380KHz 3A SYNCHRONOUS DC-DC BUCK CONVERTER

Features

- Input Voltage Range: 4.5V to 18V
- Fixed 340kHz Frequency
- High Efficiency: up to 95%
- Output Current: 3A
- Current Mode Control
- Built-In Over Current Protection
- Built-In Thermal Shutdown Function
- Built-In UVLO Function
- Built-In Over Voltage Protection
- Programmable Soft-start

Applications

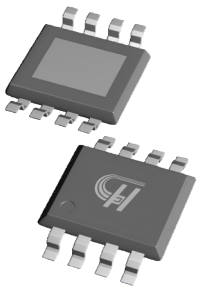
- LCD Monitor and LCD TV
- Digital Photo Frame
- Set-up Box
- Portable DVD

General Description

The HCR3183 is a 380kHz fixed frequency, current mode, PWM synchronous buck(step-down) DC-DC converter, capable of driving a 3A load with high efficiency, excellent line and load regulation. The device integrates N-channel power MOSFET switches with low on resistance. Current mode control provides fast transient response and cycle-by-cycle current limit.

The HCR3183 employs complete protection to ensure system security. Including output Over Voltage Protection, input Under Voltage LockOut, programmable soft-start, Over Temperature Protection to safeguard the circuit.

The HCR3183 is available in SOP-8(EP) ROHS compliant package.



SOP-8(EP)

Figure 1. Package Type of HCR3183

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Pin Configuration

SOP-8(EP) Top View

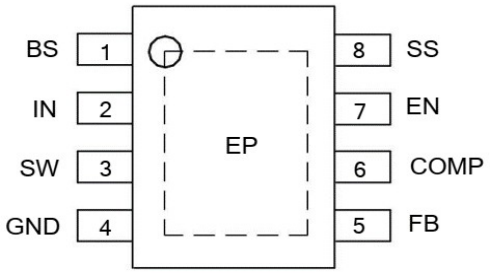
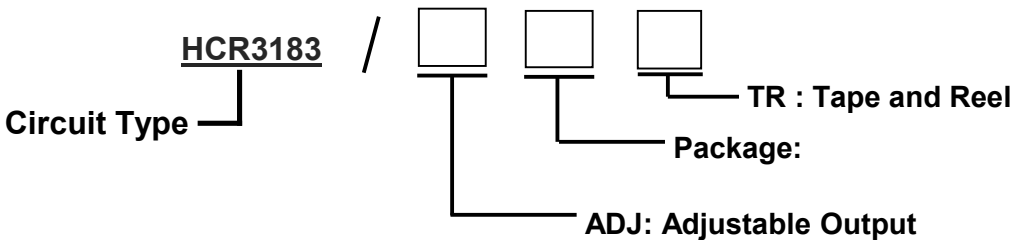


Figure 2. Pin Configuration of HCR3183 (Top View)

Pin Function Table

Pin Number	Pin Name	Function
1	BS	Bootstrap pin. A bootstrap capacitor is connected between the BS pin and SW pin. The voltage across the bootstrap capacitor drives the internal high-side power MOSFET
2	IN	Supply power input pin. A capacitor should be connected between the IN pin and GND pin to keep the input voltage constant
3	SW	Power switch output pin. This pin is connected to the inductor and bootstrap capacitor
4	GND	Ground Pin
5	FB	Feedback pin. This pin is connected to an external resistor divider to program the system output voltage. When the FB pin voltage exceeds 1.1V, the over voltage protection is triggered. When the FB pin voltage is below 0.3V, the oscillator frequency is lowered to realize short circuit protection
6	COMP	Compensation pin. This pin is the output of the transconductance error amplifier and the input to the current comparator. It is used to compensate the control loop. Connect a series RC network from this pin to GND. In some cases, an additional capacitor from this pin to GND pin is required
7	EN	Control input pin. EN is a digital input that turns the regulator on or off. Drive EN high/low to turn on/off the regulator. Pull up with 100kΩ resistor for automatic startup
8	SS	Soft-start control input pin. SS controls the soft-start period. Connect a capacitor from SS to GND to set the soft-start period. A 0.1μF capacitor sets the soft-start period to 15ms. To disable the soft-start feature, leave SS unconnected
	EP	Exposed pad. It should be connected to GND in PCB layout

Ordering Information



Ordering Code

Part Number	Marking ID [2]	Temperature Range	Package	Package Type
HCR3183/ADJM8ETR	HCR3183XX	-40'C to +85'C	SOP-8(EP)	4K/Tape&Reel

Note 2: the "XX' is date code

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Absolute Maximum Ratings Note 1

Parameter		Symbol	Value	Unit
IN Pin Voltage		V_{IN}	-0.3 to 20	V
EN Pin Voltage		V_{EN}	-0.3 to V_{IN}	V
SW Pin Voltage		V_{SW}	21	V
BS Pin Voltage		V_{BS}	-0.3 to V_{SW} +6	V
Feedback (FB) Pin Voltage		V_{FB}	-0.3 to 6	V
COMP Pin Voltage		V_{COMP}	-0.3 to 6	V
SS Pin Voltage		V_{SS}	-0.3 to 6	V
Power Dissipation		P_D	Internally limited	mW
Thermal Resistance Junction to Ambient	SOP-8(EP)	$R_{\theta JA}$	60	'C/W
Storage Temperature Range		T_{STG}	-65 to +150	'C
Operating Junction Temperature note 2		T_J	-40 to +125	'C
Lead Temperature (Soldering, 10s)		T_{LEAD}	260	'C
Human Body Model ESD Protection		ESD HBM	2	KV
Machine Model ESD Protection		ESD MM	200	V

Note 1: Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Unit
Input Voltage	VIN	4.5	18	V
Operating Ambient Temperature	TA	-40	+85	'C

380KHz 3A SYNCHRONOUS DC-DC BUCK CONVERTER

Electrical Characteristics

(TA=+25'C, VIN=VEN=12V, VOUT=3.3V, Unless Otherwise Specified.)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
SUPPLY VOLTAGE(IN PIN)						
Input Operation Voltage	V_{in}		4.5	-	18	V
Shutdown Supply Current	I_{SHDN}	V_{EN}=0V	-	0.1	10	uA
Quiescent Current	I_Q	V_{EN}=3V, V_{FB}=1V	-	1.2	1.4	mA
UNDER VOLTAGE LOCKOUT						
Input UVLO Threshold	V_{UVLO}	V_{IN} Rising	3.65	4.00	4.25	V
Input UVLO Hysteresis	V_{HYS}	-	-	200	-	mV
ENABLE (EN PIN)						
EN Shutdown Threshold Voltage	V_{EN-H}	High (Regulator ON)	1.1	1.5	2.0	V
EN Shutdown Threshold Voltage Hysteresis(Note 2)	V_{EN-L}	Low (Regulator OFF)	-	350	-	mV
EN Lockout Threshold Voltage	-	V_{EN}=2V(ON)	2.2	2.5	2.7	V
EN Lockout Hysteresis	-	V_{EN}=0V(OFF)	-	210	-	mV
VOLTAGE REFERENCE (FB PIN)						
Feedback Voltage	V_{FB}	-	0.907	0.925	0.943	V
Feedback Over Voltage Threshold	V_{FBOV}	-	-	1.1	-	V
Feedback Bias Current	I_{FB}	V_{FB}=1V	-0.1	-	0.1	uA
MOSFET						
High-Side Switch On-resistance(Note 3)	R_{DSONH}	ISW=0.2/0.7A	-	100	-	mΩ
Low-Side Switch On-resistance(Note 3)	R_{DSONL}	ISW=-0.2/-0.7A	-	100	-	
CURRENT LIMIT						
High-Side Switch Leakage Current	I_{LEAKH}	V_{IN}=18V, V_{EN}=V_{SW}=0V	-	0.1	10	uA
High-Side Switch Current Limit	I_{LIMH}	-	4.3	5.6	-	A
Low-Side Switch Current Limit	I_{LIML}	From drain to Source	-	1.4	-	A
SWITCHING REGULATOR						
Oscillator Frequency	F_{OSC1}	-	280	340	400	KHz
Short Circuit Oscillator Frequency	F_{OSC2}	-	-	90	-	KHz
Max. Duty Cycle	D_{MAX}	V_{FB}=0.85V	-	90	-	%
Min. Duty Cycle	D_{MIN}	V_{FB}=1V	-	-	0	%
ERROR AMPLIFIER						
Error Amplifier Volatge Gain (Note2)	A_{EA}	-	-	400	-	V/V
Error Amplifier Transconductance	G_{EA}	-	-	800	-	uA/V
COMP to Current Sense Transconductance	G_{CS}	-	-	5.2	-	A/V

380KHz 3A SYNCHRONOUS DC-DC BUCK CONVERTER

Electrical Characteristics(Con.)

(TA=+25'C, VIN=VEN=12V, VOUT=3.3V, Unless Otherwise Specified.)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
THERMAL SHUTDOWN						
Thermal Shutdown(Note 2)	TOTSD	-	-	+160	-	'C
Thermal Shutdown Hysteresis(Note 2)	THYS	-	-	+20	-	'C
SOFT START (SS PIN)						
Soft-start Time (Note 2)	tss	Css=0.1uF	-	15	-	ms
Soft-start Current (Note 2)	-	Vss=0V	-	6	-	uA

Notes: 2. Not tested, guaranteed by design.

3. $R_{DSON}=\frac{V_{SW1}-V_{SW2}}{I_{SW1}-I_{SW2}}$.

Functional Block Diagram

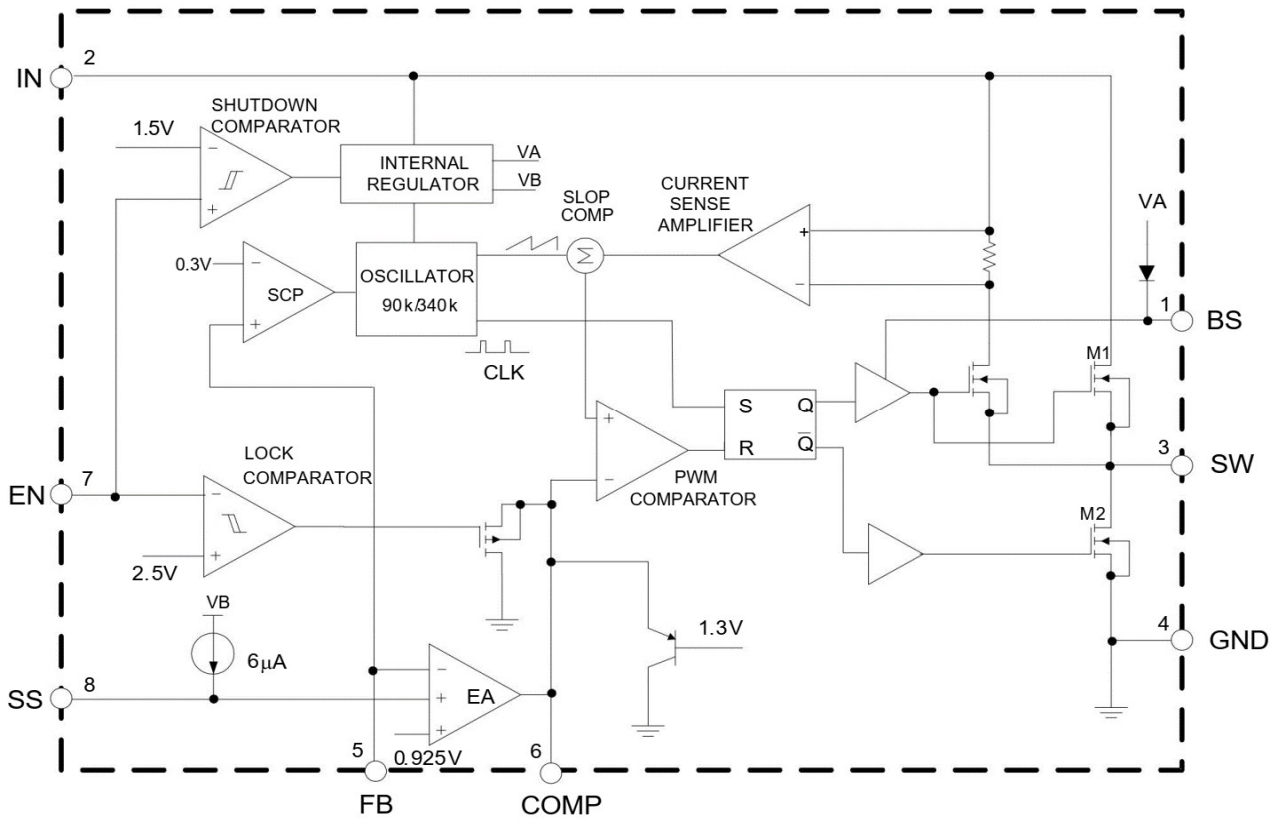
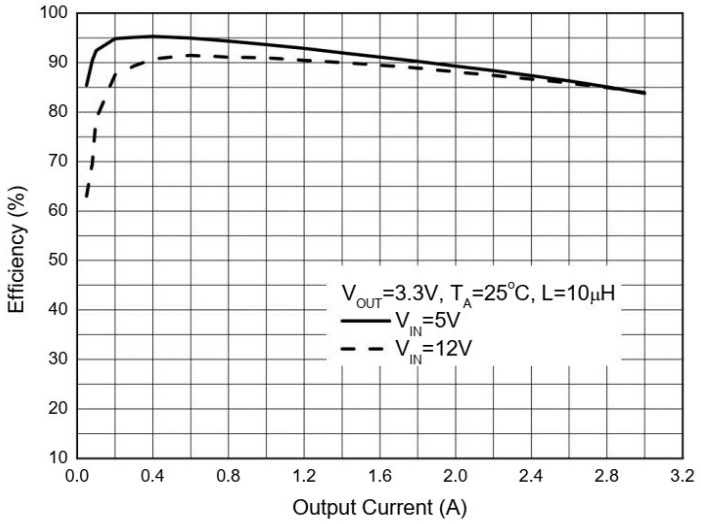


Figure 3. Functional Block Diagram of HCR3183

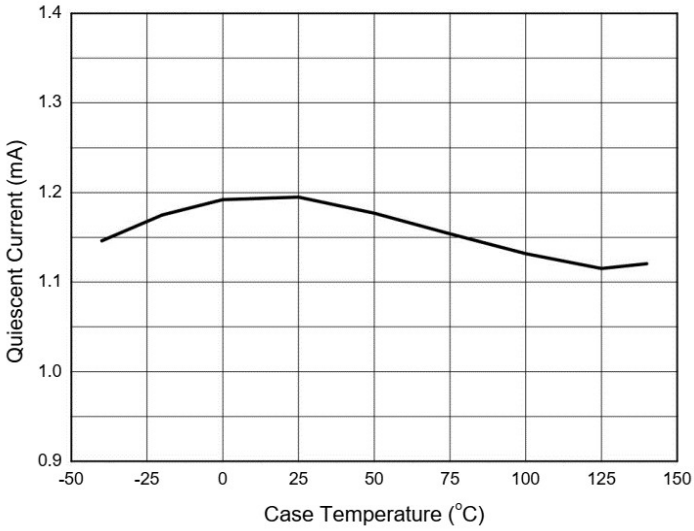
380KHz 3A SYNCHRONOUS DC-DC BUCK CONVERTER

Performance Characteristics(TA=+25'C, VIN=12V, VOUT=3.3V, unless otherwise noted.)

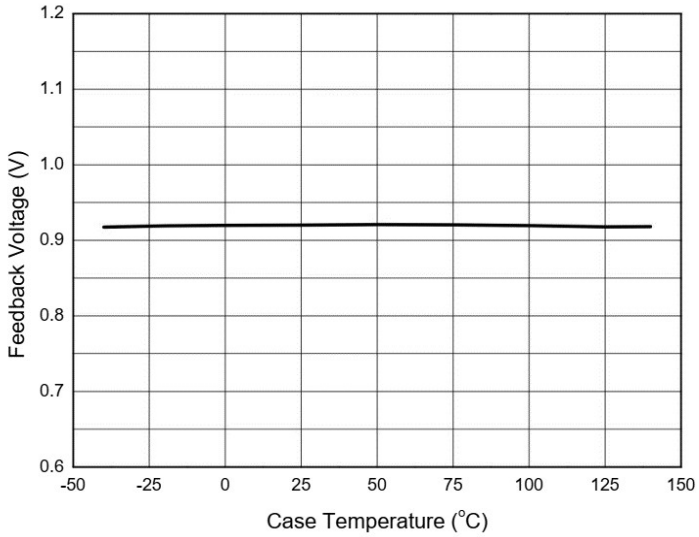
Efficiency vs. Output Current



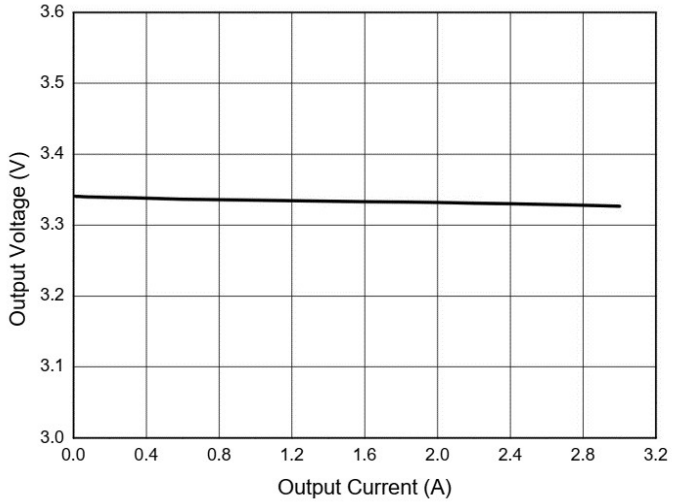
Quiescent Current vs. Case Temperature



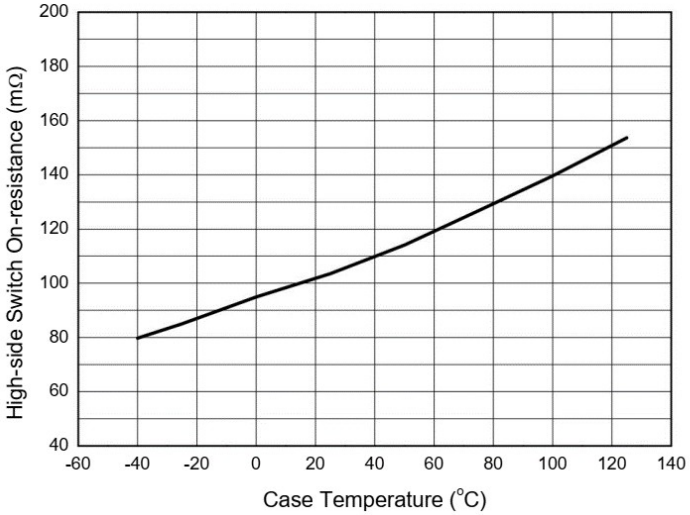
Feedback Voltage vs. Case Temperature



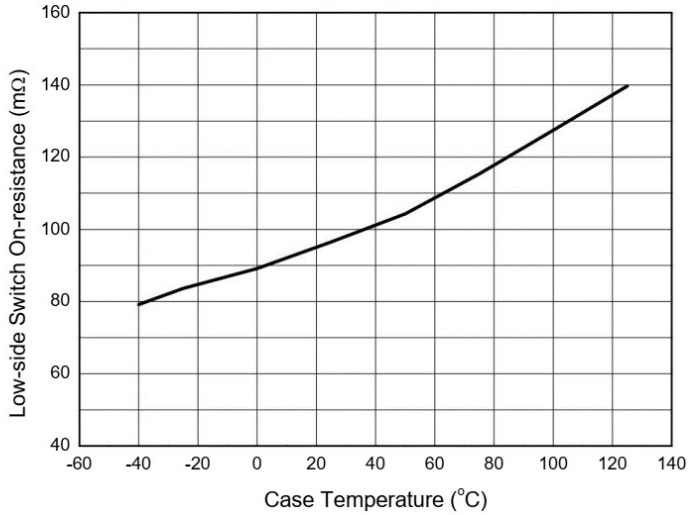
Output Voltage vs. Output Current



High-side Switch On-resistance vs. Case Temperature



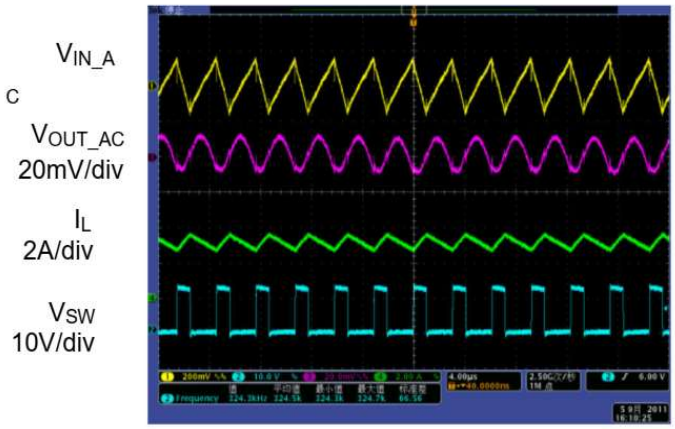
Low-side Switch On-resistance vs. Case Temperature



380KHz 3A SYNCHRONOUS DC-DC BUCK CONVERTER

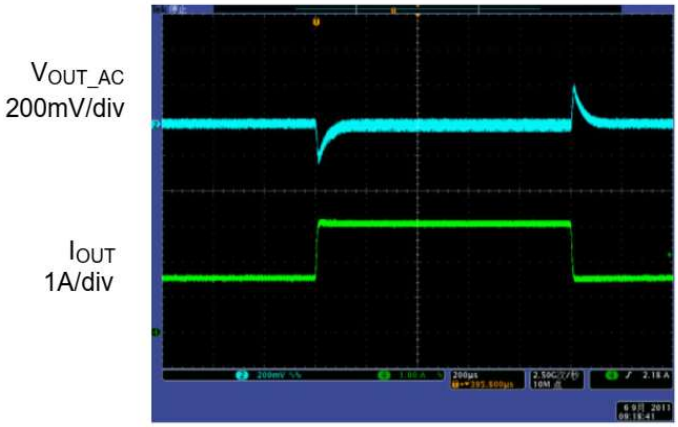
Performance Characteristics (Con.)

Output Ripple (I_{OUT}=3A)



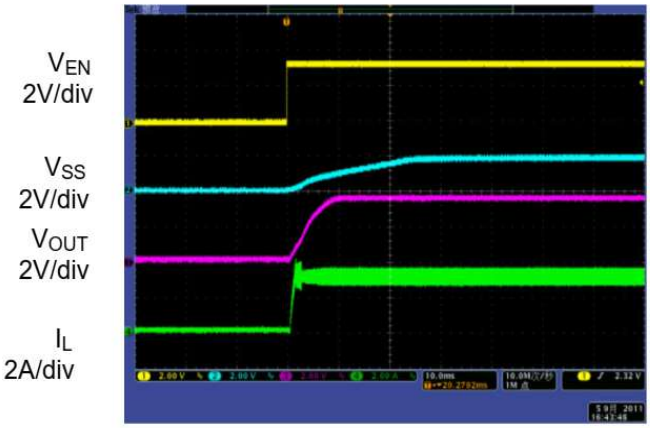
Time 4μs/div

Load Transient (I_{OUT} =1.5A to 3A)



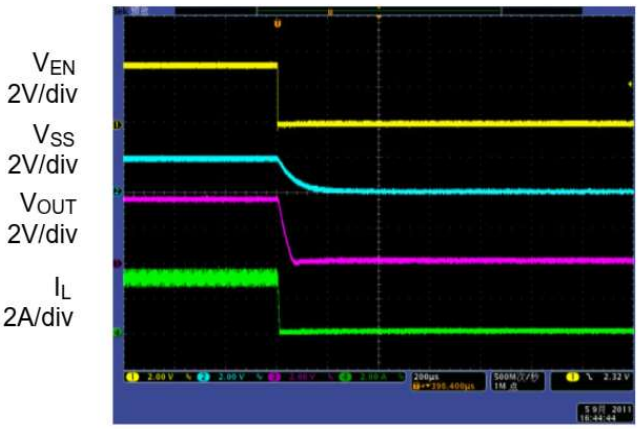
Time 200μs/div

Enable Turn on Characteristic (V_{IN}=12V, V_{EN}=3.3V, V_{OUT}=3.3V, I_L=3A)



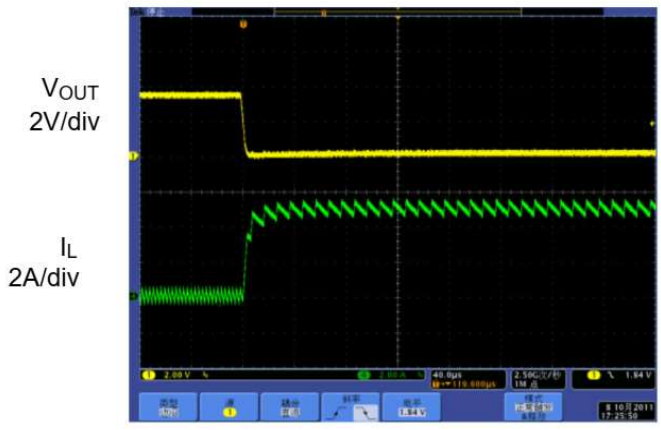
Time 10ms/div

Enable Turn off Characteristic (V_{IN}=12V, V_{EN}=3.3V, V_{OUT}=3.3V, I_L=3A)



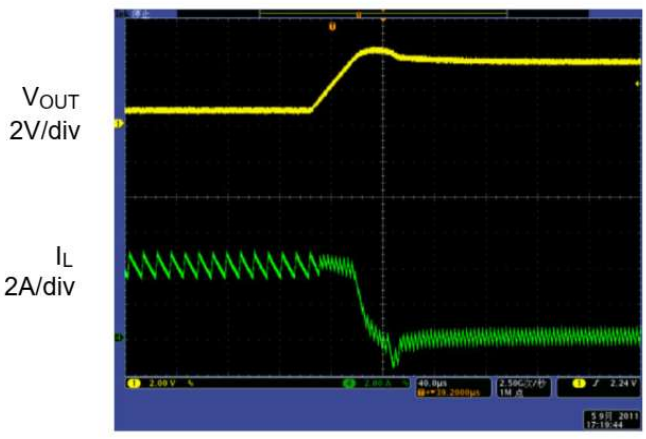
Time 200μs/div

Short Circuit Protection (I_{OUT}=0A)



Time 40μs/div

Short Circuit Recovery (I_{OUT}=0A)



Time 40μs/div

380KHz 3A SYNCHRONOUS DC-DC BUCK CONVERTER

Typical Application Circuit

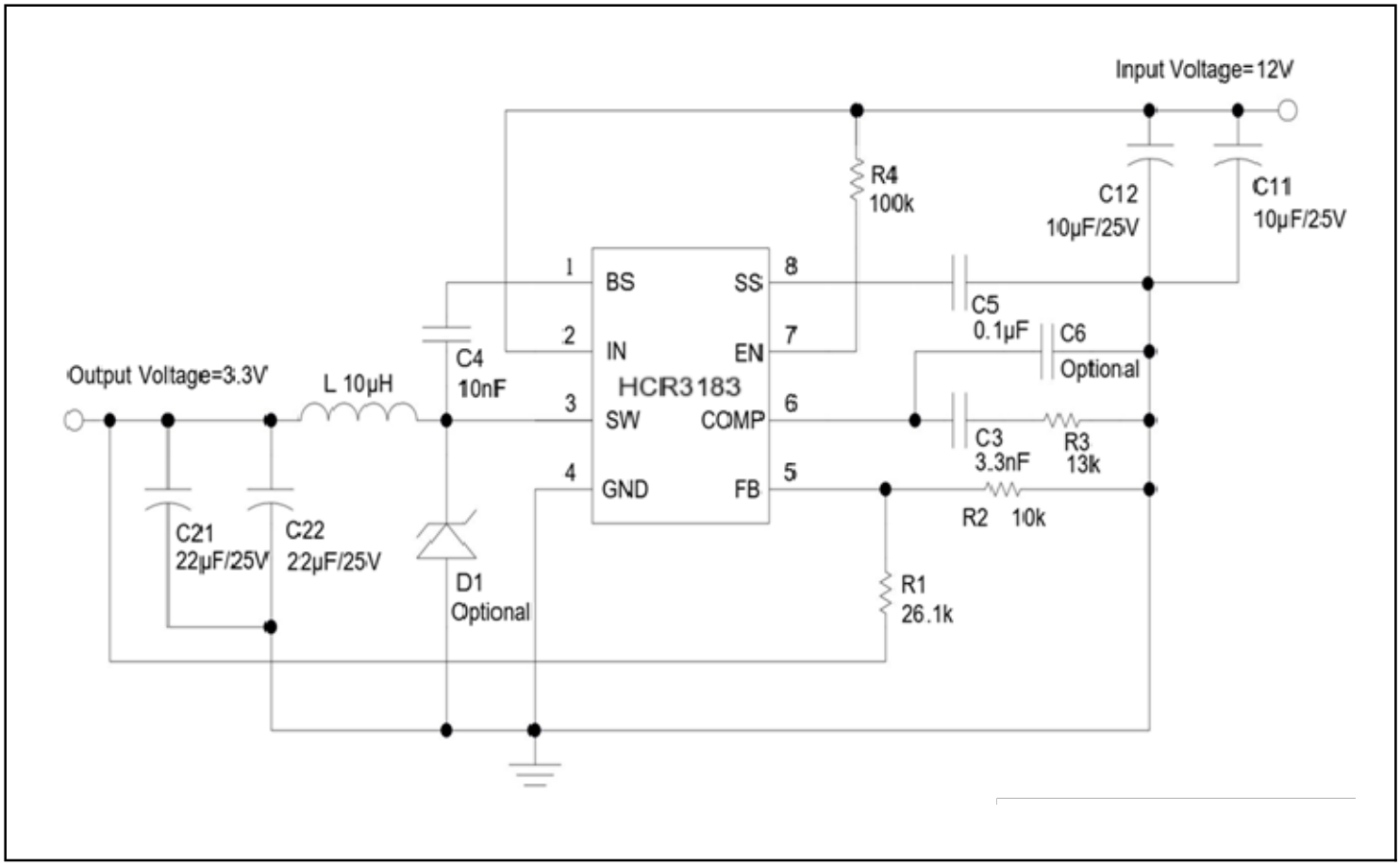


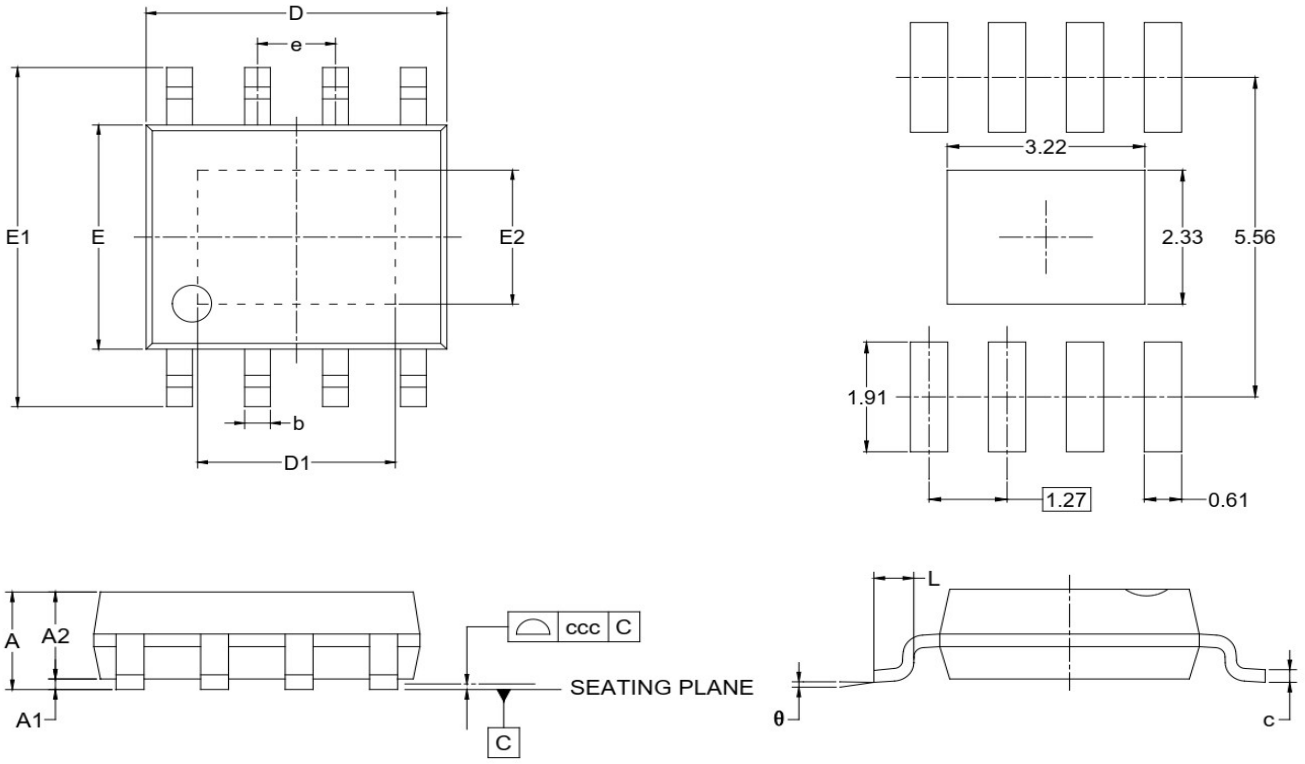
Figure 4. HCR3183 Typical Application Circuit 12V-3.3V/3A

380KHz 3A SYNCHRONOUS DC-DC BUCK CONVERTER

Mechanical Dimensions

M8E PKG: SOP-8(EP)

unit:mm

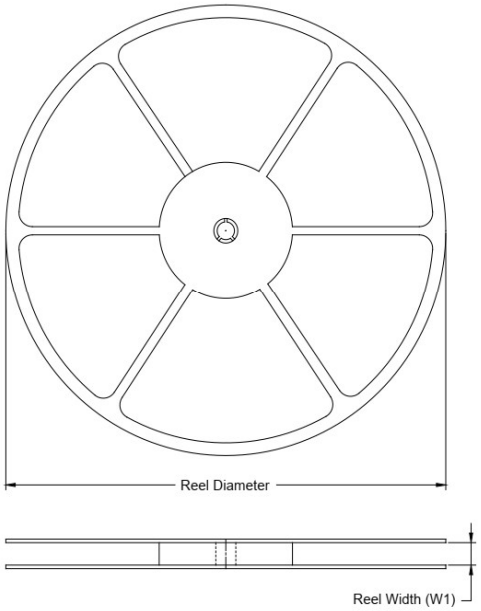


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A			1.700
A1	0.000	-	0.150
A2	1.250	-	1.650
b	0.330	-	0.510
c	0.170	-	0.250
D	4.700	-	5.100
D1	3.020	-	3.420
E	3.800	-	4.000
E1	5.800	-	6.200
E2	2.130	-	2.530
e	1.27 BSC		
L	0.400	-	1.270
θ	0°	-	8°
ccc	0.100		

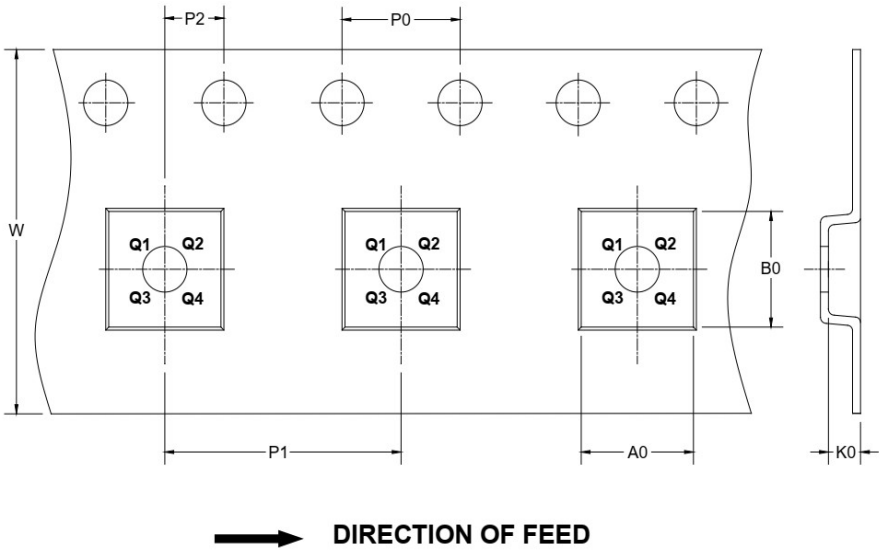
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MS-012.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

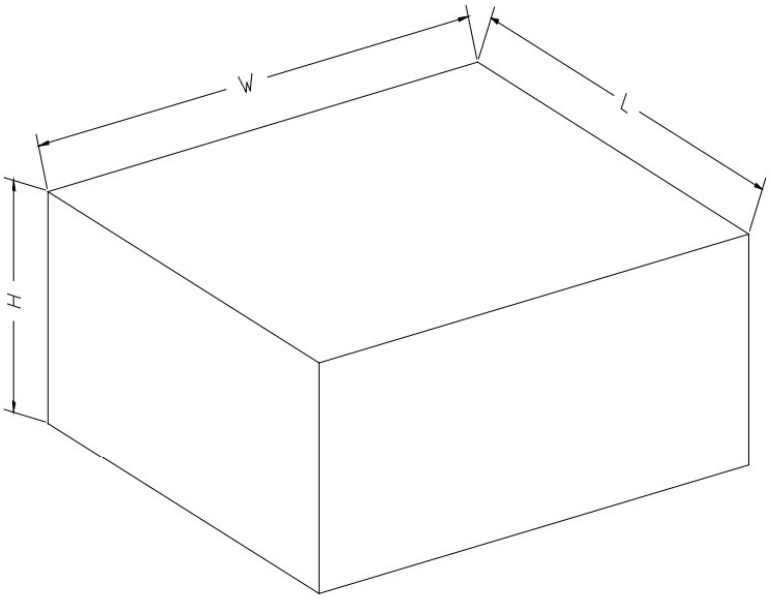


NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOP-8(EP)	13″	12.4	6.4	5.4	2.1	4.0	8.0	2.0	12.0	Q1

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5