

## 5-Bit VID Reference Generator

### General Description

The RT9401D is a digital to analog converter which generate a reference voltage for AMD Mars 5-bit VID code. The IC is proposed to pair with a series of Richtek's general purpose PWM controllers dedicated for the desktop microprocessor core power voltage regulation. The reference voltage is within 1% high accuracy. The RT9401D is available in SOT-23-8 package.

### Ordering Information

RT9401D□□

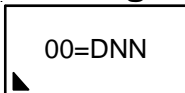
- Package Type  
V8 : SOT-23-8
- Lead Plating System  
G : Green (Halogen Free and Pb Free)

Note :

Richtek products are :

- ▶ RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- ▶ Suitable for use in SnPb or Pb-free soldering processes.

### Marking Information



00= : Product Code  
DNN : Date Code

### Features

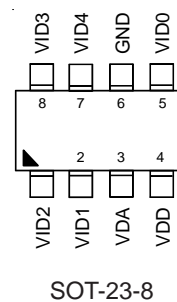
- Support 5-Bit DAC Voltage Conforming to AMD Mars VID Table
- 1% High Accuracy of  $V_{REF}$
- Small Footprint Package of SOT-23-8
- RoHS Compliant and Halogen Free

### Applications

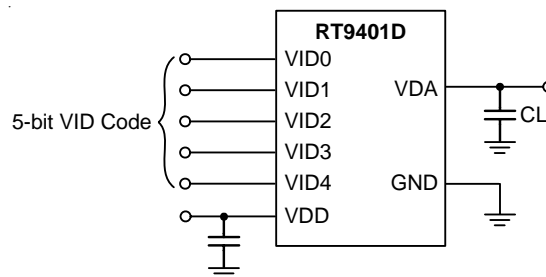
- Desktop/Motherboard Microprocessor Core Power Regulation
- High Accuracy and Programmable Voltage Power Regulation

### Pin Configurations

(TOP VIEW)



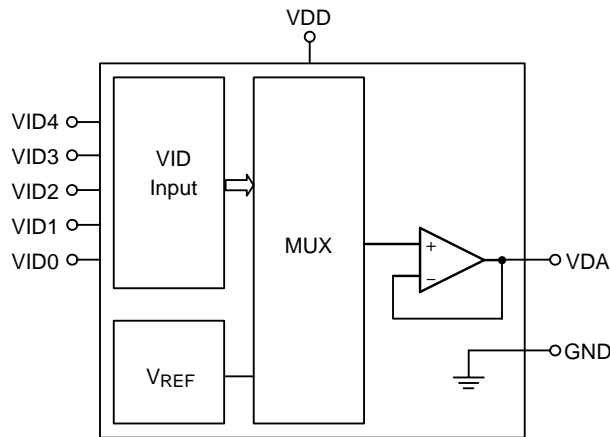
### Simplified Application Circuit



**Functional Pin Description**

Pin No.	Pin Name	Pin Function
1	VID2	DAC Voltage Identification Input.
2	VID1	DAC Voltage Identification Input.
3	VDA	Digital - to - Analog Voltage Output.
4	VDD	Power Input Pin.
5	VID0	DAC Voltage Identification Input.
6	GND	Ground.
7	VID4	DAC Voltage Identification Input.
8	VID3	DAC Voltage Identification Input.

**Function Block Diagram**



**Operation**

The VID input receives the signals from the VID0, VID2, VID3, VID4 pins, and sends them to the MUX. According to VID signals, the MUX generates a corresponding output voltage shown as Table 1 for AMD Mars 5-bit VID code.

**Absolute Maximum Ratings** (Note 1)

- Supply Input Voltage, VDD ----- 7V
- Power Dissipation, P<sub>D</sub> @ T<sub>A</sub> = 25°C  
   SOT-23-8 ----- 0.54W
- Package Thermal Resistance (Note 2)  
   SOT-23-8, θ<sub>JA</sub> ----- 186.2°C/W
- Lead Temperature (Soldering, 10 sec.) ----- 260°C
- Storage Temperature Range ----- -65°C to 150°C
- ESD Susceptibility (Note 3)  
   HBM (Human Body Model) ----- 2kV

**Recommended Operating Conditions** (Note 4)

- Supply Input Voltage, VDD ----- 5V ±10%
- Junction Temperature Range ----- -40°C to 125°C
- Ambient Temperature Range ----- -40°C to 85°C

**Electrical Characteristics**

(V<sub>DD</sub> = 5V, T<sub>A</sub> = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
<b>V<sub>DD</sub> Supply Current</b>						
Nominal Supply Current	I <sub>DD</sub>	VDA Open	--	2	5	mA
<b>Reference &amp; DAC</b>						
Output Voltage Program	See Table 1					
DAC Output Voltage Accuracy		VDA ≥ 1V	-1	--	1	%
		VDA < 1V	-10	--	10	mV
VID (4:0) Input Low			--	--	0.4	V
VID (4:0) Input High			1.05	--	--	V
VID [4:0] Internal Pull-High Current Source Capability			18	--	--	μA
VID [4:0] Internal Pull-High Voltage			2.2	2.4	2.5	V
<b>Output Buffer</b>						
DC Gain		Capacitor Load Only	--	70	--	dB
Bandwidth	GBW	CL = 1nF	--	1.64	--	MHz
Slew Rate	SR	CL = 0.1μF	--	9.5	--	mV/μs
Impedance	R <sub>OUT</sub>		60	--	110	Ω

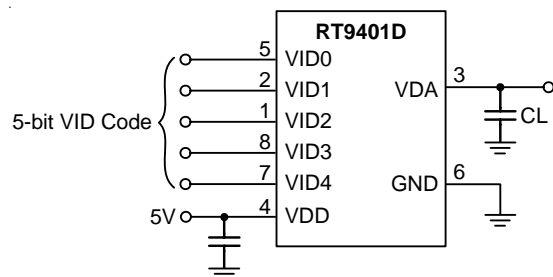
**Note 1.** Stresses beyond those listed “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

**Note 2.** θ<sub>JA</sub> is measured at T<sub>A</sub> = 25°C on a high effective thermal conductivity four-layer test board per JEDEC 51-7.

**Note 3.** Devices are ESD sensitive. Handling precaution is recommended.

**Note 4.** The device is not guaranteed to function outside its operating conditions.

## Typical Application Circuit



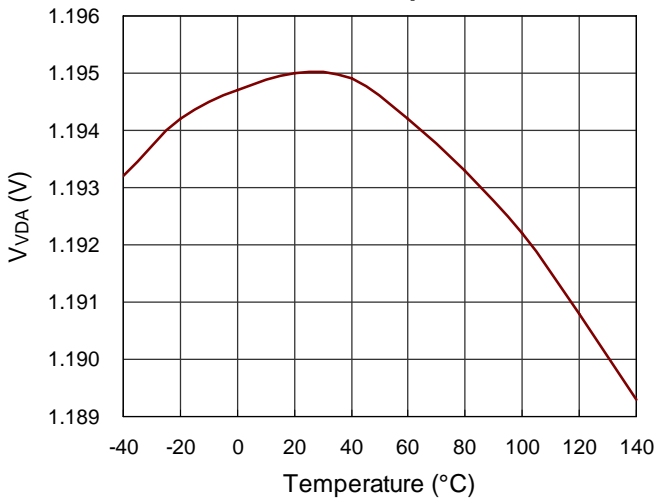
**Table 1. Output Voltage Program**

VID4	VID3	VID2	VID1	VID0	Nominal Output Voltage <b>VDA</b>
0	0	0	0	0	1.500
0	0	0	0	1	1.475
0	0	0	1	0	1.450
0	0	0	1	1	1.425
0	0	1	0	0	1.400
0	0	1	0	1	1.375
0	0	1	1	0	1.350
0	0	1	1	1	1.325
0	1	0	0	0	1.300
0	1	0	0	1	1.275
0	1	0	1	0	1.250
0	1	0	1	1	1.225
0	1	1	0	0	1.200
0	1	1	0	1	1.175
0	1	1	1	0	1.150
0	1	1	1	1	1.125
1	0	0	0	0	1.100
1	0	0	0	1	1.075
1	0	0	1	0	1.050
1	0	0	1	1	1.025
1	0	1	0	0	1.000
1	0	1	0	1	0.975
1	0	1	1	0	0.950
1	0	1	1	1	0.925
1	1	0	0	0	0.900
1	1	0	0	1	0.875
1	1	0	1	0	0.850
1	1	0	1	1	0.825
1	1	1	0	0	0.800
1	1	1	0	1	0.775
1	1	1	1	0	0.750
1	1	1	1	1	Shutdown

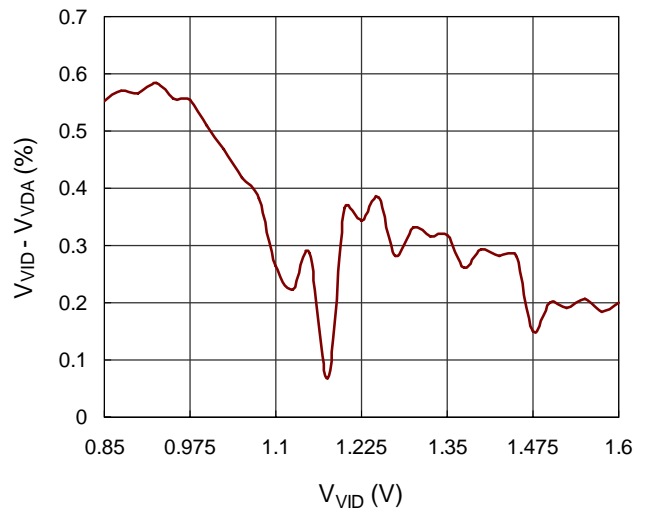
Note: (1) 0 : Connected to GND  
 (2) 1 : Open

## Typical Operating Characteristics

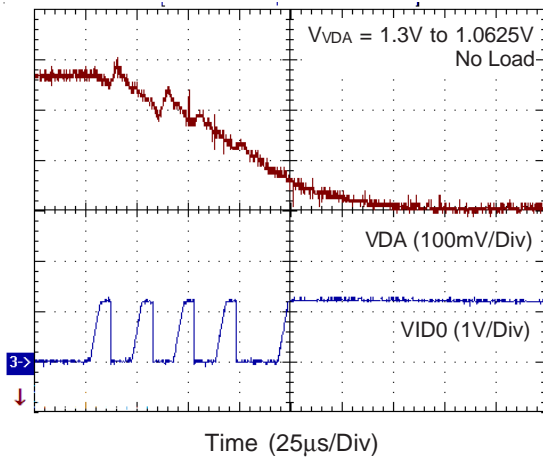
**V<sub>VDA</sub> vs. Temperature**



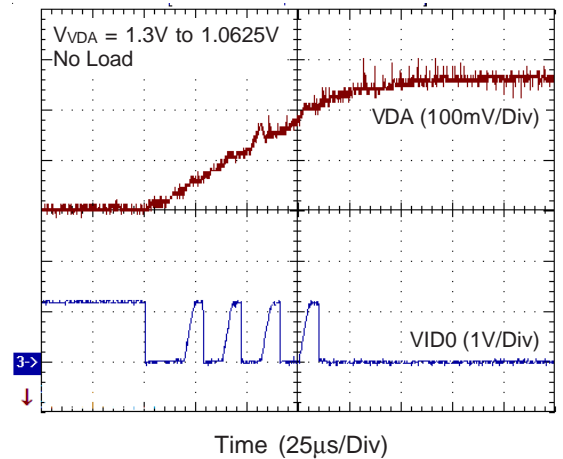
**Error Between V<sub>VID</sub> & V<sub>VDA</sub>**



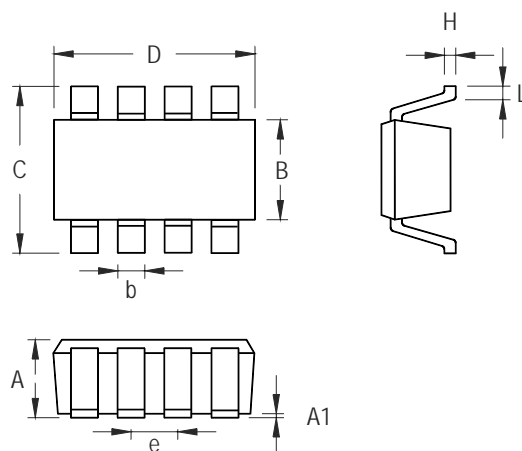
**VID on the Fly Falling**



**VID on the Fly Rising**



**Outline Dimension**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.000	1.450	0.039	0.057
A1	0.000	0.150	0.000	0.006
B	1.500	1.700	0.059	0.067
b	0.220	0.500	0.009	0.020
C	2.600	3.000	0.102	0.118
D	2.800	3.000	0.110	0.118
e	0.585	0.715	0.023	0.028
H	0.100	0.220	0.004	0.009
L	0.300	0.600	0.012	0.024

**SOT-23-8 Surface Mount Package**

**Richtek Technology Corporation**

5F, No. 20, Taiyuen Street, Chupei City  
 Hsinchu, Taiwan, R.O.C.  
 Tel: (8863)5526789

Richtek products are sold by description only. Richtek reserves the right to change the circuitry and/or specifications without notice at any time. Customers should obtain the latest relevant information and data sheets before placing orders and should verify that such information is current and complete. Richtek cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Richtek product. Information furnished by Richtek is believed to be accurate and reliable. However, no responsibility is assumed by Richtek or its subsidiaries for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Richtek or its subsidiaries.