Ordering number : EN7896D

SANYO Semiconductors
DATA SHEET

LB8652T
LB8652LP

Monolithic Digital IC

Driver for Digital Still Cameras

Features

- Actuator driver for digital camera built into one chip (no simultaneous drive)
  (1) Saturation output for AF - stepping motor (two-phase, 1 - 2 phases excitation possible)
  (2) Constant current control output for SH - VCM
    - Response speed stabilized by means of a rapid charge circuit and rapid discharge circuit
    - Shutter close control possible with the input one-port
    - Current setting possible separately for the shutter “OPEN” and “CLOSE”
      (Open loop control for the shutter “OPEN”)
  (3) Saturation output for AE - VCM or stepping motor applicable (2-phase, 1 - 2 phases excitation possible)
  (4) Constant-voltage output for ZOOM - DC motor (forward/reverse/braking) or saturation output stepping motor (two-phase, 1 - 2 phases excitation possible)

- Applications of various actuators possible.

	SH	AE	AF	ZOOM
Application Example 1	VCM	VCM	STM	DCM
Application Example 2	VCM	VCM	STM	STM
Application Example 3	VCM	STM	STM	DCM

- No standby current consumption (or zero).
- 2 system power source (VB : for DC motor, V_{CC} : others)
- Low saturation output
- Built-in thermal protection circuitry
- Small and thin package: TSSOP24 (225mil) for LB8652T and VQFN44 (5.0×5.0) for LB8652LP

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Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum Power Source Voltage	VB max	VB	10.5	V
	V_{CC} max	V_{CC}	10.5	
Maximum Applied Input Voltage	V_{IN} max	MD1 to 3, IN1 to 4	10.5	V
Maximum Applied Output Voltage	V_{OUT} max	OUT1 to 8	10.5	V
Maximum Output Current 1	I_O max1	OUT1	400	mA
Maximum Output Current 2	I_O max2	OUT2, 3, OUT5 to 7	600	mA
Maximum Output Current 3	I_O max3	OUT4, OUT8	800	mA
Allowable Power Dissipation	Pd max1	Substrate mounting (*1) [LB8652T]	800	mW
	Pd max2	Substrate mounting (*2) [LB8652LP]	1400	mW
Operating Temperature	Topr1		-20 to +80	°C
Storage Temperature	Tstg		-55 to +150	°C

(*1) Standard mounting substrate : 76.1mm×114.3mm×1.6mm glass epoxy resin (1 layerPWB)
(*2) Standard mounting substrate : 40.0mm×50.0mm×0.8mm glass epoxy resin (2 layerPWB)

Allowable Operating Range at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Source Voltage Range	VB	(*3)	2.0 to 10	V
	V_{CC}		2.0 to 10	
Input Pin High Level Voltage	$V_{IN}H$	MD1 to 3, IN1 to 4	1.8 to 10	V
Input Pin Low Level Voltage	$V_{IN}L$	MD1 to 3, IN1 to 4	-0.3 to 0.4	V
Constant Voltage Setting Input Range	VOC	VC	0.8 to 2.0	V

(*3) No restriction on priority among applied voltages of VB (Battery power source), V_{CC} (step-up power source) and V_{IN} (CPU power source).
Example1 : VB = 3.3V, V_{CC} = 4.0V, V_{IN} = 5.0V
Example2 : VB = 3.3V, V_{IN} = 5.0V

Electrical Characteristics at Ta = 25°C, VB = V_{CC} = 3V, Rf = 1Ω

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Standby Current Consumption	$I_{CC}0$	VB = V_{CC} = 8.0V MD1 to 3, IN1 to 4 = L		0.1	5.0	μA
V_{CC} Operating Current Consumption	$I_{CC}1$	AF mode IN1, 3 = H (2 phase excitation)		24	32	mA
	$I_{CC}2$	AF mode IN3 = H (1 phase excitation)		14	21	
	$I_{CC}3$	SH mode IN1 = L		42	54	
	$I_{CC}4$	SH mode IN1 = H RILM = 2kΩ		18	24	
VB Operating Current Consumption	IB	DC-ZOOM mode IN3 = H		7	15	mA
Reference Voltage	Vref	Iref = -1mA	1.74	1.8	1.86	V
Reference Voltage start-up time	Tr	Design guaranteed		0.5	2.0	μs
Input Pin Current	I_{IN}	V_{IN} = 5.0V		70	90	μA
Overheat Protection Operation Temperature	THD	Design guaranteed (*4)	160	180	200	°C
Stepping motor driver for AF (OUT2 to 3, OUT6 to 7)						
Output Saturation Voltage 1	VSAT1	V_{CC} = 3.3V, I_O = 0.2A (upper and lower)	0.15	0.25	0.40	V
AE driver (OUT5 to 6)						
Output Saturation Voltage 2	VSAT2	V_{CC} = 3.3V, I_O = 0.2A (upper and lower)	0.15	0.25	0.40	V
SH driver (OUT1 to 2)						
Output Constant Current 1	I_O1	OUT2→OUT1 V_{CC} = 3.0 to 3.7V, Rf = 1Ω	194	206	218	mA
Output Constant Current 2	I_O2	OUT1→OUT2 V_{CC} = 3.3V RILM = 1.6kΩ	130	160	190	
Output Saturation Voltage 3	VSAT3	OUT2→OUT1 V_{CC} = 3.3V, I_O = 0.2A (upper and lower)	0.15	0.25	0.40	V

(*4) For the characteristic within the guaranteed temperature range, shipping check is performed at Ta = 25°C. For all temperature range, it is design guaranteed.

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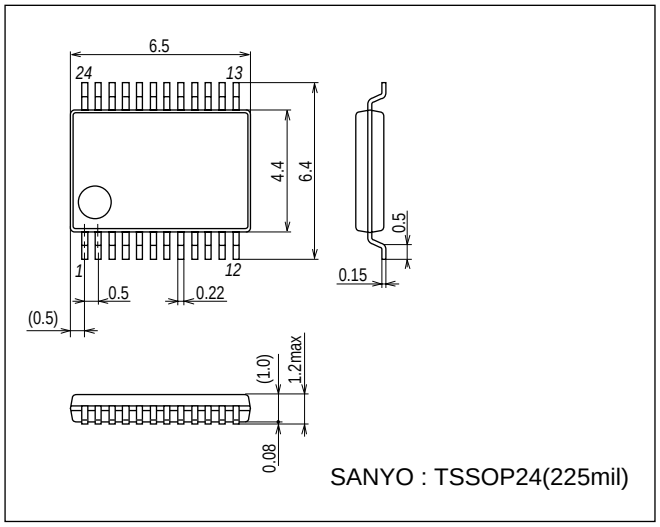
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
DC motor driver for ZOOM (OUT4 to 8)						
Output Constant Voltage	V_O	VB = 3.0 to 3.7V, VC = 1V	2.38	2.5	2.62	V
Output Saturation Voltage 4	VSAT4	VB = 3.3V, I_O = 0.3A (upper and lower)	0.2	0.3	0.45	V
Output Saturation Voltage 5	VSAT5	VB = 3.3V, I_O = 0.3A (upper)	0.1	0.18	0.25	V

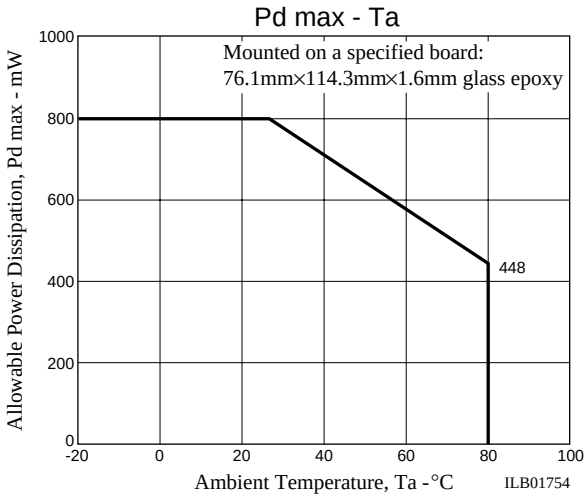
Package Dimensions

unit : mm (typ)

3260A [LB8652T]



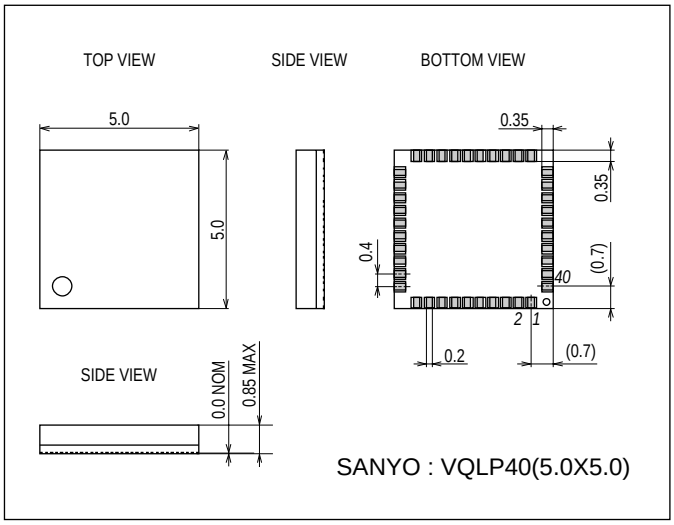
[LB8652T]



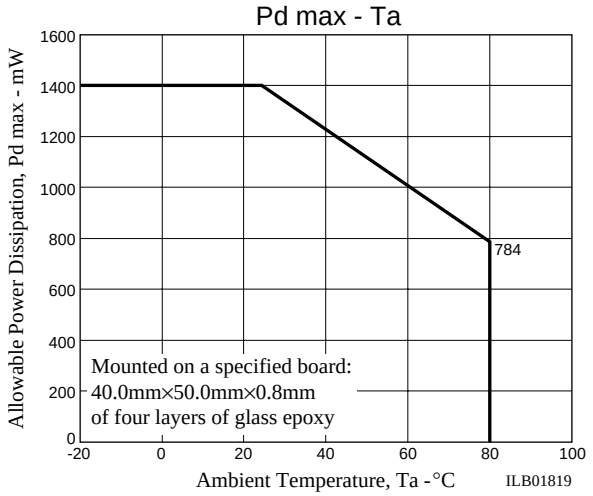
Package Dimensions

unit : mm (typ)

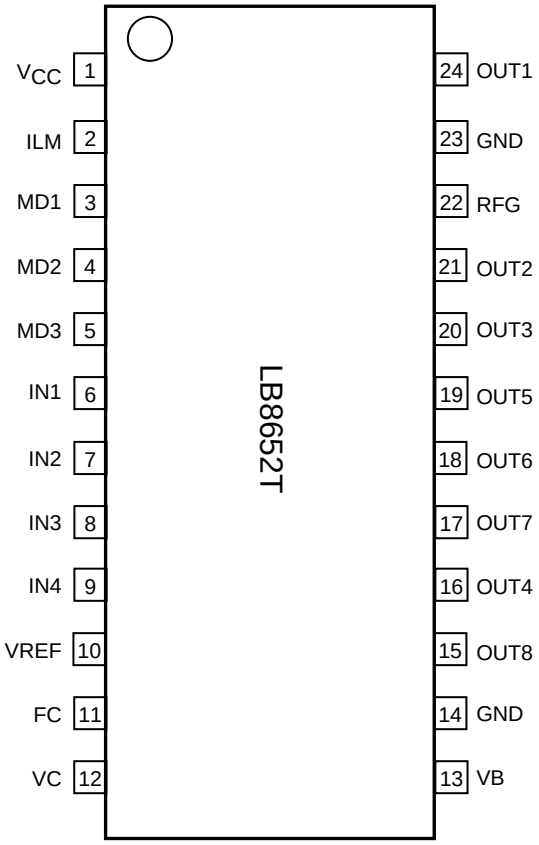
3302A [LB8652LP]



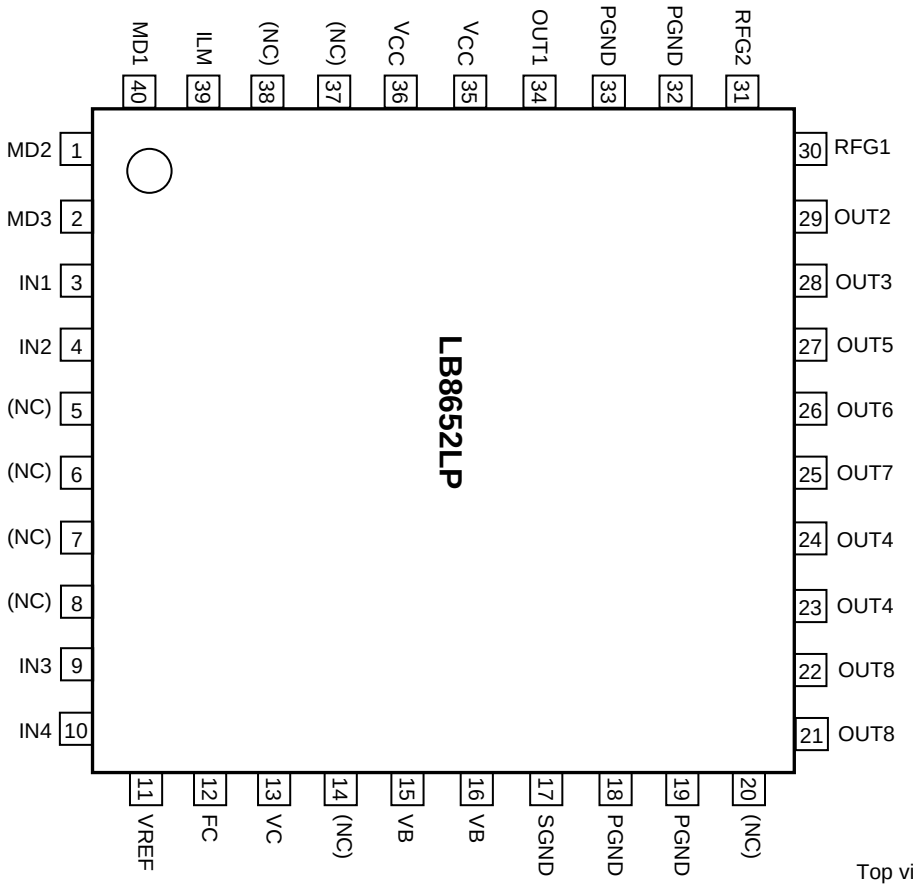
[LB8652LP]



Pin Assignment



Top view



Top view

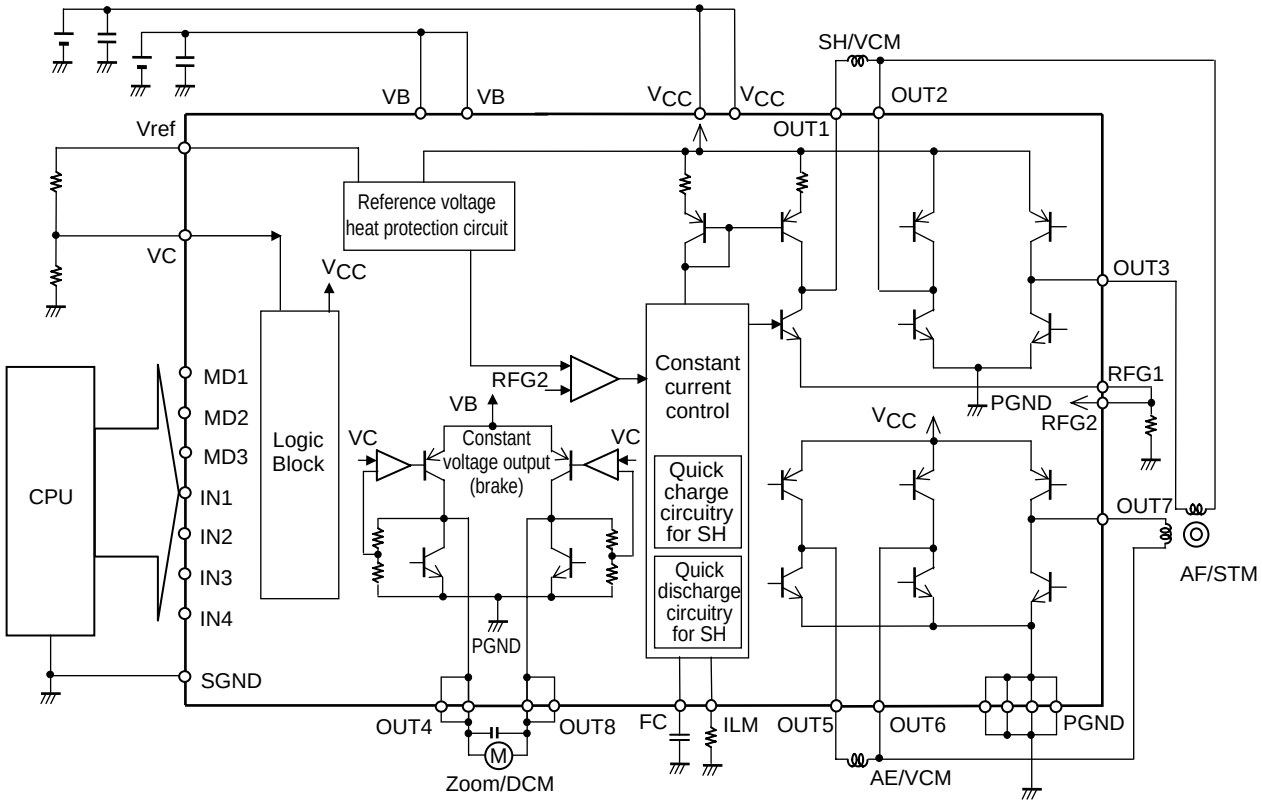
(Note) Connect all of GND pins.

True Value Table

Input							Output								Mode		
MD			IN				OUT										
1	2	3	1	2	3	4	1	2	3	4	5	6	7	8	Sample Application 1	Sample Application 2	Sample Application 3
L	L	L	L	L	L	L	-	-	-	-	-	-	-	-	Standby		
L	L	H	L	*	*	*	L	H	-	-	-	-	-	-	SH(VCM) “Closed”		
			H	*	*	*	H	L	-	-	-	-	-	-	SH(VCM) “Open”		
L	H	H	L	L			-	-	-	-			-	-			AE (STM)
			L	H			-	-	L	H			-	-			
			H	L			-	-	H	L			-	-			
			H	H			-	-	-	-			-	-			
					L	L	-	-			-	-	-	-	AE (VCM)	AE (VCM)	
					L	H	-	-			L	H	-	-			
					H	L	-	-			H	L	-	-			
					H	H	-	-			-	-	-	-			
H	L	L	*	*	L	L	-	-	-	-	-	-	-	-	ZOOM (DCM)		ZOOM (DCM)
			*	*	L	H	-	-	-	L	-	-	-	H			
			*	*	H	L	-	-	-	H	-	-	-	L			
			*	*	H	H	-	-	-	H	-	-	-	H			
H	H	L	L	L			-	-	-	-	-			-	AF (STM)		
			L	H			-	L	H	-	-			-			
			H	L			-	H	L	-	-			-			
			H	H			-	-	-	-	-			-			
					L	L	-			-	-	-	-	-			
					L	H	-			-	-	L	H	-			
					H	L	-			-	-	H	L	-			
					H	H	-			-	-	-	-	-			
H	L	H	L	L			-	-	-	-	-	-					
			L	H			-	-	L	H	-	-					
			H	L			-	-	H	L	-	-					
			H	H			-	-	-	-	-	-					
					L	L	-	-			-	-	-	-		ZOOM (STM)	
					L	H	-	-			-	-	L	H			
					H	L	-	-			-	-	H	L			
					H	H	-	-			-	-	-	-			
L	H	L	*	*	*	*	-	-	-	-	-	-	-	-	Ignore		
H	H	H	*	*	*	*	-	-	-	-	-	-	-	-			

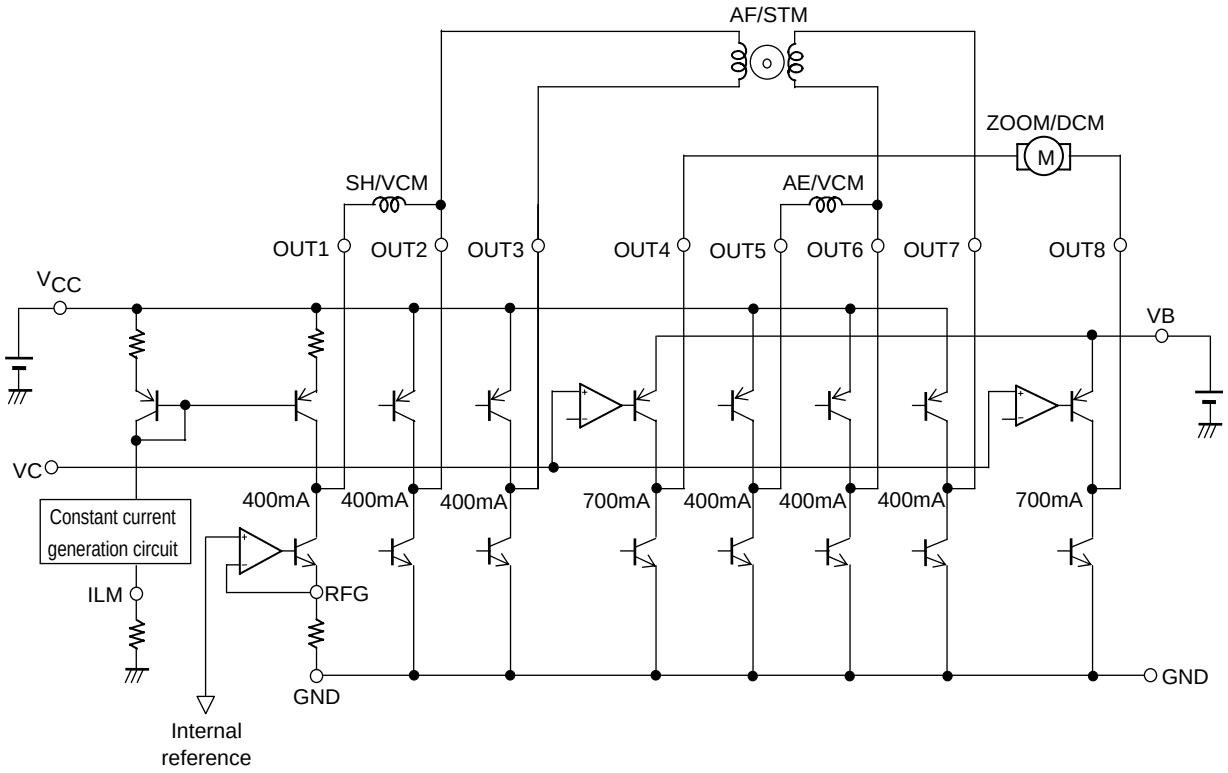
(*) : Don’t care.
(-) : Output OFF
(H) : Constant voltage output is 2.5 time the VC pin applied voltage.
(L) : Constant current output is (IC pin applied voltage÷RFG resistor current).
Note : When the current flows from OUT1 to OUT2, easy constant current output function is ON.
The output current is controlled by the resistance value connected between the ILM pin and GND.

Block Diagram [LB8652LP]

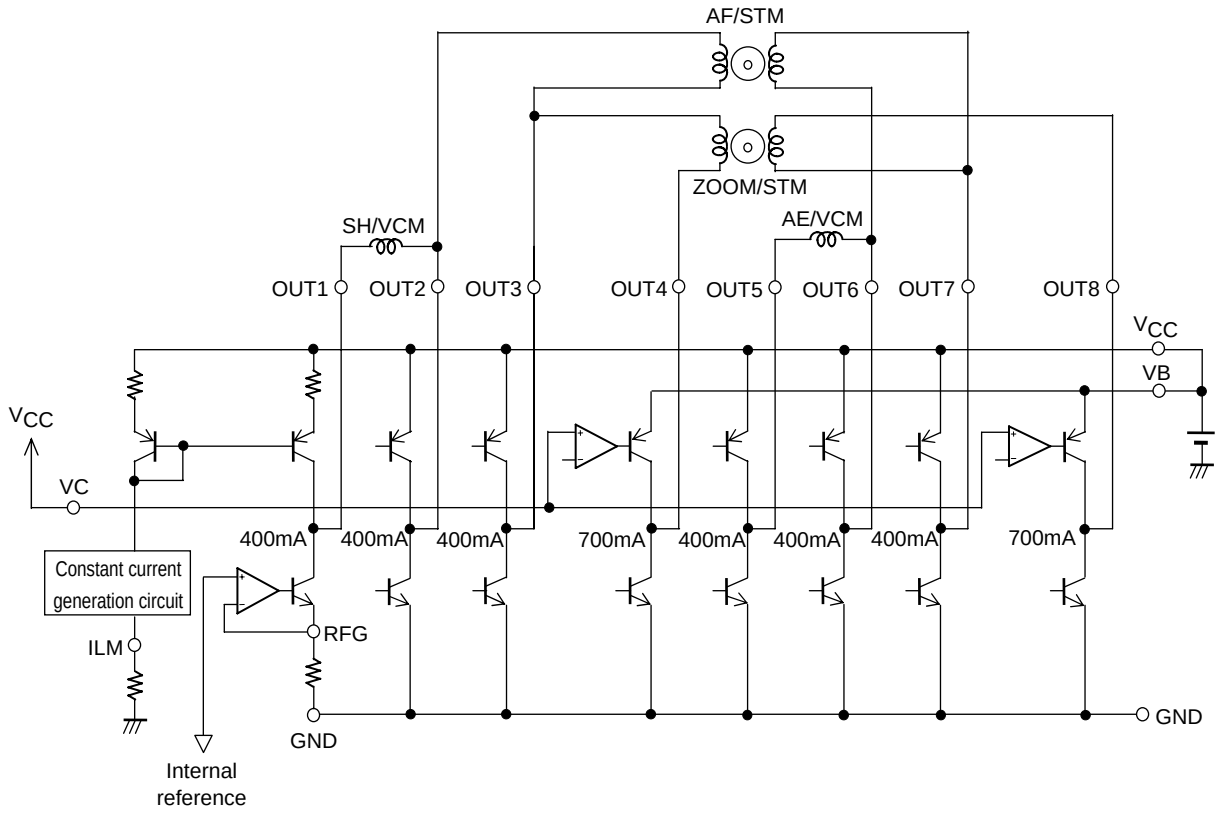


Application Circuit Diagram

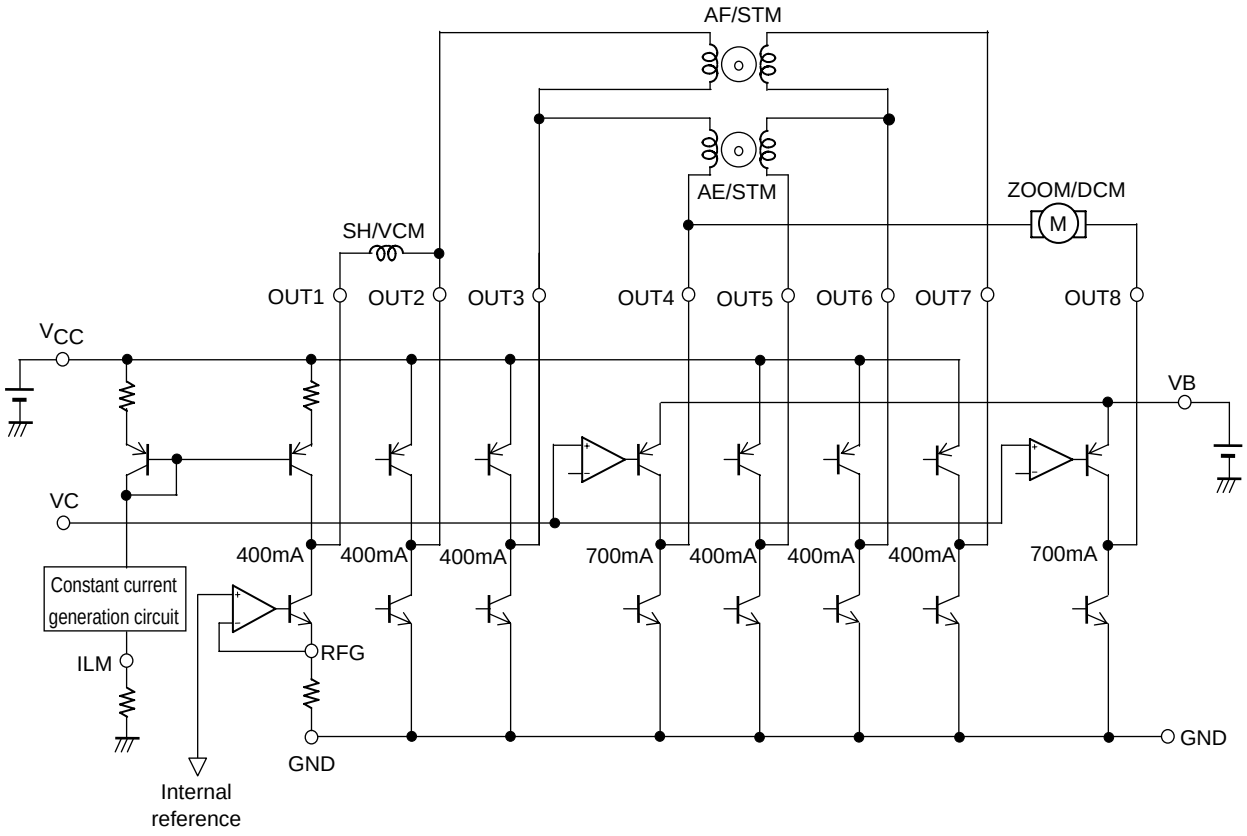
[Application Example 1]



[Application Example 2]



[Application Example 3]



Points to Take into Consideration When Designing

(1) For shutter control Constant current setting (RFG1, RFG2, OUT1, OUT2)

The constant current when flowing the current from OUT2 to OUT1 can be specified by a resistor connected between RFG and GND. (In this case, RFG1 is connected to the emitter side of NPN transistor while RFG2 is connected to the minus input side of constant-current control amplifier.) The reference voltage is generated in the IC and it is approximately 0.218V. The voltage is controlled in such a way so that the voltage generated at the resistor used for current detection connected between RFG and GND would be equal to this voltage.
The formula for calculating the output current is as given below. In addition, as a fundamental setting, it is designed so that the approx. 200mA would flow through the coil when RFG resistor is connected with 1Ω.

(Current flows from OUT2 to OUT1)
= 0.218V÷(Resistance between RFG and GND+0.05Ω) - (Drive current of output Tr)

This 0.05Ω 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.
Also, the drive current of output Tr is equal to 1/hfe (a 80th to 200th part approx.) of the coil current.
The constant current flowed from OUT2 to OUT1 is more accurate than that flowed from OUT1 to OUT2.
Therefore make sure to use this method for shutter closing drive.

(2) For shutter control Open-loop constant current control setting (ILM, OUT1, OUT2)

In order to prevent the high-current flowing when shutter opening, the output current control circuit is implemented for current flowing from OUT1 to OUT2. The constant current when flowing the current from OUT1 to OUT2 can be specified by a resistor connected between ILM and GND.
The formula for calculating the output current is as given below.

(Current flows from OUT1 to OUT2) = 1.36V÷(Resistance between ILM and GND) ×200 approx.

Due to open-loop control by which feedback signals are not sent, the accuracy of constant current is relatively inferior. It is used for shutter opening drive.

(3) Phase compensation capacitor (FC)

See and check the capacitor value for FC pin 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.

(4) Constant voltage control Oscillation-stopping capacitor (OUT4, OUT8)

When controlling the constant voltages, it is necessary to place capacitors between the OUT pins to stop oscillation. See and check the capacitance 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 capacitors.

(5) GND wiring and power line capacitors : (SGND, PGND, V_{CC}, VB)

Connect GND (2 places) near the IC, and place the capacitors as close as possible to each of the power pins.