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SIMPLIFY SCREW FIXED DESIGN FOR THIN/LIGHT/NARROW DOWN OF PRODUCT

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Simplify screw fixed design for thin/light/narrow down of product

Abstract

This idea is by using bonding the AL plate with rivet by soldering to replace its original plastic frame or CNC metal to make stud, traditional structure design needs to add plastic frame and insert nut then bonding on AL cover. Simplify screw fixed design and space but keep same structure strength. It's very useful for thin/light/narrow down produce dimension. This design had verified on hinge and click pad fixed of NB produce.

Background

Due to NB design smaller and lighter, some structure feature will impact dimension narrow down. Especially Y dimension limited on hinge and click pad fixed structure design during NB develop phase. Why we always need to insert nut to the plastic frame and bonding on Cover or CNC metal stud to fixed hinge or click pad? These solutions need to consider material strength, tooling design limitation and CNC process cost. The idea presented in this disclosure is to reduce structure space and saving cost by new technology.

Most of the current designs have three types. 1. Space limited. Insert nut on the plastic frame then bonding on AL Cover. This solution needs plastic frame, glue and nut. 2. Cost limited. Expensive solution is use CNC process on metal to make stud structure. Although don't need plastic frame but CNC process is expensive. 3. ID limited. Fully plastic cover and stud. This solution doesn't need to be bonding but need to insert nut and consider tooling design limit (Distance between stud) and can't have metal cover surface.

Invention Description

This idea is by using bonding the AL plate with rivet by soldering to replace its original plastic frame or CNC metal to make stud. There are 24% ~ 40% space saving for soldering rivet. Refer to Fig. 1 Prior and new solution comparing. This solution is use normal screw rivet to be riveting on AL plate then soldering on the core side of the cover. It's very simply and useful solution. But what kind of material, thickness and quantity of the soldering can meet test condition is very important. We try to verify different base diameter (BD), thickness (T), quantity(Q) and diameter of the solder (SD) to meet pull test >20 kgf test condition (Same with NB design spec). Finally, we found out optimization soldering parameter and rivet dimension. as Fig. 2 Optimization soldering parameter and rivet dimension. We also verified on current NB product. as Fig. 3 Verify on NB product. The most important is that this is process will not cause cavity surface bring mark. We found best value are BD=8mm, Q=10, T=0.4mm and SD=1.5mm can meet >20 kgf spec and no any bring mark on cavity side of the surface and it can PASS 25000 cycles hinge life test. as Fig. 4 Best soldering parameter.

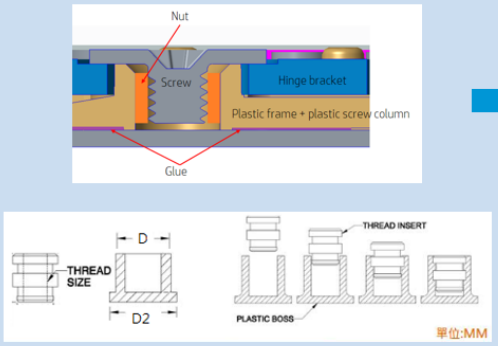
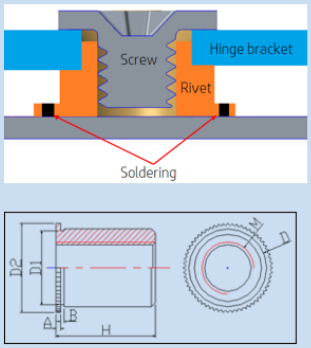
	Heat melt nut	Soldering rivet	Space Saving
			
D (M2.0)	M(2.0) + 3.25 = 5.25mm	M(2.0) + 2 = 4.0mm	5.25 – 4.0 = 1.25mm (-24%)
D2 (M2.0)	D + bonding (3+3) = 11.25mm	D + Soldering (3) = 7.0mm	11.25 – 7.0 = 4.25mm (-38%)
D (M2.5)	M(2.5) + 3.95 = 6.45mm	M(2.5) + 2 = 4.5mm	6.45 – 4.5 = 1.95mm (-30%)
D2 (M2.5)	D + bonding (3+3) = 12.45mm	D + Soldering (3) = 7.5mm	12.45 – 7.5 = 4.95mm (-40%)

Fig. 1 Prior and new solution comparing

Welding Equipment						
	Model	LWF70Z	Collimation	75	Lens	160
Continuous Welding Process Parameters						
Plate/Finished product welding (No guarantee of appearance)	Power(%)	75-85	Speed(mm/s)	80-110	Focus position	Positive focus
	Frequency(KHz)	800-999	Pulse width(ns)	100-200	Spiral size(mm)	0.8
Finished product welding (Appearance guaranteed)	Power(%)	45-60	Speed(mm/s)	120-180	Focus position	Positive focus
	Frequency(KHz)	800-999	Pulse width(ns)	70-140	Spiral size(mm)	0.8

Base Diameter (BD)	Material	Quantity (Q)	Thickness (T)	Solder Diameter (SD)	Pull Force	SPEC > 20 kgf
ϕ8	AL	10	0.4	0.8	7.4	Fail
		10	0.4	1.5	20	PASS
		10	0.5	1.5	25	PASS
ϕ10	AL	12	0.4	0.8	7.5	N/A
		12	0.4	1.5	N/A	
		12	0.5	1.5		
ϕ12	AL	12	0.4	0.8	7.5	N/A
		12	0.4	1.5	N/A	
		12	0.5	1.5		

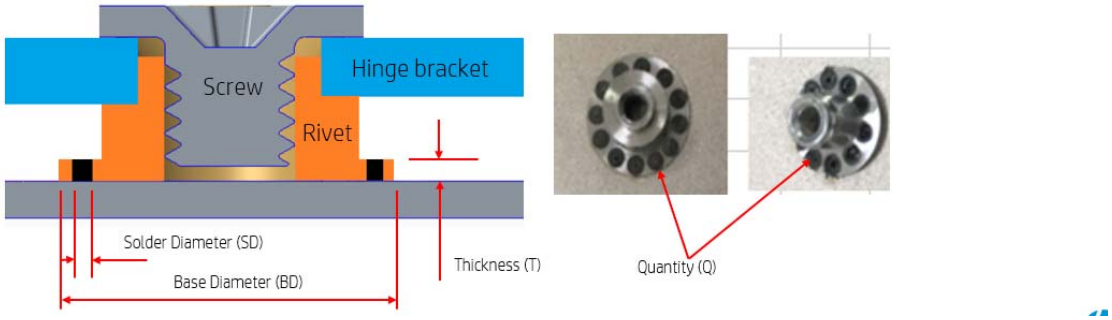


Fig. 2 Optimization soldering parameter and rivet dimension

Soldering on display (Left)

Soldering on display (Right)

Assembly hinge on the rivet

Fig. 3 shows: Verify on NB product.

Base Diameter (BD)	Material	Quantity (Q)	Thickness (T)	Solder Dimension (SD)	Pull Force	SPEC > 20 kgf
ϕ8	AL 5052 (0.8mm)	10	0.4	1.5	20	PASS

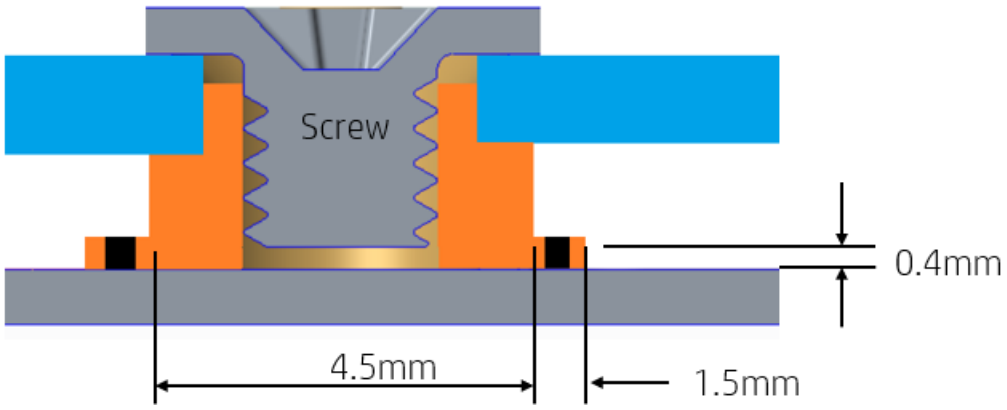


Fig. 4 Best soldering parameter

Advantages

- Saving 24% ~ 40% space for each stud. Plastic stud diameter is 6.45mm, solder rivet diameter is 4.5mm. solder rivet can save 30% space than plastic stud for each. Soldering process can save 40% space than glue bonding.
- For metal cover cosmetic, rivet can solder on cover direct but plastic stud need to insert nut and bonding on cover. Solder rivet only keep the surrounding area 1.5mm. but plastic stud needs to consider bonding glue pull force, it should be over then 3mm.
- Cost saving. For solder rivet, it doesn't need plastic and glue, only laser solder to fixed rivet, we can save plastic frame and glue cost. It also can reduce CNC stud cycle time for the cover of CNC process.
- High flexibility and unique. By using bonding the AL plate with rivet by soldering can easy change screw stud location. It can help small quantity and unique of products to saving plastic tooling cost and CNC process cycle time.

Disclosed by Danny Ding/ Joe Lin, HP Inc.