

# IL78XXC SERIES

## THREE-TERMINAL POSITIVE VOLTAGE REGULATORS

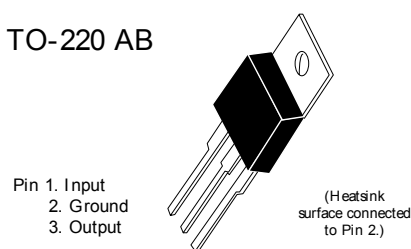
These voltage regulators are monolithic integrated circuits designed fixed-voltage regulators for a wide variety of applications including local, on card regulation. These regulators employ internal current limiting, thermal shutdown, and safe-area compensation. With adequate heatsinking they can deliver output currents in excess of 1.0 ampere.

Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

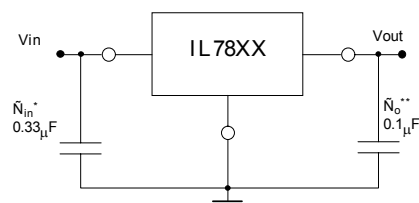
- Output Current in Excess of 1.0 Ampere
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short - Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Output Voltage Offered in 2% and 4% Tolerance

Device type/nominal output voltage			
IL7806	5 V	IL7812	12 V
IL7806	6 V	IL7815	15 V
IL7808	8 V	IL7818	18 V
IL7809	9 V	IL7824	24 V

TO-220 AB



### Standard application



A common ground is required between the input and the output voltage. The input voltage must remain typically 2.0 V above the output voltage even during the low point on the input ripple voltage.

XX = these two digits of the type number indicate voltage.

\* = C<sub>in</sub> is required if regulator is located an appreciable distance from power supply filter.

\*\* = C<sub>o</sub> is not needed for stability ; however, it does improve transient response

XX indicates nominal voltage

### Maximum ratings (T<sub>A</sub> = +25 °C unless otherwise noted)

Rating	Symbol	Value	Unit
Input Voltage (5.0 V - 18 V) (24 V)	V <sub>in</sub>	35 40	V <sub>dc</sub>
Power Dissipation and Thermal Characteristics Plastic Package T <sub>A</sub> = +25 °C Derate above T <sub>A</sub> = 25 °C Thermal Resistance, Junction to Air	P <sub>D</sub> 1/R <sub>θJA</sub> R <sub>θJC</sub>	Internally Limited 15.4 65	Watts mW/°C °C/W
T <sub>A</sub> = +25 °C Derate above T <sub>C</sub> = +75 °C (See Figure 1) Thermal Resistance, Junction to Case	P <sub>D</sub> 1/R <sub>θJC</sub> R <sub>θJC</sub>	Internally Limited 200 5.0	Watts mW/°C °C/W
Storage Junction Temperature Range	T <sub>stg</sub>	-65 to +150	°C
Operating Junction Temperature Range IL78XXC	T <sub>J</sub>	0 to +125	°C

# IL78XXC SERIES

## IL7805

### Electrical characteristics

( $V_{in} = 10V$ ,  $I_o = 500mA$ ,  $T_J = \text{Tlow to Thigh}$  (Note 1) unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage ( $T_J = +25^\circ C$ )	$V_o$	4.8	5.0	5.2	$V_{dc}$
Output Voltage ( $5.0 mA \leq I_o \leq 1.0A$ , $P_o \leq 15 W$ ) $7.0V_{dc} \leq V_{in} \leq 20V_{dc}$	$V_o$	4.75	5.0	5.25	$V_{dc}$
Line Regulation( $T_J = +25^\circ C$ , Note2) $7.0V_{dc} \leq V_{in} \leq 25V_{dc}$ $8.0V_{dc} \leq V_{in} \leq 13V_{dc}$	$Reg_{line}$	- -	9.0 3.0	100 50	mV
Load Regulation( $T_J = +25^\circ C$ , Note2) $5.0mA \leq I_o \leq 1.5A$ $250mA \leq I_o \leq 750 mA$	$Reg_{load}$	- -	43 16	100 50	mV
Quiescent Current ( $T_J = +25^\circ C$ )	$I_B$	-	4.3	8.0	mA
Quiescent Current Change $7.0V_{dc} \leq V_{in} \leq 25V_{dc}$ $5.0mA \leq I_o \leq 1.0A$	$\Delta I_B$	- -	- -	1.3 0.5	mA
Ripple Rejection $8.0V_{dc} \leq V_{in} \leq 18V_{dc}$ , $f = 120 Hz$	$RR$	-	68	-	dB
Dropout Voltage ( $I_o = 1.0A$ , $T_J = +25^\circ C$ )	$V_{in} - V_o$	-	2.0	-	$V_{dc}$
Output Noise Voltage( $T_A = +25^\circ C$ ) $10 Hz \leq f \leq 100 kHz$	$V_n$	-	10	-	$\mu V/V_o$
Output Resistance $f = 1.0 kHz$	$r_o$	-	17	-	$m\Omega$
Short -Circuit Current Limit ( $T_A = +25^\circ C$ ) $V_{in} = 35 V_{dc}$	$I_{sc}$	-	0.2	-	A
Peak Output Current( $T_J = +25^\circ C$ )	$I_{max}$	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	$TCV_o$	-	-0.8	-	$mV/^\circ C$

## IL7806

### Electrical characteristics

( $V_{in} = 11V$ ,  $I_o = 500mA$ ,  $T_J = \text{Tlow to Thigh}$  (Note 1) unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage ( $T_J = +25^\circ C$ )	$V_o$	5.75	6.0	6.25	$V_{dc}$
Output Voltage ( $5.0 mA \leq I_o \leq 1.0A$ , $P_o \leq 15 W$ ) $8.0V_{dc} \leq V_{in} \leq 21V_{dc}$ $9.0V_{dc} \leq V_{in} \leq 21V_{dc}$	$V_o$	5.7 -	6.0 -	6.3 -	$V_{dc}$
Line Regulation( $T_J = +25^\circ C$ , Note2) $8.0V_{dc} \leq V_{in} \leq 25V_{dc}$ $9.0V_{dc} \leq V_{in} \leq 13V_{dc}$	$Reg_{line}$	- -	9.0 3.0	120 60	mV
Load Regulation( $T_J = +25^\circ C$ , Note2) $5.0mA \leq I_o \leq 1.5A$ $250mA \leq I_o \leq 750 mA$	$Reg_{load}$	- -	43 16	120 60	mV
Quiescent Current ( $T_J = +25^\circ C$ )	$I_B$	-	4.3	8.0	mA
Quiescent Current Change $8.0V_{dc} \leq V_{in} \leq 25V_{dc}$ $5.0mA \leq I_o \leq 1.0A$	$\Delta I_B$	- -	- -	1.3 0.5	mA
Ripple Rejection $9.0V_{dc} \leq V_{in} \leq 19V_{dc}$ , $f = 120 Hz$	$RR$	-	65	-	dB
Dropout Voltage ( $I_o = 1.0A$ , $T_J = +25^\circ C$ )	$V_{in} - V_o$	-	2.0	-	$V_{dc}$
Output Noise Voltage( $T_A = +25^\circ C$ ) $10 Hz \leq f \leq 100 kHz$	$V_n$	-	10	-	$\mu V/V_o$
Output Resistance $f = 1.0 kHz$	$r_o$	-	17	-	$m\Omega$
Short -Circuit Current Limit( $T_A = +25^\circ C$ ) $V_{in} = 35 V_{dc}$	$I_{sc}$	-	0.2	-	A
Peak Output Current( $T_J = +25^\circ C$ )	$I_{max}$	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	$TCV_o$	-	-0.8	-	$mV/^\circ C$

Note:

1. Tlow =  $0^\circ C$ , Thigh =  $+125^\circ C$

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



## IL78XXC SERIES

### IL7808

#### Electrical characteristics

( $V_{in} = 11V$ ,  $I_o = 500mA$ ,  $T_J = T_{low}$  to  $T_{high}$  (Note 1) unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage ( $T_J = +25^\circ C$ )	$V_o$	7.7	8.0	8.0	Vdc
Output Voltage ( $5.0 mA \leq I_o \leq 1.0A$ , $P_o \leq 15 W$ ) $10.5V_{dc} \leq V_{in} \leq 23V_{dc}$	$V_o$	7.6	8.0	8.4	Vdc
Line Regulation( $T_J = +25^\circ C$ , Note2) $10.5V_{dc} \leq V_{in} \leq 25V_{dc}$ $11V_{dc} \leq V_{in} \leq 17V_{dc}$	Reg <sub>line</sub>	- -	12 5.0	160 80	mV
Load Regulation( $T_J = +25^\circ C$ , Note2) $5.0mA \leq I_o \leq 1.5A$ $250mA \leq I_o \leq 750 mA$	Reg <sub>load</sub>	- -	45 16	160 80	mV
Quiescent Current ( $T_J = +25^\circ C$ )	$I_B$	-	4.3	8.0	mA
Quiescent Current Change $10.5V_{dc} \leq V_{in} \leq 25V_{dc}$ $5.0mA \leq I_o \leq 1.0A$	$\Delta I_B$	- -	- -	1.0 0.5	mA
Ripple Rejection $11.5V_{dc} \leq V_{in} \leq 21.5V_{dc}$ , $f = 120 Hz$	RR	-	62	-	dB
Dropout Voltage ( $I_o = 1.0A$ , $T = +25^\circ C$ )	$V_{in} - V_o$	-	2.0	-	Vdc
Output Noise Voltage( $T_A = +25^\circ C$ ) $10 Hz \leq f \leq 100 kHz$	$V_n$	-	10	-	$\mu V/V_o$
Output Resistance $f = 1.0 kHz$	$r_o$	-	18	-	$m\Omega$
Short -Circuit Current Limit( $T_A = +25^\circ C$ ) $V_{in} = 35 V_{dc}$	$I_{sc}$	-	0.2	-	A
Peak Output Current( $T_J = +25^\circ C$ )	$I_{max}$	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	$TCV_o$	-	-0.8	-	$mV/^\circ C$

### IL7809

#### Electrical characteristics

( $V_{in} = 15V$ ,  $I_o = 500mA$ ,  $T_J = 0^\circ C$  to  $+125^\circ C$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage ( $T_J = +25^\circ C$ )	$V_o$	8.65	9.0	9.35	V <sub>dc</sub>
Output Voltage ( $5.0 mA \leq I_o \leq 1.0A$ , $P_o \leq 15 W$ ) $11.5V_{dc} \leq V_{in} \leq 24V_{dc}$	$V_o$	8.55	9.0	9.45	V <sub>dc</sub>
Line Regulation( $T_J = +25^\circ C$ , Note2) $11.5V_{dc} \leq V_{in} \leq 26V_{dc}$ $11.5V_{dc} \leq V_{in} \leq 17V_{dc}$	Reg <sub>line</sub>	- -	12 5.0	180 90	mV
Load Regulation( $T_J = +25^\circ C$ , Note2) $5.0mA \leq I_o \leq 1.5A$ $250mA \leq I_o \leq 750 mA$	Reg <sub>load</sub>	- -	35 12	180 90	mV
Quiescent Current ( $T_J = +25^\circ C$ )	$I_B$	-	4.3	8.0	mA
Quiescent Current Change $11.5V_{dc} \leq V_{in} \leq 26V_{dc}$ $5.0mA \leq I_o \leq 1.0A$	$\Delta I_B$	- -	- -	1.0 0.5	mA
Ripple Rejection $11.5V_{dc} \leq V_{in} \leq 21.5V_{dc}$ , $f = 120 Hz$	RR	-	61	-	dB
Dropout Voltage ( $I_o = 1.0A$ , $T = +25^\circ C$ )	$V_{in} - V_o$	-	2.0	-	V <sub>dc</sub>
Output Noise Voltage( $T_A = +25^\circ C$ ) $10 Hz \leq f \leq 100 kHz$	$V_n$	-	10	-	$\mu V/V_o$
Output Resistance $f = 1.0 kHz$	$r_o$	-	18	-	$m\Omega$
Short -Circuit Current Limit ( $T_A = +25^\circ C$ ) $V_{in} = 35 V_{dc}$	$I_{sc}$	-	0.2	-	A
Peak Output Current( $T_J = +25^\circ C$ )	$I_{max}$	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	$TCV_o$	-	-1.0	-	$mV/^\circ C$

Note:

1.  $T_{low} = 0^\circ C$ ,  $T_{high} = +125^\circ C$

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



## IL78XXC SERIES

### IL7812

#### Electrical characteristics

( $V_{in} = 19V$ ,  $I_o = 500mA$ ,  $T_J = T_{low}$  to  $T_{high}$  (Note 1) unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage ( $T_J = +25^\circ C$ )	$V_o$	11.5	12	12.5	Vdc
Output Voltage ( $5.0mA \leq I_o \leq 1.0A$ , $P_o \leq 15W$ ) $14.5Vdc \leq V_{in} \leq 27Vdc$	$V_o$	11.4	12	12.6	Vdc
Line Regulation( $T_J = +25^\circ C$ , Note2) $14.5Vdc \leq V_{in} \leq 30Vdc$ $16Vdc \leq V_{in} \leq 22Vdc$	Regline	- -	13 6.0	240 120	mV
Load Regulation( $T_J = +25^\circ C$ , Note2) $5.0mA \leq I_o \leq 1.5A$ $250mA \leq I_o \leq 750mA$	Regload	- -	46 17	240 120	mV
Quiescent Current ( $T_J = +25^\circ C$ )	$I_B$	-	4.4	8.0	mA
Quiescent Current Change $14.5Vdc \leq V_{in} \leq 30Vdc$ $5.0mA \leq I_o \leq 1.0A$	$\Delta I_B$	- -	- -	1.0 0.5	mA
Ripple Rejection $15Vdc \leq V_{in} \leq 25Vdc$ , $f = 120Hz$	RR	-	60	-	dB
Dropout Voltage ( $I_o = 1.0A$ , $T_J = +25^\circ C$ )	$V_{in} - V_o$	-	2.0	-	Vdc
Output Noise Voltage( $T_A = +25^\circ C$ ) $10Hz \leq f \leq 100kHz$	$V_n$	-	10	-	$\mu V/V_o$
Output Resistance $f = 1.0kHz$	$r_o$	-	18	-	$m\Omega$
Short - Circuit Current Limit ( $T_A = +25^\circ C$ ) $V_{in} = 35Vdc$	$I_{sc}$	-	0.2	-	A
Peak Output Current( $T_J = +25^\circ C$ )	$I_{max}$	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	$TCV_o$	-	-1.0	-	$mV/^\circ C$

### IL7815

#### Electrical characteristics

( $V_{in} = 11V$ ,  $I_o = 500mA$ ,  $T_J = T_{low}$  to  $T_{high}$  (Note 1) unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage ( $T_J = +25^\circ C$ )	$V_o$	14.4	15	15.6	Vdc
Output Voltage ( $5.0mA \leq I_o \leq 1.0A$ , $P_o \leq 15W$ ) $17.5Vdc \leq V_{in} \leq 30Vdc$	$V_o$	14.25	15	15.75	Vdc
Line Regulation( $T_J = +25^\circ C$ , Note2) $17.5Vdc \leq V_{in} \leq 30Vdc$ $20Vdc \leq V_{in} \leq 26Vdc$	Regline	- -	13 6.0	300 150	mV
Load Regulation( $T_J = +25^\circ C$ , Note2) $5.0mA \leq I_o \leq 1.5A$ $250mA \leq I_o \leq 750mA$	Regload	- -	52 20	300 150	mV
Quiescent Current ( $T_J = +25^\circ C$ )	$I_B$	-	4.4	8.0	mA
Quiescent Current Change $17.5Vdc \leq V_{in} \leq 30Vdc$ $5.0mA \leq I_o \leq 1.0A$	$\Delta I_B$	- -	- -	1.0 0.5	mA
Ripple Rejection $18.5Vdc \leq V_{in} \leq 28.5Vdc$ , $f = 120Hz$	RR	-	58	-	dB
Dropout Voltage ( $I_o = 1.0A$ , $T_J = +25^\circ C$ )	$V_{in} - V_o$	-	2.0	-	Vdc
Output Noise Voltage( $T_A = +25^\circ C$ ) $10Hz \leq f \leq 100kHz$	$V_n$	-	10	-	$\mu V/V_o$
Output Resistance $f = 1.0kHz$	$r_o$	-	19	-	$m\Omega$
Short - Circuit Current Limit ( $T_A = +25^\circ C$ ) $V_{in} = 35Vdc$	$I_{sc}$	-	0.2	-	A
Peak Output Current( $T_J = +25^\circ C$ )	$I_{max}$	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	$TCV_o$	-	-1.0	-	$mV/^\circ C$

Note:

1.  $T_{low} = 0^\circ C$ ,  $T_{high} = +125^\circ C$
2. Load and line regulation are specified at constant junction temperature. Changes in  $V_o$  due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

## IL78XXC SERIES

### IL7818

#### Electrical characteristics

(Vin = 27V, Io = 500mA, TJ = Tlow to Thigh (Note 1) unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (TJ=+25°C)	Vo	17.3	18	18.7	Vdc
Output Voltage (5.0 mA ≤ Io ≤ 1.0A, Po ≤ 15 W) 21Vdc ≤ Vin ≤ 33Vdc	Vo	17.1	18	18.9	Vdc
Line Regulation (TJ=+25°C, Note2) 21Vdc ≤ Vin ≤ 33Vdc 24Vdc ≤ Vin ≤ 30Vdc	Regline	- -	25 10	360 180	mV
Load Regulation (TJ=+25°C, Note2) 5.0mA ≤ Io ≤ 1.5A 250mA ≤ Io ≤ 750 mA	Regload	- -	55 22	360 180	mV
Quiescent Current (TJ=+25°C)	IB	-	4.5	8.0	mA
Quiescent Current Change 21Vdc ≤ Vin ≤ 33Vdc 5.0mA ≤ Io ≤ 1.0A	Δ IB	- -	- -	1.0 0.5	mA
Ripple Rejection 22Vdc ≤ Vin ≤ 33Vdc, f = 120 Hz	RR	-	57	-	dB
Dropout Voltage (Io=1.0A, TJ=+25°C)	Vin-Vo	-	2.0	-	Vdc
Output Noise Voltage (TA=+25°C) 10 Hz ≤ f ≤ 100 kHz	Vn	-	10	-	μV/Vo
Output Resistance f = 1.0 kHz	ro	-	19	-	mΩ
Short - Circuit Current Limit (TA=+25°C) Vin = 35 Vdc	Isc	-	0.2	-	A
Peak Output Current (TJ=+25°C)	I <sub>max</sub>	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	TCVo	-	-1.0	-	mV/°C

### IL7824

#### Electrical characteristics

(Vin = 33V, Io = 500mA, TJ = Tlow to Thigh (Note 1) unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (TJ=+25°C)	Vo	23	24	25	Vdc
Output Voltage (5.0 mA ≤ Io ≤ 1.0A, Po ≤ 15 W) 27Vdc ≤ Vin ≤ 38Vdc	Vo	22.8	24	25.2	Vdc
Line Regulation (TJ=+25°C, Note2) 27Vdc ≤ Vin ≤ 38Vdc 30Vdc ≤ Vin ≤ 38Vdc	Regline	- -	31 14	480 240	mV
Load Regulation (TJ=+25°C, Note2) 5.0mA ≤ Io ≤ 1.5A 250mA ≤ Io ≤ 750 mA	Regload	- -	60 25	480 240	mV
Quiescent Current (TJ=+25°C)	IB	-	4.6	8.0	mA
Quiescent Current Change 27Vdc ≤ Vin ≤ 38Vdc 5.0mA ≤ Io ≤ 1.0A	Δ IB	- -	- -	1.0 0.5	mA
Ripple Rejection 28Vdc ≤ Vin ≤ 38Vdc, f = 120 Hz	RR	-	54	-	dB
Dropout Voltage (Io=1.0A, TJ=+25°C)	Vin-Vo	-	2.0	-	Vdc
Output Noise Voltage (TA=+25°C) 10 Hz ≤ f ≤ 13100 kHz	Vn	-	10	-	μV/Vo
Output Resistance f = 1.0 kHz	ro	-	20	-	mΩ
Short - Circuit Current Limit (TA=+25°C) Vin = 35 Vdc	Isc	-	0.2	-	A
Peak Output Current (TJ=+25°C)	I <sub>max</sub>	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	TCVo	-	-1.5	-	mV/°C

Note: 1. Tlow = 0 °C, Thigh = +125 °C

2. 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 cycle is used.

