Rail to Rail I/O
375 nA Dual OpAmp with Select Option

General Description

The SLG88101 is a wide voltage range, 375 nA Dual Channel Operational Amplifier capable of rail-to-rail input and output operation. Each Amplifier can be individually powered down.

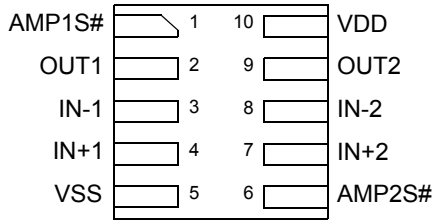
Features

- Low Quiescent Current: 375 nA per Amplifier (typ)
- Low Offset Voltage: ±400 µV per Amplifier (typ)
- Zero-Crossover
- Low Offset Drift: 2 µV/˚C
- Low Noise: 3.6 μV_{PP}
- DC Precision:
  - CMRR: 94 dB
  - PSRR: 85 dB
  - A_{OL}: 113 dB
- Gain-Bandwidth Product: 17.6 kHz
- Rail to Rail Input/Output
- Supply Voltage: 1.6 V to 5.5 V
- Tiny Package: 10-pin 2x2 STDFN
- Industrial Temperature Range: -40 °C to 85 °C

Typical Applications

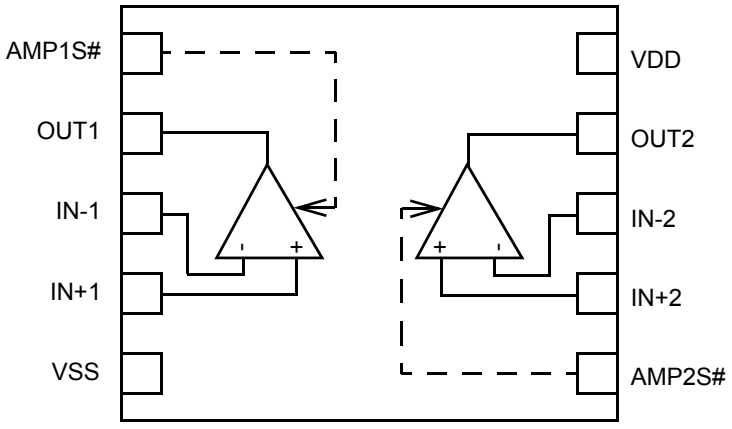
- Battery-Powered Devices
- Portable Devices
- Wearable Products
- Gas Sensors
- Pressure Sensors
- Medical Monitors
- Smoke Detectors
- Active RFID Reader
- Energy Harvester

Pin Configuration



10-pin STDFN
(Top View)

Block Diagram



Preliminary

Pin Description

Pin #	Pin Name	Type[1]	Pin Description
1	AMP1S#	I	Select (OpAmp 1)
2	OUT1	O	Analog Output (OpAmp 1)
3	IN-1	I	Inverting Input (OpAmp 1)
4	IN+1	I	Non-inverting Input (OpAmp 1)
5	VSS	GND	Negative Power Supply
6	AMP2S#	I	Select (OpAmp 2)
7	IN+2	I	Non-inverting Input (OpAmp 2)
8	IN-2	I	Inverting Input (OpAmp 2)
9	OUT2	O	Analog Output (OpAmp 2)
10	VDD	PWR	Power Supply

Notes:
1. Type Definitions
   - PWR: power
   - GND: ground
   - I: input
   - O: output

Absolute Maximum Ratings

Parameter	Description	Min.	Max.	Unit
V_{DD}	Voltage on VDD pin relative to GND	--	6.0	V
T_S	Storage Temperature	-65	150	°C
T_J	Junction Temperature	--	150	°C
ESD_{HBM}	ESD Protection (Human Body Model)	2000	--	V
MSL	Moisture Sensitivity Level	1		

Note: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Electrical Characteristics

T_A = 25 °C (unless otherwise stated)

Symbol	Description	Conditions	Min	Typ	Max	Unit
Input Offset						
V_{OS}	Input Offset Voltage, $V_{CM} = V_{DD}/2$	Room Temperature 25°C	-400	--	+400	µV
		-40 °C to 85 °C	-600	--	+600	µV
dV_{OS}/dT	Offset Drift with Temperature		--	2	--	µV/ ˚C
dV_{OS}/dV_{DD}	Offset Drift with V_{DD} @ $V_{CM} = V_{DD}/2$.		--	20	--	µV
PSRR	Power Supply Rejection Ratio	@ 1 - 300 kHz	70	114	--	dB
CS	Channel Separation		--	70	--	dB
Input Voltage Range						
V_{CMR}	Input Common-Mode Range		0	--	V_{DD}	V
CMRR	Common-Mode Rejection Ratio	Room Temperature 25°C	58	82	--	dB
		-40 °C to 85 °C	46	74	--	dB
Input Bias Current and Impedance						
I_{IB}	Input Bias Current[1]	Room Temperature 25°C	--	2	14	pA
		-40 °C to 85 °C	--	23	793	pA
I_{OS}	Input Offset Current[2]	Room Temperature 25°C	--	2	15	pA
		-40 °C to 85 °C	--	110	930	pA
R_{CM}	Common Mode Input Resistance		--	10^{13}	--	Ω||pF
R_{DIFF}	Differential Input Resistance		--	10^{13}	--	Ω||pF
C_{CM}	Input Capacitance Common-Mode		--	4.3	10	pF
C_{DIFF}	Input Capacitance Differential		--	6	7	pF
Open-Loop Gain						
A_{OL}	Open-Loop Gain	R_{LOAD} = 10 kΩ	--	74	--	dB
		R_{LOAD} = 100 kΩ	--	94	--	dB
		R_{LOAD} = 1 MΩ	95	113	--	dB

Note:
1. Part is measured to be less than 1 µA during production test, specification is guaranteed by design.
2. Guaranteed by design, not tested in production.
3. Standard deviation of 4 for min. V_{DD} @ 2.55 V.

Electrical Characteristics (cont.)

T_A = 25 °C (unless otherwise stated)

Symbol	Description	Conditions	Min	Typ	Max	Unit
Output						
V_{OUT}	Maximum Voltage Swing	R_{LOAD} = 50 kΩ	V_{SS}+10 mV	--	V_{DD}-10 mV	mV
V_{OSR}	Linear Output Swing Range	V_{OVR} from Rail	V_{SS}+100 mV	100	V_{DD}-100 mV	mV
I_{SC}	Short-circuit Current	V_{DD} = 1.8 V	4.2	4.5	--	mA
		V_{DD} = 3.3 V	14	14.5	--	mA
		V_{DD} = 5.5 V	14	14.5	--	mA
C_{LOAD}	Capacitive Load Drive		--	--	10	µF
Power Supply						
V_{DD}	Supply Voltage		1.6	--	5.5	V
I_Q	Quiescent Current (Per Amplifier)	Room Temperature 25°C	--	0.375	0.5	µA
		-40 °C to 85 °C	--	0.4	0.8	µA
Temperature Range						
T_A	Operating Range		-40	--	85	˚C
θ_{JA}	Thermal Resistance		--	80	--	˚C/W
Frequency Response						
GBW	Gain Bandwidth Product	R_{LOAD} = 1 MΩ	--	17.6	--	kHz
SR	Slew Rate		--	10.4	--	V/ms
PM	Phase Margin		--	89	--	˚
t_{OR}	Overload Recovery Time		--	5	--	ms
Noise						
e_n	Input Voltage Noise		--	3.6	--	µVPP
V_n	Input Voltage Noise Density	1 kHz	--	231	--	nV/√Hz
I_n	Input Current Noise Density	1 kHz	--	128	--	pA/√Hz

Open Loop Gain (dB) vs. Temperature (°C)

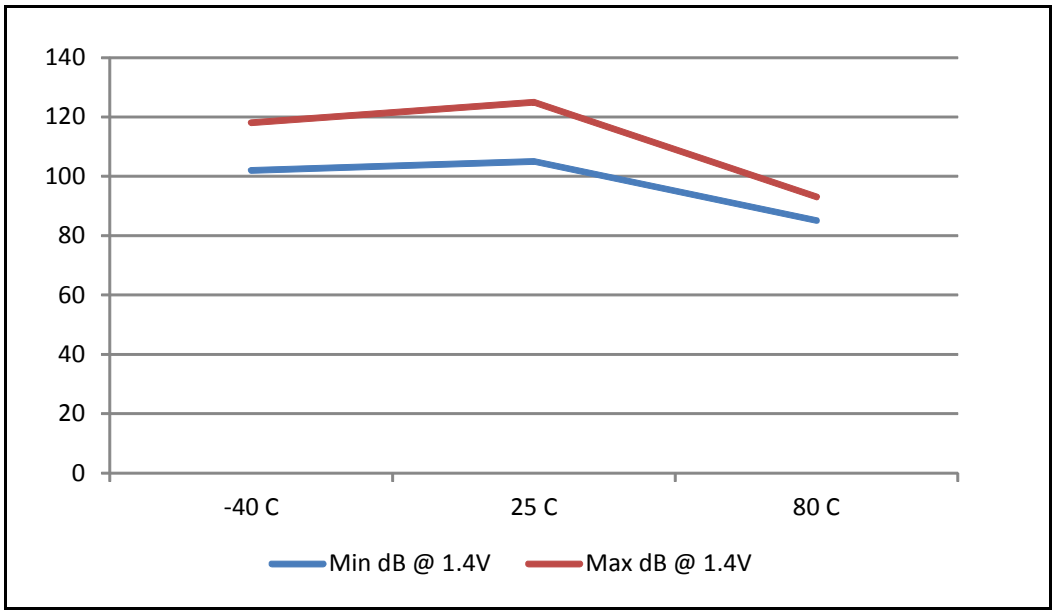


Fig 1. Open Loop Gain vs. Temperature.

Open Loop Gain (dB) vs. VDD (V)

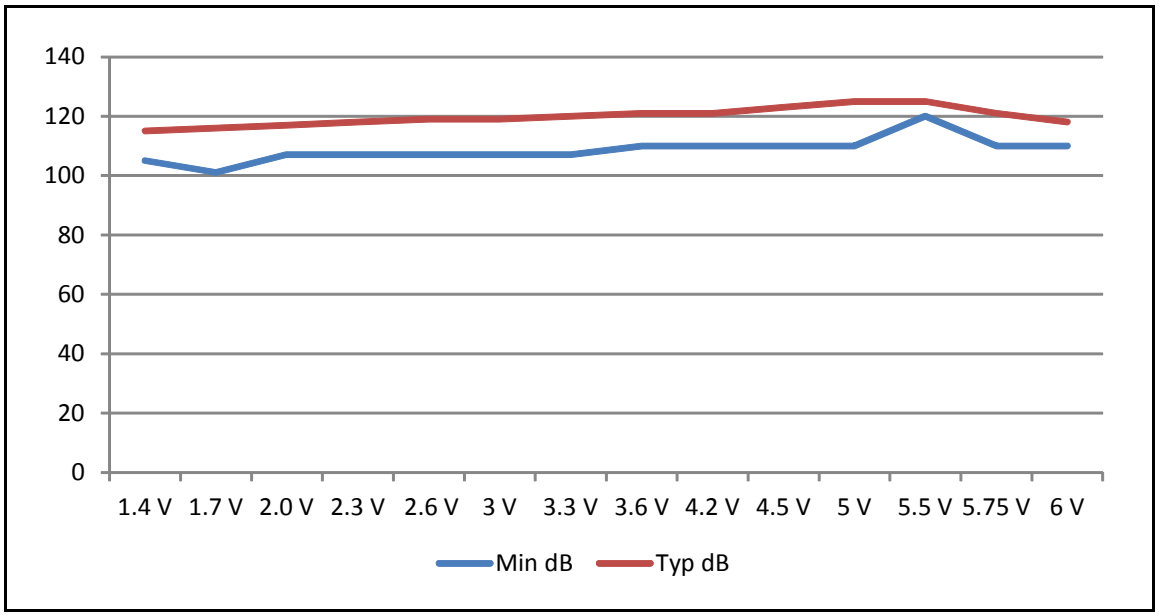


Fig 2. Open Loop Gain vs. VDD.

PSRR (dB) vs. Frequency (Hz)

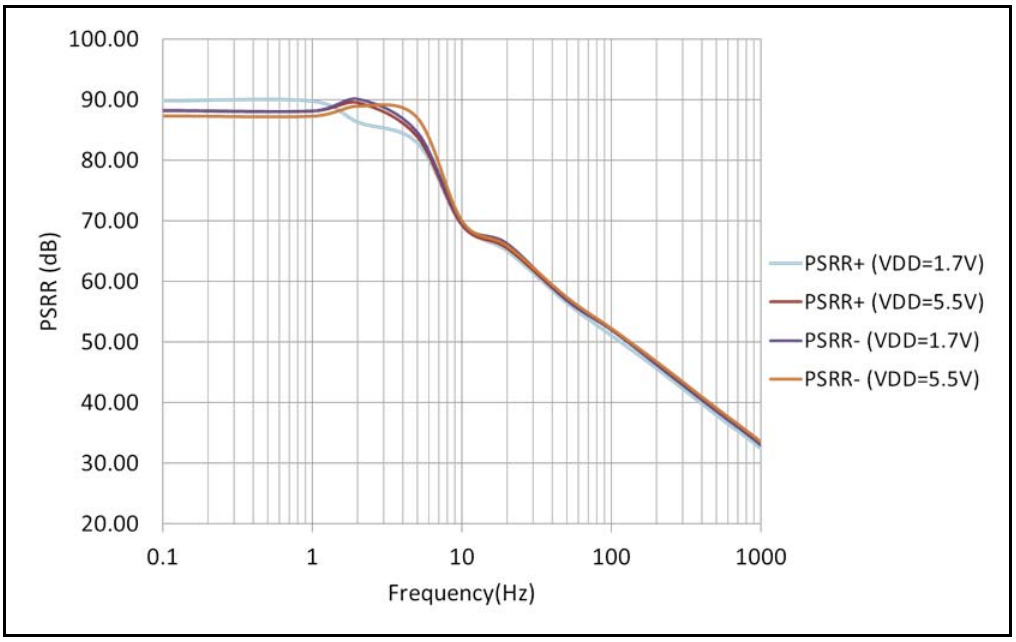


Fig 3. PSRR vs. Frequency.

CMRR (dB) vs. Frequency (Hz)

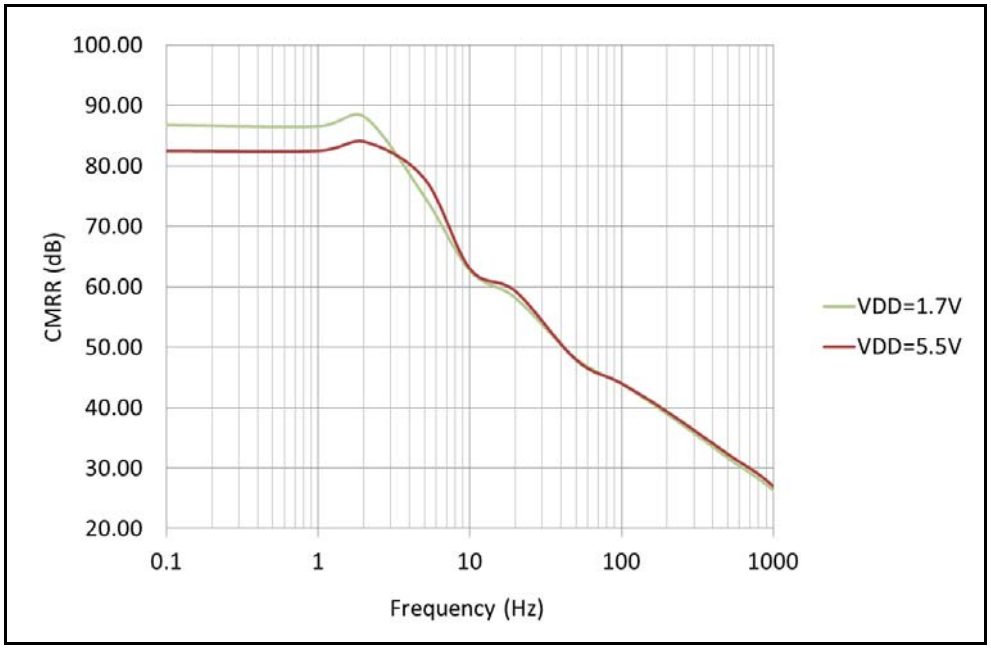


Fig 4. CMRR vs. Frequency.

Quiescent Current (µA) vs. Temperature (°C) @ 1.71 V

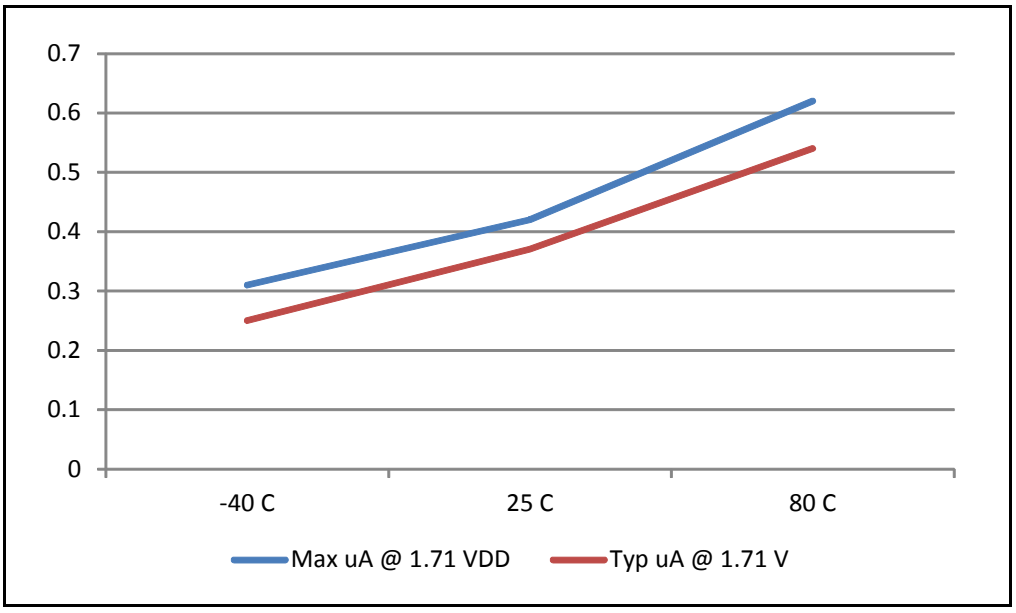


Fig 5. Quiescent Current vs. Temperature @ 1.71 V.

Quiescent Current (µA) vs. Temperature (°C) @ 3.3 V

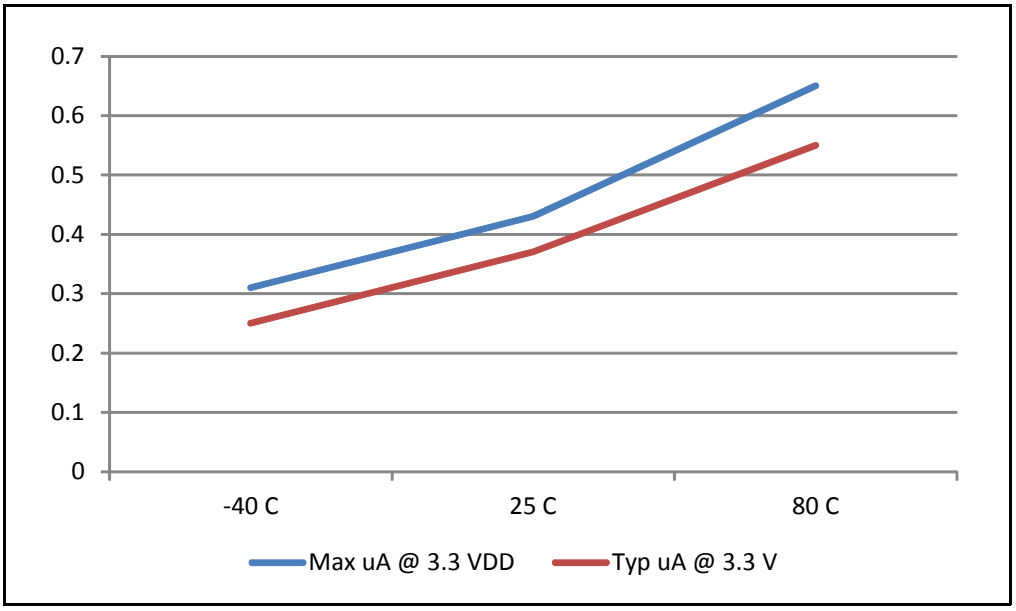


Fig 6. Quiescent Current vs. Temperature @ 3.3 V.

Quiescent Current (µA) vs. Temperature (°C) @ 5.5 V

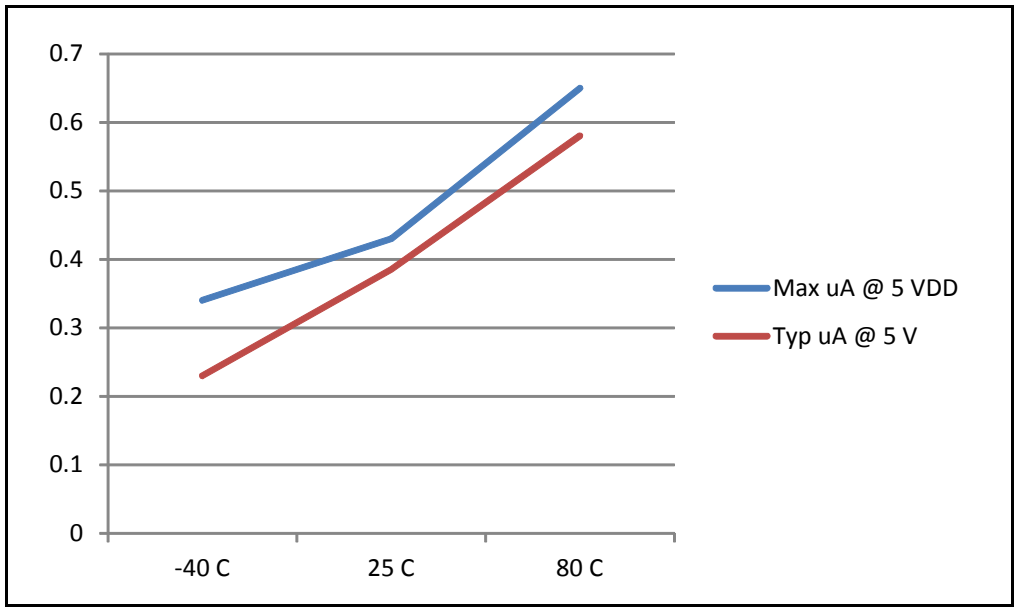


Fig 7. Quiescent Current vs. Temperature @ 5.5 V.

Quiescent Current (µA) vs. VDD (V)

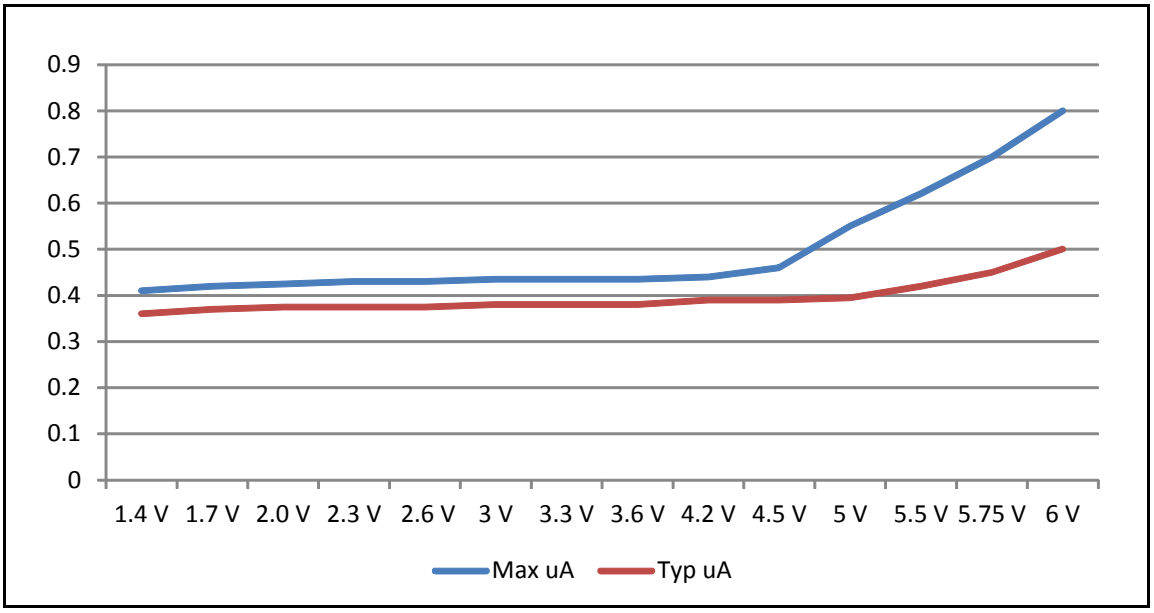
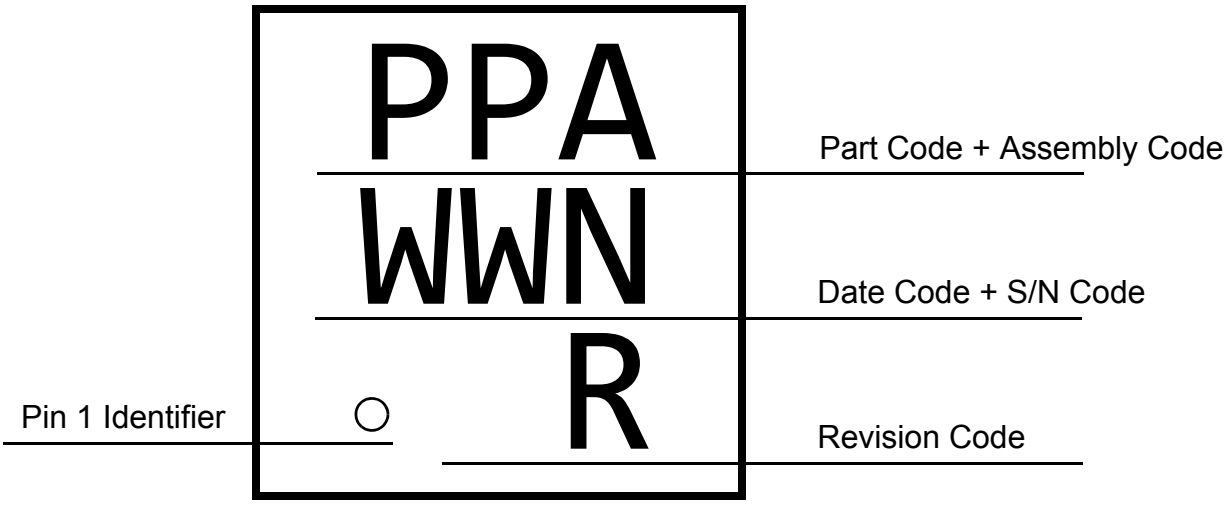


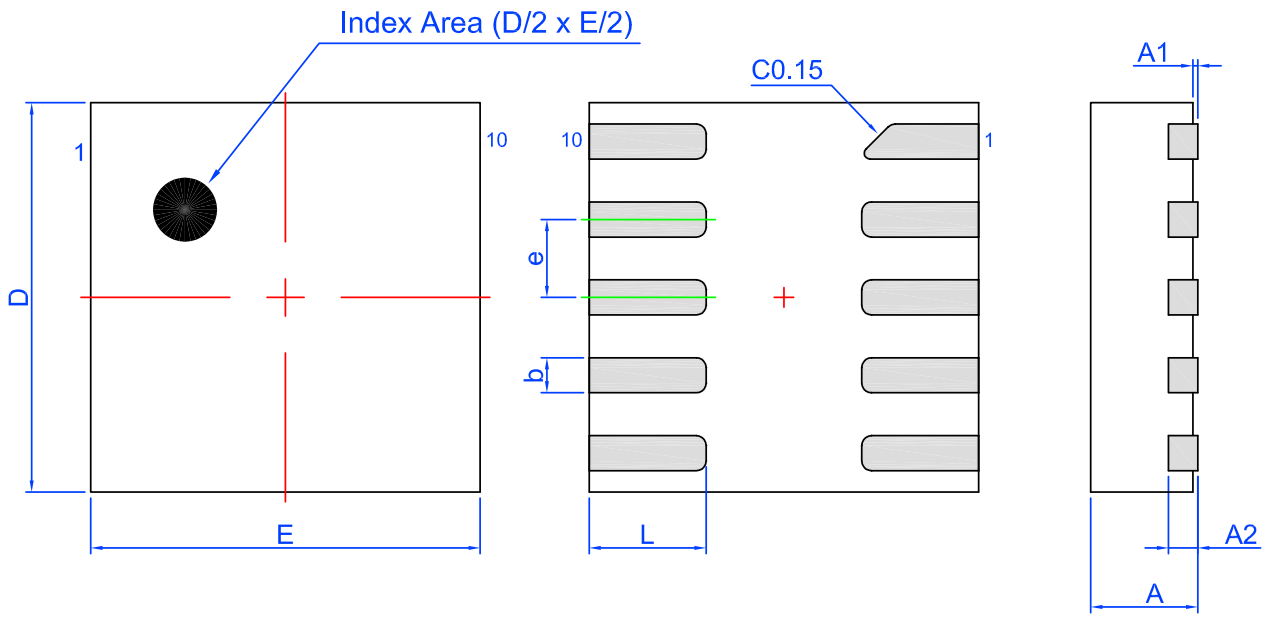
Fig 8. Quiescent Current vs. VDD.

Package Top Marking System Definition



Package Drawing and Dimensions

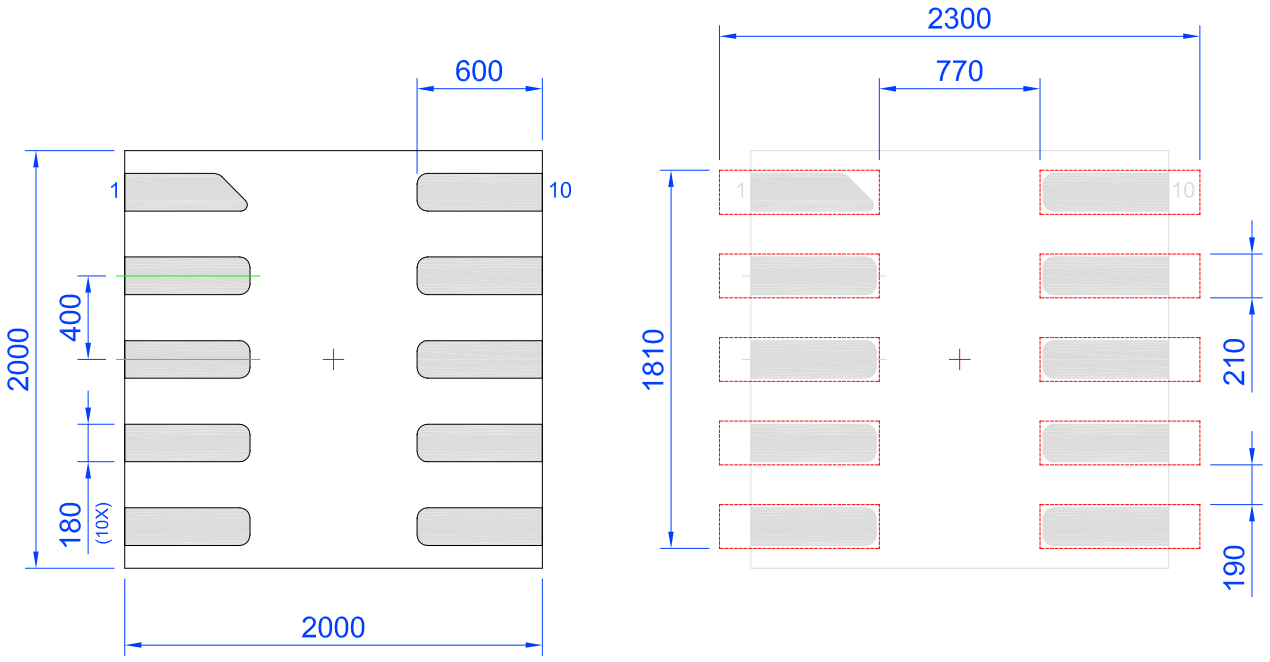
10 Lead STDFN Package
JEDEC MO-252



Unit: mm

Symbol	Min	Nom.	Max	Symbol	Min	Nom.	Max
A	0.50	0.55	0.60	D	1.95	2.00	2.05
A1	0.005	-	0.050	E	1.95	2.00	2.05
A2	0.10	0.15	0.20	L	0.55	0.60	0.65
b	0.13	0.18	0.23	C	0.15 REF		
e	0.40 BSC						

Recommended Land Pattern



Unit: um

Recommended Reflow Soldering Profile

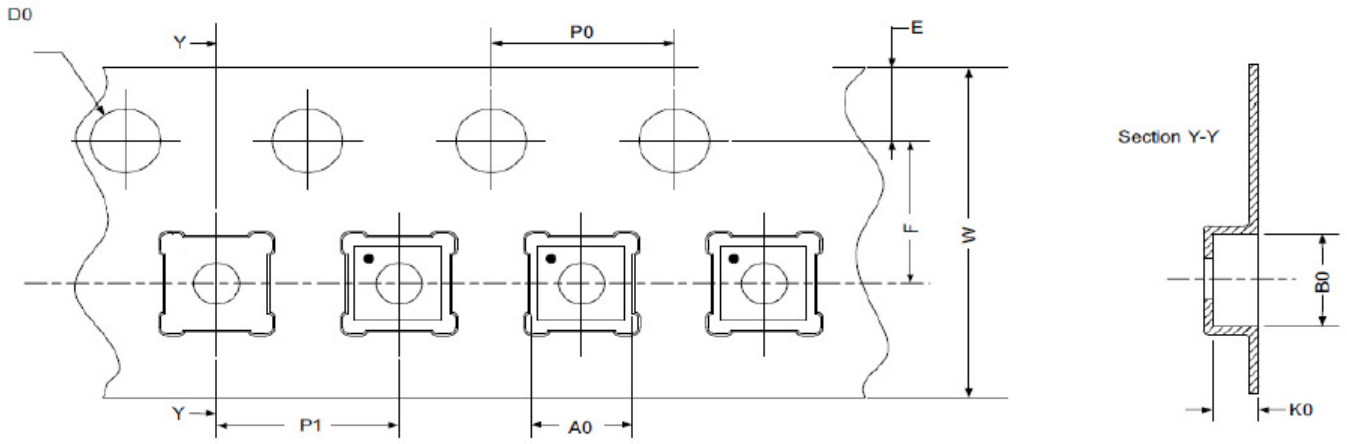
Please see IPC/JEDEC J-STD-020: latest revision for reflow profile based on package volume of 2.2 mm^3 (nominal). More information can be found at www.jedec.org.

Tape and Reel Specifications

Package Type	# of Pins	Nominal Package Size [mm]	Max Units		Reel & Hub Size [mm]	Leader (min)		Trailer (min)		Tape Width [mm]	Part Pitch [mm]
			per Reel	per Box		Pockets	Length [mm]	Pockets	Length [mm]		
STDFN 10L 2x2mm 0.4P COL Green	10	2 x 2 x 0.55	3,000	3,000	178 / 60	100	400	100	400	8	4

Carrier Tape Drawing and Dimensions

Package Type	Pocket BTM Length	Pocket BTM Width	Pocket Depth	Index Hole Pitch	Pocket Pitch	Index Hole Diameter	Index Hole to Tape Edge	Index Hole to Pocket Center	Tape Width
	A0	B0	K0	P0	P1	D0	E	F	W
STDFN 10L 2x2mm 0.4P COL Green	2.2	2.2	0.83	4	4	1.55	1.75	3.5	8



Refer to EIA-481 specification

Ordering Information

Part Number	Type	Production Flow
SLG88101V	10-pin STDFN	Industrial, -40 °C to 85 °C
SLG88101VTR	10-pin STDFN (Tape and Reel)	Industrial, -40 °C to 85 °C

Revision History

Date	Version	Change
5/3/2016	0.55	Added Package Marking Added Land Pattern Updated Tape and Reel Specs
4/18/2016	0.54	Updated AOL
4/15/2016	0.53	Updated Iq
2/8/2016	0.52	Updated Title and Typical Applications Updated Electrical Characteristics
2/3/2016	0.51	Fixed unit in Electrical Characteristics
1/26/2016	0.50	Preliminary Release
1/25/2016	0.12	Updated Electrical Characteristics Added Diagrams
10/29/2015	0.11	Updated Electrical Characteristics
8/20/2015	0.10	Advanced Release

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