

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 μ s UNDER
- Low power consumption

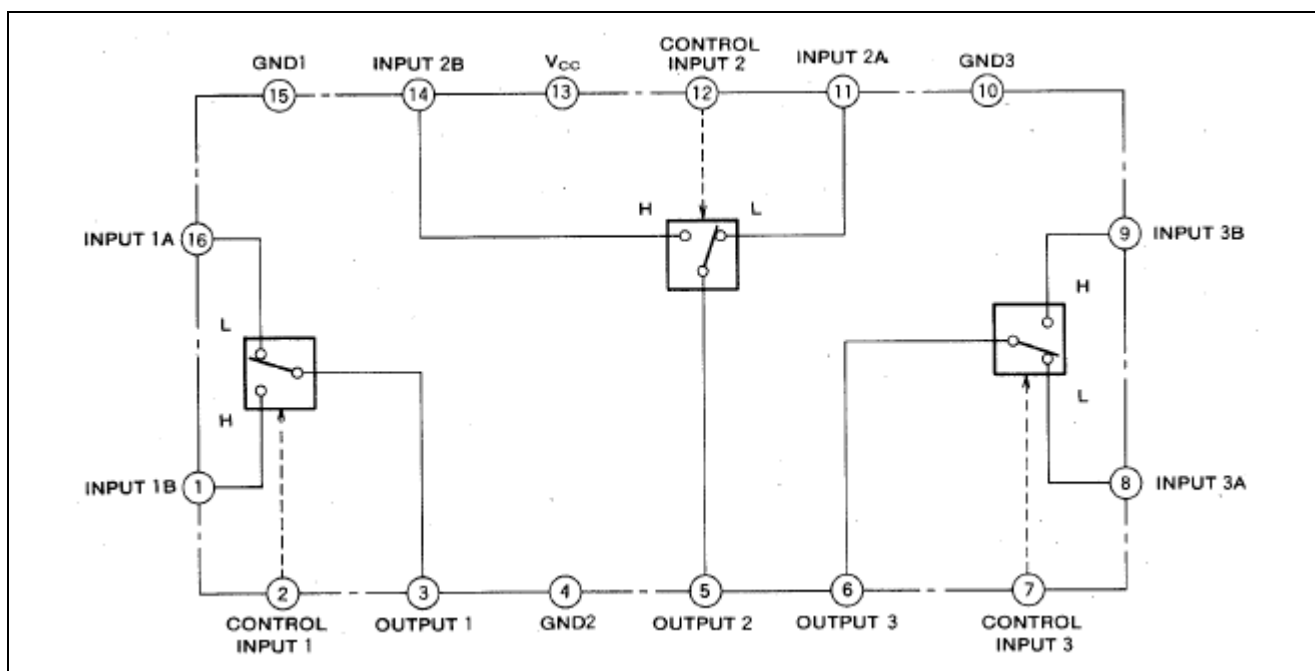
Application

- VCR, AUDIO, and other applications

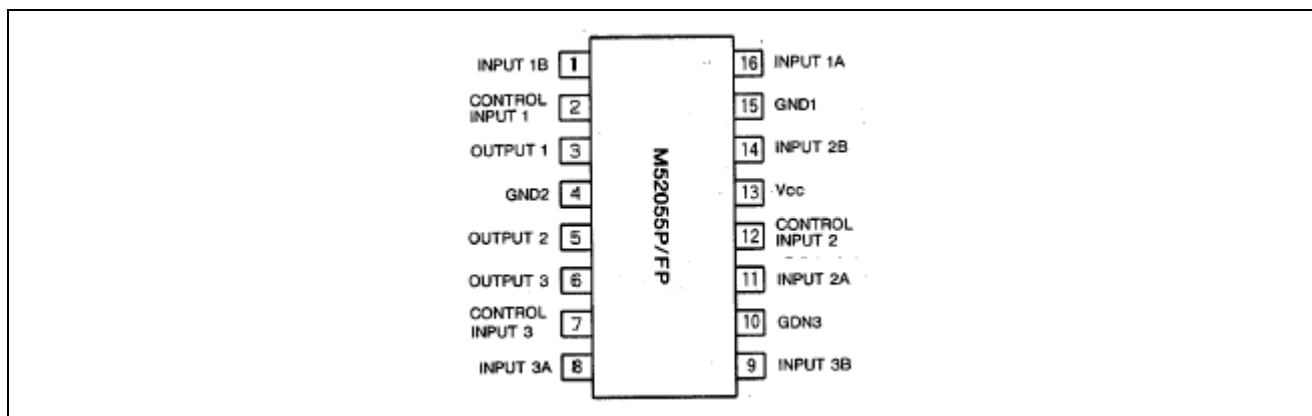
Recommended Operating Condition

- Supply voltage range: 4.5 to 13 V

Block Diagram



Pin Configuration

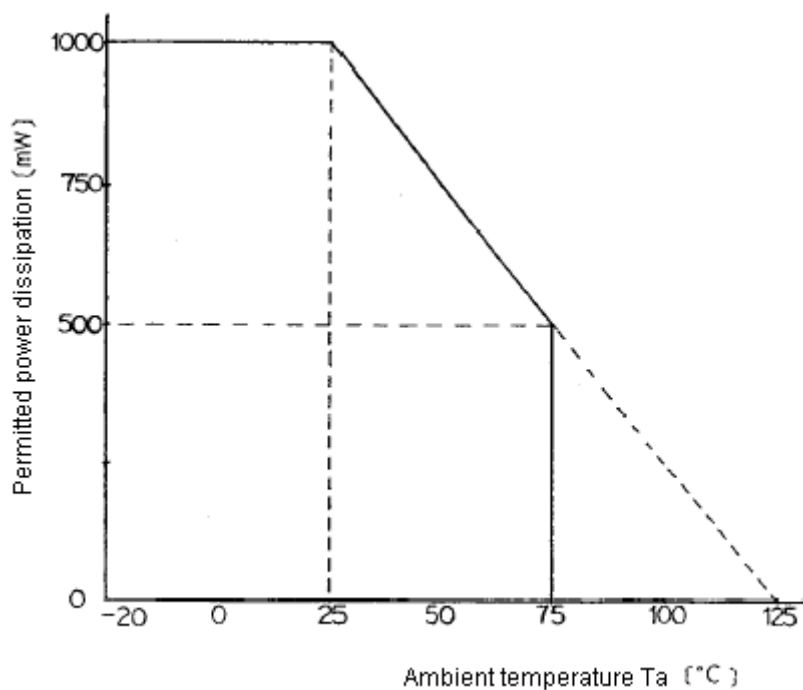


Absolute Maximum Rating

(Unless otherwise noted, $T_a = 25^\circ\text{C}$)

Symbol	Item	Ratings	Units
Vcc	Supply voltage	14	V
Pd	Power dissipation	1000	mW
Topr	Operating ambient temperature	-20 to 75	$^\circ\text{C}$
Tstg	Storing temperature	-40 to 125	$^\circ\text{C}$
k θ	Thermal derating	10	mW/ $^\circ\text{C}$

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 _{CC1}	No signal input. Measure the current flowing into pin 13 .	5.2	7.1	9.0	mA
2	Circuit current 2	I _{CC2}	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	F _{1A}	Input: 0.5-Vpp sine wave (SG1).	-0.6	-0.1	0.4	dB
4	1A, 1B	F _{1B}	Voltage gain at 10-MHz frequency.	-0.6	-0.1	0.4	dB
5	S2 frequency characteristics	F _{2A}	E1, E2 and E3: 5 V.	-0.6	-0.1	0.4	dB
6	2A, 2B	F _{2B}	2-kΩ load connected to output pin.	-0.6	-0.1	0.4	dB
7	S3 frequency characteristics	F _{3A}		-0.6	-0.1	0.4	dB
8	3A, 3B	F _{3B}		-0.6	-0.1	0.4	dB
9	S1 voltage gain	G _{1A}	Input: 0.5-Vpp sine wave (SG1)	-0.6	-0.1	0.4	dB
10	1A, 1B	G _{1B}	Voltage gain at 1-MHz frequency	-0.6	-0.1	0.4	dB
11	S2 voltage gain 2A,	G _{2A}	E1, E2 and E3: 5 V	-0.6	-0.1	0.4	dB
12	2B	G _{2B}		-0.6	-0.1	0.4	dB
13	S3 voltage gain	G _{3A}		-0.6	-0.1	0.4	dB
14	3A, 3B	G _{3B}		-0.6	-0.1	0.4	dB
15	S1 input bias voltage	V _{IDC 1A}	No signal input.	4.1	4.6	5.1	V
16	1A, 1B	V _{IDC 1B}	DC voltage at input pin.	4.1	4.6	5.1	V
17	S2 input bias voltage	V _{IDC 2A}		4.1	4.6	5.1	V
18	2A, 2B	V _{IDC 2B}		4.1	4.6	5.1	V
19	S3 input bias voltage	V _{IDC 3A}		4.1	4.6	5.1	V
20	3A, 3B	V _{IDC 3B}		4.1	4.6	5.1	V
21	S1 output bias voltage	V _{ODC 1}	No signal input.	3.05	3.2	3.35	V
22	S2 output bias voltage	V _{ODC 2}	DC voltage at output pin.	3.05	3.2	3.35	V
23	S3 output bias voltage	V _{ODC 3}	Pins 2, 7 and 12 connected to GND.	3.05	3.2	3.35	V
24	Current flow into control pins	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	1: S1, S2, S3	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	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	2: S1, S2, S3	I _{IN 22}		0	1.5	10	μA
29		I _{IN 23}		0	1.5	10	μA
30	Current flow into control pins	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	3: S1, S2, S3	I _{IN 32}		-5	0	2	μA
32		I _{IN 33}		-5	0	2	μA
33a	Threshold voltage S1,	V _{IC1L}	Input: 0.5-Vpp sine wave, f = 1 MHz (SG1). ^{*1 *2}	1.7	—	2.7	V
33b	S2,	V _{IC1H}		1.7	—	2.7	V
34a		V _{IC2L}		1.7	—	2.7	V
34b	S3	V _{IC2H}		1.7	—	2.7	V
35a		V _{IC3L}		1.7	—	2.7	V
35b		V _{IC3H}		1.7	—	2.7	V

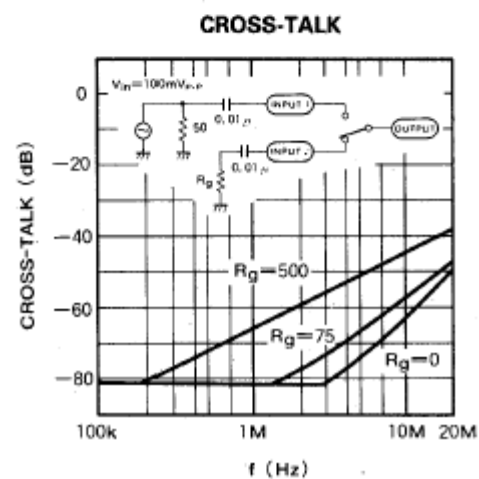
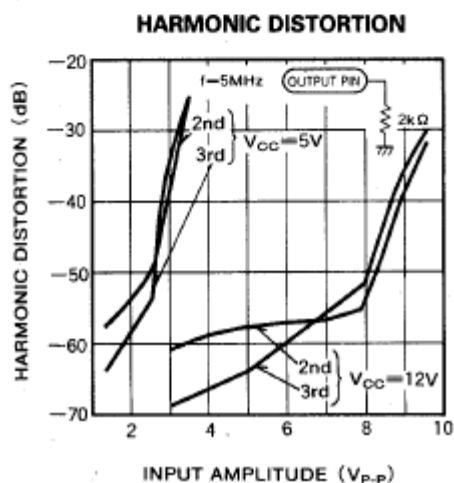
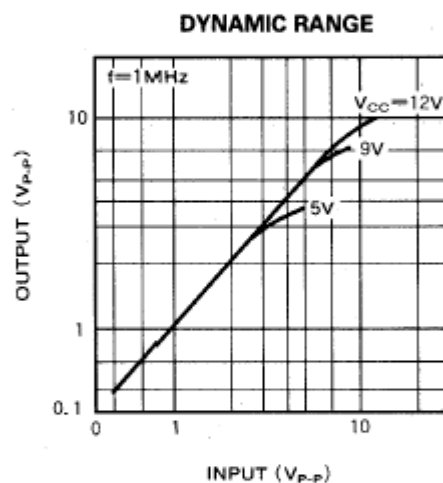
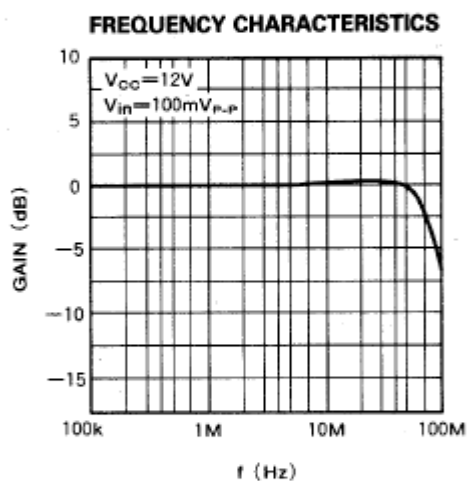
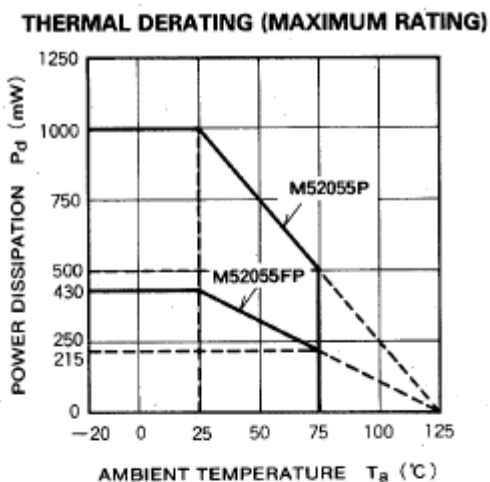
Electrical Characteristics (cont)

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

Electrical Characteristics (cont)

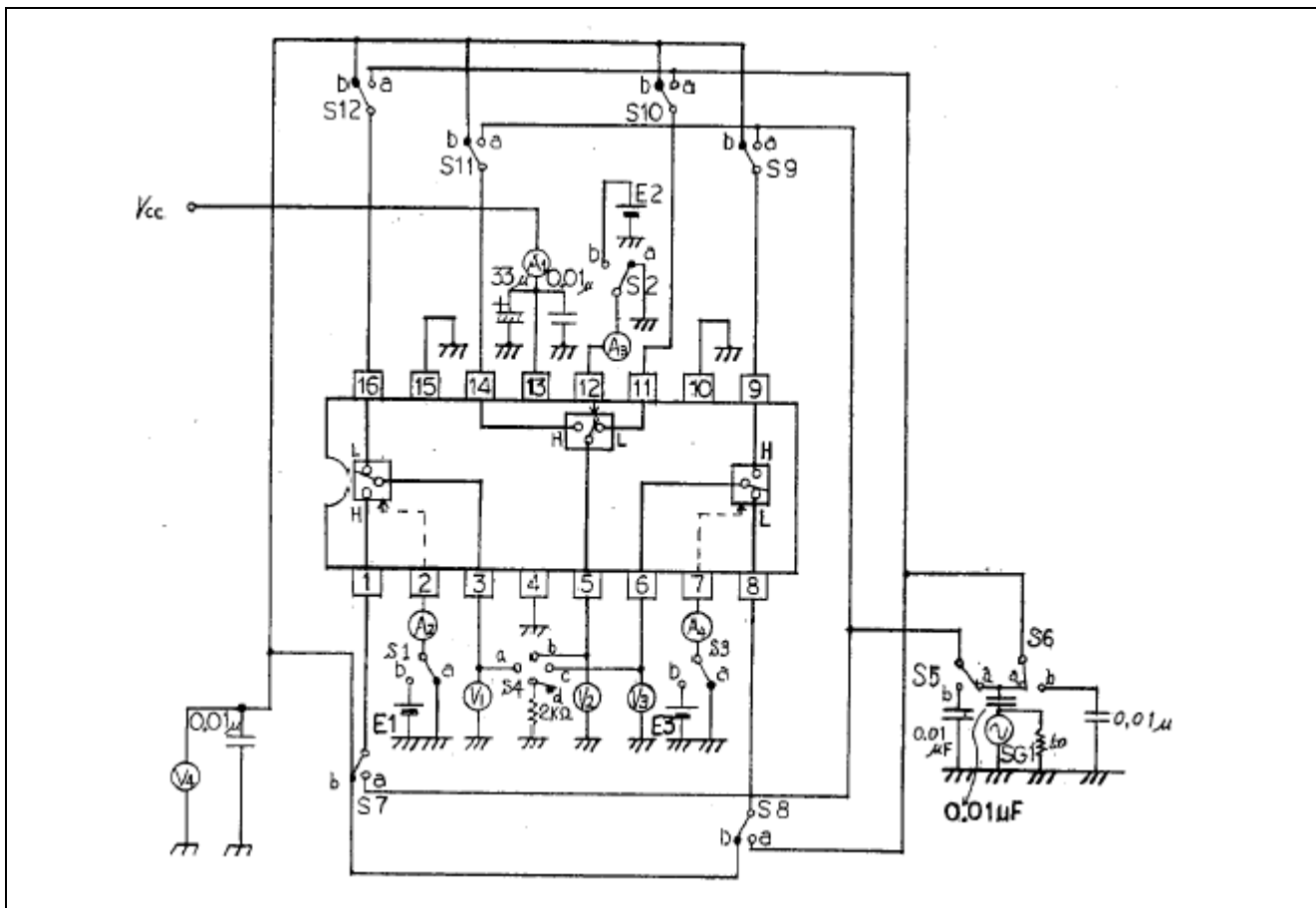
No.	Measurement item	Symbol	Measurement conditions	Limits			Unit
				Min.	Typ.	Max.	
78	S1 output DC offset voltage	V _{OS1}	No signal input. E1, E2 and E3: 5 V.	-10	0	10	mV
79	S2 output DC offset voltage	V _{OS2}	DC voltage difference in output.* ³	-10	0	10	mV
80	S3 output DC offset voltage	V _{OS3}		-10	0	10	mV
81a	Threshold voltage (V _{CC} = 5 V)	V _{IC4L}	Input: 0.5-V _{p-p} sine wave, f = 1	1.3	—	2.3	V
81b	S1, S2, S3	V _{IC4H}	MHz (SG1).	1.3	—	2.3	V
82a		V _{IC5L}	V _{CC} = 5 V.* ⁴ * ⁵	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 (V _{CC} = 12 V)	V _{IC7L}	Input: 0.5-V _{p-p} sine wave, f = 1	2.0	—	3.0	V
84b	S1, S2, S3	V _{IC7H}	MHz (SG1).	2.0	—	3.0	V
85a		V _{IC8L}	V _{CC} = 12 V.* ⁶ * ⁷	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



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 _{CC1}	a	a	a	d	b	b							A ₁
2	I _{CC2}	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)

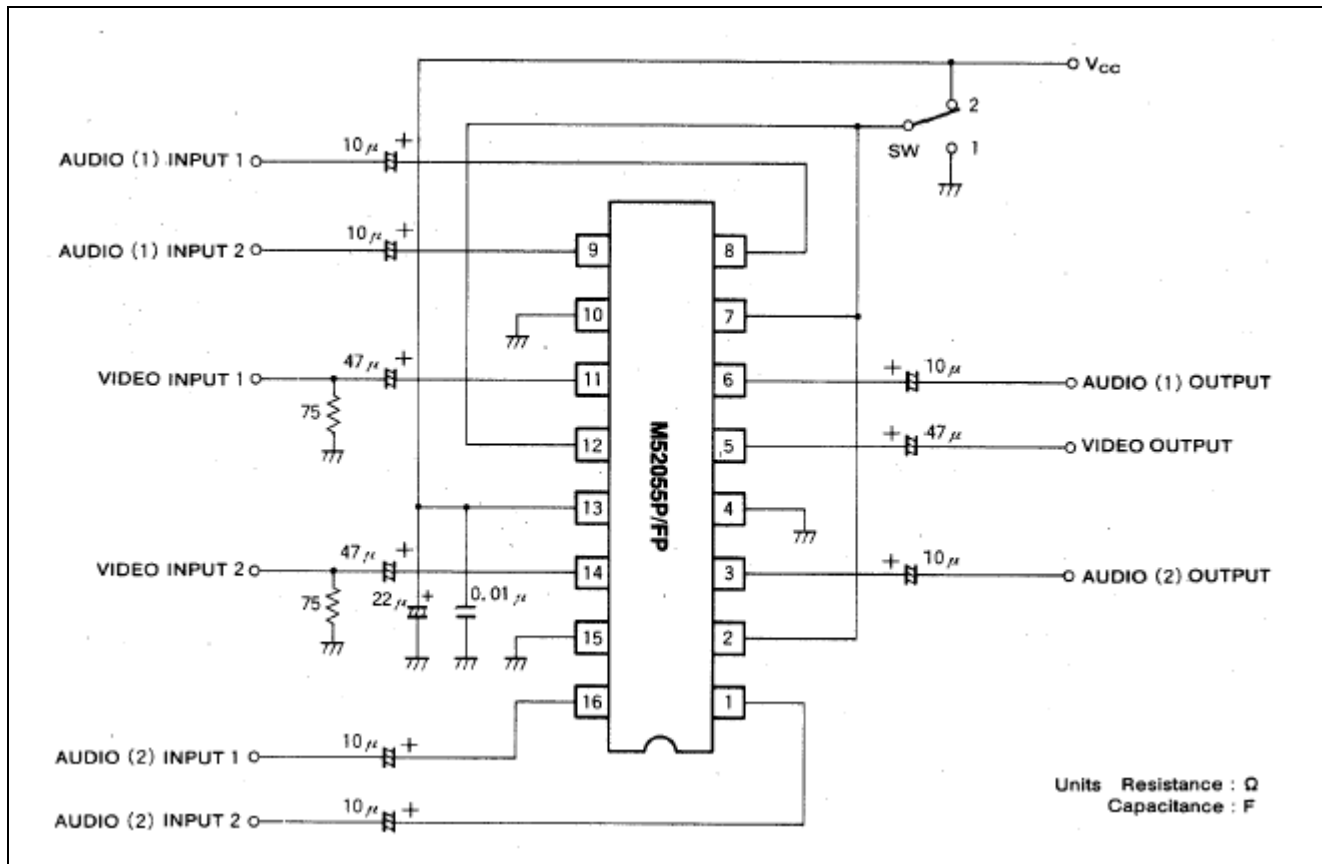
No.	Symbol	Switch status												Point to be measured
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	
42	THD1A	a			d	b	a	b	b	b	b	b	a	V ₁
43	THD1B	b			d	a	b	a	b	b	b	b	b	V ₁
44	THD2A		a		d	b	a	b	b	b	a	b	b	V ₂
45	THD2B		b		d	a	b	b	b	b	b	a	b	V ₂
46	THD3A			a	d	b	a	b	a	b	b	b	b	V ₃
47	THD3B			b	d	a	b	b	b	a	b	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 _{os1}	a b			d	b	b	a	b	b	b	b	a	V ₁ ^{Note3}
79	V _{os2}		a b		d	b	b	b	b	b	a	a	b	V ₂ ^{Note3}
80	V _{os3}			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}

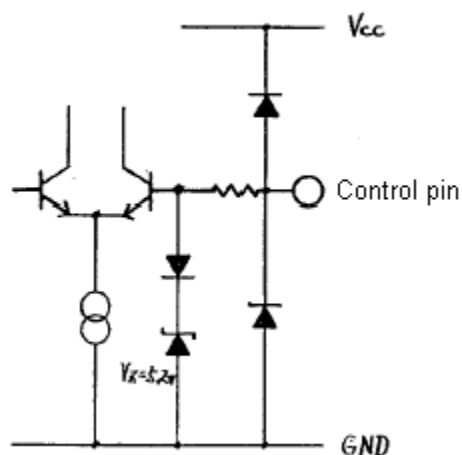
- Notes: 1. For V_{IC1L}, V_{IC2L} and V_{IC3L}, respectively read the E₁, E₂ and E₃ voltage when their output amplitudes are 0.5 dB smaller than those of V₁, V₂ and V₃ in measuring G_{1A} in No. 9, G_{2A} in No. 11 and G_{3A} in No. 13.
2. For V_{IC1H}, V_{IC2H} and V_{IC3H}, respectively read the E₁, E₂ and E₃ voltage when their output amplitudes are 0.5 dB smaller than those of V₁, V₂ and V₃ 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. V_{CC} = 5 V.
For V_{IC4L}, V_{IC5L} and V_{IC6L}, respectively read the E₁, E₂ and E₃ voltage when their output amplitudes are 1.0 dB smaller than those of V₁, V₂ and V₃ in measuring G_{1A} in No. 9, G_{2A} in No. 11 and G_{3A} in No. 13.
5. V_{CC} = 5 V.
For V_{IC4H}, V_{IC5H} and V_{IC6H}, respectively read the E₁, E₂ and E₃ voltage when their output amplitudes are 1.0 dB smaller than those of V₁, V₂ and V₃ in measuring G_{1B} in No. 10, G_{2B} in No. 12 and G_{3B} in No. 14.
6. Same as 4 above except V_{CC} = 12 V.
7. Same as 5 above except V_{CC} = 12 V.

Application Example



USAGE NOTES

1. The input impedance is 20 k Ω (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 μ A
9V	380 μ A
12 V	530 μ A

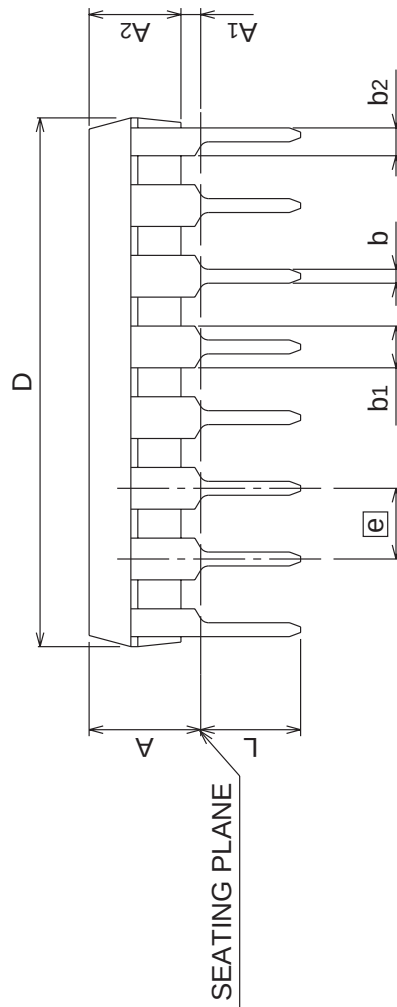
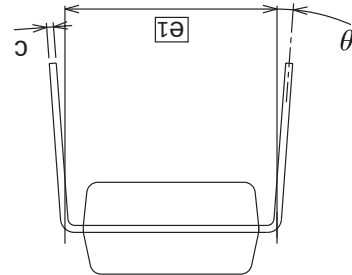
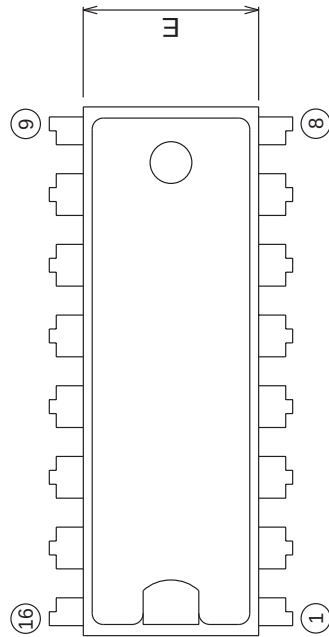
Package Dimensions

16P4

MMP

Plastic 16pin 300mil DIP

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°