3-Phase DC Fan Driver

Features

- **175°/150°sinusoidal drive for low audible noise**
- **High efficiency control algorithm**
- **Sensorless operation**
- **Full duty Start UP**
- **PWM speed control**
- **SO speed output support 4P/10P/8P/12P**
- **Lock protection**
- **Thermal protection**
- **Power Saving Function**
- **Output Frequency 64KHz or 32KHz**
- **WDFN3X3-10 package**

General Description

M8310 is designed for 3 phase motor control, especially for cooling fan control, it includes 175° sinusoidal driving algorithm for low audible noise.

Applications

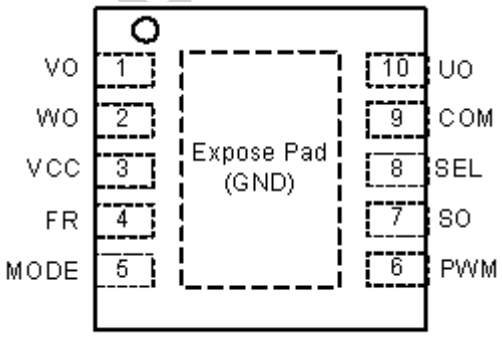
- **Notebook Fan**

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
M8310U36U	8310E	-40°C to +100°C	WDFN3X3-10

Note: U3: WDFN3X3-10
6: Bonding Code
U: Tape & Reel
Green: Lead Free / Halogen Free

Pin Configuration

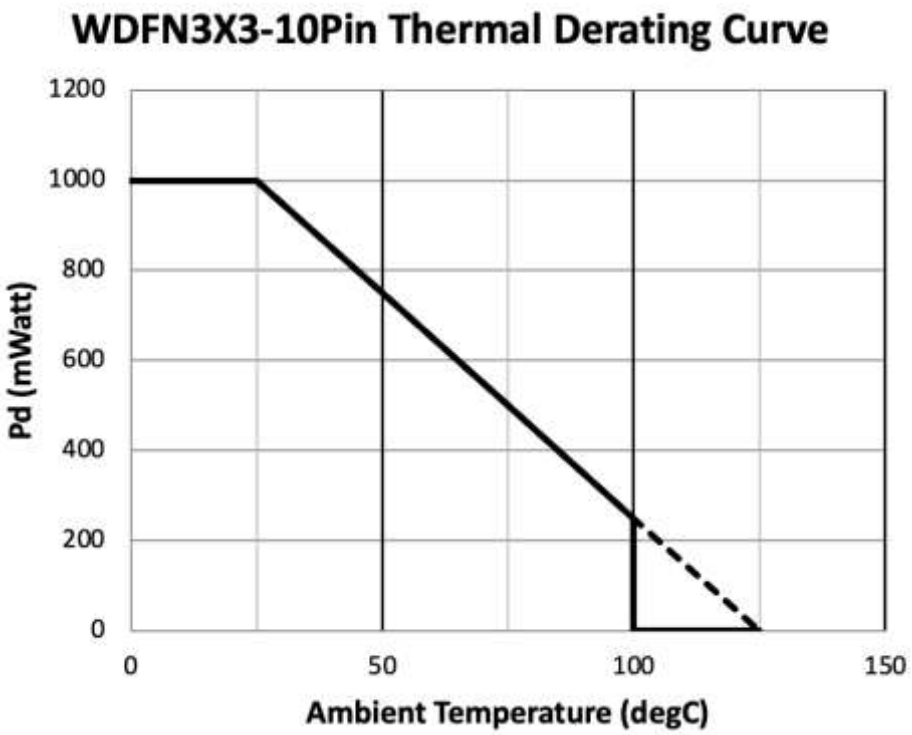


M8310U36U WDFN3X3-10

Absolute Maximum Ratings

VCC to GND . . . . . -0.3V to 6V
VCC to GND (under 100nS).....7.3V
Uo, Vo, Wo Output Peak current 1A
Uo, Vo, Wo Output Voltage . . . . . -0.3V to 6V
SO Output Voltage . . . . . .-0.3V to 6V
SO Output Current 10mA
PWM, FR, MODE, SEL, COM Pin to GND .-0.3V to 6V
Thermal Resistance of Junction to Case (θ_{JC})
WDFN3X3-10 . . . . . .110 °C/W

Continuous Power Dissipation (T_A = +25°C)
WDFN3X3-10. . . . . 1000 mW
Operating Temperature Range . . . . . -40°C to +100°C
Junction Temperature . . . . . +150°C
Storage Temperature Range . . . . . -65°C to +150°C
Reflow Temperature (soldering, 10sec) . . . . . 260°C
ESD (HBM) 4KV
ESD (MM) 400V



Note : When glass epoxy board (double layer) of 35mmx35mmX1.2mm is mounted.

Electrical Characteristics

V_{IN}=5V ; $T_A = T_J$ =25°C.

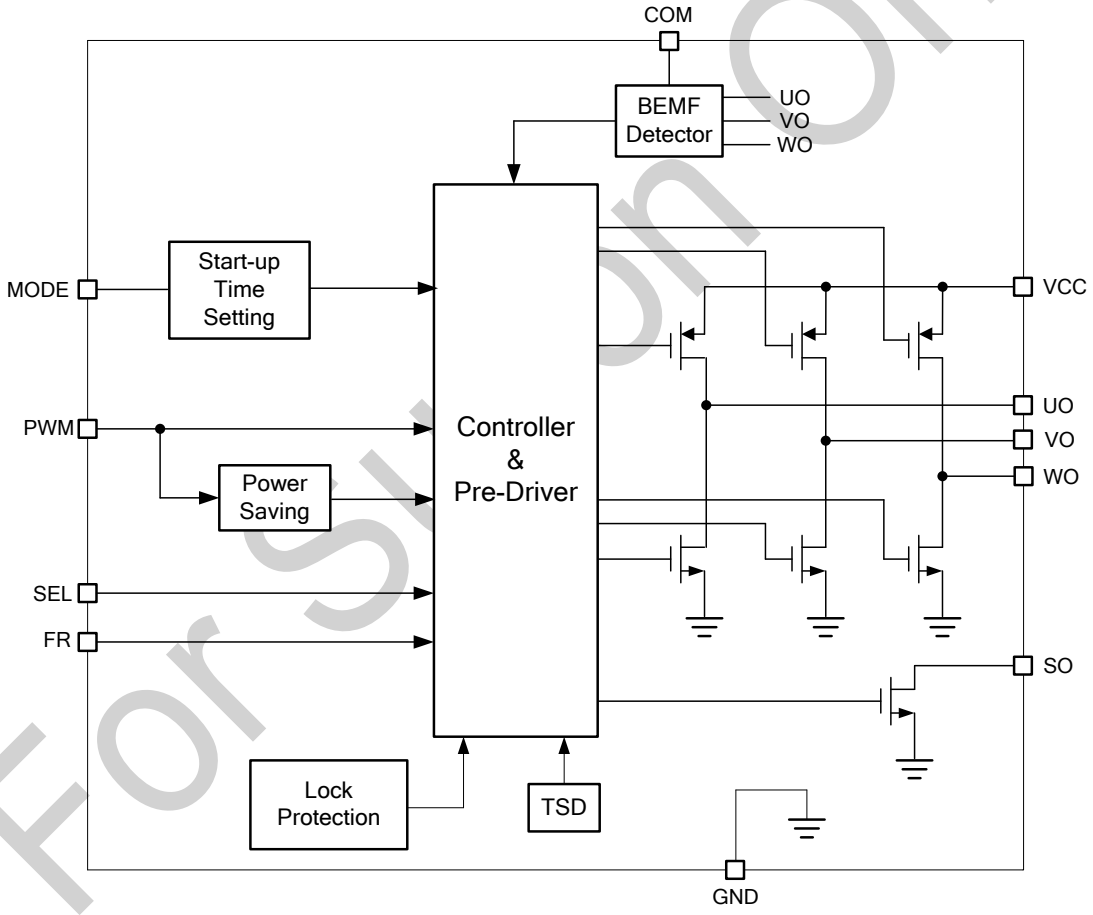
The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
V_{IN}						
Input Voltage	V_{DD}		2	5	5.5	V
Operating Current	I_Q		---	2	3	mA
Standby Current	I_{SB}		---	---	200	μA
PWM mode						
Input Low Voltage	V_{IL}		0	---	0.8	V
Input High Voltage	V_{IH}		2	---	Vcc	V
Input Pull High Current	I_{PWM}		16	20	24	μA
PWM Input Frequency	F_{PWM}		2	---	50	kHz
Output Switch Frequency	F_{OUT}		25	---	75	kHz
Output Drivers						
Output Driver Voltage	V_O	VCC = 5V, I_O = 250mA	---	0.25	0.45	V
SO pin Low Voltage	V_{SOL}	I_{SO} = 5mA	---	0.1	0.3	V
SO pin Off Leakage Current	I_{SOL}	V_{SO} = 5V	---	---	1	μA
FR						
FR Input Low Voltage	V_{FRL}	Reverse V>U>W	0	---	0.8	V
FR Input High Voltage	V_{FRH}	Forward U>V>W	2	---	Vcc	V
FR Pull High Current	I_{FR}	Floating = High	---	20	---	μA
Lock Protection						
Re-start Time *Note	T_{on_F}		1	1.25	1.5	Sec
Lock Mode Time	T_{off}		4	5	6	Sec
Lock Mode Time 1st	T_{off_1st}		0.8	1	1.2	Sec
On/Off Ratio			---	5	---	---
Vzc Comparator						
Vzc Hysteresis Voltage COM to Floating Output	Vzc		---	---	15	mV
Thermal Protection						
Thermal Protection Temp.	T_{TSD}		155	165	175	°C
Thermal Protection Hysteresis	T_{HYS}		---	30	---	°C
RPM						
Max RPM	R_limit	2 pair pole (4P)	40000	50000	---	RPM

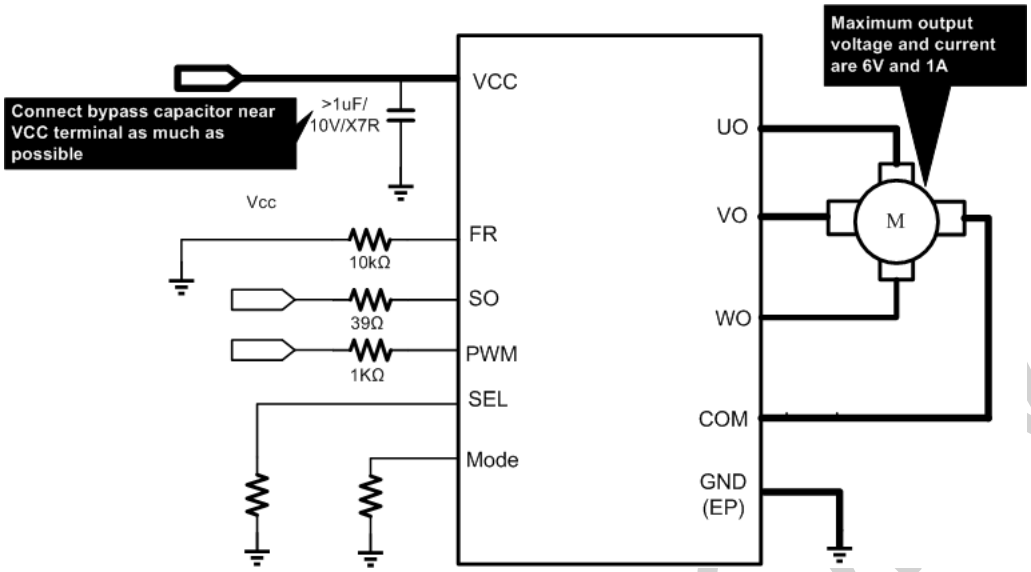
Pin Description

PIN	NAME	DESCRIPTION
1	VO	Motor Terminal V
2	WO	Motor Terminal W
3	VCC	Input Supply
4	FR	Rotation Direction Control, Floating pull High = U>V>W , Low = V>U>W
5	MODE	Start-Up Setting
6	PWM	Speed Control
7	SO	Rotation Speed/Detection Output
8	SEL	SO Mode Setting
9	COM	Output Common Node
10	UO	Motor Terminal U
Exposed Pad	GND	Ground

Block Diagram



Application Circuit



Function Descriptions

SO SEL Table

SEL Pin	SO Output
Floating or 5V	FG
150k ohm to GND	4/10FG
39k ohm to GND	4/12FG
GND	4/8FG

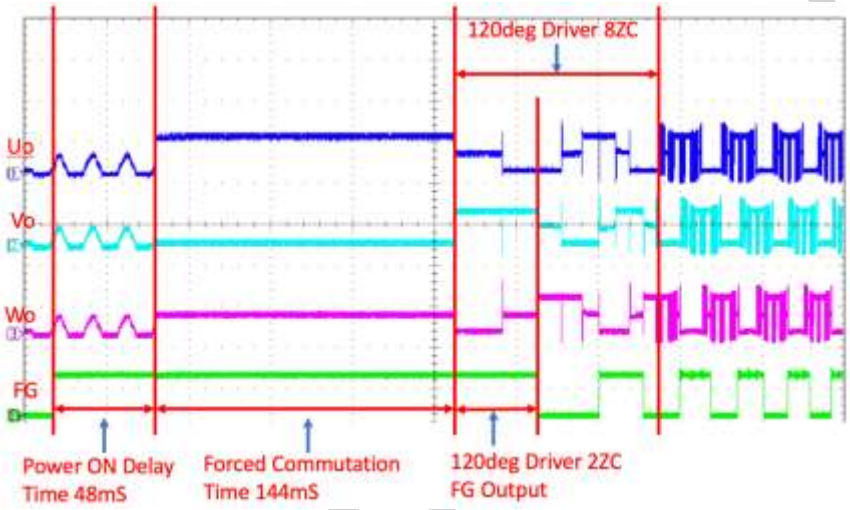
Mode Capacitor Setup

The Mode capacitor is used to set forced commutation time for start-up. The forced commutation time is 144ms when the capacitor is 2.2nF. The proper capacitor value is obtained by experiments. If Mode pin floating or set to GND, The default forced commutation time is 144ms.

OSC Pin	Start UP	Normal Operation	Force Start UP	Switching Frequency
Floating	Full Duty	175deg	144mS	64KHz
CAP(TYP=2.2nF)	Full Duty	175deg	72mS/nF	32KHz
GND	Full Duty	150deg	144mS	64KHz

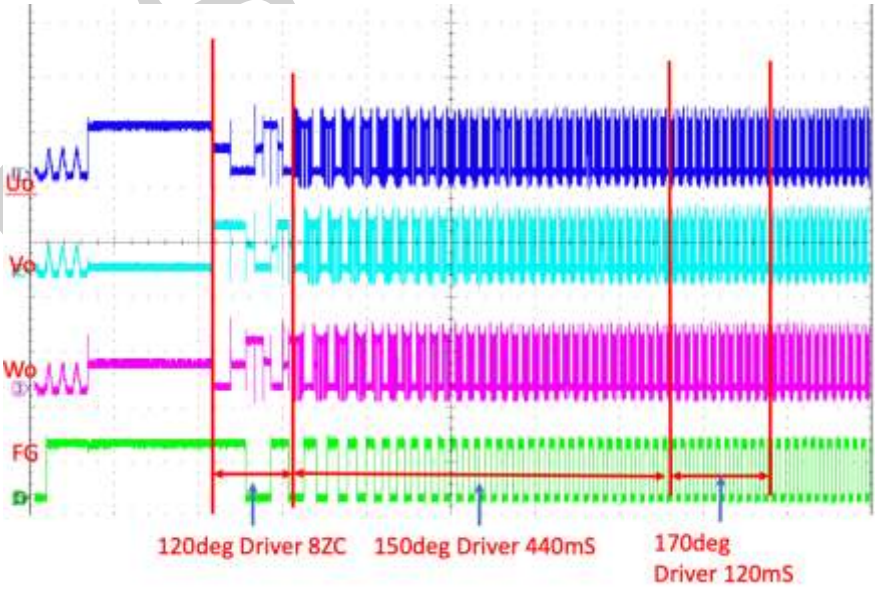
Note : Force Start UP Time with +/-20% tolerance

Full Duty Start UP FG_out Time , Vcc=5V Mode=Floating or GND



Note : Power to FG out = Power ON Delay + Forced commutation time + 120deg Driver 2 times ZC

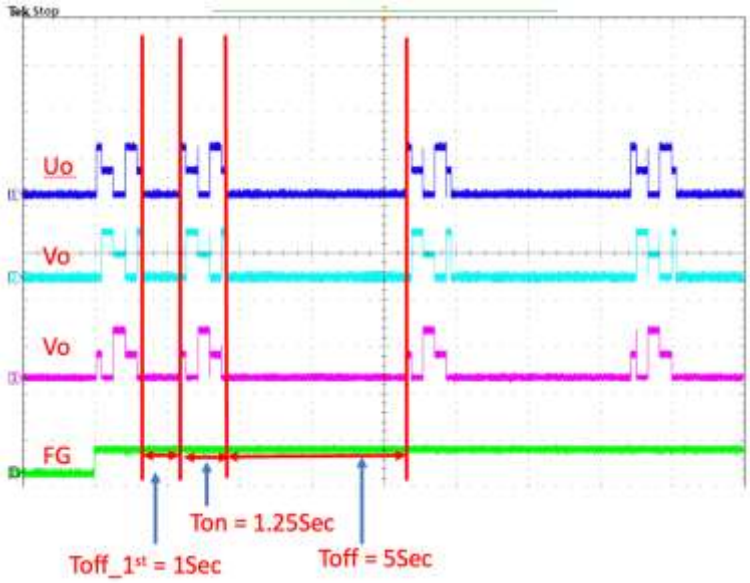
Power ON to Normal Operation 175deg Driver Flow



Lock Protection and Automatic Restart

The M8310 provides the lockup protection and automatic restart function for preventing the motor coil burns out. If the motor cannot start-up successfully, this chip internal clock will count an on time 1s (T_{ON}). Then all driver MOSFETs are turned off and auto restart after the recovery time (T_{OFF}). The first recovery time is 1s and the others are 5s.

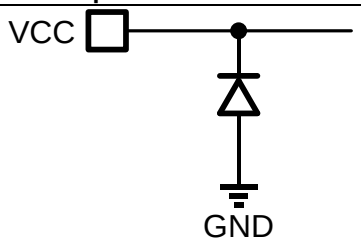
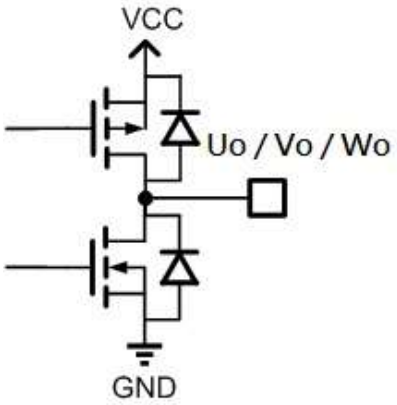
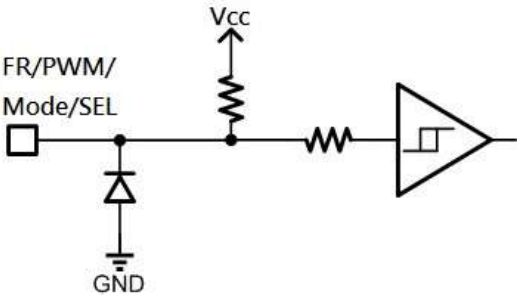
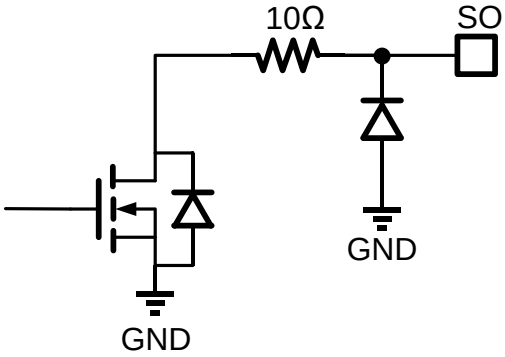
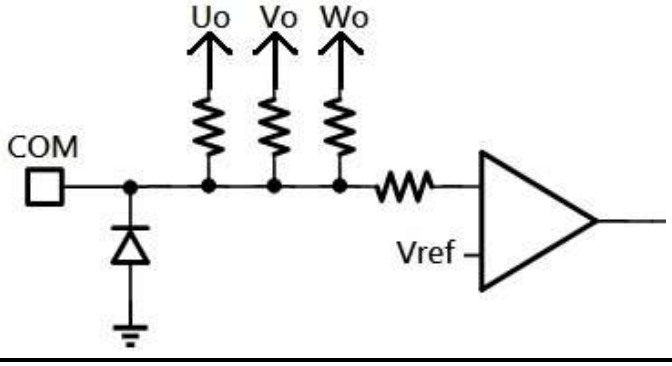
Lock Restart Time > Full Duty Start UP Mode , Vcc = 5V Mode = Floating or GND



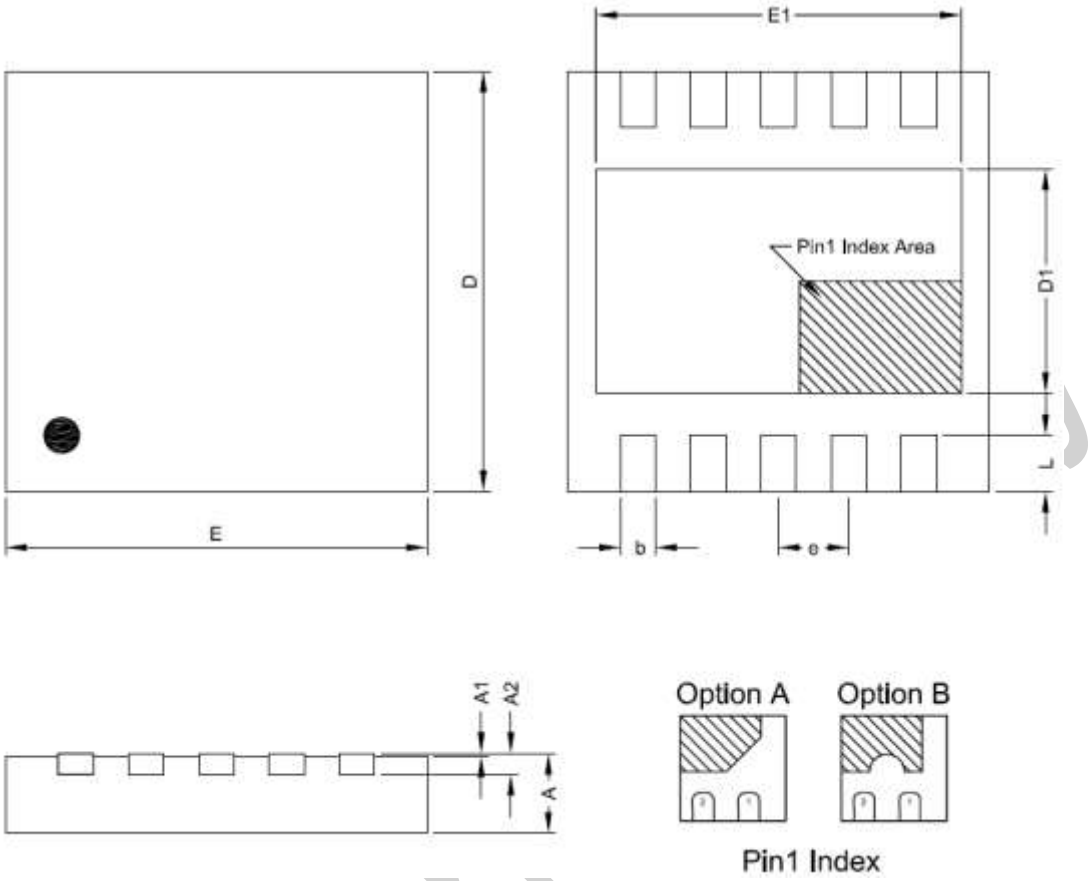
Quick Start and Standby Mode

When the input PWM duty of PWM pin is below 8% duty, the lock protection signal will be disable. Chip all circuit still work except driver MOSFETs turned off, and wait for quick start by the control signal. The M8310 also has standby mode enabled by the control signal under low duty (<0.5%) over a fixed time (1.8ms). In the standby mode, it will turn off all driver MOSFETs, internal clock and SO function, and the quiescent current is under 200μA.

I/O Equivalence Circuit

PIN	I/O	Equivalence Circuit
Power supply (VCC / GND)	Input	
Uo / Vo / Wo	Output	
PWM/SEL /FR/Mode	Input	
SO	Output	
COM	Input	

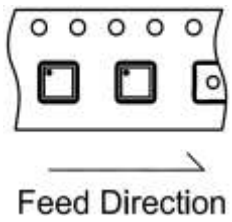
Package Information



WDFN3X3-10 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.0197	0.0217	0.0236
A1	0.00	---	0.05	0.0000	---	0.0020
A2		0.15 REF			0.0059 REF	
D	2.95	3.00	3.05	0.1161	0.1181	0.1201
E	2.95	3.00	3.05	0.1161	0.1181	0.1201
D1	1.40	1.60	1.70	0.0551	0.0630	0.0669
E1	2.40	2.60	2.70	0.0945	0.1024	0.1063
b	0.18	0.25	0.30	0.0071	0.0098	0.0118
e		0.50 BSC			0.0197 BSC	
L	0.30	0.40	0.50	0.0118	0.0157	0.0197

Taping Specification



PACKAGE	Q'TY/BY REEL
WDFN3X3-10	3,000 ea