NEC

MOS INTEGRATED CIRCUIT

μPD120Nxx Series

THREE-TERMINAL LOW-DROPOUT POSITIVE-VOLTAGE REGULATOR (OUTPUT CURRENT: 0.3 A)

DESCRIPTION

The μPD120Nxx series provides low-voltage output regulators with the output current capacitance of 0.3 A. The output voltage varies according to the product (1.5 V, 1.8 V, 2.5 V, or 3.3 V). The circuit current is low due to the CMOS structure, so the power consumption in the ICs can be reduced. Moreover, since ICs are mounted in the small package of the μPD120Nxx series, this contributes to the miniaturization of the application set.

FEATURES

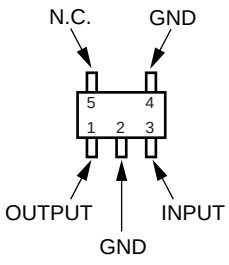
- Output current: 0.3 A
- On-chip overcurrent protection circuit
- On-chip thermal protection circuit
- Small circuit operation current: 60 μA TYP.

APPLICATIONS

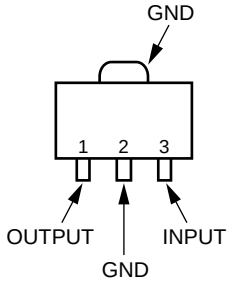
Digital TV, Audio, HDD, DVD, etc.

PIN CONFIGURATION (Marking Side)

SC-74A



SC-62



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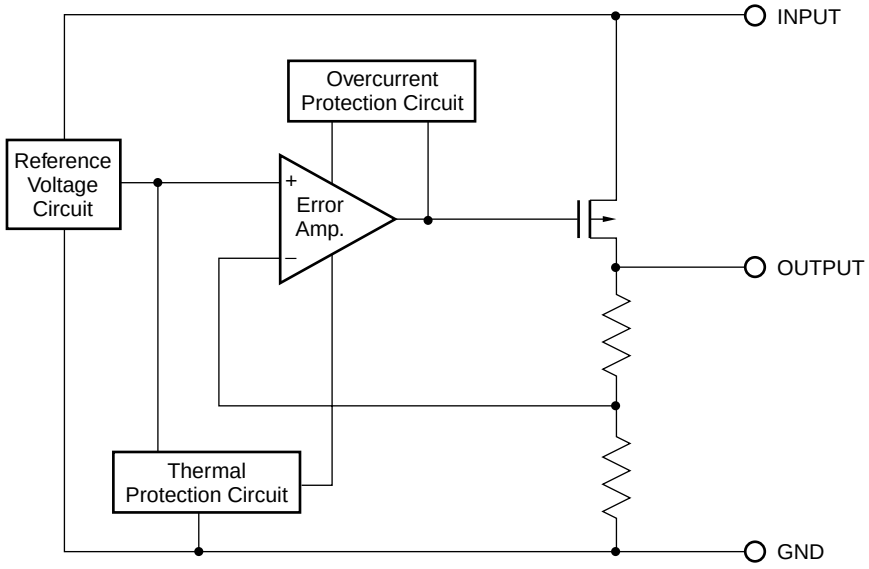
BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Package	Output Voltage	Marking
μPD120N15TA	SC-74A	1.5 V	K71
μPD120N15T1B	SC-62	1.5 V	7D
μPD120N18TA	SC-74A	1.8 V	K72
μPD120N18T1B	SC-62	1.8 V	7E
μPD120N25TA	SC-74A	2.5 V	K73
μPD120N25T1B	SC-62	2.5 V	7F
μPD120N33TA	SC-74A	.3.3 V	K74
μPD120N33T1B	SC-62	3.3 V	7G

Remark -E1 or -E2 is suffixed to the end of the part number of taping products, and -A or -AZ to that of Pb-free products. See the table below for details.

Part Number [Note1]	Package	Package Type
μPD120NxxTA	SC-74A	• Unit
μPD120NxxTA-A [Note2]	SC-74A	• Unit
μPD120NxxTA-E1	SC-74A	• 8 mm wide embossed taping • Pin 1 on take-up side • 3000 pcs/reel (MAX.)
μPD120NxxTA-E1-A [Note2]	SC-74A	• 8 mm wide embossed taping • Pin 1 on take-up side • 3000 pcs/reel (MAX.)
μPD120NxxTA-E2	SC-74A	• 8 mm wide embossed taping • Pin 1 on draw-out side • 3000 pcs/reel (MAX.)
μPD120NxxTA-E2-A [Note2]	SC-74A	• 8 mm wide embossed taping • Pin 1 on draw-out side • 3000 pcs/reel (MAX.)
μPD120NxxT1B	SC-62	• Unit
μPD120NxxT1B-AZ [Note3]	SC-62	• Unit
μPD120NxxT1B-E1	SC-62	• 12 mm wide embossed taping • Pin 1 on take-up side • 1000 pcs/reel (MAX.)
μPD120NxxT1B-E1-AZ [Note3]	SC-62	• 12 mm wide embossed taping • Pin 1 on take-up side • 1000 pcs/reel (MAX.)
μPD120NxxT1B-E2	SC-62	• 12 mm wide embossed taping • Pin 1 on draw-out side • 1000 pcs/reel (MAX.)
μPD120NxxT1B-E2-AZ [Note3]	SC-62	• 12 mm wide embossed taping • Pin 1 on draw-out side • 1000 pcs/reel (MAX.)

Notes 1. xx stands for symbols that indicate the output voltage.

2. Pb-free (This product does not contain Pb in external electrode and other parts.)

3. Pb-free (This product does not contain Pb in external electrode.)

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

Parameter	Symbol	Rating		Unit
		μPD120NxxTA	μPD120NxxT1B	
Input Voltage	V_{IN}	–0.3 to +6		V
Power Dissipation Note1	P_T	180/510 Note2	400/2000 Note3	mW
Operating Ambient Temperature	T_A	–40 to +85		°C
Operating Junction Temperature	T_J	–40 to +150		°C
Storage Temperature	T_{stg}	–55 to +150		°C
Thermal Resistance (junction to ambient)	$R_{th(J-A)}$	695/245 Note2	315/62.5 Note3	°C/W

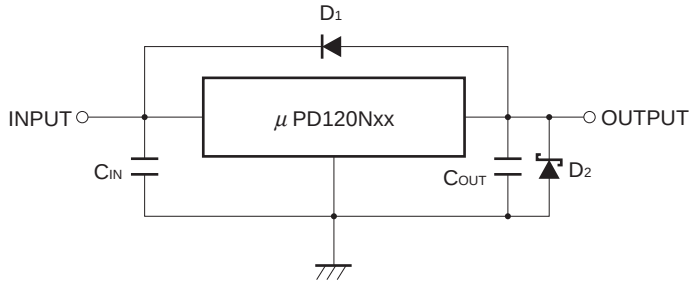
Note 1. Internally limited. When the operating junction temperature rises over 150°C, the internal circuit shuts down the output voltage.

2. Mounted on ceramic substrate of 75 mm^2 x 0.7 mm

3. Mounted on ceramic substrate of 16 cm^2 x 0.7 mm

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.

STANDARD CONNECTION



C_{IN}: 0.1 μF or higher. Set this value according to the length of the line between the regulator and INPUT pin. Be sure to connect C_{IN} to prevent parasitic oscillation. If using a laminated ceramic capacitor, it is necessary to ensure that C_{IN} is 0.1 μF or higher for the voltage and temperature range to be used.

C_{OUT}: 10 μF or higher. Be sure to connect C_{OUT} to prevent oscillation and improve excessive load regulation. Place C_{IN} and C_{OUT} as close as possible to the IC pins (within 2 cm). Be sure to use the capacitor of 10 μF or higher of capacity values and 1 to 8 Ω of equivalent series resistance under an operating condition.

D_1: If the OUTPUT pin has a higher voltage than the INPUT pin, connect a diode.

D_2: If the OUTPUT pin has a lower voltage than the GND pin, connect a schottky barrier diode.

Caution Make sure that no voltage is applied to the OUTPUT pin from external.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Type Number	MIN.	TYP.	MAX.	Unit
Input Voltage	V_{IN}	μPD120N15	3.0		5.5	V
		μPD120N18	3.2		5.5	V
		μPD120N25	4.5		5.5	V
		μPD120N33	4.5		5.5	V
Output Current	I_O	All	0		0.3	A
Operating Ambient Temperature	T_A	All	−40		+85	°C
Operating Junction Temperature	T_J	All	−40		+125	°C

Caution Use of conditions other than the above-listed recommended operating conditions is not a problem as long as the absolute maximum ratings are not exceeded. However, since the use of such conditions diminishes the margin of safety, careful evaluation is required before such conditions are used. Moreover, using the MAX. value for all the recommended operating conditions is not guaranteed to be safe.

ELECTRICAL CHARACTERISTICS

μPD120N15 (T_J = 25°C, V_{IN} = 5.0 V, I_O = 0.15 A, C_{IN} = 0.1 μF, C_{OUT} = 10 μF, unless otherwise specified.)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_{O1}		1.47	1.5	1.53	V
	V_{O2}	3.0 V ≤ V_{IN} ≤ 5.5 V, 0 A ≤ I_O ≤ 0.3 A	1.455	–	1.545	V
Line Regulation	REG_{IN}	3.0 V ≤ V_{IN} ≤ 5.5 V	–	1	30	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.3 A	–	2	30	mV
Quiescent Current	I_{BIAS}	I_O = 0 A	–	60	120	μA
Quiescent Current Change	ΔI_{BIAS}	3.0 V ≤ V_{IN} ≤ 5.5 V	–	–	25	μA
Output Noise Voltage	V_n	10 kHz ≤ f ≤ 100 kHz	–	100	–	$\mu V_{r.m.s.}$
Ripple Rejection	R•R	f = 1 kHz, 3.0 V ≤ V_{IN} ≤ 5.5 V	–	63	–	dB
Dropout Voltage	V_{DIF}	I_O = 0.15 A	–	0.6	0.9	V
		I_O = 0.3 A	–	1.0	–	V
Short Circuit Current	I_{Oshort}	V_{IN} = 5 V	–	0.2	–	A
Peak Output Current	I_{Opeak}	V_{IN} = 5 V	0.3	–	–	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 0 A, 0°C ≤ T_J ≤ 125°C	–	0.01	–	mV/°C

μPD120N18 (T_J = 25°C, V_{IN} = 5.0 V, I_O = 0.15 A, C_{IN} = 0.1 μF, C_{OUT} = 10 μF, unless otherwise specified.)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_{O1}		1.764	1.8	1.836	V
	V_{O2}	3.2 V ≤ V_{IN} ≤ 5.5 V, 0 A ≤ I_O ≤ 0.3 A	1.746	–	1.854	V
Line Regulation	REG_{IN}	3.2 V ≤ V_{IN} ≤ 5.5 V	–	1	30	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.3 A	–	2	30	mV
Quiescent Current	I_{BIAS}	I_O = 0 A	–	60	120	μA
Quiescent Current Change	ΔI_{BIAS}	3.2 V ≤ V_{IN} ≤ 5.5 V	–	–	25	μA
Output Noise Voltage	V_n	10 kHz ≤ f ≤ 100 kHz	–	120	–	$\mu V_{r.m.s.}$
Ripple Rejection	R•R	f = 1 kHz, 3.2 V ≤ V_{IN} ≤ 5.5 V	–	63	–	dB
Dropout Voltage	V_{DIF}	I_O = 0.15 A	–	0.4	0.65	V
Short Circuit Current	I_{Oshort}	V_{IN} = 5 V	–	0.2	–	A
Peak Output Current	I_{Opeak}	V_{IN} = 5 V	0.3	–	–	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 0 A, 0°C ≤ T_J ≤ 125°C	–	0.01	–	mV/°C

μPD120N25 (T_J = 25°C, V_{IN} = 5.0 V, I_O = 0.15 A, C_{IN} = 0.1 μF, C_{OUT} = 10 μF, unless otherwise specified.)

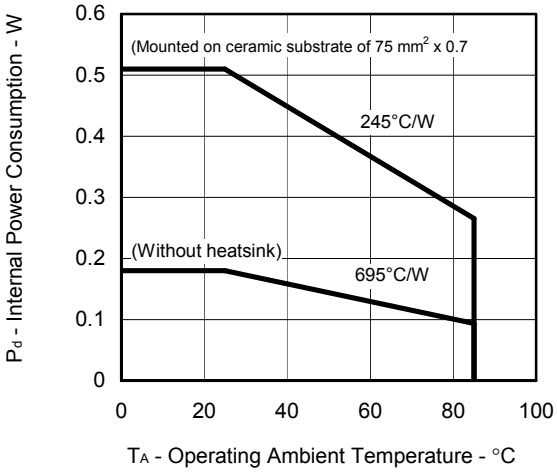
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_{O1}		2.45	2.5	2.55	V
	V_{O2}	4.5 V ≤ V_{IN} ≤ 5.5 V, 0 A ≤ I_O ≤ 0.3 A	2.425	–	2.575	V
Line Regulation	REG_{IN}	4.5 V ≤ V_{IN} ≤ 5.5 V	–	1	30	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.3 A	–	2	30	mV
Quiescent Current	I_{BIAS}	I_O = 0 A	–	60	120	μA
Quiescent Current Change	ΔI_{BIAS}	4.5 V ≤ V_{IN} ≤ 5.5 V	–	–	25	μA
Output Noise Voltage	V_n	10 kHz ≤ f ≤ 100 kHz	–	170	–	$\mu V_{r.m.s.}$
Ripple Rejection	R•R	f = 1 kHz, 4.5 V ≤ V_{IN} ≤ 5.5 V	–	60	–	dB
Dropout Voltage	V_{DIF}	I_O = 0.15 A	–	0.3	0.7	V
Short Circuit Current	I_{Oshort}	V_{IN} = 5 V	–	0.2	–	A
Peak Output Current	I_{Opeak}	V_{IN} = 5 V	0.3	–	–	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 0 A, 0°C ≤ T_J ≤ 125°C	–	0.01	–	mV/°C

μPD120N33 (T_J = 25°C, V_{IN} = 5.0 V, I_O = 0.15 A, C_{IN} = 0.1 μF, C_{OUT} = 10 μF, unless otherwise specified.)

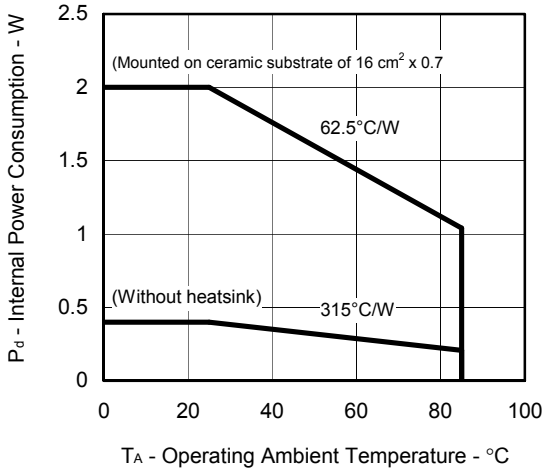
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V_{O1}		3.234	3.3	3.366	V
	V_{O2}	4.5 V ≤ V_{IN} ≤ 5.5 V, 0 A ≤ I_O ≤ 0.3 A	3.201	–	3.399	V
Line Regulation	REG_{IN}	4.5 V ≤ V_{IN} ≤ 5.5 V	–	1	30	mV
Load Regulation	REG_L	0 A ≤ I_O ≤ 0.3 A	–	2	30	mV
Quiescent Current	I_{BIAS}	I_O = 0 A	–	60	120	μA
Quiescent Current Change	ΔI_{BIAS}	4.5 V ≤ V_{IN} ≤ 5.5 V	–	–	25	μA
Output Noise Voltage	V_n	10 kHz ≤ f ≤ 100 kHz	–	220	–	$\mu V_{r.m.s.}$
Ripple Rejection	R•R	f = 1 kHz, 4.5 V ≤ V_{IN} ≤ 5.5 V	–	60	–	dB
Dropout Voltage	V_{DIF}	I_O = 0.15 A	–	0.2	0.6	V
Short Circuit Current	I_{Oshort}	V_{IN} = 5 V	–	0.2	–	A
Peak Output Current	I_{Opeak}	V_{IN} = 5 V	0.3	–	–	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 0 A, 0°C ≤ T_J ≤ 125°C	–	0.01	–	mV/°C

TYPICAL CHARACTERISTICS (Reference Value)

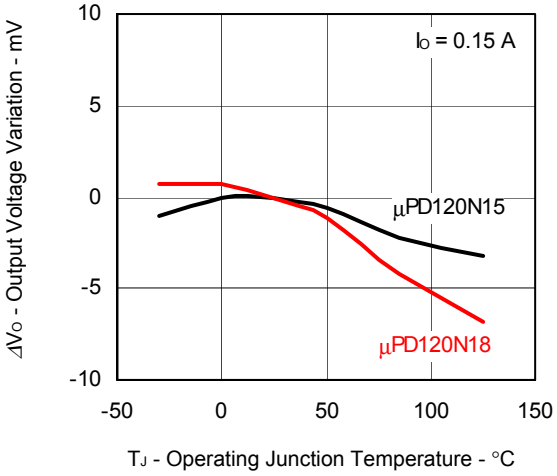
P_d vs. T_A (μPD120NxxTA)



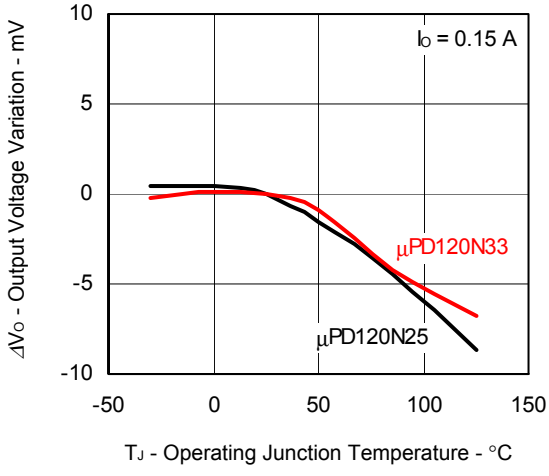
P_d vs. T_A (μPD120NxxT1B)



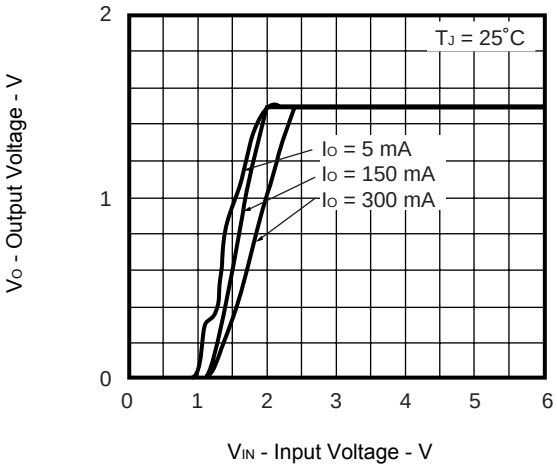
ΔV_O vs. T_J



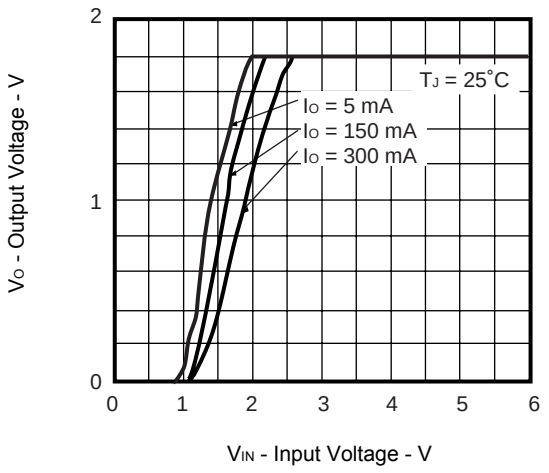
ΔV_O vs. T_J



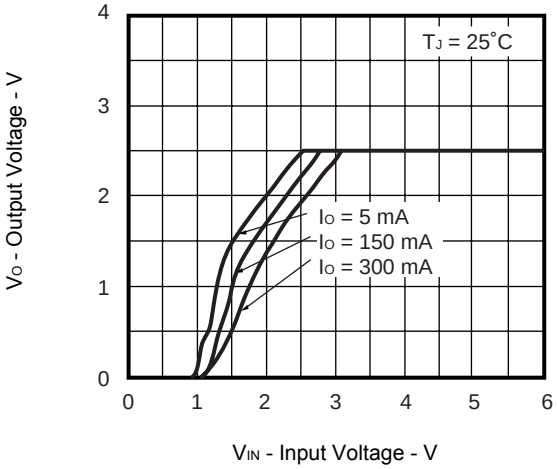
V_O vs. V_{IN} (μPD120N15)



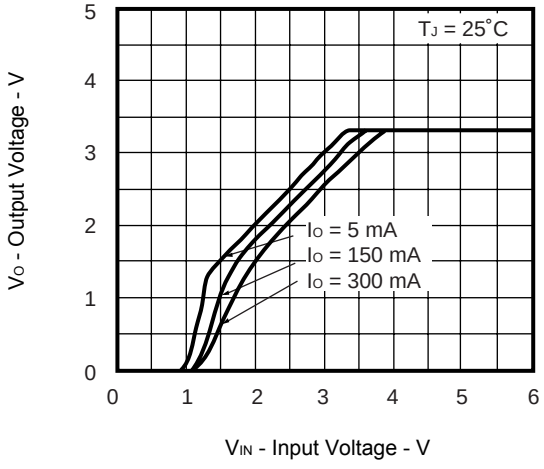
V_O vs. V_{IN} (μPD120N18)



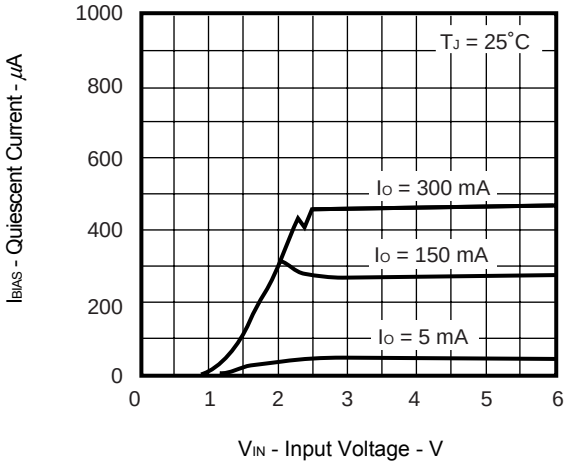
V_O vs. V_{IN} (μPD120N25)



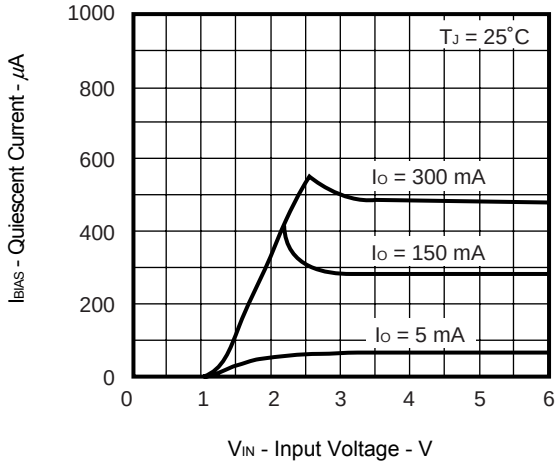
V_O vs. V_{IN} (μPD120N33)



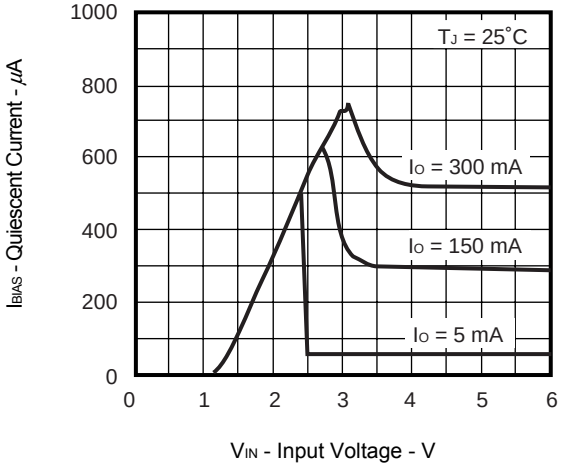
I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} (μPD120N15)



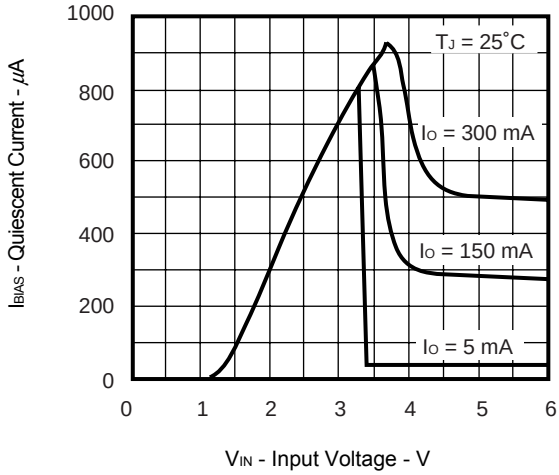
I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} (μPD120N18)



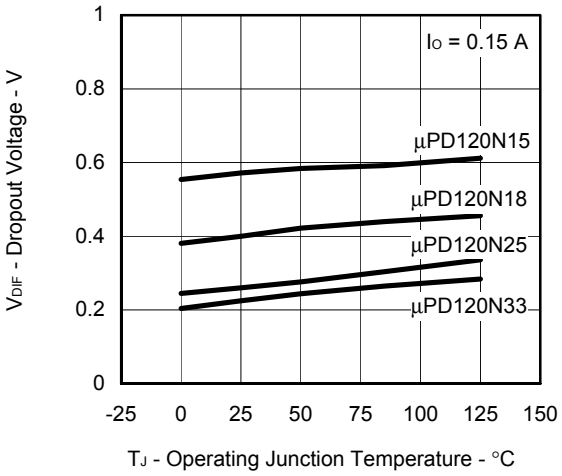
I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} (μPD120N25)



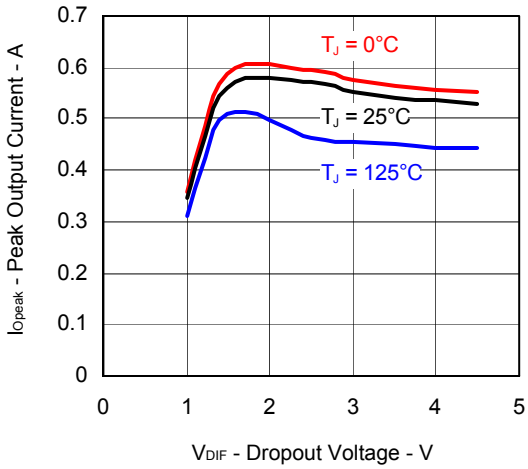
I_{BIAS} ($I_{BIAS(S)}$) vs. V_{IN} (μPD120N33)



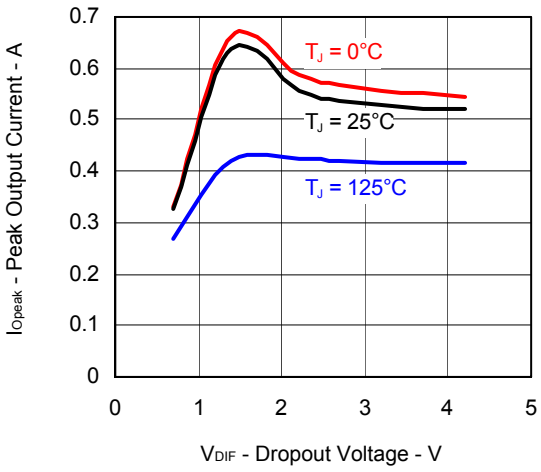
V_{DIF} vs. T_J



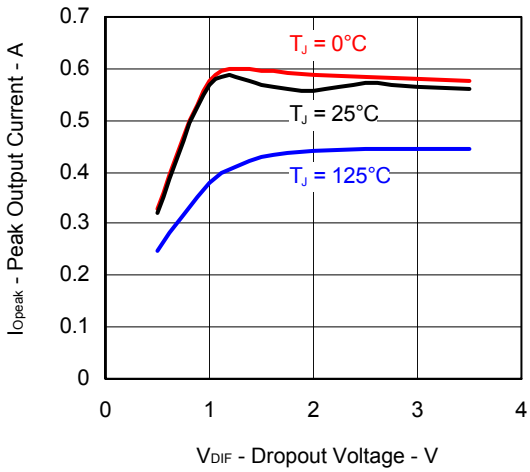
I_{Opeak} vs. V_{DIF} (μPD120N15)



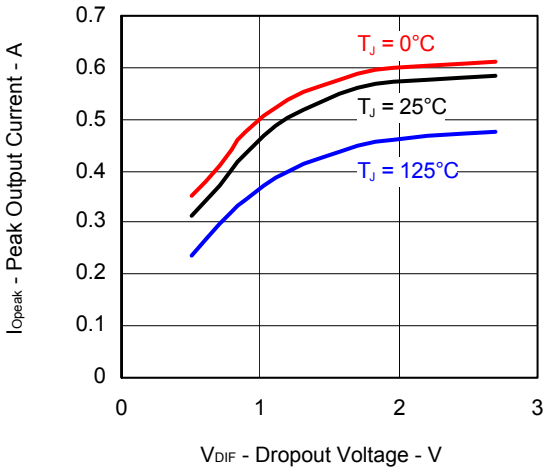
I_{Opeak} vs. V_{DIF} (μPD120N18)



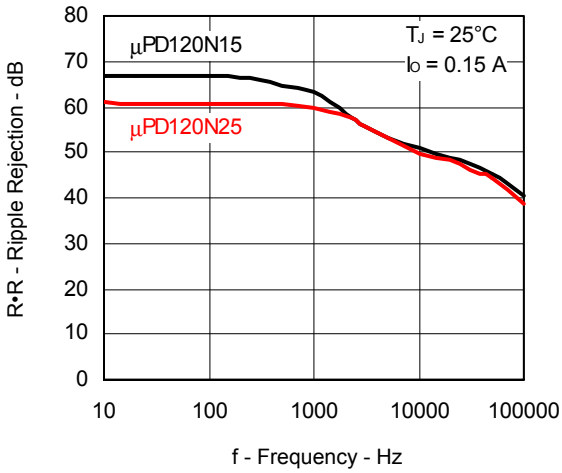
I_{Opeak} vs. V_{DIF} (μPD120N25)



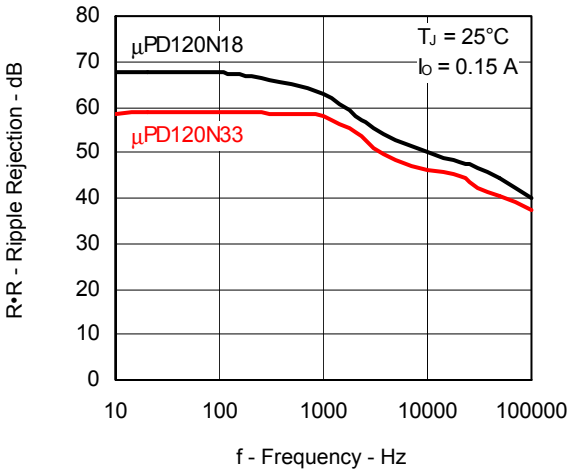
I_{Opeak} vs. V_{DIF} (μPD120N33)



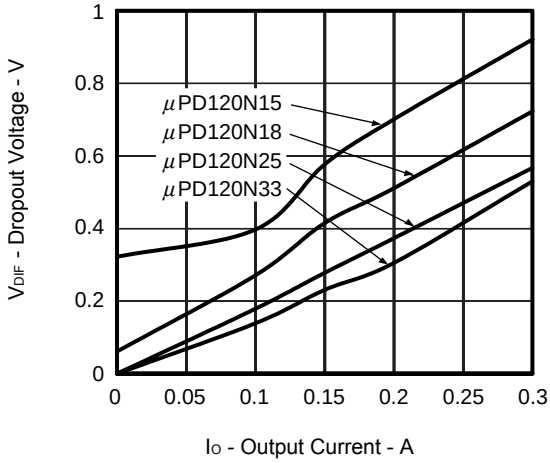
R•R vs. f



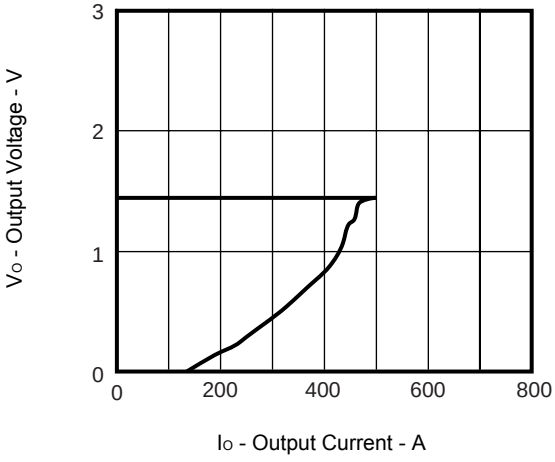
R•R vs. f



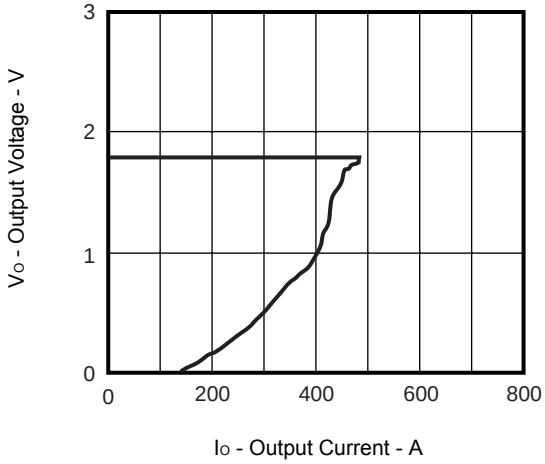
VDIF vs. IO



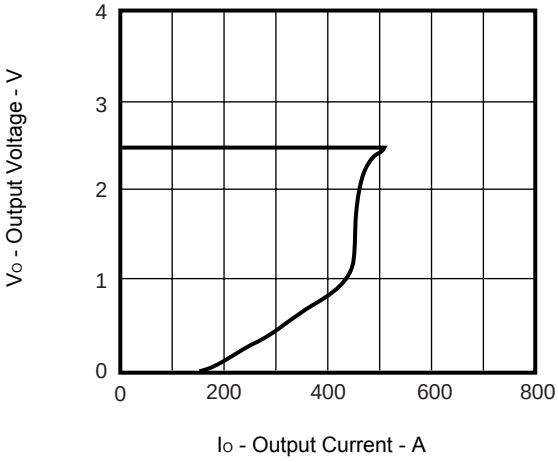
VO vs. IO (μPD120N15)



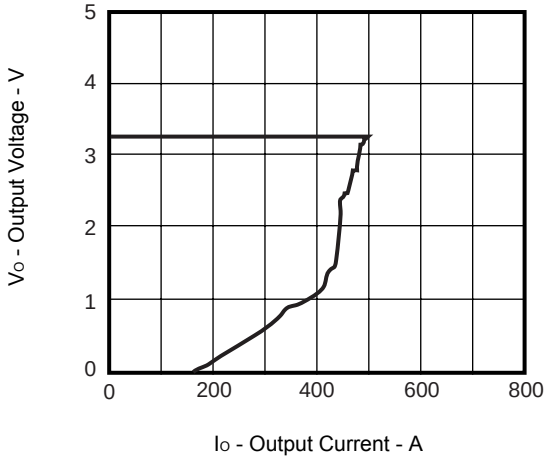
VO vs. IO (μPD120N18)



VO vs. IO (μPD120N25)



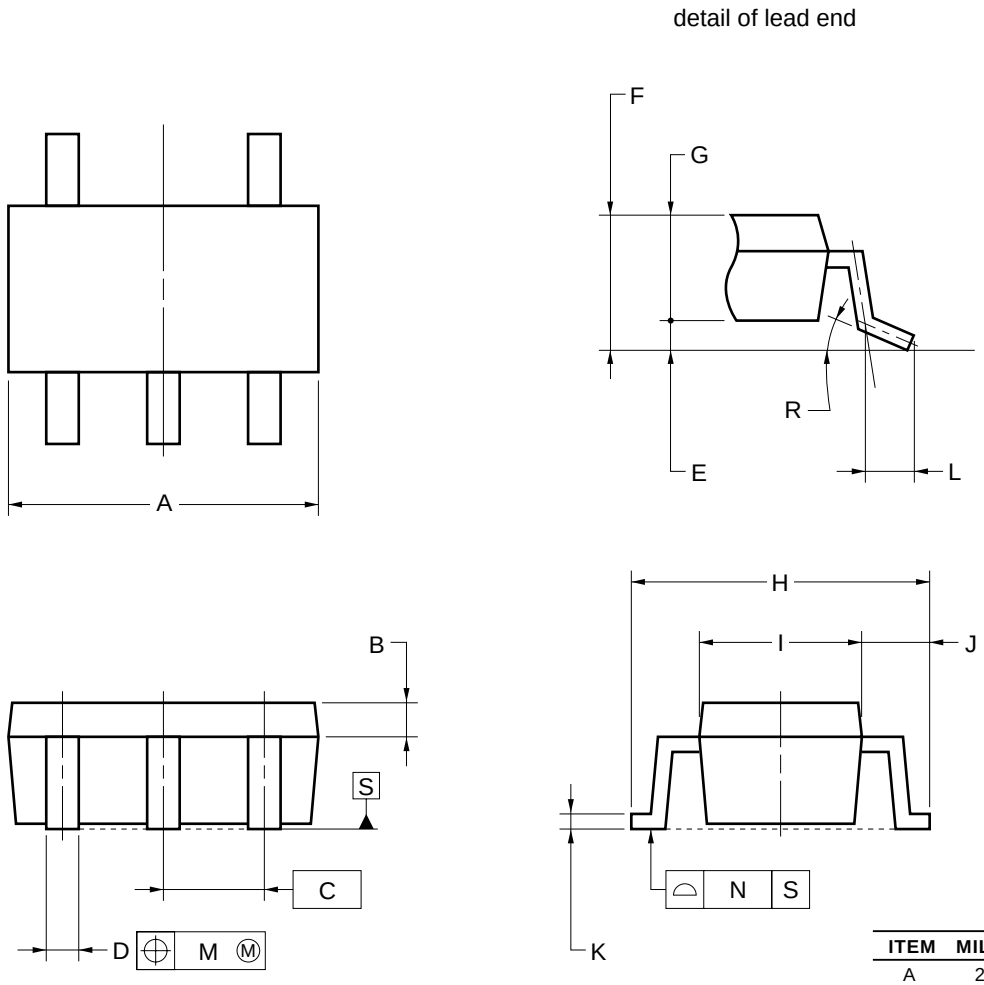
VO vs. IO (μPD120N33)



PACKAGE DRAWINGS (Unit: mm)

SC-74A

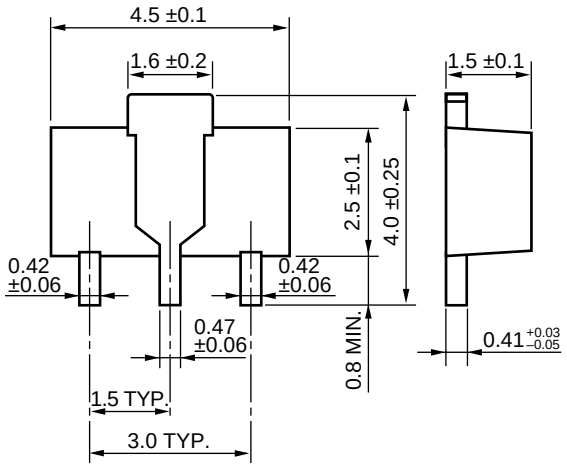
5 PIN PLASTIC MINI MOLD



ITEM	MILLIMETERS
A	2.9±0.2
B	0.3
C	0.95 (T.P.)
D	$0.32^{+0.05}_{-0.02}$
E	0.05±0.05
F	1.4 MAX.
G	$1.1^{+0.2}_{-0.1}$
H	2.8±0.2
I	$1.5^{+0.2}_{-0.1}$
J	$0.65^{+0.1}_{-0.15}$
K	$0.16^{+0.1}_{-0.06}$
L	0.4±0.2
M	0.19
N	0.1
R	5°±5°

S5TA-95-15A

SC-62


4.5 ±0.1
1.6 ±0.2
1.5 ±0.1
2.5 ±0.1
4.0 ±0.25
0.42 ±0.06
0.42 ±0.06
0.47 ±0.06
0.8 MIN.
0.41 +0.03 −0.05
1.5 TYP.
3.0 TYP.

RECOMMENDED SOLDERING CONDITIONS

The μPD120Nxx series should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html)

Type of Surface Mount Device

μPD120N15TA, μPD120N18TA, μPD120N25TA, μPD120N33TA: SC-74A
μPD120N15T1B, μPD120N18T1B, μPD120N25T1B, μPD120N33T1B: SC-62

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 reflows processes: 3 times or less.	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 reflows processes: 3 times or less.	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).	–

μPD120N15TA-A, μPD120N18TA-A, μPD120N25TA-A, μPD120N33TA-A: SC-74A Note1
μPD120N15T1B-AZ, μPD120N18T1B-AZ, μPD120N25T1B-AZ, μPD120N33T1B-AZ: SC-62 Note2

Process	Conditions	Symbol
Infrared Ray Reflow	Peak temperature: 260°C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210°C or higher), Maximum number of reflows processes: 3 times or less.	IR60-00-3
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).	–

Notes 1. Pb-free (This product does not contain Pb in external electrode and other parts.)

2. Pb-free (This product does not contain Pb in external electrode.)

Caution Do not use different soldering methods together (except for partial heating).

Remark Flux: Rosin-based flux with low chlorine content (chlorine 0.2 Wt% or below) is recommended.

NOTES FOR CMOS DEVICES

① VOLTAGE APPLICATION WAVEFORM AT INPUT PIN

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (MAX) and V_{IH} (MIN) due to noise, etc., the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (MAX) and V_{IH} (MIN).

② HANDLING OF UNUSED INPUT PINS

Unconnected CMOS device inputs can be cause of malfunction. If an input pin is unconnected, it is possible that an internal input level may be generated due to noise, etc., causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND via a resistor if there is a possibility that it will be an output pin. All handling related to unused pins must be judged separately for each device and according to related specifications governing the device.

③ PRECAUTION AGAINST ESD

A strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it when it has occurred. Environmental control must be adequate. When it is dry, a humidifier should be used. It is recommended to avoid using insulators that easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors should be grounded. The operator should be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with mounted semiconductor devices.

④ STATUS BEFORE INITIALIZATION

Power-on does not necessarily define the initial status of a MOS device. Immediately after the power source is turned ON, devices with reset functions have not yet been initialized. Hence, power-on does not guarantee output pin levels, I/O settings or contents of registers. A device is not initialized until the reset signal is received. A reset operation must be executed immediately after power-on for devices with reset functions.

⑤ POWER ON/OFF SEQUENCE

In the case of a device that uses different power supplies for the internal operation and external interface, as a rule, switch on the external power supply after switching on the internal power supply. When switching the power supply off, as a rule, switch off the external power supply and then the internal power supply. Use of the reverse power on/off sequences may result in the application of an overvoltage to the internal elements of the device, causing malfunction and degradation of internal elements due to the passage of an abnormal current.

The correct power on/off sequence must be judged separately for each device and according to related specifications governing the device.

⑥ INPUT OF SIGNAL DURING POWER OFF STATE

Do not input signals or an I/O pull-up power supply while the device is not powered. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements.

Input of signals during the power off state must be judged separately for each device and according to related specifications governing the device.

REFERENCE DOCUMENTS

Document Name	Document No.
Usage of Three-Terminal Regulators User's Manual	G12702E
Voltage Regulator of SMD Information	G11872E
Semiconductor Device Mount Manual	http://www.necel.com/pkg/en/mount/index.html
SEMICONDUCTOR SELECTION GUIDE - Products and Packages-	X13769X