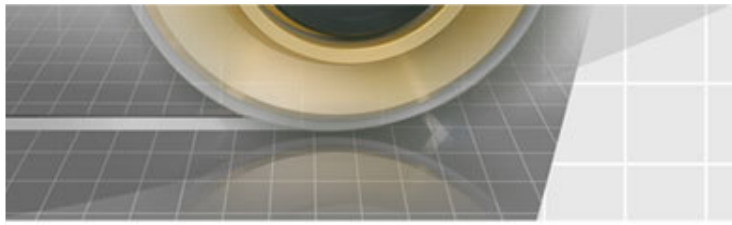


QFN SINGULATION

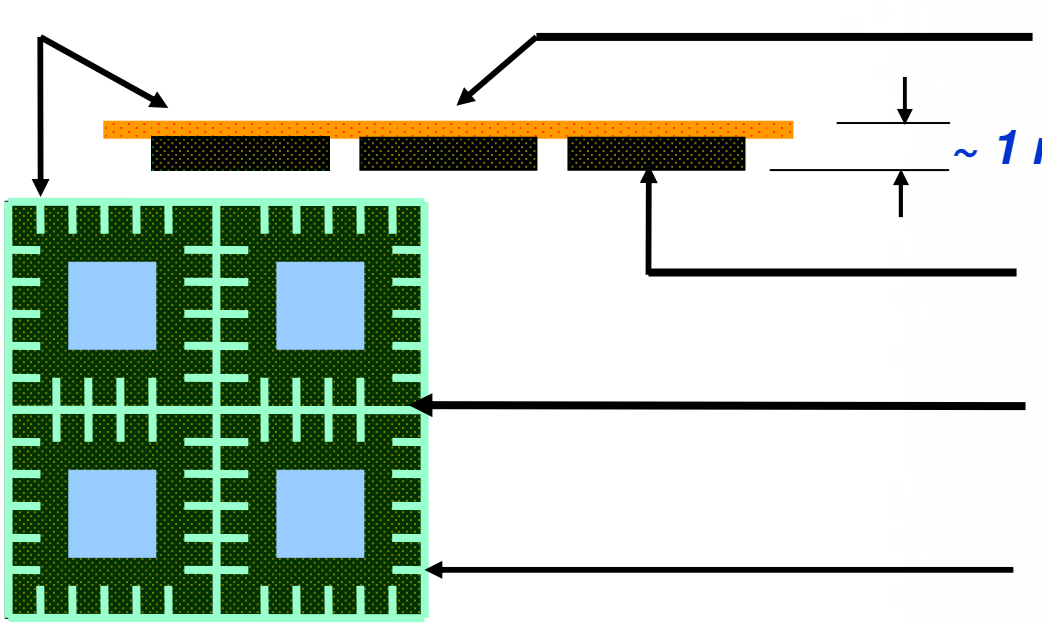
ADT = Dicing
Advanced Dicing Technologies

QFN Singulation

- **Package foundries are demanding process solutions to reduce Cost of Ownership, while maintaining product Quality**

ADT = Dicing
Advanced Dicing Technologies

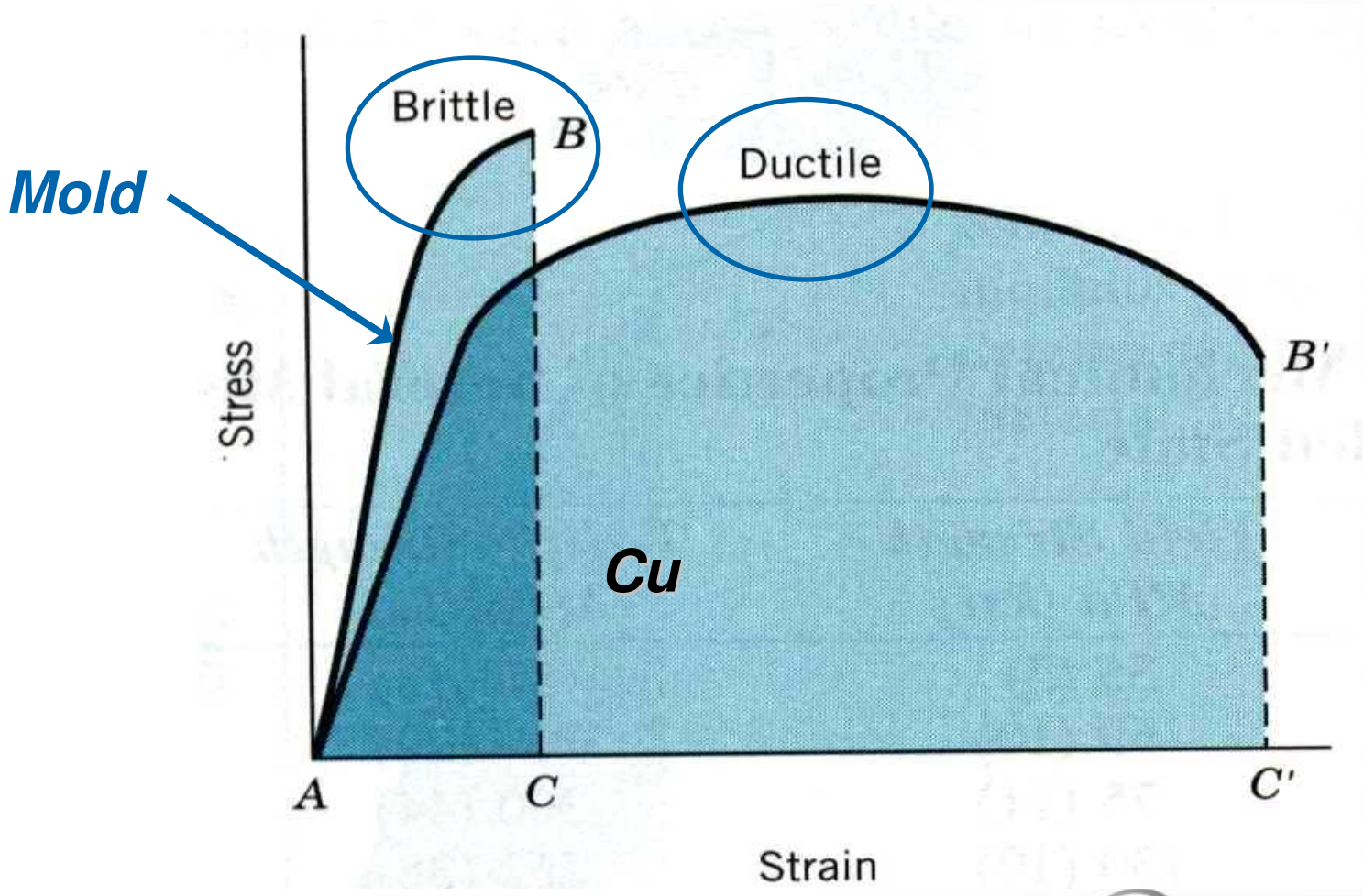
QFN Singulation



Composite Materials

ADT = Dicing
Advanced Dicing Technologies

QFN Singulation



Plastic Deformation

ADT = Dicing
Advanced Dicing Technologies

QFN Families

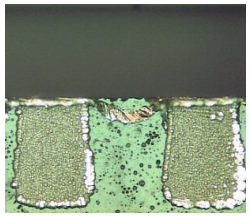
Three main family types:

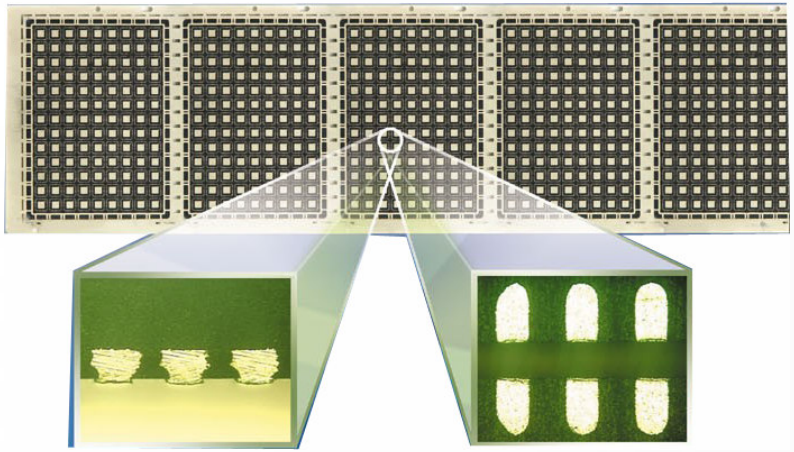
- Power - Largest thickness 1.5-2.5mm (~ 500 mic. copper lead thickness)
- Standard - HE 0.8-1.2mm (up to 200 mic. copper lead thickness)
- Thin – 0.4- 0.6mm (up to 150 mic. copper lead thickness)

Two different Types of Coating:

- Tin (Sn) – causing melting
- Ni/Pd – larger "Y" burrs

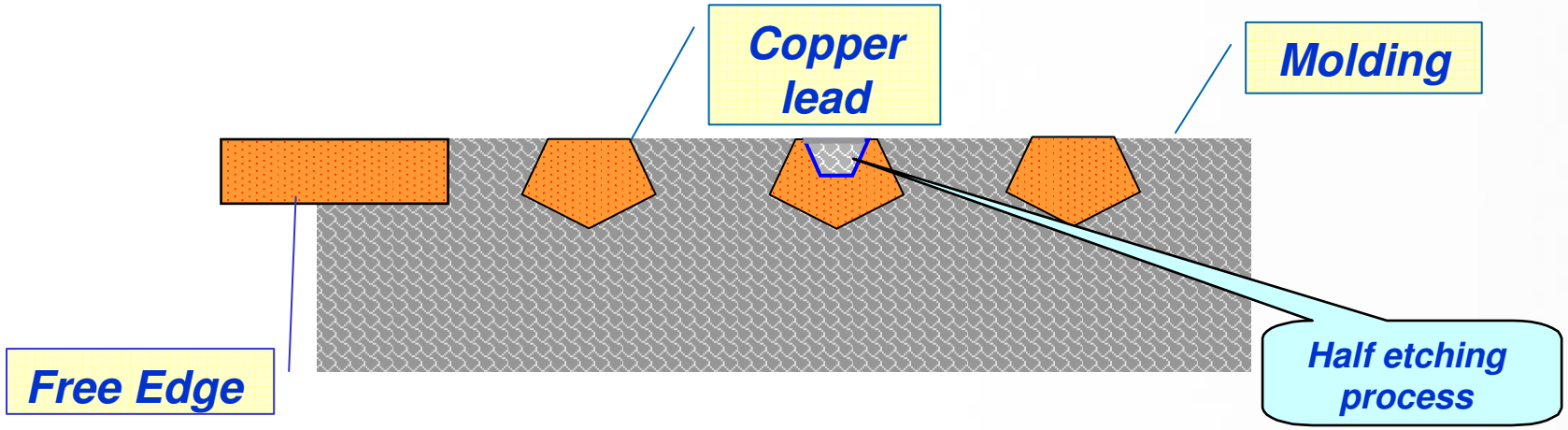
SN coating melting

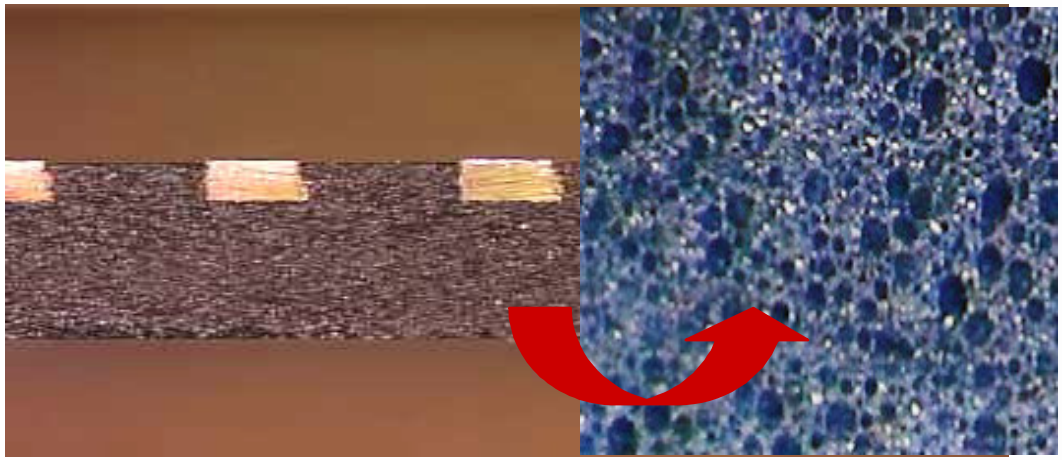




ADT = Dicing
Advanced Dicing Technologies

QFN Singulation





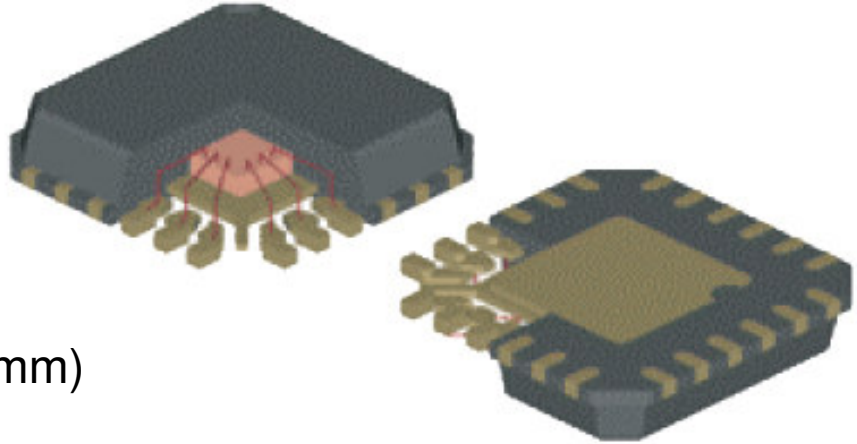
Composite material

ADT = Dicing
Advanced Dicing Technologies

QFN - Blade and Cutting Parameters

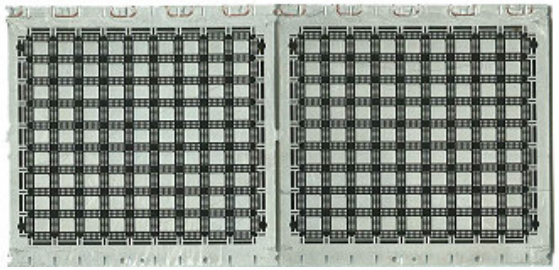
-Blade Characteristics

New



- 2”- 3” - 4” Resinoid types “E” & **“T”**
- Diamond grit size: 45 - 105 microns
- Thickness: .008”- .020” (0.2mm – 0.5mm)

-Cutting Parameters



- Feed rate:
  - Half Etched: 30 -100 mm/sec
  - Full Copper: 10 - 40 mm/sec
- Spindle speed:
  - 2”: 25-30 krpm
  - 3”: 15-25 krpm

ADT = Dicing
Advanced Dicing Technologies

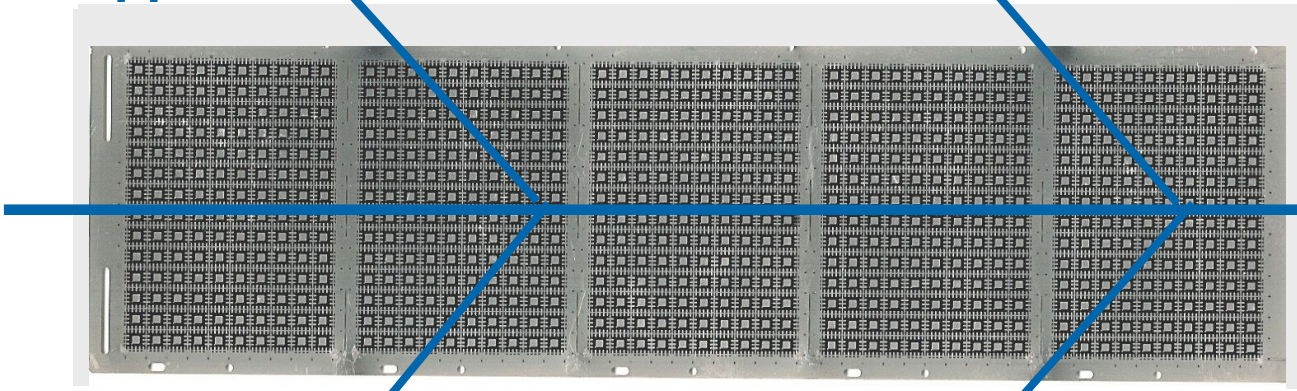
QFN Singulation

Substrate matrix

- Molding
- Copper

Throughput

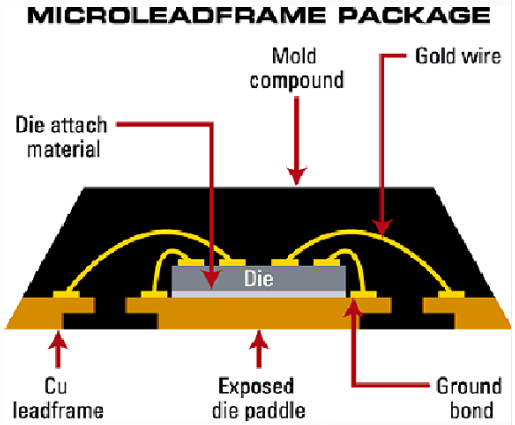
- Feed rate



QFN/MLP SINGULATION

- De-lamination
- Burrs
- Melting on Sn
- Chipping
- Smearing
- Quality

- Life
- Blade



Factors affecting the cutting results

ADT = Dicing
Advanced Dicing Technologies

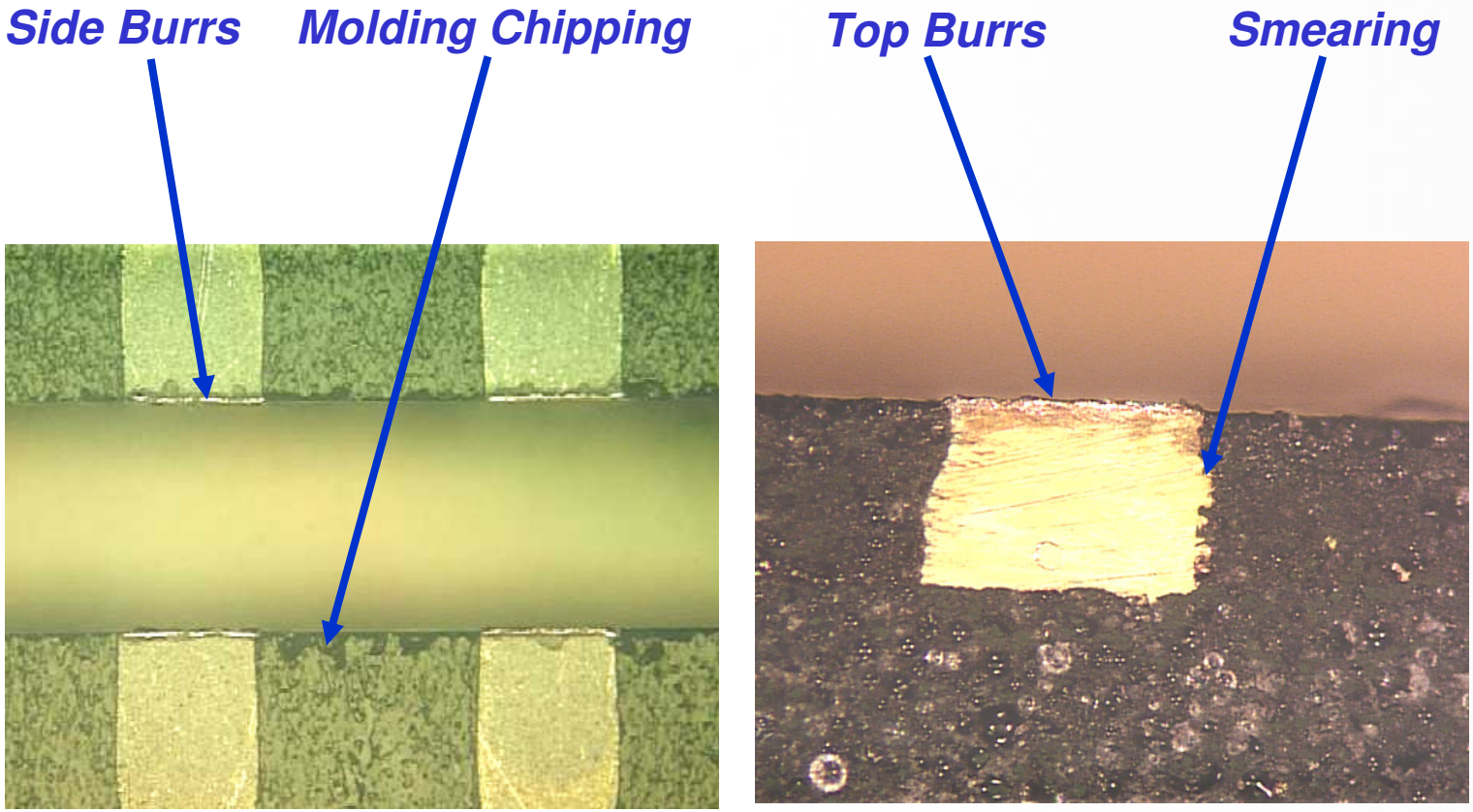
QFN Singulation

Characteristic	Current Status
Blade life	500 - 1500 meter
Feed rate	30 – 100 mm/sec
Coolant	D.I. & Additive & Chiller

Market Status

ADT = Dicing
Advanced Dicing Technologies

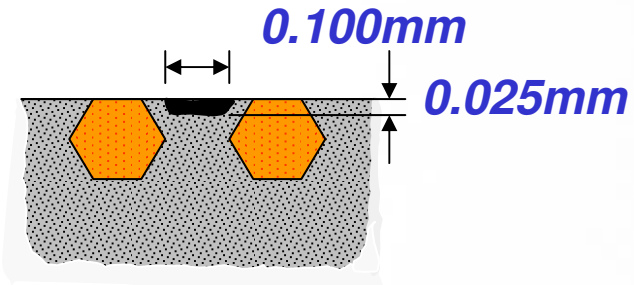
QFN Singulation



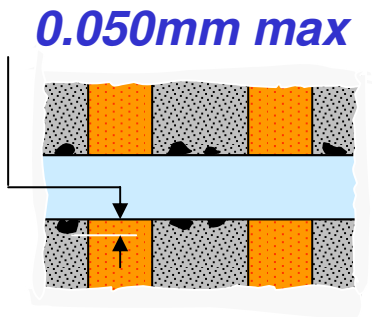
Quality Criteria

ADT = Dicing
Advanced Dicing Technologies

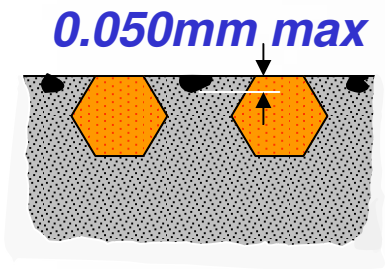
QFN Singulation



Continuous chipping



Top view



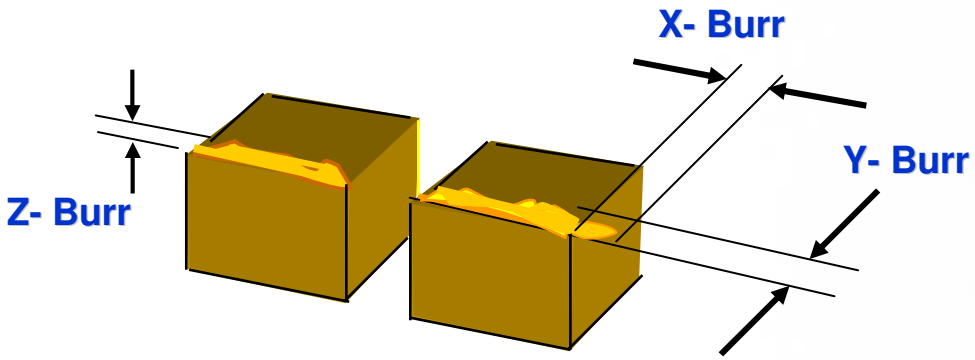
Cross section

- Specification limits may vary between end-users

Chipping Specification

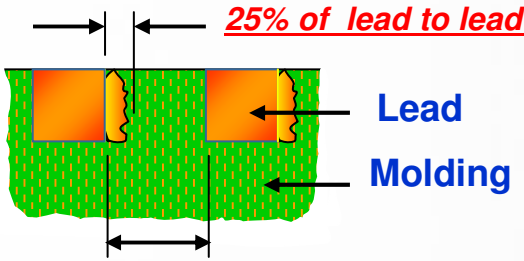
ADT = Dicing
Advanced Dicing Technologies

QFN Singulation



Burr & Smearing Geometry

Copper Smearing

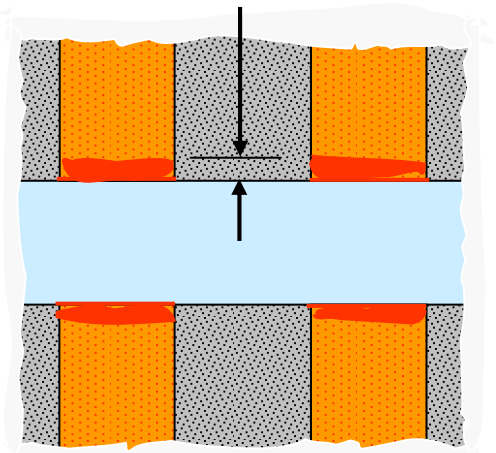


Cross Section

ADT = Dicing
Advanced Dicing Technologies

QFN Singulation

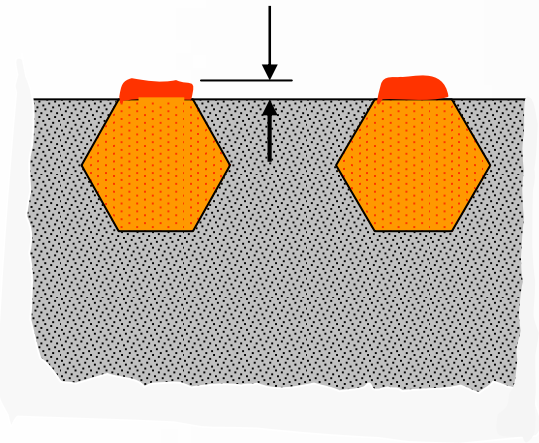
0.050mm max.



Burr Width

Top view

0.050mm max.



Burr height

Cross section

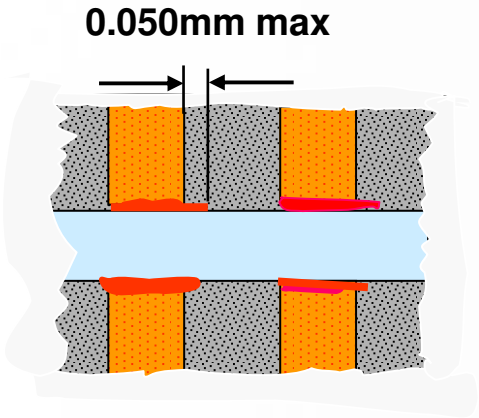
- ***Specification limits may vary between end-users***

Burrs Specification

ADT = Dicing
Advanced Dicing Technologies

QFN Singulation

- X- Burr - 0.050mm max.



Top view

- No Lead Delaminating.
- No Lead Removal.

- *Specification limits may vary between end-users*

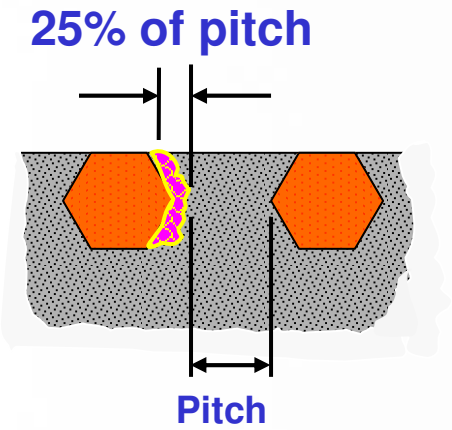
X - Burrs Specification

ADT = Dicing
Advanced Dicing Technologies

QFN Singulation

General Rules

- Smearing < 25 % of lead pitch
- No lead de-lamination
- No lead removal



Cross section

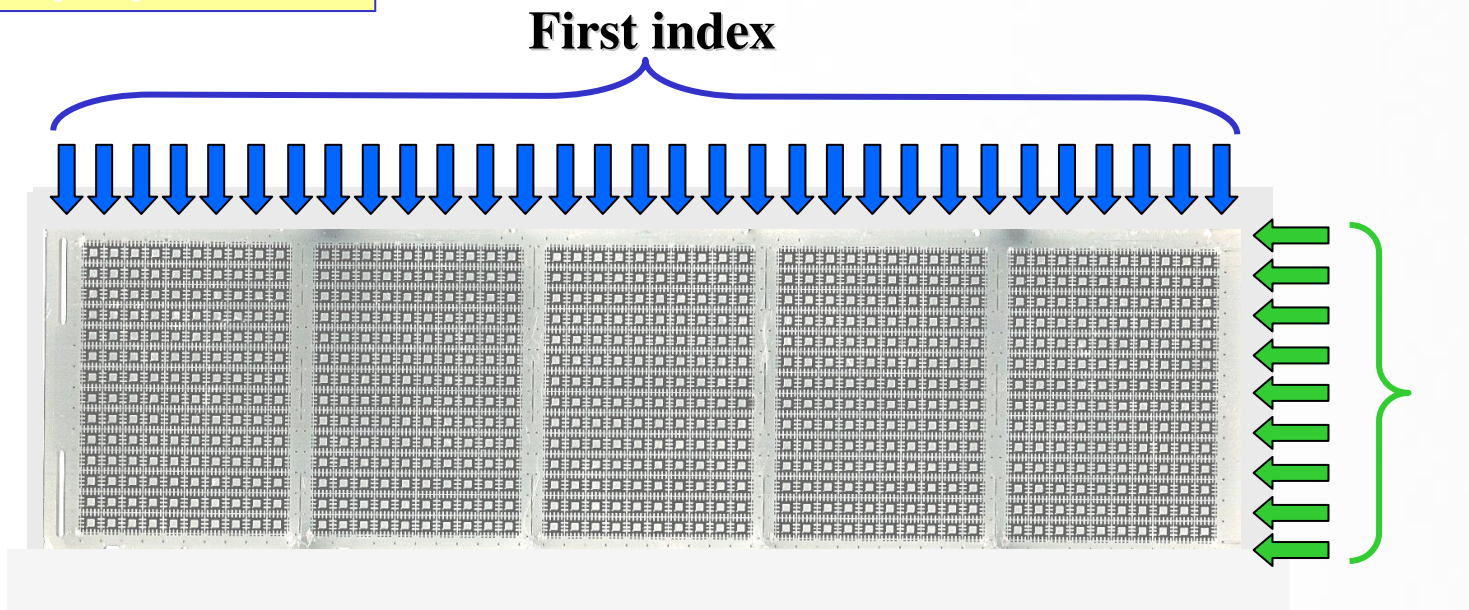
- Specification limits may vary between end-users

Smearing Specification

ADT = Dicing
Advanced Dicing Technologies

QFN Singulation

Tape process:

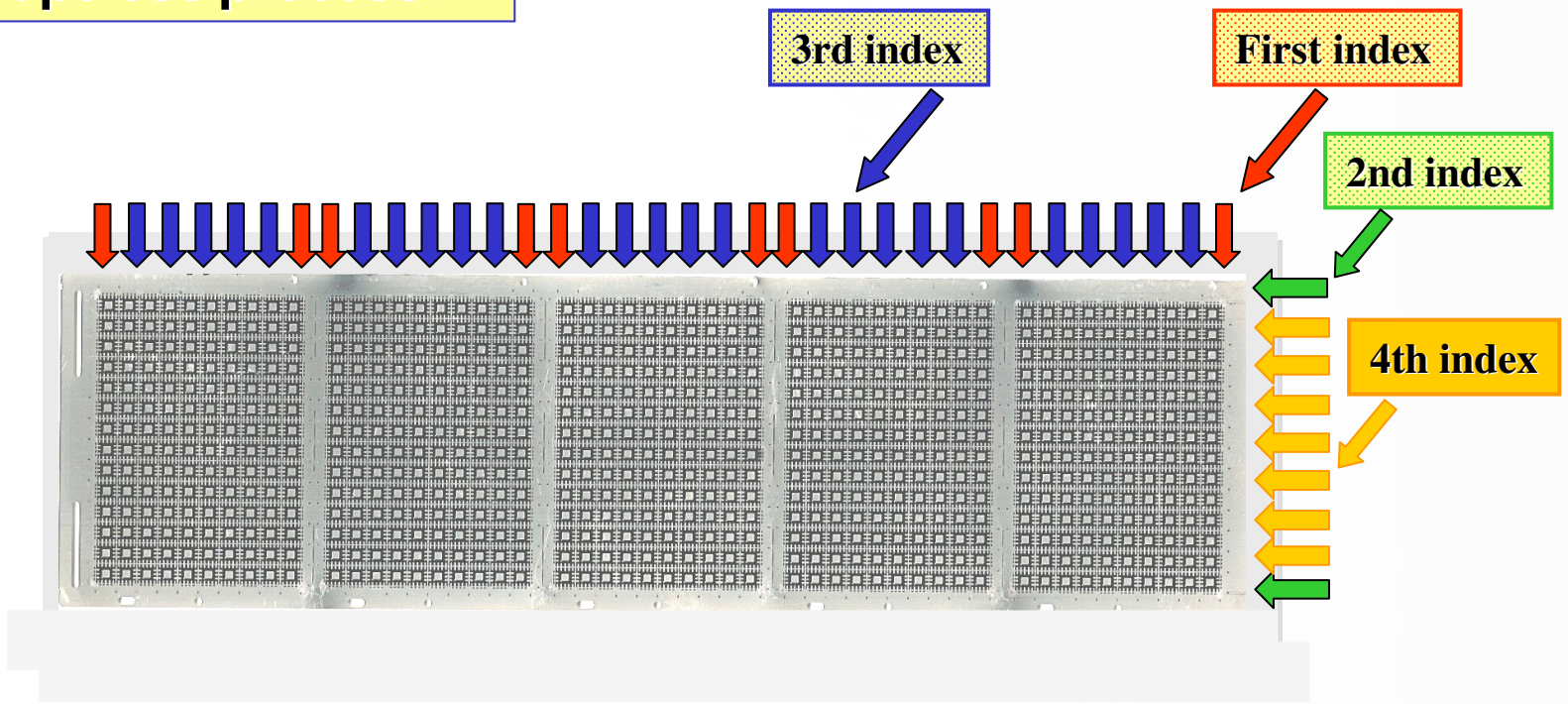


Dicing sequence to minimize load

ADT = Dicing
Advanced Dicing Technologies

QFN Singulation

Tapeless process:

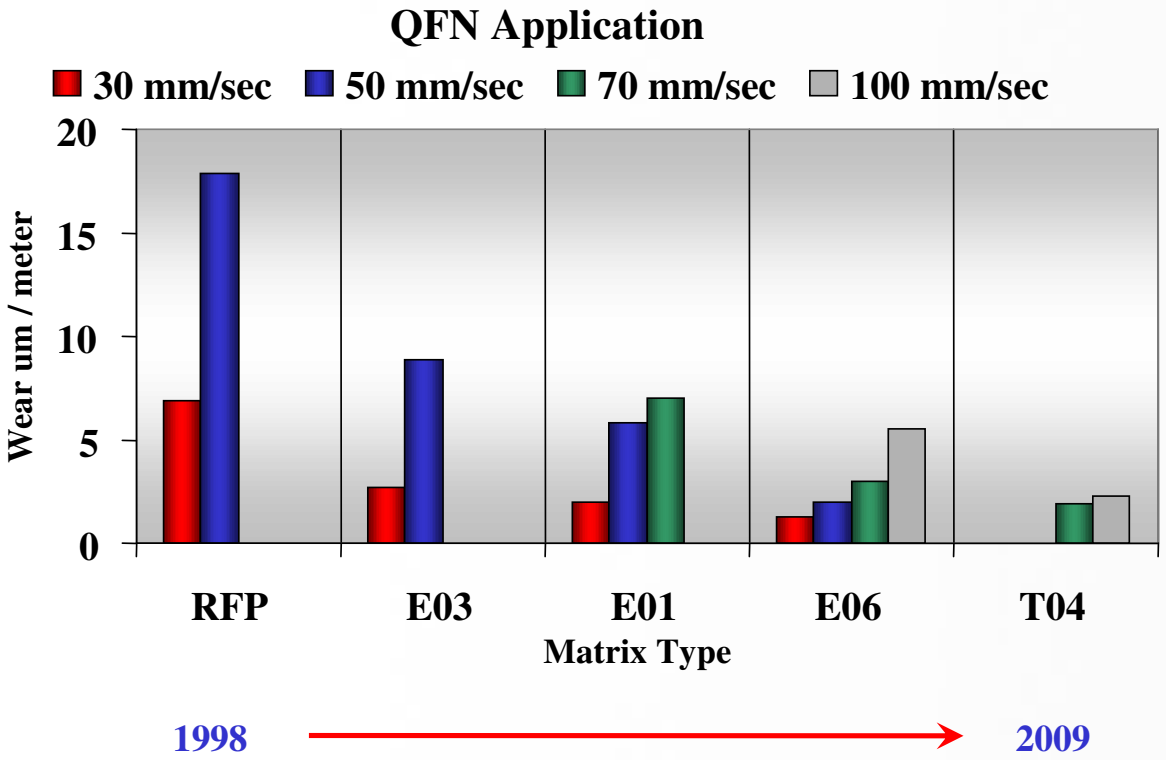


Dicing sequence to minimize load

ADT = Dicing
Advanced Dicing Technologies

"E" & "T" Types Resin Blades for QFN

- Best Cost of Ownership
- Better blade life (Exceeding 1000 m)
- Above average cut quality
- Better throughput



Cost Reduction Success Story: R → E → T Series for QFN Applications

ADT = Dicing
Advanced Dicing Technologies