Ordering number : EN7600A

SANYO Semiconductors
DATA SHEET

LV5105FN — Bi-CMOS IC For cell phone system Power supply

Overview

The LV5105FN is a power supply for a cell phone system that integrates four series regulators, LED driver (with 5V output) on a single chip.

Functions

- REG×4 (CMOS output)
- DET circuit (one for REG1, one for VBAT (with reset output)
- Thermal shutdown circuit (150°C)
- Three-color LED driver (charge pump 5V output incorporated)
- FRONT LED driver
- Mic bias output

Features

• Low power consumption	4µA when REG4 and VBATDET operate 30µA when REG1, REG2, REG3, and REG4 + DET1 and VBATDET operate
• Built-in charge pump circuit	VBAT : 3.2V to 4.5V, 5V constant output with a load of 80mA
• Built-in 3-color LED drive circuit	Three independent colors, 128-step PWM intensity control

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		7	V
Allowable power dissipation	Pd max	Ta ≤ 75°C *Mounted on a board.	440	mW
Operating temperature	Topr		-30 to +75	°C
Storage temperature	Tstg		-40 to +125	°C

* Mounted on a 50.0mm×50.0mm×0.8mm, glass epoxy board.

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Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage 1	VBAT	29, 33pin	3.2 to 4.5	V
Supply voltage 2	VBATCP	3pin	3.2 to 5.9	V

Electrical Characteristics : Analog at Ta = 25°C, VBAT = 3.6V, VCHARGE = 0V, Unless otherwise specified.

[Current dissipation]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current dissipation 1	$I_{CC}1$	REG4, VBATDET : ON REG1, 2, 3, charge punp, DET1 : OFF no-load VBAT = 3.2V to 4.2V		4	10	μA
Current dissipation 2	$I_{CC}2$	REG1, 2, 4, DET1, VBATDET : ON REG3, charge pump : OFF no load		25	35	μA
Current dissipation 3	$I_{CC}3$	REG3, 4, VBATDET : ON REG1, 2, DET1, charge pump : OFF no load		20	28	μA
Current dissipation 4	$I_{CC}4$	REG1, 2, 3, 4, DET1, VBATDET : ON charge pump : OFF no load		30	42	μA
Current dissipation 5	$I_{CC}5$	REG1, 2, 3, 4, DET1, VBATDET : ON charge pump : OFF no load ECO : L		15	21	μA
Current dissipation 6	$I_{CC}6$	REG1, 2, 3, 4, charge pump, DET1, VBATDET : ON no load		5	8	mA

[REG1]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage 1	V_O1	I_O = 30mA, ECO = H	2.74	2.8	2.86	V
Output voltage 2	V_O1E	I_O = 30mA, ECO = L	2.71	2.8	2.89	V
Output voltage 3	ΔV_O1	(I_O = 30mA, REG1 output voltage at ECO = H) - (I_O = 10mA, REG1 output voltage at I_O = 10 mA and ECO = L)	0	15	35	mV
Drop out voltage	VDR1	VBAT = 2.7V, I_O = 30mA		0.04	0.06	V
Load regulation	$\Delta V_{OLO}1$	I_O = 1 to 150mA		10	50	mV
Line regulation	$\Delta V_{OLN}1$	VBAT = 3.3 to 4.5V, I_O = 1mA		10	60	mV
Output voltage temperature coefficient	$\Delta V_O1/\Delta Tj$	Ta = -25 to 75°C, I_O = 30mA		±100		ppm/°C
Ripple rejection	V_R1	VBAT = 3.6V, I_O = 30mA, VRR = -20dBV, f_{RR} = 1kHz		65		dB
Output noise voltage	$V_{ON}1$	I_O = 30mA, 20Hz < f < 20kHz		75		μVrms
Output voltage 4	ΔV_O2	I_O = 30mA, (Output voltage with charge pump ON - Output voltage with charge pump OFF)	-35		35	mV

[REG2]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage 1	V_O2	I_O = 30mA, ECO = H	2.55	2.6	2.65	V
Output voltage 2	V_O2E	I_O = 30mA, ECO = L	2.53	2.6	2.67	V
Drop out voltage	VDR1	VBAT = 2.5V, I_O = 30mA		0.06	0.12	V
Load regulation	$\Delta V_{OLO}2$	I_O = 1 to 100mA		10	100	mV
Line regulation	$\Delta V_{OLN}2$	VBAT = 3.3 to 4.5V, I_O = 1mA		10	60	mV
Output voltage temperature coefficient	$\Delta V_O2/\Delta Tj$	Ta = -25 to 75°C, I_O = 30mA		±100		ppm/°C
Ripple rejection	V_R2	VBAT = 3.6V, I_O = 30mA, VRR = -20dBV, f_{RR} = 1kHz		65		dB
Output noise voltage	$V_{ON}2$	I_O = 30mA, 20Hz < f < 20kHz		75		μVrms

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[REG3]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage 1	V_O3	I_O = 30mA, ECO = H	2.79	2.85	2.91	V
Output voltage 2	V_O3E	I_O = 30mA, ECO = L	2.76	2.85	2.94	V
Drop out voltage	VDR3	VBAT = 2.7V, I_O = 30mA		0.06	0.12	V
Load regulation	$\Delta V_{OLO}3$	I_O = 1 to 50mA		10	50	mV
Line regulation	$\Delta V_{OLN}3$	VBAT = 3.3 to 4.5V, I_O = 1mA		10	60	mV
Output voltage temperature coefficient	$\Delta V_O3/\Delta Tj$	Ta = -25 to 75°C, I_O = 30mA		±100		ppm/°C
Ripple rejection	V_R3	VBAT = 3.6V, I_O = 30mA, VRR = -20dBV, f_{RR} = 1kHz		65		dB
Output noise voltage	$V_{ON}3$	I_O = 30mA, 20Hz < f < 20kHz		75		μVrms

[REG4]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage	V_O4	I_O = 30mA	2.91	3	3.09	V
Drop out voltage	VDR3	VBAT = 2.9V, I_O = 30mA		0.06	0.12	V
Load regulation	$\Delta V_{OLO}4$	I_O = 1 to 50mA		10	50	mV
Line regulation	$\Delta V_{OLN}4$	VBAT = 3.3 to 4.5V, I_O = 1mA		10	60	mV
Output voltage temperature coefficient	$\Delta V_O4/\Delta Tj$	Ta = -25 to 75°C, I_O = 30mA		±100		ppm/°C
Ripple rejection	V_R4	VBAT = 3.6V, I_O = 30mA, VRR = -20dBV, f_{RR} = 1kHz		55		dB
Output noise voltage	$V_{ON}4$	I_O = 30mA, 20Hz < f < 20kHz		75		μVrms

[DET1]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Detection voltage	VD1	H→L	2.45	2.5	2.55	V
Hysteresis width	ΔV_H1		75	125	175	mV
Detection voltage temperature coefficient	ΔVD1/ΔTj	Ta = -25 to 75°C		±100		ppm/°C

[VBATDET]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Detection voltage	VDB	H→L	3.04	3.1	3.16	V
Hysteresis width	ΔVHB		93	155	217	mV
Output pull-up resistance	RPDETB		1.4	1.8	2.2	MΩ
Detection voltage temperature coefficient	ΔVDB/ΔTj	Ta = -25 to 75°C		±100		ppm/°C

[Charge pump]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage 1	VCPO1	VBAT = 3.2 to 5.9V, Load current 80mA	4.8	5	5.2	V
Oscillation frequency	CPOSC		0.7	1	1.3	MHz
Output ripple	VRCP	VBAT = 3.6, Load current 80mA		±200		mVp-p
Efficiency	η	VBAT = 3.2, Load current 80mA		72		%

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[LED driver]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
LEDR output voltage	VLR	I_O = 40mA	0	0.1	0.2	V
LEDG output voltage	VLG	I_O = 40mA	0	0.1	0.2	V
LEDB output voltage	VLB	I_O = 40mA	0	0.1	0.2	V
LEDF output voltage	VLF	I_O = 40mA	0	0.15	0.3	V
LEDR OFF leak	ILR			0	1	μA
LEDG OFF leak	ILG			0	1	μA
LEDB OFF leak	ILB			0	1	μA
LEDF OFF leak	ILF			0	1	μA

[Mic bias]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output ON resistance	RMO	I_O = 10mA		10		Ω
OFF leakage current	ILM			0	1	μA

[Output voltage (GP_0, 1)]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output H level	V_{OH}	I_O = 1mA	REG10 -0.3		REG10	V
Output L level	V_{OL}	I_O = 1mA	0		0.3	V

[Input voltage 1 (SDATA, SEN, SCLK)]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
H level	$V_{INH}1$	Input H level	REG10 ×0.8		REG10	V
L level	$V_{INL}1$	Input L level	0		REG10 ×0.2	V

[Input voltage 2 (T_CNT, TCXOCNT, ECO, REG3CTL, REG12CTL, PWRON, RTCINT, MSSELO, MSSELOC, KEYSENSE4, HWRESET)]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
H level	$V_{INH}2$	Input H level	REG40 ×0.8		REG40	V
L level	$V_{INL}2$	Input L level	0		REG40 ×0.2	V

[Input voltage 3 (RESOUT_N)]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
H level	$V_{INH}3$	Input H level	REG20 ×0.8		REG20	V
L level	$V_{INL}3$	Input L level	0		REG20 ×0.2	V

[Input voltage 4 (CHG_G)]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
H level	$V_{INH}4$	Input H level	REG40 ×0.8		6	V
L level	$V_{INL}4$	Input L level	0		REG40 ×0.2	V

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[Input voltage 5 (Vcharge)]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
H level	$V_{INH}5$	Input H level	4.4		6	V
L level	$V_{INL}5$	Input L level	0		3.6	V

[Input voltage 6 (VBATBK)]

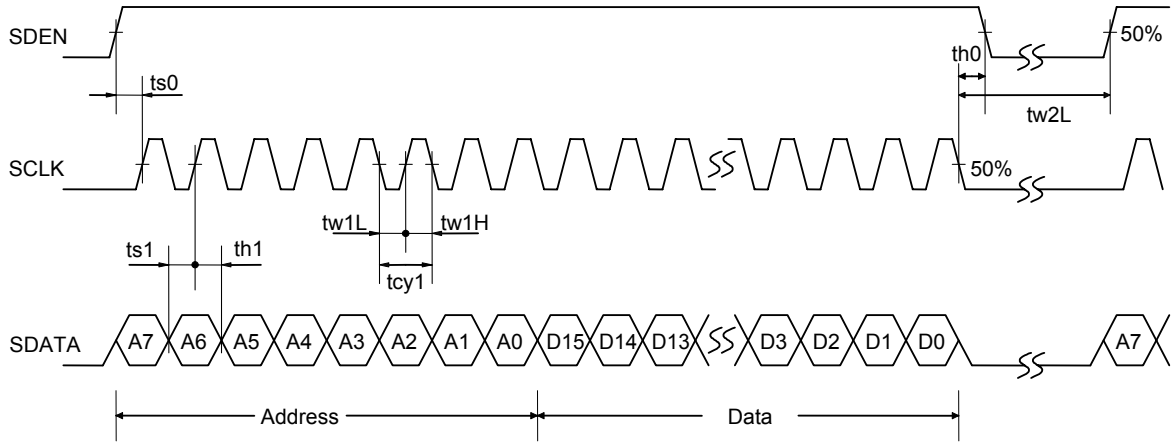
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
H level	$V_{INH}6$	Input H level	REG40 ×0.8		VBAT	V
L level	$V_{INL}6$	Input L level	0		REG40 ×0.2	V

Electrical Characteristics : Serial bus

[Serial transfer timing]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Cycle time	tcy1	SCLK clock cycle	300			ns
Data setup time 1	ts0	SDEN setup time for rise of SCLK	150	-	-	ns
Data setup time 2	ts1	SDATA setup time for rise of SCLK	150	-	-	ns
Data hold time 1	th0	SDEN hold time for fall of SCLK	150	-	-	ns
Data hold time 2	th1	SDATA hold time for rise of SCLK	150	-	-	ns
Pulse width 1	tw1L	SCLK L-period pulse width	150	-	-	ns
Pulse width 2	tw1H	SCLK H-period pulse width	150	-	-	ns
Pulse width 3	tw2L	SDEN L-period pulse width	1	-	-	μs

Serial transfer timing conditions



Data length : 24bit

Clock frequency : 3MHz or les

"SDATA" is taken in at fall of "SDEN" when "SCLK" of 24 clock is entered during H period of "SDEN."

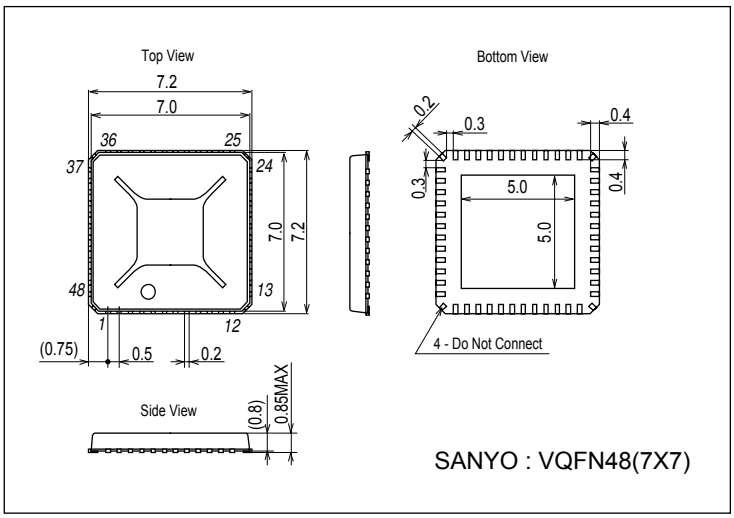
(Note) "SDATA" is not taken in when "SCLK" is 23 clock or less during H period of "SDEN."

When "SCLOCK" exceeds 25 clock, "SDATA" is taken in at the 24th clock, and subsequent "SDATA" is ignored.

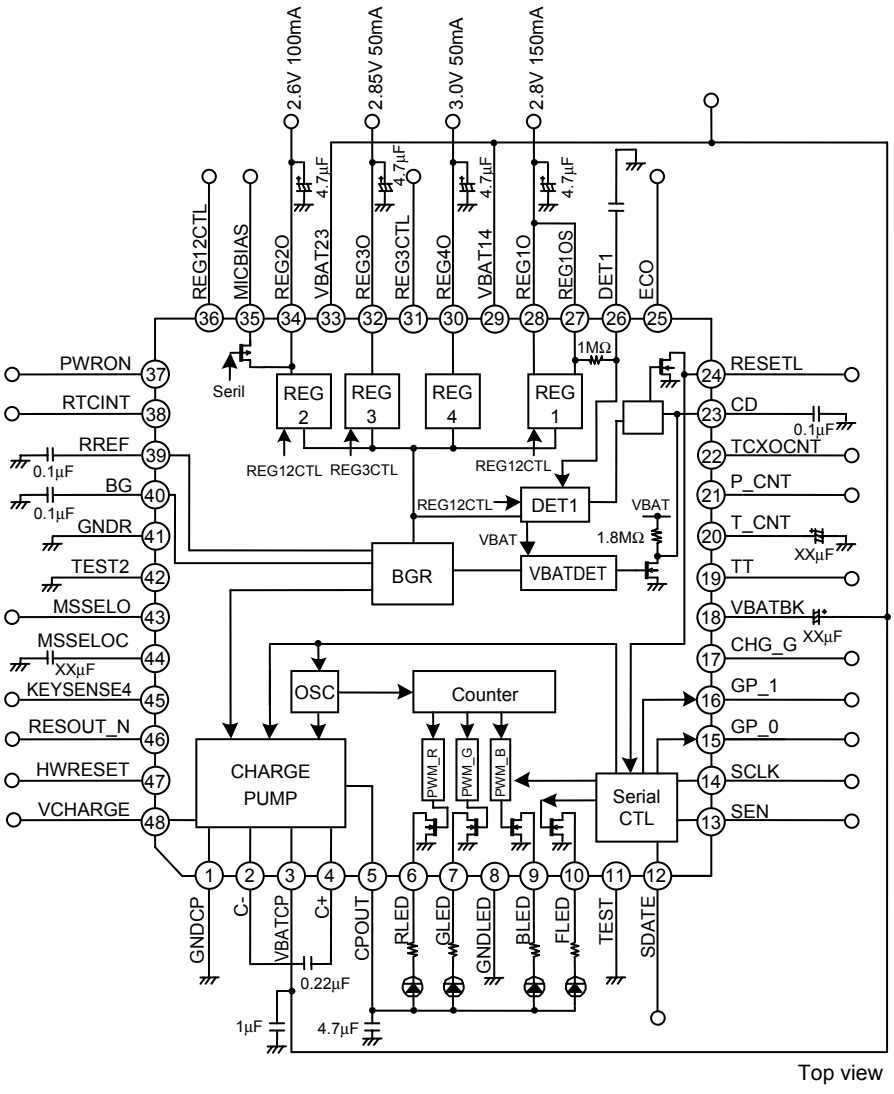
Package Dimensions

unit : mm (typ)

3272



Block Diagram

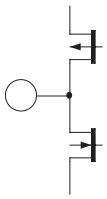
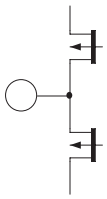
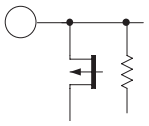
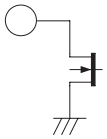
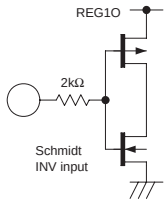


Top view

Pin Table

No.	Pin symbol	Pin description	Input form	ESD element	
				VBAT	GND
1	GNDCP	Charge pump circuit ground pin	-	-	-
2	C^-	Flying capacitor connection pin	A	-	○
3	VBATCP	Charge pum circuit power pin	-	-	○
4	C^+	Flying capacitor connection pin	B	-	○
5	CPOUT	Charge pump output pin	C	-	○
6	RLED	RLED drive pin	D	-	○
7	GLED	GLED drive pin	D	-	○
8	GNDLED	LED drive circuit ground pin	-	-	-
9	BLED	RLED drive pin	D	-	○
10	FLED	FLED drive pin	D	-	○
11	TEST	Test input pin (Be sure to connect it to GND during normal use)	-	○	○
12	SDATA	Serial data signal input pin	E	○	○
13	SEN	Serial enable signal input pin	E	○	○
14	SCLK	Serial clock signal input pin	E	○	○
15	GP_0	Serially controllable output pin	F	○	○
16	GP_1	Serially controllable output pin	F	○	○
17	CHG_G	Power control logic circuit input pin	G	-	○
18	VBATBK	Power control logic circuit input pin	H	○	○
19	TT	Power control logic circuit output pin	I	○	○
20	T_CNT	Power control logic circuit output pin	J	○	○
21	P_CNT	Power control logic circuit output pin	I	○	○
22	TCXOCNT	Power control logic circuit input pin	H	○	○
23	CD	VBATDET delay capacitor connection pin	L	○	○
24	RESET	Reset output pin	M	○	○
25	ECO	ECO mode control pin L : ECO mode, H : Normal mode	G	○	○
26	DET1	DET1 delay capacitor connection pin	N	○	○
27	REG1OS	REG1 sense pin	O	○	○
28	REG1O	REG1 output pin	P	○	○
29	VBAT14	REG1, 4 circuit power pin	-	○	○
30	REG4O	REG4 output pin	Q	○	○
31	REG3CTL	REG3 control pin L : OFF, H : ON	G	○	○
32	REG3O	REG3 output pin	Q	○	○
33	VBAT23	REG2, 3 circuit power pin	-	○	○
34	REG2O	REG2 output pin	Q	○	○
35	MICBIAS	Mic bias output pin (serial control)	R	○	○
36	REG12CTL	REG1, 2 control pin L : OFF, H : ON	G	○	○
37	PWRON	Power control logic circuit input pin	H	○	○
38	RTCINT	Power control logic circuit input pin	S	○	○
39	RREF	Regulator reference pin	T	○	○
40	BG	BGR output pin	U	○	○
41	GNDR	Regulator circuit ground pin	-	-	-
42	TEST2	Test input pin (Be sure to connect it to GND during normal use)	-	-	-
43	MSSELO	Power control logic circuit input pin	V	○	○
44	MSSELOC	Power control logic circuit input pin	W	○	○
45	KEYSENCE4	Power control logic circuit input pin	S	○	○
46	RESOUT_N	Power control logic circuit input pin	X	○	○
47	HWRESET	Power control logic circuit input pin	K	○	○
48	VCHARG	VCHARGE voltage input pin	Y	-	○

Pin Table

A	B	C	D	E
				
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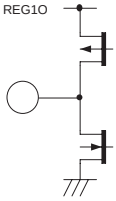	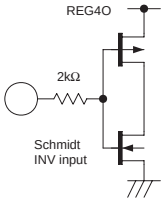	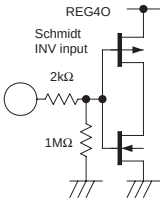	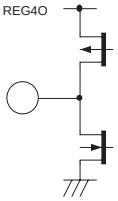	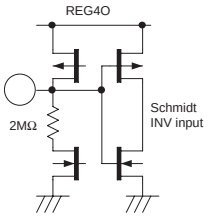
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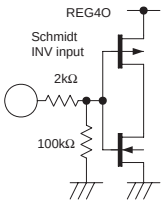	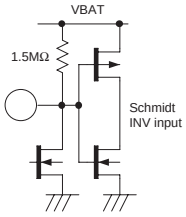	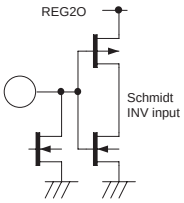	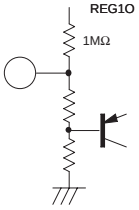	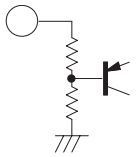
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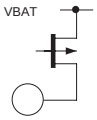	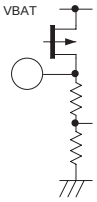	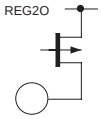	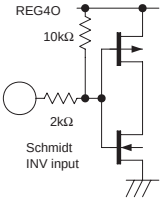	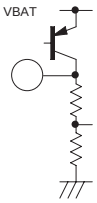
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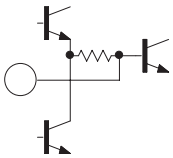	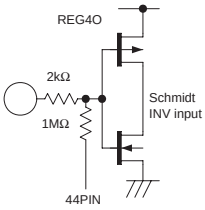	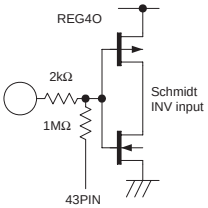	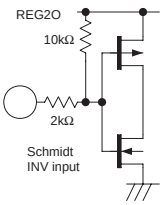	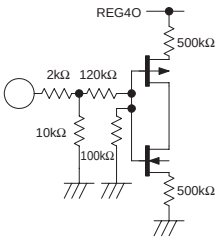

Power Control Block Diagram