

### DCK78xxMT-1A Series



### Features

- Wide operating temperature range : -40°C to +105°C
- Up to 92% efficiency
- Switching frequency: 1 MHz
- Soft start
- Compact package with surface-mount technology: LGA (9 × 7 × 1.9mm)
- 1A Output current

### DESCRIPTION

Wide Voltage Input, Output 1000mA, Non Isolated / Stabilized / Single Output / LGA Packaging.

### MODEL NUMBERING

## DCK78xxMT-1A



### SELECTION GUIDE

Product Model	Input Voltage Standard Value(range)	Output Voltage	Output Current (mA) (Max./Min.)	Efficiency (Typ./Max)	Maximum capacitive load ( $\mu$ F)
DCK7803MT-1A	24(6.5-30)	3.3	1000	84/81	680
	12(8-27)	-3.3	-500	85/81	330
DCK7805MT-1A	24(6.5-30)	5	1000	87/84	680
	12(8-27)	-5	-500	85/83	330
DCK7806MT-1A	24(6.5-30)	6.5	1000	88/86	680
	12(8-27)	-6.5	-500	85/84	330
DCK7809MT-1A	24(6.5-30)	9	1000	90/87	680
	12(8-27)	-9	-500	85/84	330

Product Model	Input Voltage Standard Value(range)	Output Voltage	Output Current (mA) (Max./Min.)	Efficiency % (Min./Typ.)	Maximum capacitive load ( $\mu$ F)
DCK7812MT-1A	24(6.5-30)	12	1000	94/91/89	680
	12(8-27)	-12	-300	83/85/84	330
DCK7815MT-1A	24(6.5-30)	15	1000	94/93/90	680
	12(8-27)	-15	-300	82/84/84	330

Note: \* For input voltage exceeding 30 VDC, an input capacitor of 22 $\mu$ F/50V is required.

## INPUT CHARACTERISTICS

Parameter	Operating Conditions	Min.	Typ.	Max.	Units
Input voltage range		4.5	--	30	V
Soft start time		--	0.6	--	ms
Quiescent current	VIN=12V, Load=0A	--	5	10	$\mu$ A
Max duty cycle		--	80	--	%
Minimum uptime		--	50	--	ns

## OUTPUT CHARACTERISTICS

Parameter	Operating Conditions	Min.	Typ.	Max.	Units
Output voltage		4.95	5.0	5.05	V
Ripple & noise	VIN = 12V, VOUT = 5.0V, IOU <sub>T</sub> = 1.2A, Cout = 22 $\mu$ F, 20MHz bandwidth	--	50	100	mV
Linear adjustment rate	VOUT=5.0V, 6.5V < VIN < 18V, ILOAD = 1.2A	--	--	$\pm$ 0.5	%
Load regulation rate	VIN=12V, VOUT=5.0V, 0A < ILOAD $\leq$ 1.2A	--	--	$\pm$ 1.5	
Dynamic load response	50-100% ILOAD, di/dt=2A/ $\mu$ S Cout=22 $\mu$ F	--	500	--	ms
Productiveness	VIN = 6.5V, VOUT = 5.0V, IOU <sub>T</sub> =1.0A	--	92	--	%
	VIN = 24V, VOUT = 5.0V, IOU <sub>T</sub> =1.0A	--	91	--	

## GENERAL CHARACTERISTICS

Parameter	Operating Conditions	Min.	Typ.	Max.	Units
Reflow soldering temperature		--	--	+245	$^{\circ}$ C
Operating temperature range		-40	--	+105	$^{\circ}$ C

Parameter	Operating Conditions	Min.	Typ.	Max.	Units
Switch frequency		--	1000	--	KHz
Storage temperature		-55	--	+125	°C

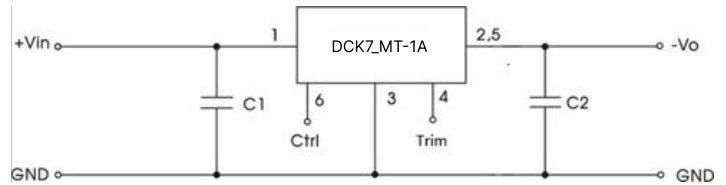
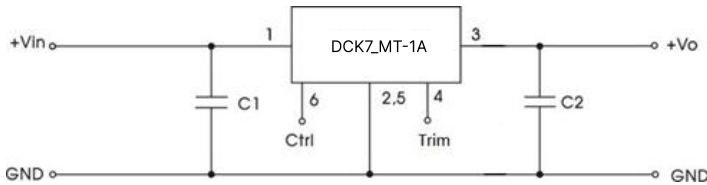
### PHYSICAL CHARACTERISTICS

Parameter	Contents
Overall dimensions	9 X 7 X 1.9mm
Weight	1.5 G(Typ.)

### CIRCUIT DESIGN AND APPLICATION

#### Typical Application

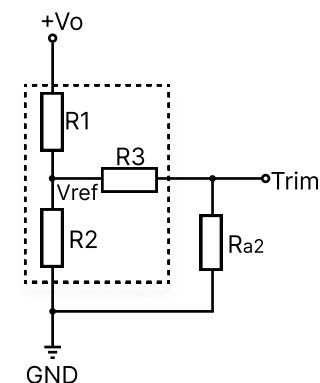
One 10uF and one 0.1uF ceramic capacitors are integrated in the internal input of the power module, and two 10uF and one 0.1uF ceramic capacitors are added to the output.



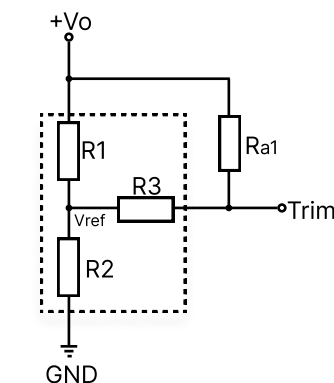
#### Operational Principle

The Use Of Trim And The Calculation Of Trim Resistance

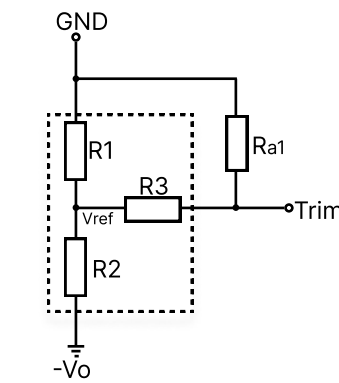
- 1.Positive Output Application: Connect Trim Resistor To GND/Vo Respectively For Adjusting Up/Down.
- 2.Negative Output Application: Connect Trim Resistor To GND/Vo- Respectively For Adjusting up/Down



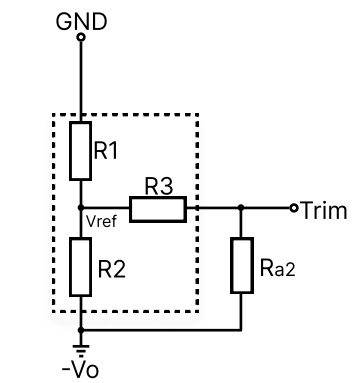
Positive Output Trim Up



Positive Output Trim Down



Negative Output Trim Up



Negative Output Trim Down

$$\text{Trim up : } R_{a2} = \frac{aR_2}{R_2 - a} - R_3, \quad a = R_2 // (R_3 + R_{a2}) = \frac{V_{ref}}{V_o' - V_{ref}} R_1$$

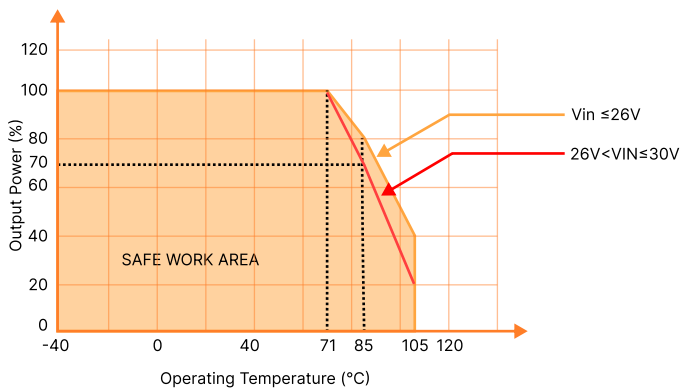
$$\text{Trim down : } R_{a1} = \frac{aR_1}{R_1 - a} - R_3, \quad a = R_1 // (R_3 + R_{a1}) = \frac{V_o' - V_{ref}}{V_{ref}} R_2$$

Vout(V)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	150	33	180	0.6
5	100	13.66	82	0.6
6.5	32.4	3.3	20	0.6
9	100	7.14	47	0.6
12	100	5.28	43	0.6
15	180	7.5	51	0.6

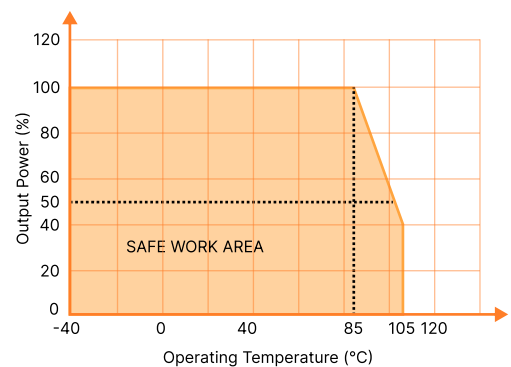
Table:

Vout Nom.	±3.3VDC		±5.0VDC		±6.5VDC		±9.0VDC		±12VDC		±15VDC	
Vout Trim.	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)
2.97	815	--	--	--	--	--	--	--	--	--	--	--
3.69	--	117.3	--	--	--	--	--	--	--	--	--	--
4.5	--	--	710	--	--	--	--	--	--	--	--	--
5.5	--	--	--	36.2	--	--	--	--	--	--	--	--
5.85	--	--	--	--	245.4	--	--	--	--	--	--	--
7.15	--	--	--	--	--	9.5	--	--	--	--	--	--
8.1	--	--	--	--	--	--	783.2	--	--	--	--	--
9.9	--	--	--	--	--	--	--	19.9	--	--	--	--
10.8	--	--	--	--	--	--	--	--	382.2	--	--	--
13.2	--	--	--	--	--	--	--	--	--	5.5	--	--
13.5	--	--	--	--	--	--	--	--	--	--	509.6	--
16.5	--	--	--	--	--	--	--	--	--	--	--	21

### PRODUCT CHARACTERISTIC CURVE

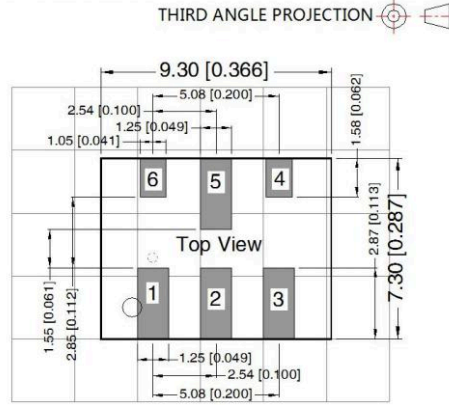
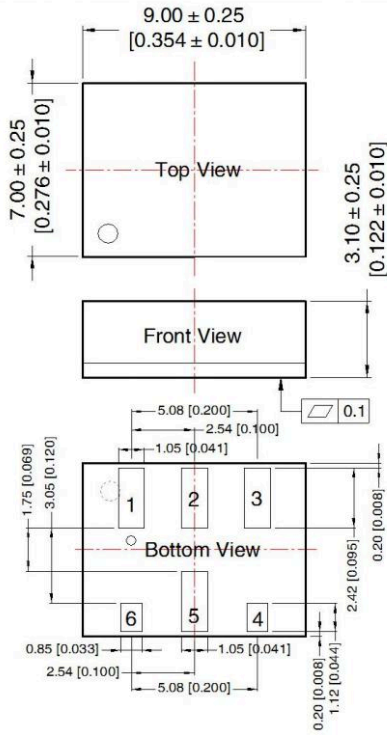


Temperature Derating Curve (9/12/15V Output)



Temperature Derating Curve (3.3/5V Output)

### OVERALL DIMENSIONS AND PIN FUNCTIONS



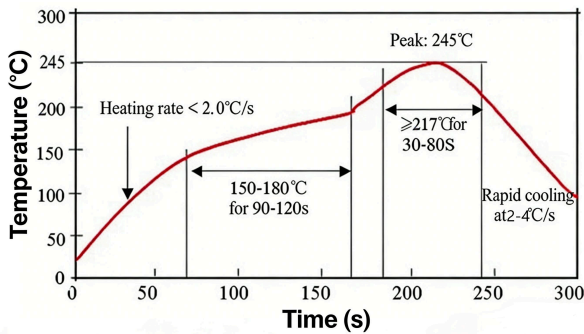
Note: Grid 2.54\*2.54mm

Table 3: Pin Function Table

Pin	Positive output	Negative output
1	+Vin	+Vin
2	GND	-Vo
3	+Vo	GND
4	Trim	Trim
5	GND	-Vo
6	Ctrl	Ctrl

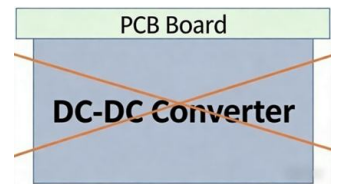
Note:  
Unit: mm[inch]  
Pin diameter tolerances: ± 0.10 [± 0.004]

### NOTES & INSTRUCTIONS



Recommended Reflow Soldering Curve

### Precautions For Welding And Storage



1. Due to the large size of the module, do not place it on the board base during reflow soldering to avoid dropping.
2. Use the package immediately after opening. If not fully used, vacuum-seal it and store in a dry chamber to prevent moisture from causing module malfunctions during reflow soldering.
3. The module uses tin soldering. Strictly control the reflow soldering temperature below 245°C to prevent internal solder melting and potential failures.
4. Do not use a hot air gun during welding. Instead, employ reflow soldering or a repair station.

## Operational Principle

DCK78xxMT-1A is a DC/DC buck power module with synchronous rectifier control, featuring integrated inductors, power MOSFET, and filter capacitors. DCK78xxMT-1A delivers a complete power solution that requires minimal external components to achieve 6.5~30V wide input voltage, 1A rated output current, adjustable output voltage, along with excellent load regulation and linear regulation performance.

DCK78xxMT-1A has a complete protection function, including overcurrent protection (OCP), overvoltage protection (OVP), undervoltage protection (UVP) and overtemperature protection (OTP). DCK78xxMT-1A minimizes the use of external components and adopts LGA-6 (plastic package 9mm× 7mm× 1.9mm) packaging.

## Internal Soft Start (SS)

The soft start function prevents overvoltage during module startup. The DCK78xxMT-1A features a built-in soft start mechanism: When the module starts, its internal circuit generates a ramp-up voltage from 0V to 0.6V (SS). If the SS voltage falls below the internal reference voltage VREF(0.6V), the internal error amplifier uses the SS voltage as the reference. When the SS voltage exceeds the internal reference voltage, the VREF voltage resumes as the control reference. The SS soft start duration is internally configured, typically 0.6ms.

## Start And Stop

The module activates when both VIN and VEN exceed their respective thresholds. The internal reference voltage circuit activates first to generate a stable reference voltage, then the internal voltage regulator is enabled. The regulator provides a stable power supply to the remaining circuits.

Three scenarios will deactivate the chip: VIN too low, VEN too low, and over-temperature shutdown protection. During shutdown, the signal loop is first isolated to prevent false triggering. Then the COMP voltage and internal power supply are pulled down. Floating drivers remain unaffected by this shutdown command.

## Overcurrent Protection And Short Circuit (OCP)

DCK78xxMT-1A features per-cycle current limiting protection. When the inductor current peak exceeds the internal peak current limiting threshold, the upper transistor turns off while the lower transistor remains on until the inductor current drops below the internal valley current limiting threshold. The valley current limiting circuit reduces operating frequency (after triggering the peak current limiting threshold). At the same time, the output voltage continues to drop until VFB is below the under-voltage (UV) threshold (typically 42%).

Once UV is triggered, DCK78xxMT-1A enters hiccup protection mode, periodically restarting the module. This protection mode is useful when the output is short-circuited to ground, greatly reducing the average short-circuit current, reducing thermal problems, and protecting the module.

Once the overcurrent condition disappears, DCK78xxMT-1A will exit the hiccup protection mode.

## Over Temperature Turn Off Protection (OTP)

To prevent any damage caused by overheating, the DCK78xxMT-1A stops switching when the internal chip temperature exceeds 150°C. Once the temperature is below the threshold (130°C typical value), the module resumes operation.

### Undervoltage Lockout Protection (UVLO)

Undervoltage Lockout Protection (UVLO) allows the module to stop operating when the input voltage is insufficient. The DCK78xxMT-1A Undervoltage Lockout Protection (UVLO) comparator monitors the output voltage of the internal LDO (VCC). The typical threshold for the rise of Undervoltage Lockout Protection (UVLO) is 4.3 V, while the typical threshold for its fall is 3.85 V.

### Error Amplifier (EA)

DCK78xxMT-1A uses a dynamic transconductance amplifier as the error amplifier (OTA). The error amplifier compares the FB voltage with the internal 0.6V reference voltage (VREF) and outputs a current proportional to the difference between them. This output current then charges or discharges the internal compensation network to form the COMP voltage, which controls the power MOSFET current. The optimized internal compensation network minimizes the number of external components used, greatly simplifying the design of the control loop.

## NOTES

1. If the product works under the minimum required load, it cannot guarantee that the performance of the product complies with all the performance indicators in this manual;
2. The maximum capacitive load is tested under the input voltage range and full load condition;
3. Unless otherwise stated, all indexes in this manual are measured at  $T_a=25^{\circ}\text{C}$ , humidity <75%RH, nominal input voltage and rated output load;
4. All index testing methods in this manual are based on the enterprise standards of the company;
5. Our company can provide product customization, specific needs can directly contact our technical staff;
6. RHENXV reserves the right to make changes to the product at any time without notice.