

# 11-MD152

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## Multi-Channels Motor Driver For DSC



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## 11-MD152

### Multi-Channels Motor Driver For DSC

#### General Specifications

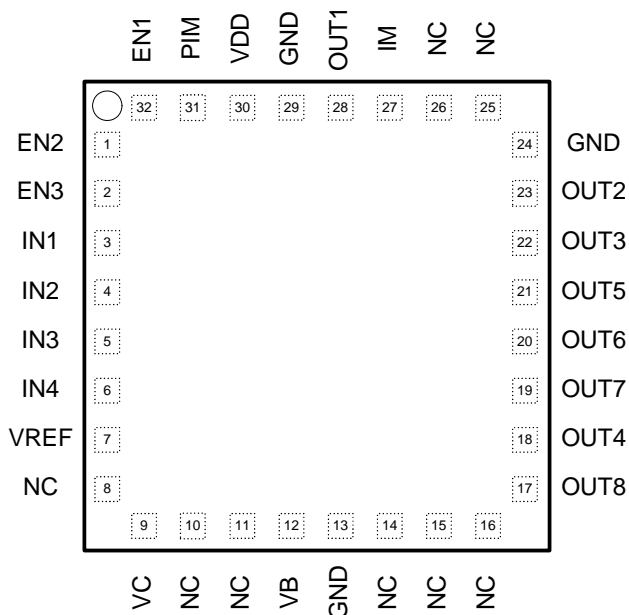
The 11-MD152 is all in one actuator driver for Digital Still Camera. It contains constant current control for M-shutter and constant voltage control for zoom DC motor. It has multiple channels, which can apply to DSC or DV zooming Lens.

#### Features and Benefits

- Low voltage operation ( $V_{DD\ Min} = V_{B\ Min} = 2.7V$ )
- Low saturation voltage (Upper transistor + lower transistor residual voltage 0.25V typically at 200mA,  $V_{DD} = V_B = 3V$ )
- Low input current
- Constant current control and constant voltage control
- Zero standby current
- Reference Voltage inside ( $V_{ref}=1.23V$ )
- Thermal shutdown protection
- Thin, highly reliable package: QFN-32(4.75mmX4.75mm) ,SSOP24 and TSSOP-24

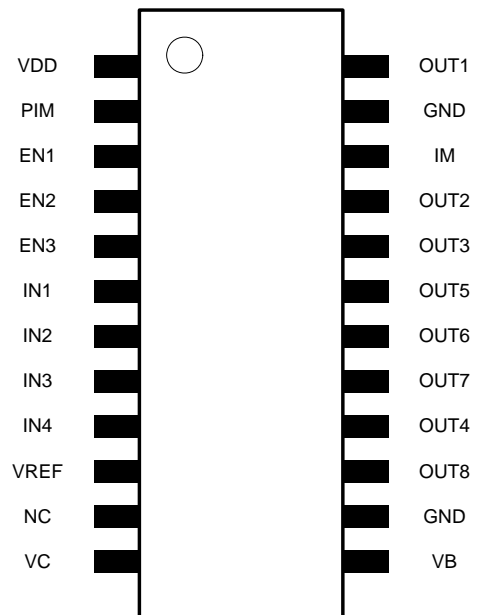
#### Pin Assignment

##### Pin Assignment of QFN-32



##### Pin Assignment of SSOP-24

##### Pin Assignment of TSSOP-24



## Pin Descriptions of QFN-32

Pin NO.	Pin Name	Description	Pin NO.	Pin Name	Description
1	EN2	Mode Selected Input pin	17	OUT8	Constant voltage Output pin
2	EN3	Mode Selected Input pin	18	OUT4	Constant voltage Output pin
3	IN1	Motor control input pin	19	OUT7	Motor output pin
4	IN2	Motor control input pin	20	OUT6	Motor output pin
5	IN3	Motor control input pin	21	OUT5	Motor output pin
6	IN4	Motor control input pin	22	OUT3	Motor output pin
7	VREF	Reference voltage output pin	23	OUT2	Motor output pin
8	NC		24	GND	Controller and driver ground
9	VC	Voltage adjust control	25	NC	
10	NC		26	NC	
11	NC		27	IM	Current sense resistor
12	VB	Power supply pin for motor driver	28	OUT1	Motor output pin
13	GND	Motor driver ground	29	GND	Controller and driver ground
14	NC		30	VDD	Power supply pin for controller.
15	NC		31	PIM	Current sense resistor
16	NC		32	EN1	Mode Selected Input pin

## Pin Descriptions of SSOP24 and TSSOP-24

Pin NO.	Pin Name	Description	Pin NO.	Pin Name	Description
1	VDD	Power supply pin for controller.	13	VB	Power supply pin for motor driver
2	PIM	Current sense resistor	14	GND	Driver ground
3	EN1	Mode selected Input pin	15	OUT8	Constant voltage output pin
4	EN2	Mode selected Input pin	16	OUT4	Constant voltage output pin
5	EN3	Mode selected Input pin	17	OUT7	Motor output pin
6	IN1	Motor control input pin	18	OUT6	Motor output pin
7	IN2	Motor control input pin	19	OUT5	Motor output pin
8	IN3	Motor control input pin	20	OUT3	Motor output pin
9	IN4	Motor control input pin	21	OUT2	Motor output pin
10	VREF	Reference voltage output pin	22	IM	Current sense resistor
11	NC		23	GND	Controller and driver ground
12	VC	Voltage adjust control	24	OUT1	Motor output pin

## Absolute Maximum Ratings ( Unless otherwise noted, $T_A = 25^\circ\text{C}$ )

Characteristic	Symbol	Rating	Unit
Supply Voltage	$V_{DD}$	5.5	V
	$V_B$	5.5	V
Input Voltage	$V_{IN}$	$V_{DD}+0.4$	V
$I_O$ Peak Current	$I_{OPeak}$	1.5	A
$I_{ODC}$ Current	$I_{ODC}$	550	mA
Power Dissipation	$P_D$	800	mW
Operating Temperature Range	$T_{OPR}$	-40 ~ 125	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 ~ 150	$^\circ\text{C}$

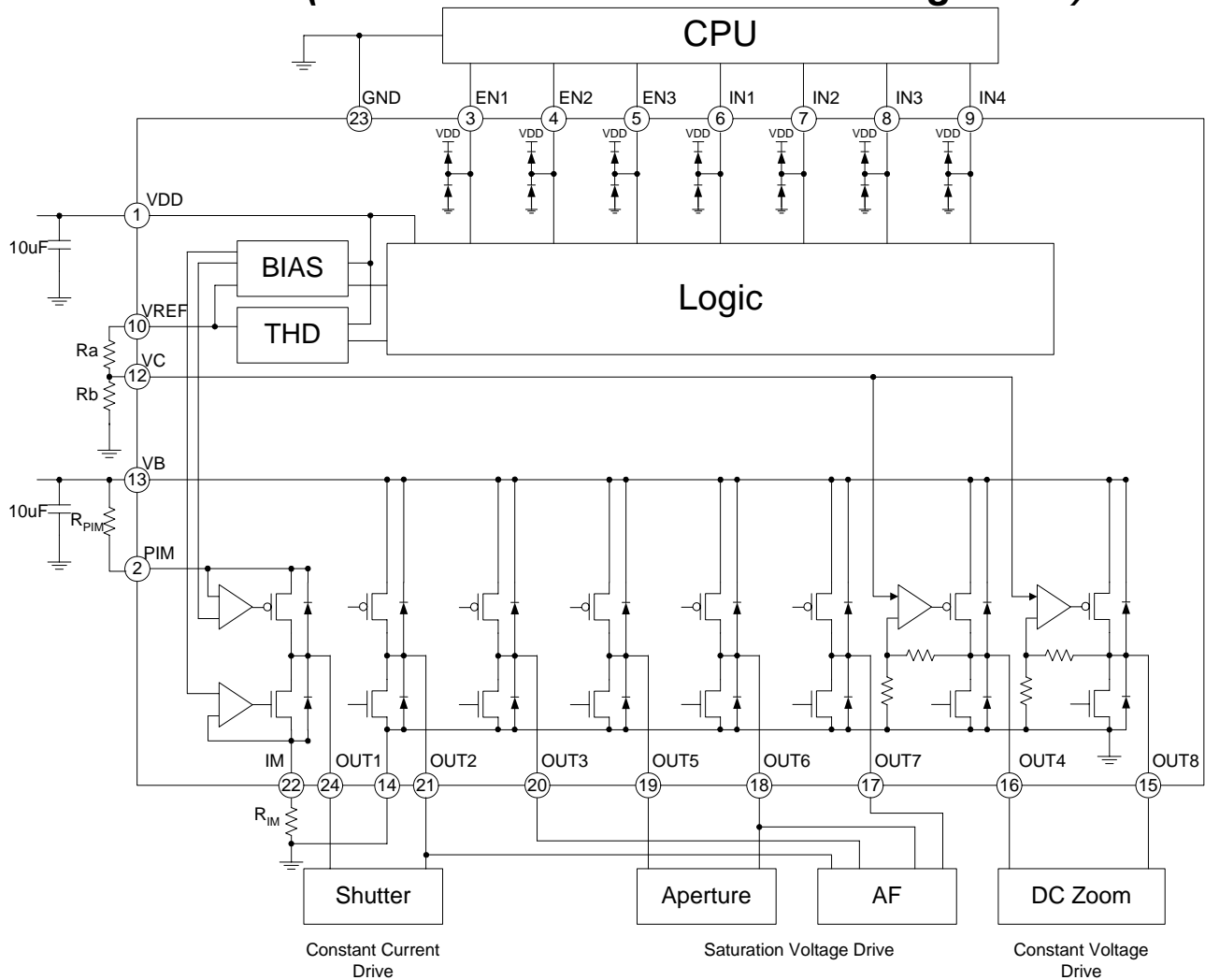
## Electrical Characteristic

( Unless otherwise noted,  $T_A = 25^\circ\text{C}$  ,  $V_{DD} = V_B = 3\text{V}$  )

Characteristic	Sym.	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	$V_{DD}$		2.7	3	5.5	V
	$V_B$		2.7	3	5.5	V
Supply Current ( $I_{DD}$ )	$I_{STB}$	$V_{EN1-EN3}=L; V_{IN1-IN4}=L$		0.1	5	$\mu\text{A}$
	$I_{DD1}$	$V_{EN1-EN3}=HHL$		1	1.5	mA
	$I_{DD2}$	$V_{EN1-EN3}=HLL$		1	1.5	mA
	$I_{DD3}$	$V_{EN1-EN3}=LLH$		1.2	2	mA
Reference Voltage Circuit						
Reference Voltage	$V_{ref}$	$V_{DD} = 3\text{V}; I_{ref} = -1\text{mA}$	1.19	1.23	1.27	V
EN1~3 / IN1~4 Input Terminal ( $T_J = 25^\circ\text{C}$ )						
Input Voltage "H"	$V_{IH}$	-	$0.8 \cdot V_{DD}$	-	$V_{DD}+0.4$	V
Input Voltage "L"	$V_{IL}$	-	-0.4	-	$0.2 \cdot V_{DD}$	V
Input Current "H"	$I_{IH}$	$V_{IN} = V_{DD}$	-	-	$\pm 5$	$\mu\text{A}$
Input Current "L"	$I_{IL}$	$V_{IN} = 0\text{V}$	-	-	$\pm 5$	$\mu\text{A}$
AF Output Terminal (OUT2-3 , OUT6-7)						
Saturation Voltage (upper + lower)	$V_{SAT1}$	$I_{OUT} = 200\text{mA}$	-	0.25	0.4	V
AE Output Terminal (OUT5-6)						
Saturation Voltage (upper + lower)	$V_{SAT2}$	$I_{OUT} = 200\text{mA}$	-	0.25	0.4	V

SH Output Terminal (OUT1-2) $R_a + R_b = 10\text{ k}\Omega$						
Output Current1	$I_{O1}$	OUT2-> OUT1 $R_{IM} = 1\Omega$	260	285	310	mA
Output Current1	$I_{O2}$	OUT1-> OUT2 $R_{PIM} = 0.9\Omega$	260	290	325	mA
Saturation Voltage (upper + lower)	$V_{SAT3}$	$I_{OUT} = 200\text{ mA}$	-	0.25	0.4	V
ZOOM Output Terminal (OUT4-8)						
Output Voltage	$V_{OUT}$	$V_B = 3 \sim 4V$ $V_c = 1V$	2.86	2.99	3.12	V
Saturation Voltage (upper + lower)	$V_{SAT4}$	$I_{OUT} = 200\text{ mA}$	-	0.22	0.36	V
Thermal Protection Circuit						
Protection Temperature	$T_{TSD}$	$V_{EN1}$ or $V_{EN2}$ or $V_{EN3} = H$		160		$^{\circ}\text{C}$

### Function Block (SSOP24 and TSSOP-24 Pin Assignment)



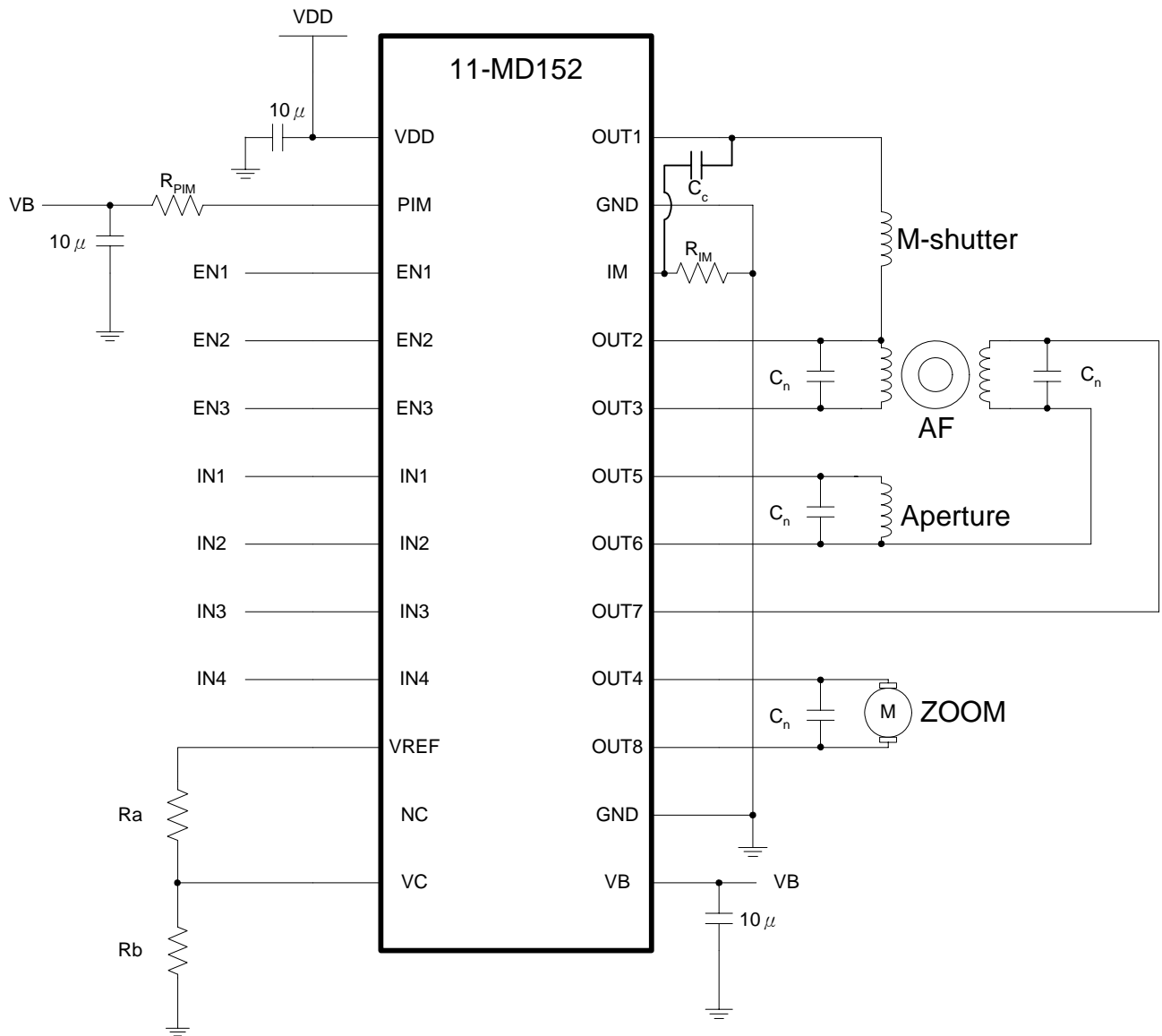
### Truth Table

INPUT							OUPUT								MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O1	O2	O3	O4	O5	O6	O7	O8	
L	L	L	—	—	—	—	—	—	—	—	—	—	—	—	STB
L	L	H	L	L			—	—	—	—			—	—	SH (VCM) & AE (VCM) or AE (STM)
			L	H			L	H	—	—			—	—	
			H	L			H	L	—	—			—	—	
			H	H			—	—	—	—			—	—	
				L	L	—	—	—	—	—	—				
				L	H	—	—	L	H	—	—				
				H	L	—	—	H	L	—	—				
	H	H	—	—	—	—	—	—	—	—	—	—	—		
L	H	H	L	L			—	—	—	—			—	—	AE (STM) or AE (VCM)
			L	H			—	—	L	H			—	—	
			H	L			—	—	H	L			—	—	
			H	H			—	—	—	—			—	—	
				L	L	—	—	—	—	—	—				
				L	H	—	—	L	H	—	—				
				H	L	—	—	H	L	—	—				
	H	H	—	—	—	—	—	—	—	—	—	—			
H	L	L	*	*	L	L	—	—	—	—	—	—	—	—	ZOOM (DCM)
			*	*	L	H	—	—	—	L	—	—	—	H	
			*	*	H	L	—	—	—	H	—	—	—	L	
			*	*	H	H	—	—	—	H	—	—	—	H	
H	H	L	L	L			—	—	—	—			—	—	AF (STM)
			L	H			—	L	H	—			—	—	
			H	L			—	H	L	—			—	—	
			H	H			—	—	—	—			—	—	
				L	L	—	—	—	—	—	—				
				L	H	—	—	L	H	—	—				
				H	L	—	—	H	L	—	—				
	H	H	—	—	—	—	—	—	—	—	—				
H	L	H	L	L			—	—	—	—			—	—	ZOOM (STM)
			L	H			—	—	L	H			—	—	
			H	L			—	—	H	L			—	—	
			H	H			—	—	—	—			—	—	
				L	L	—	—	—	—	—	—				
				L	H	—	—	—	—	L	H				
				H	L	—	—	—	—	H	L				
	H	H	—	—	—	—	—	—	—	—	—				

Note: “\*”: Don't care; “—”: High Impedance

## Application Circuit 1

- **AF:** Saturation drive for 2 phase, 1-2 phase stepping motor
- **M-shutter:** Constant current drive for shutter voice coil motor
- **Aperture:** Saturation drive for aperture voice coil motor
- **ZOOM:** Constant voltage drive for DC motor (forward/reverse/brake/standby)



## Truth Table For Application Circuit 1

### Constant current control for SH VCM

INPUT							OUPUT		MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O1	O2	
L	L	H	L	L	L	L	—	—	SH (VCM)
			L	H	L	L	L	H	
			H	L	L	L	H	L	
			H	H	L	L	—	—	

### Saturation control for AE VCM

INPUT							OUPUT		MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O5	O6	
L	H	H	L	L	L	L	—	—	AE (VCM)
			L	L	L	H	L	H	
			L	L	H	L	H	L	
			L	L	H	H	—	—	

### Constant voltage control for ZOOM DCM

INPUT							OUPUT		MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O4	O8	
H	L	L	*	*	L	L	—	—	ZOOM (DCM)
			*	*	L	H	L	H	
			*	*	H	L	H	L	
			*	*	H	H	H	H	

### Saturation control for 1-2 phase AF STM

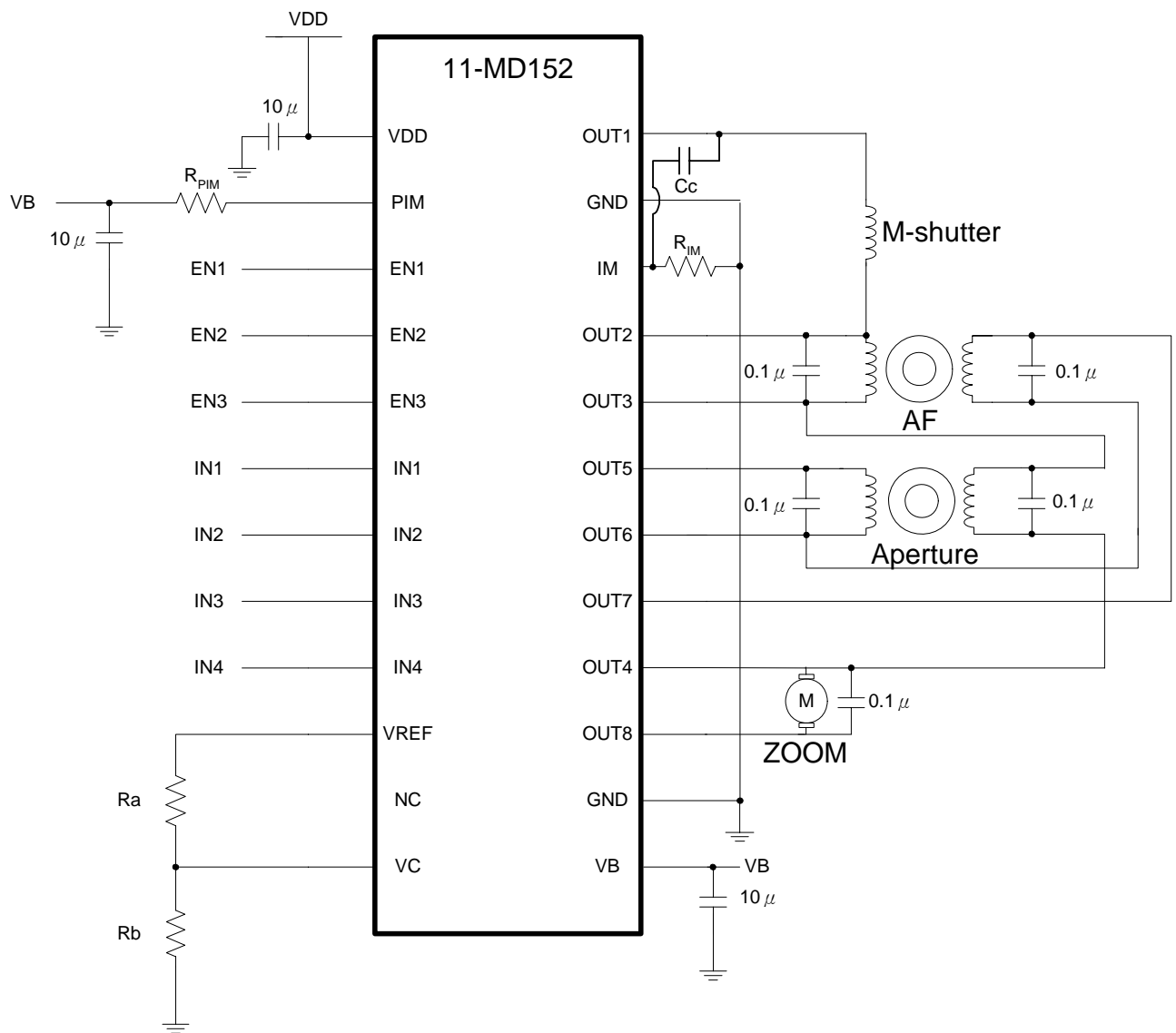
INPUT							OUPUT				MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O2	O3	O6	O7	
H	H	L	L	H	L	L	L	H	—	—	AF (STM)
			L	H	L	H	L	H	L	H	
			L	L	L	H	—	—	L	H	
			H	L	L	H	H	L	L	H	
			H	L	L	L	H	L	—	—	
			H	L	H	L	H	L	H	L	
			L	L	H	L	—	—	H	L	
			L	H	H	L	L	H	H	L	

Note: “\*” : Don't care; “—” : High Impedance



## Application Circuit 2

- **AF:** Saturation drive for 2 phase, 1-2 phase stepping motor
- **M-shutter:** Constant current drive for shutter voice coil motor
- **Aperture:** Saturation voltage drive for stepping motor
- **ZOOM:** Constant voltage drive for DC motor (forward/reverse/brake/standby)



## Truth Table For Application Circuit 2

### Constant current control for SH VCM

INPUT							OUPUT		MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O1	O2	
L	L	H	L	L	L	L	—	—	SH (VCM)
			L	H	L	L	L	H	
			H	L	L	L	H	L	
			H	H	L	L	—	—	

### Saturation voltage control for 2 phase AE STM

INPUT							OUPUT				MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O3	O4	O5	O6	
L	H	H	L	H	L	H	L	H	L	H	AE (STM)
			H	L	L	H	H	L	L	H	
			H	L	H	L	H	L	H	L	
			L	H	H	L	L	H	H	L	

### Constant voltage control for ZOOM DCM

INPUT							OUPUT		MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O4	O8	
H	L	L	*	*	L	L	—	—	ZOOM (DCM)
			*	*	L	H	L	H	
			*	*	H	L	H	L	
			*	*	H	H	H	H	

### Saturation control for 1-2 phase AF STM

INPUT							OUPUT				MODE
EN1	EN2	EN3	IN1	IN2	IN3	IN4	O2	O3	O6	O7	
H	H	L	L	H	L	L	L	H	—	—	AF (STM)
			L	H	L	H	L	H	L	H	
			L	L	L	H	—	—	L	H	
			H	L	L	H	H	L	L	H	
			H	L	L	L	H	L	—	—	
			H	L	H	L	H	L	H	L	
			L	L	H	L	—	—	H	L	
			L	H	H	L	L	H	H	L	

Note: “\*”: Don't care; “—”: High Impedance

## Application Notes

- The 11-MD152 integrates saturation voltage, constant voltage, and constant current of motor driver. The range of supply voltage of 11-MD152, VDD and VB, is from 2.7V to 5.5V. The 11-MD152 input range is defined that logic “H” is from  $0.8 \times VDD$  to  $VDD + 0.4V$  and logic “L” is from  $-0.4V$  to  $0.2 \times VDD$ . EN1, EN2 and EN3 are mode selection pins; IN1, IN2, IN3 and IN4 are motor rotation selection pins.
- Normally VB should provide enough current for output loading, thus large value of C is suggested for the terminal VB. Besides,  $0.01\mu F \sim 0.1\mu F$  of capacitors,  $C_n$ , are also suggested between each output channel and output channel to ground.
- VC provides the reference of output level at OUT4 and OUT8. If  $3 \times VC < VB$ , OUT4/OUT8 gets 3 times of VC at logic “H”. And if  $3 \times VC > VB$ , OUT4/OUT8 is saturated at logic “H”.
- Constant current operation of 11-MD152 provides the current, which can be approximated by the following formula (See the depiction of application circuit 1 & 2.  $R_a + R_b$  is the resistance connected from Vref to ground):

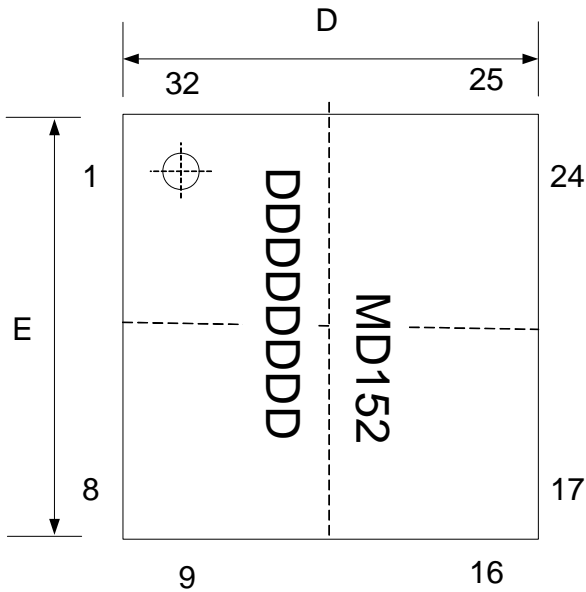
$$I_{PIM} = \frac{2900}{(R_{PIM} + 0.1)(R_a + R_b)} \quad (\text{unit : A})$$

$$I_{IM} = \frac{3150}{(R_{IM} + 0.1)(R_a + R_b)} \quad (\text{unit : A})$$

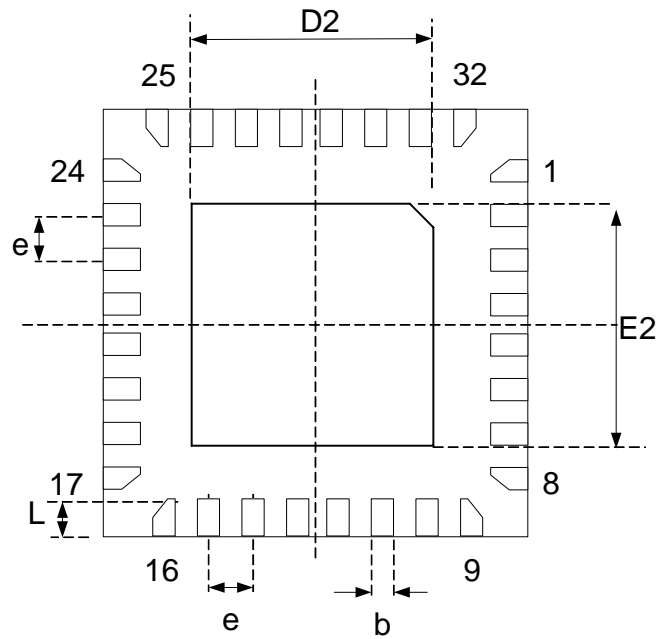
- Before switching the mode of actuator, make sure to pull low the motor rotation selection pins. Then, switch to next mode to drive the motor.
- Considering of stability of function of constant current, compensation capacitor of  $C_c$  ( $0.1 \sim 1\mu F$ ) is suggested to connect between pin OUT1 and IM.

## Package Specifications (QFN-32)

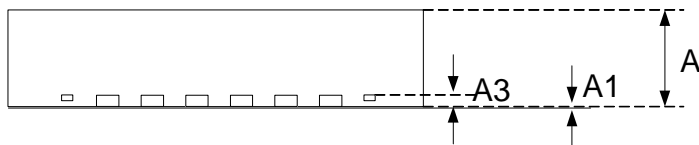
TOP VIEW



BOTTOM VIEW

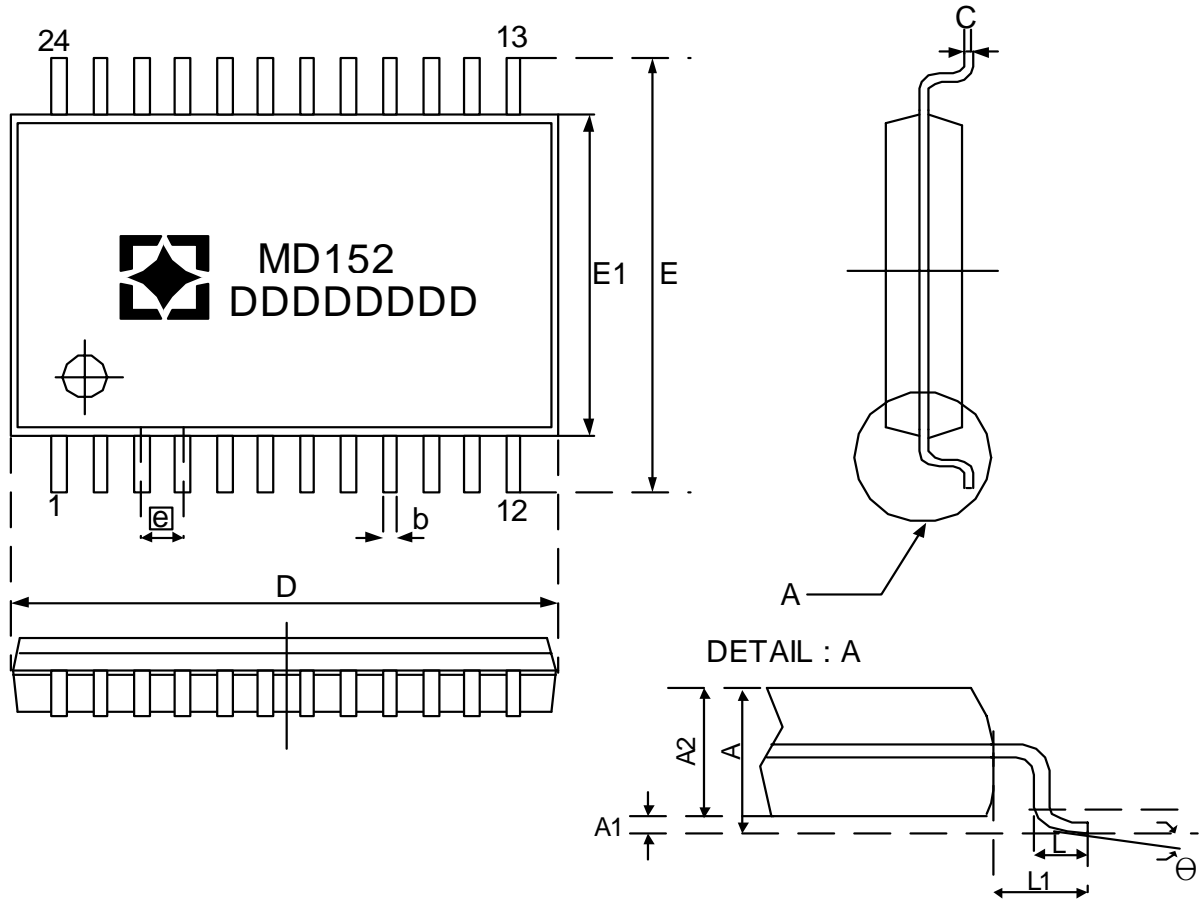


Note: "DDDDDDDD" are the date code or lot number and may be changed.



SYMBOL	Dimensions in Millimeter		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
A3	0.20 REF		
b	0.18	0.25	0.30
D	5.00 BSC		
D2	1.25	2.75	3.25
E	5.00 BSC		
E2	1.25	2.70	3.25
L	0.30	0.40	0.50
e	0.50 BSC		

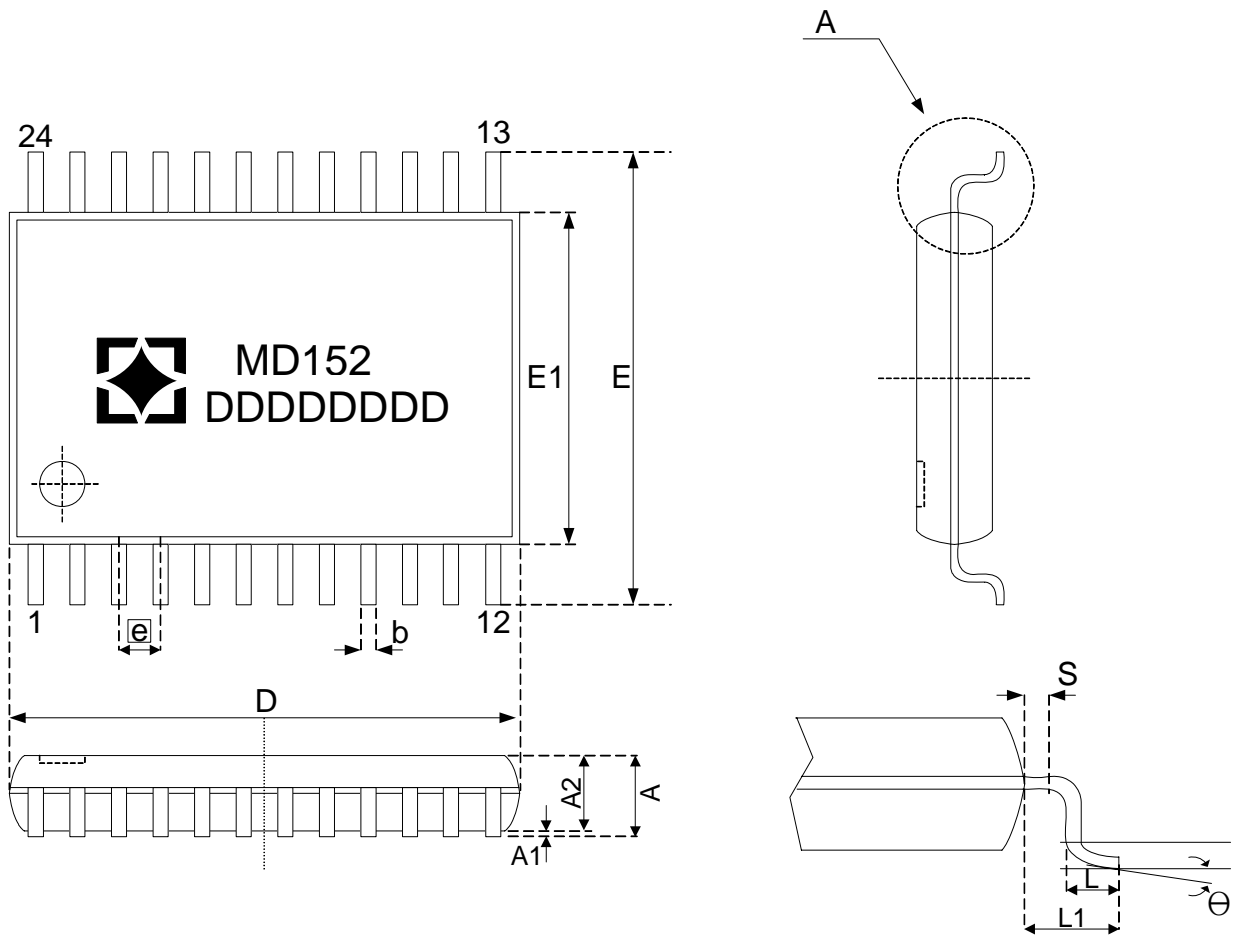
## Package Specifications (SSOP-24)



Note: "DDDDDDDD" are the date code or lot number and may be changed.

SYMBOL	Dimensions in Millimeter		
	MIN	NOM	MAX
A	1.35	1.63	1.75
A <sub>1</sub>	0.10	0.15	0.25
A <sub>2</sub>	—	—	1.50
D	8.50	8.60	8.70
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
b	0.20	—	0.30
C	0.18	—	0.25
e	0.64 BASIC		
L	0.41	0.64	1.27
L1	1.00REF		
$\theta$	0°	—	8°

## Package Specifications (TSSOP-24)



Note: "DDDDDDDD" are the date code or lot number and may be changed.

SYMBOL	Dimensions in Millimeter		
	MIN	NOM	MAX
A	—	—	1.20
A <sub>1</sub>	0.00	—	0.15
A <sub>2</sub>	0.80	1.00	1.05
B	0.19	—	0.30
e	0.65 BASIC		
D	7.70	7.80	7.90
E	6.4 BASIC		
E1	4.30	4.40	4.50
L	0.45	0.60	0.75
S	0.20	—	—
L1	1.00REF		
$\theta$	0°	—	8°

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