

2A, 1.2MHz Synchronous Step-Up DC/DC Controller

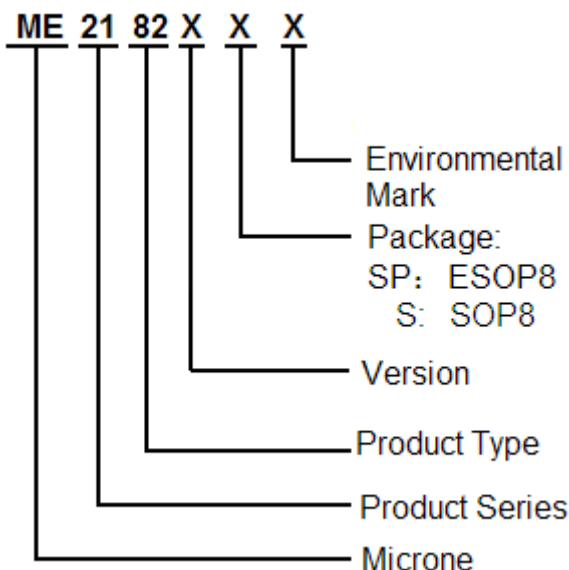
Description

The ME2182 is synchronous, 2A, 1.2MHz step-up DC-DC controller, which mainly consists of a reference voltage source, an oscillation circuit, an error amplifier, a phase compensation circuit, a PWM / PFM switching control circuit and an adjustable output current limit circuit. With an external low-on-resistance Nch Power MOS and Pch Power MOS. This product is ideal for applications requiring high efficiency and a high output current.

Feature

- High efficiency (up to 93%)
- Up to 90% Efficiency at IOUT=2A $V_{OUT} = 5V$ from 3.3V Input
- Guaranteed 2.5A Output Current at $V_{OUT} = 5V$ from 3.3V Input
- Synchronous and External Pch Power MOSFET and Nch power MOSFET, No Schottky Diode Required
- Oscillator frequency: 1.2MHz
- Reference voltage : 0.6V ($\pm 2\%$)
- Input voltage range: 2.2 V to 5.5 V
- Continuous output current: 2.0A typ. ($V_{DD}=3V, V_{out}=5.0V$)
- Soft start function: 5ms.typ.
- Shutdown function:1.0 μ A max.
- UVLO (under-voltage lockout) function
- Current Limit: adjustable by the Rcs using different valve
- Package: ESOP8, SOP8

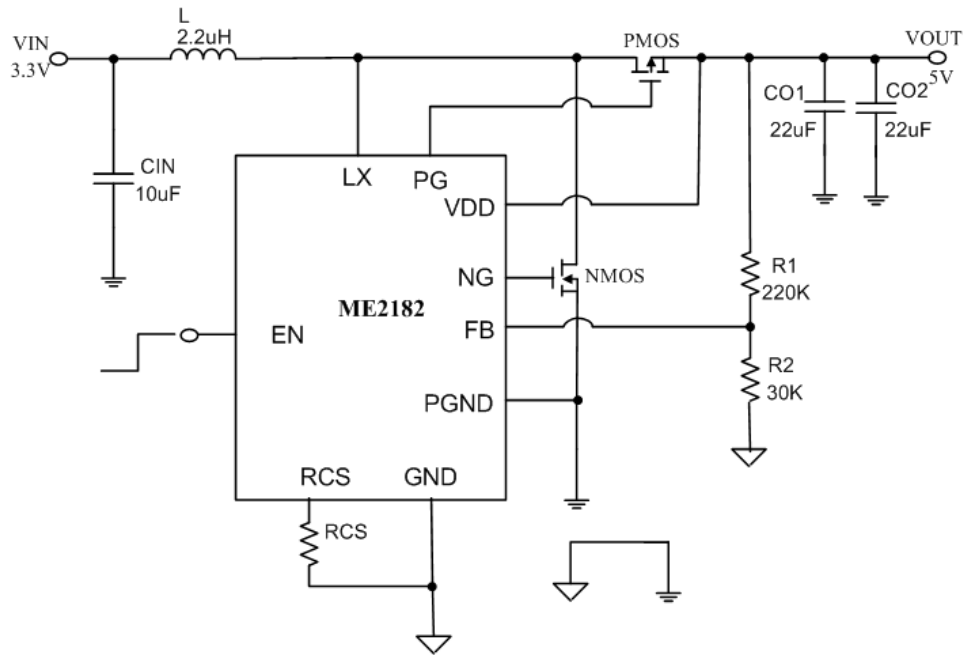
Selection Guide



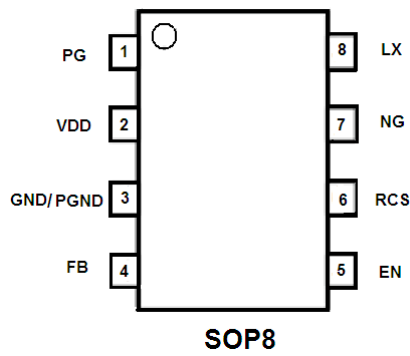
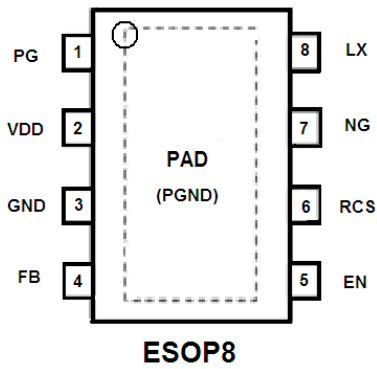
Typical Application

- Portable charger
- Digital cameras, GPS, wireless transceiver
- IPad-like computers, smart phones and portable handheld devices

Typical Application Circuit



Pin Configuration



Pin information

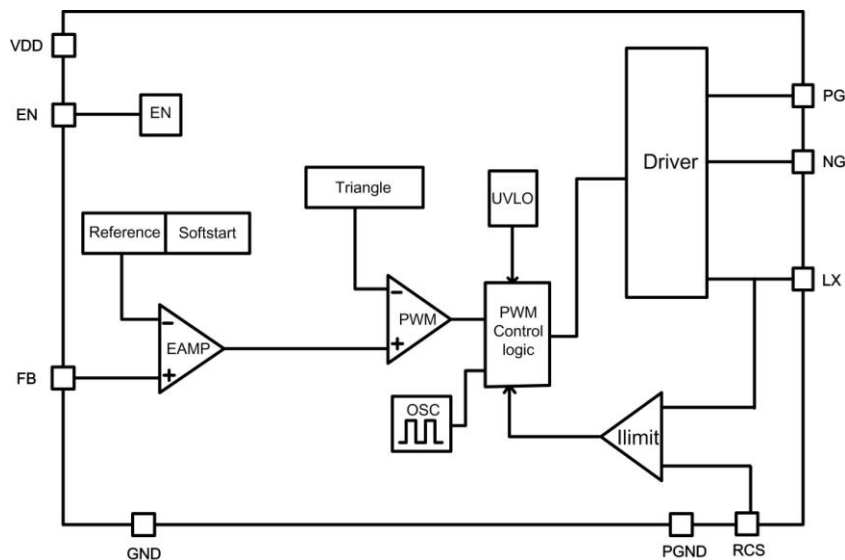
ESOP8

Pin Number	Pin Name	Function
1	PG	P-MOS gate pin
2	VDD	IC power supply pin
3	GND	Analog Ground
4	FB	Feed Back voltage pin
5	EN	Power-enable pin 0 “H” : Power-on (normal operation) “L” : Power-off (standby)
6	RCS	Current limit External transistor
7	NG	N-MOS gate pin
8	LX	Power switching pin
9	PGND	Power Ground

SOP8

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Block Diagram



Absolute Maximum Rang

PARAMETER		SYMBOL	RATING	UNIT
VDD Pin Voltage		VDD	-0.3~6.0	V
NG,PG Pin Voltage		V _G	-0.3~6.0	V
LX Pin Voltage		V _{LX}	-0.3~VDD+0.3	V
FB Pin Voltage		V _{FB}	-0.3~VDD+0.3	V
EN Pin Voltage		V _{EN}	-0.3~VDD+0.3	V
Power Dissipation	ESOP8	Pd	2000	mW
	SOP8	Pd	800	mW
Operating Temperature Range		T _{Opr}	-40~+85	°C
Storage Temperature Range		T _{stg}	-40~+125	°C

External Parts List When Measuring Electrical Characteristics

Element Name	SYMBOL	VALUE	UNIT
Inductor	L	2.2	uH
PMOSFET	-	R _{DS(ON)} : 30mΩ (typ.)	-
NMOSFET	-	R _{DS(ON)} : 30mΩ (typ.)	-
Input capacitor	CIN	10	uF
Output capacitor	Co1, Co2	22	uF
FB Resistance	R1,R2	220k,30k	Ω

Electrical Characteristics

Measuring conditions: VDD=VEN= 3.3V, Vout=5.0V, Ta=25°C。 Unless otherwise specified。

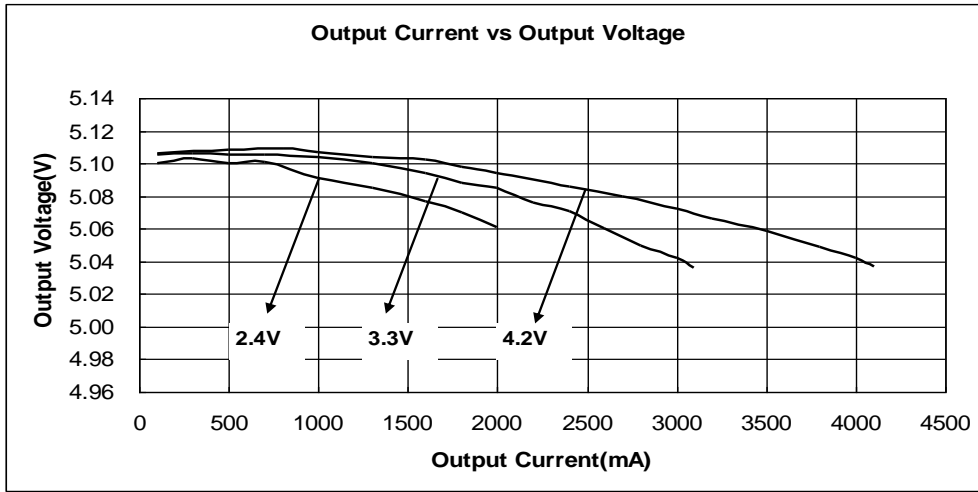
Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Feedback voltage	V _{FB}	-	0.588	0.6	0.612	V
FB pin input current	I _{FB}	VDD= 2.2 V to 5.5 V, FB pin	-0.1	-	+0.1	μA
Input voltage	V _{IN}	-	2.2	-	5.5	V
Current consumption 1	I _{SS1}	At switching operation, no load V _{FB} =V _{FB(S)} × 0.95	-	700	-	μA
Current consumption 2	I _{SS2}	At switching stop, V _{FB} =1.5V	-	70	120	μA
Current consumption during shutdown	I _{SSS}	V _{EN} =0V	-	-	1	μA
Oscillation frequency	F _{osc}	-	1.0	1.2	1.4	MHz
Max. duty ratio	MAXDUT _Y	V _{FB} =V _{FB(S)} × 0.95	75	85	90	%
PWM/PFM switching duty ratio	PFMDUT _Y	VDD=V _{OUT(S)} -0.1V, no load	10	15	30	%
UVLO release voltage	V _{UVLO+}		1.5	1.65	1.8	V
UVLO hysteresis width	V _{UVLOHYS}		0.05	0.10	0.20	V
High level input voltage	V _{SH}	VDD= 2.2 V to 5.5 V, EN pin	0.9	-	-	V
Low level input voltage	V _{SL}	VDD=2.2 V to 5.5 V, EN pin	-	-	0.3	V
Soft start time	t _{ss}	-		5		mS
Efficiency	EFFI	-	-	90	-	%
FB voltage temperature coefficient	$\frac{\Delta V_{FB}}{\Delta T_a}$	Ta =-40°C to +85°C	-	±100	-	ppm/°C

Note:

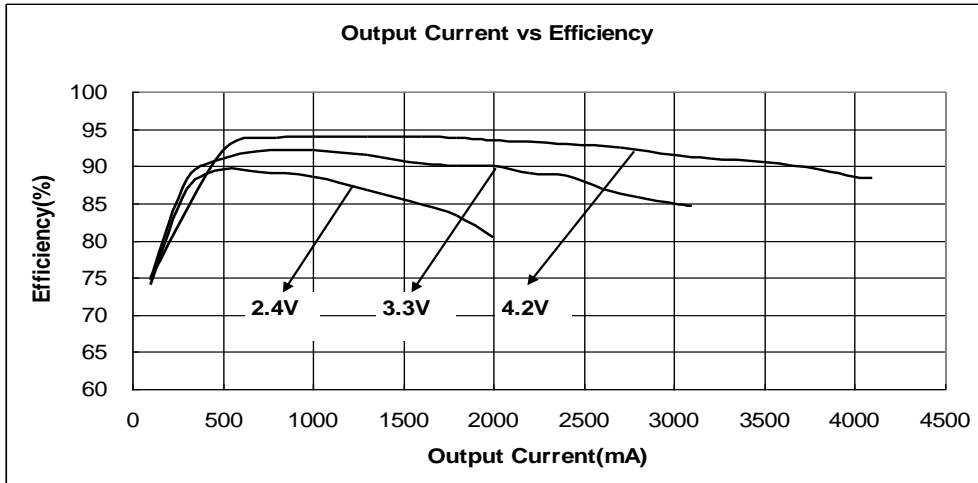
- Set the input voltage as to 2.2 V≤VIN≤5.5V for stabilizing the output voltage and oscillation frequency.
- V_{FB(S)} is a setting value for FB voltage.
- V_{OUT(S)} is a setting value for output voltage. V_{OUT} is the typical value of actual output voltage. V_{OUT(S)} can be set by using the rate of V_{FB} and output voltage setting resistors (R1, R2).

Typical Performance Characteristics

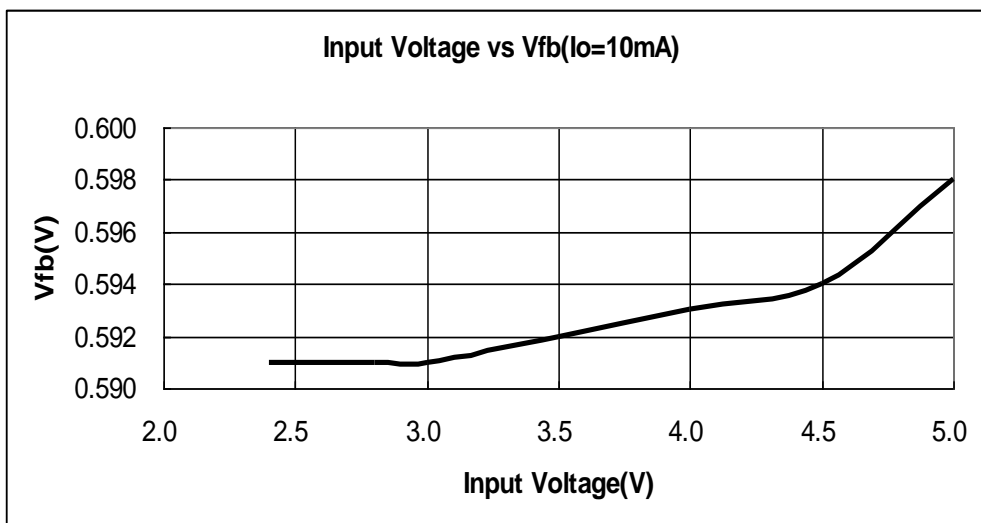
1、 Output Current VS. Output Voltage (Vout =5.0V)



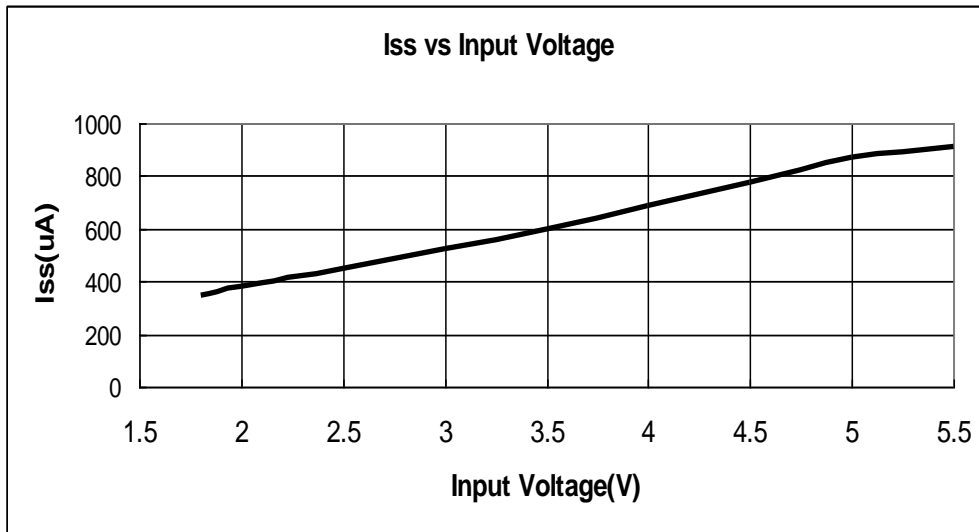
2、 Output Current VS. Efficiency (Vout=5.0V)



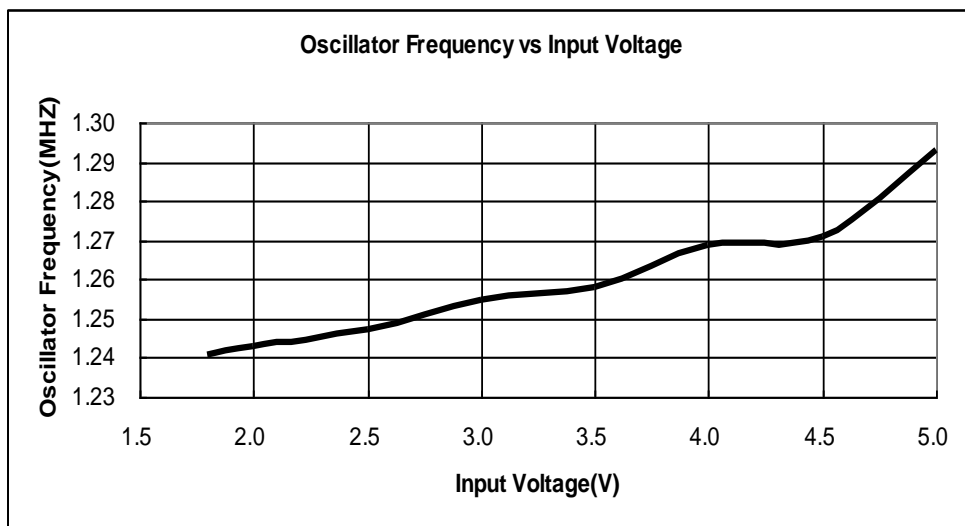
3、 Input Voltage VS. V_{FB} (I_{out}=10mA)



4、I_{SS} VS. Input Voltage



5、Oscillator Frequency VS. Input Voltage



PWM / PFM switching control

The ME2182 switching regulator controller automatically switches between the pulse width modulation method (PWM) and pulse frequency modulation method (PFM) according to the load current. A low ripple power can be supplied by operating on PWM control for which the pulse width changes from 15% to 85% in the range where the output load current is large. The ME2182 operates on PFM control when the output load current is small and the fixed pulses which have the width of 15% are skipped according to the load current amount. Therefore, the oscillation circuit intermittently oscillates, reducing the self-current consumption. This avoids decreased efficiency when the output load current is small. The point at which PWM control switches to PFM control varies depending on the external element (inductor, diode, etc.), input voltage value, and output voltage value.

Soft-start function

The ME2182 has a soft-start circuit. The output voltage (V_{out}) gradually rises after power-on or startup when the EN pin is set to high, suppressing rush current and overshooting the output voltage. The soft-start time (tss) for the ME2182 is defined as the time from startup until V_{out} reaches 90% of the output set voltage value ($V_{out(S)}$). A reference voltage adjustment method is used as the soft-start method and the reference voltage gradually rises from 0 V after soft-start.

UVLO function

The ME2182 has a UVLO (under voltage lockout) circuit for avoiding IC malfunctions due to power supply voltage drops. The ME2182 stops switching operation upon UVLO detection and retains the external transistor in the off state. After entering the UVLO detection status once, the soft-start function is reset.

Note, however, that the other internal circuits operate normally and that the status differs from the power-off status.

CURRENT LIMIT DESIGNING

The ME2182 has a cycle-by-cycle current limit to maximum inductor peak current (I_{PK}), adjust inductor peak current limit ($I_{pklimit}$) by the RCS with calculating the value for RCS as

$$RCS \approx \frac{3200}{I_{pklimit} \times R_{DS(ON)}}$$

The $R_{DS(ON)}$ is the ON-resistance of Nch Power MOS. When an over current condition is detected, the device reduces the output voltage accordingly.

When Output Current (I_{OUT}) increases The inductor peak current (I_{pk}) increases, as The inductor peak current up to $I_{pklimit}$, the Output Current is the I_{olimit}

L=2.2uH , Co1,Co2=22uF ,VOUT=5V

Table 1. Common RCS Resistor Selections

VIN=3.3V		
RCS	I _{pklimit}	I _{olimit}
25K	3.6A	2.1A
20K	4.5A	2.5A
15K	5.3A	2.9A

NOTE: When selecting an RCS .be careful about the influence of temperature at the R_{DS(ON)} and other devices , select an RCS inductor such that that I_{pklimit} does not exceed the allowable current

External parts selection for DC/DC converter

● Inductor

The recommended L value of ME2182 is 2.2uH for 1.2 MHz products. Note the following when changing the inductance. The inductance (L) has a strong influence on the maximum output current (I_{out}) and efficiency (η). The inductor peak current (I_{pk}) increases when L is decreased, which improves the circuit stability and increases the I_{out} users can obtain. If L is decreased further, the ability of the external transistor to drive the current becomes insufficient, reducing the efficiency and decreasing I_{out}.

The loss due to the I_{pk} of the switching transistor is decreased by increasing L and the efficiency maximizes at a certain L value. If L is increased further, the loss due to the serial resistance of the inductor increases, lowering the efficiency.

Caution: When selecting an inductor, be careful about its allowable current. If a current exceeding the allowable current flows through the inductor, magnetic saturation occurs, substantially lowering the efficiency and destroying ICs due to large current. Therefore, select an inductor such that I_{pk} does not exceed the allowable current. The following equations express I_{pk} in the ideal statuses in the discontinuous and continuous modes :

$$I_{pk} = \sqrt{\frac{2 * I_{out} * (V_{out} + V_D - V_{IN})}{f_{OSC} * L}} \text{ (A)} \quad \text{(Discontinuous mode)}$$

$$I_{pk} = \frac{V_{out} + V_D}{V_{IN}} * I_{out} + \frac{(V_{out} + V_D - V_{IN}) * V_{IN}}{2 * (V_{out} + V_D) * f_{OSC} * L} \text{ (A)} \quad \text{(Continuous mode)}$$

F_{OSC} is oscillation frequency, V_D is the forward voltage of a diode. The reference value is 0.4 V. However, current exceeding the above equation flows because conditions are practically not ideal. Perform sufficient evaluation with actual application.

2. Capacitor (C_{IN}, C_{O1}, C_{O2})

To improve efficiency, an input capacitor (C_{in}) lowers the power supply impedance and averages the input current. Select C_{in} according to the impedance of the power supply used. The recommended capacitance is 10μF for ME2182. An output capacitor (C_{out}), which is used to smooth the output voltage, requires a capacitance larger than that of the step-down type because the current is intermittently supplied from the input to the output side in the step-up type. A 22μF ceramic capacitor is recommended for ME2182. However, a higher capacitance is recommended if the output voltage is high or the load current is large. If the output voltage or load current is low, about 10μF can be used without problems.

Select C_{out} after sufficient evaluation with actual application.

A ceramic capacitor can be used for both the input and output.

3. Enhancement MOSFET type

Use an Nch power MOSFET and Pch power MOSFET. The MOSFETS those need has low ON-resistance (R_{DS(ON)}) and input capacitance (C_{iss}) is ideal for gaining efficiency. The ON-resistance and input capacitance generally have a tradeoff relationship. ON-resistance is efficient in the range where the output current is high with relatively low frequency switching, and input capacitance is efficient in the range where the output current is medium to low with high frequency switching. Therefore, select a MOSFET for which the ON-resistance and input capacitance are optimum under your usage conditions. We suggest the R_{DS(ON)} of Pch power MOSFET and the Nch power MOSFET less than 30mΩ.

4. Output voltage setting resistors (R1, R2)

For ME2182, V_{out} can be set to any value by using external divider resistors. Connect the divider resistors between the V_{out} and VSS pins. Because V_{fb} = 0.6 V typ., V_{out} can be calculated by using the following

$$\text{equation : } V_{\text{out}} = \left(\frac{R1 + R2}{R2} \right) \times 0.6 \text{ (V)}$$

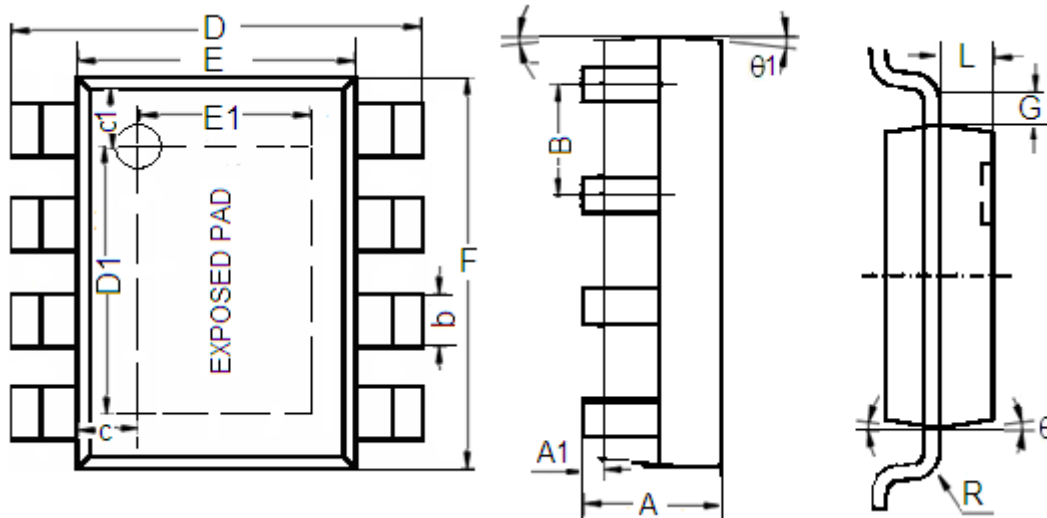
Connect divider resistors R1 and R2 as close to the IC as possible to minimize the effects of noise.

The typical constants based on our evaluation are shown in the next Table:

Vout(S) (V)	VDD (V)	R1 (KΩ)	R2 (KΩ)	L (μH)	Co1,Co2 (μF)
3.32	2.4	68	15	2.2	22
5	3.3	220	30	2.2	22

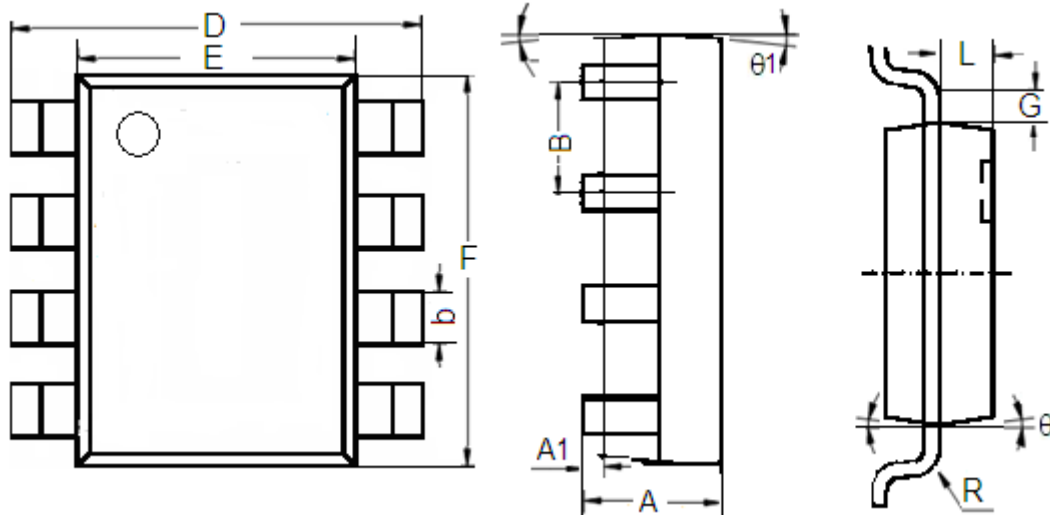
Package Dimension

Packaging Type: ESOP8



Character	Dimension (mm)		Dimension (Inches)	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.1	0.3	0.004	0.012
B	1.27(Typ.)		0.05(Typ.)	
b	0.330	0.510	0.013	0.020
c	0.9(Typ.)		0.035(Typ.)	
c1	1.0(Typ.)		0.039(Typ.)	
D	5.8	6.2	0.228	0.244
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	2.313	2.513	0.091	0.099
F	4.7	5.1	0.185	0.201
L	0.675	0.725	0.027	0.029
G	0.32(Typ.)		0.013(Typ.)	
R	0.15(Typ.)		0.006(Typ.)	
theta1	7°		7°	
theta	8°		8°	

SOP8:



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