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KA278RXXC-Series

2 A Output Low Dropout Voltage Regulators

Features

KA278RXXC-Series (33 / 05 / 12)

- 3.3 V, 5 V, 12 V Output Low-Dropout Voltage Regulator
- TO-220 Full-Mold Package (4 Pin)
- Over-Current Protection, Thermal Shutdown
- Over-Voltage Protection, Short-Circuit Protection
- Output Disable Function

KA278RA05C

- Nominal 5 V Output without Adjusting
- Output Adjustable between 1.27 V and 32 V
- 2 A Output Low-Dropout Voltage Regulator
- TO-220 Full-Mold Package (4 Pin)
- Over-Current Protection, Thermal Shutdown
- Over-Voltage Protection, Short-Circuit Protection

Description

The KA278RXXC is a low-dropout voltage regulator suitable for various electronic equipment. It provides a constant voltage power source in a TO-220 4-lead full-mold package. The dropout voltage is below 0.5 V in full-rated current (2 A). This regulator has peak current protection, thermal shutdown, and over-voltage protection.

TO-220F 4L



1. V_{IN} 2. V_O 3. GND 4. V_{dis} - KA278RXXC (33 / 05 / 12)
1. V_{IN} 2. V_O 3. GND 4. V_{adj} - KA278RA05C

Ordering Information

| Part Number | Operating Temperature Range | Top Mark | Package | Packing Method |
|---------------|-----------------------------|----------|----------------------|----------------|
| KA278R33CTU | -20 to 80°C | 278R33 | TO-220F 4L | Rail |
| KA278R05CTU | | 278R05 | | |
| KA278R12CTU | | 278R12 | | |
| KA278RA05CTU | | 278RA05 | | |
| KA278R12CYDTU | | 278R12 | TO-220F 4L (Forming) | |

Block Diagram

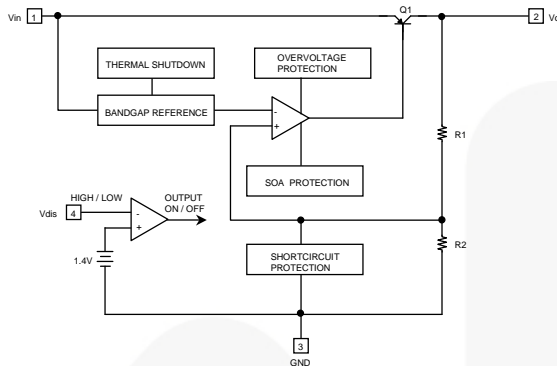


Figure 1. KA278R33 / 05 / 12C

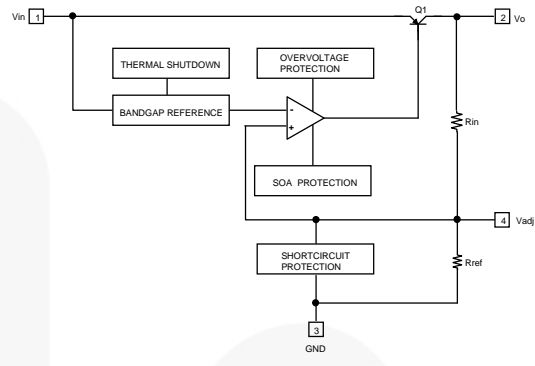


Figure 2. KA278RA05C

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | | Value | Unit |
|-----------------|---|----------------|-----------|--------------------|
| V_{IN} | Input Voltage | | 35 | V |
| V_{dis} | Disable Voltage | KA278RXXC | 35 | V |
| I_O | Output Current | | 2.0 | A |
| P_{D1} | Power Dissipation 1 | No Heat-Sink | 1.5 | W |
| P_{D2} | Power Dissipation 2 | With Heat-Sink | 15 | W |
| T_j | Junction Temperature | | 150 | $^\circ\text{C}$ |
| T_{opr} | Operating Temperature | | -20 to 80 | $^\circ\text{C}$ |
| $R_{\theta jc}$ | Thermal Resistance, Junction-to Case ⁽¹⁾ | | 2.9 | $^\circ\text{C/W}$ |
| $R_{\theta ja}$ | Thermal Resistance, Junction-to-Air | | 48.51 | $^\circ\text{C/W}$ |

Note:

- Junction-to-case thermal resistance test environments:
 - Pneumatic heat sink fixture;
 - Clamping pressure 60 psi through 12 mm diameter cylinder;
 - Thermal grease applied between PKG and heat sink fixture.

Electrical Characteristics

V_{IN} = Note 3, $I_O = 1.0$ A, $T_A = 25^\circ\text{C}$, unless otherwise specified.

| Symbol | Parameter | | Test Conditions | Min. | Typ. | Max. | Unit |
|------------|---------------------------------------|------------|----------------------------------|-------|-------|-------|---------------|
| V_O | Output Voltage | KA278R33C | | 3.22 | 3.30 | 3.38 | V |
| | | KA278R05C | | 4.88 | 5.00 | 5.12 | |
| | | KA278R12C | | 11.70 | 12.00 | 12.30 | |
| R_{load} | Load Regulation | | $5\text{ mA} < I_O < 2\text{ A}$ | | 0.1 | 2.0 | % |
| R_{line} | Line Regulation ⁽⁴⁾ | | | | 0.5 | 2.5 | % |
| RR | Ripple Rejection Ratio ⁽²⁾ | | | 45 | 55 | | dB |
| V_{drop} | Dropout Voltage | | $I_O = 2\text{ A}$ | | | 0.5 | V |
| V_{disH} | Disable Voltage High | KA278RXXC | Output Active | 2.0 | | | V |
| V_{disL} | Disable Voltage Low | KA278RXXC | Output Disabled | | | 0.8 | V |
| I_{disH} | Disable Bias Current High | KA278RXXC | $V_{dis} = 2.7\text{ V}$ | | | 20 | μA |
| I_{disL} | Disable Bias Current Low | KA278RXXC | $V_{dis} = 0.4\text{ V}$ | | | -0.4 | mA |
| I_q | Quiescent Current | | $I_O = 0\text{ A}$ | | | 10 | mA |
| V_{ref} | Reference Voltage | KA278RA05C | | 1.24 | 1.27 | 1.30 | V |

Notes:

- These parameters, although guaranteed, are not 100% tested in production.
- KA278R33C: $V_{IN} = 5\text{ V}$;
KA278R05C: $V_{IN} = 7\text{ V}$;
KA278R12C: $V_{IN} = 15\text{ V}$.
- KA278R33C: $V_{IN} = 4\text{ V}$ to 10 V ;
KA278R05C: $V_{IN} = 6\text{ V}$ to 12 V ;
KA278R12C: $V_{IN} = 13\text{ V}$ to 29 V .

Typical Performance Characteristics (KA278R33C)

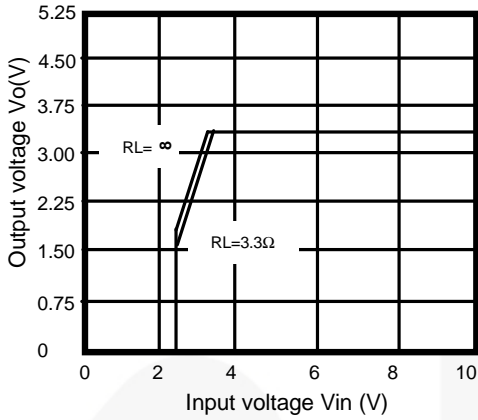


Figure 3. Output Voltage vs. Input Voltage

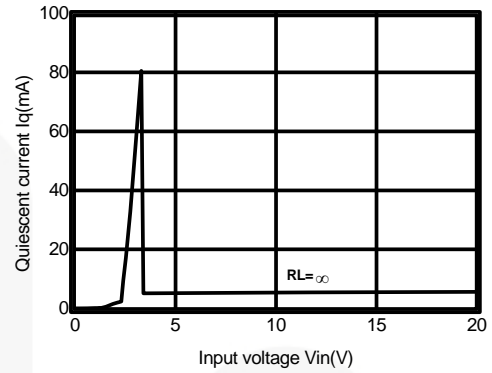


Figure 4. Quiescent Current vs. Input Voltage

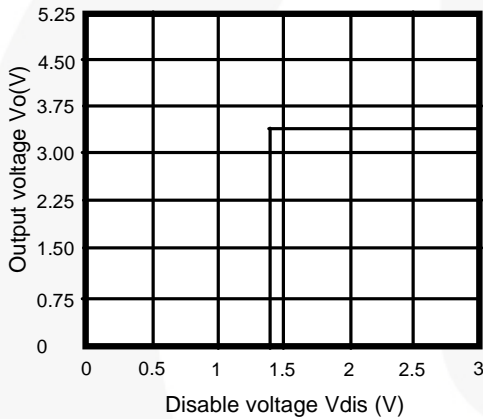


Figure 5. Output Voltage vs. Disable Voltage

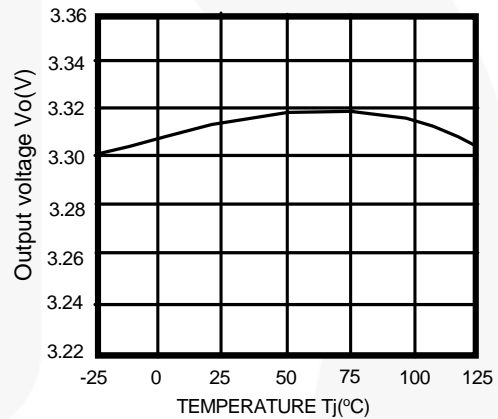


Figure 6. Output Voltage vs. Temperature (T_j)

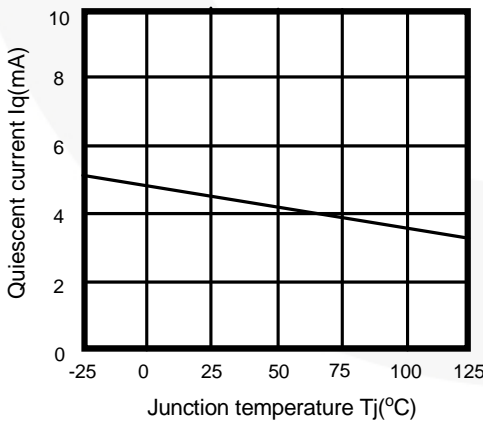


Figure 7. Quiescent Current vs. Temperature (T_j)

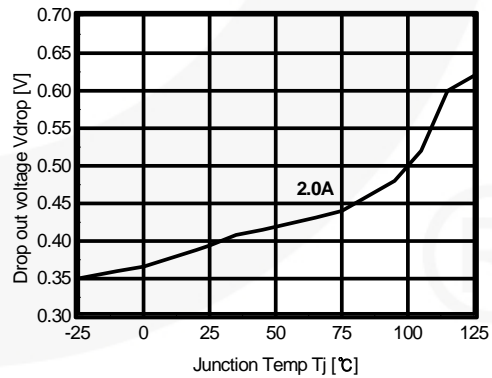


Figure 8. Dropout Voltage vs. Junction Temperature

Typical Performance Characteristics (Continued)

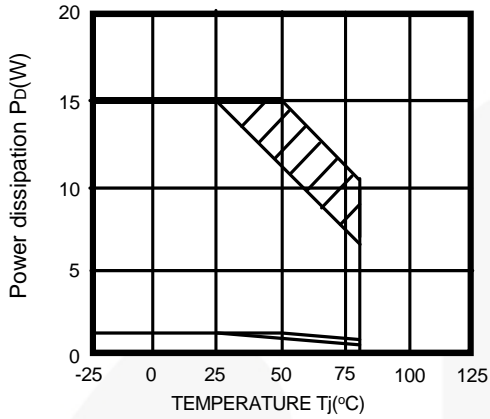


Figure 9. Power Dissipation vs. Temperature (T_j)

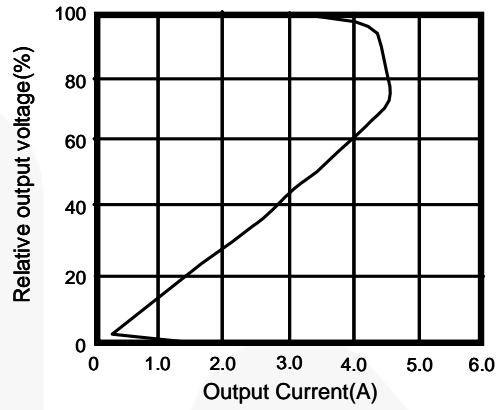


Figure 10. Over-Current Protection Characteristics (Typical Value)

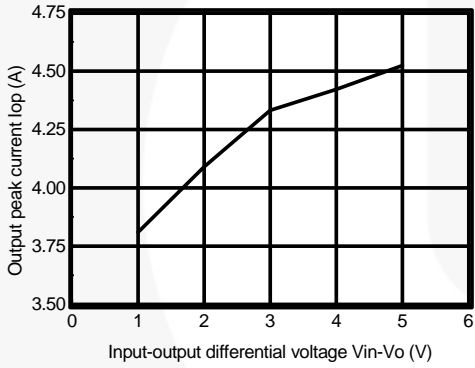


Figure 11. Output Peak Current vs. Input-Output Differential Voltage

Typical Performance Characteristics (KA278R05C)

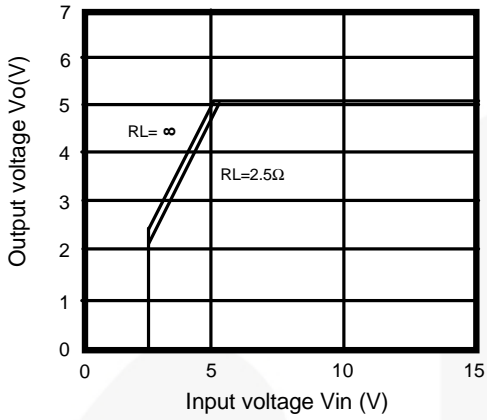


Figure 12. Output Voltage vs. Input Voltage

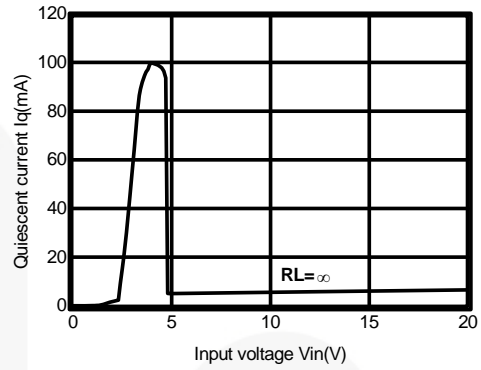


Figure 13. Quiescent Current vs. Input Voltage

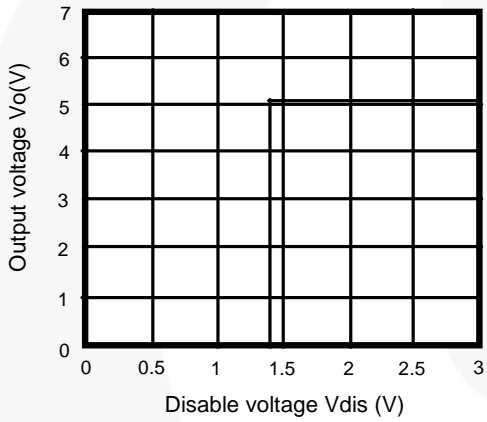


Figure 14. Output Voltage vs. Disable Voltage

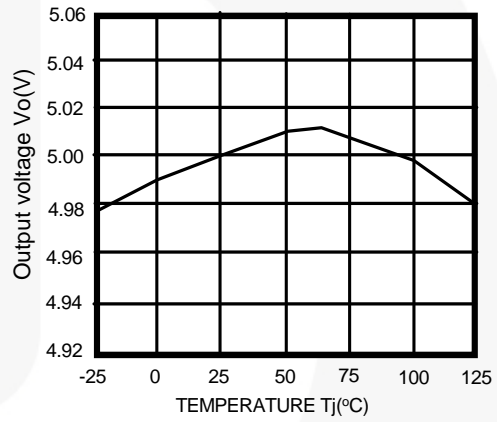


Figure 15. Output Voltage vs. Temperature (T_j)

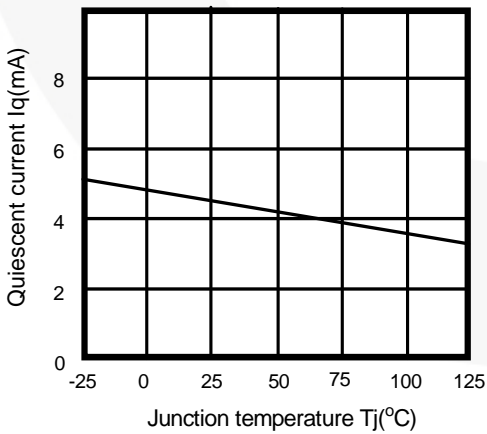


figure 16. Quiescent Current vs. Temperature (T_j)

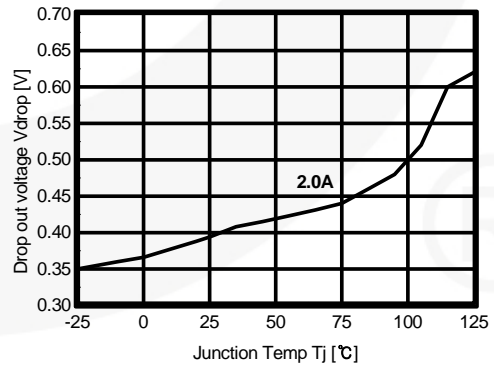


Figure 17. Dropout Voltage vs. Junction Temperature

Typical Performance Characteristics (Continued)

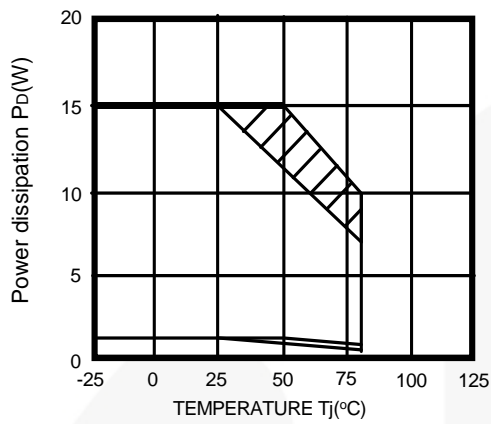


Figure 18. Power Dissipation vs. Temperature (T_j)

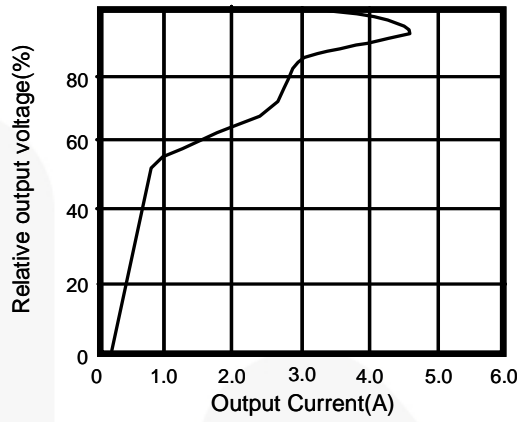


Figure 19. Over-Current Protection Characteristics (Typical Value)

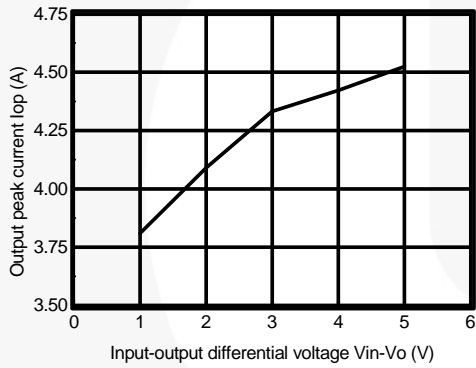


Figure 20. Output Peak Current vs. Input-Output Differential Voltage

Typical Performance Characteristics (KA278R12C)

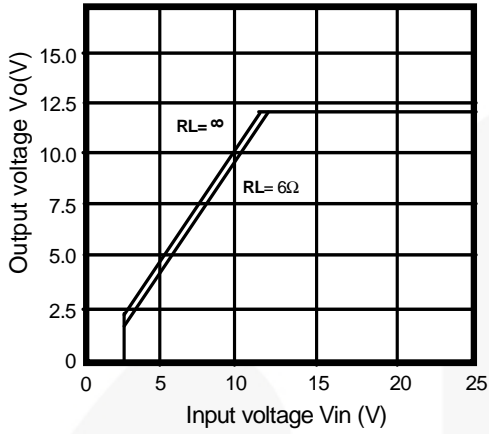


Figure 21. Output Voltage vs. Input Voltage

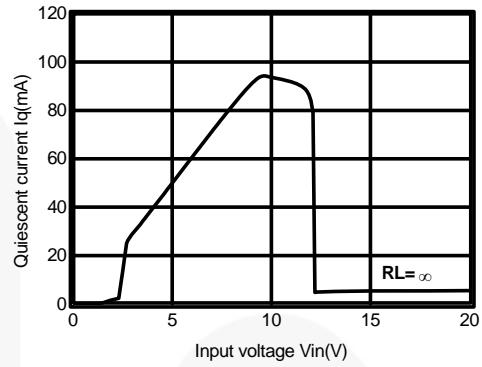


Figure 22. Quiescent Current vs. Input Voltage

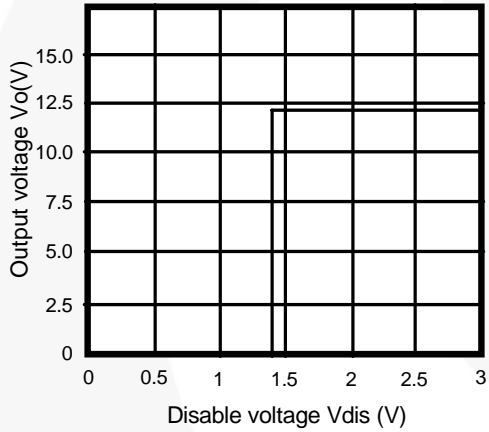


Figure 23. Output Voltage vs. Disable Voltage

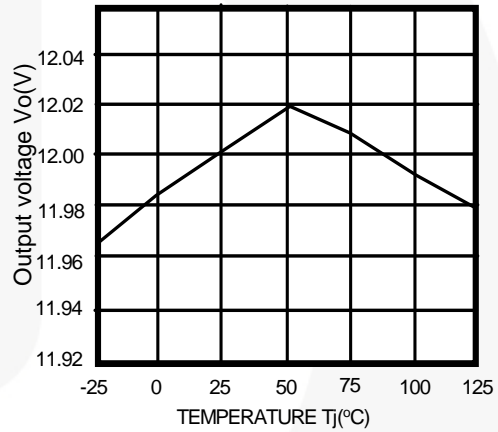
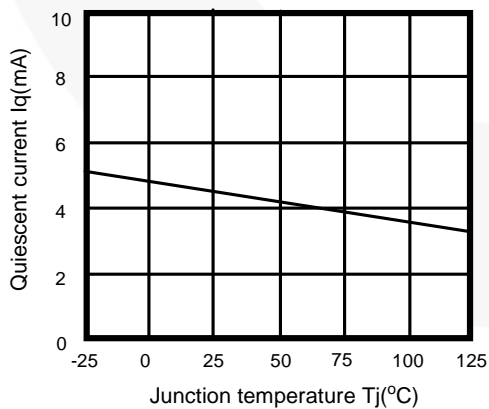


Figure 24. Output Voltage vs. Temperature (T_j)



25. Quiescent Current vs. Temperature (T_j)

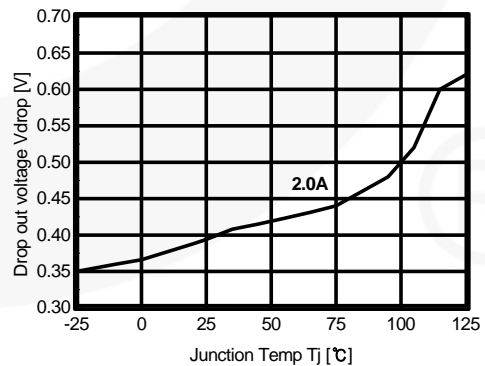


Figure 26. Dropout Voltage vs. Junction Temperature

Typical Performance Characteristics (Continued)

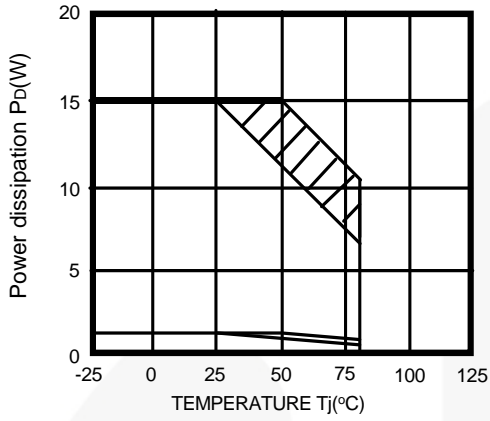


Figure 27. Power Dissipation vs. Temperature (T_j)

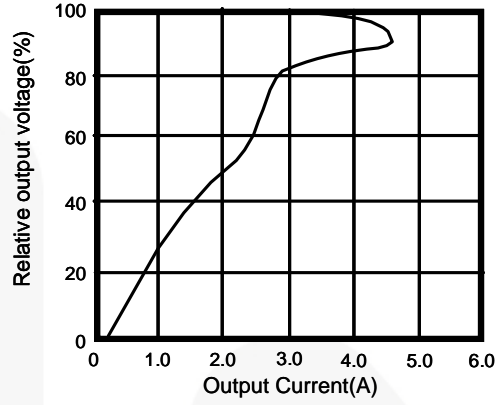


Figure 28. Over-Current Protection Characteristics (Typical Value)

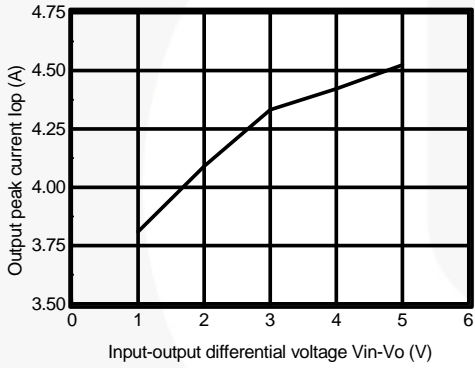


Figure 29. Output Peak Current vs. Input-Output Differential Voltage

Typical Performance Characteristics (KA278RA05C)

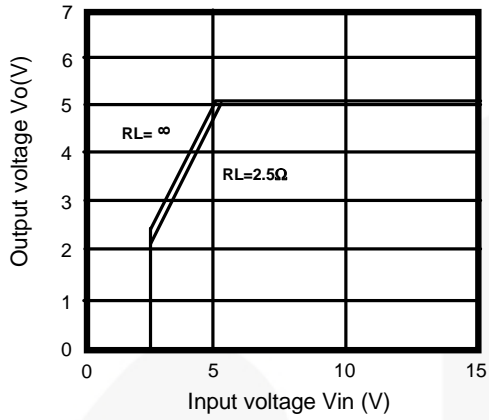


Figure 30. Output Voltage vs. Input Voltage

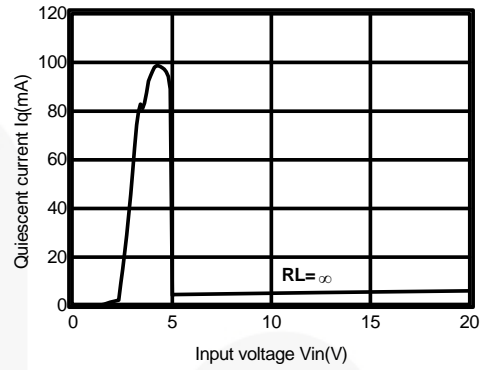


Figure 31. Quiescent Current vs. Input Voltage

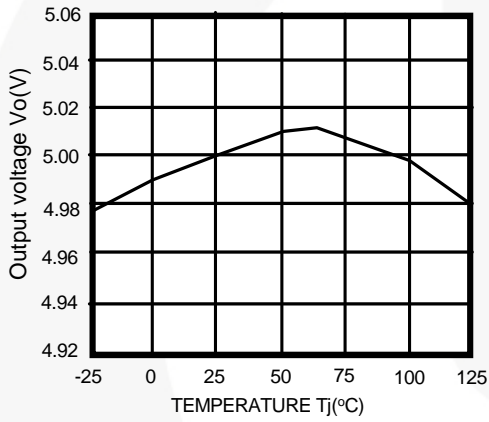


Figure 32. Output Voltage vs. Temperature (T_j)
*Fixed Mode (V_O = 5 V)

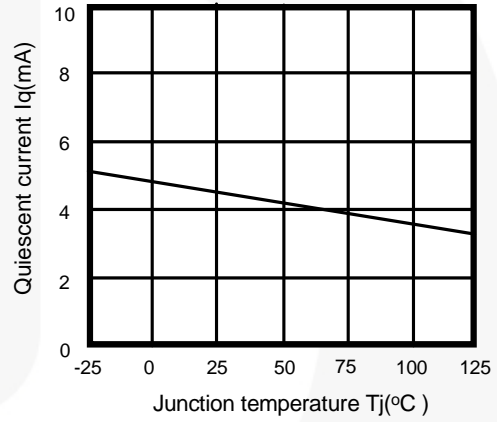


Figure 33. Quiescent Current vs. Temperature (T_j)

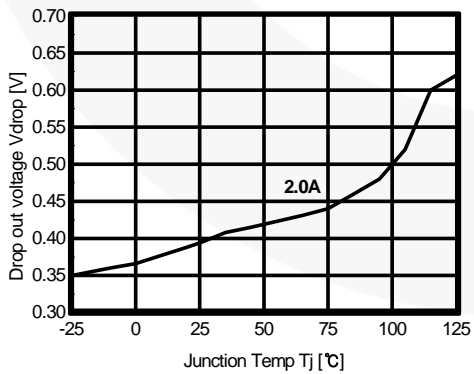


Figure 34. Dropout Voltage vs. Junction Temperature

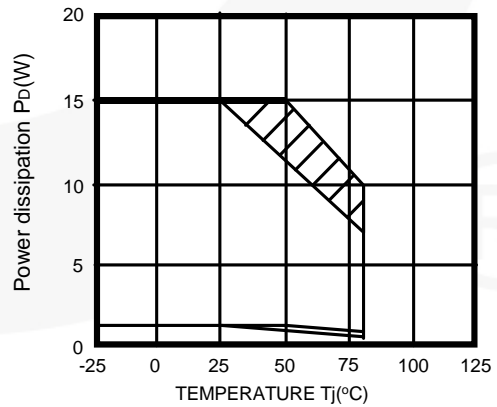


Figure 35. Power Dissipation vs. Temperature (T_j)

Typical Performance Characteristics (Continued)

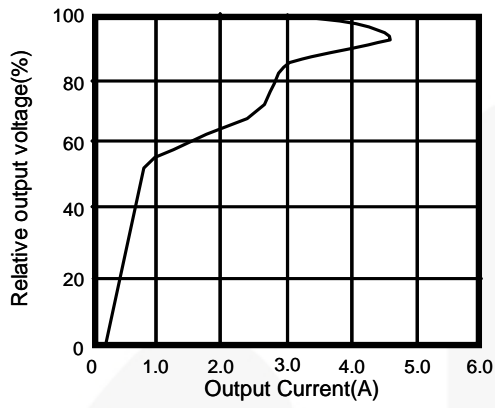


Figure 36. Over-Current Protection Characteristics (Typical Value)

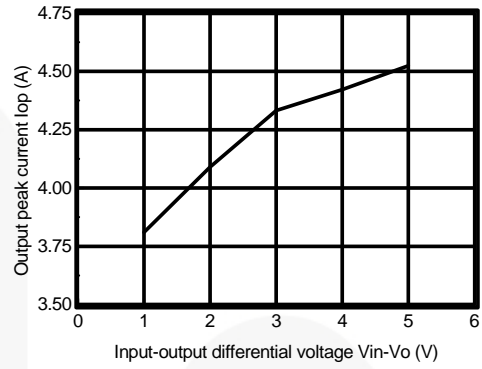


Figure 37. Output Peak Current vs. Input-Output Differential Voltage

Typical Application

KA278R33 / 05 / 12C

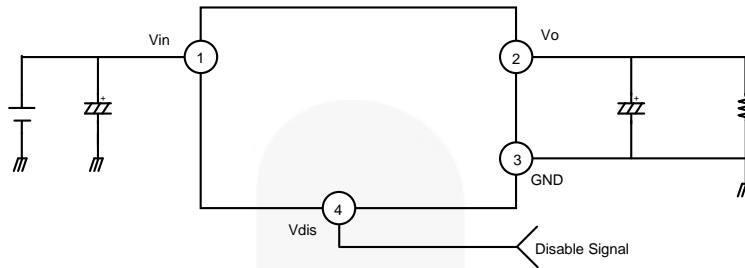


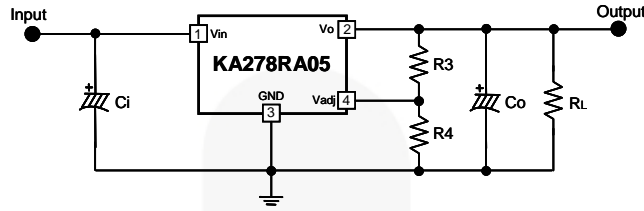
Figure 38. Application Circuit

- C_1 is required if regulator is located at an appreciable distance from power supply filter.
- C_O improves stability and transient response ($C_O > 47 \mu\text{F}$).



Typical Application (continued)

KA278RA05



$$V_o = 1.27 \left(1 + \frac{R_1/R_3}{R_2/R_4} \right) \quad R_1 = 1.8 \text{ k}\Omega, R_2 = 0.6 \text{ k}\Omega$$

Figure 39. Application Circuit (Adjustable Mode)

- C_i is required if regulator is located at an appreciable distance from power supply filter.
- C_o improves stability and transient response ($C_o > 47 \mu\text{F}$).

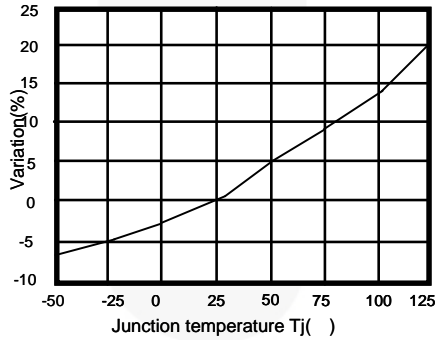


Figure 40. Internal Resistor (R_1 , R_2) Variation vs. Temperature (T_j)

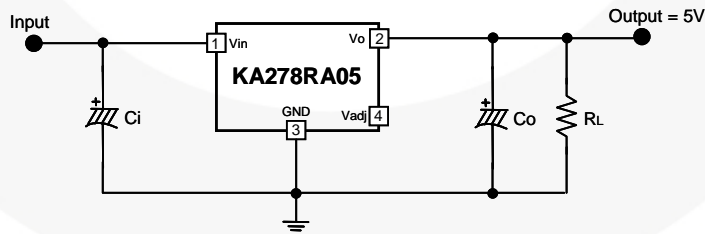


Figure 41. Application Circuit (Fixed Mode)

Physical Dimensions

TO-220F 4L

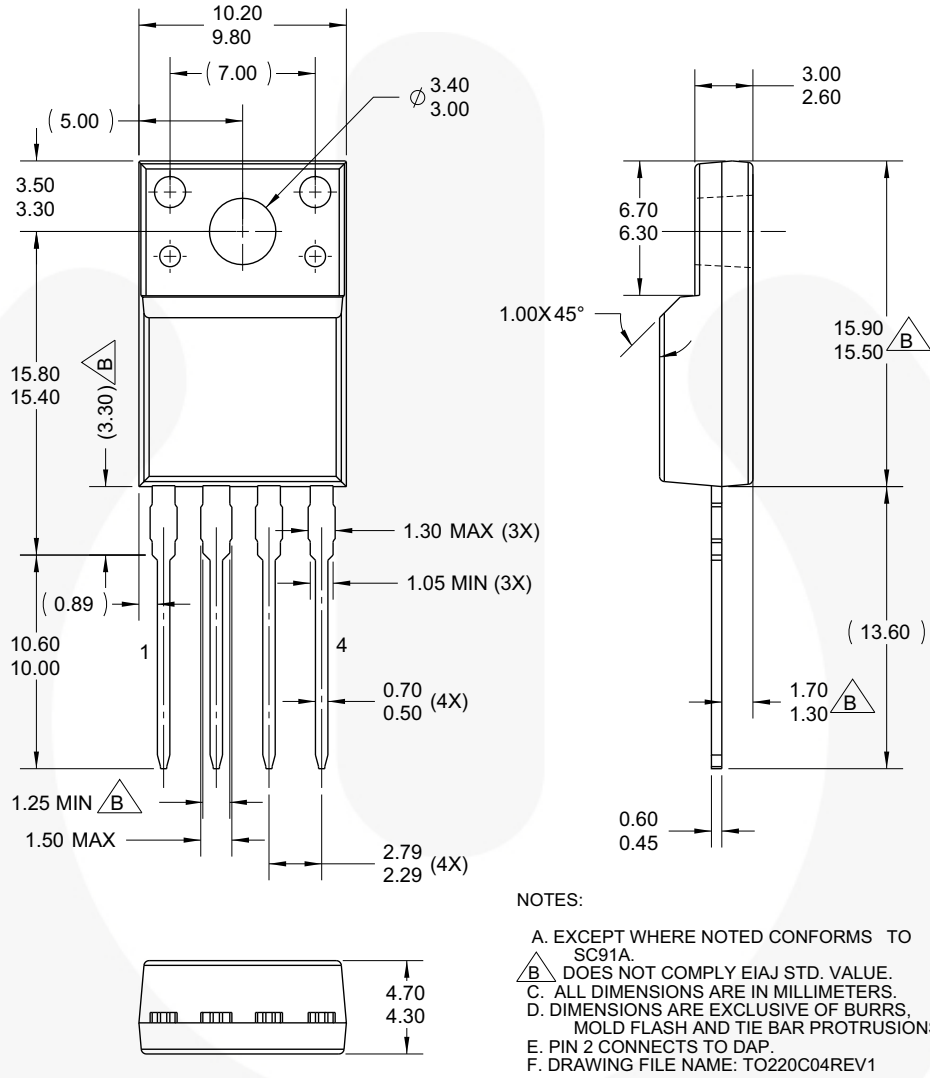


Figure 42. TO220, MOLDED, 4-LEAD, FULL-PACK, STARIGHT LEAD (ACTIVE)

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Physical Dimensions (continued)

TO-220F 4L (Forming)

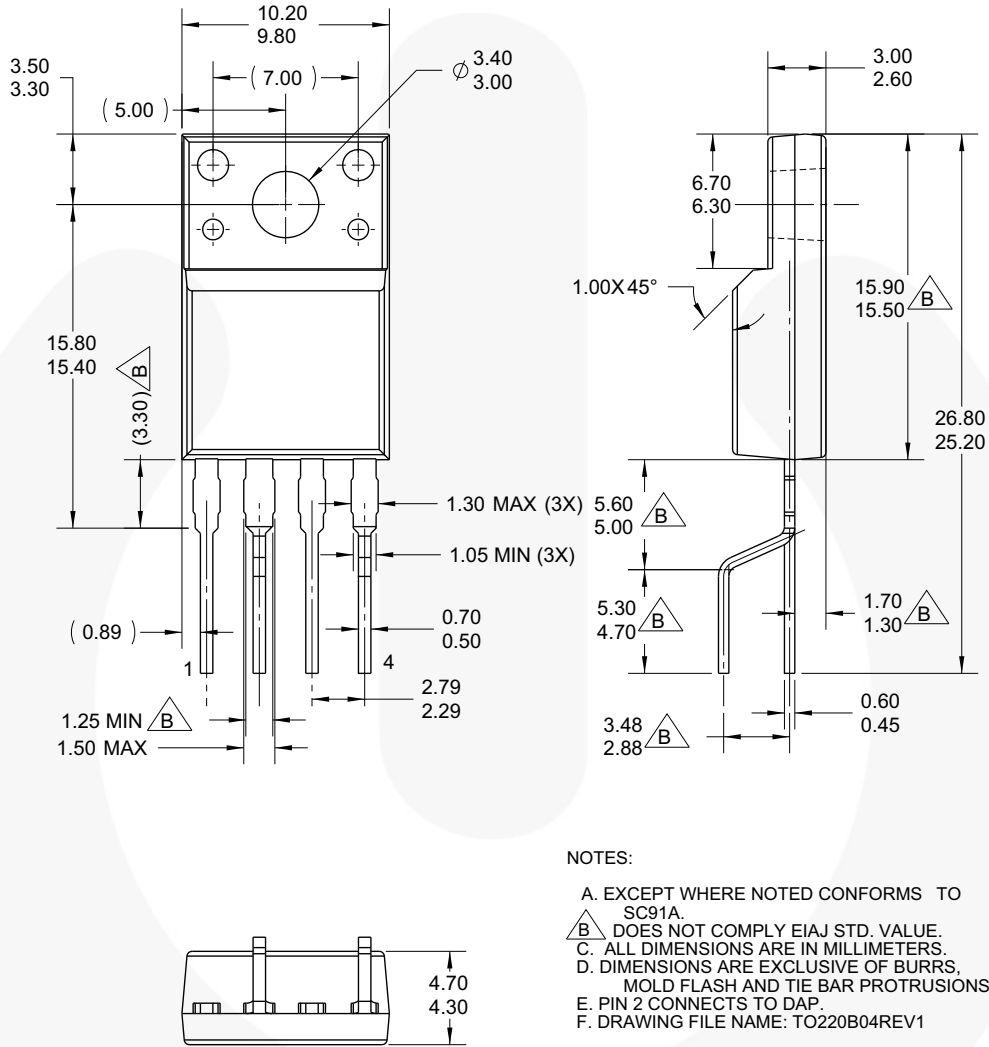


Figure 43. TO220, MOLDED, 4-LEAD, FULL-PACK, YDTU FORMING (ACTIVE)

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
| Advance Information | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design. |
| Obsolete | Not In Production | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only. |

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