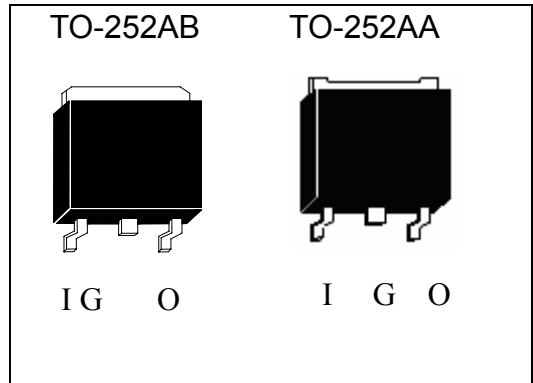


Three Terminal Medium Current Positive Voltage Regulators

LM78MXXJ3



Description

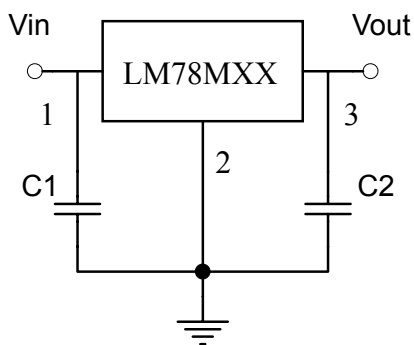
The LM78MXXJ3 series of three-terminal positive regulators are available in the TO-252 package and with 5V, 6V, 8V, 9V, 12V, 15V, 18V and 24V fixed output voltages, making them useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current-limiting, thermal shut-down and safe operating area protection, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 500mA output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

Absolute Maximum Ratings (Ta=25°C)

Parameter	Ratings	Unit
Input Voltage	35	V
Operating Temperature Range	-40 ~ +125	°C
Output Current	500	mA
Storage Temperature Range	-65 ~ +150	°C
Total Power Dissipation	1.0 (Note)	W

Note : Reduced by 8mW for each increase in Ta of 1°C over 25°C (without heat sink)

Typical Application

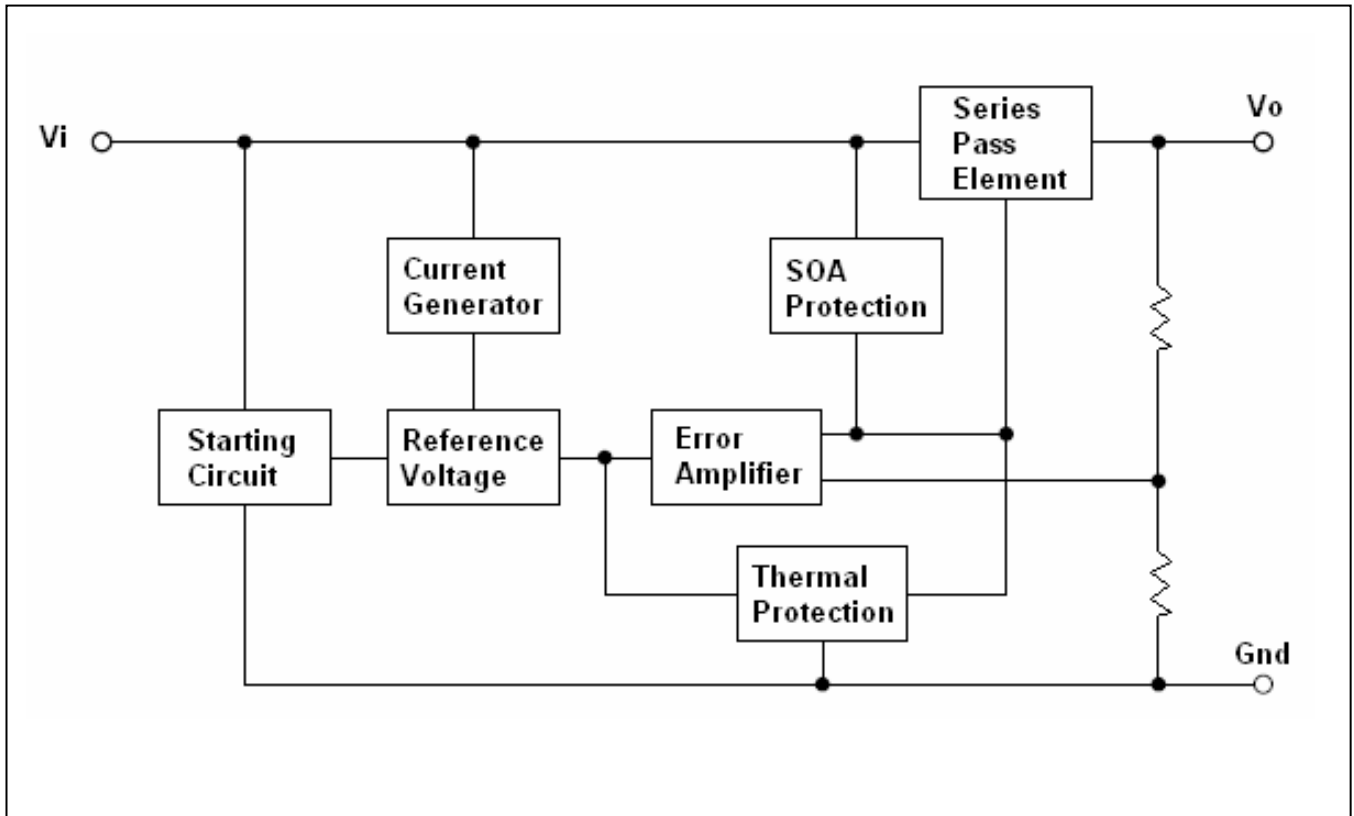


Note:
 C1 and C2 are required if regulator is located far from power supply filter and load, or oscillation may induced on the loop.

Ordering Information

Device	Output Voltage Tolerance	Package	Shipping	Marking
LM78M05J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M05
LM78M06J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M06
LM78M08J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M08
LM78M09J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M09
LM78M12J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M12
LM78M15J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M15
LM78M18J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M18
LM78M24J3	±4%	TO-252 (Pb-free)	2500 pcs / Tape & Reel	78M24

Block Diagram





Electrical Characteristics

LM78M05 (Ta=25°C, Vin=10V, Io=350mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M05			Units
			Min	Typ	Max	
Vo	Output Voltage		4.80	5.0	5.20	V
		5mA≤Io≤350mA 7.5V≤Vin≤20V	4.75	-	5.25	
ΔVo	Line Regulation	Io=200mA, 7V≤Vin≤25V	-	3	100	mV
		Io=200mA, 8V≤Vin≤12V	-	1	50	
ΔVo	Load Regulation	5mA≤Io≤500mA	-	30	100	mV
		5mA≤Io≤200mA	-	12	50	
IQ	Quiescent Current	Io=0mA	-	3	6	mA
ΔIQ	Quiescent Current Change	5mA≤Io≤350mA	-	-	0.5	mA
		8V≤Vin≤25V, Io=200mA	-	-	0.8	
Vn	Output Noise Voltage	10Hz≤f≤100KHz	-	40	-	μV
RR	Ripple Rejection	8V≤Vin≤18V, Io=100mA, f=120Hz, eIN=1Vrms	62	-	-	dB
VD	Dropout Voltage	Io=500mA	-	2	-	V
ISC	Output Short Circuit Current	Vin=25V		400		mA
IPK	Peak Output Current	Tj=25°C		700		mA
TCVo	Temperature Coefficient of Output Voltage	Io=5mA, 0≤Tj≤125°C		-1		mV/°C

LM78M06 (Ta=25°C, Vin=11V, Io=350mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M06			Units
			Min	Typ	Max	
Vo	Output Voltage		5.76	6.0	6.24	V
		5mA≤Io≤350mA 8.5V≤Vin≤21V	5.70	-	6.30	
ΔVo	Line Regulation	Io=200mA, 8V≤Vin≤25V	-	3	100	mV
		Io=200mA, 9V≤Vin≤25V	-	1	50	
ΔVo	Load Regulation	5mA≤Io≤500mA	-	30	120	mV
		5mA≤Io≤200mA	-	15	60	
IQ	Quiescent Current	Io=0mA	-	3	6	mA
ΔIQ	Quiescent Current Change	5mA≤Io≤350mA	-	-	0.5	mA
		9V≤Vin≤25V, Io=200mA	-	-	0.8	
Vn	Output Noise Voltage	10Hz≤f≤100KHz	-	60	-	μV
RR	Ripple Rejection	9V≤Vin≤19V, Io=100mA, f=120Hz, eIN=1Vrms	60	-	-	dB
VD	Dropout Voltage	Io=500mA	-	2	-	V
ISC	Output Short Circuit Current	Vin=25V		400		mA
IPK	Peak Output Current	Tj=25°C		700		mA
TCVo	Temperature Coefficient of Output Voltage	Io=5mA, 0≤Tj≤125°C		-0.5		mV/°C



LM78M08 ($T_a=25^{\circ}\text{C}$, $V_{in}=14\text{V}$, $I_o=350\text{mA}$, $C_{in}=0.33\mu\text{F}$, $C_{out}=0.1\mu\text{F}$, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M08			Units
			Min	Typ	Max	
Vo	Output Voltage		7.68	8.0	8.32	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $10.5\text{V} \leq V_{in} \leq 23\text{V}$	7.60	-	8.40	
ΔV_o	Line Regulation	$I_o=200\text{mA}$, $10.5\text{V} \leq V_{in} \leq 25\text{V}$	-	4	100	mV
		$I_o=200\text{mA}$, $11\text{V} \leq V_{in} \leq 25\text{V}$	-	1	50	
ΔV_o	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	160	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	80	
IQ	Quiescent Current	$I_o=0\text{mA}$	-	3	6	mA
ΔIQ	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$10.5\text{V} \leq V_{in} \leq 25\text{V}$, $I_o=200\text{mA}$	-	-	0.8	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	80	-	μV
RR	Ripple Rejection	$11.5\text{V} \leq V_{in} \leq 21.5\text{V}$, $I_o=100\text{mA}$, $f=120\text{Hz}$, $e_{IN}=1\text{Vrms}$	56	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=25\text{V}$		400		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$, $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.5		$\text{mV}/^{\circ}\text{C}$

LM78M09 ($T_a=25^{\circ}\text{C}$, $V_{in}=15\text{V}$, $I_o=350\text{mA}$, $C_{in}=0.33\mu\text{F}$, $C_{out}=0.1\mu\text{F}$, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M09			Units
			Min	Typ	Max	
Vo	Output Voltage		8.64	9.0	9.36	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $11.5\text{V} \leq V_{in} \leq 24\text{V}$	8.55	-	9.45	
ΔV_o	Line Regulation	$I_o=200\text{mA}$, $11.5\text{V} \leq V_{in} \leq 26\text{V}$	-	4	100	mV
		$I_o=200\text{mA}$, $12\text{V} \leq V_{in} \leq 25\text{V}$	-	2	50	
ΔV_o	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	180	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	90	
IQ	Quiescent Current	$I_o=0\text{mA}$	-	3.5	6	mA
ΔIQ	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$12\text{V} \leq V_{in} \leq 25\text{V}$, $I_o=200\text{mA}$	-	-	0.8	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	90	-	μV
RR	Ripple Rejection	$13\text{V} \leq V_{in} \leq 23\text{V}$, $I_o=100\text{mA}$, $f=120\text{Hz}$, $e_{IN}=1\text{Vrms}$	56	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$, $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.5		$\text{mV}/^{\circ}\text{C}$



LM78M12 ($T_a=25^{\circ}\text{C}$, $V_{in}=19\text{V}$, $I_o=350\text{mA}$, $C_{in}=0.33\mu\text{F}$, $C_{out}=0.1\mu\text{F}$, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M12			Units
			Min	Typ	Max	
Vo	Output Voltage		11.52	12.0	12.48	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $15\text{V} \leq V_{in} \leq 27\text{V}$	11.40	-	12.60	
ΔV_o	Line Regulation	$I_o=200\text{mA}$, $14.5\text{V} \leq V_{in} \leq 30\text{V}$	-	5	100	mV
		$I_o=200\text{mA}$, $16\text{V} \leq V_{in} \leq 30\text{V}$	-	3	50	
ΔV_o	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	240	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	120	
IQ	Quiescent Current	$I_o=0\text{mA}$	-	3.5	6	mA
ΔIQ	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$14.5\text{V} \leq V_{in} \leq 30\text{V}$, $I_o=200\text{mA}$	-	-	0.8	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	110	-	μV
RR	Ripple Rejection	$15\text{V} \leq V_{in} \leq 25\text{V}$, $I_o=100\text{mA}$, $f=120\text{Hz}$, $e_{IN}=1\text{V}_{rms}$	55	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$, $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.5		$\text{mV}/^{\circ}\text{C}$

LM78M15 ($T_a=25^{\circ}\text{C}$, $V_{in}=23\text{V}$, $I_o=350\text{mA}$, $C_{in}=0.33\mu\text{F}$, $C_{out}=0.1\mu\text{F}$, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M15			Units
			Min	Typ	Max	
Vo	Output Voltage		14.40	15.0	15.60	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $17.5\text{V} \leq V_{in} \leq 30\text{V}$	14.25	-	15.75	
ΔV_o	Line Regulation	$I_o=200\text{mA}$, $17.5\text{V} \leq V_{in} \leq 30\text{V}$	-	6	100	mV
		$I_o=200\text{mA}$, $20\text{V} \leq V_{in} \leq 30\text{V}$	-	3	50	
ΔV_o	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	300	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	150	
IQ	Quiescent Current	$I_o=0\text{mA}$	-	4.5	6	mA
ΔIQ	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$17.5\text{V} \leq V_{in} \leq 30\text{V}$, $I_o=200\text{mA}$	-	-	0.8	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	130	-	μV
RR	Ripple Rejection	$18.5\text{V} \leq V_{in} \leq 28.5\text{V}$, $I_o=100\text{mA}$, $f=120\text{Hz}$, $e_{IN}=1\text{V}_{rms}$	54	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$, $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.6		$\text{mV}/^{\circ}\text{C}$



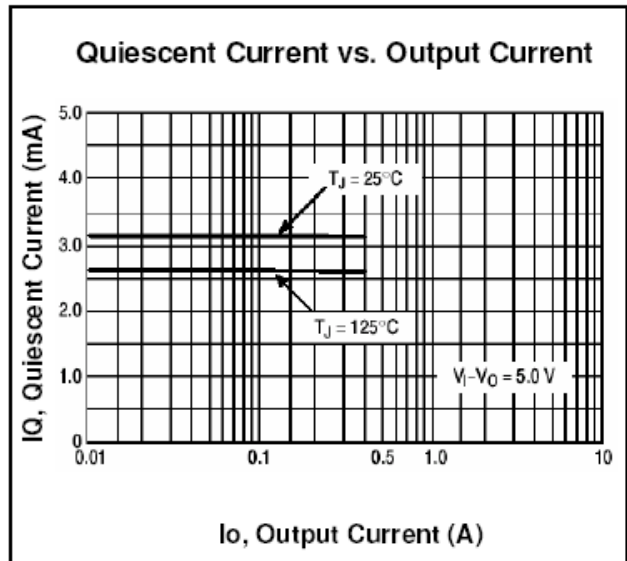
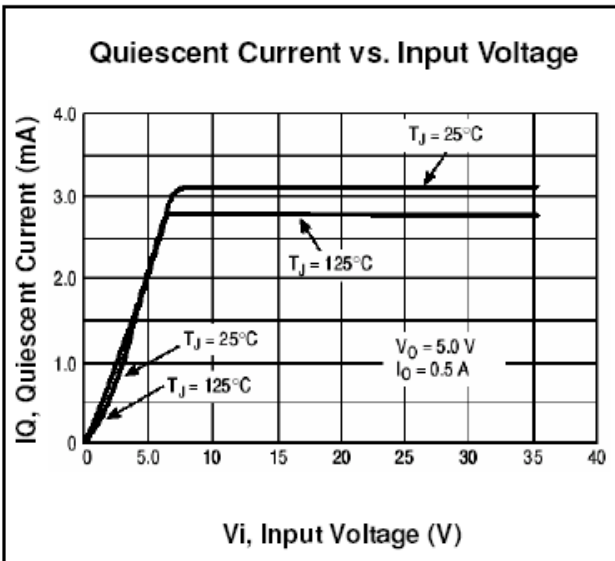
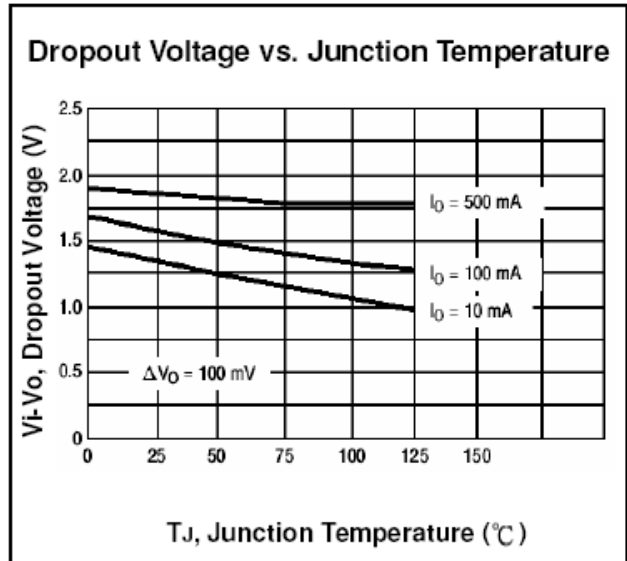
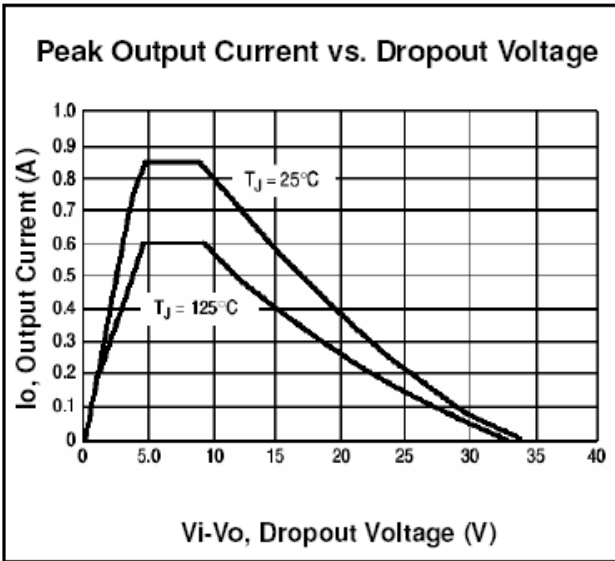
LM78M18 ($T_a=25^{\circ}\text{C}$, $V_{in}=27\text{V}$, $I_o=350\text{mA}$, $C_{in}=0.33\mu\text{F}$, $C_{out}=0.1\mu\text{F}$, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M18			Units
			Min	Typ	Max	
Vo	Output Voltage		17.28	18.0	18.72	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $21\text{V} \leq V_{in} \leq 33\text{V}$	17.10	-	18.90	
ΔV_o	Line Regulation	$I_o=200\text{mA}$, $21\text{V} \leq V_{in} \leq 33\text{V}$	-	7	100	mV
		$I_o=200\text{mA}$, $24\text{V} \leq V_{in} \leq 33\text{V}$	-	3	50	
ΔV_o	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	360	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	180	
IQ	Quiescent Current	$I_o=0\text{mA}$	-	4.5	6	mA
ΔIQ	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$21\text{V} \leq V_{in} \leq 33\text{V}$, $I_o=200\text{mA}$	-	-	0.8	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	140	-	μV
RR	Ripple Rejection	$22\text{V} \leq V_{in} \leq 32\text{V}$, $I_o=100\text{mA}$, $f=120\text{Hz}$, $e_{IN}=1\text{V}_{rms}$	53	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$, $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.6		$\text{mV}/^{\circ}\text{C}$

LM78M24 ($T_a=25^{\circ}\text{C}$, $V_{in}=33\text{V}$, $I_o=350\text{mA}$, $C_{in}=0.33\mu\text{F}$, $C_{out}=0.1\mu\text{F}$, unless otherwise noted)

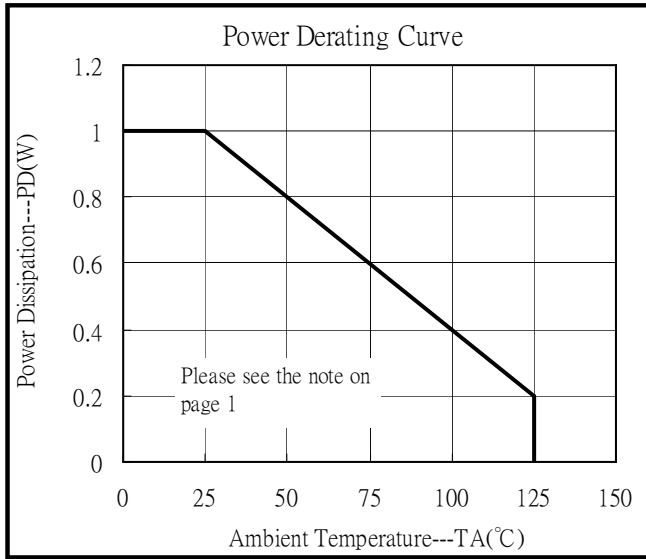
Symbol	Parameter	Conditions	LM78M24			Units
			Min	Typ	Max	
Vo	Output Voltage		23.04	24.0	24.96	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $27\text{V} \leq V_{in} \leq 33\text{V}$	22.80	-	25.20	
ΔV_o	Line Regulation	$I_o=200\text{mA}$, $27\text{V} \leq V_{in} \leq 33\text{V}$	-	10	100	mV
		$I_o=200\text{mA}$, $28\text{V} \leq V_{in} \leq 33\text{V}$	-	5	50	
ΔV_o	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	480	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	240	
IQ	Quiescent Current	$I_o=0\text{mA}$	-	4.8	6	mA
ΔIQ	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$27\text{V} \leq V_{in} \leq 33\text{V}$, $I_o=200\text{mA}$	-	-	0.8	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	170	-	μV
RR	Ripple Rejection	$28\text{V} \leq V_{in} \leq 38\text{V}$, $I_o=100\text{mA}$, $f=120\text{Hz}$, $e_{IN}=1\text{V}_{rms}$	50	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$, $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.7		$\text{mV}/^{\circ}\text{C}$

Characteristic Curves





Characteristic Curves(Cont.)



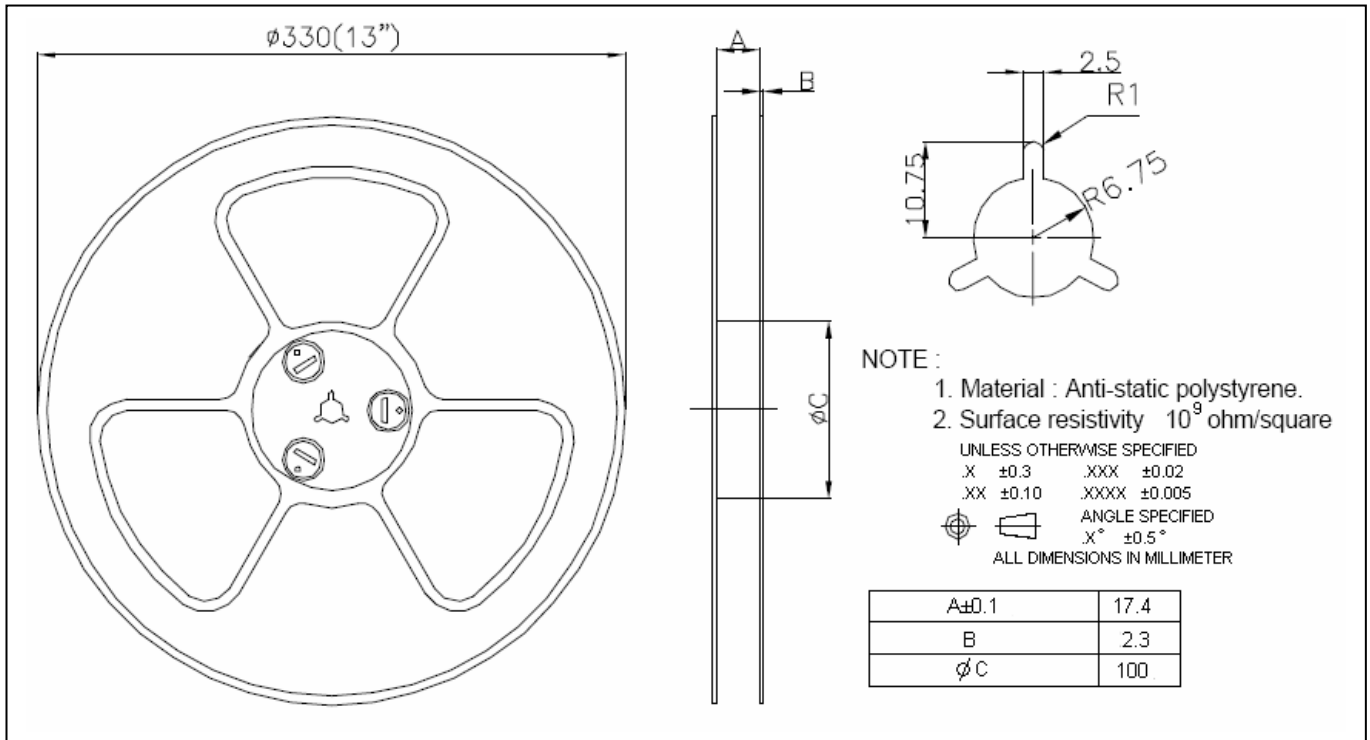
Moisture Sensitivity Level : conform to JEDEC level 3

Recommended Storage Condition:

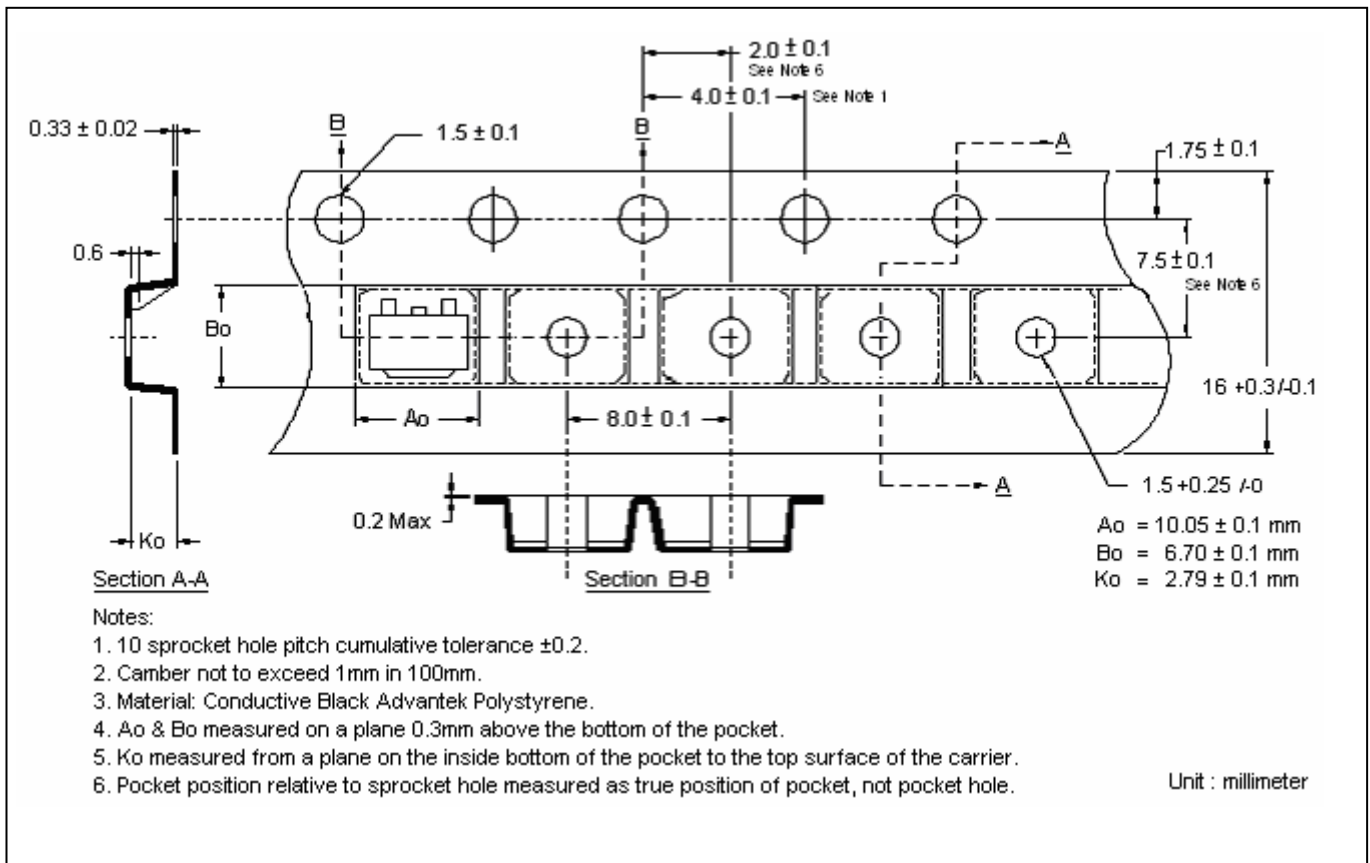
Temperature : $\leq 30\text{ }^{\circ}\text{C}$

Humidity : $\leq 60\% \text{ RH}$

Reel Dimension



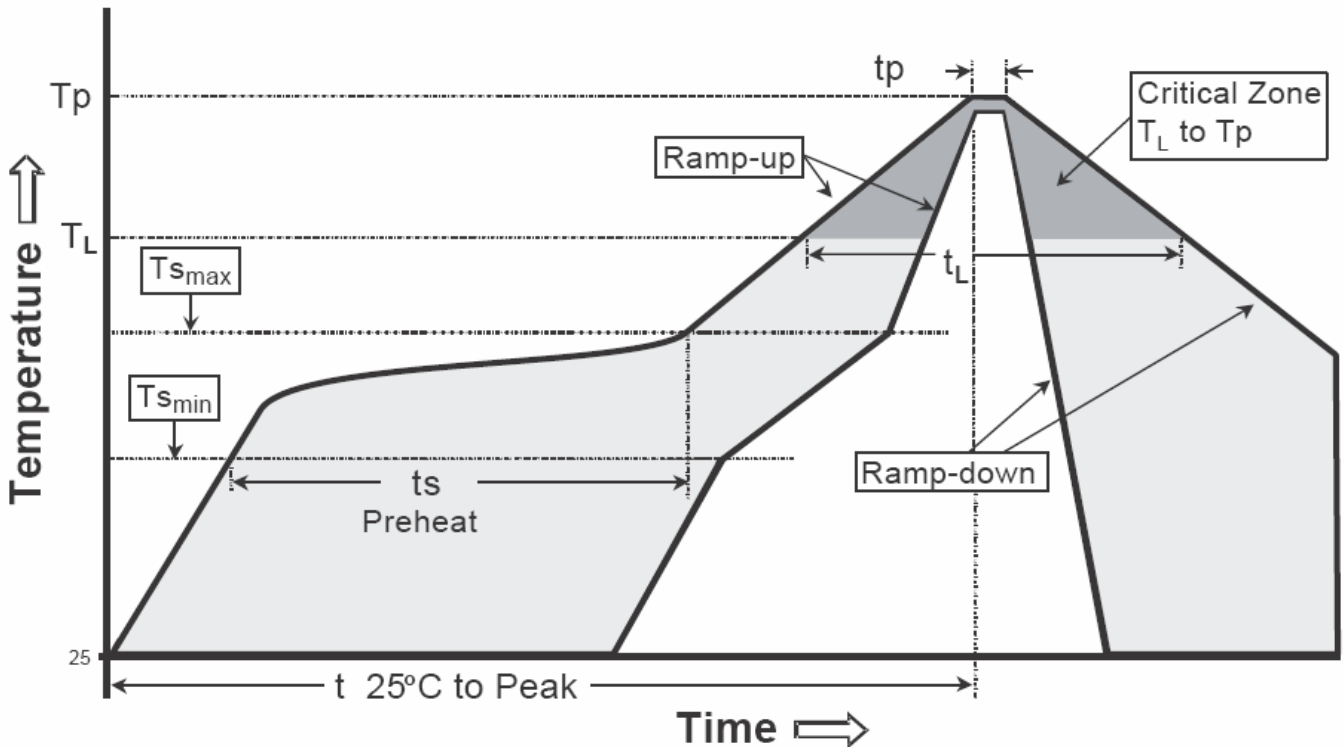
Carrier Tape Dimension



Recommended wave soldering condition

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

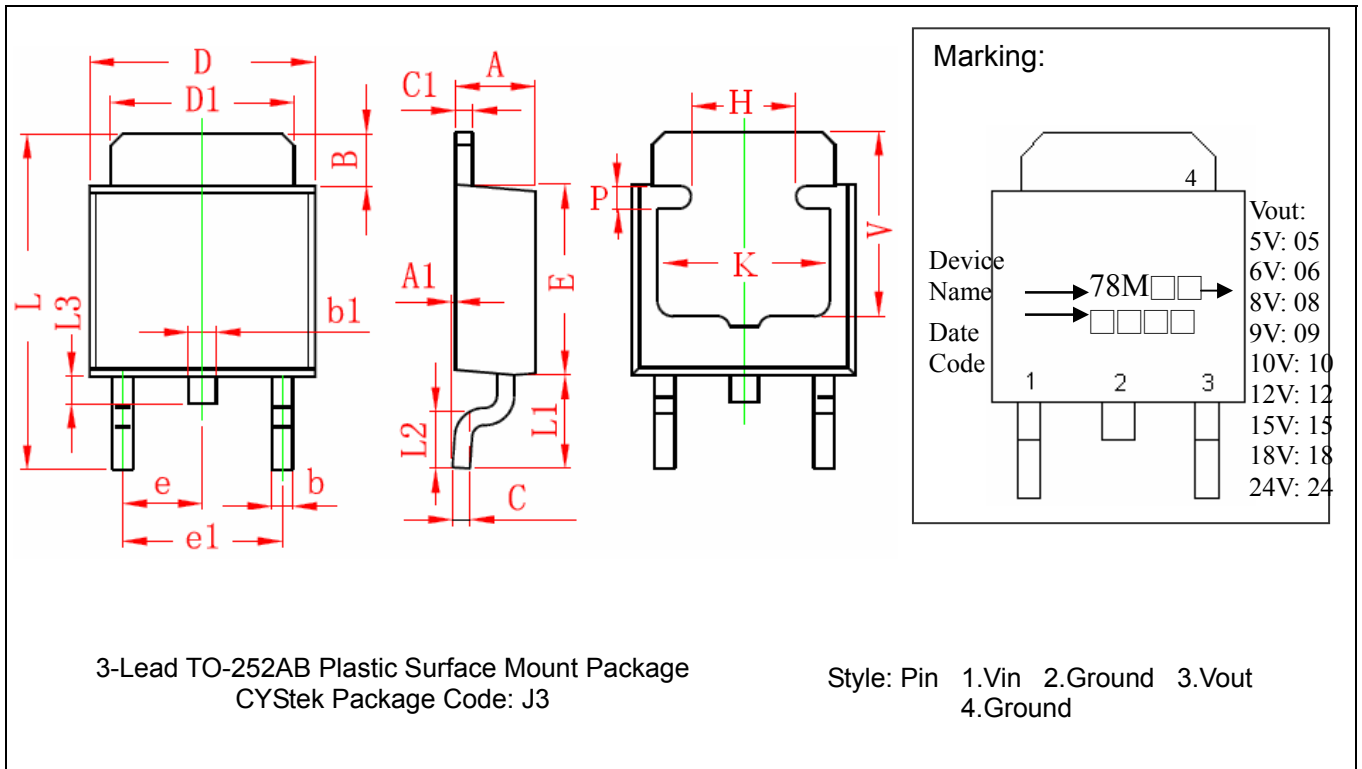
Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T _{s min})	100°C	150°C
-Temperature Max(T _{s max})	150°C	200°C
-Time(t _{s min} to t _{s max})	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T _L)	183°C	217°C
- Time (t _L)	60-150 seconds	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-252AB Dimension



*: Typical

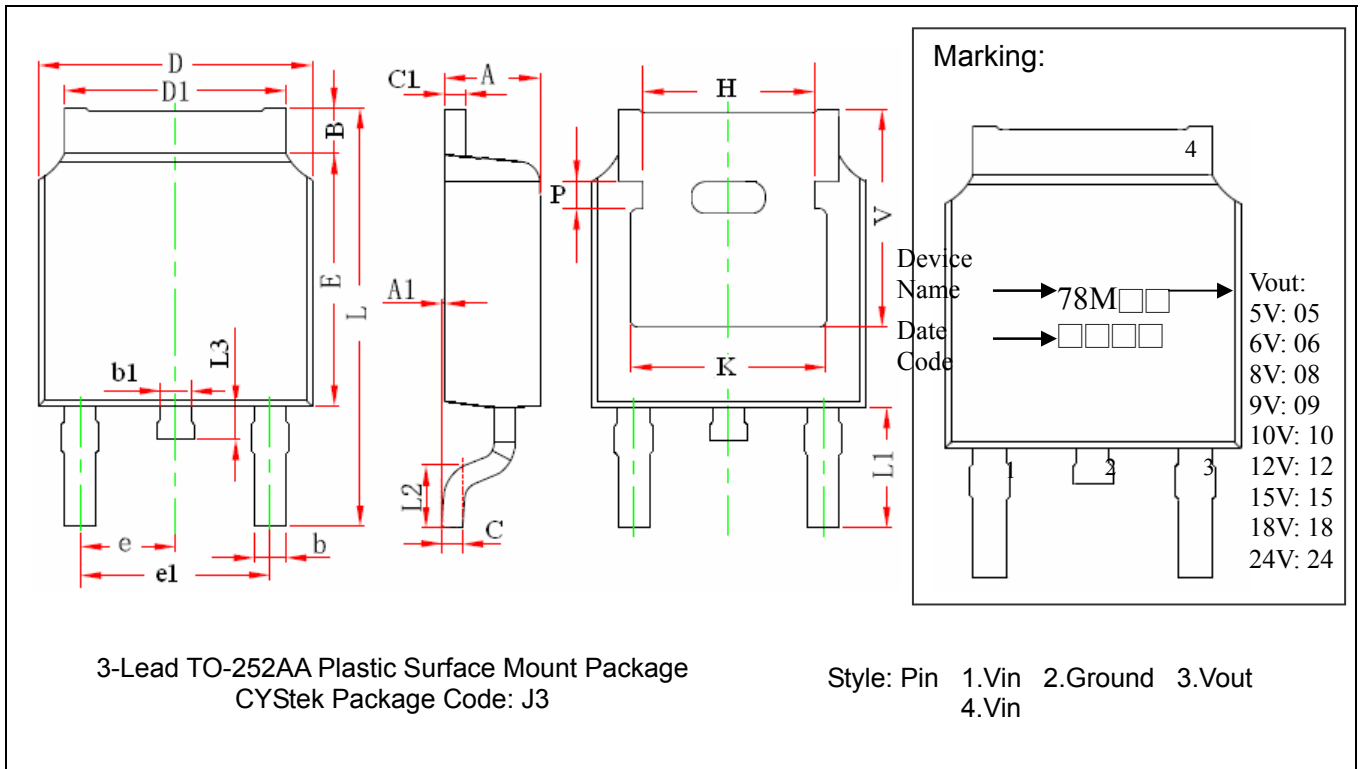
DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.087	0.094	2.200	2.400	e	*0.091		*2.300	
A1	0.000	0.005	0.000	0.127	e1	0.177	0.185	4.500	4.700
B	0.053	0.065	1.350	1.650	H	0.118	REF	3.000	REF
b	0.020	0.028	0.500	0.700	K	0.197	REF	5.000	REF
b1	0.028	0.035	0.700	0.900	L	0.374	0.390	9.500	9.900
C	0.017	0.023	0.430	0.580	L1	0.100	0.114	2.550	2.900
C1	0.017	0.023	0.430	0.580	L2	0.055	0.070	1.400	1.780
D	0.250	0.262	6.350	6.650	L3	0.024	0.035	0.600	0.900
D1	0.205	0.213	5.200	5.400	P	0.028	REF	0.700	REF
E	0.213	0.224	5.400	5.700	V	0.209	REF	5.300	REF

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

TO-252AA Dimension



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.087	0.094	2.200	2.400	e	0.086	0.094	2.186	2.386
A1	0.000	0.005	0.000	0.127	e1	0.172	0.188	4.372	4.772
B	0.039	0.048	0.990	1.210	H	0.163	REF	4.140	REF
b	0.026	0.034	0.660	0.860	K	0.190	REF	4.830	REF
b1	0.026	0.034	0.660	0.860	L	0.386	0.409	9.800	10.400
C	0.018	0.023	0.460	0.580	L1	0.114	REF	2.900	REF
C1	0.018	0.023	0.460	0.580	L2	0.055	0.067	1.400	1.700
D	0.256	0.264	6.500	6.700	L3	0.024	0.039	0.600	1.000
D1	0.201	0.215	5.100	5.460	P	0.026	REF	0.650	REF
E	0.236	0.244	6.000	6.200	V	0.211	REF	5.350	REF

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.

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