

FEATURES

- 3.6V to 40V operating input range
- 2A output current
- Up to 94% efficiency
- High efficiency (>78%) at light load
- Internal Soft-Start
- Fixed 120kHz Switching frequency
- Input under voltage lockout
- Available in thermally enhanced ESOP8 package
- Start-up current run-away protection
- Short circuit protection
- Thermal protection

APPLICATIONS

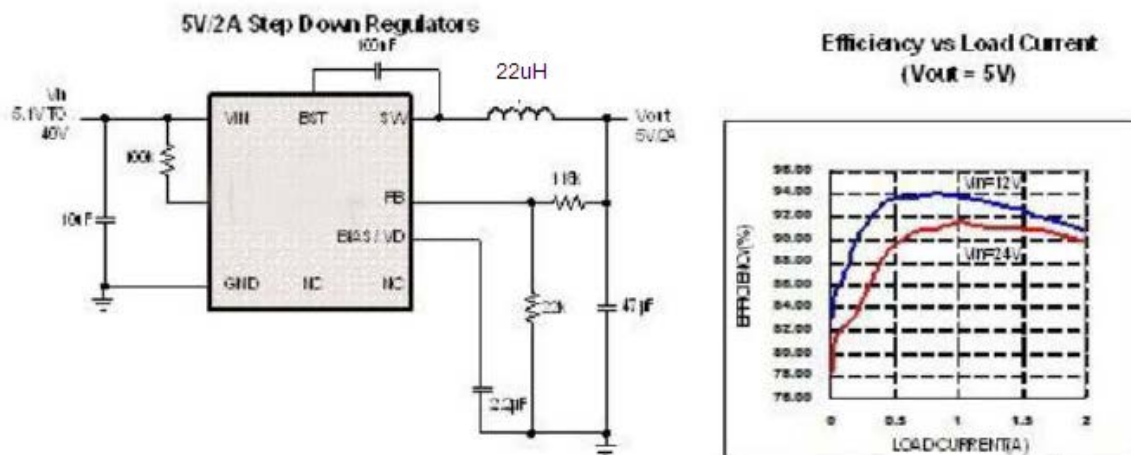
- Distributed Power Systems
- Networking Systems
- FPGA, DSP, ASIC Power Supplies
- Green Electronics/ Appliances
- Notebook Computers

DESCRIPTION

The HM1486 is a current mode monolithic buck switching regulator. Operating with an input range of 3.6-40V, the HM1486 delivers 2A of continuous output current with two integrated N-Channel MOSFETs. The internal synchronous power switches provide high efficiency without the use of an external Schottky diode. At light loads, regulators operate in low frequency to maintain high efficiency and low output ripple. Current mode control provides tight load transient response and cycle-by-cycle current limit. The HM1486 guarantees robustness with short-circuit protection, thermal protection, start-up current run-away protection, and input under voltage lockout.

The HM1486 is available in 8-pin ESOP package, which provides a compact solution with minimal external components. The package has an exposed pad for low thermal resistance.

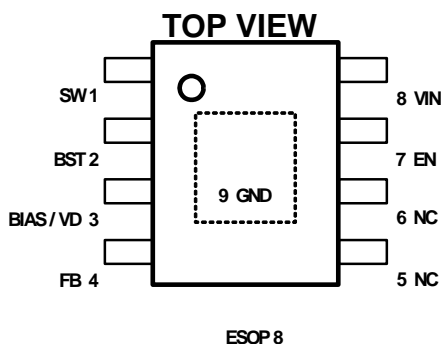
TYPICAL APPLICATION



ORDERING INFORMATION

| PART MARKING | PACKAGE DESCRIPTION | Top Marking | Package Form |
|--------------|---------------------|------------------|--|
| HM1486 | ESOP8 | HM1486 3P059C | Tape and reel packaging: 2500 pieces/tape IC tube: 100 pieces/tube |

PIN CONFIGURATION



EXPOSED PAD(PIN 9) IS GND,
 MUST BE SOLDERED TO PCB

ABSOLUTE MAXIMUM DATING

| | |
|-----------------------|-------------------|
| VIN, EN, SW Pin | -0.3V to 40V |
| BST Pin | SW-0.3V to SW+5V |
| All other pins | -0.3V to 6V |
| Junction Temperature. | 125°C |
| Lead Temperature | 260 °C |
| Storage Temperature | -65 °C to +150 °C |

RECOMMENDED OPERATING RANGE

| | |
|--------------------------------|--------------|
| Input Voltage VIN | 3.6 to 40V |
| Output voltage Vout | 0.8 to 37V |
| Operating Junction Temperature | -40 °C ~80°C |

THERMAL DESISTANCE $\theta_{JA}\theta_{JC}$

| | |
|-------|------------------|
| ESOP8 | 50... 10... °C/W |
|-------|------------------|

NOTE:

- 1) Exceeding these ratings may damage the device.
- 2) The HM1486 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 HM1486 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 JE51-7, 4-layer PCB.

ELECTRICAL CHARATERISTICS

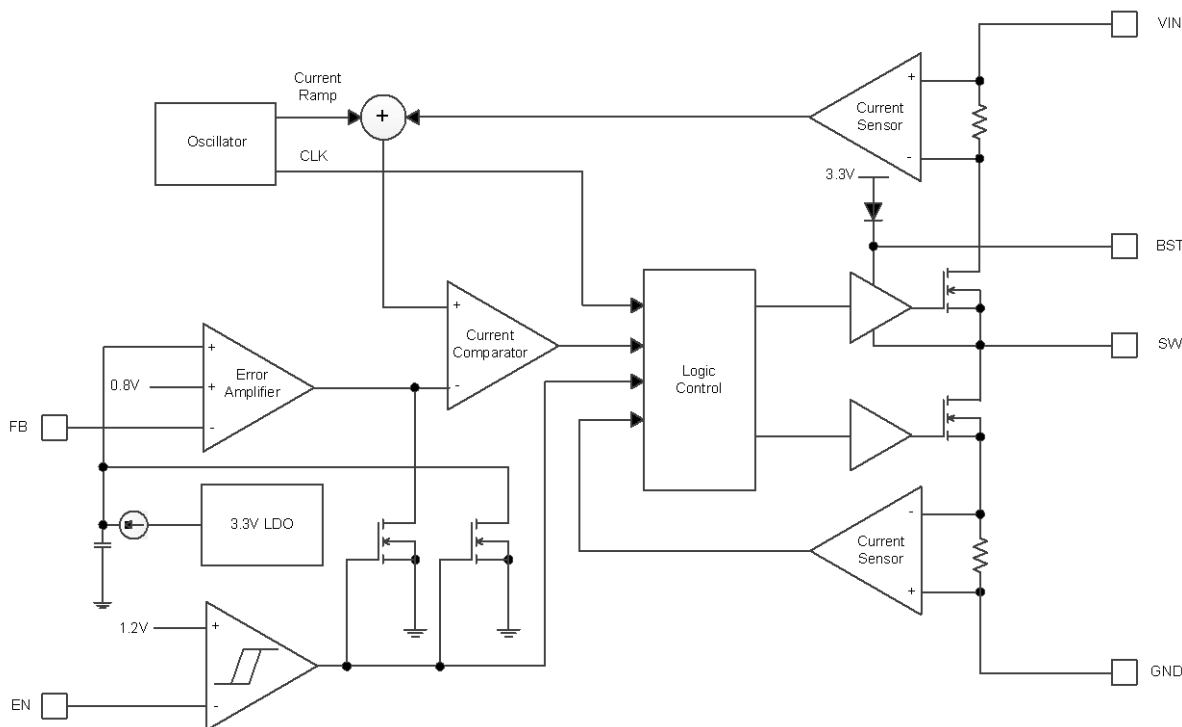
$V_{IN} = 24V, T_A = 25^{\circ}C$, unless otherwise stated.

| Item | Symbol | Condition | Min. | Typ. | Max. | Units |
|--|----------------------|------------------------------------|------|------|------|-------------|
| V_{IN} Undervoltage Lockout Thershold | V_{IN_MIN} | V_{IN} falling | | 3.6 | | V |
| V_{IN} Undervoltage Lockout Hysteresis | $V_{IN_MIN_HYST}$ | V_{IN} rising | | 160 | | mV |
| Shutdown Supply Current | I_{SD} | $V_{EN}=0V$ | | 0.07 | | μA |
| Supply Current | I_Q | $V_{EN}=5V, V_{FB}=1V$ | | 74 | | μA |
| Feedback Voltage | V_{FB} | $3.6V < V_{VIN} < 40V$ | | 0.8 | | V |
| Error Amplifier Transconductance | G_{EA} | $V_{comp} = 1.5V$ | | 250 | | $\mu A/V$ |
| Maximum COMP Sourcing Current | $I_{COMP_MAX_OUT}$ | $V_{comp} = 1V$ | | 25 | | μA |
| Maximum COMP Sinking Current | $I_{COMP_MAX_IN}$ | $V_{comp} = 3V$ | | 25 | | μA |
| Top Switch Resistance | $R_{DS(ON)T}$ | | | 126 | | m Ω |
| Bottom Switch Resistance | $R_{DS(ON)B}$ | | | 63 | | m Ω |
| Top Switch Leakage Current | I_{LEAK_TOP} | $V_{IN}=40V, V_{EN}=0V, V_{SW}=0V$ | | 0.2 | | μA |
| Bottom Switch Leakage Current | I_{LEAK_BOT} | $V_{IN}= V_{SW} = 40V, V_{EN}=0V$ | | 0.7 | | μA |
| Top Switch Current Limit | I_{LIM_TOP} | Minimum Duty Cycle | | 4.5 | | A |
| Switch Frequency | F_{SW} | $R_{RT} = 180k$ | | 120 | | kHz |
| Minimum On Time | T_{ON_MIN} | | | 117 | | ns |
| Minimum Off Time | T_{OFF_MIN} | $V_{FB}=0V$ | | 112 | | ns |
| EN shut down threshold voltage | V_{EN_TH} | V_{EN} falling, $FB=0V$ | | 1.2 | | V |
| EN shut down hysteresis | V_{EN_HYST} | V_{EN} rising, $FB=0V$ | | 120 | | mV |
| Thermal Shutdown | T_{TSD} | | | 132 | | $^{\circ}C$ |

PIN DESCRIPTION

| SOP8 Pin | Name | Description |
|----------|------|---|
| 1 | SW | SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load. |
| 2 | BST | Bootstrap pin for top switch. A 0.01uF or larger capacitor should be connected between this pin and the SW pin to supply current to the top switch and top switch driver. |
| 3 | VD | Output of the internal LDO. A capacitor of 2.2uF or larger should be connected at VD to ground. |
| 4 | FB | Output feedback pin. FB senses the output voltage and is regulated by the control loop to 0.8V. Connect a resistive divider at FB. |
| 5 | NC | |
| 6 | NC | |
| 7 | EN | Drive EN pin high to turn on the regulator and low to turn off the regulator. |
| 8 | VIN | Input voltage pin. VIN supplies power to the IC. Connect a 3.6V to 40V supply to VIN and bypass VIN to GND with a suitably large capacitor to eliminate noise on the input to the IC. |
| 9 | GND | Ground. |

BLOCK DIAGRAM

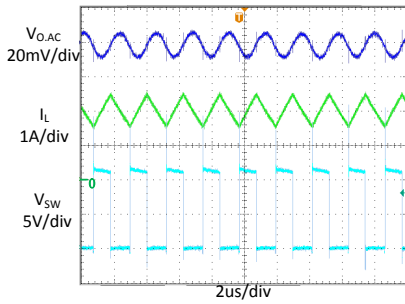


TYPICAL PERFORMANCE CHARACTERISTICS

$V_{in} = 12V$, $V_o = 5V$, $L = 10\mu H$, $C_{out} = 10\mu F$, $T_A = +25^\circ C$, unless otherwise noted

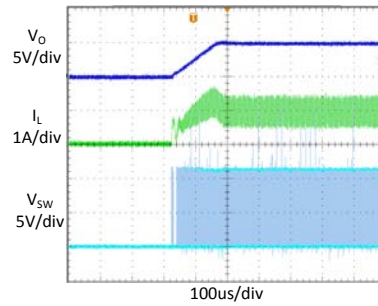
Steady State Test

$V_{IN}=12V$, $V_{out}=5V$
 $I_{out}=2A$, $I_{in}=0.65A$



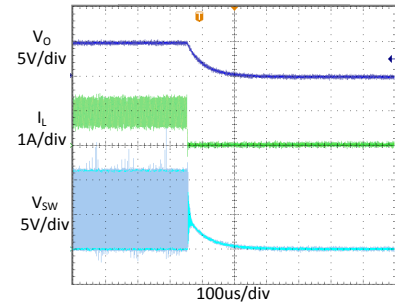
Startup through Enable

$V_{IN}=12V$, $V_{out}=5V$
 $I_{out}=1A$ (Resistive load)



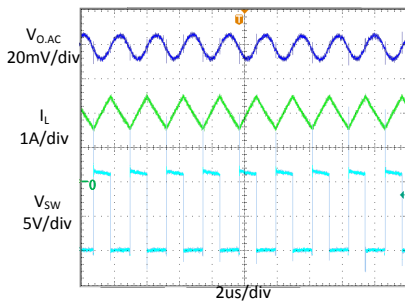
Shutdown through Enable

$V_{IN}=12V$, $V_{out}=5V$
 $I_{out}=1A$ (Resistive load)



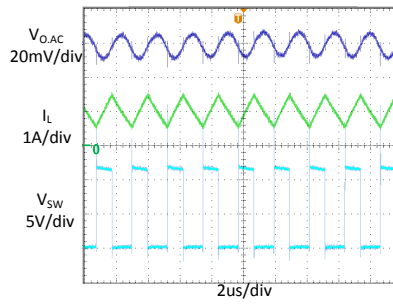
Heavy Load Operation

2A LOAD



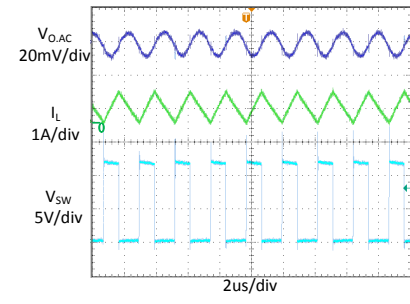
Medium Load Operation

1A LOAD

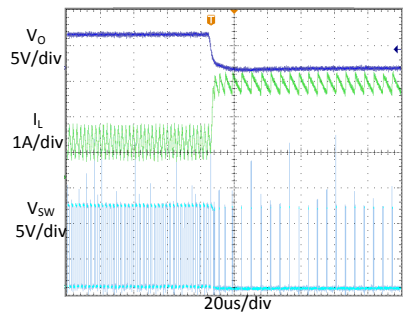


Light Load Operation

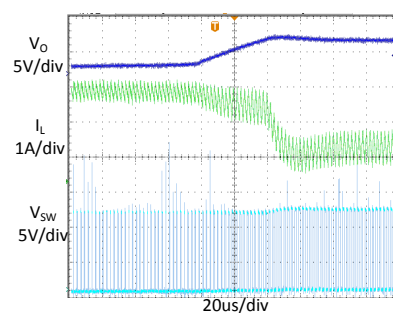
0.3A LOAD



Short Circuit Protection

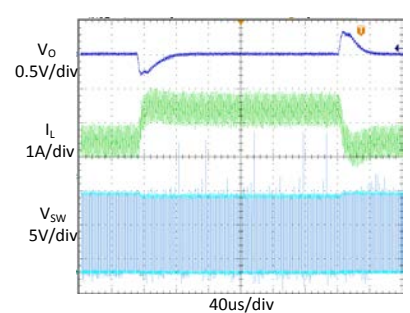


Short Circuit Recovery



Load Transient

1A LOAD \rightarrow 2A LOAD \rightarrow 1A LOAD



FUNCTIONAL DESCRIPTION

The HM1486 is a synchronous, current-mode, step-down regulator. It regulates input voltages from 3.6V to 40V down to an output voltage as low as 0.8V, and is capable of supplying up to 2A of load current.

Current-Mode Control

The HM1486 utilizes current-mode control to regulate the output voltage. The output voltage is measured at the FB pin through a resistive voltage divider and the error is amplified by the internal transconductance error amplifier. COMP pin is output of the internal error amplifier and is compared to the switch current measured internally to control the output current limit.

PFM Mode

The HM1486 operates in PFM mode at light load. In PFM mode, switch frequency is continuously controlled in proportion to the load current, i.e. switch frequency is decreased when load current drops to boost power efficiency at light load by reducing switch-loss, while switch frequency is increased when load current rises, minimizing both load current and output voltage ripples.

Shut-Down Mode

The HM1486 operates in shut-down mode when voltage at EN pin is driven below 0.3V. In shut-down mode, the entire regulator is off and the supply current consumed by the HM1486 drops below 0.1uA.

Power Switch

N-Channel MOSFET switches are integrated on the HM1486 to down convert the input voltage to the regulated output voltage. Since the top MOSFET needs a gate voltage great than the input voltage, a boost capacitor connected between BST and SW pins is required to drive the gate of the top switch. The boost capacitor is charged by the internal 3.3V rail when SW is low.

Vin Under-Voltage Protection

A resistive divider can be connected between Vin and ground, with the central tap connected to EN, so that when Vin drops to the pre-set value, EN drops below 1.2V to trigger input under voltage lockout protection.

Output Current Run-Away Protection

At start-up, due to the high voltage at input and low voltage at output, current inertia of the output inductance can be easily built up, resulting in a large start-up output current. A valley current limit is designed in the HM1486 so that only when output current drops below the valley current limit can the bottom power switch be turned off. By such control mechanism, the output current at start-up is well controlled.

Output Short Protection

When output is shorted to ground, output current rapidly reaches its peak current limit and the top power switch is turned off. Right after the top power switch is turned off, the bottom power switch is turned on and stay on until the output current falls below the valley current limit. When output current is below the valley current limit, the top power switch will be turned on again and if the output short is still present, the top power switch is turned off when the peak current limit is reached and the bottom power switch is turned on. This cycle goes on until the output short is removed and the regulator comes into normal operation again.

Thermal Protection

When the temperature of the HM1486 rises above 132°C, it is forced into thermal shut-down. Only when core temperature drops below 125°C can the regulator becomes active again.

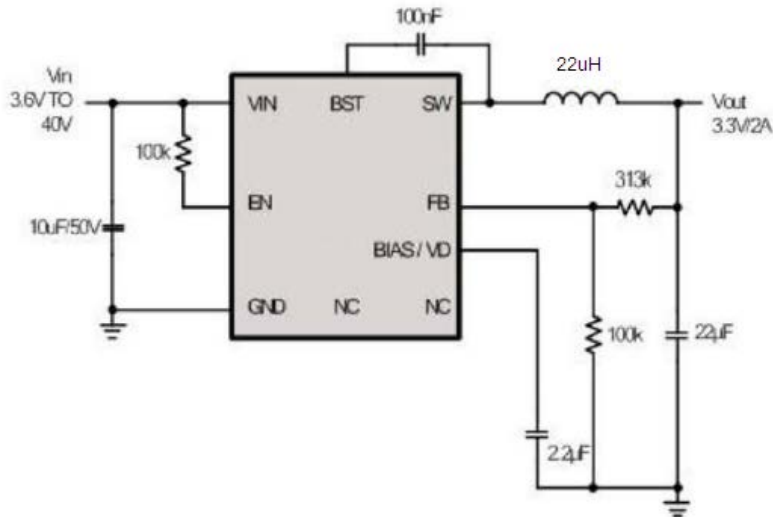
REFERENCE DESIGN

Reference 1:

V_{IN} : 3.6V ~ 40 V

V_{OUT} : 3.3V

I_{OUT} : 0~2A

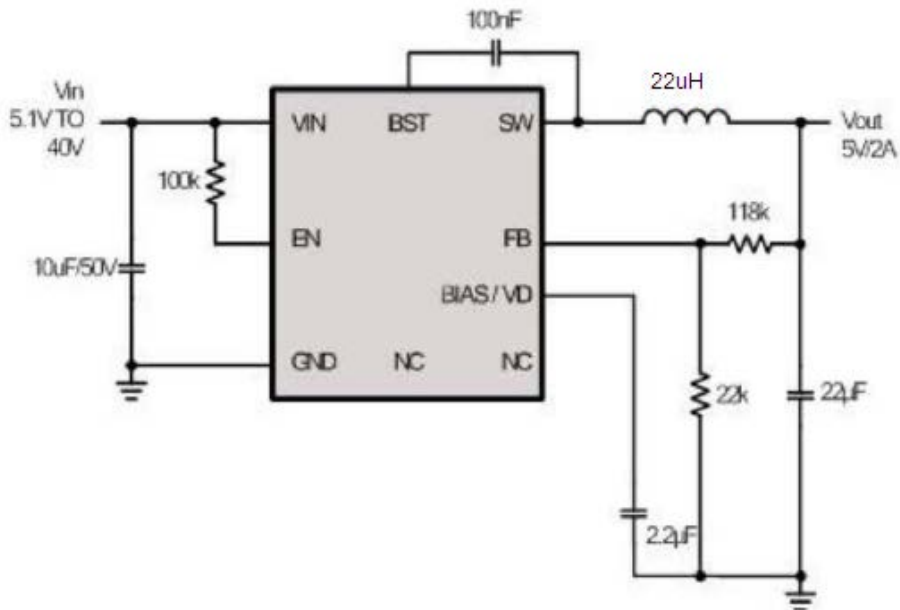


Reference 2:

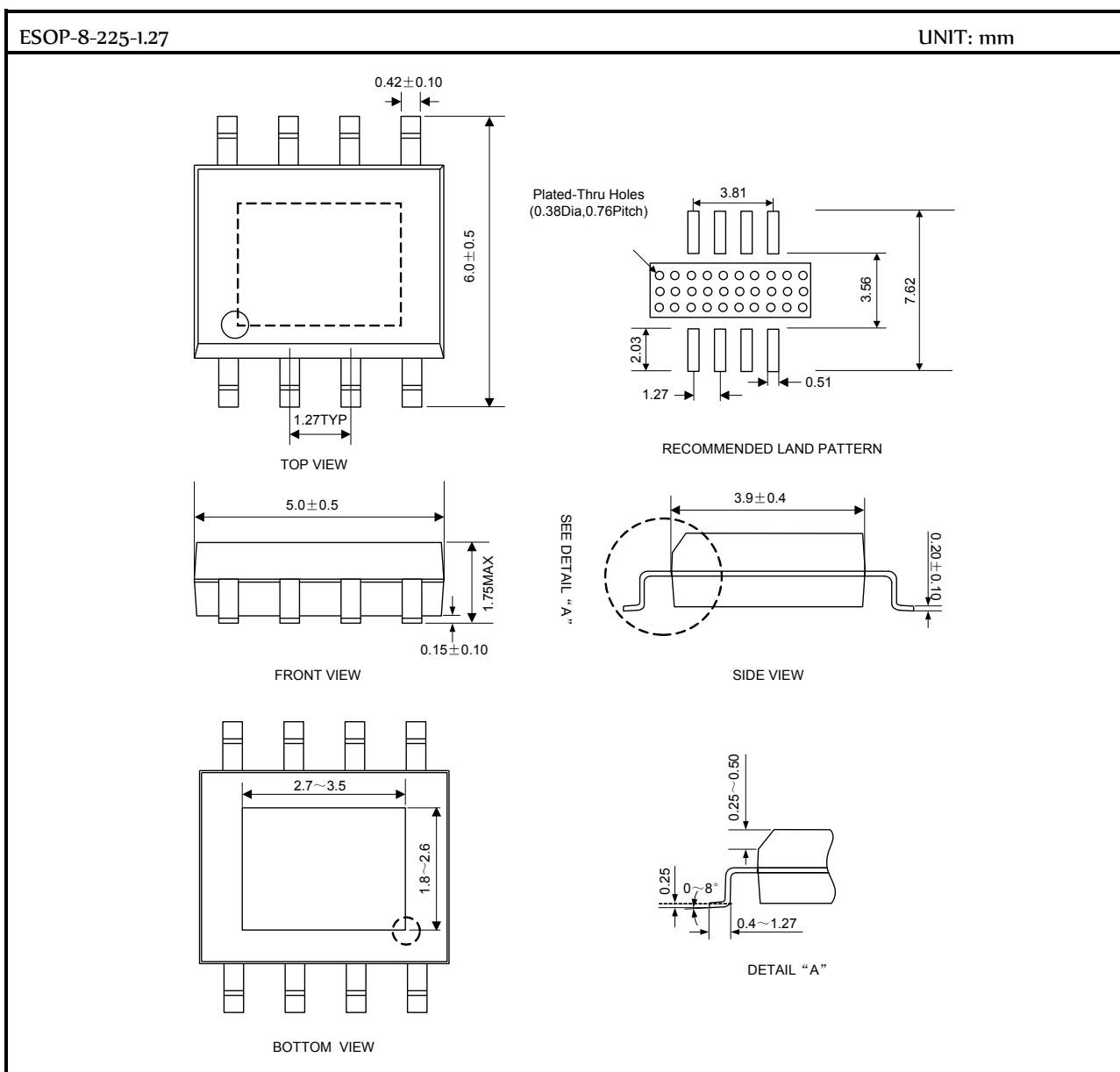
V_{IN} : 5.1V ~ 40 V

V_{OUT} : 5V

I_{OUT} : 0~2A



PACKAGE OUTLINE



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