The Hellgate Static
July 2023

Hellgate Amateur Radio Club
P.O. Box 3811, Missoula, MT 59806-3811
Web: www.w7px.org

Inside this issue:

Coming Events

Jul	07	Fox Hunt 7:00 PM
Jul	04	Indpendence Day Special event station at Fort
Jul	10	Testing, Meeting
Jul	15-16	Glacier Waterton Hamfest

Officers:

President: NZ7S
Vice-President: K7MTD
Treasurer: W7XT
Secretary: K7MSO

Standing Committees:

Emergency Coordinator: trustee@w7px.org
QSLs, Awards: trustee@w7px.org
Webmaster: webmaster@w7px.org
Asst Webmaster: editor@w7px.org
Radio License Exams Contact VE:
harc.ve.testing@gmail.com
Static Editor: editor@w7px.org

Repeater Committee:

K7MTD (Chair)
K0SN Dec 2021 for (22/23)
K7QA Dec 2022 for (23/24)
N7PAS Dec 2022 for (23 - 1Yr)
KG7WYQ Dec 2022 for (23/24)

TAC – Board + K0SN and N7PAS
C&BL – Board + N7PAS and W7RPG

HF Committee hfc@w7px.org
President: NZ7S
Members: K0SN, K7QA, W7XT.

HARC July Meeting

Program: ???

We are having in-person monthly meetings and live in person online testing. The testing and meeting are on the 2nd Monday of each Month

Meetings will be held at The Church of Jesus Christ of Latter Day Saints, 3026 South Avenue West, across the street from Big Sky High School. Use the North entrance as all others will be locked.

Testing will begin promptly at 5:30PM, and end at 6:30PM.

Meeting area will be set up between 6:30-7:00PM and meeting will begin at 7:00PM (Program & Business).

Published: 30 Jun 2023 @5:30 AM by N7PAS

12 Jun 2023 Exam Testing Results

Congratulations to:

1. Dennis Davis N5JIL of Frenchtown upgraded to General.
2. Aaron Nelson N7BIO of Missoula successfully passed his Amateur Extra

12 Jun 2023 HARC Meeting Minutes

1. **Attendance**:

	Paul Shuey N7PAS	Eric Sedgwick NZ7S	Dennis Davis N5JIL
Adam Davis – Visitor,	David Herzberg K7MTD	Jerri Ehli N7GE	Aaron Nelson N7BIO
Tom McGinley K7QA	Niles Leuthold KK7JYA	Dale Baldwin W7RPG	Bill Reese KJ7PCR

2. **Approve last meeting minutes**
   NONE
3. **Treasurer's report**
   NONE
4. **Repeater Committee**
   NONE
5. **HF Committee Report**
   NONE
6. **Discussion List**

BUSINESS MEETING WAS CANCELED

a. Field Day June 24 - 25, Will be held at Fort Missoula, Museum field, Old Chapel,
Bill Reese KJ7PCR will Coordinate, see schedgual.

7. **Net Control Operators**

05 Jul	N7PAS	Aug	02	N7PAS
12 Jul	W7RPG	Aug	09	__________
19 Jul	NZ7S	Aug	16	__________
26 Jul	N7GE	Aug	23	__________
xx		Aug	30	__________

Minutes by N7PAS

Program: Dave K7MTD was MC for a SOTA/POTA show & tell demonstration.
Dale W7RPG set up an operational operational station in the parking lot and made a contact.
Dave K7MTD and Aaron N7BIO showed their different style antennas.
We moved inside and
Dave K7MTD and Aaron N7BIO showed their different types of equipment and
Bill KJ7PCR showed his go bag backpack and the equipment he carries.

Note Please Send Information for Static to editor@w7px.org
in LibreOffice or Microsoft Office formats only. Thank You

HARC INVENTORY -- FOR SALE

Line	ITEM	MAKE	MODEL	CONDITION	VALUE	STORED	REMARKS
1	Computer	Dell	Latitude	Fair	100	N7GE	
2	Pow Supply 220-225mhz	Mirage	C106G	Good	25	N7GE	
3	Radio-Hand Held 2 met.	Realistic	HTX 202	Good	50	N7GE	
4	Radio--2 meter	Yaesu	FT-2500M	Fair	$100	N7GE	
5	Portable Repeater		TM-241X2	?		N7GE	
6	Triband Beam	Hy-Gain		Few Missing parts	200	K0SN	
7	Tuner	Signal Corps	BC939B	Parts only	25	K0SN	parts only, no cabinet
8	Speaker + Power Supply	Drake	MS-4 + AC4	Not tested	75	K7QA	needs upgrade
9	Reflected Pwr Mtr	Heathkit	HM-15	Works		K7QA	
10	Mobile Tuning Mtr	Heathkit	PM-2	Untested		K7QA	
11	Trap Vertical	Hygain	14AVQ	Clean, untested	150	K7QA	
12	Transceiver-2 mtr	Kenwood	TR-7400A	Works	70	K7QA	
13	2 Mtr HH Transceiver	Realistic	HTX-202	Error Code	25	K7QA	
14	Speaker w/volume control	Yaesu		Untested	50	K7QA	
15	1993 ARRL Handbook			like new	free	K7QA	
16	Handbooks	ARRL	1950-1980	OK	Free	KGVO	
17	Vintage Mic	Astatic	JT-30	worn, untested	50	KGVO	Ebay sales $50-300
18	13.8V, 12A power supply	Astron	RS12A	works	30	KGVO	
19	C&R checker	CDE		untested	30	KGVO	
21	Rotor	CDE?		untested	50	KGVO	w/ control head
22	Transceiver	Collins	RT-91ARC-2	untested	100	KGVO	Aircraft Military
23	Transverter Interface	Down E. Micro		untested	offer	KGVO	
24	Low pass Filter	Drake	TV-3300	untested	20	KGVO	
25	Receiver	Hallicrafters	SX-100	fair	150	KGVO	
26	Receiver	Hallicrafters	SX28	very good	900	K0SN	
27	Receiver	Hallicrafters	SX-62B	untested, rough	75	KGVO	no cabinet top
28	Vintage Speaker	Hallicrafters	PM 23	Nice, untested	150	KGVO	
29	Vintage Speaker	Hammarlund	S-100	Nice, untested	60	KGVO	
30	AC Power Supply	Heath Kit	HP-23-A	works		KGVO	for the HW-101
31	SSB Transceiver	Heath Kit	HW-101	needs repair		KGVO	Ebay $90-300
32	HF Xcvr + Power Supply	Heathkit		untested	150	KGVO	
33	Oscilloscope	Heathkit	IO-4105	untested	30	KGVO	
34	Power/SWR Meter	Heathkit	HM15	untested		KGVO	
35	Vertical antenna		Dipole 80	?		NOAA	
36	Receiver	Heathkit	HR-10	untested, rough	offer	KGVO	Ebay sales $100-300
37	SSB Adapter	Heathkit		untested	40	KGVO	
38	Transceiver	Heathkit	SB102	good	250	KGVO	W/ matching spkr. & p.s.
39	Test Oscillator	HP	650A	untested	offer	KGVO	
40	Rotor Control	Hygain	DCU-1	untested	200	KGVO	
41	VHF Mobile Transceiver	Icom	IC-25A	fair, untested	30	KGVO	
42	Transceiver	Kenwood	TS-450S	Excellent	400	KGVO	
43	2M FM Transceiver	Kenwood	TR7400A	no output	10	KGVO	
44	HF Transceiver +Man	Kenwood	TS-520	non-working	100	KGVO	
45	Transceiver	Kenwood	TS-940	Needs Repair	250	KGVO	No output on CW, others
46	Transmitter	Meissner	9-1160 (tube)	good		KGVO	was in use
47	Voice Keyer	MFJ	MFJ-432	untested	30	KGVO	
48	Fwd/Refl. pwr meter	Midland	23-126	untested	10	KGVO	
49	2 mtr, 30 Watt amp	Mirage	B23	untested	25	KGVO	
50	20-40M QRP Transceiver	Oak Hills	QRP Classic	untested	30	KGVO	
51	13.8V, 10A P.S.	Pyramid	PS15-KX	Nice, untested	30	KGVO	
52	2 mtr mobile Xcvr	Radio Shack	HTX-242	untested	40	KGVO	
53	25A switching P.S.	Radio Shack		untested	40	KGVO	
54	Field str/SWR meter	Radio Shack		untested	10	KGVO	
55	VHF/UHF/FM amp	Radio Shack		untested	20	KGVO	

56	Gen. Coverage Rvr.	Realistic	DX302	untested	125	KGVO	Ebay sales $80-350
57	12V DC p.s.	Samlex		untested	25	KGVO	
58	Receiver	Signal Corps	R-392/URR	fair	300	KGVO	Stromberg Carlson
59	VTVM	Simpson	311	untested	25	KGVO	
60	Oscilloscope	Telequipment		untested	20	KGVO	
61	Var. power resistors	Tru-ohm, etc		untested	10	KGVO	box of ~20
62	Scanner	Uniden	BC9000	untested	50	KGVO	
63	BUG KEY	unknown		fair		KGVO	
64	12V DC Backup Power	West Mtn	PG40S	good, untested	25	KGVO	
65	Radio-Sound card interface	West Mtn	Riblaster Plus			KGVO	
66	HF Transceiver	Yaesu	FT-840	fair, works	300	KGVO	
67	Speaker	Yaesu	SP-8	Good, untested	125	KGVO	
68	VHF FM Transceiver	Yaesu	FT720RU	untested	25	KGVO	
69	VHF Transceiver	Yaesu	1500M	untested	75	KGVO	
70	Many electronic parts for amps, tuners, other projects, too numerous to list.				offer	KGVO	some free, door prizes
71	Misc. panel mount meters			untested,	40	KGVO	2 boxes full
72	Patch cords w/ RCA male			good	10	KGVO	box of ~20
73	Peter Dahl 10 HY @ 1 A		new	new		KGVO	
74	Peter Dahl 40 HY @ .6 A		new	new		KGVO	
75	Peter Dahl 9 HY @ 1.5A		NEW	NEW	200	KGVO	66 pounds - pick up only
76	Peter Dahl Swgng Choke		new	new		KGVO	
77	Antenna Tuner	Icom	AH-4			NZ7S	
78	Voice Synthesizer	Icom	UT-102			NZ7S	
79	Transceivers, qty.2	Kenwood	220-225 mhz.	?		NZ7S	
80	Antenna Tuner + man	MFJ	MFJ-934			NZ7S	
81	RTTY CW	MFJ		?		NZ7S	
82	Wattmeter/SWR	Coax. Dynam.	81021	com	200	KGVO	

Contact K0SN or W7XT for further information

Contact HFC@w7px.org for further information (note this is not yet set up)

Electronics 101.5: Transistors

Switching and amplifying: the heart of modern electronics

Dave Astels

daveastels.com

Dave's career started in the 8-bit days, with the Z80 and 6502, and he's been working with computers ever since. Check him out at **daveastels.com** and **learn.adafruit.com**

Now things get exciting. We've looked at the basic passive components, and the simplest semiconductor: the diode. In this instalment, we delve into the workings and uses of the component that shook the very foundations of modern electronics, and made possible the digital devices we rely on: the transistor.

THE MOST SIGNIFICANT INVENTION IN RECENT HISTORY

Before transistors, vacuum tubes were used for signal amplification and switching. Look inside an old television or radio and you'll see the tubes gently glowing. Each one is the average size of an adult thumb (give or take a bit). The early digital computers were built from tubes. ENIAC (1946) had over 17000 tubes, consumed 150kW of power, and had a tube fail every two days, on average. That's enough electricity to run about 15000 Raspberry Pi 3B+s, with some left over. A bit of research shows that one of those Pi3B+s is around 250000 times as powerful as the ENIAC (in terms of operations per second). It's also far less expensive: ENIAC cost over $6 million in today's money.

Vacuum tubes were big, slow, power-hungry, and failure-prone. There had to be a better way.

In 1947, three researchers at Bell Labs (John Bardeen, William Shockley, and Walter Brattain) invented what they called the transistor (because it exhibited 'transresistance'. From that beginning, transistors went on to become the pivotal component that pretty much all of our current electronic devices are based on. Any modern computer is loaded with transistors.

There are two primary types of transistors: bipolar junction, and field effect. We'll focus initially on bipolar junction transistors (BJT for short). BJTs come in two flavours: NPN and PNP. In the last issue we looked at the diode. We talked about N-type silicon and P-type silicon, and how the junction between a piece of each was the key to the diode's operation. A transistor is very similar. The big structural difference is that instead of two pieces of silicon it has three, arranged like a sandwich. An NPN transistor has two layers of N-type silicon, one on either side of a piece of P-type. A PNP transistor has two pieces of P-type, sandwiching a piece of N-type.

As mentioned, a transistor has three connections. BJT schematic symbols are shown in **Figure 1**. A BJT has a collector, base, and emitter. The base is used to control the current flowing between the emitter and collector.

Right Transistors come in a range of sizes

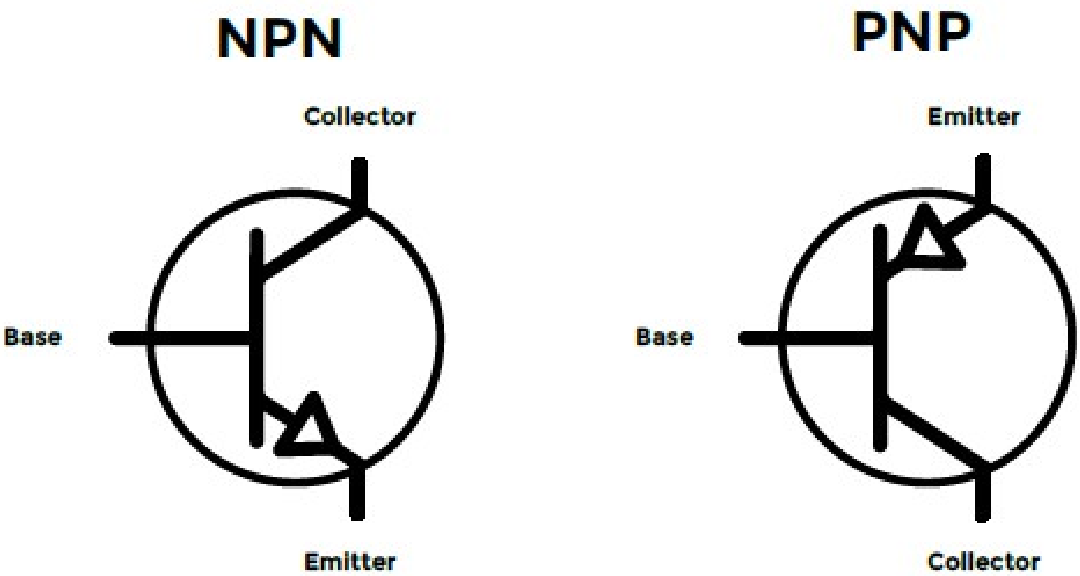


Figure 1 Transistor symbols: NPN and PNP

Let's look at the NPN (the PNP works the same way except that the polarities and silicon types are reversed). **Figure 2** gives an idea of how the layers look. Thinking back to the diode, it should be clear that this looks a lot like two diodes back to back. Close, but not quite.

The base-emitter junction does work a lot like a diode. When it's reverse biased, a depletion zone forms, and no current flows and basically nothing is happening (**Figure 3a**, overleaf), just like a diode. When the junction becomes forward biased, the depletion zone collapses and electrons flow from the emitter, across the junction, to the base (**Figure 3b**). Some of them leave through the base connection. But here's the magic: the base layer is so thin, and the electrons are moving with enough energy, that most of them slam through the base layer and go into the collector layer. The result is that the current flowing from emitter to collector is many times greater than the current flowing from the emitter to the base. Furthermore, as the base-emitter current changes, a corresponding magnified change is made to the collector-emitter current. The effect is that the base-emitter signal is amplified in the collector-emitter current. This amplification factor is typically greater than 100.

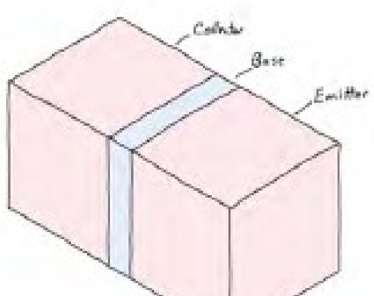


Figure 2 The physical construction of a BJT

SATURATION POINT

In addition to the signal amplification capabilities, another useful feature of a transistor is its ability to act like an on-off switch. When the B-E junction is reverse biased and the depletion zone is in place, the transistor is in cut-off and acts like an open switch:

> "**This is very, very important:** all our digital circuitry is built on top of this cut-off/saturation behaviour"

no current flows from emitter to collector. The other extreme is when maximum collector-emitter current is flowing; the transistor is said to be in saturation, and acts like a closed switch. This is very, very important: all our digital circuitry is built on top of this cut-off/saturation behaviour. In addition, this switching behaviour can be used to switch higher voltage/current devices from small signals – like the ones from a 3.3 V microcontroller GPIO pin.

As an example, let's use an 2N3904 NPN transistor to control an LED. A typical LED wants 20 mA flowing through it. A pretty common microcontroller is the ATSAMD21, which can provide at most 7 mA on an I/O pin. We can use →

YOU'LL NEED

- **Solderless breadboard**
- **5 V power supply** to use with the breadboard
- **2N3904 transistor** (these are often available in packs of five or ten)
- **LED**
- **Resistors: 180 or 220 Ω, 2.7 kΩm, and 12 kΩm**
- **3.3 V MCU board**
- **TIP120 Darlington driver**
- **12 V, 800 mA LED strip** (e.g. part 3865 at Adafruit: Flexible silicone neon-like LED Strip – 1 metre)
- **A 12 V power source for the LED strip** (at least 1 A)

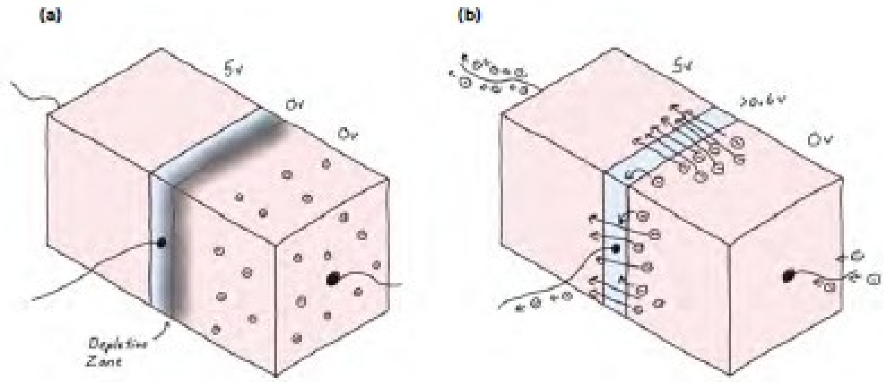


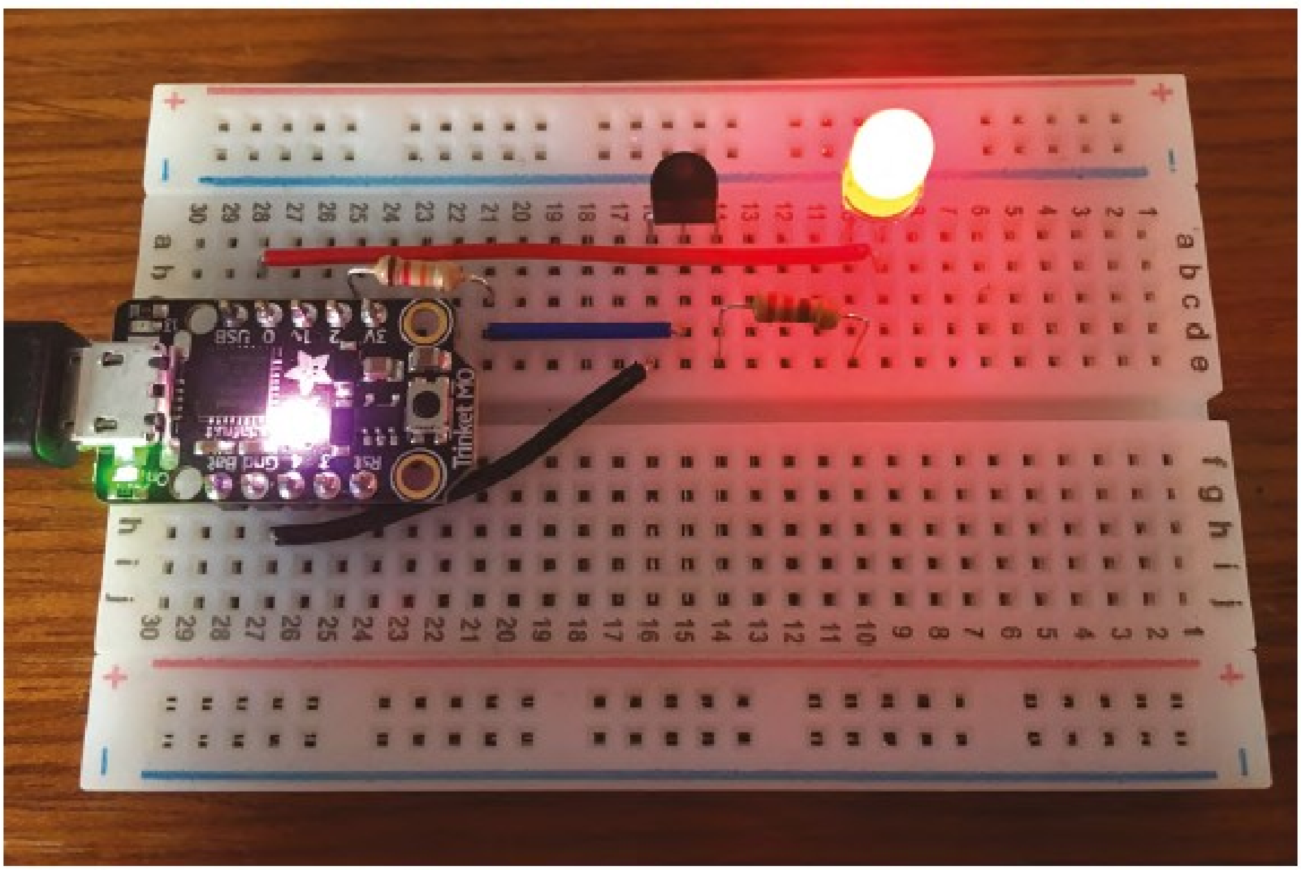
Figure 3 When the B-E junction is reverse biased (a), and when it's forward biased (b)

a transistor to control the LED and use the MCU pin to control the transistor. Assuming a typical amplification of 100 by the transistor, we need a base-emitter current of 0.2 mA. With 3.3 V on the MCU pin and 0.6V dropped across the base-emitter junction to saturate the transistor, we need a 2.7 V / 0.2 mA = 13.5 kΩ resistor between the pin and the base. Slightly less is fine. Much more and the transistor might not saturate. A common value that will do the job is 12 kΩ. Since the transistor acts as a switch, and assuming we power the LED from 5V (which, in the example circuit, we can pick up on the Trinket's USB power pin), we still need a resistor to drop the excess 4.4 V to protect the LED: 4.4 V / 20 mA = 220 Ω. This is a common value, so that's perfect. The circuit is shown in **Figure 4**.

MY DARLINGTON

We said, above, that a typical transistor will have an amplification of 100 or more. Let's say we wanted to switch 1 A of current, maybe for an LED strip. That means we'd need about 10 mA flowing through the base-emitter junction to get an amp through the collector-emitter path. Using the ATSAMD21 MCU

Figure 4 Controlling an LED with a transistor



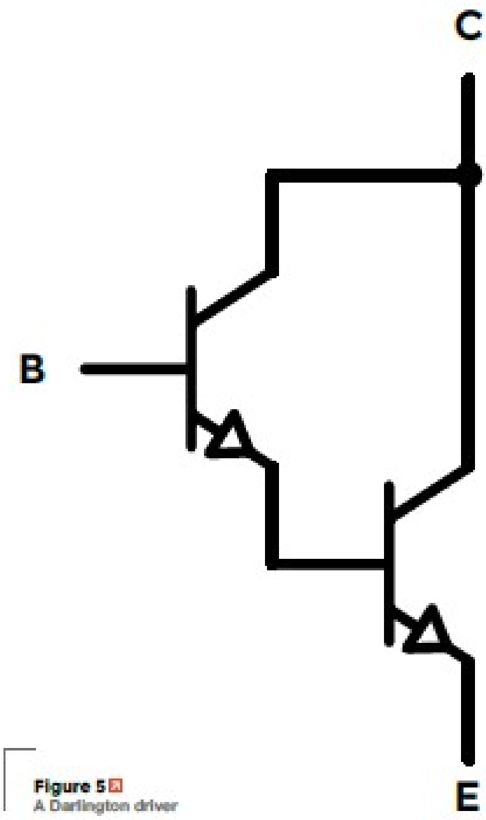


Figure 5 A Darlington driver

again will not be able to provide the needed current. It turns out that you can cascade transistors, as shown in **Figure 5**. This configuration is called Darlington, and is a pretty common approach to driving large loads from very small control signals. The advantage of this configuration is that the amplification of the individual transistors are multiplied. A typical Darlington is the TIP120, which has a current amplification of about 1000. So using it to switch 1 A means we need a 1 mA control signal. And that will work just fine.

Let's take a look at an LED strip. It needs 800 mA (0.8 A) of current to glow nice and bright. Furthermore, it needs 12 V. Clearly, you can't just connect it to a 3.3 V MCU output pin. So let's use a TIP120 Darlington. Having the separate 12 V supply for the LED strip is fine: it presents no problem to the TIP120. You just need to have all the grounds connected. Assuming an amplification factor of 1000, that means base-emitter current has to be 0.8 mA. The control voltage from the MCU will be 3.3 V and when on, 0.6 V will be dropped across the base-emitter junction. That leaves 2.7 V to drop across a resistor between the MCU pin and the TIP120 base. 2.7 V at 0.8 mA is 2.7 / 0.0008 = 3375 Ω. We can use a slightly smaller resistor that would give us slightly more than required base-emitter current, which will definitely drive the TIP120

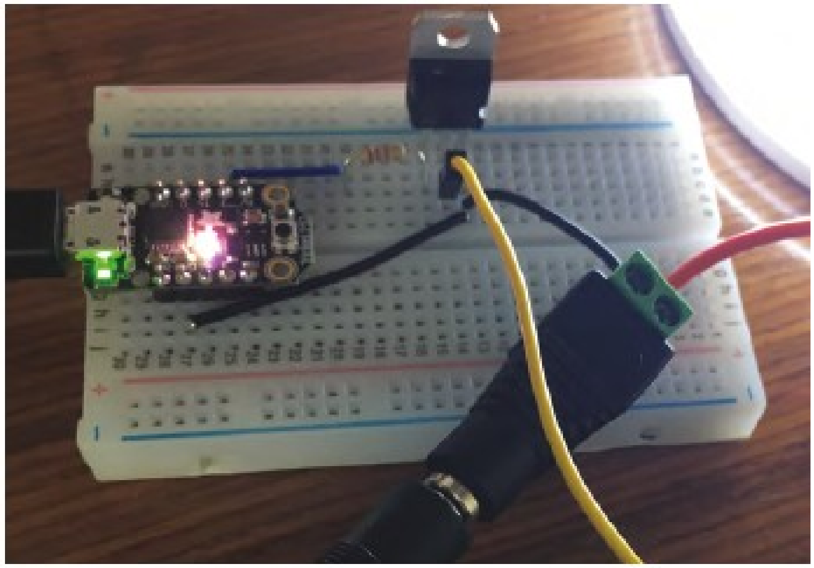


Figure 6 Switching 12 V lights with a 3 V microcontroller

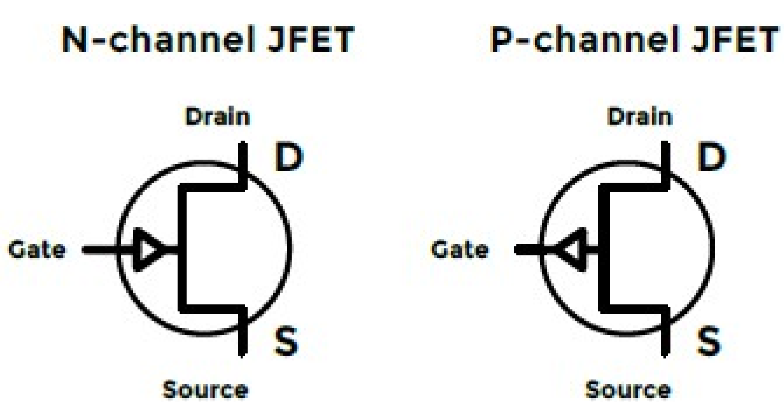
into saturation. 2.7 kΩ is a common value and will work well. **Figure 6** shows the final circuit. Note that the strip is designed to be powered directly with 12 V: no external current limiting resistor is needed for this product.

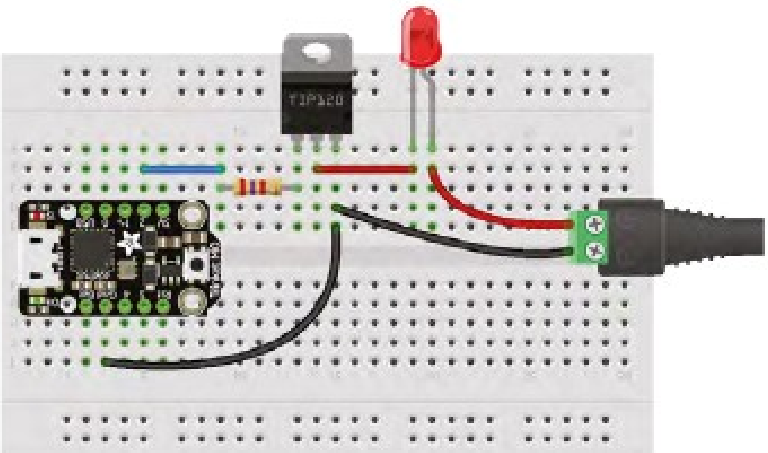
RUNNING THROUGH FIELDS

The other kind of transistor we mentioned is the FET: field-effect transistor. We'll be talking about the JFET (junction field-effect transistor) specifically. Both the construction and operation of this transistor are quite different than that of the BJT. The schematic symbol and pin names are as well. Let's go from the outside in. **Figure 7** shows the schematic symbols for the JFET. Notice that, like the BJT, there are two types: N-channel and P-channel.

Notice that not only is the symbol different, but so are the pins' names. Instead of collector and emitter, the JFET has drain and source. Electrons enter the source and exit the drain, flowing from the former to the latter inside the transistor. The gate serves as the control over that current. However, it works →

Figure 7 JFET symbols





Above The layout of our 12V LED control circuit

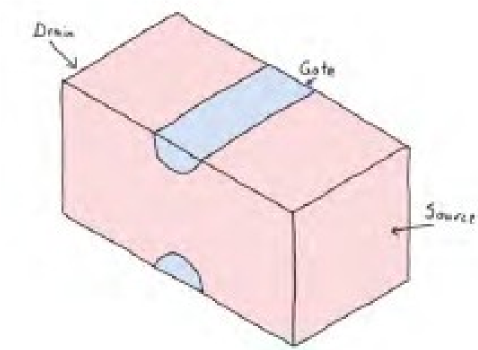


Figure 8 Physical structure of a JFET

very differently. **Figure 8** shows the internal construction of an N-channel JFET. As you can see, the source and drain are connected to opposite ends of a single piece of N-type silicon. This is the channel. The gate is connected to a piece of P-type silicon on either side of the channel.

When the gate has no voltage applied to it, the transistor is on and current flows freely between source and drain. When the gate is taken negative with respect to the source, the junction between the gate silicon and the channel is reverse biased and a depletion zone forms around each piece of the gate. This constricts the current flow in the channel. Take the gate far enough negative and the depletion zone will grow enough to completely cut off the current flow in the channel. See **Figure 9**. A P-channel JFET works the same way but in reverse: the channel is P-type silicon, the gate is N-type, and a positive gate voltage (relative to the source) will turn it off.

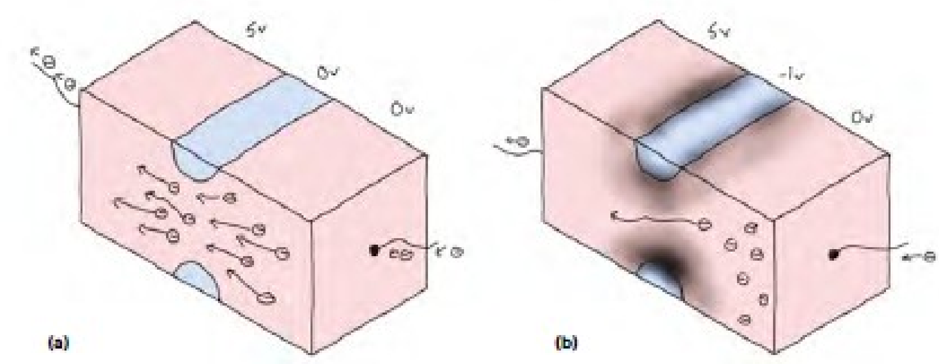
There are a couple things to take note of. With no control signal on the gate (relative to the source), the JFET is 'on'; taking the gate negative (again, relative to the source) will turn the JFET 'off'. The other thing is that the JFET is controlled by gate *voltage*, not current like the BJT. This means that the gate is extremely high impedance and has little or no impact on the controlling circuit.

FETs, and especially MOSFETs (metal oxide semiconductor field-effect transistors… that's a big name for a tiny device) in the form of CMOS (complementary metal oxide semiconductor) technology, are the most common form of transistor these days. The majority of integrated circuits are made of MOSFETs of one type or other. They are cheap and easy to make large integrated circuits out of: they are physically simpler so they take up less space, they consume very little power, and over time have become very fast. Of course, new technologies are being invented all the time, so this could change.

THYRISTORS

We've seen how transistors can be used as amplifiers and switches. Now we'll turn our attention to some similar components whose only purpose is to be electronic switches: silicon-controlled rectifiers (SCRs) and triacs. We're also going to switch away from looking at the inner workings since these are variations on the BJT. **Figure 10** shows the schematic symbol for an SCR. It does exactly what it looks like from the symbol: it's a controllable diode. When a voltage adequate to forward-bias a base-emitter junction is applied to the gate, the SCR saturates,

Figure 9 (a) no voltage on the gate; (b) negative voltage on the gate



QUICK TIP

Biasing a transistor means selecting a resistor to use at the base to control the current flowing through the base-emitter junction in order to get the desired current to flow between the collector and emitter.

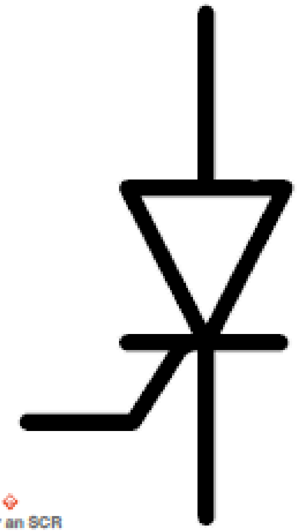


Figure 10
Symbol for an SCR

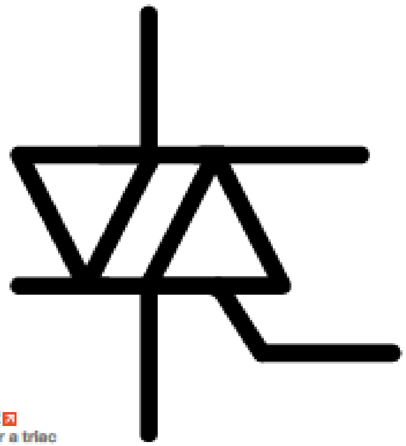


Figure 12
Symbol for a triac

switching on. The embedded diode symbol is relevant: when the SCR is on, it acts like a diode.

There are a couple of features that make an SCR especially useful. After it's turned on, it will stay on even if the forward biasing voltage is removed from the gate. That in itself is only partly useful as we would like to be able to turn it off at times. Well, it will turn itself off when the current flowing through it goes to 0. How is this useful? SCRs are often used to control AC devices, like an incandescent light bulb. If you put a pulse into the gate at some point during each positive half of the AC cycle, the SCR will turn on then. When the AC cycle goes back to 0V (hence 0A of current flowing), the SCR will turn off until it's triggered again. That's the basic idea behind a light dimmer. **Figure 11** shows the waveforms: full AC at the top, trigger, and the controlled wave at the bottom.

A problem with the SCR is that it is, at its heart, a diode. If we use it as above, we are throwing away half of the available power. The most power the load can use is half of what's available. If this is a problem, there is related component that we can turn to: the triac. A triac is like a bidirectional SCR. It will let current flow in either direction, turning on with a gate signal the same as an SCR, and turning off when current through it drops to 0 – again, like an SCR. In fact, you can think of a triac as being two SCRs in parallel, pointing in opposite directions, sharing a common gate signal. The schematic symbol is shown in **Figure 12**.

If we generate a trigger pulse during each half of the AC wave, we get waveforms as shown in **Figure 13**. Now we can vary the output power from 0 to 100% rather than 0 to 50%.

We'll be making use of SCRs and triacs later in the series.

Transistors, the heart of modern technology, are actually quite simple, as we've seen. What's not so simple is the range of circuits that we can make with them. We'll start looking at some of those in the next instalment.

That's right, now that we've covered the various concepts and components, we'll start digging into more complex applications of them and building some projects. So, get out your breadboards and stock up on some basic components.

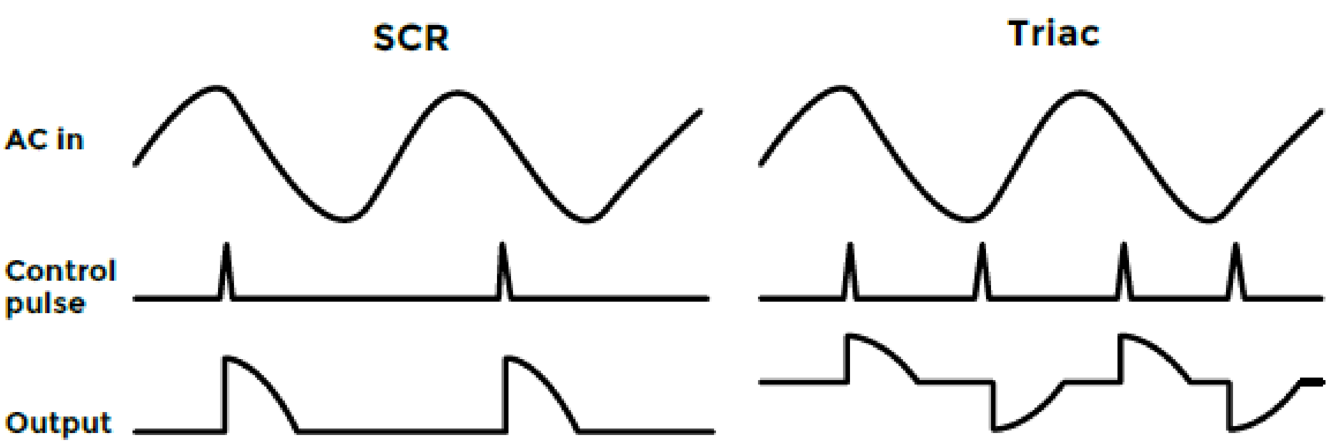


Figure 11
SCR waveforms: input AC, trigger, controlled

Figure 13
Triac waveforms: input AC, trigger, controlled

HELLGATE AMATEUR RADIO CLUB

AGENDA – 10 Jul 2023 meeting

Introductions. Please make sure you sign the attendance sheet **Quorum Y/N ____**

Last meeting minutes, May: Motion to approve May minutes: 1St ______ 2nd ______
Discussion ____ Vote: P/F/T
Last meeting minutes, Jun: Motion to approve May minutes: 1St ______ 2nd ______
Discussion ____ Vote: P/F/T

Treasurer's report: Discussion ____
____
____
Motion to approve report: 1St ________________ 2nd ________________ Vote: P/F/T

Repeater Committee Report: Discussion _____________________________________
____
Motion to approve report: 1St ________________ 2nd ________________ Vote: P/F/T

Events for 2023:

Jul	04	Independence Day Special Event - CANCELED	Aug	14	Testing 5:30p & Meeting 7:00p
Jul	10	Testing 5:30p & Meeting 7:00p			
Jul	15-16	Glacier Waterton Hamfest https://www.gwhamfest.org/			

HARC Social Net every Saturday morning @ 9:00 AM on 147.040 Repeater – Buy/Sell - During.

HARC Discussion List

1. ____
2. ____
3. ____

VHF Net Control Station assignments:

Jul	5	N7PAS	Backup	Aug	02	N7PAS
Jul	12	W7RPG	Backup	Aug	09	_______
Jul	19	NZ7S	Backup	Aug	16	_______
Jul	26	N7GE	Backup	Aug	23	_______
___	__	________	Backup	Aug	30	_______

Reminder: Backup is always the next person in line as the net control.

Good and Welfare. ____

***** Next Club meeting: Aug 14 *****

Since there are no other items of business this meeting is Adjourned.

Program: ??? Always looking for ideas/presenters -- If anyone wants to do an add-hock program, please come prepared.

July 2023

Sunday						
25	26	27	28	29	30	1
						HARC Social Net 9:00Am on 147.040 Repeater
2	3	4	5	6	7	8
		Independence Day	ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			HARC Social Net 9:00Am on 147.040 Repeater
9	10	11	12	13	14	15
	HARC Testing 5:30 & Meeting 7:00 PM		ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			HARC Social Net 9:00Am on 147.040 Repeater Glacier Waterton Hamfest www.gwhamfest.org
16	17	18	19	20	21	22
Glacier Waterton Hamfest www.gwhamfest.org			ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			HARC Social Net 9:00Am on 147.040 Repeater
23	24	25	26	27	28	29
			ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			HARC Social Net 9:00Am on 147.040 Repeater

Late Additions:

1. Forward from Lance Collister,

Subject: [Special] [FrontRange6Meter] Save The Date: 7:00 PM (Mountain Wed July 12, 2023)
Cycle 25 Update by Dr. Scott McIntosh, Deputy Director
From: Paul NO0T <sobonpaul@gmail.com>
Reply To: FrontRange6Meter@groups.io
To: FrontRange6Meter@groups.io

Hi folks - mark your calendars, tell your friends:

Wednesday July 12, 2023 at 7:00 PM Mountain Time (or Thursday July 13, 01:00 UTC).
It's time for an update on the latest activity of the sun in Cycle 25.
What's REALLY going on with the Sun? Where is it going and when is the peak? Are satellites ready to fall out of the sky?
Be on the FR6MG Zoom on Wednesday July 12th for the down to earth truth from the guy who along with his team correctly predicted the sun's activity to date. This should be a fun presentation.
As always our Zoom presentation will be posted on the Front Range 6 Meter YouTube Page.for those who can't make it.

I will provide all the Zoom links etc. as we get closer to the date.
--
73 Paul NO0T

2. Lance, Please send zoom links to **editor@w7px.org**, (See note bottom of page 2).
Thank You, editor.