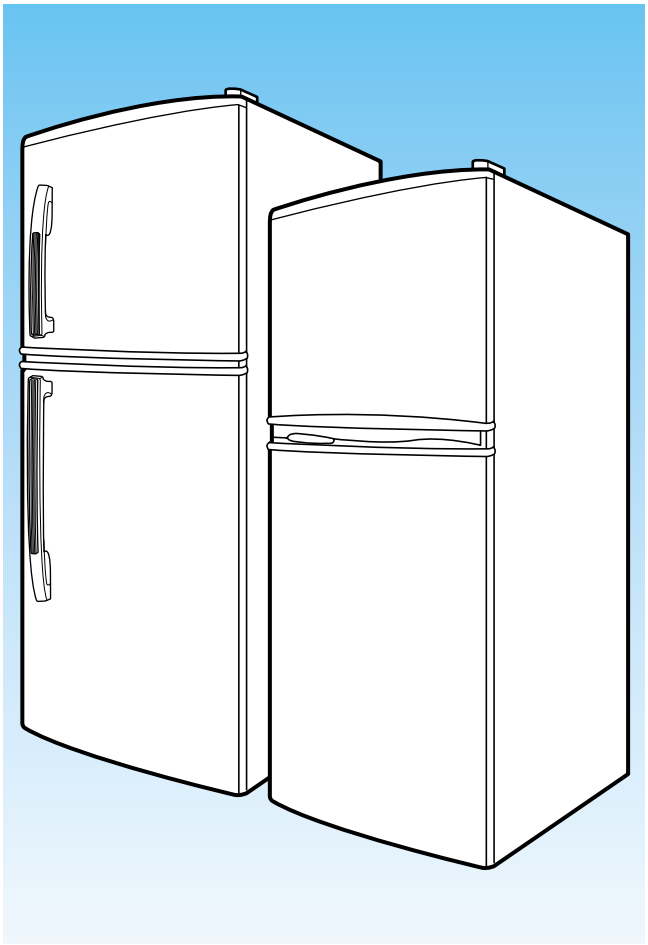
SAMSUNG

Model :RT40MA / MB
RT44MA / MB

CFC FREE GREEN

SERVICE Manual

REFRIGERATOR



CONTENTS

1. Product Specifications

[CFC-FREE]

ITEM		SPECIFICATION	
Model name		RT40MA/MB	RT44MA/MB
Vailable Capacity(cu.ft)	**Freezer**	87(3.1)	87(3.1)
	Refrigerator	260(9.2)	282(10.0)
	Total	347(12.3)	369(13.1)
Net Dimension (WidthxDepthxHeight)		670x640x1660 (670)	670x640x1730 (670)
Rated Voltage & frequency		110~115V/60Hz, 127V/60Hz, 220V/5~60Hz, 230~240V/50	
Rated Power Defrost, Heater		290W/310W	
Type of Refrigerator		forced convection	
Refrigerant		HFC-134a	
Refrigerant Mass		150g	
Freezing Capicity		4 STAR	
Weight (Net/Gross)		59/69(kg)	63/73(kg)

2. Safety warnings

Read all instructions before using this appliance in order to avoid risk of accident or possible damage.

Warning/Caution

Warning	This symbol is intended to alert the user to the possible death or injury.
Caution	This symbol is intended to alert the user to the possible injury or damage.

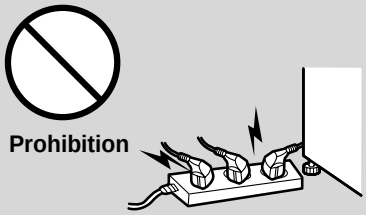
Description of symbols

	Indicates prohibition
	Do not disassemble
	Do not contact
	Follow Adhere the instruction strictly
	Unplug from the electrical outlet
	Earth the appliance to avoid the risk of an electric shock

Warning

Do not plug multiple electrical appliances into the same outlet.

• This may cause abnormal heating or a fire hazard.

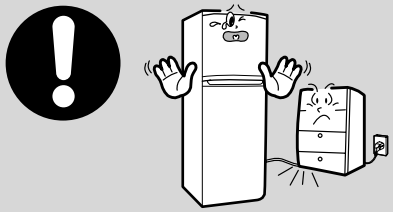


Do not attempt to make repairs yourself.

• This could lead to fire hazard or abnormal operation causing severe personal injury.

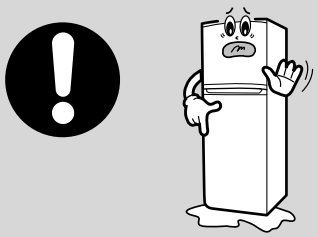
Make sure the power cord is not crushed or damaged.

• Repair immediately all power cords or outlets that have become frayed or otherwise damaged.



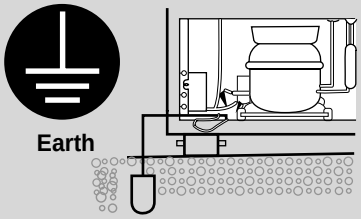
Check the operating environment.

• Do not install the refrigerator in a humid (with condensation) location or on an unstable surface.



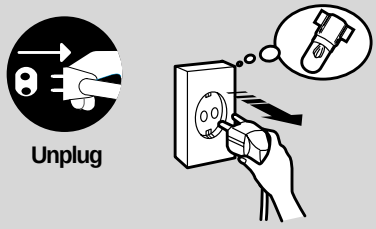
Be sure the earth.

• If earthing is not done, it will cause breakdown & electric shock.



Pull the power plug out for exchanging electrical equipment.

• It may cause electric shock.



Caution

Do not put bottles or kinds of glass in the freezer.

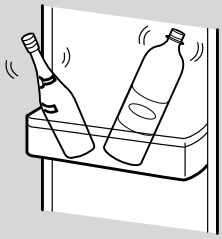
• Freezing of the contents may inflict a wound.

Prohibition

Do not store narrow and lengthy bottles or foods in a small multi-purpose room.

• It may hurt you when refrigerator door is opened and closed resulting in falling stuff down.

Prohibition



Do not store pharmaceutical products, scientific materials, etc, in the refrigerator.

• The products which cotrolled by temperature shall not be stored in the refrigerator.

Prohibition

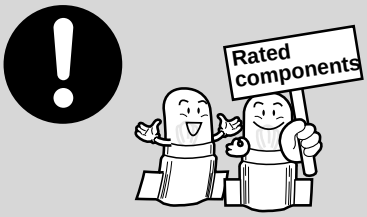
Do not store articles on the product.

• Opening or closing the door may throw down which may inflict a wound.

Prohibition

Use the rated components on the replacement.

• Check the correct model, rated voltage, rated correct, operating temperature and so on.

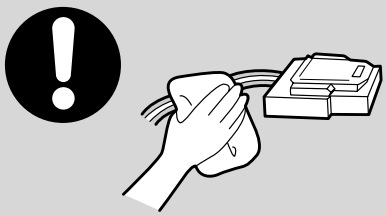


On repair, make sure that the wires such as harness should be bundled tightly.

• Bundle tightly wires in order not to be detached by the external force and then not to be wet.

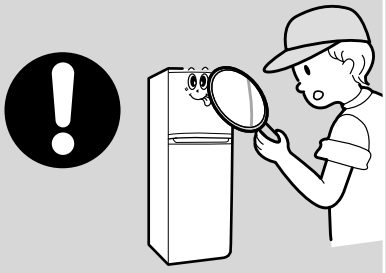
On repair, remove completely dust or other things of housing parts, harness parts, and check parts.

• Cleaning may prevent the possible fire by tracking or short



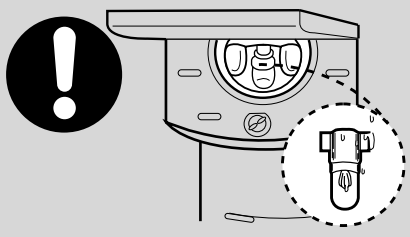
After repair, check the assembled state of components.

• It must be in the same assembled state when compared with the state before disassembly.



Check if there is any trace indicating the permeation of water.

• If there is that kind of trace, change related components or do the necessary treatment such as taping using the insulating tape.



3. Specifications of Electric Components

[CFC-FREE]

ITEM		SPECIFICATION	
Model name		RT40MA/MB	RT44MA/MB
Type		2-Door Freezer/Refrigerator	
Power Source		AC110~115V/60Hz, 127V/60Hz 220V/50~60Hz, 230~240V/50Hz	
Net Capacity (ℓ /cu.ft)	**Freezer**	87	87
	Refrigerator	260	282
	Total	347/12.3	369/13.1
Net Dimension (mm)	**Width**	670	
	Depth(MA)	640(670)	
	Height	1660	1730
Net weight (Kg)		59	63
Refrigerant		R134a (150g)	
Temperature Control		Dial (Resistance)	
Defrosting		Automatic (Start-Finish by PCB)	
Foam insulation	**Cabinet**	Cyclo-Pentane	
	Door	Cyclo-Pentane	
Liner/Door Panel		ABS (SD-0150)	
Accessory Parts	**Door Storage**	2 Guard-Freezer 1 Guard-Egg,1 Guard-Bottle 2 Guard-Variety 1 Guard-Jumbo	
	Inside Storage	1 Base Tray Ice 1 Case Tray Ice 1 Shelf Freezer 1 Vegetable Partition 1 Case Chilled Room 2 Shelf Refrigerator 1 Cover Vegetable 1 Case Vegetable	
	Interior Lamp	Refrigerator (Freezer)	
	Movable Caster	2 (Rear)	
	Angle Adjustment	2 Legs (front)	

[CFC-FREE]

ITEM			STANDARD(MECHANICAL TYPE)		
Model			RT40/44MA/MB		
Power source			110~115V/60Hz	127V/60Hz	220V/50~60Hz
Refrigeration Cycle	Compressor	Model	UK162C-L1U/T3	UK162P-L1U/T3	SK182H-L2U/E02
		Starting type	R.S.C.R		
		Oil charge	FREOL α–15c / 200cc		
	Evaporator		Fin type		
	Condenser		Natural convection type		
	Dryer		Molecular sieve (XH-9, 13g)		
	Capillary tube		ID 0.75 x L3400 (mm)		
Electrical	Thermostat	Refrigerator	PFN-174S-05F (ON:5.5˚C±1.5˚C OFF:+3.0˚C±1.5˚C)		
	Defrost-thermo	Bimetal (OFF/ON)	Rating Voltage/Ampere	AC 250V / 5A	
			Open temperature	ON:-5±3˚C/OFF:12±3˚C	
		Thermal fuse	Rating Voltage/Ampere	AC 250V / 10A	
			Open temperature	77±10˚C	
	Defrost-timer	Type	TMDE714F1	TD-20CSA	
		Defrosting	6hr 40min(60Hz)/8hr(50Hz)		
		Interval	12Min		
	PTC-relay	Model	J531Q33E100M 200-2	J531Q34E220M350-2	
		Resistance	10Ω-2PIN	22Ω-2PIN	
	Overload protector	Model	4TM419 NHBYY-53	4TM308 PHBYY-53	
		Close temp.	69±9˚C	69±9˚C	
		Open temp.	120±5˚C	125±5˚C	
	Capacitor	Running	250VAC/12μF	350VAC/5.0μF	
	Resistor Heater		MORS 1.2W		
	Heater-defrost		290W/45Ω	290W/167Ω	
	Lamp		220V~240V/15W		
	Door-Switch		250V/0.5A, 125V/1.5A		
	Earth screw		BSBN(Brass screw)		

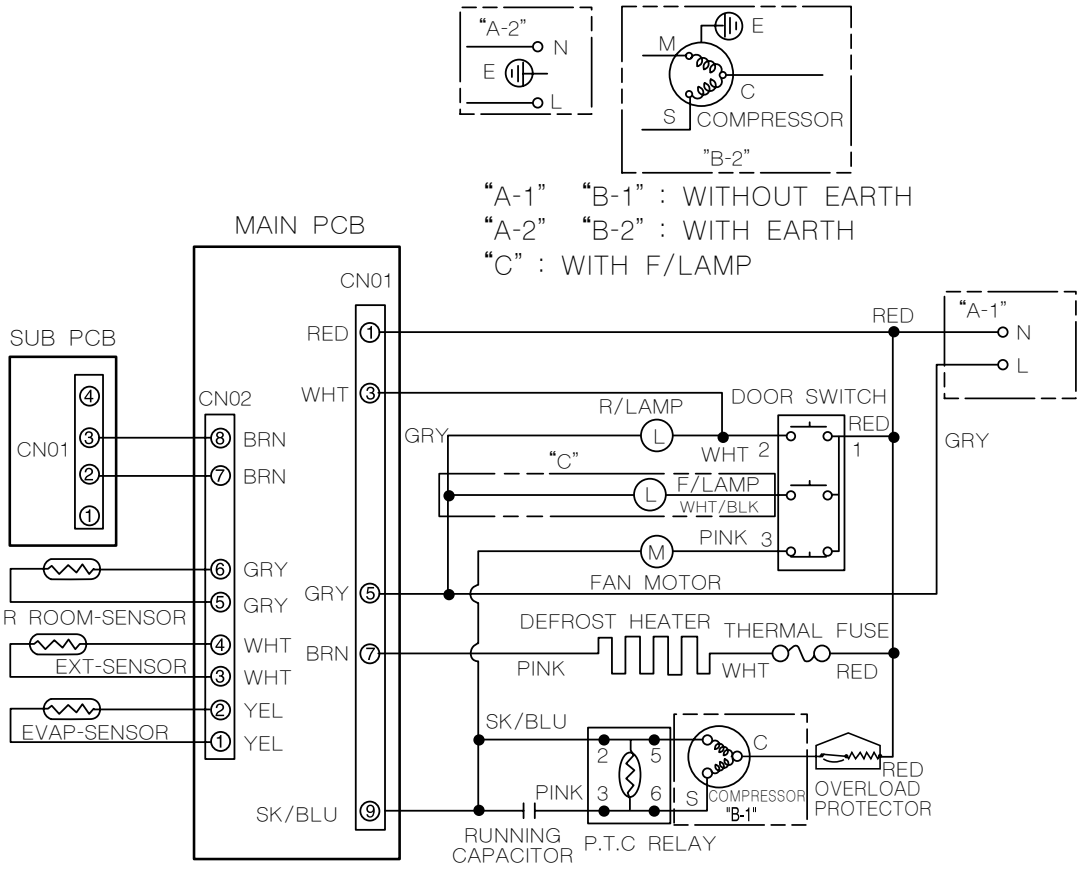
[CFC-FREE]

ITEM			STANDARD(SEMI ELECTRIC TYPE)	
Model			RT40/44MA/MB	
Power source			220V/50Hz	230~240V/50Hz
Refrigeration Cycle	Compressor	Model	MK172QL1U/E01	
		Starting type	R.S.C.R	
		Oil charge	FREOL α–15c / 200cc	
	Evaporator		Fin type	
	Condenser		Natural convection type	
	Dryer		Molecular sieve (XH-9, 13g)	
	Capillary tube		ID 0.75 x L3400 (mm)	
Electrical	Sensor		502AT	
	Defrost-sensor	Sensor	Rating Voltage/Ampere	DC 5V
			Open temperature	ON:-5˚C±3˚C/OFF:+15˚C
		Thermal fuse	Rating Voltage/Ampere	AC 250V / 10A
			Open temperature	77˚C±10˚C
	PTC-relay	Model	J531Q35E330M385-2	
		Resistance	33Ω-2PIN	
	Overload protector	Model	4TM232SHBYY-53	
		Close temp.	69±9˚C	
		Open temp.	135±5˚C	
	Capacitor	Running	350VAC/5.0μF	
	Heater-defrost		290W/167Ω	310W/170Ω
	Lamp		220V~240V/15W	
	Door-Switch		250V/0.5A, 125V/1.5A	
	Earth screw		BSBN(Brass screw)	

4. Electric Circuit Diagram

- Semi Electric Control Type

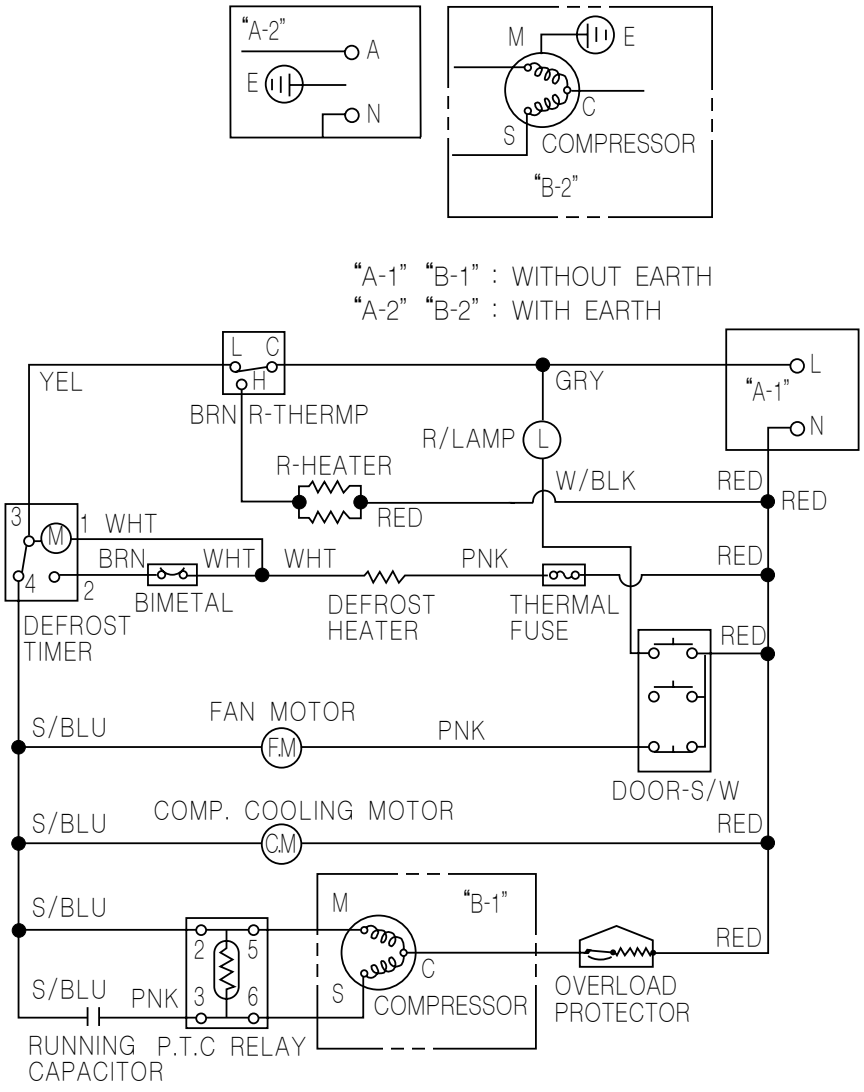
[220V/50Hz, 230~240V/50Hz]-RT40/44



GRY-GRAY
RED-RED
BRN-BROWN
YEL-YELLOW
WHT/BLK-WHITE/BLACK
PINK-PINK
WHT-WHITE
SK/BLU-SKY BLUE
E-EARTH

- Mechanical Type

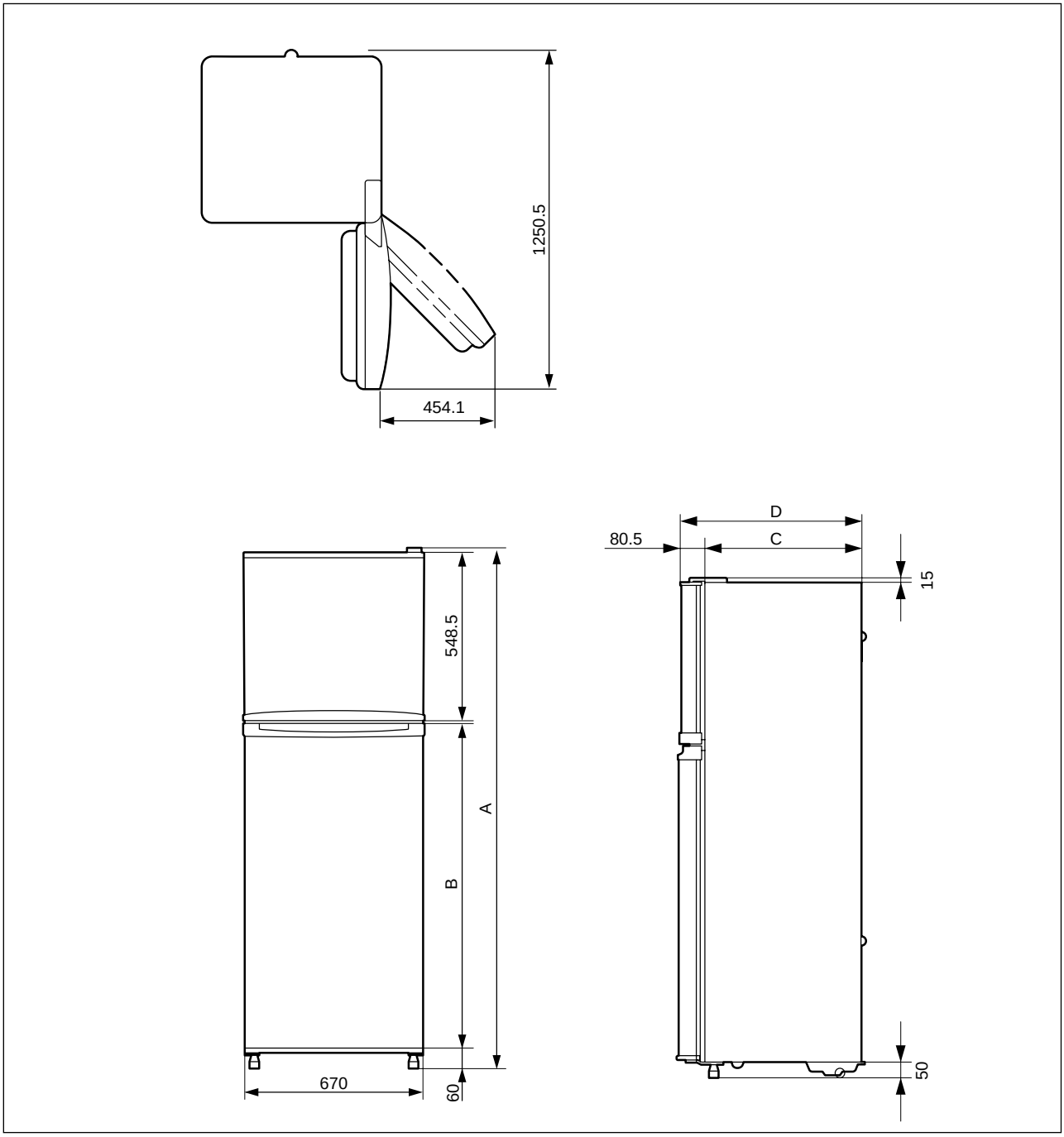
[110~115V/ 60Hz, 127V/60Hz, 220V/50~60Hz]-RT40/44



GRY- GRAY
RED- RED
BRN- BROWN
YEL- YELLOW
S/BLU- SKY BLUE
PNK- PINK
BLK- BLACK
WHT- WHITE
W/BLK- WHITE/BLACK

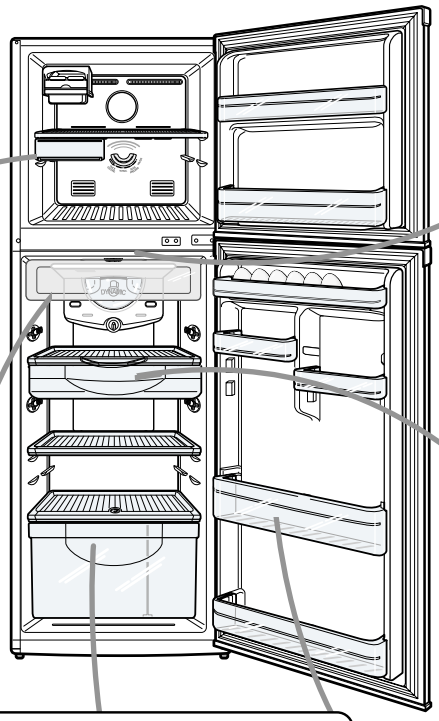
5. Extemal size and Designations

5-1) Product Dimension



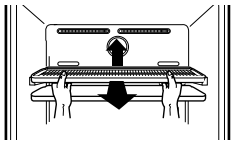
MODEL	A	B	C	D	Remark
RT40MA/MB	1660	1103.5	549.5	640(670)	( )BAR TYPE
RT44MA/MB	1730	1173.5	549.5	640(670)	

5-2) Identifying and disassembling the parts



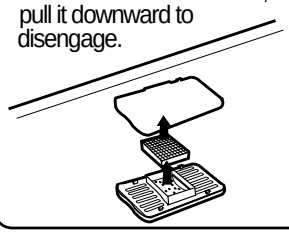
To remove shelves in the freezing compartment

• Frist remove the icemaking molds. Tilt the shell up at front, then lift it up and pull it out of the tracks.



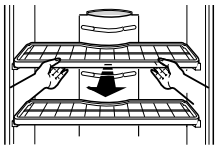
To remove bio deodorizer

• While pushing the front end knob of the bio deodorizer, pull it downward to disengage.



To remove shelves in the refrigerating compartment

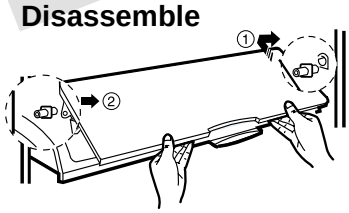
• Hold the shelf by the front and pull it forward of the rack.

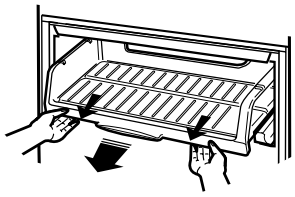


To remove shelves in the chilled compartment

• Lift up the cover, push the cover to the right (as shown) until the mounting hook(①) disengages, then disengage the other mounting hook (②) and pull out the cover.
• Pull the shelf forward until it stops. then lift it up and pull it out.

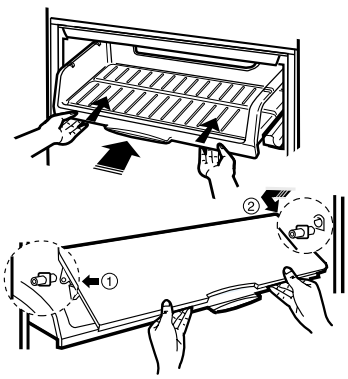
Disassemble





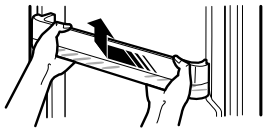
• With shelf front raised slightly, engage, the roller between the rails and slide it back.
• To repace the cover, first engage the mounting hook (①) as shown, then engage the other hook (②) and push in.

Reassemble



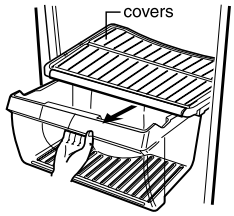
To remove door bins

• While pushing the bin to the left, lift it up to disengage.



To remove storage drawers and covers

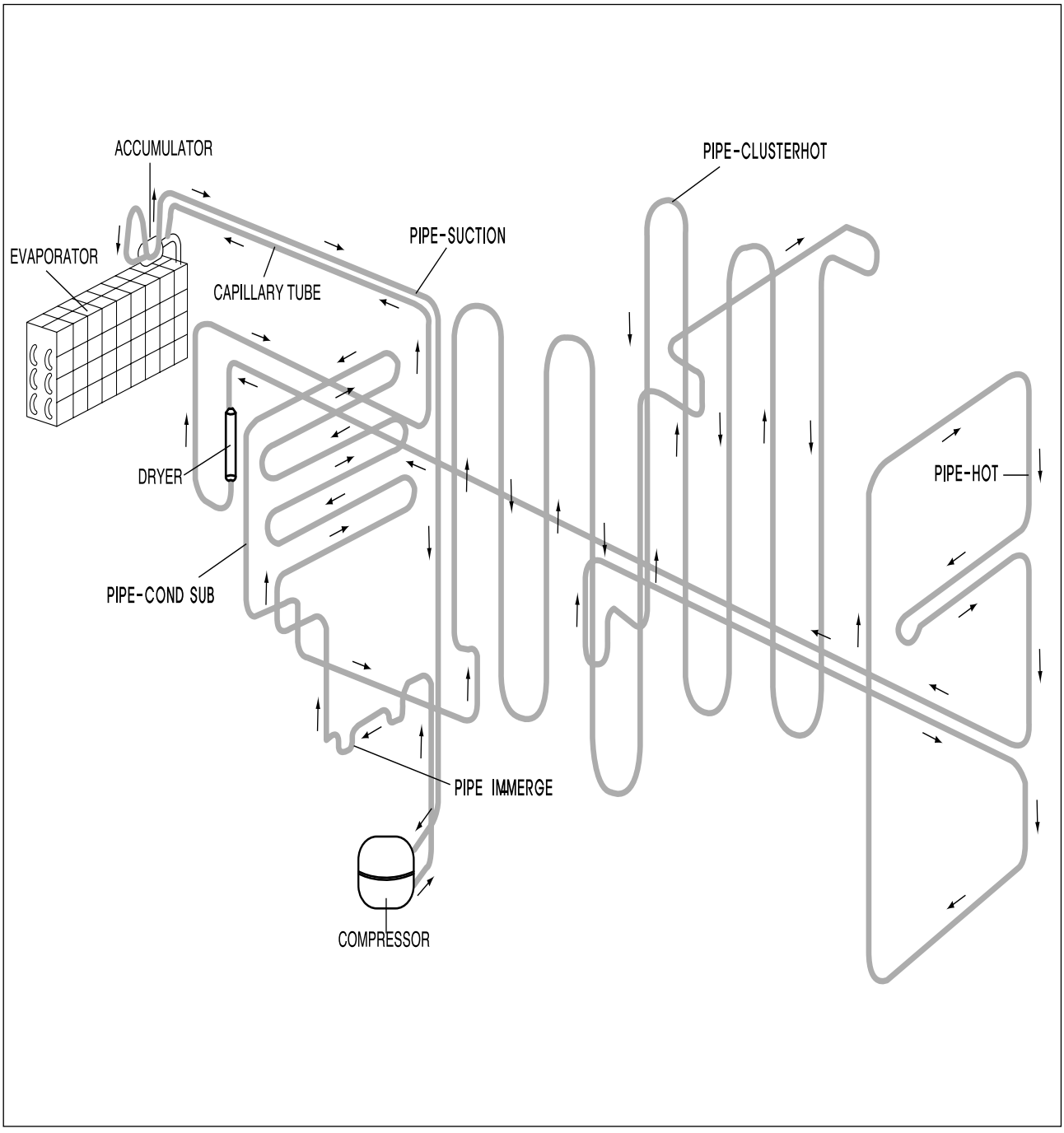
• Lift up to remove the cover. Pull the drawer helf way out, then lifting it up, pull it out completely.



6. Schematic diagram of coolant gas circulation

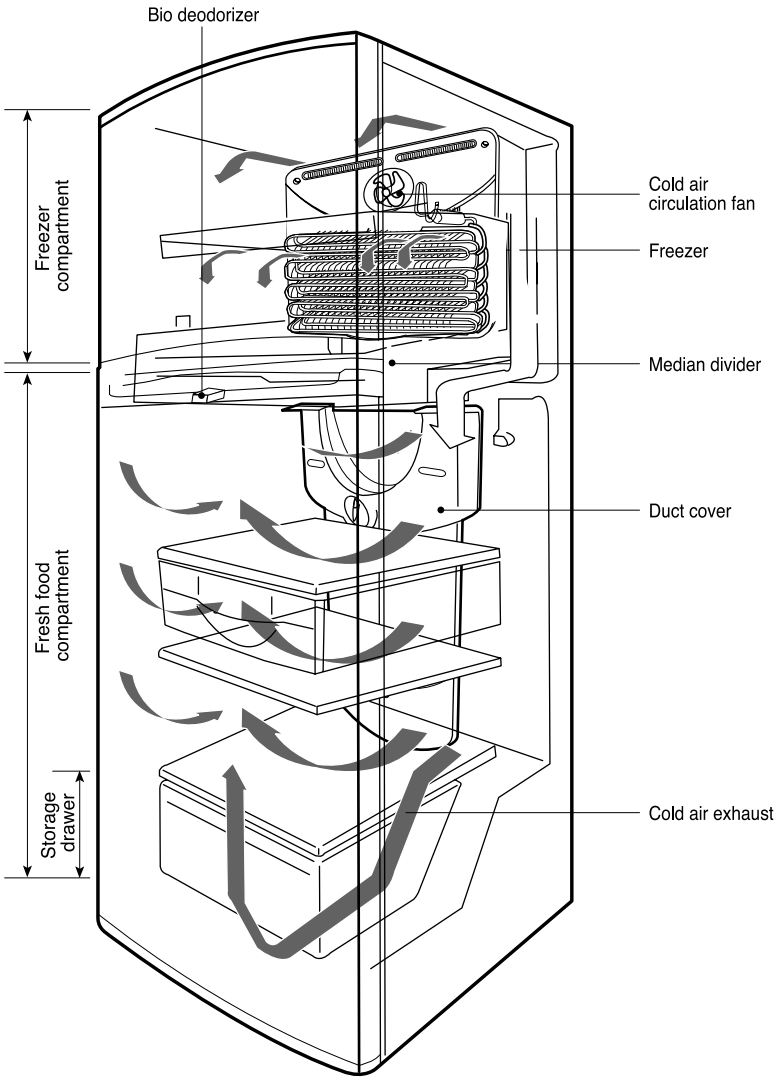
6-1) Refrigeration Cycle

COMPRESSOR → PIPE IMMERGE → PIPE SUB CONDENSER → PIPE CLUSTER → PIPE HOT → DRYER→ CAPILLARY TUBE → EVAPORATOR → ACCUMULATOR → PIPE SUCTION → COMPRESSOR



6-2) Cool Air Circulation

- Cold air generated from the cooling system is distributed to the freezing compartment and the refrigerating compartment by the air circulation fan.
- In the freezing compartment, cold air is distributed to the compartment as well as to the shelves from the cold air exhaust port, food is frozen in the freezing compartment by cold air shower. Cold air that comes out of the freezing compartment is absorbed back to the lower part of the cooling system through the suction port on the median divider.
- In the refrigerating compartment, cold air is distributed to the duct cover through the median divider. Cold air supplied to the duct cover passes through the refrigerating compartment. After cooling the refrigerating compartment, cold air is absorbed to the lower part of the cooling system through the suction port on the median divider.

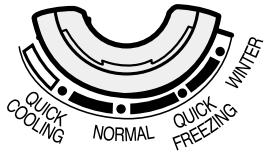


7. Circuit operation theory

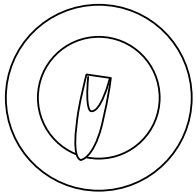
1. Temperature Control and Operational Description of Other Functions

1. Temperature Control Part Design

Freezer Temperature Controller



Refrigerator Temperature Controller



2. Temperature Control Function

1)Selecting Freezer Temperature

- Selecting "Quick cooling~Quick freezing" is possible with turning temperature control knob.
- Controlled temperature of each temperature control knob position is as follows:

Knob Position	Quick cooling	Normal	Quick Freezing	Winter
Controlled Temperature	-15±1	-19.0	-21±1	-23±1

2)Selecting Refrigerator Temperature

- Selecting ① ~ ⑧ is possible with turning temperature control knob.
- Controled temperature of each temperature control knob position is as follows:

Knob Position	①	②	③	④	⑤	⑥	⑦
Controlled Temperature	6.0	4.5	3.0	2.0	1.0	0.0	-1.0

Caution) As this controller is by the ROTARY S/W, in case it is off the position, it is set to step 4 automatically.

3. Defrosting Function

1)Defrosting is decided by the accumulated time of comp on.
2)Defrosting proceeds in order of heating → recess time.
3)The first defrosting function after the initial power on starts with 4 hours of accumulated time of comp on, and then it repeats its function at every 8th hour of comp on.
4)In the process, controlling of defrosting heater ON/OFF is done by EVA-SENSOR. When the quality of EVA-SENSOR is poor (short/open) defrosting will be terminated only after recess time function without heating.
5)In the process, comp and fan maintain ON condition, after defrosting heating it operates with 10 min. recess time.
6)defrosting heating point ON and OFF operates by EVA-SENSOR and each temperature is as follows:

Heater On Point	Heater Off Point	Remark
below -5℃	15℃	

4. Testing Function

- This function is for PCB and test of products, work process test, and SVC.
- After checking the product's function by selecting TEST S/W, let the self-diagnosis function start with the POWER OFF and ON.

1)Forced Starting Function

- COMP and FAN starts immediately after the TEST S/W on the Main PCB is pressed once. So when the forced staring function is done right at the COMP OFF point, Over Load in the COMP may be caused. Extra caution is necessary.
- When forced starting function is selected, COMP and FAN run for 24 hours regardless of the freezer/refrigerator temperature and knob selection. Indicating Lamp on main PCB shows that it is a forced starting function by 0.5sec interval ON/OFF.
- When a selected forced starting function is selected and maintains for 24 hours, defrosting function starts its operation, and when defrosting is completed normal operation is carried out according to the temperature selection knob position.
- To release it's operation during forced starting, power should be turned off and turned on again or test release mode on 3) below should be selected.

2)Forced Defrosting Function

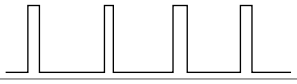
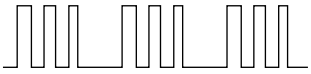
- If test switch is pressed once more during forced starting function, it is released immediately and forced defrosting function starts, and the Lamp on main PCB shows that it's forced defrosting by 1.0 sec. interval ON/OFF.
- When forced defrosting is selected COMP and FAN is turned off immediately, and defrosting heater is turned on at the same time. At this moment if the sensed temperature of EVA-SENSOR is higher than -5.0℃, defrosting heater is not turned ON and operates only for recess time and returns to normal operation.
- When Heating is completed it recesses for 10 mints. and after that indicating Lamp remains ON and returns to normal operation.

3)Test Function Release Mode

If TEST S/W is pressed once more when forced defrosting function is carried out, forced defrosting is released and stops for 10 mints. and after that it returns to normal operation.

5. Self-diagnosis Function

1)If the power is supplied to refrigerator, self-diagnosis function is carried out for 2 seconds internally.
2)If there is no defect after self-diagnosis is carried out, it returns to normal operation.
3)If there is defect after self-diagnosis is carried out, defected area is indicated with the corresponding display on the Table below by indicating Lamp on PCB, it does not start until all defects are completely repaired.
4)When the refrigerator is repaired, check if it's done completely by turning power ON and OFF.
5)In order to check OPEN/SHORT function of SVC temperature sensor, carry out self-diagnosis by turning power ON and OFF.
6)Display of Lamp Indicating Defects (Lamp On Time: 0.3sec., Lamp Off Time: 2sec.)

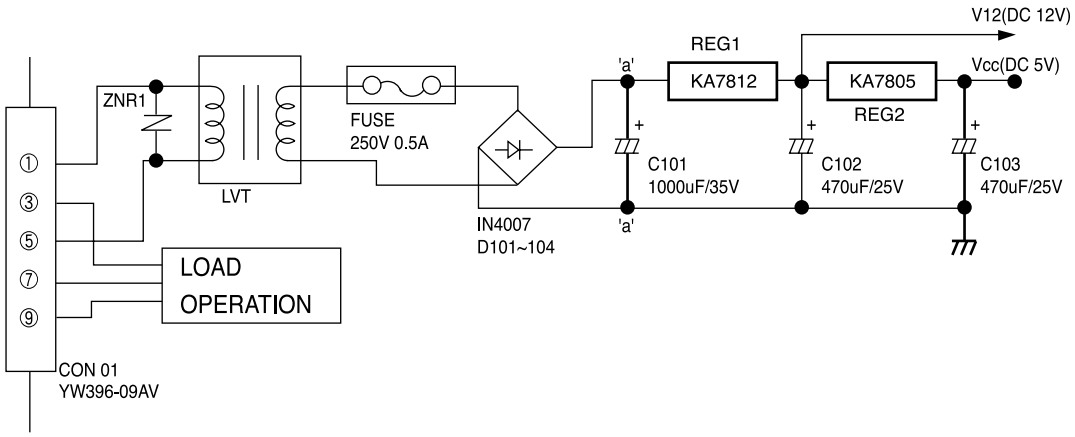
No.	Item	Led Display	Kind of Trouble	Remark
1	R-Room Sensor	On Off 	-. Poor Open -. Poor Short	When below -50℃ is sensed. When above +50℃ is sensed.
2	EVA Sensor	On Off 	-. Poor Open -. Poor Short	When below -50℃ is sensed. When above +50℃ is sensed.
3	EXT Sensor	On Off 	-. Poor Open -. Poor Short	When below -50℃ is sensed. When above +50℃ is sensed.
4	R-Room Temp. (Rotary S/W)	On Off 	-. Poor Open	When 1.0V down is sensed.
5	Normal Mode	On Off 	-	When power is supplied, Lamp remains on.

- If there are more than one defect, corresponding display is shown in sequence.

<Example of Defect Indication>
① When R-Room Sensor is defected, LAMP repeats one time of 0.3 second on, and then 2 seconds off.
② When R-Room Sensor and EXT Sensor are defected at the same time, LAMP repeats one time of 0.3 second on, 2 seconds off, and then 3 times of 0.3 second on, 2 seconds off.

2. Operational Principle of Each Circuit

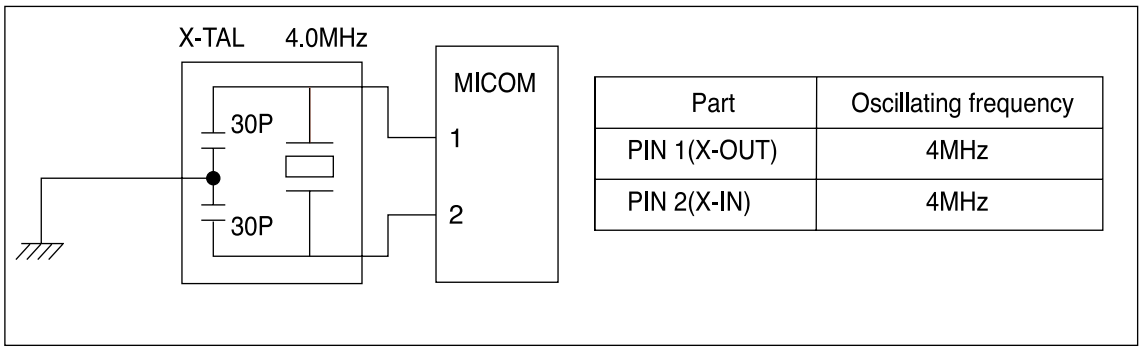
1. Power Circuit



Voltage	Applied circuit
V12(DC 12V) ⟶	RELAY operation
Vcc(DC 5V) ●⟶	Power around micom and detection part of sensor

The decompressed AC voltage on the DC-TRANS secondary outputs around AC 16V to the both sides of the 'a' point. Then, DC 12V and 5V are supplied through the circuit and regular voltage IC REG1, REG2.

2. Oscillation Circuit

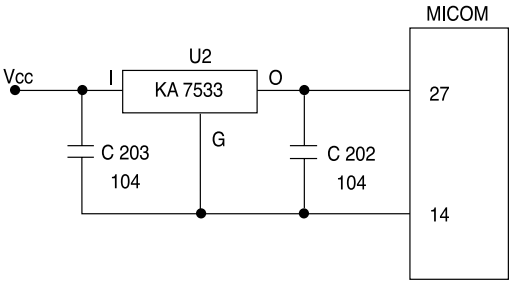


Part	Oscillating frequency
PIN 1(X-OUT)	4MHz
PIN 2(X-IN)	4MHz

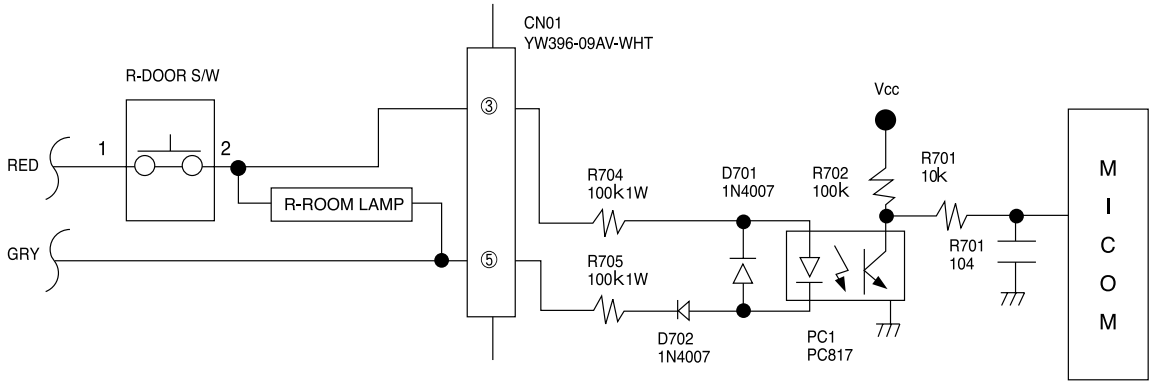
It oscillates generate clock for synchronizing the information transmission and reception of the internal elements of MICOM and to calculate the time. If the specification of resonator is changed, it is not able to operate normally because the trimming system of MICOM is altered.

3. Reset Circuit

The reset circuit makes all program functions operate at the initial stage by initializes the various parts such as RAM in MICOM when the power is supplied or the power is supplied to the MICOM power by a power failure in a moment.
When the power is supplied, the voltage of reset becomes low during scores of uSEC, and it maintains high during the normal operation.

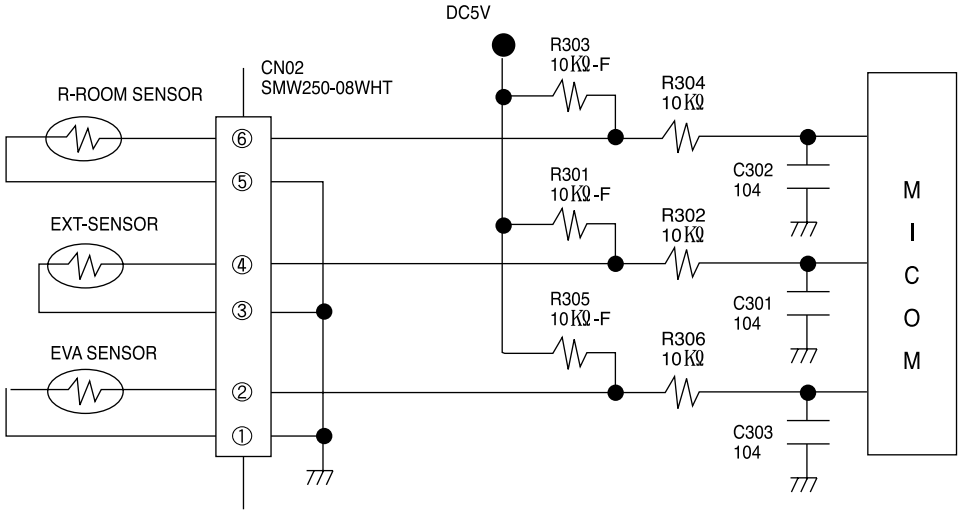


4. Door S/W Sensor Circuit



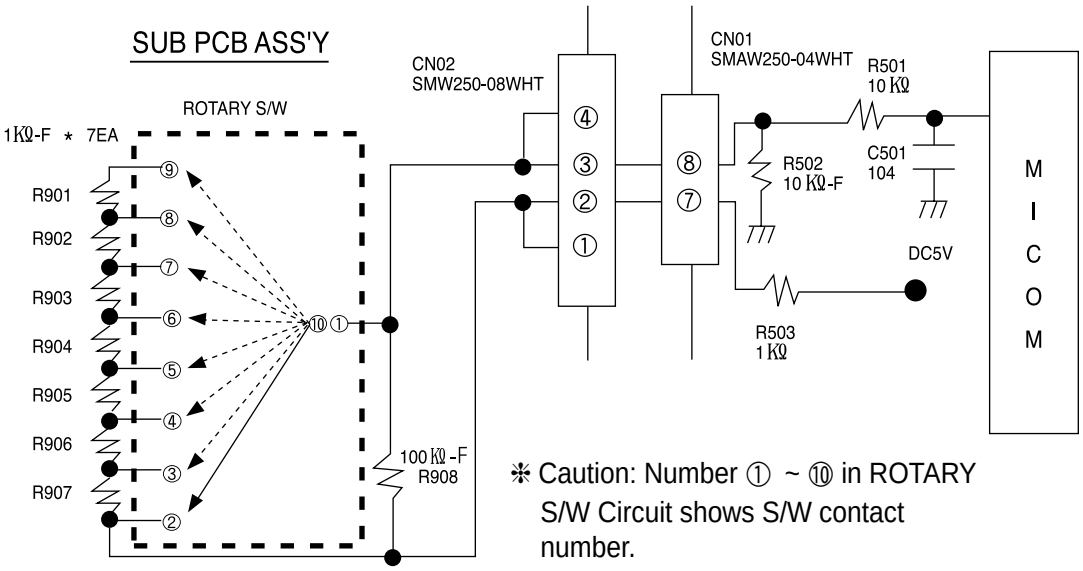
If door is open, R-DOOR S/W contact is closed. Then when RED LINE supplies power to GRAY LINE passing through R704 and PHOTO COUPLER(PC817) LED and D702, PC817 operates and generates 50 or 60HZ globe-shaped wave.
MICOM recognizes this waveform and detects that door is open.
If door is closed, R-DOOR S/W contact is open and power is not supplied to PC817, MICOM recognizes that door is closed as DC5V is maintained continuously.

5. Temperature Sensor Circuit



1) As the sensor uses a thermistor, its resistance gets smaller when the temperature is high, and it gets bigger when the temperature is low.
2) The voltage which is input to MICOM by a sensor is calculated with Vf=(Rth × Vcc)/(R303+Rth). (Vcc=DV5V,Rth:Sensor resistance)
3) Refer to the attached conversion table of resistance and input voltage of sensor for temperature.

6. Temperature Controller (Rotary S/W) Circuit



Temperature controlling is carried out by changing ROTARY S/W KNOB assembled inside the refrigerator from level 1 to level 8.

The voltage of temperature controlling SETTING is divided by combined resistance of DC5V resistance R503 and resistance value of ROTARY S/W(this is a combined parallel resistance of R908 and resistance value of ROTARY S/W position) and resistance R502.

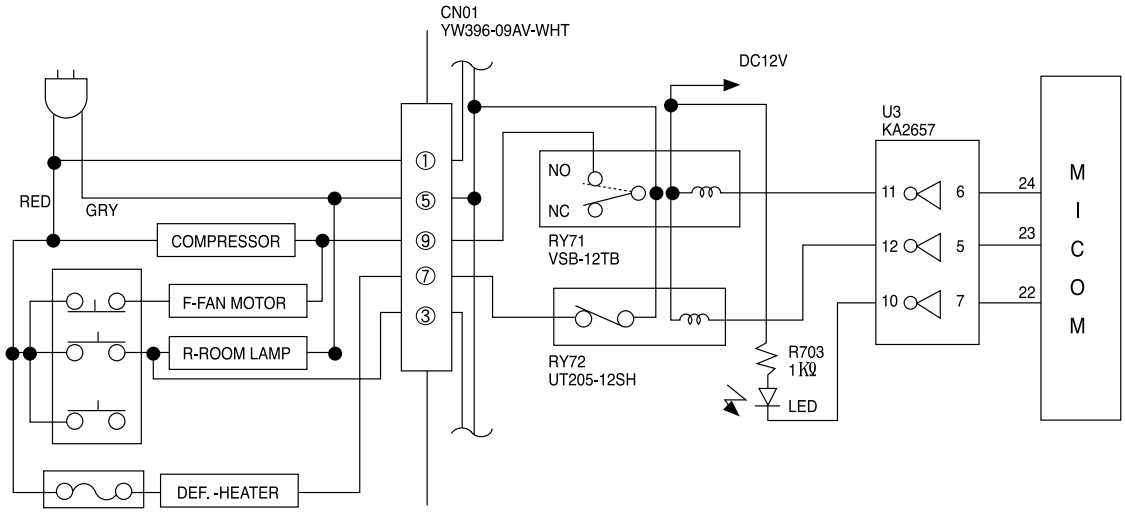
Divided voltage is supplied to MICOM through resistance R501 and recognizes temperature controlling then carries out temperature controlling SETTING.

Input Voltages and Resistance values of MAIN PCB MICOM input unit for ROTARY S/W contact position of SUB PCB ASS'Y are like below.(In case of resistance value estimation, connector terminal should be estimated after the connector of MAIN PCB CN01 is disassembled).

Class	1 Step (2nd pin)	2 Step (3rd pin)	3 Step (4th pin)	4 Step (5th pin)	5 Step (6th pin)	6 Step (7th pin)	7 Step (8th pin)	8 Step (9th pin)	Contact Point when opened
Voltage (R502 each end)	4.54 ±0.15v	4.16 ±0.15v	3.84 ±0.15v	3.57 ±0.15v	3.33 ±0.15v	3.12 ±0.15v	2.94 ±0.15v	2.77 ±0.15v	0.1～0.7V
Resistance (CN01 7-8 each end)	0 Ω	0.99㏀±1%	1.96㏀±1%	2.91㏀±1%	3.84㏀±1%	4.76㏀±1%	5.66㏀±1%	6.54㏀±1%	100㏀±1%

❊ On the above Table, resistance value is not calculated when SUB PCB ASS'Y connecting line is disconnected or there are any cracks on PCB board.

7. Load Operation and Indicating Lamp Controlling Parts

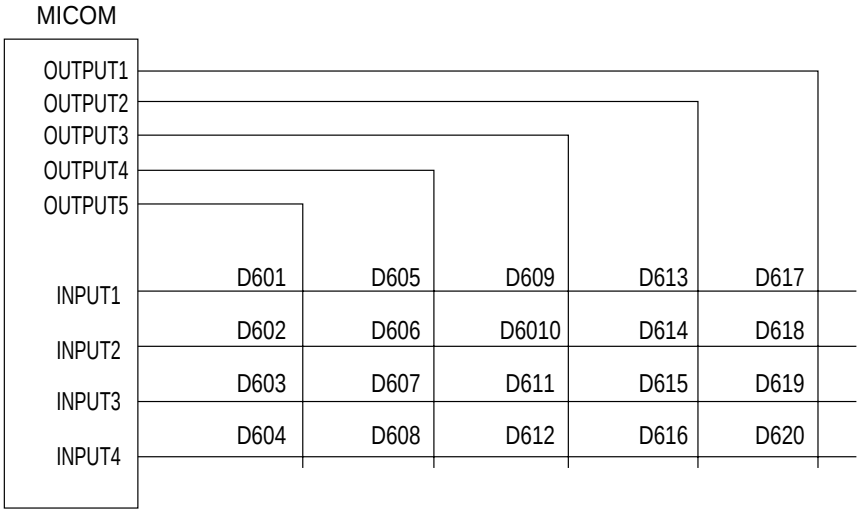


a) When the COMP is turned on, the micom (pin 24) outputs high (DC 5V) and a realy is activated. When the COMP is turned off, the micom (pin 24) outputs low (0V)

b) The defrosting heater is turned on, the micom (pin 23) outputs high (DC 5V) and a realy is activated. When the defrosting heater is turned off, the micom (pin 23) outputs low (0V).

c) Indicating Lamp is turned ON when MICOM(PIN 22) input voltage is high and DC12V is passed to LED through resistance R703.
When MICOM(PIN 22) output is low, LED is turned OFF.

8. Various OPTION function



8-1. TABLE OF TEMPERATURE CHANGE OF REFRIGERATOR(● :RELEVANT DIODE NO. USED)

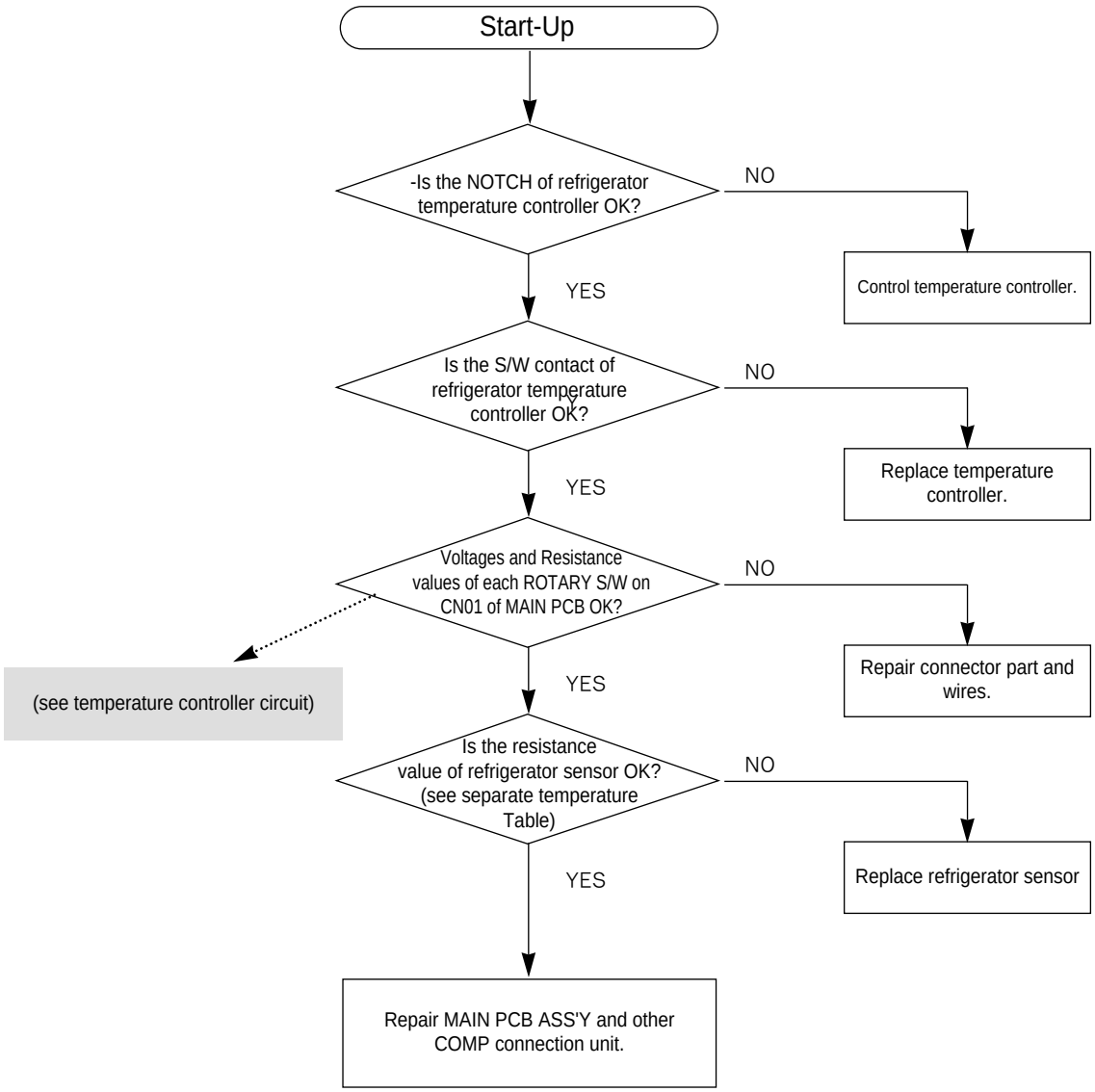
(℃)

SHIFT	605	604	603	602	601	SHIFT	605	604	603	602	601
						+0.5	●				
-0.5					●	+1.0	●				●
-1.0				●		+1.5	●			●	
-1.5				●	●	+2.0	●			●	●
-2.0			●			+2.5	●		●		
-2.5			●		●	+3.0	●		●		●
-3.0			●	●		+3.5	●		●	●	
-3.5			●	●	●	+4.0	●		●	●	●
-4.0		●				+4.5	●	●			
-4.5		●			●	+5.0	●	●			●
-5.0		●		●		+5.5	●	●		●	
-5.5		●		●	●	+6.0	●	●		●	●
-6.0		●	●			+6.5	●	●	●		
-6.5		●	●		●	+7.0	●	●	●		●
-7.0		●	●	●		+7.5	●	●	●	●	
-7.5		●	●	●	●	+8.0	●	●	●	●	●

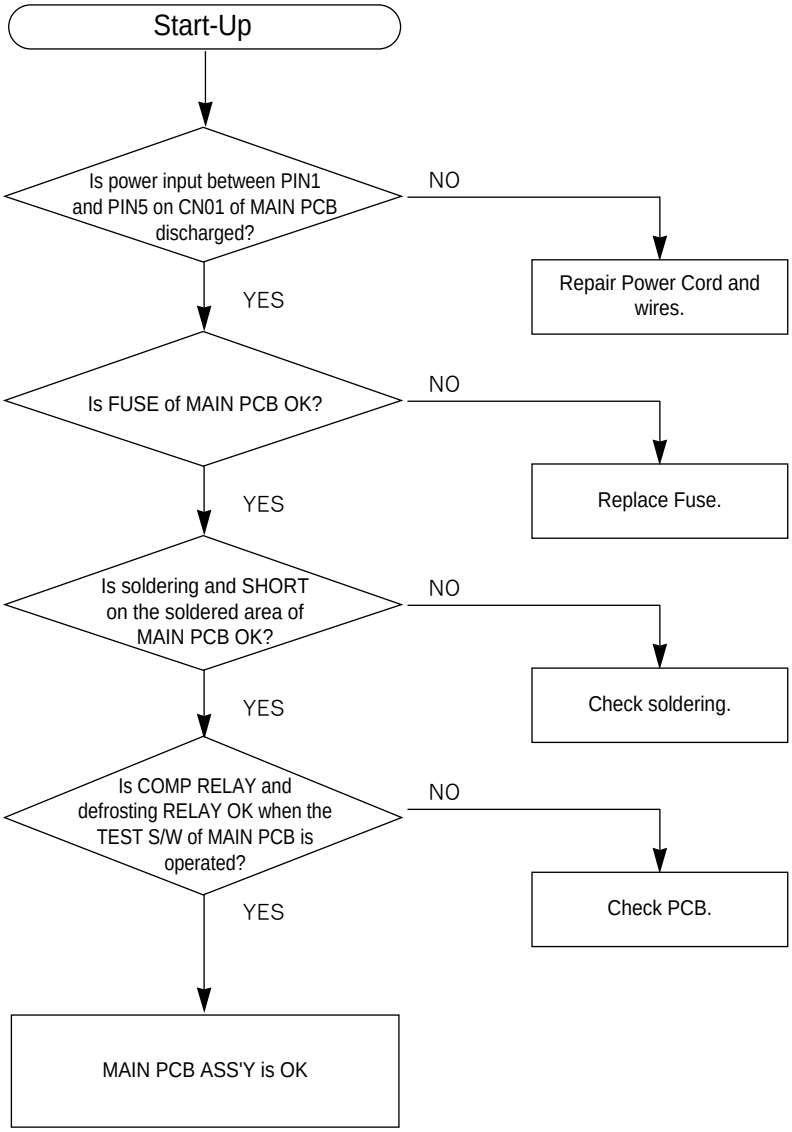
Warning) As DIODE OPTION except D601-D605 has important effects on the reliability of refrigerator, do not change it voluntarily!!!

3. Detecting Defects and Trouble Shooting

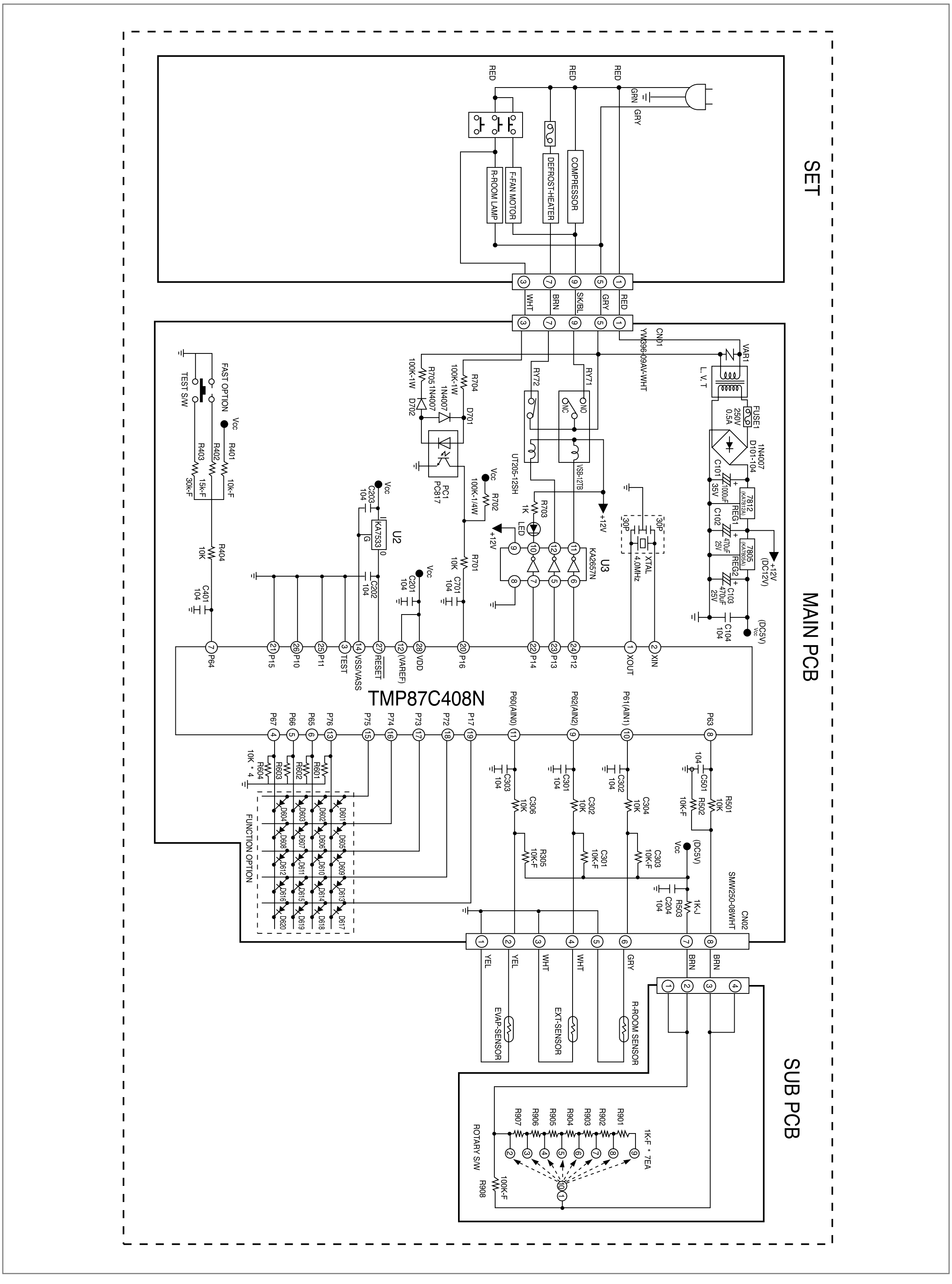
1. When refrigerator temperature is too high or too low:



2. Checking Abnormalities of MAIN PCB ASS'Y



4. Circuit



SET
MAIN PCB
SUB PCB
TMP87C408N
COMPRESSOR
DEFROST-HEATER
F-FAN MOTOR
R-ROOM LAMP
EVAP-SENSOR
EXT-SENSOR
R-ROOM SENSOR
ROTARY S/W
FUNCTION OPTION
FAST OPTION
TEST S/W

5. VSB Relay

■ **SAFETY STANDARD & FILE NUMBERS**

UL 508 (File No. E56140. E108658)
C22.2 No.0, No.14 (File No. LR35579))
VDE 0435, 0631, 0700

Please be noted that UL/CSA rating may differ from the Standard ratings.
Please request when the approval markings are required on the cover.

Relay type	Nominal coil Voltage	contact ratings
VSB	3 to 100VDC	1/3HP 125VAC/250VAC 16A 30VDC/250VAC, Resistive Pilot duty C 150

■ **ODERING INFORMATION**

VSB-12STB

(*)

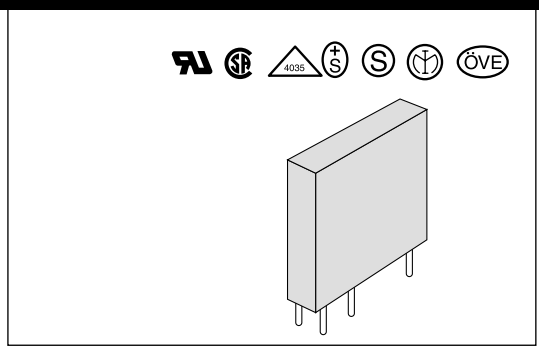
- Enclosure
  - B : Flux Free Type
  - C : Washable Type (with tape)
- Contact Arangement
  - M : 1 From A (SPST-NO)
  - T : 1 From C (SPDT)
- Coil Sensitivity
  - Ni : Standard Type
  - S : High Sensitive Type
- Nominal Voltage
- Type

Note) 1. Actual making omits the hyphen (-) of (*)

■ **COILDATA CHART**

	ORDERING CODE	Coil Nominal Voltage V DC	Coil Resistance Ω ±10% (at 20℃)	Must Operate Voltage V DC (at 20℃)	Must Release Voltage V DC (at 20℃)	Coil Nominal Power W (at 20℃)
Standard Type	VSB- 3 ( )( )	3	12.5	2.1	0.3	0.72
	VSB- 5 ( )( )	5	36	3.5	0.5	0.70
	VSB- 6 ( )( )	6	50	3.5	0.5	0.72
	VSB- 9 ( )( )	9	115	6.3	0.9	0.70
	VSB- 12 ( )( )	12	200	8.4	1.2	0.72
	VSB- 14 ( )( )	14	280	9.8	1.4	0.70
	VSB- 18 ( )( )	18	460	12.6	1.8	0.70
	VSB- 24 ( )( )	24	820	16.8	2.4	0.70
	VSB- 36 ( )( )	36	1,850	25.2	3.6	0.70
	VSB- 48 ( )( )	48	3,300	33.6	4.8	0.70
	VSB- 60 ( )( )	60	5,100	42.0	6.0	0.70
	VSB- 100 ( )( )	100	13,400	70.0	10.0	0.75
High Sensitive Type	VSB- 3S ( )( )	3	17	2.1	0.3	0.53
	VSB- 5S ( )( )	5	47	3.5	0.5	0.53
	VSB- 6S ( )( )	6	68	4.2	0.6	0.53
	VSB- 9S ( )( )	9	155	6.3	0.9	0.53
	VSB- 12S ( )( )	12	270	8.4	1.2	0.53
	VSB- 14S ( )( )	14	370	9.8	1.4	0.53
	VSB- 18S ( )( )	18	610	12.6	1.8	0.53
	VSB- 24S ( )( )	24	1,100	16.8	2.4	0.53
	VSB- 36S ( )( )	36	2,450	25.2	3.6	0.53
	VSB- 48S ( )( )	48	4,400	33.6	4.8	0.53
	VSB- 60S ( )( )	60	6,800	42.0	6.0	0.53
	VSB- 100S ( )( )	100	18,860	70.0	10.0	0.53

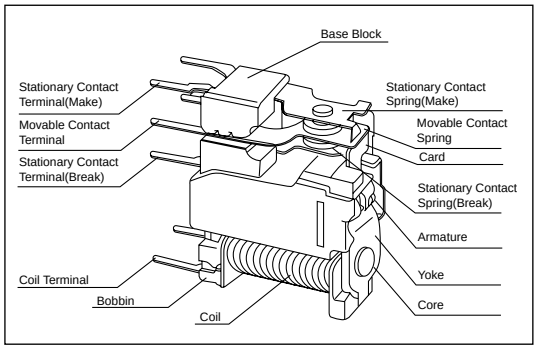
16 Amps. Miniature Slim Type Power Relay



n FEATURES

- All or Nothing Relay
- UL, CSA, VDE, SEV, SEMKO, IMQ, ÖVE, BSI Recognized
- Working Class : C
- Type of Service : Continuous Duty
- Heavy Duty 16A Miniature Power Relay
- UL Class B(130℃) Insulation
- High Isolation in Small Package
  -Insulation Distance : 8mm
  -Dielectric Strength : 5,000VAC (between coil and contacts)
  -Surge Strength : 10,000V
- Low Power Consumption and high Sensitive Type Available (VSB-S)
- Washable (With Tape) Type Available

■ STRUCTURE



■ SPECIFICATIONS

CONTACT

- Arrangement ····· 1 From A(SPST-NO)or 1 From C(SPDT)
- Material ····· Silver alloy
- Type ····· Single Type
- Resistance (initial) ····· Max. 200mΩ (at 6VDC 1A)
- Ratings (resistive)
  - Nominal Load ····· 16A 250VAC or 30VDC
  - Max. Switching Power ····· 4,000VA, 480W
  - Max. Switching Voltage ····· 380VAC, 150VDC
  - Max. Switching Current ····· 16A
  - Max. Carrying Current ····· 16A
  - Max. Switching Load(∗1) ····· 5VDC 100 mA
- Life Expectancy
  - Mechanical ····· 5×10^6 operations
  - Electrical ····· 1×10^5 operations(at nominal load)

COIL

- Nominal Voltage ····· 3 to 100VDC
- Nominal Power (at 20℃) ····· Standard Type :0.70 to 0.75W
  High sensitive Type :0.53W
- Operate Power (at 20℃) ····· Standard Type :0.35 to 0.37W
  High sensitive Type :0.26W
- Operate & Release Voltage ···· Please see Coil Data Chart
- Max. Contious Voltage ····· Please see Characteristic Data

GENERAL

- Insulation Resistance ····· Min. 1,000MΩ at 500VDC
- Dielectric Strength ····· 1,000VAC 1 minute
  IMQ ② (between open contacts)
  5,000VAC 1 minute
  (between coil and contacts)
- Surge Strengh ····· 10,000V
  IMQ ▽ (at $1.2\times50\mu s$ standard surge wave)
- Temperature Range ····· Standard Type :-30℃ to+65℃
  (at nominal Voltage) High sensitive Type :-30℃ to+75℃
- Time Value ····· Operate Max. 20ms
  (at nominal voltage) Release Max. 10ms
- Vibration Resistance
  - Misoperation ····· 10 to 55 Hz, double amplitude of 1.5mm
  - Endurance ····· 10 to 55 Hz, double amplitude of 1.5mm
- Shock Resistance
  - Misoperation ····· 100m/s²(11±1ms)
  - Endurance ····· 1,000m/s²(6±1ms)
- Unit Weight ····· Approx. 18g
- Enclosure ····· Polybutylene Terephthalate(PBT)

(∗1) Min. Switching Load mentioned above are reference values. Please perform the confimation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

■ ABSOLUTE MAXIMUM RATING (T_A=25℃)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.3 ~ +15.0	V
Detecting Voltage	V_{DET}	3.3	V
Hysteresis Voltage	R_{HYS}	50	mV
Operating Temperature	T_{OPR}	-30 ~ +75	℃
Storage Temperature	T_{STG}	-50 ~ +150	℃
Power Dissipation	P_D	200	mW
Detecting Voltage Temperature Coefficient	$\Delta V_{DET}/\Delta T$	±0.01	%/℃

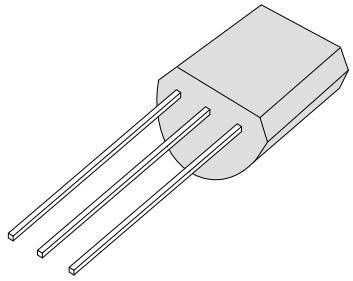
■ ELECTRICAL CHARACTERISTICS (T_A=25℃)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Detecting Voltage	V_{DET}	R_L = 200Ω, V_{OL} ≤ 0.4V	3.15	3.3	3.45	V
Low Output Voltage	V_{OL}	R_L = 200Ω	-	-	0.25	V
Output Leakage Current	I_{LKG}	V_{CC} = 15V	-	-	0.1	μA
Hystersis Voltage	V_{HYS}	R_L = 200Ω	30	50	100	mV
Detecting Voltage Temperature Coefficient	$\Delta V_{DET}/\Delta T$	R_L = 200Ω		±0.1		±/℃
Circuit Current (at on time)	I_{CCL}	V_{CC} = $V_{DET(MIN)}$-0.05V	-	300	500	μA
Circuit Current (at off time)	I_{CCH}	V_{CC} = 5.25V	-	30	50	μA
Threshold Operating Voltage	$V_{TH(OPR)}$	R_L = 200Ω, V_{OL} ≤0.4V	0.6	0.8	1.0	V
"L" Transmission Delay Time	t_{DL}	R_L = 1.0MΩ, C_L =100pF	-	10	15	μs
"H" Transmission Delay Time	t_{DM}	R_L = 1.0MΩ, C_L =100pF	-	15	20	μs
Output Current (at on time Ⅰ)	$t_{OL\ I}$	V_{CC} =$V_{DET(MIN)}$-0.05V, T_C =25℃	10	18	28	mA
Output Current (at on time Ⅱ)	$t_{OL\ II}$	V_{CC} =$V_{DET(MIN)}$-0.05V, T_C =-30 ~ +75℃	8	16	30	mA

3-3V VOLTAGE DETECTOR

The KA7533 prevents error of system from supply voltage below normal voltage level at the time power on and instantane ous power off in systems.

TO-92



1:Input 2:GND 3:Output

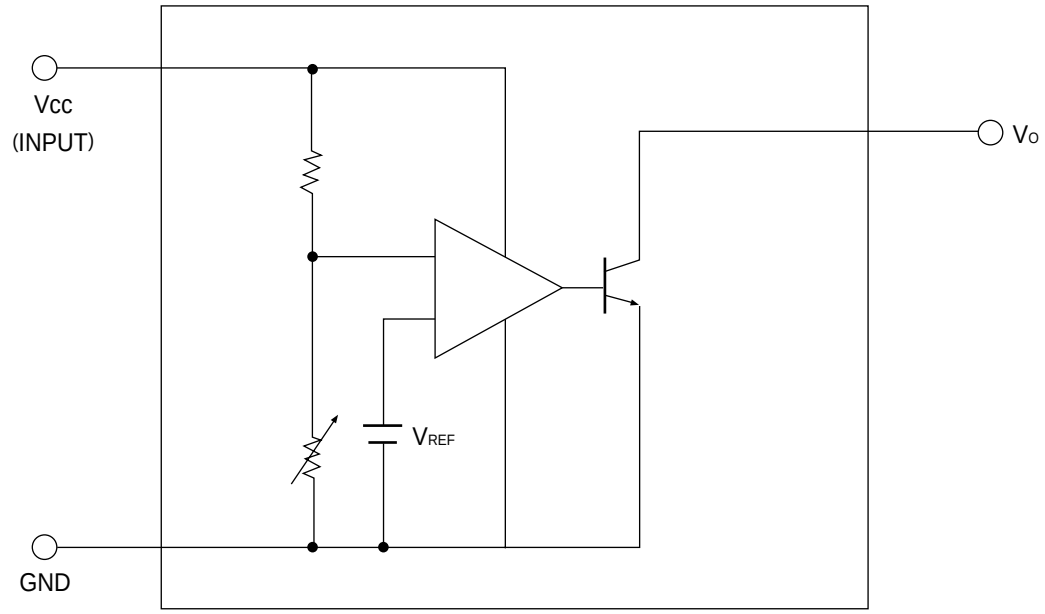
n FEATURES

- Detecting against error operations at the power ON/OFF
- Resetting function for the low voltage microprocessor.
- Checking low battery.

■ ORDERING INFORMATION

Device	Package	Operating Temperature
KA7533Z	TO-92	-30 ~ +75℃

BLOCK DIAGRAM



n ELECTRICAL CHARACTERISTICS KA7812/I

(Refer to test circuit, $T_{MIN} < T_J < T_{MAX}$, I_O=500mA, V_I=19V, C_I=0.33㎌, C_O=0.1㎌, unless otherwise specified)

Characteristic	Symbol	Test Conditions		KA7812I			KA7812I			Unit
				Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J= 25℃		11.5	12	12.5	11.5	12	12.5	V
		5.0mA ≤ 1.0A, P_D ≤ 15W V_I= 14.5V to 27V		11.4	12	12.6	11.4	12	12.6	
		V_I= 15.5V to 27V								
Line Regulation	ΔV_O	T_J= 25℃	V_I= 14.5 to 30V		10	240		10	240	mV
			V_I= 16 to 22V		3.0	120		3.0	120	
Load Regulation	ΔV_O	T_J= 25℃	I_O= 5mA to 1.5A		11	240		11	240	mV
			I_O=250mA to 750mA		5.0	120		5.0	120	
Quiescent Current	I_Q	T_J= 25℃			5.1	8		5.1	8	mA
Quiescent Current Change	ΔI_Q	I_O= 5mA to 1.0A			0.1	0.5		0.1	0.5	mA
		V_I= 14.5V to 30V						0.5	1.0	
		V_I= 15V to 30V			0.5	1.0				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O= 5mA			-1			-1		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A=25℃			76			76		㎶
Ripple Rejection	RR	f = 120Hz V_I= 15V to 25V		55	71		55	71		dB
Dropout Voltage	V_O	I_O= 1A, T_J=25℃			2			2		V
Output Resistance	R_O	f = 1KHz			18			18		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A=25℃			230			230		mA
Peak Current	I_{PK}	T_J=25℃			2.2			2.2		A

* $T_{MIN} < T_J < T_{MAX}$
  KA78XXI : T_{MIN} = -40℃, T_{MAX} = 125℃
  KA78XX, T_{MIN} = 0℃, T_{MAX} = 125℃
* Load and line regulation are specified at constant junction temperature.
  Changes in V_O due to heating effects must be taken into account separately.
  Pulse testing with low duty is used.

■ ABSOLUTE MAXIMUM RATINGS(T_A = 25℃ unless otherwise specified)

Characteristic	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V)	V_I	35	V
(for V_O = 24V)	V_I	40	V
Thermal Resistance Junction - Cases	$R_{\theta JC}$	5	℃/W
Thermal Resistance Junction - Air	$R_{\theta JA}$	65	℃/W
Operating Junction Temperature Range KA78XX/A	T_{OPR}	0 ~ +125	℃
KA78XXI		-40 ~ +125	℃
Storage Temperature Range	T_{STG}	-65 ~ +150	℃

■ ELECTRICAL CHARACTERISTICS KA7805/I
(Refer to test circuit, $T_{MIN} < T_J < T_{MAX}$, I_O = 500mA, V_I = 10V, C_I = 0.33μF, C_O = 0.1μF unless otherwise specified)

Characteristic	Symbol	Test Conditions		KA7805I			KA7805I			Unit
				Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J = 25℃		4.8	5.0	5.2	4.8	5.0	5.2	V
		5.0mA ≤ 1.0A, P_O ≤ 15W V_I = 7V to 20V V_I = 8V to 20V		4.75	5.0	5.25	4.75	5.0	5.25	
Line Regulation	ΔV_O	T_J = 25℃	V_I = 7V to 25V		4.0	100		4.0	100	mV
			V_I = 8V to 12V		1.6	50		1.6	50	
Load Regulation	ΔV_O	T_J = 25℃	I_O = 5mA to 1.5A		9	100		9	100	mV
			I_O = 250mA to 750mA		4	50		4	50	
Quiescent Current Change	I_Q	T_J = 25℃			5.0	8		5.0	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A			0.03	0.5		0.03	0.5	mA
		V_I = 7V to 25V						0.3	1.3	
		V_I = 8V to 25V			0.3	1.3				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA			-0.8			-0.8		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = 25℃			42			42		μV
Ripple Rejection	RR	f = 120Hz V_I = 8 to 18V		62	73		62	73		dB
Dropout Voltage	V_O	I_O = 1A, T_J = 25℃			2			2		V
Output Resistance	R_O	f = 1KHz			15			15		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = 25℃			230			230		mA
Peak Current	I_{PK}	T_J = 25℃			2.2			2.2		A

* $T_{MIN} < T_J < T_{MAX}$
KA78XXI : T_{MIN} = -40℃, T_{MAX} = 125℃
KA78XX, T_{MIN} = 0℃, T_{MAX} = 125℃
* Load and line regulation are specified at constant junction temperature.
Changes in V_O due to heating effects must be taken into account separately.
Pulse testing with low duty is used.

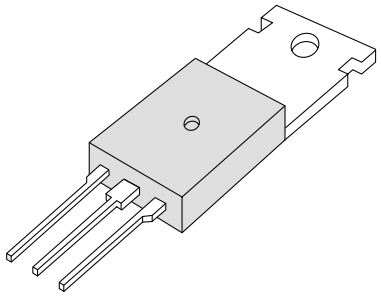
6. Circuit related Parts List

■ **REGULATOR**

3-TERMINAL 1A POSITIVE
VOLTAGE REGURATORS

The KA78XX series of three-terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

TO-220



1:Input 2:GND 3:Output

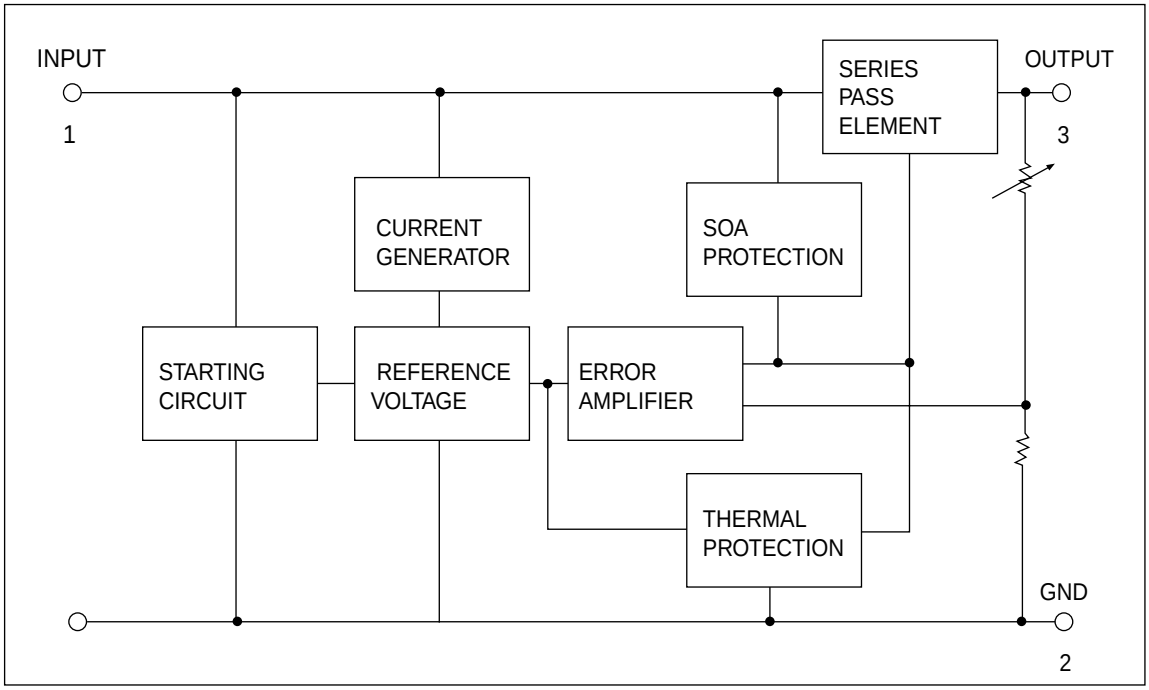
■ **FEATURES**

- Out put Current up to 1A
- Output Voltages of 5; 6; 8; 9; 10; 11; 12; 15; 18; 24V
- <None>Thermal Overload Protection
- Short Circuit Protection
- Output Transistor SOA Protection

ORDERING INFORMATION

Device	Package	Operating Temperature
KA78XX	TO-220	0 ~ +125℃
KA78XXA	TO-220	
KA78XXI	TO-220	-40 ~ +125℃

■ **BLOCK DIAGRAM**



7. Reference) Resistance and voltage conversion table of sensor for temperature

The input voltage of MICOM port can be different according to the composition of H/W and its specification is standardized using a 10㏀-F grade.
The voltage specification of relevant MICOM when the sensor is open : Around DC 5V (Vcc level)
The voltage specification of relevant MICOM when the sensor short circuits : Around DC 0V (Ground level)

Temperature	Resistance (㏀)	Voltage(v)	Temperature	Resistance (㏀)	Voltage(v)
-35	68.648	4.364	00	12.949	2.821
-34	65.011	4.333	01	12.424	2.77
-33	61.595	4.301	02	11.924	2.719
-32	58.384	4.268	03	11.447	2.668
-31	55.366	4.235	04	10.993	2.618
-30	52.526	4.2	05	10.559	2.567
-29	49.854	4.164	06	10.146	2.518
-28	47.337	4.127	07	9.752	2.468
-27	44.967	4.09	08	9.375	2.419
-26	42.733	4.051	09	9.016	2.37
-25	40.626	4.012	10	8.673	2.322
-24	38.640	3.972	11	8.345	2.274
-23	36.765	3.93	12	8.032	2.227
-22	34.995	3.888	13	7.732	2.180
-21	33.323	3.845	14	7.446	2.134
-20	31.743	3.802	15	7.172	2.088
-19	30.250	3.757	16	6.910	2.043
-18	28.838	3.712	17	6.659	1.998
-17	27.502	3.666	18	6.420	1.954
-16	26.237	3.62	19	6.190	1.911

Temperature	Resistance (㏀)	Voltage(v)
-15	25.040	3.573
-14	23.906	3.525
-13	22.832	3.477
-12	21.814	3.428
-11	20.848	3.397
-10	19.932	3.329
-09	19.062	3.279
-08	18.237	3.229
-07	17.453	3.178
-06	16.709	3.127
-05	16.001	3.076
-04	15.328	3.025
-03	14.688	2.974
-02	14.080	2.923
-01	14.501	2.872

Temperature	Resistance (㏀)	Voltage(v)
20	5.970	1.869
21	5.759	1.827
22	5.557	1.786
23	5.363	1.745
24	5.178	1.705
25	5.000	1.666
26	4.829	1.628
27	4.665	1.590
28	4.508	1.553
29	4.357	1.517
30	4.212	1.481
31	4.072	1.446
32	3.938	1.412
33	3.810	1.379

8. Specification of Main Part

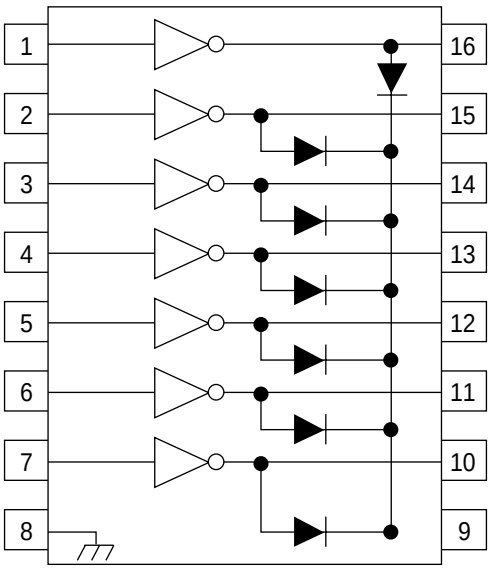
DRIVER IC(KA2657)
DRIVER : MC1413BCP(KA-2657)
KA2655/6/7/8/9

LINEAR INTEGRATED CIRCUIT

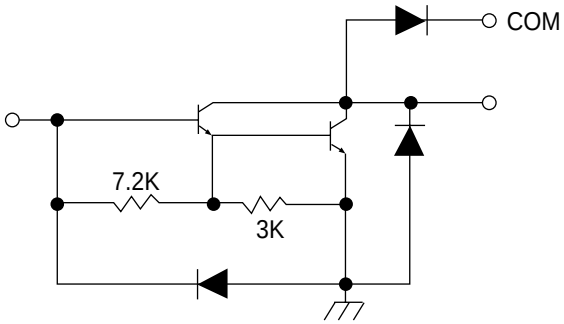
■ ELECTRICAL CHARACTERISTICS (Ta = 25℃, unless otherwise noted)

Characteristic	Symbol	Test	Min	Trp	Max	Unit
DC Current Gain	H_{FE}	V_{CD} = 2.0V, I_C = 350mA(KA2655)	1000			
Input Capacitance	C_{IN}			15	30	pF
Propagation Delay Time	T_{ON}	0.5 V_{INTO} 0.5 V_O		0.25	1.0	μs
	T_{OFF}	0.5 V_{INTO} 0.5 V_O		0.25	1.0	μs
Clamp Diode Leakage Current	I_R	V_{IN} = open, V_O = GND, V_R = 50V, Ta = 25℃			50	μA
		V_{IN} = open, V_O = GND, V_R = 50V, Ta = 25℃			100	μA
Clamp Diode Forward Voltage	V_F	$_{IF}$ = 350mA		1.7	2.0	V

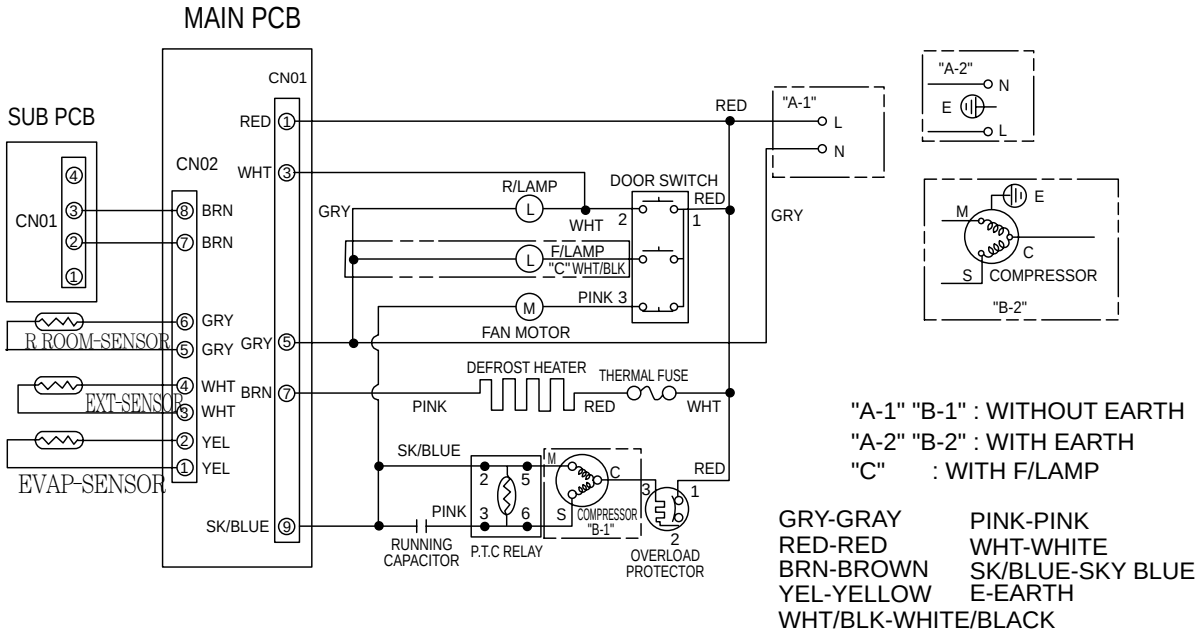
PIN CONFIGURATION



SCHEMATIC DIAGRAMS KA2655(each driver)



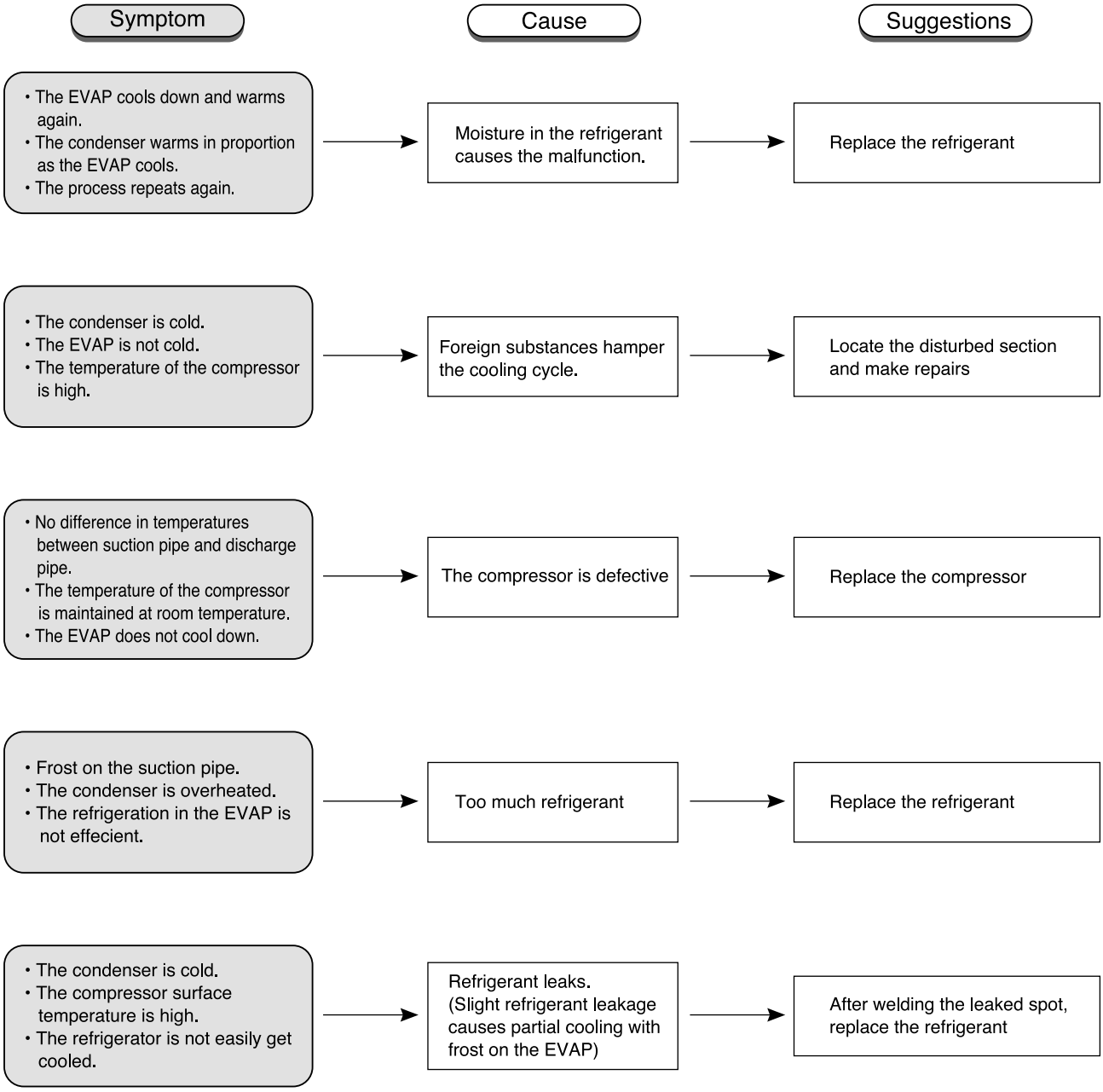
9. Specification of Main Circuit Part



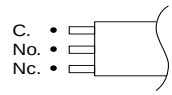
NO	CODE-NO	ITEM	DESCRIPTION	Q'ty	REMARKS
1	DA32-10105P	EVA SENSOR ASS'Y	502AT	1	
2	DA32-10109J	R-SENSOR ASS'Y	502AT	1	
3	DA41-00010A	MAIN PCB ASS'Y	AC220V/50, 60HZ	1	
4	DA41-00010B	MAIN PCB ASS'Y	AC127V/60HZ		
5	DA41-00010C	MAIN PCB ASS'Y	AC240V/50HZ		
6	DA41-00010D	MAIN PCB ASS'Y	AC115V/60HZ		
7	DA41-00012A	SUB PCB ASS'Y	T3-P/J	1	
8	DA32-10109M	EXT SENSOR ASS'Y	502AT	1	

8. Troubleshooting

8-1 Trouble check for the cooling cycle



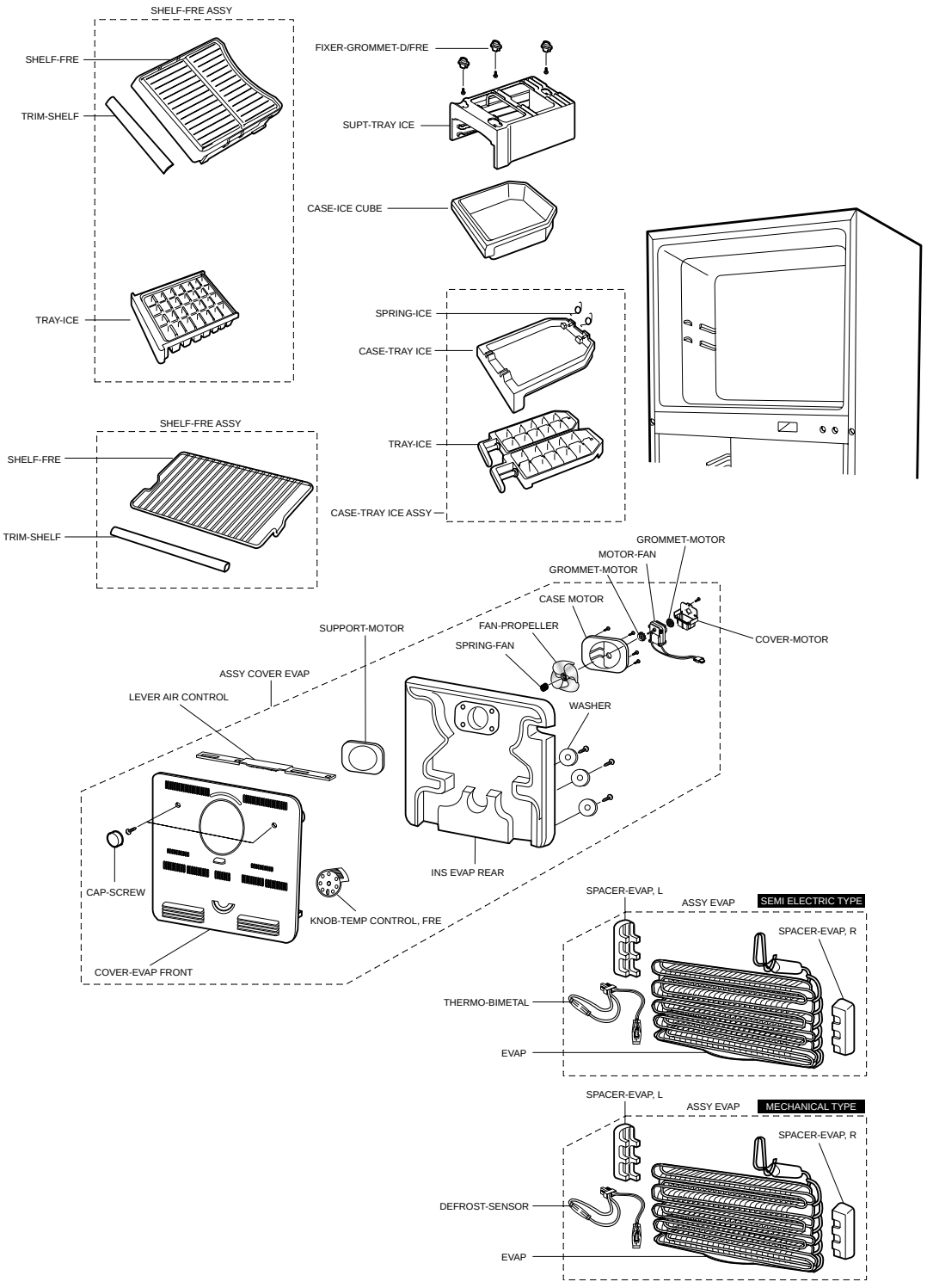
8-2 Diagnosing the main components

<table>
<tr><th>Components</th><th>Diagnosing methods and criteria</th><th>Location</th></tr>
<tr><td>Compressor</td><td>• Use the tester to measure the resistance.
– Bring the component to cool down completely before measuring.
<table>
<tr><th>Measuring point</th><th>Normal</th><th>Abnormal</th></tr>
<tr><td>Primary iwre</td><td>Approx 10 ~ 500kΩ</td><td rowspan="2">0Ω and ∞Ω</td></tr>
<tr><td>Secondary wire</td><td>3 ~ 20Ω</td></tr>
</table></td><td>Mechanical compartment</td></tr>
<tr><td>P.T.C Relay</td><td>• Use the tester to measure the resistance.
– Bring the component to cool down completely before measuring.
<table>
<tr><th>Normal</th><th>Abnormal</th></tr>
<tr><td>Approx ∞Ω ~ kΩ</td><td>0Ω and ∞Ω</td></tr>
</table></td><td>Mechanical compartment</td></tr>
<tr><td>Condenser</td><td>• Use the tester to measure the resistance.
– Bring the component to cool down completely before measuring.
<table>
<tr><th>Normal</th><th>Abnormal</th></tr>
<tr><td>Approx 10Ω ~ 80kΩ</td><td>0Ω and ∞Ω</td></tr>
</table></td><td>Electrical equipment box</td></tr>
<tr><td>Overload protector</td><td>• Use the tester to measure the resistance.
– Bring the component to cool down completely before measuring.
<table>
<tr><th>Normal</th><th>Abnormal</th></tr>
<tr><td>0Ω</td><td>∞Ω</td></tr>
</table></td><td>Mechanical compartment</td></tr>
<tr><td>Fan-motor</td><td>• Use the tester to measure the resistance.
<table>
<tr><th>Normal</th><th>Abnormal</th></tr>
<tr><td>Approx 100Ω ~ 20kΩ</td><td>0Ω and ∞Ω</td></tr>
</table></td><td>Mechanical compartment
Freezing compartment</td></tr>
<tr><td>Door switch</td><td>• Use the tester to measure the resistance.
 

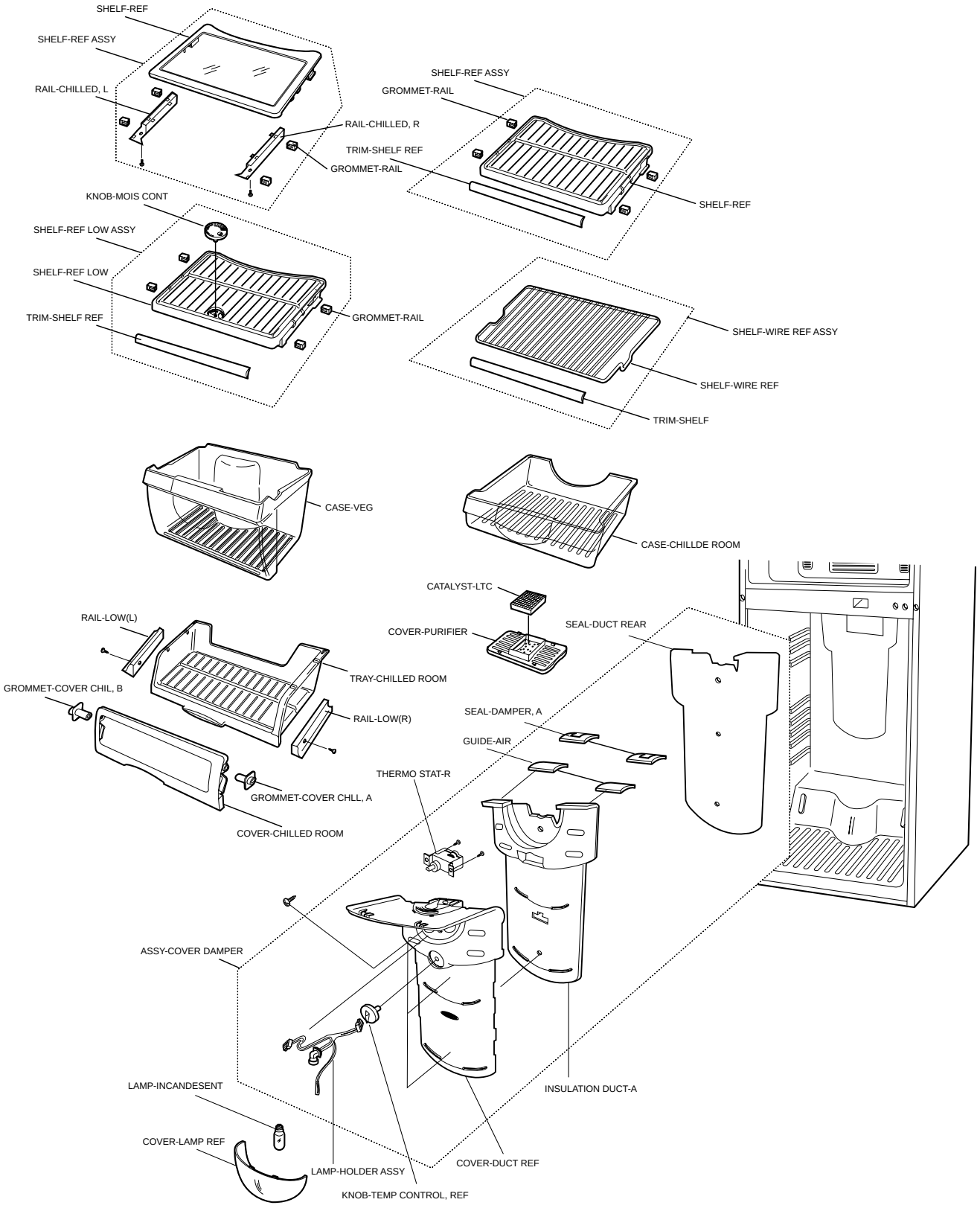
(Seperating measure)
<table>
<tr><th>Measuring point</th><th>Normal</th><th>Abnormal</th></tr>
<tr><td>A B contact point</td><td rowspan="2">Approx200MΩ</td><td>∞MΩ and∞Ω</td></tr>
<tr><td>When the switch is on by the contact</td><td></td></tr>
</table></td><td>Between the upper and the lower doors</td></tr>
<tr><td>Defrost heater</td><td>• Use the tester to measure the resistance.
– Bring the component to cool down completely before measuring.
<table>
<tr><th>Normal</th><th>Abnormal</th></tr>
<tr><td>40Ω ~200Ω</td><td>∞ MΩ ~ ∞Ω</td></tr>
</table></td><td>EVAP</td></tr>
</table>

9. Exploded View & Parts List

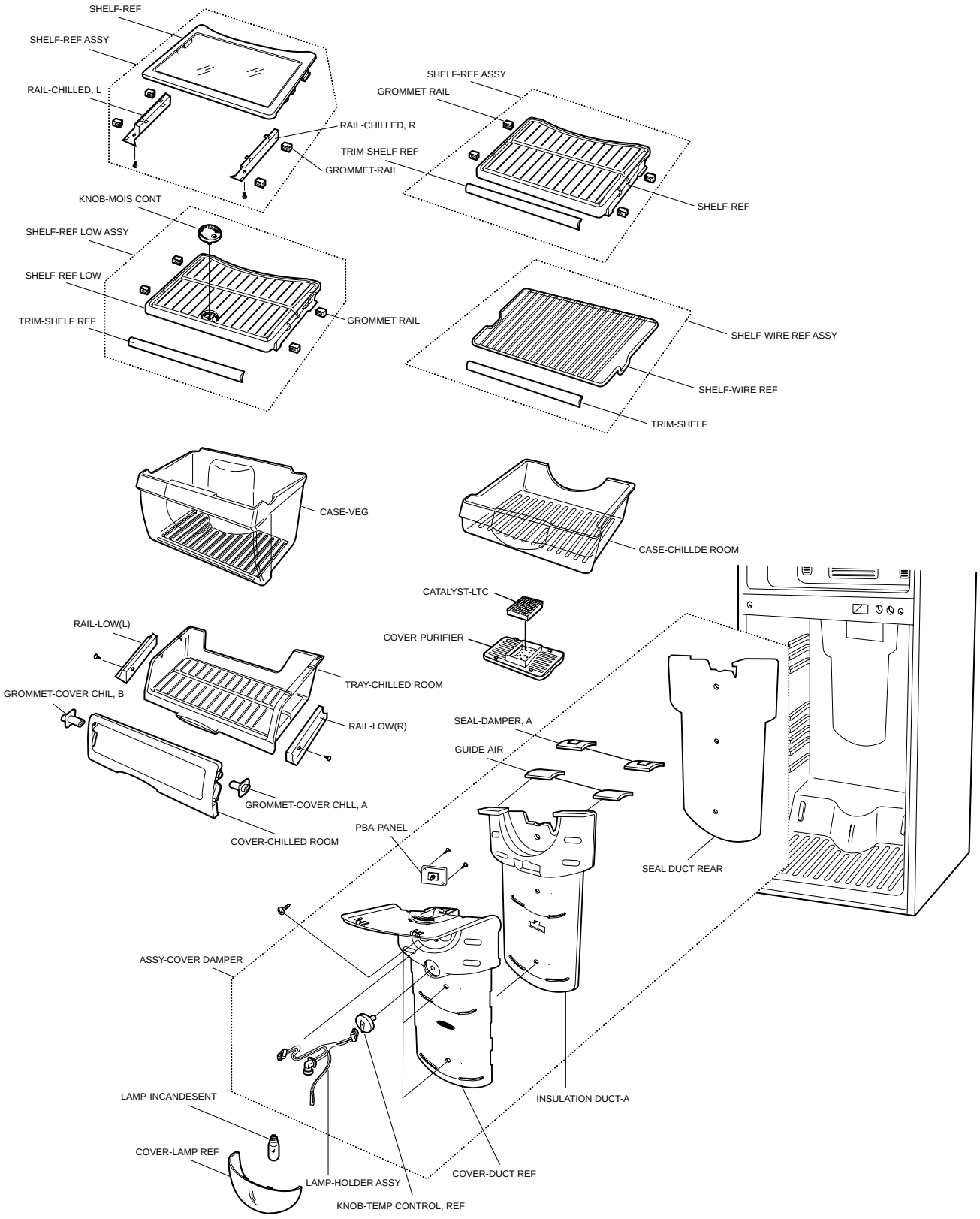
9-1 Freezing compartment



9-2 Refrigerating compartment(Mechanical Type)

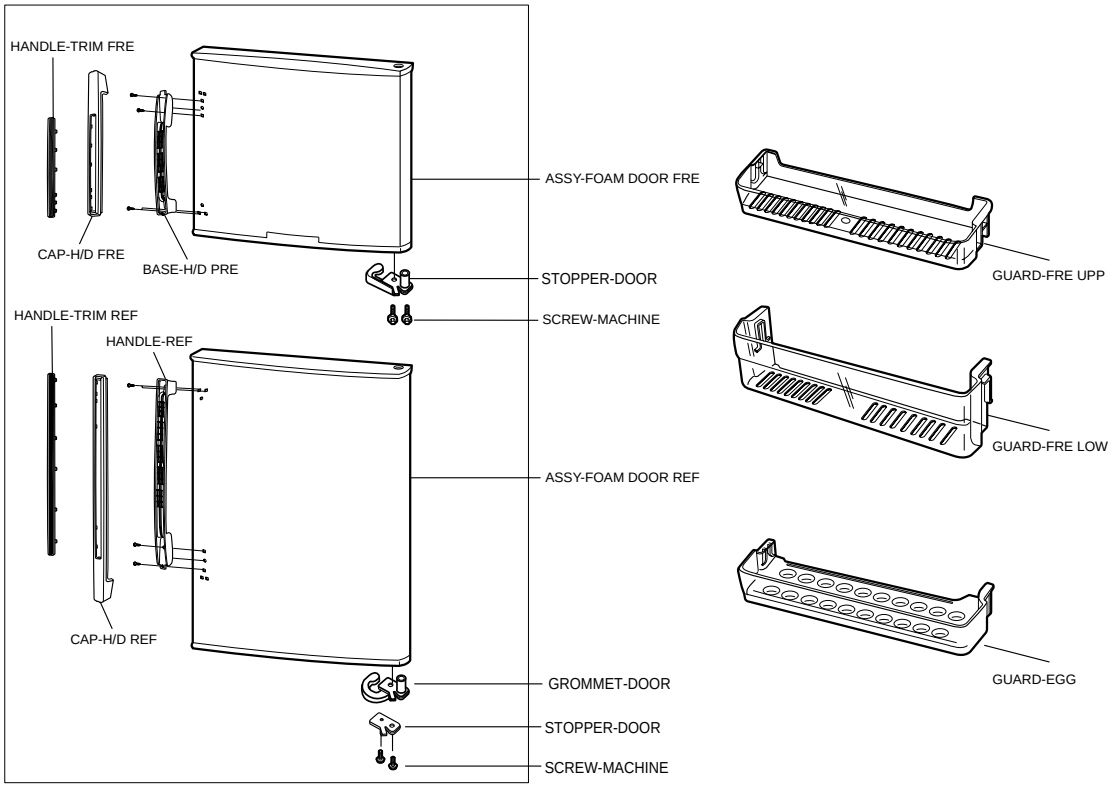


9-3 Refrigerating compartment(Semi Electric Type)

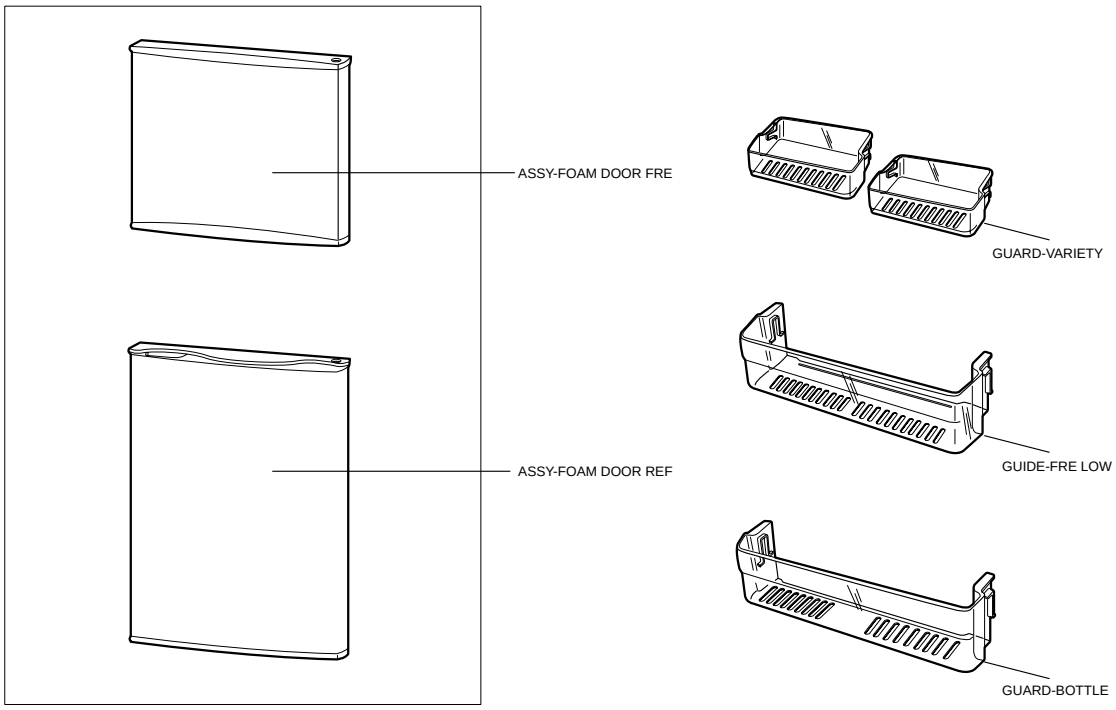


9-4 Door parts

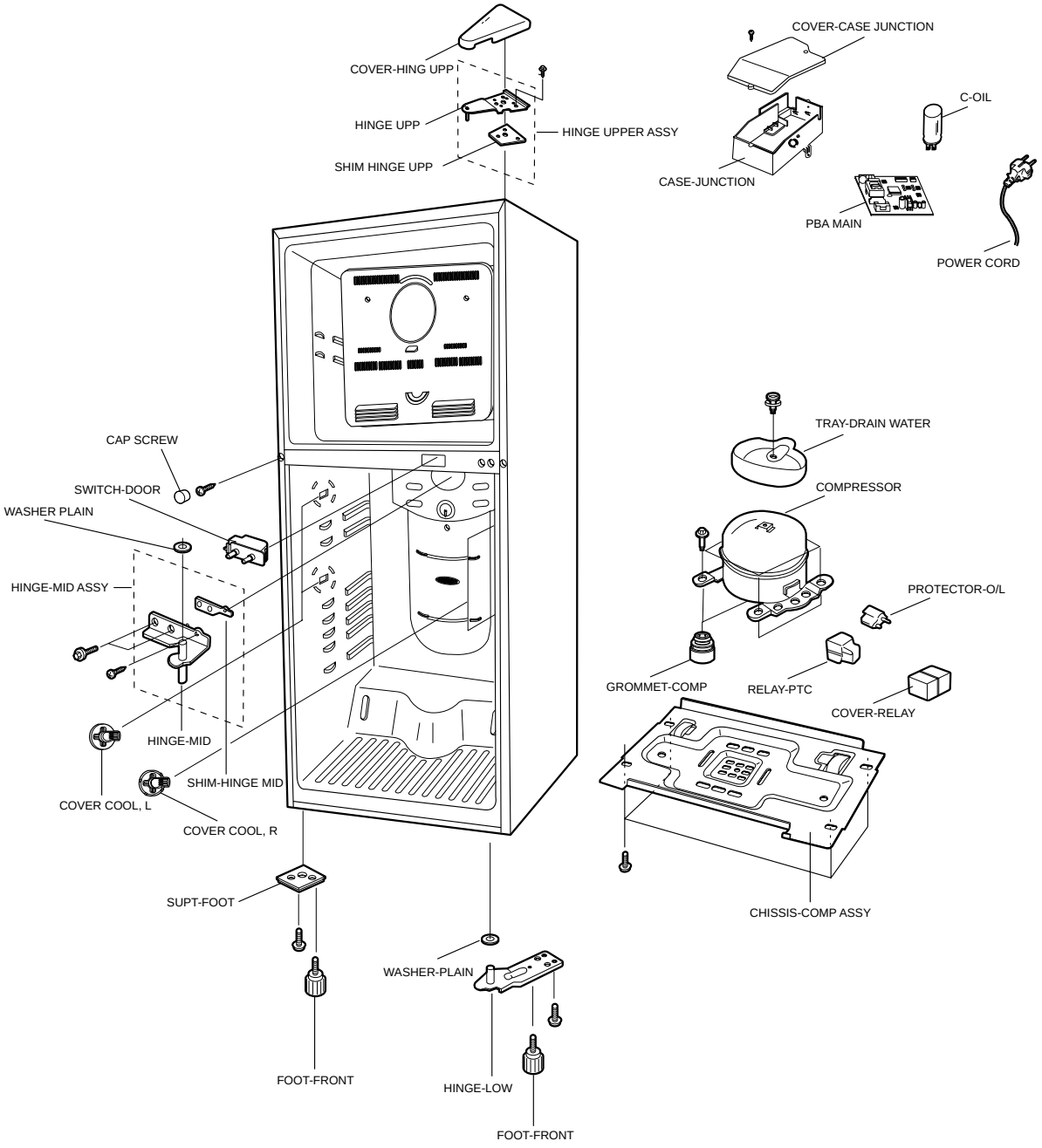
RT40/44MA



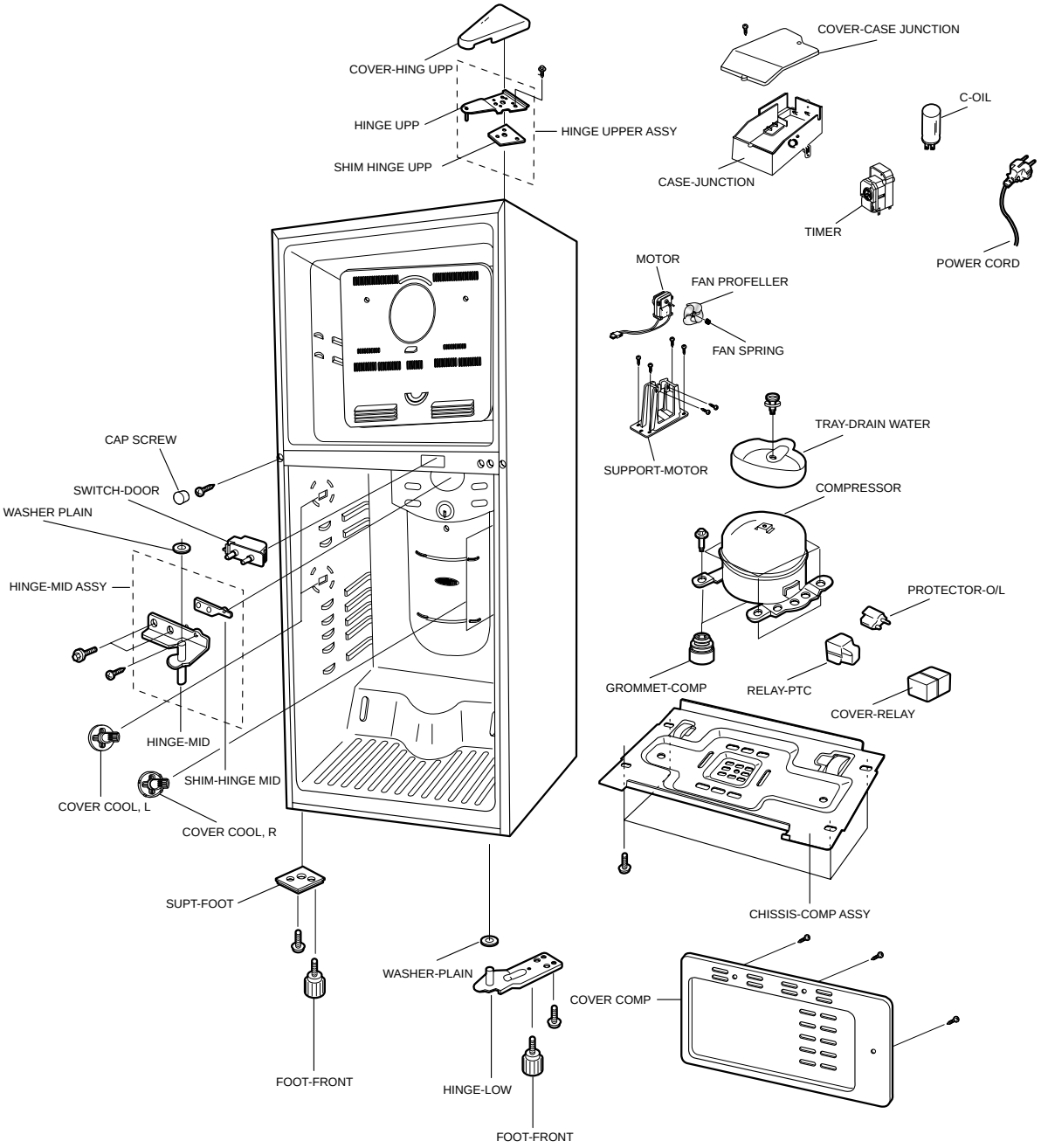
RT40/44MB



9-5 Cabinet Parts & Unit(Semi electric Type)



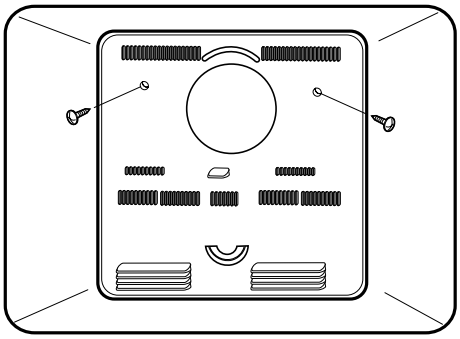
9-6 Cabinet Parts & Unit(Mechanical Type)



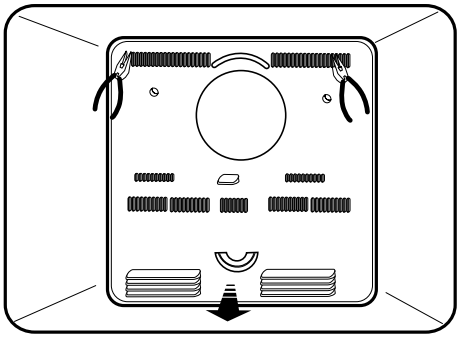
10. How to Disassemble of freezing Compartment

10-1 COVER-EVAP ASS'Y

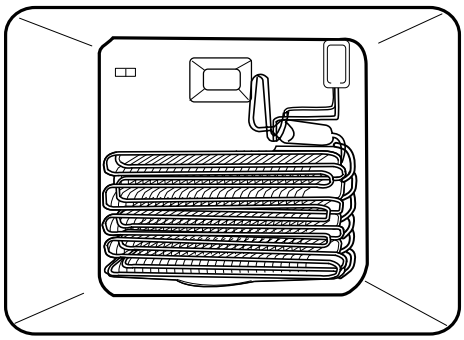
1. Take out food & useless in the freezer room and get rid of the moisture in the freezer.

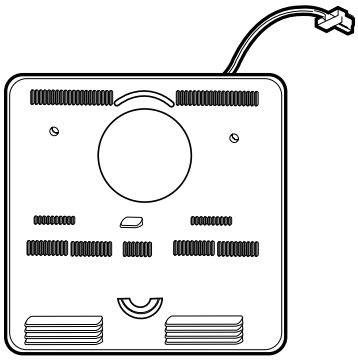


2. Please pull up the top with a long-nose and insert the hand into the gab, as shown below.
Take a part the connected housing.



3. When the COVER-EVAP, ASSY is taken a part, take an action on the problem.
Reassemble the cover evap a'ssy.



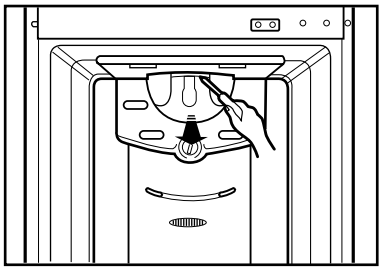


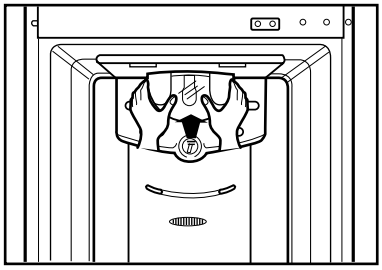
11. How to disassemble of refrigerating Compartment

11-1 Changing the Light Bulb

When you open the refrigerator door, a light comes on the help you find what you are looking for more easily. If you need to replace the bulb, proceed as follows.

1. Remove the chiller compartment by:
   - ◆ Putting it towards you until it meets the stop
   - ◆ Tilting the front up slightly and continuing to pull the compartment towards you
2. With a flat-bladed screwdriver, pries out the upper part of the light cover. Pull the cover free.
3. Unscrew and remove the light bulb.
4. Insert new bulb(maximum of 15 W. E14 small screw base).
5. Replace the light cover by pushing it until it clicks back into place.
6. Replace the chiller compartment by sliding it back into position.





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