Datasheet



Description: F82A-12BL8304-31S
Fan diameter: ϕ305mm
Rated voltage: 13.6V DC

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2.Units and Acronyms

Unit		Physical Quantity	Prefix	Dimension	
%	percent	Proportionality	M	10^6	mega
Ω	Ohm	Electrical Resistance	k	10^3	kilo
℃	degree Celsius	Temperature	m	10^{-3}	Milli
A	Ampere	Current	µ	10^{-6}	micro
h	hours	Time	n	10^{-9}	nano
dBA	deciBel (A-weighting)	Sound pressure level	p	10^{-12}	pico
Hz	Hertz	Frequency			
min	minute	Time			
Pa	Pascal	Pressure			
rpm	Revolutions per minute	Rotation frequency			
s	second	Time			
V	Volt	Voltage			
W	Watt	Power			

Table 1: Units of measurements table

Key Word	Descriptions
CCU	Custom Control Unit
Drive	Motor with axially integrated electronics
PWM	Pulse Width Modulation
R_i	Input Resistance
SBL	Sealed brushless
T	Temperature
T_{AMB}	Ambient Temperature
U_B	Supply voltage
U_n	Nominal supply Voltage
rms	root mean square

Table 2: Acronyms table

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3.General

Fan diameter：ϕ305mm

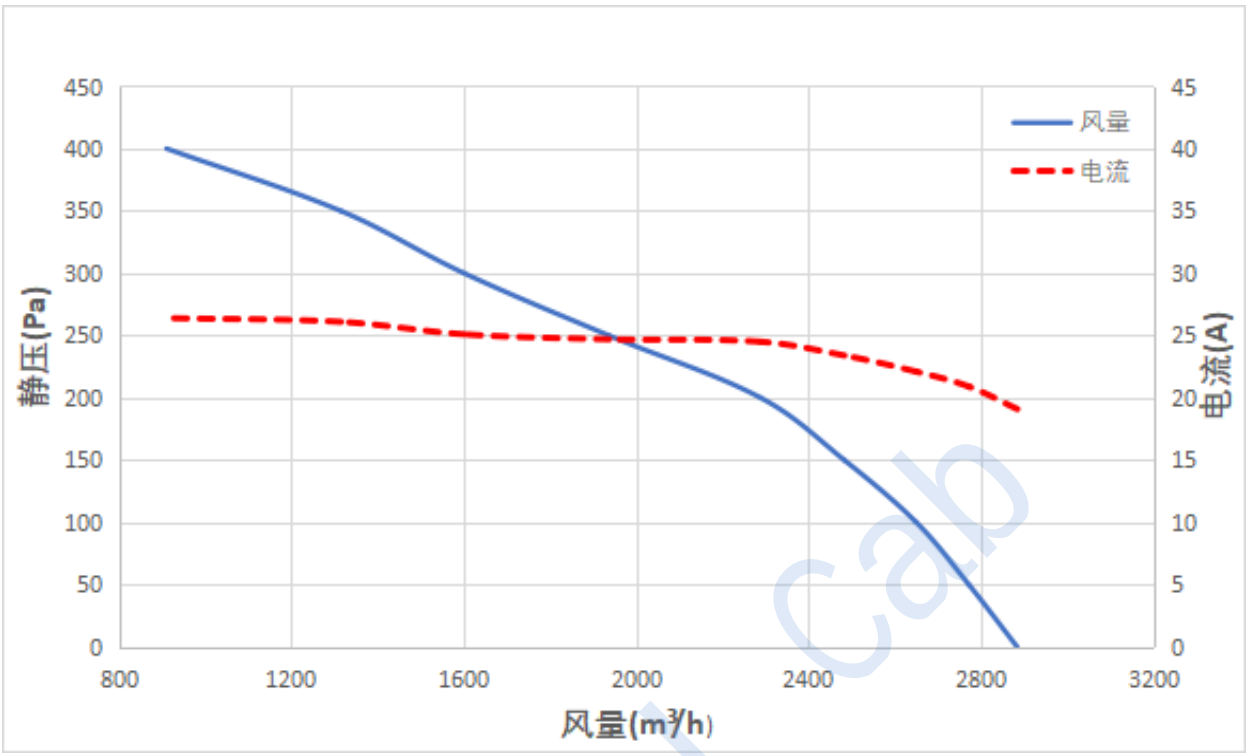
Nominal voltage ： 12V

4.Features

Max fan speed	rpm	3500
Min fan speed	rpm	1025
Sound pressure level at max speed	dBA	76- at 1 m from the fan module - lateral side (2)
Weight	kg	3.2
Operating supply voltage range	V	9.0 ~ 16.0 at the Drive connector
Supply voltage to reach max speed	V	13.6 ~ 16.0 at the Drive connector
Operating ambient temperature range	°C	-40 ~ +120
Speed derating threshold	°C	+110(1)
Storage temperature range	°C	-40 ~ +125
Lifetime	h	Up to 40000H (depending on mission profile)
Time from 0 rpm to max speed	s	12 (20°C)
Load dump protection (Pulse 5b)	V	35 (Pulse peak value voltage U_S^* -ISO16750-2:2010)
Reverse polarity protection		ISO 16750-1 functional status class C - device fully functional after correcting the polarity
Notes: (1) Due to the thermal inertia of the system, rapid temperature changes will not cause the fan to derate. Overload may cause the fan to derate prematurely. (2) The noise value in the free-air intake state is for reference only and does not represent the actual noise of the fan in application, because the noise of the fan in application will be affected by the water tank, air guide cover, etc.		

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5.Air Performance

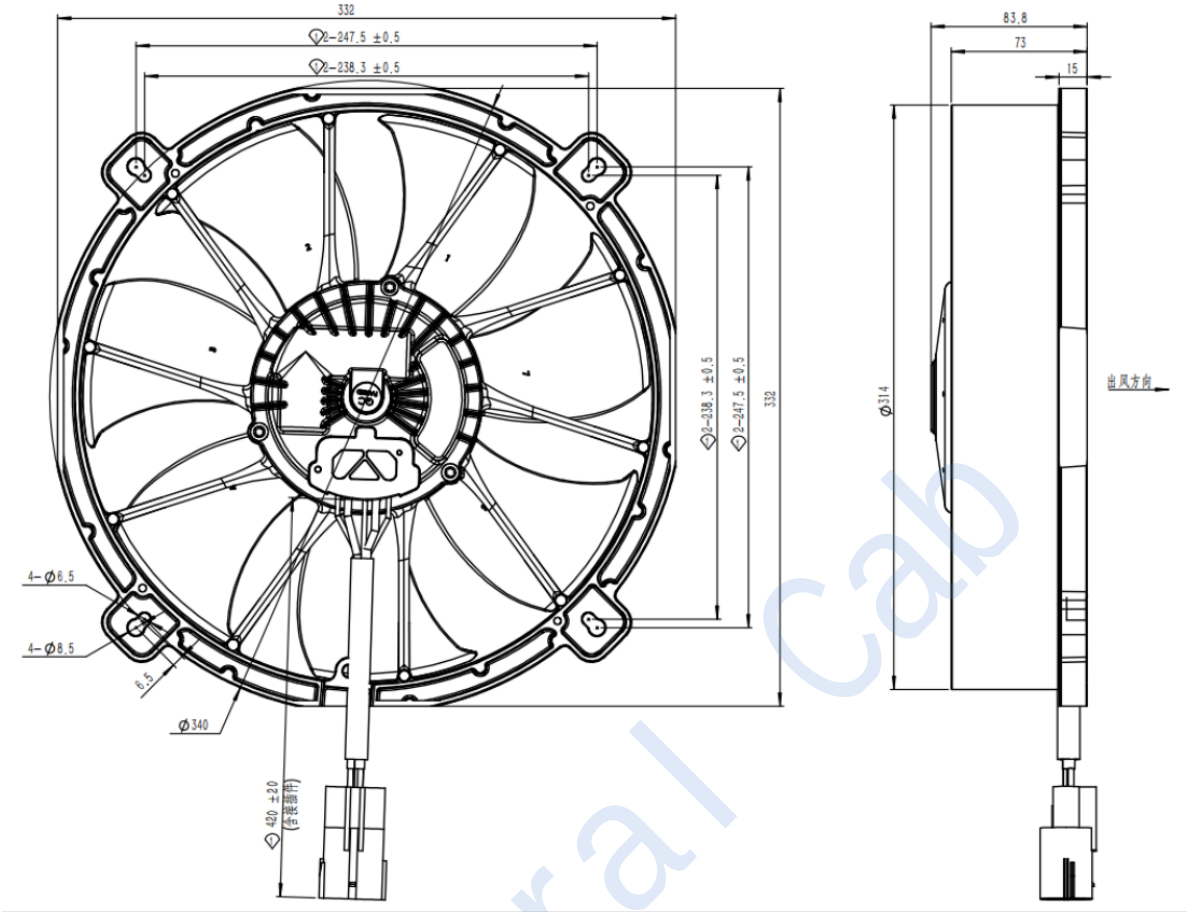


Power Supply Voltage	13.6V (at the connection)	Test Number	-	Test equipment setup in accordance with ANSI AMCA 210
Air Density	1.16 kg/m³	Ambient Temperature	20°C ± 5°C	

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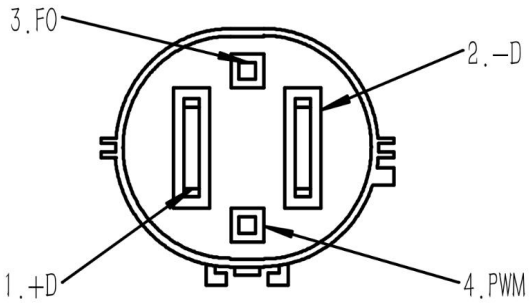
6.Mechanical Data



All the dimensions in the above figure are in millimeters. M6 or M8 bolts are used to fix the fan, and the nominal maximum tightening torque is M6-3(+1/0) Nm for M6 bolts and M8-4(+1/0) Nm for M8 bolts. The definition of the nominal tightening torque is applicable to new, clean, and lubricant-free bolts.

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7.Connector and Wires



Connector： YAZAKI				
Connector Part Number :7282-8497-90				
Identification(*)	+D	-D	FO	PWM/E
Pin Number	1	2	3	4
Wire Color	Red	Black	White	Blue
Sealing p/n	7158-3035	7158-3035	7158-3031-90	7158-3031-90
Pin p/n	7114-3250	7114-3250	7114-4103-02	7114-4103-02
Section [mm²]	5.0	5.0	0.75	0.75

* For abbreviations, please refer to the chapter on drive pin functions.

Remarks: It is prohibited to pick up the fan directly by the wire harness.

8.Further Features

Compliance		ECE Reg.10-07 and its updated content-Unified Provisions on the Approval of Vhicles in Respect of Electromagnetic Compatibility
		2002/95/EC RoHS - Directive on the Restriction of the Use of Hazardous Substances
		2000/53/EC and its updated content-End-of-Life Vehicles (ELV) Directive
Ingress Protection		IP68 and IP6K9K

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Allowed power supply max ripple	rms	1%
Fuse protection		According to the requirements of ISO8820 - 3, the specified fuses must be used in the circuit. Each fan should be equipped with a separate fuse.

9.Measurement Conditions

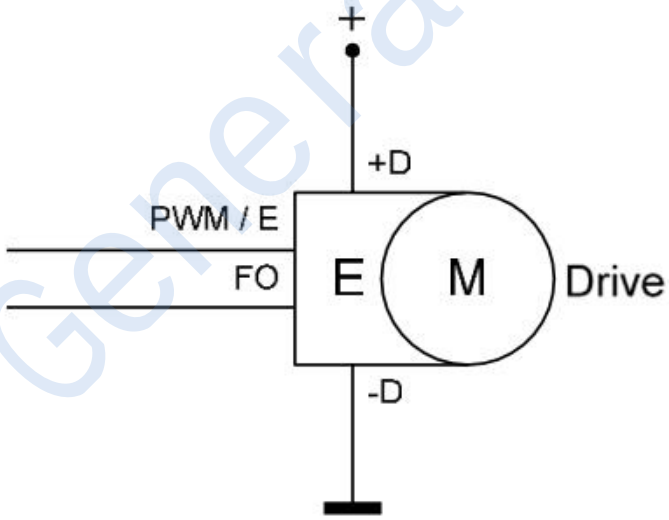
Unless otherwise specified, the below conditions are assumed:

- T_{AMB} = 20℃±5℃ and
- U_B = 13.6V±0.2V (at the Drive connector)

10.Hardware Function

10.1.Fan Drive

The drive diagram is as follows:



E stands for integrated electronics. M stands for motor. Drive stands for motor with axial integrated electronics.

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10.2.Drive pin Functions

The electrical Drive interface consists of 4 pins:
Power pins:

- supply voltage plus: +D
- supply voltage minus: -D

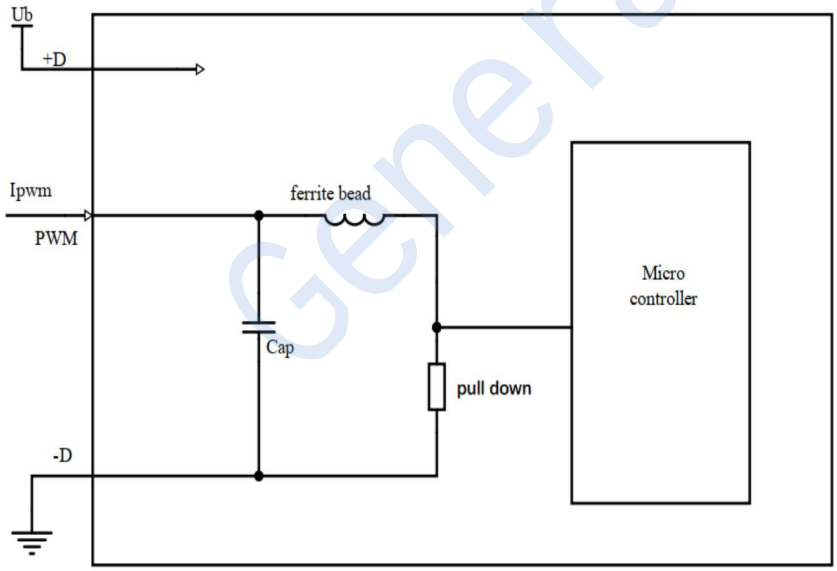
Signal pins:

1. Input: digital PWM input / active high: PWM/E
2. Output: feedback output / active high: FO

The signal pin PWM/E is used to control the Drive mode, it is the control input.
The signal pin FO is used to notify the Drive status.

11.Drive Interface

The PWM signal for the input PWM/E comes from the CCU electronics and uses a pull down resistor (PWM/E pull down) located in the Drive electronics to determine the recessive level.
This pull down resistor is connected to the supply voltage minus: -D/GND.
The schematic diagram of high active interface electronics for the PWM input is shown as follows:



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12. Interface Hardware for Digital Control: pin PWM/E

The input PWM/E is used to wake up the Drive from Quiescent current mode. Any PWM duty cycle that guarantees a pulse going to the dominant level for more than T_{wakeup} will wake up the Drive electronics.
It must be noted that the electronics activation level U_{Eact} is independent of the PWM thresholds U_{PWMH} and U_{PWML}(see the following table).

Parameter	Min	Typical	Max	Unit	Denomination
PWM/E Frequency Range	50	100	1000	Hz	f_{PWM}
PWM/E Duty Cycle Range	0		100	%	dc_{min} .. dc_{max}
PWM High Level Voltage	9			V	U_{PWMH} 1)
PWM Low Level Voltage			7	V	U_{PWML} 1)
PWM/E Resolution		1		%	Dc_{resol}
PWM/E Current			5	mA	I_{PWM}
PWM/E Wake - up Pulse	150			µs	T_{wakeup}
PWM/E Activation Level	9			V	U_{Eact} 2)

Table 1 PWM/E: Analog-Digital PWM Input/Active high Parameter Table

1. The operating temperature range of the electronics required by the PWM threshold is from -40°C to 130°C.
2. The operating temperature range of the electronics required by the activation level U_{Eact} is from -40°C to 130°C.

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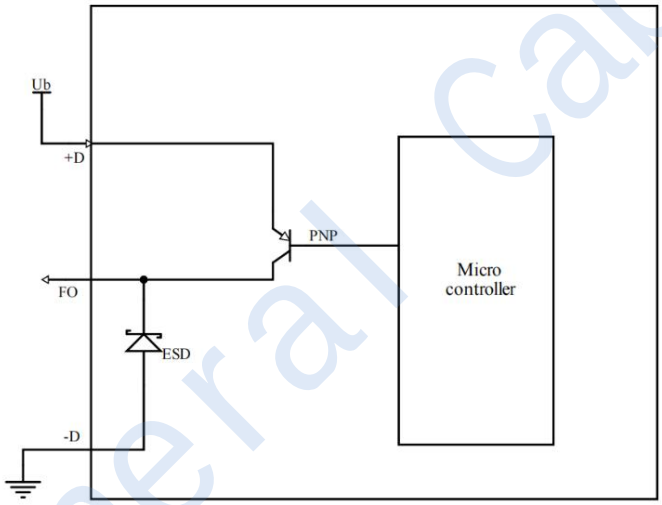
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13.Feedback Output / Active High: pin FO

Parameter	Min	Typical	Max	Unit	Denomination
FO Dominant Level	U_B-3		U_B	V	U_{FOH}
FO Recessive Level	0		3	V	U_{FOL}
FO Current			50	mA	I_{FO}

The schematic diagram of the high-active interface electronics for FO feedback is shown as follows:

The activation level of the output pin FO is dominant level, which is provided when the PNP - type transistor inside the Driver is turned on.



14.Software Functions

14.1.Drive Modes

The Drive has four working modes, and the main difference lies in the different Drive current consumption:

1. Quiescent current mode
2. Electronics active mode
3. Run mode
4. Failure mode

The Drive mode changes accordingly to the control input duty cycle on pin PWM/E.

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No.	Drive mode	Current consumption	Drive speed
1	Quiescent current mode	< 200 μA	0
2	Electronics active mode	< 50 mA	0
3	Run mode	Depends on the required speed and on the load	Depends on the duty cycle of the PWM signal
4	Failure mode	< 50 mA	Depends on the fault/alarm

When the PWM/E receives a 0% duty cycle signal, the Drive enters the Quiescent current mode. The time for the Drive to enter the Quiescent current mode depends on the actual PWM fundamental frequency and the number of samples for authenticity checking. After detecting that the PWM signal is a 0% Drive signal, the Drive will enter the Quiescent current mode after waiting for another 2 - 10 seconds.

When the PWM duty cycle is at any value between 0 (excluding 0%) and 100% and meets the conditions in Chapter 12, the Drive will enter the Electronics active mode.When the duty cycle is at 95% to 100%, the fan will work at a max speed.

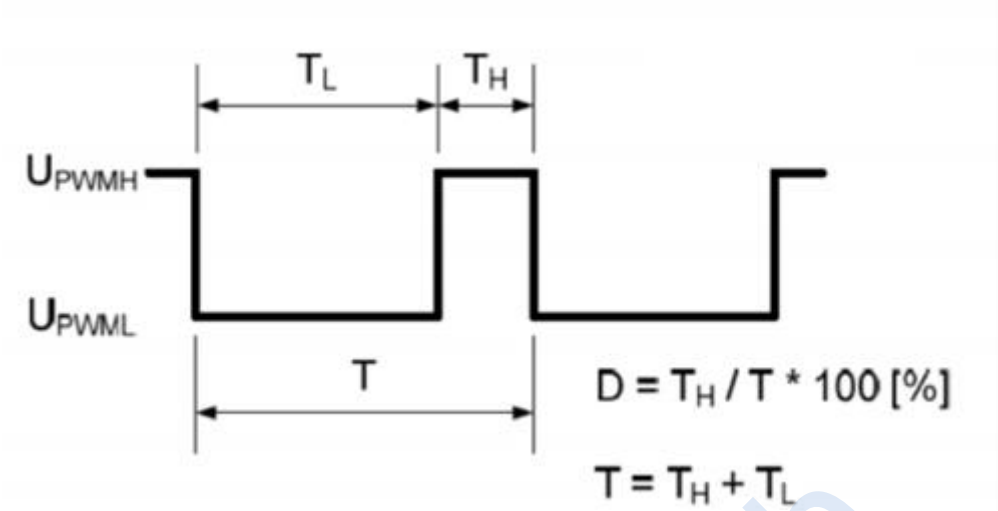
If the duty cycle of the PWM signal reaches the proportion required for the Drive to run, the Drive will enter the Run mode. Refer to Chapter 14.2.

The Failure mode is entered in case of failures of the Drive (refer to 14.3).

14.2.Digital Control: Transfer Function PWM Input

The transfer function PWM input refers to the relationship between the Drive speed and the duty cycle of the pin digital PWM input/active high:PWM/E

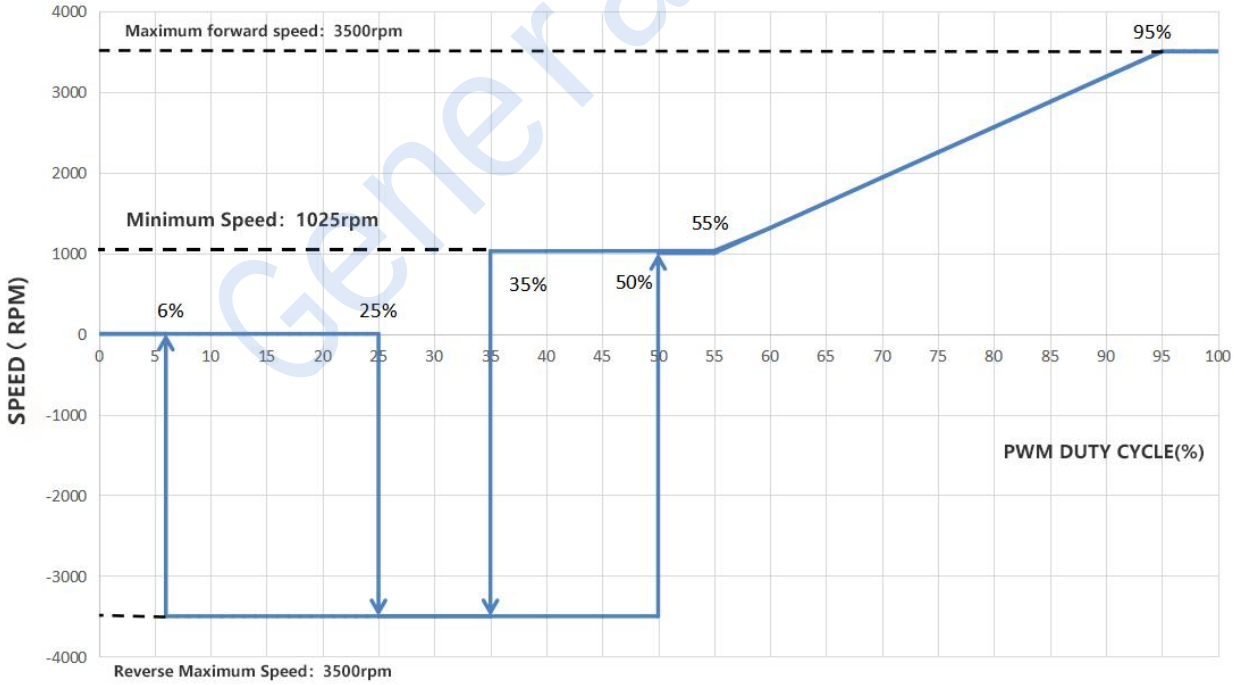
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The definition of the duty cycle in the above figure is also called the positive logic duty cycle. Refer to the following definitions:

- Continuous low voltage is 0 % duty cycle (recessive level)
- Continuous high voltage is 100% duty cycle (dominant level)

Based on the definition of the duty cycle, the transfer function of the PWM input is shown in the following figure.



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14.3.Drive Failure Modes

The feedback output FO signal is used for the notification of the Drive mode Failure mode.
In the Drive mode Quiescent current mode, Electronics active mode and Run mode , the output FO is set to recessive level.
In case of the Drive mode Failure mode the output FO is pulled to dominant level.
If the Failure mode disappears the output FO goes back to the recessive level.
There are the following cases where the Drive will go into Failure mode and stop the Drive:

Failure Mode	**Fault Handling**	**Fault Feedback (*)**
Drive blocked	Once a fan locked is detected, the following strategy will be executed: The controller attempts to automatically start 10 times (restart without power-off), with an interval of 10s each time. If it still does not recover after 10 attempts, the output FO is set to dominant level,The fan doesn't stop and keeps attempting to start at 10s intervals.	Dominant level
Over current	Once a fan over current is detected, the following strategy will be executed: The controller stops outputting, the output FO is set to dominant level, and the controller then attempts to automatically start 10 times (restart without power-off), with an interval of 10s each time. If it still does not recover after 10 attempts, the fan stops automatically. If recovery is needed, it requires manual power-off and restart to run again.	Dominant level
Drive overloaded	When Drive overload is detected, the fan will maintain a constant power reduction and work at a low speed without stopping, and the output FO is set to recessive level.	Recessive level
Drive overheated	When Drive overheating (derating temperature point) is detected, the fan will reduce its speed; when the maximum operating temperature point is exceeded, the controller stops outputting, and the output FO is set to dominant level. After the temperature returns to normal, the fan resumes operation.	Dominant level (when exceeding the maximum operating temperature)
Over and Under voltage	If the power supply voltage exceeds the operating voltage range, the controller stops outputting, and the output FO is set to dominant level. After the voltage returns to normal, the fan resumes operation.	Dominant level

In any case, when the Drive receives a valid PWM signal requiring it to run, the drive will try to recover from failures.

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15. Document Change Records

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Latest revision version number: V4

Document Author	Date	Version Number	Remarks
Fu Ying	20241112	V1	Initial Release
Chu Shimei	20250415	V2	Content format correction
SIMON	20251108	V3	PQ curve updating
SIMOM	20251206	V4	Drawing updating

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