

LAMPIRAN

A. Lampiran 1

KOMITE ETIK PENELITIAN KESEHATAN
HEALTH RESEARCH ETHICS COMMITTEE
POLTEKKES TANJUNGPINANG

KETERANGAN LAYAK ETIK
DESCRIPTION OF ETHICAL EXEMPTION
"ETHICAL EXEMPTION"

No.149/KEPK-TJK/VI/2021

Protokol penelitian yang diusulkan oleh :
The research protocol proposed by

Peneliti utama : Shinta Widyawati
Principal In Investigator

Nama Institusi : Politeknik Kesehatan Tanjungpinang
Name of the Institution

Dengan judul:
Title

**"PROTOTYPE SISTEM MONITORING KARBON MONOKSIDA (CO) DAN DEBU BERBASIS
(Internet of Things) IoT"**

*"PROTOTYPE OF CARBON MONOXIDE AND DUST MONITORING SYSTEM BASED ON INTERNET
OF THINGS (IoT)"*

Dinyatakan layak etik sesuai 7 (tujuh) Standar WHO 2011, yaitu 1) Nilai Sosial, 2) Nilai Ilmiah, 3) Pemerataan Beban dan Manfaat, 4) Risiko, 5) Bujukan/Eksploitasi, 6) Kerahasiaan dan Privacy, dan 7) Persetujuan Setelah Penjelasan, yang merujuk pada Pedoman CIOMS 2016. Hal ini seperti yang ditunjukkan oleh terpenuhinya indikator setiap standar.

Declared to be ethically appropriate in accordance to 7 (seven) WHO 2011 Standards, 1) Social Values, 2) Scientific Values, 3) Equitable Assessment and Benefits, 4) Risks, 5) Persuasion/Exploitation, 6) Confidentiality and Privacy, and 7) Informed Consent, referring to the 2016 CIOMS Guidelines. This is as indicated by the fulfillment of the indicators of each standard.

Pernyataan Laik Etik ini berlaku selama kurun waktu tanggal 14 Juni 2021 sampai dengan tanggal 14 Juni 2022.

This declaration of ethics applies during the period June 14, 2021 until June 14, 2022.

June 14, 2021
Professor and Chairperson,



Dr. Aprina, S.Kp., M.Kes

B. Lampiran 2



KEMENTERIAN KESEHATAN REPUBLIK INDONESIA
BADAN PENGEMBANGAN DAN PEMBERDAYAAN
SUMBER DAYA MANUSIA KESEHATAN
POLITEKNIK KESEHATAN TANGJUNG KARANG

Jalan Soekarno - Hatta No. 6 Bandar Lampung
Telp : 0721 - 783 852 Faksimile : 0721 - 773 918

Website : <http://poltekkes-tjk.ac.id> E-mail : direktorat@poltekkes-tjk.c.id



15 Maret 2021

Nomor : PP.03.01/I.1/1482/2021
Lampiran : Eks
Hal : Izin Penelitian

Yang terhormat:
Kepala Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kota Bandar Lampung
Di -
Tempat

Sehubungan dengan penyusunan Laporan Skripsi bagi mahasiswa Program Studi Sanitasi Lingkungan Program Sarjana Terapan Jurusan Kesehatan Lingkungan Politeknik Kesehatan Kementerian Kesehatan Tanjung Karang Tahun Akademik 2020/2021, maka kami mengharapkan dapat diberikan izin kepada mahasiswa kami untuk dapat melakukan penelitian di Institusi yang Bapak/Ibu pimpin. Adapun nama mahasiswa yang akan melakukan penelitian adalah sebagai berikut:

NAMA	JUDUL PENELITIAN	TEMPAT PENELITIAN
Shinta Widyawati NIM: 1713351044	Prototype sistem monitoring karbon monoksida (CO) dan debu berbasis (internet of Things) IoT	Dinas Lingkungan Hidup Kota Bandar Lampung

Atas perhatian dan kerjasamanya diucapkan terima kasih.



Tembusan :

1. Ka. Jurusan Kesehatan Lingkungan
2. Kepala Dinas Lingkungan Hidup Kota Bandar Lampung



**KEMENTERIAN KESEHATAN REPUBLIK INDONESIA
BADAN PENGEMBANGAN DAN PEMBERDAYAAN
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15 Maret 2021

Nomor : PP.03. 01 / I. 1 / 1461 /2021
Lampiran : Eks
Hal : Izin Penelitian

Yang terhormat:

Ketua Jurusan Kesehatan Lingkungan Poltekkes Kemenkes Tanjung Karang

Di -

Tempat

Sehubungan dengan penyusunan Laporan Skripsi bagi mahasiswa Program Studi Sanitasi Lingkungan Program Sarjana Terapan Jurusan Kesehatan Lingkungan Politeknik Kesehatan Kementerian Kesehatan Tanjung Karang Tahun Akademik 2020/2021, maka kami mengharapkan dapat diberikan izin kepada mahasiswa kami untuk dapat melakukan penelitian di Institusi yang Bapak/Ibu pimpin. Adapun nama mahasiswa yang akan melakukan penelitian adalah sebagai berikut (terlampir):

Atas perhatian dan kerjasamanya diucapkan terima kasih.



DIREKTUR,

WARJIDIN ALIYANTO, SKM, M.Kes

NIP. 196401281985021001

Lampiran : Izin Penelitian
Nomor : PP.03.01/I.1/ /2021
Tanggal : 15 Maret 2021

DAFTAR NAMA MAHASISWA

NO.	NAMA/NIM	JUDUL PENELITIAN	TEMPAT PENELITIAN
1.	Mega Sintya NIM: 1713351012	Pengaruh karbon aktif dan zeolit terhadap penurunan salinitas, TDS, dan pH pada air payau	Laboratorium Jurusan Kesehatan Lingkungan Poltekkes Kemenkes Tanjungkarang
2.	Linda Anggraini NIM: 1713351018	Evaluasi IPAL di RSUD dr.A.Dadi Tjokrodipo	
3.	Qori Nur Annisa NIM: 1713351029	Pengaruh penggunaan metode filtrasi sederhana dalam meningkatkan kualitas air hujan sebagai sumber minum	
4.	Shinta Widyawati NIM: 1713351044	Prototype sistem monitoring karbon monoksida (CO) dan debu berbasis (internet of Things) IoT	
5.	Dina Prihatilia NIM: 1713351024	Kemampuan serbuk biji asam jawa sebagai bahan alternatif dalam pengolahan limbah cair tahu skala rumah tangga	
6.	Mareta Nurmawati NIM: 1713351038	Efektifitas Ekstrak Daun Catnip (Nepeta Cataria) Sebagai Insektisida Nabati Terhadap Kecoak Amerika (Periplaneta Americana)	
7.	Lia Ulul Izmi NIM: 1713351003	Efektifitas ekstrak bawang putih (Allium Sativum) dalam membunuh lalat rumah (Muscadomestica)	
8.	Muhammad Gilang Ramadhan NIM: 1713351005	Hubungan perilaku pedagang dalam pencegahan Covid-19 di pasar natar lampung selatan tahun 2021	
9.	Windy Safitri NIM: 1713351002	Pemanfaatan limbah cair tahu sebagai pupuk organik cair dengan penambahan EM-4 tahun 2021	

DIREKTUR,



WARJIDIN ALFYANTO, SKM, M.Kes
NIP. 196401281985021001

C. Lampiran 3



PEMERINTAH KOTA BANDAR LAMPUNG DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU

Jalan Dr. Susilo Nomor 2 Bandar Lampung, Telepon (0721) 476362
Faksimile (0721) 476362 Website: www.dpmptsp.bandarlampungkota.go.id
Pos-el: sekretariat@dpmptsp.bandarlampungkota.go.id

SURAT KETERANGAN PENELITIAN (SKP) Nomor : 1871/070/00291/SKP/III.16/IV/2021

Berdasarkan Peraturan Menteri Dalam Negeri Republik Indonesia Nomor 03 Tahun 2018 tentang Penerbitan Surat Keterangan Penelitian dan Rekomendasi dari Kepala Badan Kesatuan Bangsa Dan Politik Kota Bandar Lampung Nomor 070/042/IV.05/2021 Tanggal 19 APRIL 2021, yang bertandatangan dibawah ini Kepala Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kota Bandar Lampung memberikan Surat Keterangan Penelitian (SKP) kepada :

1. Nama : SHINTA WIDYAWATI
2. Alamat : JL. HI. AGUS SALIM GG. AMAL 003/000 KEL./DESA KELAPA TIGA KEC. TANJUNG KARANG PUSAT KAB/KOTA KOTA BANDAR LAMPUNG PROV.
3. Judul Penelitian : PROTOTYPE SISTEM MONITORING KARBON MONOKSIDA (CO) DAN DEBU BERBASIS (INTERNET OF THINGS) IoT
4. Tujuan Penelitian : UNTUK MEMBUAT RANCANG BANGUN ALAT DETEKSI KADAR CO DAN DEBU BERBASIS IoT
5. Lokasi Penelitian : PADA DINAS LINGKUNGAN HIDUP KOTA BANDAR LAMPUNG
6. Tanggal dan/atau lamanya penelitian : 12 APRIL 2021
7. Bidang Penelitian : SANITASI LINGKUNGAN
8. Status Penelitian : -
9. Nama Penanggung Jawab atau Koordinator : WARIJIDIN ALIYANTO, SKM., M. Kes.
10. Anggota Penelitian : SHINTA WIDYAWATI
11. Nama Badan Hukum, Lembaga dan Organisasi : POLITEKNIK KESEHATAN TANJUNGPURBA

Dengan Ketentuan sebagai berikut :

1. Pelaksanaan Penelitian tidak disalahgunakan untuk tujuan tertentu yang dapat mengganggu stabilitas pemerintah.
2. Setelah Penelitian selesai, agar menyerahkan hasilnya kepada Badan Kesatuan Bangsa Dan Politik (BAKESBANGPOL) Kota Bandar Lampung.
3. Surat Keterangan Penelitian ini berlaku selama 1 (satu) tahun sejak tanggal ditetapkan.



Ditetapkan di : Bandar Lampung
pada tanggal : 22 April 2021

Kepala Dinas,



Drs. A. Fachruddin, M.M.
NIP 19670205 198712 1 002

Tembusan :

1. BAKESBANGPOL Kota
2. Bappeda Kota Bandar Lampung

Data Monitoring AQMS

[illegible]



TARGET
Kata
Status
Parameter

1 Juni 2011
Berdasarkan
Berkas Lampung
CD

LAPORAN BULANAN PER PARAMETER
Data Monitoring di Stasiun Pemantau

Batu
lambang

Waktu	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
01:00:00	29	288	1562	232	794	3	9	2	180	1541	177	173	2193	2890	2113														
02:00:00	49	115	1284	117	155	1	2		46	1112	84	2096	2014	1601															
03:00:00	89	206	1345	215	74	1			64	1262	4	1592	1743	1721															
04:00:00	142	159	1520	121	43				279	1214	91	1848	1762	1796															
05:00:00	4	442	1520	121	43				13	1219		1811	621	1348															
06:00:00	2	21	1447	294	34				31	2400		1750	439	1244															
07:00:00	2	13	1211	122	29				31	2713		1474	534	1112															
08:00:00	3	28	444	199	7				3	2449	2221	1107	449	745															
09:00:00	9	35	146	71	7				46	281	197	1518	411	612															
10:00:00	4	34	154	7	4				297	503	1027	1451	918	647															
11:00:00	49	71	229	7	4				644	407	2524	9	2046	1426	745														
12:00:00	17	135	110	71	23				1645	184	2061	9	2123	1549	1000														
13:00:00	21	1479	247	461	53				1	1111	221	2198	9	1316	1034	440													
14:00:00	79	1479	247	461	53				1	1111	221	2198	9	1316	1034	440													
15:00:00	8	44	1518	1271	501				78	481	225	1754	31	644	742	514													
16:00:00	3	71	1714	1518	1271	501			8	362	1272	1102	1042	20	412	994	611												
17:00:00	19	447	214	1546	14				4	11	93	8	644	3	182	441	300												
18:00:00	105	179	150	431	1				1	101	3	5	2	4	108	3	181	249	101										
19:00:00	34	144	141	316					8	2	4	108	3	181	249	101													
20:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
21:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
22:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
23:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
24:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
25:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
26:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
27:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
28:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
29:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
30:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
31:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
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36:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
37:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
38:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
39:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
40:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
41:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
42:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
43:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
44:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
45:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
46:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
47:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
48:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
49:00:00	14	144	141	316					8	2	4	108	3	181	249	101													
50:00:00	14	144	141	316					8	2	4	108	3	181	249	101													

E. Lampiran 5

Hasil Pengujian Akurasi Sensor Debu PM2,5

Jum'at, 11 Juni 2021			
Waktu	Data	Data AQMS	% Perbedaan
09.00	18,875	19	-0,66
09.30	20,375	20	1,88
10.00	37,75	39	-3,21
10.30	25,625	24	6,77
11.00	26,5	26	1,92
11.30	28,75	28	2,68
12.00	34,5	32	7,81
12.30	24,75	25	-1,00
13.00	16,25	16	1,56
13.30	18,75	19	-1,32
14.00	13,75	13	5,77
14.30	11,25	11	2,27
Rata-Rata	23,09	22,67	2,04

Sabtu, 12 Juni 2021			
Waktu	Data	Data AQMS	% Perbedaan
09.00	9,50	9	5,56
09.30	11,75	12	-2,08
10.00	15,00	14	7,14
10.30	25,38	25	1,50
11.00	32,38	33	-1,89
11.30	37,63	39	-3,53
12.00	39,63	40	-0,94
12.30	46,38	47	-1,33
13.00	32,50	33	-1,52
13.30	29,88	31	-3,63
14.00	26,75	26	2,88
14.30	18,75	21	-10,71
Rata-Rata	27,13	27,50	-0,71

Minggu, 13 Juni 2021			
Waktu	Data	Data AQMS	% Perbedaan
09.00	16,50	16	3,13
09.30	13,63	15	-9,17
10.00	18,13	19	-4,61
10.30	18,75	19	-1,32
11.00	18,63	19	-1,97

11.30	21,13	22	-3,98
12.00	19,75	19	3,95
12.30	20,38	22	-7,39
13.00	16,25	17	-4,41
13.30	14,88	14	6,25
14.00	15,25	16	-4,69
14.30	14,75	14	5,36
Rata-rata	17,33	17,67	-1,57

F. Lampiran 6

Hasil Pengujian Akurasi Sensor Karbon Monoksida (CO)

Jum'at, 11 Juni 2021			
Waktu	Data	Data AQMS	% Perbedaan
09.00	190,25	1042	-81,74
09.30	167,75	644	-73,95
10.00	182	501	-63,67
10.30	179	108	65,74
11.00	192,875	78	147,28
11.30	179,25	146	22,77
12.00	197	166	18,67
12.30	202,625	140	44,73
13.00	189,125	41	361,28
13.30	187,25	25	649,00
14.00	187,625	14	1240,18
14.30	186,7955	1	18579,55
Rata-Rata	186,80	242,17	1742,49

Sabtu, 12 Juni 2021			
Waktu	Data	Data AQMS	% Perbedaan
09.00	182,00	20	810,00
09.30	192,25	5	3745,00
10.00	183,25	3	6008,33
10.30	192,88	5	3757,50
11.00	198,75	12	1556,25
11.30	190,25	20	851,25
12.00	184,75	22	739,77
12.30	194,50	19	923,68
13.00	192,88	25	671,50
13.30	198,75	25	695,00
14.00	204,25	29	604,31
14.30	192,23	24	700,95
Rata-Rata	192,23	17,42	1755,30

Minggu, 13 Juni 2021			
Waktu	Data	Data AQMS	% Perbedaan
09.00	192,25	412	-53,34
09.30	199,38	282	-29,30
10.00	191,63	181	5,87
10.30	182,25	127	43,50
11.00	198,88	131	51,81
11.30	200,13	226	-11,45
12.00	198,38	171	16,01
12.30	201,50	170	18,53
13.00	199,88	108	85,07
13.30	204,00	45	353,33
14.00	196,38	22	792,61
14.30	196,78	27	628,83
Rata-rata	196,78	158,50	158,46

G. Lampiran 7

Dokumentasi Penelitian

	
Proses menyolder mikrokontroler ESP 32 di PCB IC	Proses menyolder sensor di PCB IC
	
Proses menyolder LCD dengan kabel jumper	Proses menyolder LCD dengan kabel jumper

	
Proses menyatukan semua komponen ke dalam kotak hitam	Proses menyatukan semua komponen ke dalam kotak hitam
	
Semua komponen sudah terpasang	Alat selesai dirakit
	
Proses dokumentasi alat dan bahan	Proses pengujian akurasi alat

H. Lampiran 8

SOP Prototype

Menyalakan Mesin:

1. Letakkan mesin pada tempat yang ingin di cek kadar udaranya dengan syarat mesin tidak basah atau terendam air.
2. Posisikan tombol power ke posisi "ON".
3. Tunggu beberapa saat hingga proses 'starting' selesai.
4. Kadar CO dan PM2,5 tertera di layar

Pengaturan Waktu Sampling dan Data Longger

1. Hidupkan mesin sesuai protocol no.1 sampai no.3
2. Tekan tombol "A".
3. Tekan tombol D/enter
4. Kemudian pilih menu no.1 dengan menekan tombol "1".

5. Kemudian masukkan nilai waktu dengan mengetikkan 4 angka (tertampil di layar, hitungan waktu dalam detik), contoh jika waktu sampling dan data logger ingin disave setiap 5 menit maka masukkan nilai '0300')
6. Lalu tekan tombol D/enter
(data akan di save setiap 300 detik atau 5 menit dengan jumlah rata-rata dari sampel per 10 detik).

I. Lampiran 9

Hasil Uji Spss

Group Statistics

GRUPING	N	Mean	Std. Deviation	Std. Error Mean
PM2.5 Prototype	36	22,51903	8,996450	1,499408
AQMS	36	22,61111	9,150419	1,525070

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means	
	F	Sig.	t	df
PM2.5 Equal variances assumed	,006	,939	-,043	70
Equal variances not assumed			-,043	69,980

Independent Samples Test

	t-test for Equality of Means			
	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
				Lower
PM2.5 Equal variances assumed	,966	-,092083	2,138706	-4,357598
Equal variances not assumed	,966	-,092083	2,138706	-4,357619

Independent Samples Test

		t-test for Equality of Means
		95% Confidence Interval of the Difference
		Upper
PM2.5	Equal variances assumed	4,173431
	Equal variances not assumed	4,173453

Group Statistics

GRUPING1		N	Mean	Std. Deviation	Std. Error Mean
CO	Prototype	36	191,936819	8,2145933	1,3690989
	AQMS	36	139,361111	212,8045586	35,4674264

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
CO	Equal variances assumed	21,720	,000	1,481	70
	Equal variances not assumed			1,481	35,104

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
					Lower
CO	Equal variances assumed	,143	52,5757083	35,4938413	-18,2145260

Equal variances not assumed	,147	52,5757083	35,4938413	-19,4729676
-----------------------------	------	------------	------------	-------------

Independent Samples Test

		t-test for Equality of Means
		95% Confidence Interval of the Difference
		Upper
CO	Equal variances assumed	123,3659426
	Equal variances not assumed	124,6243842

J. Lampiran 10

Datasheet Mikrokontroler ESP 32

Advanced Peripheral Interfaces

- 34 × programmable GPIOs
- 12-bit SAR ADC up to 18 channels
- 2 × 8-bit DAC
- 10 × touch sensors
- 4×SPI
- 2×I²S
- 2×I²C
- 3 × UART
- 1 host (SD/eMMC/SDIO)
- 1 slave (SDIO/SPI)
- Ethernet MAC interface with dedicated DMA and IEEE 1588 support
- CAN 2.0
- IR (TX/RX)
- Motor PWM
- LED PWM up to 16 channels
- Hall sensor

Blok Diagram

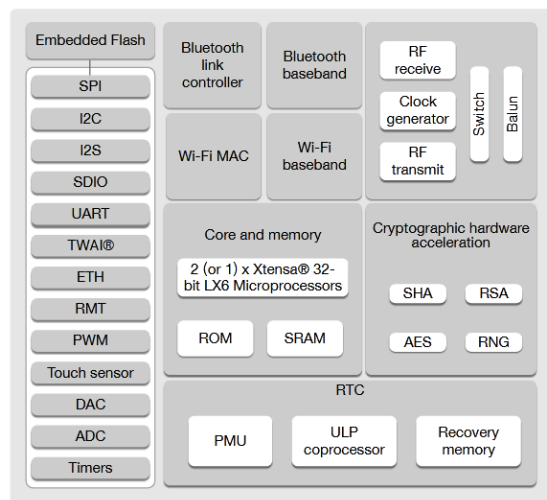


Figure 1: Functional Block Diagram

Pin Layout

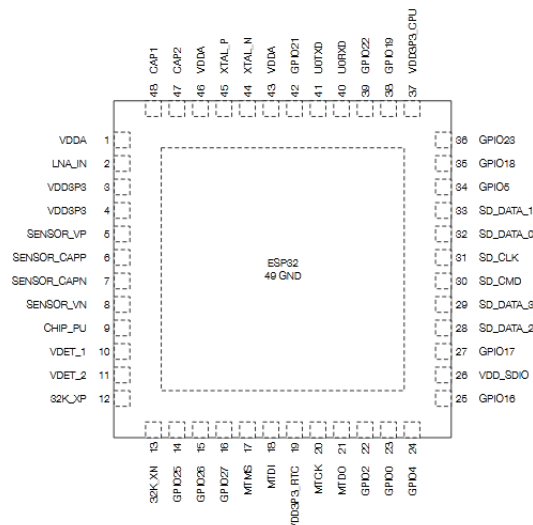


Figure 2: ESP32 Pin Layout (QFN 6*6, Top View)

Name	No.	Type	Function
GPIO2	22	I/O	GPIO2, ADC2_CH2, RTC_GPIO12, TOUCH2, HSPIWP, HS2_DATA0, SD_DATA0
GPIO0	23	I/O	GPIO0, ADC2_CH1, RTC_GPIO11, TOUCH1, EMAC_TX_CLK, CLK_OUT1,
GPIO4	24	I/O	GPIO4, ADC2_CH0, RTC_GPIO10, TOUCH0, EMAC_TX_ER, HSPIHD, HS2_DATA1, SD_DATA1
VDD_SDIO			
GPIO16	25	I/O	GPIO16, HS1_DATA4, U2RXD, EMAC_CLK_OUT
VDD_SDIO	26	P	Output power supply: 1.8 V or the same voltage as VDD3P3_RTC
GPIO17	27	I/O	GPIO17, HS1_DATA5, U2TXD, EMAC_CLK_OUT_180
SD_DATA_2	28	I/O	GPIO9, HS1_DATA2, U1RXD, SD_DATA2, SPIHD
SD_DATA_3	29	I/O	GPIO10, HS1_DATA3, U1TXD, SD_DATA3, SPIWP
SD_CMD	30	I/O	GPIO11, HS1_CMD, U1RTS, SD_CMD, SPICS0
SD_CLK	31	I/O	GPIO6, HS1_CLK, U1CTS, SD_CLK, SPICLK
SD_DATA_0	32	I/O	GPIO7, HS1_DATA0, U2RTS, SD_DATA0, SPIQ
SD_DATA_1	33	I/O	GPIO8, HS1_DATA1, U2CTS, SD_DATA1, SPID
VDD3P3_CPU			
GPIO5	34	I/O	GPIO5, HS1_DATA6, VSPICS0, EMAC_RX_CLK
GPIO18	35	I/O	GPIO18, HS1_DATA7, VSPICLK
GPIO23	36	I/O	GPIO23, HS1_STROBE, VSPID
VDD3P3_CPU	37	P	Input power supply for CPU IO (1.8 V ~ 3.6 V)
GPIO19	38	I/O	GPIO19, U0CTS, VSPIQ, EMAC_TXD0
GPIO22	39	I/O	GPIO22, U0RTS, VSPIWP, EMAC_TXD1
U0RXD	40	I/O	GPIO3, U0RXD, CLK_OUT2
U0TXD	41	I/O	GPIO1, U0TXD, CLK_OUT3, EMAC_RXD2
GPIO21	42	I/O	GPIO21, VSPIHD, EMAC_TX_EN
Analog			
VDDA	43	P	Analog power supply (2.3 V ~ 3.6 V)
XTAL_N	44	O	External crystal output
XTAL_P	45	I	External crystal input
VDDA	46	P	Analog power supply (2.3 V ~ 3.6 V)
CAP2	47	I	Connects to a 3.3 nF (10%) capacitor and 20 k Ω resistor in parallel to CAP1

Name	No.	Type	Function
CAP1	48	I	Connects to a 10 nF series capacitor to ground
GND	49	P	Ground

Power Scheme

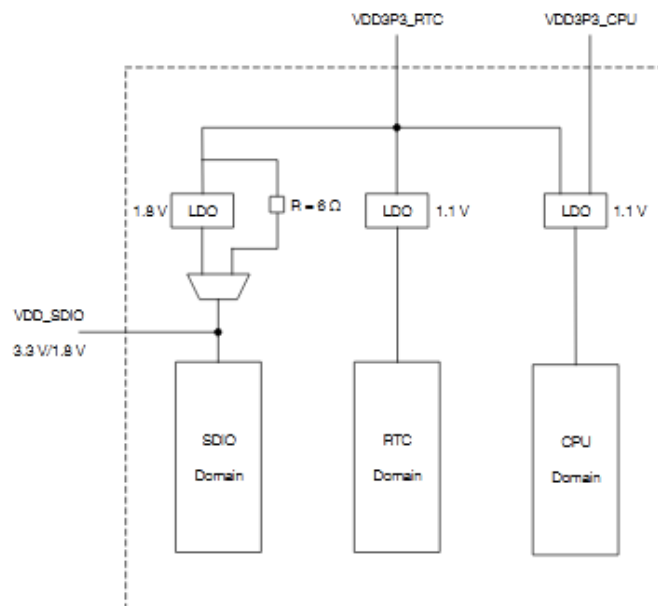


Figure 4: ESP32 Power Scheme

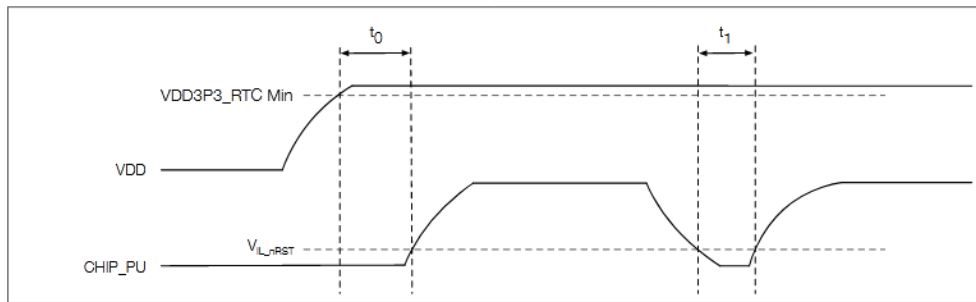


Figure 5: ESP32 Power-up and Reset Timing

Table 2: Description of ESP32 Power-up and Reset Timing Parameters

Parameters	Description	Min.	Unit
t_0	Time between the 3.3 V rails being brought up and CHIP_PU being activated	50	μs
t_1	Duration of CHIP_PU signal level < V_{IL_nRST} (refer to its value in Table 13 DC Characteristics) to reset the chip	50	μs

Table 3: Strapping Pins

Voltage of Internal LDO (VDD_SDIO)					
Pin	Default	3.3 V	1.8 V		
MTDI	Pull-down	0	1		
Bootling Mode					
Pin	Default	SPI Boot	Download Boot		
GPIO0	Pull-up	1	0		
GPIO2	Pull-down	Don't-care	0		
Enabling/Disabling Debugging Log Print over U0TXD During Bootling					
Pin	Default	U0TXD Active	U0TXD Silent		
MTDO	Pull-up	1	0		
Timing of SDIO Slave					
Pin	Default	FE Sampling FE Output	FE Sampling RE Output	RE Sampling FE Output	RE Sampling RE Output
MTDO	Pull-up	0	0	1	1
GPIO5	Pull-up	0	1	0	1

Table 4: Power Consumption by Power Modes

Power mode	Description			Power consumption
Active (RF working)	Wi-Fi Tx packet			Please refer to Table 15 for details.
	Wi-Fi/BT Tx packet			
	Wi-Fi/BT Rx and listening			
Modem-sleep	The CPU is powered on.	240 MHz [*]	Dual-core chip(s)	30 mA ~ 68 mA
			Single-core chip(s)	N/A
		160 MHz [*]	Dual-core chip(s)	27 mA ~ 44 mA
			Single-core chip(s)	27 mA ~ 34 mA

Power mode	Description			Power consumption
		Normal speed: 80 MHz	Dual-core chip(s)	20 mA ~ 31 mA
			Single-core chip(s)	20 mA ~ 25 mA
Light-sleep	-			0.8 mA
Deep-sleep	The ULP co-processor is powered on.			150 μA
	ULP sensor-monitored pattern			100 μA @1% duty
	RTC timer + RTC memory			10 μA
Hibernation	RTC timer only			5 μA
Power off	CHIP_PU is set to low level, the chip is powered off.			1 μA

Electrical Characteristics

Table 5: Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
VDDA, VDD3P3, VDD3P3_RTC, VDD3P3_CPU, VDD_SDIO	Voltage applied to power supply pins per power domain	-0.3	3.6	V
I_{output}^*	Cumulative IO output current	-	1200	mA
T_{store}	Storage temperature	-40	150	°C

Table 6: Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VDDA, VDD3P3_RTC, ^{note 1} VDD3P3, VDD_SDIO (3.3 V mode) ^{note 2}	Voltage applied to power supply pins per power domain	2.3/3.0 ^{note 3}	3.3	3.6	V
VDD3P3_CPU	Voltage applied to power supply pin	1.8	3.3	3.6	V
I_{VDD}	Current delivered by external power supply	0.5	-	-	A
T ^{note 4}	Operating temperature	-40	-	125	°C

Table 7: DC Characteristics (3.3 V, 25 °C)

Symbol	Parameter		Min	Typ	Max	Unit
C_{IN}	Pin capacitance		-	2	-	pF
V_{IH}	High-level input voltage		$0.75 \times VDD^1$	-	$VDD^1 + 0.3$	V
V_{IL}	Low-level input voltage		-0.3	-	$0.25 \times VDD^1$	V
I_{IH}	High-level input current		-	-	50	nA
I_{IL}	Low-level input current		-	-	50	nA
V_{OH}	High-level output voltage		$0.8 \times VDD^1$	-	-	V
V_{OL}	Low-level output voltage		-	-	$0.1 \times VDD^1$	V
I_{OH}	High-level source current ($VDD^1 = 3.3$ V, $V_{OH} \geq 2.64$ V, output drive strength set to the maximum)	VDD3P3_CPU power domain ^{1, 2}	-	40	-	mA
		VDD3P3_RTC power domain ^{1, 2}	-	40	-	mA
		VDD_SDIO power domain ^{1, 3}	-	20	-	mA
I_{OL}	Low-level sink current ($VDD^1 = 3.3$ V, $V_{OL} = 0.495$ V, output drive strength set to the maximum)		-	28	-	mA
R_{PU}	Resistance of internal pull-up resistor		-	45	-	k Ω
R_{PD}	Resistance of internal pull-down resistor		-	45	-	k Ω
V_{IL_nRST}	Low-level input voltage of CHIP_PU to power off the chip		-	-	0.6	V

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Datasheet Sensor MQ-7

Spesification

a. Standard work condition

Symbol	Parameter name	Technical condition	Remark
V _c	circuit voltage	5V±0.1	Ac or Dc
V _H (H)	Heating voltage (high)	5V±0.1	Ac or Dc
V _H (L)	Heating voltage (low)	1.4V±0.1	Ac or Dc
R _L	Load resistance	Can adjust	
R _H	Heating resistance	33Ω±5%	Room temperature
T _H (H)	Heating time (high)	60±1 seconds	
T _H (L)	Heating time (low)	90±1 seconds	
PH	Heating consumption	About 350mW	

a. Environment conditions

Symbol	Parameters	Technical conditions	Remark
T _{ao}	Using temperature	-20°C-50°C	
T _{as}	Storage temperature	-20°C-50°C	Advice using scope
RH	Relative humidity	Less than 95%RH	
O ₂	Oxygen concentration	21%(stand condition) the oxygen concentration can affect the sensitivity characteristic	Minimum value is over 2%

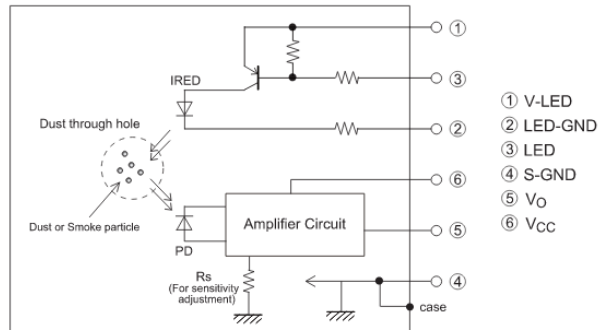
b. Sensitivity characteristic

symbol	Parameters	Technical parameters	Remark
R _s	Surface resistance	2-20k	In 100ppm Carbon Monoxide
	Of sensitive body		
a(300/100ppm)	Concentration slope rate	Less than 0.5	R _s (300ppm)/R _s (100ppm)
Standard working condition	5% Temperature -20°C±2°C relative humidity 65%± RL:10KΩ±5%		
	V _c :5V±0.1V V _H :5V±0.1V V _H :1.4V±0.1V		
Preheat time	No less than 48 hours	Detecting range: 20ppm- 2000ppm carbon monoxide	

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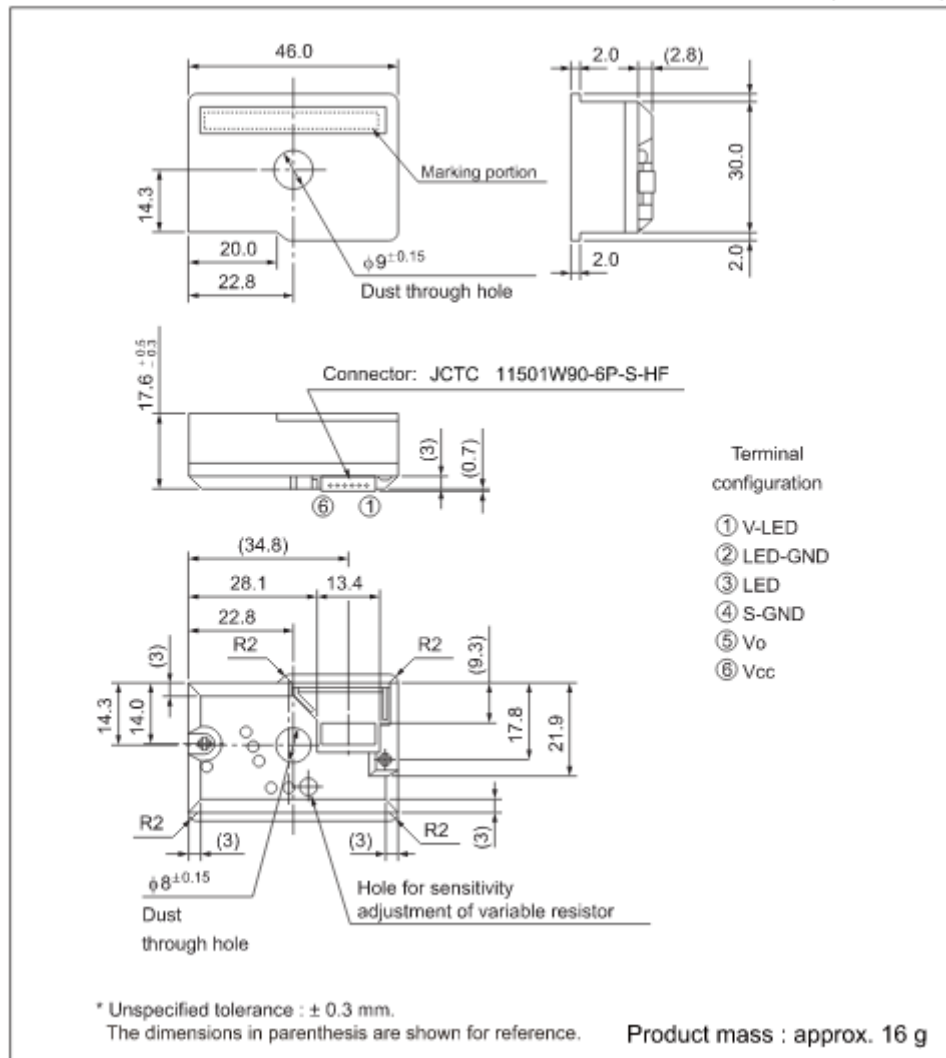
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Internal Schematic



Outline Dimensions

(Unit : mm)



Absolute Maximum Ratings

(T_a 25 C)

Parameter	Symbol	Rating	Unit
Supply voltage	V _{CC}	−0.3 to 7	V
*1 Input terminal voltage	V _{LED}	− 0.3 to V _{CC}	V
Operating temperature	T _{opr}	−10 to 65	C
Soldering temperature	T _{sol}	−20 to 80	C

*1 Open drain drive input

Electro-optical characteristics

(T_a=25°C, V_{CC}=5V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Sensitivity	K	*1 *2 *3	0.35	0.5	0.65	V/(0.1mg/m ³)
Output voltage at no dust	V _{OC}	*2 *3	0	0.9	1.5	V
Output voltage range	V _{OH}	*2 *3 R _L =4.7kΩ	3.4	—	—	V
LED terminal current	I _{LED}	*2 LED terminal voltage = 0	—	10	20	mA
Consumption current	I _{CC}	*2 R _L =∞	—	11	20	mA

*1 Sensitivity is specified by the amount of output voltage change when dust density changes by 0.1 mg/m³.

And the dust density for detection is a value of the density of cigarette (MILD SEVEN®) smoke measured by the digital dust monitor (P-5L2: manufactured by SHIBATA SCIENTIFIC TECHNOLOGY LTD.).

*2 Input condition is shown in Fig. 1

*3 Output sampling timing is shown in Fig. 2

Recommended Input Condition For LED Terminal

Parameter	Symbol	Value	Unit
Pulse Cycle	T	10 1	ms
Pulse Width	Pw	0.32 0.02	ms
Operating Supply voltage	V _{CC}	5 0.5	V

M. Lampiran13**Datasheet LCD**

Mechanical Specification			
Overall Size	84.0*44.0	Module	H2/H1
View Area	61.0*15.8	W/OB/L	5.1/9.7
Dot Sie	0.56*0.66	EL B/L	5.1/9.7
Dot Pitch	0.60*0.70	LED B/L	9.4/14.0

Bsolute Maximum Rating					
Item	Simbol	Conditions	Min	Max.	Unit
Power Supply Voltage	Vdd-Vss	-	0	7	V
LCD Driving Supply Voltage	Vdd-Vee	-	0	13	V
Input Voltage	Vin	-	-0.3	Vdd+0.3	V
Operating Temperature	Topr	Nor.	0	50	°C
Storage Temperature	Tstg	Nor.	-20	+70	°C

Electrical Characteristics (Vdd = +%V, Ta =25°C)						
Item	Symbol	Conditions	Min	Typ	Max	Unit
Logic Supply Voltage	Vdd	-	4.5	5	5	V
H Input Voltage	V _H	-	2.2	-	-	V
L Input Voltage	V _L	-	-	-	0.6	V
H Output Voltage	V _{OH}	-	2.4	-	-	V
L Output Voltage	V _{OL}	-	-	-	0.4	V
Supplyurrent C	Idd	-	2	-	-	mA
LCD Driving Voltage	V _{LCD}	Vdd-Vo	4.3	-	4.8	V

Pin Assignment					
Pin no	Symbol	Function	Pin no	Symbol	Function
1	Vss	Power supply (GND)	9	DB2	Data bus line
2	Vdd	Power supply (+5V)	10	DB3	Data bus line
3	Vo	Contrast Adjust	11	DB4	Data bus line
4	Rs	Registe select signal	12	DB5	Data bus line
5	R/W	Data read/write	13	DB6	Data bus line
6	E	Enable signal	14	DB7	Data bus line
7	DB0	Data bus line	15	A	Power supply for LED B/L (+)
8	DB1	Data bus line	16	K	Power supply for LED B/L (-)

Electrical Characteristics

Vdd = 5V±5%
Vss = 0V

Item	Symbol	Condition	Standard value			Unit	Applicable terminal
			Min.	Typ.	Max.		
Power voltage	Vdd		4.5	5.00	5.5	V	Vdd
Input H - level voltage	VIH		2.2	—	Vdd	V	RS, R/ $\overline{W}$, E DB0~DB7
Input L - level voltage	VIL		-0.3	—	0.6	V	
Output H - level voltage	VOH	- IOH = 0.205mA	2.4	—	—	V	DB0~DB7
Output L - level voltage	VOL	IOL = 1.2mA	—	—	0.4	V	
I/O leakage current	IIL	Vin = 0~Vdd	-1	—	1.0	μA	RS, R/ $\overline{W}$, E DB0~DB7
Supply current	Idd	Vdd = 5V	2	—	—	mA	Vdd
LCD operating voltage	VLCD	Vdd—V0	3.0	—	11.0	V	V0

Timing Characteristics

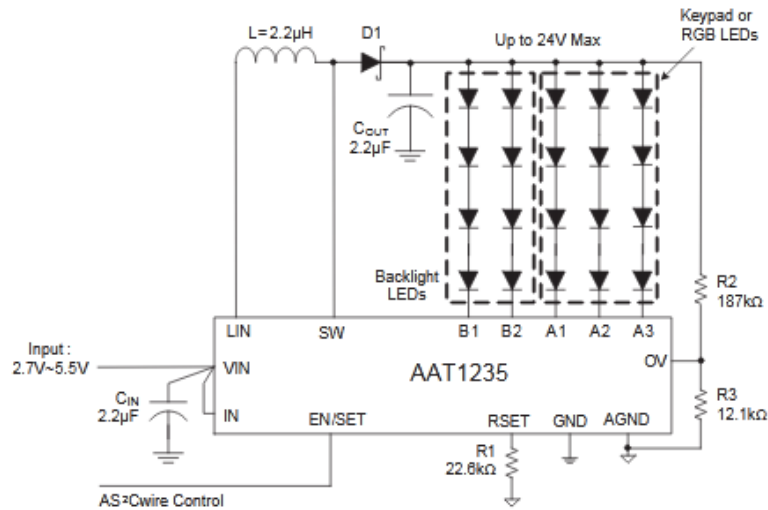
Vdd = 5V±5%
Vss = 0V

Item		Symbol	Min.	Max.	Unit
Enable cycle time		TCYCE	500	—	ns
Enable pulse width	"High" level	PWEH	220	—	ns
Enable rise / fall time		TER, TEF	—	25	ns
Set-up time	RS, R/ $\overline{W}$, E	TAS	40	—	ns
Address hold time		TAH	10	—	ns
Data set-up time		TDSH	60	—	ns
Data delay time		TDDR	60	120	ns
Data hold time (writing)		TH	10	—	ns
Data hold time (reading)		TDHR	20	—	ns
Clock oscillating frequency		TOSC	270(TYP.)		KHz

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Datasheet Keypad

Typical Application

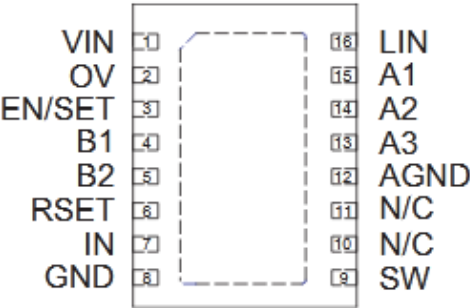


Pin Description

Pin #	Symbol	Function
1	VIN	Input supply for the converter. Connect a 2.2µF or larger ceramic capacitor from VIN to GND.
2	OV	Boost output over voltage detect pin. Use resistor divider to set the circuit's external over-voltage protection. See Applications Information for details.
3	EN/SET	AS ² Cwire control or enable pin.
4	B1	Backlight current sink 1. Connect the cathode of the last LED in the string to B1.
5	B2	Backlight current sink 2. Connect the cathode of the last LED in the string to B2.
6	RSET	LED current set resistor. A 22.6kΩ resistor from RSET to AGND sets the maximum LED current in A1-A3 and B1-B2 to 20mA.
7	IN	Input bias supply for the internal circuitry. Connect IN to VIN directly at the AAT1235.
8	GND	Ground for the boost converter. Connect GND to AGND at a single point as close to the AAT1235 as practical.
9	SW	Boost converter switching node. A 2.2µH inductor, connected between SW and LIN, sets the boost converter's switching frequency.
10, 11	N/C	Not connected.
12	AGND	Ground pin. Connect AGND to GND at a single point as close to the AAT1235 as practical.
13	A3	Auxiliary current sink 3. Connect the cathode of the last LED in the string to A3.
14	A2	Auxiliary current sink 2. Connect the cathode of the last LED in the string to A2.
15	A1	Auxiliary current sink 1. Connect the cathode of the last LED in the string to A1.
16	LIN	Switched power input. Connect LIN to the external power inductor.
EP		Exposed paddle (bottom) Connected internally to SW. Connect to SW or leave floating.

Pin Configuration

TDFN34-16
(Top View)



Absolute Maximum Ratings¹

T_A = 25°C unless otherwise noted.

Symbol	Description	Value	Units
V _{IN} , I _N	Input Voltage	-0.3 to 6.0	V
SW	Switching Node	28	V
EN/SET, B _x , A _x , RSET, OV, LIN	Maximum Rating	V _{IN} + 0.3	V
T _S	Storage Temperature Range	-65 to 150	°C
T _J	Operating Temperature Range	-40 to 150	°C
T _{LEAD}	Maximum Soldering Temperature (at leads, 10 sec)	300	°C

Thermal Information²

Symbol	Description	Value	Units
θ _{JA}	Thermal Resistance	50	°C/W
P _D	Maximum Power Dissipation ³	2	W