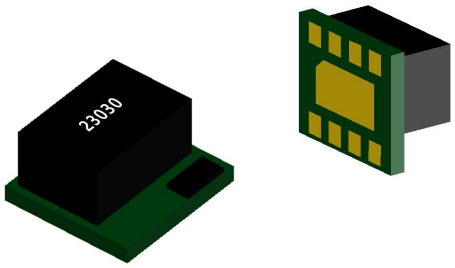
FHT23030

1.1~6.5V input, 3A output DC/DC integrated molded adjustable buck converter module.



1 Features

- **3A continuous output current**
- **Input voltage range: 4.5V-17V**
- **Output voltage: 0.9V-6V**
- **CoT control topology**
- **40uA quiescent operating current**
- **Power-saving mode for light-load efficiency**
- **Power good (PG) output indication**
- **Programmable soft-start**
- **Small-size LGA package (3mm×2.8mm×1.4mm)**

2 Applications

- **Industrial Equipment**
- **Telecommunications and Networking Systems**
- **Solid State Drives**

3 Description

The FHT23030 is a non-isolated DC/DC power module that provides a complete power solution.

It simplifies design by requiring only a minimal number of resistor and capacitor components for its periphery. With an input voltage range of 4.5~17V and a rated output current of 3A, the output voltage is adjustable, and it exhibits excellent load regulation and line regulation.

To maximize efficiency, the FHT23030 operates in PFM mode with a nominal switching frequency of 2MHz and automatically enters power-saving mode during light loads.

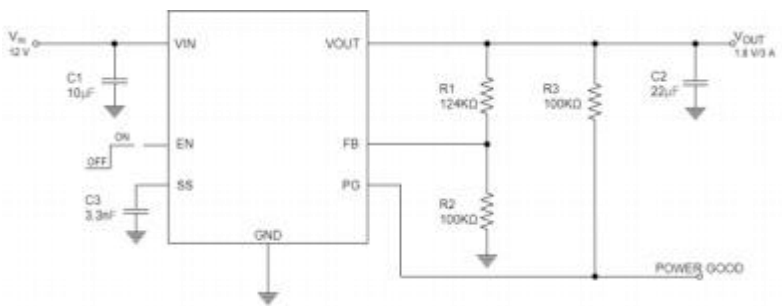
In power-saving mode, the typical quiescent operating current of the module is 40μA.

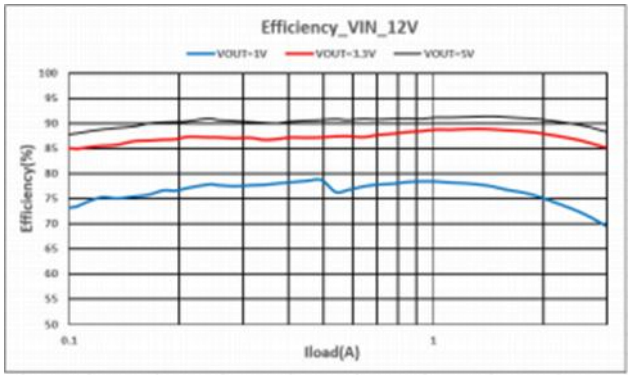
The FHT23030 features comprehensive protection characteristics, including over-current protection (OCP), short-circuit protection (SCP), under-voltage lockout protection (UVLO), and over-temperature protection.

Ordering Information

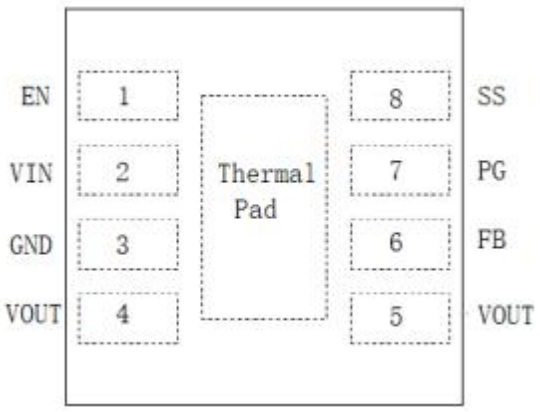
Product Model	Input		Output	Size & Encapsulation	Package
	Input Range	Nominal Input			
FHT23030	4.5V~17V	--	0.9V~6V/3A	3mm ×2.8mm × 1.4mm （LGA）	Tray

Typical Applications





Pin Configuration



Top view (perspective)

Pin	Symbol	Description
1	EN	**Enable Pin:** Connecting EN to high level turns on the module, while connecting EN to low level turns off the module. When the module is off, this pin has an internal 400KΩ pull-down resistor.
2	VIN	**Voltage Input Pin:** Connect VIN to the input power supply to power the module.
3	GND	**Module Ground.**
4，5	VOUT	**Output Voltage Pin**
6	FB	**Voltage Feedback Pin:** This pin connects to an external voltage divider to adjust the output voltage.
7	PG	**Power Good Output Indicator Pin:** This pin should be connected to a pull-up resistor to any voltage lower than 6V. If not used, leave it floating.
8	SS	**Soft-Start Pin:** Connect an external capacitor to ground on this pin to set the rise time of the internal reference voltage.
	Thermal Pad	**Exposed Heat Sink Pad:** Must be connected to GND. Soldering is required to improve thermal dissipation and mechanical reliability.

Electrical Characteristics

Input current

Absolute Maximum Ratings	Condition	Minimum	Nominal value	Maximum	Unit
VIN,		-0.3		20	V
EN , SS		-0.3		7	V
PG , FB		-0.3		7	V
VOUT		-0.3		7	V
PG Sink Current				10	mA
Storage temperature		-55		+125	℃
Input characteristic	**Condition**	**Minimum**	**Nominal value**	**Maximum**	**Unit**
Input Voltage range		4.5		17	V

Input Current

Input current at full load	V_{IN} =12V , V_{OUT} =1V , I_{OUT}=3A		0.36		A
Input current at low voltage and full load	V_{IN} =5V , V_{OUT} =1V , I_{OUT}=3A		0.75		A
Input current at no load	V_{IN} =12V , V_{OUT} =1V , I_{OUT}=0A		0.75		mA
Input current when switched off	V_{IN} =12V , V_{EN}=0V		1.5		μA
General requirements	**Condition**	**Minimum**	**Nominal value**	**Maximum**	**Unit**
PWM Switching Frequency	V_{OUT} = 1.8V , I_{OUT} = 1A		2		MHz
PG Pull-up Resistor Voltage				6	V
Efficiency	V_{IN} =8V , V_{OUT} =3.25V , I_{OUT}=1.5A		92%		%
Functionality	**Condition**	**Minimum**	**Nominal value**	**Maximum**	**Unit**
EN High-Level Input Voltage		0.9	0.73		V
EN Low-Level Input Voltage			0.63	0.33	V
PGOOD Threshold Indicator Value	V_{OUT} rise	92	95	99	%
	V_{OUT} drop	87	90	94	%
Output characteristic	**Condition**	**Minimum**	**Nominal value**	**Maximum**	**Unit**
Output Voltage	Adjusted by the RFB resistor.	0.9		6	V
Line Regulation	V_{OUT}= 1V , 4.5V < V_{IN}< 17V , I_{LOAD} = 3A			±1	%
Load Regulation	V_{IN}=12V , V_{OUT}=1V,0A < I_{LOAD} ≤ 3A			±1	%

Electrical Characteristics（Continued）

Protection Characteristics	Condition	Minimum	Nominal value	Maximum	Unit
Undervoltage Lockout (UVLO) Threshold	V_{IN} drop		3.8		
	V_{IN} rise		4.2	4.5	
Thermal Shutdown Threshold	Junction temperature rise		160		℃
	Junction temperature drop		140		℃
Structural Characteristics	**Condition**	**Minimum**	**Nominal value**	**Maximum**	**Unit**
Size	Length	2.95	3	3.05	mm
	Width	2.75	2.8	2.85	mm
	Height		1.4	1.42	mm
Environmental adaptability	**Condition**	**Minimum**	**Nominal value**	**Maximum**	**Unit**
Working temperature (ambient temperature)		-40		110	℃
High temperature storage (ambient temperature)	+125℃， 48h			125	℃
High temperature operation (ambient temperature)	+85℃， 24h; Input low-voltage, standard-voltage, and high-voltage for 8 hours each;			85	℃
Low temperature storage (ambient temperature)	-55℃， 24h	-55			℃
Low temperature operation (ambient temperature)	-40℃， 24h; Input low-voltage, standard-voltage, and high-voltage for 8 hours each	-40			℃
Hot and humid	High temperature and high humidity stage: 60 ℃, 95%; Low temperature and high humidity stage: 30 ℃, 95%; Cycle 10 times, each cycle lasting 24 hours	30		60	℃
Thermal shock	At a high temperature of 125°C and a low temperature of -55°C, one hour at each temperature constitutes one cycle, with a total of 32 cycles being tested.	-55		125	℃

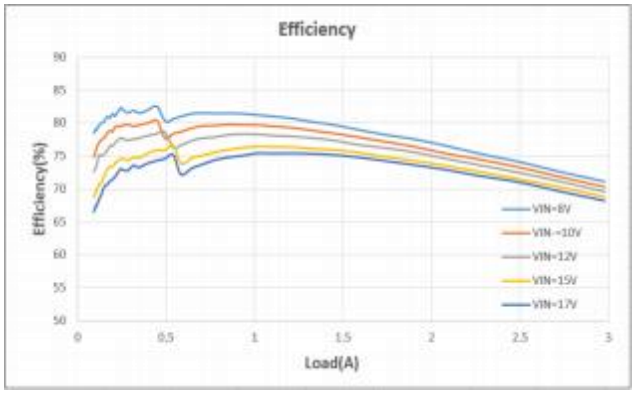
Note 1: Stresses above those listed in the "Absolute Maximum Ratings" section may cause permanent damage to the device. Prolonged exposure to any of the Absolute Maximum Ratings conditions may affect device reliability and useful life.

Note 2: The maximum continuous output current may be derated due to the junction temperature of the FHT23030.

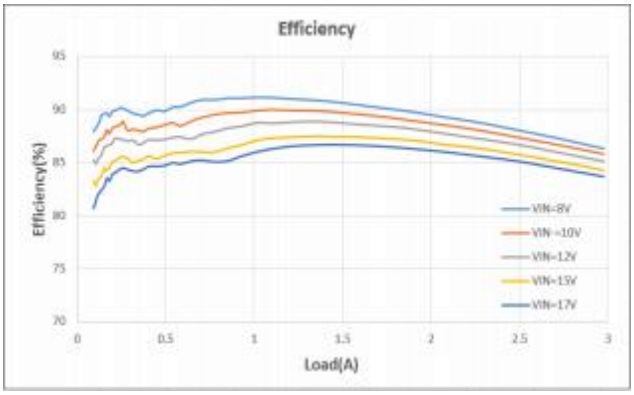
Note 3: The performance specifications of the FHT23030 are guaranteed over an internal operating temperature range of -40°C to 125°C. Please note that the maximum internal temperature is determined by specific operating conditions in conjunction with circuit board layout, the rated thermal resistance of the package, and other environmental factors.

The test conditions are V_{IN} = 12V , V_{OUT} = 1.0V, with external capacitors C_{IN}=2x10μF and C_{OUT} = 2x47μF, and a temperature of TA = 25。C , unless otherwise noted.

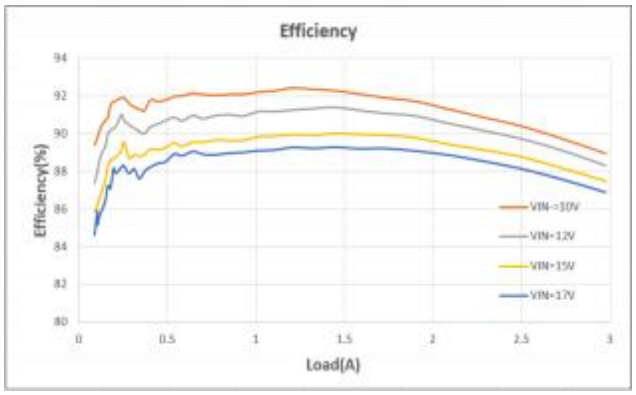
Output current vs. efficiency (V_{OUT}=1.0V)



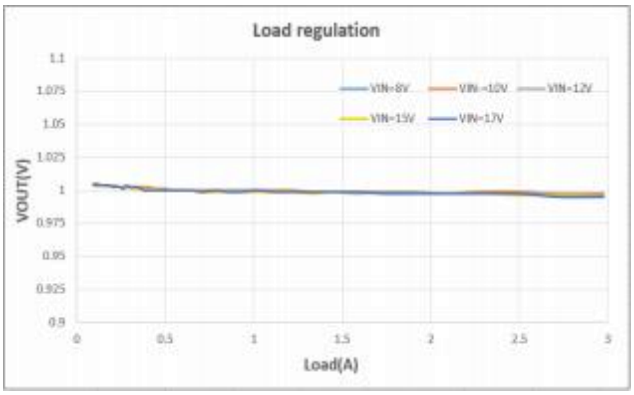
Output current vs. efficiency (V_{OUT}=3.25V)



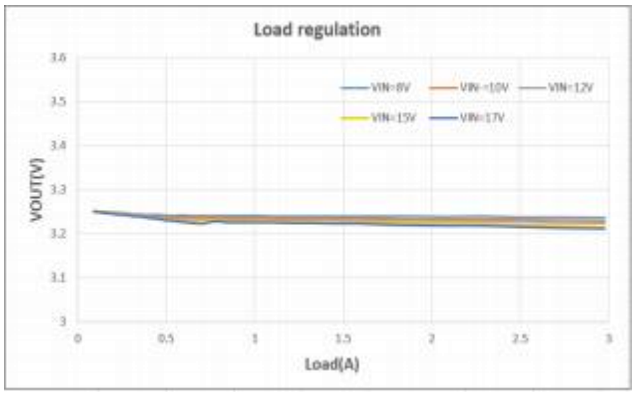
Output current vs. efficiency (V_{OUT}=5.05V)



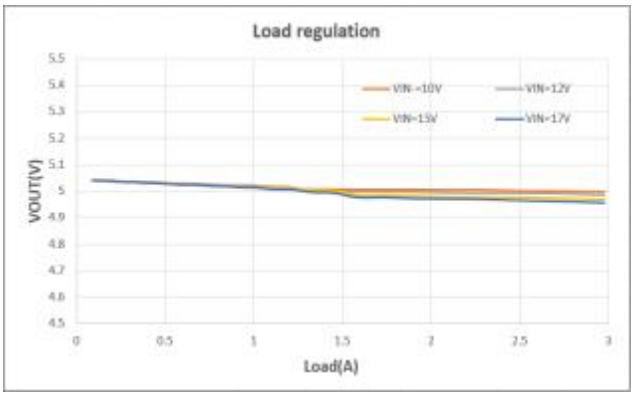
Load regulation (V_{OUT}=1.0V)



Load regulation (V_{OUT}=3.25V)

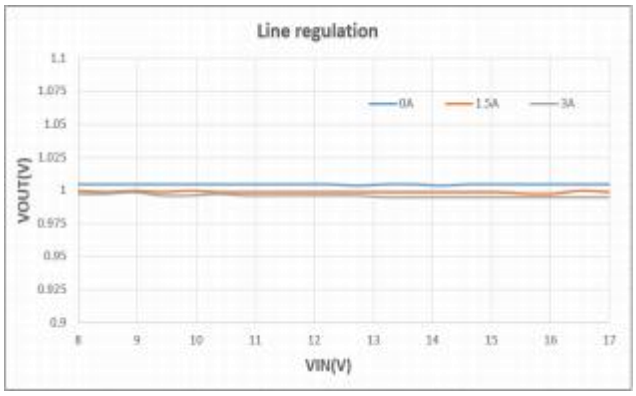


Load regulation (V_{OUT}=5.05V)

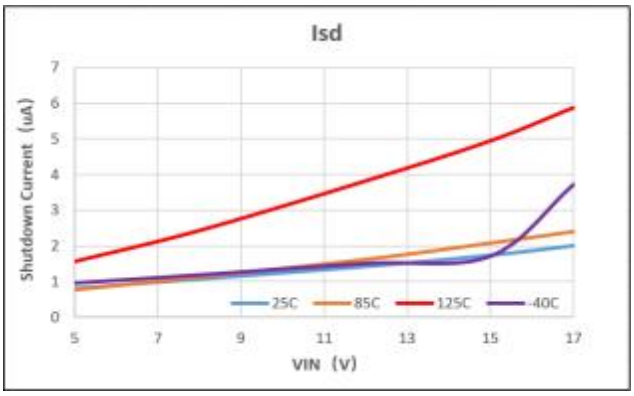


The test conditions are V_{IN} = 12V , V_{OUT} = 1.0V, with external capacitors C_{IN}=2x10μF , C_{OUT} = 2x47μF , and a temperature of TA = 25。C, unless otherwise noted.

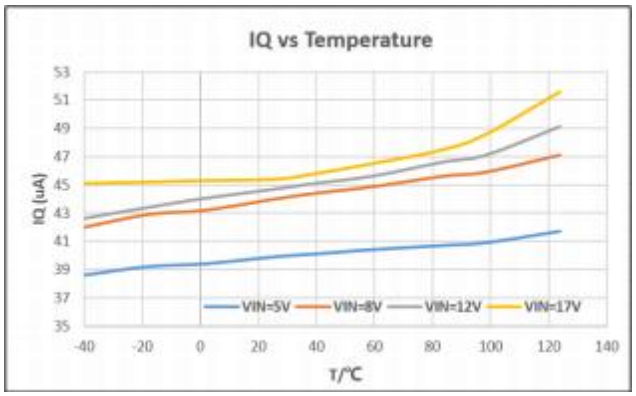
Linear regulation（V_{OUT}=1.0V）



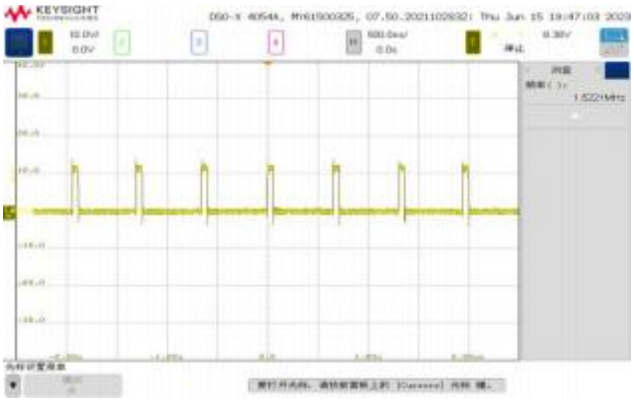
Shutdown current（V_{OUT}=5.05V）



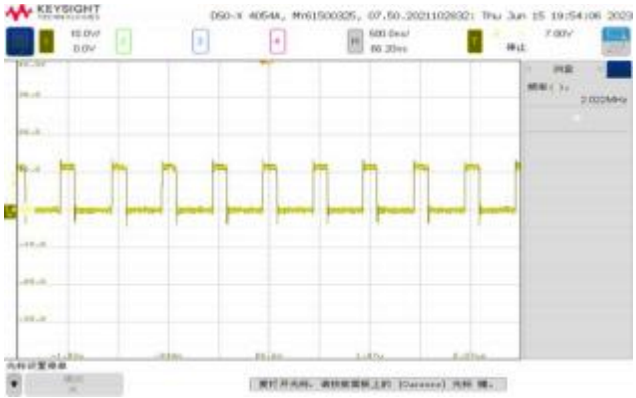
Quiescent current



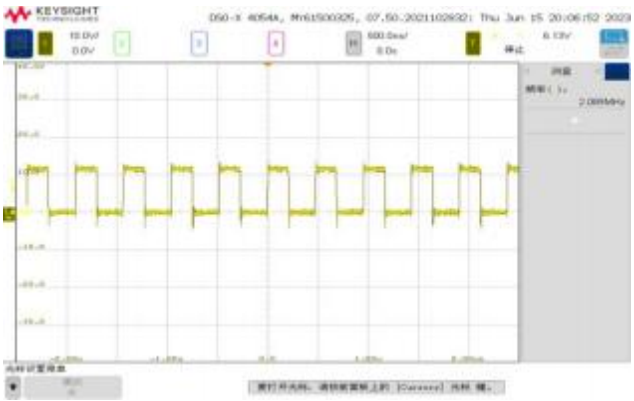
Switching frequency V_{OUT}=1.0V , I_{OUT}=3A



Switching frequency V_{OUT}=3.3V , I_{OUT}=3A

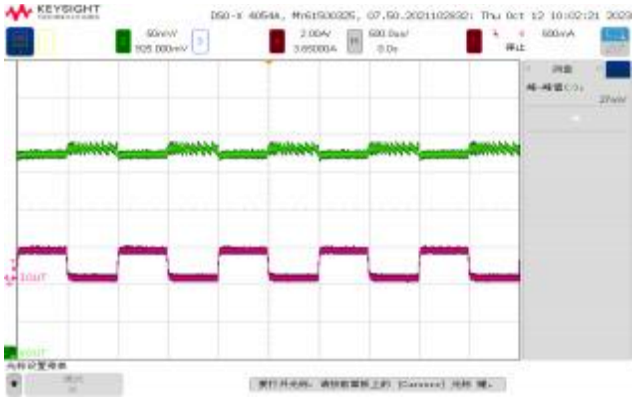


Switching frequency V_{OUT}=5V , I_{OUT}=3A

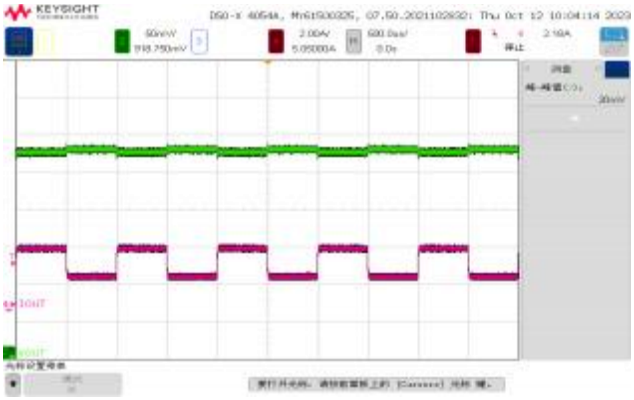


The test conditions are V_{IN} = 12V , V_{OUT} = 1.0V, with external capacitors C_{IN}=2x10μF and C_{OUT} = 2x47μF, and a temperature of TA = 25。C , unless otherwise noted.

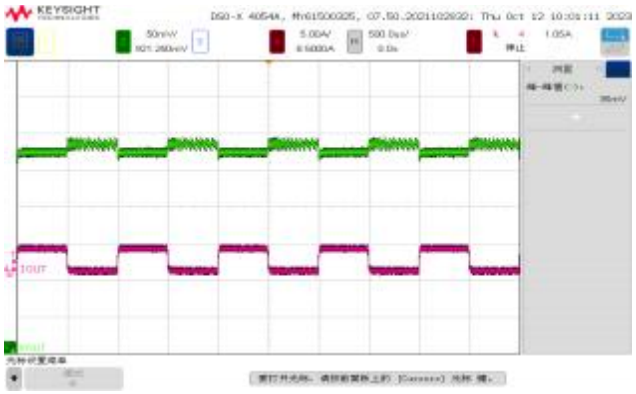
Load dynamic response, V_{OUT} = 1V , I_{OUT} = 0A -> 1.5A



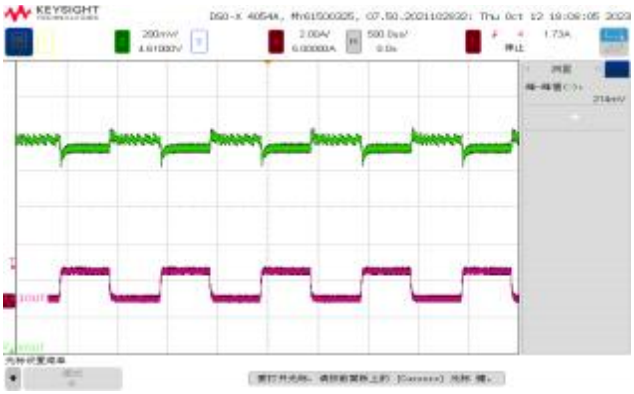
Load dynamic response, V_{OUT} = 1V , I_{OUT} = 1.5A -> 3A



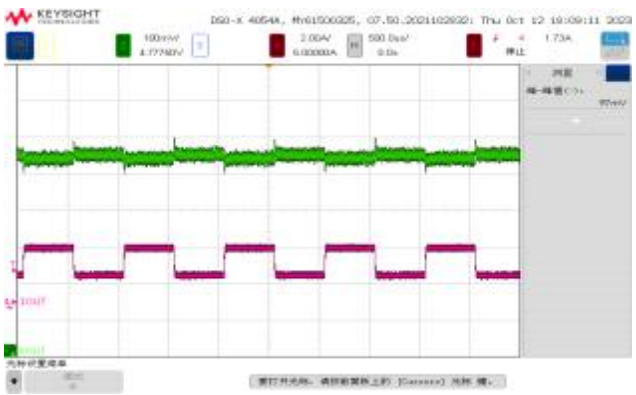
Load dynamic response , V_{OUT} = 1V , I_{OUT} = 0A -> 3A



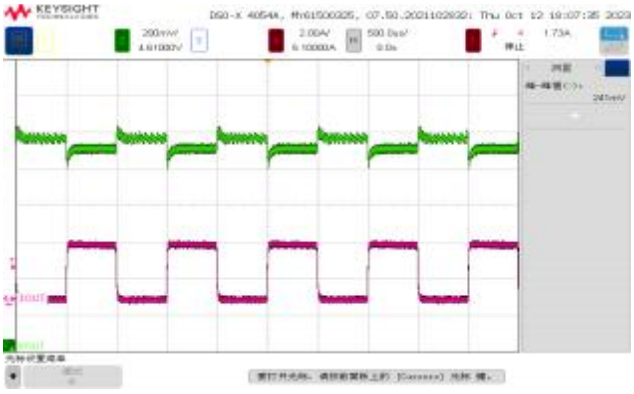
Load dynamic response, V_{OUT} = 5V , I_{OUT} = 0A -> 1.5A



Load dynamic response, V_{OUT} = 5V , I_{OUT} = 1.5A -> 3A



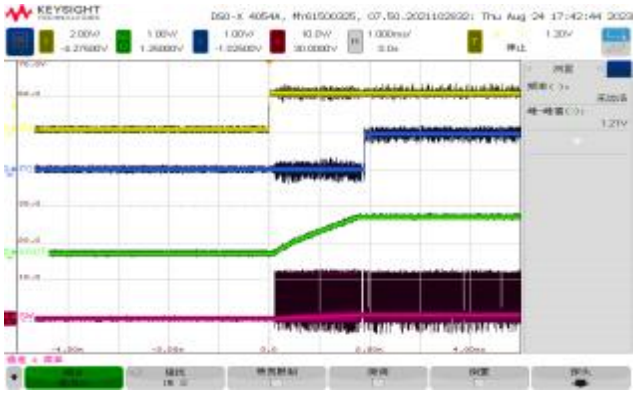
Load dynamic response, V_{OUT} = 5V,I_{OUT} = 0A -> 3A



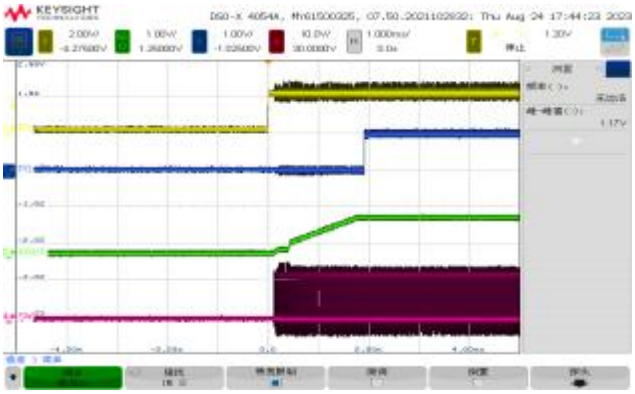
The test conditions are V_{IN} = 12V， V_{OUT} = 1.0V， with external capacitors C_{IN}=2x10μF，

C_{OUT} = 2x47μF， and a temperature of TA = 25。C， unless otherwise noted.

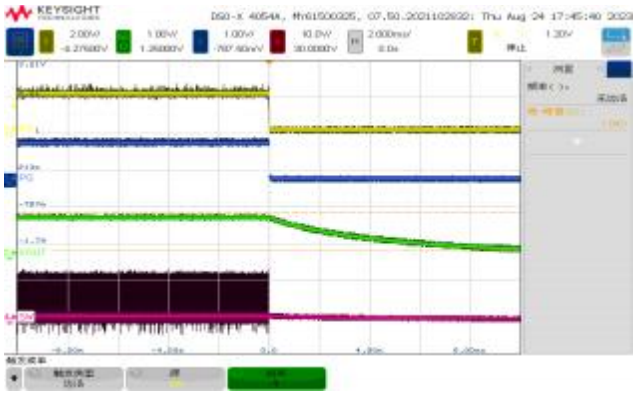
EN start，V_{IN}=12V ,V_{OUT}=1.0V, I_{OUT}=0A



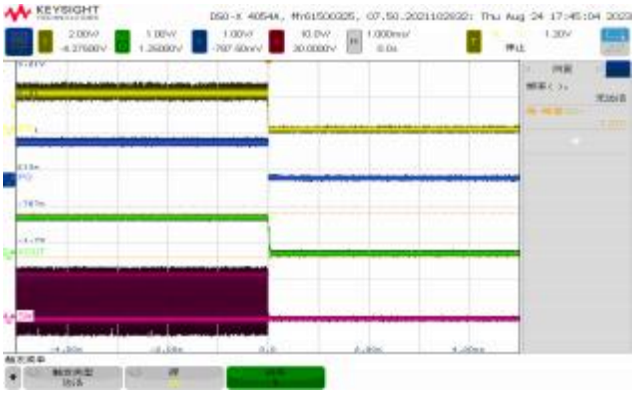
EN start，V_{IN}=12V ,V_{OUT}=1.0V, I_{OUT}=3A



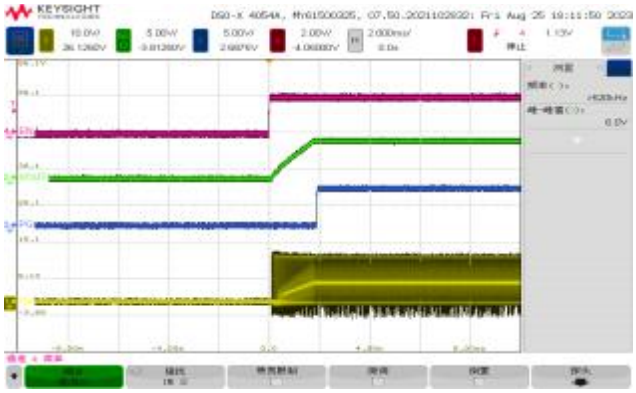
EN disable，V_{IN}=12V ,V_{OUT}=1.0V, I_{OUT}=0A



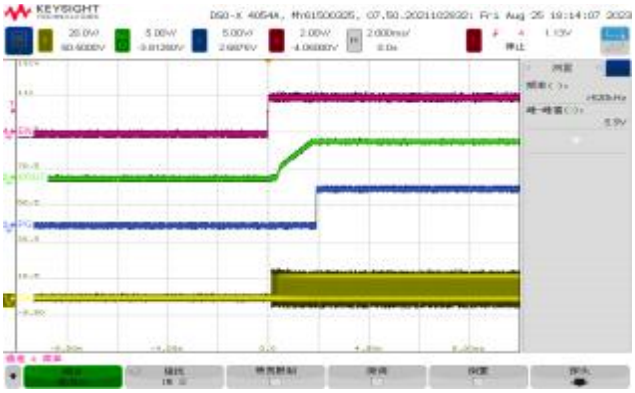
EN disable，V_{IN}=12V ,V_{OUT}=1.0V, I_{OUT}=3A



EN start，V_{IN}=12V ,V_{OUT}=5V, I_{OUT}=0A

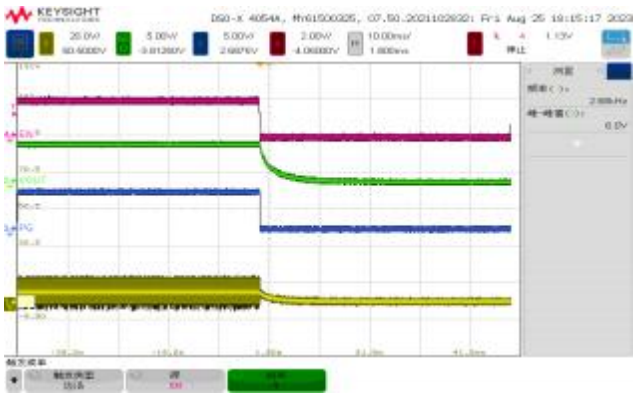


EN start，V_{IN}=12V ,V_{OUT}=5V, I_{OUT}=3A

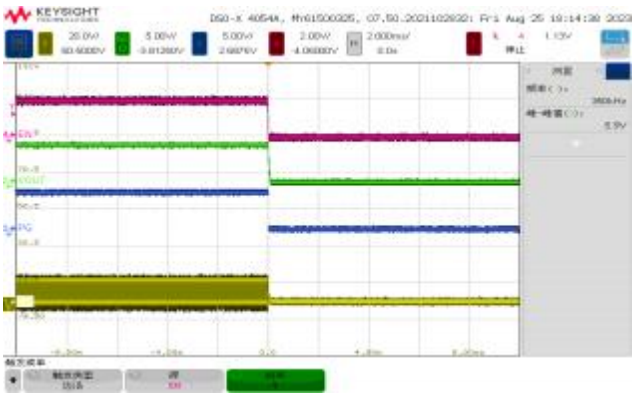


The test conditions are V_{IN} = 12V , V_{OUT} = 1.0V, with external capacitors C_{IN}=2x10μF , C_{OUT} = 2x47μF , and a temperature of TA = 25。C, unless otherwise noted.

EN disable , V_{IN}=12V ,V_{OUT}=5V, I_{OUT}=0A

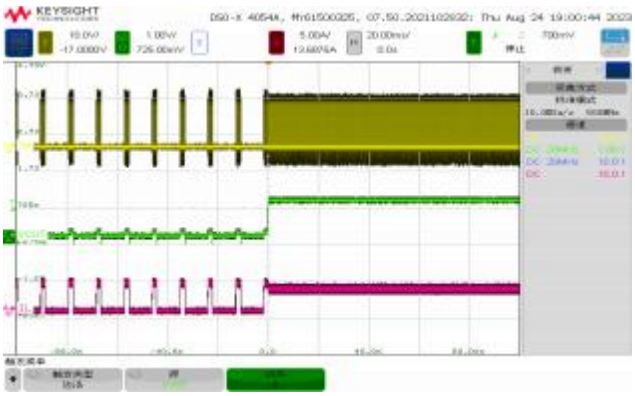


EN disable , V_{IN}=12V ,V_{OUT}=5V, I_{OUT}=3A

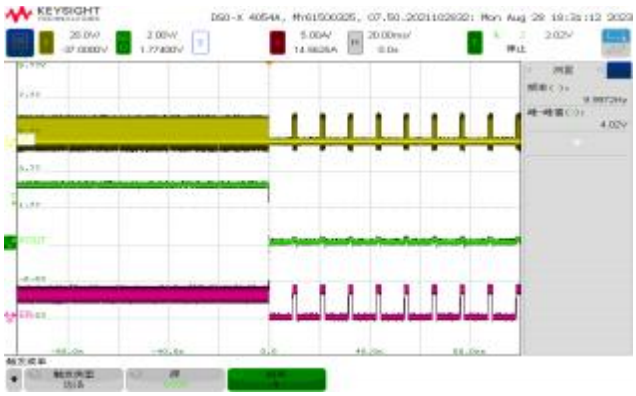


Short-circuit protection, V_{IN}=12V ,V_{OUT}=1.0V 3A to Short

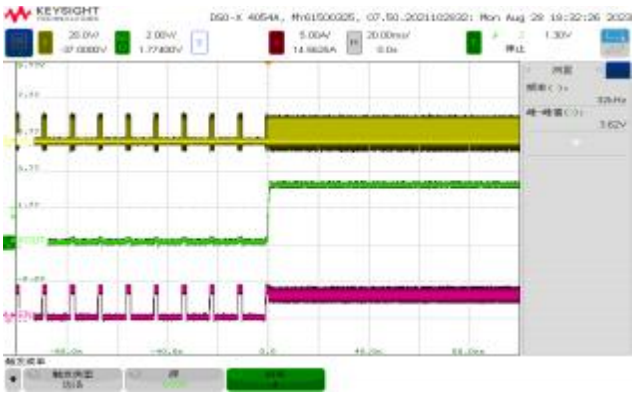
Short-circuit recovery, V_{IN}=12V ,V_{OUT}=1.0V Short to 3A



Short-circuit protection, V_{IN}=12V ,V_{OUT}=3.3V 3A to Short

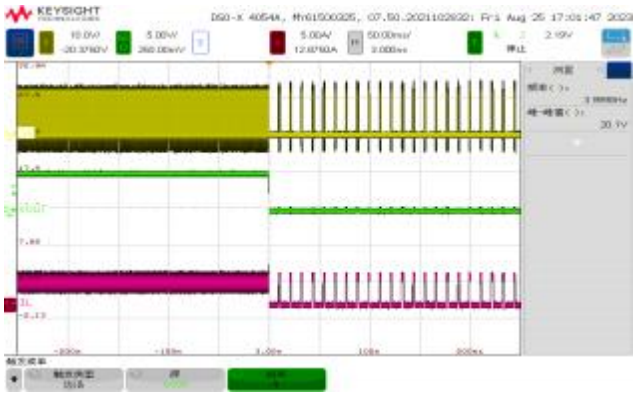


Short-circuit recovery, V_{IN}=12V ,V_{OUT}=3.3V Short to 3A

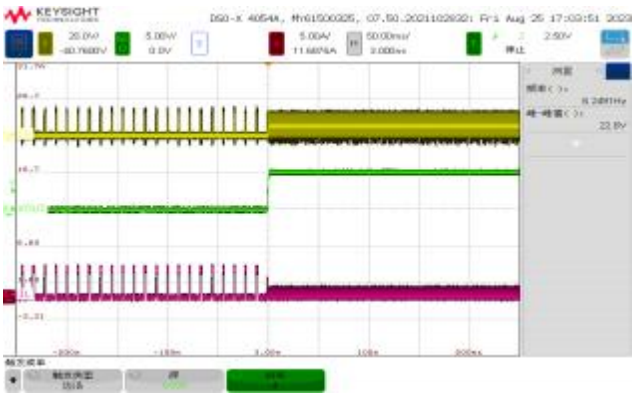


The test conditions are V_{IN} = 12V , V_{OUT} = 1.0V, with external capacitors C_{IN}=2x10μF , C_{OUT} = 2x47μF , and a temperature of TA = 25。C, unless otherwise noted.

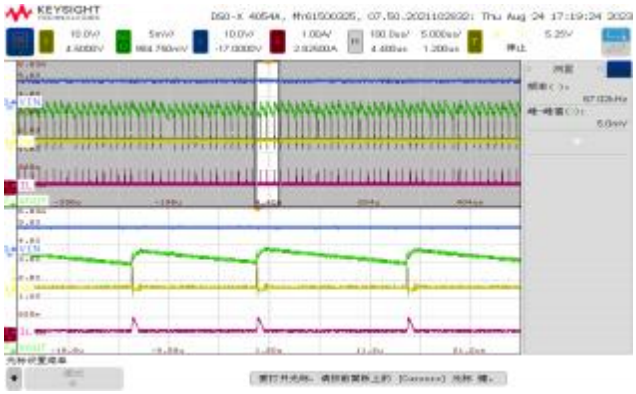
Short-circuit protection, V_{IN}=12V ,V_{OUT}=5V 3A to Short



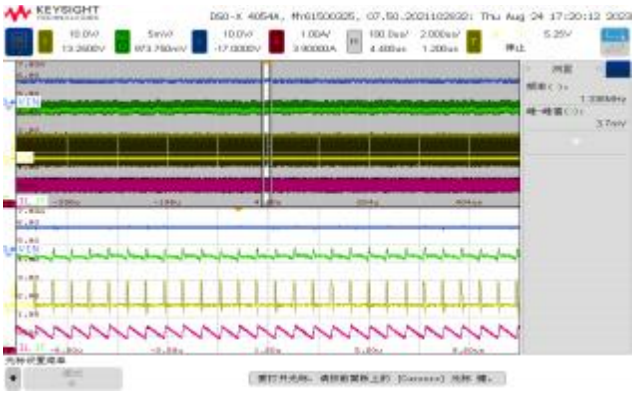
Short-circuit recovery, V_{IN}=12V ,V_{OUT}=5V Short to 3A



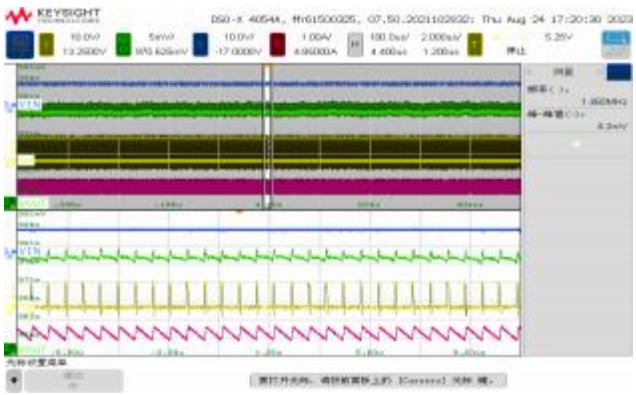
Steady state , V_{IN}=12V ,V_{OUT}=1.0V IOUT=0A



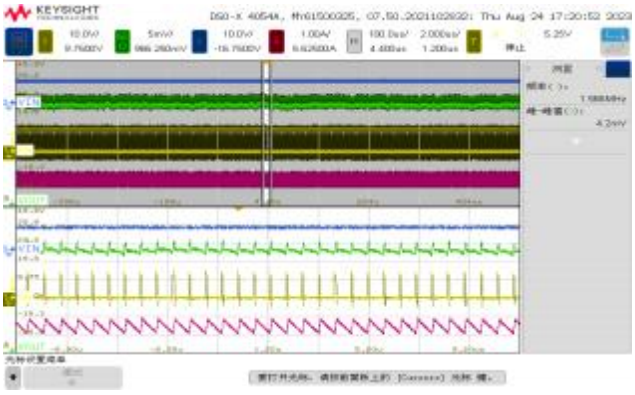
Steady state, V_{IN}=12V ,V_{OUT}=1.0V IOUT=1A



Steady state, V_{IN}=12V ,V_{OUT}=1.0V I_{OUT}=2A



Steady state, V_{IN}=12V ,V_{OUT}=1.0V I_{OUT}=3A



Operation

The FHT23030 is a synchronous buck DC-DC voltage converter with a switching frequency of 2MHz. It can achieve a continuous output current of 3A within an input voltage range of 4.5V to 17V.

Enable Control (EN)

The FHT23030 can be enabled or disabled by setting the EN pin. When the EN pin is connected to a high level, the module is enabled. When the EN pin is connected to a low level or left floating, the module is disabled. In this mode, the typical input current is 1.5μA. The EN pin can also be used to set the undervoltage lockout (UVLO) threshold of the FHT23030, with the application circuit shown in Figure 1:

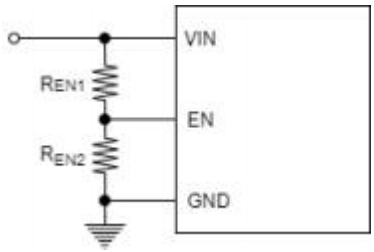


Figure 1: Undervoltage Lockout (UVLO) Voltage Divider Circuit

Soft Start (SS)

The soft-start function controls the rise slope of the output voltage within 1ms during startup, which can suppress inrush current. The FHT23030 is capable of starting up with a pre-biased output capacitor. During pre-biased startup, the two power MOSFETs cannot turn on until the internal voltage clamp sets the output voltage higher than the pre-bias voltage. When the FHT23030 is in the off state, undervoltage lockout (UVLO), or thermal shutdown state, the capacitor connected to the SS pin is discharged by an internal resistor. Returning from these states initiates a new soft-start cycle.

The startup slope of the output voltage can be set by the capacitor connected between the SS pin and GND. A constant current of 2.5μA charges the external capacitor. The given soft-start time (TSS) is set by the CSS capacitor, and the calculation formula is shown in Equation (1):

$$C_{SS} = T_{SS} \times \frac{I_{SS}}{1.25} \qquad (1)$$

Input Undervoltage Lockout (UVLO) Protection

When the input voltage is below 4.2V, the FHT23030 will undergo undervoltage lockout and remain in shutdown mode. If enabled under UVLO conditions, the module will remain in shutdown mode until the input voltage rises above the set threshold. When the input falls below 3.8V, the module will shut down with a hysteresis of 400mV.

Over-Temperature Protection (OTP)

When the junction temperature of the FHT23030 exceeds the threshold of 160°C, the thermal shutdown protection is activated. This protection is non-latching. Once the junction temperature drops to approximately 140°C, the module resumes operation through a soft-start sequence.

Over-Current Protection (OCP)

The FHT23030 features over-current protection to prevent damage under over-current conditions. The over-current protection function is triggered when the valley current reaches 3.6A. When the output drops to approximately 60%, the output is disabled. After a 10ms disable period, the module will restart and initiate a new soft-start cycle.

Power Good Output Indicator (PGOOD)

The PGOOD pin is an open-drain output. When the FB voltage is less than 92% of the nominal internal reference voltage, the PG pin is driven low. When the FB voltage is greater than 96% of the nominal internal reference voltage, the PG pin becomes high-impedance.

Table 1: Power Good Pin Logic Table

Module Status		PG Logic Status	
		High Impedance	Low Level
Enable (EN = High Level)	VFB ≥ VTH_PG	√	
	VFB ≤ VTH_PG		√
Disable (EN = Low Level)			√
UVLO	0.7V < VIN < VUVLO		√
Thermal Shutdown	TJ > TSD		√
Power Removal	VIN < 0.7V	√	

Application Information

Output Voltage Setting

The output voltage of the FHT23030 is set by an external feedback resistor divider, with the formula shown in Equation (2). The voltage regulation circuit is illustrated in Figure 2.

$$V_{OUT} = 0.8V \times \left(1 + \frac{R1}{R2}\right) \quad (2)$$

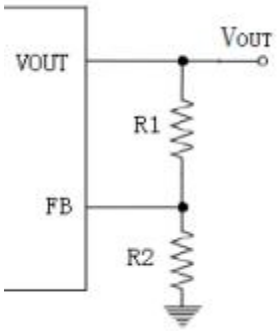
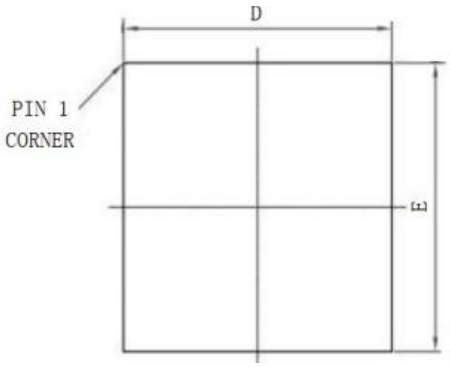


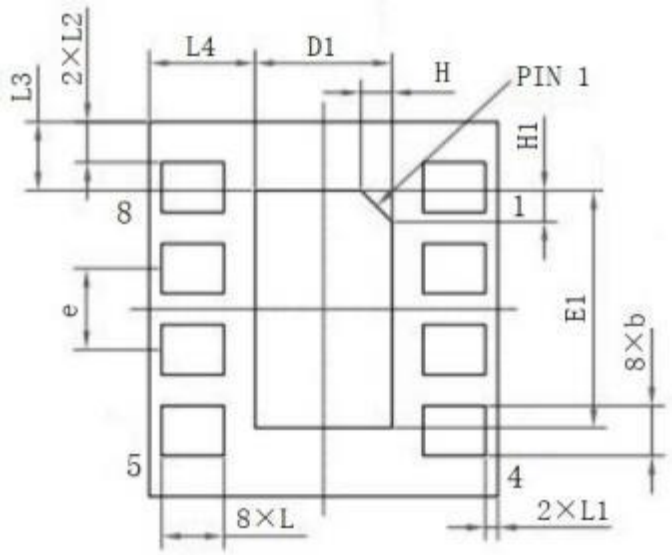
Figure 2: Voltage Divider Resistors for Setting the Output Voltage

Package Description

LGA-8
(3mm×2.8mm×1.4mm)



Top view



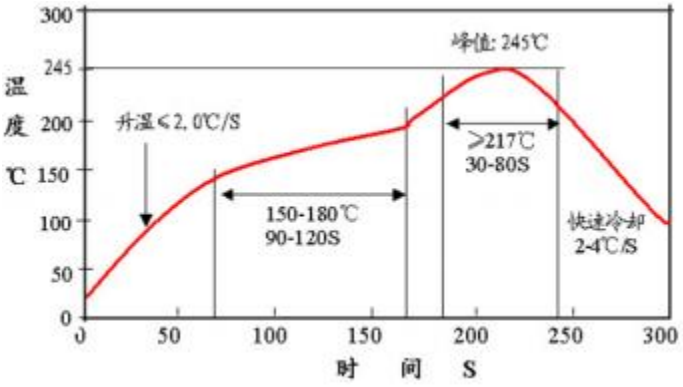
Bottom view

DIMENSIONS			
SYMBOL	**MIN**	**NOM**	**MAX**
A		1.40	1.42
D	2.750	2.800	2.850
E	2.950	3.000	3.050
D1	1.000	1.100	1.200
E1	1.800	1.900	2.000
H		0.250	
H1		0.250	
L	0.450	0.500	0.550
L1	0.025	0.100	0.175
L2	0.250	0.325	0.400
L3	0.475	0.550	0.625
L4	0.775	0.850	0.925
e		0.650	
b	0.350	0.400	0.450

Side view

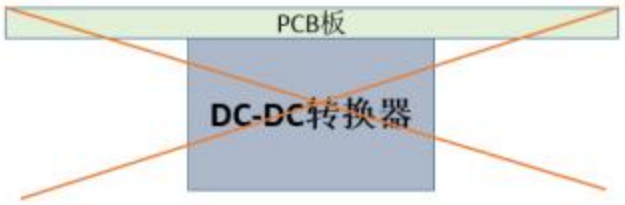
Soldering and Storage Precautions

Recommended Reflow Soldering Profile



Notes:

1. Please do not place the module on the bottom side of the board during reflow soldering to avoid it falling off.



2. For bulk and unpackaged products, store them in a desiccator(with a relative humidity of less than 10% inside). For products still in their original packaging, try to store them in a desiccator as well.

3.Before mounting the module on the board, strictly follow the baking conditions to dry the samples: bake at 125°C for more than 48 hours and control the reflow soldering temperature within 245°C.