

1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR**CL78XX****■ General Description**

The CL78XX series are three terminal positive regulators designed for a wide variety of applications including local, on-card regulation.

The CL78XX are complete with internal current limiting, thermal shutdown protection, and safe-area compensation which make them virtually immune from output overload. If adequate heat sinking is provided, these regulators can deliver output currents up to 1A.

The CL78XX are available in TO-220-3 and TO-252-2(1) Packages.

■ Features

- Output Current up to 1A
- Fixed Output Voltages of 5V, 8V, 9V, 12V and 15V
- Output Voltage Accuracy of $\pm 4\%$ over the Full Temperature Range
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- Output Transistor Safe-area Protection

■ Application

- High Efficiency Linear Regulator
- Post Regulation for Switching Supply
- Microprocessor Power Supply
- Mother Board

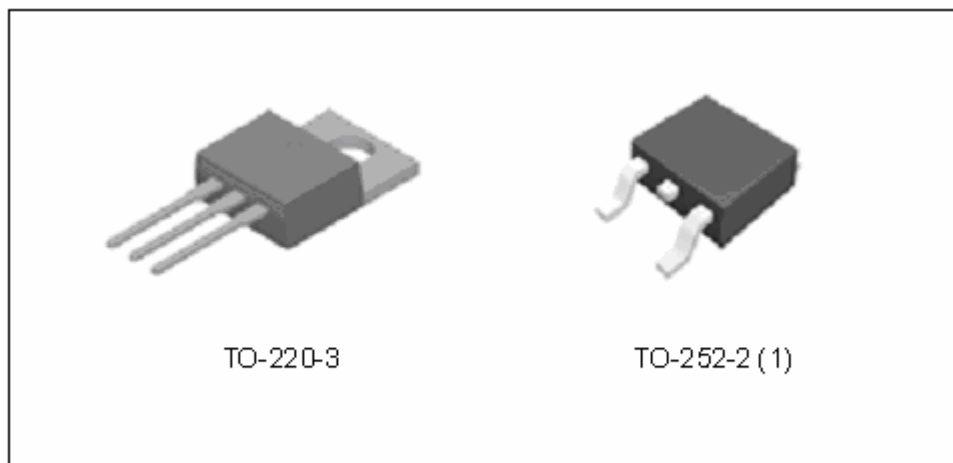


Figure 1. Package Types of CL78XX

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■ Pin Configuration

T Package
TO-220-3

D Package
TO-252-2(1)

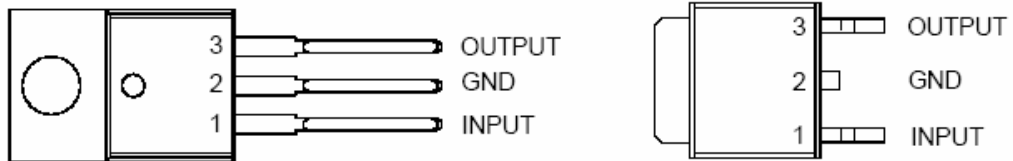


Figure 2. Pin Configuration of CL78XX

■ Pin Description

Pin Number	Pin Name	Function
1	INPUT	Voltage Input
2	GND	Ground
3	OUTPUT	Voltage Output

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Functional Block Diagram

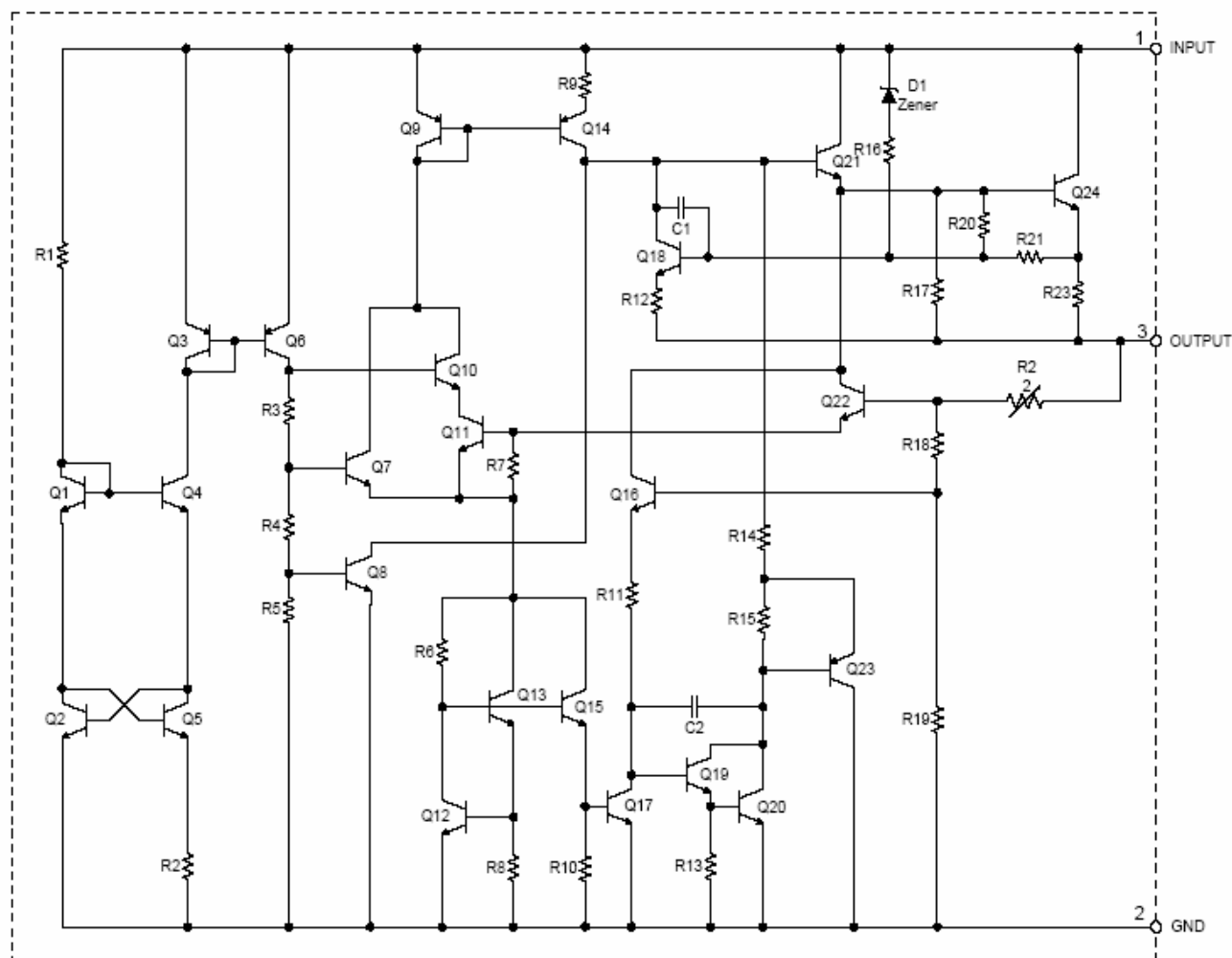
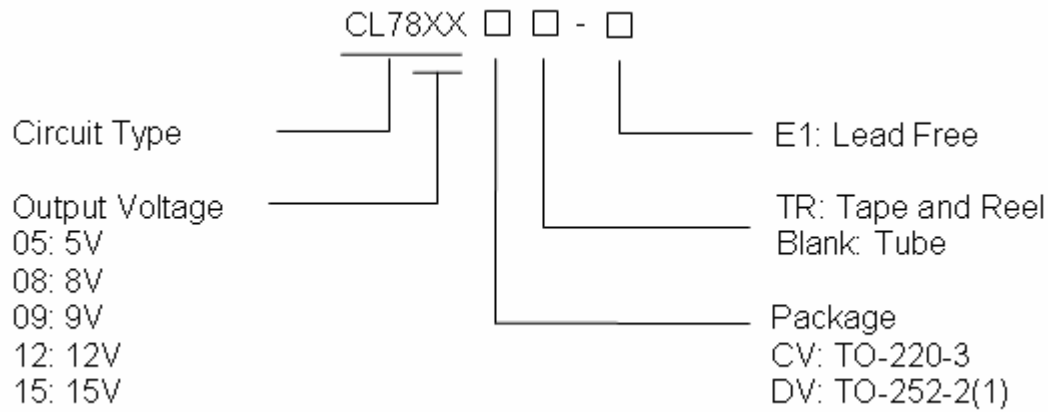


Figure 3. Functional Block Diagram of CL78XX

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Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
TO-220-3	-40 to 125°C	CL7805CV-E1	CL7805CV	Tube
		CL7808CV -E1	CL7808CV	Tube
		CL7809CV -E1	CL7809CV	Tube
		CL7812CV -E1	CL7812CV	Tube
		CL7815CV -E1	CL7815CV	Tube
TO-252-2 (1)	-40 to 125°C	CL7805DV-E1	CL7805DV	Tube
		CL7805DVTR-E1	CL7805DV	Tape & Reel
		CL7808DV-E1	CL7808DV	Tube
		CL7808DVTR-E1	CL7808DV	Tape & Reel
		CL7809DV-E1	CL7809DV	Tube
		CL7809DVTR-E1	CL7809DV	Tape & Reel
		CL7812DV-E1	CL7812DV	Tube
		CL7812DVTR-E1	CL7812DV	Tape & Reel
		CL7815DV-E1	CL7815DV	Tube
		CL7815DVTR-E1	CL7815DV	Tape & Reel

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■ Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Input Voltage	V_{IN}	36		V
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260		°C
Power Dissipation	P_D	Internally Limited		W
Operating Junction Temperature	T_J	150		°C
Storage Temperature Range	T_{STG}	-65 to 150		°C
Thermal Resistance	θ_{JA}	TO-220-3	60	°C/W
		TO-252-2 (1)	100	
ESD (Human Body Model)	ESD	6000		V
ESD (Machine Model)	ESD	600		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.

■ Recommended Operating Conditions

Parameter		Symbol	Min	Max	Unit
Input Voltage	CL7805	V_{IN}		25	V
	CL7808			25	
	CL7809			25	
	CL7812			30	
	CL7815			30	
Operating Junction Temperature Range		T_J	-40	125	°C

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■ Electrical Characteristics

CL7805 ($V_{IN}=10V$, $I_{OUT}=1A$, $T_J=-40$ to $125^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	4.9	5.0	5.1	V
		$I_{OUT}=5mA$ to $1A$, $V_{IN}=7.5V$ to $20V$ $P_D \leq 15W$	4.8		5.2	
Line Regulation	V_{RLINE}	$V_{IN}=7.5V$ to $20V$, $I_{OUT}=0.5A$ $T_J=25^{\circ}C$		25	50	mV
Load Regulation	V_{RLOAD}	$V_{IN}=10V$, $I_{OUT}=5mA$ to $1A$ $T_J=25^{\circ}C$		25	50	mV
Quiescent Current	I_Q	$V_{IN}=10V$, $I_{OUT}=0$		3.0	6	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=8V$ to $25V$, $I_{OUT}=500mA$ $T_J=25^{\circ}C$		0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$, $T_J=25^{\circ}C$		0.08	0.5	
Ripple Rejection	$PSRR$	$V_{IN}=8V$ to $18V$, $f=120Hz$ $I_{OUT}=500mA$		70		dB
Dropout Voltage	V_{DROP}	$\Delta V_{OUT}=1\%$, $I_{OUT}=1A$, $T_J=25^{\circ}C$		2		V
Output Noise Voltage	N_O	$f=10Hz$ to $100kHz$, $T_A=25^{\circ}C$		10		$\mu V/V$
Output Resistance	R_O	$f=1kHz$		10		$m\Omega$
Short Circuit Current	I_{SC}	$V_{IN}=35V$, $T_A=25^{\circ}C$		0.2		A
Peak Output Current	I_{PK}	$V_{IN}=10V$, $T_J=25^{\circ}C$		2.2		A
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			0.4		$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			80		$ppm/^{\circ}C$

1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR
CL78XX
■ Electrical Characteristics (Continued)
CL7808 ($V_{IN}=14V$, $I_{OUT}=1A$, $T_J=-40$ to $125^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	7.84	8.0	8.16	V
		$I_{OUT}=5mA$ to $1A$, $V_{IN}=10.6V$ to $23V$ $P_D \leq 15W$	7.7		8.3	
Line Regulation	V_{RLINE}	$V_{IN}=10.6V$ to $23V$, $I_{OUT}=0.5A$ $T_J=25^{\circ}C$		25	75	mV
Load Regulation	V_{RLOAD}	$V_{IN}=14V$, $I_{OUT}=5mA$ to $1A$ $T_J=25^{\circ}C$		25	75	mV
Quiescent Current	I_Q	$V_{IN}=14V$, $I_{OUT}=0$		3.0	6	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=11.5V$ to $25V$, $I_{OUT}=500mA$ $T_J=25^{\circ}C$		0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$, $T_J=25^{\circ}C$		0.08	0.5	
Ripple Rejection	$PSRR$	$V_{IN}=11.5V$ to $21.5V$, $f=120Hz$ $I_{OUT}=500mA$		70		dB
Dropout Voltage	V_{DROP}	$\Delta V_{OUT}=1\%$, $I_{OUT}=1A$, $T_J=25^{\circ}C$		2		V
Output Noise Voltage	N_O	$f=10Hz$ to $100kHz$, $T_A=25^{\circ}C$		10		$\mu V/V$
Output Resistance	R_O	$f=1kHz$		10		$m\Omega$
Short Circuit Current	I_{SC}	$V_{IN}=35V$, $T_A=25^{\circ}C$		0.2		A
Peak Output Current	I_{PK}	$V_{IN}=14V$, $T_J=25^{\circ}C$		2.2		A
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			0.6		$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			80		$ppm/^{\circ}C$

1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR
CL78XX
■ Electrical Characteristics (Continued)
CL7809 ($V_{IN}=15V$, $I_{OUT}=1A$, $T_J=-40$ to $125^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	8.82	9.0	9.18	V
		$I_{OUT}=5mA$ to $1A$, $V_{IN}=11.5V$ to $23V$ $P_D \leq 15W$	8.65		9.35	
Line Regulation	V_{RLINE}	$V_{IN}=11.5V$ to $23V$, $I_{OUT}=0.5A$ $T_J=25^{\circ}C$		25	90	mV
Load Regulation	V_{RLOAD}	$V_{IN}=15V$, $I_{OUT}=5mA$ to $1A$ $T_J=25^{\circ}C$		25	100	mV
Quiescent Current	I_Q	$V_{IN}=15V$, $I_{OUT}=0$		3.0	6	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=12.5V$ to $25V$, $I_{OUT}=500mA$ $T_J=25^{\circ}C$		0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$, $T_J=25^{\circ}C$		0.08	0.5	
Ripple Rejection	$PSRR$	$V_{IN}=12.5V$ to $22.5V$, $f=120Hz$ $I_{OUT}=500mA$		70		dB
Dropout Voltage	V_{DROP}	$\Delta V_{OUT}=1\%$, $I_{OUT}=1A$, $T_J=25^{\circ}C$		2		V
Output Noise Voltage	N_O	$f=10Hz$ to $100kHz$, $T_A=25^{\circ}C$		10		$\mu V/V$
Output Resistance	R_O	$f=1kHz$		10		$m\Omega$
Short Circuit Current	I_{SC}	$V_{IN}=35V$, $T_A=25^{\circ}C$		0.2		A
Peak Output Current	I_{PK}	$V_{IN}=15V$, $T_J=25^{\circ}C$		2.2		A
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			0.7		$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			80		$ppm/^{\circ}C$

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CL78XX
■ Electrical Characteristics (Continued)
CL7812 ($V_{IN}=19V$, $I_{OUT}=1A$, $T_J=-40$ to $125^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	11.75	12.0	12.25	V
		$I_{OUT}=5mA$ to $1A$, $V_{IN}=14.8V$ to $27V$ $P_D \leq 15W$	11.5		12.5	
Line Regulation	V_{RLINE}	$V_{IN}=14.8V$ to $27V$, $I_{OUT}=0.5A$ $T_J=25^{\circ}C$		35	120	mV
Load Regulation	V_{RLOAD}	$V_{IN}=19V$, $I_{OUT}=5mA$ to $1A$ $T_J=25^{\circ}C$		40	120	mV
Quiescent Current	I_Q	$V_{IN}=19V$, $I_{OUT}=0$		3.2	6	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=14.8V$ to $30V$, $I_{OUT}=500mA$ $T_J=25^{\circ}C$		0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$, $T_J=25^{\circ}C$		0.08	0.5	
Ripple Rejection	$PSRR$	$V_{IN}=15V$ to $25V$, $f=120Hz$ $I_{OUT}=500mA$		65		dB
Dropout Voltage	V_{DROP}	$\Delta V_{OUT}=1\%$, $I_{OUT}=1A$, $T_J=25^{\circ}C$		2		V
Output Noise Voltage	N_O	$f=10Hz$ to $100kHz$, $T_A=25^{\circ}C$		10		$\mu V/V$
Output Resistance	R_O	$f=1kHz$		10		$m\Omega$
Short Circuit Current	I_{SC}	$V_{IN}=35V$, $T_A=25^{\circ}C$		0.2		A
Peak Output Current	I_{PK}	$V_{IN}=19V$, $T_J=25^{\circ}C$		2.2		A
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			0.9		$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			80		$ppm/^{\circ}C$

1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR
CL78XX
■ Electrical Characteristics (Continued)
CL7815 ($V_{IN}=23V$, $I_{OUT}=1A$, $T_J=-40$ to $125^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	14.7	15.0	15.3	V
		$I_{OUT}=5mA$ to $1A$, $V_{IN}=17.9V$ to $30V$ $P_D \leq 15W$	14.4		15.6	
Line Regulation	V_{RLINE}	$V_{IN}=17.9V$ to $30V$, $I_{OUT}=0.5A$ $T_J=25^{\circ}C$		45	150	mV
Load Regulation	V_{RLOAD}	$V_{IN}=23V$, $I_{OUT}=5mA$ to $1A$ $T_J=25^{\circ}C$		60	150	mV
Quiescent Current	I_Q	$V_{IN}=23V$, $I_{OUT}=0$		3.2	6	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=17.9V$ to $30V$, $I_{OUT}=500mA$ $T_J=25^{\circ}C$		0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$, $T_J=25^{\circ}C$		0.08	0.5	
Ripple Rejection	$PSRR$	$V_{IN}=18.5V$ to $28.5V$, $f=120Hz$ $I_{OUT}=500mA$		60		dB
Dropout Voltage	V_{DROP}	$\Delta V_{OUT}=1\%$, $I_{OUT}=1A$, $T_J=25^{\circ}C$		2		V
Output Noise Voltage	N_O	$f=10Hz$ to $100kHz$, $T_A=25^{\circ}C$		10		$\mu V/V$
Output Resistance	R_O	$f=1kHz$		10		$m\Omega$
Short Circuit Current	I_{SC}	$V_{IN}=35V$, $T_A=25^{\circ}C$		0.2		A
Peak Output Current	I_{PK}	$V_{IN}=23V$, $T_J=25^{\circ}C$		2.2		A
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			1.1		$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			80		ppm/ $^{\circ}C$

1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR

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■ Typical Performance Characteristics

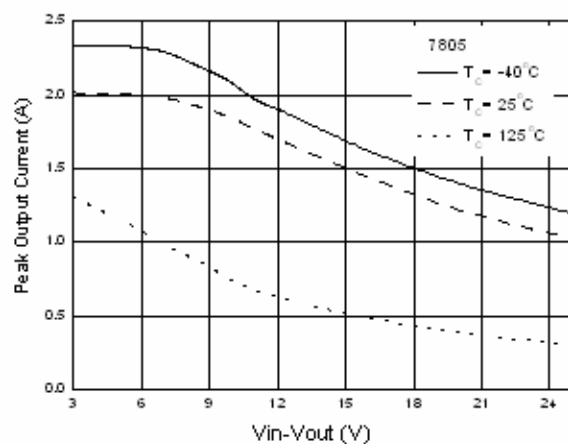


Figure 4. Peak Output Current vs. $V_{in}-V_{out}$

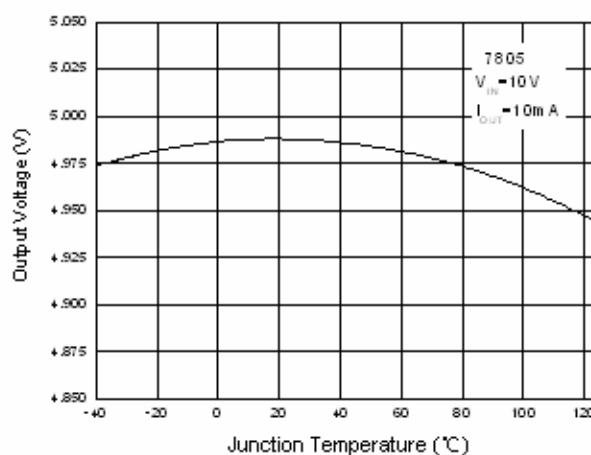


Figure 5. Output Voltage vs. Junction Temperature

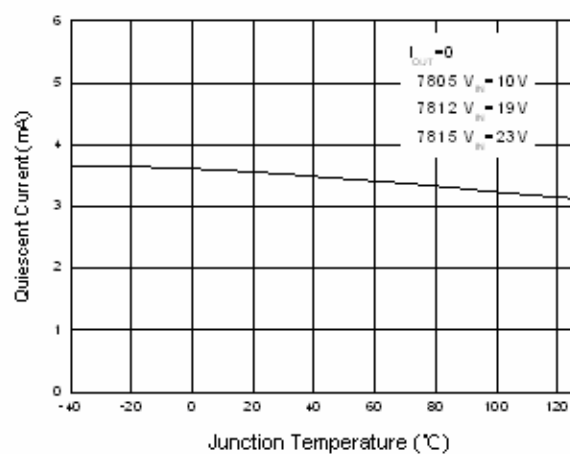


Figure 6. Quiescent Current vs. Junction Temperature

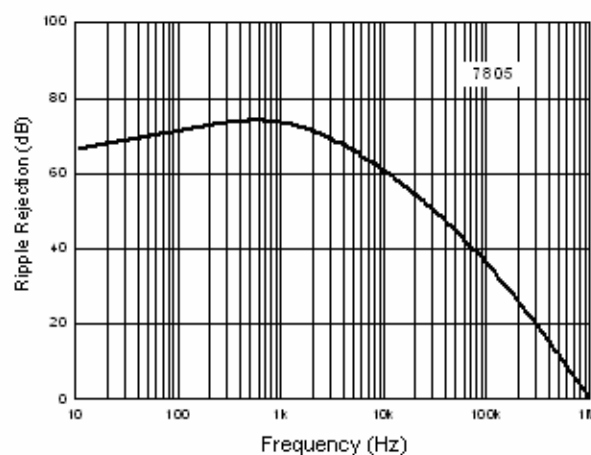


Figure 7. Ripple Rejection vs. Frequency

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■ Typical Performance Characteristics (Continued)

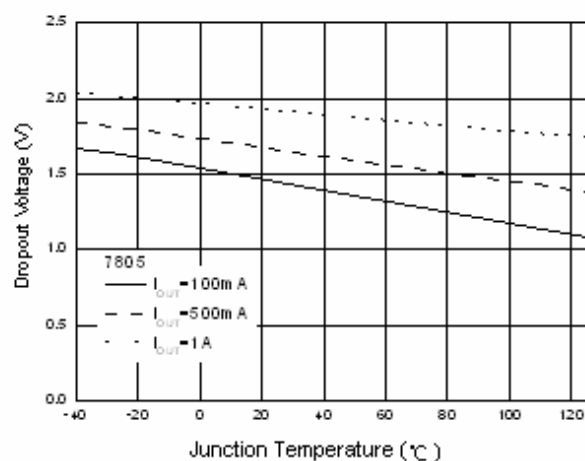


Figure 8. Dropout Voltage vs. Junction Temperature

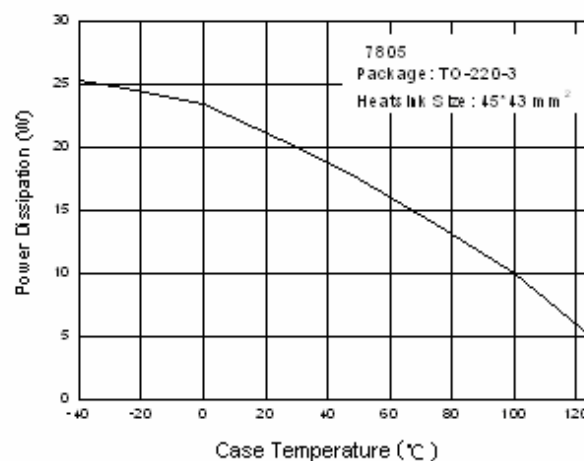


Figure 9. Power Dissipation vs. Case Temperature

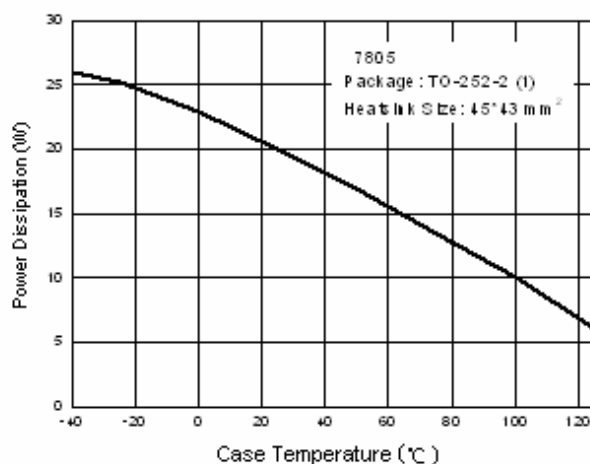


Figure 10. Power Dissipation vs. Case Temperature

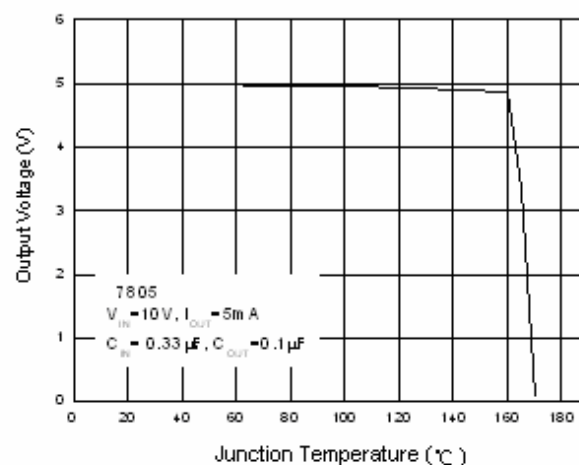


Figure 11. Thermal Shutdown Protection

1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR

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■ Typical Performance Characteristics (Continued)

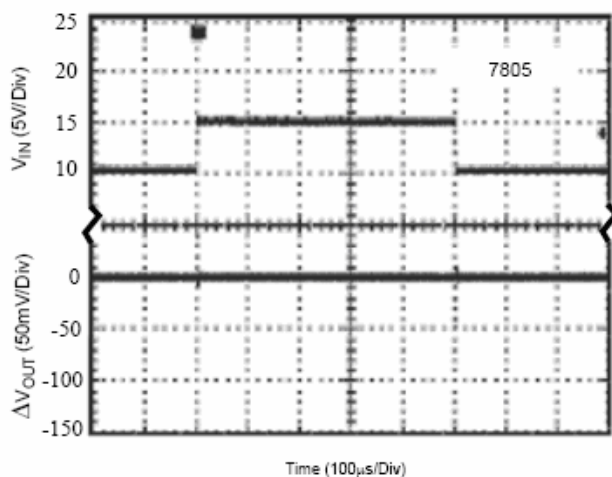


Figure 12. Line Transient
(Conditions: $I_{OUT}=500mA$, $C_{OUT}=0.1\mu F$)

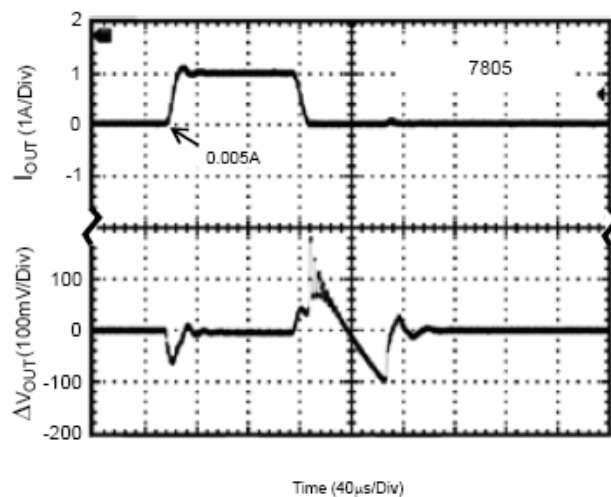


Figure 13. Load Transient
(Conditions: $V_{IN}=10V$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$)

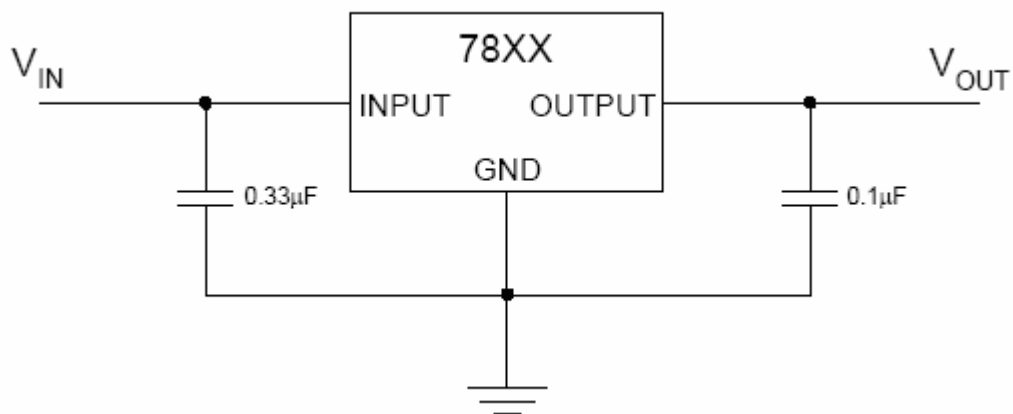
1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR**CL78XX****■ Typical Application**

Figure 14. Typical Application of CL78XX

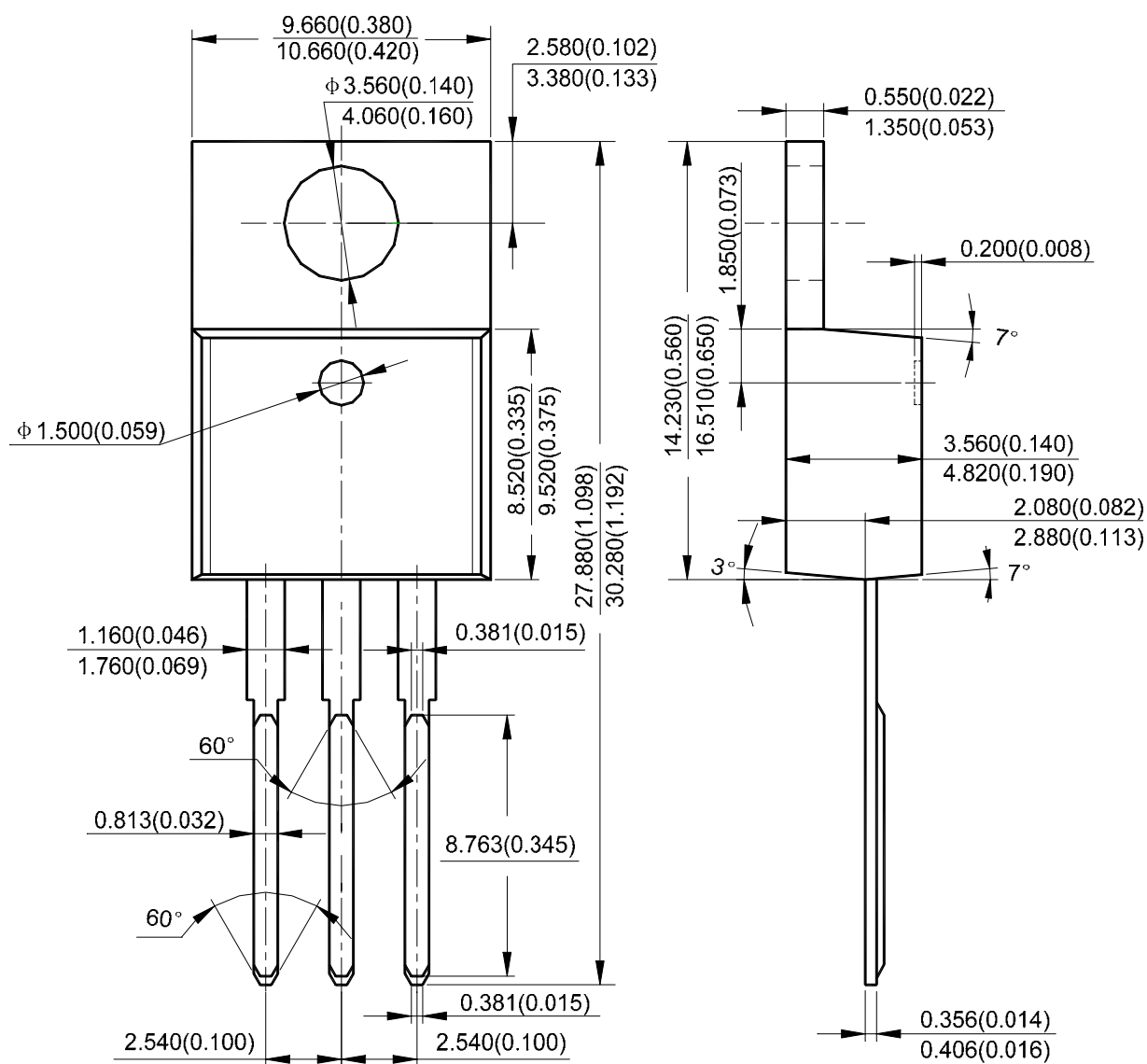
1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR

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■ Mechanical Dimensions

TO-220-3

Unit: mm (inch)



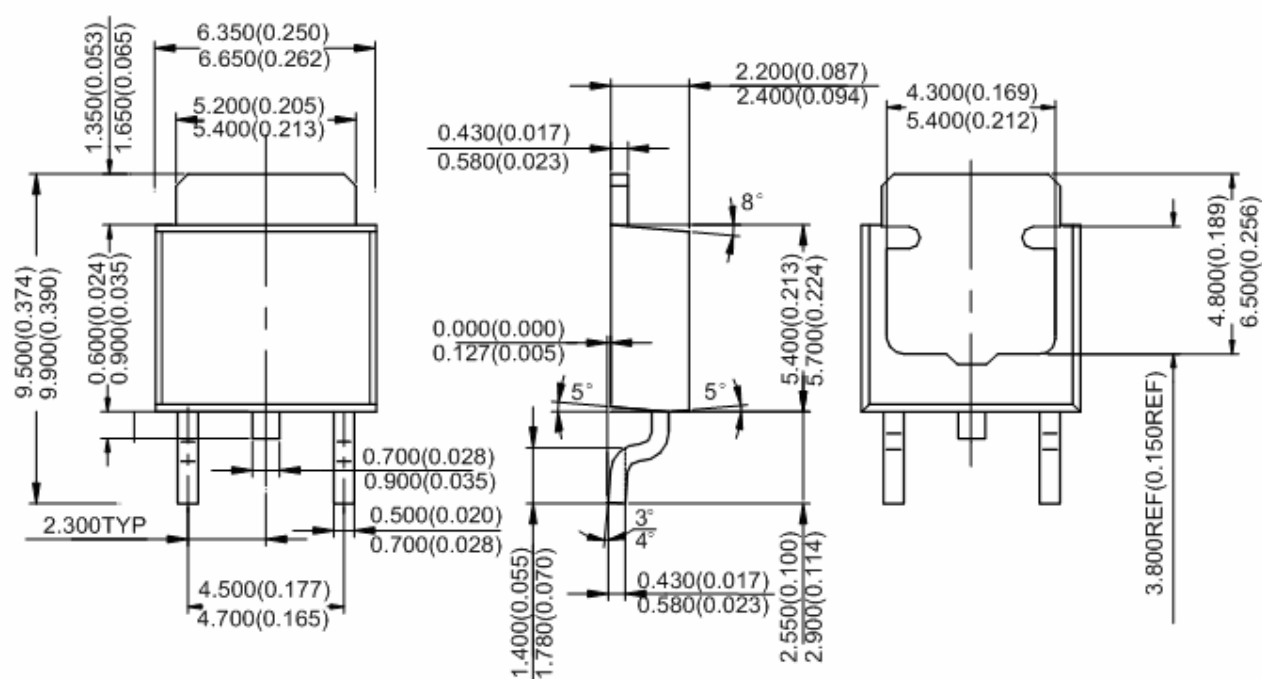
1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR

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■ Mechanical Dimensions (Continued)

TO-252-2(1)

Unit: mm (inch)



1A 3-TERMINAL POSITIVE VOLTAGE REGULATOR**CL78XX****IMPORTANT NOTICE**

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