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July 2013

# 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

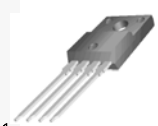
**KA278RA05C**

- 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

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

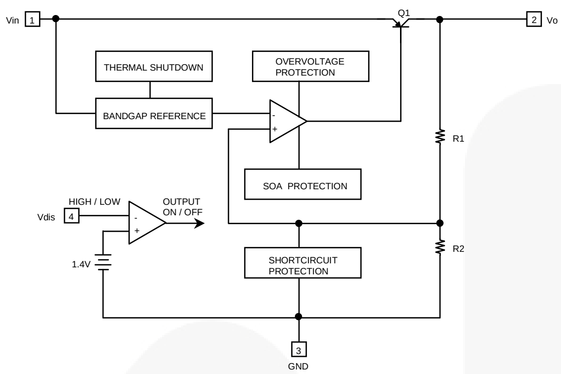



**Figure 1. KA278R33 / 05 / 12C**

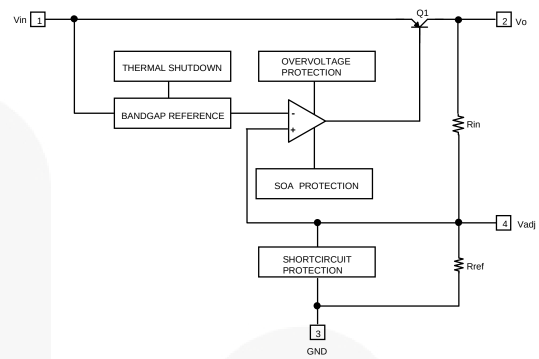



**Figure 2. KA278RA05C**

## 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°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 | °C |
| $T_{opr}$ | Operating Temperature | | -20 to 80 | °C |
| $R_{\theta jc}$ | Thermal Resistance, Junction-to Case(1) | | 2.9 | °C/W |
| $R_{\theta ja}$ | Thermal Resistance, Junction-to-Air | | 48.51 | °C/W |

**Note:**

1. 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°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 mA < $I_O$ < 2 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 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 V | | | 20 | µA |
| $I_{disL}$ | Disable Bias Current Low | KA278RXXC | $V_{dis}$ = 0.4 V | | | -0.4 | mA |
| $I_q$ | Quiescent Current | | $I_O$ = 0 A | | | 10 | mA |
| $V_{ref}$ | Reference Voltage | KA278RA05C | | 1.24 | 1.27 | 1.30 | V |

**Notes:**

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

## Typical Performance Characteristics (KA278R33C)

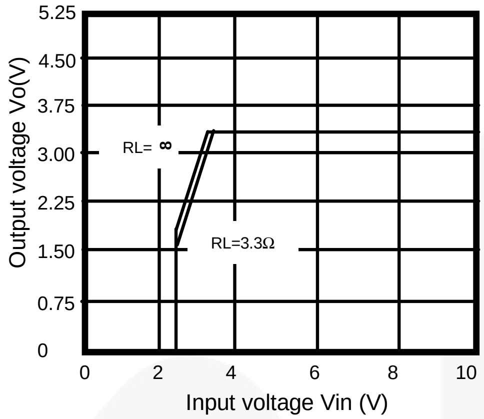



**Figure 3. Output Voltage vs. Input Voltage**

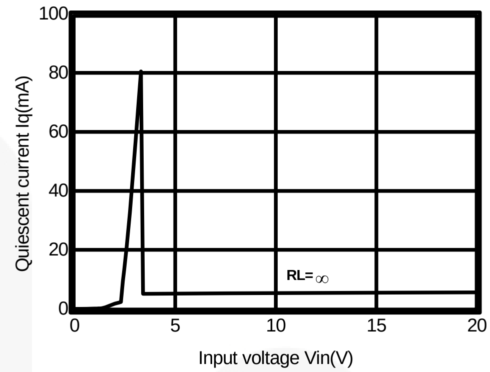



**Figure 4. Quiescent Current vs. Input Voltage**

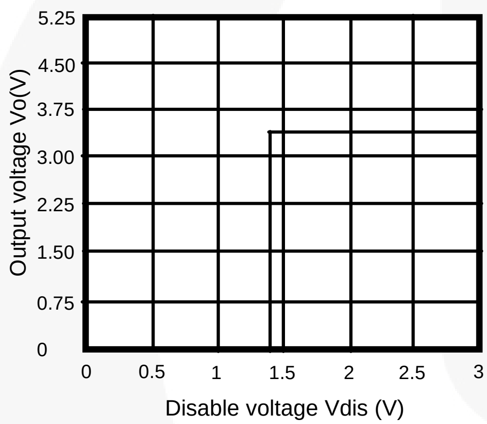



**Figure 5. Output Voltage vs. Disable Voltage**

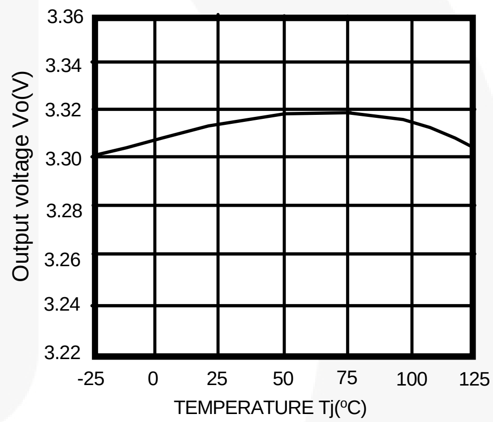



**Figure 6. Output Voltage vs. Temperature ($T_j$)**

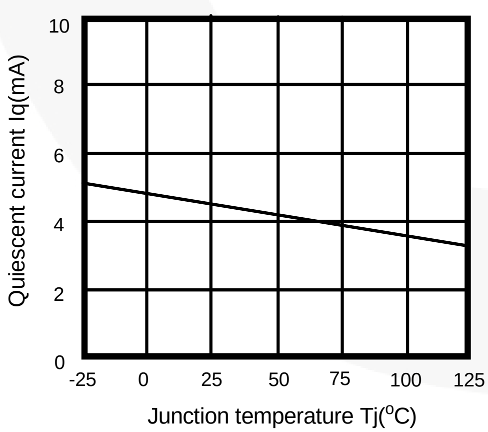



**Figure 7. Quiescent Current vs. Temperature ($T_j$)**

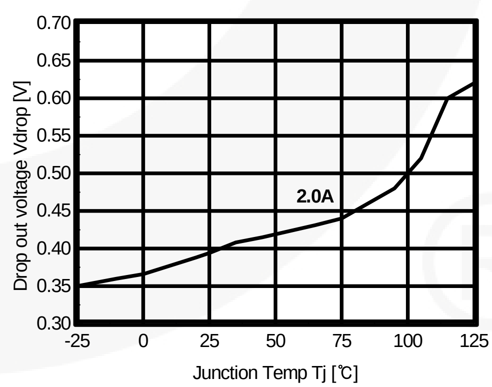



**Figure 8. Dropout Voltage vs. Junction Temperature**

## Typical Performance Characteristics (Continued)

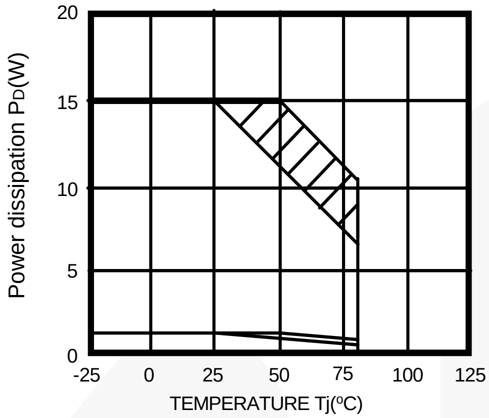



**Figure 9. Power Dissipation vs. Temperature ($T_j$)**

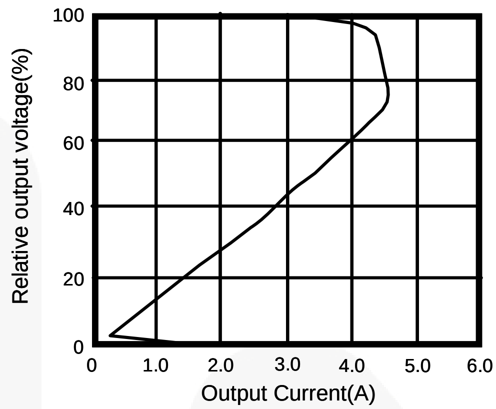



**Figure 10. Over-Current Protection Characteristics (Typical Value)**

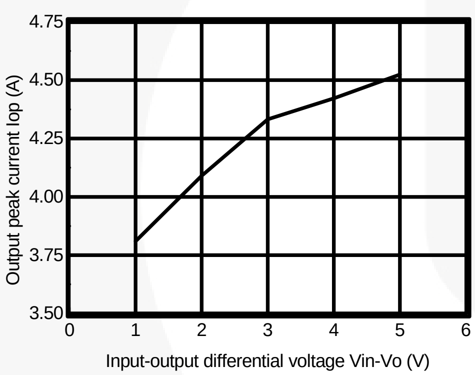



**Figure 11. Output Peak Current vs. Input-Output Differential Voltage**

## Typical Performance Characteristics (KA278R05C)

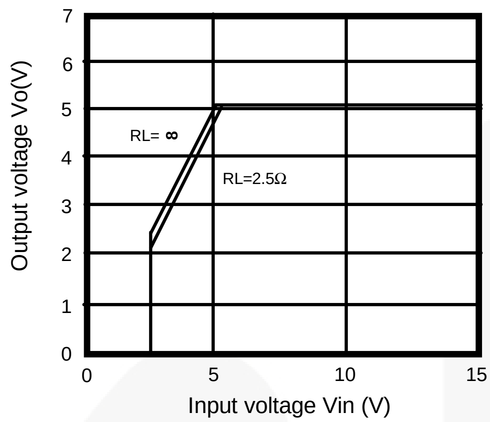



**Figure 12. Output Voltage vs. Input Voltage**

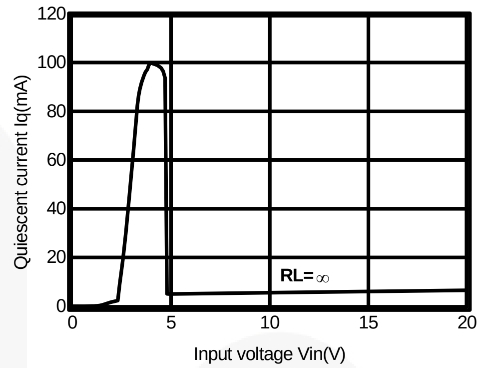



**Figure 13. Quiescent Current vs. Input Voltage**

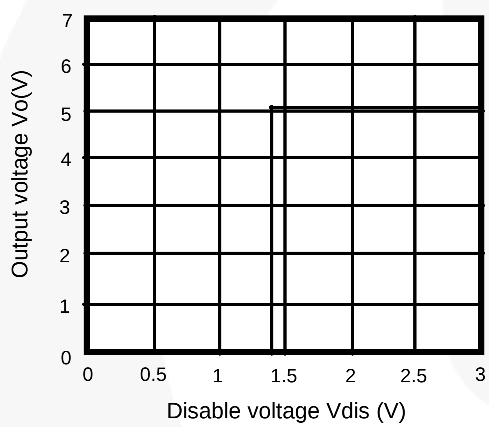



**Figure 14. Output Voltage vs. Disable Voltage**

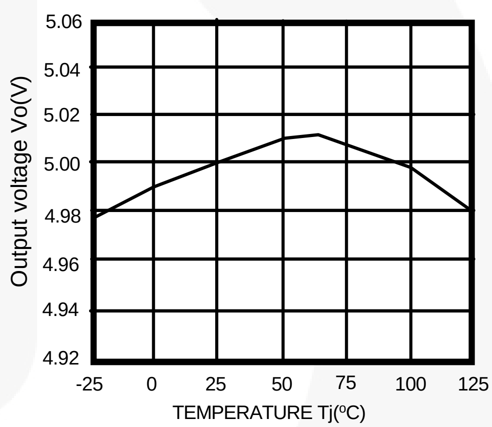



**Figure 15. Output Voltage vs. Temperature ($T_j$)**

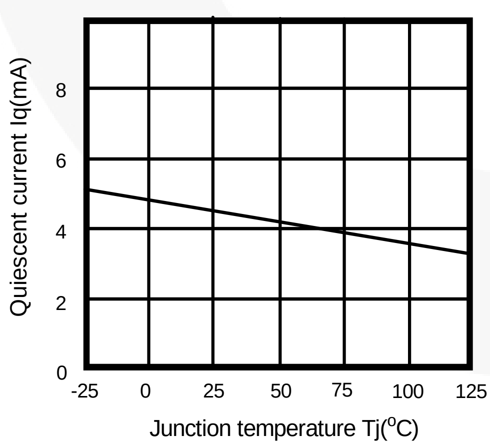



**figure 16. Quiescent Current vs. Temperature ($T_j$)**

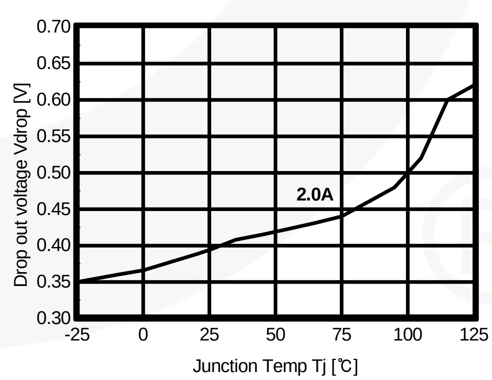



**Figure 17. Dropout Voltage vs. Junction Temperature**

## Typical Performance Characteristics (Continued)

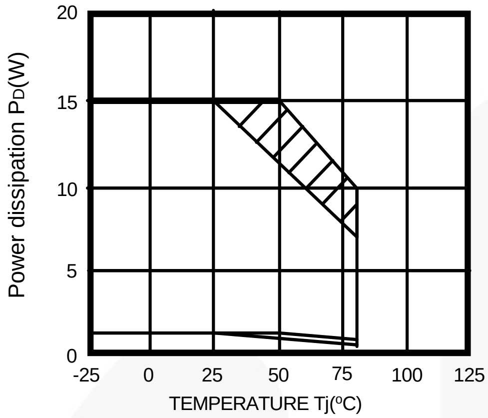



**Figure 18. Power Dissipation vs. Temperature ($T_j$)**

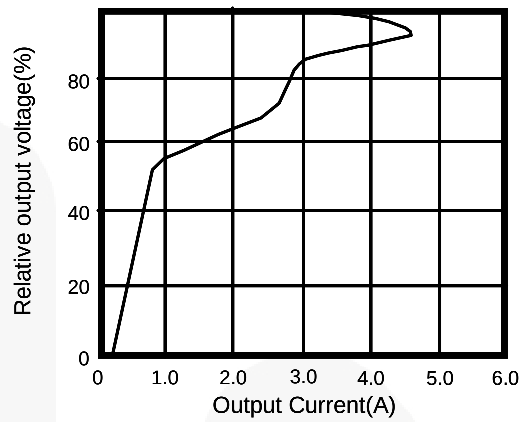



**Figure 19. Over-Current Protection Characteristics (Typical Value)**

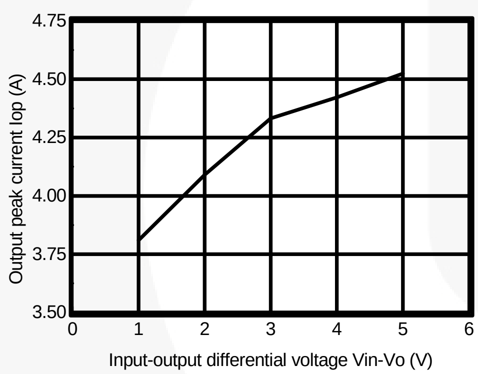



**Figure 20. Output Peak Current vs. Input-Output Differential Voltage**

## Typical Performance Characteristics (KA278R12C)

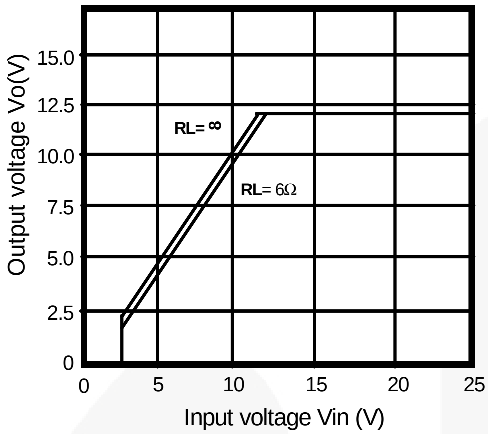



**Figure 21. Output Voltage vs. Input Voltage**

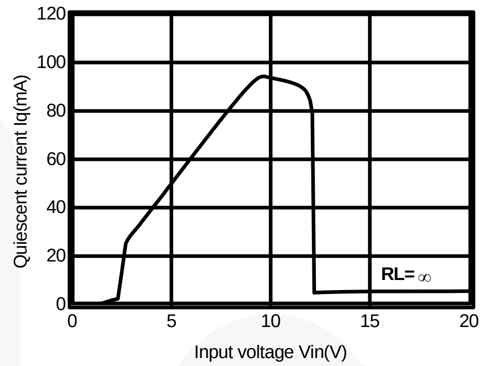



**Figure 22. Quiescent Current vs. Input Voltage**

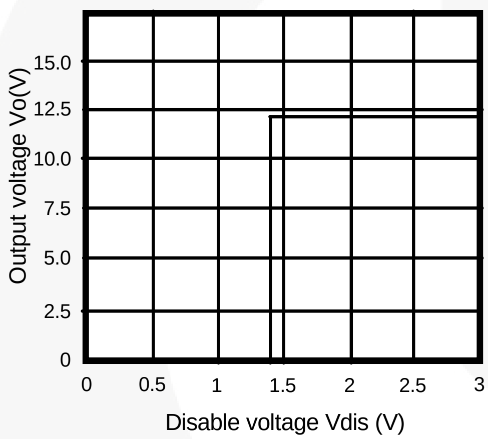



**Figure 23. Output Voltage vs. Disable Voltage**

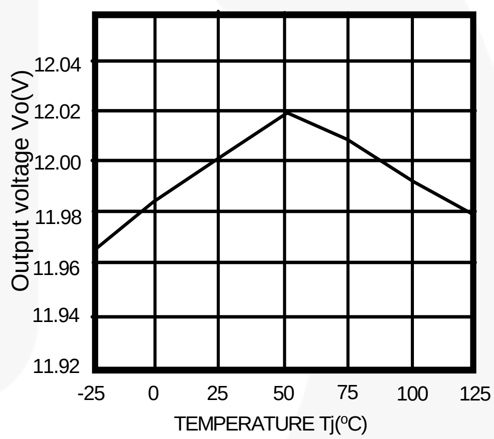
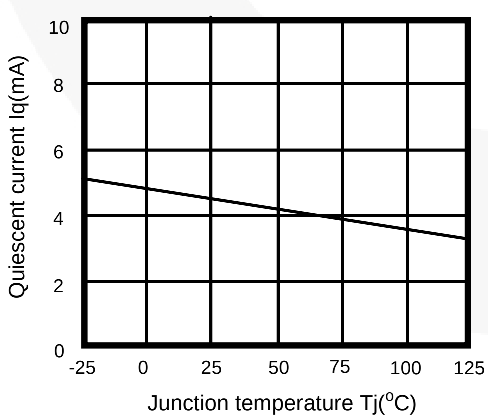



**Figure 24. Output Voltage vs. Temperature ($T_j$)**




**25. Quiescent Current vs. Temperature ($T_j$)**

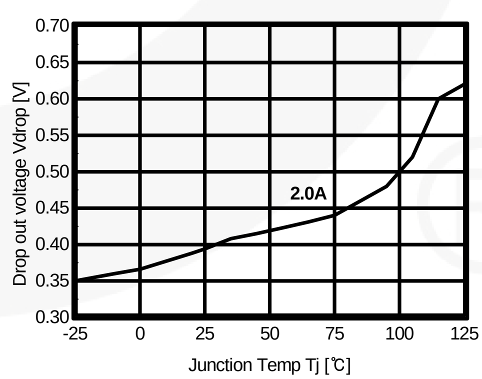



**Figure 26. Dropout Voltage vs. Junction Temperature**

## Typical Performance Characteristics (Continued)

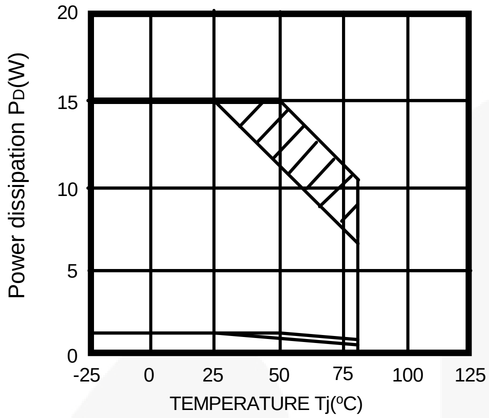



**Figure 27. Power Dissipation vs. Temperature ($T_j$)**

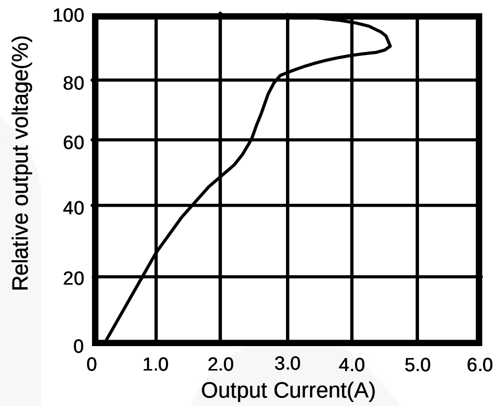



**Figure 28. Over-Current Protection Characteristics (Typical Value)**

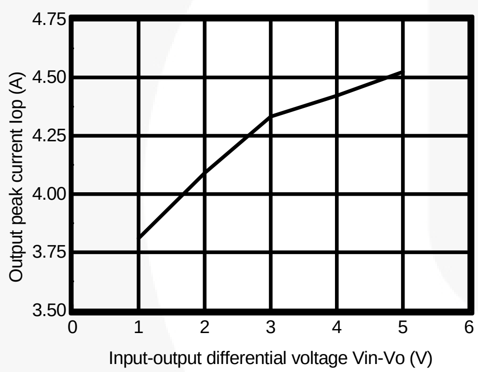



**Figure 29. Output Peak Current vs. Input-Output Differential Voltage**

## Typical Performance Characteristics (KA278RA05C)

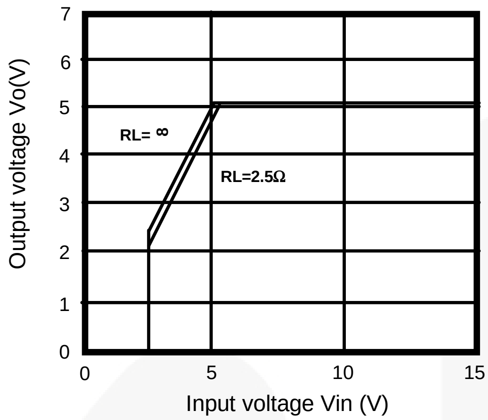



**Figure 30. Output Voltage vs. Input Voltage**

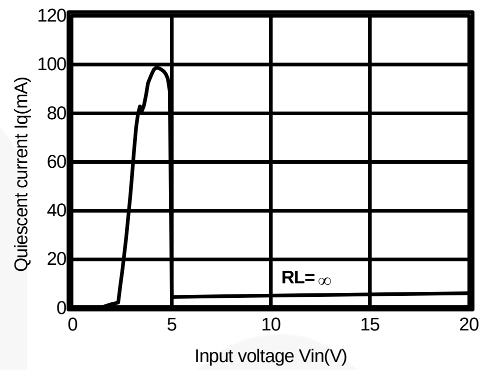



**Figure 31.Quiescent Current vs. Input Voltage**

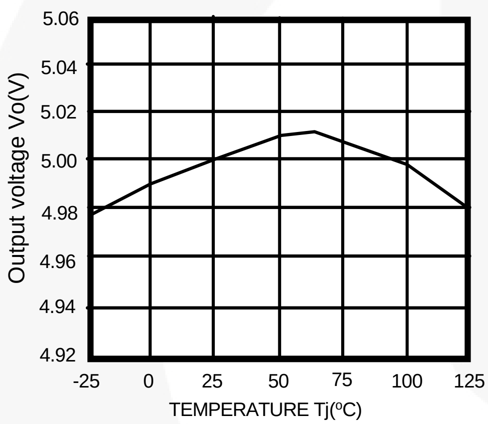



**Figure 32. Output Voltage vs. Temperature ($T_j$)**
***Fixed Mode ($V_O$ = 5 V)**

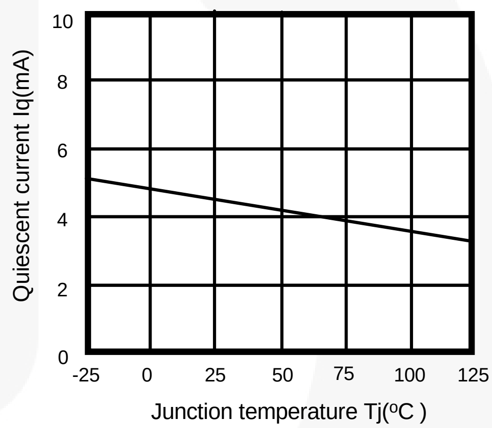



**Figure 33. Quiescent Current vs. Temperature ($T_j$)**

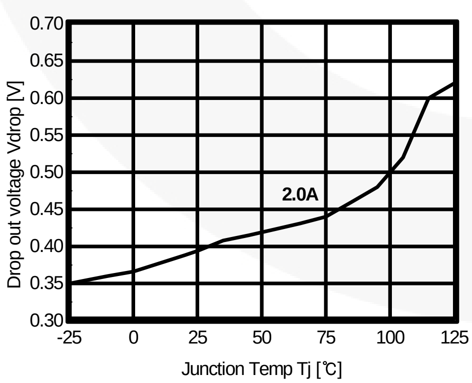



**Figure 34. Dropout Voltage vs. Junction Temperature**

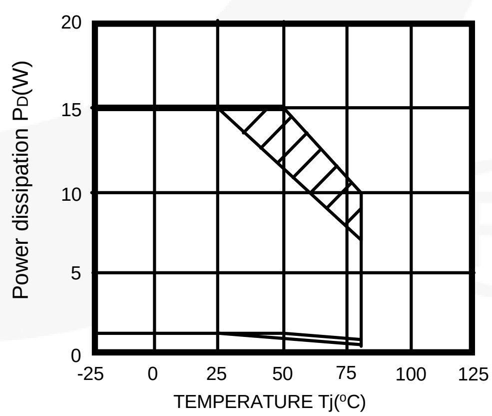



**Figure 35. Power Dissipation vs. Temperature ($T_j$)**

## Typical Performance Characteristics (Continued)

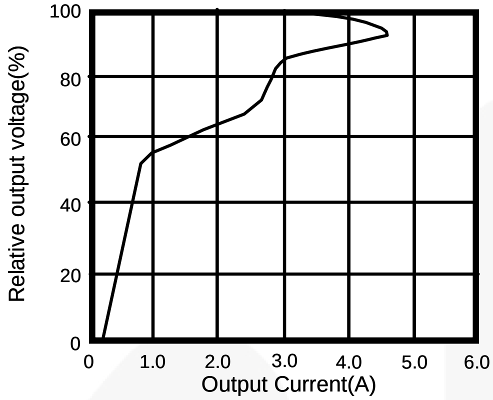



**Figure 36. Over-Current Protection Characteristics (Typical Value)**

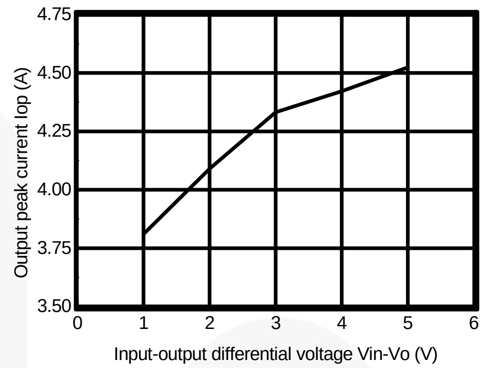



**Figure 37. Output Peak Current vs. Input-Output Differential Voltage**

## Typical Application

### KA278R33 / 05 / 12C

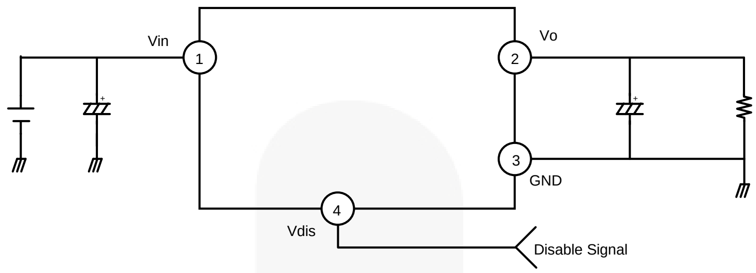
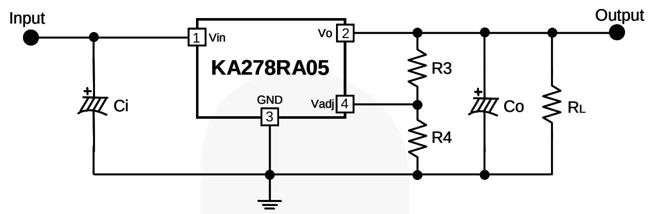



**Figure 38. Application Circuit**

- $C_I$ is required if regulator is located at an appreciable distance from power supply filter.
- $C_O$ improves stability and transient response ($C_O$ > 47 µF).

## Typical Application (continued)

### KA278RA05




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

**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 µF).

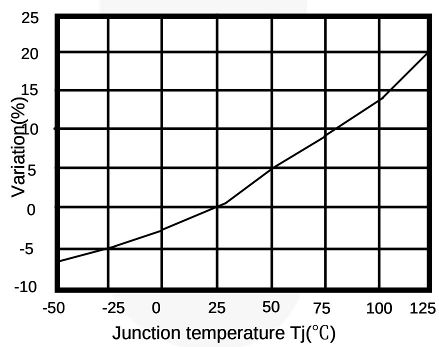



**Figure 40. Internal Resistor ($R_1$, $R_2$) Variation vs. Temperature ($T_j$)**

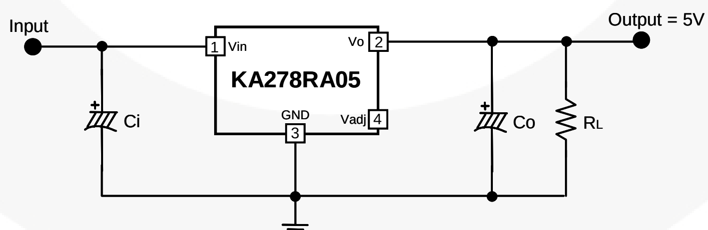



**Figure 41. Application Circuit (Fixed Mode)**

## Physical Dimensions

TO-220F 4L

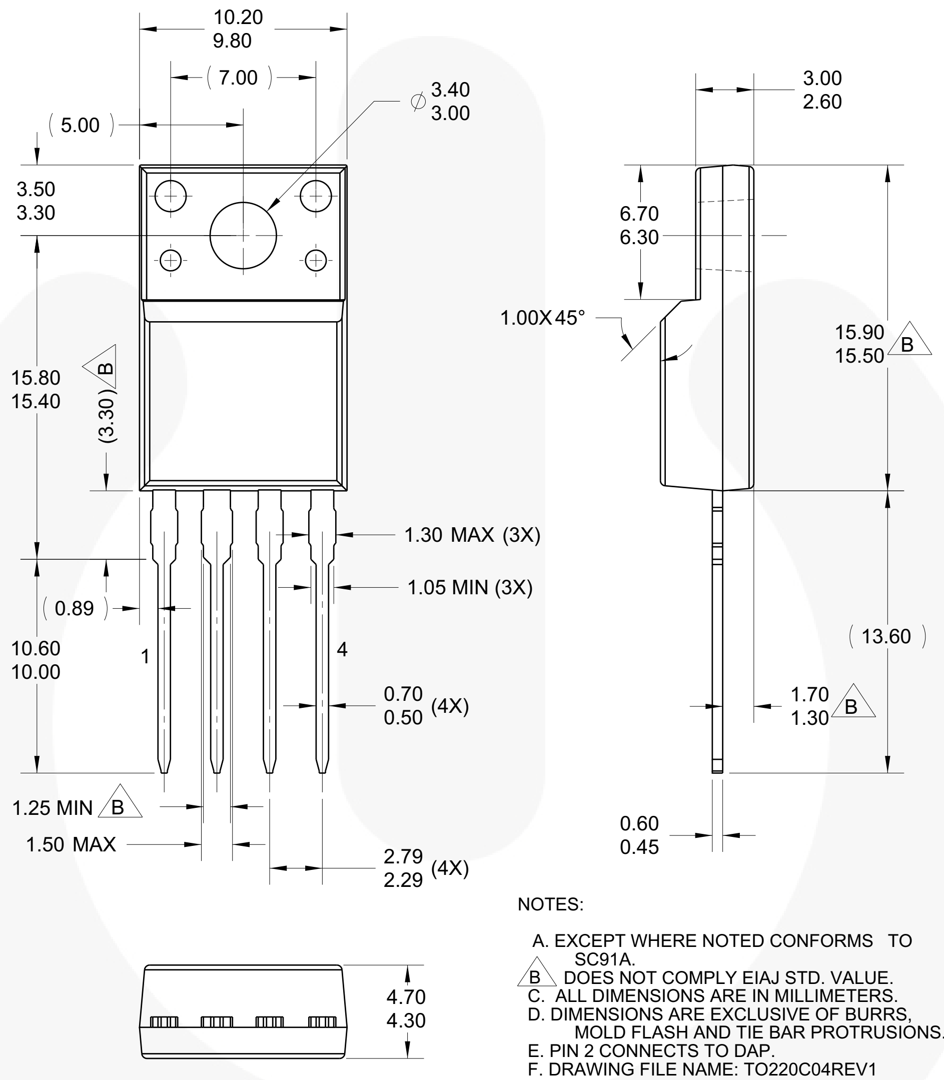



**Figure 42. TO220, MOLDED, 4-LEAD, FULL-PACK, STARIGHT LEAD (ACTIVE)**

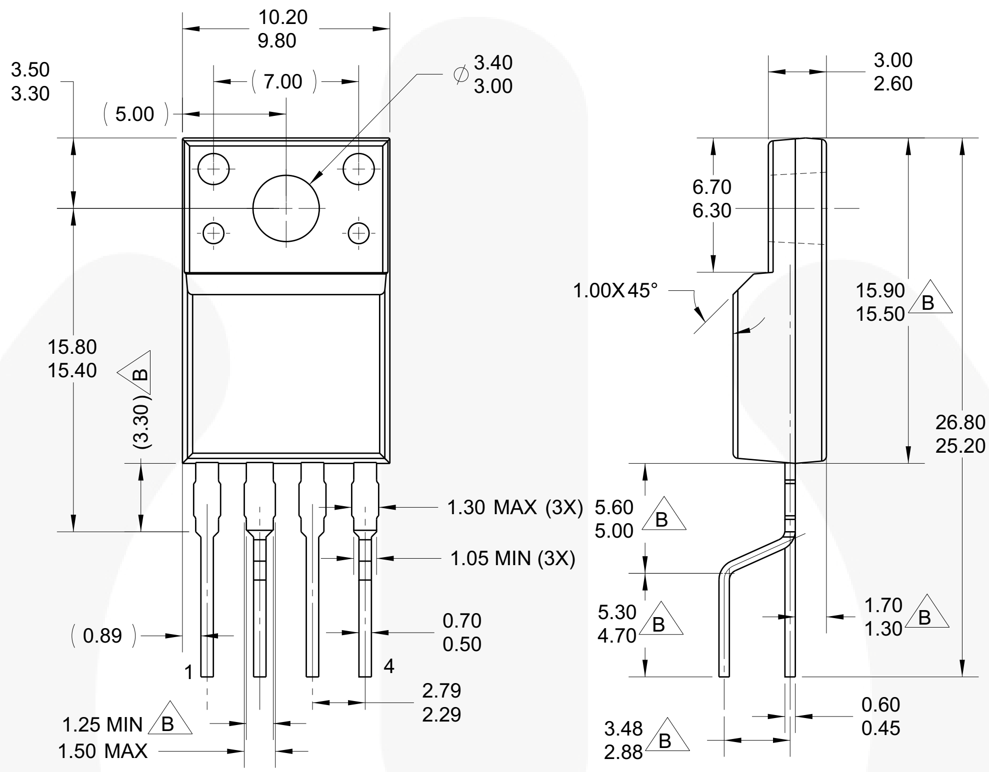
*Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.*

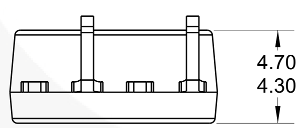
*Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:*
*http://www.fairchildsemi.com/dwg/TO/TO220C04.pdf.*

*For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:*
*http://www.fairchildsemi.com/packing_dwg/PKG-TO220C04.pdf.*

## **Physical Dimensions** (continued)

# TO-220F 4L (Forming)




NOTES:

A. EXCEPT WHERE NOTED CONFORMS TO SC91A.
B DOES NOT COMPLY EIAJ STD. VALUE.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
E. PIN 2 CONNECTS TO DAP.
F. DRAWING FILE NAME: TO220B04REV1

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

*Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.*

*Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:*
*http://www.fairchildsemi.com/dwg/TO/TO220B04.pdf.*

*For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:*
*http://www.fairchildsemi.com/packing_dwg/PKG-TO220B04.pdf.*

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SEMICONDUCTOR®

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BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
*CROSSVOLT*™
CTL™
Current Transfer Logic™
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