

1. Introduction to Design LED Products Ltd

Light-Rolls

Profile

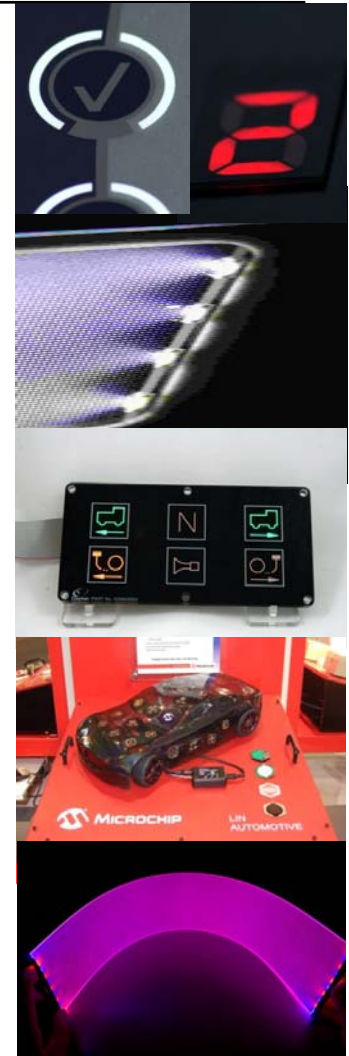
- Technology company
- Formed 2004
- Based Livingston [near Edinburgh], Scotland, UK
- IP & patents in device structures and manufacturing processes used to make thin display & switch products from based on printed Light guides with embedded Light emitting Diodes (LEDs).
- Manufacturing processes – low cost
– printing (screen and others)

Value Proposition

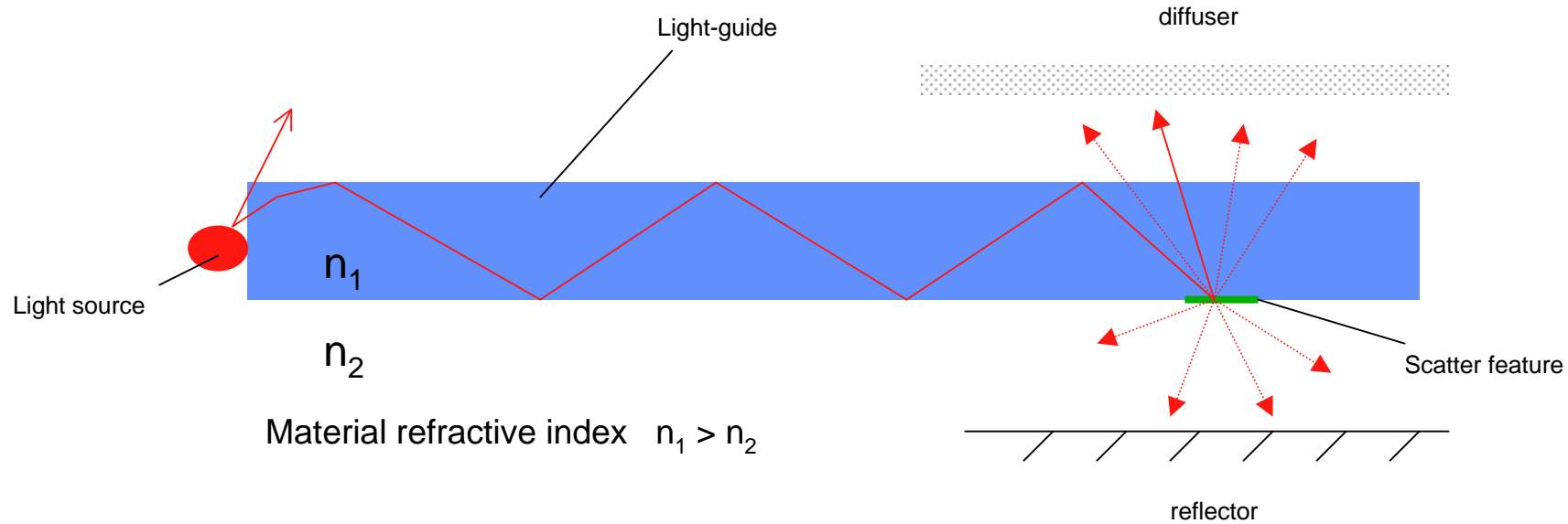
- Patented technology for printed light-guide with embedded LEDs
- Enables Thin, Flexible, Segmented and Low cost Illumination Solutions

Business Model

- Fables/Outsource Manufacturing
- IP generation & Patent protection
- Licence based manufacturing partner - Geography, Sector expertise and/or Volumization
- Technology licence based sales. Revenue via Royalty revenue stream and Licensing & Consultancy fees
- Spin-outs and Joint Ventures



Light-guiding and Total Internal Reflection

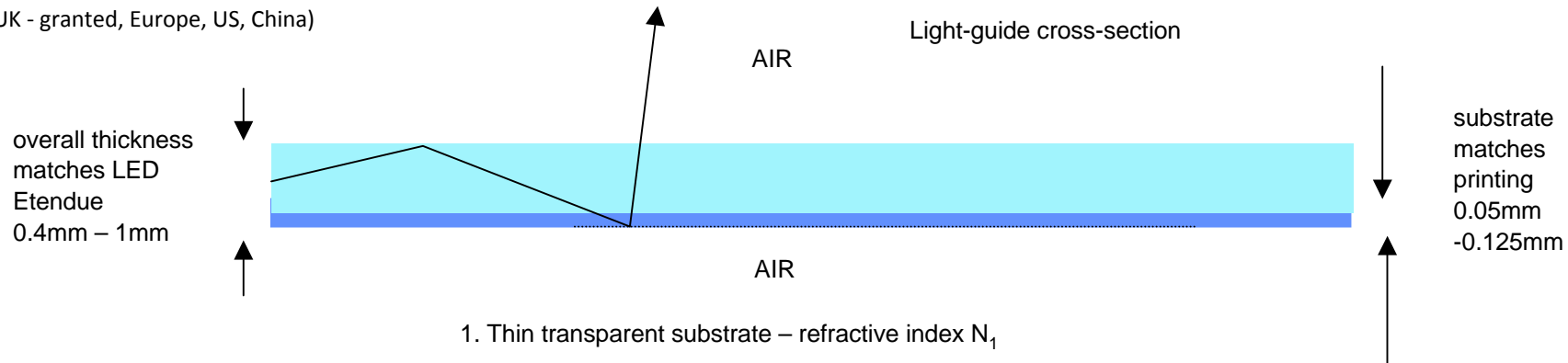


3. Intellectual Property – device with transparent substrate PCB

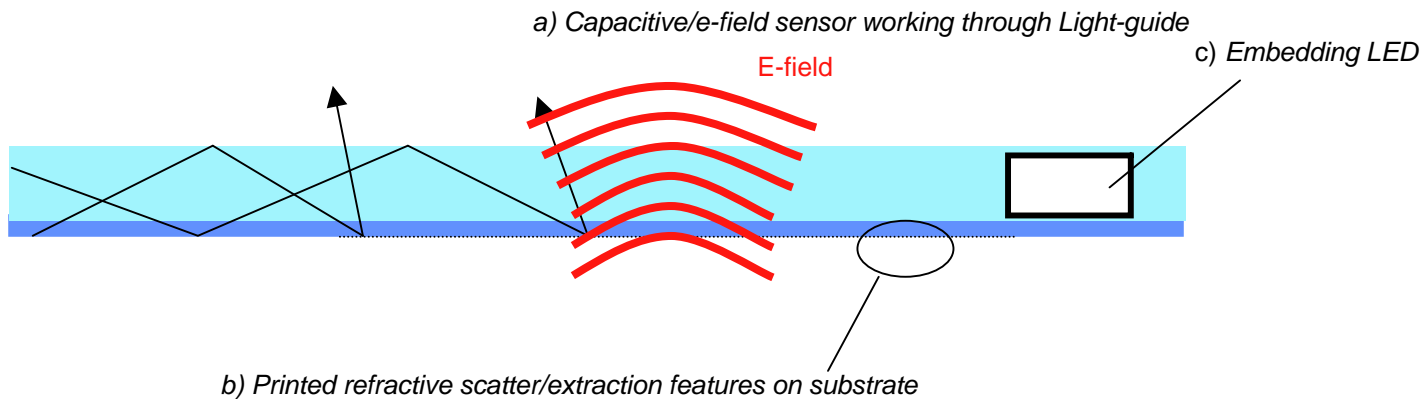
Light-Rolls

“Composite Light-guide Structure”

(UK - granted, Europe, US, China)



1. Thin transparent substrate – refractive index N_1
2. Scatter/extraction feature on substrate
3. Thick transparent light-guide – refractive index N_2 ($\leq N_1$)
4. Light-guiding in composite layers and extraction from surface feature



4. Embedded LED Technology

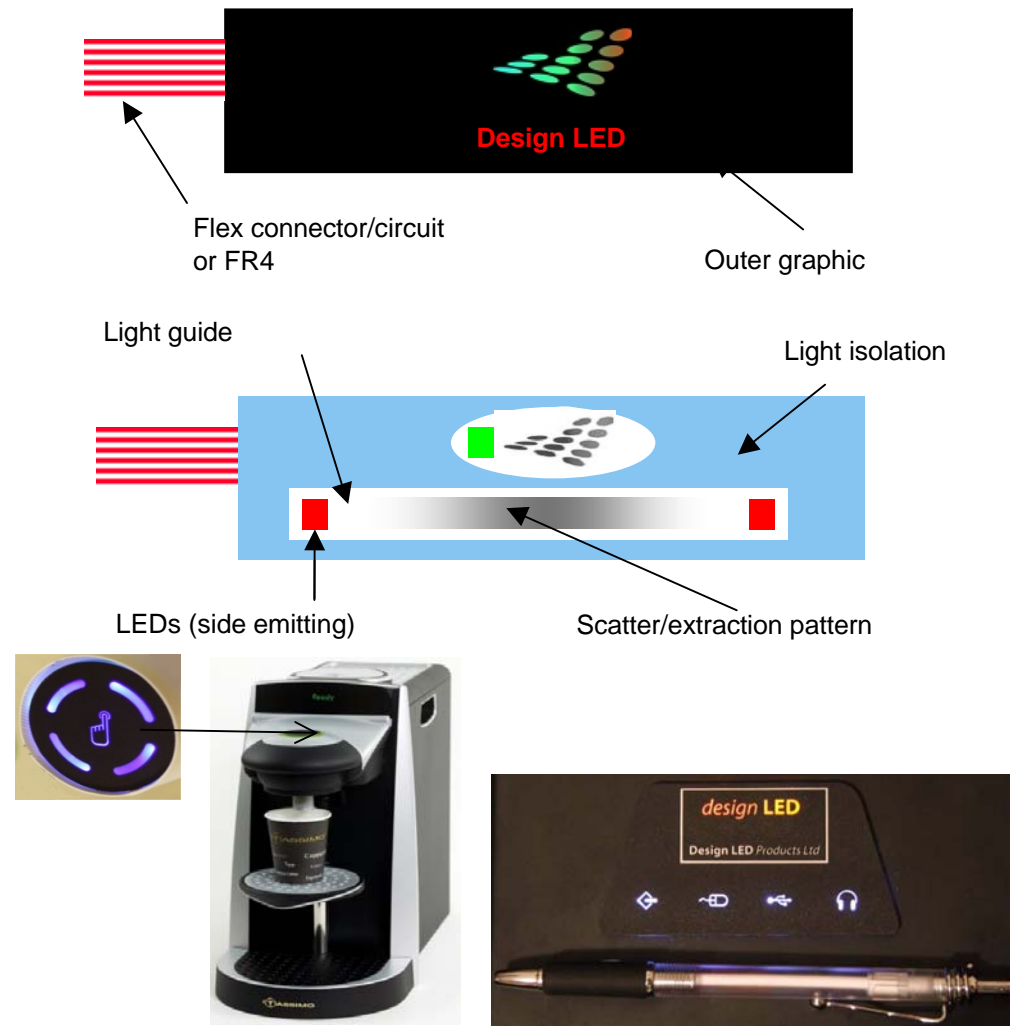
Light-Rolls

Features

- Nearest technology to membrane keypad
- LEDs integrated into Light-guide
- Best technology for thin **SEGMENTED BACKLIGHT**
- Small to Large area 5mm x 5mm to > 1m x 1m
- Printed ink extraction feature
- LEDs on standard polymer flex – typically PET

Advantages

- Mechanically flexible light-guide
- Thin component < 1mm
- Light-guide isolation features to give high contrast for segmented or selective illumination
- No hard tooling - Printing manufacture
- Excellent cost performance on

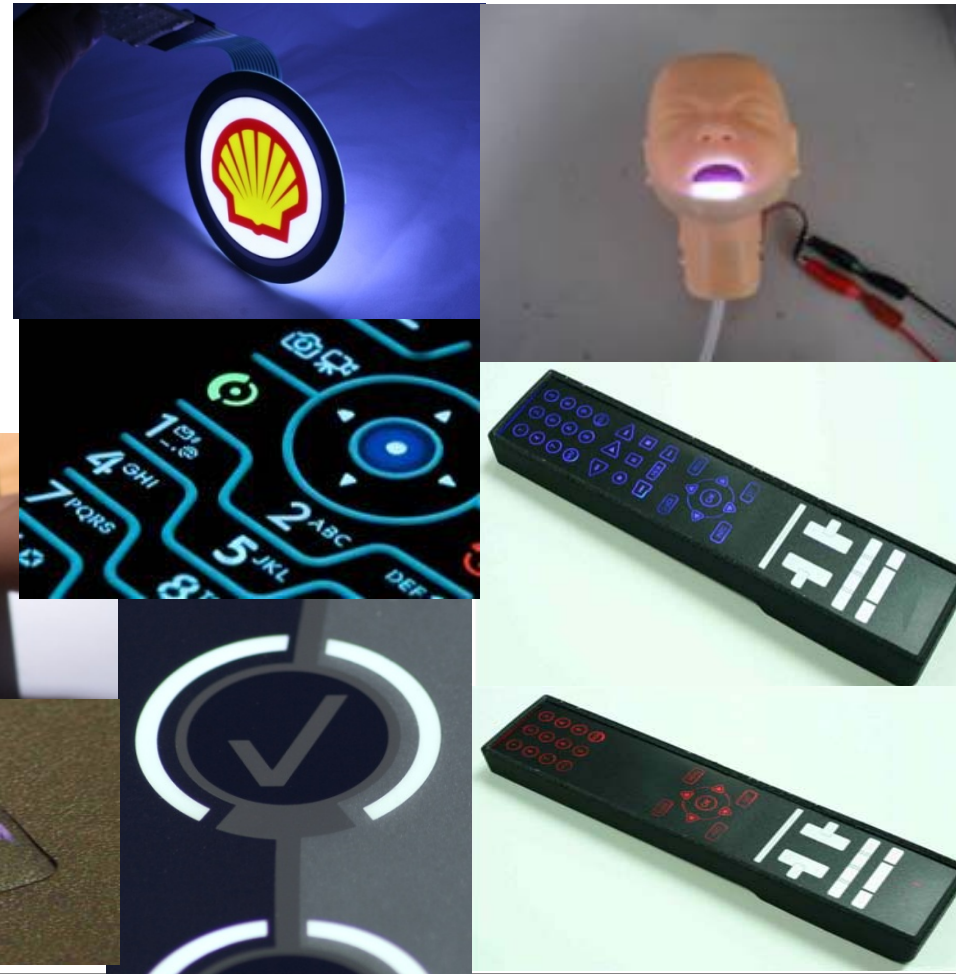


5. Embedded LED Technology

Light-Rolls

Applications

- SEGMENTED BACKLIGHT
- Human-Machine Interface
- Pixellated or Segmented displays Keypads, keyboards, remote controls with selective illumination
- Brand enhancement
- Product enhancement
- Small area lighting
- Medical device

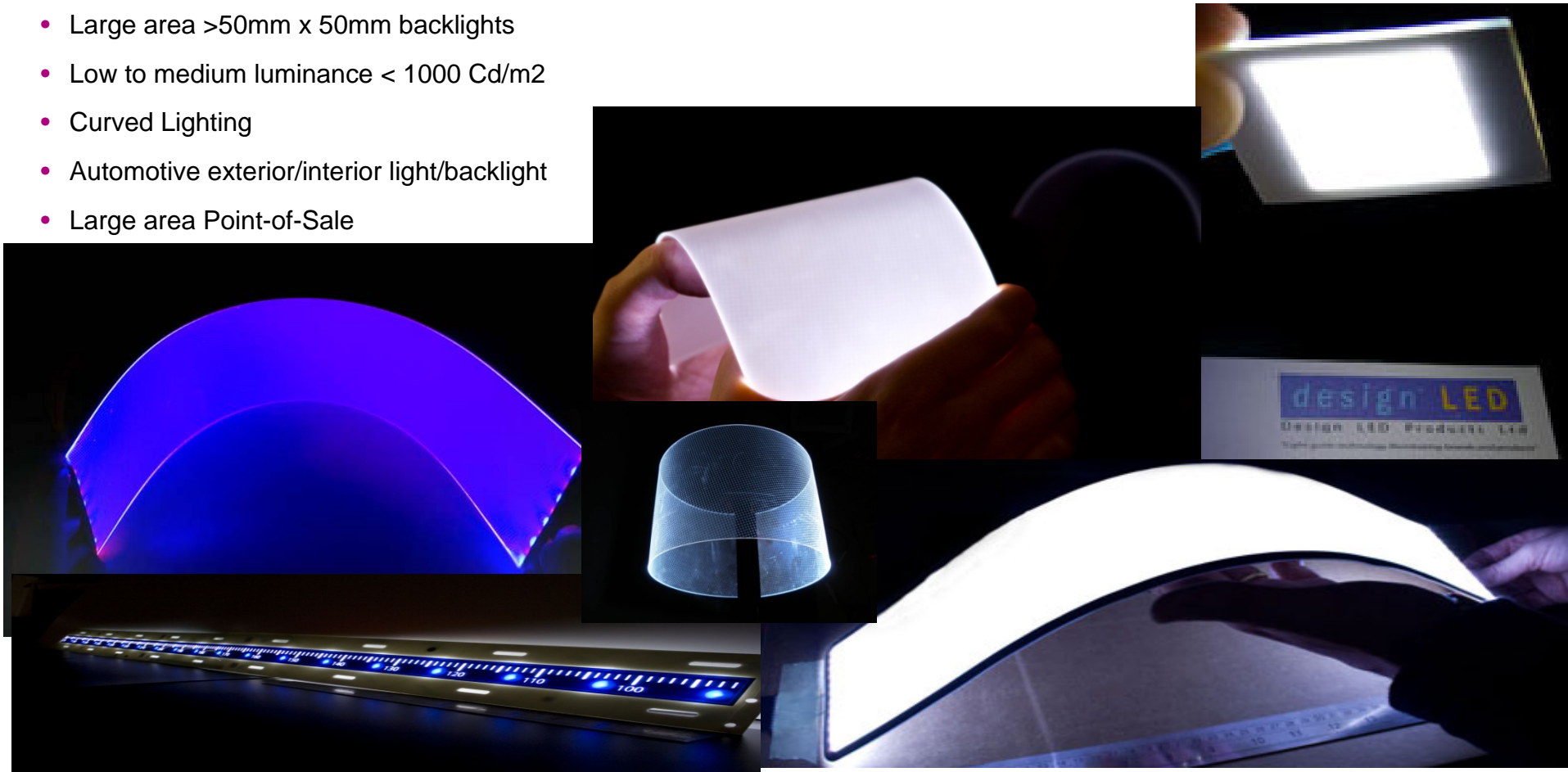


6. Passive Light-guide (separate element)

Light-Rolls

Applications

- Simplest Design LED Technology
- Large area >50mm x 50mm backlights
- Low to medium luminance < 1000 Cd/m²
- Curved Lighting
- Automotive exterior/interior light/backlight
- Large area Point-of-Sale

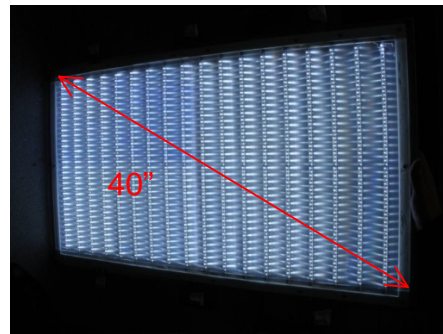


7. Enhanced Technology for large area LCD TV Backlight

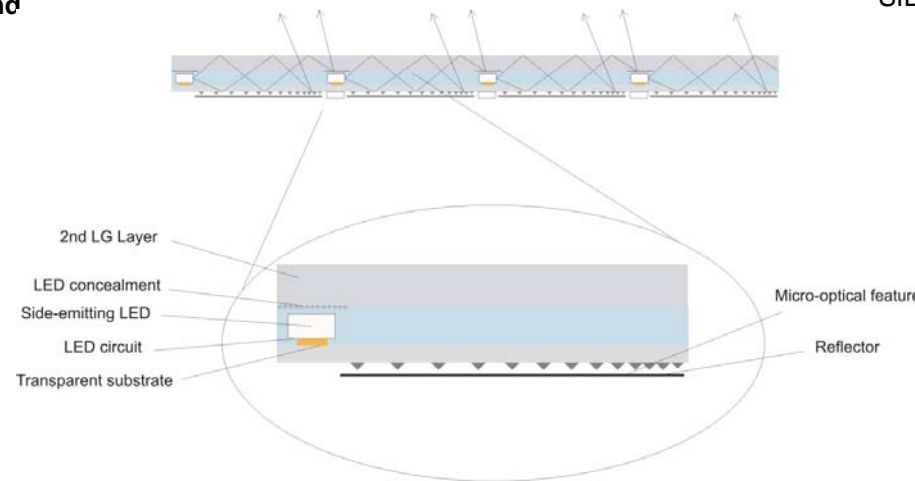
Light-Rolls

KEY SPECIFICATION PARAMETERS:

- 1. Thin < 10mm (Target 5mm)
- 2. Non-uniformity <10% (Target 1%)
- 3. Optically efficient
- 4. 2-D Segmented spatial/dimming
- 5. Low cost Bill Of Material
- 6. Low cost manufacturing
- 7. Low cost tooling (NRE etc.) for each design
- 8. Enable technology roadmap for future enhancements
- 9. Introduce colour control for high-end



SIDE ELEVATION



No air gaps
Improved
coupling

Top emitting
light
and light-
guided light
balanced at
diffuser
to give
uniform and
symmetrical
beam
output

“A light guide device to give even illumination preferably for a liquid crystal display (LCD)”
- PCT Patent (also filed in Taiwan)

8. Summary of Contribution to Lightrolls

Light-Rolls

Current Knowledge base

- Manufacturing process
- Design rules and Design methodology
- Bill of Material options
- Test and reliability
- Qualification
- Cost reduction

Technical Expertise

- Optical design
- Optical integration
- Electrical, electronic, and interconnection
- Mechanical Integration
- System Integration

Market Requirements

- Applications
- Sectors
- Pricing
- Competition
- Roadmapping



Norbert Schläfli **Maschinen**