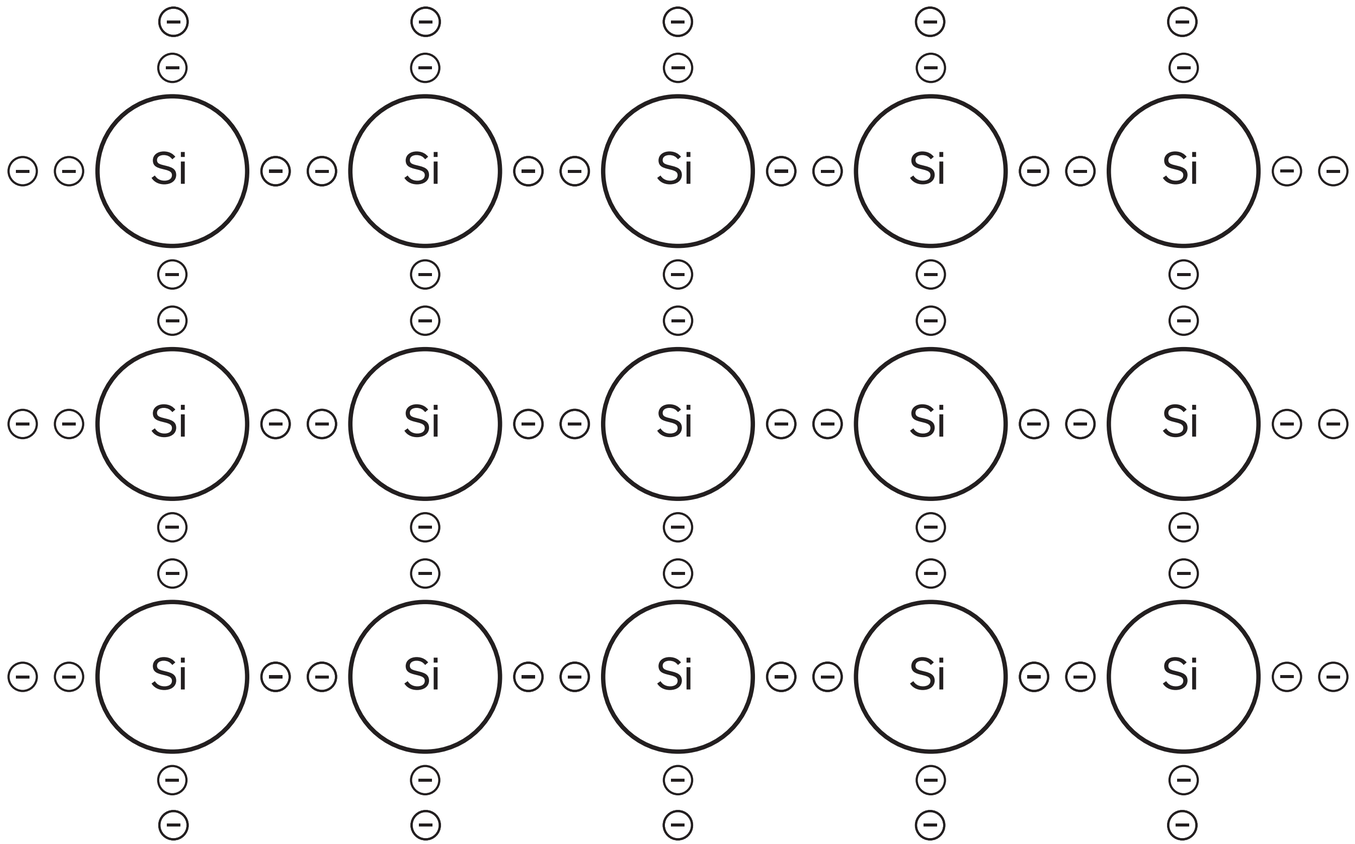
Physical Computing

WiSe 2019/20 – Grundlagen

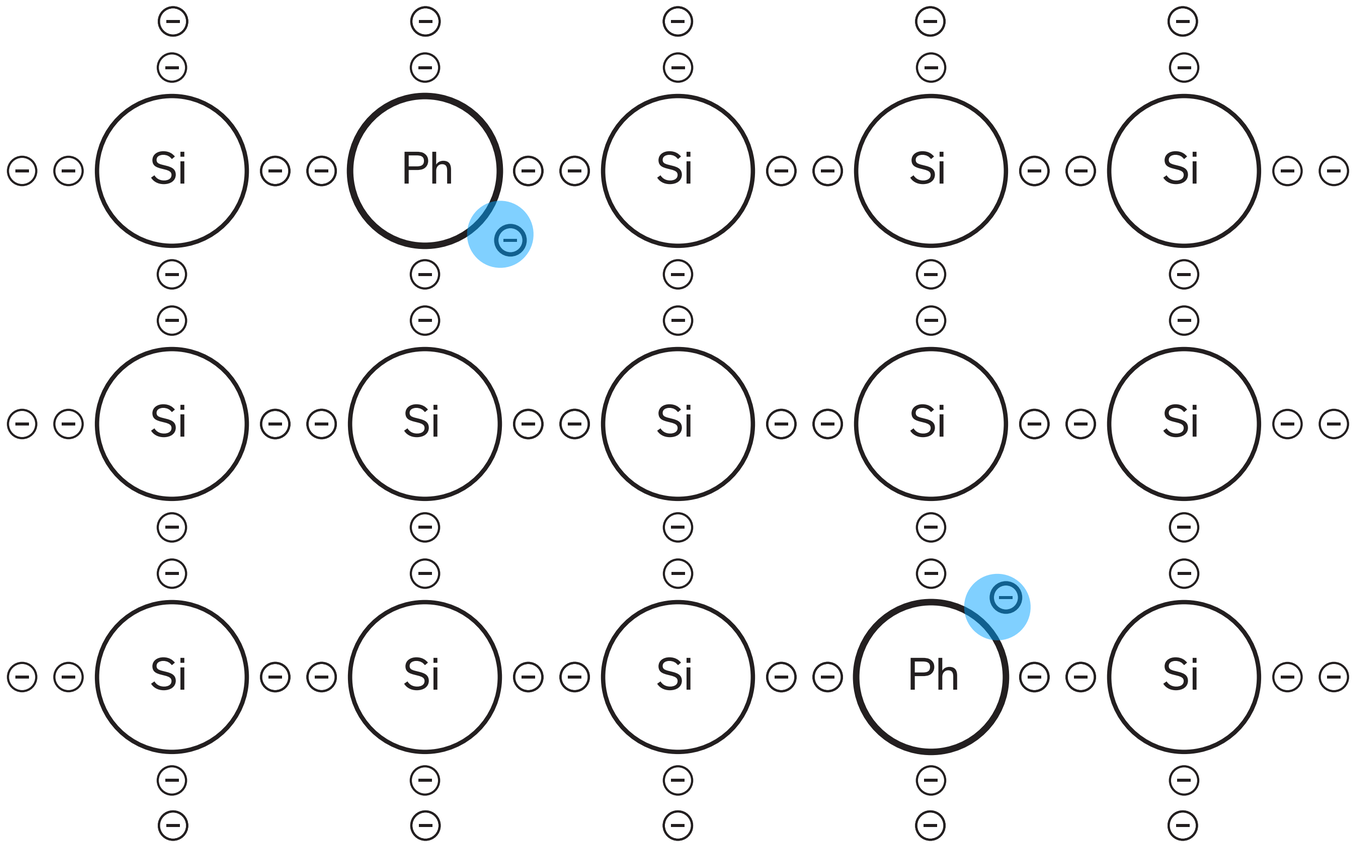
Aufgabe
Halbleiter
Transistoren
MOSFETS
Galvanische Trennung
Optokoppler
Relais

Aufgabe

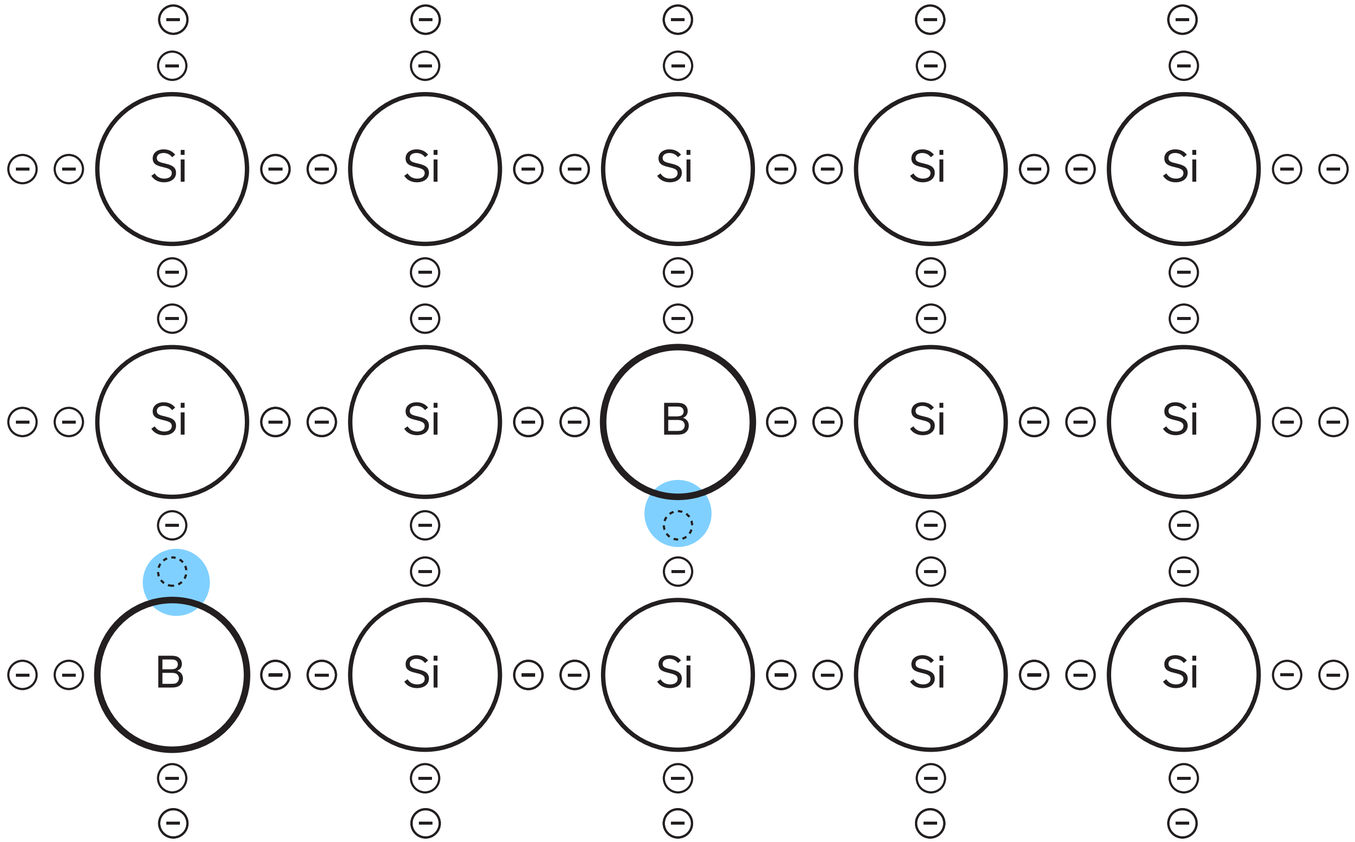
Halbleiter



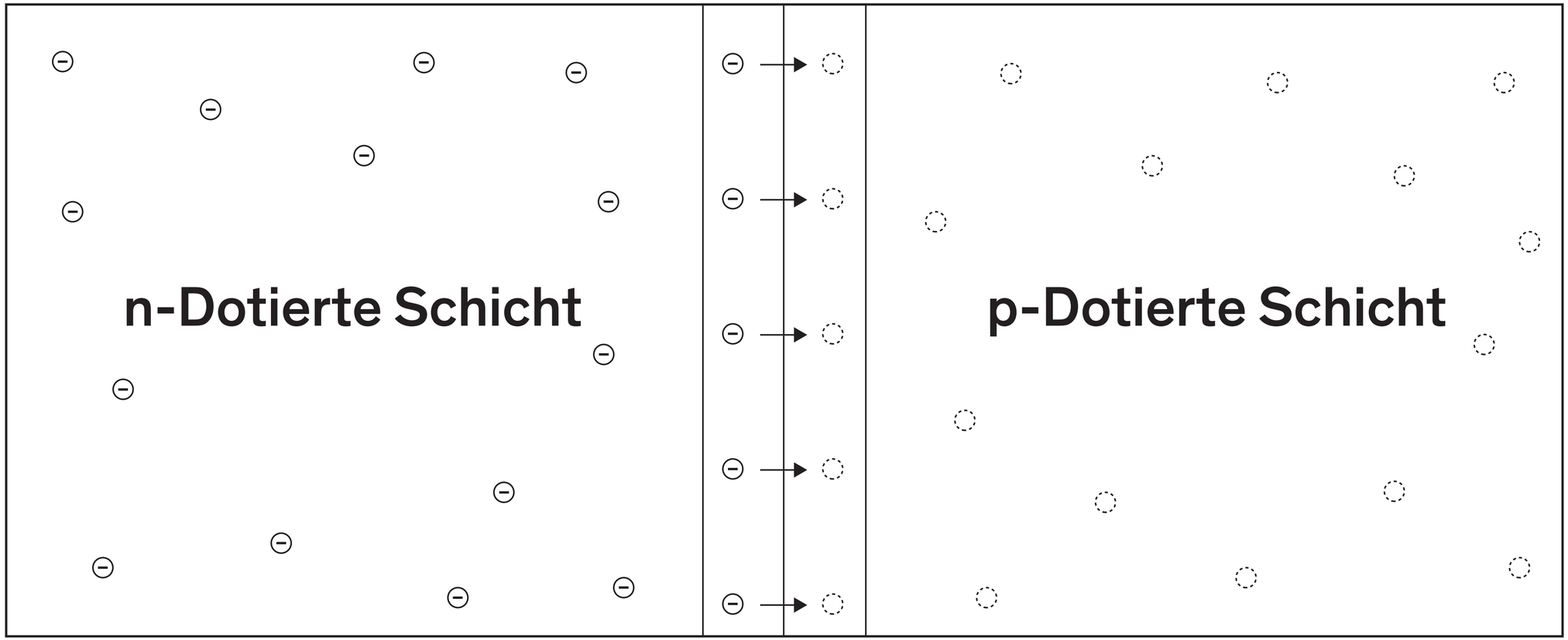
Halbleiter



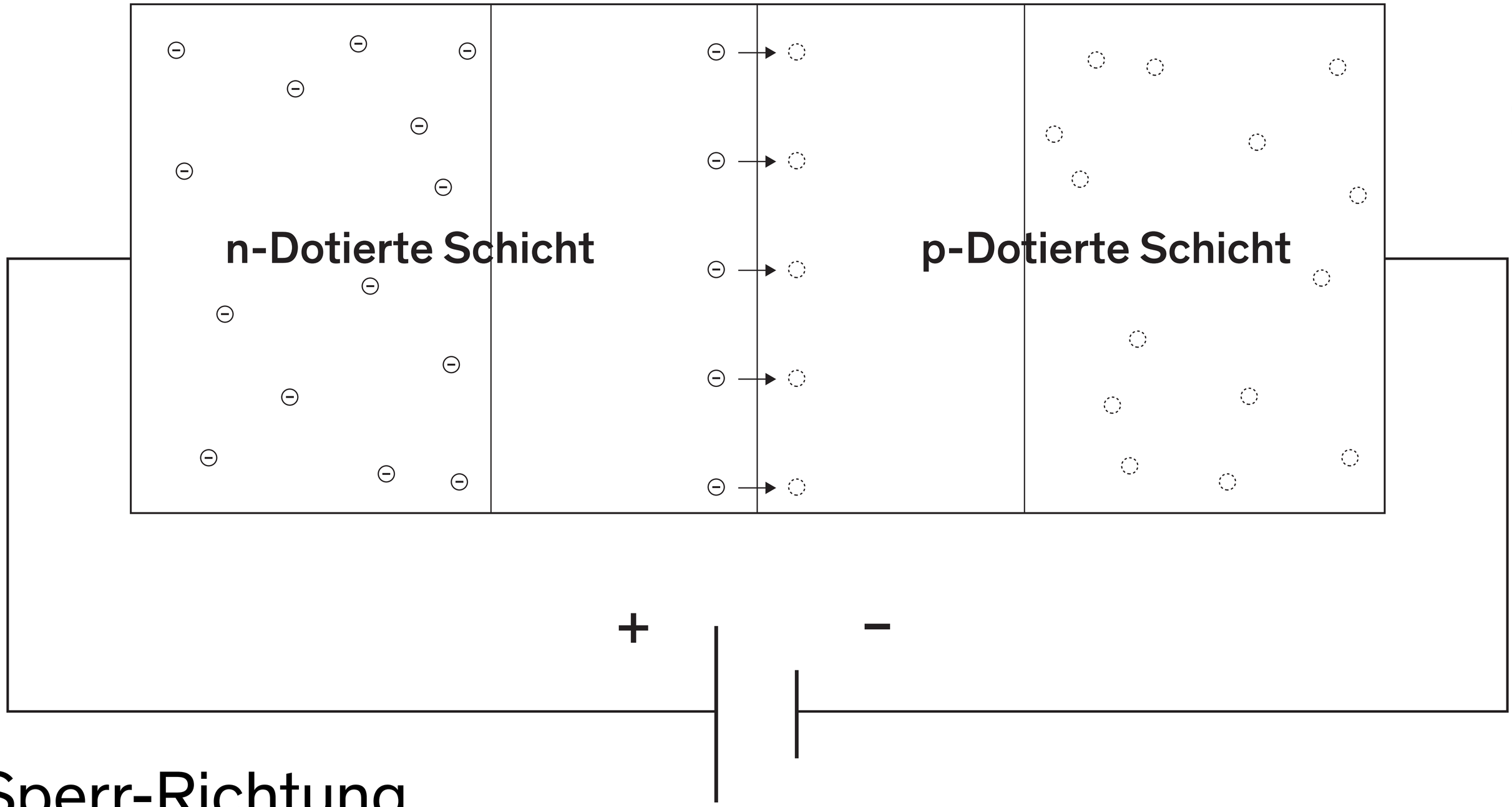
n-Dotierung



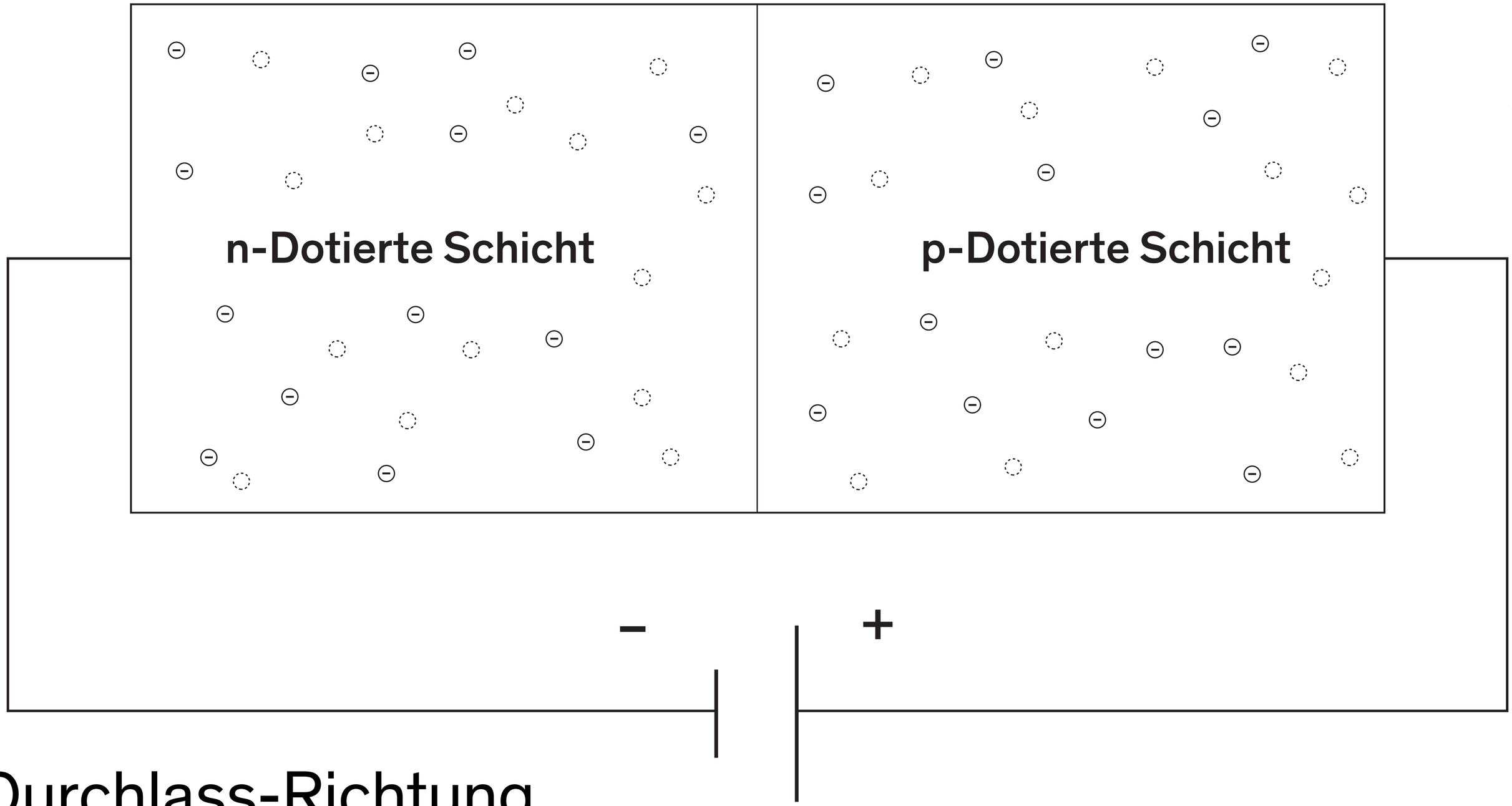
p-Dotierung



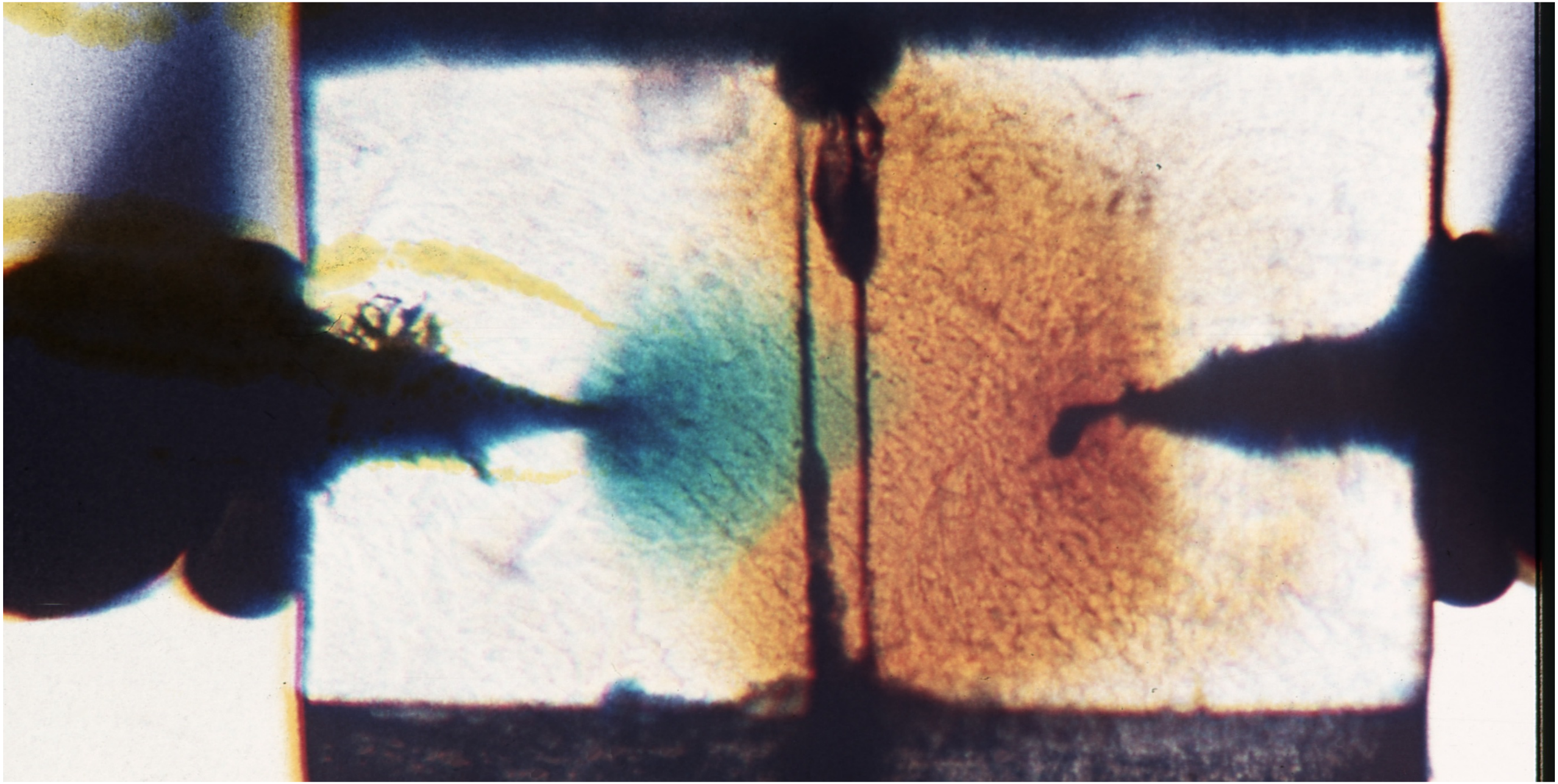
n-p-Übergang



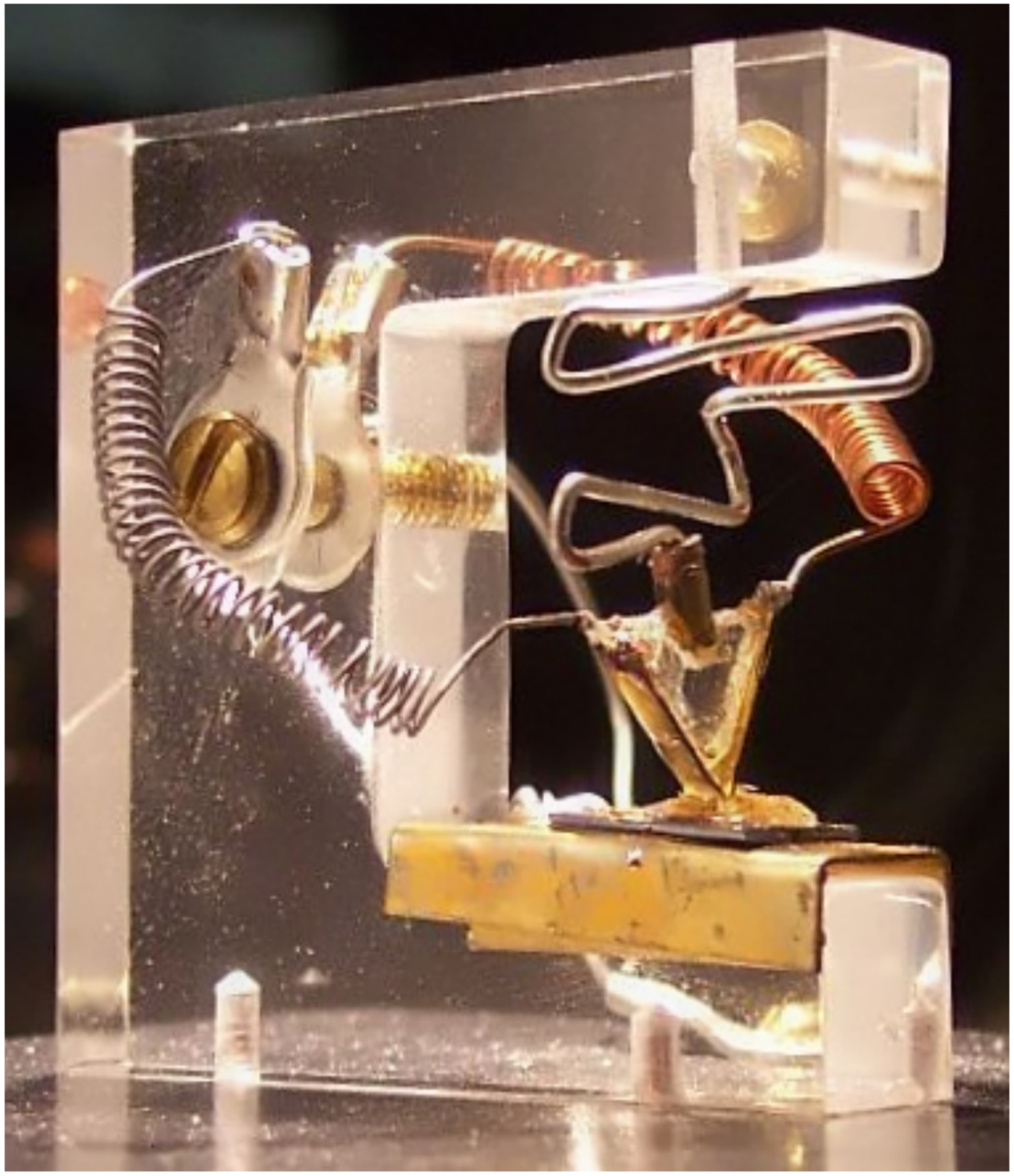
Sperr-Richtung



Durchlass-Richtung



n-P-Übergäng



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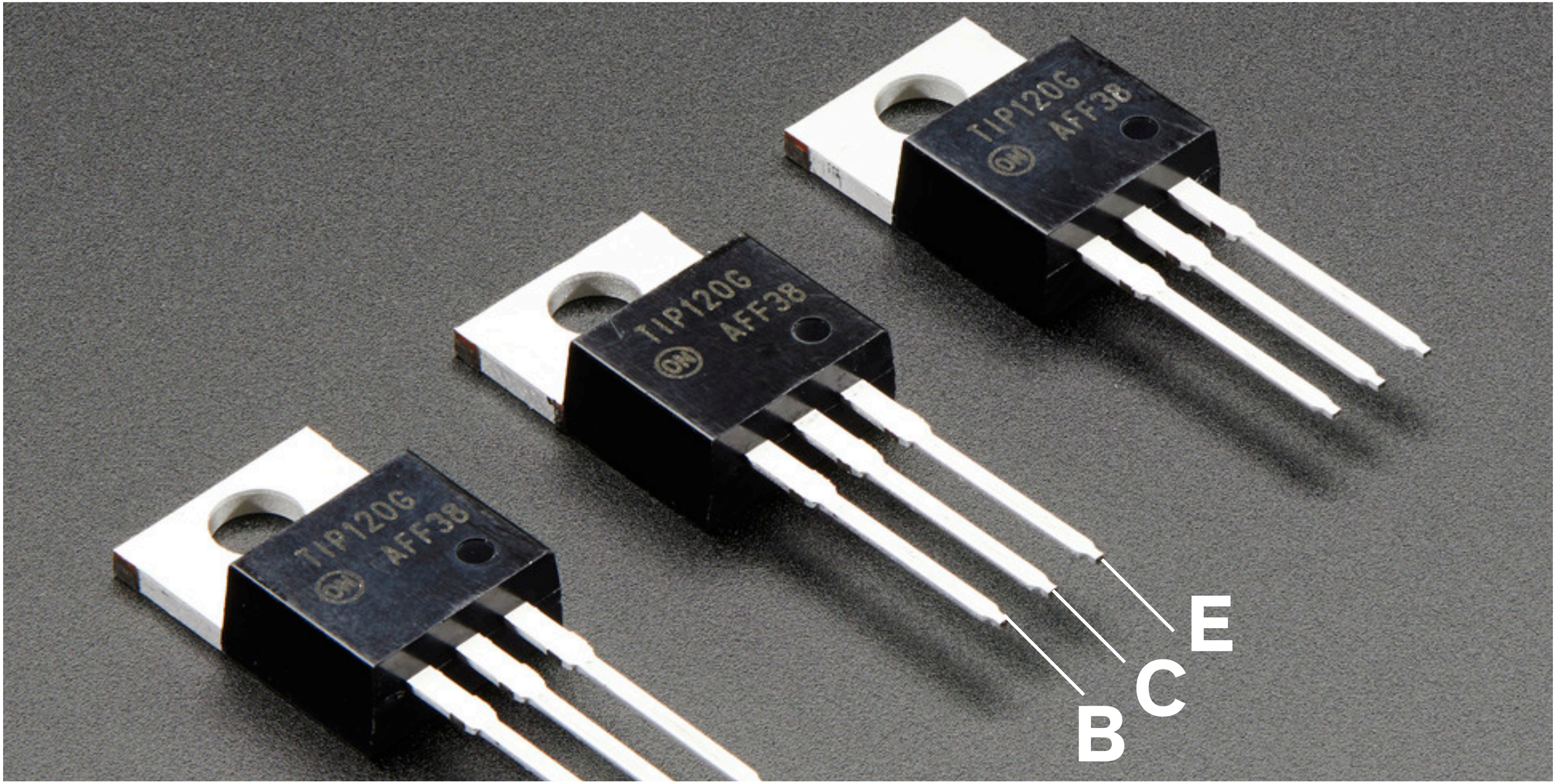

Transistoren

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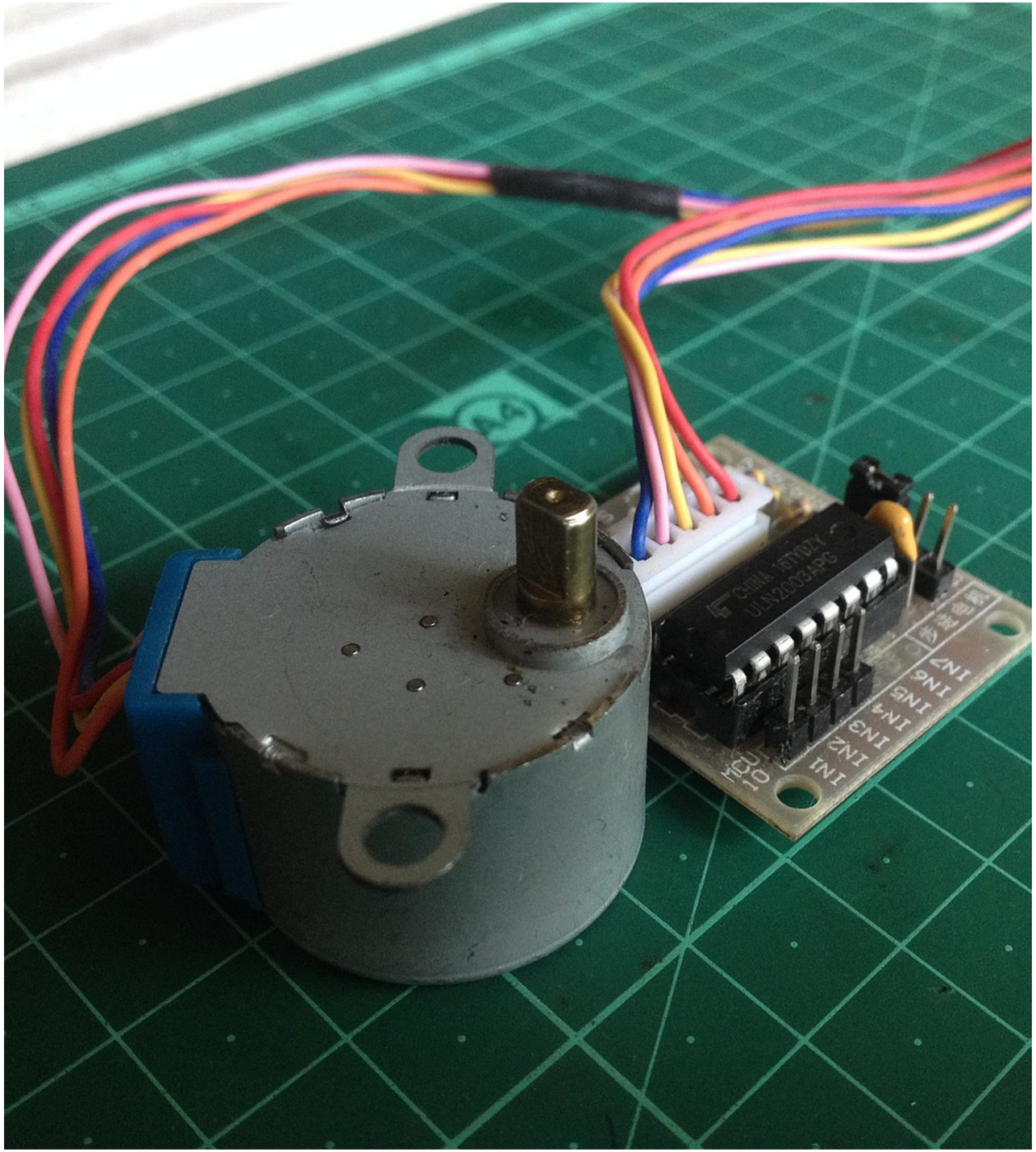

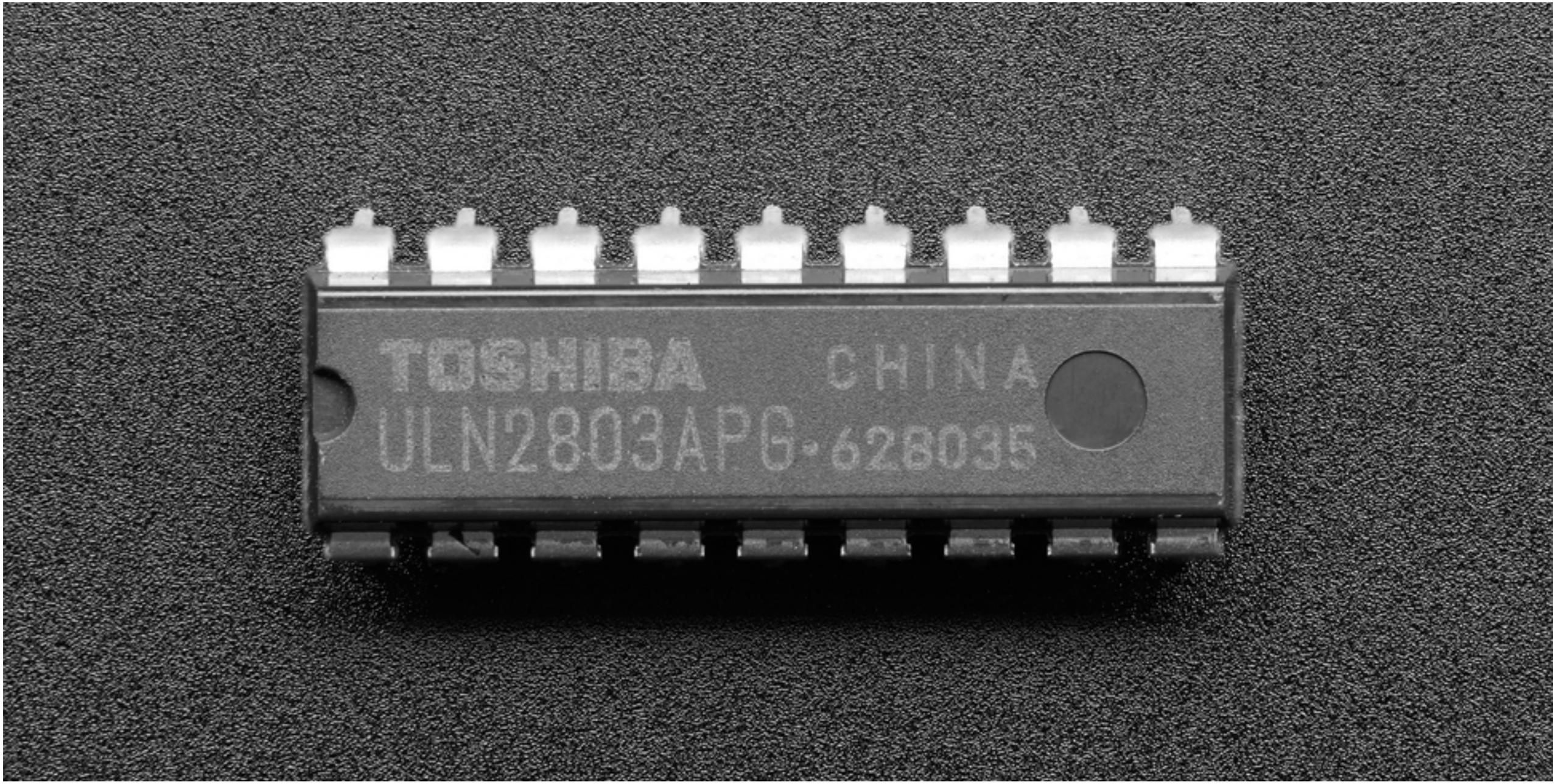

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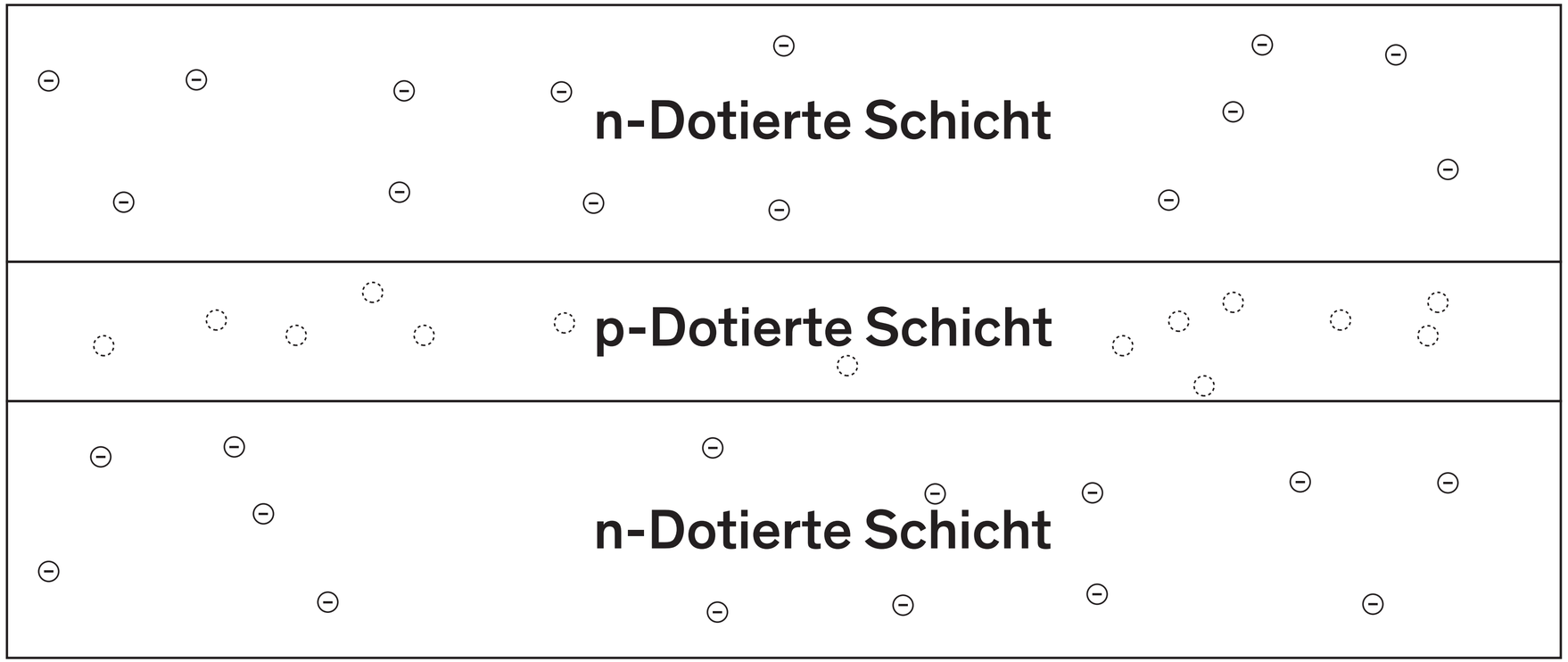
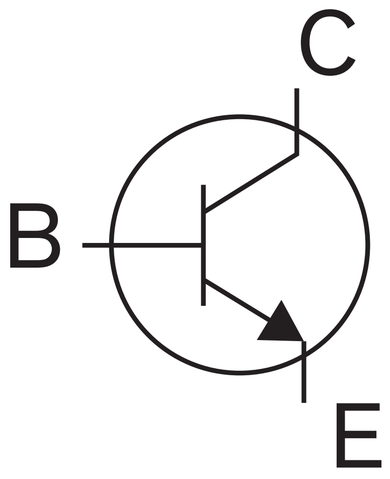


Kollektor (C)

Basis (B)

Emitter (E)

npn-Transistoren

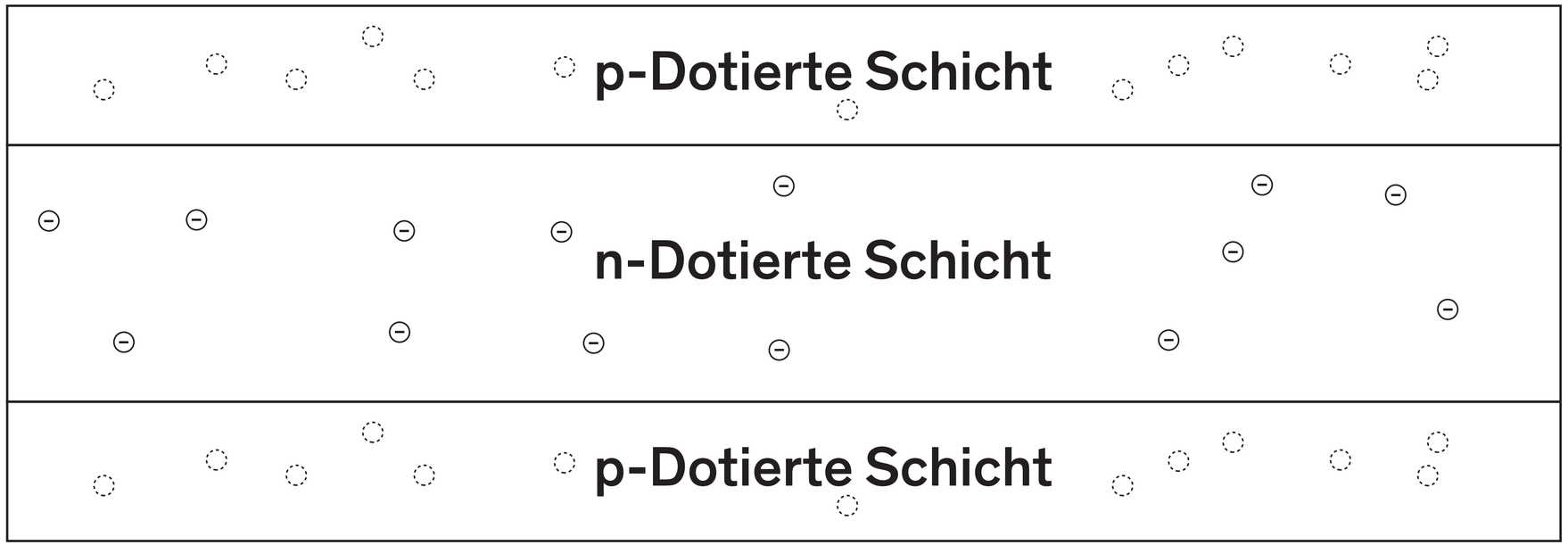


Kollektor (C)

Basis (B)

Emitter (E)

npn-Transistoren

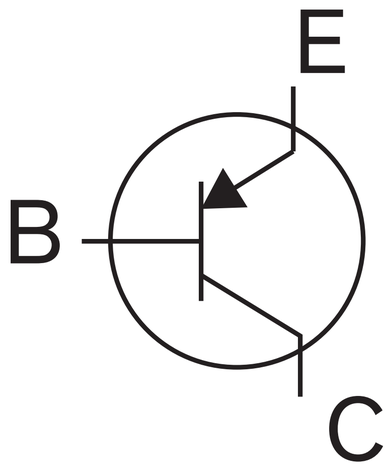


Emitter (E)

Basis (B)

Collector (C)

pnp-Transistoren

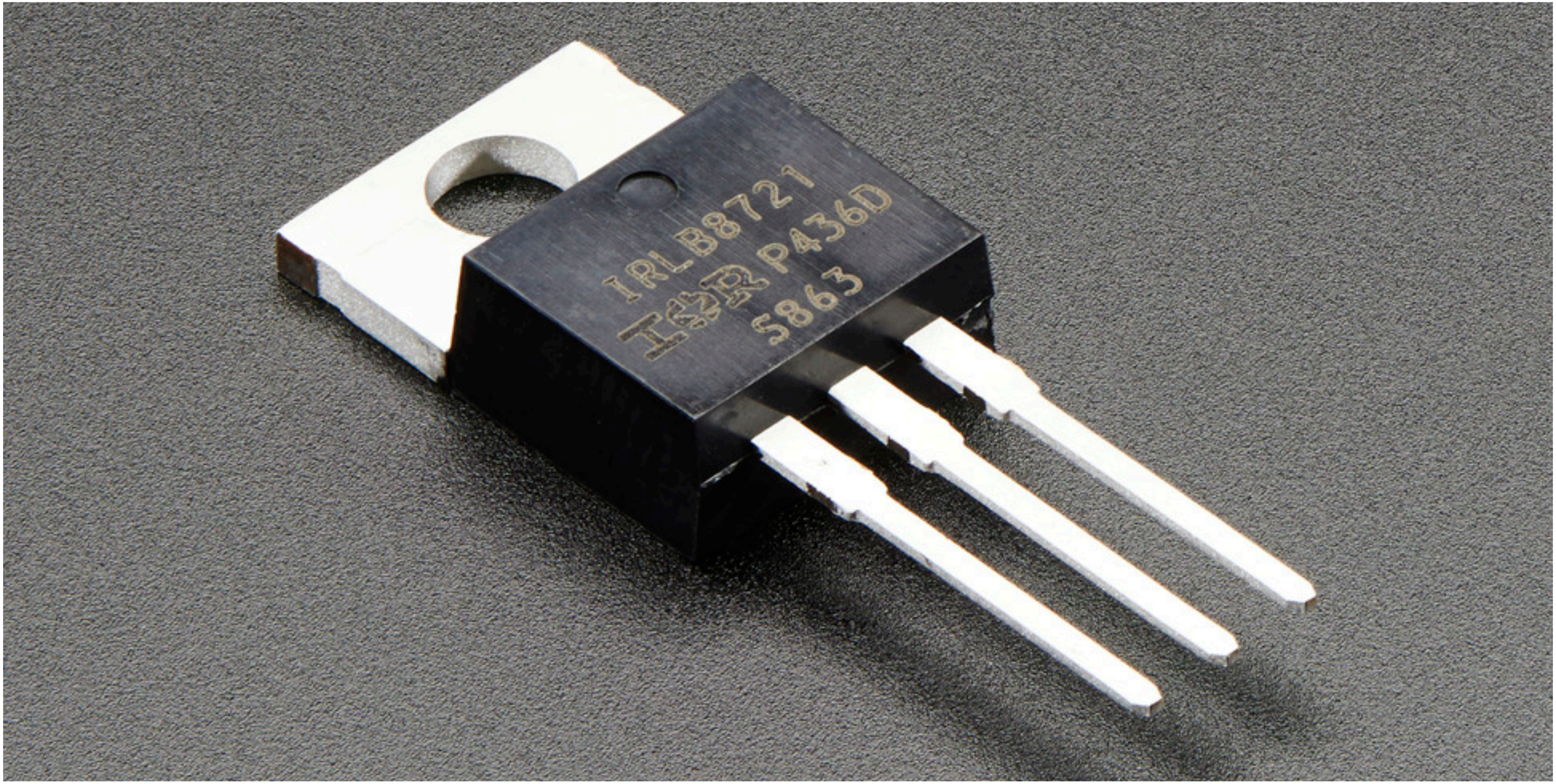


Emitter (E)

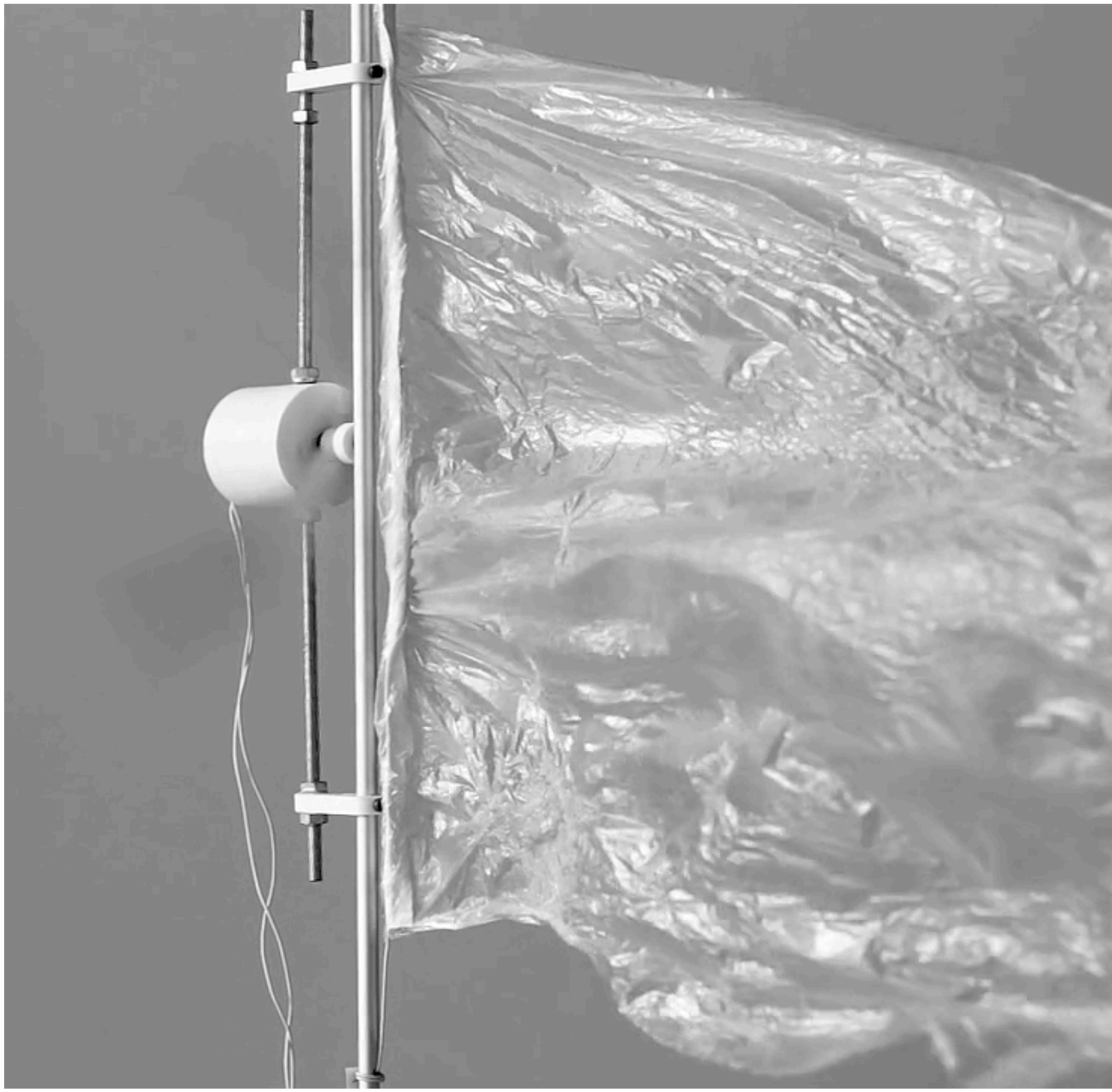
Basis (B)

Collector (C)

pnp-Transistoren



MOSFETS



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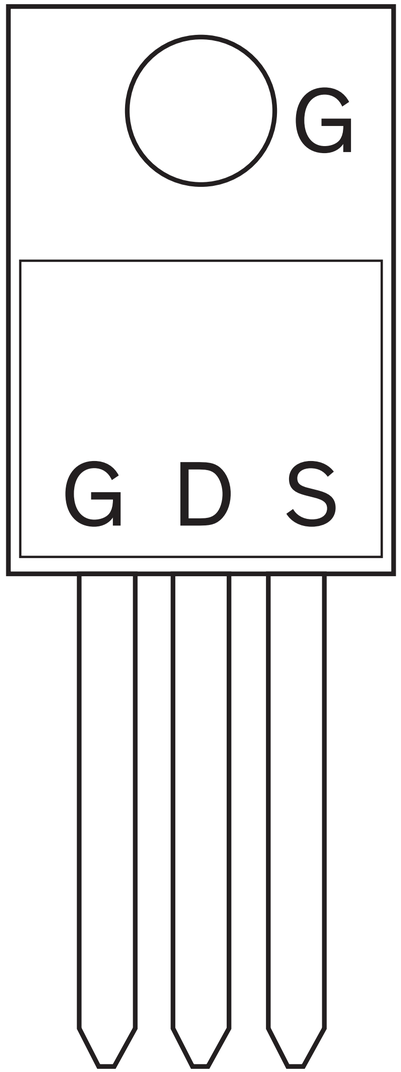

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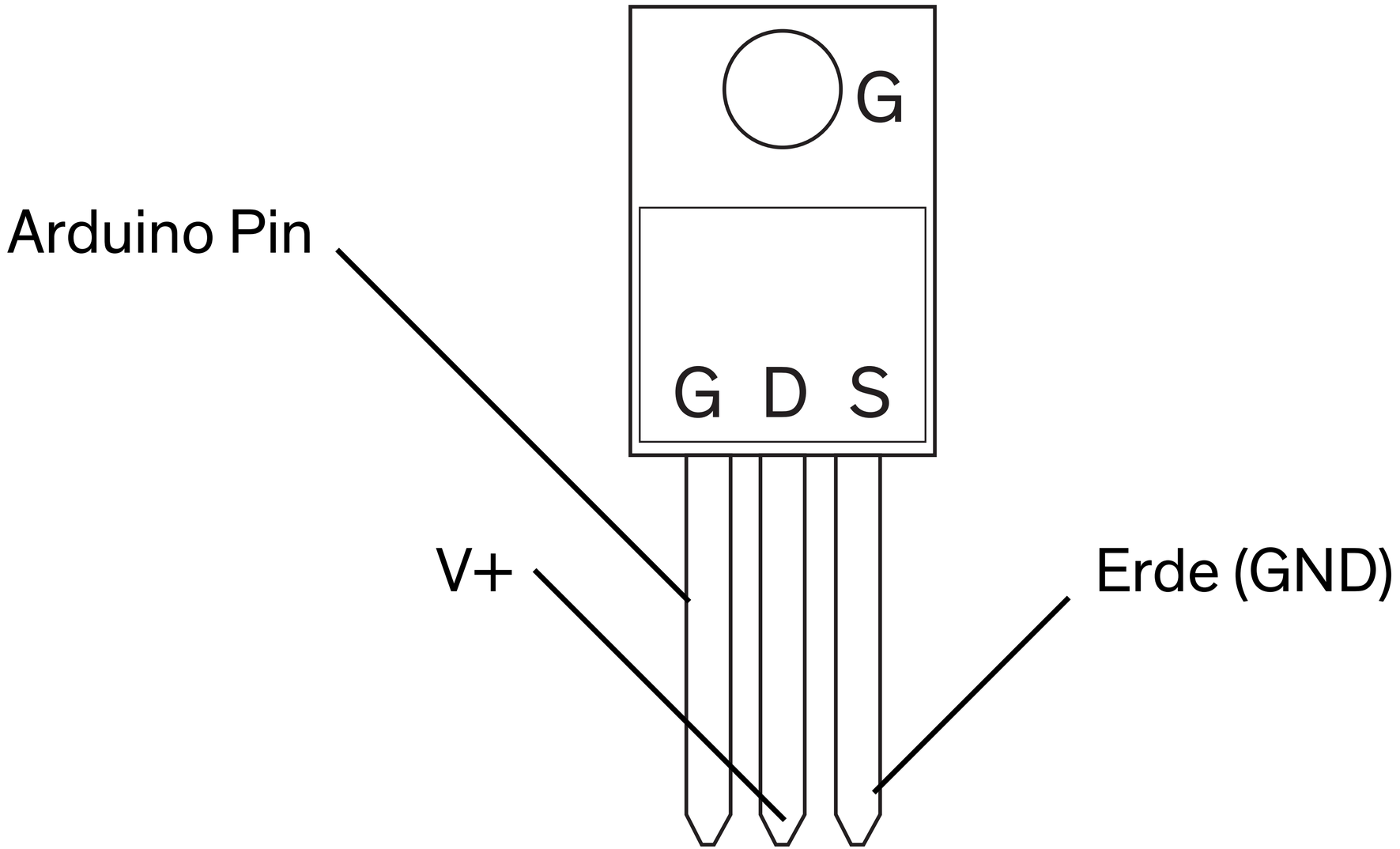
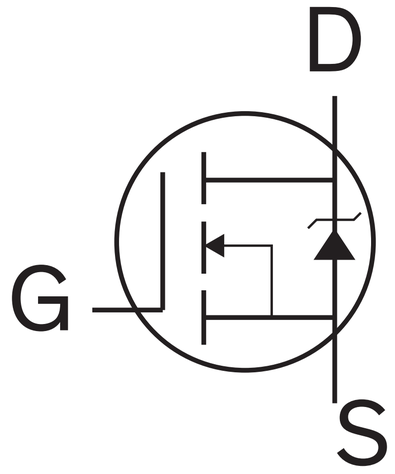


MOSFETS

IRLZ44N
IRL540N
IRLZ24N

IRF522
IRF540
IRF3205



MOSFETS

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	47	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	33	
I_{DM}	Pulsed Drain Current ①	160	
P_D @T_C = 25°C	Power Dissipation	110	W
	Linear Derating Factor	0.71	W/°C
V_{GS}	Gate-to-Source Voltage	±16	V
E_{AS}	Single Pulse Avalanche Energy ②	210	mJ
I_{AR}	Avalanche Current①	25	A
E_{AR}	Repetitive Avalanche Energy①	11	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	——	1.4	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	——	0.50	——	
$R_{\theta JA}$	Junction-to-Ambient	——	——	62	

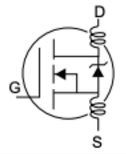
MOSFETS

IRLZ44N

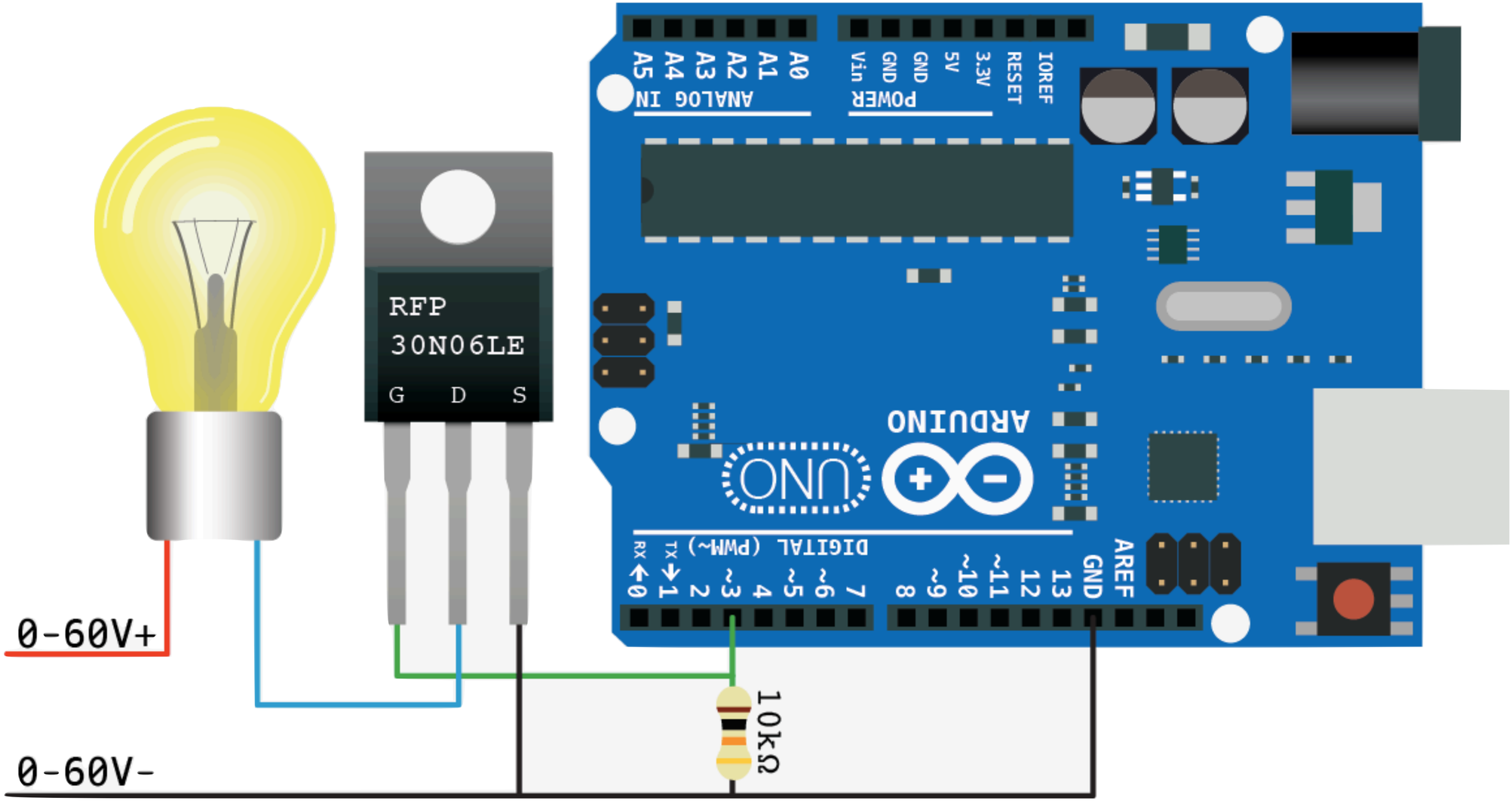
International
IOR Rectifier

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

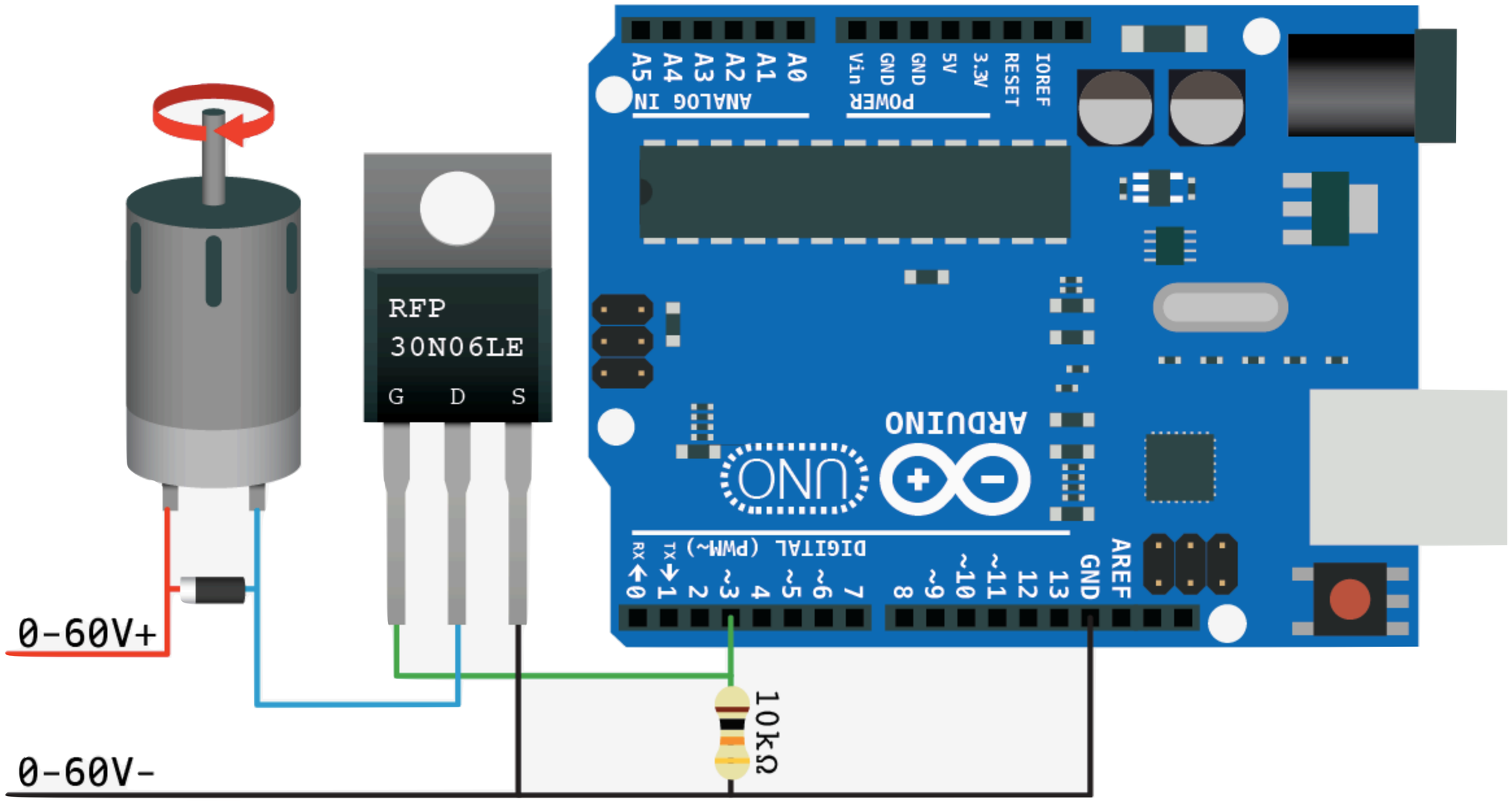
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.070	—	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.022	Ω	V_{GS} = 10V, I_D = 25A ④
		—	—	0.025		V_{GS} = 5.0V, I_D = 25A ④
		—	—	0.035		V_{GS} = 4.0V, I_D = 21A ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	21	—	—	S	V_{DS} = 25V, I_D = 25A
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	µA	V_{DS} = 55V, V_{GS} = 0V
		—	—	250		V_{DS} = 44V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS} = 16V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS} = -16V
Q_g	Total Gate Charge	—	—	48	nC	I_D = 25A
Q_{gs}	Gate-to-Source Charge	—	—	8.6		V_{DS} = 44V
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	25		V_{GS} = 5.0V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	11	—	ns	V_{DD} = 28V
t_r	Rise Time	—	84	—		I_D = 25A
$t_{d(off)}$	Turn-Off Delay Time	—	26	—		R_G = 3.4Ω, V_{GS} = 5.0V
t_f	Fall Time		15			R_D = 1.1Ω, See Fig. 10 ④
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.)
L_S	Internal Source Inductance	—	7.5	—		from package and center of die contact
C_{iss}	Input Capacitance	—	1700	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	400	—		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	—	150	—		f = 1.0MHz, See Fig. 5



MOSFETS


RFP
30N06LE
G D S
0-60V+
0-60V-
10kΩ
ARDUINO
UNO
ANALOG IN
POWER
DIGITAL (PWM~)

MOSFETS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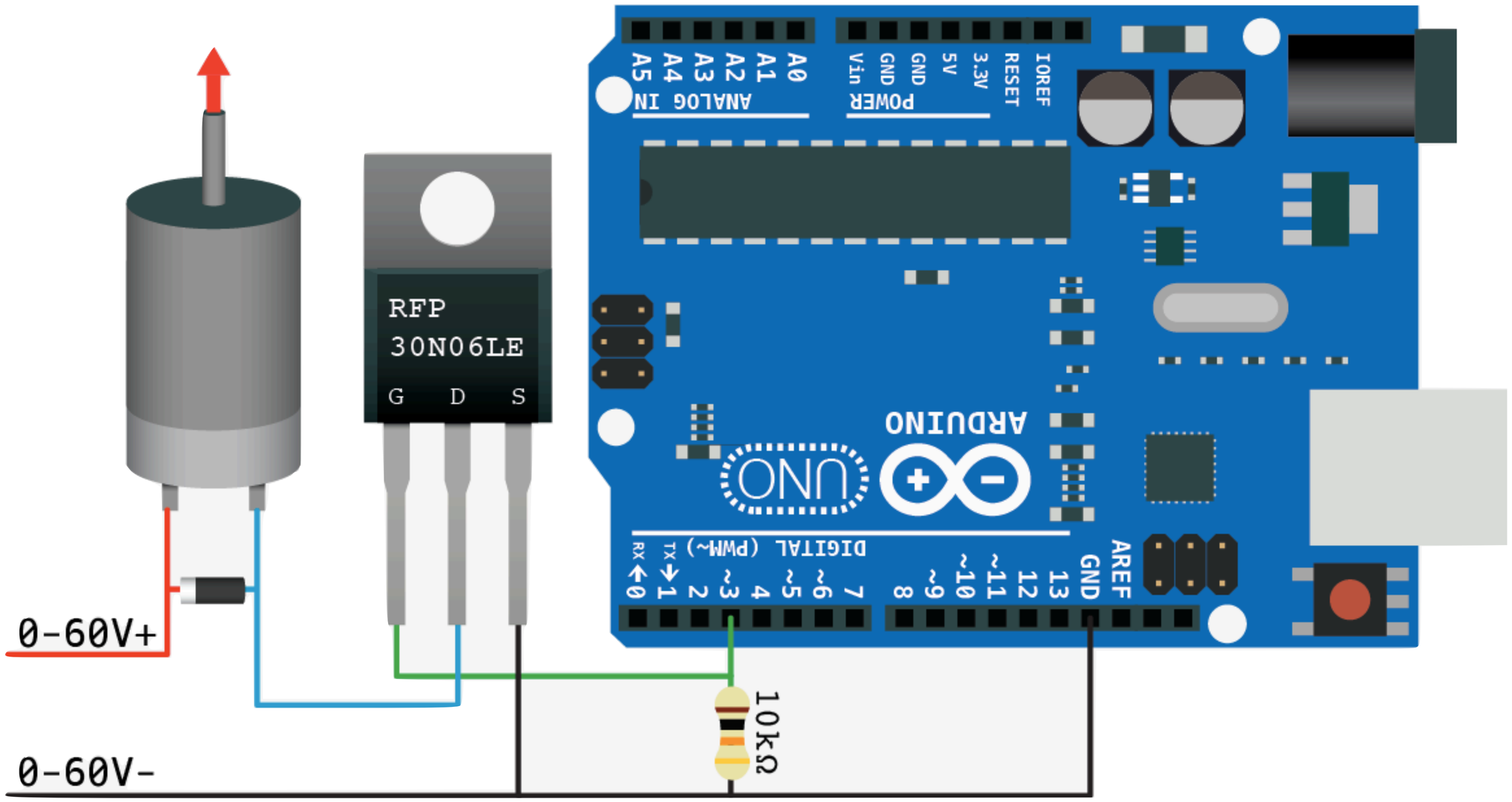
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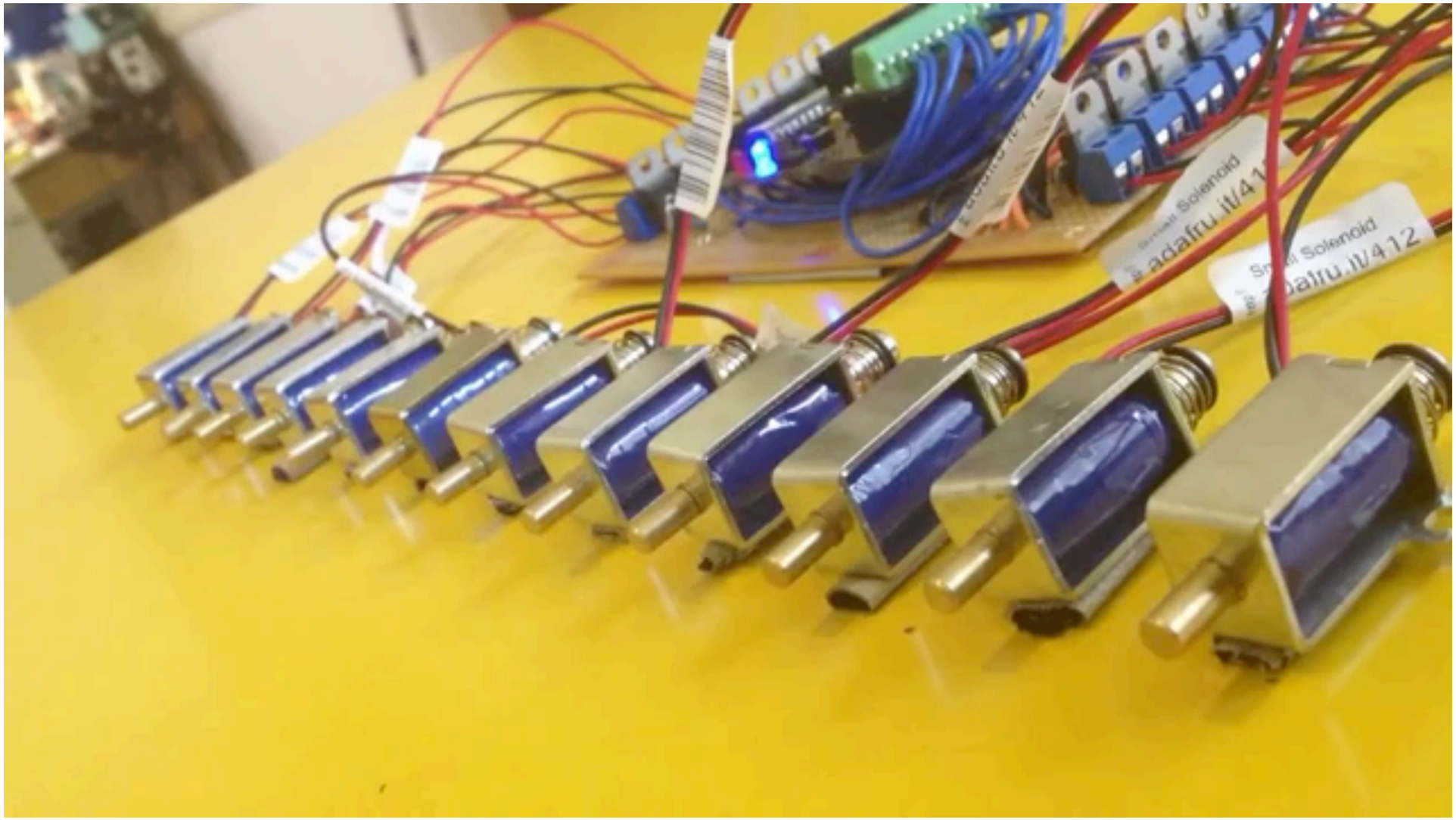
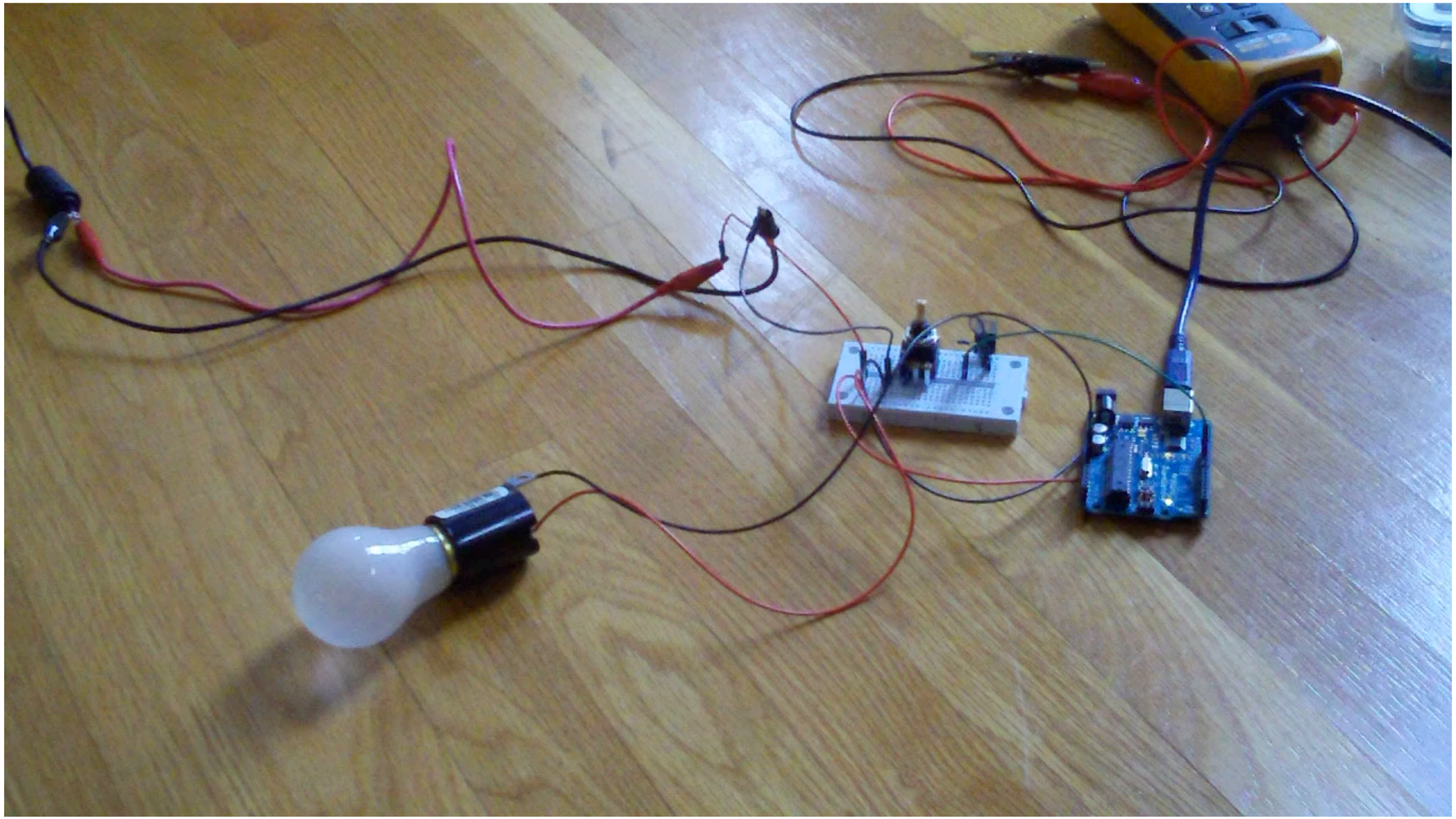
MOSFETS



MOSFETS

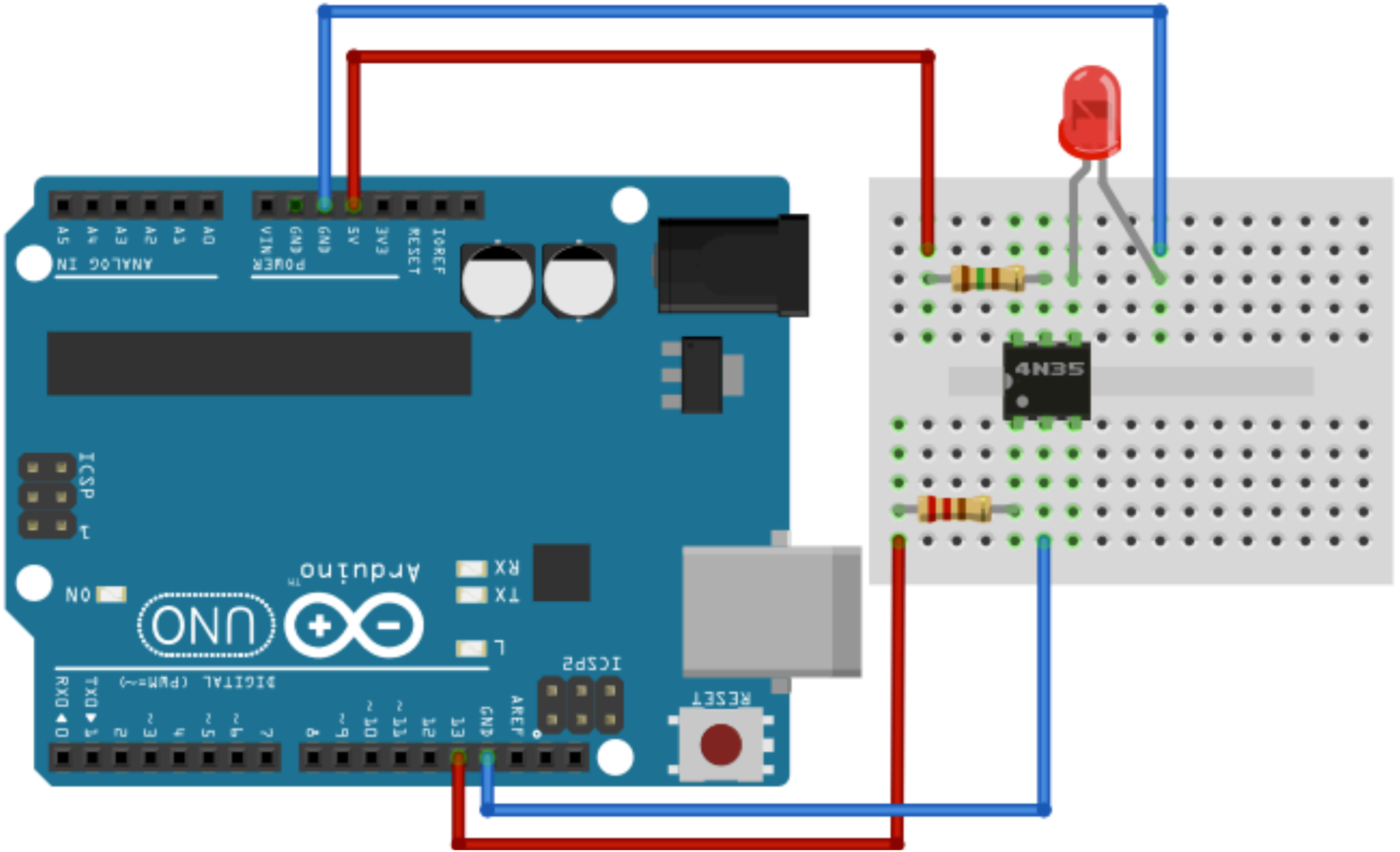


MOSFETS

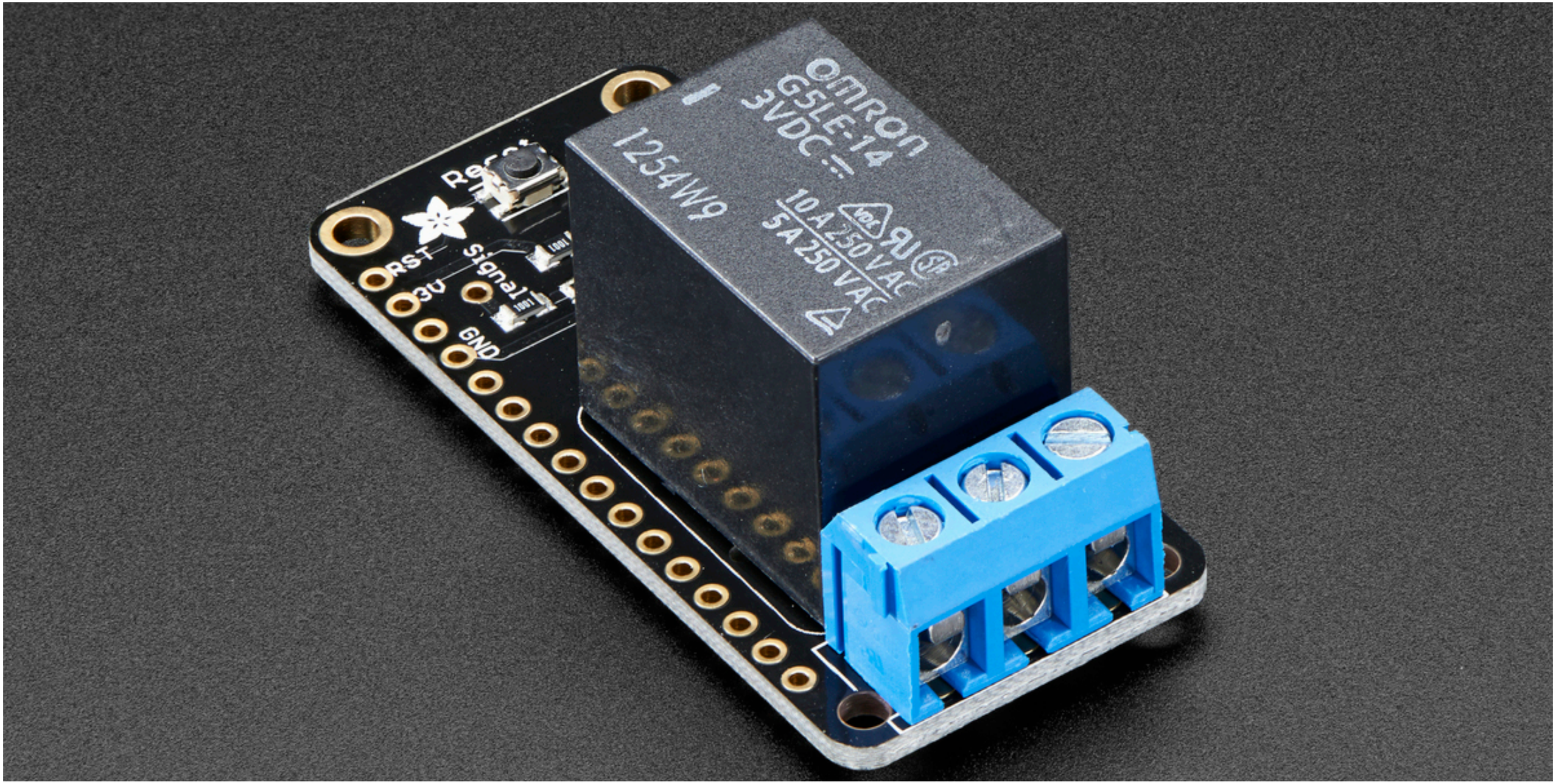
Galvanische Trennung

Masseschleifen / "Brummschleifen"
Sicherheit
Schutzmaßnahme
Vermeidung von Potentialverschiebungen

Galvanische Trennung

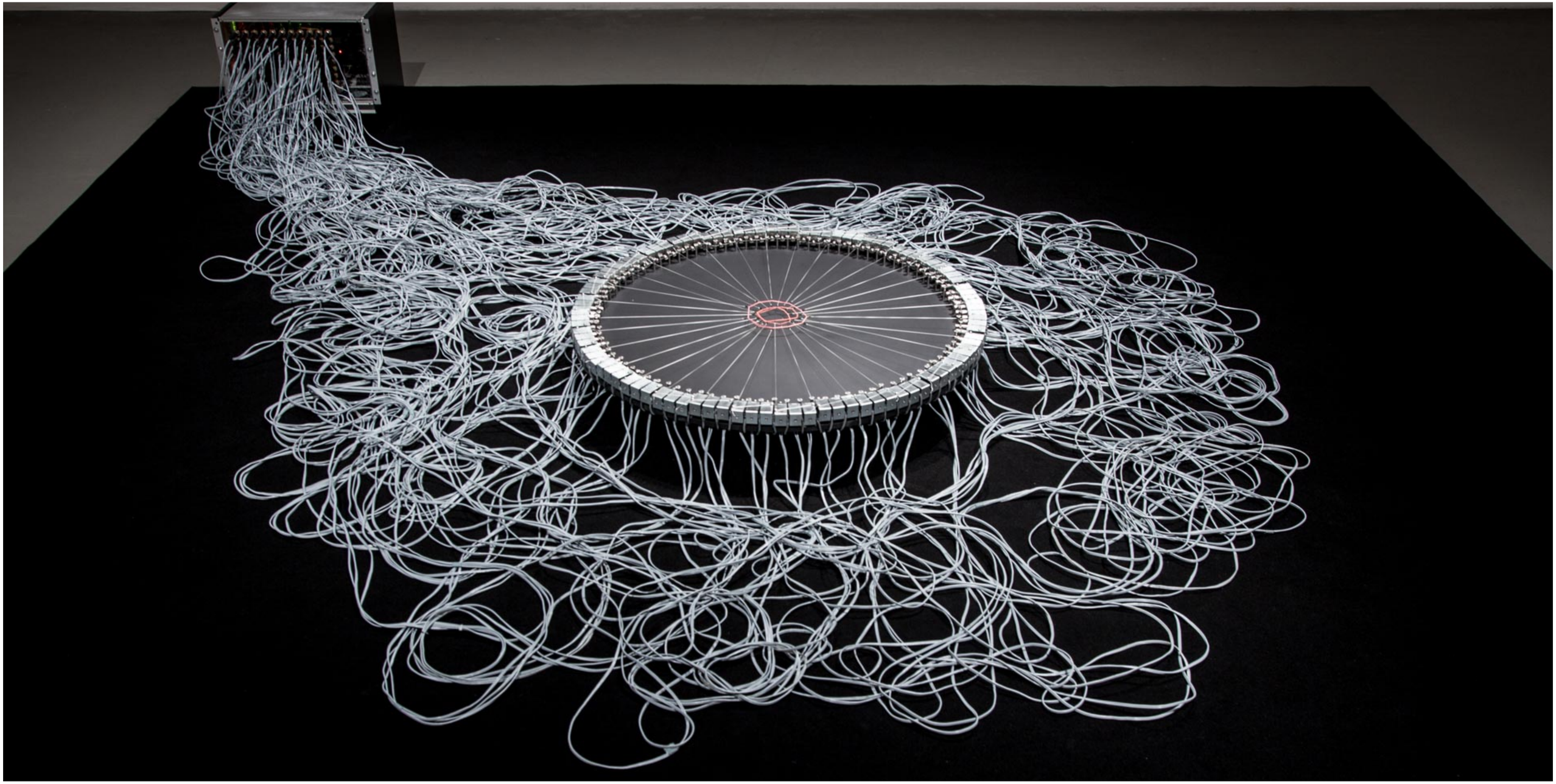


Optokoppler


omron
G5LE-14
3VDC
1254W9
10A 250 VAC
5A 250 VAC
RST
3V
Signal
GND

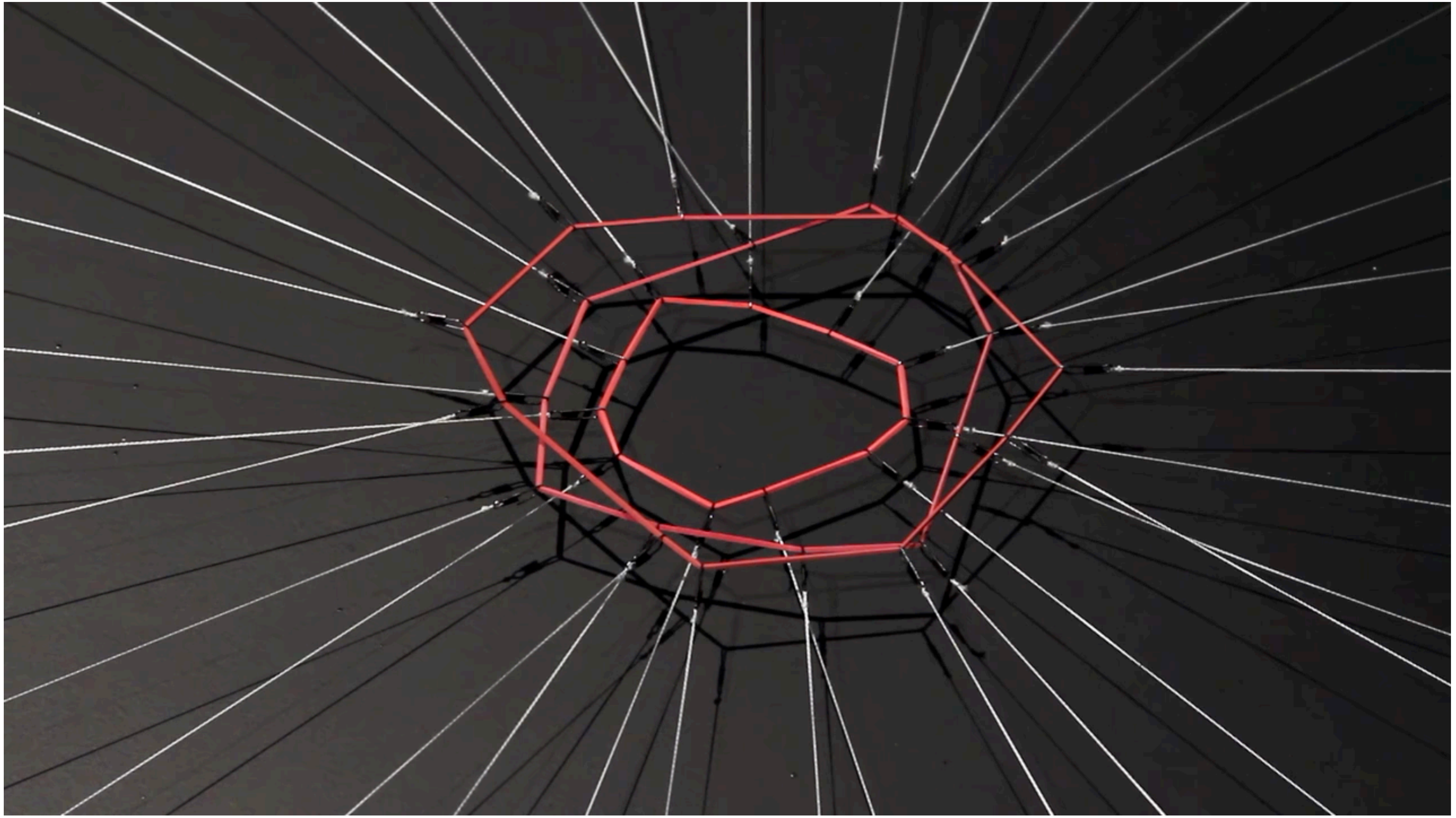
Relais

Anwendungsbeispiele



The Conversation

The Conversation

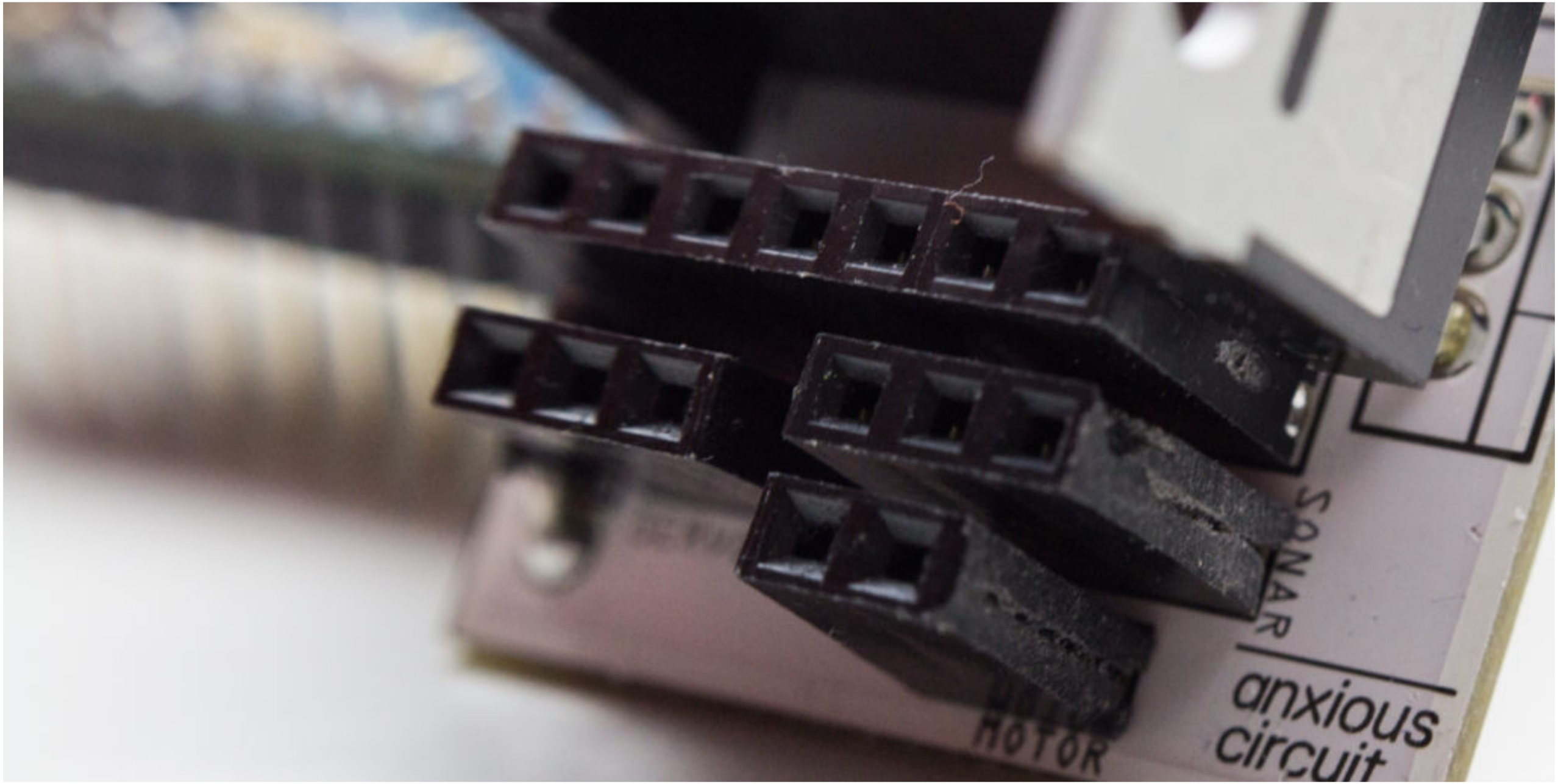


The Conversation

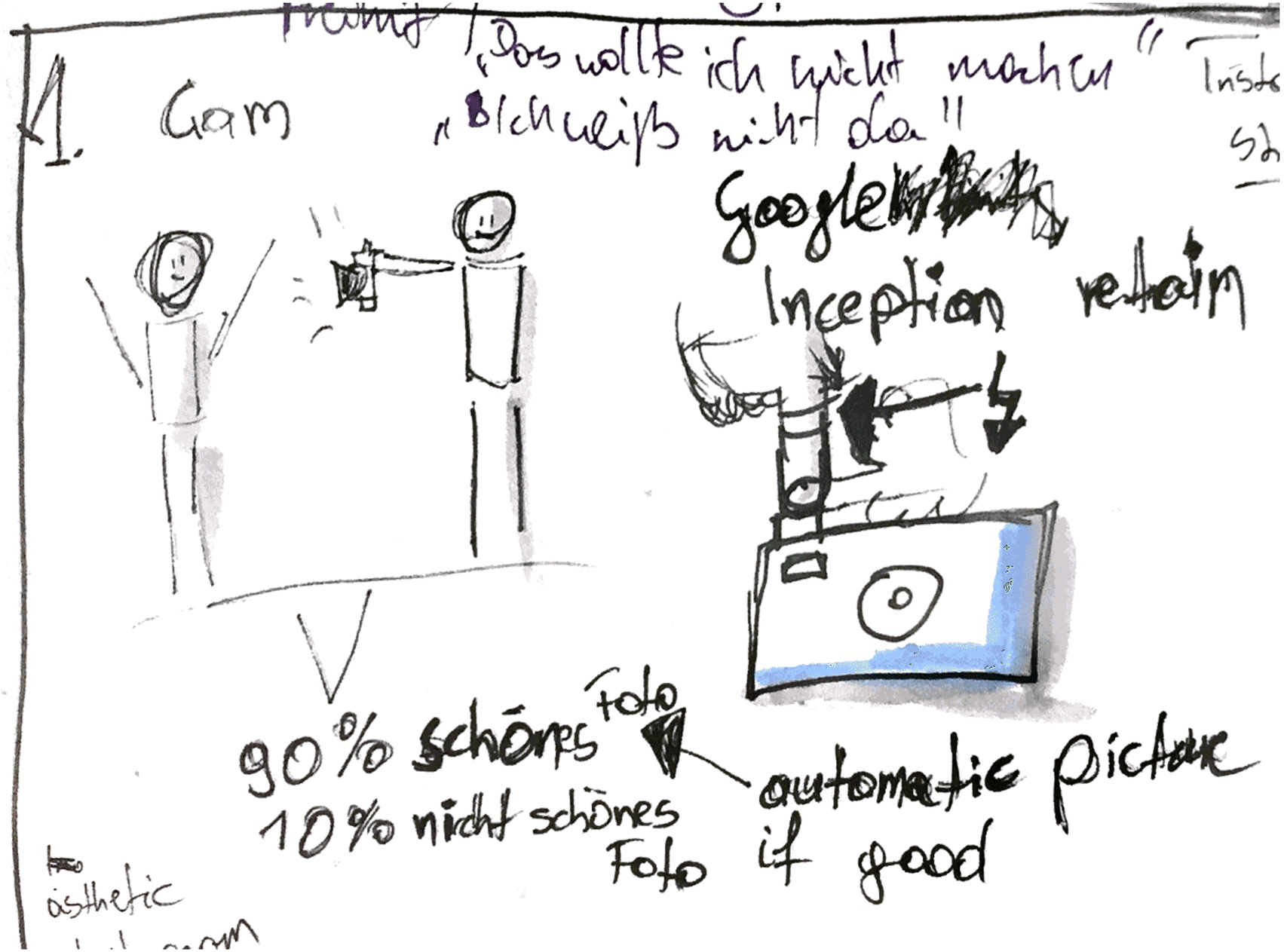
Anxious Lamp

Anxious Lamp

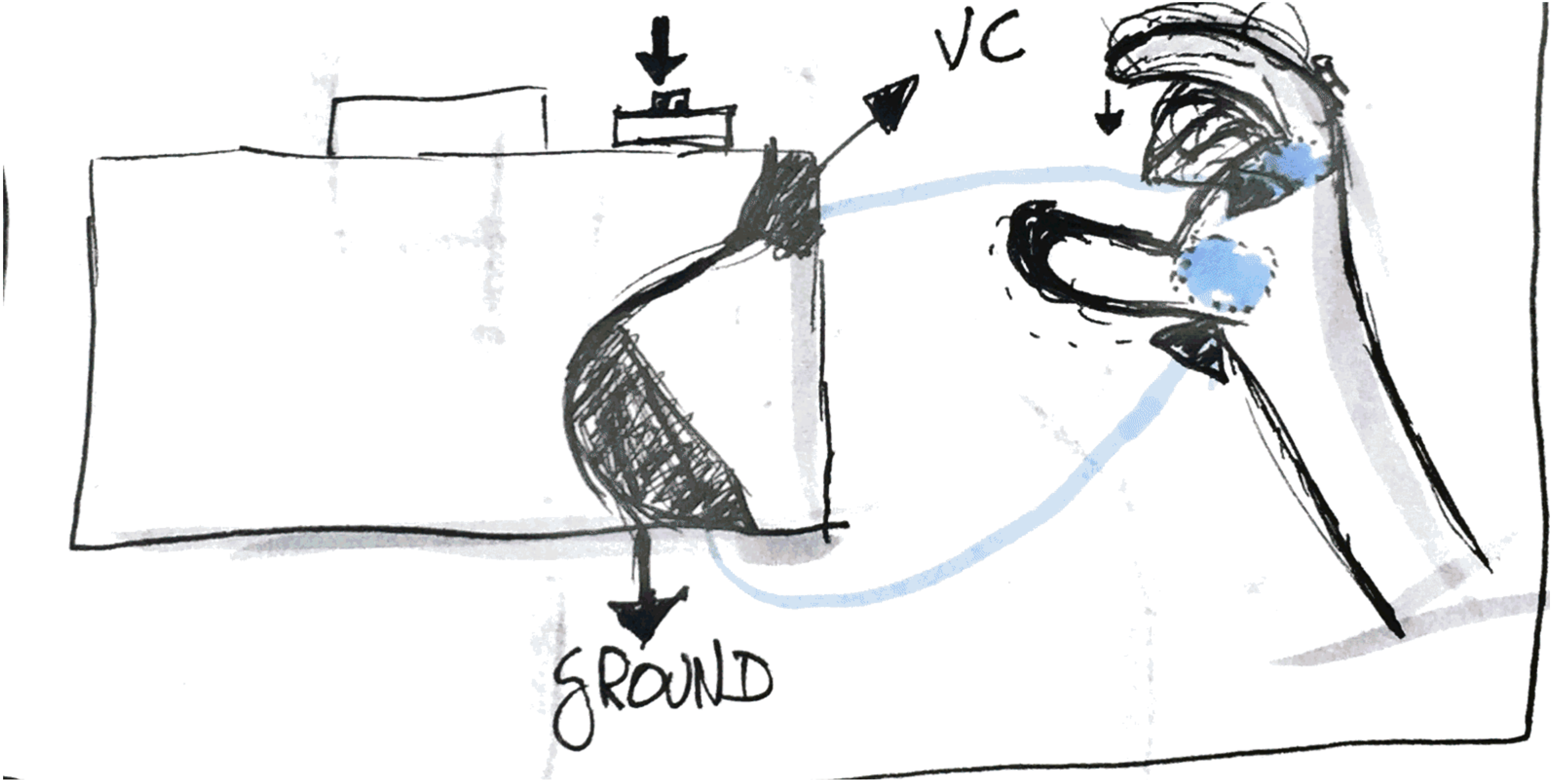
Anxious Lamp



Anxious Lamp



Prosthetic Photographer



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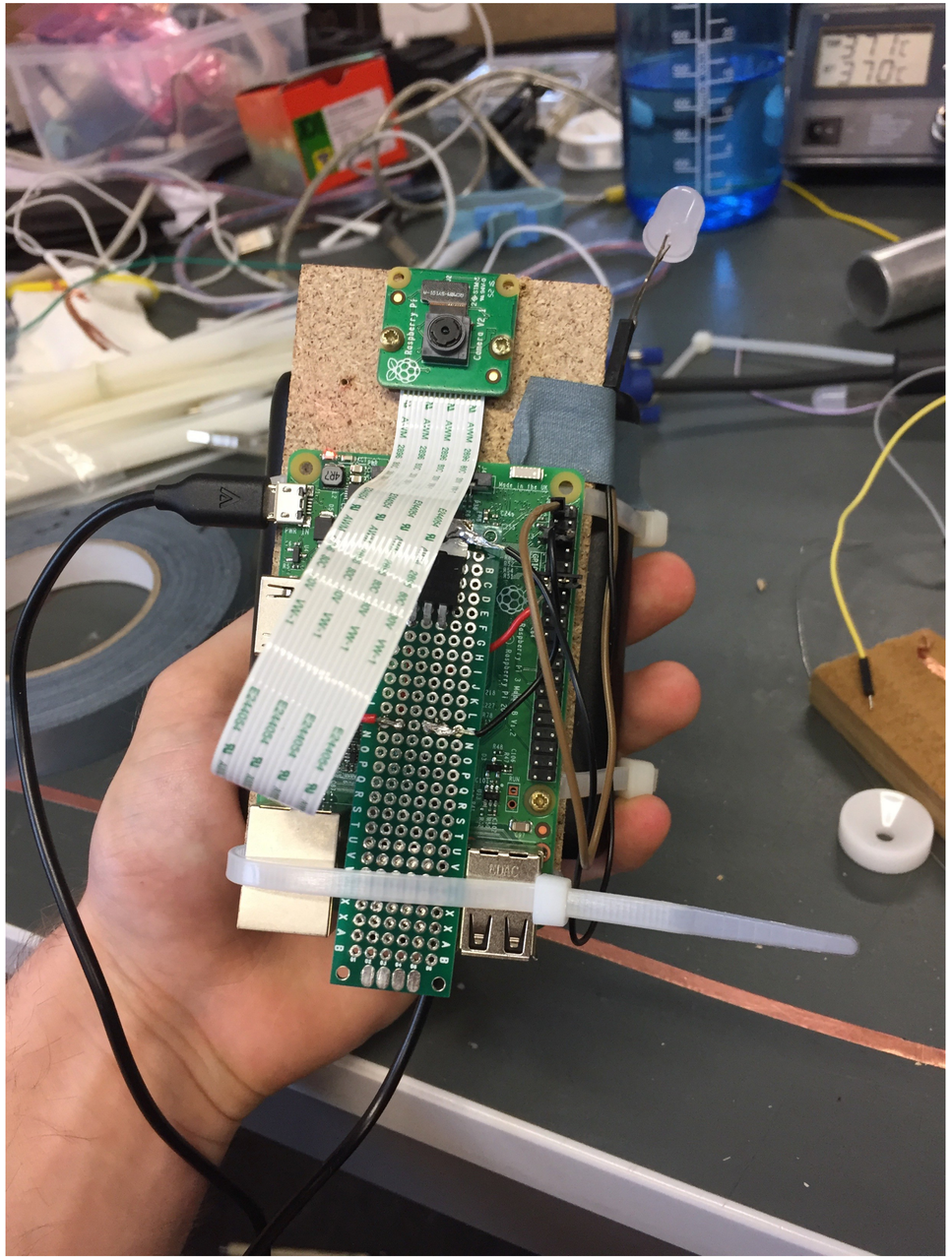

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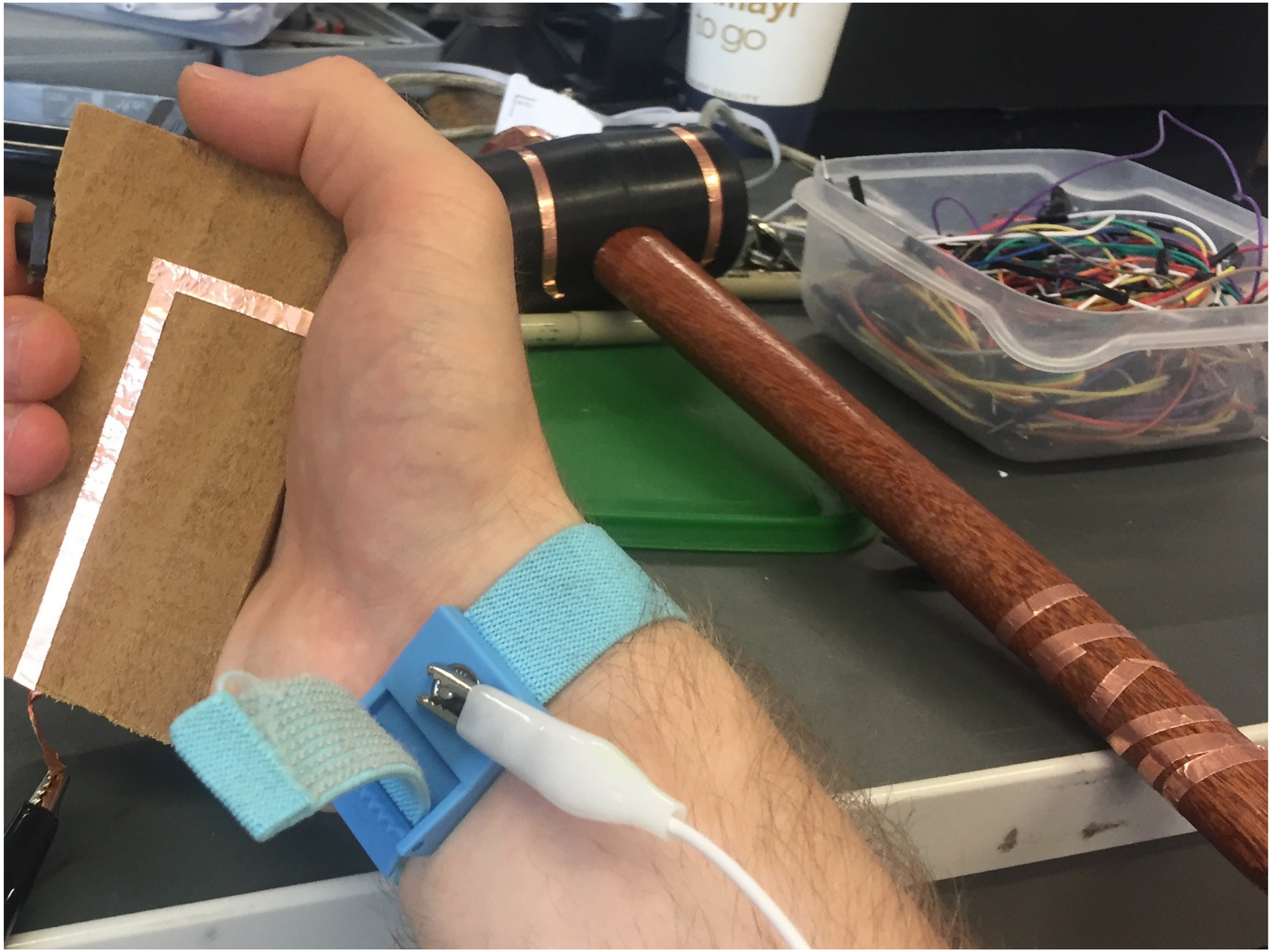

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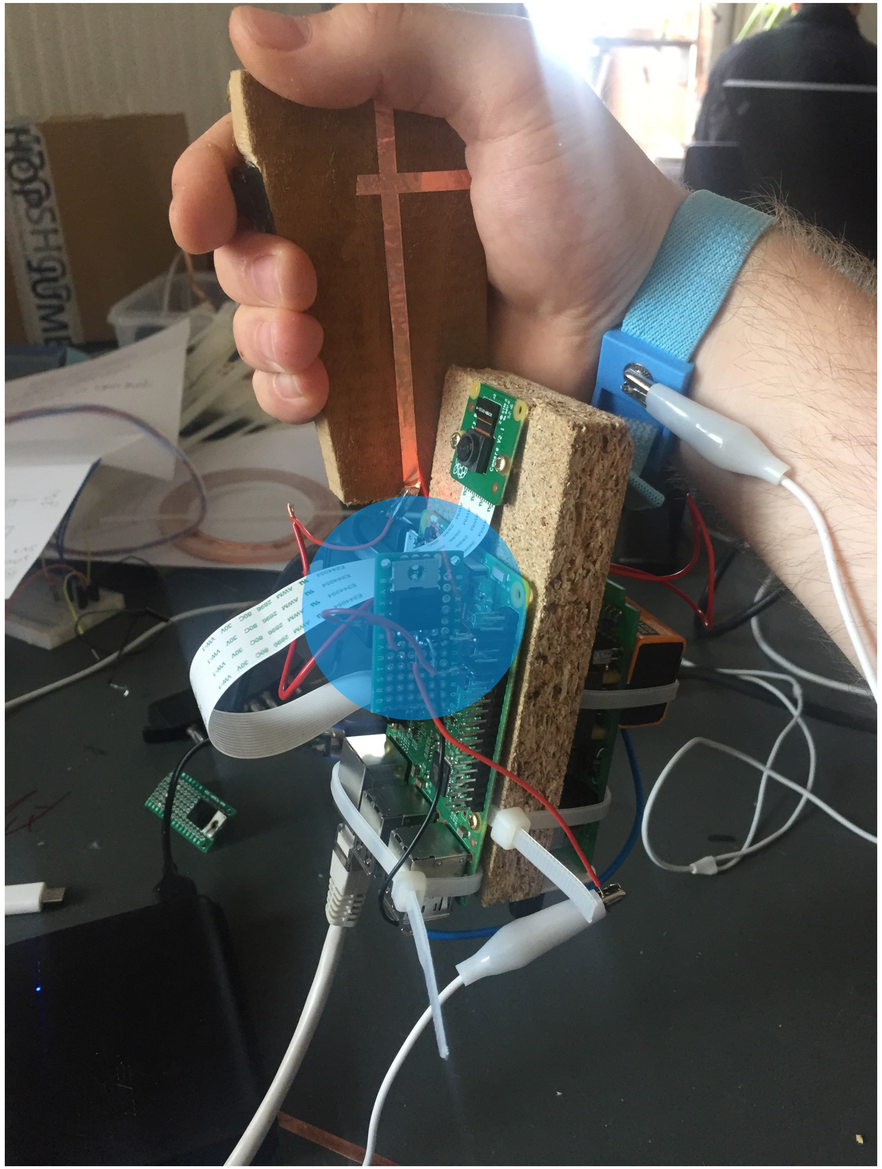


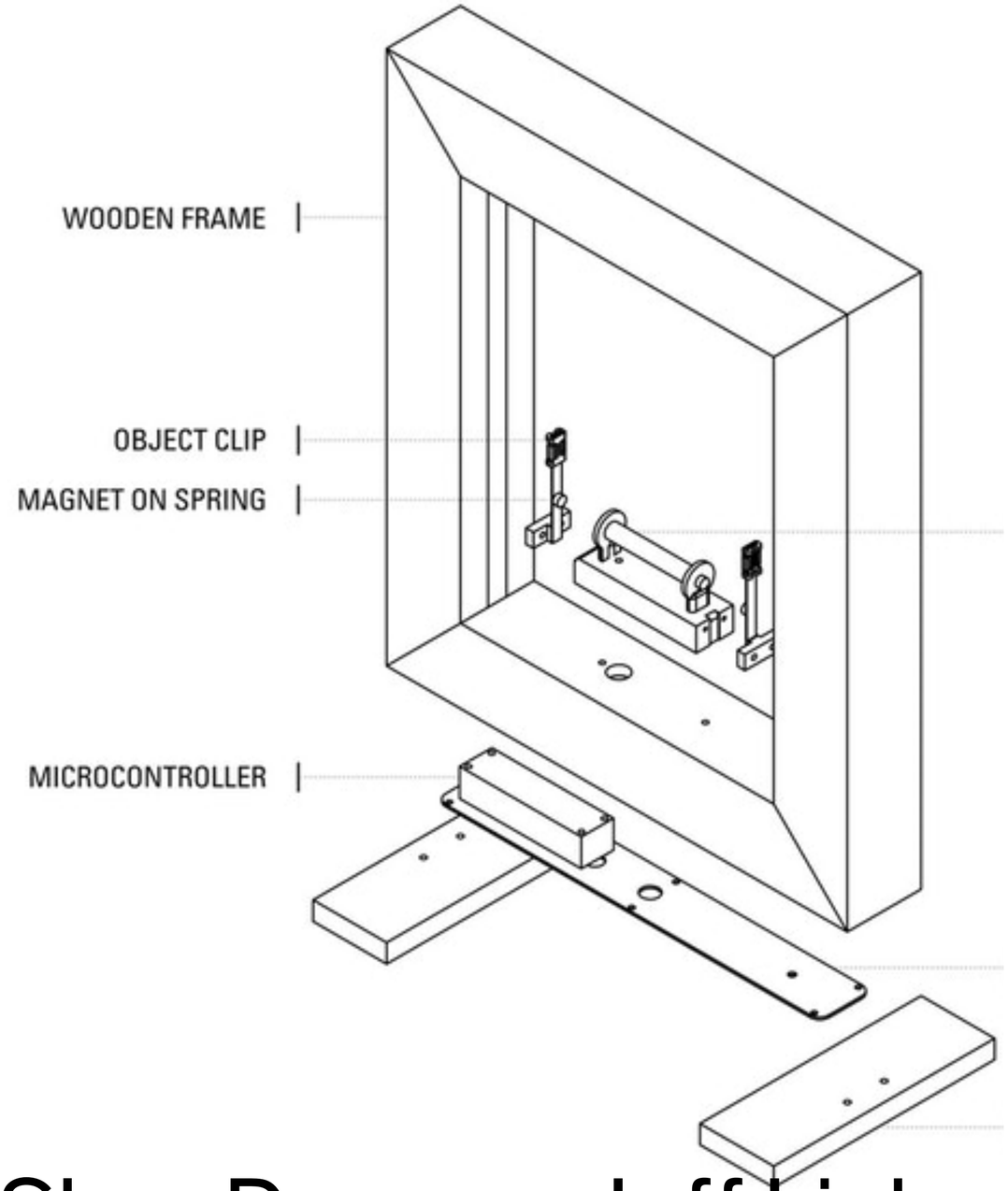
Prosthetic Photographer

Prosthetic Photographer

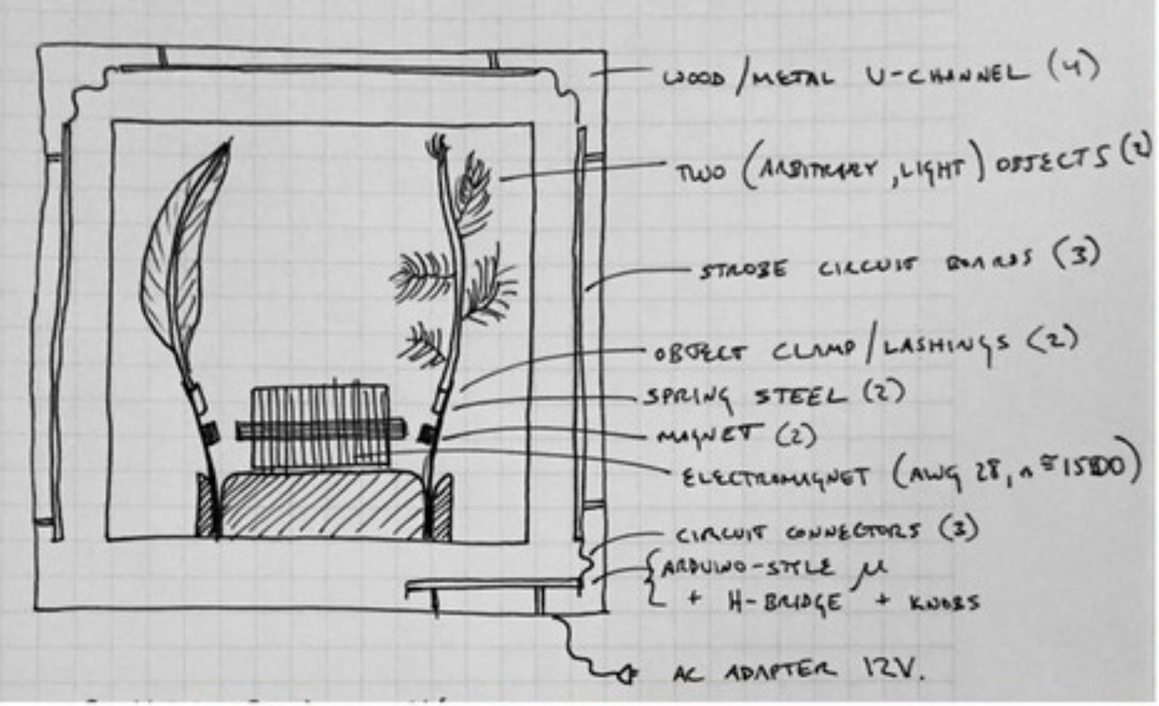
Zeit

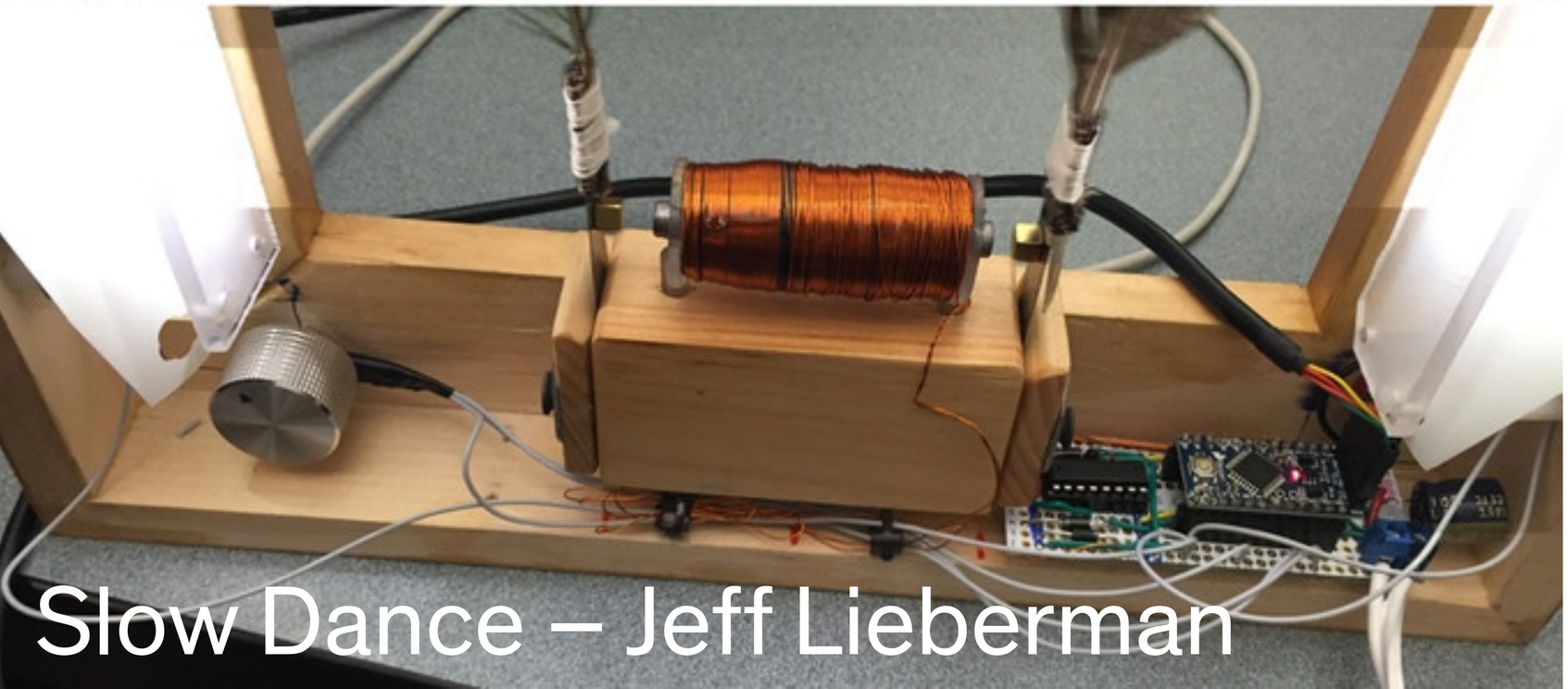
A Million Times – Humans since 1982

Slow Dance – Jeff Lieberman



Slow Dance – Jeff Lieberman



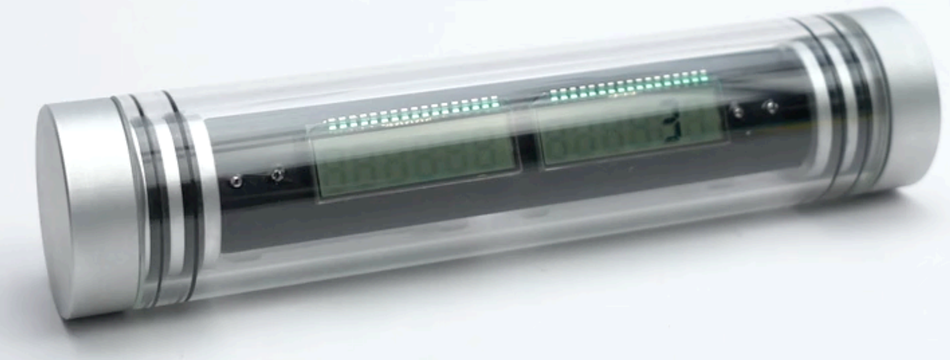


Slow Dance – Jeff Lieberman

Time Since Launch.

Time Since – CW+T

Time Since – CW+T



Bringt 3 Ideenskizzen zum Thema "Zeit" mit

*** Individualgespräche**

– "Abstract" (bis zu 500 Zeichen)
– Referenzen
– 2D/3D Skizze (Visualisierung)
– Welche Bauteile würdet ihr gerne wie einsetzen?

– Je 1 × A4 Papier pro Ideenskizze

Aufgabe 5 – Bis 06.12.2019

– Beschränkt eure Auswahl auf jeweils eine Eingabe und eine Ausgabe
– Bedient euch auch an bestehenden Dingen und "hackt" sie

Aufgabe 5 – Bis 06.12.2019

Fragen?