

Description

The PD78L series are three terminal positive regulators with several fixed output voltages. These regulators can provide local on card regulation, eliminating the distribution problems associated with single point regulation. The PD78L series can be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. When used as a Zener diode/resistor combination replacement, the PD78L series usually results an effective output impedance improvement of two orders of magnitude, and lower quiescent current.

With adequate heat sinking the PD78L series can deliver 100mA output current. Current limiting is included to limit the peak output current to a safe value. Thermal protection is also provided. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

The PD78L series are available in the plastic TO-92 (bulk or ammo packing), SOIC-8, SOT-223 and SOT-89 packages.

Feature

- Output current up to 100mA
- Fixed output voltages of 5V,6V,8V,9V and 12V
- Output Voltage tolerances of $\pm 5\%$ over the full temperature range
- Internal short circuit current-limiting
- Internal thermal overload protection
- No external components

Application

- High efficiency linear regulator
- Post regulation for switching supply
- Microprocessor power supply
- Mother board I/O power supply

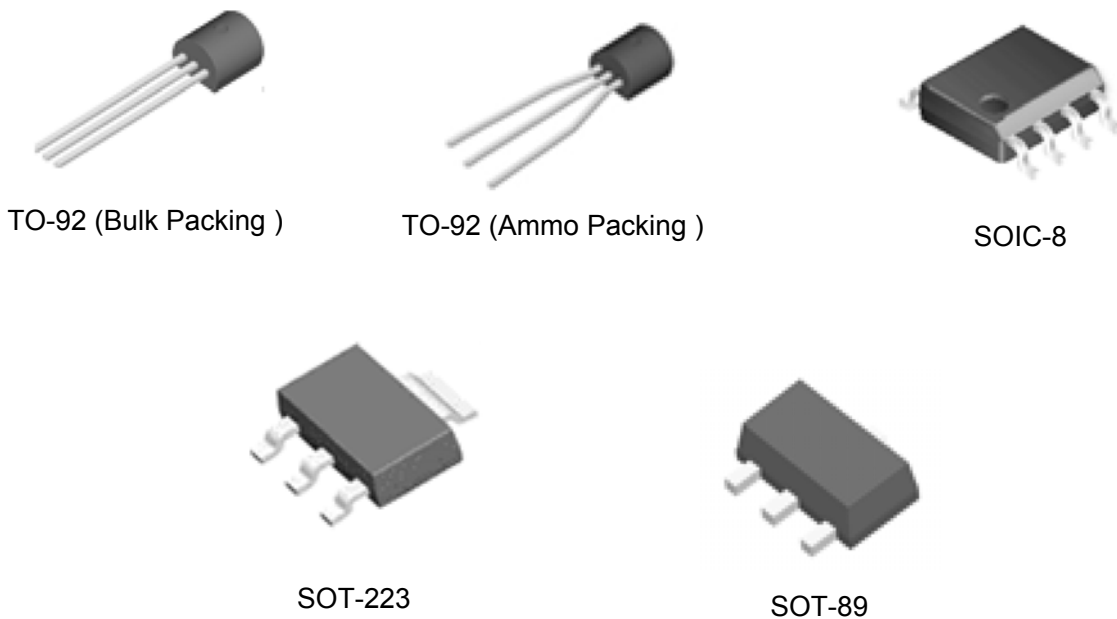


Figure 1. Package Types of the PD78L series

Functional Block Diagram

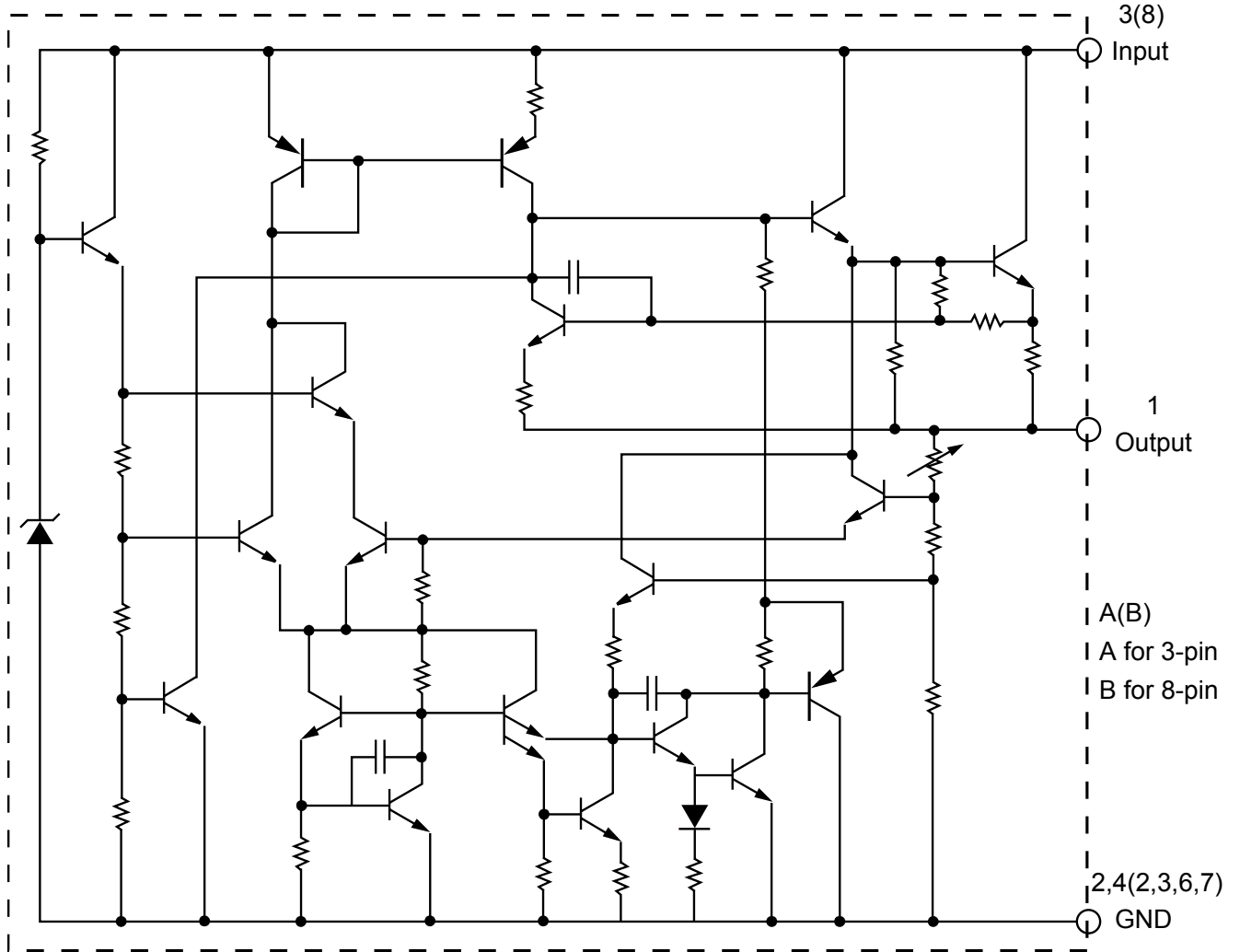


Figure 2. Functional Block Diagram of the PD78L series

Absolute maximum rating (Note 1)

Parameter	Symbol	Value		Units
Input Voltage	V_{IN}	36		V
Operating Junction temperature range	T_J	150		°C
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260		°C
Power Dissipation	P_D	TO-92	0.65	W
		SOIC-8	0.6	
		SOT-223	0.7	
		SOT-89	0.65	
Storage Temperature Range	T_{STG}	-65 to 150		°C
Operating Temperature	T_{OP}	-40 to 125		°C
ESD (Human Body Model)	ESD	2000		V
ESD (Machine Model)	ESD	2000		V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Electrical Characteristics

PD78L05 Electrical Characteristics

Limits in standard typeface are for $T_J=25^\circ\text{C}$, **Bold typeface applies over -40°C to 125°C** , $I_{OUT}=40\text{mA}$, $C_{IN}=0.33\mu\text{F}$, $C_{OUT}=0.1\mu\text{F}$, $V_{IN}=10\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	$V_{IN}=10\text{V}$	4.8	5	5.2	V
		$7.0\text{V}\leq V_{IN}\leq 20\text{V}$ $1.0\text{mA}\leq I_{OUT}\leq 40\text{mA}$ (Note 2)	4.75		5.25	
Line Regulation	V_{RLINE}	$7.0\text{V}\leq V_{IN}\leq 20\text{V}$	-	18	125	mV
Load Regulation	V_{RLOAD}	$1.0\text{mA}\leq I_O\leq 100\text{mA}$	-	25	150	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}			150		mA
Quiescent Current	I_Q	$I_{OUT}=0$ $7.0\text{V}\leq V_{IN}\leq 20\text{V}$	-	3	5	mA
Quiescent Current Change	ΔI_Q	$8.0\text{V}\leq V_{IN}\leq 20\text{V}$			1.5	mA
		$1.0\text{mA}\leq I_O\leq 40\text{mA}$			0.1	
Output Noise Voltage	N_O	$10\text{Hz}\leq f\leq 100\text{kHz}$ (Note 3)	-	40	-	μV
Ripple Rejection	PSRR	$f=120\text{Hz}$, $9.0\text{V}\leq V_{IN}\leq 20\text{V}$	41	49	-	dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of output Voltage	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5.0\text{mA}$		0.65		$\text{mV}/^\circ\text{C}$
Min Value of Input Voltage Required to Maintain Line Regulation	$V_{IN(\text{Min})}$			6.7	7	V
Thermal Resistance	θ_{JC}	TO-92	-	81	-	$^\circ\text{C}/\text{W}$
		SOIC-8		104		
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of $0.01\mu\text{F}$ to limit high frequency noise.

PD78L06 Electrical Characteristics

Limits in standard typeface are for $T_J=25^{\circ}\text{C}$, **Bold typeface applies over -40°C to 125°C** , $I_{\text{OUT}}=40\text{mA}$, $C_{\text{IN}}=0.33\mu\text{F}$, $C_{\text{OUT}}=0.1\mu\text{F}$, $V_{\text{IN}}=10\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	$V_{\text{IN}}=11\text{V}$	5.75	6	6.25	V
		$8.0\text{V}\leq V_{\text{IN}}\leq 20\text{V}$ $1.0\text{mA}\leq I_{\text{OUT}}\leq 40\text{mA}$ (Note 2)	5.7	6	6.2	
Line Regulation	V_{RLINE}	$8.0\text{V}\leq V_{\text{IN}}\leq 20\text{V}$	-	18	150	mV
Load Regulation	V_{RLOAD}	$1.0\text{mA}\leq I_{\text{O}}\leq 100\text{mA}$	-	20	75	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}			150		mA
Quiescent Current	I_{Q}	$I_{\text{OUT}}=0$ $8.0\text{V}\leq V_{\text{IN}}\leq 20\text{V}$	-	3	5	mA
Quiescent Current Change	ΔI_{Q}	$9.0\text{V}\leq V_{\text{IN}}\leq 20\text{V}$			1.5	mA
		$1.0\text{mA}\leq I_{\text{O}}\leq 40\text{mA}$			0.1	
Output Noise Voltage	N_{O}	$10\text{Hz}\leq f\leq 100\text{kHz}$ (Note 3)	-	40	-	μV
Ripple Rejection	PSRR	$f=120\text{Hz}$, $9.0\text{V}\leq V_{\text{IN}}\leq 20\text{V}$	37	57	-	dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of output Voltage	$\Delta V_{\text{OUT}}/\Delta T$	$I_{\text{OUT}}=5.0\text{mA}$		0.65		$\text{mV}/^{\circ}\text{C}$
Min Value of Input Voltage Required to Maintain Line Regulation	$V_{\text{IN(Min)}}$			6.7	7	V
Thermal Resistance	θ_{JC}	TO-92	-	81	-	$^{\circ}\text{C}/\text{W}$
		SOIC-8		104		
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of $0.01\mu\text{F}$ to limit high frequency noise.

PD78L08 Electrical Characteristics

Limits in standard typeface are for $T_J=25^{\circ}\text{C}$, **Bold typeface applies over -40°C to 125°C** , $I_{\text{OUT}}=40\text{mA}$, $C_{\text{IN}}=0.33\mu\text{F}$, $C_{\text{OUT}}=0.1\mu\text{F}$, $V_{\text{IN}}=10\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	$V_{\text{IN}}=14\text{V}$	7.7	8.0	8.3	V
		$10.5\text{V}\leq V_{\text{IN}}\leq 23\text{V}$ $1.0\text{mA}\leq I_{\text{OUT}}\leq 40\text{mA}$ (Note 2)	7.6	8.0	8.4	
Line Regulation	V_{RLINE}	$10.5\text{V}\leq V_{\text{IN}}\leq 23\text{V}$	-	18	150	mV
Load Regulation	V_{RLOAD}	$1.0\text{mA}\leq I_{\text{O}}\leq 100\text{mA}$	-	20	90	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}			150		mA
Quiescent Current	I_{Q}	$I_{\text{OUT}}=0$ $10.5\text{V}\leq V_{\text{IN}}\leq 23\text{V}$	-	3	5	mA
Quiescent Current Change	ΔI_{Q}	$11.0\text{V}\leq V_{\text{IN}}\leq 23\text{V}$			1.5	mA
		$1.0\text{mA}\leq I_{\text{O}}\leq 40\text{mA}$			0.1	
Output Noise Voltage	N_{O}	$10\text{Hz}\leq f\leq 100\text{kHz}$ (Note 3)	-	60	-	μV
Ripple Rejection	PSRR	$f=120\text{Hz}$, $12.0\text{V}\leq V_{\text{IN}}\leq 23\text{V}$	37	57	-	dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of output Voltage	$\Delta V_{\text{OUT}}/\Delta T$	$I_{\text{OUT}}=5.0\text{mA}$		0.8		$\text{mV}/^{\circ}\text{C}$
Min Value of Input Voltage Required to Maintain Line Regulation	$V_{\text{IN(Min)}}$			9.7		V
Thermal Resistance	θ_{JC}	TO-92	-	81	-	$^{\circ}\text{C}/\text{W}$
		SOIC-8		104		
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of $0.01\mu\text{F}$ to limit high frequency noise.

PD78L09 Electrical Characteristics

Limits in standard typeface are for $T_J=25^{\circ}\text{C}$, **Bold typeface applies over -40°C to 125°C** , $I_{\text{OUT}}=40\text{mA}$, $C_{\text{IN}}=0.33\mu\text{F}$, $C_{\text{OUT}}=0.1\mu\text{F}$, $V_{\text{IN}}=10\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	$V_{\text{IN}}=16\text{V}$	8.6	9.0	9.4	V
		$12\text{V}\leq V_{\text{IN}}\leq 24\text{V}$ $1.0\text{mA}\leq I_{\text{OUT}}\leq 40\text{mA}$ (Note 2)	8.55	9.0	9.45	
Line Regulation	V_{RLINE}	$12\text{V}\leq V_{\text{IN}}\leq 24\text{V}$	-	18	150	mV
Load Regulation	V_{RLOAD}	$1.0\text{mA}\leq I_{\text{O}}\leq 100\text{mA}$	-	20	90	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}			150		mA
Quiescent Current	I_{Q}	$I_{\text{OUT}}=0$ $12\text{V}\leq V_{\text{IN}}\leq 24\text{V}$	-	3	5	mA
Quiescent Current Change	ΔI_{Q}	$13.0\text{V}\leq V_{\text{IN}}\leq 24\text{V}$			1.5	mA
		$1.0\text{mA}\leq I_{\text{O}}\leq 40\text{mA}$			0.1	
Output Noise Voltage	N_{O}	$10\text{Hz}\leq f\leq 100\text{kHz}$ (Note 3)	-	70	-	μV
Ripple Rejection	PSRR	$f=120\text{Hz}$, $12.0\text{V}\leq V_{\text{IN}}\leq 23\text{V}$	37	57	-	dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of output Voltage	$\Delta V_{\text{OUT}}/\Delta T$	$I_{\text{OUT}}=5.0\text{mA}$		0.9		$\text{mV}/^{\circ}\text{C}$
Min Value of Input Voltage Required to Maintain Line Regulation	$V_{\text{IN(Min)}}$			10.7		V
Thermal Resistance	θ_{JC}	TO-92	-	81	-	$^{\circ}\text{C}/\text{W}$
		SOIC-8		104		
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of $0.01\mu\text{F}$ to limit high frequency noise.

PD78L12 Electrical Characteristics

Limits in standard typeface are for $T_J=25^{\circ}\text{C}$, **Bold typeface applies over -40°C to 125°C** , $I_{\text{OUT}}=40\text{mA}$, $C_{\text{IN}}=0.33\mu\text{F}$, $C_{\text{OUT}}=0.1\mu\text{F}$, $V_{\text{IN}}=10\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	$V_{\text{IN}}=19\text{V}$	11.5	12	12.5	V
		$14\text{V}\leq V_{\text{IN}}\leq 27\text{V}$ $1.0\text{mA}\leq I_{\text{OUT}}\leq 40\text{mA}$ (Note 2)	11.4	12	12.6	
Line Regulation	V_{RLINE}	$14.5\text{V}\leq V_{\text{IN}}\leq 27\text{V}$	-	18	225	mV
Load Regulation	V_{RLOAD}	$1.0\text{mA}\leq I_{\text{O}}\leq 100\text{mA}$	-	20	90	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}			150		mA
Quiescent Current	I_{Q}	$I_{\text{OUT}}=0$ $14.5\text{V}\leq V_{\text{IN}}\leq 27\text{V}$	-	3	5	mA
Quiescent Current Change	ΔI_{Q}	$16.0\text{V}\leq V_{\text{IN}}\leq 27\text{V}$			1.5	mA
		$1.0\text{mA}\leq I_{\text{O}}\leq 40\text{mA}$			0.1	
Output Noise Voltage	N_{O}	$10\text{Hz}\leq f\leq 100\text{kHz}$ (Note 3)	-	80	-	μV
Ripple Rejection	PSRR	$f=120\text{Hz}$, $15.0\text{V}\leq V_{\text{IN}}\leq 25\text{V}$	37	42	-	dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of output Voltage	$\Delta V_{\text{OUT}}/\Delta T$	$I_{\text{OUT}}=5.0\text{mA}$		1.0		$\text{mV}/^{\circ}\text{C}$
Min Value of Input Voltage Required to Maintain Line Regulation	$V_{\text{IN(Min)}}$			13.7		V
Thermal Resistance	θ_{JC}	TO-92	-	81	-	$^{\circ}\text{C}/\text{W}$
		SOIC-8		104		
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of $0.01\mu\text{F}$ to limit high frequency noise.

Typical Performance Characteristics

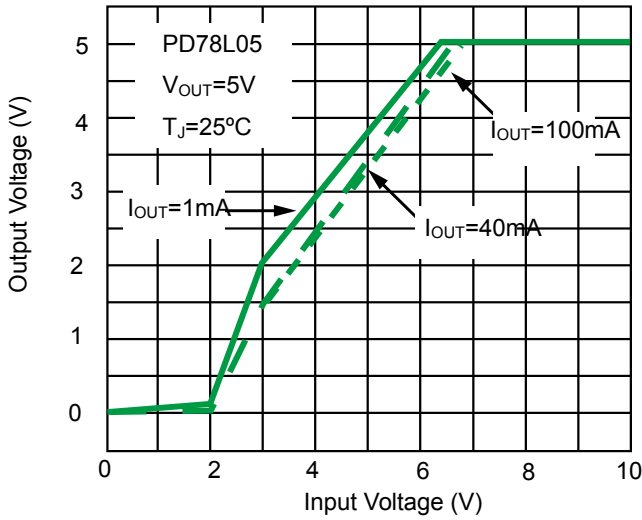


Fig.3 Dropout Characteristics

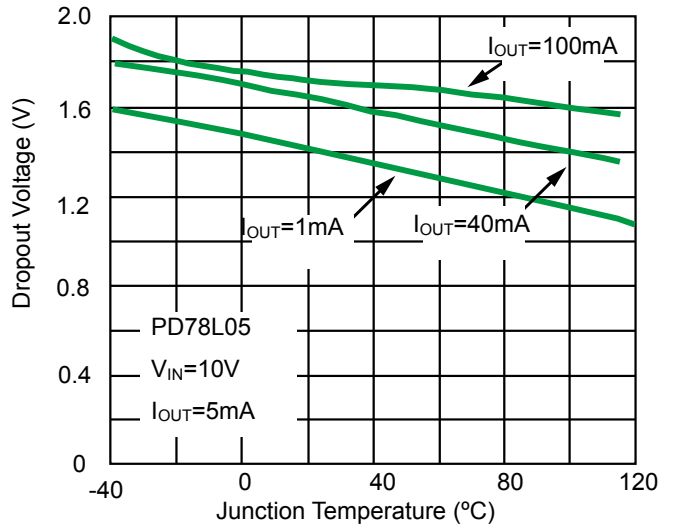


Fig. 4 Dropout Voltage vs Junction Temperature

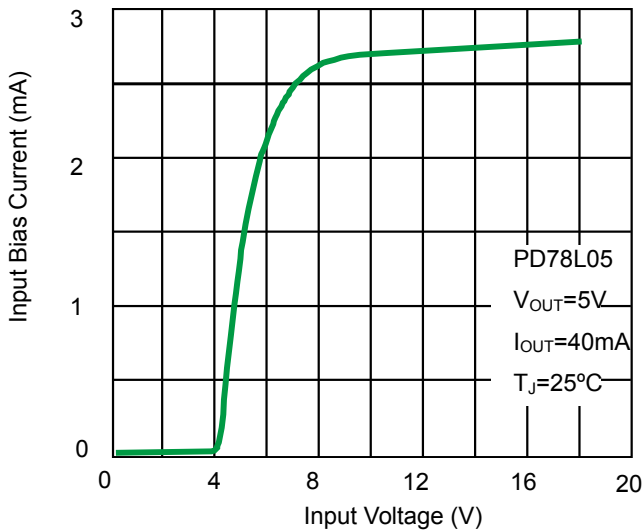


Fig.5 Input Bias Current vs. Input Voltage

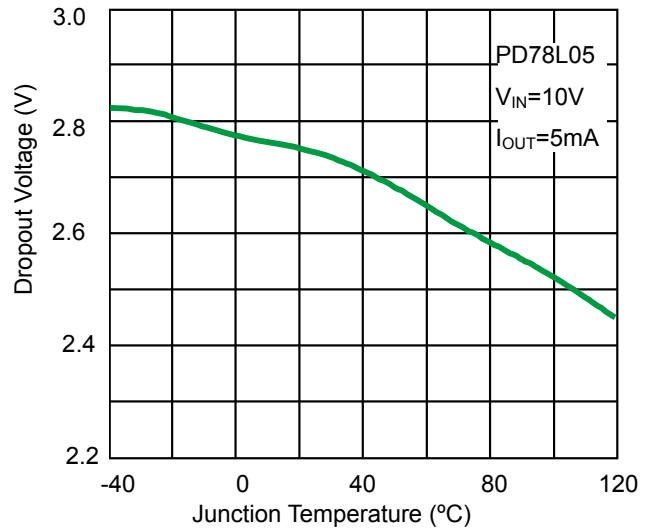


Fig. 6 Quiescent Current vs. Junction Temperature

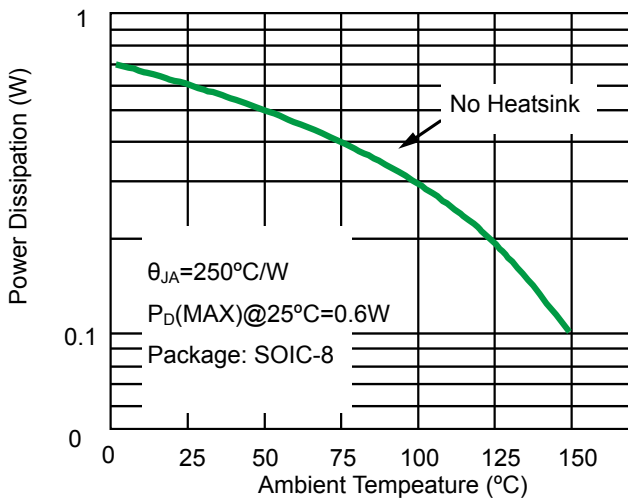
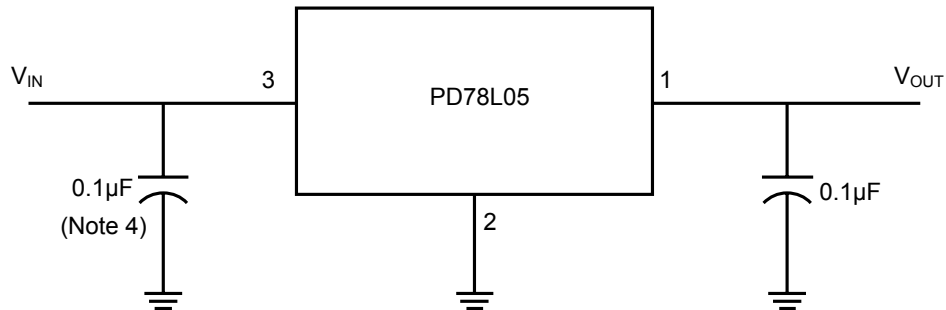


Fig.7 Power Dissipation vs. Ambient Temperature

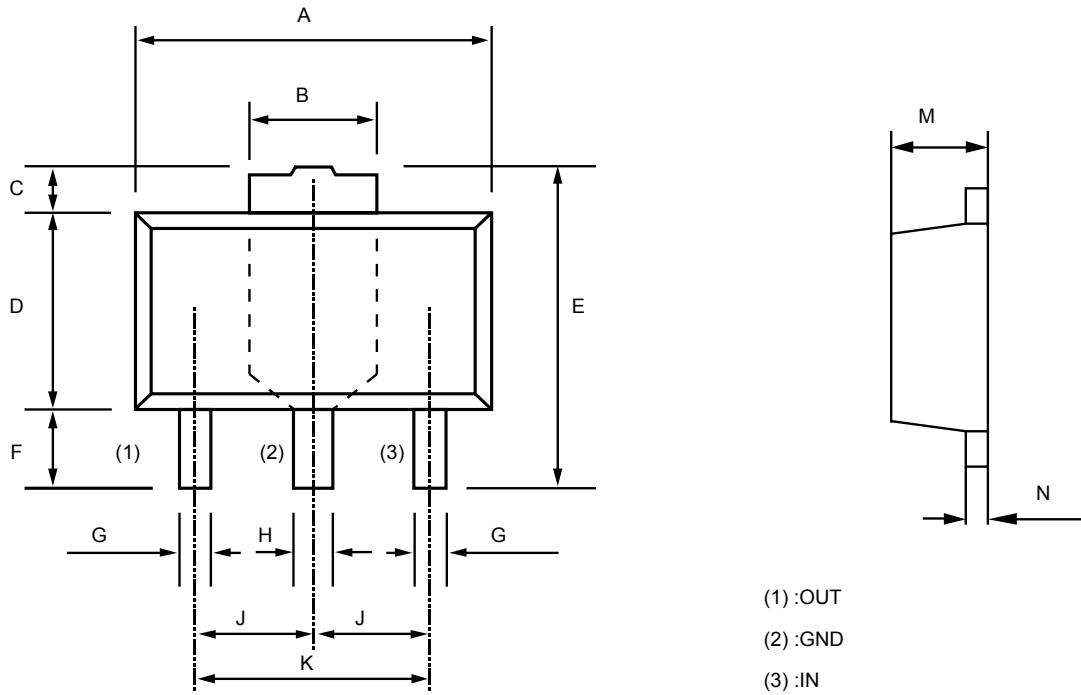
Typical Application



Note 4: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulator.

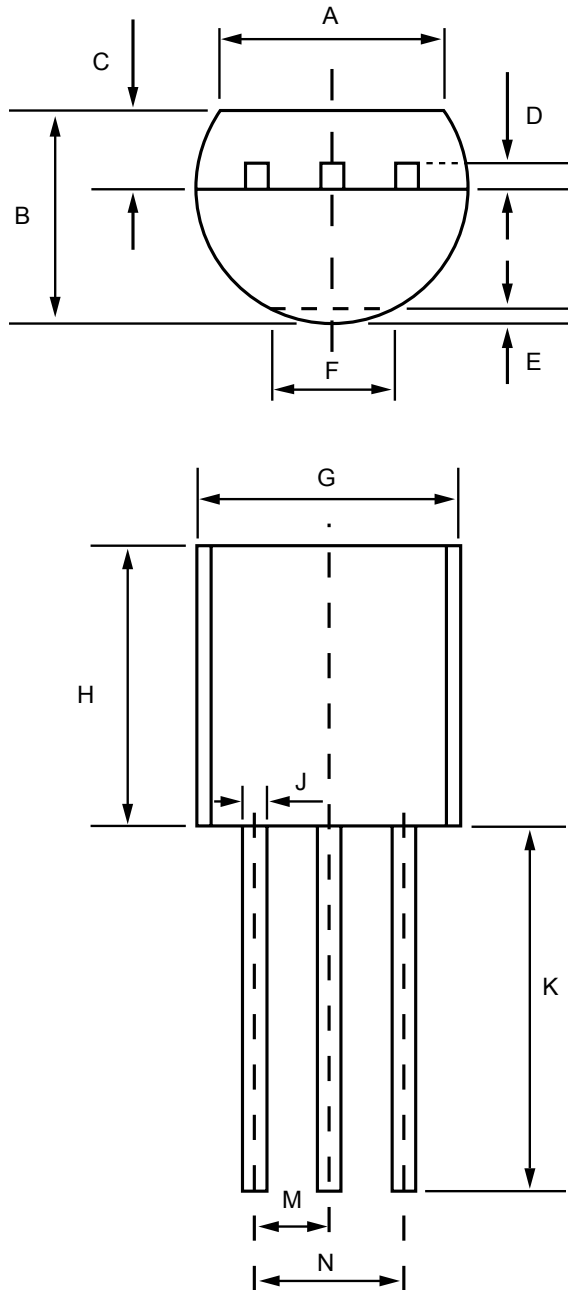
Figure 8. Typical Application of the PD78L Series

Product dimension (SOT-89)



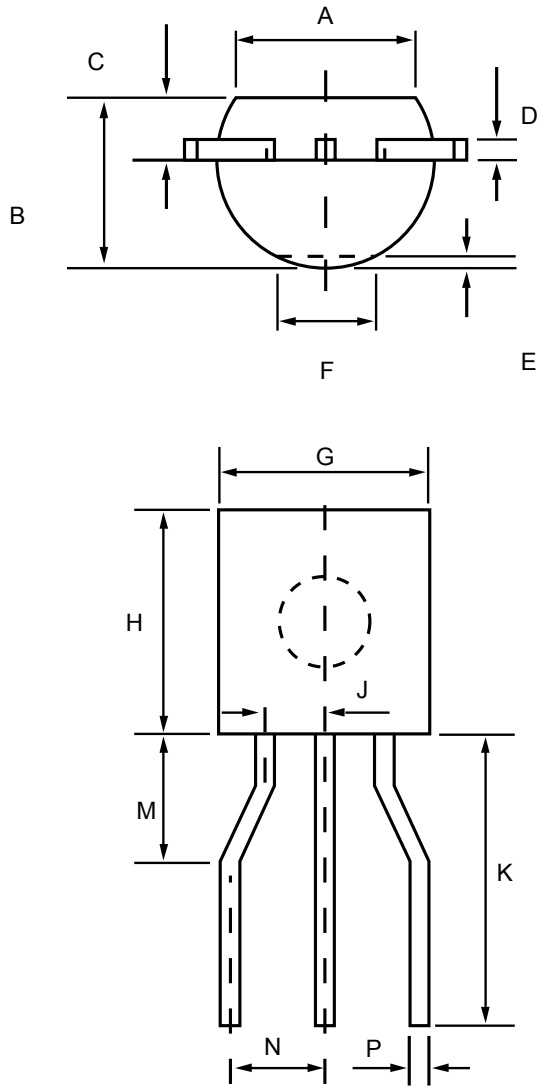
Dim	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	4.400	4.600	0.173	0.181
B	1.630	1.830	0.064	0.072
C	3.05		0.120	
D	2.300	2.600	0.091	0.102
E	3.950	4.250	0.156	0.167
F	0.900	1.200	0.035	0.047
G	0.360	0.520	0.014	0.020
H	0.440	0.560	0.017	0.022
J	1.500		0.059	
K	3.000		0.118	
M	1.400	1.600	0.055	0.063
N	0.360	0.440	0.014	0.017

Product dimension (TO-92) Bulk Packing



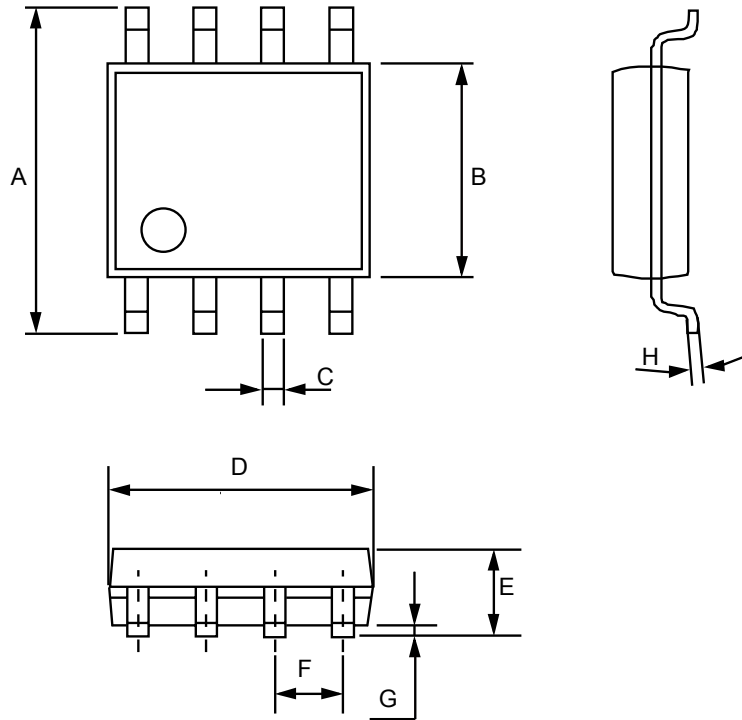
Dim	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	3.43		0.135	
B	3.300	3.700	0.130	0.146
C	1.100	1.400	0.043	0.055
D	0.360	0.510	0.014	0.020
E	0.000	0.380	0.000	0.015
F	Φ 1.600 Max		Φ 0.063 Max	
G	4.400	4.700	0.173	0.185
H	4.300	4.700	0.169	0.185
J	0.380	0.550	0.015	0.022
K	14.100	14.500	0.555	0.571
M	1.270 typ.		0.050 typ.	
N	2.440	2.640	0.096	0.104

Product dimension (TO-92) Ammo Packing



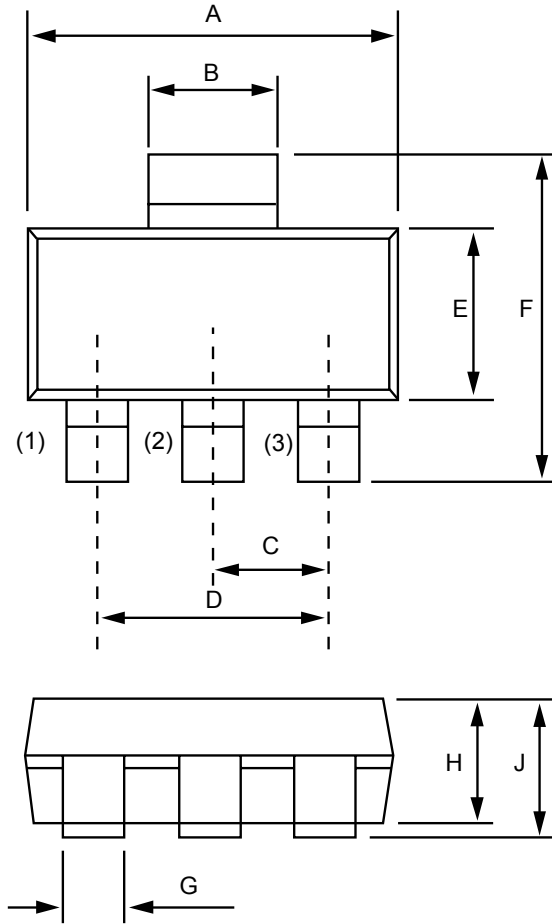
Dim	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	3.43		0.135	
B	3.300	3.700	0.130	0.146
C	1.100	1.400	0.043	0.055
D	0.360	0.510	0.014	0.020
E	0.000	0.380	0.000	0.015
F	Φ 1.600 Max		Φ 0.063 Max	
G	4.400	4.700	0.173	0.185
H	4.300	4.700	0.169	0.185
J	1.27 typ.		0.05 typ.	
K	13.000	14.000	0.512	0.551
M	4.500	5.500	0.177	0.217
N	2.540 typ.		0.100 typ.	
P	0.380	0.550	0.015	0.022

Product dimension (SOIC-8)



Dim	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	5.800	6.200	0.228	0.244
B	3.800	4.000	0.150	0.157
C	0.330	0.510	0.013	0.020
D	4.700	5.100	0.185	0.200
E	1.350	1.750	0.053	0.069
F	1.270 (BSC)		0.050 (BSC)	
G	0.100	0.250	0.004	0.010
H	0.170	0.250	0.006	0.010

Product dimension (SOT-223)



Dim	Millimeters	
	MIN	MAX
A	6.30	6.70
B	2.90	3.10
C	2.30 BSC	
D	4.60 BSC	
E	3.30	3.70
F	6.70	7.30
G	0.66	0.84
H	1.55	1.65
J		1.80

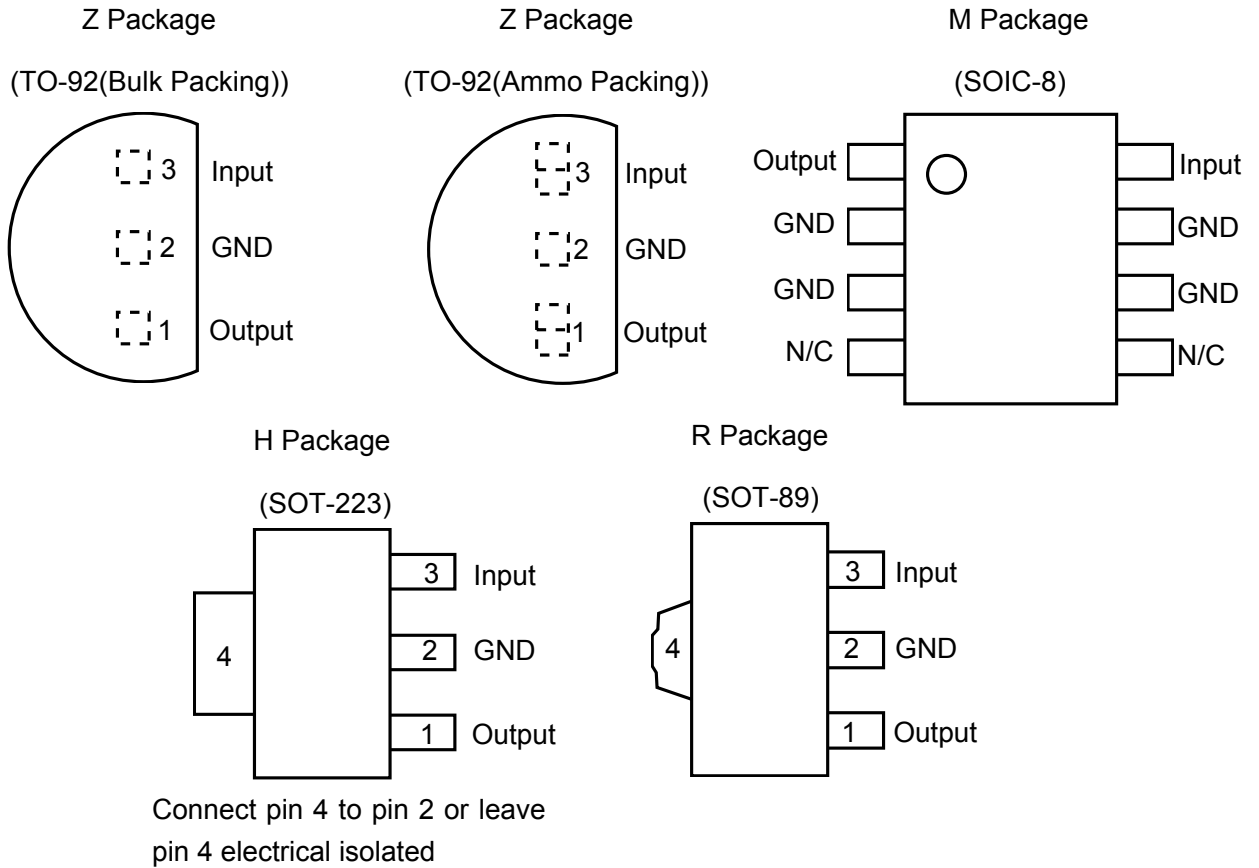
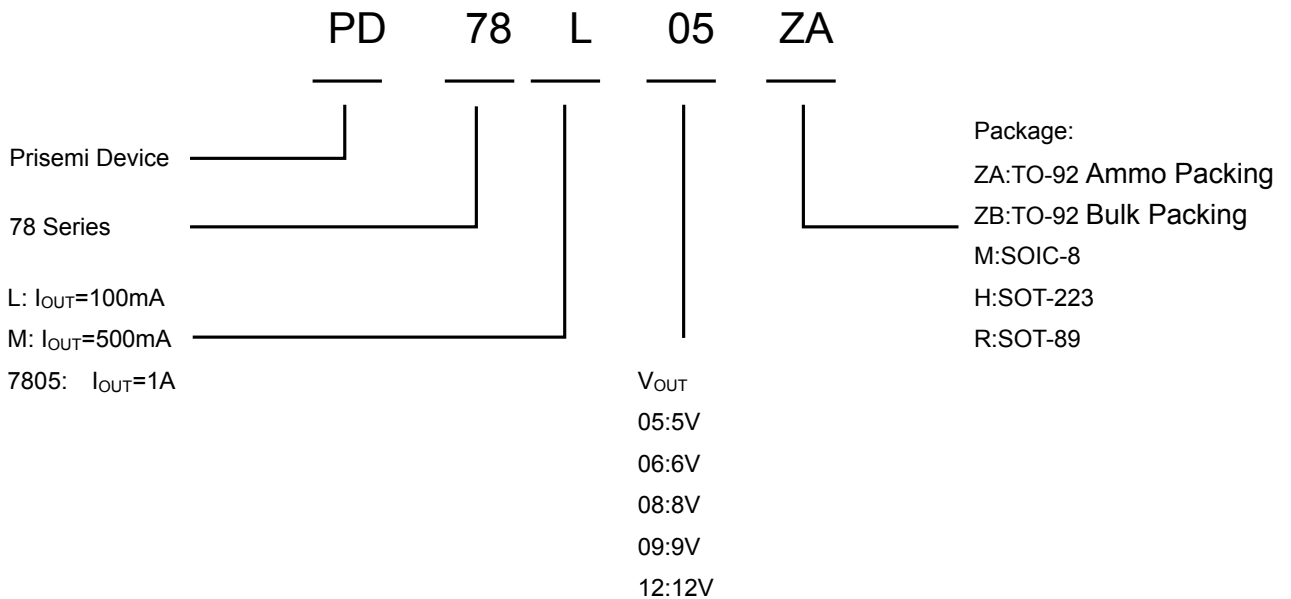



Figure 9. Pin Configuration of the PD78L series

Naming Rule




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