CJ78L00E Series Three Terminal Positive Regulators

1 Introduction

The CJ78L00E series is a group of three terminal positive voltage linear regulators with fixed voltage output. Its input voltage can reach up to 30V (or 35V) and can deliver output current up to 100mA with good power dissipation. The CJ78L00E series adopts fixed voltage output and no peripheral resistance, improving the space utilization efficiency of printed circuit boards (PCBs). In addition, the CJ78L00E series also integrates internal current limiting, thermal shutdown, and safe- area compensation, which helps protect the device from overload. Therefore, the CJ78L00E series is widely used in various scenarios, such as on card adjustment, to eliminate noise and distribution issues related to single point supervision. When used as a substitute for Zener diode resistor combinations, it can effectively increase output impedance and reduce bias current.

2 Available Packages

PART NUMBER	PACKAGE
CJ78L00E Series	SOT-23-3L
	SOT-89-3L
	TO-92

Note: For all available packages, please refer to the part *Orderable Information*.

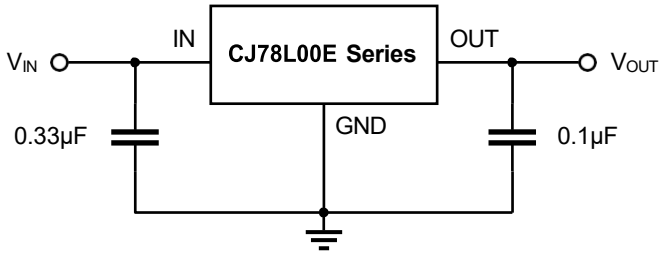


Figure 2-1. Typical Application Circuit

3 Features

- Available Output Voltage:
  - 5.0V: CJ78L05E
  - 6.0V: CJ78L06E
  - 8.0V: CJ78L08E
  - 9.0V: CJ78L09E
  - 12V: CJ78L12E
  - 15V: CJ78L15E
  - 18V: CJ78L18E
  - 24V: CJ78L24E
- Maximum Input Voltage:
  - 30V for V_{OUT} < 10V
  - 35V for V_{OUT} > 10V
- Maximum Output Current:
  - up to 100mA
- Operating Junction Temperature:
  - -40 ~ 125°C
- Output Voltage Tolerances at T_J = 25°C:
  - ±2% for Conventional Device
  - ±1% can be customized
- Output Voltage Tolerances of ±5% over the Temperature Range
- No External Components
- Build-in Current Limit
- Thermal Shutdown Protection
- Output Transistor Safe-Area Protection

4 Applications

- Chemical or Gas Sensors
- Computing and Servers
- Field Transmitter: Temperature Sensors
- Flow Meters
- On-Card Regulation
- Telecommunications
- White Goods

5 Pin Configuration and Marking Information

5.1 Pin Configuration and Function

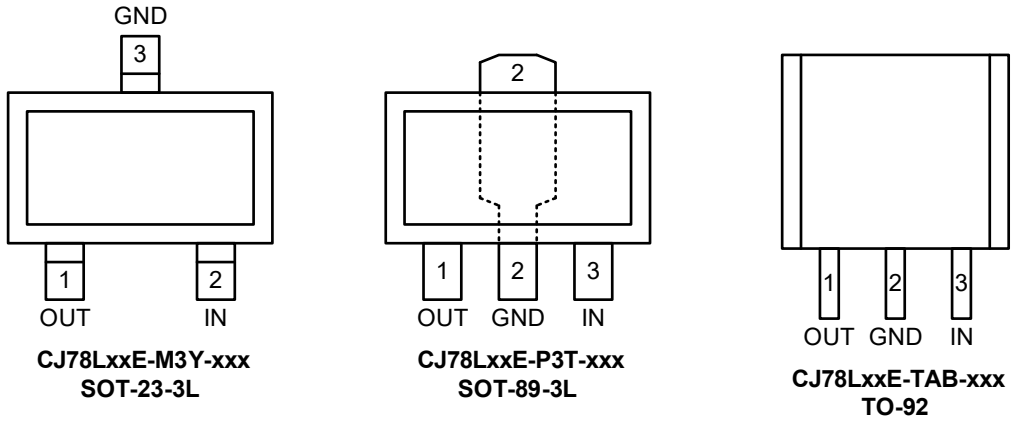
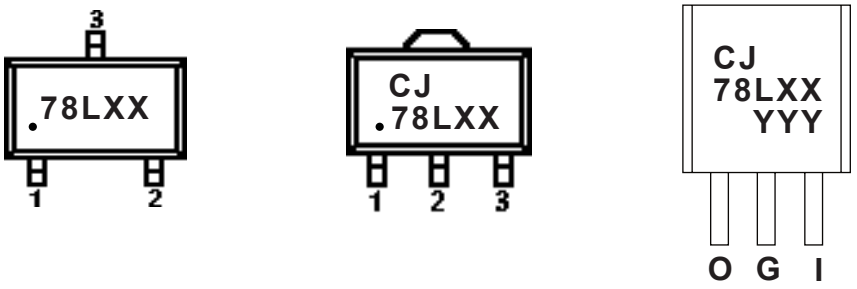


Figure 5-1. Package Top View

PIN NAME	CJ78L00E Series			I / O	DESCRIPTION
	SOT-23-3L	SOT-89-3L	TO-92		
IN	2	3	3	I	Input to the device.
GND	3	2	2	-	Regulator ground.
OUT	1	1	1	O	Output of the regulator.

5.2 Marking Information



"**78LXX**" or "**CJ78LXX**": Product number, the "**XX**" in the "**78LXXE**" or "**CJ78LXXE**" represents the output voltage, for example, if the V_{OUT} = 5.0V, "**XX**" is "05".
"**YYY**": Code.

6 Specifications

6.1 Absolute Maximum Ratings

(over operating free-air temperature range, unless otherwise specified)(1)

CHARACTERISTIC			SYMBOL	VALUE	UNIT
Maximum input voltage(2)			$V_{IN\ MAX}$	36	V
Maximum power dissipation	CJ78L00E Series	SOT-23-3L	$P_{D\ Max}$	Internally Limited(3)	W
		SOT-89-3L			
		TO-92			
Maximum junction temperature			$T_{J\ Max}$	150	°C
Storage temperature			T_{stg}	-65 ~ 150	°C
Soldering temperature & time			T_{solder}	260°C, 10s	-

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to network ground terminal.

(3) Refer to *Thermal Information* for details.

6.2 Recommended Operating Conditions

PARAMETER		SYMBOL	MIN.	NOM.	MAX.	UNIT
Input voltage range	CJ78L05E	V_{IN}	-	-	30	V
	CJ78L06E		-	-		
	CJ78L08E		-	-		
	CJ78L09E		-	-		
	CJ78L12E		-	-	35	
	CJ78L15E		-	-		
	CJ78L18E		-	-		
Operating junction temperature		T_J	-40	-	125	°C
Operating ambient temperature		T_A	-	-(4)	-	°C

(4) It is necessary to ensure that the operating junction temperature of the device does not exceed the rated value of the recommended operating conditions when using the device for design.

6 Specifications

6.3 ESD Ratings

ESD RATINGS		SYMBOL	VALUE	UNIT
Electrostatic discharge(5)	Human body model	$V_{ESD-HBM}$	5000	V

(5) ESD testing is conducted in accordance with the relevant specifications formulated by the Joint Electronic Equipment Engineering Commission (JEDEC). The human body mode (HBM) electrostatic discharge test is based on the JESD22-A114D test standard, using a 100pF capacitor and discharging to each pin of the device through a resistance of 1.5kΩ. The electrostatic discharge test in mechanical mode (MM) is based on the JESD22-A115-A test standard and uses a 200pF capacitor to discharge directly to each pin of the device.

6.4 Thermal Information

THERMAL METRIC(6)	SYMBOL	CJ78L00E Series			UNIT
		SOT-23-3L	SOT-89-3L	TO-92	
Junction-to-ambient thermal resistance	$R_{\Theta JA}$	260.7	121.6	167.2	°C/W
Junction-to-case thermal resistance	$R_{\Theta JC}$	64.9	29.4	40.3	°C/W
Reference maximum power dissipation for continuous operation	$P_{D\ Ref}$	0.38	0.82	0.60	W

(6) Thermal metric is measured in still air with T_A = 25°C and installed on a 1 in^2 FR-4 board covered with 2 ounces of copper.

6 Specifications

6.5 Electrical Characteristics

CJ78L05E (V_{IN} = 10V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS[7]		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade[8]	4.90	5.00	5.10	V
			±1% grade[8]	4.95		5.05	
		V_{IN} = 7 to 20V, I_{OUT} = 1 to 100mA, $P_D \le 0.75W$		4.75	5.00	5.25	
Output current	I_{OUT}	T_J = 25°C		100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	5.5	mA
Quiescent current change	ΔI_Q	V_{IN} = 8 to 20V,		-	-	1.5	mA
		I_{OUT} = 1 to 40mA		-	-	0.1	
Dropout voltage	V_{DO}[9]	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 7 to 20V		-	10	150	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	20	60	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	0.42	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz[10]		-	40	-	μV
Ripple rejection	RR	V_{IN} = 8 to 18V, f = 120Hz		47	62	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

6.5 Electrical Characteristics (continued)

CJ78L06E (V_{IN} = 11V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS[7]		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade[8]	5.88	6.00	6.12	V
			±1% grade[8]	5.94		6.06	
		V_{IN} = 8 to 20V, I_{OUT} = 1 to 100mA, $P_D \le 0.75W$		5.70	6.00	6.30	
Output current	I_{OUT}	T_J = 25°C		100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	5.5	mA
Quiescent current change	ΔI_Q	V_{IN} = 9 to 20V		-	-	1.5	mA
		I_{OUT} = 1 to 40mA		-	-	0.1	
Dropout voltage	V_{DO}[9]	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 8 to 20V		-	10	150	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	20	60	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	0.50	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz[10]		-	50	-	μV
Ripple rejection	RR	V_{IN} = 9 to 19V, f = 120Hz		47	59	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

6.5 Electrical Characteristics (continued)

CJ78L08E (V_{IN} = 14V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS[7]		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade[8]	7.84	8.00	8.16	V
			±1% grade[8]	7.92		8.08	
		V_{IN} = 10.5 to 23V, I_{OUT} = 1 to 100mA, $P_D \le$ 0.75W		7.60	8.00	8.40	
Output current	I_{OUT}	T_J = 25°C		100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	5.5	mA
Quiescent current change	ΔI_Q	V_{IN} = 11 to 23V,		-	-	1.5	mA
		I_{OUT} = 1 to 40mA		-	-	0.1	
Dropout voltage	V_{DO}[9]	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 10.5 to 23V		-	10	150	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	22	70	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	0.67	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz[10]		-	60	-	μV
Ripple rejection	RR	V_{IN} = 13 to 23V, f = 120Hz		44	53	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

6.5 Electrical Characteristics (continued)

CJ78L09E (V_{IN} = 16V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS[7]		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade[8]	8.82	9.00	9.18	V
			±1% grade[8]	8.91		9.09	
		V_{IN} = 12 to 24V, I_{OUT} = 1 to 100mA, $P_D \leq$ 0.75W		8.55	9.00	9.45	
Output current	I_{OUT}	T_J = 25°C		100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	5.5	mA
Quiescent current change	ΔI_Q	V_{IN} = 13 to 24V		-	-	1.5	mA
		I_{OUT} = 1 to 40mA,		-	-	0.1	
Dropout voltage	V_{DO}[9]	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 12 to 24V		-	10	150	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	25	80	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	0.76	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz[10]		-	65	-	μV
Ripple rejection	RR	V_{IN} = 15 to 25V, f = 120Hz		42	51	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

6.5 Electrical Characteristics (continued)

CJ78L12E (V_{IN} = 19V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS[7]		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	35	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade[8]	11.76	12.00	12.24	V
			±1% grade[8]	11.88		12.12	
		V_{IN} = 14.5 to 27V, I_{OUT} = 1 to 100mA, $P_D \le$ 0.75W		11.40	12.00	12.60	
Output current	I_{OUT}	T_J = 25°C		100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 16 to 27V		-	-	1.5	mA
		I_{OUT} = 1 to 40mA		-	-	0.1	
Dropout voltage	V_{DO}[9]	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 14.5 to 27V		-	20	250	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	35	110	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	1.00	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz[10]		-	80	-	μV
Ripple rejection	RR	V_{IN} = 15 to 25V, f = 120Hz		37	42	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

6.5 Electrical Characteristics (continued)

CJ78L15E (V_{IN} = 23V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS(7)		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	35	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade(8)	14.70	15.00	15.30	V
			±1% grade(8)	14.85		15.15	
		V_{IN} = 17.5 to 30V, I_{OUT} = 1 to 100mA, $P_D \le 0.75W$		14.25	15.00	15.75	
Output current	I_{OUT}	T_J = 25°C		-	-	100	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 20 to 30V		-	-	1.5	mA
		I_{OUT} = 1 to 40mA,		-	-	0.1	
Dropout voltage	V_{DO}(9)	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 17.5 to 30V		-	25	250	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	50	160	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	1.26	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz(10)		-	90	-	μV
Ripple rejection	RR	V_{IN} = 18.5 to 28.5V, f = 120Hz		34	39	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9)The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

6.5 Electrical Characteristics (continued)

CJ78L18E (V_{IN} = 26V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS[7]		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	35	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade[8]	17.64	18.00	18.36	V
			±1% grade[8]	17.82		18.18	
		V_{IN} = 20.5 to 33V, I_{OUT} = 1 to 100mA, $P_D \le$ 0.75W		17.10	18.00	18.90	
Output current	I_{OUT}	T_J = 25°C		-	-	100	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 22 to 33V		-	-	1.5	mA
		I_{OUT} = 1 to 40mA		-	-	0.1	
Dropout voltage	V_{DO}[9]	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 20.5 to 33V		-	25	250	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	50	160	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	1.51	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz[10]		-	100	-	μV
Ripple rejection	RR	V_{IN} = 21.5 to 31.5V, f = 120Hz		34	39	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

6.5 Electrical Characteristics (continued)

CJ78L24E (V_{IN} = 33V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS[7]		MIN.	TYP.	MAX.	UNIT
Input voltage	V_{IN}	-		-	-	35	V
Output voltage	V_{OUT}	T_J = 25°C	±2% grade[8]	23.52	24.00	24.48	V
			±1% grade[8]	23.76		24.24	
		V_{IN} = 27 to 35V, I_{OUT} = 1 to 100mA, $P_D \le$ 0.75W		22.80	24.00	25.20	
Output current	I_{OUT}	T_J = 25°C		-	-	100	mA
Quiescent current	I_Q	I_{OUT} = 0mA		-	3.5	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 27 to 35V		-	-	1.5	mA
		I_{OUT} = 1 to 40mA		-	-	0.1	
Dropout voltage	V_{DO}[9]	I_{OUT} = 40mA		-	1.7	2.0	V
		I_{OUT} = 100mA		-	1.8	2.3	
Line regulation	ΔV_{LINE}	V_{IN} = 27 to 35V		-	25	250	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA		-	50	160	mV
Output voltage temperature coefficient	$\Delta V_{OUT} / \Delta T$	I_{OUT} = 5mA		-	2.02	-	mV/°C
	$\Delta V_{OUT} / (V_{OUT} \times \Delta T)$			-	84	-	ppm/°C
Output noise voltage	V_N	f = 10 to 100k Hz[10]		-	100	-	μV
Ripple rejection	RR	V_{IN} = 21.5 to 31.5V, f = 120Hz		34	39	-	dB

Note:

(7) Pulse test technology is used to make T_J as close to T_A as possible. Thermal effects must be considered separately.

(8) Output voltage tolerances of ±2% for conventional device, ±1% can be customized.

(9) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

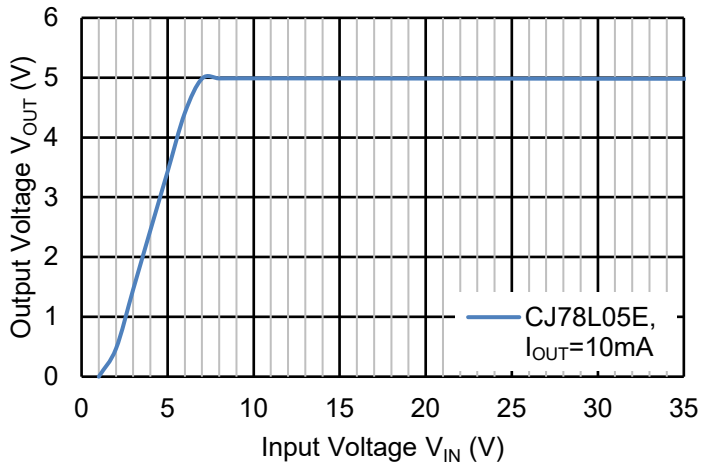
(10) 0.01μF minimum load capacitance is recommended to limit high frequency noise.

6 Specifications

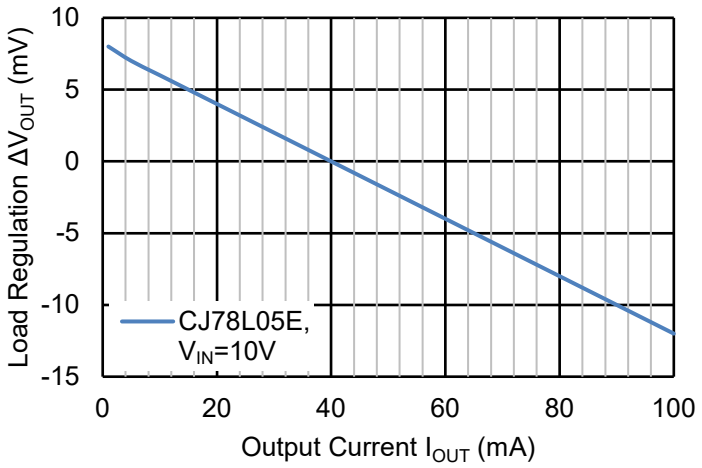
6.6 Typical Characteristics

CJ78L00E Series (V_{IN} = 10V for CJ78L05E, V_{IN} = 14.5V for CJ78L12E, V_{IN} = 23V for CJ78L15E, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_A = 25°C, unless otherwise specified)

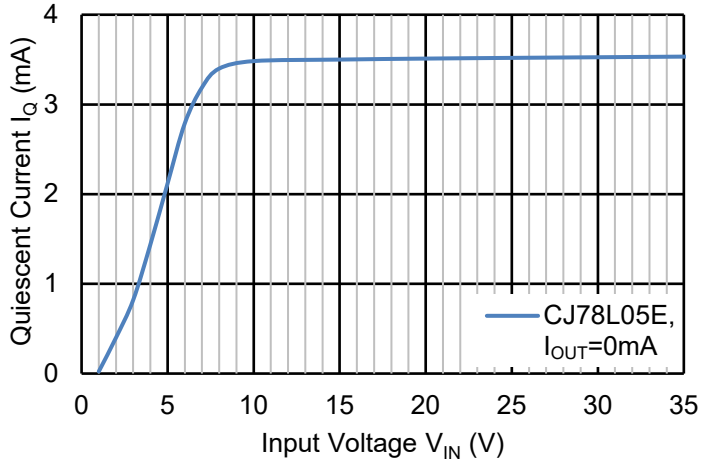
Line Regulation



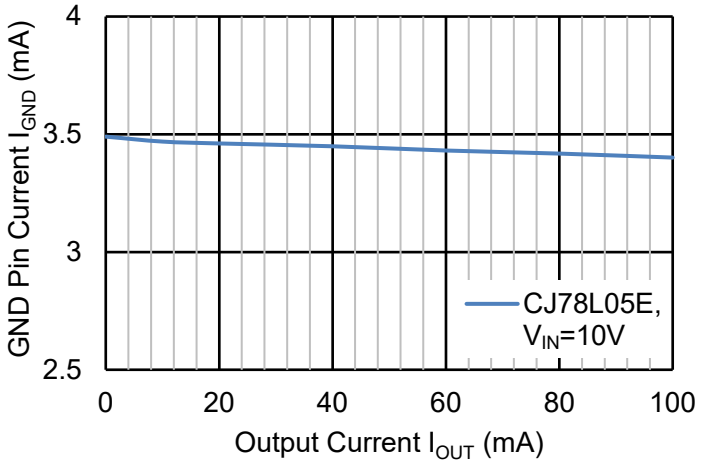
Load Regulation



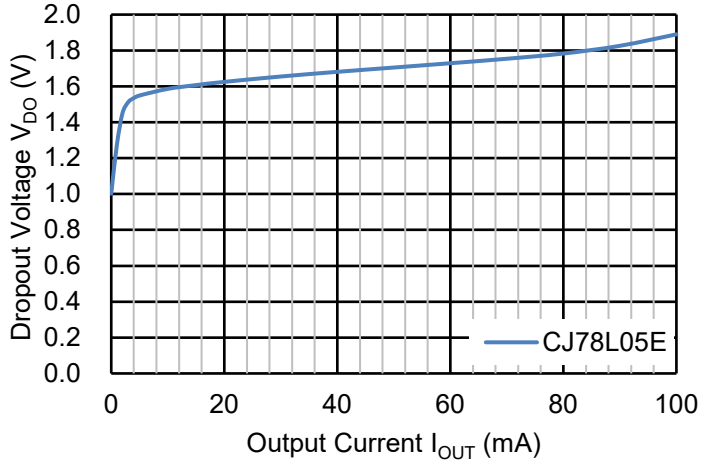
Quiescent Current



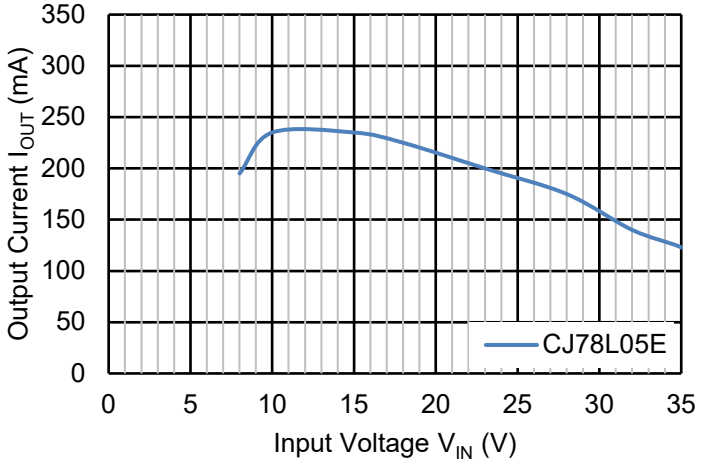
GND Pin Current



Dropout Voltage



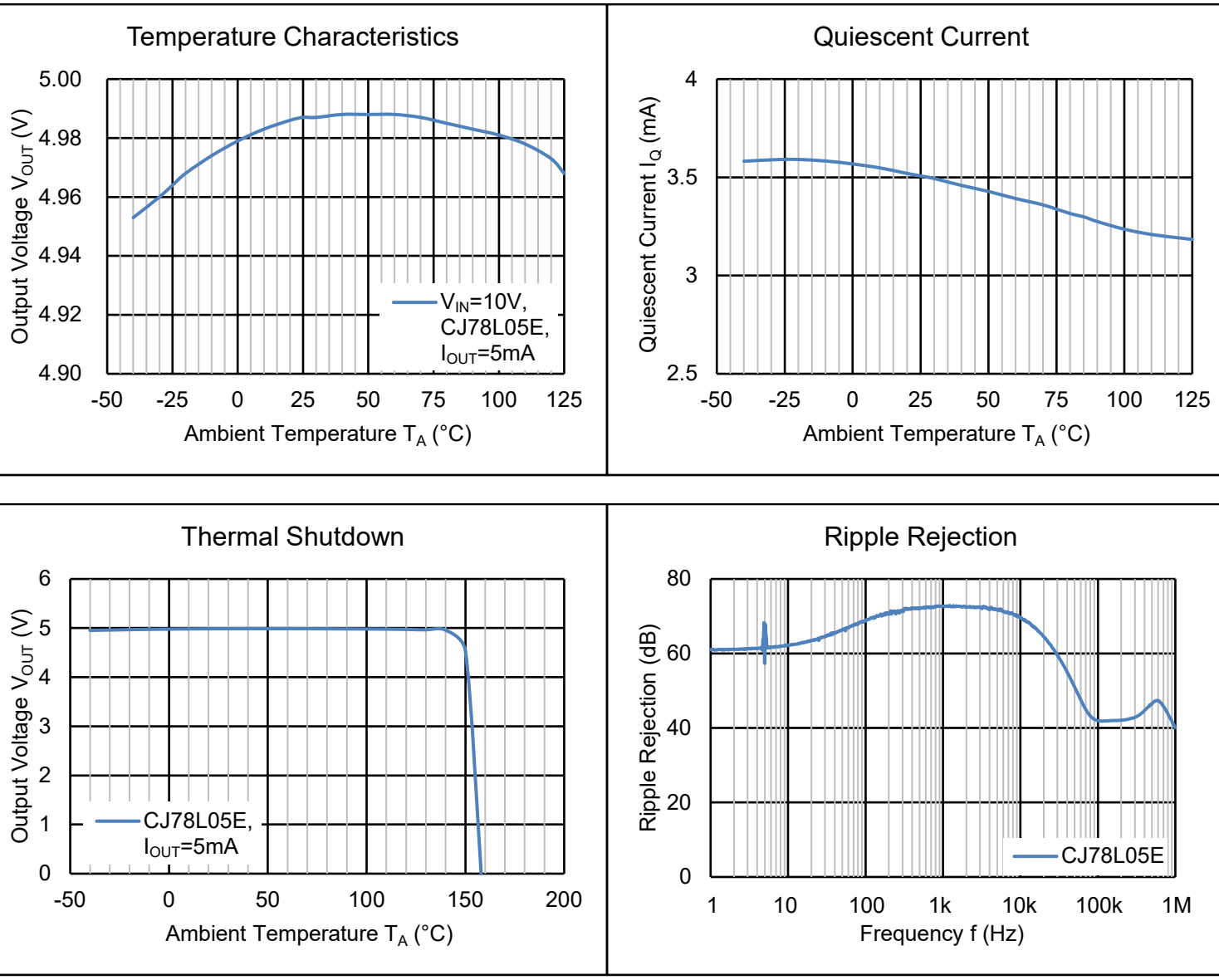
Output Current Limit



6 Specifications

6.6 Typical Characteristics (continued)

CJ78L00E Series (V_{IN} = 10V for CJ78L05E, V_{IN} = 14.5V for CJ78L12E, V_{IN} = 23V for CJ78L15E, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_A = 25°C, unless otherwise specified)



6 Specifications

6.6 Typical Characteristics (continued)

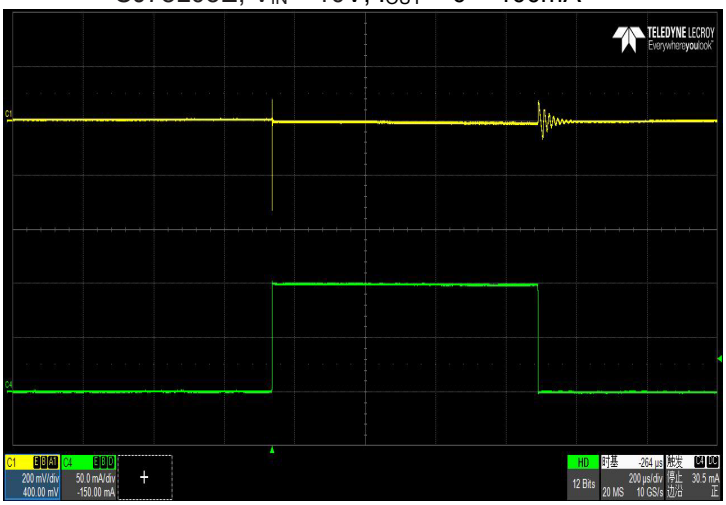
CJ78L00E Series (C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_A = 25°C, unless otherwise specified)

Load Transient (CH_2: V_{OUT}, CH_4: I_{OUT})

CJ78L05E, V_{IN} = 10V, I_{OUT} = 0 ~ 40mA

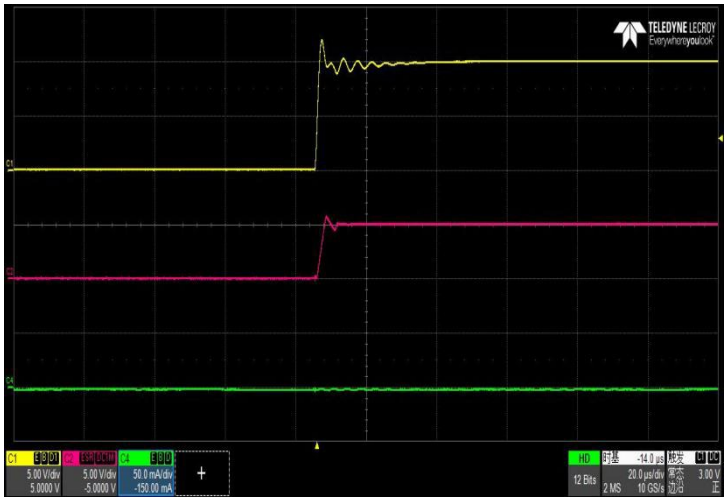


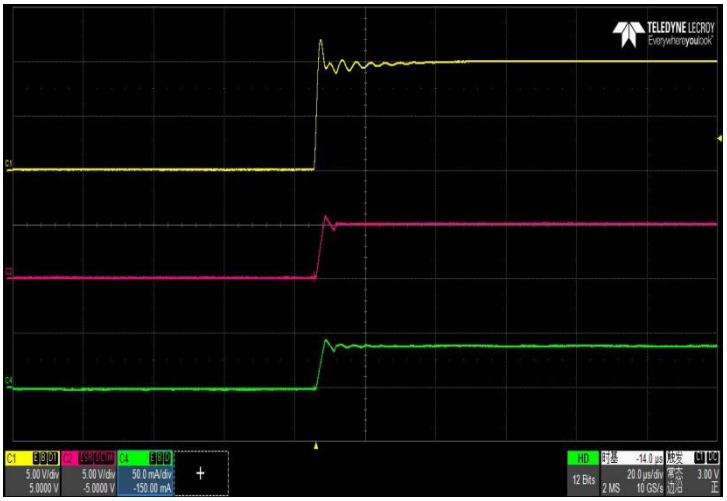
CJ78L05E, V_{IN} = 10V, I_{OUT} = 0 ~ 100mA



Power-up Response

CJ78L05E, V_{IN} = 0 ~ 10V, CH_1: V_{IN}, CH_2: V_{OUT}, CH_3: I_{OUT}。



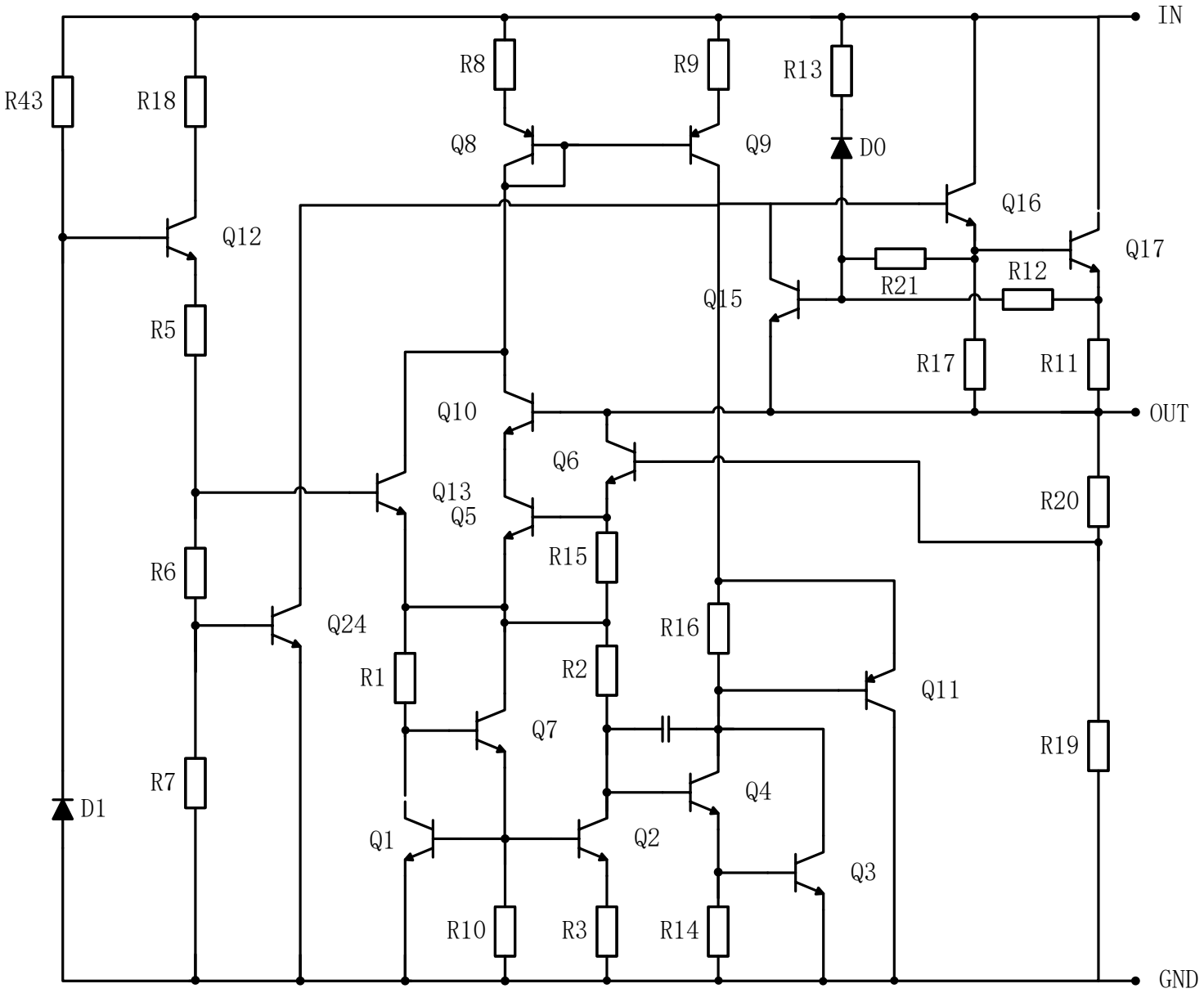


7 Detailed Description

7.1 Description

As a positive voltage linear regulator with a fixed output voltage, the CJ78L00E series is designed for a wide range of application conditions. It integrates current limiting, thermal shutdown, and output transistor SOA protection mechanisms to ensure that it is basically unaffected by output overload. By adding and setting two bypass resistors, the fixed output CJ78L00E series can be used as a voltage adjustable output circuit.

7.2 Representative Schematic Diagram



7 Detailed Description

7.3 Feature Description

Power Input

When the input voltage is lower than the rated range of the data sheet, the device will lose the regulation function of stabilizing the output voltage, that is, it is unable to maintain the output voltage within the rated range. At this time, compared with normal operation, the quiescent current of the device may exceed the rated range, and the transient response performance of the device may be seriously degraded.

When the input voltage is higher than the rated range of the data sheet, the device may cause irreversible damage or failure due to exceeding the maximum rated range of electrical stress.

Output Current

When the circuit design is appropriate, the CJ78L00E series can reach the maximum load capacity of at least 100mA. According to the heat dissipation power consumption of the package and the effective connection thermal resistance with the environment, selecting the appropriate package for the circuit design can make the device emit more heat energy.

Thermal Shutdown

The CJ78L00E series has thermal shutdown protection mechanism. When the junction temperature exceeds the rated temperature range for normal operation in the data sheet, the device will enter the thermal shutdown state. At this time, the output voltage of the device will be reduced to prevent catastrophic damage to the chip due to accidental heat. When the junction temperature decreases and no longer remains too high, the device will release the thermal shutdown and output normally.

To ensure reliable operation, please limit the junction temperature to the specified range of recommended operating conditions in the data sheet. Applications that exceed the recommended temperature range may cause the device to exceed its operating specifications. Although the internal protection circuitry of the device is designed to protect against thermal overall conditions, this circuitry is not intended to replace proper heat sinking. Continuously running the device into thermal shutdown or above the maximum recommended junction temperature reduces long-term reliability.

Current Limit & Short Circuit Protection

The CJ78L00E series has current limiting and short circuit protection mechanism. When the output current of the device is too high, the output of the device will be shut down. When the output of the device is short circuited to ground, the output of the device will also be shut down and the output current will be maintained within a certain range.

8 Application and Implementation

8.1 Risk Alert and Precautions

The CJ78L00E series is designed for thermal protection, output SOA protection and built-in current limit. However, like any IC regulator, precautions are necessary to reduce the possibility of accidental damage to the regulator. The following describes the possible causes of unit damage or failure:

Electrostatic Discharge (ESD and Instantaneous Electrical Surge

Electrostatic discharge (ESD is a common near-field hazard source. It comes from many sources, such as human body, mechanical equipment and electronic components themselves. ESD can cause phenomena such as high voltage and instantaneous high current in a very short time, resulting in damage or failure of the device due to electric shock.

In some applications, a short duration but high energy spike may occur in the circuit, including peak voltage and surge current. They may cause unstable operation of the regulator, accelerated aging and potential hazards, and even damage or malfunction of the regulator. These peaks are usually more likely to occur in hot-plug, switch inductance, heavy-load, and other types of circuits.

Precautions for ESD and Electrical Surge

In the practical application of the circuit, adopting the following suggestions can reduce the possibility of device failure due to the above reasons to a certain extent.

1. Place a TVS between the IN and GND of the voltage regulator to absorb the peak voltage that may be generated due to ESD or other reasons. As shown in Figure 8-2;
2. Place a resistor with appropriate resistance in series before the IN of the voltage regulator, which can help the voltage regulator share part of the energy in case of surge. The resistance value of the resistance should not be too large. The specific resistance value depends on the application of the circuit. Generally, the resistance value of this resistance does not exceed 20Ω. As shown in Figure 8-3.
3. For the application circuit using the low ESR multilayer ceramic capacitor (MLCC) type input capacitor, the LC resonant voltage spike caused by hot plugging or power transmission line inductance can be suppressed by using RC suppression circuit for parallel connection of the input capacitor. A very simple method is to parallel a suitable electrolytic capacitor to the input capacitor. As shown in Figure 8-4. For most 100μF/25V electrolytic capacitor has an ESR of about 0.2Ω at 100kHz. This can completely suppress the overshoot phenomenon of the input and minimize the possibility of IC damage due to input voltage spikes.

For the CJ78L00E series, it is recommended that the peak voltage should not exceed 36V. When the input voltage of the operating circuit may not meet the application conditions described above, it is recommended to adopt the circuit layout shown in Figure 8-2 to 8-4 in the circuit design. During the power supply design process, the designer must inspect the application circuit to ensure that under no circumstances will the IC be damaged due to the reasons mentioned above.

Large Output Capacitance

The CJ78L00E series can obtain better transient response with the help of output capacitance. However, if the output capacitor is relatively large, the surge current generated by the charging of the output capacitor will also be large at the moment of power on of the regulator, and the large surge current passing through the regulator may damage the internal circuit. When the output capacitance is large, adopting the circuit design shown in Figure 8-3 will reduce the possibility of damage to the device due to large surge current to a certain extent. It is recommended that the selection of output capacitor should not exceed 20μF. **If the selection of output capacitor exceeds 20μF, it is recommended to adopt the circuit design in Figure 8-3 to reduce the possibility of accidental failure of the device due to large surge current during power on.**

8 Application and Implementation

8.2 Typical Application Circuits

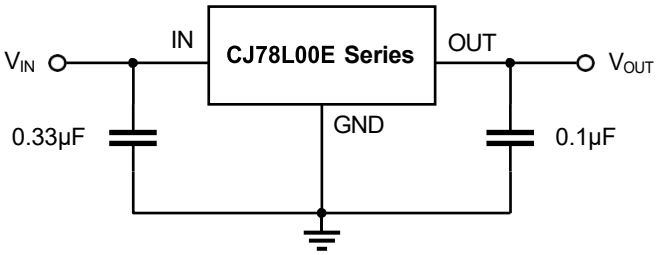


Figure 8-1. Conventional Circuit

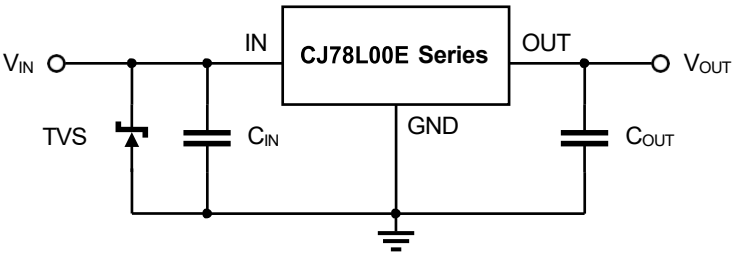


Figure 8-2. TVS is used at IN

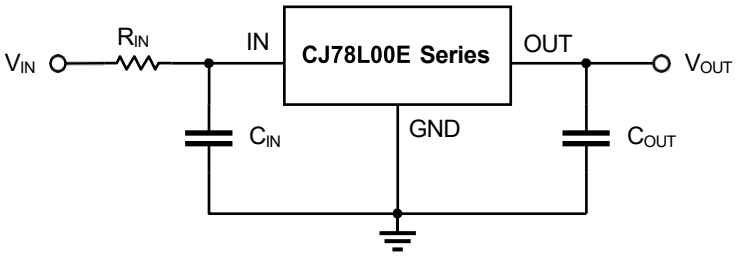


Figure 8-3. Resistance is used at IN

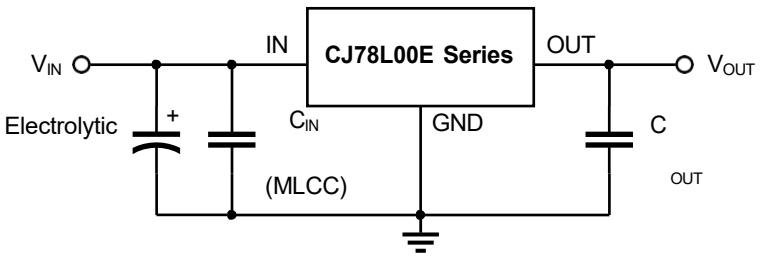


Figure 8-4. Electrolytic capacitor is used at IN

8.3 Bypass Capacitance Selection

A capacitance between IN and GND (C_{IN}) is required if the regulator is located far from the power supply filter. It is recommended to use a 0.33μF capacitor for C_{IN}, and the C_{IN} should be placed as close to the device IN pin and GND pin as possible.

It is recommended to use a 0.1μF capacitor between OUT and GND (C_{OUT}), and the C_{OUT} should be placed as close as possible between OUT and GND. The output capacitance can limit the high-frequency noise and help the device obtain the best stability and transient response.

The tolerance and temperature coefficient of the C_{IN} and C_{OUT} must be considered to ensure that the capacitor can work normally within the rated working ambient temperature and rated working conditions of the equipment.

It is recommended that the C_{OUT} should not exceed 20μF. When the C_{OUT} exceeds 20μF, it is recommended to use the circuit layout shown in Figure 8-2. See *Large Output Capacitance* for more details.

NOTE

The application information in this section is not part of the data sheet component specification, and SZCJ makes no commitment or statement to guarantee its accuracy or completeness. Customers are responsible for determining the rationality of corresponding components in their circuit design and making tests and verifications to ensure the normal realization of their circuit design.

9 Notes and Revision History

9.1 Associated Product Family and Others

To view other products of the same type or IC products of other types, please click the official website of SZCJ -- ***https: www.szcjsemi.com*** for more details.

9.2 Notes

Electrostatic Discharge Caution



This IC may be damaged by ESD. Relevant personnel shall comply with correct installation and use specifications to avoid ESD damage to the IC. If appropriate measures are not taken to prevent ESD damage, the hazards caused by ESD include but are not limited to degradation of integrated circuit performance or complete damage of integrated circuit. For some precision integrated circuits, a very small parameter change may cause the whole device to be inconsistent with its published specifications.

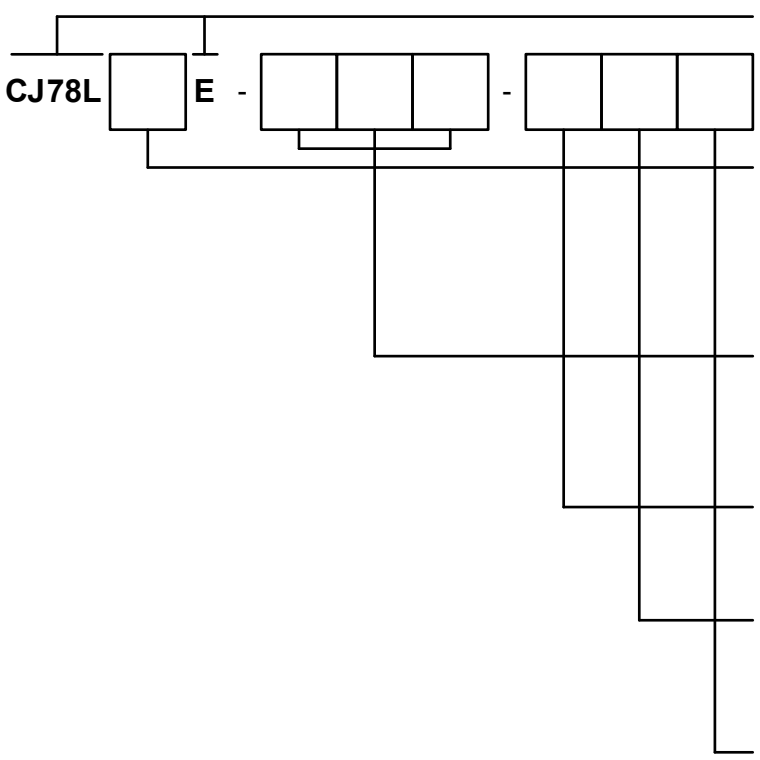
9.3 Revision History

November, 2024: released CJ78L00E series rev - 1.0.

10 Orderable, Mechanical, and Packaging Information

The following pages include mechanical packaging and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser based versions of this data sheet, refer to the left hand navigation.

Orderable Information



Device serial number.

Output voltage.
05: Fixed output 5.0V
06: Fixed output 6.0V
08: Fixed output 8.0V
09: Fixed output 9.0V
12: Fixed output 12V
15: Fixed output 15V
18: Fixed output 18V
24: Fixed output 24V

Package type.
M3Y: SOT-23-3L
P3T: SOT-89-3L
TAB: TO-92

Output voltage tolerances.
A: ±2% grade
B: ±1% grade

Outer package option.
A: Ammo
B: Bulk
R: Tape and reel

Eco-label.
G: Green device, halogen free and lead free

Figure a. CJ78L00E Series Naming Convention

MODEL	DEVICE	PACKAGE	OP T_J	ECO PLAN	MSL	PACKING OPTION	SORT
±2% Grade Products							
CJ78L00E-5.0	CJ78L05E-M3Y-ARG	SOT-23-3L	-40 ~ 125°C	RoHS & Green	Level 3 168 HR	Tape and Reel 3000 Units / Reel	Active
CJ78L00E-5.0	CJ78L05E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active
CJ78L00E-6.0	CJ78L06E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active
CJ78L00E-8.0	CJ78L08E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active
CJ78L00E-9.0	CJ78L09E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active
CJ78L00E-12	CJ78L12E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active
CJ78L00E-15	CJ78L15E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active
CJ78L00E-18	CJ78L18E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active
CJ78L00E-24	CJ78L24E-P3T-ARG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 1 Infinite	Tape and Reel 1000 Units / Reel	Active

Orderable Information

MODEL	DEVICE	PACKAGE	OP T_J	ECO PLAN	MSL	PACKING OPTION	SORT
±2% Grade Products (continued)							
CJ78L00E-5.0	CJ78L05E-TAB-AAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Active
CJ78L00E-6.0	CJ78L06E-TAB-AAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Active
CJ78L00E-8.0	CJ78L08E-TAB-AAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Active
CJ78L00E-9.0	CJ78L09E-TAB-AAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Active
CJ78L00E-12	CJ78L12E-TAB-AAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Active
CJ78L00E-15	CJ78L15E-TAB-AAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Active
CJ78L00E-18	CJ78L18E-TAB-AAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Active
CJ78L00E-5.0	CJ78L05E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active
CJ78L00E-6.0	CJ78L06E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active
CJ78L00E-8.0	CJ78L08E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active
CJ78L00E-9.0	CJ78L09E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active
CJ78L00E-12	CJ78L12E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active
CJ78L00E-15	CJ78L15E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active
CJ78L00E-18	CJ78L18E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active
CJ78L00E-24	CJ78L24E-TAB-ABG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Active

MODEL	DEVICE	PACKAGE	OP T_J	ECO PLAN	MSL	PACKING OPTION	SORT
±1% Grade Products							
CJ78L00E-x.x ±1% grade	CJ78LxxE-M3Y-BRG	SOT-23-3L	-40 ~ 125°C	RoHS & Green	Level 3 168 HR	Tape and Reel 3000 Units / Reel	Customized
	CJ78LxxE-P3T-BRG	SOT-89-3L	-40 ~ 125°C	RoHS & Green	Level 3 168 HR	Tape and Reel 1000 Units / Reel	Customized
	CJ78LxxE-TAB-BAG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Ammo 2000 Units / Box	Customized
	CJ78LxxE-TAB-BBG	TO-92	-40 ~ 125°C	RoHS & Green	N / A for Pkg Type	Bulk 1000 Units / Bag	Customized
Other	-	-	-	-	-	-	Customized

Note:

ECO PLAN: For the RoHS and Green certification standards of this product, please refer to the official report provided by SZCJ

MSL: Moisture Sensitivity Level. Determined according to JEDEC industry standard classification.

SORT: Specifically defined as follows:

Active: Recommended for new products;

Customized: Products manufactured to meet the specific needs of customers;

Preview: The device has been released and has not been fully mass produced. The sample may or may not be available;

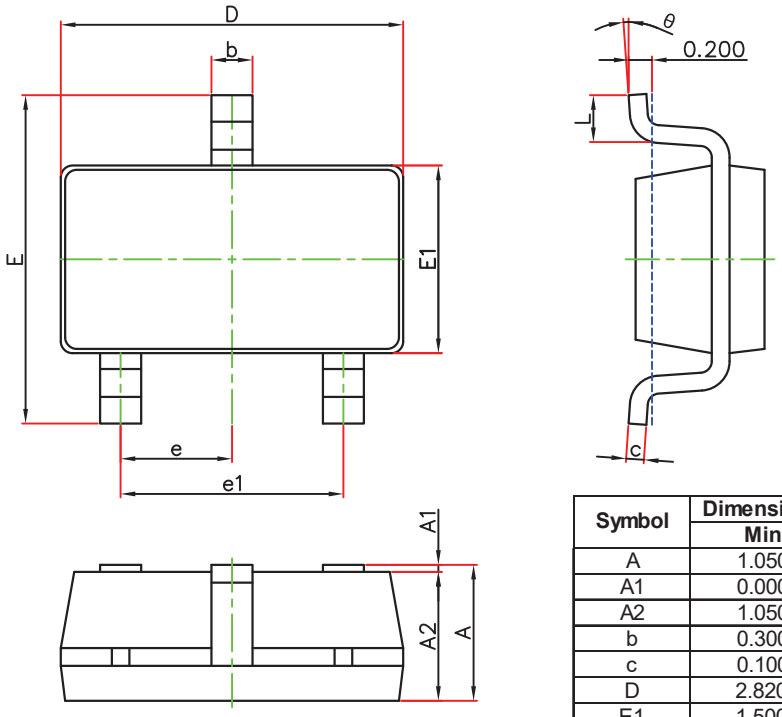
NoRD: It is not recommended to use the device for new design. The device is only produced for the needs of existing customers;

Obsolete: The device has been discontinued

Mechanical Information

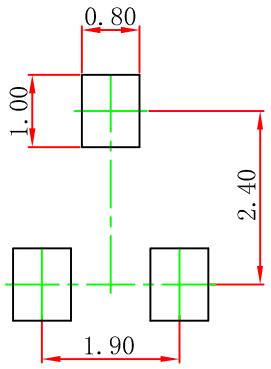
SOT-23-3L Mechanical Information

SOT-23-3L Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E1	1.500	1.700	0.059	0.067
E	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
K	0°	8°	0°	8°

SOT-23-3L Suggested Pad Layout



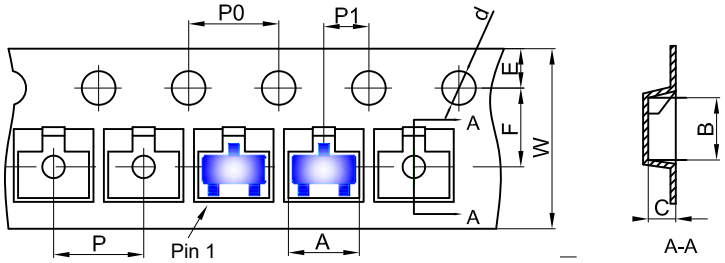
Note:

1. Controlling dimemsion: in millimeters.
2. General tolerance: ±0.05mm.
3. The pad layout is for reference purpose only.

Package Information

SOT-23-3L Tape and Reel Information

Embossed Carrier Tape

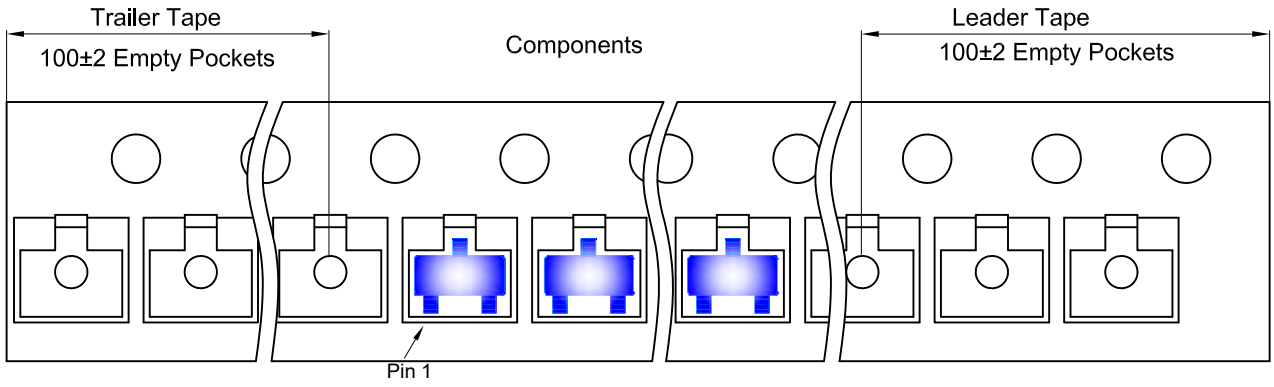


Packaging Description:

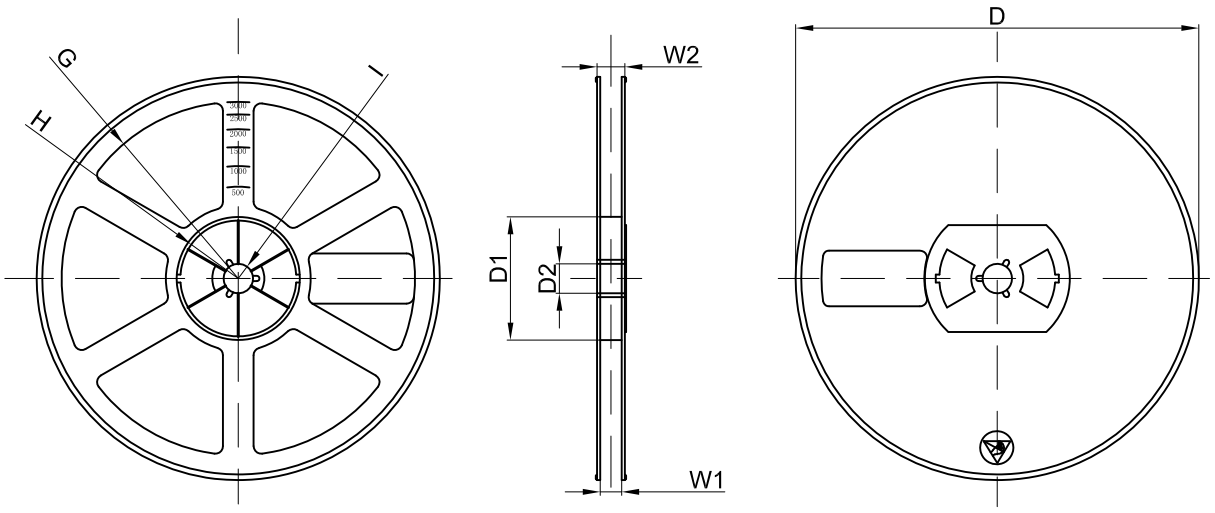
SOT-23-3L parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 18.0cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

Dimensions are in millimeter										
Pkg type	A	B	C	d	E	F	P0	P	P1	W
SOT-23-3L	3.18	3.28	1.32	Ø1.50	1.75	3.50	4.00	4.00	2.00	8.00

SOT-23-3L Tape Leader and Trailer



SOT-23-3L Reel



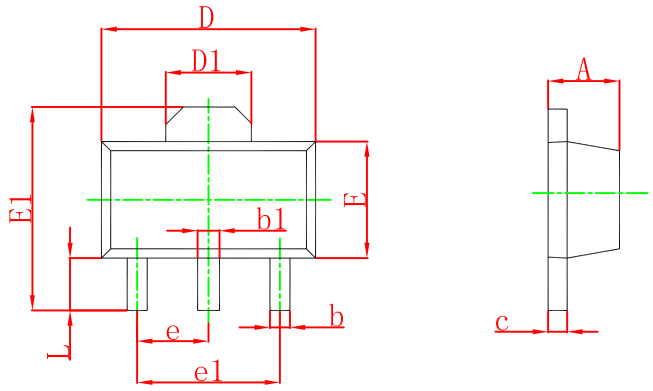
Dimensions are in millimeter								
Reel Option	D	D1	D2	G	H	I	W1	W2
7"Dia	Ø180.00	60.00	13.00	R78.00	R25.60	R6.50	9.50	13.10

REEL	Reel Size	Box	Box Size(mm)	Carton	Carton Size(mm)	G.W.(kg)
3000 pcs	7 inch	30,000 pcs	203×203×195	120,000 pcs	438×438×220	

Mechanical Information

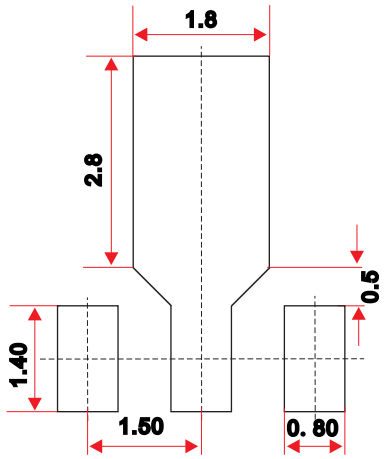
SOT-89-3L Mechanical Information

SOT-89-3L Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047

SOT-89-3L Suggested Pad Layout



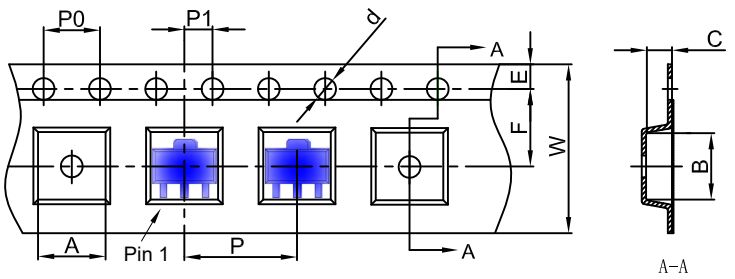
Note:

1. Controlling dimemsion: in millimeters.
2. General tolerance: ±0.05mm.
3. The pad layout is for reference purpose only.

Package Information

SOT-89-3L Tape and Reel Information

Embossed Carrier Tape

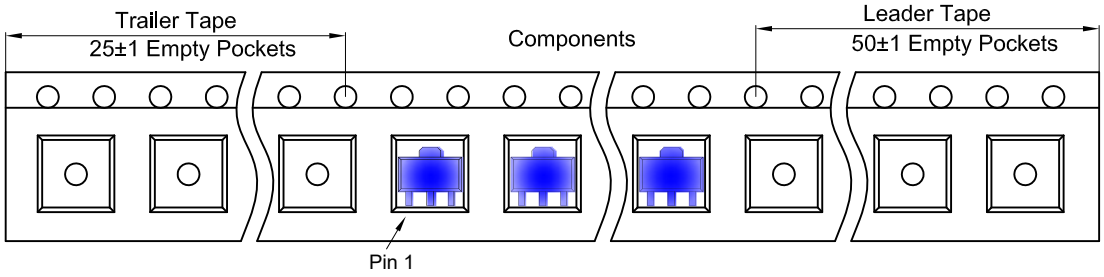


Packaging Description:

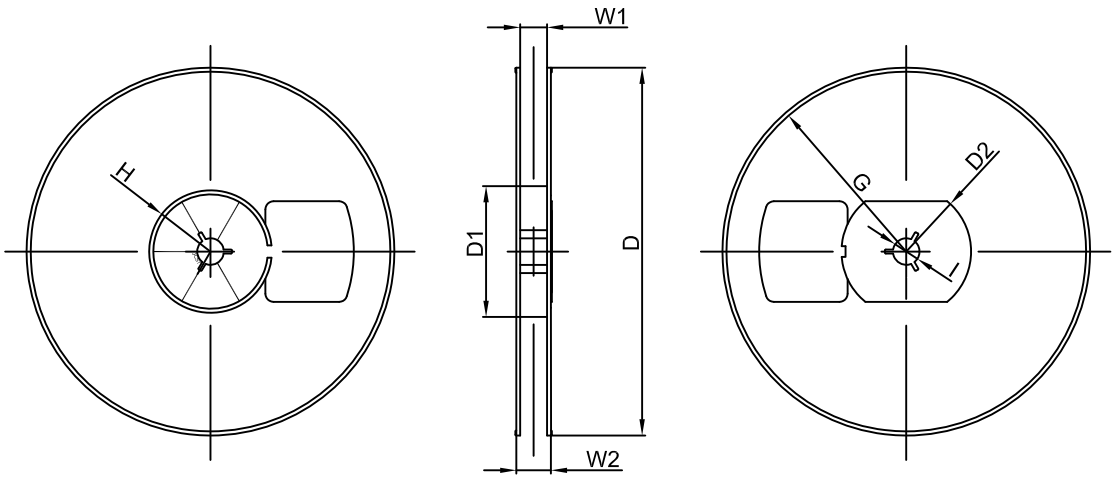
SOT-89-3L parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 1,000 units per 7" or 18.0 cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

Dimensions are in millimeter										
Pkg type	A	B	C	d	E	F	P0	P	P1	W
SOT-89-3L	4.85	4.45	1.85	Ø1.50	1.75	5.50	4.00	8.00	2.00	12.00

SOT-89-3L Tape Leader and Trailer



SOT-89-3L Reel



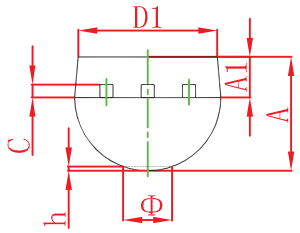
Dimensions are in millimeter								
Reel Option	D	D1	D2	G	H	I	W1	W2
7"Dia	Ø180.00	60.00	R32.00	R86.50	R30.00	Ø13.00	13.20	16.50

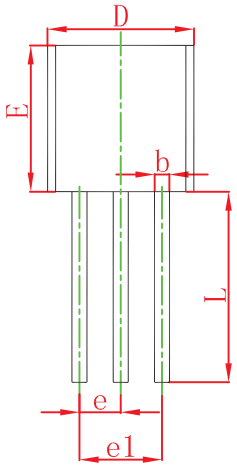
REEL	Reel Size	Box	Box Size(mm)	Carton	Carton Size(mm)	G.W.(kg)
1000 pcs	7 inch	10,000 pcs	203×203×195	40,000 pcs	438×438×220	

Mechanical Information

TO-92 Mechanical Information

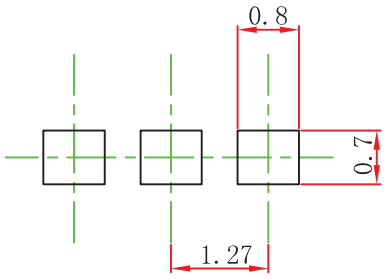
TO-92 Outline Dimensions





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
K		1.600		0.063
h	0.000	0.380	0.000	0.015

TO-92 Suggested Pad Layout



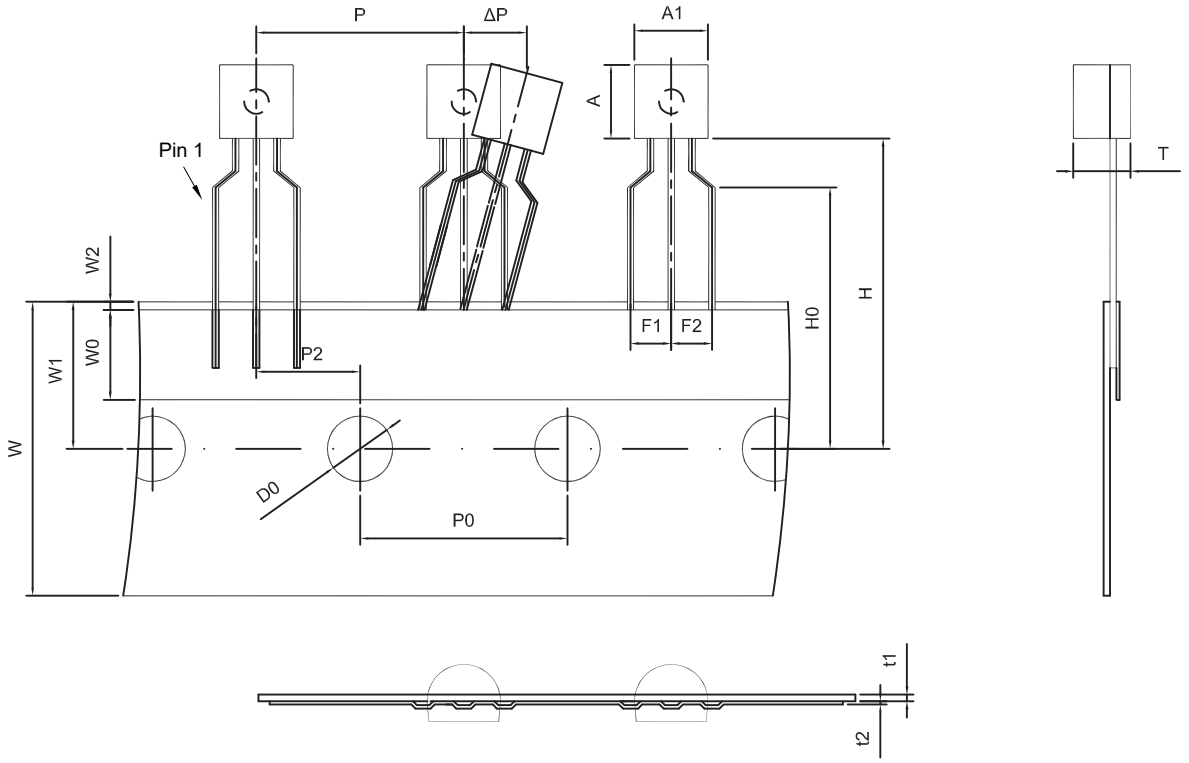
Note:

1. Controlling dimemsion: in millimeters.
2. General tolerance: ±0.05mm.
3. The pad layout is for reference purpose only.

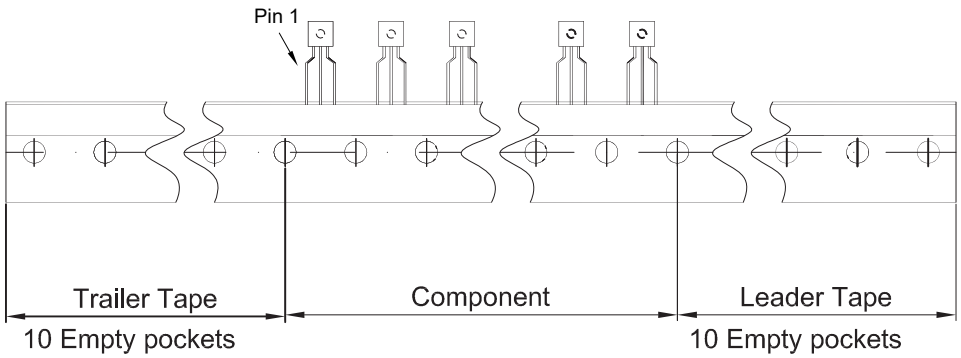
Package Information

TO-92 Tape and Reel Information

Embossed Carrier Tape



Dimiensions are in millimeter								
A1	A	T	P	P0	P2	F1	F2	W
4.5	4.5	3.5	12.7	12.7	6.35	2.5	2.5	18.0
W0	W1	W2	H	H0	D0	t1	t2	ΔP
6.0	9.0	1.0 MAX.	19.0	16.0	4.0	0.4	0.2	0



Package	Box	Box Size(mm)	Carton	Carton Size(mm)
TO-92	2000 pcs	333×162×43	20,000 pcs	350×340×250

DISCLAIMER

IMPORTANT NOTICE, PLEASE READ CAREFULLY

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