MP2184

4A, Synchronous Step-Down Converter with SS and PG

DESCRIPTION

The MP2184 is a monolithic, step-down switch-mode converter with built-in, internal power MOSFETs. It achieves 4A of continuous output current (I_{OUT}) from a 2.5V to 5.5V input voltage (V_{IN}) range, with excellent load and line regulation. The output voltage (V_{OUT}) can be regulated to as low as 0.6V.

Constant-on-time (COT) control provides fast transient response and eases loop stabilization. Fault protections include cycle-by-cycle current limiting and thermal shutdown.

The MP2184 is well-suited for a wide range of applications, including high-performance digital signal processors (DSPs), wireless power, portable and mobile devices, and other low-power systems.

The MP2184 requires a minimal number of readily available, standard external components, and is available in an ultra-small SOT583 package.

FEATURES

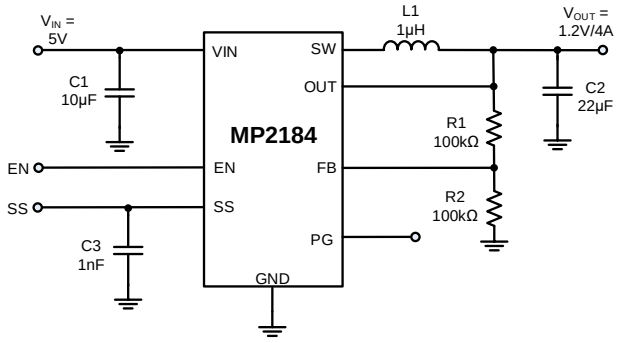
- Low 21μA Quiescent Current (I_Q)
- 1.2MHz Switching Frequency (f_{SW})
- Enable (EN) Pin for Power Sequencing
- 1% Feedback (FB) Accuracy
- Wide 2.5V to 5.5V Operating Input Voltage (V_{IN}) Range
- Output Voltage (V_{OUT}) Adjustable from 0.6V
- Up to 4A Output Current (I_{OUT})
- 65mΩ and 35mΩ Internal Power MOSFET Switches
- 100% Duty Cycle when On
- Output Discharge
- V_{OUT} Over-Voltage Protection (OVP)
- External Soft-Start/Shutdown Control
- Short-Circuit Protection (SCP) with Hiccup Mode
- Power Good (PG)
- Available in an SOT583 Package

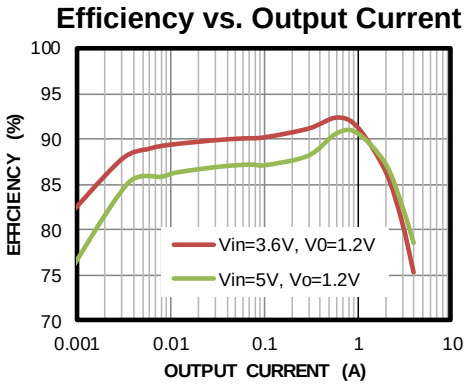
MPL Optimized Performance with MPS Inductor MPL-AL4020 Series

APPLICATIONS

- Wireless/Networking Cards
- Portable Instruments
- Battery-Powered Devices
- Low-Voltage I/O System Power
- Multi-Function Printers

TYPICAL APPLICATION





ORDERING INFORMATION

Part Number*	Package	Top Marking	MSL Rating
MP2184GTL	SOT583	*See Below*	1

* For Tape & Reel, add suffix -Z (e.g. MP2184GTL-Z).

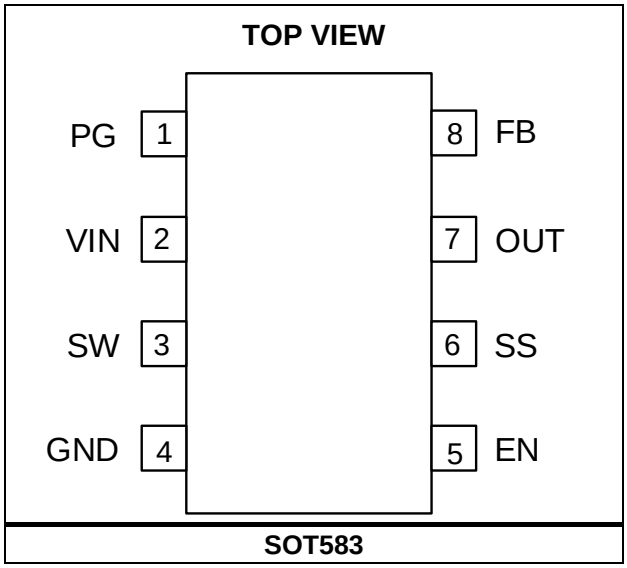
TOP MARKING

BGXY

LLL

BGX: Product code of MP2184GTL
Y: Year code
LLL: Lot number

PACKAGE REFERENCE



PIN FUNCTIONS

Pin #	Name	Description
1	PG	**Power good indicator.** The output of the PG pin is an open drain.
2	VIN	**Supply voltage.** The MP2184 operates from a 2.5V to 5.5V unregulated input. The VIN pin needs a decoupling capacitor to prevent large voltage spikes from appearing at the input.
3	SW	**Output switching node.** The SW pin is the drain of the internal high-side P-channel MOSFET. Connect the inductor to SW to complete the converter.
4	GND	**Ground.**
5	EN	**On/off control.**
6	SS	**Soft start.** Connect a capacitor across the SS and GND pins to set the soft-start time and avoid inrush current at start-up.
7	OUT	**Output voltage power rail and input sense pin for output voltage.** Connect the load to the OUT pin. The OUT pin needs an output capacitor to reduce the output voltage ripple.
8	FB	**Feedback pin.** An external resistor divider from the output to GND, tapped to the FB pin, sets the output voltage (V_{OUT}).

ABSOLUTE MAXIMUM RATINGS (1)

Supply voltage (V_{IN}) 6.5V
V_{SW}.....
….-0.3V (-5V for <10ns) to +6.5V (8V for <10ns)
All other pins .....-0.3V to +6.5V
Junction temperature (T_J) .....150°C
Lead temperature .....260°C
Continuous power dissipation (T_A = 25°C) (2) (4)
……. 2.3W
Storage temperature ..... -65°C to +150°C

ESD Ratings

Human body model (HBM) 2000V
Charged-device model (CDM).....1250V

Recommended Operating Conditions (3)

Supply voltage (V_{IN}) .....2.5V to 5.5V
Operating junction temp (T_J) .... -40°C to +125°C

Thermal Resistance θ_{JA} θ_{JC}

EV2184-TL-00A (4)	58	13 °C/W
SOT583 (5)	120	55 °C/W

Notes:

1) Exceeding these ratings may damage the device.
2) The maximum allowable power dissipation is a function of the maximum junction temperature, T_J (MAX), the junction-to-ambient thermal resistance, θ_{JA}, and the ambient temperature, T_A. The maximum allowable continuous power dissipation at any ambient temperature is calculated by P_D (MAX) = (T_J (MAX) - T_A) / θ_{JA}. Exceeding the maximum allowable power dissipation can cause excessive die temperature, and the regulator may go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.
3) The device is not guaranteed to function outside of its operating conditions.
4) Measured on an EV2184-TL-00A, 2-layer PCB.
5) Measured on a JESD51-7, 4-layer PCB.

ELECTRICAL CHARACTERISTICS

V_{IN} = 3.6V, T_J = -40°C to +125°C, typical value is tested at T_J = 25°C. The over-temperature limit is guaranteed by characterization, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Input voltage (V_{IN}) range			2.5		5.5	V
Under-voltage lockout (UVLO) threshold rising				2.3	2.45	V
UVLO threshold hysteresis				200		mV
Supply current (shutdown)		V_{EN} = 0V, T_J = 25°C		0	1	µA
Supply current (quiescent)		V_{EN} = 2V, V_{FB} = 0.63V, V_{IN} = 3.6V, T_J = 25°C		21	26	µA
Feedback voltage	V_{FB}	T_J = 25°C	594	600	606	mV
		T_J = -40°C to +125°C	591	600	609	
Feedback current	I_{FB}	V_{FB} = 0.63V		50	100	nA
P-channel MOSFET switch on resistance	R_{DSON_P}	V_{IN} = 5V		65		mΩ
N-channel MOSFET switch on resistance	R_{DSON_N}	V_{IN} = 5V		35		mΩ
Switch leakage		V_{EN} = 0V, V_{IN} = 6V V_{SW} = 0V or 6V, T_J = 25°C		0	1	µA
Switching frequency	f_{SW}	V_{IN} = 5V, V_{OUT} = 1.2V, operating in CCM		1200		kHz
Minimum on time (6)	t_{MIN-ON}	V_{IN} = 3.6V		70		ns
		V_{IN} = 2.5V		80		ns
Minimum off time	$t_{MIN-OFF}$	V_{IN} = 3.6V		80		ns
		V_{IN} = 2.5V		90		ns
P-channel MOSFET peak current limit				6		A
N-channel MOSFET valley current limit				4		A
Zero current detection (ZCD)				50		mA
Soft-start current	I_{SS_ON}		1.5	3	4.5	µA
Maximum duty cycle			100			%
Power good (PG) under-voltage (UV) rising threshold		FB rising edge	87	90	93	%
PG UV falling threshold		FB falling edge	82	85	88	%
PG delay	PG_D	PG rising/falling edge		80		µs
PG sink current capability	V_{PG-L}	Sink 1mA			0.4	V
PG logic high voltage	V_{PG-H}	V_{IN} = 5V, V_{FB} = 0.6V	4.9			V
Self-biased PG		When VIN and EN not available, while PG pull up voltage is exist			0.7	V

ELECTRICAL CHARACTERISTICS *(continued)*

V_{IN} = 3.6V, T_J = -40°C to +125°C, typical value is tested at T_J = 25°C. The over-temperature limit is guaranteed by characterization, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
PG leakage current/logic high		5V logic high			100	nA
Enable (EN) turn-on delay		EN on to SW active		100		µs
EN turn-off delay		EN off to stop switching		1		ms
EN input logic low voltage					0.4	V
EN input logic high voltage			1.2			V
EN pull-down resistor				2		MΩ
Output discharge resistor	R_{DIS}	V_{EN} = 0V, V_{OUT}= 1.2V		150		Ω
EN input current		V_{EN} = 2V		1		µA
		V_{EN} = 0V		0		µA
Output over-voltage (OV) threshold	V_{OVP}		110%	115%	120%	V_{FB}
Output voltage (V_{OUT}) over-voltage protection (OVP) hysteresis	V_{OVP_HYS}			10%		V_{FB}
OVP delay				6		µs
Low-side current limit		Current flowing from SW to GND		1.5		A
Absolute V_{IN} OVP		After V_{OUT} OVP enabled		6.1		V
Absolute V_{IN} OVP hysteresis				160		mV
Thermal shutdown (6)				160		°C
Thermal hysteresis (6)				30		°C
System Level						
Recommended input capacitance	C_{IN}	V_{IN} = 3.6V, V_{OUT} = 1.2V, I_{OUT} = 4A	10	22		µF
Recommended inductance	L		0.47		1.5	µH
Output capacitance	C_{OUT}	V_{IN} = 3.6V, V_{OUT} = 1.2V, I_{OUT} = 4A	22		100	µF
Output voltage ripple		V_{IN} = 3.6V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, PWM		3		mV
		V_{IN} = 3.6V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, PFM, I_{OUT} = 0A		9		mV
Load regulation		V_{IN} = 3.6V, V_{OUT} = 1.2V, from 0.2A to 4A			1	%
Line regulation		V_{IN} from 2.5 to 5.5V, V_{OUT} = 1.2V, I_{OUT} = 1A			0.5	%
Efficiency		V_{IN} = 5V, V_{OUT} = 1.2V, I_{OUT} = 4A		78		%
Load transient peak-to-peak voltage	V_{P2P}	V_{IN} = 5V, V_{OUT} = 1.2V, L = 0.47µH, C_{OUT} = 2 x 22uF, I_{OUT} = 0A to 4A at 1A/µs	-5%		+5%	V_{OUT}

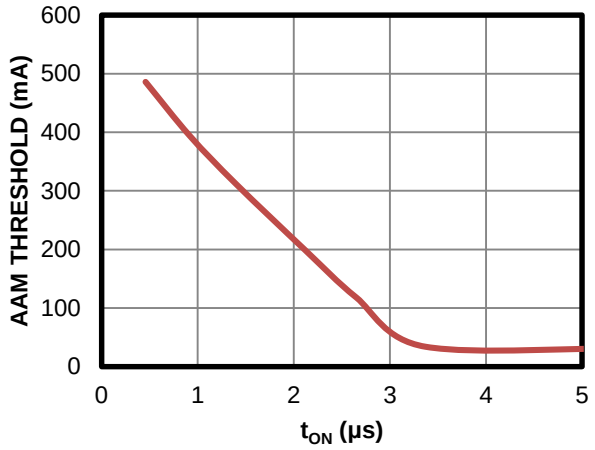
Note:

6) Guaranteed by engineer sample characterization.

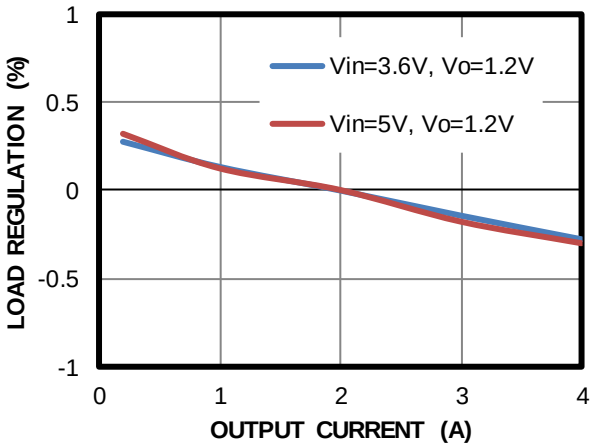
TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN} = 3.6V, V_{OUT} = 1.2V, L = 1µH, T_A = 25°C, unless otherwise noted.

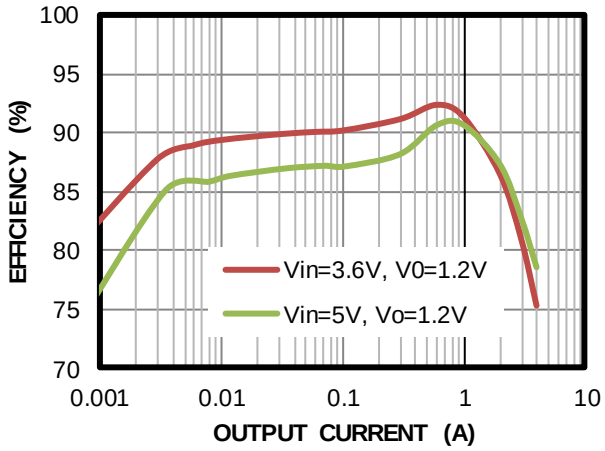
AAM Threshold vs. t_{ON}



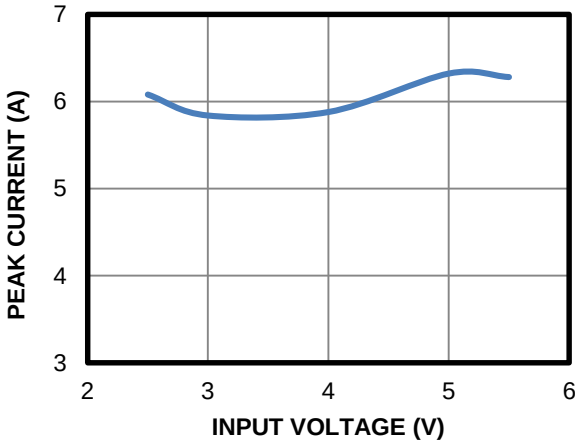
Load Regulation vs. Output Current



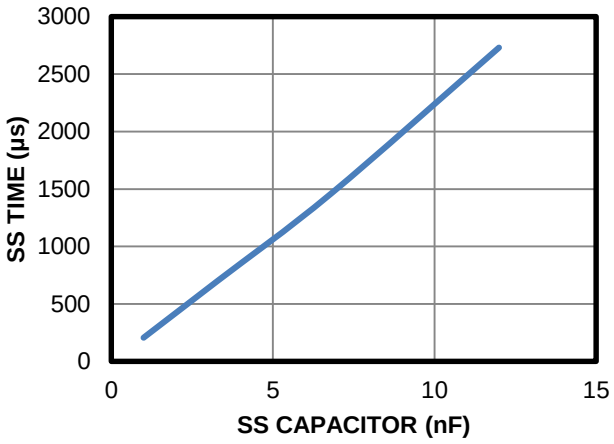
Efficiency vs. Output Current



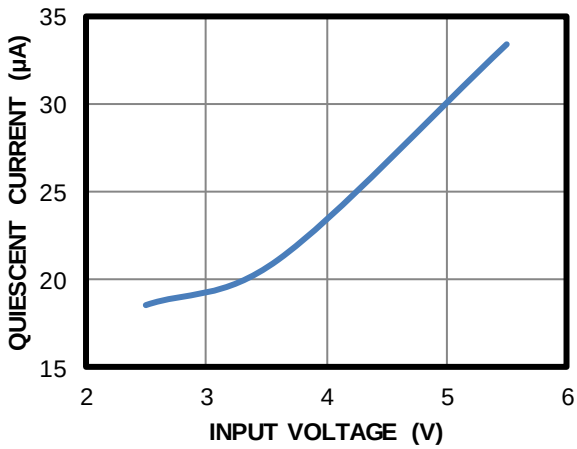
I_{PEAK} vs. V_{IN}



SS Time vs. SS Capacitor



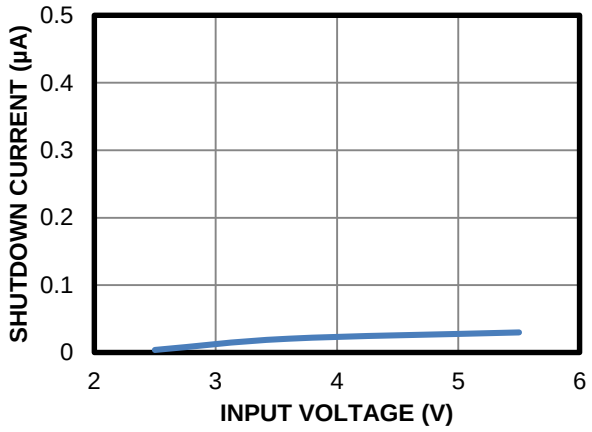
Quiescent Current vs. Input Voltage



TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

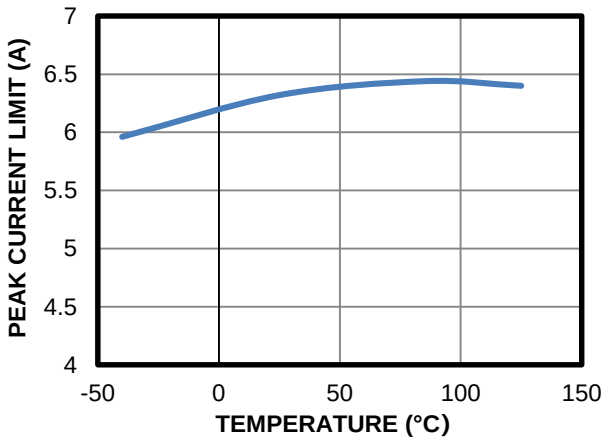
V_{IN} = 3.6V, V_{OUT} = 1.2V, L = 1µH, T_A = 25°C, unless otherwise noted.

Shutdown Current vs. Input Voltage



Peak Current Limit vs. Temperature

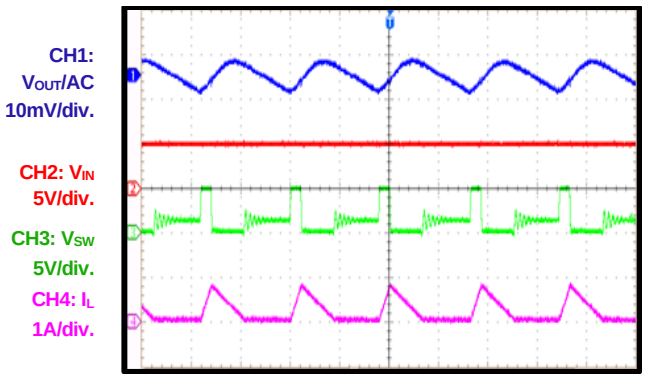
V_{IN} = 5V



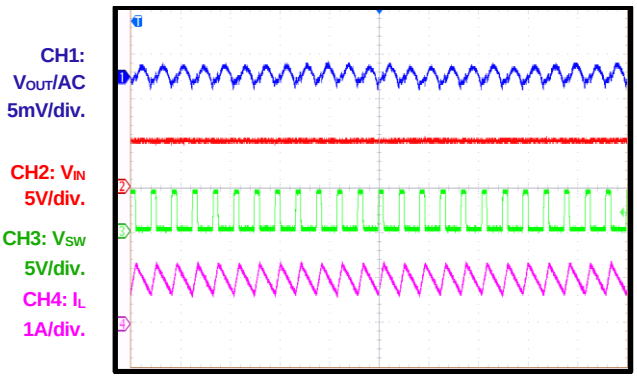
TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

V_{IN} = 3.6V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 44µF, T_A = 25°C, unless otherwise noted.

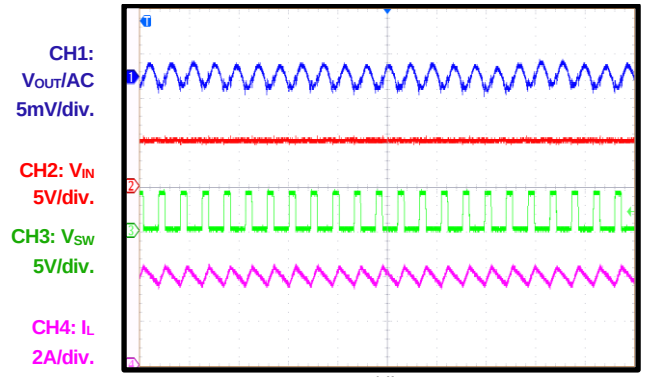
Output Voltage Ripple
0.2A load



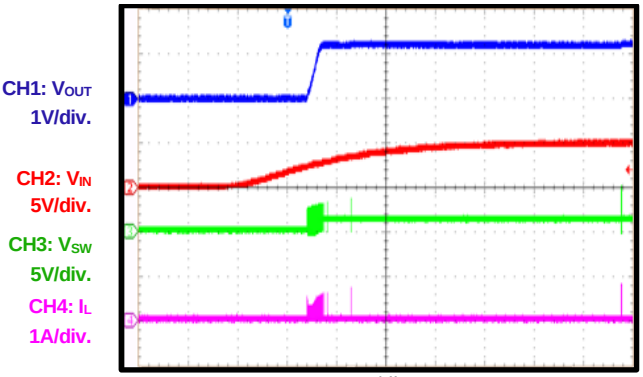
Output Voltage Ripple
1A load



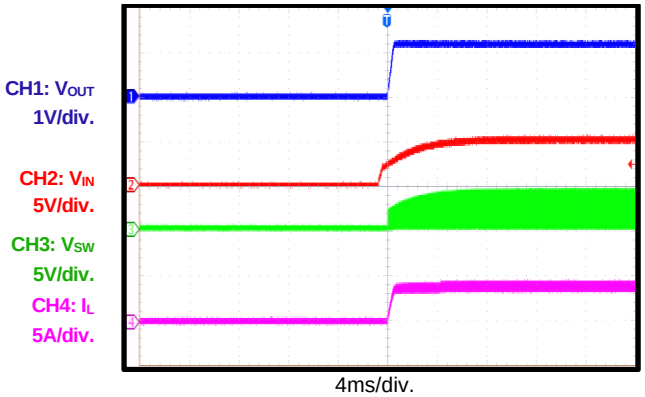
Output Voltage Ripple
4A load



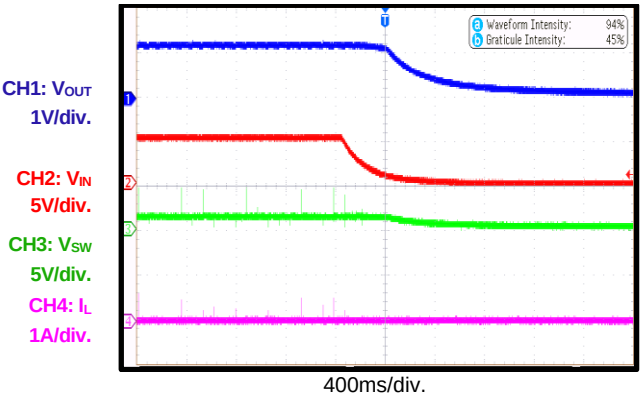
Start-Up through VIN
No load



Start-Up through VIN
4A load



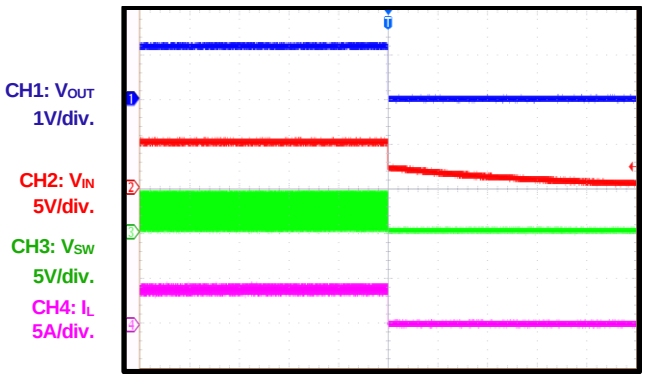
Shutdown through VIN
No load



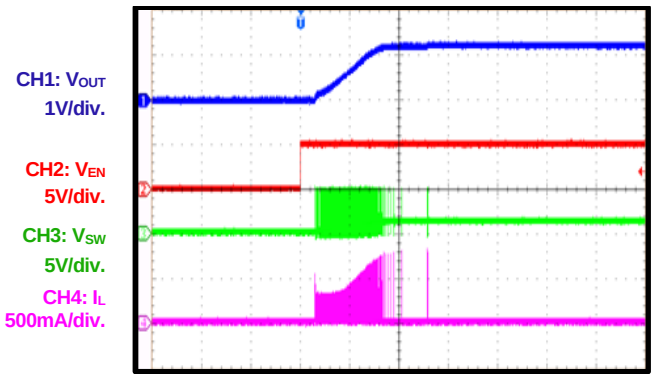
TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

V_{IN} = 3.6V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 44µF, T_A = 25°C, unless otherwise noted.

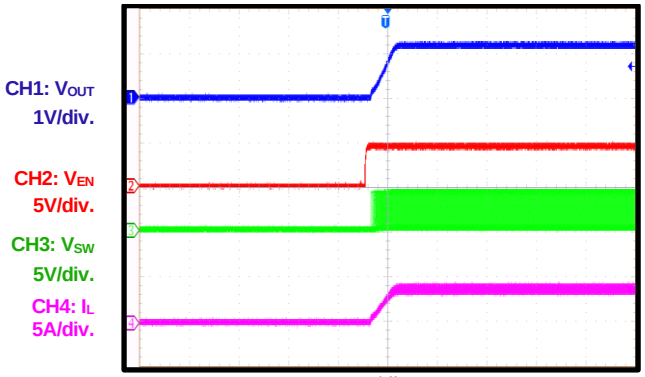
Shutdown through VIN
With 4A Load



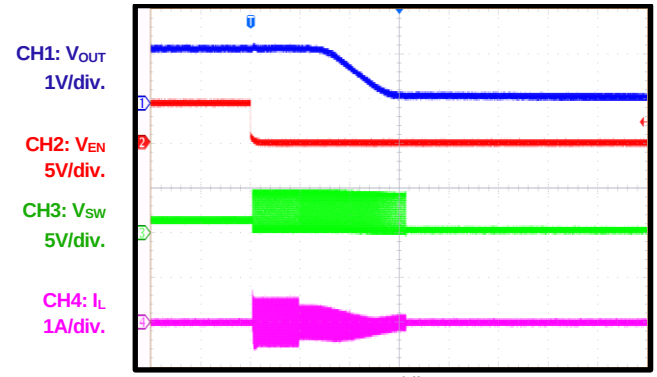
EN On
Without load



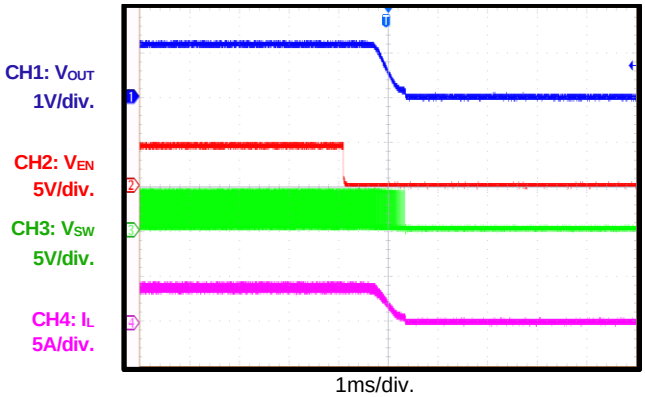
EN On
With 4A Load



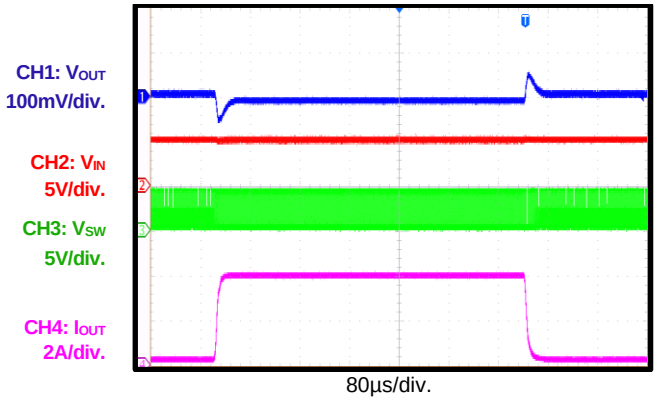
EN Off
No load



EN Off
4A load



Load Transient Response
I_{OUT} = 0.2A to 4A

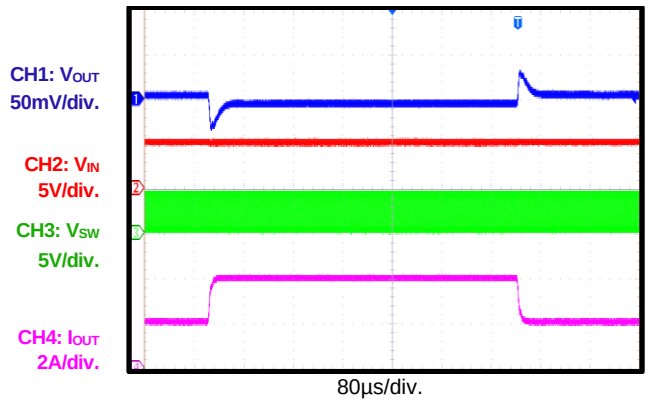


TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

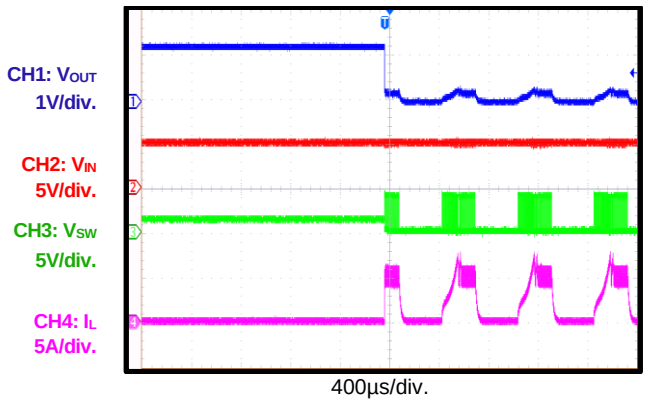
V_{IN} = 3.6V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 44µF, T_A = 25°C, unless otherwise noted.

Load Transient Response

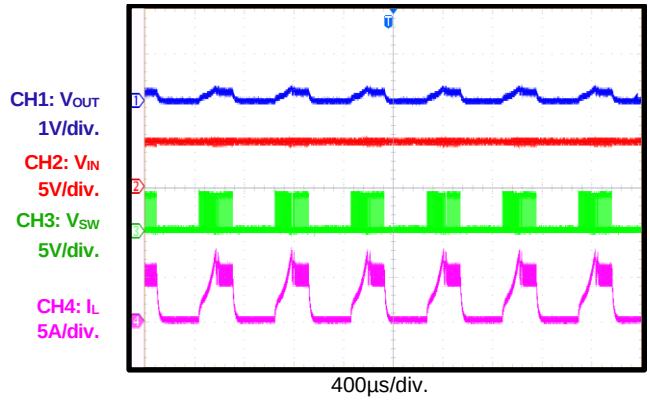
I_{OUT}= = 2A to 4A



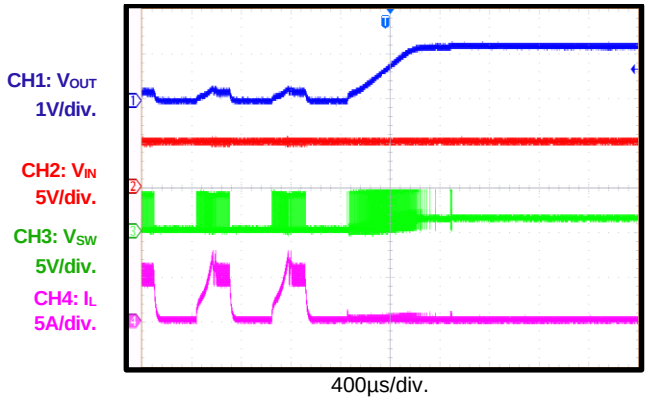
Short-Circuit Entry



Short Circuit



Short-Circuit Recovery



FUNCTIONAL BLOCK DIAGRAM

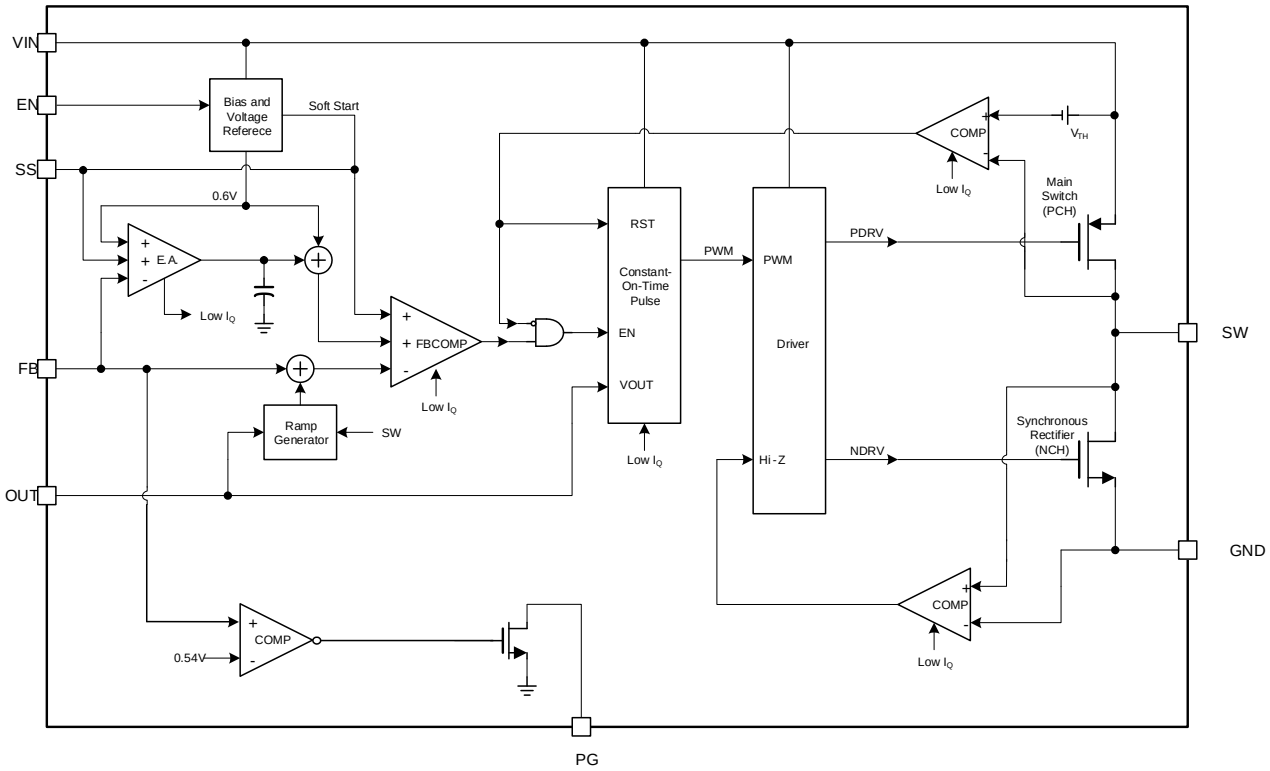


Figure 1: Functional Block Diagram

OPERATION

The MP2184 uses constant on-time (COT) control with input voltage (V_{IN}) feed-forward to stabilize the switching frequency (f_{SW}) across the full input range. The device achieves 4A of continuous output current (I_{OUT}) from a 2.5V to 5.5V V_{IN}, with excellent load and line regulation. The output voltage (V_{OUT}) can be regulated to as low as 0.6V.

Constant-On-Time (COT) Control

Compared to fixed frequency pulse-width modulation (PWM) control, COT control offers a simpler control loop and a faster transient response. By using V_{IN} feed-forward, the MP2184 maintains a nearly constant f_{SW} across the V_{IN} and V_{OUT} ranges. The switching pulse on time (t_{ON}) can be calculated with Equation (1):

$$t_{ON} = \frac{V_{OUT}}{V_{IN}} \times 0.83\mu s \quad (1)$$

To prevent inductor current (I_L) runaway during load transient response, the MP2184 has a fixed minimum off time of 90ns.

Sleep Mode Operation

The MP2184 features sleep mode to achieve high efficiency at extremely light loads. In sleep mode, most of the circuit blocks' input currents are decreased; specifically, the error amplifier and PWM comparator input currents.

When the load gets lighter, the MP2184 slows down f_{SW}. If the off time is longer than 3.5µs, then the MP2184 enters sleep mode.

If there is a high-side pulse, then the MP2184 exits sleep mode.

Advanced Asynchronous Modulation (AAM) Mode at Light Loads

The MP2184 features advanced asynchronous modulation (AAM) mode, a power-save mode, with a zero current detection (ZCD) circuit for light loads.

AAM power-save mode is offered for light-load conditions. Figure 2 shows the simplified AAM control theory. The AAM current (I_{AAM}) is set internally. The SW's on-pulse time is determined by on-timer generator or AAM comparator.

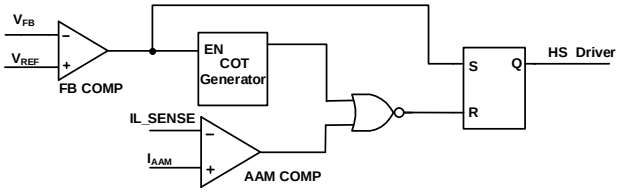


Figure 2: Simplified AAM Control Logic

Under light-load conditions, the SW on-pulse time is longer. If the AAM comparator pulse is longer than the on-timer generator, the MP2184 adopts AAM control (see Figure 3).

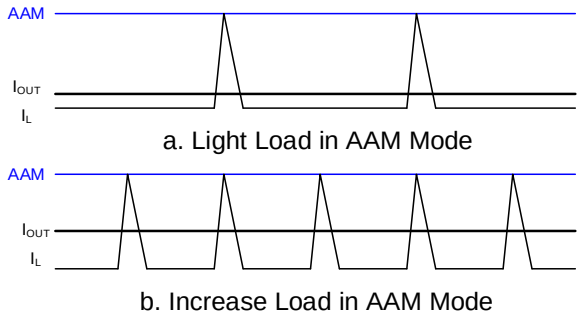


Figure 3: AAM Comparator Controls t_{ON}

If the AAM comparator pulse is shorter than the on-timer generator, the MP2184 operates with on-timer control (see Figure 4). Typically, using a very small inductance may result in the MP2184 switching to on-timer control.

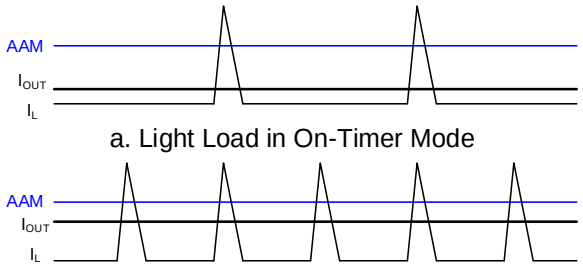


Figure 4: On-Timer Controls t_{ON}

Excluding on-timer control, the AAM circuit has a 150ns blanking time in sleep mode. That means if the on-timer is shorter than 150ns, the high-side MOSFET (HS-FET) may turn off after the on-timer generates a pulse without AAM control. Note that the on-time pulse in sleep mode is about 40% longer than that in discontinuous conduction mode (DCM) or continuous conduction mode (CCM).

In these scenarios, I_L may not reach the AAM threshold (see Figure 5).

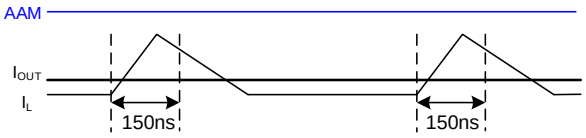


Figure 5: AAM Blanking Time in Sleep Mode

Figure 6 shows that the AAM threshold decreases while t_{ON} increases gradually. While in CCM, I_{OUT} must be greater than half of the AAM threshold.

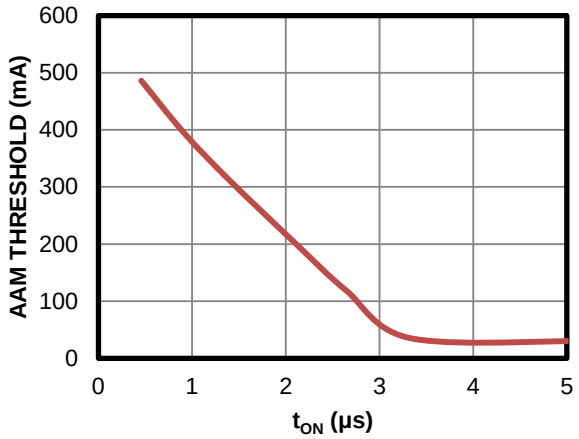


Figure 6: AAM Threshold Decreases while t_{ON} Increases

The MP2184 uses its ZCD circuit to detect if I_L starts to reverse. When I_L reaches the ZCD threshold, the low-side MOSFET (LS-FET) turns off.

AAM mode works with the ZCD circuit to ensure that the MP2184 operates in DCM at light loads, even if V_{OUT} is almost equal to V_{IN}.

Enable (EN)

When V_{IN} exceeds its under-voltage lockout threshold (UVLO) (typically 2V), the MP2184 can be enabled by pulling the EN pin above 1.2V. Leave the EN pin floating or it pull down to ground to disable the MP2184. There is an internal 2MΩ resistor connected from the EN pin to ground.

When the device is disabled, the part goes into output discharge mode automatically, and its internal discharge MOSFET provides a resistive discharge path for the output capacitor.

Soft Start (SS) and Soft Shutdown

The MP2184 has an external soft start (SS) pin that ramps up V_{OUT} at a controlled slew rate to avoid overshoot at start-up. The SS pin's charge current is about 3µA. The SS time is determined by the SS capacitor.

The MP2184 also has a soft shutdown function that allows the output capacitor to be discharged linearly. The soft shutdown discharge current on the SS pin is about 3µA. Similar to soft start, the capacitor on the SS pin determines the discharge time.

Current Limit

The MP2184 typically has a 6A HS-FET current limit. When the HS-FET reaches its current limit, the MP2184 remains in hiccup mode until the current drops. This prevents I_L from rising further and damaging other components.

Short-Circuit Protection (SCP) and Recovery

The MP2184 enters short-circuit protection (SCP) mode when it reaches its current limit, then it tries to recover with hiccup mode. The MP2184 disables the output power stage, discharges the soft-start capacitor, and then automatically tries to soft start again. If the short-circuit condition remains after soft start ends, the MP2184 repeats this cycle until the short circuit disappears. Then V_{OUT} returns to its regulation level.

Over-Voltage Protection (OVP)

The MP2184 monitors a resistor divider's feedback voltage (V_{FB}) to detect over-voltage (OV) conditions. When V_{FB} is 115% of the target voltage, the controller enters a dynamic regulation period. During this period, the LS-FET is on until the LS-FET current drops to -1.5A. This function discharges the output and tries to keep it within the normal range. If the OV condition remains, the LS-FET turns on again after an 800ns time delay. The MP2184 exits this regulation period when V_{FB} falls below 105% of the reference voltage (V_{REF}).

If dynamic regulation cannot limit the increasing V_{OUT}, and the input is detected to be 6.1V, input OVP occurs. The MP2184 stops switching until V_{IN} drops below 6V, then it begins operating again.

Power Good (PG) Indicator

The MP2184 has an open-drain output and requires an external pull-up resistor (100Ω to 500kΩ) for power good (PG) indication. When V_{FB} exceeds 90% of the regulation voltage, the PG voltage (V_{PG}) is pulled up to V_{OUT} or V_{IN} by the external resistor.

If V_{FB} exceeds this window, the internal MOSFET pulls PG to ground. The MOSFET's maximum $R_{DS(ON)}$ is below 400Ω.

If PG is pulled up to an external power supply when V_{IN} and EN are not available, then the PG pin's self-biased voltage is below 0.7V.

APPLICATION INFORMATION

COMPONENT SELECTION

Setting the Output Voltage (V_{OUT})

The external resistor divider sets V_{OUT} (see Figure 7). Select the feedback resistor (R1) that reduces the VOUT pin's leakage current (typically between 100Ω and 200kΩ). There is no strict requirement on the feedback resistor. Select R1 to exceed 10kΩ. R2 be estimated with Equation (2):

$$R2 = \frac{R1}{\frac{V_{OUT}}{0.6} - 1} \quad (2)$$

Figure 7 shows the feedback circuit.

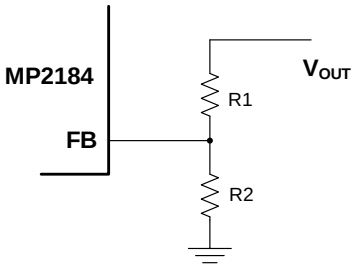


Figure 7: Feedback Network

Table 1 lists the recommended resistor value for common output voltages.

Table 1: Resistor Values for Common Output Voltages

V_{OUT} (V)	R1 (kΩ)	R2 (kΩ)
1	200 (1%)	300 (1%)
1.2	200 (1%)	200 (1%)
1.8	200 (1%)	100 (1%)
2.5	200 (1%)	63.2 (1%)
3.3	200 (1%)	44.2 (1%)

Selecting the Inductor

MPL **Optimized Performance with MPS Inductor MPL-AL4020 Series**

Most applications work best with a 0.47µH to 1.5µH inductor. Select an inductor with a DC resistance below 25mΩ to optimize efficiency.

A high-frequency, switch-mode power supply with a magnetic device introduces strong electronic magnetic inference to the system. Do not use an un-shielded inductors because they are suboptimal magnetic shields.

Shielded inductors, such as metal alloy or multi-player chip power, are recommended for most applications because they can effectively reduce the influence of magnetic interference.

MPS inductors are optimized and tested for use with our complete line of integrated circuits.

Table 2 lists our power inductor recommendations. Select a part number based on your design requirements.

Table 2: Power Inductor Selection

Part Number	Inductance	Manufacturer
MPL-AL4020-R47	0.47µH	MPS
MPL-AL4020-R68	0.68µH	MPS
MPL-AL4020-R82	0.82µH	MPS
MPL-AL4020-1R0	1µH	MPS
MPL-AL4020-1R2	1.2µH	MPS
MPL-AL4020-1R5	1.5µH	MPS

Visit MonolithicPower.com under Products > Inductors for more information.

Calculate the inductance value with Equation (3):

$$L_1 = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L \times f_{OSC}} \quad (3)$$

Where ΔI_L is the inductor ripple current.

Choose an inductor current to be approximately 30% of the maximum load current. The maximum inductor peak current can be estimated with Equation (4):

$$I_{L(MAX)} = I_{LOAD} + \frac{\Delta I_L}{2} \quad (4)$$

Selecting the Input Capacitor

The step-down converter has a discontinuous input current, and requires a capacitor to supply the AC current to the converter while maintaining the DC input voltage. Use low-ESR capacitors for the best performance. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. For most applications, a 10µF capacitor is sufficient. Applications with a higher V_{OUT} may require a 22µF capacitor to increase system stability.

The input capacitor requires an adequate ripple current rating because it absorbs the input switching current. Estimate the RMS current in the input capacitor with Equation (5):

$$I_{C1} = I_{LOAD} \times \sqrt{\frac{V_{OUT}}{V_{IN}} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right)} \quad (5)$$

The worst-case condition occurs at $V_{IN} = 2 \times V_{OUT}$, calculated with Equation (6):

$$I_{C1} = \frac{I_{LOAD}}{2} \quad (6)$$

For simplification, choose an input capacitor with an RMS current rating greater than half of the maximum load current.

The input capacitor can be electrolytic, tantalum, or ceramic. When using electrolytic or tantalum capacitors, add a small, high-quality, 0.1µF ceramic capacitor as close to the IC as possible. When using ceramic capacitors, ensure that they have enough capacitance to provide sufficient charge to prevent excessive voltage ripple at the input. The input voltage ripple caused by capacitance can be estimated with Equation (7):

$$\Delta V_{IN} = \frac{I_{LOAD}}{f_{SW} \times C1} \times \frac{V_{OUT}}{V_{IN}} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \quad (7)$$

Selecting the Output Capacitor

The output capacitor (C2) stabilizes the DC output voltage. Ceramic capacitors are recommended. Low-ESR capacitors are recommended to limit the output voltage ripple. Calculate the output voltage ripple with Equation (8):

$$\Delta V_{OUT} = \frac{V_{OUT}}{f_{SW} \times L_1} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \times \left(R_{ESR} + \frac{1}{8 \times f_{SW} \times C2}\right) \quad (8)$$

Where L_1 is the inductor value, and R_{ESR} is the equivalent series resistance (ESR) value of the output capacitor.

When using ceramic capacitors, the capacitance dominates the impedance at the switching frequency, and causes most of the output voltage ripple. For simplification, the output voltage ripple can be estimated with Equation (9):

$$\Delta V_{OUT} = \frac{V_{OUT}}{8 \times f_{SW}^2 \times L_1 \times C2} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \quad (9)$$

For tantalum or electrolytic capacitors, the ESR dominates the impedance at the switching frequency. For simplification, the output ripple can be calculated with Equation (10):

$$\Delta V_{OUT} = \frac{V_{OUT}}{f_{SW} \times L_1} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \times R_{ESR} \quad (10)$$

The characteristics of the output capacitor also affect the stability of the regulation system.

PCB Layout Guidelines

Proper layout of the switching power supplies is very important, and sometimes critical for proper function. For the high-frequency switching converter, poor layout design can result in poor line or load regulation and stability issues. For the best results, refer to Figure 8 and follow the guidelines below:

1. Place the high-current paths (GND, IN, and SW) close to the device with short, direct, and wide traces.
2. Place the input capacitor as close as possible to the IN and GND pins.
3. Place the output capacitor as close as possible to the chip's GND pins.
4. Place the external feedback resistors next to the FB pin.
5. Keep the switching node SW short, and route it away from the feedback network.
6. Keep the V_{OUT} sense line need as short as possible.
7. Route the V_{OUT} sense line away from power inductor (especially the area surrounding the inductor).

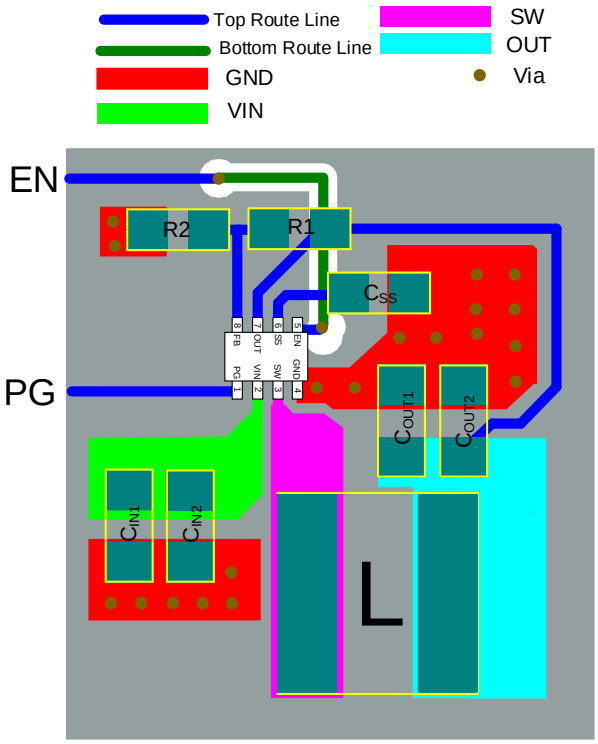


Figure 8: Recommended PCB Layout

TYPICAL APPLICATION CIRCUIT

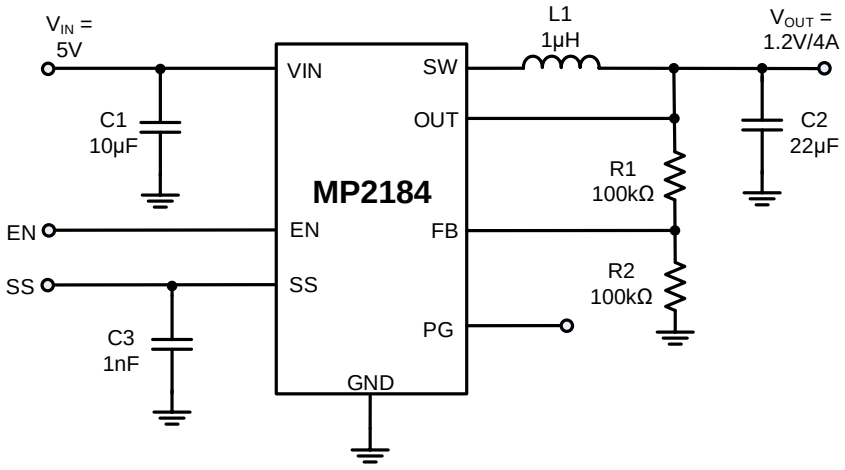


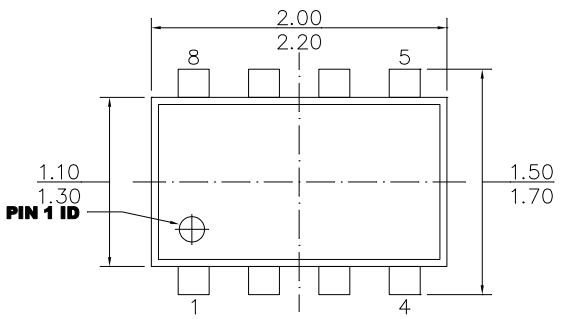
Figure 9: Typical Application Circuit for the MP2184 (7)

Note:

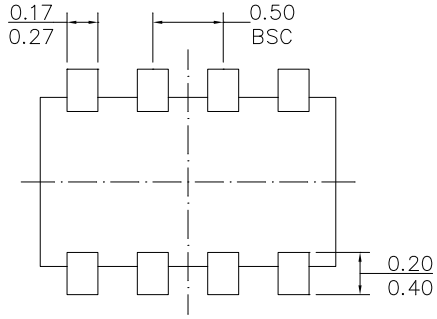
7) If V_{IN} exceeds 3.3V, an additional input capacitor may be required.

PACKAGE INFORMATION

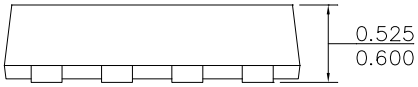
SOT583



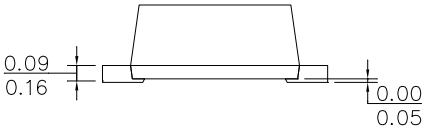
TOP VIEW



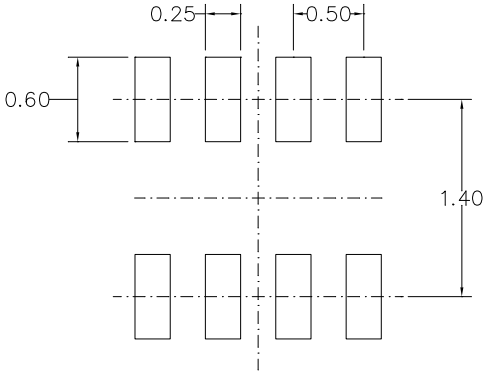
BOTTOM VIEW



FRONT VIEW



SIDE VIEW

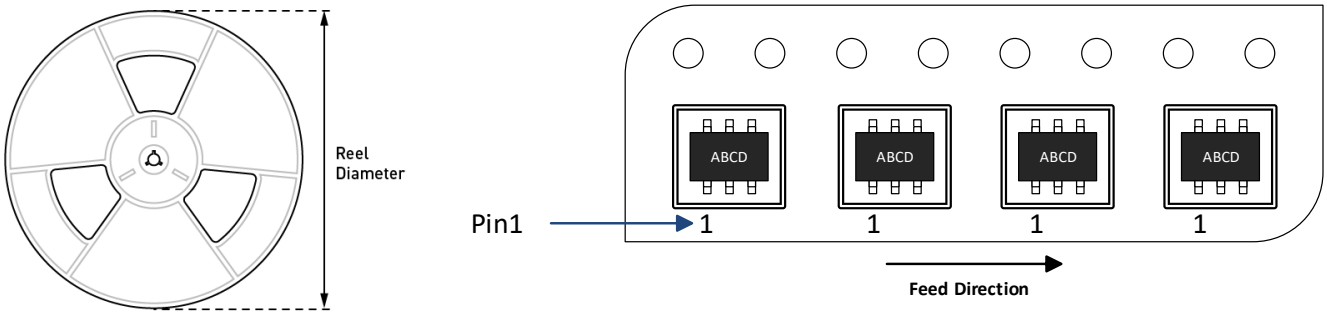


RECOMMENDED LAND PATTERN

NOTE:

1) ALL DIMENSIONS ARE IN MILLIMETERS.
2) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
3) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.10 MILLIMETERS MAX.
4) DRAWING IS NOT TO SCALE.

CARRIER INFORMATION



Part Number	Package Description	Quantity/ Reel	Quantity/ Tube	Quantity/ Tray	Reel Diameter	Carrier Tape Width	Carrier Tape Pitch
MP2184GTL-Z	SOT583	5000	N/A	N/A	7in	8mm	4mm

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	5/18/2023	Initial Release	-