SHARP

SPEC No.	

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To;

TENTATIVE SPECIFICATIONS

Product Type Power Supply IC for CCD Module

Model No. IR3M63U6

※This tentative specifications contains 24 pages including the cover and appendix.
The contents of this tentative specifications are subject to change to improve characteristics.

CUSTOMERS ACCEPTANCE

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(1) The products covered herein are designed and manufactured for the following application areas. When using the products covered herein for the equipment listed in paragraph (2), even for the following application areas, be sure to observe the precautions given in Paragraph (2). Never use the products for the equipment listed in Paragraph (3).

- Office electronics
- Instrumentation and measuring equipment
- Machine tools
- Audiovisual equipment
- Home appliances
- Communication equipment other than for trunk lines

(2) These contemplating using the products covered herein for the following equipment which demands high reliability, should first contact a sales representative of the company and then accept responsibility for incorporating into the design fail-safe operation, redundancy, and other appropriate measures for ensuring reliability and safety of the equipment and the overall system.

- Control and safety devices for airplanes, trains, automobiles, and other transportation equipment
- Mainframe computers
- traffic control systems
- Gas leak detectors and automatic cutoff devices
- Rescue and security equipment
- Other safety devices and safety equipment, etc.

(3) Do not use the products covered herein for the following equipment which demands extremely high performance in terms of functionality, reliability, or accuracy

- Aerospace equipment
- Communications equipment for trunk lines
- Control equipment for the nuclear power industry
- Medical equipment related to life support, etc.

(4) Please direct all queries and comments regarding the interpretation of the above three Paragraphs to a sales representative of the company.

● Please direct all queries regarding the products covered herein to a sales representative of the company.

CONTENTS

1. General Description

The Sharp IR3M63U6 is a power supply IC for CCD camera modules. This single chip can simultaneously offer positive and negative output voltages for CCD power supply from a single input, with a buck switching power supply, charge pumps and regulators.
Each output can be controlled by CTL input, and its order of priority is determined by internal control not to damage CCDs.

2. Features

(1) Power supply voltage : 4.5V~10V
(2) Buck switching power supply : output voltage 3.6V, frequency 1MHz
(3) Boost / inverting charge pump frequency : 200kHz
(4) Linear regulator 1 : output voltage 3.3V, maximum output current 120mA
150mA (no load on linear regulator 2)
(5) Linear regulator 2 : output voltage 1.8V, maximum output current 50mA
(6) Boost charge pump + linear regulator : 15V / max. 12mA
(7) Inverting charge pump + linear regulator : -8V / max. 2.5mA
(8) Containing power supply sequence controller
(9) Containing over-current protection circuits
(10) P type silicon substrate monolithic IC
(11) Lead free
(12) 32-pin VQFN (5.2 mm x 5.2 mm) plastic package
(13) Not designed or rated as radiation hardened

3. Pin Connections

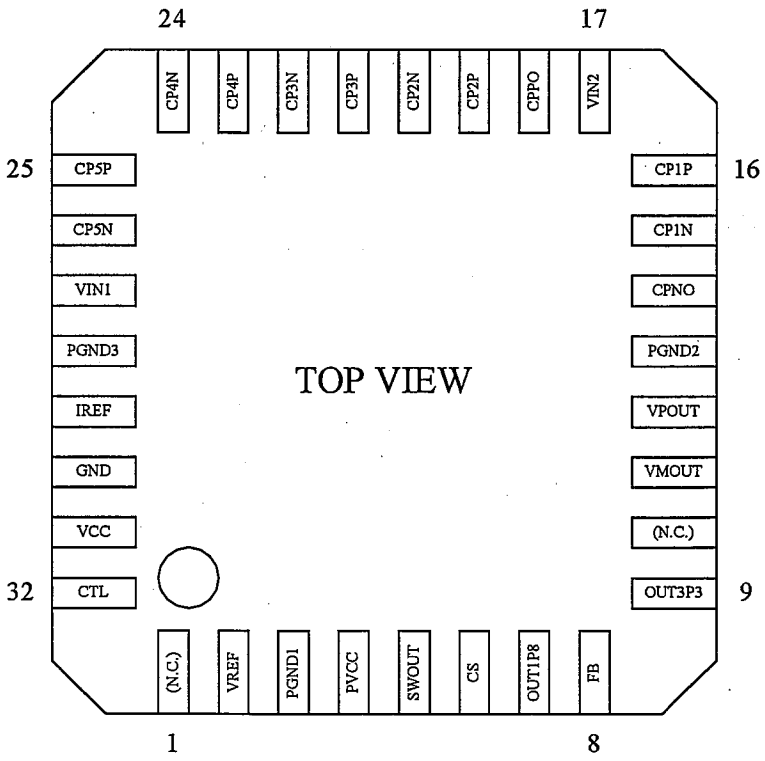
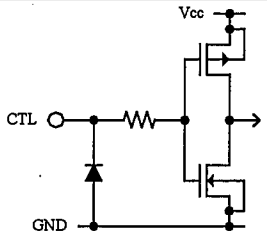
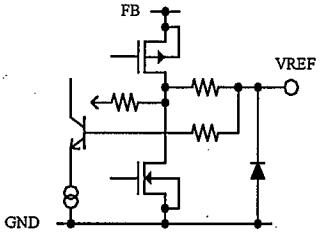
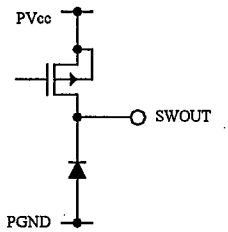
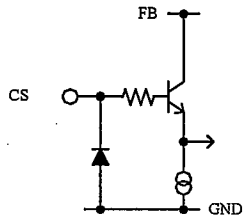
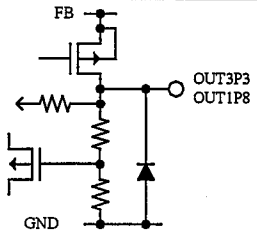
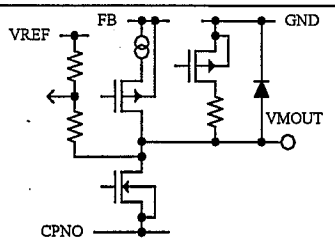
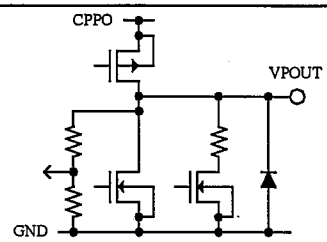
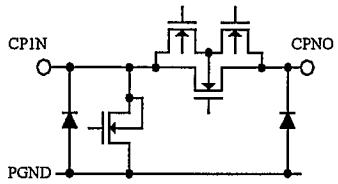
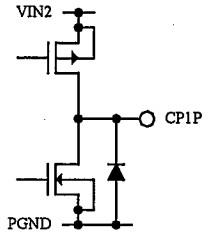
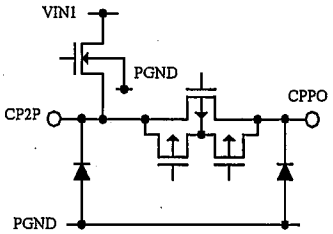
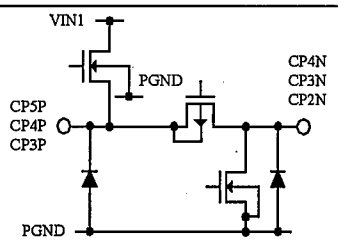
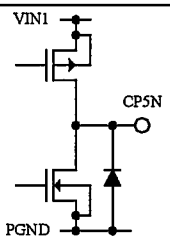
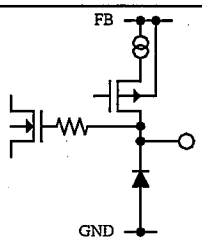


Fig. 1

4. Pin Description

Pin No.	Pin Name	I/O	Vol./ Vth	Equivalent Circuit	Description
32	CTL	I	1.5V at Vcc = 5V		Control input pin for 1.8V, 3.3V, 15V and -8V outputs. (High : Start ; Low : Stop)
2	VREF	-	1.25V		Output pin for 1.25V reference voltage. Normally open.
5	SWOUT	O			Output pin for 3.6V buck switching power supply. Connect an inductor and a diode.
6	CS	I	-		Sense voltage input (high) pin for over-current control of 3.6V power supply.
7 9	OUT1P8 OUT3P3	O	-		Output pin for 3.3V / 1.8V regulator. Connect to GND through a capacitor.
11	VMOUT	O	-		Output pin for -8V regulator. Connect to GND through a capacitor.
12	VPOUT	O	-		Output pin for 15V regulator. Connect to GND through a capacitor.

Pin No.	Pin Name	I/O	Vol./ Vth	Equivalent Circuit	Description
14	CPNO	-	-		Output capacitor connection pin for inverting charge pump. Connect to GND through a capacitor for regulating.
15	CP1N				Flying capacitor 1 negative pin. Connect a capacitor from CP1N to CP1P.
16	CP1P	-	-		Flying capacitor 1 positive pin. Connect a capacitor from CP1P to CP1N.
18	CPPO	-	-		Output capacitor connection pin for boost charge pump. Connect to GND through a capacitor for regulating.
19	CP2P				Flying capacitor 2 positive pin. Connect a capacitor from CP2P to CP2N.
20 22 24	CP2N CP3N CP4N	-	-		Flying capacitor 2, 3 and 4 negative pin. Connect capacitors from CP2N to CP2P, from CP3N to CP3P, and from CP4N to CP4P.
21 23 25	CP3P CP4P CP5P				Flying capacitor 3, 4 and 5 positive pin. Connect capacitors from CP3P to CP3N, from CP4P to CP4N, and from CP5P to CP5N.
26	CP5N	-	-		Flying capacitor 5 negative pin. Connect a capacitor from CP5N to CP5P.
29	IREF	-	1.25V		Oscillation frequency setting pin for charge pumps. Connect to GND through a resistor.
3	PGND1	-	-		GND pin (3.6V buck switching power supply)
13 28	PGND2 PGND3				GND pin (charge pumps)
30	GND				GND pin (control circuits)
4	PVCC	-	=VCC		Power supply pin (3.6V buck switching power supply)
8	FB		3.6V		Power supply (control input), input for 3.6V output voltage monitor and sense voltage input (low) pin for over-current control of 3.6V power supply.
17	VIN2		10.8V		Power supply pin (inverting charge pump) Connect to CP4P pin.
27	VIN1		=FB		Power supply pin (charge pumps) Connect to FB pin.
31	VCC		4.5V to 10V		Power supply pin (control circuits)

5. Block Diagram and Basic Connections

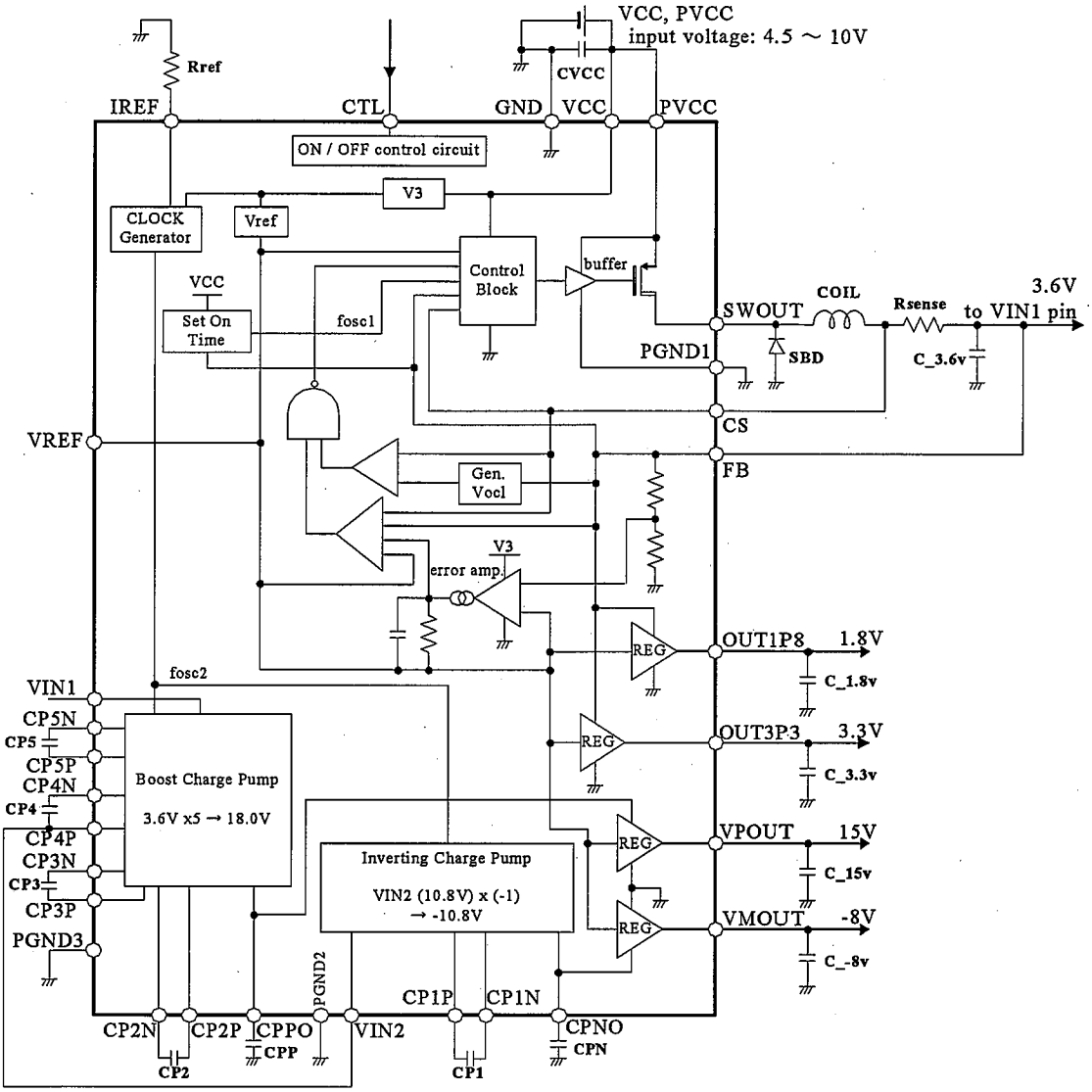


Fig. 2

6. External Components List

Symbol	Parts Name	Value	Size	Model No.	Maker	Voltage Limit (standard)
Rref	Resistor for charge pump freq. setting	120kΩ	1005			-
CVCC	Input power supply capacitor	2.2μF	1608	*MK107BJ105K	Taiyo Yuden	Vcc x 2
COIL	Inductor	10μH	3225	CBC3225T100M	Taiyo Yuden	-
SBD	Schottky diode for regenerative operation		2125	RB551V-30	Rohm	Vcc
Rsense	Current sense resistor	200mΩ	1608	ERJ3RSFR20	Matsushita	-
C_3.6v	3.6V output capacitor	2.2μF	1608	JMK107BJ225K	Taiyo Yuden	6.3
C_3.3v	3.3V output capacitor	1μF	1005	JMK105BJ105K	Taiyo Yuden	6.3
C_1.8v	1.8V output capacitor	1μF	1005	JMK105BJ105K	Taiyo Yuden	6.3
C_15v	Output capacitor for boost	1μF	1608	TMK107BJ105K	Taiyo Yuden	25
C_-8v	Output capacitor for inverting	1μF	1608	EMK107BJ105K	Taiyo Yuden	16
CPN	Power supply capacitor for inverting	1μF	1608	EMK107BJ105K	Taiyo Yuden	16
CP1	Flying capacitor 1	1μF	1608	EMK107BJ105K	Taiyo Yuden	16
CPP	Power supply capacitor for boost	1μF	1608	TMK107BJ105K	Taiyo Yuden	25
CP2	Flying capacitor 2	1μF	1005	JMK105BJ105K	Taiyo Yuden	6.3
CP3	Flying capacitor 3	1μF	1005	JMK105BJ105K	Taiyo Yuden	6.3
CP4	Flying capacitor 4	1μF	1005	JMK105BJ105K	Taiyo Yuden	6.3
CP5	Flying capacitor 5	1μF	1005	JMK105BJ105K	Taiyo Yuden	6.3

* using 2 pieces of 1uF in parallel

7. Operation Description

(1) Power Supply Generation

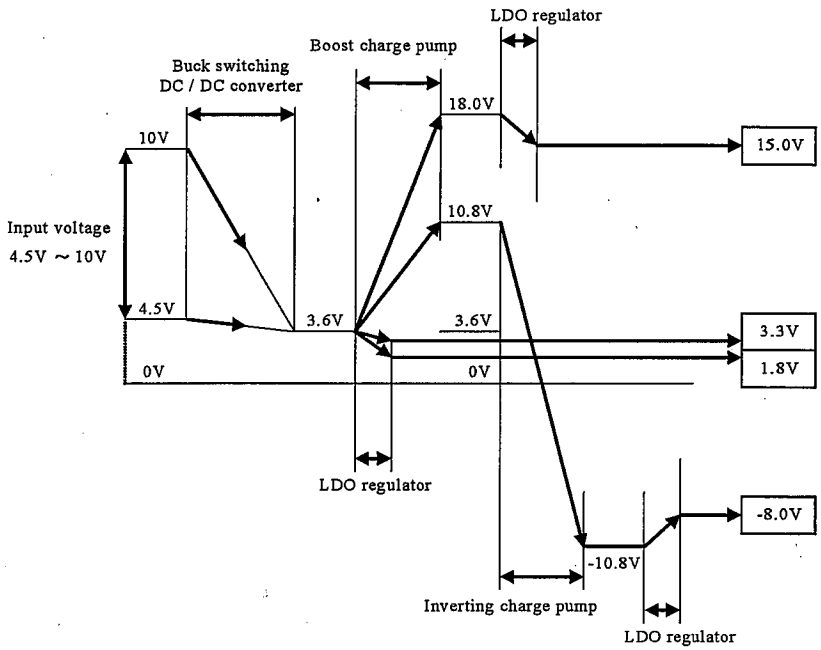


Fig. 3

(i) Buck switching DC / DC converter creates 3.6V from input voltage.

(ii) LDO linear regulator 1 makes 3.3V, and LDO linear regulator 2 makes 1.8V from 3.6V input.

(iii) After 3.6V input is boosted to 18.0V (5 times higher), 15V output is generated through an LDO linear regulator.

(iv) After 3.6V input is boosted to 10.8V (3 times higher) and then inverted to -10.8V, -8V output is generated through an LDO linear regulator.

(2) Start / Stop Sequence

Input terminal CTL controls start / stop of 1.8V, 3.3V, 15V and -8V outputs, respectively. (High: Start; Low: Stop)
Not to damage CCDs, the following priority is set in start / stop sequence by inside settings.

Start Sequence :
Start sequence by the following order : 1.8V → 3.3V → 15V → -8V
Outputs are observed in this IC for the regulations to start in the order above.
(Refer to Fig. 4)

Stop Sequence :
1.8V, 3.3 V, 15V and -8V outputs are turned off simultaneously.
1.8V, 3.3V and 3.6V outputs are only stopped their voltage generations.
15V and -8V outputs are stopped their voltage generations, and their output capacitors are discharged.

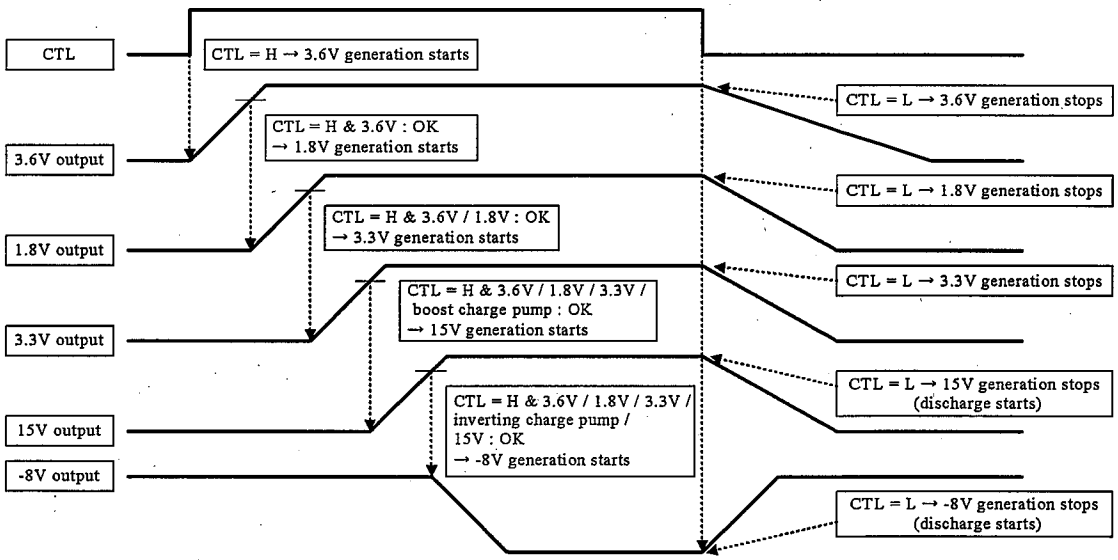


Fig. 4

(3) 3.6V Regulator

3.6V regulator starts operating when the level of CTL changes to H. It monitors output voltage and inductor current, when they are lower than regulation levels, output MOS transistor turns on for the appointed time. If the output voltage is still lower than its regulation level after the appointed time, the output MOS transistor remains on.

Over-current protection works in fold-back type drooping characteristic after the regulation starts.

(4) 3.3V Regulator, 1.8V Regulator

3.3V and 1.8V outputs are generated from 3.6V power supply. The currents are automatically limited by the maximum ability to provide set inside, and these circuits are also protected by the over-current protection of 3.6V power supply.

(5) Charge Pumps, 15V Regulator, -8V Regulator

When 3.6V power supply is set, charge pumps start operating. According to the appointed output permission conditions, each regulator (15V, -8V) starts operating to generate output voltage.

The regulators are protected against over-current by limiting maximum current provided to capacitors.

(6) Over-current Protection

Each output is protected against over-current. The details are mentioned above in (3) ~ (5) .

8. Absolute Maximum Ratings

Please use this product within the following absolute maximum ratings all the time, including startup and shutdown.

Parameter	Symbol	Conditions	Rating	Unit
Power supply voltage	Vcc	VCC, PVCC	20.0	V
Input pin voltage	V_{IN1}	CTL	-0.3 ~ 20.0	V
Power dissipation (*1)	P_D	Ta ≦ 25 ℃	1428	mW
Power dissipation derating (*1)	ΔP_D	Ta > 25 ℃	14.3	mW / ℃
Operating temperature range	T_{OPR}		-30 ~ 85	℃
Storage temperature range	T_{STG}		-55 ~ 150	℃

(*1) natural convection, on-board (based on SEMI 42-96)

Fig. 5 shows power dissipation temperature characteristic.

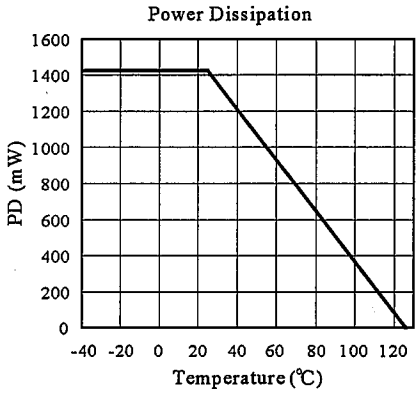


Fig. 5

9. Notes

(1) Connect all GND pins (GND, PGND1, PGND2, PGND3) together as close as possible to this IC not to make any voltage difference between these GND pins, at startup and shutdown.
(2) Connect all Vcc pins (VCC, PVCC) together as close as possible to this IC not to make any voltage difference between these Vcc pins, at startup and shutdown.
(3) Form GND patterns to reduce its impedance.
(4) Place the decoupling capacitor (CVCC) between Vcc and GND as close as possible to this IC, and do not short the GND or Vcc pins nearer to the IC than the decoupling capacitor.
(5) Form the line patterns of IREF and VREF pins not to cause noise on them.
The following pins have signals of larger amplitude in this IC, be careful of wiring them.
・Both sides of flying capacitors for charge pumps (CP1~5)
・Output of switching regulator (SWOUT)
(6) Do not leave the input pin (CTL) floating. Connect the pin to GND or Vcc when it is not in use.

10. Electrical Characteristics

Unless otherwise specified: Ta = 25℃, VCC = PVCC = 5V, CTL = 5V, other pins are connected according to "5. Block Diagram and Basic Connections" and "6. External Components List."

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	Vcco	VCC, PVCC	4.5		10.0	V
Quiescent current at operation	Ivcc	CTL = H, no load	-	19	38	mA
Shutdown current	Iccs	CTL = L	-	-	3	μA
Oscillation frequency SW	foscs	SWOUT, maximum frequency	500	1000	1800	kHz
Oscillation frequency CP	foscc	VIN2, charge pump power supply	150	200	250	kHz
Standard voltage	Vref	VREF	1.231	1.250	1.269	V
3.3V voltage	V3p3a	OUT3P3, Io = 0 ~ 120mA (outflow)	3.168	3.300	3.432	V
	V3p3b	OUT3P3, Io = 0 ~ 150mA (outflow), no load on OUT1P8	3.168	3.300	3.432	V
1.8V voltage	V1p8	OUT1P8, Io = 0 ~ 50mA (outflow)	1.728	1.800	1.872	V
Boosted voltage	Vp	VPOUT, Io = 0 ~ 12mA (outflow)	14.62	15.00	15.38	V
Inverted voltage	Vm	VMOUT, Io = 0 ~ 2.5mA (inflow)	-7.68	-8.00	-8.32	V
Control logic threshold H	Vith	CTL H threshold	0.9	1.5	2.5	V
Control logic threshold hysteresis width	Vihys	Hysteresis width at H → L	0.1	0.3	0.5	V
3.6V output over-current detection voltage	Vcs	FB = 3.6 V (*1)	80	100	120	mV
3.3V output maximum current	Imax1a	OUT3P3 (outflow)	120	-	-	mA
	Imax1b	OUT3P3 (outflow), no load on OUT1P8	150	-	-	mA
Boosted output maximum current	Iomax2	VPOUT (outflow)	12	-	-	mA
Inverted output maximum current	Iomax3	VMOUT (inflow)	2.5	-	-	mA
1.8V output maximum current	Iomax4	OUT1P8 (outflow)	50	-	-	mA

(*1) The voltage difference between CS and FB pins when the oscillation at SWOUT stops, after raising CS pin voltage from FB pin voltage.

11 Package and packing specification

[Applicability]

This specification applies to an IC package of the LEAD-FREE delivered as a standard specification.

1.Storage Conditions.

1-1.Storage conditions required before opening the dry packing.

- Normal temperature : 5～40℃
- Normal humidity : 80% (Relative humidity) max.
- Storage period : One year max.

*"Humidity" means "Relative humidity"

1-2.Storage conditions required after opening the dry packing.

In order to prevent moisture absorption after opening, ensure the following storage conditions apply:.

(1) Storage conditions for one-time soldering. (Convection reflow*1, IR/Convection reflow.*1)

- Temperature : 5～25℃
- Humidity : 60% max.
- Period : 96 hours max. after opening.

(2) Storage conditions for two-time soldering. (Convection reflow*1, IR/Convection reflow.*1)

a. Storage conditions following opening and prior to performing the 1st reflow.

- Temperature : 5～25℃
- Humidity : 60% max.
- Period : 96 hours max. after opening.

b. Storage conditions following completion of the 1st reflow and prior to performing the 2nd reflow.

- Temperature : 5～25℃
- Humidity : 60% max.
- Period : 96 hours max. after completion of the 1st reflow.

*1:Air or nitrogen environment.

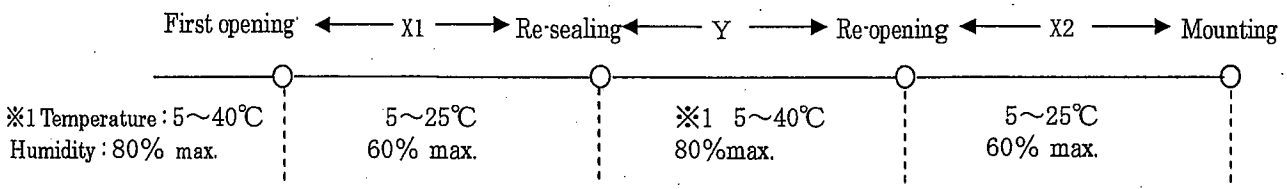
1-3.Temporary storage after opening.

To re-store the devices before soldering, do so only once and use a dry box or place desiccant (with a blue humidity indicator) with the devices and perform dry packing again using heat-sealing.

The storage period, temperature and humidity must be as follows :

(1) Storage temperature and humidity.

※1 : External atmosphere temperature and humidity of the dry packing.



(2) Storage period.

- X1＋X2 : Refer to Section 1-2(1) and (2)a , depending on the mounting method.
- Y : Two weeks max.

2. Baking Condition.

(1) Situations requiring baking before mounting.

- Storage conditions exceed the limits specified in Section 1-2 or 1-3.
- Humidity indicator in the desiccant was already red (pink) when opened.
  (Also for re-opening.)

(2) Recommended baking conditions.

- Baking temperature and period : 120＋10／-0℃ for 2～3 hours.
- The above baking conditions do not apply since the embossed carrier tape are not heat-resistant . Replace the devices on heat-resistant carrier .

(3) Storage after baking.

- After baking, store the devices in the environment specified in Section 1-2 and mount immediately.

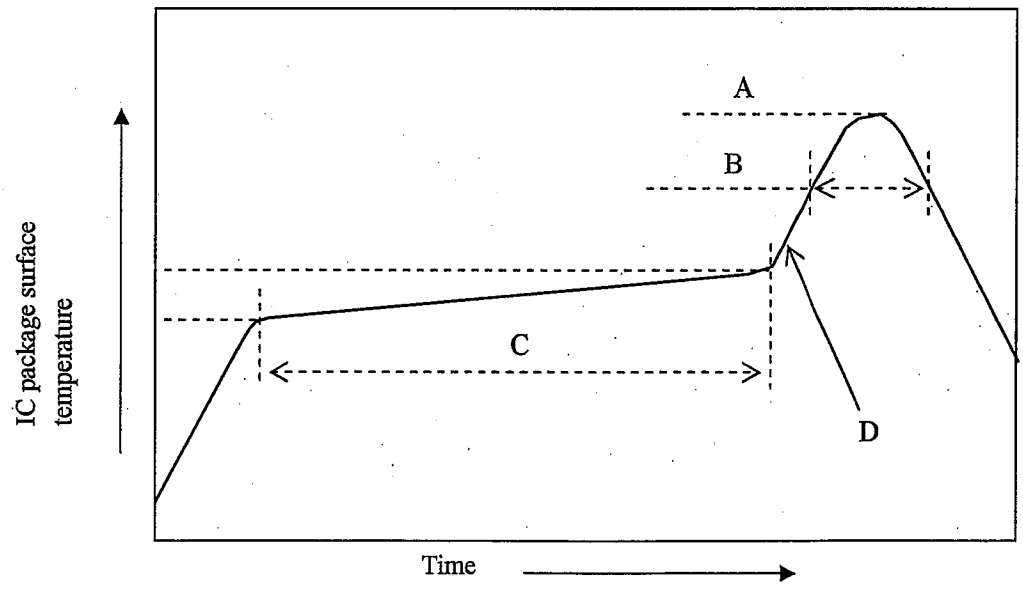
3. Surface mount conditions.

The following soldering conditions are recommended to ensure device quality.

3-1.Soldering.

(1) Convection reflow or IR/Convection reflow. (one-time soldering or two-time soldering in air or nitrogen environment)

- Temperature and period :
  - A) Peak temperature. 250℃ max.
  - B) Heating temperature.. 40 to 60 seconds as 220℃
  - C) Preheat temperature. It is 150 to 200℃, and is 120±30 seconds
  - D) Temperature increase rate. It is 1 to 3℃/seconds
- Measuring point : IC package surface.
- Temperature profile :



4. Condition for removal of residual flux.
   (1) Ultrasonic washing power : 25 watts / liter max.
   (2) Washing time : Total 1 minute max.
   (3) Solvent temperature : 15～40℃

5. Package outline specification.
   Refer to the attached drawing.
   (Plastic body dimensions do include burr of resin.)
   The contents of LEAD-FREE TYPE application of the specifications. (*2)

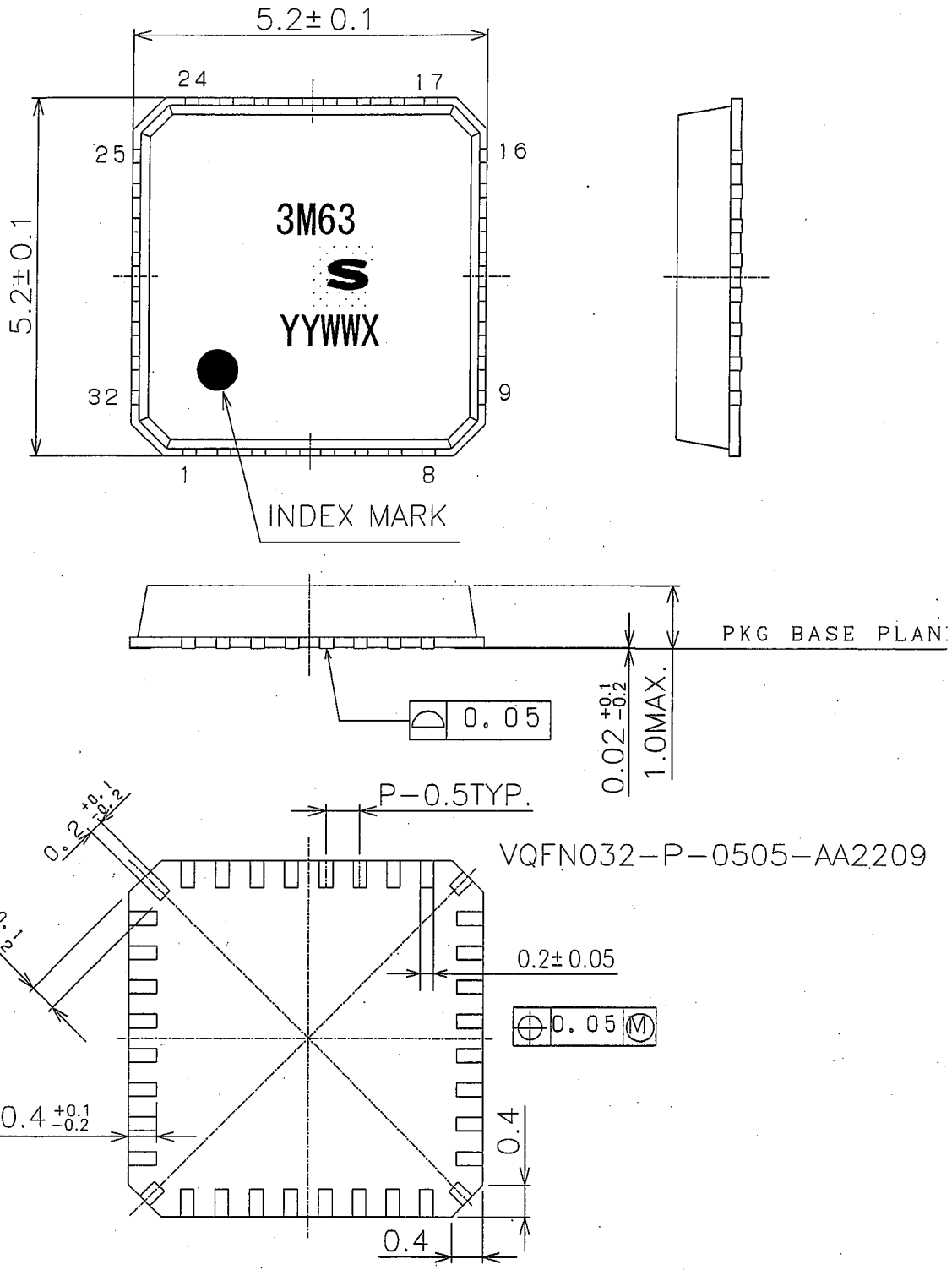
6.Markings.
   6-1.Marking details. (The information on the package should be given as follows.)
      (1) Product name : 3M63
      (2) Company name : S
      (3) Date code : (Example) YYWWX
         YY → Denotes the production year. (Last two digits of the year.)
         WW → Denotes the production week. (01・02・～・52・53)
         X → Denotes the production ref. code (1 digit).

   6-2.Marking layout.
      The layout is shown in the attached drawing.
      (However, this layout does not specify the size of the marking character and marking position.)

*2 The contents of LEAD-FREE TYPE application of the specifications.

LEAD FINISH or BALL TYPE	LEAD-FREE TYPE (Sn-2%Bi) 10μm TYP.(Min. 5μm)
DATE CODE	They are those with an underline.
The word of " LEAD FREE" is printed on the packing label	Printed

(Note) It is those with an underline printing in a date code because of a LEAD-FREE type.



LEAD TYPE	LEAD FINISH	LEAD MATERIAL
	Sn-2%Bi PLATING 10µm TYP.(Min. 5µm)	Cu

NAME	VQFN032-P-0505			NOTE : Plastic body dimensions do include burr of resin.
DRAWING NO.	AA2209	UNIT	mm	

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7.Packing specifications (Embossed carrier tape specifications)

This standard applies to the embossed carrier tape specifications for ICs supplied by SHARP CORPORATION. SHARP's embossed carrier tape specifications are generally based on those described in JIS C 0806 (Japanese Industrial Standard) and EIA481A.

7-1.Tape structure

The embossed carrier tape is made of conductive plastic. The embossed portions of the carrier tape are filled with IC packages and a top covering tape is used to enclose them.

7-2.Taping reel and embossed carrier tape size

For the taping reel and embossed carrier tape sizes, refer to the attached drawing.

7-3.IC package enclosure direction in embossed carrier tape

The IC package enclosure direction in the embossed portion relative to the direction in which the tape is pulled is indicated by an index mark on the package (indicating the No. 1 pin) shown in the attached drawing.

7-4.Missing IC packages in embossed carrier tape

The number of missing IC packages in the embossed carrier tape per reel should not exceed either 1 or 0.1 % of the total contained on the tape per reel, whichever is larger. There should never be more than two consecutive missing IC packages.

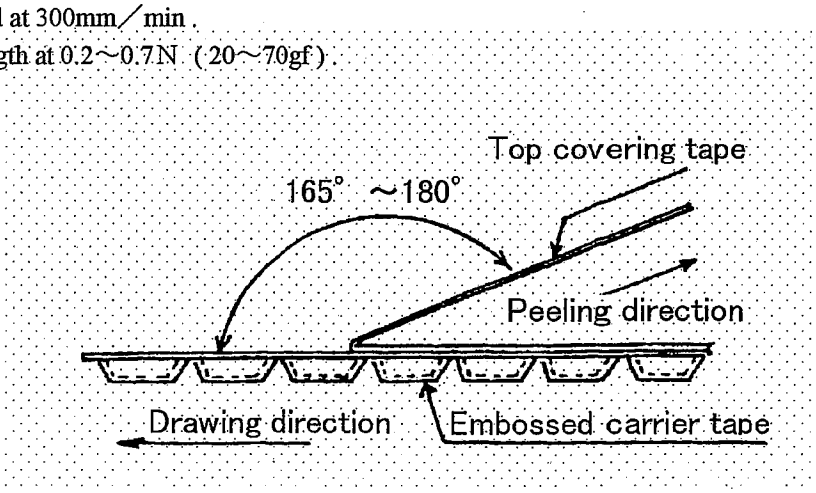
7-5.Tape joints

There is no joint in an embossed carrier tape.

7-6.Peeling strength of the top covering tape

Peeling strength must meet the following conditions.

(1) Peeling angle at 165～180°.
(2) Peeling speed at 300mm／min .
(3) Peeling strength at 0.2～0.7N (20～70gf) .



7-7. Packing

(1) The top covering tape (leader side) at the leading edge of the embossed carrier tape, and the trailing edge of the embossed carrier tape, should both be held in place with paper adhesive tape at least 30 mm in length.

(2) The leading and trailing edges of the embossed carrier tape should be left empty (with embossed portions not filled with IC packages) in the attached drawing.

(3) The number of IC packages enclosed in the embossed carrier tape per reel should generally comply with the list given below.

Number of IC Packages/ Reel	Number of IC Packages/ Inner carton	Number of IC Packages/ Outer carton
2500 devices / Reel	2500 devices / Inner carton	12500 devices / Outer carton

7-8.Indications

The following should be indicated on the taping reel and the packing carton.

・Part Number (Product Name) ・Storage Quantity ・Packed Date

・Manufacture's Name (SHARP)

Note : The IC taping direction is indicated by " EL " suffixed to the part number .

EL : Equivalent to " L " of the JIS C 0806 standard..

7-9.Protection during transportation

The IC packages should have no deformation and deterioration of their electrical characteristics resulting from transportation.

8.Precautions for use.

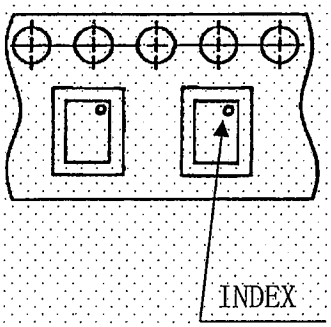
(1) Opening must be done on an anti-ESD treated workbench.
All workers must also have undergone anti-ESD treatment.

(2) The devices should be mounted within one year of the date of delivery.

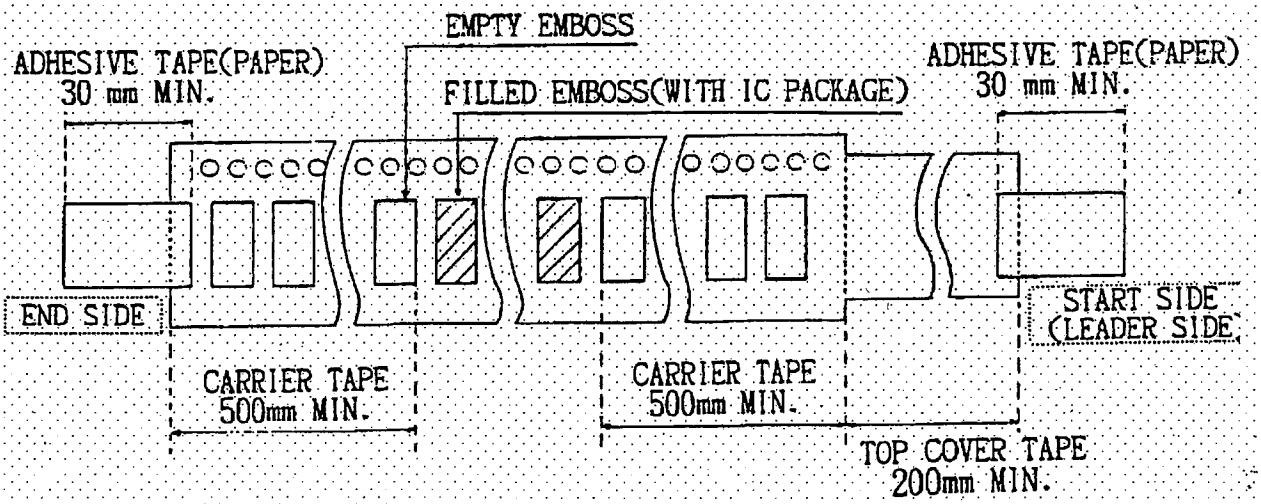
EMBOSS TAPING TYPE (EL)

IC TAPING DIRECTION

THE DRAWING DIRECTION OF TAPE →



LEADER SIDE AND END SIDE OF TAPE



名称 NAME	Emboss taping type(EL)			備考 NOTE
DRAWING NO.	CV522	単位 UNIT	mm	

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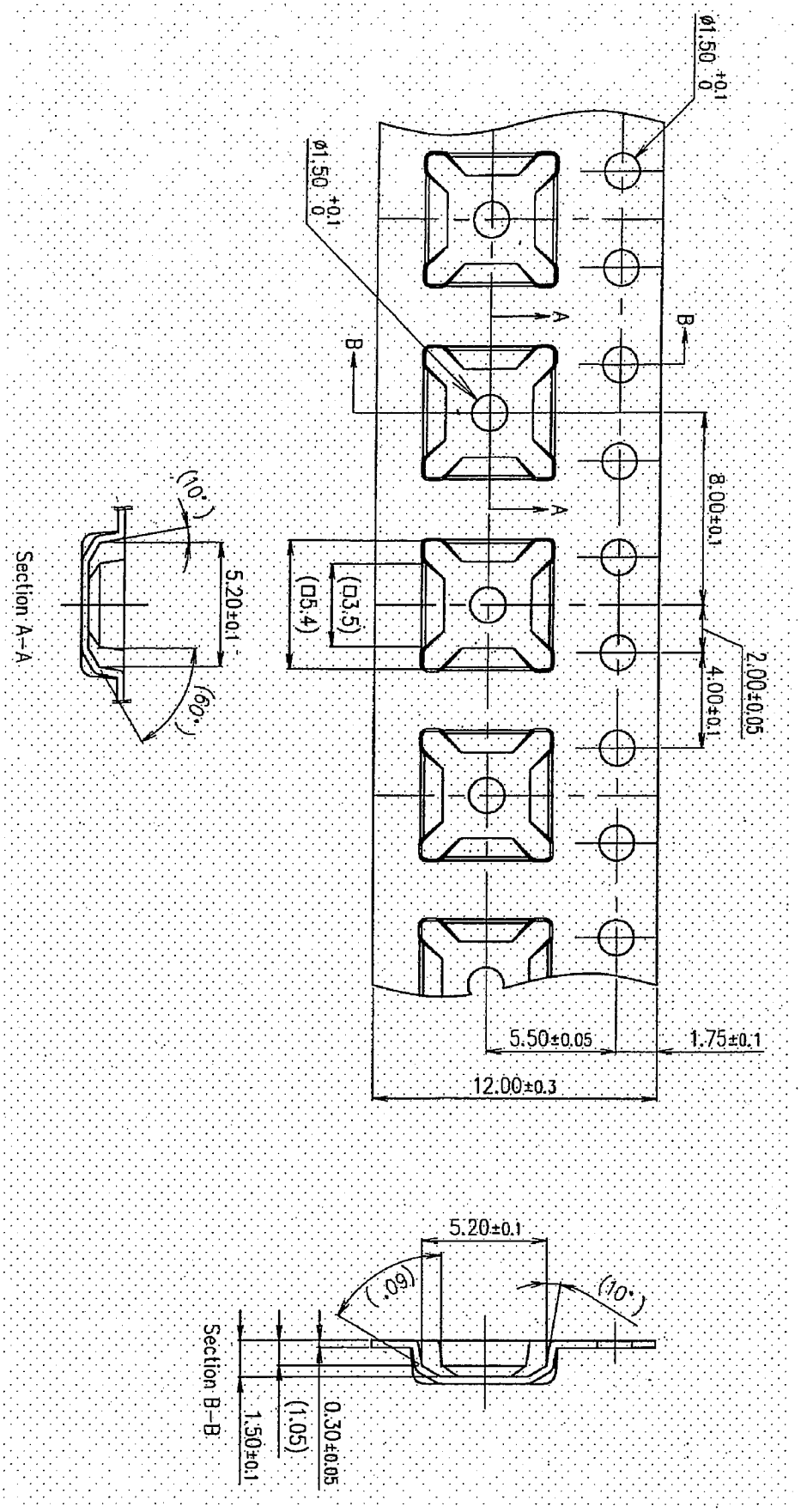

名称 NAME	EC28-0505VQNSS	備考 NOTE
DRAWING NO. CV872	単位 UNIT mm	

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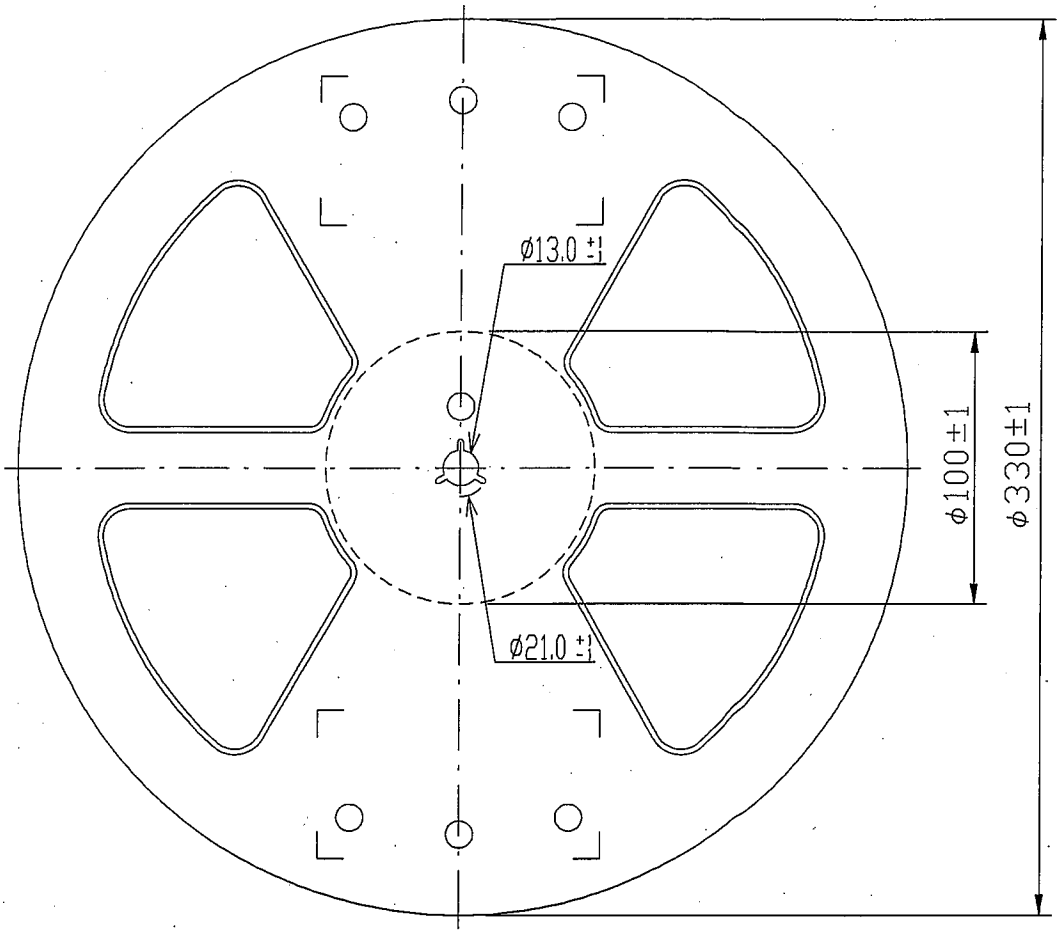

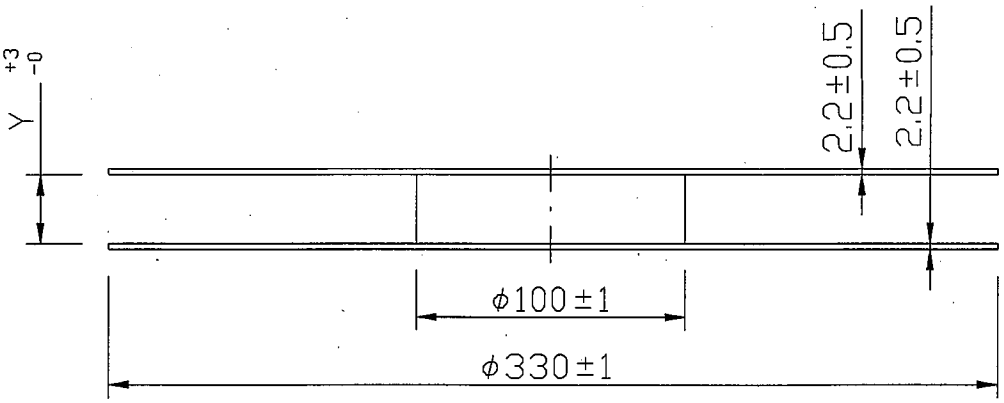

SIZE	Y	SIZE	Y
8mm	9.5	32mm	33.5
12mm	13.5	44mm	45.5
16mm	17.5	56mm	57.5
24mm	25.5		

名称 NAME	Reel for embossed carrier tape	備考 NOTE
DRAWING NO. CV755	単位 UNIT mm	

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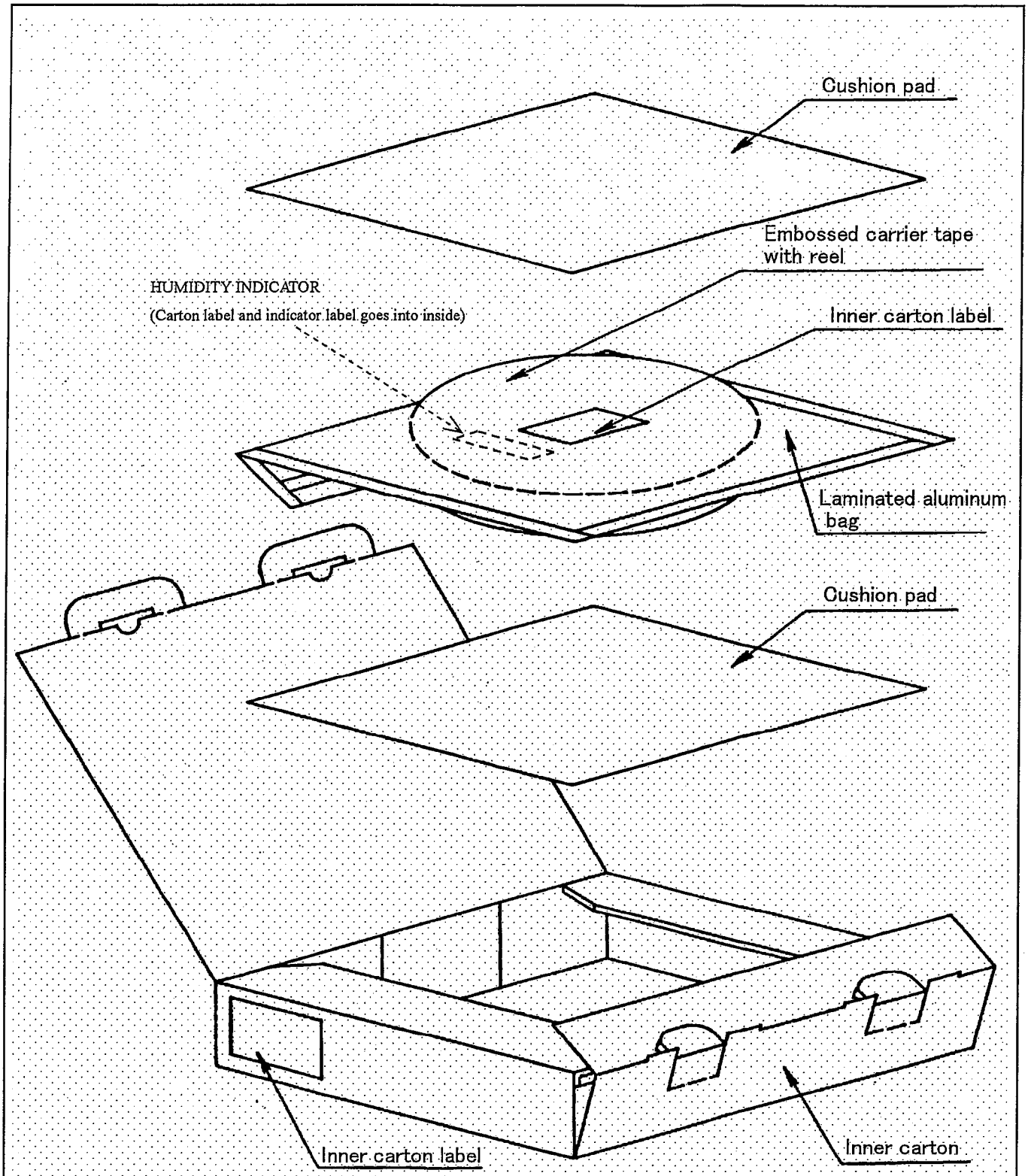

	L		W		H
Inner carton - Outer dimensions : :	345	×	345	×	55

名称 NAME	Packing specifications《1》	備考 NOTE
DRAWING NO. CV428	単位 UNIT mm	

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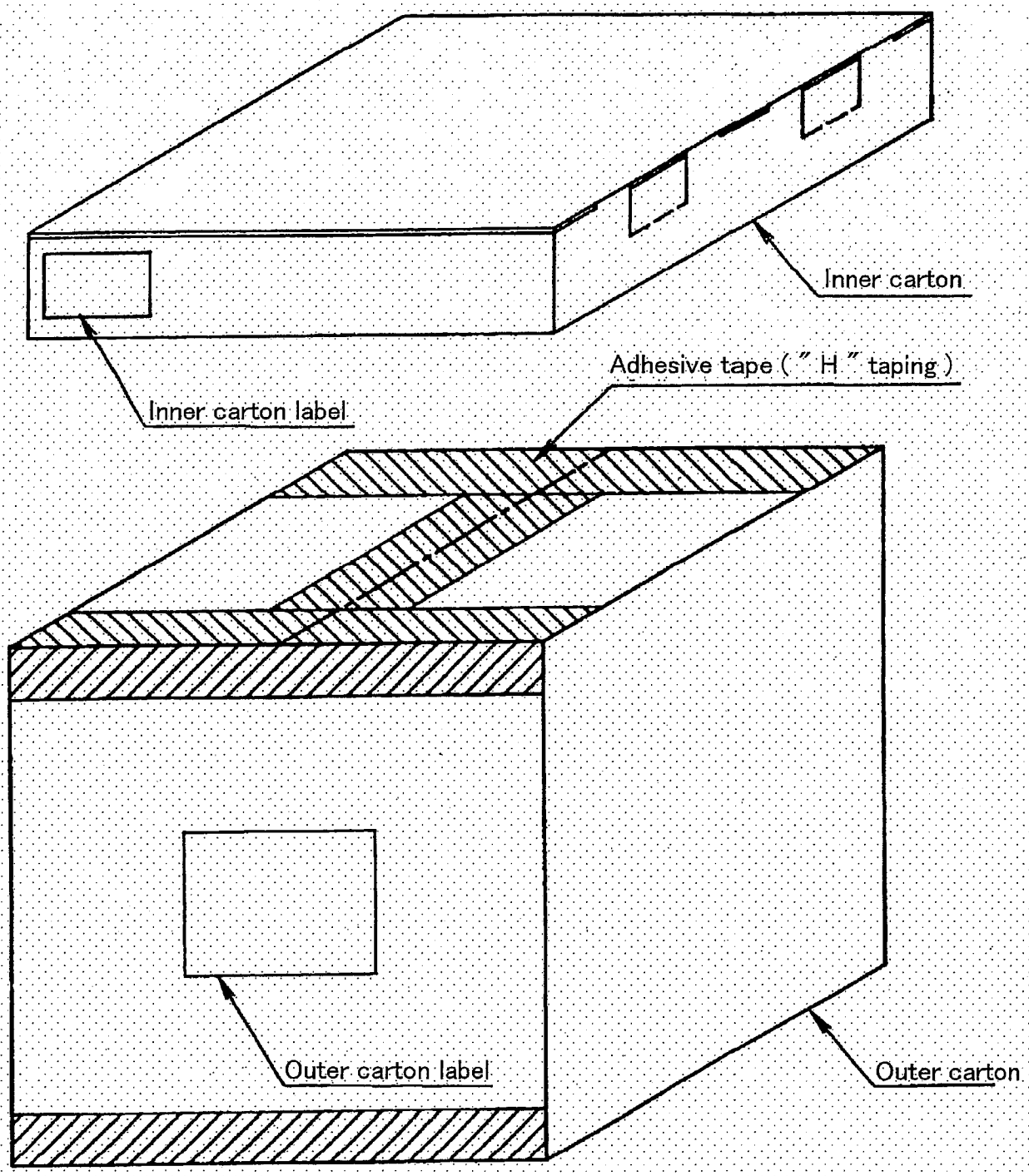

	L		W		H
Inner carton - Outer dimensions :	345	×	345	×	55
Outer carton - Outer dimensions :	365	×	315	×	385

名称 NAME	Packing specifications 《2》		
DRAWING NO.	BJ426	単位 UNIT	mm

備考　出荷数量が端数の場合、本仕様と異なることがあります。
NOTE There is a possibility different from this specification when the number of shipments is fractions.

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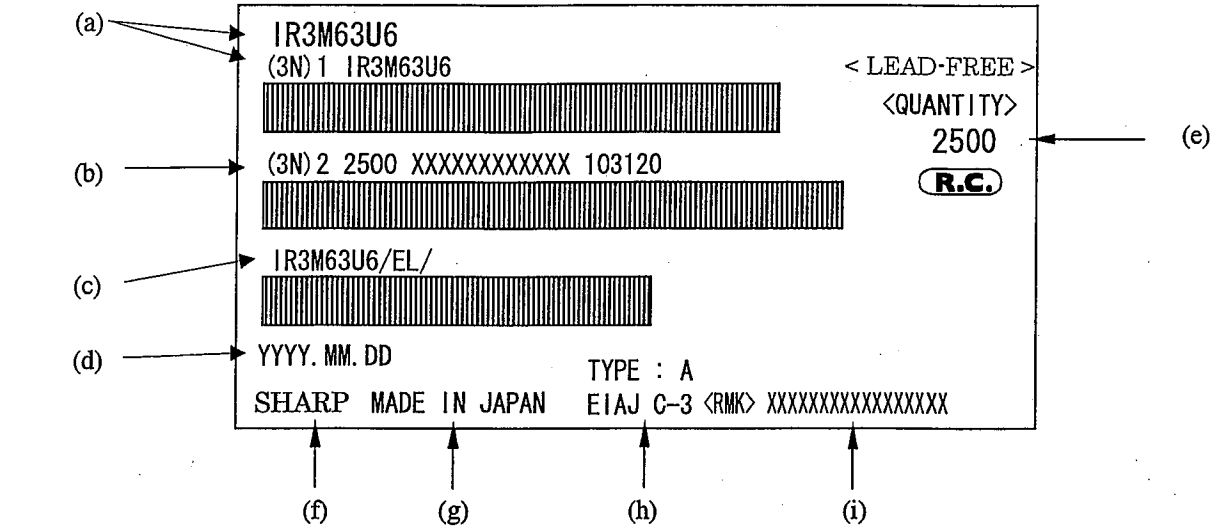
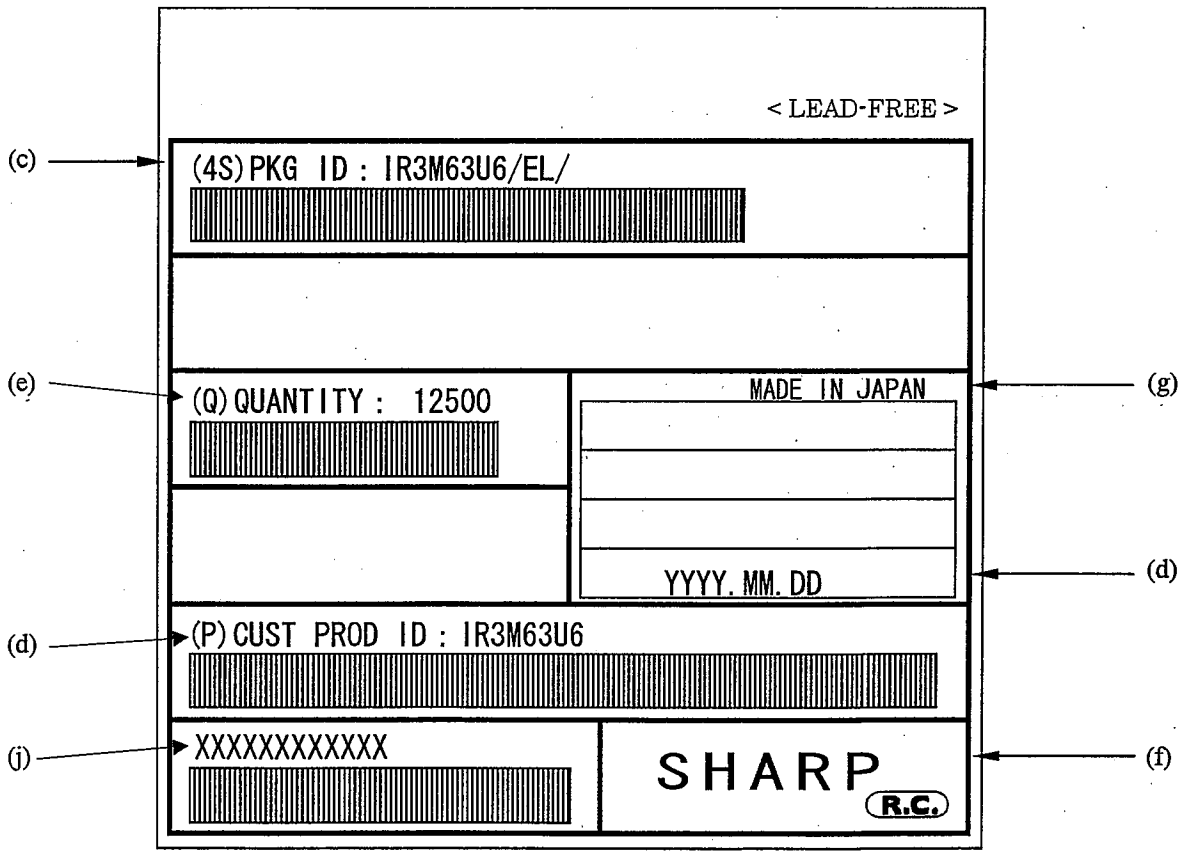
(Note) The << LEAD-FREE >> display shows a lead-free article.
"R.C." means "RoHS Compliant".

Inner carton label



Outer carton label

(Former) EIAJ B Standard conforming



(a) Product name
(b) Quantity PD lot Company code
(c) Part No. (SHARP)
(d) Packed date
(e) Quantity
(f) "SHARP" Logo
(g) The country of origin(It displays, when the country of origin is Japan.)
(h) Type name (Conformity standard)
(i) Assembly management No.
(j) Shipment lot

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