Reference Board User's Manual

THE CHIP

PRODUCT SUMMARY SiC401A/B	
Input Voltage Range	3 V to 17 V
Output Voltage Range	0.6 V to 5.5 V
Operating Frequency	200 kHz to 1 MHz
Continuous Output Current	15 A
Peak Efficiency	95 %
Package	PowerPAK MLP55-32L

PRODUCT SUMMARY SiC402A/B	
Input Voltage Range	3 V to 28 V
Output Voltage Range	0.6 V to 5.5 V
Operating Frequency	200 kHz to 1 MHz
Continuous Output Current	10 A
Peak Efficiency	95 %
Package	PowerPAK MLP55-32L

PRODUCT SUMMARY SiC403A/B	
Input Voltage Range	3 V to 28 V
Output Voltage Range	0.6 V to 5.5 V
Operating Frequency	200 kHz to 1 MHz
Continuous Output Current	6 A
Peak Efficiency	95 %
Package	PowerPAK MLP55-32L

DESCRIPTION

The Vishay Siliconix SiC401A/B, SiC402A/B and SiC403A/B are advanced stand-alone synchronous buck regulators, featuring integrated power MOSFETs, bootstrap switch, and a programmable LDO in a space-saving PowerPAK MLP55-32L pin packages.

The SiC401A/B, SiC402A/B and SiC403A/B are capable of operating with all ceramic solutions and switching frequencies up to 1 MHz. The programmable frequency, synchronous operation and selectable power-save feature allow operation at high efficiency across the full range of load current.

The internal LDO may be used to supply 5 V for the gate drive circuits or it may be bypassed with an external 5 V for optimum efficiency and used to drive external n-channel MOSFETs or other loads. Additional features include cycle-by-cycle current limit, voltage soft-start, under-voltage protection, programmable over-current protection, soft shutdown and selectable power-save. Both the SiC401A/B, SiC402A/B and SiC403A/B provides an enable input and a power good output.

FEATURES

- SiC401 provides 15 A continuous output current capability
- SiC402 provides 10 A continuous output current capability
- SiC403 provides 6 A continuous output current capability
- Light Load Power Save Operation
  - SiC401A, SiC402A and SiC403A: minimum operating frequency fixed at 25 kHz
  - SiC401B, SiC402B and SiC403B: no minimum operating frequency
- Integrated bootstrap switch
- Programmable 200 mA LDO with bypass logic
- Temperature compensated current limit
- Pseudo fixed-frequency adaptive on-time control
- All ceramic solution enabled
- Programmable input UVLO threshold
- Independent enable pin for switcher and LDO
- Programmable soft-start and soft-shutdown
- 1 % internal reference voltage
- Power good output
- Over-voltage and under-voltage protections
- PowerCAD simulation software available at www.vishay.transim.com/login.aspx
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Notebook, desktop and server computers
- Digital HDTV and digital consumer applications
- Networking and telecommunication equipment
- Printers, DSL, and STB applications
- Embedded applications
- Point of load power supplies

ORDERING INFORMATION	
DEMO BOARD PART NUMBER	**MAX. OUTPUT CURRENT**
SiC403DB	6 A
SiC402DB	10 A
SiC401DB	15 A

THE REFERENCE BOARD

This reference board allows the end user to evaluate the SiC401A/B, SiC402A/B and SiC403A/B for its features and all functionalities. It can also be a reference design for a user's application.

SPECIFICATION

Input voltage (V_{DC}): **3 V to 17 V** for SiC401A/B or **3 V to 25 V** for SiC402A/B or **3 V to 25 V** for SiC403A/B

Output voltage (V_{DC}): 0.6 V to 5.5 V

Output current (A): 15 A for SiC401A/B or 10 A for SiC402A/B or 6 A for SiC403A/B

Notes

- This board is, by default, preset to 1.2 V output with 12 V input (Note: for inputs lower than 12 V, see “Input Voltage Range Adjustment” (page 5))
- This board can be set to any output voltage between 0.6 V and 5.5 V, and any input voltage between 6 V and 28 V. For a specific input/output voltage combination, the values of inductor and ripple injection circuit may need to be modified..
- Since the internal LDO is set to 5 V, it is used to drive the V_{DD} input on the reference board. Input voltages lower then 5 V require an external 5 V supply and should be connected to V_{DD} to bias the internal drivers and logic. Since an external source is used, the internal LDO should be disabled by removing R6. Efficiency is expected to be improved since the internal LDO is not used.

INPUT CAPACITORS

The input capacitors are chosen as a combination of electrolytic and ceramics so that the capacitance, the RMS current, the ESR, the input voltage ripple and the cost can be all fairly satisfied. For a combination of high voltage input and low voltage output (low duty cycle), the electrolytic capacitor (C12) may not be required. The reference board uses 25 V input ceramics therefore, please limit Vin to 25 V or less.

INDUCTORS

If off-the-shelf inductors are to be used, then their DCR and saturation current parameters are key besides the inductance values. The DCR causes an I^2R loss, which will decrease the system efficiency and generate heat. The saturation current has to be higher than the maximum output current plus 1/2 the ripple current. In over current condition the inductor current may be very high. All this needs to be considered when selecting the inductor. On this board Vishay IHLP4040DZ or IHLP5050 series inductors are used to meet cost requirement and get better efficiency.

OUTPUT CAPACITORS

Voltage, ESR and RMS current capability and capacitance are essential elements to consider when choosing output capacitors. The ESR and capacitance affect the output voltage ripple, transient response and system stability. The current capability determines the capacitor power dissipation and life time. To meet all of these 4 requirements, a combination of ceramics and tantalums can be used.

Due to the nature of this controller, which requires a minimum amount of ripple of 20 mVpp to operate properly, if an all ceramic output solution is required, an additional ripple injection circuit (R9, C19 and C24) must be used. This will "artificially" generate ripple and apply it directly to the FB pin while the output ripple is very low. More detail can be found in the datasheet and in the output voltage ripple section below.

CONNECTION AND SIGNAL/TEST POINTS

Power sockets

V_{IN} (B1), **V_{IN_GND} (B2)**: Input voltage source with **V_{IN}** to be positive. Connect to a 12 V to 25 V source that powers SiC40xCD.

V_O (B3), **V_{O_GND} (B4)**: Output voltage with V_{OUT} to be positive. Connect to a load that draws less than 15 A current.

Signal and test leads

V_{IN} (P8), **V_{IN_GND} (P9)**: Input voltage sense pins with **V_{IN}** to be positive. An oscilloscope or Volt meter can be connected to these terminals to measure or observe the input.

V_O (P10), **V_{OUT_GND} (P11)**: Output voltage sense pins with **V_O** to be positive. An oscilloscope or Volt meter can be connected to these terminals to measure or observe the output.

VCTRL (P5), **LDTRG (P4)**, **V_{O_GND} (P11)**: Load step control signal input. Connect **VCTRL** and **GND** to a power source, which supplies the correct voltage to generate the needed load step. Connect **LDTRG** and **GND** to a pulse generater that drives the MOSFET which is used for transient testing.

EN/PSV (P2): This pin on the SiC401A/B, SiC402A/B and SiC403A/B have three functions: continuous run is enabled by floating this pin, HI enables power save (PSV) and grounding this pin disables switching. Continuous run mode has poor light load efficiency which is typical in traditional fixed frequency switchers. By enabling PSV light load, efficiency is greatly improved. Connecting a jumper from V_{DD} (P1) to EN/PSV (P2) will pull this pin HI and PSV is enabled. Tying this pin to ground disables switching.

ENL (P6): This pin is pulled up to V_{IN} through a 100K resistor and enables the internal adjustable LDO. An external power source may be used by removing R6 and applying +5 V to P1. The IC has an internal switchover circuit which improves efficiency by tying V_{OUT} to VLDO if V_{OUT} is within ~ 0.5 V of VLDO and disables the internal LDO. The default setting is LDO enabled and VLDO is set to 5 V. Detailed description can be found in the datasheet.

PGOOD (P7): This is an open drain output and is pulled up with a 10K resistor. When the voltage at the FB pin is 10 % below the nominal voltage, PGOOD is pulled low. It is held low until the output voltage returns above -8 % of nominal. PGOOD will transition low if the V_{FB} pin exceeds +20 % of nominal, which is also the over-voltage shutdown threshold. PGOOD also pulls low if the EN/PSV pin is low when V_{DD} is present.

SET UP LOAD STEP

The hardware to test transient response is included in the board, which allows users to see how the transient response performs. The setup steps are:

1. Decide what load step is wanted, then based on the output voltage calculate the external voltage V_{EXT} that will be connected between **V_{CTRL}** and **GND**. For example, a load step of 5 A between 0 A (I_1) and 5 A (I_2) is required and the output voltage is 1.2 V. $V_{EXT} = V_O - (I_2 - I_1) * 1\ \Omega = 1.2 - (5\ A - 0\ A) * 1\ \Omega = -3.8\ V$. Preset a DC source voltage to V_{EXT} = 3.8 V (current capability around 2 A) and connect it to the board with positive side to **GND** and negative side to **V_{CTRL}** (if V_{EXT} is a positive value, then connect the DC source positive to **V_{CTRL}** and negative to **GND**).
   (Note: R4 need to change to 0.5 Ω for the transient load step test if the step output current is more than 7.5 A.)
2. Preset a waveform from a function generator using the following parameters and set its output to OFF (refer to the specific function generator manual for its setup):
   Shape: Pulse
   Frequency: 50 Hz or whatever is required
   Duty cycle: ~ 0.1 % or whatever is required (keep duration small so load step resistor will not be damaged)
   Amplitude: +10 V level
   Rising time and **falling time**: 1 μs or whatever is required.
3. Connect the function generator output positive to **LDTRG** and negative to **GND**.
4. Preset the current of an electronic load to I_1 and turn it on.
5. Set up an oscilloscope using the following parameters.
   Channel 1 for probing output voltage: AC coupled, 50 mV/div or whatever is required.
   Channel 2 for probling the current on the 1 Ω resistor (R4) (use differential probe): DC coupled, 1 V/div (corresponds to 1 A/div), for the step load current more than 7.5 A, please use 0.5 Ω resistor for R4. 1 V/div is corresponds to 2 A/div. To view the output choke current, a simpler method is to install a current loop using 18AWG wire after the inductor and using a current probe. Lift the side of the inductor connected to the output caps and solder the loop of wire from the inductor to where it was connected on the board. Keep the loop of wire just big enough for the probe to fit. This will have a slight delay in the waveform compared to the output voltage, but is really used to varify the load step amplitude is correct.
   Time base: ~ 2 ms/div
   Bandwidth: 20 MHz
6. Connect oscilloscope channel 1 probe positive to **V_O (P10)** and negative to **V_{O_GND} (P11)**, and channel 2 probe positive to **V_O (P10)** and negative to **Step_I_SENSE (P3)**.
7. Turn on the system power. Output voltage should be shown on the electronic load with current of I_1.
8. Turn on the power source for V_{EXT}.
9. Set the function generator output to be ON. The transient response waveforms should be seen on the oscilloscope.
10. If needed, re-adjust the trigger waveform's rising and falling time on the function generator so that the current slew rate is satisfied (the current slew rate can be seen on oscilloscope channel 2 waveform by setting the time base to 1 μs or 500 ns).
11. To change load step, decrease or increase the value of V_{EXT}.
12. To cease transient response test, simply set the function generator output to off, turn off the power source for V_{EXT}, and then shut down the system power.

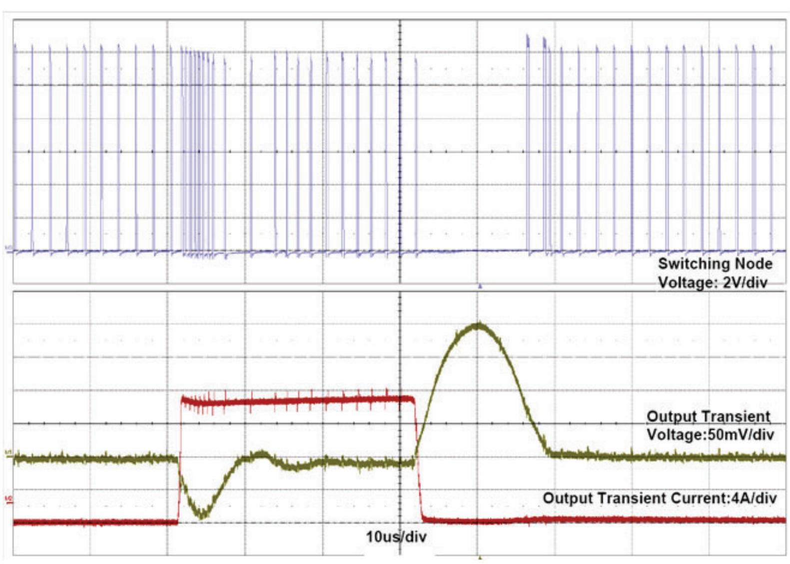


Fig. 1 - SiC401A Transient Step Load Response in Forced Continuous Mode

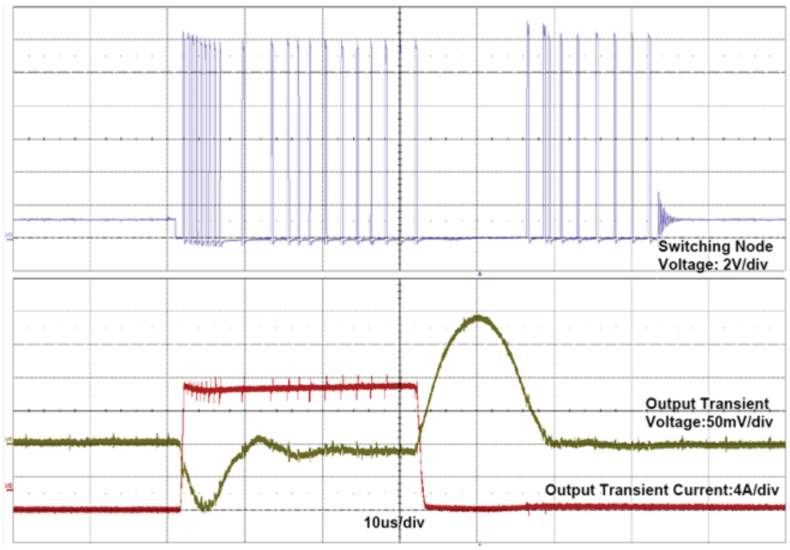


Fig. 2 - SiC401A Transient Step Load Response in Power Saving Mode

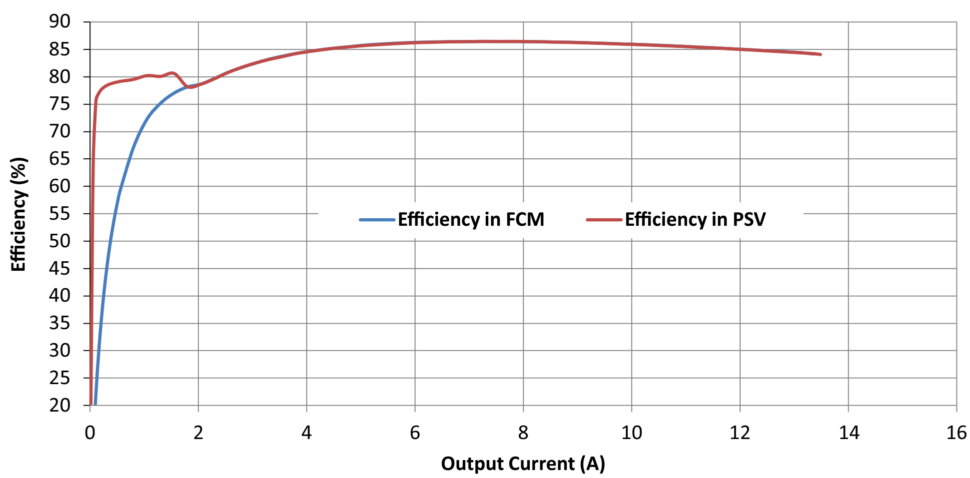


Fig. 3 - SiC401A Efficiency

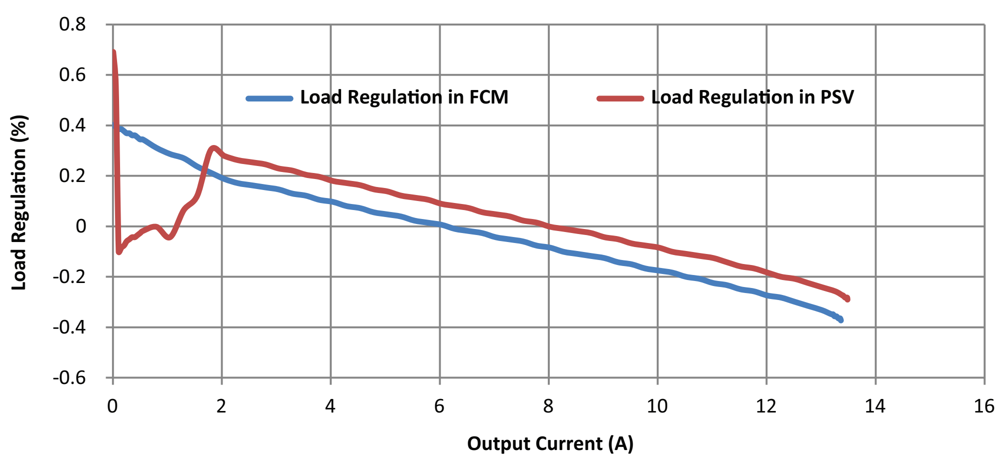


Fig. 4 - SiC401A Load Regulation

OUTPUT VOLTAGE ADJUSTMENT

The evaluation board is configured for a 1.2 V output. If a different output voltage is needed, simply change the value of R23 based on the following formula:

$$V_O = 0.6 * (1 + R10/R23) + V_{ripple}/2$$

Where:

R10 is the upper resistor of the feedback voltage divider

R23 is the lower resistor of the feedback voltage divider

V_{ripple} is the output ripple voltage.

See the following demo board schematic for R10 and R23.

INPUT VOLTAGE RANGE ADJUSTMENT

The input voltage range for this demo board is from 12 V to 25 V because a input power UVLO circuit is designed in to protect the demo board. For the user who wants to explorer the operation of the demo board in the lower input voltage, he can remove the R52 to disable the input power UVLO function of the demo board.

OUTPUT RIPPLE VOLTAGE

The controller used in the SiC40x requires at least of 20 mV of ripple at the FB pin of the I_C. This is easily attainable when using a combination of output capacitors with higher ESR like Electrolytic or Tantalum in parallel with low ESR ceramic. The rule of thumb used for setting a limit for output ripple voltage is a nominal 3 % of the output voltage. Using this as a representative value and choosing a ripple current (•I) that is between 20 % to 40 % of full load current we can now calculate for an inductor value. By measuring the actual ripple voltage using the values calculated so far and adjusting one or more of the following: the inductor value, number of output caps and F_{sw} used would lock in the final values chosen for the design.

$$ESR = (0.03 * V_{OUT}) / (0.4 * I_{OUTmax.})$$

using 40 % for the ripple current

$$L = [(V_{IN} - V_{OUT}) * (V_{OUT}/(F_{sw} * V_{IN}))] / [0.4 * (I_{OUTmax.})]$$

When an all ceramic output capacitor is used which limits the amount of ripple voltage because of the very low ESR an additional ripple voltage injection circuit consisting of 3 inexpensive passive components (R9, C19 and C24) is needed. The network is a series RC connected across the output inductor and a cap which couples this signal to the FB pin. The objective is to stabilize the IC by increasing the ripple at the FB pin by summing the ripple generated by this ESR circuit with the low ripple generated by the ceramic output capacitors. Using the following formula and the circuit below we can get approximate values. For example, L1 = 1 μH, DCR of inductor = 3.5 mΩ, Let R1 = 3K solving for C1 we get

$$L1/DCR = R9 * C19$$

$$C19 = (1\ \mu H/3.5\ m\Omega)/3K = 95\ nF = 0.1\ \mu F$$

Decreasing R9 will allow more signal through, hence more ripple will be seen at the FB pin. Be sure to check that the signal from the virtual ESR circuit is in phase with the output ripple. C24 is a 0.1 μF capacitor.

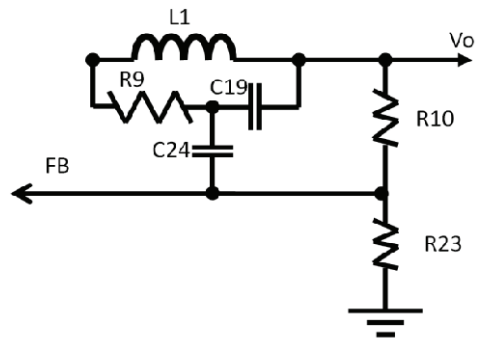


Fig. 5 - Ripple Voltage Injection Circuit

Before adding a ripple injection circuit, the ripple voltage in the feedback of the device need to be determined first to make sure the ripple voltage is lower than 20 mV. The ripple injection circuit is required only when the ripple voltage in the feedback is lower than 20 mV. There may be difficulty measuring the ripple voltage of feedback pin on the demo board. However, it is recommended to measure the ripple voltage on the output voltage V_O. The ripple voltage on the feedback can be easily calculated from the output ripple voltage by the following formula.

$$V_{FB\_ripple}/V_{ripple} = R23/ (R10 + R23)$$

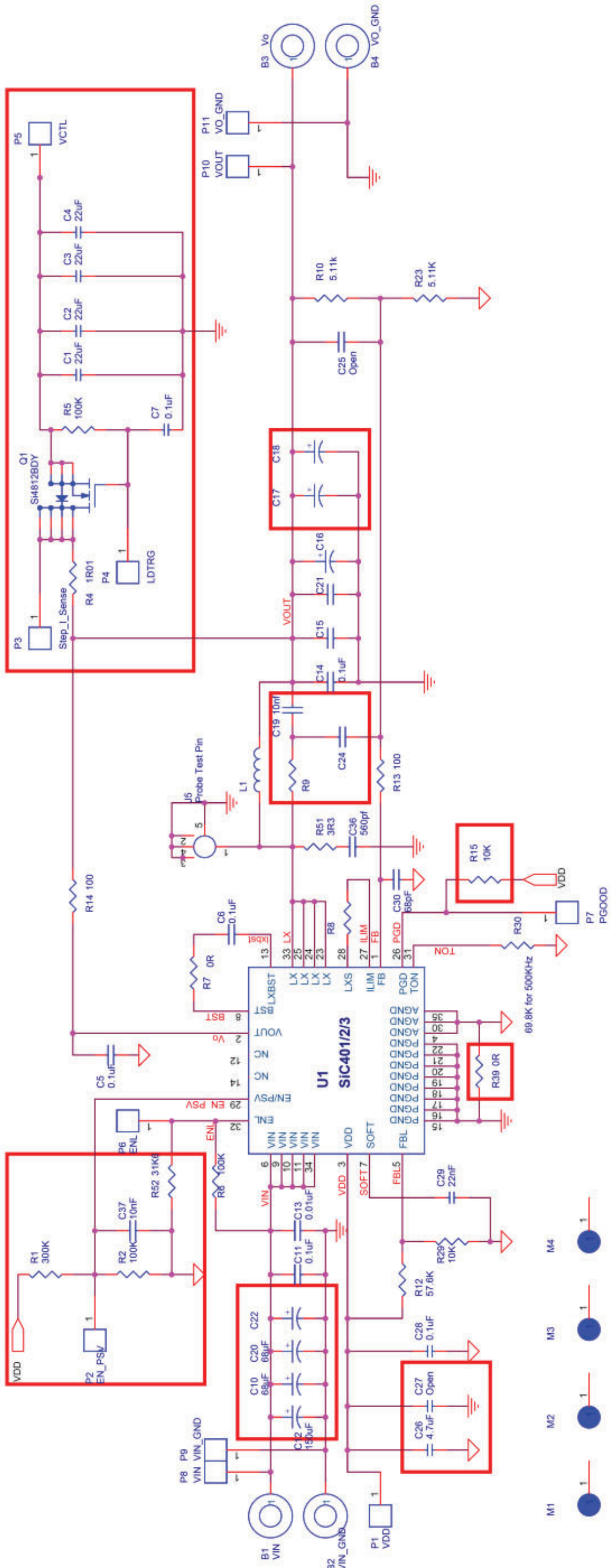
Where: V_{FB_ripple} is the ripple voltage on the feedback.

V_{ripple} is the output ripple voltage.

R10 is the upper resistor of the feedback voltage divider.

R23 is the lower resistor of the feedback voltage divider.

SCHEMATIC OF DEMO BOARD



BILL of MATERIAL for SiC401A							
ITEM	QTY	REFERENCE	PCB FOOTPRINT	VALUE	VOLTAGE	DESCRIPTION	PART NUMBER
1	4	C1, C2, C3, C4	SM1210	22 µF	16 V	CAP, 22 µF, 16 V, 1210	GRM32ER71C226ME18L
2	1	C5	SM0402	0.1 µF	10 V	CAP, 0.1 µF, 10 V, 0402	VJ0402Y104MXQCW1BC
3	4	C6, C7, C11, C14	SM0603	0.1 µF	50 V	CAP, 0.1 µF, 50 V, 0603	VJ0603Y104KXACW1BC
4	3	C10, C20, C22	593D	68 µF	20 V	68 µF, TAN, 20 V, 593D, 20 %	593D686X0020D2TE3
5	1	C12	Radial	150 µF	35 V	Cap, Radial, 150 µF, 35 V	EU-FM1V151
6	1	C13	SM0402	0.01 µF	50 V	CAP, 0.01 µF, 50 V, 0402	VJ0402Y103KXACW1BC
7	4	C15, C21, C18A, C18B for SiC401	SM1812	100 µF	10 V	CAP CER 100 µF, 10 V, 20 %, X5R, 1206	C3216X5R1A107M160AC
8	1	C30	SM0402	68 pF	50 V	CAP, 68 pF, 50 V, 0402	VJ0402Y680KXACW1BC
9	1	C26	SM0805	4.7 µF	10 V	4.7 µF, 10 V, 0805	LMK212B7475KG-T
10	1	C28	SM0402	0.1 µF	10 V	CAP, 0.1 µF, 10 V, 0402	VJ0402Y104MXQCW1BC
11	1	C29	SM0603	22 nF	25 V	CAP,CER 22 nF, 25 V	VJ0603Y223KXACW1BC
12	1	C36	SM0402	560 pF	50 V	CAP, 560 pF, 0402	VJ0402A561KXAPW1BC
13	1	C37	SM0402	10 nF	50 V	CAP, 10 nF, 50 V, 0402	VJ0402A103KXACW1BC, GRM155R71H103KA88D
14	1	L1 for SiC401	IHLP4040	0.56 µH		0.56 µH	IHLP4040DZERR56M01
15	11	P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11	Terminal	0	0	Test points	1573-3
16	1	Q1	SO-8	0	30 V	N-Channel 30 V (D-S) MOSFET with Schottky Diode	0
17	1	R1	SM0603	300K	50 V	RES, 300K Ω, 1/10 W, 5 %	CRCW0603300KJNEA
18	1	R2	SM0603	100K	50 V	RES, 100K, 0603	CRCW0603100KFKEA
19	1	R4	SM2512	1 Ω	200 V	1 Ω, 2512	CRCW25121R00FKEG
20	2	R5, R6	SM0603	100K	50 V	RES, 100K, 0603	CRCW0603100KFKEA
21	1	R7	SM0603	0 Ω	50 V	RES 0 Ω	CRCW06030000ZOEA
22	1	R8	SM0603	12.4K	50 V	RES, 12.4K, 0603	CRCW060312K4FKEA
23	1	R10	SM0603	5.11K	50 V	RES, 5.11K, 0603	CRCW06035K11FKEA
24	1	R29	SM0603	10K	50 V	RES, 10K , 50 V ,0603	CRCW060310KFKED
25	1	R12	SM0603	57.6K	50 V	RES, 57.6K, 0603	CRCW060357K6FKEA
26	1	R13	SM0402	100 Ω	50 V	100R, 50 V, 0402	CRCW0402100RFKED
27	1	R14	SM0402	100 Ω	50 V	100R, 50 V, 0402	CRCW0402100RFKED
28	1	R15	SM0603	10K	50 V	RES, 10K, 50 V, 0603	CRCW060310KFKED
29	1	R23	SM0603	5.11K	50 V	RES, 5.11K, 0603	CRCW06035K11FKEA
30	1	R30	SM0603	69.8K	50 V	RES, 69.8K, 0603	CRCW060369K8FKEA
31	1	R39	SM0402	0 Ω	50 V	0R, 50 V, 0402	CRCW04020000ZOED
32	1	R51	SM0805	3.3R	50 V	RES, 3.3R, 0805	CRCW08053R3FKEA
33	1	R52	SM0603	31.6K	50 V	RES, 31.6K, 50 V, 0603	CRCW060331K6FKEA
34	1	U1	MLP55-32L	0	0	SiC401B MicroBuck Regulator	0
35	4	B1, B2, B3, B4	0	0	0	BANANA JACK	575-4
36	1	R9 for SiC401	SM0603	33.2K		RES, 33.2K Ω, 1/10W, 1 %, 0603 SMD	CRCW060333K2FKEA
37	1	C24	SM0603	820 pF		CAP, CER, 820 pF, 50 V, 5 %, NP0, 0603	C1608C0G1H821J080AA
38	1	C19	SM0603	10 nF		CAP, CER, 10 000 pF, 10 V, 10 %, X5R, 0201	C0603X5R1A103K030BA
39	1	PCB				SiC401/2/3 Demo Board PCB	

BILL of MATERIAL for SiC402A

ITEM	QTY	REFERENCE	PCB FOOTPRINT	VALUE	VOLTAGE	DESCRIPTION	PART NUMBER
1	4	C1, C2, C3, C4	SM1210	22 µF	16 V	CAP, 22 µF, 16 V, 1210	GRM32ER71C226ME18L
2	1	C5	SM0402	0.1 µF	10 V	CAP, 0.1 µF, 10 V, 0402	VJ0402Y104MXQCW1BC
3	4	C6, C7, C11, C14	SM0603	0.1 µF	50 V	CAP, 0.1 µF, 50 V, 0603	VJ0603Y104KXACW1BC
4	3	C10, C20, C22	593D	68 µF	20 V	68 µF, TAN, 20 V, 593D, 20 %	593D686X0020D2TE3
5	1	C12	Radial	150 µF	35 V	CAP, Radial, 150 µF, 35 V	EU-FM1V151
6	1	C13	SM0402	0.01 µF	50 V	CAP, 0.01 µF, 50 V, 0402	VJ0402Y103KXACW1BC
7	3	C15, C21, C18 for SiC402	SM1206	100 µF	10 V	CAP, CER, 100 µF, 10 V, 20 %, X5R, 1206	C3216X5R1A107M160AC
8	1	C30	SM0402	68 pF	50 V	CAP, 68 pF, 50 V, 0402	VJ0402Y680KXACW1BC
9	1	C26	SM0805	4.7 µF	10 V	4.7 µF, 10 V, 0805	LMK212B7475KG-T
10	1	C28	SM0402	0.1 µF	10 V	CAP, 0.1 µF, 10 V, 0402	VJ0402Y104MXQCW1BC
11	1	C29	SM0603	22 nF	25 V	CAP, CER, 22 nF, 25 V	VJ0603Y223KXACW1BC
12	1	C36	SM0402	560 pF	50 V	CAP, 560 pF, 0402	VJ0402A561KXAPW1BC
13	1	C37	SM0402	10 nF	50 V	CAP, 10 nF, 50 V, 0402	VJ0402A103KXACW1BC, GRM155R71H103KA88D
14	1	L1	IHLP4040	1 µH	0	1 µH	IHLP4040DZER1R0M01
15	11	P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11	Terminal	0	0	Test points	1573-3
16	1	Q1	SO-8	0	30 V	N-Channel 30 V (D-S) MOSFET with Schottky Diode	0
17	1	R1	SM0603	300K	50 V	RES 300K Ω, 1/10 W, 5 %	CRCW0603300KJNEA
18	1	R2	SM0603	100K	50 V	RES, 100K, 0603	CRCW0603100KFKEA
19	1	R4	SM2512	1 Ω	200 V	1 Ω, 2512	CRCW25121R00FKEG
20	2	R5, R6	SM0603	100K	50 V	RES, 100K, 0603	CRCW0603100KFKEA
21	1	R7	SM0603	0 Ω	50 V	RES, 0 Ω	CRCW06030000ZOEA
22	1	R8	SM0603	11K	50 V	RES, 11K, 0603	CRCW060311K0FKEA
23	1	R10	SM0402	5.11K	50 V	RES, 5.11K, 0402	CRCW04025K11FKED
24	1	R29	SM0603	10K	50 V	RES, 10K, 50 V, 0603	CRCW060310KFKED
25	1	R12	SM0603	57.6K	50 V	RES, 57.6K, 0603	CRCW060357K6FKEA
26	1	R13	SM0402	100 Ω	50 V	100R, 50 V, 0402	CRCW0402100RFKED
27	1	R14	SM0402	100 Ω	50 V	100R, 50 V, 0402	CRCW0402100RFKED
28	1	R15	SM0603	10K	50 V	RES, 10k, 50 V, 0603	CRCW060310KFKED
29	1	R23	SM0402	5.11K	50 V	RES, 5.11K, 0402	CRCW04025K11FKED
30	1	R30	SM0603	69.8K	50 V	RES, 69.8K, 0603	CRCW060369K8FKEA
31	1	R39	SM0402	0 Ω	50 V	0R, 50 V, 0402	CRCW04020000ZOED
32	1	R51	SM0805	3.3R	50 V	RES, 3.3R, 0805	CRCW08053R3FKEA
33	1	R52	SM0603	31.6K	50 V	RES, 31.6K, 50 V, 0603	CRCW060331K6FKEA
34	1	U1	MLP55-32L	0	0	SiC402B MicroBuck Regulator	0
35	4	B1, B2, B3, B4	0	0	0	BANANA JACK	575-4
36	1	R9 for SiC402	SM0603	26.7K		RES, 26.7K Ω, 1/10 W, 1 %, 0603 SMD	CRCW060326K7FKEA
37	1	C24	SM0603	820 pF		CAP, CER, 820 pF, 50 V, 5 %, NP0 0603	C1608C0G1H821J080AA
38	1	C19	SM0603	10 nF		CAP, CER, 10 000 pF, 10 V, 10 %, X5R, 0201	C0603X5R1A103K030BA
39	1	PCB				SiC401/2/3 Demo Board PCB	

BILL of MATERIAL for SiC403A							
ITEM	**QTY**	**REFERENCE**	**PCB FOOTPRINT**	**VALUE**	**VOLTAGE**	**DESCRIPTION**	**PART NUMBER**
1	4	C1, C2, C3, C4	SM1210	22 µF	16 V	CAP, 22 µF, 16 V, 1210	GRM32ER71C226ME18L
2	1	C5	SM0402	0.1 µF	10 V	CAP, 0.1 µF, 10 V, 0402	VJ0402Y104MXQCW1BC
3	4	C6, C7, C11, C14	SM0603	0.1 µF	50 V	CAP,0.1 µF, 50 V, 0603	VJ0603Y104KXACW1BC
4	2	C10, C20	593D	68 µF	20 V	68 µF, TAN, 20 V, 593D, 20 %	593D686X0020D2TE3
5	1	C12	Radial	150 µF	35 V	CAP, Radial, 150 µF, 35 V	EU-FM1V151
6	1	C13	SM0402	0.01 µF	50 V	CAP, 0.01 µF, 50 V, 0402	VJ0402Y103KXACW1BC
7	2	C15, C21 for SiC403	SM1206	100 µF	10 V	CAP, CER, 100 µF, 10 V, 20 %, X5R, 1206	C3216X5R1A107M160AC
8	1	C30	SM0402	68 pF	50 V	CAP, 68 pF, 50 V, 0402	VJ0402Y680KXACW1BC
9	1	C26	SM0805	4.7 µF	10 V	4.7 µF, 10 V, 0805	LMK212B7475KG-T
10	1	C28	SM0402	0.1 µF	10 V	CAP, 0.1 µF, 10 V, 0402	VJ0402Y104MXQCW1BC
11	1	C29	SM0603	22 nF	25 V	CAP, CER, 22 nF, 2 5 V	VJ0603Y223KXACW1BC
12	1	C36	SM0402	560 pF	50 V	CAP, 560pF, 0402	VJ0402A561KXAPW1BC
13	1	C37	SM0402	10 nF	50 V	CAP, 10 nF, 50 V, 0402	VJ0402A103KXACW1BC, GRM155R71H103KA88D
14	1	L1 for SiC403	IHLP2525	1.5 µH	0	1.5 µH	IHLP2525CZER1R5M01
15	11	P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11	Terminal	0	0	Test points	1573-3
16	1	Q1	SO-8	0	30 V	N-Channel 30 V (D-S) MOSFET with Schottky Diode	0
17	1	R1	SM0603	300K	50 V	RES, 300K Ω, 1/10 W, 5 %	CRCW0603300KJNEA
18	1	R2	SM0603	100K	50 V	RES, 100K, 0603	CRCW0603100KFKEA
19	1	R4	SM2512	1 Ω	200 V	1 Ω, 2512	CRCW25121R00FKEG
20	2	R5, R6	SM0603	100K	50 V	RES, 100K, 0603	CRCW0603100KFKEA
21	1	R7	SM0603	0 Ω	50 V	RES, 0 Ω	CRCW06030000ZOEA
22	1	R8	SM0603	10K	50 V	RES, 10K, 50 V, 0603	CRCW060310KFKED
23	1	R10	SM0402	5.11K	50 V	RES, 5.11K, 0402	CRCW04025K11FKED
24	1	R29	SM0603	10K	50 V	RES, 10K, 50 V, 0603	CRCW060310KFKED
25	1	R12	SM0603	57.6K	50 V	RES, 57.6K, 0603	CRCW060357K6FKEA
26	1	R13	SM0402	100 Ω	50 V	100R, 50 V, 0402	CRCW0402100RFKED
27	1	R14	SM0402	100 Ω	50 V	100R, 50 V, 0402	CRCW0402100RFKED
28	1	R15	SM0603	10K	50 V	RES, 10K, 50 V, 0603	CRCW060310KFKED
29	1	R23	SM0402	5.11K	50 V	RES, 5.11K, 0402	CRCW04025K11FKED
30	1	R30	SM0603	69.8K	50 V	RES, 69.8K, 0603	CRCW060369K8FKEA
31	1	R39	SM0402	0 Ω	50 V	0R, 50 V, 0402	CRCW04020000ZOED
32	1	R51	SM0805	3.3R	50 V	RES, 3.3R, 0805	CRCW08053R3FKEA
33	1	R52	SM0603	31.6K	50 V	RES, 31.6K, 50 V, 0603	CRCW060331K6FKEA
34	1	U1	MLP55-32L	0	0	SiC403B MicroBuck Regulator	0
35	4	B1, B2, B3, B4	0	0	0	BANANA JACK	575-4
36	1	R9 for SiC403	SM0603	10.7K		RES, 10.7K Ω, 1/10 W, 1 %, 0603 SMD	CRCW060310K7FKEA
37	1	C24 for SiC403	SM0603	150 pF		CAP, CER, 150 pF, 50 V, 5 %, NP0 0603	C1608C0G1H151J080AA
38	1	C19	SM0603	10 nF		CAP, CER, 10 000 pF, 10 V, 10 %, X5R, 0201	C0603X5R1A103K030BA
39	1	PCB				SiC401/2/3 Demo Board PCB	

REFERENCE BOARD PHOTOS

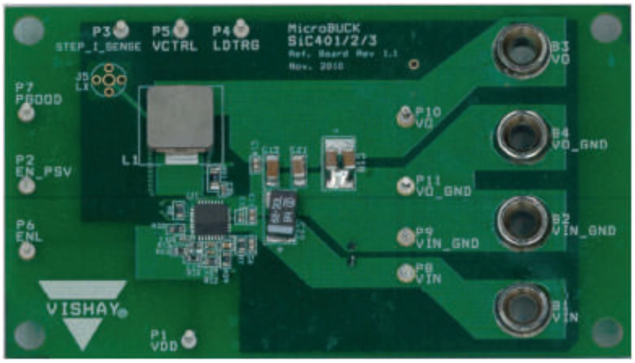


Fig. 6 - Top Side View

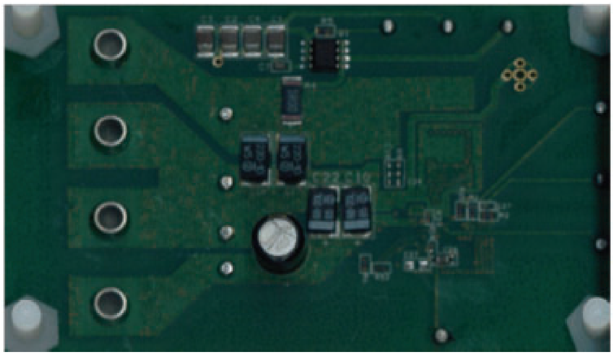


Fig. 7 - Bottom Side View

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