

SCD5035

Quintet Precision Current Sources Built-In Comparators

PCS5035

Features

- Radiation performance
 - Total dose ≥ 100 krad(Si), Dose rate = 50 - 300 rads(Si)/s
 - ELDRS ≥ 15 krads(Si), Dose rate = .01 rads(Si)/s
- Five high precision 80 μ A current source outputs/comparator inputs
- Monolithic construction
- Designed for thermistor temperature monitoring
- Enable control
- Long term stability
- Low drift
- Zener protected input
- DC supply voltage +5V
- Low supply current
- High impedance sensor interface
- Designed for aerospace and high reliability space applications
- 0.63" Sq x 0.125" Ht, 18 lead, hermetic flat package
- **CAES Radiation Hardness Assurance Plan is DLA Certified to MIL-PRF-38534, Appendix G.**

General Description

The CAES PCS5035 contains "Five Monolithic" precision current sources designed for thermistor current monitor and resistive sensor applications. The precision current source (80 μ A \pm 2 μ A)/Comparator inputs are compared to an external reference of 0V_{DC} to 3V_{DC}. A precision internal 2.0V_{DC} reference is provided if an external reference is not available. See Figure 1.

The comparator outputs of two (2) PCS5035 can be wired OR to provide 10 sensors inputs. Current source output/comparator inputs of two or more units can be tied together to provide more sensor current. A logic "high" of 3.4V_{DC} maximum on the enable pin turns on the current source/comparators. Any unused current source output/comparator inputs can be left open circuit without affecting other I/O's.



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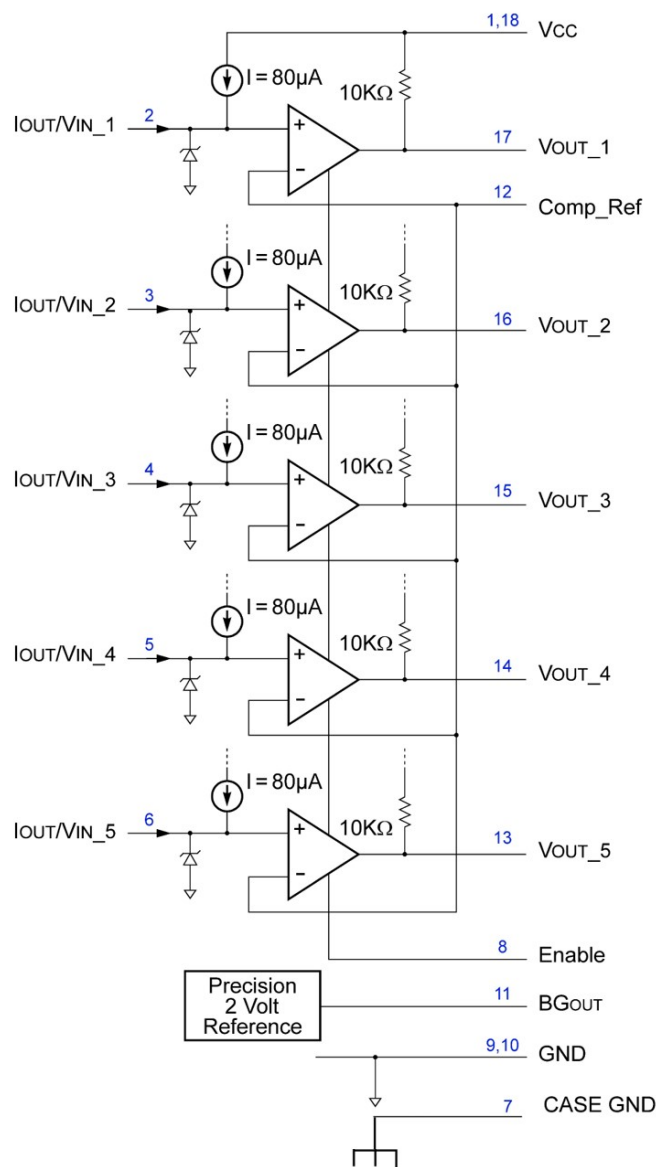


Figure 1 – Schematic Diagram

Absolute Maximum Ratings

Parameter	Range	Units
Operating Case Temperature	-55 to +125	°C
Storage Case Temperature	-65 to +150	°C
Power Supply Voltages (V_{CC})	+7.0	V

Notice: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress rating only; functional operation beyond the "Operation Conditions" is not recommended and extended exposure beyond the "Operation Conditions" may affect device reliability.

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Electrical Performance Characteristics

(T_c = -55°C TO +125°C, +V_{CC} = +5.0V_{DC} ±5% -- Unless Otherwise Specified)

Parameter	Symbol	Condition	MIN	MAX	Unit
Source Current 1-5 <u>1/</u>	I _O	0 ≤ V _{IN} ≤ 3.1V, V _{EN} = V _{ENH}	77	83	μA
	I _{OFF}	0 ≤ V _{IN} ≤ 3.1V, V _{EN} = V _{ENL}	-	150	nA
Comparator In Voltage	V _{IN}	I _{OUT} = 80μA	0	3.1	V
Comparator Ref In Voltage <u>2/</u>	V _{REF}		-	3.1	V
Comparator Ref In Current	I _{REF}		-	1200	nA
Enable Input Voltage Low	V _{ENL}		-	0.8	V
Enable Input Voltage High	V _{ENH}		2.4	-	V
Comparator Hysteresis <u>2/</u>	-		-	30	mV
Output Voltage Low 1-5 <u>1/</u>	V _{OL}	I _{SINK} ≤ 2.0mA	-	0.4	V
Output Voltage High 1-5 <u>1/</u>	V _{OH}		4.4	-	V
Input Open Circuit Voltage	V _{INOC}		4.0	4.6	V
Band Gap Regulator Output Voltage	V _{BG}	T _A = 25°C	1.990	2.010	V
		T _C = -55°C, +125°C	1.980	2.020	V
BG Regulator Voltage Max Change <u>1/</u> <u>2/</u>	ΔBG		-75	75	mV
Band Gap Load Regulation	$\frac{\Delta V_{BG}}{\Delta I_{BG}}$	I _{BG} = 0 to 2mA	-5	5	mV
Internal Output Pull-Up Resistor	R _{INT}		8	12	KΩ
Comparator Pulse Delay Low to High	t _{DLH}	C _L = 37pF, V _{EN} = V _{ENH} , V _{REF} = 1V,	0.2	10	μS
Comparator Pulse Delay High to Low	t _{DHL}	V _{IN} = 2V, I _{SINK} = 0, See Figure 2 <u>3/</u>	80	150	nS
Enable Delay to Vout	t _{EDVLH}	C _L = 37pF, V _{IN} = 0V, V _{REF} = 1V, I _{SINK} = 0, See Figure 2 <u>3/</u>	100	1500	nS
	t _{EDVHL}		500	3000	nS
Enable Delay to Iout	t _{EDILH}	C _L = 68pF, I _{SINK} = 0, See Figure 2 <u>3/</u>	100	250	nS
	t _{EDIHL}		100	250	nS
Supply current Disabled Enabled <u>1/</u>	I _{CCD}		-	4.0	mA
	I _{CCE}		-	7.0	mA

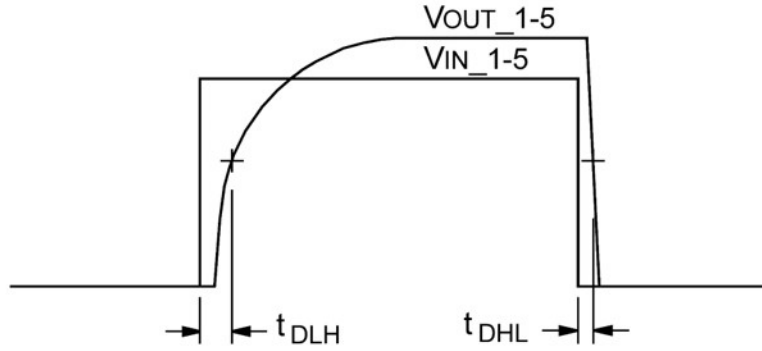
Notes:

- 1) The active element that makes up this device has been tested to 200 krad(Si) to assure RHA designator level 'R' (100 krad(Si)) of Method 1019, condition A of MIL-STD-883 at +25°C for these parameters. The element will be re-tested after design or process changes that can affect RHA response of these elements.
- 2) Guaranteed by design, but not tested.
- 3) Test fixture node capacitance plus 10pF scope capacitance.

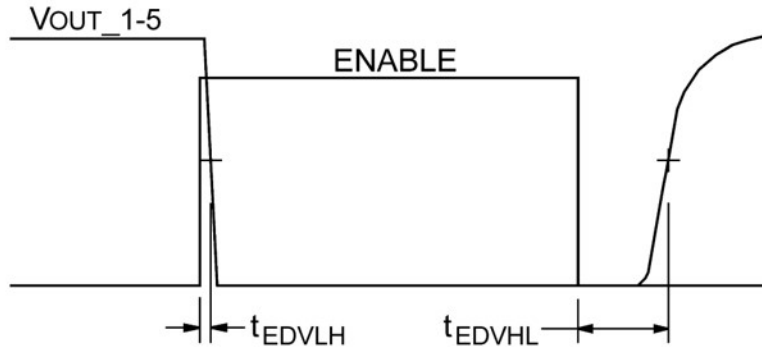
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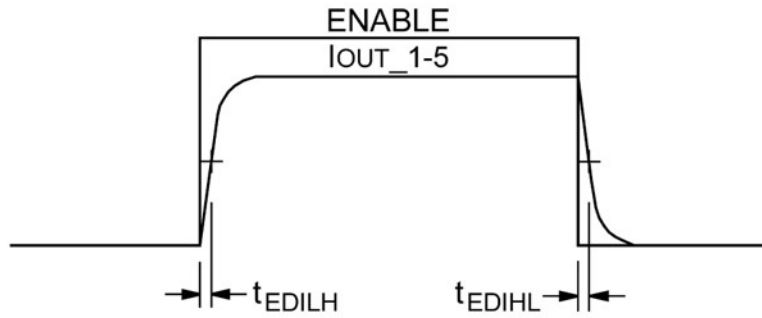
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Comparator Pulse Delay



ENABLE Delay to VOUT_1-5



ENABLE Delay to IOUT_1-5

Figure 2 – Timing Diagrams

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One primary application for the CAES PCS5035, as shown in Figure 3 below, would be to monitor the temperature of different electronic bay areas in a Satellite, and report when any bay area has exceeded a maximum temperature limit.

Thermistors with defined temperature characteristics are used as the sensors, and by providing a constant stable current to the external Thermistor (Temp T1 to Temp T5), an accurate analog voltage of a specified temperature trip point can be established. The comparator voltage reference input can be tailored to set the trip point for the characteristic of the particular thermistor sensor used. The on-board precision 2V reference can be used directly for voltages of 2 volts or less, or can be scaled with an external operational amplifier to provide a voltage between 2 volts and the maximum input of 3.1V. Various temperature trip points could be accomplished by using thermistors with different temperature characteristics.

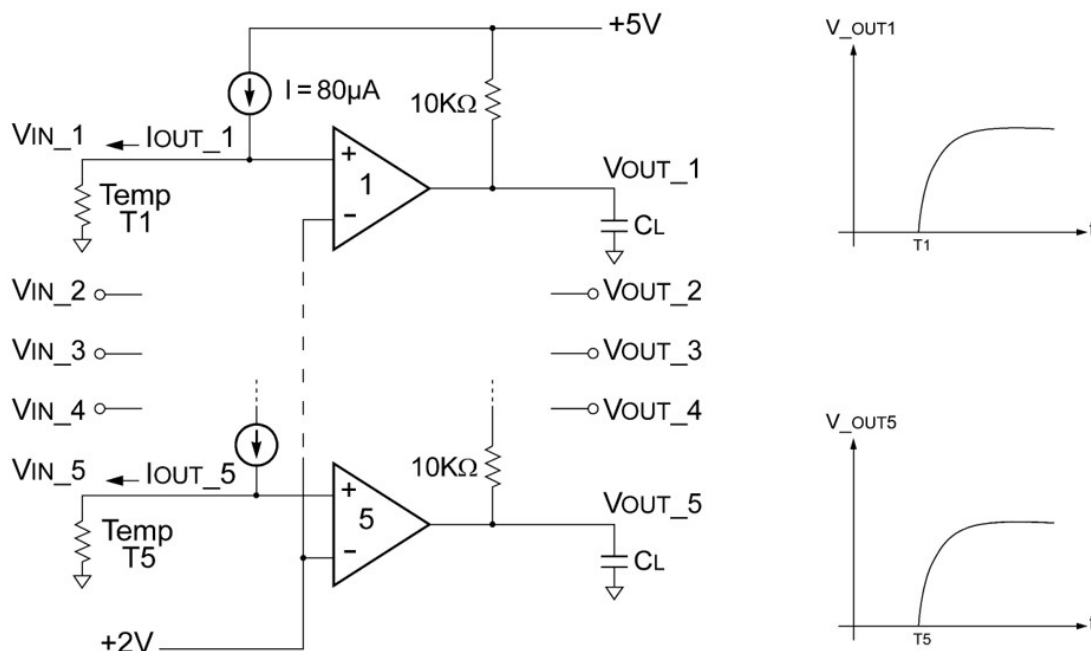


Figure 3 – Typical Temperature Sensing Application

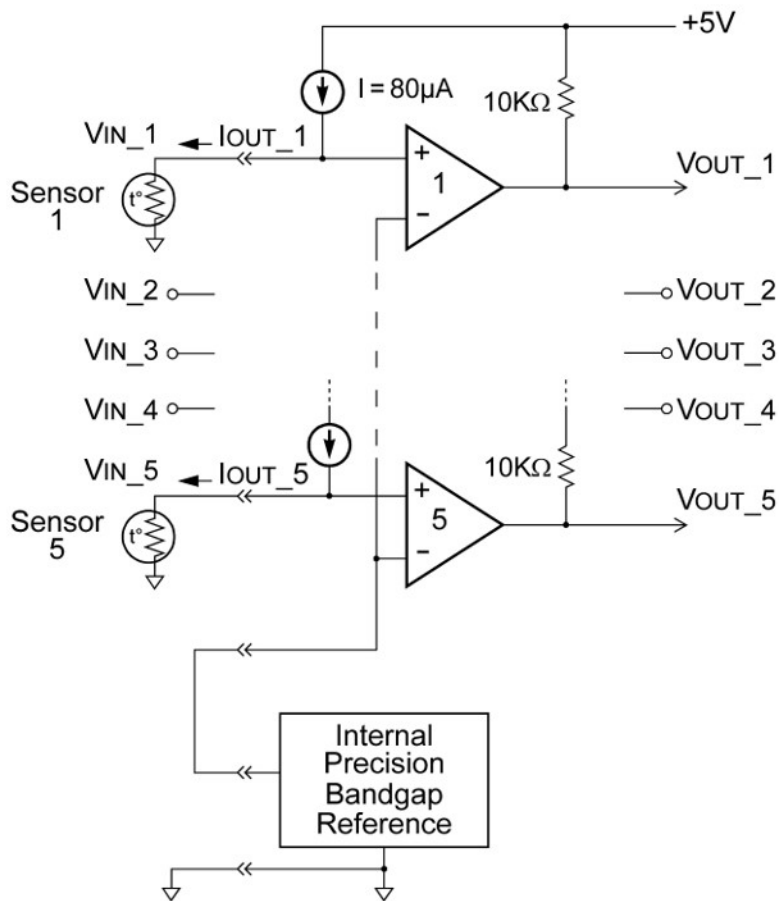
Another application for the CAES PCS5035 device is to provide precision excitation sources and threshold detection for five temperature sensors. The temperature sensors are typically thermistors, but can also be RTDs or silicon diodes. Since these devices have negative temperature coefficients, the device resistance is inversely related to the temperature. A typical application is shown below. The PCS5035 contains five independent current sources, internally trimmed to 80 uA ($\pm 2\mu\text{A}$) each. The PCS5035 also contains an internal precision bandgap voltage reference, set to 2.000 Volts ($\pm 0.010\text{Volts}$). Five complete temperature monitor circuits can be obtained by connecting external thermistors as shown below. The threshold is reached when the temperature of the thermistor produces a resistance of exactly 25KΩ (2.00V/80uA). If the temperature is low, the sensor voltage is greater than 2.000 Volts and the comparator output is high; when the temperature is high, the comparator output goes low. The comparator output configurations are open-collector, with internal 10KΩ pullup resistors. This allows the comparator outputs to be wired-OR.

To set the thresholds at other temperatures, several options are available: Other thermistor types may be selected; shunt resistors may be used to adjust the sensor response; an external reference voltage may be used.

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Temperature Threshold Monitor with Internal Bandgap Reference Voltage

When more "Temperature Sensing" inputs are needed two PCS5035 hybrids can be used as shown below in Figure 4.

The outputs of the two PCS5035 hybrids can be wired together to produce a wired "OR" function. Each bank of 5 inputs can then be separately controlled by its associated Enable input.

One application of this multiple input arrangement could be circuit board temperature monitoring using the temperature characteristics of a PN (diode) junction. With a constant current to the diode sensor the diode voltage can be a calibrated function of temperature. Diodes can be placed on or near vital electronic components to monitor their case temperatures so that they can be shut down before a catastrophic temperature failure occurs.

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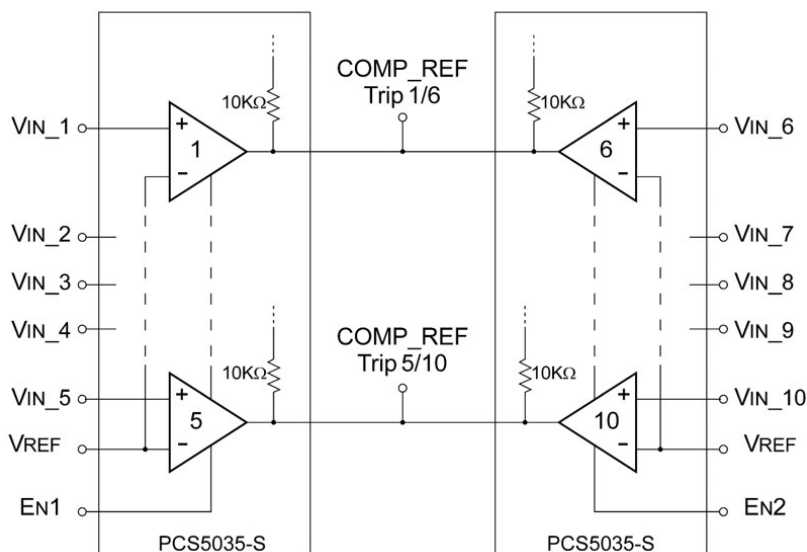


Figure 4 – Wired "Or" Application

Signal Description

Pin #	Signal Names	Description
1, 18	V _{CC}	+5V _{DC} ±5%
2 - 6	I _{OUT} /V _{IN_1} thru I _{OUT} /V _{IN_5}	Current Source Outputs / Comparator Inputs 1 thru 5
8	ENABLE	Turns all Current/Comparators "ON" or "OFF"
9, 10	GND	Logic and Power Return.
17 - 13	V _{OUT_1} thru V _{OUT_5}	Voltage Outputs corresponding to Current source outputs 1 thru 5, includes 10K pull-ups
11	BG Reg _{OUT}	Band Gap Regulator Precision Output 2.0V _{DC}
7	CASE_GND	Case Ground
12	COMPREF	External voltage to all 5 comparator inputs

Pin # vs Function Table

Pin #	Function	Pin #	Function
1	V _{CC}	10	GND
2	I _{OUT} /V _{IN_1}	11	BG Reg _{OUT}
3	I _{OUT} /V _{IN_2}	12	COMPREF
4	I _{OUT} /V _{IN_3}	13	V _{OUT_5}
5	I _{OUT} /V _{IN_4}	14	V _{OUT_4}
6	I _{OUT} /V _{IN_5}	15	V _{OUT_3}
7	CASE_GND	16	V _{OUT_2}
8	ENABLE	17	V _{OUT_1}
9	GND	18	V _{CC}

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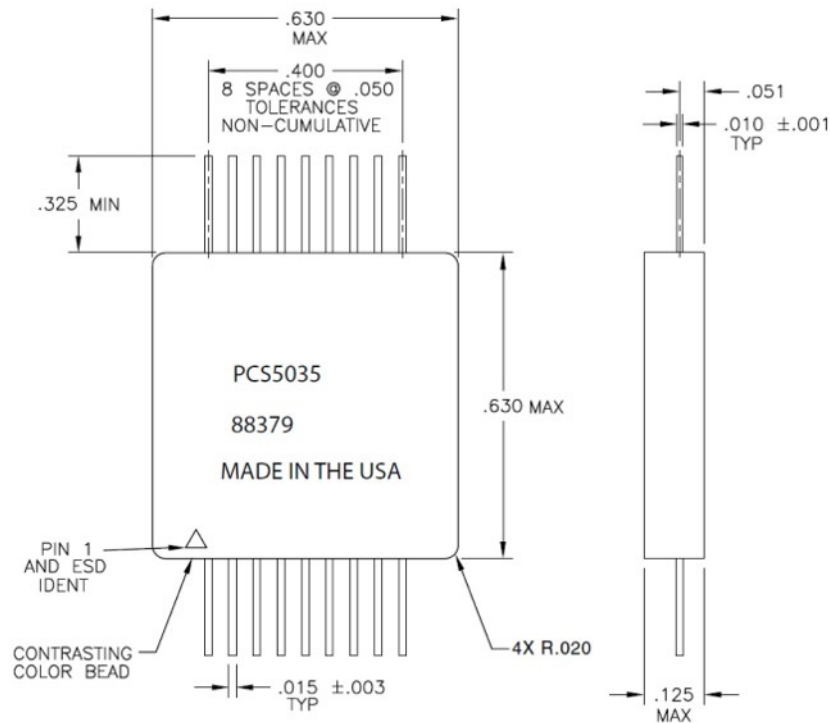
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Ordering Information

Model	DLA SMD #	Screening	Package
PCS5035-7	-	Commercial Flow, +25°C testing only	18 lead Flat Package
PCS5035-S	-	Military Temperature, -55°C to +125°C Screened in accordance with the individual Test Methods of MIL-STD-883 for Space Applications.	
PCS5035-201-1S PCS5035-201-2S	5962-0923401KXC 5962-0923401KXA	In accordance with DLA SMD	
PCS5035-901-1S PCS5035-901-2S	5962R0923401KXC 5962R0923401KXA	In accordance with DLA Certified RHA Program Plan to RHA Level "R", 100 krad(Si)	

Package Configuration Outline



Revision History

Date	Rev. #	Change Description	Initials
02/18/2021	K	REVISED PER ECN 23533	CL

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Datasheet Definitions

	DEFINITION
Advanced Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the datasheet is subject to change . Specifications can be TBD and the part package and pinout are not final .
Preliminary Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.

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