

AC1299A2 Datasheet

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Version: 1.0

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AC1299A2 Features

CPU

- 32bit DSP
- Maximum speed 192MHz
- 8 Levels interrupt priority

Memory

- ROM
- Optional built-in flash memory

Clocks

- On-chip 16 MHz clock
- On-chip 200KHz lower-temperature-drift clock

DSP Audio Processing

- Multi-band EQ configuration for voice Effects

Audio Codec

- Two channels 16-bit DAC
SNR $\geq$ 98dB@730mVrms
- One channel 16-bit ADC
SNR $\geq$ 95dB@1Vrms
- Audio DAC Sampling rates of
8KHz/11.025KHz/16KHz/22.05KHz/24KHz/
32KHz/44.1KHz/48KHz/64KHz/88.2KHz/
96KHz are supported
- Audio ADC Sampling rates of
8KHz/11.025KHz/16KHz/22.05KHz/24KHz/
32KHz/44.1KHz/48KHz are supported
- Audio DAC support single-ended and
differential cap-less mode
- Support AMUX and ADC to DAC
- Support for driving 16 or 32 ohm Speaker

Peripherals

- One full speed USB OTG controller
- One SD host controller for MMC/SD
- Three multi-function 32-bit timers, support
capture and PWM mode
- UART controller supports DMA
- One IIC Master controller
- Two SPI Master / Slaver controller with DMA
- One QDEC interface
- 7-channel 10-bit general purpose ADC
- Two pairs MCPWM
- 7 Individually programmable and multiplexed
GPIO pins
- Digital peripheral crossbar
- Up to 7 external interrupt / wake-up source
(low power available, can be multiplexed to
any I/O)

PMU

- VPWR range : 2.7V to 5.5V
- IOVDD range : 2.1V to 3.6V

Packages

- QFN16(3mm*3mm)

Temperature

- Operating temperature: -40°C to +85°C
- Storage temperature: -65°C to +150°C

Applications

- USB Headset

1 Block Diagram

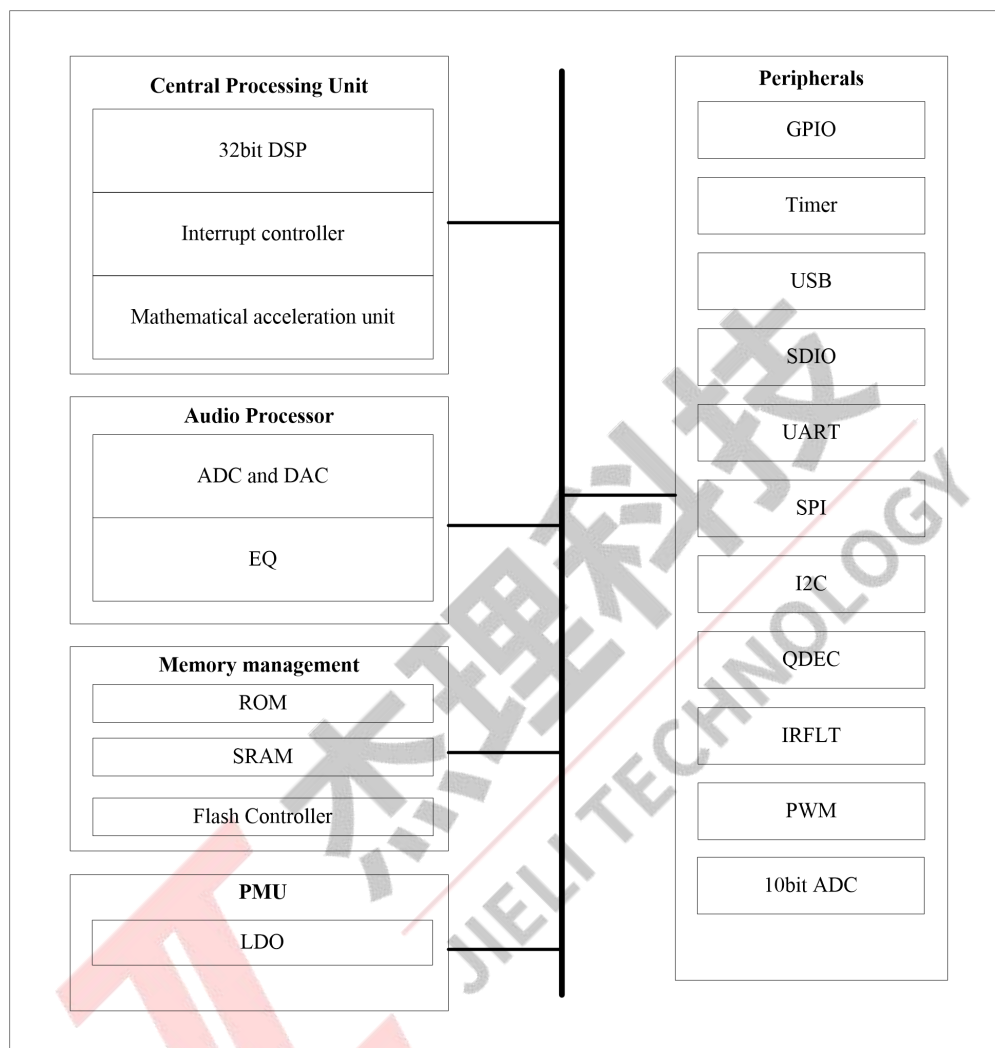


Figure 1-1 AC1299A Block Diagram

2 Pin Definition

2.1 Pin Assignment

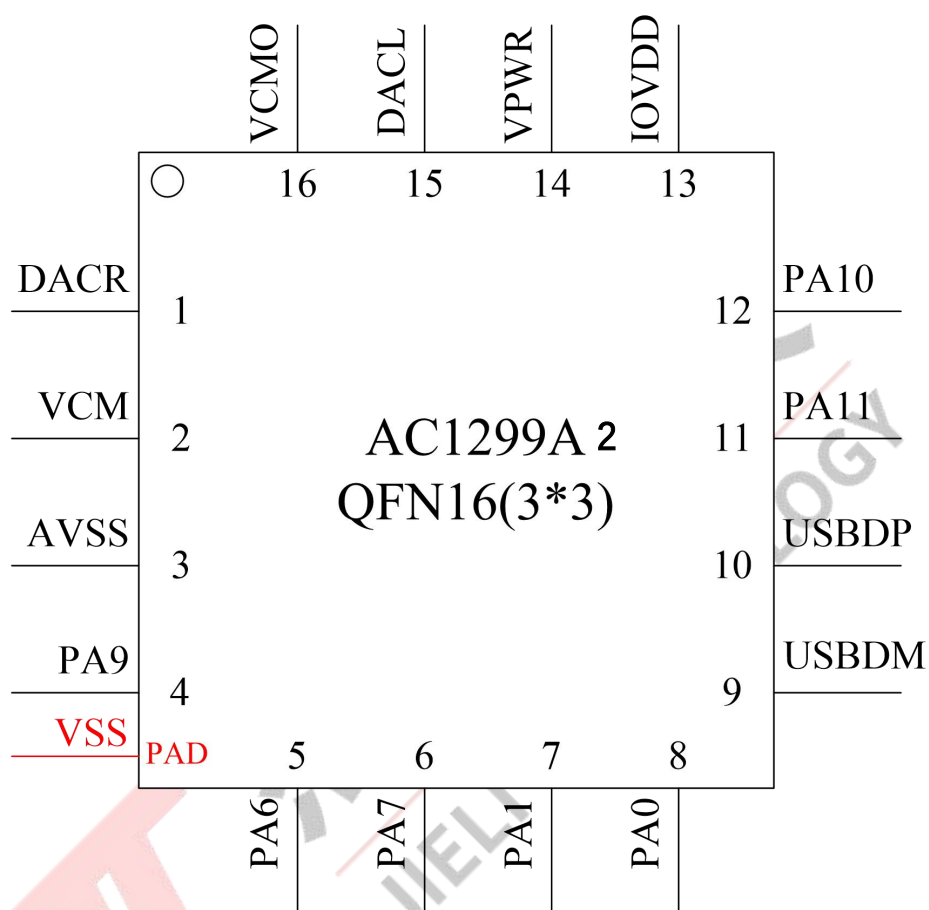


Figure 2-1 AC1299A Package Diagram

2.2 Pin Description

Table 2-1 AC1299A Pin Description

PIN NO.	Name	Type	Function	Other Function
1	DACR	AO		Right channel audio output;
2	VCM	P		Audio analog reference bias;
3	AVSS	G		Audio ground;
4	PA9	I/O	GPIO	ADC9:ADC Input Channel 9; MICLDO:MIC linear voltage regulator output; MIC_BIAS:MIC Bias Output(Built-in resistor);
5	PA6	I/O	GPIO	ADC6:ADC Input Channel 6; AIN_N:Different MIC Negative; AUX2:Analog input Channel 2;
6	PA7	I/O	GPIO	ADC7:ADC Input Channel 7; MICIN:MIC Input Channe; AUX1:Analog input Channel 1;
7	PA1	I/O	GPIO (pull up)	Long press reset; MCLR; ADC1:ADC Input Channel 1;
8	PA0	I/O	GPIO	ADC0:ADC Input Channel 0;
9	UDBDM	I/O	USB Negative Data (pull down)	ADC15:ADC Input Channel 15;
10	USBDP	I/O	USB Positive Data (pull down)	ADC14:ADC Input Channel 14;
11	PA11	I/O	GPIO	ADC11:ADC Input Channel 11;
12	PA10	I/O	GPIO	ADC10:ADC Input Channel 10; LVD:Low Voltage Detect;
13	IOVDD	PO	Power supply for GPIO	Built-in linear voltage regulator output;
14	VPWR	PI		Power supply input;
15	DACL	AO		Left channel audio output;
16	VCMO	AO		Reference output of the audio;
PAD	VSS	G		System ground;

Pin Type	Description	Pin Type	Description
P	Power	I/O	Input or Output
PI	Power Input	I	Input
PO	Power Output	O	Output
AO	Analog Output	G	Ground

CROSSBAR						
SPI1	SDC	IIC	Q-decoder	UART0	UART1	MCPWM
SPI1_CLK	SD_CLK	IIC_CLK	Q-decoder 0	UART0_TX	UART1_TX	PWMCH0H
SPI1_DI	SD_CMD	IIC_DAT	Q-decoder 1	UART0_RX	UART1_RX	PWMCH0L
SPI1_D0	SD_DAT				UART1_CTS	PWMCH1H
SPI1_DAT2					UART1_RTS	PWMCH1L
SPI1_DAT3						M_TMR0CK
						M_TMR1CK

Input Channel x8			Output Channel x8	
Timer0	CAP0	IRFLT	PWM0	CLK_OUT0
Timer1	CAP1		PWM1	CLK_OUT1
Timer2	CAP2		PWM2	CLK_OUT2
				CLK_OUT3

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3-1

Symbol	Parameter	Min	Max	Unit
T _{opt}	Operating temperature	-40	+85	°C
T _{stg}	Storage temperature	-65	+150	°C
VPWR	Power supply input	-0.3	6.0	V
V _{IOVDD}	Voltage applied at IOVDD	-0.3	3.6	V
V _{GPIO}	Voltage applied to GPIO	-0.3	IOVDD+0.3	V

Note : The chip can be damaged by any stress in excess of the absolute maximum ratings listed below

3.2 ESD Protectio

Table 3-2

Parameter	Typ.	Test pin	Reference standard
Human Body Mode	±4KV	All pins	JEDEC EIA/JESD22-A114
Machine Mode	±200V	All pins	JEDEC EIA/JESD22-A115
Charge Device Model	±2KV	All pins	JEDEC EIA/JESD22-C101F
Latch up	±200mA	All GPIO pins	JEDEC STANDARD NO.78E
	1.5xV _{opmax}	All power pins	

Note : 1.5xV_{opmax} = 1.5 times maximum operating voltage.

3.3 PMU Characteristics

Table 3-3

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VPWR	Charger supply Voltage	2.7	5.0	5.5	V	—
IOVDD	Voltage output	2.1	3.0	3.6	V	VPWR = 4.2V, 10mA loading
	Loading current	—	—	100	mA	IOVDD=3.3V@VPWR = 3.6V
V _{LVD}	Voltage input	1.8	2.5	2.5	V	Low-Voltage Detection of IOVDD

3.4 IO Input/Output Electrical Logical Characteristics

Table 3-4

GPIO input characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V_{IL}	Low-Level Input Voltage	-0.3	—	$0.3 \cdot IOVDD$	V	$IOVDD = 3.0V$
V_{IH}	High-Level Input Voltage	$0.7 \cdot IOVDD$	—	$IOVDD + 0.3$	V	$IOVDD = 3.0V$
GPIO output characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V_{OL}	Low-Level Input Voltage	—	—	$0.1 \cdot IOVDD$	V	$IOVDD = 3.0V$
V_{OH}	High-Level Input Voltage	$0.9 \cdot IOVDD$	—	—	V	$IOVDD = 3.0V$

3.5 IO Output Drive Strength Pull Up/Down Characteristics

Table 3-5

Port	Drive Strength	Pull Up Resistance	Pull DownResistance	Test Conditions
PA0,PA1 PA6,PA7 PA9,PA10,PA11	00: 3mA 01: 9mA 10: 21mA 11: 50mA	10K/100K/1M	10K/100K/1M	$IOVDD = 3.3V$
DP	8mA	1.5K	15K	$IOVDD = 3.3V$
DM	8mA	180K	15K	$IOVDD = 3.3V$

Note1: precision of 10K/100K pull-up and pull-down resistor is $\pm 30\%$

Note2: precision of 1M pull-up and pull-down resistor is $\pm 50\%$

Note3: PA1 default pull up,USBDM and USBDP default pull down

3.6 Audio DAC Characteristics

Table 3-6

Parameter	Loading	Min	Typ	Max	Unit	Test Conditions
Frequency Response		20	—	20K	Hz	VPWR=5.0V Fin=1KHz/0dB B/W=20Hz~20kHz A-Weighted Filter
Output Swing	10kohm	—	740	—	mVrms	
	32ohm	—	730	—	mVrms	
	16ohm	—	640	—	mVrms	
THD+N	10kohm	—	-77	—	dB	
	32ohm	—	-65	—	dB	
	16ohm	—	-65	—	dB	
S/N	10kohm	—	98	—	dB	
	32ohm	—	98	—	dB	
	16ohm	—	97	—	dB	
Dynamic Range	10kohm	—	92	—	dB	VPWR=5.0V Fin=1KHz/-60dB B/W=20Hz~20kHz A-Weighted Filter
	32ohm	—	92	—	dB	
	16ohm	—	91	—	dB	
Noise Floor	10kohm	—	10	—	uVrms	VPWR=5.0V A-Weighted Filter
	32ohm	—	10	—	uVrms	
	16ohm	—	10	—	uVrms	
Crosstalk	10kohm	—	-110	—	dB	VPWR=5.0V Fin=1KHz/0dB
	32ohm	—	-64	—	dB	
	16ohm	—	-60	—	dB	
Output Power	32ohm	—	16.5	—	mW	Fin=1KHz THD+N < 0.1%
	16ohm	—	25.5	—	mW	

3.7 Audio ADC Characteristics

Table 3-7

Parameter	MODE	Min	Typ	Max	Unit	Test Conditions
Dynamic Range	Differential	—	79@VCM cap	—	dB	Gain=28dB, Fsample=44.1KHz Fin=1KHz @64mVrms A-wt B/W=20Hz-20KHz
		—	75@VCM capless	—	dB	
	Single-ended	—	77@VCM cap	—	dB	Gain=23dB, Fsample=44.1KHz Fin=1KHz @57mVrms A-wt B/W=20Hz-20KHz
		—	72@VCM capless	—	dB	
S/N	Differential	—	78@VCM cap	—	dB	Gain=28dB, Fsample=44.1KHz Fin=1KHz @64mVrms A-wt B/W=20Hz-20KHz
		—	73@VCM capless	—	dB	
	Single-ended	—	76@VCM cap	—	dB	Gain=23dB, Fsample=44.1KHz Fin=1KHz @57mVrms A-wt B/W=20Hz-20KHz
		—	71@VCM capless	—	dB	
THD+N	Differential	—	-69@VCM cap	—	dB	Gain=28dB, Fsample=44.1KHz Fin=1KHz @64mVrms A-wt B/W=20Hz-20KHz
		—	-67@VCM capless	—	dB	
	Single-ended	—	-73@VCM cap	—	dB	Gain=23dB, Fsample=44.1KHz Fin=1KHz @57mVrms A-wt B/W=20Hz-20KHz
		—	-68@VCM capless	—	dB	

4 Package Information

4.1 QFN16_3×3mm

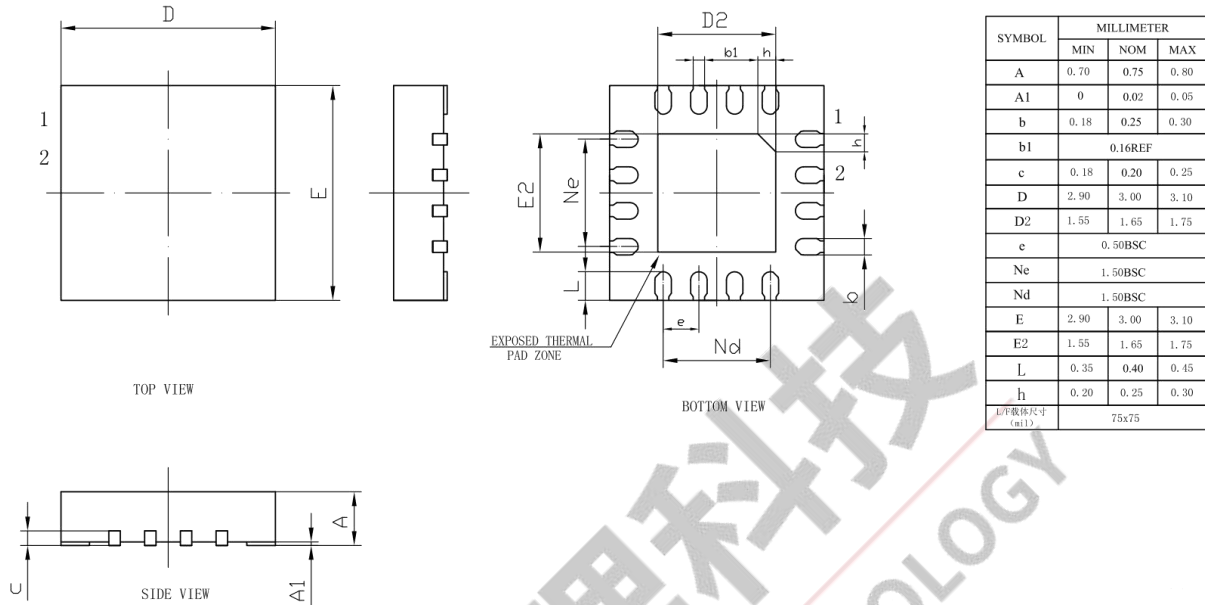
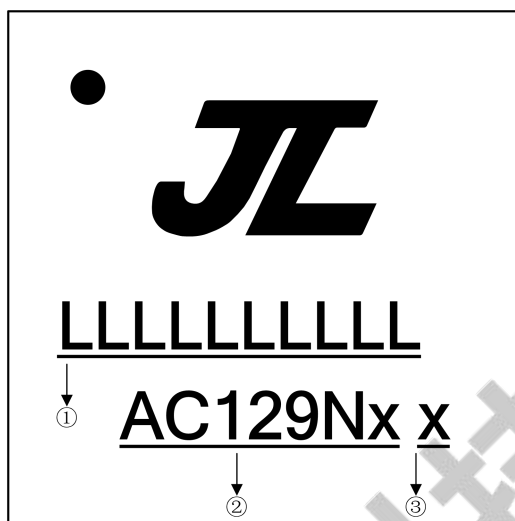


Figure 4-1 AC1299A Package

5 IC Marking Information



① LLLLLLLLLL : Production Batch

② AC129Nx : Chip Model

③ Built-in flash size

0: No Flash Memory

2: 2Mbit Flash

4: 4Mbit Flash

8: 8Mbit Flash

6: 16Mbit Flash

3: 32Mbit Flash

6 Solder-Reflow Condition

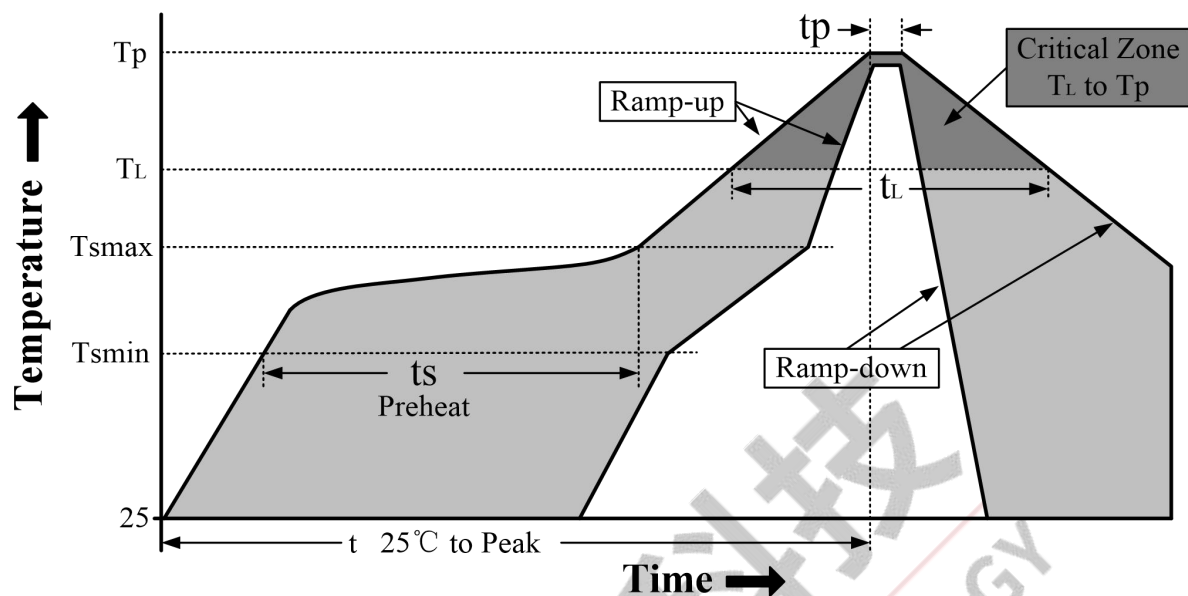


Figure 6-1 Classification Reflow Profile

Classification Profiles

Table 6-1

Profile Feature		Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/ Soak	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	60-180 seconds
Average ramp-up rate (T_{smax} 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)		See Table 6-2.	See Table 6-3.
Time within 5°C of actual Peak Temperature (t_p)		10-30 seconds	20-40 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.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.

Note 2: Time within 5°C of actual peak temperature (t_p) specified for the reflow profiles is a “supplier” minimum and “user” maximum.

SnPb - Classification Temperature

Table 6-2

Package Thickness	Volume mm ³ < 350	Volume mm ³ ≥ 350
<2.5 mm	240 +0/-5 °C	225 +0/-5 °C
≥ 2.5 mm	225 +0/-5 °C	225 +0/-5 °C

Pb-free - Classification Temperature **Table 6-3**

Package Thickness	Volume mm ³ < 350	Volume mm ³ 350 - 2000	Volume mm ³ > 2000
< 1.6mm	260 °C	260 °C	260 °C
1.6 mm - 2.5mm	260 °C	250 °C	245 °C
> 2.5mm	250 °C	245 °C	245 °C

7 Storage Condition

7.1 Moisture Sensitivity Level

AC1299A is qualified to moisture sensitivity level MSL3 in accordance with JEDEC J-STD-033.

7.2 Storage Alert

1. Calculated shelf life in sealed bag 12 months at $\leq 40^{\circ}\text{C}$ and 90% relative humidity (RH).
 2. Peak package body temperature $\leq 260^{\circ}\text{C}$.
 3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be mounted within 168 hours of factory conditions $\leq 30^{\circ}\text{C}/60\%\text{RH}$ or stored per J-STD-033.
 4. Devices require bake before mounting if humidity indicator card reads $> 10\%$ for level 2a-5a devices or $> 60\%$ for level 2 devices when read at $23 \pm 5^{\circ}\text{C}$, or 3a or 3b are not met.
- Please refer to IPC/JEDEC J-STD-033 for baking procedure if necessary.

8 Revision History

Date	Revision	Description
2023.11.27	V1.0	Initial Release.

