



Dual Operational Amplifier and Voltage Reference

LM103AQ8

Description

The LM103AQ8 is a monolithic integrated circuit that includes one independent op-amp and another op-amp, for which the non-inverting input is wired to a 2.5V fixed voltage reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.

Features

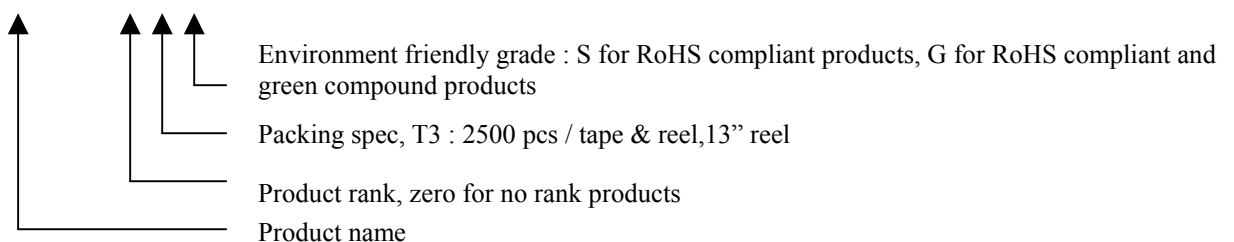
- Low input offset voltage : 0.5mV(typ.)
- Low supply current : 350µA/op (@V_{CC}=5V)
- Medium bandwidth (unity gain) : 0.9MHz
- Large output voltage swing : 0V to V_{CC}-1.5V
- Input common mode voltage range includes ground
- Wide power supply range : 3 to 32V
- Pb-free lead plating package
- Fixed output voltage reference, 2.5V
- 0.4% and 1% voltage precision
- Sink current capability : 1 ~ 100mA
- Typical output impedance : 0.2Ω

Applications

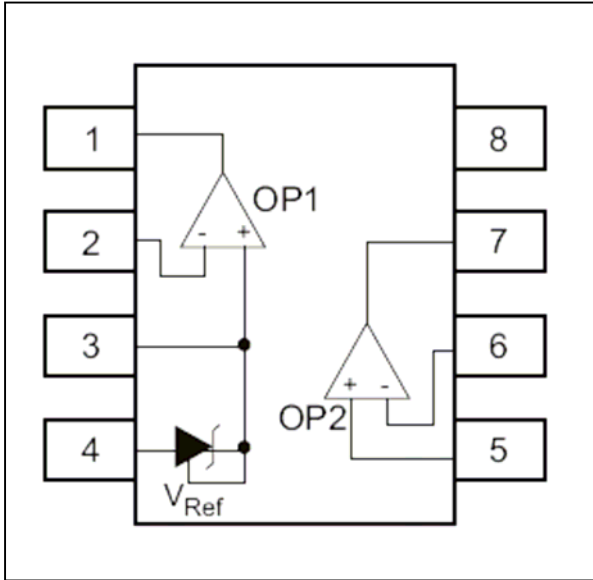
- Battery charger
- Switch mode power supply
- Linear regulator

Ordering Information

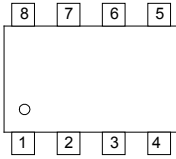
Device	Package	Shipping
LM103AQ8-0-T3-G	SOP-8 (Pb-free lead plating and halogen-free package)	2500 pcs/ Tape & Reel



Equivalent Circuit



Pin Connections

	Pin1:Output 1	Pin5: Non-inverting input 2
	Pin2:Inverting input 1	Pin6: Inverting input 2
	Pin3:Non-inverting input 1	Pin7: Output 2
	Pin4:Vcc-	Pin8: Vcc+

Absolute Maximum Rating

Parameter	Symbol	Value	Unit
Supply Voltage	V _{CC}	36	V
Differential Input Voltage	V _{id}	36	V
Input Voltage	V _i	-0.3 to +36	V
Operating Temperature Range	T _{opr}	-40 to +105	°C
Maximum Junction Temperature	T _J	150	°C
Thermal Resistance, Junction to Ambient	R _{th,ja}	175	°C/W



Electrical Characteristics

Parameter	Test Condition	Symbol	Min.	Typ.	Max.	Unit
Total supply current, excluding current in the voltage reference	V _{CC+} =+5V, no load, T _{min} ≤T _a ≤T _{max} V _{CC+} =+30V, no load, T _{min} ≤T _a ≤T _{max}	I _{CC}	-	0.7	1.2 2	mA

●Operator 1 (Independent op-amp) V_{CC+}=+5V, V_{CC}=ground, V_O=1.4V, T_a=25°C (unless otherwise specified)

Parameter	Test Condition	Symbol	Min.	Typ.	Max.	Unit
Input offset voltage	T _a =25°C T _{min} ≤T _a ≤T _{max}	V _{IO}	-	0.5	3 5	mV
Input offset voltage deviation over temperature range		DV _{IO}	-	-	7	μV/°C
Input offset current	T _a =25°C T _{min} ≤T _a ≤T _{max}	I _{IO}	-	2	30 50	nA
Input bias current	T _a =25°C T _{min} ≤T _a ≤T _{max}	I _{IB}	-	20	150 200	nA
Large signal voltage gain	V _{CC} =15V, R _L =2K, V _O =1.4V~11.4V, T _{min} ≤T _a ≤T _{max}	A _{vd}	50	100	-	V/mV
Supply voltage rejection ratio	V _{CC} =5~30V	SVR	65	100	-	dB
Input common mode voltage range	V _{CC} =+30V (Note) T _{min} ≤T _a ≤T _{max}	V _{icm}	0	-	(V _{CC+})-1.5 (V _{CC+})-2	V
Common mode rejection ratio	T _{min} ≤T _a ≤T _{max}	CMR	70	85	-	dB
Output current source	V _{CC} =+15V, V _O =2V, V _{id} =+1V	I _{source}	20	40	-	mA
Short circuit ground	V _{CC} =+15V	I _O	-	40	60	mA
Output current sink	V _{CC} =+15V, V _O =2V, V _{id} =-1V	I _{sink}	10	20	-	mA
High level output voltage	V _{CC+} =30V, R _L =10K T _a =25°C T _{min} ≤T _a ≤T _{max}	V _{OH}	27 27	28	-	V
Low level output voltage	R _L =10K, T _a =25°C T _{min} ≤T _a ≤T _{max}	V _{OL}	-	5	20 20	mV
Slew rate at unity gain	V _i =0.5~3V, V _{CC} =15V, R _L =2K, C _L =100pF, unity gain	SR	0.2	0.4	-	V/μs
Gain bandwidth product	V _{CC} =30V, R _L =2K, C _L =100pF, f=100kHz, V _{IN} =10mV	GBP	0.5	0.9	-	MHz
Total harmonic distortion	f=1kHz, A _v =20dB, R _L =2K, V _{CC} =30V, C _L =100pF, V _O =2V _{pp}	THD	-	0.02	-	%

Note : The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is (V_{CC+})-1.5V. But either of both inputs can go to +36V without damage.



Electrical Characteristics (Cont.)

● Operator 2 (op-amp with non-inverting input connected to the internal Vref)

V_{CC+}=+5V, V_{CC}=ground, T_a=25°C (unless otherwise specified)

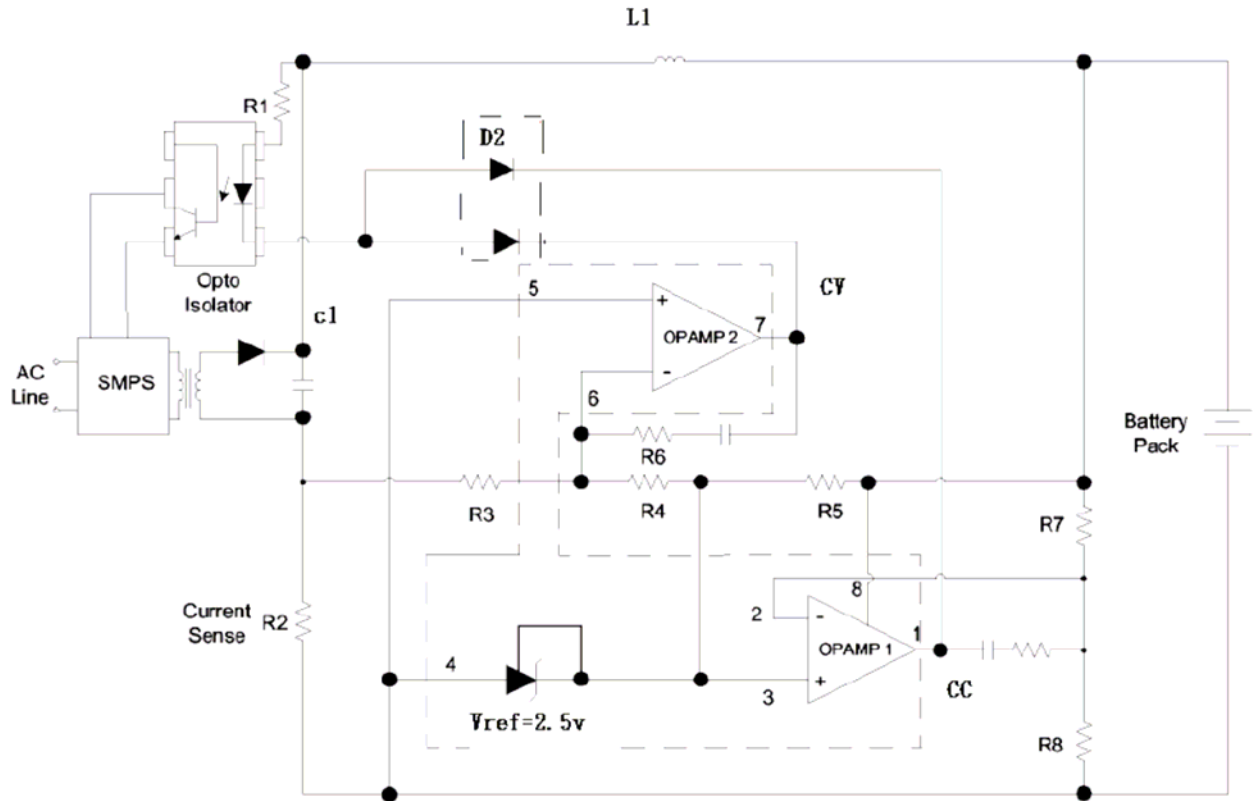
Parameter	Test Condition	Symbol	Min.	Typ.	Max.	Unit
Input offset voltage	T _a =25°C T _{min} ≤T _a ≤T _{max}	V _{IO}	-	0.5	3 5	mV
Input offset voltage deviation over temperature range		DV _{IO}	-	-	7	μV/°C
Input bias current	Negative input	I _{IB}	-	20	-	nA
Large signal voltage gain	V _{CC} =15V, R _L =2K, V _{icm} =0V	A _{vd}	-	100	-	V/mV
Supply voltage rejection ratio	V _{icm} =0V, V _{CC} =5~30V	SVR	65	100	-	dB
Output current source	V _{CC} =+15V, V _O =2V, V _{id} =+1V	I _{source}	20	40		mA
Short circuit ground	V _{CC} =+15V	I _O	-	40	60	mA
Output current sink	V _{CC} =+15V, V _O =2V, V _{id} =-1V	I _{sink}	10	20	-	mA
High level output voltage	V _{CC+} =30V, R _L =10K T _a =25°C T _{min} ≤T _a ≤T _{max}	V _{OH}	27 27	28	-	V
Low level output voltage	R _L =10K T _{min} ≤T _a ≤T _{max}	V _{OL}	-	5	20 20	mV
Slew rate at unity gain	V _i =0.5~2V, V _{CC} =15V, R _L =2K, C _L =100pF, unity gain	SR	0.2	0.4	-	V/μs
Gain bandwidth product	V _{CC} =30V, R _L =2K, C _L =100pF, f=100kHz, V _{IN} =10mV	GBP	0.5	0.9		MHz
Total harmonic distortion	f=1kHz, A _v =20dB, R _L =2K, V _{CC} =30V, C _L =100pF, V _O =2V _{pp}	THD	-	0.02	-	%

● Voltage reference

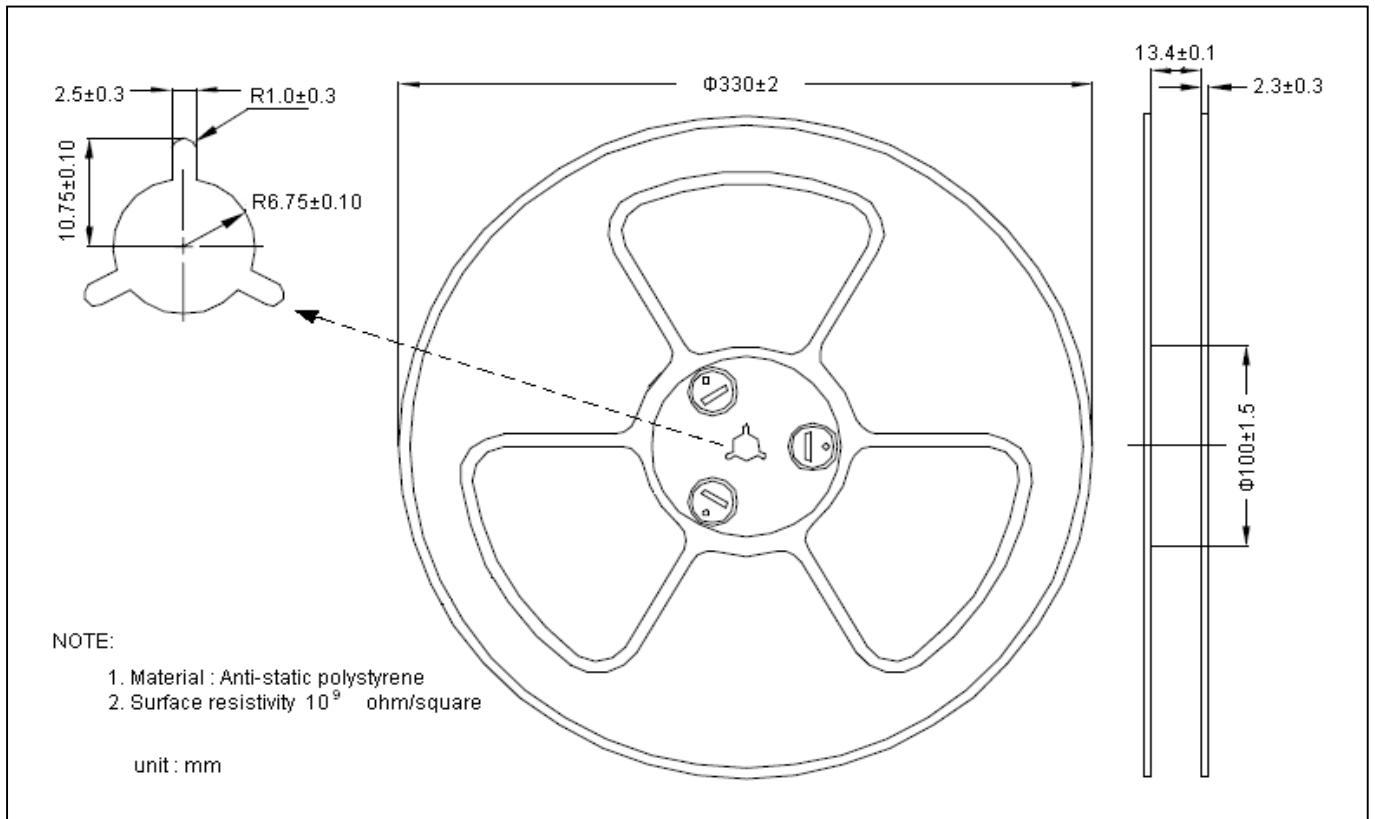
Parameter	Test Condition	Symbol	Min.	Typ.	Max.	Unit
Cathode current		I _K	1	-	100	mA
Reference input voltage	T _a =25°C T _{min} ≤T _a ≤T _{max}	V _{REF}	2.49 2.48	2.5	2.51 2.52	V
Reference input voltage deviation over temperature range	V _{KA} =V _{REF} , I _K =10mA, T _{min} ≤T _a ≤T _{max}	DV _{REF}	-	5	24	mV
Minimum cathode current for regulation	V _{KA} =V _{REF}	I _{min}	-	0.5	1	mA
Dynamic impedance (Note)	V _{KA} =V _{REF} , I _K =1~100mA, f<1kHz	Z _{KA}	-	0.2	0.5	Ω

Note : The dynamic impedance is defined as |Z_{KA}|=V_{KA}/I_K

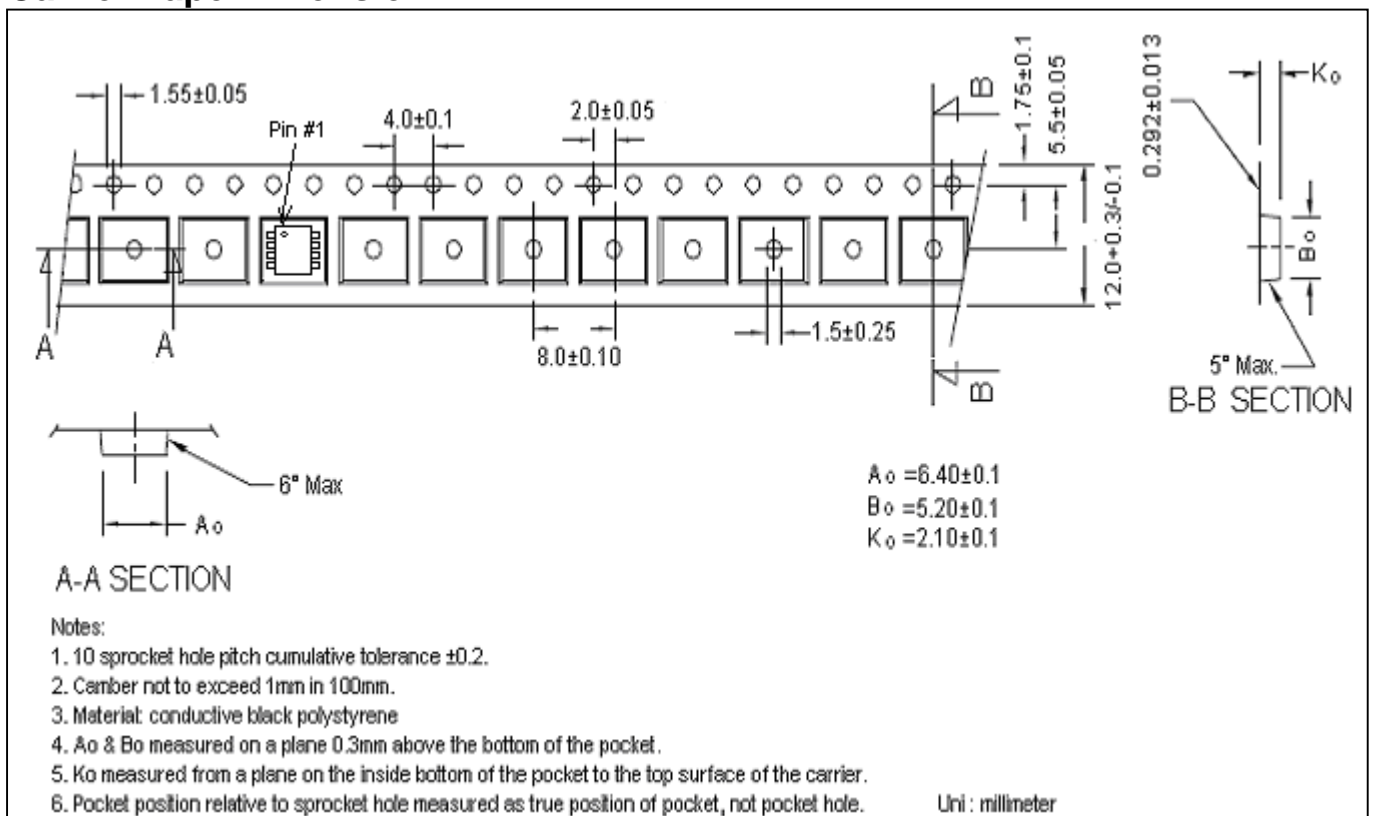
TYPICAL APPLICATION



Reel Dimension



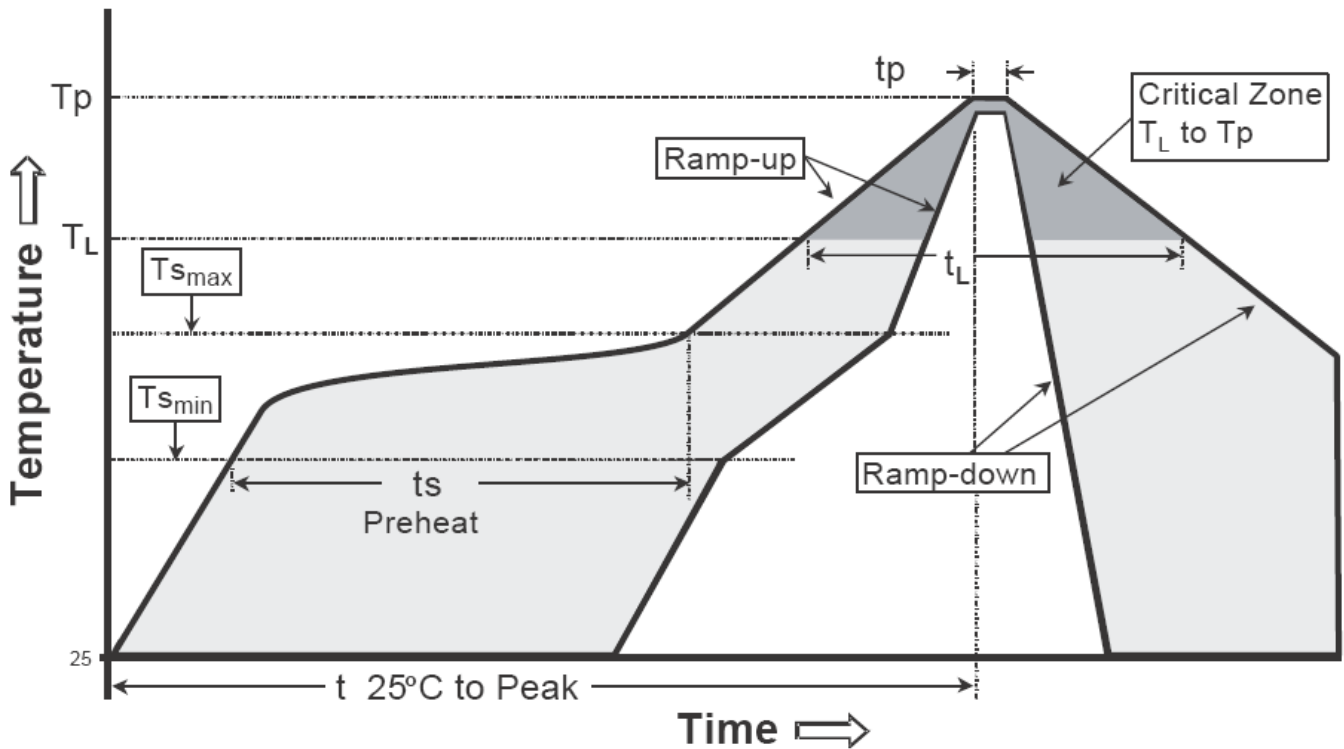
Carrier Tape Dimension



Recommended wave soldering condition

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

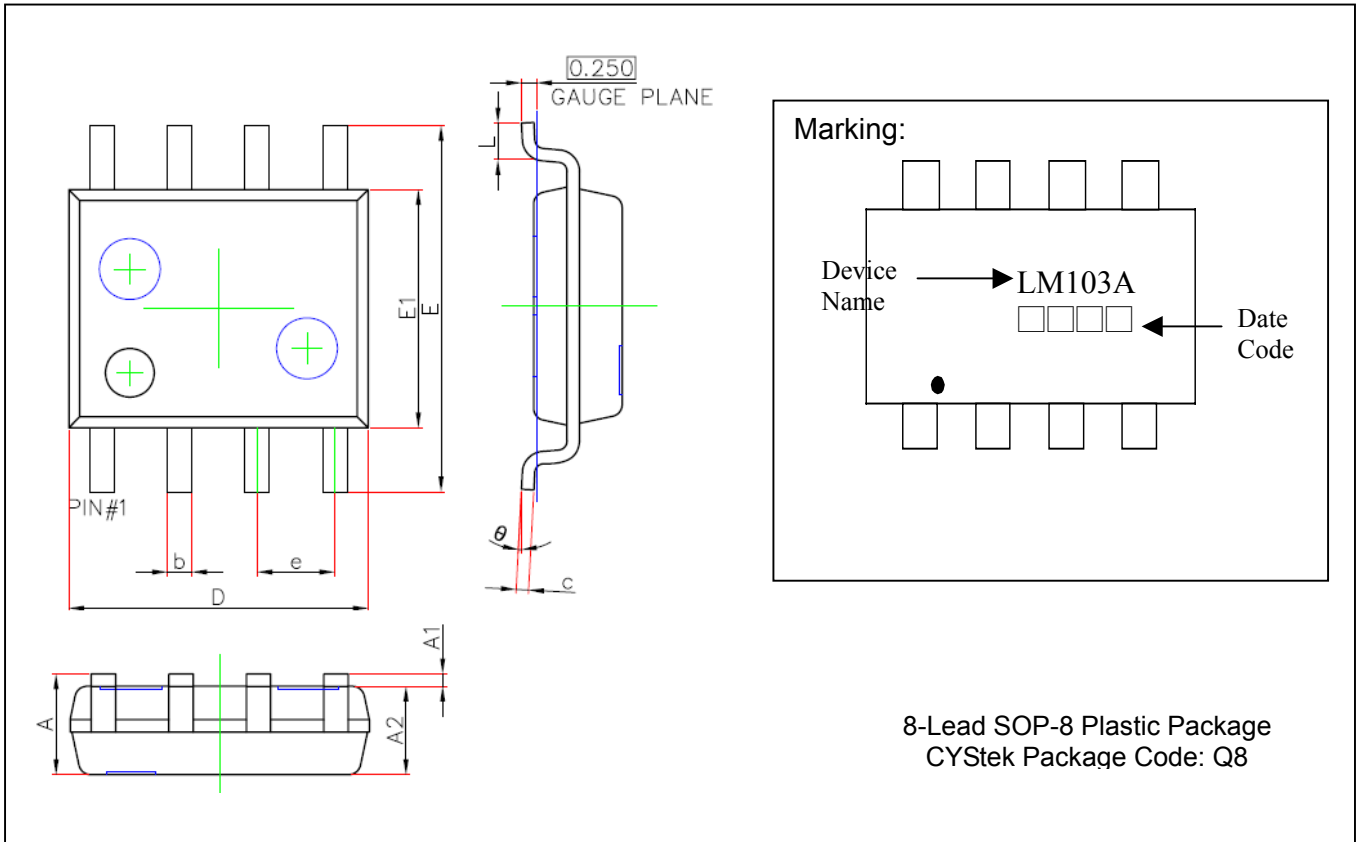
Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (TL)	183°C	217°C
- Time (tL)	60-150 seconds	60-150 seconds
Peak Temperature(TP)	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 :1. All temperatures refer to topside of the package, measured on the package body surface.
 2.For devices mounted on FR-4 PCB of 1.6mm or equivalent grade PCB. If other grade PCB is used, care should be taken to match the coefficients of thermal expansion between components and PCB. If they are not matched well, the solder joints may crack or the bodies of the parts may crack or shatter as the assembly cools.

SOP-8 Dimension



DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069	E	5.800	6.200	0.228	0.244
A1	0.100	0.250	0.004	0.010	E1	3.800	4.000	0.150	0.157
A2	1.350	1.550	0.053	0.061	e	1.270 (BSC)		0.050 (BSC)	
b	0.330	0.510	0.013	0.020	L	0.400	0.800	0.016	0.031
c	0.170	0.250	0.007	0.010	θ	0°	8°	0°	8°
D	4.700	5.100	0.185	0.201					

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: Solder plating
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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