# FS220

2-PHASE HIGH VOLTAGE DC MOTOR DRIVE IC

GENERAL DESCRIPTION

The FS220, a 1-chip composed of hall sensor and output coil drivers, applied to a 2-phase DC motor. The high sensitivity of Hall effect sensor is suitable for motors from mini-type CPU coolers to blowers and DC fans. Typical operation current is 0.3A and operating voltage range is from 3.5V ~ 28V.

Using few external components, FS220, a high performance integrated IC, is designed for a single-phase DC motor circuit.   The circuit diagram of the typical application example is as below.

FEATURES

· 1 chip hall sensor/drivers

· Wide operating voltage range: 3.5V~28V

· Output sink current up to 0.3A

· Low quiescent supply current under 5mA

· Package : TO-92SP-4

TO-92SP-4
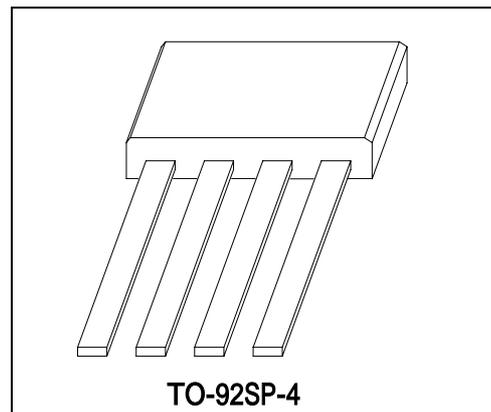
TYPICAL APPLICATION CIRCUIT
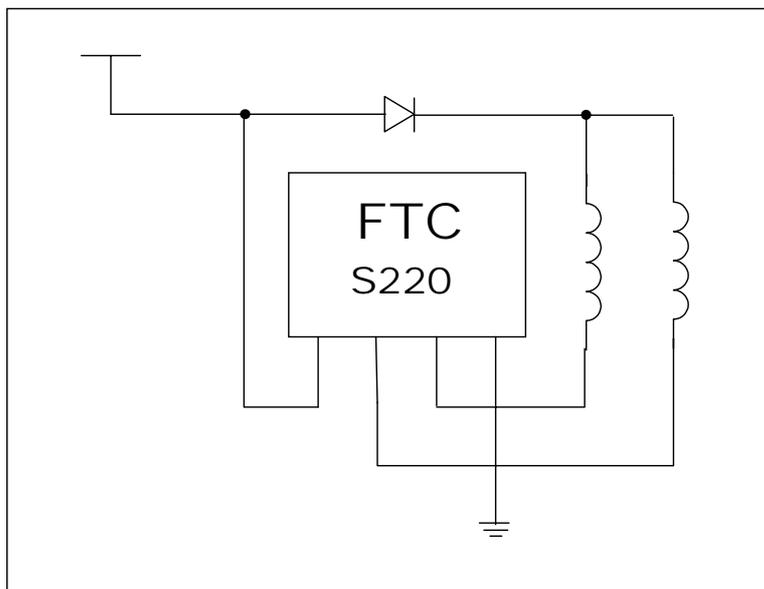
FUNCTIONAL BLOCK DIAGRAM

MARK VIEW

F T C
S 220□□□

① ② ③ ④
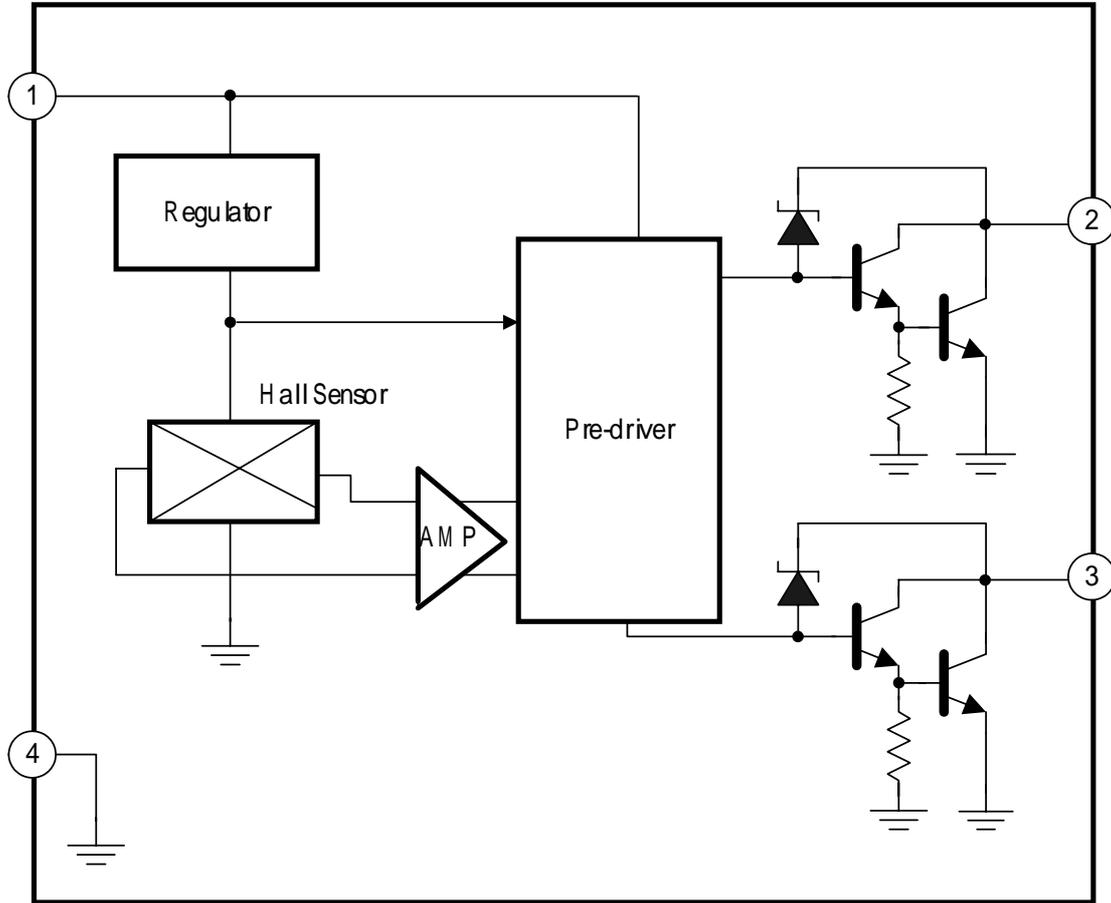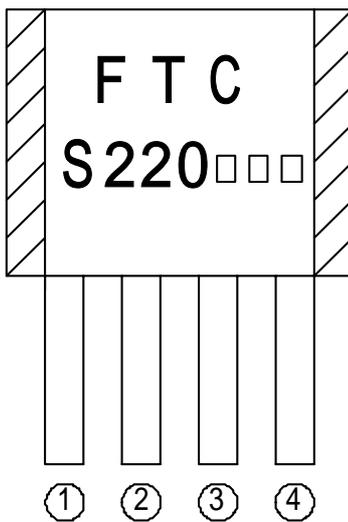
PIN DESCRIPTION

NAME	NO.	STATUS	DESCRIPTION
VCC	1	P	IC Power Supply
NO	2	O	Coil driver output It is low state during the N magnetic field.
SO	3	O	Coil driver output It is low state during the S magnetic field.
GND	4	P	IC Ground

FS220

ABSOLUTE MAXIMUM RATINGS

NO/SO Pin Voltage -- 45V

VCC Pin Voltage -- 30V

Peak Sink Current (Io)

        Hold Current-- 600mA

        Continuous Current --- 350mA

Peak Reverse Current (I_R) --- 100mA

Power Dissipation

      Ta=25 --- 850mW

      Ta=85 --- 450mW

Thermal Resistance

    Θ_{ja}= -- 0.15 /mW

Operating Temperature Range --- -20°C 85°C

Storage Temperature Range -- -65°C 150°C

Junction Temperature --- +150°C

Lead Temperature (Soldering, 10 sec) --------------------------------------- +230°C

Soldering Condition

FS220
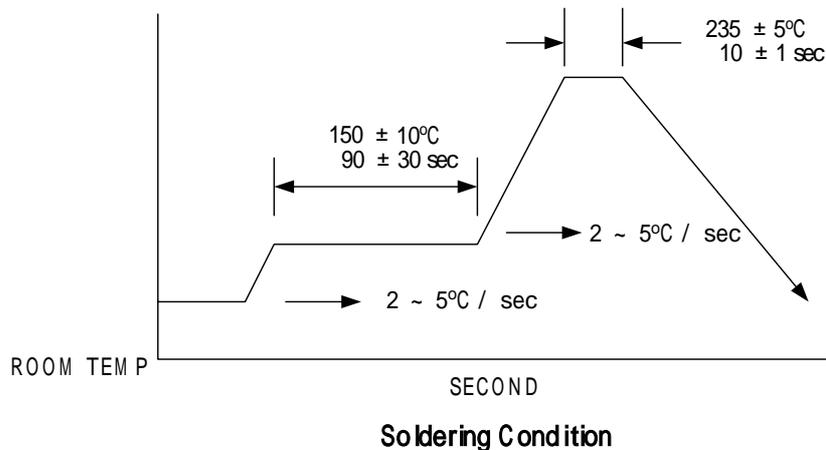
DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Minimum Operating Voltage	V_{CC}	No use pin is open (Fig1)		3.5		V
Maximum Operating Voltage	V_{CC}	I_{CP} 10mA No use pin is open (Fig1)		28.0		V
Quiescent Supply current	I_{CC}	No use pin is open V_{CP} : 4.0V 30V (Fig1)	2.0		6.0	mA
NO/SO Saturation Voltage	V_{SAT}	Io = 300mA (Fig1)			1.5	V
Note: Fig1 The IC output state is under N magnetic field.						

AC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Rise time	(t_r)	RL=100 (5w) CL=20pF (Fig1)			10	uS
Fall time	(t_f)	RL=100 (5w) CL=20pF (Fig1)			300	nS

MAGNETIC CHARACTERISTICS

FS220-A	Ta=-20 85		
PARAMETER	MIN	MAX	UNIT
Bop	+5	+65	G
Brp	-65	-5	G
Bhys	10	130	

FS220-B	Ta=-20 85		
PARAMETER	MIN	MAX	UNIT
Bop		+95	G
Brp	-95		G
Bhys		190	

V_{NO} V_{SO}

(-95   ,   +95)   (-95   ,   +95)

NO   PIN   SO   PIN

TEST CIRCUITS:

$R_{L1} = R_{L2} = 820$ ohm
$C_{L1} = C_{L2} = 20$ pF
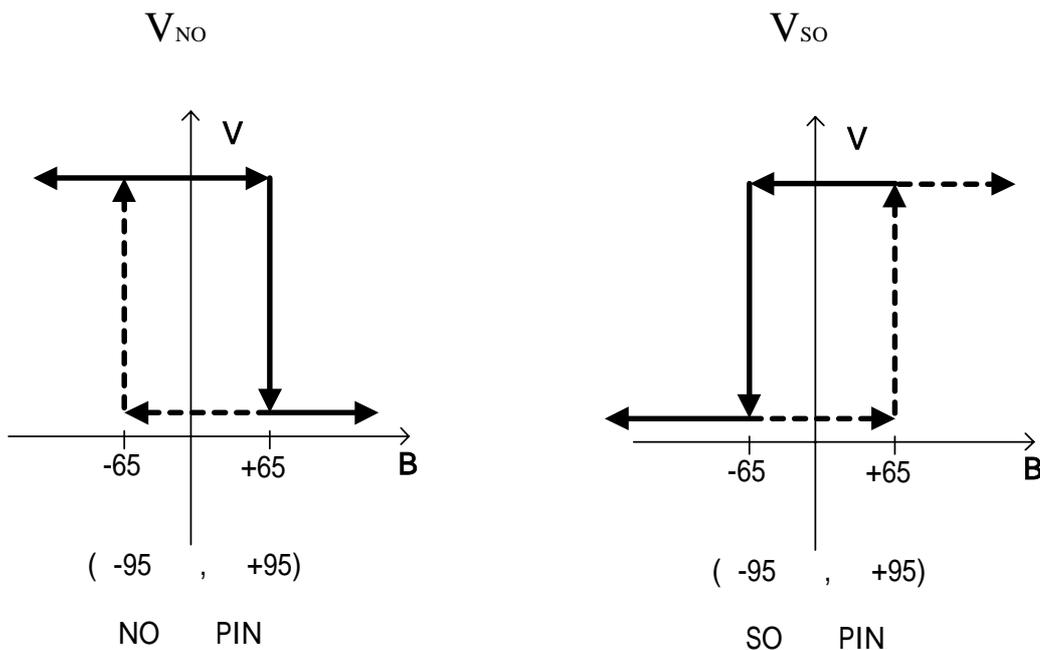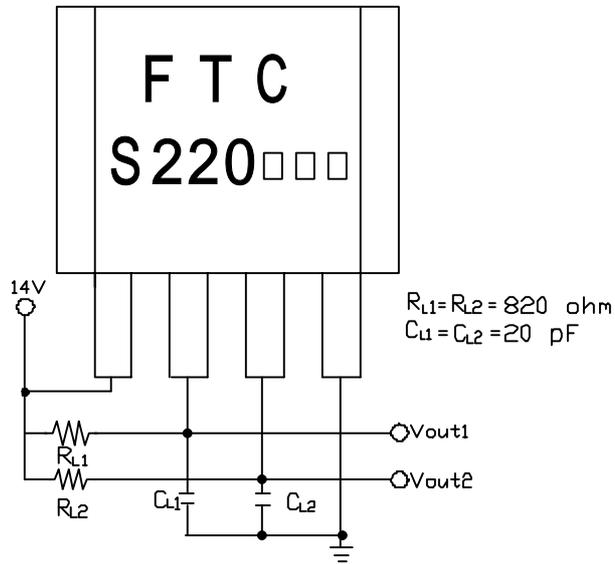
Fig 1

TYPICAL CHARACTERISTICS
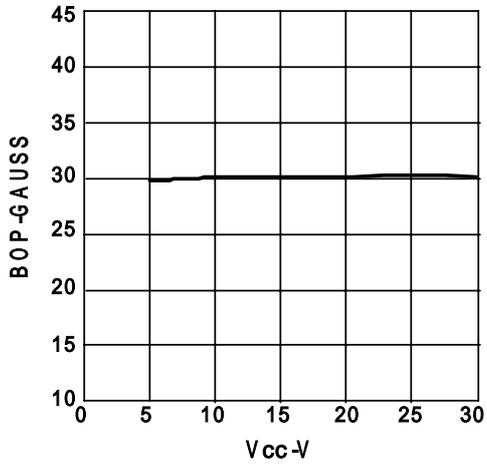

Figure 1
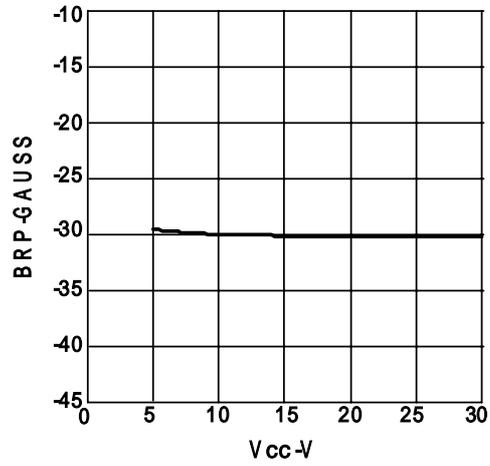
Figure 2
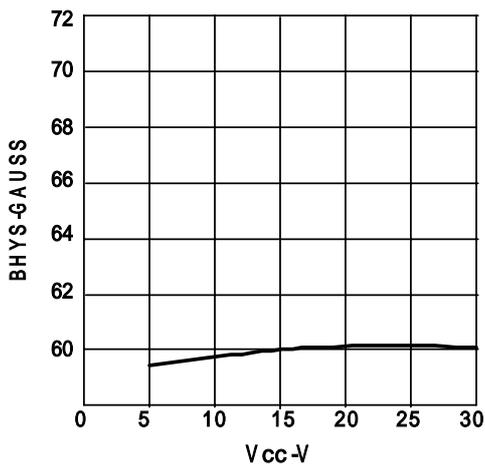

Figure 3
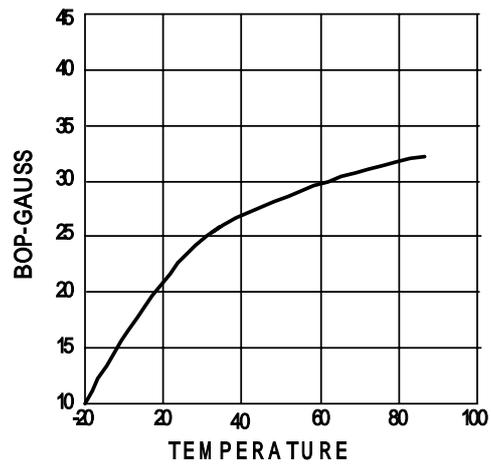
Figure 4
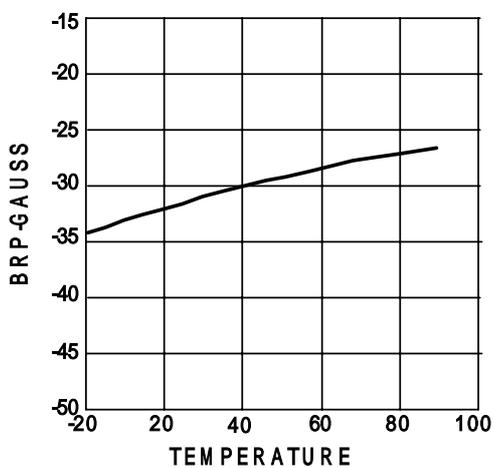
Figure 5
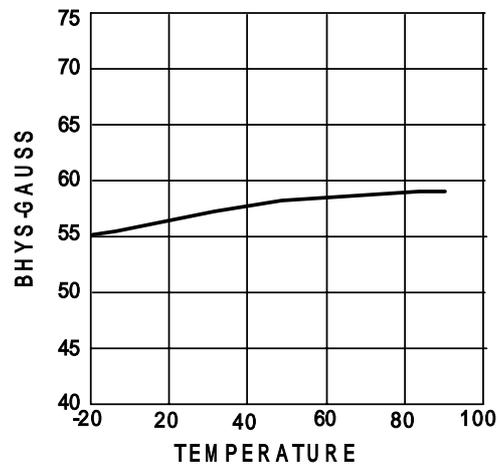
Figure 6

FUNCTION DESCRIPTIONS

HALL SENSOR LOCATION

The Fig 2 is the hall sensor location, where marks the IC number. The best sensitivity, which can be intensified as much as possible, depends on the vertical distance and position between magnetic pole and the hall sensor (Fig 3). For the single-phase motor, this design is very important.


		UNIT
X	1.75	mm
Y	1.35	mm
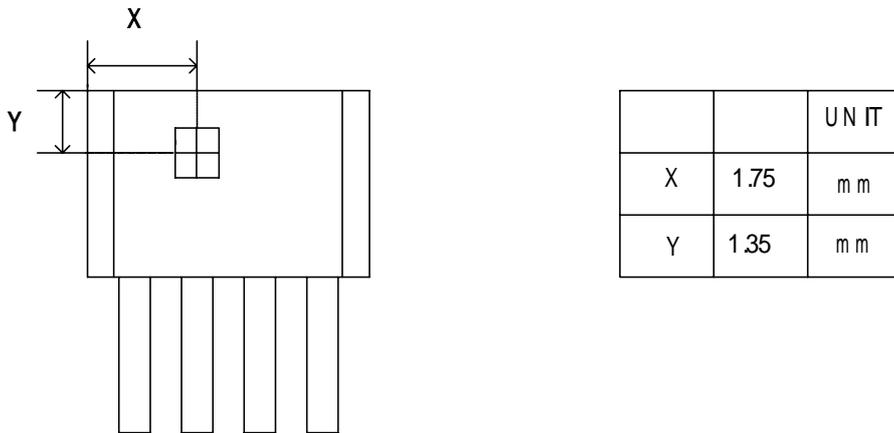
Fig 2 FS220 Hall Sensor Location


d1: hall sensor to case is 0.52mm
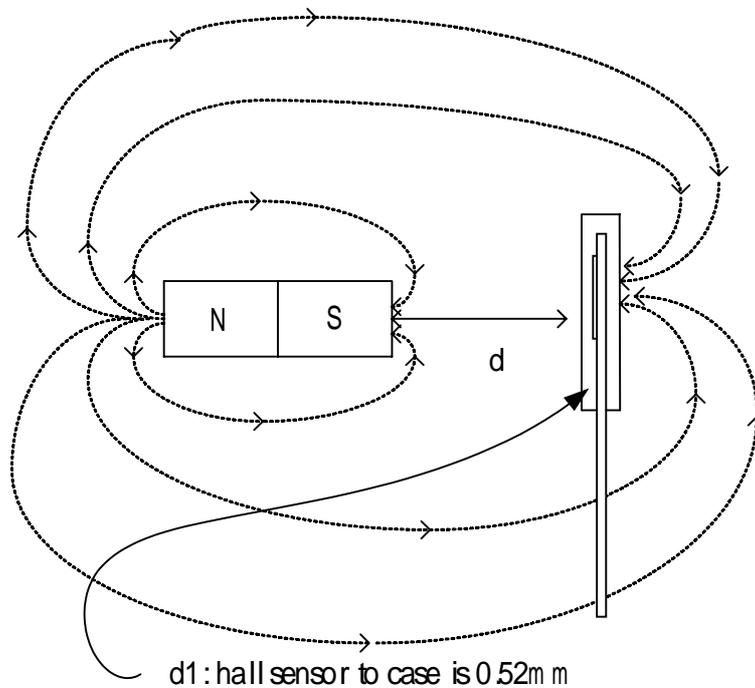
Fig 3 Magnetic Distribution and Z-axis position

DARLINGTON-PAIR TRANSISTOR OUTPUT

The figure 4 is the circuit diagram of Darlington-pair transistor.   Under the heavy current loading, the power loss of the high saturation voltage can be calculated into the following formula:

$$Pc= (V_{BEQ1}+V_{CE(SAT)Q2}) * I_o$$

According to the IC package and the curve of the power loss, the Pc should be applied to and within the safety value.

45V is the voltage of Zener breakdown diode.   However, if the voltage, excluding that of the

power supply, is more than 45V under the long-time operation, the diode will be destroyed.
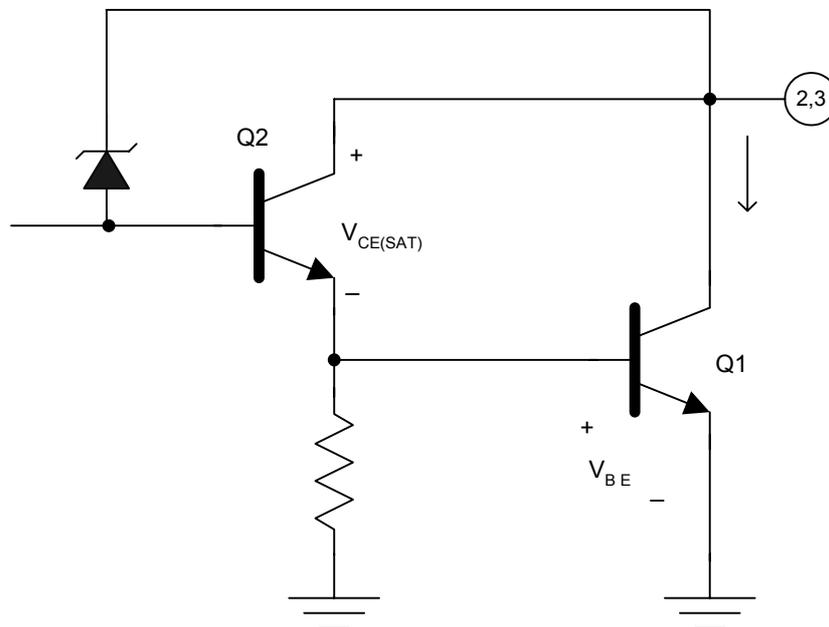
FIG. 4 Darlington-pair Transistor Circuits

APPLICATION NOTE

The Example of Typical Application Circuit

Fig 5 is the example of typical application circuit. The red, yellow, and black wires are the input points of the motor system: red, the input of power supply; yellow, the output of FG; black, the ground signal. R_C is an external pull-up resistance for the use of measuring FG signal. In view of the design, the value of R_C could be decided by the transistor saturation voltage (V_{ON}), sink current (I_C), and off-level voltage (V_C).

The formula is: $R_C = \dfrac{V_C - V_{ON}}{I_C}$

For example:

V_C = +5V for TTL level.

I_C = 10mA at 0.2V saturation voltage

The safety value of R_C = 470

D1 is the reverse protection diode. As if the red and black wires reversely connect with the power source, the current will flow through the ground via IC and coils L1 and L2 to power supply. Under such kind of circumstances, the IC and coils are easy to be burned out. Therefore, D1, the reverse protection diode, is necessary for the design.   However, D1 will also cause an extra voltage drop on the supply voltage.

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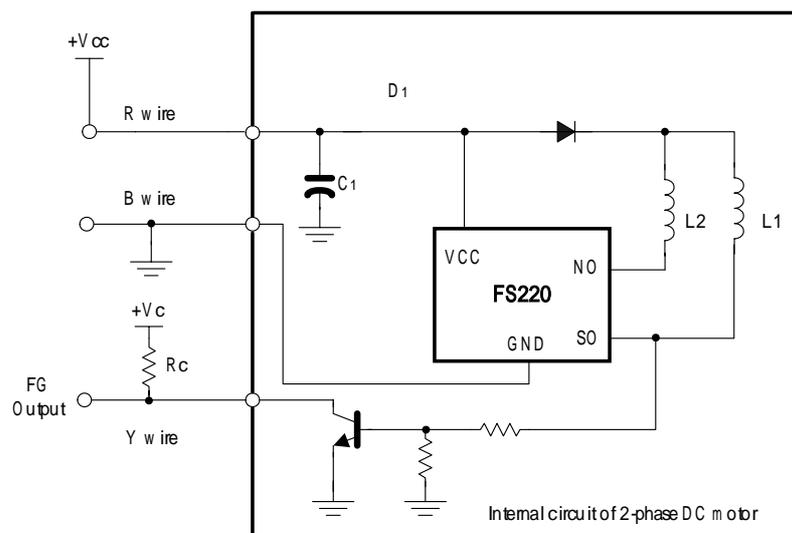

Fig 5 Application Circuit

PACKAGE OUTLINE

5.22±0.05
(0.206±0.002)

2.3 deg

2-0.3C
(2-0.012C)

2.5 deg

1.55±0.05
(0.061±0.002)

4.2±0.1
(0.165±0.04)

0.73±0.03
(0.029±0.0012)

3.65±0.05
(0.144±0.002)

0.457±0.025
(0.018±0.001)

15±0.3

1.27±0.025
(0.05±0.001)

0.381±0.025
(0.015±0.001)

mm
(inch)

0.381±0.013
(0.015±0.0005)

FS220
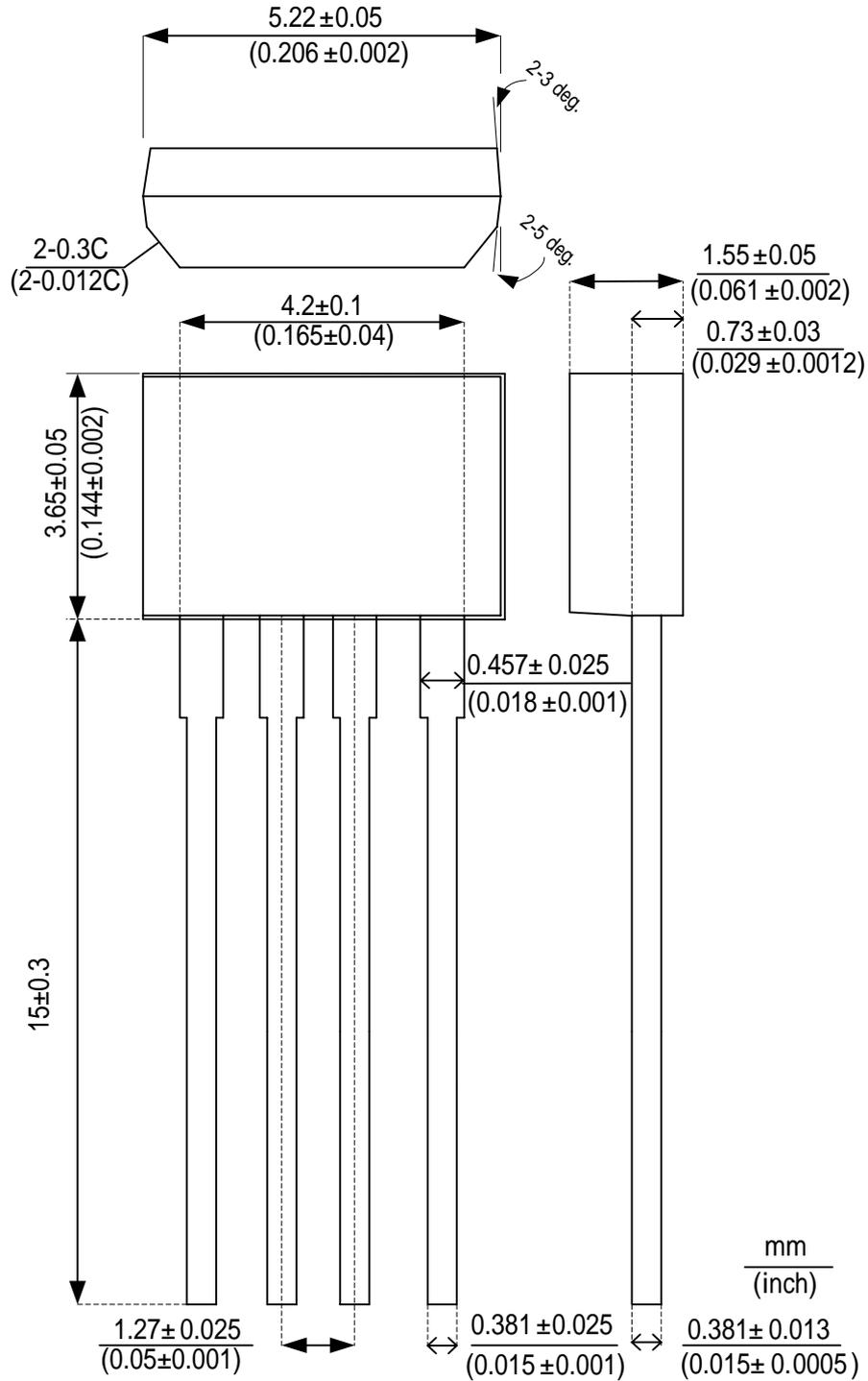
PACKING SPECIFICATIONS

BAG & BOX DIMENSION

BAG
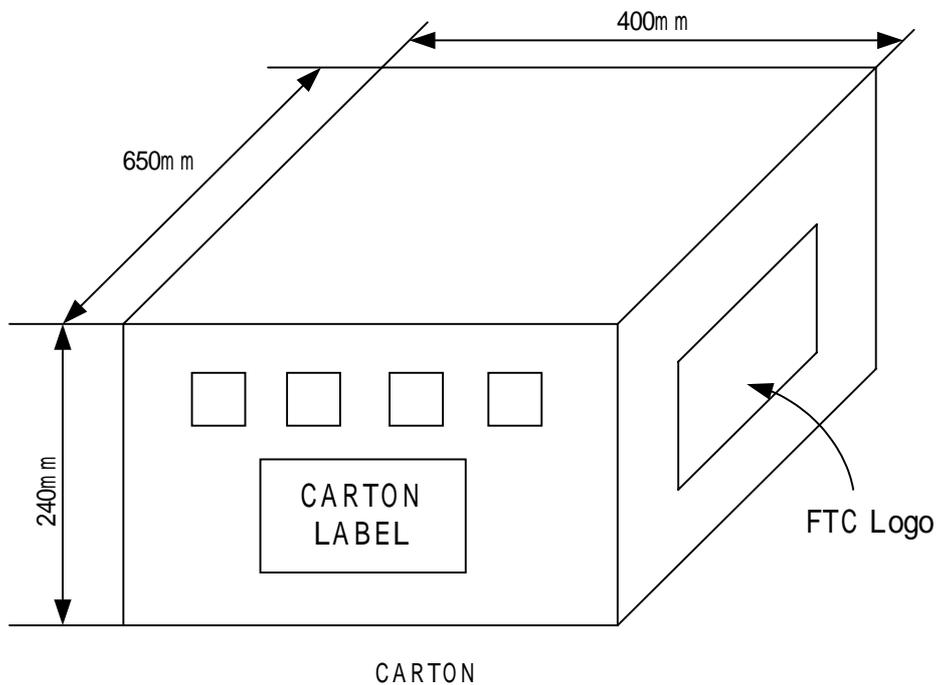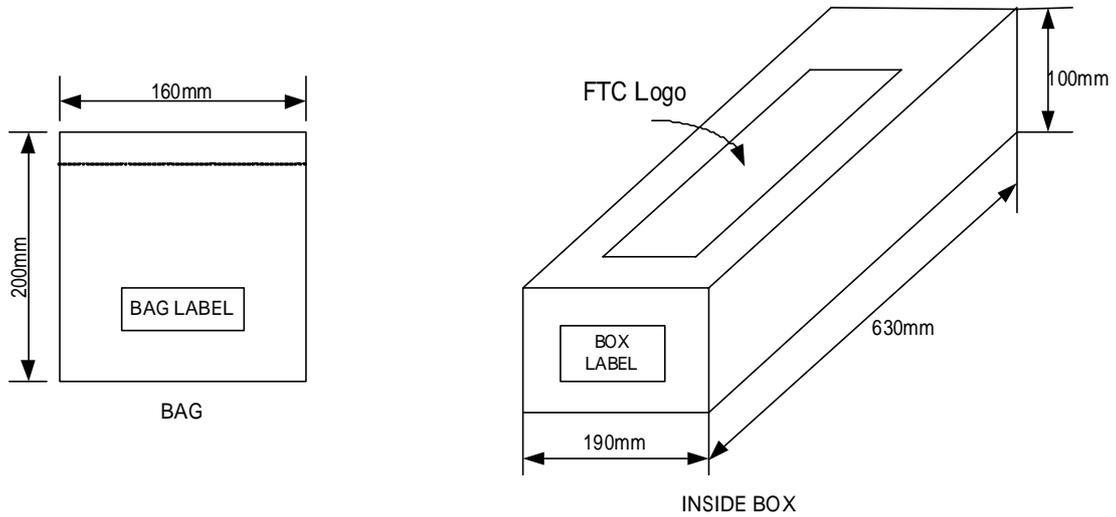
INSIDE BOX

CARTON

PACKING QUANTITY SPECIFICATIONS

1000 EA/1 BAG

25 BAGS/1 INSIDE BOX

4 INSIDE BOXES/1 CARTON

LABEL SPECIFICATIONS

70mm

36mm

```
Device Type :  FS220-B
Lot No. :   XXXXXXXX (D/C:XX)
Qty :    1,000 EA
Marking Type : INK
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BAG LABEL

102mm

74mm

Feeling Technology Corp.

Device Type	FS220-B	Total Qty	25,000
Lot No.	XXXXXXXX	Date Code	3C
PKG Type	SIP-4L	OP No.	022
Marking Type	INK	QC	
Packing Date	02/12/2003		
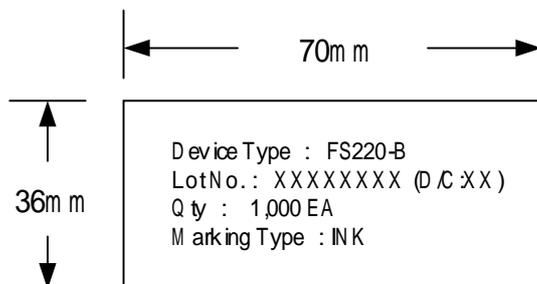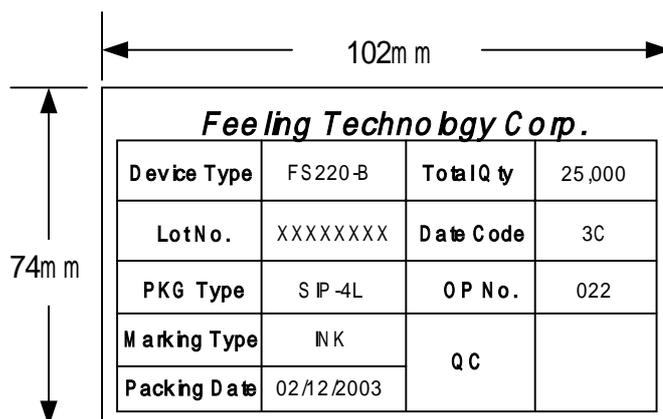
INSIDE BOX & CARTON LABEL

ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FS220-A	-20 ~ +85	TO-92SP-4	±65G (B)
FS220-B	-20 ~ +85	TO-92SP-4	±95G (B)