



## Dual Operational Comparator

# LM358QN

### Description

The LM358QN consists of two independent high gain, internally frequency compensated operational amplifier. It can be operated from a single power supply and also split power supplies.

### Features

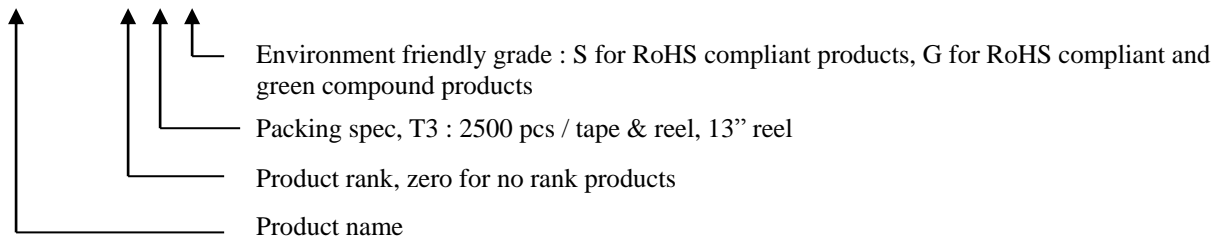
- Internally frequency compensated for unity gain
- Single supply operation:3V to 32V
- Input common-mode voltage range includes ground
- Large DC voltage gain

### Applications

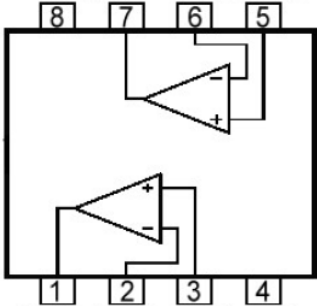
- General purpose amplifier
- Transducer amplifier

### Ordering Information

Device	Package	Shipping
LM358QN-0-T3-G	MSOP-8 (Pb-free lead plating and halogen-free package)	2500 pcs / tape& reel



## Pin Configurations

	Pin1: OUTPUT 1	Pin5: INPUT 2 (+)
	Pin2: INPUT 1 (-)	Pin6: INPUT 2 (-)
	Pin3: INPUT 1 (+)	Pin7: OUTPUT 2
	Pin4: Gnd/VEE	Pin8: VCC

## Absolute Maximum Rating(Ta=25°C)

Parameter	Symbol	Value	Unit
Supply Voltage	V <sub>CC</sub>	±16 or 32	V
Input Differential Voltage Range	V <sub>I(DIFF)</sub>	±32	V
Input Common Mode Voltage Range	V <sub>ICR</sub>	-0.3 ~ +32	V
Output Short Circuit Duration	t <sub>sc</sub>	Continuous	
Operating Temperature	T <sub>opr</sub>	0 ~ +70	°C
Storage Temperature	T <sub>stg</sub>	-65 ~ +150	°C

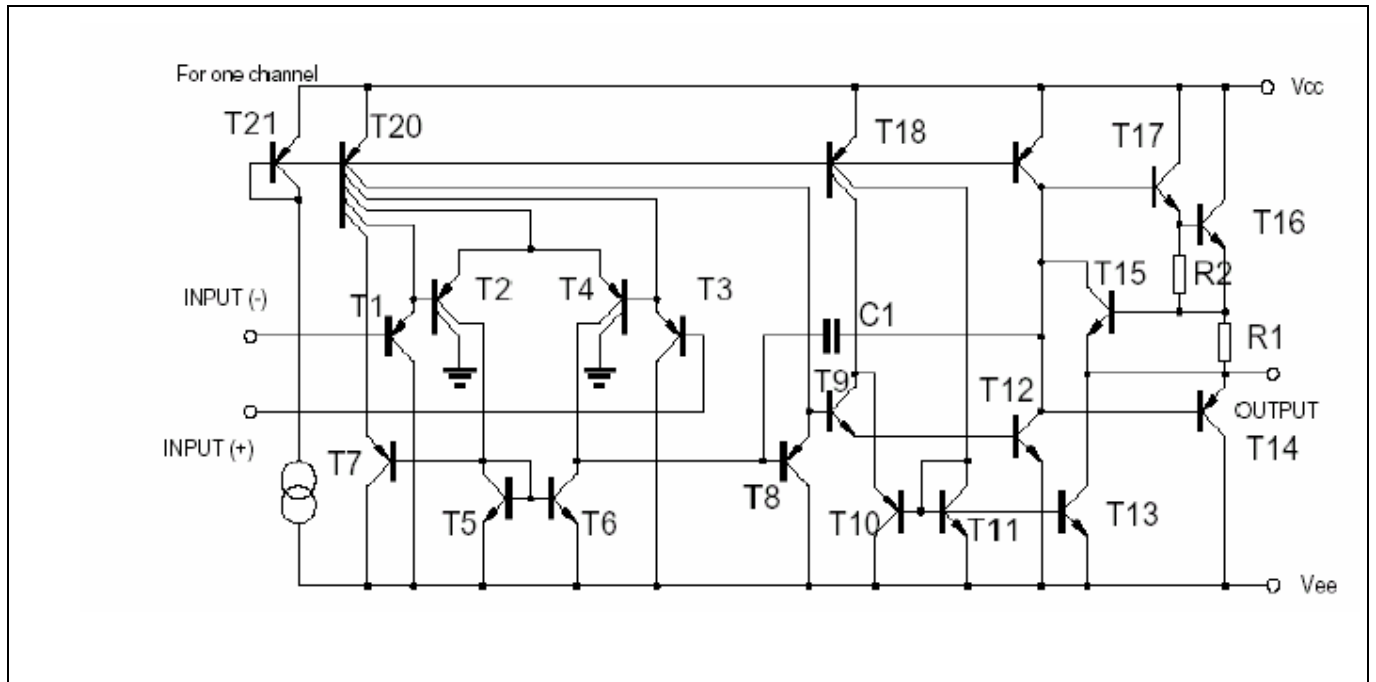
## Electrical Characteristics (V<sub>CC</sub>=5V, Ta=25°C, V<sub>EE</sub>=GND, unless otherwise specified.)

Parameter	Test Condition	Symbol	Min.	Typ.	Max.	Unit
Input Offset Voltage	V <sub>CM</sub> =0 to V <sub>CC</sub> -1.5V V <sub>o(p)</sub> =1.4V, R <sub>s</sub> =0	V <sub>IO</sub>	-	2.9	7.0	mV
Input Offset Current		I <sub>IO</sub>	-	5	50	nA
Input Bias Current		I <sub>IB</sub>	-	45	250	nA
Input Common-Mode Voltage	V <sub>CC</sub> =30V	V <sub>ICR</sub>	0	-	V <sub>CC</sub> -1.5	V
Power Supply Current	R <sub>L</sub> =∞, V <sub>CC</sub> =5V, V <sub>o</sub> =0V	I <sub>CC</sub>	-	0.5	1.2	mA
	R <sub>L</sub> =∞, V <sub>CC</sub> =30V, V <sub>o</sub> =0V		-	0.8	2.0	mA
Large Signal Voltage Gain	V <sub>CC</sub> =15V, R <sub>L</sub> ≥2kΩ V <sub>o(p)</sub> =1V to 11V	G <sub>v</sub>	25	100	-	V/mV
Output Voltage-High Limit	V <sub>CC</sub> =30V, R <sub>L</sub> =2kΩ	V <sub>o(H)</sub>	26	-	-	V
	V <sub>CC</sub> =30V, R <sub>L</sub> =10kΩ		27	28	-	
Output Voltage-Low Limit	V <sub>CC</sub> =5V, R <sub>L</sub> ≥10kΩ	V <sub>o(L)</sub>	-	5	20	mV
Common Mode Rejection Ratio		CMRR	65	80	-	dB
Power Supply Rejection Ratio		PSRR	65	100	-	dB

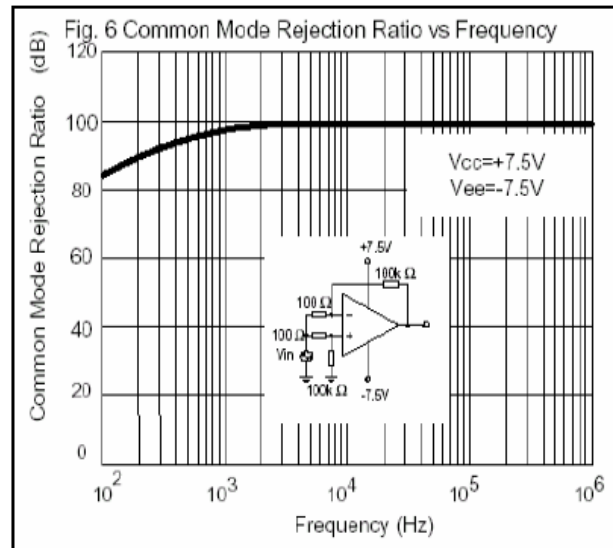
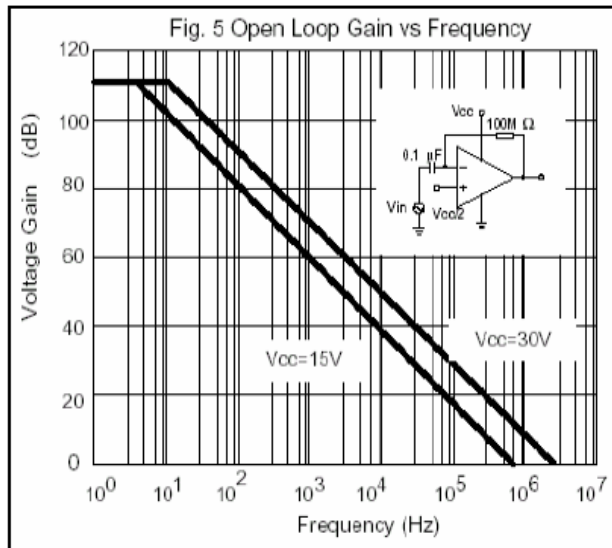
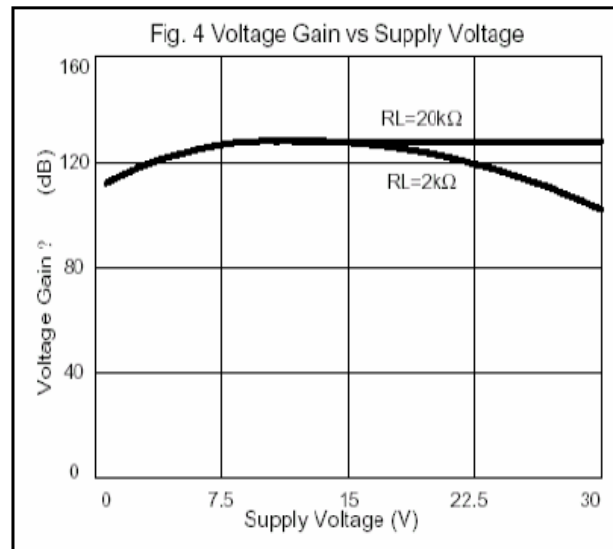
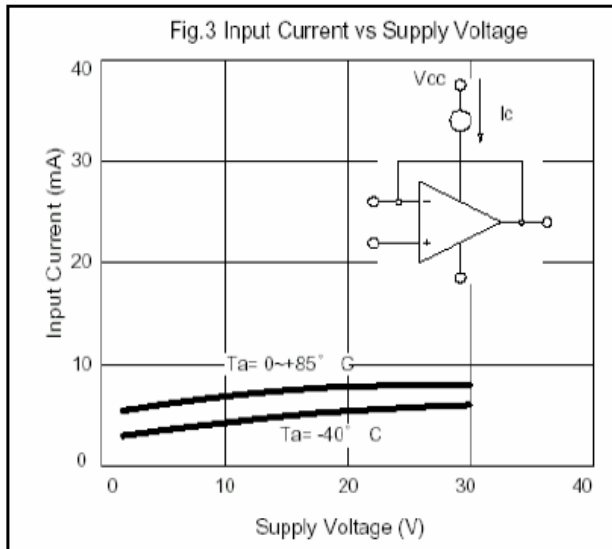
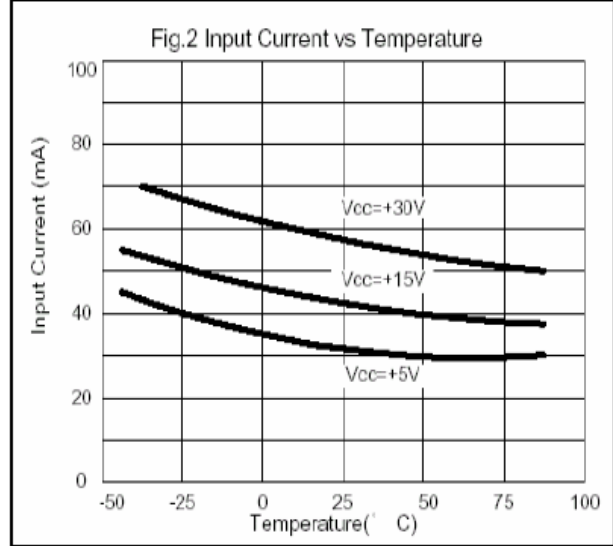
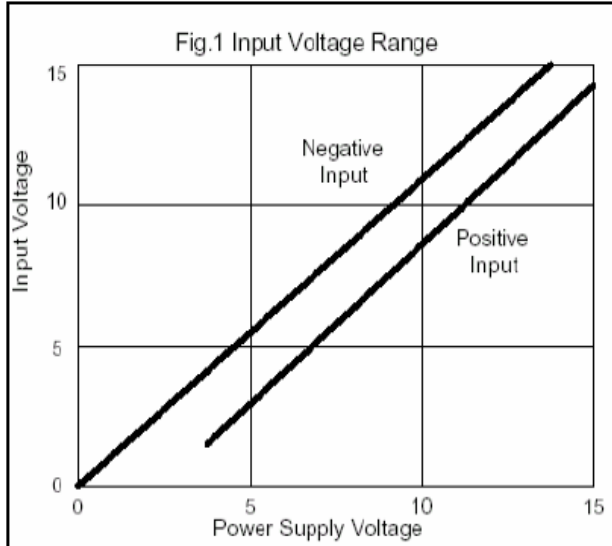


Channel Separation	f=1kHz to 20kHz	CS	-	120	-	dB
Short Circuit Current to Ground		I <sub>SC</sub>	-	40	60	mA
Output Source Current	V <sub>i(+)</sub> =1V, V <sub>i(-)</sub> =0V, V <sub>CC</sub> =15V, V <sub>o(p)</sub> =2V	I <sub>source</sub>	10	30	-	mA
Output Sink Current	V <sub>i(+)</sub> =0V, V <sub>i(-)</sub> =1V, V <sub>CC</sub> =15V, V <sub>o(p)</sub> =2V	I <sub>sink</sub>	10	15	-	mA
	V <sub>i(+)</sub> =0V, V <sub>i(-)</sub> =1V, V <sub>CC</sub> =15V, V <sub>o(p)</sub> =0.2V		12	100	-	μA
Differential Input Voltage		V <sub>I(DIFF)</sub>	-	-	V <sub>CC</sub>	V

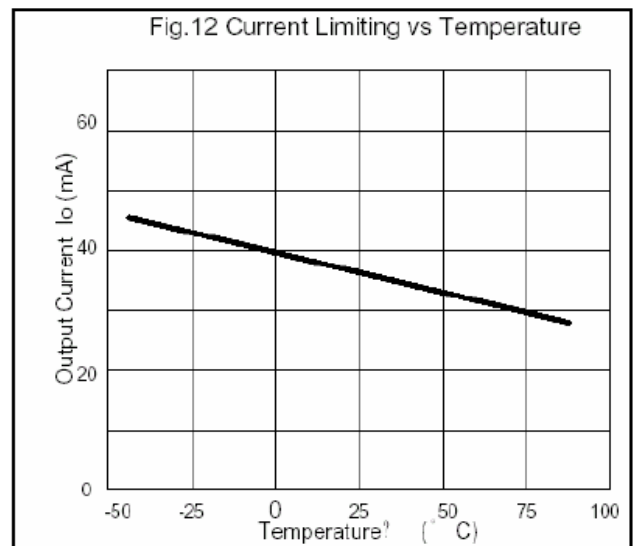
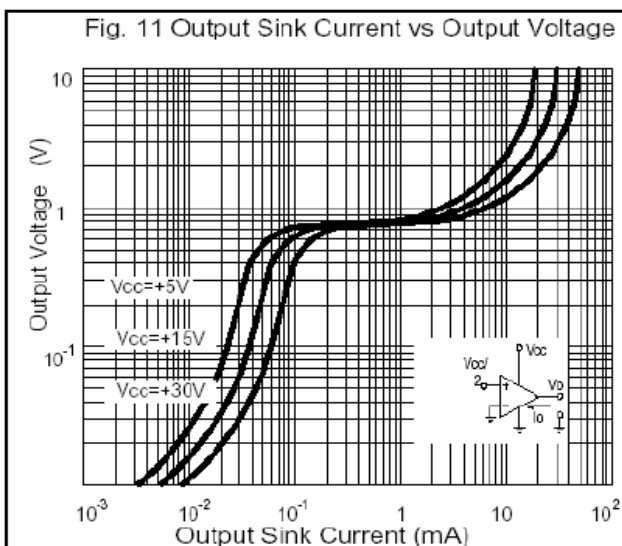
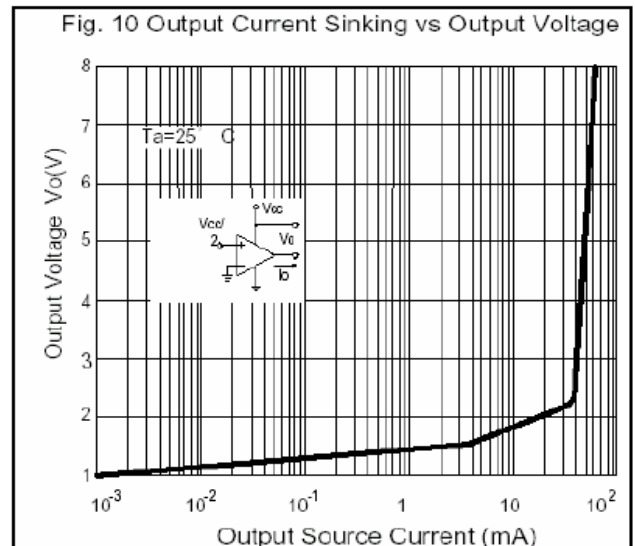
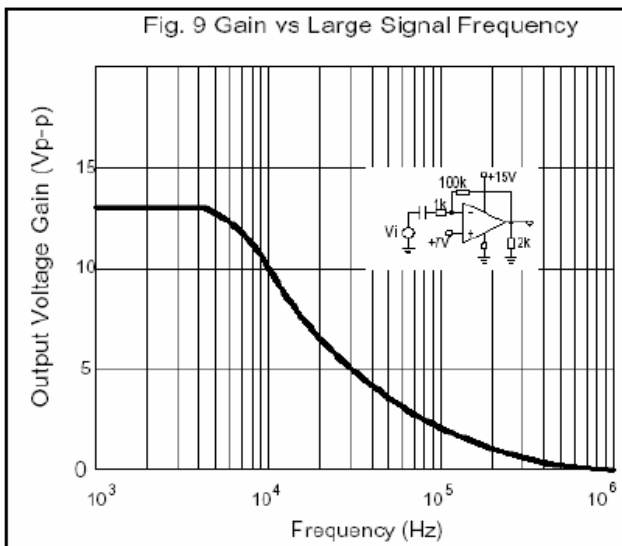
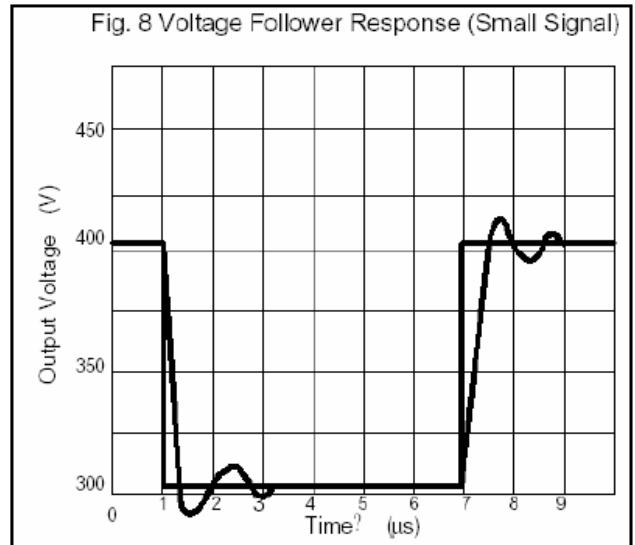
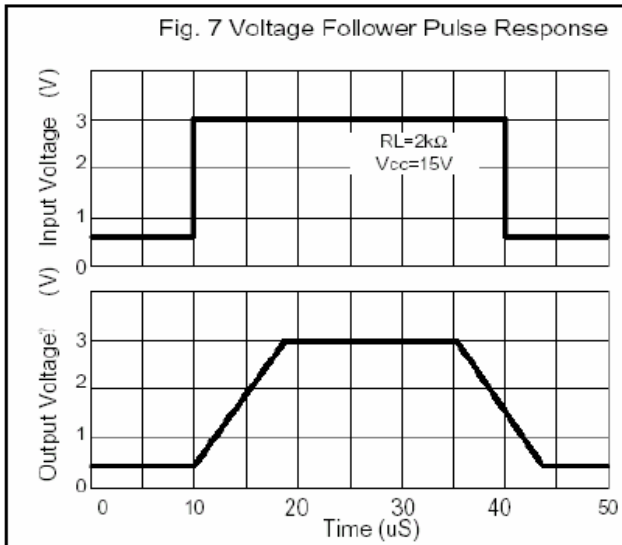
### Block Diagram



**Characteristic Curves**

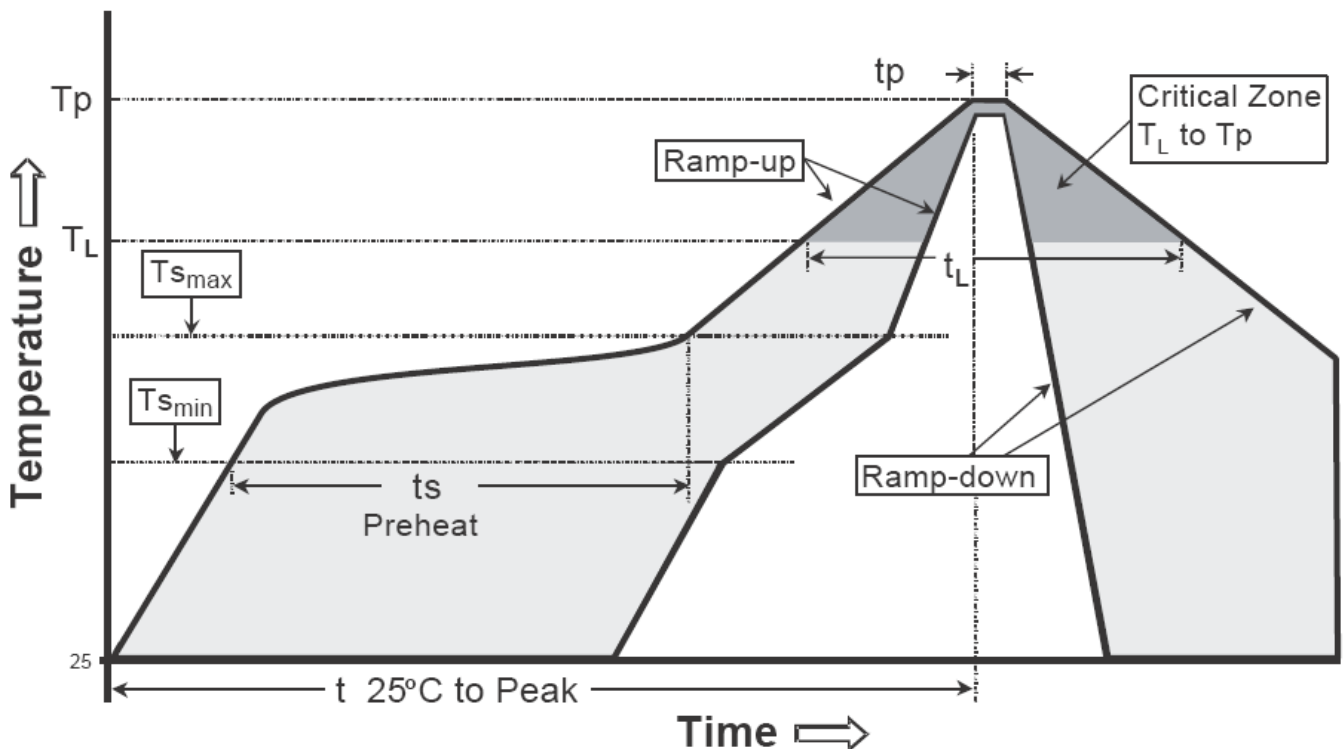


**Characteristic Curves(Cont.)**



**Recommended wave soldering condition**

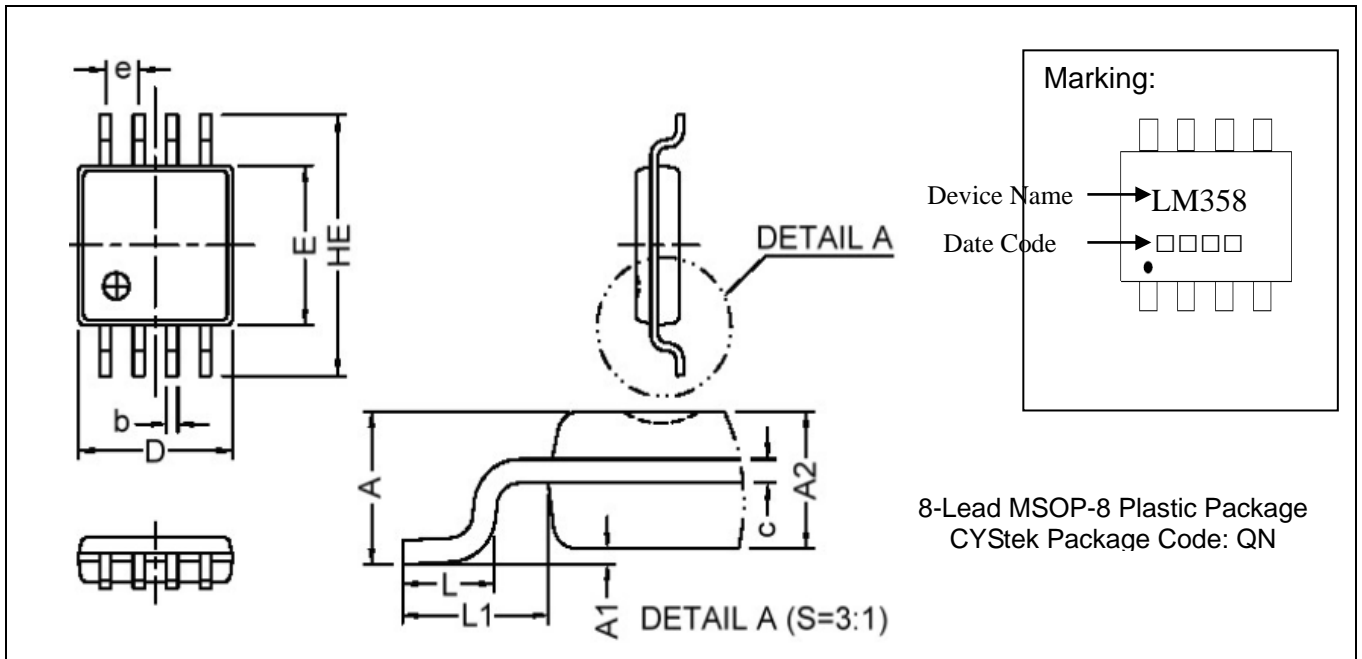
Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

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

**MSOP-8 Dimension**



\*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	-	0.043	-	1.10	L	0.016	0.028	0.40	0.70
A1	0.002	0.006	0.05	0.15	L1	0.037 BSC		0.95 BSC	
A2	0.031	0.037	0.78	0.94	b	0.009	0.015	0.22	0.38
D	0.114	0.122	2.90	3.10	c	0.003	0.009	0.08	0.23
E	0.114	0.122	2.90	3.10	e	0.026 BSC		0.65 BSC	
HE	0.187	0.199	4.75	5.05					

**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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