

## 10MHz, Low noise, Excellent EMI Immunity, Rail-to-rail I/O, Operational Amplifiers

### ■ FEATURES ( $V^+ = 5V$ , Typical value)

- Wide Gain Bandwidth 10MHz
- Low Noise  $8nV/\sqrt{Hz}$  ( $f = 10kHz$ )
- Enhanced C-Drive™
  - 1000pF High Capacitive Load Drive
  - Maintains GBW 10MHz under High Capacitive Load
- Input Offset Voltage Drift  $0.7\mu V/^\circ C$
- Integrated EMI filter EMIRR = TBDdB ( $f = 1.8GHz$ )
- Input Tolerant
- High Slew Rate  $5V/\mu s$
- Rail-to-Rail Input and Output
- Unity-Gain stable
- Supply Voltage 2.7V to 5.5V
- Input Offset Voltage 4mV max.
- Input Bias Current 1pA
- Supply Current 1.1mA / ch
- Packages MSOP8 (VSP8)

### ■ APPLICATIONS

- Sensor Signal Conditioning
- High-Speed Cable Drivers
- Multi-Pole Active Filters
- Security
- Scanners
- Photodiode Amplifier
- ADC front ends

### ■ DESCRIPTION

The NJU77572 is a dual rail-to-rail input and output single supply OpAmp featuring wide bandwidth and low noise. The combination of very low noise ( $8nV/\sqrt{Hz}$  at 10kHz), high-gain bandwidth (10MHz), and fast slew rate ( $5V/\mu s$ ) make the devices ideal for a wide variety of applications, including signal conditioning and sensor amplification requiring high gains.

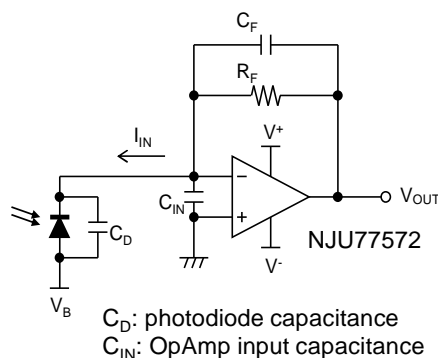
Low input bias current, low noise and low offset voltage drift of  $0.7\mu V/^\circ C$  performances are also excellent for filters, integrators, photodiode amplifiers, and high impedance sensors. The ability of rail-to-rail input and output enables the designers to buffer ADC, DAC, and other wide output swing devices in single-supply systems.

The Enhanced C-Drive™ of NJU77572 can directly drive a 1000pF capacitive load, and can output an AC signal with little distortion even with a large capacitive load by suppressing the decrease in GBW. This feature is ideal for high-speed signal cable drivers and high-speed active filter circuits that are sensitive to wiring capacitance.

NJU77572 includes integrated EMI filter to reduce malfunctions caused by RF noises from mobile phones and other wireless devices. And the input tolerant that allows the input voltage (Recommended:  $V^+ + 5.5V$ ) that exceed positive supply voltage is ideal for design for robust industrial applications.

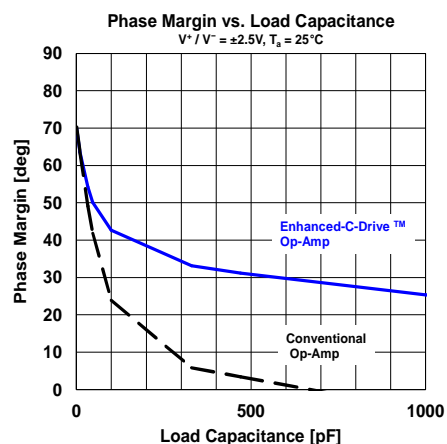
NJU77572 operates from supply range of 2.7V to 5.5V over the  $-55^\circ C$  to  $125^\circ C$  extended industrial temperature range. The NJU77572 is available in 8-pin SOP8, MSOP (VSP): meet JEDEC MO-187-DA type package.

### ■ TYPICAL APPLICATION



Transimpedance amplifier

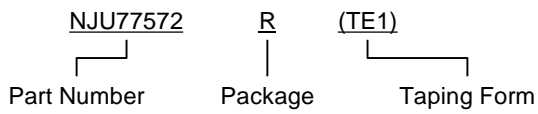
### 1000pF Capacitive Load Drive



## ■ PIN CONFIGURATION

PRODUCT NAME	NJU77572R
Package	MSOP8 (VSP8)
Pin Functions	<p>(Top View)</p> <p>1 A OUTPUT      8 V<sup>+</sup></p> <p>2 A -INPUT      7 B OUTPUT</p> <p>3 A +INPUT      6 B -INPUT</p> <p>4 V<sup>-</sup>              5 B +INPUT</p>

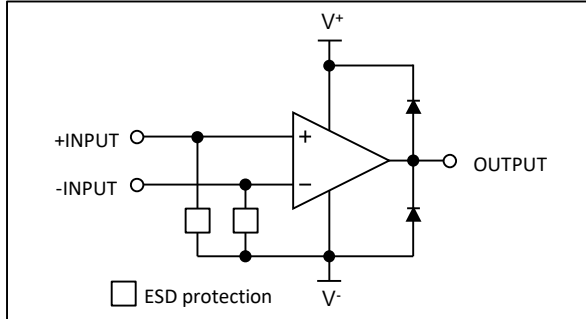
## ■ PRODUCT NAME INFORMATION



## ■ ORDERING INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJU77572R (TE1)	MSOP8 (VSP8)	Yes	Yes	Sn2Bi	77572	21	2000

## ■ BLOCK DIAGRAM



### ■ ABSOLUTE MAXIMUM RATINGS

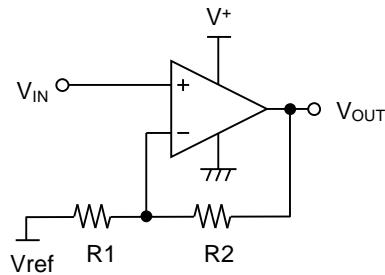
PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V^+ - V^-$	7	V
Input Voltage <sup>(1)</sup>	$V_{IN}$	$V^- - 0.3$ to $V^+ + 7$	V
Input Current <sup>(1)</sup>	$I_{IN}$	10	mA
Output Terminal Input Voltage <sup>(2)</sup>	$V_O$	$V^- - 0.3$ to $V^+ + 0.3$	V
Differential Input Voltage <sup>(3)</sup>	$V_{ID}$	$\pm 7$	V
Output Short-Circuit Duration <sup>(4)</sup>		Continuous	
Power Dissipation ( $T_a = 25^\circ\text{C}$ ) MSOP8 (VSP8)	$P_D$	2-Layer / 4-Layer <sup>(5)</sup> 500 / 660	mW
Storage Temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$
Junction Temperature	$T_J$	150	$^\circ\text{C}$

- (1) Input voltages below the negative supply voltage will be clamped by ESD protection diodes. If the input voltage lower than  $V^- - 0.3\text{V}$ , the current must be limited 10 mA or less by using a restriction resistance.
- (2) The output terminal input voltage is limited at 7V.
- (3) Differential voltage is the voltage difference between +INPUT and -INPUT.
- (4) Short-circuit can cause excessive heating and destructive dissipation.
- (5) 2-Layer: Mounted on glass epoxy board (76.2 mm x 114.3 mm x 1.6 mm: based on EIA/JEDEC standard, 2-Layer FR-4).  
4-Layer: Mounted on glass epoxy board (76.2 mm x 114.3 mm x 1.6 mm: based on EIA/JEDEC standard, 4-Layer FR-4), internal Cu area: 74.2 mm x 74.2 mm.

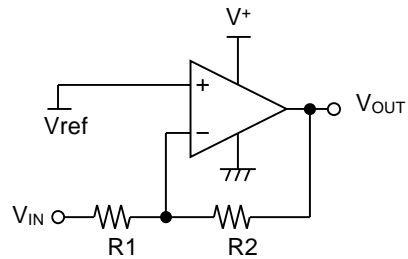
### ■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	VALUE	UNIT
Supply Voltage	$V^+ - V^-$		2.7 to 5.5	V
Input Voltage	$V_{IN}$	Closed-Loop	$V^- - 0.3$ to $V^- + 5.5$	V
Operating Temperature	$T_{opr}$		-55 to 125	$^\circ\text{C}$

### ■ TYPICAL APPLICATIONS



Non-inverting amplifier



Inverting amplifier

**■ ELECTRICAL CHARACTERISTICS**

 ( $V^+ = 2.7V$  to  $5.5V$ ,  $V^- = 0V$ ,  $R_L = 10k\Omega$  to  $V^+ / 2$ ,  $T_a = 25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>INPUT CHARACTERISTICS</b>						
Input Offset Voltage	$V_{IO}$	$V_{COM} = V^-$	-	0.6	4	mV
Input Bias Current	$I_B$		-	1	-	pA
Input Offset Current	$I_{IO}$		-	1	-	pA
Input Offset Voltage Drift	$\Delta V_{IO}/\Delta T$	$V_{COM} = 0V$	-	0.7	-	$\mu V/^\circ C$
Input Resistance	$R_{IC}$		-	TBD	-	G $\Omega$
Input Capacitance	$C_{IN}$		-	TBD	-	pF
Open-Loop Voltage Gain	$A_V$	$V^+ = 5.5V$ , $R_L = 10k\Omega$ , $V_O = V^- - 0.3V$ to $V^+ - 0.3V$	80	100	-	dB
Common-Mode Rejection Ratio	CMR	$V^+ = 5.5V$ , $V_{COM} = V^- - 0.2V$ to $V^+ - 2V$	65	85	-	dB
		$V^+ = 5.5V$ , $V_{COM} = V^- - 0.2V$ to $V^+ + 0.2V$ <sup>(7)</sup>	55	75	-	dB
Common-Mode Input Voltage Range	$V_{ICM}$	Guaranteed by CMR	$V^- - 0.2$	-	$V^+ + 0.2$ <sup>(7)</sup>	V
<b>OUTPUT CHARACTERISTICS</b>						
High-level Output Voltage	$V_{OH}$	$V^+ = 5.5V$ , $R_L = 10k\Omega$ to $V^+ / 2$	-	$V^+ - 0.005$	$V^+ - 0.050$	V
		$V^+ = 2.7V$ , $R_L = 10k\Omega$ to $V^+ / 2$	-	$V^+ - 0.002$	$V^+ - 0.050$	V
Low-level Output Voltage	$V_{OL}$	$V^+ = 5.5V$ , $R_L = 10k\Omega$ to $V^+ / 2$	-	7	50	mV
		$V^+ = 2.7V$ , $R_L = 10k\Omega$ to $V^+ / 2$	-	2	50	mV
Capacitive Load Drive	$C_L$		-	1000	-	pF
Output Impedance	$Z_O$	$V^+ = 5V$ , $f = 1MHz$	-	TBD	-	$\Omega$
Output Short-Circuit Current	$I_{SC}$	$V^+ = 5V$ , Source / Sink	-	TBD	-	mA
<b>POWER SUPPLY</b>						
Supply Current per Amplifier	$I_{SUPPLY}$	$V^+ = 5V$ , $V_{COM} = 0V$ , $V^+$	-	1.10	2.10	mA
		$V^+ = 2.7V$ , $V_{COM} = 0V$ , $V^+$	-	0.95	1.90	mA
Supply Voltage Rejection Ratio	SVR	$V^+ = 2.7$ to $5.5V$ , $V_{COM} = 0V$ , $V^+$	65	85	-	dB
<b>AC CHARACTERISTICS</b> ( $V^+ = 5V$ , $V_{COM} = V^+ / 2$ )						
Slew Rate	SR	$C_L = 50pF$ , $V_{IN} = 4V_{PP}$ , Gain = 1	-	5	-	V/ $\mu s$
Gain Bandwidth Product	GBW	$C_L = 50pF$	-	10	-	MHz
Settling Time 0.1%	$t_s$	$C_L = 50pF$ , $V_{IN} = 4V_{PP}$ , Gain = 1	-	TBD	-	$\mu s$
Phase Margin	$\Phi_M$	$C_L = 10pF$	-	60	-	Deg
		$C_L = 50pF$	-	45	-	Deg
Total Harmonic Distortion + Noise	THD+N	$f = 1kHz$ , $V_O = 1.5V_{rms}$	-	TBD	-	%
		$V_{NI}$	$f = 0.1Hz$ to $10Hz$	-	TBD	-
Equivalent Input Noise Voltage	$e_n$	$f = 1kHz$	-	9	-	nV/ $\sqrt{Hz}$
		$f = 10kHz$	-	8	-	nV/ $\sqrt{Hz}$
Channel Separation	CS	NJU77572, $f = 1kHz$	-	TBD	-	dB

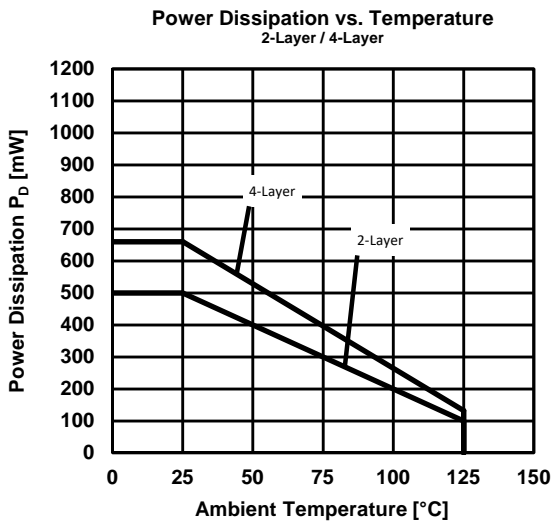
 (7)  $V^+ + 0.2V$  value is limited at  $5.5V$ .

## ■ THERMAL CHARACTERISTICS

PACKAGE	SYMBOL	VALUE	UNIT
Junction-to-Ambient Thermal Resistance MSOP8 (VSP8)	$\theta_{ja}$	2-Layer / 4-Layer <sup>(6)</sup> 250 / 189	°C/W
Junction-to-Top of Package Characterization Parameter MSOP8 (VSP8)	$\psi_{jt}$	2-Layer / 4-Layer <sup>(6)</sup> 62 / 53	°C/W

(6) 2-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 2-Layer FR-4).  
 4-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 4-Layer FR-4), internal Cu area: 74.2 mm × 74.2 mm.

## ■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

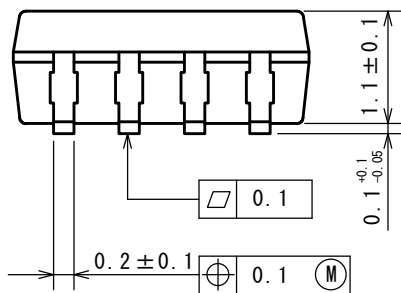
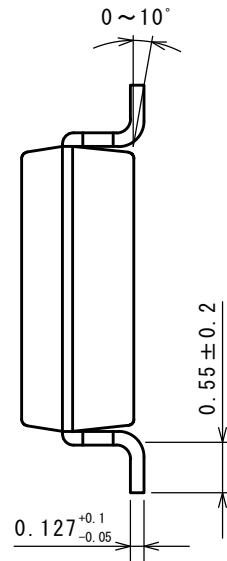
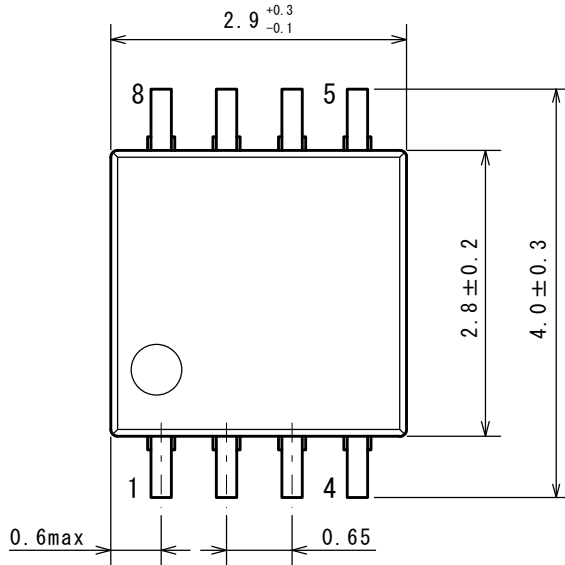


## MSOP8 (VSP8) JEDEC MO-187-DA

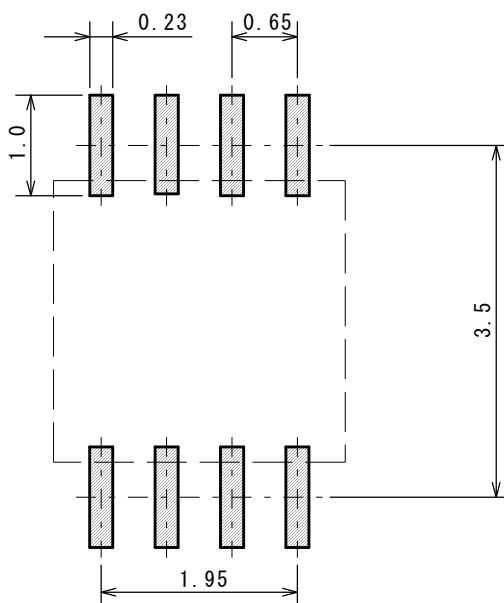
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

Unit: mm

### ■ PACKAGE DIMENSIONS



### ■ EXAMPLE OF SOLDER PADS DIMENSIONS



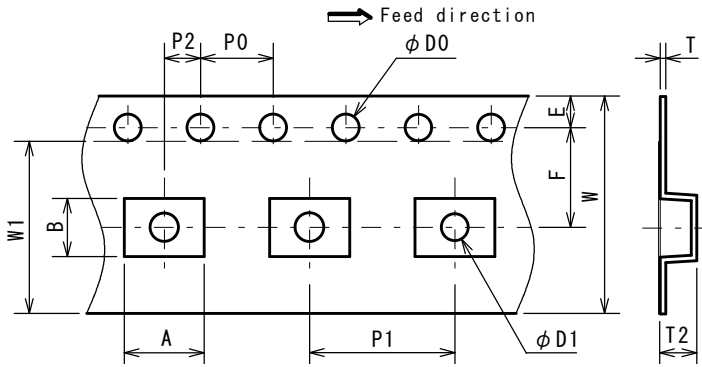
## MSOP8 (VSP8) MEET JEDEC MO-187-DA

PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

### PACKING SPEC

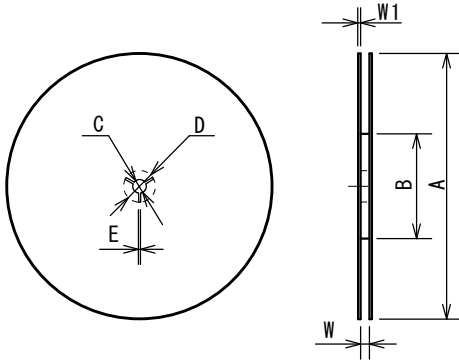
Unit: mm

#### TAPING DIMENSIONS



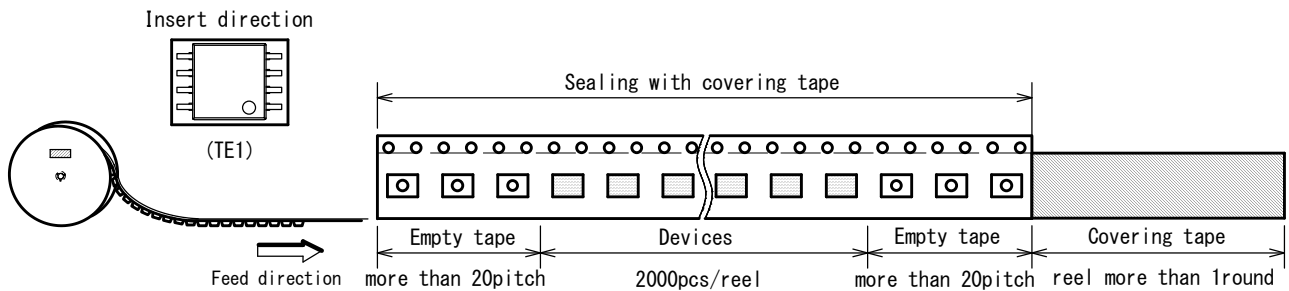
SYMBOL	DIMENSION	REMARKS
A	4.4	BOTTOM DIMENSION
B	3.2	BOTTOM DIMENSION
D0	1.5 <sup>+0.1</sup> <sub>0</sub>	
D1	1.5 <sup>+0.1</sup> <sub>0</sub>	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	2.0 (MAX.)	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

#### REEL DIMENSIONS

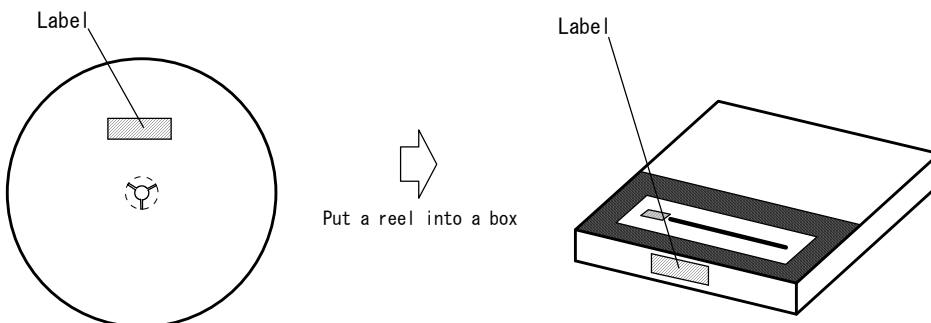


SYMBOL	DIMENSION
A	φ 254±2
B	φ 100±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

#### TAPING STATE

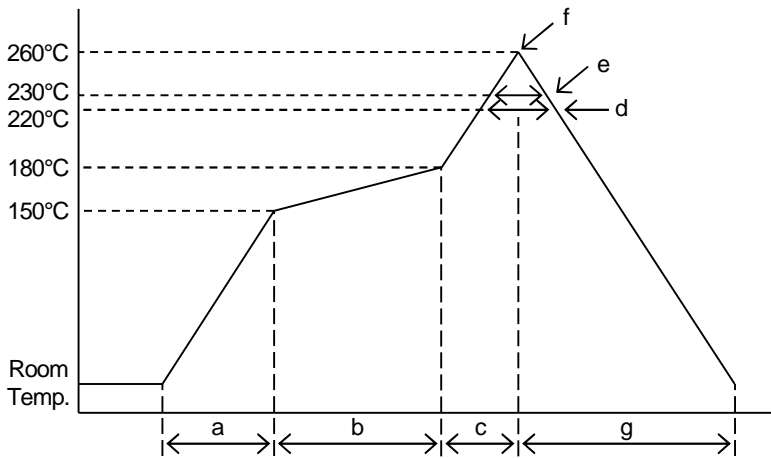


#### PACKING STATE



■ RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING PROFILE



a	Temperature ramping rate	1 to 4°C/s
b	Pre-heating temperature	150 to 180°C
	Pre-heating time	60 to 120s
c	Temperature ramp rate	1 to 4°C/s
d	220°C or higher time	shorter than 60s
e	230°C or higher time	shorter than 40s
f	Peak temperature	lower than 260°C
g	Temperature ramping rate	1 to 6°C/s

The temperature indicates at the surface of mold package.

■ REVISION HISTORY

DATE	REVISION	CHANGES
March 16, 2021	Ver.0.0	Initial Release
July 8, 2018	Ver.2.0	Updated Genrral Description



**PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE****[ CAUTION ]**

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