

Surface Finishes (Characteristics and Applications) for Printed Circuit Boards

Characteristics	HASL	HASL (Lead Free)	ENIG	ENEPIG	Hard Gold	Soft Gold	Silver	OSP	White Tin
Deposit	Dipped	Dipped	Immersion	Immersion	Electrolytic	Electrolytic	Immersion	Dipped	Immersion
Process Control	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Poor/Fair	Fair
Process Cost	Low	Low	Medium	High	High	High	Medium	Low	Medium
SMT	Dome	Dome	Flat	Flat	Flat	Flat	Flat	Flat	Flat
Thin Board Finish	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thermal Cycle (times)	>2	>3	>2	>2	>2	>2	>2	~2	>2
Shelf Life	Long (1+ Years)	Long (1+ Years)	Long (1+ Years)	Long (1+ Years)	Long (1+ Years)	Long (1+ Years)	Medium (9-12 Months)*	Medium (9-12 Months)*	Medium (9-12 Months)*
Handling	Normal	Normal	Normal	Normal	Normal	Normal	Critical	Critical	Normal
Exposed copper	No	No	No	No	Yes	No	No	Yes	No
Contact Applications	No	No	Yes	Yes	Yes	Yes	No	No	No
Thickness	25 - 2000 µin	25 - 2000 µin	3 - 10 µin of Gold over 150 - 200 µin of Nickel	1 - 2 µin of Gold over 4 - 8 µin Palladium over 100 -150 µin Nickel	98% Pure, 23 Karat 30 - 50 µin over 100 - 150 µin of Nickel	99.99% Pure, 24 Karat 30 - 50 µin over 100 - 200 µin of Nickel	6 - 18 µin	8 - 24 µin	25 - 60 µin

Application	HASL	HASL (Lead Free)	ENIG	ENEPIG	Hard Gold	Soft Gold	Silver	OSP	White Tin
RoHS Compliant	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fine Pitch SMT	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BGA & µBGA	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Flip Chip	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wire Bonding	No	No	Yes (Al)	Yes	No	Yes (Au)	No	No	No
Contact/Connector	No	No	Yes	Yes	Yes	No	No	No	No
High Reliability	High	Low/Medium	High	High	Medium/High	High	Medium/High	Medium/High	Medium
Solder Joint Integrity	Excellent	Good	Good	Good	Poor	Poor	Excellent	Good	Good

*Requires Unique Storage Techniques
µin = Microinches