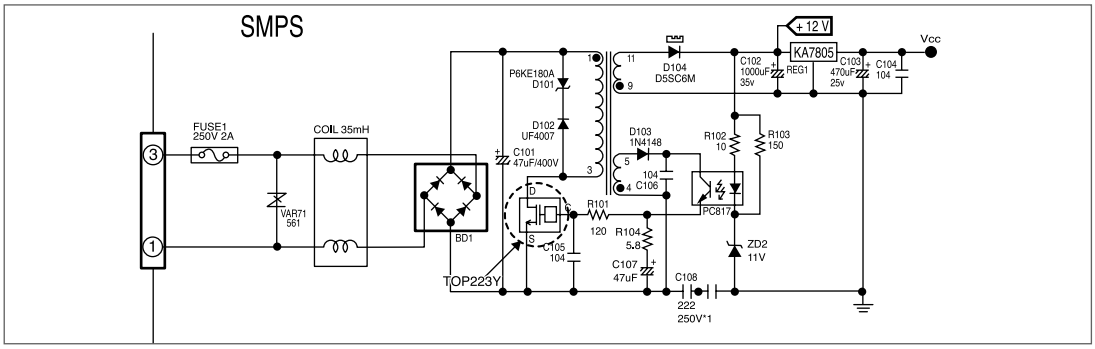
10. Circuit Descriptions

Circuit Descriptions

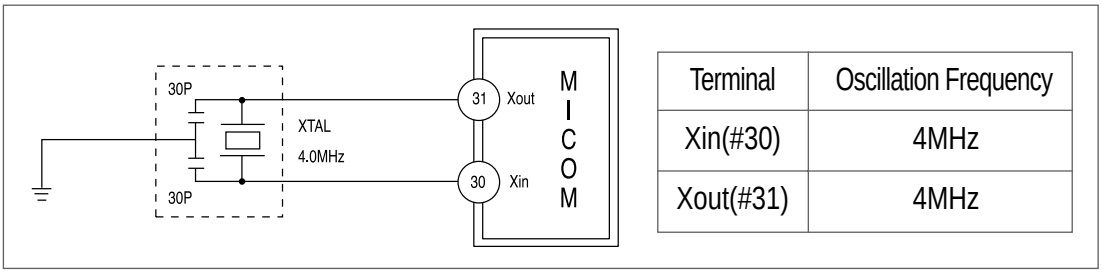
10-1) Source Power Circuit



This circuit shows SMPS(Switch Mode Power Supply) which converts AC input voltage (230V, 50Hz) to a high DC voltage (about 320V). The input AC source power is converted to DC through a wave rectifier (BD1) and the converted DC power will generate a constant waveform on the switching transformer using a high speed (100KHz) switching motion of TOP223Y. The D104 will rectify the generated voltage and transform into a steady 12V DC source power used for the digital display panel and relays. The regulator (KA7805) finally transforms into 5V DC source power for the control board and sensor's circuits.

Caution) Be careful to handle this circuit due to high voltages (AC115V, DC170V)

10-2) Oscillator Circuit

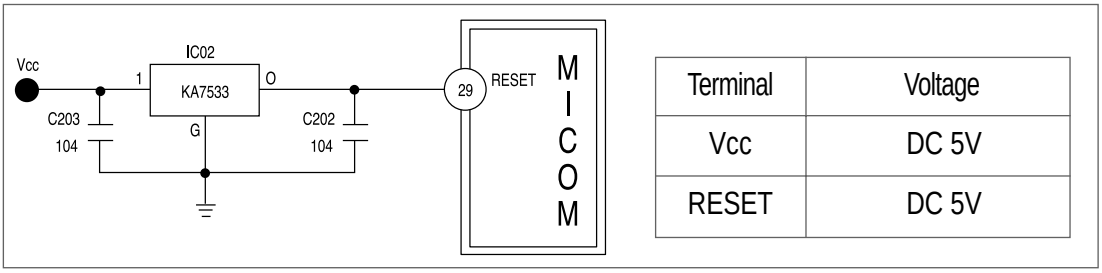


Terminal	Oscillation Frequency
Xin(#30)	4MHz
Xout(#31)	4MHz

This is oscillator circuit to generate synchronous clocks used to calculate the time for the microprocessor operation.

Note) If the specification of a resonator changes, micro-processor can not work properly.

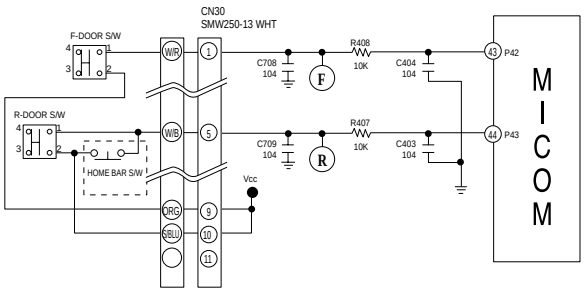
10-3) Reset Circuit



Terminal	Voltage
Vcc	DC 5V
RESET	DC 5V

The reset circuit is to initialize the values RAM & other sectors of micro-processor. When the power is engaged initially, the reset voltage becomes "Low," and it keeps "High" in the normal operation.

10-4) Door S/W Sensing Circuit



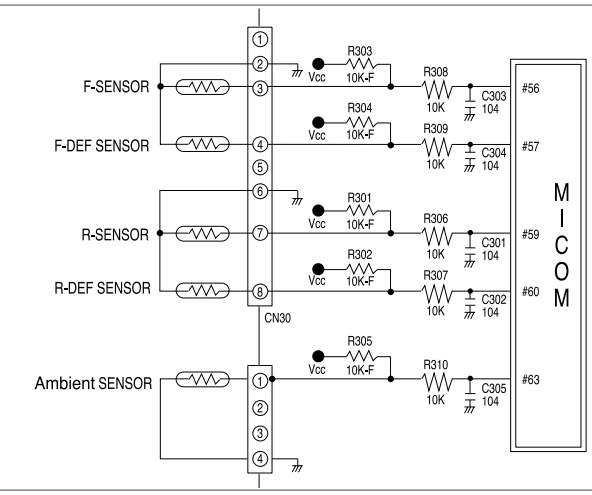
Terminal	Operation	Volt(state)
Freezer (MICOM43PORT)	DOOR OPEN	0V (LOW)
	DOOR CLOSE	5V (HIGH)
Ref. (MICOM44PORT)	DOOR OPEN	0V (LOW)
	DOOR CLOSE	5V (HIGH)

1) F-Room door open is picked up based on the state (5V/0V) of the MICOM No.43 Port.
When the F-Room door opens, it becomes short between the Door S/W 1 &2.And,5V is supplied in the following order. CN30 No.⑨ → F-Door S/W → CN30 No.① → R408(1 0K)→MICOM 43 PORT
When the state of MICOM 43 PORT is 0V, the door is picked up as closed. When it is 5V, the door is considered to be open.

2) R-Room door open is picked up based on the state (5V/0V) of the MICOM No.44 Port.
When the R-Room door opens, it becomes short between the Door S/W 1 &2.And,5Vis supplied in the following order. CN30 No.⑩ → R-Door S/W → CN30 No.⑤ → R407(1 0K)→MICOM 44 PORT
When the state of MICOM 44 PORT is 0V, the door is picked up as closed. When it is 5V, the door is considered to be open.

3) When door open is detected, the MICOM have the relevant Fan Motor stop and the relevant Room Lamp light up. Depending on the state of Door Open/Close, there are following operations; Lamp On/Off, Fan Motor On/Off and Door open alarm. So, check relevant items upon A/S.

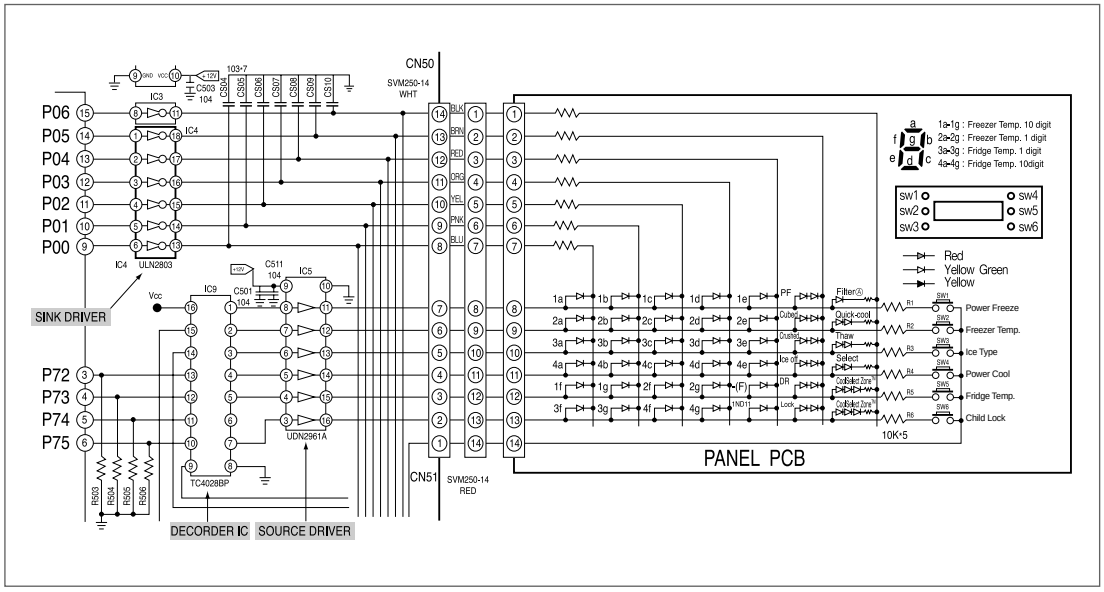
10-5) Temperature Sensing Circuit



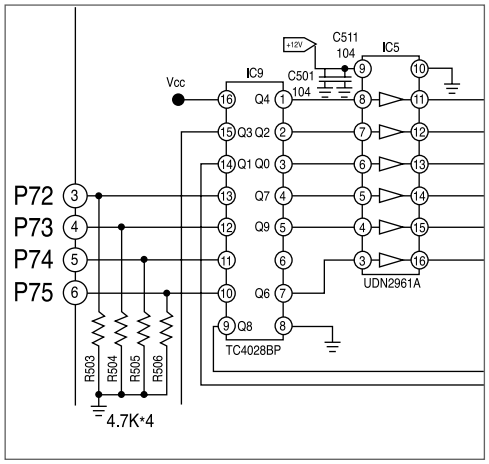
# of terminal in MICOM	Remark
PIN #56 (F-SENSOR)	Micom terminal voltage may change according to temp.
PIN #57 (F-DEF-SENSOR)	
PIN #59 (R-SENSOR)	
PIN #60 (R-DEF-SENSOR)	
PIN #63 (EXT-SENSOR)	

1) A thermistor with a negative temperature coefficient (NTC) is used for a temperature sensor.
2) Resistors, R 306 ~ R310 and capacitors, C 301 ~ C 305 are used for a noise protection purpose.
3) For the F-sensor, the input voltage into the micro processor (MICOM), VF is calculated by (Rth x Vcc)/(R303+ Rth), where Rth is a corresponding resistance to the thermistor's output (See Ref. 6 in Appendix).
4) The F-Def sensor is connected with a bimetal and a temperature sensor is in parallel. In a normal operation of the system, the bimetal is on and 0V is input into the micro-processor. During a defrost cycle, the bimetal will be off from 54˚F, and a divided voltage with R304 enter to the micro-processor to keep sensing the set temperature.

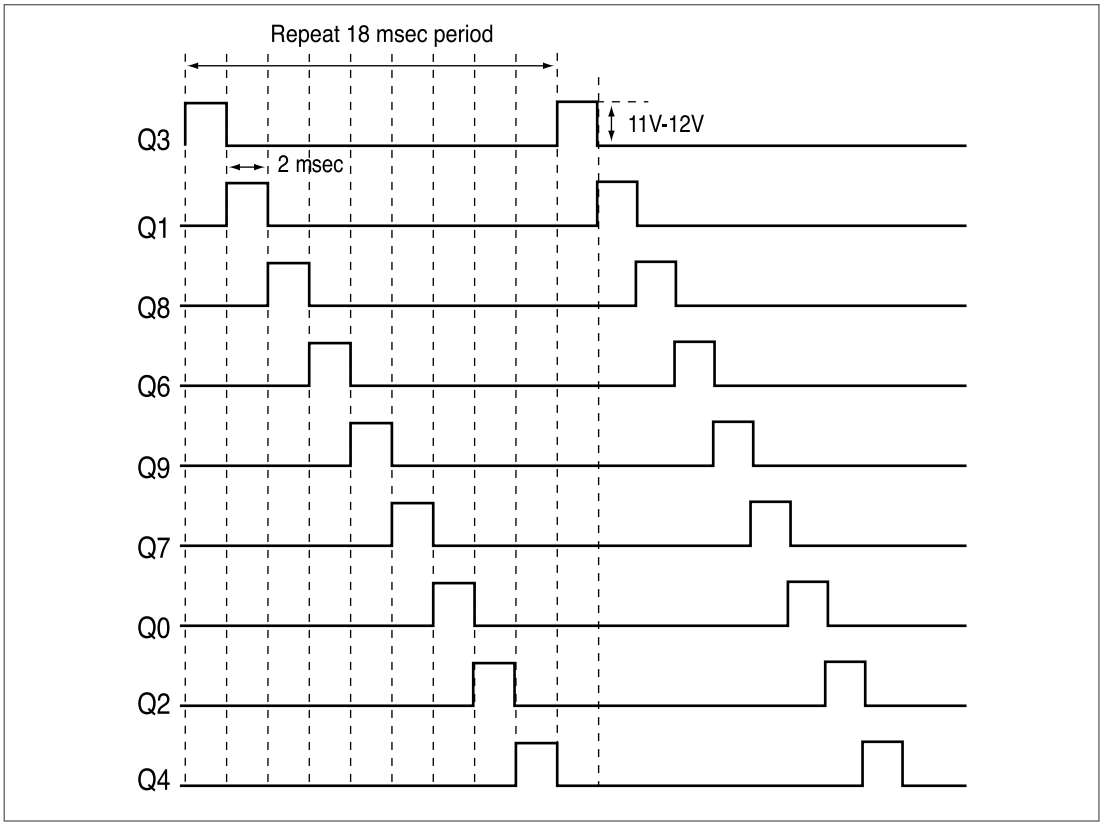
10-6) Key Scan and Display Circuit



1) Key Scan and display operation.



The model uses a decorder IC which 4 inputs and 9 outputs. If the IC 9 decorder (TC4028BP) receivesd signals from MICOM pins (3~6), an output signal per 2 miliseconds comes out from Q3, Q41, Q8, Q6, Q9, Q7, Q0, Q2, and Q4 pin in sequence. This signal enters to a driver IC input terminal of the CoolSelect Zone™ PCB and IC5 (TD 62783AP), then approximate 11V peaks will generate from an output terminal as shown on the next page.



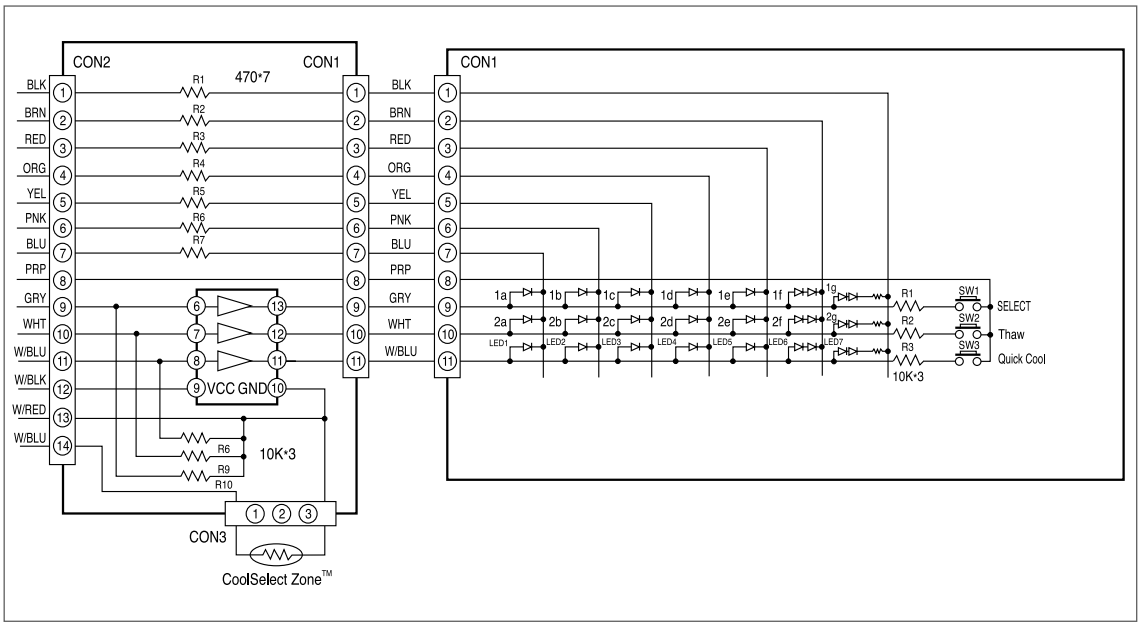
The step signals of DC 11～ 12V will be generated periodically. If a sink signal outputs from IC4, DC 11-12V will be applied to the LED input terminal and sink the LED output terminal to 0V. Therefore, LED will be ON for 2 miliseconds.

2) Key Scan

The 6 step signals, Q6～Q4 are applied to scan the 6 keys (buttons). When SW6 is pressed, the step signal from Q6 will be reduced to 5V and entered to the MICOM, then MICOM will match a corresponding function for SW6 key.

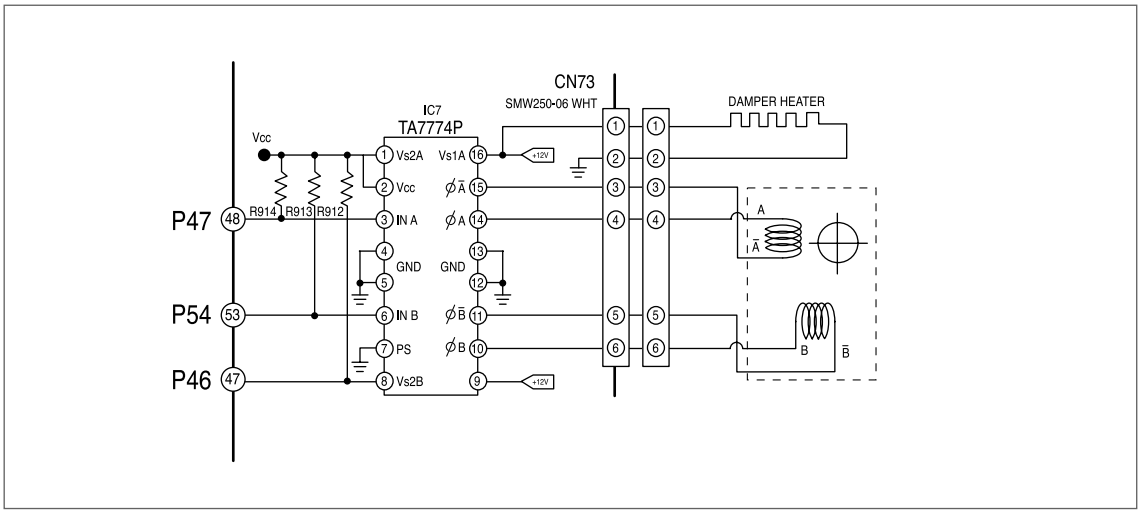
10-7) CoolSelect Zone™ Panel Circuit

1) CoolSelect Zone™ display panel and temperature sensor



1-1) CoolSelect Zone™ is referred to as a storage drawer to implement features of Quick cool, Thaw, and Select (Soft Freeze, Chill, and Cool).
1-2) CoolSelect Zone™ has an additional display panel. Panel LED are off while the doors are closed. When a door is open, micro-processor senses its signal and LEDs will be on.
1-3) The basic operational principle is the same as the key scan process.
1-4) The additional sensor can measure the temperature of CoolSelect Zone™. This sensor enables to control the features of CoolSelect Zone™.

2) Damper drive circuit

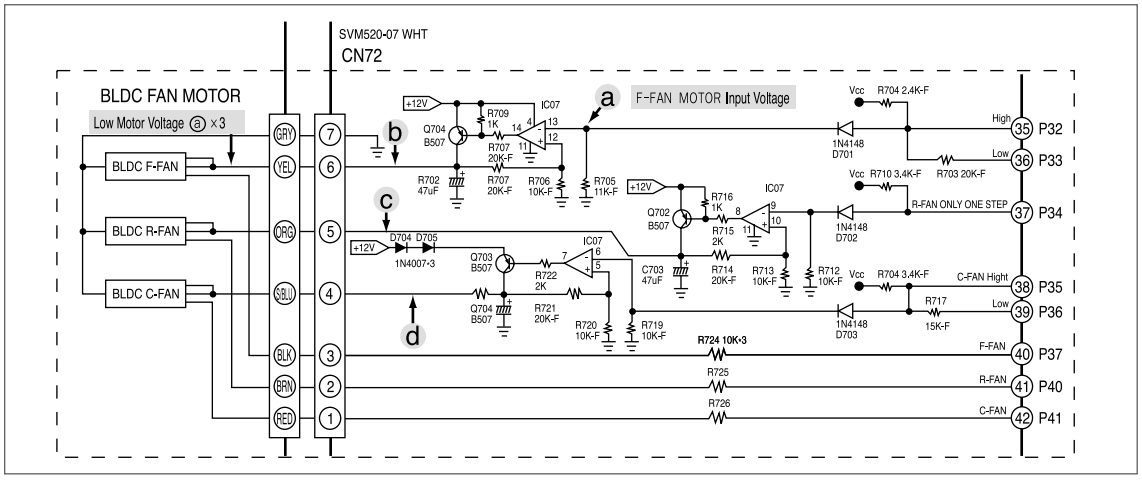


2-1) CoolSelect Zone™ Drawer is controlled by a damper to supply or block cold air. For Quick Cool, the damper will be close. So cold air is supplied only to CoolSelect Zone™ Drawer. For Thaw, the evaporator heater of refrigerator is ON and the damper is controlled by the refrigerator temperature.

2-2) The stepping motor controlled by a Driver IC TA7774P(IC7) operates the damper. The stepping motor uses 4 combined signals to open and close the damper.

Note) To prevent the malfunction from a high humidity, a DC 12V, 1 watt heater is mounted and activated continuously.

10-8) Fan Motor (BLDC) Drive Circuit



1) Motor drive circuit

1-1) This refrigerator adopts a BLDC motor froeduce energy consumption, Motors of the freezer, refrigerator and the machine compartment are composed of the BLDC. For RS2533, R-fan is operated by AC 115V Motor.

1-2) Voltages between high-speed and low-speed

	Voltage of motor			Remark
	Measure b (F-FAN)	Measure C (R-FAN)	Measure d(C-FAN)	In the normal operation, MICOM No. 40, 41 and 42 applies a constant frequency; and MICOM defects the signal to check the failure of motor. (frequency(Hz) × 12 = motor rpm)
High	11.1V	10V	10V	
Low	10V	10V	8.3V	

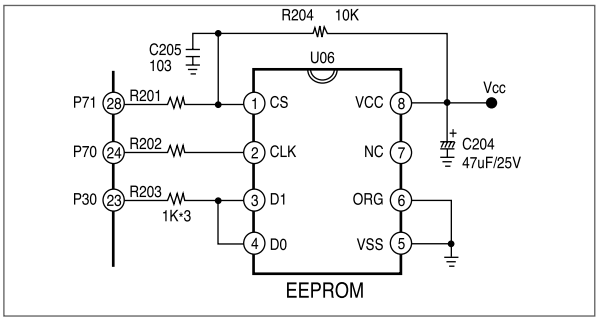
Note) Under the conditions, the fans will be operated in 2 options, such as High and Low mode. Generally, it is operated in the High mode during a day time and in the Low mode at night.

1-3) When the motor rpm is in 600∼700, it will stop automatically and it tries to resume after 10 seconds. If the motor is not working properly after 5 time trials, it will rest for 10 minutes, then try to resume again. This process will be done continuously.

Note) If there is an abnormal situation for the motor, the self-diagnostics will show the corresponding LED segment.

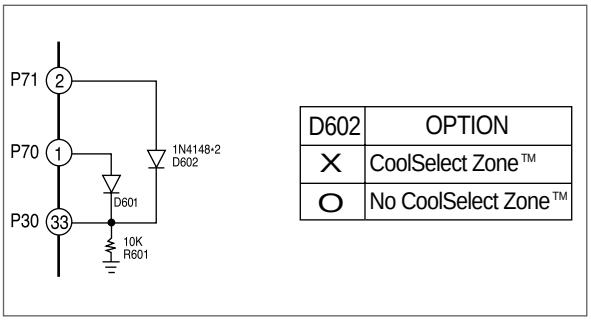
10-9) EEPROM Circuit

EEPROM is semiconductor memory not to be erased. It can be used in the area of unstable electric power.



10-10) Option Circuit

There are a variety of models that have a different function. A different model can set up to use option circuit as shown.



D602	OPTION
X	CoolSelect Zone™
O	No CoolSelect Zone™

10-11) Load Drive Circuit

1) The control of load in the system is accomplished by the main PCB.

2) Most of relays or SSRs can control the compressor, refrigerator/freezer defrost heater, and several option functions.

3) For the compressor, #18 pin of micro processor signals High (5V). This signal enters #5 pin of IC3 and #14 of output terminal which have base and collector functions of IC3 turns on and connects the GND. Relay 73 will be grounded through #14 of IC. Magnetic field will generate so that the second side of RY73 is activated and 115V is supplied to the compressor. On the other hands, if #18 of micro processor turns Low(0V), #5 of IC3, the current of RY 73 relay, and magnetic field will shut down in sequence. A contact point in secondary side of Relay 73 is off. Finally compressor will stop.

4) The principles of other loads is the same as 3) item described.

Note) SSR(Solid State Relay) is a kind of Relay.