

Parameters Subject to Change Without Notice

DESCRIPTION

JW[®]1992M/A/B/C/D is a non-isolated constant current LED regulator with high current accuracy which applies to single stage step-down LED drivers. Operating in the boundary mode makes it high efficiency and low radiation. Patented algorithms ensure good current accuracy and excellent line/load regulations.

JW1992M/A/B/C/D is supplied from the line directly without auxiliary winding or external capacitor, which can lower the system BOM cost. With unique sampling techniques, JW1992M/A/B/C/D has multi-protection functions which can largely enhance the safety and reliability of the system, including LED short protection, LED open protection and over-temperature protection.

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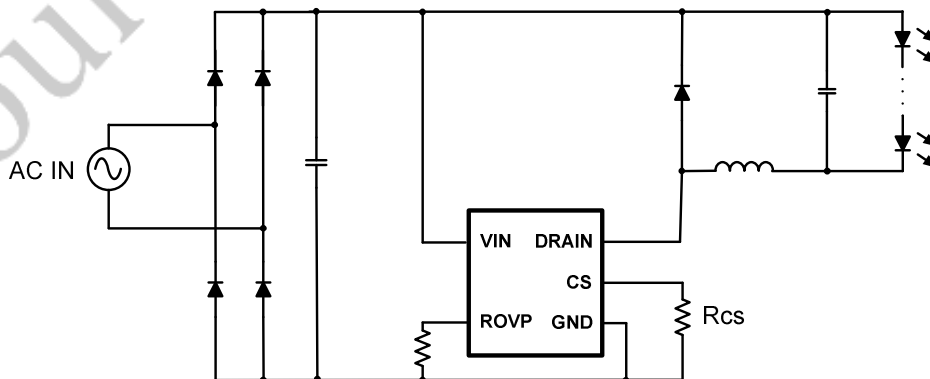
FEATURES

- No auxiliary winding
- Excellent line/load regulation
- Boundary mode operation
- High efficiency
- LED short protection
- LED open protection
- SOP7 and DIP7 packages

APPLICATIONS

- LED driver

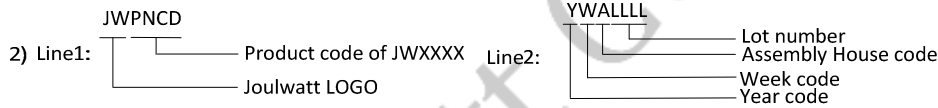
TYPICAL APPLICATION



ORDER INFORMATION

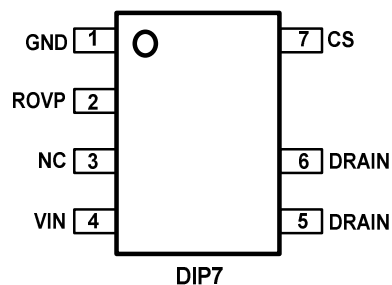
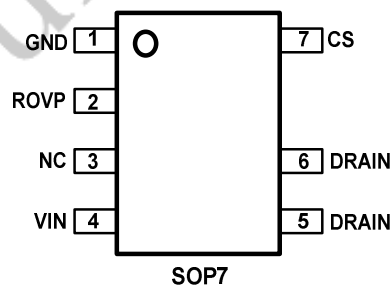
DEVICE ¹⁾	PACKAGE	TOP MARKING ²⁾
JW1992MSOPA#TRPBF	SOP7	JW1992M YWALLLL
JW1992ASOPA#TRPBF	SOP7	JW1992A YWALLLL
JW1992ADIPA#PBF	DIP7	JW1992A YWALLLL
JW1992BSOPA#TRPBF	SOP7	JW1992B YWALLLL
JW1992BDIPA#PBF	DIP7	JW1992B YWALLLL
JW1992CSOPA#TRPBF	SOP7	JW1992C YWALLLL
JW1992CDIPA#PBF	DIP7	JW1992C YWALLLL
JW1992DDIPA#PBF	DIP7	JW1992D YWALLLL

Note:



PIN CONFIGURATION

TOP VIEW



ABSOLUTE MAXIMUM RATING¹⁾

VIN Voltage 550V
 CS Voltage.....-0.3V to 8V
 ROVP Voltage.....-0.3V to 8V
 DRAIN Pin(JW1992M/A/B/C/D)500V
 Junction Temperature²⁾³⁾150°C
 Storage Temperature.....-65°C to +150°C

RECOMMENDED OPERATING CONDITIONS

VIN Voltage400V
 Operating Junction Temp.-25°C to 125°C

PN/Package	Limit Output Current (T _J =125°C) ⁵⁾	Recommended MAX Output Current (T _J =125°C) ⁵⁾
JW1992M/SOP7	<250mA	220mA
JW1992A/SOP7	<350mA	280mA
JW1992B/SOP7	<550mA	350mA
JW1992C/DIP7	<800mA	500mA
JW1992D/DIP7	<1000mA	600mA ⁶⁾

THERMAL PERFORMANCE⁴⁾

	θ_{JA}	θ_{JC}
SOP7.....	96...	45°C/W
DIP7.....	80...	45°C/W

Note:

- 1) Exceeding these ratings may damage the device.
- 2) The JW1992M/A/B/C/D guarantees robust performance from -40°C to 150°C junction temperature. The junction temperature range specification is assured by design, characterization and correlation with statistical process controls.
- 3) The JW1992M/A/B/C/D includes thermal protection that is intended to protect the device in overload conditions. Thermal protection is active when junction temperature exceeds the maximum operating junction temperature. Continuous operation over the specified absolute maximum operating junction temperature may damage the device.
- 4) Measured on JESD51-7, 4-layer PCB.
- 5) The maximum output current is recommended in the application according to chip junction temperature T_J=125°C (chip case temperature difference about 20°C). The maximum output current could be increased properly if the heat dissipation is better.
- 6) Limit by over current protection.

ELECTRICAL CHARACTERISTICS

T_A=25 °C, unless otherwise stated

Item	Symbol	Condition	Min.	Typ.	Max.	Units
Threshold of VIN power on	V _{IN_ON}	V _{IN} rising		8		V
VIN Operation Current	I _{op}			200		μA
Reference Voltage	V _{REF}		380	400	420	mV
MOS Max ON Time	T _{ONMAX}			60		μs
MOS Min ON Time ⁷⁾	T _{ONMIN}			0.4		μs
MOS Max OFF Time	T _{OFFMAX}			400		μs
OVP Threshold	T _{OVP}	R _{OVP} =25K		4		μs
Minimum OVP Threshold	T _{OVP_MIN}	R _{OVP} ≤12.5K		2		μs
Maximum OVP Threshold	T _{OVP_MAX}	R _{OVP} ≥100K		16		μs
OVP hic-cup time ⁷⁾	T _{OVP_HC}			560		ms
CSL Protection hic-cup time ⁷⁾	T _{CSL_HC}			280		ms
Drain-source Voltage	JW1992M/A/B/C/D BV _{DSS}	Vg=0V Ids=250μA	500			V
MOS R _{DSON}	JW1992M	R _{DSON} Vg=15V Ids=0.5A		13	15	ohm
	JW1992A			8.0	10	
	JW1992B			5.5	6.2	
	JW1992C			2.8	3	
	JW1992D			1.8	2	
DS Leakage Current	JW1992M/A/B/C/D I _{DSS}	Vg=0V Vds=500V			5	μA
Thermal Protection Threshold ⁷⁾	OTP _{CHIP}			150		°C

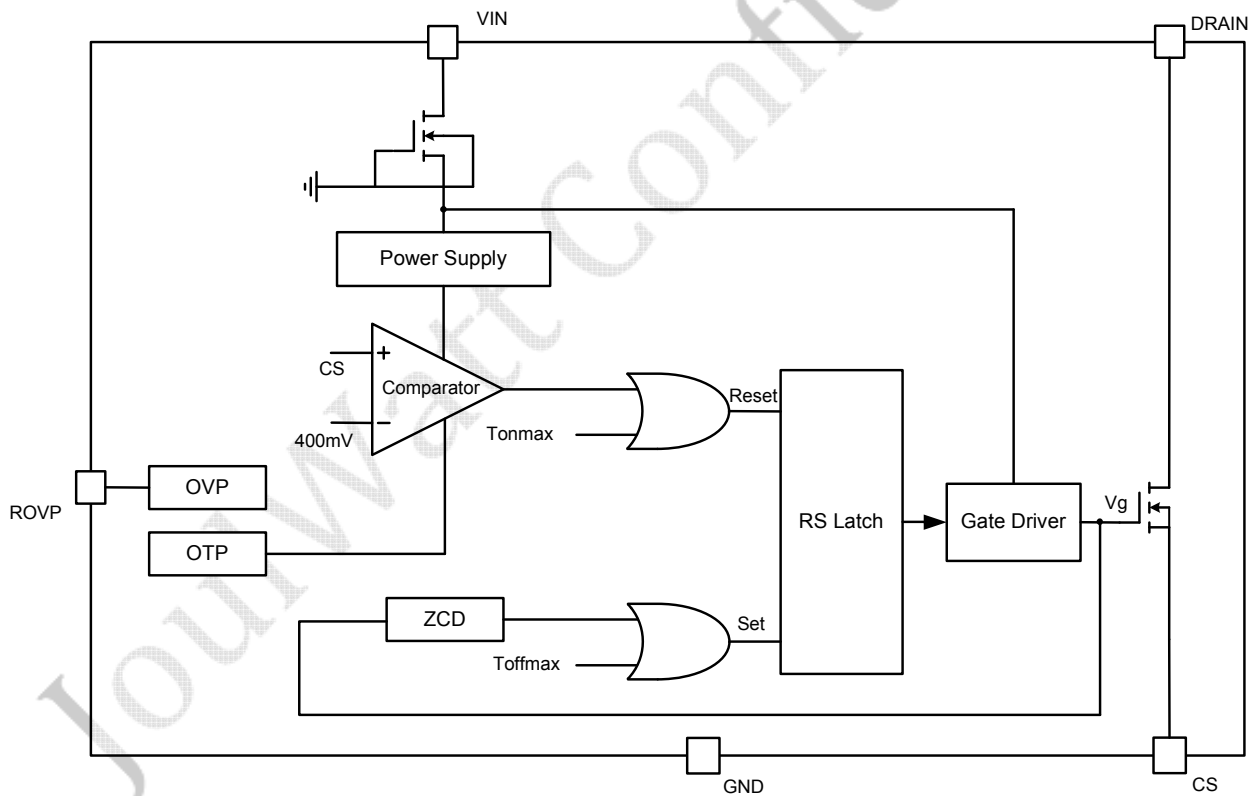
Notes:

7) **Guaranteed by design**

PIN DESCRIPTION

Pin	Name	Description
1	GND	Chip ground
2	ROVP	LED OVP set pin
3	NC	Not Connected
4	VIN	Power supply
5,6	DRAIN	The drain of internal power MOSFET
7	CS	Current Sensing Pin

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The JW1992M/A/B/C/D is a constant current LED regulator, which applies to non-isolation step-down LED system. JW1992M/A/B/C/D can achieve excellent line and load regulation, high efficiency and low system cost with few peripheral components.

Start Up

When the VIN exceeds the turn-on threshold, the gate driver will start to switch after 10ms delay.

Constant Current Control

JW1992M/A/B/C/D controls the output current from the information of the current sensing resistor. The output LED average current can be calculated as:

$$I_{LED} = V_{REF} / (2 R_{CS})$$

Where,

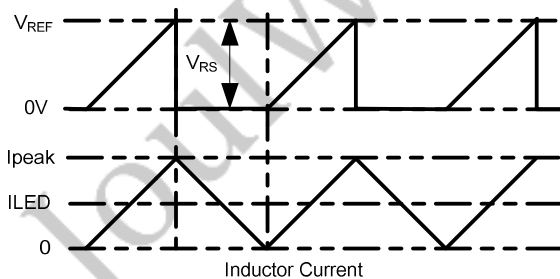
V_{REF} is the reference voltage;

R_{CS} – the sensing resistor connected between the PIN CS and chip GND.

The inductor current and V_{RS} waveforms are as follows:

Where,

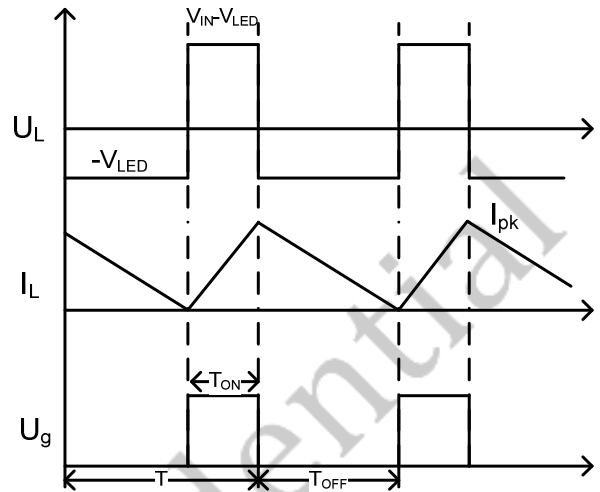
V_{RS} – the voltage between PIN CS and chip GND.



Critical Conduction Mode Operation

JW1992M/A/B/C/D works in the critical conduction mode of the inductor current. When the power MOSFET turns on, the inductor current increases from zero linearly. The turn on time of

the MOSFET can be calculated as:



$$T_{ON} = 2 I_{LED} \times L / (V_{IN} - V_{LED})$$

Where,

L – inductance.

I_{LED} – output led current.

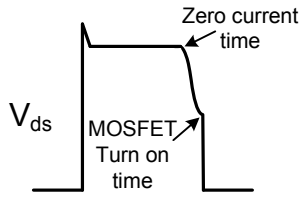
V_{IN} – input voltage after rectification and filtering.

V_{LED} – output voltage.

When the power MOSFET turns off, the inductor current decreases. The power MOSFET turns on again when the inductor current is zero. The turn-off time of the MOSFET can be calculated as:

$$T_{OFF} = 2 I_{LED} \times L / V_{LED}$$

JW1992M/A/B/C/D works in quasi-resonant mode. When the inductor current decreases to zero, resonance takes place between the power inductor, MOSFET output capacitor and stray capacitor. JW1992M/A/B/C/D can detect the zero-current signals of the inductor, and turn on the MOSFET in the valley, which can reduce the power loss and the EMI radiation. If JW1992M/A/B/C/D cannot get the zero current signals, the turn off time will be changed to T_{OFFMAX}.



Over Temperature Protection

When the junction temperature is higher than 150°C, JW1992M/A/B/C/D works in DCM by increasing the MOS OFF time to decrease the LED current and help the chip cooling.

LED Open Protection

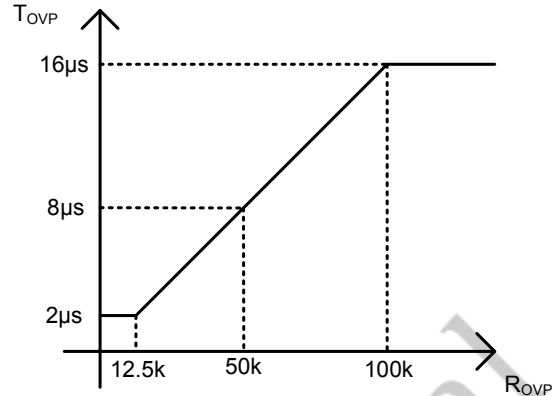
In the LED open condition, the system frequency increases and the demagnetization time decreases accordingly. When the T_{OFF} time is smaller than T_{OVP} (Setup by R_{OVP}) and T_{ON}<T_{ONMAX}, the power MOSFET is shut down and restarts after T_{OVP_HC} (560ms typical). The triggering voltage of LED open protection is given by

$$V_{LED_OVP} (V) = \frac{I_{PK} \times L}{T_{OVP}} \cong \frac{400mV}{R_{CS} (\Omega)} \times \frac{L}{T_{OVP}}$$

Where,

L--- Inductance of Power Inductor.

The T_{OVP} and R_{OVP} waveforms are as follows:



The calculation of R_{OVP} and T_{OVP} are as follows:

$$R_{OVP} = \begin{cases} 12.5 \times 10^3 & T_{OVP} < 2\mu s \\ 6.25 \times T_{OVP} \times 10^9 & 2 < T_{OVP} < 16\mu s \\ 100 \times 10^3 & T_{OVP} > 16\mu s \end{cases}$$

LED Short Protection

When the output is shorted, JW1992M/A/B/C/D stops switching for T_{OFFMAX} until the next pulse.

CS Low Protection

In the LED open condition, the chip may switch on for T_{ONMAX} and LED open protection is disabled, the output capacitor will be over charged accordingly. Thus the power MOSFET will shut down and restart after T_{CSL_HC} (280ms typical) when the chip enters CS Low Protection.

PCB Layout Guidelines

1. Make the area of the power loop as small as possible in order to reduce the EMI radiation.
2. JW1992M/A/B/C/D should be kept away from noisy and heating components, such as power inductor and diode.

APPLICATION REFERENCE

This reference design is suitable for 10~20W non-isolated Step-down LED driver, using JW1992M/A/B/C/D, with high efficiency, excellent line regulation.

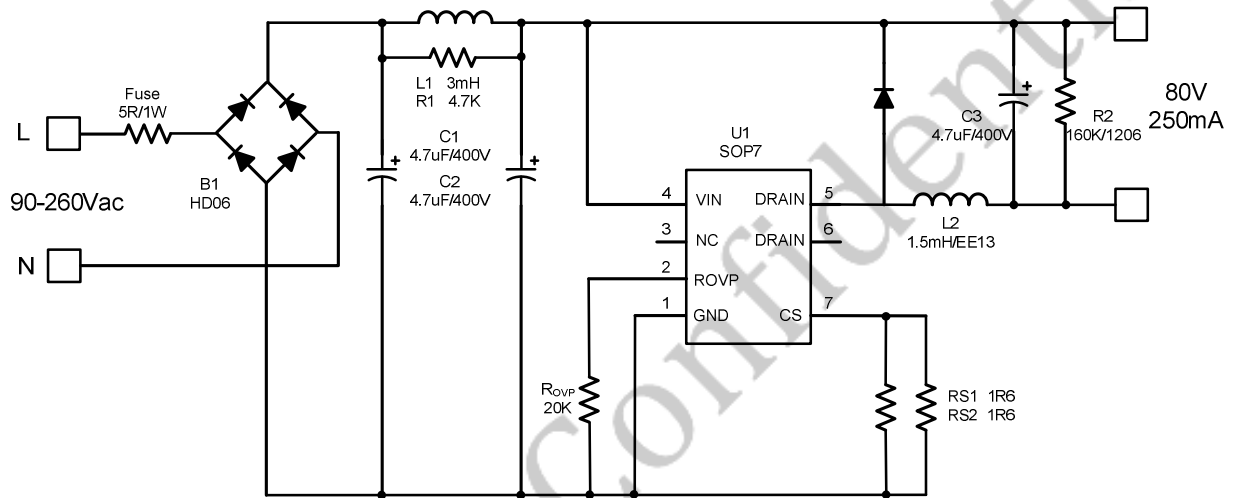
Reference :

V_{IN}: 90VAC~260VAC

V_{OUT}: 40~80V

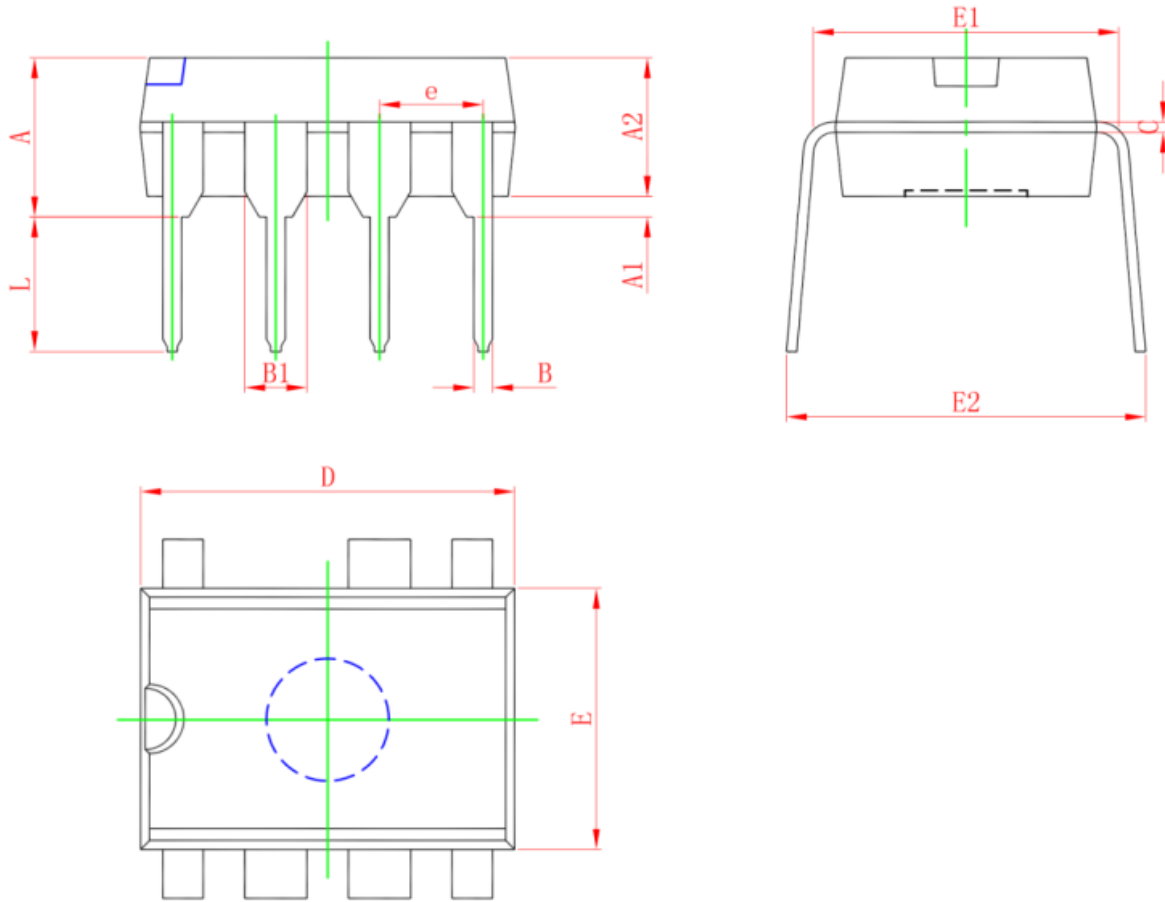
I_{OUT}: 250mA

PF: >0.5



DIP7

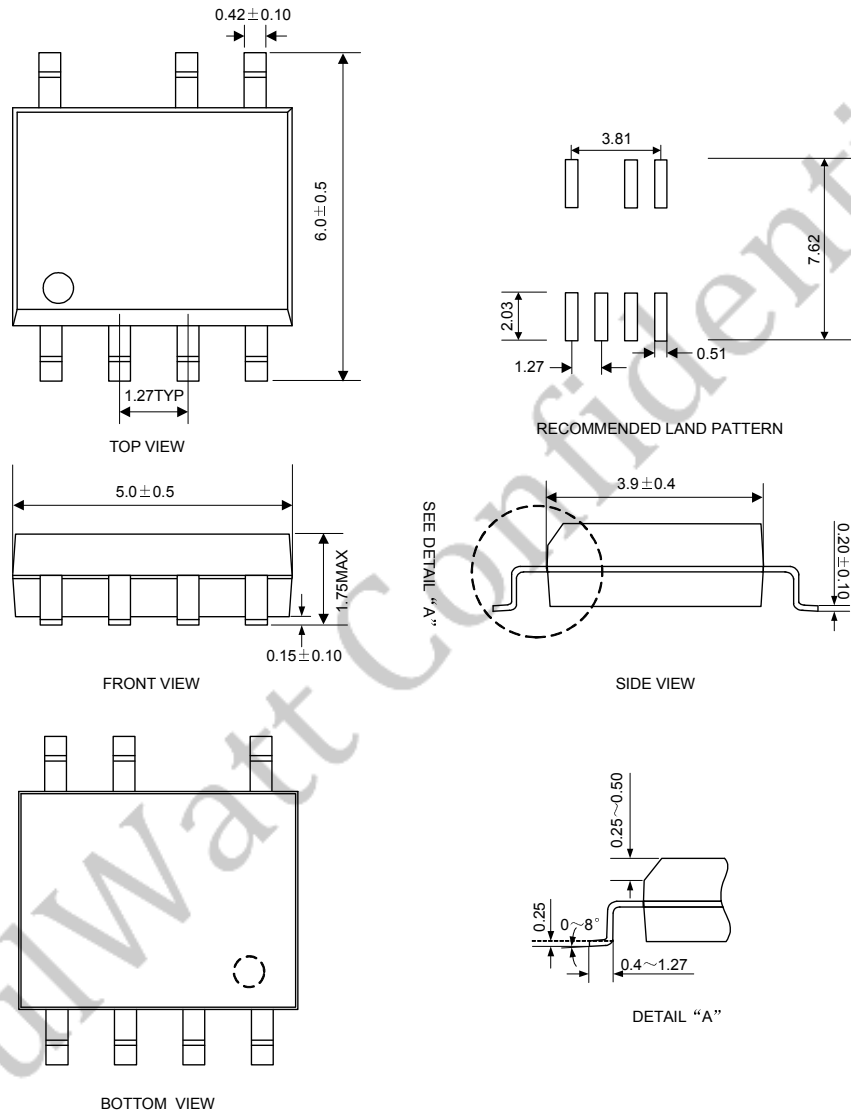
UNIT: mm



符号	Symbol		Dimension in Millimeters	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524 (BSC)		0.060 (BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540 (BSC)		0.100 (BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354

SOP7

UNIT: mm



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