APÉNDICE A

GLOSARIO

ALU (unidad de aritmética y lógica): Circuito integrado que lleva a cabo operaciones aritméticas o lógicas con sus entradas.

Amplificador: Circuito que puede aumentar la excursión pico a pico de la tensión, la corriente o la potencia de una señal.

Amplificador de instrumentación: Amplificador diferencial con alta impedancia de entrada y alto CMRR. Este tipo de amplificador se encuentra en las etapas de entrada de instrumentos de medida.

Amplificador diferencial: Circuito con dos transistores cuya salida es una versión simplificada de la señal de entrada diferencial entre las dos bases.

Amplificador inversor: Amplificador con una relación de la forma $v_{\mathrm{sal}} = -Bv_{\mathrm{f}}$, siendo B una constante, v_{sal} el voltaje de salida y v_{f} el voltaje de la fuente.

Amplificador no inversor: Amplificador con una relación $v_{\mathrm{sal}} = Bv_{\mathrm{f}}$, siendo B una constante, v_{sal} el voltaje de salida y v_{f} el voltaje de la fuente.

Amplificador operacional: Amplificador caracterizado por una impedancia de entrada muy alta, una impedancia de salida muy baja, y una alta ganancia.

Analógico: Relativo a información que es una variable continua y que no está dividida en unidades discretas.

Analógico a digital: Conversión de una cantidad continua o analógica en una señal digital de valor proporcional; esta señal digital con frecuencia es un número binario.

Ancho de banda: Intervalo de frecuencias entre dos frecuencias dadas siendo la magnitud de la razón de ganancia $1/\sqrt{2}$ para $|H|/|H_0|$, donde H_0 es el valor máximo de la magnitud de $H_0 = 1$.

Ánodo: Elemento de los dispositivos electrónicos que recibe el flujo de corriente de electrones.

ANSI: American National Standard Institute (Instituto Nacional Americano de Estándares)

Átomo: Partícula eléctricamente neutra que constituyen los elementos químicos. Cada átomo consta de un núcleo, formado esencialmente por protones y neutrones, y de electrones que se mueven velozmente alrededor del núcleo.

Automatización: Operación o control automáticos de un proceso, un dispositivo o un sistema.

Binario: Sistema de numeración de base 2 que emplea dos dígitos, 0 y 1.

Bit: Contracción en inglés de digito binario.

Bus de datos: Los circuitos que generan, almacenan, utilizan, introducen o sacan datos se conectan al bus de datos. El bus cuenta con una línea para cada bit de datos.

Capacitancia: Razón de la carga almacenada a la diferencia de voltaje entre dos placas o alambres conductores.

Capacitor: Elemento de dos terminales cuya función básica es introducir capacitancia en un circuito eléctrico.

Carga: Propiedad fundamental de la materia responsable de los fenómenos eléctricos.

Cátodo: Elemento de los dispositivos electrónicos que proporciona el flujo de corriente de electrones.

Circuito: Interconexión de elementos eléctricos en una trayectoria cerrada.

Circuito integrado: Dispositivo que contiene sus propios transistores, resistencias y diodos, interconectados inseparablemente en o dentro de un semiconductor continuo.

CI monolítico: Circuito integrado fabricado totalmente en una sola pastilla.

CMOS (metal-óxido semiconductor complementario): Familia de circuitos integrados digitales.

Comparador: Circuito o dispositivo que detecta cuándo la tensión de entrada es mayor que un valor límite predeterminado. La salida es una tensión alta o bien una tensión baja. El límite predeterminado se llama punto de conmutación.

Conmutar: Cambiar de estado

Constante de tiempo: Valor en segundos, τ, de la respuesta exponencial $Ae^{-t/\tau}$. La constante τ es el tiempo en que se completa el 63 por ciento del valor final.

Controlador: Subsistema que genera la entrada a la planta o proceso.

Control automático: Empleo de un sistema de autorregulación para controlar un proceso y obtener el desempeño deseado.

Corriente eléctrica: La corriente eléctrica es un flujo de electrones.

Corriente directa: Paso unidireccional de electricidad, con magnitud constante.

Datos en paralelo: Cada bit tiene su propia línea de datos. Toda la palabra se transmite durante el mismo pulso de reloj.

Datos en serie: Se tiene una sola línea de datos y éstos se transmiten o reciben un bit a la vez.

Diagrama de bloques: Representación de la interconexión de subsistemas que forman un sistema.

Digital: Relativo a información que no es de naturaleza continua y que cambia en unidades discretas.

Digital a analógico: Conversión de un número (usualmente binario) en una cantidad proporcional analógica continua.

Diodo: Dispositivo semiconductor que conduce en una dirección pero no en la otra.

Ecuación diferencial de primer orden: Ecuación diferencial donde el término de mayor orden de derivada es uno, es decir, dx/dt .

EEPROM: Memoria programable y borrable eléctricamente sólo de lectura. Memoria no volátil que puede programarse y borrarse por medios eléctricos o electrónicos.

Electrón: Una de las partículas del átomo; posee carga negativa.

Entrada inversora: Entrada en un amplificador diferencial o en un amplificador operacional que produce una salida invertida.

Entrada no inversora: Entrada en un amplificador diferencial o en un amplificador operacional que produce una salida en fase.

Error: Diferencia entre la entrada y salida de un sistema

Error en estado estable: Diferencia entre la entrada y salida de un sistema después que la respuesta libre haya caído a cero

Filtro: Circuito diseñado para suministrar una ganancia o una atenuación de magnitud sobre un intervalo de frecuencias.

Filtro pasa-bajo: Filtro que idealmente dejará pasar todas las frecuencias hasta la frecuencia de corte ω_c, y rechazará perfectamente las que estén por encima de ésta.

Formas de onda: Representación gráfica de una señal. Gráfica de la amplitud como una función del tiempo.

Frecuencia: Número de ciclos que una forma de onda completa en un segundo.

Función de transferencia: Cociente entre la transformada de Laplace de la salida de un sistema y la transformada de Laplace de la entrada.

Ganancia: Cociente entre salida y entrada.

Hexadecimal: Sistema numérico de base 16 que emplea 16 dígitos, 0 a 9 y A a F.

Histéresis: Diferencia entre los dos puntos de conmutación de un disparador de Schmitt. En cualquier otro caso, la histéresis se refiere a la diferencia entre los dos puntos de conmutación sobre la característica de transferencia.

Impedancia: Razón del voltaje fasorial **V** a la corriente fasorial **I** para un elemento o conjunto de elementos del circuito, de forma que $Z = \frac{V}{I}$.

LCD: Proveniente del acrónimo del inglés Liquid Crystal Display, es una pantalla delgada y plana formada por un número de píxeles en color o monocromos colocados delante de una fuente de luz o reflectora.

LED (diodo emisor de luz): Diodo que emite luz cuando es polarizado en directa.

Modelo de parámetros concentrados: Modelo matemático de un sistema físico en el cual se emplean ecuaciones diferenciales.

Modelo de parámetros distribuidos: Modelo matemático de un sistema físico que produce ecuaciones en derivadas parciales.

Momento cinético: El producto del momento de inercia y de la velocidad angular de un cuerpo en rotación.

Núcleo atómico: Parte del átomo que contiene a los protones y neutrones.

PCB (tarjeta de circuito impreso): Tarjeta que tiene pistas o franjas de cobre para interconectar componentes.

Periodo: Espacio de tiempo, T, en el que una onda se repite a sí misma.

Perturbación: Cualquier variable que ocasiona que la variable controlada se desvíe del punto de control.

PID: Un PID (Proporcional-Integral-Derivativo) es un mecanismo de control por realimentación que se utiliza en sistemas de control industriales.

Polos: Valores de la variable de transformada de Laplace, s, que hace que la función de transferencia sea infinita.

Polos dominantes: Polos que de modo predominante generan la respuesta transitoria.

Potencia: Energía por unidad de tiempo.

Protón: Partícula del átomo, la cual posee carga positiva.

Puerto de salida: Registro que retiene datos para transferirlos del sistema al mundo externo.

Pulso: Función del tiempo que vale cero para $t < t_0$, tiene magnitud M para $t_0 < t < t_1$ y es igual a cero para $t > t_1$.

Punto de control: Es el valor que se desea tenga la variable controlada.

RAM: Memoria de acceso aleatorio.

Realimentación negativa: Caso en donde una señal de realimentación se resta de una señal previa en la trayectoria directa.

Relación de rechazo al modo común (CMRR): La razón entre la ganancia diferencial y la ganancia en modo común en un amplificador. Es una medida de la capacidad de rechazar una señal en modo común y normalmente se expresa en dB.

Reloj: Forma de onda rectangular continua utilizada para temporización.

Resistencia: Parte real de la impedancia, denotada por R. Sus unidades son [Ω]. Propiedad física de un elemento que impide el flujo de corriente.

Respuesta en estado estable: Parte de la respuesta total que permanece después de que la respuesta transitoria se ha desvanecido.

Respuesta transitoria: Parte de la curva de respuesta debida al sistema y la forma en que el sistema adquiere o disipa energía. En sistemas estables, es la parte de la gráfica de respuesta antes de la respuesta en estado estable.

ROM: Memoria únicamente de lectura.

RTD: Los detectores de temperatura resistivos (RTD – Resistance Temperature Detector) son sensores de temperatura basados en la variación de la resistencia de un conductor con la temperatura.

Ruido: Señal no deseada.

Seguidor de voltaje: Amplificador con una ganancia de voltaje de uno, de forma que el voltaje de salida sigue al de entrada.

Señal de actuación: Señal que alimenta al controlador. Si esta señal es la diferencia entre la entrada y la salida, se llama error.

Sistema en lazo cerrado: Sistema que observa su salida y corrige perturbaciones. Se caracteriza por trayectorias de realimentación provenientes de la salida.

Sobrepaso en porcentaje, M_p%: Cantidad que la respuesta escalón subamortiguada sobrepasa al valor en estado estable, o final, en el tiempo pico, expresado como porcentaje del valor en estado estable.

Temporizador 555: Circuito comúnmente usado que puede funcionar en dos modos: monoestable y astable. En modo monoestable produce unos retardos de tiempo exactos y en modo astable produce ondas rectangulares con ciclos de trabajo variables.

Termistor: Dispositivo cuya resistencia sufre grandes cambios con la temperatura.

Tiempo de asentamiento, t_a: Cantidad de tiempo necesario para que la respuesta escalón alcance y permanezca con una variación de $\pm 2\%$ alrededor del valor en estado estable.

Tiempo de levantamiento, t_r: Tiempo necesario para que la respuesta escalón pase de 0.1 al 0.9 de su valor final

Tiempo pico, t_p: Tiempo necesario para que la respuesta de escalón subamortiguada alcance el primer pico, o máximo.

Transductor: Dispositivo que convierte una señal de una forma a otra, por ejemplo, de un desplazamiento mecánico a un voltaje eléctrico.

Transformada de Laplace: Transformación que permite representar ecuaciones diferenciales lineales como expresiones algebraicas. La transformación es especialmente útil para modelar, analizar y diseñar sistemas de control, así como para resolver ecuaciones diferenciales lineales.

Transistor: Dispositivo semiconductor activo con tres o más terminales.

Triac: Tiristor que puede conducir en ambas direcciones. Debido a esta propiedad es útil para controlar corrientes alternas.

Valor rms: Empleado en las señales dependientes del tiempo. Conocido también como valor eficaz. Es el valor equivalente de una fuente de continua que produciría la misma cantidad de calor o potencia sobre el ciclo completo de una señal dependiente del tiempo.

Variable controlada: Salida de una planta o proceso que el sistema está controlando con el fin de obtener respuesta transitoria, estabilidad y características de error en estado estable deseados.

Variable manipulada: Variable que se utiliza para mantener a la variable controlada en el punto de control.

APÉNDICE B

HOJAS DE DATOS DE COMPONENTES ELECTRÓNICOS

ANALOG DEVICES

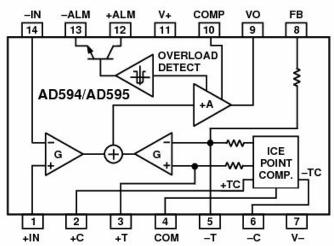
Monolithic Thermocouple Amplifiers with Cold Junction Compensation

AD594/AD595

FEATURES

- Pretrimmed for Type J (AD594) or Type K (AD595) Thermocouples
- Can Be Used with Type T Thermocouple Inputs
- Low Impedance Voltage Output: 10 mV/°C
- Built-In Ice Point Compensation
- Wide Power Supply Range: +5 V to ±15 V
- Low Power: <1 mW typical
- Thermocouple Failure Alarm
- Laser Wafer Trimmed to 1°C Calibration Accuracy
- Setpoint Mode Operation
- Self-Contained Celsius Thermometer Operation
- High Impedance Differential Input
- Side-Brazed DIP or Low Cost Cerdip

FUNCTIONAL BLOCK DIAGRAM



PRODUCT DESCRIPTION

The AD594/AD595 is a complete instrumentation amplifier and thermocouple cold junction compensator on a monolithic chip. It combines an ice point reference with a precalibrated amplifier to produce a high level (10 mV/°C) output directly from a thermocouple signal. Pin-strapping options allow it to be used as a linear amplifier-compensator or as a switched output setpoint controller using either fixed or remote setpoint control. It can be used to amplify its compensation voltage directly, thereby converting it to a stand-alone Celsius transducer with a low impedance voltage output.

The AD594/AD595 includes a thermocouple failure alarm that indicates if one or both thermocouple leads become open. The alarm output has a flexible format which includes TTL drive capability.

The AD594/AD595 can be powered from a single ended supply (including +5 V) and by including a negative supply, temperatures below 0°C can be measured. To minimize self-heating, an unloaded AD594/AD595 will typically operate with a total supply current 160 µA, but is also capable of delivering in excess of ±5 mA to a load.

The AD594 is precalibrated by laser wafer trimming to match the characteristic of type J (iron-constantan) thermocouples and the AD595 is laser trimmed for type K (chromel-alumel) inputs. The temperature transducer voltages and gain control resistors are available at the package pins so that the circuit can be recalibrated for the thermocouple types by the addition of two or three resistors. These terminals also allow more precise calibration for both thermocouple and thermometer applications.

The AD594/AD595 is available in two performance grades. The C and the A versions have calibration accuracies of ±1°C and ±3°C, respectively. Both are designed to be used from 0°C to +50°C, and are available in 14-pin, hermetically sealed, side-brazed ceramic DIPs as well as low cost cerdip packages.

PRODUCT HIGHLIGHTS

1. The AD594/AD595 provides cold junction compensation, amplification, and an output buffer in a single IC package.
2. Compensation, zero, and scale factor are all precalibrated by laser wafer trimming (LWT) of each IC chip.
3. Flexible pinout provides for operation as a setpoint controller or a stand-alone temperature transducer calibrated in degrees Celsius.
4. Operation at remote application sites is facilitated by low quiescent current and a wide supply voltage range +5 V to dual supplies spanning 30 V.
5. Differential input rejects common-mode noise voltage on the thermocouple leads.

REV. C

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 World Wide Web Site: http://www.analog.com
Fax: 781/326-8703

AD594/AD595–SPECIFICATIONS (@ +25°C and V_S = 5 V, Type J (AD594), Type K (AD595) Thermocouple, unless otherwise noted)

Model	AD594A			AD594C			AD595A			AD595C			
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Units
ABSOLUTE MAXIMUM RATING													
$+V_S$ to $-V_S$			36			36			36			36	Volts
Common-Mode Input Voltage	$-V_S - 0.15$		$+V_S$	$-V_S - 0.15$		$+V_S$	$-V_S - 0.15$		$+V_S$	$-V_S - 0.15$		$+V_S$	Volts
Differential Input Voltage	$-V_S$		$+V_S$	$-V_S$		$+V_S$	$-V_S$		$+V_S$	$-V_S$		$+V_S$	Volts
Alarm Voltages													
+ALM	$-V_S$		$-V_S + 36$	$-V_S$		$-V_S + 36$	$-V_S$		$-V_S + 36$	$-V_S$		$-V_S + 36$	Volts
–ALM	$-V_S$		$+V_S$	$-V_S$		$+V_S$	$-V_S$		$+V_S$	$-V_S$		$+V_S$	Volts
Operating Temperature Range	–55		+125	–55		+125	–55		+125	–55		+125	°C
Output Short Circuit to Common	Indefinite			Indefinite			Indefinite			Indefinite			
TEMPERATURE MEASUREMENT (Specified Temperature Range 0°C to +50°C)													
Calibration Error at +25°C[1]			**±3**			**±1**			**±3**			**±1**	°C
Stability vs. Temperature[2]			**±0.05**			**±0.025**			**±0.05**			**±0.025**	°C/°C
Gain Error			**±1.5**			**±0.75**			**±1.5**			**±0.75**	%
Nominal Transfer Function			10			10			10			10	mV/°C
AMPLIFIER CHARACTERISTICS													
Closed Loop Gain[3]		**193.4**				**193.4**			**247.3**			**247.3**	
Input Offset Voltage		(Temperature in °C) × 51.70 µV/°C			(Temperature in °C) × 51.70 µV/°C			(Temperature in °C) × 40.44 µV/°C			(Temperature in °C) × 40.44 µV/°C		µV
Input Bias Current		0.1			0.1			0.1			0.1		µA
Differential Input Range	–10		+50				–10		+50	–10		+50	mV
Common-Mode Range	$\mathbf{-V_S - 0.15}$		$\mathbf{-V_S - 4}$	$\mathbf{-V_S - 0.15}$		$\mathbf{-V_S - 4}$	$\mathbf{-V_S - 0.15}$		$\mathbf{-V_S - 4}$	$\mathbf{-V_S - 0.15}$		$\mathbf{-V_S - 4}$	Volts
Common-Mode Sensitivity – RTO			**10**			**10**			**10**			**10**	mV/V
Power Supply Sensitivity – RTO			**10**			**10**			**10**			**10**	mV/V
Output Voltage Range													
Dual Supply	$\mathbf{-V_S + 2.5}$		$\mathbf{+V_S - 2}$	$\mathbf{-V_S + 2.5}$		$\mathbf{+V_S - 2}$	$\mathbf{-V_S + 2.5}$		$\mathbf{+V_S - 2}$	$\mathbf{-V_S + 2.5}$		$\mathbf{+V_S - 2}$	Volts
Single Supply	0		$+V_S - 2$	0		$-V_S - 2$	0		$+V_S + 2$	0		$+V_S - 2$	Volts
Usable Output Current[4]		±5			±5			±5			±5		mA
3 dB Bandwidth		15			15			15			15		kHz
ALARM CHARACTERISTICS													
$V_{CE(SAT)}$ at 2 mA		0.3			0.3			0.3			0.3		Volts
Leakage Current			**±1**			**±1**			**±1**			**±1**	µA max
Operating Voltage at – ALM			$\mathbf{+V_S - 4}$			$\mathbf{+V_S - 4}$			$\mathbf{+V_S - 4}$			$\mathbf{+V_S - 4}$	Volts
Short Circuit Current		20			20			20			20		mA
POWER REQUIREMENTS													
Specified Performance		$+V_S = 5, -V_S = 0$			$+V_S = 5, -V_S = 0$			$+V_S = 5, -V_S = 0$			$+V_S = 5, -V_S = 0$		Volts
Operating[5]		$+V_S$ to $-V_S \le 30$			$+V_S$ to $-V_S \le 30$			$+V_S$ to $-V_S \le 30$			$+V_S$ to $-V_S \le 30$		Volts
Quiescent Current (No Load)													
$+V_S$		160	300		160	300		160	300		160	300	µA
$-V_S$		100			100			100			100		µA
PACKAGE OPTION													
TO-116 (D-14)		AD594AD			AD594CD			AD595AD			AD595CD		
Cerdip (Q-14)		AD594AQ			AD594CQ			AD595AQ			AD595CQ		

NOTES

[1]Calibrated for minimum error at +25°C using a thermocouple sensitivity of 51.7 µV/°C. Since a J type thermocouple deviates from this straight line approximation, the AD594 will normally read 3.1 mV when the measuring junction is at 0°C. The AD595 will similarly read 2.7 mV at 0°C.

[2]Defined as the slope of the line connecting the AD594/AD595 errors measured at 0°C and 50°C ambient temperature.

[3]Pin 8 shorted to Pin 9.

[4]Current Sink Capability in single supply configuration is limited to current drawn to ground through a 50 kΩ resistor at output voltages below 2.5 V.

[5]$-V_S$ must not exceed –16.5 V.

Specifications shown in **boldface** are tested on all production units at final electrical test. Results from those tests are used to calculate outgoing quality levels. All min and max specifications are guaranteed, although only those shown in **boldface** are tested on all production units.

Specifications subject to change without notice.

INTERPRETING AD594/AD595 OUTPUT VOLTAGES

To achieve a temperature proportional output of 10 mV/°C and accurately compensate for the reference junction over the rated operating range of the circuit, the AD594/AD595 is gain trimmed to match the transfer characteristic of J and K type thermocouples at 25°C. For a type J output in this temperature range the TC is 51.70 µV/°C, while for a type K it is 40.44 µV/°C. The resulting gain for the AD594 is 193.4 (10 mV/°C divided by 51.7 µV/°C) and for the AD595 is 247.3 (10 mV/°C divided by 40.44 µV/°C). In addition, an absolute accuracy trim induces an input offset to the output amplifier characteristic of 16 µV for the AD594 and 11 µV for the AD595. This offset arises because the AD594/AD595 is trimmed for a 250 mV output while applying a 25°C thermocouple input.

Because a thermocouple output voltage is nonlinear with respect to temperature, and the AD594/AD595 linearly amplifies the compensated signal, the following transfer functions should be used to determine the actual output voltages:

AD594 output = (*Type J Voltag*e + 16 *µV*) × 193.4

AD595 output = *(Type K Voltage* + 11 *µV)* × 247.3 *or conversely:*

Type J voltage = *(AD594 output*/193.4*)* – 16 *µV*

Type K voltage = *(AD595 output*/247.3*)* – 11 *µV*

Table I lists the ideal AD594/AD595 output voltages as a function of Celsius temperature for type J and K ANSI standard thermocouples, with the package and reference junction at 25°C. As is normally the case, these outputs are subject to calibration, gain and temperature sensitivity errors. Output values for intermediate temperatures can be interpolated, or calculated using the output equations and ANSI thermocouple voltage tables referred to zero degrees Celsius. Due to a slight variation in alloy content between ANSI type J and DIN FE-CUNI

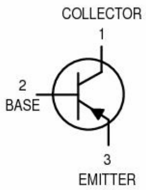
MOTOROLA
SEMICONDUCTOR TECHNICAL DATA

Order this document
by BC556/D

Amplifier Transistors

PNP Silicon

BC556,B
BC557A,B,C
BC558B



CASE 29–04, STYLE 17
TO–92 (TO–226AA)

MAXIMUM RATINGS

Rating	Symbol	BC 556	BC 557	BC 558	Unit
Collector–Emitter Voltage	V_{CEO}	–65	–45	–30	Vdc
Collector–Base Voltage	V_{CBO}	–80	–50	–30	Vdc
Emitter–Base Voltage	V_{EBO}		–5.0		Vdc
Collector Current — Continuous	I_C		–100		mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D		625 5.0		mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D		1.5 12		Watt mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}		–55 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector–Emitter Breakdown Voltage (I_C = –2.0 mAdc, I_B = 0)	BC556 BC557 BC558	$V_{(BR)CEO}$	–65 –45 –30	— — —	— — —	V
Collector–Base Breakdown Voltage (I_C = –100 μAdc)	BC556 BC557 BC558	$V_{(BR)CBO}$	–80 –50 –30	— — —	— — —	V
Emitter–Base Breakdown Voltage (I_E = –100 μAdc, I_C = 0)	BC556 BC557 BC558	$V_{(BR)EBO}$	–5.0 –5.0 –5.0	— — —	— — —	V
Collector–Emitter Leakage Current (V_{CES} = –40 V) (V_{CES} = –20 V)	BC556 BC557 BC558	I_{CES}	— — —	–2.0 –2.0 –2.0	–100 –100 –100	nA
(V_{CES} = –20 V, T_A = 125°C)	BC556 BC557 BC558		— — —	— — —	–4.0 –4.0 –4.0	μA

MOTOROLA

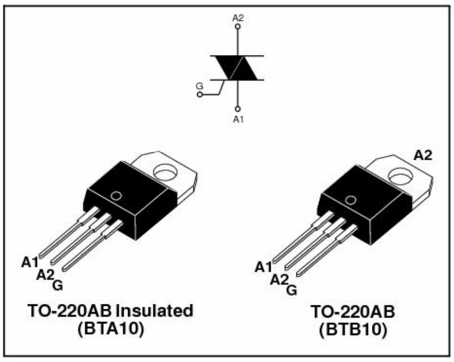
BTA/BTB10 Series

SNUBBERLESS™ & STANDARD

10A TRIACS

MAIN FEATURES:

Symbol	Value	Unit
$I_{T(RMS)}$	10	A
V_{DRM}/V_{RRM}	600 and 800	V
$I_{GT\ (Q_1)}$	25 to 50	mA



DESCRIPTION

Available either in standard or snubberless version, the BTA/BTB10 triac series is suitable for general purpose AC switching. They can be used as an ON/OFF function in applications such as static relays, heating regulation, induction motor starting circuits... or for phase control operation in light dimmers, motor speed controllers, ...

The snubberless version (W suffix) is specially recommended for use on inductive loads, thanks to their high commutation performances.

By using an internal ceramic pad, the BTA series provides voltage insulated tab (rated at 2500 V RMS) complying with UL standards (File ref.: E81734).

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	TO-220AB	Tc = 105°C	10	A
		TO-220AB Ins.	Tc = 95°C		
I_{TSM}	Non repetitive surge peak on-state current (full cycle, Tj initial = 25°C)	F = 60 Hz	t = 16.7 ms	105	A
		F = 50 Hz	t = 20 ms	100	
I^2t	I^2t Value for fusing	tp = 10 ms		55	A^2s
dI/dt	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$, tr ≤ 100 ns	F = 120 Hz	Tj = 125°C	50	A/µs
V_{DSM}/V_{RSM}	Non repetitive surge peak off-state voltage	tp = 10 ms	Tj = 25°C	V_{DRM}/V_{RRM} + 100	V
I_{GM}	Peak gate current	tp = 20 µs	Tj = 125°C	4	A
$P_{G(AV)}$	Average gate power dissipation		Tj = 125°C	1	W
T_{stg} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	°C

National Semiconductor

June 1999

DAC0800/DAC0802
8-Bit Digital-to-Analog Converters

General Description

The DAC0800 series are monolithic 8-bit high-speed current-output digital-to-analog converters (DAC) featuring typical settling times of 100 ns. When used as a multiplying DAC, monotonic performance over a 40 to 1 reference current range is possible. The DAC0800 series also features high compliance complementary current outputs to allow differential output voltages of 20 Vp-p with simple resistor loads as shown in *Figure 1*. The reference-to-full-scale current matching of better than ±1 LSB eliminates the need for full-scale trims in most applications while the nonlinearities of better than ±0.1% over temperature minimizes system error accumulations.

The noise immune inputs of the DAC0800 series will accept TTL levels with the logic threshold pin, V_{LC}, grounded. Changing the V_{LC} potential will allow direct interface to other logic families. The performance and characteristics of the device are essentially unchanged over the full ±4.5V to ±18V power supply range; power dissipation is only 33 mW with ±5V supplies and is independent of the logic input states.

The DAC0800, DAC0802, DAC0800C and DAC0802C are a direct replacement for the DAC-08, DAC-08A, DAC-08C, and DAC-08H, respectively.

Features

- Fast settling output current: 100 ns
- Full scale error: ±1 LSB
- Nonlinearity over temperature: ±0.1%
- Full scale current drift: ±10 ppm/°C
- High output compliance: −10V to +18V
- Complementary current outputs
- Interface directly with TTL, CMOS, PMOS and others
- 2 quadrant wide range multiplying capability
- Wide power supply range: ±4.5V to ±18V
- Low power consumption: 33 mW at ±5V
- Low cost

Typical Applications

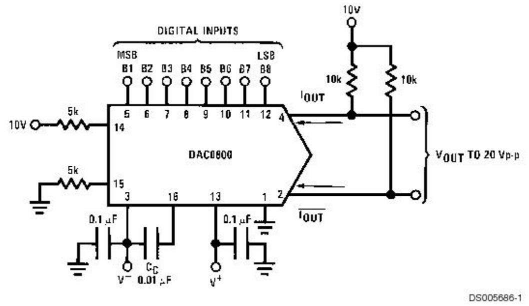


FIGURE 1. ±20 V_{P-P} Output Digital-to-Analog Converter (Note 5)

Ordering Information

Non-Linearity	Temperature Range	Order Numbers				
		J Package (J16A) (Note 1)		**N Package (N16E)** (Note 1)		**SO Package (M16A)**
±0.1% FS	0°C ≤ T_A ≤ +70°C	DAC0802LCJ	DAC-08HQ	DAC0802LCN	DAC-08HP	DAC0802LCM
±0.19% FS	−55°C ≤ T_A ≤ +125°C	DAC0800LJ	DAC-08Q			
±0.19% FS	0°C ≤ T_A ≤ +70°C	DAC0800LCJ	DAC-08EQ	DAC0800LCN	DAC-08EP	DAC0800LCM

Note 1: Devices may be ordered by using either order number.

LM317, NCV317

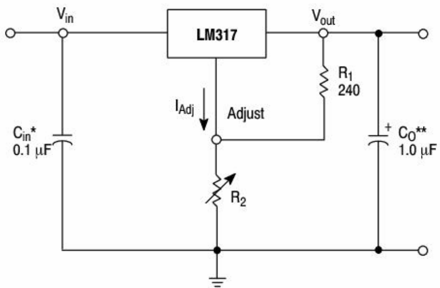
1.5 A Adjustable Output, Positive Voltage Regulator

The LM317 is an adjustable 3−terminal positive voltage regulator capable of supplying in excess of 1.5 A over an output voltage range of 1.2 V to 37 V. This voltage regulator is exceptionally easy to use and requires only two external resistors to set the output voltage. Further, it employs internal current limiting, thermal shutdown and safe area compensation, making it essentially blow−out proof.

The LM317 serves a wide variety of applications including local, on card regulation. This device can also be used to make a programmable output regulator, or by connecting a fixed resistor between the adjustment and output, the LM317 can be used as a precision current regulator.

Features

- Output Current in Excess of 1.5 A
- Output Adjustable between 1.2 V and 37 V
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting Constant with Temperature
- Output Transistor Safe−Area Compensation
- Floating Operation for High Voltage Applications
- Available in Surface Mount D^{2}PAK−3, and Standard 3−Lead Transistor Package
- Eliminates Stocking many Fixed Voltages
- Pb−Free Packages are Available



* C_{in} is required if regulator is located an appreciable distance from power supply filter.
** C_O is not needed for stability, however, it does improve transient response.

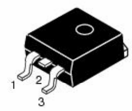
$$V_{out} = 1.25\,V\left(1 + \frac{R_2}{R_1}\right) + I_{Adj}R_2$$

Since I_{Adj} is controlled to less than 100 μA, the error associated with this term is negligible in most applications.

Figure 1. Standard Application

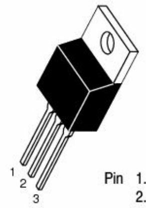
ON Semiconductor®

http://onsemi.com



D^{2}PAK−3
D2T SUFFIX
CASE 936

Heatsink surface (shown as terminal 4 in case outline drawing) is connected to Pin 2.



TO−220
T SUFFIX
CASE 221A

Pin 1. Adjust
2. V_{out}
3. V_{in}

Heatsink surface connected to Pin 2.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 10 of this data sheet.

Low power quad op amps

LM124/224/324/324A/ SA534/LM2902

DESCRIPTION

The LM124/SA534/LM2902 series consists of four independent, high-gain, internally frequency-compensated operational amplifiers designed specifically to operate from a single power supply over a wide range of voltages.

UNIQUE FEATURES

In the linear mode, the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage.

The unity gain crossover frequency and the input bias current are temperature-compensated.

FEATURES

- Internally frequency-compensated for unity gain
- Large DC voltage gain: 100 dB
- Wide bandwidth (unity gain): 1 MHz (temperature-compensated)
- Wide power supply range Single supply: 3 V_{DC} to 30 V_{DC} or dual supplies: ±1.5 V_{DC} to ±15 V_{DC}
- Very low supply current drain: essentially independent of supply voltage (1 mW/op amp at +5 V_{DC})
- Low input biasing current: 45 nA_{DC} (temperature-compensated)
- Low input offset voltage: 2 mV_{DC} and offset current: 5 nA_{DC}
- Differential input voltage range equal to the power supply voltage
- Large output voltage: $0V_{DC}$ to V_{CC}–1.5 V_{DC} swing

PIN CONFIGURATION

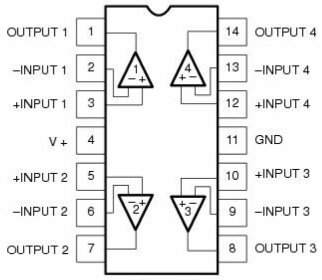


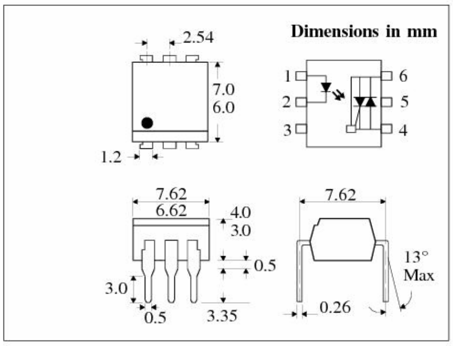
Figure 1. Pin configuration.

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
14-Pin Plastic Dual In-Line Package (DIP)	–55° C to +125 °C	LM124N	SOT27-1
14-Pin Plastic Small Outline (SO) Package	–25 °C to +85 °C	LM224D	SOT108-1
14-Pin Plastic Dual In-Line Package (DIP)	–25 °C to +85 °C	LM224N	SOT27-1
14-Pin Plastic Small Outline (SO) Package	0 °C to +70 °C	LM324D	SOT108-1
14-Pin Plastic Thin Shrink Small Outline Package (TSSOP)	0 °C to +70 °C	LM324DH	SOT402-1
14-Pin Plastic Dual In-Line Package (DIP)	0 °C to +70 °C	LM324N	SOT27-1
14-Pin Plastic Small Outline (SO) Package	0 °C to +70 °C	LM324AD	SOT108-1
14-Pin Plastic Dual In-Line Package (DIP)	0 °C to +70 °C	LM324AN	SOT27-1
14-Pin Plastic Small Outline (SO) Package	–40 °C to +85 °C	SA534D	SOT108-1
14-Pin Plastic Dual In-Line Package (DIP)	–40 °C to +85 °C	SA534N	SOT27-1
14-Pin Plastic Small Outline (SO) Package	–40 °C to +125 °C	LM2902D	SOT108-1
14-Pin Plastic Dual In-Line Package (DIP)	–40 °C to +125 °C	LM2902N	SOT27-1
14-Pin Plastic Thin Shrink Small Outline Package (TSSOP)	–40 °C to +125 °C	LM2902DH	SOT402-1

MOC3030, MOC3031, MOC3032, MOC3033

OPTICALLY COUPLED BILATERAL SWITCH LIGHT ACTIVATED ZERO VOLTAGE CROSSING TRIAC



DESCRIPTION

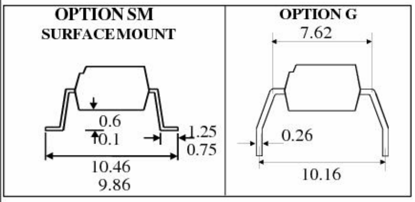
The MOC303_ Series are optically coupled isolators consisting of a Gallium Arsenide infrared emitting diode coupled with a monolithic silicon detector performing the functions of a zero crossing bilateral triac mounted in a standard 6 pin dual-in-line package.

FEATURES

- Options :-
  10mm lead spread - add G after part no.
  Surface mount - add SM after part no.
  Tape&reel - add SMT&R after part no.
- High Isolation Voltage ($5.3kV_{RMS}$, $7.5kV_{PK}$)
- Zero Voltage Crossing
- 250V Peak Blocking Voltage
- All electrical parameters 100% tested
- Custom electrical selections available

APPLICATIONS

- CRTs
- Power Triac Driver
- Motors
- Consumer appliances
- Printers



ABSOLUTE MAXIMUM RATINGS
(25 °C unless otherwise noted)

Storage Temperature	-40°C - +150°C
Operating Temperature	-40°C - +100°C
Lead Soldering Temperature (1.6mm from case for 10 seconds)	260°C
Input-to-output Isolation Voltage (Pk) (60 Hz , 1sec. duration)	7500 Vac

INPUT DIODE

Forward Current	50mA
Reverse Voltage	6V
Power Dissipation (derate linearly 1.41mW/°C above 25°C)	120mW

OUTPUT PHOTO TRIAC

Off-State Output Terminal Voltage	250V
RMS Forward Current	100mA
Forward Current (Peak)	1.2A
Power Dissipation (derate linearly 1.76mW/°C above 25°C)	150mW

POWER DISSIPATION

Total Power Dissipation (derate linearly 2.94mW/°C above 25°C)	250mW

ISOCOM COMPONENTS LTD
Unit 25B, Park View Road West,
Park View Industrial Estate, Brenda Road
Hartlepool, Cleveland, TS25 1YD
Tel: (01429) 863609 Fax :(01429) 863581

ISOCOM INC
1024 S. Greenville Ave, Suite 240,
Allen, TX 75002 USA
Tel: (214)495-0755 Fax: (214)495-0901
e-mail info@isocom.com
http://www.isocom.com

19/12/01 DB92006m-AAS/A4

NE555
SA555 - SE555

GENERAL PURPOSE SINGLE BIPOLAR TIMERS

- LOW TURN OFF TIME
- MAXIMUM OPERATING FREQUENCY GREATER THAN 500kHz
- TIMING FROM MICROSECONDS TO HOURS
- OPERATES IN BOTH ASTABLE AND MONOSTABLE MODES
- HIGH OUTPUT CURRENT CAN SOURCE OR SINK 200mA
- ADJUSTABLE DUTY CYCLE
- TTL COMPATIBLE
- TEMPERATURE STABILITY OF 0.005% PER^{o}C

N
DIP8
(Plastic Package)

D
SO8
(Plastic Micropackage)

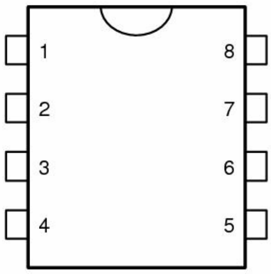
DESCRIPTION

The NE555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays or oscillation. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For a stable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200mA. The NE555 is available in plastic and ceramic minidip package and in a 8-lead micropackage and in metal can package version.

ORDER CODES

Part Number	Temperature Range	Package	
		N	D
NE555	0°C, 70°C	•	•
SA555	–40°C, 105°C	•	•
SE555	–55°C, 125°C	•	•

PIN CONNECTIONS (top view)



1 - GND
2 - Trigger
3 - Output
4 - Reset
5 - Control voltage
6 - Threshold
7 - Discharge
8 - V_{CC}

PIC16F87X

28/40-Pin 8-Bit CMOS FLASH Microcontrollers

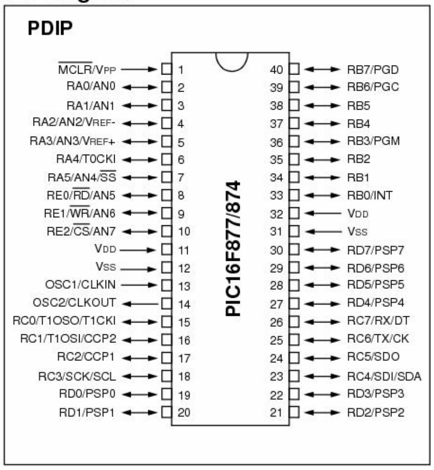
Devices Included in this Data Sheet:

- PIC16F873
- PIC16F874
- PIC16F876
- PIC16F877

Microcontroller Core Features:

- High performance RISC CPU
- Only 35 single word instructions to learn
- All single cycle instructions except for program branches which are two cycle
- Operating speed: DC - 20 MHz clock input
  DC - 200 ns instruction cycle
- Up to 8K x 14 words of FLASH Program Memory,
  Up to 368 x 8 bytes of Data Memory (RAM)
  Up to 256 x 8 bytes of EEPROM Data Memory
- Pinout compatible to the PIC16C73B/74B/76/77
- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack
- Direct, indirect and relative addressing modes
- Power-on Reset (POR)
- Power-up Timer (PWRT) and
  Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low power, high speed CMOS FLASH/EEPROM technology
- Fully static design
- In-Circuit Serial Programming™ (ICSP) via two pins
- Single 5V In-Circuit Serial Programming capability
- In-Circuit Debugging via two pins
- Processor read/write access to program memory
- Wide operating voltage range: 2.0V to 5.5V
- High Sink/Source Current: 25 mA
- Commercial, Industrial and Extended temperature ranges
- Low-power consumption:
  - < 0.6 mA typical @ 3V, 4 MHz
  - 20 µA typical @ 3V, 32 kHz
  - < 1 µA typical standby current

Pin Diagram



Peripheral Features:

- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler, can be incremented during SLEEP via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
  - Capture is 16-bit, max. resolution is 12.5 ns
  - Compare is 16-bit, max. resolution is 200 ns
  - PWM max. resolution is 10-bit
- 10-bit multi-channel Analog-to-Digital converter
- Synchronous Serial Port (SSP) with SPI™ (Master mode) and I^{2}C™ (Master/Slave)
- Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection
- Parallel Slave Port (PSP) 8-bits wide, with external RD, WR and CS controls (40/44-pin only)
- Brown-out detection circuitry for Brown-out Reset (BOR)

TL081
TL081A - TL081B

GENERAL PURPOSE J-FET SINGLE OPERATIONAL AMPLIFIERS

- WIDE COMMON-MODE (UP TO V_{CC}^{+}) AND DIFFERENTIAL VOLTAGE RANGE
- LOW INPUT BIAS AND OFFSET CURRENT
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J–FET INPUT STAGE
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE : 16V/µs (typ)

N
DIP8
(Plastic Package)

D
SO8
(Plastic Micropackage)

DESCRIPTION

The TL081, TL081A and TL081B are high speed J–FET input single operational amplifiers incorporating well matched, high voltage J–FET and bipolar transistors in a monolithic integrated circuit.

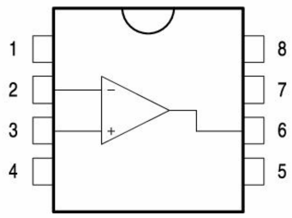
The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient.

ORDER CODE

Part Number	Temperature Range	Package	
		N	D
TL081M/AM/BM	-55°C, +125°C	•	•
TL081I/AI/BI	-40°C, +105°C	•	•
TL081C/AC/BC	0°C, +70°C	•	•
Example : TL081CD, TL081IN			

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)

PIN CONNECTIONS (top view)



1 - Offset null 1
2 - Inverting input
3 - Non-inverting input
4 - V_{CC}^{-}
5 - Offset null 2
6 - Output
7 - V_{CC}^{+}
8 - N.C.

NPN switching transistors 2N2222; 2N2222A

FEATURES

- High current (max. 800 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Linear amplification and switching.

DESCRIPTION

NPN switching transistor in a TO-18 metal package.
PNP complement: 2N2907A.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector, connected to case

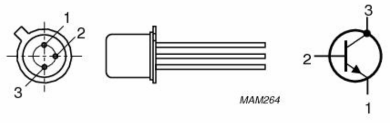


Fig.1 Simplified outline (TO-18) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	2N2222		–	60	V
	2N2222A		–	75	V
V_{CEO}	collector-emitter voltage	open base			
	2N2222		–	30	V
	2N2222A		–	40	V
I_C	collector current (DC)		–	800	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 10$ V	75	–	
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 20$ V; f = 100 MHz			
	2N2222		250	–	MHz
	2N2222A		300	–	MHz
t_{off}	turn-off time	$I_{Con} = 150$ mA; $I_{Bon} = 15$ mA; $I_{Boff} = -15$ mA	–	250	ns

APÉNDICE C

ARCHIVOS DE FABRICACIÓN

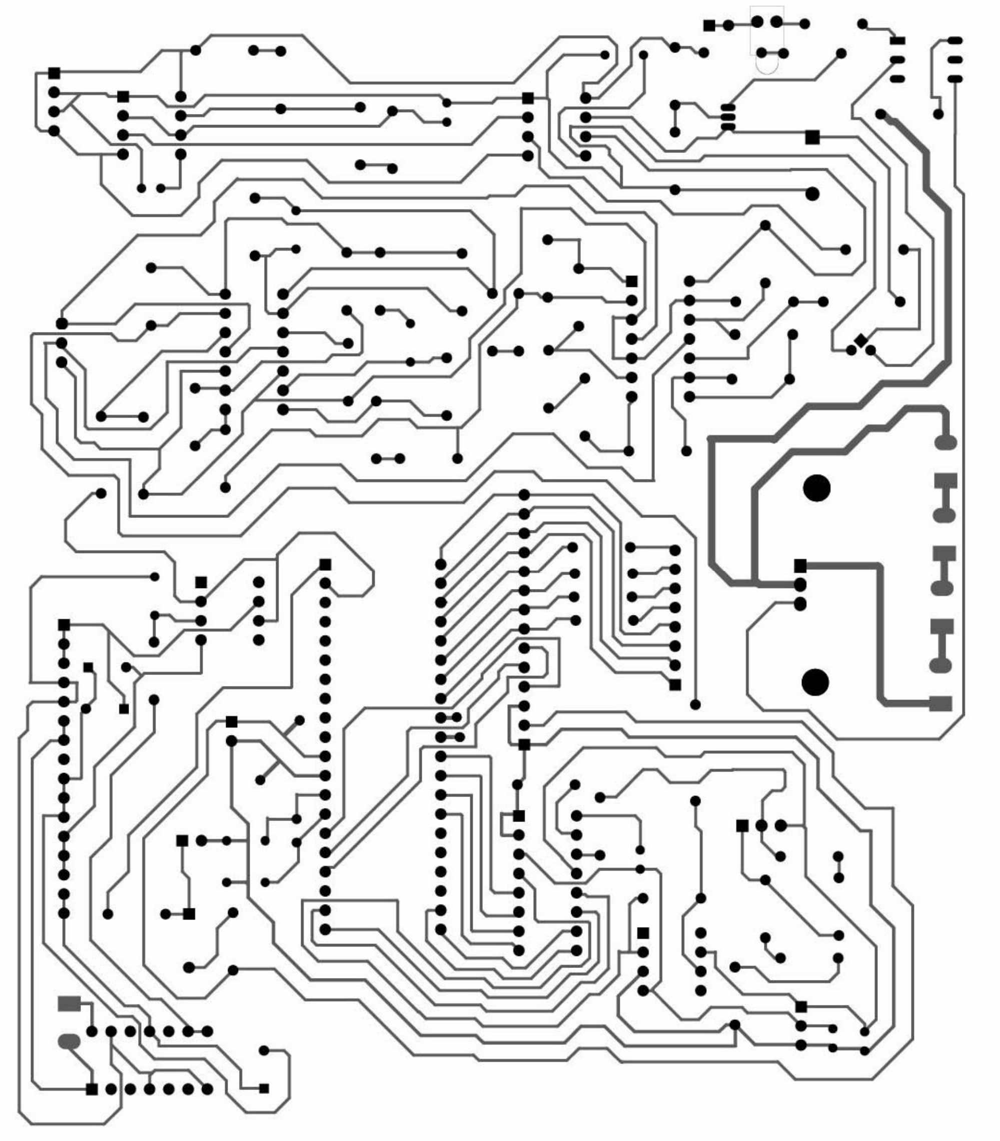


Figura C.1 Cara inferior de la placa fenólica

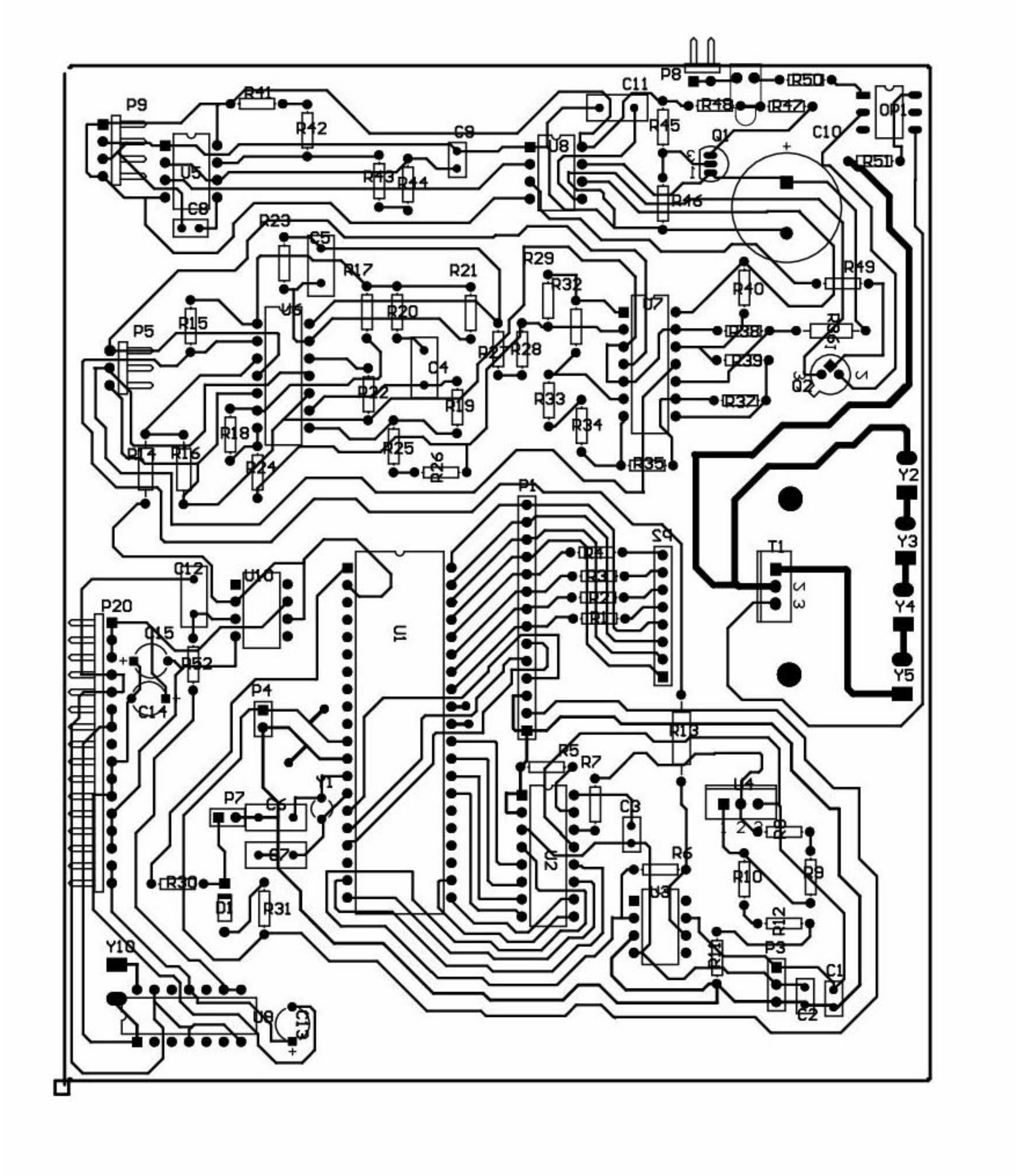


Figura C.2 Cara inferior de la placa fenólica que incluye el número de parte de los componentes

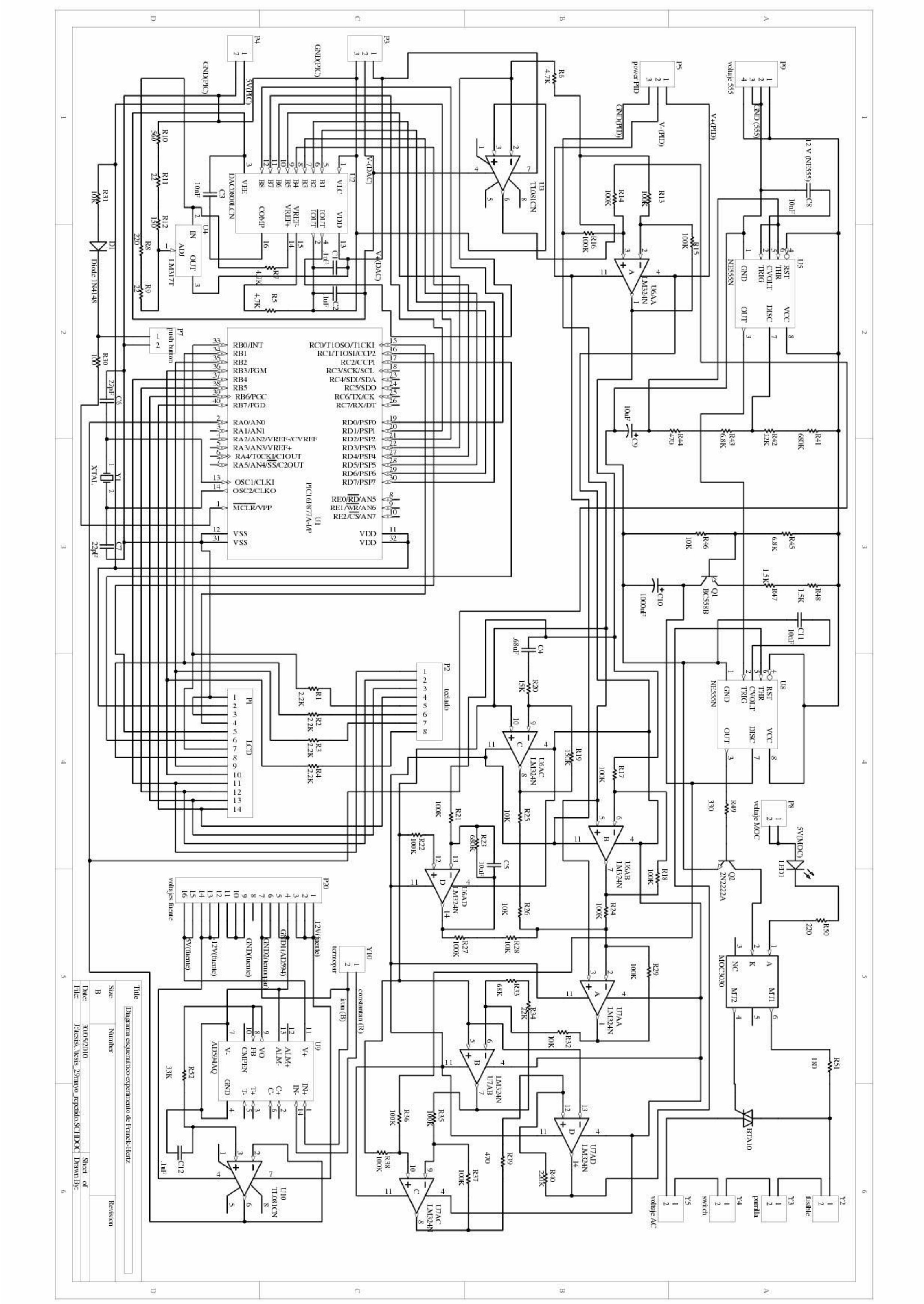


Figura C.3 Diagrama esquemático del sistema de control electrónico para el experimento de Franck-Hertz