1. Scope

The specification made a standard for the product performance and test methods, as the basis of technical confirmation.

2. General Specification

Generally,the standard range of atmospheric conditions for making measurements and tests are as followed:
Ambient temperature：15℃～35℃
Humidity：≤85%RH
Air Pressure：86kPa~106kPa

If there is any doubt about the results,measurement shall be made within the following conditions:
Ambient temperature：20℃±2℃
Humidity：60%RH～70%RH
Air Pressure：86kPa~106kPa

How to order

HD	5R5	S	474	DA	B	000
↓	↓	↓	↓	↓	↓	↓
Series Code	Voltage Code	Temperature Code	Capacitance	Type	Package	Internal Code
HD Series (coin)	2R7: 2.7V 3R8: 3.8V 3R6: 3.6V 5R5: 5.5V	S : -20~50℃	224: 0.22F 474: 0.47F	DA:Lead at two ends	B:Bulk T: AMMO TAPED	Dia+H; or 000 000 for standard

3.1 Test condition:

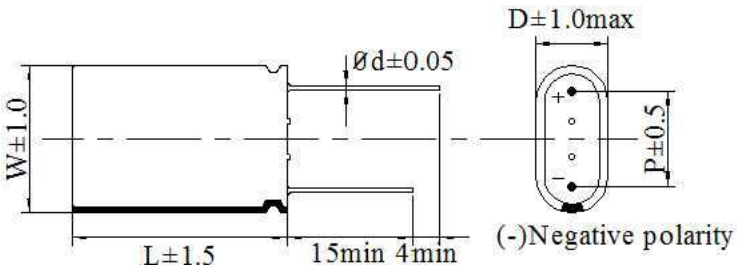
Generally, testing will be performed under normal atmosphere, temperature:5～35℃, Humidity:≤95%RH The test condition in this Specification is under normal atmosphere, temperature:25℃,Humidity:<60%RH

3.2 Test Standard

IEC62391-1；MAXWELL test standard

4 . Main technical parameters

ITEM	Specification
Rated Volatge(U_R)	5.5 V
Max. Surge Voltage	6.0 V
Nominal Capacitance(C)	0.47 F
Capacitance Tolerance	-20%～+50%
Operating Temperature Range	-40℃～+65℃
Maximum Equivalent Series Resistance， R_{AC}(1kHz)	360 mΩ
Maximum Leakage Current(72hrs)	0.002 mA
Maximum Operating Current(△T=15℃)	0.25 A
Maximum Peak Current	0.73 A
Maximum Storage Energy	0.0020 Wh
Available Energy	1.0 Wh
Power density	1124 W/kg



Unit:mm

Dimensions	
W(±1.0)	16.0
D(±1.0)	8.0
L(±1.5)	14.0
d(±0.05)	0.6
P(±0.5)	11.5

5. Illustration

5.1 IEC test method details:

Charge under constant current to rated voltage, 10 more minutes charge under constant voltage

After 10 minutes constant voltage, discharge under constant current, see below chart 1,record voltage to U_1, U_2 and its seperate t_1, t_2, and it could get the capacitance per the formula.

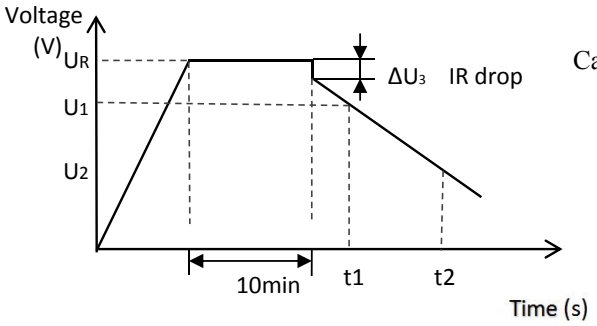


Chart 1: Voltage time characteristics

Capacitance formula: $C=\frac{I\times(t_2-t_1)}{U_1-U_2}$

I: Discharge current, $4\times C\times U_R$(mA)

U_1: Initial voltage, $0.8\times U_R$(V);

U_2: Ending voltage, $0.4\times U_R$(V);

t_1: Time from discharge starting to nitial voltage U_1(s)

t_2: Time from discharge starting to test ending voltage U_2(s)

5.2.MAXWELL six-steps test method:

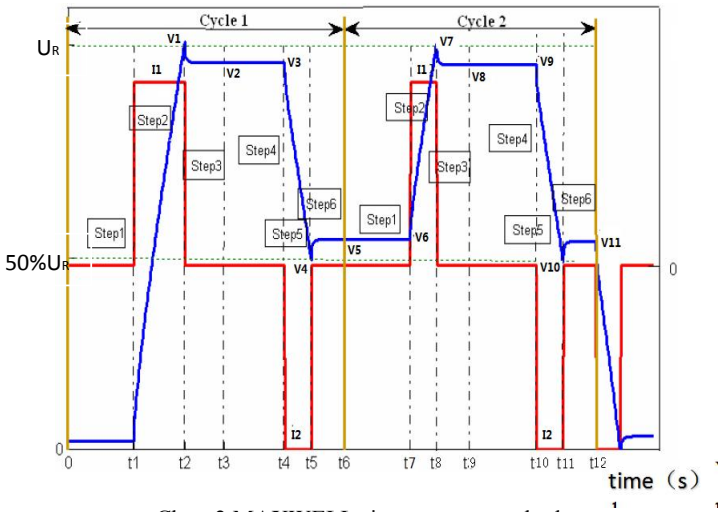


Chart 2 MAXWELL six-steps test method

Test Steps:

step1: Rest 10s;

step2: Charge under constant current (I_1) to rated voltage (U_R)

step3: Rest 5s;

step4: Rest 10s, record V_3,t4

step5: Discharge under constant current(I_2) rated to 1/2 voltage U_R, record I_2, V_4, t_5

step6: Rest 5s, record V_5,t_6

Repeat step1～step6, and record current , voltage,time,accordingly, finally discharge to below 0.1V under constant current(I_2)

Parameters calculate:

2 time cycle discharge capacitances: $\mathbf{C_{dch1}} = I_2\times(t_5-t_4)/(V_3-V_4)$; $\mathbf{C_{dch2}} = I_2\times(t_{11}-t_{10})/(V_9-V_{10})$;

Discharge capacitance: $\mathbf{C_{dch}} = (C_{dch1} + C_{dch2})/2$;

2 times cycle discharge DC resistance: $\mathbf{ESR_{dch1}} = (V_5-V_4)/I_2$; $\mathbf{ESR_{dch2}} = (V_{11}-V_{10})/I_2$;

Discharge DC resistance; **ESRdch** = $(ESR_{dch1}+ESR_{dch2})/2$;

Remarks: $I_1=I_2=30$A, the rated capacitance in the chart means discharge capacitance, DC resistance(ESRDC)means discharge DC resistance.

6.Product normal performance

NO.	Item		Standard	Test Method
1	**Life test**		|ΔC/C25℃|≤30%|Δ ESR/ESR25℃|≤100%	The capacitors storage 1500 hours at rated voltage at 65±2℃,Capacitance & ESR meet the standard, with no visible damage, no leakage, test method as previous stated.
2	**Cycle Life (25℃)**		≥500,000 cycles	Charge under constant current to rated voltage U_R, and discharge to $1/2U_R$ under constant current at 25℃
3	**Temperature characteristics**	-40℃	|ΔC/C25℃|≤5%|Δ ESR/ESR25℃|≤100%	Test method as previous stated
		65℃		

7. Product electric circuit

7.1 Electric circuit schematic diagram

7.3 Power plate parameters

NO.	Item	Condition	Parameters	Tolerance	Unit
1	**balance start voltage**	Cell voltage	V≥2.65	±0.05	V
2	**balance off voltage**	Cell voltage	V＜2.65	±0.05	V
3	**Over temperature limit**				℃

8. Cautions

8.1 Charge

8.1.1 Charge current

Charge current shall not exceed max. work current,The current greater than max. work current may cause problems for charge & discharge performance, mechanical performance and safety performance,and may cause heat or leakage.

8.1.2 Charge Voltage

Charge voltage shall not exceed rated voltage240V),259.2V is the upper limit, the design for charger shall meet this requirement.,The voltage greater than max. work voltage may cause problems for charge & discharge performance, mechanical performance and safety performance,and may cause heat or leakage.

8.1.3 Charge temperature

-40～65℃.

The products MUST charge under 40～65℃.

8.1.4 Reverse charging is not permitted

Connect the module positive pole & negative pole rightly,No reverse charging are allowed,as it will reduce module performance.

8.2 Discharge

8.2.1 Discharge current

Discharge current shall not exceed max. work current, large discharge current will cause rapid capacitance decline and over heat.

8.2.2 Discharge temperature

-40～65℃.

The products MUST discharge under 40～65℃.

8.3 Storage

It is suggested to storage the modules under temperature-40～70℃, and humidity≤95%.