

11-VM148

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130mA, 10Bit Current Sinking VCM Driver with I²C Interface



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11-VM148

130mA, 10-Bit Current Sinking VCM Driver with I²C Interface

General Specifications

The 11-VM148 is a VCM(Voice Coil Motor) driver IC with I²C interface control that is capable of programmable sinking output current. It has a built-in internal voltage reference and operates with a supply voltage range from 2.4V to 5.5V. The DAC is controlled by a signal transmit through a 2-wire I²C serial interface which operates in an I²C fast mode (400 kHz). The 11-VM148 is designed for applications such as image stabilization, auto-focus, optical zoom in camera phones, and other portable module devices.

Features and Benefits

- Programmable sinking output current
- I²C serial interface
- DAC with 10-BIT resolution
- 2.4V – 5.5V power source
- Low voltage control for digital pin PD, SDA, and SCL(i.e., V_{IH} = 1.54V @ VDD = 2.8V)
- Power off operation
- Automatic power on reset
- Small package: DFN10 (3*3*0.8 mm), WLCSP(0.99*1.87*0.5 mm)

Ordering Information

Part Number	Package	Marking
11-VM148 WLCSP	WLCSP, 8Pin	GXX* or HXX*
11-VM148 DFN	DFN, 10Pin	XXXX**G

*XX reserved for a data code

**XXXX reserved for a date code

Terminology

Resolution

The DAC resolution is defined by the power factor of 2, which defines the number of distinct analog levels.

N-bit resolution $\rightarrow 2^N$ distinct analog levels

Differential Nonlinearity (DNL) error

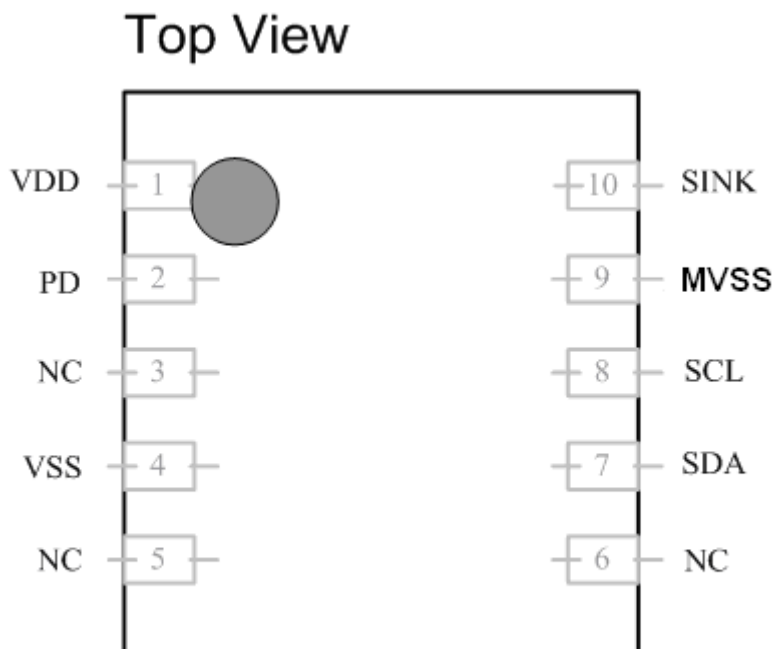
The variation in analog step sizes away from 1 LSB by any two adjacent codes. Usually, gain and offset errors have been removed.

Integral Nonlinearity (INL)

It is the deviation of actual transfer response from a straight line. Usually, INL error is referred to as the maximum INL error.

Pin Assignment

Pin Assignment of DFN10 (3*3*0.8 mm)



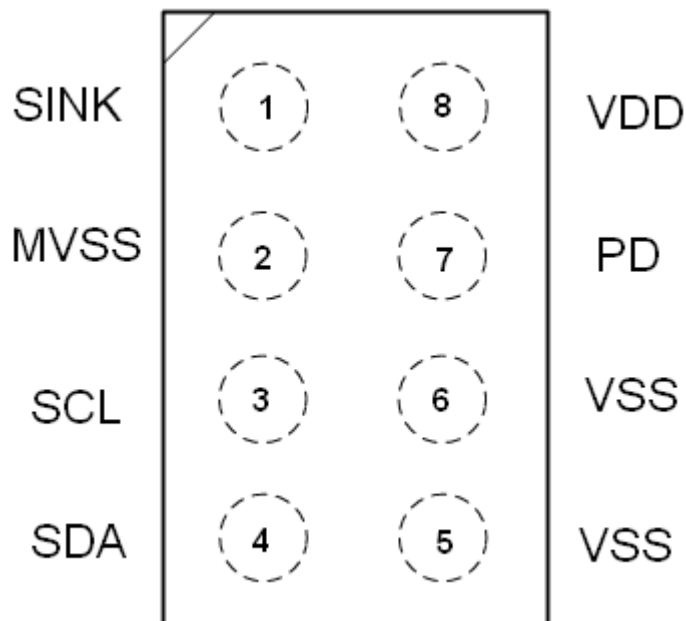
Pin Descriptions

Pin NO.	Pin Name	Description
1	VDD	Input Power Pin
2	PD	Digital Input: Power off Mode (When PD=High ,chip disable) (When PD=Low ,chip enable)
3	NC	
4	VSS	Input Ground Pin
5	NC	
6	NC	
7	SDA	I ² C Interface Data(Serial Data Line)
8	SCL	I ² C Interface Data(Serial Clock Line)
9	MVSS	Input Motor driver GND Pin
10	SINK	Analog Output : Output current Sink Pin

- The 7 address bits of 11-VM148 for I²C slave true port is 0001-1xx.

Pin Assignment of WLCSP (0.99*1.87*0.5mm)

TOP View



Pin Number	Pin Name	Description
1	SINK	Analog Output : Output Current Sink Pin
2	MVSS	Input Motor Driver GND Pin
3	SCL	I ² C Interface Data(Serial Clock Line)
4	SDA	I ² C Interface Data(Serial Data Line)
5	VSS	Input Ground Pin
6	VSS	Input Ground Pin
7	PD	Digital Input: Power off Mode (When PD=High ,chip disable) (When PD=Low ,chip enable)
8	VDD	Input Power Pin

Absolute Maximum Ratings

Unless otherwise noted, T_A= 25°C

Characteristic	Symbol	Rating	Unit
Supply Input Voltage	V _{DD}	5.5	V
Input Voltage	V _{IN}	V _{DD} +0.4	V
Maximum Sink Current	I _{SINK}	150	mA
Operating Temperature Range	T _{OPR}	-40 ~ 125	°C
Storage Temperature Range	T _{STG}	-65 ~ 150	°C

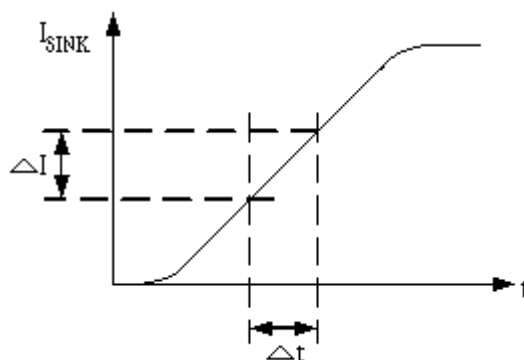
Electrical Characteristic

Unless otherwise noted, $T_A = 25^\circ\text{C}$, $V_{DD} = 2.8\text{ V}$ and $V_{CM} \approx 18\Omega$, $460\mu\text{H}$.

Item	Sym.	Condition	Limit			Unit
			Min.	Typ.	Max.	
Power Supply						
Supply Voltage	V _{DD}		2.4	2.8	5	V
Supply Current (I _{DD})	I _{PD}	PD = High (chip disable)	-	-	0.5	uA
	I _{DD}	PD = Low, SPD= High	-	-	0.1	mA
	I _{DD1}	PD = Low, SPD= Low			0.5	mA
PD, SDA, SCL digital control pin						
Input Voltage High	V _{IH}	-	0.55*V _{DD}	-	V _{DD} +0.4	V
Input Voltage Low	V _{IL}	-	-0.4	-	0.2*V _{DD}	V
Parameters						
DAC Resolution				10		Bits
DNL				+/-0.8	+/-1	LSB
INL				+/-1	+/-5	LSB
Output Offset Current	I _{OS}	PD = L, SPD= logic H			5	uA
Current Slew Rate	SR	SR = ΔI / Δt (*1)		3		mA/us
Output Constant Current Settling Time	t _s	VDD = 2.8V, I _{SINK} = 100mA		40	80	us
Voltage Drop	ΔV	ΔV = V _{SINK} - V _{MVSS} (*2) (@I _{SINK} = 80 mA)	-	0.32	0.35	V

Note:

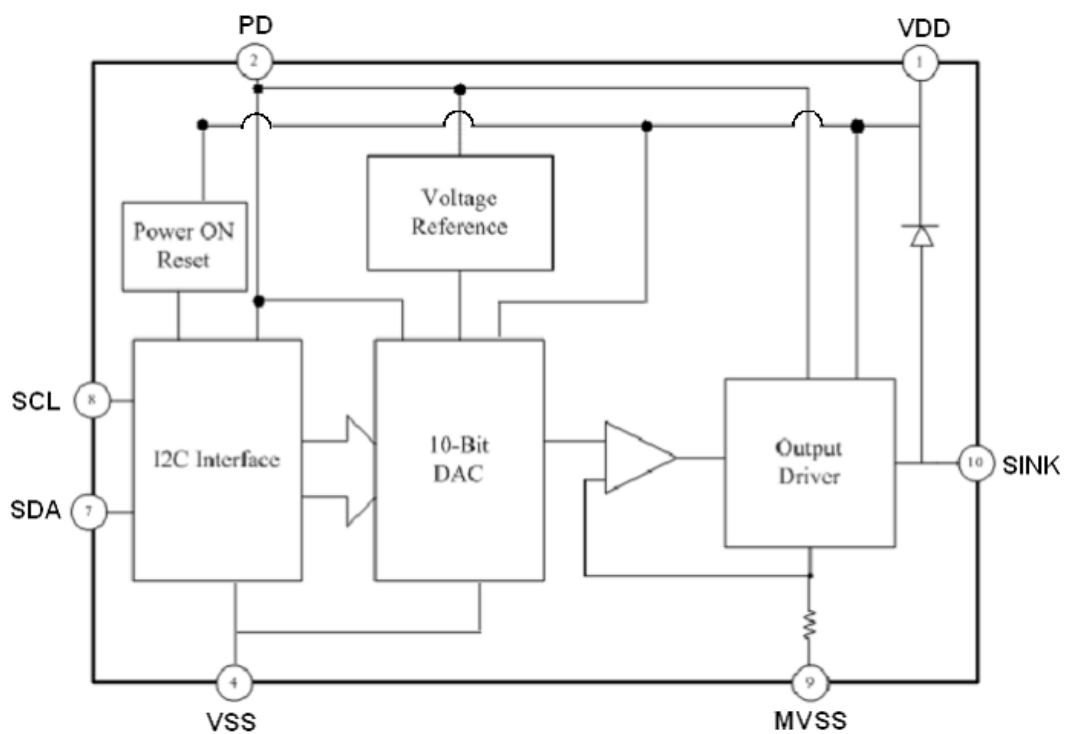
(*1) $SR = \Delta I / \Delta t$, I_{SINK} is the current of sink pin



(*2): V_{SINK} is the voltage of sink pin and V_{MVSS} is the voltage of motor driver GND pin

Block Diagram

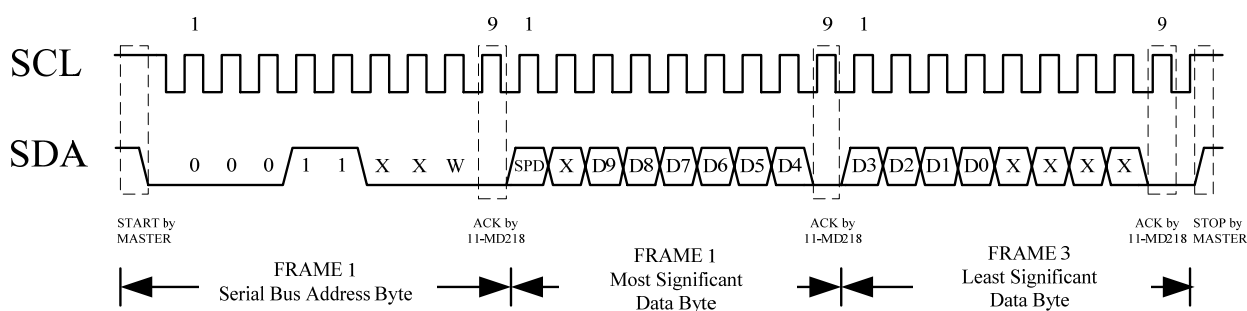
(DFN10)



Data Format

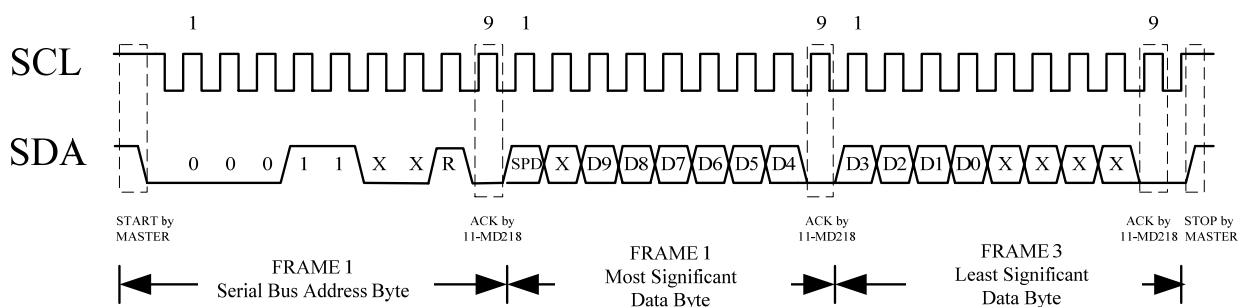
11-VM148 Write Mode

When in the write mode, data is written to the 11-VM148 and shifted byte-by-byte into a 16-bit input register. After all 16 bits of data have been shifted in, a STOP condition is transmit by master and the loaded data in the input register is transferred to the DAC.



11-VM148 Read Mode

When 11-VM148 is in the read mode, data is read from IC to a master controller in the same bit order.



Table

	MSB								LSB							
Serial Data Bits	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Input Register	R15	R14	R13	R12	R11	R10	R09	R08	R07	R06	R05	R04	R03	R02	R01	R00
Function	SPD	X	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X	X

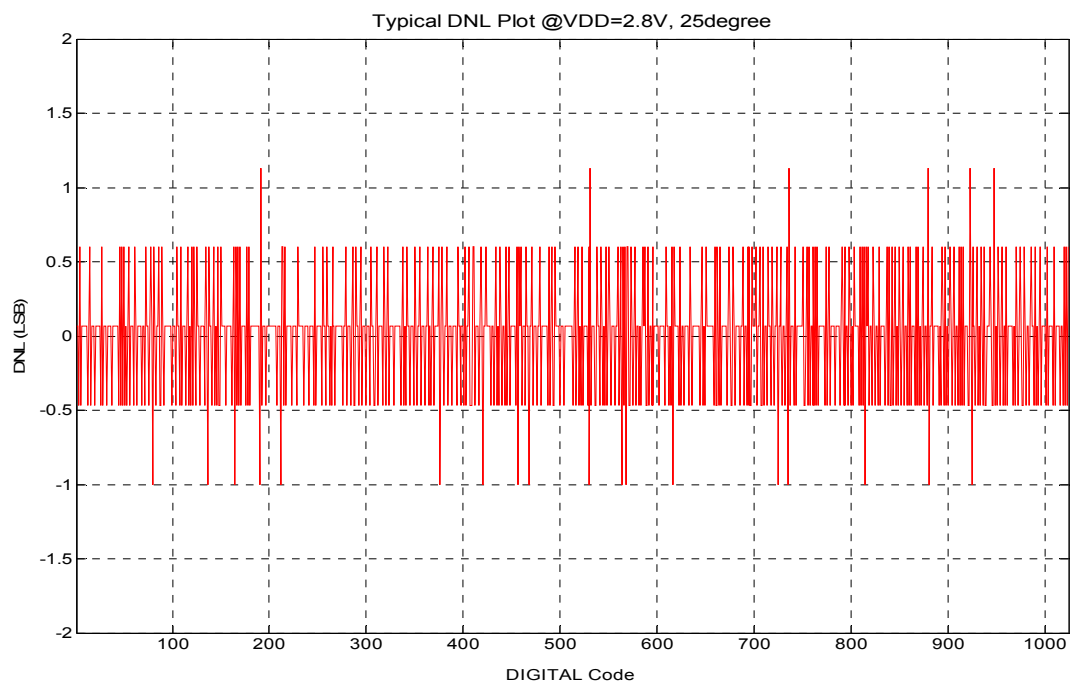
- SPD (Soft Power off, 2nd standby mode): IC power off controlled by software.
- X denotes “Don’t care/Unused”.
- Regarding to all kinds of IC operation situations please refers to following table.

PD	SPD	IC status
High	-	Power off
Low	Low	IC Active
	High	Soft power off

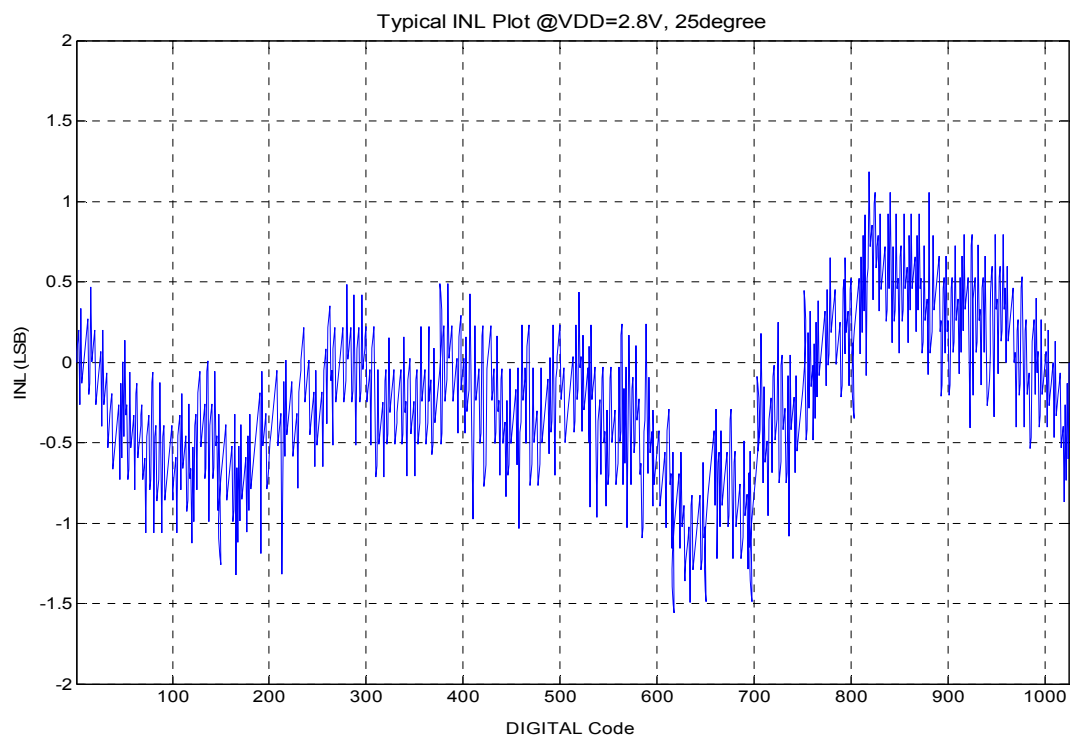
The PD pin is the power off pin of 11-VM148. Logic low level (PD = Low) is for IC operation. On the other hand, its logic high level (PD = High) puts the chip into power off mode for power saving. It is recommended to keep PD at high level (PD = H) before while the chip is no operation to save power, especially for applications in portable devices.

Performance Characteristics

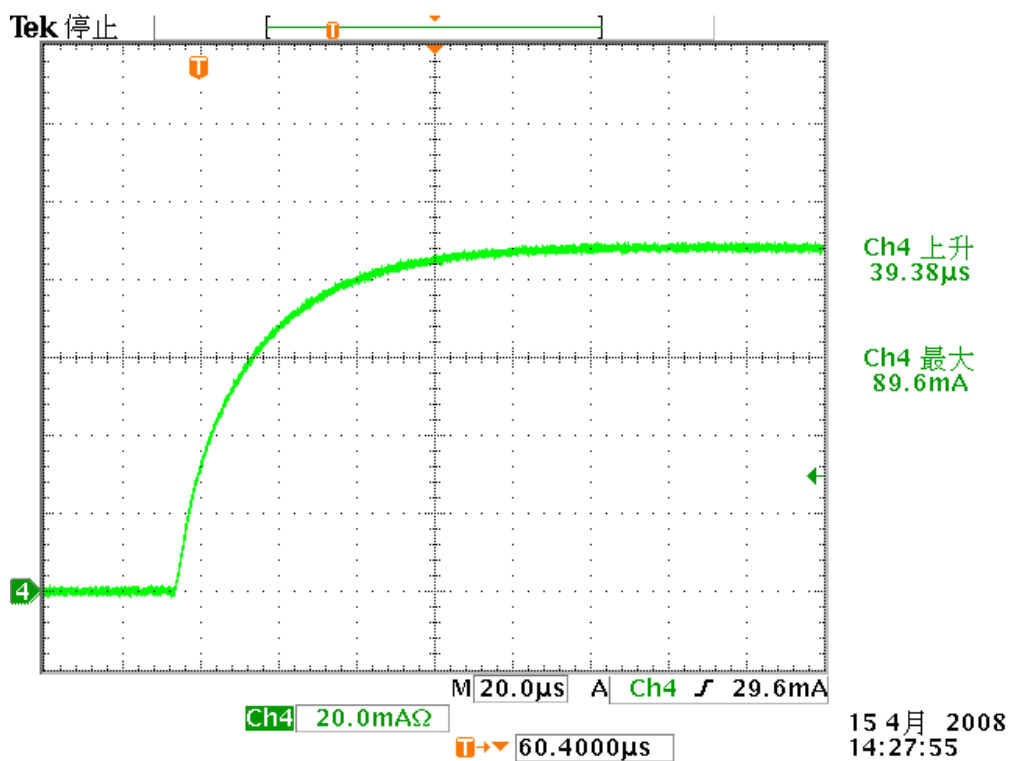
1. DNL Plot



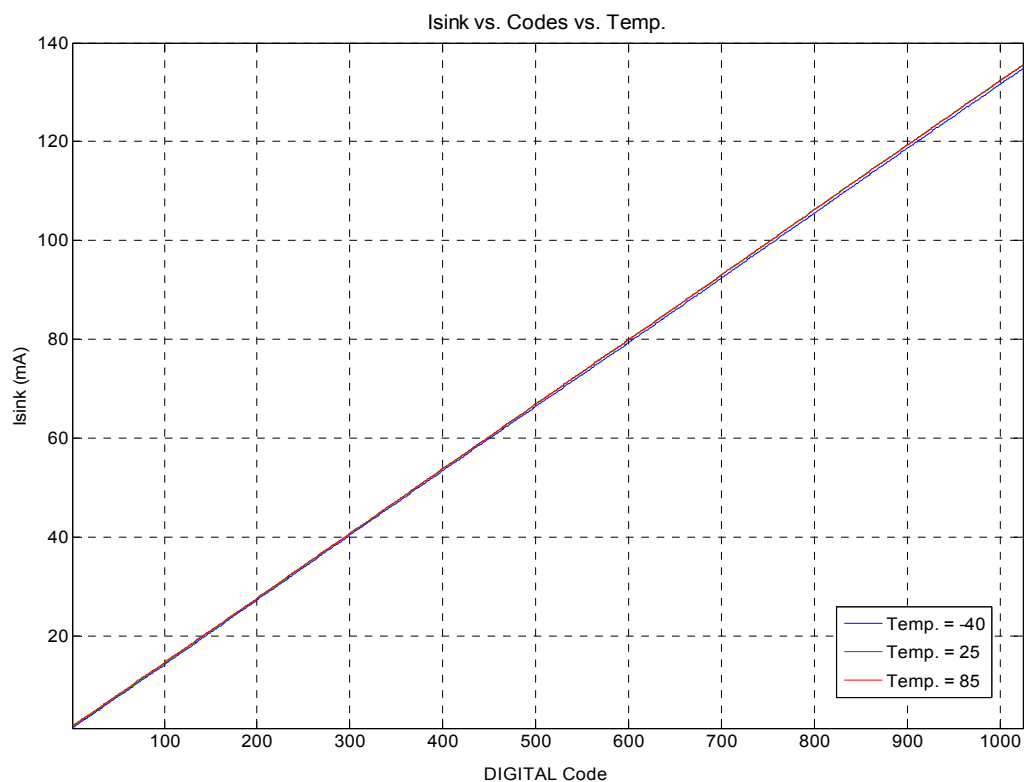
2. INL Plot



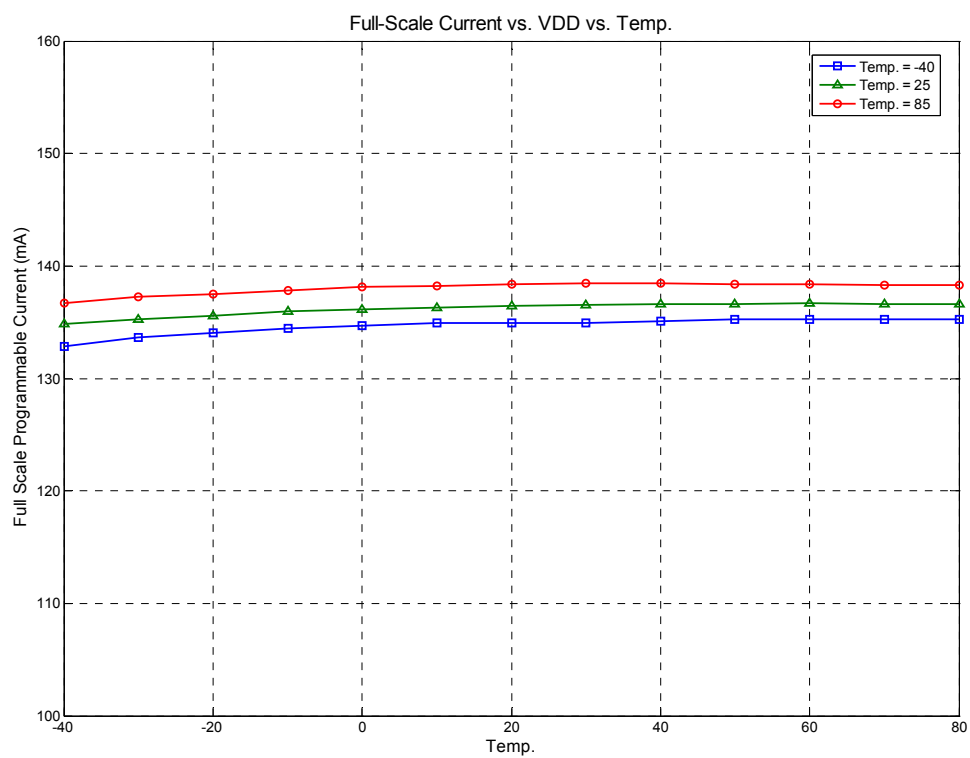
3. Settling Time ($V_{DD} = 2.8V$, $V_{CM} = 270\Omega$ with $430\mu H@500Hz$, $550\mu H@1kHz$, respectively, $C_L = 0.1\mu F$ @Temp. = 25)



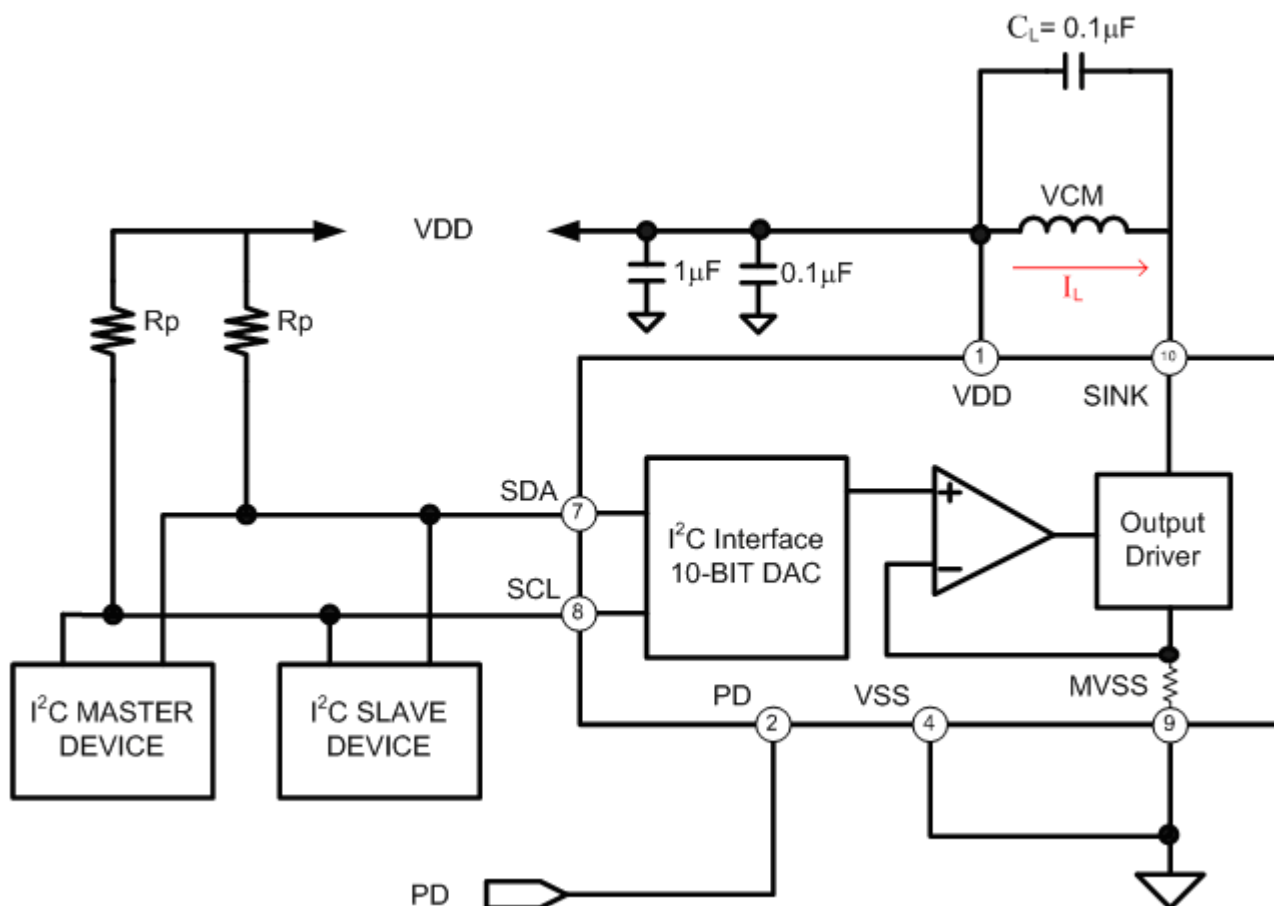
4. Sink Current vs. Codes vs. Temp.



5. Full-Scale Programmable Current vs. Temp. vs. VDD



Application Circuit

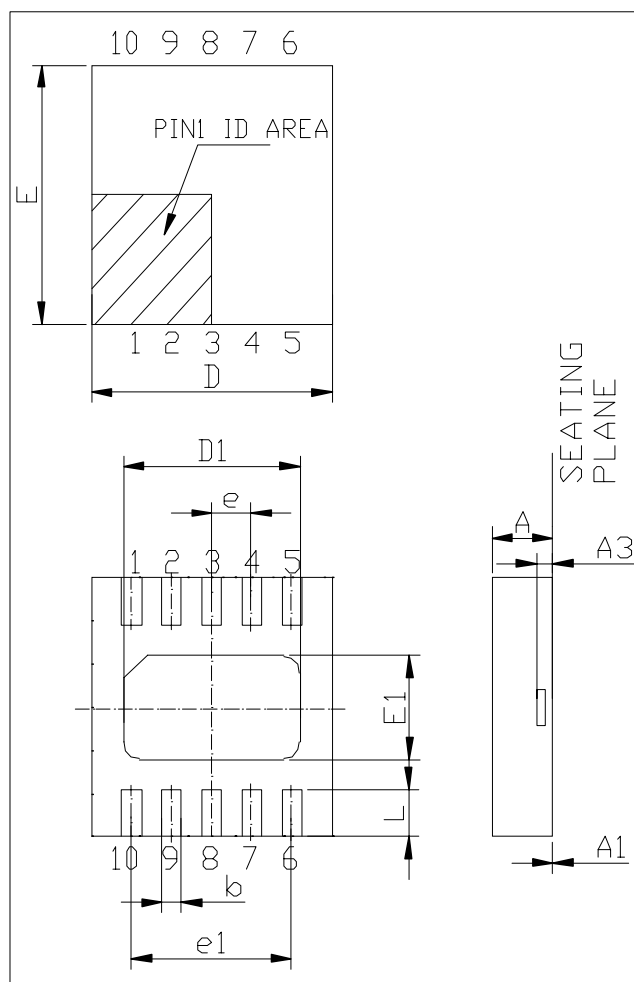


Application Notes

- The 11-VM148 is a constant current driving IC for applications in Auto-Focus. The supply voltage range VDD of 11-VM148 is from 2.4V to 5.5V. The input range of digital control pin PD, and digital I/O pins SCL and SDA, are defined such that logic “High” is from $0.55 \times VDD$ to $VDD + 0.4V$ and logic “Low” is from $-0.4V$ to $0.2 \times VDD$. Therefore, the three digital pins are suitable controlled by 1.8V ISP.
- The PD pin is the power off pin of 11-VM148. Logic low level (PD = Low) is for IC operation. On the other hand, its logic high level (PD = High) puts the chip into power off mode for power saving. It is recommended to keep PD at high level (PD = H) before while the chip is no operation to save power, especially for applications in portable devices.
- In order to ensure the stability of output current, a compensation capacitance C_L is suggested placing across the two terminals of VCM. The suggested value of C_L is about 0.1~0.22 μF and could be fine tuned for different VCM.

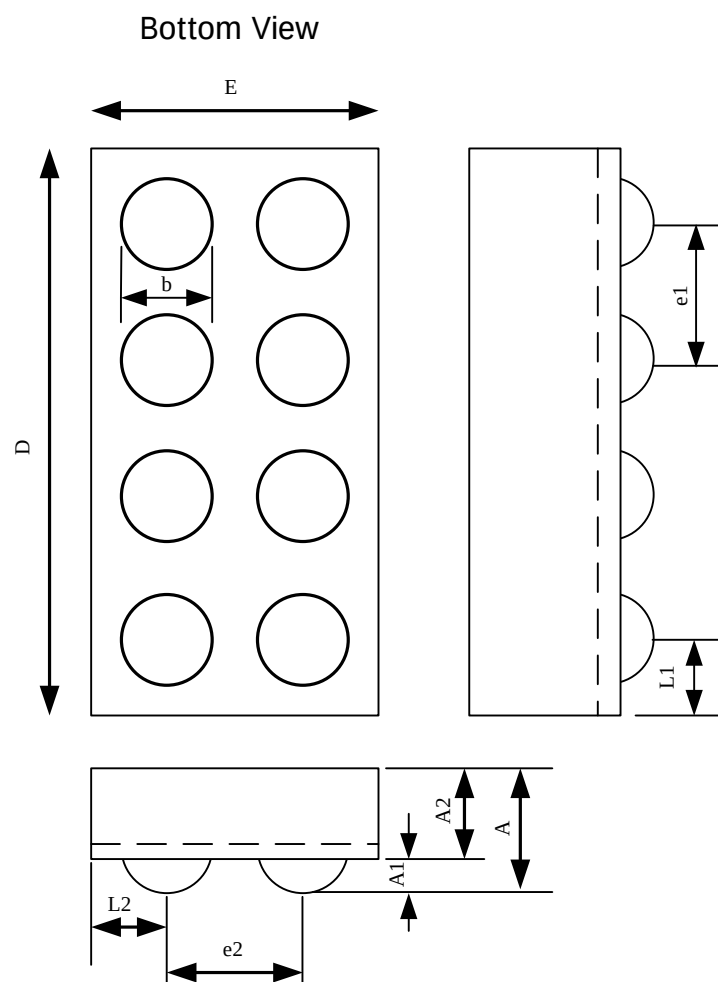
Package Specification

(DFN-10)



SYMBOL	DIMENSION (mm)			DIMENSION (mil)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	28	30	32
A1	0.00	0.02	0.05	0	0.8	2
A3	0.203 REF			8 REF		
b	0.18	0.25	0.30	7	10	12
D	2.90	3.00	3.10	114	118	122
D1	2.10	2.20	2.30	83	87	91
E	2.90	3.00	3.10	114	118	122
E1	1.10	1.20	1.30	86	87	91
L	0.45	0.55	0.65	18	22	26
e	0.50 BASIC			20 BASIC		
e1	2.00 BASIC			80 BASIC		

Package Specifications (WLCSP)



SYMBOL	DIMENSION (mm)		
	MIN.	NOM.	MAX.
A	0.445	0.5	0.555
A1	0.17	0.20	0.23
A2	0.275	0.30	0.325
b	0.24	0.26	0.28
D	1.83	1.87	1.91
E	0.95	0.99	1.03
e1		0.50	
e2		0.50	
L1	0.160	0.185	0.210
L2	0.220	0.245	0.270

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