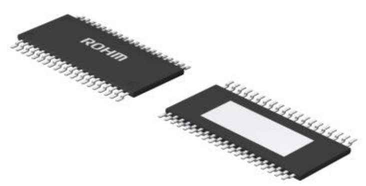
5ch System Motor Driver
BD8203EFV

General Description
BD8203EFV is a 5ch system motor driver for CD/DVD. A linear BTL mode can be adopted for all 5ch to reduce noise. It has a Built-in 5V regulator, a changeable regulator, and a general-purpose operational amplifier. Designed best for car audio systems.

Key Specifications
- Power Supply Voltage Range:
  - Driver Part Pre Steps and Regulator1 7.5V to 14V
  - Driver Part Power Steps 4.5V to V_{PREVCC} V
  - Power Steps of Two Regulators 4.5V to V_{PREVCC} V
- Standby-on Current: 1mA(Max)
- Operating Temperature Range: -40°C to +85°C

Features
- Linear BTL method is implemented for the actuator driver and the DC motor driver to reduce noise.
- Loading driver 1ch
- Built-in regulator 2ch (1ch output changeable)
- MUTE function and Standby function
- Built-in general-purpose operational amplifier 1ch
- Built-in internal operational amplifier for the voltage detection between driver outputs and for VC standard

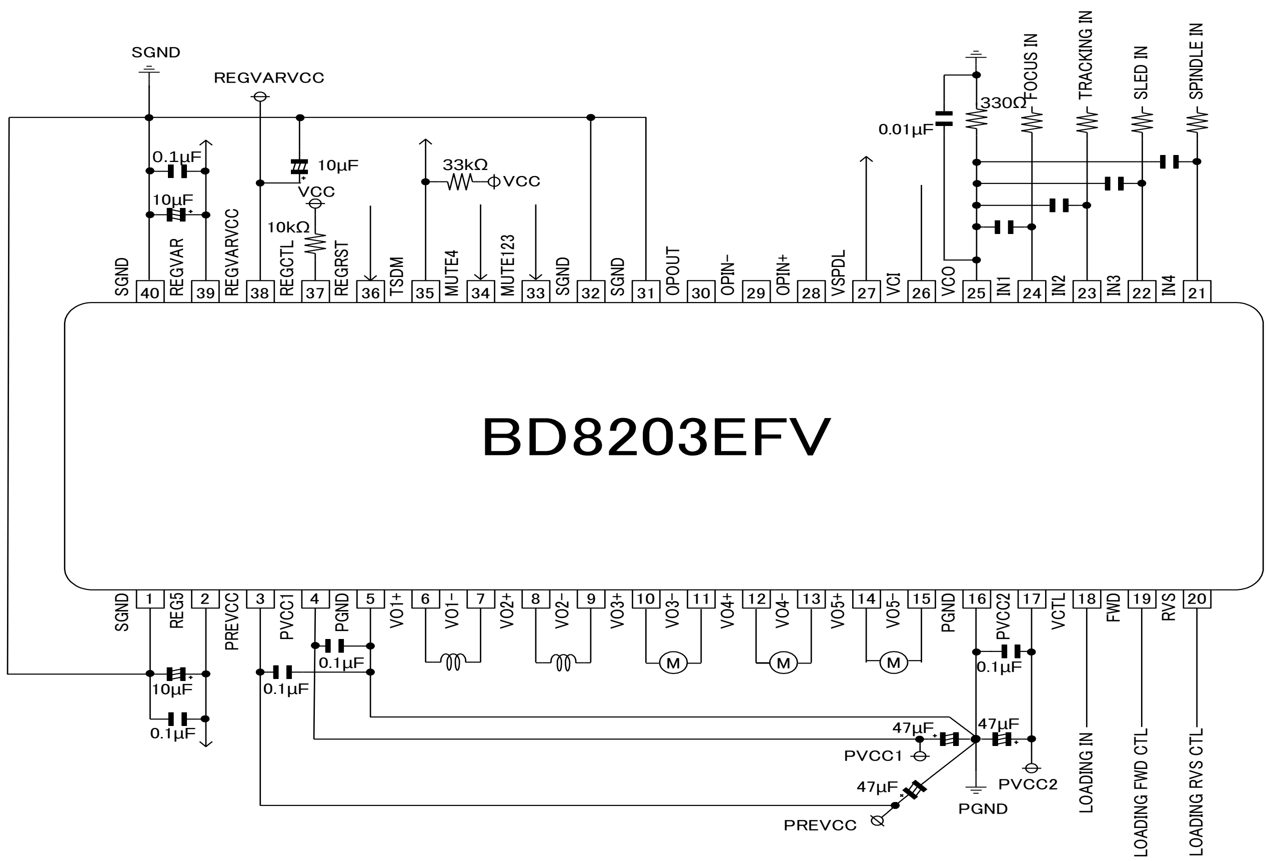
Package
W(Typ) x D(Typ) x H(Max)



HTSSOP-B40
13.60mm x 7.80mm x 1.00mm

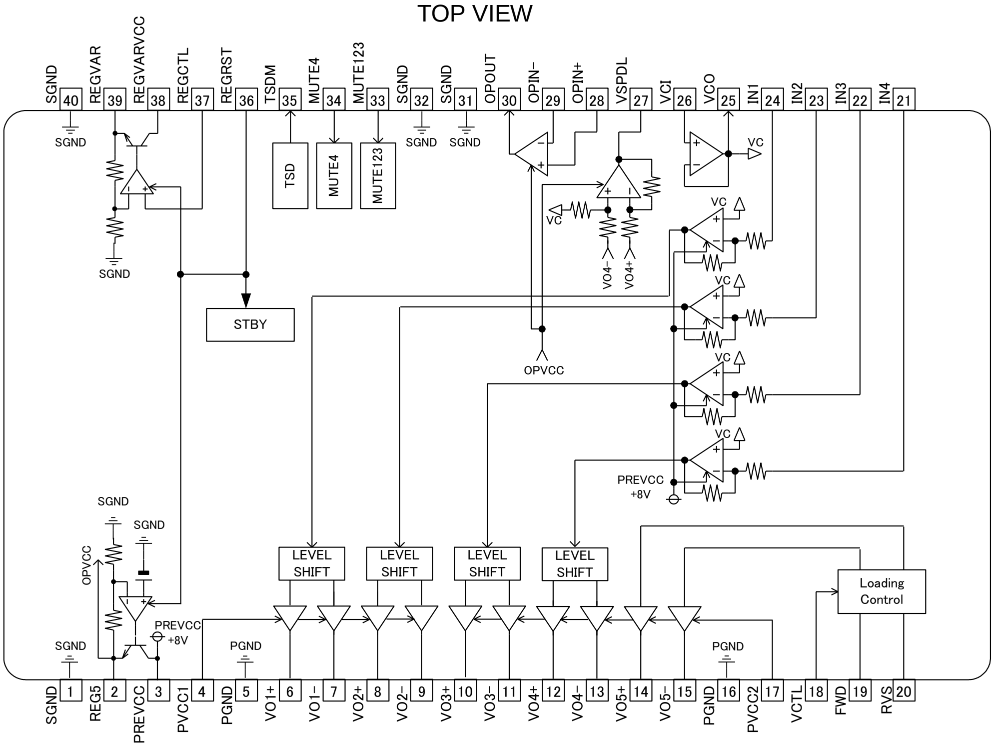
Applications
Car Audio

Typical Application Circuit



〇Product structure：Silicon monolithic integrated circuit 〇This product has no designed protection against radioactive rays

Block Diagram and Pin Configuration



Pin Description

No.	Symbol	Description	No.	Symbol	Description
1	SGND	Signal GND	21	IN4	CH4(SPDL)input
2	REG5	REG5V Output	22	IN3	CH3(SLD)input
3	PREVCC	PRE part, REG circuit, power supply terminal(+8V)	23	IN2	CH2(TRK)input
4	PVCC1	Power supply 1	24	IN1	CH1(FCS) input
5	PGND	Power GND	25	VCO	Standard voltage (VC) output
6	VO1+	CH1(FCS) Positive output	26	VCI	Standard voltage (VC) input
7	VO1-	CH1(FCS) Negative output	27	VSPDL	Voltage detection value output between VO4 outputs
8	VO2+	CH2(TRK) Positive output	28	OPIN+	General purpose Op Amp non-reversing input
9	VO2-	CH2(TRK) Negative output	29	OPIN-	General purpose Op Amp reversing input
10	VO3+	CH3(SLD) Positive output	30	OPOUT	General purpose Op Amp output
11	VO3-	CH3(SLD) Negative output	31	SGND	Signal GND
12	VO4+	CH4(SPDL) Positive output	32	SGND	Signal GND
13	VO4-	CH4(SPDL) Negative output	33	MUTE123	MUTE CH1,2,3
14	VO5+	CH5(LOAD) Positive output	34	MUTE4	MUTE CH4(SPDL)
15	VO5-	CH5(LOAD) Negative output	35	TSDM	Thermal shutdown flag output
16	PGND	Power GND	36	REGRST	REG Reset input
17	PVCC2	Power supply 2	37	REGCTL	REGVAR Output changeability input terminal
18	VCTL	CH5(LOAD) Voltage control input	38	REGVARVCC	REGVAR Tr power supply terminal
19	FWD	CH5(LOAD) FWD input	39	REGVAR	REGVAR output
20	RVS	CH5(LOAD) RVS input	40	SGND	Signal GND

Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limit	Unit
Power Supply Voltage	V_{PREVCC},V_{PVCC1},V_{PVCC2}, $V_{REGVARVCC}$	15	V
Input Terminal Voltage1	V_{IN1} (Note 1)	V_{PREVCC}	V
Input Terminal Voltage2	V_{IN2} (Note 2)	V_{REG5}	V
Output Terminal Voltage	V_{OUT} (Note 3)	V_{REG5}	V
Operating Temperature Range	Topr	-40 to +85	°C
Storage Temperature	Tstg	-55 to +150	°C
Junction Temperature	Tjmax	150	°C
Power Dissipation	Pd (Note 4)	4.7	W

(Note 1) Input terminal 1 : REGRST
(Note 2) Input terminal 2 : REGCTL, MUTE123, MUTE4, VCI, RVS, FWD, IN1, IN2, IN3, IN4, OPIN+, OPIN-, VCTL
(Note 3) Output terminal : VCO, TSDM, VSPDL
(Note 4) Ta =25°C, Standard board mounting
(70mm x 70mm x 1.6mm, 4 glass epoxy layer substrate, 70mm x 70mm of the back copper foil area)
Reduce power by 34.6mW for each degree above 25°C.

Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Recommended Operating Conditions (Ta=-40°C to +85°C)

(Set the power supply voltage taking allowable dissipation into considerations.)

Parameter	Symbol	Min	Typ	Max	Unit
Driver Part Pre Steps and Regulator 1 Power-Supply Voltage	V_{PREVCC}	7.5	8	14	V
Driver Part Power Steps Power-Supply Voltage	V_{PVCC1},V_{PVCC2}	4.5	8	V_{PREVCC}	V
Power Steps of Two Regulators Power-Supply Voltage	$V_{REGVARVCC}$	4.5	5	V_{PREVCC}	V

Electrical Characteristics

(Unless otherwise specified, V_{PREVCC}=V_{PVCC1}=V_{PVCC2}=8V, $V_{REGVARVCC}$=5V, V_{VCO}=1.65V, Ta=25°C)

Parameter		Symbol	MIN	TYP	MAX	Unit	Conditions
Circuit Current	Quiescent Current	I_Q	-	37	55	mA	MUTE123=MUTE4=H , FWD=RVS=L
	Standby-on Current	I_{STBY}	-	-	1	mA	Standby mode(REGRST = L)
BTL Driver	Input Offset Voltage	V_{IOBTL}	-5	0	+5	mV	
	Output Offset Voltage	V_{OFBTL}	-75	-	+75	mV	
	Output Saturation Voltage (Vertical Harmony)	$V_{OSATBTL}$	-	1.5	2.3	V	I_L=500mA
	Input Output Gain	G_{VBTL}	16.8	18	19.2	dB	
	Input Impedance	R_{ZINBTL}	20	40	80	kΩ	
	Slew Rate	V_{SLBTL}	1.0	-	-	V/µs	
General-purpose Operational Amplifier	Input Offset Voltage	V_{IOOP1}	-10	-	+10	mV	
	Input Bias Voltage	I_{BOP1}	-300	-	-	nA	
	H Level Output Voltage	V_{OHOP1}	4	-	-	V	
	L Level Output Voltage	V_{OLOP1}	-	-	0.2	V	
	Output Sink Current Ability	$I_{SINKOP1}$	2	-	-	mA	
	Output Source Current Ability	I_{SOUOP1}	2	-	-	mA	
	Range of Same Phase Input	V_{ICMOP1}	0		3.8	V	V_{REG5}=5.0V
	Slew Rate	V_{SLOP1}	0.5	-	-	V/µs	

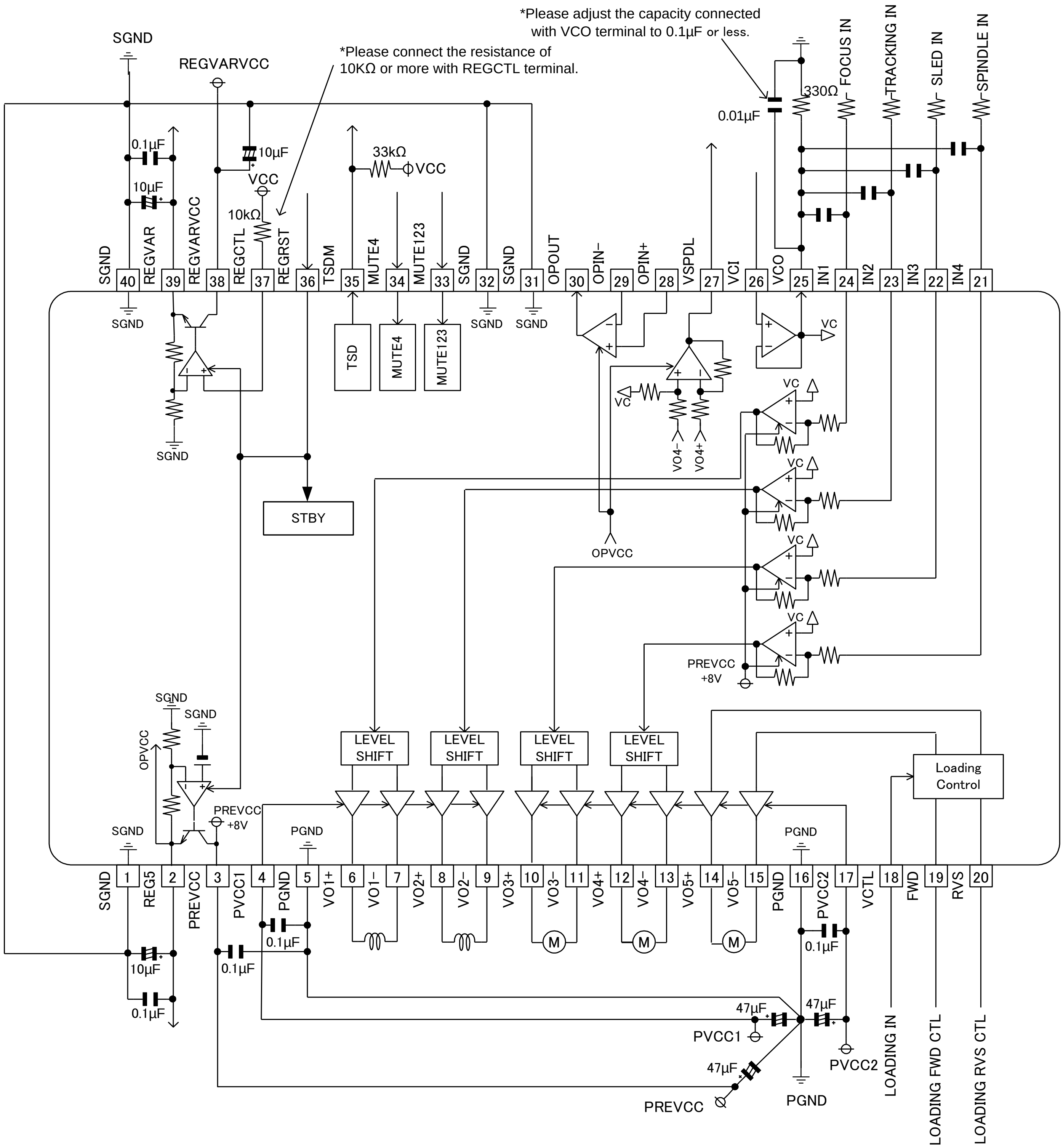
Electrical Characteristics – continued

(Unless otherwise specified, V_{PREVCC}=V_{PVCC1}=V_{PVCC2}=8V, $V_{REGVARVCC}$=5V, V_{VCO}=1.65V, Ta=25°C)

Parameter		Symbol	MIN	TYP	MAX	Unit	Conditions
Operational Amplifier for the Voltage Detection between Driver Outputs	Output Offset Voltage	V_{OOOP2}	-50	-	+50	mV	V_{VO4+} = V_{VO4-} = 3.4V
	H Level Output Voltage	V_{OHOP2}	4	-	-	V	
	L Level Output Voltage	V_{OLOP2}	-	-	0.2	V	
	Output Sink Current Ability	$I_{SINKOP2}$	2	-	-	mA	
	Output Source Current Ability	I_{SOUOP2}	2	-	-	mA	
	Range of Same Phase Input	V_{ICMOP2}	0		6.8	V	V_{REG5}=5.0V
	Input Output Gain	G_{VOP2}	-6.2	-5	-3.8	dB	
	Slew Rate	V_{SLOP2}	0.5	-	-	V/µs	
Internal Operational Amplifier for VC Standard	Output Offset Voltage	V_{OOOP3}	-10	-	+10	mV	
	Input Bias Voltage	I_{BOP3}	-300	-	-	nA	
	H level Output Voltage	V_{OHOP3}	3.5	-	-	V	
	L level Output Voltage	V_{OLOP3}	-	-	0.2	V	
	Output Sink Current Ability	$I_{SINKOP3}$	0.5	-	-	mA	
	Output Source Current Ability	I_{SOUOP3}	10	-	-	mA	
	Range of Same Phase Input	V_{ICMOP3}	1.1	-	3.5	V	V_{REG5}=5.0V BTL range of operation
Loading Driver	Input Terminal Inflow Current	I_{INLD}	-	27	55	µA	V_{FWD},V_{RVS}=3.3V
	VCTL Terminal Inflow Current	I_{INVCTL}	-1	-	-	µA	V_{VCTL} =2V
	Output Offset Voltage	V_{OFLD}	-50	0	+50	mV	
	Output Saturation Voltage H	V_{OHLD}	-	1.1	1.4	V	I_L=500mA
	Output Saturation Voltage L	V_{OLLD}	-	0.45	0.8	V	I_L=500mA
	Input Output Gain	GVLD	7.5	9.0	10.5	dB	V_{VCTL}=1V
Regulator 1	REG5 Terminal Output Voltage	V_{OREG5}	4.75	5.0	5.25	V	I_L=100mA
	REG5 Terminal Output Current Ability	I_{REG5_I}	100	-	-	mA	
	Load Change Regulation	V_{REG5_LOAD}	-80	-	-	mV	I_L=0mA to 100mA
	Input Change Regulation	V_{REG5_LINE}	-20	-	+30	mV	V_{PREVCC}=7.5V to 9V, I_L=100mA
Regulator 2 (Output Changeability)	Range of REGVAR Output Voltage Setting	$V_{REGVARR}$	0.5	-	4.1	V	I_L=100mA
	REGVAR Terminal Output Current Ability	I_{REGVAR_I}	100	-	-	mA	
	REGVAR Terminal Output Voltage	V_{REGVAR}	3.4	3.6	3.8	V	I_L=100mA,V_{REGCTL}=3.3V
	Input Output Gain	G_{V2}	-	1.09	-	V/V	
	Load Change Regulation	V_{REGVAR_LOAD}	-80	-	-	mV	I_L=0mA to 100mA
	Input Change Regulation	V_{REGVAR_LINE}	-20	-	+30	mV	V_{REGCTL}=3.3V, $V_{REGVARVCC}$=4.5V to 5.5V, I_L=100mA
	Range of REGVARVCC Voltage	V_{REGVAR_ON}	V_{REGVAR} +0.9V	-	V_{PREVCC}	V	
	REGCTL Terminal Input Current	I_{REGCTL_I}	-1	-	-	µA	V_{REGCTL}=3.3V
Function	Input Voltage of Input Terminal H	V_{IHFUN}	2.0	-	V_{PREVCC}	V	MUTE123,MUTE4,RVS,FWD
	Input Voltage of Input Terminal L	V_{ILFUN}	-	-	0.8	V	MUTE123,MUTE4,RVS,FWD
	TSDM Terminal L Output Voltage	V_{OL_TSDM}	-	-	0.4	V	R_{TSDM}=33kΩ Pull-up3.3V
	VCO Drop Mute Voltage	VMV_{CO}	0.4	0.7	1	V	
	PREVCC Drop Mute Voltage	$VMPREV_{CC}$	3.4	3.8	4.2	V	
	REGRST Terminal Reset ON Voltage	V_{RESON1}	-	-	0.8	V	Turning OFF of regulator 1 and regulator 2
	REGRST Terminal Reset OFF Voltage	V_{RESOFF}	2.0	-	V_{PREVCC}	V	Turning ON of regulator 1 and regulator 2

Application Information

1. Standard Example Application Circuit



2. Functional Description

Table for operation (V_{PREVCC}=V_{PVCC1}=V_{PVCC2}=8V, $V_{REGVARVCC}$=5V, V_{VCO}=1.65V)

Input					Output					
REGRST	MUTE123	MUTE4	FWD	RVS	REG5	REGVAR	Operational amplifier	VO1 to VO3	VO4	VO5
Low	-	-	-	-	STANDBY	STANDBY	STANDBY	STANDBY	STANDBY	STANDBY
High	Low	Low	-	-	ON	ON	ON	OFF	OFF	
High	High	Low	-	-	ON	ON	ON	ON	OFF	
High	Low	High	-	-	ON	ON	ON	OFF	ON	
High	High	High	-	-	ON	ON	ON	ON	ON	
High	-	-	Low	Low	ON	ON	ON			OFF
High	-	-	High	Low	ON	ON	ON			Forward
High	-	-	Low	High	ON	ON	ON			Reverse
High	-	-	High	High	ON	ON	ON			Brake

(1) BTL Driver Control

BTL driver's ON/OFF can control with MUTE123 and MUTE4 terminal.

Input			Output mode	VO1(FCS), VO2(TRK), VO3(SLD)	VO4(SPDL)
REGRST	MUTE123	MUTE4			
Low	-	-	STANDBY	Hi-Z	Hi-Z
High	Low	Low	ALL OFF	Hi-Z(M) (Note 1)	Hi-Z(M) (Note 1)
High	High	Low	FCS, TRK, SLD,	ON	Hi-Z(M) (Note 1)
High	Low	High	SPDL ON	Hi-Z(M) (Note 1)	ON
High	High	High	ALL ON	ON	ON

(Note 1) V_{VO1+} = V_{VO1-} = V_{PVCC1}/2 [V] (Typ), V_{VO2+} = V_{VO2-} = V_{PVCC1}/2 [V] (Typ)

V_{VO3+} = V_{VO3-} = (V_{PVCC2}-0.7)/2 [V] (Typ),

V_{VO4+} = V_{VO4-} = [[(V_{PVCC2}-0.7)/2] x 15.6 + V_{VCO} x 20] / (15.6 + 20) [V] (Typ) at Hi-Z(M).

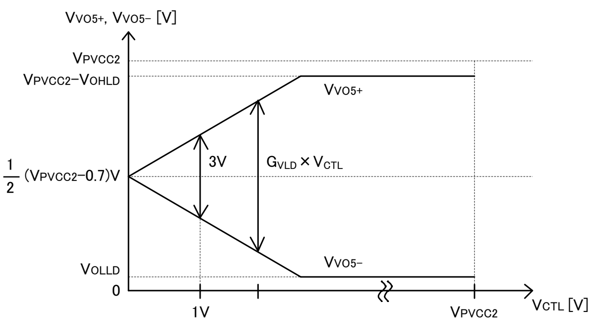
(Example) V_{VO4+} = V_{VO4-} ≈ 2.53 [V](Typ) at V_{PVCC2}=8[V],V_{VCO}=1.65[V]

(2) Loading Driver

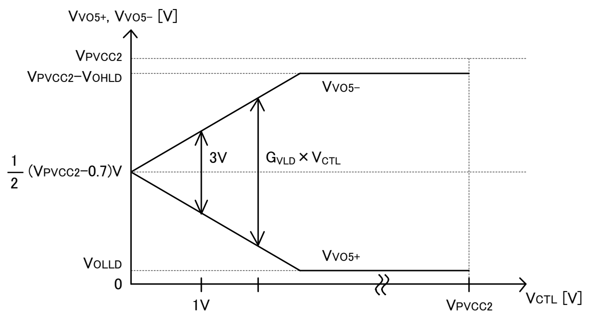
Only VCTL, FWD, and RVS terminal individually controls the load.
(This is not controlled by turning ON/OFF the MUTE123 and MUTE4 terminal)
It operates according to the truth table below.

Input				Output mode	Voltage between outputs	VO5+(Pin14)	VO5-(Pin15)
REGRST	VCTL(Pin18)	FWD(Pin19)	RVS(Pin20)				
Low	-	-	-	STANDBY	0	Hi-Z	Hi-Z
High	(Note 2)	L	L	OFF	0	Hi-Z(M)(Note 3)	Hi-Z(M)(Note 3)
High	(Note 2)	H	L	Forward	G_{VLD} x V_{CTL}	H	L
High	(Note 2)	L	H	Reverse	G_{VLD} x V_{CTL}	L	H
High	(Note 2)	H	H	Brake	0	M (Note 4)	M (Note 4)

(Note 2) VCTL (Pin18) is an arbitrary value of 0- REG5 (= 5.0[V](Typ)).
(Note 3) V_{VO5+} = V_{VO5-} = (V_{PVCC2}-0.7)/2[V] (Typ) at Hi-Z(M).
(Note 4) V_{VO5+} = V_{VO5-} = (V_{PVCC2}-0.7)/2[V] (Typ) at M.

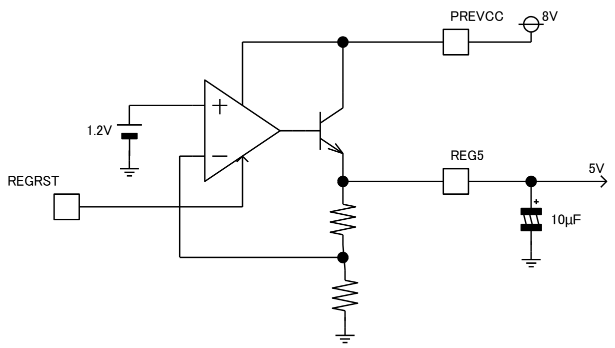


When Forward mode is set



When Reverse mode is set

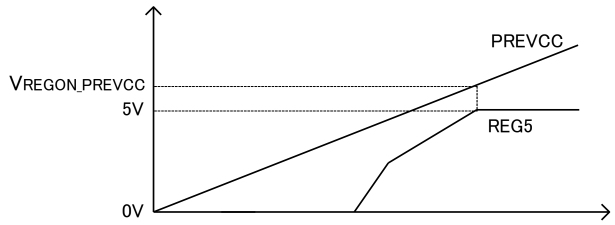
(3) 5V Regulator 1



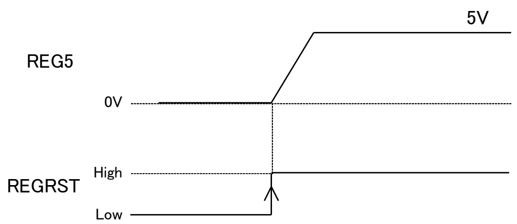
(a) Regulator 1 Control
ON/OFF of regulator 1 can be controlled by REGRST terminal.

REGRST	Regulator 1
Low	OFF
High	ON

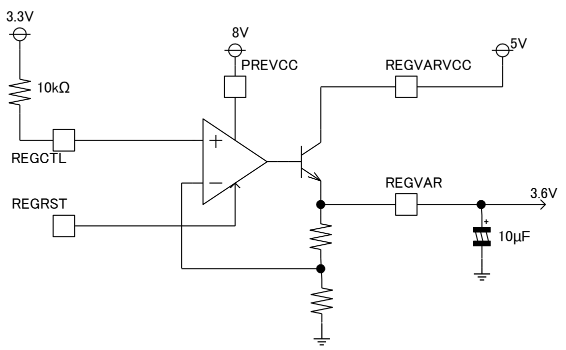
(b) V_{CC} - V_{OUT} Characteristic



(c) Timing Chart



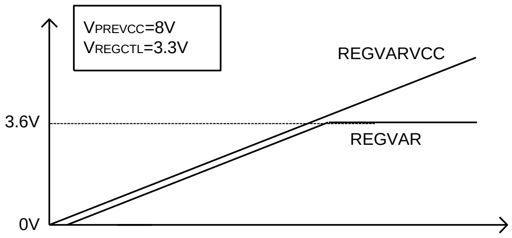
(4) 3.6V Changeable Regulator 2

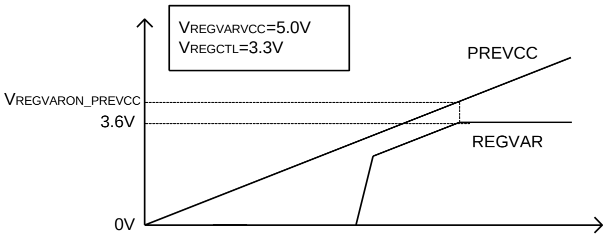


(a) Regulator 2 Controls
ON/OFF of regulator 2 can be controlled by REGRST terminal.

REGRST	Regulator 2
Low	OFF
High	ON

(b) V_{CC} – V_{OUT} Characteristics

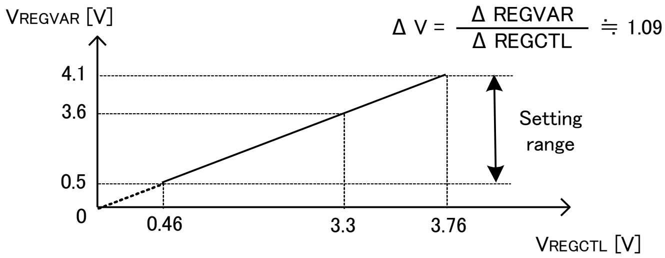




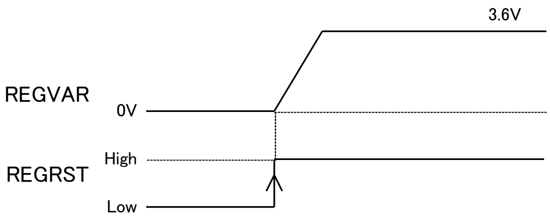
(c) V_{REGCTL} - V_{OUT} Characteristic

REGVAR can be set through REGCTL terminal.

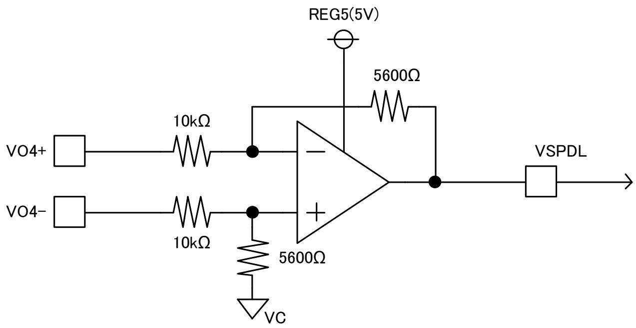
The range of REGVAR of the output voltage setting is 0.5-4.1V (At $V_{REGVARVCC}$=5V (Typ)).



(d) Timing Chart

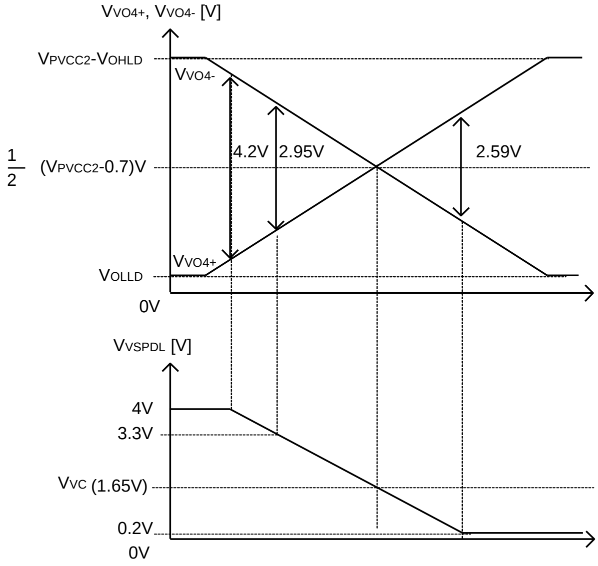


(5) OPAMP for the Voltage Detection between Driver Outputs

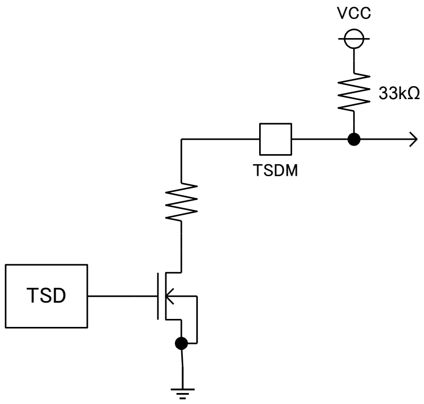


The voltage difference between VO4+, VO4- of the BTL driver for VSPDL is measured and outputted to VSPDL terminal.

$$V_{VSPDL} = \frac{5600}{10k}\left(V_{VO4-} - V_{VO4+}\right) + V_{VC}$$



(6) Thermal Shutdown Flag Output Function
TSDM = Hi-Z (normal operation)
When thermal shutdown is activated, TSDM terminal becomes Low, all driver outputs (VO1-VO5) and regulator outputs (REG5, REGVAR) are turned OFF (output Hi-Z).



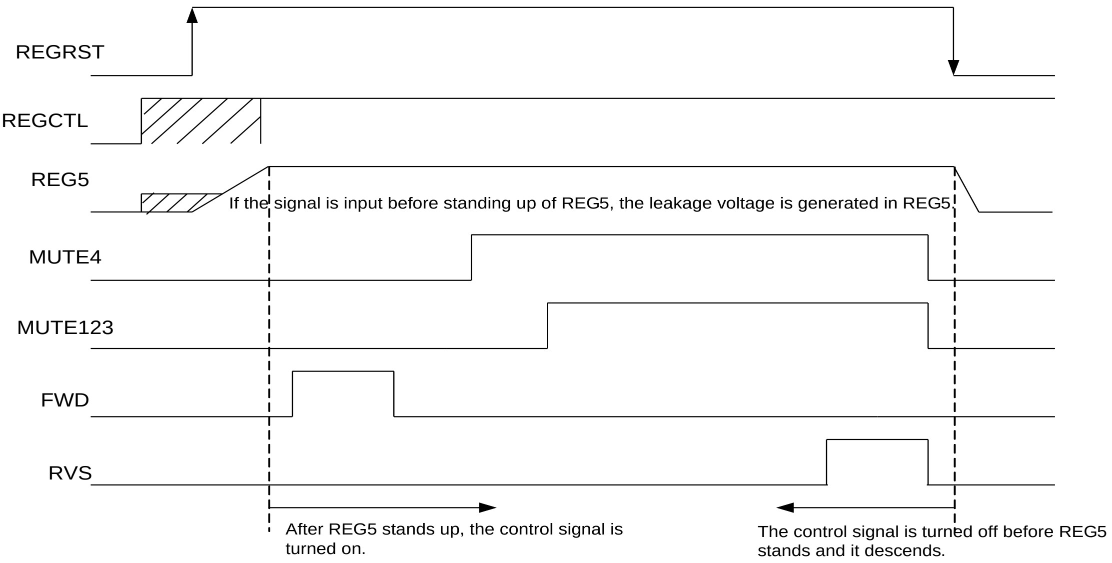
Thermal shutdown	TSDM
OFF	Hi-Z
ON	Low

(7) Power Supply Drop Mute and VC Drop Mute Function
Power supply drop mute functions at V_{PREVCC}<$V_{MPREVCC}$(3.8V Typ). At this condition all driver outputs (VO1-VO5) are turned OFF (output Hi-Z).
VC drop mute functions at V_{VCO}<V_{MVCO}(0.7V Typ). At this condition driver outputs (VO1-VO4) also are turned OFF (output Hi-Z).

Mute function list (REGRST=MUTE123=MUTE4=FWD=High at the mode state of turning ON)

Thermal shutdown	PREVCC	VCO	REG5,REGVAR	VO1 to VO4	VO5
OFF	> $V_{MPREVCC}$	> V_{MVCO}	ON	ON	ON
ON	-	-	OFF	OFF	OFF
OFF	< $V_{MPREVCC}$	-	ON	OFF	OFF
OFF	> $V_{MPREVCC}$	< V_{MVCO}	ON	OFF	ON

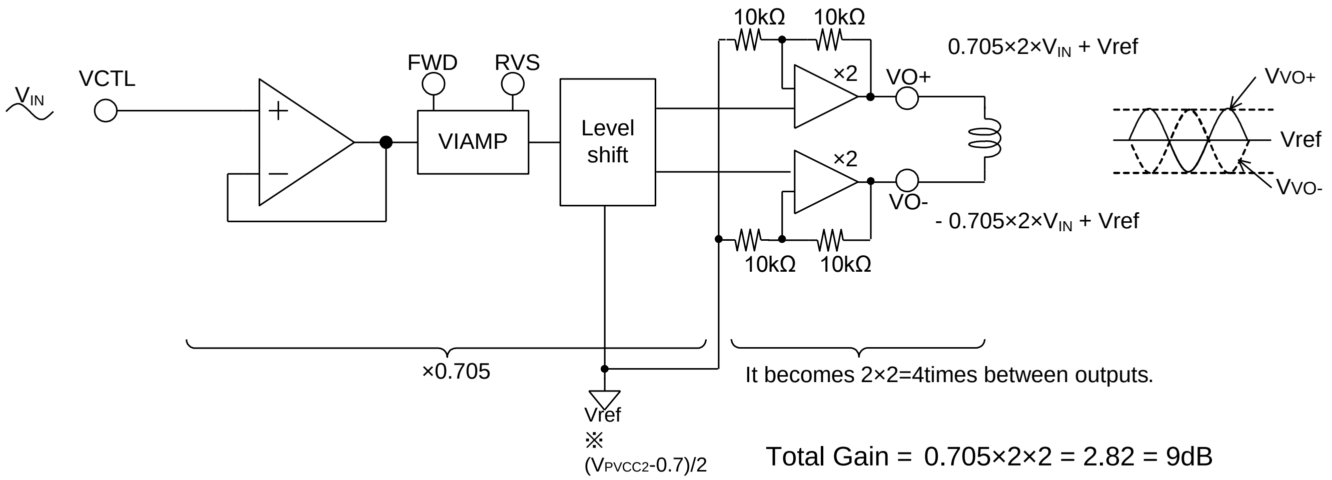
(8) Start-up Sequence Regulations



Terminal ※ where the destination of hanging the diode on the power supply side is REG5 must defend the above-mentioned sequence so as not to impress the voltage more than the voltage of REG5 terminal.
Please insert in the cereal and use the limit resistance for the terminal when you impress the voltage more than the voltage of REG5 terminal.
(Limit resistance 10kO or more is inserted in the cereal about REGCTL terminal.)
※Terminal where destination of hanging diode on power supply side is REG5
REGCTL、MUTE123、MUTE4、VCI、RVS、FWD、IN1、IN2、IN3、IN4、OPIN＋、OPIN-、VCTL

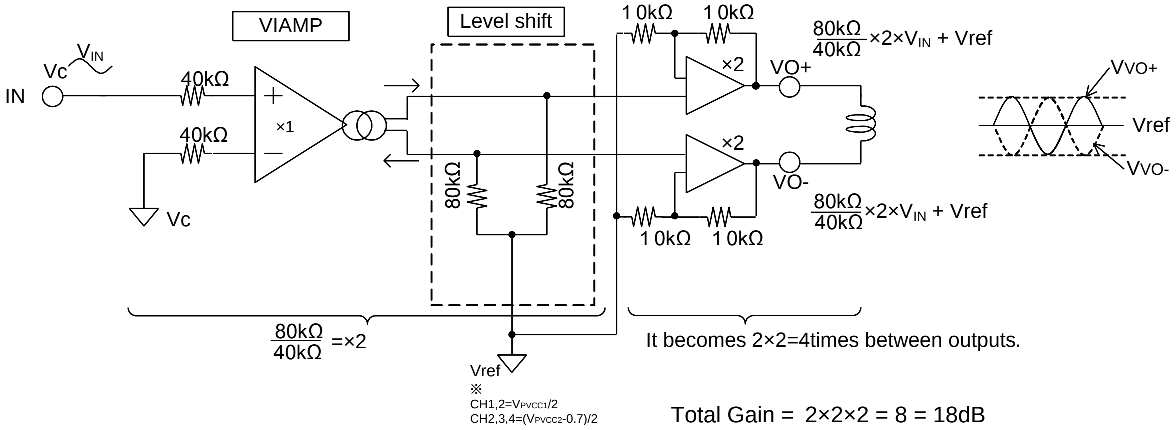
Method of Calculating Gain

(a) Loading



Total Gain = 0.705×2×2 = 2.82 = 9dB

(b) Focus, Tracking, Sled, Spindle



Total Gain = 2×2×2 = 8 = 18dB

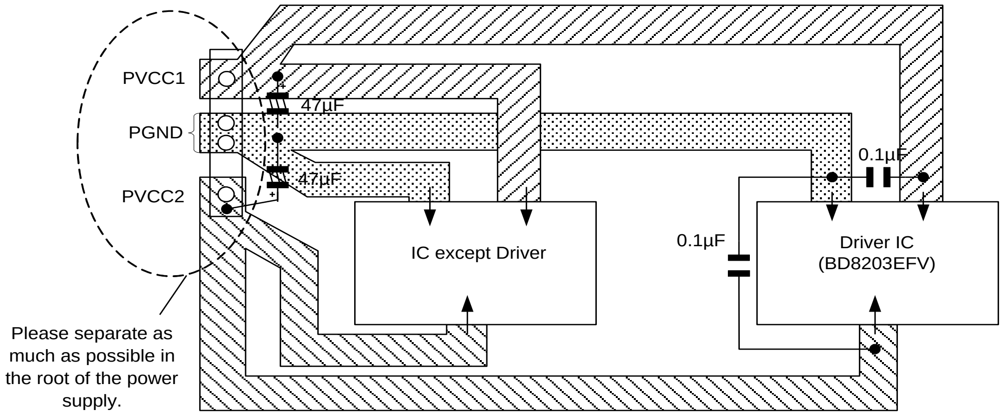
- Noise Measures

    The cause of PWM driver's noise is the following.
    A. Noise from VCC and GND line
    B. Radiation noise

Measures of A

① Because a high current is generated by the PWM, Lower wiring impedance at driver's power supply (PVCC) and GND line (PGND) is recommended. This can be achieved by separating the power supply line of other devices from the main supply to eliminate the common impedance, and connecting it to another line.

② Use electrolytic capacitor with low ESR to power supply pin (PVCC1, PVCC2, PREVCC) of drivers and GND pin (PGND) to make it stable. Please connect the ceramic capacitor with a high frequency characteristic directly to the pin (or as close as possible to the IC).



③ There is a method of inserting LC filter in the power supply line or GND line, when the first two measures are not sufficient to solve the noise problem.

(Example)

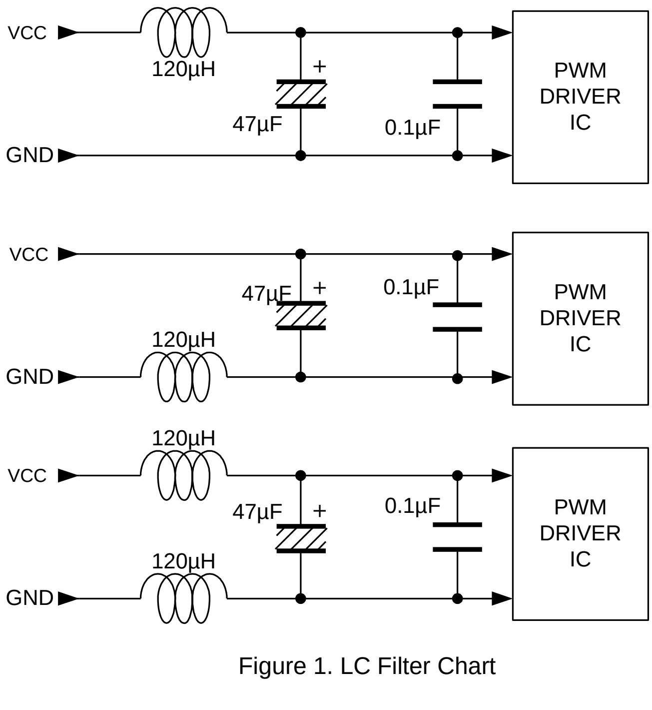


Figure 1. LC Filter Chart

④ In addition, there is a technique of adding a capacitor of about 2200pF (arbitrary capacitance) between each output and GND in the PWM driver. In this case, the wiring for GND must not be common with other signals.

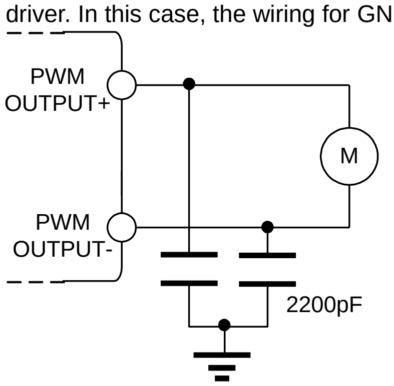


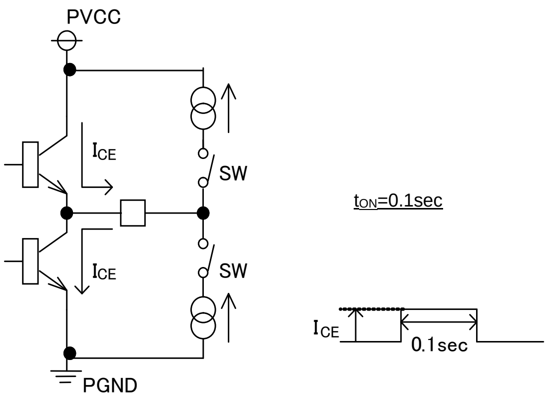
Figure 2. Snubber Circuit

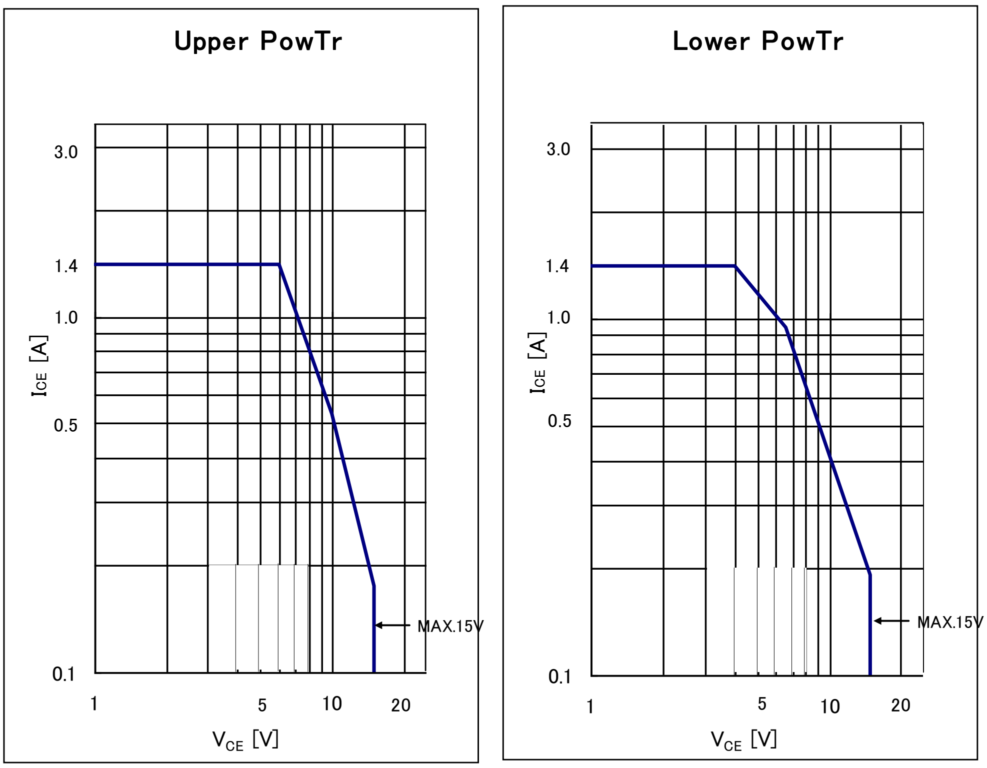
3. ASO

Pin 6 to Pin 15 ASO Data (TON = 0.1sec)

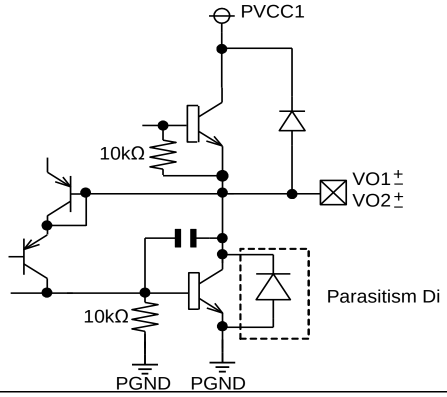
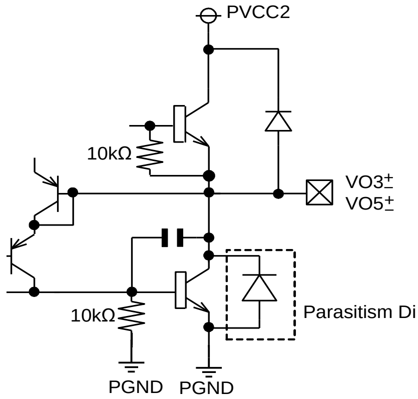
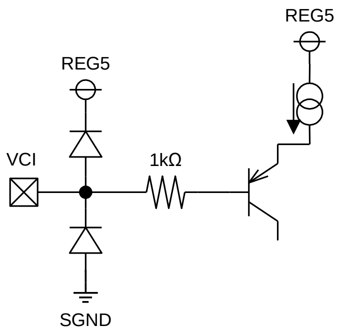
$V_{PREVCC}=V_{PVCC1}=V_{PVCC2}$ = 15V

Ta = 25°C

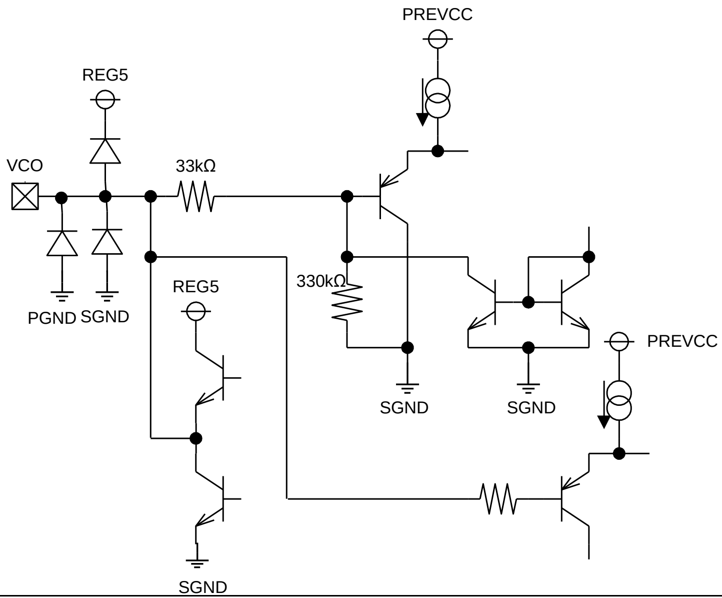
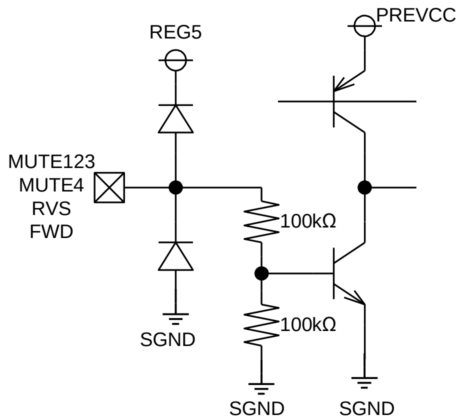
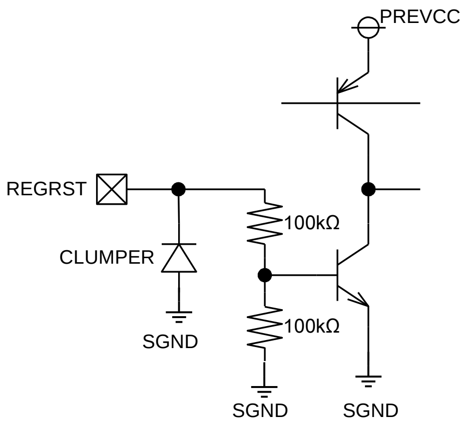




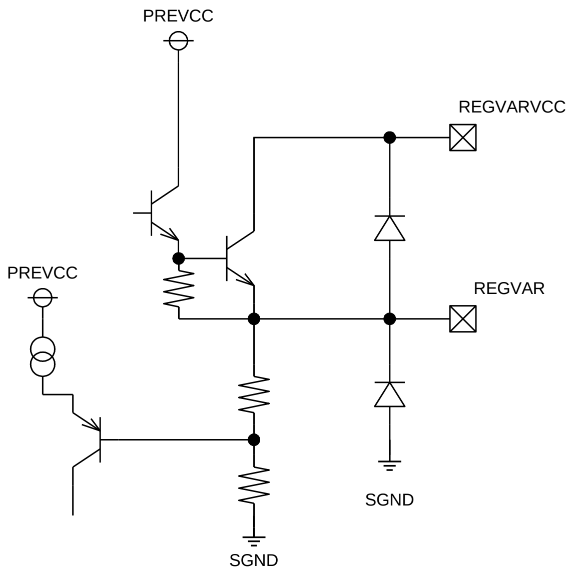
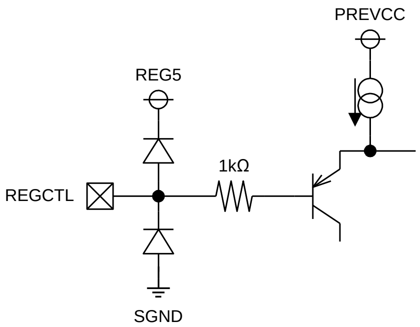
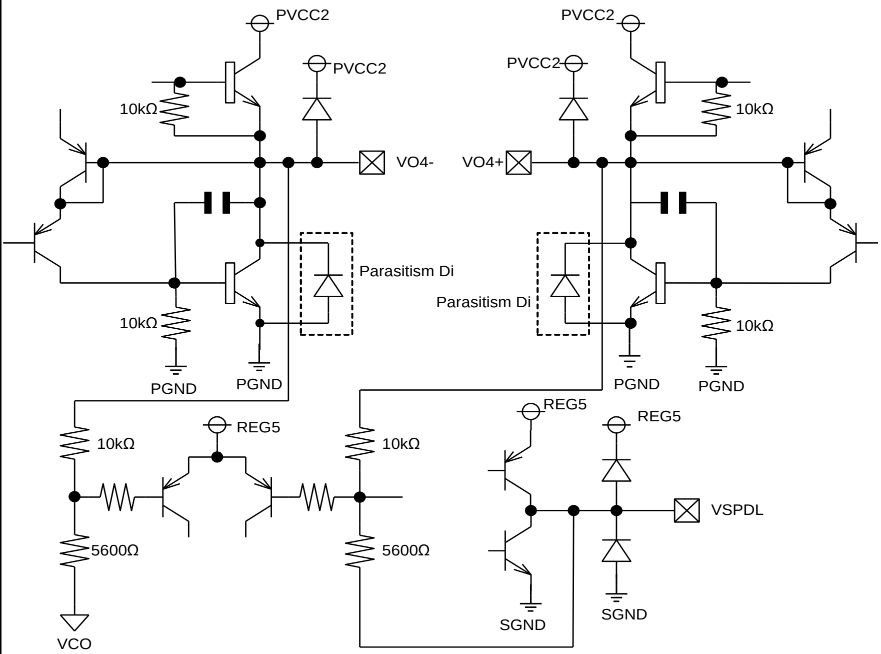
I/O Equivalent Circuits

Pin Name	Equivalent-Circuit Diagram of the Terminals
VO1± VO2±	
VO3± VO5±	
VCI	

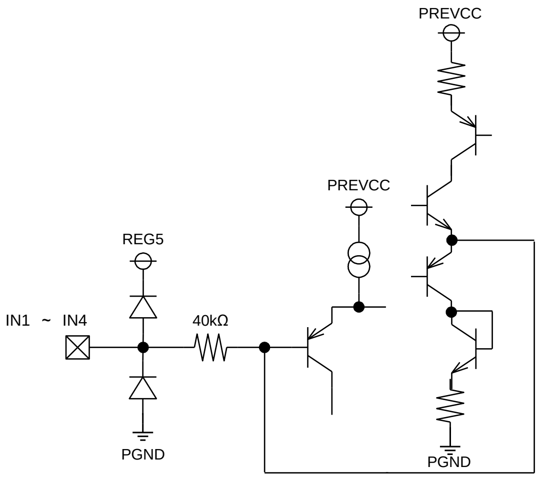
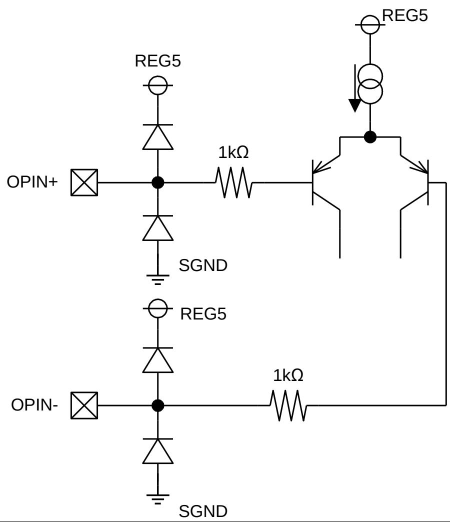
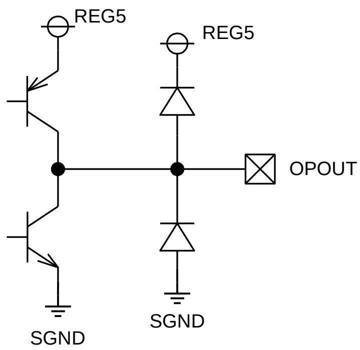
I/O Equivalent Circuit – continued

Pin name	Equivalent-Circuit Diagram of the Terminals
VCO	
MUTE123, MUTE4, RVS, FWD	
REGRST	

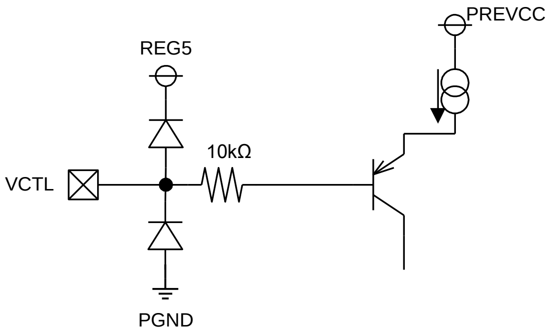
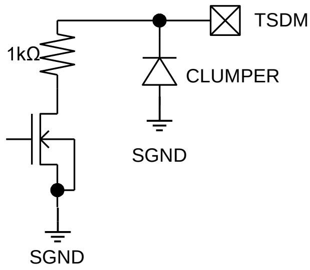
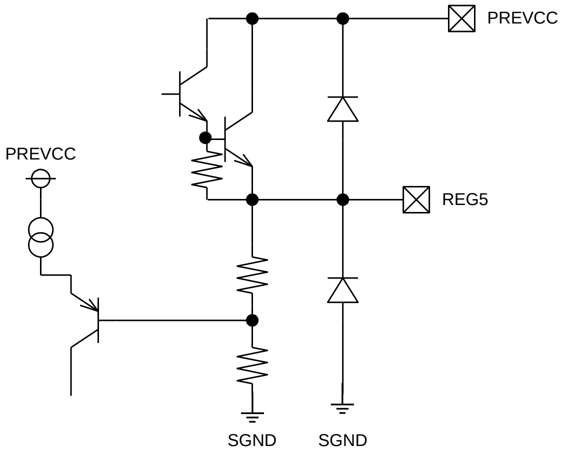
I/O Equivalent Circuit – continued

<table>
<tr><th>Pin Name</th><th>Equivalent-Circuit Diagram of the Terminals</th></tr>
<tr><td>REGVAR, REGVARVCC</td><td>
</td></tr>
<tr><td>REGCTL</td><td>
</td></tr>
<tr><td>VO4±, VSPDL</td><td>
</td></tr>
</table>

I/O Equivalent Circuit – continued

Pin Name	Equivalent-Circuit Diagram of the Terminals
IN1, 2, 3, 4	
OPIN + -	
OPOUT	

I/O Equivalent Circuit – continued

Pin Name	Equivalent-Circuit Diagram of the Terminals
VCTL	
TSDM	
REG5	

(Note) Resistance in the above-mentioned equivalent-circuit diagram of the terminals is 25°C, and a value at typical.

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Thermal Consideration**
   Should by any chance the power dissipation rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the Pd rating.

6. **Recommended Operating Conditions**
   These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

7. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

8. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

9. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

10. **Inter-pin Short and Mounting Errors**
    Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

11. **Unused Input Pins**
    Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

Operational Notes – continued

12. Regarding the Input Pin of the IC

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.
When GND > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

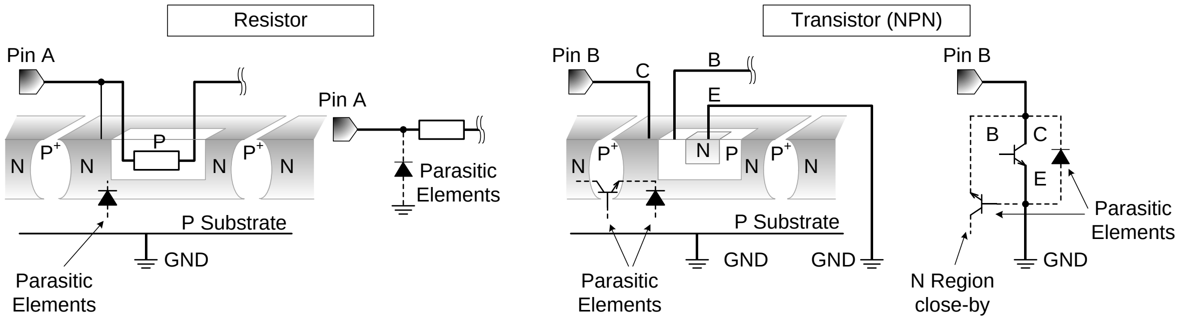


Figure 3. Example of monolithic IC structure

13. Area of Safe Operation (ASO)

Operate the IC such that the output voltage, output current, and power dissipation are all within the Area of Safe Operation (ASO).

14. Thermal Shutdown Circuit(TSD)

This IC has a built-in thermal shutdown circuit that prevents heat damage to the IC. Normal operation should always be within the IC's power dissipation rating. If however the rating is exceeded for a continued period, the junction temperature (Tj) will rise which will activate the TSD circuit that will turn OFF all output pins. When the Tj falls below the TSD threshold, the circuits are automatically restored to normal operation.
Note that the TSD circuit operates in a situation that exceeds the absolute maximum ratings and therefore, under no circumstances, should the TSD circuit be used in a set design or for any purpose other than protecting the IC from heat damage.

15. Capacitor Between Output and Ground

If a large capacitor is connected between the output pin and ground pin, current from the charged capacitor can flow into the output pin and may destroy the IC when the VCC or IN pin is shorted to ground or pulled down to 0V. Use a capacitor smaller than 0.1µF between output and ground.

16. About the capacitor between the outputs

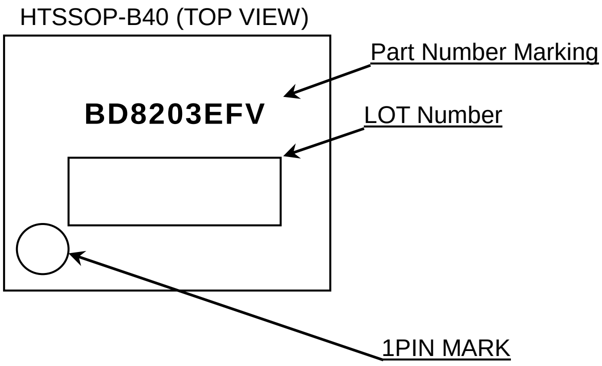
The output current increases with reference to the change between the outputs when the capacitor is connected between the driver outputs. Therefore, please add bypass capacitor (0.1µF) as nearest as possible to the power supply (PVCC) and GND(PGND) of this IC as the route of the output current. Please select the value of the capacitor which will have no effect on the IC's normal characteristics, it is possible to pull out capacity at the low temperature happening to the electrolytic capacitor more than the capacity value of the capacitor between the outputs.

Ordering Information

B D 8 2 0 3 E F V - E 2

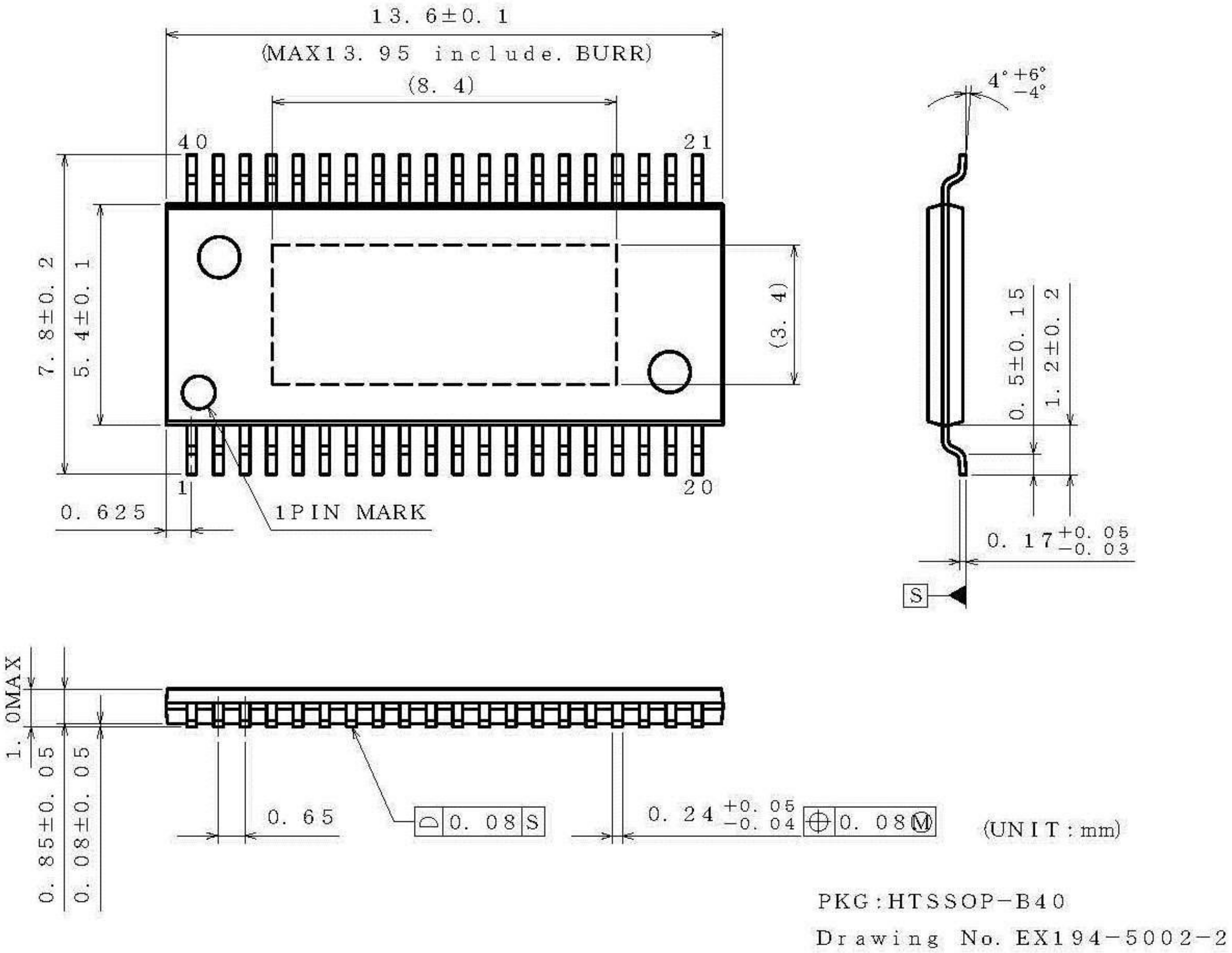
- Part Number
- Package
  EFV : HTSSOP-B40
- Packaging and forming specification
  E2: Embossed tape and reel

Marking Diagram



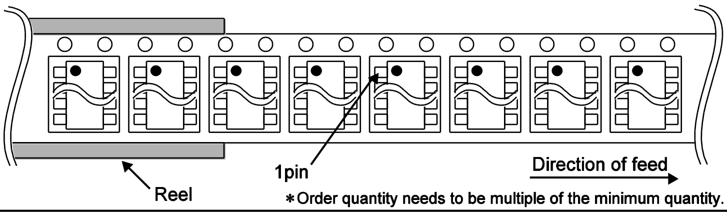
Physical Dimension Tape and Reel Information

Package Name	HTSSOP-B40



<Tape and Reel information>

Tape	Embossed carrier tape (with dry pack)
Quantity	2000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

Revision History

Date	Revision	Changes
04.Nov.2015	001	New Release

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JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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