

## Inductive Counting Solution for Flow Metering

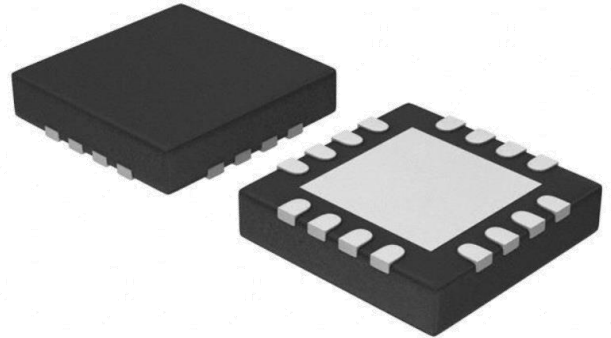
### 1 Product Description

The MTL100 is an ASIC chip provides counting solution for flow metering based on inductive technology.

The MTL100 provides digital output for counting the turns of flow metering. CWOUT & CCWOUT links to clockwise output & counter clockwise output. Both CWOUT & CCWOUT is open-drain output.

The MTL100 can also be communicated through I2C, and supports 24-bits CW counting & 16-bits CCW counting.

The MTL100 provides QFN3\*3-16L for surface mount. The package is RoHS compliant.



### 2 Features

- CMOS Technology
- Icc=6uA @64Hz Sampling & 16Hz Data Refresh Frequency
- 2.4~4.5V Operating Vcc Range
- 64Hz Sampling Frequency
- 16Hz Data Refresh Frequency
- -10~55°C Operating Temperature
- Dual Digital Output for CW & CCW Signal
- Auto Calibration
- I2C Interface
  - 24 Bits CW Counting
  - 16 Bits CCW Counting
- Package Option: QFN3\*3-16L

### 3 Product Overview of MTL100

Part No.	Description
MTL100QT	QFN3*3-16L, tape & reel (5000pcs/bag)

### 4 Applications

- Position Detection
- Smart Meter

### 5 Pin Configuration and Functions

Pin No.	Name	Description
1	Vcc	Power
2	SDA	I2C Data
3	SCL	I2C Clock
4	GND	Ground
5	TG4	Trigger Signal 4
6	Coil4	Coil Signal 4
7	Coil3	Coil Signal 3
8	TG3	Trigger Signal 3
9	EC	External Cap
10	NA	
11	CCW <sub>OUT</sub>	Counter Clockwise Output
12	CW <sub>OUT</sub>	Clockwise Output
13	TG2	Trigger Signal 2
14	Coil2	Coil Signal 2
15	Coil1	Coil Signal 1
16	TG1	Trigger Signal 1

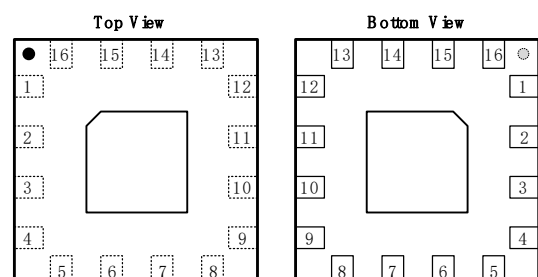


Figure.1 Pin Configuration & Functions

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## Reversion History

- 1 Originally Version

## 6 Electrical and Magnetic Characteristics

### 6.1 Absolute Maximum Ratings

Absolute maximum ratings are limited values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

Symbol	Parameters	Min	Max	Units
V <sub>CC</sub>	Supply Voltage	-0.7	6	V
V <sub>OUT</sub>	CW <sub>OUT</sub> & CCW <sub>OUT</sub> Voltage	-0.7	6	V
V <sub>SDA</sub> & V <sub>SCL</sub>	SDA & SCL Voltage	-0.7	6	V
I <sub>OUT</sub>	Continuous Output Current	-	10	mA
T <sub>A</sub>	Operating Ambient Temperature	-10	55	°C
T <sub>S</sub>	Storage Temperature	-50	150	°C

### 6.2 Electrical Specifications

At T<sub>A</sub> = -10~55°C, V<sub>CC</sub> = 2.4V~4.5V (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V <sub>CC</sub>	Supply Voltage	Operating	2.4	3.6	4.5	V
I <sub>CC</sub>	Supply Current ①	T <sub>A</sub> = 25°C, V <sub>CC</sub> = 3.3V F <sub>D</sub> R = 16Hz F <sub>S</sub> ampling = 64Hz	-	6	10	uA
V <sub>SAT</sub>	Digital Output Saturation Voltage	I <sub>OUT</sub> = 2mA, V <sub>OUT</sub> = Low Level	-	-	0.4	V
I <sub>OFF</sub>	Digital Output Leakage Current	V <sub>OUT</sub> = High Level	-	-	1	uA
T <sub>PO</sub>	Power on Time	V <sub>CC</sub> = 3.3V	-	-	20	ms
F <sub>S</sub> ampling	Sampling Frequency (Can be adjusted through I2C)		-	64	-	Hz
F <sub>D</sub> R	Data Refresh Frequency (Can be adjusted through I2C)		-	16	-	Hz
T <sub>OUT</sub>	The Low Voltage Continued Time of CW <sub>OUT</sub> & CCW <sub>OUT</sub> (Refer to Figure3) (Can be adjusted through I2C)		-	-	64	ms
R <sub>TH</sub>	Thermal Resistance of QFN3*3-16L		-	301	-	°C/W

Note: The MTL100 will detect the interference from the NB-IoT automatically, and switch into the anti-interference mode with ~1.2mA I<sub>CC</sub>

### 6.3 Register Characteristics

At T<sub>A</sub> = -10~55°C, V<sub>CC</sub> = 2.4V~4.5V (unless otherwise specified)

Symbol	Parameters	Min	Typ	Max	Unit
COUNT_CW	Clockwise Counting	-	24	-	Bit
COUNT_CCW	Counter Clockwise Counting	-	16	-	Bit

### 6.4 ESD Ratings

Symbol		Reference	Values	Unit
V <sub>ESD</sub>	Human-body model (HBM)	AEC-Q100-002	±6000	V
	Charged-device model (CDM)	AEC-Q100-011	±1000	V

### 6.5 NVM Specifications

At TA=-10~55°C, VCC=2.4V~4.5V (unless otherwise specified)

Symbol	Parameters	Min	Typ	Max	Unit
V <sub>PGRM</sub>	Programing Voltage	-	3.6	-	V
V <sub>WRITE</sub>	Writing Voltage	2.4	-	-	V
V <sub>READ</sub>	Reading Voltage	2.4	-	-	V

### 6.6 Characteristic Performance

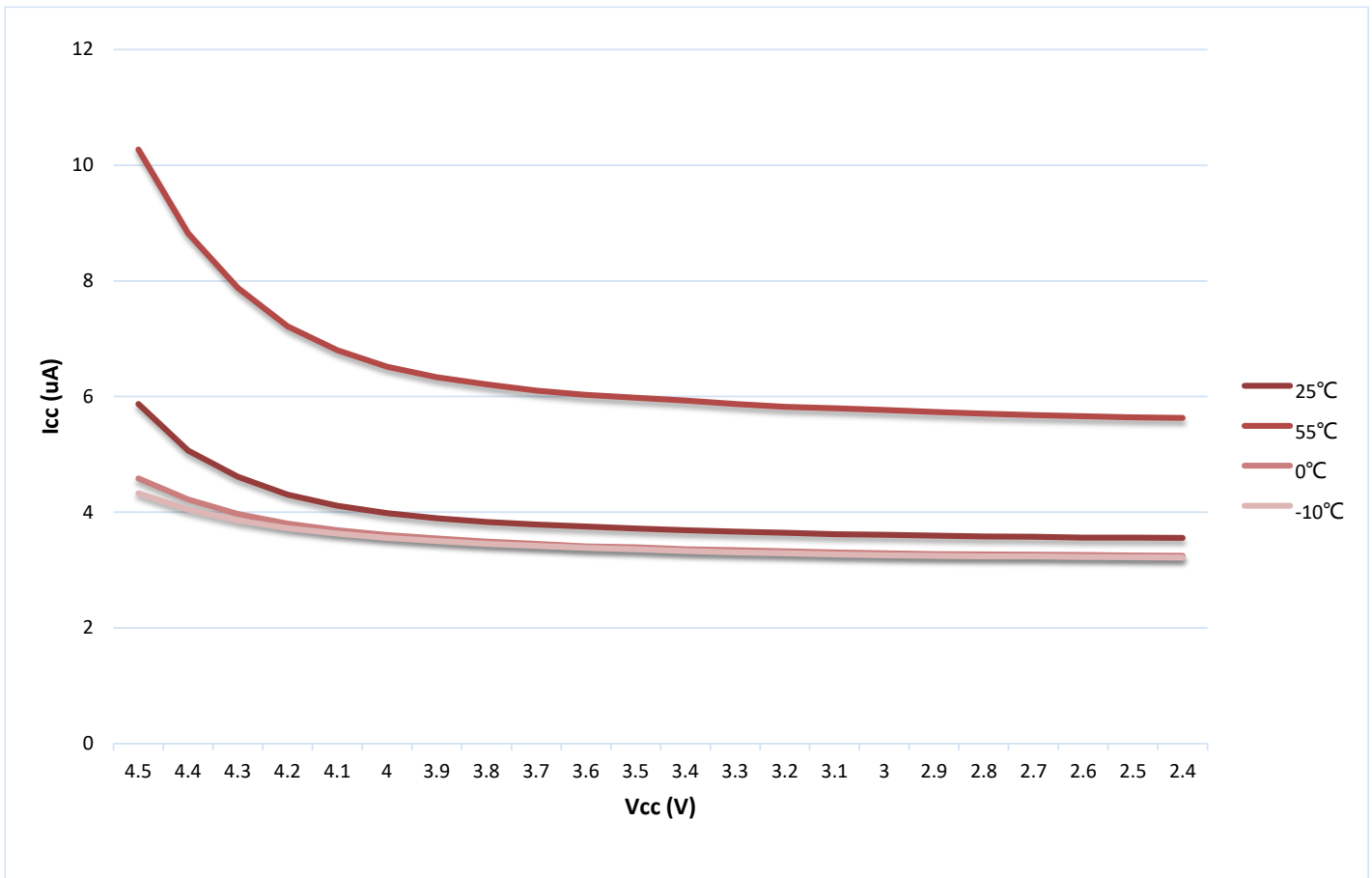


Figure.2 Icc vs. Temp. & Vcc @ 64Hz F<sub>Sampling</sub> 16Hz F<sub>DR</sub>

## 7 Typical Output Waveform

### 7.1 CW & CCW Output

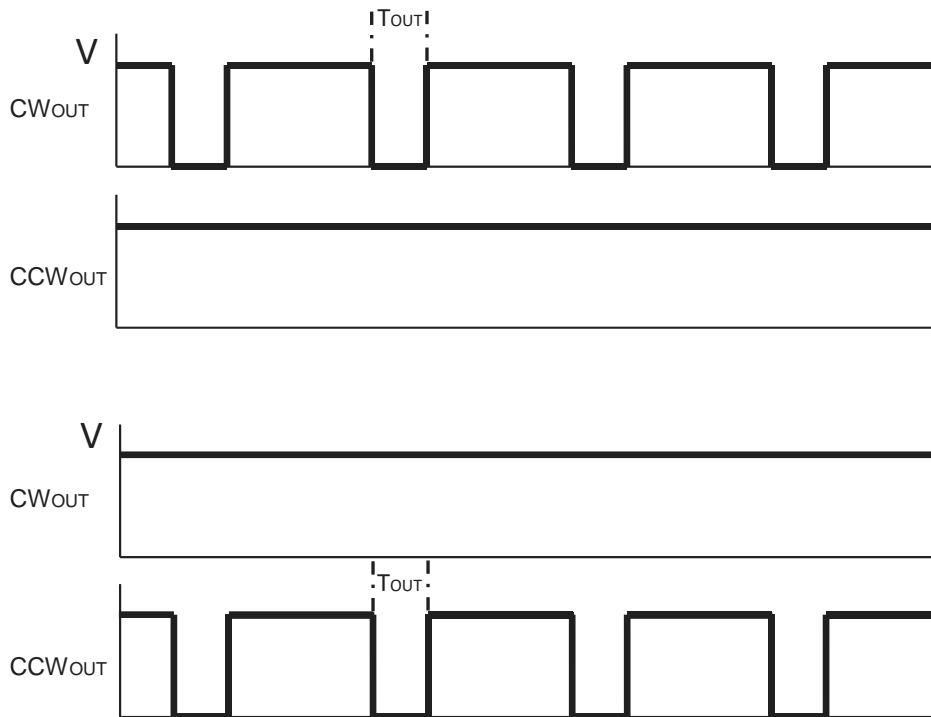


Figure.3 CW & CCW Output Diagram (Default T<sub>out</sub>=64ms)

## 8 Functional Block Diagram

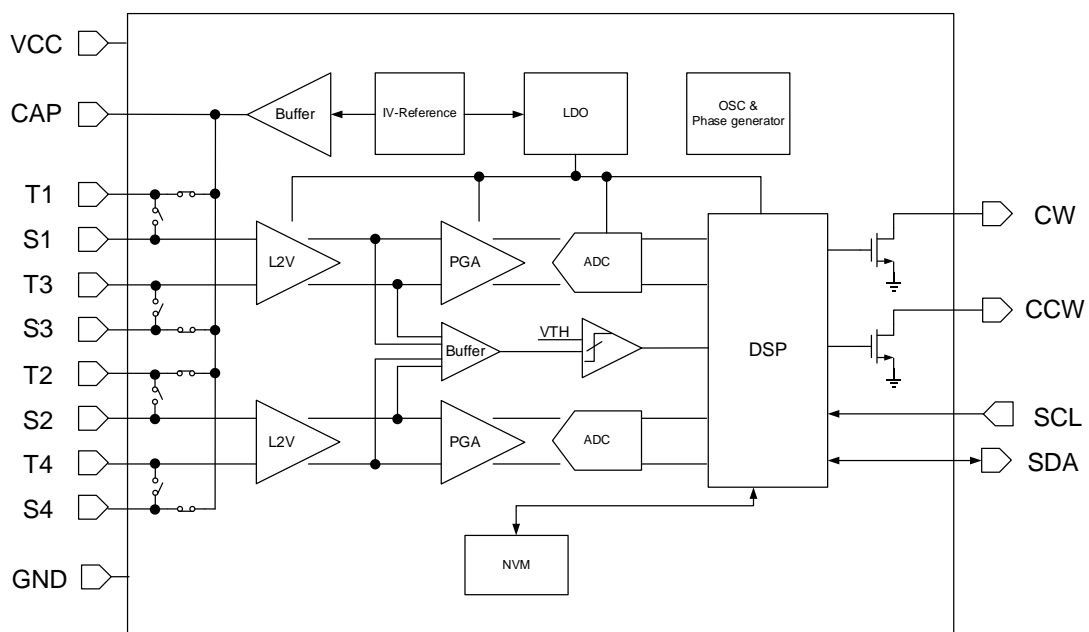


Figure.4 Functional Block Diagram

## 9 I2C Interface

### 9.1 Timing Requirement

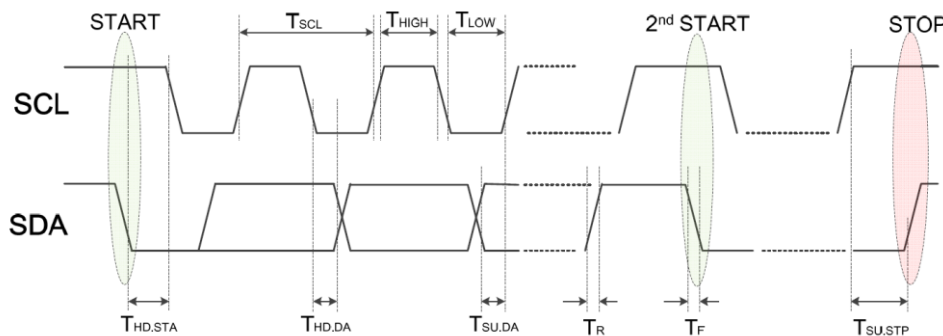


Figure.5 I2C Timing Diagram

Parameter	Description	Min.	Max.	Unit
$T_{SCL}$	SCL Clock Period	1	-	Ms
$T_{HD,STA}$	Hold Time of 'START'	250	-	ns
$T_{LOW}$	Low Phase of SCL	250	-	ns
$T_{HIGH}$	High Phase of SCL	250	-	ns
$T_{SU,DA}$	Setup Time of SDA	100	-	ns
$T_{HD,DA}$	Hold Time of SDA	50	-	ns
$T_R$	Rising Time of SDA/SCL	-	150	ns
$T_F$	Falling Time of SDA/SCL	-	150	ns
$T_{SU,STP}$	Setup Time of 'Stop'	250	-	ns

### 9.2 Register Map

Name	Addr.	Type	DATA							
			Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
COUNTER_CLEAR	0x21	R/W								CLEAR [0]
COUNT_CW	0x44	R/O	COUNT_CW [ 23 : 16 ]							
	0x45	R/O	COUNT_CW [ 15 : 8 ]							
	0x46	R/O	COUNT_CW [ 7 : 0 ]							
COUNT_CCW	0x47	R/O	COUNT_CCW [ 15 : 8 ]							
	0x48	R/O	COUNT_CCW [ 7 : 0 ]							

10 Package Material Information (For Reference Only – Not for Tooling Use)

10.1 QFN3\*3-16L Package Information

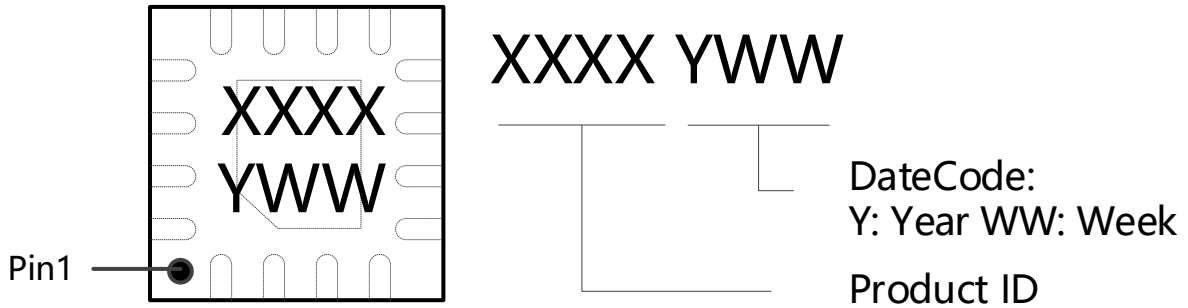


Figure.6 QFN3\*3-16L Chip Marking Spec

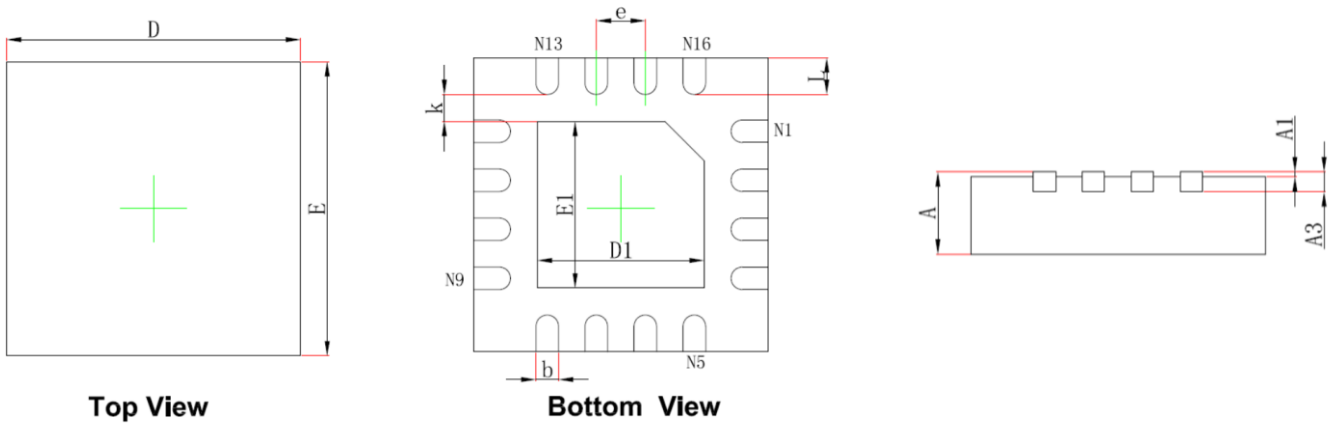


Figure.7 QFN3\*3-16L Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF		0.008REF	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E1	1.600	1.800	0.063	0.071
k	0.275REF		0.011REF	
b	0.180	0.300	0.007	0.012
e	0.500REF		0.020REF	
L	0.300	0.500	0.012	0.020
X	1.690	1.990	0.066	0.078
Y	1.110	1.410	0.043	0.055
Z	0.420	0.620	0.016	0.024

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