To. :

DATE : 20 . . .

RoHS	Halogen Free

SPECIFICATION

PRODUCT : STARCAP

MODEL : SM series

(SM3R3703)

WRITTEN	CHECKED	APPROVED

KORCHIP CORP.

KORCHIP B/D, 359, Manan-ro, Manan-gu, Anyang-si, Gyeonggi-do, KOREA

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Revision History

No.	Documentation	Check	Description of Revision	Approval	Date
1	Sung-Eun Kim (R&D)	Kee-Bock Chung(Q.A.)	Initial Release	B.I. Lim (R&D)	Nov. 17, 2015

Manufacturer Information

Manufacturer : Korchip Corporation

Location : KORCHIP B/D, 359, Manan-ro, Manan-gu, Anyang-si, Gyeonggi-do, KOREA

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1. Scope

This specification applies to STARCAP(Electric Double Layer Capacitor), submitted to specified customer in cover page.

2. Part Number System

SM ① 3R3 ② 703 ③ T01 ④ U ⑤ *(Example)*

① Series Name
② Rated Voltage : 3.3VDC
③ Capacitance : 0.07 F (703 = 70 × 10^{+3} uF)
④ Terminal Type : T01-type
⑤ Suffix Code : Upgraded

3. Photo (by terminal type)

T01

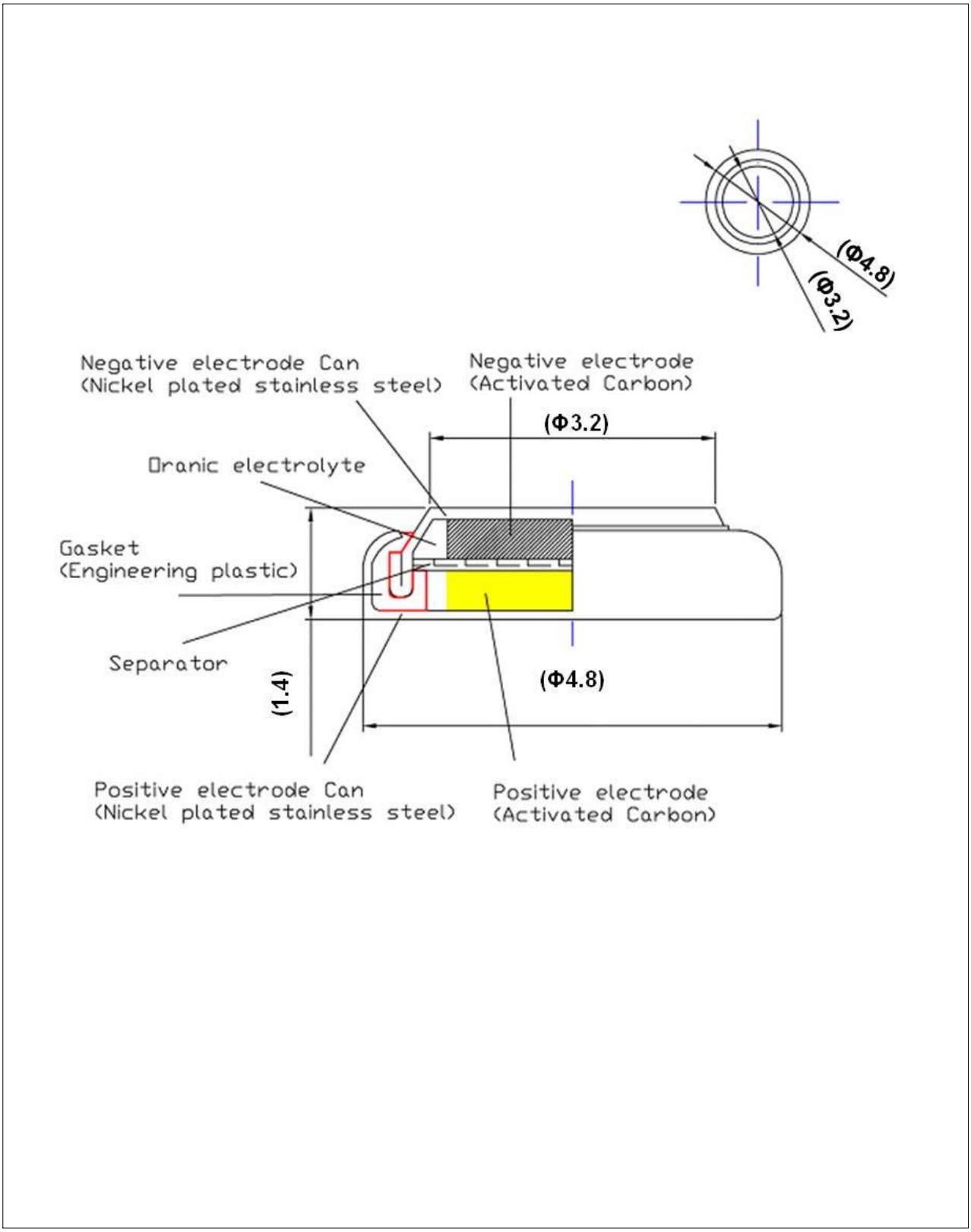
T02

R01

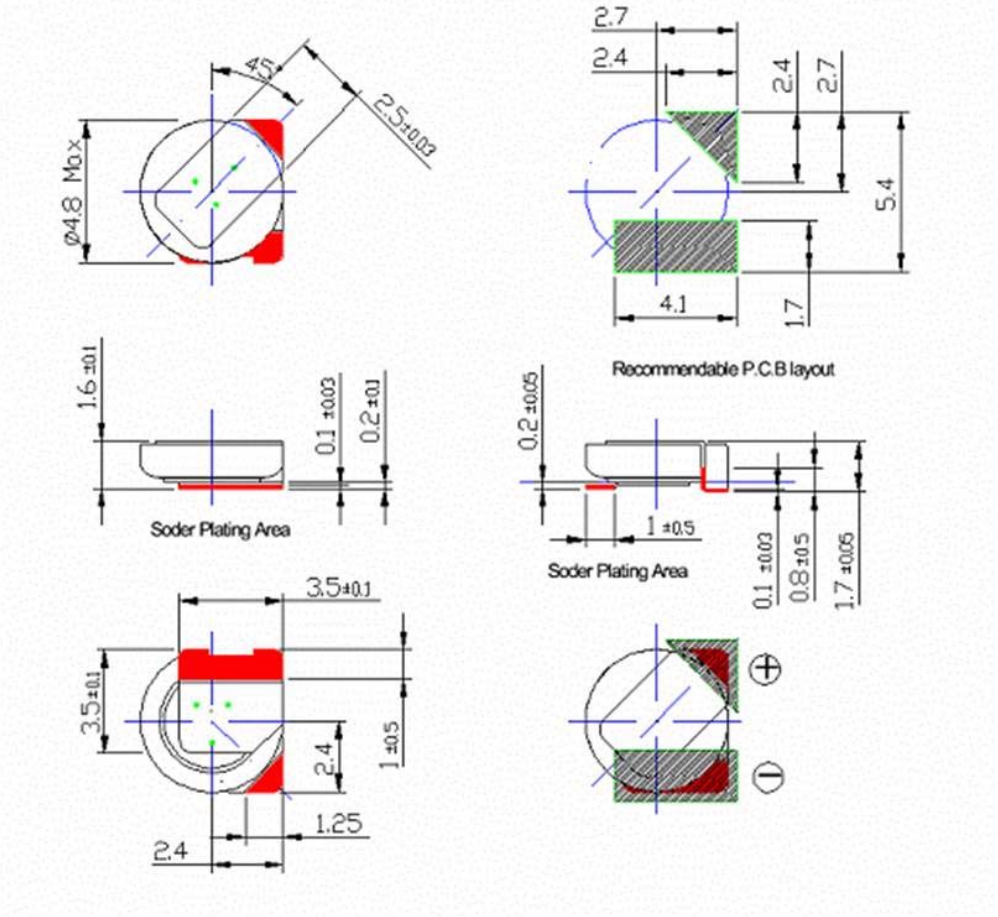
4. General Specifications

ITEMS	VALUE
Cell Size	Ø4.8 × 1.4mm
Operating Temperature	-10 ~ +60 ℃
Rated Voltage	3.3 VDC
Electrostatic Capacitance	0.07 F
Capacitance Tolerance	25.3 uAh (3.3V-2.0V)
Discharge Capacity	-20 ~ 80 %
Equivalent Series Resistance (ESR)	Less than 200Ω
Leakage Current (LC, 30min.)	Less than 100㎂

5. Cell Structure

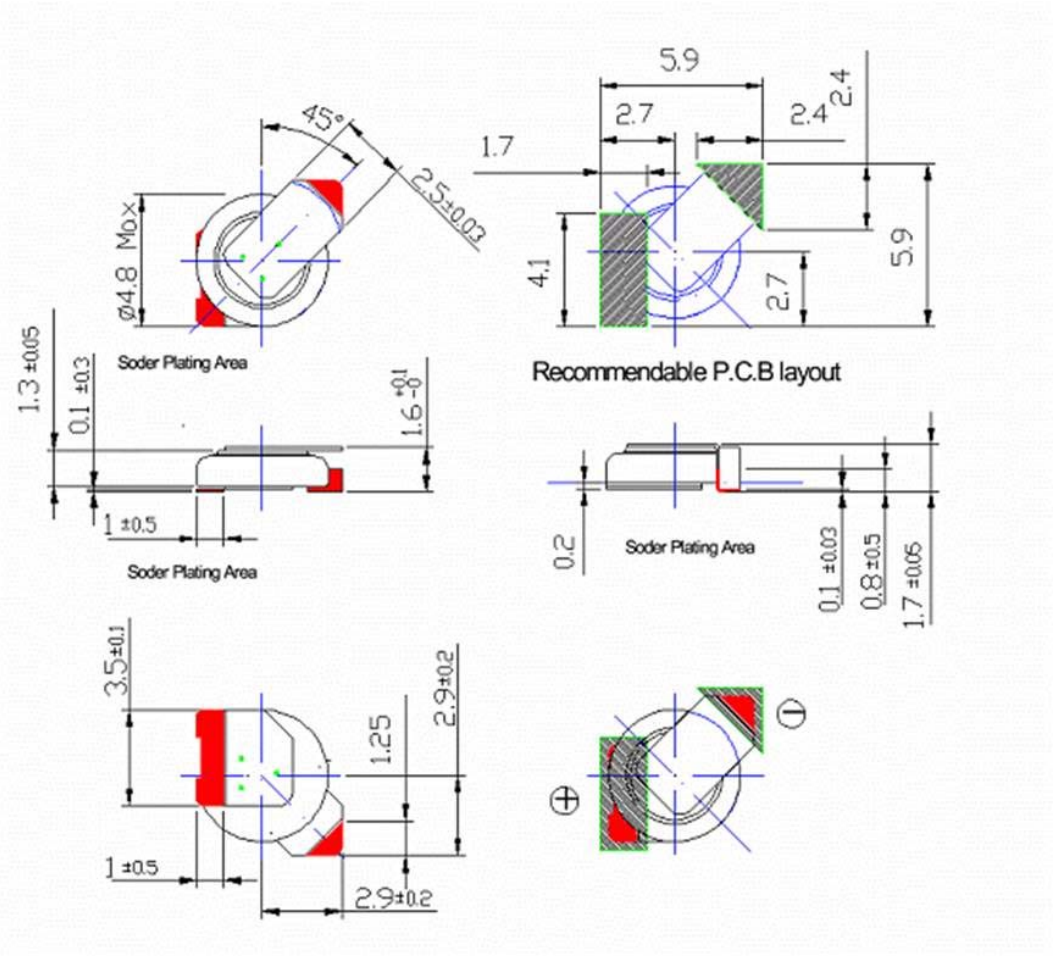


6. Product Construction and Dimensions (Terminal Type : T01)



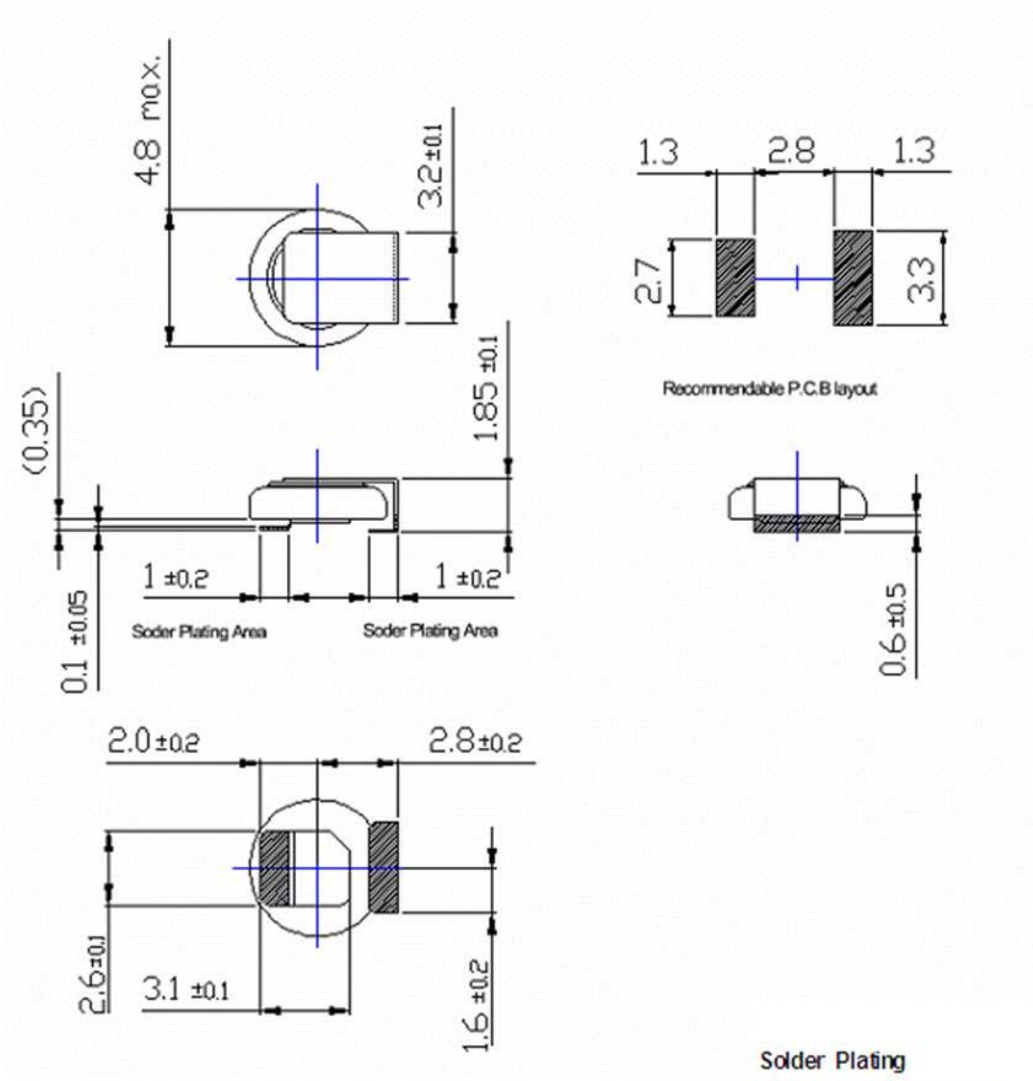
Solder Plating
Ni-Substrate : 0.4~0.7㎛
Au Plating : min. 0.05㎛

6. Product Construction And Dimensions (Terminal Type : T02)

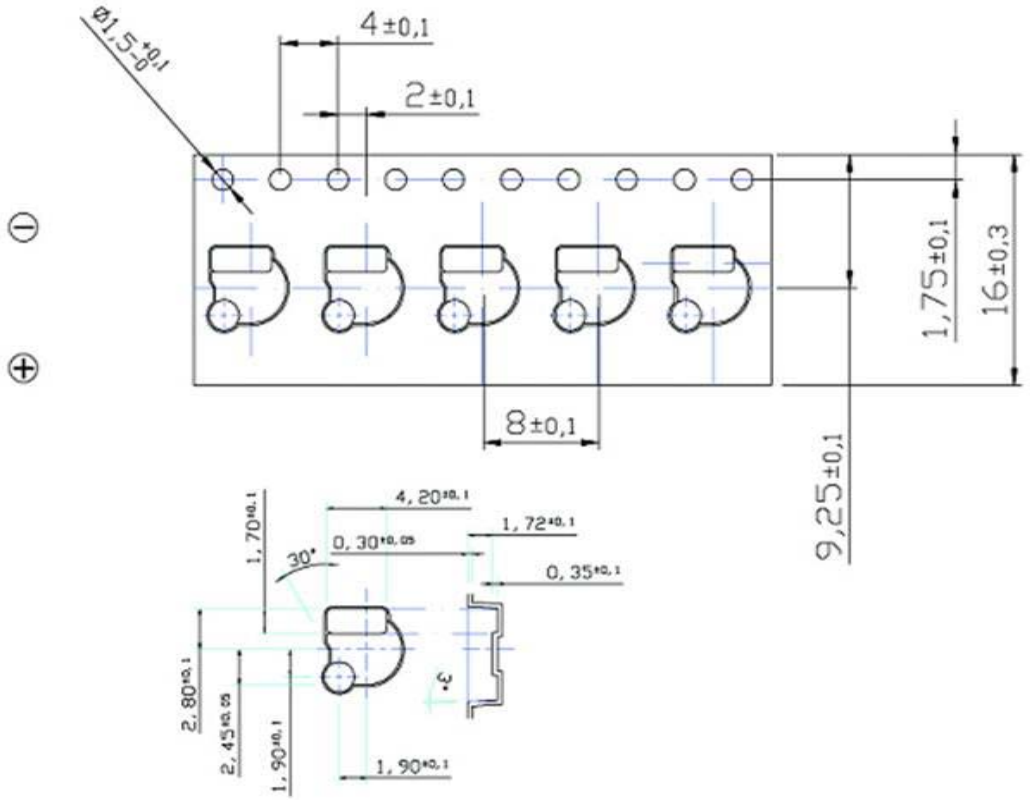


Solder Plating
Ni-Substrate : 0.4~0.7㎛
Au Plating : min. 0.05㎛

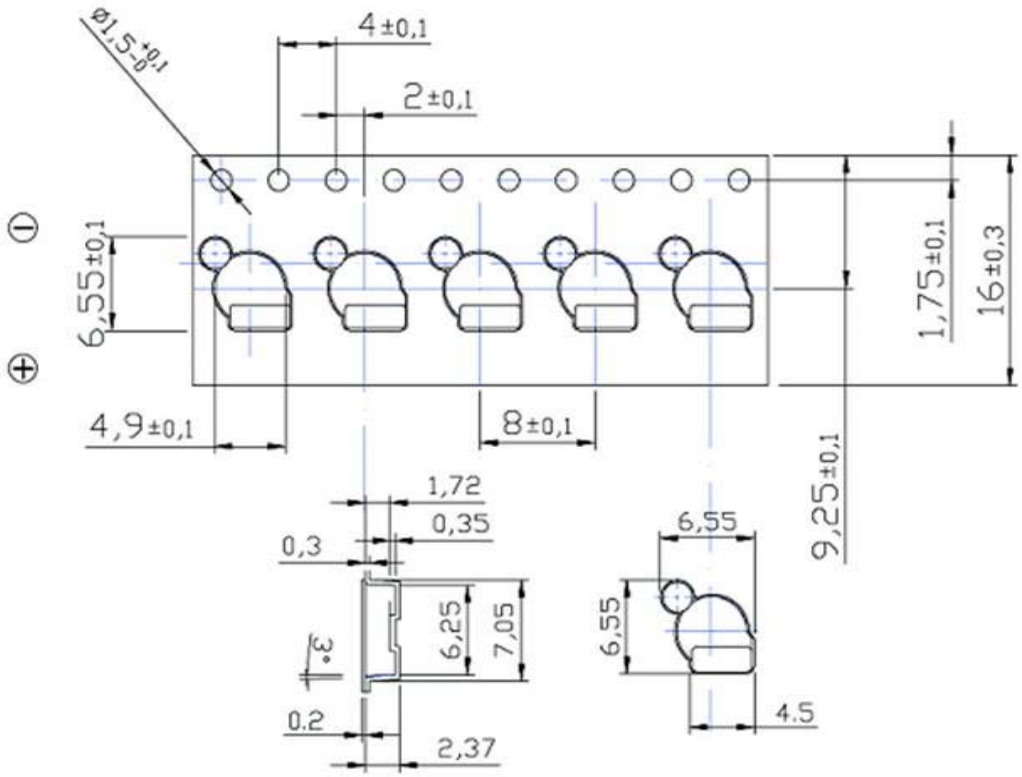
6. Product Construction and Dimensions (Terminal Type : R01)



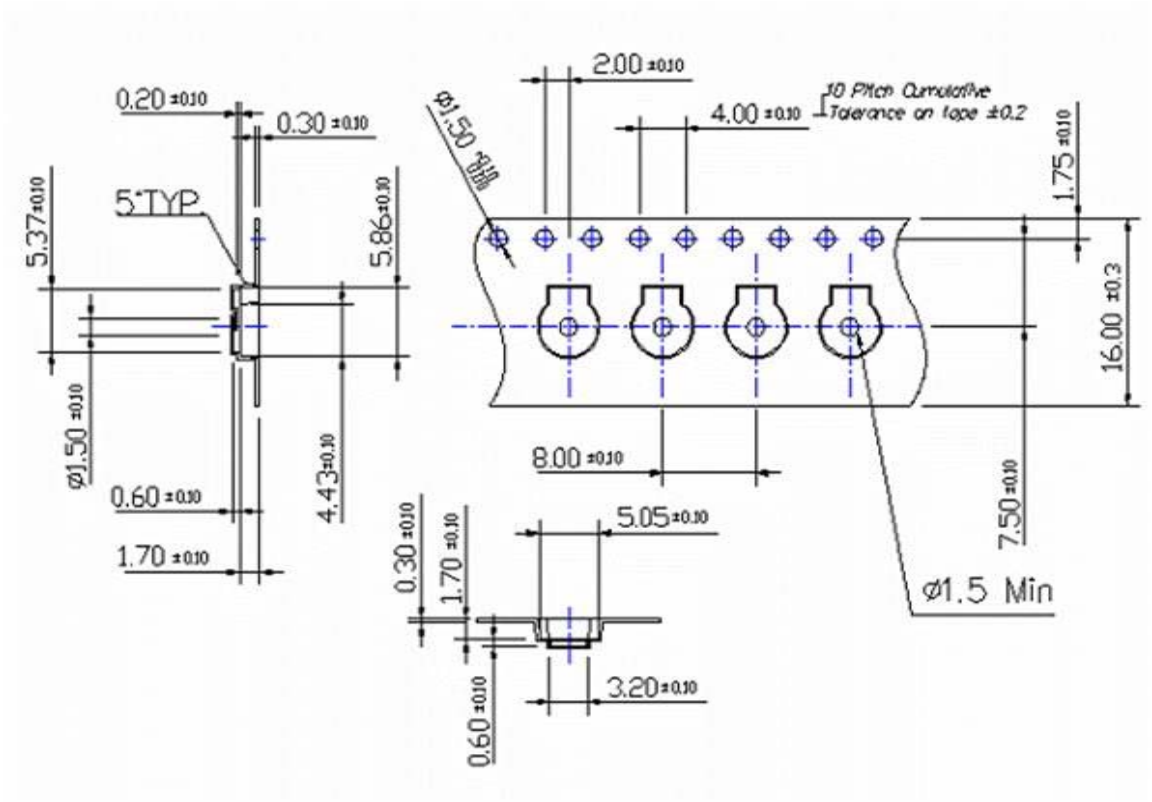
7. Carrier Tape Construction and Dimensions (Terminal Type : T01)



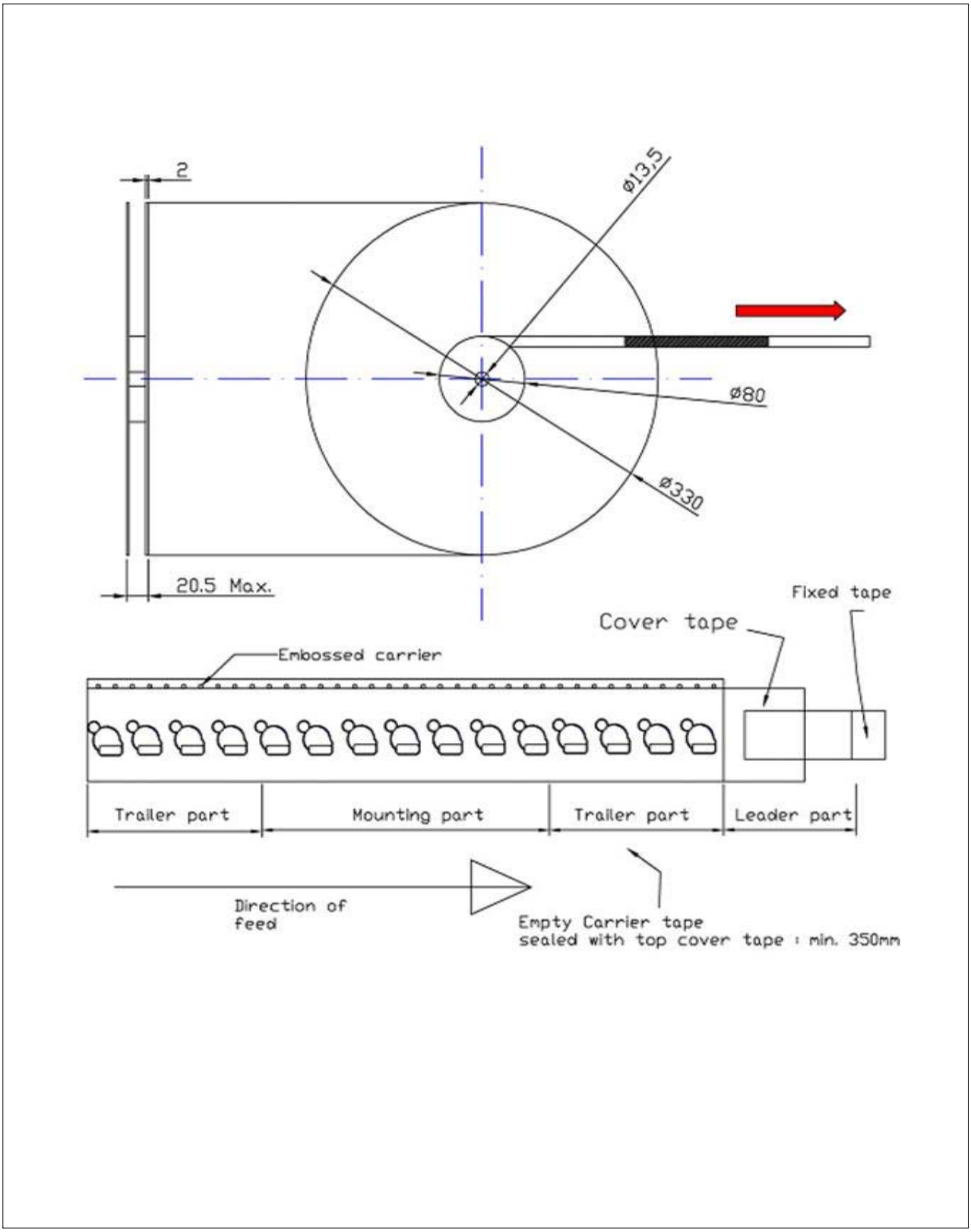
7. Carrier Tape Construction and Dimensions (Terminal Type : T02)



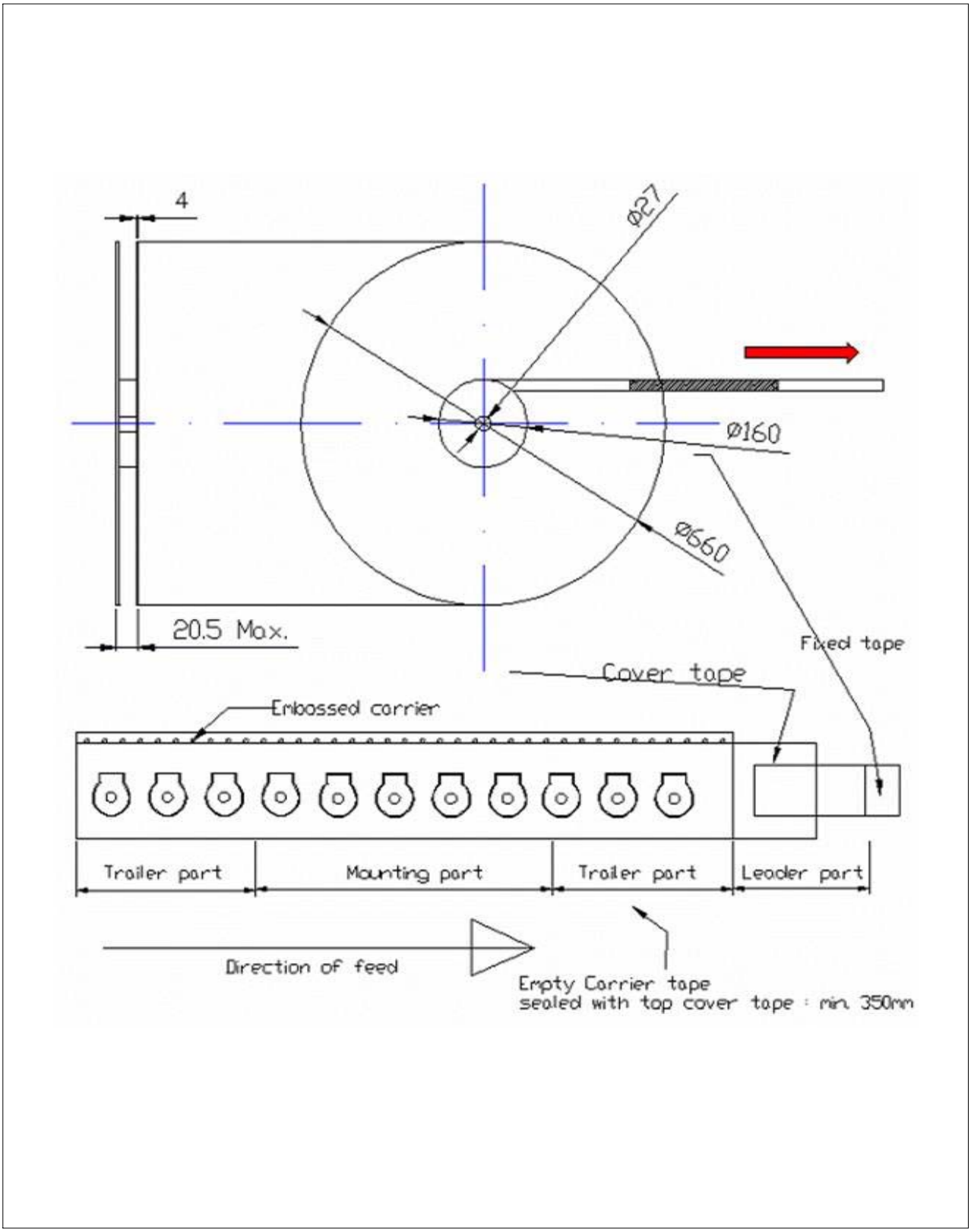
7. Carrier Tape Construction and Dimensions (Terminal Type : R01)



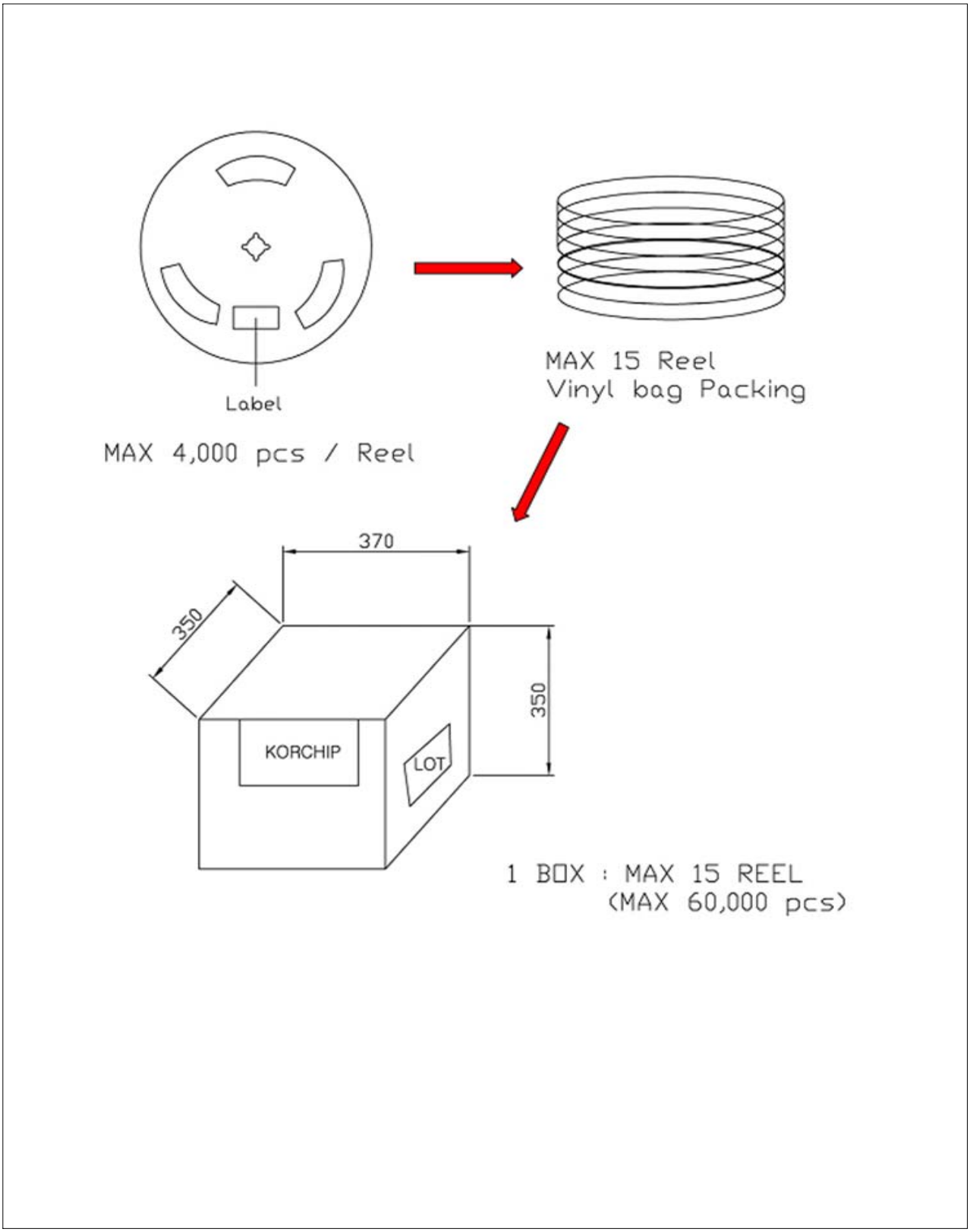
8. Taping Construction and Dimensions (Terminal Type : T01, T02)



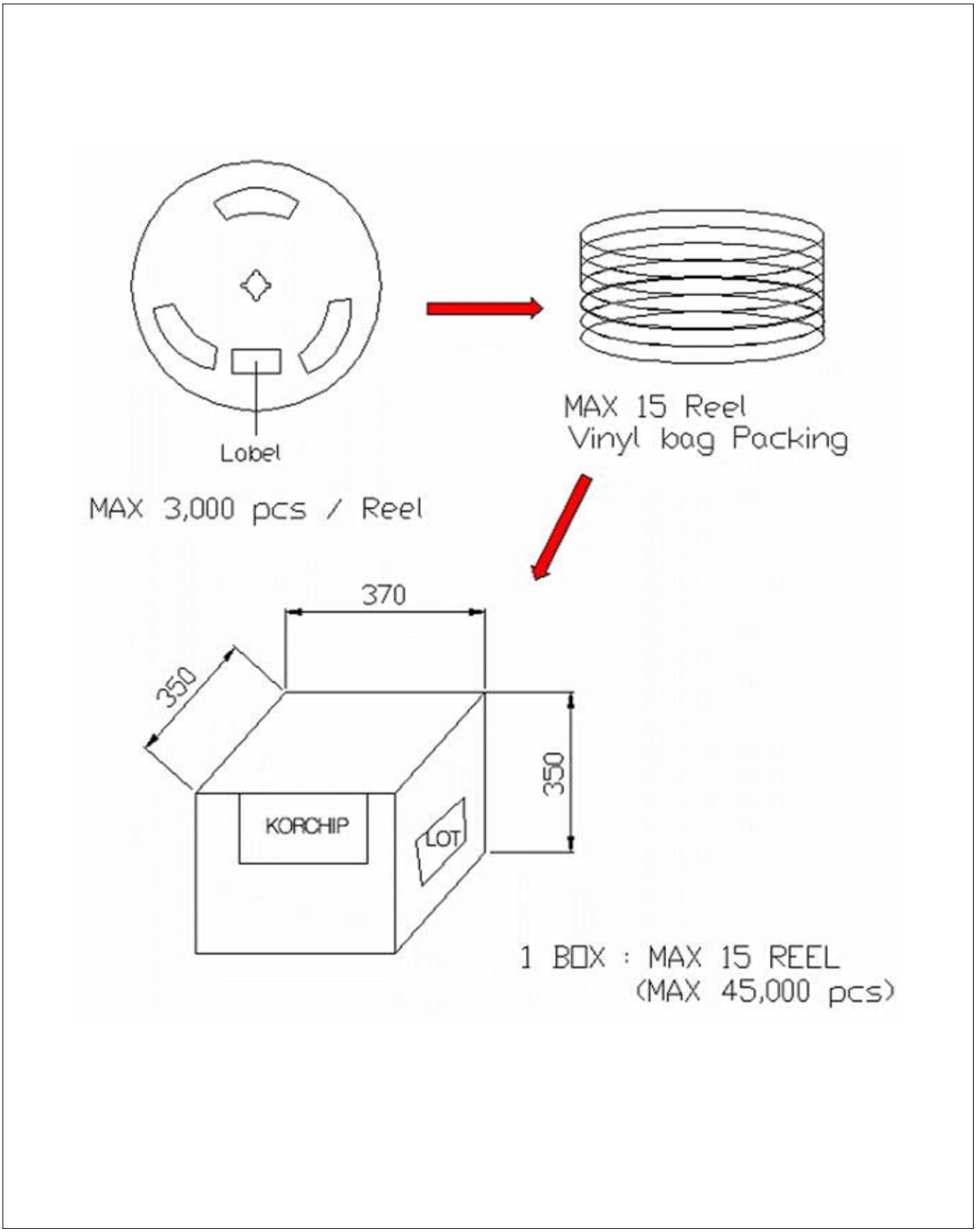
8. Taping Construction and Dimensions (Terminal Type : R01)



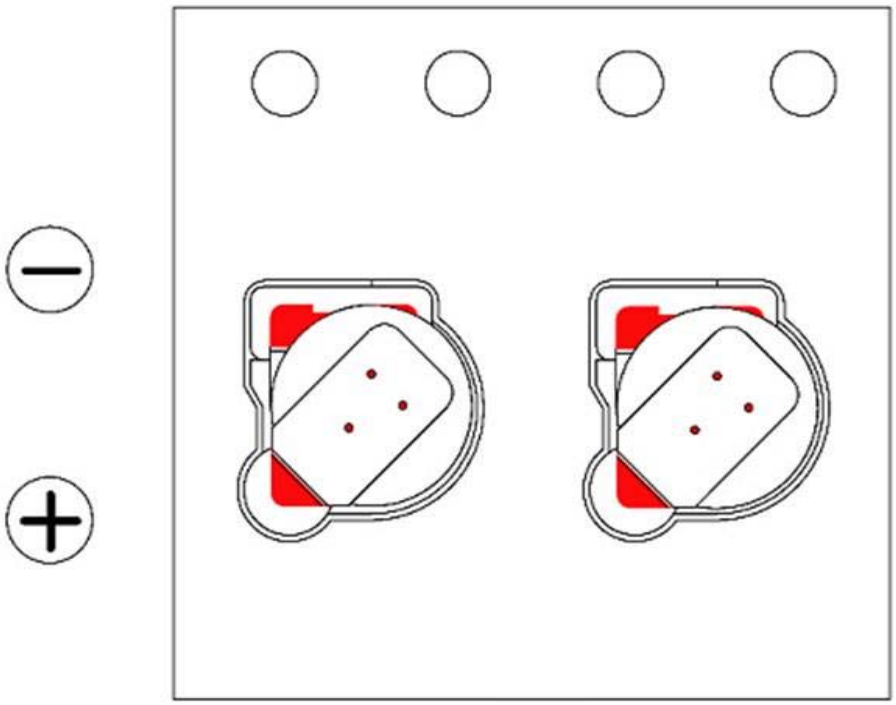
9. Packing Specifications (Terminal Type : T01, T02)



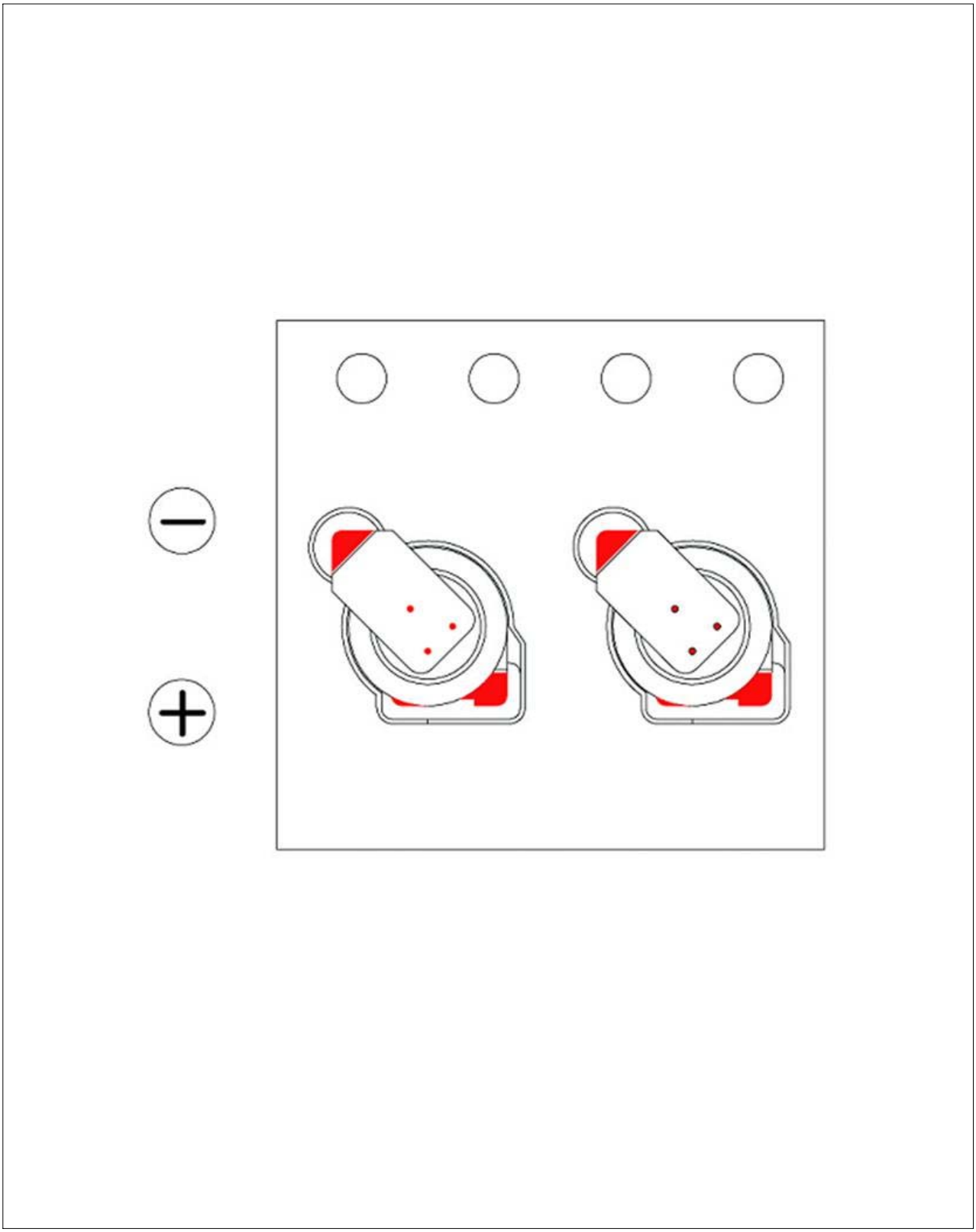
9. Packing Specifications (Terminal Type : R01)



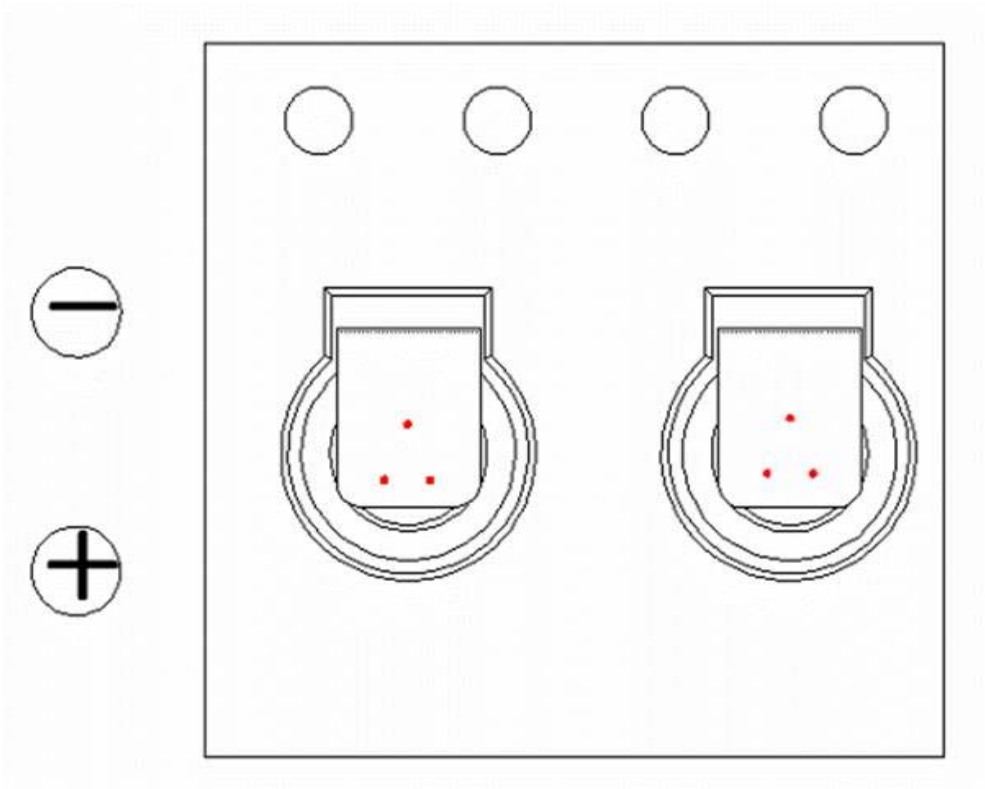
10. Position in Carrier tape (Terminal Type : T01)



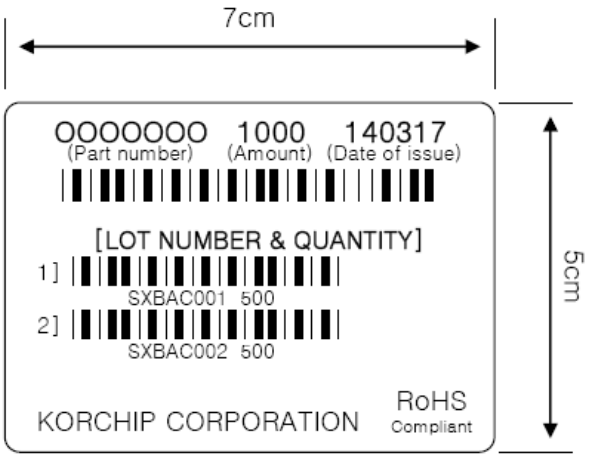
10. Position in Carrier tape (Terminal Type : T02)



10. Position in Carrier tape (Terminal Type : R01)



11. Labeling Standards



← **(Example)**

Lot No. System

Ex.) S X B A C 002

① ② ③ ④ ⑤ ⑥

① Product Code : S (STARCAP)

② Production Year Code : X (2013), Y (2014), Z (2015)…

③ Factory Identification Code : B (Factory 2)

④ Production Month Code : A (Jan.), B (Feb.), … , J (Oct.), K (Nov.), L (Dec.)

⑤ Production Date Code : 1 (1st), 2 (2nd), … , 9 (9th), A (10th), B (11th), C (12th) …
Q (26th), R (27th), S (28th), … , V (31th)

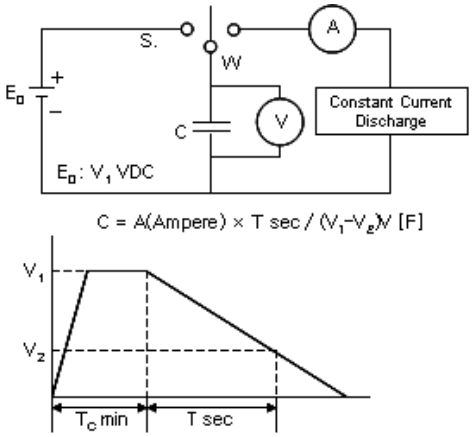
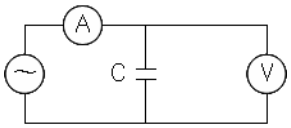
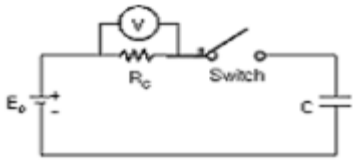
⑥ Lot Issuing Serial Code : 001 (First lot of a specific day), 002 (Second lot of a specific day), 003 (Third lot of a specific day)…

12. Reliability Specifications

<table>
<tr><th colspan="3">Item</th><th colspan="2">Specification</th><th>Test Condition (JISC5102)</th></tr>
<tr><td rowspan="11">Temperature Characteristics</td><td>Capacitance Change</td><td rowspan="2">Step 2</td><td>Within ± 50% of Initial Value</td><td rowspan="11">Measure electrical characteristics after exposing STARCAP Capacitor to each temperature atmosphere for one(1) hour
<table><tr><th>Step</th><th>Temperature</th></tr><tr><td>1</td><td>20±2℃</td></tr><tr><td>2</td><td>-10±2℃</td></tr><tr><td>3</td><td>20±2℃</td></tr><tr><td>4</td><td>60±2℃</td></tr><tr><td>5</td><td>20±2℃</td></tr></table></td></tr>
<tr><td>ESR</td><td>6,000Ω or Less</td></tr>
<tr><td>Capacitance Change</td><td rowspan="3">Step 4</td><td>Within ± 30% of Initial Value</td></tr>
<tr><td>ESR</td><td>300Ω or Less</td></tr>
<tr><td>LC(30min.)</td><td>Spec. Value</td></tr>
<tr><td>Capacitance Change</td><td rowspan="3">Step 5</td><td>Within ± 10% of Initial Value</td></tr>
<tr><td>ESR</td><td>Spec. Value</td></tr>
<tr><td>LC(30min.)</td><td>Spec. Value</td></tr>
<tr><td rowspan="2">Reflow Soldering Effect</td><td colspan="2">Capacitance</td><td>Spec. Value</td><td rowspan="2">Pb-Free Reflow Solder
Peak Temp. : 260± 5℃
Duration at Peak Temp. : 5± 0.5sec.</td></tr>
<tr><td colspan="2">Appearance</td><td>No Marked Defect (Level 2* or less)</td></tr>
<tr><td rowspan="4">Humidity Resistance</td><td colspan="2">Capacitance Change</td><td>Within ± 10% of Initial Value</td><td rowspan="4">Temp. : 40±2℃
Humidity : 90 ~ 95%RH
Time : 240±8 Hours
<u>No Voltage Applied</u></td></tr>
<tr><td colspan="2">ESR</td><td>200Ω or Less</td></tr>
<tr><td colspan="2">LC(30min.)</td><td>120㎂ or Less</td></tr>
<tr><td colspan="2">Appearance</td><td>No Marked Defect (Level 2* or less)</td></tr>
<tr><td rowspan="4">Vibration Resistance</td><td colspan="2">Capacitance</td><td>Spec. Value</td><td rowspan="4">Amplitude : 1.5㎜
Frequency : 10 ~ 55㎐
Direction : X, Y, Z 3 Directions
Test Time : 6 Hours</td></tr>
<tr><td colspan="2">ESR</td><td>Spec. Value</td></tr>
<tr><td colspan="2">LC(30min.)</td><td>Spec. Value</td></tr>
<tr><td colspan="2">Appearance</td><td>No Marked Defect (Level 2* or less)</td></tr>
<tr><td>Terminal Strength</td><td colspan="2">Appearance</td><td>Terminals shall not be separated</td><td>Load 1kg , 10±1 Sec.</td></tr>
<tr><td rowspan="4">Endurance</td><td colspan="2">Capacitance Change</td><td>Within ± 30% of Initial Value</td><td rowspan="4">Temp. : 60±2℃
Test Time : 500(+24,-0) Hours
Applied Voltage : 3.3Vdc</td></tr>
<tr><td colspan="2">ESR</td><td>2,000Ω or Less</td></tr>
<tr><td colspan="2">LC(30min.)</td><td>300㎂ or Less</td></tr>
<tr><td colspan="2">Appearance</td><td>No Marked Defect (Level 2* or less)</td></tr>
<tr><td rowspan="4">Cycle Characteristics</td><td colspan="2">Capacitance Change</td><td>Within ± 30% of Initial Value</td><td rowspan="4">Temp. : 25±2℃
Cycle No. : 10,000
Charge Voltage : 3.3Vdc
Resistance : 100Ω, Time : 9min.
Discharge Resistance:100Ω, Time:1min.</td></tr>
<tr><td colspan="2">ESR</td><td>2,000Ω or Less</td></tr>
<tr><td colspan="2">LC(30min.)</td><td>300㎂ or Less</td></tr>
<tr><td colspan="2">Appearance</td><td>No Marked Defect (Level 2* or less)</td></tr>
<tr><td rowspan="4">Shelf Life</td><td colspan="2">Capacitance Change</td><td>Within ± 30% of Initial Value</td><td rowspan="4">Temp. : 60± 2℃
Test Time : 500(+24, -0) Hours
<u>No Voltage Applied</u></td></tr>
<tr><td colspan="2">ESR</td><td>2,000Ω or Less</td></tr>
<tr><td colspan="2">LC(30Min.)</td><td>300㎂ or Less</td></tr>
<tr><td colspan="2">Appearance</td><td>No Marked Defect (Level 2* or less)</td></tr>
</table>

***** Refer to "17. Leakage Level Criteriia" on page 25

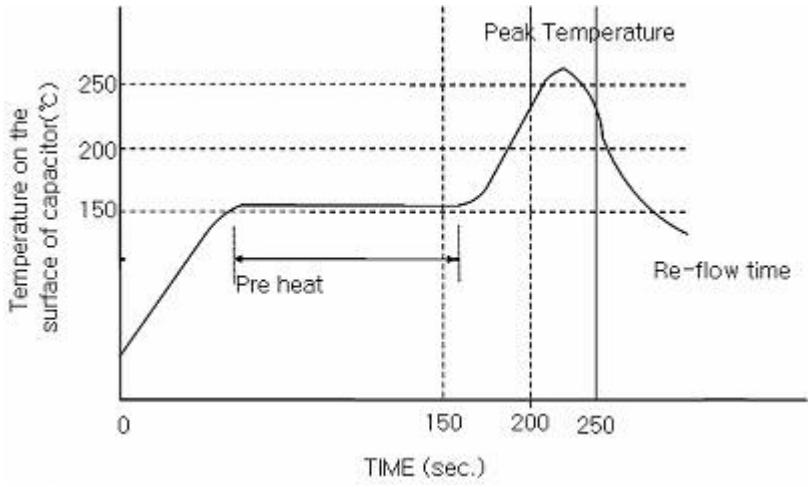
13. Measuring Method of Characteristics

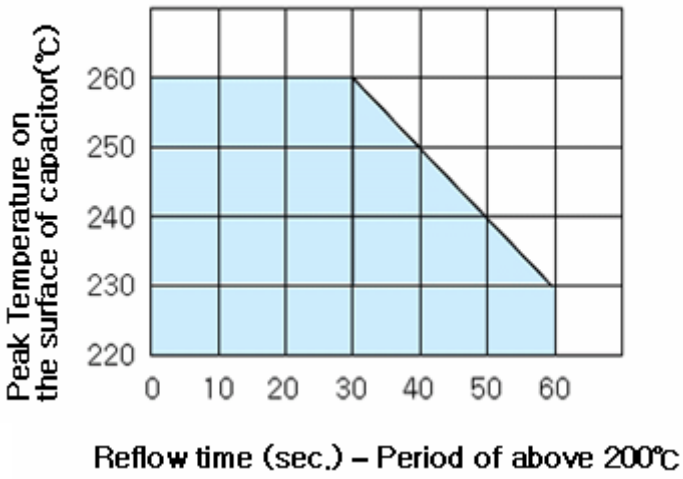
Capacitance	1) Charge the STARCAP with constant current 1±0.1㎃ to operation voltage V1 (=2.6V) for 1 hour. 2) Discharge the STARCAP with constant current(A) 10±1㎂ to the voltage of V2 (=1.3V) while measure the discharge time(T). 3) Calculate capacitance using the following formula.  C = A(Ampere) × T sec / (V_1−V_2)V [F]
Equivalent Series Resistance (ESR @1kHz)	● Measure ESR by the LCR meter. (Frequency:1㎑, Bias Voltage : $0^{+0.05}$V) or ● Calculate ESR using the following formula.  ESR[Ω] = V / i **R[Ω] = V[V] / I[A]** * i[uA] = I[A] x 10^{-6} R : Internal resistance(ESR) [Ω] V : Measured voltage between terminals [V] i : Current 10uA(A.C.)
Leakage Current	1) Apply 3.3V to the STARCAP.(E_0) 2) Measure V_R after 30±0.5 min. 3) Calculate current using the following formula.  *$LC = (V_R/R_C) \times 10^3$ [mA]* V_R = Measured value R_C : 1,000Ω
☞ The STARCAP should be shorted before each measurement as follows ; Capacitance : 60 Min. , ESR : 15 Min. , LC : 15 Min.	

14. Reflow Soldering

Excessive heat stress may result in the deterioration of the electrical characteristics of the capacitor, loss of air tightness, and electrolyte leakage due to the rise in internal pressure. Use the general reference chart then set soldering temperature and time.

Max. 260℃ (within 5 seconds)





The time of repeated reflow soldering must be two times or less.

Time above 200℃ should be less than 80 seconds.

Do not use reflow soldering when the cell voltage is above 0.3V.

15. Manual Soldering

For use of a soldering iron, it should **not touch the cell body**.

Temperature of the soldering iron should be less than 350℃.

Soldering time for terminals should be less than 3 seconds.

16. Cautions for Use

Please be careful for following points when you use STARCAP.

1) Do not apply more than rated voltage.

If you apply more than rated voltage, STARCAP's electrolyte will be decomposed and its ESR increase. At the worst, it may be broken.

2) Do not use STARCAP for ripple absorption.

3) Polarity

Please mount it in accordance with its polarity.

4) Operating temperature and life

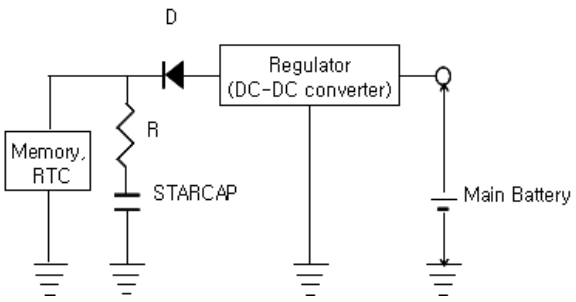
Generally, STARCAP has a lower leakage current, longer back-up time and longer life in the low temperature i.e. the room temperature. But it has a higher leakage current, shorter back-up time and shorter life in the high temperature.

Please design to keep STARCAP away from calorific parts.

5) Cleaning

Some detergent or high temperature drying causes deterioration of STARCAP.
If you wash STARCAP, Consult us.

6) Following figure shows the general back-up circuit.



D : Diode to prevent the reverse current
R : Resistor to control the charging current

7) Short-circuit STARCAP

DO NOT short-circuit between terminals of STARCAP without resistor.

8) Storage

In long term storage, please store STARCAP in following condition;

① TEMP. : 10 ~ 30 ℃

② HUMIDITY : 60 %RH or less

③ Non-dust, non-acidic and/or non-alkaline atmosphere

④ Avoid direct sun light, strong magnetic field

Storage period limit is one(1) year when a STARCAP is stored in the above condition. Storage in improper condition may cause some damage to STARCAP.

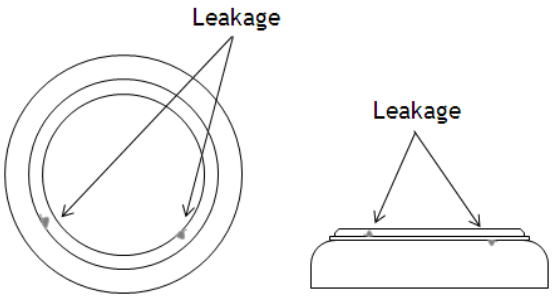
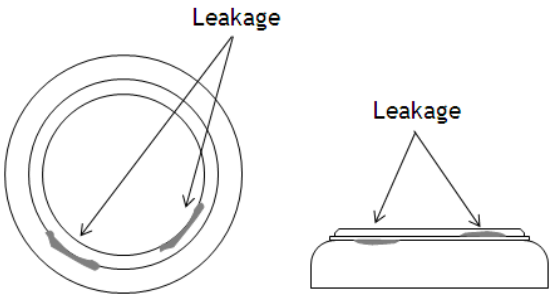
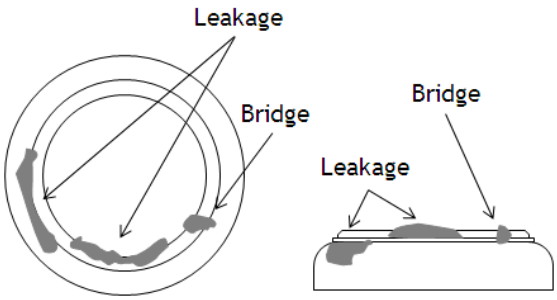
9) Do not disassemble STARCAP. It contains electrolyte.

10) Series connection of STARCAP

Over-rated voltage may be applied to a single STARCAP in series connection due to the deviation of capacitance and ESR of each STARCAP. Please inform us if you are using STARCAP in series connection and please design so as not to apply over-rated voltage to each STARCAP, and use STARCAPs from same lot.

11) The tips of STARCAP terminals are very sharp. Please handle with care.

17. Leakage Level Criteria

Level	Appearance of Leakage	Definition
Level 1		Leakage can not be recognizable with naked eyes, it can be recognizable only by microscope (magnification of 10 or more)
Level 2		Leakage can be recognizable by naked eyes. But there is no bridge between cap(-) and case(+).
Level 3		Leakage reaches the flat line of cap(-) or flow down to side of case(+). Leaked bridge between cap(-) and case(+) is observed.

18. Environmental Management

All STARCAP products are RoHS compliant, Halogen Free and environment friendly.

Series	RoHS directive (Pb, Cr+6, Hg, Cd, PBB,PBDE)	ELV directive (Pb, Cr+6, Hg, Cd)	PVC	Halogen Flame Retardant Free (Cl, Br)	etc.
SM	N.D.	N.D.	N.D.	N.D.	

* N.D. : Not detected