AS1015

300KHz, 5A Step-Down DC-DC Converter

FEATURES

- Operating Voltage up to 23V
- Adjustable Output voltage: 0.8V to V_{IN}.
- Great Output Capability: 5A
- Oscillation frequency: 300KHz
- Built-in P-channel MOSFET
- External ON/OFF Control Function
- Low Shutdown Current:1uA
- Current Limit and Thermal Protection
- Short Circuit Protection
- Stable with Low ESR Output Ceramic Capacitor
- SOP-8L Package
- All Products Meet ROHS Standard

APPLICATIONS

- Broadband Communication Device
- LCD TV/Monitor
- Storage Device
- Wireless Application

GENERAL DESCRIPTION

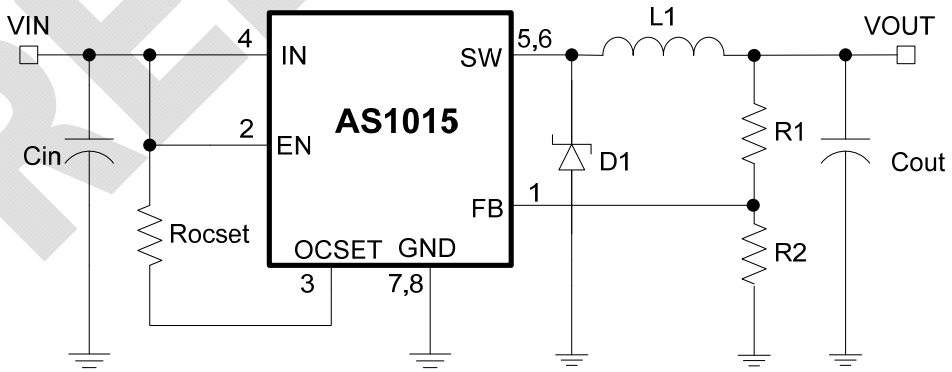
The AS1015 is a voltage mode, step-down DC-DC converter that is designed to meet 5A output current and utilizes PWM control scheme that switches with 300KHz fixed frequency. This device includes a voltage reference source, error amplifier, oscillation circuit, P-channel MOSFET etc.

The input voltage range of AS1015 is from 3.6V to 23V, and provides adjustable output voltage range from 0.8V to VIN for customers in application.

The AS1015 provides an enable function that can be controlled by external logic signal and excellent regulation during line or load transient due to the internal compensation. Other features of thermal protection, current limit and short circuit protection are also included. Due to the low Drain-Source resistance of internal power MOSFET, the AS1015 provides a high efficiency step-down application. It can also operate with a maximum duty cycle of 100% for use in low drop-out conditions.

The package is available in a standard SOP-8L.

TYPICAL APPLICATION



Note: $V_{OUT}=V_{FB}\times(1+R1/R2)$

ABSOLUTE MAXIMUM RATINGS

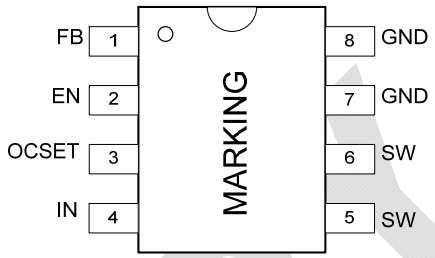
(Note1)

Input Voltage ..... +25V
SW Pin Voltage.....-0.5V to V_{IN}+0.5V
FB Pin Voltage.....-0.3V to V_{IN}
EN Pin Voltage.....-0.3V to V_{IN}+0.3V
P_D Power Dissipation (T_A=25℃)..... Internal Limited
Junction Temperature .....150℃
Storage Temperature Range ..... -65℃ to 150℃
Lead Temperature(Soldering, 10sec.) .....300℃

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

PACKAGE/ORDER INFORMATION

TOP VIEW



PART NUMBER	PACKAGE	MARKING
AS1015KBT	SOP-8L	AS1015

ELECTRICAL CHARACTERISTICS

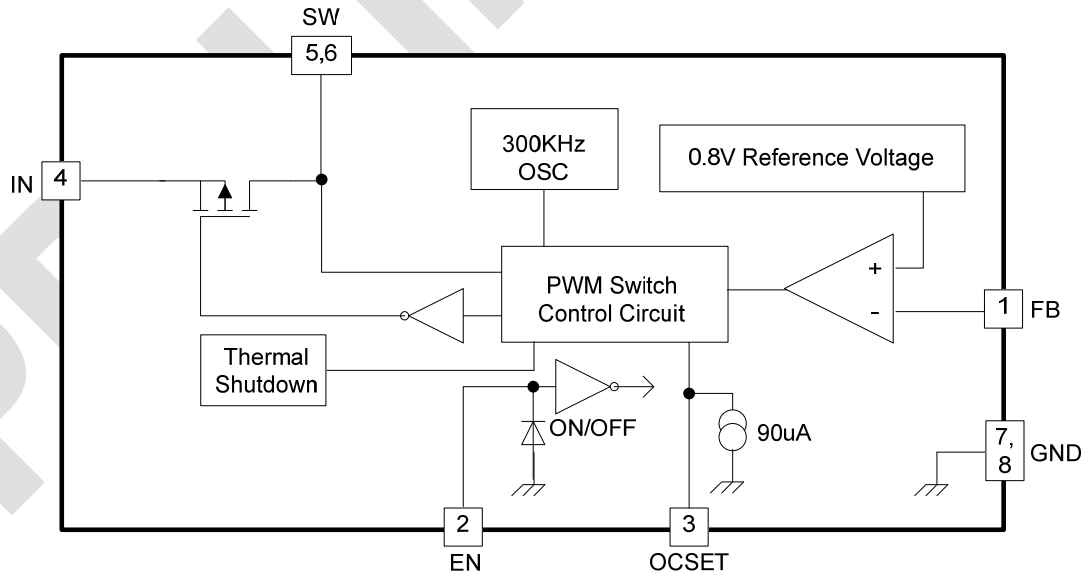
V_{CC} =12V, V_{OUT} =3.3V,T_A = 25°C, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		3.6	-	23	V
Junction Temperature Range		-40	-	125	℃
Feedback Voltage	I_{LOAD}=0.1A	0.784	0.8	0.816	V
Oscillation Frequency	V_{IN} =3.6~23V, I_{LOAD}=0.2~5A	240	300	360	KHz
SCP Frequency	V_{IN} =3.6~23V	30	50	70	KHz
Duty Cycle	V_{FB} =0V force driver on	-	100	-	%
Internal MOSFET $R_{DS(ON)}$	V_{IN}=5V, V_{FB} =0V	-	35	45	mΩ
	V_{IN}=12V, V_{FB} =0V		28	35	
Quiescent Current	V_{IN} =3.6~23V, V_{FB} =1.5V force driver off	-	3	10	mA
Shutdown Current	V_{EN}=GND	-	1	10	uA
EN Threshold Voltage		0.8	1.3	2.0	V
EN Pin Bias Voltage		-	1	20	uA
FB Pin Bias Voltage	I_{LOAD}=0.2A	-	0.1	0.5	uA
OCSET Pin Bias Voltage	I_{LOAD}=0.2A	75	95	105	uA
Line Regulation	V_{IN} =3.6~23V, I_{LOAD}=0.2A	-	2	-	%
Load Regulation	I_{LOAD}=0.2A~5A	-	0.1	-	%
Over Temperature Shutdown		-	150	-	℃
Over Temperature Hysteresis		-	25	-	
Efficiency: η	V_{IN}=12V, V_{OUT}=5V, I_O=5A	-	90	-	%
	V_{IN}=5V, V_{OUT}=3.3V, I_O=5A	-	88	-	
Thermal Resistance θ_{JC}		-	-	20	℃/W
Thermal Resistance θ_{JA}		-	-	60	

PIN FUNCTIONS

PIN NUMBER	PIN NAME	FUNCTION
1	FB	This pin senses the feedback voltage to regulate the output voltage. Connect this pin to a resistor divider to set the output voltage.
2	EN	This pin allows an external logic control signal to turn on/off this device. Float this pin or drive it to low level to turn-off this device, drive it to high level to turn on this device. If this feature is not needed, connect this pin to IN pin directly.
3	OCSET	Add an external resistor from this pin to IN pin to set peak current.
4	IN	The input pin of the step-down converter. A suitably large capacitor must be connected from this pin to ground to bypass noise on the input of the IC.
5, 6	SW	The output pin of the step-down converter. This pin is the switching node that supplies power to the output. Connect a LC filter from this pin to the output load and a rectifier diode to the ground
7, 8	GND	The ground pin of the step-down converter. Connect this pin to the circuit ground.

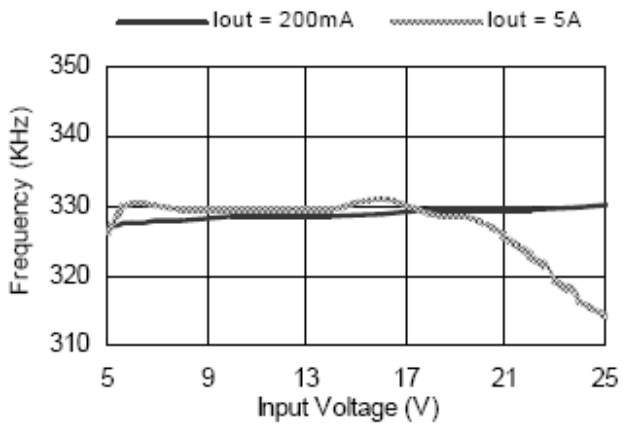
BLOCK DIAGRAM



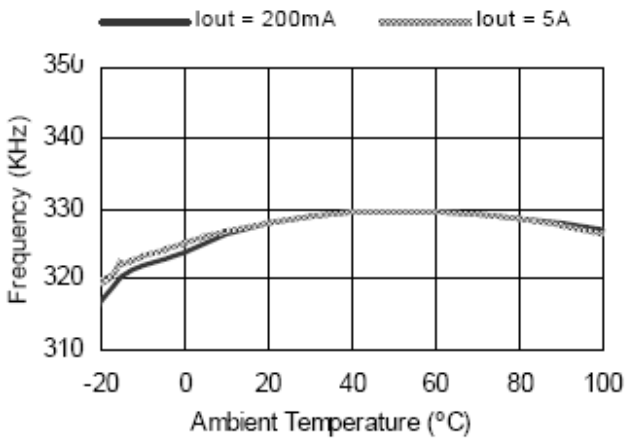
TYPICAL PERFORMANCE CHARACTERISTICS

V_{CC} =12V, V_{OUT} =3.3V,T_A = 25°C, unless otherwise noted.

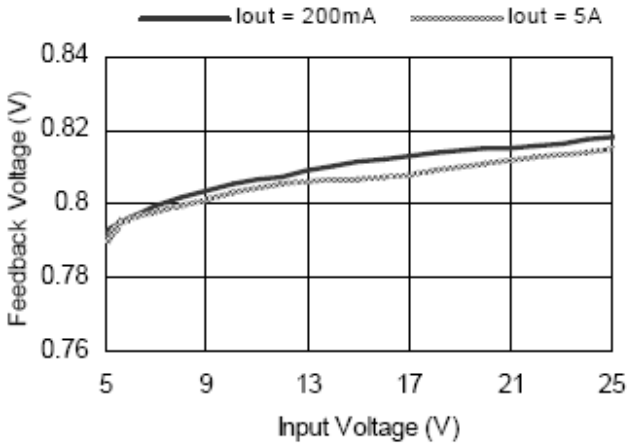
Frequency vs. Input Voltage



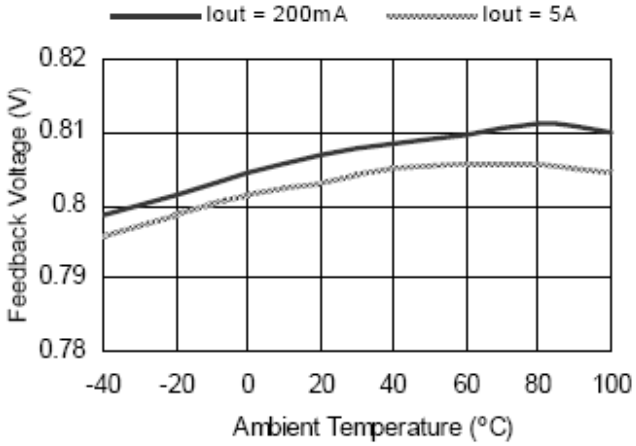
Frequency vs. Temperature



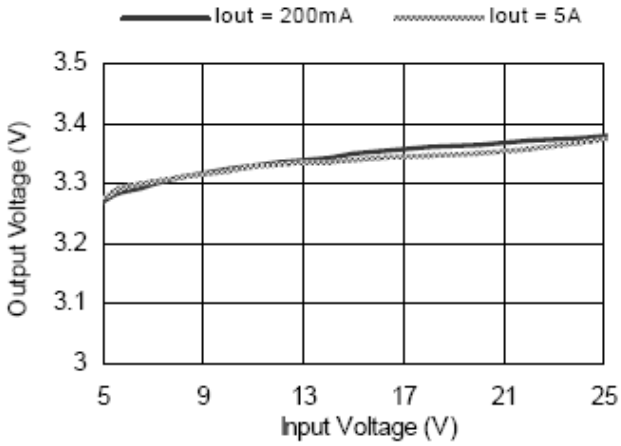
Feedback Voltage vs. Input Voltage



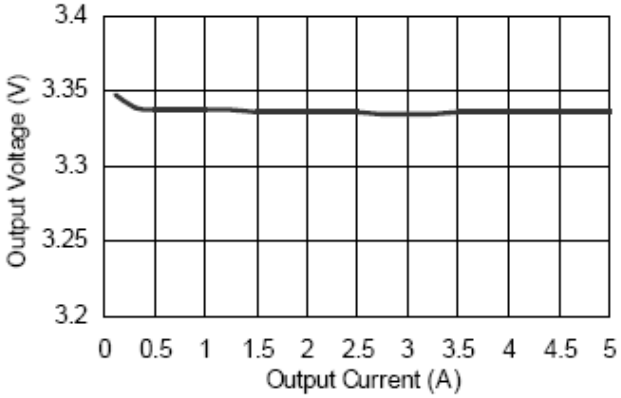
Feedback Voltage vs. Temperature



Line Regulation



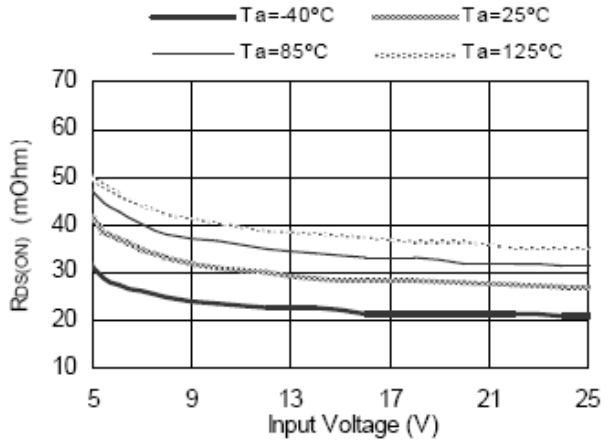
Load Regulation



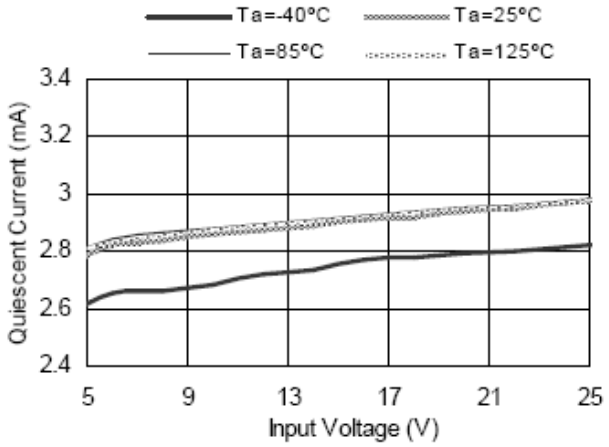
TYPICAL PERFORMANCE CHARACTERISTICS

V_{CC} =12V, V_{OUT} =3.3V,T_A = 25°C, unless otherwise noted.

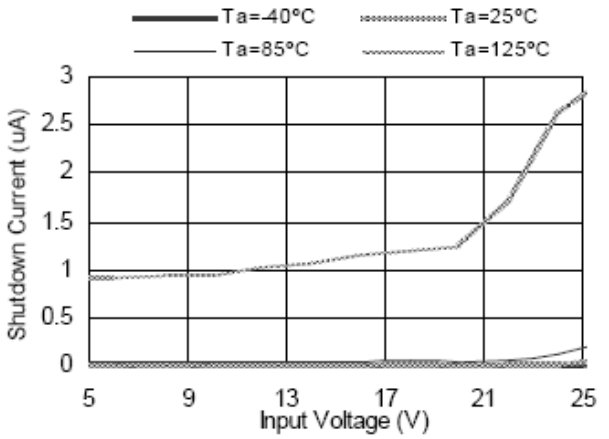
$R_{DS(ON)}$ vs. Input Voltage



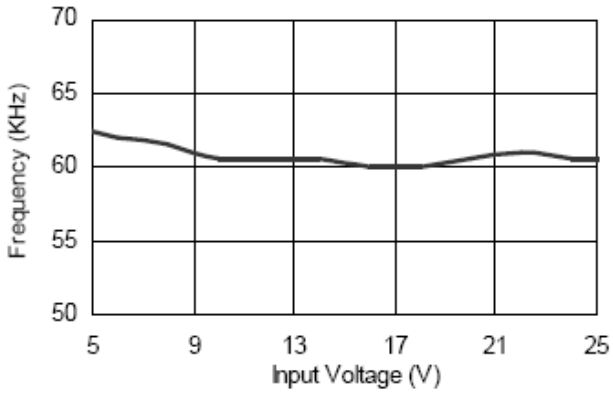
Quiescent Current vs. Input Voltage



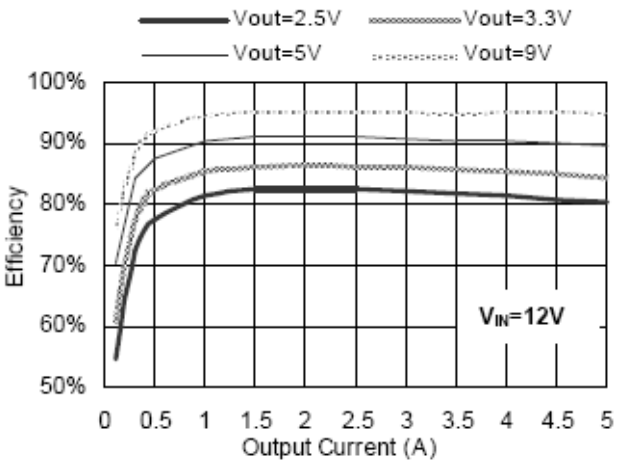
Shutdown Current vs. Input Voltage



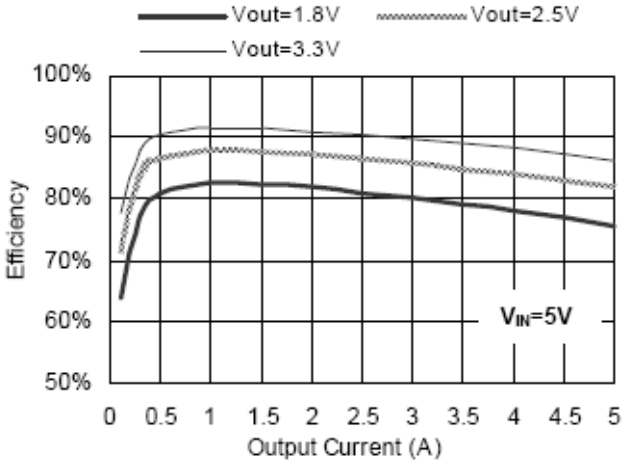
Short Circuit Frequency vs. Input Voltage



Efficiency



Efficiency

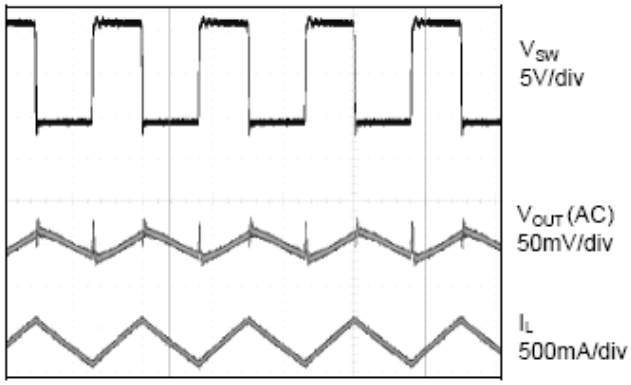


TYPICAL PERFORMANCE CHARACTERISTICS

V_{CC} =12V, V_{OUT} =3.3V,T_A = 25°C, unless otherwise noted.

Output Voltage Ripple - CCM

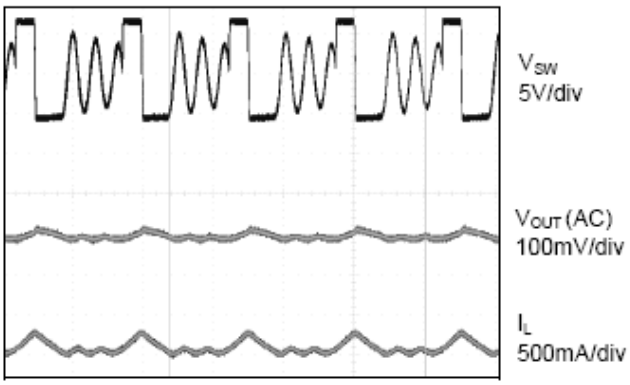
V_{IN}=12V V_{OUT}=5V, I_{LOAD}=5A



Time Base: 2us/div

Output Voltage Ripple - DCM

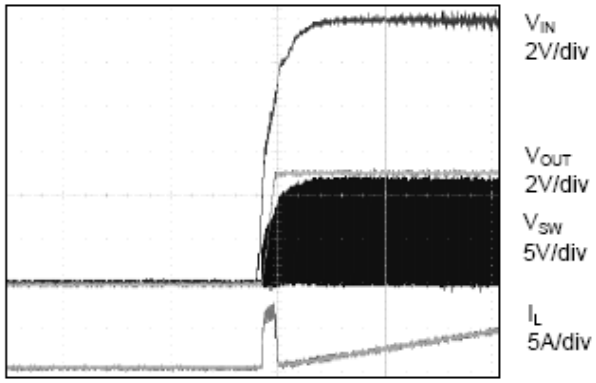
V_{IN}=12V V_{OUT}=5V, I_{LOAD}=0.05A



Time Base: 2us/div

Start-up

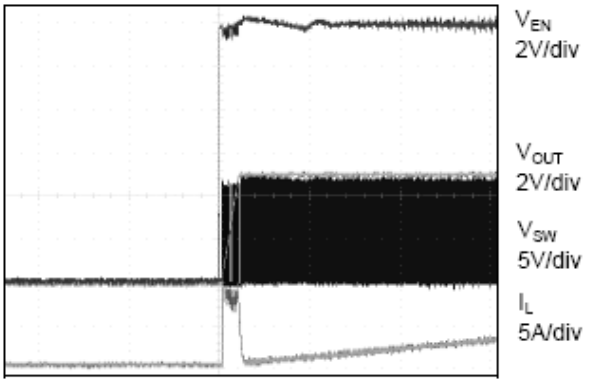
V_{IN}=12V V_{OUT}=5V, I_{LOAD}=5A



Time Base: 2ms/div

Start-up From Enable

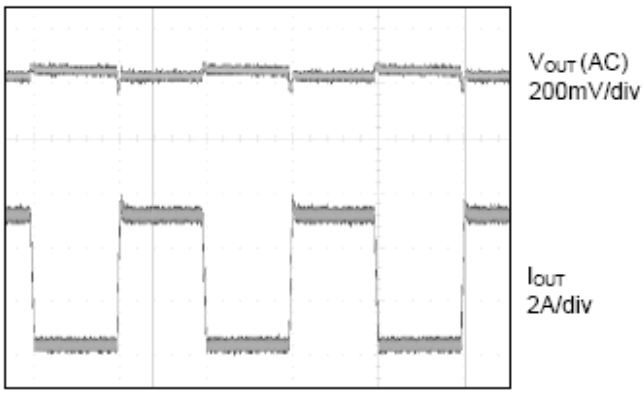
V_{IN}=12V V_{OUT}=5V, I_{LOAD}=5A



Time Base: 1ms/div

Load Transient

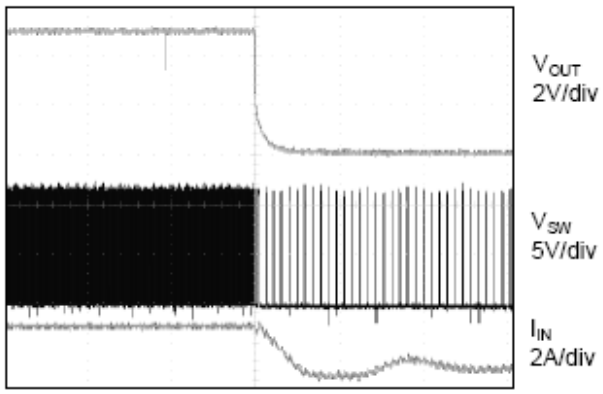
V_{IN}=12V V_{OUT}=5V, I_{LOAD}=200mA~5A
T_{ON}=T_{OFF}=1ms, T_f=T_r=100mA/us



Time Base: 1ms/div

Short Circuit Protection

V_{IN}=12V V_{OUT}=5V, I_{LOAD}=5A



Time Base: 200us/div

APPLICATION INFORMATION

OUTPUT VOLTAGE PROGRAMMING

The device develops a band-gap between the feedback pin and ground pin. Therefore, the output voltage can be formed by R1 and R2. Use 1% metal film resistors for the lowest temperature coefficient and the best stability. Select lower resistor value to minimize noise pickup in the sensitive feeback pin, or higher resistor value to improve efficiency.

The output voltage is given by the following formula:

$$\text{Vout} = \text{Vfb} \times \left(1 + \frac{\text{R1}}{\text{R2}}\right) ; \text{where Vfb} = 0.8\text{V}$$

SHORT CIRCUIT PROTECTION

This device includes short circuit protection. When the output is shorted to ground, the protection circuit will be triggered and force the oscillation frequency down to approximately 50KHz. The oscillation frequency will return to the normal value once the output voltage or the feedback voltage rises above 0V.

PEAK CURRENT SETTING

This device reserves OCSET pin to set the switching peak current. In general, the peak current must be 1.5 times of the continuous output current. It can be calculated as below:

$$\text{Ipk} = (\text{Iocset} \times \text{Rocset})/\text{Rds(on)}$$

Where:

Ipk - Peak current

Iocset – OCSET Pin Bias Current

Rds(on) – Internal MOSFET ON-Resistance

DELAY START-UP

Uses the EN pin to provide a time delay between the input voltage is applied and the output voltage comes up. As the instant of the input voltage rises, the charging of capacitor C_{DELAY} pulls the EN pin low, Keeping the device off. Once the capacitor voltage rises above the EN pin threshold voltage, the device will start to operate.

For example, setting at V_{IN}=12V, R_{DELAY}=100K, C_{DELAY}=0.1uF. The start-up delay time can be calculated as below:

$$\text{Vc} = \text{Vin} \times 1 - \text{e}^{-\text{T}/\tau}) > \text{Ven}$$

T>1.147ms

Where

Vc is capacitor voltage

Ven is 1.3V typical, EN pin threshold voltage

T is delay time

τ is Rdelay * Cdelay

This feature is useful in situations where the input power source is limited in the amount of current it can deliver. It allows the input voltage to rise to a higher voltage before the device starts operating.

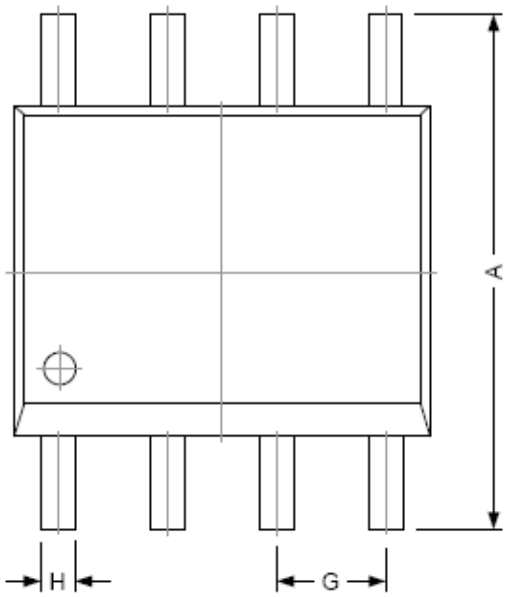
THERMAL CONSIDERATION

Thermal protection limits total power dissipation in this device. When the junction temperature reaches approximately 150°C, the thermal sensor signals the shutdown logic turning off this device. The thermal sensor will turn this device on again after the IC's junction temperature cools by 25°C.

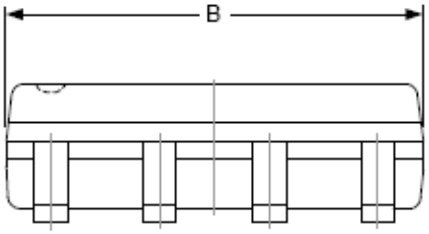
For continuous operation, do not exceed the maximum operation junction temperature 125°C.

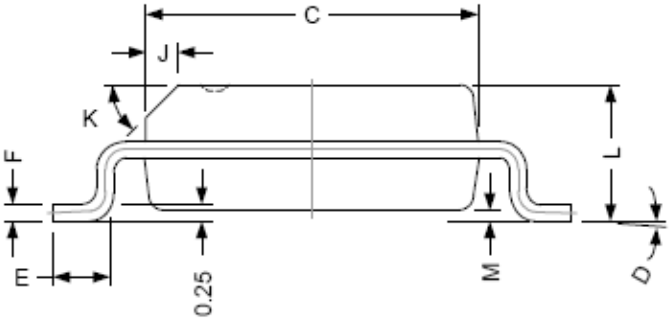
PACKAGE DESCRIPTION Units: mm

Package
8-Lead Plastic SOP-8L



REF.	DIMENSIONS	
	Millimeter	
	Min.	Max.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	0.90
F	0.19	0.25
M	0.10	0.25
H	0.35	0.49
L	1.35	1.75
J	0.375 REF.	
K	45°	
G	1.27 TYP.	





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