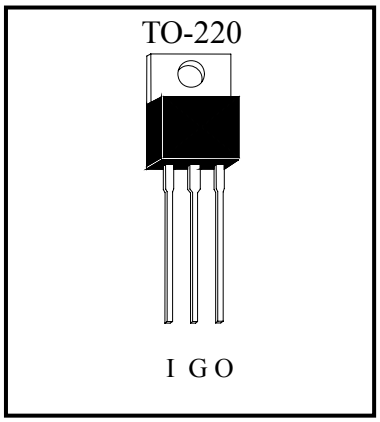
Three Terminal Positive Voltage Regulators

LM78XXE3



Description

The LM78XXE3 series of fixed voltage monolithic integrated circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single point regulation. Each of these regulators can deliver up to 1.5A of output current. The internal current limiting and thermal shutdown features of these regulators make them essentially immune to overload.

Features:

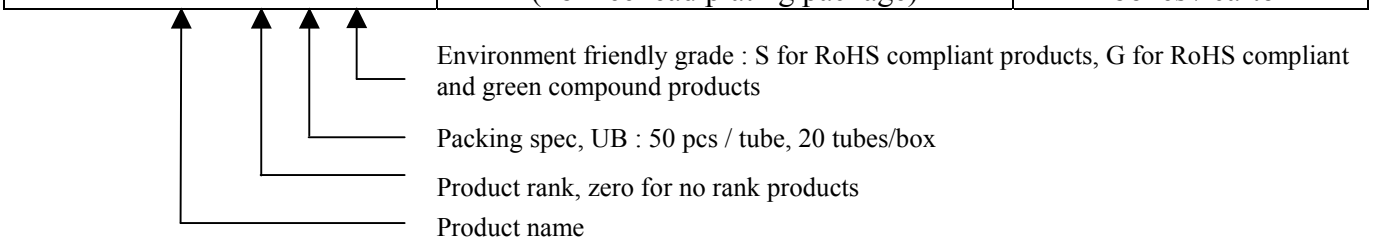
- 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 24V output voltage available
- Internal Short-Circuit Current Limiting
- High Power Dissipation Capability
- Internal Thermal Overload Protection
- No External Components Required
- Output Transistor Safe Area Compensation
- RoHS compliant package

Absolute Maximum Ratings (Ta=25°C)

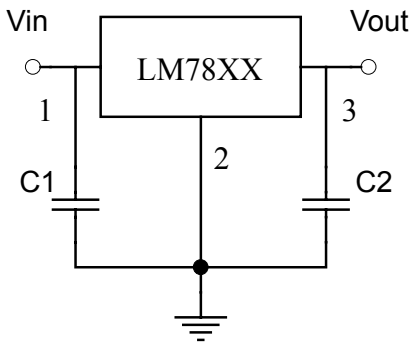
Parameter		Ratings	Unit
Input Voltage	LM7805~LM7818	35	V
	LM7824	40	
Output Current		1.5	A
Operating Junction Temperature Range		-40 ~ +125	℃
Storage Temperature Range		-55 ~ +150	℃
Thermal Resistance, Junction to Ambient ($R_{\theta JA}$)		65	℃/W
Thermal Resistance, Junction to Case ($R_{\theta JC}$)		5	℃/W

Ordering Information

Device	Package	Shipping
LM78XXE3-X-UB-S	TO-220 (Pb-free lead plating package)	50 pcs/tube, 20 tubes/box, 4 boxes / carton



Typical Application



Note:
C1 and C2 are required if regulator is located far from power supply filter and load, or oscillation may induced on the loop.

Electrical Characteristics

LM7805 (Tj=0~125°C, Vin=10V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	4.85	5.0	5.15	Vin=10V, Io=500mA,Tj=25°C 7.5V≤Vin≤20V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		4.75	-	5.25		
ΔVo		Line Regulation	-	3	50	7V≤Vin≤25V, Tj=25°C	mV
			-	1	25	8V≤Vin≤12V, Tj=25°C	
ΔVo		Load Regulation	-	-	100	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	50	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=10V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.3	7V≤Vin≤25V	
Vn		Output Noise Voltage	-	40	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	80	-	8V≤Vin≤18V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-0.6	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

LM7806 (Tj=0~125°C, Vin=11V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	5.82	6.0	6.18	Vin=11V, Io=500mA,Tj=25°C 8V≤Vin≤21V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		5.70	-	6.30		
ΔVo		Line Regulation	-	3	60	8V≤Vin≤25V, Tj=25°C	mV
			-	1	25	9V≤Vin≤13V, Tj=25°C	
ΔVo		Load Regulation	-	-	100	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	50	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=11V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.3	8V≤Vin≤25V	
Vn		Output Noise Voltage	-	45	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	75	-	9V≤Vin≤19V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-0.7	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

LM7808 (Tj=0~125°C, Vin=14V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	7.76	8.0	8.24	Vin=14V, Io=500mA,Tj=25°C 10.5V≤Vin≤23V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		7.60	-	8.40		
ΔVo		Line Regulation	-	3	80	10.5V≤Vin≤25V, Tj=25°C	mV
			-	1	40	11V≤Vin≤17V, Tj=25°C	
ΔVo		Load Regulation	-	-	100	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	50	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=14V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.3	10.5V≤Vin≤25V	
Vn		Output Noise Voltage	-	58	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	72	-	11.5V≤Vin≤21.5V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-0.9	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

LM7809 (Tj=0~125°C, Vin=15V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	8.73	9.0	9.27	Vin=15V, Io=500mA,Tj=25°C 11.5V≤Vin≤24V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		8.55	-	9.45		
ΔVo		Line Regulation	-	5	90	11.5V≤Vin≤25V, Tj=25°C	mV
			-	3	45	13V≤Vin≤19V, Tj=25°C	
ΔVo		Load Regulation	-	-	100	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	50	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=15V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.3	11.5V≤Vin≤26V	
Vn		Output Noise Voltage	-	58	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	72	-	12.5V≤Vin≤22.5V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-1.1	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

LM7810 (Tj=0~125°C, Vin=16V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	9.70	10.0	10.30	Vin=16V, Io=500mA,Tj=25°C 12.5V≤Vin≤25V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		9.50	-	10.50		
ΔVo		Line Regulation	-	-	100	13V≤Vin≤25V, Tj=25°C	mV
			-	-	50	14V≤Vin≤20V, Tj=25°C	
ΔVo		Load Regulation	-	-	100	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	50	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=16V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.0	12.5V≤Vin≤25V	
Vn		Output Noise Voltage	-	58	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	72	-	13V≤Vin≤23V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-1.1	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

LM7812 (Tj=0~125°C, Vin=19V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	11.64	12.0	12.36	Vin=19V, Io=500mA,Tj=25°C 14.5V≤Vin≤27V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		11.40	-	12.60		
ΔVo		Line Regulation	-	10	120	14.5V≤Vin≤30V, Tj=25°C	mV
			-	3	60	16V≤Vin≤22V, Tj=25°C	
ΔVo		Load Regulation	-	-	100	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	60	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=19V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.3	14.5V≤Vin≤30V	
Vn		Output Noise Voltage	-	75	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	72	-	15V≤Vin≤25V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-1.5	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

LM7815 (Tj=0~125°C, Vin=23V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	14.55	15.0	15.45	Vin=23V, Io=500mA,Tj=25°C 17.5V≤Vin≤30V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		14.25	-	15.75		
ΔVo		Line Regulation	-	-	150	17.5V≤Vin≤30V, Tj=25°C	mV
			-	-	75	18.5V≤Vin≤30V, Tj=25°C	
ΔVo		Load Regulation	-	-	150	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	75	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=23V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.3	17.5V≤Vin≤30V	
Vn		Output Noise Voltage	-	90	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	70	-	18.5V≤Vin≤28.5V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-1.8	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

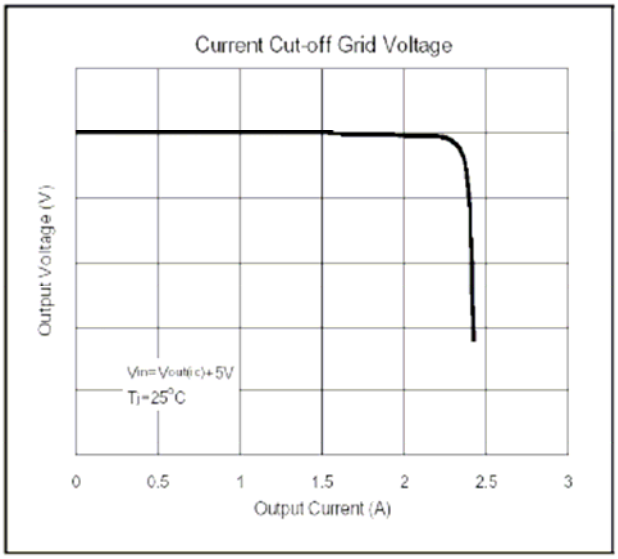
LM7818 (Tj=0~125°C, Vin=27V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

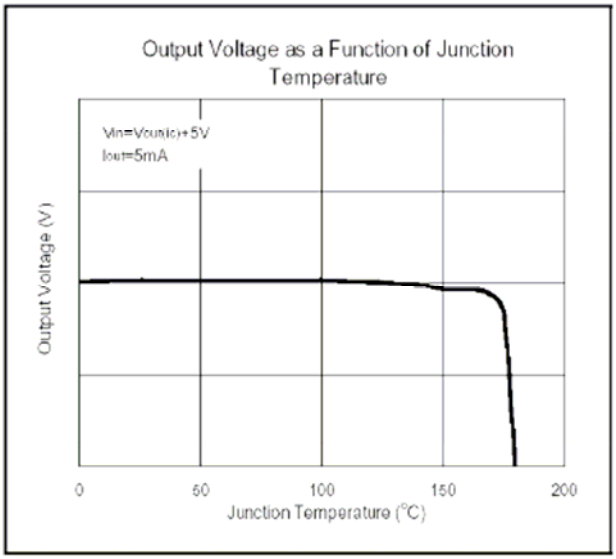
Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	17.46	18.0	18.54	Vin=27V, Io=500mA,Tj=25°C 21V≤Vin≤33V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		17.10	-	18.90		
ΔVo		Line Regulation	-	-	180	21V≤Vin≤33V, Tj=25°C	mV
			-	-	90	24V≤Vin≤30V, Tj=25°C	
ΔVo		Load Regulation	-	-	180	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	90	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=27V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.0	21V≤Vin≤33V	
Vn		Output Noise Voltage	-	110	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	69	-	22V≤Vin≤32V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-2.2	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

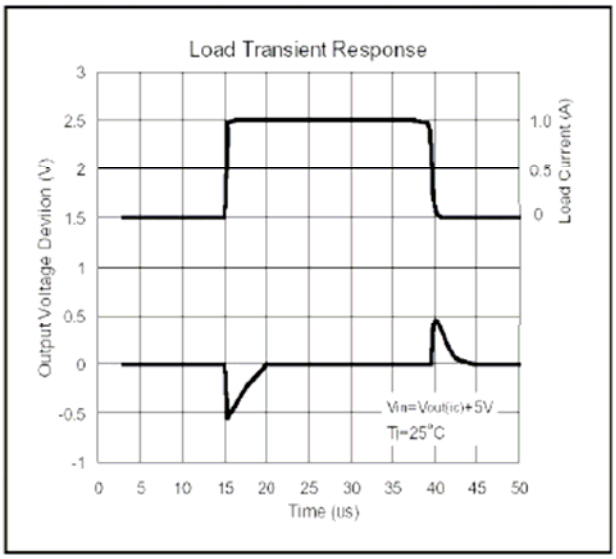
LM7824 (Tj=0~125°C, Vin=33V, Io=500mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

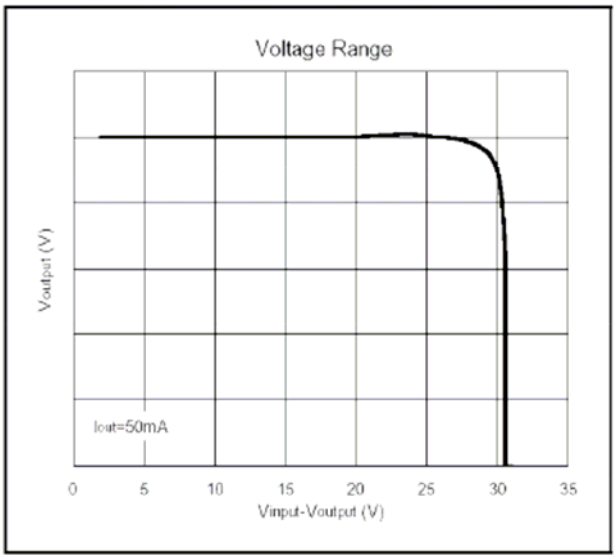
Symbol		Parameter	Min	Typ	Max	Conditions	Units
Vo	A-rank(3%)	Output Voltage	23.28	24.0	24.72	Vin=33V, Io=500mA,Tj=25°C 27V≤Vin≤38V, 5mA≤Io≤1A, PD≤15W	V
	B-rank(5%)		22.80	-	25.20		
ΔVo		Line Regulation	-	-	240	27V≤Vin≤38V, Tj=25°C	mV
			-	-	120	30V≤Vin≤36V, Tj=25°C	
ΔVo		Load Regulation	-	-	240	5mA≤Io≤1.5A, Tj=25°C	mV
			-	-	120	250mA≤Io≤750mA, Tj=25°C	
IQ		Quiescent Current	-	-	8	Vin=33V, Io=500mA, Tj=25°C	mA
ΔIQ		Quiescent Current Change	-	-	0.5	5mA≤Io≤1A	mA
			-	-	1.0	28V≤Vin≤38V	
Vn		Output Noise Voltage	-	170	-	10Hz≤f≤100KHz, Tj=25°C	μV
RR		Ripple Rejection	-	66	-	28V≤Vin≤38V, f=120Hz, Tj=25°C	dB
VD		Dropout Voltage	-	2	-	Io=1A, Tj=25°C	V
ISC		Output Short Circuit Current	-	250	-	Vin=35V, Tj=25°C	mA
IPK		Peak Output Current	-	1.8	-	Tj=25°C	A
ΔVo/ΔTj		Temperature Stability	-	-2.8	-	Io=5mA, 0°C ≤Tj≤125°C	mV/℃

Characteristic Curves





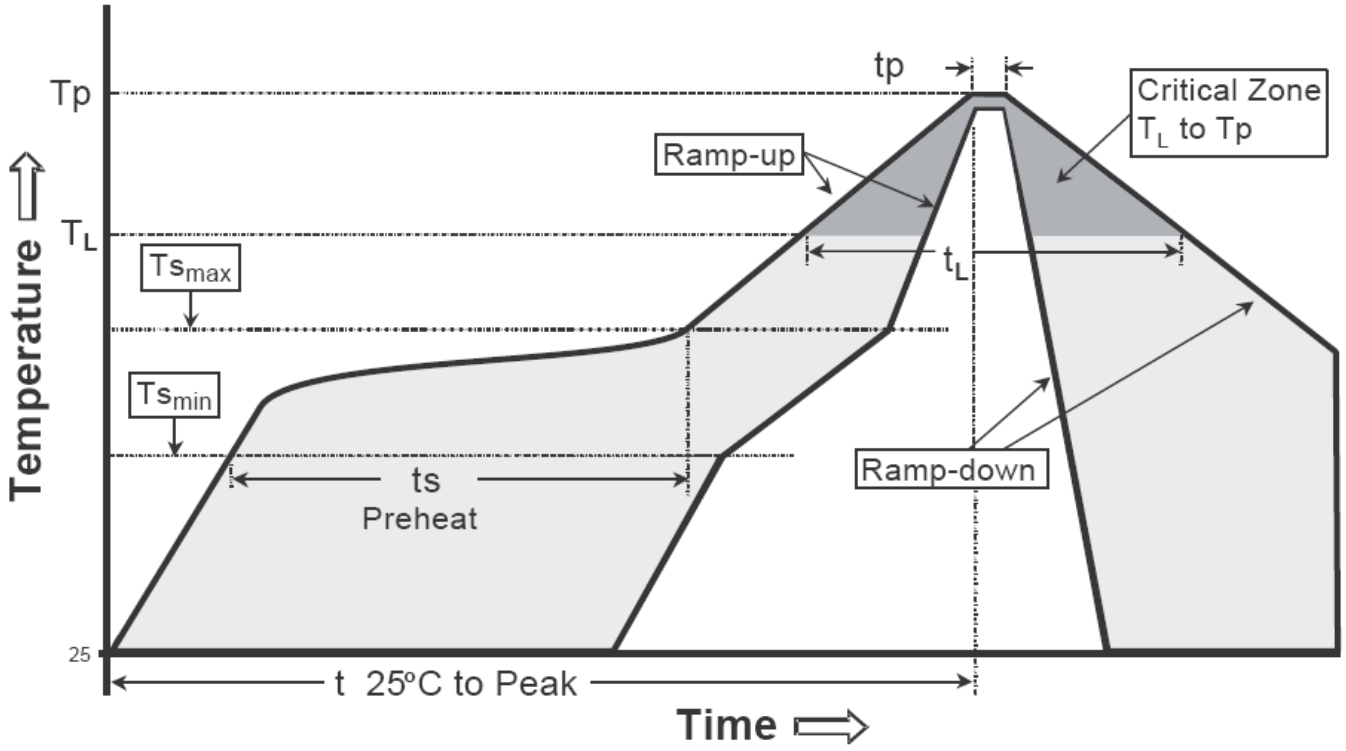




Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

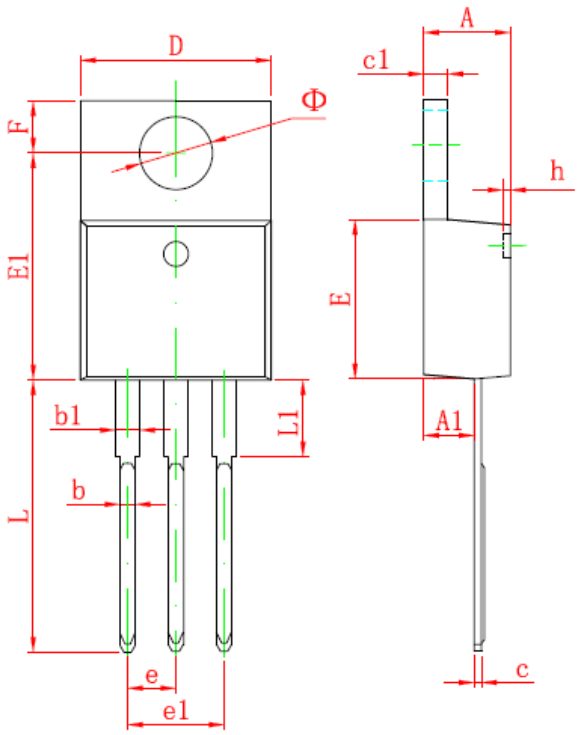
Recommended temperature profile for IR reflow



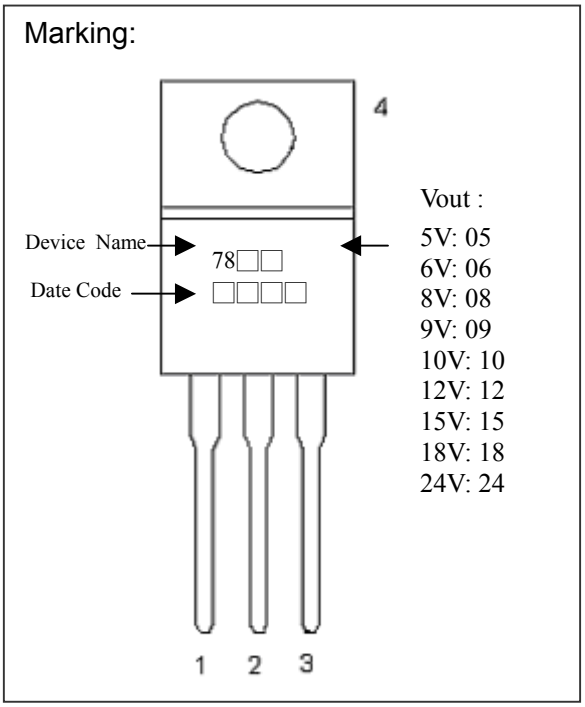
Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat −Temperature Min(T_S min) −Temperature Max(T_S max) −Time($t_{s\ min}$ to $t_{s\ max}$)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: −Temperature (T_L) − Time (t_L)	 183°C 60-150 seconds	 217°C 60-150 seconds
Peak Temperature(T_P)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

TO-220 Dimension



3-Lead TO-220 Plastic Package
CYStek Package Code: E3



Style: Pin 1.Vin 2.Ground 3.Vout
4.Ground

*: Typical

DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184	E1	12.060	12.460	0.475	0.491
A1	2.520	2.820	0.099	0.111	e	2.540*		0.100*	
b	0.710	0.910	0.028	0.036	e1	4.980	5.180	0.196	0.204
b1	1.170	1.370	0.046	0.054	F	2.590	2.890	0.102	0.114
c	0.310	0.530	0.012	0.021	h	0.000	0.300	0.000	0.012
c1	1.170	1.370	0.046	0.054	L	13.400	13.800	0.528	0.543
D	10.010	10.310	0.394	0.406	L1	3.560	3.960	0.140	0.156
E	8.500	8.900	0.335	0.350	Φ	3.735	3.935	0.147	0.155

Notes: 1.Controlling dimension: millimeters.
2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

Material:

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.