

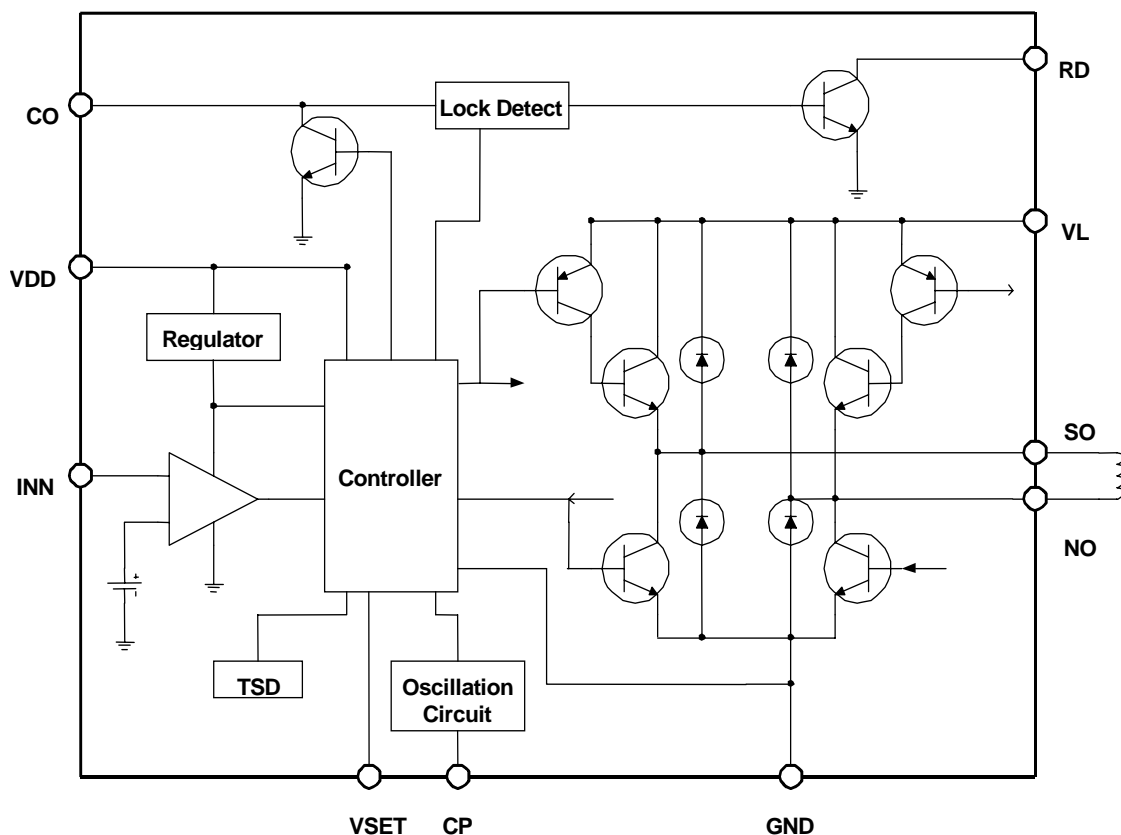
General Description

- The FD128 series is a direct PWM drive IC with single-phase and bipolar drive. The IC is suitable for variable speed control Fan of PC.

Features

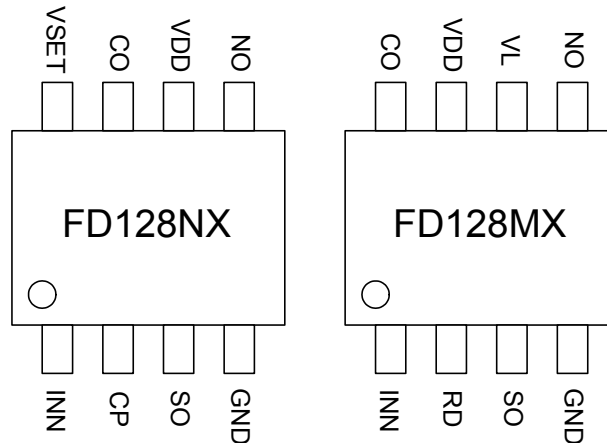
- Single-phase coil driver, applied to fan or motor.
- Lock function built-in and a lock detect output signal (RD).
- Thermistor or PWM modes are available for speed control.
- An external capacitor (CO) is necessary for lock function.
- An external capacitor (CP = 47pf) for internal 25KHz saw-tooth wave
- Thermal Shutdown built-in.
- Hall IC input (INN) can use as rotation output (FG)
- Internal minimum speed

Function Block Diagram



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Pin Assignment



Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply Voltage	VCCmax		20	V
Output Current	IOUTmax		1.0	A
Output Supply Voltage	VOUTmax		20	V
VSET input Range	VSETmax	Vcc-1.0V	19	V
RD output supply voltage	VRD		20	V
RD output current	IRDmax		20	mA
Maximum power dissipation	Pdmax	For exposed pad	2.4	W
Output continuous current	I _{con}		500	mA
Output lock current	I _{ck}		900	mA
Output Peak current	I _{Peak}	<100us	1000	mA
Thermal shutdown protect	T _{sd}	Chip inner thermal	>150	°C
Operating Temperature	T _{opr}		-20 to 125	°C
Storage Temperature	T _{stg}		150	°C
Junction Temperature	T _J		150	°C
Thermal resistor	θ _{JC}		10.8	°C/W
Thermal resistor	θ _{JA}		54	°C/W

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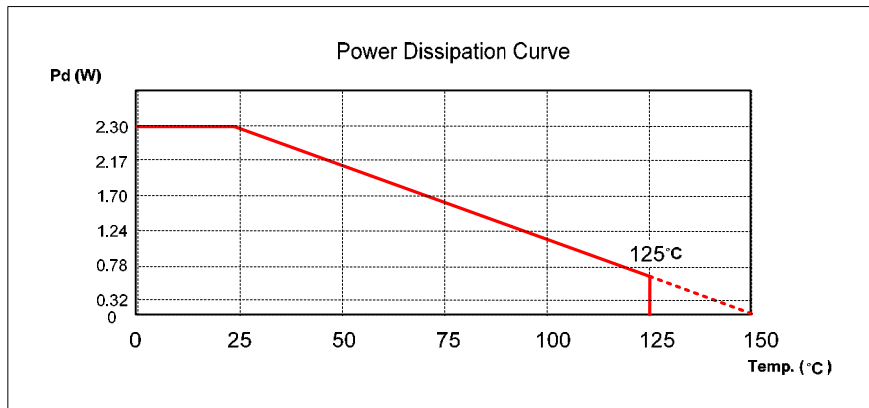
Recommended operating condition at Ta=25°C

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	VCC		4.5 to 20	V
VSET input range	VSET		0 to VCC-1.0	V
INN input Range	INN		0 to VCC	V

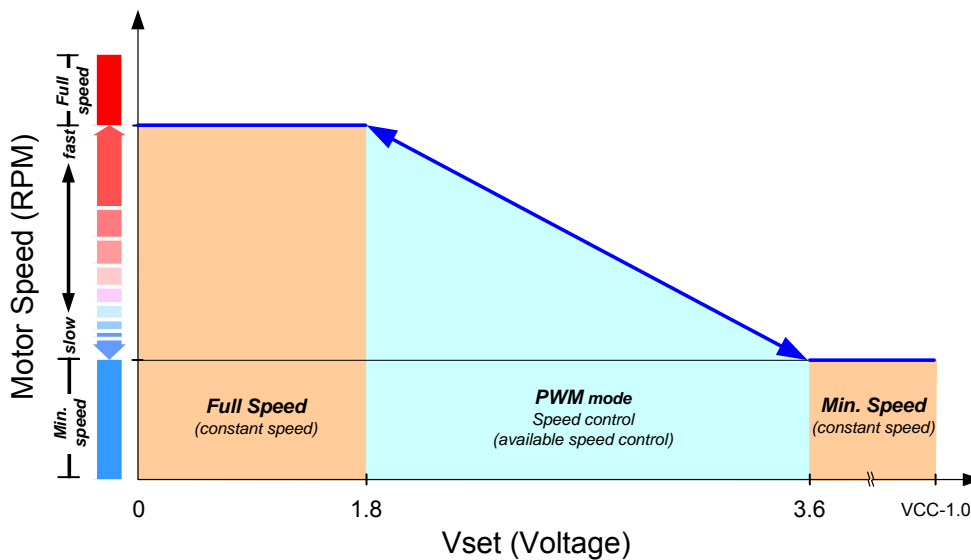
Electrical Characteristics at Ta=25 °C ; Vcc=12V

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Current	I _{CC1}	Rotation mode		20		mA
	I _{CC2}	Lock mode		12		mA
CO pin high level	V _{COH}			3.9		V
CO pin low level	V _{COL}			1.0		V
CO charge current I1	I _{COC1}	V _{CO} =0.5V		22		uA
CO charge current I2	I _{COC2}	V _{CO} =1.0V		35		uA
CO discharge current	I _{COD}	V _{CO} =4V		1.6		uA
CO lock voltage	V _{COK}			3.6		V
OFF/ON ratio	T _{off} /T _{on}			10		
Output lower side saturation voltage	V _{OL}	I _O =200mA		0.2		V
Output upper side saturation voltage	V _{OH}	I _O =200mA		0.9		V
RD pin low voltage	V _{RDL}	I _{RD} =5mA		0.2		V
RD pin leakage current	I _{RDL}	V _{RD} =12			10	uA
INN pin high voltage	IN _H		2.4			V
INN pin low voltage	IN _L				0.8	V
CP pin high level	V _{CPH}			3.9		V
CP pin low level	V _{CPL}			1.8		V
CP charge current	I _{CPOC}	V _{CO} =0.5V		8.3		uA
CP discharge current	I _{CPD}	V _{CO} =4V		8.3		uA
Start-up Voltage	V _{st}		3.5			V
Minimum Speed				15		%

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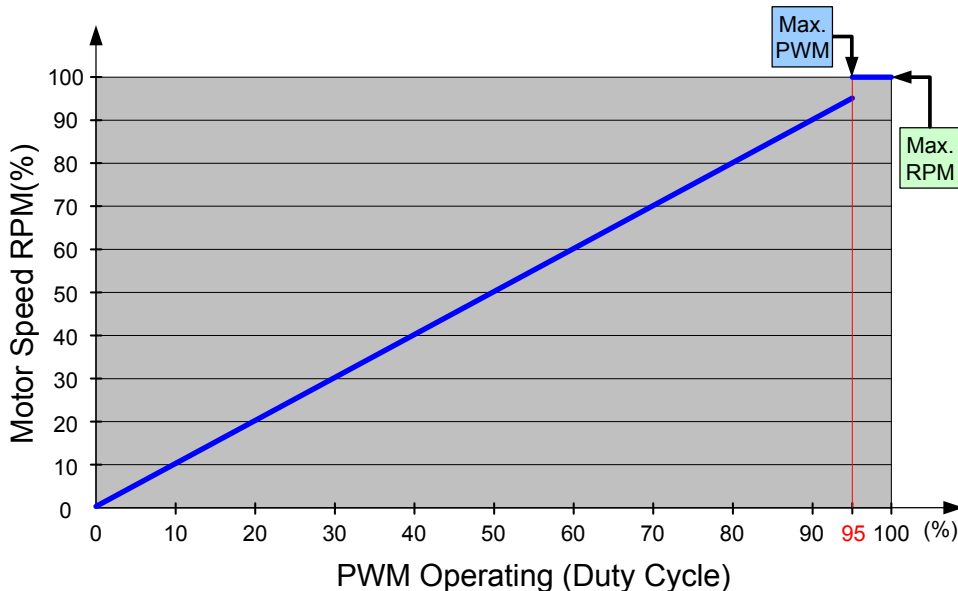


Vset voltage level vs. Motor speed(RPM)

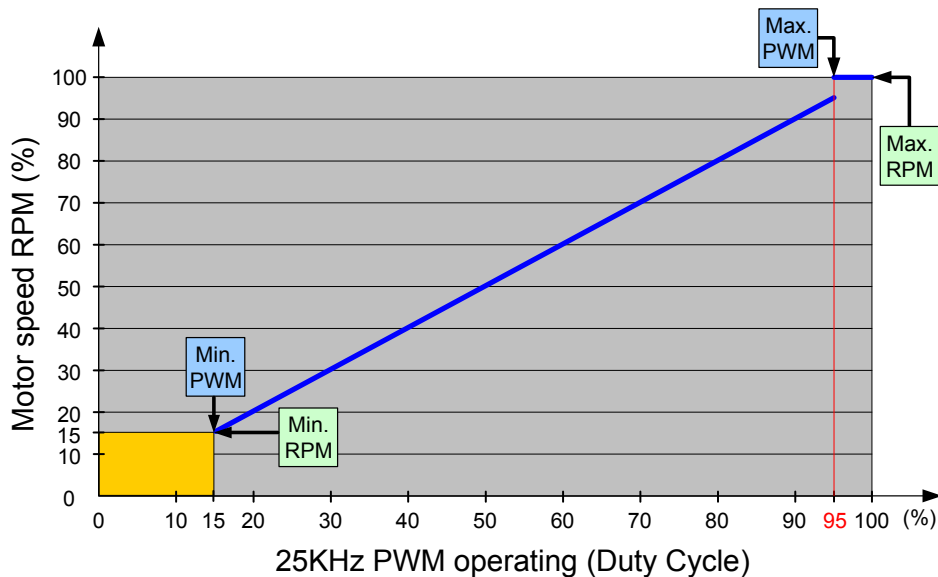


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Motor Speed vs. CP pin connect PWM signal operating Duty Cycle



Motor Speed vs. Vset pin connect PWM signal Operating Duty cycle



Two kinds use the outside PWM signal to control the difference of way of rotational speed of the fan to prove: :

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1. Input PWM signal by Vset pin

The slowest rotational speed is limited, it is unable to totally stop operating.

2. Input PWM signal by CP pin

The slowest rotational speed is not limited, can totally stop operating

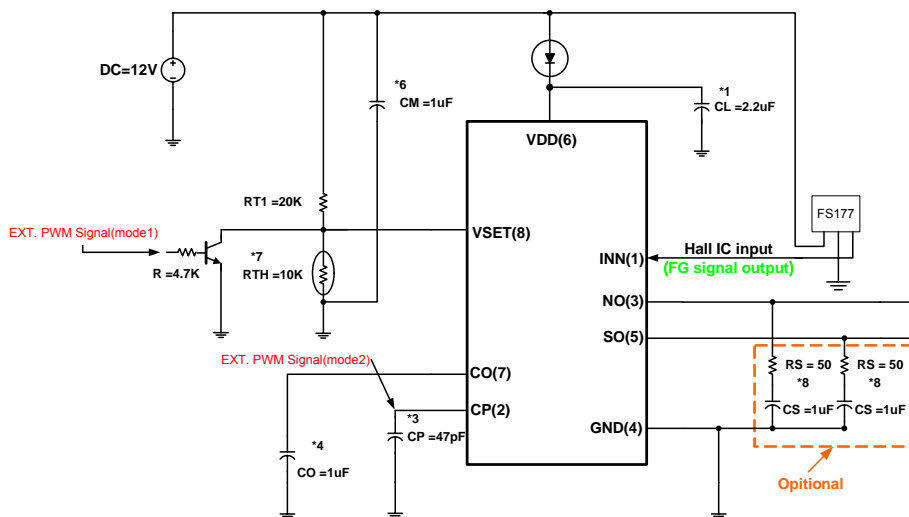
Note: Circuit of using that please watch the application circuits.

Truth Table

INN	CP	CO	NO	SO	FG	RD	Mode
H	H	Un-lock	L	H	OFF	L	Rotation
L			H	L	L	L	
H	L		L	OFF	OFF	L	Re-circulation
L			OFF	L	L	L	
H		Lock	OFF	H	OFF	OFF	Lock Protect
L			H	OFF	L	OFF	

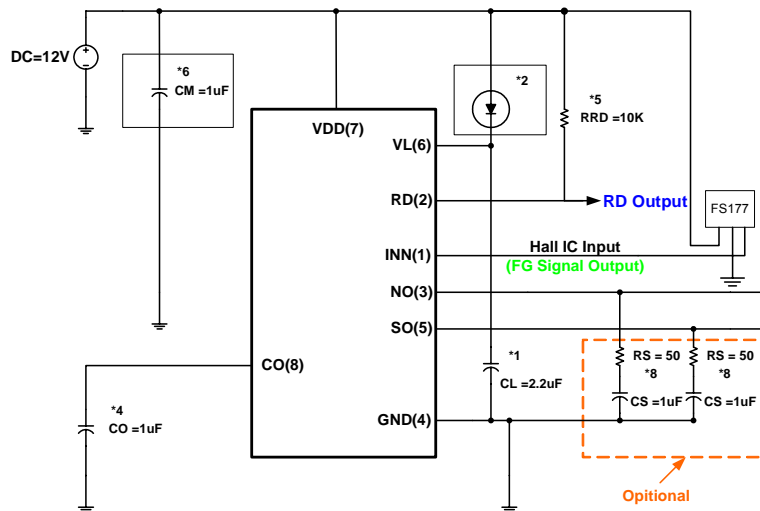
Note: CP-H = CP > VSET, CP-L = CP < VSET

Application Notes



FD128NX Application circuit

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FD128MX Application Circuit

***1 Recirculation Capacitance**

CL (2.2uF) capacitor is for PWM drive and kick back absorption, especially when the diode used.

***2 Thermal Dissipation Handle Diode**

To decrease the Output Transistor Voltage drop, then improve the thermal handle capability.

***3 PWM Oscillator frequency setting capacitor**

Setting the CP = 47pF to get the 25KHz PWM frequency.

***4 Lock shutdown time setting capacitor**

CO value decides the time of lock function to turn on or turn off drivers.

***5 Rotation Detect pull-up Resistor**

For RD open collector structure, low for rotation mode and high for lock mode.

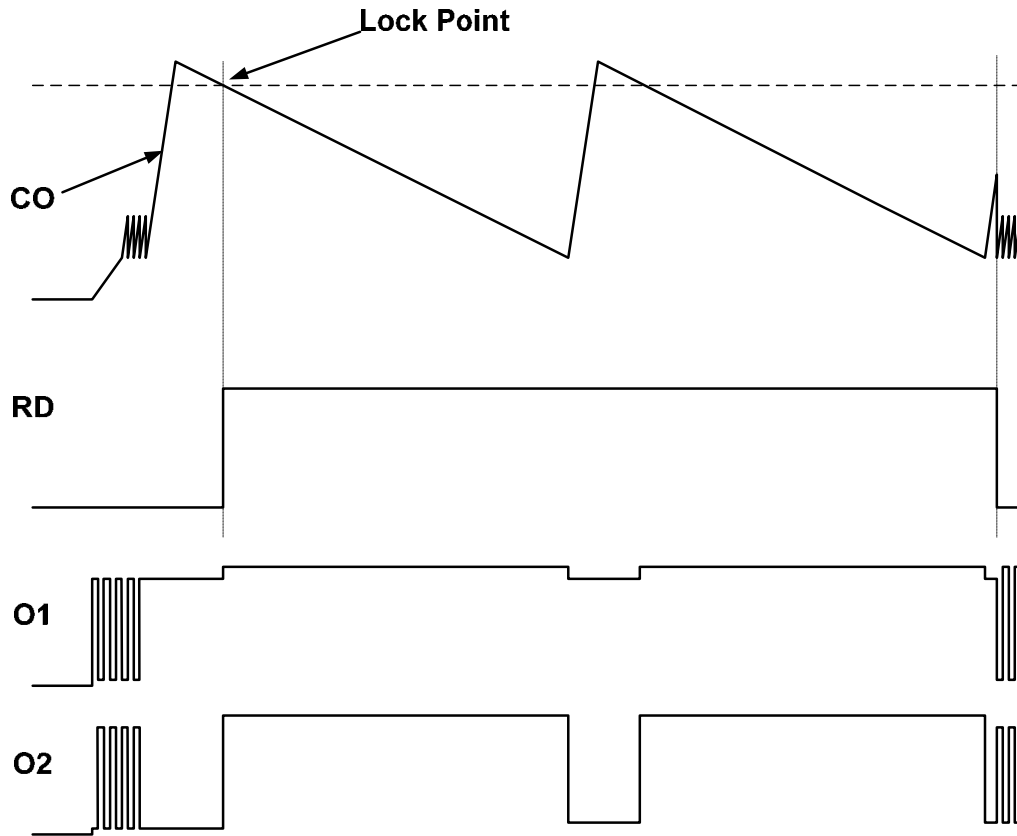
***6 VDD stability capacitor**

When the (*1,*2) does not exist, the CM capacitor replace the CL to absorption the VDD spike and work as the re-circulation capacitor.

***7 Thermistor Resistor**

For speed control runs at the PWM mode.

***8 Output overshoot hold RC**



Auto-Shutdown Timing

Function Description

I. Minimum Speed Mode

When VSET voltage larger than the voltage of the internal minimum speed setting voltage (V_{SL}). Then the fan would sustain about 15% duty ratio to make the fan working on lowest speed.

If the VSET is left open, then the fan also enters the minimum speed mode.

II. PWM Control mode(Vset pin connect DC voltage)

When VSET is between V_{SL} and V_{CPL} . Then the output would be turned on at $VSET < V(CP)$ and turned off at $VSET > V(CP)$. The CP frequency decided the Switch Period and the result of VSET compared to $V(CP)$ had the duty ratio.

III. Full Speed Mode

When VSET is lower than V_{CPL} , then the fan would enter the full speed mode.

IV. Thermistor Mode

The VSET pin can use the Thermistor to produce the thermal control of system, and saving the power around the room temperature.

V. External 25KHZ input control

The signal is suggested to send into CP. The result is similar as that VSET must be left open to use the V_{SL} . So, the input voltage must be over the V_{SL} to turn on drivers.

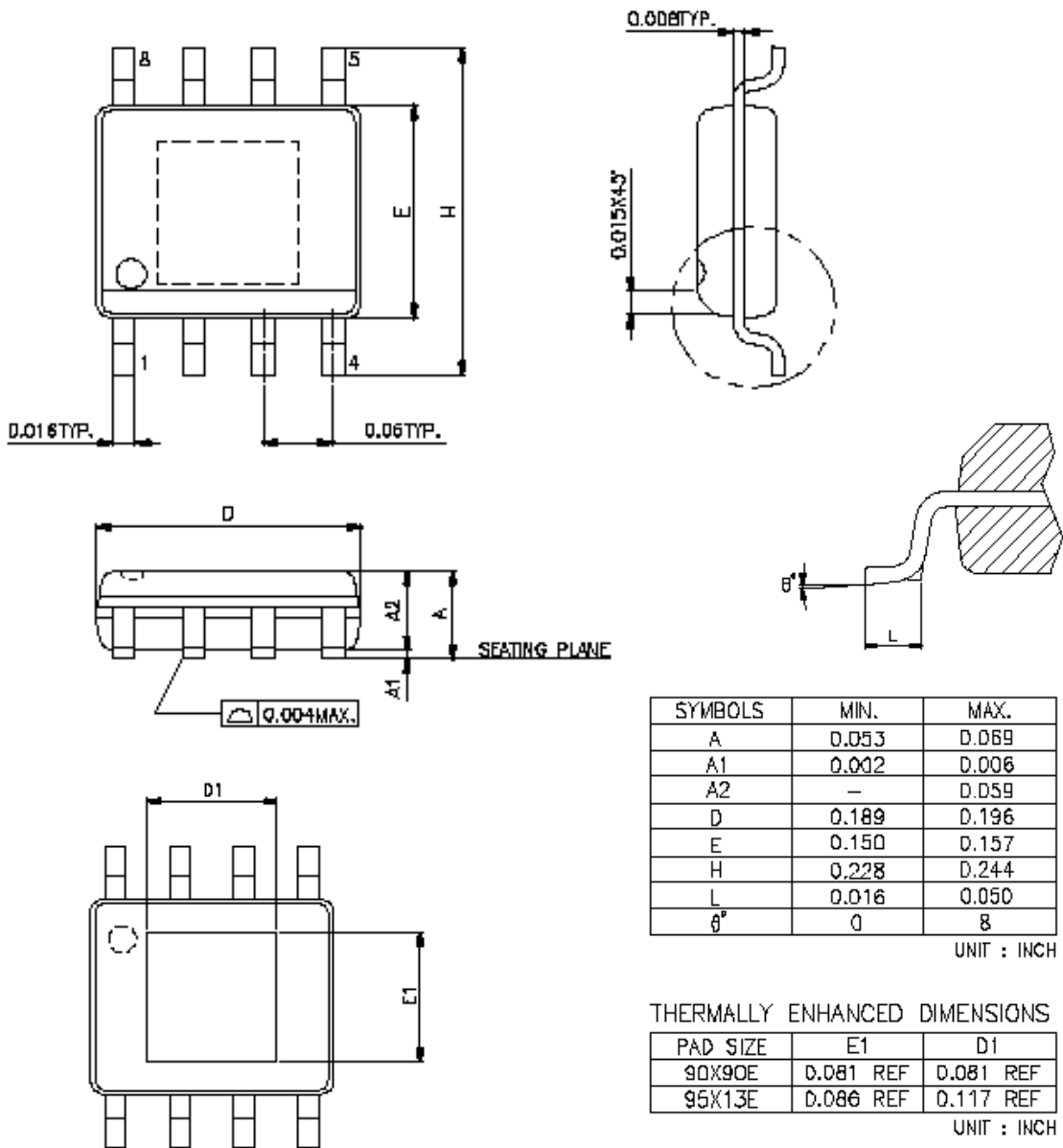
VI. Lock Mode

When the fan stop and the capacitor (CO) continue to be discharged until the V_{COK} point. Then the fan should enter the lock mode to turn off the low-side drivers. This action would save the power consumption and avoid the over-heating philosophy. It would be released until the V_{COL} point. The rotation detect signal (RD) would set to High at lock mode.

VII. Other

Package Outline

Sop8 : (exposed pad)



E.P. VERSION ONLY

P.S. Under Exposed pad, the PCB layout rather to be uncovered copper and connected to GND or Floating

- NOTES:
1. JEDEC OUTLINE : N/A
 2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.006in) PER SIDE.
 3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.010in) PER SIDE.

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ORDER INFORMATION

Part Number	Operating Temperature	Package
FD128MX-LF	-20 °C to +125 °C	SOP8(E.P)
FD128NX-LF	-20 °C to +125 °C	SOP8(E.P)

E.P.: exposed pad

Product Part Number Vs. Function Table

Part Number	Auto lock- shutdown restart	Thermal- shutdown restart	Rotation- detection (RD)	PWM
FD128MX-LF				
FD128NX-LF				

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