

Subject:	PRODUCT ENGINEERING SPECIFICATION	Part No.:	9Z.P5E**.***;	Rev.: 0
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## 1. Introduction

These specifications will give a description on the **U10B** keyboard modules designed to be installed into the Notebook PCs. **64keys module for US versions**. They are designed with excellent silent tactile feeling by switch-stroke up to **1.1±0.2** mm full stroke and feeling technology improvements. And they are different with keyboard technology (Backlit and Non backlit):

**U10B**: Printing legends and over coating for keycaps.

**U10B**: is a retail package, the key module is owned by Darfon.

## 2. Electrical specifications

### 2.1 Pseudo N-key rollover

The key module is pseudo N-key rollover, more than 2 key pressed at the same time are acceptable except those keys are in the phantom position of scan matrix.

### 2.2 Cables and Connectors

The keyboards use **26 pins connector** for system

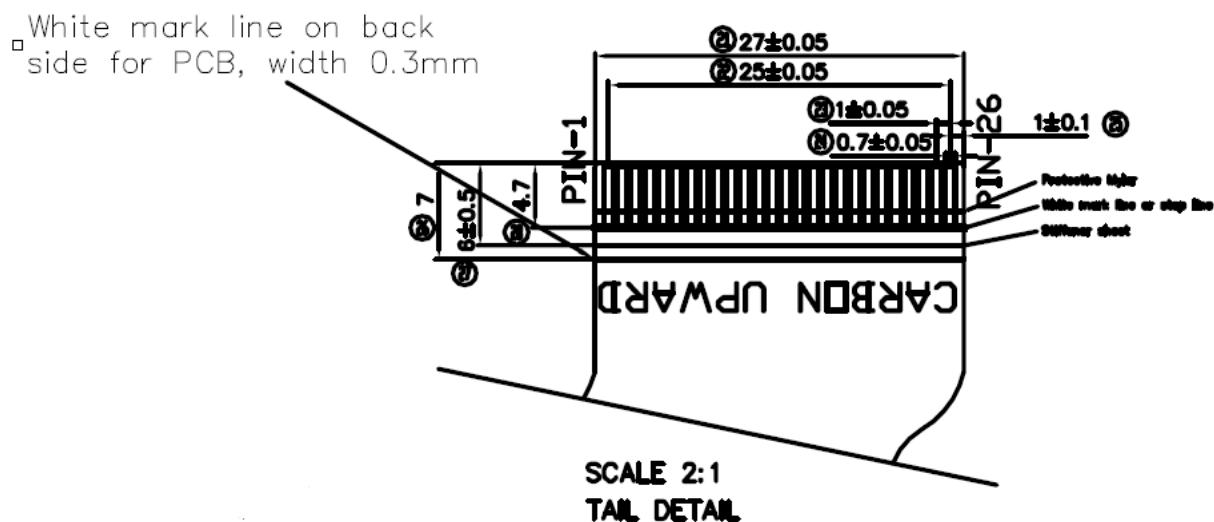
The keyboards use **4 pins connector** for backlit module

### 2.3 Connectors to match with

**U10B** keyboards use **26pins, 1mm** pitch connector of ZJ.XFE(1.0C-26PBS) for system.

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## 2.4 Safety and EMI Requirements

- 2.4.1 There shall be no over-standard **EMI** emitting from keyboard module while assembled on the Notebook PC housing so as to assist notebook PC successfully granted by **FCC (class-B) & CE (class-B)**.
- 2.4.2 No clear coats or enamels will be used as a surface finish of the keyboard mounting/base plate. Keyboard mounting/base plate should have good electrical connection through mounting bosses and should be electrically connected to the main keyboard plate.
- 2.4.3 The keyboard shall meet ISO 9241-4 requirements and all relevant national keyboard layouts such as DIN2137 and ZH1/618. Must also meet all keycap inscription durability requirements.
- 2.4.4 Keyboard module shall has potential to obtain the **TUV** approval, but unnecessary to apply it unless special request from customer.
- 2.4.5 The keyboard module should be approved by **UL**.

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## 2.5 Membrane Switch Electrical Requirements

### 2.5.1 Contact resistance:

Test method – Apply finger load on the center of keycap down to bottom, resistance must meet the following: (pin end to end)

**500-ohm max. (Initially)**

**1000-ohm max. (After life & Environmental testing)**

### 2.5.2 Bounce:

Striking the center of key 3 times per second with load 400 grams, Contact bounce must be lower than 20 ms. (all the life time)

### 2.5.3 Dielectric strength:

Apply **100V A.C.** across any adjacent circuit paths; and across circuit paths and metal plate. There shall be no abnormality happening on circuit.

## 3. Mechanical Specification

### 3.1 General Items

#### 3.1.1 Overall Dimensions/ Weight

Keyboard module overall dimensions and weight and key layouts.

(1). Dimensions:

Length: **229.9 ±0.1 mm**

Width: **82.6 ±0.1 mm**

Height: **3.0 ±0.2 mm**

(2). Weight:

**U10B: 46 grams (max)**

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### 3.1.2 Keycap Legend

**U10B**: Legends are made by laser etching or printing.

### 3.1.3 Row offsets

Defined by drawing.

### 3.1.4 Key Pitch

16.9 mm.

### 3.1.5 Keycap Texture

**U10B** NBL keycap texture is MT 11010.

**U10B** with BL keycap is polish 800.

### 3.1.6 Color

(1) Laser etch keycaps:

MCS-A0QN + MCS-A982 for **U10B**

Gloss: 6±1 units at 60 degrees

Sample appearance also needs to be approved by DARFON.

Paint:

#### Primer:

Paint: 大瑞 AP10101

Color: White

Dry film thickness: 12~16 μm

#### Color Coat:

Paint: 大瑞 AF1092

Color: Black

Dry film thickness: 14~18 μm

### Protective Coating

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UV coating: 大瑞 UV0093

Color: Clear

Dry film thickness: 12~18  $\mu\text{m}$

Gloss: 6 $\pm$ 1 units at 60 degrees

MCS-A0UN + MCS-A982 for U10B

Gloss: 3 $\pm$ 1 units at 60 degrees

Sample appearance also needs to be approved by DARFON.

Paint:

**Primer:**

Paint: 歐力生 ECONET EY MIDDLE GRAY BASE NO.2

Color: Gray

Dry film thickness: 10~14  $\mu\text{m}$

**Color Coat:**

Paint: 歐力生 ECONET EY KBD BEZEL WHITE

Color: White

Dry film thickness: 10~14  $\mu\text{m}$

**Protective Coating**

UV coating: 歐力生 UV COAT S-200 CLEAR HX -2

Color: Clear

Dry film thickness: 15~19  $\mu\text{m}$

Gloss: 3 $\pm$ 1 units at 60 degrees

(2) Printing keycaps:

MCS-A0BU for U10B

**Color of legend:**

Print (Panton coolgray 3c)

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MCS-A0C8 for U10B

### Color of legend:

Print (Panton coolgray 8c)

(3) Note: Specification of keycap color comparison.

Refer to appendix A.

### 3.1.7 Flammability of materials (Unless otherwise specified):

Part	Material	UL grade	Note
Keycap	ABS PA 758 – U10B BL ABS PA 757 – U10B NBL	94 – HB	Paint + Laser Etching – U10B Print – U10B
Rubber dome/return spring	Silicone (transparent)	94 – HB	
Membrane	PET	94 – VTM2	
Support plate	Stainless(SUS 304) – U10B		Thickness: 0.2mm
Scissors mechanism	POM or Darfon approved equivalent	94 – HB	

### 3.1.8 Key Switch Function

The keyboard should have well switch function by following definition.

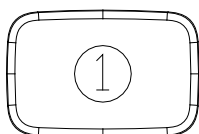
Key-in SPEC as below:

Test probe diameter :  $\varnothing 4.0\text{mm}$

1. The measurement of P1 at corner < Nominal P1 at center \*1.5

2. The force of fire point at corner < the P1 at corner

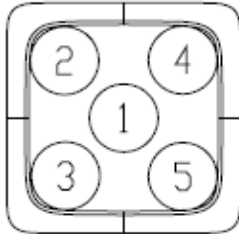
A. Small keys(Key size < 1.0X)



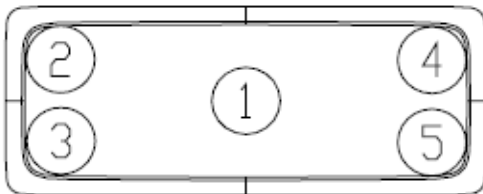


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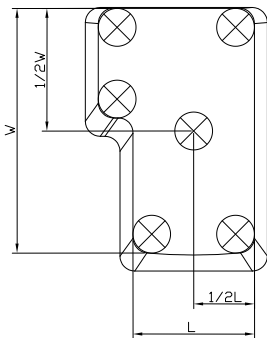
### B. Normal keys



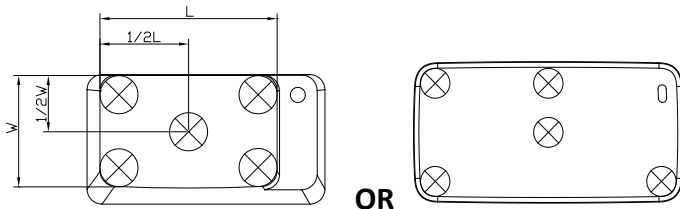
### C. Multiple key and spacebar



### D. Enter key



### E. Special key(Caps lock key)



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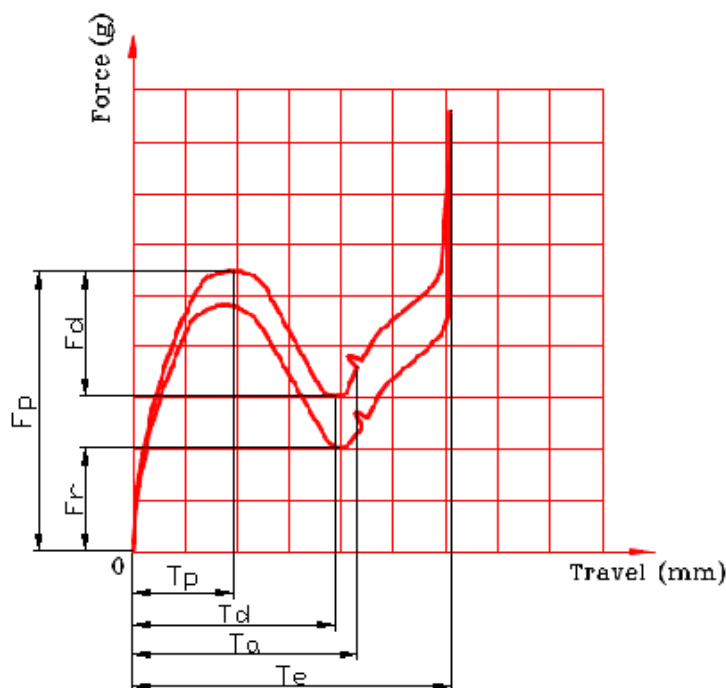
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### 3.2 Mechanical Requirements

#### 3.2.1 Switch Operating Characteristics (silent tactile):



Key Switch Specification for regular keys

	Regular Keys		Small Keys	
Total Travel(Te)	1.1±0.2mm	1.1±0.3mm	1.1±0.2mm	1.1±0.3mm
Peak Force(Fp)	60±15g	Min 50% of P1	60±15g	Min 50% of P1
Peak Travel(Tp)	0.45±0.2mm	0.45±0.25mm	0.45±0.2mm	0.45±0.25mm
Drop Force(Fd)	35%~50% of Fp	n/a	35%~50% of Fp	n/a
Return Force(Fr)	Min 15g	Min 5g	Min 15g	Min 5g
Life Cycles	5 Million		2 Million	

Placing the keyboard such that the direction of the keyboard operation is vertical and then applying a static load twice the actuating force to the center of the key top, the travel distance for the key top to come to a stop shall be measured.

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### 3.2.2 Smoothness:

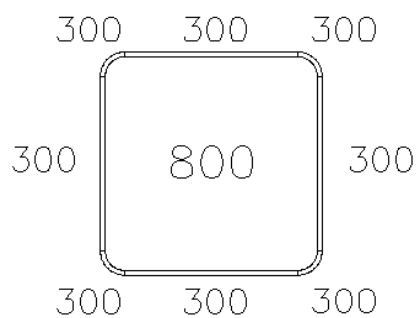
Press key at random, the key must be up and down actively and freely without slow return, rubbing or sticking motions.

### 3.2.3 KB Strengths:

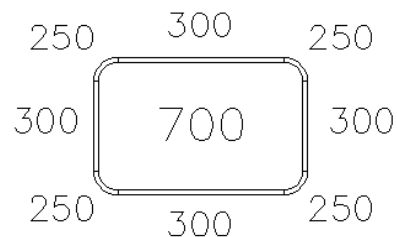
#### (1) Pull Off Force

Center pull off force (all keys, backlit)" 800g      Minimum w/equal load applied to all 4 corners of the keycap edge and corner specs shown below:

Regular



Small



		Backlit	
		Regular Key	Function Key
Center	All	800 g	700 g
Edge	Front	300 g	300 g
	Rear	300 g	300 g
	Side	300 g	300 g
Corner	Left Front	300 g	250 g
	Right Front	300 g	250 g
	Left Rear	300 g	250 g
	Right Rear	300 g	250 g

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Placing the keyboard such that the direction of keyboard operation is vertical, the maximum pulling force required to remove a key cap shall be measured. The above values are based on initial keycap removal test cycle. No permanent damage to any component of the key switch should occur and no removal of any other component (w/exception of leveling mechanism or wire on multi-wide keycaps) except the keycap when the keycap pull test is performed. Keycap shall be easily replaceable by user.

## (2) Keyboard stop strength:

There shall be no sign of damage, mechanically or electrically to the keyboard or point stick (if applicable) when the keyboard is placed such that the direction of keyboard operations is vertical, and a static load of the following force is applied in the direction of keycap operation for a period of time or in the direction of stick operation.

A test shall be performed with the keyboard fixed to avoid keyboard warp and a test probe 13.0mm in diameter minimum applied made of a high Durometer rubber so as not to damage the keycap or point stick cap.

Operation Direction	Load, N (Kg)	Period (second)
Key cap Z	29.4 (3)	60
Stick XY	39.2 (4)	60
Stick Z	98 (10)	60

## (3) Cable Strain Relief

The Cable, if applicable, on the keyboard shall have a minimum bend radius of 1.0mm and a Strain Relief of 0.45kg in any direction.

## (4) Flex Termination/Connector Mate and Un-Mate Life

The Keyboard Connection to the system (or Touchpad) interface shall support twenty-five (25) mate/un-mate cycles at all possible angles of insertion (determined on a product by product basis via Dell Engineering) without any functional degradation or change in signal integrity outside of specification range.

## (5) Keyboard Bending Strength

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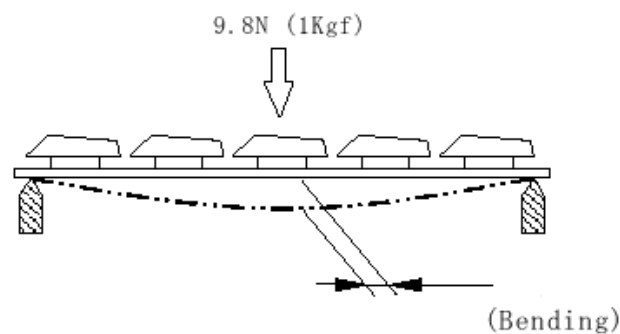


Figure. Keyboard Bending Strength

With the keyboard is placed on the bench supporting both at top and bottom end, applying 9.8N (1 kgf) load to the center of keyboard, the keyboard bending should be 5mm maximum. During the test, the keycaps and scissors should not dislodge. After the testing, the keyboard should be fully functional without any degradation and mechanical damages.

## 4. Environment Test Specification

### 4.1 Environment test items for keyboard function:

#### 4.1.1 High Temperature Operation

The keyboard shall be operable at 60°C without condensation continuously for a minimum 48 hrs. There must be no evidence of internal corrosion or bacteria – fungus growth after the test.

#### 4.1.2 High Temperature and High Humidity Operation

The keyboard shall be operable at 60°C at 90% humidity without condensation continuously for a minimum 48 hrs. There must be no evidence of internal corrosion or bacteria – fungus growth after the test.

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## 4.1.3 High Temperature Storage

The keyboard shall be able to withstand storage at 70°C without condensation continuously for a minimum 96 hrs. There must be no evidence of internal corrosion or bacteria – fungus growth after the test.

## 4.1.4 High Temperature and High Humidity Storage

The keyboard shall be able to withstand at 70°C at 95% humidity without condensation continuously for a minimum 96 hrs. There must be no evidence of internal corrosion or bacteria – fungus growth after the test.

## 4.1.5 Low Temperature Operation

The keyboard shall be operable at 0°C continuously for a minimum 48 hrs without failure or any degradation of performance.

## 4.1.6 Low Temperature Storage

The keyboard shall be able to withstand storage at -40°C continuously for a minimum 96 hrs without failure or any degradation of performance.

## 4.1.7 Temperature Shock

The keyboard shall be able to withstand 12 cycles of thermal shock testing between -25°C and 60°C external ambient temperatures (minimum 30°C/min. transition rates and 2 hr dwells at each extreme) without failure or any degradation of performance.

## Below test items for keyboard with backlit module:

### Non-operational temperature/humidity(package with PE bag)

Test Step #	Conditions (from)	Conditions (to)	Elapsed time (hours)	Test purpose	Test Mode
1	25°C/50% RH	-40°C	4	Temperature and Humidity ramp	
2	-40°C	-40°C	24	Low temperature soak	Cold
3	-40°C	39°C/0%RH	5	Temperature ramp (15C/hour)	
4	39°C/0%RH	39°C/95%RH	5	Humidity ramp (20%/hour)	
5	39°C/95%RH	39°C/95%RH	12	High humidity soak	Damp

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6	39°C/95%RH	65°C/20%RH	4	Temperature and Humidity ramp	
7	65°C/20%RH	65°C/20%RH	24	High temperature & high humidity soak	Hot
8	65°C/20%RH	25°C/50%RH	4	Temperature and Humidity ramp	

### Operational temperature/humidity(package with PE bag)

Test Step #	Conditions (from)	Conditions (to)	Operation	Duration (hours)	Test purpose	Test Mode
1	25°C/50% RH	0°C	Power On, Function test	2	Temperature and Humidity ramp	
2	0°C/10% RH	-----	Function test	12	Low temperature function test	Cold
3	0°C	31°C/90%RH	Function test	4	Temperature and Humidity ramp	
4	31°C/90%RH	-----	Function test	12	High humidity test	Damp
5	31°C/90%RH	40°C/45%RH	Function test	3	Temperature and Humidity ramp	
6	40°C/45%RH	-----	Function test	12	High temperature & high humidity test	Hot
7	40°C/45%RH	25°C/50%RH	Function test	2	Temperature and Humidity ramp	
8	Go to step 1	Repeat steps 1-8 for second cycle	Function test	47	Run 2 <sup>nd</sup> loop undocked	

Sample shall not show visual crack and deformation after test.

## 4.2 Environmental Data for reference only

Note: All test-sample to be oven cured 65°C at 24 hours at least prior to carrying out the following tests to secure the sealing of membrane assembly.

### 4.2.1 H<sub>2</sub>S gas test: (reference)

3.0±1 ppm, 28°C, 90%±5% RH Non-Condensing, 200 hours, then reduce RH to 50%±5%RH, keep other conditions, 50 hours. (250 hours in total)

### 4.2.2 O<sub>3</sub> gas test: (reference)

2.5±0.3 ppm, 28°C, 90%±5% RH Non-Condensing, 200 hours, then reduce RH to 50%±5% RH, 50 hours. (250 hours in total)

#### Criterion of 4.2.1 & 4.2.2:

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1. No evidence degradation & No flux activity on membrane assembly. (Discoloration may be acceptable if pass the following)
2. Max. loop Contact resistance (switch contacted) to be less than 1 K $\Omega$ Contact Resistance Increasing Less then 30 %.
3. Pass the basic function test & switch reaction test (4 strikes/sec).
4. Pass the trace-peeling test.

## 4.2.3 Altitude (reference):

10K ft, Operating, 35K ft Non-Operating.

Criterion: Basic functional test shall be passed.

## 4.2.4 ESD test: (meet customer's requirement)

“The keyboard must be designed to be immune up to 8kVcontact discharges to any exposed conductive surfaces and up to 15kV air discharges to any part of the keyboard that will attract an ESD event. This immunity, applies to any part of the keyboard which could be damaged from such a discharge. In addition, the keyboard when integrated into the system must afford immunity at the system level to said discharges.

Air discharges will seek areas or points that have a difference of potential from the tip of the ESD generator (path of least impedance). This usually means, but is not limited to, ‘ground’ potential. All circuit traces should be either insulated in a fashion to prevent an ESD event from occurring and/or have a “safe” ground potential from which the discharge is attracted. In either case, the design of the keyboard must be made to disallow any discharges to circuit traces.

# 5. Durability

## 5.1 Life test

Switch life must exceed a life expectancy of 10 million actuation (2 million for Function and Cursor keys). This life performance must be demonstrated by actual testing using 150 grams minimum



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actuation force at a 3-5 cycles per second frequency. After testing individual keys must function properly. If keycap have linkbar, after life test the linkbar can't come off.

Item	Requirement
Cycle Rate	3-5 times/sec
Keys	20 keys minimum
Force	150g at full travel
Stress cycles	5 / 3 million cycles for normal key / fun & cursor key
Sample size	20 keys per keyboard
Time between intervals	24 hours

Force displacement measurements and keyboard functionality will be tested at the following intervals: 0, 5, and 10 million cycles. The keyboards will be tested 24 hours after the end of each interval.

The minimum keys to be tested shall include: E, A, G, X, Esc, Left Shift, Enter, and Spacebar center (2 keyboard min), Spacebar left end (1 keyboard min) and Spacebar Right end (1 keyboard min) as part of the 20 key minimum requirement stated above.

## 5.2 Keycap Printing tests

### 5.2.1 Legend Wear Resistance

The keyboard legend life should be compliant with IEC 68-2-70 standard "Abrasion of Markings and Letterings by Rubbing of Fingers and Hands" with a severity level for of 1.5N(153g) at 5 million cycles.

### 5.2.2 Keycap Chemical Resistance

The keyboard surface, including all key caps, shall resist erosion due to common chemicals that exist on persons during use of the keyboard. These common chemicals include hand lotion (Oil of Olay,Vaseline, and Sunscreen), hand cleaner, perfume and cologne.

Resistance to erosion by wiping the above mentioned chemicals onto the surface of the keyboard shall be verified and the erosion under a 40°C temperature environment for 24 hours minimum shall be observed.

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### 5.2.3 Paint Keycap Test

#### a. Adhesion (ASTM D3359-02)

##### Test Parameters:

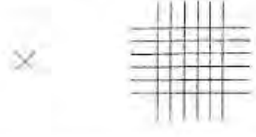
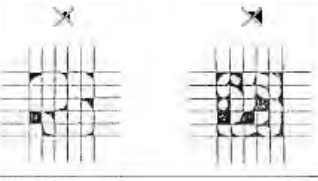
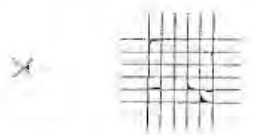
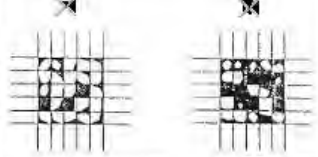
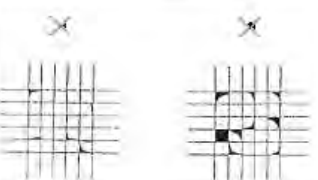

Curved surfaces or surfaces too small (with one dimension less than 10mm) for Cross-cut – use Method A, “X-cut Tape Test” – Permacell, 3M 250 tape, (or equivalent) shall be used for testing purposes.

Flat surfaces – where possible, use Method B, “Cross-cut Tape Test,” – Permacell, 3M 250 tape (or equivalent) shall be used for testing purposes.

##### Pass Criteria:

4A minimum, (trace peeling or removal along incisions or intersection), for all coating technologies when using method A, (X-cut).

4B minimum, (less than 5% of the area removed), for all coating technologies when using method B, (cross-hatch).

CLASSIFICATION	PERCENT AREA REMOVED	SURFACE OF CROSS-CUT AREA FROM WHICH FLAKING HAS OCCURRED FOR SIX PARALLEL CUTS AND ADHESION RANGE BY PERCENT	CLASSIFICATION	PERCENT AREA REMOVED	SURFACE OF CROSS-CUT AREA FROM WHICH FLAKING HAS OCCURRED FOR SIX PARALLEL CUTS AND ADHESION RANGE BY PERCENT
5A, 5B	0% None		2A	15 - 35%	
4A, 4B	Less than 5%		1A	35 - 65%	
3A	5 - 15%		0A, 0B	Greater than 65%	

#### b. Film (Pencil) Hardness (ASTM D3363)

##### Test Parameters:

Follow the test method as defined in the ASTM D3363 standard. Calibrated pencils that meet the hardness scale in section 5.1 of the ASTM D3363 standard are required.

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Piece part test location for hardness test shall be determined by the piece part drawing. If the specific test location is not called out, test will be performed in the same area as color and gloss measurements.

Pencil preparation / use:



Begin testing with the hardest lead in an environment controlled to  $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , 50%  $\pm 5\%$  relative humidity on a flat, firm, horizontal surface with the pencil positioned at a  $45^{\circ}$  angle to the surface. Repeat the process of selecting and testing with progressively softer leads until a lead is identified which fails to scratch the surface. Record the coating hardness as the hardest lead that will **not** scratch the surface. Repeat 3 times to confirm the accuracy of your conclusion.

$6B-5B-4B-3B-2B-B-HB-F-H-2H-3H-4H-5H-6H$   
 Softer Harder

### Pass Criteria:

Checks shall be made by close visual inspection and fingernail feel. There shall be no visible cuts or scratches per ASTM D3363 when viewed under cool white fluorescent light of 80 to 120 foot-candles at a distance of 18 inches, (460 mm). Inspectors should hold the part 30 degrees from the horizontal plane and rotate the part 30 degrees to the left and right along the vertical axis. Pencil hardness is indicated by the hardest pencil that will leave the film uncut and unscratched. Any defacement of the surface other than a cut (gouge) is considered a scratch. In some cases pencil lead transfer to the surface may be misinterpreted as a scratch. Verify that scratches are indeed scratches by removing any residual pencil lead marks with dry or moist cloth before making the scratch determination.

1. 2K low bake	H or harder
2. 1K high bake	2H or harder
3. Powdercoat	2H or harder
4. UV	H or harder
5. 1K low bake	HB or harder
6. Soft Touch	F or harder
7. IMR	HB or harder

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8. Thermal Ink Transfer	H or harder
9. Plated Finish	H or harder
10. Conductive Coatings	H or harder
11. NCVM	H or harder
12. ED	H or harder
13. Carbon Fiber Composite	H or harder

c. **Cure (Solvent Resistance) (ASTM D4752)**

**Test Parameters:**

1. 2K low bake	50 double rubs MEK (100%)
2. 1K high bake	50 double rubs MEK (100%)
3. Powdercoat	50 double rubs MEK (100%)
4. UV	50 double rubs MEK (100%)
5. 1K low bake	50 double rubs IPA (70%)
6. Soft Touch	50 double rubs MEK (100%)
7. IMR	50 double rubs MEK (100%)
8. Thermal Ink Transfer	50 double rubs MEK (100%)
9. Plated Finish	50 double rubs MEK (100%)
10. Conductive Coatings	50 double rubs MEK (100%)
11. Silk Screen / Pad Print	50 double rubs IPA (70%)
12. NCVM	50 double rubs MEK (100%)
13. ED	50 double rubs MEK (100%)
14. Carbon Fiber Composite	50 double rubs MEK (100%)

IPA – Isopropyl Alcohol - CAS # 67-63-0

MEK – Methyl Ethyl Ketone - CAS # 78-93-3

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Resistance Rating	Description
5	No effect on surface; no color on cloth after 50 double rubs.
4	Burnished appearance in rubbed area; slight amount of color on cloth after 50 double rubs.
3	Some marring and apparent depression of the film after 50 double rubs.
2	Heavy marring; obvious depression in film after 50 double rubs.
1	Heavy depression in the film but no actual penetration to the substrate after 50 double rubs.
0	Penetration to the substrate after 50 double rubs or less.

## d. Norman Abrasion (ASTM F2357)

### Test Parameters:

Equipment: Norman Tool or RCA abramer

Subject the test specimen to abrasion with 175g weight .

1. 2K low bake 60 cycles
2. 1K high bake 50 cycles
3. Powdercoat 150 cycles
4. UV 150 cycles
5. IMR 50 cycles
6. Thermal Ink Transfer 50 cycles
7. Plated Finish 50 cycles
8. Conductive Coatings 50 cycles
9. Silk Screen / Pad Print 50 cycles
10. NCVI 150 cycles
11. ED 50 cycles
12. Carbon Fiber Composite 50 cycles
13. Anodized 150 cycles

### Pass Criteria:

No visual wear through the primary paint layer to either the substrate or a different color coating layer after the specified number of cycles listed below are completed.

## e. Compacted wool felt test

Keypac finish (e.g. gloss) shall be determined on a product by product basis and stay within drawing tolerance for 100,000 cycles.

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Item	Requirement
Test Wheel	Felt, Taber CS-5
Load	200g
Stroke	36 mm
Frequency	3 cycles/second
Number of cycles	100,000

## 5.2.4 Boiling Test

Poured pure water into waterbath, and set up the constant temperature to 60°C. When temperature rise to the constant (60±3°C), put the object into waterbath and boil for 2 hours, object must be immersed in water during the test. Placed the object which surface has been wiped down for 30 min.

Test Equipment: Waterbath

Specification

Externals must be regular, whitening, bubble and others are unacceptable.

## 5.3 Vibration Test

All tests below must be performed in each of the following planes:

- Top side to bottom side;
- Left side to right side; and
- Front side to back side.

The fixture should be as rigid as possible so as not to distort the vibration imparted to the keyboard. Securely fasten the fixture and keyboard to the vibration table so that it will not leave the surface of the table during testing.

### Measuring Method:

#### 1. Random Non-Operational Vibration

The keyboard shall be able to withstand vibration of 2.1 GRMS, (truck/air) spectrum for duration of 30 minutes per side.

#### 2. Sinusoidal Non-Operational Vibration

The keyboard shall be able to withstand vibration of 0.5 GRMS from 5-500 Hz at a sweep rate of 0.5 octaves per minute. The total dwell time at each major resonance shall be 15 minutes.

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## Judgment:

Meet the KB module requirements and no keycaps failing out/all key switches function OK.

## 5.4 Drop Test

### (1) Drop Test – Packaged

All keyboards in the bulk and individual shipping package shall be able to withstand being dropped on 3 edges and six sides. No key caps shall dislodge and there will be no deformation in the keyboard structure. The keyboard shall be operational and the mechanism will continue to function in a smooth and fluid motion. The drop height is determined according to the table below:

#### Measuring Method:

- Condition: Package, non-operating.

*Package Drop Height (Dell Specification)*

Mass of Packaged Container		Drop Height	
(lbs)	(kg)	(inch)	(cm)
0 - 10	0 - 4.5	42	106
11 - 24	4.6 - 11.0	36	91
25 - 45	11.1 - 20.5	30	76
46 - 75	20.6 - 34.0	24	61
76 - 100	34.1 - 45.5	18	46

- Ten drops: **1 corner, 3 edges and 6 surfaces, as follows:**

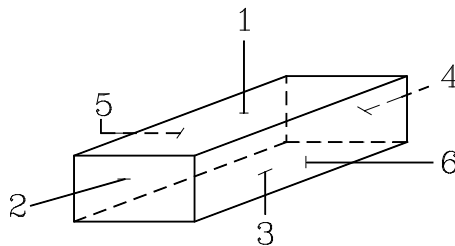
- A corner drop with the weakest corner of product determined by the concern mechanical engineer.
- An edge drop with impact on the shortest edge radiating from the corner.
- An edge drop with impact on the next shortest edge radiating from the corner.
- An edge drop with impact on the longest edge radiating from the corner.
- A flat drop with impact on the rear side.
- A flat drop with impact on the front side.
- A flat drop with impact on the right side.
- A flat drop with impact on the left side.
- A flat drop with impact on the bottom side.

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j. A flat drop with impact on the top.

### Judgment:

Meet the requirement of no keycaps falling out & all key switches are OK in function.



### (2) Drop Test – Unpackaged

All unpacked keyboards shall be fully operational and without mechanical degradation after being dropped from the heights below. No key caps or scissors shall dislodge during the test.

### Measuring Method:

Drop Surface	Height, mm	Drop Orientation
Wood Desk	300	Corner
Wood Desk	400	Edges
1/4" Industry carpet surface over steel or concrete floor	600	Surface

### Judgment:

All unpacked keyboards shall be fully operational and without mechanical degradation after being dropped from the heights below. No key caps or scissors shall dislodge during the test.

## 5.5 Shock and Simple Shock Tests

### 5.5.1 Shock test

#### (1) Shock test – half sine wave

System Test: Shock level of 80 inches per second at 2 millisecond half sine.

Keyboard Only Test: Shock level of 400 G's at 2 millisecond half sine (performed by keyboard manufacturer)

**Judgment:** The structure would remain in condition without loose keycaps and deformation of module



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### (2) Shock test – square wave

Keyboard Only Test: The keyboard shall withstand not less than a 60 G faired square wave with velocity at 5080 mm/sec (200 in/s).

**Judgment:** The structure would remain in condition without loose keycaps and deformation of module.

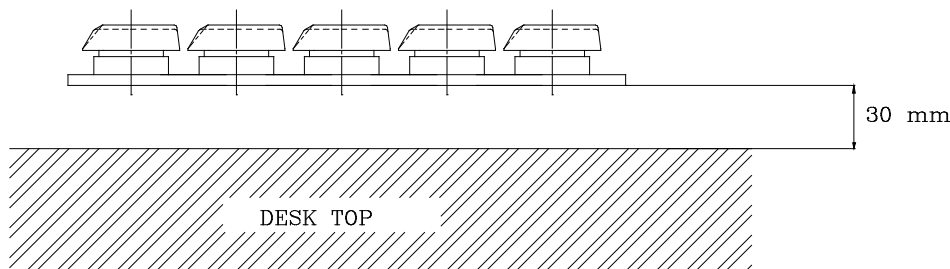
### 5.5.2 Simple Shock Test

#### (1) Measuring Method 1: Operating, non-packaged.

Drop from 3cm high from the desktop as shown. (Total 4 side each side 3 times)

Judgment: Without any wrong output from monitor screen except the characters of 1.5x, 2x, and 2x above keys.

SIMPLE SHOCK (OPERATING)

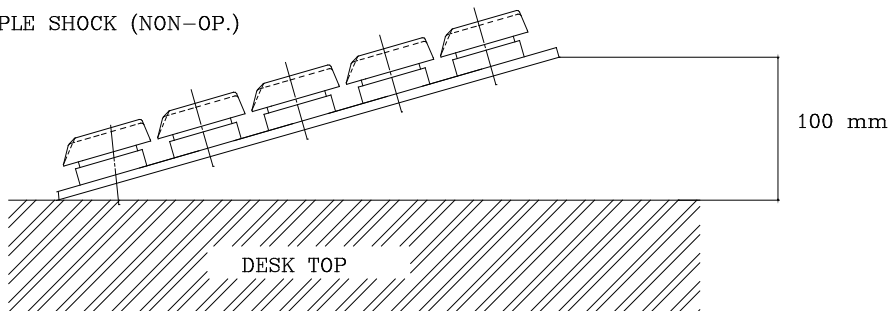


#### (2) Measuring Method 2: Non-operating, non-packaged.

.Randomly drop the non-packaging keyboard (face us as shown) from 10cm high to the desk for 3 times.

Judgment: The structure would remain in condition without loose keycaps and deformation of module.

SIMPLE SHOCK (NON-OP.)



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## 5.6 Water Spill test

Equipment required for test: **Kept at room temperature, Water, Small containers**

Use a syringe or small container to pour 20cc (20 mL, about 2/3 fluid ounce) of water on three evenly spaced spots on the keyboard: **A and S**, **G and H**, **L and ;**. The total liquid will be 60cc (60mL, about 2.03 fluid ounces). The spill locations are between the following keys. Wait **60** minutes then remove the liquid from the keyboard, taking care to limit the motions to only one axis ,type on all keys to verify functionality.

## 5.7 Coke Spill test

Equipment required for test: **Kept at room temperature, Diet Coke™, Small containers**

Use a syringe or small container to pour 20cc (20 mL, about 2/3 fluid ounce) of Diet Coke™ on three evenly spaced spots on the keyboard: **A and S**, **G and H**, **L and ;**. The total liquid will be 60cc (60mL, about 2.03 fluid ounces). The spill locations are between the following keys.

Immediately tilt the keyboard towards its left side in an attempt to remove the liquid from the system, taking care to limit the motions to only one axis

Wipe down surfaces of system with paper towels for exactly **45 seconds** to remove as much visible moisture as possible. Wait **60** minutes type on all keys to verify functionality.

## 5.8 UV Stability

The keyboard UV stability shall be in compliance with ASTM D4674 - 89. The test is applied to the color of the key caps and legend. After the test, the materials used in the keyboard, shall not exhibit significant cosmetic defects such as fading, flaking, crazing, or color change with  $\Delta E$  of 1.0 or above. The mechanical properties of the materials shall not be degraded to an extent which causes the system to fail any of the life, shock or vibration tests.

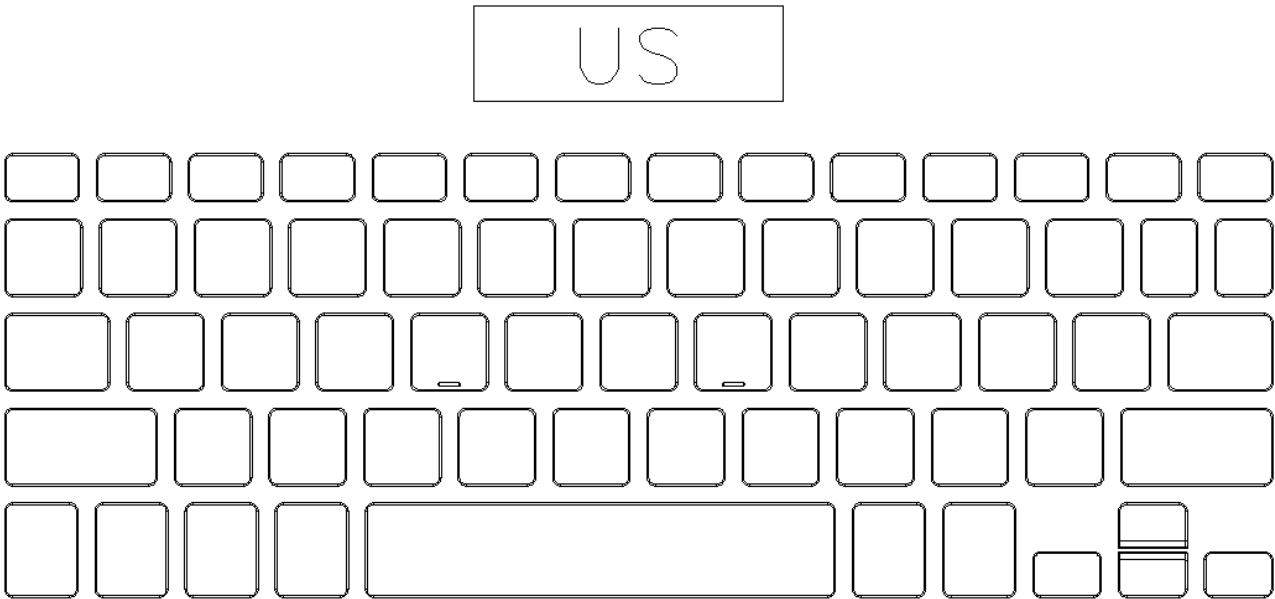
## 5.9 Hot plate test

The Keyboard must put on temperature 80°C hot plate, It need to endure 24 hour test, If the keyboard function OK this test is pass, else is fail.

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6. Keyboard Layout

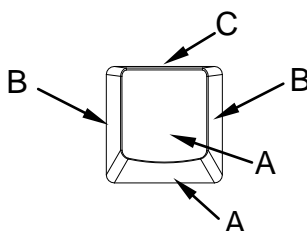
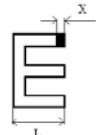
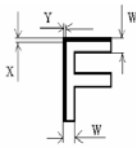
6.1 U10B Layout Drawing



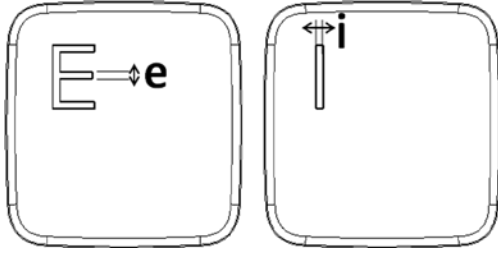

U10B US Layout

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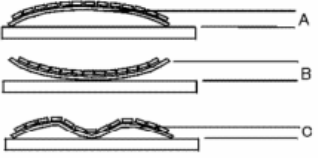
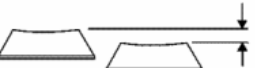


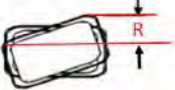
### Appendix A (Appearance Spec)

Item	Normal	Backlit	IMR
Definition of Keycap surface A, B, C			
Viewing angle, distance and lighting requirement for inspection	300mm, 45°(from horizontal), 800Lux ~ 1200Lux		
Discolored spots(異色點)	Surface A: <0.1mm <sup>2</sup> Surface B, C: <0.2mm <sup>2</sup>		
Scratch for Keycap	Sensed scratch: surface A, B, C <0.1mm <sup>2</sup> Senseless scratch and tiny scratch found by special angle view: less than 5.0mm length		
Flash for Keycap	Surface A, B: ≤0.08mm Surface C: ≤0.1mm	≤0.2mm	
Shrink for Keycap	Non-uniform texture: No detect is acceptable by 30mm normal visual review or by golden sample. Mark and shrink: The shadow that Keycap structure located is acceptable but the area of shrink or ejection gate mark must be smaller than 0.3mm <sup>2</sup> .		
Appearance of legend printing	Broken printing(印刷斷字) ≤1/3 width		
	 Line cut(印刷缺損) <1/8L, as following:		
	 Width of line(字體粗細) ≤0.3W, as following:		
	Legend shift(字體偏移) ≤0.3mm		
	Sawtooth type printing(鋸齒狀字體) ≤0.08mm		
	Printing pin hole(印刷空點) ≤0.05mm <sup>2</sup>		

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	Coating heap(堆疊) $\leq 0.1\text{mm}^2$
Appearance of laser etching legend	 <p>"e" &amp; "i" width tolerance is <math>\pm 0.05\text{mm}</math></p>
Folding mark of MEM tail	<p>No function issue, mark can't be through MEM tail width and broken surface can't be acceptable.</p> <p>The amount of "LINE" type folding mark is not more than two and the gap between them is larger than 10mm.</p> <p>The amount of "SPOT" type folding mark is not more than four.</p>
Arch for RUB Mylar	<p>Folding edge of metal plate: Arched height of RUB Mylar must be lower than folding edge of metal plate with normal function.</p> <p>No folding edge of metal plate: Arched height of RUB Mylar must be lower than 1/2 height between Keycap and metal plate(Z height).</p>
Scratch for RUB Mylar	<p>Scratch with raw material: <math>\leq 0.2\text{mm}^2</math></p> <p>Sensed scratch without raw material: Width <math>\leq 0.1\text{mm}</math>, Length <math>\leq 3\text{mm}</math></p> <p>Senseless scratch: Width <math>\leq 0.2\text{mm}</math>, Length <math>\leq 10\text{mm}</math></p>
Folding mark of RUB Mylar or PET	<p>Folding mark direction by X-direction: It is acceptable to be less than 3 marks for whole keyboard but can't be found on adjacent locations and the distance must be larger than 100mm between 2 marks; The following picture is NG sample.</p>  <p>Folding mark direction by Y-direction: Length <math>&lt; 5\text{mm}</math>, less than 3 marks for whole keyboard.</p>
Appearance of AL Foil	<ol style="list-style-type: none"> <li>1. Break can't be acceptable.</li> <li>2. Folding mark length <math>&lt; 1/3</math> long length of Foil and not more than 3 marks within each 50mm.</li> <li>3. Senseless scratch and finger marks can be acceptable.</li> </ol>
Paint appearance of metal plate edge	Paint loss area $\leq 0.2\text{mm}^2$
Specification of Keycap color comparison	$\Delta E < 1.0$ , $\Delta L$ , a, b $< 0.4$

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Keyboard warp	<p>No warp spec: <math>0 \pm 1.5\text{mm}</math>  Warp spec:  Short side: <math>0\text{mm} &lt; A &lt; 0\text{mm}; 0.5\text{mm} &lt; B &lt; 2\text{mm}; 0\text{mm} &lt; C &lt; 0.5\text{mm}</math>  Long side: <math>0\text{mm} &lt; A &lt; 0\text{mm}; 0\text{mm} &lt; B &lt; 2\text{mm}; 0\text{mm} &lt; C &lt; 0.5\text{mm}</math></p> 
Gap between keys	<p>Gap G between keys: <math>G \pm 0.4\text{mm}</math>  Gap G between keys and frame: <math>G \pm 0.3\text{mm}</math></p>
Keycap height alignment	<p>Less than 0.4mm between neighboring keys by surface A.</p> 
Keycap alignment in the row	<p>Less than 0.4mm between neighboring keys.</p> 
Keycap slant	<p>Less than 0.3mm</p> 
Keycap twist	<p>Less than 0.3mm for Normal Key; 0.2mm for FUN key.</p> 

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## FCC Statement :

### Federal Communications Commission (FCC) Statement

15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**This device complies with Part 15 of the FCC Rules.**

**Operation is subject to the following two conditions:**

- 1) this device may not cause harmful interference and
- 2) this device must accept any interference received, including interference that may cause undesired operation of the device.

**FCC RF Radiation Exposure Statement:**

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This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

## Industry Canada (IC) Statement

### Canada, Industry Canada (IC)

This Class B digital apparatus complies with Canadian ICES-003 and RSS-210.

This device complies with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

### Canada, avis d'Industry Canada (IC)

Cet appareil numérique de classe B est conforme aux normes canadiennes ICES-003 et RSS-210.

Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne doit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

### Informations concernant l'exposition aux fréquences radio (RF)

La puissance de sortie émise par l'appareil de sans fil **Darfon Electronics Corp.** est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Utilisez l'appareil de sans fil **Darfon Electronics Corp.** de façon à minimiser les contacts humains lors du fonctionnement normal.



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cULus Caution

## CAUTION

**RISK OF EXPLOSION IF BATTERY IS REPLACED  
BY AN INCORRECT TYPE.  
DISPOSE OF USED BATTERIES ACCORDING  
TO THE INSTRUCTIONS**

## ATTENTION

**IL Y A RISQUE D'EXPLOSION SI LA BATTERIE EST REMPLACÉE  
PAR UNE BATTERIE DE TYPE INCORRECT.  
METTRE AU REBUT LES BATTERIES USAGÉES  
CONFORMÉMENT AUX INSTRUCTIONS**