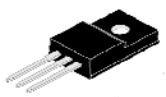
3-Terminal Positive Voltage Regulator

LM78XXF



TO-220FP

TO-220FP
Fully Isolated
Plastic Package
RoHS compliant

GENERAL DESCRIPTIONS:

The LM78XXF series are three-terminal positive voltage regulators with fixed output voltage, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shutdown and safe operating area protection, making it essentially indestructible. With adequate heat-sinking they can deliver output currents in excess of 1.0 A.

FEATURES:

1. Output current up to 1A
2. Few external components and high flexibility
3. Internal thermal and overload protection
4. Output transistor safe-area compensation
5. Internal short circuit current limiting
6. Package: TO-220FP

ABSOLUTE MAXIMUM RATINGS (Ta = 25 ℃ Unless otherwise specified)

PARAMETER	SYMBOL	VALUE	UNIT
Input Voltage	V_{IN}	7.5 to 35	V
Power Dissipation	P_D	Internal Limit	W
Thermal Resistance Junction-air	$R_{\theta JA}$	65	°C/W
Thermal Resistance Junction-cases	$R_{\theta JC}$	5.0	°C/W
Operation Temperature	T_{OPR}	-30 to +125	°C
Storage Temperature	T_{stg}	-+65 to +150	°C
Maximum Junction Temperature	$T_{J(MAX)}$	150	°C

Output Voltage of the LM78XXF series:

LM7805F	5V	LM7810F	10V
LM7806F	6V	LM7812F	12V
LM7808F	8V	LM7815F	15V
LM7809F	9V	LM7818F	18V

ELECTRICAL CHARACTERISTICS at (Ta = 25 ℃ Unless otherwise specified)

LM7805F (V_{IN}=10V, I_O=100mA, -30°C≤T_J≤125°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	4.8	5.0	5.2	V
		5mA≤I_O≤750mA 8V≤V_{IN}≤20V P_D≤10W	4.75	5.0	5.25	
Line Regulation (Note)	R_{EGV}	7.5V≤V_{IN}≤25V	--	0.5	20	mV
		8V≤V_{IN}≤12V	--	0.8	10	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A	--	1.3	25	mV
		250mA≤I_O≤750mA	--	0.9	13	
Quiescent Current	I_Q	T_J=25°C	--	3.2	8.0	mA
Quiescent Current Change	ΔI_Q	8V≤V_{IN}≤25V	--	--	1.3	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 8V≤V_{IN}≤18V	--	68	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Output Resistance	R_o	f=1kHz	--	15	--	mΩ
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-0.3	--	mV/°C

ELECTRICAL CHARACTERISTICS at (Ta = 25 ℃ Unless otherwise specified)

LM7806F (V_{IN}=11V, I_O=100mA, -30°C≤T_J≤125°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	5.75	6.0	6.25	V
		5mA≤I_O≤750mA 9V≤V_{IN}≤21V P_D≤10W	5.7	6.0	6.3	
Line Regulation (Note)	R_{EGV}	8.0V≤V_{IN}≤25V	--	0.5	24	mV
		9V≤V_{IN}≤13V	--	0.8	12	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A	--	1.3	30	mV
		250mA≤I_O≤750mA	--	1.0	15	
Quiescent Current	I_Q	T_J=25°C	--	3.3	8.0	mA
Quiescent Current Change	ΔI_Q	9.0V≤V_{IN}≤25V	--	--	1.3	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 9V≤V_{IN}≤19V	--	65	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Output Resistance	R_o	f=1kHz	--	15	--	mΩ
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-0.3	--	mV/°C

ELECTRICAL CHARACTERISTICS at (Ta = 25 ℃ Unless otherwise specified)

LM7808F (V_{IN}=13V, I_O=100mA, -30°C≤T_J≤125°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	7.7	8.0	8.3	V
		5mA≤I_O≤750mA 10.5V≤V_{IN}≤23V P_D≤10W	7.6	8.0	8.4	
Line Regulation (Note)	R_{EGV}	10.5V≤V_{IN}≤25V	--	2.5	32	mV
		10.5V≤V_{IN}≤17V	--	1.7	16	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A	--	6.0	38	mV
		250mA≤I_O≤750mA	--	3.0	19	
Quiescent Current	I_Q	T_J=25°C	--	3.3	8.0	mA
Quiescent Current Change	ΔI_Q	11.5V≤V_{IN}≤25V	--	--	1.0	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 11.5V≤V_{IN}≤18.0V	--	62	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Output Resistance	R_o	f=1kHz	--	15	--	mΩ
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-0.4	--	mV/°C

ELECTRICAL CHARACTERISTICS at (Ta = 25 ℃ Unless otherwise specified)

LM7809F (V_{IN}=14V, I_O=100mA, -30°C≤T_J≤125°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	8.65	9.0	9.35	V
		5mA≤I_O≤750mA 11.5V≤V_{IN}≤24V P_D≤10W	8.55	9.0	9.45	
Line Regulation (Note)	R_{EGV}	11.5V≤V_{IN}≤26V	--	3.0	36	mV
		11.5V≤V_{IN}≤17V	--	1.8	18	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤5A	--	7.0	40	mV
		250mA≤I_O≤750mA	--	3.2	20	
Quiescent Current	I_Q	T_J=25°C	--	3.4	8.0	mA
Quiescent Current Change	ΔI_Q	11.5V≤V_{IN}≤26V	--	--	1.0	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 12V≤V_{IN}≤22V	--	61	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Output Resistance	R_o	f=1kHz	--	15	--	mΩ
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-0.5	--	mV/°C

ELECTRICAL CHARACTERISTICS at (Ta = 25 ℃ Unless otherwise specified)

LM7810F (V_{IN}=15V, I_O=100mA, -30°C≤T_J≤125°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	9.6	10.0	10.4	V
		5mA≤I_O≤750mA 12.5V≤V_{IN}≤25V P_D≤10W	9.5	10.0	10.5	
Line Regulation (Note)	R_{EGV}	12.5V≤V_{IN}≤27V	--	3.3	40	mV
		12.5V≤V_{IN}≤18V	--	2.0	20	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A	--	7.0	50	mV
		250mA≤I_O≤750mA	--	3.5	25	
Quiescent Current	I_Q	T_J=25°C	--	3.4	8.0	mA
Quiescent Current Change	ΔI_Q	12.5V≤V_{IN}≤27V	--	--	1.0	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 13V≤V_{IN}≤23V	--	60	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Output Resistance	R_o	f=1kHz	--	15	--	mΩ
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-0.6	--	mV/°C

ELECTRICAL CHARACTERISTICS at (Ta = 25 °C Unless otherwise specified)

LM7812F (V_{IN}=17V, I_O=100mA, -30°C≤T_J≤125°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	11.5	12.0	12.5	V
		5mA≤I_O≤750mA 14.5V≤V_{IN}≤27V P_D≤10W	11.4	12.0	12.6	
Line Regulation (Note)	R_{EGV}	14.5V≤V_{IN}≤30V	--	3.8	48	mV
		16V≤V_{IN}≤22V	--	2.2	24	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A	--	9.0	60	mV
		250mA≤I_O≤750mA	--	3.5	30	
Quiescent Current	I_Q	T_J=25°C	--	3.4	8.0	mA
Quiescent Current Change	ΔI_Q	15.0V≤V_{IN}≤30V	--	--	1.0	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 15V≤V_{IN}≤25V	--	60	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Output Resistance	R_o	f=1kHz	--	15	--	mΩ
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-0.8	--	mV/°C

ELECTRICAL CHARACTERISTICS at (Ta = 25 °C Unless otherwise specified)

LM7815F (V_{IN}=20V, I_O=100mA, -30°C≤T_J≤125°C)

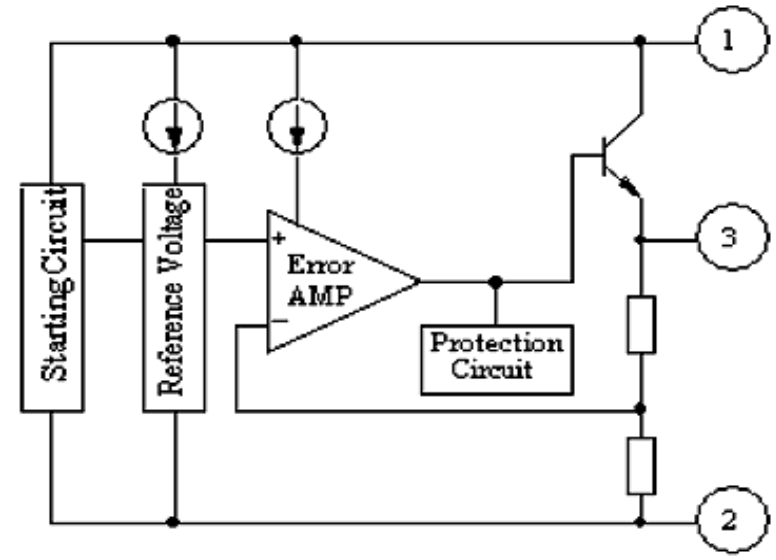
PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	14.4	15.0	15.6	V
		5mA≤I_O≤750mA 17.5V≤V_{IN}≤30V P_D≤10W	14.25	15.0	15.75	
Line Regulation (Note)	R_{EGV}	17.9V≤V_{IN}≤30V	--	5.0	60	mV
		20V≤V_{IN}≤26V	--	3.0	30	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A	--	10.0	75	mV
		250mA≤I_O≤750mA	--	3.5	38	
Quiescent Current	I_{CCQ}	T_J=25°C	--	3.5	8.0	mA
Quiescent Current Change	ΔI_{CCQ}	18.5V≤V_{IN}≤30V	--	--	1.0	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 18.5V≤V_{IN}≤28.5V	--	58	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	--	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-0.8	--	mV/°C

ELECTRICAL CHARACTERISTICS at (Ta = 25 °C Unless otherwise specified)

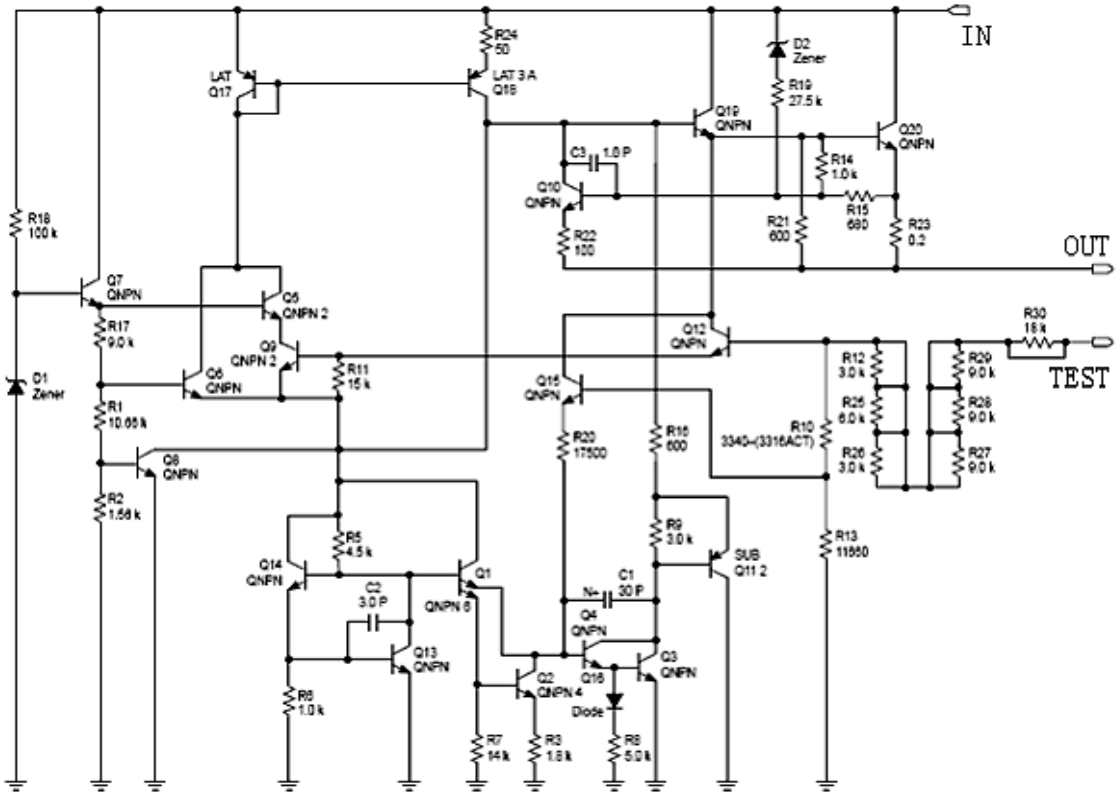
LM7818F (V_{IN}=23V, I_O=100mA, -30°C≤T_J≤125°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	17.28	18.0	18.72	V
		5mA≤I_O≤750mA 21V≤V_{IN}≤33V P_D≤10W	17.1	18.0	18.9	
Line Regulation (Note)	R_{EGV}	21V≤V_{IN}≤33V	--	6.0	72	mV
		23V≤V_{IN}≤29V	--	3.6	36	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A	--	12	90	mV
		250mA≤I_O≤750mA	--	3.5	46	
Quiescent Current	I_{CCQ}	T_J=25°C	--	3.6	8.0	mA
Quiescent Current Change	ΔI_{CCQ}	21.5V≤V_{IN}≤33V	--	--	1.0	mA
		5mA≤I_O≤750mA	--	--	0.5	
Ripple Rejection	R.R	f=120Hz 22V≤V_{IN}≤32V	--	56	--	dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25°C	--	2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz	--	10	--	μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25°C	--	0.2	--	A
Output Resistance	R_o	f=1kHz	--	15	--	mΩ
Average Temperature Coefficient of Output Voltage	ΔV/T	I_O=5mA T_J=0~125°C	--	-1.0	--	mV/°C

Functional Block Diagram of LM78XXF

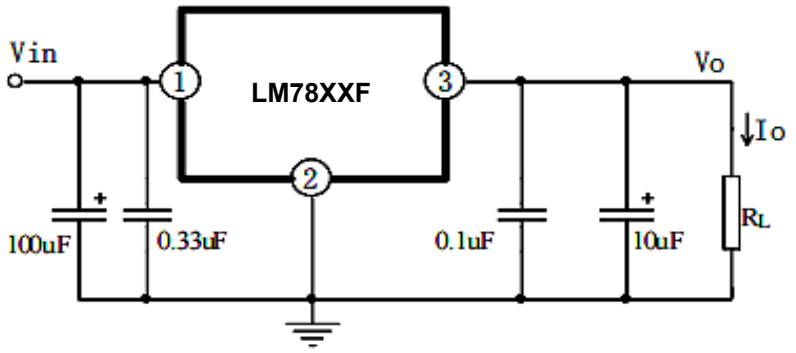


Equivalent Circuit

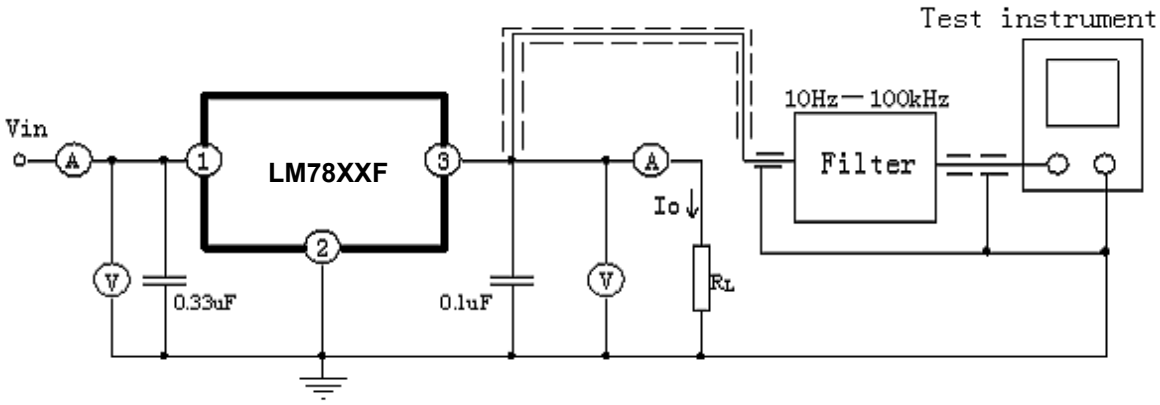


Test Circuit and Diagrams

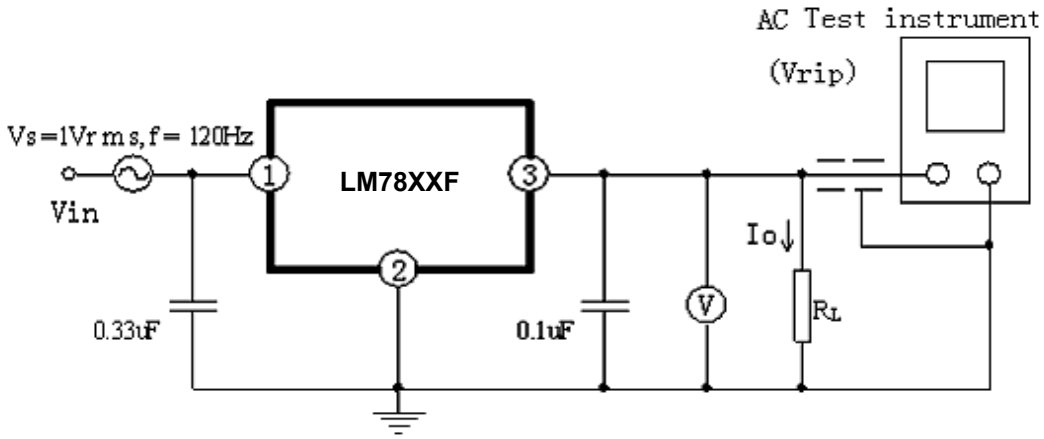
Standard Test Circuit



V_{NO} Test Circuit



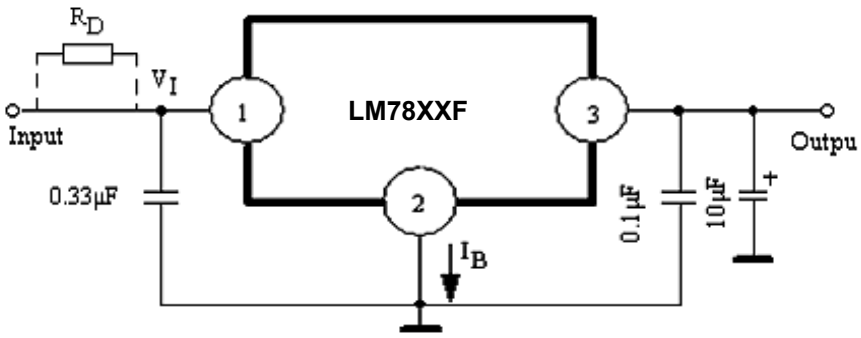
Ripple Rejection Test Circuit



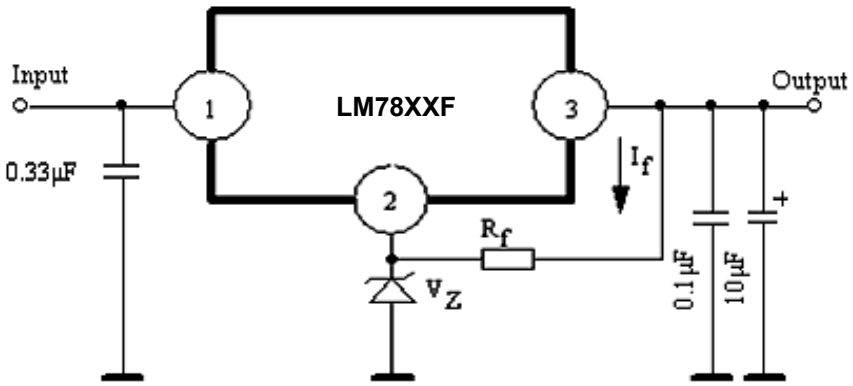
R.R=20log（1000/Vrip）

Test Circuit and Diagrams

Typical Application

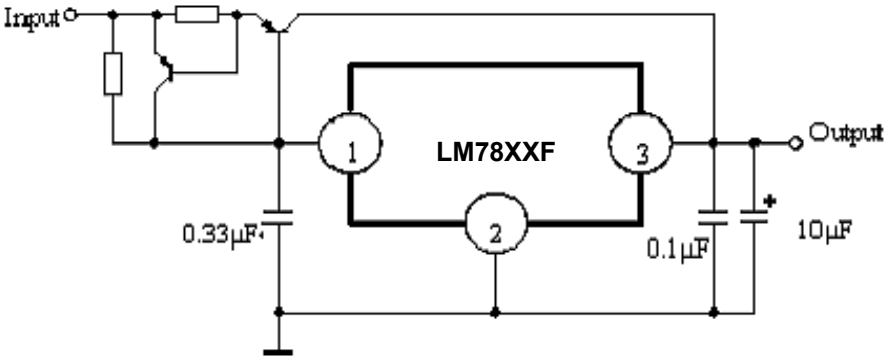


Voltage Boost Regulator



$V_O=V_O(IC)+V_Z$, $I_f=V_O(IC)/R_f$, $I_f \geq 5mA$

Current Boost Regulator With Over Current Protection



TYPICAL CHARACTERISTICS CURVES

Fig 1: Junction Temperature vs Output Voltage

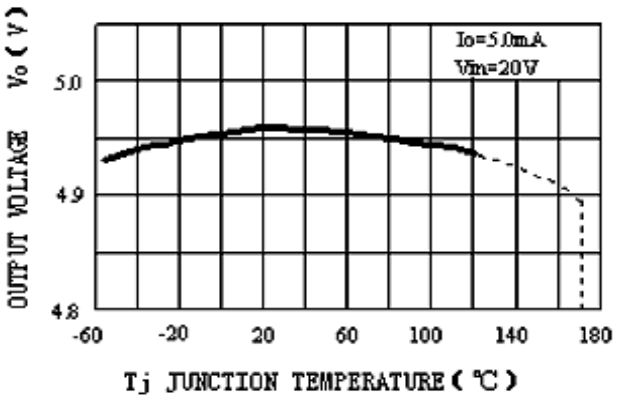


Fig 2: Frequency vs Ripple Rejection

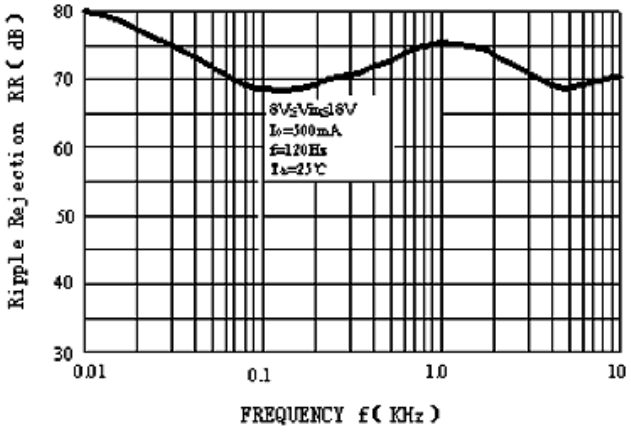


Fig 3: Junction Temperature vs Quiescent Current

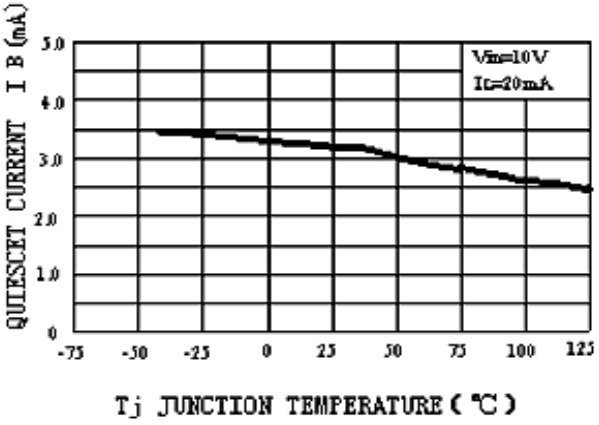
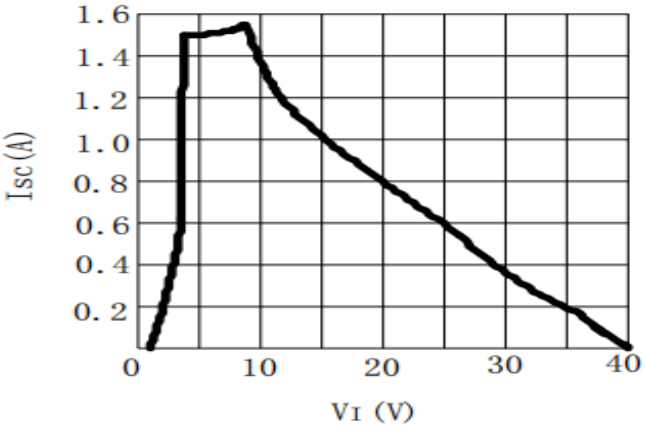
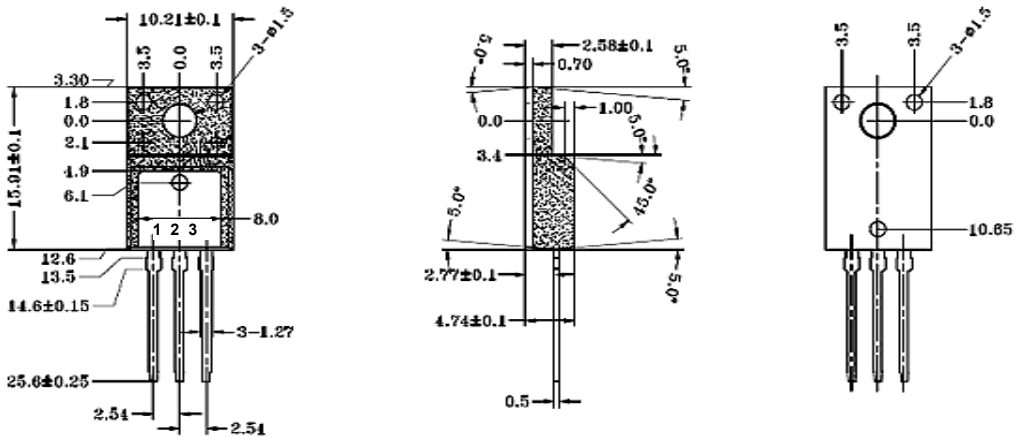


Fig 4: Short Circuit Current Limit vs Dropout Voltage



PACKAGE DETAILS

SOT-220F Fully Isolated Package



All dimensions are in mm

Pin configuration

Pin	Symbol	Function	Pin	Symbol	Function
1	V_{IN}	Input Voltage	3	V_{OUT}	Output Voltage
2	GND	Ground			

Recommended Product Storage Environment for Discrete Semiconductor Devices

This storage environment assumes that the Diodes and transistors are packed properly inside the original packing supplied by CDIL.

- Temperature 5 °C to 30 °C
- Humidity between 40 to 70 %RH
- Air should be clean.
- Avoid harmful gas or dust.
- Avoid outdoor exposure or storage in areas subject to rain or water spraying .
- Avoid storage in areas subject to corrosive gas or dust. Product shall not be stored in areas exposed to direct sunlight.
- Avoid rapid change of temperature.
- Avoid condensation.
- Mechanical stress such as vibration and impact shall be avoided.
- The product shall not be placed directly on the floor.
- The product shall be stored on a plane area. They should not be turned upside down. They should not be placed against the wall.

Shelf Life of CDIL Products

The shelf life of products is the period from product manufacture to shipment to customers. The product can be unconditionally shipped within this period. The period is defined as 2 years.
If products are stored longer than the shelf life of 2 years the products shall be subjected to quality check as per CDIL quality procedure.
The products are further warranted for another one year after the date of shipment subject to the above conditions in CDIL original packing.

Floor Life of CDIL Products and MSL Level

When the products are opened from the original packing, the floor life will start.
For this, the following JEDEC table may be referred:

JEDEC MSL Level		
Level	**Time**	**Condition**
1	Unlimited	≤30 °C / 85% RH
2	1 Year	≤30 °C / 60% RH
2a	4 Weeks	≤30 °C / 60% RH
3	168 Hours	≤30 °C / 60% RH
4	72 Hours	≤30 °C / 60% RH
5	48 Hours	≤30 °C / 60% RH
5a	24 Hours	≤30 °C / 60% RH
6	Time on Label(TOL)	≤30 °C / 60% RH

Customer Notes

Component Disposal Instructions

1. CDIL Semiconductor Devices are RoHS compliant, customers are requested to please dispose as per prevailing Environmental Legislation of their Country.
2. In Europe, please dispose as per EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).

Disclaimer

The product information and the selection guides facilitate selection of the CDIL's Semiconductor Device(s) best suited for application in your product(s) as per your requirement. It is recommended that you completely review our Data Sheet(s) so as to confirm that the Device(s) meet functionality parameters for your application. The information furnished in the Data Sheet and on the CDIL Web Site/CD are believed to be accurate and reliable. CDIL however, does not assume responsibility for inaccuracies or incomplete information. Furthermore, CDIL does not assume liability whatsoever, arising out of the application or use of any CDIL product; neither does it convey any license under its patent rights nor rights of others. These products are not designed for use in life saving/support appliances or systems. CDIL customers selling these products (either as individual Semiconductor Devices or incorporated in their end products), in any life saving/support appliances or systems or applications do so at their own risk and CDIL will not be responsible for any damages resulting from such sale(s).

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