Serial No. : 2013-1380
DATE : 2013/11/26

ITEM : CRYSTAL RESONATOR

TYPE :	DSR211ATH
NOMINAL FREQUENCY :	19.200MHz
SPEC No. :	1RAE19200BAA

Please acknowledge receipt of this specification by signing and returning a copy to us.

RECEIPT	
DATE	
RECEIVED	(signature) (name)

General Manufacturer of Quartz Devices
DAISHINKU CORP.
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Country	Spec No.
INDONESIA	1RAE19200BAA

Device Name Crystal Resonator (with dedicated temperature sensor)
Model Name DSR211ATH
Nominal Frequency 19.200 MHz
Mass 0.015g max.
Absolute Maximum Ratings

Item	Rating	unit
Storage Temperature Range	-40~105	°C

Recommended Operating Conditions

Item	min.	typ.	max.	unit
Operating Temperature Range	-30	-	105	°C

1. ELECTRICAL CHARACTERISTICS

Crystal Resonator

(This test shall be performed under the conditions of temp.at 25 ± 3°C, Relative Humidity 60% max.)

	Item	Limits			unit	Conditions	Notes
		min.	typ.	max.			
1	Mode of Vibration	-	AT-cut Fundamental	-			
2	Initial Frequency Tolerance	-	-	±10	ppm	T_A=+25°C	
3	Tolerance Over Temperature	-	-	±12	ppm	T_A= -30~85°C	
4	Aging	-	-	±0.7	ppm/year		
		-	-	±5	ppm/7years		
5	Frequency Drift After Reflow	-	-	±2	ppm	After two reflows	
6	Equivalent Series Resistance	-	-	80	Ω		
7	Quality Factor	75000	-	-			
8	Spurious Mode Series Resistance	1100	-	-	Ω	±1MHz	
9	Motional Capacitance	1.50	-	3.10	fF		
10	Shunt Capacitance	0.3	-	1.3	pF		
11	Load Capacitance	-	7	-	pF		
12	Inflection Point	30.5	-	33.5	°C	T=T0-C2/3C3	
13	First-order Curve Fitting Parameter/ C1	-0.4	-	-0.1	ppm/°C	Between +25 and +35°C	*1
14	Second-order Curve Fitting Parameter/ C2	-4.50	-	4.50	$\times 10^{-4}$ ppm/°C		*1
15	Third-order Curve Fitting Parameter/ C3	8.5	10	11.5	$\times 10^{-5}$ ppm/°C		*1
16	Residual Frequency Stability Slope	-	-	±50	ppb/°C		*2,3
17	5°C Small Orbit Hysteresis1	-	-	±50	ppb/°C	T_A= -30~85°C	*2,3,4
18	5°C Small Orbit Hysteresis2	-	-	100 (magnitude)	ppb pk-pk	T_A= -30~85°C	*5,6
19	Drive Level	10	-	100	uW		
20	Insulation Resistance	500	-	-	MΩ		

Notes

*1. The FT curve of an AT-cut crystal can be modeled as a third-order polynomial.
C0, C1, C2, and C3 are coefficients that need to be defined are calculated in the order specified by Qualcomm's 80-V9690-23 Rev C

$$f(t) = c_3(\theta)(t-t_0)^3 + c_2(\theta)(t-t_0)^2 + c_1(\theta)(t-t_0) + c_0$$

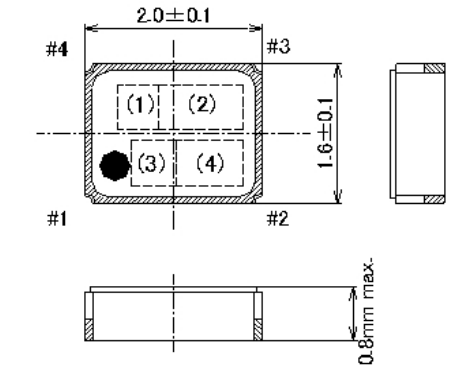
C0, C1, C2, and C3 are coefficients that need to be defined.
C1: First-order Curve Fitting Parameter/ C2: Second-order Curve Fitting Parameter/
C3: Third-order Curve Fitting Parameter/ T0=+32°C

*2. Measure FT point every 1°C, heating up from -30 to +85°C, subtract off a 5th order polynomial best fit and calculate the slope of the residual.
*3. Continuous temperature rate change of ~1.0°C/min
*4. Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit, an example 5°C small orbit temperature cycle is +30 to +35 to +30°C.
Subtract the 5th order polynomial best fit from *2(discard the first point of each heating and cooling cycle), and calculate the slope of the residual for each of these heating and cooling 10 points curves.
*5. Continuous temperature rate change of ~1.0°C/min
*6. Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit, an example 5°C small orbit temperature cycle is +30 to +35 to +30°C.
Calculate the average difference between each pair of 9 same temperature cooling - heating frequency measurement (discard the first and last point of each heating and cooling cycle).

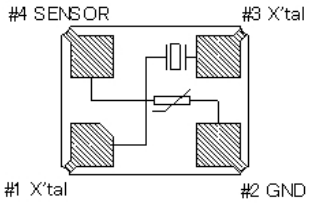
Thermistor

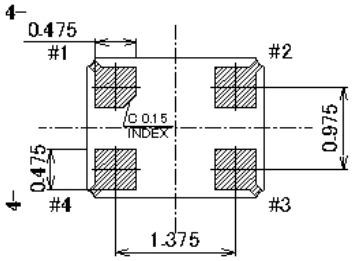
	Item	Limits			unit	Conditions
		min.	typ.	max.		
1	Resistance	-	100	-	kΩ	T_A=+25°C
2	B-constant	-	4250	-	K	+25°C - +50°C
3	Tolerance	-	-	1	%	

2. DIMENSIONS AND MARKING



Connection (Top View)





Marking

(1) Model code	(2) Frequency (MHz, 3digits)	(3) Logo	(4) Date code
TH	19.2	D	Year (1digit) +Week (2digits)

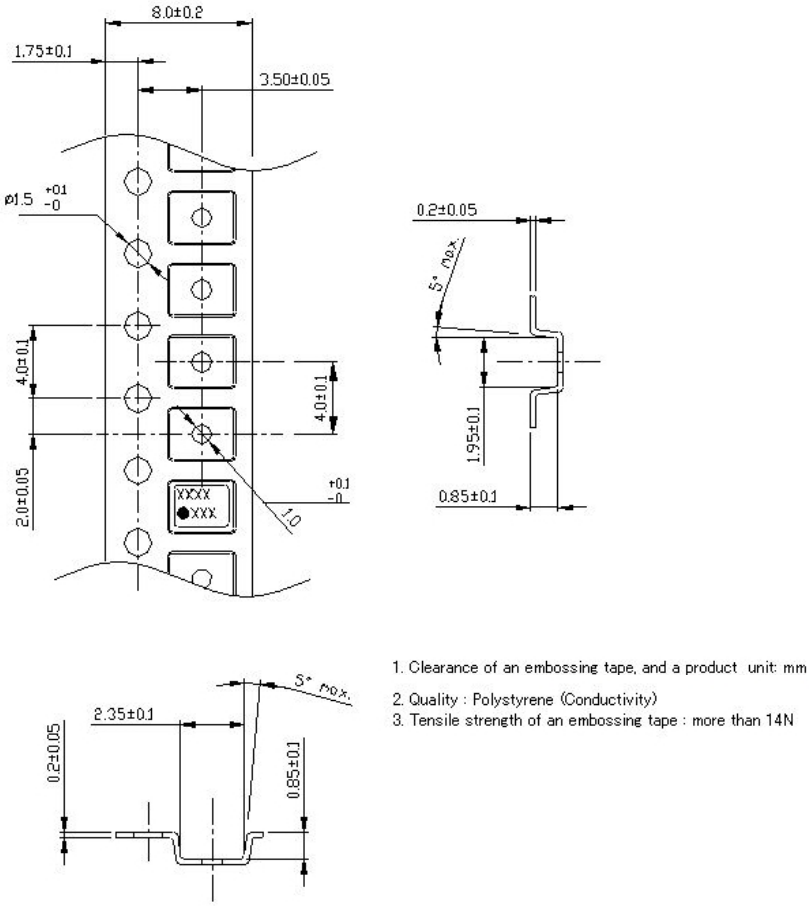
e.g.2013/1/1→ 301

unit:mm general dimension tolerance:0.1mm

Figure-1

TITLE DSR211ATH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE	SPEC. No.	REV.	PAGE
2013/11/26	-		3 / 14

3. EMBOSS CARRIER TAPE & REEL
   (1) Dimensions of embossed carrier tape

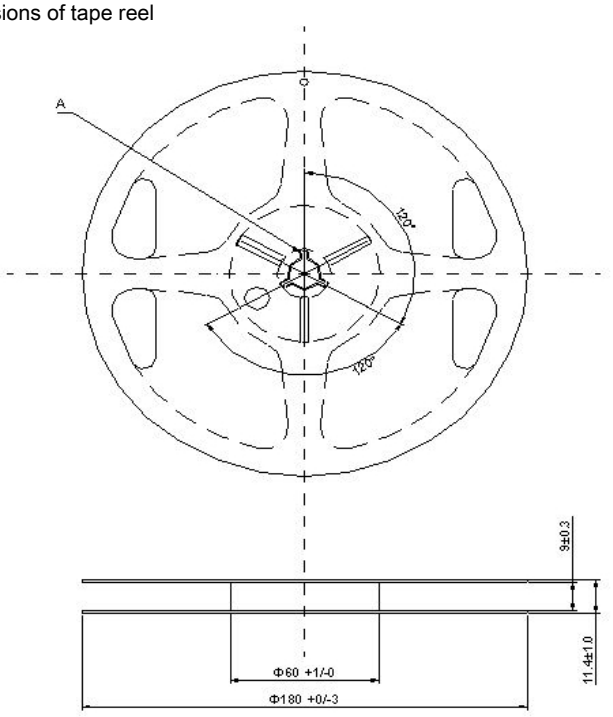


1. Clearance of an embossing tape, and a product unit: mm
2. Quality : Polystyrene (Conductivity)
3. Tensile strength of an embossing tape : more than 14N

Figure-2

TITLE DSR211ATH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE 2013/11/26	SPEC. No. -	REV.	PAGE 4 / 14

(2) Dimensions of tape reel



Material:Polystyrene (Conductivity)
unit:mm

Section A

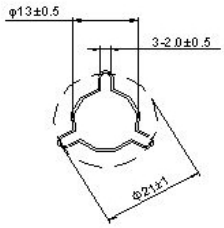


Figure-3

TITLE DSR211ATH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE	SPEC. No.	REV.	PAGE
2013/11/26	-		5 / 14

(3) Storage condition

Temperature : +40 °C max.
Relative Humidity : 80% max.

(It is a guaranteed term because it obtains an excellent soldering: 1 year)

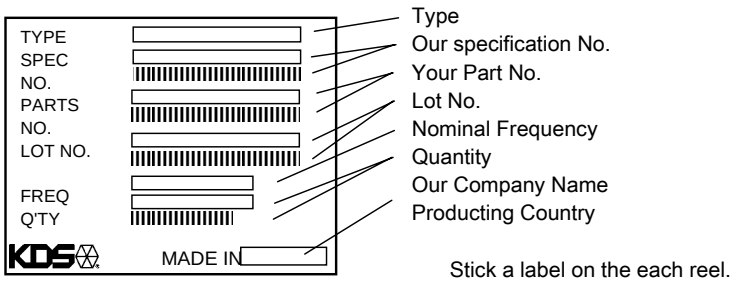
(4) Standard packing quantity

3,000 pcs/reel

(5) Material of the tape

Tape	Material
Carrier tape	Polystyrene (Electrically Conductive)
Cover tape	PET+Olefin resin (Electrically Conductive)
Reel	Polystyrene (Electrically Conductive)

(6) Label contents



Stick a label on the each reel.

(7) Taping dimension

Leader	Cover-tape	The length of cover-tape in the leader is more than 400mm including empty embossed area.
	Carrier-tape	After all products were packaged, must remain more than twenty pieces or 400mm empty area, which should be sealed by cover-tape.
Terminal	Cover-tape	The tip of cover-tape shall be fixed temporary by paper tape and roll around the core of reel one round.
	Carrier-tape	The empty embossed area which are sealed by cover-tape must remain more than 40mm.

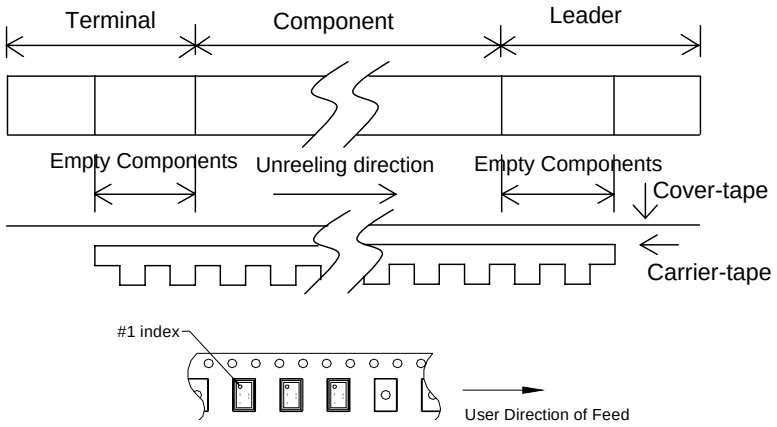


Figure-4

(8) Joint of tape
The carrier-tape and cover-tape should not be jointed.

(9) Release strength of cover tape
It has to between 0.1 ~ 0.7N under following condition.
Pulling direction 165 ~ 180 °
Speed 300mm/min
Otherwise unless specified.

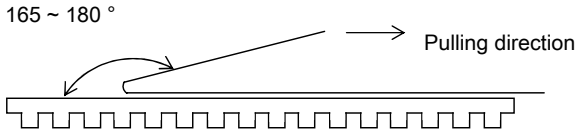
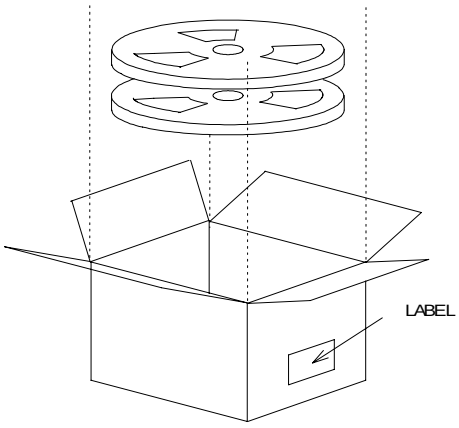


Figure-5

Other standards shall be based on JIS C 0806 -1990.

4. PACKING

(1) STORAGE METHOD



Label contents

The type of product
Lot No.
Specification
Quantity
Shipment Day
Remark

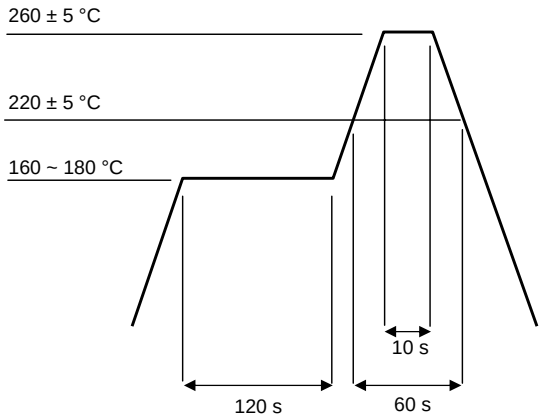
Figure-6

(2) BOX SIZE

From lot size packingsize shall be changed.
In the upper and lower part and the opening in box it shall be protected products using aircushion sheets.

5. REFLOW CONDITIONS (REFERENCE)

During the solder reflow process, please complete within following temperature, period.
Reflow soldering shall be allowed only 3 times.

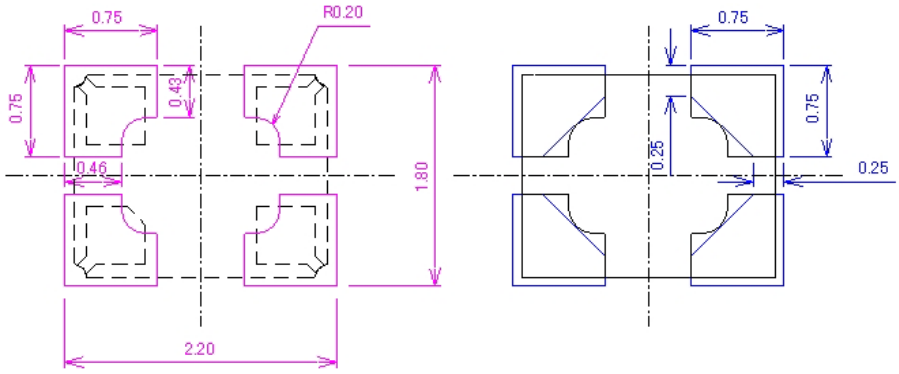


Total time : 240 s max.

Figure-7

HANDSOLDERING METHOD : +350 ± 10 °C , 3+1/-0s Each terminal once
(Please take care so that a soldering iron should not touch a product directly.)

6. LAND PATTERN (REFERENCE)



unit : mm

Figure-8

TITLE DSR211ATH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE 2013/11/26	SPEC. No. -	REV.	PAGE 9 / 14

7. MECHANICAL ENDURANCE

(1) SHOCK (ACCELERATION)
After the following test,parts shall conform specification 9.A
1000m/s^2 by 6ms X,Y,Z each axis (6 directions) , 3cycles

(2) SHOCK (MOUNTING DROP)
After the following test,parts shall conform specification 9.A
3cycles(18times) drop from 150 cm heights to concrete.
Further,parts shall be solderd on substrate, fixed Aluminum materials(about 100g).

Substrate materials	:	Glass Epoxy
1 cycle	:	each 1 times of 6 directions

(3) VIBRATION
After the following test,parts shall conform specification 9.A
and no abnormal appearance shall be observed.

Frequency of Vibration	:	10 ~ 500 ~ 10 Hz
Amplitude(p-p)	:	Sine waves of 1.5mm or 100m/s^2
Cycle	:	11min
Vibration axis	:	X.Y.Z
Vibration period	:	2 h for each axis

(4) SEAL
Less than 2.0×10^{-9} Pa m^3/s. by Helium leak detector.
Also, no serial bubble is observed by Fluorocarbon tests.

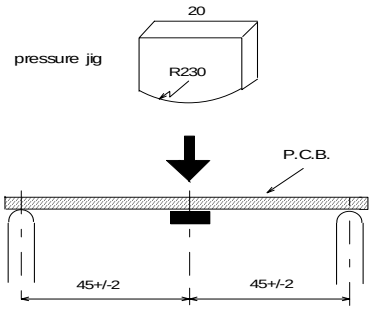
(5) SOLDERABILITY
After the following test, more than 95% of terminal shall be covered by new solder.
3 ± 0.5 s dip in +245 ± 5 °C solder.
(Solder composition : Sn-3Ag-0.5Cu) (Use rosin type flux for solder.)

(6) RESISTANCE TO SOLDERING HEAT (REFLOW)
48 h past at room temperature from following test,parts shall conform specification 9.A
perform the attached Reflow conditions to reference.

(7) RESISTANCE TO SOLDERING HEAT (HAND SOLDERING METHOD)
48 h past at room temperature from following test,parts shall conform specification 9.A
+350 ± 10°C , 3+1/-0s Each terminal once.

(8) SUBSTRATE BENDING
After the following test,parts shall conform specification 9.A
and no abnormality shall be observed in external appearance and sealing
tightnen and others shall be based on ET-7403 of EIAJ.
Mount the specimen on substrate.
Apply the following pressure

Direction	:	see right figure
Speed	:	about 1.0 mm/s
Hours	:	5 ± 1 s
Amount of substrate	:	3 mm max.

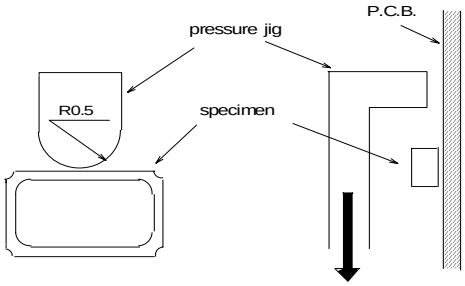


(9) SHEAR

After the following test,parts shall conform specification 9.A
and no abnormality shall be observed in external appearance and sealing
tightness and others shall be based on ET-7403 of EIAJ.

Mount the specimen on substrate.
Apply the following pressure

Weight	:	10 N
Hours	:	10 ± 1 s
Direction	:	see right figure

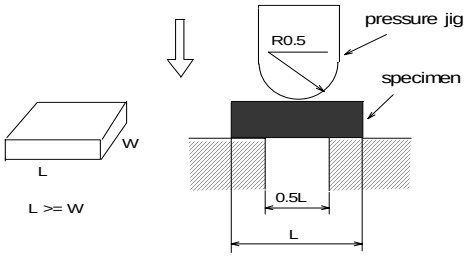


(10) BODY STRENGTH

After the following test,parts shall conform specification 9.A
and no abnormality shall be observed in external appearance and sealing
tightness and others shall be based on ET-7403 of EIAJ.

Mount the specimen on substrate.
Apply the following pressure

Weight	:	5N
Hours	:	10 ± 1 s
Direction	:	see right figure



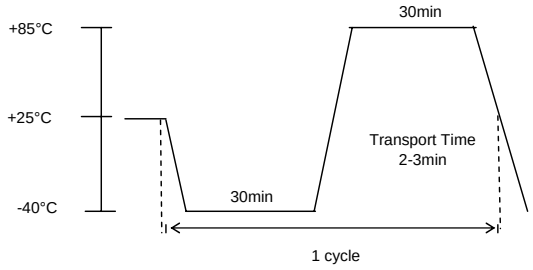
8. ENVIRONMENTAL ENDURANCE

(1) LOW TEMPERATURE
2 h past at room temperature after following test, parts shall conform specification 9.A
240 h , -40 ± 3 °C.

(2) HUMIDITY
2 h past at room temperature after following test, parts shall conform specification 9.A
240 h , +85 ± 2 °C , relative humidity 85 ± 5%.

(3) HIGH TEMPERATURE
2 h past at room temperature after following test, parts shall conform specification 9.A
240 h , +85 ± 2 °C.

(4) TEMPERATURE CYCLE
2 h past at room temperature after 1000 cycles of followingtest, parts shall conform specification 9.A



9. SPECIFICATION

Frequency Variation and Equivalent Resistance shall be within Table below after the reliability test.

Spec.	Frequency Variation	Equivalent Resistance
A	±2ppm	±15 % or 2.0 Ω max. (Use larger specification)
B	±5ppm	±20 % or 3.0 Ω max. (Use larger specification)
C	±10ppm	±20 % or 3.0 Ω max. (Use larger specification)
D	±20ppm	±25 % or 10.0 Ω max. (Use larger specification)

10. DSR211ATH TYPE QUARTZ CRYSTAL HANDLING INSTRUCTIONS

(1) SOLDERING

Please perform the attached Reflow conditions to reference within 3 times.

(2) MOUNT

Crystal products are designed to be compatible with automatic mounting.
Be sure to have a mounting test in advance by using the actual mounting machine
and check that the characteristics of the products are not damaged
by the automatic mounting.
In the process where the boad is warped, such as board separation process,
be careful that the warping does not influence the characteristics
and soldering of crystal products.
Since mounting by Ultrasonic welding and processing have a possibility of an excessive
vibration spreading inside a crystal resonator and becoming the cause of characteristic
deterioration and not oscillating, it does not recommend.

(3) WASHING

About use of the washing liquid of a basin system,
an alcoholic system, and a chlorofluorocarbon-replacing
material system, it is checking that it is satisfactory.
However please consult in advance about other washing liquid.
Although the check about ultrasonic washing is performed,
since it is an examination with a simple substance,
the check for the second time by the use state is recommended.

(4) THE CAUTIONS ON USE

The piece of crystal it is processed very smaller than the conventional thing
inside DSR211ATH series crystal unit may be damaged,
if excessive excitation electric power is applied.
Please use it below with the value specified on a catalog and specifications.
Please refrain from forming patterns between crystal land pattern's since there is
a possibility to cause crack in base.

(5) HANDLING OF A PRODUCT

DSR211ATH series has sufficient intensity to fall and vibration.
However when too much shock is added according to a certain cause,
the use after a characteristic check is recommended.

(6) STORAGE

Since the soldering nature of a terminal may be degraded,
please avoid storage in high temperature and a humid place.
Please keep it in the place which direct rays do not hit
and dew condensation does not generate.

2013-1380 REVISION RECORD

Rev.No	Date	Reason	Contents	Approved	Checked	Drawn
-	2013/11/26	-	Initial Release	A.Hishikawa	H.Takase	H.Takase