

2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop**Features**

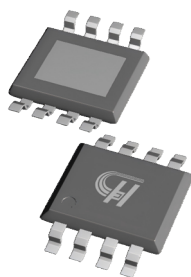
- 2A Constant output Current Capability
- Internal Optimize Power MOSFET
- Feedback Voltage Accuracy $\pm 2\%$
- 5V to 45V Input Operating Range
- Output Adjustable from 1.25V to 40V
- High efficiency up to 93%
- Max. Output power up to 12W
- Fixed 200KHz Switching Frequency
- Excellent line and load regulation
- EN pin TTL ON/OFF Capability
- Built in thermal shutdown function
- Built in current limit protection function
- Built in output short protection function
- Built in constant voltage loop and constant current loop
- Temperature range from -40°C to $+125^{\circ}\text{C}$
- Device HBM ESD Classification Level Class3A

General Description

The HCR3320 is a 200KHz fixed frequency PWM synchronous buck DC/DC converter, capable of driving a 2.0A load with high efficiency, low ripple and excellent line and load regulation. HCR3320 supports wide input operating voltage range of 5V~45V and a maximum duty cycle of 100% output. Output supports constant voltage loop and constant current loop. A built-in loop compensation module reduces components in the system, lowering power system cost and reducing printed circuit board space. The HCR3320 has built-in TTL ON/OFF capability, thermal shutdown, current limit protection and output short protection function and so on. When the output short protection function happens, the operation frequency will be reduced about from 200KHz to 50KHz. The HCR3320 require a minimum number of external components. It is available in SOP-8(EP) Package.

Applications

- Automotive Electronics
- Industrial Control
- Networking Equipment
- Internet of Things

**SOP-8(EP)****Figure 1. Package Type of HCR3320**

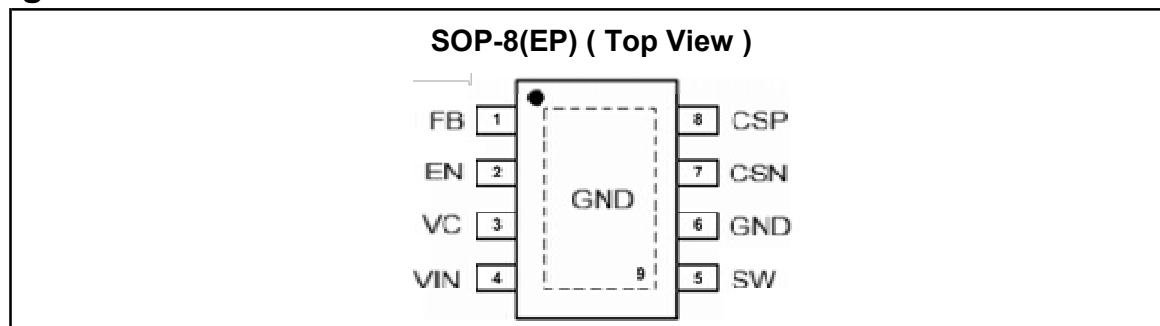
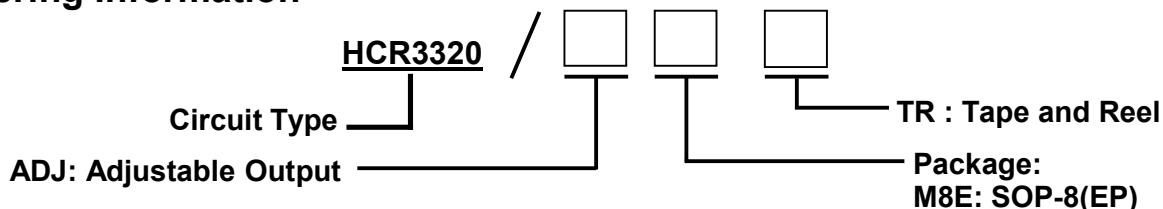
2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop
Pin Configuration


Figure 2. Pin Configuration of HCR3320 (Top View)

Pin Function Table

Pin Number	Pin Name	Function
1	FB	Feedback Pin (FB). Through an external resistor divider network, Feedback senses the output voltage and regulates it. The feedback threshold voltage is 1.25V.
2	EN	Enable Pin. Drive EN pin high to turn on the device, drive it low to turn it off. Floating is default high.
3	VC	Internal Voltage Regulator Bypass Capacity. In typical system application, The VC pin connect a 1uF capacitor to VIN.
4	VIN	Supply Voltage Input Pin. The HCR3320 operates from 5V to 45V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
5	SW	Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.
6	GND	Ground Pin.
7	CSN	Current detection negative terminal pin.
8	CSP	Current detection positive terminal pin.

Ordering Information

Ordering Code

Part Number	Marking ID ²	Temperature Range	Package	Quantity per Reel
HCR3320/ADJM8ETR	HCR3320XXX	-40°C to +125°C	SOP-8(EP)	4000pcs/TR

Note2: the HCR3320 is type and "XXX" is date code.

2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop**Absolute Maximum Ratings** ^{Note 1}

Parameter	Symbol	Value	Unit
Supply Voltage	V _{IN}	-0.3 to +50	V
Enable Voltage	V _{EN}	-0.3 to +7	V
Feedback Pin Voltage	V _{FB}	-0.3 to +7	V
output Switch Pin Voltage	V _{SW}	-0.3 to V _{IN}	V
Internal Voltage Regulator Bypass Capacity	V _C	-0.3 to V _{IN}	V
CSP Pin Voltage	V _{CSP}	-0.3 to V _{IN}	V
CSN Pin Voltage	V _{CSN}	-0.3 to V _{IN}	V
Maximum Power Dissipation	P _D	Internally limited	W
Thermal Resistance (Junction to Ambient, No Heatsink, Free Air)	R _{θJA}	60	'C/W
Thermal Resistance Junction to Case	R _{θJC}	20	'C/W
Storage Temperature Range	T _{STG}	-65 to 150	'C
Operating Junction Temperature	T _J	-40 to 150	'C
Lead Temperature (Soldering, 10s)	T _{LEAD}	260	'C
ESD (HBM)	HBM	6000	V

Note1: 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 these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommend Operating Conditions ^{note2}

Parameter	Symbol	Min.	Max.	Unit
Input Voltage	V _{IN}	5.0	45.0	V
Ambient Operating Temp	T _A	-40	+125	'C

Note 1: Stresses beyond those listed under "Absolute maximum Ratings" may damage the device.

2: The device is not guaranteed to function outside the recommended operating conditions.

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Electrical Characteristics

The specifications which apply over the full operating temperature range, otherwise specification are VIN=12V, (Ta=25°C; unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
Input Operation Voltage	V _{in}		5.0	-	45	V
Shutdown Supply Current	I _{STBY}	V _{EN} =2V	-	35	100	uA
Quiescent Supply Current	I _q	V _{FB} =2V	-	2.5	5.0	mA
Feedback Voltage	V _{FB}	V _{IN} =12V, V _{out} =5.0V, I _{out} =0.5A	1.225	1.250	1.275	V
Efficiency	η	V _{IN} =12V, V _{out} =5.0V, I _{out} =1A	-	91.4	-	%
Efficiency	η	V _{IN} =24V, V _{out} =12V, I _{out} =1A	-	93.0	-	%
Efficiency	η	V _{IN} =24V, V _{out} =15V, I _{out} =0.8A	-	93.6	-	%
High-side Switch On-Resistance	R _{DS(ON)H}		-	68	-	mΩ
Low-side Switch On-Resistance	R _{DS(ON)L}		-	50	-	mΩ
Switch Current Limit	I _{LIMIT}	V _{FB} =0V	-	2.0	-	A
Oscillator Frequency	F _{osc}		170	200	230	KHz
Short Circuit Oscillator Frequency	F _{SHT}	V _{FB} =0V	-	50	-	KHz
Maximum Duty Cycle	D _{MAX}	V _{FB} =0V	-	-	100	%
Minimum On Time	T _{on}		-	330	-	us
EN Input Voltage	V _{EN}	EN High Threshold	1.4	-	-	V
		EN Low Threshold	-	-	0.8	
Thermal Shutdown Temperature	T _{SD}		-	160	-	°C
Thermal Shutdown Hysteresis	T _D		-	30	-	°C

2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop

Typical Performance Characteristics

(See Figure 4, C1=10uF, C2=22uFX2, L=10uH, TA=+25'C)

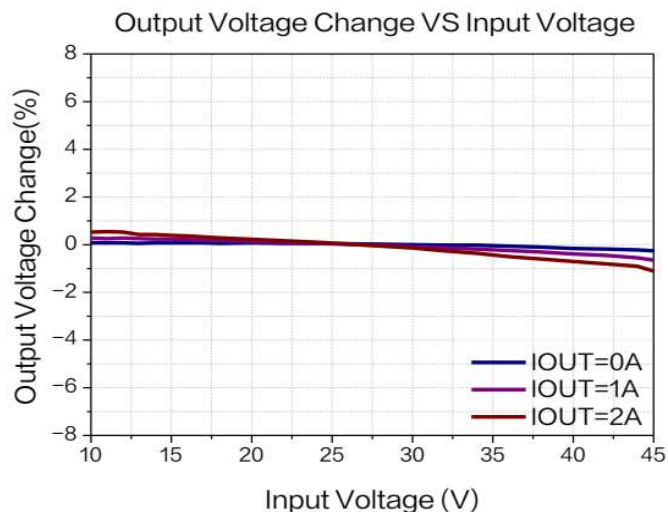


Figure 3. Line Regulation

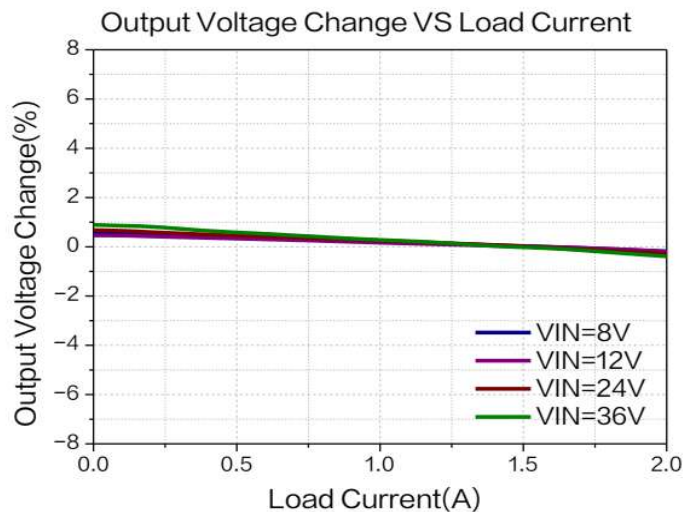


Figure 4. Load Regulation

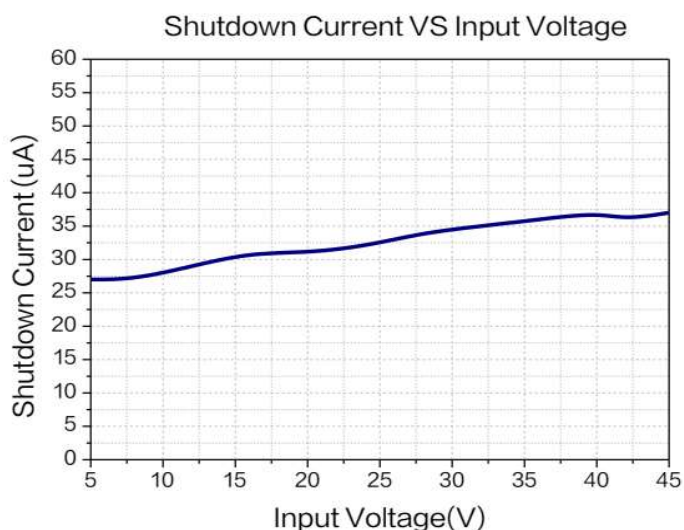


Figure 5. Shutdown Current

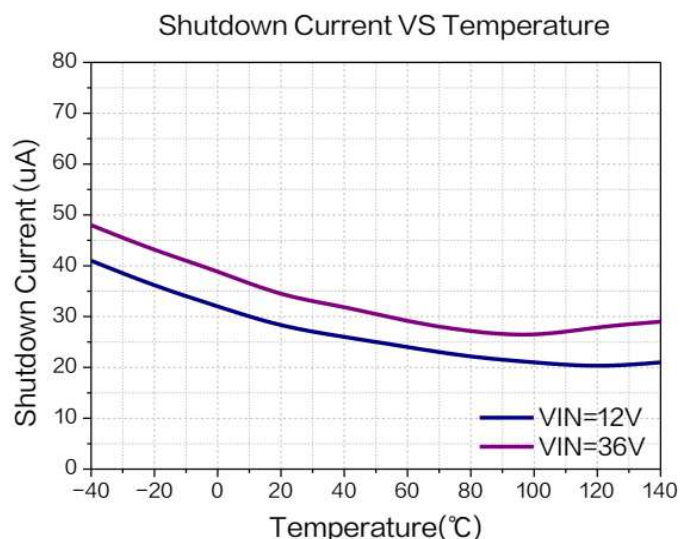


Figure 6. Shutdown Current

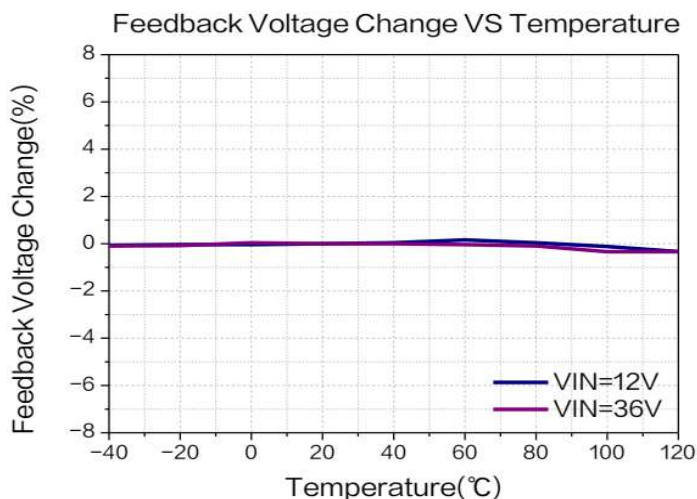


Figure 7. Feedback Voltage Regulation

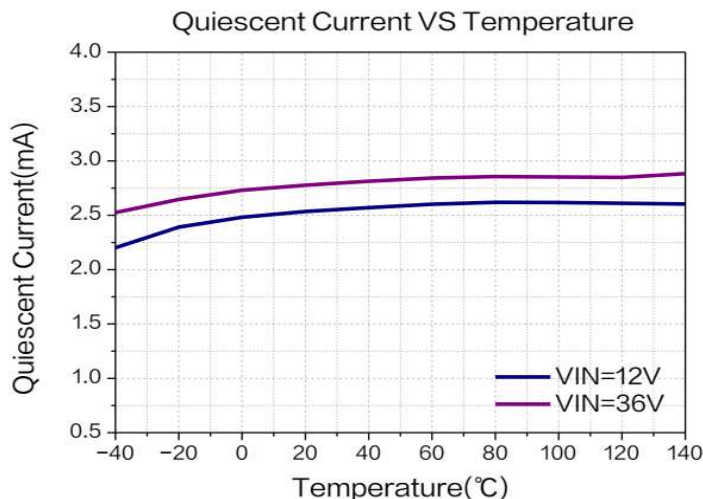


Figure 8. Quiescent Current

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Typical Performance Characteristics(con)

(See Figure 4, C1=10uF, C2=22uFX2, L=10uH, TA=+25'C)

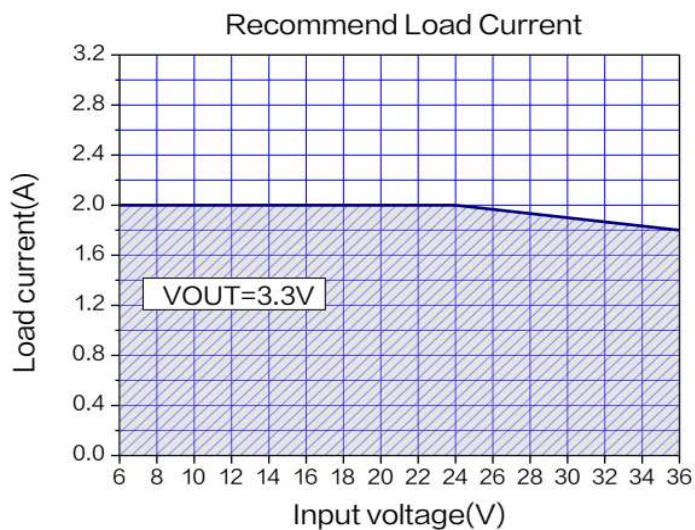


Figure 9. Max. Output Current

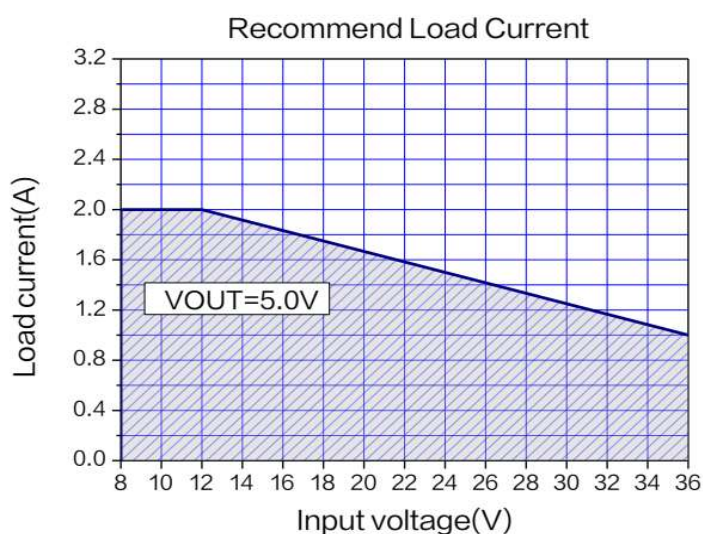


Figure 10. Max. Output Current

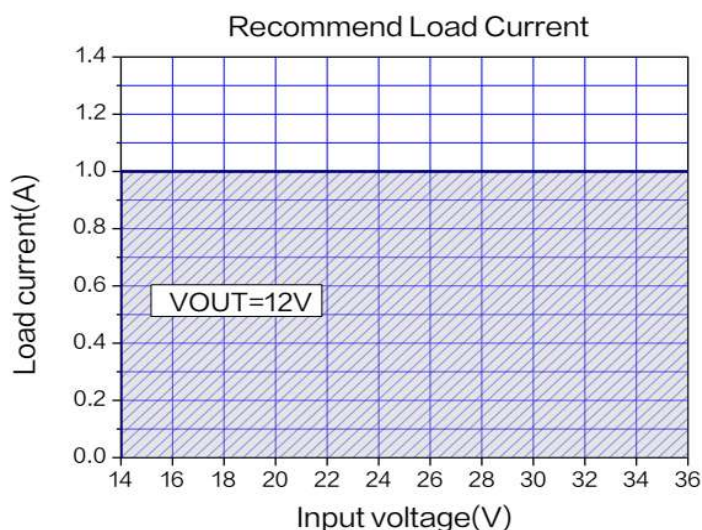


Figure 11. Max. Output Current

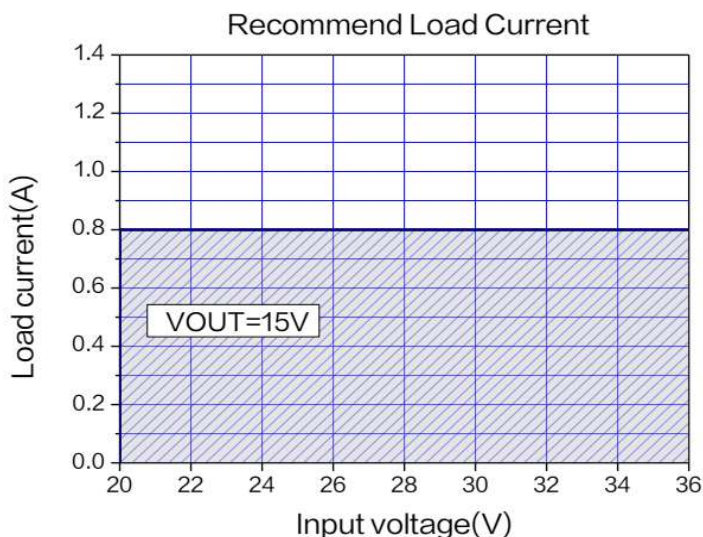


Figure 12. Max. Output Current

(VIN=8V, Vout=5.0V, Iout=0.1A)

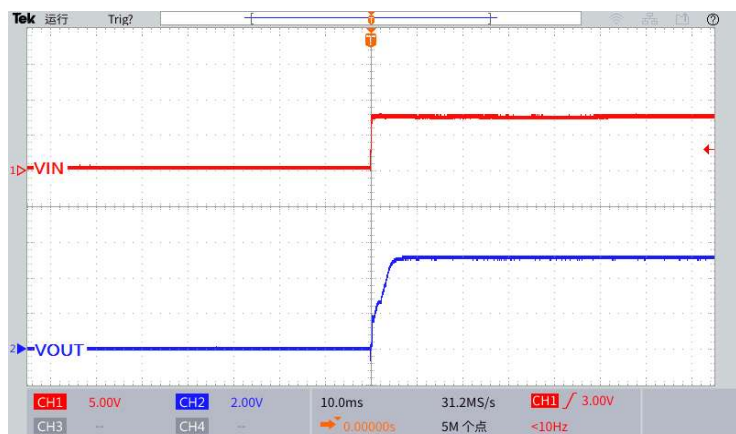


Figure 13. Star-Up Characteristic

(VIN=12V, Vout=5.0V, Iout=0.1A)

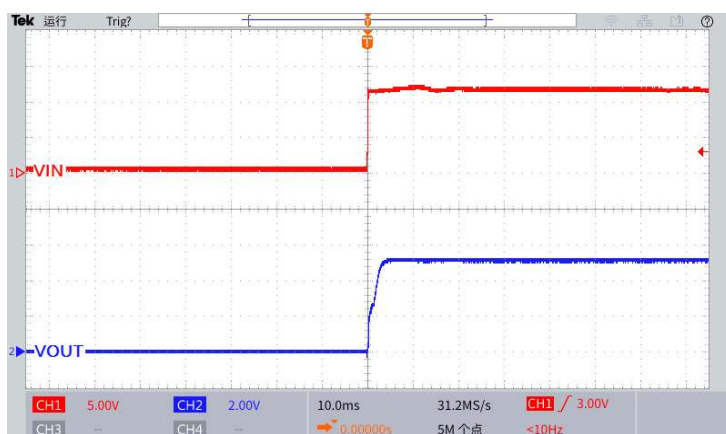


Figure 14. Star-Up Characteristic

2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop

Typical Performance Characteristics(con)

(See Figure 4, C1=10uF, C2=22uFX2, L=10uH, TA=+25'C)

(VIN=24V, Vout=5.0V, Iout=0.1A)



Figure 15. Star-Up Characteristic

(VIN=36V, Vout=5.0V, Iout=0.1A)



Figure 16. Star-Up Characteristic

(VIN=8V, Vout=5.0V)

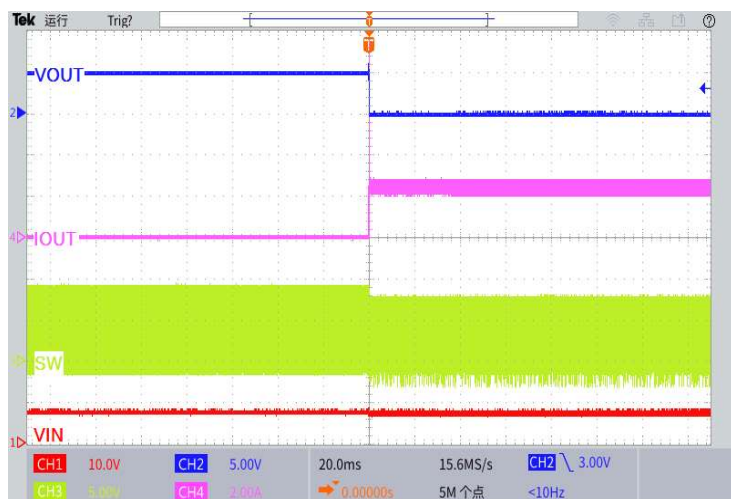


Figure 17. Output Short Current Waveform

(VIN=12V, Vout=5.0V)

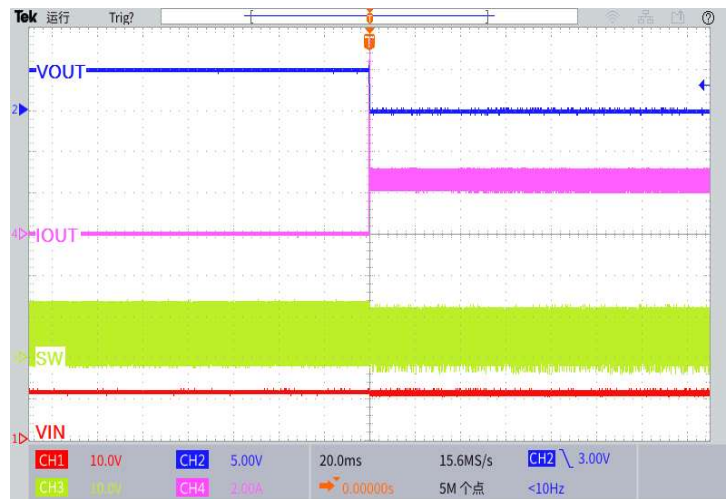


Figure 18. Output Short Current Waveform

(VIN=24V, Vout=5.0V)

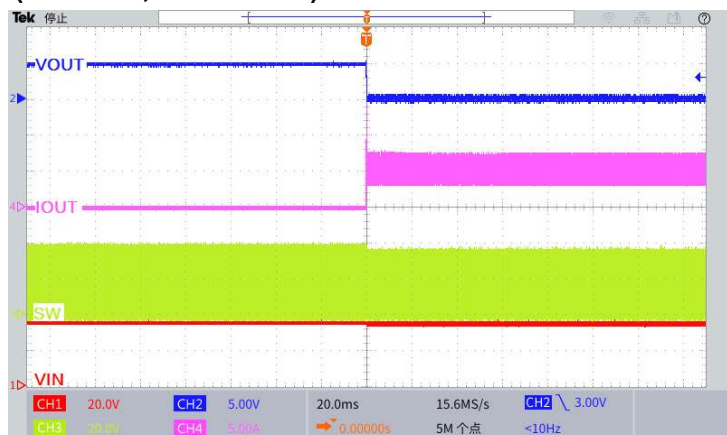


Figure 19. Output Short Current Waveform

(VIN=36V, Vout=5.0V)

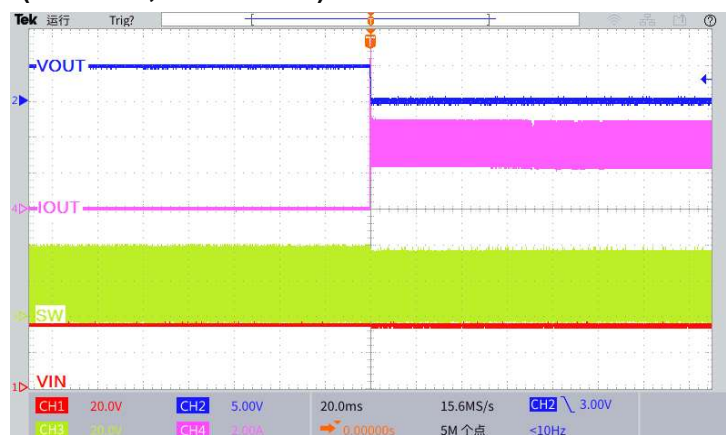


Figure 20. Output Short Current Waveform

2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop

Typical Performance Characteristics(con)

(See Figure 4, C1=10uF, C2=22uFX2, L=10uH, TA=+25'C)

(VIN=8V, Vout=5.0V, Iout=0.1 to 1A)

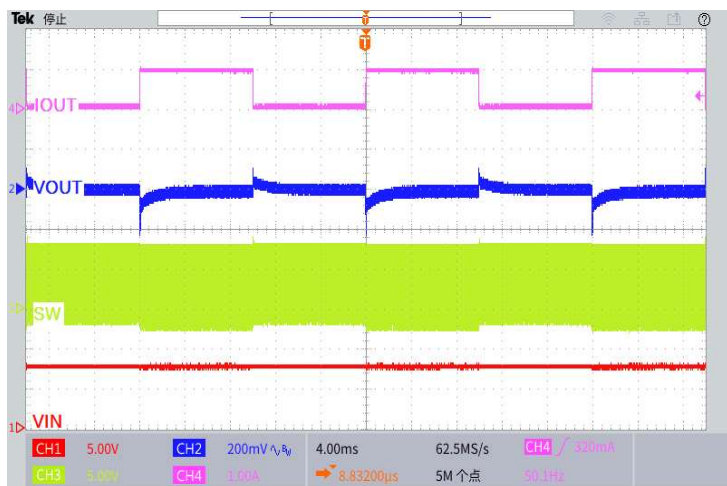


Figure 21. Load Transient Response

(VIN=12V, Vout=5.0V, Iout=0.1 to 1A)

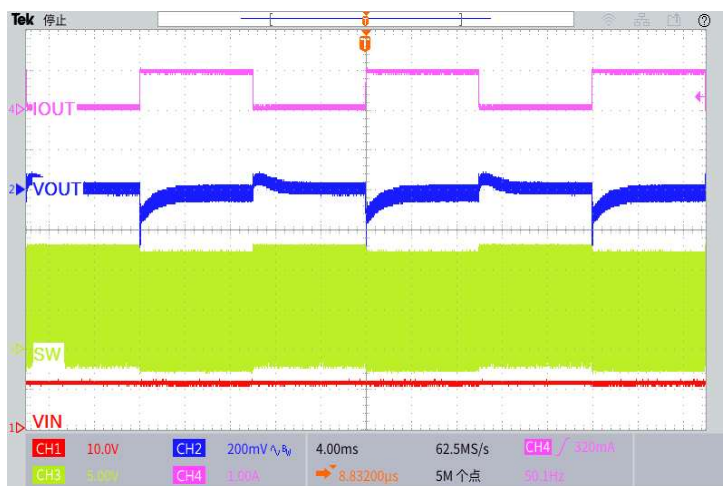


Figure 22. Load Transient Response

(VIN=24V, Vout=5.0V, Iout=0.1 to 1A)

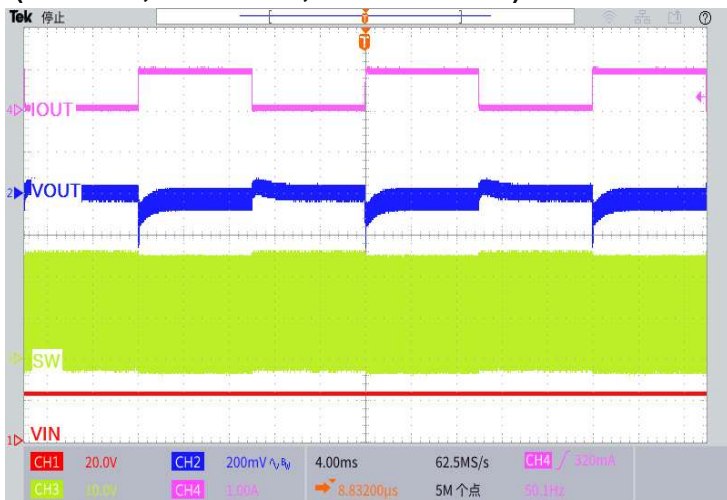


Figure 23. Load Transient Response

(VIN=36V, Vout=5.0V, Iout=0.1 to 1A)

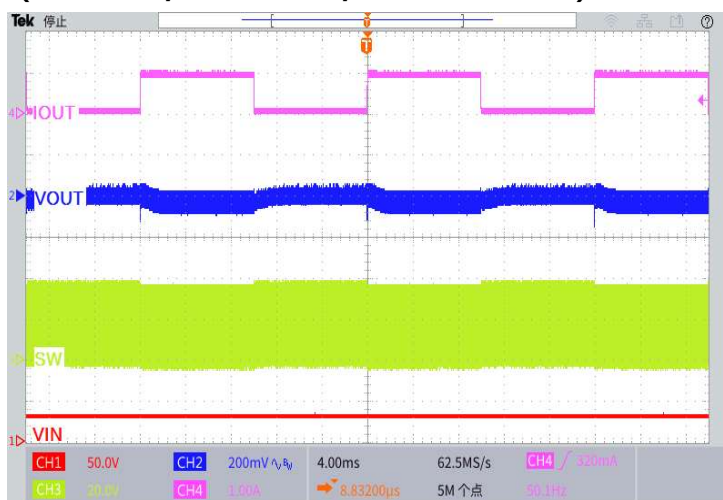


Figure 24. Load Transient Response

(VIN=8V, Vout=5.0V, Iout=0.5A)



Figure 25. Start or Shutdown Using EN Pin

(VIN=12V, Vout=5.0V, Iout=0.5A)



Figure 26. Start or Shutdown Using EN Pin

2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop

Typical Performance Characteristics(con)

(See Figure 4, C1=10uF, C2=22uFX2, L=10uH, TA=+25'C)

(VIN=24V, Vout=5.0V, Iout=0.5A)



Figure 27. Start or Shutdown Using EN Pin

(VIN=36V, Vout=5.0V, Iout=0.5A)

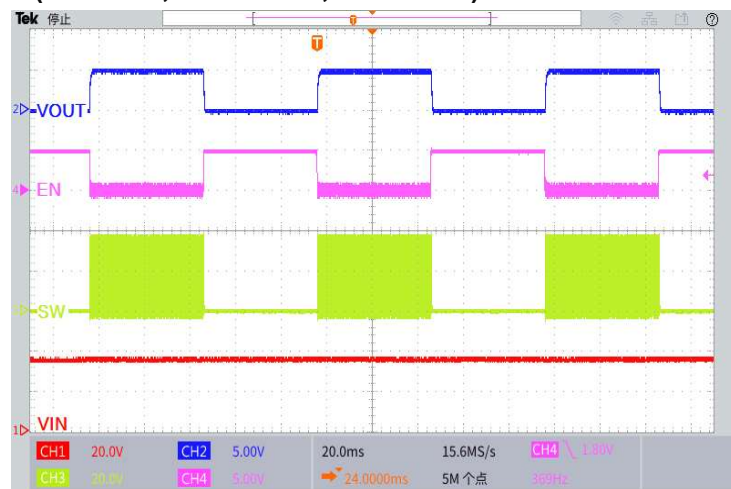


Figure 28. Start or Shutdown Using EN Pin

Typical System Application Circuit

(VIN=5V~45V, Vout=3.3V, Iout=0~2.0A)

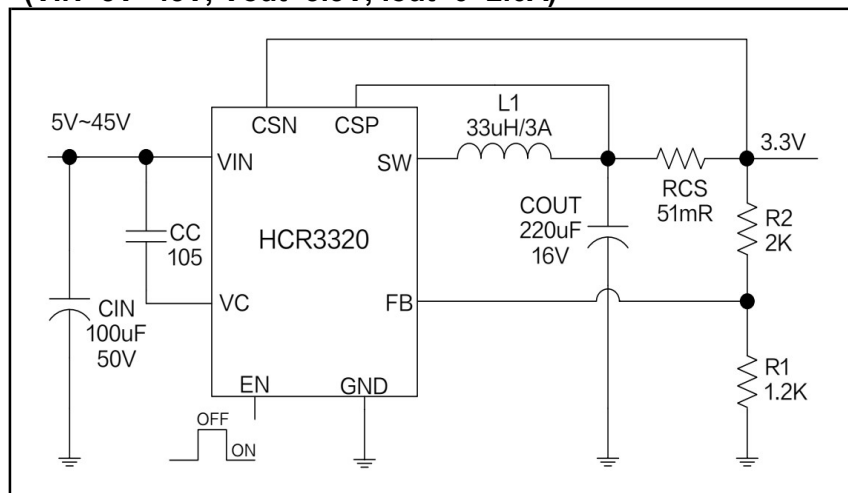


Figure 29. Typical System Application Schematic

Transfer Efficiency

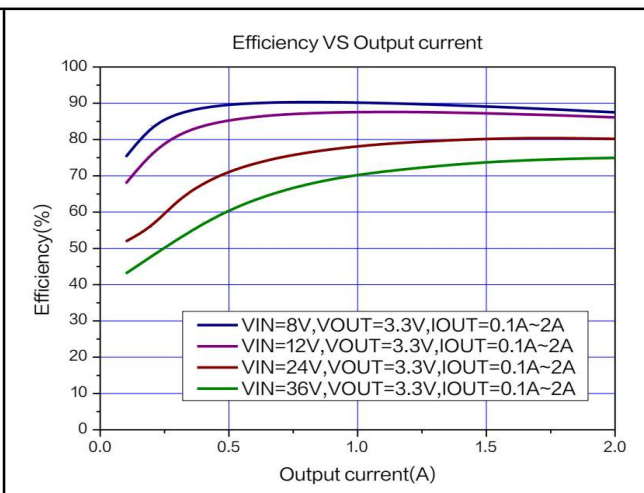


Figure 30. Efficiency Curve(Vout=3.3V)

(VIN=8V~45V, Vout=5V, Iout=0~2.0A)

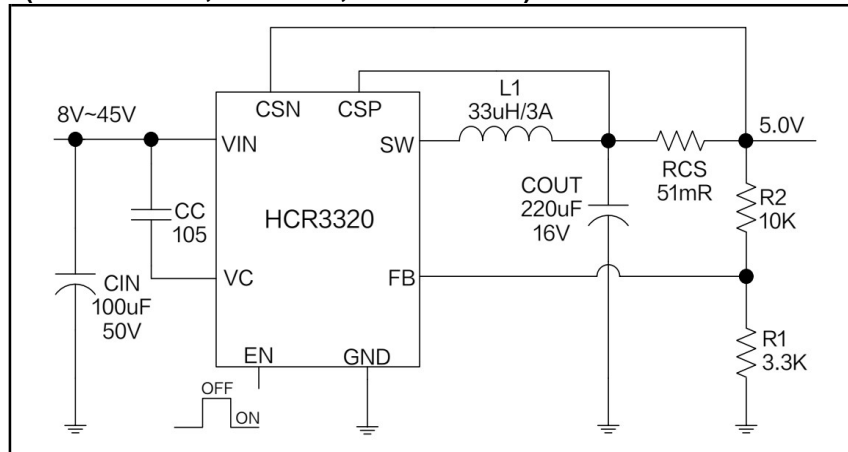


Figure 31. Typical System Application Schematic

Transfer Efficiency

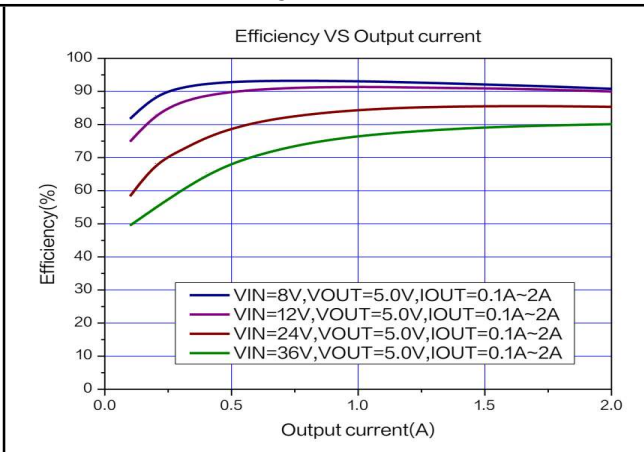


Figure 32. Efficiency Curve(Vout=5V)

2A, 45V, 200KHz Synchronous Step-Down Converter With CV/CC Loop

Typical System Application Circuit

(VIN=18V~45V, Vout=12V, Iout=0~1.0A)

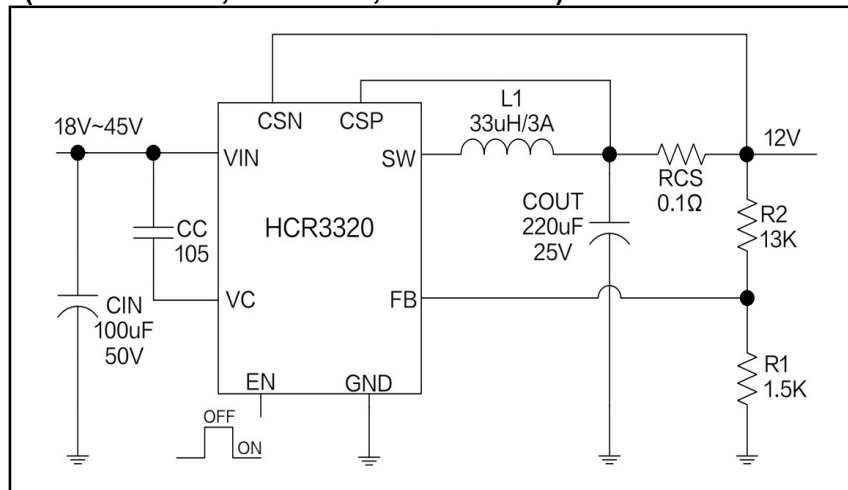


Figure 33. Typical System Application Schematic

Transfer Efficiency

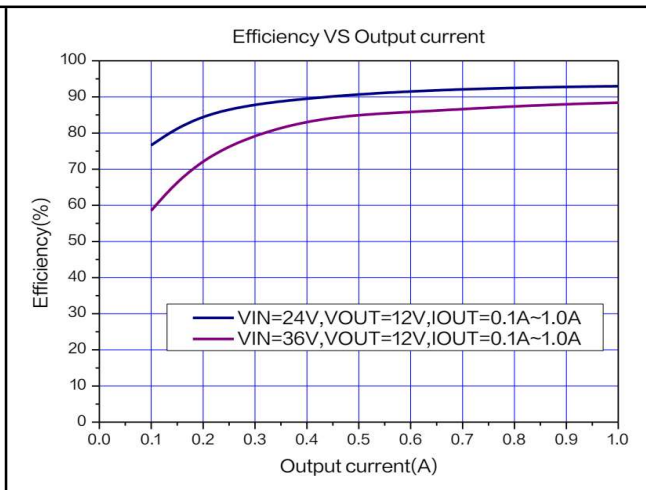
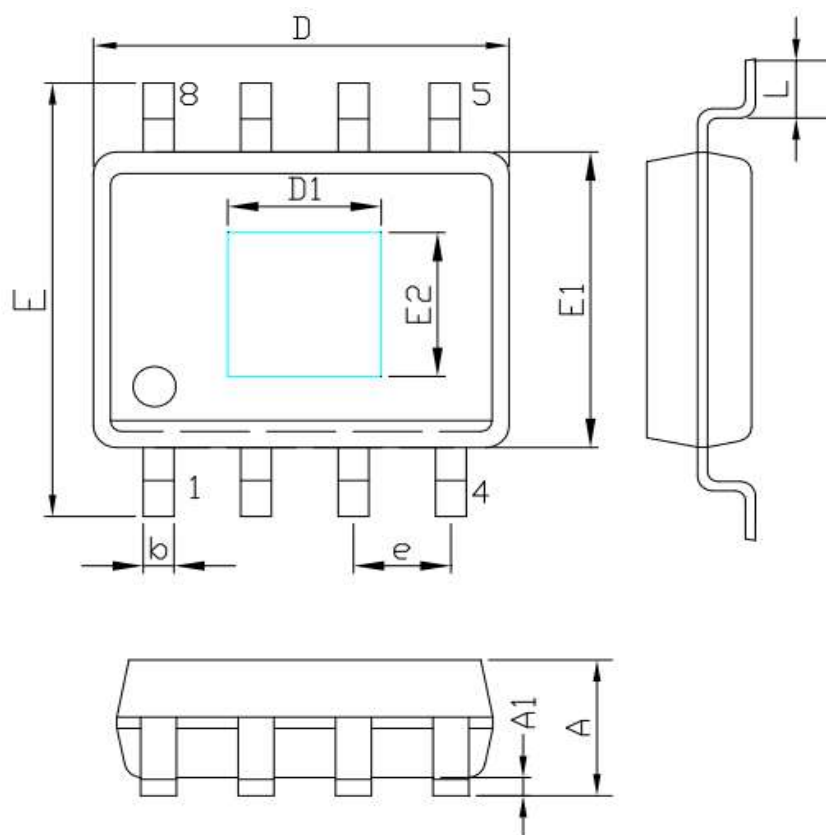


Figure 34. Efficiency Curve(Vout=12V)

Mechanical Dimensions
M8E PKG: SOP-8(EP)

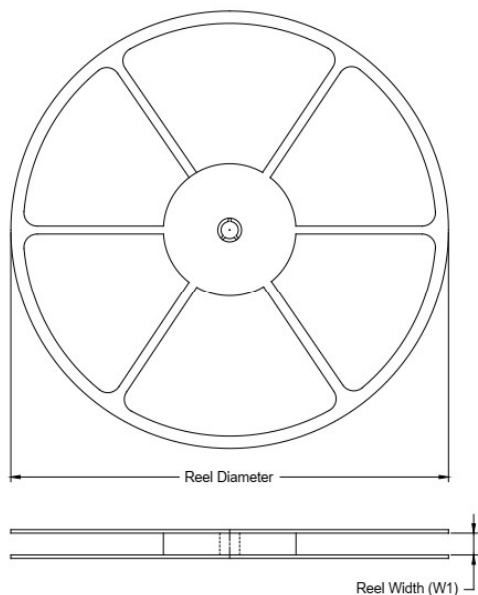
Unit: mm(inch)



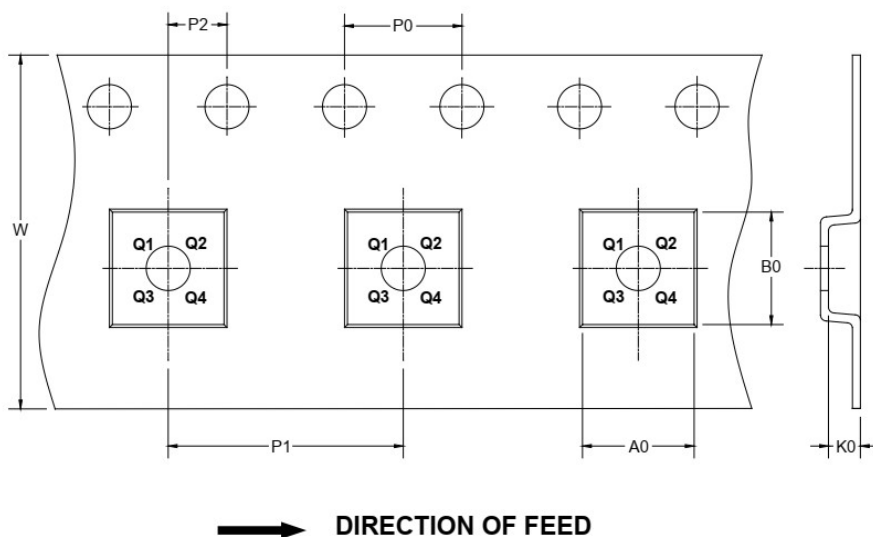
SYMBOLS	MILLIMETERS			INCHES		
	MIN.	Normal	MAX.	MIN.	Normal	MAX.
A	1.35	-	1.75	0.053	-	0.069
A1	0.00	-	0.25	0.000	-	0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E1	3.70	3.90	4.00	0.146	0.154	0.157
D1	2.67	2.97	3.50	0.105	0.117	0.138
E2	1.78	2.18	2.60	0.070	0.086	0.102
E	5.80	6.00	6.20	0.228	0.236	0.244
L	0.40	-	1.27	0.016	-	0.050
b	0.31	-	0.51	0.012	-	0.020
e	1.27 REF			0.050 REF		

TAPE AND REEL INFORMATION

REEL DIMENSIONS



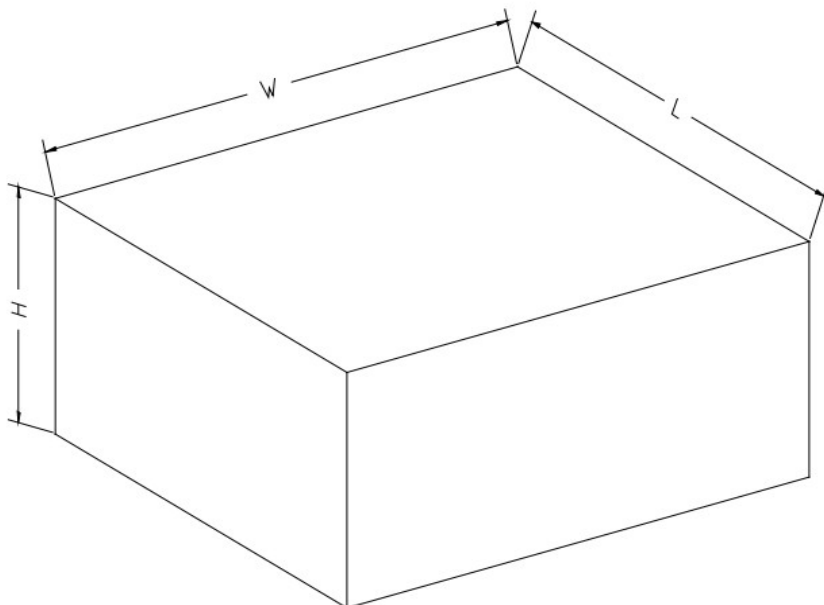
TAPE DIMENSIONS



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	6.40	5.40	2.10	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