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DATE : 20 . . .



SPECIFICATION

PRODUCT : STARCAP

MODEL : SM series (SM 3R3 333)

WRITTEN	CHECKED	APPROVED

Process \ Site	1st. Case	2nd. Case	3rd. Case
Fab	KOREA	KOREA	KOREA
Assembly	KOREA	KOREA	KOREA
Final Test	KOREA	KOREA	KOREA

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Index

Page No.	ITEM	etc.
1	Cover Page	
2	Index	
3	Revision History	
4	1. Scope	
	2. Part Number System	
	3. Product Model Name	
	4. Photo	
	5. Nominal Specifications	
5	6. Cell Structure	
6-7	7. Product Construction And Dimension	
8-9	8. Carrier Tape Construction And Dimension	
10	9. Specifications And Test Method	
11	10. Measuring Method Of Characteristics	
12	11. Reflow Soldering	
	12. Manual Soldering	
13	13. Cautions For Use	
14	14. Environmental Management	

1. Scope

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

2. Part Number System

SM 3R3 333 T01 (Example)
 ① ② ③ ④

- ① Series Name
- ② Rated Voltage : 3.3VDC
- ③ Capacitance : 0.033 F (333 = $33 \times 10^{+3}$ uF)
- ④ Terminal Type : T01-type

3. Product Model Name

- 1) Product : Electric Double Layer Capacitor
- 2) Model name : SM3R3333 T01, H01

4. Photo (by terminal type)



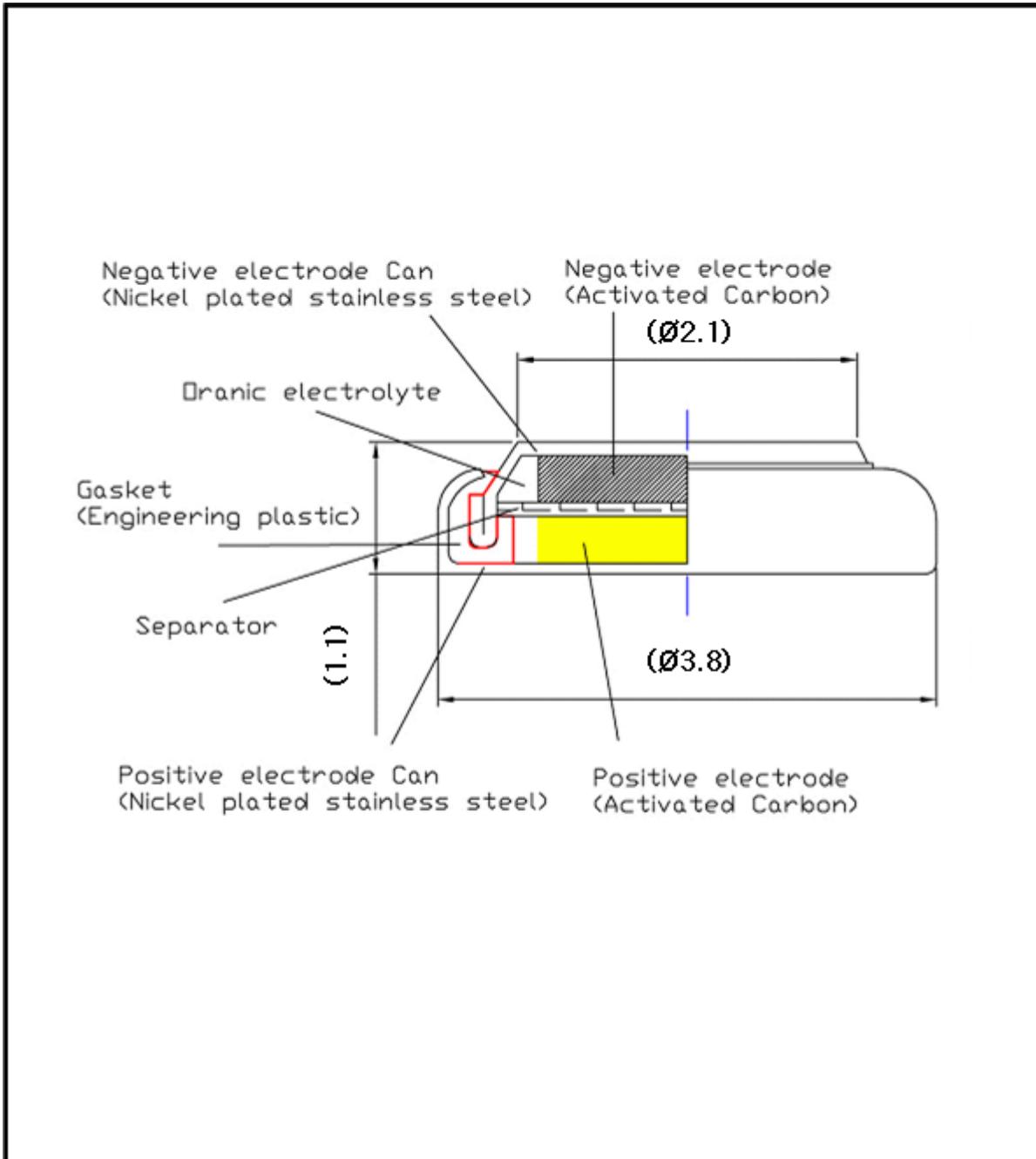
T01

H01

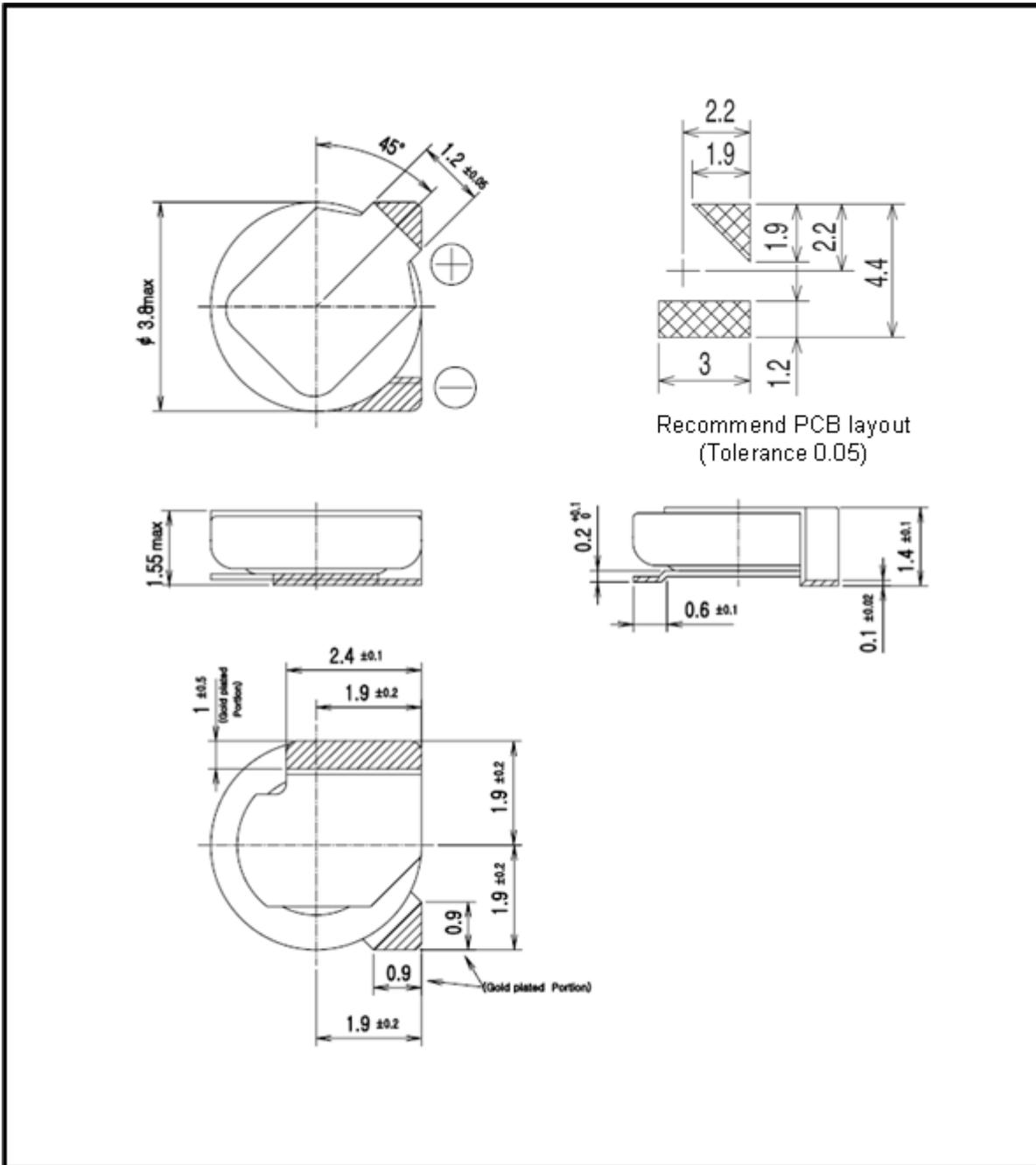
5. Nominal Specifications

Items	SM 3R3 333
Cell Size	Ø3.8 × 1.1mm
OPERATING TEMPERATURE	-25 ~ +60 °C
RATED VOLTAGE	3.3 VDC
ELECTROSTATIC CAPACITANCE (F)	0.033 F
CAPACITANCE (mAh)	13.8 uAh (3.0V-1.5V)
CAPACITANCE TOLERANCE	-20 ~ 80 %
EQUIVALENT SERIES RESISTANCE (ESR)	LESS THAN 200Ω
LEAKAGE CURRENT (LC)	LESS THAN 100µA

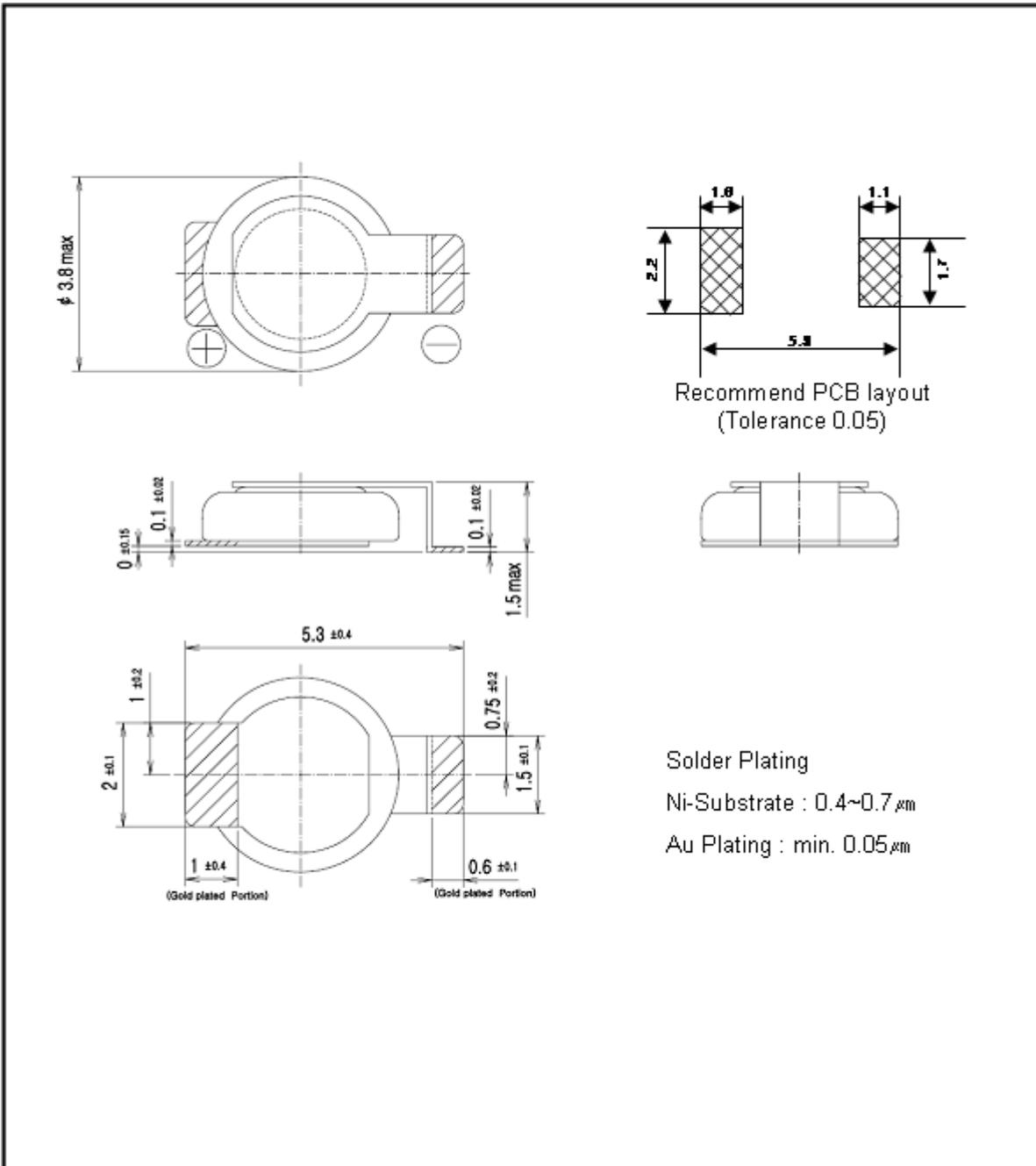
6. Cell Structure



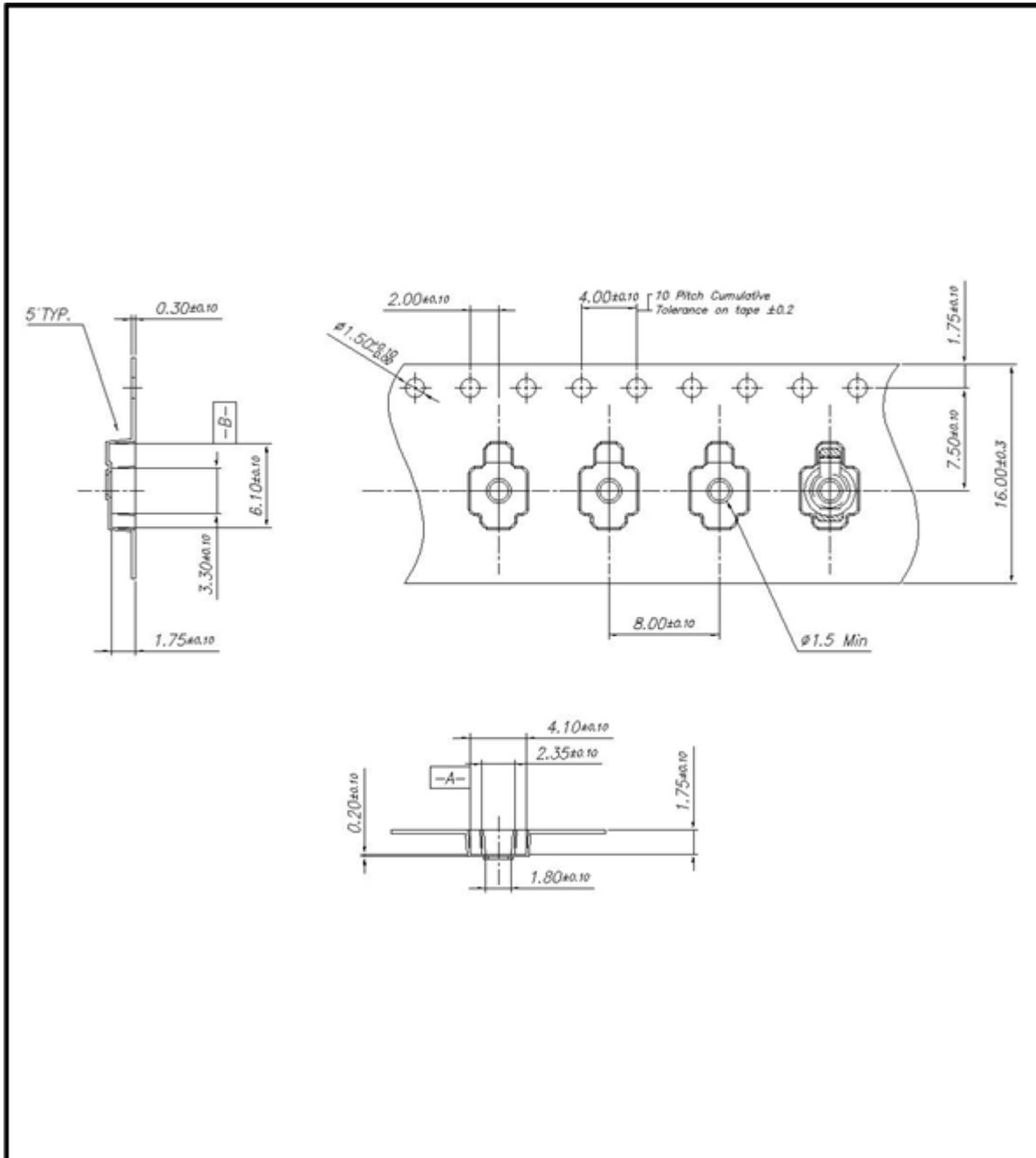
7. Product Construction And Dimension (Terminal Type : T01)



7. Product Construction And Dimension (Terminal Type : H01)



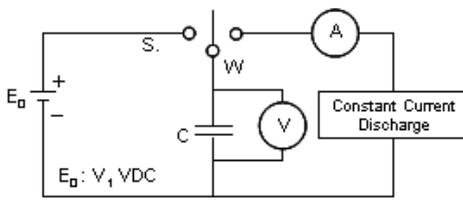
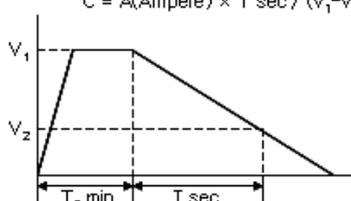
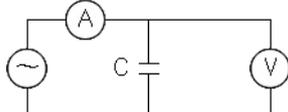
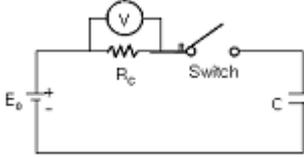
8. Carrier Tape Construction And Dimension (Terminal Type : H01)



9. Specifications And Test Method

ITEMS		SPECIFICATIONS	TEST CONDITION												
OPERATING TEMP. RANGE		-25℃ ~ +60℃													
RATED VOLTAGE		3.3 Vdc													
CAPACITANCE		0.033F	See Measuring Method of Characteristics												
CAPACITANCE TOLERANCE		+80% , -20%													
EQUIV. SERIES. RES. (ESR)		200Ω OR LESS	See Measuring Method of Characteristics												
LEAKAGE CURRENT (30MIN)		200μA OR LESS	VOLTAGE : 3.3VDC CHARGING RESISTANCE : 100Ω See Measuring Method of Characteristics												
TEMPERATURE CHARACTERISTICS	STAGE 2	CAPACITANCE	± 50% OF INI. VAL												
		ESR	10 TIMES↓ OF INI. VAL												
	STAGE 4	CAPACITANCE	± 50% OF INI. VAL												
		ESR	200Ω OR LESS												
		LC (30MIN)	SPEC. VALUE												
	STAGE 5	CAPACITANCE	± 10% OF INI. VAL												
		ESR	200Ω OR LESS												
		LC (30MIN)	SPEC. VALUE												
				Measure electrical characteristics after exposing Double-Layer Capacitor to each temperature atmosphere for 1 hour <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>STAGE</th> <th>TEMPERATURE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20± 2℃</td> </tr> <tr> <td>2</td> <td>-25± 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> </tbody> </table>	STAGE	TEMPERATURE	1	20± 2℃	2	-25± 2℃	3	20± 2℃	4	60± 2℃	5
STAGE	TEMPERATURE														
1	20± 2℃														
2	-25± 2℃														
3	20± 2℃														
4	60± 2℃														
5	20± 2℃														
REFLOW SOLDERING	CAPACITANCE	SPEC. VALUE	Pb-Free REFLOW SOLDER PEAK TEMP. : 260± 5℃ PEAK TIME : 5± 0.5sec.												
	APPEARANCE	NO MARKED DEFECT													
HUMIDITY	CAPACITANCE	90%↑ OF SPEC. VALUE	TEMP:40± 2℃ HUMIDITY:90 ~ 95%RH TEST TIME:240± 8HOURS NO VOLTAGE APPLIED												
	ESR	1.2TIMES ↓ OF SPE. V													
	LC(30MIN)	1.2TIMES ↓ OF SPE. V													
	APPEARANCE	NO MARKED DEFECT													
CYCLE CHARACTERISTICS	CAPACITANCE	70%↑ OF SPEC. VALUE	TEMP. : 25± 2℃ CYCLE NUMBER : 10,000 CHARGE VOLTAGE :3.3V, RESISTANCE :150Ω, TIME :9min. DISCHARGE RESISTANCE:150Ω, TIME:1min.												
	APPEARANCE	NO MARKED DEFECT													
VIBRATION RESISTANCE	CAPACITANCE	± 10% OF INI. VAL	AMPLITUDE: 1.5mm FREQUENCY: 10-55Hz DIRECTION: X, Y, Z 3DIRECTIONS TEST TIME: 6HOURS												
	ESR	200Ω OR LESS													
	LC(30MIN)	SPEC. VALUE													
	APPEARANCE	NO MARKED DEFECT													
TERMINAL STRENGTH	APPEARANCE	TERMINALS SHALL NOT BE SEPARATED	LOAD 1kg , 10±1 SEC												
ENDURANCE	CAPACITANCE	± 30% OF SPEC. VAL	TEMP. :60± 2℃ TEST TIME : 500(+24, -0) HOURS APPLIED VOLTAGE : 3.3Vdc												
	ESR	4 KΩ OR LESS													
	LC(30MIN)	300uA OR LESS													
	APPEARANCE	NO MARKED DEFECT													

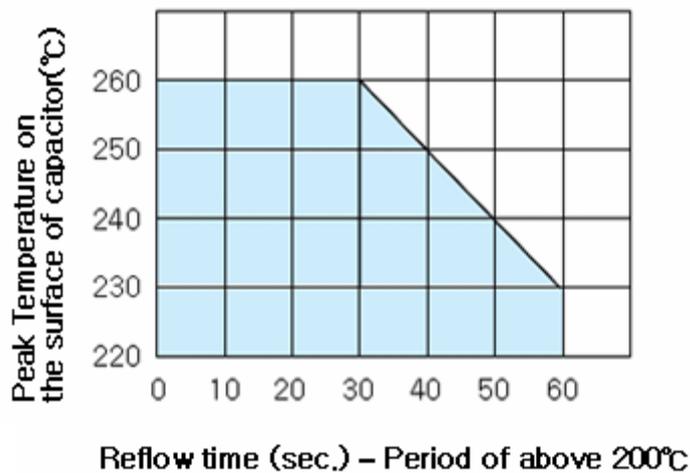
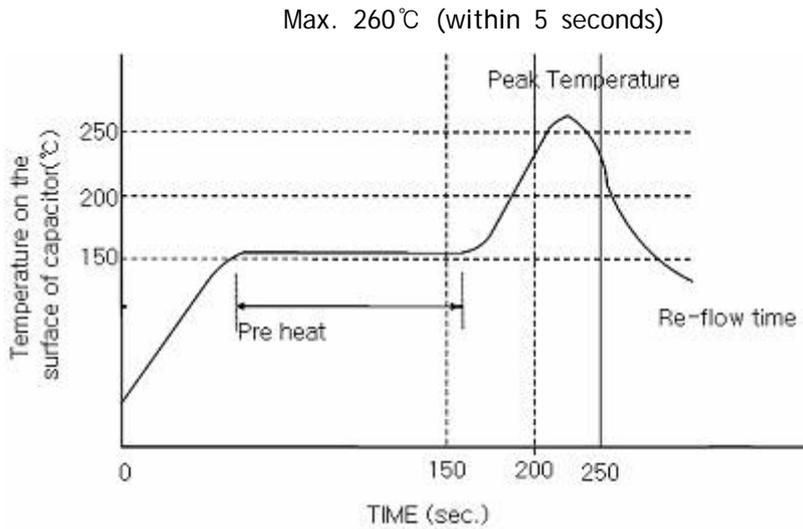
10. Measuring Method Of Characteristics

<p>Capacitance</p>	<ol style="list-style-type: none"> 1) CHARGE THE STARCAP WITH $1 \pm 0.1 \text{mA}$ TO OPERATION VOLTAGE(V_1) FOR 1 HOUR. 2) DISCHARGE THE STARCAP WITH CONSTANT CURRENT(A) $10 \pm 1 \mu\text{A}$ TO THE VOLTAGE OF V_2(NORMALLY 2V) WHILE MEASURE THE DISCHARGE TIME(T). ※ STANDARD OPERATING CURRENT FOR SM3R3703R01 STARCAP IS $10 \mu\text{A}$. 3) CALCULATE CAPACITANCE USING THE FOLLOWING FORMULA.  $C = A(\text{Ampere}) \times T \text{ sec} / (V_1 - V_2) \text{V [F]}$ 
<p>Equivalent Series Resistance (ESR @1kHz)</p>	<ul style="list-style-type: none"> ● MEASURE ESR BY THE LCR METER. (Frequency:1kHz, Bias Voltage : $0^{+0.05}\text{V}$) or ● CALCULATE ESR USING THE FOLLOWING FORMULA.  $R[\Omega] = V[V] / I[A] \quad * i[\text{mA}] = I[A] \times 10^{-3}$ <p> R : Internal resistance(ESR) [Ω] V : Measured voltage between terminals [V] i : Current 1mA(A.C.) </p> $\text{ESR}[\Omega] = V / i$
<p>Leakage Current</p>	<ol style="list-style-type: none"> 1) APPLY $3.3 \pm 0.1\text{V}$ TO THE STARCAP. 2) MEASURE V_R AFTER $30 \pm 0.5 \text{MIN}$. 3) CALCULATE CURRENT USING THE FOLLOWING FORMULA.  <p> E_0 : Vdc R_c : 100Ω </p> $\text{LC} = (V_R / R_c) \times 10^3 [\text{mA}]$
<p>☞ THE STARCAP SHOULD BE SHORTED BEFORE EACH MEASUREMENT AS FOLLOWS ; CAPACITANCE : 60 MIN. , ESR : 15 MIN. , LC : 15 MIN.</p>	

11. 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.



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

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

12. 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°C.

Soldering time for terminals should be less than 3 seconds.

13. 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 electrolyzed and its ESR increase. At the worst, it may be broken.

2) Do not use STARCAP for ripple absorption.

3) Polarity

The STARCAP is non-polar fundamentally, however STARCAP gets polarity through aging process before it is packed. Please mount it in accordance with its polarity to maintain the best condition.

4) Operating temperature and life

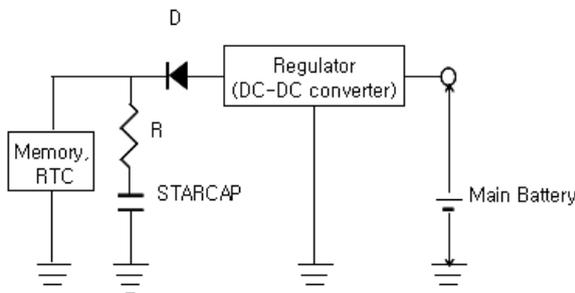
Generally, STARCAP has a lower leakage current, longer back-up time and longer life in the low temperature i.e. the room temperature. But it has a higher leakage current, shorter back-up time and shorter life in the high temperature.

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

You can short-circuit between terminals of STARCAP without resistor. However when you short-circuit frequently, please consult us.

8) Storage

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

- ① TEMP. : 15 ~ 35 °C
- ② HUMIDITY : 45 ~ 75 %RH
- ③ NON-DUST ENVIRONMENT

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.

14. Environmental Management

All STARCAP products are RoHS compliant and environment friendly.

By changing the solder plating from leaded solder to lead-free solder, our new STARCAP has become even more friendly to the environment.

Series	RoHS directive Pb, Cr+6, Hg, Cd, PBB,PBDE	ELV directive Pb, Cr+6, Hg, Cd	PVC	etc.
SM	N.D.	N.D.	N.D.	

* N.D. : Not detected