

自製 Bipolar 電磁鐵系統

一、目的

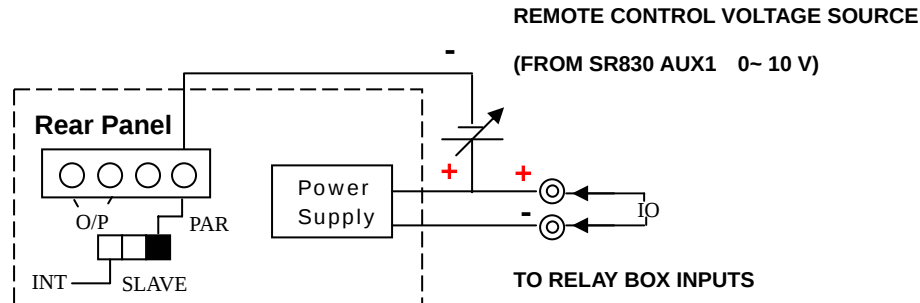
利用自行繞製的電磁鐵線圈，接線反轉電路及 GPIB 介面，設計低磁場（0 - 300 gauss）磁光實驗所需求的双極性電磁鐵系統。

二、方法

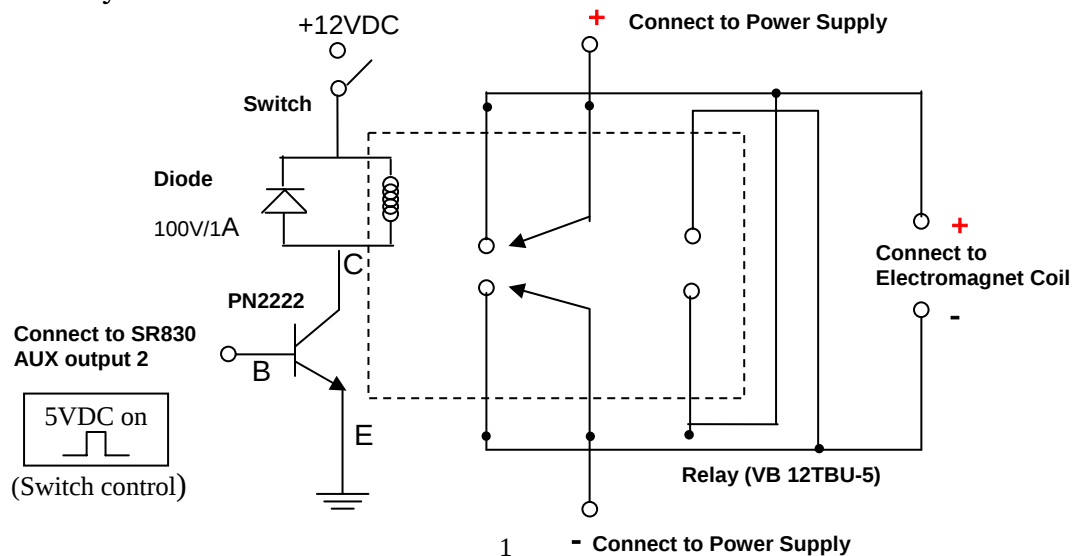
利用鎖相放大器 SR830 的 D/A 輸出功能，我們可以透過 GPIB 介面控制電磁鐵線圈與電源供應器的接線方式，並進行遠端控制設定電源供應器輸出的電流大小。

三、系統設計圖

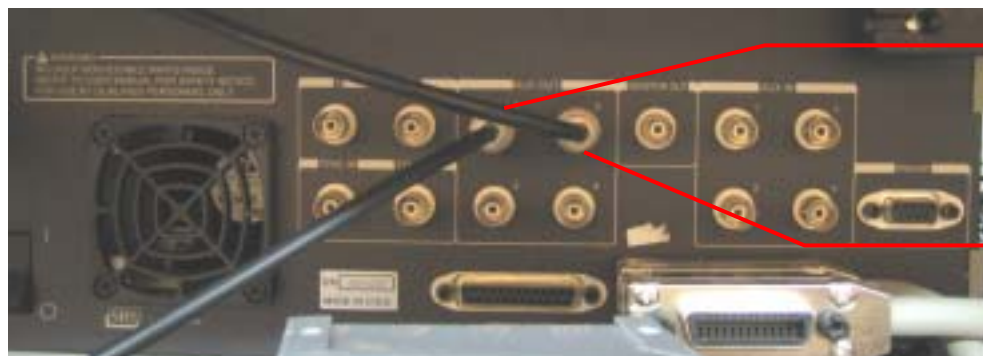
I. Power Supply: GPS-3030DD



II. Relay Box



四、系統接線圖示



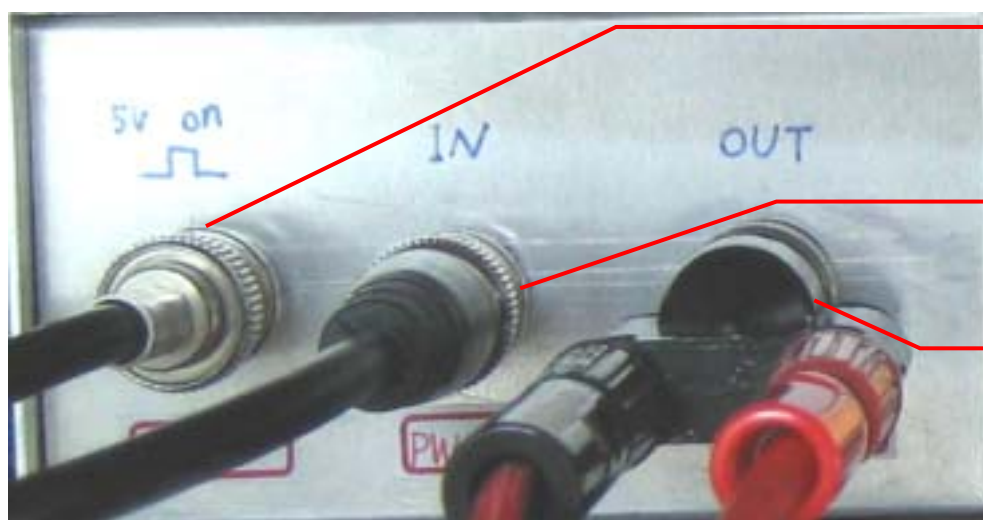
SR 830

AUX 1

Connect to Relay **5V on**

AUX 2

Connect to Relay **box IN**



Relay box

5 V on

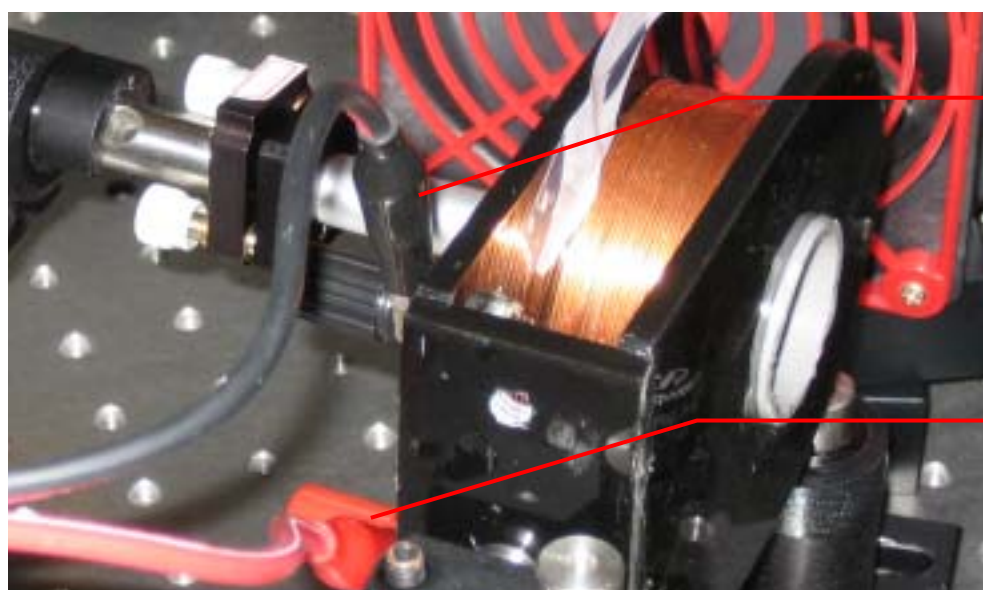
Connect to SR830 **AUX 2**

IN

Connect to **Power Supply**

OUT

Connect to **Electromagnet Coil**



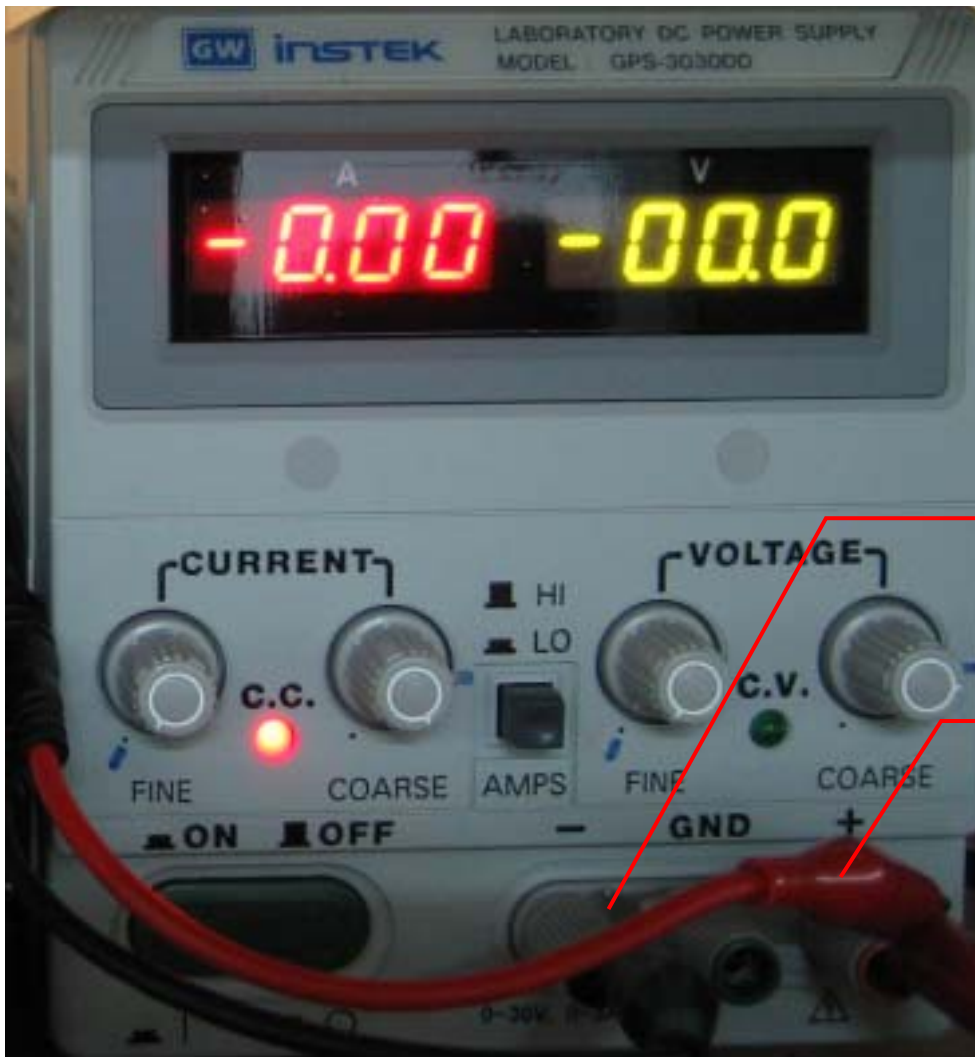
Electromagnet Coil

Electromagnet Coil -

Connect to relay box **OUT(-)**

Electromagnet Coil +

Connect to relay box **OUT(+)**



Power Supply -
Connect to relay box IN(+)

Power Supply +
Connect to relay box IN(+)
& SR830 AUX 2 (core)

Power Supply GPS-3030DD



0-10V input
Connect to
SR830 AUX 1 (ground)

GPS-3030DD Rear Panel

五、電磁鐵操作程式簡易使用說明

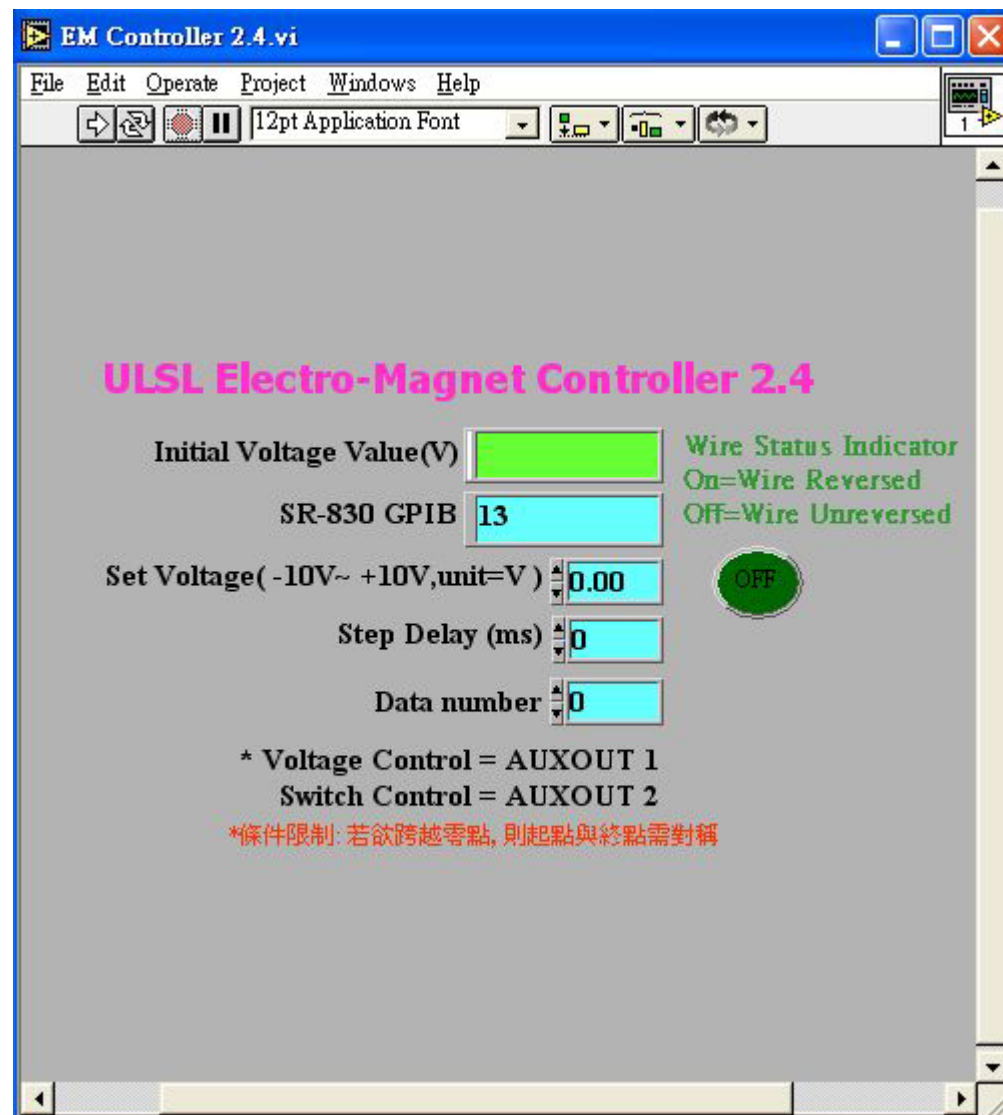
1. 使用平台：NI Labview 5.1。

2. 程式檔名：EM Controller 2.4.vi

SR-830 AuxOut scan for EM 2.1.vi

DTM-133 & SR-830 AuxOut scan for EM 2.0.vi

< EM Controller 2.4.vi>



輸入說明：淺藍色空格處為必須輸入，分項說明如下：

SR-830 GPIB：輸入鎖相放大器(SR-830)之位址值。

Set Voltage (-10V~ +10V, unit=V)：輸入欲設定之電壓值。

Step Delay (ms)：輸入間隔單位步長。

Data number：輸入間隔數。

顯示說明：淺綠色處為程式顯示格，分項說明如下：

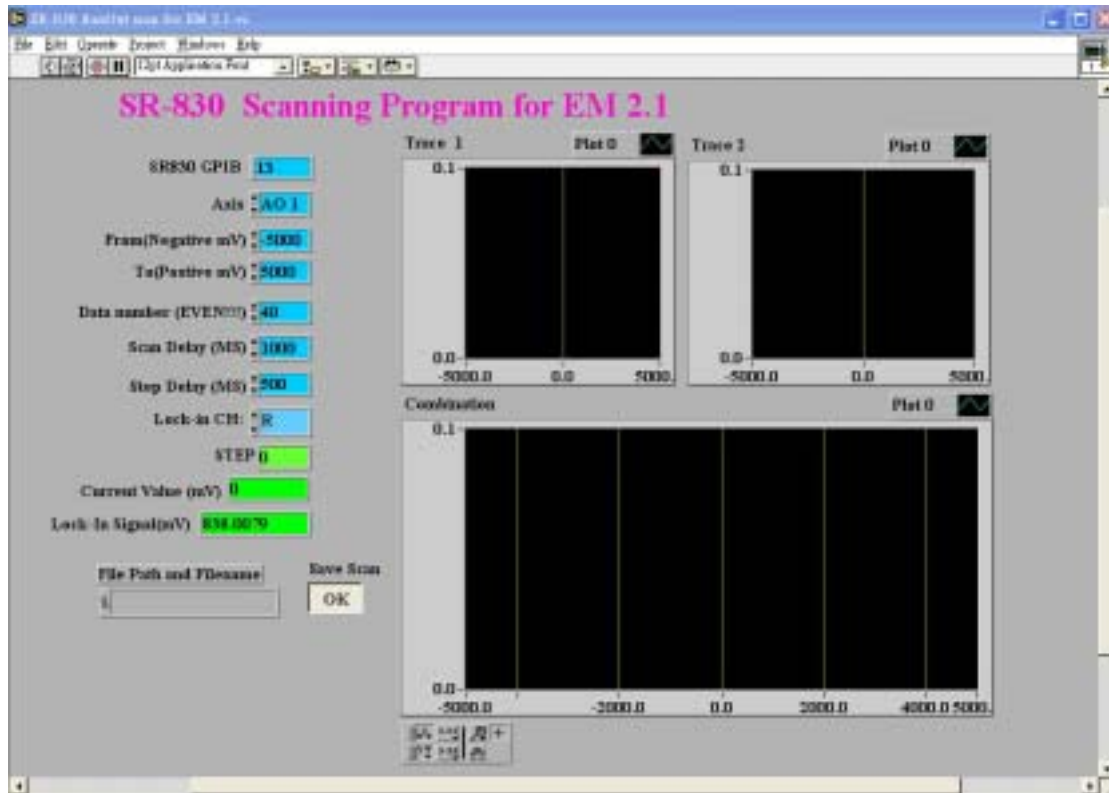
Initial Voltage Value(V)：初始電壓值，程式結束時將自動

更新為目前之設定電壓值。

Wire Status Indicator：顯示目前電流是否為反向。

條件限制：唯一的限制在於若欲輸入正負號相反的值時，只能輸入大小相同，但符號相反的值，否則程式無法正常工作。

< SR-830 AuxOut scan for EM 2.1.vi >



輸入說明：淺藍色空格處為必須輸入，分項說明如下：

SR-830 GPIB：輸入鎖相放大器(SR-830)之位址值。

Axis：選擇鎖相放大器(SR-830)用來控制電壓值的外部輸出頻道。

From(Negative mV)：輸入起始值。

To(Negative mV)：輸入終點值。

Data number(EVEN!!!)：輸入資料點數(偶數)。

Scan Delay(MS)：輸入掃描前等待時間

Step Delay(MS)：輸入掃描時間隔時間。

Lock-in CH：選擇鎖相放大器(SR-830)接收頻道。

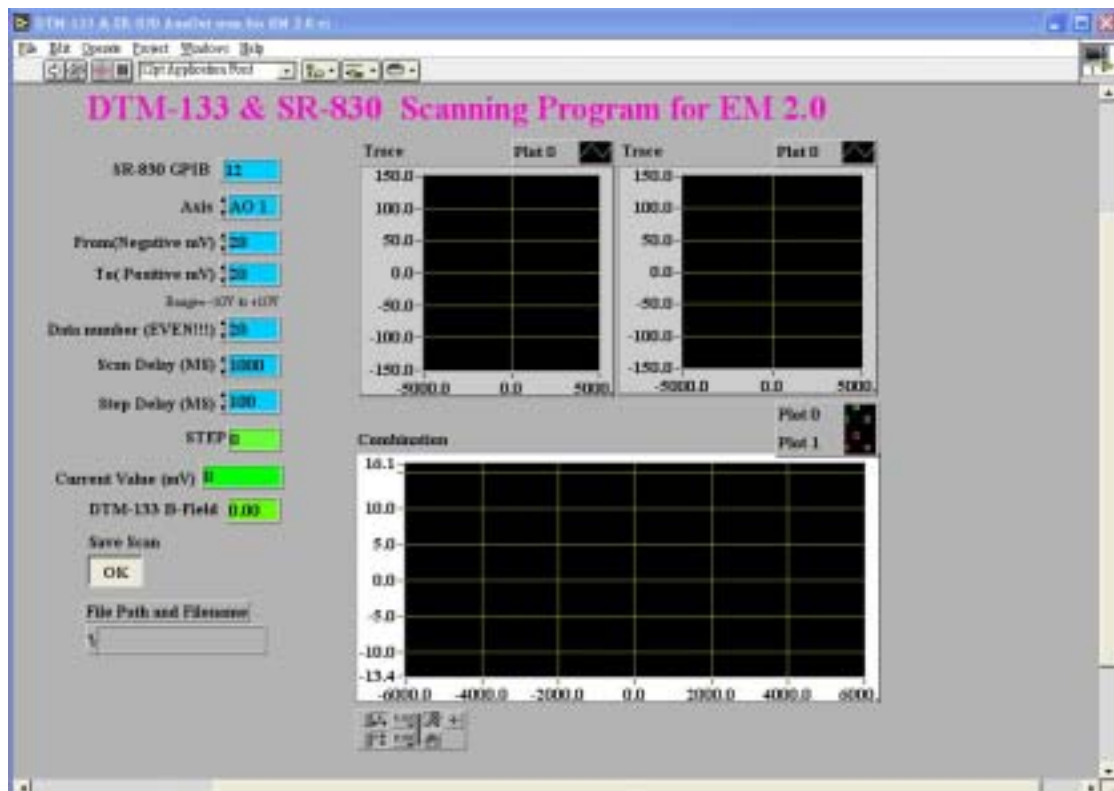
顯示說明：淺綠色處為程式顯示格，分項說明如下：

Step：目前步數。

Current Value(mV)：目前設定之電壓值。

Lock-in Signal(mV)：接收訊號值。

< DTM-133 & SR-830 AuxOut scan for EM 2.0.vi>



輸入說明：淺藍色空格處為必須輸入，分項說明如下：

SR-830 GPIB：輸入鎖相放大器(SR-830)之位址值。

Axis：選擇鎖相放大器(SR-830)用來控制電壓值的外部輸出頻道。

From(Negative mV)：輸入起始值。

To(Negative mV)：輸入終點值。

Data number(EVEN!!!)：輸入資料點數(偶數)。

Scan Delay(MS)：輸入掃描前等待時間

Step Delay(MS)：輸入掃描時間隔時間

顯示說明：淺綠色處為程式顯示格，分項說明如下：

Step：目前步數。

Current Value(mV)：目前設定之電壓值。

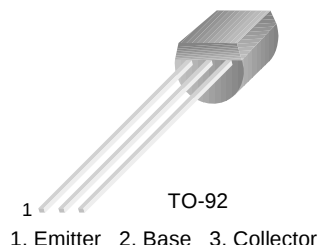
DTM-133 B-Field：接收 DTM-133 訊號值。

六、附件規格

1. PN2222
2. Relay (VB 12TBU-5)

PN2222

General Purpose Transistor



NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings $T_a=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	60	V
V_{CEO}	Collector-Emitter Voltage	30	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	600	mA
P_C	Collector Power Dissipation	625	mW
T_J	Junction Temperature	150	$^\circ\text{C}$
T_{STG}	Storage Temperature	-55 ~ 150	$^\circ\text{C}$

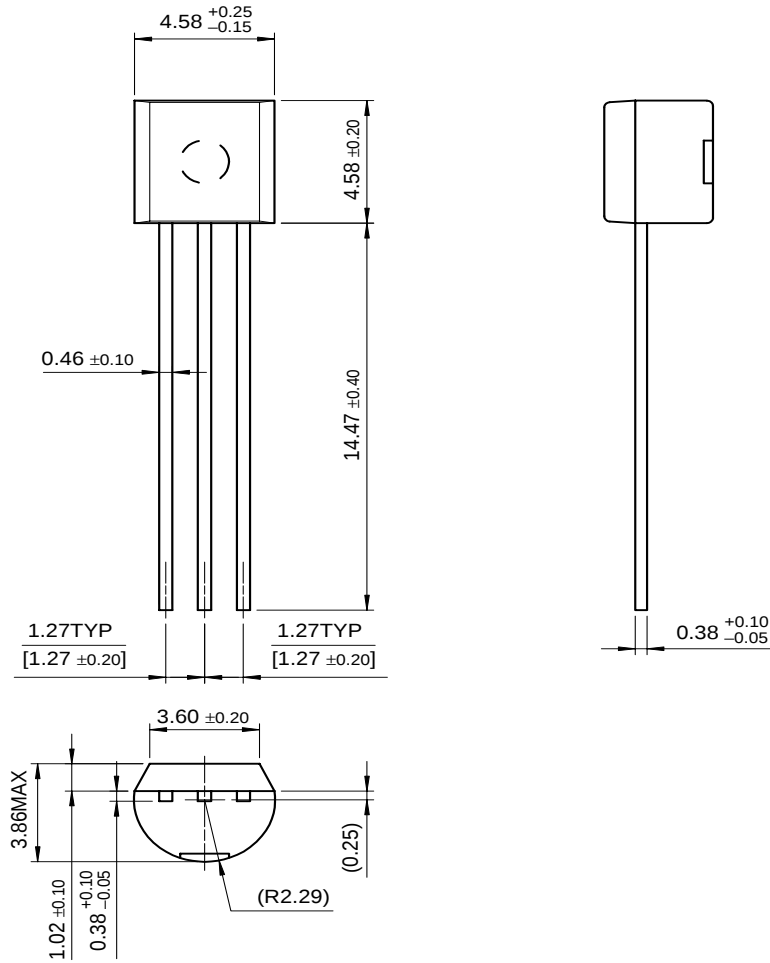
Electrical Characteristics $T_a=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	$I_C=10\mu\text{A}$, $I_E=0$	60		V
BV_{CEO}	Collector Emitter Breakdown Voltage	$I_C=10\text{mA}$, $I_B=0$	30		V
BV_{EBO}	Emitter-Base Breakdown Voltage	$I_E=10\mu\text{A}$, $I_C=0$	5		V
I_{CBO}	Collector Cut-off Current	$V_{CB}=50\text{V}$, $I_E=0$		0.01	μA
I_{EBO}	Emitter Cut-off Current	$V_{EB}=3\text{V}$, $I_C=0$		10	nA
h_{FE}	DC Current Gain	$V_{CE}=10\text{V}$, $I_C=0.1\text{mA}$ $V_{CE}=10\text{V}$, $I_C=150\text{mA}$	35 100	300	
$V_{CE}(\text{sat})$	* Collector-Emitter Saturation Voltage	$I_C=500\text{mA}$, $I_B=50\text{mA}$		1	V
$V_{BE}(\text{sat})$	* Base-Emitter Saturation Voltage	$I_C=500\text{mA}$, $I_B=50\text{mA}$		2	V
f_T	Current Gain Bandwidth Product	$V_{CE}=20\text{V}$, $I_C=20\text{mA}$, $f=100\text{MHz}$	300		MHz
C_{ob}	Output Capacitance	$V_{CB}=10\text{V}$, $I_E=0$, $f=1\text{MHz}$		8	pF

* Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$

Package Dimensions

TO-92



Dimensions in Millimeters

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CoolFET™	FRFET™	MicroFET™	PowerTrench [®]	SuperSOT™-6
CROSSVOLT™	GlobalOptoisolator™	MicroPak™	QFET [®]	SuperSOT™-8
DOME™	GTO™	MICROWIRE™	QS™	SyncFET™
EcoSPARK™	HiSeC™	MSX™	QT Optoelectronics™	TinyLogic [®]
E ² CMOS™	I ² C™	MSXPro™	Quiet Series™	TINYOPTO™
EnSigna™	i-Lo™	OCX™	RapidConfigure™	TruTranslation™
FACT™	ImpliedDisconnect™	OCXPro™	RapidConnect™	UHC™
FACT Quiet Series™		OPTOLOGIC [®]	μSerDes™	UltraFET [®]
Across the board. Around the world.™		OPTOPLANAR™	SILENT SWITCHER [®]	VCX™
The Power Franchise [®]		PACMAN™	SMART START™	
Programmable Active Droop™		POP™	SPM™	

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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體機小,適用與密集安裝。 耐壓可達 5000 伏。

接觸電阻 (6 V DC 1A)		100m Ω Max.
觸點材料		銀合金
UL/C-UL 負載 阻性負載 ($\cos\phi=1$) 感性負載 ($\cos\phi=0.75-0.80$)		5A 250VAC 5A 24VDC 24VDC 2A 120/240VAC
TUV 負載 阻性負載 ($\cos\phi=1$)		5A 240VAC 5A 30VDC
CQC 負載		5A/40A 250VAC
最大切換功率		600VA 150W
最大切換電壓		240VAC 110VDC
最大切換電流		5A
壽命 機械壽命 (120 次/分) 電氣壽命 (20 次/分)		1x10 ⁷ 1x10 ⁵
線圈		
額定功耗		540mW, 720mW
性能		
	SMI-D	SMI-L
吸合時間	15 msec.Max.	20 msec.Max.
釋放時間	8 msec.Max.	
絕緣阻抗	1,000 M Ω Min.(at 500 VDC)	
耐壓 觸點間 觸點與線圈間	1,000 VAC(50/60Hz) for 1 min. 5,000 VAC(50/60Hz) for 1 min.	
線圈與觸點間耐衝擊電壓	10,000V	
最大溫升 (在額定電壓下)	45°C	35°C
環境溫度		-30to+ 70°C
衝擊	耐久	10 GMin.
	誤動作	100 GMin.
振動	耐久	10 to 55 Hz at 複振幅 of 1.5mm
	誤動作	10 to 55 Hz at 複振幅 of 1.5mm
重量		約 13 克

用途： 家用電器，空調，微波爐，音響，顯示器，工業控制，儀器儀錶等