3-Terminal 1A Positive Voltage Regulator

BL78XX

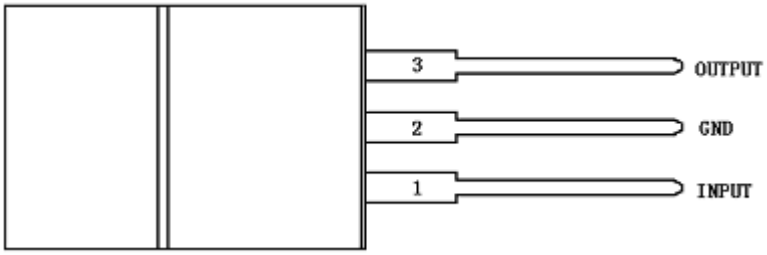
GENERAL DESCRIPTION

The BL78XX series of three-terminal positive regulator are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

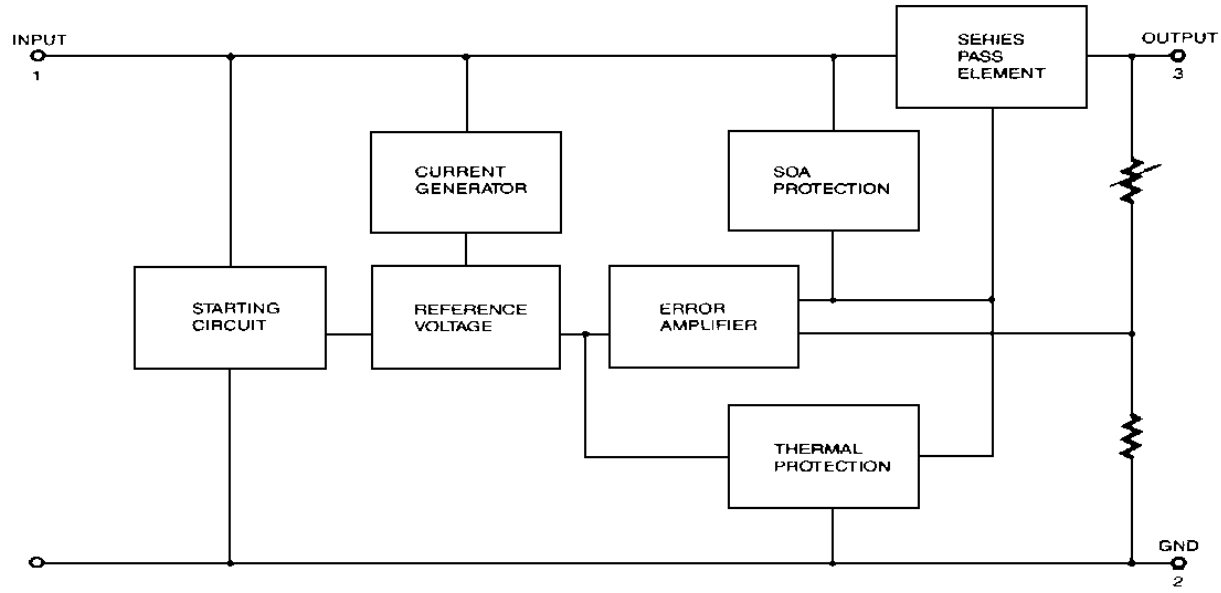
FEATURE

- Output Current up to 1A
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection
- Output Voltages : BL7805: 5V BL7806: 6V BL7808: 8V
  BL7809: 9V BL7812: 12V BL7815:15V

PIN CONNECTIONS



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristics	Symbol	Value	Units
Input Voltage	Vi	35	V
Thermal Resistance Junction-Case	$R_{\theta JC}$	5	°C/W
Thermal Resistance Junction-Air	$R_{\theta JA}$	65	°C/W
Operating Temperature Range	T_{OPR}	-20~+85	°C
Storage Temperature Range	T_{STG}	-55~+150	°C

BL7805 ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, -20°C＜T_J＜85°C ,Io=500mA, Vi=10V, Ci=0.33μF, Co=0.1μF, unless otherwise specified

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	Vo	T_J=+25°C		4.8	5.0	5.2	V
		5.0mA≤Io≤1.0A,Po≤15W Vi=7V to 20V		4.75	5.0	5.25	
Line Regulation*	Regline	T_J=+25°C	Vi=7V to 25V		4.0	100	mV
			Vi=8V to 12V		1.6	50	
Load Regulation*	Regload	T_J=+25°C	Io=5.0mA to 1.5A		15	100	mV
			Io=250mA to 750mA		4	50	
Quiescent Current	I_Q	T_J=+25°C			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	Io=5.0mA to 1.0A			0.03	0.5	mA
		Vi=7V to 25V			0.3	1.3	
Output Voltage Drift	$\Delta Vo/\Delta T$	Io=5.0mA			-0.8		mV/°C
Output Noise Voltage	V_N	f=10Hz to 100KHz,T_A=+25°C			42		μV/Vo
Ripple Rejection	RR	f=120Hz Vi=8V to 18V		62	73		dB
Dropout Voltage	VDrop	Io=1A, T_J=+25°C			2		V
Short Circuit Current	I_{SC}	Vi=35V, T_A=+25°C			230		mA
Peak Current	I_{PK}	T_J=+25°C			2.2		A

*Load and line regulation are specified at constant junction temperature. Changes in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

BL7806 ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, -20°C＜T_J＜85°C ,Io=500mA, Vi=11V, Ci=0.33μF, Co=0.1μF, unless otherwise specified

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	Vo	T_J=+25°C		5.75	6.0	6.25	V
		5.0mA≤Io≤1.0A,Po≤15W Vi=8V to 21V		5.7	6.0	6.3	
Line Regulation*	Regline	T_J=+25°C	Vi=8V to 25V		5.0	120	mV
			Vi=9V to 13V		1.5	60	
Load Regulation*	Regload	T_J=+25°C	Io=5.0mA to 1.5A		9	120	mV
			Io=250mA to 750mA		3	60	
Quiescent Current	I_Q	T_J=+25°C			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	Io=5.0mA to 1.0A				0.5	mA
		Vi=8V to 25V				1.3	
Output Voltage Drift	$\Delta Vo/\Delta T$	Io=5.0mA			-0.8		mV/°C
Output Noise Voltage	V_N	f=10Hz to 100KHz,T_A=+25°C			45		μV/Vo
Ripple Rejection	RR	f=120Hz Vi=9V to 19V		59	75		dB
Dropout Voltage	VDrop	Io=1A, T_J=+25°C			2		V
Short Circuit Current	I_{SC}	Vi=35V, T_A=+25°C			250		mA
Peak Current	I_{PK}	T_J=+25°C			2.2		A

*Load and line regulation are specified at constant junction temperature. Changes in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

BL7808 ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, -20°C＜T_J＜85°C ,Io=500mA, Vi=14V, Ci=0.33μF, Co=0.1μF, unless otherwise specified

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	Vo	T_J=+25°C		7.7	8.0	8.3	V
		5.0mA≤Io≤1.0A,Po≤15W Vi=10.5V to 23V		7.6	8.0	8.4	
Line Regulation*	Regline	T_J=+25°C	Vi=10.5V to 25V		5.0	160	mV
			Vi=11.5V to 17V		2.0	80	
Load Regulation*	Regload	T_J=+25°C	Io=5.0mA to 1.5A		10	160	mV
			Io=250mA to 750mA		5.0	80	
Quiescent Current	I_Q	T_J=+25°C			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	Io=5.0mA to 1.0A			0.05	0.5	mA
		Vi=10.5V to 25V			0.5	1.0	
Output Voltage Drift	$\Delta Vo/\Delta T$	Io=5.0mA			-0.8		mV/°C
Output Noise Voltage	V_N	f=10Hz to 100KHz,T_A=+25°C			52		μV/Vo
Ripple Rejection	RR	f=120Hz Vi=11.5V to 21.5V		56	73		dB
Dropout Voltage	VDrop	Io=1A, T_J=+25°C			2		V
Short Circuit Current	I_{SC}	Vi=35V, T_A=+25°C			230		mA
Peak Current	I_{PK}	T_J=+25°C			2.2		A

*Load and line regulation are specified at constant junction temperature. Changes in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

BL7809 ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, -20°C＜T_J＜85°C ,Io=500mA, Vi=15V, Ci=0.33μF, Co=0.1μF, unless otherwise specified

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	Vo	T_J=+25°C		8.68	9.0	9.32	V
		5.0mA≤Io≤1.0A,Po≤15W Vi=11.5V to 26V		8.55	9.0	9.45	
Line Regulation*	Regline	T_J=+25°C	Vi=11.5V to 26V		5.0	150	mV
			Vi=12.5V to 18V		2.0	80	
Load Regulation*	Regload	T_J=+25°C	Io=5.0mA to 1.5A		10	160	mV
			Io=250mA to 750mA		5.0	80	
Quiescent Current	I_Q	T_J=+25°C			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	Io=5.0mA to 1.0A			0.05	0.5	mA
		Vi=11.5V to 26V			0.5	1.0	
Output Voltage Drift	$\Delta Vo/\Delta T$	Io=5.0mA			-0.8		mV/°C
Output Noise Voltage	V_N	f=10Hz to 100KHz,T_A=+25°C			52		μV/Vo
Ripple Rejection	RR	f=120Hz Vi=11.5V to 21.5V		56	73		dB
Dropout Voltage	VDrop	Io=1A, T_J=+25°C			2		V
Short Circuit Current	I_{SC}	Vi=35V, T_A=+25°C			230		mA
Peak Current	I_{PK}	T_J=+25°C			2.2		A

*Load and line regulation are specified at constant junction temperature. Changes in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

BL7812 ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, -20°C＜T_J＜85°C,Io=500mA, Vi=19V, Ci=0.33μF, Co=0.1μF, unless otherwise specified

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	Vo	T_J=+25°C		11.5	12	12.5	V
		5.0mA≤Io≤1.0A,Po≤15W Vi=14.5V to 27V		11.4	12	12.6	
Line Regulation*	Regline	T_J=+25°C	Vi=14.5V to 30V		10	240	mV
			Vi=16V to 22V		3.0	120	
Load Regulation*	Regload	T_J=+25°C	Io=5.0mA to 1.5A		11	240	mV
			Io=250mA to 750mA		5.0	120	
Quiescent Current	I_Q	T_J=+25°C			5.1	8.0	mA
Quiescent Current Change	ΔI_Q	Io=5.0mA to 1.0A			0.1	0.5	mA
		Vi=14.5V to 30V			0.5	1.0	
Output Voltage Drift	$\Delta Vo/\Delta T$	Io=5.0mA			-1		mV/°C
Output Noise Voltage	V_N	f=10Hz to 100KHz,T_A=+25°C			76		μV/Vo
Ripple Rejection	RR	f=120Hz Vi=15V to 25V		55	71		dB
Dropout Voltage	VDrop	Io=1A, T_J=+25°C			2		V
Short Circuit Current	I_{SC}	Vi=35V, T_A=+25°C			230		mA
Peak Current	I_{PK}	T_J=+25°C			2.2		A

*Load and line regulation are specified at constant junction temperature. Changes in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

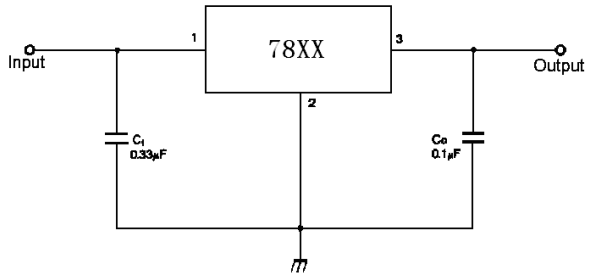
BL7815 ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, -20°C＜T_J＜85°C ,Io=500mA, Vi=23V, Ci=0.33μF, Co=0.1μF, unless otherwise specified

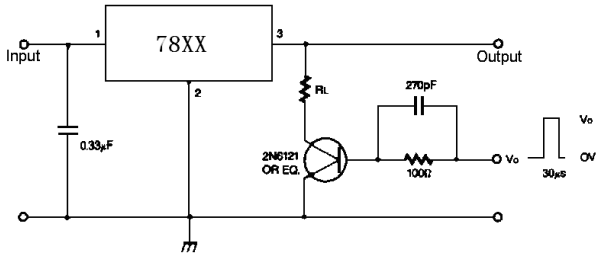
Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	Vo	T_J=+25°C		14.4	15	15.6	V
		5.0mA≤Io≤1.0A,Po≤15W Vi=17.5V to 30V		14.25	15	15.75	
Line Regulation*	Regline	T_J=+25°C	Vi=17.5V to 30V		11	300	mV
			Vi=20V to 26V		3.0	150	
Load Regulation*	Regload	T_J=+25°C	Io=5.0mA to 1.5A		12	300	mV
			Io=250mA to 750mA		4.0	150	
Quiescent Current	I_Q	T_J=+25°C			5.2	8.0	mA
Quiescent Current Change	Δ I_Q	Io=5.0mA to 1.0A				0.5	mA
		Vi=17.5V to 30V				1.0	
Output Voltage Drift	Δ Vo/Δ T	Io=5.0mA			-1		mV/°C
Output Noise Voltage	V_N	f=10Hz to 100KHz,T_A=+25°C			90		μV/Vo
Ripple Rejection	RR	f=120Hz Vi=18.5V to 28.5V		54	70		dB
Dropout Voltage	VDrop	Io=1A, T_J=+25°C			2		V
Short Circuit Current	I_{SC}	Vi=35V, T_A=+25°C			250		mA
Peak Current	I_{PK}	T_J=+25°C			2.2		A

*Load and line regulation are specified at constant junction temperature. Changes in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

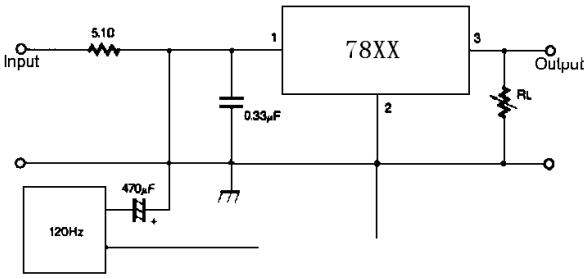
APPLICATION CIRCUIT



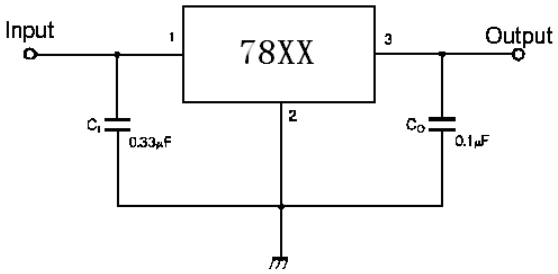
DC Parameters



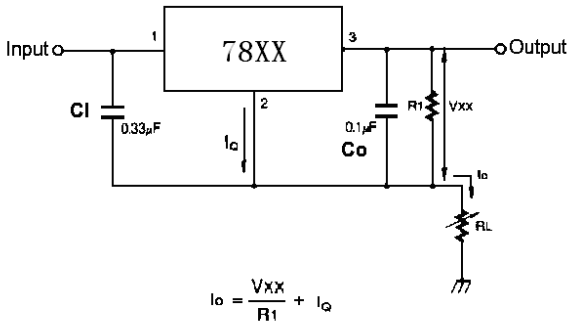
Load Regulation



Ripple Rejection



Fixed Output Regulator



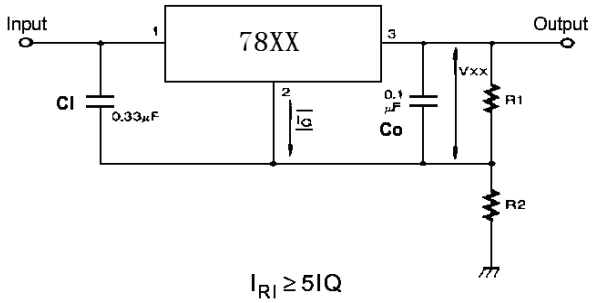
Constant Current Regulator

Notes:

(1) To specify an output voltage. substitute voltage value for "XX." A common ground is required between the input and the Output voltage. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.

(2) Ci is required if regulator is located an appreciable distance from power Supply filter.

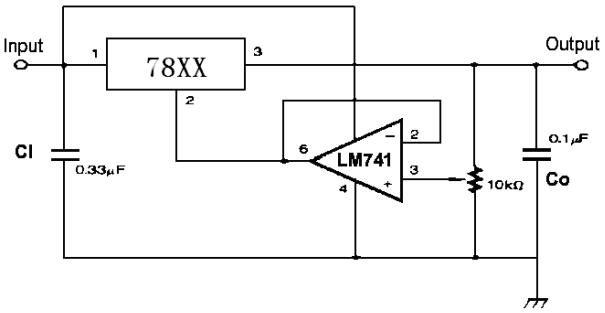
(3) Co improves stability and transient response.



$I_{RI} \geq 5IQ$

$V_O = V_{XX}(1+R_2/R_1)+I_QR_2$

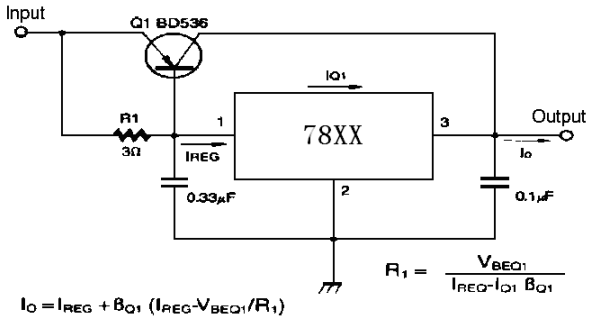
Circuit for Increasing Output Voltage



$I_{RI} \geq 5\ I_Q$

$V_O = V_{XX}(1+R_2/R_1)+I_QR_2$

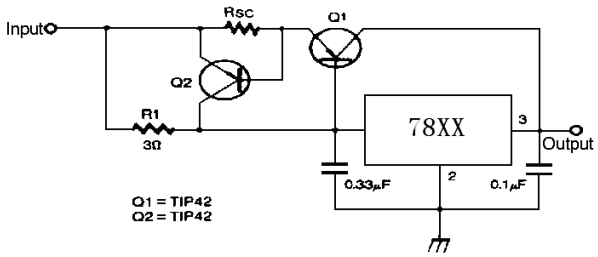
Adjustable Output Regulator (7 to 30V)



$R_1 = \frac{V_{BEQ1}}{I_{REG}-I_{Q1}\ \beta_{Q1}}$

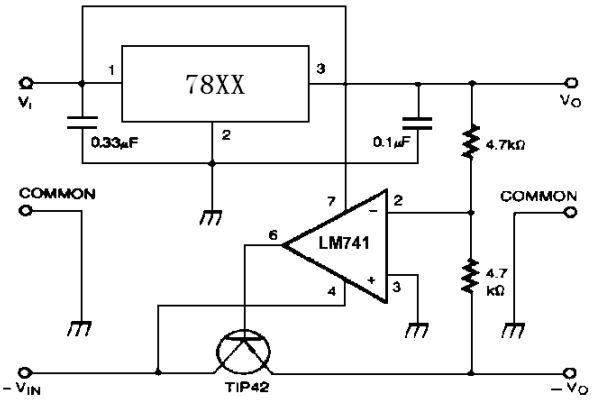
$I_O = I_{REG} + \beta_{Q1}\ (I_{REG}-V_{BEQ1}/R_1)$

High Current Voltage Regulator

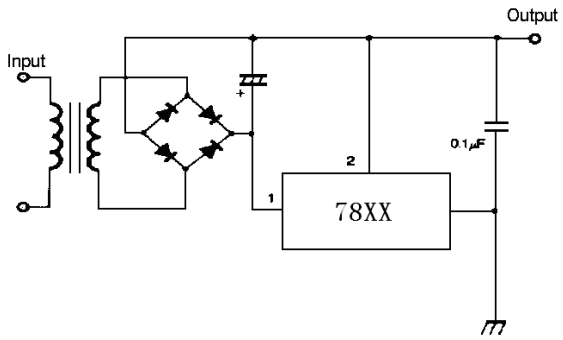


$R_{SC} = \frac{V_{BEQ2}}{I_{SC}}$

High Output Current with Short Circuit Protection

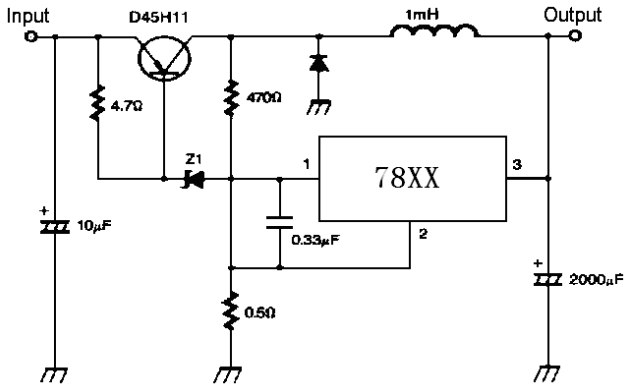


Tracking Voltage Regulator



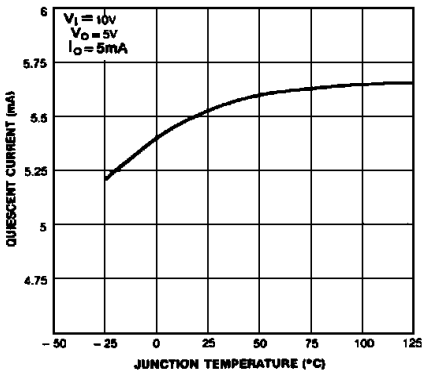
Negative Output Voltage Circuit

Tracking Voltage Regulator

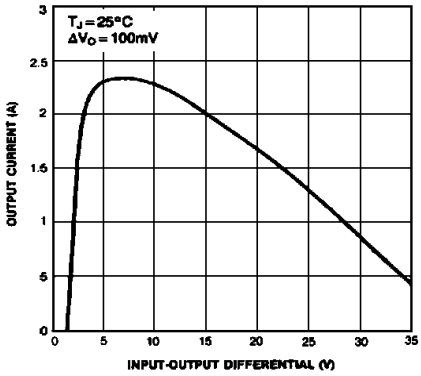


Switching Regulator

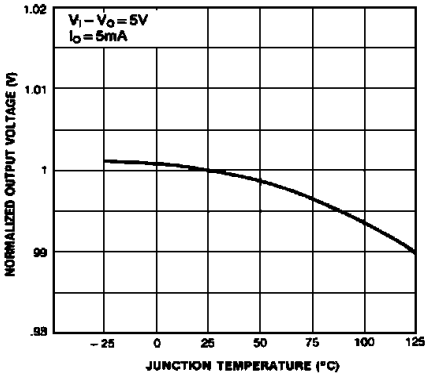
CHARACTERISTIC CURVES



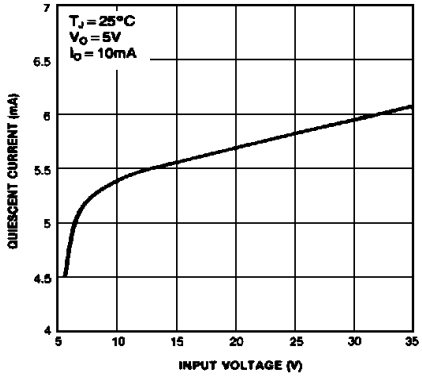
Quiescent Current



Peak Output Current



Output Voltage



Quiescent Current

OUTLINE DRAWING

TO-220 Unit:mm