

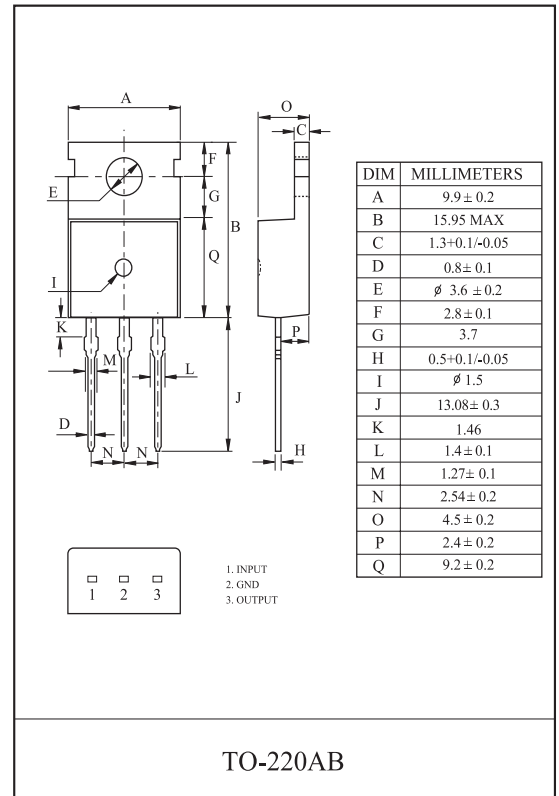
THREE TERMINAL POSITIVE VOLTAGE REGULATORS 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V

FEATURES

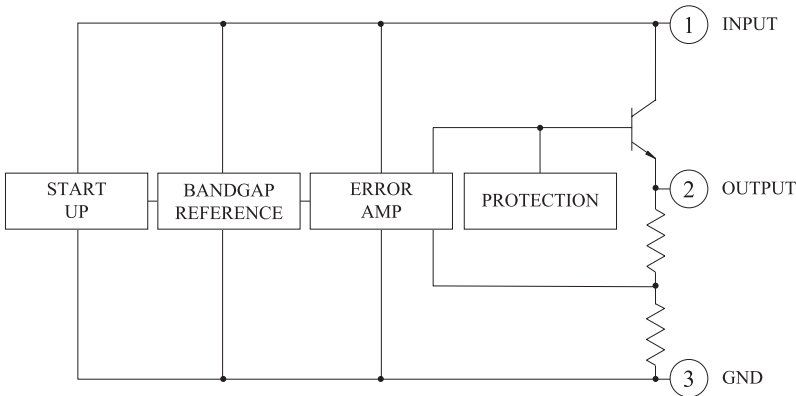
- Internal Thermal Overload Protection.
- Internal Short Circuit Current Limiting.
- Output Current up to 1.5A.
- Package is TO-220AB

LINE-UP

ITEM	OUTPUT VOLTAGE (Typ.)	UNIT
KIA7805AP	5	V
KIA7806AP	6	
KIA7807AP	7	
KIA7808AP	8	
KIA7809AP	9	
KIA7810AP	10	
KIA7812AP	12	
KIA7815AP	15	
KIA7818AP	18	
KIA7820AP	20	
KIA7824AP	24	



BLOCK DIAGRAM



MAXIMUM RATINGS (Ta=25)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	KIA7805~ KIA7815	V _{IN}	32	V
	KIA7818~ KIA7824		40	
Power Dissipation-1 (No Heatsink)		P _{D1}	1.9	W
Power Dissipation-2 (Infinite Heatsink)		P _{D2}	30	
Operating Junction Temperature		T _j	-40 150	
Storage Temperature		T _{stg}	-55 150	
Maximum Junction Temperature		T _{j(max)}	150	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7805AP (Unless otherwise specified, $V_{IN}=10V$, $I_{OUT}=500mA$, $T_j=25$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$	4.8	5.0	5.2	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	7.0V V_{IN} 25V	-	3	100	mV
				8.0V V_{IN} 12V	-	1	50	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.5A	-	15	100	mV
				250mA I_{OUT} 750mA	-	5	50	
Output Voltage	V_{OUT}	Fig. 1	7.0V V_{IN} 20V 5.0mA I_{OUT} 1.0A, P_o 15W	4.75	5.0	5.25	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.2	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	7.0V V_{IN} 25V	-	-	1.3	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, 10Hz f 100kHz	-	42	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, 8.0V V_{IN} 18V	62	73	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$V_{IN}=30V$, $T_j=25$	-	50	-	mA	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$	-	-0.6	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7806AP (Unless otherwise specified, $V_{IN}=11V$, $I_{OUT}=500mA$, $T_j=25$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$	5.75	6.0	6.25	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	8.0V V_{IN} 25V	-	4	120	mV
				9V V_{IN} 13V	-	2	60	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.5A	-	15	120	mV
				250mA I_{OUT} 750mA	-	5	60	
Output Voltage	V_{OUT}	Fig. 1	8V V_{IN} 21V 5.0mA I_{OUT} 1.0A, P_o 15W	5.7	6.0	6.3	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.3	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	8V V_{IN} 25V	-	-	1.3	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, 10Hz f 100kHz	-	45	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, 9V V_{IN} 19V	59	75	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$V_{IN}=30V$, $T_j=25$	-	50	-	mA	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$	-	-0.7	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7807AP (Unless otherwise specified, $V_{IN}=12V$, $I_{OUT}=500mA$, $0 < T_j < 125$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$, $I_{OUT}=100mA$	6.72	7.0	7.28	V	
Input Regulation	Reg line	Fig. 1	$T_j=25$	9V V_{IN} 25V	-	5	140	mV
				10V V_{IN} 14V	-	2	70	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.4A	-	15	140	mV
				250mA I_{OUT} 750mA	-	5	70	
Output Voltage	V_{OUT}	Fig. 1	9V V_{IN} 22V	6.65	-	7.35	V	
Quiescent Current	I_B	Fig. 1	5.0mA I_{OUT} 1.0A, P_o 15W	-	4.3	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	-	1.3	mA	
Output Noise Voltage	V_{NO}	Fig. 2	9V V_{IN} 25V	-	60	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$T_a=25$, 10Hz f 100kHz	59	75	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=50mA$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$f=120Hz$, 10V V_{IN} 20V,	-	1.3	-	A	
Average Temperature	TC_{VO}	Fig. 1	$I_{OUT}=50mA$, $T_j=25$	-	-0.8	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7808AP (Unless otherwise specified, $V_{IN}=14V$, $I_{OUT}=500mA$, $T_j=25$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$	7.7	8.0	8.3	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	10.5V V_{IN} 25V	-	6	160	mV
				11V V_{IN} 17V	-	2	80	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.5A	-	12	160	mV
				250mA I_{OUT} 750mA	-	4	80	
Output Voltage	V_{OUT}	Fig. 1	10.5V V_{IN} 23V 5.0mA I_{OUT} 1.0A, P_o 15W	7.6	8.0	8.4	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.3	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	10.5V V_{IN} 25V	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, 10Hz f 100kHz	-	52	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, 11.5V V_{IN} 21.5V	56	73	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$V_{IN}=30V$, $T_j=25$	-	50	-	mA	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$	-	-1.0	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7809AP (Unless otherwise specified, $V_{IN}=15V$, $I_{OUT}=500mA$, $0 < T_j < 125$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$, $I_{OUT}=100mA$	8.64	9.0	9.36	V	
Input Regulation	Reg line	Fig. 1	$T_j=25$	$11.5V < V_{IN} < 26V$	-	7	180	mV
				$13V < V_{IN} < 19V$	-	2.5	90	
Load Regulation	Reg load	Fig. 1	$T_j=25$	$5mA < I_{OUT} < 1.4A$	-	12	180	mV
				$250mA < I_{OUT} < 750mA$	-	4	90	
Output Voltage	V_{OUT}	Fig. 1	$11.5V < V_{IN} < 26V$ $5.0mA < I_{OUT} < 1.0A$, $P_o < 15W$	8.55	-	9.45	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.3	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	$11.5V < V_{IN} < 26V$	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, $10Hz < f < 100kHz$ $I_{OUT}=50mA$	-	75	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, $12.5V < V_{IN} < 22.5V$, $I_{OUT}=50mA$, $T_j=25$	56	72	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$T_j=25$	-	1.0	-	A	
Average Temperature	TC_{VO}	Fig. 1	$I_{OUT}=5mA$, $0 < T_j < 125$	-	-1.1	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7810AP (Unless otherwise specified, $V_{IN}=16V$, $I_{OUT}=500mA$, $0 < T_j < 125$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$, $I_{OUT}=100mA$	9.6	10.0	10.4	V	
Input Regulation	Reg line	Fig. 1	$T_j=25$	12.5V V_{IN} 27V	-	8	200	mV
				14V V_{IN} 20V	-	2.5	100	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.4A	-	12	200	mV
				250mA I_{OUT} 750mA	-	4	100	
Output Voltage	V_{OUT}	Fig. 1	12.5V V_{IN} 25V 5.0mA I_{OUT} 1.0A, P_o 15W	9.5	-	10.5	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.3	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	12.5V V_{IN} 27V	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, 10Hz f 100kHz $I_{OUT}=50mA$	-	80	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, 13.5V V_{IN} 23.5V, $I_{OUT}=50mA$, $T_j=25$	55	72	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$T_j=25$	-	0.9	-	A	
Average Temperature	TC_{VO}	Fig. 1	$I_{OUT}=5mA$, $0 < T_j < 125$	-	-1.3	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7812AP (Unless otherwise specified, $V_{IN}=19V$, $I_{OUT}=500mA$, $T_j=25$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$	11.5	12.0	12.5	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	14.5V V_{IN} 30V	-	10	240	mV
				16V V_{IN} 22V	-	3	120	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.5A	-	12	240	mV
				250mA I_{OUT} 750mA	-	4	120	
Output Voltage	V_{OUT}	Fig. 1	14.5V V_{IN} 27V 5.0mA I_{OUT} 1.0A, P_o 15W	11.4	12.0	12.6	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.3	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	14.5V V_{IN} 30V	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, 10Hz f 100kHz	-	76	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, 15V V_{IN} 25V	55	71	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$V_{IN}=30V$, $T_j=25$	-	50	-	mA	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$	-	-1.6	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7815AP (Unless otherwise specified, $V_{IN}=23V$, $I_{OUT}=500mA$, $0 < T_j < 125$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$, $I_{OUT}=100mA$	14.4	15.0	15.6	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	17.5V V_{IN} 30V	-	11	300	mV
				20V V_{IN} 26V	-	3	150	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.5A	-	12	300	mV
				250mA I_{OUT} 750mA	-	4	150	
Output Voltage	V_{OUT}	Fig. 1	17.5V V_{IN} 30V 5.0mA I_{OUT} 1.5A, P_o 15W	14.25	-	15.75	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.4	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	17.5V V_{IN} 30V	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, 10Hz f 100kHz $I_{OUT}=50mA$	-	110	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, 18.5V V_{IN} 28.5V, $I_{OUT}=50mA$, $T_j=25$	54	70	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$T_j=25$	-	0.5	-	A	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$, $0 < T_j < 125$	-	-2.0	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7818AP (Unless otherwise specified, $V_{IN}=27V$, $I_{OUT}=500mA$, $0 \leq T_j \leq 125$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$, $I_{OUT}=100mA$	17.3	18.0	18.7	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	$21V \leq V_{IN} \leq 33V$	-	13	360	mV
				$24V \leq V_{IN} \leq 30V$	-	4	180	
Load Regulation	Reg load	Fig. 1	$T_j=25$	$5mA \leq I_{OUT} \leq 1.5A$	-	12	360	mV
				$250mA \leq I_{OUT} \leq 750mA$	-	4	180	
Output Voltage	V_{OUT}	Fig. 1	$21V \leq V_{IN} \leq 33V$ $5.0mA \leq I_{OUT} \leq 1.5A$, $P_o \leq 15W$	17.1	-	18.9	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.5	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	$21V \leq V_{IN} \leq 33V$	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, $10Hz \leq f \leq 100kHz$ $I_{OUT}=50mA$	-	125	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, $22V \leq V_{IN} \leq 32V$, $I_{OUT}=50mA$, $T_j=25$	52	68	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$T_j=25$	-	0.4	-	A	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$, $0 \leq T_j \leq 125$	-	-2.5	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7820AP (Unless otherwise specified, $V_{IN}=29V$, $I_{OUT}=500mA$, $0 \leq T_j \leq 125$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$, $I_{OUT}=100mA$	19.2	20.0	20.8	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	23V V_{IN} 35V	-	15	400	mV
				26V V_{IN} 32V	-	5	200	
Load Regulation	Reg load	Fig. 1	$T_j=25$	5mA I_{OUT} 1.5A	-	12	400	mV
				250mA I_{OUT} 750mA	-	4	200	
Output Voltage	V_{OUT}	Fig. 1	23V V_{IN} 35V 5.0mA I_{OUT} 1.5A, P_o 15W	19.0	-	21.0	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.6	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	23V V_{IN} 35V	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, 10Hz f 100kHz $I_{OUT}=50mA$	-	135	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, 24V V_{IN} 34V, $I_{OUT}=50mA$, $T_j=25$	50	66	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$T_j=25$	-	0.4	-	A	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$, $0 \leq T_j \leq 125$	-	-3.0	-	mV/	

KIA7805AP~KIA7824AP

ELECTRICAL CHARACTERISTICS

KIA7824AP (Unless otherwise specified, $V_{IN}=33V$, $I_{OUT}=500mA$, $0 < T_j < 125$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	Fig. 1	$T_j=25$, $I_{OUT}=100mA$	23.0	24.0	25.0	V	
Line Regulation	Reg line	Fig. 1	$T_j=25$	$27V < V_{IN} < 38V$	-	18	480	mV
				$30V < V_{IN} < 36V$	-	6	240	
Load Regulation	Reg load	Fig. 1	$T_j=25$	$5mA < I_{OUT} < 1.5A$	-	12	480	mV
				$250mA < I_{OUT} < 750mA$	-	4	240	
Output Voltage	V_{OUT}	Fig. 1	$27V < V_{IN} < 38V$ $5.0mA < I_{OUT} < 1.5A$, $P_o < 15W$	22.8	-	25.2	V	
Quiescent Current	I_B	Fig. 1	$T_j=25$, $I_{OUT}=5mA$	-	4.6	8.0	mA	
Quiescent Current Change	I_B	Fig. 1	$27V < V_{IN} < 38V$	-	-	1.0	mA	
Output Noise Voltage	V_{NO}	Fig. 2	$T_a=25$, $10Hz < f < 100kHz$ $I_{OUT}=50mA$	-	150	-	μV_{rms}	
Ripple Rejection Ratio	RR	Fig. 3	$f=120Hz$, $28V < V_{IN} < 38V$, $I_{OUT}=50mA$, $T_j=25$	50	66	-	dB	
Dropout Voltage	V_D	Fig. 1	$I_{OUT}=1.0A$, $T_j=25$	-	2.0	-	V	
Short Circuit Current Limit	I_{SC}	Fig. 1	$T_j=25$	-	0.3	-	A	
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	$I_{OUT}=5mA$, $0 < T_j < 125$	-	-3.5	-	mV/	

KIA7805AP~KIA7824AP

TEST CIRCUIT

Fig. 1 Standard Test Circuit & Application Circuit

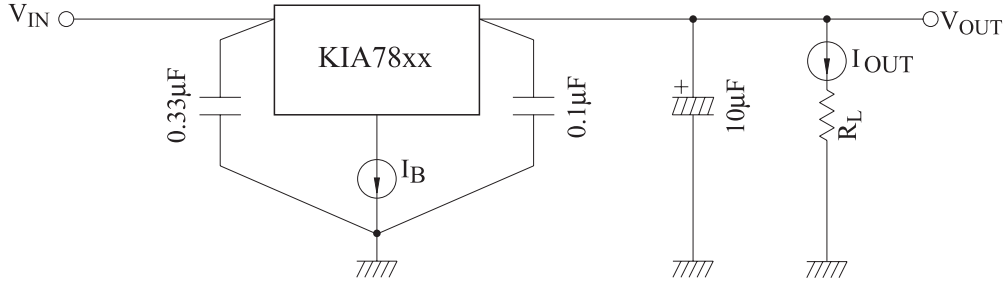


Fig. 2 V_{NO} Test Circuit

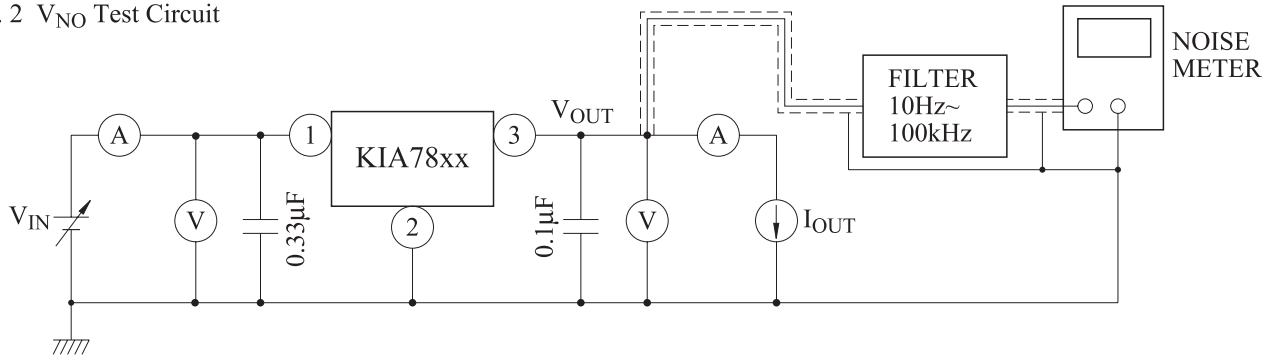
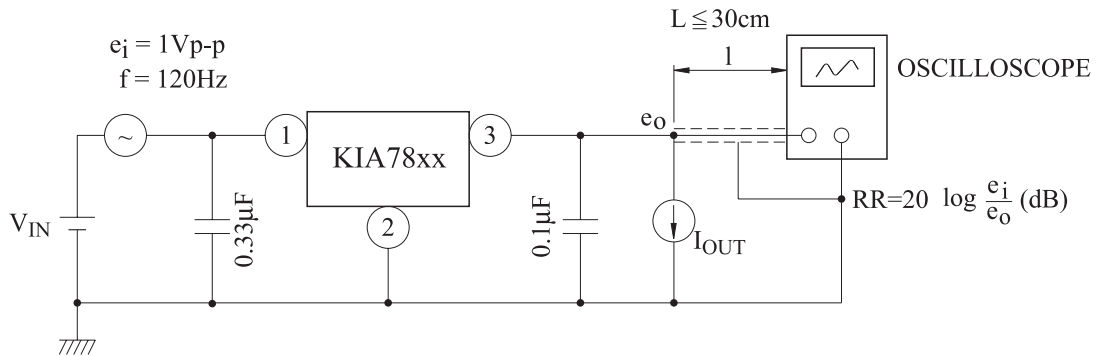


Fig. 3 Ripple Rejection Test Circuit

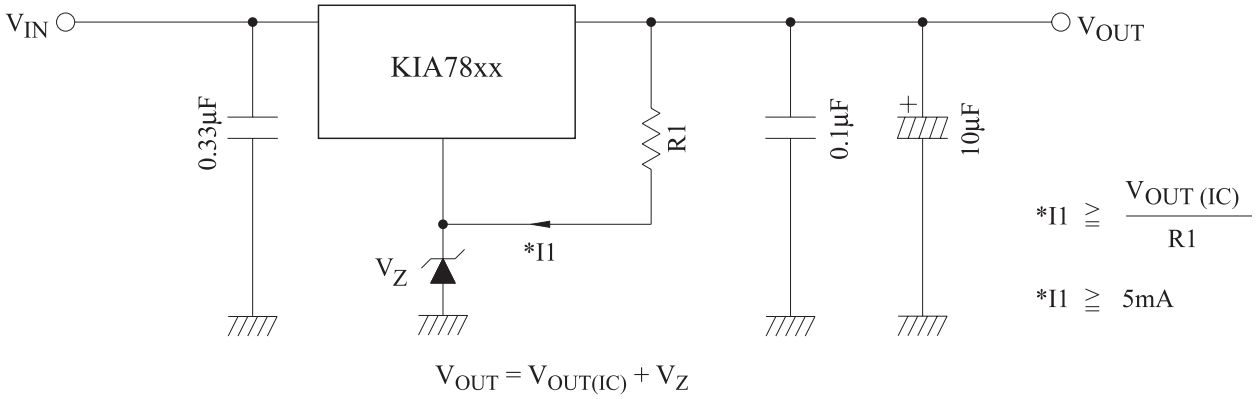


KIA7805AP~KIA7824AP

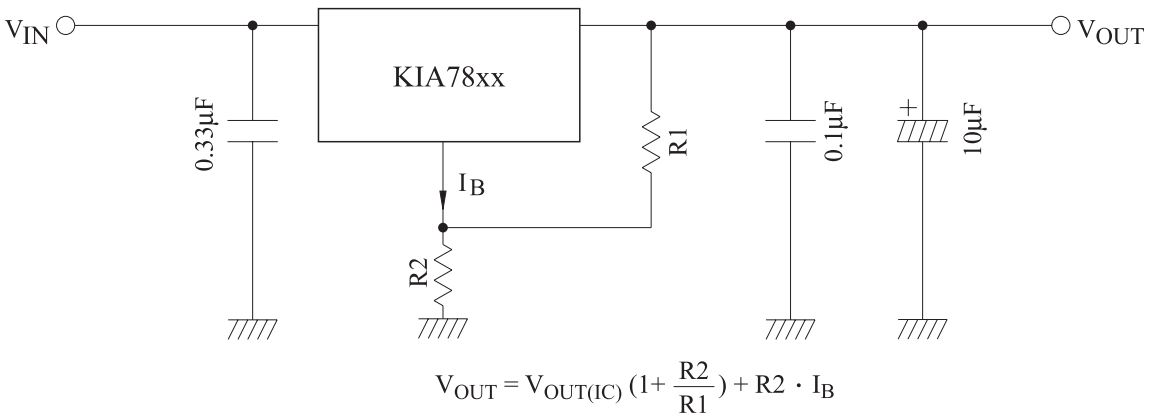
APPLICATION CIRCUIT

(1) VOLTAGE BOOST REGULATOR

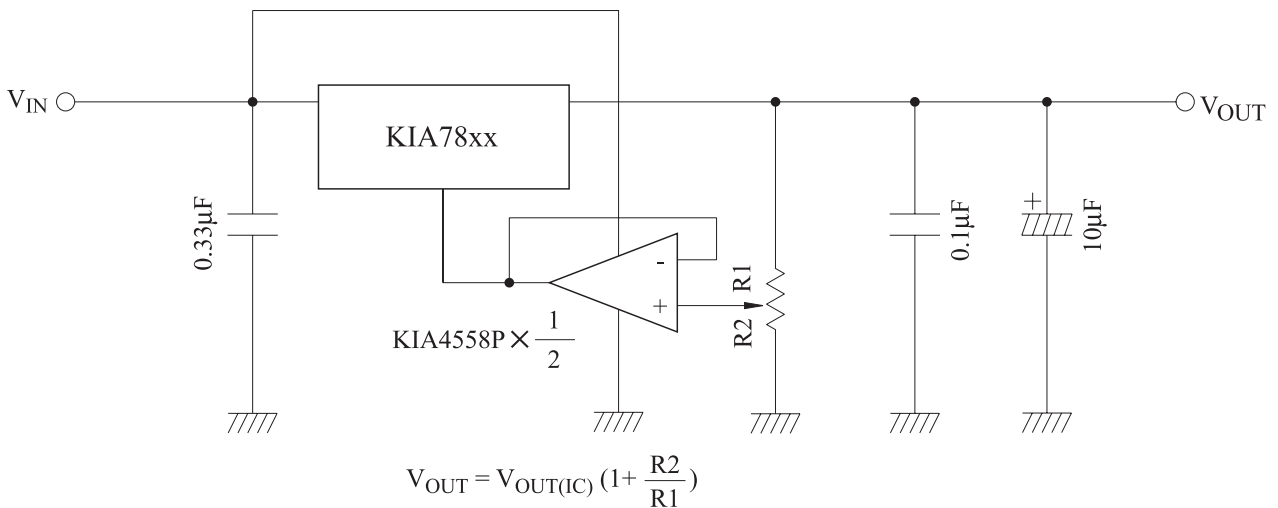
(a) Voltage boost by use of zener diode



(b) Voltage boost by use of resistor

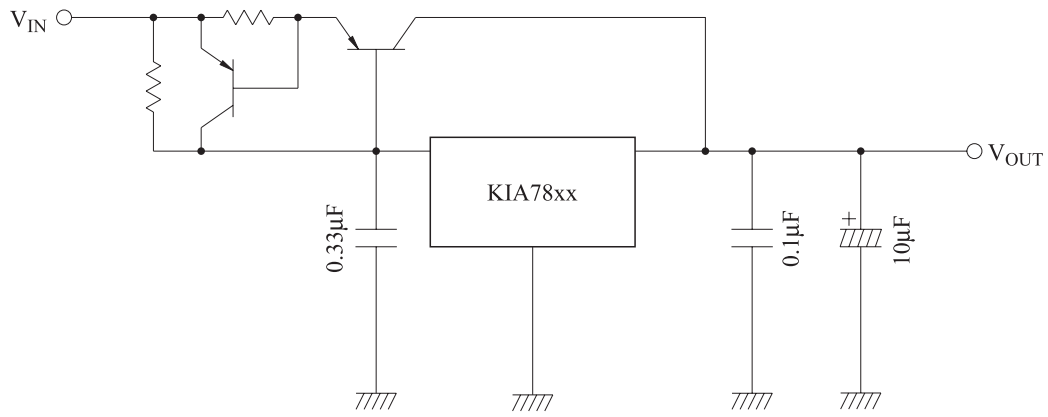


(c) Adjustable output regulator



KIA7805AP~KIA7824AP

(2) CURRENT BOOST REGULATOR



KIA7805AP~KIA7824AP

Fig. 4 $I_B - T_j$

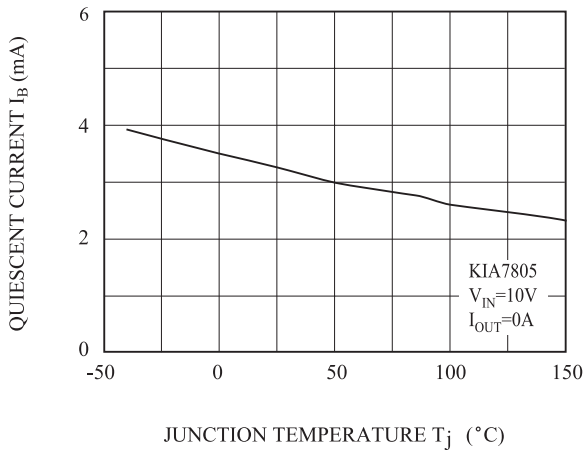


Fig. 5 $V_{OUT} - T_j$

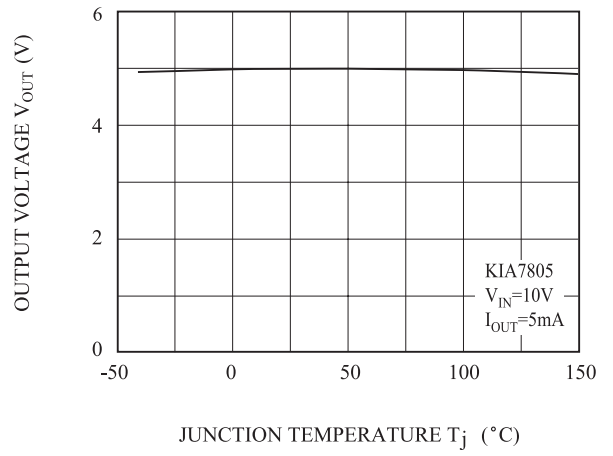


Fig. 6 $V_D - T_j$

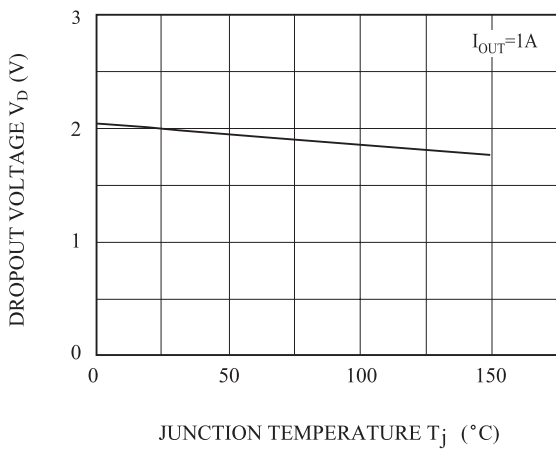


Fig. 7 $P_D - T_a$

