AT5556

Preliminary Product Information

6-Channel DSC Motor Driver

Features

- Independent 6-Channel H-Bridge
- Built-in 4 constant voltage drivers, all of those drivers with brake function.
- Built-in 2 constant current drivers with brake function.
- Low on-resistance <1.2Ω (typ.)
- Built-in charge pump(to drive the upside NMOS of H-bridge drivers)
- Low Voltage operation
- Built-in Thermal Shutdown Function
- LQFP-48/QFN-48 Package

General Description

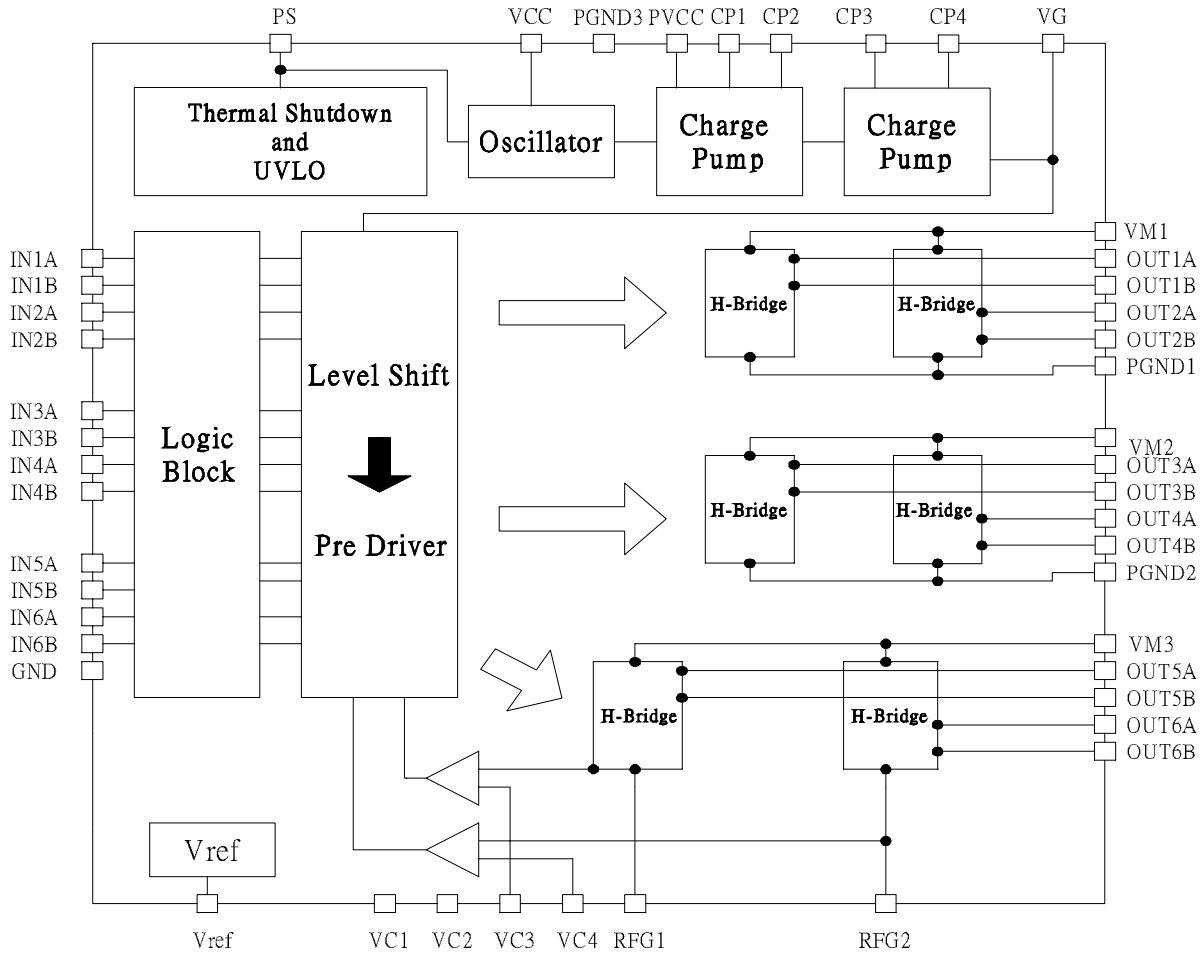
The AT5556 is a 6-channel H-bridge drivers IC for DSC motor application. It built in with 4 constant voltage drivers and 2 constant current blocks to drive auto-focus, zoom, shutter, auto-exposure motors.

Applications

•DSC motor Driver

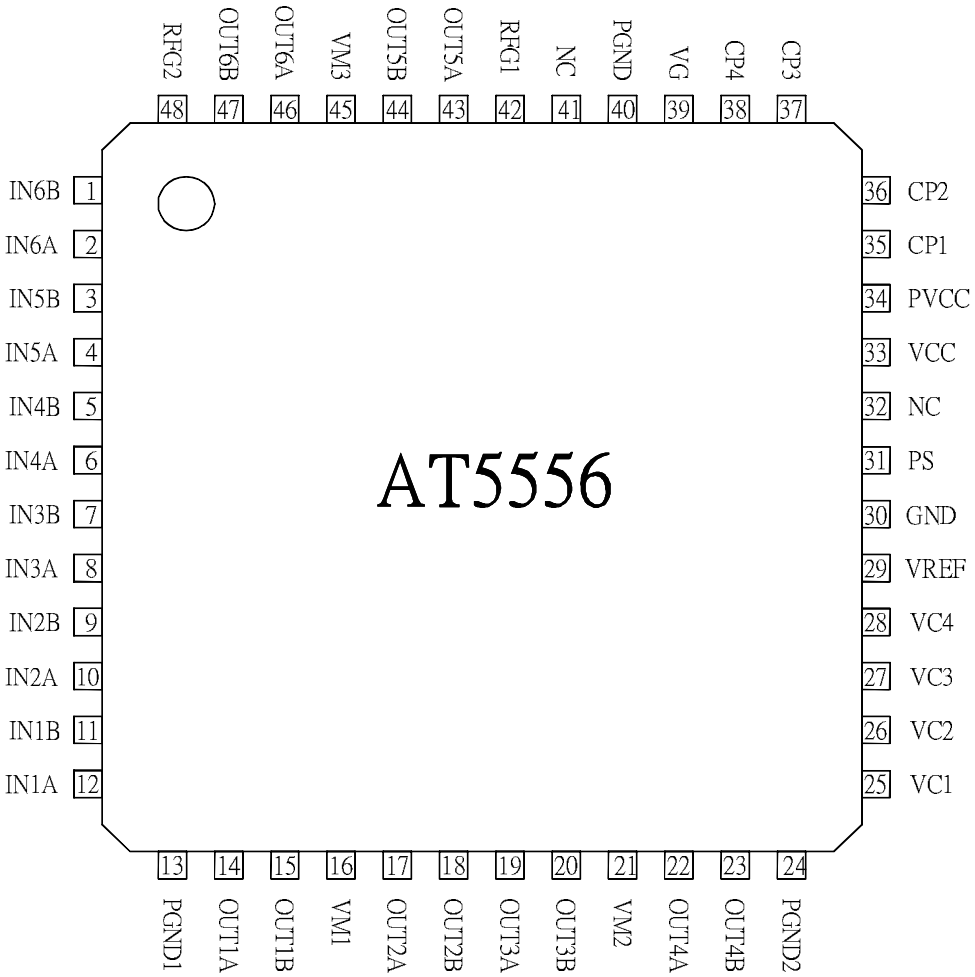
** Protected by U.S. Patent #6,943,514*

Block Diagram



Aimtron reserves the right without notice to change this circuitry and specifications.

Pin Configuration



Ordering Information

Part number	Package	Marking
AT5556F	LQFP48	AT5556F
AT5556F_PBF	LQFP48, PB-Free	AT5556F, date code with one bottom line
AT5556F_GRE	LQFP48, Green	AT5556F, date code with two bottom line
AT5556N_GRE	QFN48, Green	AT5556N

Pin Description

Pin NO.	Symbol	I/O	Description
1	IN6B	I	It combines IN6A to decide the state of the constant current driver6
2	IN6A	I	It combines IN6B to decide the state of the constant current driver6
3	IN5B	I	It combines IN5A to decide the state of the constant current driver5
4	IN5A	I	It combines IN5B to decide the state of the constant current driver5
5	IN4B	I	It combines IN4A to decide the state of the constant voltage driver4
6	IN4A	I	It combines IN4B to decide the state of the constant voltage driver4
7	IN3B	I	It combines IN3A to decide the state of the constant voltage driver3
8	IN3A	I	It combines IN3B to decide the state of the constant voltage driver3
9	IN2B	I	It combines IN2A to decide the state of the constant voltage driver2
10	IN2A	I	It combines IN2B to decide the state of the constant voltage driver2
11	IN1B	I	It combines IN1A to decide the state of the constant voltage driver1
12	IN1A	I	It combines IN1B to decide the state of the constant voltage driver1
13	PGND1	P	GND1
14	OUT1A	O	H-bridge output terminal 1A of the constant voltage driver1
15	OUT1B	O	H-bridge output terminal 1B of the constant voltage driver1
16	VM1	P	Power supply for Motor1, 2
17	OUT2A	O	H-bridge output terminal 2A of the constant voltage driver2
18	OUT2B	O	H-bridge output terminal 2B of the constant voltage driver2
19	OUT3A	O	H-bridge output terminal 3A of the constant voltage driver3
20	OUT3B	O	H-bridge output terminal 3B of the constant voltage driver3
21	VM2	P	Power supply for Motor3, 4
22	OUT4A	O	H-bridge output terminal 4A of the constant voltage driver4
23	OUT4B	O	H-bridge output terminal 4B of the constant voltage driver4
24	PGND2	P	GND2
25	VC1	I	It is used to control the output voltage of constant voltage driver1~2
26	VC2	I	It is used to control the output voltage of constant voltage driver3~4
27	VC3	I	Voltage for current limit control of the constant current driver5
28	VC4	I	Voltage for current limit control of the constant current driver6
29	VREF	I	Reference voltage being divided for VC1~4 to individually use
30	GND	P	GND
31	PS	I	Power save which can force all outputs to become open state
32	NC		
33	VCC	P	Power supply
34	PVCC	P	Power supply for input voltage of charge pump
35	CP1	I	Capacitor terminal 1 for charge pump
36	CP2	I	Capacitor terminal 2 for charge pump
37	CP3	I	Capacitor terminal 3 for charge pump
38	CP4	I	Capacitor terminal 4 for charge pump
39	VG	P	Output voltage of charge pump
40	PGND	P	GND
41	NC		
42	RFG1		Current detection terminal for the constant current driver5
43	OUT5A	O	H-bridge output terminal 5A of the constant current driver5
44	OUT5B	O	H-bridge output terminal 5B of the constant current driver5
45	VM3	P	Power supply for Motor5, 6
46	OUT6A	O	H-bridge output terminal 6A of the constant current driver6
47	OUT6B	O	H-bridge output terminal 6B of the constant current driver6
48	RFG2		Current detection terminal for the constant current driver6

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage VCC	VCC	-0.5 ~ +5.5	V
Supply voltage VM	VM	-0.5 ~ +5.5	V
Supply voltage PVCC	PVCC	-0.5 ~ +5.5	V
Charge pump voltage	VG	12	V
Control input voltage	VIN	-0.5 ~ VCC	V
Power dissipation	Pd	1000	mW
Operating temperature	Topr	-20 ~ +85	° C
Junction temperature	Tj	~ +150	° C
Storage temperature range	Tstg	-55 ~ +150	° C
Maximum output current	Iout	800	mA
ESD Susceptibility *2	HBM	2	KV
	MM	200	V

1. **Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.**
2. **Device are ESD sensitive. Handling precaution recommended. The Human Body model is a 100pF capacitor discharged through a 1.5KΩ resistor into each pin.**

Recommended Operating Conditions(Ta=25°C)

Item	Symbol	Ratings	Unit
Supply voltage VCC	VCC	+2.5 ~ +5.5	V
Supply voltage VM1,2,3	VM1,2,3	+1.9 ~ +5.5	V
Charge pump voltage	VG	+7.5~ +10.0	V
Control input voltage	VIN	0 ~ VCC	V
H Bridge output current	Iout	-400 ~ +400	mA
Logic input frequency	Fin	0 ~ 100	kHz
Capacitor for Charge pump	CCP	0.01 ~ 0.1	μF

Electrical Characteristic

(Ta=25°C, VCC=PVCC=3.0V, VM=2.5V, $R_{L1} = R_{L2} = R_{L3} = R_{L4} = 7.5\Omega$, $R_{L5} = R_{L6} = 5\Omega$)

Parameter	Symbol	Condition	Values			Unit
			Min.	Typ.	Max.	
Whole circuits						
Circuit current at standby	ICCST	PS=L	-	0	10	μA
Circuit current1	ICC1	PS=H, IN1A1B~6A6B=L	-	1.5	3	mA
Circuit current2	ICC2	PS=H, IN1A or IN1B or IN2A or IN2B=H	-	2.65	4.7	mA
Circuit current3	ICC3	PS=H, IN3A or IN3B or IN4A or IN4B=H	-	2.65	4.7	mA
Circuit current4	ICC4	PS=H, IN5A or IN5B or IN6A or IN6B=H	-	2.65	4.7	mA
Circuit current5	ICC5	PS=H,IN1A=IN2A=IN3A=IN4A =IN5A=IN6A=H or IN1B=IN2B=IN3B=IN4B=IN5B =IN6B=H	-	4.90	5.5	mA
Power save						
H level input voltage	VPSH		2.0	-	-	V
L level input voltage	VPSL		-	-	0.8	V
H level input voltage	IPSH	PS=3V	-	5	20	μA
L level input voltage	IPSL	PS=0V	-1	0	-	μA
Pull-down resistance	RIN		-	1.5	-	MΩ
Control input						
H level input voltage	VINH		2.0	-	-	V
L level input voltage	VINL		-	-	0.8	V
H level input voltage	IINH	VIN=3V	-	5	20	μA
L level input voltage	IINL	VIN=0V	-1	0	-	μA
Pull-down resistance	RIN		-	1.5	-	MΩ
Charge Pump						
Charge pump voltage	VCP	PVCC=5V,VG=PVCC*2	9	10	-	V
UVLO						
UVLO voltage	VUVLO		1.8	2.0	2.2	V
Vref						
VREF output voltage	VREF	Iout=0 ~ 1mA	0.88	0.90	0.92	V
Constant voltage driver1,2(For AF/STP)						
Output ON Resistance	RON	Io=+-200mA, Sum of on-resistance		1.20	1.50	Ω
Output constant voltage	VO1	VC1=0.3V, Rload=7.5Ω	1.40	1.50	1.60	V
Constant voltage driver3,4(For ZOOM)						
Output ON Resistance	RON	Io=+-200mA, Sum of on-resistance		1.20	1.50	Ω
Output constant voltage	VO2	VC2=0.3V, Rload=7.5Ω	1.40	1.50	1.60	V

Constant current driver5,6						
Output ON Resistance	RON	Io=+-300mA, Sum of on-resistance	-	1.00	1.25	Ω
Output Limit voltage	VOL	RFG=1Ω, VC3=VC4=0.3V	287	300	313	mV
Thermal Protection Circuit						
Protection Temperature	TSD			130		°C

Input-output logic table

Driver1,2: Stepping motor constant-voltage control for AF

Input				Output				Mode
IN1A	IN1B	IN2A	IN2B	OUT1A	OUT1B	OUT2A	OUT2B	
L	L	L	L	Z	Z	Z	Z	Standby
H	L	L	L	H	L	Z	Z	1,2 phase excitation
H	L	H	L	H	L	H	L	
L	L	H	L	Z	Z	H	L	
L	H	H	L	L	H	H	L	
L	H	L	L	L	H	Z	Z	
L	H	L	H	L	H	L	H	
L	L	L	H	Z	Z	L	H	
H	L	L	H	H	L	L	H	
H	H			H	H			BRAKE
		H	H			H	H	

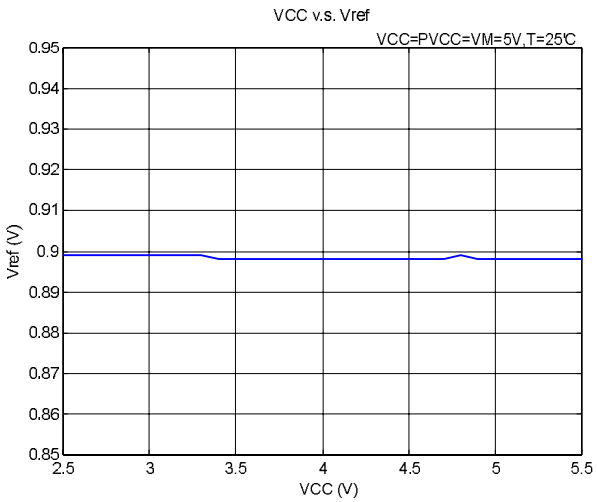
Stepping motor constant-voltage control for ZOOM or DC motor drive

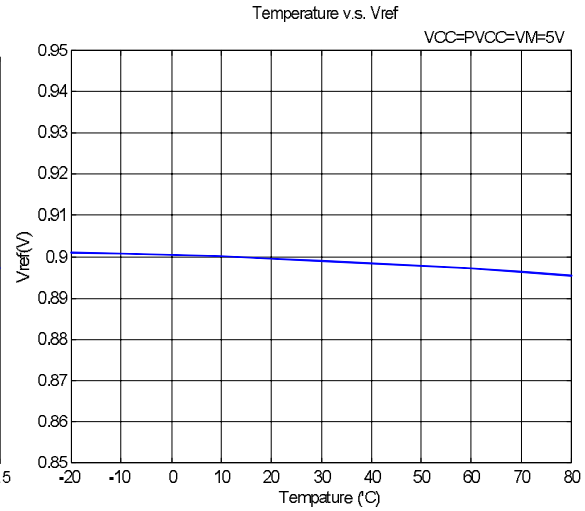
Input				Output				Mode
IN3A	IN3B	IN4A	IN4B	OUT3A	OUT3B	OUT4A	OUT4B	
L	L	L	L	Z	Z	Z	Z	Standby
H	L	L	L	H	L	Z	Z	1,2 phase excitation
H	L	H	L	H	L	H	L	
L	L	H	L	Z	Z	H	L	
L	H	H	L	L	H	H	L	
L	H	L	L	L	H	Z	Z	
L	H	L	H	L	H	L	H	
L	L	L	H	Z	Z	L	H	
H	L	L	H	H	L	L	H	
H	H			H	H			BRAKE
		H	H			H	H	

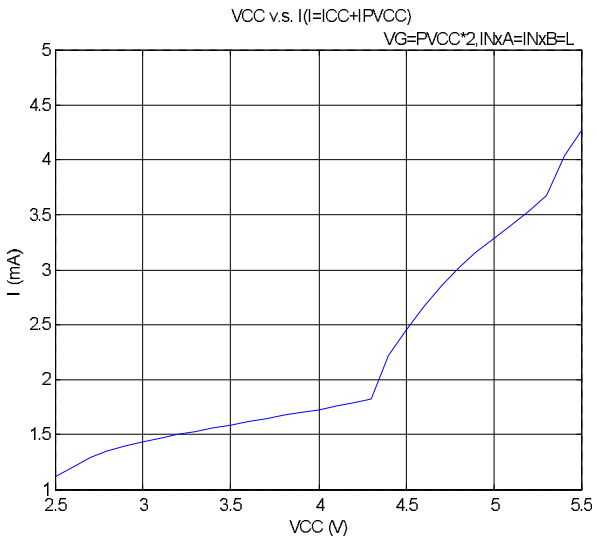
VCM constant-current control for SH/AE or stepping motor drive

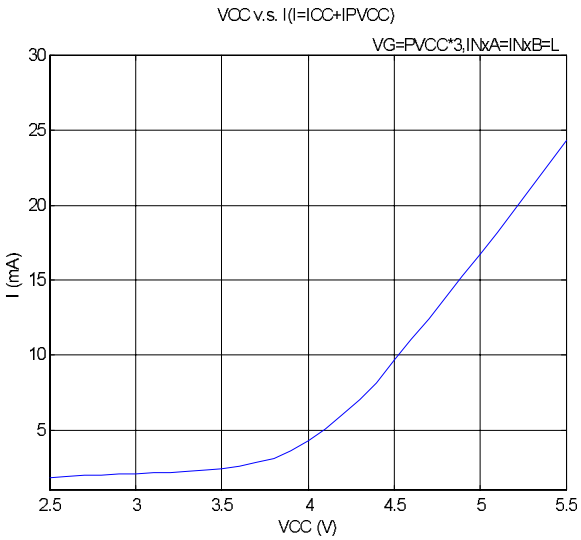
Input				Output				Mode
IN5A	IN5B	IN6A	IN6B	OUT5A	OUT5B	OUT6A	OUT6B	
L	L	L	L	Z	Z	Z	Z	Standby
H	L			H	L			SH&AE
L	H			L	H			
		H	L			H	L	
		L	H			L	H	
H	H			L	L			BRAKE
		H	H			L	L	

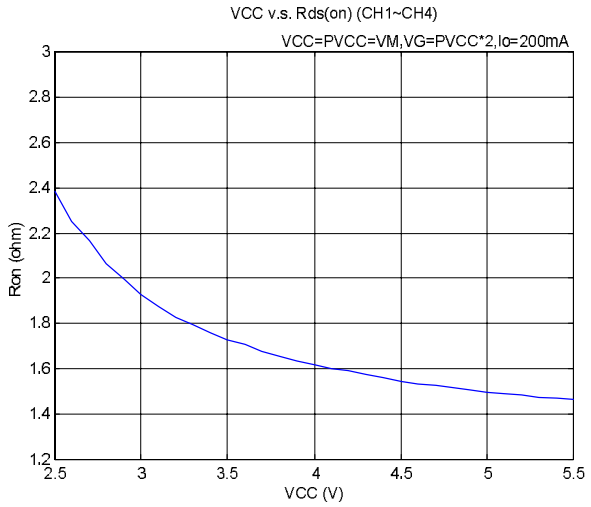
Typical Characteristics

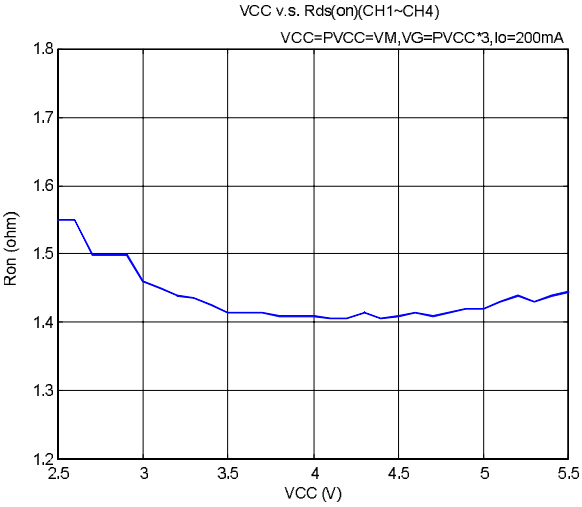


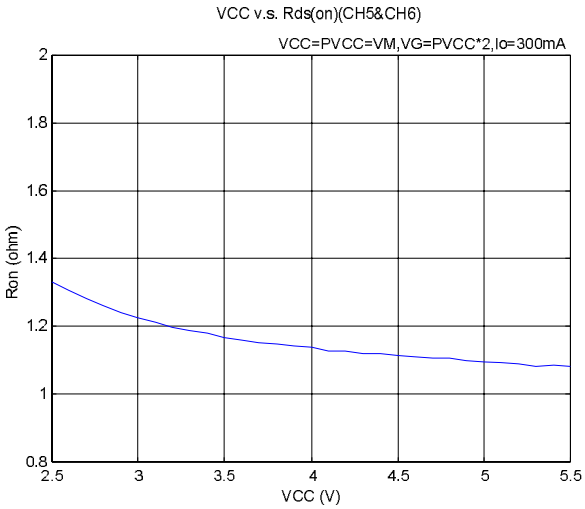


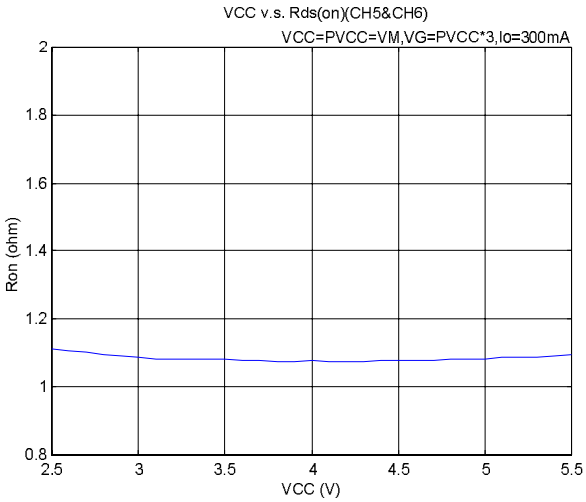


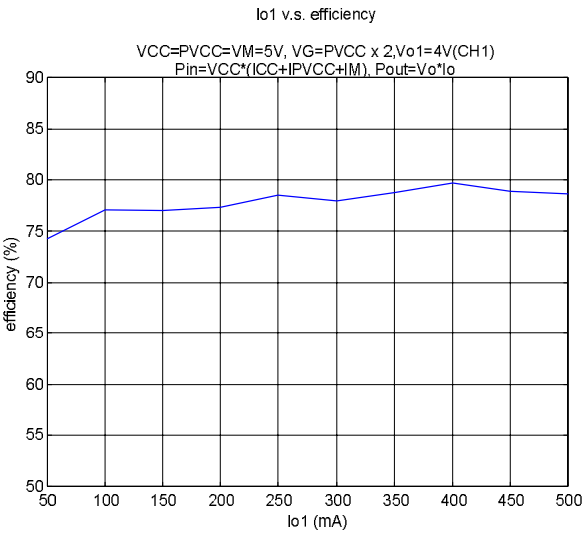


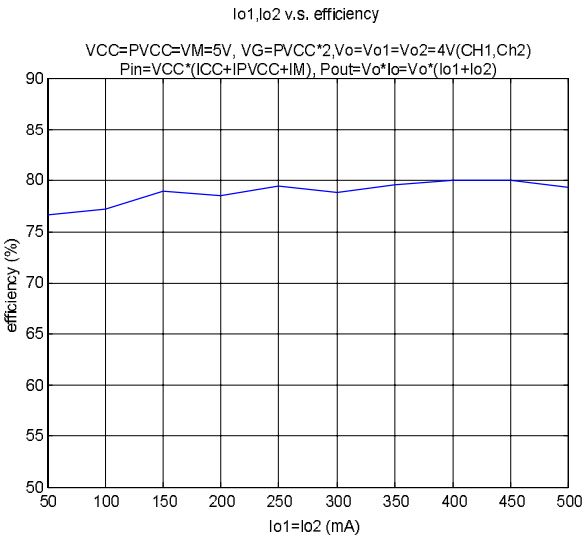




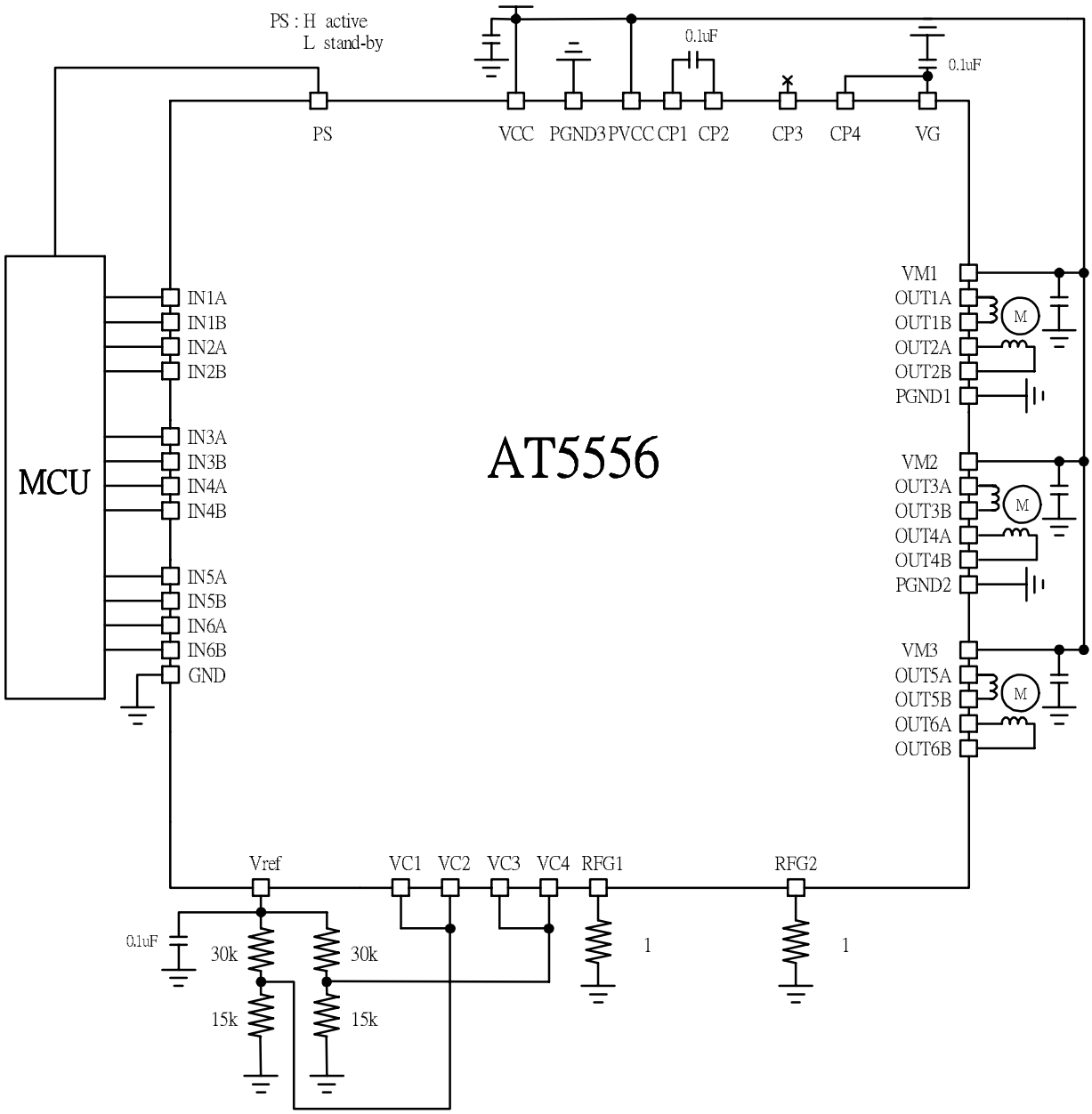

VCC v.s. Rds(on)(CH5&CH6)
VCC=PVCC=VM,VG=PVCC*2,Io=300mA
Ron (ohm)
VCC (V)


VCC v.s. Rds(on)(CH5&CH6)
VCC=PVCC=VM,VG=PVCC*3,Io=300mA
Ron (ohm)
VCC (V)


Io1 v.s. efficiency
VCC=PVCC=VM=5V, VG=PVCC x 2,Vo1=4V(CH1)
Pin=VCC*(ICC+IPVCC+IM), Pout=Vo*Io
efficiency (%)
Io1 (mA)


Io1,Io2 v.s. efficiency
VCC=PVCC=VM=5V, VG=PVCC*2,Vo=Vo1=Vo2=4V(CH1,Ch2)
Pin=VCC*(ICC+IPVCC+IM), Pout=Vo*Io=Vo*(Io1+Io2)
efficiency (%)
Io1=Io2 (mA)

Application reference 1



Output voltage of charge pump(two times PVCC)： $VG = PVCC \times 2$

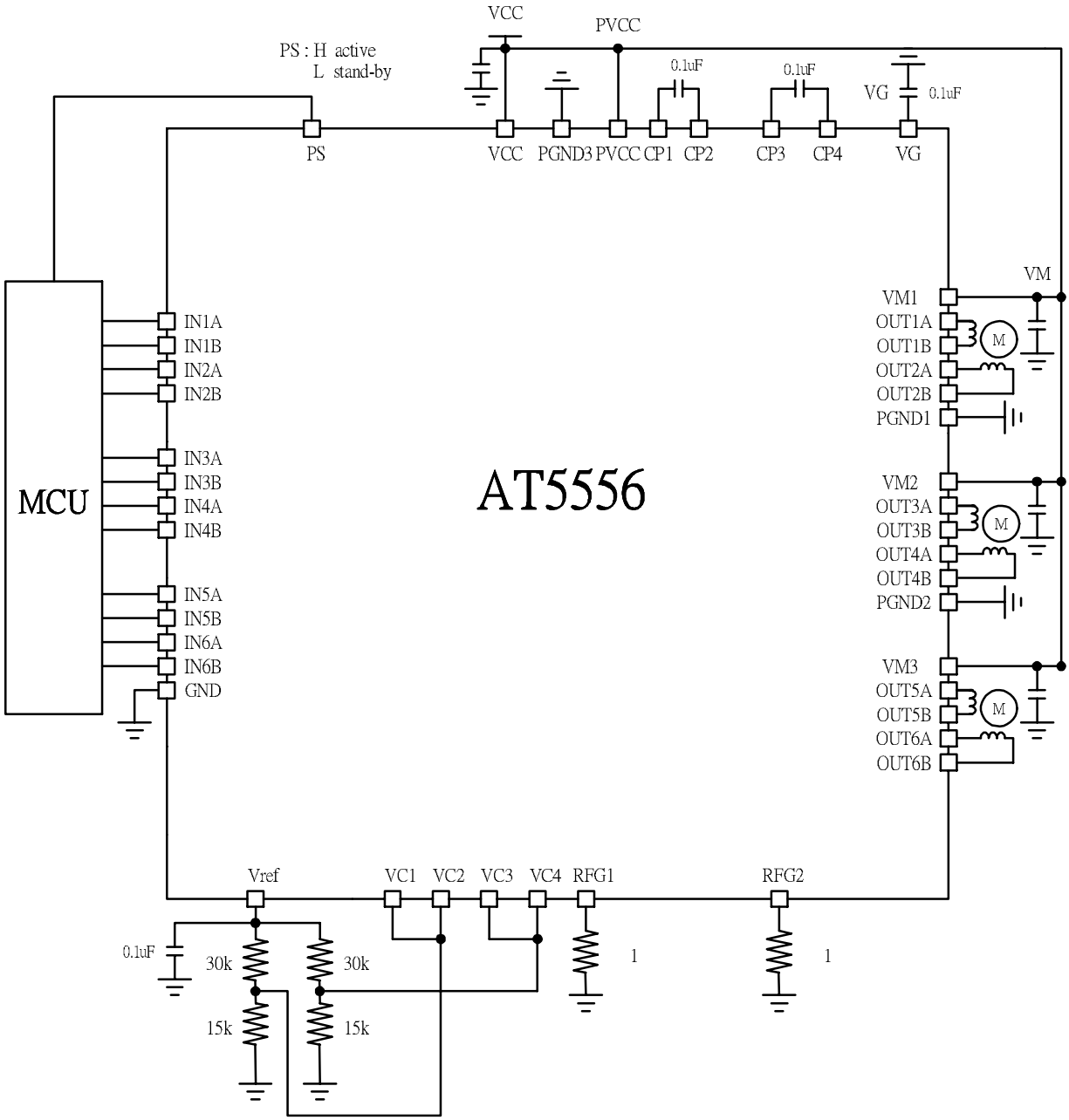
Constant voltage： **CH1&CH2→** $V_O = V_{C1} \times 5 - 0.5 \times R_{ON} \times I_o$

CH3&CH4→ $V_O = V_{C2} \times 5 - 0.5 \times R_{ON} \times I_o$

Constant current： **CH5→** $I_o = V_{C3} / RFG1$

CH6→ $I_o = V_{C4} / RFG2$

Application reference 2



Output voltage of charge pump(three times PVCC)： $VG = PVCC \times 3$

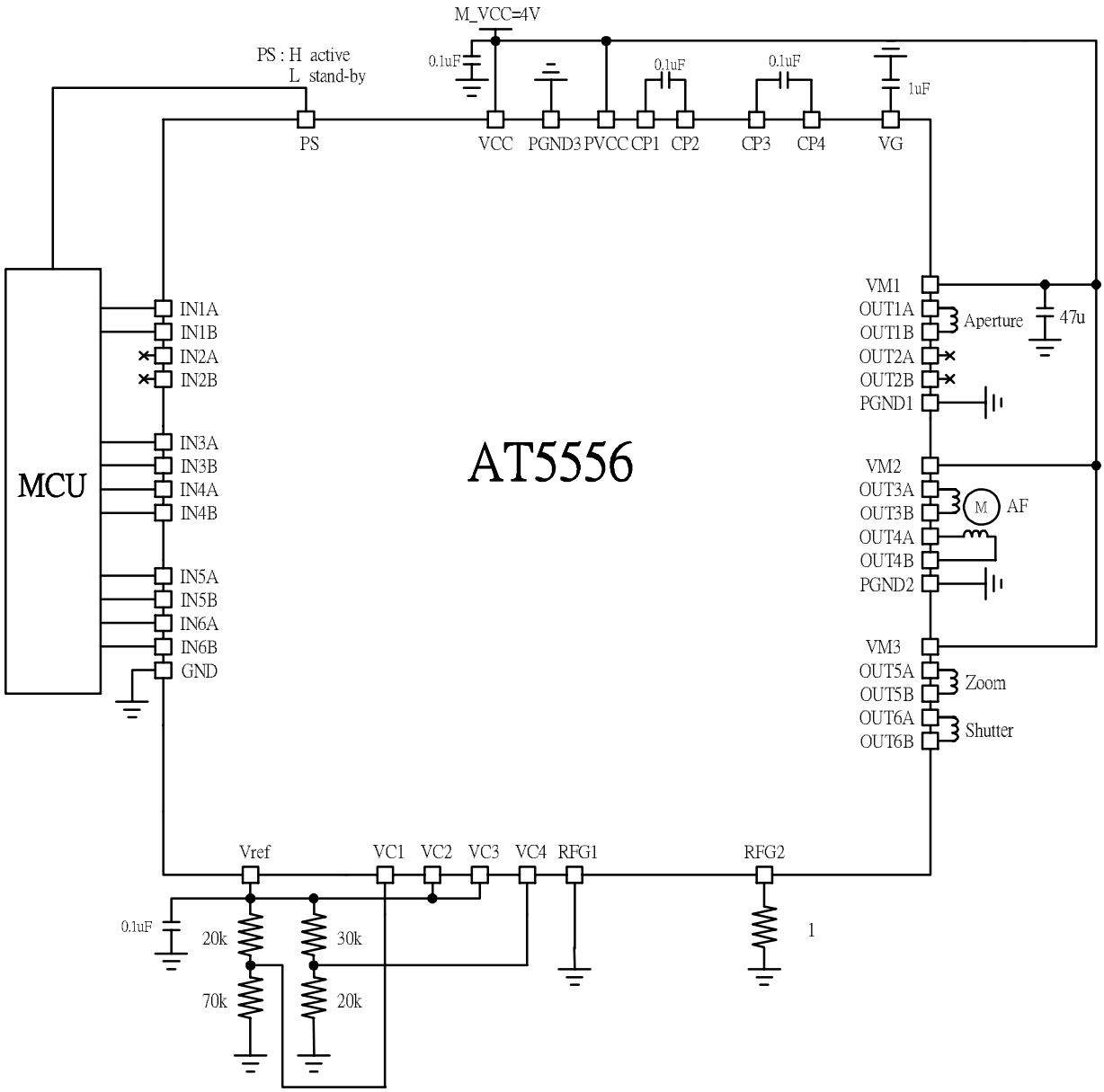
Constant voltage ： **CH1&CH2→** $V_O = V_{C1} \times 5 - 0.5 \times R_{ON} \times I_o$

CH3&CH4→ $V_O = V_{C2} \times 5 - 0.5 \times R_{ON} \times I_o$

Constant current： **CH5→** $I_o = V_{C3} / RFG1$

CH6→ $I_o = V_{C4} / RFG2$

Application reference 3



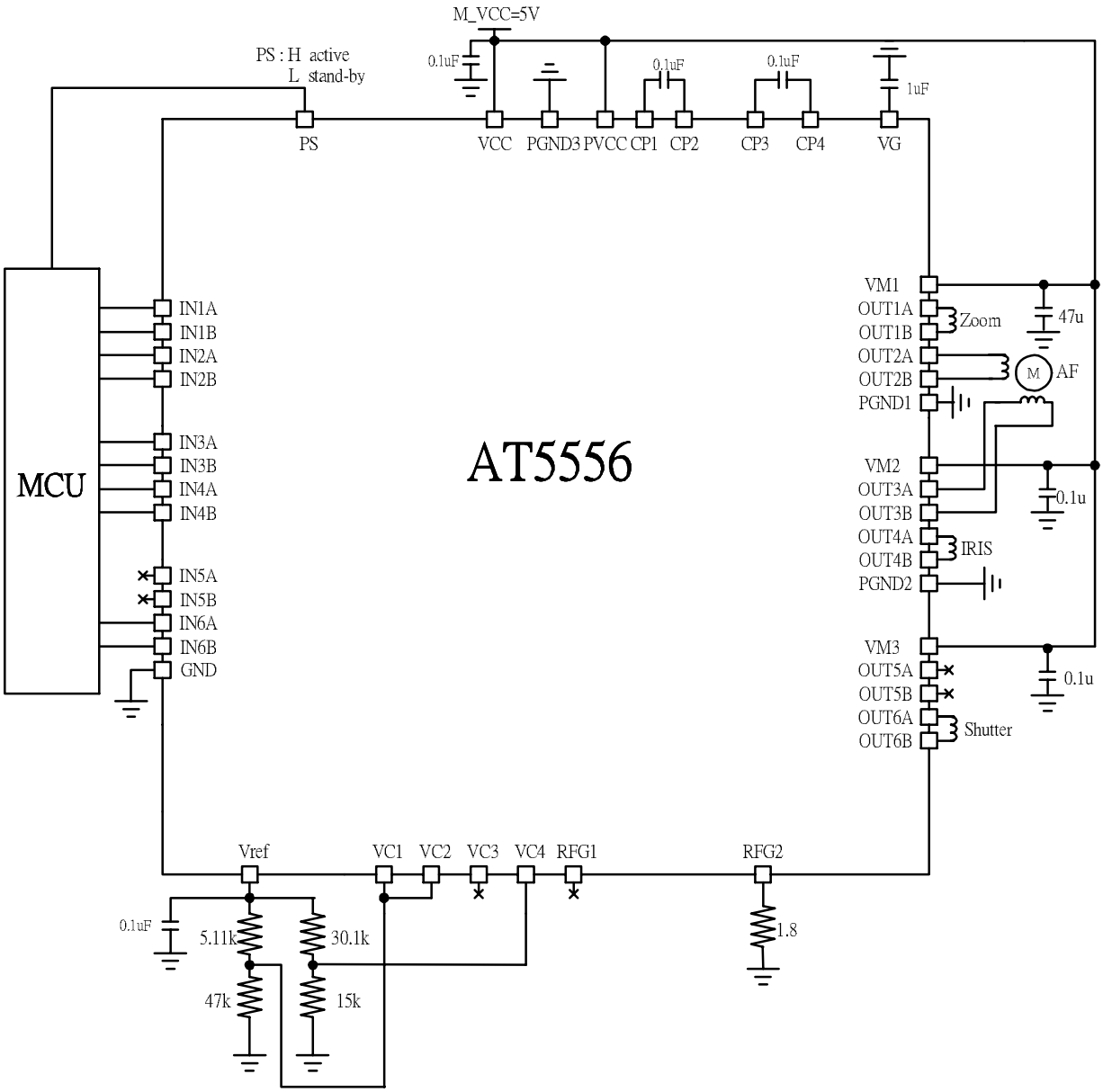
Output voltage of charge pump(three times PVCC)： $\mathrm{VG} = \mathrm{PVCC} \times 3$

Constant voltage ：CH1&CH2→ $V_O = V_{C1} \times 5 - 0.5 \times R_{ON} \times I_o$

Saturation mode ：CH3&CH4&CH5→ $V_O = VM - R_{ON} \times I_o$

Constant current：CH6→ $I_o = V_{C4} / RFG2$

Application reference 4



Output voltage of charge pump(three times PVCC)： $\mathrm{VG} = \mathrm{PVCC} \times 3$

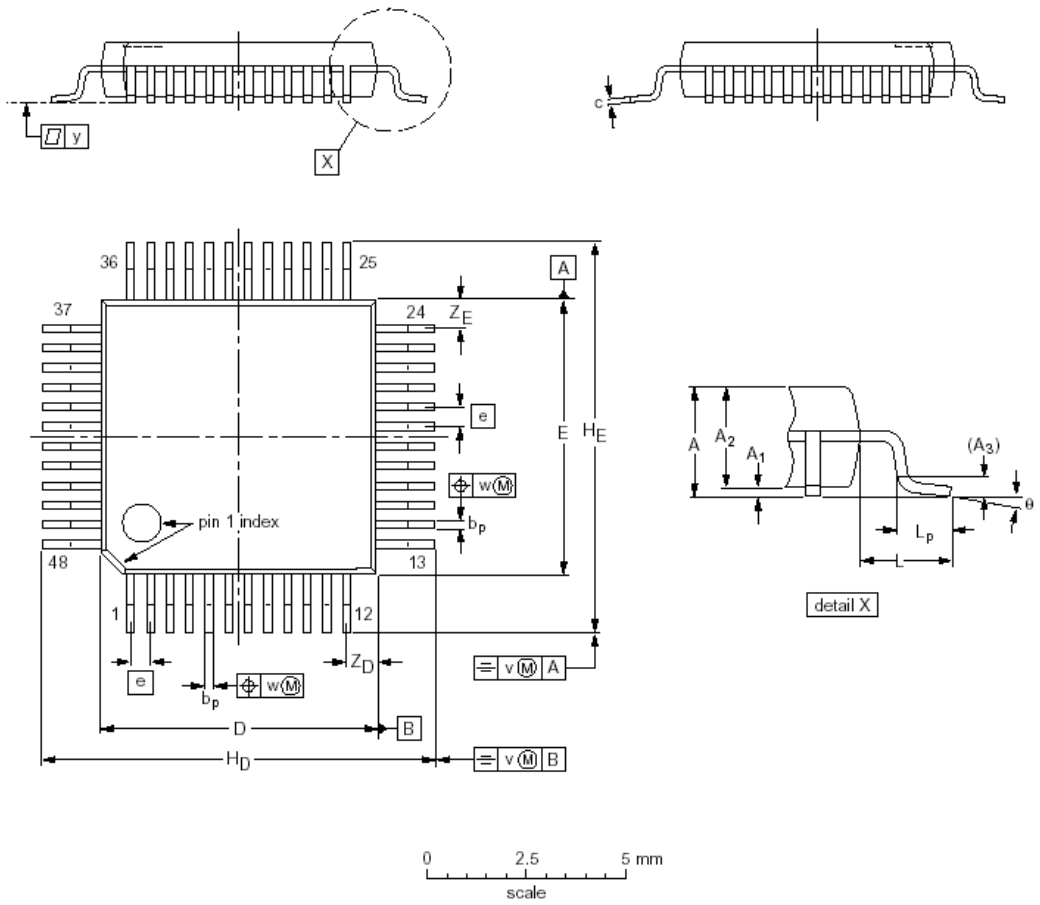
Constant voltage ：CH1&CH2→ $V_O = V_{C1} \times 5 - 0.5 \times R_{ON} \times I_o$

CH3&CH4→ $V_O = V_{C2} \times 5 - 0.5 \times R_{ON} \times I_o$

Constant current：CH6→ $I_o = V_{C4} / RFG2$

Package Description

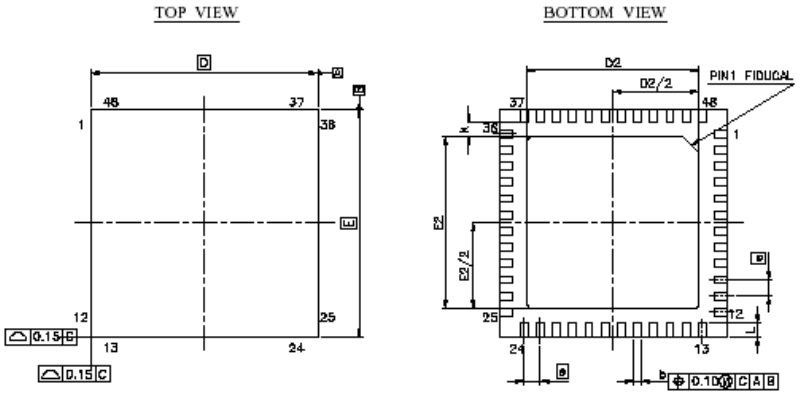
LQFP48



DIMENSIONS (mm are the original dimensions)

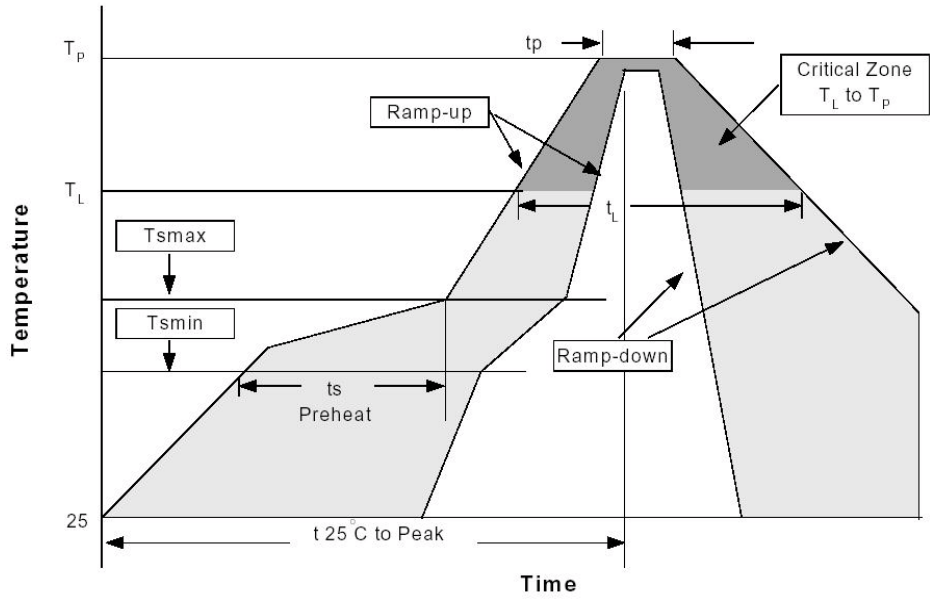
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_D	H_E	L	L_p	v	w	y	$Z_D^{(1)}$	$Z_E^{(1)}$	θ
mm	1.60	0.20 0.05	1.45 1.35	0.25	0.27 0.17	0.18 0.12	7.1 6.9	7.1 6.9	0.5	9.15 8.85	9.15 8.85	1.0	0.75 0.45	0.2	0.12	0.1	0.95 0.55	0.95 0.55	7° 0°

QFN48



SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	27.6	29.5	31.5
A1	0	0.02	0.05	0	0.79	1.97
A3	0.203 REF			8 REF		
b	0.18	0.23	0.30	7.1	9.1	11.8
D	7.00 BSC			276 BSC		
D2	5.10	5.30	5.50	201	209	217
E	7.00 BSC			276 BSC		
E2	5.10	5.30	5.50	201	209	217
e	0.50 BSC			19.7 BSC		
K	0.20			7.9		
L	0.30	0.40	0.50	11.8	15.7	19.7
y	0.08			3.15		

Reflow Profiles



Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body Pkg. thickness ≥2.5mm or Pkg. volume ≥350mm^3	**Small Body Pkg. thickness <2.5mm or Pkg. volume <350mm^3**	**Large Body Pkg. thickness ≥2.5mm or Pkg. volume ≥350mm^3**	**Small Body Pkg. thickness ≥2.5mm or Pkg. volume ≥350mm^3**
Average ramp-up rate (T_L to T_P)	3°C/second max.		3°C/second max.	
Preheat -Temperature Min(Tsmin) -Temperature Max (Tsmax) -Time (min to max)(ts)	 100°C 150°C 60-120 seconds		 150°C 200°C 60-180 seconds	
Tsmax to T_L -Ramp-up Rate			3°C/second max.	
Time maintained above: -Temperature (T_L) -Time (t_L)	 183°C 60-150 seconds		 217°C 60-150 seconds	
Peak Temperature(T_P)	225+0/-5°C	240+0/-5°C	245+0/-5°C	250+0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10-30 seconds	10-30 seconds	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.		3°C/second max.	
Time 25°C to Peak Temperature	6 minutes max.		8 minutes max.	

***All temperatures refer to topside of the package, measured on the package body surface.**