KIA7905P/PI~ KIA7924P/PI

BIPOLAR LINEAR INTEGRATED CIRCUIT

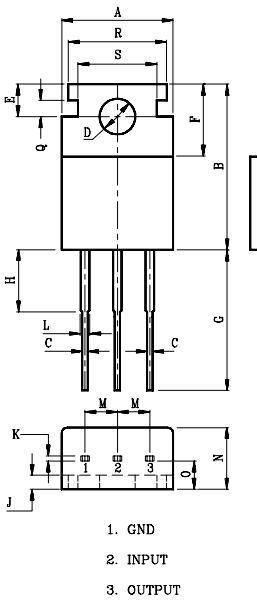
1A THREE TERMINAL NEGATIVE VOLTAGE REGULATORS
-5V, -6V, -8V, -9V, -10V, -12V, -15V, -18V, -20V, -24V

FEATURES:

- Suitable for C-MOS, TTL, and the other digital IC power supply.
- Internal thermal overload protecting.
- Internal short circuit current limiting.
- Output current in excess of 1.0A.

MAXIMUM RATINGS (Ta=25℃)

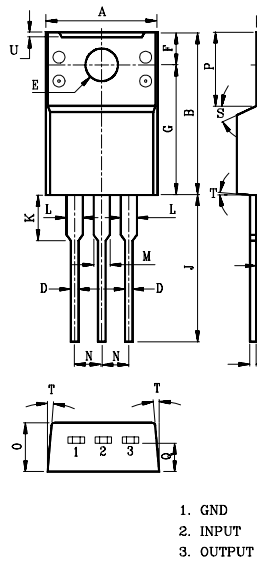
CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	KIA7905P/PI~ KIA7915P/PI	V_{IN}	-35	V
	KIA7918P/PI~ KIA7924P/PI		-40	
Power Dissipation (Tc=25℃)		P_D	20.8	W
Operating Junction Temperature		T_j	-30~150	℃
Operating Temperature		T_{opr}	-30~75	℃
Storage Temperature		T_{stg}	-55~150	℃



DIM	MILLIMETERS
A	10.30 MAX
B	15.30 MAX
C	0.80
D	ø3.60±0.20
E	3.00
F	6.70 MAX
G	13.60±0.50
H	5.60 MAX
J	1.37 MAX
K	0.50
L	1.50 MAX
M	2.54
N	4.70 MAX
O	2.60
P	1.50 MAX
Q	1.50
R	9.50±0.20
S	8.00±0.20
T	2.90 MAX

1. GND
2. INPUT
3. OUTPUT

TO-220AB

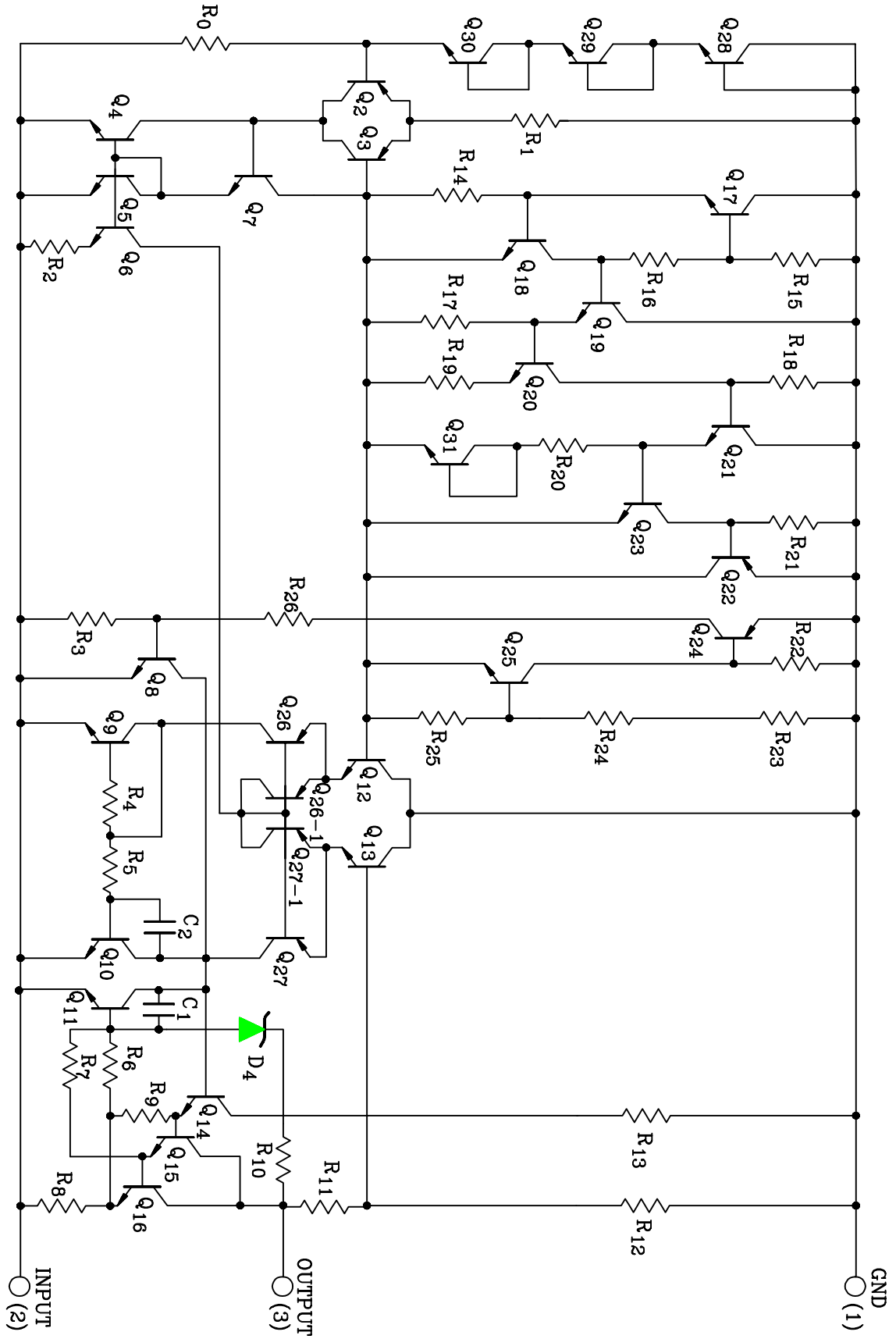


DIM	MILLIMETERS
A	10.30 MAX
B	15.30 MAX
C	2.70±0.30
D	0.85 MAX
E	ø3.20±0.20
F	3.00±0.30
G	12.30 MAX
H	0.75 MAX
J	13.60±0.50
K	3.90 MAX
L	1.20
M	1.30
N	2.54
O	4.50±0.20
P	6.80
Q	2.60±0.20
R	10°
S	25°
T	5°
U	0.5
V	2.60±0.15

1. GND
2. INPUT
3. OUTPUT

TO-220IS

EQUIVALENT CIRCUIT



ELECTRICAL CHARACTERISTICS

KIA7905P/PI

(Unless otherwise specified, V_{IN}=-10V, I_{OUT}=500mA, 0℃≤T_j≤125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j=25℃		-5.2	-5.0	-4.8	V
Input Regulation	Reg line	1	T_j=25℃	-12V≤V_{IN}≤-8V	-	5	50	mV
				-25V≤V_{IN}≤-7V	-	10	100	
Load Regulation	Reg load	1	T_j=25℃	5mA≤I_{OUT}≤1.5A	-	10	100	mV
				250mA≤I_{OUT}≤750mA	-	3	50	
Output Voltage	V_{OUT}	1	-20V≤V_{IN}≤-7V 5mA≤I_{OUT}≤1.0A		-5.25	-5.0	-4.75	V
Quiescent Current	I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	ΔI_{BI}	1	-25V≤V_{IN}≤-8V		-	0.1	1.3	mA
	ΔI_{BO}		5mA≤I_{OUT}≤1.0A		-	0.05	0.5	
Output Noise Voltage	V_{NO}	2	Ta=25℃, 10Hz≤f≤100kHz		-	100	-	μV_{rms}
Ripple Rejection Ratio	RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit	I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT}=5.0mA		-	-0.4	-	mV/℃
Dropout Voltage	V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7906P/PI

(Unless otherwise specified, V_{IN}=-11V, I_{OUT}=500mA, 0℃≤T_j≤125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-6.25	-6.0	-5.75	V
Input Regulation		Reg line	1	T_j=25℃	-13V≤V_{IN}≤-9V	-	5	60	mV
					-25V≥V_{IN}≥-8V	-	10	120	
Load Regulation		Reg load	1	T_j=25℃	5mA≤I_{OUT}≤1.5A	-	10	120	mV
					250mA≤I_{OUT}≤750mA	-	3	60	
Output Voltage		V_{OUT}	1	-21V≤V_{IN}≤-9V 5mA≤I_{OUT}≤1.0A		-6.3	-6.0	-5.7	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-25V≤V_{IN}≤-9V		-	-	1.3	mA
	Load	ΔI_{BO}		5mA≤I_{OUT}≤1.0A		-	-	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≤f≤100kHz		-	130	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-0.5	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7908P/PI

(Unless otherwise specified, V_{IN}=-14V, I_{OUT}=500mA, 0℃≤T_j≤125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-8.3	-8.0	-7.7	V
Input Regulation		Reg line	1	T_j=25℃	-17V≤V_{IN}≤-11V	-	5	80	mV
					-25V≤V_{IN}≤-10.5V	-	10	100	
Load Regulation		Reg load	1	T_j=25℃	5mA≤I_{OUT}≤1.5A	-	12	160	mV
					250mA≤I_{OUT}≤750mA	-	4	80	
Output Voltage		V_{OUT}	1	-23V≤V_{IN}≤-11.5V 5mA≤I_{OUT}≤1.0A		-8.4	-8.0	-7.6	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-25V≤V_{IN}≤-11.5V		-	0.1	1.0	mA
	Load	ΔI_{BO}		5mA≤I_{OUT}≤1.0A		-	0.05	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≤f≤100kHz		-	175	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-0.6	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7909P/PI

(Unless otherwise specified, V_{IN}=-15V, I_{OUT}=500mA, 0℃≤T_j≤125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-9.3	-9.0	-8.7	V
Input Regulation		Reg line	1	T_j=25℃	-19V≤V_{IN}≤-13V	-	5	90	mV
					-26V≤V_{IN}≤-11.5V	-	10	100	
Load Regulation		Reg load	1	T_j=25℃	5mA≤I_{OUT}≤1.5A	-	10	150	mV
					250mA≤I_{OUT}≤750mA	-	5	120	
Output Voltage		V_{OUT}	1	-24V≤V_{IN}≤-11.5V 5mA≤I_{OUT}≤1.0A		-9.4	-9.0	-8.6	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-26.5V≤V_{IN}≤-13V		-	0.1	1.0	mA
	Load	ΔI_{BO}		5mA≤I_{OUT}≤1.0A		-	0.05	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≤f≤100kHz		-	180	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-0.7	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7910IP/PI

(Unless otherwise specified, V_{IN}=-16V, I_{OUT}=500mA, 0℃≤T_j≤125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-10.4	-10	-9.6	V
Input Regulation		Reg line	1	T_j=25℃	-20V≤V_{IN}≤-14V	-	5	100	mV
					-27V≤V_{IN}≤-12.5V	-	10	110	
Load Regulation		Reg load	1	T_j=25℃	5mA≤I_{OUT}≤1.5A	-	10	180	mV
					250mA≤I_{OUT}≤750mA	-	6	120	
Output Voltage		V_{OUT}	1	-25V≤V_{IN}≤-12.5V 5mA≤I_{OUT}≤1.0A		-10.5	-10	-9.5	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-27.5V≤V_{IN}≤-14V		-	0.1	1.0	mA
	Load	ΔI_{BO}		5mA≤I_{OUT}≤1.0A		-	0.05	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≤f≤100kHz		-	190	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-0.7	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7912P/PI

(Unless otherwise specified, V_{IN}=-18V, I_{OUT}=500mA, 0℃≤T_j≤125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-12.5	-12	-11.5	V
Input Regulation		Reg line	1	T_j=25℃	-22V≤V_{IN}≤-16V	-	6	120	mV
					-30V≤V_{IN}≤-14.5V	-	12	240	
Load Regulation		Reg load	1	T_j=25℃	5mA≤I_{OUT}≤1.5A	-	12	240	mV
					250mA≤I_{OUT}≤750mA	-	4	120	
Output Voltage		V_{OUT}	1	-27V≤V_{IN}≤-15.5V 5mA≤I_{OUT}≤1.0A		-12.6	-12	-11.4	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-30V≤V_{IN}≤-15V		-	0.1	1.0	mA
	Load	ΔI_{BO}		5mA≤I_{OUT}≤1.0A		-	0.05	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≤f≤100kHz		-	200	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-0.8	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7915P/PI

(Unless otherwise specified, V_{IN}=-23V, I_{OUT}=500mA, 0℃≦T_j≦125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-15.6	-15	-14.4	V
Input Regulation		Reg line	1	T_j=25℃	-26V≦V_{IN}≦-20V	-	6	150	mV
					-30V≦V_{IN}≦-17.5V	-	12	300	
Load Regulation		Reg load	1	T_j=25℃	5mA≦I_{OUT}≦1.5A	-	12	300	mV
					250mA≦I_{OUT}≦750mA	-	4	150	
Output Voltage		V_{OUT}	1	-30V≦V_{IN}≦-18V 5mA≦I_{OUT}≦1.0A		-15.75	-15	-14.25	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-30V≦V_{IN}≦-17.5V		-	0.1	1.0	mA
	Load	ΔI_{BO}		5mA≦I_{OUT}≦1.0A		-	0.05	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≦f≦100kHz		-	250	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-0.9	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7918P/PI

(Unless otherwise specified, V_{IN}=-27V, I_{OUT}=500mA, 0℃≦T_j≦125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-18.7	-18	-17.3	V
Input Regulation		Reg line	1	T_j=25℃	-30V≦V_{IN}≦-24V	-	8	180	mV
					-33V≦V_{IN}≦-21V	-	15	360	
Load Regulation		Reg load	1	T_j=25℃	5mA≦I_{OUT}≦1.5A	-	15	360	mV
					250mA≦I_{OUT}≦750mA	-	5	180	
Output Voltage		V_{OUT}	1	-33V≦V_{IN}≦-22.5V 5mA≦I_{OUT}≦1.0A		-18.85	-18	-17.15	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-33V≦V_{IN}≦-22V		-	-	1.0	mA
	Load	ΔI_{BO}		5mA≦I_{OUT}≦1.0A		-	-	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≦f≦100kHz		-	300	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-1.0	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

KIA7920P/PI

(Unless otherwise specified, V_{IN}=-30V, I_{OUT}=500mA, 0℃≦T_j≦125℃, C_{IN}=2.2μF, C_{OUT}=1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-20.8	-20	-19.2	V
Input Regulation		Reg line	1	T_j=25℃	-32V≦V_{IN}≦-26V	-	10	180	mV
					-35V≦V_{IN}≦-24V	-	18	360	
Load Regulation		Reg load	1	T_j=25℃	5mA≦I_{OUT}≦1.5A	-	18	360	mV
					250mA≦I_{OUT}≦750mA	-	10	180	
Output Voltage		V_{OUT}	1	-35V≦V_{IN}≦-24V 5mA≦I_{OUT}≦1.0A		-21.0	-20	-19.0	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-36.5V≦V_{IN}≦-25V		-	-	1.0	mA
	Load	ΔI_{BO}		5mA≦I_{OUT}≦1.0A		-	-	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≦f≦100kHz		-	350	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-1.0	-	mV/℃
Dropout Voltage		V_D	1	T_j=25℃, I_{OUT}=1A		-	2.0	-	V

ELECTRICAL CHARACTERISTICS

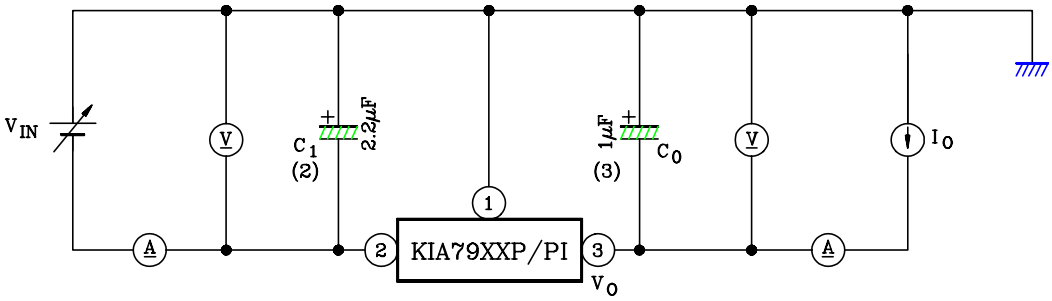
KIA7924P/PI

(Unless otherwise specified, V_{IN}=-33V, I_{OUT}=500mA, 0℃≤T_j≤125℃, C_{IN}=0.33μF, C_{OUT}=0.1μF)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage		V_{OUT}	1	T_j=25℃		-25	-24	-23	V
Input Regulation		Reg line	1	T_j=25℃	-36V≤V_{IN}≤-30V	-	8	240	mV
					-38V≤V_{IN}≤-27V	-	15	480	
Load Regulation		Reg load	1	T_j=25℃	5mA≤I_{OUT}≤1.5A	-	15	480	mV
					250mA≤I_{OUT}≤750mA	-	5	240	
Output Voltage		V_{OUT}	1	-38V≤V_{IN}≤-27V 5mA≤I_{OUT}≤1.0A		-25.2	-24	-22.5	V
Quiescent Current		I_B	1	T_j=25℃		-	3	6	mA
Quiescent Current Change	Line	ΔI_{BI}	1	-38V≤V_{IN}≤-27V		-	-	1.0	mA
	Load	ΔI_{BO}		5mA≤I_{OUT}≤1.0A		-	-	0.5	
Output Noise Voltage		V_{NO}	2	Ta=25℃, 10Hz≤f≤100kHz		-	400	-	μV_{rms}
Ripple Rejection Ratio		RR	3	f=120Hz, I_{OUT}=20mA,		54	60	-	dB
Short Circuit Current Limit		I_{SC}	1	T_j=25℃		-	1.9	-	A
Average Temperature Coefficient of Output Voltage		T_{CVO}	1	I_{OUT}=5mA		-	-1.0	-	mV/℃
Dropout Voltage		V_D	1	T_a=25℃, I_{OUT}=1A		-	2.0	-	V

TEST CIRCUIT

1. V_{OUT}, Reg·Line, Reg·Load, I_B, ΔI_B, V_D, T_{CVO}

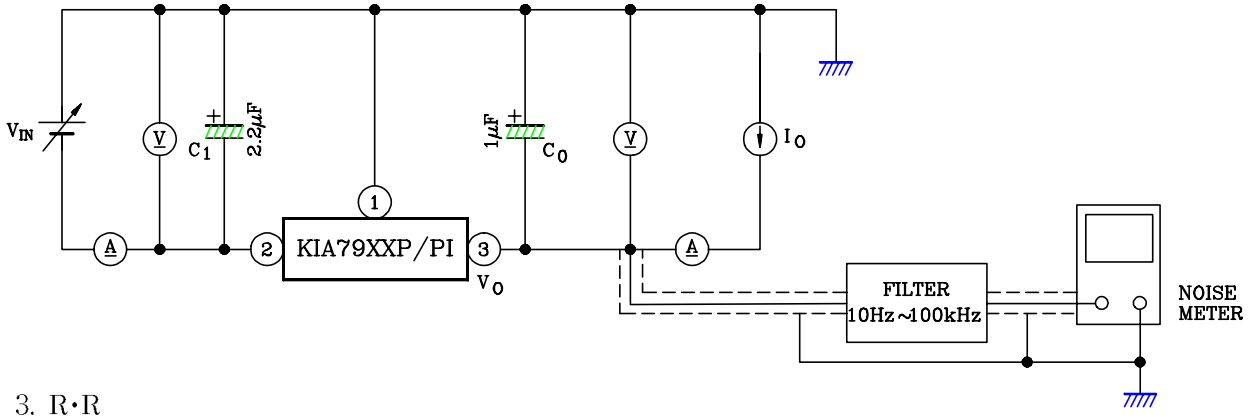


Notes : (1) To specify an output voltage, substitute voltage value for "XX"

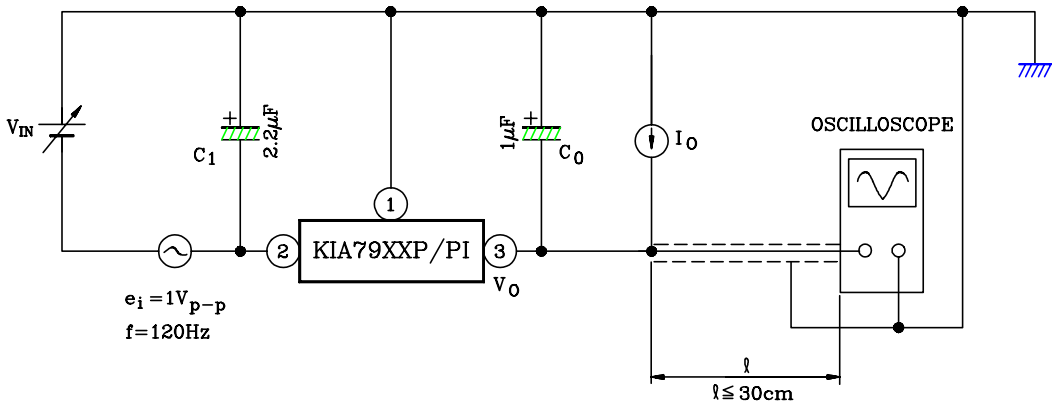
(2) Required for stability. For value given, capacitor must be solid tantalum. If aluminum electrolitics are used, at least ten times value shown should be selected. C_I is required if regulator is located an appreciable distance from power supply filter.

(3) To improve transient response. If large capacitors are used, a high current diode from input to output (1N4001 or similar) should be introduced to protect the device from momentary iput short circuit.

2. V_{NO}

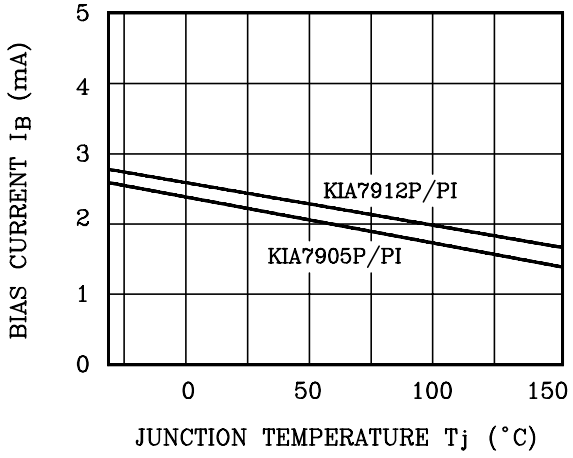


3. R·R

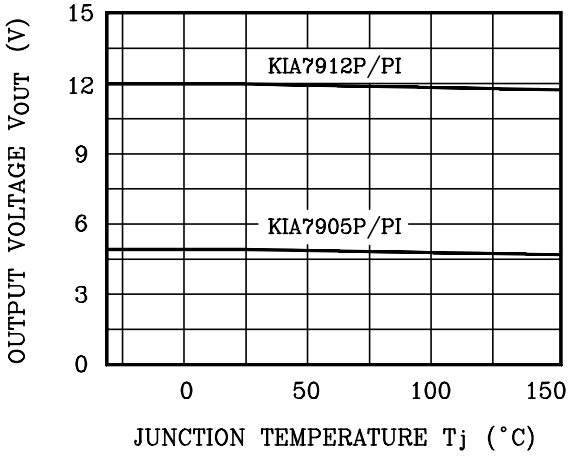


$R.R.=20\log\frac{e_i}{e_o}$ (dB)

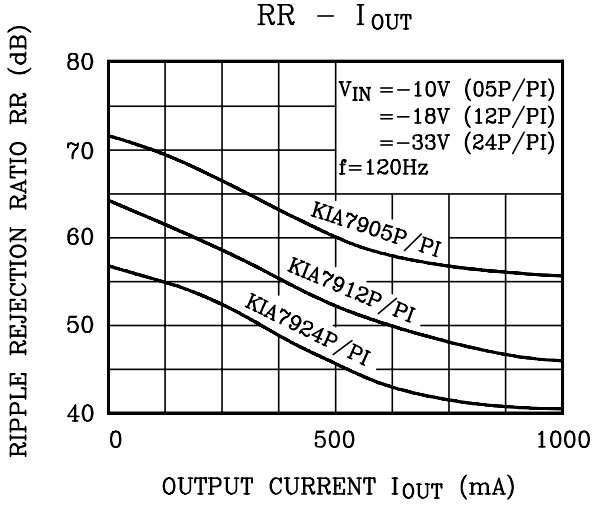
$I_B - T_j$



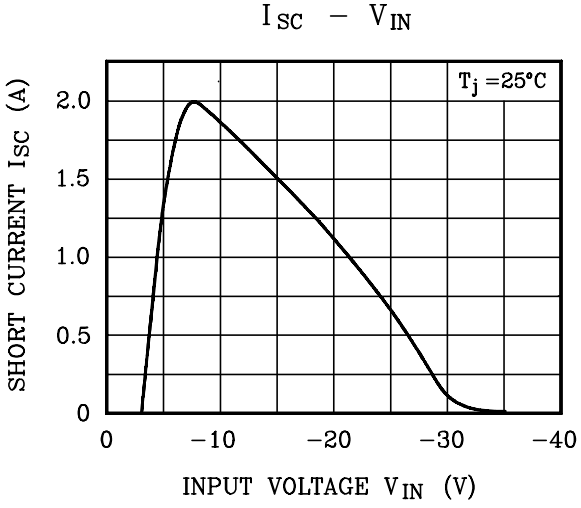
$V_{OUT} - T_j$



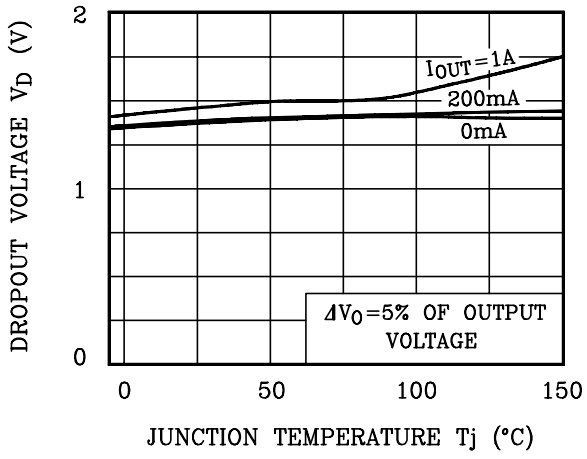
RR - I_{OUT}



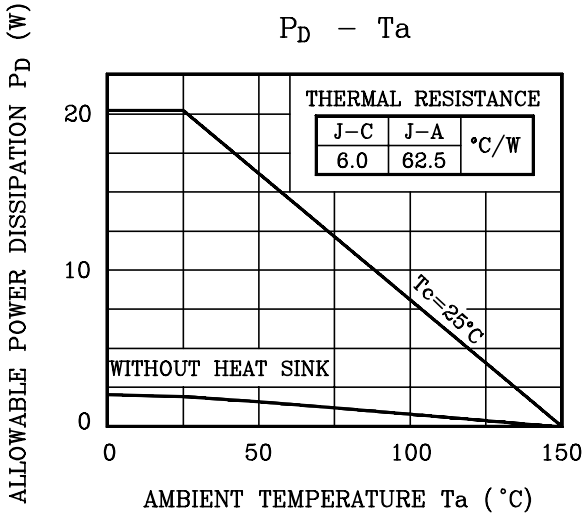
$I_{SC} - V_{IN}$



$V_D - T_j$



$P_D - Ta$



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