FA3621F

CMOS IC
For Switching Power Supply Control

■ Description

FA3621F is a control IC for 6-channel DC-DC converter.
This IC can directly drive a Nch/Pch-MOSFET.
This IC is suitable to reduce converter size because it has many functions in a small package LQFP-48.

■ Features

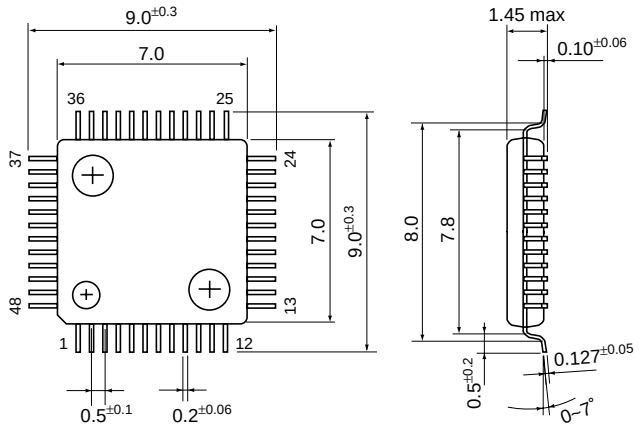
- 6-channel PWM control with MOSFET direct driving :
  5-channel for Pch-MOSFET, 1channel for Nch-MOSFET
- Low input voltage: 4.5V to 20V
- ±1.5% high accuracy bandgap reference
- Low power consumption by means of CDMOS
  Standby mode: 10μA(max.)
  Operating mode: 6mA(max.)
- Soft start function for each channel
- ON/OFF function for each channel
- Timer latch for short protection
- Overheat protection
- Undervoltage lockout
- Wide range of operation frequency: 50kHz to 1MHz
- Package: LQFP-48(Thin and small)

■ Application

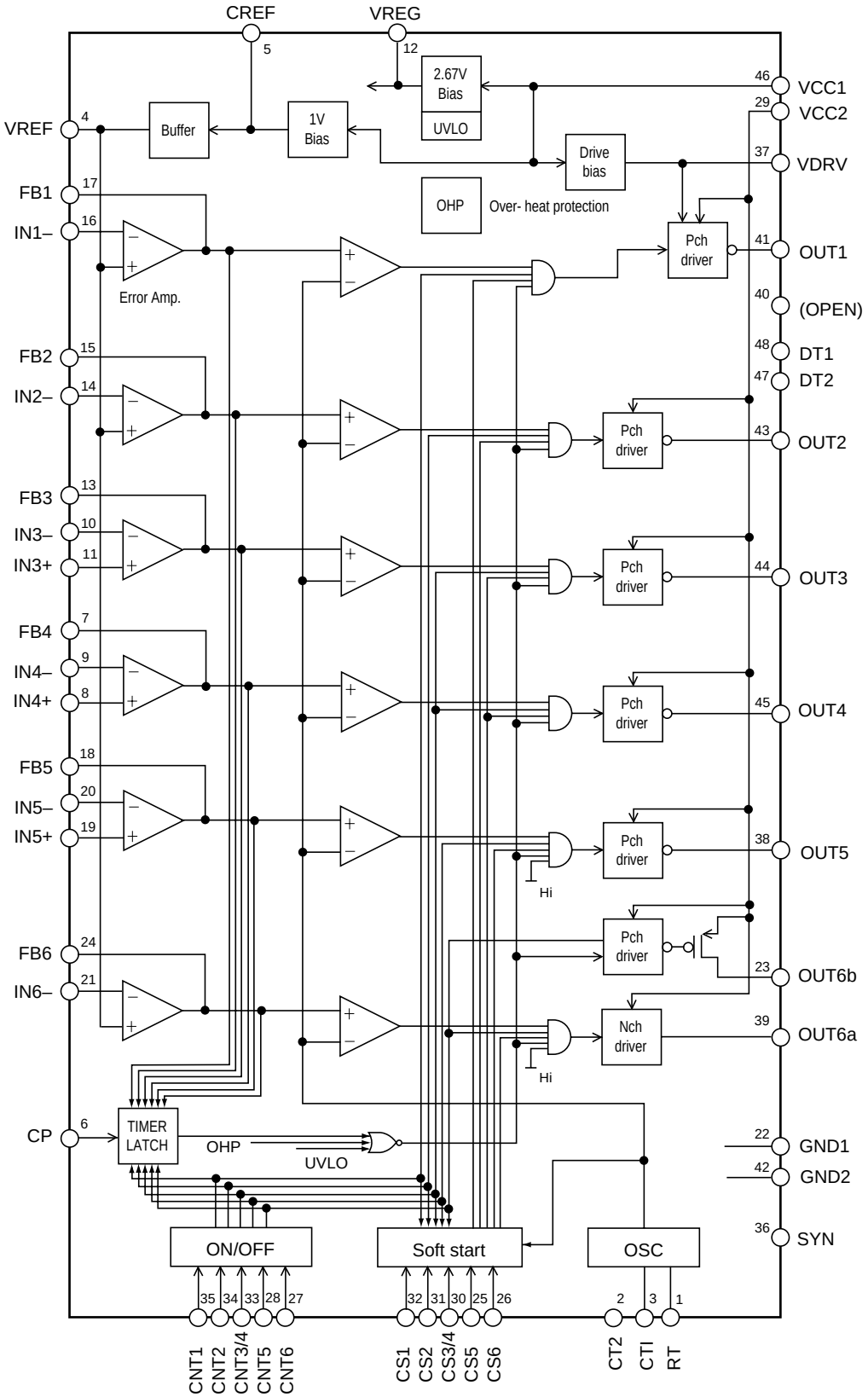
- VTR-camera, digital-steel-camera and portable equipment

■ Dimensions, mm

● LQFP-48



■ Block diagram



Pin No.	Pin symbol	Description
1	RT	Oscillator timing resistor
2	CT2	(Not connect any component)
3	CT1	Oscillator timing capacitor
4	VREF	Reference voltage output
5	CREF	Capacitor for reference voltage output
6	CP	Timing capacitor for timer latch delay
7	FB4	Ch. 4 output of error amplifier
8	IN4+	Ch. 4 non-inverting input to error amplifier
9	IN4–	Ch. 4 inverting input to error amplifier
10	IN3–	Ch. 3 inverting input to error amplifier
11	IN3+	Ch. 3 non-inverting input to error amplifier
12	VREG	Regulated voltage output
13	FB3	Ch. 3 output of error amplifier
14	IN2–	Ch. 2 inverting input to error amplifier
15	FB2	Ch. 2 output of error amplifier
16	IN1–	Ch. 1 inverting input to error amplifier
17	FB1	Ch. 1 output of error amplifier
18	FB5	Ch. 5 output of error amplifier
19	IN5+	Ch. 5 non-inverting input to error amplifier
20	IN5–	Ch. 5 inverting input to error amplifier
21	IN6–	Ch. 6 inverting input to error amplifier
22	GND1	Ground
23	OUT6b	ON/OFF switch for ch.6 power supply
24	FB6	Ch. 6 output of error amplifier

Pin No.	Pin symbol	Description
25	CS5	Soft start for Ch. 5
26	CS6	Soft start for Ch. 6
27	CNT6	Ch. 6 ON/OFF function
28	CNT5	Ch. 5 ON/OFF function
29	VCC2	Power supply for output stage
30	CS3/4	Soft start for Ch. 3 & Ch. 4
31	CS2	Soft start for Ch. 2
32	CS1	Soft start for Ch. 1
33	CNT3/4	Ch. 3 & Ch. 4 ON/OFF function
34	CNT2	Ch. 2 ON/OFF function
35	CNT1	Ch. 1 ON/OFF function
36	SYN	(Connect to GND1/ GND2 terminal)
37	VDRV	Bias for logic circuit of outputs
38	OUT5	Ch. 5 output (for Pch-MOSFET)
39	OUT6a	Ch. 6 output (for Nch-MOSFET)
40	(OPEN)	(Not connect any component)
41	OUT1	Ch. 1 output (for Pch-MOSFET)
42	GND2	Ground
43	OUT2	Ch. 2 output (for Pch-MOSFET)
44	OUT3	Ch. 3 output (for Pch-MOSFET)
45	OUT4	Ch. 4 output (for Pch-MOSFET)
46	VCC1	Power supply for control circuit
47	DT2	(Connect to DT1)
48	DT1	(Connect to DT2)

■ Absolute maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	20.0	V
Source peak current	I_{OUT}	–200	mA
Sink peak current	I_{OUT}	200	mA
Output peak current of OUT6b	I_{OUT6b}	–500	mA
Input voltage for analog input	V_{ANA}	–0.3 to +2.8	V
Input voltage for logic input	V_{LOG}	–0.3 to +5.5	V
Total power dissipation *	Pd	550	mW
Junction temperature	T_J	125	°C
Ambient temperature	T_{OP}	–20 to +85	°C
Storage temperature	Tstg	–40 to +125	°C

* Ta < 25°C

■ Recommended operating conditions

Item	Symbol	Min.	Max.	Unit
Power supply voltage	V_{CC}	4.5	18.0	V
Input voltage for logic input	V_{LOG}	0.0	5.25	V
Oscillation frequency	f_{OSC}	50	1000	kHz
Oscillator timing resistor	R_T	6.8	100	kΩ
Oscillator timing capacitor	C_T	68	1000	pF
CREF terminal by-pass capacitor	C_{REF}	0.01		µF
VREF terminal output current	I_{REF}	–60	0	µA

■ Electrical characteristics (Ta=25°C, V_{CC1}=V_{CC2}=6V, C_T=100pF, R_T=18kΩ)

Reference voltage section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V_{REF}		0.985	1.00	1.015	V
Line regulation	V_{RLIN}	V_{CC}=4.5 to 18V		3	10	mV
Output voltage variation due to temperature change	V_{RTa}	T_a=–20 to +85°C		±0.5		%

Regulated voltage section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V_{REG}		2.40	2.67	2.95	V

Oscillator section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{OSC}	R_T=18kΩ, C_T=100pF	414	460	506	kHz
Frequency variation due to supply voltage change	f_{dV}	V_{CC}=4.5 to 18V		±1	±3	%
Frequency variation due to temperature change	f_{dT}	T_a=–20 to +25°C		±1.5		%
		T_a=+25 to +85°C		±1.5		

Error amplifier section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input offset voltage	V_{IOF}				10	mV
Input common mode voltage range	V_{ICOM}		0.2		1.7	V
Open-loop gain	A_{VOL}		70	75		dB
Unity-gain bandwidth	f_T			1.2		MHz
Output sink current	I_{FBL}	V_{FB}=1.0V	1.5	2.8		mA
Output source current	I_{FBH}	V_{FB}=0V		–0.25	–0.15	mA

PWM control section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Maximum duty cycle	D_{max}				100	%

Soft-start circuit section 1 (CS1, CS2, CS3/4)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage	V_{CSO}	Duty cycle=0%		0.78		V
	V_{CS100}	Duty cycle=100%		1.38		V
Charge current	I_{CS}		–7.5	–5.1	–2.5	µA

Soft-start circuit section 2 (CS5, CS6)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage	V_{CSO}	Duty cycle=0%		0.79		V
	V_{CS100}	Duty cycle=100%		1.40		V
Charge current	I_{CS}			0		µA

Short-circuit protection section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Threshold voltage at CP	V_{CPTH}		1.90	2.16	2.42	V
Charge current at CP	I_{CP}		–3.45	–2.30	–1.15	μA
Threshold voltage at error amplifier output	V_{FBTL}			2.16		V

Overheat protection section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Operating temperature	T_{OH}		125	135	145	°C
Hysteresis width	ΔT_{OH}		45	50	55	°C

ON/OFF logic input section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input voltage for ON mode	V_{DH}		1.0		5.25	V
Input voltage for OFF mode	V_{DL}		0		0.4	V

Output section 1 (OUT1)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
L-level ON resistance	R_{ONL}	I_O=10mA		6	10	Ω
H-level ON resistance	R_{ONH}	I_O=–10mA		6	10	Ω
Rise time	tr	C_{LOAD}=1000pF		30	50	ns
Fall time	tf	C_{LOAD}=1000pF		45	70	ns

Output section 2 (OUT2, OUT3, OUT4, OUT5, OUT6a)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
L-level ON resistance	R_{ONL}	I_O=10mA		10	15	Ω
H-level ON resistance	R_{ONH}	I_O=–10mA		10	15	Ω
Rise time	tr	C_{LOAD}=1000pF		40	60	ns
Fall time	tf	C_{LOAD}=1000pF		55	80	ns

Output section 3 (OUT6b)

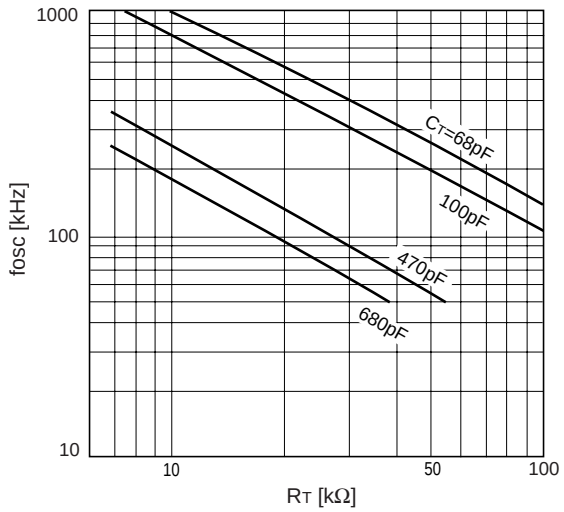
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
ON resistance	R_{ON6b}	I_O=–10mA		1	2	Ω

Overall device

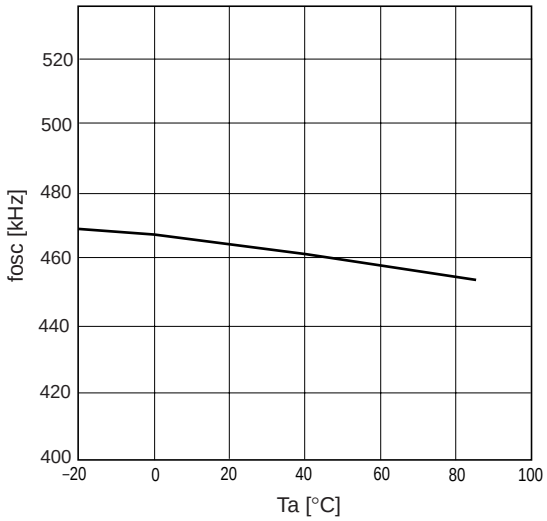
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Standby current	I_{CCO}			3	10	μA
Operating-state supply current	I_{CC}	Duty cycle=0%, R_L=∞		4	6	mA

■ Characteristic curves (Ta = 25°C)

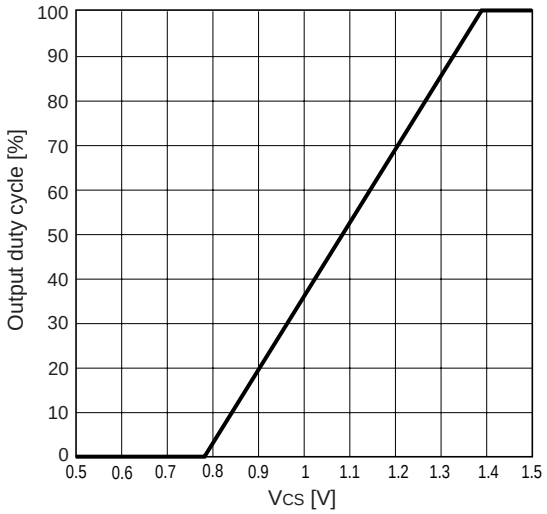
Oscillation frequency (fosc) vs. timing resistor resistance (R_T)



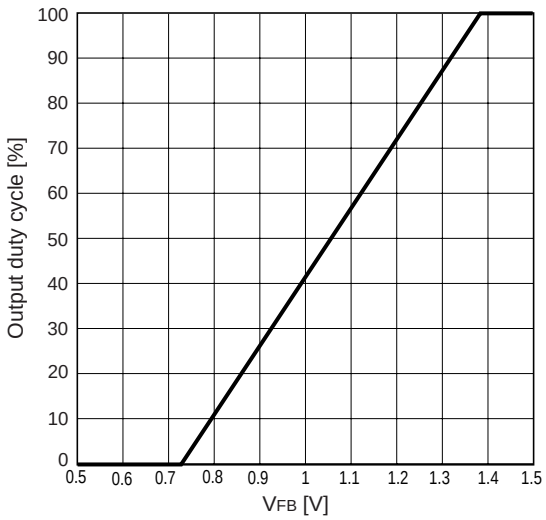
Oscillation frequency (fosc) vs. ambient temperature (Ta)



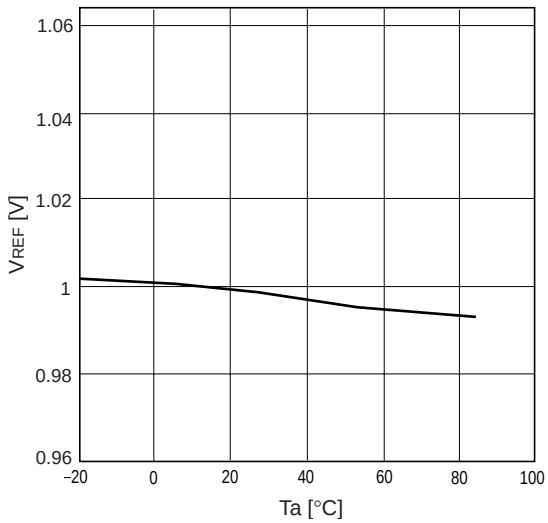
Output duty cycle vs. CS terminal voltage (V_{CS})



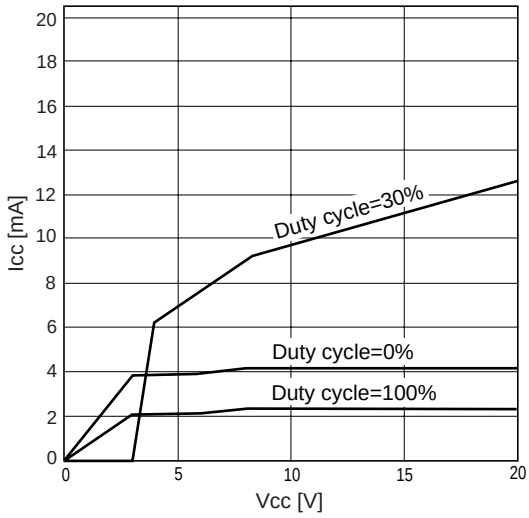
Output duty cycle vs. FB terminal voltage (V_{FB})



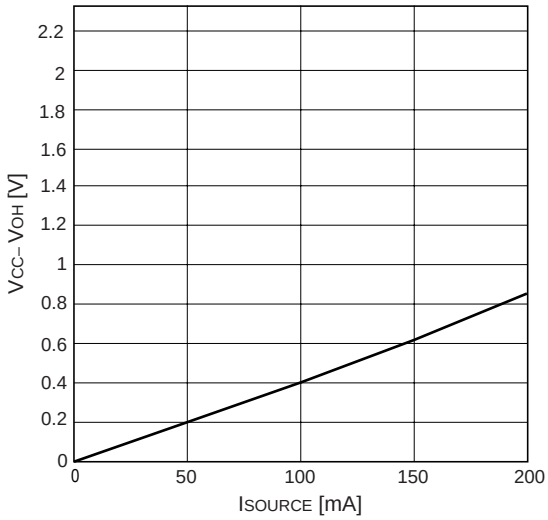
Reference voltage (V_{REF}) vs ambient temperatare (T_a)



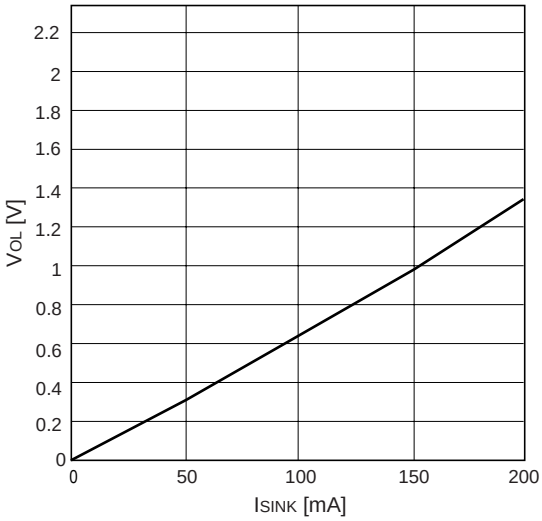
Supply current (I_{CC}) vs Supply voltage (V_{CC})



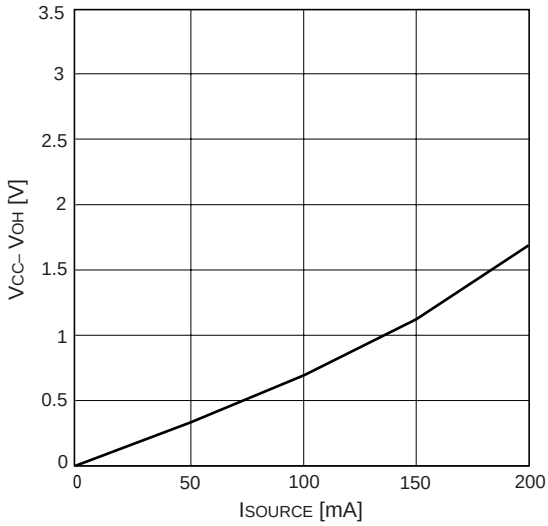
H-level output voltage (V_{CC}-V_{OH}) vs. output source current (I_{SOURCE}) for OUT1



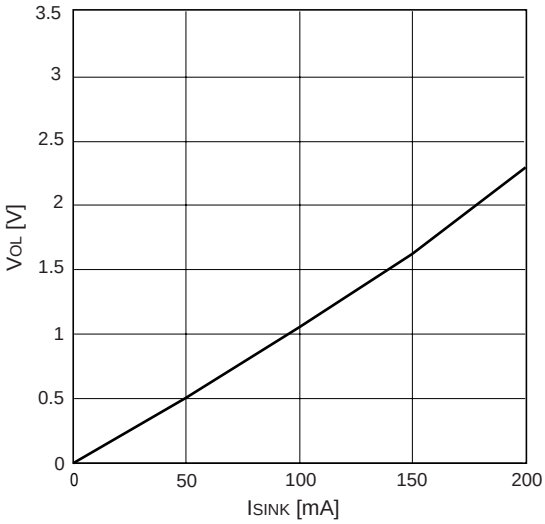
L-level output voltage(V_{OL}) vs. output sink current (I_{SINK}) for OUT1



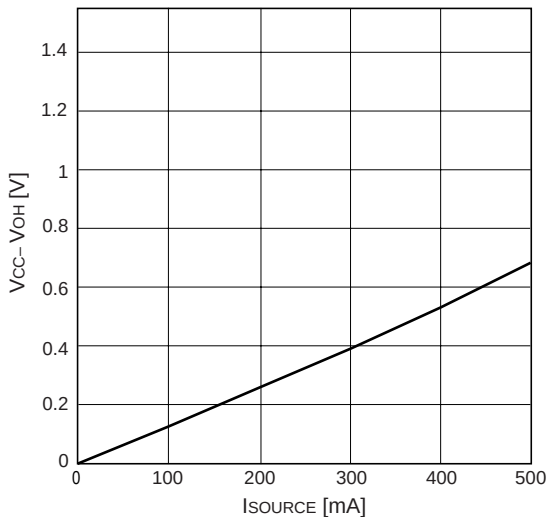
H-level output voltage (V_{CC}-V_{OH}) vs. output source current (I_{SOURCE}) for OUT2, 3, 4, 5, 6a



L-level output voltage(V_{OL}) vs. output sink current (I_{SINK}) for OUT2, 3, 4, 5, 6a

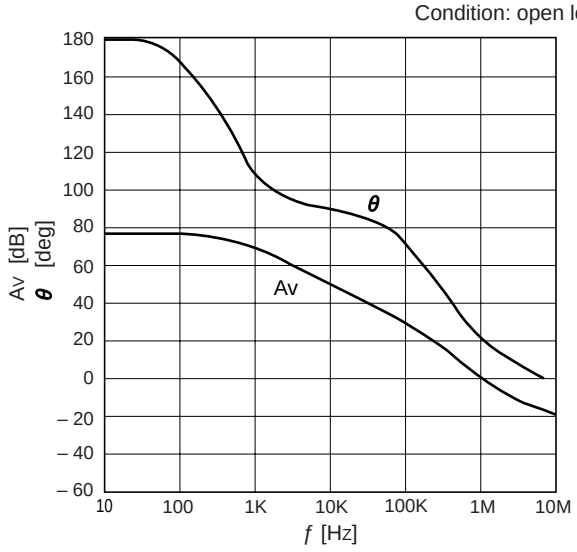


H-level output voltage (V_{CC}-V_{OH}) vs. output source current (I_{SOURCE}) for OUT6b

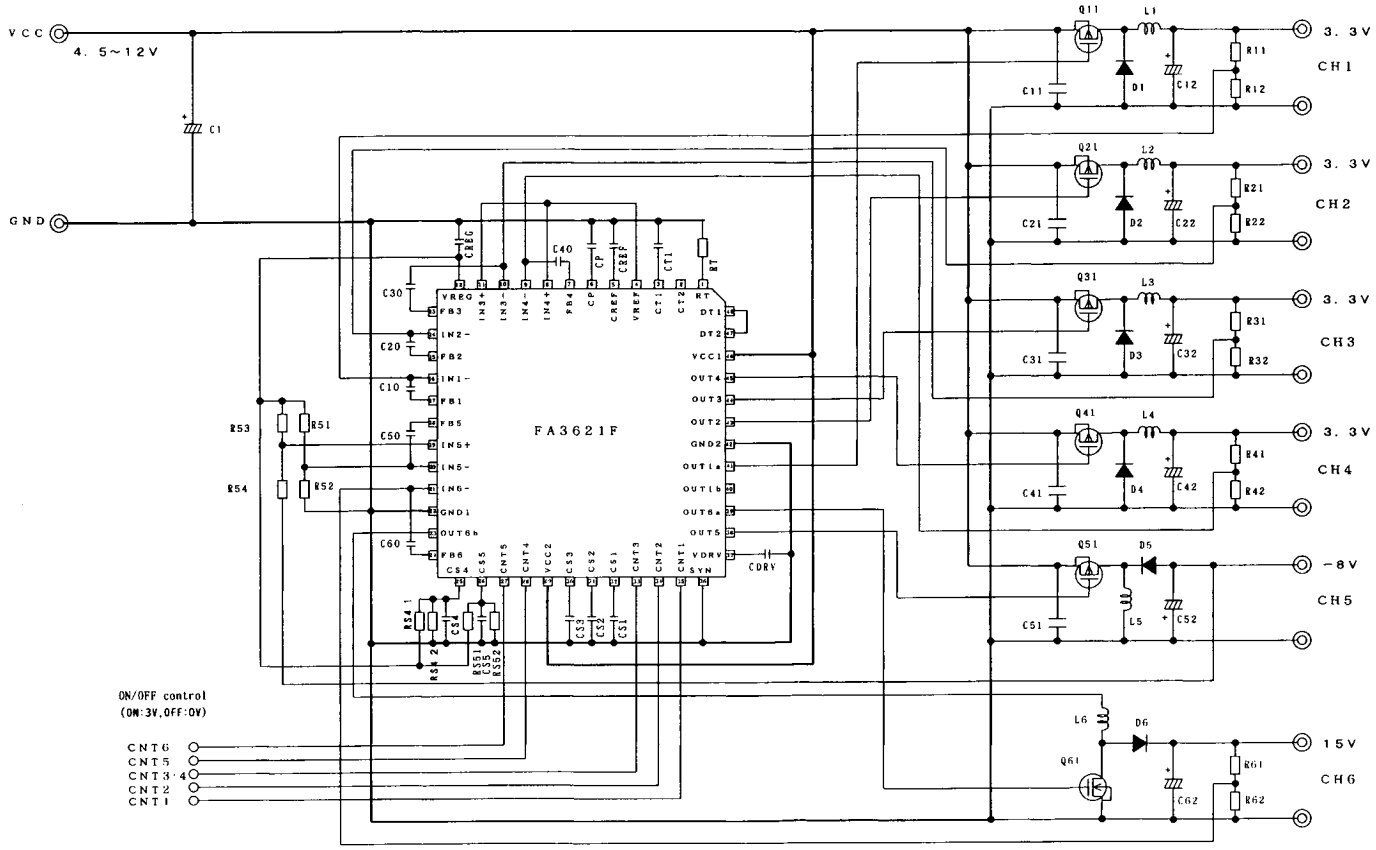


Error amplifier voltage gain(Av) / phase(θ) vs. frequency(f)

Condition: open loop



■ Application circuit



Parts tolerances characteristics are not defined in the circuit design sample shown above. When designing an actual circuit for a product, you must determine parts tolerances and characteristics for safe and economical operation.