

IP Data Sheet

Very-low-Noise and Programmable very-high-Gain DC-Voltage Amplifier with Precision Offset Trimming

The TS_VA_LNDC_X8 comprises the main function dcamp and its companion dcamptrim. The dcamp is a very-low-output-noise-level ($604\mu\text{V}_{\text{RMS}}$ max) and 1%-precise programmable very-high-gain (32 selectable gains up to 400V/V) DC-voltage amplifier, with an extra differential input for precision offset trimming by the dual 8-bit one's-complement-coded DAC dcamptrim.

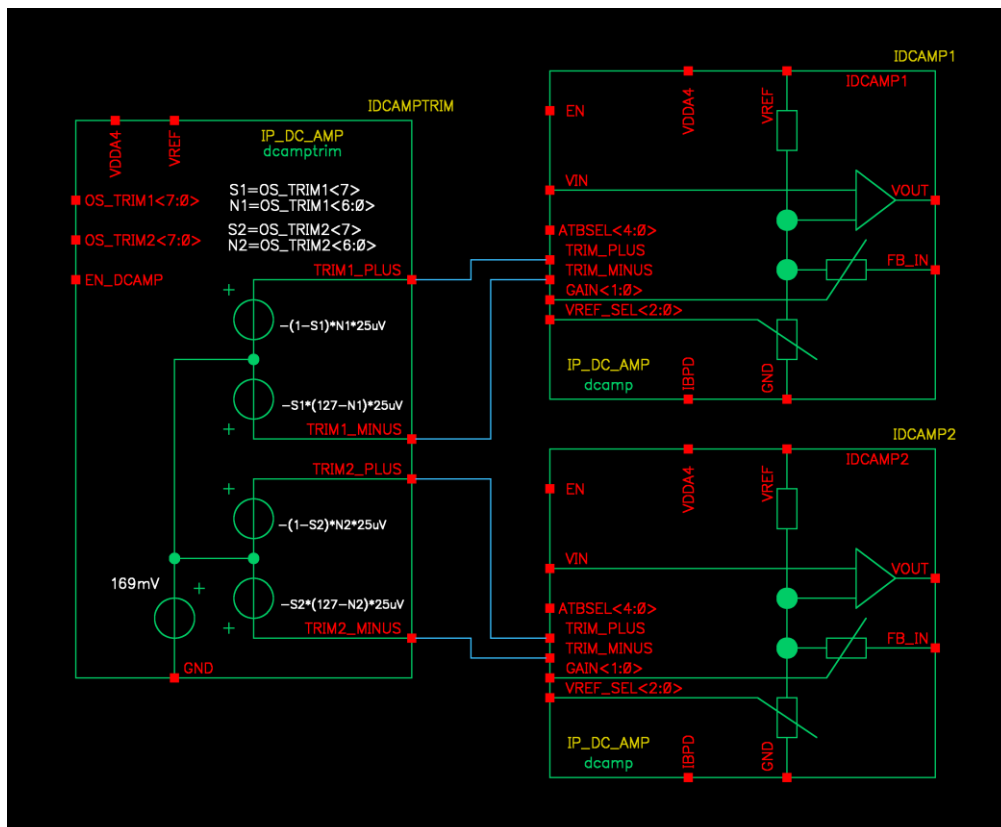
The dcamp and dcamptrim operate with one supply

voltage VDDA4 (4V typical) and one precision reference voltage VREF (2.5V).

The dcamp complies with 2kV electrostatic discharges on its analog terminals VIN, FB_IN and VOUT.

The minimum continuous operation lifetime spans 100000 hours.

Technology: X-FAB XT018-0.18 μm BCD-on-SOI CMOS



Operating conditions

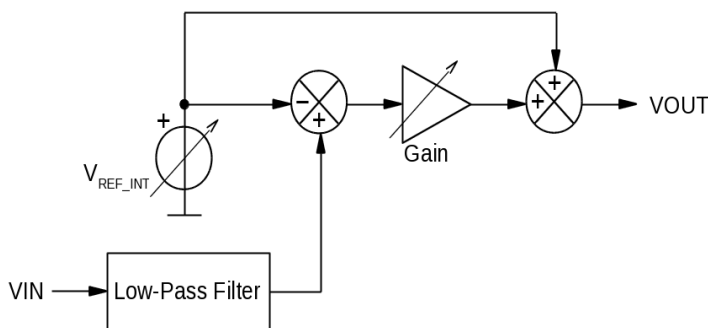
Parameters	Values
Junction temperature range	20°C to +80°C
Supply voltage	VDDA4: 3.9V to 4.1V (supplied by the additional IP Reg_4V)
Reference voltage	VREF: 2.5V
Reference sink current intensity	I(IBPU): 19.5µA to 20.5µA
Switched load to dcamp output	35pF to 45pF with series switch resistance within 70Ω to 110Ω

Specification

Parameters	Values
dcamp output noise level over 1Hz to 10MHz, at max gain	604µV _{RMS} max
dcamp DC output offset at maximum gain, after offset calibration by means of dcamptrim	-10mV to +10mV
dcamptrim differential output voltage step width	-25µV
dcamptrim differential output voltage range	±3.175mV
dcamp 1%-precision-linear-response output voltage range	100mV to 2.5V
dcamp recovery time of output voltage precision within 38µV, upon charging switched load capacitor from 0.1V to 2.4V or discharging from 2.4V to 0.1V, at maximum gain	2µs max
dcamp 3dB cut-off frequency, at max gain	15.2Hz min, 30.5Hz max
dcamp PSRR over frequencies up to 10 MHz, DC-level PSRR	21.8dB min, 50.6dB min
dcamp + dcamptrim operating power consumption Enable EN, EN_DCAMP high	2.7mW max
dcamp + dcamptrim powerdown-mode current consumption Enable EN, EN_DCAMP low	20nA max
dcamp Area	2.56mm ²
dcamptrim Area	0.64mm ²

Programmable Gain and Input Reference-Level

	GAIN<1:0>	00	01	10	11
VREF_SEL<2:0>	V _{REF_INT} [mV]	Gain [V/V]	Gain [V/V]	Gain [V/V]	Gain [V/V]
000	16.13	200	267	333	400
001	16.63	194	259	323	388
010	17.16	188	251	313	376
011	17.73	182	243	303	364
100	18.34	176	235	293	352
101	18.99	170	227	283	340
110	19.69	164	219	273	328
111	20.44	158	211	263	316



VOUT and FB_IN must be interconnected.

APPLICATION NOTE

A valid voltage range for VIN guarantees that the dcamp output voltage on VOUT remains within 100mV and 2.5V, which is the 1%-precision linearity range. This valid range can be calculated by applying the following formula to VOUT precision limits: $VIN = \frac{VOUT - V_{REF_INT}}{Gain} + V_{REF_INT}$. For example, assuming Gain = 400V/V, then V_{REF_INT}=16.13mV and VIN must be constrained to vary within 16.34mV and 22.34mV.

The dcamp internal opamp can individually be turned off to make its output high-ohmic, when ATBSEL<4:0>= LLHHL. This test mode allows the direct access to the dcamp internal resistor network for electrical inspection, without the need for any additional circuit to break the feedback loop at the VOUT-FB_IN interconnection.

LAYOUT VIEWS, dcamp, dcamptrim

