Power driver IC for CD changer

BD7962FM

BD7962FM is a 6-channel driver (3-channel BTL driver + 3-channel loading driver) for car CD changer. This IC integrates 1-channel operational amplifier for various purposes. The size reduction of the set is achieved by integrating loading driver and actuator driver into a single chip.

●Applications

CD changer

●Features

1) This circuit is a 6-channel driver IC consisting of three BTL drivers and three loading drivers.
2) Two wide dynamic range loading drivers of MOS output (R_{ON}=1.0Ω).
3) The circuit is provided with loading driver voltage setting terminals.
4) A general Opamp and Pre Opamp are built in.
5) The circuit has a mute switch.
6) The circuit has a reset terminal.
7) A thermal shutdown circuit is built in.
8) Since HSOP-M36 power package is used, the set requires a reduced space.

●Absolute maximum ratings (Ta=25°C)

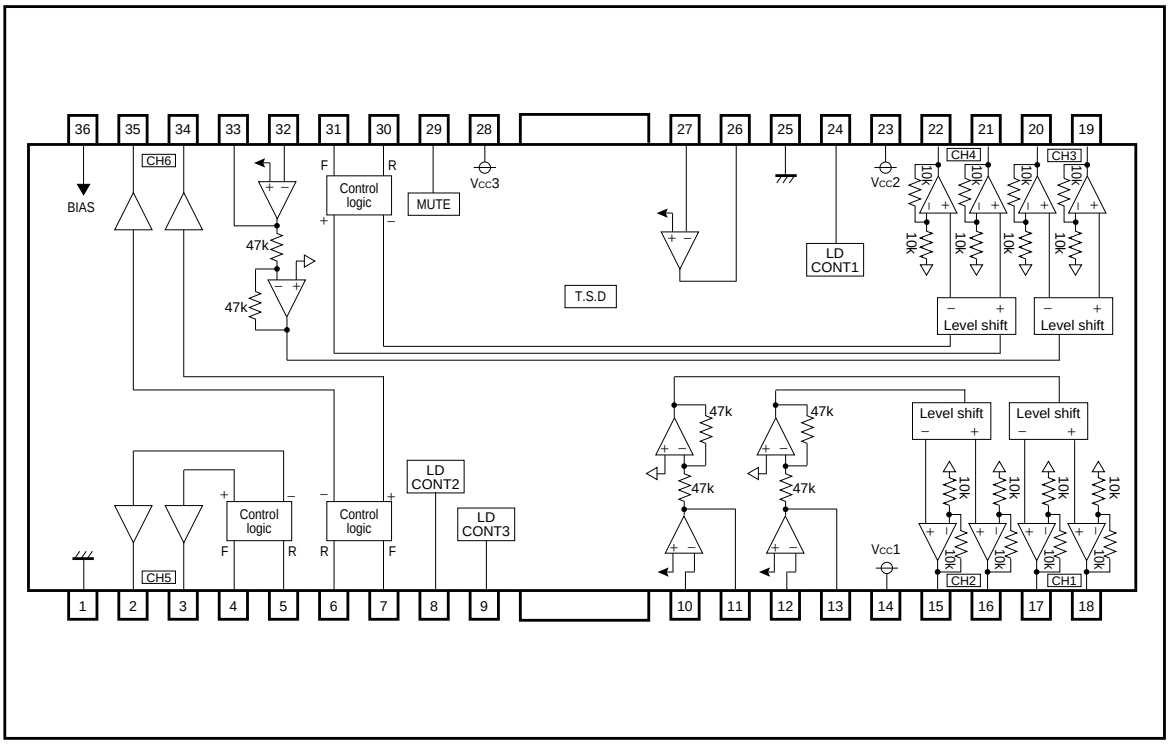
Parameter	Symbol	Limits	Unit
Supply voltage	V_{CC}	15	V
Power dissipation	Pd	2.2*	W
Operating temperature range	Topr	–40 to +85	°C
Storage temperature range	Tstg	–55 to +150	°C

* Reduced by 17.6mW for each increase in Ta of 1°C over 25°C,
on less than 3% (percentage occupied by copper foil), 70mm×70mm, t=1.6mm, glass epoxy mounting.

●Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage 1 (CH1, CH2)	$V_{CC}1$	4.5	5.0	$V_{CC}3$	V
Supply voltage 2 (CH3, CH4)	$V_{CC}2$	4.5	8.0	14.0	V
Supply voltage 3 (CH5, CH6)	$V_{CC}3$	4.5	8.0	14.0	V

●Block diagram



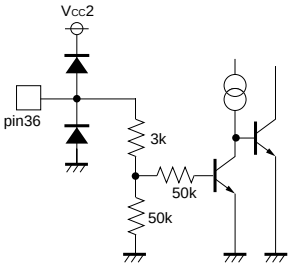
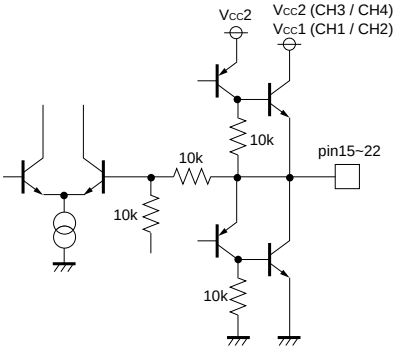
●Pin descriptions

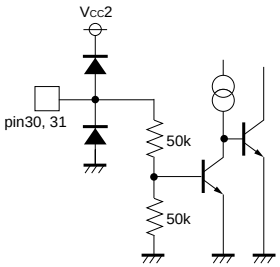
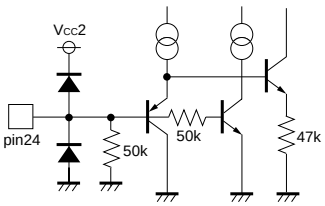
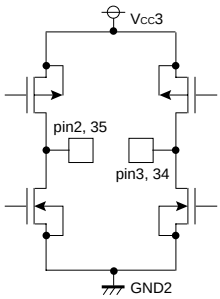
Pin No.	Pin name	Function
1	GND2	POW GND (loading driver unit)
2	OUT5–	Loading driver (CH5) output –
3	OUT5+	Loading driver (CH5) output +
4	IN5FWD	Loading driver (CH5) FWD input
5	IN5REV	Loading driver (CH5) REV input
6	IN6REV	Loading driver (CH6) REV input
7	IN6FWD	Loading driver (CH6) FWD input
8	LDCONT2	Loading driver (CH5) voltage setting terminal
9	LDCONT3	Loading driver (CH6) voltage setting terminal
10	OPIN1–	CH1 opamp negative input
11	OP1OUT	CH1 opamp output
12	OPIN2–	CH2 opamp negative input
13	OP2OUT	CH2 opamp output
14	Vcc1	Supply voltage (CH1, CH2)
15	OUT2–	BTL driver (CH2) output –
16	OUT2+	BTL driver (CH2) output +
17	OUT1–	BTL driver (CH1) output –
18	OUT1+	BTL driver (CH1) output +

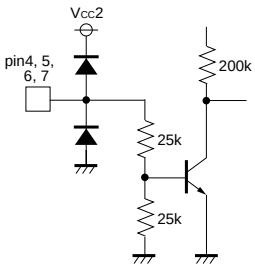
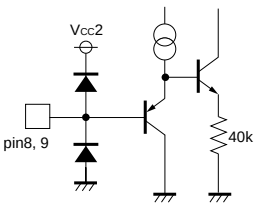
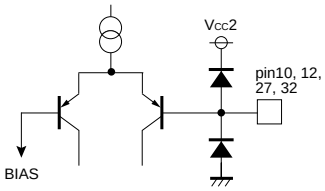
Pin No.	Pin name	Function
19	OUT3+	BTL driver (CH3) output +
20	OUT3–	BTL driver (CH3) output –
21	OUT4+	Loading driver (CH4) input +
22	OUT4–	Loading driver (CH4) input –
23	Vcc2	Supply voltage (CH3, CH4)
24	LDCONT1	Loading driver (CH4) voltage setting terminal
25	GND1	POW GND (BTL driver unit)
26	OPOUT	Opamp output
27	OPIN–	Opamp negative input
28	Vcc3	Supply voltage (CH5, CH6)
29	MUTE	BTL driver mute terminal
30	IN4REV	Loading driver (CH4) REV input
31	IN4FWD	Loading driver (CH4) FWD input
32	OPIN3–	CH3 opamp negative input
33	OP3OUT	CH3 opamp output
34	OUT6+	Loading driver (CH6) output +
35	OUT6–	Loading driver (CH6) output –
36	BIAS	BIAS terminal

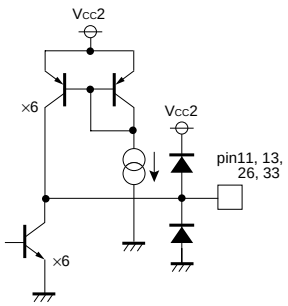
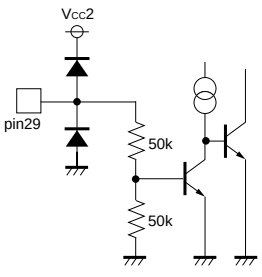
∗ Symbol of + and – (output of BTL driver) means polarity to opamp output pin.
For example if Opamp output voltage is H, BTL driver +output is H, –output is L

●**Input output circuit**

BIAS	OUT1+/OUT1–/OUT2+/OUT2– OUT3+/OUT3–/OUT4+/OUT4–
	

IN4FWD/IN4REV	LDCONT1	OUT5+/OUT5– OUT6+/OUT6–
		

IN5FWD/IN5REV IN6FWD/IN6REV	LDCONT2/LDCONT3	OPIN1–/OPIN2– OPIN3–/OPIN–
		

OP1OUT/OP2OUT OP3OUT/OPOUT	MUTE
	

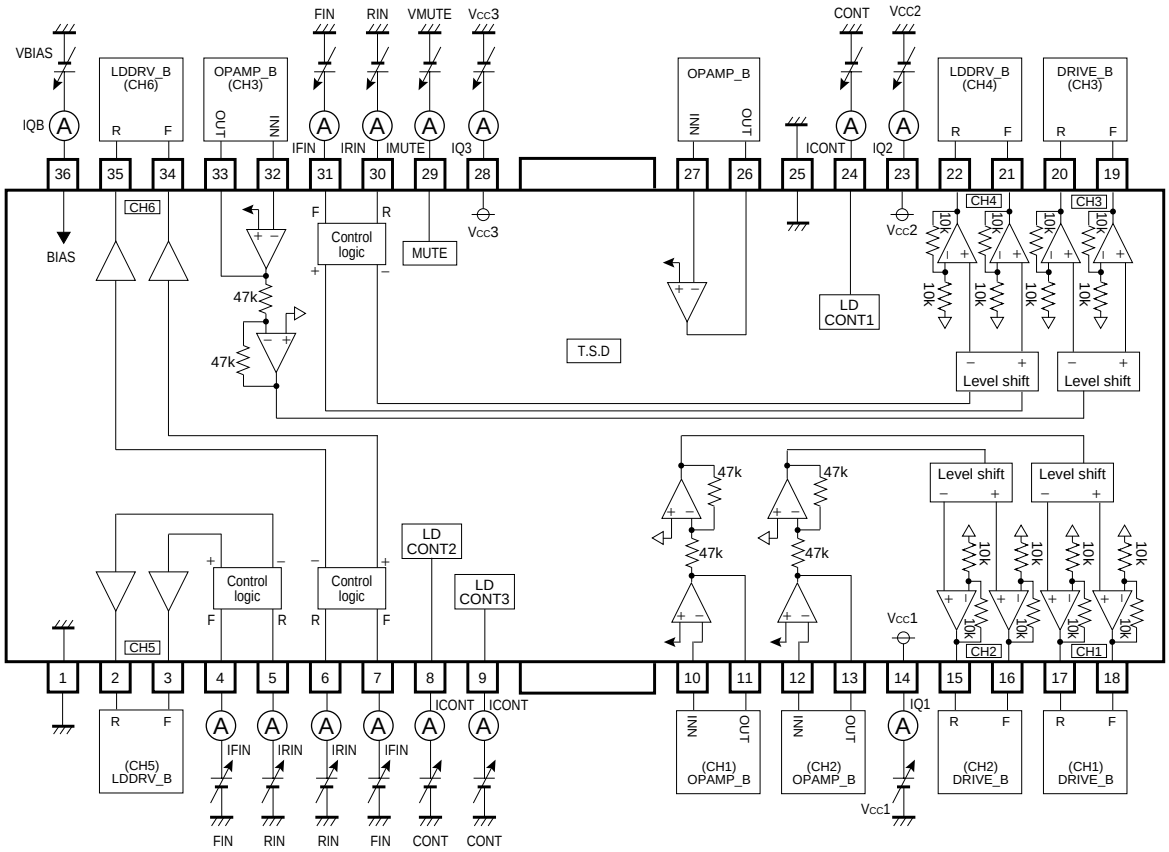
●Electrical characteristics

(unless otherwise noted, Ta=25°C, $V_{CC}1$=5V, $V_{CC}2$=$V_{CC}3$=8V, BIAS=1.65V, R_L=8Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current ($V_{CC}1$)	$I_{CC}1$	–	0.30	0.70	mA	Under no load
Quiescent current ($V_{CC}2$)	$I_{CC}2$	11.5	23	32	mA	Under no load
Quiescent current ($V_{CC}2$)	$I_{CC}3$	1.9	3.8	5.7	mA	Under no load
〈 BTL driver CH1 to CH3 〉						
Output offset voltage	V_{OFS}	−40	0	+70	mV	
Max. output amplitude (CH1, CH2)	V_{OM1}	3.7	4.0	–	V	
Max. output amplitude (CH3)	V_{OM2}	5.4	6.0	–	V	
Closed circuit voltage gain	G_{VC}	10	12	14	dB	V_{IN}=BIAS±0.5V Opamp : Buffer
Mute terminal sink current	I_{MUTE}	–	80	125	μA	VMUTE=5V
Bias terminal sink current	I_{BIAS}	–	75	120	μA	VBIAS=2.5V
〈 Loading driver CH4 to CH6 〉						
Output offset voltage	V_{OFSL}	−35	0	+35	mV	When brake is applied
Max. output amplitude (CH4)	V_{OML}	5.4	6.0	–	V	R_L=8Ω
Output saturation voltage H (CH5, CH6)	V_{OLH}	–	0.38	0.70	V	I_O=500mA
Output saturation voltage L (CH5, CH6)	V_{OLL}	–	0.12	0.25	V	I_O=500mA
Voltage gain	G_{VLD}	4.0	6.0	8.0	dB	LDCONT=1V
Input terminal sink current	I_{INL}	–	180	270	μA	LDIN=5V
LDCONT terminal source current (LDCONT1)	I_{LDC1}	–	–	0.5	mA	LDCONT=5V
LDCONT terminal source current (LDCONT2, 3)	I_{LDC2}	–	–	300	nA	LDCONT=5V
〈 Opamp and Pre opamp CH1 to CH3 〉						
Input offset voltage	V_{OPOFS}	−5	0	5	mV	
Input bias current	I_{OPIB}	–	–	300	nA	
Common mode input voltage range	V_{OPICM}	0.3	–	V_{CC}−1.2	V	
Maximum output source current	I_{SOURCE}	500	800	–	μA	
Maximum output sink current	I_{SINK}	2	–	–	mA	
Slew rate	SR	–	2	–	V/μs	

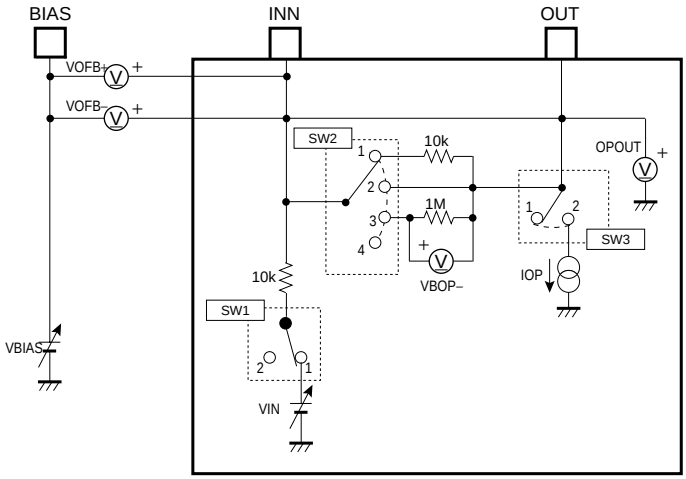
◎ The product is not designed for protection against radioactive rays.

●Measurement circuits

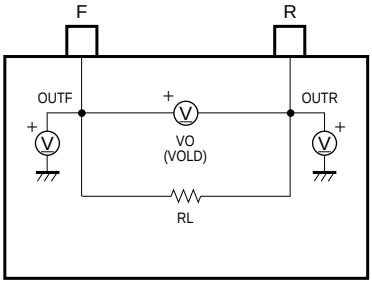


The resistance values are indicated in Ω.

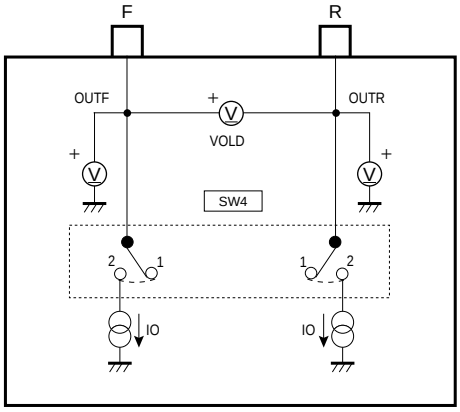
Fig.1



OPAMP_B



DRIVE_B



LDDRV_B

Fig.2

●Switch table for measuring circuit diagrams

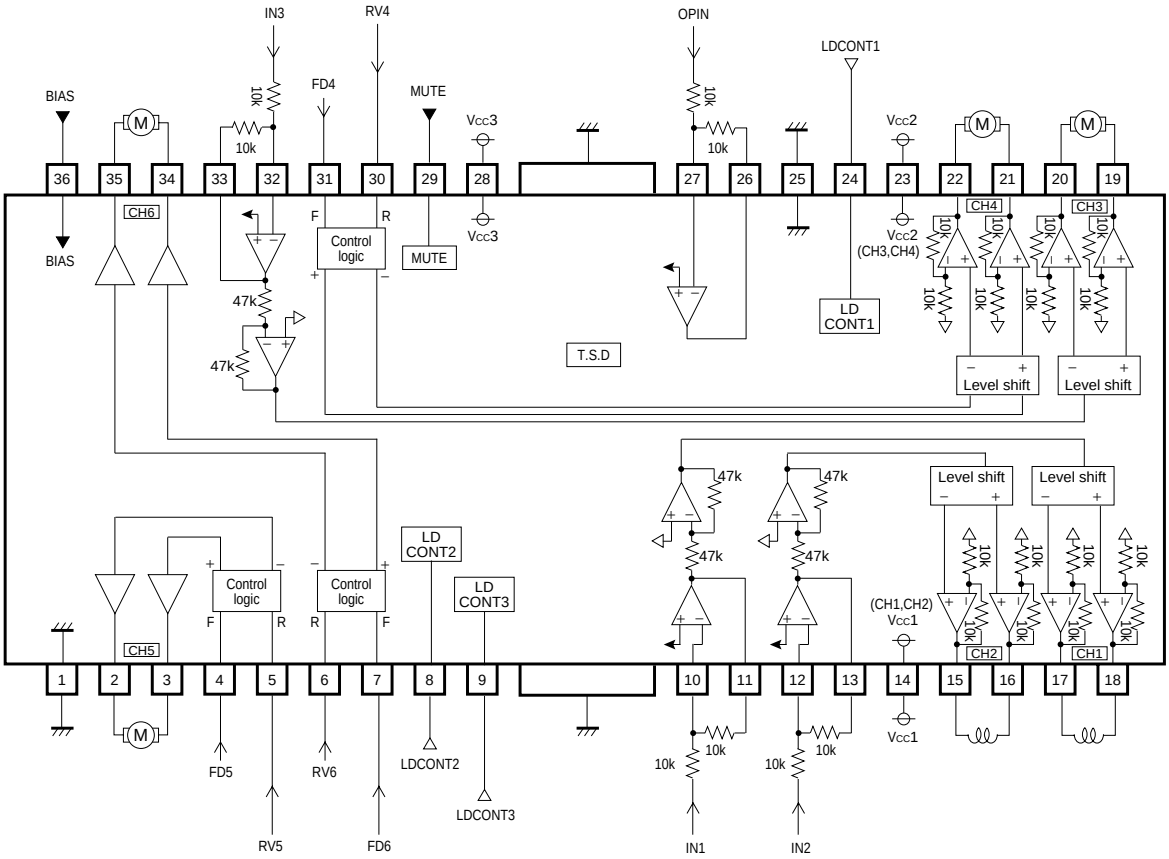
(unless otherwise noted, Ta=25°C, $V_{CC}1$=5V, $V_{CC}2$=$V_{CC}3$=8V, BIAS=1.65V, R_L=8Ω Unless otherwise specified, the switch 1 is used.)

Parameter	Symbol	Switching				Conditions	Measurement circuit
		1	2	3	4		
Quiescent current ($V_{CC}1$)	$I_{CC}1$	2				Under no load	Fig.1, 2
Quiescent current ($V_{CC}2$)	$I_{CC}2$	2				Under no load	Fig.1, 2
Quiescent current ($V_{CC}3$)	$I_{CC}3$	2				Under no load	Fig.1, 2
〈 BTLdriver CH1 to CH3 〉							
Output offset voltage	V_{OFS}	2				V_{OFS}=V_O	Fig.1, 2
Max. output amplitud (CH1, CH2)	V_{OM1}					V_{IN}=GND, V_{OM1}=V_O	Fig.1, 2
Max. output amplitud (CH3)	V_{OM2}					V_{IN}=GND, V_{OM1}=V_O	Fig.1, 2
Closed circuit voltage gain(CH1 to CH3)	G_{VC}		2			V_{IN}=VB±0.5V, GVC=20log (VO/0.5)	Fig.1, 2
Difference between positive and negative voltage gains (CH1 to CH3)	ΔG_{VC}						Fig.1, 2
Mute terminal sink current	I_{MUTE}					VMUTE=5V, IMUTE=IMUTE	Fig.1, 2
Bias terminal sink current	I_{BIAS}					VB=2.5V, IBIAS=IB	Fig.1, 2
〈 Loading driver CH4 to CH6 〉							
Output offset voltage	V_{OFSL}					F_{IN}=R_{IN}=5V, V_{OFSL}=V_{OLD}	Fig.1, 2
Max. output amplitud (CH4)	V_{OML}					F_{IN}=5V, R_{IN}=0V,V_{OML}=L_{OLD}	Fig.1, 2
Output saturation voltage H (CH5, 6)	V_{OLH}				2	I_O=500mA[*1]	Fig.1, 2
Output saturation voltage L (CH5, 6)	V_{OLL}				2	I_O=500mA[*2]	Fig.1, 2
Voltage gain (Loading)	G_{VLD}					CONT=1V, G_{VLD}=20log (V_{OLD}/1V)	Fig.1, 2
Difference between positive and negative voltage gains (Loading)	ΔG_{VLD}						Fig.1, 2
Input terminal sink current	I_{INL}					F_{IN}=R_{IN}=5V, I_{INL}=I_{FIN}, I_{RIN}	Fig.1, 2
LDCONT terminal source current	I_{LDC}					CONT=5V, I_{LDC}=ICONT	Fig.1, 2
〈 Opamp and Pre opamp CH1 to CH3 〉							
Input offset voltage	V_{OPOFS}	2				V_{OPOFS}=VOFB+	Fig.1, 2
Input bias current	I_{OPIB}	2	3			I_{OPIB}=V_{BOP}–/1MΩ	Fig.1, 2
Common mode input voltage range	V_{OPICM}		2			V_{OPICM} : VIN=OPOUT range	Fig.1, 2
Max. output source current	I_{SOURCE}	2	2	2			Fig.1, 2
Max. output sink current	I_{SINK}	2	2	2			Fig.1, 2
Slew rate	SR		2			V_{IN}=f : 100kHz, 1V to 3V pulse	Fig.1, 2

*1 F_{IN}=5V, R_{IN}=0V, V_{OLH}=V_{CC}–OUT+
F_{IN}=0V, R_{IN}=5V, V_{OLH}=V_{CC}–OUT–

*2 F_{IN}=5V, R_{IN}=0V, V_{OLL}=OUT–
F_{IN}=0V, R_{IN}=5V, V_{OLL}=OUT+

●**Application example**



The resistance values are indicated in Ω.

Fig.3

●**Operation notes**

(1) BD7962FM has a built-in thermal shutdown circuit.
When the chip temperature reaches 175°C (Typ.), the output current from all drivers is muted.
When the chip temperature returns to 150°C (Typ.), the circuit of the driver unit starts up.

(2) When the mute terminal (pin29) is opened or the terminal voltage is reduced to 0.5V or less, the output current of the BTL driver (CH1~CH3) unit is muted.
In the normal state of use, pull up the voltage to 2.0V or more.

(3) When the bias terminal (pin36) voltage is reduced to 0.7V or less, the BTL driver (CH1~CH3) unit is muted.
In the normal state of use, set the voltage to 1.1V or more.

(4) Thermal shutdown mutes all drivers. When the mute ON voltage and the bias terminal voltage are reduced, only the BTL drivers are muted. But Opamp are not muted by all condition.
When the drivers are muted, the BTL driver (CH1, CH2) output terminal voltage becomes the internal bias voltage Vcc1/2V and the BTL driver (CH3) output terminal voltage become the internal bias voltage (Vcc2–0.7)/2V.

(5) The loading drivers operate according to the following logic.

INPUT		OUTPUT		Function
FWD	REV	OUT+	OUT−	
L	L	Hi Z	Hi Z	High impedance
L	H	L	H	REV mode
H	L	H	L	FED mode
H	H	L	L	Brake mode

The output voltage can be changed by adjusting the voltage input to the LDCONT terminal (gain of 6dB Typ.). However, even if the input voltage is increased excessively, the output voltage will not exceed the max. output voltage that depends on the supply voltage.
When the LDCONT terminal (pin 8, 9, 24) voltage is reduced to 0.7V or less, the loading driver is High impedance mode. But loading driver (CH4) output terminal voltage becomes the internal bias voltage ($V_{CC}1-0.7)/2V$.

(6) Supply voltage of $V_{CC}2$ (pin23) should be equal to or higher than $V_{CC}1$ (pin14) and $V_{CC}3$ (pin28).
Insert by the pass capacitor (approx. 0.1μF) between V_{CC} pin and GND pin of IC as near as possible.

(7) Connect the radiating fin with external GND.

(8) Output pin is to avoid short-circuit with V_{CC}, GND and other output pins.
An integrated circuit is damaged, and smoke may come out by the case.

●Electrical characteristic curves

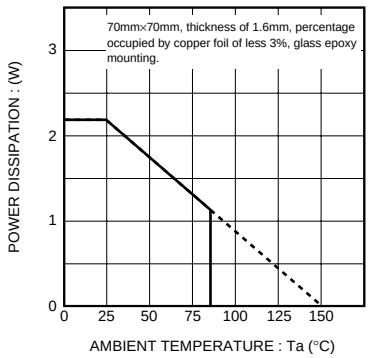


Fig.4 Power dissipation

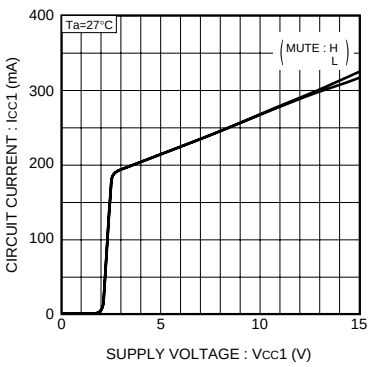


Fig.5 Circuit current characteristic $V_{CC}1$

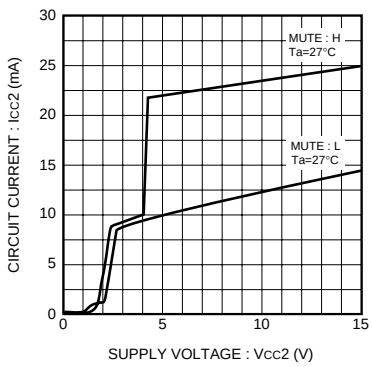


Fig.6 Circuit current characteristic $V_{CC}2$

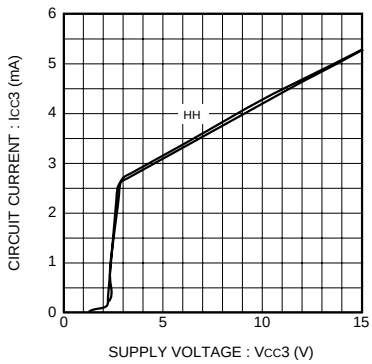


Fig.7 Circuit current characteristic $V_{CC}3$

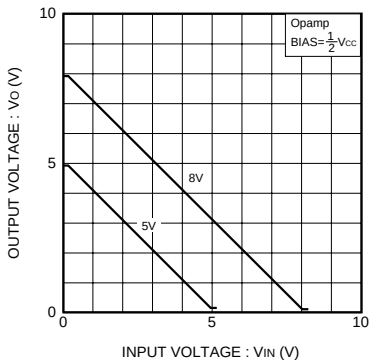


Fig.8 Input output characteristic

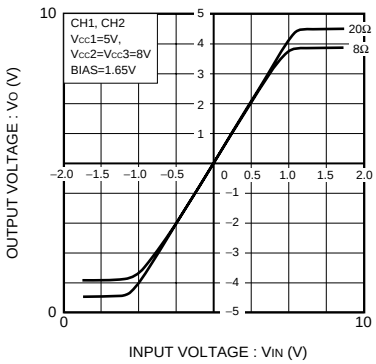


Fig.9 Input output characteristic

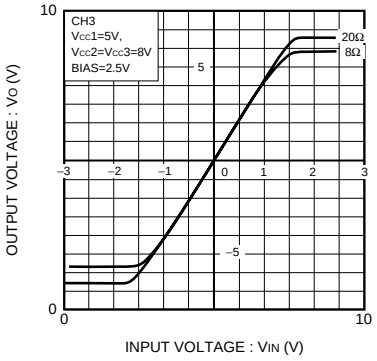


Fig.10 Input output characteristic

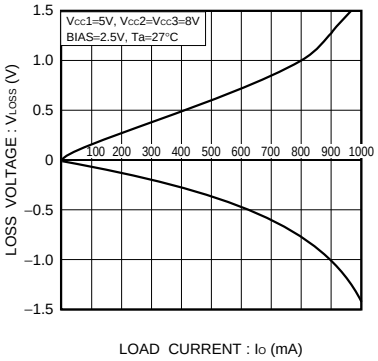


Fig.11 Output load current regulation

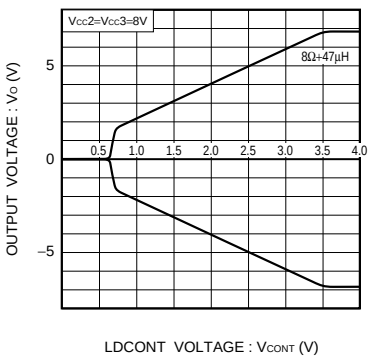


Fig.12 Input output characteristic

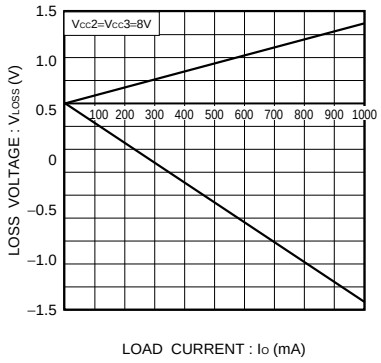
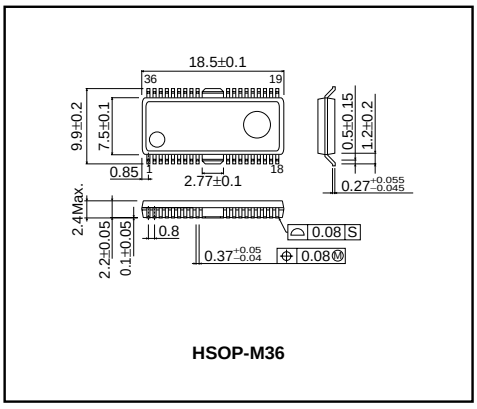


Fig.13 Output load current regulation

●**External dimensions** (Units : mm)



HSOP-M36

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