type

Package
Z4: TO-94 (SIP-4L)

E1: Lead Free

Magnetic Characteristics
A: 5 to 60 Gauss
B: 90 Gauss

Package	Temperature Range	Part Number	Marking ID	Packing Type
TO-94	-20 to 85 ^{o}C	AH211Z4-AE1	AH211	Bulk
		AH211Z4-BE1	AH211	Bulk

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

Absolute Maximum Ratings (Note 1)

(T_A=25^{o}C)

Parameter		Symbol	Value	Unit
Supply Voltage		V_{CC}	20	V
Magnetic Flux Density		B	Unlimited	Gauss
Output Current	Continuous	I_O	400	mA
	Hold		600	mA
	Peak (start up)		800	mA
FG Current		I_{FG}	20	mA
Power Dissipation		P_D	550	mW
Thermal Resistance	Die to atmosphere	θJA	227	^{o}C/W
	Die to package case	θJC	49	^{o}C/W
Storage Temperature		T_{STG}	-50 to 150	^{o}C
ESD (Machine Model)			300	V
ESD (Human Body Model)			3000	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. "Absolute Maximum Ratings" for extended period may affect device reliability.

Recommended Operating Conditions

(T_A=25^{o}C)

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	3.5	16	V
Ambient Temperature	T_A	-20	85	^{o}C

Electrical Characteristics

(T_A=25°C, V_{CC}=14V, unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output Saturation Voltage	V_{SAT}	B>150Gauss, V_{CC}=3.5V, V_{DOB}=V_{CC}, I_{DO}=100mA (or B<-150Gauss, V_{CC}=3.5V, V_{DO}=V_{CC}, I_{DOB}=100mA)		1.1		V
		B>150Gauss, V_{DOB}=V_{CC}, I_{DO}=400mA (or B<-150Gauss, V_{DO}=V_{CC}, I_{DOB}=400mA)		1.05	1.3	V
FG Saturation Voltage	V_{SATF}	B<-150Gauss, V_{DO}=V_{CC}, I_{FG}=20mA		0.35	0.6	V
FG Leakage Current	I_{OLF}	B>150Gauss, V_{DOB}=V_{CC}, V_{FG}=16V		0.1	10	μA
Supply Current	I_{CC}	B>150Gauss, V_{DOB}=V_{CC}, (or B<-150Gauss, V_{DO}=V_{CC})		8	10	mA
Output Rise Time	tr	R_L=1kΩ, C_L=10pF		3.0	10	μs
Output Fall Time	tf	R_L=1kΩ, C_L=10pF		0.3	1.0	μs
Switch Time Differential	Δt	R_L=1kΩ, C_L=10pF		3.0	10	μs
Output Zener Breakdown Voltage	V_Z			55		V

Magnetic Characteristics

(T_A=25°C)

Parameter	Symbol	Grade	Min	Typ	Max	Unit
Operating Point	B_{OP}	A	5	30	60	Gauss
		B			90	Gauss
Releasing Point	B_{RP}	A	-60	-30	-5	Gauss
		B	-90			Gauss
Hysteresis	B_{HYS}			60		Gauss

Magnetic Characteristics (Continued)

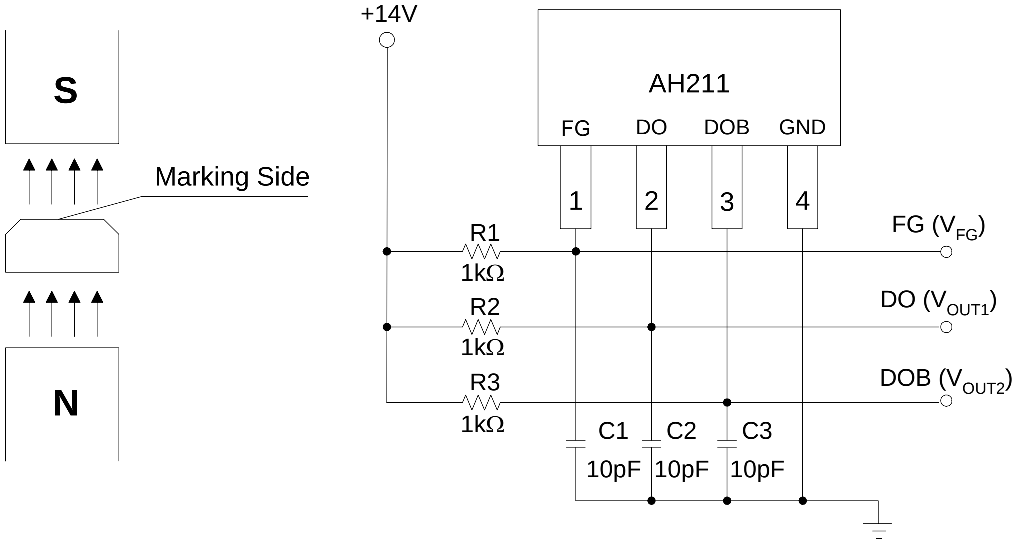


Figure 4. Basic Test Circuit

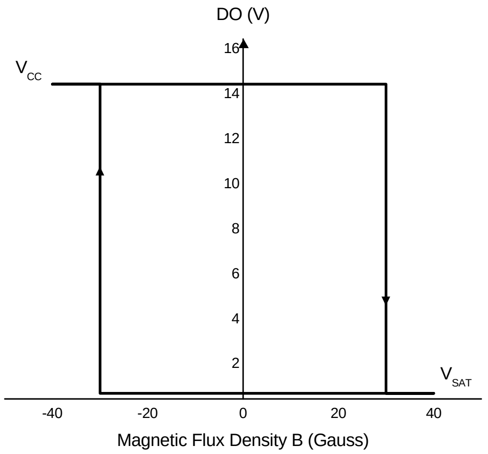


Figure 5. V_{DO} vs. Magnetic Flux Density

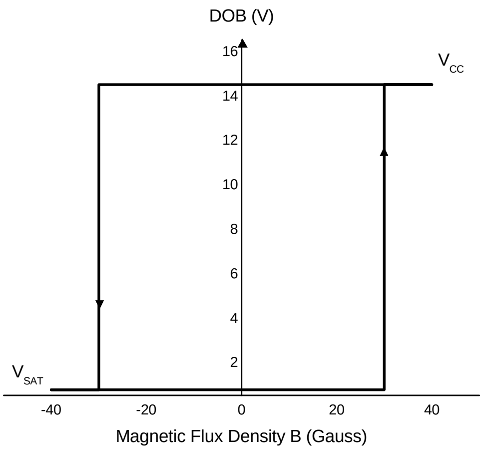


Figure 6. V_{DOB} vs. Magnetic Flux Density

Typical Performance Characteristics

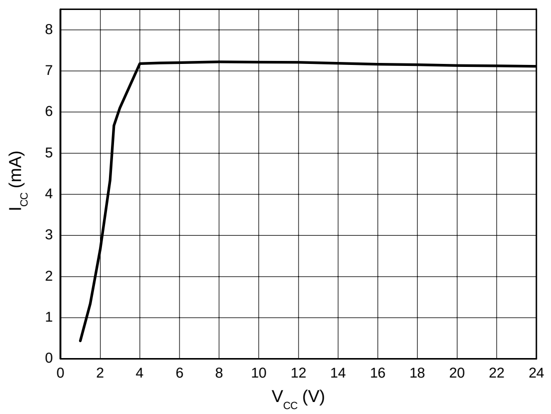


Figure 7. I_{CC} vs. V_{CC}

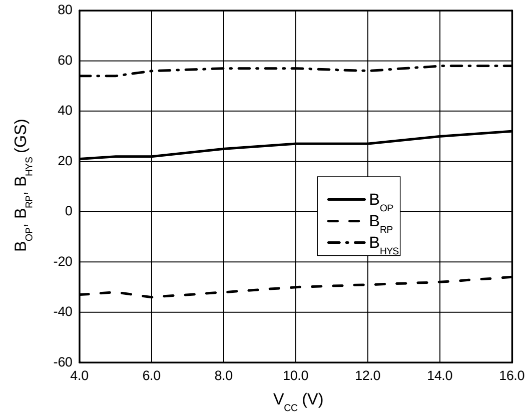


Figure 8. B_{OP}/B_{RP}/B_{HYS} vs. V_{CC}

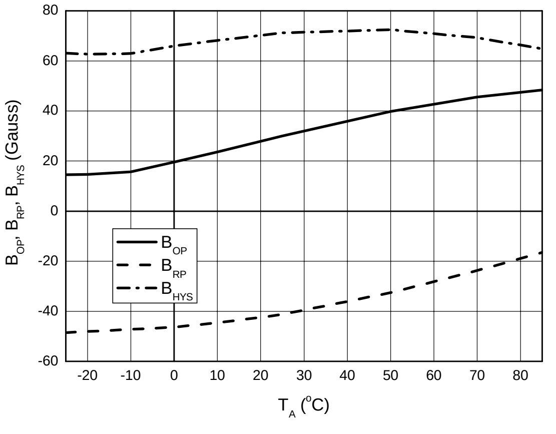


Figure 9. B_{OP}/B_{RP}/B_{HYS} vs. Ambient Temperature

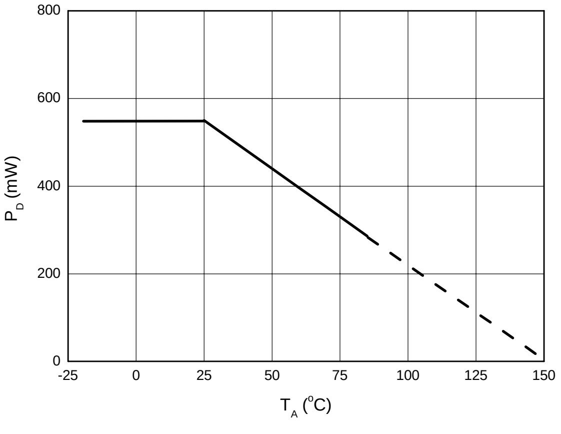


Figure 10. P_D vs. Ambient Temperature

Typical Performance Characteristics (Continued)

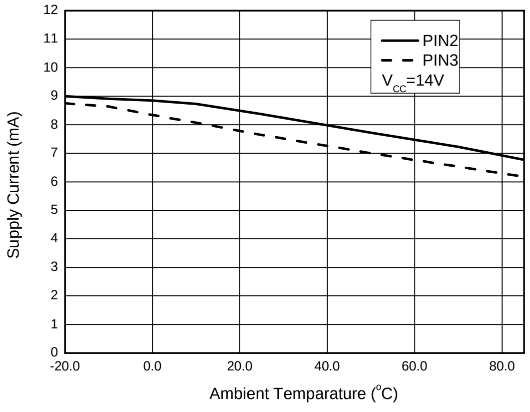


Figure 11. Supply Current vs. Ambient Temperature

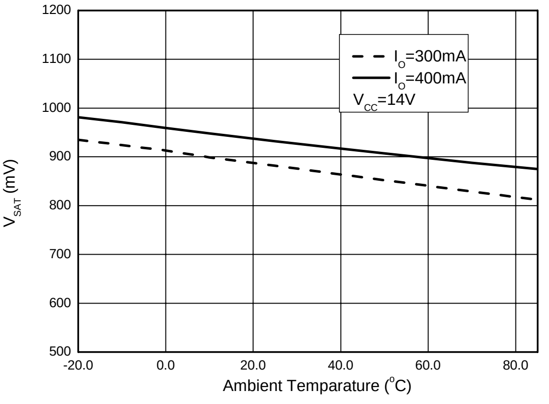


Figure 12. V_{SAT} vs. Ambient Temperature

Application Information

Figure 13 is the typical application circuit for AH211. Usually, there are three wires for fan connection: the red is input of power supply; the yellow is the output of FG; the black is the ground. R1 is an external pull-up resister for the use of measuring FG signal from fan. The value of R1 could be decided by the transistor saturation voltage (V_{ON}), sink current (I_{FG}), and pull-up voltage (V_{DD}). The calculation formula is:

$R1=(V_{DD}-V_{ON}) / I_{FG}$

For example:
V_{DD}=5V for TTL level.
If saturation voltage is 0.6V (IC specification) I_{FG}=20mA (≤20mA) , then R1=220Ω ;

If saturation voltage is 0.1V, I_{FG}=1mA (=<20mA) , the value of R1=4.9kΩ

According AH211's specification, if V_{DD}=5V, R1 must be larger than 220Ω

D1 is the reverse protection diode. If the red and black wires reversely connected, the current will flow from the ground via IC and coils L1 and L2 to power supply. Under such circumstances, the IC and coils are easy to be burned out. Therefore, the reverse protection diode D1is necessary. However, D1 will also cause an extra voltage drop on the supply voltage.

C1 is a capacitor to reduce the ripple noise caused by the transient of the output stages. The amplitude of the ripple noise depends on the coil impedance and its characteristics.

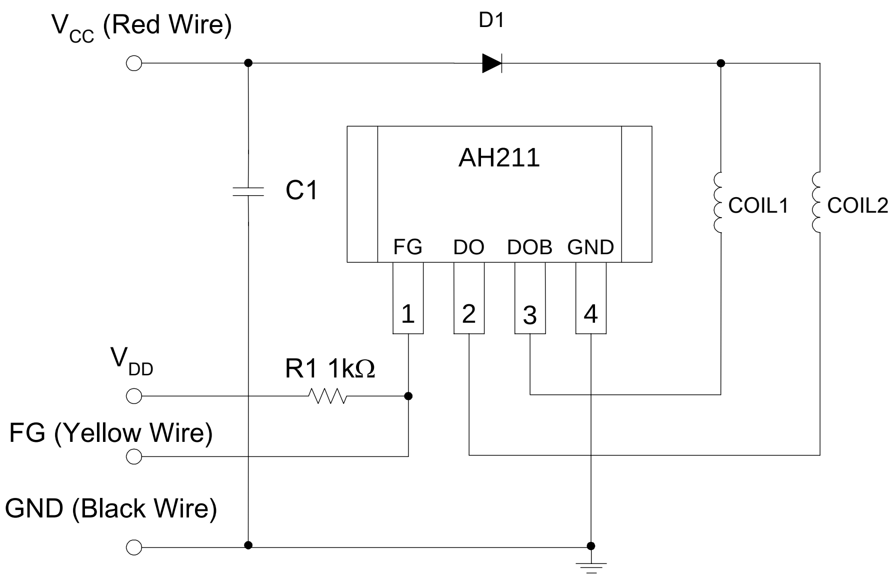
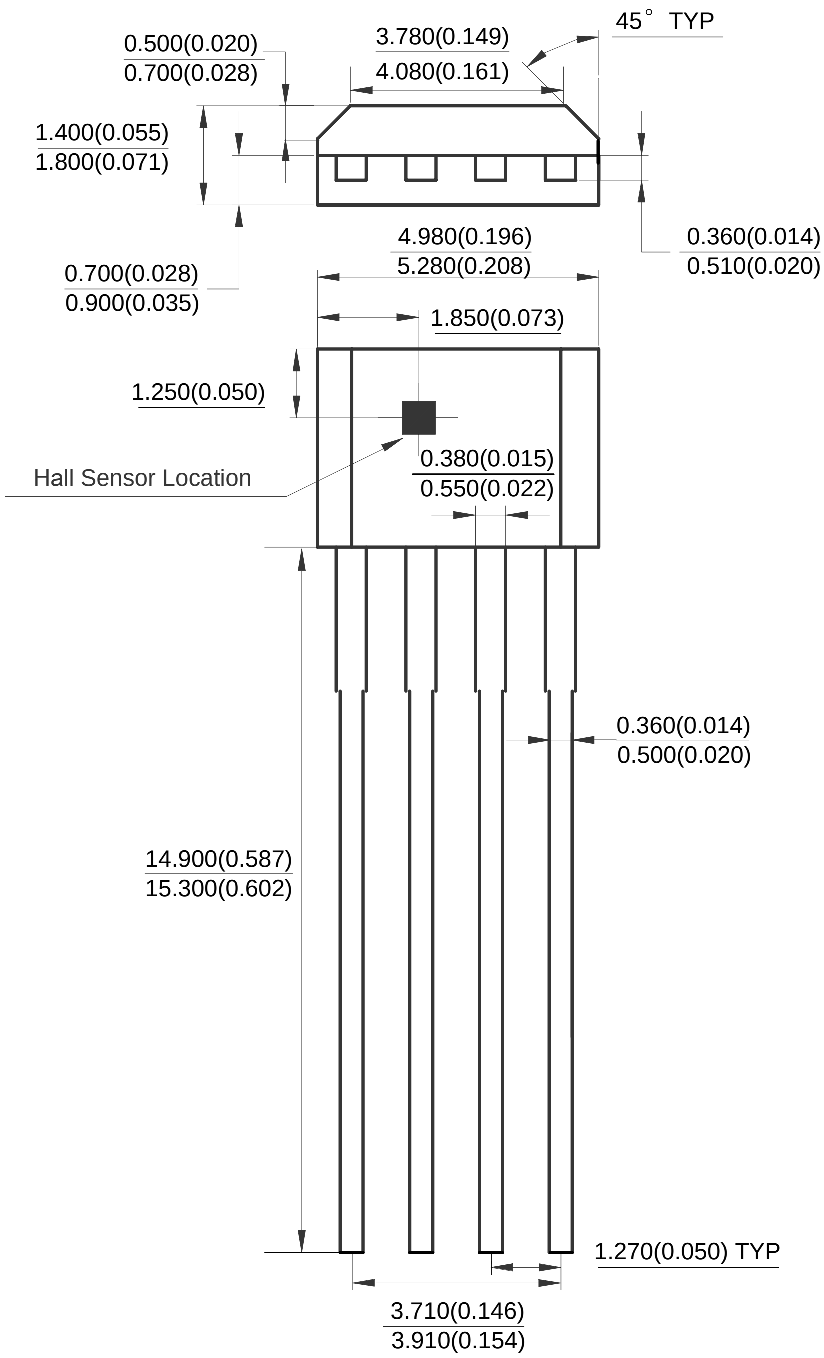


Figure 13. AH211 Typical Application Circuit

Mechanical Dimensions

TO-94 **Unit: mm(inch)**



BCD Semiconductor Manufacturing Limited

http://www.bcdsemi.com

IMPORTANT NOTICE

MAIN SITE

BCD Semiconductor Manufacturing Limited
- Wafer Fab
Shanghai SIM-BCD Semiconductor Manufacturing Limited
800, Yi Shan Road, Shanghai 200233, China
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

BCD Semiconductor Manufacturing Limited
- IC Design Group
Advanced Analog Circuits (Shanghai) Corporation
8F, Zone B, 900, Yi Shan Road, Shanghai 200233, China
Tel: +86-21-6495 9539, Fax: +86-21-6485 9673

REGIONAL SALES OFFICE

Shenzhen Office
Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd. Shenzhen Office
Advanced Analog Circuits (Shanghai) Corporation Shenzhen Office
Room E, 5F, Noble Center, No.1006, 3rd Fuzhong Road, Futian District, Shenzhen 518026, China
Tel: +86-755-8826 7951
Fax: +86-755-8826 7865

Taiwan Office
BCD Semiconductor (Taiwan) Company Limited
4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei, Taiwan
Tel: +886-2-2656 2808
Fax: +886-2-2656 2806

USA Office
BCD Semiconductor Corporation
30920 Huntwood Ave. Hayward, CA 94544, U.S.A
Tel : +1-510-324-2988
Fax: +1-510-324-2788