



System Solution Guide - Preview

Augmented and Virtual Reality Headset



onsemi.com



Table of Contents

Get Latest
Version

Overview

Applications

03

Market Information & Trend

Emerging Technologies in Augmented and Virtual Reality Vision

04

Trends in AR and VR in 2025

05

System Implementation

AR / VR Headset Types

06

Solution Overview

Block Diagram - Augmented and Virtual Reality Headset

07

Block Diagram - Augmented and Virtual Reality Controller

08

onsemi's Image Sensors in AR/VR Headsets

09

Hyperlux LP - Image Sensor Family

10

Hyperlux LP AR0830 & Hyperlux LP AR0544

11

Additional Hyperlux LP Family Features

12

Hyperlux™ SG - Global Shutter Image Sensor Family

13

Unlocking Precision in AR/VR: The Value of **onsemi's** Hyperlux™ SG Global Shutter Sensors

14

Smart iToF Global Shutter Depth Sensors – AF0130 & AF0131

15

onsemi RSL10 & RSL15 Bluetooth Modules for AR/VR Communication

17

Treo Platform

18

Recommended Products

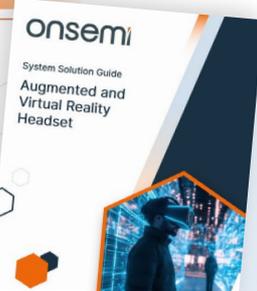
19

Complementary Products

20



onsemi™



onsemi
System Solution Guide
Augmented and
Virtual Reality
Headset

Register now to unlock all System Solution Guides



1



2



3



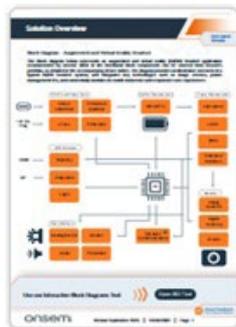
4



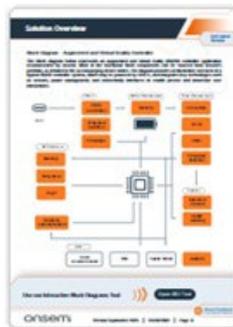
5



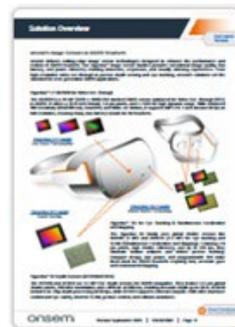
6



7



8



9



10



11



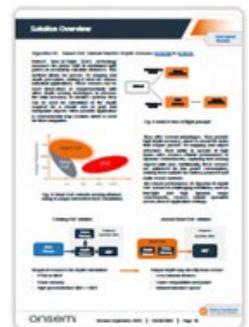
12



13



14



15



16



17



18



19



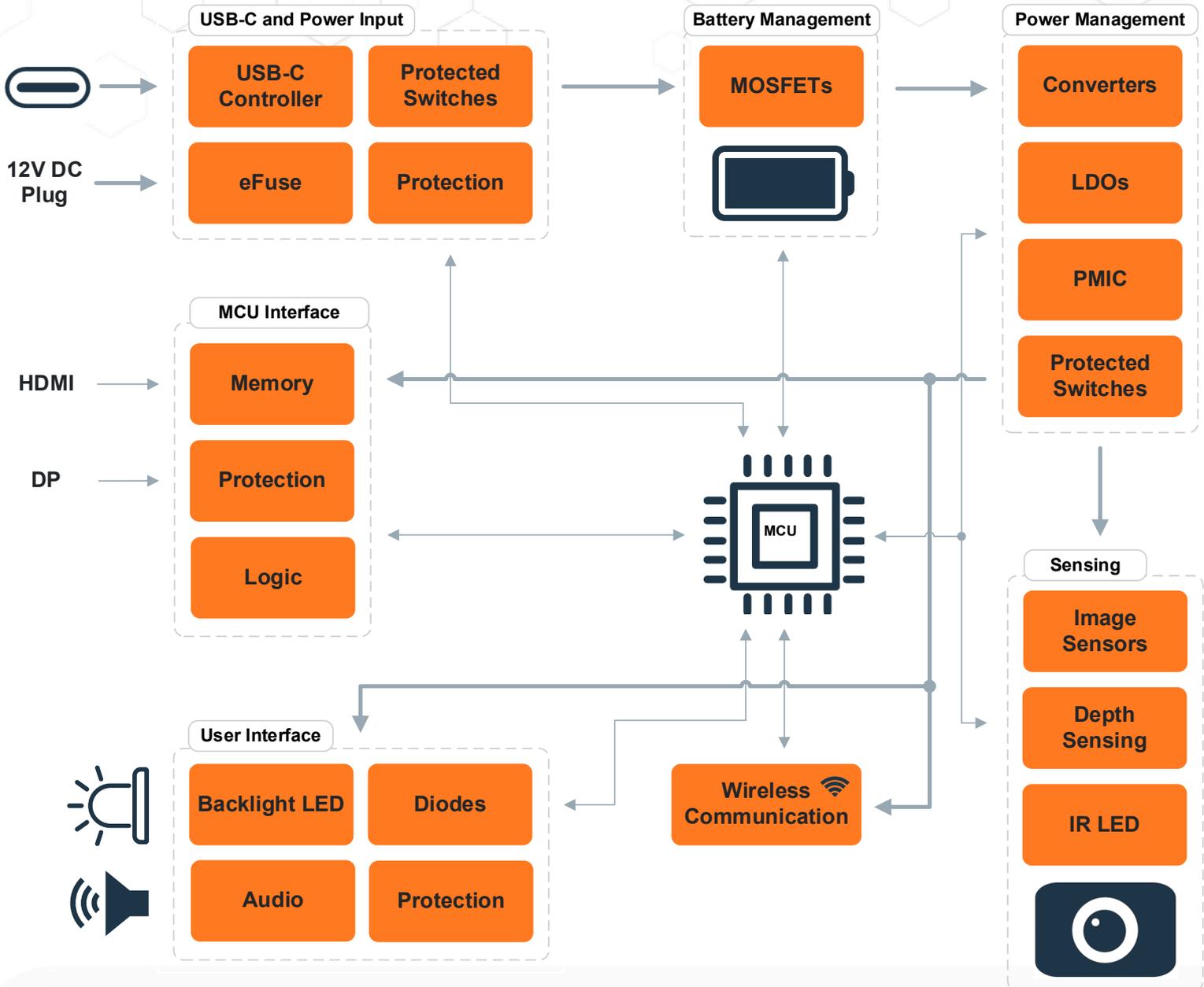
20

Block Diagram

Get Latest Version

Block Diagram – Augmented and Virtual Reality Headset

The block diagram below represents an augmented and virtual reality (AR/VR) headset application recommended by onsemi. Most of the functional block components can be sourced from onsemi's portfolio, as detailed in the accompanying device tables. The diagram provides an illustrative overview of a typical AR/VR headset system, and integrates key technologies such as image sensors, power management ICs, and connectivity modules to enable immersive and responsive user experiences.



Use our Interactive Block Diagrams Tool



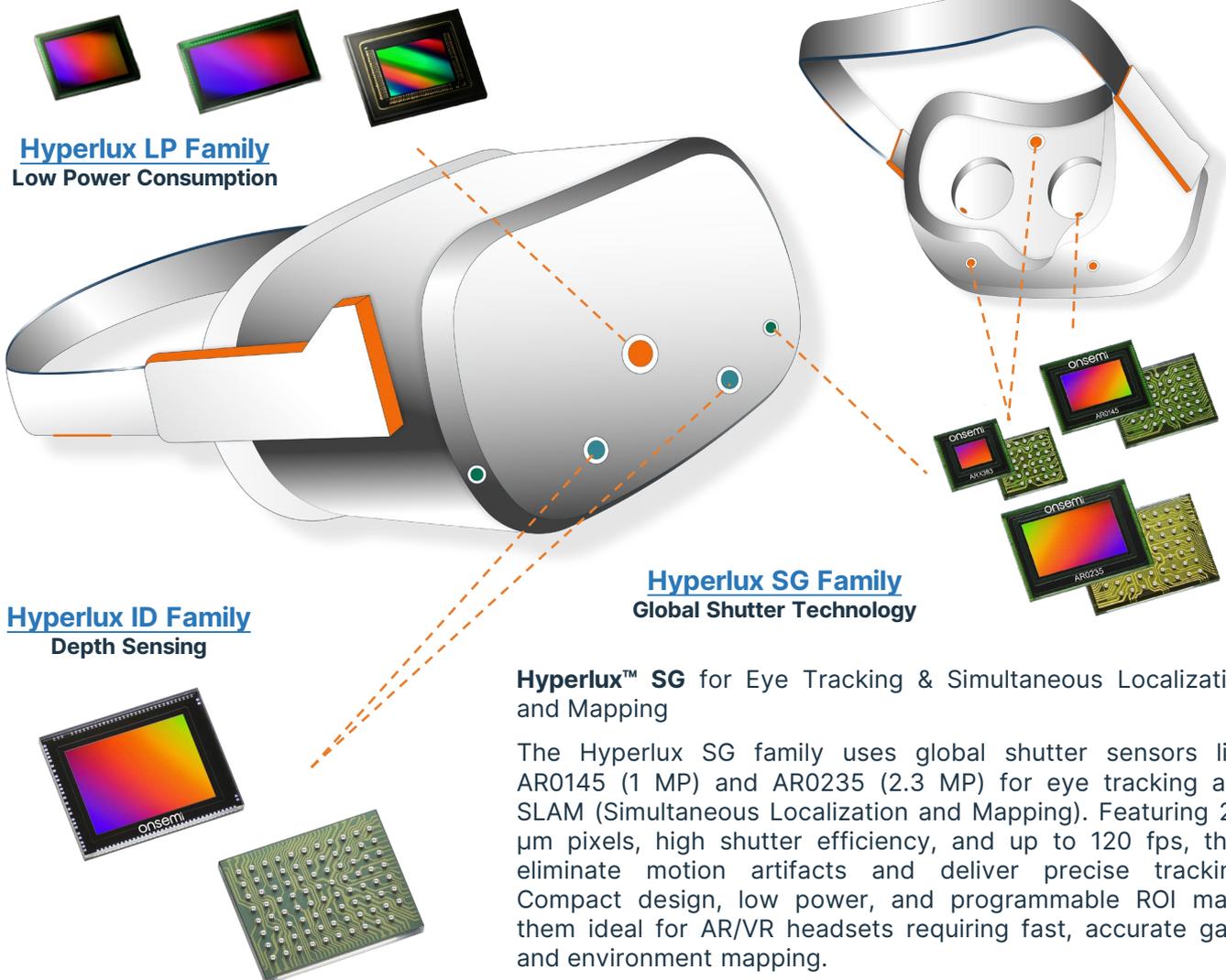
Open IBD Tool

onsemi's Image Sensors in AR/VR Headsets

onsemi delivers cutting-edge image sensor technologies designed to enhance the performance and realism of AR/VR headsets. Our Hyperlux™ image sensor families provides exceptional image quality, low latency, and power efficiency enabling immersive, responsive, and visually stunning experiences. From high-resolution video see-through to precise depth sensing and eye-tracking, **onsemi's** solutions set the standard for next-generation AR/VR applications.

Hyperlux™ LP AR2020 for Video See-Through

The AR2020 is a 20 MP (5120 × 3840) BSI stacked CMOS sensor optimized for Video See-Through (VST) in AR/VR. It offers a 1/1.8-inch format, 1.4 μm pixels, and LI-HDR for high dynamic range. With enhanced NIR sensitivity (850/940 nm), SmartROI, and Wake-on-Motion, it supports MIPI CSI-2 and streams 60 fps at full resolution, ensuring sharp, low-latency visuals for AR headsets.



Hyperlux LP Family
Low Power Consumption

Hyperlux ID Family
Depth Sensing

Hyperlux SG Family
Global Shutter Technology

Hyperlux™ SG for Eye Tracking & Simultaneous Localization and Mapping

The Hyperlux SG family uses global shutter sensors like AR0145 (1 MP) and AR0235 (2.3 MP) for eye tracking and SLAM (Simultaneous Localization and Mapping). Featuring 2.8 μm pixels, high shutter efficiency, and up to 120 fps, they eliminate motion artifacts and deliver precise tracking. Compact design, low power, and programmable ROI make them ideal for AR/VR headsets requiring fast, accurate gaze and environment mapping.

Hyperlux™ ID Depth Sensors (AF0130/AF0131)

The AF0130 and AF0131 are 1.2 MP iToF depth sensors for AR/VR navigation. They feature 3.5 μm global shutter pixels, 200 MHz modulation, and >40% QE at 940 nm, enabling accurate depth up to 30 m. AF0130 includes on-chip depth processing at 60 fps, while AF0131 supports external compute. Both offer dual laser control and eye-safety, ideal for SLAM, gesture control, and collision avoidance.

Hyperlux LP - Image Sensor Family

Recently, **onsemi** launched the [Hyperlux™ LP](#) series of image sensors. This series incorporates cutting-edge electronic rolling shutter technology and consists of three product variants: the [AR0544](#) with a resolution of 5MP, the [AR0830](#) with 8.3MP, and the [AR2020](#) with 20MP. All sensors within the Hyperlux™ LP family feature identical pixel sizes and optical performance. The product lines provide a variety of options, including mono, RGB, and RGBIR variants, available in both packaged and die forms. This extensive selection allows vision system designers to optimize development efforts, reduce expenses, and accelerate time-to-market (TTM) by leveraging diverse solutions.

Power Consumption

In the pre-detect state, Hyperlux™ LP image sensors consume less than 1/100th of the power consumed in the native mode. This results in substantial power savings and extends the operational cycle of vision systems that are sensitive to power consumption.

Tab. 1: Hyperlux image sensors specifications

	AR0544	AR0830	AR2020
Resolution	5MP, 2592 x 1944	8 MP, 3840 x 2160	20 MP, 5120 x 3840
Pixel, Color Filter	1.4 μm BSI, RGB/Mono/RG B-IR	1.4 μm BSI, RGB/Mono/ RGB-IR	1.4 μm BSI, RGB/Mono
Optical Format	1/4.2-inch (4:3)	1/2.9-inch (16:9)	1/1.8-inch (4:3)
SNR - Max	39.9 dB		
Dynamic Range	73 dB (eDR 1-exp)		
Subsampling Modes	Binning/Skipping/Summing		

Tab. 2: Image sensor power consumption comparison in full resolution mode

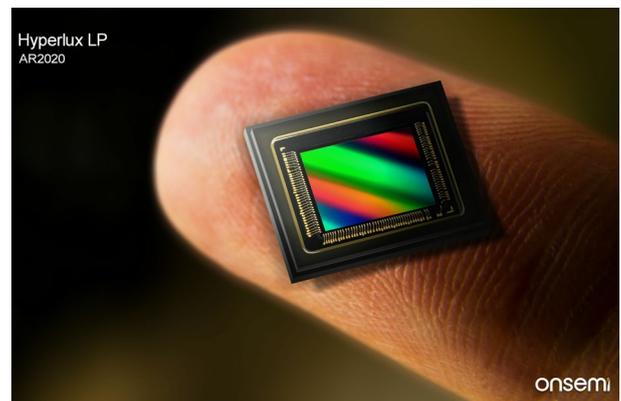
	AR0544	AR0830	AR2020
Power Consumption (Full Resolution, Typical 25C)	< 170 mW @ 60 fps	190 mW @ 60 fps	~400 mW @ 60 fps

Hyperlux LP AR2020

onsemi's [Hyperlux AR2020](#) image sensor stands out as a top-tier choice, offering a suite of advanced features that cater specifically to the demanding needs of modern security systems. This advanced sensor is capable of capturing images in either linear or enhanced Dynamic Range (eDR) modes, with a rolling-shutter readout. Additionally, it features a built-in **Wake on Motion (WoM)** function and supports **Smart Region of Interest (ROI)**, allowing for optimized image capture and processing efficiency.

Features and Specifications:

- 20 MP CMOS Sensor with 1/1.8-inch Back-Side Illuminated (BSI) stacked CMOS sensor and 1.4 μm pixel technology
- Enhanced NIR Response at 850 nm and 940 nm Wavelength
- LI-HDR: Supports Line Interleaved T1/T2 Readout to Enable HDR Processing in ISP Chip (eDR)
- Bit-depth Compression Available for MIPI Interface
- Various Trigger Modes for Multi-sensor Synchronization
- Electronic Rolling Shutter (ERS) and Global Reset Release (GRR) Modes Supported



Solution Overview

Get Latest Version

Hyperlux ID - Smart iToF Global Shutter Depth Sensors [AF0130](#) & [AF0131](#)

Indirect Time-of-Flight (iToF) technology measures the phase shift of modulated light pulses to accurately calculate distances. This method allows for precise 3D imaging and depth perception, making it ideal for various industrial applications. These sensors can be used stand-alone or complementarily with other depth sensing techniques to increase the data accuracy. In robotics systems they can be used for calculation of the depth required for a robotic arm to grab and manipulate objects. Other possible application is environmental map creation which is used for floor navigation.

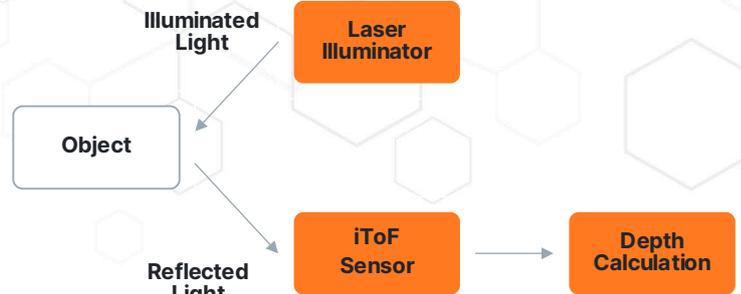


Fig. 2: Indirect time of flight principle

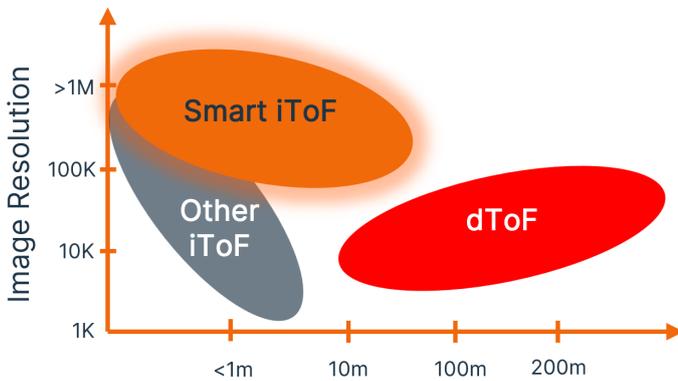
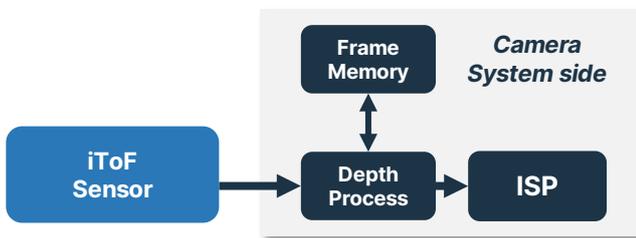


Fig. 3: Smart iToF extends sensing distance owing to unique intermitted laser modulation

They offer several advantages. They provide high depth accuracy, which is crucial for tasks that require precise 3D mapping and object detection. Their ability to operate at high frame rates ensures reliable performance in dynamic environments, capturing fast-moving objects with ease. Additionally, these sensors are optimized for low power consumption, making them suitable for battery-powered and multi-sensor systems.

The robust performance of Hyperlux ID depth iToF sensors in challenging conditions, such as low-light and high dynamic range environments, ensures reliable operation across diverse application settings.

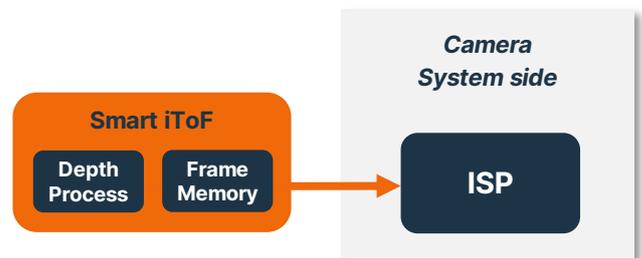
Existing iToF solution



Required resources for depth calculation:

- FPGA or MCU
- Frame memory
- High speed interface (for > 1 MP)

onsemi Smart iToF solution



Output depth map directly from sensor:

- Less external devices
- Lower computation and power
- Relaxed interface speed

onsemi™

Intelligent Technology. Better Future.

Register now to unlock all System Solution Guides and get additional exclusive benefits!

- Join the conversation on community forum.
- Utilize Elite Power Simulator & other developer tools.
- Watch exclusive webinars and seminars.

Open full System Solution Guide



onsemi, the onsemi logo, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use onsemi products for any such unintended or unauthorized application, Buyer shall indemnify and hold onsemi and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that onsemi was negligent regarding the design or manufacture of the part. onsemi is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.