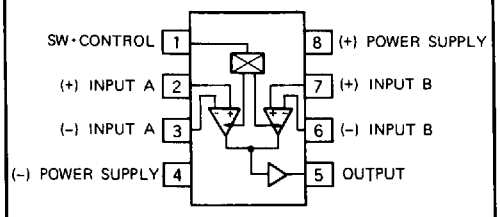
M5203AP

HIGH-SPEED SWITCH OPERATIONAL AMPLIFIER (2-INPUT, 1-OUTPUT)

DESCRIPTION

The M5203AP is a semiconductor integrated circuit with analog switching functions that equips two input channel (A and B) and one output terminal. Two channels of input differential circuits (A and B), one output circuit, and one switch circuit for the operational amplifier are contained in an 8-pin SIP or DIP or 8-pin DIP mini-flat (SOP type) package. By externally setting the control pin to HIGH or LOW, either input A or input B will be enabled, allowing you to operate the device as an existing operational amplifier. Under the voltage follower condition of G_V is equal to 0 dB, the device can be used as a simple analog switch or an amplifier with switching functions where the gain setting for (A and B) can be done separately. As for the basic characteristics of the device, it has almost the same performance as that of M5260, therefore, it is best applicable for wide range of electrical systems such as audios, videos, and music instruments.

PIN CONFIGURATION (TOP VIEW)



Outline 8P4

FEATURES

- Has two input channel (A and B) for which the gain can be set independently.
- Can use single or dual-power supply.
- High gain and low distortion
  ·····G_{VO}=110dB, THD=0.002% (typ.)
- High slew rate, high f_T
  ·····SR=4V/μsec., f_T=14MHz (typ.)
- Low noise (R_S = 1kΩ) FLAT ·····V_{NI}=2μVrms (typ.)
- Small switching shock noise
- High load current, high power dissipation
  ····· I_{LP} = ±50mA, P_d = 800mW (SIP)
  P_d = 625mW (DIP)
  P_d = 440mW (FP)

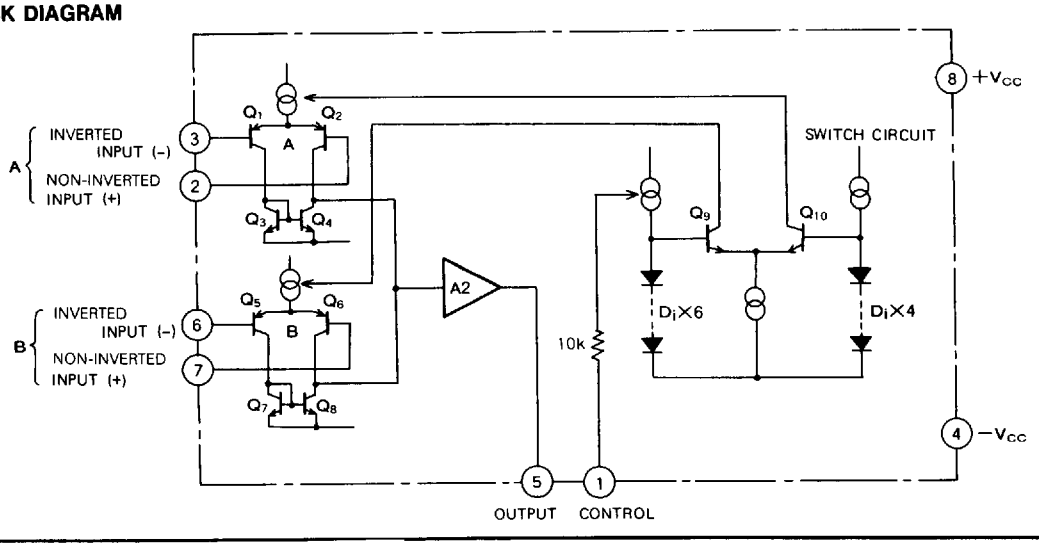
APPLICATION

General amplifiers for compact disk units, VCRs, video disk players, or OA equipments and various operational circuits in general electrical devices, servo amplifiers, and active filters

RECOMMENDED OPERATING CONDITION

Supply voltage range ..... ±2.5 ~ 16V
Rated supply voltage ..... ±15V

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

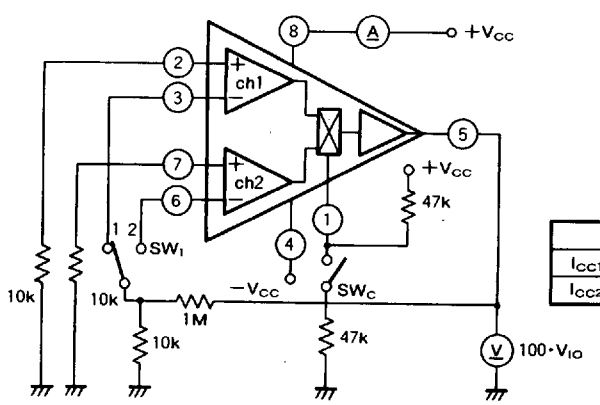
Symbol	Parameter	Ratings	Unit
V_{CC}	Supply voltage	±18(36)	V
V_{id}	Differential input voltage	±30	V
V_{ic}	Common input voltage	±15	V
I_{LP}	Load current	±50	mA
P_d	Power dissipation	800(SIP)/625(DIP)/440(FP)	mW
Topr	Operating temperature	−20～75	℃
Tstg	Storage temperature	−55～125	℃

ELECTRICAL CHARACTERISTICS (V_{CC} = ±15V)

Symbol	Parameter	Test conditions		Limits			Unit
				Min.	Typ.	Max.	
I_{CC}	Circuit current	V_{in}	SW ON		2.3	6.0	mA
			SW OFF		2.1	6.0	
V_{IO}	Input offset voltage	R_S = 10kΩ			0.8	6.0	mV
I_B	Input bias current				0.2	1.0	μA
G_{VO}	Open voltage gain	R_L = 2kΩ			110		dB
V_{OM}	Maximum output voltage	R_L ≧ 10kΩ		±12	±14		V
THD	Total harmonic distortion	f = 1kHz, V_O = 5Vrms, G_V = 20dB			0.002		%
SVR	Supply voltage rejection ratio				20	150	μV/V
CS	Channel separation	f = 1kHz			82		dB
f_T	Gain-band width product	G_V = 0dB			14		MHz
SR	Slewing rate	G_V = 0dB, R_L = 2kΩ // 100pF			4		V/μs
V_{NI}	Noise voltage	R_S = 1kΩ, BW = 10Hz～30kHz, Flat			2.0		μVrms

TEST CIRCUIT

(1) I_{CC}, V_{IO}, SVR



	SW_C	SW_1	Select ch
I_{CC1}, V_{IO1}, SVR_1	OFF	1	ch1
I_{CC2}, V_{IO2}, SVR_2	ON	2	ch2

Unit Resistance: Ω
Capacitance: F

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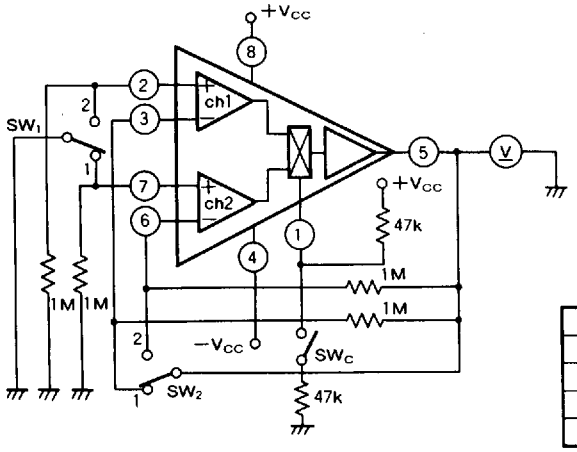
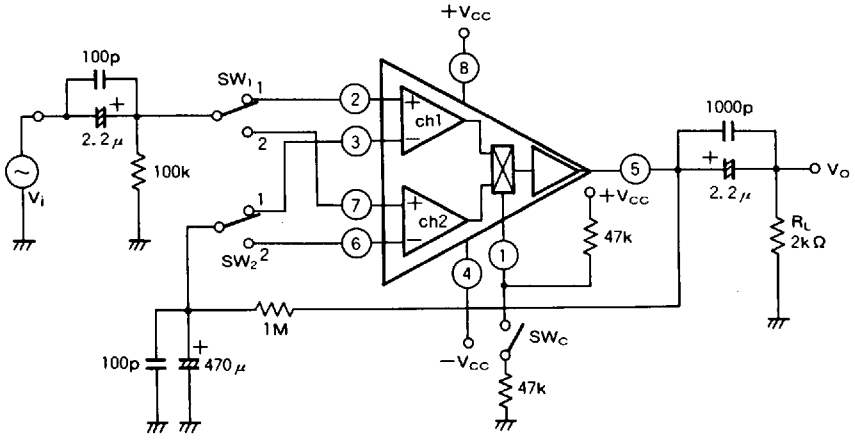
(2) I_B, I_{IO}



$I_B^+ = V_O^+ / 1M\Omega$
$I_B^- = V_O^- / 1M\Omega$
$I_{IO} = | I_B^+ - I_B^- |$

	SW_C	SW_1	SW_2	Select ch
V_{O1}	OFF	1	1	ch1
V_{O1}	OFF	2	2	ch1
V_{O2}	ON	2	2	ch2
V_{O2}	ON	1	1	ch2

(3) f_T, G_V



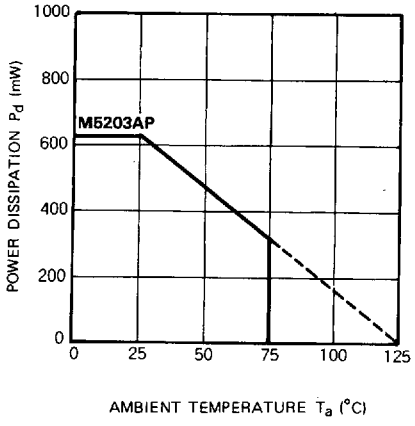
	SW_C	SW_1	SW_2	Select ch
f_{T1}, G_{V1}	OFF	1	1	ch1
f_{T2}, G_{V2}	ON	2	2	ch2

Unit Resistance: Ω
Capacitance: F

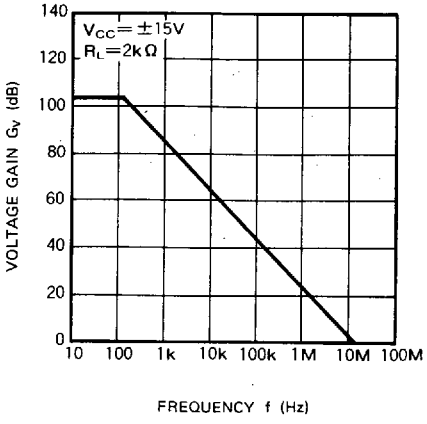
HIGH-SPEED SWITCH OPERATIONAL AMPLIFIER (2-INPUT, 1-OUTPUT)

TYPICAL CHARACTERISTICS

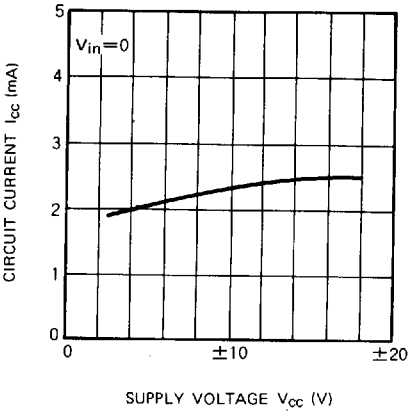
THERMAL DERATING (MAXIMUM RATING)



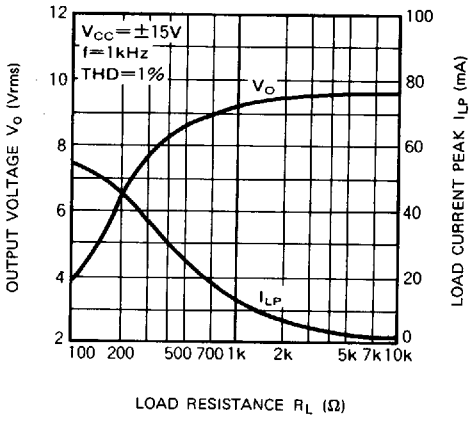
VOLTAGE GAIN VS. FREQUENCY RESPONSE



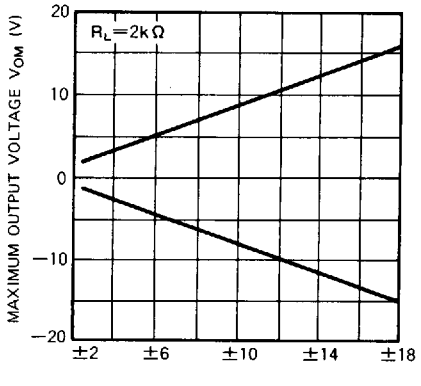
CIRCUIT CURRENT VS. SUPPLY VOLTAGE



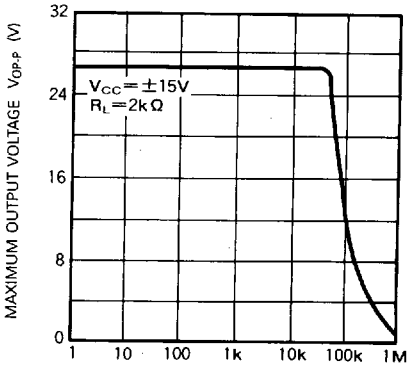
OUTPUT VOLTAGE/LOAD CURRENT PEAK VS. LOAD RESISTANCE



MAXIMUM OUTPUT VOLTAGE VS. SUPPLY VOLTAGE



MAXIMUM OUTPUT VOLTAGE VS. FREQUENCY RESPONSE



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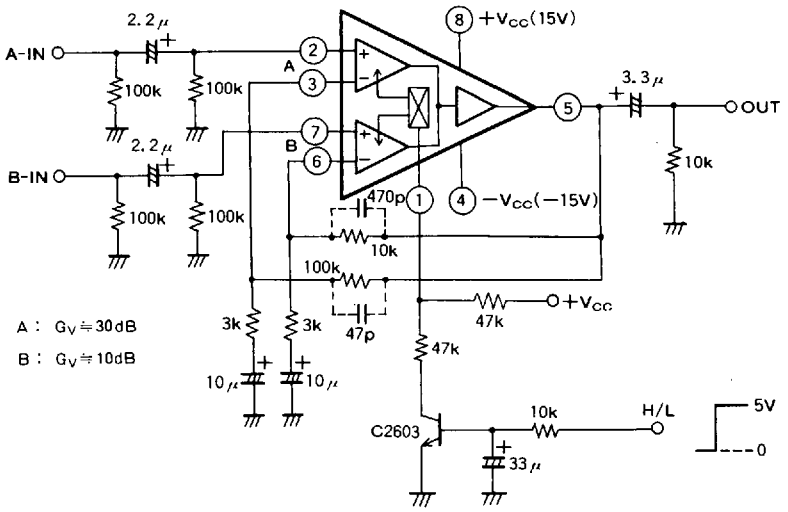
TYPICAL APPLICATION EXAMPLE

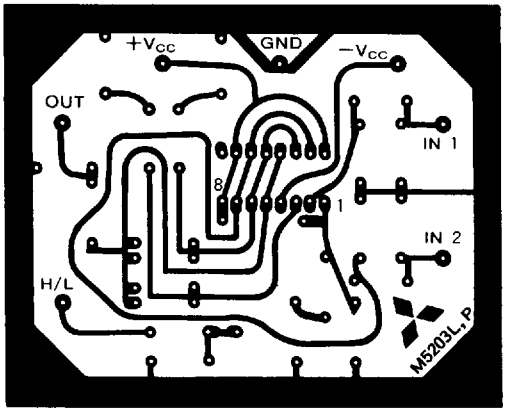


※ When the current is present on control pin ⑦, chB is active. When the current is not present on control pin ⑦, chA is active.

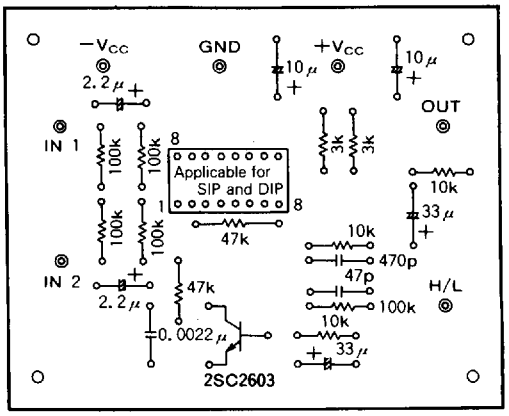
Unit Resistance: Ω
Capacitance: F

PCB FOR CIRCUIT TESTING

WIRING ON THE PCB



(PARTS INSERTION SIDE)



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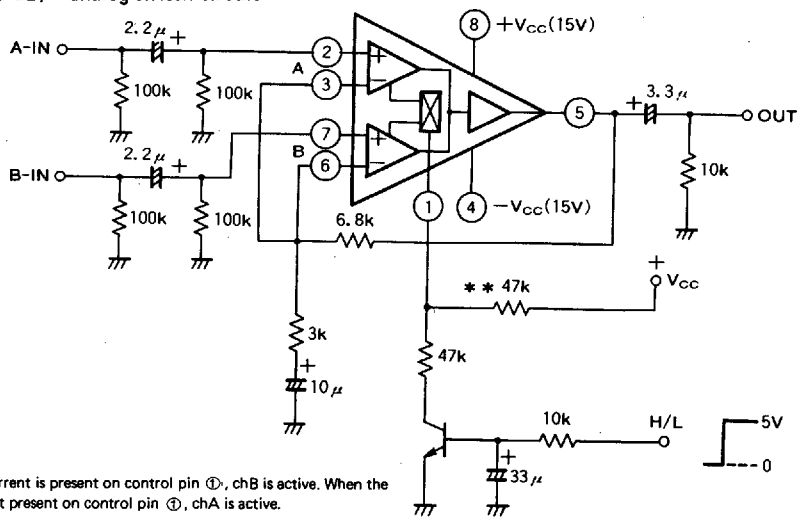
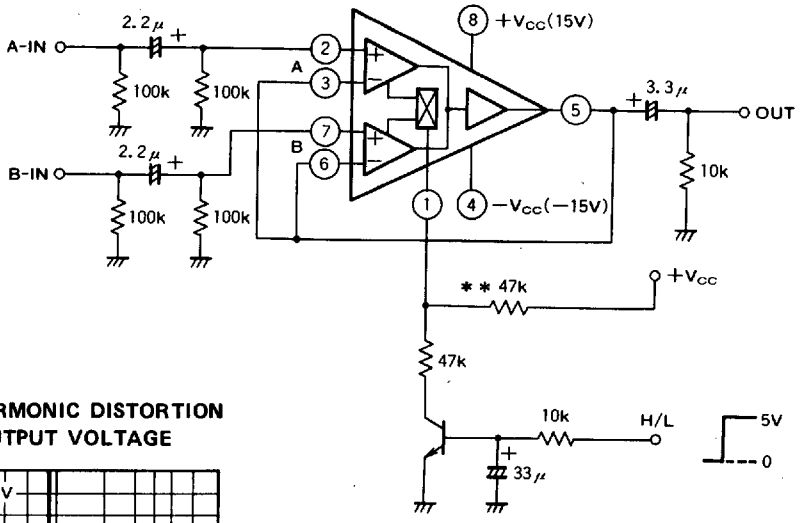
APPLICATION EXAMPLES

(1) FLAT amplifier ($G_V \fallingdotseq 10$ dB) + analog switch circuit



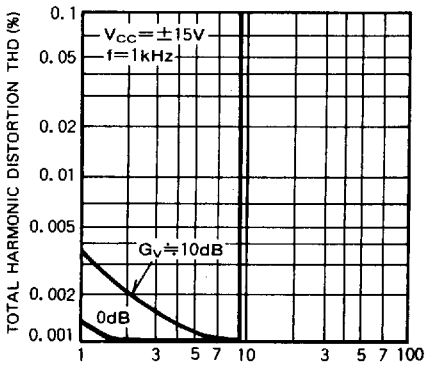
* When the current is present on control pin ①, chB is active. When the current is not present on control pin ①, chA is active.

(2) Analog switch circuit (G_V = 0 dB, voltage follower amplifier)



A resistor indicated by ** is a pull-up resistor to prevent switching pin ① from being activated by the leak current from an external circuit (i.e. TR).

TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE



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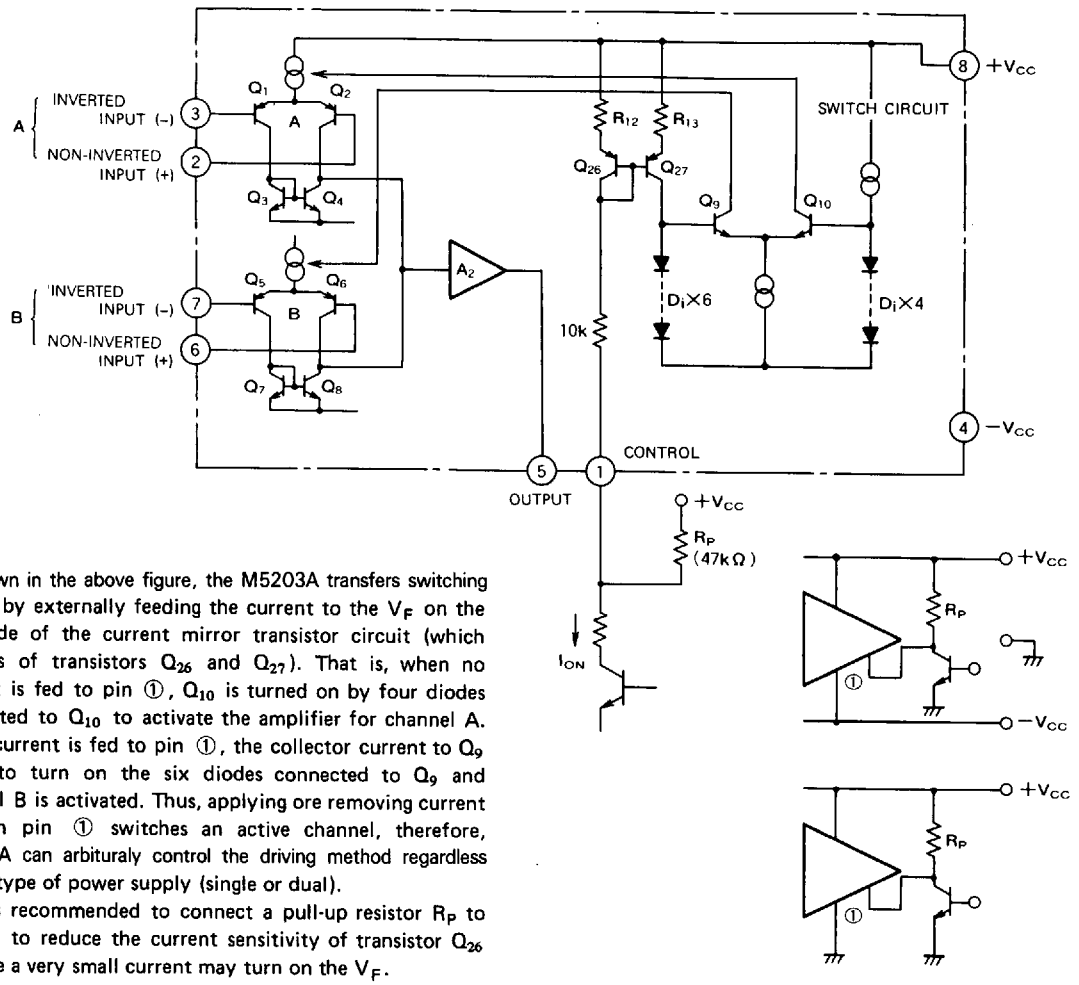
SWITCHING MECHANISM



As shown in the above figure, the M5203A transfers switching signals by externally feeding the current to the V_F on the Q_{26} side of the current mirror transistor circuit (which consists of transistors Q_{26} and Q_{27}). That is, when no current is fed to pin ①, Q_{10} is turned on by four diodes connected to Q_{10} to activate the amplifier for channel A. When current is fed to pin ①, the collector current to Q_9 flows to turn on the six diodes connected to Q_9 and channel B is activated. Thus, applying ore removing current to/from pin ① switches an active channel, therefore, M5203A can arbituraly control the driving method regardless of the type of power supply (single or dual).

It is recommended to connect a pull-up resistor R_P to pin ① to reduce the current sensitivity of transistor Q_{26} because a very small current may turn on the V_F.