TA78L005AP ~ TA78L015AP

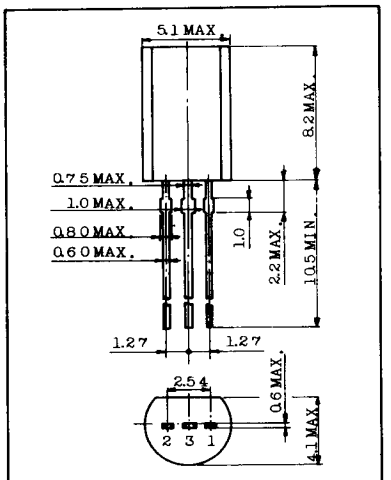
BIPOLAR LINEAR INTEGRATED CIRCUIT
SILICON MONOLITHIC

THREE TERMINAL POSITIVE REGULATORS

5V, 9V, 12V, 15V

- Suitable for TTL, DTL, HTL, C-MOS Power Supply
- Internal Short-Circuit Current Limiting
- Internal Thermal Overload Protection
- Maximum Output Current of 150mA (T_j=25°C)
- Available in the Plastic TO-92MOD Package

Unit in mm



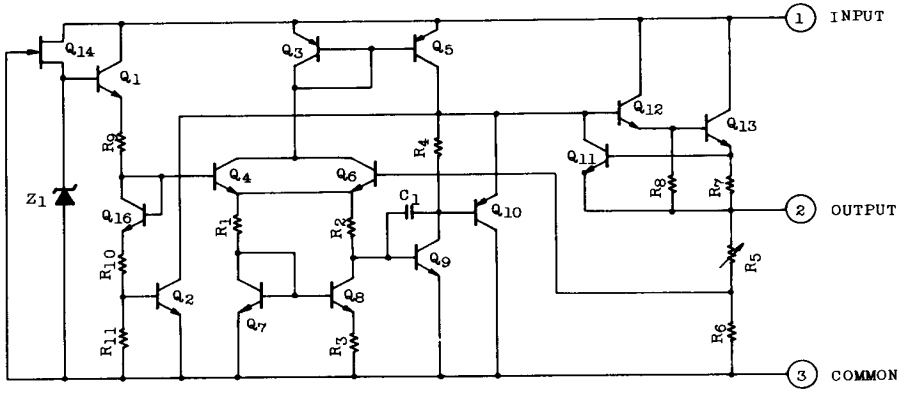
1. INPUT
2. OUTPUT
3. COMMON

JEDEC	TO-92MOD
EIAJ	—
TOSHIBA	5-5

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	(5V ~ 15V)	V_{IN}	35	V
Power Dissipation		P_D	800	mW
Operating Temperature		T_{opr}	-30 ~ 75	°C
Storage Temperature		Tstg	-55 ~ 150	°C

EQUIVALENT CIRCUIT



TA78L005P/AP ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN}=10V, I_{OUT}=40mA, C_{IN}=0.33μF, C_{OUT}=0.1μF, $0^{\circ}C < T_j < 125^{\circ}C$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION		TA78L005AP MIN.	TA78L005AP TYP.	TA78L005AP MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j=25°C		4.8	5.0	5.2	V
Input Regulation	Reg.line	1	T_j=25°C	7.0 ≤ V_{IN} ≤ 20V	-	55	150	mV
				8.0 ≤ V_{IN} ≤ 20V	-	45	100	
Load Regulation	Reg.load	1	T_j=25°C	1.0mA ≤ I_{OUT} ≤ 100mA	-	11	60	mV
				1.0mA ≤ I_{OUT} ≤ 40mA	-	5.0	30	
Output Voltage	V_{OUT}	1	7.0V ≤ V_{IN} ≤ 20V, 1.0mA ≤ I_{OUT} ≤ 40mA		4.75	-	5.25	V
			V_{IN}=10V, 1.0mA ≤ I_{OUT} ≤ 70mA		4.75	-	5.25	
Quiescent Current	I_B	1	T_j=25°C		-	3.1	6.0	mA
			T_j=125°C		-	-	5.5	
Quiescent Current Change	ΔI_B	1	8.0V ≤ V_{IN} ≤ 20V		-	-	1.5	mA
			1.0mA ≤ I_{OUT} ≤ 40mA		-	-	0.1	
Output Noise Voltage	V_{NO}	1	Ta=25°C, 10Hz ≤ f ≤ 100kHz		-	40	-	μV
Long Term Stability	$\Delta V_{OUT}/\Delta t$	1			-	12	-	mV/1.0 KHrs
Ripple Rejection	RR	2	f=120Hz, 8.0V ≤ V_{IN} ≤ 18V, T_j=25°C		41	49	-	dB
Dropout Voltage	$\lvert V_{IN} - V_{OUT} \rvert$	1	T_j=25°C		-	1.7	-	V
Average Temperature Coefficient of Output Voltage	TC_{VO}	1	I_{OUT}=5mA		-	-0.6	-	mV/°C

TA78L009P/AP ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN}=15V, I_{OUT}=40mA, C_{IN}=0.33μF, C_{OUT}=0.1μF, $0^{\circ}C < T_j < 125^{\circ}C$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION		TA78L009AP MIN.	TA78L009AP TYP.	TA78L009AP MAX.	UNIT
Output Voltage	V_{OUT}	1	$T_j=25^{\circ}C$		8.64	9.0	9.36	V
Input Regulation	Reg.line	1	$T_j=25^{\circ}C$	$11.4V \leq V_{IN} \leq 24V$	-	80	200	mV
				$12V \leq V_{IN} \leq 24V$	-	20	160	
Load Regulation	Reg.load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	17	90	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	8.0	45	
Output Voltage	V_{OUT}	1	$11.4V \leq V_{IN} \leq 24V$, $1.0mA \leq I_{OUT} \leq 40mA$		8.55	-	9.45	V
			V_{IN}=15V, $1.0mA \leq I_{OUT} \leq 70mA$		8.55	-	9.45	
Quiescent Current	I_B	1	$T_j=25^{\circ}C$		-	3.2	6.5	mA
			$T_j=125^{\circ}C$		-	-	6.0	
Quiescent Current Change	ΔI_B	1	$11.5V \leq V_{IN} \leq 26V$		-	-	1.5	mA
			$1.0mA \leq I_{OUT} \leq 40mA$		-	-	0.1	
Output Noise Voltage	V_{NO}	1	$Ta=25^{\circ}C$, $10Hz \leq f \leq 100kHz$		-	65	-	μV
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1			-	21	-	mV / 1.0 KHrs
Ripple Rejection	RR	2	f=120Hz, $12V \leq V_{IN} \leq 24V$, $T_j=25^{\circ}C$		36	44	-	dB
Dropout Voltage	$\lvert V_{IN} - V_{OUT} \rvert$	1	$T_j=25^{\circ}C$		-	1.7	-	V
Average Temperature Coefficient of Output Voltage	TC_{VO}	1	I_{OUT}=5mA		-	-0.85	-	mV/°C

TA78L012P/AP ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN}=19V, I_{OUT}=40mA, C_{IN}=0.33μF, C_{OUT}=0.1μF, $0^{\circ}C < T_j < 125^{\circ}C$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION		TA78L012AP MIN.	TA78L012AP TYP.	TA78L012AP MAX.	UNIT
Output Voltage	V_{OUT}	1	$T_j=25^{\circ}C$		11.5	12	12.5	V
Input Regulation	Reg.line	1	$T_j=25^{\circ}C$	$14.5V \leq V_{IN} \leq 27V$	-	120	250	mV
				$16V \leq V_{IN} \leq 27V$	-	100	200	
Load Regulation	Reg.load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	20	100	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	10	50	
Output Voltage	V_{OUT}	1	$14.5V \leq V_{IN} \leq 27V$, $1.0mA \leq I_{OUT} \leq 40mA$		11.4	-	12.6	V
			V_{IN}=19V, $1.0mA \leq I_{OUT} \leq 70mA$		11.4	-	12.6	
Quiescent Current	I_B	1	$T_j=25^{\circ}C$		-	3.2	6.5	mA
			$T_j=125^{\circ}C$		-	-	6.0	
Quiescent Current Change	ΔI_B	1	$16V \leq V_{IN} \leq 27V$		-	-	1.5	mA
			$1.0mA \leq I_{OUT} \leq 40mA$		-	-	0.1	
Output Noise Voltage	V_{NO}	1	Ta=25°C, 10Hz ≤ f ≤ 100kHz		-	80	-	μV
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1			-	24	-	mV / 1.0 KHrs
Ripple Rejection	RR	2	f=120Hz, $15V \leq V_{IN} \leq 25V$, $T_j=25^{\circ}C$		36	41	-	dB
Dropout Voltage	$\lvert V_{IN} - V_{OUT} \rvert$	1	$T_j=25^{\circ}C$		-	1.7	-	V
Average Temperature Coefficient of Output Voltage	TC_{VO}	1	I_{OUT}=5mA		-	-1.0	-	mV/°C

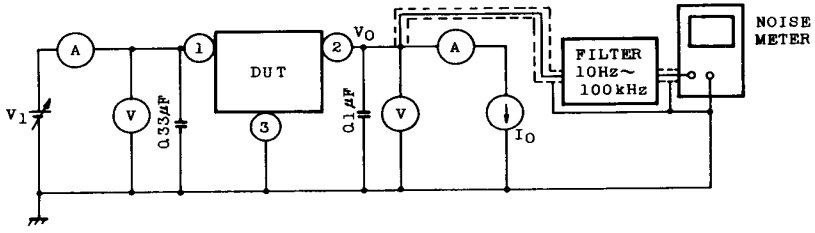
TA78L015P/AP ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN}=23V, I_{OUT}=40mA, C_{IN}=0.33μF, C_{OUT}=0.1μF, $0^{\circ}C < T_j < 125^{\circ}C$)

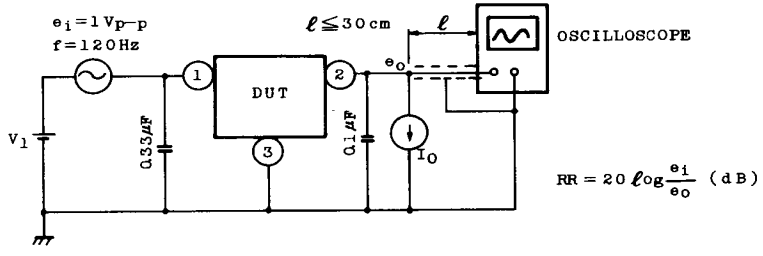
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION		TA78L015AP MIN.	TA78L015AP TYP.	TA78L015AP MAX.	UNIT
Output Voltage	V_{OUT}	1	$T_j=25^{\circ}C$		14.4	15	15.6	V
Input Regulation	Reg.line	1	$T_j=25^{\circ}C$	$17.5V \leq V_{IN} \leq 30V$	-	130	300	mV
				$20V \leq V_{IN} \leq 30V$	-	110	250	
Load Regulation	Reg.load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	25	150	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	12	75	
Output Voltage	V_{OUT}	1	$17.5V \leq V_{IN} \leq 30V$, $1.0mA \leq I_{OUT} \leq 40mA$		14.25	-	15.75	V
			V_{IN}=23V, $1.0mA \leq I_{OUT} \leq 70mA$		14.25	-	15.75	
Quiescent Current	I_B	1	$T_j=25^{\circ}C$		-	3.3	6.5	mA
			$T_j=125^{\circ}C$		-	-	6.0	
Quiescent Current Change	ΔI_B	1	$20V \leq V_{IN} \leq 30V$		-	-	1.5	mA
			$1.0mA \leq I_{OUT} \leq 40mA$		-	-	0.1	
Output Noise Voltage	V_{NO}	1	Ta=25°C, 10Hz ≤ f ≤ 100kHz		-	90	-	μV
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1			-	30	-	mV / 1.0 KHrs
Ripple Rejection	RR	2	f=120Hz, $18.5V \leq V_{IN} \leq 28.5V$, $T_j=25^{\circ}C$		34	40	-	dB
Dropout Voltage	$\lvert V_{IN} - V_{OUT} \rvert$	1	$T_j=25^{\circ}C$		-	1.7	-	V
Average Temperature Coefficient of Output Voltage	TC_{VO}	1	I_{OUT}=5mA		-	-1.3	-	mV/°C

TEST CIRCUIT

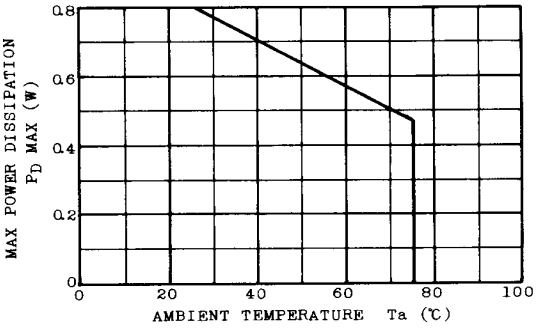
1. V_{OUT}, Reg.line, Reg.load, V_{OUT}, I_B, ΔI_B, V_{NO}, $\Delta V_{OUT}/\Delta t$, $|V_{IN}-V_{OUT}|$, TC_{VO}



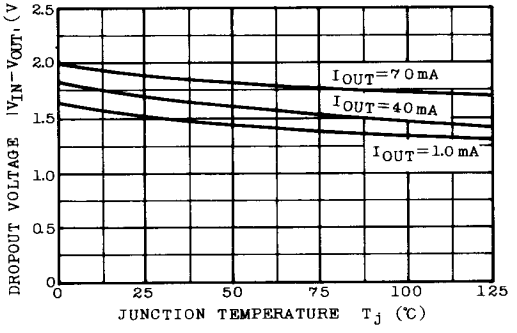
2. RR



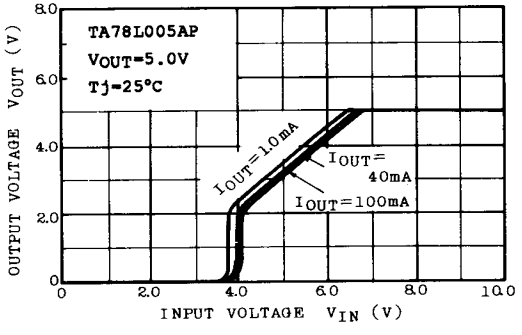
P_D MAX – Ta



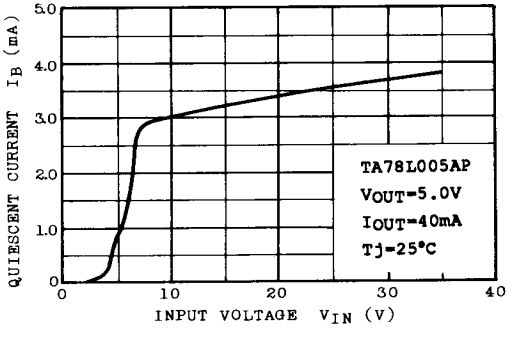
$|V_{IN} - V_{OUT}|$ – T_j



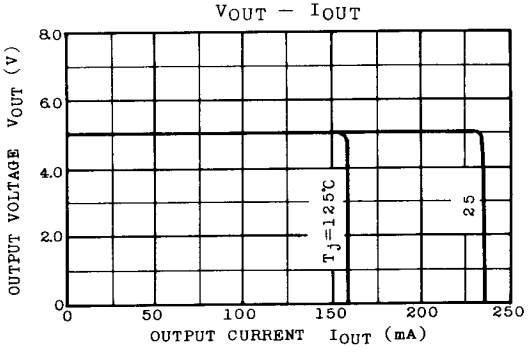
V_{OUT} – V_{IN}



I_B – V_{IN}

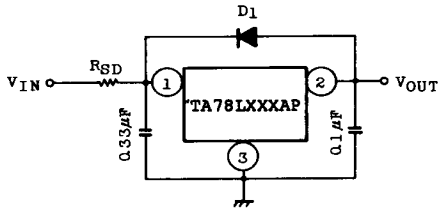


V_{OUT} – I_{OUT}



APPLICATION CIRCUIT

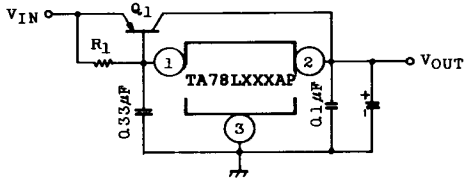
(1) STANDARD APPLICATION



D_1 : Protection Diode
High speed diode D_1 should be connected as shown in the figure if the condition $V_{IN} < V_{OUT}$ might occur by surge voltage or power supply ON/OFF.

R_{SD} : Power Limiting Resistor
For large V_{IN}, resistor R_{SD} is needed to limit IC power dissipation.

(2) A. CURRENT BOOST VOLTAGE REGULATOR



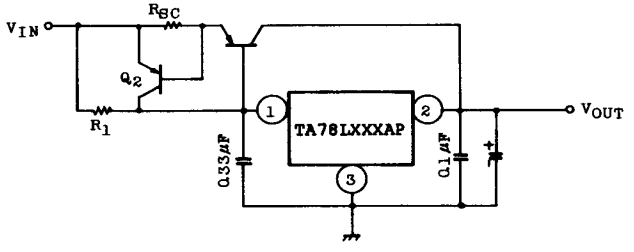
Heat sink is needed for Q_1

$$R_1 \leq \frac{V_{BE1}}{I_B \text{ MAX}}$$

where, V_{BE1} : V_{BE} of external transistor Q_1

I_B MAX : Quiescent current of IC

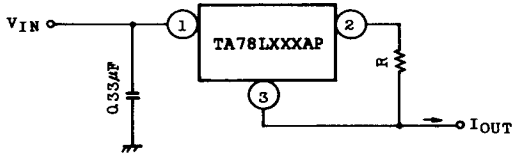
B. SHORT-CIRCUIT PROTECTION



$$R_{SC} = \frac{V_{BE2}}{I_{SC}}$$

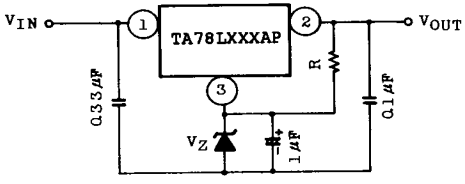
where, I_{SC} : Short-Circuit current

(3) CURRENT REGULATOR



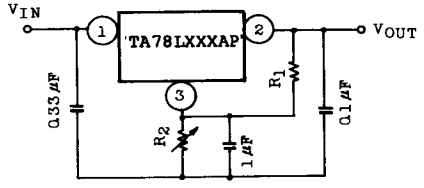
$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

(4) VOLTAGE BOOST REGULATOR



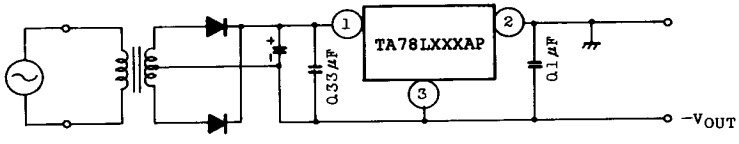
$V_{OUT}=V_Z+V_{OUT}$(of IC)

A little current in resistor R is needed.

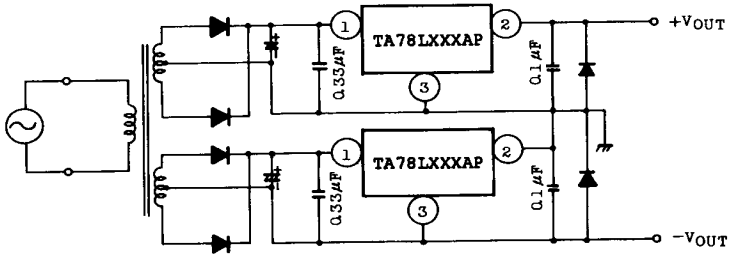


$V_{OUT}=R_2(I_B \cdot \frac{V_{OUT}(\text{of IC})}{R_1}) + V_{OUT}(\text{of IC})$

(5) NEGATIVE REGULATOR



(6) POSITIVE AND NEGATIVE REGULATOR



PRECAUTIONS FOR USE

When a high voltage exceeding 10V beyond the fixed output voltage (TYP. Value) of IC is applied to the output terminal of IC, the IC may be destroyed. In such a case, it is advised to prevent an excessive voltage from being applied to the IC by connecting a zener diode between the output terminal and the GND. In the current boost circuit as shown in Example (2) of Application Circuits, an input voltage may be suddenly applied to the output terminal of IC in the form of steps, and that in case of light load, an excessive voltage may be transiently applied to the output terminal of IC.
Great care should be taken to this matter. In this case, in addition to the above, it may become necessary to consider such a countermeasure as replacing the output capacitor with a capacitor of larger capacitance, or as R_1 (resistor for IC bias current) or bypass is replaced with a resistor of smaller resistance according to circumstances, or as the input voltage is gradually raised.