M52055P

3-Channel Analog Switch

REJ03F0083-0100Z
Rev.1.0
Sep.22.2003

Description

The M52055 is semiconductor integrated circuit for electronic switches used in VCR, AUDIO signal processing applications. It contains three channel two input switch circuits with each switch is controlled independently.

Features

- Low offset voltage at output: Typ. 5 mV UNDER
- Low switching noise
- Wide dynamic range
- Wide frequency range: Typ. 40 MHz OVER
- Low crosstalk
- High speed response: Typ. 0.2 µs UNDER
- Low power consumption

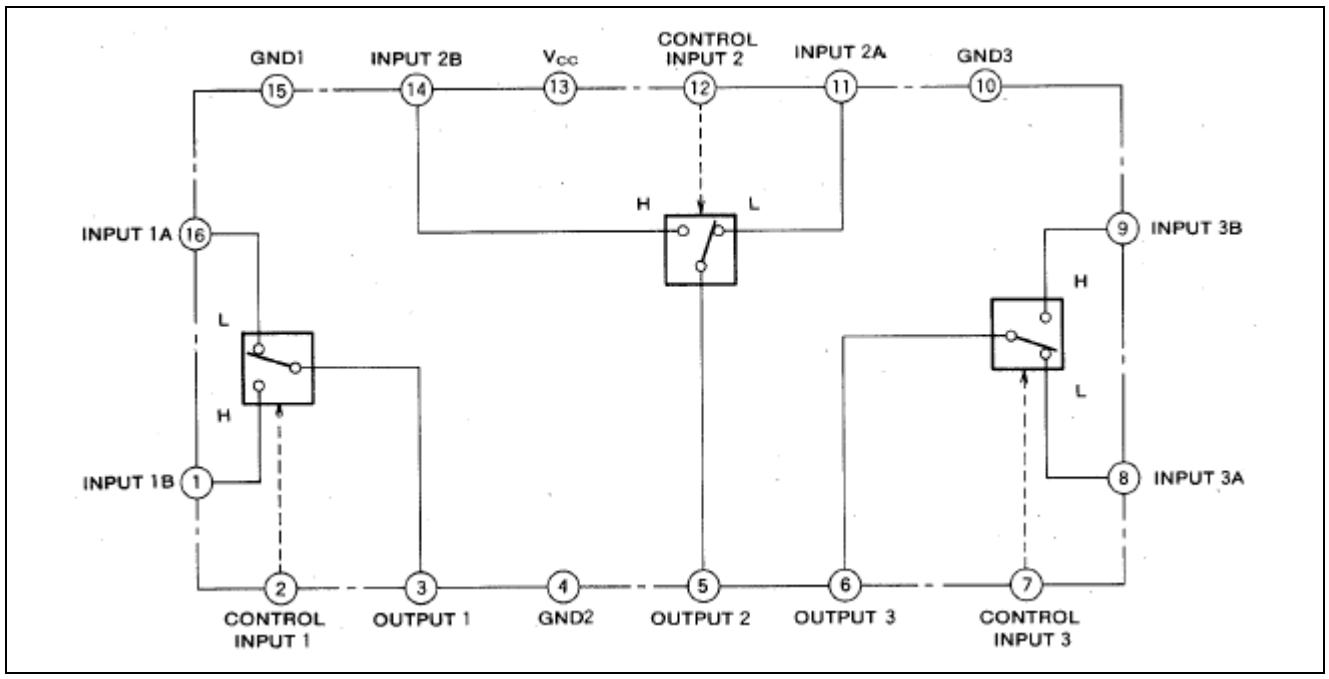
Application

- VCR, AUDIO, and other applications

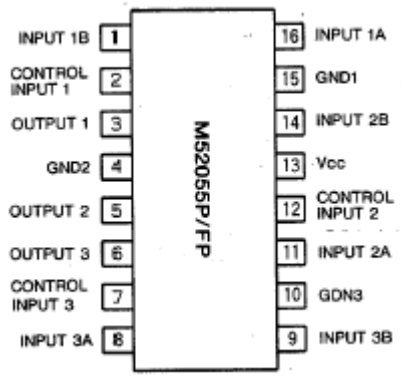
Recommended Operating Condition

- Supply voltage range: 4.5 to 13 V

Block Diagram



Pin Configuration

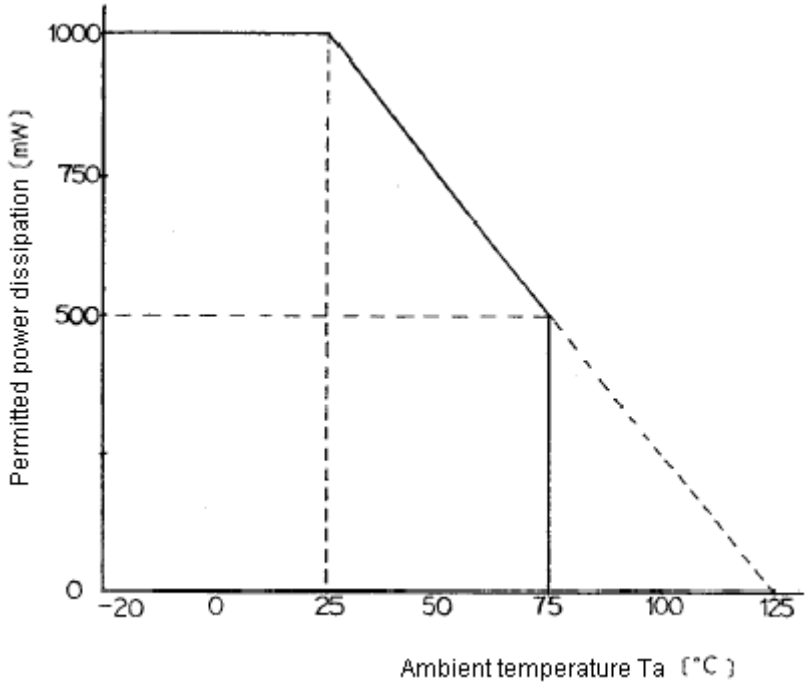


Absolute Maximum Rating

(Unless otherwise noted, Ta = 25°C)

Symbol	Item	Ratings	Units
Vcc	Supply voltage	14	V
Pd	Power dissipation	1000	mW
Topr	Operating ambient temperature	–20 to 75	°C
Tstg	Storing temperature	–40 to 125	°C
kθ	Thermal derating	10	mW/°C

Thermal Derating Curve



Electrical Characteristics

(unless otherwise noted, the ambient temperature (Ta) = 25°C, power supply voltage (Vcc) = 9 V, and current direction = current flowing into the IC is "+")

No.	Measurement item	Symbol	Measurement conditions	Limits			Unit
				Min.	Typ.	Max.	
1	Circuit current 1	$I_{CC}1$	No signal input. Measure the current flowing into pin 13 .	5.2	7.1	9.0	mA
2	Circuit current 2	$I_{CC}2$	No signal input. Measure the current flowing into pin 13 with Vcc = 5 V.	2.4	3.4	4.4	mA
3	S1 frequency characteristics 1A, 1B	F_{1A}	Input: 0.5-Vpp sine wave (SG1). Voltage gain at 10-MHz frequency. E1, E2 and E3: 5 V. 2-kΩ load connected to output pin.	–0.6	–0.1	0.4	dB
4		F_{1B}		–0.6	–0.1	0.4	dB
5	S2 frequency characteristics 2A, 2B	F_{2A}		–0.6	–0.1	0.4	dB
6		F_{2B}		–0.6	–0.1	0.4	dB
7	S3 frequency characteristics 3A, 3B	F_{3A}		–0.6	–0.1	0.4	dB
8		F_{3B}		–0.6	–0.1	0.4	dB
9	S1 voltage gain 1A, 1B	G_{1A}	Input: 0.5-Vpp sine wave (SG1) Voltage gain at 1-MHz frequency E1, E2 and E3: 5 V	–0.6	–0.1	0.4	dB
10		G_{1B}		–0.6	–0.1	0.4	dB
11	S2 voltage gain 2A, 2B	G_{2A}		–0.6	–0.1	0.4	dB
12		G_{2B}		–0.6	–0.1	0.4	dB
13	S3 voltage gain 3A, 3B	G_{3A}		–0.6	–0.1	0.4	dB
14		G_{3B}		–0.6	–0.1	0.4	dB
15	S1 input bias voltage 1A, 1B	V_{IDC} 1A	No signal input. DC voltage at input pin.	4.1	4.6	5.1	V
16		V_{IDC} 1B		4.1	4.6	5.1	V
17	S2 input bias voltage 2A, 2B	V_{IDC} 2A		4.1	4.6	5.1	V
18		V_{IDC} 2B		4.1	4.6	5.1	V
19	S3 input bias voltage 3A, 3B	V_{IDC} 3A		4.1	4.6	5.1	V
20		V_{IDC} 3B		4.1	4.6	5.1	V
21	S1 output bias voltage	V_{ODC} 1	No signal input. DC voltage at output pin. Pins 2, 7 and 12 connected to GND.	3.05	3.2	3.35	V
22	S2 output bias voltage	V_{ODC} 2		3.05	3.2	3.35	V
23	S3 output bias voltage	V_{ODC} 3		3.05	3.2	3.35	V
24	Current flow into control pins 1: S1, S2, S3	I_{IN} 11	Current flow into each of pins 2, 7 and 12 when these pin voltage is 9 V.	0.35	0.6	1	mA
25		I_{IN} 12		0.35	0.6	1	mA
26		I_{IN} 13		0.35	0.6	1	mA
27	Current flow into control pins 2: S1, S2, S3	I_{IN} 21	Current flow into each of pins 2, 7 and 12 when these pin voltage is 5 V.	0	1.5	10	µA
28		I_{IN} 22		0	1.5	10	µA
29		I_{IN} 23		0	1.5	10	µA
30	Current flow into control pins 3: S1, S2, S3	I_{IN} 31	Current flow into each of pins 2, 7 and 12 when these pin voltage is 0 V.	–5	0	2	µA
31		I_{IN} 32		–5	0	2	µA
32		I_{IN} 33		–5	0	2	µA
33a	Threshold voltage S1, S2, S3	V_{IC1L}	Input: 0.5-Vpp sine wave, f = 1 MHz (SG1).*1 *2	1.7	—	2.7	V
33b		V_{IC1H}		1.7	—	2.7	V
34a		V_{IC2L}		1.7	—	2.7	V
34b		V_{IC2H}		1.7	—	2.7	V
35a		V_{IC3L}		1.7	—	2.7	V
35b		V_{IC3H}		1.7	—	2.7	V

Electrical Characteristics (cont)

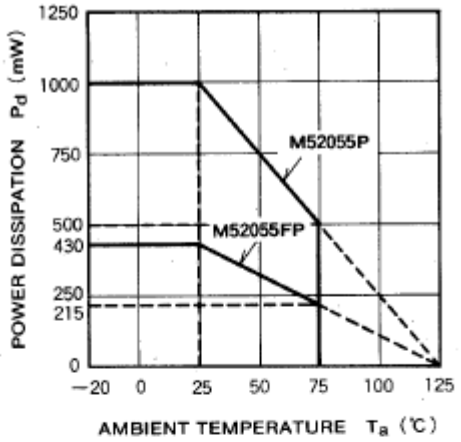
No.	Measurement item	Symbol	Measurement conditions	Limits			Unit
				Min.	Typ.	Max.	
36	S1 2nd harmonic distortion 1A, 1B	H_{1A}	Input: 4.5-Vpp sine wave, f = 5 MHz (SG1). E1, E2 and E3: 5 V Voltage ratio of 10-MHz output element against 5-MHz output element 2-kΩ load connected to output pin	—	–60	–50	dB
37		H_{1B}		—	–60	–50	dB
38	S2 2nd harmonic distortion 2A, 2B	H_{2A}		—	–60	–50	dB
39		H_{2B}		—	–60	–50	dB
40	S3 2nd harmonic distortion 3A	H_{3A}		—	–60	–50	dB
41	S3 2nd harmonic distortion	H_{3B}	Input: 4.5-Vpp sine wave, f = 5 MHz (SG1).	—	–60	–50	dB
42	S1 total harmonic distortion ratio 1A, 1B	THD1A	Measure THD with sine wave input of 1 Vrms and f = 5 MHz (SG1). E1, E2 and E3: 5 V.	—	0.05	0.2	%
43		THD1B		—	0.05	0.2	%
44	S2 total harmonic distortion ratio 2A, 2B	THD2A		—	0.05	0.2	%
45		THD2B		—	0.05	0.2	%
46	S3 total harmonic distortion ratio 3A, 3B	THD3A		—	0.05	0.2	%
47		THD3B		—	0.05	0.2	%
48	S1 crosstalk 1B-1A, 1A-1B	CT11	Input: 0.5-Vpp sine wave, f = 5 MHz (SG1). Voltage ratio of non-input-side output against input-side output when the non-input-side pin is connected to GND with 0.01 µF. E1, E2 and E3: 5 V	—	–70	–60	dB
49		CT12		—	–70	–60	dB
50	S2 crosstalk 2B-2A, 2A-2B	CT21		—	–70	–60	dB
51		CT22		—	–70	–60	dB
52	S3 crosstalk 3B-3A, 3A-3B	CT31		—	–70	–60	dB
53		CT32		—	–70	–60	dB
54	S1 crosstalk between channels 2A-1A, 2B-1A, 3A-1A, 3B-1A	CT13	Input: 0.5-Vpp sine wave, f = 5 MHz (SG1). Voltage ratio of no-input-side output against input-side output when no-input-side pin is connected to GND with 0.01 µF. E1, E2 and E3: 5 V	—	–70	–60	dB
55		CT14		—	–70	–60	dB
56		CT15		—	–70	–60	dB
57		CT16		—	–70	–60	dB
58	2A-1B, 2B-1B, 3A-1B, 3B-1B	CT17		—	–70	–60	dB
59		CT18		—	–70	–60	dB
60		CT19		—	–70	–60	dB
61		CT1A		—	–70	–60	dB
62	S2 crosstalk between channels 1A-2A, 1B-2A, 3A-2A, 3B-2A	CT23		—	–70	–60	dB
63		CT24		—	–70	–60	dB
64		CT25		—	–70	–60	dB
65		CT26		—	–70	–60	dB
66	1A-2B, 1B-2B, 3A-2B, 3B-2B	CT27		—	–70	–60	dB
67		CT28		—	–70	–60	dB
68		CT29		—	–70	–60	dB
69		CT2A		—	–70	–60	dB
70	S3 crosstalk between channels 1A-3A, 1B-3A, 2A-3A, 2B-3A	CT33		—	–70	–60	dB
71		CT34		—	–70	–60	dB
72		CT35		—	–70	–60	dB
73		CT36		—	–70	–60	dB
74	1A-3B, 1B-3B, 2A-3B, 2B-3B	CT37		—	–70	–60	dB
75		CT38		—	–70	–60	dB
76		CT39		—	–70	–60	dB
77		CT3A		—	–70	–60	dB

Electrical Characteristics (cont)

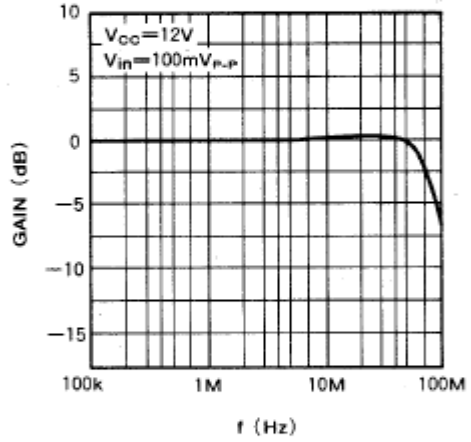
No.	Measurement item	Symbol	Measurement conditions	Limits			Unit
				Min.	Typ.	Max.	
78	S1 output DC offset voltage	$V_{OS}1$	No signal input. E1, E2 and E3: 5 V.	–10	0	10	mV
79	S2 output DC offset voltage	$V_{OS}2$	DC voltage difference in output.*3	–10	0	10	mV
80	S3 output DC offset voltage	$V_{OS}3$		–10	0	10	mV
81a	Threshold voltage (Vcc = 5 V) S1, S2, S3	V_{IC4L}	Input: 0.5-Vp-p sine wave, f = 1 MHz (SG1). Vcc = 5 V.*4 *5	1.3	—	2.3	V
81b		V_{IC4H}		1.3	—	2.3	V
82a		V_{IC5L}		1.3	—	2.3	V
82b		V_{IC5H}		1.3	—	2.3	V
83a		V_{IC6L}		1.3	—	2.3	V
83b		V_{IC6H}		1.3	—	2.3	V
84a	Threshold voltage (Vcc = 12 V) S1, S2, S3	V_{IC7L}	Input: 0.5-Vp-p sine wave, f = 1 MHz (SG1). Vcc = 12 V.*6 *7	2.0	—	3.0	V
84b		V_{IC7H}		2.0	—	3.0	V
85a		V_{IC8L}		2.0	—	3.0	V
85b		V_{IC8H}		2.0	—	3.0	V
86a		V_{IC9L}		2.0	—	3.0	V
86b		V_{IC9H}		2.0	—	3.0	V

Typical Characteristics

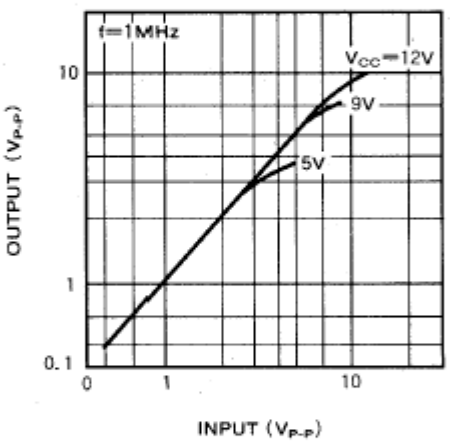
THERMAL DERATING (MAXIMUM RATING)



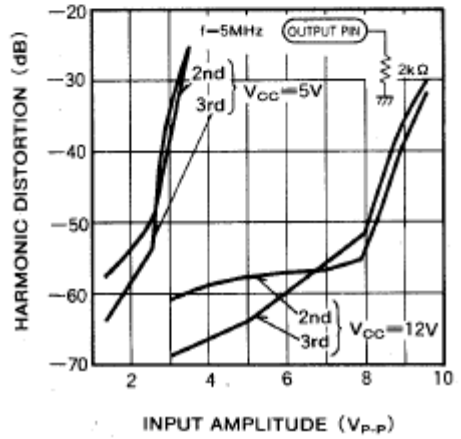
FREQUENCY CHARACTERISTICS



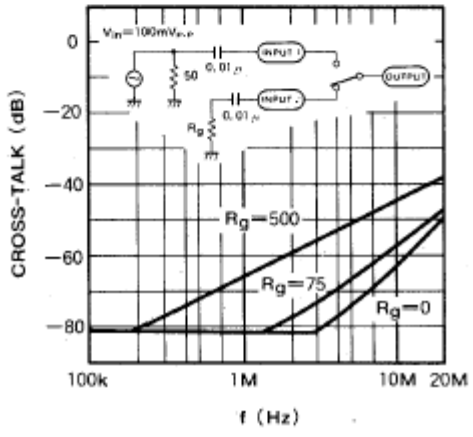
DYNAMIC RANGE



HARMONIC DISTORTION

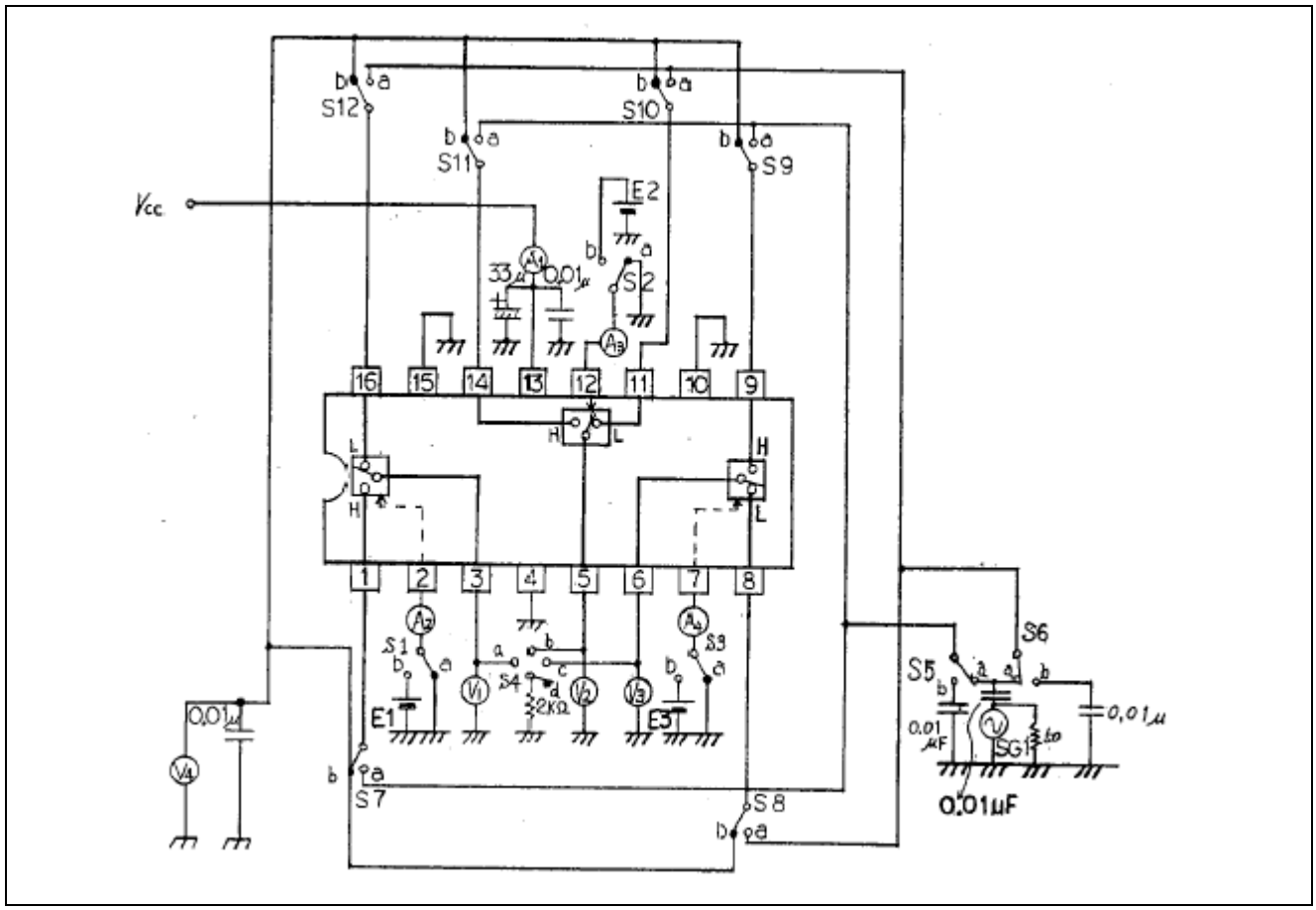


CROSS-TALK



Method to Measure Electric Characteristics

1. Measurement Circuit



2 Measurement Conditions

No.	Symbol	Switch status												Point to be measured
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	
1	$I_{CC}1$	a	a	a	d	b	b							A_1
2	$I_{CC}2$	a	a	a	d	b	b							A_1
3	F_{1A}	a			a		a	b	b	b	b	b	a	V_1
4	F_{1B}	b			a	a		a	b	b	b	b	b	V_1
5	F_{2A}		a		b		a	b	b	b	a	b	b	V_2
6	F_{2B}		b		b	a		b	b	b	b	a	b	V_2
7	F_{3A}			a	c		a	b	a	b	b	b	b	V_3
8	F_{3B}			b	c	a		b	b	a	b	b	b	V_3
9	G_{1A}	a			d		a	b	b	b	b	b	a	V_1
10	G_{1B}	b			d	a		a	b	b	b	b	b	V_1
11	G_{2A}		a		d		a	b	b	b	a	b	b	V_2
12	G_{2B}		b		d	a		b	b	b	b	a	b	V_2
13	G_{3A}			a	d		a	b	a	b	b	b	b	V_3
14	G_{3B}			b	d	a		b	b	a	b	b	b	V_3
15	V_{IDC} 1A	a			d	b	b	a	a	a	a	a	b	V_4
16	V_{IDC} 1B	a			d	b	b	b	a	a	a	a	a	V_4
17	V_{IDC} 2A		a		d	b	b	a	a	a	b	a	a	V_4
18	V_{IDC} 2B		a		d	b	b	a	a	a	a	b	a	V_4
19	V_{IDC} 3A			a	d	b	b	a	b	a	a	a	a	V_4
20	V_{IDC} 3B			a	d	b	b	a	a	b	a	a	a	V_4
21	V_{ODC} 1	a			d	b	b	a	b	b	b	b	a	V_1
22	V_{ODC} 2		a		d	b	b	b	b	b	a	a	b	V_2
23	V_{ODC} 3			a	d	b	b	b	a	a	b	b	b	V_3
24	I_{IN} 11	b			d	b	b							A_2
25	I_{IN} 12		b		d	b	b							A_3
26	I_{IN} 13			b	d	b	b							A_4
27	I_{IN} 21	b			d	b	b							A_2
28	I_{IN} 22		b		d	b	b							A_3
29	I_{IN} 23			b	d	b	b							A_4
30	I_{IN} 31	a			d	b	b							A_2
31	I_{IN} 32		a		d	b	b							A_3
32	I_{IN} 33			a	d	b	b							A_4
33a	V_{IC1L}	b			d	b	a	b	b	b	b	b	a	E_1 Note1
33b	V_{IC1H}					a	b	a					b	E_1 Note2
34a	V_{IC2L}		b		d	b	a	b	b	b	a	b	b	E_2 Note1
34b	V_{IC2H}					a	b				b	a		E_2 Note2
35a	V_{IC3L}			b	d	b	a	b	a	b	b	b	b	E_3 Note1
35b	V_{IC3H}					a	b		b	a				E_3 Note2
36	H_{1A}	a			a	b	a	b	b	b	b	b	a	V_1
37	H_{1B}	b			a	a	b	a	b	b	b	b	b	V_1
38	H_{2A}		a		b	b	a	b	b	b	a	b	b	V_2
39	H_{2B}		b		b	a	b	b	b	b	b	a	b	V_2
40	H_{3A}			a	c	b	a	b	a	b	b	b	b	V_3
41	H_{3B}			b	c	a	b	b	b	a	b	b	b	V_3

Measurement Conditions (cont)

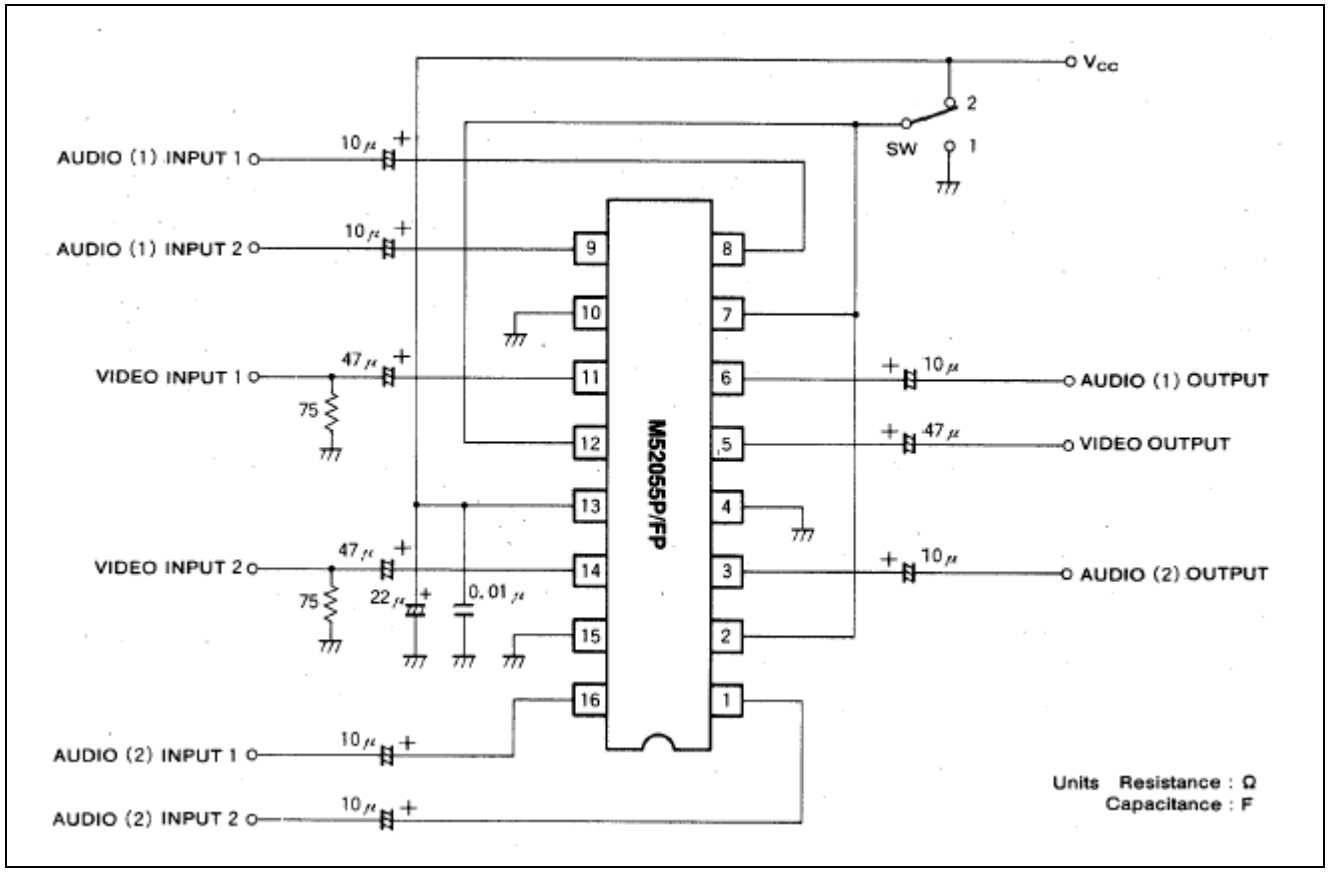
No.	Symbol	Switch status												Point to be measured
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	
42	THD1A	a			d	b	a	b	b	b	b	b	a	V_1
43	THD1B	b			d	a	b	a	b	b	b	b	b	V_1
44	THD2A		a		d	b	a	b	b	b	a	b	b	V_2
45	THD2B		b		d	a	b	b	b	b	b	a	b	V_2
46	THD3A			a	d	b	a	b	a	b	b	b	b	V_3
47	THD3B			b	d	a	b	b	b	a	b	b	b	V_3
48	CT11	a			a	a	b	a	b	b	b	b	a	V_1
49	CT12	b			a	b	a	a	b	b	b	b	a	V_1
50	CT21		a		b	a	b	b	b	b	a	a	b	V_2
51	CT22		b		b	b	a	b	b	b	a	a	b	V_2
52	CT31			a	c	a	b	b	a	a	b	b	b	V_3
53	CT32			b	c	b	a	b	a	a	b	b	b	V_3
54	CT13	a	b		a	b	a	b	b	b	a	b	b	V_1
55	CT14	a	a		a	a	b	b	b	b	b	a	b	V_1
56	CT15	a		b	a	b	a	b	a	b	b	b	b	V_1
57	CT16	a		a	a	a	b	b	b	a	b	b	b	V_1
58	CT17	b	b		a	b	a	b	b	b	a	b	b	V_1
59	CT18	b	a		a	a	b	b	b	b	b	a	b	V_1
60	CT19	b		b	a	b	a	b	a	b	b	b	b	V_1
61	CT1A	b		a	a	a	b	b	b	a	b	b	b	V_1
62	CT23	b	a		b	b	a	b	b	b	b	b	a	V_2
63	CT24	a	a		b	a	b	a	b	b	b	b	b	V_2
64	CT25		a	b	b	b	a	b	a	b	b	b	b	V_2
65	CT26		a	a	b	a	b	b	b	a	b	b	b	V_2
66	CT27	b	b		b	b	a	b	b	b	b	b	a	V_2
67	CT28	a	b		b	a	b	a	b	b	b	b	b	V_2
68	CT29		b	b	b	b	a	b	a	b	b	b	b	V_2
69	CT2A		b	a	b	a	b	b	b	a	b	b	b	V_2
70	CT33	b		a	c	b	a	b	b	b	b	b	a	V_3
71	CT34	a		a	c	a	b	a	b	b	b	b	b	V_3
72	CT35		b	a	c	b	a	b	b	b	a	b	b	V_3
73	CT36		a	a	c	a	b	b	b	b	b	a	b	V_3
74	CT37	b		b	c	b	a	b	b	b	b	b	a	V_3
75	CT38	a		b	c	a	b	a	b	b	b	b	b	V_3
76	CT39		b	b	c	b	a	b	b	b	a	b	b	V_3
77	CT3A		a	b	c	a	b	b	b	b	b	a	b	V_3
78	$V_{OS}1$	a b			d	b	b	a	b	b	b	b	a	V_1 Note3
79	$V_{OS}2$		a b		d	b	b	b	b	b	a	a	b	V_2 Note3
80	$V_{OS}3$			a b	d	b	b	b	a	a	b	b	b	V_3 Note3

Measurement Conditions (cont)

No.	Symbol	Switch status												Point to be measured
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	
81a	V_{IC4L}	b			d	b	a	b	b	b	b	b	a	E_1 Note4
81b	V_{IC4H}					a	b	a					b	E_1 Note5
82a	V_{IC5L}		b		d	b	a	b	b	b	a	b	b	E_2 Note4
82b	V_{IC5H}					a	b				b	a		E_2 Note5
83a	V_{IC6L}			b	d	b	a	b	a	b	b	b	b	E_3 Note4
83b	V_{IC6H}					a	b		b	a				E_3 Note5
84a	V_{IC7L}	b			d	b	a	b	b	b	b	b	a	E_1 Note6
84b	V_{IC7H}					a	b	a					b	E_1 Note7
85a	V_{IC8L}		b		d	b	a	b	b	b	a	b	b	E_2 Note6
85b	V_{IC8H}					a	b				b	a		E_2 Note7
86a	V_{IC9L}			b	d	b	a	b	a	b	b	b	b	E_3 Note6
86b	V_{IC9H}					a	b		b	a				E_3 Note7

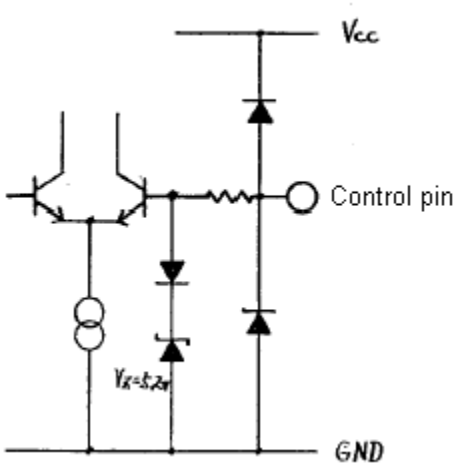
Notes:
1. For V_{IC1L}, V_{IC2L} and V_{IC3L}, respectively read the E_1, E_2 and E_3 voltage when their output amplitudes are 0.5 dB smaller than those of V_1, V_2 and V_3 in measuring G_{1A} in No. 9, G_{2A} in No. 11 and G_{3A} in No. 13.
2. For V_{IC1H}, V_{IC2H} and V_{IC3H}, respectively read the E_1, E_2 and E_3 voltage when their output amplitudes are 0.5 dB smaller than those of V_1, V_2 and V_3 in measuring G_{1B} in No. 10, G_{2B} in No. 12 and G_{3B} in No. 14.
3. Read the potential difference "V_{OS}" = V_H - V_L, where V_L indicates output voltage when the control voltage is 0 V and V_H indicates output voltage when the control voltage is 5 V.
4. Vcc = 5 V.
   For V_{IC4L}, V_{IC5L} and V_{IC6L}, respectively read the E_1, E_2 and E_3 voltage when their output amplitudes are 1.0 dB smaller than those of V_1, V_2 and V_3 in measuring G_{1A} in No. 9, G_{2A} in No. 11 and G_{3A} in No. 13.
5. Vcc = 5 V.
   For V_{IC4H}, V_{IC5H} and V_{IC6H}, respectively read the E_1, E_2 and E_3 voltage when their output amplitudes are 1.0 dB smaller than those of V_1, V_2 and V_3 in measuring G_{1B} in No. 10, G_{2B} in No. 12 and G_{3B} in No. 14.
6. Same as 4 above except Vcc = 12 V.
7. Same as 5 above except Vcc = 12 V.

Application Example



USAGE NOTES

1. The input impedance is 20 kΩ (standard value).
2. Output drive current should be 5 mA or less when using this IC.
3. Note that voltage applied to the control pins (pins 2, 7 and 12) should be less than the power supply voltage (Vcc) and more than the ground voltage (GND). The following shows an internal equivalent circuit coupled to a control pin.



4. Output pins are the emitter follower type. The following drive current is applied inside the IC normally. If the drive performance is insufficient, apply external drive current within the range shown in 2.

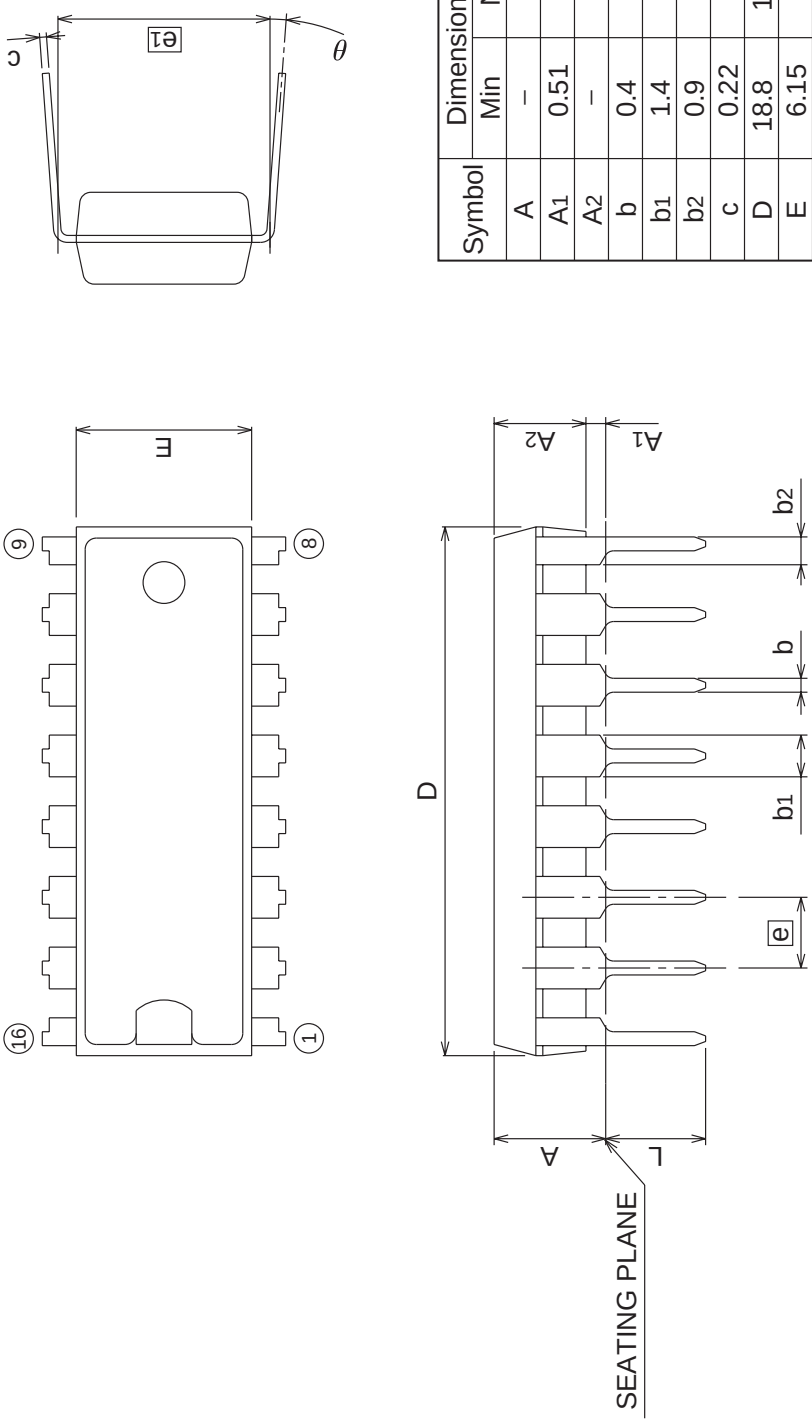
Power supply voltage (Vcc)	Drive current in the IC (standard value)
5 V	190 µA
9V	380 µA
12 V	530 µA

Package Dimensions

16P4 — **Plastic 16pin 300mil DIP** — MMP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
DIP16-P-300-2.54	–	1.0	Alloy 42/Cu Alloy

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	–	–	4.5
A1	0.51	–	–
A2	–	3.3	–
b	0.4	0.5	0.59
b1	1.4	1.5	1.8
b2	0.9	1.0	1.3
c	0.22	0.27	0.34
D	18.8	19.0	19.2
E	6.15	6.3	6.45
e	–	2.5	–
e1	–	7.62	–
L	3.0	–	–
θ	0°	–	15°



Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

RENESAS SALES OFFICES

http://www.renesas.com

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

Renesas Technology Europe Limited.
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

Renesas Technology Europe GmbH
Dornacher Str. 3, D-85622 Feldkirchen, Germany
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

Renesas Technology Hong Kong Ltd.
7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2375-6836

Renesas Technology Taiwan Co., Ltd.
FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

Renesas Technology Singapore Pte. Ltd.
1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Colophon 1.0