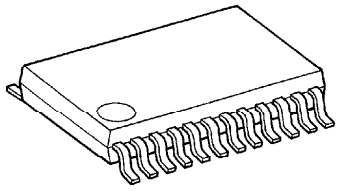
TENTATIVE TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA2120FN

LOW CONSUMPTION CURRENT STEREO HEADPHONE POWER AMPLIFIER FOR PORTABLE CD (3V USE)

The TA2120FN is a low consumption current stereo headphone power amplifier developed for portable CD players (3V). This IC has active bass boost, output limiter, input pin for beep sound.



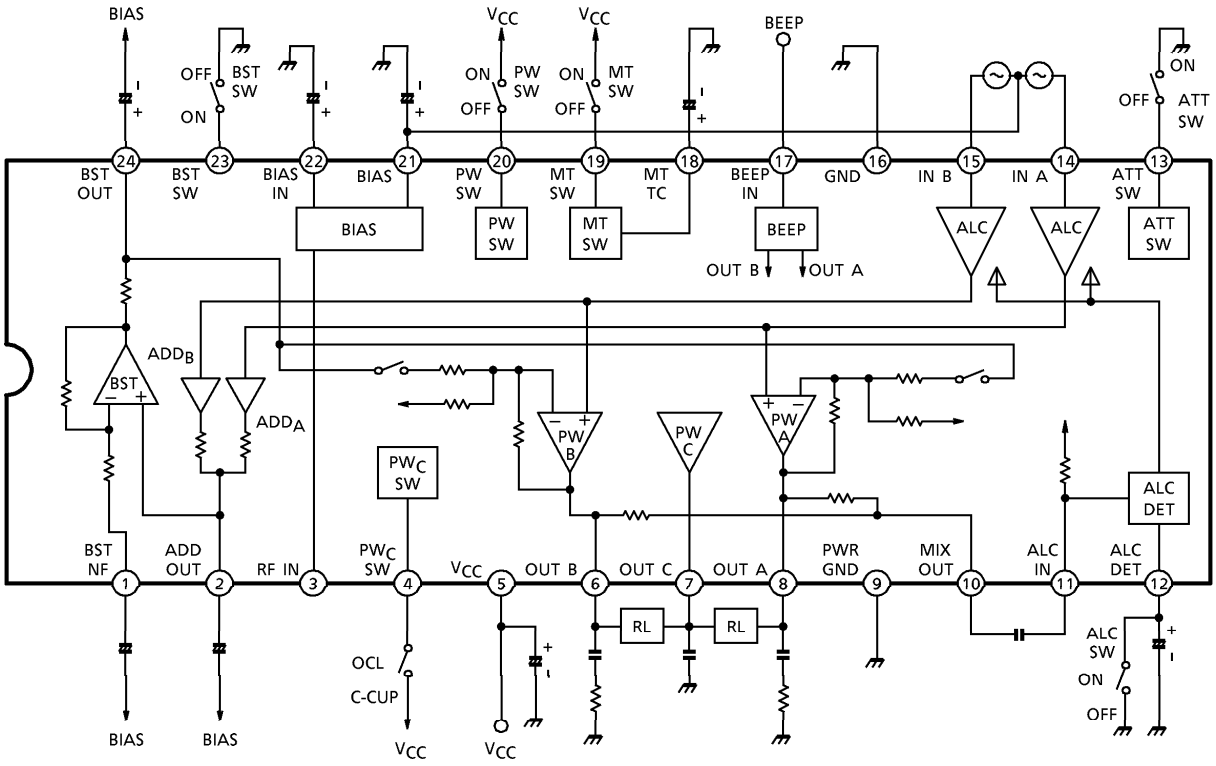
SSOP24-P-300-0.65A

Weight : 0.14g (Typ.)

FEATURES

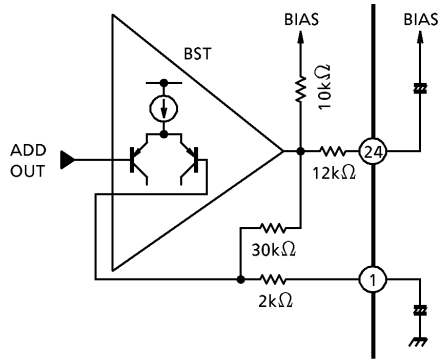
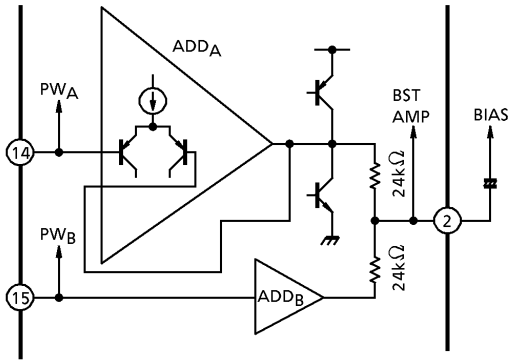
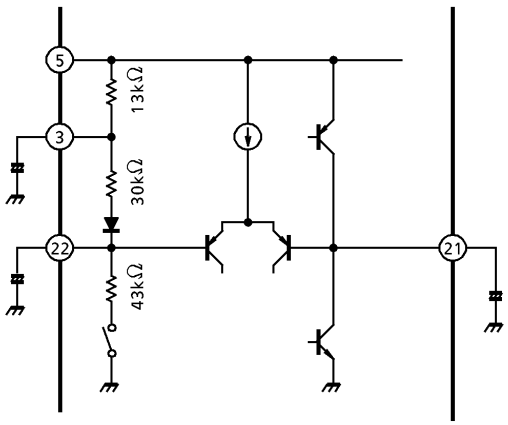
- Low consumption current : I_{CCQ} = 1.9mA (C-CUP) (typ.)
  I_{CCQ} = 2.6mA (OCL) (typ.)
- Two kinds of gain mode available : G_V = 16dB or 8.5dB
- Output power (V_{CC} = 2.0V, f = 1kHz, THD = 10%, R_L = 16Ω)
  Po = 8mW (typ.)
- Low noise : V_{no} = −98dBV (typ.)
- Built-in the center amplifier ON / OFF function.
  (Favorable for low dissipation current in the C-Couple output configuration)
- Built-in active bass boost system
- Built-in output limiter function
- Input pin for beep sound
- Excellent ripple rejection ratio
- Built-in capacitor for reducing buzz noise
- Built-in power mute
- Built-in a power on / off switch
- Operating supply voltage range (Ta = 25°C) : $V_{CC\ (opr)}$ = 1.8~4.5V

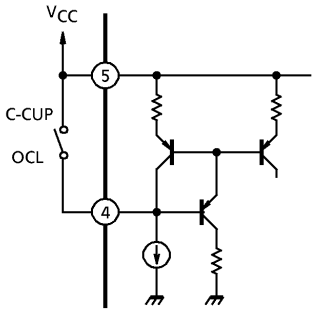
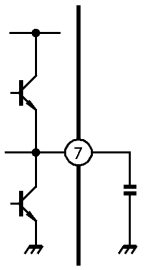
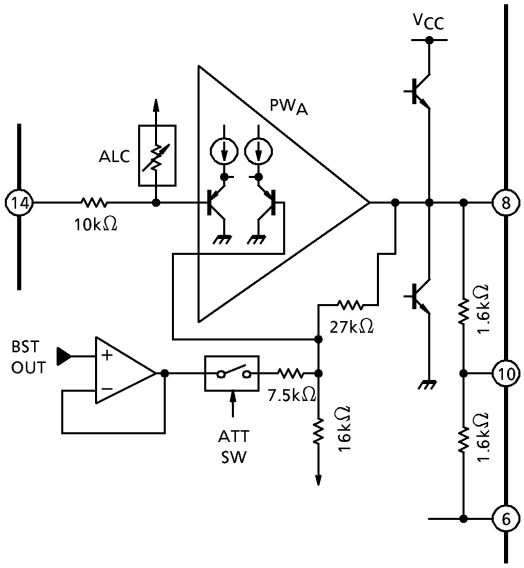
BLOCK DIAGRAM

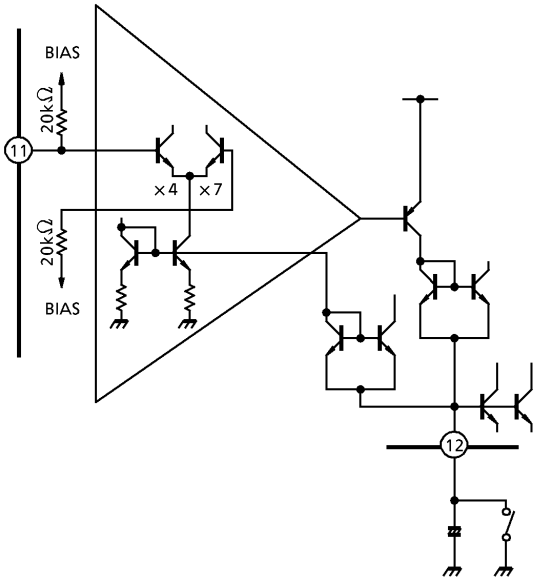
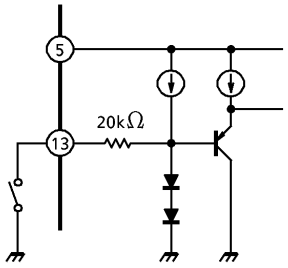
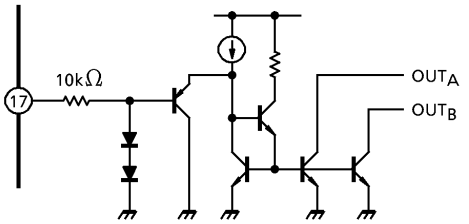


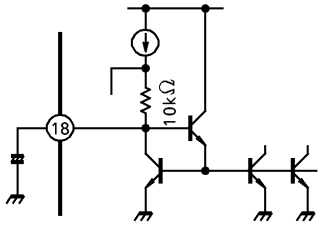
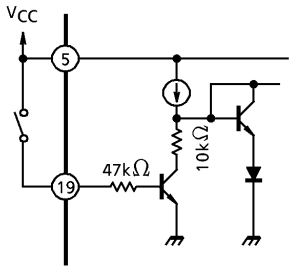
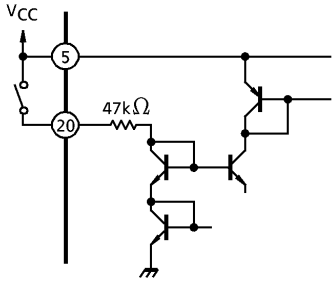
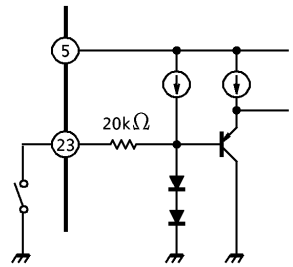
TERMINAL EXPLANATION

(Terminal voltage : Typical terminal voltage at no signal with test circuit, V_{CC} = 2.4V, Ta = 25°C)

TERMINAL No.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
1	BST NF	NF of BST amplifier		0.85
24	BST OUT	Output of BST amplifier (Terminal for filter)		0.85
2	ADD OUT	Output of ADD amplifier (Terminal for filter)		0.85
3	RF IN	Terminal for ripple filter circuit		1.44
21	BIAS	BIAS voltage		0.85
22	BIAS IN	Filter terminal for BIAS circuit		0.85

TERMINAL No.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
4	PW_C SW	Center amplifier on / off switchover V_{CC} : Center amplifier off (C-Couple) OPEN : Center amplifier on (OCL)		—
7	OUT_C	Output of center amplifier (Common terminal for OCL output configuration)		0.85
5	V_{CC}	—	—	2.4
6	OUT_B	Output of power amplifier		0.85
8	OUT_A			
14	IN_A	Input of power amplifier		0.85
15	IN_B			
10	MIX OUT	Output of power amplifier (Mixed)		0.85

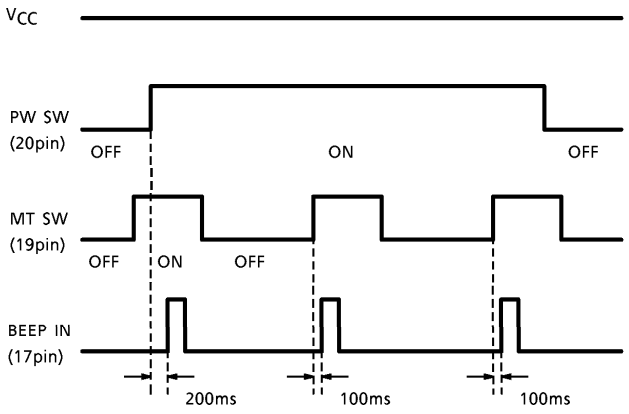
TERMINAL No.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
9	PWR GND	GND of power amplifier	—	0
11	ALC IN	Input terminal for ALC detector circuit		0.85
12	ALC DET	Smoothing for ALC detection, ALC on / off switchover GND : ALC off OPEN : ALC on		—
13	ATT SW	Power amplifier gain switchover OPEN / V_{CC} : ATT off (G_V = 16dB) GND : ATT on (G_V = 8.5dB)		—
16	GND	GND of input stage in power amplifier	—	0
17	BEEP IN	Input terminal for Beep sound It receive beep sound from microcomputer. And power amplifier outputs this beep sound.		0

TERMINAL No.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
18	MT TC	Terminal of mute smoothing Smoothing for shock noise at power muting switch over		1.4
19	MT SW	Power mute switchover GND / OPEN : Mute off V_{CC} : Mute on		—
20	PW SW	Power on / off switchover V_{CC} : Power on GND / OPEN : Power off		—
23	BST SW	Bst on / off switchover BST on : OPEN / V_{CC} BST off : GND		—

APPLICATION NOTE

1. Beep Sound

Beep sound signals from, for example, a micro controller can be received through the beep input pin 17. At power mute mode, PW_A and PW_B are turned off. The current of the beep signal input to been via beep amplifier is amplified at the output stage of PW_A and PW_B. The output from beep amplifier becomes the constant voltage source. As a result, the beep sound is output to the headphone load.
If the input signal for beep (Pin 17) is not, this terminal should be fixed GND level.



2. Power Switch

As long as the power switch is not connect to V_{CC}, the IC does not operate.
If external noise causes malfunctions, we recommend to connect a pull-down resistor externally (Sensitivity of the power mute switch is high).

3. Center Amplifier (PW_C)

Terminal for PW_C output is common terminal for OCL output configuration.
PW_C ON / OFF mode is controlled by PW_C switch (Pin 4).
To reduce the consumption current, PW_C should be turned off by this switch.

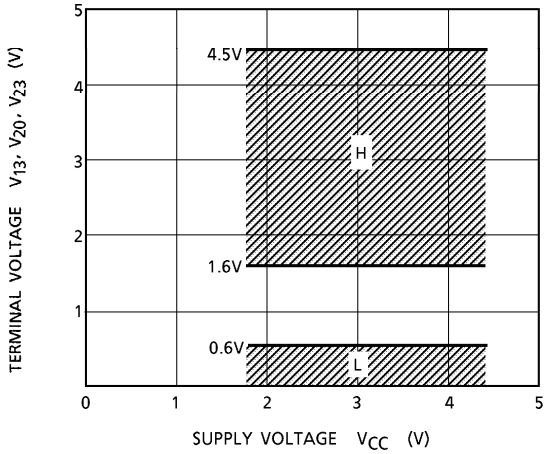
PW_C SW (OPEN : OCL
V_{CC} : C-Couple

4. Terminal of RF IN (3pin)

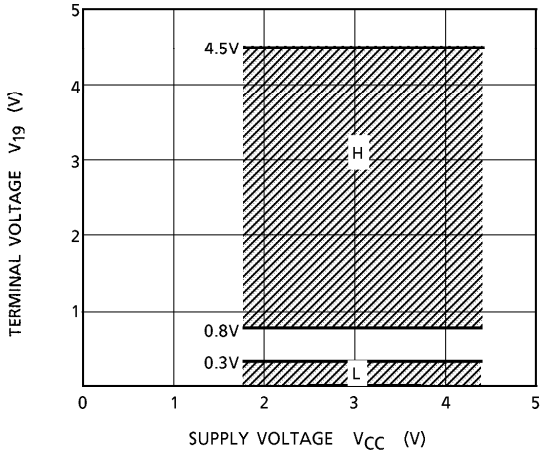
Adding Capacitor (Recommendation : 10μF) to terminal of RF IN (Pin 3), the ripple rejection ratio is improved by secondly ripple filter (In the C-Couple output configuration , this capacitor should be connected.)

5. Threshold Voltage of Each Switches

① PW SW, BST SW, ATT SW



② MT SW



	PW SW (V_{20})
'H'	OPERATING
'L' OPEN	IC OFF

	MT SW (V_{19})
'H'	MUTE ON
'L' OPEN	MUTE OFF

	ATT SW (V_{13})	BST SW (V_{23})
'H' OPEN	ATT OFF	BST ON
'L'	ATT ON	BST OFF

6. Exterminal capaciter

These capacitors which are prevent oscillation of power amplifier and de-coupled at terminals of BIAS and V_{CC} need to be small temperature coefficient and excellent frequency characteristic.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	4.5	V
Output Current	$I_{o\,(peak)}$	100	mA
Power Dissipation	P_D (Note)	550	mW
Operating Temperature	T_{opr}	−25~75	°C
Storage Temperature	T_{stg}	−55~150	°C

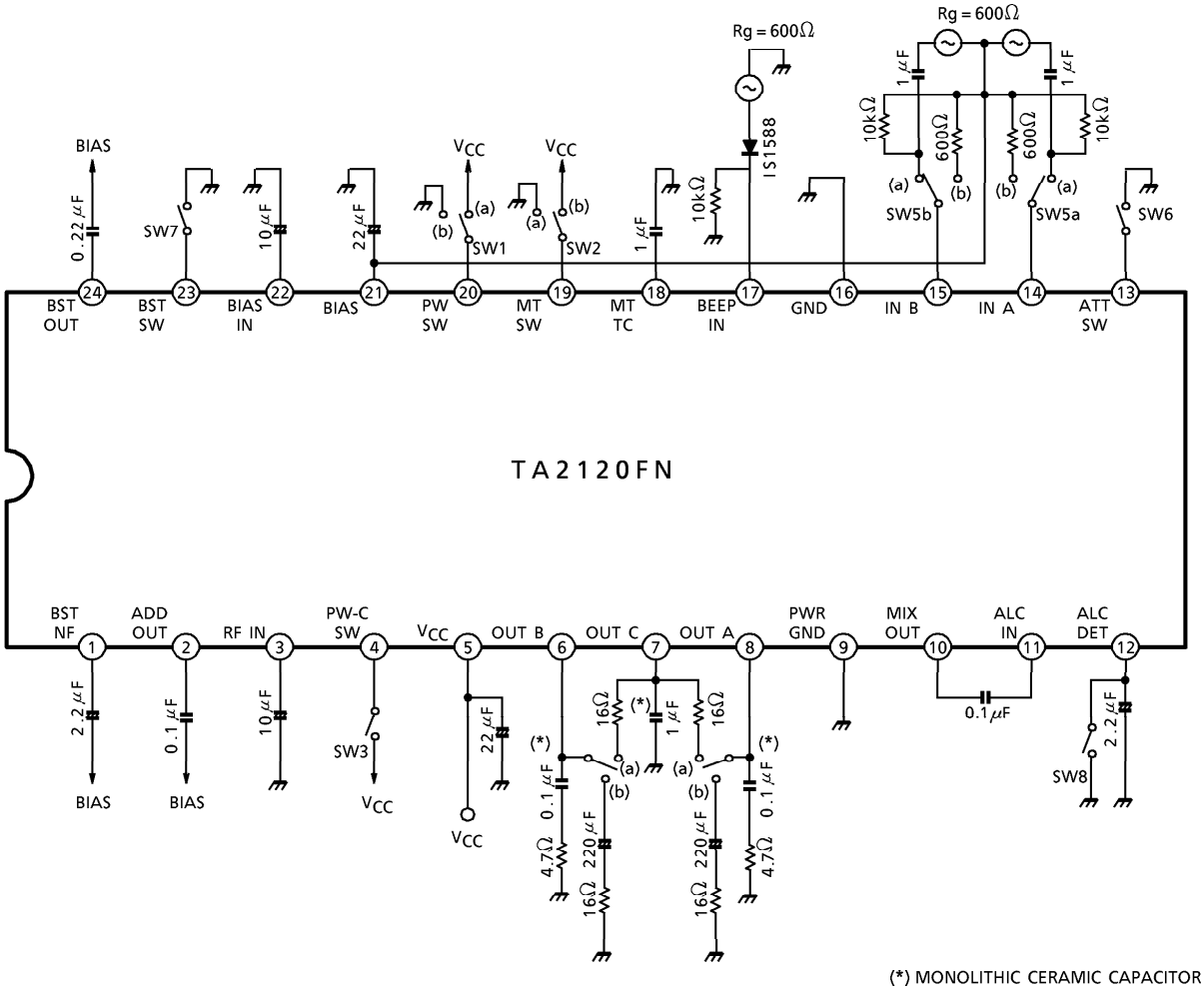
(Note) Deleted above 25°C in the proportion of 4.4mW / 1°C.

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified : V_{CC} = 2.4V, R_g = 600Ω, R_L = 16Ω, f = 1kHz, Ta = 25°C
SW1 : a, SW2 : a, SW3 : OPEN, SW4 : a, SW5 : a, SW6 : OPEN, SW7 : ON, SW8 : ON

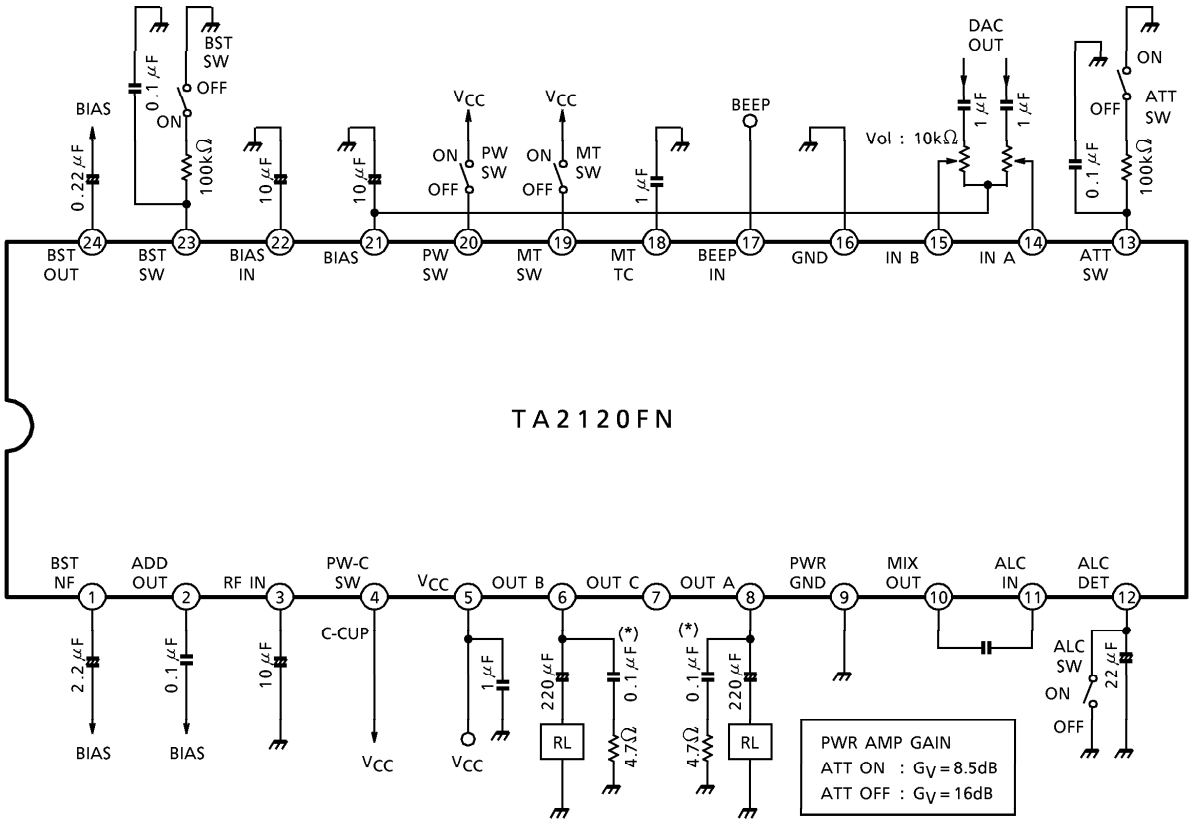
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Supply Current		I_{CC1}	—	IC OFF (C-Couple) SW1 : b, SW2 : b, SW3 : ON	—	0.1	5	μA
		I_{CC2}		IC OFF (OCL) SW1 : b, SW2 : b	—	0.1	5	μA
		I_{CC3}		MUTE ON (C-Couple) SW2 : b, SW3 : ON	—	1	2	mA
		I_{CC4}		MUTE ON (OCL) SW2 : b	—	1.7	3	mA
		I_{CC5}		No signal (C-Couple) SW3 : ON	—	1.9	3.5	mA
		I_{CC6}		No signal (OCL)	—	2.6	4.5	mA
Consumption Supply Current		I_{CC7}	—	P_O = 0.5mW + 0.5mW (C-Couple), SW3 : ON	—	6.6	—	mA
		I_{CC8}		P_O = 0.5mW + 0.5mW (OCL)	—	12.1	—	
Power Amplifier Stage	Voltage Gain (1)	G_{V1}	—	V_O = −22dBV, SW6 : GND	5.5	8.5	10.5	dB
	Voltage Gain (2)	G_{V2}	—	V_O = −22dBV	14	16	18	
	Output Power	P_{omax}	—	THD = 10%, V_{CC} = 2.0V	5	8	—	mW
	Total Harmonic Distortion	THD	—	V_O = −12.2dBV	—	0.1	0.5	%
	Output Noise Voltage	V_{no}	—	R_g = 600Ω, Filter : IHF-A, SW5 : b	—	−98	−92	dBV
	Crosstalk	CT	—	V_O = −12.2dBV	24	40	—	dB
	Ripple Rejection Ratio	RR	—	V_{CC} = 1.8V, fr = 100Hz, Vr = −20dBV	69	75	—	dB
	Mute Attenuation	MUTE	—	V_O = −12.2dBV, SW2 : b	80	90	—	dB
	Beep Voltage	VBEEP	—	V Beep IN = 0dBV, SW2 : b	−56	−51	−46	dBV
Boost Gain		Bst	—	V_O = −30dBV, f = 100Hz, SW7 : ON→OPEN	9	11.5	14	dB
Output Limiter Level		V_{ALC}	—	V_{in} = −20dBV, SW8 : OPEN	−41.5	−39.5	−37.5	dBV

TEST CIRCUIT



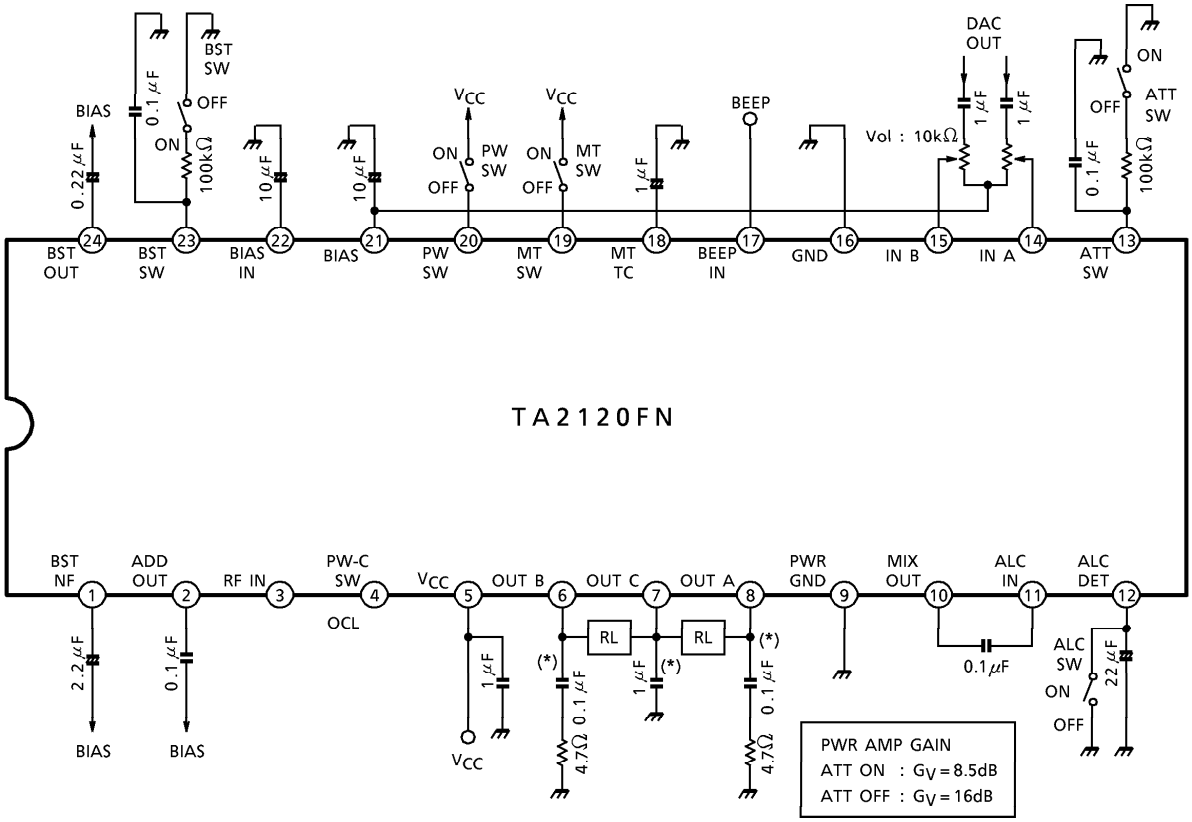
(*) MONOLITHIC CERAMIC CAPACITOR

APPLICATION CIRCUIT 1 (C-Couple MODE)



(*) MONOLITHIC CERAMIC CAPACITOR

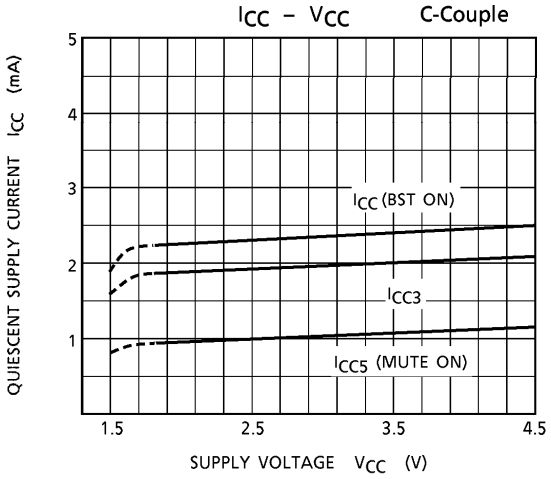
APPLICATION CIRCUIT 2 (OCL MODE)

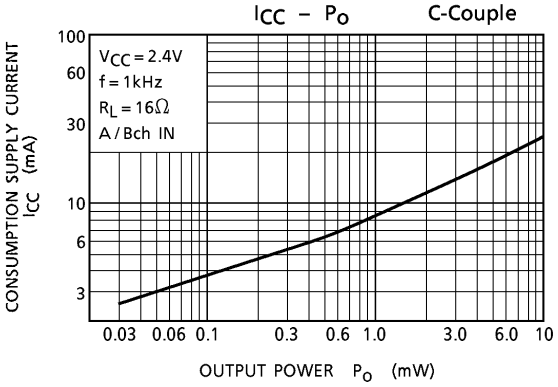


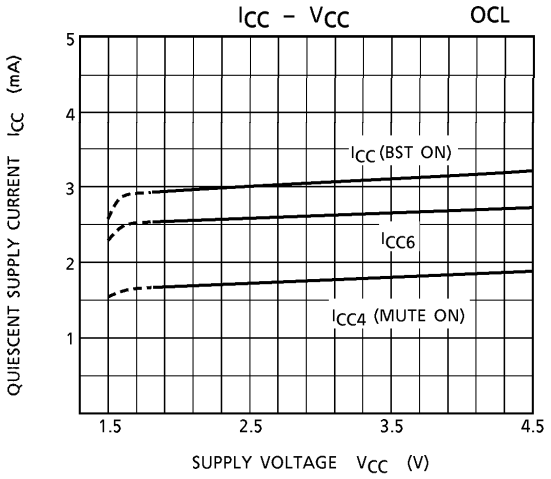
(*) MONOLITHIC CERAMIC CAPACITOR

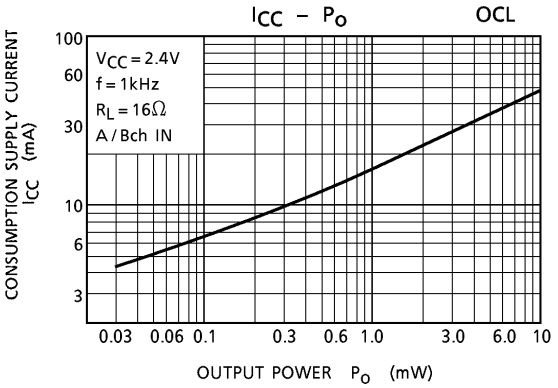
CHARACTERISTICS

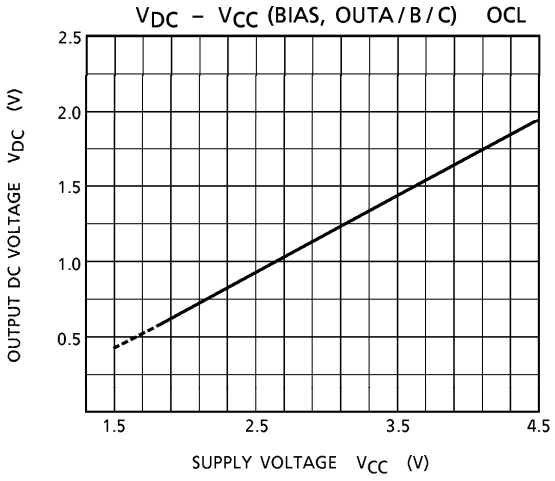
(Unless otherwise specified : V_{CC} = 2.4V, R_L = 16Ω, R_g = 600Ω, f = 1kHz, Ta = 25°C, OCL, ATT OFF)

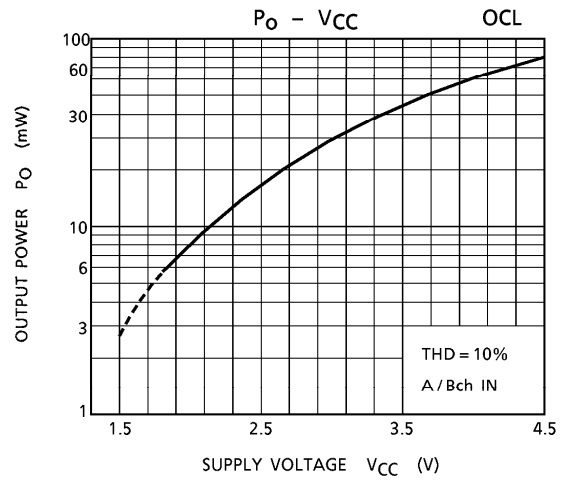




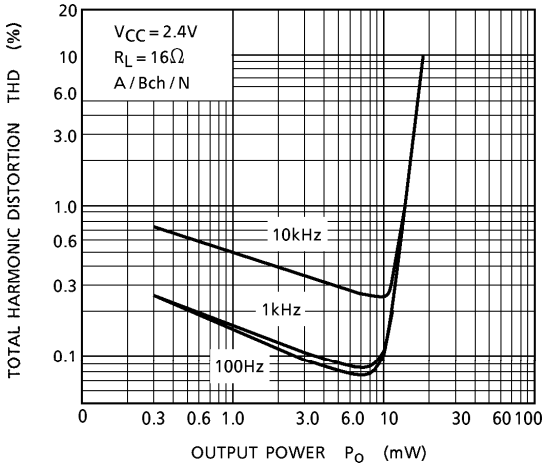




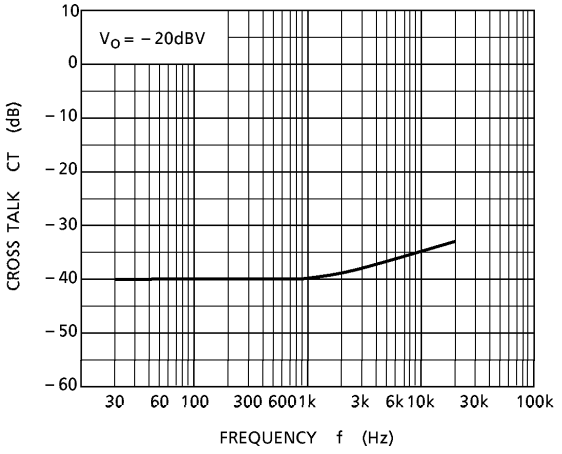




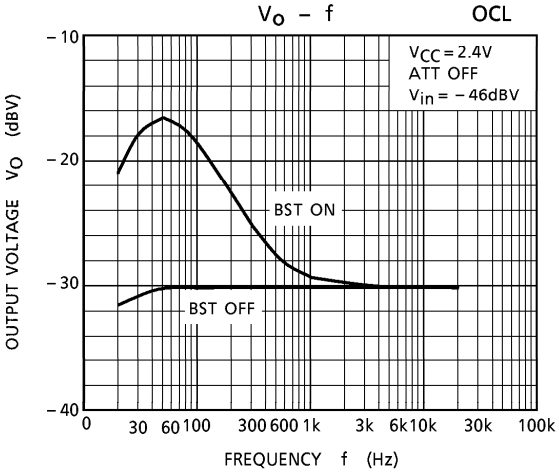
THD – P_O OCL



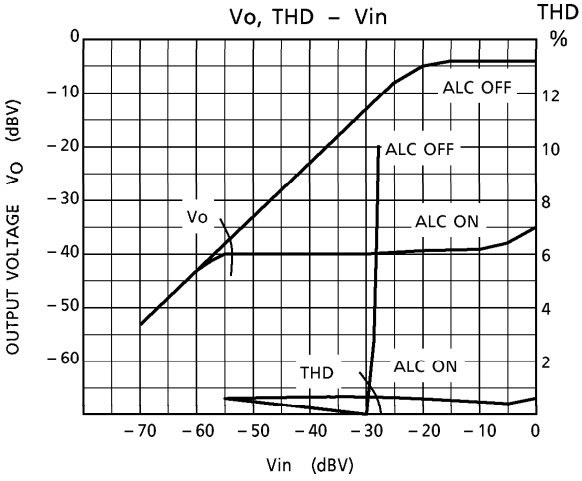
CT – f OCL



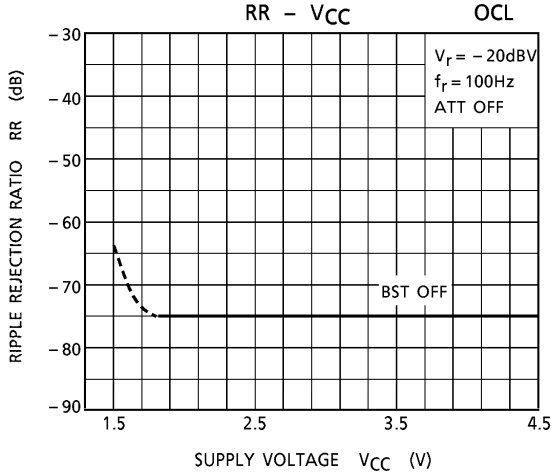
V_O – f OCL



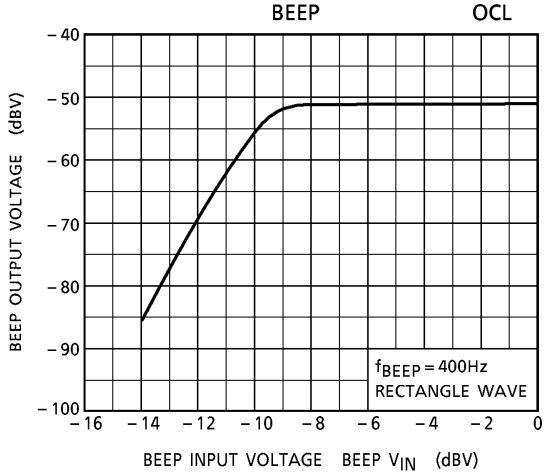
Vo, THD – Vin

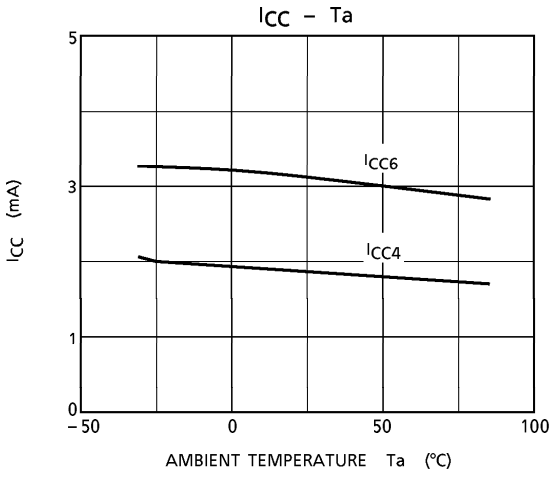


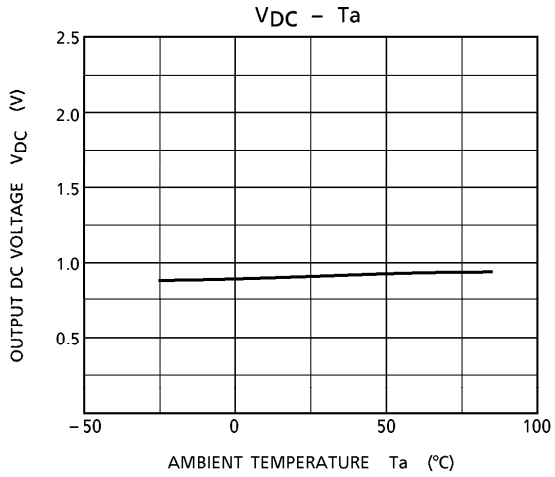
RR – V_{CC} OCL



BEEP OCL



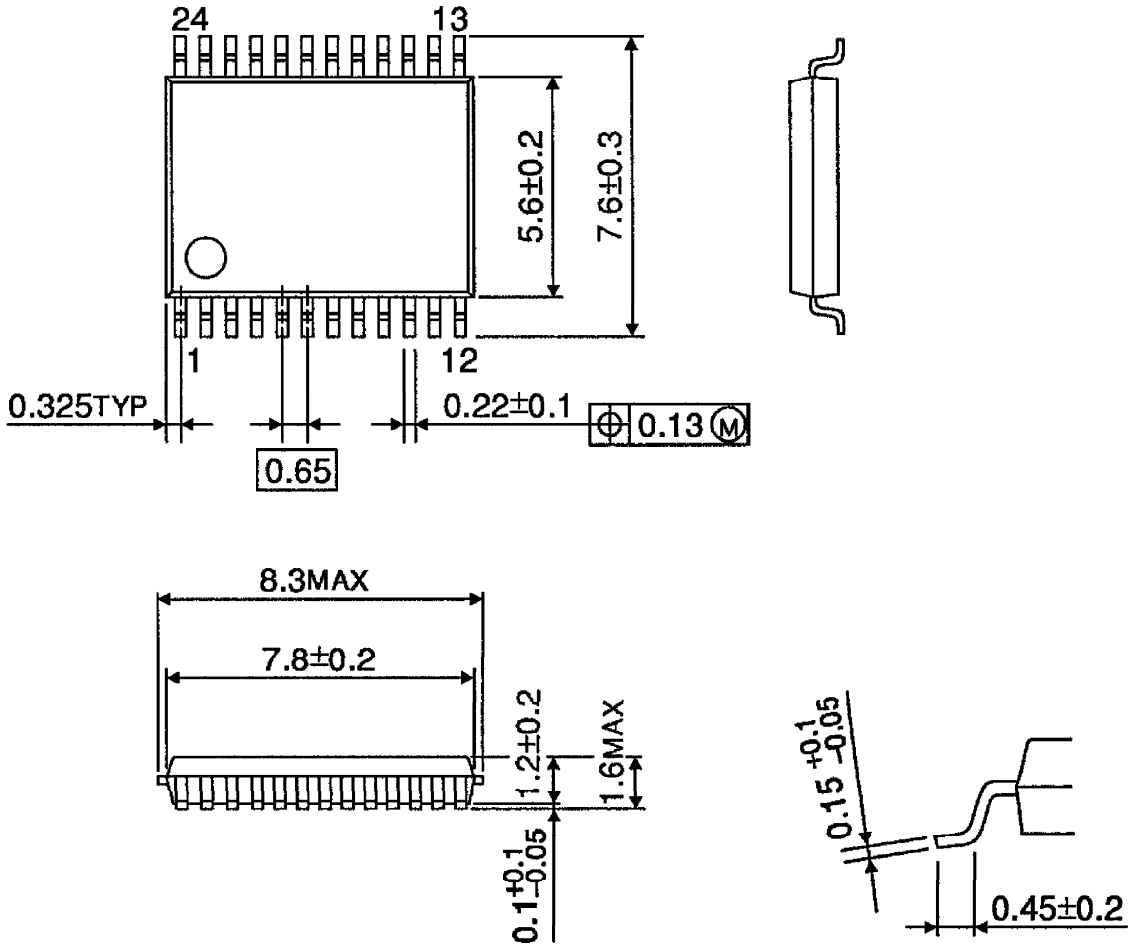

I_{CC} – Ta
5
3
1
0
I_{CC} (mA)
I_{CC6}
I_{CC4}
– 50
0
50
100
AMBIENT TEMPERATURE Ta (°C)


V_{DC} – Ta
2.5
2.0
1.5
1.0
0.5
OUTPUT DC VOLTAGE V_{DC} (V)
– 50
0
50
100
AMBIENT TEMPERATURE Ta (°C)

OUTLINE DRAWING

SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14g (Typ.)