Looking Out For You

Rear Vision Technology
Full Display Mirror and Video Camera System
Gentex Corporation - Overview
Electro-Optical Products for Automotive, Aerospace, Fire Protection

- **Established:** 1974
- **Ownership:** GNTX – NASDAQ Global Select Market
- **Operations:**
  - Headquarters & Manufacturing - Zeeland, Michigan USA
  - Sales & Logistics – England, France, Sweden, Germany, Japan, Korea, China
- **Products:**
  - Automotive Automatic-Dimming Rearview Mirrors
  - Automotive Electronics
  - Dimmable Aircraft Windows
  - Fire Protection Devices
- **Employees:** 4,000+
- **Sales (2014):** $1.38 billion
- **Mirrors Shipped (2014):** 31,079,818
Corporate Milestones
Managing the Evolution of the Rearview Mirror

1980

1982: World’s first electro-mechanical rearview mirror

1987: World’s first electrochromic rearview mirror

1990

1998: Acquire CMOS camera technology from Photobit

1991: World’s first exterior electrochromic mirror

1997: Thin flat, convex, aspheric exterior electrochromic mirrors

2000

2000: HomeLink® license, telematics, microphones, compass, interior lighting

2004: SmartBeam® high-beam assist

2006: Video display mirrors

2010

2004: Full Display Mirror and camera integration

2010: Dimmable Aircraft windows

2012: SmartBeam with ADAS

2013: HomeLink® acquisition

2014: Full Display Mirror and camera integration

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Technologies

REAR VISION SYSTEMS
ADAS FUNCTIONALITY
VIDEO DISPLAYS
TELEMATICS, MICROPHONES, LIGHTING, ETC.
MICRO-ELECTRONICS & VISION SYSTEMS
GLASS BENDING & COATING
ELECTRONICS, ELECTROCHROMICS, CHEMICAL DEVELOPMENT & SOFTWARE DESIGN
Core Competencies
Vertically Integrated to Control Quality and Leverage Innovation

- Electronics
- Microelectronics
- Engineering
- Chemistry
- Automated Assembly
- Software Design
- Microphone Development
- Displays
- Glass Processing
- Vision Systems & Cameras
Gentex Full Display Mirror
Feature Overview and Need/Demand for Enhanced Rear Vision
Vehicle Styling Trends
The Mirror’s Rearward View is Often Obstructed or Minimized

- Higher, upward-sloping beltlines
- Downward-sloping rooflines
- Smaller rear windows
- Wider C/D pillars
- Full-sized rear headrests
- Multi-row seating
- Theater seating
- Drop-down entertainment screens

Rearward visibility is becoming a major issue!
The Solution: Gentex Full Display Mirror System

Dual-Mode, Full Display Mirror and Camera for Optimal Rear Vision

More Than Doubles Mirror’s Field of View

Gentex FDM – Mirror Mode

Gentex FDM – Display Mode
Industry Trends
Full Display Mirror Technology Stirring Interest with Customers and Consumers Alike
Product Debut – Cadillac CT6

GM Announced the “Rear Camera Mirror” Will Debut on First-Ever CT6 Sedan

REAR CAMERA MIRROR

Enjoy a more expansive view of the world behind you when driving. With just a touch, the driver can activate the available Rear Camera Mirror and stream HD video through the rearview mirror itself. This creates a less obstructed view that offers 300 percent more vision than an ordinary standard mirror allows. And just as easily as it was turned on, a simple touch reverts to a traditional rear view mirror as needed.
Consumer Demand
FDM One of Top 5 Technologies Consumers Most Prefer on Next Vehicle

• According to the J.D. Power 2015 U.S. Tech Choice Study℠, the full display mirror/camera system is one of the most desired new technologies.
• Study used advanced statistical methodologies to measure preference for and perceived value of 59 future and emerging technologies.
Gentex Full Display Mirror
System Overview – Custom Integration of Entire Rear Vision System

• Ideal for vehicles with limited rear visibility
• Bi-Modal Functionality:
  – Mirror Mode – operates as a standard auto-dimming mirror; fails safe
  – Display Mode – rear video display for optimal rear vision
• New Gentex-designed Gen 4 high dynamic range imager
  – Each pixel determines its own exposure
  – Ensures brightest and darkest areas of any given scene are clear and visible
• Custom camera integration options
Gentex Type R Series
Gentex Cameras and Displays for OEM Racing Programs

• Rear vision matters, that’s why multiple OEM race teams have looked to Gentex for rear vision systems and components

• Cameras
• Mirror displays
• Image processing
• Auto-dimming exterior mirrors
Gentex Rear Vision System
Full Mirror Display and Camera
Why Bimodal Functionality?
HMI and Safety Considerations Support Dual Mirror Modes

• Why do you need a combination of EC mirror and display?
  – Failsafe
    • Camera or display can become non-operational
    • Blocked camera due to dirt or ice
  – Consumer Preference
    • Farsighted drivers may have difficulty focusing on display
    • Driver may want to see vehicle interior, back seat, etc.
  – Auto-Dimming EC Mirror
    • Full auto-dimming function when in mirror mode
    • Control of auto-dimming exterior mirrors in both display and mirror modes
  – Meets FMVSS-111 mirror regulations
Full Display Mirror Functionality

The Details

• EC mirror
  – Full auto-dimming function
  – Control of exterior auto-dimming mirrors
  – Reverse inhibit function

• Display
  – On/Off activation with flipper switch
  – ~40° Horizontal displayed for approximately 2X FOV of mirror

• Video Processing
  – FPGA based video processing done inside interior mirror
  – LVDS or Coax video connection to camera
  – System can be on LIN or CAN bus for vehicle integration
Gentex Cameras – Current Applications
Multiple Imager Platforms for Customized System Performance

Glare Elimination
- Ambient Light Sensing
- Glare Sensing

Forward Lighting Optimization
- Auto High Beam
- Dynamic Forward Lighting
- Matrix Beam

Forward Lighting Optimization w/ ADAS
- Auto High Beam
- Dynamic Forward Lighting
- Matrix Beam
- Fog Detection
- Lane Detection
- Object Detection

Rear Camera Video
- HDR Video – 60 fps
Gentex Gen 4 Imager – Rear Vision
One Imager – Multiple Uses

• Rear Camera Video
  – Ideal for optimizing rear visibility
    • Full display mirrors
    • Around view monitor
  – High dynamic range (HDR)
    • Each pixel determines its own exposure
    • Ensures brightest and darkest areas of scene are clear and visible
Gentex Gen 4 Imager – Rear Vision

Proven Performance

- Track-proven by Audi at 2012 Le Mans 24 Hours Race
- Debuted on Audi e-tron
Gentex Full Display Mirror
Camera Integration
Camera Integration – Shark Fin

Designs That Allow The Camera To Blend In Or Stand Out

- Camera can be integrated with satellite radio and/or GPS antennae
Camera Integration – Roof Mounted
Designs That Allow The Camera To Blend In Or Stand Out

• Camera integrated in sleek, stand-alone, roof-mounted pod
Camera Integration – Spoiler or CHMSL
Designs That Allow The Camera To Blend In Or Stand Out

- Camera integrated in spoiler, trunk lid or center high-mounted stop lamp
- Variety of bezel options
Camera Integration – Interior Mount

Designs That Allow The Camera To Blend In Or Stand Out

- Camera mounted interior of the rear window for protection from elements and to take advantage of rear wiper path