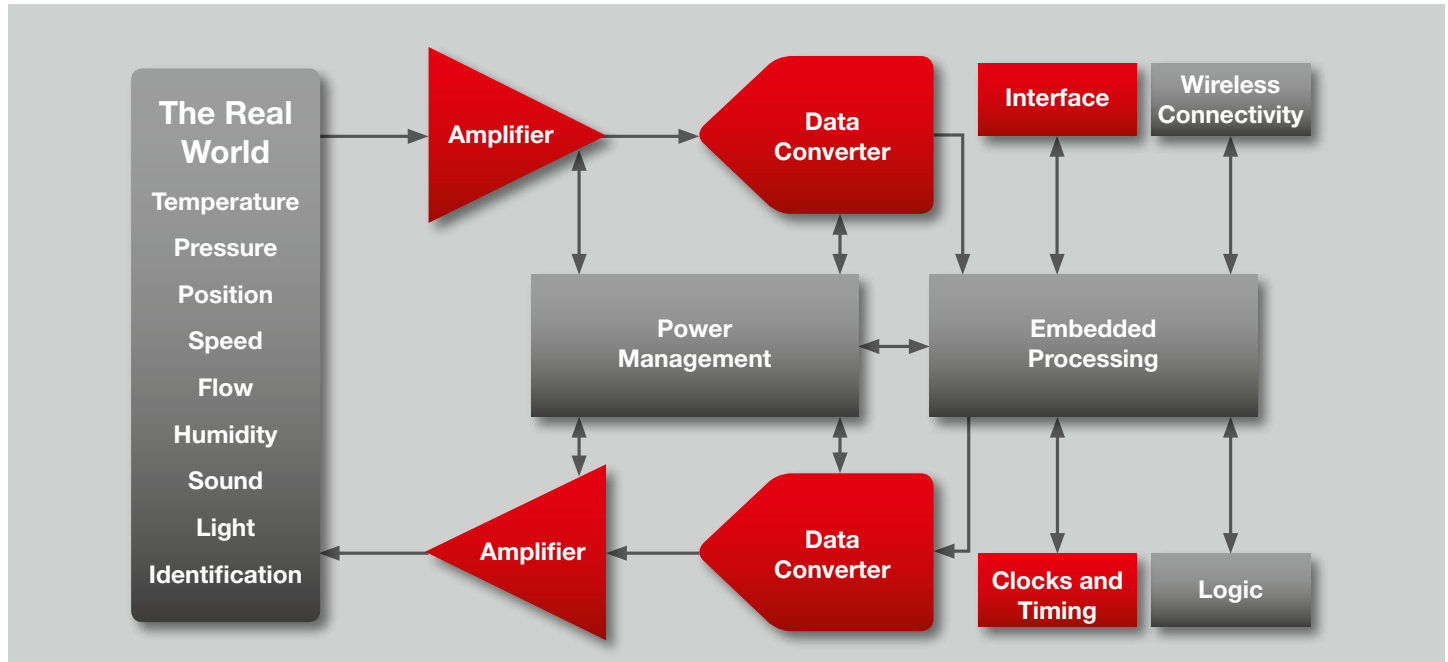


Analog Signal Chain Portfolio Overview



Analog Signal Chain Product Portfolio



**Space
Qualification**



**DIE
Services**



**High Temperature
Qualification**



**Automotive
Qualification**

 **TEXAS
INSTRUMENTS**

Data Converters Portfolio

Product Highlights	Analog-to-Digital			Digital-to-Analog	Audio	Embedded ADC
	Delta-Sigma (oversampling)	Successive Approximation (SAR)	High Speed	String, R2R Current Steering	ADC DAC Codec	Embedded Processing
	12 to 31 bits up to 125 KSPS	8 to 18 bits up to 4 MPS	8 to 16 bits up to 4 GSPS	8 to 18 bits up to 1.475 GSPS		
	ADS1118 ADS1231 ADS1248 ADS1259 ADS1278 AMC1204 LMP90100 ADC161S626	ADS8331 ADS8363 ADS8568 ADS8636 ADS8881	ADS4149 ADS5400 ADC12D1x00 ADS5294 ADS4249	DAC7678 DAC8562 DAC9881 DAC161P997 DAC34SH84	ADC PCMxxxx TLV320ADC3xxx DAC PCMxxxx TLV320DAC3xxx Codec PCMxxxx TLV320AIC3xxx	C5000™ DSP Stellaris® Cortex M3/M4F C2000™ 32 bit floating point MCU MSP430™ ULP 16 bit MCU Hercules™ Cortex R4F
Functions/Features	\$0.50 to \$35	\$0.50 to \$35	\$2.50 to \$2000	\$0.50 to \$80	\$0.95 to \$16.45	\$0.25 to \$30
	PGA, current sources, references, MUX, modulator-only isolation	Simultaneous sampling, bipolar inputs, references, MUX	Digital processing for filtering, decimation 1/f noise reduction, interleaving ready	Voltage output, current output, multiplying references, bipolar output, multichannel	miniDSP, integrated amplifier, DirectPath HP amplifier, scalability, 2Vrms output, integrated PLL, 3rd party algorithms	10 – 12 bit SAR, 200K sps to 12.5 Msps, 2 – 24 channels, 16/24 bit sigma delta ADC, Up to 4ksps, 3 – 7 channels
	Low-frequency signals at high resolution, temperature, pressure, level seismic instrumentation, industrial process control	Industrial process control, motor control, three-phase power control, multi-axis positioning, power quality	Communication, imaging, defense, medical imaging, test and measurement	Industrial, test and measurement, digitally controlled calibration, communication	Consumer, prosumer, pro-audio, e.g. portable consumer electronics, low power applications, TV, STB, noise cancelling HP, iPod-docks, soundbars, mixing consoles	Measurement, motor control, security, audio, lighting, industrial, renewable energy, medical, safety
Applications						

Data Converter Nomenclature

ADSxxxx

ADS1xxx = Delta-Sigma ADCs
 ADS120x = Delta-Sigma Modulators
 AMC120x = Isolated Delta-Sigma Modulators
 ADS4xxx
 ADS5xxx
 ADS6xxx
 ADS7xxx = SAR (Successive Approximation Register) ADCs
 /8xxx

Speed Single-Ended Input:
 02 = 50–200 KSPS
 05 = 200–500 KSPS
 10 = 500–1000 KSPS
Differential Input:
 62 = 50–200 KSPS
 65 = 200–500 KSPS
 70 = 500–1000 KSPS

ADC12 2 S 02 1

Resolution
 14 = 14-bit
 12 = 12-bit
 10 = 10-bit
 08 = 8-bit
Ref/Supply Options
 Number of Supplies, Reference
 1 = VA Reference, single supply
 2 = VA Reference, dual supply
 3 = Internal/External/VA Reference, signal supply
 4 = Internal/External/VA Reference, dual supply
 5 = External Reference, signal supply
 6 = External Reference, dual supply
I/F Options
 S = SPI
 C = I2C

DACs

DAC8xxx (Precision DACs)
 DAC7xxx
 DAC3xxx (High-speed DACs)
 DAC5xxx



Amplifier Portfolio

	Value Line	Precision	High Speed	Power Amplifiers	Audio/Video
	Industry Standard	Offset Voltage $V_{os} < 500 \mu V$ Low Temperature Drift $< 1 \mu V/^{\circ}C$	Gain Bandwidth Product and Equivalents $> 50 \text{ MHz}$	$> 50 \text{ mA}$	Application-Specific Solutions
Product Highlights	OPA x141 OPA x171 OPA x314 OPA x322 OPA x330 LPV 521 LMV 551 LMV 651 LMV 841	OPA x140 OPA x188 OPA x209 OPA x320 OPA x320 LMP 7721 LMP 7731	OPA 835/6 OPA 2835/6 THS 4509 THS 4521/2/4 THS 770006 LMH 6521 LMH 6554 LMH 6629	OPA 454 OPA 464 OPA 548 OPA 552	OPA 1632/ OPA 161x OPA 164x/ OPA 160x OPA 165x OPA 166x LME 49990
	\$0.50 to \$49	\$0.55 to \$12	\$1.35 to \$6.60	\$1.75 to \$40	\$0.75 to \$3.30
Functions/Features	Price/performance, high voltage, low voltage, ultra-small package	Ultra-low offset, low input bias current, low noise, high/low voltage, zero-drift	Wide bandwidth $\geq 50 \text{ MHz}$, increased dynamic range, low noise and low distortion, high-slew rate, low power, high voltage, digital variable gain	High output current	FET/bipolar inputs, fully-differential architecture (OPA 1632), low noise and distortion, low-power consumption, wide bandwidth, rail-to-rail output
Application	Smoke detector, industrial, general purpose	Industrial process control, high-precision sensing, test and measurement, data acquisition	Industrial process control, test and measurement, video, A/D buffering, data acquisition systems, high-speed communications, high-speed signal conditioning	Test equipment, avalanche photodiode biasing, piezoelectric cells, transducer driver, servo driver, audio amplifier, high-voltage current sources, high-voltage regulator	Line drivers, line receiver, microphone/audio preamps, general purpose audio, volume control

	Low Iq (Iq in μA)	Low Noise (V_n in $nV/\sqrt{Hz}$)	Bandwidth (GBW in MHz)	Voltage Range (V_S in V)
Value Line	Down to 0.002 mA OPA 349	Down to 7.5 $nV/\sqrt{Hz}$ OPA 377	Up to 20 MHz and 8.5 $nV/\sqrt{Hz}$ @1KHz OPA 322	Up to 36 V OPA 171 (2.7 V-36 V)
Precision	Down to 400 nA LPV 521 (400 nA)	Down to 1.1 $nV/\sqrt{Hz}$ OPA 211 (1.1 $nV/\sqrt{Hz}$)	Up to 45 MHz OPA 211	Up to 48 V OPA 209
High Speed	Down to 250 $\mu A/ch$ (250 μA) THS 4521/2/4 (1.25 mA) OPA 2889 (0.46 mA)	Down to 0.69 $nV/\sqrt{Hz}$ OPA 847 (0.85 $nV/\sqrt{Hz}$) LMH 6629 (0.69 $nV/\sqrt{Hz}$)	Up to 2.8 GHz OPA 695 (1.4 GHz) THS 4509 (1.9 GHz) LMH 6654 (2.8 GHz) THS 77006 (2.4 GHz)	Up to $\pm 15 \text{ V}$ THS 3095
Power Amplifier	Down to 6 mA OPA 567	Down to 12 $nV/\sqrt{Hz}$ OPA 567	Up to 17 MHz OPA 564	Up to 60 V OPA 549

Amplifier Nomenclature

Channels	Amplifier class	Amplifier class	Amplifier class
No character = Single 2 = Dual 3 = Triple 4 = Quad	TLV = Low supply voltage TLC = 5-V CMOS TLE = Wide supply voltage	THS = High speed	LMC = CMOS LMV = Low voltage LMP = Low power LME = Audio LMH = High speed LPV = Ultra-low power
OPA x163	TLV 278x	THS xy01	
Base model 100s = FET 200s = Bipolar 300s = CMOS (5.5 V) 400s = High voltage ($>40 \text{ V}$) 500s = High power ($>200 \text{ mA}$) 600s = High speed ($>50 \text{ MHz}$) 700s = CMOS (12 V) 800s = High speed ($>50 \text{ MHz}$)	Channels and shutdown options 0 = Single with shutdown 1 = Single 2 = Dual 3 = Dual with shutdown 4 = Quad 5 = Quad with shutdown	Amplifier type 30 = Current feedback 31 = Current feedback 40 = Voltage feedback 41 = Fully differential 42 = Voltage feedback 43 = Fast voltage feedback 45 = Fully differential 46 = Transimpedance 60 = Line receiver 61 = Line driver 73 = Programmable	

Interface Portfolio

	RS-485	CAN	Ethernet	USB	Digital isolation	UART	SDI	SERDES
Product	SN65HVD	HVD10xx HVD2xx	TLK1xx DP83xx	TUSB	ISO	TL16Cxxx	LMHxxx	DS9xyy TLKxxxx SN65LVDS
	\$0.75 to \$5.10	\$0.40 to \$1.50	\$1.20 to \$10	\$0.55 to \$4.75	\$0.85 to \$3.30	\$1.30 to \$8.85	\$2 to \$26	\$2 to \$45
Functions/Features	3.3-V and 5-V RS-485 half and full duplex 70-V bus protection 16-kV ESD protection Non-isolated and isolated (560V/4kVpk) versions of 3.3 and 5V RS-485 High ESD protection versions with built in TVS diodes	3.3-V and 5-V CAN transceiver Bus fault protection -27 V/40 V and ± 36 V	Robust industrial Ethernet PHY 10/100/1000 Mb Timing parameters for real-time Ethernet RMII/MII and single/dual options available Industrial temp range	Complete USB portfolio Host/OTG, peripheral, transceivers, hub USB 2.0, 3.0 support	Capacitive digital couplers replacing opto-couplers Superior lifetime reliability Speed up to 150 Mbps IEC 60747-5-2 Basic/ Insulation and UL1577 Integrated or stand alone transformer driver	UART expanders with and without FIFO 1 UART up to 4 UARTs Support for down to 1.8V processor I/Os	Professional Broadcast Video Solutions for SD/HD/3G Equalizers with 200m cable reach at 3bps and 155mW First configurable I/O over BNC with integrated return loss network	Industrial and Automotive SERDES with I2C back channel up to 3Gbps Communication SERDES for Gigabit and 10G Ethernet. LVDS SERDES for Display drive up to 100MHz pixel clock
Standard	ProfiBus rs-485 rs-422	DeviceNet CANopen	ProfiNET EtherCAT Sercos 3	Super Speed USB Certified	VDE UL TÜV CSA		SMPTE	CameraLink Flatlink 1G and 10G Ethernet

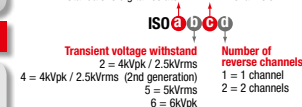
Special functionality of the interface portfolio

- 1394
- LVDS/M-LVDS
- HDMI/Flatlink
- PCI/PCIe
- Crosspoint

Interface Nomenclature

Digital Isolators

- Integrated function**
- 1 = Integrated standard interfaces
 - 2 = Integrated standard interfaces
 - 5 = Isolated gate driver
 - 7 = Standalone digital isolator
- Total number of channels**
- 1 = 1 channel
 - 2 = 2 channels
 - 3 = 3 channels
 - 4 = 4 channels



RS-485

- Operation temperature range**
- 5 = -55 to 125°C
 - 6 = -40 to 85°C
 - 7 = 0 to 70°C

SN65HVD00xx

- RS-485 Function**
- 08 = 3.3 to 5V RS-485
 - 1c = 3.3V Half-duplex
 - 2c = 5V Half-duplex
 - 3c = 3.3V Full-duplex
 - 17 = 70V Bus-pin protection
 - 30 = 5V economical and small package

CAN

- Operation temperature range**
- 5 = -55 to 125°C
 - 6 = -40 to 85°C
 - 7 = 0 to 70°C

SN65HVD00xx

- Function**
- 10 = Industry standard CAN
 - 23 = 3.3V CAN
 - 25 = 5V CAN

USB

- Function**
- 1 = Discrete physical layer
 - 2 = Hub controller fullspeed
 - 3 = Peripheral fullspeed
 - 6 = Peripheral or host controller highspeed
 - 7 = Host controller
 - 8 = Hub controller superspeed
 - 9 = Peripheral superspeed

TUSB00xx

- Speed**
- 1 = USB 2.0 Full speed
 - 2 = USB 2.0 High speed
 - 3 = USB 3.0 Super speed

UART

- FIFO**
- 4 = No FIFO
 - 5 = 16kB
 - 6 = 64kB

TL16C05D

- Number of Channels**
- 0 = 1 channel
 - 1 = 1 channel
 - 2 = 2 channels
 - 4 = 4 channels



Motor Drive Portfolio

	Motor Drivers			Solenoid/Relay or unipolar Stepper Drivers
	Brushed DC	Stepper	3-Phase	Quad low-side switch
	2.7V to 52.5V up to 24A	2.7V to 52.5V up to 12A	8V to 60V Integrated FETs < 13A Pre-Drivers support >60A	8.2 to 60V up to 1.5A
	↓	↓	↓	↓
	DRV880x DRV881x DRV883x DRV884x DRV84x2	DRV881x DRV882x DRV883x DRV884x DRV84x2	DRV8301/2 DRV83x2	DRV8803 DRV8804 DRV8805
Product Highlights	\$0.85 to \$5.50	\$0.95 to \$5.50	\$2.50 to \$4.70	\$1.40
	Single, dual and quad H-bridge versions, inrush current limitation, slow, fast & mixed current decay modes	Single, dual and quad H-bridge versions, up to 32 u-steps indexer support, up to 256 u-steps and greater with external reference, slow, fast and mixed current decay modes	CBC inrush current protection, DRV8301/2 integrates DCDC converter and 2x current sense amplifier	Integrated free wheeling diodes, PWM or serial interface
	Office & POS printers, cash machines, gate and door controls, toys, valve actuators, textile machinery	Office & POS printers, cash machines, camera control, door locks, textile machinery, toys, valve actuators, positioning systems	E-bikes, power tools, pumps, industrial drives, medical drives	Unipolar stepper motors, textile machinery, industrial automation systems
Functions/Features				
Applications				

Motor Drive Nomenclature

DRV8xyz

Bridges
3 = Three half-bridges
4 = Four half-bridges
8 = One, two or four H-bridges

Advantages of the integrated DRV8x Motor Drivers:

- Robust solution, thanks to the integrated protection features (over-current, over-temp, under-voltage, cross-conduction, etc).
- Reduced development time, efforts and costs.
- Reduced PCB space and BOM.
- Different interfaces and levels of control loop integration.

Critical questions to choose the right DRV8x Motor Driver:

1. Which type of motor?
 - Brushed DC - Stepper - 3-Phase
2. Which voltage and current rating?
 - Motor Drivers with integrated MOSFETs go up to 60V and 24A.
 - Pre-Drivers for external MOSFETs can drive up to 60V and 60A.
3. What kind of interface / on-chip intelligence?
 - Generic PWM interface.
 - Easy to use Indexer, Serial or Phase/Enable interfaces with on-chip control intelligence.

Software and Development Tools

- Combined DRV and MCU development kits:
 - DRV8301-HC-C2-kit
 - DRV8412-C2-kit
 - DRV8312-C2-kit
 - DRV88xx plus MSP430 EVMs
- Application notes
- Motor Driver forum in E2E™



Clock Portfolio

	Clock distribution		Clock generator		Jitter-cleaners		Memory Clocks
	Without output dividers	With output dividers	Single-ended (LVCMOS)	Differential (LVDS, LVPECL, CML)	Integrated VCO	External VCXO	
Product highlights	CDCLVC11x CDCLVx12xx CDCLVPxxx	CDCE18005 CDCL1810 LMK01xxx	CDCE9xx	CDCM6100x CDC421Ax	CDCE6200x LMK03xxx LMK04xxx	CDCE72010 CDCM7005 LMK02xxx	SN74SSQx SN74SSTUx
	\$1.05 to \$8.20	\$6.00 to \$7.20	\$1.60 to \$2.35	\$4.20 to \$6.50	\$6.60 to \$12.50	\$7 to \$11	\$2.20 to \$6.20
Functions/Features	Fmax output <2 GHz Universal output RMS jitter 100 fs typ Output skew 10 ps	Fmax output <1.6 GHz Universal output RMS jitter <10fs typ Output skew 75 ps	Fmax <230 MHz Spread-spectrum option Output skew 60 ps	LVDS output <1.175 GHz LVPECL output <1.175 GHz Output skew 30 ps	Fmax <1.5 GHz Up to 5 D/10 single-ended outputs RMS jitter 112 ps typ Output skew 75 ps	Fmax <1536 MHz Up to 14 D/20 single-ended outputs RMS jitter <200fs typ Adjustable phase	-40° to +85°C options
Applications	Single-ended and differential clock buffering	Single-ended and differential clock divider	DSP, FPGA, MPU clock XO replacement	PCIe, Gigabit Ethernet XO replacement	ADC/DAC clocking, clock recovery	High-speed ADC/DAC clocking	DDR1, DDR2, DDR3 clocking
I/O	Up to 16 different outputs Input MUX	Max 10 single-ended outputs Built-in phase adjust	Standard low-frequency XTAL input	Standard low-frequency XTAL input	Three reference clock inputs Built-in EEPROM	Up to three reference clock inputs Built-in EEPROM	Spread-spectrum option Up to 60 outputs

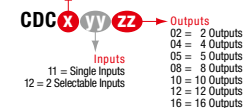
Clock Nomenclature

Clock distribution devices

LVC = with LVTTL or LVCMOS outputs (single-ended)
 LVP = with LVPECL outputs (differential)
 LVD = with LVDS outputs (differential)

Clock Generation or Jitter Cleaners

E = with EPROM
 L = Current Mode Logic
 M = without EPROM



LMK0xyyy

1 = 1st Generation
 2 = 2nd Generation
 3 = 3rd Generation
 4 = 4th Generation

Audio and Imaging Portfolio

Audio					
Battery Powered Applications			Line Powered Applications		
Low Power Speaker Amps		Low Power Converters (ADC/CODEC/DAC)	Headphone Amps and Line Drivers	High Performance Converters	Medium-High Power Amps and PWM Modulators
Product Highlights	TPA2015D1 TPA2025D1 LM49155 LM48411 TPA2011D1 LM48901	TLV320AIC3256 TLV320ADC3101 TLV320DAC3120 LM49350 LM49321 LMV1051	TPA6140 TPA6132 LM48824 LM4808 DRV632 DRV602	PCM3070 PCM5100 PCM1792A PCM4220	TAS5727 TAS5630 TPA3116 LM4781
	\$0.35 to \$2.10	\$1.35 to \$8.65	\$0.31 to \$2.45	\$0.95 to \$16.45	\$0.75 to \$7.95
	Class-AB/D up to 3W, boosted Class-D, battery tracking features, subsystems with high level of integration, spread-spectrum output	miniDSP with 3rd party algorithms, integrated Class-D amplifier, DirectPath HP amplifier, scalability (pin-to-pin options), 2Vrms output, integrated PLL	Class-AB, power savings through Class-G, 2Vrms outputs from single supply, high output power HP	miniDSP with 3rd party algorithms, integrated HP amplifier, 2Vrms output, integrated PLL, USB options	Up to 2x300W output power, closed/open loop architectures, analog, PWM or I2S inputs, audio processing capabilities, 8 channels PWM modulators
	Mobile phones, portable consumer electronics, home audio (e.g. docks)	Smart/mobile phones, portable consumer electronics, video conferencing systems	Mobile phones, televisions, set top boxes, docks	Video conferencing systems, audio Docks/HTIB/AVR systems, soundbars, pro-audio applications STB	Audio docks/HTIB/AVR systems, soundbars, televisions, STB
	Applications				

Audio Nomenclature

Audio Amplifier

TPA2... = Analog Input Low Power Amplifiers (<3.5W/ch)

TPA2100... = Analog Input, Low Power Amplifiers with Piezo speaker support

TPA3... = Analog Input Medium Power Amplifiers (6-50W/ch)

TPA6... = Analog Input HP Amps 24 bit

TAS2... = I2S Input Low Power Amplifiers (<3.5W/ch)

TAS50.../55... = PWM Modulators

TAS51.../53... = PWM Input, Open Loop High Power Amplifiers (15-200W/ch)

TAS56... = Analog/PWM Input, Closed Loop High Power Amplifiers (15-300W/ch)

TAS57... = 16 bit-18 bit, up to 10 MPS

LM4... = Analog Input Low Power Amplifiers (<3.5W/ch)

LM48.../49... = Analog Input, Low Power Amplifiers with Piezo speaker support

LM47.../38... = Analog Input Medium Power Amplifiers

Audio Converter

PCM... = High Performance Converters

TLV320ADC... = Low Power ADCs

TLV320AIC... = Low Power Codecs

TLV320DAC... = Low Power DACs

LM49... = Audio subsystem with integrated converters

Audio and Imaging Portfolio

Audio, Imaging and Sensing Solutions					
Product Highlights	Audio	Sensing		Touch Solutions	Imaging
	Audio Interfaces	Current Sense	Temperature Sense	Touch Screen & Haptics Controllers	Imaging AFE
	SRC4192 SRC4392 DIR9001 DIX9211 PGA2500	INA216 INA226 INA282 TMP512 LMP8480 LMP8646	TMP006 TMP103 TMP112 TMP512 LM57 LM94022	TSC2014 TSC2020 TSC3060 DRV8601 DRV8662	VSP7500 VSP8133 VSP8244 VSP5610 LM98620
	\$0.70 to \$11.45	\$0.35 to \$7.15	\$0.20 to \$3.95	\$1.25 to \$5.60	\$3.55 to \$27
Functions/Features	Sample rate converters, digital audio transceivers, microphone pre-amplifiers	Highest accuracy, zero drift architecture, low gain error, small size, wide-dynamic range, high integration	Low power high accuracy, IR sensor, small size, true beta correction, fan control/ HW monitor	Resistive/multi-touch resistive/capacitive touch, small size, low power, superior analog frontend, fast speed, high level of integration (Audio/Haptics), haptics drivers with integrated boost converter	High integration (timing generator, vertical drivers) low power, 12-16 bit, multichannel support, up to 65 MHz sampling
	Pro-Audio, soundbar, AVR, HTiB, audio dock	Current/voltage/power monitoring, consumer electronics, white goods, industrial	Consumer electronics, white goods, industrial	Consumer electronics, medical applications, white goods HMI, industrial HMI	Security cameras, machine surveillance, IPTV cams, digital cameras, consumer electronics

Audio, Sensing and Imaging Nomenclature

Current Sense

INA ...

Temperature Sense

TMP ...

LMxy

Touchscreen Controller

TSC ...

LM8300/8500

Haptics Driver

DRV86 .../DRV26 ...

LM48580, LM4570

Imaging AFE

VSP ...

LM98 ...

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