NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT
μPC29S00 Series

LOW DROPOUT VOLTAGE REGULATOR WITH ON/OFF FUNCTION

DESCRIPTION

The μPC29S00 series is a low dropout regulator, which has 100 mA capable for the output current. This series features ON/OFF function to control output voltage.

The μPC29S00 series is suitable for NEC Electronics' single chip microcomputers, which have on-chip flash memory. The μPC29S00 series is use of erasing and writing data on its flash memory.

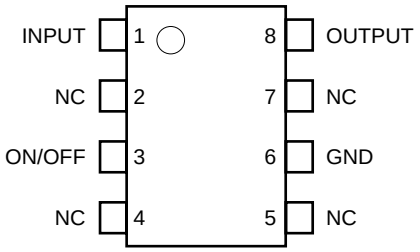
FEATURES

- ON/OFF control function (active high)
- Output current excess of 100 mA
- ★ • Surface mount device package: 8-pin plastic SOP (5.72 mm (225)) (7.8 V output, 10 V output)
- High accuracy output voltage: ±2% (7.8 V output)
  −2 to +1% (10 V output)
- On-chip all kinds of protection circuit

★ ORDERING INFORMATION

Part Number	Package	Output Voltage
μPC29S78GR	8-pin plastic SOP (5.72 mm (225))	7.8 V
μPC29S10GR	8-pin plastic SOP (5.72 mm (225))	10 V

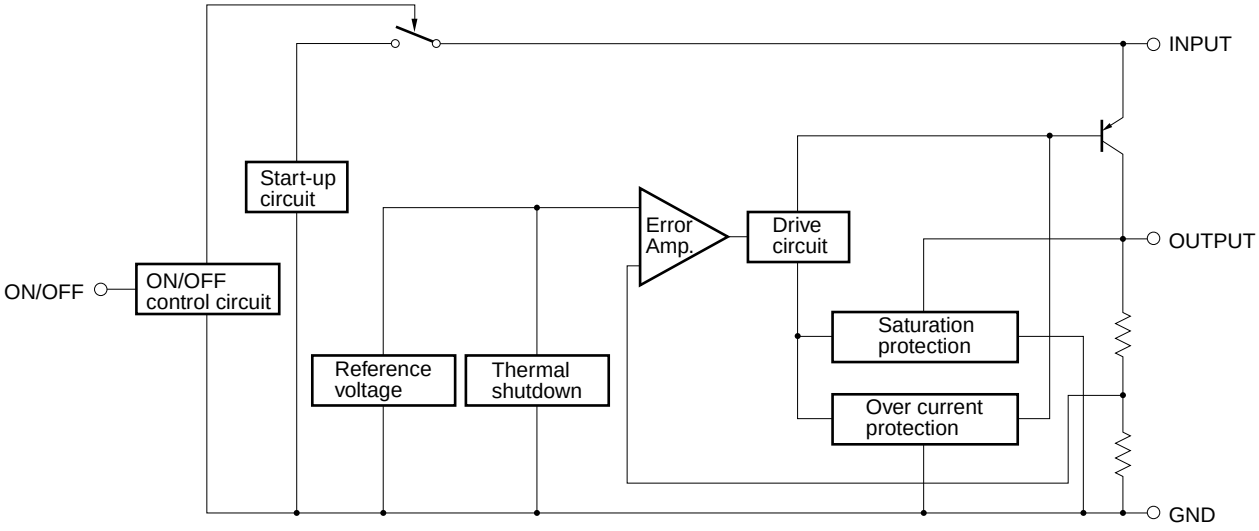
PIN CONFIGURATION (Marking Side)



Document No. G12905EJ5V0DS00 (5th edition)
Date Published January 2003 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

BLOCK DIAGRAM



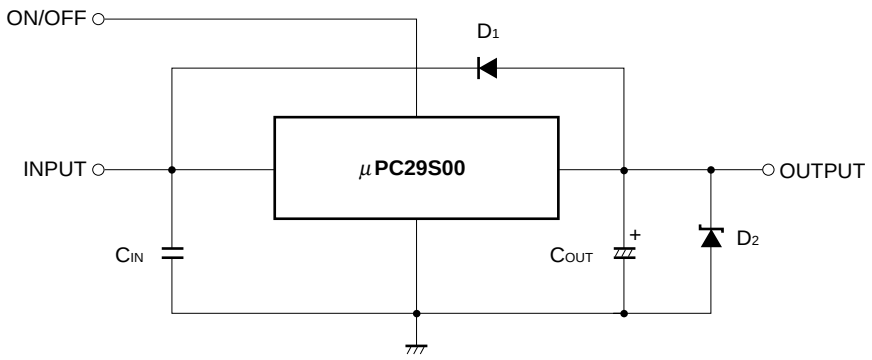
ABSOLUTE MAXIMUM RATINGS (T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Rating	Unit
Input Voltage	V_{IN}	20	V
Internal Power Dissipation	P_T Note	0.48	W
Operating Ambient Temperature	T_A	–30 to +85	°C
Operating Junction Temperature	T_J	–30 to +150	°C
Storage Temperature	T_{stg}	–55 to +150	°C
Thermal Resistance (Junction to Ambient)	$R_{th(J-A)}$	260	°C/W

Note $T_A \leq 25$°C, internally limited. When the operating junction temperature rises up to 150°C, the internal circuit shuts down the output voltage.

Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

★ TYPICAL CONNECTION



C_{IN}: 0.1 to 0.47 μF. Be sure to connect to prevent abnormal oscillation. For using capacitors, film capacitors whose voltage and temperature characteristics are excellent are recommended. Take care that some monolithic ceramic capacitor is inferior in the temperature and voltage characteristics. When using the monolithic ceramic capacitor, the C_{IN} needs to be held these capacities in voltage and temperature used.

C_{OUT}: 10 μF or higher. Be sure to connect to prevent oscillation and to improve the transient load stabilization. Connect the C_{IN} and C_{OUT} as close as possible to the IC pins (within 2 cm).

D_1: Need for $V_O > V_{IN}$

D_2: Need a shottky barrier diode for $V_O <$ GND

Cautions 1. When output is off ($V_{ON/OFF}$ = low level), the OUTPUT pin should not be supplied higher voltage than V_{IN} voltage from external.

2. Design your circuit and mounting with consideration for heat radiation when using this device.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Input Voltage	V_{IN}	μPC29S78	8.8		18	V
		μPC29S10	11		18	V
Output Current	I_O		0		100	mA
Operating Ambient Temperature	T_A		–30		+85	°C
Operating Junction Temperature	T_J		–30		+125	°C

Caution If the Absolute Maximum Rating is not exceeded, there is no problem for using recommended operating range or more. Use and evaluate the μPC29S00 series since the leeway is decreased with the Absolute Maximum Rating. Moreover, the recommended operating range is not prescribed to use when all parameters are maximum value.

ELECTRICAL CHARACTERISTICS

μPC29S78 (T_J = 25°C, V_{IN} = 12 V, I_O = 50 mA, $V_{ON/OFF}$ = 5 V, unless otherwise specified)

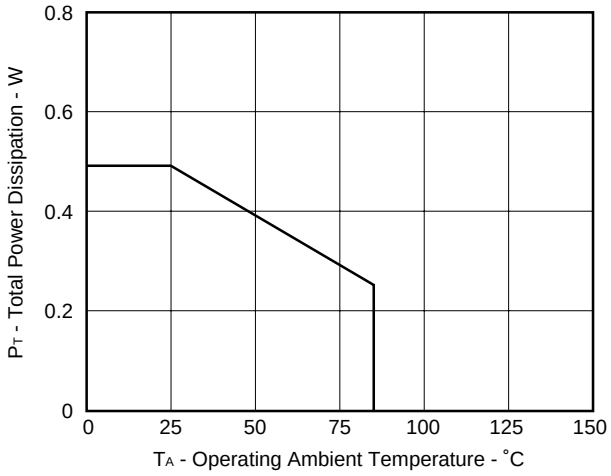
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		7.64	7.8	7.96	V
		8.8 V ≤ V_{IN} ≤ 18 V, 0 mA ≤ I_O ≤ 50 mA, 0°C ≤ T_J ≤ +125°C	7.56		8.04	V
		0 mA ≤ I_O ≤ 100 mA, 0°C ≤ T_J ≤ +125°C	7.56		8.04	V
Line Regulation	REG_{IN}	8.8 V ≤ V_{IN} ≤ 18 V		22	75	mV
Load Regulation	REG_L	0 mA ≤ I_O ≤ 100 mA		21	75	mV
Quiescent Current	I_{BIAS}	I_O = 0 mA		3.0	5.0	mA
		I_O = 100 mA		11	25	mA
Startup Quiescent Current	$I_{BIAS(S)1}$	V_{IN} = 7.3 V, I_O = 0 mA		10	20	mA
	$I_{BIAS(S)2}$	V_{IN} = 7.3 V, I_O = 100 mA			50	mA
Quiescent Current Change	ΔI_{BIAS}	8.8 V ≤ V_{IN} ≤ 18 V, 0°C ≤ T_J ≤ +125°C			10	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		160		μVr.m.s.
Ripple Rejection	R•R	f = 120 Hz, 8.8 V ≤ V_{IN} ≤ 13.5 V	42	51		dB
Dropout Voltage	V_{DIF}	I_O = 100 mA, 0°C ≤ T_J ≤ +125°C			1.0	V
Peak Output Current	I_{Opeak}	V_{IN} = 9.8 V	150	250	400	mA
Short Circuit Current	I_{Oshort}	V_{IN} = 18 V		250		mA
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 5 mA, 0°C ≤ T_J ≤ +125°C		–0.4		mV/°C
ON/OFF Voltage	$V_{ON/OFF1}$	V_{IN} = 12 V, I_O = 10 mA		1.8	2.0	V
	$V_{ON/OFF2}$	V_{IN} = 12 V, I_O = 0 mA	0.8	1.6		V
ON/OFF Current	$I_{ON/OFF1}$	$V_{ON/OFF}$ = 2.7 V, I_O = 0 mA		250	450	μA
	$I_{ON/OFF2}$	$V_{ON/OFF}$ = 5 V, I_O = 0 mA		450	800	μA
Standby Current	$I_{BIASOFF}$	$V_{ON/OFF}$ = 0 V, I_O = 0 mA			10	μA

μPC29S10 (T_J = 25°C, V_{IN} = 12 V, I_O = 50 mA, $V_{ON/OFF}$ = 5 V, unless otherwise specified)

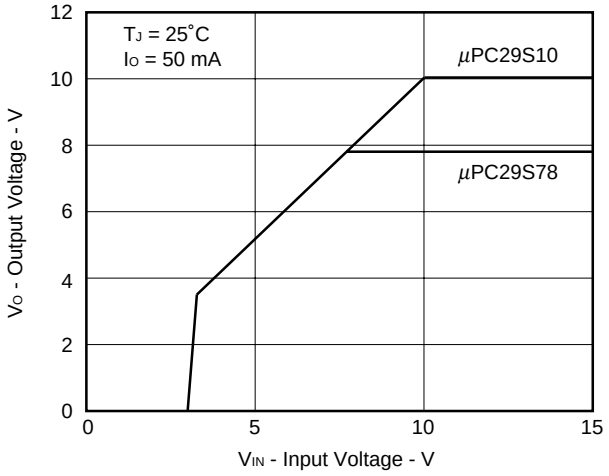
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_O		9.80	10.00	10.10	V
		11 V ≤ V_{IN} ≤ 18 V, 0 mA ≤ I_O ≤ 50 mA, 0°C ≤ T_J ≤ +125°C	9.70		10.20	V
		0 mA ≤ I_O ≤ 100 mA, 0°C ≤ T_J ≤ +125°C	9.70		10.20	V
Line Regulation	REG_{IN}	11 V ≤ V_{IN} ≤ 18 V		27	100	mV
Load Regulation	REG_L	0 mA ≤ I_O ≤ 100 mA		18	100	mV
Quiescent Current	I_{BIAS}	I_O = 0 mA		3.3	5.0	mA
		I_O = 100 mA		12	25	mA
Startup Quiescent Current	$I_{BIAS(S)1}$	V_{IN} = 9.5 V, I_O = 0 mA		10	20	mA
	$I_{BIAS(S)2}$	V_{IN} = 9.5 V, I_O = 100 mA			50	mA
Quiescent Current Change	ΔI_{BIAS}	11 V ≤ V_{IN} ≤ 18 V, 0°C ≤ T_J ≤ +125°C		1.0	10	mA
Output Noise Voltage	V_n	10 Hz ≤ f ≤ 100 kHz		210		μVr.m.s.
Ripple Rejection	R•R	f = 120 Hz, 11 V ≤ V_{IN} ≤ 13.5 V	40	48		dB
Dropout Voltage	V_{DIF}	I_O = 100 mA, 0°C ≤ T_J ≤ +125°C		0.4	1.0	V
Peak Output Current	I_{Opeak}	V_{IN} = 12 V	150	250	400	mA
Short Circuit Current	I_{Oshort}	V_{IN} = 18 V		180		mA
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 5 mA, 0°C ≤ T_J ≤ +125°C		−0.5		mV/°C
ON/OFF Voltage	$V_{ON/OFF1}$	V_{IN} = 12 V, I_O = 10 mA		1.8	2.0	V
	$V_{ON/OFF2}$	V_{IN} = 12 V, I_O = 0 mA	0.8	1.6		V
ON/OFF Current	$I_{ON/OFF1}$	$V_{ON/OFF}$ = 2.7 V, I_O = 0 mA		250	450	μA
	$I_{ON/OFF2}$	$V_{ON/OFF}$ = 5 V, I_O = 0 mA		450	800	μA
Standby Current	$I_{BIASOFF}$	$V_{ON/OFF}$ = 0 V, I_O = 0 mA			10	μA

TYPICAL CHARACTERISTICS (Reference Values)

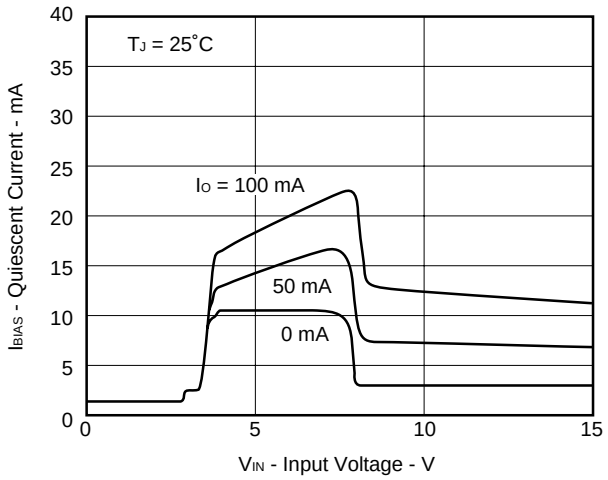
P_T vs. T_A



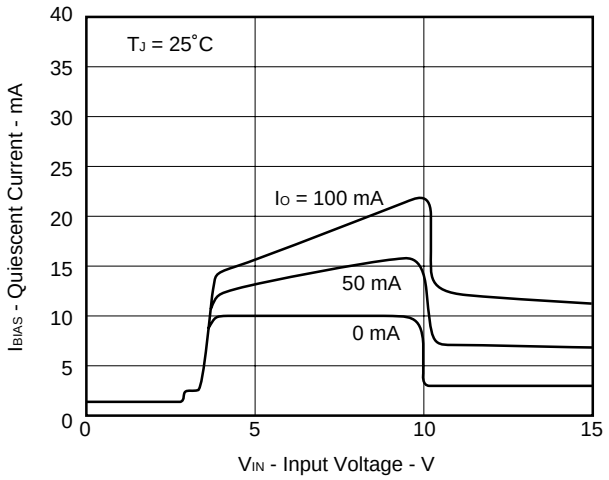
V_O vs. V_{IN}



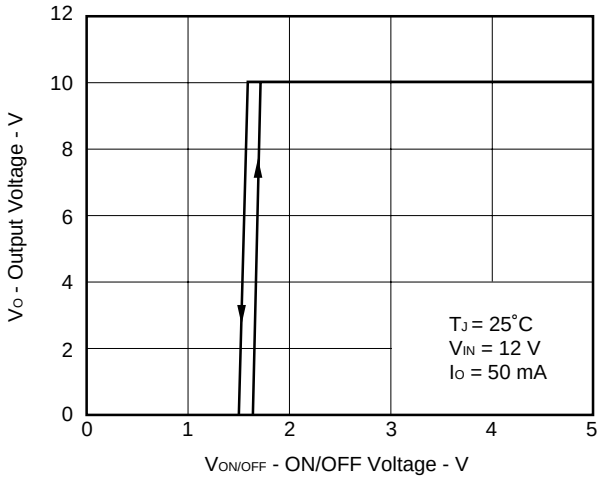
I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} (μPC29S78)



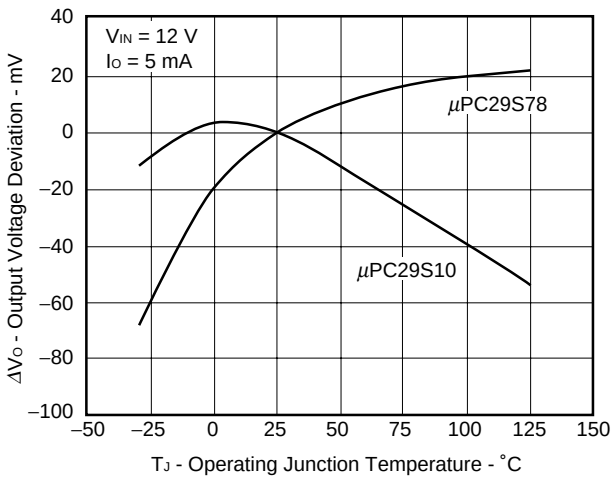
I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} (μPC29S10)



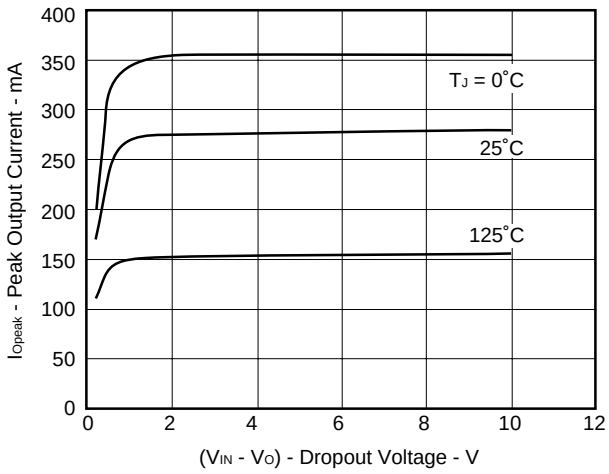
V_O vs. $V_{ON/OFF}$



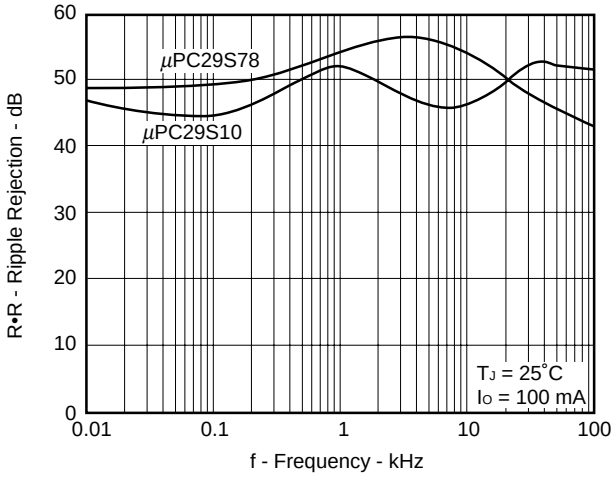
ΔV_O vs. T_J



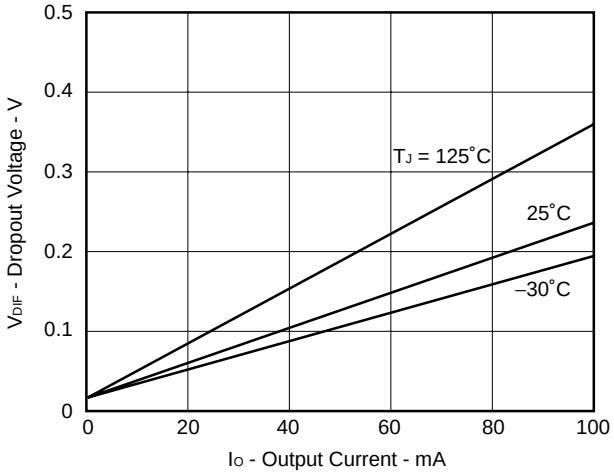
I_{Opeak} vs. (V_{IN} - V_O)



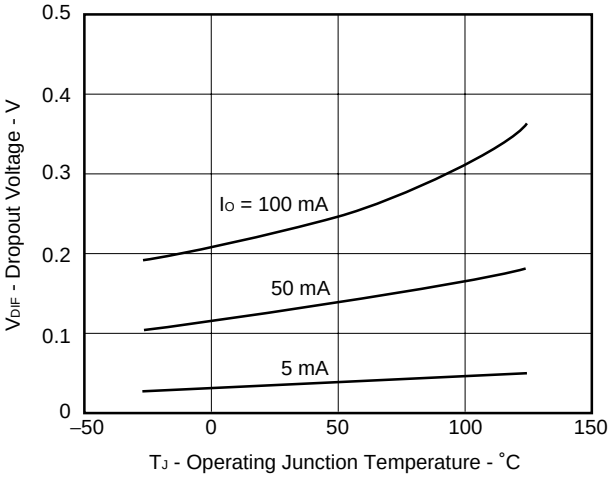
R•R vs. f



V_{DIF} vs. I_O

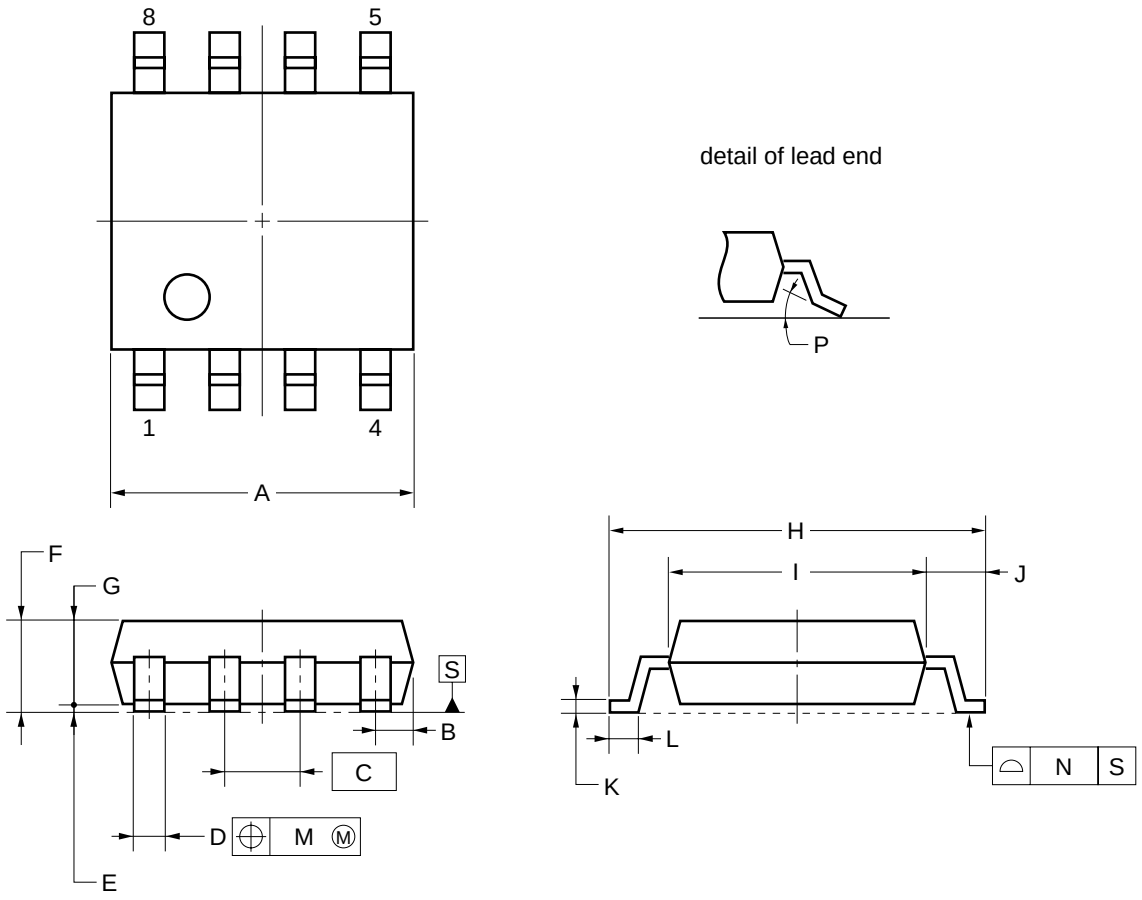


V_{DIF} vs. T_J



★ **PACKAGE DRAWINGS (Unit: mm)**

8-PIN PLASTIC SOP (5.72 mm (225))



NOTE

Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	$5.2^{+0.17}_{-0.20}$
B	0.78 MAX.
C	1.27 (T.P.)
D	$0.42^{+0.08}_{-0.07}$
E	0.1±0.1
F	1.59±0.21
G	1.49
H	6.5±0.3
I	4.4±0.15
J	1.1±0.2
K	$0.17^{+0.08}_{-0.07}$
L	0.6±0.2
M	0.12
N	0.10
P	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

S8GM-50-225B-6

RECOMMENDED SOLDERING CONDITIONS

When soldering this product, it is highly recommended to observe the conditions as shown below. If other soldering processes are used, of if the soldering is performed under different conditions, please make sure to consult with our sales offices.

For more details, refer to below our document.

"Semiconductor Device Mounting Technology Manual (C10535E)"

Type of Surface Mount Device

μPC29S78GR, μPC29S10GR: 8-PIN PLASTIC SOP (5.72 mm (225))

Process	Conditions	Symbol
Infrared Ray Reflow	Peak temperature: 235°C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210°C or higher), Maximum number of reflow processes: 3 times.	IR35-00-3
Vapor Phase Soldering	Peak temperature: 215°C or below (Package surface temperature), Reflow time: 40 seconds or less (at 200°C or higher), Maximum number of reflow processes: 3 times.	VP15-00-3
Wave Soldering	Solder temperature: 260°C or below, Flow time: 10 seconds or less, Maximum number of flow processes: 1 time, Pre-heating temperature: 120°C or below (Package surface temperature).	WS60-00-1
Partial Heating Method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (Per each side of the device).	–

Caution Apply only one kind of soldering condition to a device, except for "partial heating method", or the device will be damaged by heat stress.

CAUTION ON USE

When using the μPC29S00 series at the input voltage which is lower than in the recommended operating condition the big quiescent current flows through device because the transistor of the output paragraph is saturated (Refer to the I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} curves in TYPICAL CHARACTERISTICS). The specification of this characteristics is the start-up quiescent current, $I_{BIAS(S)}$. The μPC29S00 series has saturation protection circuit, but they sometimes need about 50 mA current. Therefore, the power supply on the input needs the enough current capacity to pass this quiescent current when the device starts up.

★ REFERENCE DOCUMENTS

Usage of Three-Terminal Regulators (G12702E)

Quality Grades on NEC Semiconductor Devices (C11531E)

Semiconductor Device Mounting Technology Manual (C10535E)

Review of Quality and Reliability Handbook (C12769E)

Semiconductor Selection Guide -Products and Packages- (X13769X)