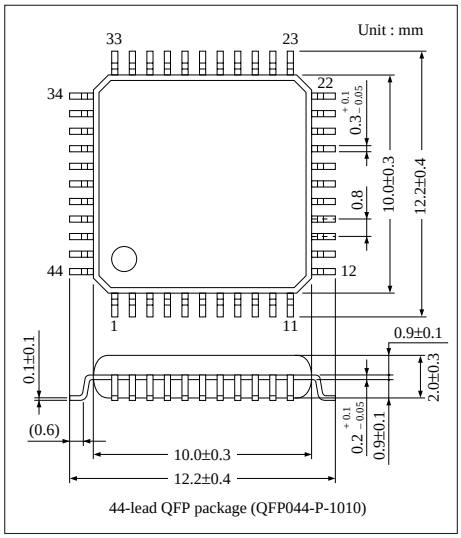
AN8819NFB

4Ch. Linear Driver IC + DC-DC Converter Control for CD

■ Overview

The AN8819NFB is a 4ch. driver employing the low consumption power type H-bridge method which can operate with low voltage. It is suitable particularly for a portable CD player.



44-lead QFP package (QFP044-P-1010)

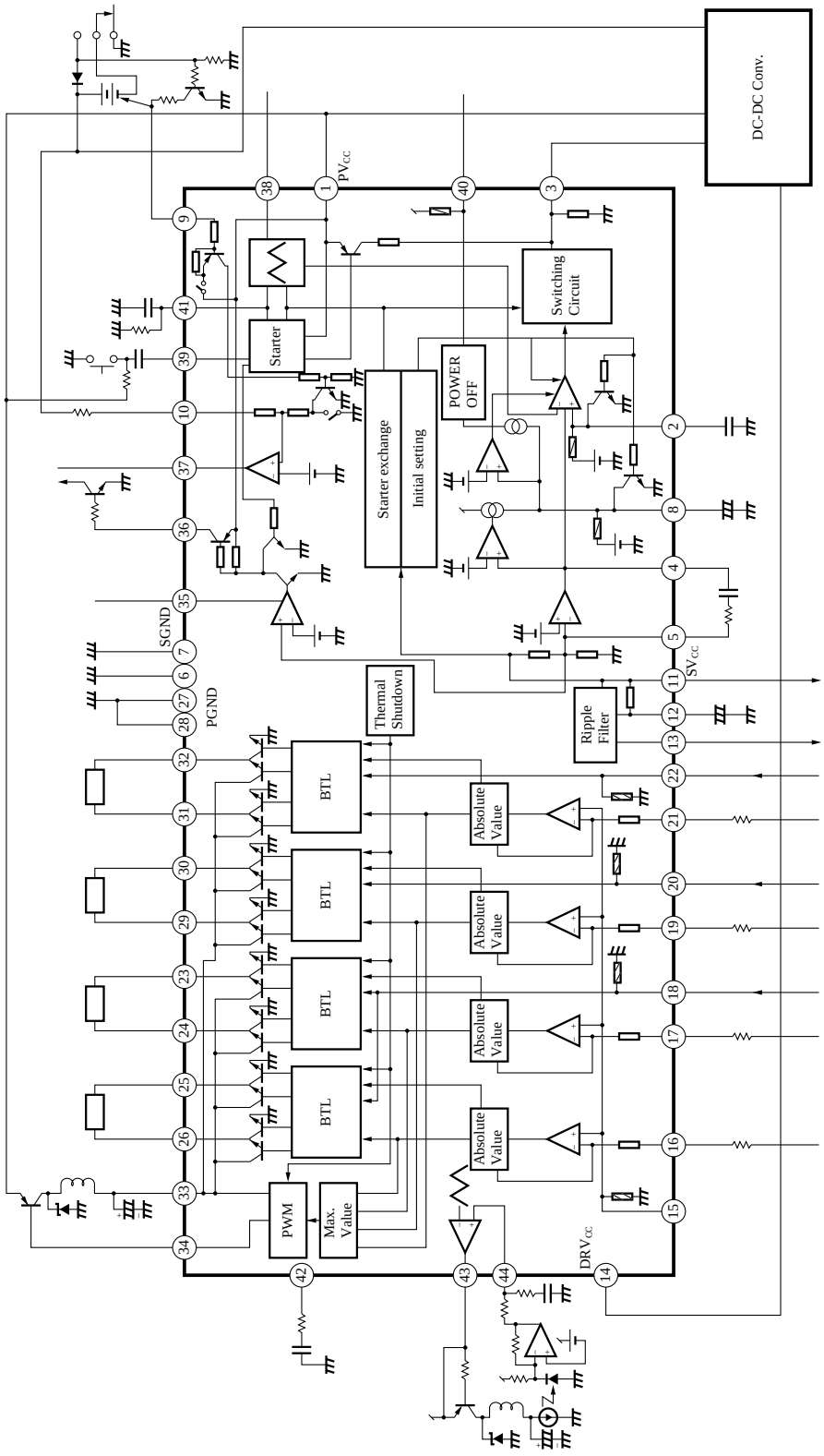
■ Features

- Wide output D-range is available regardless of the reference voltage on the system
- Driver input/output gain setting enabled by an external resistance
- For 2 channels, independent power on/off feature built-in. For other 2 channels, simultaneous on/off feature provided.
- Thermal shut down circuit (with hysteresis) built-in
- PWM control of the driver supply enabled by an external circuit for low consumption power operation
- Construction of DC-DC converter enabled by an external circuit
- Construction of ripple filter for D/A converter enabled by an external capacitor
- Construction of PWM control circuit of laser output by an external circuit for low consumption power operation
- Reset circuit with a mute and battery voltage detection circuit built-in for rational design of a set

■ Application

Actuator for CD, motor drive

■ Block Diagram



■ Pin Description

Pin No.	Pin Name	Pin No.	Pin Name
1	PV_{CC} Supply Pin	23	TR– Driver Output Pin
2	DED Dead Time Input Pin	24	TR+ Driver Output Pin
3	OUT DC-DC Converter Output Pin	25	FO – Driver Output Pin
4	FB Error Amp. Input Pin	26	FO + Driver Output Pin
5	IN Error Amp. Output Pin	27	PGND Ground Pin
6	DRGND Ground Pin	28	PGND Ground Pin
7	SGND Ground Pin	29	SP + Driver Output Pin
8	SPRO Short-Circuit Protection Input Pin	30	SP – Driver Output Pin
9	BSEL Empty Detection Level Changeover Pin	31	TV+ Driver Output Pin
10	V_{SEN} Empty Detection Input Pin	32	TV– Driver Output Pin
11	SV_{CC} Power Pin	33	VC Driver Power Voltage Pin
12	CRIP Capacitor Pin for Ripple Rejection	34	TB PWM Circuit Output Pin
13	AVDD Ripple Filter Ouput Pin	35	RESET Reset Output Pin
14	DRV_{CC} Supply Pin	36	MRST Muting Reset Output Pin
15	V_{REF} 1/2 V_{CC} Input Pin	37	EMP Empty Detection Output Pin
16	INFO Driver Input Pin	38	CLK External Synchronization Input Pin
17	INTR Driver Input Pin	39	START Start Oscillation Start Input Pin
18	LDON Driver ON – OFF Control Pin	40	POWER Power On/Off Input Pin
19	INSP Driver Input Pin	41	CT Triangular Wave Oscillation Pin
20	PC Driver ON – OFF Control Pin	42	PWMG PWM Loop Gain Adjustment Pin
21	INTV Driver Input Pin	43	COMPO APC Comparator Output Pin
22	TRVSTOP Driver ON – OFF Control Pin	44	COMPI APC Comparator Input Pin

■ Absolute Maximum Ratings (Ta=25˚C)

Parameter	Symbol	Rating	Unit
Supply Voltage	PV_{CC}	15	V
	SV_{CC}	6	
	DRV_{CC}	6	
V_{SEN} Pin Maximum Applied Voltage	$V_{10max.}$	15	V
V_C Pin Maximum Applied Voltage	$V_{33max.}$	9	V
Supply Current	I_{CC}	—	mA
Power Dissipation Note)	P_D	880	mW
Operating Ambient Temperature	T_{opr}	–25 ~ + 75	˚C
Storage Temperature	T_{stg}	–55 ~ + 125	˚C

Note) Unit

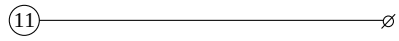
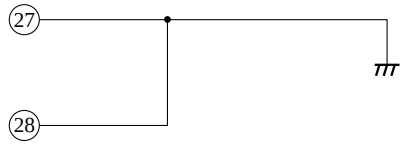
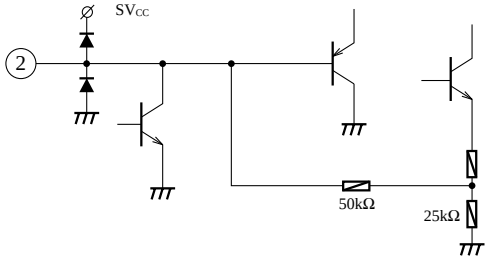
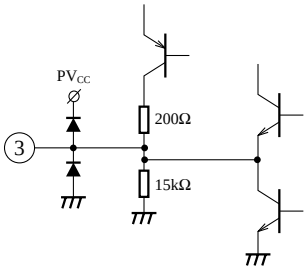
■ Recommended Operating Range (Ta=25˚C)

Parameter	Symbol	Range
Operating Supply Voltage Range	PV_{CC}	1.5V ~ 9V
	SV_{CC}	2.7V ~ 5.5V
	DRV_{CC}	2.7V ~ 5.5V

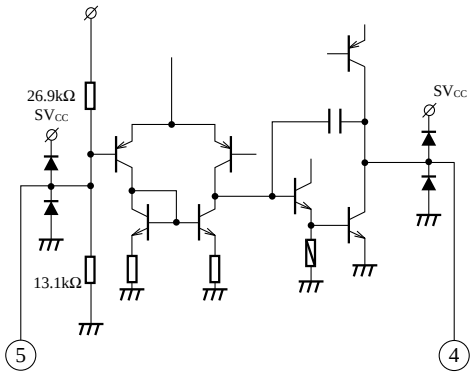
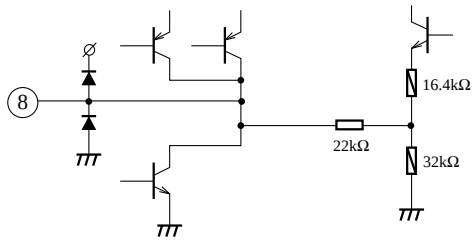
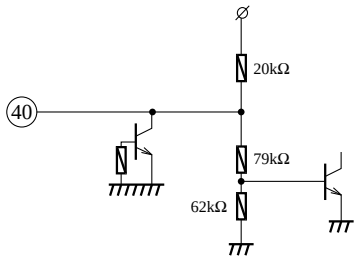
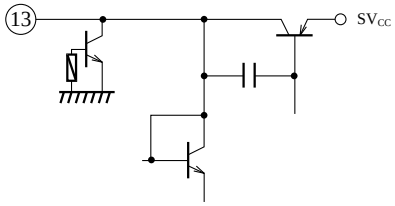
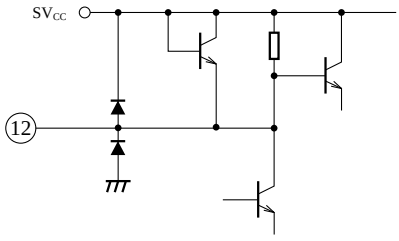
■ Electrical Characteristics (Ta=25˚C±2˚C)

Parameter	Symbol	Condition	min.	typ.	max.	Unit
SV_{CC} No Load Supply Current	I_{11Q}	PV_{CC} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, V_{REF} = 1.6V	2.0	3.1	4.5	mA
DRV_{CC} No Load Supply Current	I_{14Q}	PV_{CC1} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, V_{REF} = 1.6V	1.8	2.4	3.0	mA
PV_{CC} No Load Supply Current	I_{1Q}	PV_{CC1} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, V_{REF} = 1.6V	1.8	2.6	5.1	mA
PV_{CC} Leak Current	I_{1L}	PV_{CC} = 9V, SV_{CC} = DRV_{CC} = 0V, V_{ERF} = 0V	—	—	2.0	µA
Driver Portion						
Maximum Drive Voltage of Pins FO, TR, SP and TV	V_{DMAX}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	—	—	DRV_{CC} –1.2	V
Maximum Drive Current	I_{DMAX}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	500	—	—	mA
Focus/Tracking/Traverse Transmission Gain (+)	G_{+}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	33	43	53	kΩ
Spindle Transmission Gain (+)	G_{sp+}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	67	87	107	kΩ
Focus/Tracking/Traverse Output Offset Voltage	V_{OFF}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	–50	—	50	mV
Spindle Output Offset Voltage	V_{SPOFF}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	–100	—	100	mV
Focus/Tracking/Traverse Input Conversion Dead Zone	I_{DZ}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	–1	—	1	µA
Spindle Input Conversion Dead Zone	I_{SpDZ}	PV_{CC} = 4V, SV_{CC} = DRV_{CC} = 3.2V	–2	—	2	µA
DC-DC Converter Portion						
CLK Synchronization Output Pulse Maximum Duty	D_{2C}	PV_{CC} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, CT = 390pF/470kΩ, V_{IN} = 0.8V	65	74	83	%
Self-Running Output Pulse Maximum Duty	D_{2F}	PV_{CC} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, CT = 390pF/470kΩ, V_{IN} = 0.8V	74	80	86	%
Starting Output Pulse Maximum Duty	D_{2S}	PV_{CC} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, CT = 390pF/470kΩ, V_{IN} = 0.8V	35	45	55	%
Self-Running Output Voltage (H)	V_{20H}	PV_{CC} = 2.4V, SV_{CC} = 3.2V I_{OUT} = –25mA, V_{CT} = 0V, V_{FB} = 0.7V	1.08	1.5	1.71	V
Self-Running Output Voltage (L)	V_{20L}	PV_{CC} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, I_{OUT} = 15mA, V_{CT} = 1V, V_{FB} = 0.5V	0.15	0.3	0.4	V
Starting Oscillation Frequency	F_{41S}	PV_{CC} = 3.2V, SV_{CC} = 0V CT = 390pF/470kΩ	60	83	115	kHz
Self-Running Oscillation Frequency	F_{41F}	PV_{CC} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, CT = 390pF/470kΩ	54	65	76	kHz
Ripple Filter Portion						
Ripple Rejection Ratio	R_{R13}	PV_{CC} = 2.4V, SV_{CC} = DRV_{CC} = 3.2V, Input = 35mVrms/20kHz	40	—	—	dB

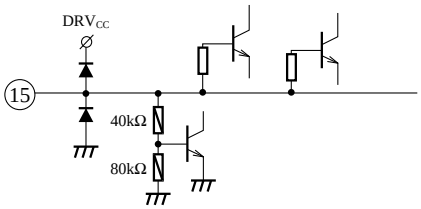
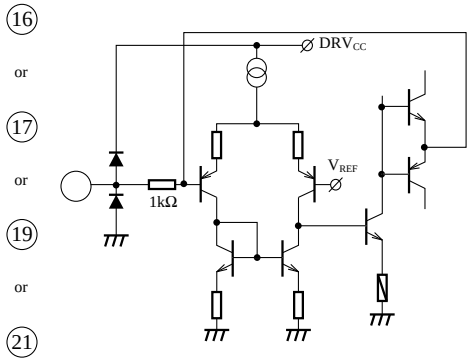
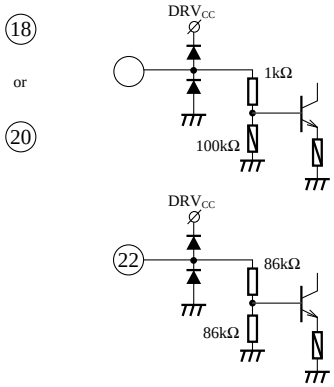
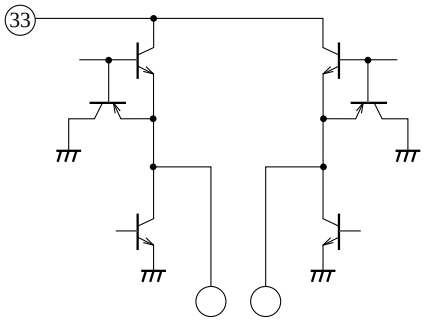
■ Pin Description

Pin No.	Symbol	I/O	Pin Description	Equivalent Circuit
11	SV_{CC}	I	Supply pin for control circuits other than of driver, not connected with DRV_{CC}, PV_{CC}	
7	SGND	I	Ground pin for control circuits other than of driver	
14	DRV_{CC}	I	Supply pin for control circuit of driver, not connected with SV_{CC}, PV_{CC}	
6	DRGND	I	Ground pin for control circuit of driver	
1	PV_{CC}	I	Supply pin supplying the current for output power transistor	
27 28	PGND	I	Ground pin for output power transistor	
2	DED	—	Setting pin for dead time control input and soft start	
3	OUT	O	Switching output pin	

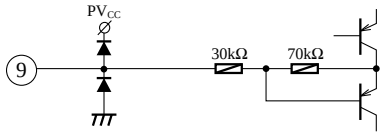
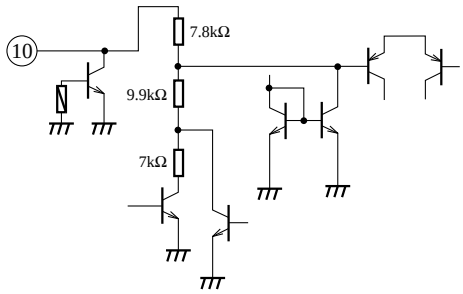
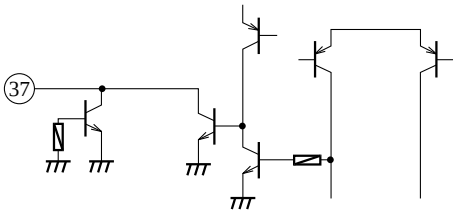
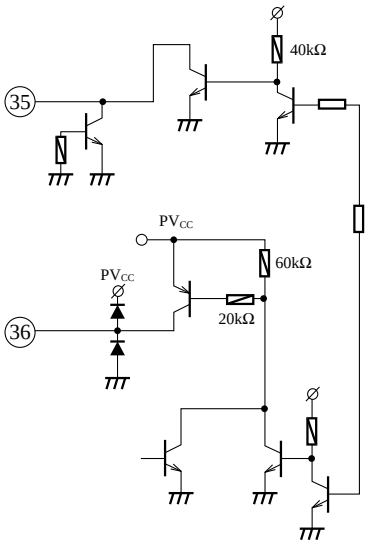
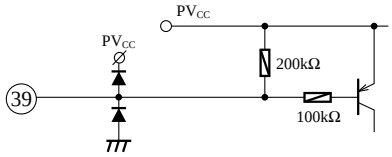
■ Pin Description (Cont.)

Pin No.	Symbol	I/O	Pin Description	Equivalent Circuit
4	FB	O	Error amp. output pin	
5	IN	I	Error amp. input pin	
8	SPRO	I	Short-circuit protection input pin	
40	POWER	I	Switching output ON/OFF pin	
13	AVDD	O	Supply pin for D/A converter	
12	CRIP	—	External capacitor pin for ripple rejection	

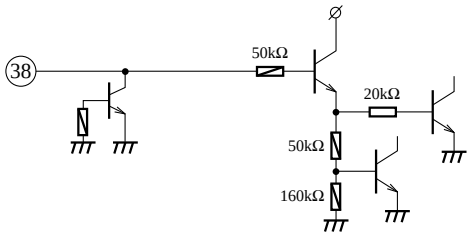
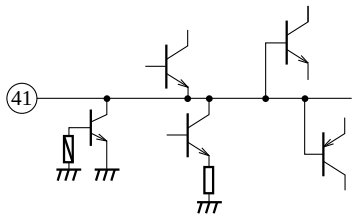
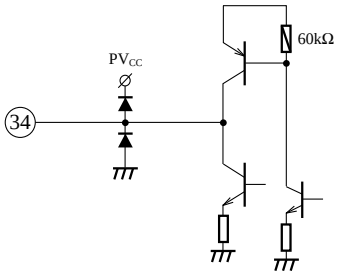
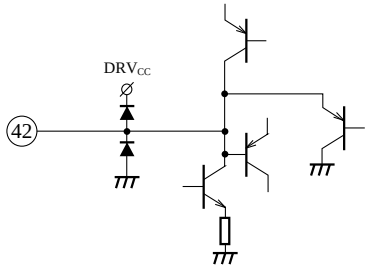
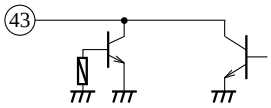
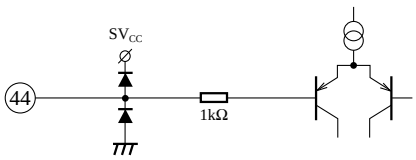
■ Pin Description (Cont.)

Pin No.	Symbol	I/O	Pin Description	Equivalent Circuit
15	V_{REF}	I	V_{REF} input pin	
16	INFO	I	Input pin for Driver FO	
17	INTR	I	Input pin for Driver TR	
19	INSP	I	Input pin for Driver SP	
21	INTV	I	Input pin for Driver TV	
18	LDON	I	Power cut input pin for Drivers FO, TR. Driver output at L = GND	
20	PC	I	Power cut input pin for Driver SP. Driver output at H = GND	
22	TRV STOP	I	Power cut input pin for Driver TV. Driver output at H = GND	
23	TR–	O	– output pin of Driver TR	
24	TR+	O	+ output pin of Driver TR	
25	FO –	O	– output pin of Driver FO	
26	FO +	O	+ output pin of Driver FO	
30	SP –	O	– output pin of Driver SP	
29	SP +	O	+ output pin of Driver SP	
32	TV–	O	– output pin of Driver TV	
31	TV+	O	+ output pin of Driver TV	
33	VC	O	Driver supply pin	

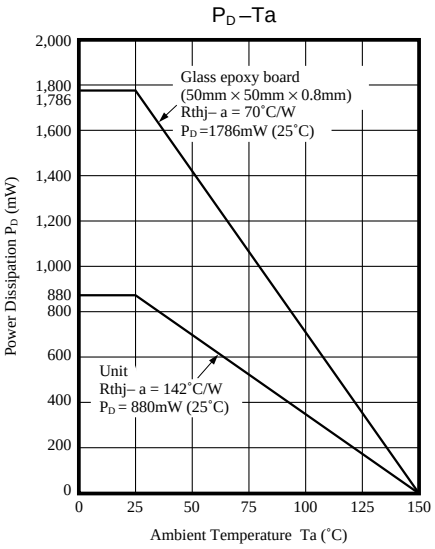
■ Pin Description (Cont.)

Pin No.	Symbol	I/O	Pin Description	Equivalent Circuit
9	BSEL	I	Pin switching the dry cell and charger battery for battery voltage detection circuit	
10	V_{SEN}	I	Battery voltage detection input pin for battery voltage detection circuit	
37	EMP	I	Battery shortage detection output pin for battery voltage detection circuit	
35	RESET	O	Reset output pin. Reset voltage = Output voltage × 90%	
36	MRST	O	Muting reset output pin. Reset voltage = Output voltage × 90%	
39	START	O	Start pin. OUT pin starts switching in start mode	

■ Pin Description (Cont.)

Pin No.	Symbol	I/O	Pin Description	Equivalent Circuit
38	CLK	I	Clock input pin, used to synchronize the triangular wave oscillation with clock.	
41	CT	O	Triangular wave oscillation pin. Oscillation frequency determined by external R and C. Recommendable values : 470kΩ, 390pF	
34	TB	O	Transistor base pin for controlling the driver supply voltage PWM	
42	PWMG	—	Gain adjustment pin for controlling the driver supply voltage PWM	
43	COMP0	O	APC switching comparator output pin	
44	COMP1	I	APC switching comparator input pin	

■ Characteristic Curve



■ Description for use

• Driver Portion

Set the driver gain calculated by the equation shown below, except for SP driver. For SP driver, the gain must be set to the calculated value + 6dB.

$$G = \frac{43k\Omega}{1.0k\Omega + R}$$ R : External input resistance

The total channel driver supply is Pin33.

Set the driver supply as necessary, since the output amplitude increases with increase of the supply voltage. However, also increase the voltage of DRV_{CC} pin (Pin14) at the same time.

As protection functions, V_{REF} detection and heat protection circuits are incorporated.

V_{REF} detector sets the driver output to high impedance, when the voltage applied to V_{REF} is 0.75V or less.

For the heat protective circuit, the set temperature for operation is approx. 150˚C and the release temperature is approx. 120˚C.

FO and TR drivers have the built-in function for making short-circuit between either loading end and GND by LDON (Pin18), and for SP and TV drivers by PC (Pin20) and TRVSTOP (Pin22).

LDON : Output GND at L

PC : Output GND at H

TRVSTOP : Output GND at H

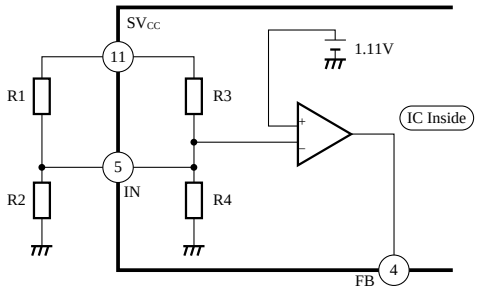
• DC-DC Converter Portion

3.4V regulator can be constructed by using external components. The output voltage can be made variable by using an external resistance.

The short-circuit protective function stops switching of OUT pin (Pin3), unless the output of error amplifier (Pin4) reaches L after H, within $t = C_{SPRO} \times V_{TH}/I_{SPRO}$ (V_{TH} = 1.1V I_{SPRO} = 30μA). (It is recommended that an electrolytic capacitor of 4.7μF around should be used for Pin3.)

The soft start function works by attaching a capacitor to Pin2 for GND. $t = C_{DED} \times R$ (R = 60kΩ)

Also, MAX duty can be changed by attaching an external resistance to Pin2. The output voltage is determined as follows:



(Example)

Assuming R1 + R2 = 50kΩ

$$SV_{CC} = 1.1 \times \frac{\left(\frac{R1 \times R3}{R1 + R3}\right) + \left(\frac{R2 \times R4}{R2 + R4}\right)}{\left(\frac{R2 \times R4}{R2 + R4}\right)}$$

Where

R3 = 26.9kΩ

R4 = 13.1kΩ

• Ripple Filter Portion for DA Converter (Ripple Filter of Low Saturation Voltage Type)

Attach a capacitor for noise removal to CRIP pin for GND.

(A capacitor of 22μF around is recommended.) Output current : 10mA (typ.)

• Battery Voltage Detection Circuit

The voltage applied to V_{SEN} pin (Pin10) and the constant voltage are compared for output to EMP pin (Pin37).

There is approx. 50mV of hysteresis from detection to reset to prevent the output chattering.

The detection threshold voltage can be made variable by an external resistance.

The threshold values with no external resistances at V_{SEN} pin (Pin10) are as follows:

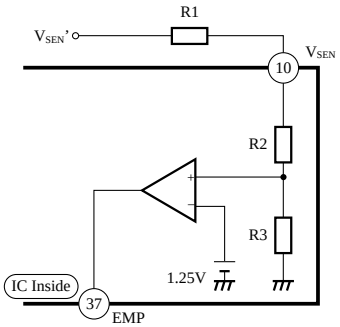
Detection : V_{SEN} = 2.2V (typ.) BSEL (Pin9) = L

Reset : V_{SEN} = 2.25V (typ.) BSEL (Pin9) = L

Detection : V_{SEN} = 1.8V (typ.) BSEL (Pin9) = HiZ

Reset : V_{SEN} = 1.85V (typ.) BSEL (Pin9) = HiZ

Use the following equation as reference to determine the detection threshold voltage:



Assuming that the voltage of V_{SEN} (Pin10) at battery shortage detection is V_{SEN}'

$$V_{SEN}' = \frac{R1 + R2 + R3}{R3} \times 1.25$$

Where R1 : External Resistance

R2 : 8.0kΩ

R3 : 16.5kΩ (BSEL = HiZ)

R3 : 10.5kΩ (BSEL = L)

• RESET and MRST Portions

RESET (Pin35) is changed from L to H, and MRST pin is changed from H to L, with approx. 90% of the output voltage by a DC-DC converter.