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## PWM Controlled Fan for MEC140x/MEC141x/MEC142x

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### INTRODUCTION

Pulse Width Modulation (PWM) modules, which produce basically digital waveforms, can be used in many applications as a more efficient and lower power alternative to the traditional 8 bit Digital-to-Analog (D/A) converters using only two inexpensive filter components. A wide variety of microcontroller applications that exist today are better served by utilizing a PWM generated analog output as opposed to an 8 bit D/A converter. One application where using a high resolution PWM has value vs. a traditional 8 Bit DAC is in driving the 3-wire voltage controlled fan in a PC.

### Audience

This document is written for a reader that is familiar with hardware design. The goal of this application note is to provide information regarding how to use a PWM to drive 3-wire fans that provides system benefits and an enhanced customer experience.

### References

The following documents should be referenced when using this application note. Please contact your Microchip representative for availability.

- Microchip MEC140x/MEC141x/MEC142x Data Sheet
- Microchip MEC140x/MEC141x/MEC142x EVBs

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## 1.0 OVERVIEW

Key potential benefits of using a high resolution PWM generated analog output for 3 wire fan control include:

- Finer RPM resolution (4x) control vs a traditional 8 bit DAC.
- Finer RPM control can potentially solve the issue of having two consumer platforms at the same thermal condition each running at a different RPM Zoned speed – since the finer control would allow you to control RPM closer to mechanical resonant points of the box and thus significantly reduce the chance of one machine running at different binned zone speeds).

**Note:** A typical PC has up to 10 bands (zones) of RPMs that they run the fan in – stepping around mechanical resonant frequencies of the platform.

The purpose of this white paper is to show the benefits of using the MEC140x/MEC141x/MEC142x 16 bit PWM vs a traditional 8 bit DAC to control 3 wire fans. (see typical schematic of a 3 wire fan drive in [Figure 1-1](#) by DAC and [Figure 1-2](#) by PWM).

**FIGURE 1-1: 3-WIRE FAN DRIVE BY DAC**

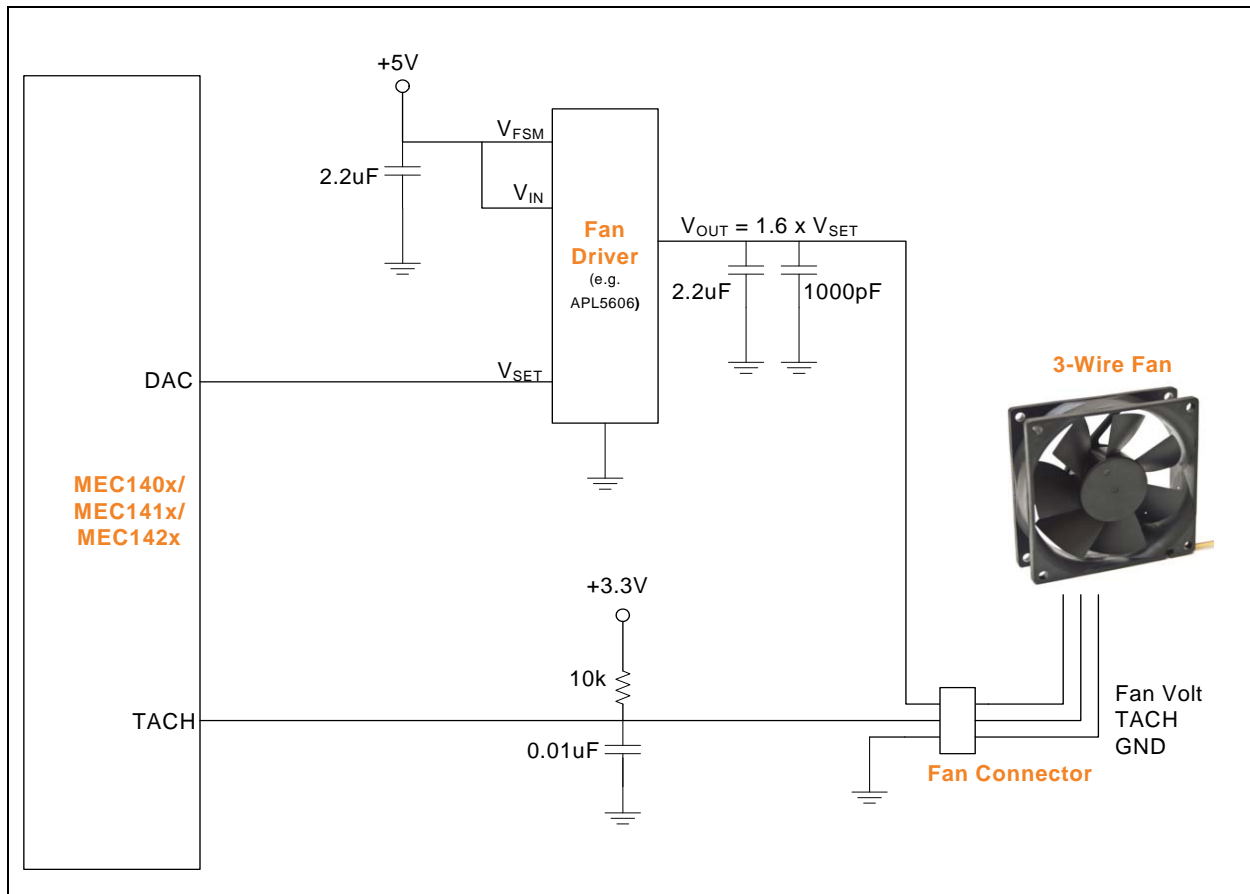
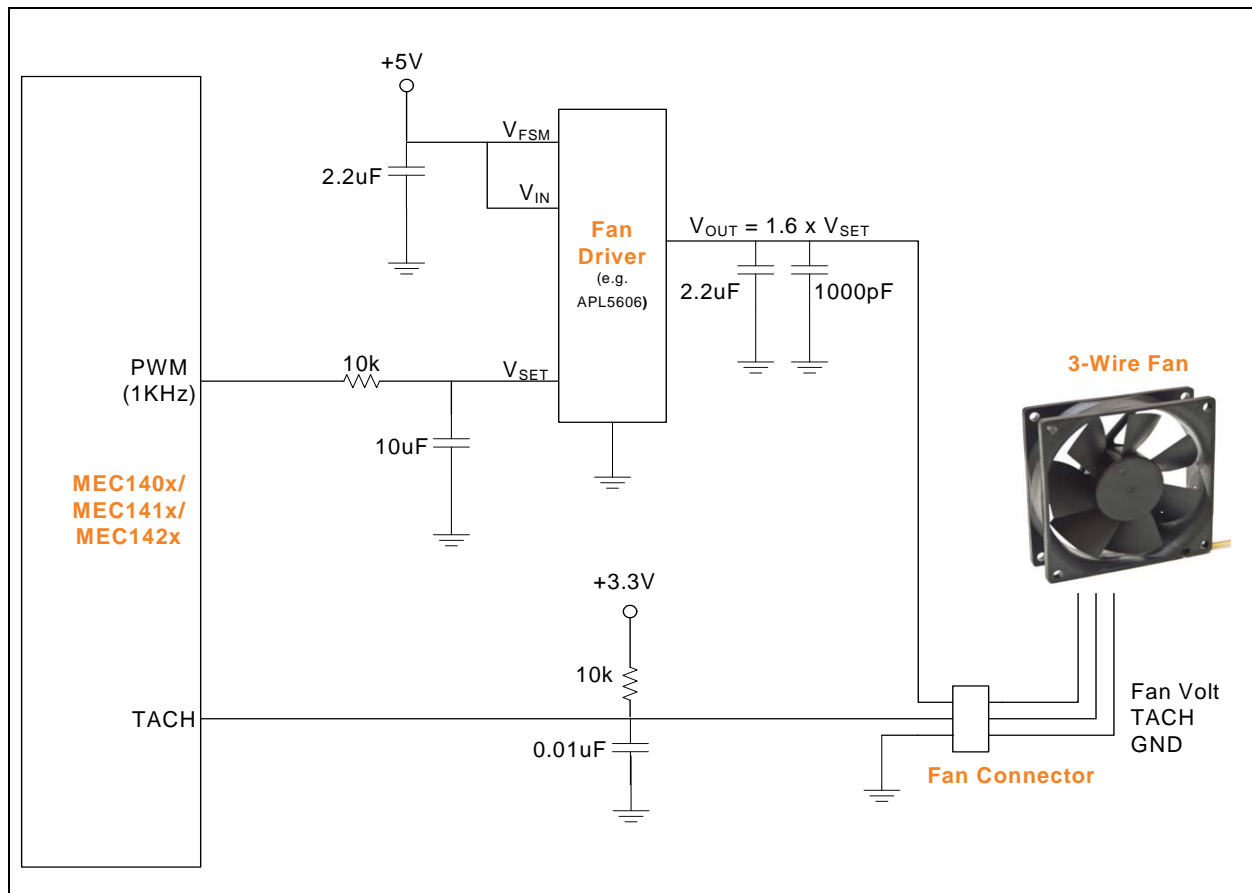


FIGURE 1-2: 3-WIRE FAN DRIVE BY PWM WITH R/C FILTER



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## 2.0 RPM CONTROL ADVANTAGE

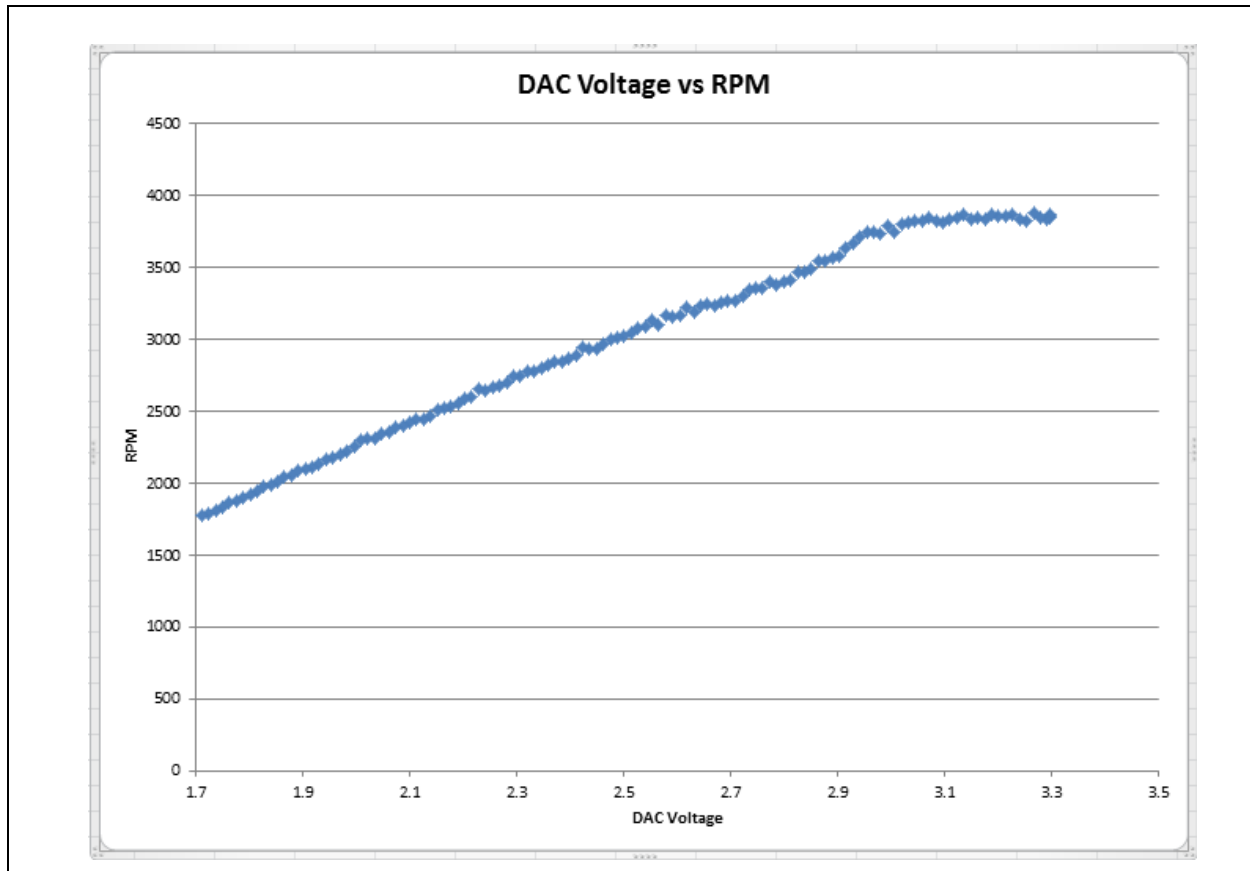
This section shows the RPM control advantage (measured data) of PWM generated analog output vs 8 bit DAC.

To establish a baseline of the RPM control of 3-wire fans using the 8 bit DAC today, data was taken at the following three points ( $V_{SET}$  input to fan driver,  $V_{OUT}$  voltage to 3-wire fan, and RPM for given fan Voltage) in the above schematic, shown in [Figure 1-1](#), to characterize the 8 Bit DAC based 3 wire fan control implemented by today.

**Note:** Theoretical expectations based on a 6000 RPM fan would be  $6000/256 = \sim 24$  RPM step control resolution.

The measured data is shown in [Table 3-1](#) and [Figure 2-1](#).

**FIGURE 2-1: DAC VOLTAGE VS RPM**

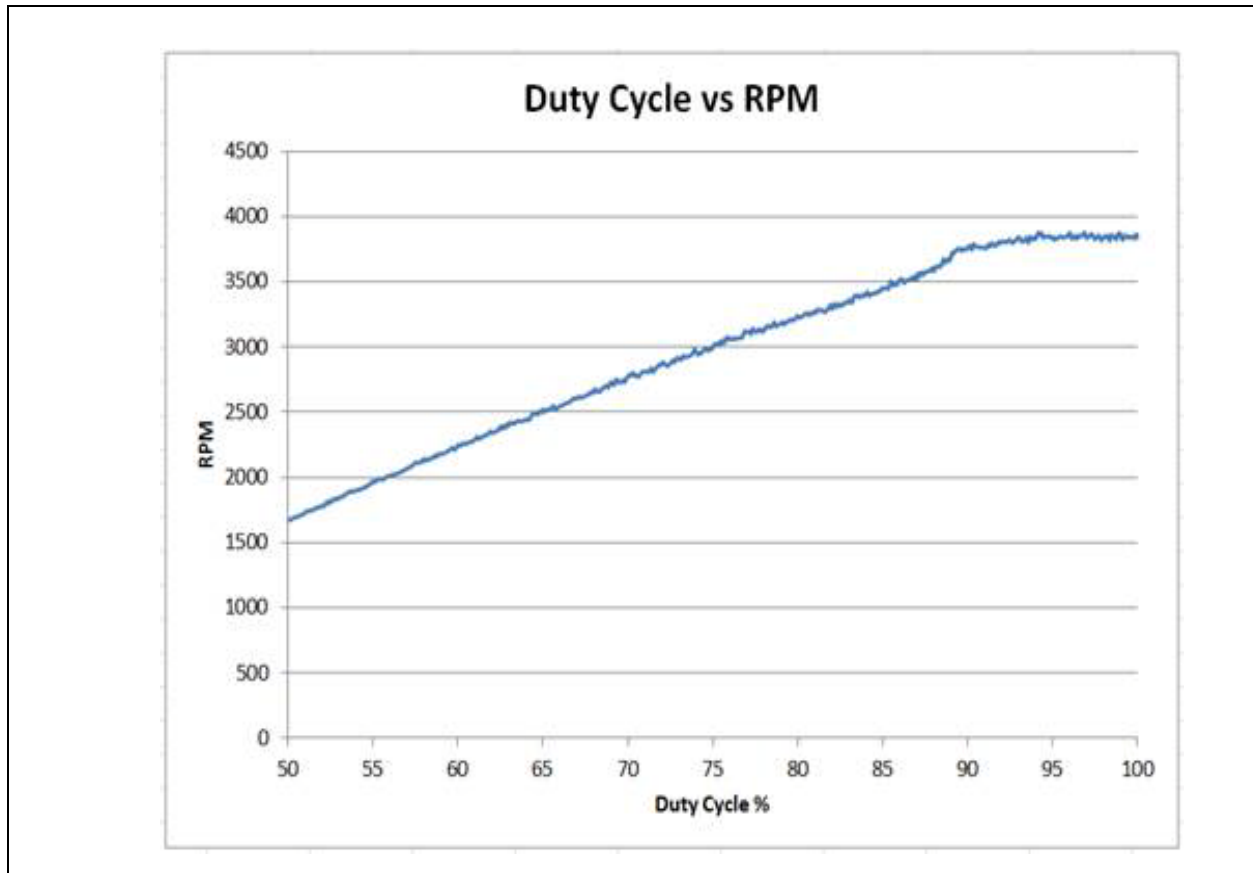


As you can see from the above data for the average RPM step resolution is  $\sim 24$  RMP.

**Note:** The measured RPM data also shows that in reality the DAC generates worse than the average  $\sim 24$  RMP (i.e. with system noise, the data shows jumping of more than 45 RPM).

Now utilizing the MEC140x/MEC141x/MEC142x PWM (1KHz) output with a simple single pole (set at 1.6Hz) Low pass filter the data was retaken as shown in [Table 3-2](#) and [Figure 2-2](#).

**FIGURE 2-2: DUTY CYCLE VS RPM**



As a result, the average RPM step control was significant reduced to approx. 5 – 8 RPM. Resulting in much finer RPM fan control.

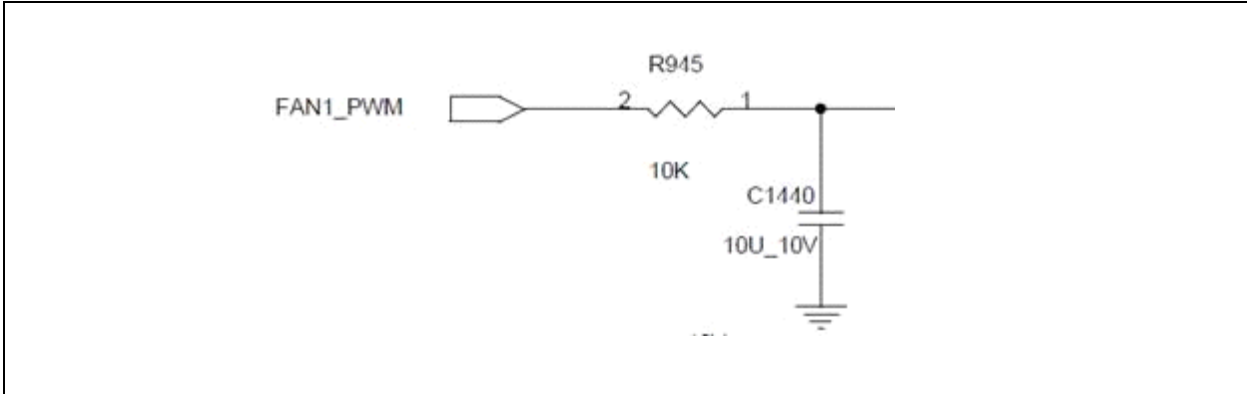
**Note:** The PWM data shown in [Figure 2-2](#) is 10-bit stepping.

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## 3.0 THEORY AND MATH OF CONVERTING THE PWM TO ANALOG VOLTAGE

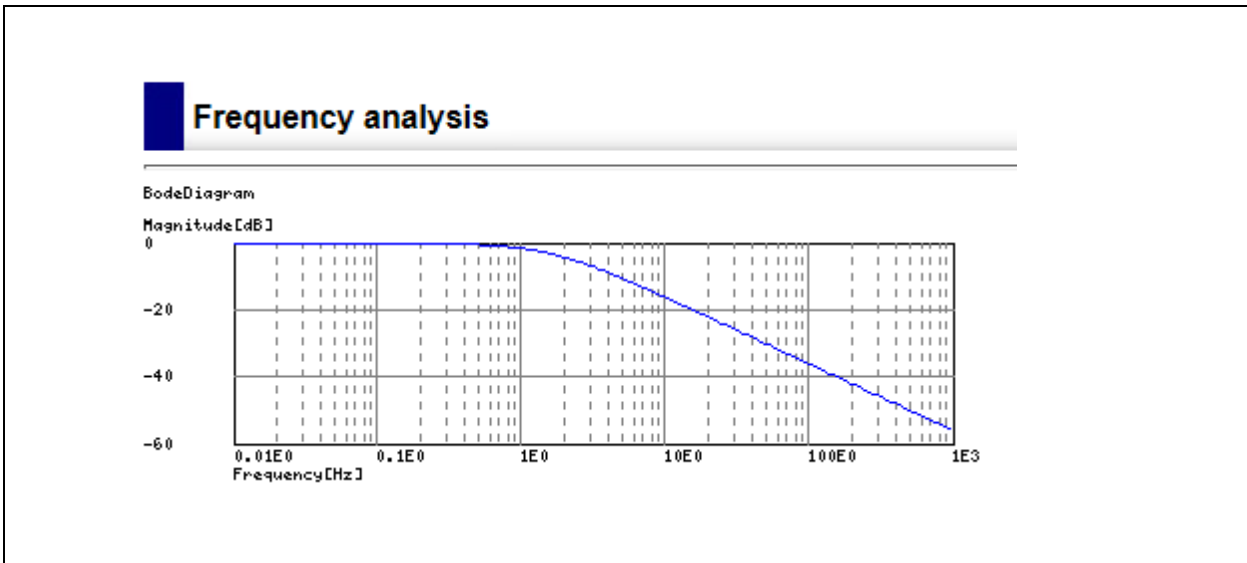
Use a simple in expensive R/C Low pass filter: R=10K and C= 10uF cap, sets the pole at ~1.6Hz to filter our 1Khz PWM output.

FIGURE 3-1: TYPICAL IN-EXPENSIVE R/C LOW PASS FILTER



With a fan PWM is 1Khz, the ripple is down ~60db (factor of 1000) - see bode plot below in [Figure 3-2](#).

FIGURE 3-2: BODE PLOT FOR FREQUENCY ANALYSIS



Calculated error with this filter introduced would be  $\sim 3V / 1000 = 3\text{mv}$  ripple on the filtered PWM value (essentially 1 bit of resolution on 10 bit PWM – which is in noise level for the PC board environment).

**Note:** This 3mV is input voltage ripple that is insignificant (i.e. factor of 20 less) compared to the error associated with the Fan driver chip itself, which shows for a fixed 1V Vset input the output voltage could vary almost 100mV. See Fan driver spec: as shown in [Figure 3-3](#).

FIGURE 3-3: TYPICAL FAN DRIVER SPEC

Output Voltage/ VSET Voltage	$V_{OUT}/V_{SET}$	$V_{IN}=5.5V, V_{SET}=1V \text{ to } 3.2V,$ $I_{OUT}=30mA$	1.552	1.6	1.648	V/V
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## APPENDIX A: DAC GENERATED ANALOG OUTPUT DATA

TABLE 3-1: DAC GENERATED ANALOG OUTPUT

DAC 8-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
4094	3.298	4.989	3851.091
4078	3.298	4.99	3868.472
4062	3.298	4.989	3858.521
4046	3.293	4.989	3836.317
4030	3.28	4.989	3848.621
4014	3.267	4.99	3886.01
3998	3.254	4.989	3824.092
3982	3.241	4.989	3841.229
3966	3.227	4.989	3875.969
3950	3.215	4.989	3858.521
3934	3.202	4.989	3856.041
3918	3.189	4.989	3868.472
3902	3.176	4.989	3836.317
3886	3.163	4.989	3846.154
3870	3.15	4.989	3838.772
3854	3.137	4.99	3868.472
3838	3.124	4.989	3843.69
3822	3.111	4.981	3838.772
3806	3.098	4.961	3819.223
3790	3.085	4.94	3831.418
3774	3.072	4.92	3843.69
3758	3.059	4.899	3831.418
3742	3.046	4.878	3821.656
3726	3.033	4.857	3811.944
3710	3.02	4.836	3802.281
3694	3.007	4.815	3752.345
3678	2.994	4.795	3792.668
3662	2.981	4.774	3740.648
3646	2.969	4.753	3752.345
3630	2.956	4.733	3745.318
3614	2.943	4.712	3710.575

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**TABLE 3-1: DAC GENERATED ANALOG OUTPUT (CONTINUED)**

DAC 8-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
3598	2.93	4.692	3667.482
3582	2.916	4.671	3636.364
3566	2.904	4.651	3577.818
3550	2.891	4.631	3571.429
3534	2.878	4.611	3544.005
3518	2.865	4.59	3548.196
3502	2.852	4.57	3496.503
3486	2.839	4.549	3470.214
3470	2.826	4.529	3470.214
3454	2.813	4.508	3418.803
3438	2.8	4.487	3401.361
3422	2.787	4.467	3384.095
3406	2.774	4.446	3407.155
3390	2.761	4.426	3357.583
3374	2.748	4.405	3363.229
3358	2.735	4.385	3346.347
3342	2.723	4.364	3302.146
3326	2.709	4.343	3273.322
3310	2.696	4.323	3264.418
3294	2.684	4.302	3253.796
3278	2.671	4.281	3237.992
3262	2.658	4.261	3243.243
3246	2.645	4.24	3231.018
3230	2.632	4.219	3188.098
3214	2.619	4.199	3224.073
3198	2.606	4.178	3169.572
3182	2.593	4.157	3157.895
3166	2.58	4.137	3169.572
3150	2.567	4.116	3103.983
3134	2.554	4.096	3131.524
3118	2.541	4.075	3089.598
3102	2.528	4.054	3078.502

TABLE 3-1: DAC GENERATED ANALOG OUTPUT (CONTINUED)

DAC 8-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
3086	2.515	4.034	3051.882
3070	2.502	4.013	3030.303
3054	2.489	3.992	3019.628
3038	2.476	3.972	3000
3022	2.463	3.951	2971.768
3006	2.45	3.931	2941.176
2990	2.437	3.91	2938.296
2974	2.425	3.89	2949.853
2958	2.412	3.869	2891.566
2942	2.398	3.848	2866.699
2926	2.386	3.828	2850.356
2910	2.373	3.807	2851.711
2894	2.36	3.787	2823.529
2878	2.347	3.766	2801.12
2862	2.334	3.745	2781.641
2846	2.321	3.725	2780.352
2830	2.308	3.704	2744.739
2814	2.295	3.683	2744.739
2798	2.282	3.663	2702.703
2782	2.269	3.642	2683.363
2766	2.256	3.622	2665.482
2750	2.243	3.601	2652.52
2734	2.23	3.581	2654.867
2718	2.217	3.56	2605.297
2702	2.204	3.54	2588.438
2686	2.191	3.519	2554.278
2670	2.178	3.498	2538.071
2654	2.165	3.478	2524.19
2638	2.153	3.457	2518.892
2622	2.14	3.436	2472.188
2606	2.127	3.416	2450.98
2590	2.114	3.395	2445.985

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**TABLE 3-1: DAC GENERATED ANALOG OUTPUT (CONTINUED)**

DAC 8-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
2574	2.101	3.375	2424.242
2558	2.088	3.354	2404.81
2542	2.075	3.333	2392.344
2526	2.062	3.313	2358.491
2510	2.049	3.292	2345.582
2494	2.036	3.272	2311.248
2478	2.023	3.251	2310.358
2462	2.01	3.23	2301.496
2446	1.997	3.21	2253.098
2430	1.984	3.189	2227.171
2414	1.971	3.168	2205.072
2398	1.958	3.148	2183.406
2382	1.945	3.127	2173.126
2366	1.932	3.106	2137.513
2350	1.919	3.086	2117.896
2334	1.906	3.065	2097.169
2318	1.893	3.044	2088.409
2302	1.88	3.023	2054.795
2286	1.867	3.003	2042.206
2270	1.855	2.982	2013.423
2254	1.841	2.962	1992.693
2238	1.829	2.941	1980.198
2222	1.816	2.92	1949.318
2206	1.803	2.9	1924.31
2190	1.79	2.879	1899.335
2174	1.777	2.858	1880.878
2158	1.764	2.838	1863.933
2142	1.751	2.817	1839.362
2126	1.738	2.797	1815.431
2110	1.725	2.776	1789.442
2094	1.712	2.755	1784.652
2078	1.699	2.735	1755.926

TABLE 3-1: DAC GENERATED ANALOG OUTPUT (CONTINUED)

DAC 8-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
2062	1.686	2.714	1729.107
2046	1.673	2.693	1699.717
2030	1.66	2.672	1682.086
2014	1.647	2.652	1656.543
1998	1.634	2.631	1632.209
1982	1.621	2.611	1609.874
1966	1.608	2.59	1591.934
1950	1.595	2.569	1571.503
1934	1.582	2.549	1553.599
1918	1.569	2.528	1529.442
1902	1.556	2.507	1496.633
1886	1.544	2.486	1478.925
1870	1.531	2.466	1450.677
1854	1.518	2.445	1425.856
1838	1.505	2.424	1397.95
1822	1.492	2.404	1378.676
1806	1.479	2.383	1355.626
1790	1.466	2.362	1328.904
1774	1.453	2.342	1310.902
1758	1.44	2.321	1279.863
1742	1.427	2.3	1253.918
1726	1.414	2.28	1229.508
1710	1.401	2.259	1207.973
1694	1.388	2.238	1182.965
1678	1.375	2.217	1160.766
1662	1.362	2.196	1134.859
1646	1.349	2.176	1110.905
1630	1.336	2.155	1083.619
1614	1.323	2.134	1059.696
1598	1.31	2.114	1037.703
1582	1.297	2.093	1007.557
1566	1.284	2.072	987.492

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**TABLE 3-1: DAC GENERATED ANALOG OUTPUT (CONTINUED)**

<b>DAC 8-bit (Steps)</b>	<b>V<sub>SET</sub> Voltage</b>	<b>V<sub>OUT</sub> (Voltage to Fan) V<sub>OUT</sub> = 1.6 V<sub>SET</sub> + Inaccuracies of Fan Driver</b>	<b>RPM</b>
1550	1.271	2.052	962.773
1534	1.258	2.031	935.745
1518	1.245	2.01	911.854
1502	1.233	1.989	883.392
1486	1.22	1.969	860.709
1470	1.206	1.948	835.189
1454	1.194	1.927	808.952
1438	1.181	1.907	782.779
1422	1.168	1.886	763.359
1406	1.155	1.855	737.01
1390	1.142	1.845	710.732
1374	1.129	1.825	91.554
1358	1.116	1.804	91.554
1342	1.103	1.784	91.554
1326	1.09	1.763	91.554
1310	1.077	1.742	91.554
1294	1.064	1.722	91.554
1278	1.051	1.7	91.554

## APPENDIX B: PWM GENERATED ANALOG OUTPUT DATA

TABLE 3-2: PWM GENERATED ANALOG OUTPUT

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
99.9985	3.301	4.992	3841.229
99.9008	3.299	4.992	3863.49
99.8032	3.295	4.992	3831.418
99.7055	3.292	4.992	3843.69
99.6078	3.289	4.992	3846.154
99.5102	3.286	4.992	3836.317
99.4125	3.283	4.992	3851.091
99.3149	3.279	4.992	3843.69
99.2172	3.276	4.992	3856.041
99.1196	3.273	4.992	3821.656
99.0219	3.27	4.992	3841.229
98.9242	3.266	4.992	3873.467
98.8266	3.263	4.992	3861.004
98.7289	3.26	4.992	3824.092
98.6313	3.257	4.992	3848.621
98.5336	3.254	4.992	3843.69
98.4360	3.25	4.992	3858.521
98.3383	3.247	4.992	3816.794
98.2406	3.244	4.992	3853.565
98.1430	3.241	4.992	3838.772
98.0453	3.237	4.992	3851.091
97.9477	3.234	4.992	3836.317
97.8500	3.231	4.992	3819.223
97.7523	3.228	4.992	3843.69
97.6547	3.225	4.992	3856.041
97.5570	3.221	4.992	3833.866
97.4594	3.218	4.992	3828.973
97.3617	3.215	4.992	3848.621
97.2641	3.212	4.992	3868.472
97.1664	3.209	4.992	3848.621
97.0687	3.205	4.992	3843.69

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
96.9711	3.202	4.992	3836.317
96.8734	3.199	4.992	3878.474
96.7758	3.196	4.992	3858.521
96.6781	3.192	4.992	3856.041
96.5805	3.189	4.992	3843.69
96.4828	3.186	4.992	3853.565
96.3851	3.183	4.992	3828.973
96.2875	3.18	4.992	3853.565
96.1898	3.176	4.992	3836.317
96.0922	3.173	4.991	3833.866
95.9945	3.17	4.992	3875.969
95.8968	3.167	4.991	3853.565
95.7992	3.163	4.991	3846.154
95.7015	3.16	4.991	3843.69
95.6039	3.157	4.991	3836.317
95.5062	3.154	4.992	3846.154
95.4086	3.151	4.991	3848.621
95.3109	3.147	4.992	3838.772
95.2132	3.144	4.992	3831.418
95.1156	3.141	4.991	3821.656
95.0179	3.138	4.992	3843.69
94.9203	3.135	4.992	3831.418
94.8226	3.131	4.991	3848.621
94.7250	3.128	4.991	3851.091
94.6273	3.125	4.99	3848.621
94.5296	3.122	4.99	3838.772
94.4320	3.118	4.988	3838.772
94.3343	3.115	4.986	3873.467
94.2367	3.112	4.983	3856.041
94.1390	3.109	4.979	3878.474
94.0414	3.106	4.974	3843.69
93.9437	3.102	4.969	3826.531

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
93.8460	3.099	4.964	3841.229
93.7484	3.096	4.959	3821.656
93.6507	3.093	4.954	3846.154
93.5531	3.09	4.949	3799.873
93.4554	3.086	4.944	3836.317
93.3577	3.083	4.939	3824.092
93.2601	3.08	4.933	3809.524
93.1624	3.077	4.928	3807.107
93.0648	3.073	4.923	3833.866
92.9671	3.07	4.918	3841.229
92.8695	3.067	4.913	3821.656
92.7718	3.064	4.907	3816.794
92.6741	3.061	4.902	3799.873
92.5765	3.057	4.897	3799.873
92.4788	3.054	4.892	3821.656
92.3812	3.051	4.887	3816.794
92.2835	3.048	4.882	3802.281
92.1859	3.045	4.876	3802.281
92.0882	3.041	4.871	3811.944
91.9905	3.038	4.866	3809.524
91.8929	3.035	4.861	3795.066
91.7952	3.032	4.856	3804.692
91.6976	3.028	4.851	3783.102
91.5999	3.025	4.845	3773.585
91.5023	3.022	4.84	3783.102
91.4046	3.019	4.835	3797.468
91.3069	3.016	4.83	3768.844
91.2093	3.012	4.825	3785.489
91.1116	3.009	4.82	3761.755
91.0140	3.006	4.814	3757.044
90.9163	3.003	4.809	3764.115
90.8186	2.999	4.804	3759.398

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
90.7210	2.996	4.799	3766.478
90.6233	2.993	4.794	3766.478
90.5257	2.99	4.789	3766.478
90.4280	2.987	4.783	3778.338
90.3304	2.983	4.778	3790.272
90.2327	2.98	4.773	3745.318
90.1350	2.977	4.768	3775.96
90.0374	2.974	4.763	3771.213
89.9397	2.97	4.758	3750
89.8421	2.967	4.752	3745.318
89.7444	2.964	4.747	3754.693
89.6468	2.961	4.742	3738.318
89.5491	2.958	4.737	3745.318
89.4514	2.954	4.732	3757.044
89.3538	2.951	4.727	3740.648
89.2561	2.948	4.722	3738.318
89.1585	2.945	4.717	3715.17
89.0608	2.942	4.712	3724.395
88.9631	2.938	4.707	3665.241
88.8655	2.935	4.702	3676.471
88.7678	2.932	4.697	3663.004
88.6702	2.929	4.691	3645.2
88.5725	2.925	4.686	3676.471
88.4749	2.922	4.681	3638.569
88.3772	2.919	4.676	3614.458
88.2795	2.916	4.671	3623.188
88.1819	2.913	4.666	3610.108
88.0842	2.909	4.661	3614.458
87.9866	2.906	4.656	3579.952
87.8889	2.903	4.651	3605.769
87.7913	2.9	4.646	3586.372
87.6936	2.897	4.641	3579.952

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
87.5959	2.893	4.636	3579.952
87.4983	2.89	4.631	3575.685
87.4006	2.887	4.626	3554.502
87.3030	2.884	4.621	3571.429
87.2053	2.88	4.616	3548.196
87.1077	2.877	4.611	3569.304
87.0100	2.874	4.605	3519.062
86.9123	2.87	4.6	3548.196
86.8147	2.868	4.595	3514.938
86.7170	2.864	4.59	3533.569
86.6194	2.861	4.585	3523.194
86.5217	2.858	4.58	3510.825
86.4240	2.855	4.575	3512.881
86.3264	2.851	4.569	3504.673
86.2287	2.848	4.564	3490.401
86.1311	2.845	4.56	3521.127
86.0334	2.842	4.554	3516.999
85.9358	2.838	4.549	3510.825
85.8381	2.835	4.544	3476.246
85.7404	2.832	4.539	3488.372
85.6428	2.829	4.534	3472.222
85.5451	2.826	4.529	3480.278
85.4475	2.823	4.524	3504.673
85.3498	2.819	4.519	3448.276
85.2522	2.816	4.514	3450.259
85.1545	2.813	4.508	3454.231
85.0568	2.81	4.503	3446.295
84.9592	2.806	4.498	3454.231
84.8615	2.803	4.493	3430.532
84.7639	2.8	4.488	3422.704
84.6662	2.797	4.483	3426.613
84.5686	2.794	4.478	3409.091

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
84.4709	2.79	4.473	3414.912
84.3732	2.787	4.467	3403.29
84.2756	2.784	4.462	3409.091
84.1779	2.781	4.457	3391.747
84.0803	2.777	4.452	3422.704
83.9826	2.774	4.447	3401.361
83.8849	2.771	4.442	3389.831
83.7873	2.768	4.437	3401.361
83.6896	2.764	4.432	3386.005
83.5920	2.761	4.427	3378.378
83.4943	2.758	4.421	3397.508
83.3967	2.755	4.416	3387.916
83.2990	2.751	4.411	3389.831
83.2013	2.748	4.406	3340.757
83.1037	2.745	4.401	3346.347
83.0060	2.742	4.396	3361.345
82.9084	2.739	4.391	3337.041
82.8107	2.735	4.386	3340.757
82.7131	2.732	4.381	3338.898
82.6154	2.729	4.376	3316.75
82.5177	2.726	4.371	3316.75
82.4201	2.723	4.366	3331.483
82.3224	2.72	4.36	3309.432
82.2248	2.716	4.355	3311.258
82.1271	2.713	4.35	3331.483
82.0294	2.71	4.345	3289.474
81.9318	2.707	4.34	3320.421
81.8341	2.704	4.335	3307.607
81.7365	2.7	4.33	3284.072
81.6388	2.697	4.325	3271.538
81.5412	2.694	4.32	3266.195
81.4435	2.691	4.315	3284.072

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
81.3458	2.688	4.31	3280.481
81.2482	2.685	4.305	3282.276
81.1505	2.682	4.3	3289.474
81.0529	2.678	4.294	3260.87
80.9552	2.675	4.289	3271.538
80.8576	2.672	4.284	3255.562
80.7599	2.669	4.279	3260.87
80.6622	2.665	4.274	3241.491
80.5646	2.662	4.269	3259.098
80.4669	2.659	4.264	3255.562
80.3693	2.656	4.259	3248.511
80.2716	2.653	4.254	3232.759
80.1740	2.649	4.248	3232.759
80.0763	2.646	4.243	3222.342
79.9786	2.643	4.238	3237.992
79.8810	2.64	4.233	3225.806
79.7833	2.636	4.228	3210.273
79.6857	2.633	4.223	3201.708
79.5880	2.63	4.218	3211.991
79.4903	2.627	4.212	3205.128
79.3927	2.624	4.207	3191.489
79.2950	2.62	4.202	3191.489
79.1974	2.617	4.197	3172.924
79.0997	2.614	4.192	3191.489
79.0021	2.611	4.187	3181.336
78.9044	2.608	4.182	3169.572
78.8067	2.604	4.177	3167.899
78.7091	2.601	4.172	3159.558
78.6114	2.598	4.166	3191.489
78.5138	2.595	4.161	3157.895
78.4161	2.592	4.156	3152.916
78.3185	2.588	4.151	3161.222

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
78.2208	2.585	4.146	3164.557
78.1231	2.582	4.141	3139.717
78.0255	2.579	4.136	3143.007
77.9278	2.575	4.131	3115.265
77.8302	2.572	4.126	3123.373
77.7325	2.569	4.12	3138.075
77.6349	2.566	4.115	3121.748
77.5372	2.563	4.11	3113.648
77.4395	2.559	4.105	3125
77.3419	2.556	4.1	3141.361
77.2442	2.553	4.095	3099.174
77.1466	2.55	4.09	3118.503
77.0489	2.546	4.085	3115.265
76.9512	2.543	4.079	3116.883
76.8536	2.54	4.074	3120.125
76.7559	2.537	4.069	3078.502
76.6583	2.533	4.064	3069.054
76.5606	2.53	4.059	3070.624
76.4630	2.527	4.054	3065.917
76.3653	2.524	4.048	3065.917
76.2676	2.521	4.044	3058.104
76.1700	2.517	4.038	3067.485
76.0723	2.514	4.033	3058.104
75.9747	2.511	4.028	3058.104
75.8770	2.508	4.023	3076.923
75.7794	2.505	4.018	3064.351
75.6817	2.501	4.013	3030.303
75.5840	2.498	4.008	3053.435
75.4864	2.495	4.002	3021.148
75.3887	2.492	3.998	3037.975
75.2911	2.489	3.993	3015.075
75.1934	2.485	3.987	3021.148

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
75.0958	2.482	3.982	3022.67
74.9981	2.479	3.977	2992.519
74.9004	2.476	3.972	2980.626
74.8028	2.473	3.967	2985.075
74.7051	2.469	3.962	2970.297
74.6075	2.466	3.957	2989.537
74.5098	2.463	3.952	2980.626
74.4121	2.46	3.946	2973.241
74.3145	2.456	3.941	2948.403
74.2168	2.453	3.936	2957.122
74.1192	2.45	3.931	2941.176
74.0215	2.447	3.926	2958.58
73.9239	2.444	3.921	2983.59
73.8262	2.44	3.916	2954.21
73.7285	2.437	3.911	2936.858
73.6309	2.434	3.905	2931.119
73.5332	2.431	3.9	2931.119
73.4356	2.428	3.896	2921.13
73.3379	2.424	3.89	2925.402
73.2403	2.421	3.885	2932.551
73.1426	2.418	3.88	2901.354
73.0449	2.414	3.875	2904.163
72.9473	2.411	3.87	2918.288
72.8496	2.408	3.865	2909.796
72.7520	2.405	3.86	2881.844
72.6543	2.401	3.855	2898.551
72.5566	2.399	3.849	2880.461
72.4590	2.395	3.844	2870.813
72.3613	2.392	3.839	2854.424
72.2637	2.389	3.834	2861.23
72.1660	2.386	3.829	2868.069
72.0684	2.382	3.824	2883.229

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
71.9707	2.379	3.819	2859.867
71.8730	2.376	3.814	2865.33
71.7754	2.373	3.809	2858.504
71.6777	2.369	3.803	2836.879
71.5801	2.366	3.798	2830.189
71.4824	2.363	3.793	2806.361
71.3848	2.36	3.788	2836.879
71.2871	2.357	3.783	2823.529
71.1894	2.354	3.778	2805.049
71.0918	2.35	3.773	2811.621
70.9941	2.347	3.768	2812.94
70.8965	2.344	3.762	2811.621
70.7988	2.341	3.757	2801.12
70.7012	2.337	3.752	2781.641
70.6035	2.334	3.747	2771.363
70.5058	2.331	3.742	2785.515
70.4082	2.328	3.737	2777.778
70.3105	2.324	3.732	2802.429
70.2129	2.321	3.727	2782.931
70.1152	2.318	3.722	2788.104
70.0175	2.315	3.716	2772.643
69.9199	2.311	3.711	2762.431
69.8222	2.309	3.706	2730.997
69.7246	2.305	3.701	2748.511
69.6269	2.302	3.696	2729.754
69.5293	2.299	3.691	2729.754
69.4316	2.296	3.686	2729.754
69.3339	2.292	3.68	2753.557
69.2363	2.289	3.675	2718.623
69.1386	2.286	3.67	2708.804
69.0410	2.283	3.665	2733.485
68.9433	2.28	3.66	2716.161

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
68.8457	2.276	3.655	2686.968
68.7480	2.273	3.65	2702.703
68.6503	2.27	3.645	2699.055
68.5527	2.267	3.64	2688.172
68.4550	2.263	3.634	2676.182
68.3574	2.26	3.629	2657.219
68.2597	2.257	3.624	2664.298
68.1621	2.254	3.619	2656.042
68.0644	2.251	3.614	2678.571
67.9667	2.247	3.609	2649.007
67.8691	2.244	3.604	2659.574
67.7714	2.241	3.599	2639.683
67.6738	2.238	3.594	2639.683
67.5761	2.235	3.588	2631.579
67.4784	2.231	3.584	2623.524
67.3808	2.228	3.578	2617.801
67.2831	2.225	3.573	2614.379
67.1855	2.222	3.568	2609.83
67.0878	2.218	3.563	2620.087
66.9902	2.215	3.558	2604.167
66.8925	2.212	3.553	2605.297
66.7948	2.209	3.548	2606.429
66.6972	2.206	3.543	2594.034
66.5995	2.202	3.537	2578.427
66.5019	2.199	3.532	2576.213
66.4042	2.196	3.527	2568.493
66.3066	2.193	3.522	2566.296
66.2089	2.189	3.517	2559.727
66.1112	2.186	3.512	2547.771
66.0136	2.183	3.506	2548.853
65.9159	2.18	3.501	2539.145
65.8183	2.177	3.496	2528.445

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
65.7206	2.173	3.491	2517.835
65.6229	2.17	3.486	2548.853
65.5253	2.167	3.481	2532.714
65.4276	2.164	3.476	2527.38
65.3300	2.161	3.471	2518.892
65.2323	2.157	3.466	2517.835
65.1347	2.154	3.461	2505.219
65.0370	2.151	3.456	2522.068
64.9393	2.148	3.45	2497.918
64.8417	2.145	3.445	2510.46
64.7440	2.141	3.44	2494.802
64.6464	2.138	3.435	2480.364
64.5487	2.135	3.43	2494.802
64.4511	2.132	3.425	2489.627
64.3534	2.128	3.42	2482.416
64.2557	2.125	3.415	2447.98
64.1581	2.122	3.41	2439.024
64.0604	2.119	3.404	2446.982
63.9628	2.116	3.399	2439.024
63.8651	2.112	3.394	2438.033
63.7675	2.109	3.389	2429.15
63.6698	2.106	3.384	2431.118
63.5721	2.103	3.379	2433.09
63.4745	2.1	3.374	2432.104
63.3768	2.096	3.369	2417.405
63.2792	2.093	3.364	2410.607
63.1815	2.09	3.358	2418.38
63.0838	2.087	3.353	2421.308
62.9862	2.083	3.348	2398.082
62.8885	2.08	3.343	2409.639
62.7909	2.077	3.338	2378.121
62.6932	2.074	3.333	2396.166

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
62.5956	2.071	3.328	2371.542
62.4979	2.067	3.323	2391.391
62.4002	2.064	3.317	2366.864
62.3026	2.061	3.312	2357.564
62.2049	2.058	3.307	2349.256
62.1073	2.055	3.302	2347.418
62.0096	2.051	3.297	2339.181
61.9120	2.048	3.292	2353.864
61.8143	2.045	3.287	2339.181
61.7166	2.042	3.281	2325.581
61.6190	2.039	3.277	2321.981
61.5213	2.035	3.271	2315.708
61.4237	2.032	3.266	2313.03
61.3260	2.029	3.261	2298.851
61.2284	2.026	3.256	2295.333
61.1307	2.022	3.251	2313.03
61.0330	2.019	3.246	2290.951
60.9354	2.016	3.241	2286.585
60.8377	2.013	3.236	2271.007
60.7401	2.01	3.231	2272.727
60.6424	2.006	3.225	2270.148
60.5447	2.003	3.22	2260.739
60.4471	2	3.215	2254.791
60.3494	1.997	3.21	2264.151
60.2518	1.993	3.205	2256.487
60.1541	1.99	3.2	2241.315
60.0565	1.987	3.195	2249.719
59.9588	1.984	3.19	2242.991
59.8611	1.981	3.184	2215.657
59.7635	1.977	3.179	2214.022
59.6658	1.974	3.174	2229.654
59.5682	1.971	3.169	2212.389

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
59.4705	1.968	3.164	2207.506
59.3729	1.965	3.159	2200.22
59.2752	1.961	3.154	2190.581
59.1775	1.958	3.149	2183.406
59.0799	1.955	3.143	2181.818
58.9822	1.952	3.138	2184.201
58.8846	1.948	3.133	2173.126
58.7869	1.945	3.128	2161.383
58.6893	1.942	3.123	2173.913
58.5916	1.939	3.118	2151.309
58.4939	1.936	3.113	2155.172
58.3963	1.932	3.108	2141.328
58.2986	1.929	3.102	2135.991
58.2010	1.926	3.097	2142.092
58.1033	1.923	3.092	2124.646
58.0056	1.92	3.087	2142.092
57.9080	1.916	3.082	2120.141
57.8103	1.913	3.077	2122.391
57.7127	1.91	3.072	2111.932
57.6150	1.907	3.067	2110.447
57.5174	1.903	3.062	2115.656
57.4197	1.9	3.057	2103.787
57.3220	1.897	3.051	2089.864
57.2244	1.894	3.046	2080.444
57.1267	1.891	3.041	2078.282
57.0291	1.887	3.036	2068.252
56.9314	1.884	3.031	2061.147
56.8338	1.881	3.026	2055.498
56.7361	1.878	3.02	2049.18
56.6384	1.874	3.015	2038.736
56.5408	1.871	3.01	2034.588
56.4431	1.868	3.005	2029.084

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
56.3455	1.865	3	2031.144
56.2478	1.862	2.995	2020.202
56.1501	1.858	2.99	2015.452
56.0525	1.855	2.985	2018.843
55.9548	1.852	2.98	2010.724
55.8572	1.849	2.974	2005.348
55.7595	1.846	2.969	2001.334
55.6619	1.842	2.964	1992.032
55.5642	1.839	2.959	1982.161
55.4665	1.836	2.954	1985.44
55.3689	1.833	2.949	1988.072
55.2712	1.83	2.944	1987.413
55.1736	1.826	2.939	1970.443
55.0759	1.823	2.933	1962.709
54.9783	1.82	2.928	1971.738
54.8806	1.817	2.923	1953.761
54.7829	1.813	2.918	1944.895
54.6853	1.81	2.913	1931.745
54.5876	1.807	2.907	1933.613
54.4900	1.804	2.903	1916.933
54.3923	1.801	2.898	1916.933
54.2947	1.797	2.892	1913.265
54.1970	1.794	2.887	1902.95
54.0993	1.791	2.882	1902.346
54.0017	1.788	2.877	1902.95
53.9040	1.785	2.872	1897.533
53.8064	1.781	2.867	1887.98
53.7087	1.778	2.862	1893.939
53.6110	1.775	2.857	1893.342
53.5134	1.772	2.852	1875.586
53.4157	1.768	2.846	1875
53.3181	1.765	2.841	1862.776

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TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
53.2204	1.762	2.836	1850.709
53.1228	1.759	2.831	1854.141
53.0251	1.756	2.826	1843.318
52.9274	1.752	2.821	1831.502
52.8298	1.749	2.816	1842.752
52.7321	1.746	2.811	1827.597
52.6345	1.743	2.806	1830.943
52.5368	1.74	2.8	1807.773
52.4392	1.736	2.795	1818.733
52.3415	1.733	2.79	1800.18
52.2438	1.73	2.785	1807.773
52.1462	1.727	2.78	1780.415
52.0485	1.723	2.775	1780.944
51.9509	1.72	2.77	1773.574
51.8532	1.717	2.764	1778.832
51.7556	1.714	2.759	1765.225
51.6579	1.711	2.754	1766.264
51.5602	1.707	2.749	1753.361
51.4626	1.704	2.744	1755.413
51.3649	1.701	2.739	1745.201
51.2673	1.698	2.734	1742.666
51.1696	1.695	2.729	1744.186
51.0719	1.691	2.724	1737.619
50.9743	1.688	2.718	1726.122
50.8766	1.685	2.713	1715.756
50.7790	1.682	2.708	1711.352
50.6813	1.678	2.703	1706.485
50.5837	1.675	2.698	1696.833
50.4860	1.672	2.693	1699.235
50.3883	1.669	2.688	1691.094
50.2907	1.666	2.682	1688.714
50.1930	1.662	2.677	1679.261

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
50.0954	1.659	2.672	1674.107
49.9977	1.656	2.667	1668.057
49.9001	1.653	2.662	1660.21
49.8024	1.649	2.657	1661.13
49.7047	1.646	2.652	1648.352
49.6071	1.643	2.647	1642.486
49.5094	1.64	2.641	1642.486
49.4118	1.637	2.636	1640.241
49.3141	1.633	2.631	1637.108
49.2164	1.63	2.626	1622.499
49.1188	1.627	2.621	1617.251
49.0211	1.624	2.616	1615.074
48.9235	1.621	2.611	1612.037
48.8258	1.617	2.606	1610.738
48.7282	1.614	2.6	1595.32
48.6305	1.611	2.595	1597.444
48.5328	1.608	2.59	1575.63
48.4352	1.605	2.585	1589.825
48.3375	1.601	2.58	1570.681
48.2399	1.598	2.575	1574.39
48.1422	1.595	2.57	1558.037
48.0446	1.592	2.564	1559.657
47.9469	1.588	2.559	1554.404
47.8492	1.585	2.554	1544.402
47.7516	1.582	2.549	1542.416
47.6539	1.579	2.544	1533.35
47.5563	1.576	2.539	1529.442
47.4586	1.572	2.534	1515.917
47.3610	1.569	2.529	1506.024
47.2633	1.566	2.524	1515.534
47.1656	1.563	2.518	1513.241
47.0680	1.56	2.513	1494.024

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
46.9703	1.556	2.508	1498.127
46.8727	1.553	2.503	1483.68
46.7750	1.55	2.498	1476.378
46.6773	1.547	2.493	1478.925
46.5797	1.543	2.488	1466.634
46.4820	1.54	2.482	1460.565
46.3844	1.537	2.477	1454.545
46.2867	1.534	2.472	1455.957
46.1891	1.531	2.467	1448.226
46.0914	1.527	2.462	1451.73
45.9937	1.524	2.457	1434.377
45.8961	1.521	2.452	1433.692
45.7984	1.518	2.447	1418.104
45.7008	1.515	2.441	1412.097
45.6031	1.511	2.436	1404.166
45.5055	1.508	2.431	1395.998
45.4078	1.505	2.426	1394.7
45.3101	1.502	2.421	1395.024
45.2125	1.499	2.416	1393.081
45.1148	1.495	2.411	1382.17
45.0172	1.492	2.405	1385.042
44.9195	1.489	2.4	1363.946
44.8219	1.486	2.395	1359.619
44.7242	1.482	2.39	1358.696
44.6265	1.479	2.385	1345.895
44.5289	1.476	2.38	1353.791
44.4312	1.473	2.375	1337.494
44.3336	1.47	2.369	1327.727
44.2359	1.466	2.364	1327.434
44.1382	1.463	2.359	1320.132
44.0406	1.46	2.354	1314.924
43.9429	1.457	2.349	1308.044

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
43.8453	1.453	2.344	1303.781
43.7476	1.45	2.339	1295.057
43.6500	1.447	2.334	1281.23
43.5523	1.444	2.328	1282.325
43.4546	1.441	2.323	1278.772
43.3570	1.437	2.318	1271.725
43.2593	1.434	2.313	1262.095
43.1617	1.431	2.308	1259.446
43.0640	1.428	2.303	1254.443
42.9664	1.425	2.298	1247.92
42.8687	1.421	2.293	1239.157
42.7710	1.418	2.287	1236.858
42.6734	1.415	2.282	1231.274
42.5757	1.412	2.277	1219.264
42.4781	1.408	2.272	1216.792
42.3804	1.405	2.267	1211.876
42.2827	1.402	2.262	1206.515
42.1851	1.399	2.257	1203.128
42.0874	1.396	2.251	1192.132
41.9898	1.392	2.246	1187.648
41.8921	1.389	2.241	1179.941
41.7945	1.386	2.236	1174.168
41.6968	1.383	2.231	1168.224
41.5991	1.38	2.226	1167.315
41.5015	1.376	2.221	1162.34
41.4038	1.373	2.215	1149.205
41.3062	1.37	2.21	1149.866
41.2085	1.367	2.205	1138.304
41.1109	1.364	2.2	1135.718
41.0132	1.36	2.195	1126.126
40.9155	1.357	2.19	1120.448
40.8179	1.354	2.185	1110.289

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**TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)**

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
40.7202	1.351	2.179	1110.289
40.6226	1.347	2.174	1096.091
40.5249	1.344	2.169	1095.69
40.4273	1.341	2.164	1089.127
40.3296	1.338	2.159	1084.599
40.2319	1.335	2.154	1083.619
40.1343	1.331	2.149	1072.77
40.0366	1.328	2.144	1067.806
39.9390	1.325	2.138	1059.509
39.8413	1.322	2.133	1050.236
39.7436	1.319	2.128	1043.478
39.6460	1.315	2.123	1044.386
39.5483	1.312	2.118	1036.807
39.4507	1.309	2.113	1027.925
39.3530	1.306	2.108	1021.624
39.2554	1.302	2.102	1020.061
39.1577	1.299	2.097	1012.829
39.0600	1.296	2.092	1006.036
38.9624	1.293	2.087	998.835
38.8647	1.29	2.082	995.19
38.7671	1.286	2.077	991.736
38.6694	1.283	2.072	977.995
38.5718	1.28	2.066	975.134
38.4741	1.277	2.061	967.898
38.3764	1.274	2.056	962.464
38.2788	1.27	2.051	954.047
38.1811	1.267	2.046	947.269
38.0835	1.264	2.041	946.522
37.9858	1.261	2.036	940.586
37.8882	1.257	2.03	929.512
37.7905	1.254	2.025	924.357
37.6928	1.251	2.02	920.245

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
37.5952	1.248	2.015	911.023
37.4975	1.245	2.01	906.208
37.3999	1.241	2.005	897.935
37.3022	1.238	2	893.123
37.2045	1.235	1.995	886.656
37.1069	1.232	1.989	878.735
37.0092	1.229	1.984	876.552
36.9116	1.225	1.979	866.301
36.8139	1.222	1.974	865.052
36.7163	1.219	1.969	854.944
36.6186	1.216	1.964	845.428
36.5209	1.212	1.959	841.397
36.4233	1.209	1.953	836.237
36.3256	1.206	1.948	829.073
36.2280	1.203	1.943	821.918
36.1303	1.2	1.938	813.118
36.0327	1.196	1.933	811.579
35.9350	1.193	1.928	801.925
35.8373	1.19	1.923	799.148
35.7397	1.187	1.917	790.097
35.6420	1.184	1.912	781.759
35.5444	1.18	1.907	779.018
35.4467	1.177	1.902	772.4
35.3491	1.174	1.897	766.381
35.2514	1.171	1.892	759.686
35.1537	1.168	1.886	757.193
35.0561	1.164	1.881	748.503
34.9584	1.161	1.876	740.741
34.8608	1.158	1.871	737.644
34.7631	1.155	1.866	731.886
34.6654	1.152	1.861	722.369
34.5678	1.148	1.856	717.274

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TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
34.4701	1.145	1.851	714.031
34.3725	1.142	1.845	708.634
34.2748	1.138	1.84	700.771
34.1772	1.135	1.835	696.136
34.0795	1.132	1.83	690.211
33.9818	1.129	1.825	685.949
33.8842	1.126	1.82	678.043
33.7865	1.123	1.814	674.233
33.6889	1.119	1.81	666.297
33.5912	1.116	1.804	660.284
33.4936	1.113	1.799	651.112
33.3959	1.11	1.794	647.598
33.2982	1.106	1.789	641.78
33.2006	1.103	1.784	635.122
33.1029	1.1	1.779	630.848
33.0053	1.097	1.774	623.571
32.9076	1.094	1.768	616.65
32.8099	1.09	1.763	613.685
32.7123	1.087	1.758	604.534
32.6146	1.084	1.753	602.591
32.5170	1.081	1.748	596.718
32.4193	1.078	1.743	589.739
32.3217	1.074	1.737	585.823
32.2240	1.071	1.732	576.868
32.1263	1.068	1.727	573.066
32.0287	1.065	1.722	570.994
31.9310	1.062	1.717	563.116
31.8334	1.058	1.711	558.036
31.7357	1.055	1.706	555.607
31.6381	1.052	1.701	551.065
31.5404	1.049	1.696	542.888
31.4427	1.045	1.691	539.326

TABLE 3-2: PWM GENERATED ANALOG OUTPUT (CONTINUED)

PWM 10-bit (Steps)	V <sub>SET</sub> Voltage	V <sub>OUT</sub> (Voltage to Fan) V <sub>OUT</sub> = 1.6 V <sub>SET</sub> + Inaccuracies of Fan Driver	RPM
31.3451	1.042	1.686	536.337
31.2474	1.039	1.681	528.634
31.1498	1.036	1.676	523.606
31.0521	1.032	1.671	519.481
30.9545	1.029	1.666	91.554
30.8568	1.025	1.661	91.554
30.7591	1.023	1.655	91.554
30.6615	1.019	1.65	91.554

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## APPENDIX C: APPLICATION NOTE REVISION HISTORY

TABLE C-1: REVISION HISTORY

Revision Level & Date	Section/Figure/Entry	Correction
DS00002137B (07-10-17)	All	Added MEC142x part number
DS00002137A (04-18-16)		Initial Release

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