FAIRCHILD
A Schlumberger Company

µA78H05 • µA78H05A 5-Volt 5-Amp Voltage Regulators

Hybrid Products

Description

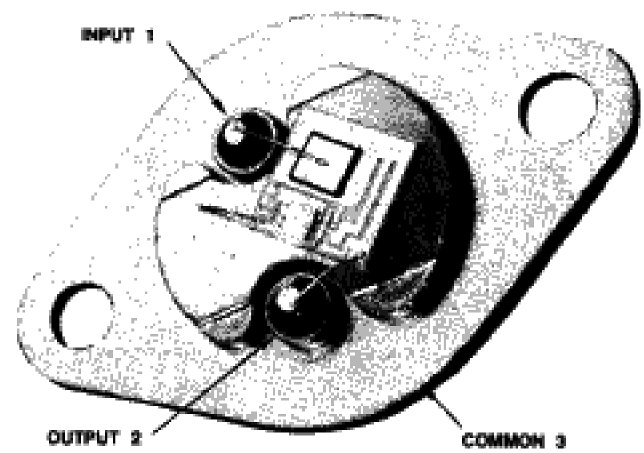
The µA78H05 and µA78H05A are hybrid regulators with 5.0 V fixed outputs and 5.0 A output capabilities. They have the inherent characteristics of the monolithic 3-terminal regulators, i.e., full thermal overload, short-circuit and safe-area protection. All devices are packaged in hermetically sealed TO-3s providing 50 W power dissipation. If the safe operating area is exceeded, the device shuts down rather than failing or damaging other system components (Note 1). This feature eliminates costly output circuitry and overly conservative heat sinks typical of high-current regulators built from discrete components.

- 5.0 A OUTPUT CURRENT
- INTERNAL CURRENT AND THERMAL OVERLOAD PROTECTION
- INTERNAL SHORT CIRCUIT PROTECTION
- LOW DROPOUT VOLTAGE (TYPICALLY 2.3 V @ 5.0 A)
- 50 W POWER DISSIPATION
- STEEL TO-3 PACKAGE
- ALL PIN-FOR-PIN COMPATIBLE WITH THE SH323

Note

1. These voltage regulators offer output transistor safe-area protection. However, to maintain full protection, the devices must be operated within the maximum input-to-output voltage differential ratings, as listed on this data sheet under "Absolute Maximum Ratings." For applications violating these limits, devices will not be fully protected.

Connection Diagram
TO-3 Metal Package

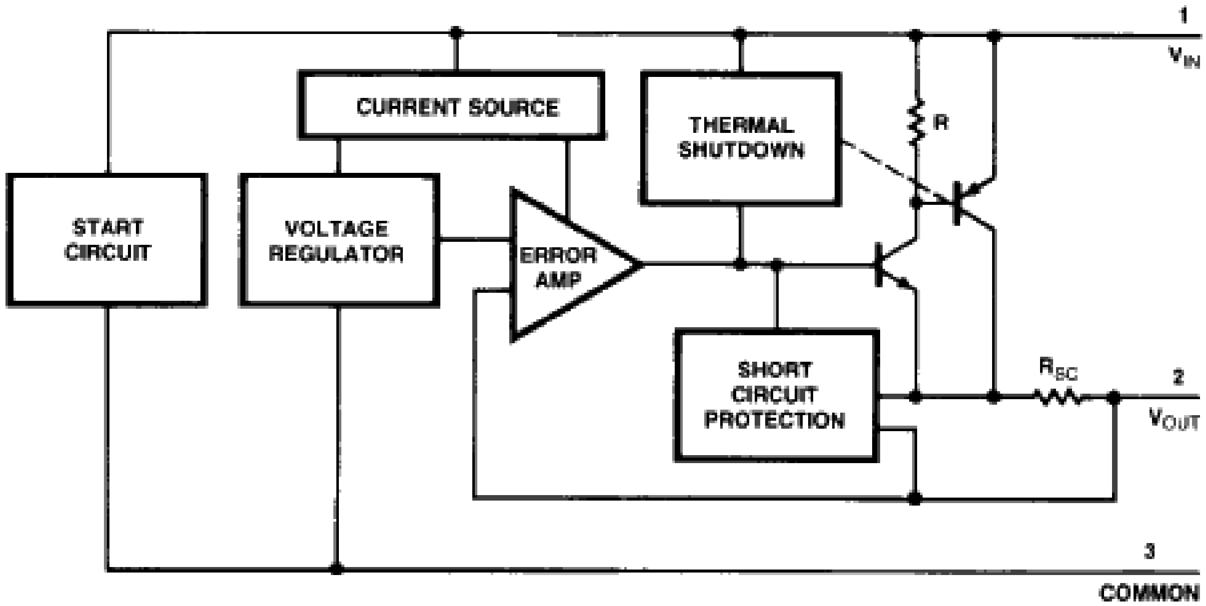


(Top View)

Order Information

Type	Package	Code	Part No.
µA7805	Metal	GN	µA78H05SC
µA7805A	Metal	GN	µA78H05ASC
µA7805	Metal	GN	µA78H05SM
µA7805A	Metal	GN	µA78H05ASM

Block Diagram



Absolute Maximum Ratings

Input Voltage	40 V
Input-to-Output Voltage Differential, Output Short Circuited	35 V
Internal Power Dissipation	50 W @ 25°C Case
Operating Junction Temperature	150°C
Military Temperature Range	
μA78H05SM	−55°C to +150°C
μA78H05ASM	−55°C to +150°C
Commercial Temperature Range	
μA78H05SC	0°C to +150°C
μA78H05ASC	0°C to +150°C
Storage Temperature Range	−55°C to +150°C
Pin Temperature (Soldering, 60 s)	300°C

μA78H05 • μA78H05A
Electrical Characteristics T_J = 25°C, V_{IN} = 10 V, I_{OUT} = 2.0 A unless otherwise specified.

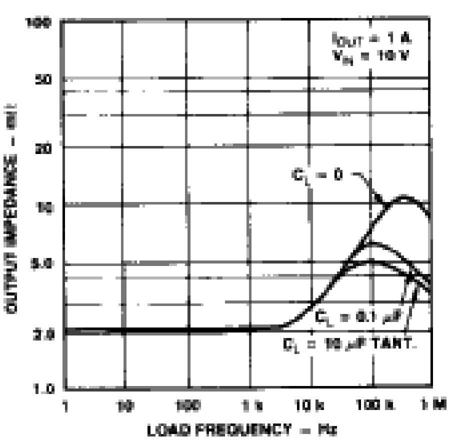
Symbol	Characteristic	Condition		Limits Min	Typ	Max	Unit
V_{OUT}	Output Voltage	I_{OUT} = 2.0 A		4.85	5.0	5.25	V
ΔV_{OUT}	Line Regulation (Note 2)	V_{IN} = 8.5 to 25 V (μA78H05)			10	50	mV
		V_{IN} = 7.5 to 25 V (μA78H05A)			10	50	mV
ΔV_{OUT}	Load Regulation (Note 2)	10 mA ≤ I_{OUT} ≤ 5.0 A			10	50	mV
I_Q	Quiescent Current	I_{OUT} = 0			3.0	10	mA
RR	Ripple Rejection	I_{OUT} = 1.0 A, f = 120 Hz, 5.0 $V_{pk\text{-}pk}$		60			dB
V_n	Output Noise	10 Hz ≤ f ≤ 100 kHz			40		μV_{RMS}
V_{DD}	Dropout Voltage (Note 3)	μA78H05	I_{OUT} = 5.0 A		2.3		V
			I_{OUT} = 3.0 A		2.0		V
		μA78H05A	I_{OUT} = 5.0 A		2.3	2.5	V
			I_{OUT} = 3.0 A		2.0	2.3	V
I_{OS}	Short-Circuit Current Limit				7.0	12.0	A_{pk}

Notes

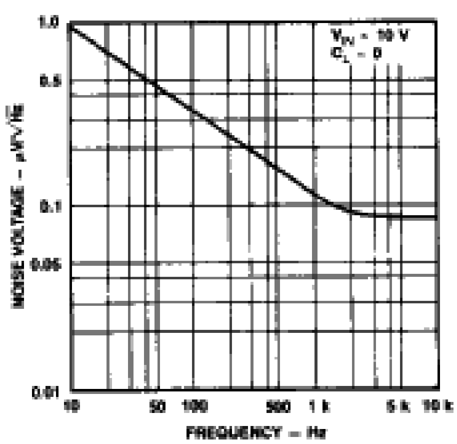
2. Load and line regulation are specified at constant junction temperature. Pulse testing is required with a pulse width ≤ 1 ms and a duty cycle of ≤ 5%. Full Kelvin connection methods must be used to measure these parameters.
3. Dropout Voltage is the input-output voltage differential that causes the output voltage to decrease by 5% of its initial value.

Typical Performance Curves

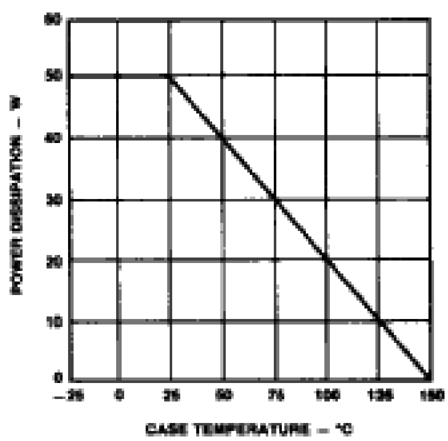
Output Impedance



Output Noise Voltage

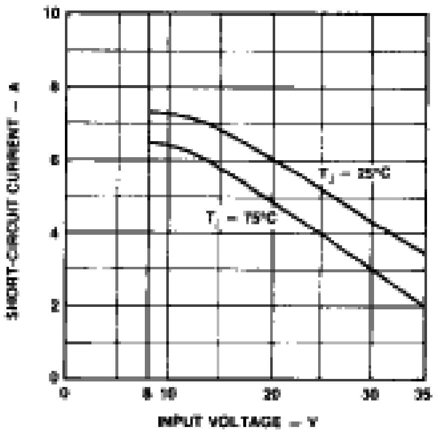


Maximum Power Dissipation

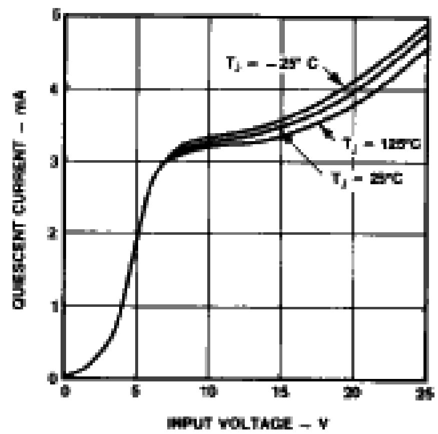


Typical Performance Curves (Cont.)

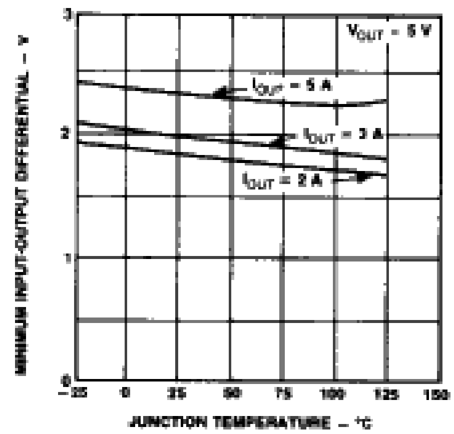
Short Circuit Current



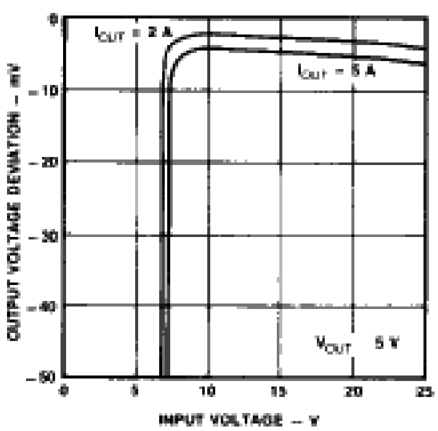
Quiescent Current



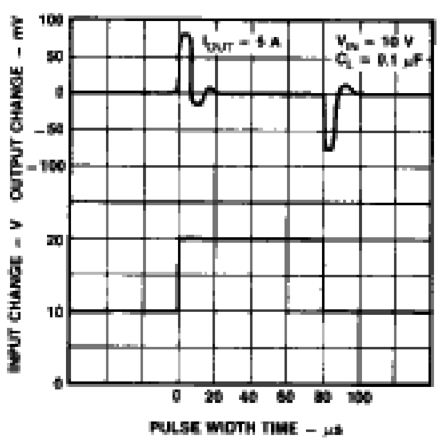
Dropout Voltage



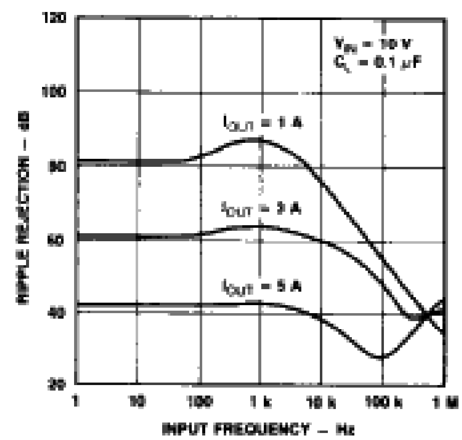
Line Regulation



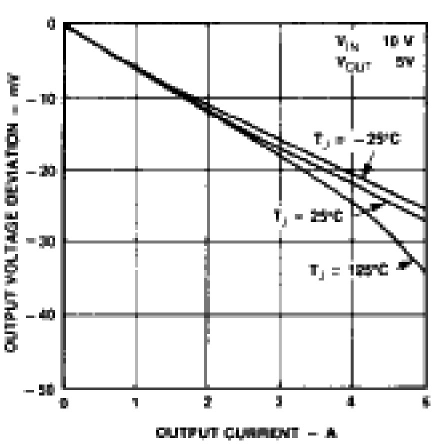
Line Transient Response



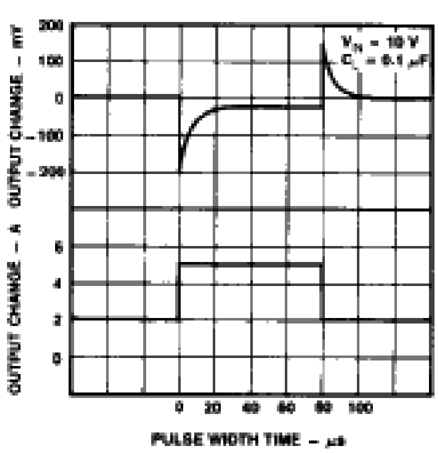
Ripple Rejection



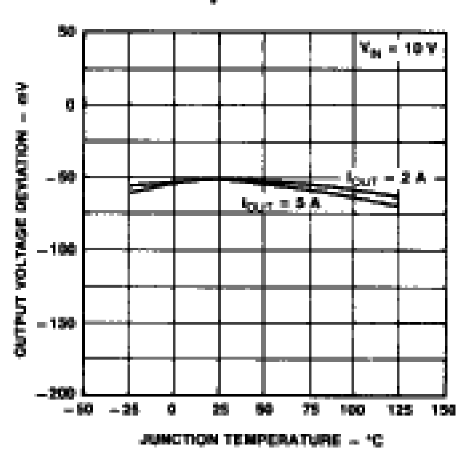
Load Regulation



Load Transient Response



Output Voltage Deviation vs Junction Temperature



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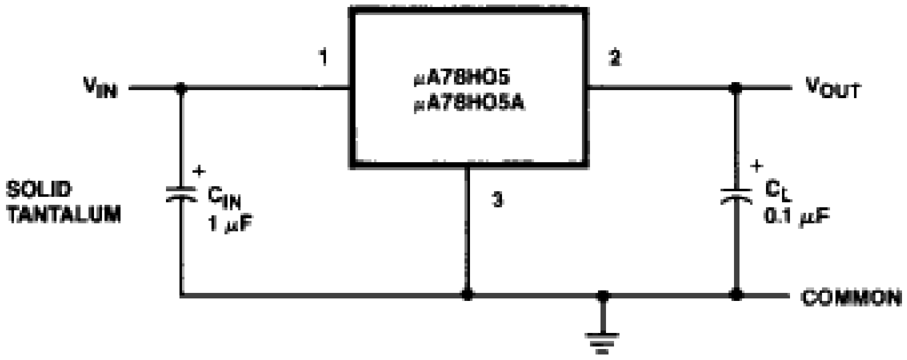
Test Circuit

Fixed Output Voltage



Design Considerations

These devices have thermal-overload protection from excessive power and internal short-circuit protection which limits the circuit's maximum current. Thus, the devices are protected from overload abnormalities. Although the internal power dissipation is limited, the junction temperature must be kept below the maximum specified temperature (150°C). It is recommended by the manufacturer that the maximum junction temperature be kept as low as possible for increased reliability. To calculate the maximum junction temperature or heat sink required, the following thermal resistance values should be used:

Package	Typ θ_{JC}	Max θ_{JC}
TO-3	1.8	2.5

$$P_{D(max)} = \frac{T_{J(max)} - T_A}{\theta_{JC} + \theta_{CA}}$$

$$\theta_{CA} = \theta_{CS} + \theta_{SA}$$

Solving for T_J:

$$T_J = T_A + P_D(\theta_{JC} + \theta_{CA})$$

Where:

T_J = Junction Temperature
T_A = Ambient Temperature
P_D = Power Dissipation
θ_{JC} = Junction-to-case thermal resistance
θ_{CA} = Case-to-ambient thermal resistance
θ_{CS} = Case-to-heat sink thermal resistance
θ_{SA} = Heat sink-to-ambient thermal resistance

The devices are designed to operate without external compensation components. However, the amount of external filtering of these voltage regulators depends upon the circuit layout. If in a specific application the regulator is more than four inches from the filter capacitor, a 1 μF solid tantalum capacitor should be used at the input. A 0.1 μF capacitor should be used at the output to reduce transients created by fast switching loads, as seen in the basic test circuit. These filter capacitors must be located as close to the regulator as possible.

Caution: Permanent damage can result from forcing the output voltage higher than the input voltage. A protection diode from output to input should be used if this condition exists.