How to Turn On a Power MOSFET With a VOMDA1271

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INTRODUCTION

The “VOMDA1271 - How to Turn On a Power MOSFET” evaluation board, schematic shown in Fig. 1, provides a readily available platform for performance and design evaluation of Vishay’s VOMDA1271 PV MOSFET driver. It contains provisions for an additional LED driver to reach a higher forward current, a possibility to increase the output current with additional transistor at the output, additional resistor capacitor combination at the input as well as footprints for customers to evaluate various through-hole TO-220 and TO-247 packaged power MOSFETs.

DESCRIPTION

The IR diode on the input side can be driven with the MOSFET T1 and a 5 V input signal, that can be measured at the test pad TP1. The V_{CC1} should be connected to the 5 V supply voltage.

With help of additional RC combination (resistor RP and capacitor CP) via PULSE jumper, the turn on time of the VOMDA1271 can be improved dependent on the used values.

At the output side the photovoltaic voltage can be measured between test pads TP3 and TP4. This provides the gate-source voltage to switch custom power MOSFETs Q1 and Q2 or Q3 and Q4.

AC/DC CONFIGURATION

AC/DC configuration requires the connection of an external load and voltage source (AC or DC voltage) at pad S or S’ with a pulse source generator at V_{IN} and supply voltage at V_{CC1}.

DC ONLY CONFIGURATION

Q1 and Q2 provide footprints for assembling custom MOSFETs in combination with pads S, DC, and S’.

For switching purely DC signals it is possible to dispense with two MOSFETs and work only with one MOSFET.

To reduce R_{DSon}, increase the current capability and the overall power dissipation, two MOSFETs can be connected in parallel to a DC only configuration by connecting pads S and S’ via DC_ONLY jumper.

This configuration requires the connection of an external load and voltage source (DC voltage) at pad DC.

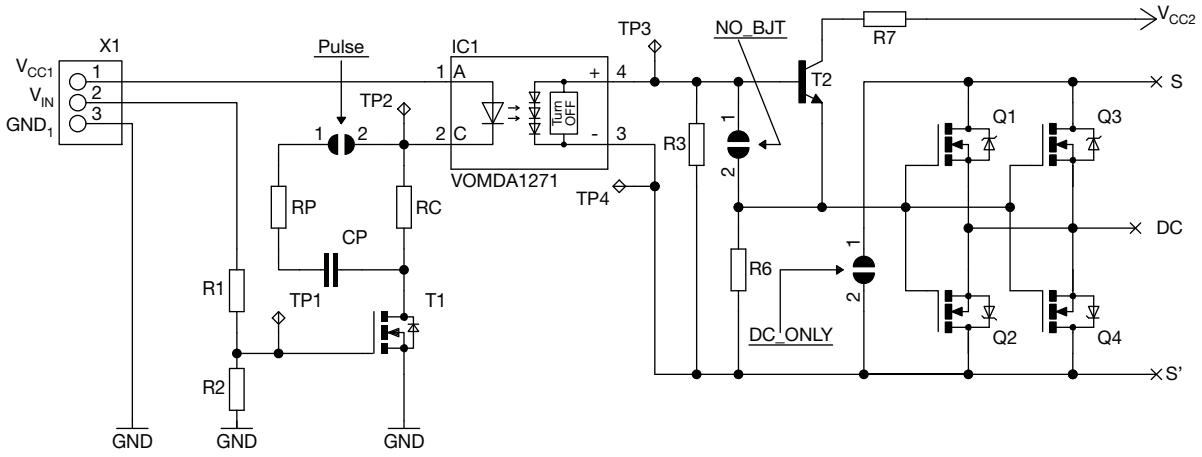

Fig. 1 - Schematic

APPLICATION NOTE

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BIPOLAR TRANSISTOR CONFIGURATION (OUTPUT)

The charging time of the MOSFETs gate is limited due to low photocurrent possibility of the VOMDA1271. Dependent on the used MOSFETs and the possibility to use additional supply voltage at the output, a bipolar transistor T2 could be used by removing the resistors R3, disconnecting the NO_BJT jumper and adding the resistors R6 and R7. In this case the transistor with high current gain factor (hFE) is recommended to get faster charging time of the MOSFETs gate. In this configuration the pad S' should be connected to the ground (GND) and the MOSFET can only be used as a low side switch.

PULSED INPUT WITH A BIPOLAR TRANSISTOR

If there is no supply voltage and the possibility to use an additional transistor at the output, a pulsed input configuration is recommended.

This configuration consists of a bipolar transistor or MOSFET T1, resistor-capacitor network (RP and CP) for high inrush forward current with a parallel resistor RC for constant forward current after the capacitance is fully charged.

The values of the resistors and capacitance can be calculated with the equations below:

Constant Forward Current:

$$R_C = \frac{V_{CC1} - V_F}{I_{F_{constant}}}$$

Pulsed Forward Current:

$$R_P = \frac{V_{CC1} - V_F}{I_{F_{pulse}}}$$

$$C_P = \frac{t_{pulse}}{5 \times R_p}$$

Please note, in this configuration the pulse time and the maximum peak current should not exceed the max. values which are specified in the VOMDA1271 datasheet.

MEASUREMENT RESULTS

A pulsed input with a MOSFET configuration measurement is shown in Table 1 and Fig. 2, that show the improvement of the turn-on time compared to a standard configuration.

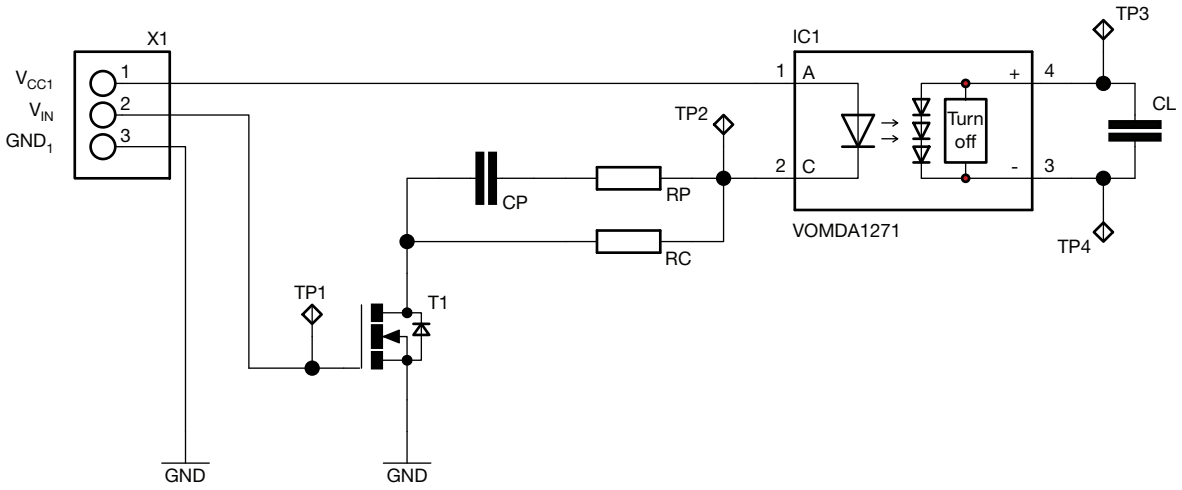

Fig. 2 - Test Circuit

TABLE 1 - TEST CONDITIONS:
R_C = 820 Ω, R_P = 170 Ω, V_{IN} = 5 V, V_{CC1} = 10 V AND OUTPUT CAPACITANCE = 100 nF

FORWARD CURRENT	CAPACITOR C_P	TURN-ON TIME
$I_{Fconstant}$ = 10 mA	No C_P	t_{ON} at 5 V = 30 ms
$I_{Fconstant}$ = 10 mA + I_{Fpulse} = 50 mA	C_P = 2.2 µF	t_{ON} at 5 V = 28 ms
$I_{Fconstant}$ = 10 mA + I_{Fpulse} = 50 mA	C_P = 22 µF	t_{ON} at 5 V = 11.9 ms
$I_{Fconstant}$ = 10 mA + I_{Fpulse} = 50 mA	C_P = 56 µF	t_{ON} at 5 V = 6.3 ms

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TABLE 2 - BILL OF MATERIALS

IDENTIFIER	PART NUMBER	COMMENT	MANUFACTURER
IC1	VOMDA1271T	Vishay, automotive MOSFET driver	VISHAY
X1	90120-0763	Pin header, 3 circuits, n.c.	MOLEX
R1	CRCW08050000Z0EA	0805, 0 Ω	VISHAY
R2	-	0805, n.c.	-
R3	CRCW08051M00FKEC	0805, 1 MΩ	VISHAY
RC	CRCW0805360RFKEAC	0805, 360 Ω	VISHAY
RP	-	1210, n.c.	-
R6	-	0805, n.c.	-
R7	-	0805, n.c.	-
CP	-	1206, n.c.	-
T1	SI2308BDS-T1-BE3	SOT23, N-channel, 60 V	VISHAY
T2	-	SOT23, NPN-transistor, n.c.	-
Q1	-	TO-220, N-channel, n.c.	-
Q2	-	TO-220, N-channel, n.c.	-
Q3	-	TO-247, N-channel, n.c.	
Q4	-	TO-247, N-channel, n.c.	

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