

## 4, 5 TERMINAL LOW DROP VOLTAGE REGULATOR [Low Quiescent Current-Type]

The KIA78R × × × ZF/ZPI Series are Low Dropout Voltage Regulator suitable for various electronic equipments. The Regulator has multi function such as over current protection, overheat protection.

### FEATURES

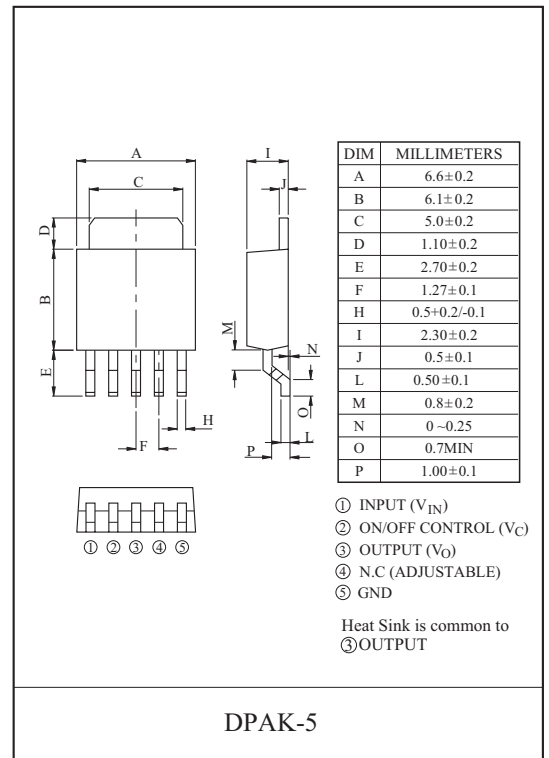
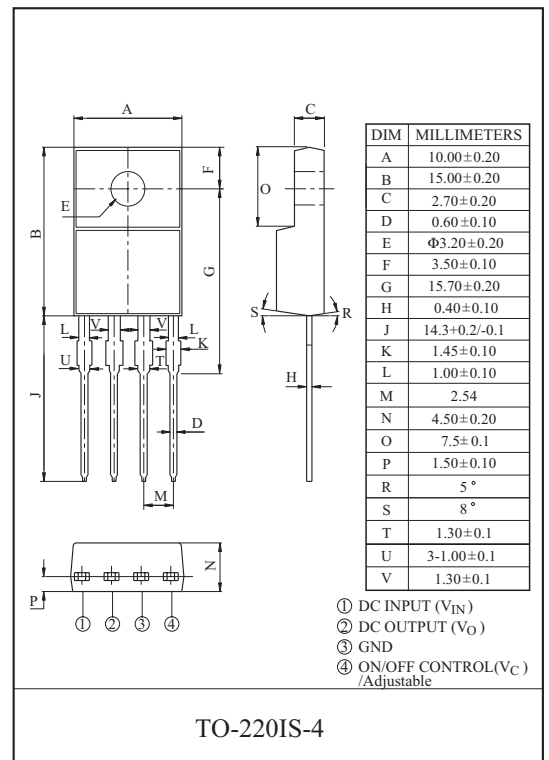
- 1.0A Output Low Drop Voltage Regulator.
- Built in ON/OFF Control Terminal. (Active High)
- Built in Over Current Protection, Over Heat Protection Function.
- ASO Protection Function.
- Low Quiescent Current (Output OFF mode) : 0.1μA(Typ.)
- Adjustable Outut Voltage Type :  $V_{OUT} = 1.5\sim 14V$
- Low Voltage Operation :  $V_{opr(min.)} = 2.35V$

### LINE UP

| ITEM            | OUTPUT VOLTAGE (V)              | PACKAGE                         |
|-----------------|---------------------------------|---------------------------------|
| KIA78R000ZF/ZPI | Adjustable ( $V_{rf} = 1.25V$ ) | ZF : DPAK-5<br>ZPI : TO-220IS-4 |
| KIA78R015ZF/ZPI | 1.5                             |                                 |
| KIA78R018ZF/ZPI | 1.8                             |                                 |
| KIA78R020ZF/ZPI | 2.0                             |                                 |
| KIA78R025ZF/ZPI | 2.5                             |                                 |
| KIA78R030ZF/ZPI | 3.0                             |                                 |
| KIA78R033ZF/ZPI | 3.3                             |                                 |
| KIA78R050ZF/ZPI | 5.0                             |                                 |

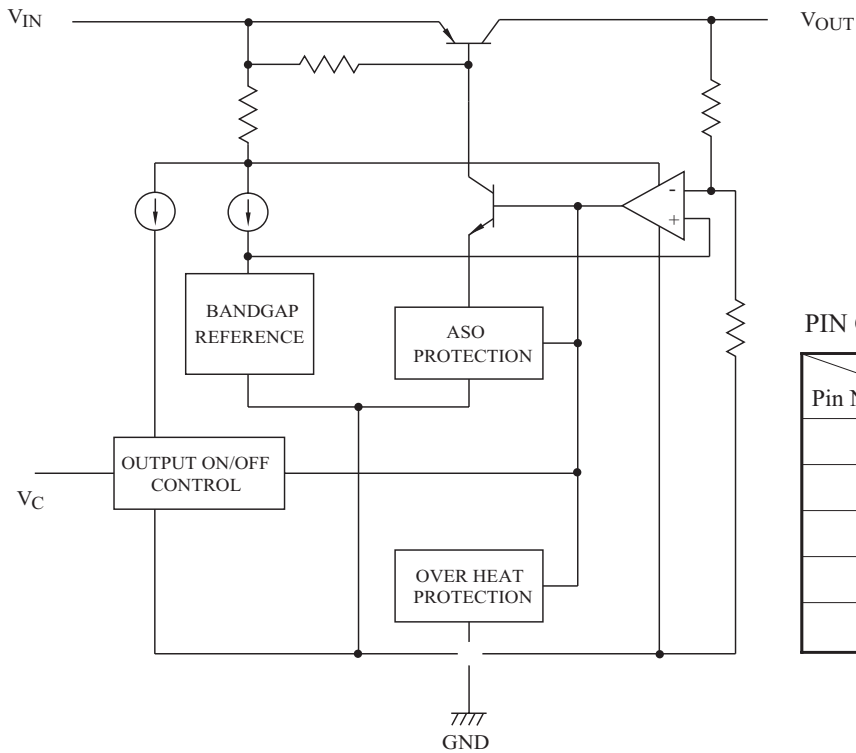
### MAXIMUM RATINGS ( $T_a=25^\circ C$ )

| CHARACTERISTIC                              | SYMBOL    | RATING    | UNIT       |
|---|-----------|-----------|------------|
| Input Voltage                               | $V_{IN}$  | 15        | V          |
| ON/OFF Control Voltage                      | $V_C$     | 15        | V          |
| Output Adjustment Terminal Voltage          | $V_{ADJ}$ | 10        | V          |
| Output Current                              | $I_{OUT}$ | 1         | A          |
| Power Dissipation -1<br>(No heatsink)       | ZF        | 1.3       | W          |
|   | ZPI       | 1.5       |            |
| Power Dissipation -2<br>(Infinite heatsink) | ZF        | 13        | W          |
|   | ZPI       | 15        |            |
| Junction Temperature                        | $T_j$     | 150       | $^\circ C$ |
| Operating Junction Temperature              | $T_{opr}$ | -40 ~ 125 | $^\circ C$ |
| Storage Temperature                         | $T_{stg}$ | -55 ~ 150 | $^\circ C$ |



# KIA78R000ZF/ZPI~KIA78R050ZF/ZPI

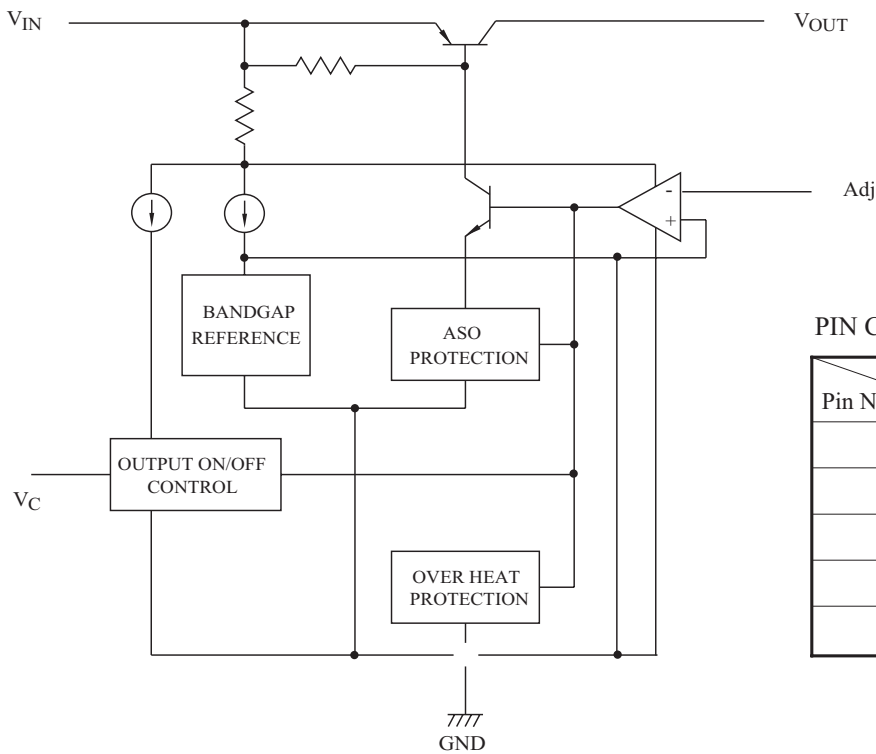
**Fig.1 BLOCK DIAGRAM -1(Fixed - Type)**



**PIN CONNECTION**

| Pin No. | Item | KIA78R***ZPI<br>(TO-220IS-4) | KIA78R***ZF<br>(DPAK-5) |
|---------|------|------------------------------|-------------------------|
| 1       |      | $V_{IN}$                     | $V_{IN}$                |
| 2       |      | $V_{OUT}$                    | $V_C$                   |
| 3       |      | GND                          | $V_{OUT}$               |
| 4       |      | $V_C$                        | NC                      |
| 5       |      | -                            | GND                     |

**Fig.2 BLOCK DIAGRAM -2(Adjustable - Type)**



**PIN CONNECTION**

| Pin No. | Item | KIA78R000ZPI<br>(TO-220IS-4) | KIA78R000ZF<br>(DPAK-5) |
|---------|------|------------------------------|-------------------------|
| 1       |      | $V_{IN}$                     | $V_{IN}$                |
| 2       |      | $V_{OUT}$                    | $V_C$                   |
| 3       |      | GND                          | $V_{OUT}$               |
| 4       |      | Adj                          | Adj                     |
| 5       |      | -                            | GND                     |

# KIA78R000ZF/ZPI~~KIA78R050ZF/ZPI

## ELECTRICAL CHARACTERISTICS (KIA78R000ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=3.5V$ ,  $V_O=2.5V$ ,  $I_O=0.5A$ ,  $R_1,R_2=1k$ ,  $T_j=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN. | TYP.      | MAX.      | UNIT    |
|---|--------------|---|------|-----------|-----------|---------|
| Input Voltage                             | $V_{IN}$     | -   | 2.35 | -         | 15        | V       |
| Output Voltage                            | $V_{OUT}$    | -   | 1.5  | -         | 14        | V       |
| Reference Voltage                         | $V_{REF}$    | $V_{IN}=2.5V$ , $I_{OUT}=0.5A$  | 1.22 | 1.25      | 1.28      | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 1A  | -    | 0.2       | 2.0       | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=3.5V\sim 8.5V$ , $I_O=5mA$                                    | -    | 0.2       | 1.0       | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$   | -    | $\pm 1.0$ | $\pm 2.0$ | %       |
| Ripple Rejection                          | $R \cdot R$  | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ , $V_{IN}=4V$ | 45   | 60        | -         | dB      |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0  | -         | -         | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -    | -         | 200       | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | $I_O=0$   | -    | -         | 0.8       | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -    | -         | 2.0       | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0$   | -    | 1         | 2         | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$  | -    | 0.1       | 5         | $\mu A$ |

## ELECTRICAL CHARACTERISTICS (KIA78R015ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=V_O+1V$ ,  $I_O=0.5A$ ,  $T_a=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN. | TYP.       | MAX.       | UNIT    |
|---|--------------|---|------|------------|------------|---------|
| Input Voltage                             | $V_{IN}$     | -   | 2.35 | -          | 15         | V       |
| Output Voltage                            | $V_O$        | -   | 1.45 | 1.50       | 1.55       | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 1A  | -    | 0.2        | 2.0        | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=2.5V\sim 6.5V$ , $I_O=5mA$                      | -    | 0.2        | 1.0        | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$                                 | -    | $\pm 0.02$ | $\pm 0.05$ | %/      |
| Ripple Rejection                          | $R \cdot R$  | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ | 45   | 60         | -          | dB      |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0  | -          | -          | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -    | -          | 200        | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | -   | -    | -          | 0.8        | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -    | -          | 2.0        | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0A$  | -    | 1          | 2          | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$ , $I_O=0A$                                   | -    | 0.1        | 5          | $\mu A$ |

# KIA78R000ZF/ZPI~KIA78R050ZF/ZPI

## ELECTRICAL CHARACTERISTICS (KIA78R018ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=V_O+1V$ ,  $I_O=0.5A$ ,  $T_a=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN. | TYP.       | MAX.       | UNIT    |
|---|--------------|---|------|------------|------------|---------|
| Input Voltage                             | $V_{IN}$     | -   | 2.45 | -          | 15         | V       |
| Output Voltage                            | $V_O$        | -   | 1.75 | 1.8        | 1.85       | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 1A  | -    | 0.2        | 2.0        | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=2.5V\sim 7V$ , $I_O=5mA$                        | -    | 0.2        | 1.0        | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$                                 | -    | $\pm 0.02$ | $\pm 0.05$ | %/      |
| Ripple Rejection                          | R · R        | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ | 45   | 60         | -          | dB      |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0  | -          | -          | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -    | -          | 200        | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | -   | -    | -          | 0.8        | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -    | -          | 2.0        | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0A$  | -    | 1          | 2          | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$ , $I_O=0A$                                   | -    | 0.1        | 5          | $\mu A$ |

## ELECTRICAL CHARACTERISTICS (KIA78R020ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=V_O+1V$ ,  $I_O=0.5A$ ,  $T_a=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN.  | TYP.       | MAX.       | UNIT    |
|---|--------------|---|-------|------------|------------|---------|
| Output Voltage                            | $V_O$        | -   | 1.944 | 2.0        | 2.056      | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 1A  | -     | 0.2        | 2.0        | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=3V\sim 8V$ , $I_O=5mA$                          | -     | 0.2        | 1.0        | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$                                 | -     | $\pm 0.02$ | $\pm 0.05$ | %/      |
| Ripple Rejection                          | R · R        | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ | 45    | 60         | -          | dB      |
| Dropout Voltage                           | $V_D$        | $I_O=1A$ , $V_{IN}=0.95V_{OUT}$                         | -     | -          | 0.5        | V       |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0   | -          | -          | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -     | -          | 200        | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | -   | -     | -          | 0.8        | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -     | -          | 2.0        | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0A$  | -     | 1          | 2          | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$ , $I_O=0A$                                   | -     | 0.1        | 5          | $\mu A$ |

# KIA78R000ZF/ZPI~~KIA78R050ZF/ZPI

## ELECTRICAL CHARACTERISTICS (KIA78R025ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=V_O+1V$ ,  $I_O=0.5A$ ,  $T_a=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN.  | TYP.       | MAX.       | UNIT    |
|---|--------------|---|-------|------------|------------|---------|
| Output Voltage                            | $V_O$        | -   | 2.438 | 2.50       | 2.562      | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 2.0A  | -     | 0.2        | 2.0        | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=3.5V\sim 8.5V$ , $I_O=5mA$                      | -     | 0.2        | 1.0        | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$                                 | -     | $\pm 0.02$ | $\pm 0.05$ | %/      |
| Ripple Rejection                          | $R \cdot R$  | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ | 45    | 60         | -          | dB      |
| Dropout Voltage                           | $V_D$        | $I_O=1A$ , $V_{IN}=0.95V_{OUT}$                         | -     | -          | 0.5        | V       |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0   | -          | -          | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -     | -          | 200        | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | -   | -     | -          | 0.8        | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -     | -          | 2.0        | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0A$  | -     | 1          | 2          | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$ , $I_O=0A$                                   | -     | 0.1        | 5          | $\mu A$ |

## ELECTRICAL CHARACTERISTICS (KIA78R030ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=V_O+1V$ ,  $I_O=0.5A$ ,  $T_a=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN.  | TYP.       | MAX.       | UNIT    |
|---|--------------|---|-------|------------|------------|---------|
| Output Voltage                            | $V_O$        | -   | 2.928 | 3.0        | 3.072      | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 1A  | -     | 0.2        | 2.0        | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=4V\sim 9V$ , $I_O=5mA$                          | -     | 0.2        | 1.0        | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$                                 | -     | $\pm 0.02$ | $\pm 0.05$ | %/      |
| Ripple Rejection                          | $R \cdot R$  | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ | 45    | 60         | -          | dB      |
| Dropout Voltage                           | $V_D$        | $I_O=1A$ , $V_{IN}=0.95V_{OUT}$                         | -     | -          | 0.5        | V       |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0   | -          | -          | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -     | -          | 200        | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | -   | -     | -          | 0.8        | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -     | -          | 2.0        | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0A$  | -     | 1          | 2          | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$ , $I_O=0A$                                   | -     | 0.1        | 5          | $\mu A$ |

# KIA78R000ZF/ZPI~KIA78R050ZF/ZPI

## ELECTRICAL CHARACTERISTICS (KIA78R033ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=V_O+1V$ ,  $I_O=0.5A$ ,  $T_a=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN.  | TYP.       | MAX.       | UNIT    |
|---|--------------|---|-------|------------|------------|---------|
| Output Voltage                            | $V_O$        | -   | 3.221 | 3.30       | 3.379      | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 1A  | -     | 0.2        | 2.0        | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=4V\sim 9V$ , $I_O=5mA$                          | -     | 0.2        | 1.0        | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$                                 | -     | $\pm 0.02$ | $\pm 0.05$ | %/      |
| Ripple Rejection                          | $R \cdot R$  | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ | 45    | 60         | -          | dB      |
| Dropout Voltage                           | $V_D$        | $I_O=1A$ , $V_{IN}=0.95V_{OUT}$                         | -     | -          | 0.5        | V       |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0   | -          | -          | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -     | -          | 200        | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | -   | -     | -          | 0.8        | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -     | -          | 2.0        | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0A$  | -     | 1          | 2          | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$ , $I_O=0A$                                   | -     | 0.1        | 5          | $\mu A$ |

## ELECTRICAL CHARACTERISTICS (KIA78R050ZF/ZPI)

(Unless otherwise specified,  $V_{IN}=V_O+1V$ ,  $I_O=0.5A$ ,  $T_a=25$  )

| CHARACTERISTIC                            | SYMBOL       | CONDITIONS  | MIN. | TYP.       | MAX.       | UNIT    |
|---|--------------|---|------|------------|------------|---------|
| Output Voltage                            | $V_O$        | -   | 4.88 | 5.0        | 5.12       | V       |
| Load Regulation                           | Reg Load     | $I_O=5mA$ 1A  | -    | 0.2        | 2.0        | %       |
| Line Regulation                           | Reg Line     | $V_{IN}=6V\sim 10V$ , $I_O=5mA$                         | -    | 0.2        | 1.0        | %       |
| Temperature Coefficient of Output Voltage | $T_C V_O$    | $T_j=0$ 125 , $I_O=5mA$                                 | -    | $\pm 0.02$ | $\pm 0.05$ | %/      |
| Ripple Rejection                          | $R \cdot R$  | $I_{OUT}=0.3A$ , $f=120Hz$ ,<br>$V_{ripple}=0.5V_{rms}$ | 45   | 60         | -          | dB      |
| Dropout Voltage                           | $V_D$        | $I_O=1A$ , $V_{IN}=0.95V_{OUT}$                         | -    | -          | 0.5        | V       |
| Output ON state for control Voltage       | $V_{C(ON)}$  | -   | 2.0  | -          | -          | V       |
| Output ON state for control Current       | $I_{C(ON)}$  | $V_C=2.7V$  | -    | -          | 200        | $\mu A$ |
| Output OFF state for control Voltage      | $V_{C(OFF)}$ | -   | -    | -          | 0.8        | V       |
| Output OFF state for control Current      | $I_{C(OFF)}$ | $V_C=0.4V$  | -    | -          | 2.0        | $\mu A$ |
| Quiescent Current                         | $I_Q$        | $I_O=0A$  | -    | 1          | 2          | mA      |
| Quiescent Current (OFF Mode)              | $I_{Q(OFF)}$ | $V_C=0.4V$ , $I_O=0A$                                   | -    | 0.1        | 5          | $\mu A$ |

# KIA78R000ZF/ZPI ~ KIA78R050ZF/ZPI

Fig. 3 Test Circuit (Fixed-Type)

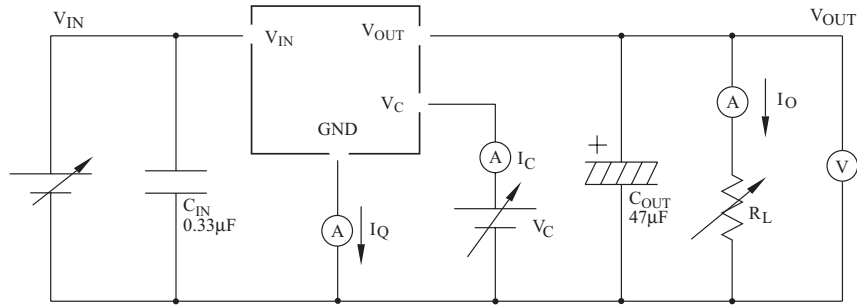
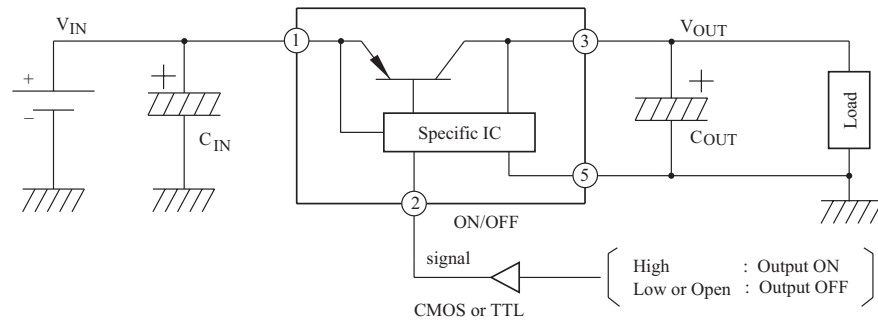


Fig. 4 Application Circuit for Standard (Fixed-Type)



$C_{IN}$  : More than  $0.33\mu F$  required if regulator is located an appreciable distance from power supply filter.

You must use to prevent from the parasitic oscillation.

$C_{OUT}$  : More than  $47\mu F$ . You must use the Low-impedance-type(low ESR) capacitor.

Fig. 5 Test Circuit (Adjustable - Type)

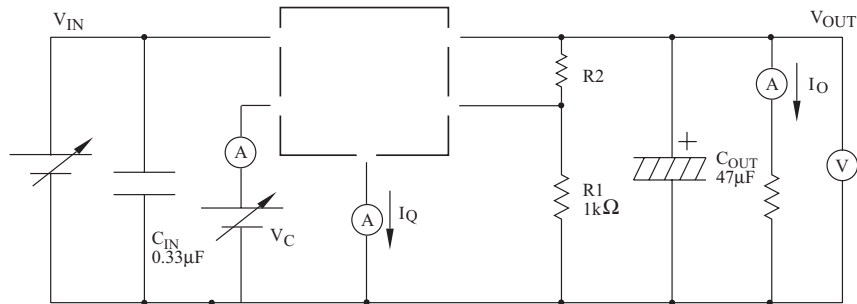
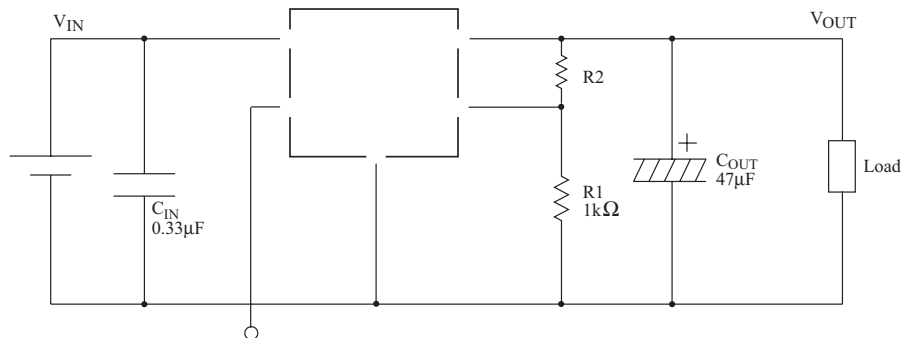


Fig. 6 Application Circuit (Adjustable - Type)



$C_{IN}$  : More than  $0.33\mu F$  required if regulator is located an appreciable distance from power supply filter.

You must use to prevent from the parasitic oscillation.

$C_{OUT}$  : More than  $47\mu F$ . You must use the Low-impedance-type(low ESR) capacitor.

# KIA78R000ZF/ZPI~KIA78R050ZF/ZPI

Fig. 7  $I_O - V_O$

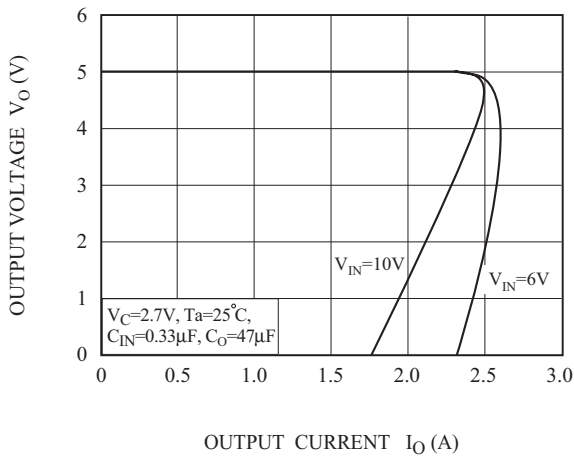


Fig. 8  $T_a - \Delta V_{ref}$

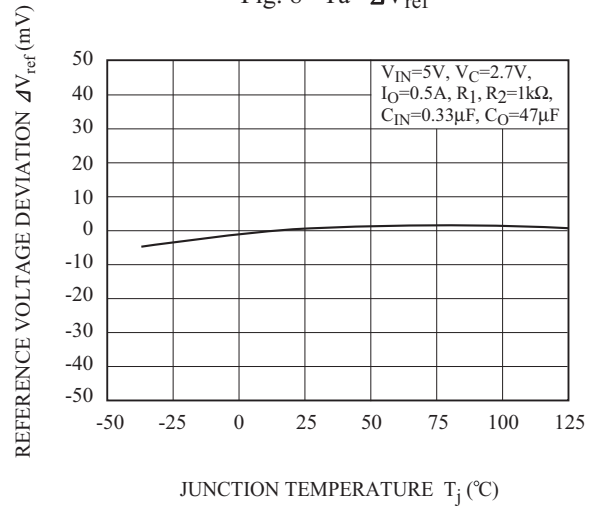


Fig. 9  $V_{IN} - V_O$

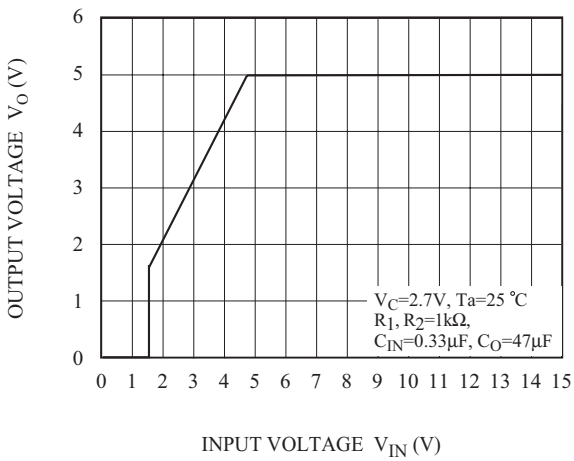


Fig. 10  $V_{IN} - I_{BIAS}$

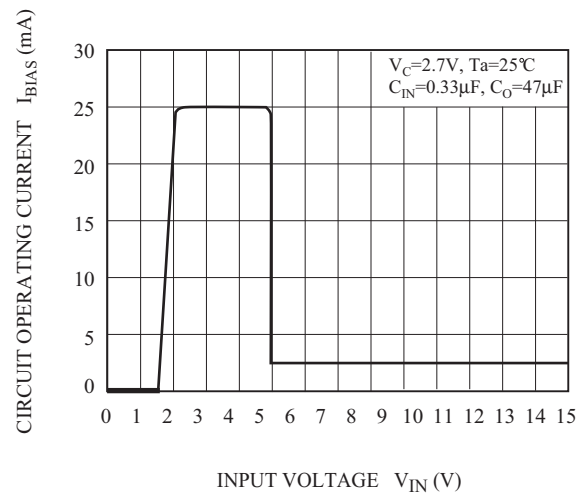


Fig. 11  $T_j - V_D$

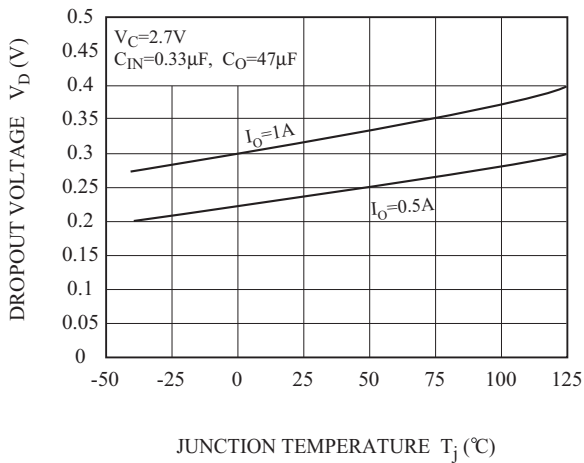
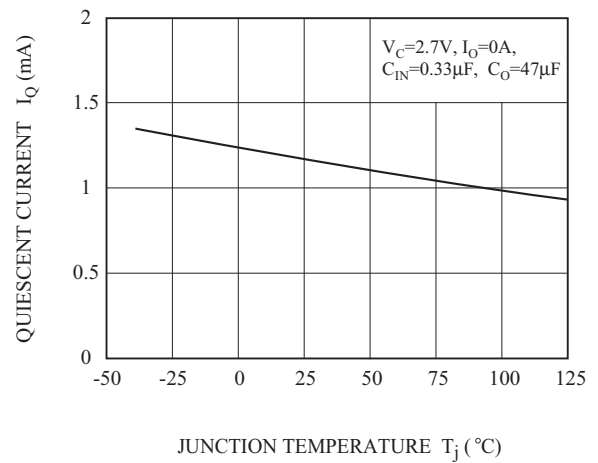


Fig. 12  $T_j - I_Q$





# KIA78R000ZF/ZPI ~ KIA78R050ZF/ZPI

Fig. 13  $f_{IN}$  - R.R

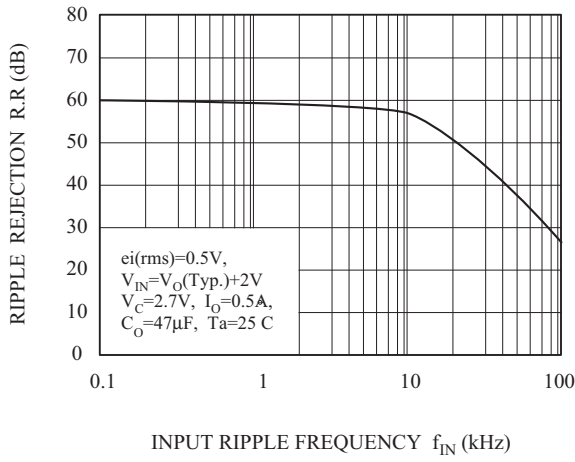


Fig. 14  $I_{OUT}$  - R.R

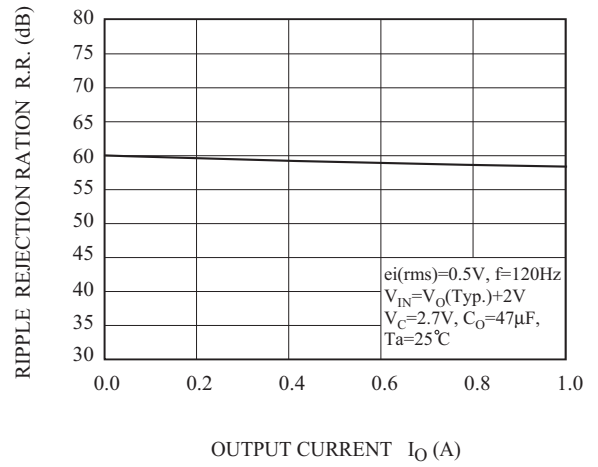


Fig. 15  $P_D$  -  $T_a$  (F-Type : DPAK-5)

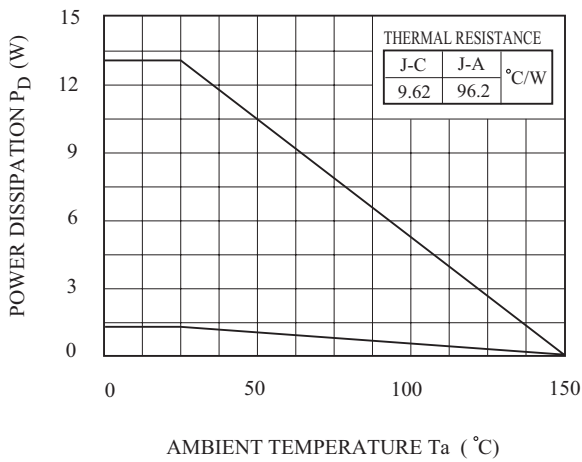


Fig. 16  $P_D$  -  $T_a$  (PI-Type : TO-220IS-4)

