

# **RFD3T28125-701**

## **SP3T PIN Switch Driver – Positive Voltage Driver**

### **Features:**

- Supports High Output Drive Voltage and Current
- Support SP3T High Power Switches
- Operates on Two Positive Voltages: +5V and +28V to +125V
- Independent TTL Input Controls
- High Output Current (200mA) for Low Switch Loss and High Isolation
- Complimentary Driver Outputs
- RoHS Compliant

### **Description:**

The RFD3T28125-701 surface mount PIN Switch Driver supports high biasing voltages required when operating PIN diodes at high power applications. The fundamental building block consists of a PIN Diode and it is the intrinsic layer which gives this device its unique characteristics. When charge is injected into the intrinsic layer it becomes highly conductive and present a very low insertion loss on the order of a few tenth of a dB. When charge is depleted from the intrinsic layer it becomes nonconductive and presents a high isolation. As the operating power increase or the frequency of interest drops into the HF & VHF realms, the necessary biasing voltages climb into the hundreds of voltage which exceeds the capabilities of all MMIC style Switch Drivers.

This device has been designed to support optimum biasing voltages required to support SP3T switch offering requiring two positive biasing voltages: +5V and a High Voltage between +28 to +125V.

The RFD3T28125-701 driver can source up to 200mA from the  $V_{HIGH}$  source to enable low insertion loss and high isolation. The driver is controlled via an independent TTL control signals. There are three complimentary outputs to support a Series-Shunt PIN diode switch topology.

The RFD3T28125-701 is packaged in a 33mm x 33mm x 8.4mm surface mount package. The device is compatible with surface mount, solder reflow processes typically employed in high volume production.

### **Environmental Capabilities**

The RFD3T28125-701 Driver is capable of meeting the environmental requirements of MIL-STD-202 and MIL-STD-750.

### **ESD and Moisture Sensitivity Rating**

The ESD rating for this device is Class 1A, HBM. The moisture sensitivity level rating is MSL1.

## Absolute Maximum Ratings

$T_A = +25^\circ\text{C}$  as measured on the base ground surface of the device.

Parameter	Conditions	Absolute Maximum Value
Input Voltage, $+V_{CC1}$		-0.5 to 6.0 V
Input Voltage, $+V_{CC2}$		-0.5 to +130 V
Control Port Input Voltage		-0.5 to 5.5 V
Output Sink Current	$V_{OUT} = 0\text{ V}$	+200 mA
Output Source Current	$V_{OUT} \sim +V_{CC}\text{ V}$	+25 mA
Operating Temperature		$-40^\circ\text{C}$ to $85^\circ\text{C}$
Storage Temperature		$-65^\circ\text{C}$ to $150^\circ\text{C}$
Assembly Temperature	$T < 10\text{ sec}$	$+260^\circ\text{C}$
Total Dissipated Power	$T_{CASE} = 85^\circ\text{C}$	2.0 W

Note 1:  $T_{CASE}$  is defined as the temperature of the bottom ground surface of the device.

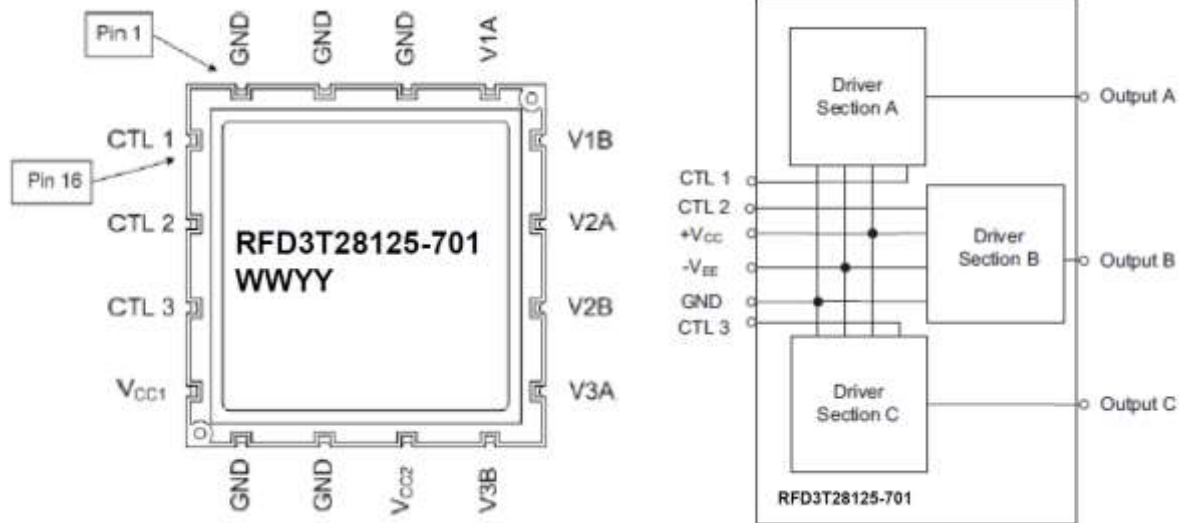
## RFD3T28125-701 Electrical Specifications

@  $Z_o=50\Omega$ ,  $T_A = +25^\circ\text{C}$  as measured on the base ground surface of the device.

Parameters	Symbol	Test Conditions	Min Value	Typ Value	Max Value	Units
Operating Frequency	PRF	$+V_{CC1}=5\text{V}$ ; $+V_{CC2} = +28\text{ to }125\text{V}$	0	100	500	KHz
Supply Voltage	$+V_{CC1}$		4.5	5	5.5	V
Supply Voltage	$+V_{CC2}$		10		125	V
Quiescent Current ( $+V_{CC1}$ )	$I_{Q1}$	$+V_{CC1}=5\text{V}$ , $+V_{CC2} = +28\text{V to }+125\text{V}$ , No load connected to output A & B	5	10	20	mA
Quiescent Current ( $+V_{CC2}$ )	$I_{Q2}$	$+V_{CC1}=5\text{V}$ , $+V_{CC2} = +28\text{V to }+125\text{V}$ , No load connected to output A & B	30	40	50	mA
TTL Input Voltage	$V_{LOW}$ $V_{HIGH}$	Logic 0: sink current = 20 $\mu\text{A}$ Logic 1: source current = 500 $\mu\text{A}$	0 2		0.8 5.0	V
Low Level Output Voltage Output A, B or C	$V_{OUTL}$	$+V_{CC1}=5\text{V}$ , $+V_{CC2} = +28\text{V to }+125\text{V}$ , Sink current = 200 mA	0.05	0.1	0.2	V
Low Level Output Voltage Output A, B or C	$V_{OUTH}$	$+V_{CC1}=5\text{V}$ , $+V_{CC2} = +28\text{V to }+125\text{V}$ , Source current = 20mA	$+V_{CC2}$ -1	$+V_{CC2}$ -0.3	$+V_{CC2}$ -0.1	V
Switching Time	$T_{SW}$	$+V_{CC1}=5\text{V}$ , $+V_{CC2} = +28\text{V to }+125\text{V}$ , $F = 10\text{kHz}$ , 50% TTL to 10% or 90% RF output voltage		1.5	2	usec

Notes: Switching time is measured using the MSW3T3100-310,  $f_{RF} = 500\text{ MHz}$ ,  $+V_{CC1}=5\text{V}$  &  $+V_{CC2}=+28\text{V}$

## RFD3T28125-701 Pin Out



## Pin Out Description

Pin	Pin Name	Input/Output	Description
1	GND		+V <sub>CC1</sub> & +V <sub>CC2</sub> ground return
2	GND		+V <sub>CC1</sub> & +V <sub>CC2</sub> ground return
3	GND		+V <sub>CC1</sub> & +V <sub>CC2</sub> ground return
4	V1A	O	Bias Voltage/Current Output – Driver 1 (V1A, Inverted output wrt CTL1)
5	V1B	O	Bias Voltage/Current Output – Driver 1 (V1B, Non-Inverted output wrt CTL1)
6	V2A	O	Bias Voltage/Current Output – Driver 2 (V2A, Inverted output wrt CTL2)
7	V2B	O	Bias Voltage/Current Output – Driver 2 (V2B, Non-Inverted output wrt CTL2)
8	V3A	O	Bias Voltage/Current Output – Driver 3 (V3A, Inverted output wrt CTL3)
9	V3B	O	Bias Voltage/Current Output – Driver 3 (V3B, Non-Inverted output wrt CTL3)
10	+VCC2		High Voltage (VHIGH): +28V to +125V
11	GND		+V <sub>CC1</sub> & +V <sub>CC2</sub> ground return
12	GND		+V <sub>CC1</sub> & +V <sub>CC2</sub> ground return
13	+VCC1		+V <sub>CC</sub> & -V <sub>EE</sub> ground return
14	CTL3	I	TTL input control 3 (CTL3)
15	CTL2	I	TTL input control 2 (CTL2)
16	CTL1	I	TTL input control 1 (CTL1)

## Truth Table

CTL1 (notes 1 & 2)	CTL2 (notes 1 & 2)	CTL3 (notes 1 & 2)	Driver Output Section 1	Driver Output Section 2	Driver Output Section 3
V <sub>HIGH</sub>	V <sub>LOW</sub>	V <sub>LOW</sub>	V1A Low, 0V, current sink mode V1B V <sub>High</sub> , ~+V <sub>CC2</sub> , current source mode	V2A, High, ~+V <sub>CC2</sub> , current source mode V2B, V <sub>Low</sub> , 0V, current sink mode	V3A, High, ~+V <sub>CC2</sub> , current source mode V3B, V <sub>Low</sub> , 0V, current sink mode
V <sub>LOW</sub>	V <sub>HIGH</sub>	V <sub>HIGH</sub>	V1A, High, ~+V <sub>CC2</sub> , current source mode V1B, V <sub>Low</sub> , 0V, current sink mode	V2A Low, 0V, current sink mode V2B V <sub>High</sub> , ~+V <sub>CC2</sub> , current source mode	V3A, Low, ~0V, current sink mode V3B, V <sub>HIGH</sub> , ~+V <sub>CC2</sub> , current source mode
V <sub>HIGH</sub>	V <sub>LOW</sub>	V <sub>HIGH</sub>	V1A Low, 0V, current sink mode V1B, V <sub>High</sub> , ~+V <sub>CC2</sub> , current source mode	V2A, High, ~+V <sub>CC2</sub> , current source mode V2B, V <sub>Low</sub> , 0V, current sink mode	V3A, Low, 0V, current sink mode V3B, V <sub>HIGH</sub> , ~+V <sub>CC2</sub> , current source mode
V <sub>LOW</sub>	V <sub>HIGH</sub>	V <sub>LOW</sub>	V1A, High, ~+V <sub>CC2</sub> , current source mode V1B, V <sub>Low</sub> , 0V, current sink mode	V2A Low, 0V, current sink mode V2B V <sub>High</sub> , ~+V <sub>CC2</sub> , current source mode	V3A, High, ~+V <sub>CC2</sub> , current source mode V3B, V <sub>Low</sub> , 0V, current sink mode
V <sub>HIGH</sub>	V <sub>HIGH</sub>	V <sub>LOW</sub>	V1A Low, 0V, current sink mode V1B V <sub>High</sub> , ~+V <sub>CC2</sub> , current source mode	V2A Low, 0V, current sink mode V2B V <sub>High</sub> , ~+V <sub>CC2</sub> , current source mode	V3A, High, ~+V <sub>CC2</sub> , current source mode V3B, V <sub>Low</sub> , 0V, current sink mode
V <sub>LOW</sub>	V <sub>LOW</sub>	V <sub>HIGH</sub>	V1A, High, ~+V <sub>CC2</sub> , current source mode V1B, V <sub>Low</sub> , 0V, current sink mode	V2A, High, ~+V <sub>CC2</sub> , current source mode V2B, V <sub>Low</sub> , 0V, current sink mode	V3A, Low, 0V, current sink mode V3B, V <sub>HIGH</sub> , ~+V <sub>CC2</sub> , current sourcing mode
V <sub>LOW</sub>	V <sub>LOW</sub>	V <sub>LOW</sub>	Note 3	Note 3	Note 3
V <sub>HIGH</sub>	V <sub>HIGH</sub>	V <sub>HIGH</sub>	Note 3	Note 3	Note 3

Notes:

- 1) CTL V<sub>HIGH</sub>:  $2V \leq V_{HIGH} \leq 5V$
- 2) CTL V<sub>LOW</sub>:  $0V \leq V_{LOW} \leq 0.8V$
- 3) Not recommended state

## Control of Symmetrical SP3T Switch

The RFD3T28125-701 can control a symmetrical SP3T series-shunt PIN Diode switch. Each driver section is connected to one series-shunt switch element to provide biasing voltages required in the two operating states: RF State Low Loss and High Isolation. The RF State of the SP3T is determined by the inputs to the three Control signals: CTL1, CTL2 & CTL3. Each Control signal states drives the SP3T into a state where one port is in the Low Loss state while the other two ports are in the Isolation state.

CTL1	CTL2	CTL3	RF State	Path J0 to J1	Path J0 to J2	Path J0 to J3	V1A	V2A	V3A	V1B	V2B	V3B
LOW	HIGH	HIGH	1	Low Loss	High ISO	High ISO	0V, -100mA	28V, 0mA	28V, 0mA	28V, 0mA	0V, -25mA	0V, -25mA
HIGH	LOW	HIGH	2	High ISO	Low Loss	High ISO	28V, 0mA	0V, -100mA	28V, 0mA	0V, -25mA	28V, 0mA	0V, -25mA
HIGH	HIGH	LOW	3	High ISO	High ISO	Low Loss	28V, 0mA	28V, 0mA	0V, -100mA	0V, -25mA	0V, -25mA	28V, 0mA

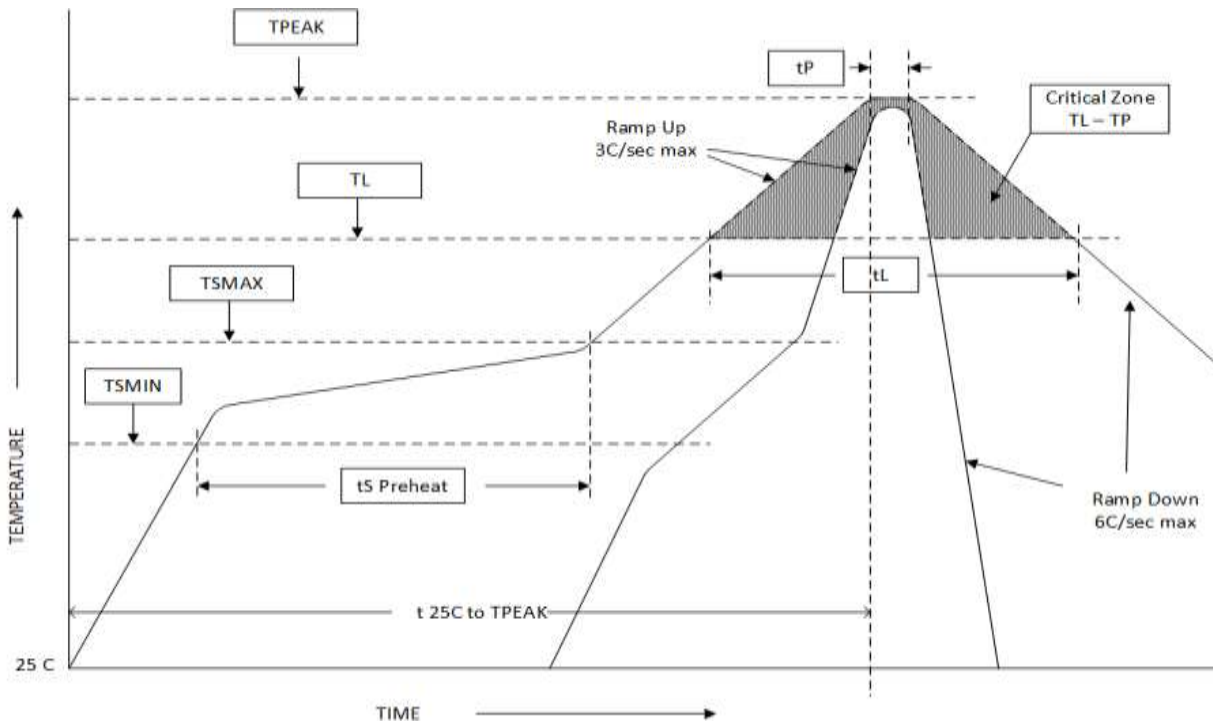
Note: All other conditions are not recommended.

## Assembly Instructions

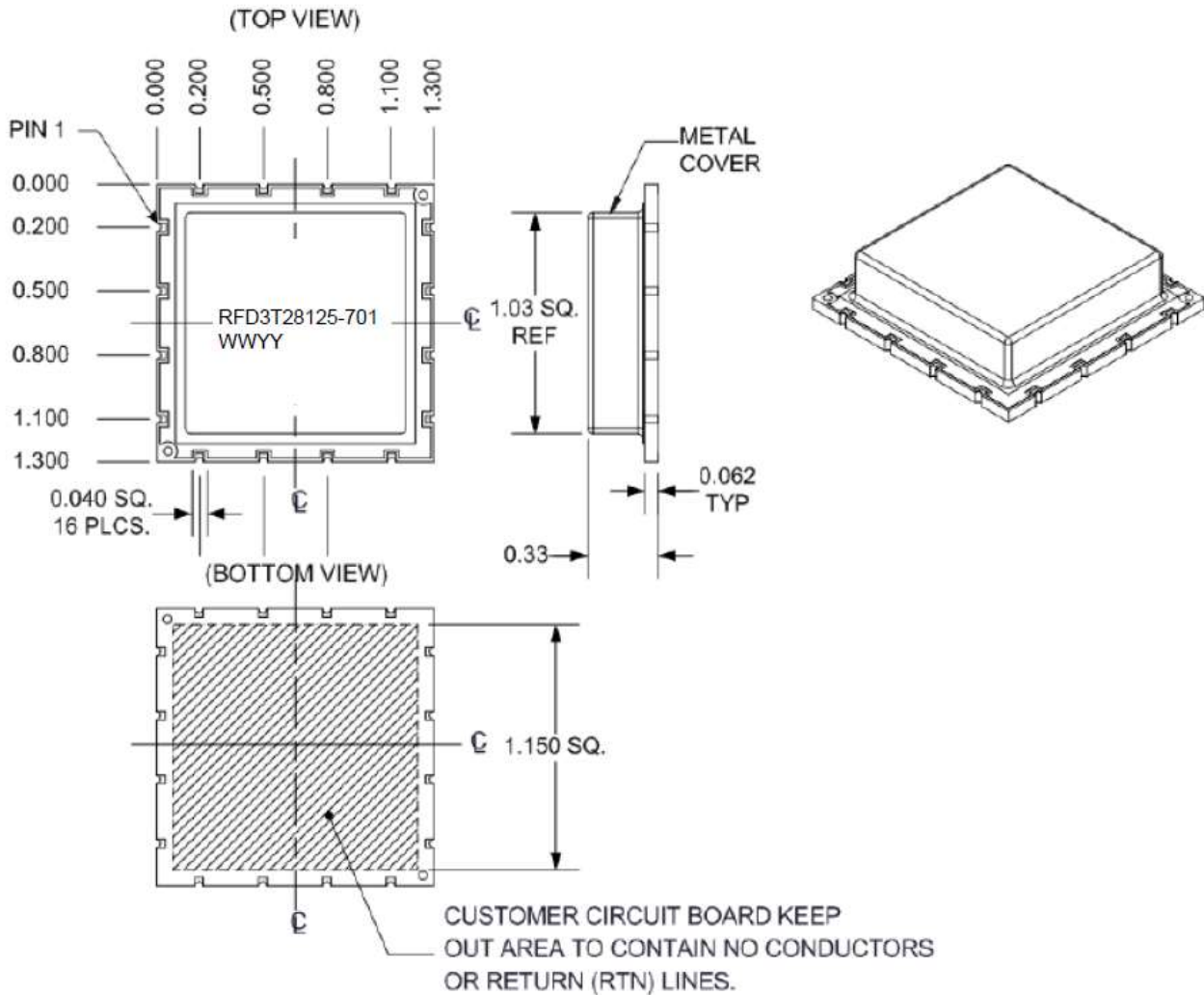
The RFD3T28125-701 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

Profile Parameter	Sn-Pb Assembly Technique	RoHS Assembly Technique
Average ramp-up rate ( $T_L$ to $T_P$ )	3°C/sec (max)	3°C/sec (max)
Preheat		
Temp Min ( $T_{smin}$ )	100°C	100°C
Temp Max ( $T_{smax}$ )	150°C	150°C
Time (min to max) ( $t_s$ )	60 – 120 sec	60 – 180 sec
$T_{smax}$ to $T_L$		
Ramp up Rate		3°C/sec (max)
Peak Temp ( $T_P$ )	225°C +0°C / -5°C	260°C +0°C / -5°C
Time within 5°C of Actual Peak Temp ( $T_P$ )	10 to 30 sec	20 to 40 sec
Time Maintained Above:		
Temp ( $T_L$ )	183°C	217°C
Time ( $t_L$ )	60 to 150 sec	60 to 150 sec
Ramp Down Rate	6°C/sec (max)	6°C/sec (max)
Time 25°C to $T_P$	6 minutes (max)	8 minutes (max)

## Solder Re-Flow Time-Temperature Profile



# RFD3T28125-701 Package Outline Drawing



Notes:

- 1) Circuit Board material is FR4.
- 2) Metallization: 2 Oz Cu followed by 150uin (TYP), followed by 4uin (TYP) Au
- 3) Unit = inches

## Part Number Ordering Detail:

The RFD3T28125-701 PIN Switch Driver is available in the following format.

Part Number	Description	Packaging
RFD3T28125-701	SP3T Positive & Negative Voltage Switch Driver	Gel-Pack
RFD3T28125-701-EVB	RFD3T28125-701 Evaluation Board	Box