CYT
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001

DC/DC µModule Regulator

Features

- Quad Output Step-down µModule Regulator with 4A per Output
- Wide Input Voltage Range: 4V to 14V, as low as 2.4V with External Bias Supply
- Output Voltage Range:0.6V to 5.5V
- 4A DC, 5A Peak Output Current Each Channel
- Up to 5.5W Power Dissipation is allowed under Radiator-Free Conditions (T_A=60℃, 200LFM)
- ±1.5% Total Output Voltage Regulation
- Current Mode Control Achieves Fast Transient Response
- Multiplexed Parallel for Higher Output Current
- Output Voltage Tracking
- Internal Temperature Sensing Diode Output
- External Frequency Synchronization
- Overvoltage, Overcurrent and Over-temperature Protection
- Package Size:
  9mm × 15mm × 5.01mm BGA77 Package

Applications

- Multi-rail Point of Load Regulation
- FPGAs, DSPs and ASICs Applications

Description

The CDM4644 is a quad DC/DC step-down µModule regulator with 4A per output. Outputs can be multiplexed or paralleled in an array for up to 16A capability.

Included in the module are the switching controllers, power FETs, inductors, high-precision upper divider resistance (0.1%) and support components. A few filters, holding capacitors and resistors are required externally to form a complete step-down quad output DC/DC regulator.

The input voltage range of the module is 4V to 14V, and the output voltage can be set in the range of 0.6V to 5.5V with an external sampling resistor.

The module supports external frequency synchronization, continuous or discontinuous mode and output voltage tracking sort operation. The module has the function of built-in temperature monitoring, over-temperature, overvoltage and overcurrent protection.

Absolute Maximum Ratings Note1

V_{IN},SV_{IN}……..-0.3V to 15V

V_{OUT}……-0.3V to SV_{IN} or 6V

RUN……-0.3V to 15V

$INTV_{CC}$……-0.3V to 3.6V

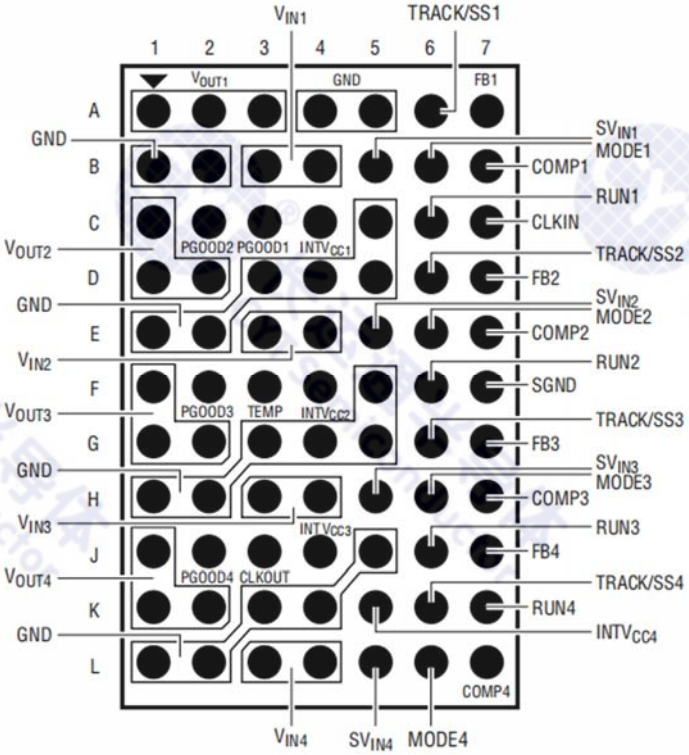
PGOOD,MODE,TRACK/SS,CLKOUT,CLKIN,FB……-0.3V to $INTV_{CC}$

Operating Temperature Range……-40℃ to 125℃

Storage Temperature Range……-65℃ to 150℃

Peak Solder Reflow Body Temperature……245℃±5℃

Pin Diagram (Top View)



9mm×15mm×5.01mm BGA77

Electrical Characteristics

Symbol	Parameter	Conditions (Unless otherwise specified) -40℃≤T_A≤125℃		Min.	Typ.	Max.	Unit
V_{IN},SV_{IN}	Input DC Voltage [a]	SV_{IN}=V_{IN}		4	-	14	V
V_{OUT}	Output Voltage Range[a]	-		0.6	-	5.5	V
V_{RUN}	RUN Pin On Threshold	T_A=25℃, High Level		1.1	1.2	1.3	V
$I_{Q(VIN)}$	Input Supply Bias Current	T_A=25℃, V_{IN}=12V, V_{OUT}=1.5V	MODE=INTV$_{CC}$	-	15	-	mA
			MODE=GND	-	5	-	mA
I_{OUT}	Output Continuous Current Range [a]	-		0	-	4	A
S_V	Line Regulation Accuracy [a]	V_{OUT}=1.5V,V_{IN}=4V～14V I_{OUT}=0A		-	0.02	0.2	%/V
S_I	Load Regulation Accuracy [a]	V_{OUT}=1.5V,I_{OUT}=0A～4A		-	0.5	1.5	%
V_{OPP}	Output Ripple Voltage [a]	V_{IN}=12V, V_{OUT}=1.5V C_{OUT}=100μF/MLCC		-	-	20	mV
$\Delta V_{OUT(START)}$	Turn-On Overshoot	T_A=25℃,I_{OUT}=4A, C_{OUT}=100μF Ceramic, V_{IN}=12V,V_{OUT}=1.5V		-	20	-	mV
t_{START}	Turn-On Time	T_A=25℃, No Load C_{OUT}=100μF/MLCC TRACK/SS=0.01μF V_{IN}=12V,V_{OUT}=1.5V		-	2.4	-	ms
ΔV_{OUTLS}	Peak Deviation for Dynamic Load	T_A=25℃, C_{OUT}=47μF/MLCC V_{IN}=12V,V_{OUT}=1.5V Load:0%～50%～0%		-	160	-	mV
I_{OPK}	Output Current Limit	T_A=25℃,V_{IN}=12V, V_{OUT}=1.5V		6	7	9	A
V_{FB}	Voltage at FB Pin	T_A=25℃,I_{OUT}=0A, V_{OUT}=1.5V		0.590	0.600	0.610	V
$V_{IN(UVLO)}$	V_{IN} Undervoltage Lockout	T_A=25℃,V_{IN} Falling T_A=25℃,V_{IN} Hysteresis		2.8 -	3.0 350	3.2 -	V mV
R_{FBHI}	Resistor Between VOUT and FB Pins	T_A=25℃		60.10	60.40	60.70	kΩ
V_{INTVCC}	Internal V_{CC} Voltage	T_A=25℃, SV_{IN} =4V～14V		3.5	3.6	3.7	V
V_{INTVCC}Load Reg	INTV$_{CC}$ Load Regulation	T_A=25℃, I_{CC} = 0mA～20mA		-	0.5	1	%
f_{OSC}	Oscillator Frequency	T_A=25℃		-	1	-	MHz
CLKIN	CLKIN Threshold	T_A=25℃		-	0.7	-	V

Note 1：Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime. The CDM4644 is tested under pulsed load conditions such that $T_J \approx T_A$. The CDM4644 is guaranteed to meet specifications over the full -40℃ to 125℃ internal operating temperature range.

Note 2：Four outputs are tested separately and the same testing condition is applied to each output.

Note 3：The switching frequency is set to 1MHz, and can be synchronized to the clock from the outside is 700kHz to 1.3MHz if desired.

[a] Keep blowing (forced convection) when testing at 125℃, I_{OUT}≤2A、t＜2s.

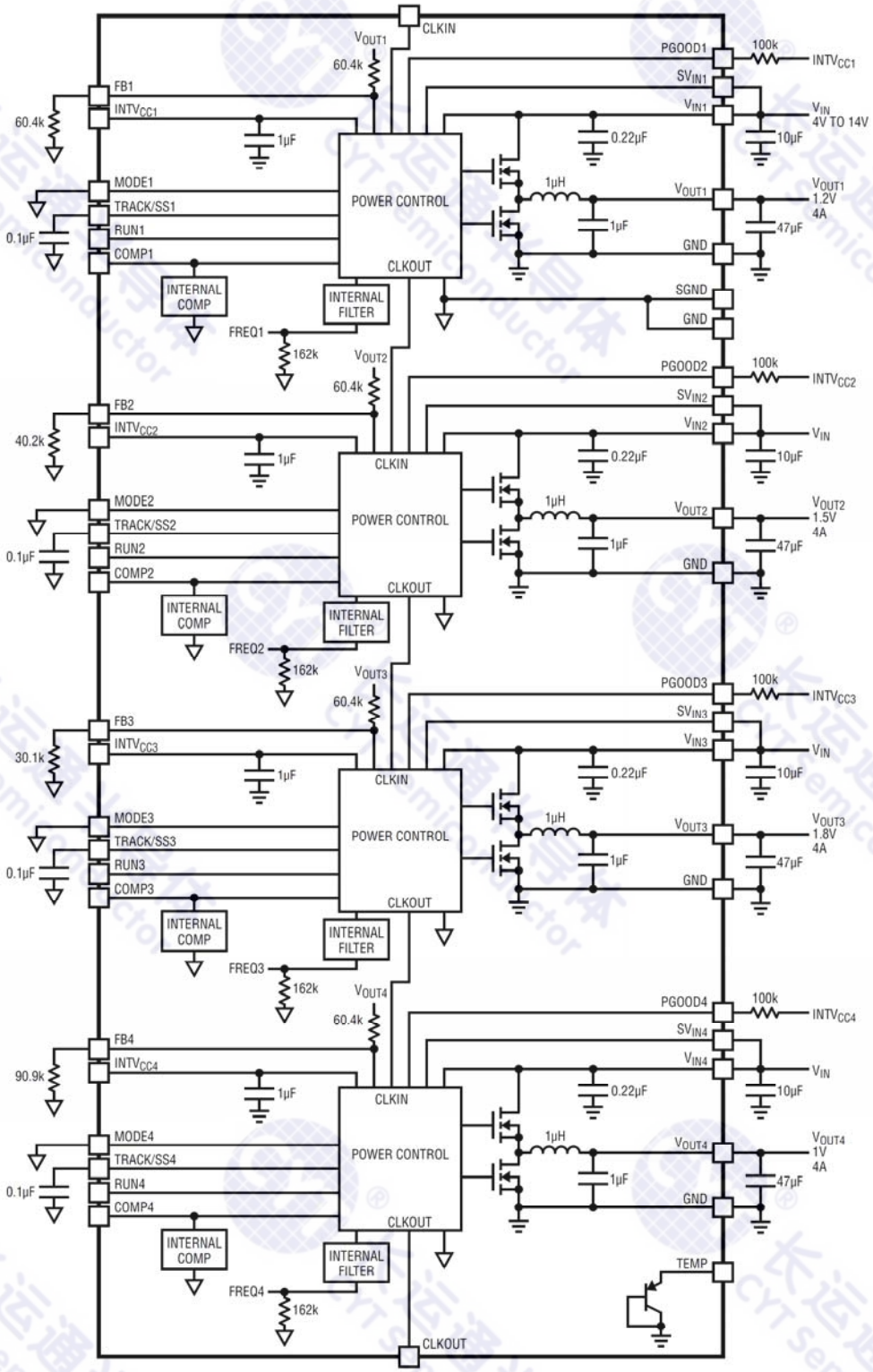
Pin Functions

Name and coordinate point	Function	Description
V_{OUT1} (A1,A2,A3) V_{OUT2} (C1,D1,D2) V_{OUT3} (F1,G1,G2) V_{OUT4} (J1,K1,K2)	Power Output Pins （four-way）	A filter capacitor is installed nearby between V_{OUT} and GND.
GND (A4-A5,B1-B2,C5, D3-D5,E1-E2,F5,G3-G5, H1-H2,J5,K3-K4,L1-L2)	Power Ground Pins	Input and output power loop ground.
V_{IN1} (B3,B4),V_{IN2} (E3,E4) V_{IN3} (H3,H4),V_{IN4} (L3,L4)	Power input pins	A filter capacitor is installed nearby between V_{IN} and GND.
PGOOD1,PGOOD2 PGOOD3,PGOOD4 (C3,C2,F2,J2)	Output Power Good	PGOOD is pulled to ground when the voltage on the FB pin is not within ±10% of the internal 0.6V reference.
CLKOUT (J3)	Output Clock Signal	The phase of CLKOUT with respect to CLKIN is set to 180°. CLKOUT's peak-to-peak amplitude is $INTV_{CC}$ to GND. CLKOUT is only active when RUN4 is enabled.
$INTV_{CC1}$,$INTV_{CC2}$, $INTV_{CC3}$,$INTV_{CC4}$ （C4,F4,J4,K5）	Internal 3.6V Regulator Output	The internal power drivers and control circuits are powered from this voltage. Each pin is internally decoupled to GND with 1μF low ESR ceramic capacitor already.
SV_{IN1},SV_{IN2},SV_{IN3},SV_{IN4} （B5,E5,H5,L5）	Power Supply Input Terminal of Regulator	Internal 3.6V regulator voltage input, V_{IN} is filtered by RC and then connected to SV_{IN} or directly connected. Connect SV_{IN} to an external voltage supply of at least 4V which must also be greater than V_{OUT}.
TRACK/SS1,TRACK/SS2 TRACK/SS3,TRACK/SS4 （A6,D6,G6,K6）	Output Tracking and Soft-Start Pin	This terminal sources 2.5μA of current; can be used for voltage sequencing (proportional or synchronous) of the four outputs, and can also set independent soft-start times.
MODE1,MODE2, MODE3,MODE4 （B6,E6,H6,L6）	Switching Mode Select	Tie this pin to $INTV_{CC}$ to force continuous synchronous operation at all output loads. Tying it to SGND enables discontinuous current mode operation at light loads. Do not leave floating.
RUN1,RUN2,RUN3,RUN4 （C6,F6,J6,K7）	Enable Control Pin	The output is turned on when the terminal voltage is higher than the turn-on threshold, and turned off when the terminal voltage is lower than the shutdown threshold.
FB1,FB2,FB3,FB4 （A7,D7,G7,J7）	The Negative Input of the Error Amplifier	An internal 0.1% accuracy 60.4kΩ resistor is connected to V_{OUT}. Different output voltages can be programmed with an additional resistor between the FB and GND pins. In PolyPhase operation, tying the FB pins together allows for parallel operation.
COMP1,COMP2, COMP3,COMP4 (B7,E7,H7,L7)	Current Control Threshold and Error Amplifier Compensation Point	Current threshold control and error amplifier compensation, already internally compensated. In PolyPhase operation, tying the COMP pins together allows for parallel operation.

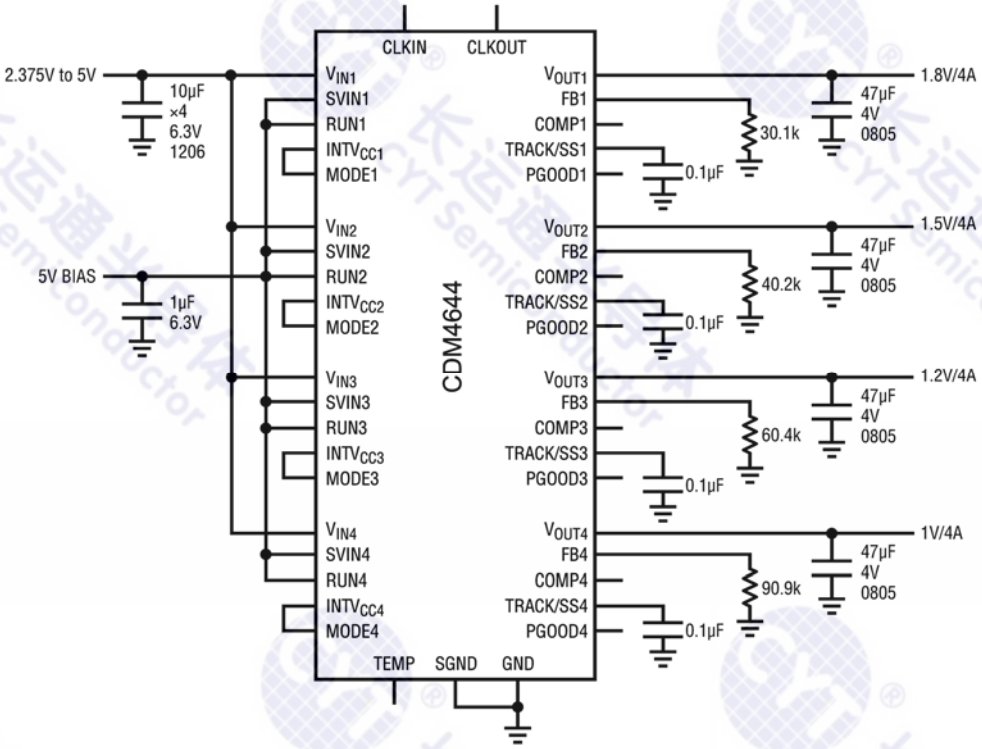
Pin Functions(continued)

Name and coordinate point	Function	Description
CLKIN (C7)	External Synchronization Input	This pin is internally terminated to SGND with 20kΩ. The phase-locked loop will force the channel 1 turn-on signal to be synchronized with the rising edge of the CLKIN signal. Channel 2, channel 3 and channel 4 will also be synchronized with the rising edge of the CLKIN signal with a pre-determined phase shift.
SGND (F7)	Signal Ground	Return ground path for all analog and low power circuitry, single point connection to C_{OUT} power ground (GND).
TEMP (F3)	Temperature Detection Output	External resistance R_T is connected to V_{IN} （$R_T=V_{IN}/100\mu A$）,the temperature coefficient is -2 mV/℃。Measure the voltage value at a certain temperature of the terminal V_T and calculate the real-time temperature: T=（1200-V_T）/2-273 ℃。

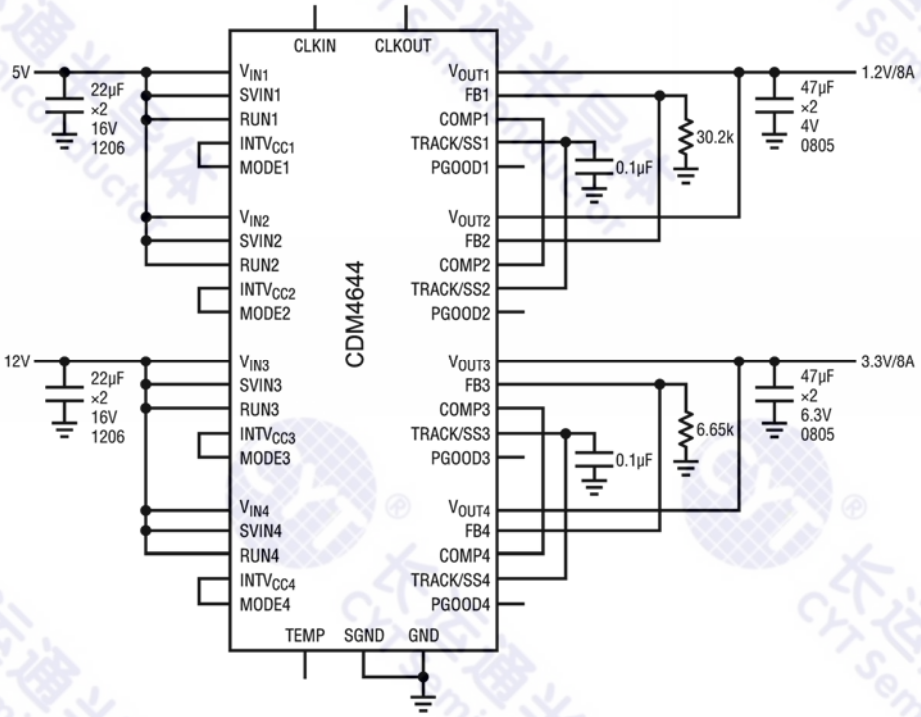
Internal Function Block Diagram



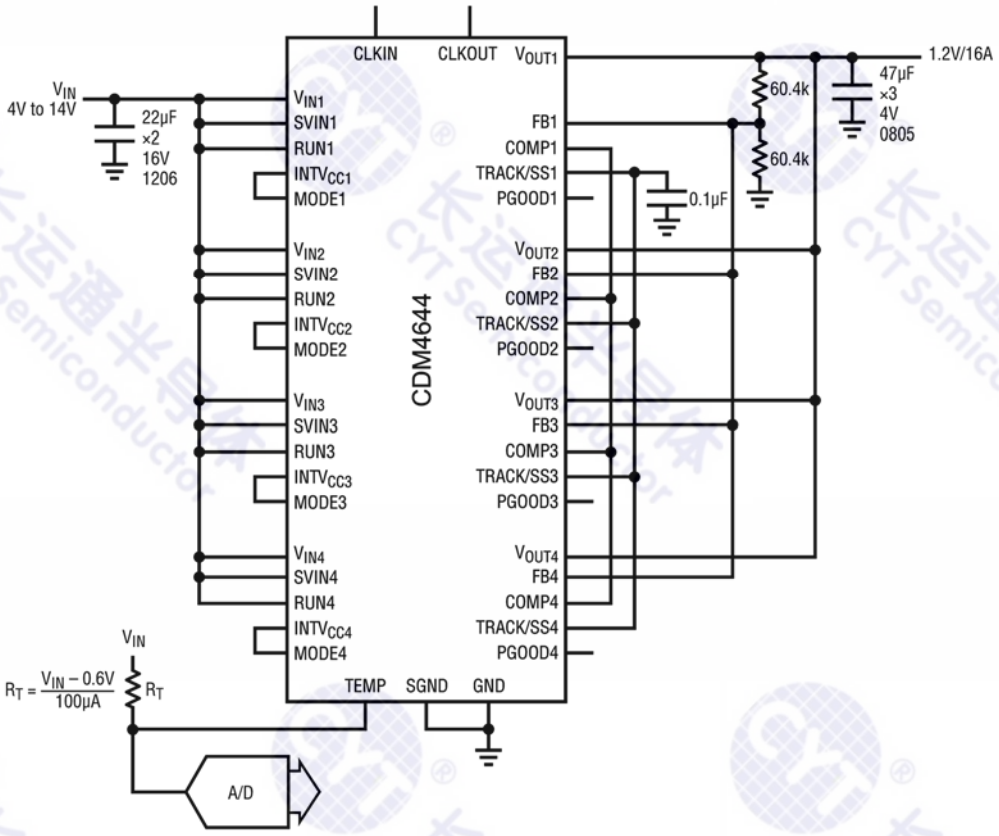
Typical Applications



2.375V to 5V input, quad 1V、1.2V、1.5V、1.8V/4A output

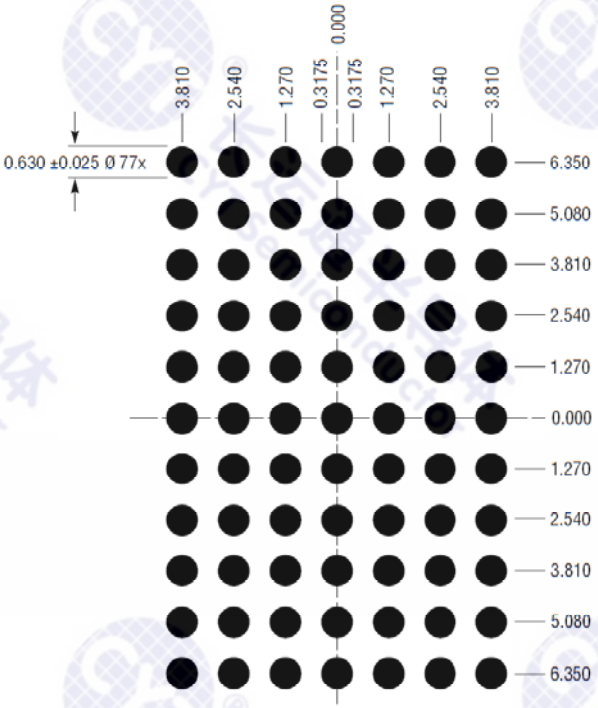


12V and 5V two separate input rails, 1.2V/8A and 3.3V/8A output



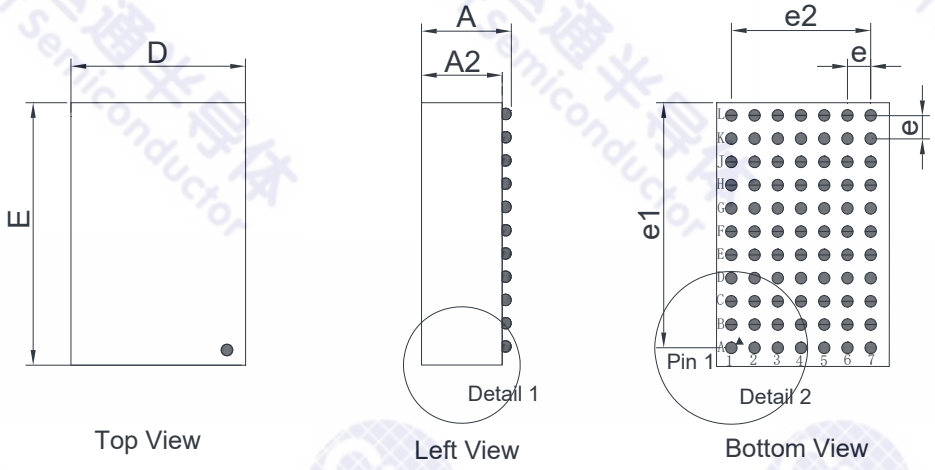
4V to 14V input, 4-phase, 1.2V/16A output

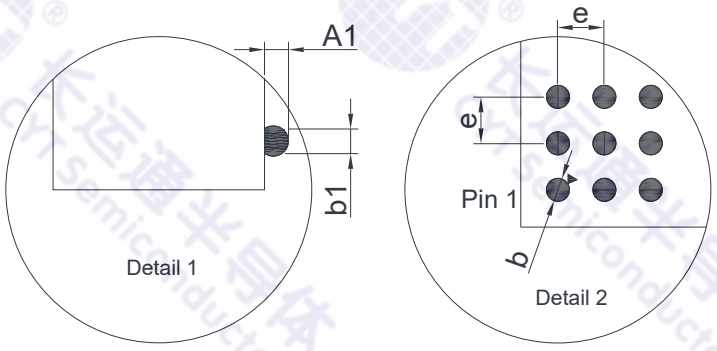
PCB Layout Diagram (Top View)



BGA Package

Package Diagram





Size（mm）			
Symbol	Min.	Nom.	Max.
A	4.81	5.01	5.21
A1	0.50	0.60	0.70
A2	4.31	4.41	4.51
b	0.60	0.75	0.90
b1	0.60	0.63	0.66
D	-	9.00	-
E	-	15.00	-
e	-	1.27	-
e1	-	12.70	-
e2	-	7.62	-

9mm×15mm×5.01mm BGA77

Order Information

Part Number	Package Size
CDM4644IY	9mm×15mm×5.01mm BGA77

Declaration

1. The product cannot be used for equipment or devices that may cause personal injury or death for military, aircraft, automobile, medical, life support or life-saving. If you need to apply high reliability products to the above specific equipment or devices, please contact our sales staff to obtain relevant data manuals and samples.
2. Our company shall not be responsible for the quality of any of our products which are damaged by improper use or by exceeding even for a moment the rated value (such as maximum value, operating range, or other parameters) during use.
3. Our company continuously improves product quality, reliability, function or design, and reserves the right to change specifications.
4. Without the authorization of the company, the specification shall not be copied in whole or in part.