



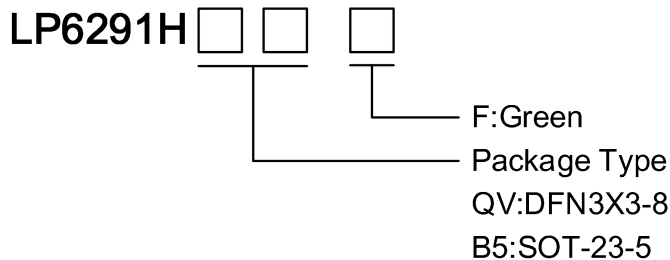
### Features

- Wide Supply Operation Range : +4.5V to +19.5V
- Input Common Voltage Range Beyond the Rails
- High Source/Sink Capability : 1300mA
- Low Input Offset Voltage : 3mV (Typical)
- Wide -3dB Bandwidth : 35MHz
- Quiescent Current : 3.0mA
- Large DC Voltage Gain : 100dB (Typical)
- Slew-Rate : 50V/μs
- Improved unit gain stability

### Applications

- Portable Equipment
- LCD-TV Equipment
- Battery-Powered Equipment
- ASIC Input or Output Amplifier
- Low Power/Low Voltage Applications

### Order Information



### General Description

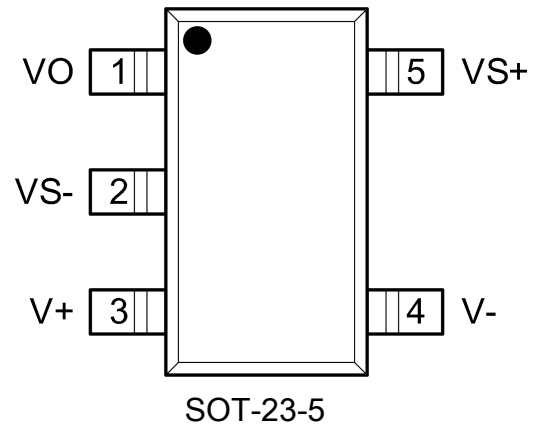
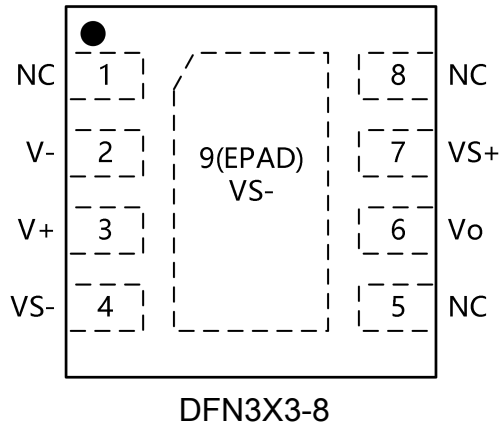
LP6291H is a single channel, low power, high voltage, high current, VCOM and half AVDD buffer. The device operates on supplies from 4.5V to 19.5V with 3.0mA typical quiescent current. LP6291H also provides common mode input ability beyond the supply rails and rail-to-rail output capability to provide maximum dynamic range for the specified operating voltage range.

LP6291H features high output drive capability of 1.3A peak AC current (typical, sink and source), 50V/μs slew rate, and 35MHz bandwidth to quickly settle outputs for 120Hz frame rate and full HD resolution. In addition, LP6291H provides Over Temperature Protection (OTP), Over Current Protection (OCP), and Output Short Circuit Protection functions (SCP), which provide maximum system protection for demanding TFT-LCD panel applications.

LP6291H is housed in a DFN3X3-8 package with exposed pad for excellent heat dissipation. LP6291H operates over a temperature range of -40°C to +85°C



## Pin Configuration

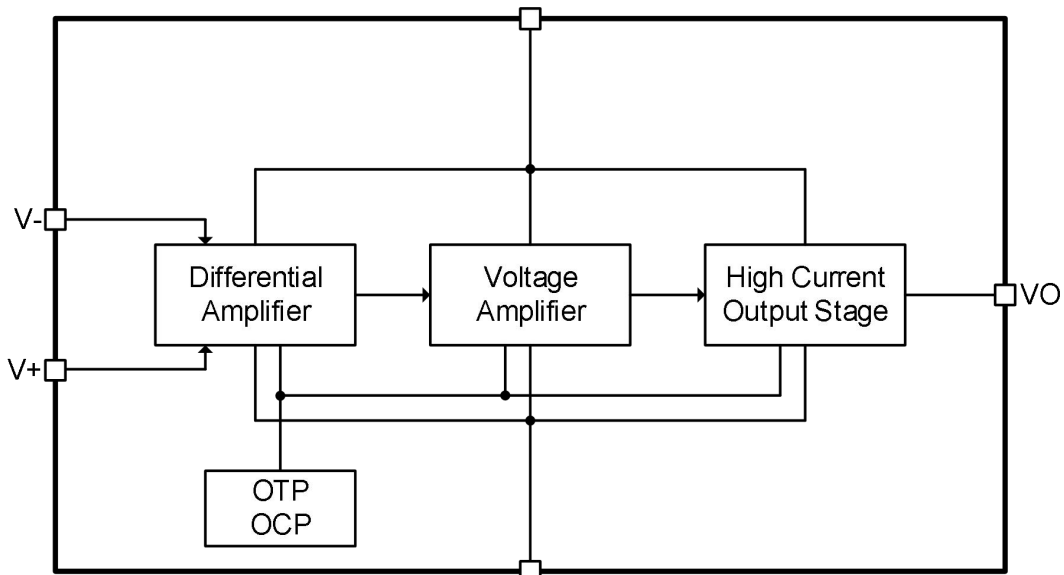


## Device Information

Part Number	Top Marking	Moisture Sensitivity Level	Package	Shipping
LP6291HQVF	LPS LP6291H YWX	MSL3	DFN3X3-8	5K/REEL
LP6291HB5F	LPS 5KYWX	MSL3	SOT-23-5	3K/REEL

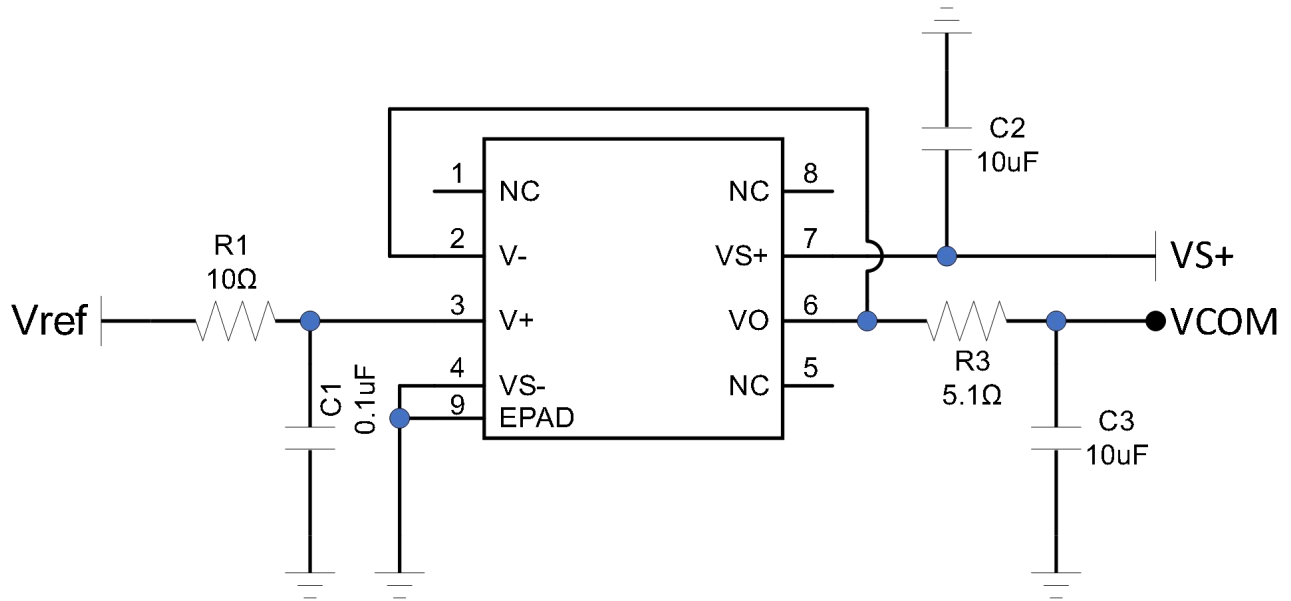
Marking indication:  
Y: Year code. W: Week code. X: Batch numbers.

## Functional Block Diagram





## Typical Application Circuit



## Pin Description(DFN3X3-8)

PIN		NAME	I/O	FUNCTION
DFN3X3-8	SOT-23-5	NC	---	No connection.
1	---	NC	---	No connection.
2	4	V-	I	Inverting input of OPA.
3	3	V+	I	Non-inverting input of OPA.
4	2	VS-	I	Negative power supply or IC GND.
5	---	NC	---	No connection.
6	1	VO	O	Output of OPA.
7	5	VS+	I	Positive power supply
8	---	NC	---	No connection.
9	---	EPAD	I	Exposed Pad. Connect this pin to VS- pin.

## Absolute Maximum Ratings (Note 1)

Supply Voltage (VS+ to VS-)	-----	24V
Storage Temperature Range	-----	-65°C to 150°C
Input Voltage	-----	-0.3V to VS+ +0.3V
Junction Temperature	-----	150°C
Thermal Resistance Junction to Ambient, ( $\theta_{JA}$ )		
DFN3X3-8	-----	98°C/W
SOT-23-5	-----	203°C/W
Continuous Power Dissipation ( $T_A=25^\circ\text{C}$ )		
DFN3X3-8	-----	1.3W
SOT-23-5	-----	0.48 W
Thermal Resistance Junction to Case, ( $\theta_{JC}$ )		
DFN3X3-8	-----	30°C/W
SOT-23-5	-----	60°C/W
Reflow Temperature (soldering, 10sec)	-----	260°C

Note 1. Stresses beyond those listed “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability

## ESD Susceptibility (Note 2)

HBM(Human Body Model)	-----	3500V
MM(Machine Model)	-----	200V
CDM(Charged Device Model)	-----	750V

Note 2. Devices are ESD sensitive. Handling precaution is recommended.

## Recommended Operating Conditions (Note 3)

Operating Supply Voltage Range	-----	$4.5\text{V} \leq \text{VS+} \leq 19.5\text{V}$
Operating Junction Temperature Range ( $T_J$ )	-----	-40°C to 125°C
Ambient Temperature Range	-----	-40°C to 85°C

Note 3. The device is not guaranteed to function outside its recommended operating conditions.

## Electrical Characteristics

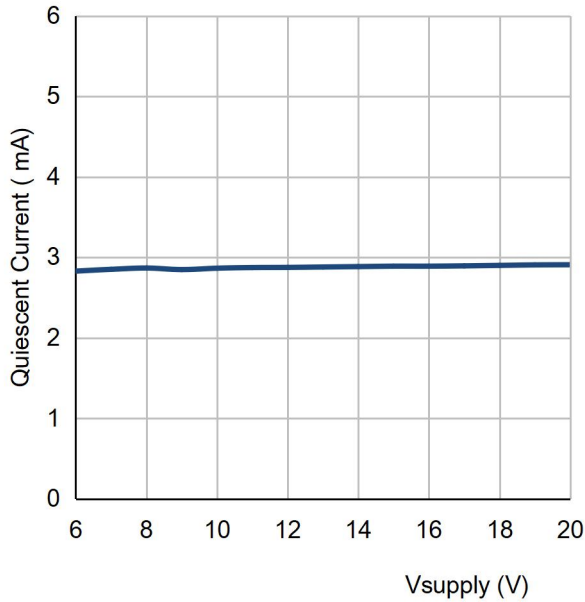
VS+ = 16V; VS- = 0V; TAMB = 25°C; CL=10pF, RL=10kΩ to VS+/2.

The device is not guaranteed to function outside its recommended operating conditions.

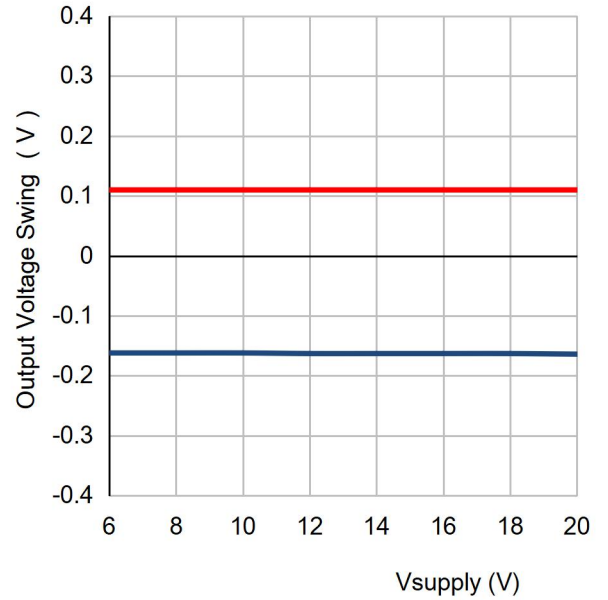
Parameter	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supplies						
Supply Voltage Range	VS+ - VS-		4.5	12	19.5	V
Supply Quiescent Current	$I_{VS+}$	VO=0V, No Load	1.0	3.0	5.0	mA
DC Characteristics						
Input Offset Voltage	$V_{I(OS)}$		-14	3	14	mV
Common Mode Voltage	$V_{CM}$	Inferred from CMRR test	VS- -0.5	--	VS+ +0.5	V
Input Bias Current	$I_B$	$V_{CM}=0$	--	2	100	nA
Input Impedance			--	1	--	GΩ
Open Loop Gain	$A_V$	VO= 5V to 14V	60	100	--	dB
Output Voltage Swing High	$V_{OH}$	V+ = 3V, V- = 0V, ILOAD = -50mA	VS+ -1.5	VS+ -1.0	--	V
Output Voltage Swing Low	$V_{OL}$	V+ = 0V, V- = 3V, ILOAD = 50mA	--	1.0	1.5	V
Continuous Output Current	$I_O$	VS+=12V, Vo=8V	±400	±450	--	mA
High Peak Source Current	$I_{SOURCE}$		--	1300	--	mA
High Peak Sink Current	$I_{SINK}$		--	1300	--	mA
Power Supply Rejection Ratio	PSRR	$5V \leq VS+ \leq 19V$	60	70	--	dB
Common Mode Rejection Ratio	CMRR	$VS- \leq V_{CM} \leq VS+$	50	90	--	dB
Slew Rate		2V to +8V 20% to 80%	30	50	--	V/μS
-3dB Bandwidth		RL=10kΩ CL=10pF	20	35	--	MHz

## Typical Performance Characteristics

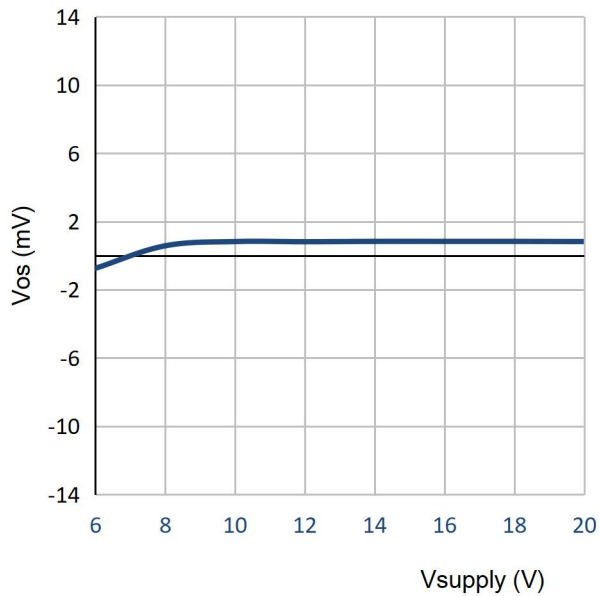
Quiescent Current vs. Input Voltage



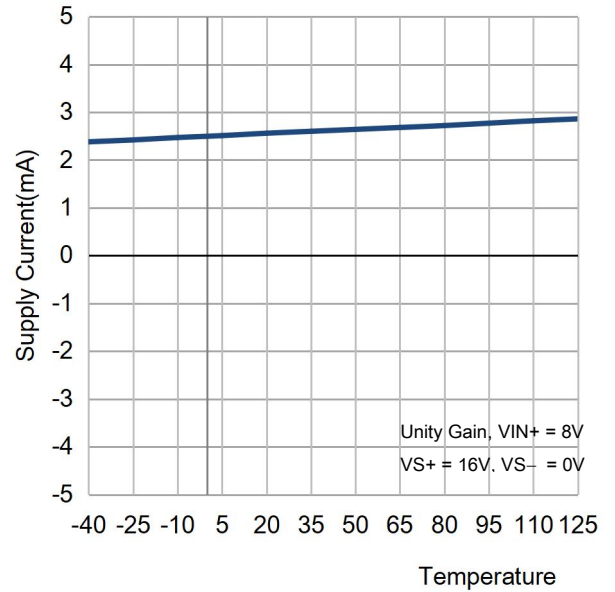
Output Voltage Swing vs. Supply Voltage



VIN vs. Input Offset Voltage



Supply Current vs. Temperature



## Applications Information

The LP6291H is a high performance operational amplifier capable of driving large loads for different applications. High slew rates and low power consumption are features that make the LP6291H ideal for LCD applications. The LP6291H also has wide bandwidth and phase margin to drive a load with 10kΩ resistance and 10pF capacitance.

## Operating Voltage

The total supply voltage range of LP6291H is guaranteed from 4.5V to 19.5V. The specifications are stable over both full supply range and operating temperatures from -40°C to 85°C. The output swing of the LP6291H typically extends to within 1.5V of

positive/negative supply rails with 50mA source/sink load current. Decreasing the load current will obtain an output swing even closer to the supply rails.

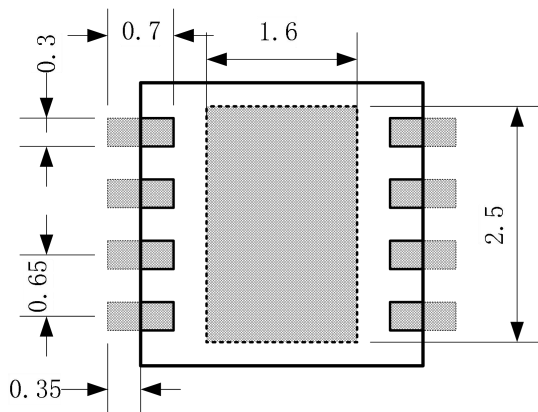
## Short-Circuit Condition

An internal short-circuit protection is implemented to protect the device from output short-circuit. The LP6291H limits the short-circuit current to  $\pm 1.3A$  if the output is directly shorted to positive/negative supply rails.

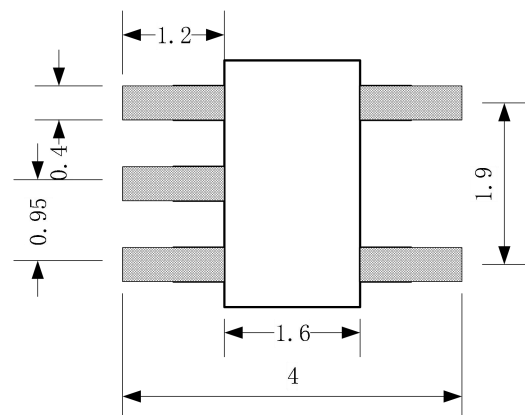
## LCD Panel Applications

The LP6291H is mainly designed for LCD VCOM buffers. The operational amplifier has 1.3A instantaneous source/ sink peak current.

## Minimum Footprint PCB Layout Section



DFN3X3-8



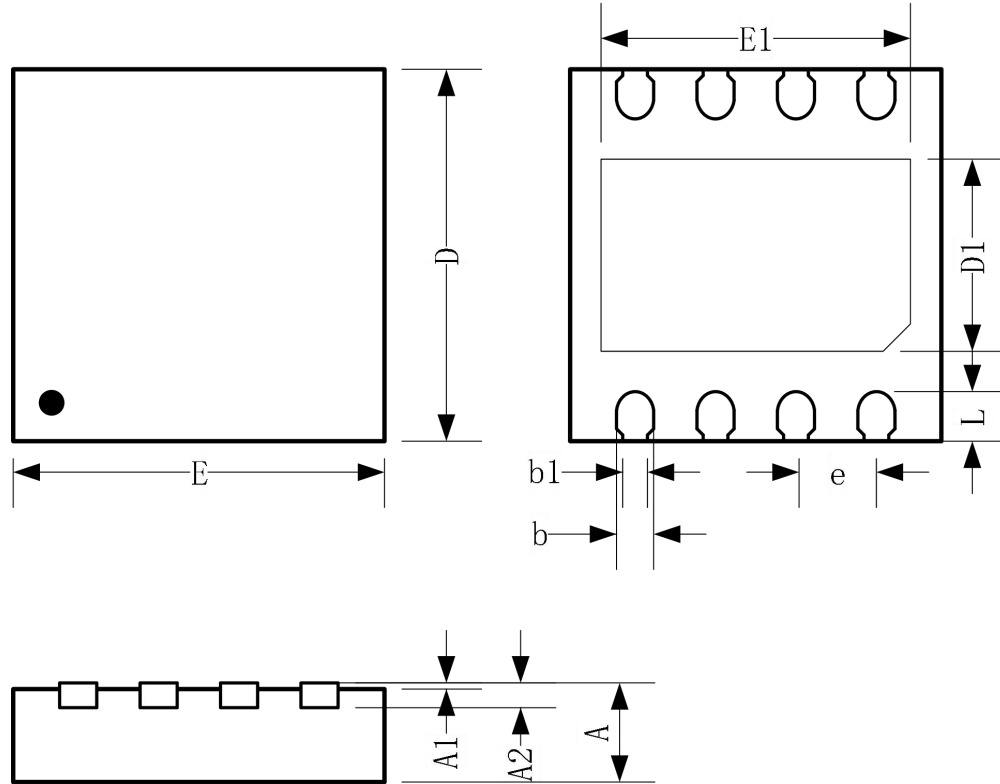
SOT-23-5

## Layout Consideration

PCB layout is very important for designing power converter circuits. The following layout guidelines should be strictly followed for best performance of the LP6291H. Place the power components as close to the IC as possible. The traces should be wide and short, especially for the high current loop. A series resistor may be needed at the output for some applications. Connect a 0.1 $\mu$ F capacitor from VS+ to ground and place it as close to the IC as possible for better performance. The exposed pad of the chip should be connected to a large PCB plane for maximum thermal consideration.



## Packaging Information

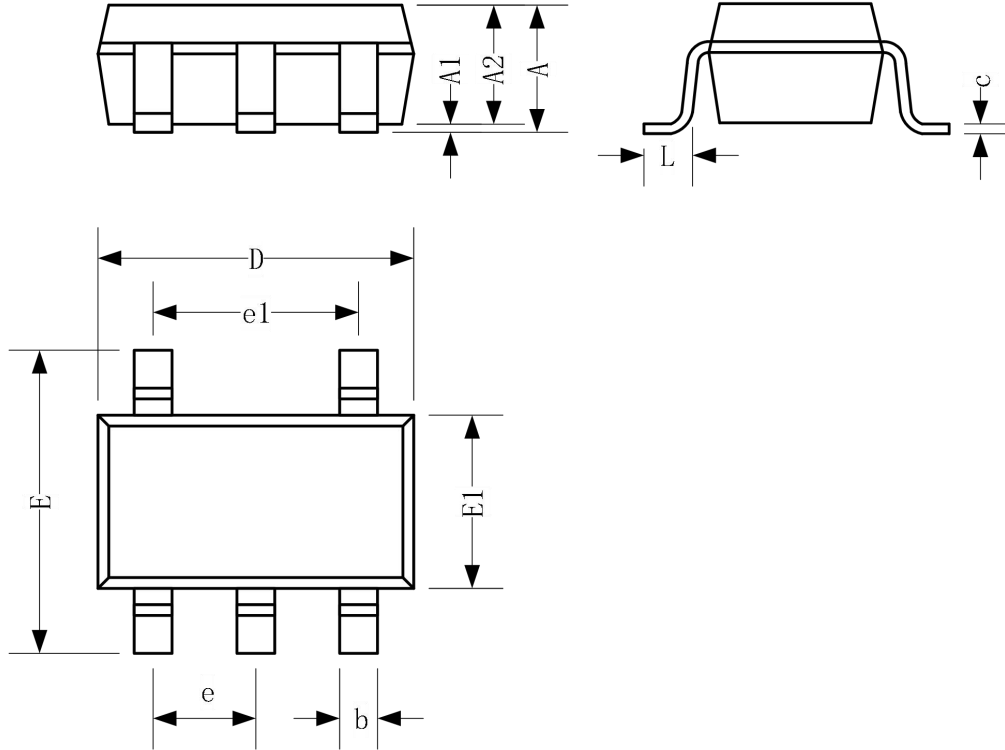


### DFN3X3-8

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	0.02	0.05	0.0000	---	0.0020
A2	0.20 REF			0.0079 REF		
D	2.90	3.00	3.10	0.1142	0.1181	0.122
E	2.90	3.00	3.10	0.1142	0.1181	0.122
D1	1.45	1.55	1.65	0.0570	0.0610	0.0649
E1	2.40	2.50	2.60	0.0945	0.0984	0.1023
b	0.25	0.30	0.35	0.0098	0.0118	0.0138
b1	0.20 REF			0.0079 REF		
e	0.65 BSC			0.0256 BSC		
L	0.35	0.40	0.45	0.0138	0.0157	0.0177



## Packaging Information

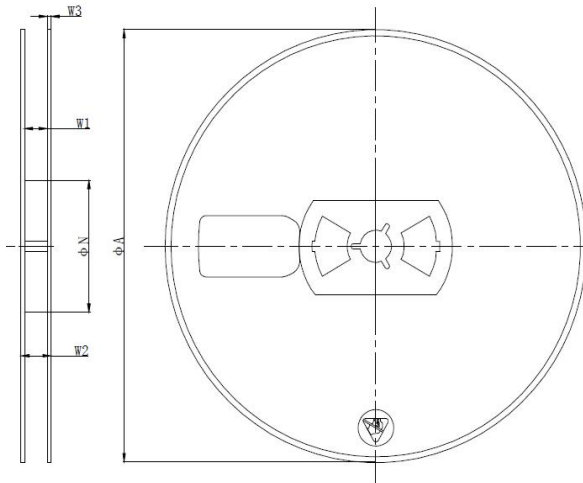


## SOT-23-5

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.10	1.45	0.037	0.043	0.057
A1	0.00	---	0.15	0.0000	---	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
c	0.08	0.15	0.25	0.003	0.006	0.010
L	0.30	0.45	0.60	0.012	0.018	0.024

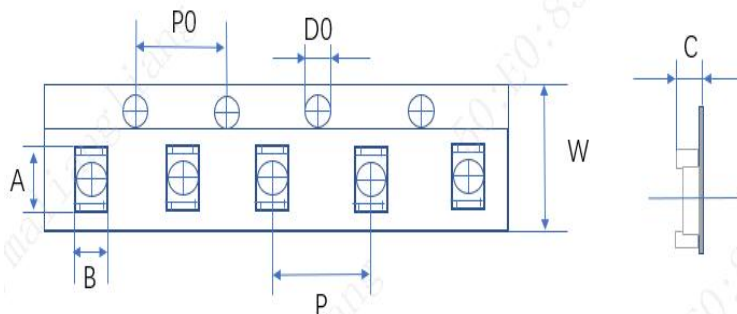
## Tape and Reel information (DFN3X3-8)

REEL DIMENSIONS ( Unit:mm )



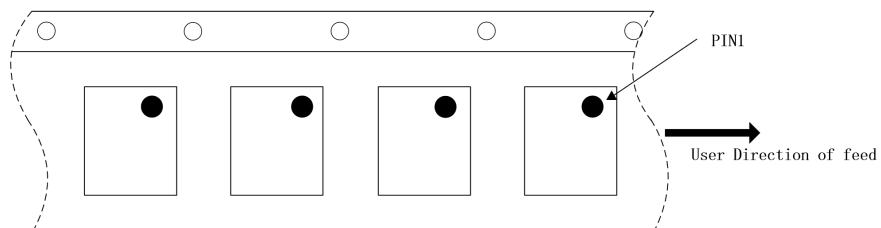
$\Phi A$	W2
329±2	16.4±2

TAPE DIMENSIONS ( Unit:mm )



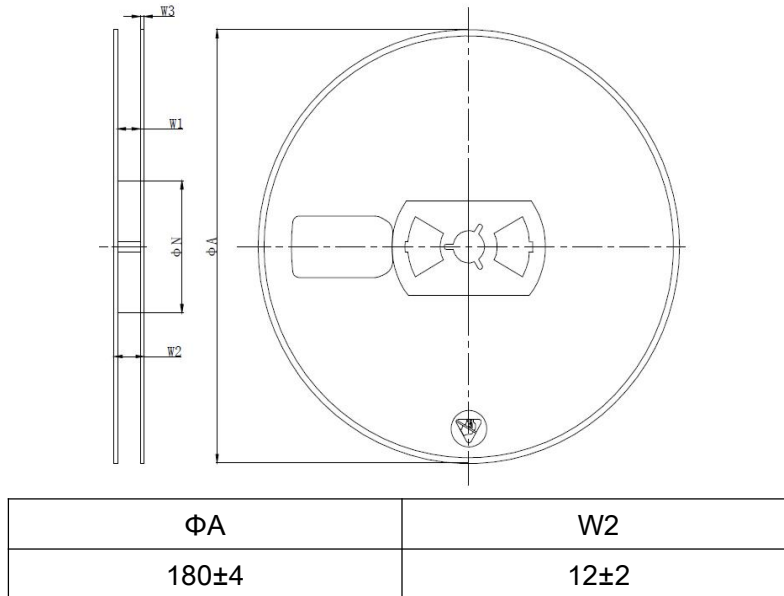
A	B	P0	P	D0	W	C
3.40±0.30	3.40±0.30	4.00±0.10	8.00±0.10	1.55±0.10	12.00±0.30	1.10±0.15

PIN1 AND TAPE FEEDING DIRECTION

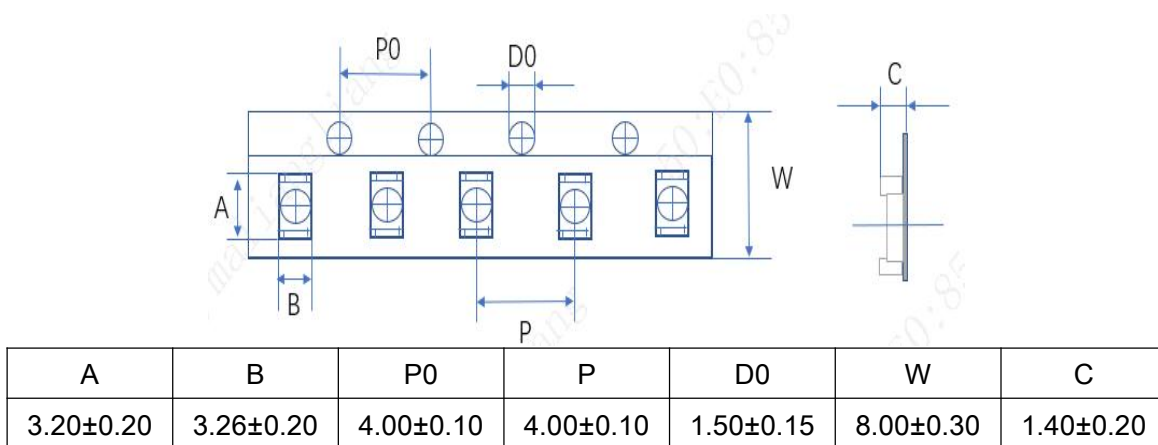


## Tape and Reel information (SOT-23-5)

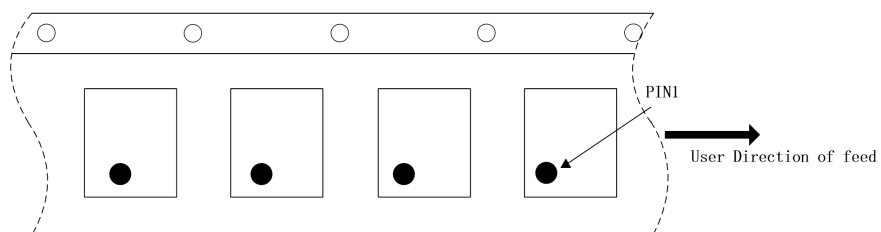
REEL DIMENSIONS ( Unit:mm )



TAPE DIMENSIONS ( Unit:mm )



PIN1 AND TAPE FEEDING DIRECTION



## Classification of IR Reflow Profile

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat/Soak</b>		
Temperature Min( $T_{SMIN}$ )	100°C	150°C
Temperature Max( $T_{SMAX}$ )	150°C	200°C
Time( $T_S$ ) from ( $T_{SMIN}$ to $T_{SMAX}$ )	60~120 seconds	60~120 seconds
Ramp-up rate ( $T_L$ to $T_P$ )	3°C/second max	3°C/second max
Liquidous temperature( $T_L$ )	183°C	217°C
Time( $t_L$ ) maintained above $T_L$	60~150 seconds	60~150 seconds
Peak package body temperature ( $T_P$ )	For users $T_P$ must not exceed the Classification temp in Table 1. For suppliers $T_P$ must equal or exceed the Classification temp in Table 1.	For users $T_P$ must not exceed the Classification temp in Table 2. For suppliers $T_P$ must equal or exceed the Classification temp in Table 2.
Time( $t_p$ )* within 5°C of the specified classification temperature( $T_C$ ), see Figure 1	20* seconds	30* seconds
Ramp-down rate ( $T_P$ to $T_L$ )	6°C/second max	6°C/second max
Time 25°C to peak temperature	6 minutes max	8 minutes max
* Tolerance for peak profile temperature ( $T_P$ ) is defined as a supplier minimum and a user maximum.		

**Table 1 Sn-Pb Eutectic Process - Classification Temperatures ( $T_C$ )**

Package Thickness	Volume mm <sup>3</sup>	
	<350	≥350
<2.5mm	235°C	220°C
≥2.5mm	220°C	220°C

Table 2 Pb-Free Process - Classification Temperatures ( $T_c$ )

Package Thickness	Volume $\text{mm}^3$ <350	Volume $\text{mm}^3$ 350~2000	Volume $\text{mm}^3$ $\geq 350$
<1.6mm	260°C	260°C	260°C
1.6mm~2.5mm	260°C	250°C	245°C
>2.5mm	250°C	245°C	245°C

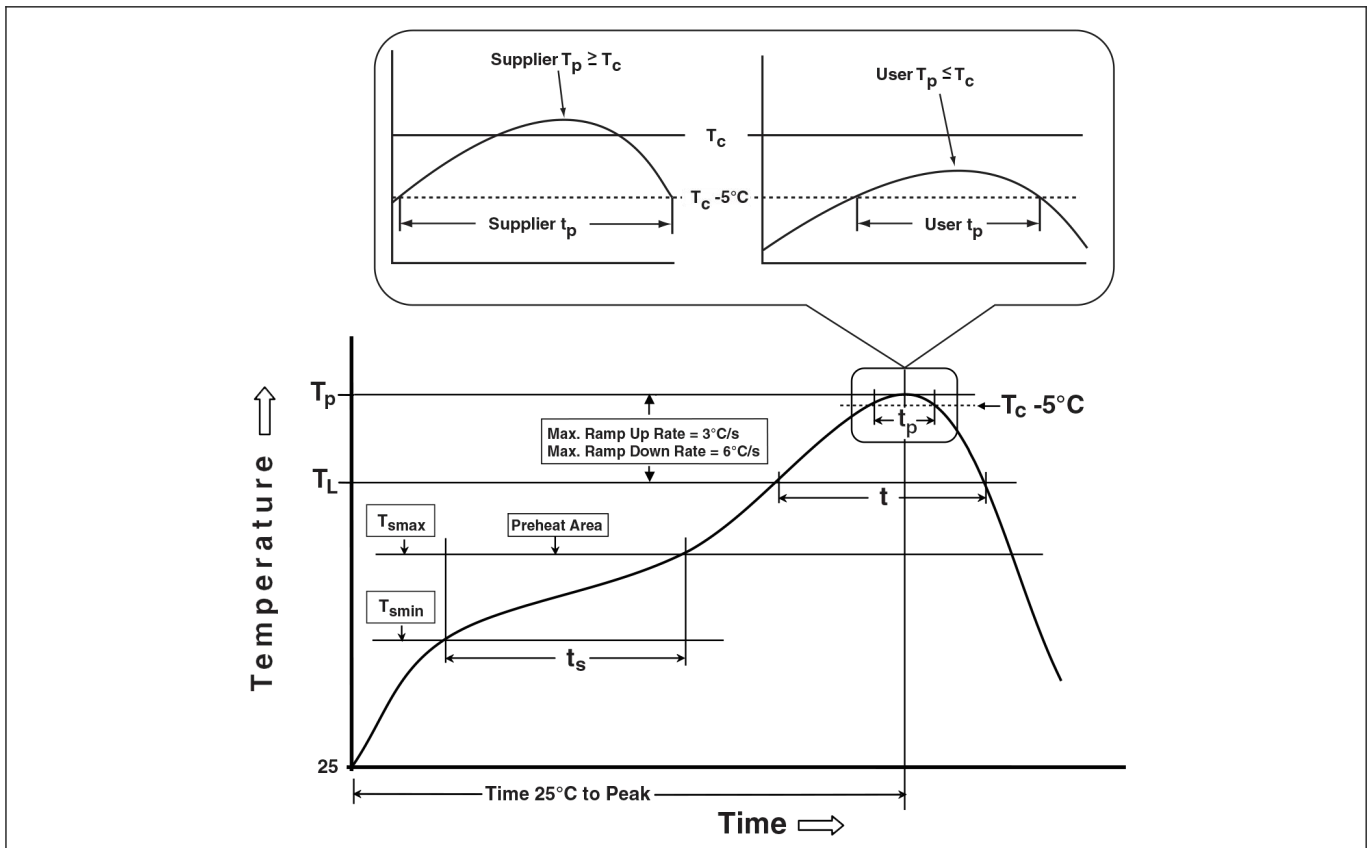


Figure1 Classification Profile (Not to scale)

Products conform to “JEDEC J-STD-020C” standards;

Products shipped conform to “Rohs” standards;

Moisture Sensitivity Level: MSL3 (CONDITION:  $\leq 30^\circ\text{C}/60\%RH$ 、Time control:168 hours)