LAMPIRAN

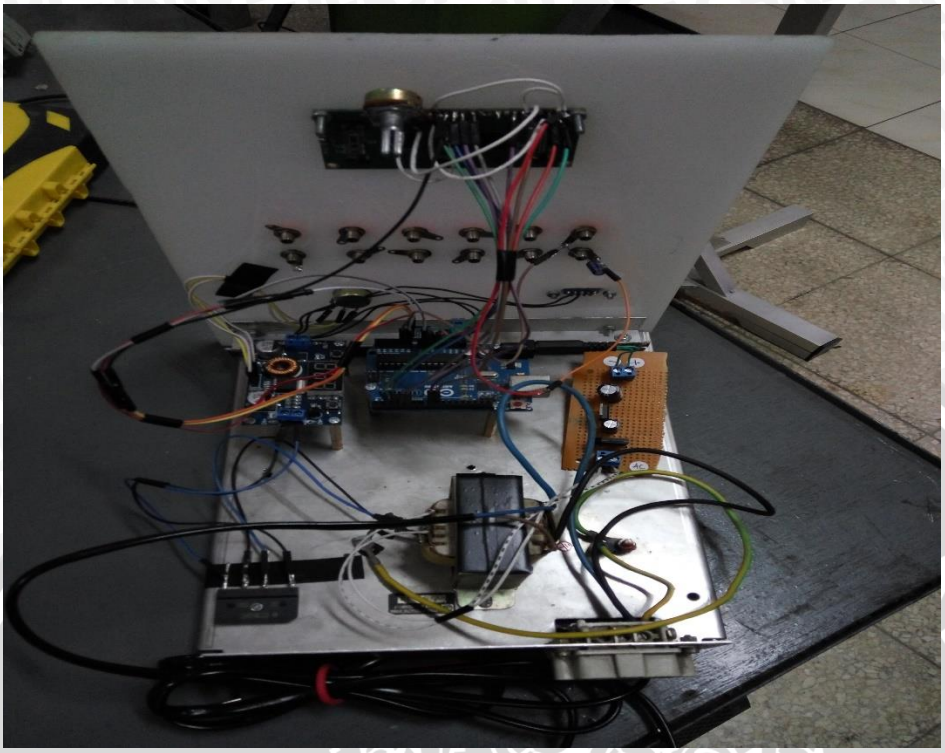
Lampiran 1

Listing program

```
// include the library code:
#include <LiquidCrystal.h>


// initialize the library with the numbers of the interface
pins
LiquidCrystal lcd(9, 8, 5, 4, 3, 2);
float potensio, V, t;
float x,tg;
int kcptn,P,n;
void setup() {
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  // Print a message to the LCD.
  lcd.print("torsi=");
   pinMode(A0,INPUT);
   pinMode(A1,INPUT);
lcd.setCursor(8 , 1);
   lcd.print("P=");
   lcd.setCursor(0 , 1);
   lcd.print("n=");
}

void loop() {
  // set the cursor to column 0, line 1
```

```
  // (note: line 1 is the second row, since counting begins
with 0):
  potensio=analogRead(A0);
  tg=analogRead(A1);
 V= (((potensio-46)/775)*18.8)+1.2;
 n=tg/418*2000;
 t= -0.453805+0.247142*(V);
 if(t<0){t=0;}

 P=t*2*3.14*(n/60);
  lcd.setCursor(10 , 1);
    lcd.print(P);
    lcd.setCursor(7 , 0);
    lcd.print(t);
    lcd.setCursor(2 , 1);
    lcd.print(n);
    delay (1000);
}
```

Lampiran 2 Gambar Alat dan Pengujian



Gambar L 2. 1 *Control unit magnetic powder brake*

Gambar L 2. 2 *Control unit magnetic powder brake* tampak depan

Gambar L 2. 3 Rangkaian LCD 16x2

Gambar L 2. 4 Proses pengujian sistem keseluruhan dari *control unit magnetic powder brake*

Gambar L 2. 5 Rangkaian pengujian *control unit magnetic powder brake*

Gambar L 2. 6 Tampilan hasil pengujian *control unit magnetic powder brake* pada LCD

Lampiran 3 *Datasheet*
Datasheet bridge dioda

DIODES INCORPORATED

DB101 - DB107

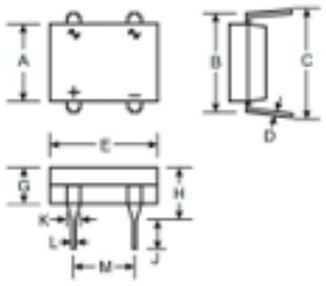
1.0A GLASS PASSIVATED BRIDGE RECTIFIER

Features

- UL Recognized Component
- Ideal for Printed Circuit Board
- Glass Passivated Chip Junctions, Surge Overload Rating of 50A Peak
- Simple, Compact Structure for Trouble-free Performance
- Plastic Package - UL Flammability Classification 94V-0

Mechanical Data

- Terminals: Tin Plated Leads Solderable per MIL-STD-202, Method 208
- Case: Transfer Molded Epoxy
- Mounting Position: Any
- Polarity: Polarity Symbols Marked on Body
- Approx. Weight: 1.0 grams



DB-1		
Dim	Min	Max
A	6.10	6.60
B	7.11	8.13
C	8.13	9.40
D	0.20	0.38
E	-	9.40
G	-	3.30
H	-	5.51
J	2.80	3.68
K	1.02	1.40
L	0.51 Typical	
M	5.15 Typical	
All Dimensions in mm		

Maximum Ratings and Electrical Characteristics @ T_A = 25°C unless otherwise specified

Characteristic	Symbol	DB 101	DB 102	DB 103	DB 104	DB 105	DB 106	DB 107	Unit
Maximum Recurrent Peak Reverse Voltage	V_{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Input Voltage	V_{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V_{DC}	50	100	200	400	600	800	1000	V
Maximum Average Rectified Output Current @ T_A = 40°C	$I_{(AV)}$	1.0							A
Peak Forward Surge Current Single Half Sine-wave Superimposed on Rated Load (JEDEC Method)	I_{FSM}	50							A
Maximum Instantaneous Forward Voltage drop per Element at I_F = 1.0A	V_F	1.1							V
Maximum Reverse DC Current at Rated DC Blocking Voltage per Element @ T_A = 25°C @ T_A = 100°C	I_R	10 1.0							µA mA
Typical Thermal Resistance (Note 1)	$R_{\theta JA}$	40							K/W
Storage and Operating Temperature Range	T_J, T_{STG}	-55 to +150							°C

Notes: 1. Thermal resistance from junction to ambient mounted on PC board with 13mm x 13mm copper pads.
2. 60 Hz resistive or inductive load.
3. For capacitive load, derate current by 20%.

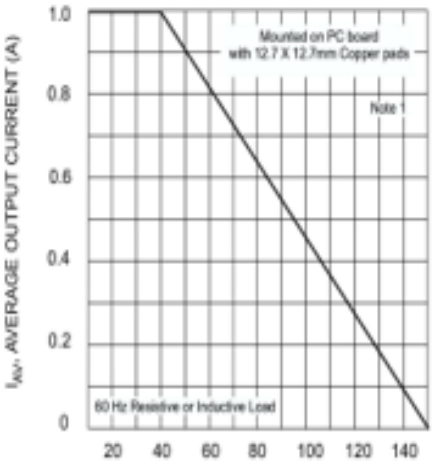


Fig. 1 Maximum Output Rectified Current

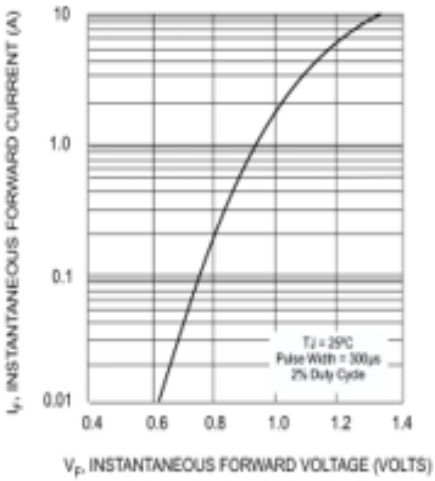


Fig. 2 Typical Forward Characteristics

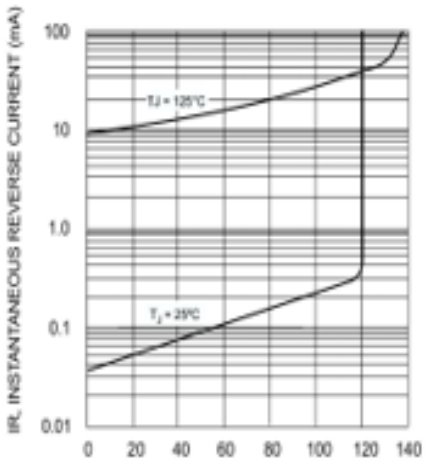


Fig. 3 Typical Reverse Characteristics

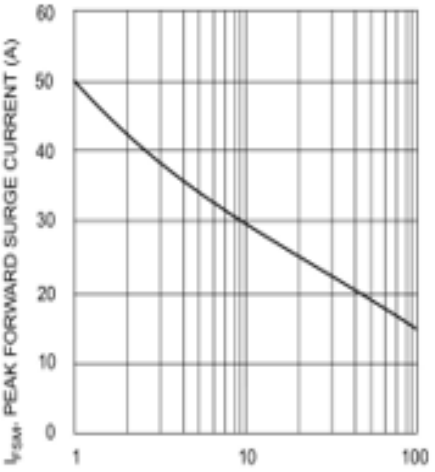


Fig. 4 Max Non-Repetitive Peak Forward Surge Current

Datasheet LM2596 (*voltage regulator DC-DC*)

LM2596 SIMPLE SWITCHER® Power Converter 150 kHz 3A Step-Down Voltage Regulator

Check for Samples: LM2596

FEATURES

- 3.3V, 5V, 12V, and Adjustable Output Versions
- Adjustable Version Output Voltage Range, 1.2V to 37V ±4% Max Over Line and Load Conditions
- Available in TO-220 and TO-263 Packages
- Ensured 3A Output Load Current
- Input Voltage Range Up to 40V
- Requires Only 4 External Components
- Excellent Line and Load Regulation Specifications
- 150 kHz Fixed Frequency Internal Oscillator
- TTL Shutdown Capability
- Low Power Standby Mode, I_Q Typically 80 µA
- High Efficiency
- Uses Readily Available Standard Inductors
- Thermal Shutdown and Current Limit Protection

APPLICATIONS

- Simple High-Efficiency Step-Down (Buck) Regulator
- On-Card Switching Regulators
- Positive to Negative Converter

DESCRIPTION

The LM2596 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 3A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3V, 5V, 12V, and an adjustable output version.

Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation , and a fixed-frequency oscillator.

The LM2596 series operates at a switching frequency of 150 kHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Available in a standard 5-lead TO-220 package with several different lead bend options, and a 5-lead TO-263 surface mount package.

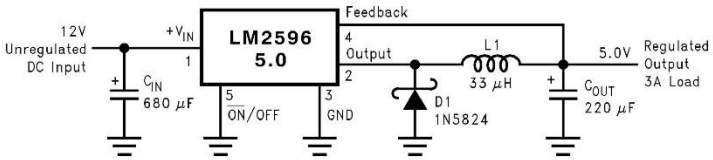
A standard series of inductors are available from several different manufacturers optimized for use with the LM2596 series. This feature greatly simplifies the design of switch-mode power supplies.

Other features include a ensured ±4% tolerance on output voltage under specified input voltage and output load conditions, and ±15% on the oscillator frequency. External shutdown is included, featuring typically 80 µA standby current. Self protection features include a two stage frequency reducing current limit for the output switch and an over temperature shutdown for complete protection under fault conditions. (1)

(1) † Patent Number 5,382,918.

Typical Application

(Fixed Output Voltage Versions)



Connection Diagrams

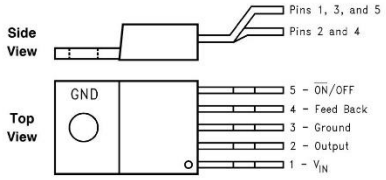


Figure 1. 5-Lead Bent and Staggered Leads, Through Hole TO-220 (T) Package See Package Number NDH0005D

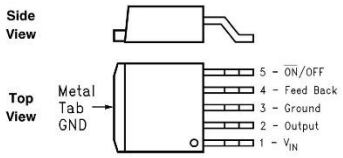


Figure 2. 5-Lead DDPAK/TO-263 (S) Package See Package Number KTT0005B

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings (1)(2)

Maximum Supply Voltage	45V
$\overline{ON}$ /OFF Pin Input Voltage	−0.3 ≤ V ≤ +25V
Feedback Pin Voltage	−0.3 ≤ V ≤+25V
Output Voltage to Ground (Steady State)	−1V
Power Dissipation	Internally limited
Storage Temperature Range	−65°C to +150°C
ESD Susceptibility	
Human Body Model (3)	2 kV
Lead Temperature	
DDPAK/TO-263 Package	
Vapor Phase (60 sec.)	+215°C
Infrared (10 sec.)	+245°C
TO-220 Package (Soldering, 10 sec.)	+260°C
Maximum Junction Temperature	+150°C

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
(3) The human body model is a 100 pF capacitor discharged through a 1.5k resistor into each pin.

Operating Conditions

Temperature Range	−40°C ≤ T_J ≤ +125°C
Supply Voltage	4.5V to 40V

LM2596-3.3 Electrical Characteristics

Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over **full Operating Temperature Range**

Symbol	Parameter	Conditions	LM2596-3.3		Units (Limits)
			Typ (1)	Limit (2)	
SYSTEM PARAMETERS (3) Test Circuit Figure 20					
V_{OUT}	Output Voltage	4.75V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 3A	3.3		V
				3.168/**3.135**	V(min)
				3.432/**3.465**	V(max)
η	Efficiency	V_{IN} = 12V, I_{LOAD} = 3A	73		%

(1) Typical numbers are at 25°C and represent the most likely norm.
(2) All limits specified at room temperature (standard type face) and at temperature extremes (bold type face). All room temperature limits are 100% production tested. All limits at temperature extremes are ensured via correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).
(3) External components such as the catch diode, inductor, input and output capacitors, and voltage programming resistors can affect switching regulator system performance. When the LM2596 is used as shown in the Figure 20 test circuit, system performance will be as shown in system parameters of Electrical Characteristics section.

LM2596-5.0 Electrical Characteristics

Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over **full Operating Temperature Range**

Symbol	Parameter	Conditions	LM2596-5.0		Units (Limits)
			Typ (1)	Limit (2)	
SYSTEM PARAMETERS (3) Test Circuit Figure 20					
V_{OUT}	Output Voltage	7V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 3A	5.0		V
				4.800/**4.750**	V(min)
				5.200/**5.250**	V(max)
η	Efficiency	V_{IN} = 12V, I_{LOAD} = 3A	80		%

(1) Typical numbers are at 25°C and represent the most likely norm.
(2) All limits specified at room temperature (standard type face) and at temperature extremes (bold type face). All room temperature limits are 100% production tested. All limits at temperature extremes are ensured via correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).
(3) External components such as the catch diode, inductor, input and output capacitors, and voltage programming resistors can affect switching regulator system performance. When the LM2596 is used as shown in the Figure 20 test circuit, system performance will be as shown in system parameters of Electrical Characteristics section.

LM2596-12 Electrical Characteristics

Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over **full Operating Temperature Range**

Symbol	Parameter	Conditions	LM2596-12		Units (Limits)
			Typ (1)	Limit (2)	
SYSTEM PARAMETERS (3) Test Circuit Figure 20					
V_{OUT}	Output Voltage	15V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 3A	12.0		V
				11.52/**11.40**	V(min)
				12.48/**12.60**	V(max)
η	Efficiency	V_{IN} = 25V, I_{LOAD} = 3A	90		%

(1) Typical numbers are at 25°C and represent the most likely norm.
(2) All limits specified at room temperature (standard type face) and at temperature extremes (bold type face). All room temperature limits are 100% production tested. All limits at temperature extremes are ensured via correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).
(3) External components such as the catch diode, inductor, input and output capacitors, and voltage programming resistors can affect switching regulator system performance. When the LM2596 is used as shown in the Figure 20 test circuit, system performance will be as shown in system parameters of Electrical Characteristics section.

LM2596-ADJ Electrical Characteristics

Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over **full Operating Temperature Range**

Symbol	Parameter	Conditions	LM2596-ADJ		Units (Limits)
			Typ (1)	Limit (2)	
SYSTEM PARAMETERS (3) Test Circuit Figure 20					
V_{FB}	Feedback Voltage	4.5V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 3A	1.230		V
		V_{OUT} programmed for 3V. Circuit of Figure 20		1.193/**1.180**	V(min)
				1.267/**1.280**	V(max)
η	Efficiency	V_{IN} = 12V, V_{OUT} = 3V, I_{LOAD} = 3A	73		%

(1) Typical numbers are at 25°C and represent the most likely norm.
(2) All limits specified at room temperature (standard type face) and at temperature extremes (bold type face). All room temperature limits are 100% production tested. All limits at temperature extremes are ensured via correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).
(3) External components such as the catch diode, inductor, input and output capacitors, and voltage programming resistors can affect switching regulator system performance. When the LM2596 is used as shown in the Figure 20 test circuit, system performance will be as shown in system parameters of Electrical Characteristics section.

All Output Voltage Versions Electrical Characteristics

Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over **full Operating Temperature Range**. Unless otherwise specified, V_{IN} = 12V for the 3.3V, 5V, and Adjustable version and V_{IN} = 24V for the 12V version. I_{LOAD} = 500 mA

Symbol	Parameter	Conditions	LM2596-XX		Units (Limits)
			Typ (1)	Limit (2)	
DEVICE PARAMETERS					
I_b	Feedback Bias Current	Adjustable Version Only, V_{FB} = 1.3V	10		nA
				50/**100**	nA (max)
f_O	Oscillator Frequency	See (3)	150		kHz
				127/**110**	kHz(min)
				173/**173**	kHz(max)
V_{SAT}	Saturation Voltage	I_{OUT} = 3A (4) (5)	1.16		V
				1.4/**1.5**	V(max)
DC	Max Duty Cycle (ON)	See (5)	100		%
	Min Duty Cycle (OFF)	See (6)	0		
I_{CL}	Current Limit	Peak Current (4) (5)	4.5		A
				3.6/**3.4**	A(min)
				6.9/**7.5**	A(max)
I_L	Output Leakage Current	Output = 0V (4) (6)		50	µA(max)
		Output = −1V (7)	2		mA
				30	mA(max)
I_Q	Quiescent Current	See (6)	5		mA
				10	mA(max)

(1) Typical numbers are at 25°C and represent the most likely norm.
(2) All limits specified at room temperature (standard type face) and at temperature extremes (bold type face). All room temperature limits are 100% production tested. All limits at temperature extremes are ensured via correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).
(3) The switching frequency is reduced when the second stage current limit is activated.
(4) No diode, inductor or capacitor connected to output pin.
(5) Feedback pin removed from output and connected to 0V to force the output transistor switch ON.
(6) Feedback pin removed from output and connected to 12V for the 3.3V, 5V, and the ADJ. version, and 15V for the 12V version, to force the output transistor switch OFF.
(7) V_{IN} = 40V.

TIGER ELECTRONIC CO.,LTD

Product specification

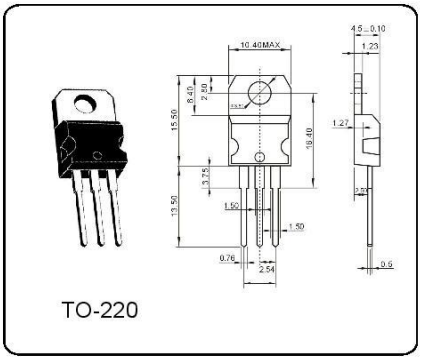
3-Terminal 1A Positive Voltage Regulator **LM7812**

GENERAL DESCRIPTION

The LM7812 series of three terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Parameter	Symbol	Typ	Unit
Input Voltage	V_I	35	V
Output Voltage	V_O	12.0	V
Peak Current	I_{PK}	2.2	A
Operating Temperature Range	T_{OPR}	0~125	°C
Storage Temperature Range	T_{STG}	-65~150	°C



TO-220

ELECTRICAL CHARACTERISTICS (Ta = 25 °C)

(Refer to test circuit, Io = 500mA, Vi = 19V, Ci= 0.33uF, Co=0.1uF unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_O	V_I = 14.5V to 30V	11.64	12.0	12.36	V
Line Regulation (Note1)	Regline	V_I = 14.5V to 30V		10	240	mV
		V_I = 16V to 22V		3.0	120	
Load Regulation (Note1)	Regload	I_O = 5.0mA to1.5A		11	240	mV
		I_O =250mA to 750mA		5	120	
Quiescent Current	I_Q	T_J =+25 °C		5.1	8	mA
Ripple Rejection	RR	f = 120Hz, V_O = 15V to 30V	56	73		dB
Dropout Voltage	V_{Drop}	I_O = 1A, T_J =+25 °C		2		V
Output Resistance	r_O	f = 1KHz		0.018		Ω
Short Circuit Current	I_{SC}	V_I = 35V, T_A =+25 °C		230		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2		A