How is the gate trigger resistor value calculated for a triac

Asked 3 years, 2 months ago Active 5 months ago Viewed 4k times

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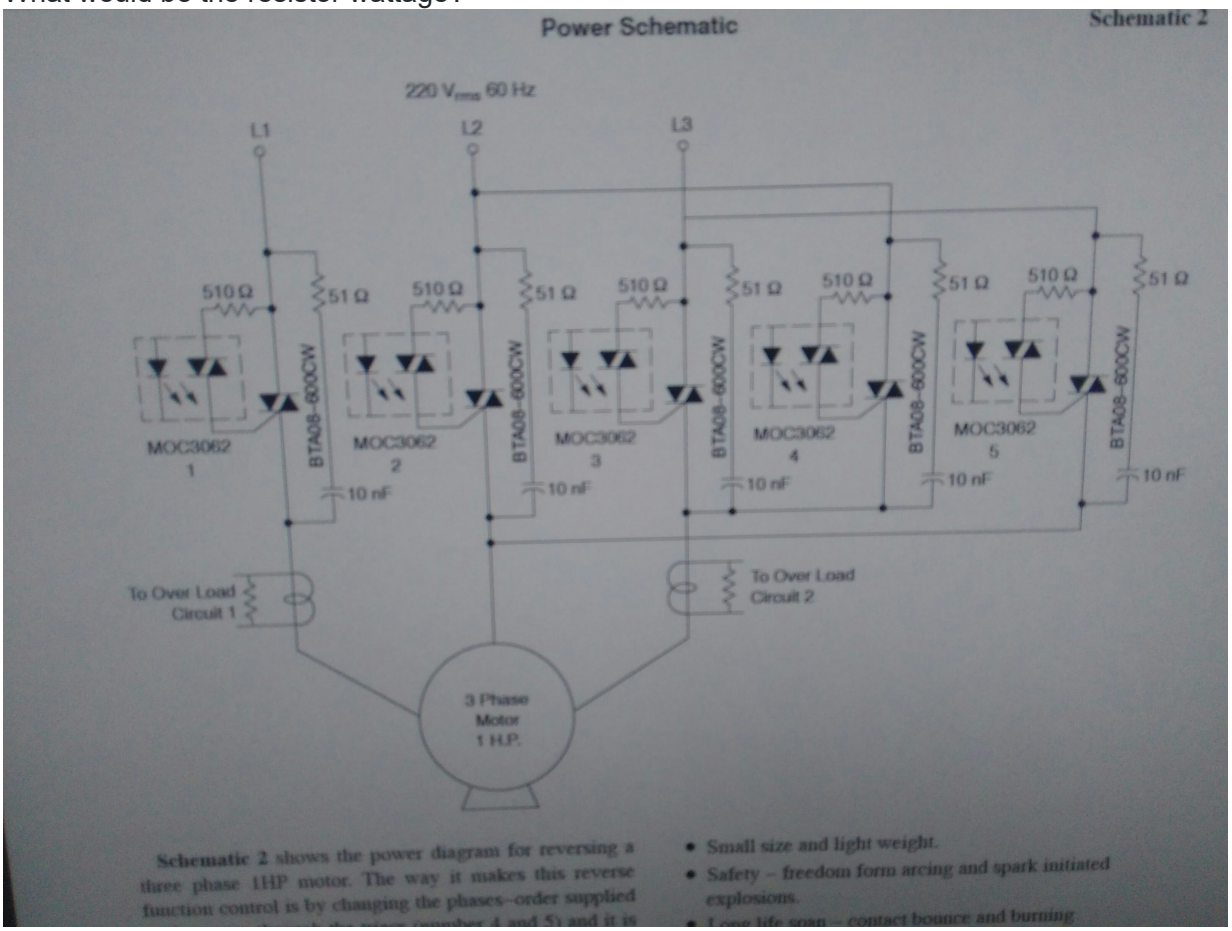
As per the application notes of bta08-600cw, to control a three phase induction motor, for triggering the triac gate, the value of resistor is shown as 510 ohm. How is this value arrived at? What would be the resistor wattage?



From the From the data sheet, which quadrant to be considered to know the gate trigger current?

Table 2. Electrical characteristics (T_j = 25 °C, unless otherwise specified) Snubberless and logic level (3 quadrants)

Symbol	Test conditions	Quadrant		T8		BTA08 / BTB08				Unit
				T810	T835	TW	SW	CW	BW	
I_{GT} (1)	V_D = 12 V R_L = 30 Ω	I - II - III	MAX.	10	35	5	10	35	50	mA
V_{GT}		I - II - III	MAX.	1.3						V
V_{GD}	$V_D = V_{DRM}$ R_L = 3.3 k Ω T_j = 125 °C	I - II - III	MIN.	0.2						V
I_H (2)	I_T = 100 mA		MAX.	15	35	10	15	35	50	mA
I_L	I_G = 1.2 I_{GT}	I - III	MAX.	25	50	10	25	50	70	mA
		II		30	60	15	30	60	80	
dV/dt (2)	V_D = 67% V_{DRM} gate open T_j = 125 °C		MIN.	40	400	20	40	400	1000	V/µs
$(dI/dt)_c$ (2)	$(dV/dt)_c$ = 0.1 V/µs T_j = 125 °C		MIN.	5.4	-	3.5	5.4	-	-	A/ms
	$(dV/dt)_c$ = 10 V/µs T_j = 125 °C			2.8	-	1.5	2.98	-	-	
	Without snubber T_j = 125 °C			-	4.5	-	-	4.5	7	

Also for three phase supply, how is the voltage shown as 220v instead of 440v(in the schematic diagram)?

Can the gate be triggered with either AC or DC? If so what is the impact of calculating the resistor value in both these cases?

power-electronics triac

edited Jul 30 '16 at 5:39

asked Jul 30 '16 at 3:22

ke7

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1 Answer

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As per the application notes of BTA08-600CW, to control a three phase induction motor, for triggering the triac gate, the value of resistor is shown as 510 ohm. How is this value arrived at?

Fairchild application note AN-3004 page 3 reads as follows:

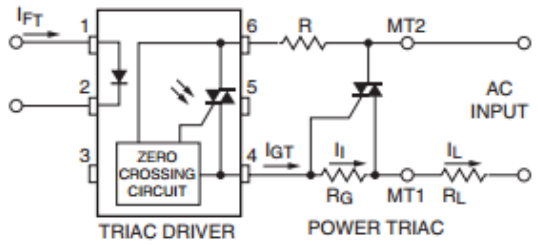

Figure 7. Basic Driving Circuit – Triac Driver, Triac and Load

Resistor R (shown in Figure 7) is not mandatory when RL is a resistive load since the current is limited by the gate trigger current (IGT) of the power triac. However, resistor R (in combination

with R-C snubber networks that are described in the section "Inductive and Resistive Loads") prevents possible destruction of the triac drive in applications where the load is highly inductive.

Unintentional phase control of the main triac may happen if the current limiting resistor R is too high in value. The function of this resistor is to limit the current through the triac driver in case the main triac is forced into the non-conductive state close to the peak of the line voltage and the energy stored in a "snubber" capacitor is discharged into the triac driver. A calculation for the current limiting resistor R is shown below for a typical 220 volt application: Assume the line voltage is 220 volts RMS. Also assume the maximum peak repetitive drive current (normally for a 10 micro second maximum time interval is 1 ampere. Then

$$R = \frac{V_{peak}}{I_{peak}} = \frac{220\sqrt{2}}{1} = 311\ \Omega$$

R=VpeakIpeak=22021=311 Ω

One should select a standard resistor value >311 ohms → 330 ohms.

The gate resistor RG (also shown in Figure 7) is only necessary when the internal gate impedance of the triac or SCR is very high which is the case with sensitive gate thyristors. These devices display very poor noise immunity and thermal stability without RG. The value of the gate resistor in this case should be between 100 and 500. The circuit designer should be aware that use of a gate resistor increases the required trigger current (IGT) since RG drains off part of IGT. Use of a gate resistor combined with the current limiting resistor R can result in an unintended delay or phase shift between the zero-cross point and the time the power triac triggers.

> What would be the resistor wattage?

I'm not going to work this out for you but it only carries current for the very short time between turning on of the opto triac until the big triac switches on.

> From the data sheet, which quadrant to be considered to know the gate trigger current?

I and III. Since the trigger voltage is derived from the supply voltage they always match.

> Also for three phase supply, how is the voltage shown as 220 V instead of 440 V (in the schematic diagram)?

Why not? That's a 60 Hz supply and 220 V may be available.

> Can the gate be triggered with either AC or DC? If so what is the impact of calculating the resistor value in both these cases?

No. This system is using zero-cross opto-isolated trigger devices. You feed about 5 to 20 mA into the opto LED and it will only light when forward biased. See the datasheet (which I didn't check). The LED has to be on at zero-cross so if you tried to trigger from AC it would be off (unless the trigger AC was from another phase).

For further reading, see my answer to Using AC current to trigger Triac where I explain the operation of the zero-cross circuit.