

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

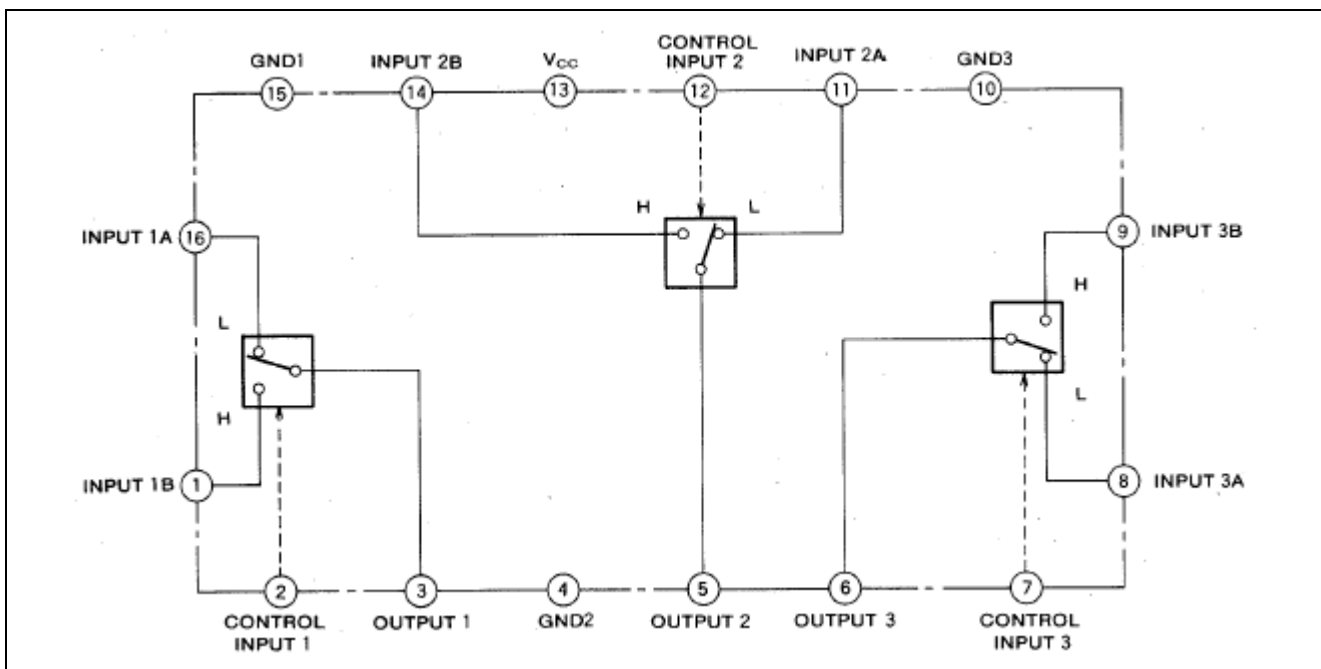
Application

- VCR, AUDIO, and other applications

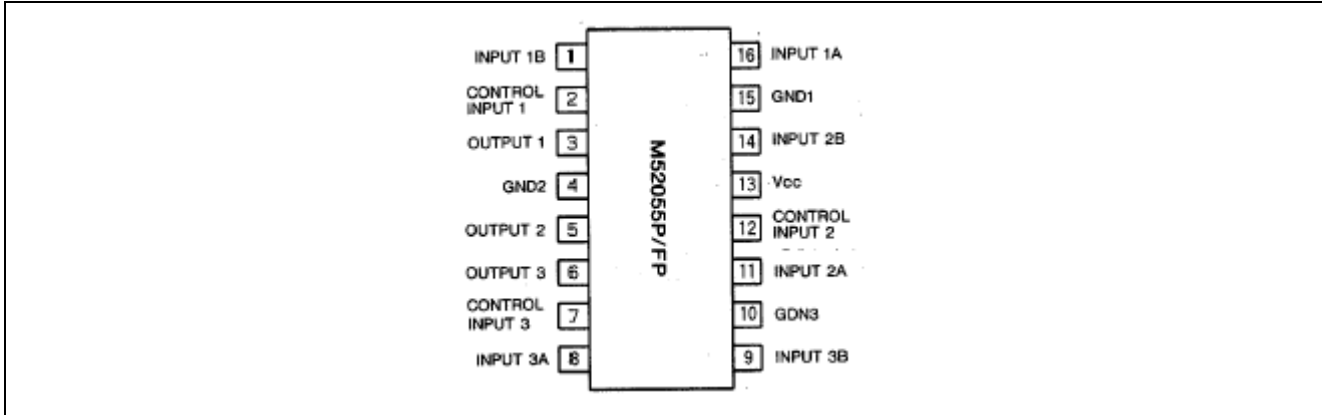
Recommended Operating Condition

- Supply voltage range: 4.5 to 13 V

Block Diagram



Pin Configuration

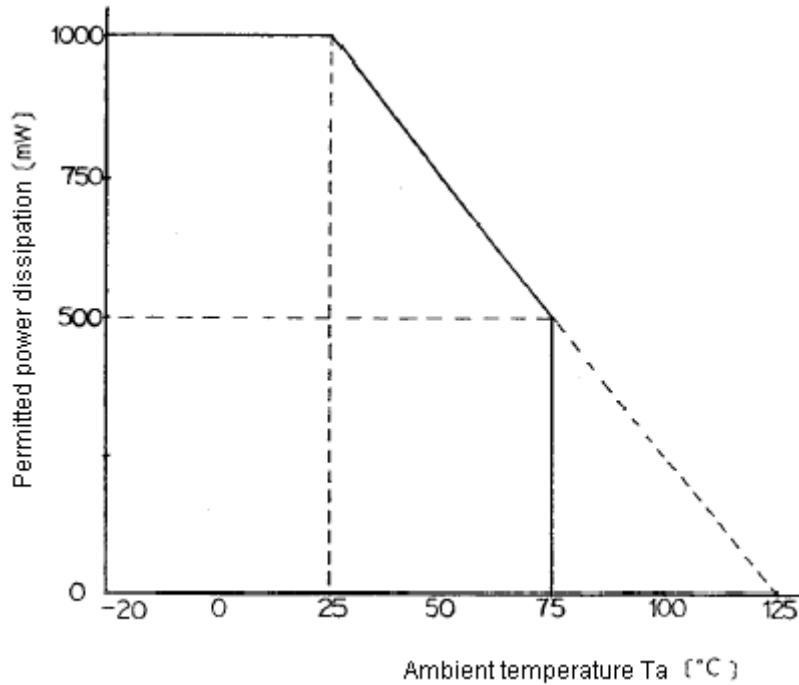


Absolute Maximum Rating

(Unless otherwise noted, 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 (T_a) = 25°C, power supply voltage (V_{CC}) = 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 $V_{CC} = 5$ 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-k Ω 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, | 0.35 | 0.6 | 1 | mA |
| 25 | 1: S1, S2, S3 | $I_{IN 12}$ | 7 and 12 when these pin voltage is 9 V. | 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, | 0 | 1.5 | 10 | μ A |
| 28 | 2: S1, S2, S3 | $I_{IN 22}$ | 7 and 12 when these pin voltage is 5 V. | 0 | 1.5 | 10 | μ A |
| 29 | | $I_{IN 23}$ | | 0 | 1.5 | 10 | μ A |
| 30 | Current flow into control pins | $I_{IN 31}$ | Current flow into each of pins 2, | -5 | 0 | 2 | μ A |
| 31 | 3: S1, S2, S3 | $I_{IN 32}$ | 7 and 12 when these pin voltage is 0 V. | -5 | 0 | 2 | μ A |
| 32 | | $I_{IN 33}$ | | -5 | 0 | 2 | μ A |
| 33a | Threshold voltage S1, | V_{IC1L} | Input: 0.5-Vpp sine wave, $f = 1$ | 1.7 | — | 2.7 | V |
| 33b | S2, | V_{IC1H} | MHz (SG1). ^{*1 *2} | 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)

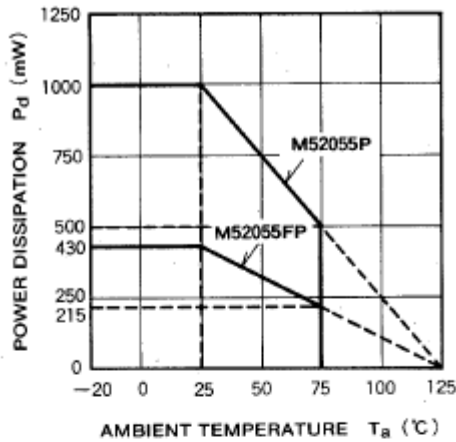
| No. | Measurement item | Symbol | Measurement conditions | Limits | | | Unit |
|-----|------------------------------------|-----------------|--|--------|------|------|------|
| | | | | Min. | Typ. | Max. | |
| 36 | S1 2nd harmonic distortion 1A, | H _{1A} | Input: 4.5-Vpp sine wave, f = 5 MHz (SG1). | — | -60 | -50 | dB |
| 37 | 1B | H _{1B} | | — | -60 | -50 | |
| 38 | S2 2nd harmonic distortion 2A, | H _{2A} | E1, E2 and E3: 5 V Voltage ratio of 10-MHz output element against 5-MHz output element | — | -60 | -50 | dB |
| 39 | 2B | H _{2B} | | — | -60 | -50 | |
| 40 | S3 2nd harmonic distortion 3A | H _{3A} | 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 | |
| 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 | |
| 52 | S3 crosstalk | CT31 | E1, E2 and E3: 5 V | — | -70 | -60 | dB |
| 53 | 3B-3A, 3A-3B | CT32 | | — | -70 | -60 | |
| 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 | |
| 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 | |
| 58 | 2A-1B, | CT17 | E1, E2 and E3: 5 V | — | -70 | -60 | dB |
| 59 | 2B-1B, | CT18 | | — | -70 | -60 | |
| 60 | 3A-1B, | CT19 | | — | -70 | -60 | |
| 61 | 3B-1B | CT1A | | — | -70 | -60 | |
| 62 | S2 crosstalk between channels | CT23 | | — | -70 | -60 | dB |
| 63 | 1A-2A, 1B-2A, 3A-2A, 3B-2A | CT24 | | — | -70 | -60 | |
| 64 | | CT25 | | — | -70 | -60 | |
| 65 | | CT26 | | — | -70 | -60 | |
| 66 | 1A-2B, | CT27 | | — | -70 | -60 | dB |
| 67 | 1B-2B, | CT28 | | — | -70 | -60 | |
| 68 | 3A-2B, | CT29 | | — | -70 | -60 | |
| 69 | 3B-2B | CT2A | | — | -70 | -60 | |
| 70 | S3 crosstalk between channels | CT33 | | — | -70 | -60 | dB |
| 71 | 1A-3A, 1B-3A, 2A-3A, 2B-3A | CT34 | | — | -70 | -60 | |
| 72 | | CT35 | | — | -70 | -60 | |
| 73 | | CT36 | | — | -70 | -60 | |
| 74 | 1A-3B, | CT37 | | — | -70 | -60 | dB |
| 75 | 1B-3B, | CT38 | | — | -70 | -60 | |
| 76 | 2A-3B, | CT39 | | — | -70 | -60 | |
| 77 | 2B-3B | CT3A | | — | -70 | -60 | |

Electrical Characteristics (cont)

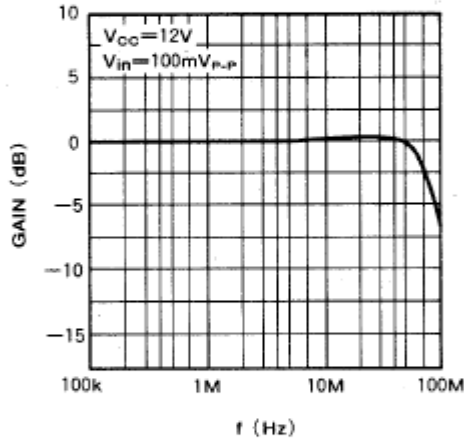
| No. | Measurement item | Symbol | Measurement conditions | Limits | | | Unit |
|-----|--------------------------------------|------------|--|--------|------|------|------|
| | | | | Min. | Typ. | Max. | |
| 78 | S1 output DC offset voltage | V_{OS1} | No signal input. E1, E2 and E3: 5 V. | -10 | 0 | 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-Vp-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-Vp-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

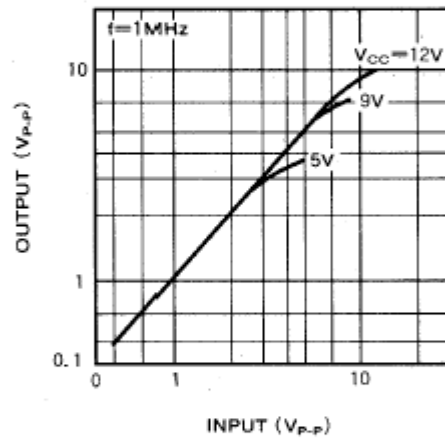
THERMAL DERATING (MAXIMUM RATING)



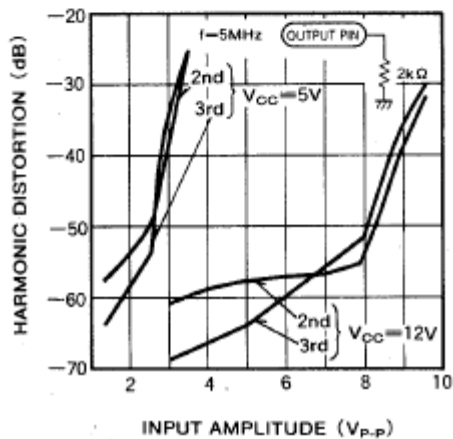
FREQUENCY CHARACTERISTICS



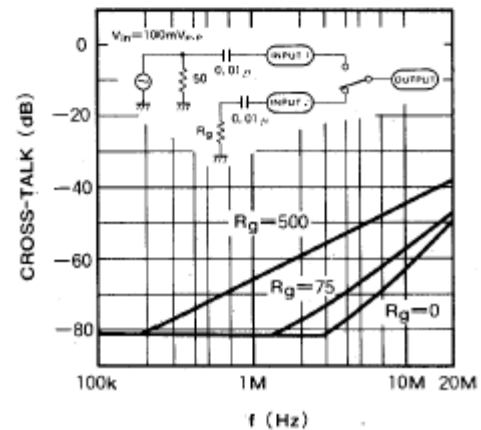
DYNAMIC RANGE



HARMONIC DISTORTION

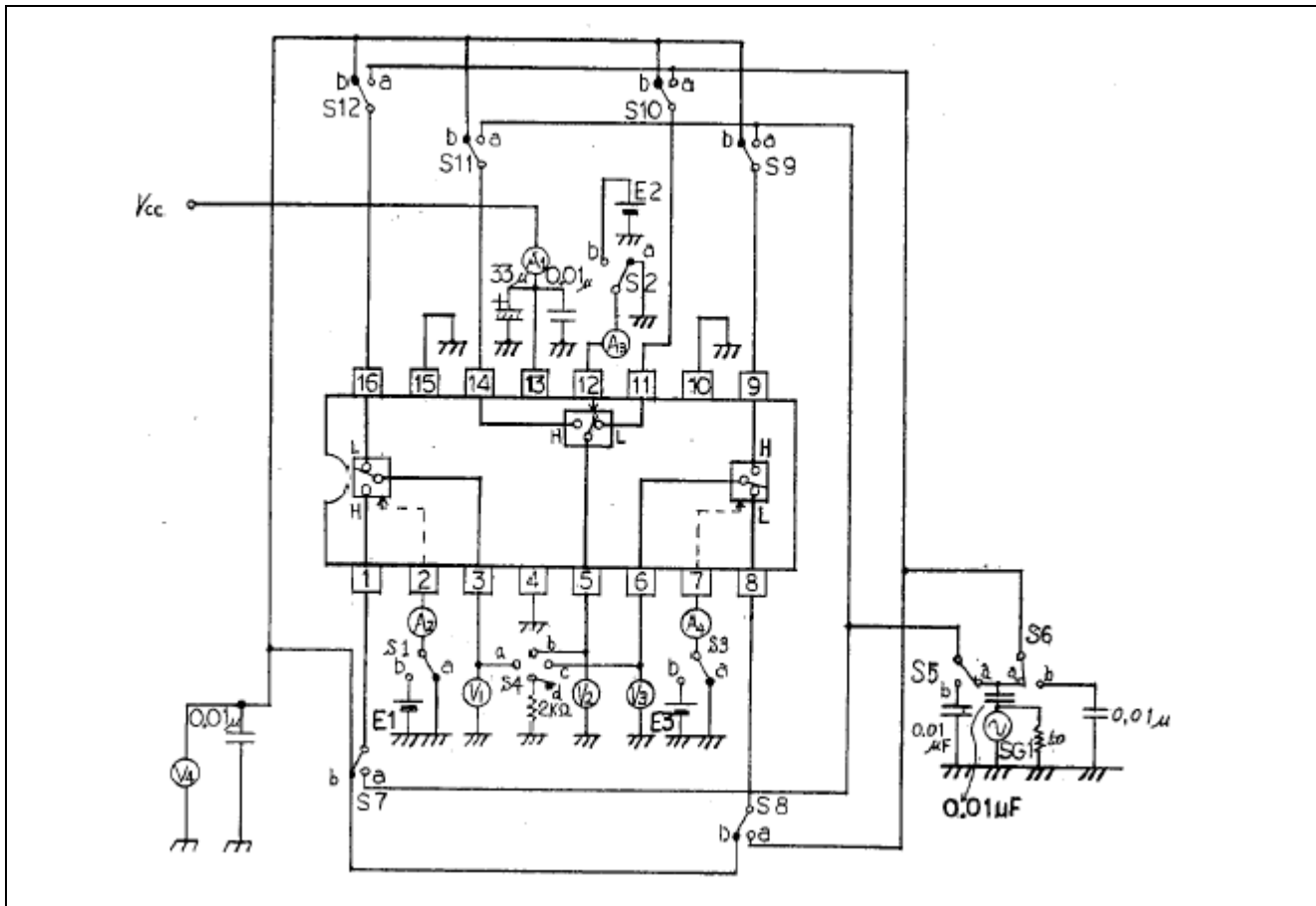


CROSS-TALK



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 _{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)

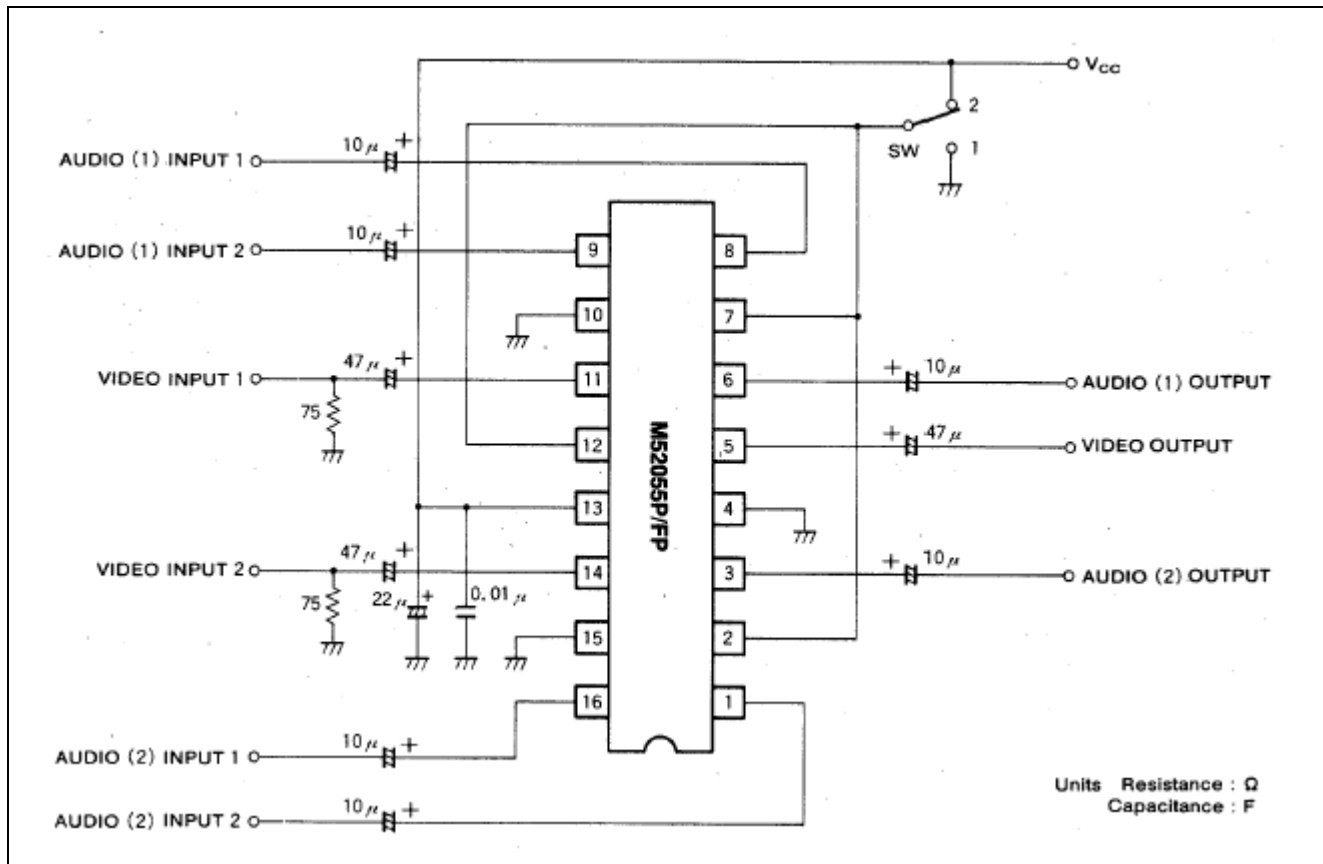
| No. | Symbol | Switch status | | | | | | | | | | | | Point to be measured |
|-----|------------------|---------------|----|----|----|----|----|----|----|----|-----|-----|-----|---------------------------------|
| | | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | |
| 42 | THD1A | a | | | 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 | | | d | b | b | a | b | b | b | b | a | V ₁ ^{Note3} |
| | | b | | | | | | | | | | | | |
| 79 | V _{os2} | | a | | d | b | b | b | b | b | a | a | b | V ₂ ^{Note3} |
| | | | b | | | | | | | | | | | |
| 80 | V _{os3} | | | a | d | b | b | b | a | a | b | b | b | V ₃ ^{Note3} |
| | | | | b | | | | | | | | | | |

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} |

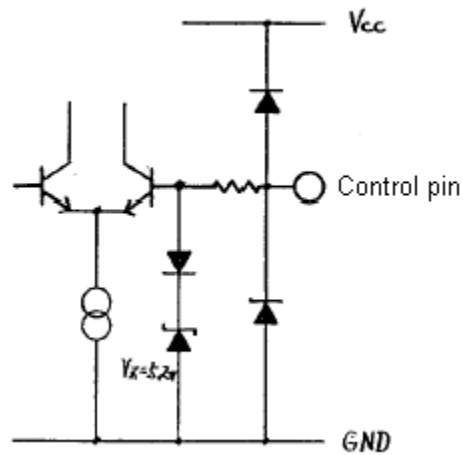
- Notes:
- For V_{IC1L}, V_{IC2L} and V_{IC3L}, respectively read the E₁, E₂ and E₃ voltage when their output amplitudes are 0.5 dB smaller than those of V₁, V₂ and V₃ in measuring G_{1A} in No. 9, G_{2A} in No. 11 and G_{3A} in No. 13.
 - For V_{IC1H}, V_{IC2H} and V_{IC3H}, respectively read the E₁,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

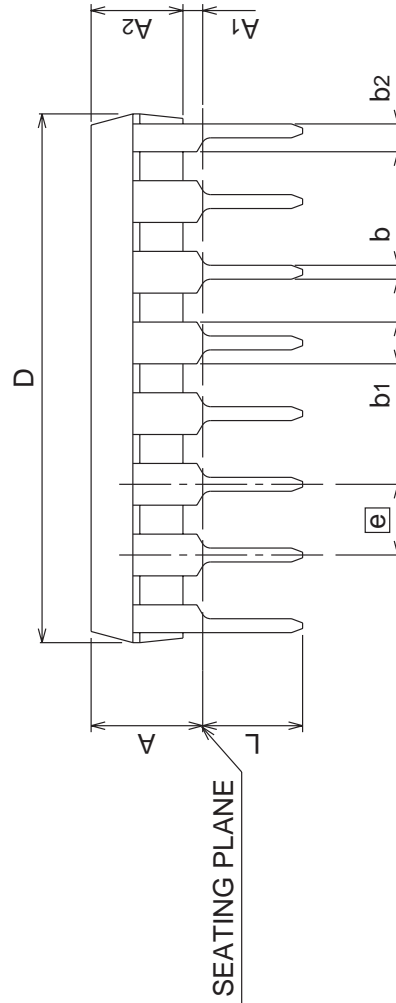
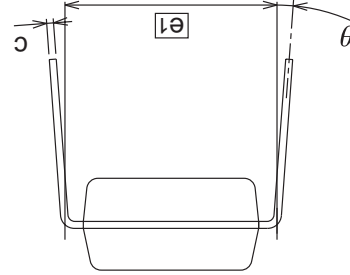
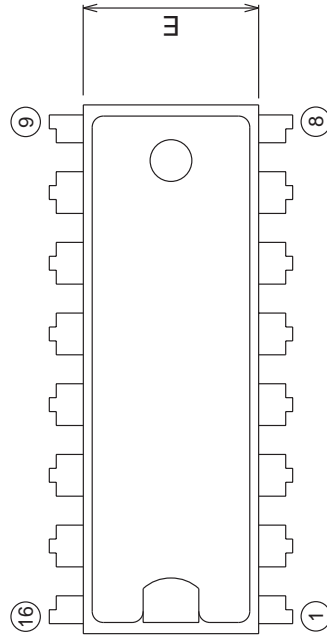
Package Dimensions

16P4

MMP

Plastic 16pin 300mil DIP

| | | | |
|---------------------------------------|-----------------|------------------|------------------------------------|
| EIAJ Package Code DIP16-P-300-2.54 | JEDEC Code - | Weight(g) 1.0 | Lead Material 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 | - |
| ei | - | 7.62 | - |
| L | 3.0 | - | - |
| theta | 0° | - | 15° |

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

Keep safety first in your circuit designs!

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.
The information described here may contain technical inaccuracies or typographical errors.
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (<http://www.renesas.com>).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.



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