M5236L, ML

GENERAL PURPOSE 3-TERMINAL VARIABLE VOLTAGE OUTPUT REGULATOR (FOR DRIVER)

DESCRIPTION

The M5236 is a semiconductor integrated circuit designed for general-purpose output voltage regulator.

A high-performance variable output voltage regulator with small input-output voltage differences can be made in combination with externally connected PNP transistors.

It is housed in a small 3-pin package, including a reference voltage circuit, error amplifier, and driver, and the output voltage can be set freely by externally connected resistors, and a small, compact power supply circuit can be achieved, making the device suitable for use in small electronic equipment, such as car stereo, radio cassette recorder and portable stereo equipment.

FEATURES

- Wide operating voltage range ························ V_{IN}=3.5V~36V, V_O=1.5V~33V
- Capable of operating at low input-output voltage for driver by externally connected power transistors [$V_{CE(sat)}$ state of TR] ························ $V_{I-O(min)} \doteqdot 0.2V$
- Output voltage can be set freely by externally connected resistors
- Built-in ASO protection and thermal cutoff circuits
- Capable of taping (automated insertion) and lead forming

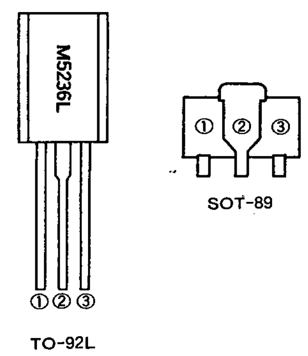
APPLICATION

For car stereo equipment, radio casette recorder, portable stereo and other general electronic equipment.

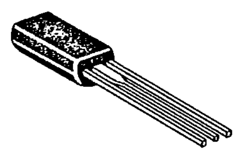
RECOMMENDED OPERATING CONDITIONS

Supply voltage range ························ V_{IN}=3.5V~30V
Rated supply voltage ························ V_O=1.5V~25V

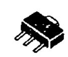
PIN CONFIGURATION



PIN CONNECTION
① INPUT
② GND
③ VOLTAGE ADJUSTMENT

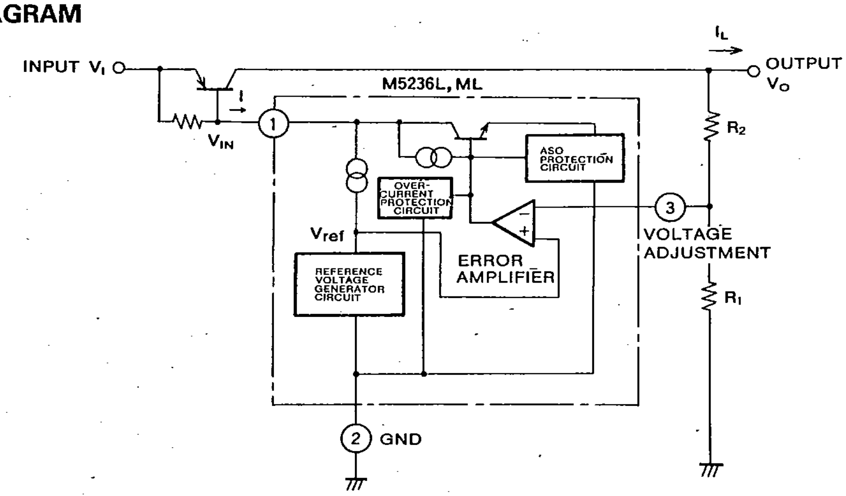


TO-92L package



SOT-89 package

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Symbol	Parameter	Ratings	Unit
V_{IN}	Input voltage	36	V
I_D	Drive current	30	mA
$V_I - V_O$	Input-output voltage difference	30	V
Pd	Power dissipation	900(SIP)/500(ML)	mW
T_{opr}	Operating temperature	−20～+75	°C
T_{stg}	Storage temperature	−55～+150	°C

ELECTRICAL CHARACTERISTICS (measurement circuit (a) is used with, T_a=25°C, V_I=15V, V_O=12V, I_L=200mA, C_{REF}=1μF, R_1=4.3kΩ, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits Min	Limits Typ	Limits Max	Unit
V_{IN}	Input voltage	(between pin ① and pin ②)	3.5		36	V
V_O	Output voltage	R_2≒0.82kΩ～108kΩ	1.5		33	V
$V_I - V_O$	Minimum input-output voltage difference			0.2		V
V_{REF}	Reference voltage	(between pin ③ and pin ②)	1.20	1.26	1.32	V
$R_{eg\text{-}In}$	Input regulation	V_I=15～20V		0.02	0.1	%/V
$R_{eg\text{-}L}$	Load regulation	I_L=10～200mA		0.02	0.1	%
I_B	Bias current	I_L=0(disregarding the current in resistors R_1, R_2)		1.7	3.0	mA
TC_{VO}	Temperature coefficient of output voltage	T_a=0～75°C		0.02		%/°C
RR	Ripple rejection ratio	f=120Hz(measured with circuit (b))		68		dB
V_{NO}	Output noise voltage	f=20Hz～100kHz		33		μVrms

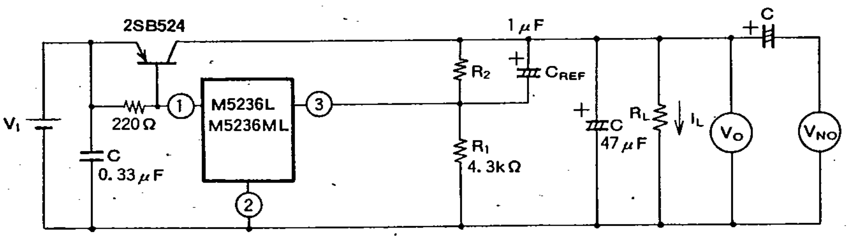
TEST CIRCUITS

(a) Standard test circuit

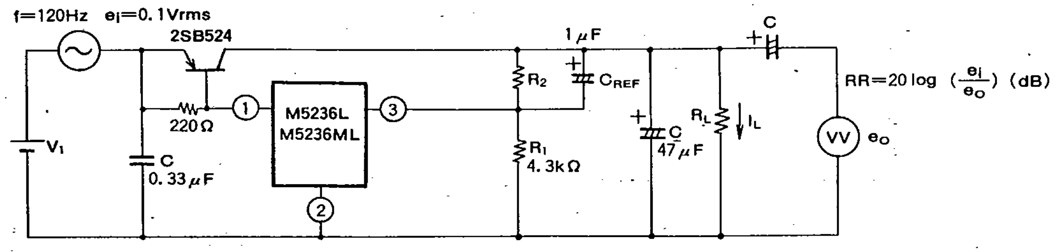
$$V_O = V_{REF}\left(1+\frac{R_2}{R_1}\right) \fallingdotseq 1.26\times\left(1+\frac{R_2}{4.3}\right)\ (V)$$

$$R_2 = R_1\left(\frac{V_O}{V_{REF}}-1\right) \fallingdotseq 4.3\times\left(\frac{V_O}{1.26}-1\right)\ (k\Omega)$$

(R_1=4.3kΩ, V_{REF}≒1.26V)



(b) Ripple rejection test circuit



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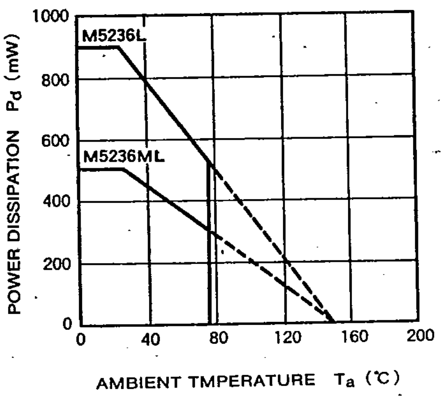
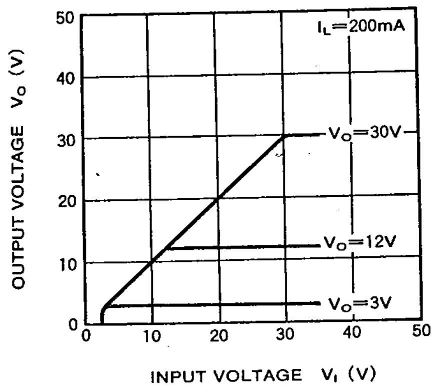
TYPICAL CHARACTERISTICS

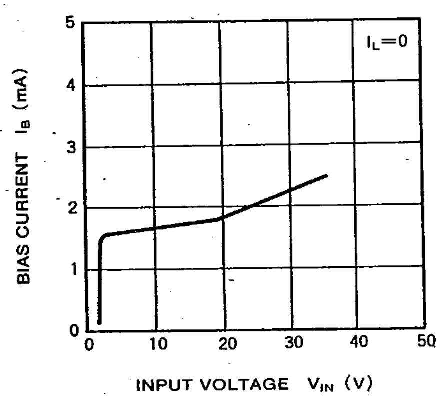
THERMAL DERATING (MAXIMUM RATINGS)



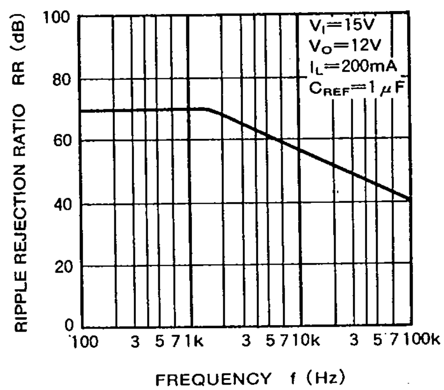
OUTPUT VOLTAGE CHARACTERISTICS



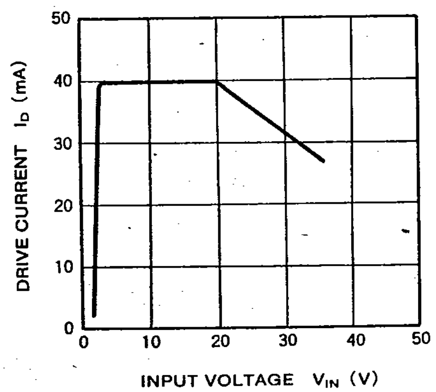
BIAS CURRENT VS. INPUT VOLTAGE



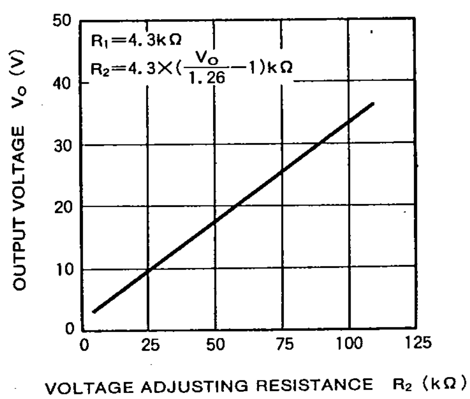
RIPPLE REJECTION



DRIVE CURRINT VS. INPUT VOLTAGE



OUPUT VOLTAGE VS. VOLTAGE ADJUSTING RESISTANCE



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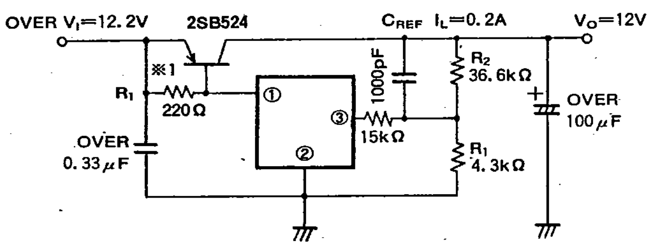
APPLICATION EXAMPLES

1. Standard application circuit



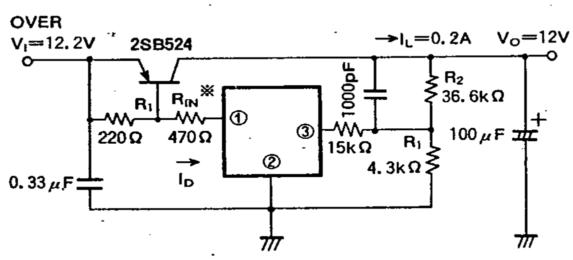
$$V_O = V_{REF} \times \left(1+\frac{R_2}{R_1}\right) V$$

V_{REF}=1.26V(typ.)

※1. R_1 of 180~220Ω should be used.

Note) Capacitors displaying small capacity change with temperature should be used.

2. Control circuit for maximum drive current (I_{DM})



When the input voltage (V_I) is lower than the set output voltage (V_O), drive current of approximately 30mA to 45mA runs in Pin ① of the integrated circuit. (Refer to TYPICAL CHARACTERISTICS DRIVE CURRENT VS INPUT VOLTAGE. For example, when the input voltage V_I of 20V is higher than the fixed output voltage of 20V or above, and input and output are inverted, power dissipation in the circuit is P_d=20V×45mA=900mW, and reaches the maximum rating, making it necessary to control the drive current.) When the input power supply is supplied by batteries and the current needs to be controlled, a resistor R_{IN} can be inserted to control the drive current. (Fig. 1 shows input voltage dependency of the control current and input resistor R_{IN}.)

When the input voltage reaches 12V (=V_O), the current at Pin ① is limited to approximately to 20mA.

Fig. 2 shows I_D-V_I characteristics of the circuit.

Fig. 1 MAXIMUM DRIVE CURRENT CONTROL CHARACTERISTICS (I_{DM})

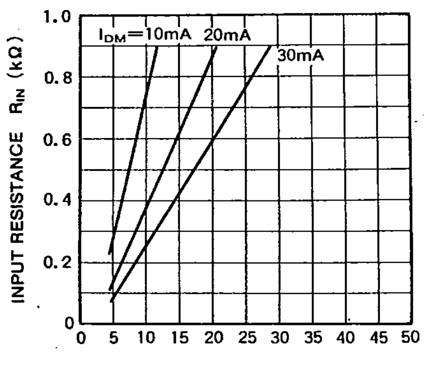
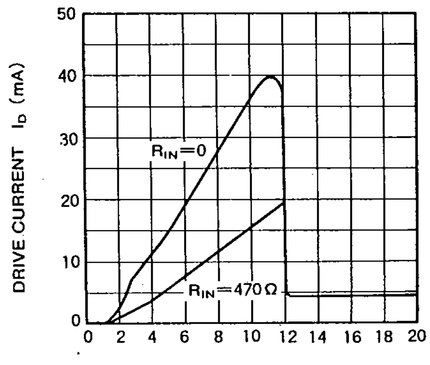
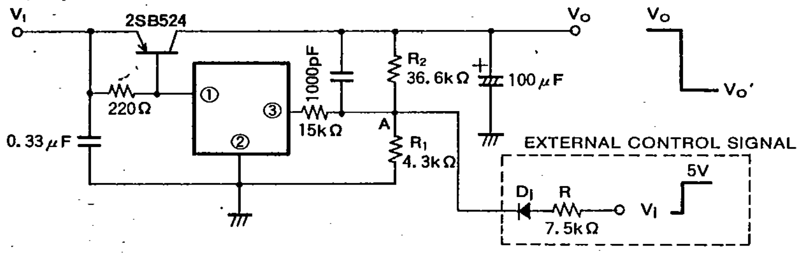


Fig. 2 I_D—V_I CHARACTERISTICS IN APPLICATION EXAMPLE 2



3. ON/OFF control of output voltage circuit



Resistor R in the control circuit is determined by the following equation.

$$R=\frac{V_I-V_F-V_{REF}'}{\frac{V_{REF}'}{R_1}+\frac{V_{REF}'-V_O'}{R_2}}$$

where, V_I: External control voltage
V_F: Forward voltage of diode (D_I)
V_{REF}: 1.4V Pin ③ voltage when V_{REF}' is $V_{O(OFF)}$
V_O': 0V output voltage when V_O' is $V_{O(OFF)}$