Low–Power, Single–Inductor, Buck–Boost, 2.6A DC–DC Voltage Regulator

General Description

IU5528D is an ultra-miniature, ultra-low-power, high-efficiency buck-boost integrated DC-DC regulator, suitable for application scenarios with two or three dry batteries or a single lithium battery, which can effectively extend the battery life. IU5528D is composed of modules such as a current-mode PWM control loop, error amplifier, comparator, and power switch. The chip can work efficiently and stably within a wide load range.

IU5528D has an input voltage of 1.8V to 5.0V and provides an adjustable output voltage of (1.2V to 5V). When the output voltage is 3.3V and the input ranges from 3.0V to 5.0V, it can provide a maximum load current of 2.6A. The output voltage of IU5528D can be set by adjusting two external resistors.

Features

- High Efficiency: Maximum Efficiency up to 95%.
- Current Output Capability:
  - 4.2V → 3.3V : 2.6A
  - 3.0V → 3.3V : 1.7A
  - 2.5V → 3.3V : 1.3A
  - 1.8V → 3.3V : 0.7A
  - 3.0V → 5.0V : 1.4A
  - 3.7V → 5.0V : 1.8A
- Low-power quiescent current: 8μA (MD=0V)
- Shutdown current: <0.1μA
- Input voltage range: 1.8~5V
- Adjustable output voltage range: 1.2~5V
- Switching frequency: 1.5MHz
- Reference voltage: 0.6V
- Soft start
- Low-voltage operation with up to 100% duty cycle
- Automatic switching between PWM/PSM and adjustable duty cycle to maintain high efficiency and low ripple over a wide load range

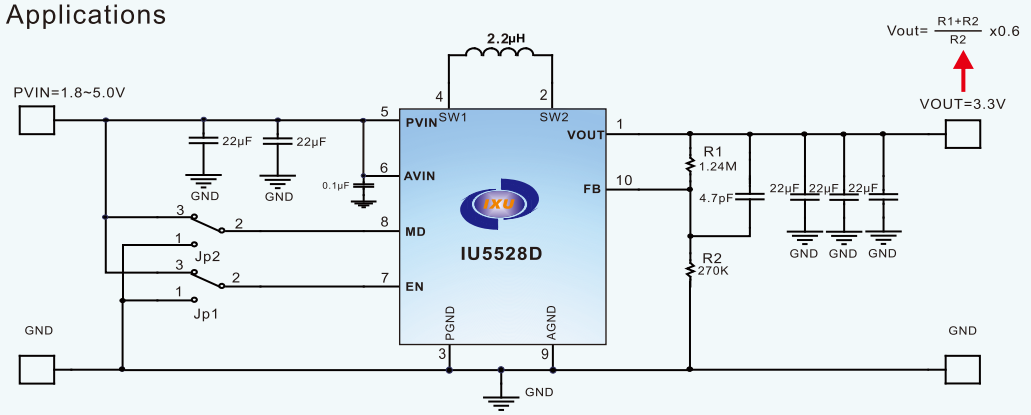
Applications

- Battery Products
- 4G/5G Modules
- AIOT, POS System

Package

- DFN3X3_10L

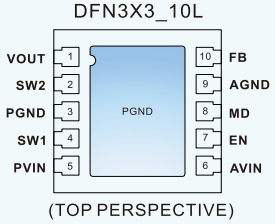
Typical Applications

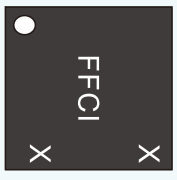


IU5528D Application Circuit

Note: The low-power mode can be entered only when MD=0V, and MD="1" is the forced PWM mode.

PIN Configuration and Functions

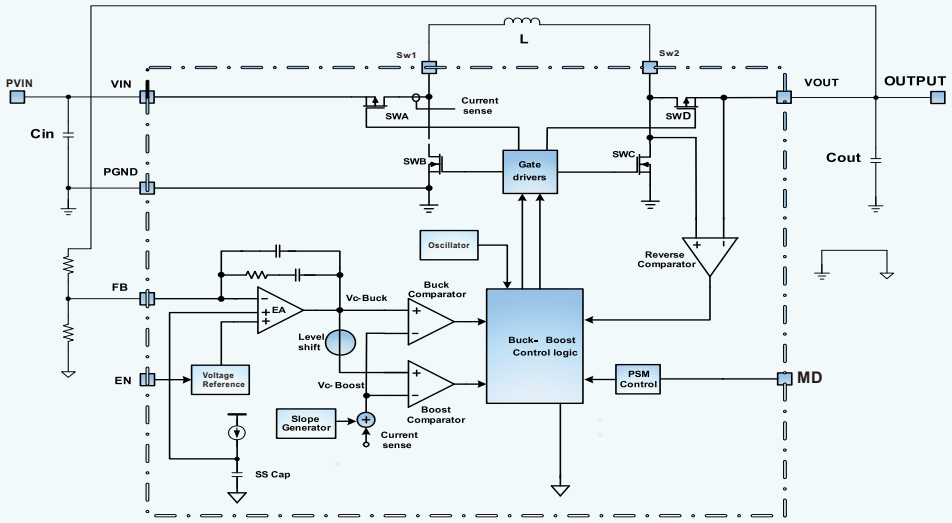




(TOP VIEW)

PIN	NAME	I/O	DESCRIPTION
1	VOUT	O	Output Voltage Port
2	SW2	O	Boost Inductor Port
3	PGND	-	Power Ground
4	SW1	O	Buck Inductor Port
5	PVIN	I	Input Voltage Port
6	AVIN	I	Analog Power Input
7	EN	I	Enable Control Terminal: The chip works at high level.
8	MD	I	Mode selection: high level for forced PWM mode, low level for PSM mode.
9	AGND	-	Analog Ground
10	FB	I	Output Voltage Feedback Terminal, V_{FB}=0.6V
11	PGND	-	Power Ground

Functional Block Diagram



Absolute Maximum Ratings [1]

SYMBOL	PARAMETER	VALUE	UNIT
VMAX	AVIN, PVIN, VOUT, EN, MD, VOUT, SW1, SW2	-0.3~6	V
T_J	Junction operating temperature range	-40~150	℃
T_{STG}	Storage temperature range	-55~150	℃
T_{SDR}	Lead temperature (Soldering, 10 sec.)	260	℃

Recommended Operating Conditions

SYMBOL	PARAMETER	VALUE	UNIT
VIN	Input voltage	1.8~5	V
T_J	Junction operating temperature range	-40~125	℃
T_A	Ambient temperature range	-40~85	℃

Thermal Information [2]

SYMBOL	PARAMETER	VALUE	UNIT
θ_{JA}	Package thermal resistance - chip to environment thermal resistance	50	℃/W

Ordering Information

Device	Package	Making	Reel Size	Tape Width	Quantity
IU5528D	DFN3X3_10L	FFCI XXXX	13”	12mm	3000 units

ESD Range

HBM (Human Body Model) ---------- ±2kV

MM (Machine model) ---------- ±200V

1. The above parameters are only the limit values of device operation. It is not recommended that the working conditions of the device exceed the limit values. Otherwise, the reliability and life of the device will be affected, and even permanent damage will be caused.
2. Where the PCB board is placed in IU5528D, a heat dissipation design is needed. The heat sink at the bottom of IU5528D is connected with the heat sink area of PCB board.

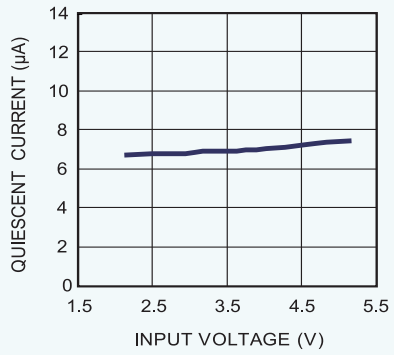
Electrical Characteristics (V_{IN}=4V , C_{IN}=22uF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage	VOUT	-	1.2		5	V
Input voltage	PVIN	-	1.8	-	5	
FB voltage	VFB	MD="1"	588	600	612	mV
Input under-voltage protection	UVLO_R	-	-	1.6		V
Under-voltage protection hysteresis	UVLO_HYS	-	-	200	-	mV
Shutdown current	IOFF	VEN<VENL	-	0.01	1	μA
Quiescent current	IQ	PVIN=3.6V, MD=0V	-	7	-	μA
Switching frequency	FS		1.35	1.5	1.65	MHz
Boost maximum duty cycle	DMAX	VFB=0V	85	-	-	%
HS On-Resistance	RDSON_H	PVIN=3.6V,IL=0.1A	-	60		mΩ
LS On-Resistance	RDSON_L	PVIN=3.6V,IL=0.1A		100		mΩ
Switching current	IL	PVIN=4.2V		3.6		A
Line regulation	VLINE	ILOAD=0.5A , PVIN=2.5~5.0V	-	0.4	-	%
Load regulation	VLOAD	PV_{IN}=3.6V ,VOUT=3.3V, Load from 10mA to 0.8A	-	0.4	-	%
EN, MD high level	VENH	PVIN=3.6V	1.1	-	-	V
EN, MD low level	VENL	PVIN=3.6V	-	-	0.6	V
Temperature protection	TSHD	PVIN=3.6V, ILOAD=10mA	-	150	-	℃
Temperature protection hysteresis	TSHD_HYS	PVIN=3.6V, ILOAD=10mA		20		℃

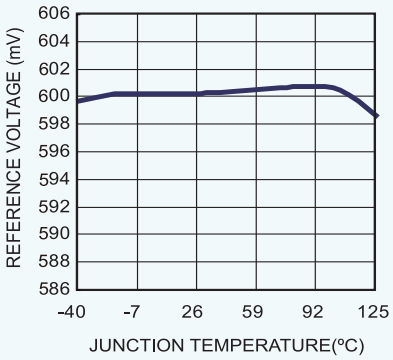
Typical Operating Characteristics

V_{IN}=3.3V,V_{OUT}=3.3V,L=4.7uH,C_{OUT}=3x22uF,T_A=25℃,unless otherwise noted.

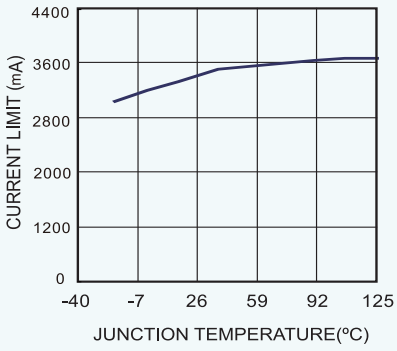
Quiescent Current
V_{FB}=0.6V



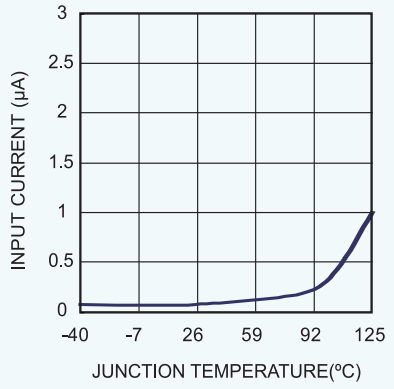
Referenve Voltage vs. Temperature



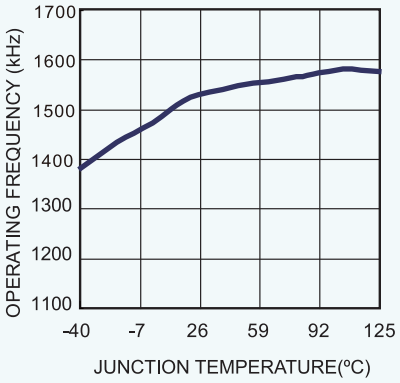
Primary Current Limit vs. Temperature



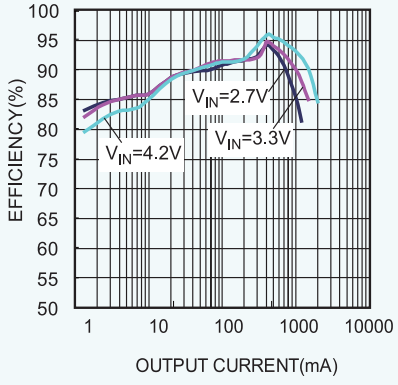
Disabled Supply Current vs. Temperature
V_{EN}=0V



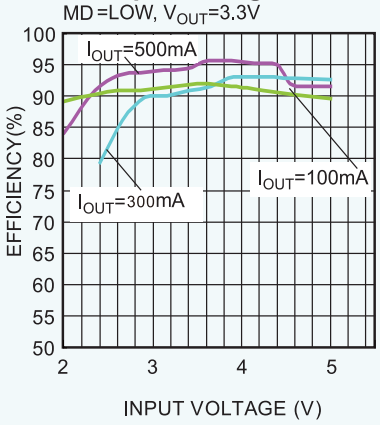
Frequency vs. Temperature
I_{OUT}=0A



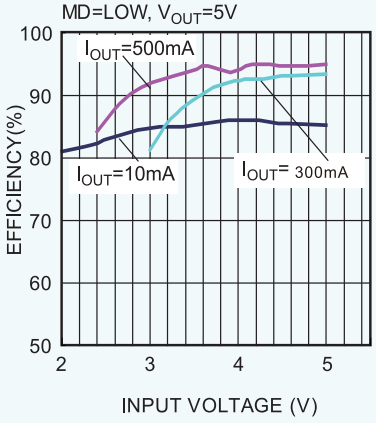
Efficiency vs. Output Current
MODE=LOW, V_{OUT}=3.3V



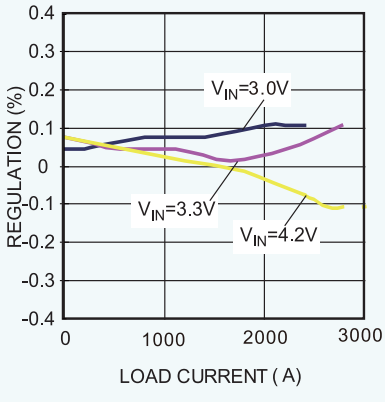
Efficiency vs. Input Voltage
MD =LOW, V_{OUT}=3.3V



Efficiency vs. Input Voltage
MD=LOW, V_{OUT}=5V



Load Regulation
MODE=HIGH

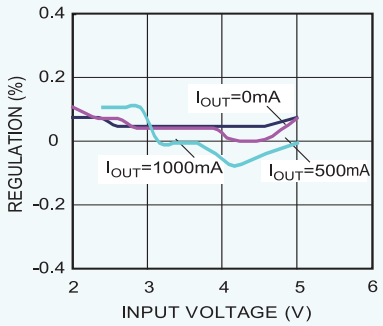


Typical Operating Characteristics

V_{IN}=3.3V,V_{OUT}=3.3V,L=4.7uH,C_{OUT}=3x22uF,T_A=25℃,unless otherwise noted.

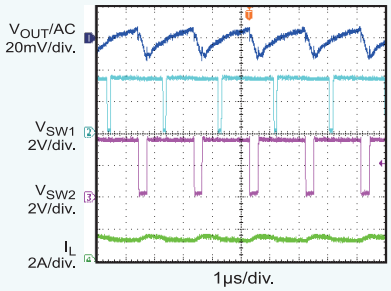
Line Regulation

MODE=HIGH



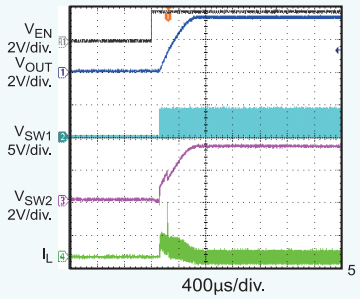
Steady State

V_{IN}=3.3V, I_{OUT}=0.3A , MODE=HIGH



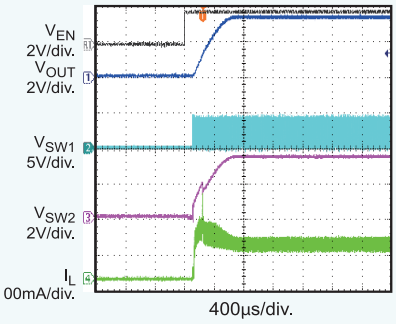
EN Start Up

V_{IN}=4.2V, I_{OUT}=0A, MODE=HIGH



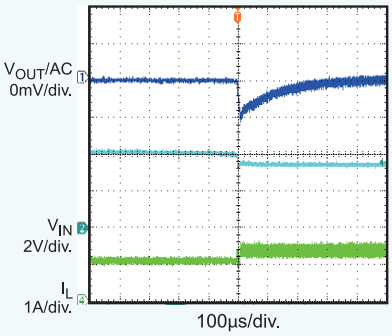
EN Start Up

V_{IN}=4.2V, I_{OUT}=0.5A, MODE=HIGH



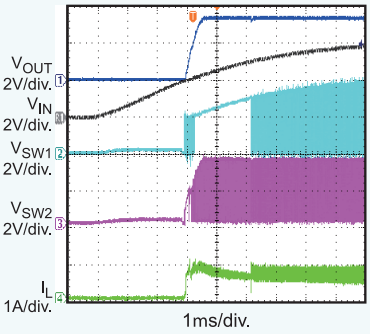
Line Transient Response

V_{IN}=4.2V-->3.3V, I_{OUT}=0.3A



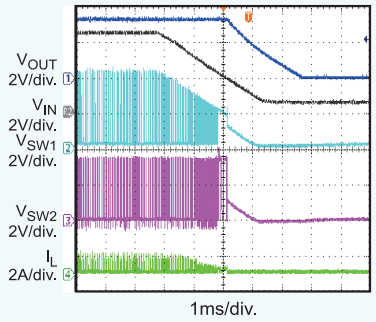
Power Up

V_{IN}=4.2V, I_{OUT}=0.5A, MODE=HIGH



Power Off

V_{IN}=4.2V, I_{OUT}=0.05A, MODE=LOW



IU5528D Application Points

- The Setting of Output Voltage

The output voltage value can be calculated by the following formula through the voltage division of external resistors at FB.

$$Vout = \frac{R1+R2}{R2} \times 0.6$$

To minimize the leakage current of the system, the values of R1 and R2 should be set above the hundred-kilohm level.

- Inductor Selection

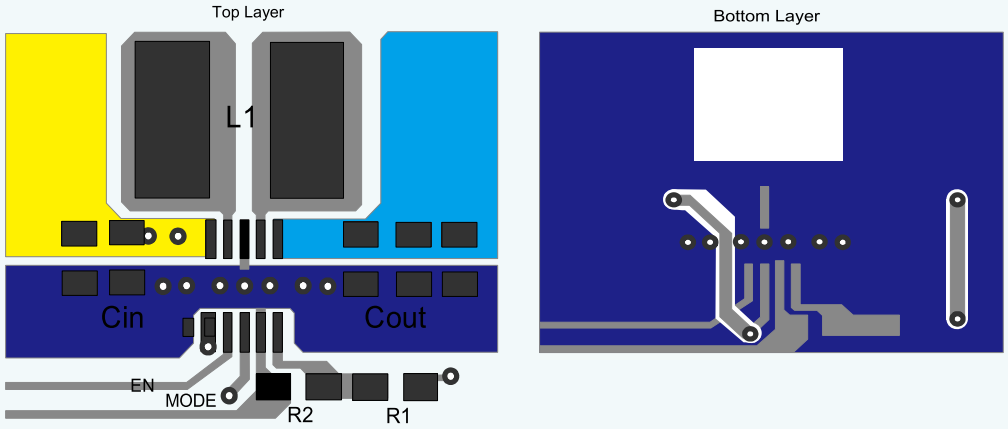
It is recommended to select the inductor value within the range of 2.2μH to 6.8μH. The inductor selection mainly considers a smaller DCR (DC resistance) to ensure high efficiency.

- Input and Output Capacitors

It is recommended to use two capacitors with a capacitance of more than 22μF for both input and output capacitors. To obtain smaller output ripple, it is suggested to use ceramic capacitors for the output.

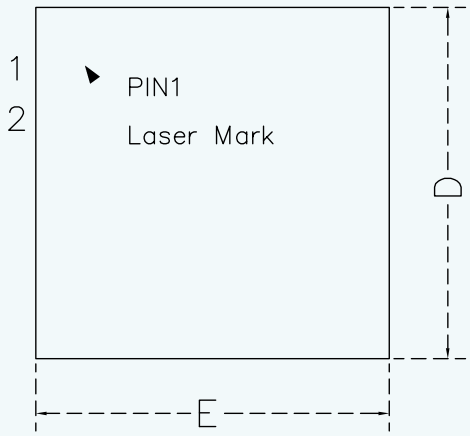
- PCB Layout

To achieve better performance, the main considerations for PCB layout are as follows:
（1）Input and output capacitors should be placed as close as possible to the chip pins.
（2）For the power path from PVIN to inductor L and then to VOUT, the traces should be as short and thick as possible.
（3）The L1 pin has high-frequency switching signals, so pay attention to isolating it from other components on the board.



Package Information

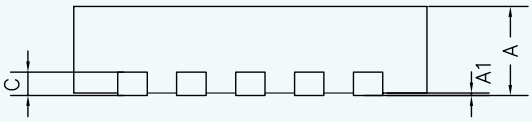
DFN10L(3X3X0.75-0.50)



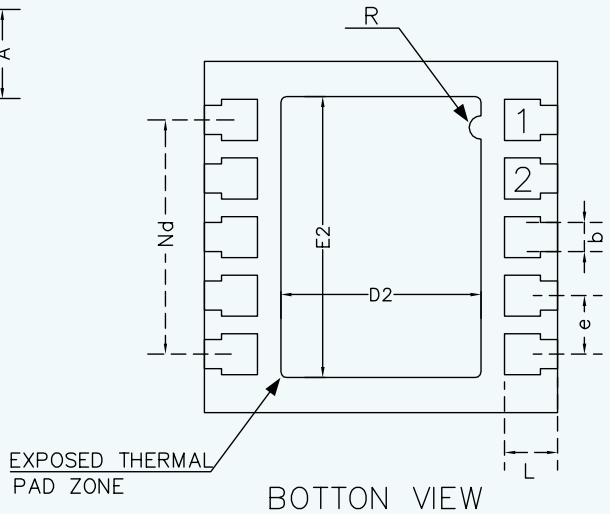
TOP VIEW

SYMBOL	MIN	NOM	MAX
A	0.7	0.75	0.8
A1	–	0.02	0.05
b	0.2	0.25	0.3
c	0.18	0.2	0.25
D	2.9	3.0	3.1
D2	1.6	1.7	1.8
e	0.5BSC		
Nd/Ne	2.0BSC		
E	2.9	3.0	3.1
E2	2.3	2.4	2.5
L	0.4	0.45	0.5
R	0.1		

NOTES:
1.All DIMENSIONS REFER TO JEDEC STANDARD MO-229 (VEED-4/WEED-4)
2.DIMENSION D DOES NOT INCLUDE MOLD FLASH
3.DIMENSION E1 DOSE NOT INCLUDE MOLD FLASH
4.FLASH OR PROTRUSION SHALL NOT EXCEED 0.25mm PER SIDE.



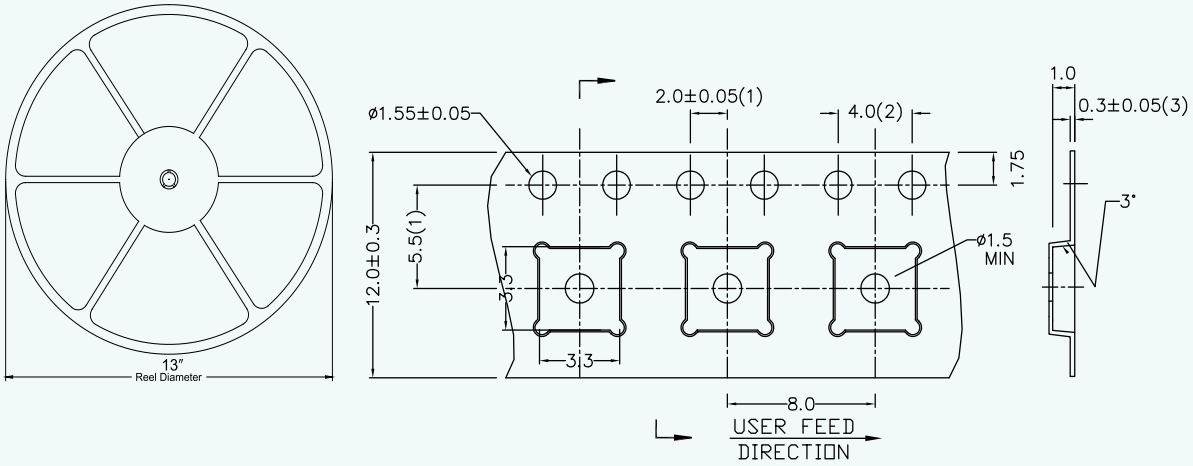
SIDE VIEW



BOTTON VIEW

TAPE AND REEL INFORMATION

REEL DIMENSIONS



Attention!
Electrostatic Sensitive Devices
Operating ESD Products
Protective Measures Shall Be Taken

Precautions for MOS Circuit Operation:

Static electricity can be generated in many places. The following precautions can effectively prevent MOS circuit from being damaged due to the sound of electrostatic discharge:

- Operators shall be grounded through anti-static wrist strap.
- The equipment enclosure must be grounded.
- Tools used during assembly must be grounded.
- Conductor packaging or anti-static materials must be used for packaging or transportation.

Declaration:
•Shanghai IXU Micro-electronics Co., Ltd. reserves the right to make changes to the manual without prior notice! Customers should obtain the latest version of the material before use and verify whether the relevant information is complete and up-to-date.
•Any semiconductor product has a certain possibility of failure or malfunction under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using products from Shanghai IXU Micro-electronics Co., Ltd. for system design and complete machine manufacturing, in order to avoid potential risks of failure that may cause personal injury or property damage!
•The pursuit of enhancing product quality is endless. Shanghai IXU Micro-electronics Co., Ltd. will wholeheartedly provide customers with even better products!