FA3629AV

CMOS IC
For Switching Power Supply Control

■ Description

FA3629AV is a Power IC which includes DC-DC converter controller and Nch-power MOSFET.
This IC can directly drive Nch/Pch MOSFET.
This IC is suitable to reduce converter size because it has many functions in a small package TSSOP.

■ Features

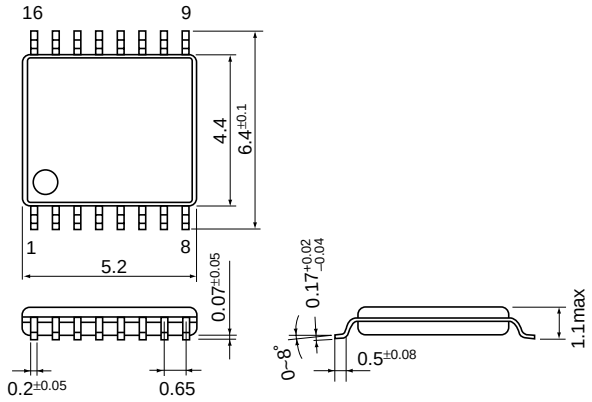
- Low input voltage: 2.5V to 6.5V
- 40V CDMOS Process:
  Built-in 0.3Ω Nch-Power MOSFET(ch1, open drain)
- 3-channels PWM Control:
  2 boost circuits(ch1, ch2), 1 inverting circuit (ch3)
- Adjustable soft start time and maximum duty cycle
- Built-in timer latch for short circuit protection:
  Delay time = 2^{16} / (switching frequency)
- Built-in protection functions: Overcurrent limit for MOSFET, overheat protection, undervoltage lockout
- Wide range of operation frequency: 100kHz to 1MHz
- Package: TSSOP-16(Thin and small)

■ Applications

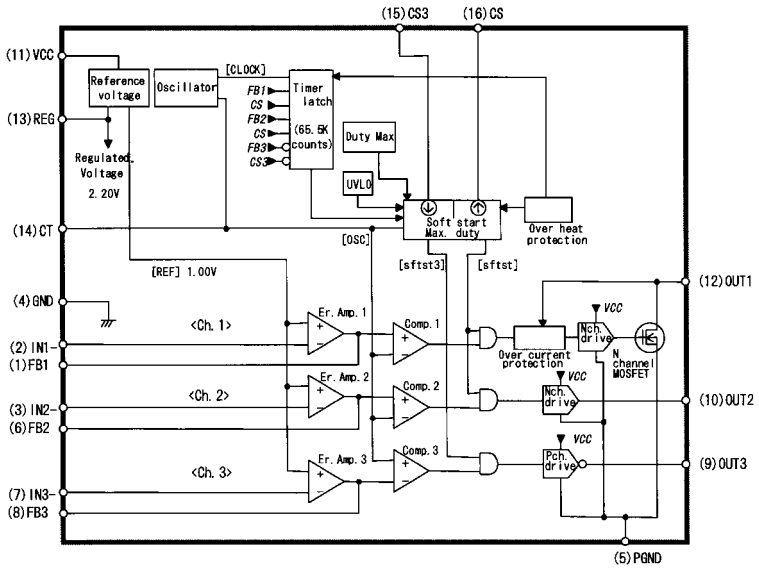
- Power supply for general equipment

■ Dimensions, mm

● TSSOP-16



■ Block diagram



Pin No.	Pin symbol	Description
1	FB1	Ch.1 output of error amplifier
2	IN1–	Ch.1 inverting input to error amplifier
3	IN2–	Ch. 2 inverting input to error amplifier
4	GND	Ground of control blocks
5	PGND	Ground of large power blocks
6	FB2	Ch. 2 output of error amplifier
7	IN3–	Ch. 3 inverting input to error amplifier
8	FB3	Ch. 3 output of error amplifier
9	OUT3	Ch. 3 output (for Pch-MOSFET)
10	OUT2	Ch. 2 output (for Nch-MOSFET)
11	VCC	Power supply
12	OUT1	Ch.1 drain output of internal Nch-MOSFET
13	REG	Regulated voltage output
14	CT	Oscillator timing capacitor
15	CS3	Soft start for Ch. 3
16	CS	Soft start for Ch.1 and Ch. 2

■ Absolute maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	6.5	V
Output voltage at OUT1 pin	V_{OUT1}	40	V
Output current at OUT1 pin*1	I_{OUT1}	2.8	A
Source peak current of OUT2	I_{OUT2+}	–400	mA
Sink peak current of OUT2	I_{OUT2-}	400	mA
Source peak current of OUT3	I_{OUT3+}	–400	mA
Sink peak current of OUT3	I_{OUT3-}	400	mA
Source average current of OUT2	I_{OUT2+}	–50	mA
Sink average current of OUT2	I_{OUT2-}	50	mA
Source average current of OUT3	I_{OUT3+}	–50	mA
Sink average current of OUT3	I_{OUT3-}	50	mA
Input voltage to err. amp.	V_{EI}	5.0	V
Total power dissipation*2	P_d	500	mW
Ambient temperature	T_{OPR}	–25 to +95	°C
Junction temperature	T_J	125	°C
Storage temperature	T_{STG}	–40 to +125	°C

*1 Output current is limited by the overcurrent protection
*2 Ta < 25°C

■ Recommended operating conditions

Item	Symbol	Min.	Max.	Unit
Power supply voltage	V_{CC}	2.5	5.8	V
Output voltage of OUT1	V_{OUT1}	0	32	V
Output current of OUT1	I_{OUT1}	0	1.8	A
Oscillation frequency	f_{OSC}	100	1000	kHz
Ambient temperature	T_{OPR}	–20	85	°C

■ Electrical characteristics (V_{CC}=3.0V, Ta=25°C)

Reference voltage section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Reference voltage	V_{REF}		0.98	1.00	1.02	V
Variation with supply voltage	$V_{REF-LINE}$	V_{CC}=2.5 to 5.8V		1	3	mV
Variation with temperature	$V_{REF-TC1}$	Ta=–20 to +25°C		0.5	1.2	%
	$V_{REF-TC2}$	Ta=+25 to +85°C		0.5	1.2	%

Regulated voltage for internal control blocks

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Regulated voltage	V_{REG}	C_O=0.1µF	2.16	2.20	2.24	V
Variation with supply voltage	$V_{REG-LINE}$	V_{CC}=2.5 to 5.8V		3	8	mV
Variation with temperature	$V_{REG-TC1}$	Ta=–20 to +25°C		0.5	1.5	%
	$V_{REG-TC2}$	Ta=+25 to +85°C		0.7	1.5	%
Source current	I_{REG}		–40		–15	mA

Oscillator section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{OSC}	C_T=150pF	480	550	620	kHz
High level voltage	V_{OSCH}	C_T=150pF		1.38		V
Low level voltage	V_{OSCL}	C_T=150pF		0.78		V
Variation with supply voltage	f_{dv}	V_{CC}=2.5 to 5.8V		1	2	%
Variation with temperature	f_{dT1}	Ta=–20 to +25°C		5	7	%
	f_{dT2}	Ta=+25 to +85°C		5	7	%

Soft-start and duty section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Charge current of CS (Source)	I_{CS}		–1.2	–1.0	–0.8	µA
Charge current of CS3 (Sink)	I_{CS3}		0.8	1.0	1.2	µA
Max. duty cycle of OUT1 & OUT2	D_{max}	f_{OSC}=500kHz	80	87	90	%
Max. duty cycle of OUT3	D_{max3}	f_{OSC}=500kHz	80	86	90	%
Invalid TL threshold voltage of CS	V_{CSLO}		0.42	0.52	0.62	V
Invalid TL threshold voltage of CS3	V_{CSHI}		1.58	1.68	1.78	V

Timer latch section (TL)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Threshold voltage of FB1 (Ch.1)	V_{TLTH1}		1.58	1.68	1.78	V
Threshold voltage of FB2 (Ch. 2)	V_{TLTH2}		1.58	1.68	1.78	V
Threshold voltage of FB3 (Ch. 3)	V_{TLTH3}		0.42	0.52	0.62	V
Start up count	count		–	2^{16}	–	counts
Start up time	T_{TL}	C_T=150pF	105	119	137	ms

Error amplifier section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input offset voltage	V_{IO}				10	mV
Common mode input voltage range	V_{COM}		0.2		1.5	V
DC open loop gain	A_{VO}		70	75	80	dB
Unity gain band width	f_T		1.0	1.7	2.0	MHz
Sink current (Ch.1)	I_{OL1}	V_{FB1}=0.5V	1.0	1.5	2.0	mA
Source current (Ch.1)	I_{OH1}	$V_{FB1}=V_{REG}$ –0.5V	–160	–120	–80	µA
Sink current (Ch. 2)	I_{OL2}	V_{FB2}=0.5V	0.5	0.7	0.9	mA
Source current (Ch. 2)	I_{OH2}	$V_{FB2}=V_{REG}$ –0.5V	–160	–120	–80	µA
Sink current (Ch. 3)	I_{OL3}	V_{FB3}=0.5V	1.0	1.5	2.0	mA
Source current (Ch. 3)	I_{OH3}	$V_{FB3}=V_{REG}$ –0.5V	–160	–120	–80	µA
Sink current variation with temperature	$I_{OL\text{-}TC1}$	Ta=–20 to +25°C			20	%
	$I_{OL\text{-}TC2}$	Ta=+25 to +85°C			20	%
Source current variation with temperature	$I_{OH\text{-}TC1}$	Ta=–20 to +25°C			20	%
	$I_{OH\text{-}TC2}$	Ta=+25 to +85°C			20	%

Overcurrent protection section (OCP)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Threshold current	I_{OCDTH}	V_{CC}=3.0V	1.4	1.8	2.0	A
		V_{CC}=5.0V	1.8	2.0	2.2	A
Delay time	f_{OCD}		100	200	400	ns

Overheat protection section (OHP)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Threshold temperature	T_{OH}		125	135	145	°C

Undervoltage lockout circuit section (UVLO)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Threshold voltage of REG	V_{UVTH}		1.95	2.05	2.15	V

Output section (OUT1)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
On resistance of MOSFET	R_{ON1}	V_{CC}=3.0V, I_{O1}=200mA	0.25	0.275	0.3	Ω
Rise time of OUT1	tr	V_{CC}=3.0V		25	35	ns
Fall time of OUT1	tf	V_{OUT1}=10V, I_{O1}=1.0A		25	35	ns

Output section (OUT2, OUT3)

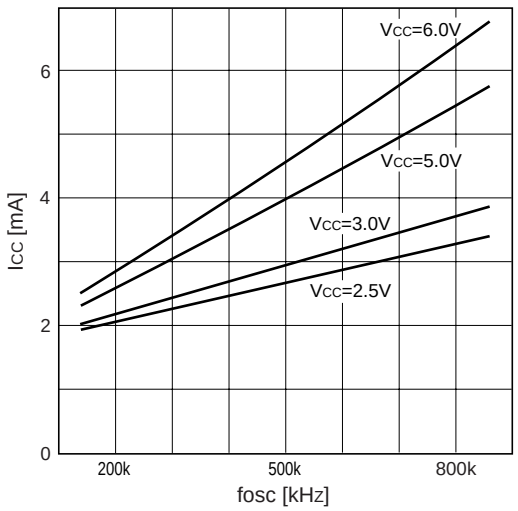
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Rise time of OUT2	t_{r2}	V_{CC}=3V, C_{O2}=1000pF	20	25	35	ns
Fall time of OUT2	t_{f2}	(Between OUT2-GND)	20	25	35	ns
Rise time of OUT3	t_{r3}	V_{CC}=3V, C_{O3}=1000pF	20	25	35	ns
Fall time of OUT3	t_{f3}	(Between VCC-OUT3)	20	25	35	ns
High level on resistance of OUT2	R_{2AH}	V_{CC}=3V, I_{OUT2}=–150mA	2.5	4.0	5.5	Ω
Low level on resistance of OUT2	R_{2AL}	V_{CC}=3V, I_{OUT2}=150mA	2.5	4.0	5.5	Ω
High level on resistance of OUT3	R_{3AH}	V_{CC}=3V, I_{OUT3}=–150mA	2.5	4.0	5.5	Ω
Low level on resistance of OUT3	R_{3AL}	V_{CC}=3V, I_{OUT3}=150mA	2.5	4.0	5.5	Ω
High level on resistance of OUT2	R_{2AH}	V_{CC}=5V, I_{OUT2}=–150mA	2.0	3.5	5.0	Ω
Low level on resistance of OUT2	R_{2AL}	V_{CC}=5V, I_{OUT2}=150mA	2.0	3.5	5.0	Ω
High level on resistance of OUT3	R_{3AH}	V_{CC}=5V, I_{OUT3}=–150mA	2.0	3.5	5.0	Ω
Low level on resistance of OUT3	R_{3AL}	V_{CC}=5V, I_{OUT3}=150mA	2.0	3.5	5.0	Ω

Overall device

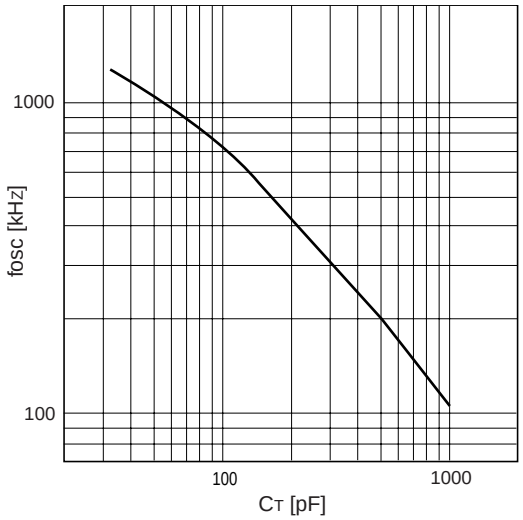
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Operating current (Overall)	I_{CCA}	D=50%, f_{OSC}=500kHz		3.0	3.8	mA
Operating current of control blocks	I_{CTRL}			1.8		mA

■ Characteristic curves (Ta=25°C)

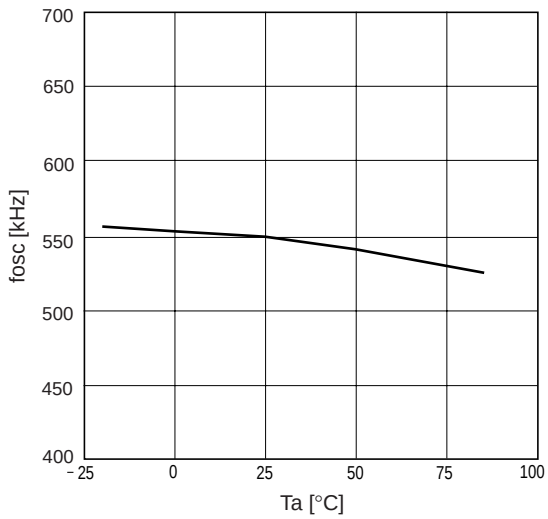
Supply current (I_{CC}) vs oscillation frequency (fosc)



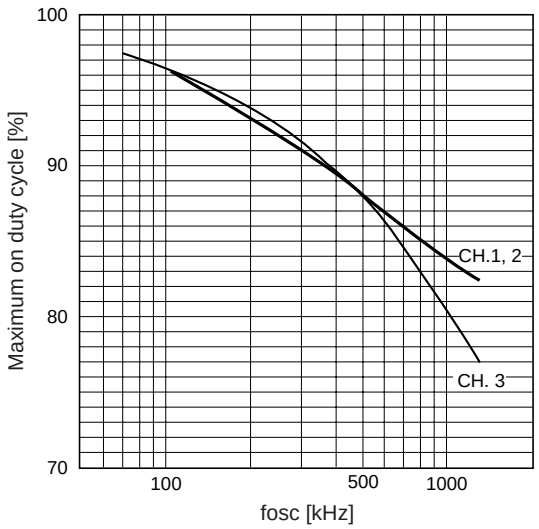
Oscillation frequency (fosc) vs. timing capactior(C_T)



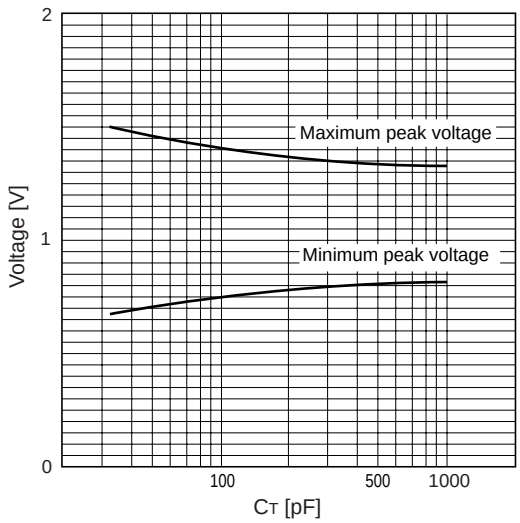
Oscillation frequency (fosc) vs. ambient temperature (Ta)



Max. on duty cycle vs. oscillation frequency (fosc)

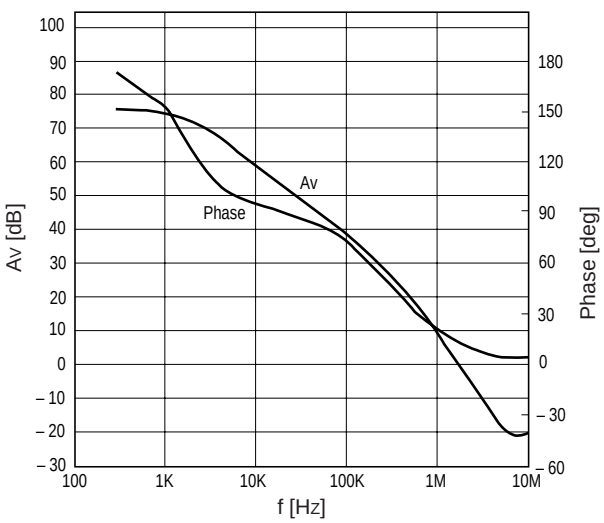


Oscillation peak voltage vs. timing capactior(C_T)

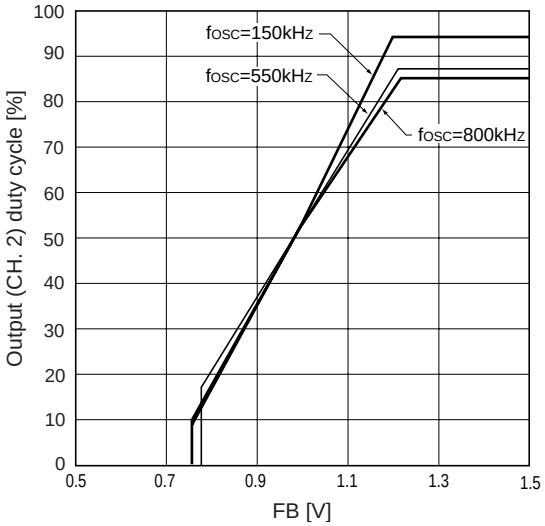


Error amplifier voltage gain (Av) /phase vs. frequency (f)

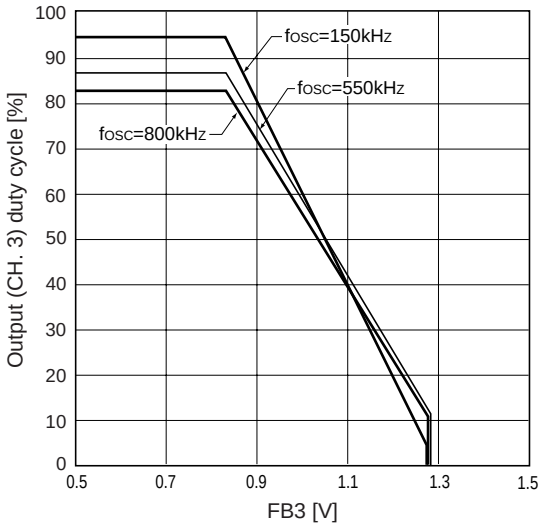
Condition: Open loop



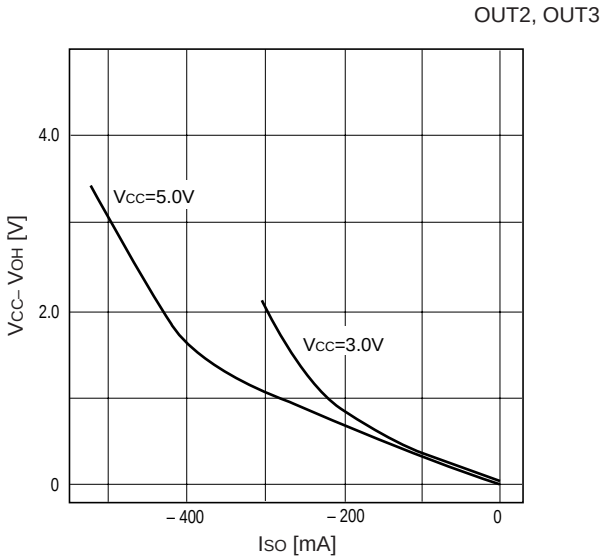
Output (Ch. 2) duty cycle vs FB terminal voltage (V_{FB})



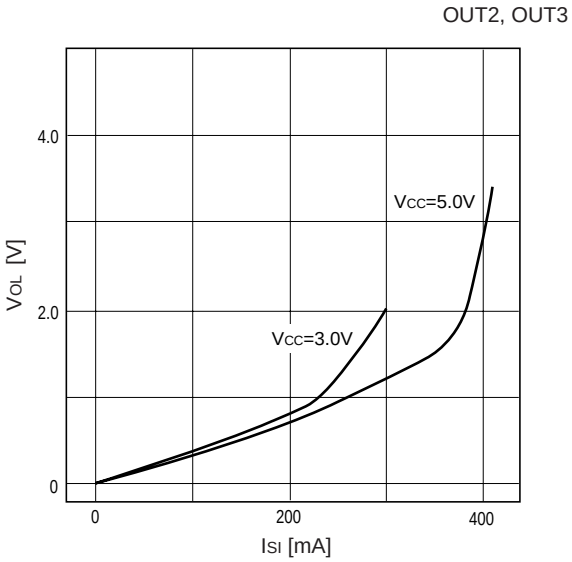
Output (Ch. 3) duty cycle vs. FB3 terminal voltage (V_{FB3})



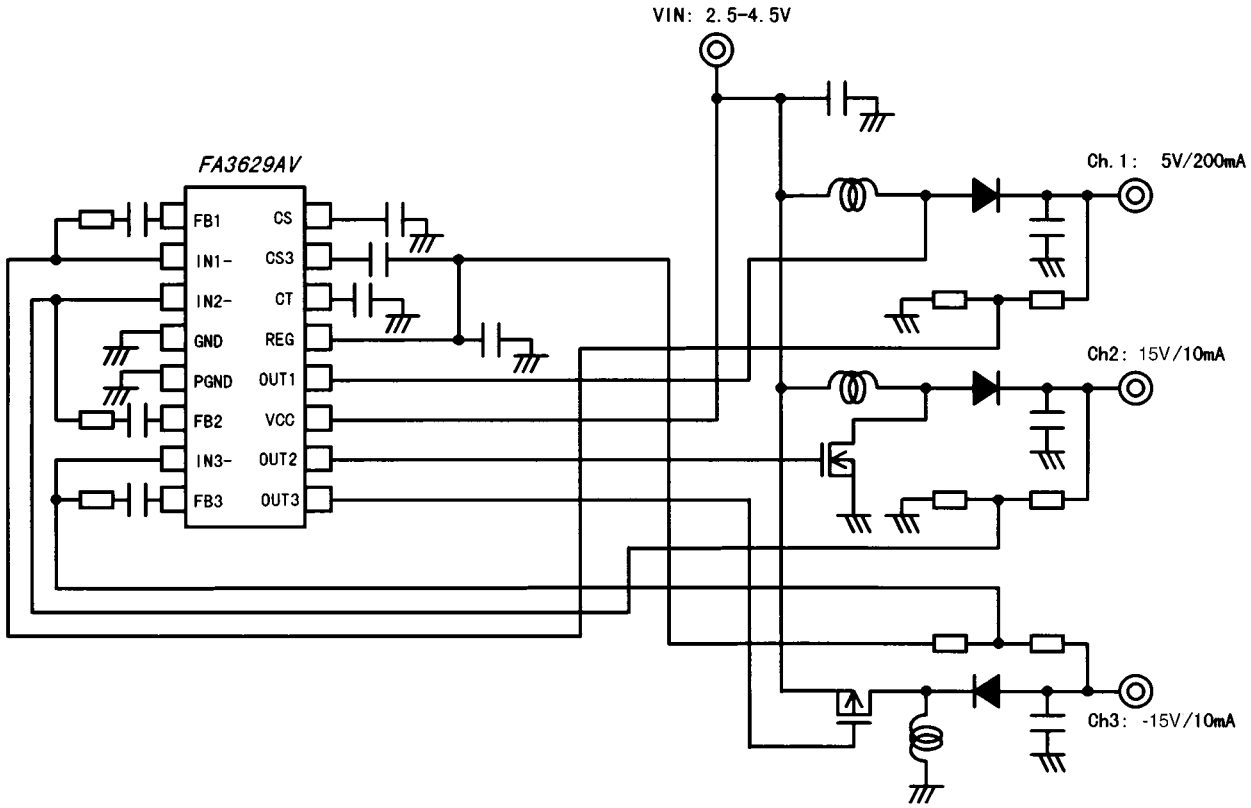
H-level output voltage (V_{OH}) vs output source current (I_{SO})



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



■ 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.

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