PRODUCT GUIDE
2008

NiPdAu
EEPROMs
• Serial to 256Kb
• Parallel to 512Kb

World's Best LED Drivers

Low Dropout Driver – LDD™
CAT4004
LDD™

100mA LDO in Thin SOT-23
Fast "Turn On" x 100μs
CAT6219

High Power Buck LED Driver
Transportation Lighting
General Lighting
Signage

Voltage Supervisors with Embedded Memory

16-Channel, Constant Current LED Driver
CAT4016

Popular Digital Potentiometer
Now in 3mm x 3mm TDFN
DPP™

Low-Noise, Space-Saving 10-LED Driver

16-Bit I²C Bus Expander
CAT9555

CATALYST
SEMICONDUCTOR, INC.
BEYOND MEMORY™

Balancing System Performance and Board Costs

CATALYST TAKES YOU BEYOND MEMORY

CATALYST
SEMICONDUCTOR, INC.
BEYOND MEMORY™

LEADING-EDGE PRODUCTS
Rapidly growing Analog and Mixed Signal product lines.

BROAD LINE OF EEPROMs
Serial and Parallel.

AWARD-WINNING PRODUCTS
Quad-Mode™ LED Drivers.

PROVEN HIGH VOLUME
Catalyst delivers over 150 million ICs every quarter.[1]

WORLD-CLASS QUALITY
ISO 9001:2000 certified.

Smarter. Smaller. Lower power. Lower cost.

Today's designers need every edge. From consumer applications, to communications, automotive instrumentation, industrial equipment and LCD displays, Catalyst can make the difference. Catalyst goes beyond memory – to deliver the power of analog, mixed signal and programmable memory. Our commitment is to help designers balance system performance and board costs via our proven, high-volume, cost-effective global technology development and manufacturing processes.

We offer a rapidly growing portfolio of analog, mixed signal and non-volatile memory ICs, many of which incorporate our Quantum Charge Programmable™ technology to deliver Adaptive Analog™ products, which offer a new level of flexibility, lower power and smaller die size.

Our strategy combines a fabless business model with in-house design centers in North America and Europe to deliver the high performance, low cost and fast time-to-market required for success in today's global electronics markets.

Catalyst is a financially sound, publicly traded[2] company, with a proven history of delivering high quality products in high volume for over 20 years.

Notes:
1   Approximate quarterly average, as of FY Q 1 2008.
2   Catalyst Semiconductor is traded on the NASDAQ equities exchange. The trading symbol is: CATS.

Balancing System Performance and Board Costs

Catalyst Semiconductor, Inc.

2008 Product Guide Contents

HALOGEN FREE
LEAD FREE™
RoHS Compliance

CATALYST
SEMICONDUCTOR, INC.
BEYOND MEMORY™

LED DRIVERS

CAT3643 / CAT3644   Quad-Mode™ LED Drivers Offer 10% Higher Efficiency

QUAD-MODE™

The CAT3643 and CAT3644 offer industry-leading efficiency and charge pump simplicity without adding cost, components or board space.

FEATURES

✓ Fourth charge pump mode achieves 1.33x boost mode with only 2 flying capacitors
✓ Power efficiency 92% maximum, lifetime average efficiency 84%
✓ CAT3643 drives up to 3 LEDs (32mA each)
✓ CAT3644 drives up to 4 LEDs (32mA each)
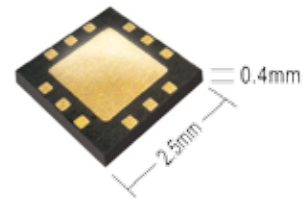✓ 1-wire EZDim™ LED current programming
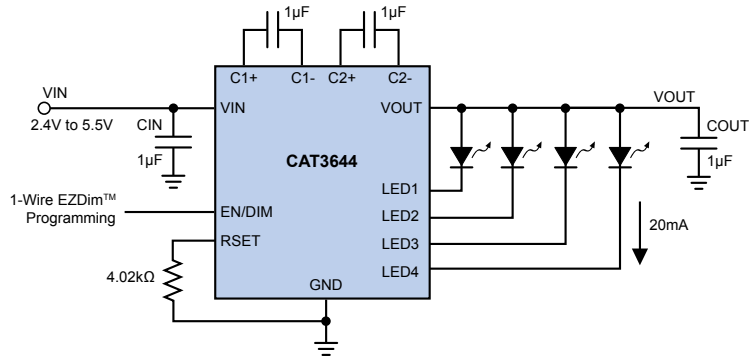
PACKAGE INFORMATION

- CAT3643: Ultra-small XQFN 12-Pad (2.5mm x 2.5mm) (0.4mm height)
  TDFN 12-Pad (3mm x 3mm)
  TQFN 16-Pad (3mm x 3mm)
- CAT3644: TQFN 16-Pad (3mm x 3mm)

APPLICATIONS

- LCD display backlights
- Color RGB LEDs
- Handheld devices
- GPS systems
- Thermostat controllers

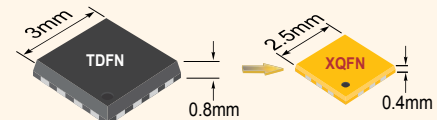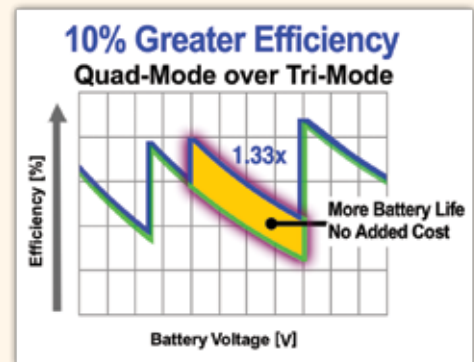**Ultra-small, 2.5 x 2.5mm, low-profile (0.4mm) 12-Pad XQFN package**

World's Best Charge Pump Architecture Delivers 10% More Efficiency

QUAD-MODE™

Catalyst Semiconductor's innovative, patented Quad-Mode™ charge pump switching architecture delivers high efficiency levels normally associated with inductor-based LED drivers, while eliminating the high-profile inductors and unwanted EMI.

Most charge pump LED drivers today offer three modes of operation corresponding to the ratio of the output voltage to the input voltage: 1x, 1.5x and 2x. Catalyst's Quad-Mode architecture incorporates a fourth mode of operation, 1.33x, without the need for the additional capacitor required by all existing four-mode charge pumps. The 1.33x fractional operating mode also reduces the input switching currents seen at the battery, minimizing the overall supply noise – a critical parameter in portable devices such as cell phones.

Catalyst Quad-Mode LED drivers deliver 10% greater efficiency compared to traditional charge pumps, extending battery life with no added cost or components.

LED Drivers

DC/DC Converters

Linear Voltage Regulators

Bus Products

Voltage Supervisors

Digital Potentiometers

Serial EEPROMs

Parallel EEPROMs

FLASH Memories

NVRAM

LED DRIVERS

Charge Pump / Parallel Configuration
Fractional Charge Pumps with Regulated Output Current

| Part Number	V_{IN} [V]	LEDs	Total I_{OUT} (max) [mA]	RSET Control	Dimming Interface	Pump Modes	Packages (size in mm)
CAT3603	2.7 - 5.5	3	90	Yes	PWM	1x / 1.5x	TDFN–12 (3 x 3)
CAT3604	2.7 - 5.5	4	120	Yes	PWM	1x / 1.5x	TQFN–16 (4 x 4)
CAT3606	2.7 - 5.5	6	180	Yes	PWM	1x / 1.5x	TQFN–16 (4 x 4)
CAT3612	2.7 - 5.5	2	300	–	1-Wire (32 levels)	1x / 1.5x	TDFN–12 (3 x 3)
CAT3614	2.7 - 5.5	4	124	–	1-Wire (32 levels)	1x / 1.5x	TDFN–12 (3 x 3)
CAT3616	2.7 - 5.5	6	186	–	1-Wire (32 levels)	1x / 1.5x	TQFN–16 (4 x 4)
CAT3626	2.7 - 5.5	6	192	–	I²C™	1x / 1.5x	TQFN–16 (4 x 4)
CAT3604V	2.7 - 5.5	4	120	Yes	PWM	1x / 1.33x / 1.5x / 2x	TQFN–16 (4 x 4)
CAT3636	2.2 - 5.5	6	192	–	1-Wire (32 levels)	1x / 1.33x / 1.5x / 2x	TQFN–16 (3 x 3)
CAT3637	2.2 - 5.5	6	192	–	1-Wire (16 levels)	1x / 1.33x / 1.5x / 2x	TQFN–16 (3 x 3)
CAT3643	2.2 - 5.5	3	90	Yes	1-Wire (6 levels)	1x / 1.33x / 1.5x / 2x	XQFN–12 (2.5 x 2.5) (0.4 height) TDFN–12 (3 x 3), TQFN–16 (3 x 3)
CAT3644	2.2 - 5.5	4	100	Yes	1-Wire (6 levels)	1x / 1.33x / 1.5x / 2x	TQFN–16 (3 x 3)
CAT3647	2.2 - 5.5	3	100	Yes	1-Wire (32 levels)	1x / 1.33x / 1.5x / 2x	TQFN–16 (3 x 3)
CAT3648	2.2 - 5.5	4	100	Yes	1-Wire (32 levels)	1x / 1.33x / 1.5x / 2x	TQFN–16 (3 x 3)

QUAD-MODE™

Inductive Boost / Series Configuration
Low Noise Step-Up LED Drivers

Part Number	V_{IN} [V]	LEDs	V_{FB}, V_{RSET} [mV]	I_{SW-LIM} [mA]	V_{OUT} (max) [V]	Dimming Interface	Packages (size in mm)
CAT37	2.0 - 5.5	4	95	350	20	PWM	TSOT23–5
CAT4137	2.0 - 5.5	5	300	350	24	PWM	TSOT23–5
CAT4237	2.0 - 5.5	8	300	450	34	PWM	TSOT23–5
CAT4238	2.0 - 5.5	10	300	450	38	PWM	TSOT23–5
CAT4139	2.0 - 5.5	5	300	850	24	PWM	TSOT23–5
CAT4240	2.0 - 5.5	10	300	850	38	PWM	TSOT23–5
CAT32	2.0 - 5.5	4	95	350	20	PWM	TSOT23–6
CAT4134	2.0 - 5.5	2 x 3	1200	2000	16	PWM	TDFN–12 (3 x 3)

1-Wire EZDim™ LED/Flash Interface Simplifies Programming

For programming simplicity, Catalyst's EZDim™ interface helps reduce system complexity by providing full programmability of flash and LED functions via one wire. This allows users to enable/disable outputs, manage flash brightness level, and control LED dimming all from a single I/O on the MCU.
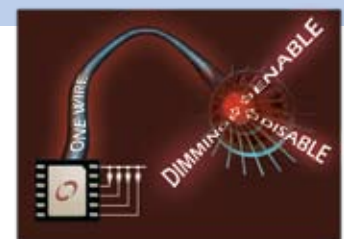
R_{SET} Minimizes Programming Overhead

Catalyst offers an R_{SET} function for a number of LED drivers to minimize programming overhead by allowing the maximum full-scale LED brightness level at power-on to be set via a single external resistor.

LED DRIVERS

Linear LED Drivers
Serial Interface Display Drivers

| Part Number	V_{IN} [V]	LEDs	Total I_{OUT} (max) [mA]	V_{OUT} (max) [V]	Dimming Interface	Packages
CAT310	5.5	10	500	40	PWM	SOIC–20
CAT4004	2.0 - 5.5	4	100	-	1-Wire	TDFN–8 (2 x 3mm)
CAT4008	3.0 - 5.5	8	800	-	4-Wire	SOIC–16, TSSOP–16
CAT4016	3.0 - 5.5	16	1600	-	4-Wire	QSOP–24, SOIC-24, TQFN–24 (4 x 4mm), TSSOP–24

Inductive Buck Series Configuration
High-Voltage, Step-Down Converter with Regulated Current Control

Part Number	V_{IN} [V]	LEDs	Total I_{OUT} (max) [mA]	Dimming Interface	R_{SET} Control	Package
CAT4201	7 - 24	7	350	PWM	Yes	TSOT23–5

CAT4201   High-Power Buck LED Driver – Smaller, More Efficient Alternative to Linear Drivers

The CAT4201 inductive buck converter offers a simpler and dramatically smaller alternative to linear regulators for driving high-brightness LEDs in step-down applications, including automotive and general lighting.

FEATURES

- ✓ Drives up to 7 LEDs in series (24V systems)
- ✓ Regulates LED currents up to 350mA
- ✓ 12V to 24V system compatible
- ✓ Handles transients up to 40V
- ✓ 94% power efficiency
- ✓ Eliminates need for dedicated heat sink
- ✓ Single Pin Control and Dimming functions
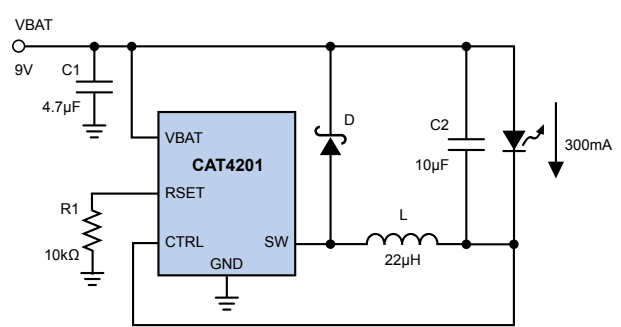
PACKAGE INFORMATION

- Tiny, space-saving TSOT-23, 5-Lead

APPLICATIONS

- Transportation
  - Automotive illumination lighting
    - Turn signal, brake, interior lights
  - Aircraft
    - Interior lighting
- General Lighting
  - Light bulb replacement
  - Gaming lights
  - Decorative lighting
- Signage
  - Roadway signage

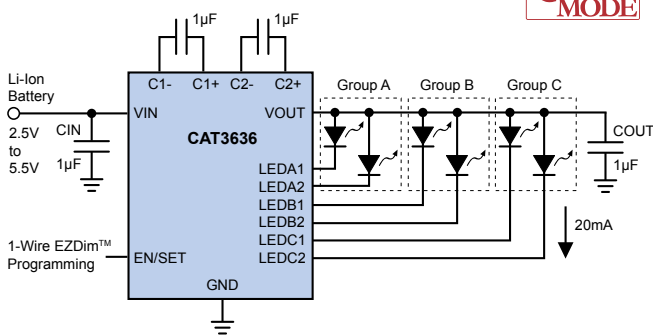# LED DRIVERS: BACKLIGHTING / ILLUMINATION / BILLBOARDS
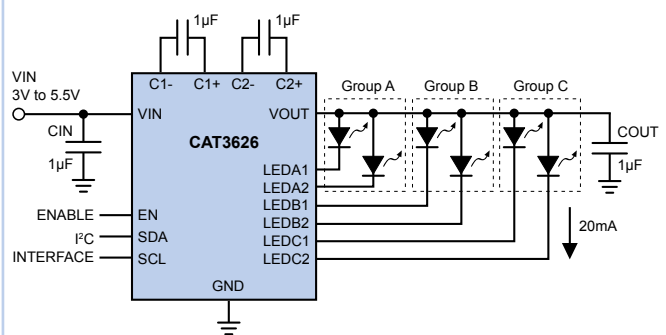
CAT4238 High Voltage 10 LED Boost Converter
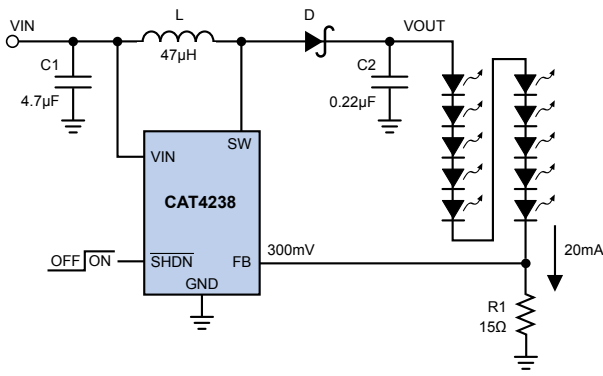
CAT4240 High-Voltage, High-Current Boost LED Driver
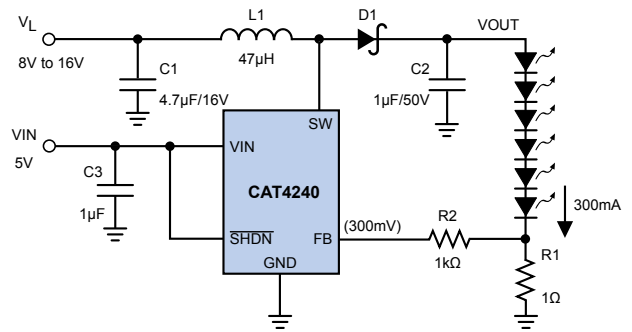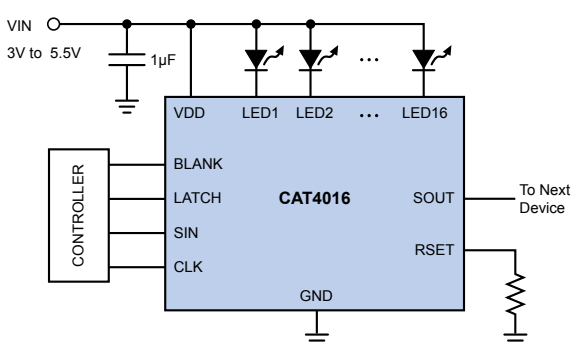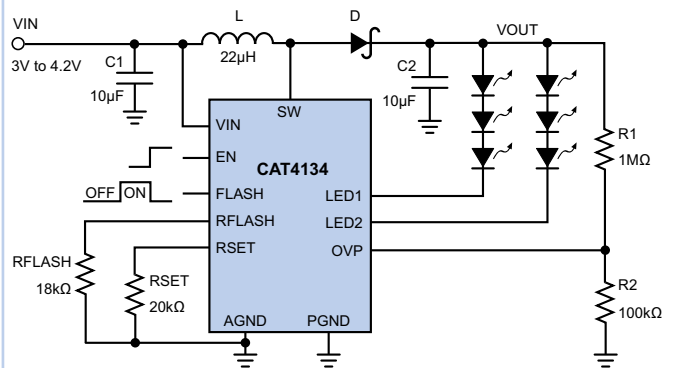

CAT3636 6-Channel Quad-Mode™ Fractional LED Driver

CAT3626 6-Channel LED Driver with I²C™ Interface

CAT4016 16-Channel Constant Current LED Driver

CAT4134 500mA Flash/Movie Mode LED Driver

DC-DC CONVERTERS

DC-DC Converters Charge Pumps
Low Noise Regulated Charge Pumps

Part Number	V_{IN} [V]	Frequency (typ) [MHz]	Total I_{OUT} (max) [mA]	R_{OUT} (typical) [Ω]	Pump Modes	V_{OUT} (max) [V]	Packages
CAT3200	2.7 - 4.5	2	100	10	2x	6 (adjustable)	MSOP−8
CAT3200-5	2.7 - 4.5	2	100	10	2x	5 (fixed)	TSOT23−6

Charge Pump Doublers and Inverters

Part Number	V_{IN} [V]	Frequency (typ) [kHz]	Total I_{OUT} (max) [mA]	R_{OUT} (typical) [Ω]	Pump Modes	V_{OUT} (max) [V]	Packages
CAT660	1.5 - 5.5	80	100	4	+2x, -1x	11	PDIP−8, SOIC−8
CAT661	1.5 - 5.5	135	100	4	+2x, -1x	11	PDIP−8, SOIC−8

LINEAR VOLTAGE REGULATORS

Shunt Regulator Regulator

Part Number	Type	Reference Voltage [V]	Voltage Across Temperature[1] [V]		V_{IN} [V]	Initial Accuracy	Package
			Min	Max			
CAT102	Shunt	0.6	0.588	0.612	2.2 to 18	±1%	TSOT23−5

Low Dropout Regulators

Part Number	No. of Outputs	Type	I_{OUT} [mA]	V_{OUT} [V]	V_{IN} [V]	$V_{DROPOUT}$ [mV]	Packages (size in mm)
CAT6217	1	LDO	150	1.5, 1.8, 2.5, 2.8, 2.85, 3.3	2.3 to 5.5	150	TSOT23−5
CAT6218	1	LDO	300	1.8, 2.4, 2.7, 2.85, 3.0, 3.2, 3.3	2.3 to 5.5	300	TSOT23−5
CAT6219	1	LDO	500	1.8, 2.85, 3.3	2.3 to 5.5	500	TSOT23−5, TDFN-6
CAT6221	2	LDO	300, 300	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3	2.3 to 5.5	300	TSOT23−6 (0.8 height)

Note:

1 Operating temperature range of -40ºC to +85ºC with junction temperatures from -40ºC to +105ºC.
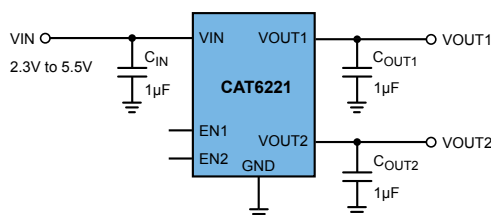
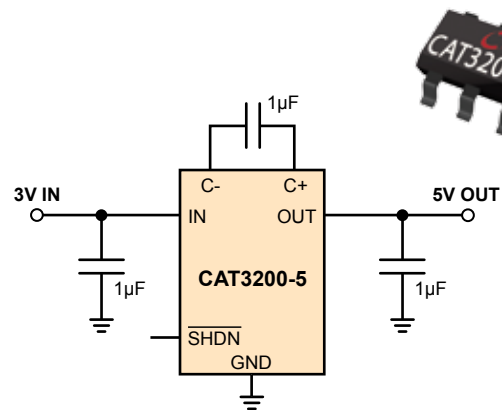## CAT6221   Two LDO Regulators in Space-Saving TSOT-23

FEATURES

- ✓ Two outputs with guaranteed 300mA peak output current
- ✓ Low dropout voltages of 210mV typical at 300mA
- ✓ Each LDO optimized for low noise and high crosstalk isolation
- ✓ 1% initial accuracy

PACKAGE INFORMATION

- TSOT-23, 6-Lead (0.8mm height)

## CAT3200-5   Regulated 5V Charge Pump LED Driver

BUS PRODUCTS

CAT9554	8-bit I²C™ and SMBus I/O Port Expander with Interrupt
CAT9555	16-bit I²C™ and SMBus I/O Port Expander with Interrupt

FEATURES

- ✓ 2.3V to 5.5V operation
- ✓ 400kHz I²C bus compatible
- ✓ 5V tolerant I/Os
- ✓ High drive capability
- ✓ Drive LEDs by sinking 25mA current
- ✓ Active low interrupt output
- ✓ Individual I/O configuration
- ✓ Cascadable up to 8 devices
- ✓ Internal power-on reset
- ✓ Noise filter on SDA/SCL inputs
- ✓ Industrial temperature range

PACKAGE INFORMATION

- • SOIC 16-Lead (CAT9554), SOIC 24-Lead (CAT9555)
- • TSSOP 16-Lead (CAT9554), TSSOP 24-Lead (CAT9555)
- • TQFN 16-Pad (4 x 4mm) (CAT9554), TQFN 24-Pad (4 x 4mm) (CAT9555)
- • Pin compatible with PCA9554 / 9554A and PCA9555
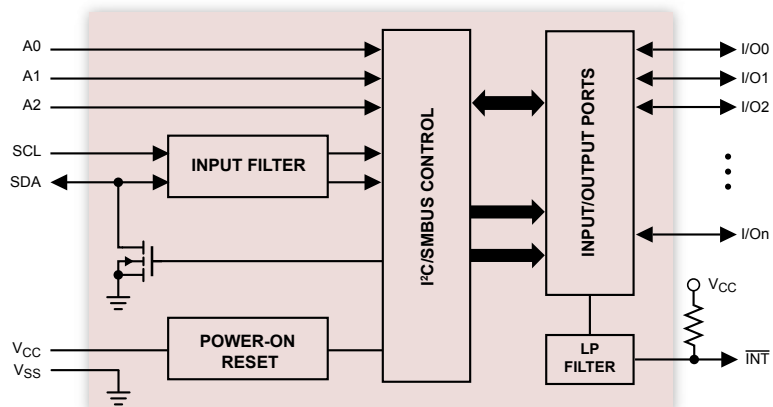
Notes:
All I/Os are set to INPUTs at RESET.
n = 7 for CAT9554 / CAT9554A
n = 15 for CAT9555

Catalyst Semiconductor is licensed by Philips Corporation to carry the I²C Bus Protocol.

Bus Products

| Part Number	I/Os	Cascadable	Operating Voltage [V]	$\overline{INT}$	Internal I/O Pullups	LED Blink / PWM	Packages (size in mm)
CAT9534	8 GPIO	8 Slave ID Addresses	2.3 to 5.5	✓		NA	SOIC–16[1], TSSOP–16, TQFN–16 (4 x 4)
CAT9554	8 GPIO	8 Slave ID Addresses	2.3 to 5.5	✓	✓	NA	SOIC–16[1], TSSOP–16, TQFN–16 (4 x 4)
CAT9554A	8 GPIO	8 Slave ID Addresses	2.3 to 5.5	✓	✓	NA	SOIC–16[1], TSSOP–16, TQFN–16 (4 x 4)
CAT9532	16 LED outputs	8 Slave ID Addresses	2.3 to 5.5			✓	SOIC–24, TSSOP–24, TQFN–24 (4 x 4)
CAT9552	16 LED outputs	8 Slave ID Addresses	2.3 to 5.5			✓	SOIC–24, TSSOP–24, TQFN–24 (4 x 4)
CAT9555	16 GPIO	8 Slave ID Addresses	2.3 to 5.5	✓	✓	NA	SOIC–24, TSSOP–24, TQFN–24 (4 x 4)

Note:
1 300mil wide

VOLTAGE SUPERVISORS

CAT130xx, CAT140xx, CAT150xx   Voltage Supervisors with Broadest Selection of On-Chip EEPROM

FEATURES

- ✓ Combined 1 to 16-kbit EEPROM densities
- ✓ Seven threshold voltage options: 4.63V, 4.38V, 4.00V, 3.08V, 2.93V, 2.63V, 2.32V
- ✓ Active high or low reset
- ✓ Valid reset guaranteed at $V_{CC} = 1V$
- ✓ Supported interfaces: Microwire, I²C™, SPI™

PACKAGE INFORMATION

- • SOIC 8-Lead

CAT130xx   **CAT140xx**   **CAT150xx**
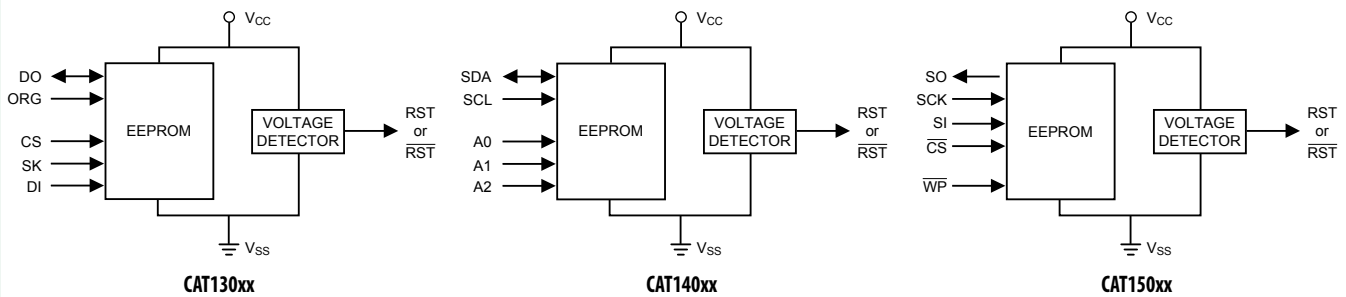
Voltage Supervisors with EEPROM Memory

Part Number	Memory Interface[1]	Density	Reset Low	Reset High	Typical Reset Width	Write Protect	Manual Reset	Watchdog Timer Input	Power Fail Voltage	Packages (size in mm)
CAT1021	I²C	2 Kbits	✓	✓	200ms	✓	✓	SDA		PDIP–8, MSOP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 3)
CAT1022	I²C	2 Kbits	✓		200ms		✓	SDA		PDIP–8, MSOP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 3)
CAT1023	I²C	2 Kbits	✓	✓	200ms		✓	WDI		PDIP–8, MSOP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 3)
CAT1024	I²C	2 Kbits	✓		200ms		✓			PDIP–8, MSOP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 3)
CAT1025	I²C	2 Kbits	✓	✓	200ms	✓	✓			PDIP–8, MSOP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 3)
CAT1026	I²C	2 Kbits	✓	✓	200ms		✓ [2]		1 Monitor @ 1.25 V	PDIP–8, MSOP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 3)
CAT1027	I²C	2 Kbits	✓		200ms		✓ [2]	WDI	1 Monitor @ 1.25 V	PDIP–8, MSOP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 3)
CAT1161	I²C	16 Kbits	✓	✓	200ms	✓	✓ [2]	SDA		PDIP–8, SOIC–8
CAT1162	I²C	16 Kbits	✓	✓	200ms	✓	✓ [2]			PDIP–8, SOIC–8
CAT1163	I²C	16 Kbits	✓	✓	200ms	✓	✓ [2]	WDI		PDIP–8, SOIC–8
CAT1320	I²C	32 Kbits	✓		200ms		✓ [2]			PDIP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 4.9)
CAT1321	I²C	32 Kbits		✓	200ms					PDIP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 4.9)
CAT1640	I²C	64 Kbits	✓		200ms		✓ [2]			PDIP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 4.9)
CAT1641	I²C	64 Kbits		✓	200ms					PDIP–8, SOIC–8, TSSOP–8, TDFN–8 (3 x 4.9)
CAT130xx	µ-wire	1, 4, 8, 16 Kbits	✓		240ms					SOIC–8
CAT140xx	I²C	2, 4, 8, 16 Kbits	✓		240ms					SOIC–8
CAT150xx	SPI	2, 4, 8, 16 Kbits	✓		240ms					SOIC–8

Broadest Selection of Memory

Notes:
1 I²C™ is a trademark of Philips Corporation. Catalyst Semiconductor is licensed by Philips Corporation to carry the I²C Bus Protocol.
   SPI is a trademark of Motorola, Inc.
2 RESET pin can be used as an input for Push-Button Manual Reset.

VOLTAGE SUPERVISORS

Voltage Supervisors

Part Number	No. of Voltage Monitors	Nominal Threshold Voltage [V]													Reset			Manual Reset	Watchdog Timer	Power Fail Voltage	Packages
		4.63	4.38	4.0	3.2	3.08	2.93	2.88	2.7	2.63	2.55	2.32	2.19	1.68	Low	High	Open Drain				
CAT705	2	✓													✓			✓	✓	1 Monitor @ 1.25 V	SOIC–8
CAT706	2		✓												✓	✓		✓		1 Monitor @ 1.25 V	SOIC–8
CAT707	2	✓													✓			✓	✓	1 Monitor @ 1.25 V	SOIC–8
CAT708	2		✓												✓	✓		✓		1 Monitor @ 1.25 V	SOIC–8
CAT803	1	L	M	J		T	S			R		Z			✓		✓				SC70–3, SOT23–3
CAT808N[1]	1				✓				✓						✓		✓				TSOT23–5
CAT809	1	L	M	J		T	S			R		Z			✓						SC70–3, SOT23–3
CAT810	1	L	M	J		T	S			R		Z				✓					SC70–3, SOT23–3
CAT811	1	L	M	J		T	S			R		Z			✓			✓			SOT143–4
CAT812	1	L	M	J		T	S			R		Z				✓		✓			SOT143–4
CAT813	2	✓														✓		✓	✓	1 Monitor @ 1.25 V	SOIC–8
CAT823	1	L	M			T	S			R		Z	Y		✓			✓	✓		TSOT23–5, SC70–5
CAT824	1	L	M			T	S			R		Z	Y		✓	✓			✓		TSOT23–5, SC70–5
CAT825	1	L	M			T	S			R		Z	Y		✓	✓		✓			TSOT23–5, SC70–5
CAT853	1		M			T	S								✓		✓				SOT23–3
CAT859	1		M			T	S								✓						SOT23–3
CAT863	1		M			T	S								✓		✓				SOT23–3
CAT869	1		M			T	S								✓						SOT23–3
CAT882	3	✓				✓	✓	✓				✓		✓	✓		✓	✓		1 Monitor @ 0.6 V	MSOP–8, SOIC–8
CAT883	3	✓				✓	✓	✓				✓		✓	✓		✓	✓		1 Monitor @ 0.6 V	MSOP–8, SOIC–8
CAT884	4														✓		✓	✓		4 Monitors @ 0.6 V	MSOP–8, SOIC–8
CAT885	5	✓				✓	✓	✓				✓		✓	✓		✓	✓		3 Monitors @ 0.6 V	MSOP–8, SOIC–8
CAT1232LP	1	✓	✓												✓	✓		✓	✓		PDIP–8, MSOP–8, SOIC–8, SOIC–16
CAT1832	1							✓		✓					✓	✓		✓	✓		PDIP–8, MSOP–8, SOIC–8

Note:

1 Voltage detector (no delay).

LED Drivers

DC/DC Converters

Linear Voltage Regulators

Bus Products

Voltage Supervisors

Digital Potentiometers

Serial EEPROMS

Parallel EEPROMS

FLASH Memories
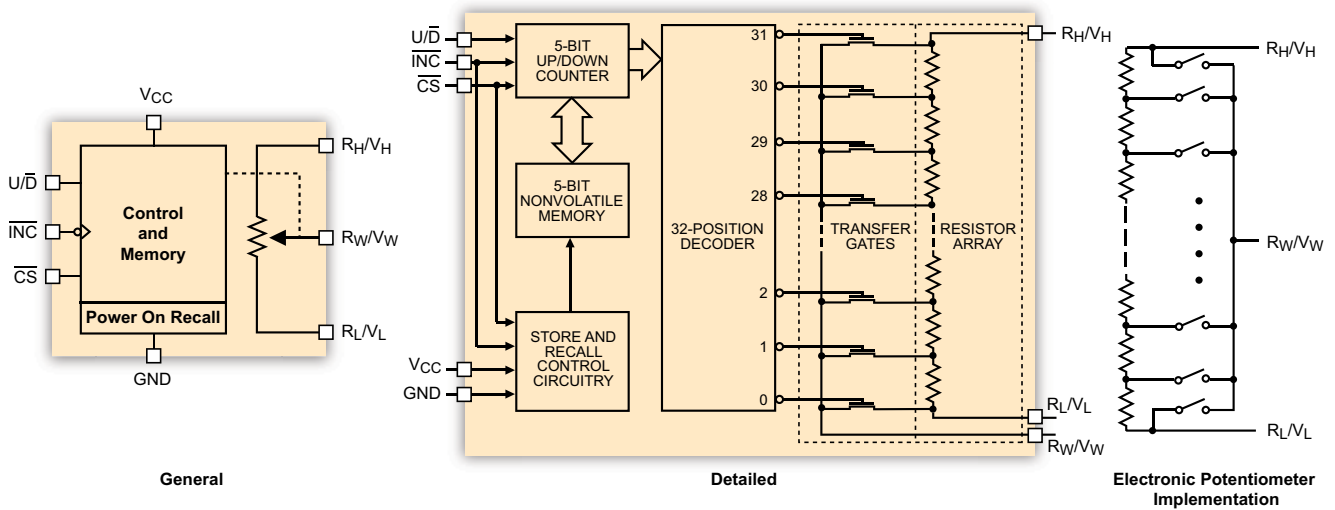
NVRAM

DIGITALLY PROGRAMMABLE POTENTIOMETERS (DPP™)

CAT5114   32-Tap, Non-Volatile DPP™ in 2 x 2.5mm TDFN

FEATURES

- ✓ 32-position linear taper potentiometer
- ✓ Resistance values: 10kΩ, 50kΩ, 100kΩ
- ✓ Non-volatile EEPROM wiper storage
- ✓ Increment up/down serial interface
- ✓ Single supply operation: 2.5V – 6V
- ✓ Low standby current
- ✓ Can be used as three-terminal resistive divider, or two-terminal variable resistor

PACKAGE INFORMATION

- • TDFN 8-Pad (2 x 2.5mm)
- • TSSOP 8-Lead
- • SOIC 8-Lead
- • PDIP 8-Lead
- • MSOP 8-Lead

General

Detailed

Electronic Potentiometer Implementation

CAT5132   16V, 128 Tap DPP™ with 2-Wire Interface

FEATURES

- ✓ 128 resistor taps
- ✓ 2-wire (I²C™-like) interface
- ✓ Power supply: 2.7V to 5.5V
- ✓ Non-volatile memory storage for wiper settings
- ✓ Automatic wiper setting recall at power up

PACKAGE INFORMATION

- • MSOP 10-Lead
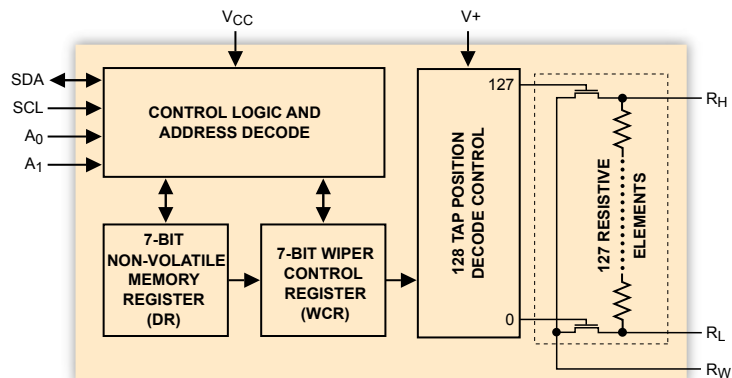
DIGITALLY PROGRAMMABLE POTENTIOMETERS (DPP™)

Digitally Programmable Potentiometers (DPP™)

Part Number	Number of Pots	Number of Taps	Resistance [kΩ]	Buffered Wiper	Interface	Volatile	Non-Volatile	Packages
CAT5120	1	16	10, 50, 100		INC/DEC	✓		SOT23–6, SC70–6
CAT5121	1	16	10, 50, 100		INC/DEC	✓		SOT23–6, SC70–6
CAT5122	1	16	10, 50, 100		INC/DEC	✓		SOT23–5, SC70–5
CAT5110	1	32	10, 50, 100		INC/DEC	✓		SOT23–6, SC70–6
CAT5112	1	32	10, 50, 100	✓	INC/DEC		✓	PDIP–8, SOIC–8, MSOP–8, TSSOP–8
CAT5114	1	32	10, 50, 100		INC/DEC		✓	PDIP–8, SOIC–8, MSOP–8, TDFN-8, TSSOP–8
CAT5115	1	32	10, 50, 100		INC/DEC	✓		PDIP–8, SOIC–8, MSOP–8, TSSOP–8
CAT5118	1	32	10, 50, 100		INC/DEC	✓		SOT23–5, SC70–5
CAT5119	1	32	10, 50, 100		INC/DEC	✓		SOT23–6, SC70–6
CAT5123	1	32	10, 50, 100		INC/DEC	✓		SOT23–5
CAT5124	1	32	10, 50, 100		INC/DEC	✓		SOT23–6
CAT5125	1	32	10, 50, 100		INC/DEC	✓		SOT23–6
CAT5126	1	32	10, 50, 100		2-Wire	One-Time Programmable		MSOP-8, TDFN-8
CAT5127	1	32	10, 50, 100		INC/DEC		✓	MSOP-8, TDFN-8
CAT5128	1	32	10, 50, 100		UP/DOWN	✓		SOT23–8
CAT5129	1	32	10, 50, 100		INC/DEC		✓	TSOT23-6
CAT5111	1	100	10, 50, 100	✓	INC/DEC		✓	PDIP–8, SOIC–8, MSOP–8, TSSOP–8
CAT5113	1	100	1, 10, 50, 100		INC/DEC		✓	PDIP–8, SOIC–8, MSOP–8, TSSOP–8
CAT5116	1	100	32 (Log Taper)		INC/DEC		✓	PDIP–8, SOIC–8, MSOP–8, TSSOP–8
CAT5132	1	128	10, 50, 100		2-Wire		✓	MSOP–10
CAT5133	1	128	10, 50, 100		INC/DEC		✓	MSOP–10
CAT521	1	256	6	✓	Microwire		✓	PDIP–14, SOIC–14
CAT5221	2	64	2.5, 10, 50, 100		2-Wire		✓	SOIC–20, TSSOP–20
CAT5411	2	64	2.5, 10, 50, 100		SPI		✓	SOIC–24, TSSOP–24
CAT5419	2	64	2.5, 10, 50, 100		2-Wire		✓	SOIC–24, TSSOP–24
CAT522	2	256	24	✓	Microwire		✓	PDIP–14, SOIC–14
CAT523	2	256	6	✓	Microwire		✓	PDIP–14, SOIC–14
CAT5261	2	256	50, 100		SPI		✓	SOIC–24, TSSOP–24
CAT5269	2	256	50, 100		2-Wire		✓	SOIC–24, TSSOP–24
CAT5241	4	64	2.5, 10, 50, 100		2-Wire		✓	SOIC–20, TSSOP–20
CAT5401	4	64	2.5, 10, 50, 100		SPI		✓	SOIC–24, TSSOP–24
CAT5409	4	64	2.5, 10, 50, 100		2-Wire		✓	SOIC–24, TSSOP–24
CAT524	4	256	6	✓	Microwire		✓	PDIP–14, SOIC–14
CAT525	4	256	24	✓	Microwire		✓	PDIP–20, SOIC–20
CAT5251	4	256	50, 100		SPI		✓	SOIC–24, TSSOP–24
CAT5259	4	256	50, 100		2-Wire		✓	SOIC–24, TSSOP–24

CATALYST
SEMICONDUCTOR, INC.
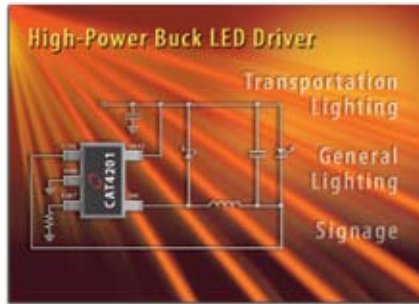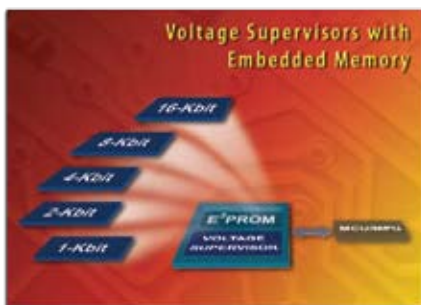BEYOND MEMORY™

MIXED SIGNAL PRODUCTS

World's Best LED Drivers
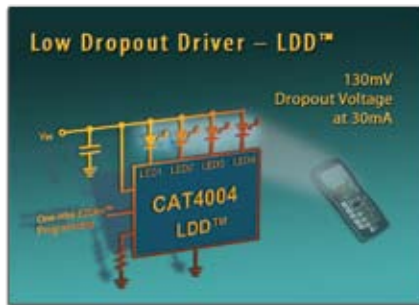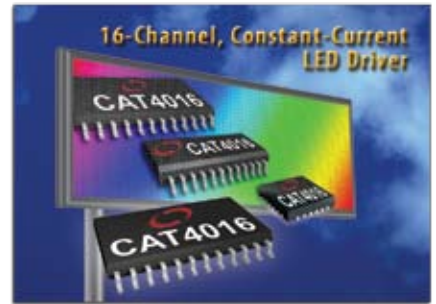
LDO Regulators
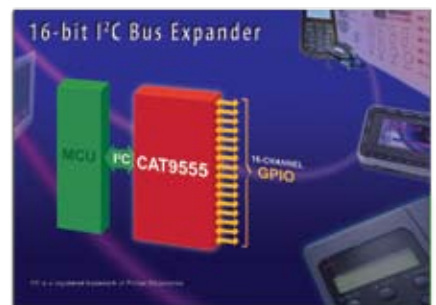

Voltage Supervisors

World's Smallest Digital Potentiometers
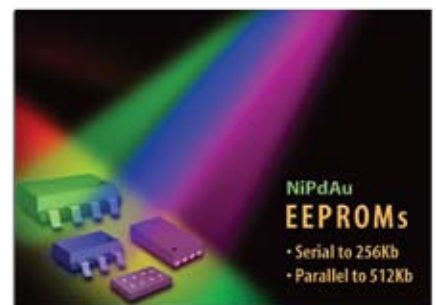
Bus Products

MEMORY PRODUCTS

Serial EEPROMs

I²C™ Bus, Full Array Write Protect

CAT24C01
CAT24C02
CAT24C04
CAT24C08
CAT24C16
CAT24C164
CAT24C32
CAT24C64
CAT24C128
CAT24C256

I²C™ Bus, Full Array Write Protect No Address Input Pins

CAT24AA02
CAT24AA04
CAT24AA08
CAT24AA16

I²C™ Bus, Partial Array Write Protect

CAT24C03
CAT24C05

Application Specific EEPROM

CAT34C02
CAT24C21
CAT24C208

SPI Bus with Block Write Protection

CAT25010
CAT25020
CAT25040
CAT25080
CAT25160
CAT25320
CAT25640
CAT25128
CAT25256

Microwire Bus

CAT93C46
CAT93C46R
CAT93C56
CAT93C57
CAT93C66
CAT93C76
CAT93C86

Parallel EEPROMs

CAT28C16A
CAT28C17A
CAT28C64B
CAT28C65B
CAT28LV64
CAT28LV65
CAT28C256
CAT28C257
CAT28LV256
CAT28C512
CAT28C513

Flash

Boot Block

CAT28F001

Bulk Erase

CAT28F512
CAT28F010
CAT28F020

NVRAM

CAT22C10
CAT24C44

Wide Range of EEPROMs, FLASH, NVRAM

NiPdAu
EEPROMs
• Serial to 256Kb
• Parallel to 512Kb

LED Drivers

DC/DC Converters

Linear Voltage Regulators

Bus Products

Voltage Supervisors

Digital Potentiometers

Serial EEPROMs

Parallel EEPROMs

FLASH Memories

NVRAM

SERIAL EEPROMS

## CAT34C02   2-Kb I²C™ Serial EEPROM, Serial Presence Detect

FEATURES

✓ Software Write Protection for first 128 Bytes
  – Permanent Software Write Protect (PSWP)
  – Reversible Software Write Protect (RSWP)
✓ Standard and Fast (400kHz) I²C™* Protocol
✓ 1.7V to 5.5V Supply Voltage
✓ 16-Byte Page Write Buffer
✓ Hardware Write Protection for entire memory
✓ 1, 000, 000 Program/Erase Cycles
✓ 100 Year Data Retention

PACKAGE INFORMATION

✓ RoHS-compliant packages
  • TSSOP (Y)
  • TDFN 2 x 3mm (VP2)

APPLICATIONS

• DDR1 and DDR2 memory modules
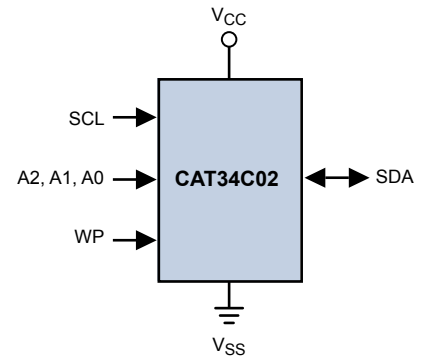
[Block diagram: CAT34C02 with pins SCL; A2, A1, A0; WP on left; SDA on right; V_{CC} top; V_{SS} bottom]

* I²C™ is a trademark of Philips Corporation. Catalyst Semiconductor is licensed by Philips Corporation to carry the I²C Bus Protocol.

CAT34C02 and Serial Presence Detect (SPD) for DDR2 Memory Modules

• **Permanent and Reversible Software Write Protect**
  – Compatible with JEDEC standard for the DDR2 DIMM memory market

• **PSWP backward compatible with DDR1 SPD**
  – V_{CC} = 1.7V to 5.5V

• **RSWP is a temporary lock command for SPD**
  – Requires a High Voltage (V_{HV}) on A0 pin
    • V_{CC} = 1.7V to 3.6V
    • V_{HV} = 7V to 10V; overdrive V_{HV} - V_{CC} > 4.8V

	PIN			Slave Address							
Command	A2	A1	A0	B7	B6	B5	B4	B3	B2	B1	B0
Set PSWP	SA2	SA1	SA0	0	1	1	0	SA2	SA1	SA0	0
Set RSWP	0	0	V_{HV}	0	1	1	0	0	0	1	0
Clear RSWP	0	1	V_{HV}	0	1	1	0	0	1	1	0

Serial EEPROMs Overview

✓ Complete Industry Standard Protocols:
  – I²C™: **CAT24Cxxx Family**
  – Microwire: **CAT93Cxx Family**
  – SPI™: **CAT25xxx Family**

✓ Wide V_{CC} Operating Range: 1.8V / 1.7V to 5.5V

✓ High Endurance: 1 million cycles

✓ Low Power

✓ Industrial and Extended Temperature Range

✓ RoHS-Compliant Packages with NiPdAu Finish
  – PDIP, TSSOP, SOIC, MSOP 8-Lead
  – TDFN, UDFN 8-Pad (2 x 3mm)
  – TSOT-23 5-Lead

✓ Chip Scale Package Solutions: contact factory for availability

NOW Available in Chip Scale Packaging

NOW Available in TSOT-23

SERIAL EEPROMS

I²C™ Bus Serial EEPROM Family, Full Array Write Protect

Part Number	Density (Organization)	Address Pins	V$_{IN}$ [V]	Max. Clock Frequency	PDIP–8	SOIC–8 (JEDEC)	TSSOP–8	TDFN (2 x 3mm)	TDFN (3 x 3mm)	TDFN (3 x 4.9mm)	TSOT 23–5	Temperature Range
								Packages				
CAT24C01	1 Kb (128x8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	VP2			TD	I, E
CAT24C02	2 Kb (256x8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	VP2			TD	I, E
CAT24AA02	2 Kb (256x8)	No	1.7 - 5.5	400 kHz		W					TD	I
CAT24C04	4 Kb (512x8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	VP2			TD	I, E
CAT24AA04	4 Kb (512x8)	No	1.7 - 5.5	400 kHz		W					TD	I
CAT24C08	8 Kb (1Kx8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	VP2			TD	I, E
CAT24AA08	8 Kb (1Kx8)	No	1.7 - 5.5	400 kHz		W					TD	I
CAT24C16	16 Kb (2Kx8)	No	1.8 - 5.5	400 kHz	L	W	Y	VP2			TD	I, E
CAT24AA16	16 Kb (2Kx8)	No	1.7 - 5.5	400 kHz		W					TD	I
CAT24C164	16 Kb (2Kx8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	VP2				I, E
CAT24C32	32 Kb (4Kx8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	VP2				I, E
CAT24C64	64 Kb (8Kx8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	VP2				I, E
CAT24C128	128 Kb (16Kx8)	Yes	1.8 - 5.5	400 kHz	L	W	Y	HU3[1]				I, E
CAT24C256	256 Kb (32Kx8)	Yes	1.8 - 5.5	400 kHz	L	W	Y			ZD2		I, E

I²C™ Bus Serial EEPROM Family, Partial Array Write Protect

Part Number	Density (Organization)	V$_{IN}$ [V]	Max. Clock Frequency	PDIP–8	SOIC–8 (JEDEC)	TSSOP–8	TDFN (2 x 3mm)	TDFN (3 x 3mm)	TDFN (3 x 4.9mm)	TSOT 23–5	Temperature Range
CAT24C03	2 Kb (256x8)	1.8 - 5.5	400 kHz	L	W	Y	VP2			TD	I, E
CAT24C05	4 Kb (512x8)	1.8 - 5.5	400 kHz	L	W	Y	VP2			TD	I, E

I²C™ Bus Application Specific EEPROM

Part Number	Density (Organization)	V$_{IN}$ [V]	Max. Clock Frequency	PDIP–8	SOIC–8 (JEDEC)	TSSOP–8	TDFN (2 x 3mm)	TDFN (3 x 3mm)	TDFN (3 x 4.9mm)	TSOT 23–5	Temperature Range
CAT34C02	2 Kb (256x8)	1.7 - 5.5[2]	400 kHz			Y	VP2				I
CAT24C21	1 Kb (128x8)	2.5 - 5.5	400 kHz	L	W	Y		ZD4			I, E
CAT24C208	8 Kb (1Kx8)	2.5 - 5.5	400 kHz		W						I

Notes:
1 UDFN (2 x 3mm)
2 CAT34C02 Reversible Software Write Protect Feature V$_{CC}$ = 1.7V to 3.6V

SERIAL EEPROMS

SPI Bus Serial EEPROM Family with Block Write Protection

Part Number	Density (Organization)	V_{IN} [V]	Max. Clock Frequency / Min. V_{CC}	Packages						Temperature Range
				PDIP–8	SOIC–8 (JEDEC)	TSSOP–8	TDFN (2 x 3mm)	SOIC–8 (EIAJ)	TDFN (3 x 4.9mm)	
CAT25010	1 Kb (128x8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2			I, E
CAT25020	2 Kb (256x8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2			I, E
CAT25040	4 Kb (512x8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2			I, E
CAT25080	8 Kb (1Kx8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2			I, E
CAT25160	16 Kb (2Kx8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2			I, E
CAT25320	32 Kb (4Kx8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2			I, E
CAT25640	64 Kb (8Kx8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2			I, E
CAT25128	128 Kb (16Kx8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y	VP2	X		I, E
CAT25256	256 Kb (32Kx8)	1.8 - 5.5	10MHz/2.5V, 5MHz/1.8V	L	V	Y		X	ZD2	I, E

Microwire Bus Serial EEPROM Family

Part Number	Density (Organization)	V_{IN} [V]	Max. Clock Frequency	Packages						Temperature Range
				PDIP–8	SOIC–8 (JEDEC)	SOIC–8 (EIAJ)	TSSOP–8	TDFN (2 x 3mm)	TDFN (3 x 3mm)	
CAT93C46	1 Kb (64x16/128x8)	1.8 - 5.5	2MHz	L	V / W[1]	X	Y	VP2		I, E
CAT93C46R	1 Kb (64x16/128x8)	1.8 - 5.5	2MHz	L	V / W[1]	X	Y	VP2		I, E
CAT93C56	2 Kb (128x16/256x8)	1.8 - 5.5	2MHz	L	V / W[1]	X	Y	VP2		I, E
CAT93C57	2 Kb (128x16/256x8)	1.8 - 5.5	2MHz	L	V / W[1]	X	Y	VP2		I, E
CAT93C66	4 Kb (256x16/512x8)	1.8 - 5.5	2MHz	L	V / W[1]	X	Y	VP2		I, E
CAT93C76	8 Kb (512x16/1024x8)	1.8 - 5.5	3MHz/2.5V, 1MHz/1.8V	L	V		Y		ZD4	I, E
CAT93C86	16 Kb (1024x16/2048x8)	1.8 - 5.5	3MHz/4.5V, 1MHz/2.5V, 0.5MHz/1.8V	L	V / W[1]	X	Y		ZD4	I, E

Note:
1 W = Rotated pinout with V_{CC} on pin 2.

PARALLEL EEPROMS

Parallel EEPROMs

Part Number	Density (Organization)	Access Time (ns)	I_CC (Active/Standby)	V_IN [V]	PDIP	SOIC-JEDEC	SOIC-EIAJ	PLCC	TSOP	Temperature Range
CAT28C16A	16 Kb (2Kx8)	90, 120, 200	25mA/100µA	4.5 - 5.5	L (24)	W (24)	X (24)	G (32)		C, I, A
CAT28C17A	16 Kb (2Kx8)	90, 120, 200	25mA/100µA	4.5 - 5.5	L (28)	W (28)	X (28)	G (32)		C, I, A
CAT28C64B	64 Kb (8Kx8)	90, 120, 150	25mA/100µA	4.5 - 5.5	L (28)	W (28)	X (28)	G (32)	H13 (28)	C, I, A
CAT28C65B	64 Kb (8Kx8)	90, 120, 150	25mA/100µA	4.5 - 5.5	L (28)	W (28)	X (28)	G (32)	H13 (28)	C, I, A
CAT28LV64	64 Kb (8Kx8)	150, 200, 250	8mA/100µA	3.0 - 3.6	L (28)	W (28)	X (28)	G (32)	H13 (28)	C, I, A
CAT28LV65	64 Kb (8Kx8)	150, 200, 250	8mA/100µA	3.0 - 3.6	L (28)	W (28)	X (28)	G (32)	H13 (28)	C, I, A
CAT28C256	256 Kb (32Kx8)	120, 150	25mA/150µA	4.5 - 5.5	L (28)			G (32)	H13 (28)	C, I, A
CAT28C257	256 Kb (32Kx8)	120, 150	25mA/150µA	4.5 - 5.5	L (28)			G (32)		C, I, A
CAT28LV256	256 Kb (32Kx8)	200, 250, 300	15mA/150µA	3.0 - 3.6	L (28)			G (32)	H13 (28)	C, I, A
CAT28C512	512 Kb (64Kx8)	120, 150	50mA/500µA	4.5 - 5.5	L (28)			G (32)	H14 (32)	C, I, A
CAT28C513	512 Kb (64Kx8)	120, 150	50mA/500µA	4.5 - 5.5				G (32)		C, I, A

FLASH

Flash Memories – Boot Block

Part Number	Density (Organization)	Access Time (ns)	I_CC (Active/Standby)	V_IN [V]	PDIP	PLCC	TSOP	TSOP Reverse	Temperature Range
CAT28F001	1 Mb (128Kx8)	90, 120	30mA/100µA	5 - 12	L (32)	G (32)	H14 (32)		C, I, A

Flash Memories – Bulk Erase

Part Number	Density (Organization)	Access Time (ns)	I_CC (Active/Standby)	V_IN [V]	PDIP	PLCC	TSOP	TSOP Reverse	Temperature Range
CAT28F512	512 Kb (64Kx8)	90, 120, 150	30mA/100µA	5 - 12	L (32)	G (32)	H14 (32)	HR (32)	C, I, A
CAT28F010	1 Mb (128Kx8)	90, 120	30mA/100µA	5 - 12	L (32)	G (32)	H14 (32)	HR (32)	C, I, A
CAT28F020	2 Mb (256Kx8)	90, 120	30mA/100µA	5 - 12	L (32)	G (32)	H14 (32)	HR (32)	C, I, A

NVRAM

NVRAM

Part Number	Density (Organization)	Access Time (ns)	I_CC (Active/Standby)	V_IN [V]	PDIP	SOIC-JEDEC	Temperature Range
CAT22C10	256 b (64x4)	200, 300	40mA/30µA	4.5 - 5.5	L (18)	W (16)	C, I, A
CAT24C44	256 b (16x16)	375	3mA/30µA	4.5 - 5.5	L (8)	V (8)	C, I, A

Catalyst Semiconductor offers an environment-friendly package option for all products. By combining Pb-free finish and halogen-free package molding compound, manufacturers can qualify and put into production a complete "Green" solution.
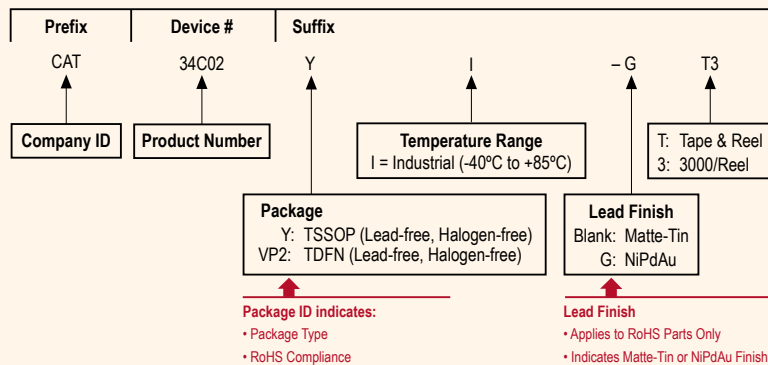
All of Catalyst's "Green" parts are fully compliant with the China and European RoHS[1] regulations, which set specific limits on the levels of certain prohibited substances including: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), polybrominated diphenyl ethers (PBDE).

All of the elements that comprise an IC can contain banned substances. The package mold compound may contain polybromide and even the ink used to mark a device needs to be verified for compliance to the RoHS directive. However, the major issue related to green is plating of the device leads. Leads are typically copper and to ensure solderability to a PCB, they are plated. This plating in the past has typically been a tin-lead alloy (SnPb). Catalyst's green products use Pb-free nickel-palladium-gold (NiPdAu) or matte-tin for the finish.

- Pb-Free Finish
- Green Molding Compound (Halogen Free)
- Environment Friendly

Catalyst Package Code Summary

Catalyst recognizes the need for manufacturers to quickly and easily discriminate between RoHS and non-RoHS-compliant devices. We meet this requirement through the use of a unique package ID to denote RoHS-compliant packages. Each package has one ID for non-RoHS-compliant versions and a separate ID to denote RoHS compliance.

We provide further traceability on the actually lead finish used on RoHS-compliant parts. When NiPdAu finish has been used, "-G" is added after the part number. RoHS-compliant parts that do not have the "-G" after the part number have matte-tin finish.

Prefix	Device #	Suffix			
CAT	34C02	Y	I	– G	T3

- Company ID
- Product Number

Temperature Range
I = Industrial (-40ºC to +85ºC)

T: Tape & Reel
3: 3000/Reel

Package
Y: TSSOP (Lead-free, Halogen-free)
VP2: TDFN (Lead-free, Halogen-free)

Lead Finish
Blank: Matte-Tin
G: NiPdAu

Package ID indicates:
- Package Type
- RoHS Compliance

Lead Finish
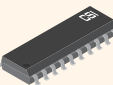- Applies to RoHS Parts Only
- Indicates Matte-Tin or NiPdAu Finish
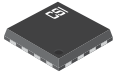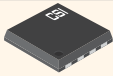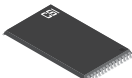
Environmentally Sound Commitment

Catalyst is committed to environmentally sound semiconductor practices and to providing products that fully conform to RoHS directives and beyond.

Note:
1   RoHS: Restriction of Hazardous Substances

Package	Description	Number of Leads/Pads	Package Codes Legacy (SnPb)	RoHS-Compliant
XQFN	XQFN (2.5 x 2.5mm) (eXtra low profile: 0.4mm height)	12	–	HL1
UDFN	UDFN (2 x 2mm)	8	–	HU2
	UDFN (2 x 3mm)	8	–	HU3
TQFN	TQFN (3 x 3mm)	16	HS3	HV3
	TQFN (4 x 4mm)	16	HS4	HV4
	TQFN (4 x 4mm)	20	HS5	HV5
	TQFN (4 x 4mm)	24	HS6	HV6
TDFN	TDFN (2 x 2mm)	6	–	VP5
	TDFN-S-MSOP (3 x 4.9mm)	8	RD2	ZD2
	TDFN (3 x 3mm)	8	RD4	ZD4
	TDFN (2 x 2.5mm)	8	RD7	ZD7
	TDFN (4 x 4mm)	8	RD8	ZD8
	TDFN (2 x 3mm)	8	SP2	VP2
	TDFN (3 x 3mm)	10	HS1	HV1
	TDFN (3 x 3mm)	12	HS2	HV2
PLCC	PLCC	32	N	G
SC-70	SC-70	3, 5, 6	SB	SD
SOT	SOT-23	3, 5, 6, 8	TP	TB
	TSOT-23	5, 6	TS	TD
	SOT-143	4	TP	TB
TSSOP	TSSOP (4.4mm)	8, 14, 16, 20, 24, 28	U	Y
TSOP	TSOP (8 x 13.4mm)	28	T13	H13
	TSOP (8 x 14mm)	32	T14	H14, HR
	TSOP (8 x 20mm)	32	T20	H20
MSOP	MSOP (3.0mm)	8, 10	R	Z
QSOP	QSOP	16, 24	–	V5
SOIC	SOIC (150 mils)	8, 14, 16	S, J	V, W
	SOIC (300 mils)	16, 20, 24, 28	S, J	V, W
	SOIC (208 mils) EIAJ	8	K	X
	SOIC (300 mils) ext. leads	24, 28	K	X
PDIP	PDIP 300 mils	8, 14, 18, 20	P	L
	PDIP 600 mils	24, 28, 32	P	L

For specific package outline drawings and other package information, see website: http://www.Catsemi.com/techsupport/packaging.html

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Submit technical questions on Catalyst website at:
http://www.catsemi.com/techsupport/form.html

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