Features

- Input Voltage from 2.2V to 5.0V
- Adjustable Output Voltage from 2.6V to 5.2V
- Guaranteed Continuous Output Capability: 2A/3A(HT79171/HT79181) with V_{OUT}=5.0V and V_{IN}=3.3V
- Internal Ultra-Low Power Switches: 25mΩ/45mΩ (HT79171) and 20mΩ/40mΩ (HT79181) at 5.0V output
- Up to 95% Efficiency
- Fixed PWM Switching Frequency: 500kHz
- Precision Feedback Reference Voltage: 0.6V (±1.5%)
- Ultra-Low Shutdown Current < 1μA
- Load Disconnect (V_{OUT}=0V) and Fast Discharging to Ground during Shutdown
- Embedded Loop Frequency Compensation
- Programmable OCP Threshold via External Resistor, R_{CS}
- Extensive Protection Functions: Soft-Start when Power-On/Enable (SS), Input Under Voltage Lockout (UVLO), Over Current Limit Protection (OCP), Over Temperature Protection (OTP), Output Over Voltage Protection (OVP) and Output Short Protection without Heating (OSP)
- Package Types: 10-pin QFN and 8-pin SOP-EP

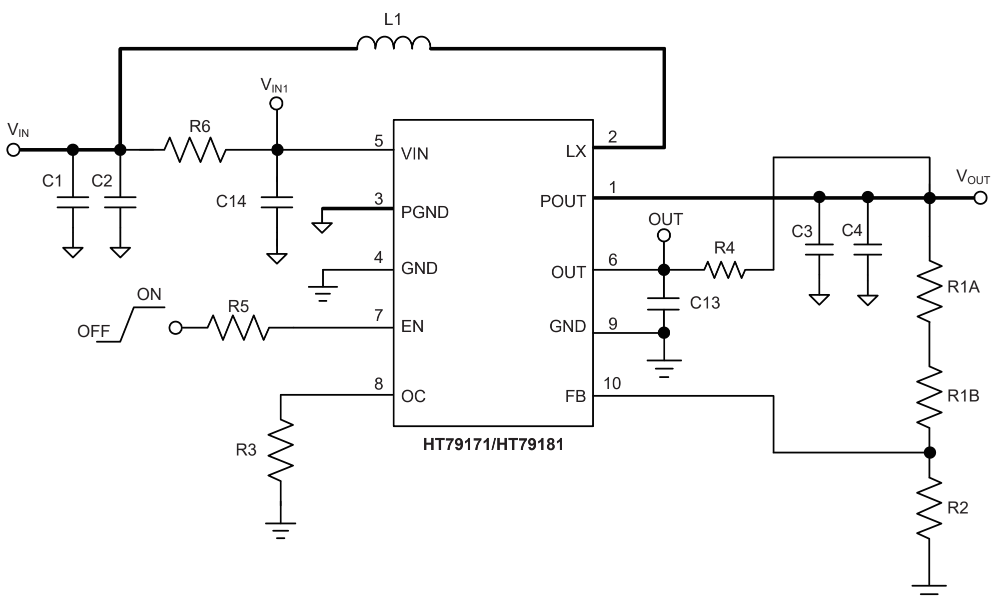
Applications

- All Single Cell Li or Dual Cell Batteries
- Portable Equipment

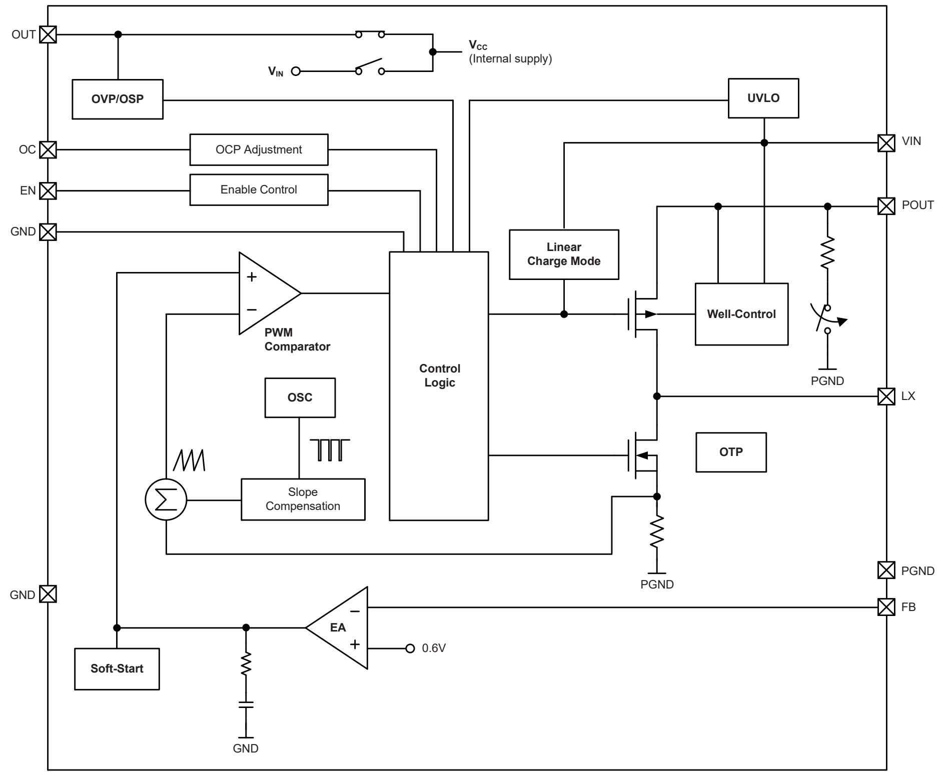
General Description

The HT79171 and HT79181 are synchronous step-up DC-DC converters. With a wide input range from 2.2V to 5.0V, the devices are suitable for portable li-battery based applications such as power banks. The devices are able to provide a continuous 2A/3A current output due to their ultra-low integrated R_{DSONs} which is 25mΩ/45mΩ and 20mΩ/40mΩ for the main FET and synchronous FET respectively. This greatly improves the efficiency and reduces the junction/case temperature. Due to a high operation switching frequency of 500kHz, the devices require only a small number of external components while still have the advantages of low output voltage ripple. The embedded loop frequency compensation circuitry simplifies the system design and reduces the required number of external components.

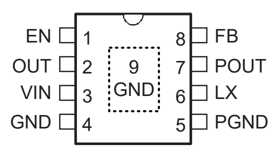
Typical Application Circuit



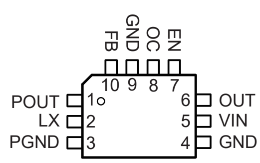
Block Diagram



Pin Assignment



HT79171
8 SOP-EP-A



HT79171/HT79181
10 QFN-A

Pin Description

Pin Name	Pin No.		Type	Description
	10QFN	8SOP-EP		
POUT	1	7	O	Power output Decouple this pin by connecting a capacitor with a minimum value of 22μF for noise immunity.
LX	2	6	O	Inductor connection
PGND	3	5	G	Power ground
GND	4	4	G	Signal ground
VIN	5	3	P	Power supply input
OUT	6	2	O	Signal output. Decouple this pin by connecting a capacitor with a minimum value of 1μF for noise immunity.
EN	7	1	I	Enable control – high active
OC	8	—	I	Adjust current limit via an external resistor connected to ground
GND	9	—	I	Remains connected to GND
FB	10	8	I	Error amplifier inverting input
EP	—	9	G	Exposed pad. Connect to GND

Note: The 8-pin SOP-EP package is only available for the HT79171.

Absolute Maximum Ratings

Parameter		Value	Unit
VIN Pin Input Voltage Range		-0.3 to +6	V
EN Pin Input Voltage Range		-0.3 to (V_{OUT}+0.3)	V
Other Pin Voltage Range		+6	V
Power Dissipation		+2.5	W
Maximum Junction Temperature		+150	°C
Storage Temperature Range		-65 to +150	°C
Lead Temperature – soldering 10 seconds		+260	°C
ESD Susceptibility	Human Body Model	2000	V
	Machine Model	200	V
Junction-to-Ambient Thermal Resistance, θ_{JA}	10QFN	50	°C/W
	8SOP-EP	125	
Junction-to-Case Thermal Resistance, θ_{JC}	10QFN	10	°C/W
	8SOP-EP	25	

Recommended Operating Ratings

Parameter	Value	Unit
VIN Pin Input Voltage Range	2.2 to 5.0	V
POUT and OUT Pin Output Voltage Range	2.6 to 5.2	V
EN Pin Input Voltage Range	0 to (V_{OUT}+0.3)	V
Other Pin Voltage Range	0 to 5.5	V
Junction Temperature Range	-40 to +125	°C
Operating Temperature Range	-40 to +85	°C

Note that Absolute Maximum Ratings indicate limitations beyond which damage to the device may occur. Recommended Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specified performance limits.

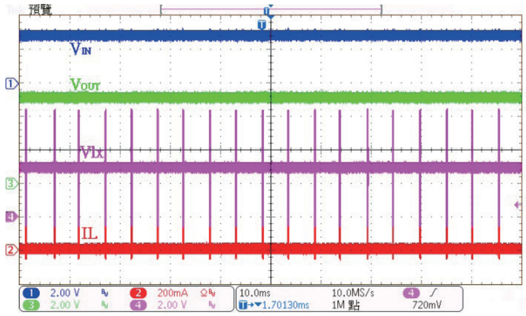
Electrical Characteristics

V_{IN}=2.2V, V_{OUT}=5V, I_{OUT}=0.5A and T_A=25°C, unless otherwise specified.

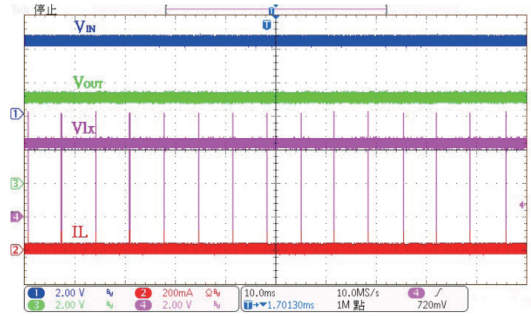
Symbol	Parameter		Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage							
V_{IN}	Input Voltage Range		—	2.2	—	5.0	V
I_Q	Quiescent Current – no switching	V_{IN}	V_{EN}=2.2V, V_{FB}=0.66V, V_{OUT}=5V, I_{OUT}=0A	—	30	45	μA
		V_{OUT}		—	65	80	
I_{SHD}	Shutdown Current		V_{EN}=0V, measure I(V_{IN})	—	0.1	1.0	μA
Boost Converter							
V_{OUT}	Output Voltage Range		—	2.6	—	5.2	V
f_{SW}	Switching Frequency		V_{FB}=0.54V	400	500	600	kHz
$t_{OFF(min)}$	Minimum OFF Time		—	—	100	150	ns
$t_{ON(min)}$	Minimum ON Time		—	—	180	—	ns
$R_{ON(N)}$	Low Side Main FET		V_{OUT}=5V, HT79171	—	25	—	mΩ
			V_{OUT}=5V, HT79181	—	20	—	mΩ
$R_{ON(P)}$	Synchronous FET		V_{OUT}=5V, HT79171	—	45	–	mΩ
			V_{OUT}=5V, HT79181	—	40	—	mΩ
I(V_{LX})	Low Side Main FET Leakage Current		V_{EN}=0V, V_{IN}=V_{LX}=5.5V	—	0.1	1.0	μA
I(V_{OUT})	Synchronous FET Leakage Current		V_{EN}=V_{IN}=5.5V,V_{FB}=0.66V, V_{LX}=0V, V_{OUT}=5.2V	—	0.1	1.0	μA
V_{FB}	Feedback Voltage		V_{IN}=2.2V, V_{OUT}=5V, I_{OUT}=0A	0.591	0.600	0.609	V
I_{FB}	Feedback Leakage Current		V_{FB}=5V	—	0.1	0.5	μA
R_{EN}	EN Pull Down Resistance		—	—	3	—	MΩ
V_{IH}	EN High Voltage Threshold		2.2V≤V_{IN}≤5.5V	—	—	1.5	V
V_{IL}	EN Low Voltage Threshold		2.2V≤V_{IN}≤5.5V	0.4	—	—	V
R_{DIS}	Discharge Resistance to GND		V_{EN}=0V	—	1.8	—	kΩ
Protections							
V_{UVLO+}	Input Supply Turn ON Level		—	—	—	2.2	V
V_{UVLO_HYS}	UVLO Hysteresis		—	—	0.2	—	V
t_{SS}	Soft-Start Time		V_{IN}=3.3V, I_{OUT}=3.0A	—	1.75	—	ms
I_{OCP}	Over Current Protection Threshold		HT79171, OC pin is floating	5.0	—	—	A
			HT79181, OC pin is floating	6.0	—	—	
V_{OVP}	Output Over Voltage Threshold		—	5.55	5.60	6.50	V
V_{OVP_HYS}	OVP Release Hysteresis		—	—	0.3	—	V
V_{OSP_TR}	Output Short Circuit Trigger Threshold		2.2V≤V_{IN}≤5.5V, measure at V_{OUT}	—	0.87×V_{IN}	—	V
V_{OCP_RE}	Output Short Circuit Release Threshold		2.2V≤V_{IN}≤5.5V, measure at V_{OUT}	—	0.93×V_{IN}	—	V
$t_{OSP(RE)}$	OSP Re-Detection Time		2.2≤V_{IN}≤5.5V, V_{OUT}=0.85×V_{IN}	—	120	—	ms
t_{OSP}	OSP Decision Time		2.2V≤V_{IN}≤5.5V, V_{OUT}=0.85×V_{IN}	—	3	—	ms
T_{OTP}	Thermal Shutdown Threshold		—	—	150	—	°C
$T_{OTP(RE)}$	Thermal Recovery Temperature		—	—	125	—	°C

Typical Performance Characteristics

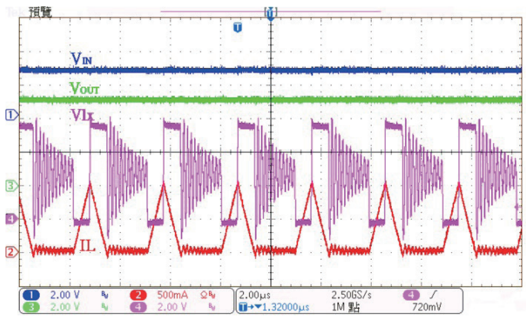
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



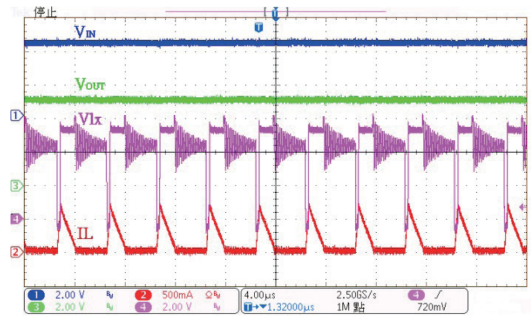
HT79171 Steady State
(V_{IN}=2.5V, I_{OUT}=0A, V_{OUT}=5V)



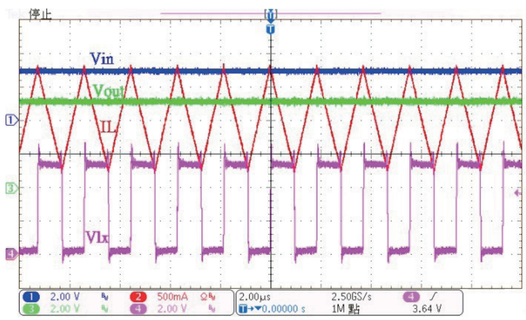
HT79171 Steady State
(V_{IN}=4.2V, I_{OUT}=0A, V_{OUT}=5V)



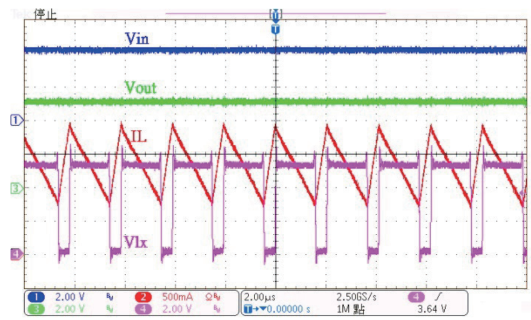
HT79171 Steady State
(V_{IN}=2.5V, I_{OUT}=0.1A, V_{OUT}=5V)



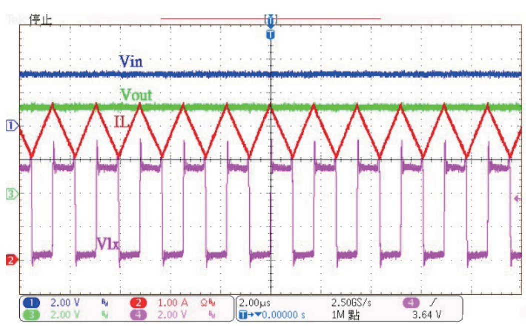
HT79171 Steady State
(V_{IN}=4.2V, I_{OUT}=0.1A, V_{OUT}=5V)



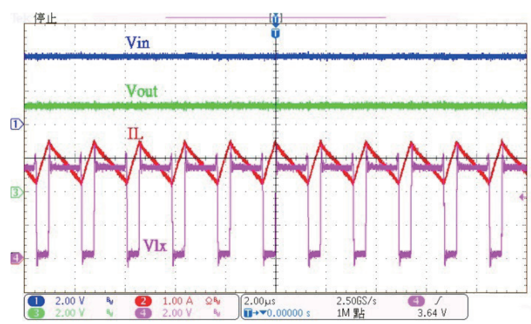
HT79171 Steady State
(V_{IN}=2.5V, I_{OUT}=1.0A, V_{OUT}=5V)



HT79171 Steady State
(V_{IN}=4.2V, I_{OUT}=1.0A, V_{OUT}=5V)



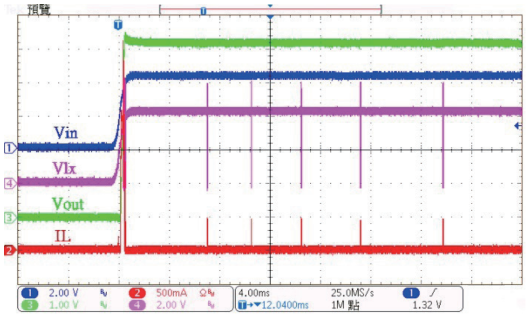
HT79171 Steady State
(V_{IN}=3.0V, I_{OUT}=2.0A, V_{OUT}=5V)



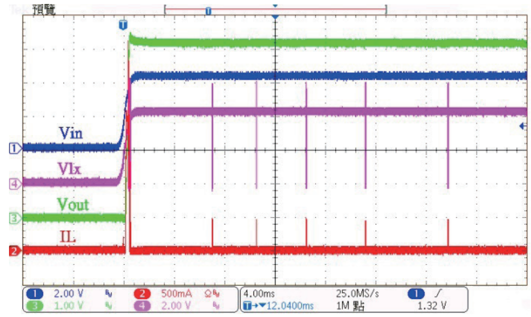
HT79171 Steady State
(V_{IN}=4.2V, I_{OUT}=2.0A, V_{OUT}=5V)

Typical Performance Characteristics (Continued)

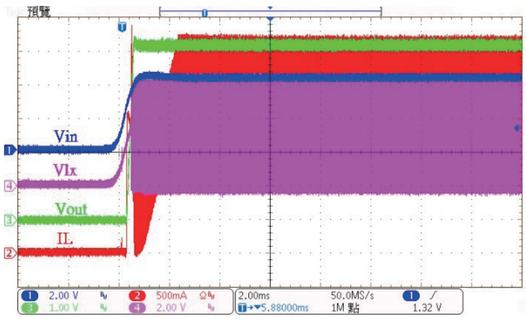
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



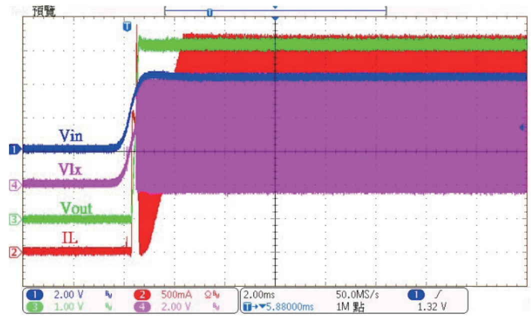
HT79171 Start Up
(V_{IN}=2.5V, I_{OUT}=0A, V_{OUT}=5V)



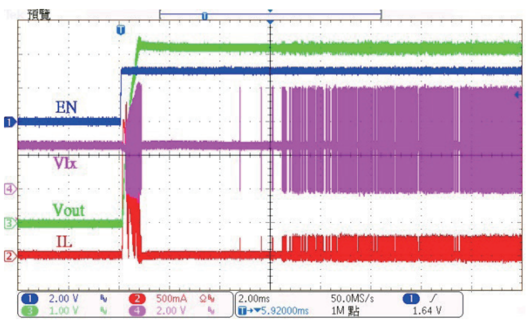
HT79171 Start Up
(V_{IN}=4.2V, I_{OUT}=0A, V_{OUT}=5V)



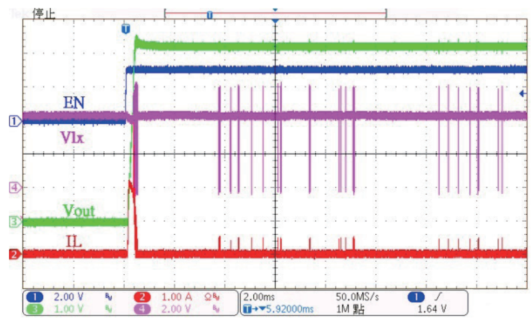
HT79171 Start Up
(V_{IN}=2.5V, I_{OUT}=1.0A, V_{OUT}=5V)



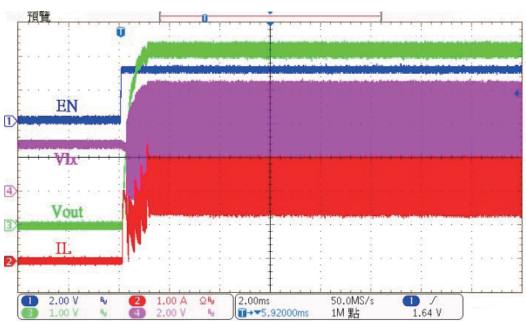
HT79171 Start Up
(V_{IN}=4.2V, I_{OUT}=2.0A, V_{OUT}=5V)



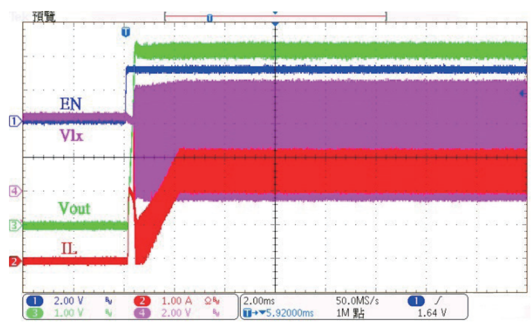
HT79171 Start Up from EN
(V_{IN}=2.5V, I_{OUT}=0A, V_{OUT}=5V)



HT79171 Start Up from EN
(V_{IN}=4.2V, I_{OUT}=0A, V_{OUT}=5V)



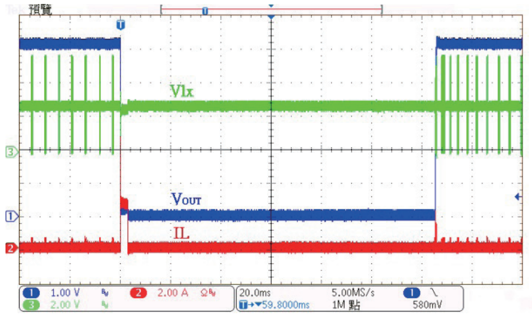
HT79171 Start Up from EN
(V_{IN}=2.5V, I_{OUT}=1.0A, V_{OUT}=5V)



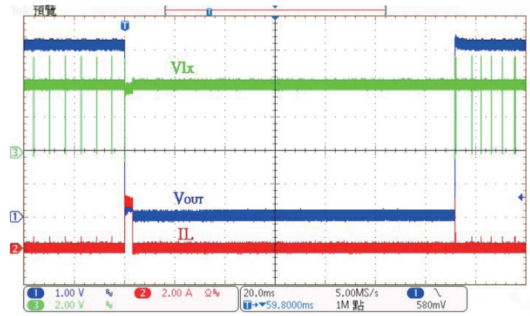
HT79171 Start Up from EN
(V_{IN}=4.2V, I_{OUT}=2.0A, V_{OUT}=5V)

Typical Performance Characteristics (Continued)

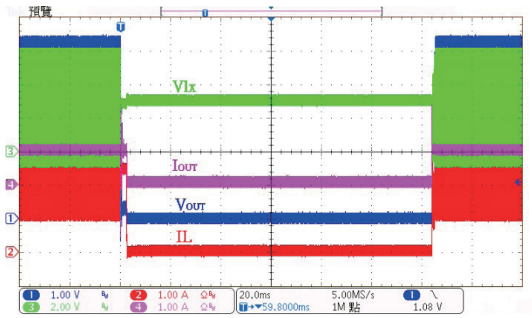
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



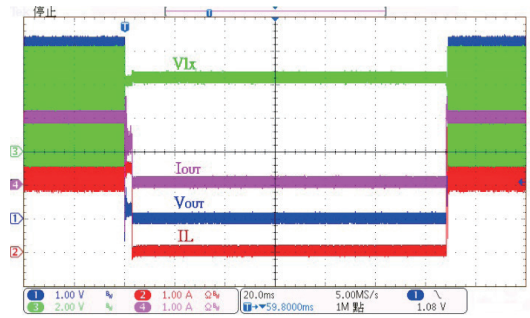
HT79171 Output Short and Recovery
(V_{IN}=2.5V, I_{OUT}=0A, V_{OUT}=5V)



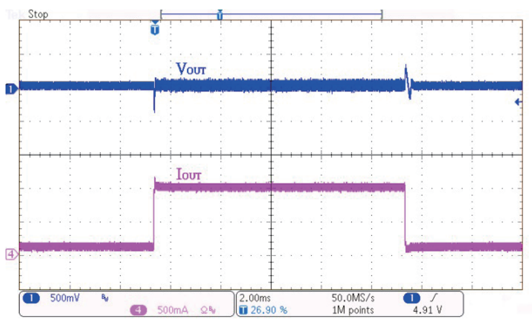
HT79171 Output Short and Recovery
(V_{IN}=4.2V, I_{OUT}=0A, V_{OUT}=5V)



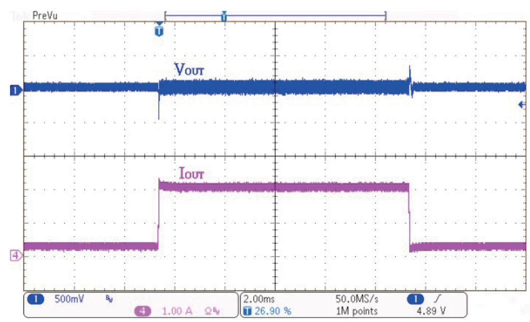
HT79171 Output Short and Recovery
(V_{IN}=2.5V, I_{OUT}=1.0A, V_{OUT}=5V)



HT79171 Output Short and Recovery
(V_{IN}=4.2V, I_{OUT}=2.0A, V_{OUT}=5V)



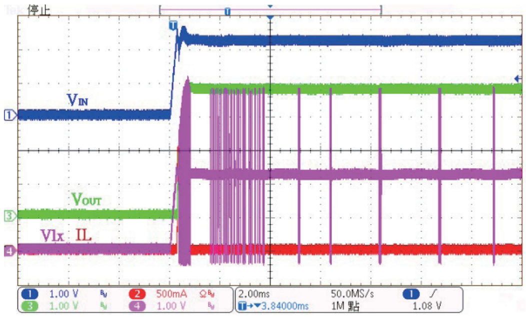
HT79171 Load Transient
(V_{IN}=2.5V, I_{OUT}=0.1A->1.0A, V_{OUT}=5V)



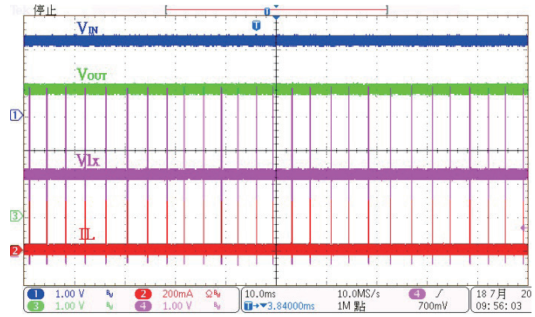
HT79171 Load Transient
(V_{IN}=4.2V, I_{OUT}=0.2A->2.0A, V_{OUT}=5V)

Typical Performance Characteristics (Continued)

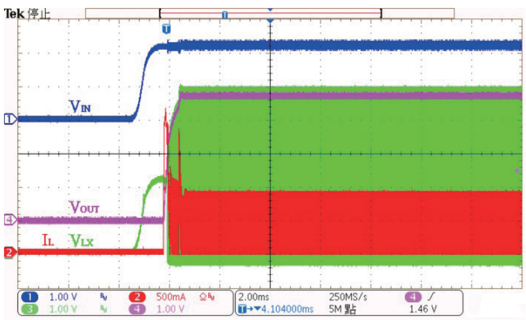
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



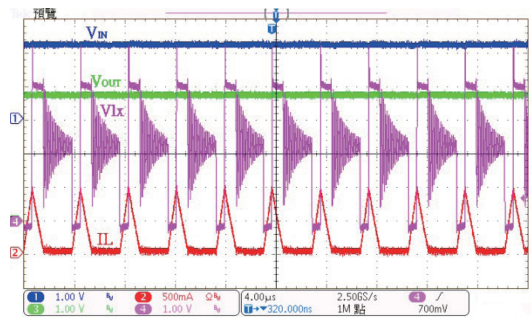
HT79171 Start Up (V_{IN}=2.2V, I_{OUT}=0A, V_{OUT}=3.7V)



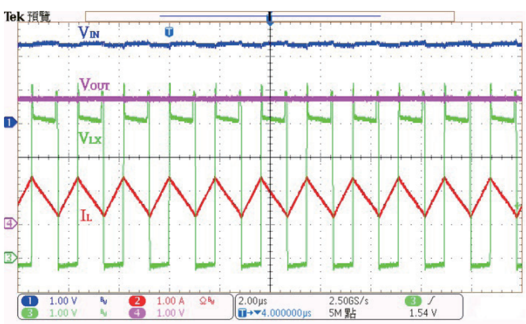
HT79171 Steady State (V_{IN}=2.2V, I_{OUT}=0A, V_{OUT}=3.7V)



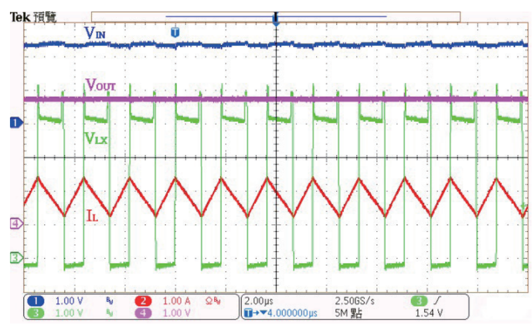
HT79171 Start Up (V_{IN}=2.2V, I_{OUT}=0.1A, V_{OUT}=3.7V)



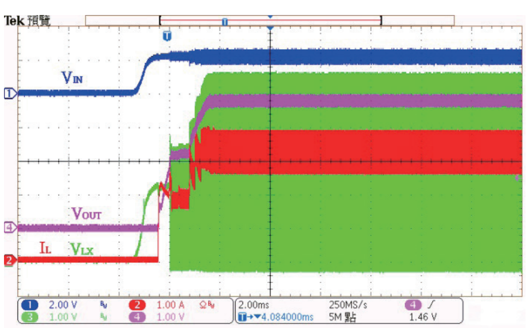
HT79171 Steady State (V_{IN}=2.2V, I_{OUT}=0.1A, V_{OUT}=3.7V)



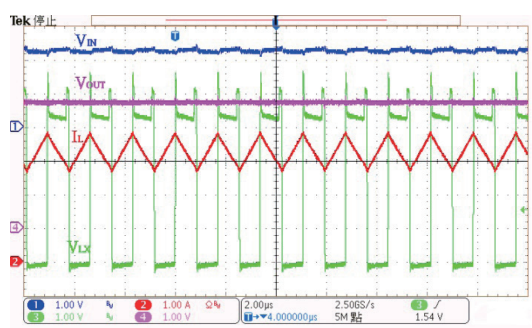
HT79171 Start Up (V_{IN}=2.2V, I_{OUT}=1.0A, V_{OUT}=3.7V)



HT79171 Steady State (V_{IN}=2.2V, I_{OUT}=1.0A, V_{OUT}=3.7V)



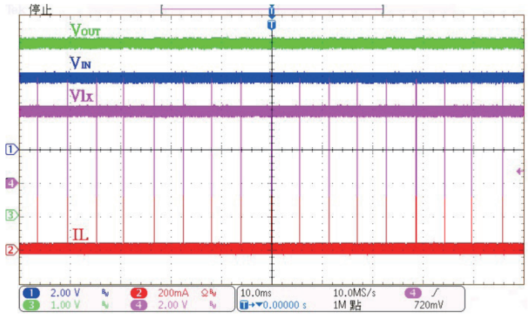
HT79171 Start Up (V_{IN}=2.2V, I_{OUT}=1.6A, V_{OUT}=3.7V)



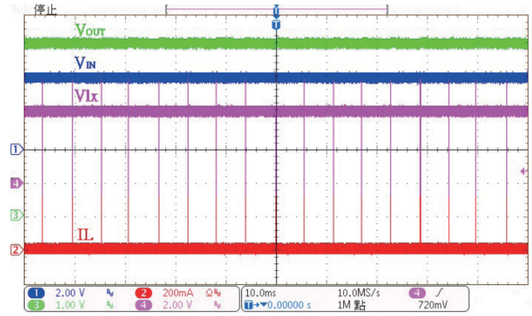
HT79171 Steady State (V_{IN}=2.2V, I_{OUT}=1.6A, V_{OUT}=3.7V)

Typical Performance Characteristics (Continued)

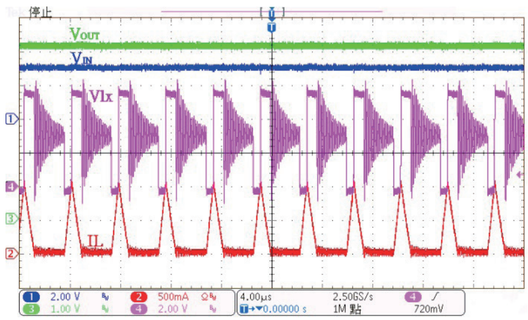
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



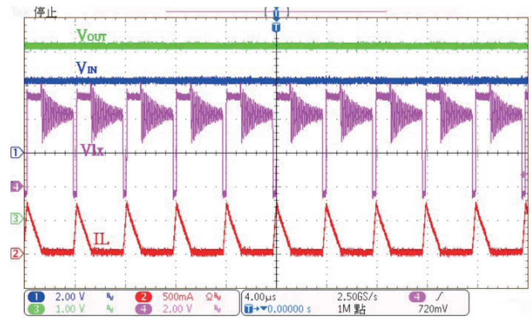
HT79181 Steady State (V_{IN}=3.0V, I_{OUT}=0A, V_{OUT}=5V)



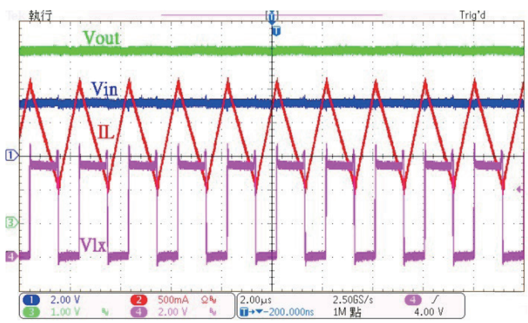
HT79181 Steady State (V_{IN}=4.2V, I_{OUT}=0A, V_{OUT}=5V)



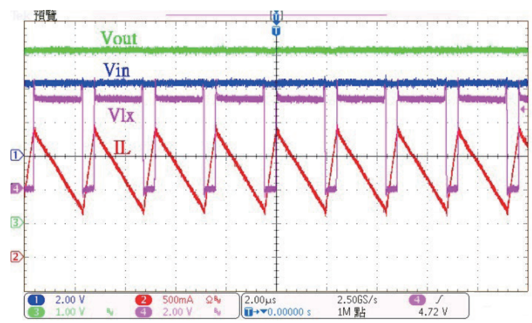
HT79181 Steady State (V_{IN}=3.0V, I_{OUT}=0.1A, V_{OUT}=5V)



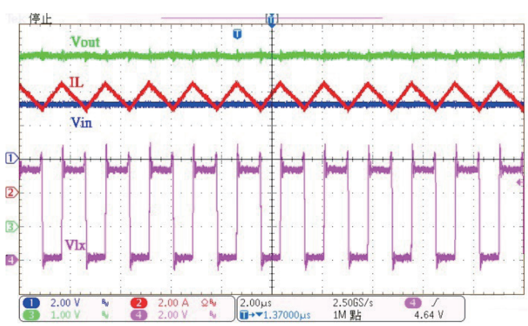
HT79181 Steady State (V_{IN}=4.2V, I_{OUT}=0.1A, V_{OUT}=5V)



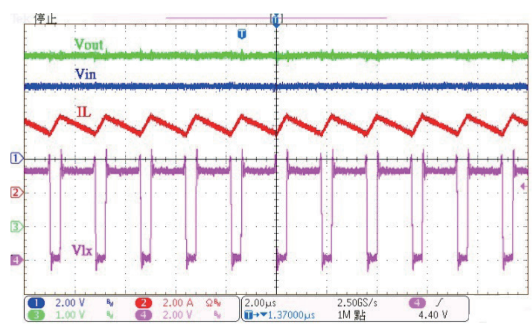
HT79181 Steady State (V_{IN}=3.0V, I_{OUT}=1.0A, V_{OUT}=5V)



HT79181 Steady State (V_{IN}=4.2V, I_{OUT}=1.0A, V_{OUT}=5V)



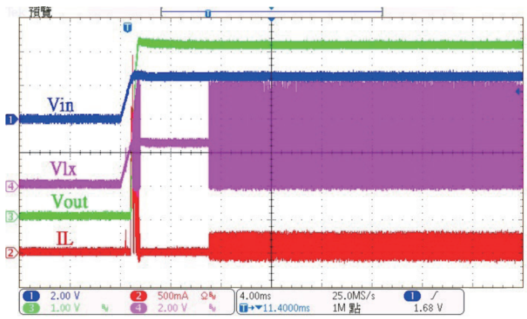
HT79181 Steady State (V_{IN}=3.0V, I_{OUT}=3.0A, V_{OUT}=5V)



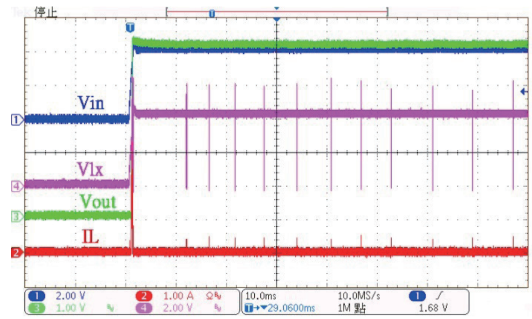
HT79181 Steady State (V_{IN}=4.2V, I_{OUT}=3.0A, V_{OUT}=5V)

Typical Performance Characteristics (Continued)

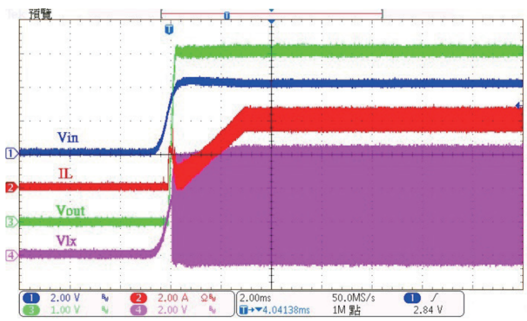
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



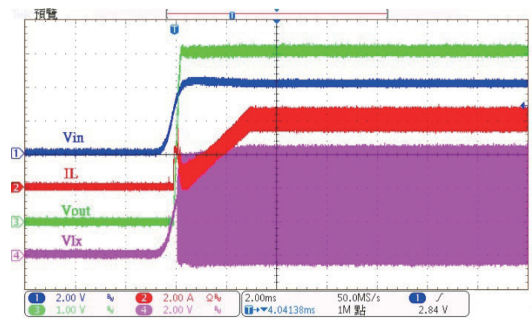
HT79181 Start Up
(V_{IN}=2.5V, t_r=1ms, I_{OUT}=0A, V_{OUT}=5V)



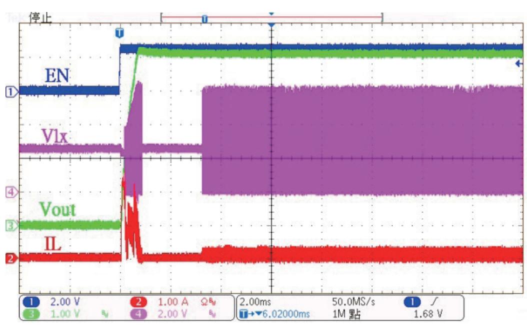
HT79181 Start Up
(V_{IN}=4.2V, t_r=1ms, I_{OUT}=0A, V_{OUT}=5V)



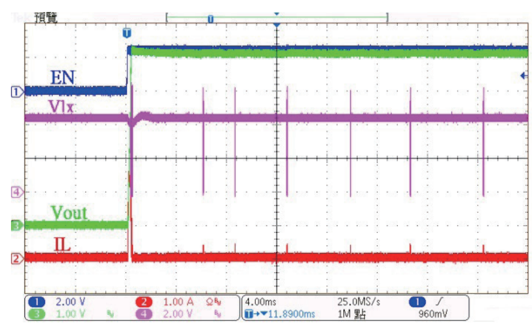
HT79181 Start Up
(V_{IN}=2.5V, t_r=1ms, I_{OUT}=1.5A, V_{OUT}=5V)



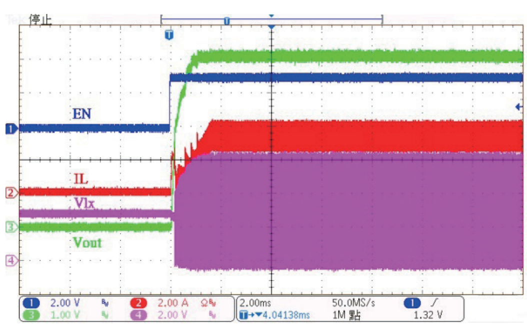
HT79181 Start Up
(V_{IN}=4.2V, t_r=1ms, I_{OUT}=3.0A, V_{OUT}=5V)



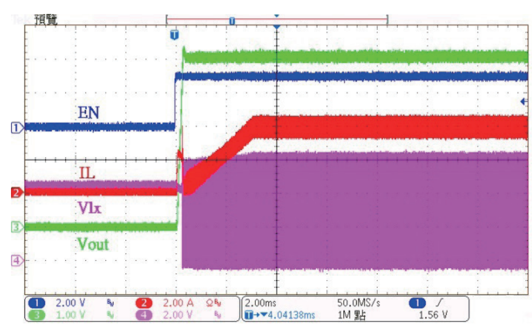
HT79181 Start Up from EN
(V_{IN}=2.5V, I_{OUT}=0A, V_{OUT}=5V)



HT79181 Start Up from EN
(V_{IN}=4.2V, I_{OUT}=0A, V_{OUT}=5V)



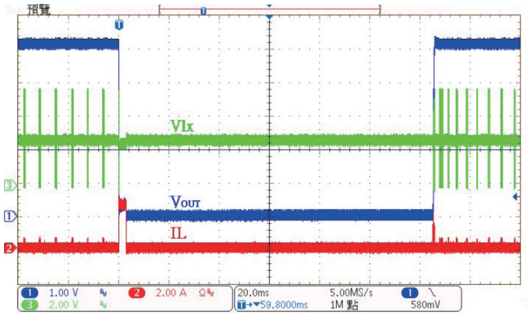
HT79181 Start Up from EN
(V_{IN}=2.5V, I_{OUT}=1.5A, V_{OUT}=5V)



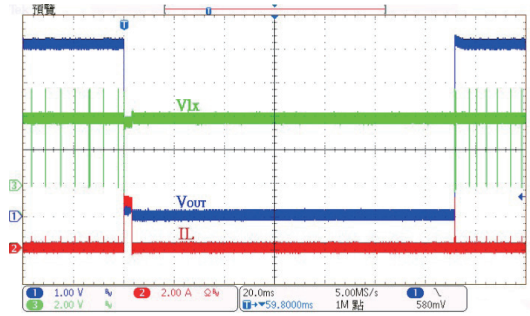
HT79181 Start Up from EN
(V_{IN}=4.2V, I_{OUT}=3.0A, V_{OUT}=5V)

Typical Performance Characteristics (Continued)

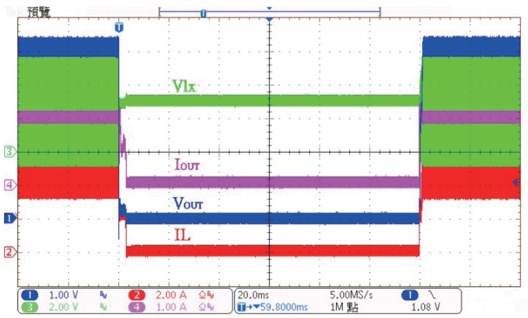
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



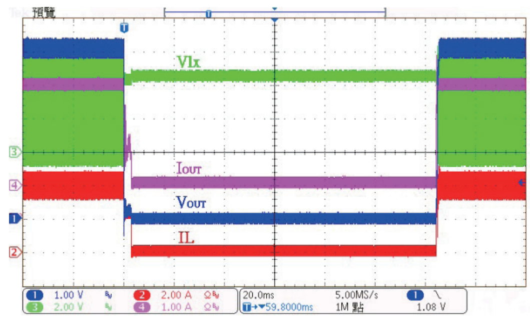
HT79181 Output Short and Recovery (V_{IN}=2.5V, I_{OUT}=0A, V_{OUT}=5V)



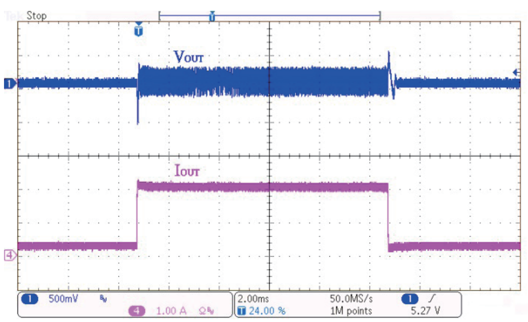
HT79181 Output Short and Recovery (V_{IN}=4.2V, I_{OUT}=0A, V_{OUT}=5V)



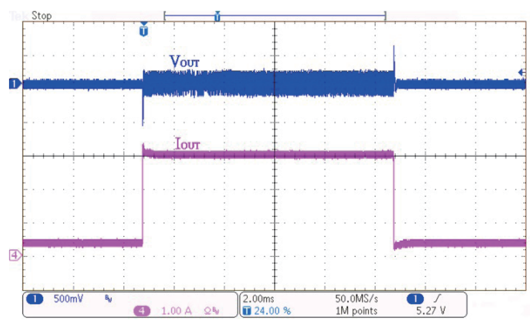
HT79181 Output Short and Recovery (V_{IN}=2.5V, I_{OUT}=2.0A, V_{OUT}=5V)



HT79181 Output Short and Recovery (V_{IN}=4.2V, I_{OUT}=3.0A, V_{OUT}=5V)



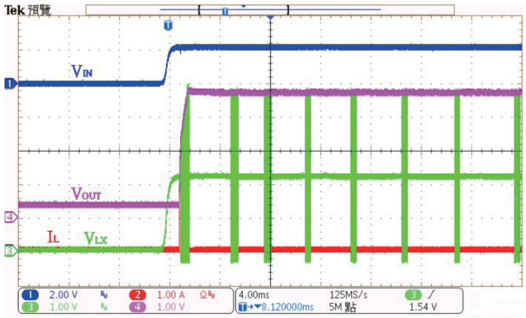
HT79181 Load Transient (V_{IN}=2.5V, I_{OUT}=0.2A->2.0A, V_{OUT}=5V)



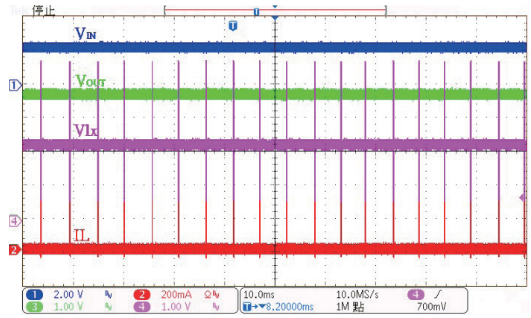
HT79181 Load Transient (V_{IN}=4.2V, I_{OUT}=0.3A->3.0A, V_{OUT}=5V)

Typical Performance Characteristics (Continued)

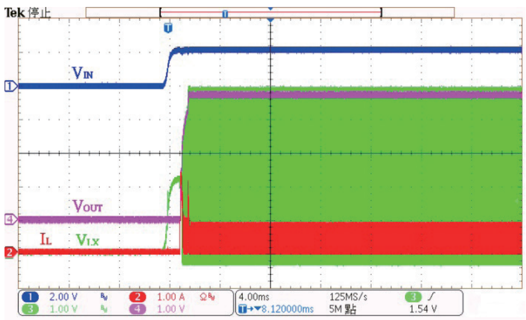
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22µF×6, C_{OUT}=22µF×6, L=1.5µH, T_A=25°C, unless otherwise noted.



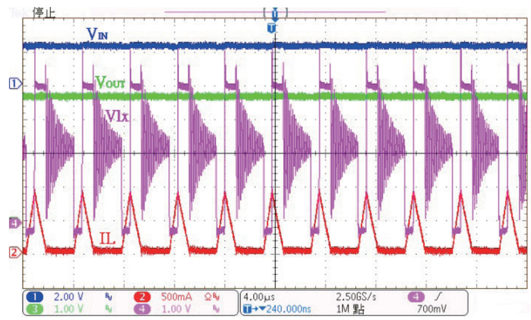
HT79181 Start Up (V_{IN}=2.2V, I_{OUT}=0A, V_{OUT}=3.7V)



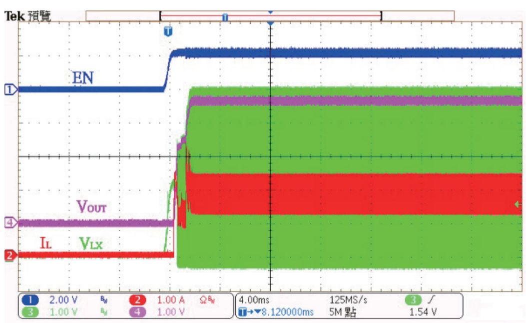
HT79181 Steady State (V_{IN}=2.2V, I_{OUT}=0A, V_{OUT}=3.7V)



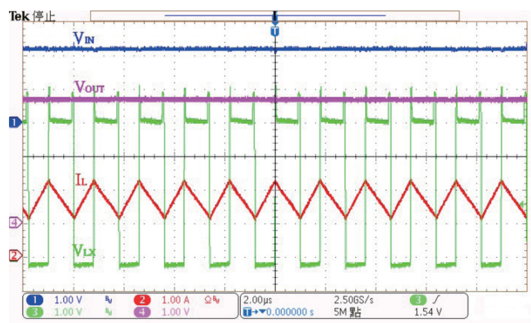
HT79181 Start Up (V_{IN}=2.2V, I_{OUT}=0.1A, V_{OUT}=3.7V)



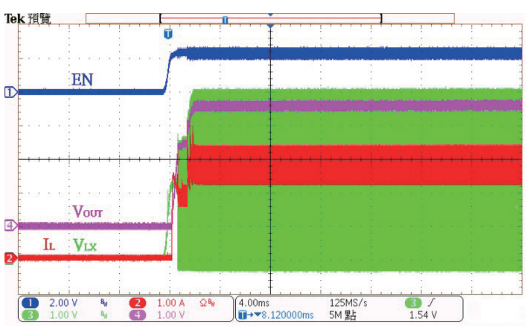
HT79181 Steady State (V_{IN}=2.2V, I_{OUT}=0.1A, V_{OUT}=3.7V)



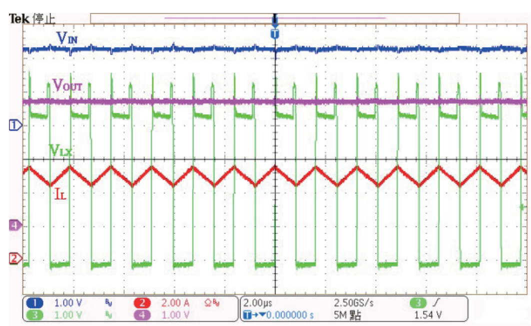
HT79181 Start Up from EN
(V_{IN}=2.2V, I_{OUT}=1.0A, V_{OUT}=3.7V)



HT79181 Steady State
(V_{IN}=2.2V, I_{OUT}=1.0A, V_{OUT}=3.7V)



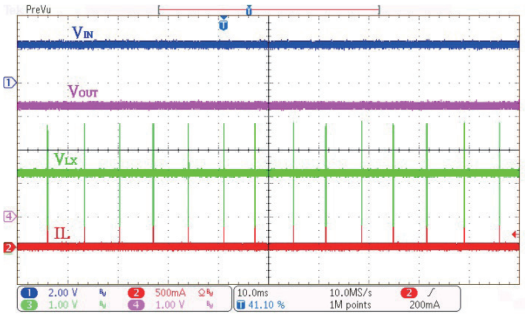
HT79181 Start Up from EN
(V_{IN}=2.2V, I_{OUT}=1.5A, V_{OUT}=3.7V)



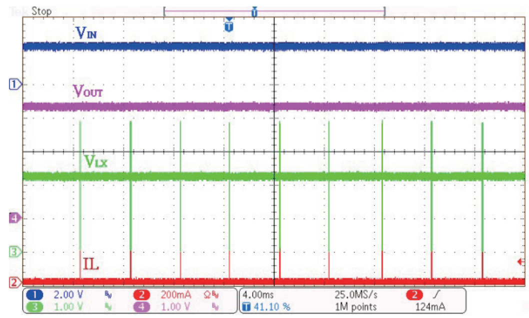
HT79181 Steady State
(V_{IN}=2.2V, I_{OUT}=2.5A, V_{OUT}=3.7V)

Typical Performance Characteristics (Continued)

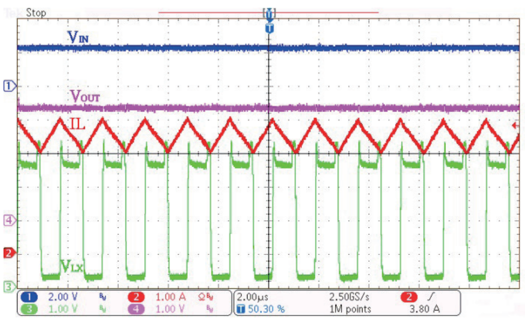
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



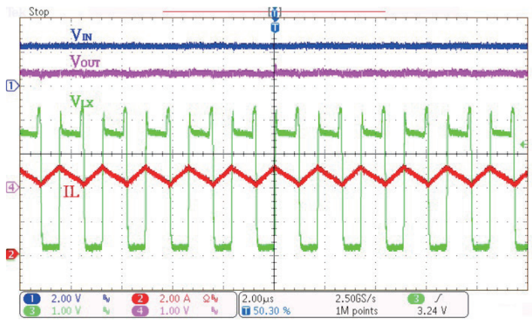
HT79171 Steady State (V_{IN}=2.2V,I_{OUT}=0A,V_{OUT}=3.3V)



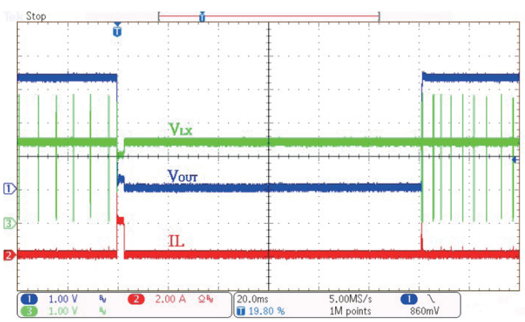
HT79181 Steady State (V_{IN}=2.2V,I_{OUT}=0A,V_{OUT}=3.3V)



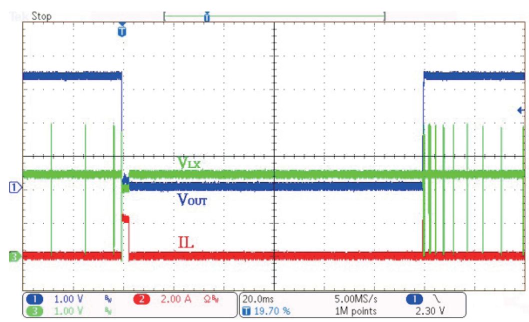
HT79171 Steady State (V_{IN}=2.2V,I_{OUT}=1.5A,V_{OUT}=3.3V)



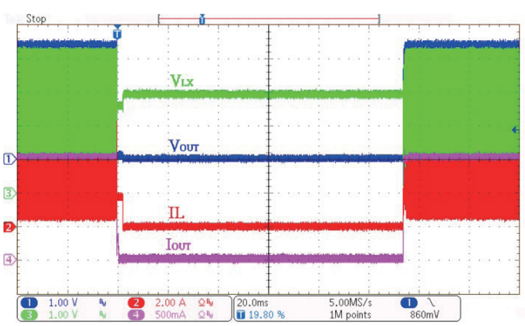
HT79181 Steady State (V_{IN}=2.2V,I_{OUT}=2.5A,V_{OUT}=3.3V)



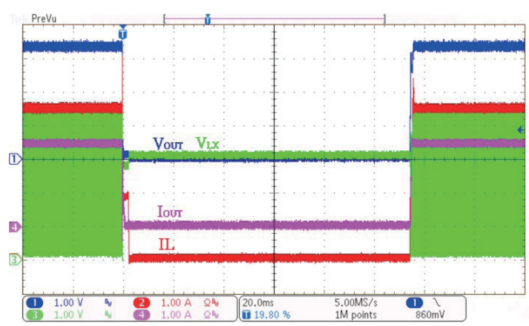
HT79171 Output Short and Recovery
(V_{IN}=2.2V, I_{OUT}=0A, V_{OUT}=3.3V)



HT79181 Output Short and Recovery
(V_{IN}=2.2V, I_{OUT}=0A, V_{OUT}=3.3V)



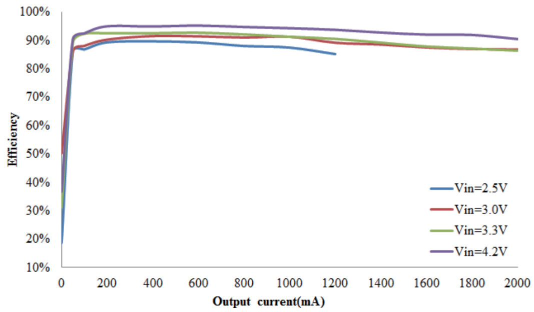
HT79171 Output Short and Recovery
(V_{IN}=2.2V, I_{OUT}=1.5A, V_{OUT}=3.3V)



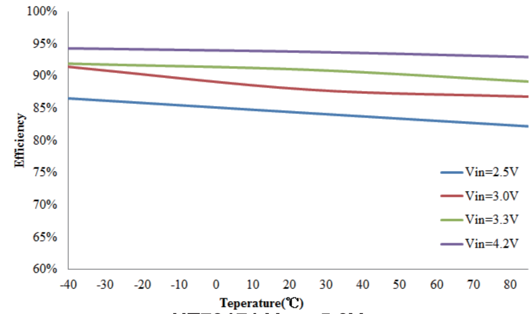
HT79181 Output Short and Recovery
(V_{IN}=2.2V, I_{OUT}=2.5A, V_{OUT}=3.3V)

Typical Performance Characteristics (Continued)

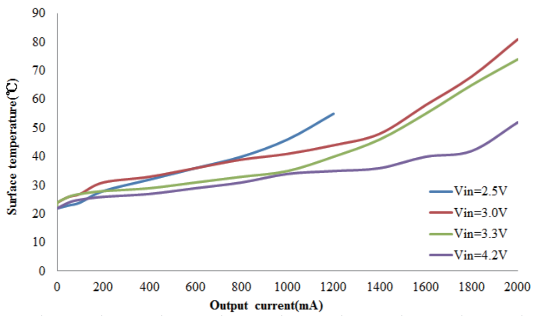
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



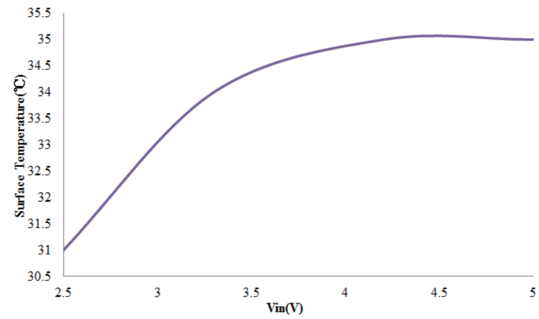
HT79171 V_{OUT}=5.0V
Efficiency vs. Output Current



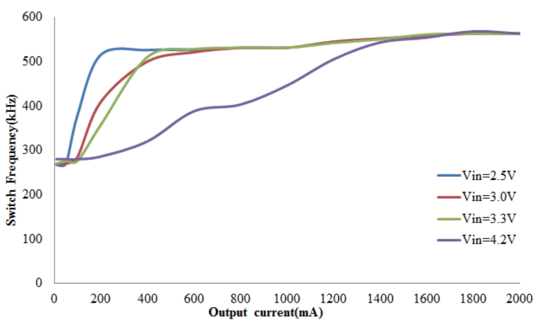
HT79171 V_{OUT}=5.0V
Efficiency vs. Temperature (I_{OUT}=1A)



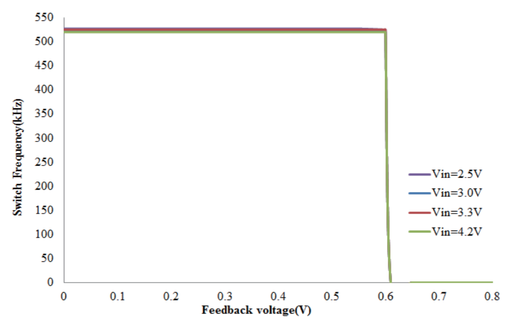
HT79171 V_{OUT}=5.0V
Surface Temperature vs.Output Current



HT79171 V_{OUT}=5.0V
Surface Temperature vs. V_{IN} (Output Short)



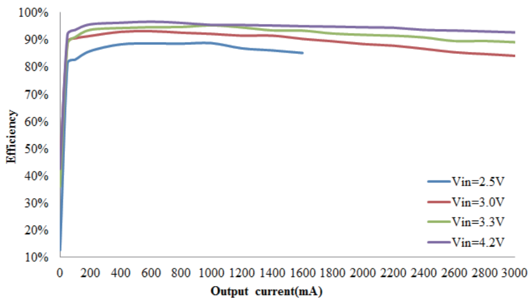
HT79171 V_{OUT}=5.0V f_{SW} vs. Output Current



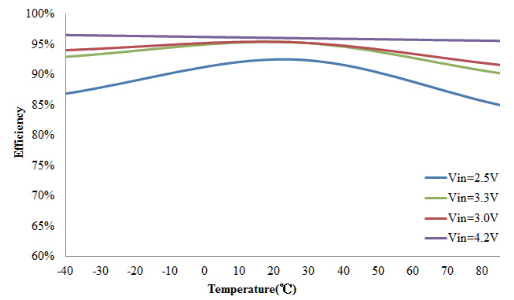
HT79171 V_{OUT}=5.0V f_{SW} vs. Feedback Voltage

Typical Performance Characteristics (Continued)

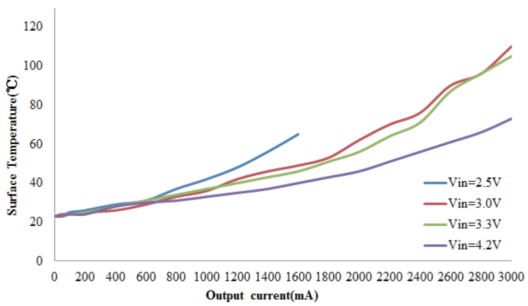
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



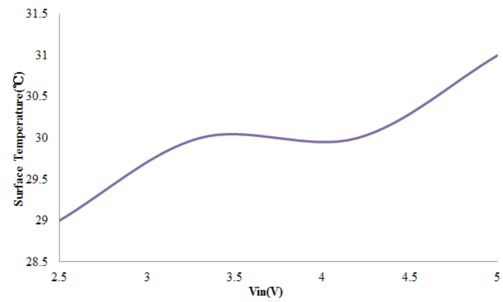
HT79181 V_{OUT}=5.0V Efficiency vs. Output Current



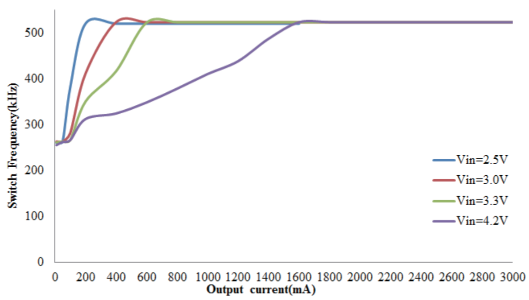
HT79181 V_{OUT}=5.0V Efficiency vs. Temperature (I_{OUT}=1A)



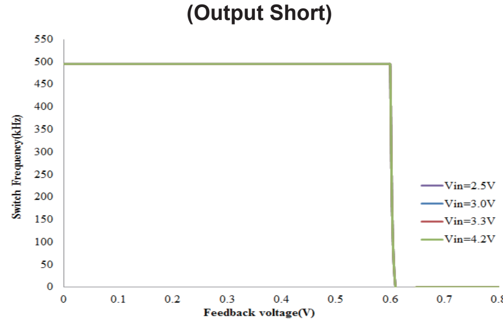
HT79181 Surface Temperature vs. Output Current



HT79181 V_{OUT}=5.0V Surface Temperature vs. V_{IN} (Output Short)



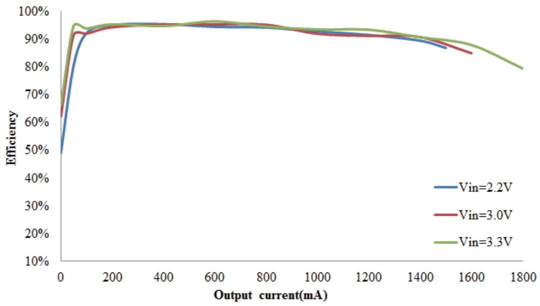
HT79181 V_{OUT}=5.0V f_{SW} vs. Output Current



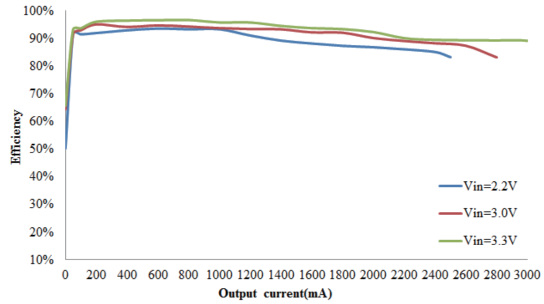
HT79181 V_{OUT}=5.0V f_{SW} vs. Feedback Voltage

Typical Performance Characteristics (Continued)

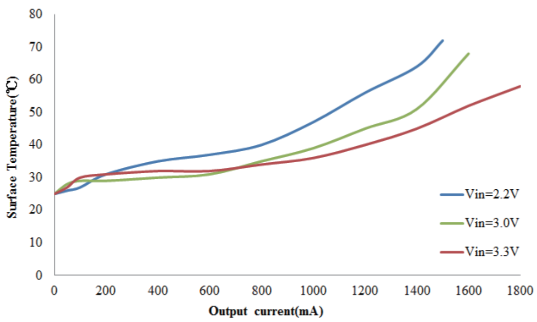
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



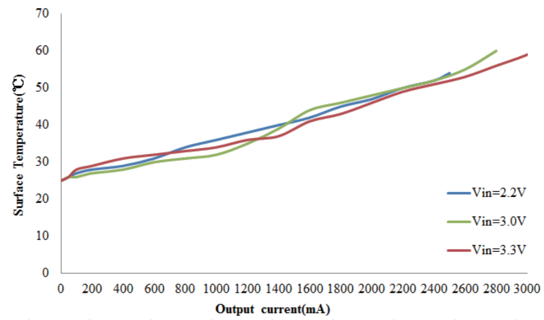
HT79171 V_{OUT}=3.7V
Efficiency vs. Output Current



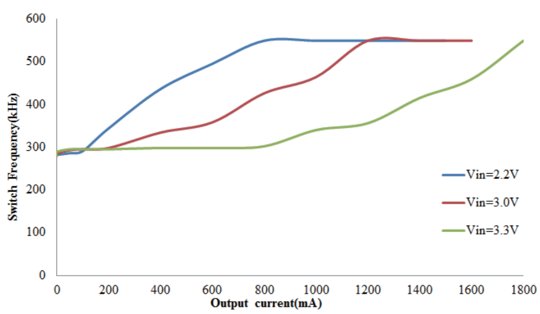
HT79181 V_{OUT}=3.7V
Efficiency vs. Output Current



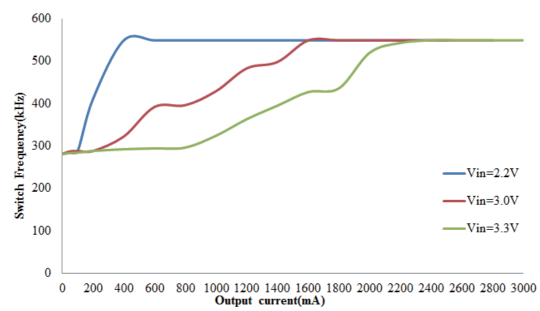
HT79171 V_{OUT}=3.7V
Surface Temperature vs. Output Current



HT79181 V_{OUT}=3.7V
Surface Temperature vs. Output Current



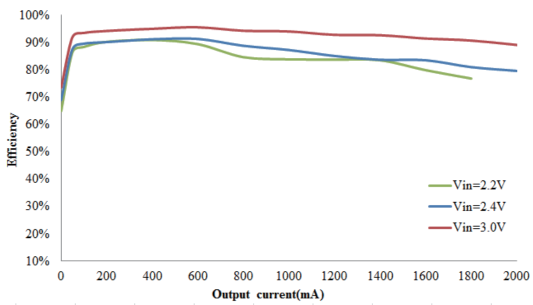
HT79171 V_{OUT}=3.7V f_{SW} vs. Output Current



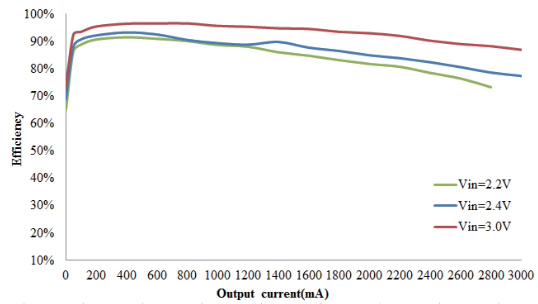
HT79181 V_{OUT}=3.7V f_{SW} vs. Output Current

Typical Performance Characteristics (Continued)

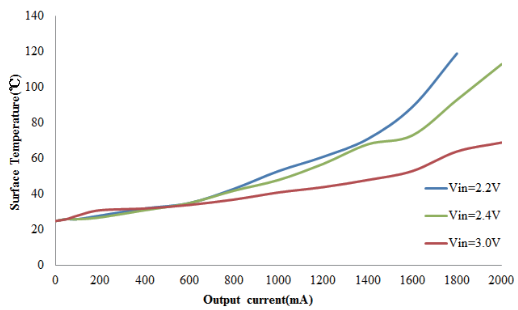
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



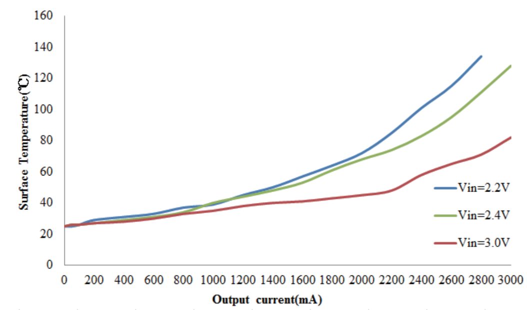
HT79171 V_{OUT}=3.3V
Efficiency vs. Output Current



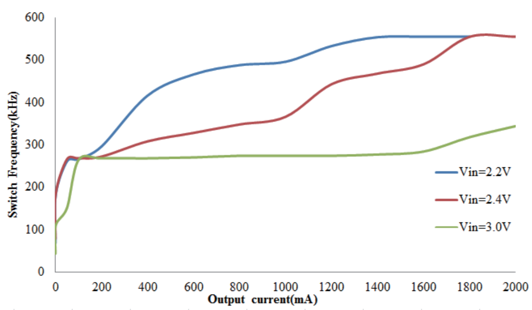
HT79181 V_{OUT}=3.3V
Efficiency vs. Output Current



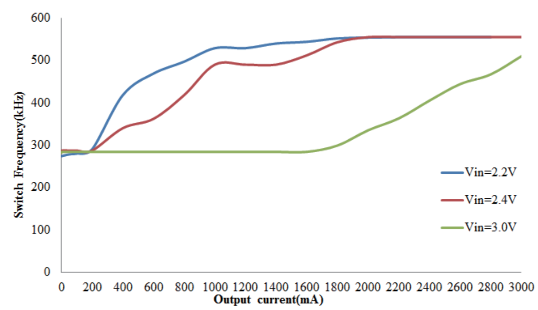
HT79171 V_{OUT}=3.3V
Surface Temperature vs. Output Current



HT79181 V_{OUT}=3.3V
Surface Temperature vs. Output Current



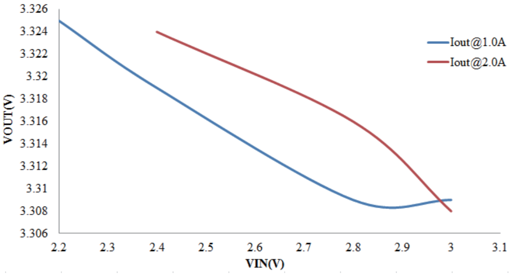
HT79171 V_{OUT}=3.3V
f_{SW} vs. Output Current



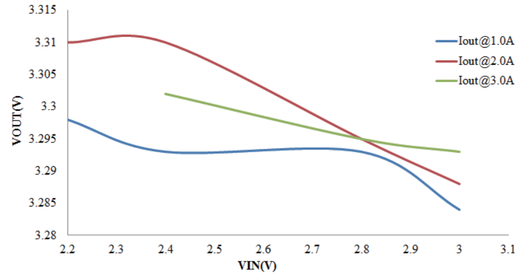
HT79181 V_{OUT}=3.3V
f_{SW} vs. Output Current

Typical Performance Characteristics (Continued)

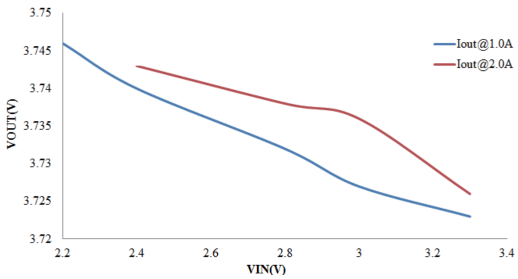
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



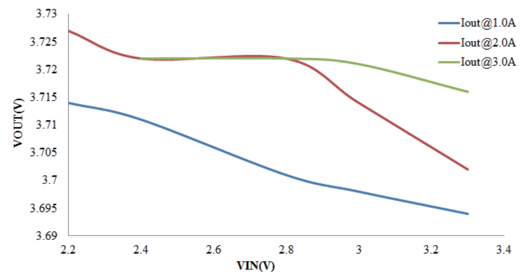
HT79171 V_{OUT}=3.3V, Line Regulation



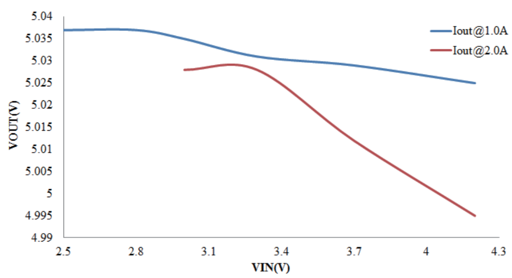
HT79181 V_{OUT}=3.3V, Line Regulation



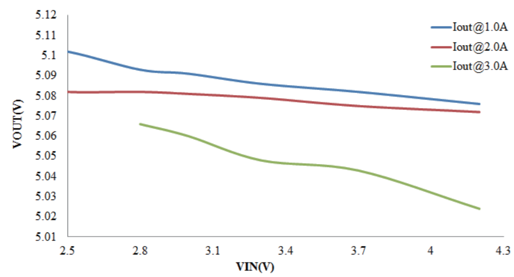
HT79171 V_{OUT}=3.7V, Line Regulation



HT79181 V_{OUT}=3.7V, Line Regulation



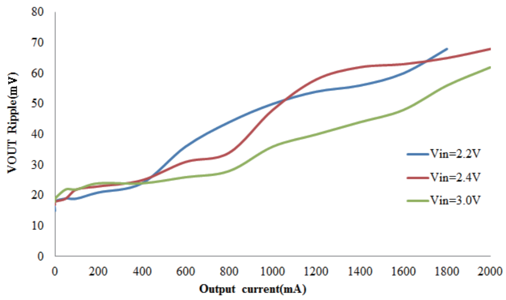
HT79171 V_{OUT}=5V, Line Regulation



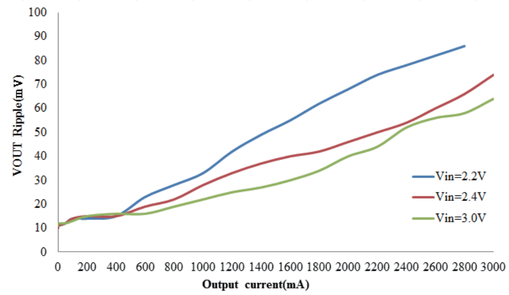
HT79181 V_{OUT}=5V, Line Regulation

Typical Performance Characteristics (Continued)

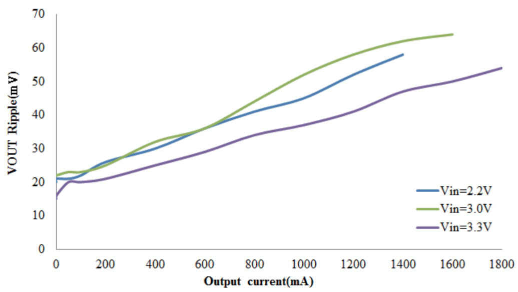
V_{IN}=2.2V~4.2V, V_{OUT}=3.3V/3.7V/5.0V, C_{IN}=22μF×6, C_{OUT}=22μF×6, L=1.5μH, T_A=25°C, unless otherwise noted.



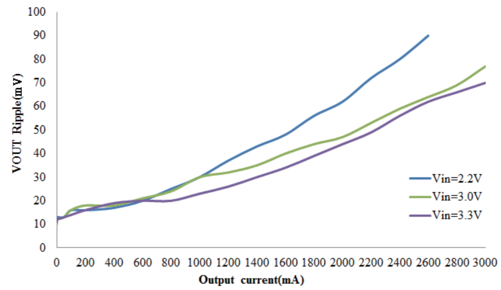
HT79171 V_{OUT}=3.3V, V_{OUT} Ripple



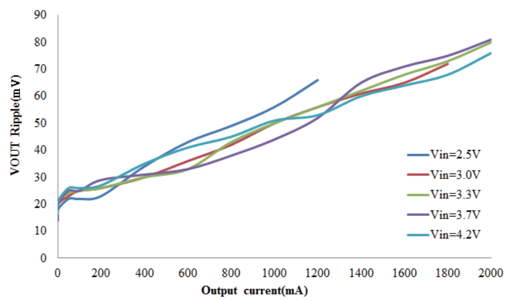
HT79181 V_{OUT}=3.3V, V_{OUT} Ripple



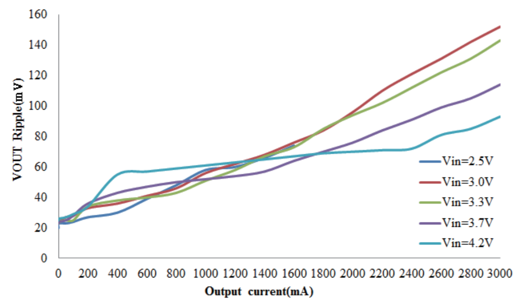
HT79171 V_{OUT}=3.7V, V_{OUT} Ripple



HT79181 V_{OUT}=3.7V, V_{OUT} Ripple



HT79171 V_{OUT}=5V, V_{OUT} Ripple



HT79181 V_{OUT}=5V, V_{OUT} Ripple

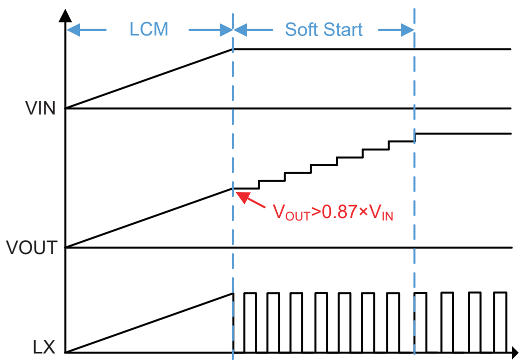
Functional Description

Linear Charge Mode – LCM

The HT79171/79181 will enter the Linear Charge Mode (LCM) when $V_{OUT}<0.87\times V_{IN}$. In this mode, the high side MOSFET is conducted and charges the output capacitor. The device will exit the linear charge mode once $V_{OUT}=0.87\times V_{IN}$.

Soft Start

The HT79171 and HT79181 devices include a soft start function to prevent inrush current and overshoot situations from occurring during the power-on period. The soft start function is executed when $V_{OUT}>0.87\times V_{IN}$. The time duration is 1.75ms (V_{IN}=3.3V@3.0A) to steady output voltage. In the light load condition, the output will reach the operating voltage in advance and finish the soft start process.



Setting the Output Voltage

As shown in the Typical Application Circuit, the external resistor divider defines the output voltage. The feedback resistor, R1, together with the internal compensation capacitor, defines the feedback loop bandwidth. The output voltage, V_{OUT}, is calculated by the following equation:

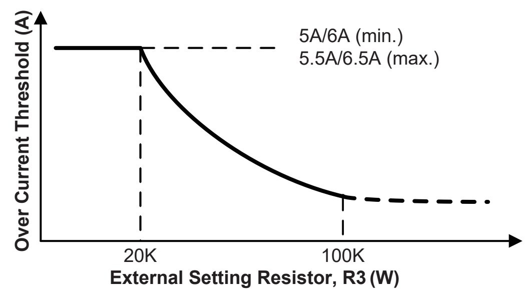
$V_{OUT}=0.6V\times(R1A+R1B+R2)/R2$ (V)

Setting the Over Current Threshold using an External Resistor

By default, the HT79171/HT79181's maximum peak current passing through the main FET is restricted to 5A/6A when the OC pin is floating. When a resistor is connected and whose value is between 20kΩ and 100kΩ, the current limit will be set within a range from 5A/6A to 1A/1.2A for the HT79171/HT79181 respectively. Do not connect any capacitor to this pin. The over current trip point can be calculated according to the equation:

$I_{OCP}=100000/R3$ (A) …… HT79171

$I_{OCP}=120000/R3$ (A) …… HT79181

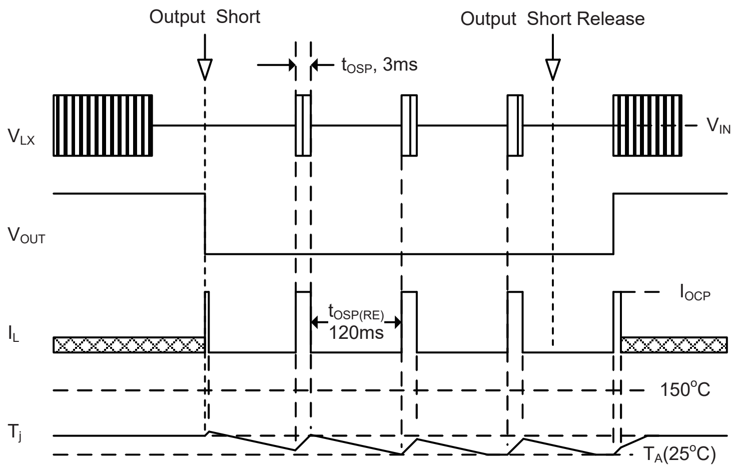


Output Disconnect During Shutdown

The HT79171 and HT79181 devices also support a shutdown mode which reduces the supply current to approximately 0.1mA and separates the output node (V_{OUT}) and input node (V_{IN}) by reversing the intrinsic diode of the synchronous FET. Therefore, the output node could be fully connected to the ground terminal (0V) without resulting in any current leakage. A 1kΩ discharge path to ground is also applied to reduce the time taken for V_{OUT} to fall to 0V.

Protections

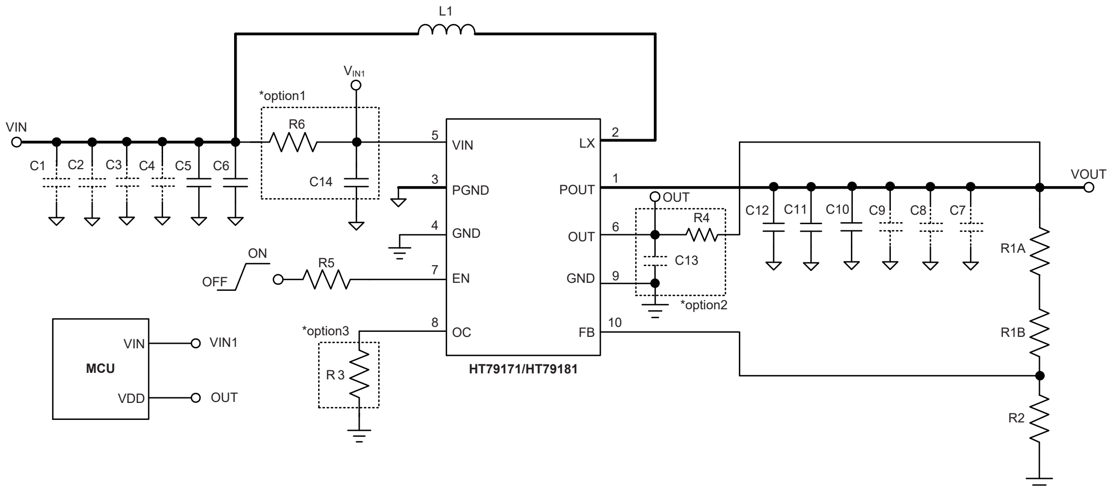
The HT79171 and HT79181 both have dedicated protection circuits running during normal operation to protect the IC. The linear charge mode is implemented to limit the inrush current during the power-on period. The Over Current Protection (OCP) sets a maximum current value and is illustrated below. The Over Temperature Protection (OTP) turns off the power device when the die temperature reaches an excessive level. The Under Voltage Lock-Out comparator (UVLO) protects the power device during power supply startup and shutdown periods to prevent the devices from operating at voltages which are less than the minimum input voltage. The devices restrict their maximum output voltage to 6.5V (OVP) to avoid damage to the internal components. Once the output voltage exceeds the specified voltage, the devices will switch off both the main FET and the synchronous FET. When an output short fault occurs, the devices will turn off for 120ms and then restart the boost converter for 3ms, cycle by cycle (OSP). The following figure shows what happens when an output short fault happens. Once the OSP, OTP, OVP and UVLO situations are released, the devices will be restarted.



Protection Type	Protection Entry Condition	V_{OUT} During Protection Period	Protection Release Condition
UVLO	V_{IN}<2.0V	V_{OUT}=0V	V_{IN}>2.2V
OCP	I_{LX}>5A (for HT79171) I_{LX}>6A (for HT79181)	Decreasing along with I_{OUT} increasing	I_{LX}<5A (for HT79171) I_{LX}<6A (for HT79181)
OVP	V_{OUT}>6.5V(max.)	Clamp V_{OUT} between 5.6V and 5.3V	Fault is removed
OTP	Tj>150°C	V_{OUT}=0V	Tj<125°C
OSP	V_{OUT} is short connected to GND	V_{OUT}=0V	Short fault is released

Protection Function Conditions

Component Selection Guide



Reference	Package	Description	Mfgr.
R3	SMD 0603	N.C.	—
R4	SMD 0603	0Ω±1%	Liker Corp.
R5	SMD 0603	10kΩ±1%	Liker Corp.
R6	SMD 0603	0Ω±1%	Liker Corp.

Reference	Package	Description	Part Number	Mfgr.
C5	SMD 0805	Ceramic, 22μF,10V	CM0805Y5V226M6R3AT	QSEC
C6	SMD 0805	Ceramic, 22μF,10V	CM0805Y5V226M6R3AT	QSEC
C10	SMD 0805	Ceramic, 22μF,10V	CM0805Y5V226M6R3AT	QSEC
C11	SMD 0805	Ceramic, 22μF,10V	CM0805Y5V226M6R3AT	QSEC
C12	SMD 0603	Ceramic, 0.1μF,10V	0603B104K500CT	WALSIN
C13	SMD 0603	N.C.	—	—
C14	SMD 0603	Ceramic, 1nF,10V	GRM188R71H103KA01D	Murata
L1	SMD 6030	ZPWM-6030M-1R5M	—	ZenithTek

V_{OUT}	Package	R1A	R1B	R2
2.5	SMD 0603	240kΩ±1%	20kΩ±1%	82kΩ±1%
3.0	SMD 0603	300kΩ±1%	0Ω±1%	75kΩ±1%
3.3	SMD 0603	330kΩ±1%	7.5k±1%	75kΩ±1%
3.71	SMD 0603	300kΩ±1%	22kΩ±1%	62kΩ±1%
4.0	SMD 0603	430kΩ±1%	0Ω±1%	75kΩ±1%
5.1	SMD 0603	560kΩ±1%	0Ω±1%	75kΩ±1%

*option1: Add this circuit when the load carrying capacity of the input power is limited. R6 and C14 are recommended to be 1kΩ and 10μF respectively.

*option2: Add the R4 and C13 filter if the application requires lower V_{OUT} ripple. R4 and C13 are recommended to be 100Ω and 10μF respectively.

*option3: R3 resistance can be adjusted according to the required current limit.

Inductor

In most applications, it is recommended to use a 1.5μH or higher inductance to maintain a low output ripple voltage. Inductance DCR, inductor core loss and efficiency loss caused by the switching frequency will influence the overall efficiency. A low DCR with a value less than 50mΩ is suggested to reduce efficiency loss. The inductance could be calculated using the following formula:

$$L1 = \left(\frac{V_{IN}}{V_{OUT}}\right)^2 \times \left(\frac{V_{OUT} - V_{IN}}{I_{RIPPLE} \times f_{SW}}\right)$$

$I_{RIPPLE} = I_{OUTMAX} \times 40\%$, I_{OUTMAX} stands for the maximum load current; f_{SW} stands for the switching frequency; I_{RIPPLE} stands for the ripple current. The saturation current is suggested to be at least 10A.

Input Capacitor

Multiple capacitors are required between the VIN and GND pins to reduce the input power ripple noise. Use ceramic capacitors with X5R or X7R dielectrics for their low ESRs and small temperature coefficients. For most applications, 22μF×2 will be a suitable value. It is recommended to use the 22μF, 0805,10V capacitors. If the load carrying capacity of the input power is limited, more capacitors and an additional input flter circuit are recommended to add.

Output Capacitor

To reduce the output voltage ripple noise, multiple capacitors are required between the VOUT and GND pins. Their selection is determined by the steady state and transient state response. Use ceramic capacitors with X5R or X7R dielectrics for their low ESRs and small temperature coefficients. For most applications, 22μF×2 will be a suitable value. It is recommended to use the 22μF, 0805,10V capacitors. To avoid undesired OVP function triggered by V_{OUT}=5.2V or when the application requires lower output ripple, it is recommended to add more output capacitors and an output filter.

Input Fiter

If the load carrying capacity of the input power is limited, such as dry battery, solar battery etc., the IC UVLO protection may be mistakenly triggered because the battery voltage is dropped to a lower level by the internal large resistance and heavy load of the battery. It is suggested to add a low-pass filter (R6 and C14) before the input to avoid this situation. If the system has an MCU to detect V_{IN}, a more stable input power can be detected from the filtered VIN1 point. The recommended values are R6=1kΩ and C14=10μF.

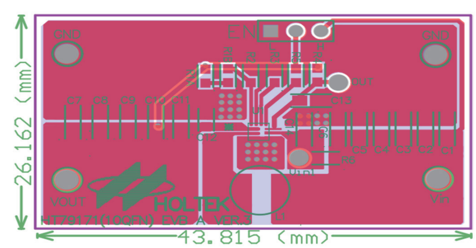
Output Filter

Considering that the system usually needs a low ripple voltage to supply power for the MCU ADC and AVDD, etc. a low-pass filter (R4 and C13) can be added at the OUT. In this way, the main load is supplied by VOUT while the low consumption loads requiring low ripple, such as MCU ADC and AVDD, are supplied by OUT. The recommended values are R4=100Ω and C13=10μF.

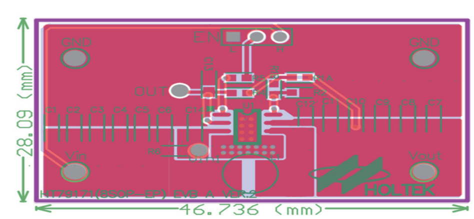
Layout Consideration Guide

To achieve the best efficiency and to reduce noise, there are some important points to note regarding the PCB layout.

1. The C_{OUT} capacitors should be placed as close to the POUT and PGND pins as possible.
2. The feedback resistors R1A, R1B and R2 should not be close to the LX pin to avoid noise interference. It is suggested to pull the feedback from the farthest COUT in parallel.
3. Considering the large current problem, the trace width between VIN and LX is suggested to be wider than 3mm.
4. GND is the grounding for the internal control signal and PGND is the grounding of large current. Gather the GND signals and connect them with PGND, then lay a large area of copper and add vias to improve heat dissipation.
5. It is recommended to place R4 and C13 close to the OUT and place R6 and C14 close to the VIN.
6. L1 should be placed as close to the IC as possible. It is recommended to lay a large area of copper on the PCB board for the VIN and VOUT signals.



10-pin QFN PCB Layout Example



8-pin SOP-EP PCB Layout Example

Thermal Considerations

For continuous operation, do not exceed the absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow and the allowed difference between the junction and ambient temperatures. The maximum power dissipation can be calculated by the following formula:

$$P_{D(MAX)}=(T_{J(MAX)}-T_A)/\theta_{JA} \qquad (W)$$

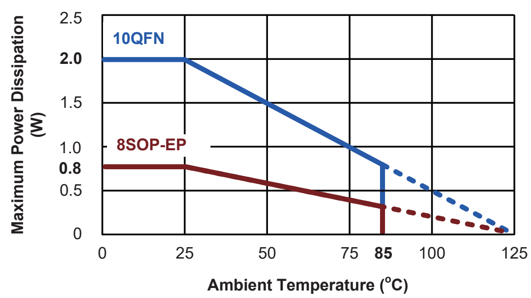
Where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature and θ_{JA} is the junction to ambient thermal resistance.

The recommended operating conditions specify a maximum junction temperature of 125°C. The junction to ambient thermal resistance, θ_{JA}, is dependent upon the layout. On a standard JEDEC 51-7 four-layer thermal test board, the thermal resistance, θ_{JA}, of the 10-pin QFN package is 50°C /W and 8SOP-EP package is 125°C/W.. The maximum power dissipation at T_A=25°C can be calculated by the following formula:

10QFN: $P_{D(MAX)}$=(125°C–25°C)/(50°C/W)=2.0W

8SOP-EP: $P_{D(MAX)}$=(125°C–25°C)/(125°C/W)=0.8W

For a fixed $T_{J(MAX)}$ of 125°C, the maximum power dissipation depends on the operating ambient temperature and the package's thermal resistance, θ_{JA}. The derating curve below shows the effect of rising ambient temperature on the maximum recommended power dissipation.



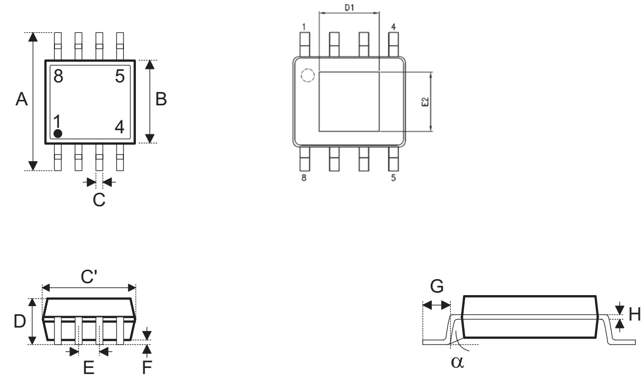
Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the Holtek website for the latest version of the package information.

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- Further Package Information (include Outline Dimensions, Product Tape and Reel Specifications)
- Packing Meterials Information
- Carton information

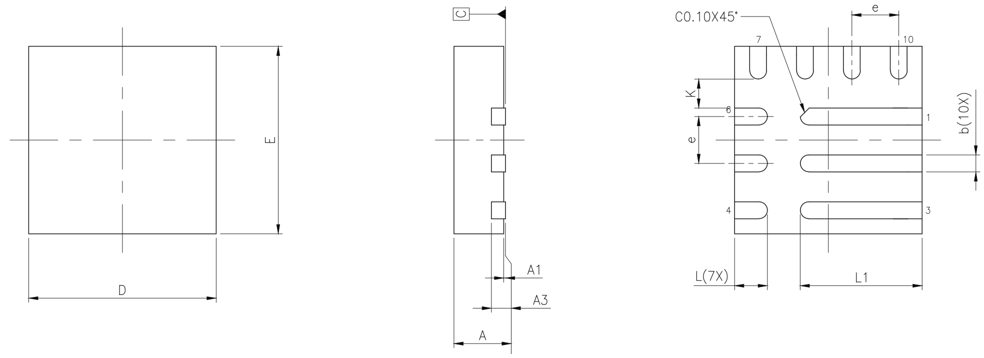
8-pin SOP-EP (150mil) Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	—	0.236 BSC	—
B	—	0.154 BSC	—
C	0.012	—	0.020
C′	—	0.193 BSC	—
D	—	—	0.069
D1	0.059	—	—
E	—	0.050 BSC	—
E2	0.039	—	—
F	0.004	—	0.010
G	0.016	—	0.050
H	0.004	—	0.010
α	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	—	6.0 BSC	—
B	—	3.9 BSC	—
C	0.31	—	0.51
C′	—	4.9 BSC	—
D	—	—	1.75
D1	1.50	—	—
E	—	1.27 BSC	—
E2	1.00	—	—
F	0.10	—	0.25
G	0.40	—	1.27
H	0.10	—	0.25
α	0°	—	8°

SAW Type 10-pin QFN (2mm×2mm) Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.020	0.022	0.024
A1	0.000	0.001	0.002
A3	—	0.006 BSC	—
b	0.006	0.008	0.010
D	—	0.079 BSC	—
E	—	0.079 BSC	—
e	—	0.020 BSC	—
L	0.010	0.014	0.018
L1	0.047	0.051	0.055
K	0.008	0.012	0.016

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	—	0.15 BSC	—
b	0.15	0.20	0.25
D	—	2.00 BSC	—
E	—	2.00 BSC	—
e	—	0.50 BSC	—
L	0.25	0.35	0.45
L1	1.20	1.30	1.40
K	0.20	0.30	0.40