Ordering number : EN7893B

SANYO Semiconductors
DATA SHEET

LB8649FN — Monolithic Digital IC Motor Driver for DSCs

Feature

- Actuator drivers for digital cameras embedded in one chip.
  1. Constant current output car stepping motor for SH/AE or VCM × 2
  2. Constant voltage output car stepping motor for ZOOM or DC motor driver (Normal rotation/Reverse rotation/Brake)
  3. Constant voltage output car stepping motor for AF
- No standby current consumption (or zero). (Direct battery connection possible.)
- 4 systems for independent power supply (SH/AE, AF, ZOOM or input logic system)
- Low voltage driving (Driving by two nickel hydride batteries possible)
- Built-in thermal protection circuitry

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Max. Power Source Voltage	VB max	VB power supply	10.5	V
	V_{CC} max	V_{CC} power supply	10.5	
Max. Input Applied Voltage	V_{IN} max		10.5	V
Max. Output Applied Voltage	V_{OUT} max		10.5	V
Max. Output Current	I_O max	per CH	600	mA
Allowable Power Consumption	Pd max	Circuit board mounting (*1)	1.0	W
Operating Temperature	Topr		-20 to +80	°C
Storage Temperature	Tstg		-55 to +150	°C

(*1) Mounting circuit board : 50.0mm × 50.0mm × 0.8mm glass epoxy resin

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Allowable Operating Range at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Source Voltage Range	VB1, 2, 3	(*2)	1.9 to 10	V
	V_{CC}		1.9 to 10	
Input Pin "H" Voltage	$V_{IN}H$		1.8 to 10	V
Input Pin "L" Voltage	$V_{IN}L$		-0.3 to 0.4	V
Constant Voltage Setting Input Range	VOC	VC1, VC2	0.1 to VB	V
Constant Current Setting Input Range	V_O1	IAE, ISH	0.1 to 1.0	V

(*2) There is no priority on each power supply ; VB1, 2, V_{DD}, V_{CC} and V_{IN}.
Example1 : VB1 = VB2 = V_{DD} = 2.4V (Battery power supply), V_{CC} = 4V (Step-up power supply), V_{IN} (CPU power supply) = 5V
Example2 : VB1 = VB2 = 2.4V, V_{IN} = 3.3V, V_{DD} = V_{CC} = 5V

Electrical Characteristics at Ta = 25°C, VB1 = VB2 = V_{DD} = V_{CC} = 2.4V, Rf = 1Ω

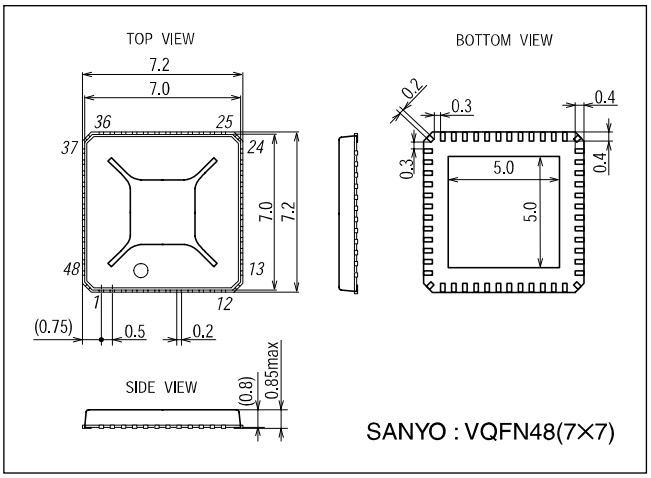
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Standby Current Consumption	$I_{CC}0$	VB1 = VB2 = V_{DD} = V_{CC} = 8.0V (*3)		0.1	5.0	μA
Operating Current Consumption	$I_{CC}1$	IN1 or IN2 or IN3 or IN4 = H (*3)		6	9	mA
	$I_{CC}2$	IN5 or IN6 or IN7 or IN8 = H (*3)		14	19	
	$I_{CC}3$	IN9 or IN10 or IN11 or IN12 = H (*3)		18	25	
Reference Voltage	Vref1	Iref = -1mA, INHD = L	0.95	1.0	1.05	V
	Vref2	Iref = -1mA, INHD = H	0.64	0.67	0.70	
Control Pin Input Current	I_{IN}	V_{IN} = 5.0V		60	90	μA
Overheat Protection Detection Temperature	THD	Design guaranteed (*4)	160	180	200	°C
[Constant voltage stepping motor driver for AF] (OUT1, 2, 3, 4)						
Output Constant Voltage 1	V_O1	VC1 = 0.30V	1.46	1.53	1.60	V
Output Saturation Voltage 1	VSAT1	I_O = 0.2A (upper and lower)	0.27	0.37	0.50	V
[Constant voltage driver for ZOOM] (OUT5, 6, 7, 8)						
Output Constant Voltage 2	V_O2	VC2 = 0.30V	1.46	1.53	1.60	V
Output Saturation Voltage 2	VSAT2	I_O = 0.2A (upper and lower)	0.27	0.37	0.50	V
[Constant current driver for SH/AE] (OUT9, 10, 11, 12)						
Output Constant Current	I_O	Rf = 1Ω, ISH = 0.3V	271	285	302	mA
Output Saturation Voltage 3	VSAT3	I_O = 0.3A (upper and lower)	0.33	0.44	0.60	V

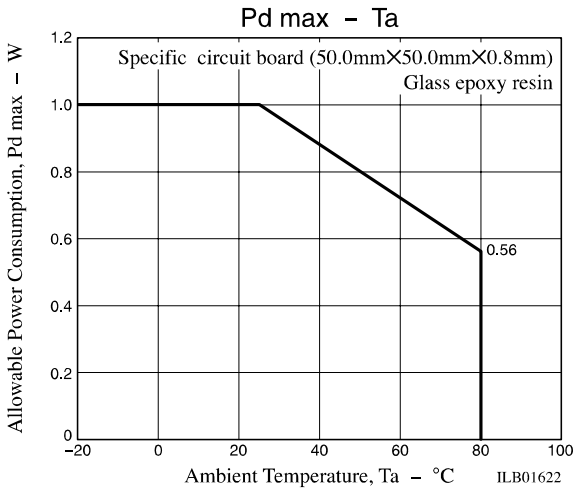
(*3) Measures by summation of current dissipation for each line of VB1, VB2, V_{DD} and V_{CC}.
(*4) For the characteristic within the guaranteed temperature range, shipment check is performed at Ta = 25°C. For all temperature range, it is design guaranteed.

Package Dimensions

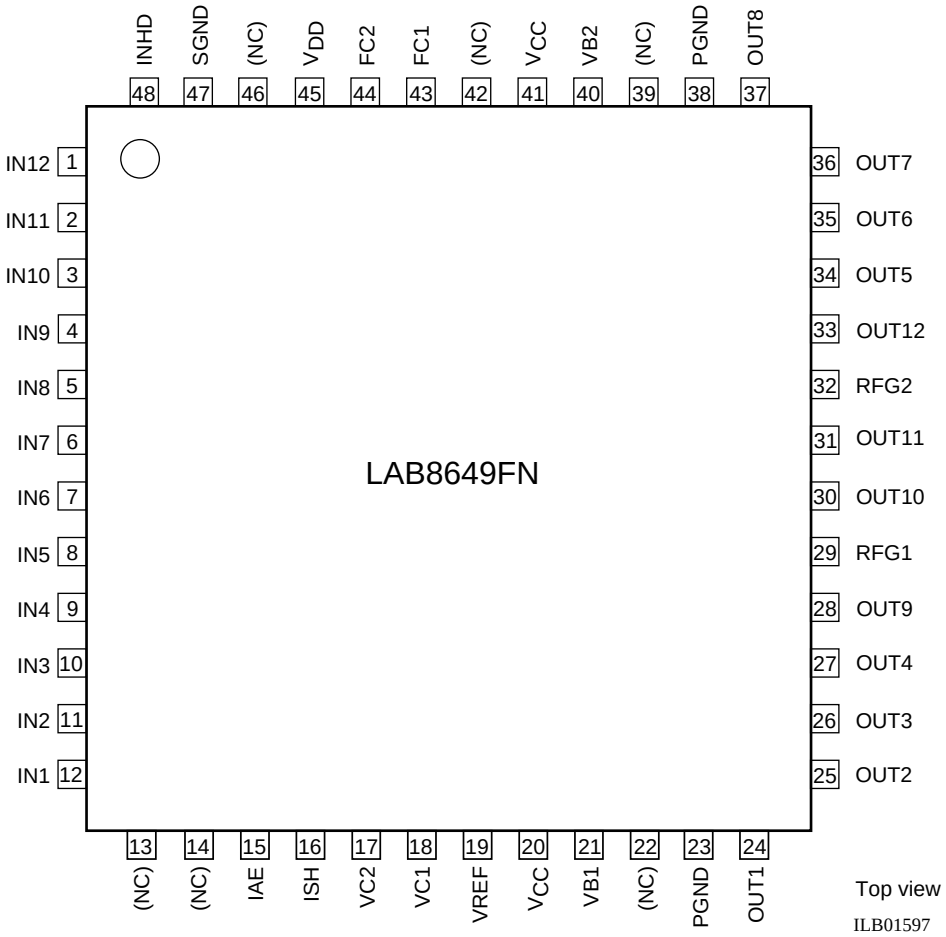
unit : mm (typ)

3272





Pin Assignment



(Note) PGND is connected with both 2 pins.

V_{DD} : Input, reference voltage, logic power supply

V_{CC} : Constant current control part, output (OUT9, 10, 11, 12) part power supply

VB1 : Constant voltage control part, output (OUT1, 2, 3, 4) part power supply

VB2 : Constant voltage control part, output (OUT5, 6, 7, 8) part power supply

Truth Table

1. Stepping motor constant voltage control for AF

Input					Output					Mode
IN1	IN2	IN3	IN4	INHD	OUT1	OUT2	OUT3	OUT4	Vref	
L	L	L	L	L	-	-	-	-	-	Stand-by
H	L	L	L	L	H	L	-	-	1.0V	1-2 phase excitation
H	L	H	L		H	L	H	L		
L	L	H	L		-	-	H	L		
L	H	H	L		L	H	H	L		
L	H	L	L		L	H	-	-		
L	H	L	H		L	H	L	H		
L	L	L	H		-	-	L	H		
H	L	L	H		H	L	L	H		
H	H	*	*		-	-				Output OFF
*	*	H	H				-	-		
*	*	*	*	L					1.0V	
				H					0.67V	

- (-) is output OFF.
- When setting output to “H”, the output voltage is 5.1 times the VC1.

2. Stepping motor constant voltage control for ZOOM or DC motor drive

Input					Output					Mode
IN5	IN6	IN7	IN8	INHD	OUT5	OUT6	OUT7	OUT8	Vref	
L	L	L	L	L	-	-	-	-	-	Stand-by
H	L	L	L	L	H	L	-	-	1.0V	1-2 phase excitation
H	L	H	L		H	L	H	L		
L	L	H	L		-	-	H	L		
L	H	H	L		L	H	H	L		
L	H	L	L		L	H	-	-		
L	H	L	H		L	H	L	H		
L	L	L	H		-	-	L	H		
H	L	L	H		H	L	L	H		
H	H	*	*		H	H				Brake
*	*	H	H				H	H		
*	*	*	*	L					1.0V	
				H					0.67V	

- (-) is output OFF, and (*) is “Don’t care”.
- When setting output to “H”, the output voltage is 5.1 times the VC2.

3. VCM constant current control for SH/AE, or stepping motor drive.

Input					Output						Mode
IN9	IN10	IN11	IN12	INHD	OUT9	OUT10	OUT11	OUT12	Vref	ISH	
L	L	L	L	L	-	-	-	-	-	-	Stand-by
H	L	*	*		H	L			1.0V	Setting voltage state	SH & AE
L	H	*	*		L	H					
*	*	H	L				H	L			
*	*	L	H				L	H			
H	L	*	*	H	H	L			0.67V		Hold
L	H	*	*		L	H					
*	*	H	L				H	L			
*	*	L	H				L	H			
L	L	L	L		-	-	-	-		Discharge	Stand-by

- (-) is output OFF, and (*) is “Don’t care”.
- OUT9 and OUT10 are used for the SH.
  Quick charge and quick discharge circuitry allows the stabilization of start-up characteristic.
- OUT10 and OUT11 are used for the AF.
- At the time of stand-by, ISH pin voltage becomes discharge state by the internal transistor and it is set to 0V.
- In addition, when IN1 to 8 are input, ISH pin is in discharge state (for start-up correction).
- When INHD = “L”, Vref voltage is 1.0V. When INHD = “H”, Vref voltage is 0.67V.

Application Design Notes

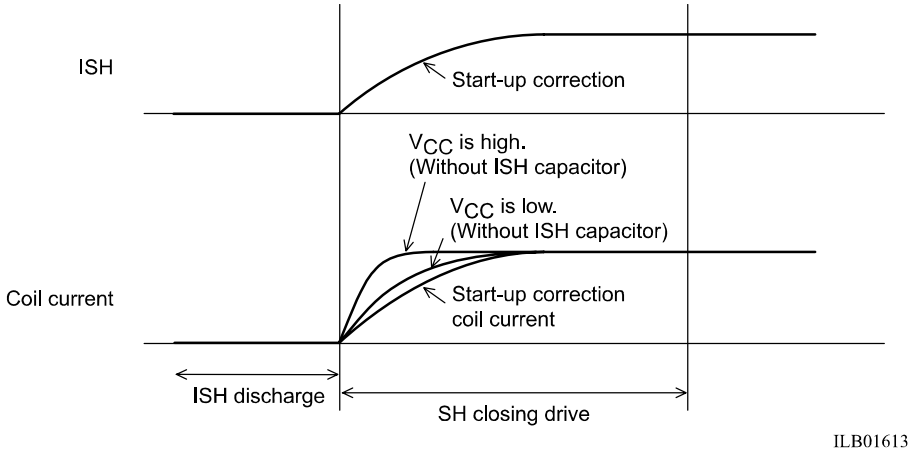
1. Constant current setting (ISH, IAE, RFG1, 2, OUT9 to 12)
   The constant current setting between pins OUT9 and OUT10 is determined from the ISH input voltage and the connecting resistor of RFG1. As shown in the block diagram, it is controlled in such a way so that the voltage generated at the resistor used for current detection connected between RFG1 and GND would be equal to the ISH input voltage. The formula for calculating the output current is as given below.

   (OUT9 to OUT10 Output Current) = (ISH Input Voltage) ÷ (RFG1 Resistor + 0.05Ω)

   The 0.05Ω here is for a common impedance of the output Tr emitter which drives constant current in the RFG pin and the sensing wiring for the constant current control amplifier.
   In the same way, the constant current setting between pins OUT11 and OUT12 is determined from the IAE input voltage and the connecting resistor of RFG2.
   Furthermore, as the constant current control block within the IC is connected to PGND, when supplying voltage to the ISH pin or IAE pin which has been divided by resistors be sure to connect the ground side of these resistors to PGND.

2. Quick charge/discharge circuitry (FC1, OUT9, OUT10)
   Quick discharge circuitry has been built in to the shutter control block (OUT9 to OUT10) to support high-speed shutter control, quick recharge, quick discharge and consecutive shots.
   Quick recharge and quick discharge circuitry has not been built in to the AE control block (OUT11 to OUT12). Therefore, make sure to use the block (OUT9 to OUT10) for the shutter drive.

3. Start-up correction function (ISH, OUT9, OUT10)



The ISH pin input voltage is set with the decay time constant to be larger than the coil decay time constant by using the external CR and the start-up correction occurs with respect to the coil wave.
By doing this, stable shutter operation can be carried out with respect to the power supply variations.
(Note) For the ISH pin start-up correction, check the coil current start-up wave for the V_{CC} reduced voltage when there is no ISH pin capacitor and choose a capacitance so that the decay time constant is lower than this wave.
However, at times such as when the power supply voltage is stable or the start-up correction function is not required, such a start-up correction capacitor is not necessary.

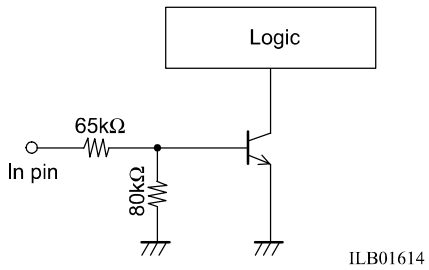
4. Phase compensation capacitor (FC1, FC2)
See and check the capacitor value for FC1 and FC2 between 0.0015 to 0.033μF. Choose a capacitance value which does not cause oscillation problems for output. (In particular, when a coil with large inductance is used, it is necessary to choose a sufficiently large capacitance.) Also, as the constant current control block within the IC is connected to PGND, be sure to connect the ground side of the FC1 pin and FC2 pin capacitor to PGND.

5. Constant voltage control Oscillation-stopping capacitor (OUT1 to 8)
When controlling the constant voltages, it is necessary to place capacitors between the OUT pins to stop oscillation. See and check the capacitor value between 0.01μF to 0.1μF. Choose a capacitance value which does not cause oscillation problems for output. When driving at saturation, there is no need for such oscillation-stopping capacitor.

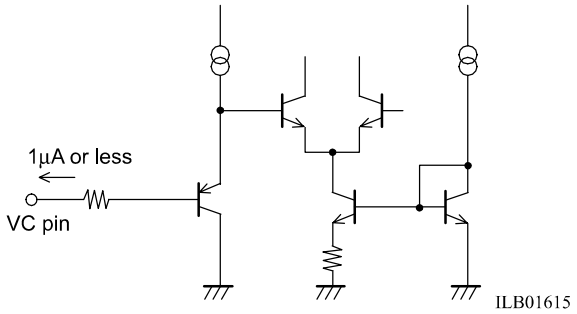
6. GND wiring and power line capacitors : (PGND, SGND, V_{CC}, VB1, 2, V_{DD})
Connect PGND (2 places) and SGND near the IC, and place the capacitors as close as possible to each of the power pins.

7. Input pin equivalent circuit

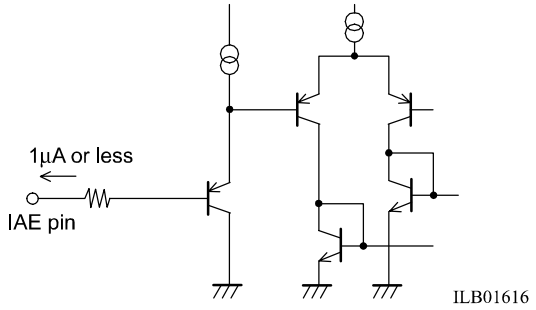
IN1 to 12, INHD pin



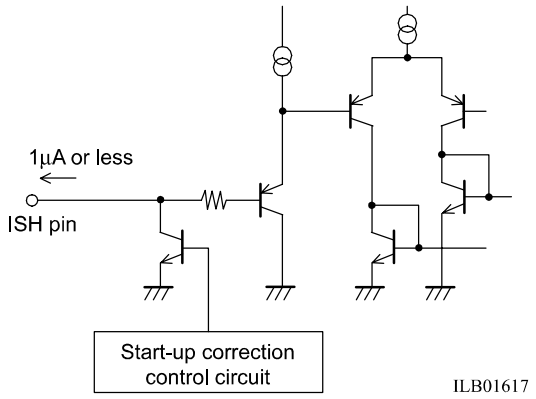
VC1, 2 pin



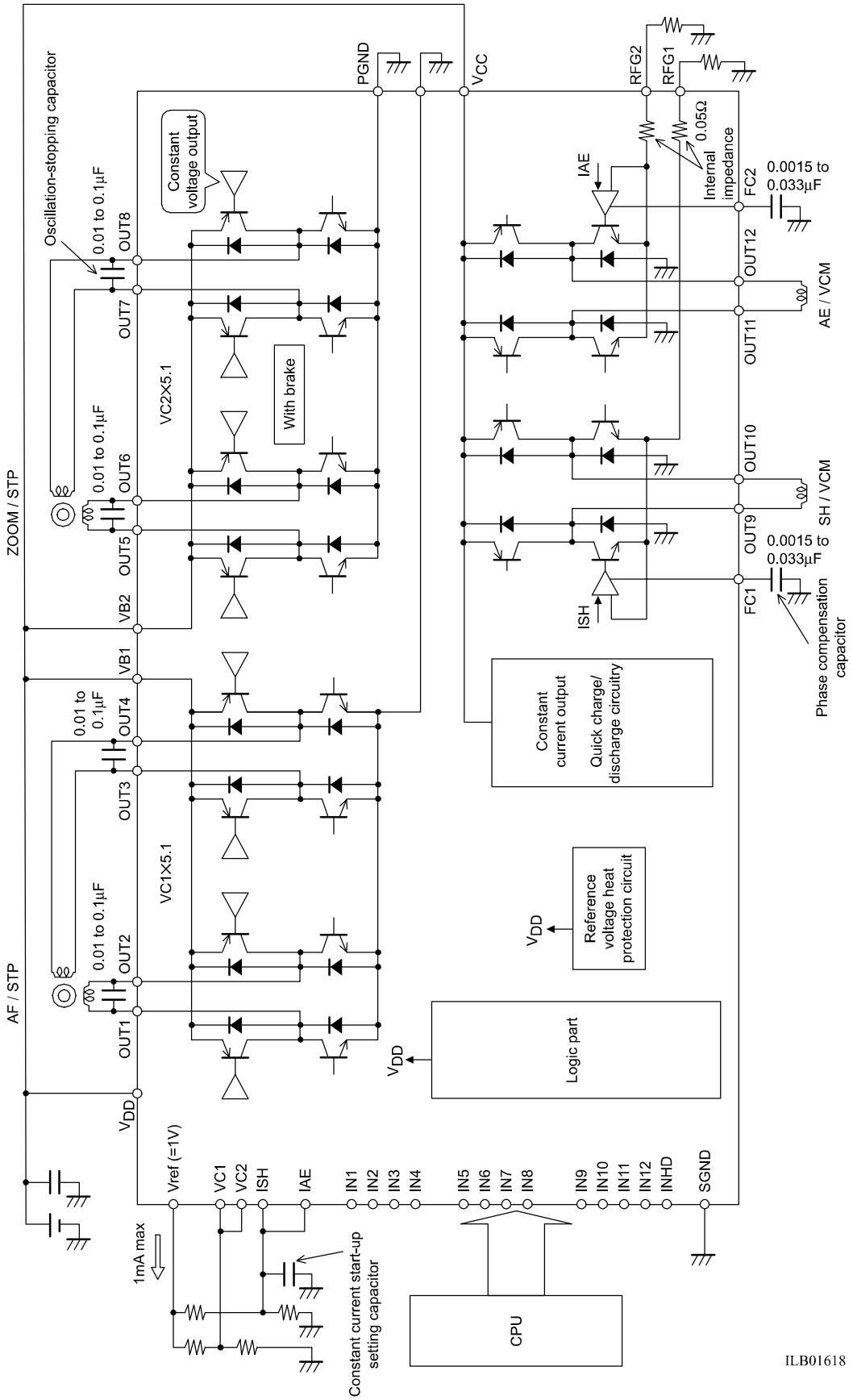
IAE pin



ISH pin



Block Diagram



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