

# FAN65005A-GEVB

## High Performance 65 V, 8 A Voltage Mode Synchronous PWM Buck Regulator Evaluation Board User's Manual

### Description

FAN65005A is a wide VIN highly efficient synchronous buck regulator, with integrated high side and low side power MOSFETs. The device incorporates a fixed frequency voltage mode PWM controller supporting a wide voltage range from 4.5 V to 65 V and can handle continuous currents up to 8 A.

FAN65005A includes a 0.67% accurate reference voltage to achieve tight regulation. The switching frequency can be programmed from 100 kHz to 1 MHz. To improve efficiency at light load condition, the device can be set to discontinuous conduction mode with pulse skipping operation.

FAN65005A has dual LDOs to minimize power loss and integrated current sense circuit that provides cycle-by-cycle current limiting. This single phase buck regulator offers complete protection features including Over current protection, Thermal shutdown, Under-voltage lockout, Over voltage protection, Under voltage protection and Short-circuit protection.

FAN65005A uses ON Semiconductor's high performance POWERTRENCH<sup>®</sup> MOSFETs that reduces ringing in switching applications. FAN65005A integrates the controller, driver, and power MOSFETs into a thermally enhanced, compact 6 × 6 mm PQFN package. With an integrated approach, the complete DC/DC converter is optimized from the controller and driver to MOSFET switching performance, delivering a high power density solution.

### Performance Specifications of the FAN65005A-GEVB

Parameter	Conditions	Performance Value
Input Voltage	Range 4.5 V to 65 V	48 V
Inductor Current	RILIM = 147 kΩ (Unless Otherwise Noted)	8 A
Output Voltage	3.3 V and 5 V	5 V
Output Voltage Ripple		20 mV p-p
Transient Response	Peak Deviation Load step 3 A/μs to 7 A/μs	0.1 V
Switching Frequency	100 kHz – 1 MHz	250 kHz
Efficiency		91.5%



ON Semiconductor<sup>®</sup>

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### EVAL BOARD USER'S MANUAL

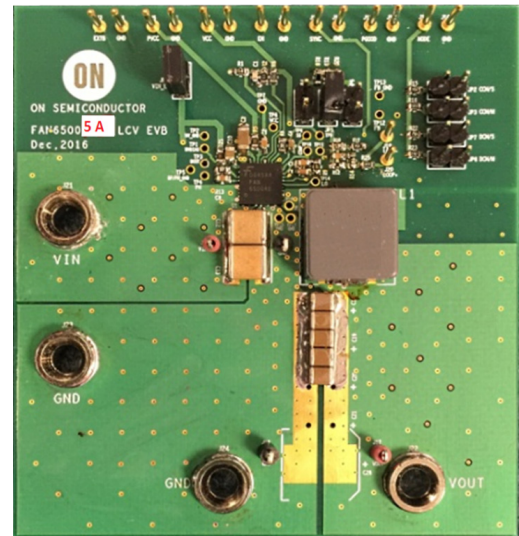


Figure 1. FAN65005A Evaluation Board

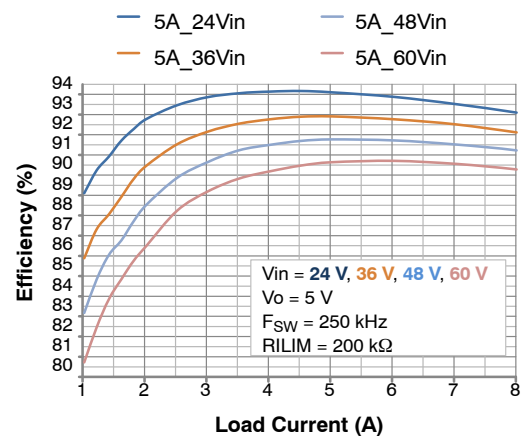


Figure 2. FAN65005A Efficiency

## FAN65005A-GEVB

The FAN65005A-GEVB has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance, follow the procedure below and refer to Figure 3.

1. Connect a power supply to the input terminals  $V_{IN}$  and GND. Set  $V_{in}$  between 10 V to 60 V.
2. Connect the positive terminal of the electronic load to  $V_{OUT}$  and negative terminal to GND.
3. There are 2 ways to enable the device:
  - a. Use external voltage source of 2 V~5 V regardless of input voltage range, on the EN pin.
  - b. Use  $V_{IN}$  voltage divider. If so, 2 requirements need to be satisfied: J1 jumper be connected,  $V_{IN} \geq V_{IN\_UVLO}$ .
4. The evaluation board should now power up with a 3.3 V output voltage.
5. Check for the proper output voltage of 3.3 V ( $\pm 1\%$ ) at the output terminals  $V_{OUT}$  and GND. Measurement can also be done with a multimeter with the positive and negative leads between  $V_{OUT}$  and GND.
6. Set the load to 6 A through the electronic load. Check for the stable operation of the PH (TP16) signal on the oscilloscope. Measure the switching frequency. A test point is conveniently located at the head of the inductor.

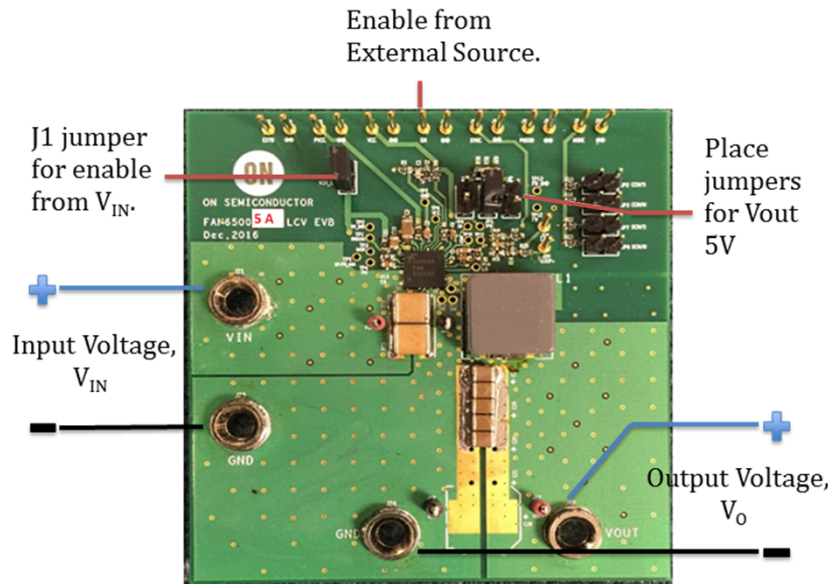


Figure 3. EVM Board Connections

### Measurement/Performance Guidelines:

1. The evaluation board has an easy access to measure AC analysis, if required. Connect the injection signal across the resistor (R25) as shown and measure AC analysis through a network analyzer.
2. When measuring the output voltage ripple, maintain the shortest possible ground lengths on the oscilloscope probe. Long ground leads can erroneously inject high frequency noise into the measured ripple.
3. For efficiency measurements, connect an ammeter in series with the input supply to measure the input current. Connect an electronic load to the output for output current



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## TYPICAL PERFORMANCE CHARACTERISTICS

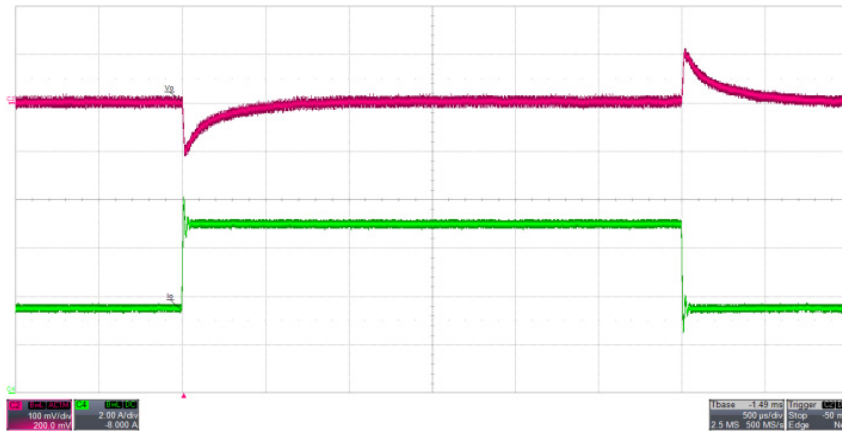


Figure 4. Load Step between 50% and 100% Load

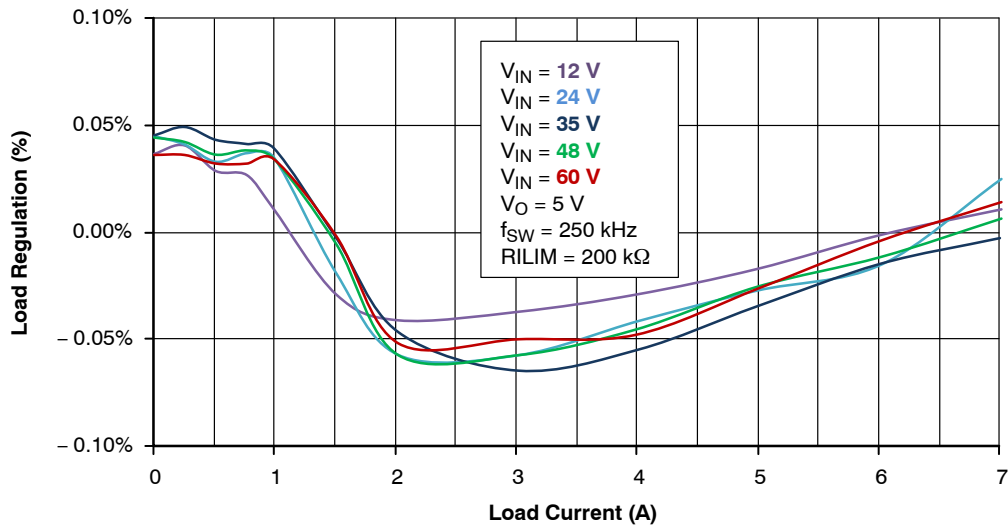


Figure 5. Load Regulation

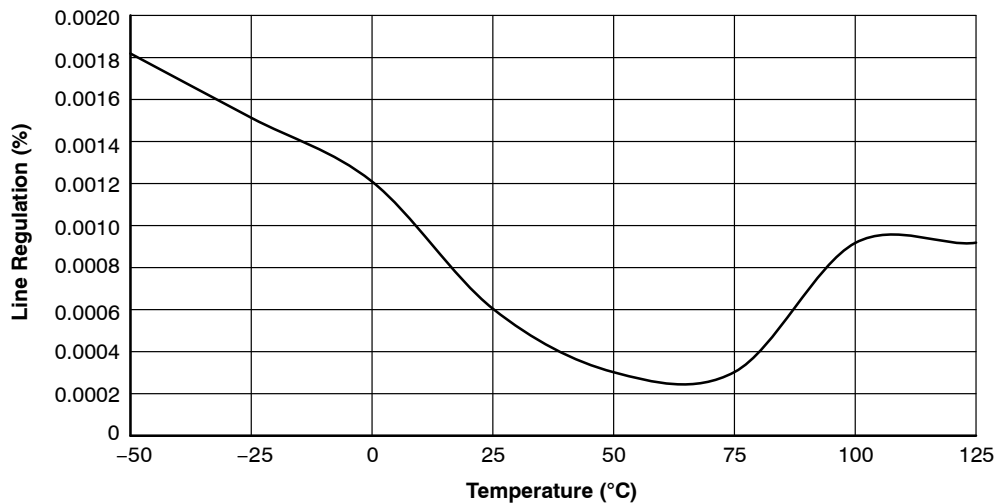


Figure 6. Line Regulation vs. Temperature

# FAN65005A-GEVB

## SCHEMATIC

### FAN65 Demo Board (High Current Version)

For FAN65005A

VIN: 48V  
 VO: 3.3V and 5V IO\_MAX: 8A  
 f: 250kHz  
 L: 5.5uH (744325550)

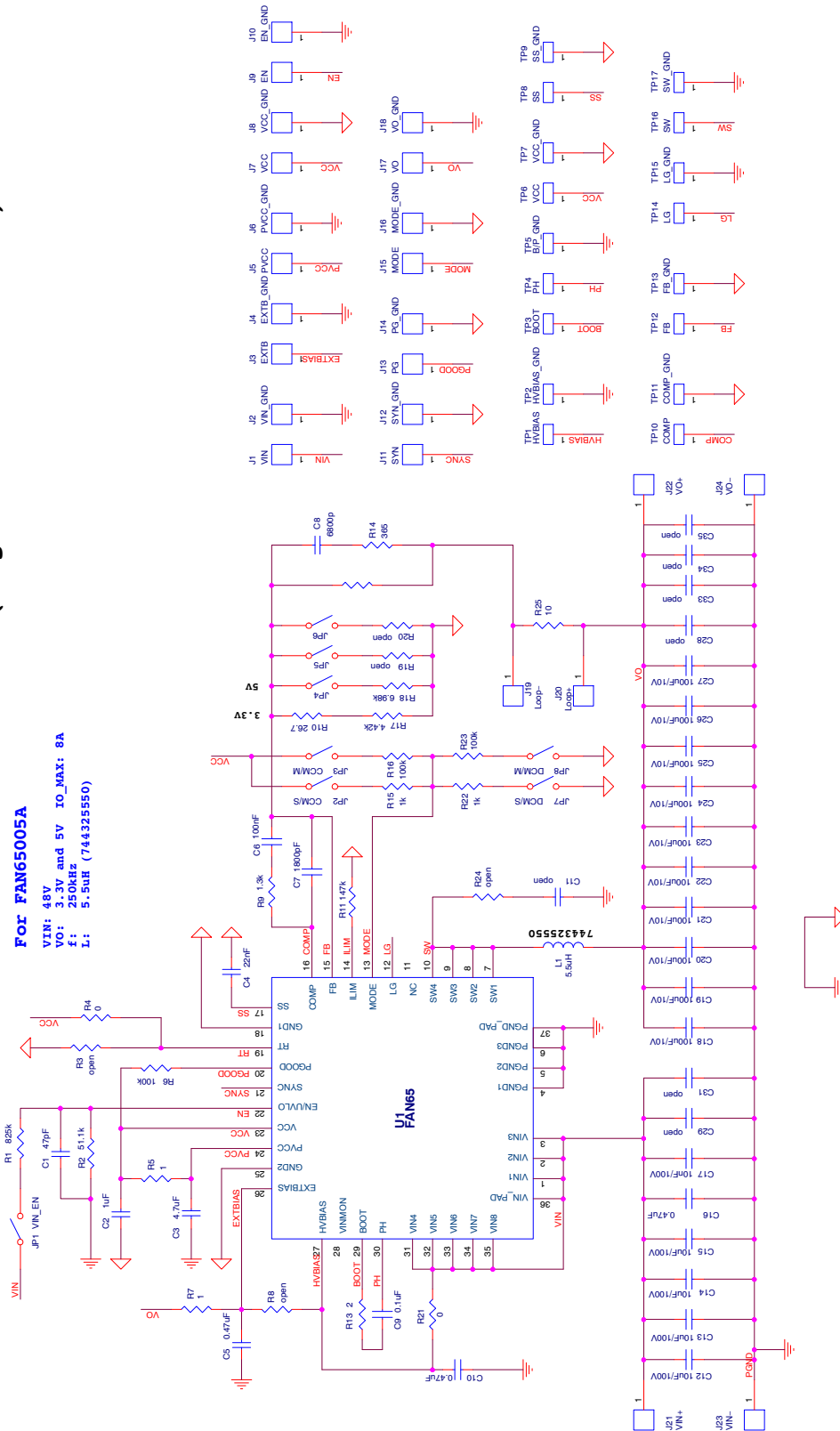


Figure 7. EVM Schematic

# FAN65005A-GEVB

## PCB LAYERS

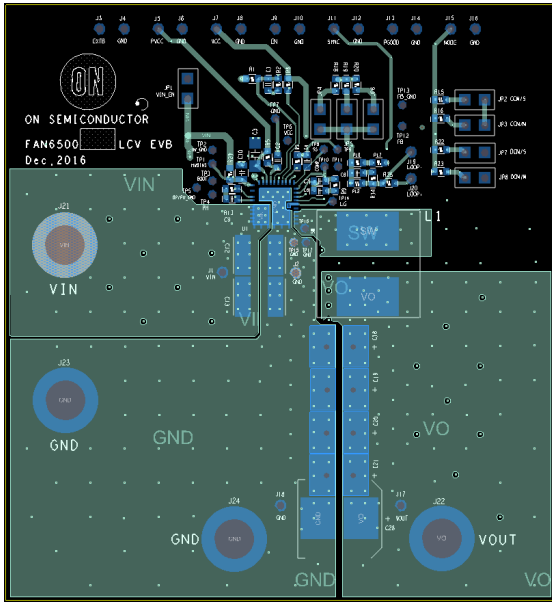


Figure 8. Top Layer

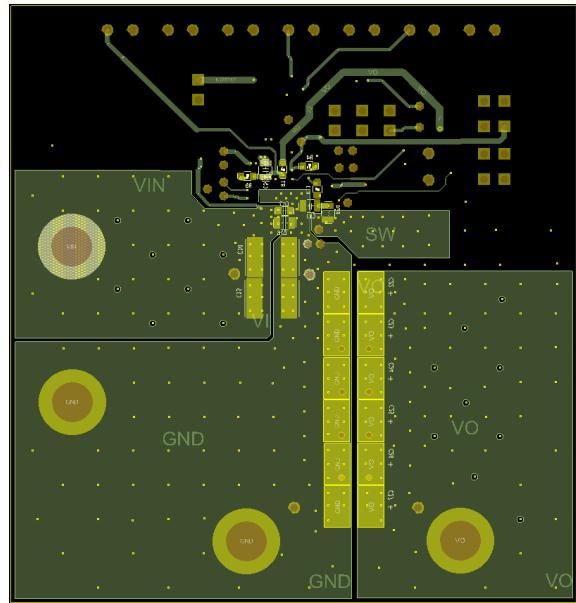


Figure 9. Bottom Layer

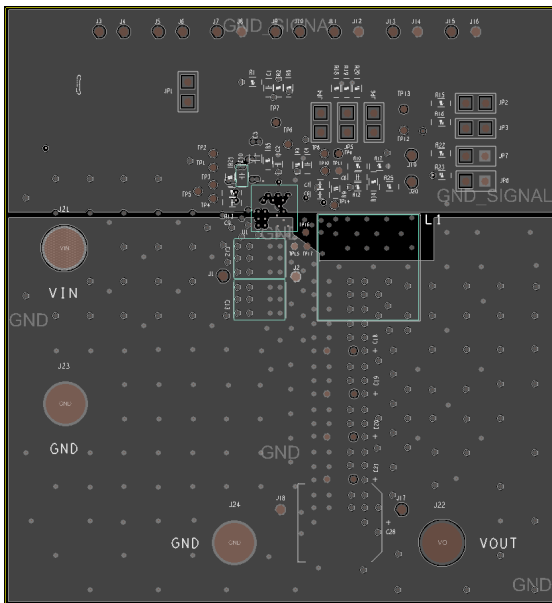


Figure 10. Inner Layer 1

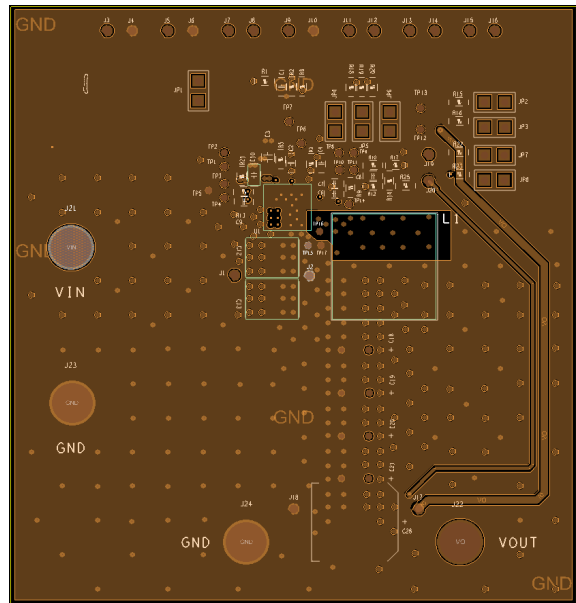


Figure 11. Inner Layer 2

# FAN65005A-GEVB

## BILL OF MATERIALS

**Table 1. BILL OF MATERIALS**

Item	Qty	Reference	Value	Voltage	PCB Footprint	Manufacturer Part Number	Part Number Preferred	TC	Manufacturer
1	1	C1	47 pF	50 V	603	06035C470JAT2A		X7R	AVX
2	1	C2	1 $\mu$ F	10 V	603	GRM188R71A105KA61D		X7R	Murata
3	1	C3	4.7 $\mu$ F	10 V	612	GRM31CR71A475KA01L		X7R	Murata
4	1	C4	22 nF	50 V	603	GRM188R71H223KA01D		X7R	Murata
5	3	C5, C10, C16	0.47 $\mu$ F	100 V	805	GRM21BR72A474KA73L		X7R	Murata
6	2	C6, C9	100 nF	25 V	603	GRM188R71E104KA01D		X7R	Murata
7	1	C7	1.8 nF	25 V	603	GRM188R71H182KA01D		X7R	Murata
8	1	C8	6.8 nF	25 V	603	GRM188R71E682KA01D		X7R	Murata
9	1	C11	Open	100-200 V	805				
10	4	C12, C13, C14, C15	10 $\mu$ F	100 V	2220	22201C106MAT2A		X7R	AVX
11	1	C17	10 nF	100 V	603	C1608X7R2A103K080AA	GRM188R72A103KA01	X7R	Taiyo Yuden
12	10	C18, C19, C20, C21, C22, C23, C24, C25, C26, C27	100 $\mu$ F	10 V	1210	LMK325ABJ107MM-P	GRM32ER61A107ME20L	X7R	TDK
13	1	C28	Open	10 V					
14	3	JP1	VIN_EN		HEADER .100 SINGL STR 2POS	77311-818-02LF			Amphenol
15	1	JP2	CCM/S		HEADER .100 SINGL STR 2POS	77311-818-02LF			Amphenol
16	1	JP3	CCM/M		HEADER .100 SINGL STR 2POS	77311-818-02LF			Amphenol
17	1	JP4	V2		HEADER .100 SINGL STR 2POS	77311-818-02LF			Amphenol
18	2	JP5, JP6	Open						
19	1	JP7	DCM/S		HEADER .100 SINGL STR 2POS	77311-818-02LF			Amphenol
20	1	JP8	DCM/M		HEADER .100 SINGL STR 2POS	77311-818-02LF			Amphenol
21	1	J1	VIN		SMALL RED TERM	151-207A-RC			Kobiconn
22	1	J2	VIN_GND		SMALL BLK TERM	151-203-RC			Kobiconn
23	1	J3	Open						
24	1	J4	Open						
25	1	J5	Open						
26	1	J6	PVCC_GND		0.043" pin	3103-2-00-21-00-00-08-0			Mill-Max Manufacturing Corp.
27	1	J7	Open						
28	1	J8	Open						
29	1	J9	EN		0.043" pin	3103-2-00-21-00-00-08-0			Mill-Max Manufacturing Corp.
30	1	J10	Open						
31	1	J11	Open						
32	1	J12	SYN_GND		0.043" pin	3103-2-00-21-00-00-08-0			Mill-Max Manufacturing Corp.

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**Table 1. BILL OF MATERIALS** (continued)

Item	Qty	Reference	Value	Voltage	PCB Footprint	Manufacturer Part Number	Part Number Preferred	TC	Manufacturer
33	1	J13	Open						
34	1	J14	Open						
35	1	J15	Open						
36	1	J16	Open						
37	1	J17	VO		SMALL RED TERM	151-207A-RC			Kobiconn
38	1	J18	VO_GND		SMALL BLK TERM	151-203-RC			Kobiconn
39	1	J19	Loop-		0.043" pin	3103-2-00-21-00-00-08-0			Mill-Max Manufacturing Corp.
40	1	J20	Loop+		0.043" pin	3103-2-00-21-00-00-08-0			Mill-Max Manufacturing Corp.
41	1	J21	VIN+		JACK	575-4			Keystone
42	1	J22	VO+		JACK	575-4			Keystone
43	1	J23	VIN-		JACK	575-4			Keystone
44	1	J24	VO-		JACK	575-4			Keystone
45	1	L1	5.5 $\mu$ H		0.867" x 0.748"	744325550			Würth
46	1	R1	825 k $\Omega$		603	RC0603FR-07825KL			Yageo
47	1	R2	51.1 k $\Omega$		603	RC0603FR-0751K1L			Yageo
48	5	R3, R8, R19, R20, R24	Open		603				
49	1	R4, R21	0 $\Omega$		603	RC0603JR-070RL			Yageo
50	3	R5, R7	1 $\Omega$		603	RC0603FR-071RL			Yageo
51	3	R6, R16, R23	100 k $\Omega$		603	RC0603FR-07100KL			Yageo
52	1	R9	1.3 k $\Omega$		603	RC0603FR-071K3L			Yageo
53	1	R10	26,7 $\Omega$		603	RC0603FR-0726R7L			Yageo
54	1	R11	147 k $\Omega$		603	RC0603FR-07147KL		< 100 ppm	Yageo
55	1	R12	20 k $\Omega$		603	RC0603FR-0720KL			Yageo
56	1	R13	2 $\Omega$		603	AC0603FR-072RL			Yageo
57	1	R14	365 $\Omega$		603	RC0603FR-07365RL			Yageo
58	2	R15, R22	1 k $\Omega$		603	RC0603FR-071KL			Yageo
59	1	R17	4.42 k $\Omega$		603	RC0603FR-074K42L			Yageo
60	1	R18	6.98 k $\Omega$		603	RC0603FR-076K98L			Yageo
61	1	R25	10 $\Omega$		603	RC0603FR-0710RL			Yageo
62	1	TP1	Open		0.8 mm-Hole				
63	1	TP2	Open		0.8 mm-Hole				
64	1	TP3	Open		0.8 mm-Hole				
65	1	TP4	Open		0.8 mm-Hole				
66	1	TP5	Open		0.8 mm-Hole				
67	1	TP6	Open		0.8 mm-Hole				
68	1	TP7	Open		0.8 mm-Hole				
69	1	TP8	Open		0.8 mm-Hole				
70	1	TP9	Open		0.8 mm-Hole				
71	1	TP10	Open		0.8 mm-Hole				
72	1	TP11	Open		0.8 mm-Hole				
73	1	TP12	Open		0.8 mm-Hole				
74	1	TP13	Open		0.8 mm-Hole				

# FAN65005A-GEVB

Table 1. BILL OF MATERIALS (continued)

Item	Qty	Reference	Value	Voltage	PCB Footprint	Manufacturer Part Number	Part Number Preferred	TC	Manufacturer
75	1	TP14	Open		0.8 mm-Hole				
76	1	TP15	Open		0.8 mm-Hole				
77	1	TP16	SW		HEADER .100 SINGL STR 1POS	77311-818-01LF			Amphenol
78	1	TP17	Open		0.8 mm-Hole				
79	1	U1	FAN65005A	65 V	MLP6x6	FAN65005A			ON Semiconductor

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