

SN74LS195A

Universal 4-Bit Shift Register

The SN74LS195A is a high speed 4-Bit Shift Register offering typical shift frequencies of 39 MHz. It is useful for a wide variety of register and counting applications. It utilizes the Schottky diode clamped process to achieve high speeds and is fully compatible with all ON Semiconductor TTL products.

- Typical Shift Right Frequency of 39 MHz
- Asynchronous Master Reset
- J, \bar{K} Inputs to First Stage
- Fully Synchronous Serial or Parallel Data Transfers
- Input Clamp Diodes Limit High Speed Termination Effects

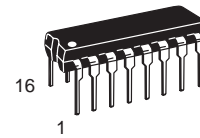
GUARANTEED OPERATING RANGES

Symbol	Parameter	Min	Typ	Max	Unit
V _{CC}	Supply Voltage	4.75	5.0	5.25	V
T _A	Operating Ambient Temperature Range	0	25	70	°C
I _{OH}	Output Current – High			–0.4	mA
I _{OL}	Output Current – Low			8.0	mA

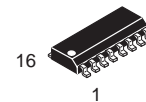


ON Semiconductor
Formerly a Division of Motorola
<http://onsemi.com>

**LOW
POWER
SCHOTTKY**



**PLASTIC
N SUFFIX
CASE 648**



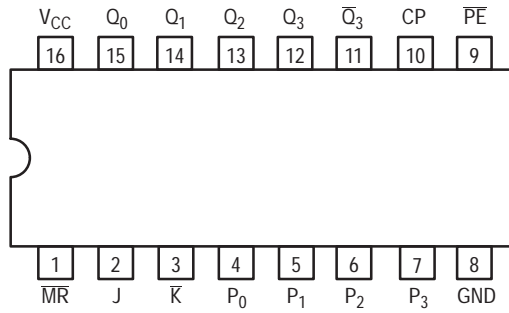
**SOIC
D SUFFIX
CASE 751B**

ORDERING INFORMATION

Device	Package	Shipping
SN74LS195AN	16 Pin DIP	2000 Units/Box
SN74LS195AD	16 Pin	2500/Tape & Reel

SN74LS195A

CONNECTION DIAGRAM DIP (TOP VIEW)



NOTE:
The Flatpak version has the same pinouts (Connection Diagram) as the Dual In-Line Package.

PIN NAMES

\overline{PE}	Parallel Enable (Active LOW) Input
$P_0 - P_3$	Parallel Data Inputs
J	First Stage J (Active HIGH) Input
\overline{K}	First Stage K (Active LOW) Input
CP	Clock (Active HIGH Going Edge) Input
\overline{MR}	Master Reset (Active LOW) Input
$Q_0 - Q_3$	Parallel Outputs
\overline{Q}_3	Complementary Last Stage Output

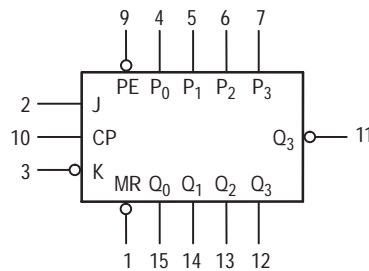
LOADING (Note a)

	HIGH	LOW
\overline{PE}	0.5 U.L.	0.25 U.L.
$P_0 - P_3$	0.5 U.L.	0.25 U.L.
J	0.5 U.L.	0.25 U.L.
\overline{K}	0.5 U.L.	0.25 U.L.
CP	0.5 U.L.	0.25 U.L.
\overline{MR}	0.5 U.L.	0.25 U.L.
$Q_0 - Q_3$	10 U.L.	5 U.L.
\overline{Q}_3	10 U.L.	5 U.L.

NOTES:

a) 1 TTL Unit Load (U.L.) = 40 μ A HIGH/1.6 mA LOW.

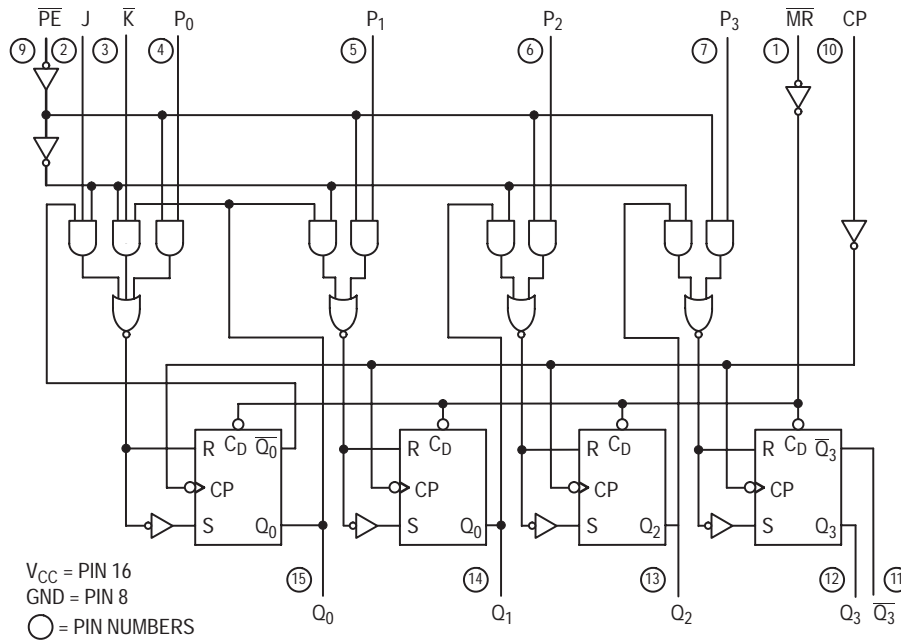
LOGIC SYMBOL



V_{CC} = PIN 16
GND = PIN 8

SN74LS195A

LOGIC DIAGRAM



FUNCTIONAL DESCRIPTION

The Logic Diagram and Truth Table indicate the functional characteristics of the LS195A 4-Bit Shift Register. The device is useful in a wide variety of shifting, counting and storage applications. It performs serial, parallel, serial to parallel, or parallel to serial data transfers at very high speeds.

The LS195A has two primary modes of operation, shift right ($Q_0 \rightarrow Q_1$) and parallel load which are controlled by the state of the Parallel Enable (\overline{PE}) input. When the PE input is HIGH, serial data enters the first flip-flop Q_0 via the J and \overline{K} inputs and is shifted one bit in the direction $Q_0 \rightarrow Q_1 \rightarrow Q_2 \rightarrow Q_3$ following each LOW to HIGH clock transition. The \overline{JK} inputs provide the flexibility of the JK type input for special applications, and the simple D type input for general applications by tying the two pins together. When the \overline{PE}

input is LOW, the LS195A appears as four common clocked D flip-flops. The data on the parallel inputs P_0, P_1, P_2, P_3 is transferred to the respective Q_0, Q_1, Q_2, Q_3 outputs following the LOW to HIGH clock transition. Shift left operations ($Q_3 \rightarrow Q_2$) can be achieved by tying the Q_n Outputs to the P_{n-1} inputs and holding the \overline{PE} input LOW.

All serial and parallel data transfers are synchronous, occurring after each LOW to HIGH clock transition. Since the LS195A utilizes edge-triggering, there is no restriction on the activity of the J, \overline{K} , P_n and \overline{PE} inputs for logic operation — except for the set-up and release time requirements.

A LOW on the asynchronous Master Reset (\overline{MR}) input sets all Q outputs LOW, independent of any other input condition.

MODE SELECT — TRUTH TABLE

OPERATING MODES	INPUTS					OUTPUTS				
	\overline{MR}	\overline{PE}	J	\overline{K}	P_n	Q_0	Q_1	Q_2	Q_3	\overline{Q}_3
Asynchronous Reset	L	X	X	X	X	L	L	L	L	H
Shift, Set First Stage	H	h	h	h	X	H	q_0	q_1	q_2	\overline{q}_2
Shift, Reset First	H	h	l	l	X	L	q_0	q_1	q_2	\overline{q}_2
Shift, Toggle First Stage	H	h	h	l	X	\overline{q}_0	q_0	q_1	q_2	\overline{q}_2
Shift, Retain First Stage	H	h	l	h	X	q_0	q_0	q_1	q_2	\overline{q}_2
Parallel Load	H	l	X	X	p_n	p_0	p_1	p_2	p_3	\overline{p}_3

L = LOW voltage levels

H = HIGH voltage levels

X = Don't Care

l = LOW voltage level one set-up time prior to the LOW to HIGH clock transition.

h = HIGH voltage level one set-up time prior to the LOW to HIGH clock transition.

p_n (q_n) = Lower case letters indicate the state of the referenced input (or output) one set-up time prior to the LOW to HIGH clock transition.

SN74LS195A

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
V _{IH}	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage for All Inputs
V _{IL}	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage for All Inputs
V _{IK}	Input Clamp Diode Voltage		-0.65	-1.5	V	V _{CC} = MIN, I _{IN} = -18 mA
V _{OH}	Output HIGH Voltage	2.7	3.5		V	V _{CC} = MIN, I _{OH} = MAX, V _{IN} = V _{IH} or V _{IL} per Truth Table
V _{OL}	Output LOW Voltage		0.25	0.4	V	I _{OL} = 4.0 mA V _{CC} = V _{CC} MIN, V _{IN} = V _{IL} or V _{IH} per Truth Table
			0.35	0.5	V	
I _{IH}	Input HIGH Current			20	μA	V _{CC} = MAX, V _{IN} = 2.7 V
				0.1	mA	V _{CC} = MAX, V _{IN} = 7.0 V
I _{IL}	Input LOW Current			-0.4	mA	V _{CC} = MAX, V _{IN} = 0.4 V
I _{OS}	Short Circuit Current (Note 1)	-20		-100	mA	V _{CC} = MAX
I _{CC}	Power Supply Current			21	mA	V _{CC} = MAX

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

AC CHARACTERISTICS (T_A = 25°C)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
f _{MAX}	Maximum Clock Frequency	30	39		MHz	V _{CC} = 5.0 V C _L = 15 pF
t _{PLH} t _{PHL}	Propagation Delay, Clock to Output		14 17	22 26	ns	
t _{PHL}	Propagation Delay, MR to Output		19	30	ns	

AC SETUP REQUIREMENTS (T_A = 25°C)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
t _W	CP Clock Pulse Width	16			ns	V _{CC} = 5.0 V
t _W	MR Pulse Width	12			ns	
t _s	PE Setup Time	25			ns	
t _s	Data Setup Time	15			ns	
t _{rec}	Recovery Time	25			ns	
t _{rel}	PE Release Time			10	ns	
t _h	Data Hold Time	0			ns	

DEFINITIONS OF TERMS

SETUP TIME(t_s) —is defined as the minimum time required for the correct logic level to be present at the logic input prior to the clock transition from LOW to HIGH in order to be recognized and transferred to the outputs.

HOLD TIME (t_h) — is defined as the minimum time following the clock transition from LOW to HIGH that the logic level must be maintained at the input in order to ensure

continued recognition. A negative HOLD TIME indicates that the correct logic level may be released prior to the clock transition from LOW to HIGH and still be recognized.

RECOVERY TIME (t_{rec}) — is defined as the minimum time required between the end of the reset pulse and the clock transition from LOW to HIGH in order to recognize and transfer HIGH Data to the Q outputs.

AC WAVEFORMS

The shaded areas indicate when the input is permitted to change for predictable output performance.

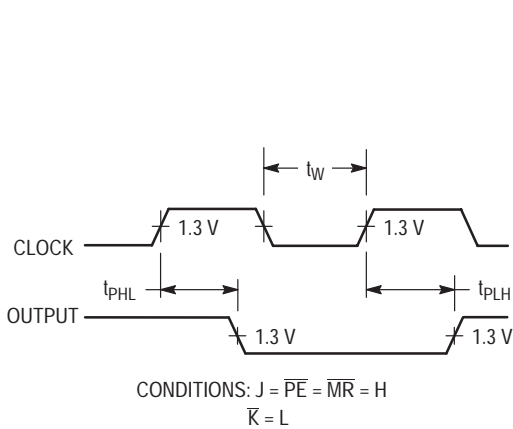


Figure 1. Clock to Output Delays and Clock Pulse Width

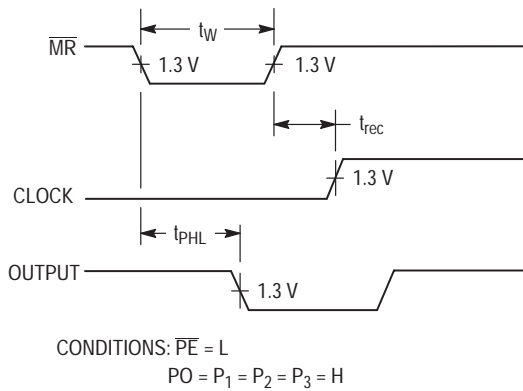


Figure 2. Master Reset Pulse Width, Master Reset to Output Delay and Master Reset to Clock Recovery Time

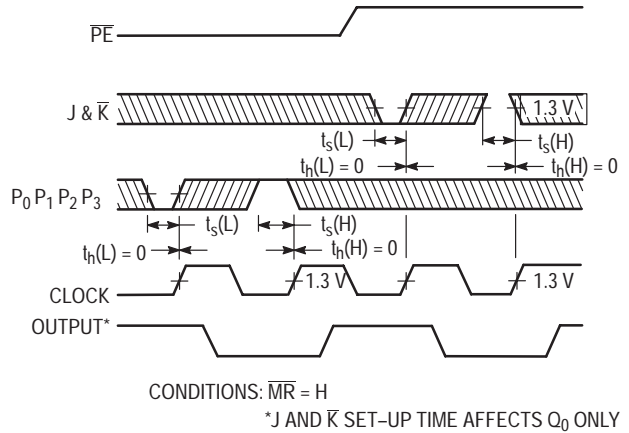


Figure 3. Setup (t_s) and Hold (t_h) Time for Serial Data (J & \bar{K}) and Parallel Data (P_0, P_1, P_2, P_3)

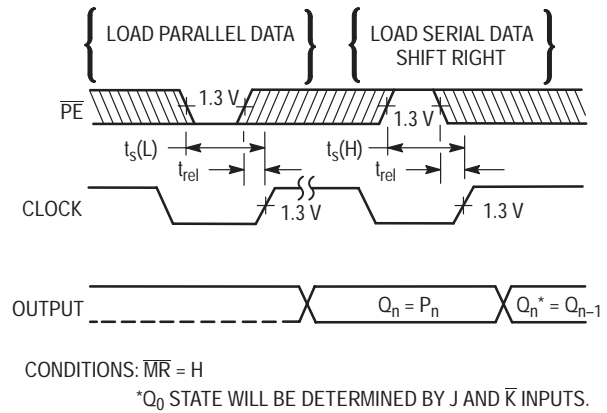
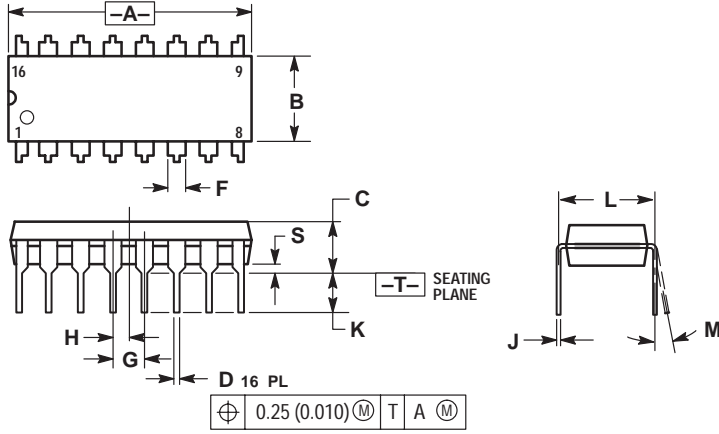


Figure 4. Setup (t_s) and Hold (t_h) Time for \bar{P} Input

SN74LS195A

PACKAGE DIMENSIONS

N SUFFIX
PLASTIC PACKAGE
CASE 648-08
ISSUE R



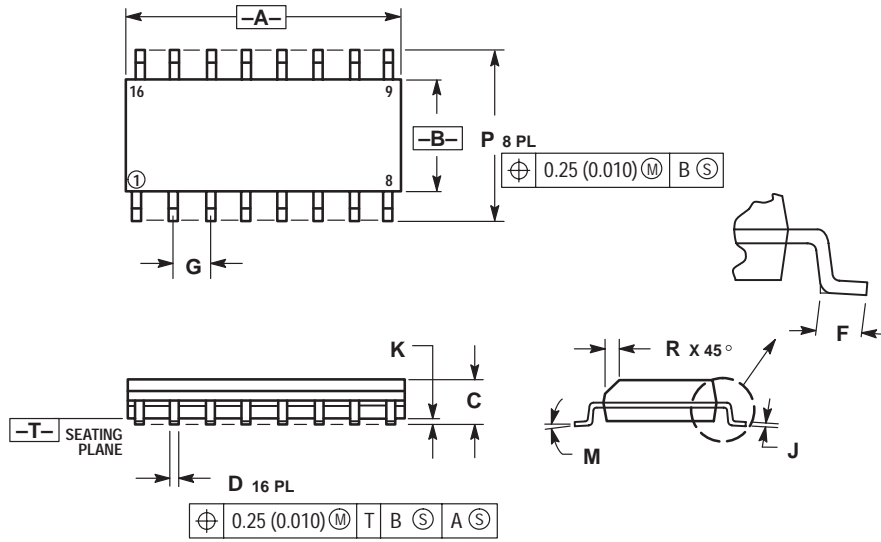
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

SN74LS195A


D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0° 7°		0° 7°	
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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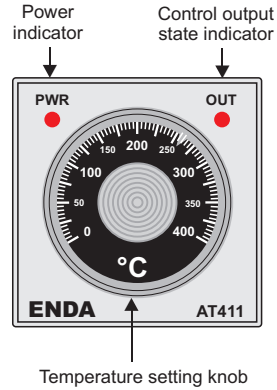
Datasheets for electronic components.



Read this document carefully before using this device. The guarantee will be expired by damaging of the device if you don't attend to the directions in the user manual. Also we don't accept any compensations for personal injury, material damage or capital disadvantages.

ENDA AT411 ANALOG THERMOSTAT

Thank you for choosing ENDA AT411 temperature controller.



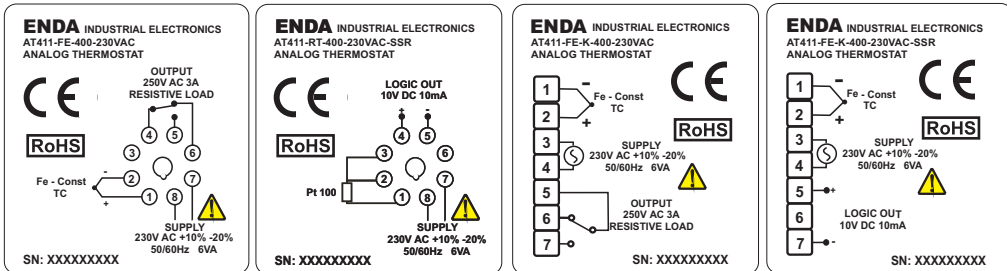
- * 48 x 48mm sized.
- * Fe-Const thermocouple or Pt100 input.
- * Selectable On-Off or time proportional controls.
- * Adjustable proportional band.
- * Suitable for 8-pins octal connector or screw terminal connection.
- * Control output is de-energised in the case of sensor failure.
- * CE marked according to European Norms.

Order Code : AT411-□-□-□-□-□-□-□-□-□-□

- 1- Sensor Type 2- Connection Type 3- Scale 4- Supply Voltage 5- Control Output
- FE...Fe-Const K.....Screw Terminal (for Fe-Const) 400....400°C 230VAC...230V AC SSR....Logic Output
- RT...Pt100 None...Octal Connector 300....300°C (for Fe-Const) 24VAC.....24V AC None...Relay
- 200....200°C (for Fe-Const) SM.....9-30V DC / 7-24V AC

Connection Diagram

ENDA AT411 is intended for installation in control panels. Make sure that the device is used only for intended purpose. The electrical connections must be carried on by a qualified staff and must be according to the relevant locally applicable regulations. During an installation, all of the cables that are connected to the device must be free of energy. The device must be protected against inadmissible humidity, vibrations, severe soiling and make sure that the operation temperature is not exceeded. All input and output lines that are not connected to the supply network must be laid out as shielded and twisted cables. These cables should not be close to the power cables or components. The shielding must be grounded on the instrument side.



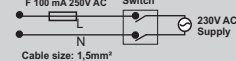
Logic output of the instrument is not electrically insulated from the internal circuits. Therefore, when using a grounding thermocouple, do not connect the logic output terminals to the ground.

- 1) Mains supply cords shall meet the requirements of IEC 60799 or IEC 60245.
- 2) In accordance with the safety regulations, the power supply switch shall bring the identification of the relevant instrument and it should be easily accessible by the operator.

NOTE :

SUPPLY:

Fuse should be connected.



SENSOR INPUT:

For Fe-Const thermocouple :
Use suitable compensation cables. Don't use jointed cables. Pay attention to the polarities of the thermocouple cables as shown in the figure below.

For resistance thermometer :
When 2 wired Pt 100 is used, terminals 2 and 3 must be short circuited.

Technical Specifications

ENVIRONMENTAL CONDITIONS	
Ambient/storage temperature	0 ... +50 °C/25 ... +70°C
Max. relative humidity	80%, up to 31 °C decreasing linearly 50% at 40 °C
Rated pollution degree	According to EN 60529 Front panel : IP60 Rear panel : IP20
Height	Maximum 2000m
Do not use the device in locations subject to corrosive and flammable gasses.	

ELECTRICAL CHARACTERISTICS	
Supply voltage	230V AC +10% -20% or 24VAC ±10%, 50/60Hz or optional 9-30V DC / 7-24V AC ±10% SMPS
Power consumption	Maximum 6VA
Connection	8-pins octal connector or screw terminal connection.
Scale	0 ... 400 °C / 0 ... 300 °C / 0 ... 200 °C
Sensitivity	5°C
Accuracy	±4% (of full scale)
EMC	EN 61326-1: 1997, A1: 1998, A2: 2001 (Performance criterion B is satisfied for EMC tests)
Safety requirements	EN 61010-1: 2001 (Pollution degree 2, overvoltage category II)

OUTPUT	
Control output	Relay: 250V AC, 3A (for resistive load), NO+NC or 10V DC 10mA logic output.
Life expectancy for relay	Mechanical 30.000.000 operation; Electrical 300.000 operation.
Control output state	When control output is energised OUT LED becomes on

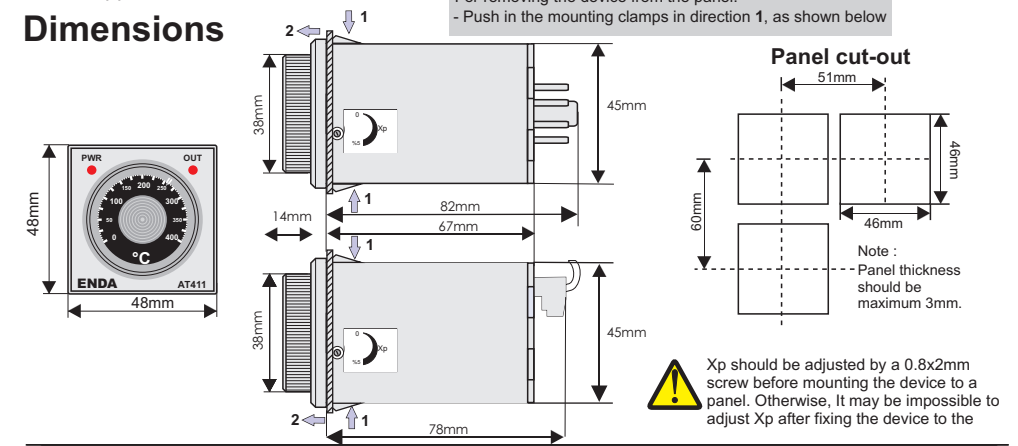
CONTROL	
Control type	Single-setpoint control
Control algorithm	On-Off (Xp=0) or time proportional controls
Proportional band	0 ... 5% (adjustable from the right sight.)
Hysteresis	3°C (for On-Off control)

HOUSING	
Housing type	Suitable for flush-panel mounting.
Dimensions	W48xH48xD82mm
Weight	Approx. 170g (after packing)
Enclosure material	Self extinguishing plastics
While cleaning the device, solvents (thinner, benzene, acid etc.) or corrosive materials must not be used.	

Application areas

Plastic injection presses, automatic bread making ovens, nylon bag machines, shrink packing machines, furniture presses, industrial ovens, textile machines, ironing presses and other temperature control applications.

Dimensions



SİSEL MÜHENDİSLİK ELEKTRONİK SAN. VE TİC. A.Ş.
Yukarı Dudullu Barbaros Cad. Kutup Sok. No:20 34775 - ÜMRANIYE/İSTANBUL/TURKEY
Tel : +90 216 499 46 64 Pbx. Fax : +90 216 365 74 01
url : www.enda.com.tr

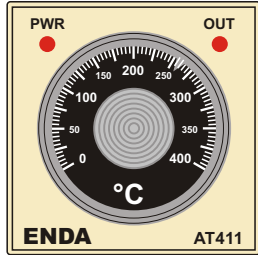
deutsch

! Lesen Sie bitte vor Inbetriebnahme des Gerätes die Bedienungsanleitung sorgfältig durch!
Bei Schäden, die durch Nichtbeachten dieser Bedienungsanleitung verursacht werden, erlischt der Garantieanspruch! Für Folgeschäden übernehmen wir keine Haftung!
Wir übernehmen ebenfalls keine Haftung für Personen-, Sach- oder Vermögensschäden.

ENDA AT411 ANALOGER TEMPERATURREGLER

Vielen Dank dafür, daß Sie sich für den ENDA AT411 Temperaturregler entschieden haben!

- * 48 x 48mm Schalttafeleinbau
- * Meßeingang für Pt100 oder Fe-CuNi (Typ J) Thermoemlement
- * ON-OFF Funktion bzw. einstellbare Proportionalband
- * Geeignet für DIN-Schienenmontage
- * Ausgangsrelais wird bei Fehler nicht aktiviert



Skala (°C)	Spannungsversorgung	Ausgang	Order code
400	230V AC +10% -20%	Relais	AT411
	24V AC ±10%	Logik Ausgang	AT411-SSR
300	230V AC +10% -20%	Relais	AT411-24
		Logik Ausgang	AT411-24-SSR
	24V AC ±10%	Relais	AT411-300
		Logik Ausgang	AT411-300-SSR
		Relais	AT411-300-24
		Logik Ausgang	AT411-300-24-SSR

Zubehör : **ERS08**, 8-polige Sockel für Hutschienenmontage (nicht im Lieferumfang enthalten!)

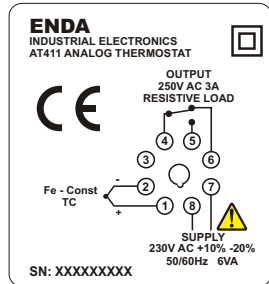
! Das Gerät darf nur mit einem feuchten Tuch abgewischt werden, keine aggressive Reinigungsmittel verwenden!

WICHTIGE HINWEISE!

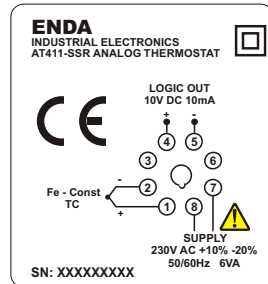
Das AT411 ist ausschließlich für den Schalttafeleinbau vorgesehen. Es ist unbedingt darauf zu achten, daß die Geräte nur bestimmungsgemäß eingesetzt werden dürfen. Bei Arbeiten an der Schalttafel müssen alle zum Gerät führenden Leitungen spannungsfrei sein, wenn die Gefahr besteht, daß die am Gerät befindlichen Anschlußklemmen berührt werden könnten. Zur Einhaltung der CE-Konformität sind abgeschirmte Kabel- und Signalleitungen zu verwenden. Diese sind getrennt von den Leistungsgeführten-/Nettleitungen zu verlegen. Die Abschirmung ist geräteseitig zu erden. Das Gerät ist so zu montieren, daß es vor Feuchtigkeit, Vibrationen und starker Verschmutzung geschützt ist und auch die Betriebsumgebungstemperatur eingehalten wird. Die Verdrahtung, Inbetriebnahme und Bedienung der Geräte muß durch ein entsprechend qualifiziertes Fachpersonal gemäß den örtlichen Vorschriften vorgenommen werden.



Anschlußbild AT411



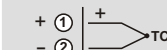
Anschlußbild AT411-SSR



Logikausgang des Gerätes AT411-SSR ist zur Elektronik nicht galvanisch isoliert. Bei Verwendung von geerdeten Fühlern dürfen diese nicht mit Logikausgang verbunden werden!

SENSOR Eingang:

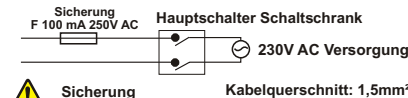
Verwenden Sie richtige Ausgleichsleitungen und achten Sie auf die Polarität des Thermoemlementes, wie unten abgebildet.



BEREMKUNG :

Versorgung :

184-253V AC (7) ← L
50/60Hz 6VA (8) ← N



! Sicherung anschließen!

Bei der Absicherung ist Last nicht berücksichtigt. Evtl. Last getrennt absichern!

Bemerkung :
1) Versorgungsanschußleitungen sollten IEC60799 oder IEC60245 konform sein.
2) Gemäß Sicherheitsnorm sollte der Hauptschalter am Schaltschrank leicht zugänglich angebracht und auch mit einem Hinweisschild versehen werden!

Technische Daten

BETRIEBSBEDINGUNGEN	
Betriebstemperatur / Lagerung	0 ... +50°C/-25 ... +70°C
Luftfeuchtigkeit	Bis 31°C 80%, bis 40°C 50% Luftfeuchtigkeit, <2000m
Schutzart	Entspricht nach EN 60529 Frontseite : IP60 Rückseite : IP20



Das Gerät nicht in explosiver oder korrosiver Umgebung einsetzen!

ELEKTRISCHE ANSCHLÜSSE	
Spannungsversorgung	230V AC +10% -20%, 50/60Hz, lieferbar auch in 24V AC ±10%, 50/60Hz
Leistungsaufnahme	Max. 2VA
Eingang / Anschluß	Thermoemlement FeCuNi Typ "J" oder Pt100 Widerstandsfühler / 8-polige Stecker
Skala	0 ... 400°C / 0 ... 300°C
Skalenaufösung	5°C
Genauigkeit	±3% (vom Skalenbereich)
Elektromagnetische Verträglichkeit	EN 61326-1: 1997, A1: 1998, A2: 2001 (Normkonform nach EN 61000-4-3, Prüfschärfe Kriterium B)
Elektrische Sicherheit	EN 61010-1: 2001 (Verschmutzungsgrad 2, Schutzklasse II)

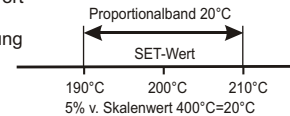
AUSGANG	
Heizstromausgang	Relais : Wechslerkontakt 250V AC, 3A (cosPhi=1) bzw. 10VDC/10mA Logikausgang
Lebensdauer Relais	Ohne Last 30 Mio. Schaltspiele, bei 250V AC, 2A (cosPhi=1) 300.000 Schaltspiele.
Ausgangszustandsanzeige	OUT LED leuchtet wenn das Relais aktiv ist

REGELUNGSART	
Sollwert	1 SollwertEinstellung
Regelungsart	Einstellbar zwischen "ON-OFF" (Xp=0) und Proportionalbandregelung
Prppotionalbandbereich	0 ... 5% vom Skalenwert (einstellbar auf der Geräteseite)
Hysterese	4°C (bei ON-OFF Regelung)

GEHÄUSE	
Gehäuseart	Schalttafeleinbau nach DIN43700, mit Befestigungsvorrichtung
Abmessungen	L48xB48xT95mm (ohne Sockel)
Gewicht	180g
Gehäusematerial	Selbstverlöschend

Das Proportionalband stellt ein "Band" um den Sollwert dar (Regelbereich). Liegt der Istwert außerhalb dieses Bandes, so wird die Ausgangsstellgröße (heizen) zu 100% bzw. 0% ausgegeben. Bei Unterschreitung wird das Relais ständig eingeschaltet, bei Überschreitung ausgeschaltet. Bei Annäherung an den Sollwerttemperatur die Schaltzeit des Relais immer kürzer, um ein Überspringen niedrig zu halten.

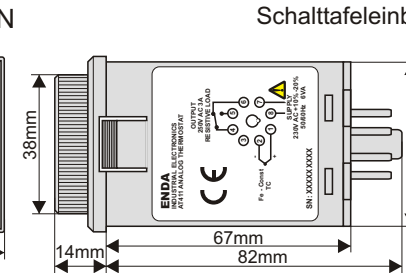
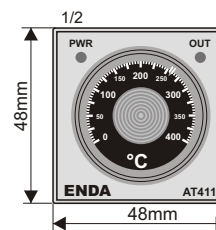
Xp=0 Schalthysterese klein bzw. 0 (Schaltzyklus hoch)



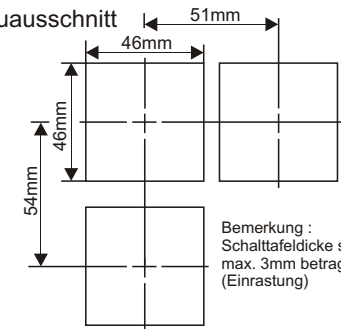
Einige Anwendungsgebiete :

Glasindustrie, Chemie und Pharmazie, Getränkeindustrie, Trocknungsanlagen, Papierindustrie, Nahrungsmittelindustrie, Bäckereianlagen, Kunststoffverarbeitungsmaschinen

ABMESSUNGEN



Schalttafeleinbauausschnitt



Bemerkung : Schalttafelstärke sollte max. 3mm betragen. (Einrastung)

SURAN Industrieelektronik
Dettinger Str. 9 / D-72160 Horb a.N

Tel.: +49 (0)7451 / 625 617
Fax: +49 (0)7451 / 625 0650

E-mail : info@suran-elektronik.de
Internet : www.suran-elektronik.de

POSITIVE VOLTAGE REGULATORS

- OUTPUT CURRENT TO 1.5A
- OUTPUT VOLTAGES OF 5; 5.2; 6; 8; 8.5; 9; 10; 12; 15; 18; 24V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSITION SOA PROTECTION

DESCRIPTION

The L7800 series of three-terminal positive regulators is available in TO-220, TO-220FP, TO-220FM, TO-3 and D²PAK packages and several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe 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 voltage and currents.

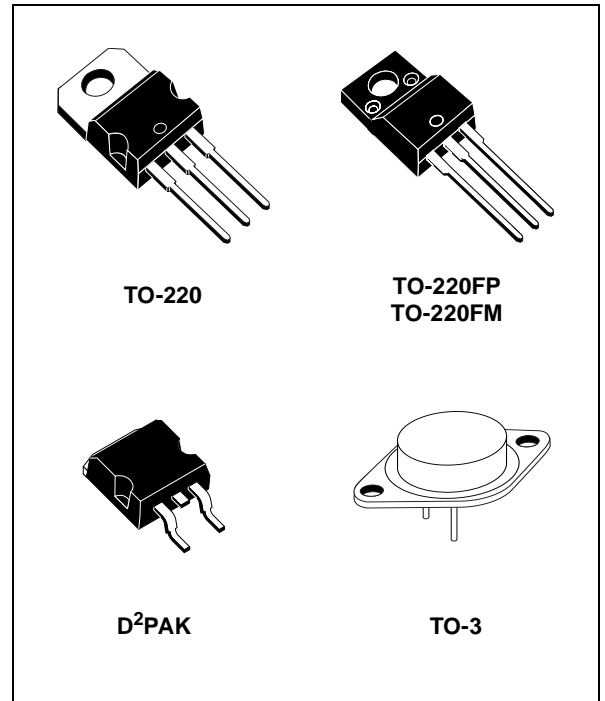


Figure 1: Schematic Diagram

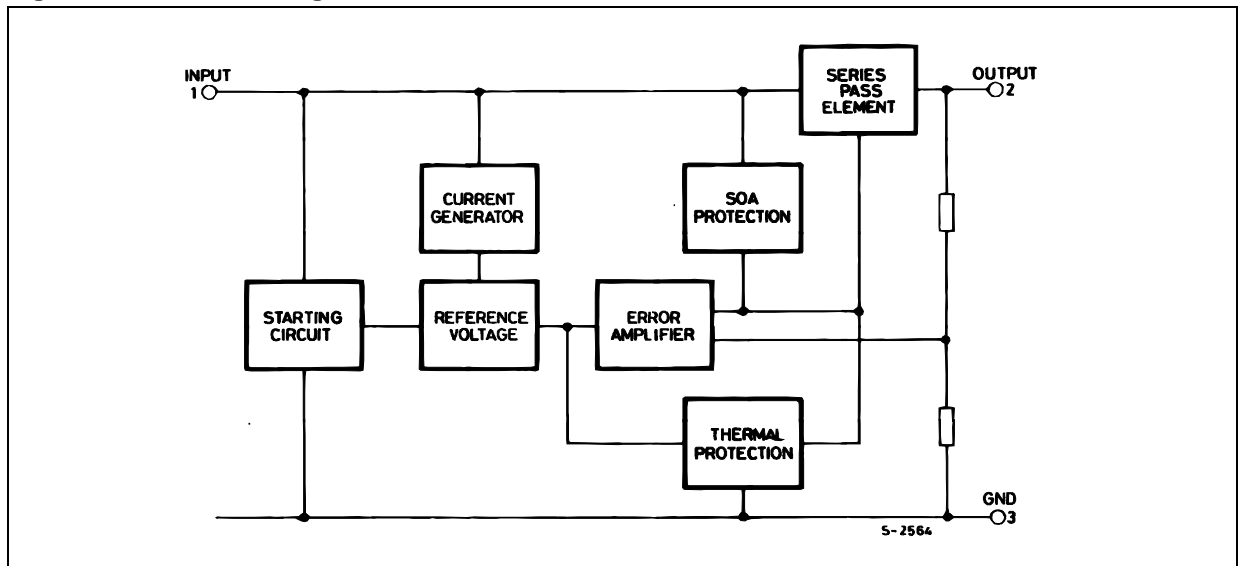


Table 1: Absolute Maximum Ratings

Symbol	Parameter		Value	Unit
V_I	DC Input Voltage	for $V_O= 5$ to $18V$	35	V
		for $V_O= 20, 24V$	40	
I_O	Output Current		Internally Limited	
P_{tot}	Power Dissipation		Internally Limited	
T_{stg}	Storage Temperature Range		-65 to 150	°C
T_{op}	Operating Junction Temperature Range	for L7800	-55 to 150	°C
		for L7800C	0 to 150	

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 2: Thermal Data

Symbol	Parameter	D ² PAK	TO-220	TO-220FP	TO-220FM	TO-3	Unit
$R_{thj-case}$	Thermal Resistance Junction-case Max	3	5	5	5	4	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max	62.5	50	60	60	35	°C/W

Figure 2: Schematic Diagram

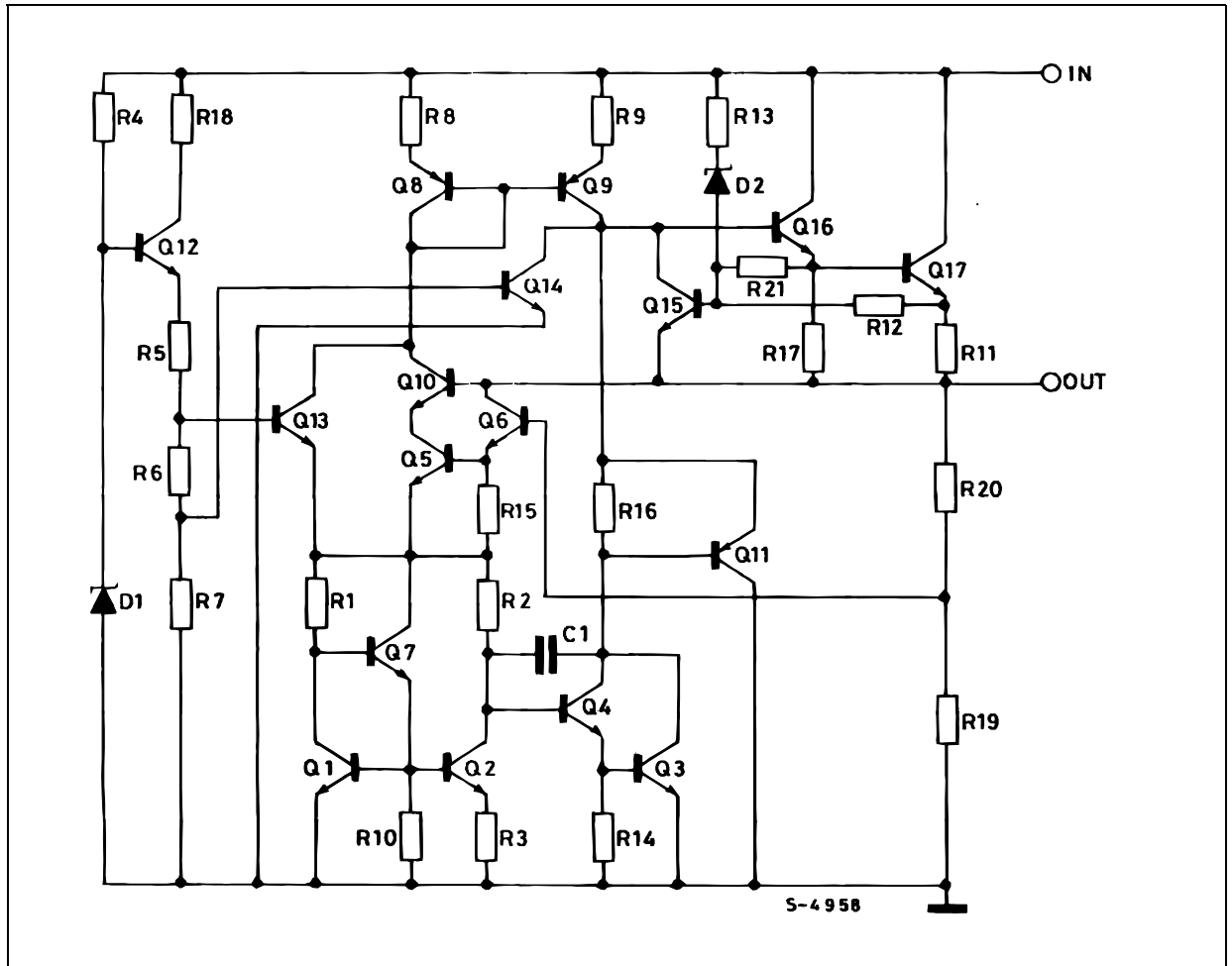


Figure 3: Connection Diagram (top view)

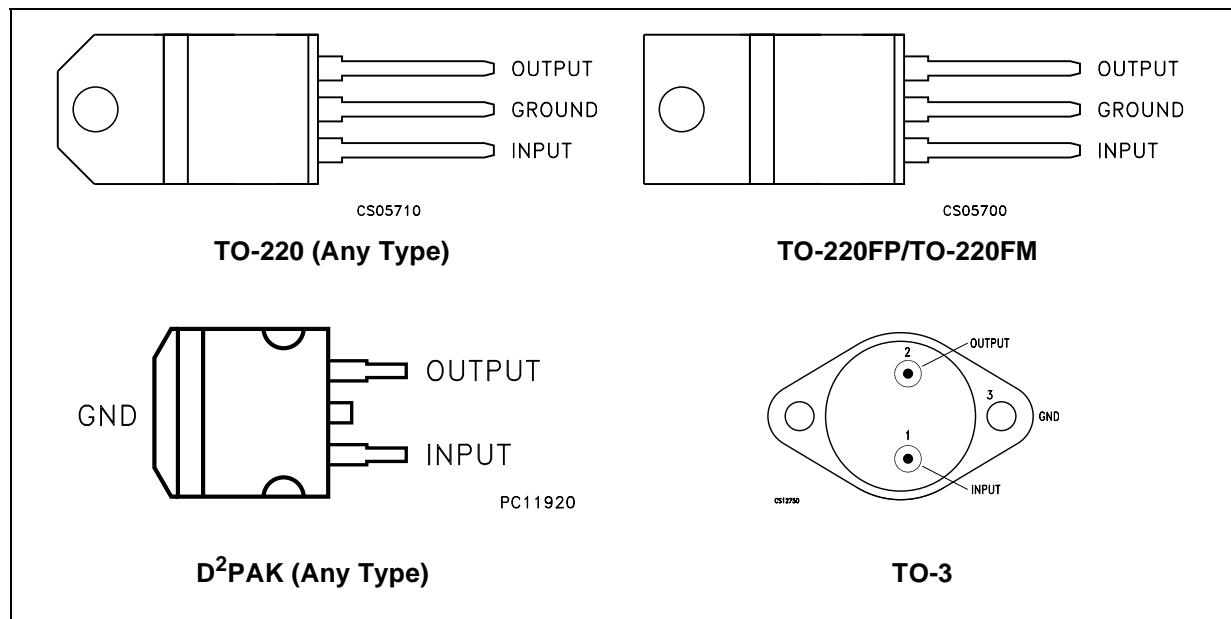
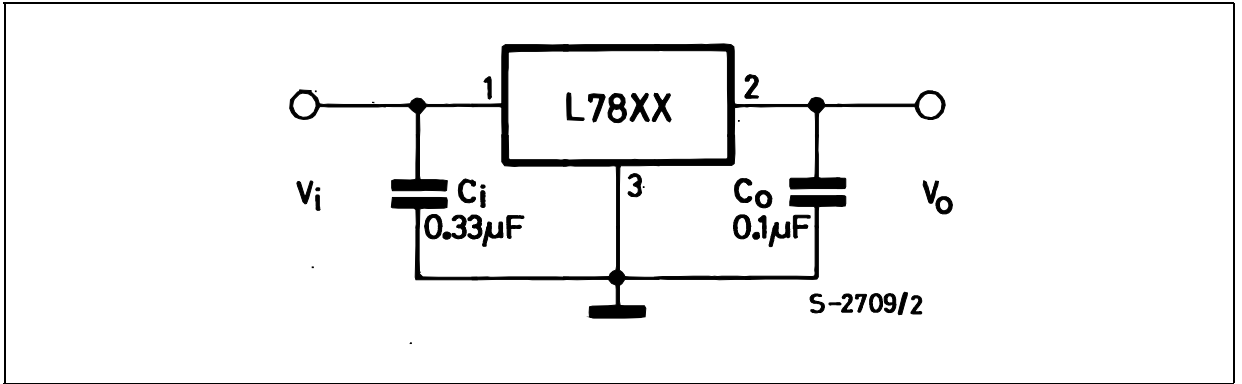


Table 3: Order Codes

TYPE	TO-220 (A Type)	TO-220 (C Type)	TO-220 (E Type)	D ² PAK (A Type) (*)	D ² PAK (C Type) (T & R)	TO-220FP	TO-220FM	TO-3
L7805								L7805T
L7805C	L7805CV	L7805C-V	L7805CV1	L7805CD2T	L7805C-D2TR	L7805CP	L7805CF	L7805CT
L7852C	L7852CV			L7852CD2T		L7852CP	L7852CF	L7852CT
L7806								L7806T
L7806C	L7806CV	L7806C-V		L7806CD2T		L7806CP	L7806CF	L7806CT
L7808								L7808T
L7808C	L7808CV	L7808C-V		L7808CD2T		L7808CP	L7808CF	L7808CT
L7885C	L7885CV			L7885CD2T		L7885CP	L7885CF	L7885CT
L7809C	L7809CV	L7809C-V		L7809CD2T		L7809CP	L7809CF	L7809CT
L7810C	L7810CV			L7810CD2T		L7810CP		
L7812								L7812T
L7812C	L7812CV	L7812C-V		L7812CD2T		L7812CP	L7812CF	L7812CT
L7815								L7815T
L7815C	L7815CV	L7815C-V		L7815CD2T		L7815CP	L7815CF	L7815CT
L7818								L7818T
L7818C	L7818CV			L7818CD2T		L7818CP	L7818CF	L7818CT
L7820								L7820T
L7820C	L7820CV			L7820CD2T		L7820CP	L7820CF	L7820CT
L7824								L7824T
L7824C	L7824CV			L7824CD2T		L7824CP	L7824CF	L7824CT

(*) Available in Tape & Reel with the suffix "-TR".

Figure 4: Application Circuits



TEST CIRCUITS

Figure 5: DC Parameter

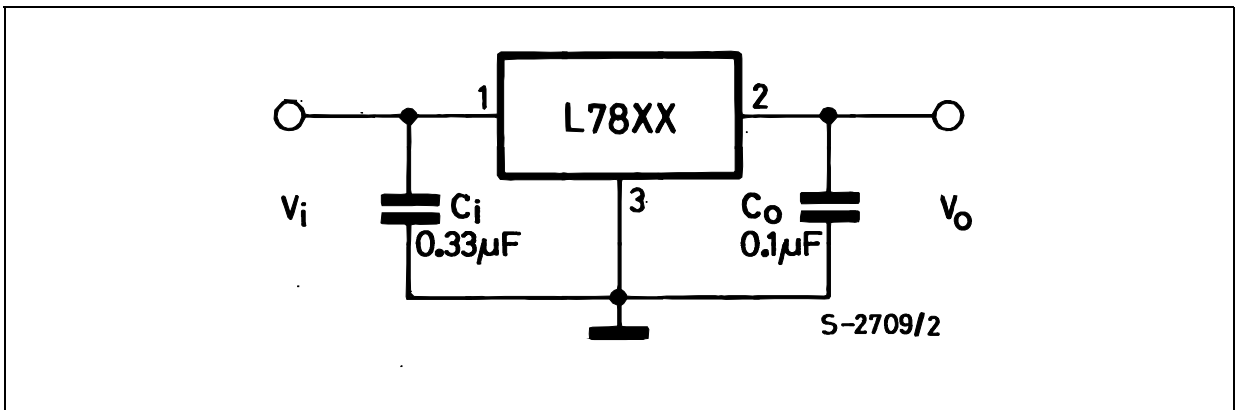


Figure 6: Load Regulation

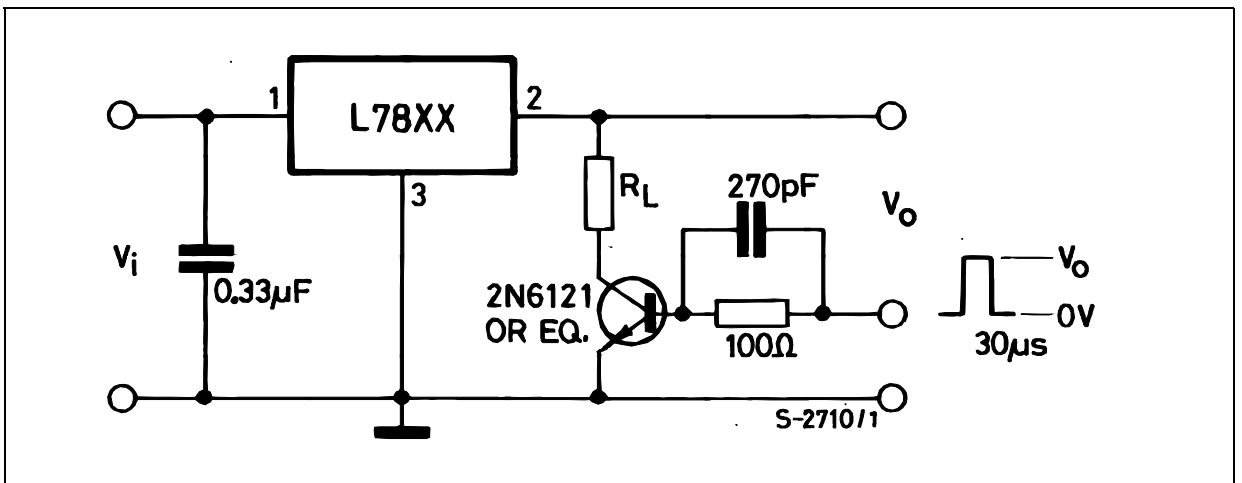


Figure 7: Ripple Rejection

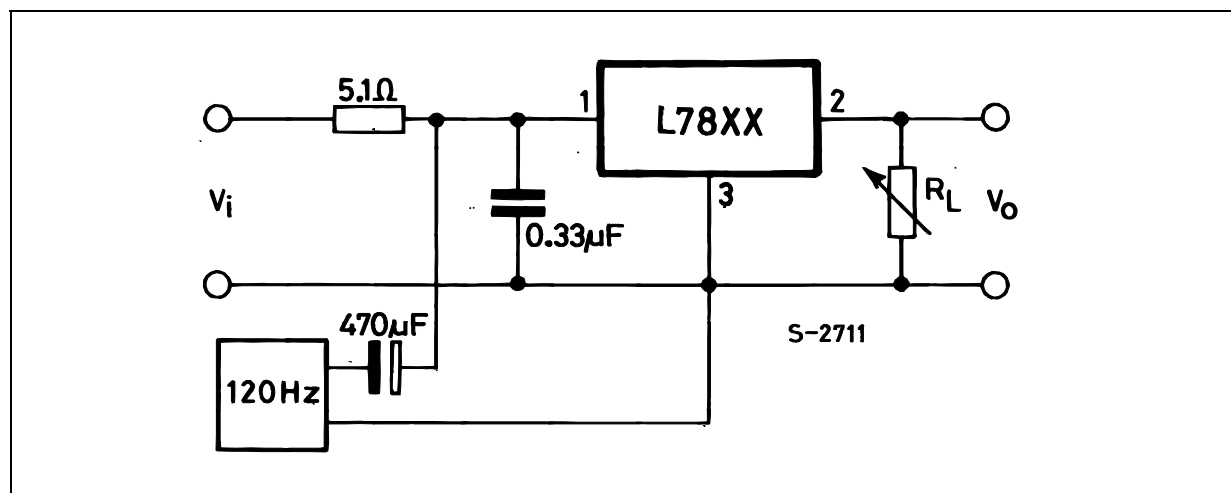


Table 4: Electrical Characteristics Of L7805 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 10\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	4.8	5	5.2	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 8\text{ to }20\text{ V}$	4.65	5	5.35	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 7\text{ to }25\text{ V}$ $T_J = 25^\circ\text{C}$		3	50	mV
		$V_I = 8\text{ to }12\text{ V}$ $T_J = 25^\circ\text{C}$		1	25	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			25	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 8\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		0.6		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 8\text{ to }18\text{ V}$ $f = 120\text{Hz}$	68			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1\text{ KHz}$		17		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 5: Electrical Characteristics Of L7806 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 11\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	5.75	6	6.25	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 9\text{ to }21\text{ V}$	5.65	6	6.35	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 8\text{ to }25\text{ V}$ $T_J = 25^\circ\text{C}$			60	mV
		$V_I = 9\text{ to }13\text{ V}$ $T_J = 25^\circ\text{C}$			30	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			30	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 9\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		0.7		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 9\text{ to }19\text{ V}$ $f = 120\text{Hz}$	65			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1\text{ KHz}$		19		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 6: Electrical Characteristics Of L7808 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 14\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	7.7	8	8.3	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 11.5\text{ to }23\text{ V}$	7.6	8	8.4	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 10.5\text{ to }25\text{ V}$ $T_J = 25^\circ\text{C}$			80	mV
		$V_I = 11\text{ to }17\text{ V}$ $T_J = 25^\circ\text{C}$			40	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			40	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 11.5\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 11.5\text{ to }21.5\text{ V}$ $f = 120\text{Hz}$	62			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1\text{ KHz}$		16		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 7: Electrical Characteristics Of L7812 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 19\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	11.5	12	12.5	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 15.5\text{ to }27\text{ V}$	11.4	12	12.6	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 14.5\text{ to }30\text{ V}$ $T_J = 25^\circ\text{C}$			120	mV
		$V_I = 16\text{ to }22\text{ V}$ $T_J = 25^\circ\text{C}$			60	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			60	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 15\text{ to }30\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		1.5		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 15\text{ to }25\text{ V}$ $f = 120\text{Hz}$	61			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1\text{ KHz}$		18		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 8: Electrical Characteristics Of L7815 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 23\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	14.4	15	15.6	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 18.5\text{ to }30\text{ V}$	14.25	15	15.75	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 17.5\text{ to }30\text{ V}$ $T_J = 25^\circ\text{C}$			150	mV
		$V_I = 20\text{ to }26\text{ V}$ $T_J = 25^\circ\text{C}$			75	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			150	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			75	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 18.5\text{ to }30\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		1.8		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 18.5\text{ to }28.5\text{ V}$ $f = 120\text{Hz}$	60			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1\text{ KHz}$		19		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 9: Electrical Characteristics Of L7818 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 26\text{V}$, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	17.3	18	18.7	V
V_O	Output Voltage	$I_O = 5$ mA to 1 A $P_O \leq 15\text{W}$ $V_I = 22$ to 33 V	17.1	18	18.9	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 21$ to 33 V $T_J = 25^\circ\text{C}$			180	mV
		$V_I = 24$ to 30 V $T_J = 25^\circ\text{C}$			90	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5$ mA to 1.5 A $T_J = 25^\circ\text{C}$			180	mV
		$I_O = 250$ to 750 mA $T_J = 25^\circ\text{C}$			90	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 22$ to 33 V			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5$ mA		2.3		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	B = 10Hz to 100KHz $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 22$ to 32 V $f = 120\text{Hz}$	59			dB
V_d	Dropout Voltage	$I_O = 1$ A $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1$ KHz		22		m Ω
I_{sc}	Short Circuit Current	$V_I = 35$ V $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 10: Electrical Characteristics Of L7820 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 28\text{V}$, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	19.2	20	20.8	V
V_O	Output Voltage	$I_O = 5$ mA to 1 A $P_O \leq 15\text{W}$ $V_I = 24$ to 35 V	19	20	21	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 22.5$ to 35 V $T_J = 25^\circ\text{C}$			200	mV
		$V_I = 26$ to 32 V $T_J = 25^\circ\text{C}$			100	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5$ mA to 1.5 A $T_J = 25^\circ\text{C}$			200	mV
		$I_O = 250$ to 750 mA $T_J = 25^\circ\text{C}$			100	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 24$ to 35 V			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5$ mA		2.5		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	B = 10Hz to 100KHz $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 24$ to 35 V $f = 120\text{Hz}$	58			dB
V_d	Dropout Voltage	$I_O = 1$ A $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1$ KHz		24		m Ω
I_{sc}	Short Circuit Current	$V_I = 35$ V $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 11: Electrical Characteristics Of L7824 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 33\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	23	24	25	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 28\text{ to }38\text{ V}$	22.8	24	25.2	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 27\text{ to }38\text{ V}$ $T_J = 25^\circ\text{C}$			240	mV
		$V_I = 30\text{ to }36\text{ V}$ $T_J = 25^\circ\text{C}$			120	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			240	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			120	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 28\text{ to }38\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		3		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 28\text{ to }38\text{ V}$ $f = 120\text{Hz}$	56			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output Resistance	$f = 1\text{ KHz}$		28		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 12: Electrical Characteristics Of L7805C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 10\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	4.8	5	5.2	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 7\text{ to }20\text{ V}$	4.75	5	5.25	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 7\text{ to }25\text{ V}$ $T_J = 25^\circ\text{C}$		3	100	mV
		$V_I = 8\text{ to }12\text{ V}$ $T_J = 25^\circ\text{C}$		1	50	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			50	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 7\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1.1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		40		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 8\text{ to }18\text{ V}$ $f = 120\text{Hz}$	62			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		17		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 13: Electrical Characteristics Of L7852C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 10\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	5.0	5.2	5.4	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 8\text{ to }20\text{ V}$	4.95	5.2	5.45	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 7\text{ to }25\text{ V}$ $T_J = 25^\circ\text{C}$		3	105	mV
		$V_I = 8\text{ to }12\text{ V}$ $T_J = 25^\circ\text{C}$		1	52	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			105	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			52	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 7\text{ to }25\text{ V}$			1.3	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		42		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 8\text{ to }18\text{ V}$ $f = 120\text{Hz}$	61			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		17		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.75		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 14: Electrical Characteristics Of L7806C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 11\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	5.75	6	6.25	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 8\text{ to }21\text{ V}$	5.7	6	6.3	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 8\text{ to }25\text{ V}$ $T_J = 25^\circ\text{C}$			120	mV
		$V_I = 9\text{ to }13\text{ V}$ $T_J = 25^\circ\text{C}$			60	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			120	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			60	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 8\text{ to }25\text{ V}$			1.3	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-0.8		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		45		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 9\text{ to }19\text{ V}$ $f = 120\text{Hz}$	59			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		19		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.55		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 15: Electrical Characteristics Of L7808C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 14\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	7.7	8	8.3	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 10.5\text{ to }25\text{ V}$	7.6	8	8.4	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 10.5\text{ to }25\text{ V}$ $T_J = 25^\circ\text{C}$			160	mV
		$V_I = 11\text{ to }17\text{ V}$ $T_J = 25^\circ\text{C}$			80	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			160	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			80	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 10.5\text{ to }25\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-0.8		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		52		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 11.5\text{ to }21.5\text{ V}$ $f = 120\text{Hz}$	56			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		16		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.45		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 16: Electrical Characteristics Of L7885C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 14.5\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	8.2	8.5	8.8	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 11\text{ to }26\text{ V}$	8.1	8.5	8.9	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 11\text{ to }27\text{ V}$ $T_J = 25^\circ\text{C}$			160	mV
		$V_I = 11.5\text{ to }17.5\text{ V}$ $T_J = 25^\circ\text{C}$			80	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			160	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			80	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 11\text{ to }27\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-0.8		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		55		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 12\text{ to }22\text{ V}$ $f = 120\text{Hz}$	56			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		16		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.45		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 17: Electrical Characteristics Of L7809C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 15\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	8.64	9	9.36	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 11.5\text{ to }26\text{ V}$	8.55	9	9.45	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 11.5\text{ to }26\text{ V}$ $T_J = 25^\circ\text{C}$			180	mV
		$V_I = 12\text{ to }18\text{ V}$ $T_J = 25^\circ\text{C}$			90	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			180	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			90	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 11.5\text{ to }26\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		70		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 12\text{ to }23\text{ V}$ $f = 120\text{Hz}$	55			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		17		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.40		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 18: Electrical Characteristics Of L7810C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 16\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	9.6	10	10.4	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 12.5\text{ to }26\text{ V}$	9.5	10	10.5	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 12.5\text{ to }26\text{ V}$ $T_J = 25^\circ\text{C}$			200	mV
		$V_I = 13.5\text{ to }19\text{ V}$ $T_J = 25^\circ\text{C}$			100	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			200	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			100	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 12.5\text{ to }26\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		70		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 13\text{ to }23\text{ V}$ $f = 120\text{Hz}$	55			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		17		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.40		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 19: Electrical Characteristics Of L7812C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 19\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	11.5	12	12.5	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 14.5\text{ to }27\text{ V}$	11.4	12	12.6	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 14.5\text{ to }30\text{ V}$ $T_J = 25^\circ\text{C}$			240	mV
		$V_I = 16\text{ to }22\text{ V}$ $T_J = 25^\circ\text{C}$			120	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			240	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			120	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 14.5\text{ to }30\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		75		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 15\text{ to }25\text{ V}$ $f = 120\text{Hz}$	55			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		18		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.35		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 20: Electrical Characteristics Of L7815C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 23\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	14.5	15	15.6	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 17.5\text{ to }30\text{ V}$	14.25	15	15.75	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 17.5\text{ to }30\text{ V}$ $T_J = 25^\circ\text{C}$			300	mV
		$V_I = 20\text{ to }26\text{ V}$ $T_J = 25^\circ\text{C}$			150	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			300	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			150	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 17.5\text{ to }30\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		90		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 18.5\text{ to }28.5\text{ V}$ $f = 120\text{Hz}$	54			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		19		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.23		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 21: Electrical Characteristics Of L7818C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 26\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	17.3	18	18.7	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 21\text{ to }33\text{ V}$	17.1	18	18.9	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 21\text{ to }33\text{ V}$ $T_J = 25^\circ\text{C}$			360	mV
		$V_I = 24\text{ to }30\text{ V}$ $T_J = 25^\circ\text{C}$			180	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			360	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			180	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 21\text{ to }33\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		110		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 22\text{ to }32\text{ V}$ $f = 120\text{Hz}$	53			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		22		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.20		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.1		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 22: Electrical Characteristics Of L7820C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 28\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	19.2	20	20.8	V
V_O	Output Voltage	$I_O = 5\text{ mA to }1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 23\text{ to }35\text{ V}$	19	20	21	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 22.5\text{ to }35\text{ V}$ $T_J = 25^\circ\text{C}$			400	mV
		$V_I = 26\text{ to }32\text{ V}$ $T_J = 25^\circ\text{C}$			200	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to }1.5\text{ A}$ $T_J = 25^\circ\text{C}$			400	mV
		$I_O = 250\text{ to }750\text{ mA}$ $T_J = 25^\circ\text{C}$			200	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 23\text{ to }35\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to }100\text{KHz}$ $T_J = 25^\circ\text{C}$		150		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 24\text{ to }35\text{ V}$ $f = 120\text{Hz}$	52			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		24		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.18		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.1		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 23: Electrical Characteristics Of L7824C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = 33\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	23	24	25	V
V_O	Output Voltage	$I_O = 5\text{ mA to } 1\text{ A}$ $P_O \leq 15\text{W}$ $V_I = 27\text{ to } 38\text{ V}$	22.8	24	25.2	V
$\Delta V_{O(*)}$	Line Regulation	$V_I = 27\text{ to } 38\text{ V}$ $T_J = 25^\circ\text{C}$			480	mV
		$V_I = 30\text{ to } 36\text{ V}$ $T_J = 25^\circ\text{C}$			240	
$\Delta V_{O(*)}$	Load Regulation	$I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$			480	mV
		$I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$			240	
I_d	Quiescent Current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent Current Change	$I_O = 5\text{ mA to } 1\text{ A}$			0.5	mA
		$V_I = 27\text{ to } 38\text{ V}$			1	
$\Delta V_O/\Delta T$	Output Voltage Drift	$I_O = 5\text{ mA}$		-1.5		mV/ $^\circ\text{C}$
eN	Output Noise Voltage	$B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$		170		$\mu\text{V}/V_O$
SVR	Supply Voltage Rejection	$V_I = 28\text{ to } 38\text{ V}$ $f = 120\text{Hz}$	50			dB
V_d	Dropout Voltage	$I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$		2		V
R_O	Output Resistance	$f = 1\text{ KHz}$		28		m Ω
I_{sc}	Short Circuit Current	$V_I = 35\text{ V}$ $T_J = 25^\circ\text{C}$		0.15		A
I_{scp}	Short Circuit Peak Current	$T_J = 25^\circ\text{C}$		2.1		A

(*) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Figure 8: Dropout Voltage vs Junction Temperature

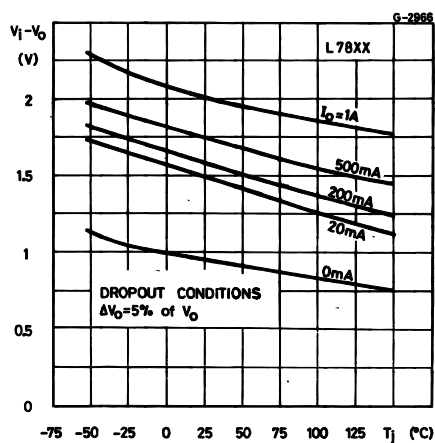


Figure 9: Peak Output Current vs Input/output Differential Voltage

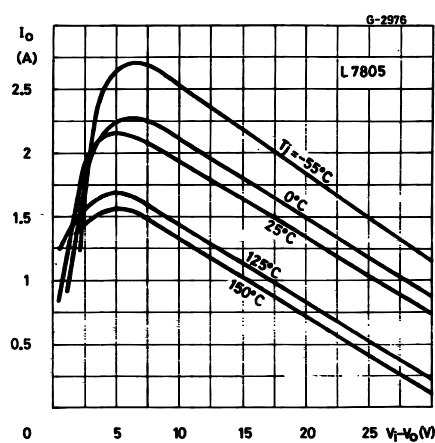


Figure 10: Supply Voltage Rejection vs Frequency

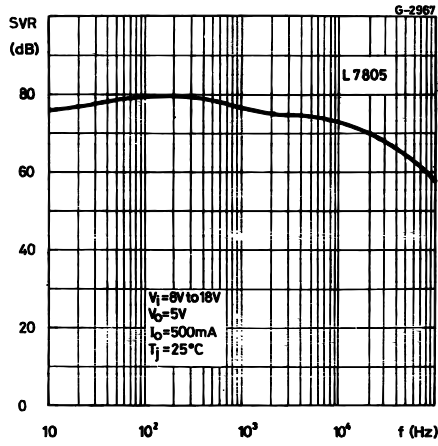


Figure 13: Quiescent Current vs Junction Temperature

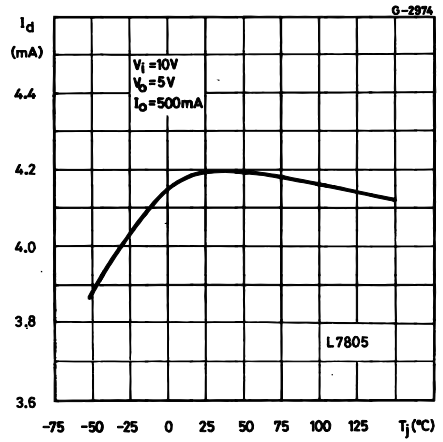


Figure 11: Output Voltage vs Junction Temperature

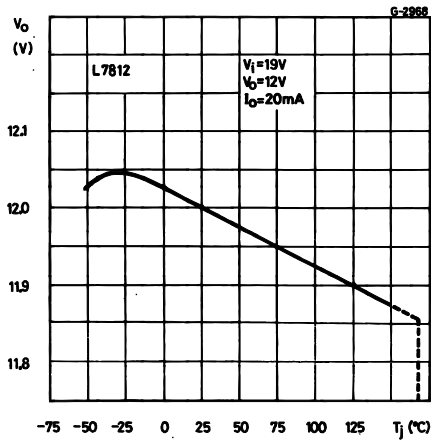


Figure 14: Load Transient Response

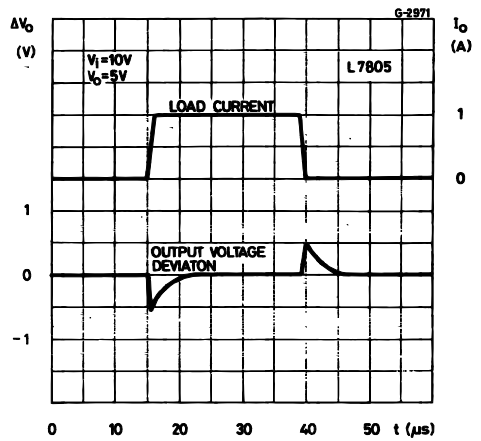


Figure 12: Output Impedance vs Frequency

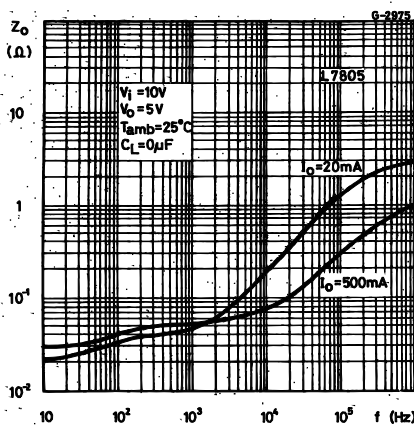


Figure 15: Line Transient Response

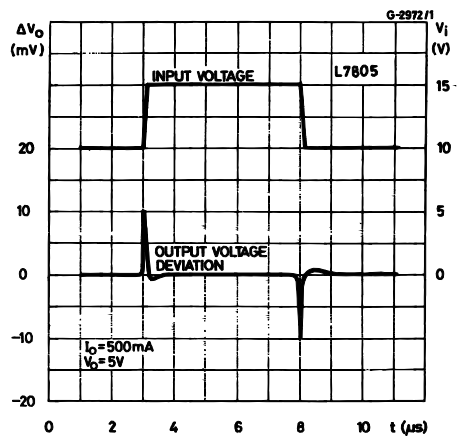


Figure 16: Quiescent Current vs Input Voltage

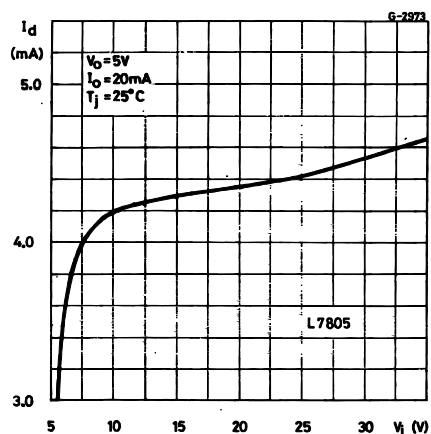
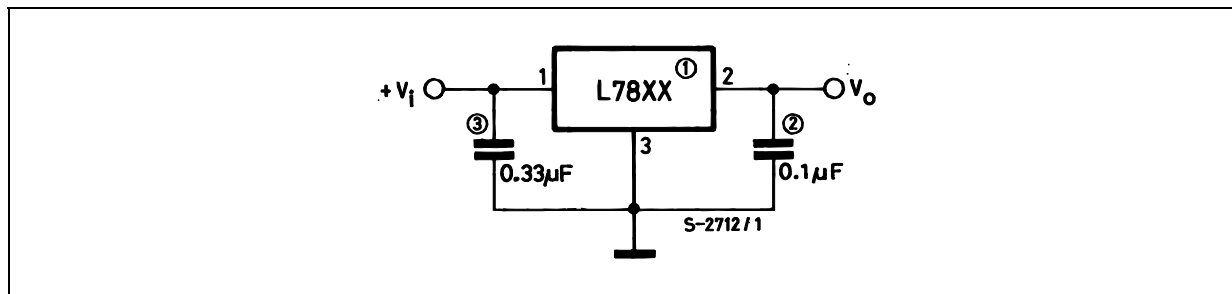


Figure 17: Fixed Output Regulator



NOTE:

1. To specify an output voltage, substitute voltage value for "XX".
2. Although no output capacitor is need for stability, it does improve transient response.
3. Required if regulator is locate an appreciable distance from power supply filter.

Figure 18: Current Regulator

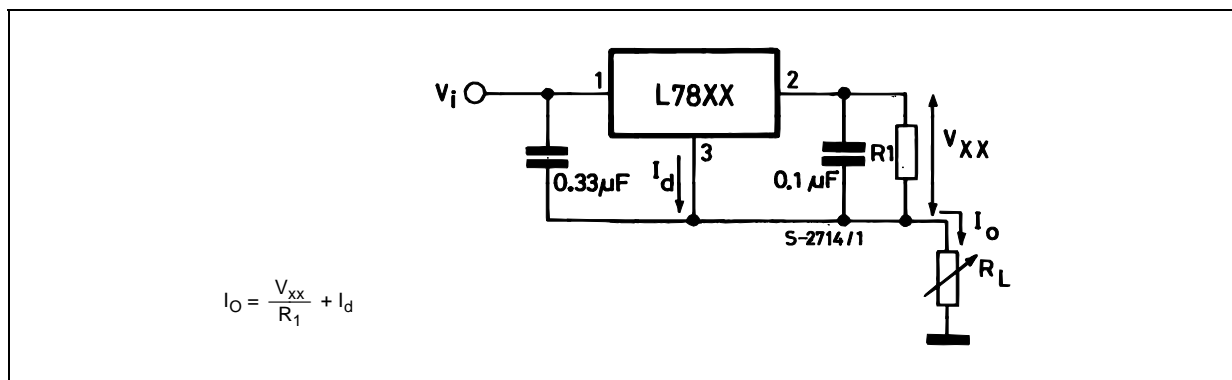


Figure 19: Circuit for Increasing Output Voltage

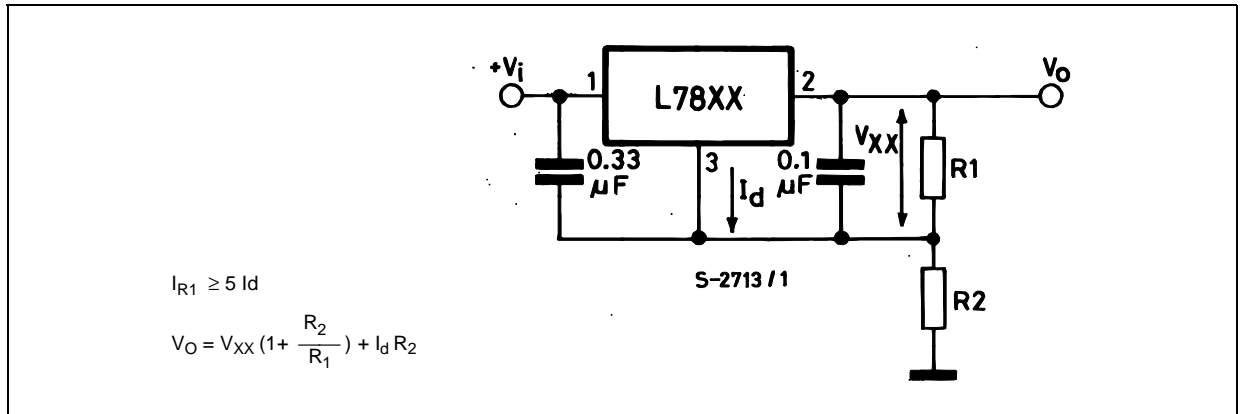


Figure 20: Adjustable Output Regulator (7 to 30V)

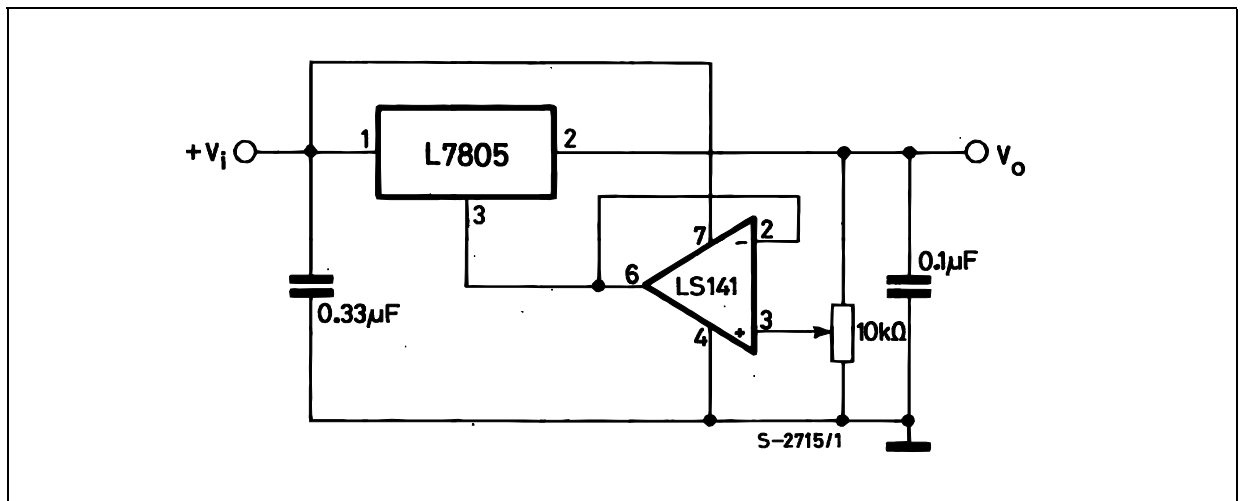


Figure 21: 0.5 to 10V Regulator

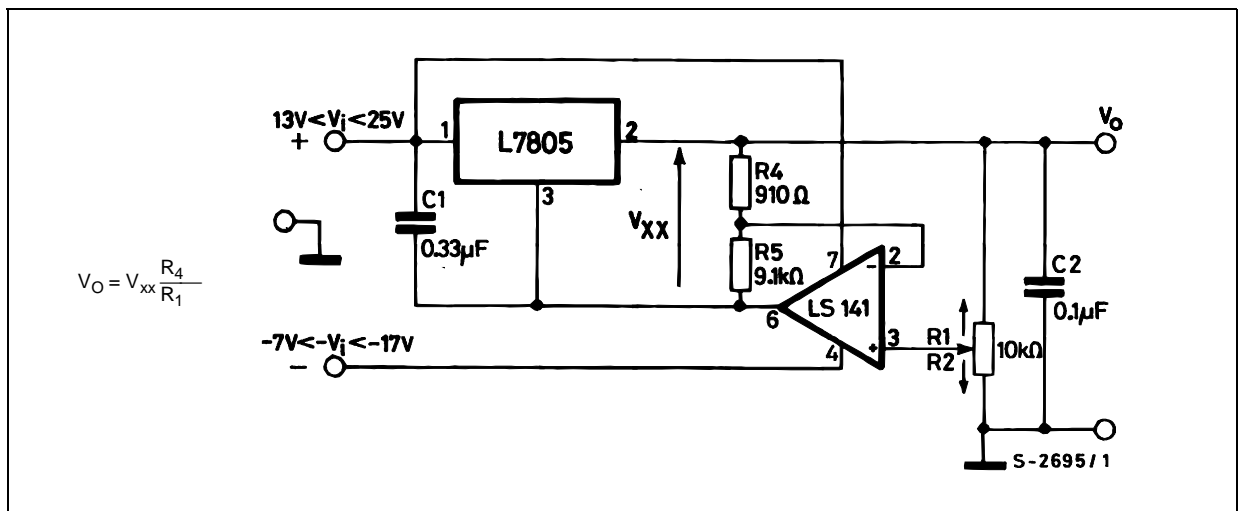


Figure 22: High Current Voltage Regulator

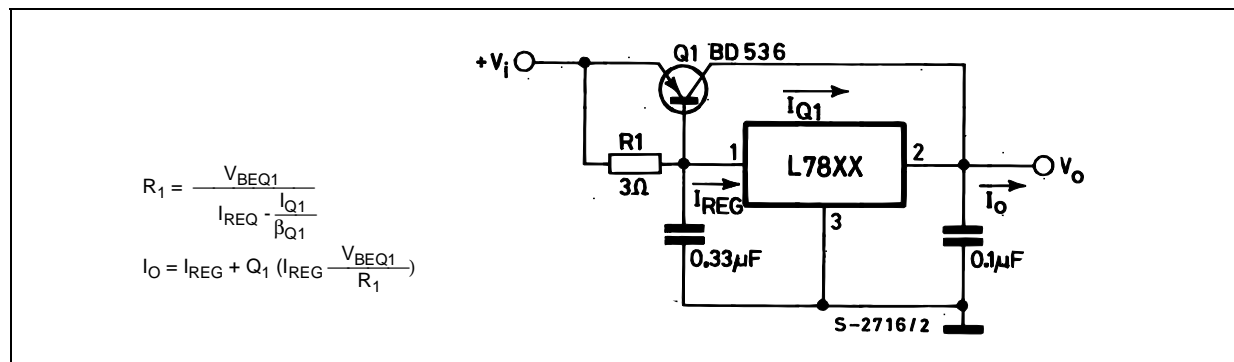


Figure 23: High Output Current with Short Circuit Protection

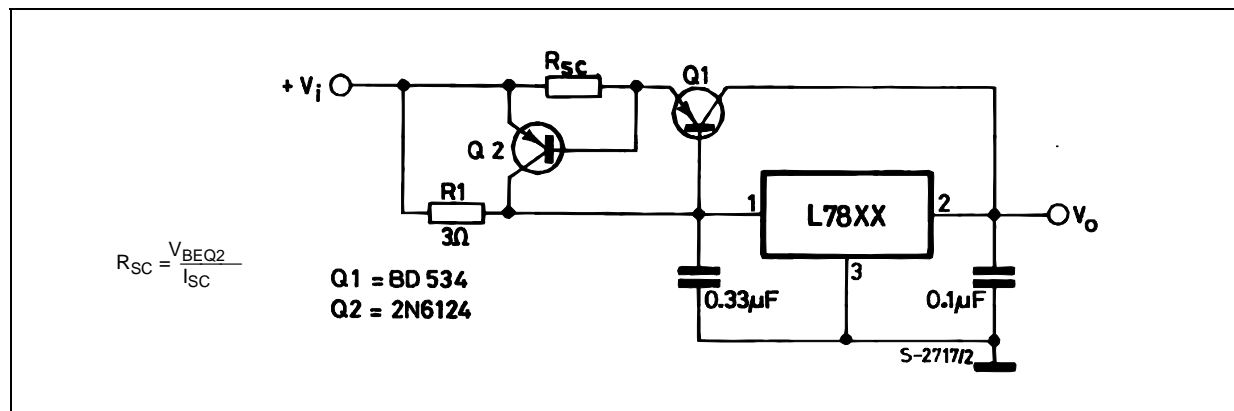


Figure 24: Tracking Voltage Regulator

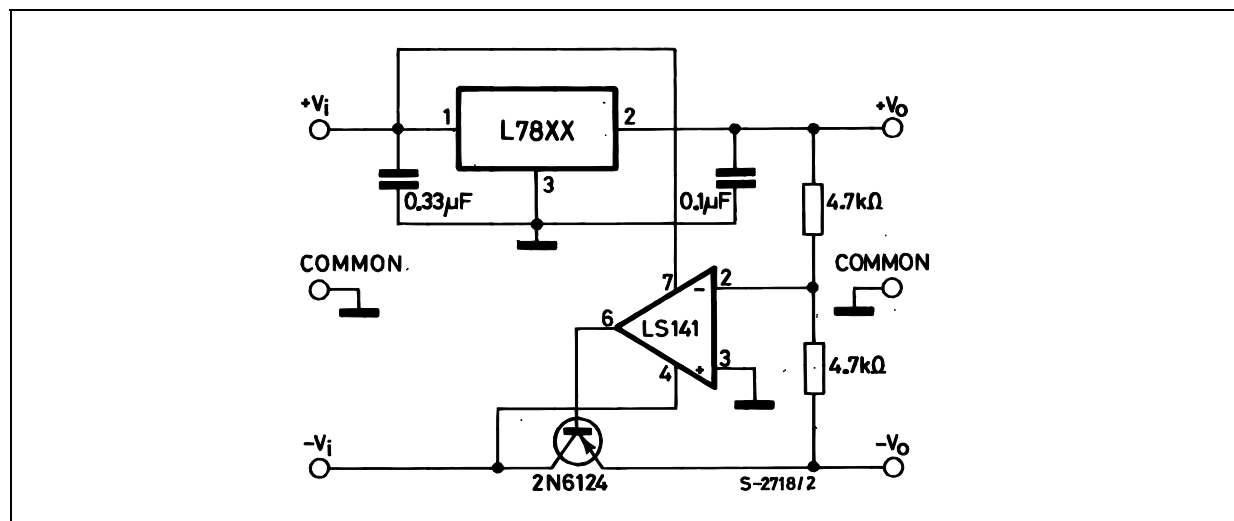
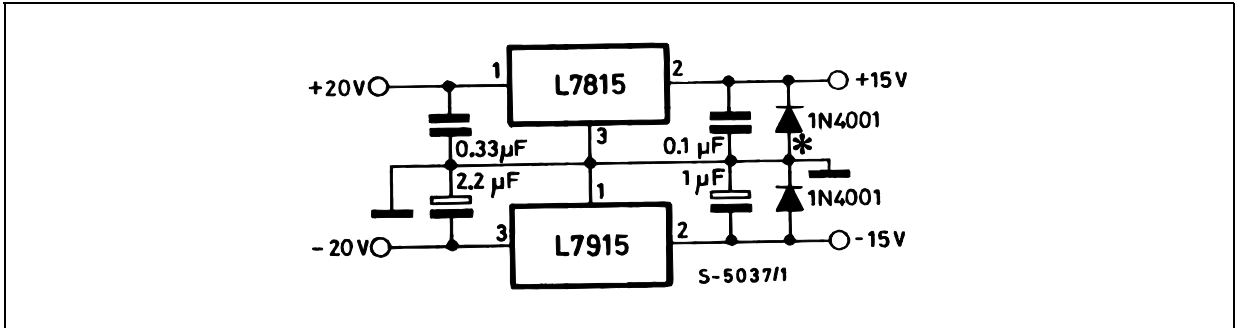


Figure 25: Split Power Supply ($\pm 15\text{V} - 1\text{A}$)



* Against potential latch-up problems.

Figure 26: Negative Output Voltage Circuit

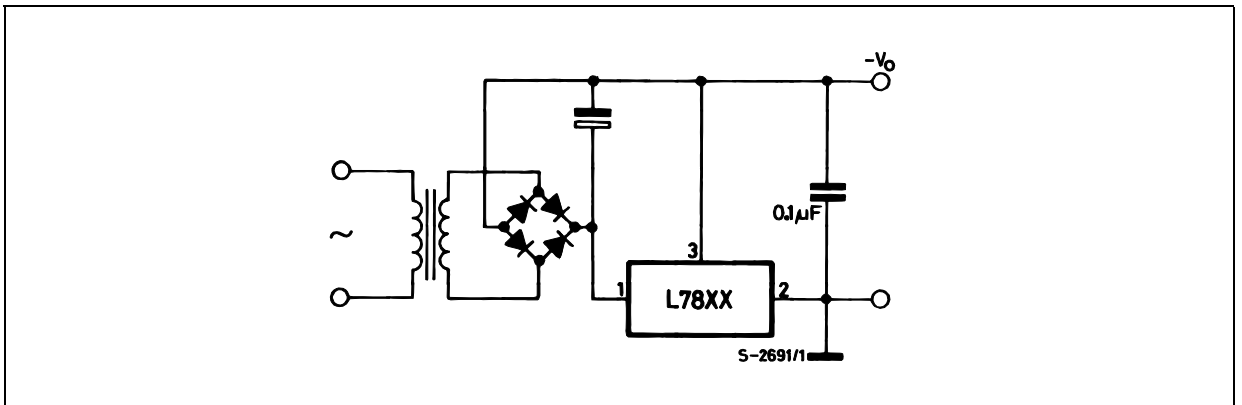


Figure 27: Switching Regulator

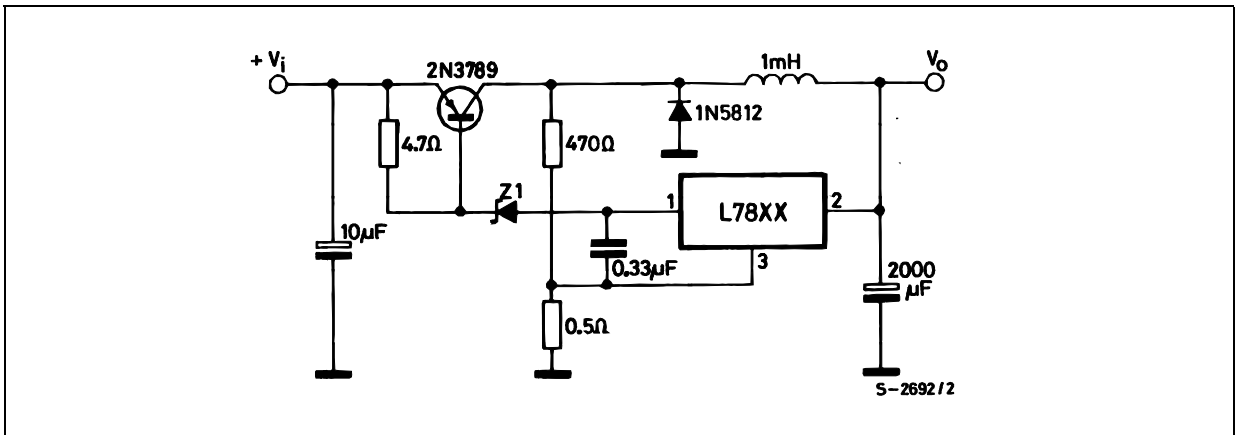


Figure 28: High Input Voltage Circuit

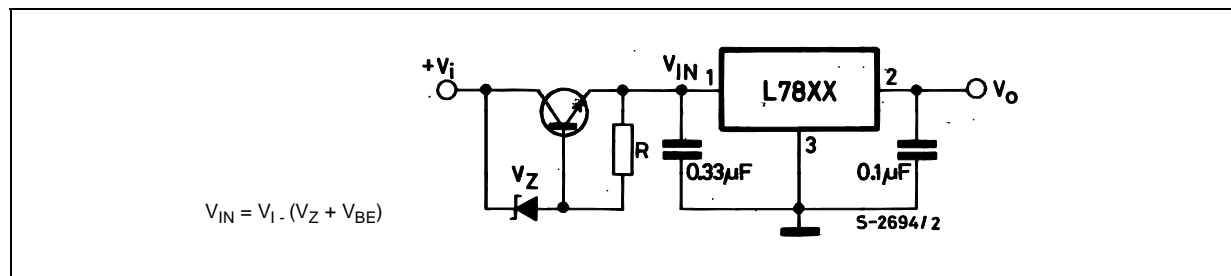


Figure 29: High Input Voltage Circuit

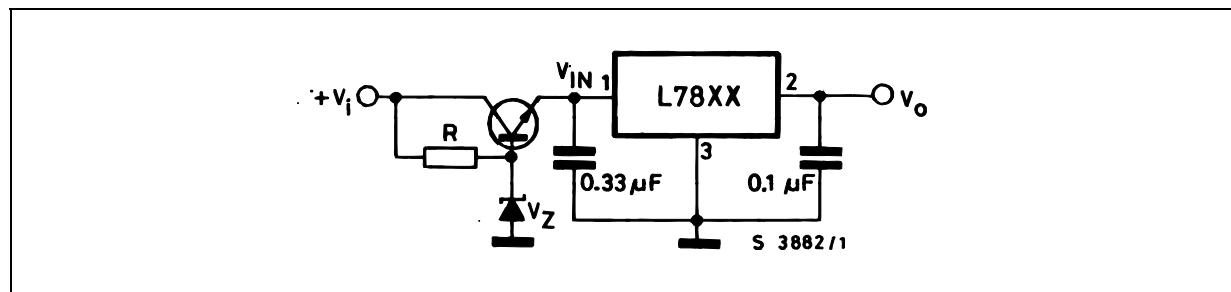


Figure 30: High Output Voltage Regulator

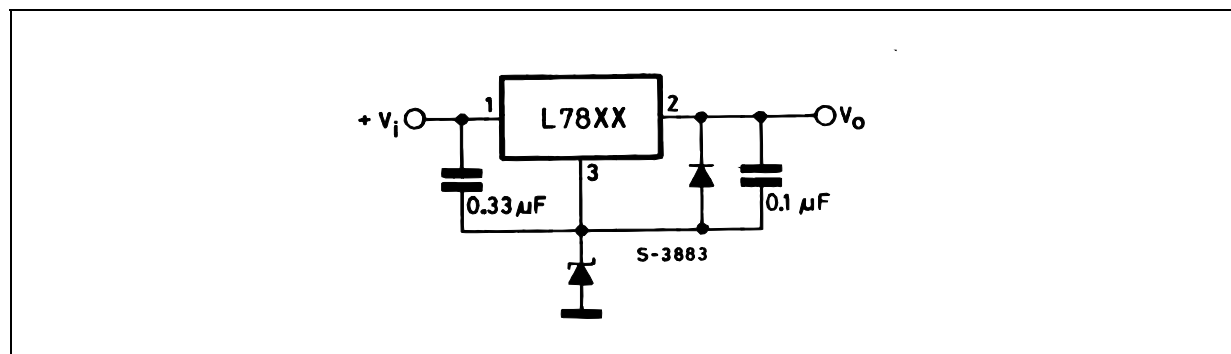


Figure 31: High Input and Output Voltage

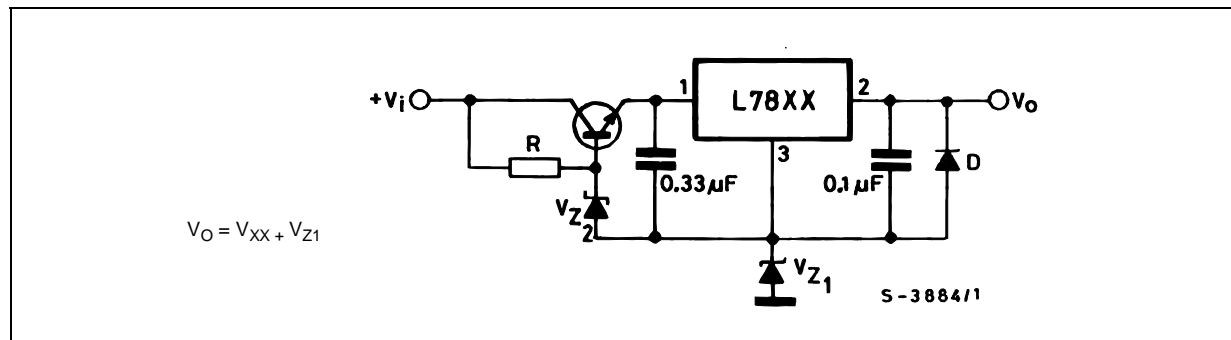


Figure 32: Reducing Power Dissipation with Dropping Resistor

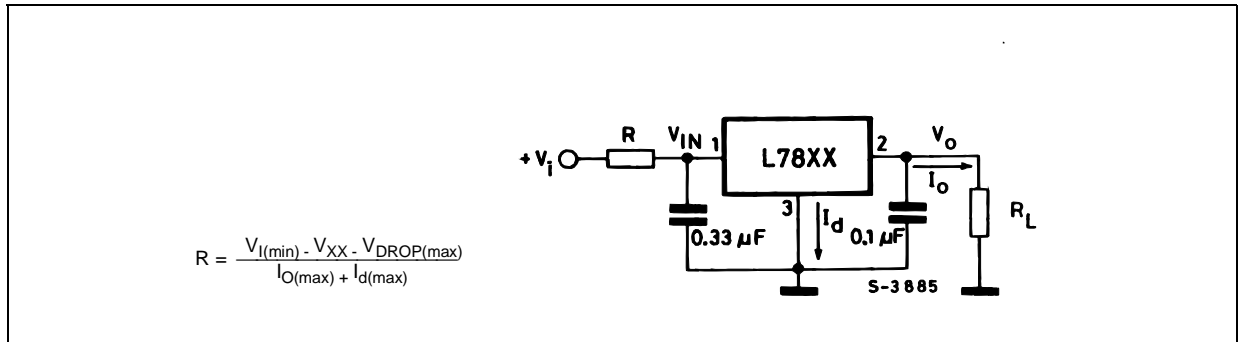


Figure 33: Remote Shutdown

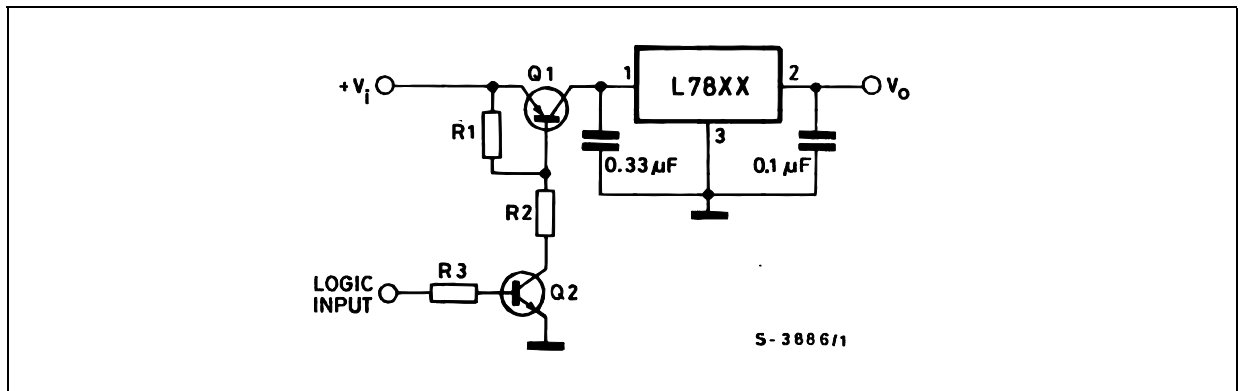
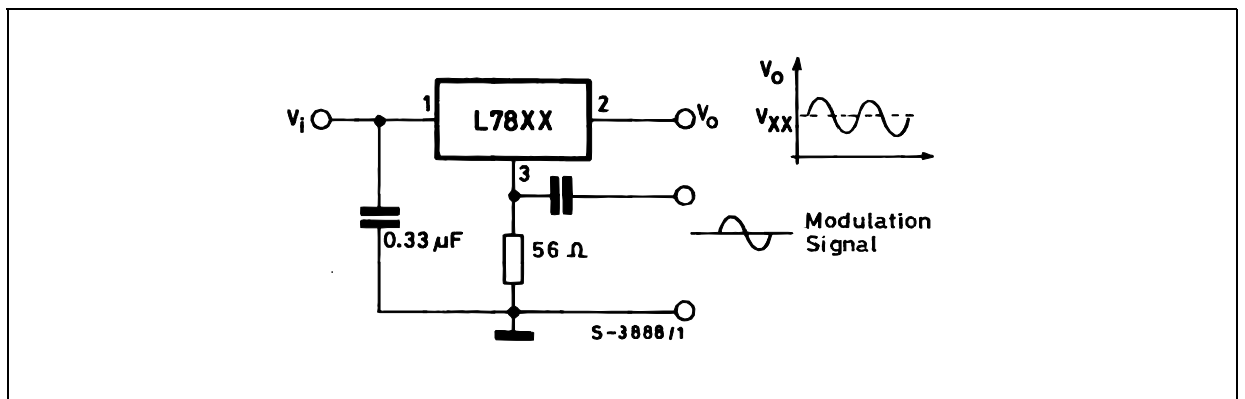
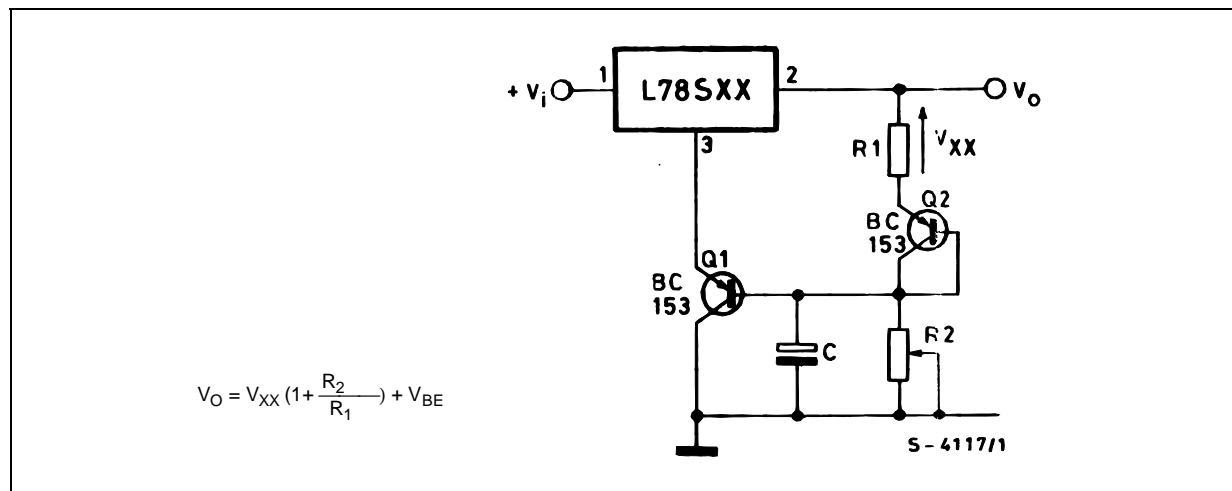


Figure 34: Power AM Modulator (unity voltage gain, $I_o \leq 0.5$)



NOTE: The circuit performs well up to 100 KHz.

Figure 35: Adjustable Output Voltage with Temperature Compensation



NOTE: Q₂ is connected as a diode in order to compensate the variation of the Q₁ V_{BE} with the temperature. C allows a slow rise time of the V_O.

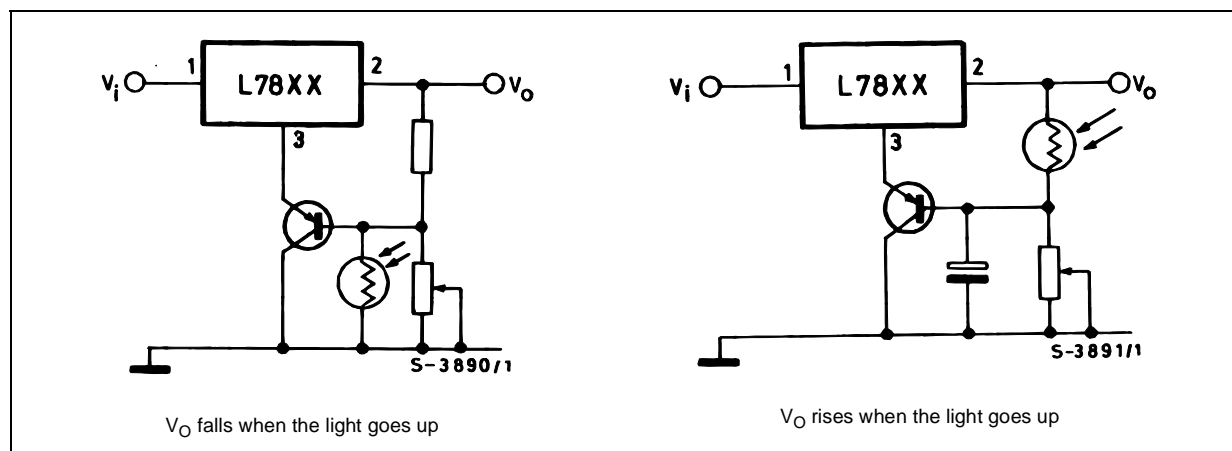
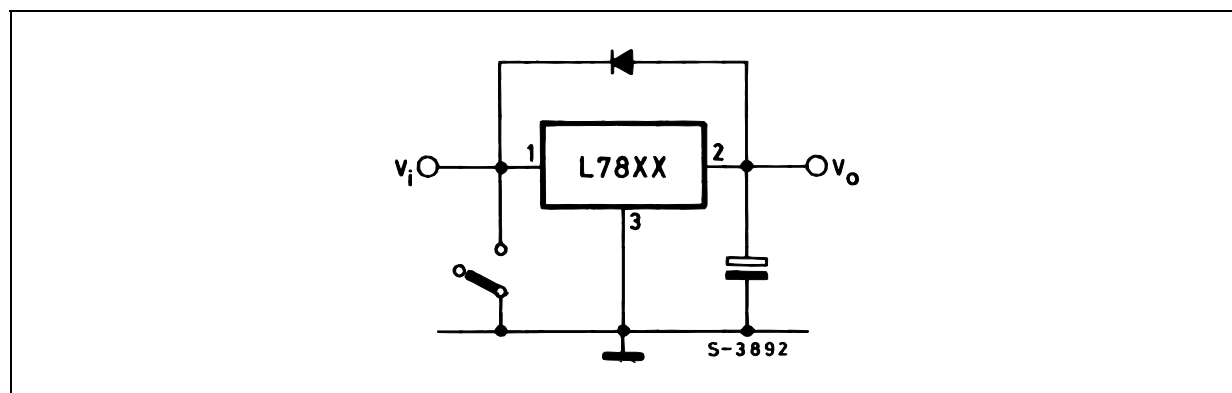
Figure 36: Light Controllers ($V_{Omin} = V_{XX} + V_{BE}$)

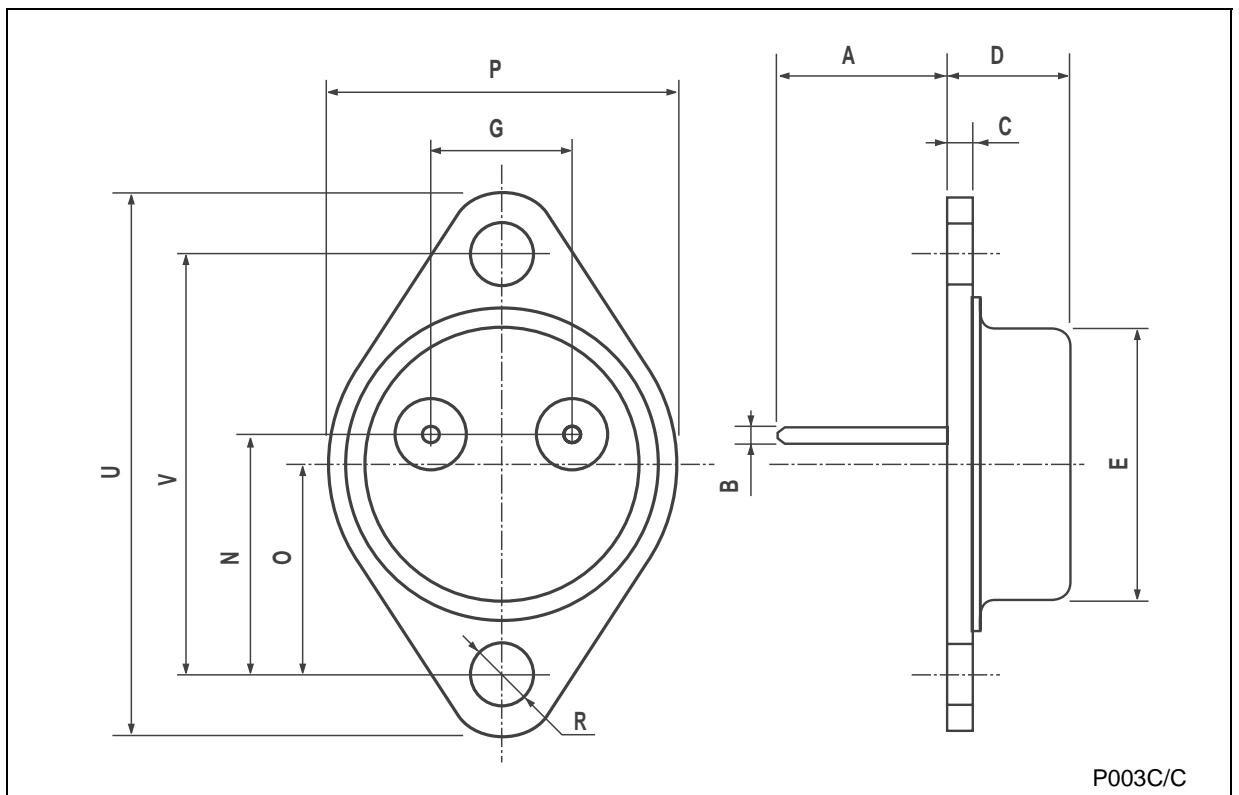
Figure 37: Protection against Input Short-Circuit with High Capacitance Loads



Application with high capacitance loads and an output voltage greater than 6 volts need an external diode (see fig. 33) to protect the device against input short circuit. In this case the input voltage falls rapidly while the output voltage decrease slowly. The capacitance discharges by means of the Base-Emitter junction of the series pass transistor in the regulator. If the energy is sufficiently high, the transistor may be destroyed. The external diode by-passes the current from the IC to ground.

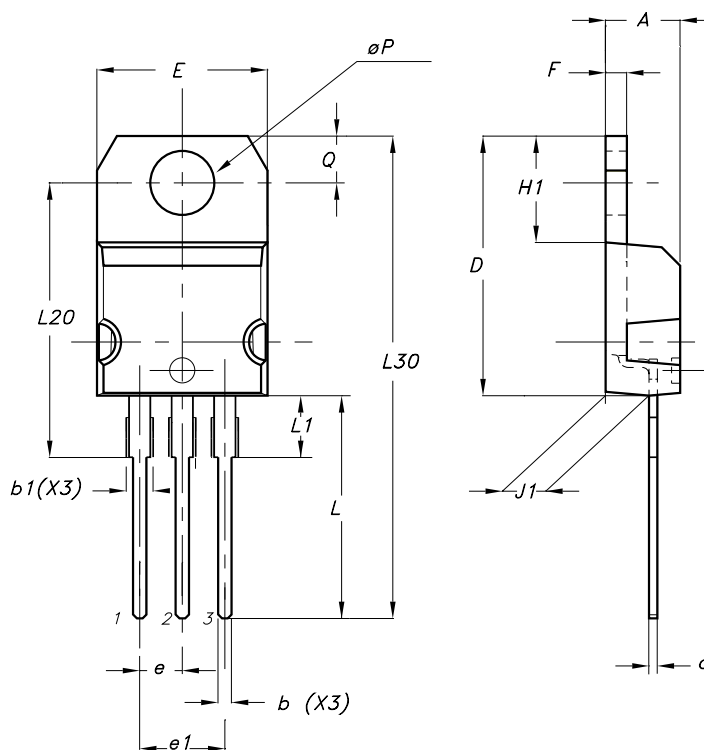
TO-3 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		11.85			0.466	
B	0.96	1.05	1.10	0.037	0.041	0.043
C			1.70			0.066
D			8.7			0.342
E			20.0			0.787
G		10.9			0.429	
N		16.9			0.665	
P			26.2			1.031
R	3.88		4.09	0.152		0.161
U			39.5			1.555
V		30.10			1.185	



TO-220 (A TYPE) MECHANICAL DATA

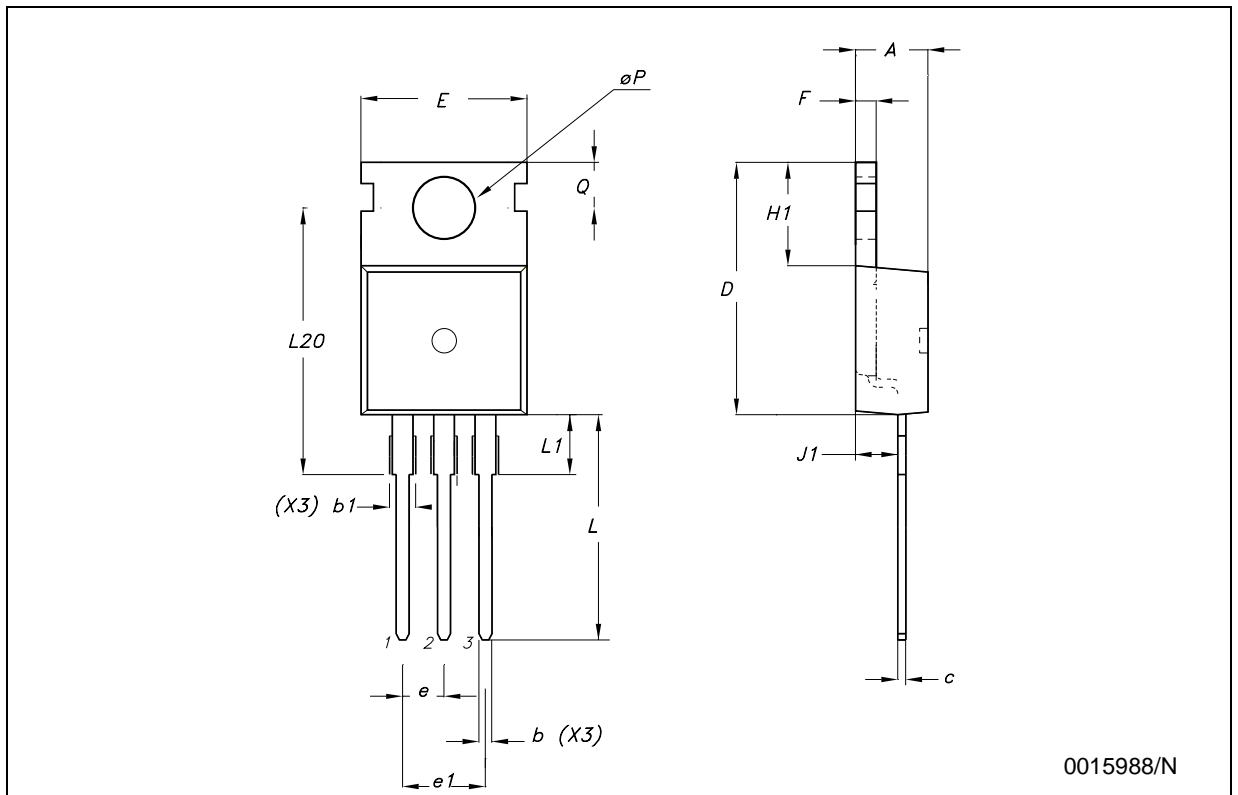
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.067
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.600		0.620
E	10.0		10.40	0.393		0.409
e	2.4		2.7	0.094		0.106
e1	4.95		5.15	0.194		0.203
F	1.23		1.32	0.048		0.051
H1	6.2		6.6	0.244		0.260
J1	2.40		2.72	0.094		0.107
L	13.0		14.0	0.511		0.551
L1	3.5		3.93	0.137		0.154
L20		16.4			0.645	
L30		28.9			1.138	
ϕP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



0015988/N

TO-220 (C TYPE) MECHANICAL DATA

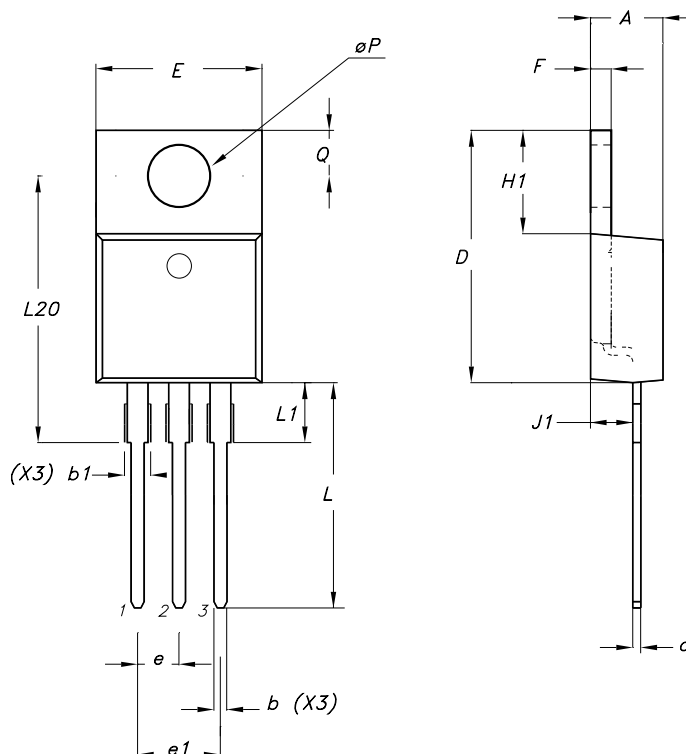
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.30		4.70	0.169		0.185
b	0.70		0.90	0.028		0.035
b1	1.42		1.62	0.056		0.064
c	0.45		0.60	0.018		0.024
D		15.70			0.618	
E	9.80		10.20	0.386		0.402
e		2.54			0.100	
e1		5.08			0.200	
F	1.25		1.39	0.049		0.055
H1		6.5			0.256	
J1	2.20		2.60	0.087		0.202
L	12.88		13.28	0.507		0.523
L1		3			0.118	
L20	15.70		16.1	0.618		0.634
L30		28.9			1.138	
φP	3.50		3.70	0.138		0.146
Q	2.70		2.90	0.106		0.114



0015988/N

TO-220 (E TYPE) MECHANICAL DATA

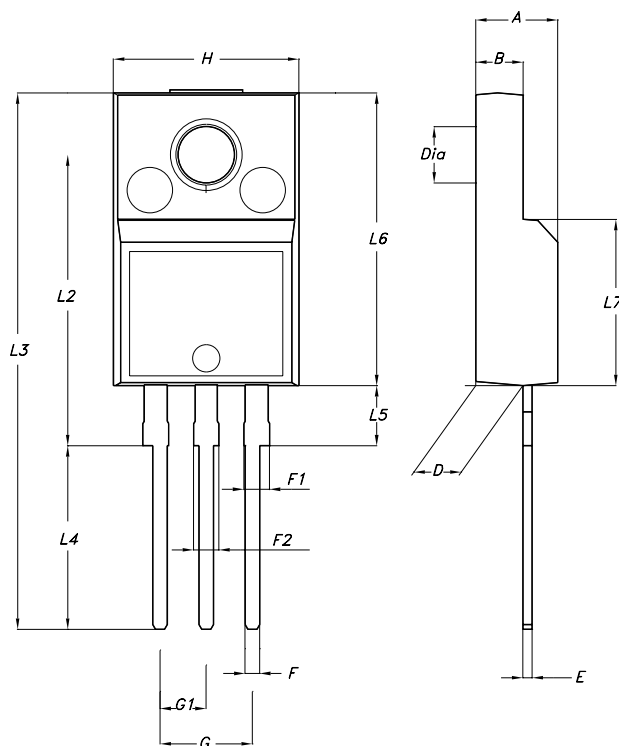
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.47		4.67	0.176		0.184
b	0.70		0.91	0.028		0.036
b1	1.17		1.37	0.046		0.054
c	0.31		0.53	0.012		0.021
D	14.60		15.70	0.575		0.618
E	9.96		10.36	0.392		0.408
e		2.54			0.100	
e1		5.08			0.200	
F	1.17		1.37	0.046		0.054
H1	6.1		6.8	0.240		0.268
J1	2.52		2.82	0.099		0.111
L	12.70		13.80	0.500		0.543
L1	3.20		3.96	0.126		0.156
L20	15.21		16.77	0.599		0.660
ϕP	3.73		3.94	0.147		0.155
Q	2.59		2.89	0.102		0.114



7655923/A

TO-220FP MECHANICAL DATA

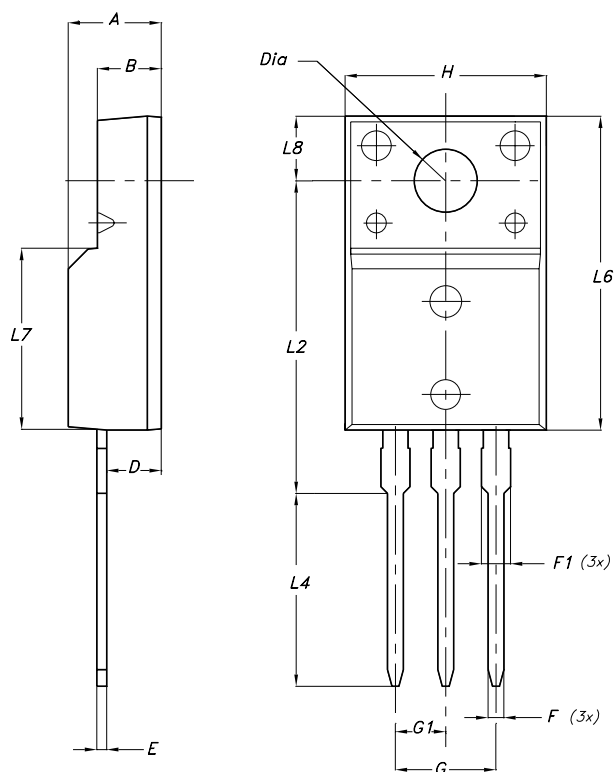
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.70	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.50	0.045		0.059
F2	1.15		1.50	0.045		0.059
G	4.95		5.2	0.194		0.204
G1	2.4		2.7	0.094		0.106
H	10.0		10.40	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L5	2.9		3.6	0.114		0.142
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
DIA.	3		3.2	0.118		0.126



7012510A-H

TO-220FM MECHANICAL DATA

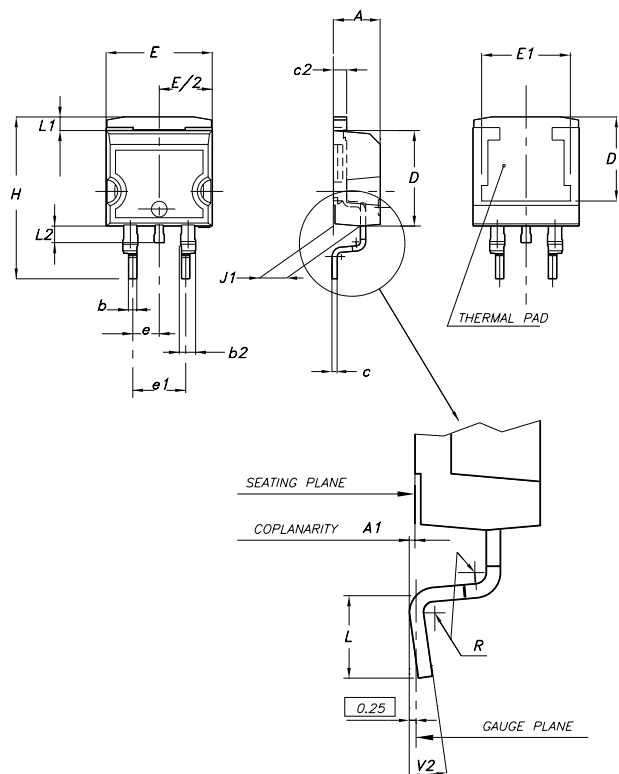
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.50		4.90	0.177		0.193
B	2.34		2.74	0.092		0.108
D	2.56		2.96	0.101		0.117
E	0.45	0.50	0.60	0.018	0.020	0.024
F	0.70		0.90	0.028		0.035
F1			1.47			0.058
G		5.08			0.200	
G1	2.34	2.54	2.74	0.092	0.100	0.108
H	9.96		10.36	0.392		0.408
L2		15.8			0.622	
L4	9.45		10.05	0.372		0.396
L6	15.67		16.07	0.617		0.633
L7	8.99		9.39	0.354		0.370
L8		3.30			0.130	
DIA.	3.08		3.28	0.121		0.129



7012510C-H

D²PAK (A TYPE) MECHANICAL DATA

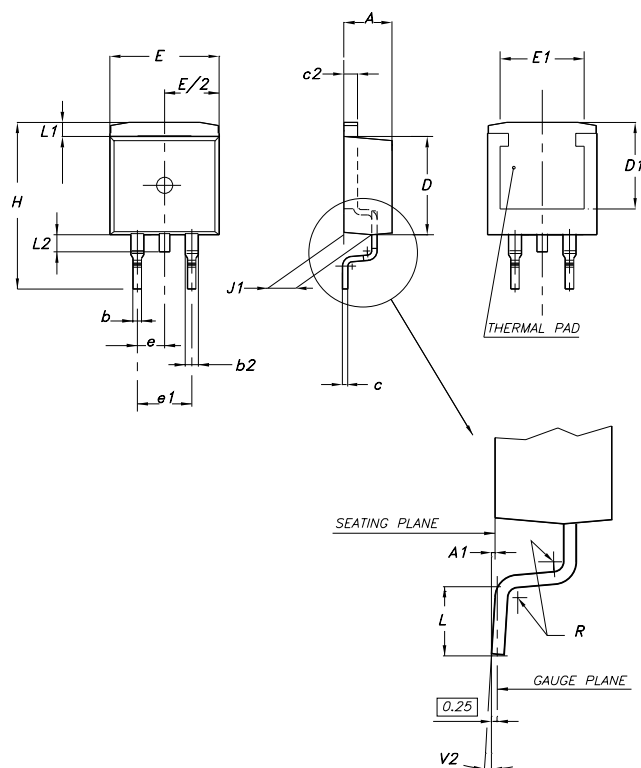
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.7		0.93	0.027		0.036
b2	1.14		1.7	0.044		0.067
c	0.45		0.6	0.017		0.023
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	8			0.315		
E	10		10.4	0.393		0.409
E1	8.5			0.335		
e		2.54			0.100	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.098		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.4	0.050		0.055
L2	1.3		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°



0079457/J

D²PAK (C TYPE) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.3		4.7	0.169		0.185
A1	0		0.20	0.000		0.008
b	0.70		0.90	0.028		0.035
b2	1.17		1.37	0.046		0.054
c	0.45	0.50	0.6	0.018	0.020	0.024
c2	1.25	1.30	1.40	0.049	0.051	0.055
D	9.0	9.2	9.4	0.354	0.362	0.370
D1	7.5			0.295		
E	9.8		10.2	0.386		0.402
E1	7.5			0.295		
e		2.54			0.100	
e1		5.08			0.200	
H	15	15.30	15.60	0.591	0.602	0.614
J1	2.20		2.60	0.087		0.102
L	1.79		2.79	0.070		0.110
L1	1.0		1.4	0.039		0.055
L2	1.2		1.6	0.047		0.063
R		0.3			0.012	
V2	0°		3°	0°		3°



0079457/J

Tape & Reel D²PAK-P²PAK-D²PAK/A-P²PAK/A MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			180			7.086
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	10.50	10.6	10.70	0.413	0.417	0.421
Bo	15.70	15.80	15.90	0.618	0.622	0.626
Ko	4.80	4.90	5.00	0.189	0.193	0.197
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	11.9	12.0	12.1	0.468	0.472	0.476

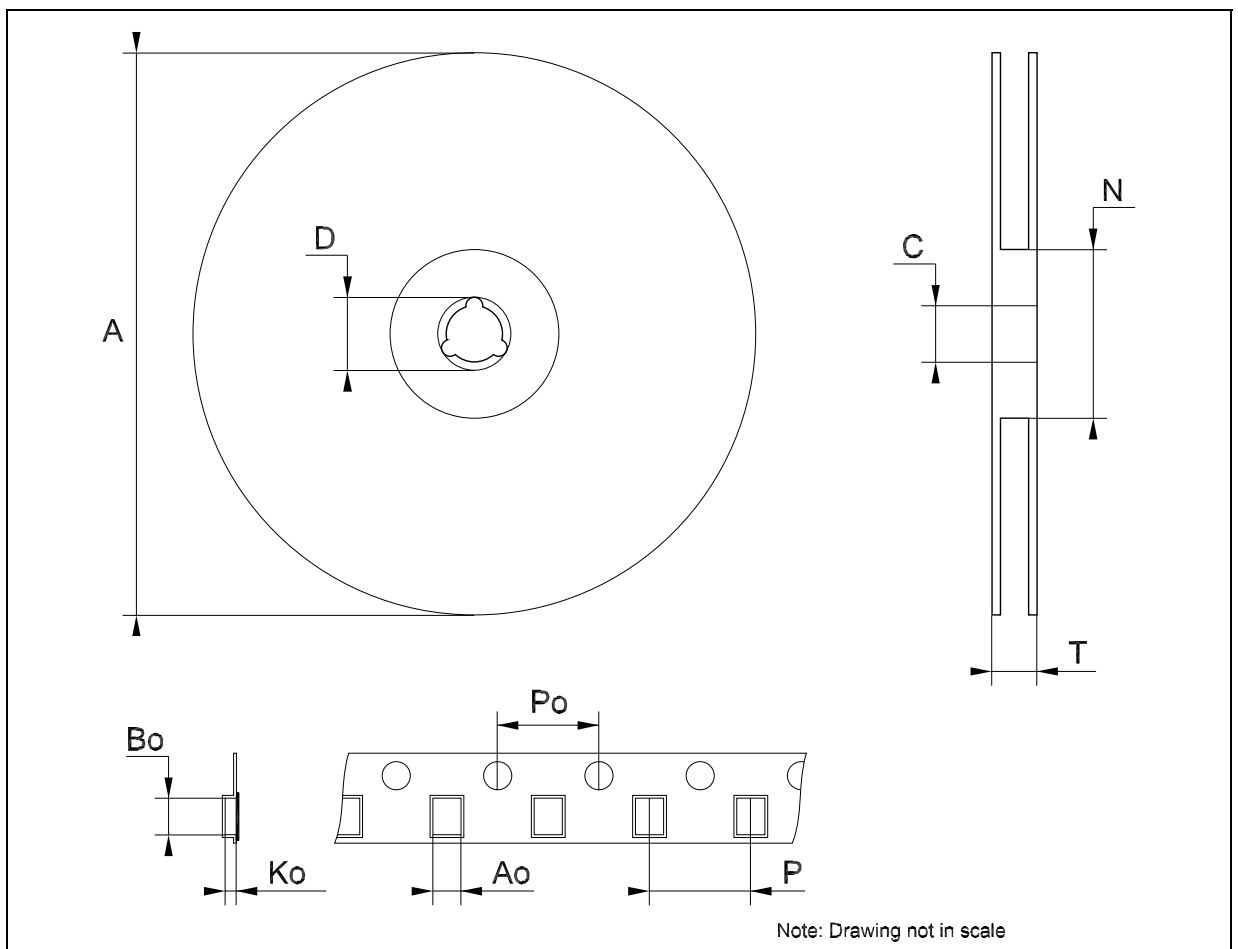


Table 24: Revision History

Date	Revision	Description of Changes
09-Nov-2004	12	Add New Part Number.

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UM66TXXL

CMOS IC

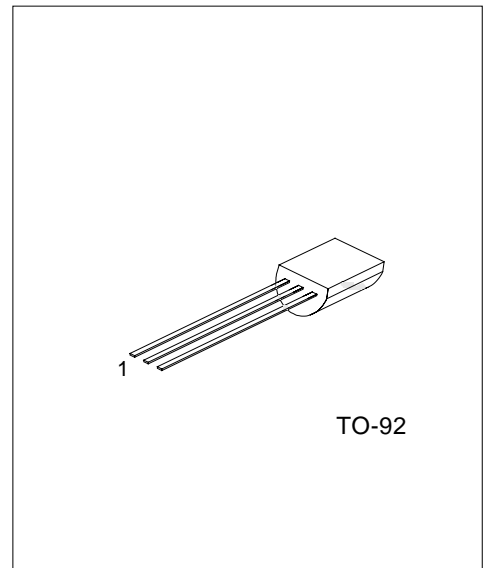
MELODY INTEGRATED CIRCUIT

DESCRIPTION

The UTC UM66TXXL series are CMOS LSI designed for using in door bell, telephone and toy application. It is an on-chip ROM programmed for musical performance. Produced by CMOS technology, the device results in very low power consumption. Since the UTC UM66TXXL series include oscillation circuits a compact melody module can be constructed with only a few additional components.

FEATURES

- *64-Note Rom memory
- *1.5V ~ 4.5V power supply and low power consumption
- *Dynamic speaker can be driven with external NPN transistor
- *OSC resistor hold mode
- *Power on reset: melody begins from the first note
- *Built in level hold mode



*Pb-free plating product number: UM66TxxLK

ORDERING INFORMATION

Order Number		Package	Pin Assignment			Packing
Normal	Lead Free Plating		1	2	3	
UM66TxxL-T92-B	UM66TxxLK-T92-B	TO-92	V _{SS}	V _{DD}	O/P	Tape Box
UM66TxxL-T92-K	UM66TxxLK-T92-K	TO-92	V _{SS}	V _{DD}	O/P	Bulk
UM66TxxL-T92-R	UM66TxxLK-T92-R	TO-92	V _{SS}	V _{DD}	O/P	Tape Reel

<p>UM66TxxLK-T92-B</p>	<p>(1) Packing Type (2) Package Type (3) Lead Plating (4) Song Series</p> <p>(1) B: Tape Box, K: Bulk, R: Tape Reel (2) T92: TO-92 (3) K: Lead Free Plating Blank: Pb/Sn (4) xx: refer to SONG SERIES LIST</p>
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SONG SERIES LIST

P/N	SONG NAME
UTC UM66T05L	Home Sweet Home
UTC UM66T08L	Happy Birthday
UTC UM66T11L	Love Me Tender
UTC UM66T19L	For Alice
UTC UM66T32L	COO COO waltz

■ ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified.)

PARAMETER	SYMBOL	RATINGS	UNIT
DC Supply Voltage	V _{DD}	1.5 ~ 4.5	V
Operating Temperature	T _{OPR}	-10 ~ +60	°C
Storage Temperature	T _{STG}	-55 ~ +125	°C

Notes: Stress above those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only. Functional operations of this device at these or any other conditions above those indicated in the operational section of this specification is not implied and exposure to absolute maximum ratings conditions for extended periods may affect device reliably.

■ ELECTRICAL CHARACTERISTICS (V_{SS}=0V, F_{osc}=65536Hz, T_J=25 , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Operating Voltage	V _{DD}		1.5		4.5	V
Operating Current	I _{DD}	V _{DD} =1.5V, O/P open			60	μA
O/P Drive Current	I _{O(DRIVE)}	V _{DD} =1.5V, O/P=0.8V	400	600		μA
O/P Sink Current	I _{O(SINK)}	V _{DD} =1.5V, O/P=0.5V open	350	450		μA
Frequency Deviation Deviation Per Lot	ΔF/F	V _{DD} =1.5V			-12	%
Frequency Stability	ΔF/F	$\frac{F_{osc}(1.6V) - F_{osc}(1.5V)}{F_{osc}(1.5V)}$			10	%

■ FUNCTIONAL DESCRIPTION

OSCILLATOR CIRCUIT

The oscillator frequency is used as a time for tone and beat generators. Its accuracy affects the quality of the music.

TONE GENERATOR

Tone Frequencies are oscillator frequencies-M, where m is any even number from 64 to 256. Within a melody 14C scales can be selected including Pause code and End code. The tone generator is a programmed divider, The Range of Scales is from "C4" to "C6" and range of frequency varies from 258Hz to 23768Hz.

RHYTHM GENERATOR

The rhythm generator is also programmed dividers. It contain 15 available rhythms as follows:1/4,1/2,3/4,1,1-1/4,1-1/2,1-3/4,2,2-1/4,2-1/2,2-3/4,3,3-1/4,3-1/2,3-3/4.Four rhythms can be selected from these.

MELODY ROM

The Mask Rom can memorize 64 notes with 6 bit.4 bits are used for controlling the scale code and 2 bits are used for controlling the rhythm code.

TEMPO GENERATOR

There are 15 available tempos in the UTC UM66T series. The 15 tempos are:128,137,148,160,175,192,213, 240 , 274, 320,480,640,960,1920 J/minute.

■ APPLICATION CIRCUITS

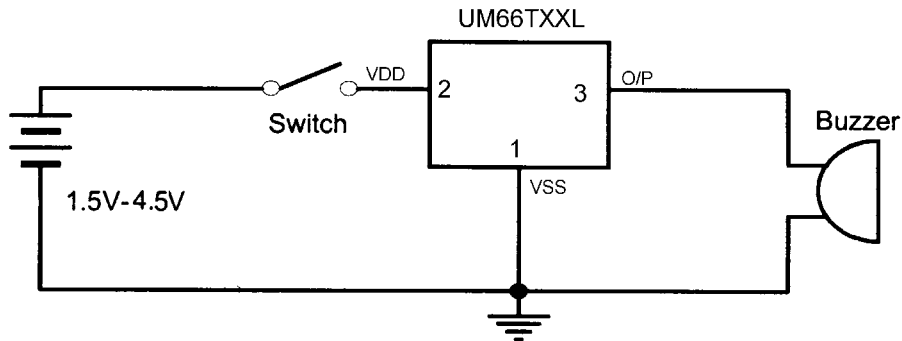


Fig.1

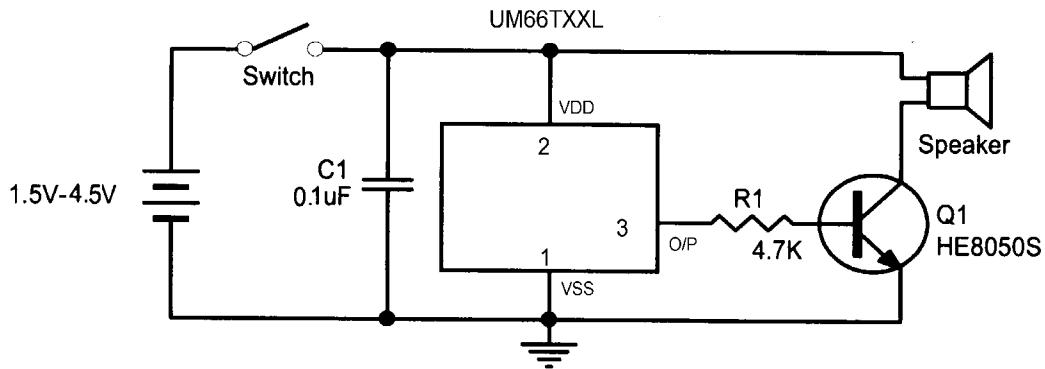


Fig.2

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