Analogue Integration

AISC1000

Rail to Rail I/O Op-Amp Cell

Rev.1 31-5-01

Features

- Rail to Rail Input and Output
- High Efficiency Class AB Output
- 2 - 5 Volt Operation
- Low Quiescent Supply Current: 162 µA typ @ V_{DD} = 5 V
- Gain-Bandwidth Product: 2.2 MHz typ.
- Slew rate: 1.8 V/µs

Applications

- Monitoring near supply rails
- Interfacing to High Impedance Transducers
- Unity Gain Non-inverting Buffers

Process Technology

- XFAB CX08 CMOS 0.8 µ

Product Description

Introduction

Analogue Integration's 'off the peg' analogue cells provide a quick and complete solution for mixed signal and analogue IC designs. Cells are fully simulated and characterised for the target semiconductor process and have a track record of use in existing designs. Once a customer has reviewed a cell's datasheet and determined its suitability for their design, a full schematic, netlist and layout in the target process can be down loaded upon payment of a one-off fee.

AISC1000 Op-Amp Cell

This Op-Amp cell provides an input with a common mode range that extends to both supply rails. The output also has an output range extending to within a few millivolts of the supply rails dependent on the load resistance. The output stage is class AB to minimise power consumption when the op-amp is not driven. A power down input is also provided for use with low power applications. The user needs to provide a bias current sink to ground of 4 µA. As this cell is intended to be embedded into a larger design no ESD cells are provided.

Simulation Data

The rest of this datasheet contains AISP1000 cell's characteristics obtained from SPICE simulation. Unless otherwise stated these simulations were conducted under the conditions of nominal process parameters and at a temperature of 27 °C.

Process Technology

AISC1000 is initially available characterised for XFAB CX08 0.8 µ CMOS technology. Other technologies can be offered upon request.

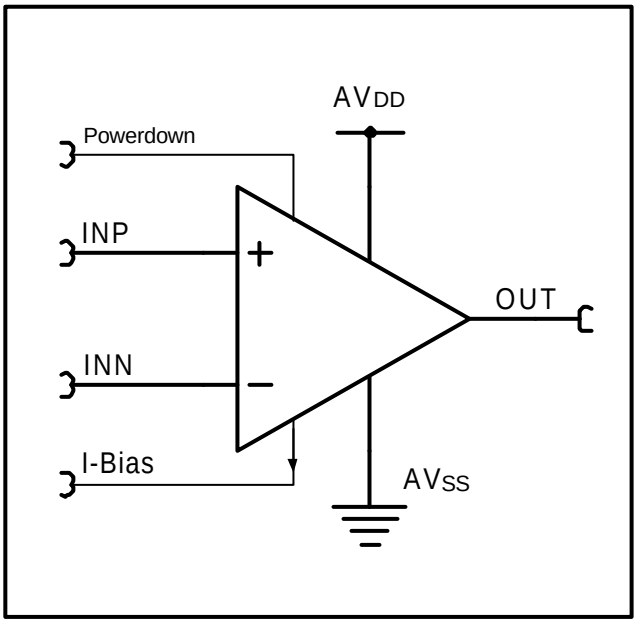
Absolute Maximum Ratings

Parameter	Unit	Rating
Supply voltage	V	- 0.3 to 5.5
Control voltages	V	- 0.3 to 5.5
Power dissipation	mW	100
Storage Temperature	°C	- 40 to + 85
Operating Temperature	°C	- 40 to + 85

Operating Conditions

Parameter	Min	Typ.	Max	Unit
Supply voltage	2	3.6	5	V

Block Diagram



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Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Unit
DC Characteristics					
CMRR	Common mode rejection ratio		108		dB
+PSRR	Positive power supply rejection ratio		73.8		dB
-PSRR	Negative power supply rejection ratio		70.2		dB
V_{CM}	Input common mode voltage range			V_{DD} - V_{SS}	V
A_V	Large signal voltage gain	No load		79.9	dB
		100 kΩ load		72.3	dB
		10 kΩ load		57.2	dB
		2 kΩ load		43.7	dB
		600 Ω load		33.4	dB
V_O	Output swing	V_{DD} = 5 V, 100 kΩ to V_{DD}/2, THD < 0.1%.		5	V_{pp}
		V_{DD} = 5 V, 2 kΩ to V_{DD}/2, THD < 0.3%.		4.8	V_{pp}
		V_{DD} = 5 V, 600 Ω to V_{DD}/2, THD < 0.5%.		4.3	V_{pp}
		V_{DD} = 3.6 V, 100 kΩ to V_{DD}/2, THD < 0.1%.		3.6	V_{pp}
		V_{DD} = 3.6 V, 2 kΩ to V_{DD}/2, THD < 0.2%.		3.4	V_{pp}
		V_{DD} = 2 V, 100 kΩ to V_{DD}/2, THD < 0.2%		2	V_{pp}
I_{SC}	Output short circuit current	V_{DD} = 2 V Sourcing		2.31	mA
		V_{DD} = 2 V Sinking		-2.6	mA
		V_{DD} = 3.6 V Sourcing		9.26	mA
		V_{DD} = 3.6 V Sinking		-8.3	mA
		V_{DD} = 5 V Sourcing		17.5	mA
		V_{DD} = 5 V Sinking		-15.7	mA
I_S	Quiescent supply current	V_{DD} = 2 V		60	µA
		V_{DD} = 3.6 V		120	µA
		V_{DD} = 5 V		162	µA
AC Characteristics					
SR	Slew Rate			1.8	V/µs
GBW	Gain-Bandwidth product	No load V_{DD} = 3.6		2.2	MHz
phi_M	Phase margin			80	Deg
G_M	Gain margin			18	dB
e_n	Input refered noise voltage	f = 1 kHz		16.75	µV/vHz
		f = 1 MHz		0.54	µV/vHz
THD	Total Harmonic distortion	V_{DD} = 3.6 V, Load = 100 kΩ to V_{DD}/2 A_V = -1, V_O = 3.36 V_{pp}		0.01	% THD
		V_{DD} = 2 V, Load = 100 kΩ to V_{DD}/2 A_V = -1, V_O = 1.82 V_{pp}		0.01	% THD
		V_{DD} = 5 V, Load = 100 kΩ to V_{DD}/2 AV = -1, V_O = 4.67 V_{pp}		0.01	% THD

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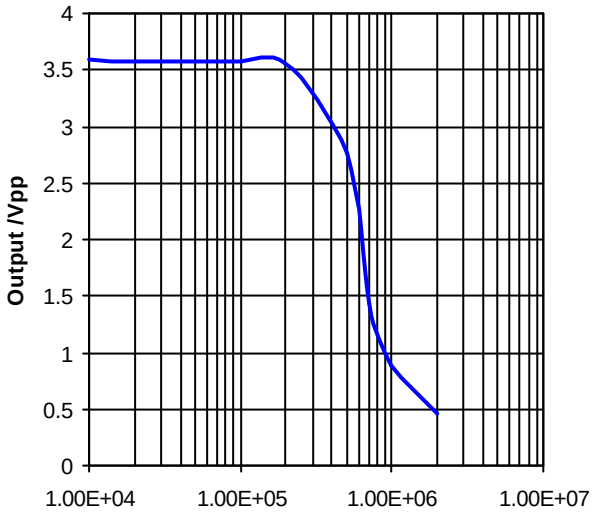
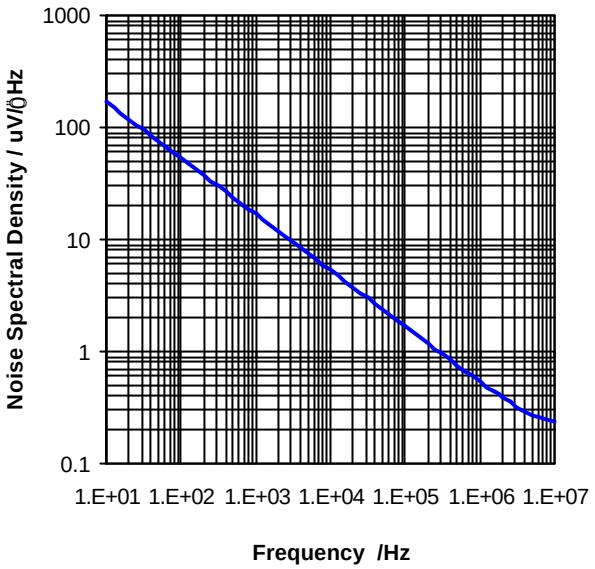
Typical Performance Characteristics

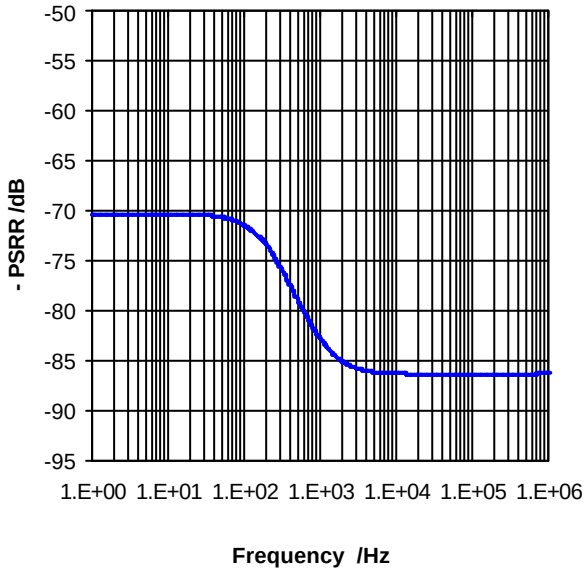
Maximum Output Swing vs Frequency



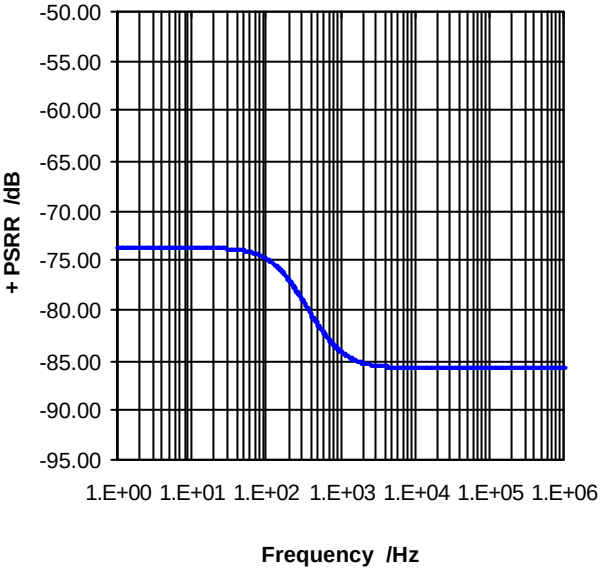
Noise Spectral Density V/ÖHz



Negative PSRR vs Frequency



Positive PSRR vs Frequency



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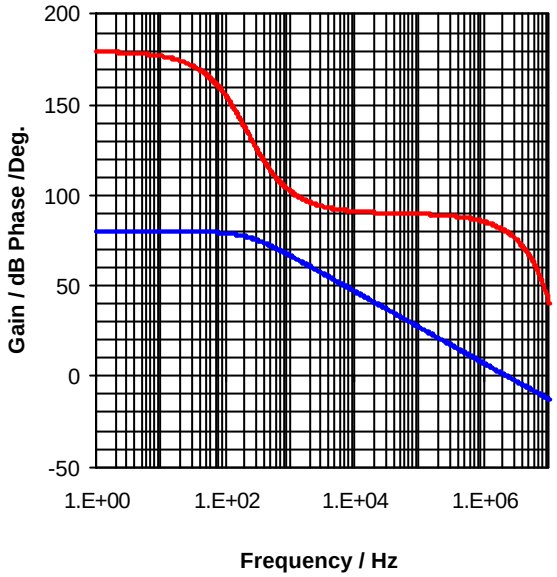
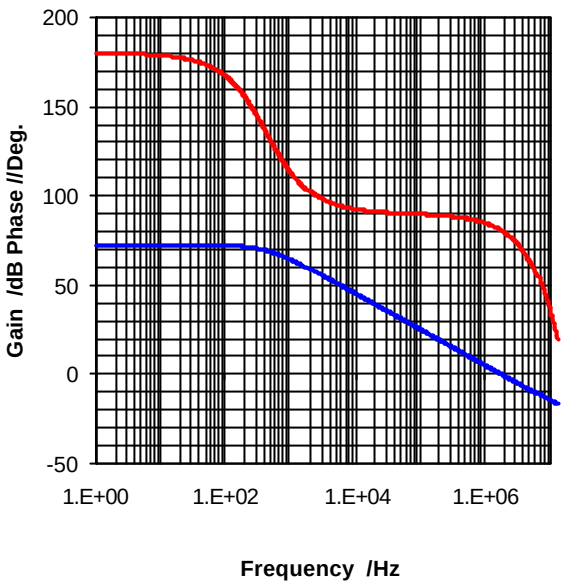
Typical Performance Characteristics

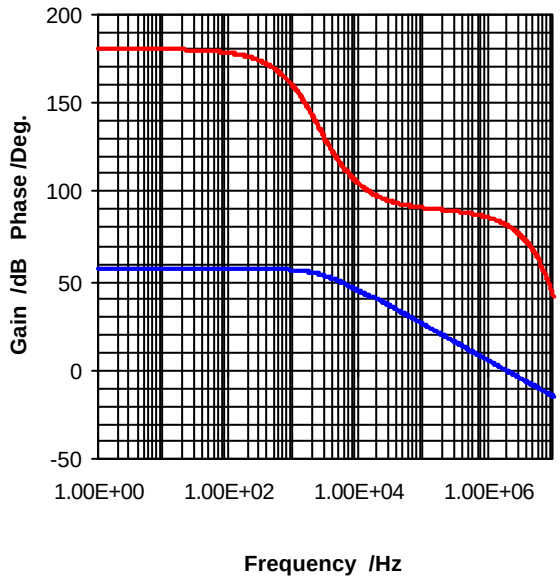
Gain and Phase Response vs Frequency.
No Load



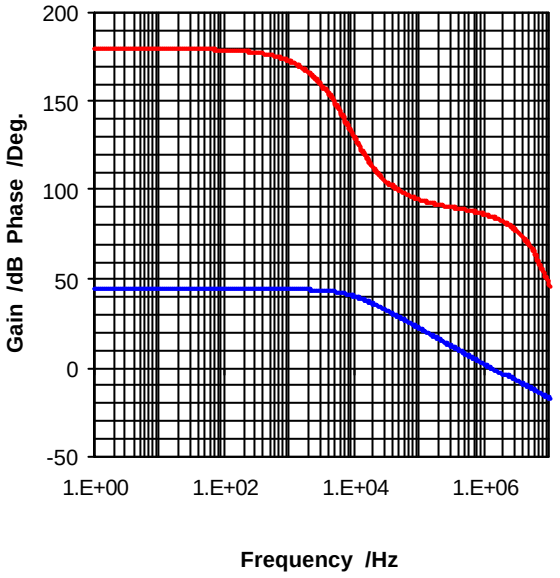
Gain and Phase Response vs Frequency.
Load = 100 kW



Gain and Phase Response vs Frequency.
Load = 10 kW



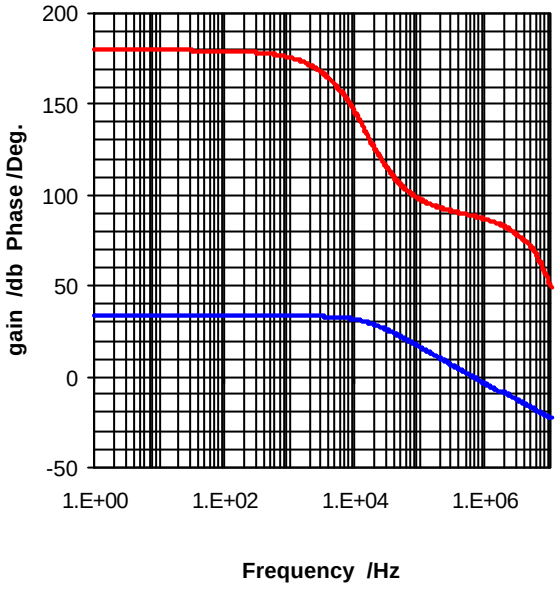
Gain and Phase Response vs Frequency.
Load = 2kW



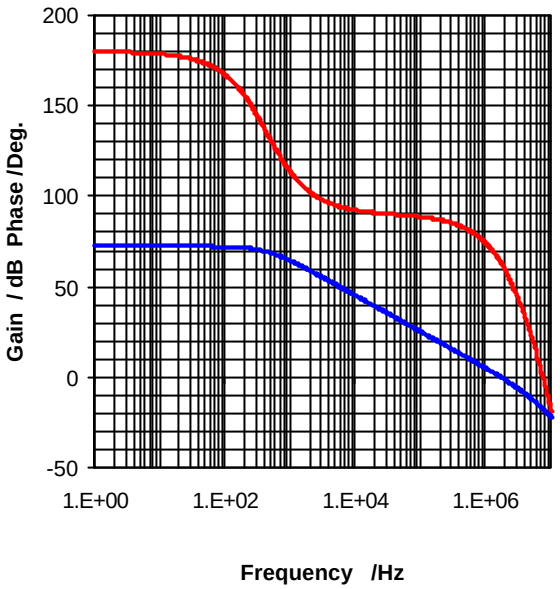
Note: All Gain and Phase Responses plotted above were simulated using nominal processing and T = 27 ºC

Typical Performance Characteristics

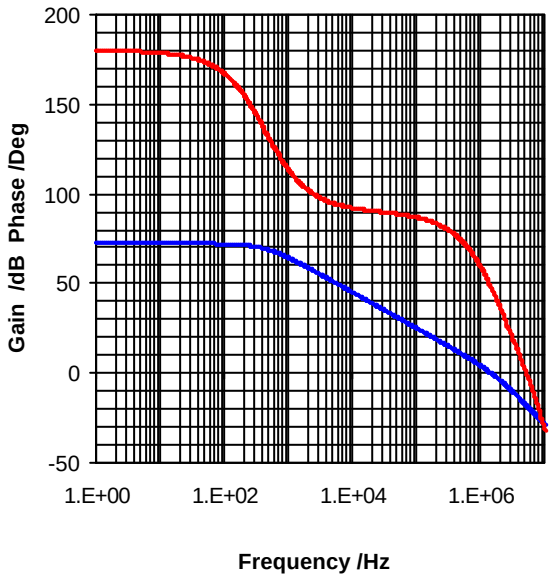
Gain and Phase Reponse vs Frequency.
Load = 600 W



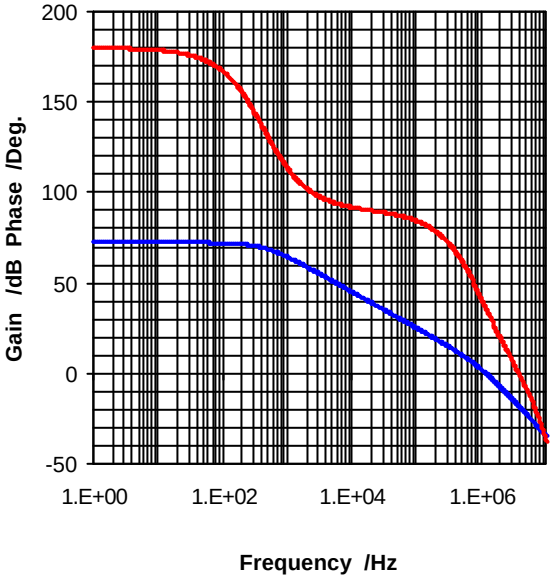
Gain and Phase Response vs Frequency
Load = 20 pF // 100 kW



Gain and Phase Response vs Frequency.
Load = 50 pF // 100 kW



Gain and Phase Response vs Frequency
Load = 100 pF // 100 kW



Note: All Gain and Phase Responses plotted above were simulated using nominal processing and T = 27 °C

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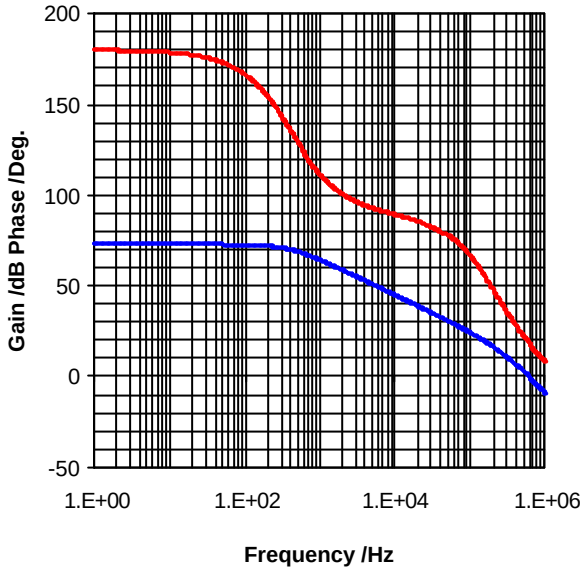
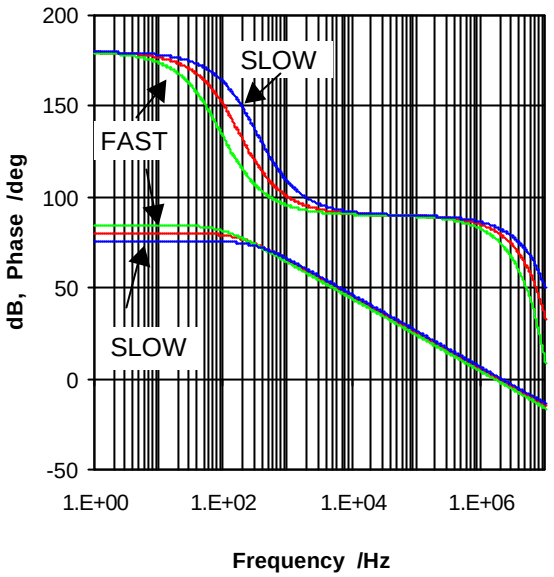
Typical Performance Characteristics

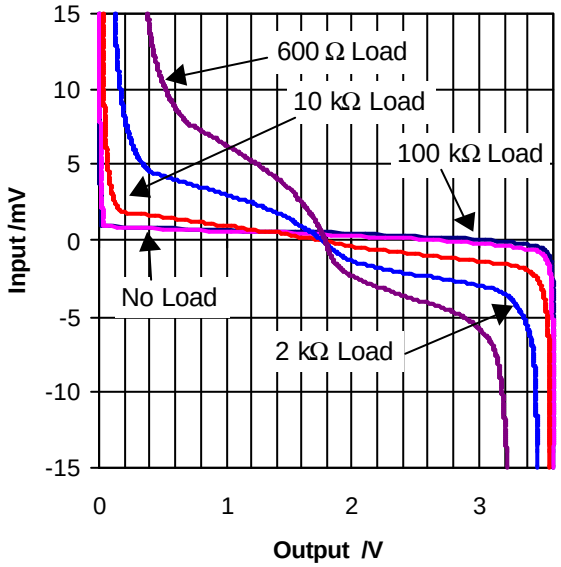
Gain and Phase Response vs Frequency.
Load = 500 pF // 100 kW



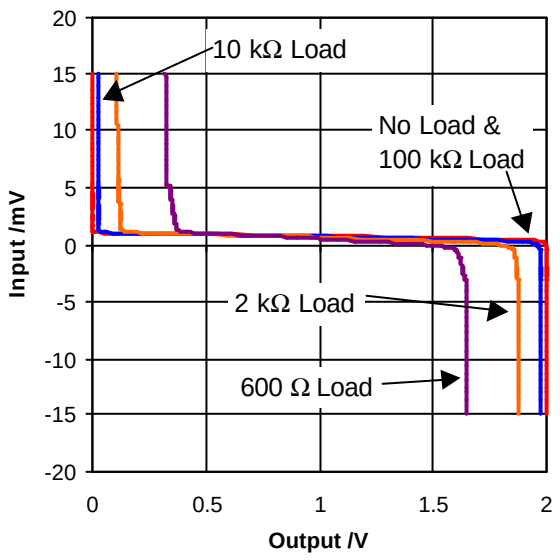
Gain and Phase Response vs Frequency and Process Spread



Input vs Output
V_{DD} = 3.6 V



Input vs Output
V_{DD} = 2V



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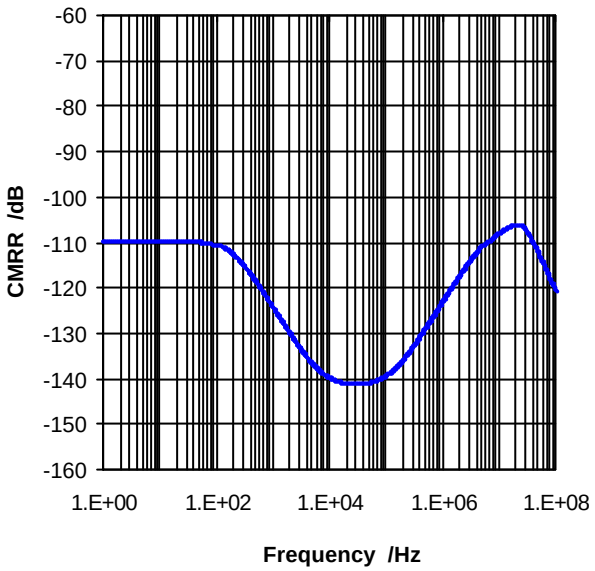
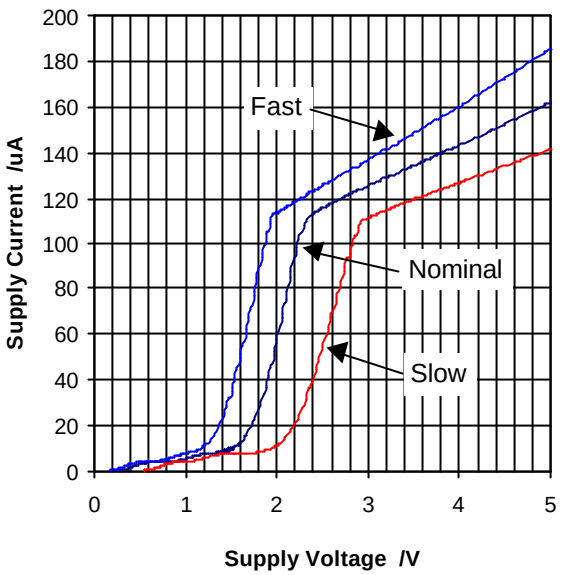
Typical Performance Characteristics

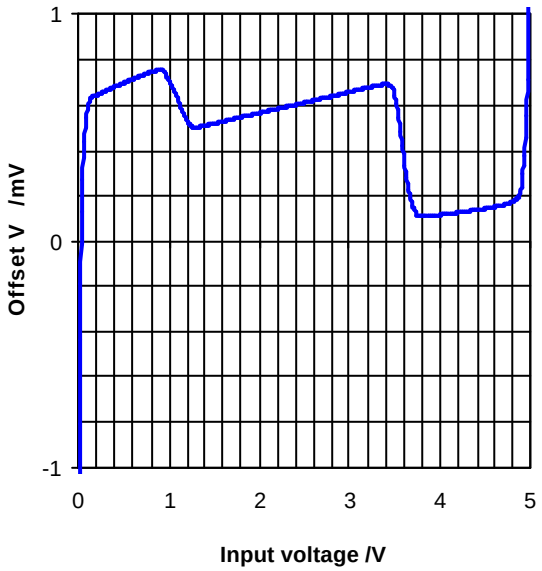
CMRR vs Frequency



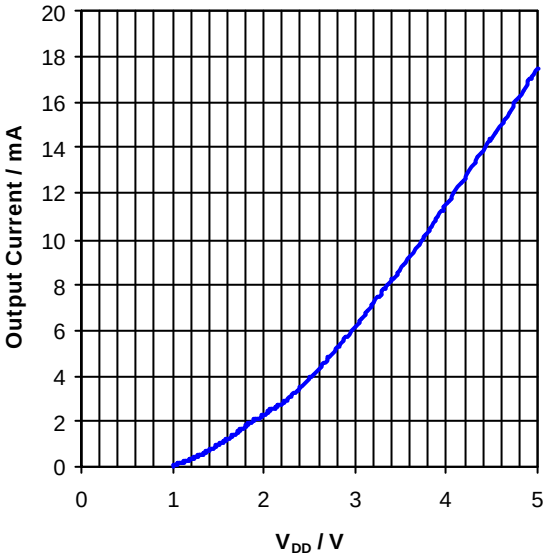
Supply Current vs V_{DD} and Process



Input Offset Voltage vs Input Range



Short Circuit Output Current to GND



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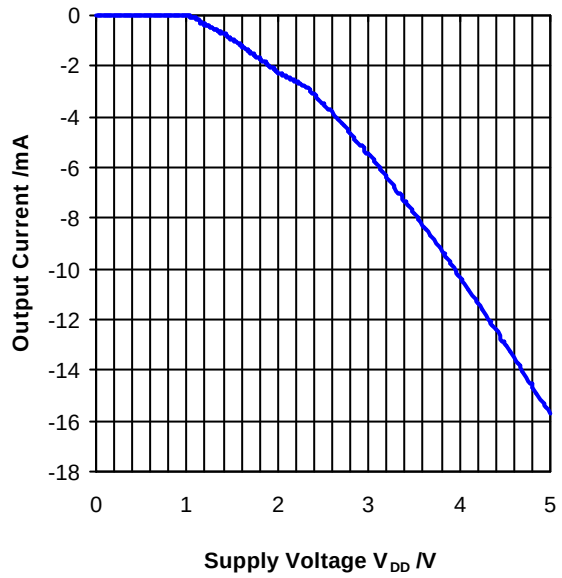
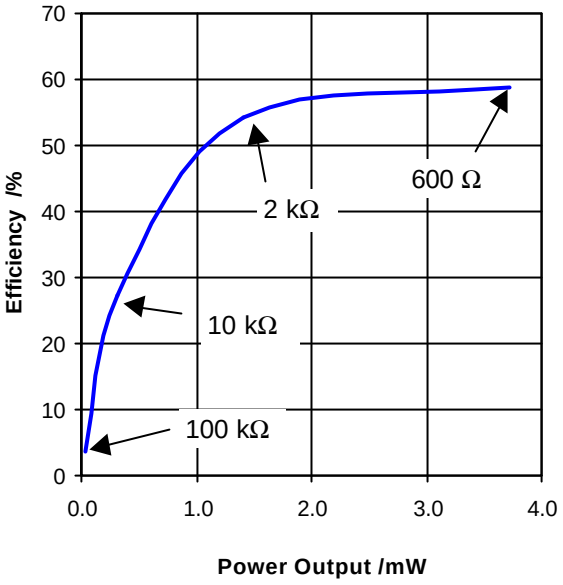
Typical Performance Characteristics

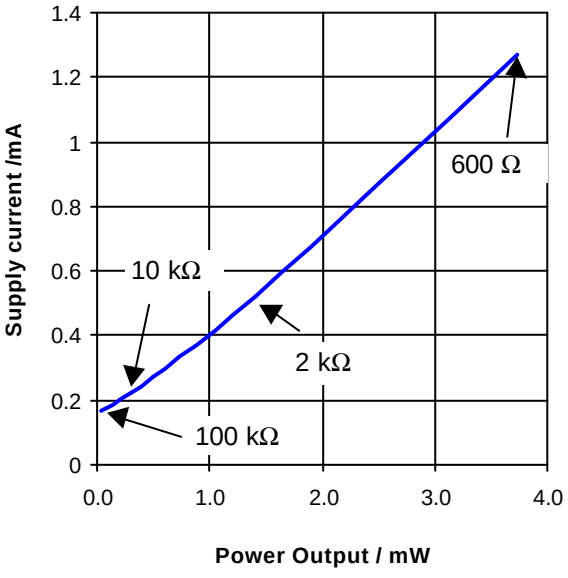
Short Circuit Output Current to VDD



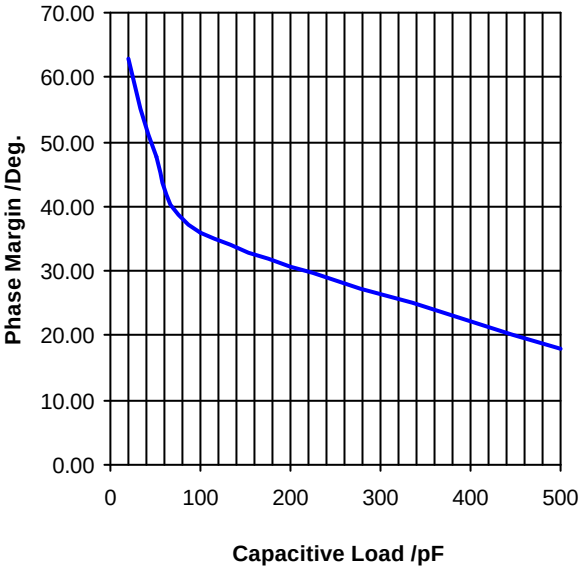
Efficiency vs Power Output
V_{DD} = 5 V THD < 0.2%



Supply Current vs Power Output
V_{DD} = 5 V, THD < 0.2 %



Phase Margin vs Capacitive Load



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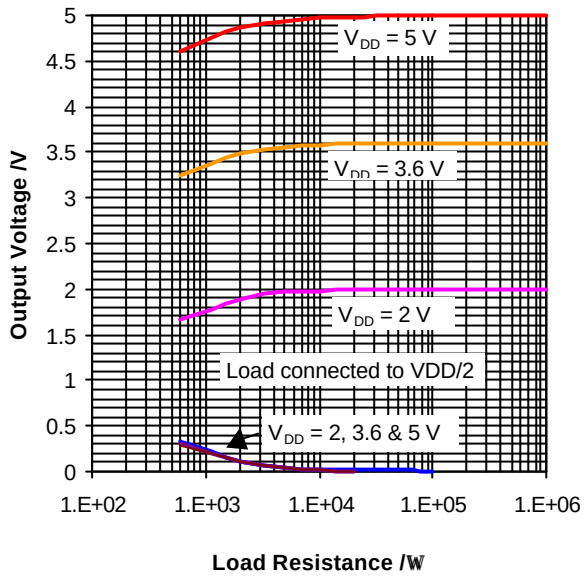
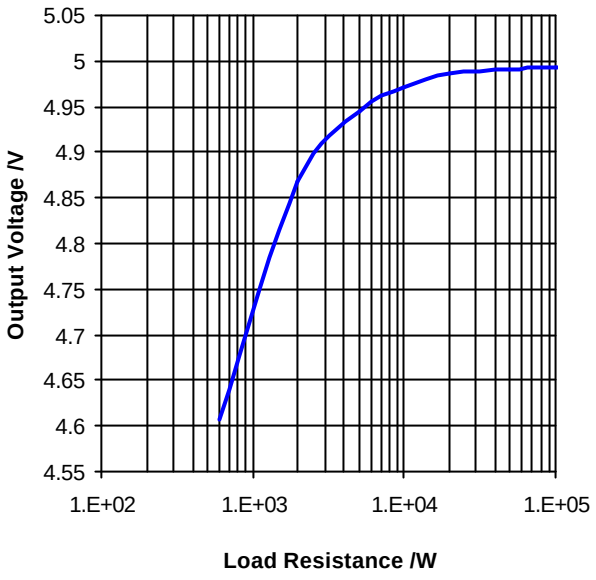
Typical Performance Characteristics

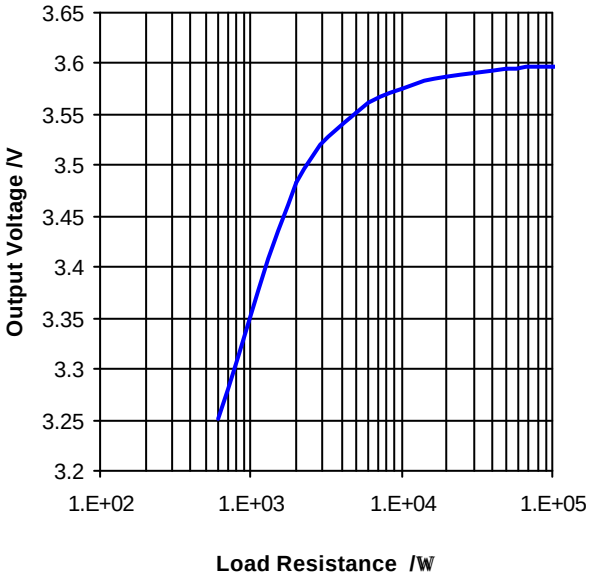
Maximum and Minimum Output vs Load



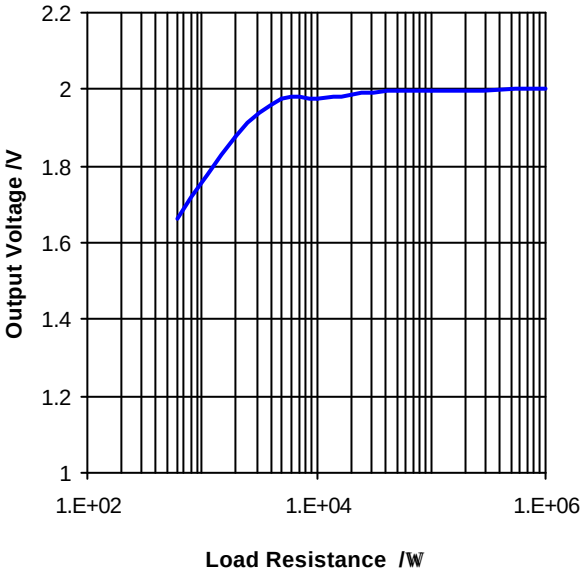
Maximum Output vs Load V_{DD} = 5 V



Maximum Output vs Load V_{DD} = 3.6 V

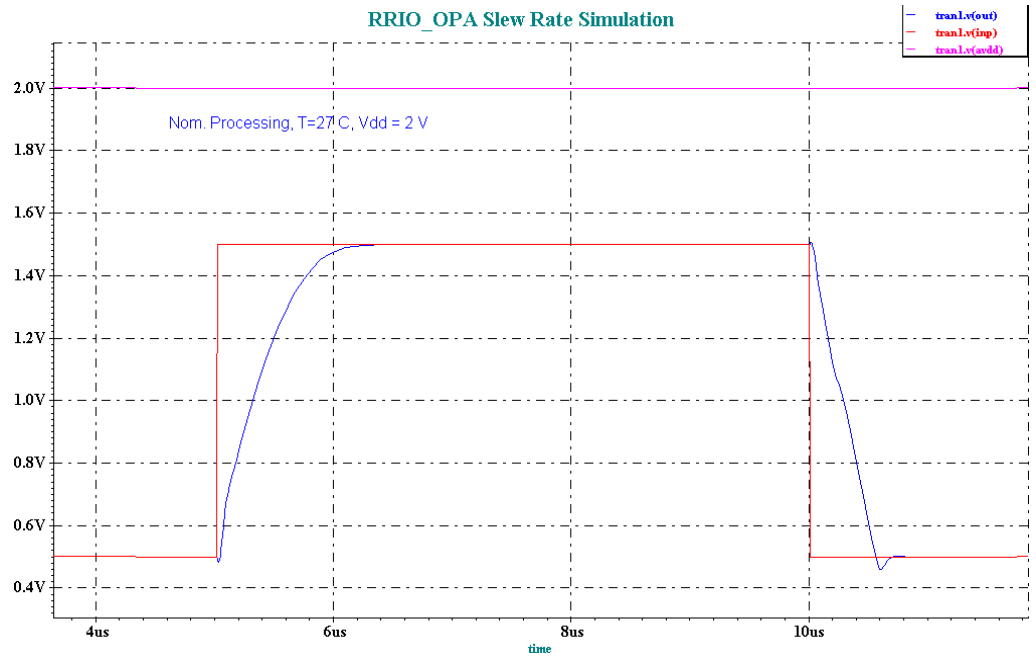


Maximum Output vs Load V_{DD} = 2 V

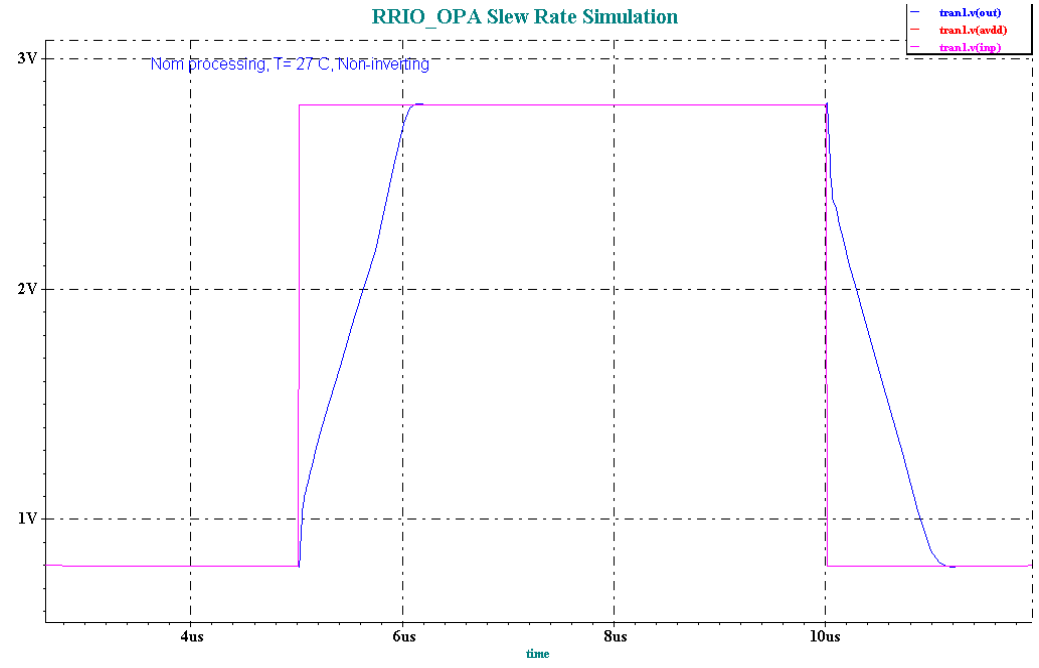


Typical Performance Characteristics

Slew Rate V_{DD} = 2 V Input signal amplitude = 1 V_{pp}

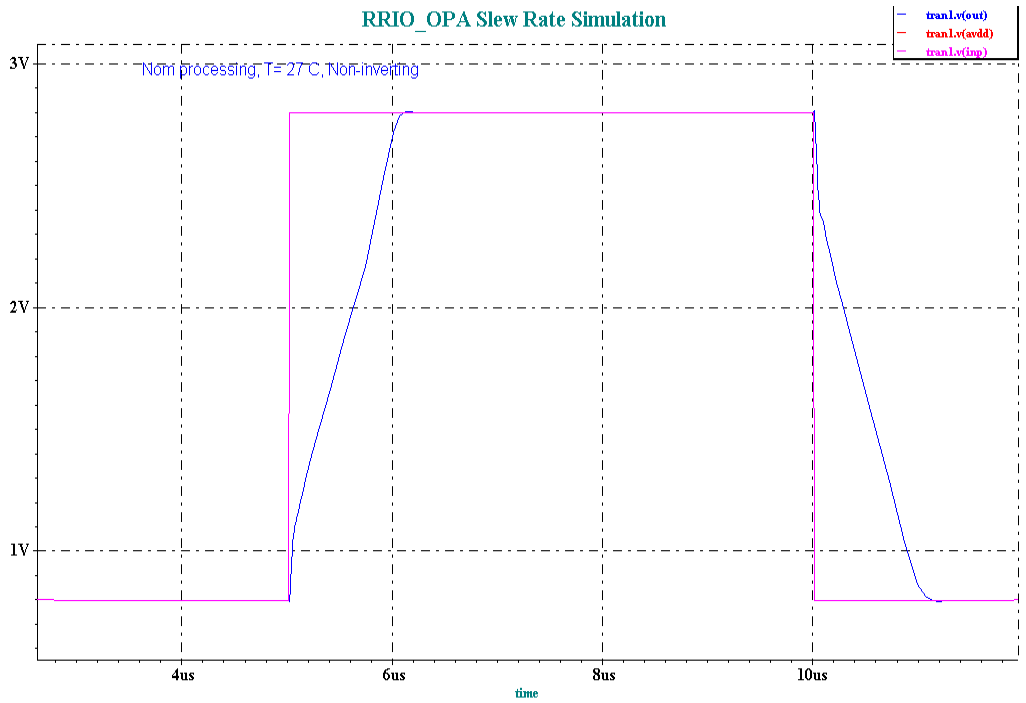


Slew Rate V_{DD} = 3.6 V Input signal amplitude = 2 V_{pp}

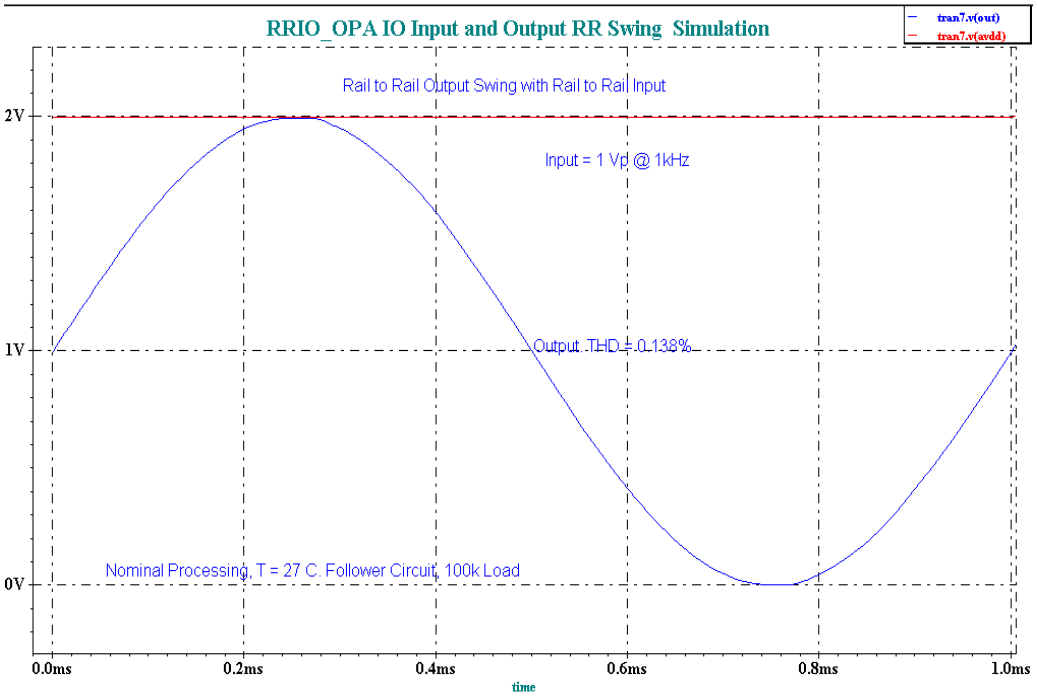


Typical Performance Characteristics

Slew Rate V_{DD} = 5 V Input signal amplitude = 4 V_{pp}

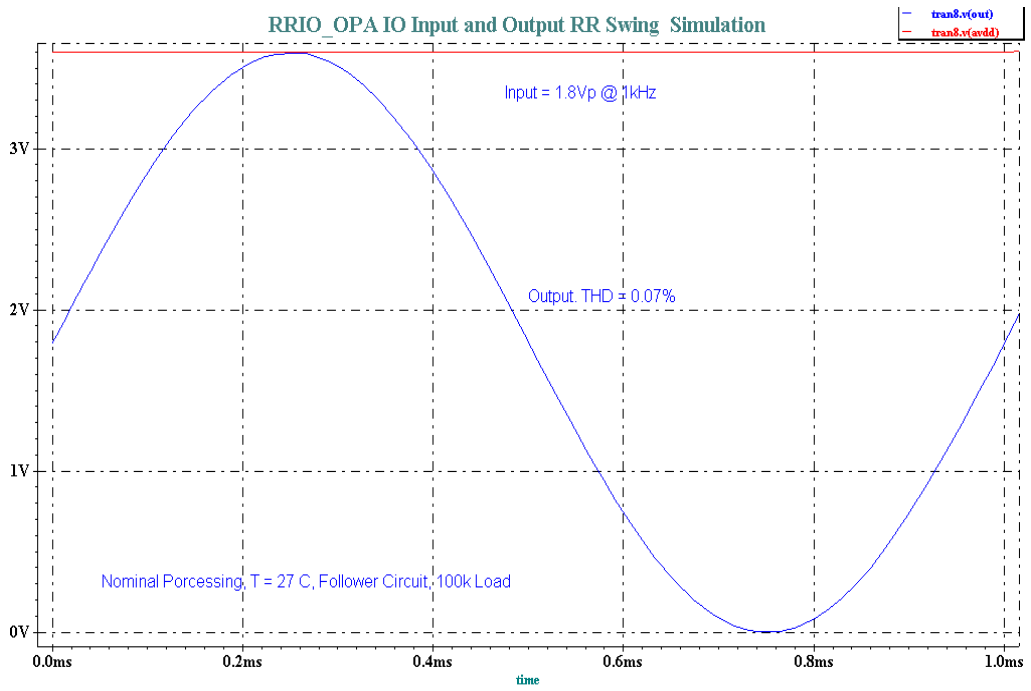


Rail to rail input and output swing V_{DD} = 2 V

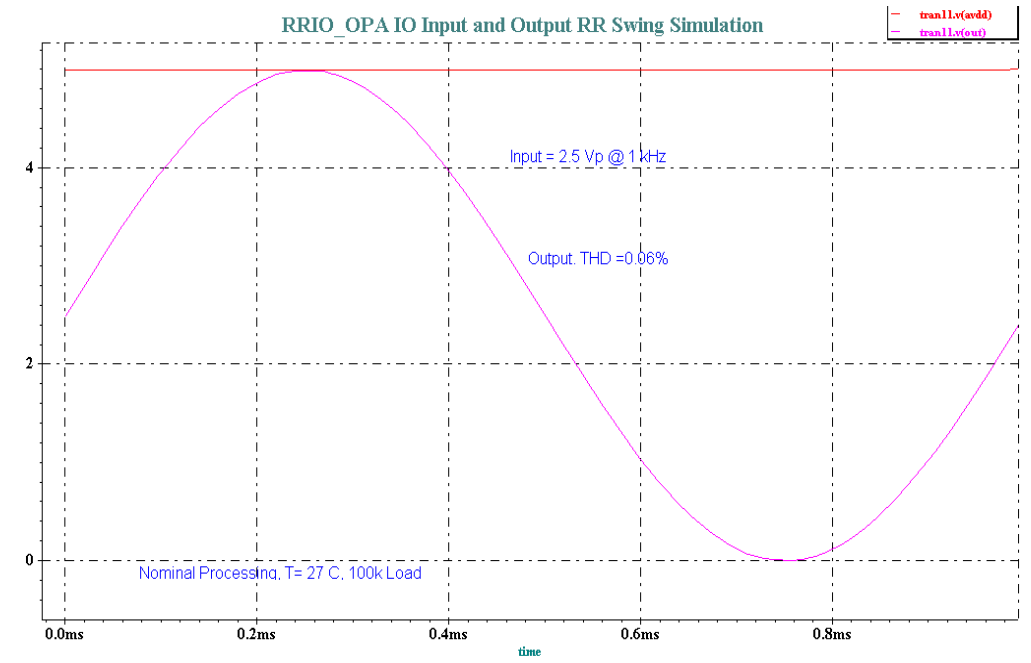


Typical Performance Characteristics

Rail to rail input and output swing V_{DD} = 3.6 V



Rail to rail input and output swing V_{DD} = 5 V



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