

### 1. 適用範圍 / SCOPE

此份規格書涵蓋 HFCL2512/3015/3618/3921-series 金屬陶瓷電流感測電阻元件相關規格。

This specification covers HFCL2512/3015/3618/3921-series, which are Metal Foil Current Sensing Resistor.

### 2. 產品型號/TYPE NUMBER

<b>HFCL</b>	<b>2512/3015/3618/3921</b>	<b>M</b>	<b>xWx</b>	<b>Rxxx</b>	<b>*</b>
	(1)	(2)	(3)	(4)	(5)

- (1) 產品系列號 / SERIES NUMBER : Ex.HFCL2512 = 長電極/ Long electrode ; 四端子 / four terminal ; 無側導/ without side electrode ; 尺寸 / size “0.25x0.12”
- (2) 產品材質 / Material : M = 錳銅合金 / MnCu alloy
- (3) 產品瓦特數 / Power Rating : Ex. 2W0=2.0 Watt ; 4W0=4.0 Watt
- (4) 產品阻值 / Nominal Resistance Value : Ex. 5mΩ →R005 ; 10mΩ →R010
- (5) 元件電阻偏差值 / Resistance Tolerance : Ex. D=±0.5% ; F=±1%

### 3. 產品尺寸 / PRODUCT DIMENSIONS

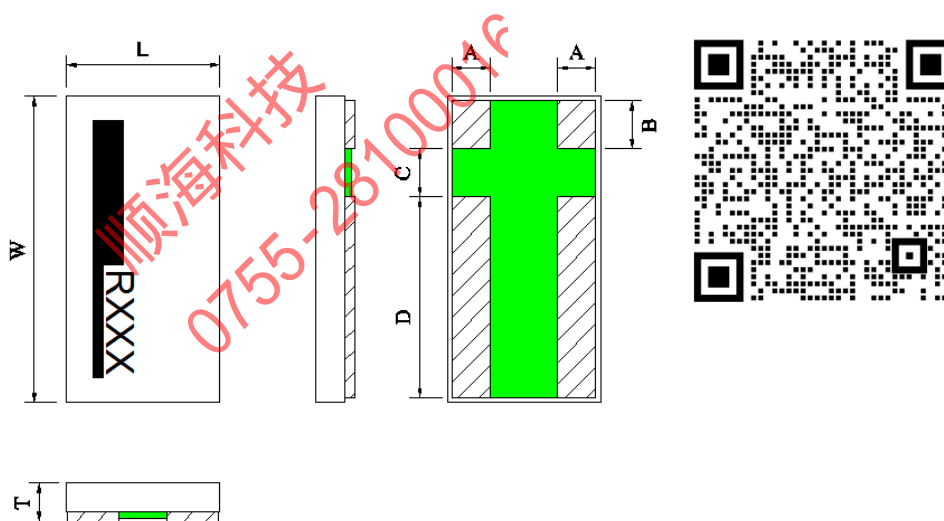


圖 1 / Fig.1

Part Number	w	L	A	B	C	D	T
HFCL2512M2W0-series R001~R025	6.30±0.20	3.10±0.20	0.50±0.20	0.62±0.20	0.50±0.20	5.12±0.20	0.60±0.20
HFCL3015M2W0-series R001~R025	7.60±0.30	3.80±0.30	0.55±0.20	0.75±0.20	0.60±0.20	6.15±0.30	0.60±0.20
HFCL3618M3W0-series R001~R025	9.00±0.30	4.50±0.30	0.65±0.20	0.90±0.20	0.75±0.20	7.25±0.30	0.60±0.20
HFCL3921M4W0-series R001~R025	11.0±0.30	5.00±0.30	0.70±0.20	1.40±0.20	1.05±0.20	8.50±0.30	0.60±0.20

4. 產品結構及使用材料說明 (參考圖 2) / STRUCTURE & MATERIAL (Ref to Fig.2)

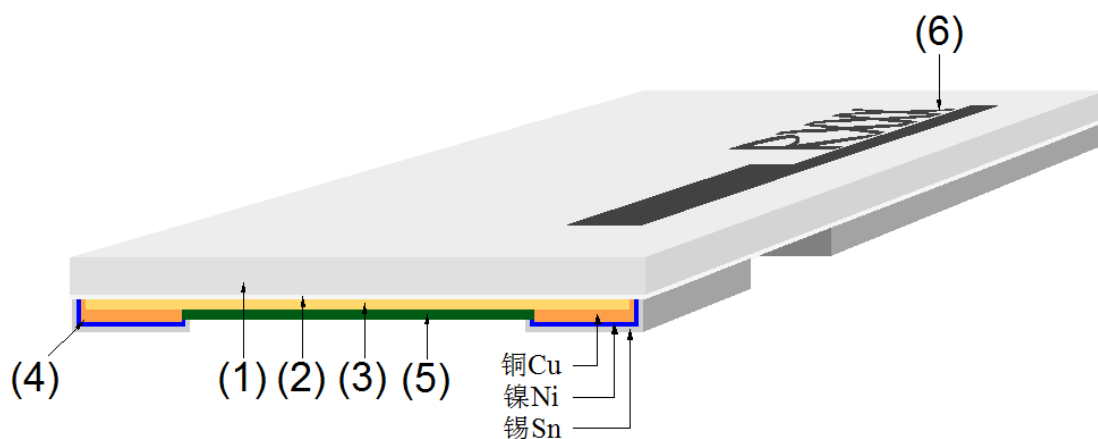


圖 2 / Fig.2



4.1 基板 / Substrate(1) : 氧化鋁陶瓷基板 / Alumina Ceramic

4.2 粘著層 / Adhesion layer(2) : 環氧樹脂 / Epoxy

4.3 電阻本體 / Resistive element(3) : 銅合金 / Cu - alloy

4.4 端電極 / Terminal electrode(4) : 錫、鎳、銅 / Sn、Ni、Cu

4.5 保護防焊層 / Protective coating(5) : 防火級環氧樹脂,符合 UL- 94-V0 要求(綠色) /  
Flame-retardant epoxy, meets UL- 94-V0 requirements(green)

4.6 文印防焊層 / Marking coating(6) : 防火級環氧樹脂,符合 UL- 94-V0 要求(黑色) /  
Flame-retardant epoxy, meets UL- 94-V0 requirements (black)

5. 電氣特性 / ELECTRICAL CHARACTERISTICS

Part Number	Resistance Value (mΩ)	Power Rating (Watt)	Resistance Tolerance (%)	TCR (ppm)
HFCL2512M2W0-series R001~R025	1~4	2.0	±1%(F)	±100
	5~25	2.0	±0.5%(D) / ±1%(F)	±50
HFCL3015M2W0-series R001~R025	1~4	2.0	±1%(F)	±100
	5~25	2.0	±0.5%(D) / ±1%(F)	±50
HFCL3618M3W0-series R001~R025	1~4	3.0	±1%(F)	±100
	5~25	3.0	±0.5%(D) / ±1%(F)	±50
HFCL3921M4W0-series R001~R025	1~4	4.0	±1%(F)	±100
	5~25	4.0	±0.5%(D) / ±1%(F)	±50

規格外阻值可依客戶需求提供 / We can provide other resistance value per request

6. 產品特性及信賴性測試規範 / PRODUCT CHARACTERISTICS AND RELIABILITY TEST STANDARD

測試方法 Parameter	條件 Conditions	允收標準 Requirements
瞬間過載測試 / Short Time Over Load	$P = 2.5P_r$ ; $T = 25 \pm 2^\circ\text{C}$ , $t = 5\text{sec.}$	$\pm(1.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.13
高溫測試 / High Temp. Exposure	$T = +170 \pm 2^\circ\text{C}$ ; $t = 1000\text{h}$	$\pm(1.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.25
低溫測試 / Low Temp. Storage	$T = -55 \pm 2^\circ\text{C}$ ; $t = 1000\text{h}$	$\pm(1.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.25
濕度負載壽命測試 / Moisture Load Life (60°C, 95%RH)	$V_{\text{test}} = V_{\text{max}}$ ; $T = 60 \pm 2^\circ\text{C}$ ; $\text{RH} = 95\%$ ; $t = 90\text{min ON}$ , $30\text{min OFF}$ , $1000\text{h}$	$\pm(2.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.25
冷熱衝擊測試 / Thermal Shock	$[-55^\circ\text{C } 30\text{min.} \rightarrow \text{R.T. } 3\text{min.} \rightarrow +155^\circ\text{C } 30\text{min.}$ $\rightarrow \text{R.T. } 3\text{min.}]$ , 100 個連續循環 / 100Cycles	$\pm(1.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.19
在 70°C 下負載壽命測試 / Load Life at 70°C	$V_{\text{test}} = V_{\text{max}}$ ; $T = 70 \pm 2^\circ\text{C}$ ; $t = 90\text{min ON}$ , $30\text{min OFF}$ , $1000\text{h}$	$\pm(2.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.25
可焊性測試 / Solderability	浸入錫爐 / Dip into solder at $T = 245 \pm 5^\circ\text{C}$ , $t = 3 \pm 0.5\text{sec.}$	錫涵蓋面積 / The covered area >95% IEC60115-1 4.17
抗焊熱性測試 / Resistance to Solder Heat	經熱風式迴焊爐 / Through Reflow $T = 275 \pm 5^\circ\text{C}$ , $t = 20 \pm 1\text{sec.}$	$\pm(1.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.18
機械衝擊測試 / Mechanical Shock	加速度 $a = 100\text{G}$ , 振幅時間 $t = 11\text{ms}$ , 5 個衝擊 $a = 100\text{G}$ , $t = 11\text{ms}$ , 5 times shock	$\pm(1.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.21
基板彎曲測試 / Substrate Bending	兩支撐點間距 / Span between fulcrums : 90mm ; 振幅 / Bend Width: 2mm ; 測試板 / Test board: 玻璃纖維板 / Glass-Epoxy Board 厚度 / Thickness: 1.6mm	$\pm(1.0\% + 0.5\text{m}\Omega)$ IEC60115-1 4.33

7. 環境特性 / ENVIRONMENTAL CHARACTERISTIC

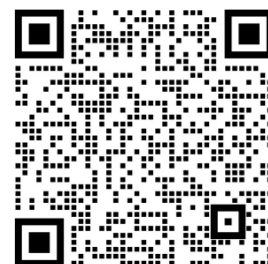
7.1 操作溫度範圍:  $-55^\circ\text{C} \sim 155^\circ\text{C}$  / Operating Temperature:  $-55^\circ\text{C} \sim 155^\circ\text{C}$

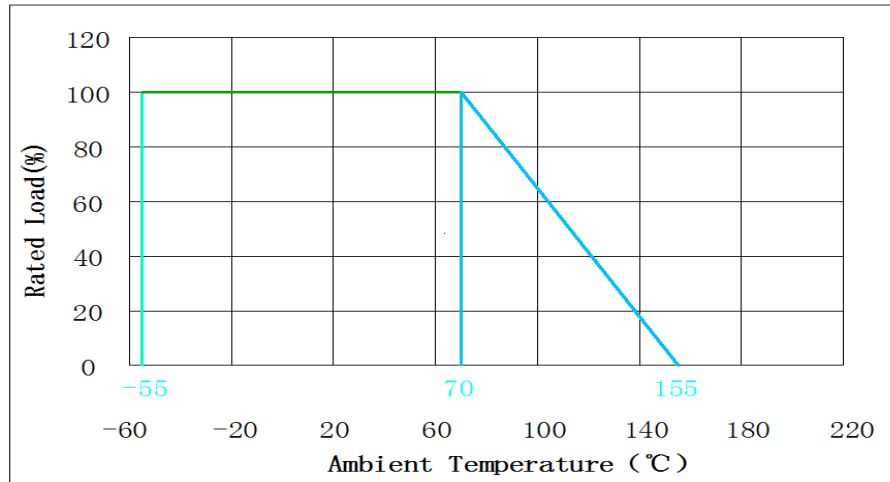
額定功率溫度衰變曲線 / Typical Thermal Derating Curve

額定功率乃指於  $70^\circ\text{C}$  以內可連續滿額功率使用的術語。

下圖為當操作溫度高於  $70^\circ\text{C}$  時的可使用功率衰減曲線。

Power rating is based on continuous full load operation at rated ambient temperature of  $70^\circ\text{C}$ . For resistors operated at ambient temp. in excess of  $70^\circ\text{C}$ , the max. load shall be derated in accordance with the following curve.





### 7.2 存儲條件 / STORAGE CONDITIONS

在溫度+10°C~40°C、相對濕度 $\leq 75\%$ 的密閉條件下可存放2年。 /

Under airtight in temperature+10°C~40°C、relative humidity  $\leq 75\%$  can store 2 years.

在溫度+10°C~60°C、相對濕度為95%的非露天下最多可存放30天。 /

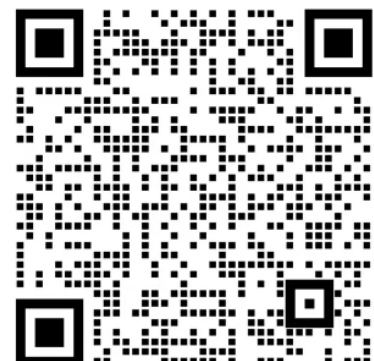
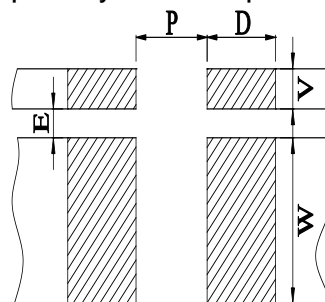
Without dew in temperature+10°C~60°C、relative humidity be 95% maximum value for 30days.

### 8. 焊錫墊尺寸及焊接條件 / SOLDER PAD SIZE AND WELDING CONDITIONS

8.1 建議如下圖焊接方式焊接，並滿足所要求的尺寸。 / Propose that the following picture installation way is installed, and satisfied the required size

Part Number	P	W	D	V	E	Loading
HFCL2512M2W0-series R001~R025	2.00mm	5.10mm	1.00mm	0.70mm	0.50mm	2.0W
HFCL3015M2W0-series R001~R025	2.40mm	6.60mm	1.20mm	0.95mm	0.45mm	2.0W
HFCL3618M3W0-series R001~R025	2.80mm	7.80mm	1.40mm	1.10mm	0.55mm	3.0W
HFCL3921M4W0-series R001~R025	3.30mm	8.90mm	1.50mm	1.70mm	0.80mm	4.0W

loading : 適用於本公司建議焊墊設計並使用於限定穩定電流下 /  
suit for specific pad layout and specific steady current



## 8.2 建議客戶焊接參數 / Recommended Customer Soldering Parameters

### 8.2.1 回流焊溫度曲線 / Solder reflow Temperature condition (圖 3 / Fig.3)

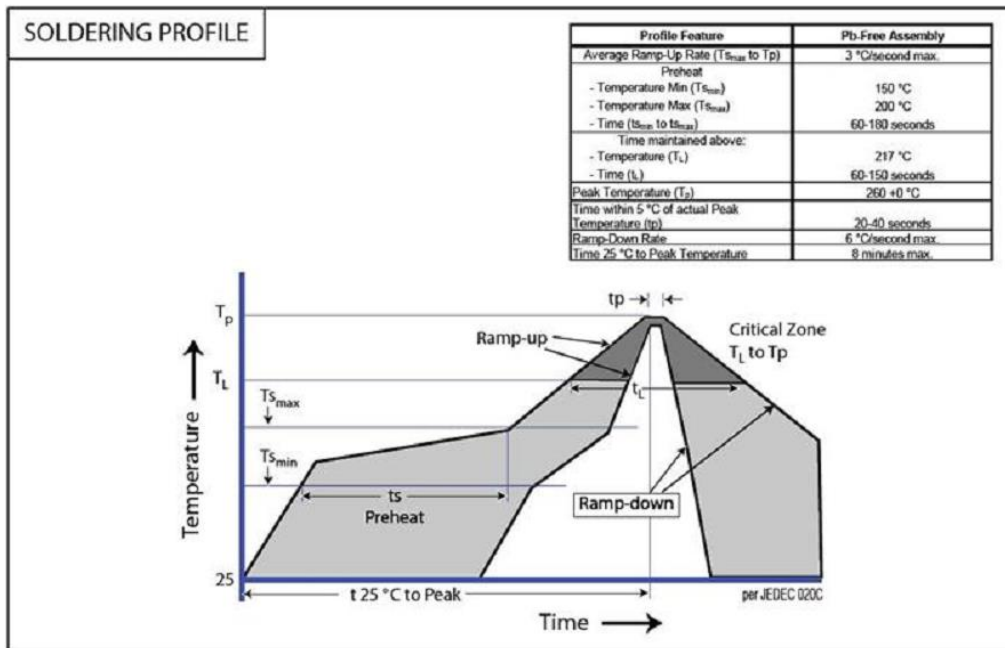


圖3 / Fig.3

8.2.2 允許烙鐵焊接條件(熱風設備) / Rework temperature (hot air equipment) : 350°C, 3~5seconds

8.2.3 焊接方法建議 / Recommended reflow methods

焊接熱源方式可用紅外線, 熱蒸氣, 熱風, / IR, vapor phase oven, hot air oven

如果焊錫溫度超過允許最高溫度, 則產品本身會有功能損壞的疑慮. / If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

## 9. 批量生產後出貨測試項目 / Lot ACCEPTANCE TEST REQUIREMENTS

每一批生產均須作入庫檢驗, 每一批生產單量不可超過500Kpcs. /

Qualification shall consist of passing a program of following tests. Parts shall be pulled from each lot and maximum lot quantity shall be within 500Kpcs.

### 9.1 外觀 / Visual

方法 / Procedure : 利用放大鏡進行檢查 / Visual

標準 / Acceptance Criteria : 不能有髒污、不潔、文印錯誤、破損等 / No parts are outstandingly stained

### 9.2 尺寸 / Dimensions

方法 / Procedure : 使用合適且經校正的尺規 / As appropriate, calipers, micrometers, optical comparator, or approved gages

標準 / Acceptance Criteria : 尺寸均在規定標準範圍內 / No parts outside specific dimensions

### 9.3 單體元件電阻(Ro) / Resistance (Ro)

方法 / Procedure : 在 25°C 下利用四線量測技術量測之 / Resistance shall be measured with 25 °C in the 4-wire resistance test

標準 / Acceptance Criteria : 電阻值均在規定標準範圍內 / The resistance of the test device shall be within the limits specified

### 9.4 電阻溫度係數 / TCR

方法 / Procedure : 利用四線法量測出元件分別在 25°C 及 125°C 下的電阻值, 並將其帶入下面公式中即可得出 TCR 值 / Getting the sampling device resistance values measured in 25°C and 125°C and put them in to the following equation to calculate the TCR

標準 / Acceptance Criteria : 溫度係數值均在規定標準範圍內 / All parts must within the specific  $TCR = (R_b - R_a) / R_a \times 1 / (T_b - T_a) \times 10^6$

### 9.5 絕緣電阻 / Insulation resistance (Ri)

方法 / Procedure : 利用絕緣測試儀量測 / Resistance between protective layer and resistive shall be measured by high ohm meter

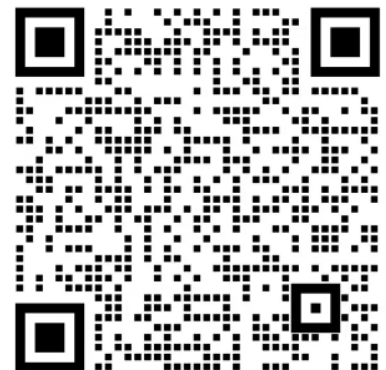
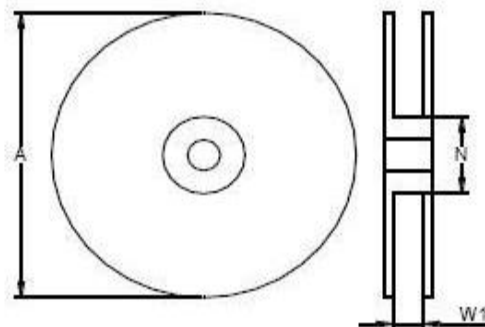
標準 / Acceptance Criteria : 防焊層與電阻本體絕緣電阻至少高於 100MΩ / The resistance of the test device shall over 100MΩ

## 10. 包裝訊息 / PACKAGING INFORMATION

### 10.1 包裝數量、重量 / QUANTITY & WEIGHT

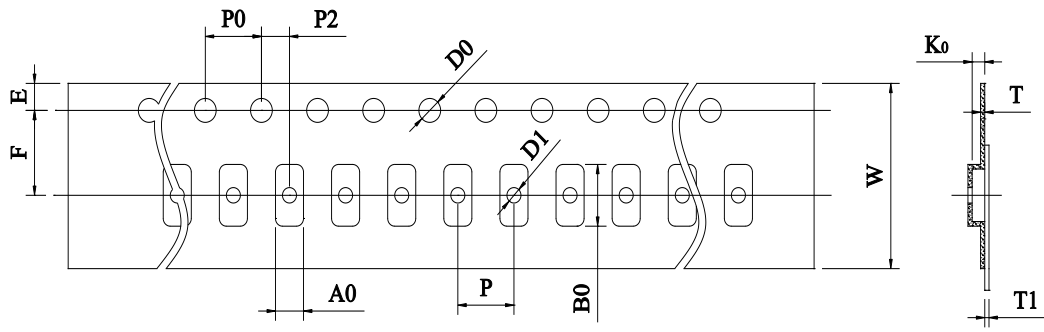
型號 / Type Number	數量 / Quantity (pcs)	重量 / Weight (g)
HFCL2512M2W0-series	4,000	270±50
HFCL3015M2W0-series	2,000	360±50
HFCL3618M3W0-series	2,000	440±50
HFCL3921M4W0-series	2,000	510±60

### 10.2 捲輪規格 / Reel & Tape specifications





型號 / Type Number	A±5 (mm)	N±2 (mm)	W1±1 (mm)
HFCL2512M2W0-series	178	60	13.0
HFCL2512M2W0-series	178	60	17
HFCL3921M3W0-series	178	60	17
HFCL3921M4W0-series	178	60	24.5



Unit(mm)

HFCL2512M2W0-series							
W	12.00 ± 0.30	P0	4.00 ± 0.10	P	4.00 ± 0.10	P2	2.00 ± 0.10
A0	3.40 ± 0.20	B0	6.75 ± 0.20	D0	1.50 ± 0.10	F	5.50 ± 0.10
E	1.75 ± 0.10	T	0.25 ± 0.10	T1	Max. 0.1	K0	1.00 ± 0.20

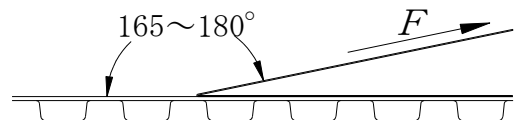
HFCL3015M2W0-series							
W	16.00 ± 0.30	P0	4.00 ± 0.10	P	8.00 ± 0.10	P2	2.00 ± 0.10
A0	4.15 ± 0.20	B0	7.95 ± 0.20	D0	1.50 ± 0.10	F	7.50 ± 0.10
E	1.75 ± 0.10	T	0.30 ± 0.10	T1	Max. 0.1	K0	0.90 ± 0.20

HFCL3618M3W0-series							
W	16.00 ± 0.30	P0	4.00 ± 0.10	P	8.00 ± 0.10	P2	2.00 ± 0.10
A0	4.85 ± 0.20	B0	9.35 ± 0.20	D0	1.50 ± 0.10	F	7.50 ± 0.10
E	1.75 ± 0.10	T	0.30 ± 0.10	T1	Max. 0.1	K0	0.90 ± 0.20

HFCL3921M4W0-series							
W	24.00 ± 0.30	P0	4.00 ± 0.10	P	8.00 ± 0.10	P2	2.00 ± 0.10
A0	5.50 ± 0.20	B0	11.50 ± 0.20	D0	1.50 ± 0.10	F	11.50 ± 0.10
E	1.75 ± 0.10	T	0.30 ± 0.10	T1	Max. 0.1	K0	0.90 ± 0.20

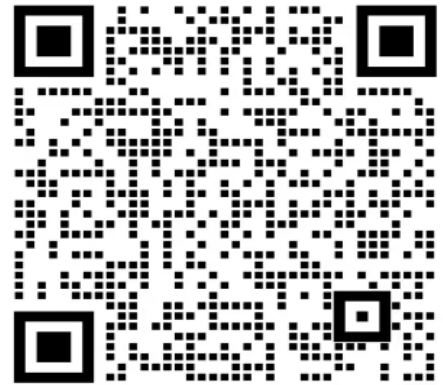
### 10.3 密封膠膜剝離強度要求 / Peeling Strength of Seal Tape

F = 剝離強度 : 0.1 – 1.0N ( 10 - 100gf )  
F = Peeling Strength: 0.1 – 1.0N (10 - 100gf)



## 11. 其他 / OTHERS

- 11.1 如果在使用中有超出本規格書的要求，必須經由雙方協商確認。 / In the event that an impropriety is found beyond this specification , it shall be fixed by mutual agreement between the parties.
- 11.2 如果本規格書有不適當的情況，必須通過雙方協商並由本公司修改。 / In the event that an impropriety is found in this specification , Juneway Electronic Technology Co., Ltd. shall amend it by mutual agreement between the parties.



順海科技  
0755-28100016