

■ 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

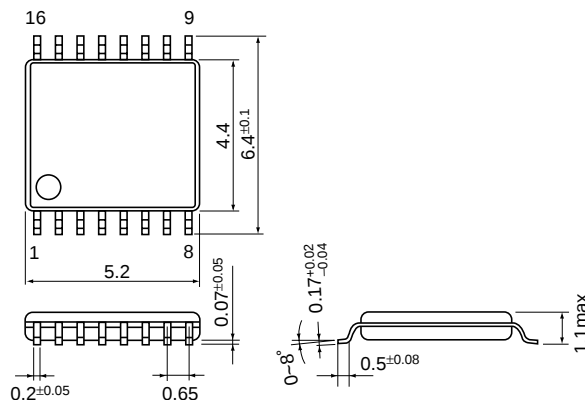
- Low input voltage: 2.5V to 6.5V
- 40V CDMOS Process:
Built-in 0.3Ω Nch-Power MOSFET(ch1, open drain)
- 3-channels PWM Control:
2 boost circuits(ch1, ch2), 1 inverting circuit (ch3)
- Adjustable soft start time and maximum duty cycle
- Built-in timer latch for short circuit protection:
Delay time = 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

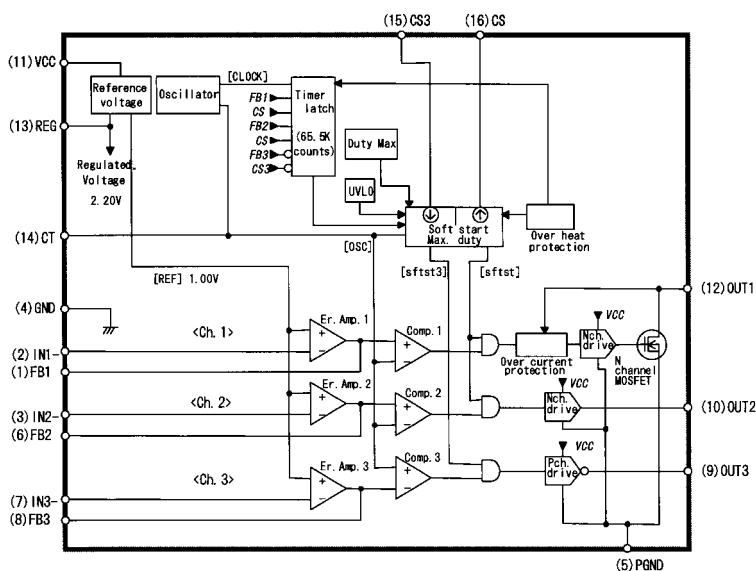
- Power supply for general equipment

■ 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}	Co=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-TC1}	T _a =-20 to +25°C			20	%
	I _{OL-TC2}	T _a =+25 to +85°C			20	%
Source current variation with temperature	I _{OH-TC1}	T _a =-20 to +25°C			20	%
	I _{OH-TC2}	T _a =+25 to +85°C			20	%

Overcurrent protection section (OCP)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Threshold current	I _{OC DTH}	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 _{OC D}		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	t _r	V _{CC} =3.0V V _{OUT1} =10V, I _{O1} =1.0A		25	35	ns
Fall time of OUT1	t _f			25	35	ns

Output section (OUT2, OUT3)

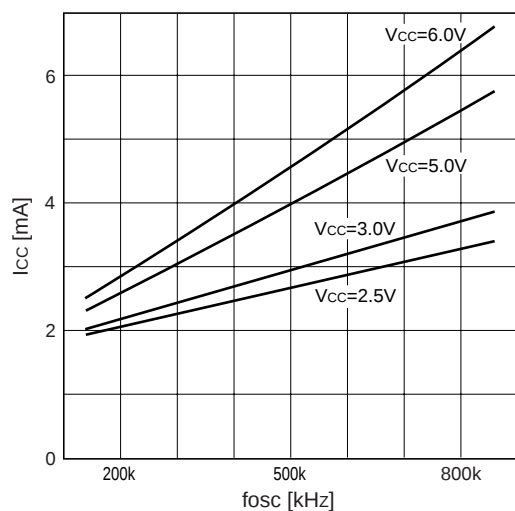
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Rise time of OUT2	t _{r2}	V _{CC} =3V, C _{O2} =1000pF (Between OUT2-GND)	20	25	35	ns
Fall time of OUT2	t _{f2}		20	25	35	ns
Rise time of OUT3	t _{r3}	V _{CC} =3V, C _{O3} =1000pF (Between VCC-OUT3)	20	25	35	ns
Fall time of OUT3	t _{f3}		20	25	35	ns
High 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

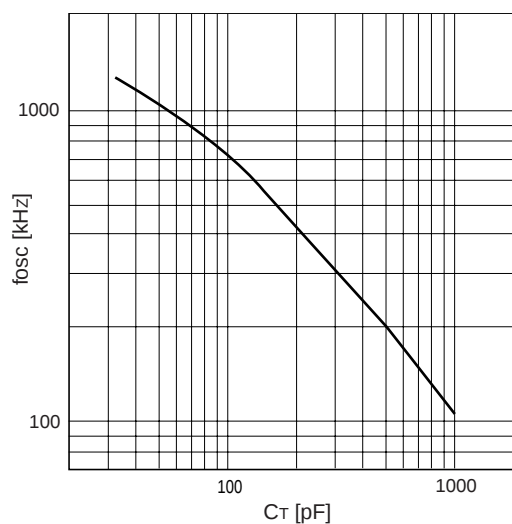
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Operating current (Overall)	I _{CCA}	D=50%, f _{osc} =500kHz		3.0	3.8	mA
Operating current of control blocks	I _{CTRL}			1.8		mA

■ Characteristic curves ($T_a=25^\circ\text{C}$)

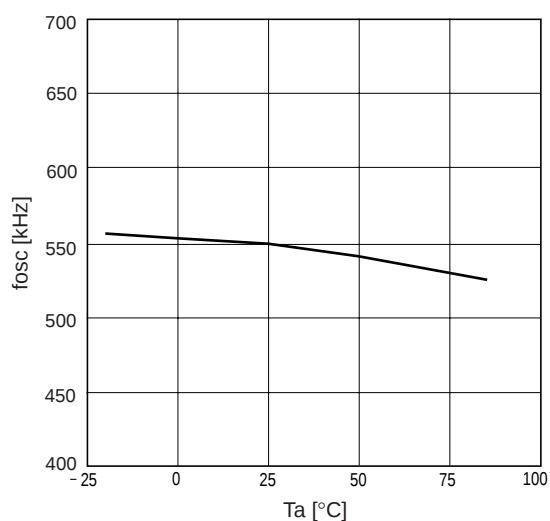
Supply current (I_{CC}) vs oscillation frequency (f_{osc})



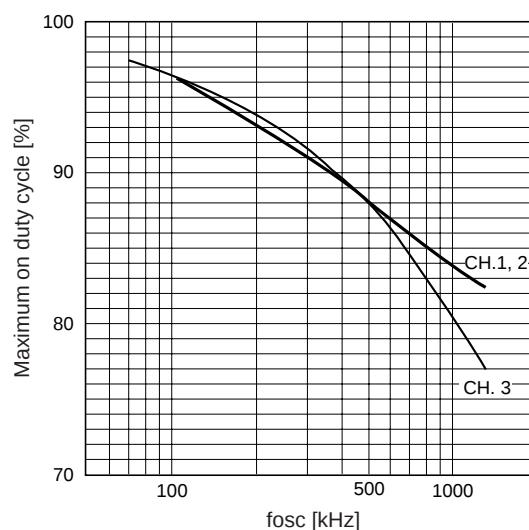
Oscillation frequency (f_{osc}) vs. timing capacitor (C_T)



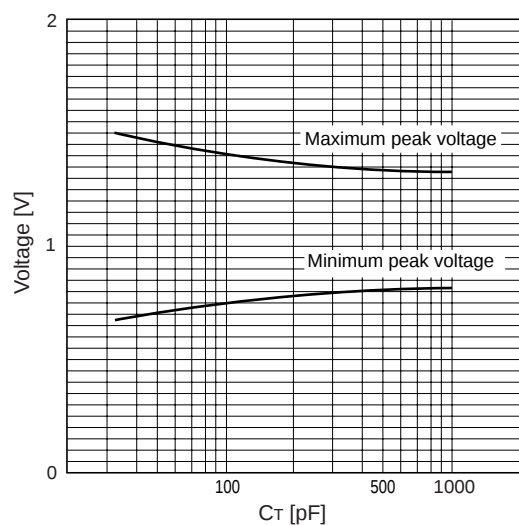
Oscillation frequency (f_{osc}) vs. ambient temperature (T_a)



Max. on duty cycle vs. oscillation frequency (f_{osc})

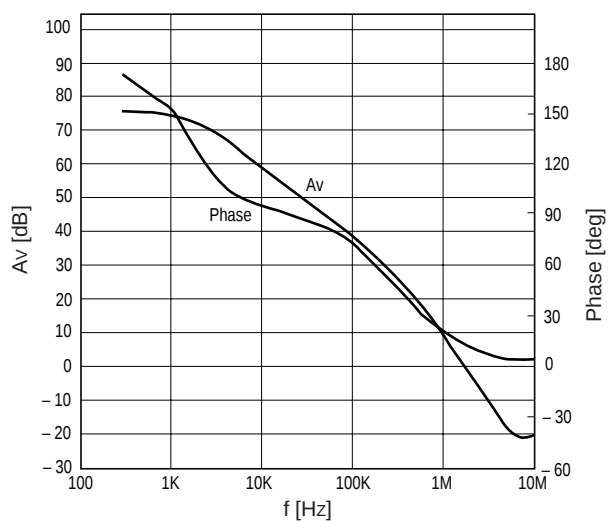


Oscillation peak voltage vs. timing capacitor (C_T)

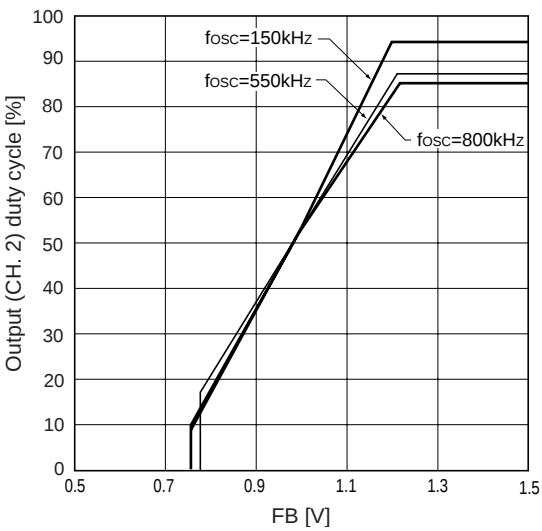


Error amplifier voltage gain (A_v) / phase vs. frequency (f)

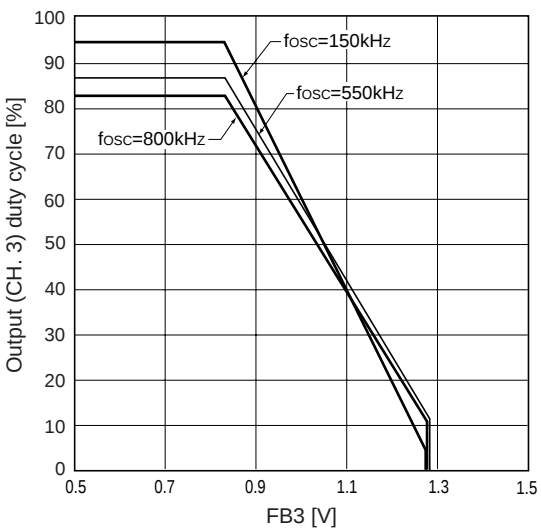
Condition: Open loop



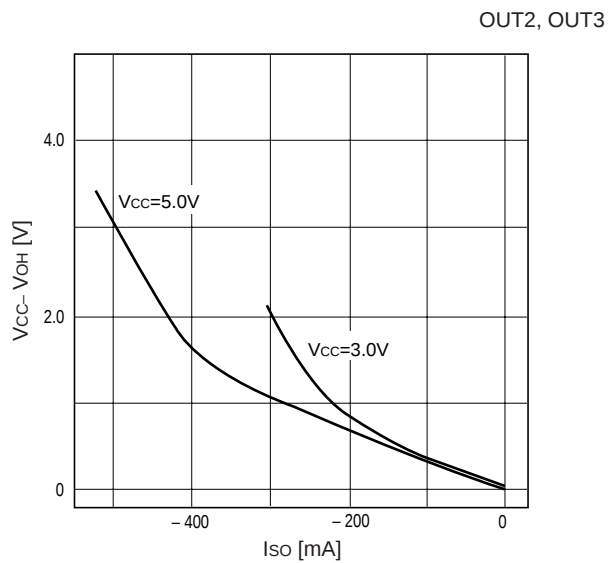
Output (Ch. 2) duty cycle vs FB terminal voltage (V_{FB})



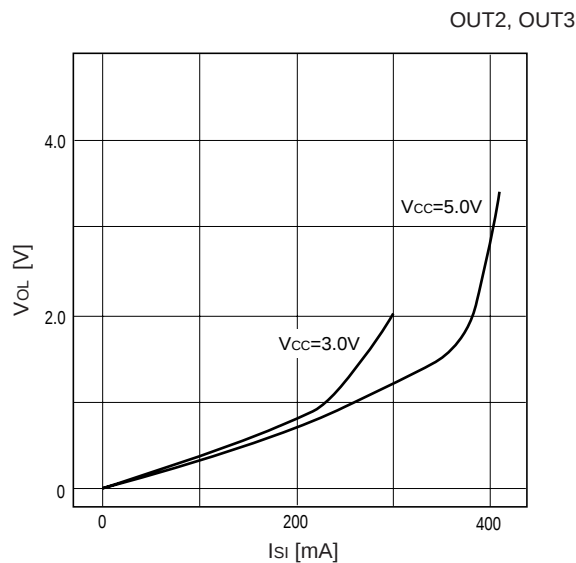
Output (Ch. 3) duty cycle vs. FB3 terminal voltage (V_{FB3})



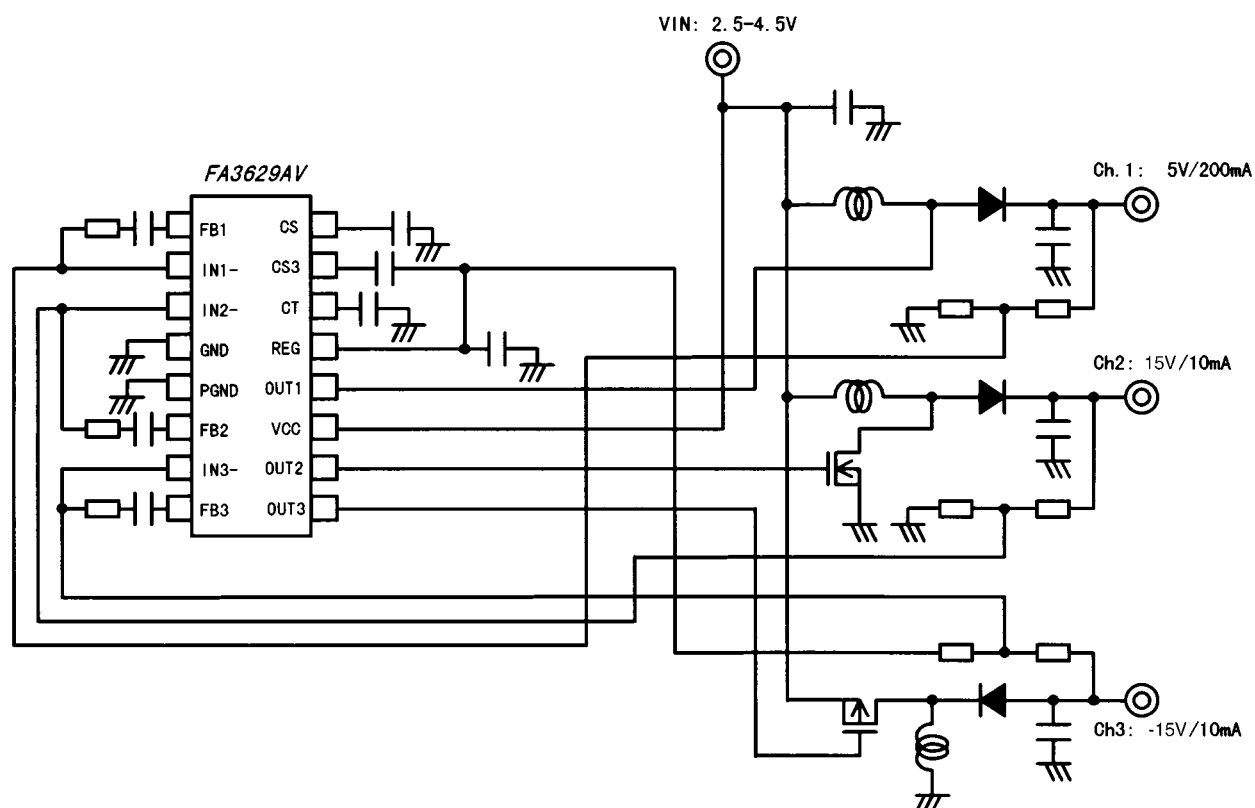
H-level output voltage (V_{OH}) vs output source current (I_{so})



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.