



# Pulse-Width Modulation (PWM) Technology

Benefits of Delta's Advance PWM Control:

- Advance soft switching control (available on certain models)
- Wide PWM frequency input range (30Hz-30kHz)
- Flexible speed control
- Prevent current spikes
- Low switching noise
- Low vibration
- High power efficiency

Web: [www.delta-fan.com](http://www.delta-fan.com)

Email: [dcfansales.us@deltaww.com](mailto:dcfansales.us@deltaww.com)





# Advanced Cooling Solutions Deliver Superior Performance with Greater Efficiency



## The PWM Advantage

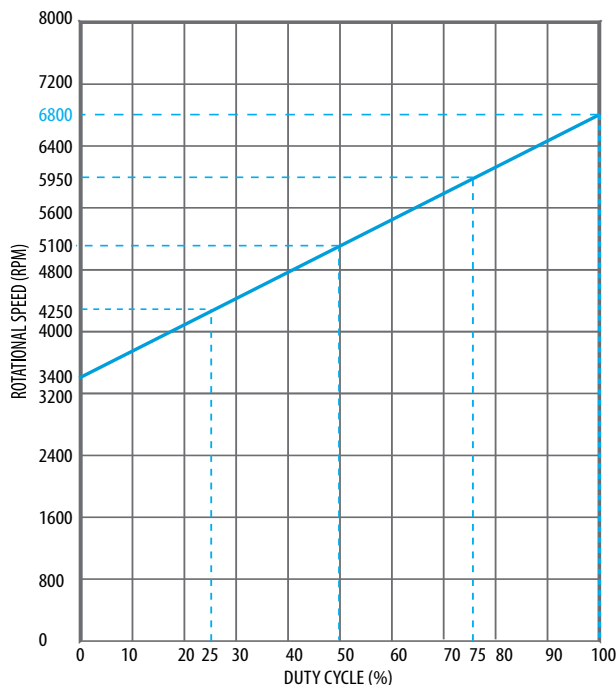
PWM regulates the voltage signal between fully on and fully off, controlling the speed of a fan. The main advantage is that power loss in the switching device is very low. When a switch is off, there is practically no current, and when it is on, there is almost no voltage drop across the switch. Therefore, power loss is close to zero.

## PWM Saves Energy and Extends the Life of Delta Fans

Delta's thermal technology continues to provide better performance, high reliability, and cost-effective thermal cooling solutions. PWM is one of the primary reasons Delta fans have a clear advantage over other manufacturers.

Delta carries a full line of PWM speed control fans with dimension ranging from 36x36x28mm up to 280x280x162mm.

## PWM Fan Curve – Speed Characteristics



## Speed vs PWM Control Signal:

(at rated voltage 48V; PWM signal with 3.3 VDC TTL; Frequency: 2K Hz; Temperature: 25C)

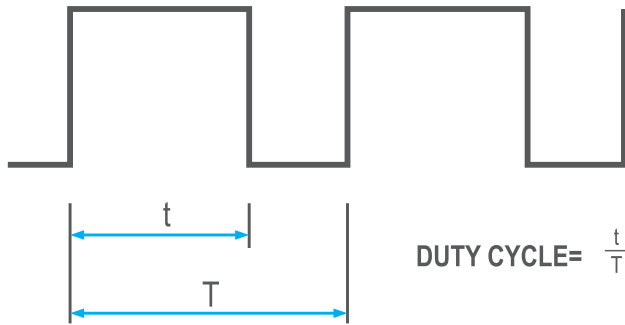
Duty Cycle (%)	Speed (RPM +/-10%)	Current (A)	Noise (dB-A)
100	6800	0.14	46.5
75	5950	0.09	43.5
50	5100	0.06	40.5
25	4250	0.03	36.5
0	3400	0.02	32.0

\* Above referenced part number AFB0648EH-TP27

# Pulse Width Modulation (PWM) Technology

## PWM Input Signal

SIGNAL VOLTAGE RANGE: 0~10 VDC



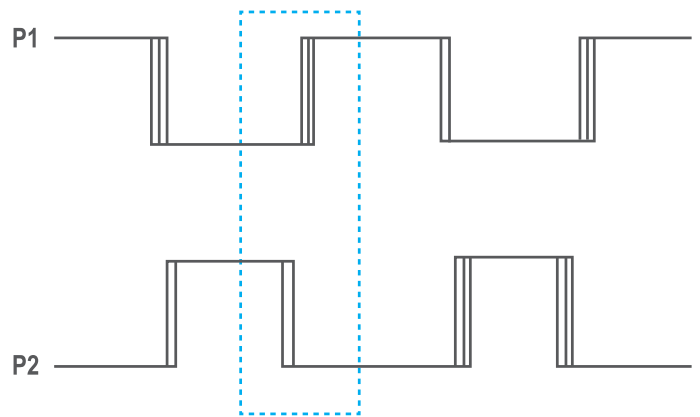
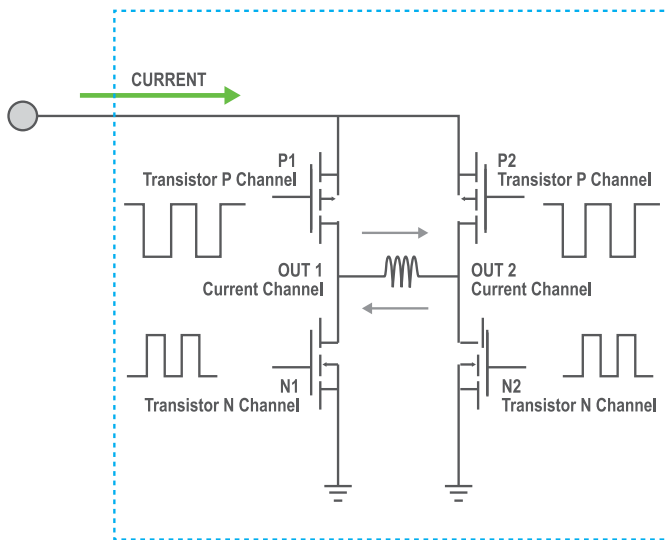
**HIGH SIGNAL:**  
10.0 VDC Max  
3.3 VDC Min

**LOW SIGNAL:**  
0.8 VDC Max  
0 VDC Min

$$\text{DUTY CYCLE} = \frac{t}{T} * 100(\%)$$

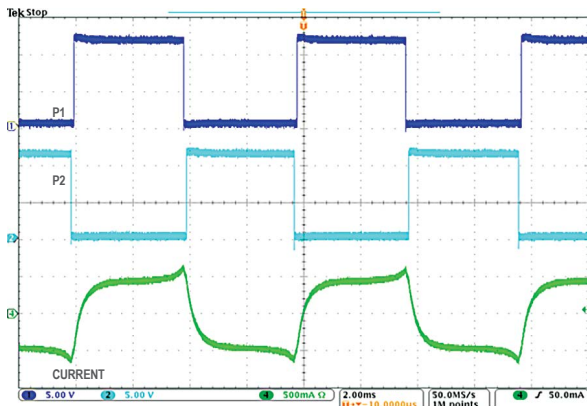
## Delta Advance PWM Control

Delta internally developed an advanced PWM circuit control utilizing soft switching to regulate resulting in a smooth current signal to fan, further reducing vibration and noise.

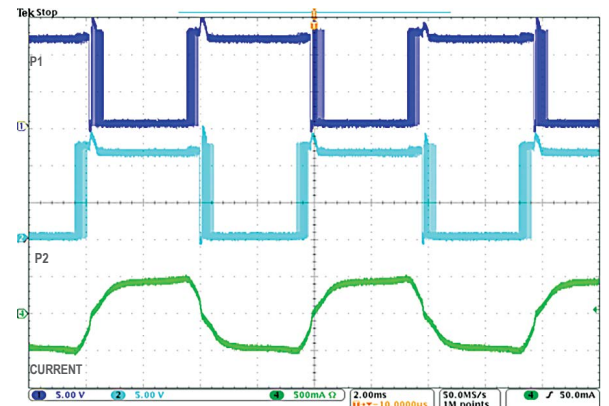


SOFT SWITCHING CONTROL

BEFORE



AFTER



## Pulse Width Modulation (PWM) Technology

Part Number	Dimension (mm)	Operating Voltage Range (VDC)	Voltage (VDC)	Bearing Type	Current (A)	Power (W)	Speed (RPM)	Noise (dB-A)	Air Flow (CFM)	Air Pressure (in H <sub>2</sub> O)
FFB03612EHN-ALB	36x36x28	10.8~13.2	12V	Ball	0.33	3.96	14500	50	16.3	1
FFB03612EHN-BGA	36x36x28	10.8~13.2	12V	Ball	0.39	4.68	14500	50	16.3	1
FFB03812VHN-9C3P	38x38x28	10.8~13.2	12V	Ball	0.55	6.6	16000	58.5	20.23	1.46
FFB03812VN-SPC	38x38x28	10.8~13.2	12V	Ball	0.85	10.2	23000	62.5	23	3.4
GFC03812HG-DV46	38x38x48	10.8~12.6	12V	Ball	1.52	18.24	21700	64	26.42	3.87
AFB0412VHA-DU48	40x40x10	7.0~15.0	12V	Ball	0.09	1.08	8000	33	8.81	0.22
AFB0412SHB-SP04	40x40x15	10.8~13.2	12V	Ball	0.16	1.92	11000	41.5	14.83	0.6
AFB0412VHB-TP25	40x40x15	7.0 ~ 13.0	12V	Ball	0.18	2.16	9500	36.5	13	0.46
AFB0412VHB-TP29	40x40x15	7.0~13.8	12V	Ball	0.18	2.16	9500	36.5	13	0.46
EFB0412VHD-SP05	40x40x20	5.0~13.8	12V	Ball	0.12	1.44	9000	34.5	10.1	0.42
THA0412AD	40x40x20	7.0~15.0	12V	Ball	0.43	5.16	15600	52	20.56	1.38
FFB0412EN-00Y2E	40x40x28	10.8~13.2	12V	Ball	1.45	17.4	25000	64	32.9	4.44
FFB0412GHN-TXQG	40x40x28	5.5~13.2	12V	Ball	0.5	6	16500	56	23.39	1.63
FFB0412SN-00Y2F	40x40x28	10.8~13.2	12V	Ball	0.93	11.16	22000	61.5	29.23	3.46
FFB0412UHN-SP4Z	40x40x28	7.0~13.2	12V	Ball	0.84	10.08	23000	59.9	26.55	3.15
FFB0412VHN-TP03	40x40x28	7 ~13.2	12V	Ball	0.6	1.92	9500	45	15.79	0.51
FFB0424VHN-TZT4	40x40x28	21.6~26.4	24V	Ball	0.1	2.4	9500	45	15.79	0.51
PFB0412EHN-TP06	40x40x28	10.8~13.2	12V	Ball	0.5	6	16000	54.5	21.83	1.43
TFA0412BN-CN	40x40x28	8.0~13.2	12V	Ball	0.42	5.04	15600	50.8	22.2	1.5
TFA0412CN-CN	40x40x28	7.0~13.2	12V	Ball	0.6	7.2	17600	55	25.29	1.87
THA0412BN	40x40x28	7.0~13.2	12V	Ball	0.89	10.68	19000	59	29.52	2.4
GFC0412DG-CMA4	40x40x48	10.8~13.2	12V	Ball	1.4	16.8	15150	64.4	32.35	2.38
GFC0412DS-CMA5	40x40x56	10.8~12.6	12V	Ball	0.85	10.2	17200	64	25.29	2.7
GFC0412DS-DF00	40x40x56	10.8~12.6	12V	Ball	1.3	15.6	16000	64.5	32.18	2.63
GFC0412DS-DU49	40x40x56	10.8~12.6	12V	Ball	1.85	22.2	23000	68.5	35.85	3.98
GFC0412DS-DV17	40x40x56	10.8~13.2	12V	Ball	1.5	18	20500	66	33.22	3.33
GFC0412DS-TP01	40x40x56	5.5~13.2	12V	Ball	1	12	15300	61	30.5	1.73
GFM0412SS-BL4F	40x40x56	10.8~12.6	12V	ball	0.8	9.6	17200	61.5	27.07	2.23
GFM0412SS-DE1PB7Q	40x40x56	10.8~12.6	12V	ball	1.1	12.6	19000	68.5	21.56	3.42
EFB0512HA-TP42	50x50x10	10.8~12.6	12V	Ball	0.1	1.2	5500	30	11.4	0.17
AFB0512HB-TP41	50x50x15	10.8~13.2	12V	Ball	1.2	1.44	6300	34	17.97	0.23
AUC0512DB-AF00	50x50x15	10.8 ~ 13.2	12V	Ball	0.18	2.16	7400	38.5	20.22	0.3
GFM0412SS-DE1PB7Q	40x40x56	10.8~12.6	12V	Ball	1.1	12.6	19000	68.5	21.56	3.42
AFC0612DB-F00	60x60x15	8~13.2	12V	Ball	0.33	3.96	7200	47.5	29.24	0.52
AFB0612VHX03	60x60x25	5.0~13.8	12V	ball	0.2	2.4	5000	40	27.55	0.29
AFB0612DH-TP11	60x60x25	10.8 ~ 13.2	12V	Ball	0.84	10.08	9000	55	50.4	0.93
AFB0624EH-SP50	60x60x25	21.6~26.6	24V	Ball	0.24	5.76	6800	46.5	38.35	0.54
AFB0648EH-TP27	60x60x25	36 ~ 60	48V	Ball	0.14	6.72	6800	46.5	38.35	0.54
AFC0612D-SP07	60x60x25	10.8~13.8	12V	Ball	0.13	1.56	4250	34	23.38	0.21
QFR0612DH-SP00	60x60x25	10.8-13.2	12V	Ball	0.75	9	10600	54.5	51.17	1.02
AFC0612DE-AF00	60x60x38	8~13.2	12V	Ball	1.5	18	12000	61.5	66.75	1.74
FFC0612DE-PP01	60x60x38	7.0~13.2	12V	Ball	0.9	10.8	9000	60	54.79	1.18
PFC0612DE-F00	60x60x38	10.8~13.2	12V	Ball	1.4	16.8	12000	61.5	67.85	2.13
PFM0612XHEB7T	60x60x38	10.8~12.6	12V	Ball	1.15	13.8	18500	65.1	64.44	2.34
PFR0612DHE-SP00	60x60x38	7.0~13.2	12V	Ball	1.6	19.2	14500	63.3	65.98	2.5

Part Number	Dimension (mm)	Operating Voltage Range (VDC)	Voltage (VDC)	Bearing Type	Current (A)	Power (W)	Speed (RPM)	Noise (dB-A)	Air Flow (CFM)	Air Pressure (in H2O)
PFR0612XHE-SP00	60x60x38	7~13.2	12V	Ball	2.3	27.6	16500	67.7	76.16	3.19
THB0648BE	60x60x38	36.0~75.0	48V	Ball	0.34	16.32	14700	61.5	68.6	2.87
GFC0612DS-AQ14	60x60x56	10.8~13.2	12V	Ball	1.6	19.2	10400	66	65.03	2
GFC0624DW-DT48	60x60x76	18.0~26.0	24V	Ball	1.4	31.2	11300	71.5	69.44	3.03
AFC0712DB-F00	70x70x15	8.0~13.2	12V	Ball	0.35	4.2	6000	46.5	41.95	0.33
AFC0712DD-TP10	70x70x20	8 ~ 13.2	12V	Ball	0.35	4.2	5000	44.3	46.86	0.28
AFB0712SHX02	70x70x25	5.0~13.8	12V	Ball	0.65	7.8	6300	50.5	61.05	0.63
EFC0812DB-F00	80x80x15	7~12.6	12V	Ball	0.33	3.96	3800	41	48.8	0.17
AFB0824SHBAV1	80x80x15	14.0~27.6	24V	Ball	0.16	3.84	4000	42.5	42.73	0.22
AUB0812HHDXHN	80x80x20	10.8~12.6	12V	Superflo	0.3	3.6	4500	43	51.46	0.29
AFB0812SH-TP12	80x80x25	10 ~ 13.2	12V	Ball	0.3	3.6	4500	46	55.59	0.38
AUB0812L-9X41	80x80x25	10.8~13.8	12V	superflo	0.09	1.08	2400	25	27.9	0.1
AUB0812VH-SP00	80x80x25	10.8~13.2	12V	Ball	0.19	2.28	3600	39	42.02	0.22
FFB0812XHXHC	80x80x25	7.0~15.0	12V	Ball	1	12	9000	59	92.69	1.1
QFR0812SH-CX13	80x80x25	5.0~13.2	12V	Ball	0.33	3.96	4300	41.2	54.57	0.33
QFR0812UH-CX14	80x80x25	10.8~ 12.6	12V	Ball	0.55	6.6	5600	50.5	70.24	0.55
FFB0848XHA01	80x80x25	32.0~72.0	48V	Ball	0.27	12.96	9000	59	92.69	1.23
FFB0812EHE-SP15	80x80x38	7.0~13.8	12V	Ball	0.75	9	5700	52.5	80.16	0.81
FFC0812DE-F00	80x80x38	7.0~13.2	12V	Ball	1.5	18	7500	62.2	102.02	1.23
PFB0812DHE-TYNT	80x80x38	10.8~13.2	12V	Ball	2.75	33	9000	66	132.6	2.03
PFB0824DHEYDG	80x80x38	12.0~27.6	24V	Ball	1.35	32.4	9000	65	132.56	2.03
PFC0812DE-SP04	80x80x38	10.8~13.2	12V	Ball	2.75	33	9000	65	132.6	2.03
PFM0812HE-01BFY	80x80x38	10.8~12.6	12V	Ball	4.3	51.6	16300	77	129.42	4.97
PFR0812XHE-SP00	80x80x38	9.0~12.6	12V	Ball	3.5	42	13300	71.5	134.29	3
PFR0848XHE-DV82	80x80x38	36.0~56.0	48V	Ball	1	48	13800	73	144.18	3.46
QFR0812UHEYDW	80x80x38	10.8~13.2	12V	Ball	1.15	13.8	9000	60	105.21	1.34
THB0848BEB51	80x80x38	36.0~72.0	48V	Ball	0.7	33.6	15000	70	127.54	4.54
THD0848ME	80x80x38	36.0~75.0	48V	Ball	0.55	26.4	9500	60	128	1.48
GFC0812DS-CMA8	80x80x56	10.8~12.6	12V	Ball	2.17	26.02	12000	72.6	90.12	3.83
GFM0812DS-SMB7R	80x80x56	10.8~12.6	12V	Ball	2.4	28.8	12500	73.3	93.23	4.49
GFC0812DW-TD2G	80x80x76	10.8~12.6	12V	Ball	8.27	99.24	13500	80	177.1	4.5
GFC0812DW-SM00B7P	80x80x80	10.8~12.6	12V	Ball	5.2	62.4	12000	74.5	167.02	4.17
GFC0848DWB74	80x80x80	36.0~60.0	48V	Ball	1.56	74.88	12500	76.5	175	4.47
GFM0812DUB7S	80x80x80	10.8~12.6	12V	Ball	9	1080	13800	82.5	190.63	5.79
AFC0912DB-F00	92x92x15	7.0~13.6	12V	Ball	0.31	3.72	3300	41.5	51.53	0.16
AFC0912D-AF00	92x92x25	8 ~ 13.2	12V	Ball	0.75	9	4800	53	102.59	0.53
AUB0912VH-CX09	92x92x25	10.8~13.2	12V	superflo	0.38	4.56	3800	45	67.8	0.3
FFC0948BY7T	92x92x25	36.0~75.0	48V	Ball	0.17	8.16	3900	49.5	86.4	0.35
QFR0912VH-SP00	92x92x25	10.8~13.2	12V	Ball	0.4	4.8	4200	45	74.78	0.34
AFC0912DE-AF00	92x92x38	10.8~12.6	12V	Ball	2.5	31.2	6000	63	160.22	1
AFC0948DE-TP20	92x92x38	36 ~ 75	48V	Ball	0.6	28.8	7500	67	159.369	1.53
FFB0924EHE-SP20	92x92x38	21.6~26.4	24V	Ball	0.5	12	4800	55	110.18	0.66
FFB0948SHE-TP28	92x92x38	32~56	48V	Ball	0.2	9.6	4400	52.5	100.29	0.57
FFC0912DE-TP04	92x92x38	7.0 ~ 13.2	12V	Ball	0.8	9.6	4800	55	110.18	0.66
PFB0948UHE-TP16	92x92x38	36 ~ 75	48V	Ball	0.52	24.96	7000	64	153.52	1.45
PFR0912XHE-SP00	92x92x38	10.8~12.6	12V	Ball	3.7	44.4	11500	71	185.66	2.55
THA0948BE	92x92x38	30.0~60.0	48V	Ball	1.4	67.2	9500	71	189.67	3.02
THB0948AE	92x92x38	36.0~60.0	48V	Ball	0.76	36.5	13000	72.5	162.5	3.09

## Pulse Width Modulation (PWM) Technology

Part Number	Dimension (mm)	Operating Voltage Range (VDC)	Voltage (VDC)	Bearing Type	Current (A)	Power (W)	Speed (RPM)	Noise (dB-A)	Air Flow (CFM)	Air Pressure (in H2O)
THD0948HE-A	92x92x38	36.0~75.0	48V	Ball	1.1	52.8	13500	71	182.41	3.44
THD0948HE-AXHH	92x92x38	36.0~75.0	48V	Ball	1.1	52.8	13500	71	182.41	3.44
AFC1212D-F00	120x120x25	10.2 ~ 13.8	12V	Ball	0.53	6.36	3400	46.5	113.11	0.43
AFC1212D-SP19	120x120x25	10.8~12.6	12V	Ball	0.32	3.84	3000	46	89.7	0.34
AUB1212H-CK15	120x120x25	10.8~13.2	12V	superflo	0.27	3.24	2200	38	88.6	0.16
FFC1212D-F00	120x120x25	7.0~13.2	12V	Ball	1.4	16.8	4000	56.4	150.33	0.49
THB1212B-AXHF	120x120x25	7.0~15.0	12V	Ball	1.6	19.2	5300	59	184.2	0.9
THB1248B-A	120x120x25	36~75	48V	Ball	0.4	19.2	5300	59	186.6	0.96
THB1248B-AXHG	120x120x25	36.0~75.0	48V	Ball	0.4	19.2	5300	59	186.57	0.96
AFB1212HHE-TP02	120x120x38	10.8 ~ 13.2	12V	Ball	0.4	4.8	2900	44	120.07	0.35
AFB1224GHEYNU	120x120x38	21.6~26.4	24V	Ball	1.3	31.2	5200	62	240.96	1.08
AFB1248VHE-T9LN	120x120x38	34~56	48V	Ball	0.31	14.88	4100	55.5	190.48	0.69
AFB1248VHE-TP18	120x120x38	34.0 ~ 56	48V	Ball	0.31	14.88	4100	55.5	190.481	0.69
PFB1248UHE309	120x120x38	36.0~72.0	48V	Ball	1.1	52.8	5500	66.5	252.85	1.41
PFB1248UHE-CN	120x120x38	36.0~72.0	48V	Ball	1.1	52.8	5500	66.5	252.85	1.41
PFB1248UHE-EP	120x120x38	30.0~60.0	48V	Ball	0.88	42.24	5300	66	243.66	1.31
PFB1248XHE-TP17	120x120x38	33 ~ 52.8	48V	Ball	1.6	76.8	7000	72.5	306.92	2.17
PFC1212DE-F00	120x120x38	8~13.2	12V	Ball	4	48	5500	66.5	252.85	1.41
PFC1224DE-6L52	120x120x38	14.0 ~ 25.6	24V	Ball	2	48	5500	66.5	252.85	1.41
PFC1248DE-F00	120x120x38	30~56	48V	Ball	1	48	5500	66.5	252.85	1.41
PFR1212DHE-SP00	120x120x38	8~13.2	12V	Ball	3.7	44.4	7400	68.5	254.35	1.44
PFR1212UHE-SP00	120x120x38	8.0-13.2	12V	Ball	2.7	32.4	6600	65.5	228.65	1.21
QFR1212GHEXUM	120x120x38	8 ~ 13.2	12V	Ball	1.8	21.6	6000	64	210.38	1.17
QFR1224GHEYPR	120x120x38	21.6~26.4	24V	Ball	0.91	21.84	5800	64	195.68	1.03
THA1248BE-AXHE	120x120x38	36.0~60.0	48V	ball	1.68	80.2	9000	72	302.8	3.39
THB1248CE	120x120x38	36.0~60.0	48V	Ball	0.95	45.6	7800	70	262	2.06
THD1248HE	120x120x38	32~59	48V	Ball	2.2	105.82	10900	75	287	4.4
PFM1412DEB7V	140x140x38	10.8~12.8	12V	Ball	3.9	46.8	6500	70	282.31	2.03
THB1448AE	140x140x38	30.0~60.0	48V	Ball	1.1	52.8	6100	66.8	325.9	1.13
EFB1548VHG-TP14	172x150x51	36 ~ 60	48V	Ball	0.49	23.52	4000	60	302.29	0.94
THB1548DG-CN	172x150x51	36.0~72.0	48V	Ball	1.72	82.56	6100	70	427.8	2.29
THB1548DG-CXKQ	172x150x51	24.0~72.0	48V	Ball	1.57	75.36	5800	70	410.51	2.08
EFC1748DG-TP07	172x172x51	28.0 ~ 53	48V	Ball	1.23	59.04	5500	63.4	415.66	1.77
EFC1748DG-TYSG	172x172x51	28.0~53.0	48V	Ball	1.23	59.04	5500	63.4	415.66	1.77
THB1748BG	172x172x51	36.0~56.0	48V	Ball	3.5	168	8000	75	607.07	4.14
THB2048HG-A	200x200x51	36.0~72.0	48V	Ball	4.2	201.6	7700	78	690.3	4.14
THB2048CT	200x200x70	36.0~75.0	48V	Ball	4.8	230	5800	73.6	827.37	2.69
THD2048HT	200x200x70	36.0~75.0	48V	Ball	8	384	7400	78	1026	4.94

## Delta PWM Fans Blowers

Part Number	Dimension (mm)	Operating Voltage Range (VDC)	Voltage (VDC)	Bearing Type	Current (A)	Power (W)	Speed (RPM)	Noise (dB-A)	Air Flow (CFM)	Air Pressure (in H2O)
BFB04512HHA-DV52	45x45x10	5.0~13.5	12V	Ball	0.14	1.68	6100	36.0	3.60	0.6
BFB0512HA-CX3D	50x50x10	10.8~13.2	12V	Ball	0.12	1.44	5100	32.5	3.53	0.56
BFB0512VHD-SP01	50x50x20	10.8~12.8	12V	Ball	0.20	2.40	5500	32.0	6.12	0.65
BCB0812UHN-TP09	75x80x30	10.8~12.6	12V	Ball	2.30	27.60	10800	69.3	30.16	3.68
BFB1012HH-TP48	97x94x33	10.8~13.2	12V	Ball	0.69	8.28	3200	53.5	28.33	0.95
TCA1048AB0C	100x100x25	36.0~60.0	48V	Ball	0.39	18.72	6700	65.0	68.67	1.89
TEA1248CS	120x120x54	32.0~60.0	48V	Ball	2.05	98.40	8500	69.2	284.90	2.9
KFB1248EHSB80	120x120x54	36.0~57.0	48V	ball	0.45	21.6	4060	61	174.8	1.35
KFB1724SHT-SP09	175x175x69	21.7~26.4	24V	Ball	2.88	69.12	3300	67.5	334.79	1.89
TCA1748ATXHD	175x175x69	36.0~60.0	48V	Ball	1.6	76.8	4000	70.8	428	1.96





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**Delta Electronics (Americas) Ltd.**

46101 Fremont Boulevard

Fremont, CA 94538

TEL: 1-866-407-4278

EMAIL: [dcfansales.us@deltaww.com](mailto:dcfansales.us@deltaww.com)



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