

## **SPECIFICATION APPROVAL**

## **FLYING INTERNATIONAL**

承	訒	書	編	號	:	
客				戶	:	
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公司承認章	客 戶 承 認章

# FLYiNG 沉翊國際有限公司

Powercap silicon capacitors have been developed with a semiconductor MOS (Metal Oxide Semiconductor) structure and process. Available in wafer level chip scale package.

This specification is applies to silicon capacitors for use in electric equipment for the voltage is ranging from 10V to 100V and MSL 1 regardless of thickness and termination.

The series suitable for optical fiber communication (ROSA/TOSA, SONET and all optoelectronics), DC decoupling, impedance matching, coupling and RF bypass in ultra-broadband application, electric's circuit, telecommunications, automotive, mm Wave, personal computers and peripheral, PA, VCO and mobile application. (ROHS Compliant)

#### 2. Parts Number Code



#### (1)Product

Product Code	
RFSC	Radio Frequency Silicon Capacitors

#### (2)Chip Size

Code	Length×Width	unit : mm(inch)	
0201	0.60× 0.30	(.024×.012)	
0402	1.00×0.50	(.039×.020)	

#### (5)Capacitance Tolerance Code Tolerance **Nominal Capacitance** ± 0.05 pF Less Than 10 pF А В ± 0.10 pF С ± 0.25 pF D ± 0.50 pF F ± 1.00 pF More Than 10 pF F ± 1.00 % (Include 10 pF) G ± 2.00 % ± 5.00 % 1 К ± 10.0 % Μ ± 20.0 %

#### (3) Temperature Characteristics

Code	Temperature	Temperature	Temperature	
	Characteristic	Range	Coefficient	
CG	COG	-55°C~+125°C	30 ppm/°C	
СН	COH	-55°C~+125°C	60 ppm/°C	

(4)Capacitance	unit: pico farads (pF)				
Code	Nominal Capacitance (pF)				
R10	0.1				
1R5	1.5				
100	10.0				
101	100.0				
222	2,200.0				
103	10,000.0				
224	220,000.0				
105	1,000,000.0				

X. If there is a decimal point, it shall be expressed by an English capital letter R

#### (6) Rated Voltage

Code	Rated Voltage (Vdc)
6R3	6.3V
100	10V
160	16V
250	25V
500	50V
101	100V

#### (7) Tapping

Code	Туре
Т	Tape & Reel
W	Waffle Packaging

#### 3. Nominal Capacitance and Tolerance

#### 3.1 Standard Combination of Nominal Capacitance and Tolerance

Class	Characteristic	Tole	rance	Nominal Capacitance		
I	COG/COH	Less Than 10 pF	A(± 0.05 pF)	0.1,0.2,0.3,0.4,0.5,1		
			B (± 0.10 pF)	0.5,1,1.5,2,2.5,3		
			C (± 0.25 pF)	0.5,1,1.5,2,2.5,3,3.5,4,4.5,5		
			D (± 0.50 pF)	5,6,7,8,9,10		
			F (± 1.00 pF)	6,7,8,9,10		
		More Than 10 pF	F (±1.00 %)	E-3, E-6 , E-12, E-24 series		
			G (±2.00 %)			
			J (± 5.00 %)			
			K (± 10.0 %)			
			M (± 20.0 %)			

#### 3.2 E Series (standard Number)

Standard No.		Application Capacitance										
E- 3	1.0				2.2				4.7			
E- 6	1.0		1.5		2.2		3.3		4.7		6.8	
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
E-24	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
	1.1	1.3	1.6	2.0	2.4	3.0	3.6	4.3	5.1	6.2	7.5	9.1

#### 4. Operation Temperature Range

Class	Characteristic	Temperature Range	Reference Temp.
I	CG	-55°C ~ +125°C	25°C
	СН	-55°C ~ +125°C	25°C

#### 6. Dimensions

6.1 Configuration and Dimension :



						Unit:mm
Type(EIA)	L	W	T (max)	P (min)	BW (min)	В
0402	1.05±0.10	0.55±0.10	0.50	0.40±0.10	0.30±0.05	0.50±0.05
	·			•		

#### 6.2 Capacitor Structure :



Electrode Termination Passivation Top Metal Silicon Device

#### 7. Capacitance Range

Series	Size	RVDC	Capacitance		Capacitance Range (EIA Code)		
			Range(pF)	R10	1R0	100	101
		50V	1.9pF-16.9pF				
RFSC	0402	25V	1.9pF-16.9pF				
		16V	1.9pF-16.9pF				

\*Others dimension, capacitance value and voltage rating. Please contact PEC sales.

#### 8. Performance

No.	Item			Specification		Test Condition		
1	Visual		No abnoi	rmal exterior appe	earance	Visual Inspection		
2	Dimension		See Page	3				
3	Insulation Resistance		10,000M	Ω or 500/C Ω whi	chever is smaller.	Applied Voltage : Rated Voltage Charge Time : 120±5 sec. Charge-Discharge current shall be less than 50mA current.		
4	Capacitance		Within T	he Specified Tolera	ance	Capacitance Frequency Voltage		
5	Q		Q≥1000			C≤1000pF         1MHz±10%         0.5-5Vrms           C>1000pF         1KHz±10%		
6	Dielectric Wit Voltage	hstanding	No dieleo breakdov	ctric breakdown o wn	r mechanical	250% of the rated voltage for 1~5 sec. Current is limited to less than 50mA		
7	Temperature		Туре	Temp. Range	Cap. Change (%)	C2-C1 ×100%		
	Capacitance		CG	-55°C~+125°C	± 30 ppm/°C	C1(T2-T1)		
	Coefficient		СН	-55°C~+125°C	± 60 ppm/°C			
						T1: Standard Temperature(25°C)		
						T2: Test Temperature		
						C1:Capacitance at standard temperature $(25^{\circ}C)$		
0	A dha chua Ctaraith		No indica	tion of pooling ch	all accur on the	$\Delta EN f(x_0) EKg f(x_0) = 0$		
0	Of Terminatio	n	terminal	electrode.	ectrode.			
						5N·f		
9	Resistance to	sistance Appearance		No mechanical damage		The board shall be bend 1.0mm with a rate of 1.0 mm/sec.		
F	Flexure of Substrate	C-Meter	Capacitance Change ≤ ± 5.0% of initial value			R230 Bending Limit 45±1mm 45±1mm		
10	Solderability		More tha	an 90% of the term	ninal surface is to be	Solder Temperature : 240 $\pm$ 5 $^\circ\!{ m C}$		
10	o o la c l	soldered newly, so metal part does not come		art does not come	Dip Time : 2 ± 0.5sec			
			out or dis	ssolve.		Immersing Speed : 25±10% mm/s		
					Solder : H63A /Sn-Ag-Cu			
						Flux : KOSIN Preheat : At 80~120°C for 10~30sec		
14	Desistance Americana		Ne stati					
11	Kesistance	Appearance	NO Mech	anical damage sha	an occur.	Preheat : at 150± 10°C for 60~120sec.		
	Soldering	Capacitance	Within ±	2.5% or ± 0.25pF		Dip : solder temperature of 260± 5°C		
	Heat		whicheve	er is larger of initia	Il value	$\mu$ p rime : 10 ± 1sec. Immersing Speed : 25+10% mm/s		
		Q	To satisfy	the specified init	ial value	Solder : H63A or Sn-3.0Ag-0.5Cu		
		Insulation Resistance	To satisfy	/ the specified init	ial value	Flux :Rosin		
						Measure at room temperature after cooling for 24 ± 2 Hours		

No.	Item		Specification			Test Condition		
12	Temperature Cycle	Appearance	No mechanical damage shall occur.	Capa	acito	r shall be subjected to 1 ture cycle as following:	00 cycles of the	
	Cycle	Capacitance	Within ± 3.0% or ± 0.3pF		ber d		$\overline{T}$	
			whichever is larger of initial value		tep	Temp.(°C)	Time(min)	
		Q	Q≥350		1	-55 +0/-3	30	
		Insulation	1000MΩ or 50/C Ω whichever is smaller		2	+125 +3/-0	30	
		Resistance	(C in Farad)		4	25	3	
				Me	asur	e at room temperature	after cooling for	
				24 ±	±2⊦	lours		
13	Humidity	Appearance	No mechanical damage shall occur.	Ten	Temperature : 40± 2°C			
		Capacitance	Within ±5.0% or ±0.5pF	Relative Humidity : 90 ~ 95%RH			1	
			whichever is larger of initial value	Tes	t Tir	ne : 500 +12/-0Hr		
		Q	Q≥350	Mar		a at room tomporature	ofter cooling for	
				24 +	asui + 2 F	e at room temperature lours		
		Inculation	1000MO or 50/C O whichever is smaller					
		Resistance	(C in Farad)					
14	Humidity	Appearance	No mechanical damage shall occur.	Арр	olied	Voltage: 100% of Rate	d Voltage	
	road	Capacitance	Within ±7.5% or ±0.75pF	Relative Humidity : 85%RH				
			whichever is larger of initial value	Tes	at Tir	ne : 500 +12/-0Hr		
		Q	Q 2200	,,				
		Insulation	500MΩ or 25/C Ω whichever is smaller	Me	easu	re at room temperature	after cooling for	
		Resistance	(C in Farad)	24	±21	Hours		
15	High	Appearance	No mechanical damage shall occur.	Арр	plied	l Voltage: 200% Rated V	oltage	
	Temperature	Capacitance	Within ±3.0% or ±0.3pF	Ten	npei	rature: max. operation t	emperature	
	Load		whichever is larger of initial value	Tes	st Tir	ne : 1000 +48/-0 Hr		
	(Life Test)	ų –	Q ≥350	Cur	rent	Applied : 50mA Max		
		Insulation	1,000M $\Omega$ or 50/C $\Omega$ whichever is smaller	Me	asur	e at room temperature	after cooling for	
		Resistance		24 :	±2⊦	lours	0	
16	Vibration	Appearance	No mechanical damage shall occur	Solde	er th	ne capacitor on P.C. boa	rd.	
		Capacitance Within the specified tolerance		Frequencies from 10Hz to 2,000Hz and back to 10Hz Sweep time: 20 min.(10-2000-10Hz)			Hz and back to 10Hz	
		L L		1ota 4 hor	i am urs i	plitude: 3.0mm	rpendicular directions	
				(Tota	alof	12 hours)		

#### Note:

	OUR STANDARD MEASURING INSTRUMENT
MEASURING INSTRUMENT	4284A 1KHZ/1MHZ CAPACITANCE METER (Agilent)
MEASURING MODE	PARALLEL MODE
RECOMMENDED MEASURING JIG	TEST FIXTURE (Agilent)
STANDARD ENVIRONMENT	Temperature 25°C
	Relate Humidity 50±2%

### Fig.1



#### Test Substrate (JIS-C 6429)

#### Fig.2

#### P.C. Board for Bending Strength Test (JIS-C 6429)



Material : Glass Epoxy Substrate : Copper (Thickness : 0.035mm) : Solder Resist

#### 9. Packing

#### 9.1 Bulk Packing

According to customer request.

#### 9.2 Chip Capacitors Tape Packing



**Drawing Direction** 

400mm min.

#### 9.3 Material And Quantity

Таре	0402
Material	T≦0.55mm
Plastic	10,000 pcs/Reel

#### 9.4 Cover Tape Reel Off Force

- 9.4.1 Peel-Off Force
  - $5 \text{ g-f} \leq \text{Peel-Off Force} \leq 70 \text{ g-f}$
- 9.4.2 Measure Method



#### 9.5 Plastic Tape

Embossed Tape (8mm wide)



Unit:mm

Туре	А	В	С	D	E	F
0402	0.6±0.2	1.1±0.2	4.0± 0.1	$2.0 \pm 0.05$	4.0± 0.1	1. 75± 0.1
Туре	G	Н	I	J	t	0
0402	3.5± 0.05	8.0±0.3	$\phi$ 1.5+0.1/-0	0.6 max.	0.3 max.	0.15 min.

#### 9.6 Reel Dimensions



Unit:mm

Туре	А	В	С	D	E	W
0402	φ178±0.2	φ50 min	φ13± 0.5	φ21± 0.8	2.0±0.5	10±1.5

#### **Precautionary Notes:**

#### 1. Handling precautions and storage

Silicon die must always be handled in a clean room environment (usually class 1000 (ISO 6)) but the assembled devices don't need to be handled in such an environment as the product is already well packed. The remaining quantities have to be repacked immediately after any process step, in the same conditions as before the opening (ESD bag + N2).

Store the capacitors in the manufacturer's package in the following conditions without a rapid thermal change in an indoor room:

- Temperature: -10 to 40 °C
- Humidity: 30 to 70%RH

Avoid storing the capacitors in the following conditions:

- Ambient air containing corrosive gas. (Chlorine, Hydrogen sulfide, Ammonia, Sulfuric acid, Nitric oxide, etc.)
- Ambient air containing volatile or combustible gas
- In environments with a high concentration of airborne particles
- In liquid (water, oil, chemical solution, organic solvents, etc.)
- In direct sunlight
- In freezing environment

To avoid contamination and damage like scratches and cracks, our recommendations are:

- Die must never be handled with bare hands
- Avoid touching the active face
- Do not store and transport die outside protective bags, tubes, boxes, sawn tape
- Work only in ESD environments
- A soft vacuum pick up tool is recommended to remove the silicon die from the packing to target.

#### 2. Construction of Board Pattern

2.1 Size and recommend land dimensions for reflow soldering



#### 2.2 Solder print material and stencil printing recommendations

A solder joint thickness of 40  $\mu$ m +/-10 is targeted to limit the risk of contact between the solder paste and the side of the capacitor. Such a contact would have a negative effect and would probably create a high leakage or a short circuit. Limited solder joint thickness will also avoid an excessive tilting of the capacitor.

#### Ex.: design of stencils

•	•		
EIA Code	Stencil opening size	Stencil Opening Size	Recommend Stencil Quality
	(um)	(um)	
0201	200 x 130	150-300	EXAKUT Technology
0402	370 x 260	500-700	NICKEL LASER

#### 3. Soldering

#### 3.1. Wave Soldering

Most of components are wave soldered with solder at 230 to 250°C. Adequate care must be taken to prevent the potential of thermal cracks on the silicon capacitors. Refer to the soldering methods below for optimum soldering benefits.

#### **Recommend flow soldering temperature Profile**



Soldering MethodChange in Temp.(  $^{\circ}$ C)1206 and Under $\Delta T \leq 150 ^{\circ}$ C

To optimize the result of soldering, proper preheating is essential:

- 1) Preheat temperature is too low
  - a. Flux flows to easily
  - b. Possibility of thermal cracks
- 2) Preheat temperature is too high
  - a. Flux deteriorates even when oxide film is removed
  - b. Causes warping of circuit board
  - c. Loss of reliability in chip and other components

#### Cooling Condition:

Natural cooling using air is recommended. If the chips are dipped into a solvent for cleaning, the temperature difference ( $\Delta$ T) between the solvent and the chips must be less than 100°C.

#### 3.2 Reflow Soldering

Preheat and gradual increase in temperature to the reflow temperature is recommended to decrease the potential of thermal crack on the components. The recommended heating rate depends on the size of components; however it should not exceed 3°C/Sec.



**Recommend reflow soldering temperature Profile** 

Change in Temp.(°C)
$\Delta T \leq 190 \ ^{\circ}C$
$\Delta T \leq 130 \ {\rm C}$

#### 4. Shelf life indications

Standard packing is tape & reel for die size larger than 0201 but silicon capacitors can be provided within waffle pack, unsawn pack. Please contact the Si-Cap sales.

The capacitors can be delivered in the following packaging: tape & reel and waffle pack.

#### Packaging Shelf Life

Packaging	Storage Condition Recommendations
Tape & Reel	1 years
	Temperature: 18°C to 35°C,
	Humidity: 35-60%RH or(+N <sub>2</sub> )
Tray Packaging	1 years
	Temperature: 18°C to 35°C,
	Humidity: 35-60%RH or(+N <sub>2</sub> )

#### 5. Contacts

Powercap Sales: service@flying1688.com