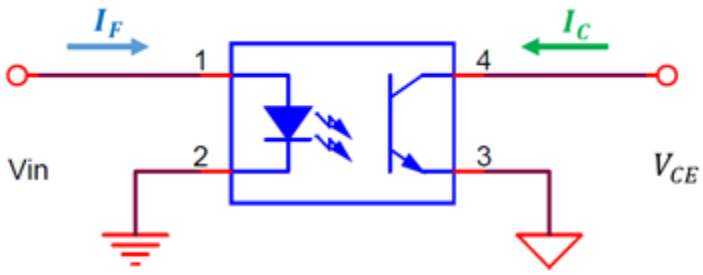
APPLICATION NOTE

General Purpose Photo Coupler

Current Transfer Ratio(CTR) Measurement and Calculation

1. Current Transfer Ratio (CTR) Definition

Current Transfer Ratio (CTR) is define as the ratio of output current (I_C) to input current (I_F) express as percentage ($\frac{I_C}{I_F} * 100\%$). CTR ratio can view as photo coupler amplification, for example when CTR=200% means if I_F = 5mA then I_C = 10mA. But this does not mean when I_F = 10mA then I_C = 20mA, because ambient temperature (T_a) can affect CTR ratio. This application note is design to help user know how to evaluate CTR range.



Current Transfer Ratio (CTR)=$\frac{I_C}{I_F}$ x 100%

Fig.1

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2. Simple CTR circuit measurement

When calculate CTR, user needs to know I_F and I_C output current. I_F and I_C can measure by using two multimeters separately in input and output circuit loop as shown in figure 2.

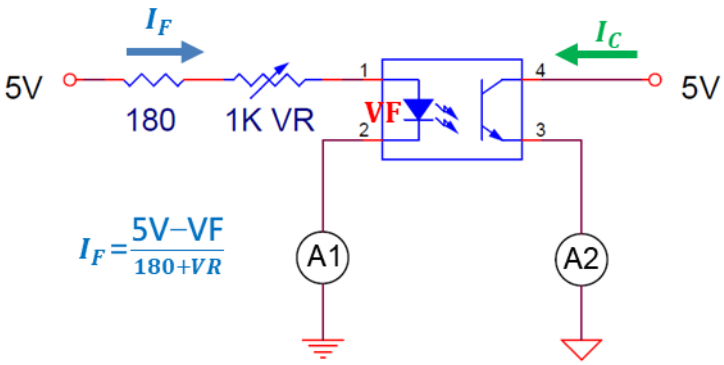

Fig.2

3. CTR normalization curve

CTR differ as I_F value changes, take Everlight EL817 as an example, in figure 3 shown when T_a = 25℃, that I_F = 5mA is correspond to CTR = 1.

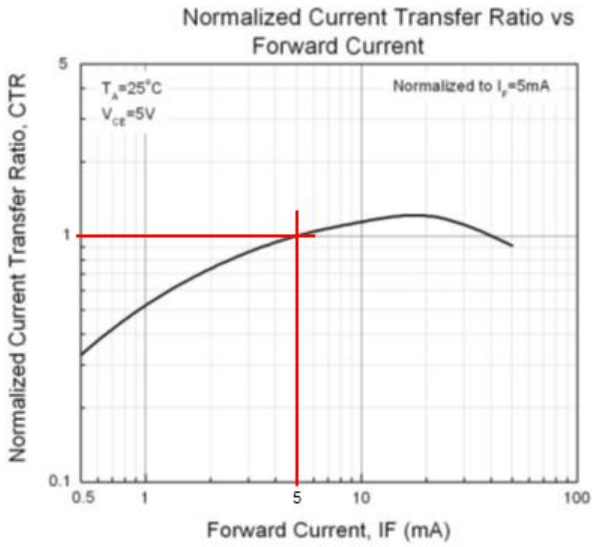

Fig.3

When T_a change it will affect CTR ratio, especially high temperature can cause CTR to decay, figure 4 include two factors (IF and Ta) that affect CTR.

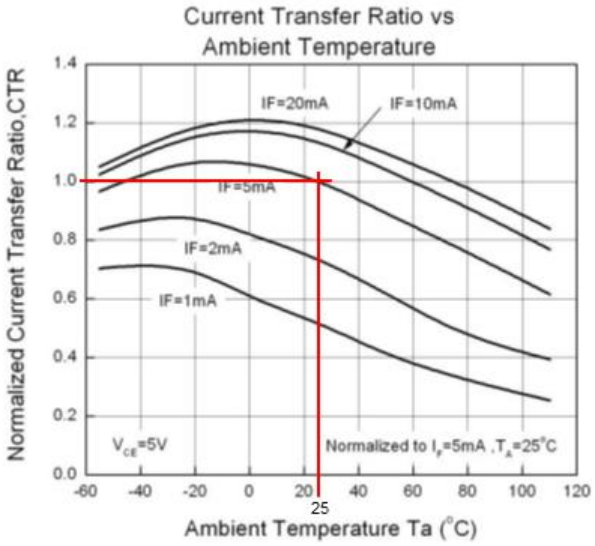

Fig.4

4. Calculate CTR range

In figure 5 chart, every model has correspond CTR range. When I_F differ from condition I_F (5mA), then CTR range needs to be recalculated.

Transfer Characteristics

Parameter		Symbol	Min	Typ.	Max.	Unit	Condition
Current Transfer ratio	EL817	CTR	50	-	600	%	I_F = 5mA ,V_{CE} = 5V
	EL817A		80	-	160		
	EL817B		130	-	260		
	EL817C		200	-	400		
	EL817D		300	-	600		
	EL817X		100	-	200		
	EL817Y		150	-	300		

Fig.5

As shown in figure 6, X value is T_a and Y value is CTR normalization value. This also include when I_F equal to 1mA, 2mA, 5mA, 10mA and 20mA curve change.

Red line indicates T_a = 25℃, I_F = 5mA and CTR = 1. Green line indicates as T_a increase to 70℃, CTR = 0.8. Blue line indicates T_a increase to 80℃, I_F = 2mA and CTR = 0.48.

Use EL817C as an example from figure 5, this model CTR range from 200~400%

Red line (T_a =25℃) :

I_F =5mA, CTR=200~400%

I_C =5mA*(200~400%) = 10mA~20mA

Green line (T_a =70℃) :

I_F =5mA, CTR=(200~400%)*0.8=160%~320%

I_C =5mA*(160~320%) = 8mA~16mA

Blue line (T_a =80℃) :

I_F =2mA, CTR=(200~400%)*0.48=96%~192%

I_C =2mA*(96~192%) = 1.92mA~3.84mA

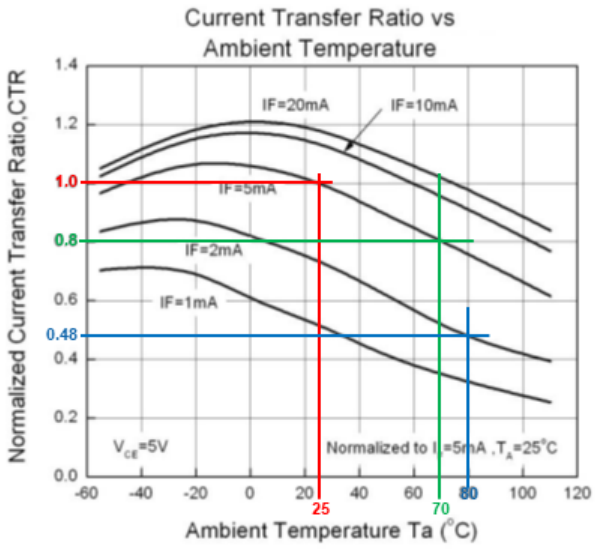

Fig.6

This I_C results can be used for reference circuit design, for more usage information, please go to Everlight website to download **General Purpose Photo Coupler application in Data Transmission** application note.

The information in this application manual is only for customers' design reference. Please verify when actually use it. If have any other questions, please contact Everlight for further technical support.