To all our customers

Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

M5237L,ML

3-TERMINAL ADJUSTABLE REGULATOR

DESCRIPTION

The M5237 is a semiconductor integrated circuit which is designed for variable output voltage regulator and is low power dissipation type with input-output voltage difference are quite low.

Housed in its 3-pin package are Reference voltage generator circuit, Differential amplifier and Drive circuit.

FEATURES

- Wide operating supply voltage range.
  V_{IN} = 3.5V ~ 36V. V_O = 1.5V ~ 33V
- The input-output voltage differences can be small moved by the external PNP transistors.
  (T_R: $V_{CE(sat)}$ state)
  $V_{I-O(min)} \fallingdotseq 0.2V$
- The output voltage can be freely adjusted by the external resistors.
- Built in Over-current protection circuit (Drooping fold-back unit), ASO protection circuit and Thermal protection circuit.
- Its possible Taping (Automatic insert) and Lead forming.

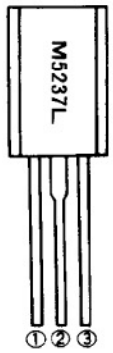
APPLICATION

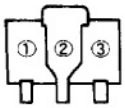
Car stereos, radio cassettes, portable stereos, and other general usage electronic power supplies

RECOMMENDED OPERATING CONDITIONS

Supply voltage range . . . . . V_{IN} = 3.5V ~ 30V
Output voltage range . . . . . V_O = 1.5V ~ 25V

PIN CONFIGURATION



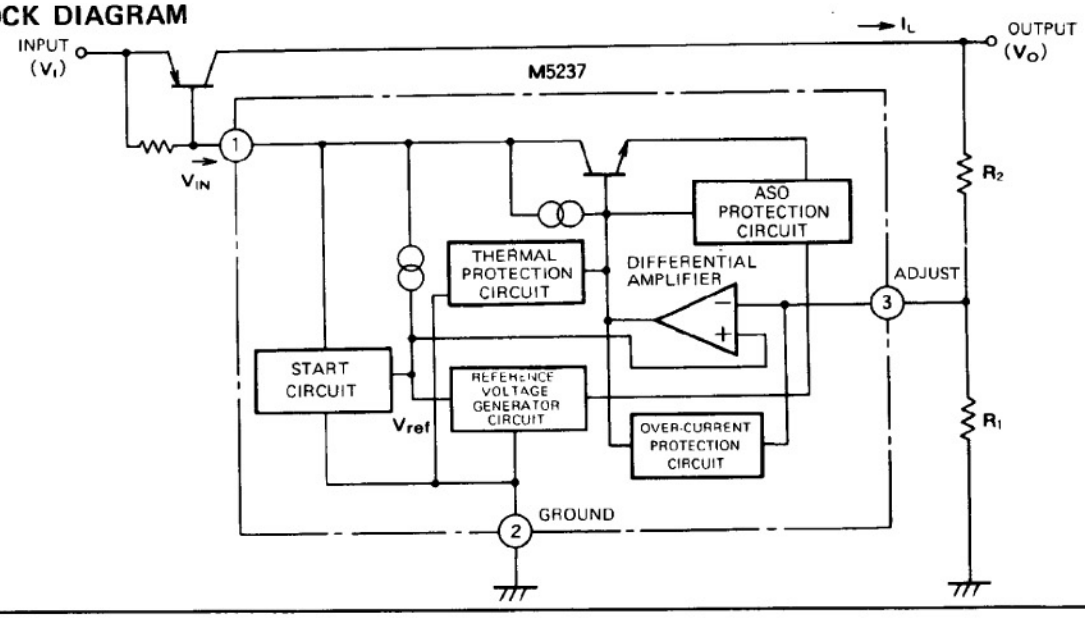


Outline SOT-89(ML)

Outline TO-92L(L)

ELECTRODE CONNECTIONS
① INPUT
② GROUND
③ OUTPUT

BLOCK DIAGRAM



3-TERMINAL ADJUSTABLE REGULATOR

ABSOLUTE MAXIMUM RATINGS (Ta=25℃, unless otherwise noted)

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	Internal power dissipation	900(L)/500(ML)	mW
Topr	Operating ambient temperature	−20 ~ +75	℃
Tstg	Storage temperature	−55 ~ +150	℃

ELECTRICAL CHARACTERISTICS

(measurement circuit (a) is used with Ta=25℃, V_I=15V, V_O=12V, I_L=200mA, C_{REF}=1μF, R_1=4.3kΩ)

Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
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 2 and Pin 3)	1.20	1.26	1.32	V
Reg-in	Input voltage regulation	V_I = 15 ~ 20V		0.02	0.1	%/V
Reg-L	Loading voltage 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}	Output voltage thermal confficient	Ta=0 ~ 75℃		0.02		%/℃
RR	Ripple rejection	f=120Hz (measured with circuit (b))		68		dB
V_{NO}	Output noise voltage	f=20Hz ~ 100kHz		25		μVrms

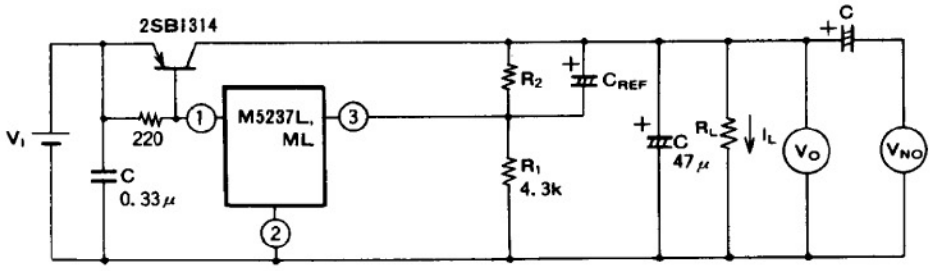
TEST CIRCUIT

(a) Standard test circuit

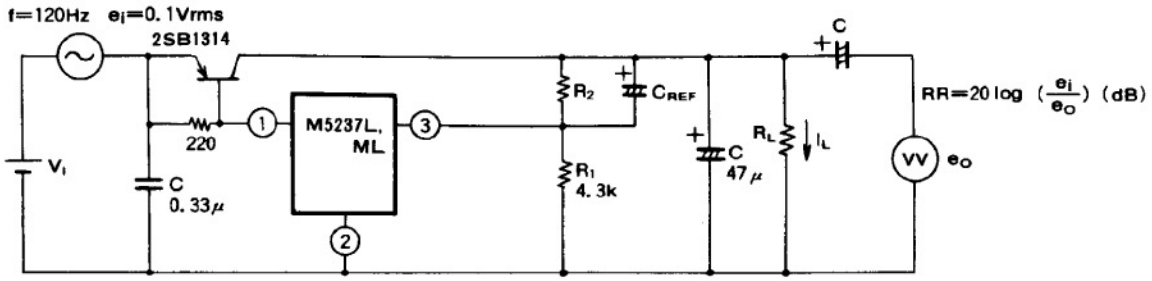
$$V_O = V_{REF}\left(1+\frac{R_2}{R_1}\right) \fallingdotseq 1.26\times\left(1+\frac{R_2}{4.3}\right)\ (V)$$

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

$(R_1 = 4.3k\Omega,\ V_{REF} \fallingdotseq 1.26V)$

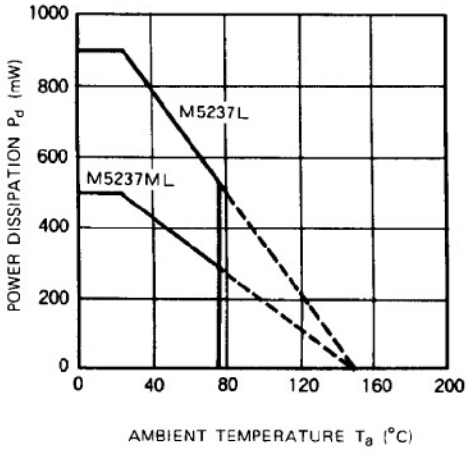


(b) Ripple rejection test circuit

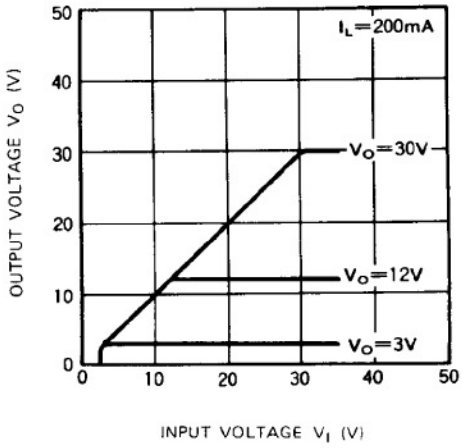


TYPICAL CHARACTERISTICS

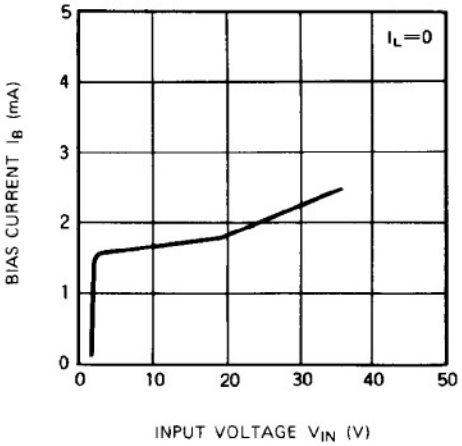
THERMAL DERATING



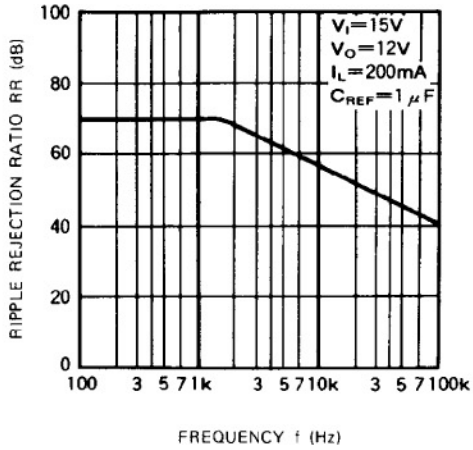
OUTPUT VOLTAGE VS. INPUT VOLTAGE



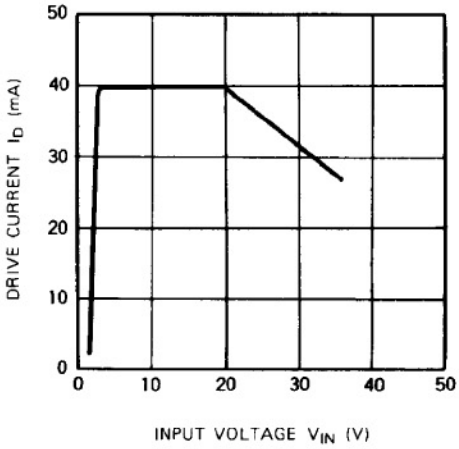
BIAS CURRENT VS. INPUT VOLTAGE



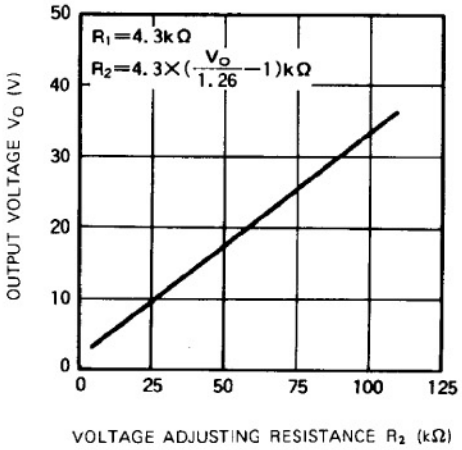
RIPPLE RELECTION RATIO VS. FREQUENCY



DRIVE CURRENT VS. INPUT VOLTAGE

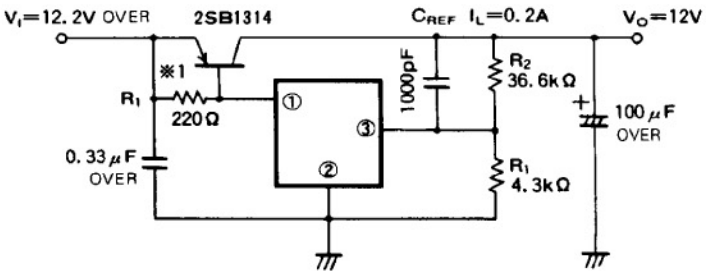


OUTPUT VOLTAGE VS. VOLTAGE ADJUSTING RESISTANCE



APPLICATION CIRCUIT

1. Standard application circuit



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

V_{REF}=1.26V

※1. R_1=180～220Ω

Note: Please use the capacitor not to depend on the ambient temperature.

2. Maximum drive current controller application circuit

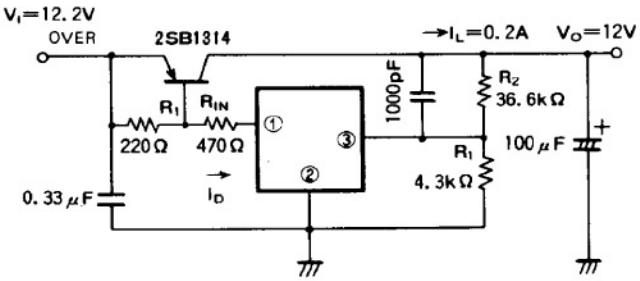


Fig. 1 MAXIMUM DRIVE CURRENT

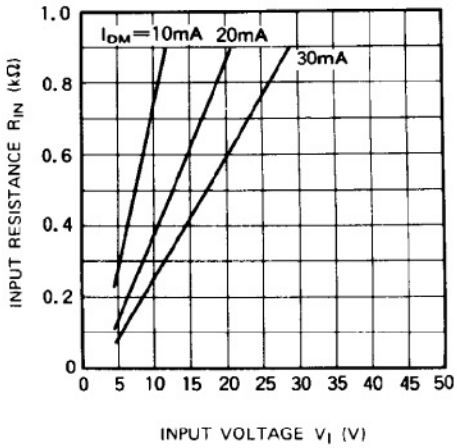
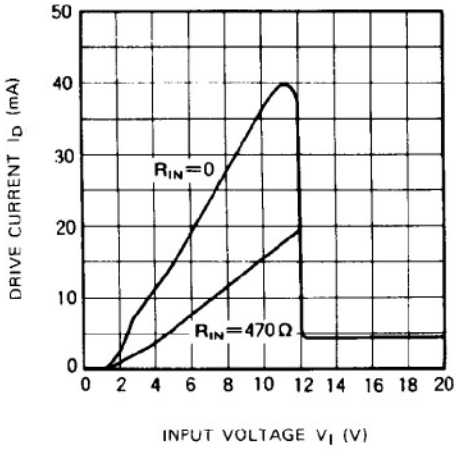
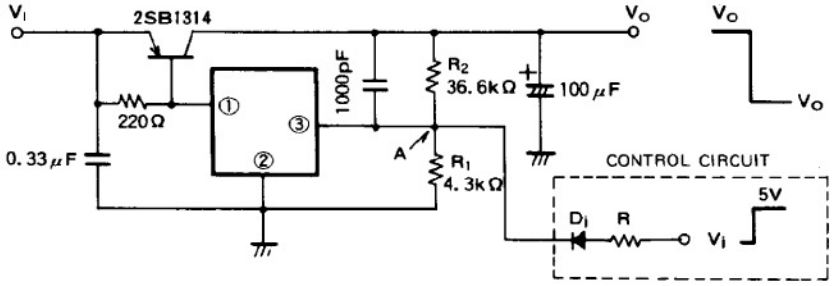


Fig. 2 DRIVE CURRENT VS. INPUT VOLTAGE

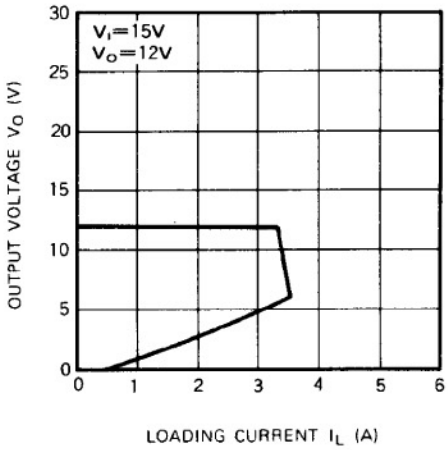


3. Output voltage ON/OFF controller

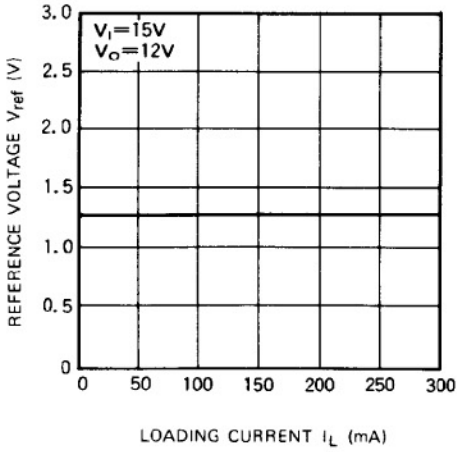


Set control circuit resistor R so that voltage of point A is more than 1.5V and less than 5V.

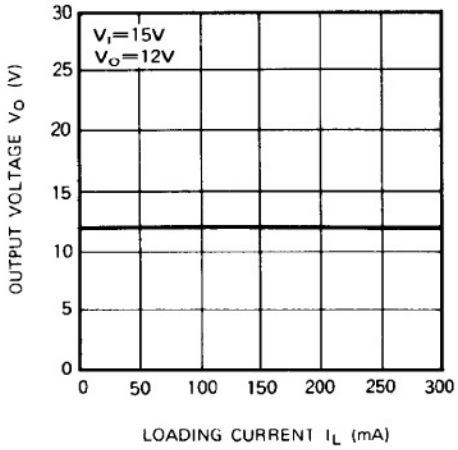
LOAD CHARACTERISTICS



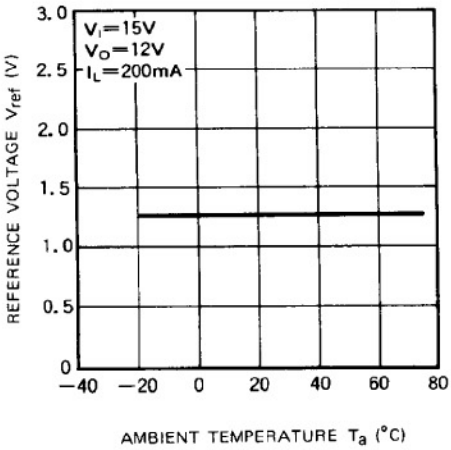
REFERENCE VOLTAGE VS. LOADING CURRENT



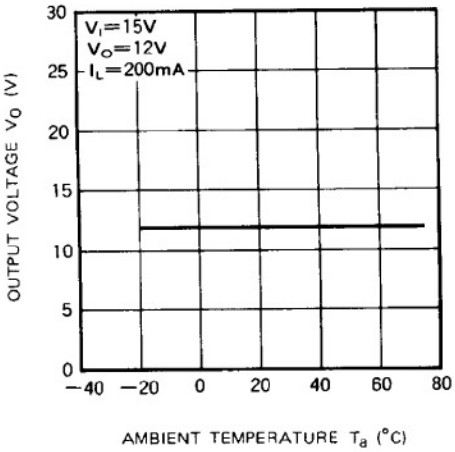
OUTPUT VOLTAGE VS. LOADING CURRENT



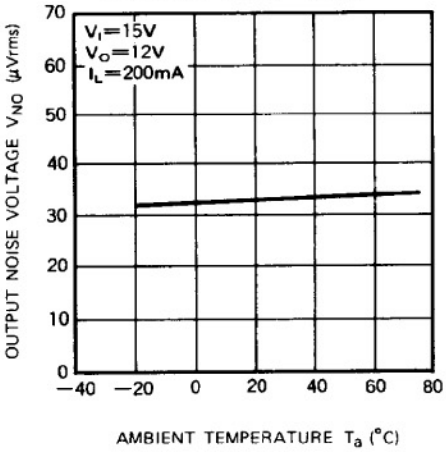
REFERENCE VOLTAGE VS. AMBIENT TEMPERATURE



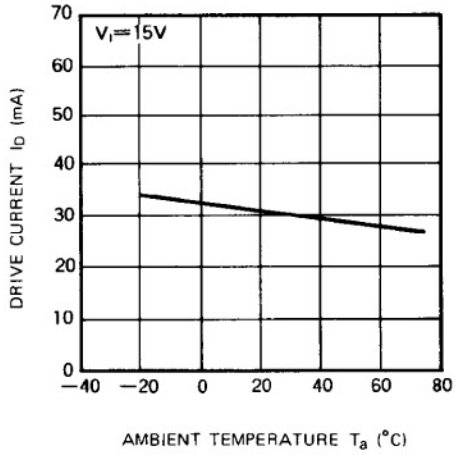
OUTPUT VOLTAGE VS. AMBIENT TEMPERATURE



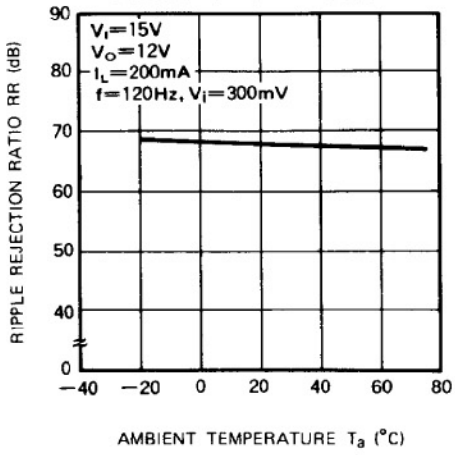
OUTPUT NOISE VOLTAGE VS. AMBIENT TEMPERATURE



DRIVE CURRENT VS. AMBIENT TEMPERATURE



RIPPLE REJECTION RATIO VS. AMBIENT TEMPERATURE



BIAS CURRENT VS. AMBIENT TEMPERATURE