No. DO2021-00204E-H01

Change of Assembly material

TOSHIBA

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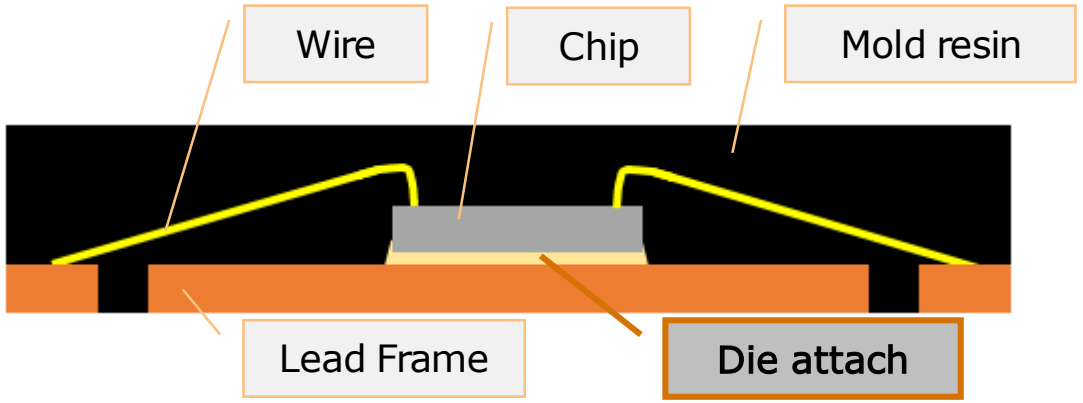
01

Change Overview

1 Change Overview

■Background/reason

Due to the discontinuation of production , We will change the die attach material of the assembly material. The die attach material to be change is from the same manufacturer , and we have a track record of mass production.
We ask for approval by January 2023.
In addition , since the IC standard does not change , it can be use in the same way as conventional products.



Package cross section schematic

02

Change Point

2 Change Point 5M1E

	5M1E	Change point	Presence or absence of change	Remark
⊖	Man	—	No	
⊖	Machine	—	No	
⊛	Material	Die attach (A→B)	Yes	A and B are the same manufacturer and have a track record of mass production.
④	Method	Connection conditions for new Die attach	Yes	
⑤	Measurement	—	No	
⑥	Environment	—	No	

2 Change Point　Detailed　description

■About material Die attach

		Type	Maker	Principal component
A	Current	Epoxy silver paste	S	・Silver (filler) ・Modified epoxy resin (Main agent) ・Other (Hardener , etc)
B	New	Acrylic silver paste	S	・Silver (filler) ・Acrylic resin (Main agent) ・Other (Hardener , etc)

■Products

Please refer to the attached sheet.

03

Risk Analysis

3 Risk Analysis DRBFM

No	Parts / Process	Change Point	Function	Failure Mode	Failure Cause	Effect of Failure	Item to be feflected on evaluation	Countermeasure Rusult
1	Dice Bond	・Paste Material ・from Epoxy silver paste to Acrylic silver paste	・Stick Chip to Lead frame ・Transfer the heat generated from Chip to Die pad	Insufficient wetness of Paste	The discharge rate is small because the manufacturing conditions do not match the material characteristics.	Performance degradation	Paste wettability	page 10 onwards please refer
				Large amount of Paste creeps up	Large discharge rate because the manufacturing conditions do not match the material characteristics.	Malfunction	Paste craw up	
				The Paste thickness is thin	The discharge rate is small because the manufacturing conditions do not match the material characteristics.	・Yield decline ・performance degradation	Paste thickness	
				Thick Paste	Large discharge rate because the manufacturing conditions do not match the material characteristics.	Yield decline	Paste thickness	
				Chip decrease in adhesive strength	Insufficient wetness of Paste	Yield decline	Die share strength	
					The Paste thickness is thin	Decreased reliability	Reliability test (Temperature Cycling)	
				Delamination on the back side of Chip	Since the amount of Paste material discharged is small , the adhesive strength between Chip and Lead frame's die pad decreases , and delamination occurs due to thermal stress etc.	Decreased reliability	Reliability test (Temperature Cycling)	
					Due to material properties , the stress when heat is applied increases and delamination occurs.	Decreased reliability	Reliability test (Temperature Cycling)	
					Moisure in the package avaporates due to the heat during reflow , and delamination occurs at that pressure.	Decreased reliability	Reliability test (MRT)	
				Decrease in wire bond strength	Material properties spoil US/load	Malfunction	Wire bond strength	
				Reduced heat dissipation	Decrease in the thermal conductivity	Product malfunction	Thermal resistance Transient heat transfer	

3 Risk Analysis　Extraction of evaluation items

Item			Condition	Criteria
Assembly performance	Die attach	Paste wettability	—	Process capability >1.33
		Paste crawl up	—	Process capability >1.33
		Paste thickness	—	Process capability >1.33
		Die share strength	—	Process capability >1.33
	Wire bond	Wire bond share strength	—	Process capability >1.33
		Wire bond pull strength	—	Process capability >1.33
Reliability test	MRT (Pre Condition)		Bake(125℃/24h)+Moisture Soak(30℃/60%/192h) Reflow260℃3times	No Delamination
	Temperature Cycling		Pre Condition + -65~150℃　300cyc	No electrical characteristics failure
Thermal resistance /Transient heat transfer			sim.	No significant different between before and after change

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Evaluation Result

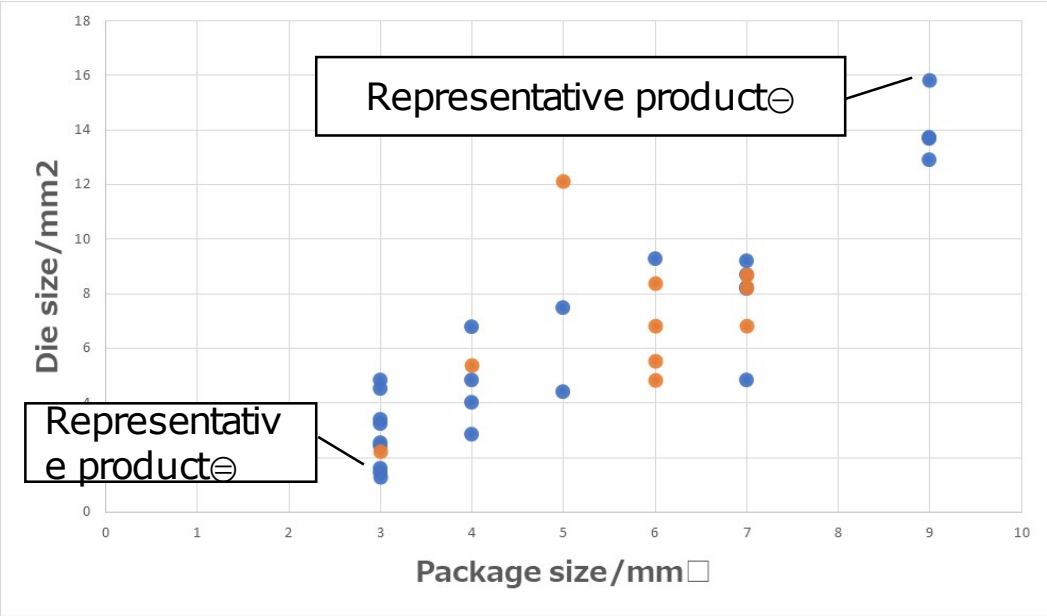
4 Evaluation result

■Concept of evaluation representative product

●Die attachability , Reliability test

Representative product⊖ : Die size / Package size maximum

Representative product⊜ : Die size / Package size minimum



● =Although it is a different product ,

it is a package that uses a new die attach material.

●Wire bondability

Representative product ⊛ : Wire type ~ Gold (minimum diameter)

Representative product ④ : Wire type ~ Copper (maximum diameter)

4 Evaluation result

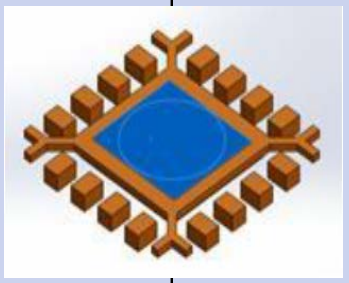
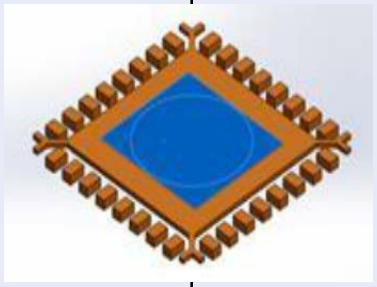
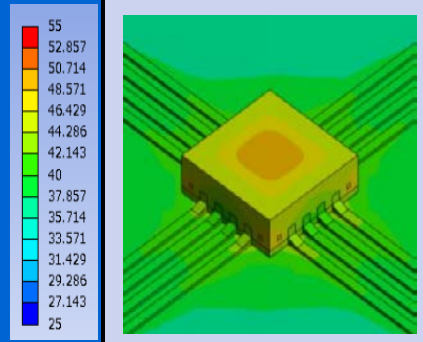
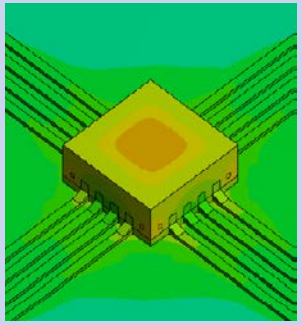
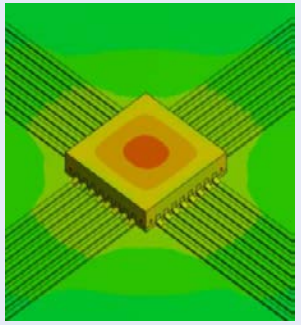
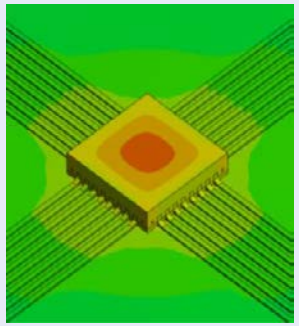
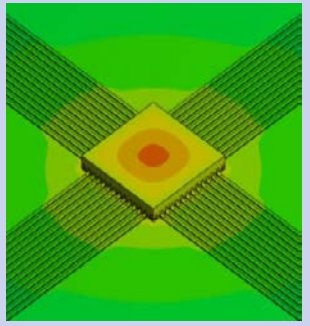
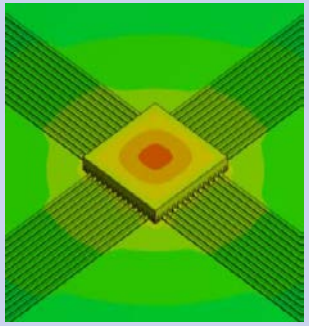
Item			Criteria	Result(sample size)
Assembly performance	Die attach	Paste wettability	Process capability >1.33	Product㊀ : All100%(n=6pcs) Product㊁ : All100%(n=17pcs)
		Paste crawl up	Process capability >1.33	Product㊀ : Process capability =2.21(n=6pcs) Product㊁ : Process capability =3.04(n=17pcs)
		Paste thickness	Process capability >1.33	Product㊀ : Process capability =2.21(n=6pcs) Product㊁ : Process capability =3.04(n=17pcs)
		Die share strength	Process capability >1.33	Product㊀ : Process capability =8.05(n=6pcs) Product㊁ : Process capability =3.83(n=17pcs)
	Wire bond	Wire bond share strength	Process capability >1.33	Product㊇ : Process capability =5.97(n=30wire) Product④ : Process capability =5.02(n=30wire)
		Wire bond pull strength	Process capability >1.33	Product㊇ : Process capability =2.91(n=30wire) Product④ : Process capability =2.99(n=30wire)
Reliability test	Pre Condition		No Delamination	Product㊀ : 22/22pcs OK Product㊁ : 22/22pcs OK
	Temperature Cycling		No electrical characteristics failure	Product㊀ : 22/22pcs OK Product㊁ : 22/22pcs OK

There are no defects and no problems.

4 Evaluation result

Substrate specification : □74-1.6t-4 layers FR-4 substrates
Mounting solder : Sn-3.0Ag-0.5Cu
Exposed die pad connection : Yes
Power consumption : 1.0[W]

■Thermal resistance(sim. result)

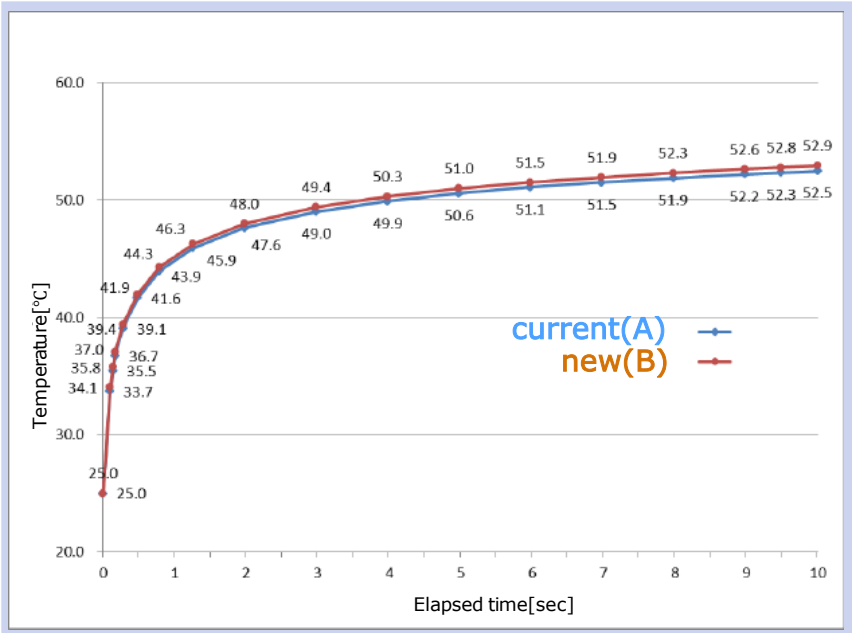
Package		WQFN16(3mm□)		WQFN32(5mm□)		WQFN48(7mm□)	
Die size		1.53 X 1.44 X 0.20		2.84 x 2.63 x 0.20		2.20 x 2.20 x 0.20	
Wet area (Model)							
Die attach material		Current(A)	New(B)	Current(A)	New(B)	Current(A)	New(B)
Fever state							
Junction temp.	: Tj [℃]	66.45	66.90	55.37	55.52	51.44	51.62
Ambient temp.	: Ta [℃]	25.00	25.00	25.00	25.00	25.00	25.00
Case surface temp.	: Tc1 [℃]	66.05	66.47	55.24	55.38	51.29	51.46
Thermal resistance	: θja [℃/W]	**41.45**	**41.90**	**30.37**	**30.52**	**26.44**	**26.62**
Thermal resistance	: θjc [℃/W]	0.40	0.43	0.13	0.14	0.15	0.16
Allowable loss	[W]	2.41	2.39	3.29	3.28	3.78	3.76

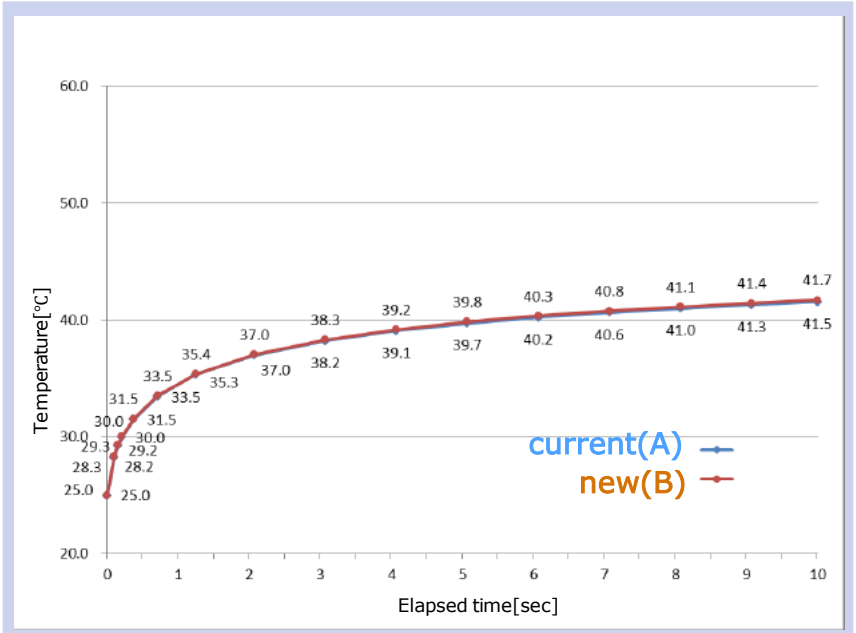
4 Evaluation result

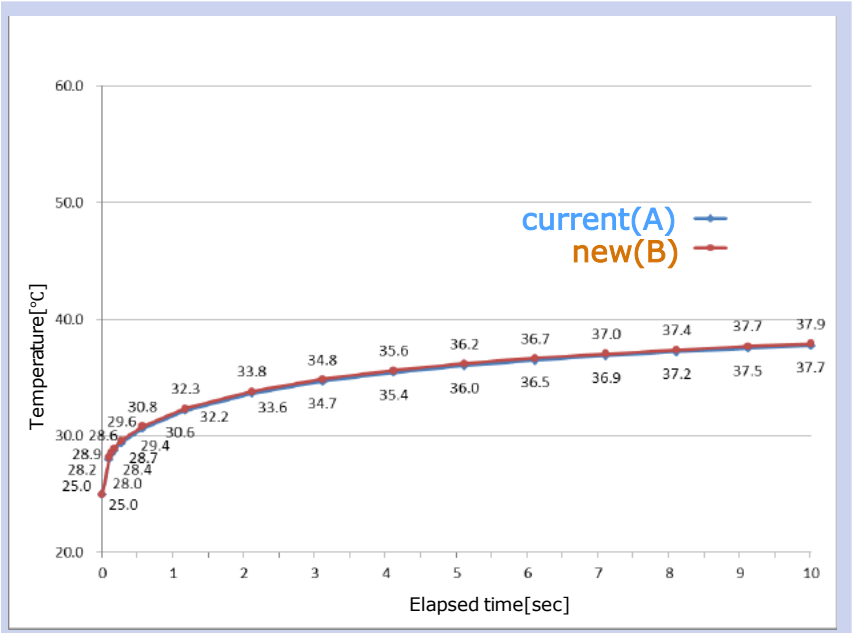
■Transient electro thermal comparison(sim. result)

Time to calculate：0~10[sec]
Measurement position：Above die
Power consumption：1.0[W]

WQFN16(3mm□)	WQFN32(5mm□)	WQFN48(7mm□)







Analysis results are equivalent regardless of package size.

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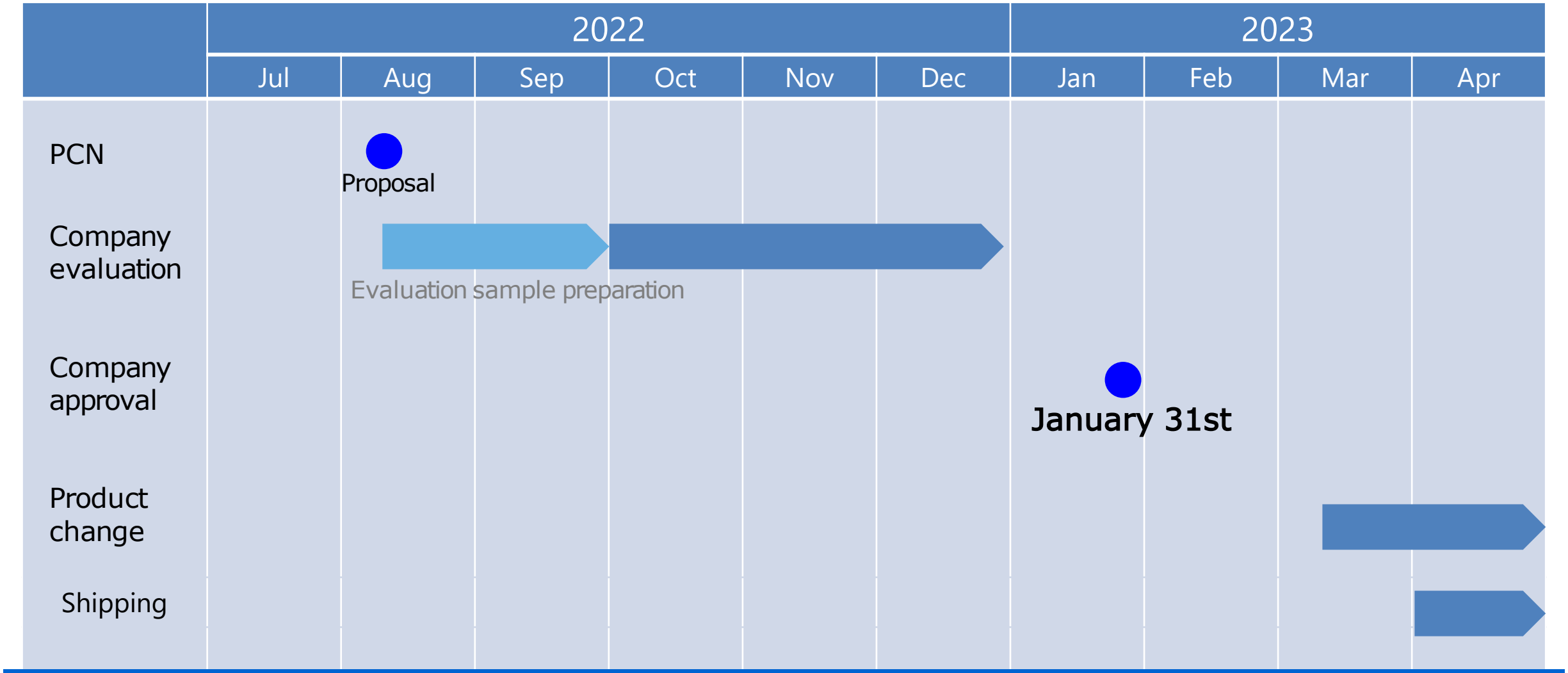
Changeover Schedule

5 Changeover schedule



Since the expiration date of the current material is until March 2023, We would appreciate by the end of January 2023.

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The END