

# 11-MD218A

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*130mA, 10Bit Current Sinking VCM Driver  
with I<sup>2</sup>C Interface*



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11-MD218A

## *130mA, 10-Bit Current Sinking VCM Driver with I<sup>2</sup>C Interface*

### **General Specifications**

The 11-MD218A is a VCM driver IC with I<sup>2</sup>C interface control that is capable of programmable output current sinking. It has a built-in internal voltage reference and operates in a wide supply voltage range from 2.4V to 5.5V. The DAC is controlled by a 2-wire I<sup>2</sup>C serial interface which operates in I<sup>2</sup>C fast mode (400 kHz). The 11-MD218A is designed for applications like image stabilization, auto-focus, and optical zoom in camera phones, digital still cameras, and other portable module devices.

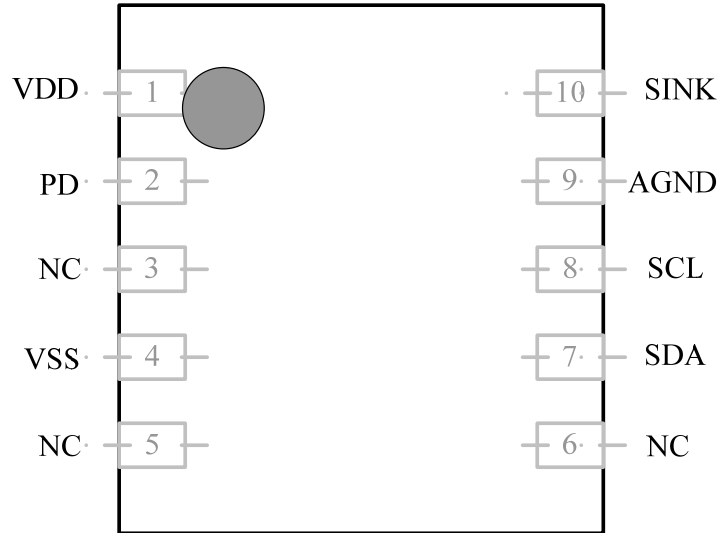
### **Features and Benefits**

- Programmable output current sinking
- I<sup>2</sup>C serial interface
- 10-BIT DAC resolution
- 2.4V – 5.5V power supply
- Low voltage control for digital pin PD, SDA, and SCL(i.e., V<sub>IH</sub> = 1.54V @ VDD = 2.8V)
- Power down operation
- Power on reset
- Constant current control
- Ultra small package: DFN10 (3\*3\*0.8 mm), WLCSP(0.99\*1.87\*0.5 mm)

## Pin Assignment

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

#### Top View

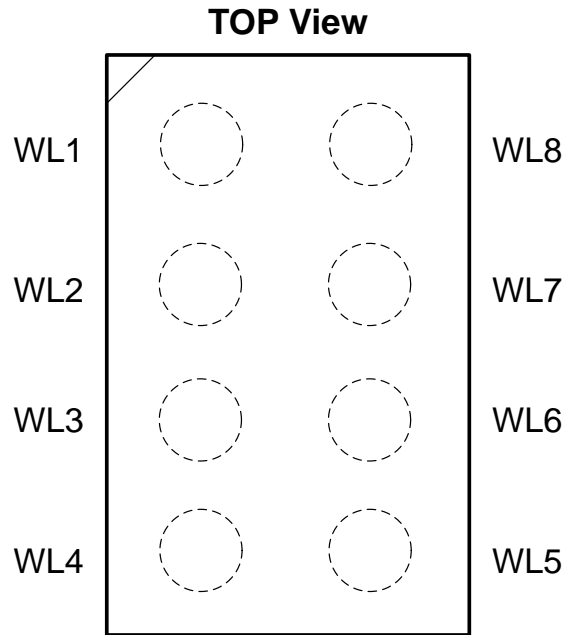


## Pin Descriptions

Pin NO.	Pin Name	Description
1	VDD	Power Supply Pin
2	PD	Digital Input: Power Down Mode ('H' Operation, 'L' Power Down)
3	NC	
4	VSS	Ground Pin
5	NC	
6	NC	
7	SDA	I <sup>2</sup> C Interface Data
8	SCL	I <sup>2</sup> C Interface Data
9	AGND	Analog GND
10	SINK	Analog Output : Output Current Sink

1. The I<sup>2</sup>C slave 7-bit address of 11-MD218A is 0001-1xx.

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



Pin NO.	Pin Name	Description
WL1	SINK	Programmable Sink Current
WL2	AGND	Current Sinking GND
WL3	SCL	I <sup>2</sup> C Interface Data
WL4	SDA	I <sup>2</sup> C Interface Data
WL5	VSS	Ground Pin
WL6	VSS	Ground Pin
WL7	PD	IC Power Down Pin(Logic 'L': power down)
WL8	VDD	IC Power Pin

**Absolute Maximum Ratings**

Unless otherwise noted, T<sub>A</sub>= 25°C

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



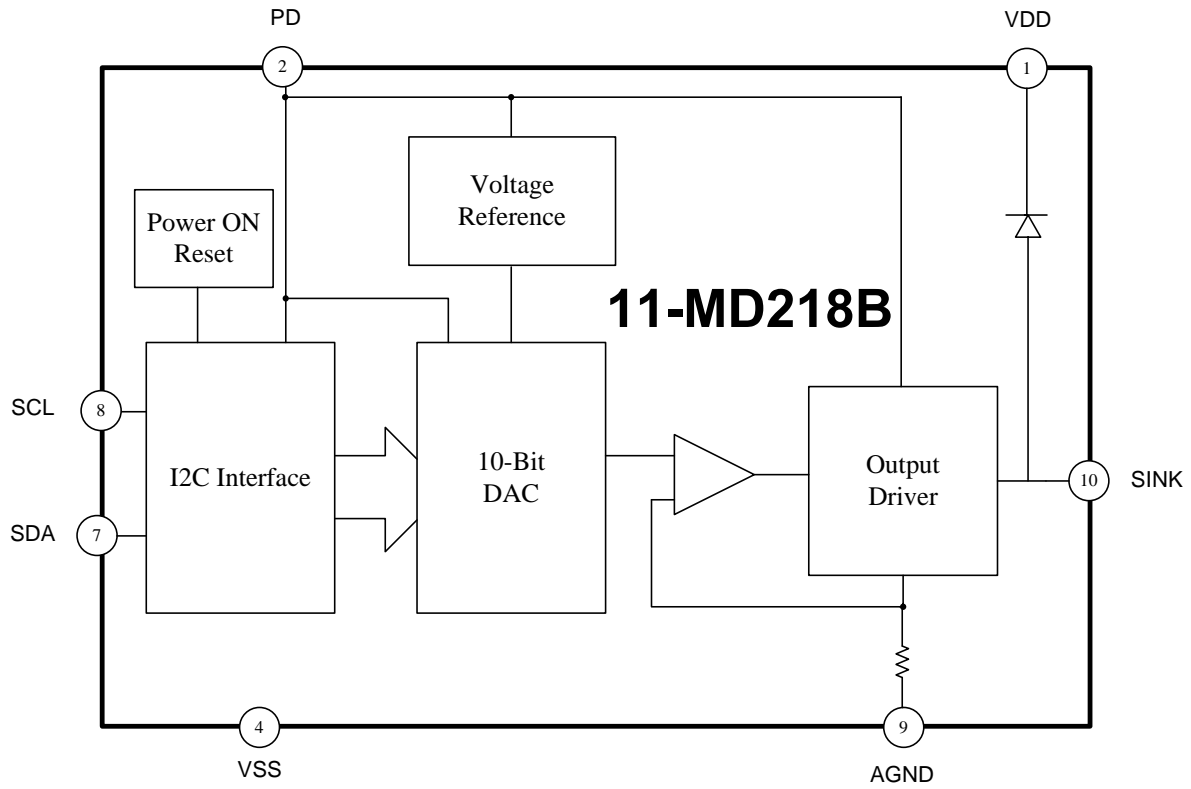
## Electrical Characteristic

Unless otherwise noted,  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 2.8\text{ V}$  and  $V_{CM} = 28.5\Omega, 460\mu\text{H}$ .

Item	Sym.	Condition	Limit			Unit
			Min.	Typ.	Max.	
<b>Power Supply</b>						
Supply Voltage	$V_{DD}$		2.4	2.8	5.5	V
Supply Current ( $I_{DD}$ )	$I_{PD}$	PD = L (Power down mode)	-	-	0.5	$\mu\text{A}$
	$I_{DD}$	PD = H, I2C= logic H	-	-	0.1	mA
<b>PD, SDA, SCL digital control pin</b>						
Input Voltage H	$V_{IH}$	-	$0.55 \cdot V_{DD}$	-	$V_{DD} + 0.4$	V
Input Voltage L	$V_{IL}$	-	-0.4	-	$0.2 \cdot V_{DD}$	V
<b>Parameters</b>						
DAC Resolution				10		Bits
DNL				+/-0.8	+/-1	LSB
INL				+/-1	+/-5	LSB
Output Offset Current	$I_{OS}$	PD = H, I2C= logic H			5	$\mu\text{A}$
Current Slew Rate	SR			3		mA/us
Output Constant Current Settling Time	$t_s$	$V_{DD} = 2.8\text{V}, I_{SINK} = 100\text{mA}$		40	80	$\mu\text{s}$
Voltage Drop	$\Delta V$	$\Delta V = V_{SINK} - V_{AGND}$ (@ $I_{SINK} = 80\text{ mA}$ )	-	0.32	0.35	V

## Block Diagram

(DFN10)



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## Terminology

### Resolution

The DAC resolution is defined by the number of distinct analog levels corresponding to the number of bits it uses.

N-bit resolution ->  $2^N$  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.

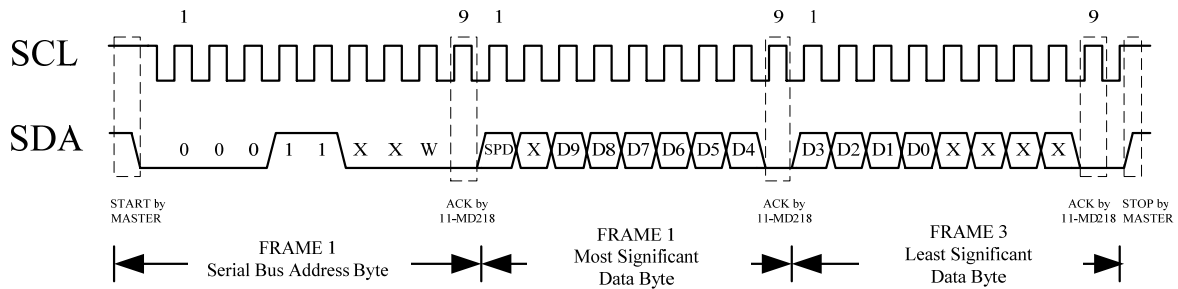
### Integral Nonlinearity (INL)

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

## Data Format

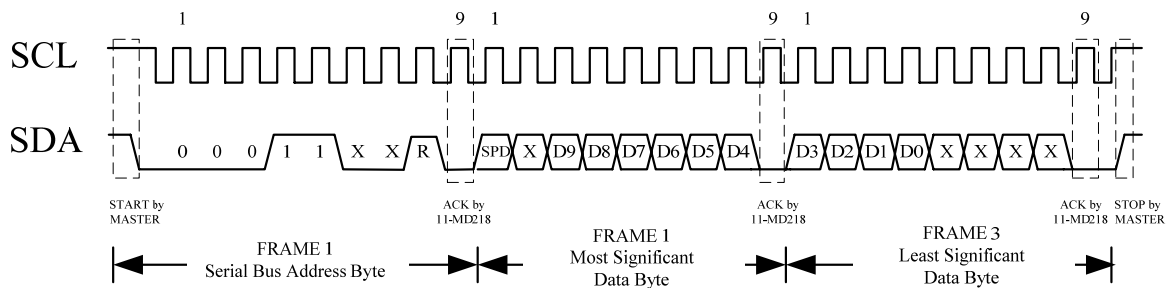
### 11-MD218A Write Mode

When in the write mode, data is written to the 11-MD218A and shifted step-by-step into the 16-bit input register. When all data has been loaded in and master signal receives a STOP condition, the loaded data in the input register is transferred to the DAC.



### 11-MD218A Read Mode

When 11-MD218A is in the write mode, data is read back from IC to master in the same bit order.





**Table**

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

- SPD (Soft Power Down, 2<sup>nd</sup> standby mode): IC power down controlled by software.

Regarding to all kinds of IC operation situations please refers to following table.

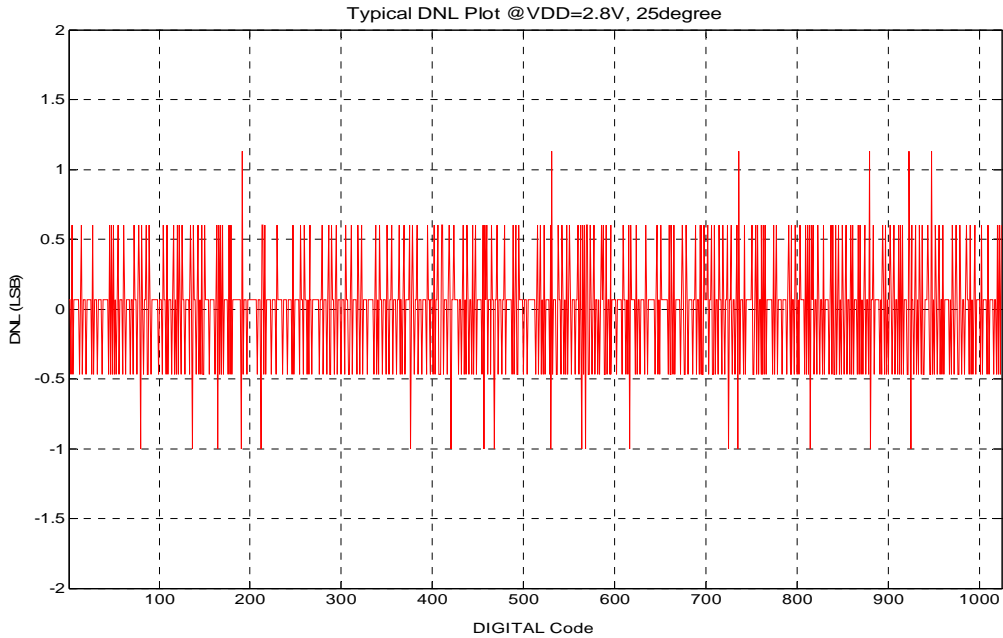
PD	SPD	IC status
H	-	Power down
L	L	IC Active
	H	Soft power down

- X denotes “Don’t care/Unused”.

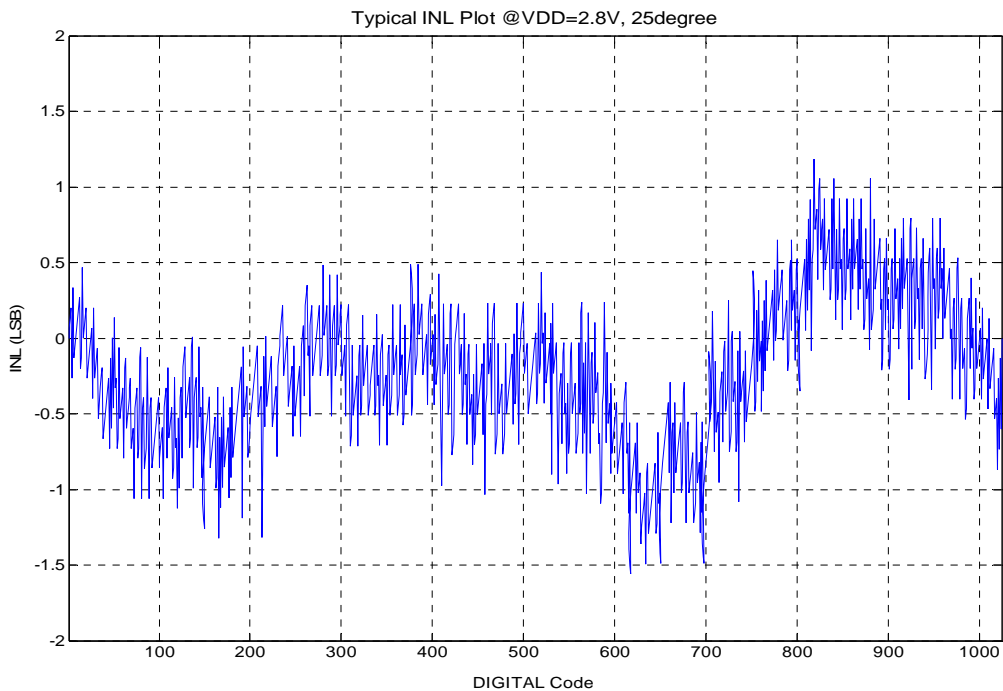


## Performance Characteristics

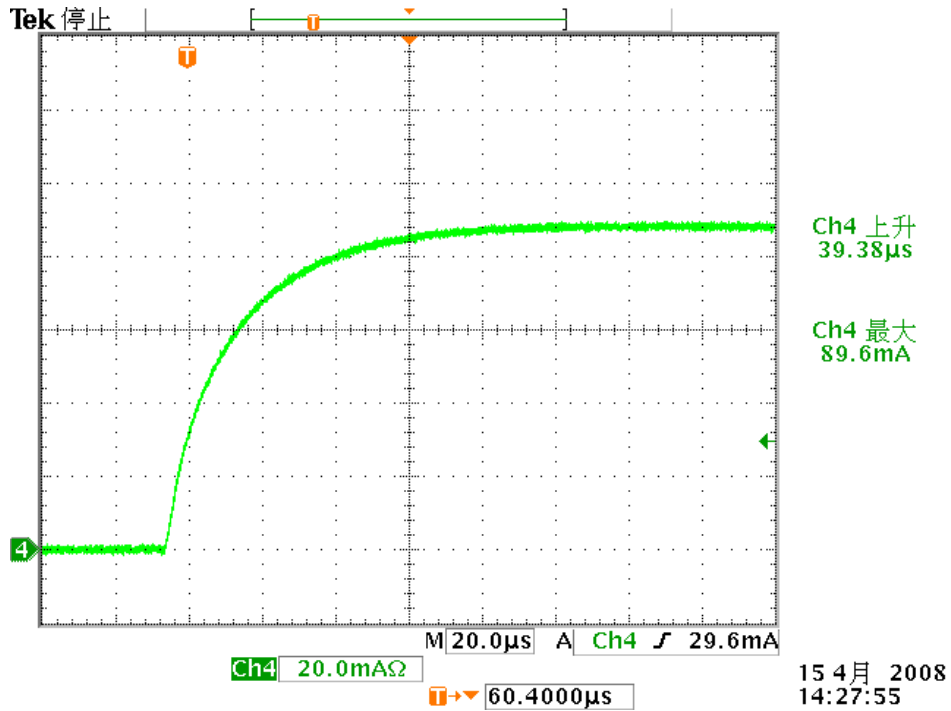
### 1. DNL Plot



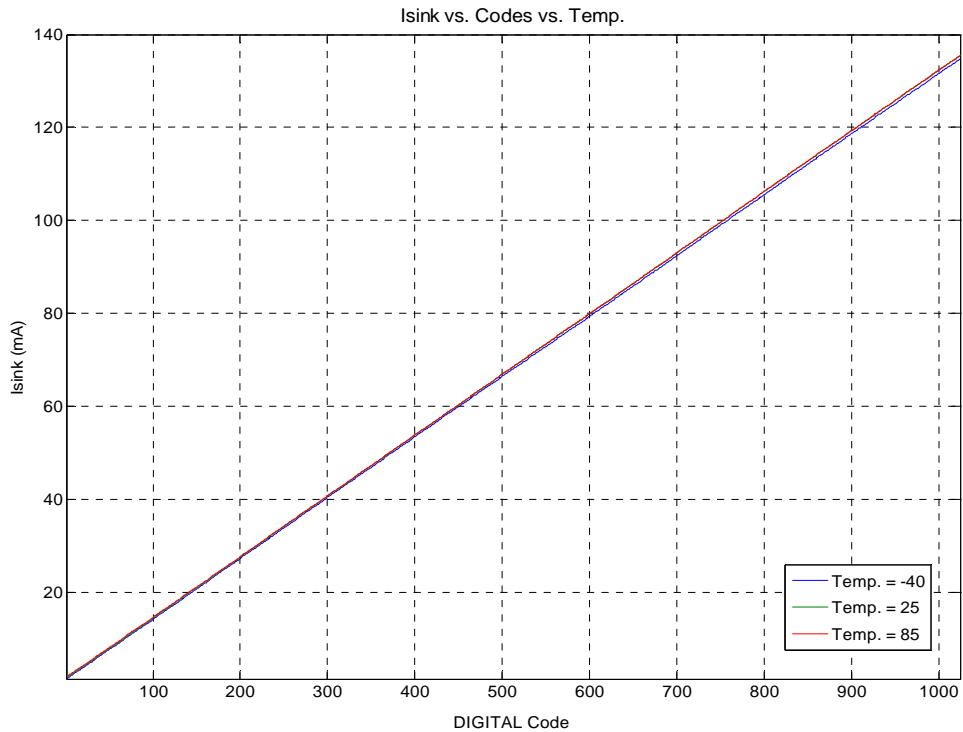
### 2. INL Plot



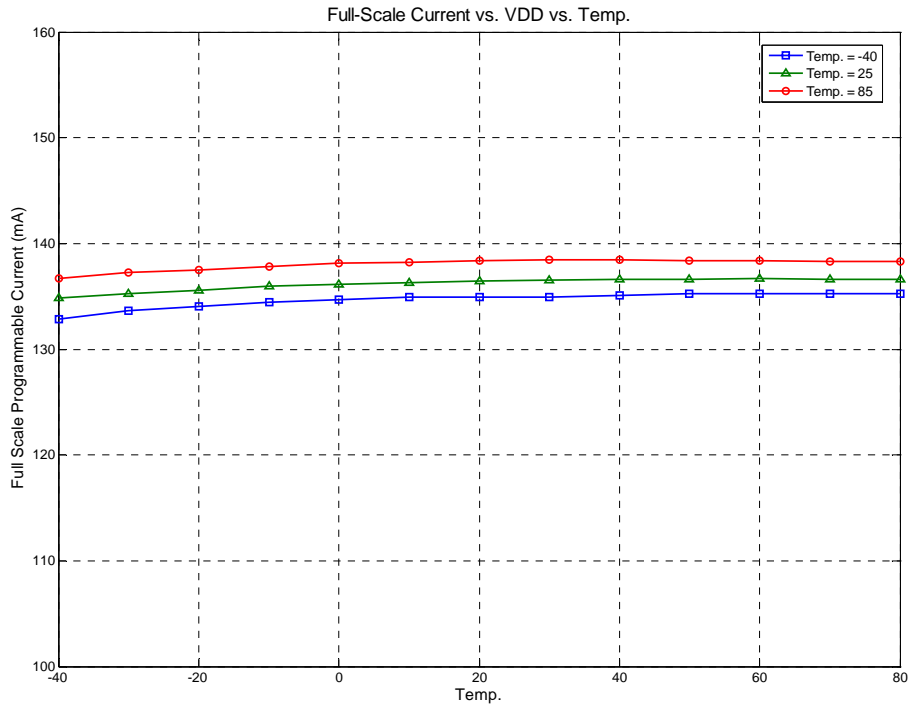
3. Settling Time (VDD = 2.8V, VCM = 270 $\Omega$  with 430 $\mu$ H@500Hz, 550 $\mu$ H@1kHz, respectively, C<sub>L</sub> = 0.1 $\mu$ F @Temp. = 25)



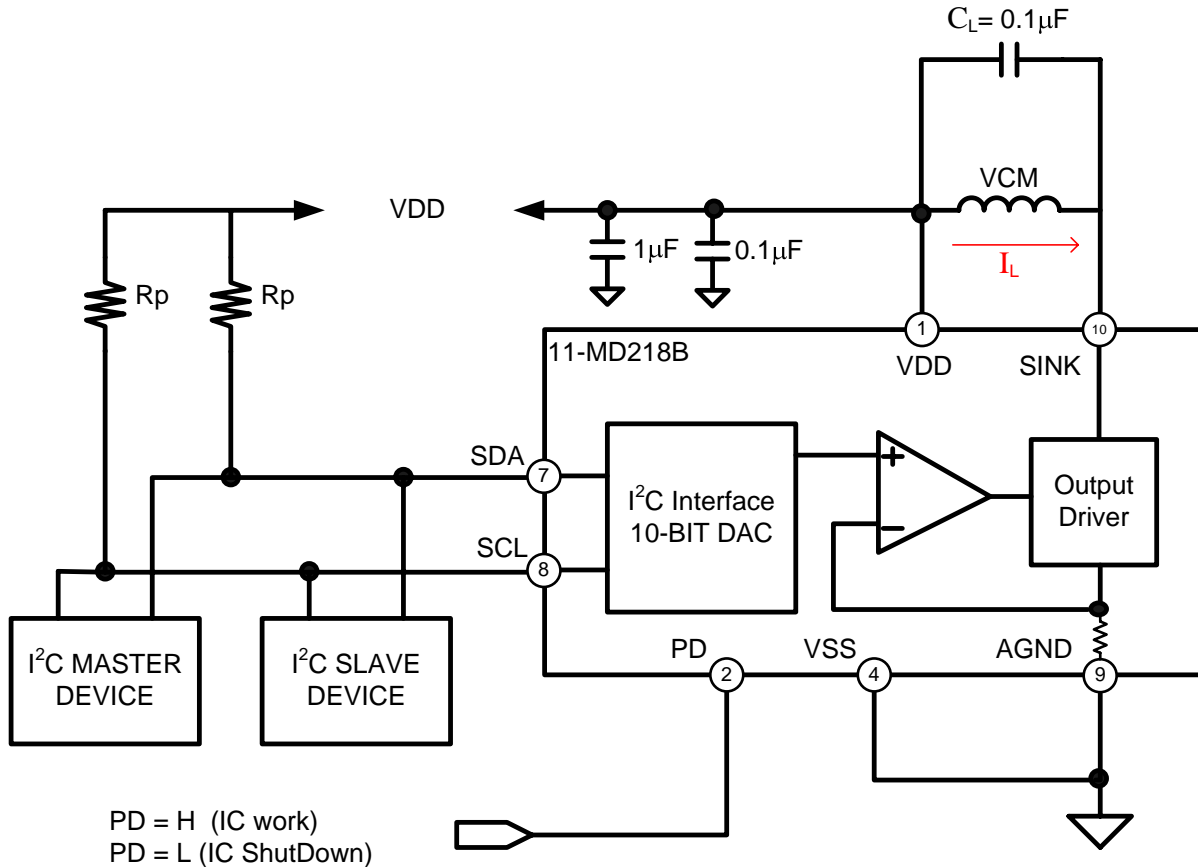
4. Sink Current vs. Codes vs. Temp.



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



## Application Circuit



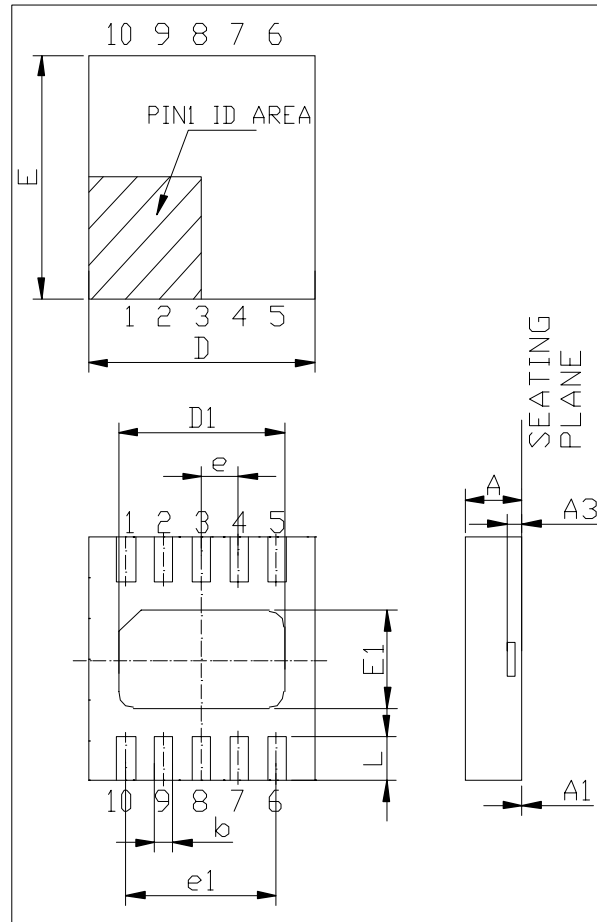
## Application Notes

- The 11-MD218A is a constant current control IC for application in Auto-Focus. The supply voltage range VDD of 11-MD218A 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 "H" is from  $0.55 \cdot VDD$  to  $VDD + 0.4V$  and logic "L" is from  $-0.4V$  to  $0.2 \cdot VDD$ . Therefore, the three digital pins are suitable controlled by 1.8V ISP.
- The PD pin is the power down pin of 11-MD218A. Logic low level (PD = H) is for IC operation. On the other hand, its logic high level (PD = L) puts the chip into power down mode for power saving. It is recommended to keep PD at high level (PD = L) before operation to reach the maximum efficiency of power saving, especially for applications in portable devices.



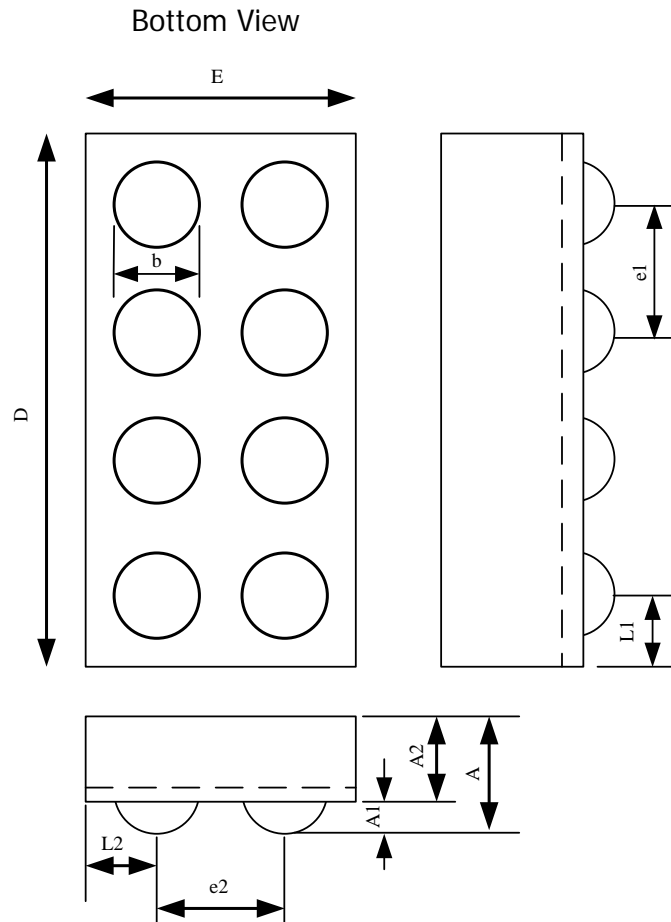
- The I2C bus would not be well controlled by master if VDD of Driver IC is shutdown(i.e., not applying voltage on VDD pin) because of ESD diode turning on via P-diode of SDA/or SCL. To avoid the application issue, **NOT** to turn off VDD of driver IC during whole module operation. It could be controlled by PD pin via GPIO of ISP. The power consumption of Driver IC should be 1.4uW in the standby mode (PD = L).
- 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 0.1~0.22uF 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



The products listed herein are designed for ordinary electronic applications, such as electrical appliances, audio-visual equipment, communications devices and so on. Hence, it is advisable that the devices should not be used in medical instruments, surgical implants, aerospace machinery, nuclear power control systems, disaster/crime-prevention equipment and the like. Misusing those products may directly or indirectly endanger human life, or cause injury and property loss.

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