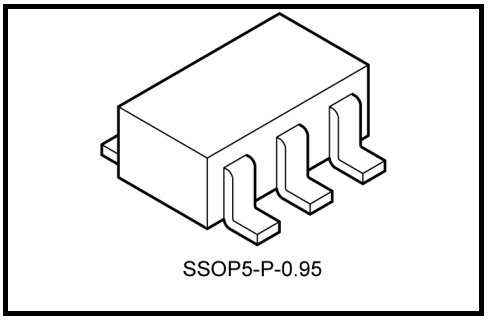
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TAR5SB15 ~ TAR5SB50

Point Regulators (Low-Dropout Regulator)

The TAR5SBxx Series is comprised of general-purpose bipolar single-power-supply devices incorporating a control pin which can be used to turn them ON/OFF.

Overtemperature and overcurrent protection circuits are built in to the devices' output circuit.

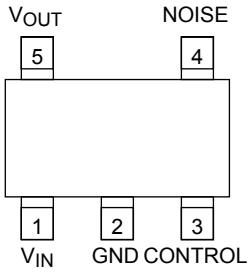


Weight: 0.014 g (typ.)

Features

- Low stand-by current
- Overtemperature/overcurrent protection
- Operation voltage range is wide.
- Maximum output current is high.
- Difference between input voltage and output voltage is low.
- Small package. (SOT-23 5pin)
- Ceramic capacitors can be used.

Pin Assignments (top view)



Overtemperature protection and overcurrent protection functions are not necessary guarantee of operating ratings below the absolute maximum ratings.

Do not use devices under conditions in which their absolute maximum ratings will be exceeded.

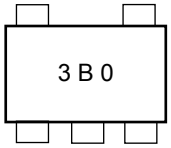
Start of commercial production
2002-09

List of Products Number and Marking

Products No.	Marking	Products No.	Marking
TAR5SB15	1B5	TAR5SB33	3B3
TAR5SB16	1B6	TAR5SB34	3B4
TAR5SB17	1B7	TAR5SB35	3B5
TAR5SB18	1B8	TAR5SB36	3B6
TAR5SB19	1B9	TAR5SB37	3B7
TAR5SB20	2B0	TAR5SB38	3B8
TAR5SB21	2B1	TAR5SB39	3B9
TAR5SB22	2B2	TAR5SB40	4B0
TAR5SB23	2B3	TAR5SB41	4B1
TAR5SB24	2B4	TAR5SB42	4B2
TAR5SB25	2B5	TAR5SB43	4B3
TAR5SB26	2B6	TAR5SB44	4B4
TAR5SB27	2B7	TAR5SB45	4B5
TAR5SB28	2B8	TAR5SB46	4B6
TAR5SB29	2B9	TAR5SB47	4B7
TAR5SB30	3B0	TAR5SB48	4B8
TAR5SB31	3B1	TAR5SB49	4B9
TAR5SB32	3B2	TAR5SB50	5B0

Marking on the Product

Example: TAR5SB30 (3.0 V output)



Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{IN}	15	V
Output current	I_{OUT}	200	mA
Power dissipation	P_D	200 (Note 1)	mW
		380 (Note 2)	
Operation temperature range	T_{opr}	−40 to 85	°C
Storage temperature range	T_{stg}	−55 to 150	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Unit Ratintg

Note 2: Mounted on a glass epoxy circuit board of 30 × 30 mm. Pad dimension of 50 mm^2

TAR5SB15~TAR5SB22

Electrical Characteristic (unless otherwise specified, $V_{IN} = V_{OUT} + 1$ V, $I_{OUT} = 50$ mA, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $C_{NOISE} = 0.01$ μF, $T_j = 25°C$)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	Please refer to the Output Voltage Accuracy table.				
Line regulation	Reg·line	$V_{OUT} + 1$ V ≤ V_{IN} ≤ 15 V, $I_{OUT} = 1$ mA	—	3	15	mV
Load regulation	Reg·load	1 mA ≤ I_{OUT} ≤ 150 mA	—	25	75	mV
Quiescent current	I_{B1}	$I_{OUT} = 0$ mA	—	170	—	μA
	I_{B2}	$I_{OUT} = 50$ mA	—	550	850	
Stand-by current	$I_{B\ (OFF)}$	$V_{CT} = 0$ V	—	—	0.1	μA
Output noise voltage	V_{NO}	$V_{IN} = V_{OUT} + 1$ V, $I_{OUT} = 10$ mA, 10 Hz ≤ f ≤ 100 kHz, $C_{NOISE} = 0.01$ μF, Ta = 25°C	—	30	—	μV_{rms}
Temperature coefficient	T_{CVO}	−40°C ≤ T_{opr} ≤ 85°C	—	100	—	ppm/°C
Input voltage	V_{IN}	—	2.4	—	15	V
Ripple rejection	R.R.	$V_{IN} = V_{OUT} + 1$ V, $I_{OUT} = 10$ mA, $C_{NOISE} = 0.01$ μF, f = 1 kHz, $V_{Ripple} = 500\ mV_{p-p}$, Ta = 25°C	—	70	—	dB
Control voltage (ON)	$V_{CT\ (ON)}$	—	1.5	—	V_{IN}	V
Control voltage (OFF)	$V_{CT\ (OFF)}$	—	—	—	0.4	V
Control current (ON)	$I_{CT\ (ON)}$	$V_{CT} = 1.5$ V	—	3	10	μA
Control current (OFF)	$I_{CT\ (OFF)}$	$V_{CT} = 0$ V	—	0	0.1	μA

TAR5SB23~TAR5SB50

Electrical Characteristic (unless otherwise specified, $V_{IN} = V_{OUT} + 1$ V, $I_{OUT} = 50$ mA, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $C_{NOISE} = 0.01$ μF, $T_j = 25°C$)

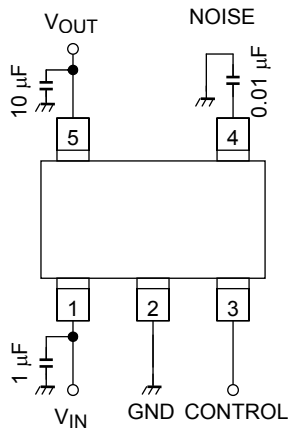
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	Please refer to the Output Voltage Accuracy table.				
Line regulation	Reg·line	$V_{OUT} + 1$ V ≤ V_{IN} ≤ 15 V, $I_{OUT} = 1$ mA	—	3	15	mV
Load regulation	Reg·load	1 mA ≤ I_{OUT} ≤ 150 mA	—	25	75	mV
Quiescent current	I_{B1}	$I_{OUT} = 0$ mA	—	170	—	μA
	I_{B2}	$I_{OUT} = 50$ mA	—	550	850	
Stand-by current	$I_{B\ (OFF)}$	$V_{CT} = 0$ V	—	—	0.1	μA
Output noise voltage	V_{NO}	$V_{IN} = V_{OUT} + 1$ V, $I_{OUT} = 10$ mA, 10 Hz ≤ f ≤ 100 kHz, $C_{NOISE} = 0.01$ μF, Ta = 25°C	—	30	—	μV_{rms}
Dropout volatge	$V_{IN} - V_{OUT}$	$I_{OUT} = 50$ mA	—	130	200	mV
Temperature coefficient	T_{CVO}	−40°C ≤ T_{opr} ≤ 85°C	—	100	—	ppm/°C
Input voltage	V_{IN}	—	V_{OUT} + 0.2 V	—	15	V
Ripple rejection	R.R.	$V_{IN} = V_{OUT} + 1$ V, $I_{OUT} = 10$ mA, $C_{NOISE} = 0.01$ μF, f = 1 kHz, $V_{Ripple} = 500\ mV_{p-p}$, Ta = 25°C	—	70	—	dB
Control voltage (ON)	$V_{CT\ (ON)}$	—	1.5	—	V_{IN}	V
Control voltage (OFF)	$V_{CT\ (OFF)}$	—	—	—	0.4	V
Control current (ON)	$I_{CT\ (ON)}$	$V_{CT} = 1.5$ V	—	3	10	μA
Control current (OFF)	$I_{CT\ (OFF)}$	$V_{CT} = 0$ V	—	0	0.1	μA

Output Voltage Accuracy
(V_{IN} = V_{OUT} + 1 V, I_{OUT} = 50 mA, C_{IN} = 1 μF, C_{OUT} = 10 μF, C_{NOISE} = 0.01 μF, T_j = 25°C)

Product No.	Symbol	Min	Typ.	Max	Unit
TAR5SB15	V_{OUT}	1.44	1.5	1.56	V
TAR5SB16		1.54	1.6	1.66	
TAR5SB17		1.64	1.7	1.76	
TAR5SB18		1.74	1.8	1.86	
TAR5SB19		1.84	1.9	1.96	
TAR5SB20		1.94	2.0	2.06	
TAR5SB21		2.04	2.1	2.16	
TAR5SB22		2.14	2.2	2.26	
TAR5SB23		2.24	2.3	2.36	
TAR5SB24		2.34	2.4	2.46	
TAR5SB25		2.43	2.5	2.57	
TAR5SB26		2.53	2.6	2.67	
TAR5SB27		2.63	2.7	2.77	
TAR5SB28		2.73	2.8	2.87	
TAR5SB29		2.83	2.9	2.97	
TAR5SB30		2.92	3.0	3.08	
TAR5SB31		3.02	3.1	3.18	
TAR5SB32		3.12	3.2	3.28	
TAR5SB33		3.21	3.3	3.39	
TAR5SB34		3.31	3.4	3.49	
TAR5SB35		3.41	3.5	3.59	
TAR5SB36		3.51	3.6	3.69	
TAR5SB37		3.6	3.7	3.8	
TAR5SB38		3.7	3.8	3.9	
TAR5SB39		3.8	3.9	4.0	
TAR5SB40		3.9	4.0	4.1	
TAR5SB41		3.99	4.1	4.21	
TAR5SB42		4.09	4.2	4.31	
TAR5SB43		4.19	4.3	4.41	
TAR5SB44		4.29	4.4	4.51	
TAR5SB45		4.38	4.5	4.62	
TAR5SB46		4.48	4.6	4.72	
TAR5SB47		4.58	4.7	4.82	
TAR5SB48		4.68	4.8	4.92	
TAR5SB49		4.77	4.9	5.03	
TAR5SB50		4.87	5.0	5.13	

Application Note

1. Recommended Application Circuit



Control Level	Operation
HIGH	ON
LOW	OFF

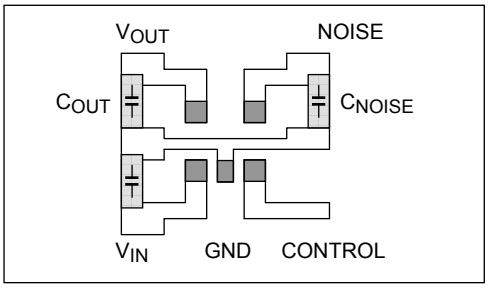
The figure above shows the recommended configuration for using a point regulator. Insert a capacitor for stable input/output operation.

If the control function is not to be used, Toshiba recommend that the control pin (pin 1) be connected to the V_{CC} pin.

2. Power Dissipation

The power dissipation for board-mounted TAR5SBxx Series devices (rated at 380 mW) is measured using a board whose size and pattern are as shown below. When incorporating a device belonging to this series into your design, derate the power dissipation as far as possible by reducing the levels of parameters such as input voltage, output current and ambient temperature. Toshiba recommend that these devices should typically be derated to 70% to 80% of their absolute maximum power dissipation value.

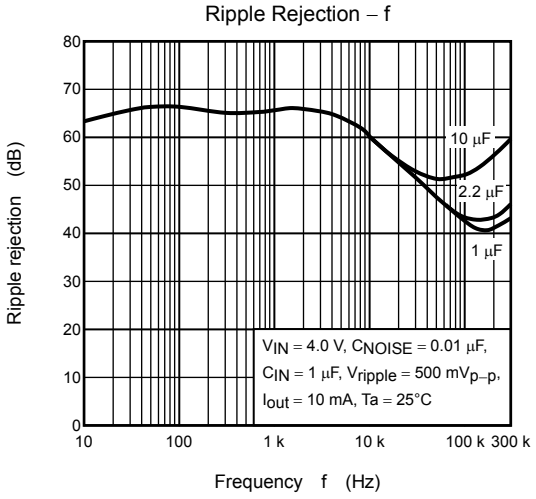
Thermal Resistance Evaluation Board

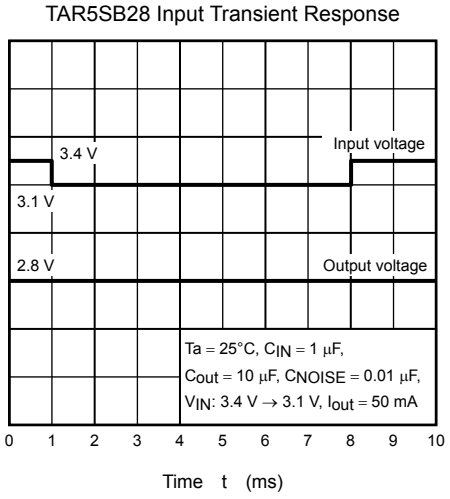


Circuit board material: glass epoxy,
Circuit board dimension: 30 mm × 30 mm,
Copper foil pad area: 50 mm^2 (t = 0.8 mm)

3. Ripple Rejection

The devices of the TAR5SBxx Series feature a circuit with an excellent ripple rejection characteristic. Because the circuit also features an excellent output fluctuation characteristic for sudden supply voltage drops, the circuit is ideal for use in the RF blocks incorporated in all mobile telephones.

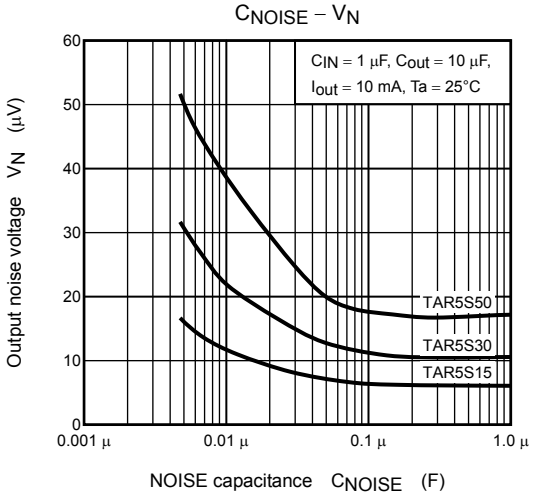


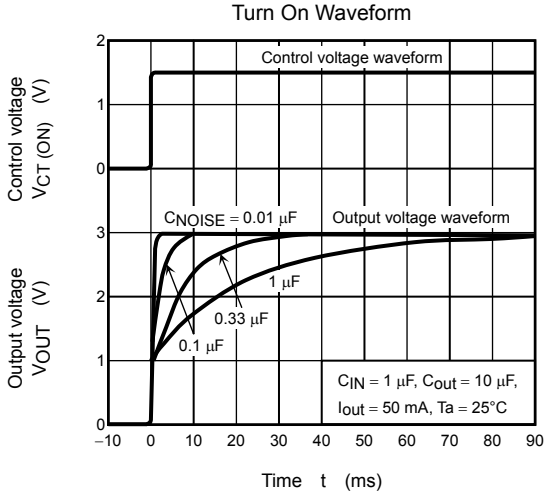


4. NOISE Pin

TAR5SBxx Series devices incorporate a NOISE pin to reduce output noise voltage. Inserting a capacitor between the NOISE pin and GND reduces output noise. To ensure stable operation, insert a capacitor of 0.0047 μF or more between the NOISE pin and GND.

The output voltage rise time varies according to the capacitance of the capacitor connected to the NOISE pin.





5. Example of Characteristics when Ceramic Capacitor is Used

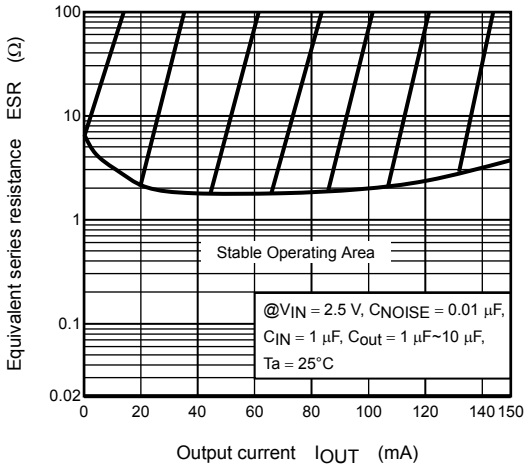
Shown below is the stable operation area, where the output voltage does not oscillate, evaluated using a Toshiba evaluation circuit. The equivalent series resistance (ESR) of the output capacitor and output current determines this area. TAR5SBxx Series devices operate stably even when a ceramic capacitor is used as the output capacitor.

If a ceramic capacitor is used as the output capacitor and the ripple frequency is 30 kHz or more, the ripple rejection differs from that when a tantalum capacitor is used. This is shown below.

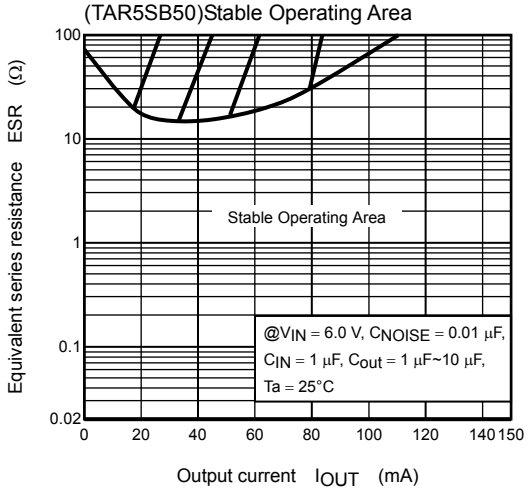
Toshiba recommend that users check that devices operate stably under the intended conditions of use.

Examples of safe operating area characteristics

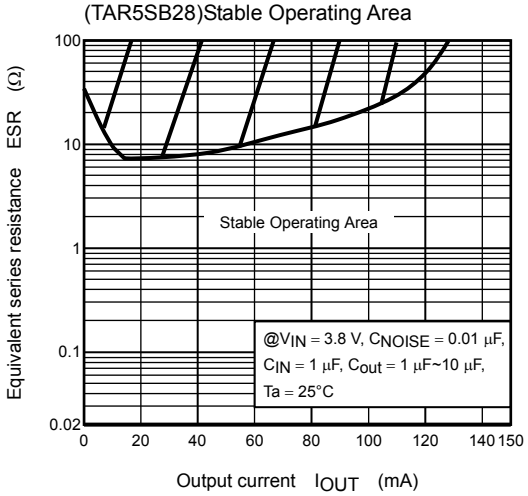
(TAR5SB15)Stable Operating Area



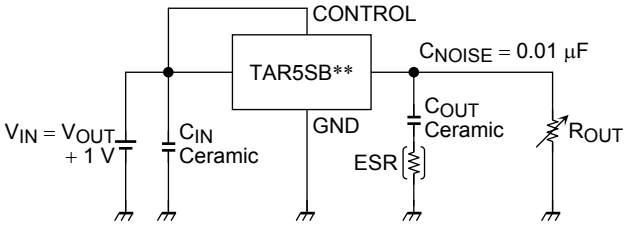
(TAR5SB50)Stable Operating Area



(TAR5SB28)Stable Operating Area



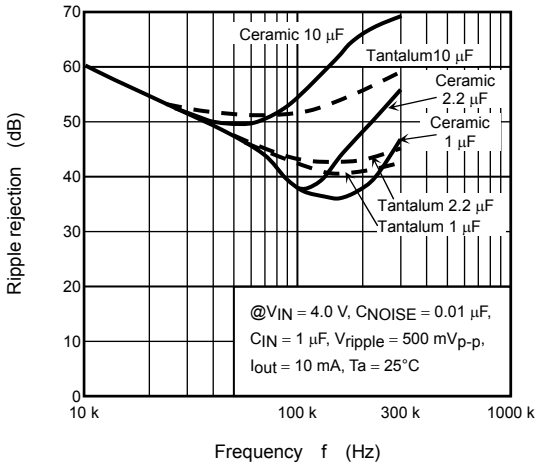
Evaluation Circuit for Stable Operating Area



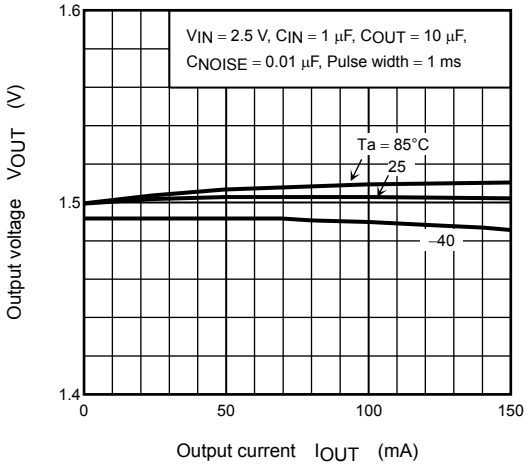
Capacitors used for evaluation
Made by Murata C_{IN}: GRM40B105K
C_{OUT}: GRM40B105K/GRM40B106K

Ripple Rejection Characteristic (f = 10 kHz~300 kHz)

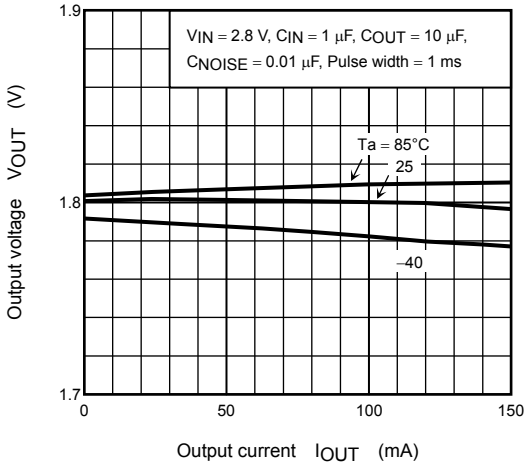
(TAR5SB30) Ripple Rejection – f



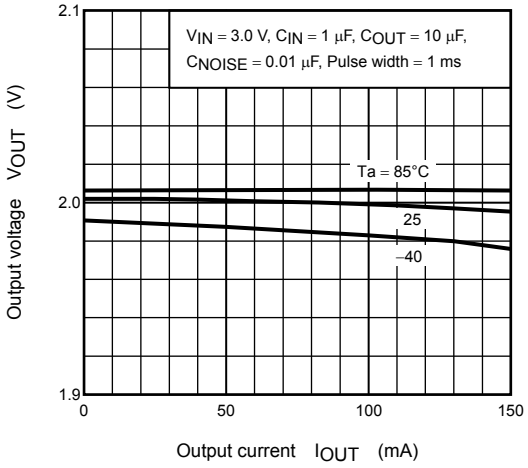
(TAR5SB15) $I_{OUT} - V_{OUT}$



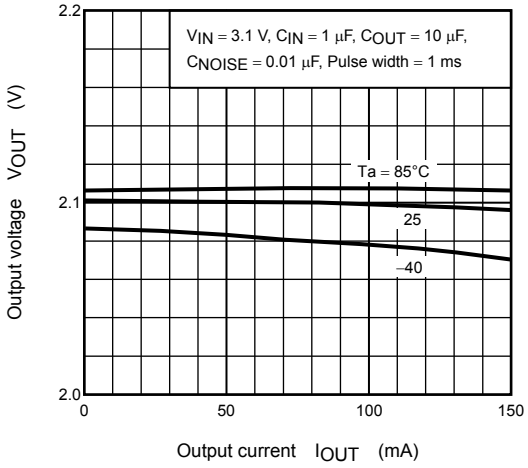
(TAR5SB18) $I_{OUT} - V_{OUT}$



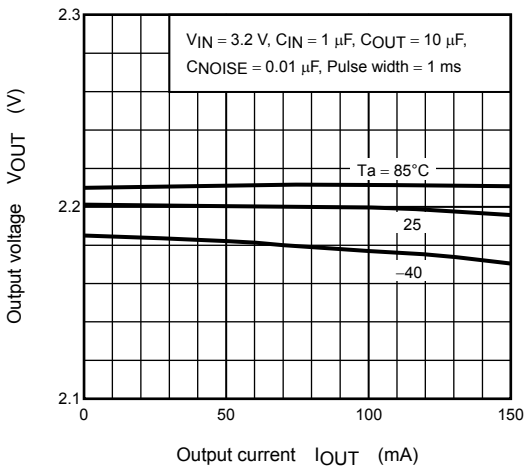
(TAR5SB20) $I_{OUT} - V_{OUT}$



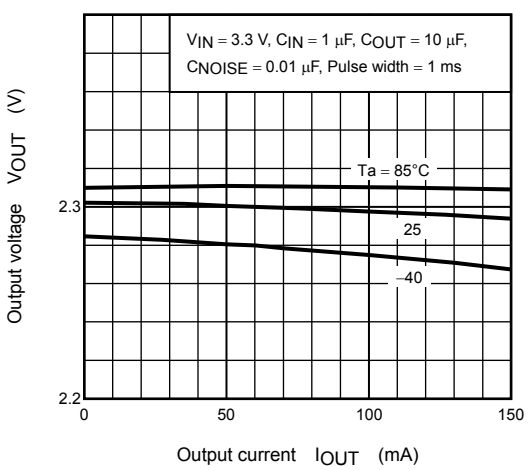
(TAR5SB21) $I_{OUT} - V_{OUT}$



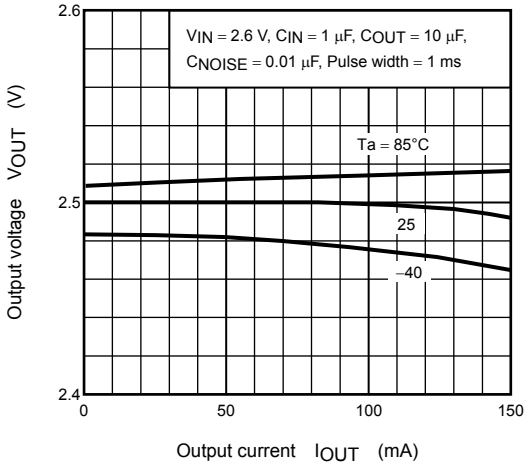
(TAR5SB22) $I_{OUT} - V_{OUT}$



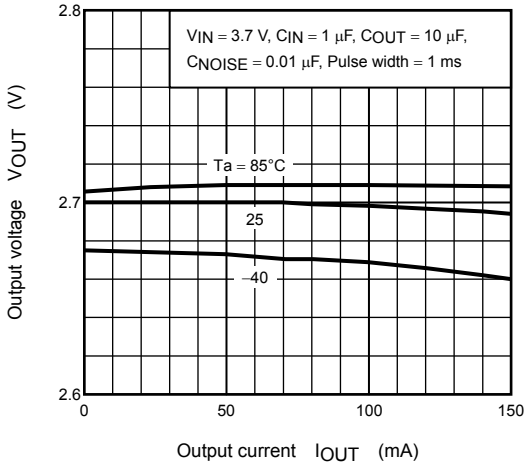
(TAR5SB23) $I_{OUT} - V_{OUT}$



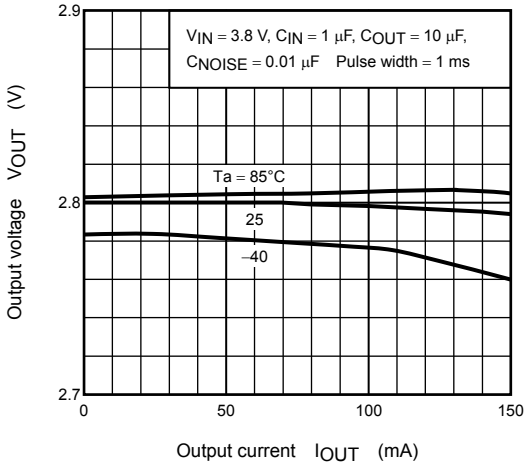
(TAR5SB25) $I_{OUT} - V_{OUT}$



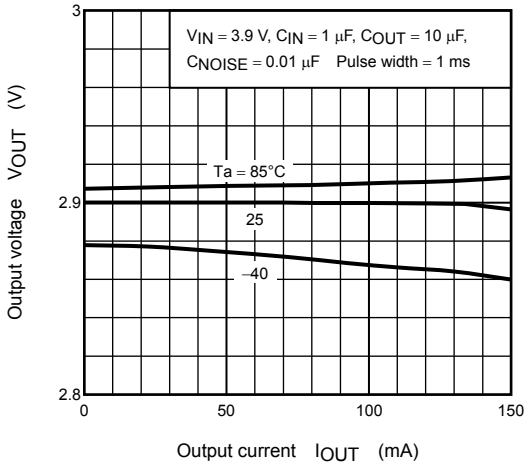
(TAR5SB27) $I_{OUT} - V_{OUT}$



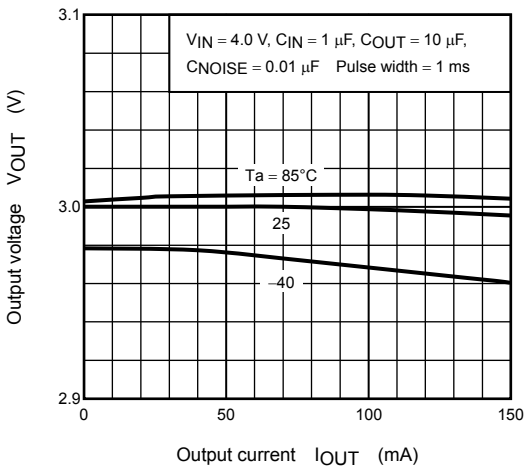
(TAR5SB28) $I_{OUT} - V_{OUT}$



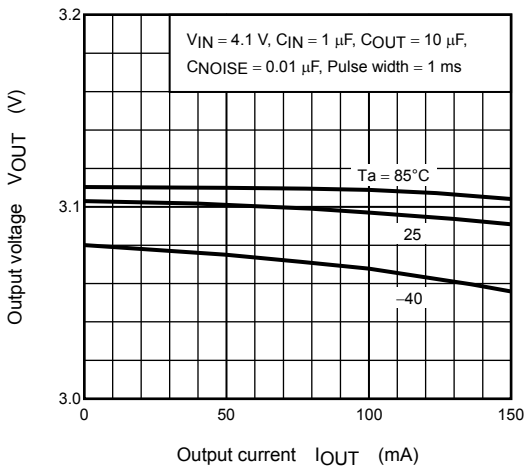
(TAR5SB29) $I_{OUT} - V_{OUT}$



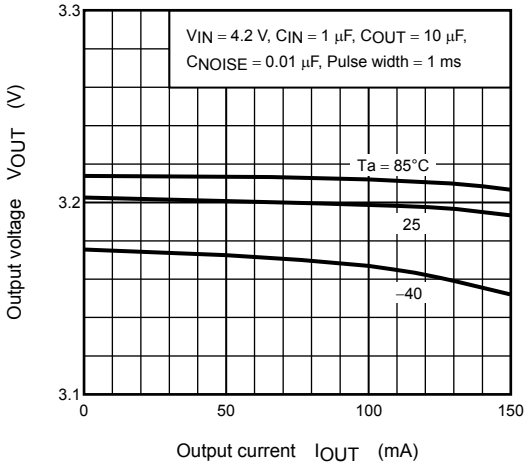
(TAR5SB30) $I_{OUT} - V_{OUT}$



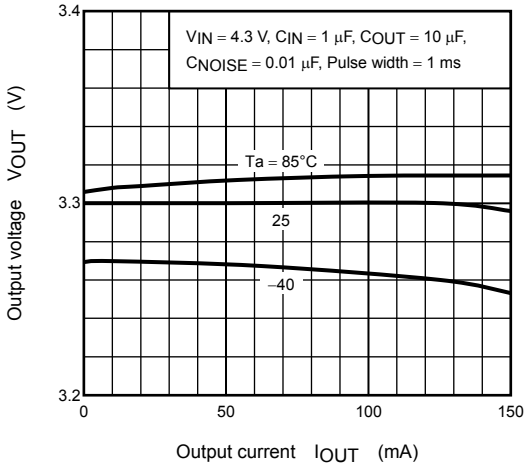
(TAR5SB31) $I_{OUT} - V_{OUT}$



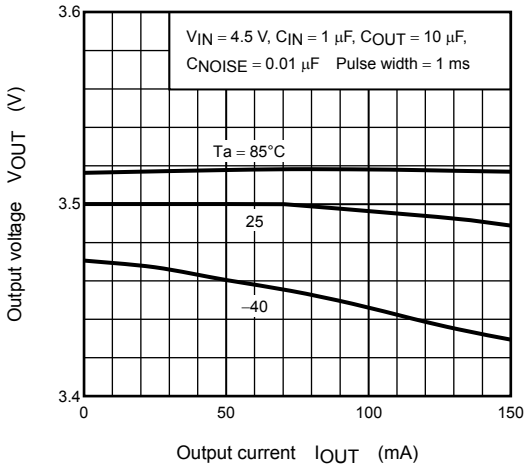
(TAR5SB32) $I_{OUT} - V_{OUT}$



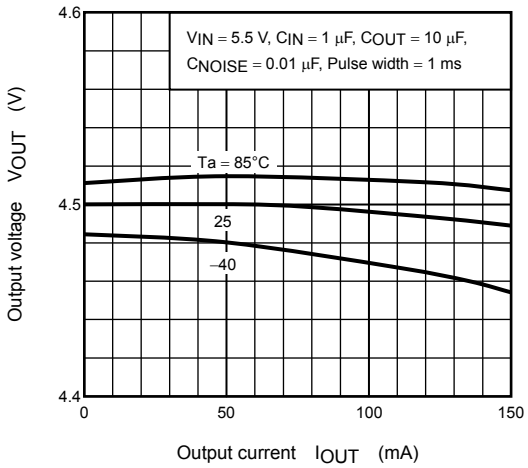
(TAR5SB33) $I_{OUT} - V_{OUT}$



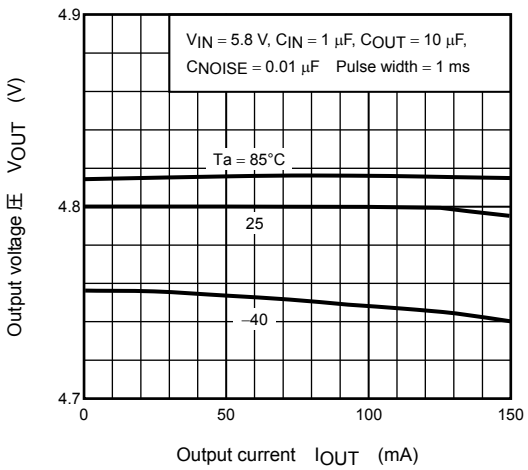
(TAR5SB35) $I_{OUT} - V_{OUT}$



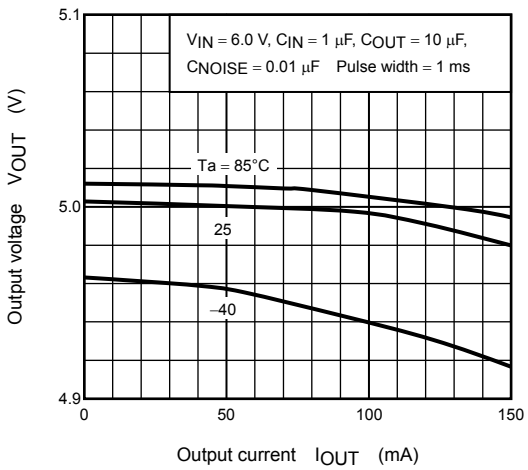
(TAR5SB45) $I_{OUT} - V_{OUT}$



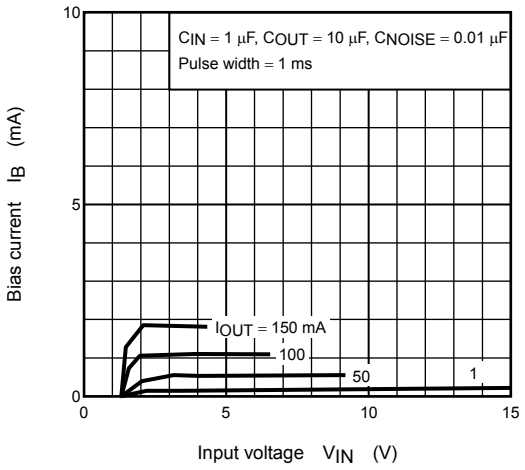
(TAR5SB48) $I_{OUT} - V_{OUT}$



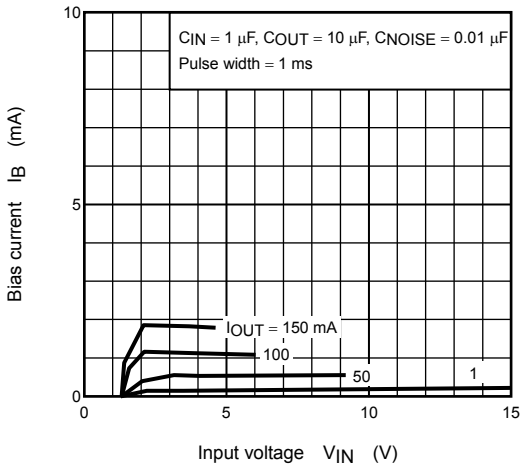
(TAR5SB50) $I_{OUT} - V_{OUT}$



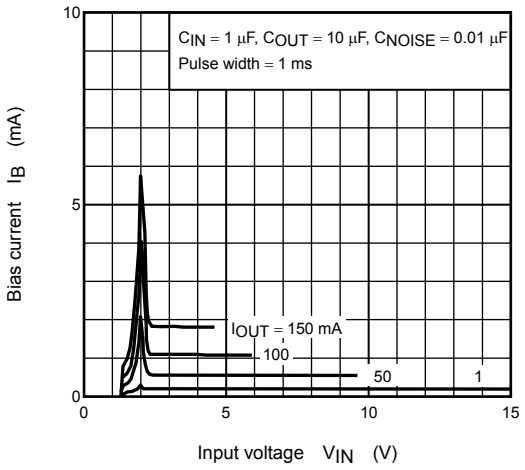
(TAR5SB15) $I_B - V_{IN}$



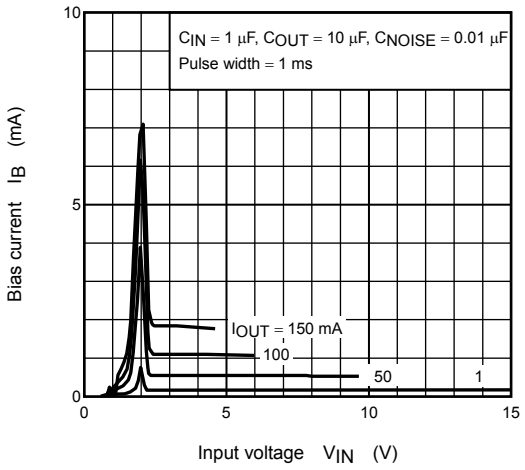
(TAR5SB18) $I_B - V_{IN}$



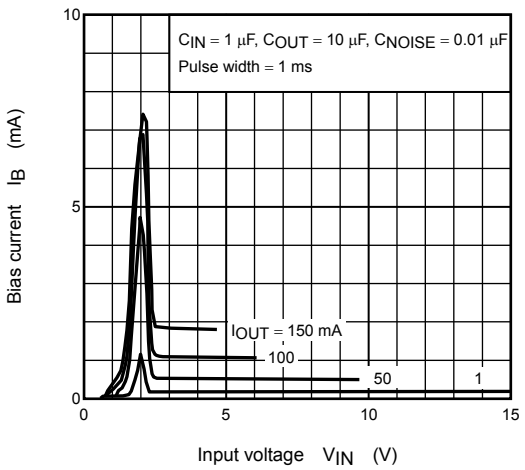
(TAR5SB20) $I_B - V_{IN}$



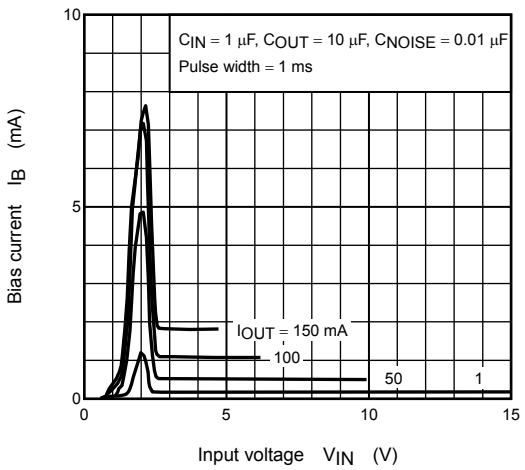
(TAR5SB21) $I_B - V_{IN}$



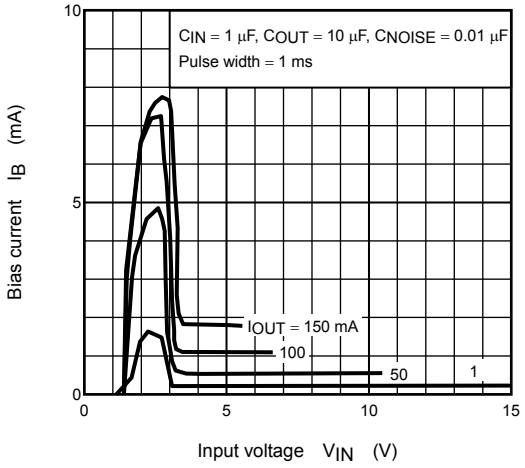
(TAR5SB22) $I_B - V_{IN}$



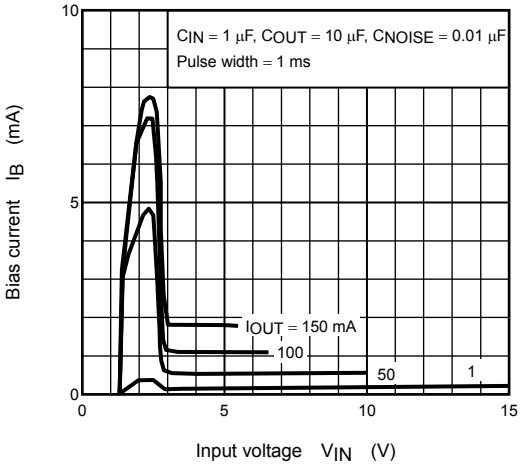
(TAR5SB23) $I_B - V_{IN}$



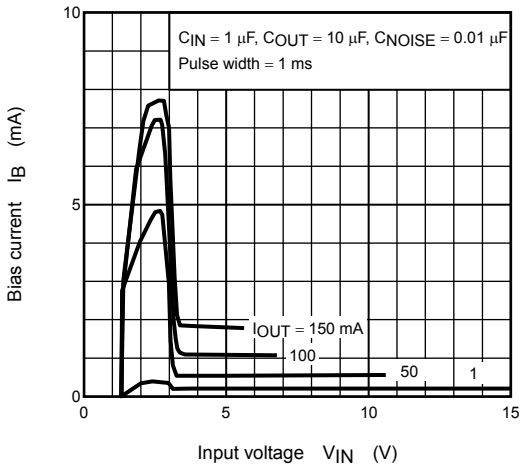
(TAR5SB25) $I_B - V_{IN}$



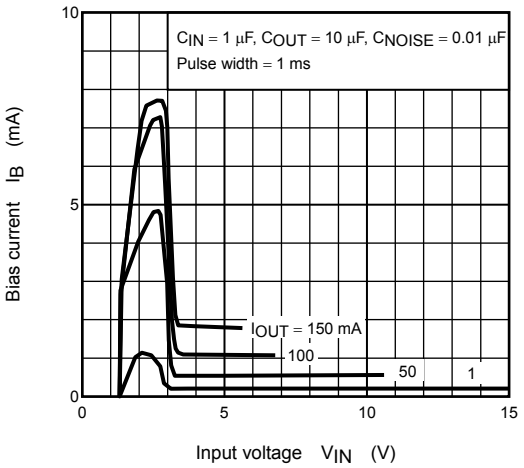
(TAR5SB27) $I_B - V_{IN}$



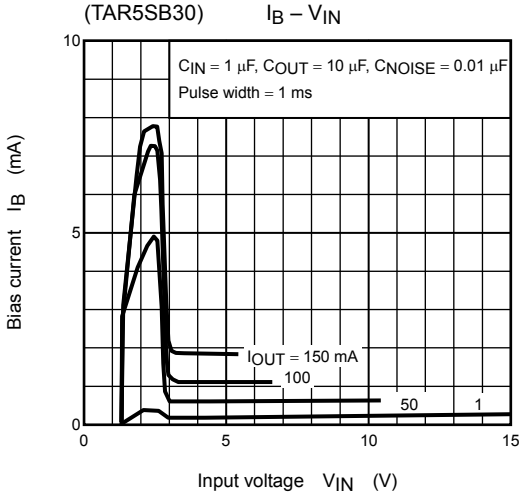
(TAR5SB28) $I_B - V_{IN}$



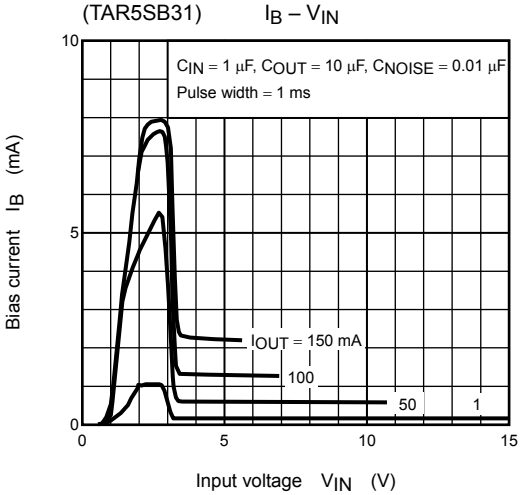
(TAR5SB29) $I_B - V_{IN}$



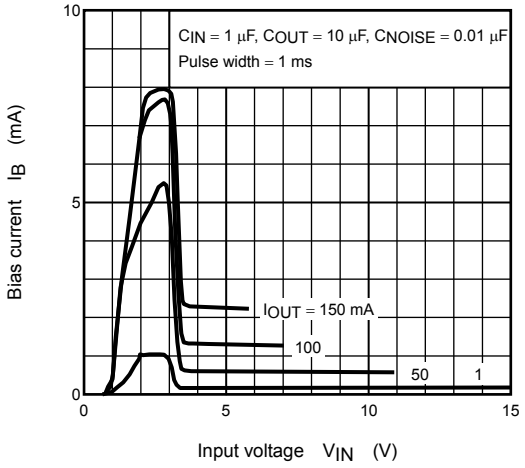
(TAR5SB30) $I_B - V_{IN}$



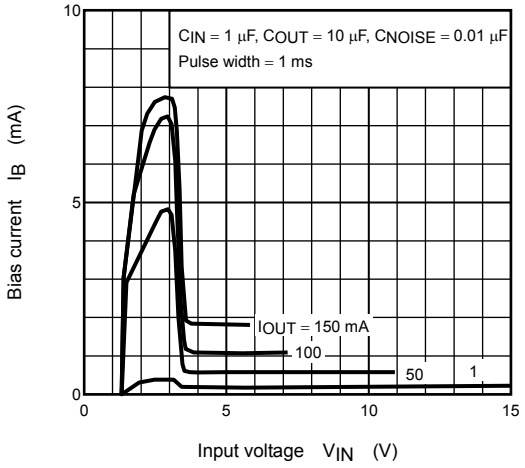
(TAR5SB31) $I_B - V_{IN}$



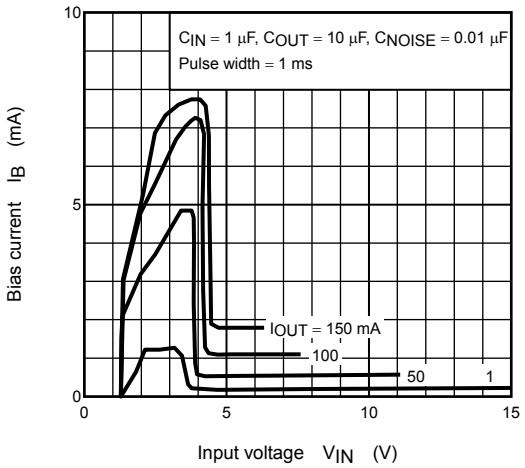
(TAR5SB32) $I_B - V_{IN}$



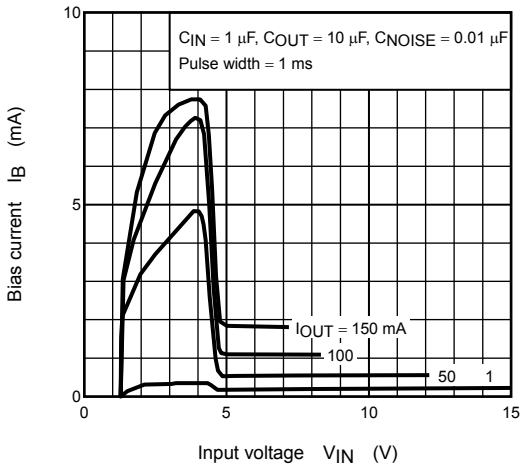
(TAR5SB33) $I_B - V_{IN}$



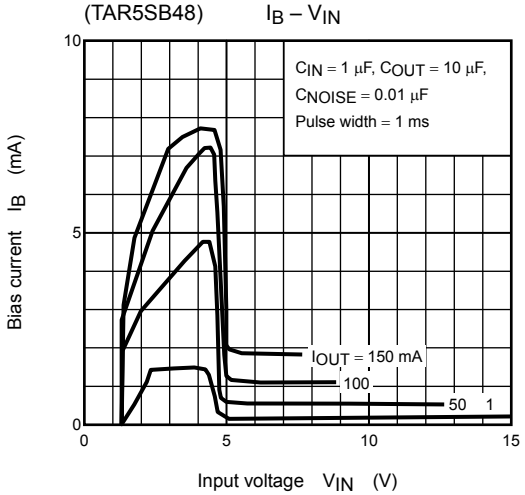
(TAR5SB35) $I_B - V_{IN}$



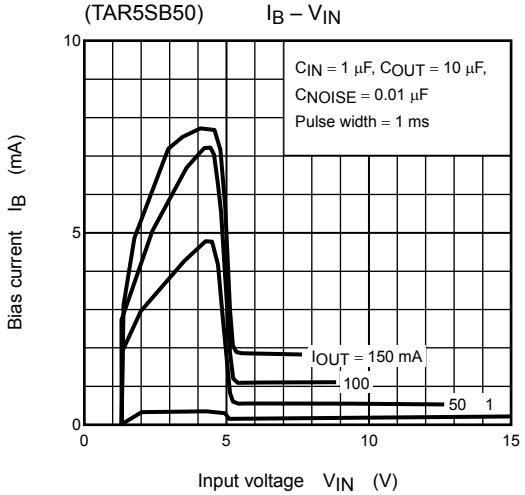
(TAR5SB45) $I_B - V_{IN}$



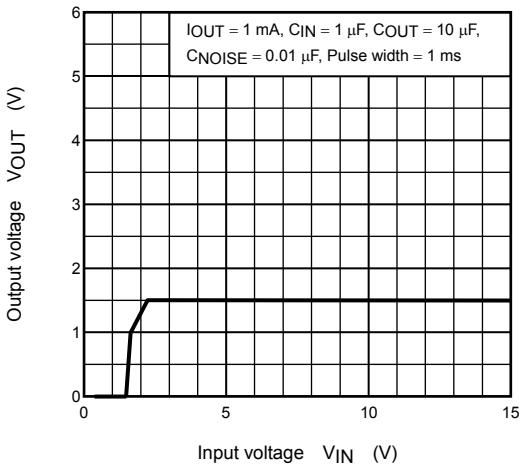
(TAR5SB48) $I_B - V_{IN}$



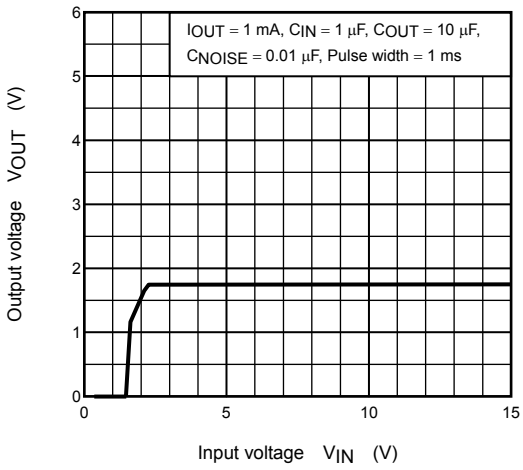
(TAR5SB50) $I_B - V_{IN}$



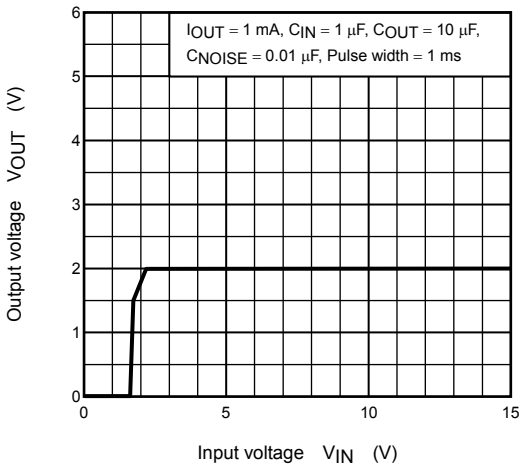
(TAR5SB15) $V_{OUT} - V_{IN}$



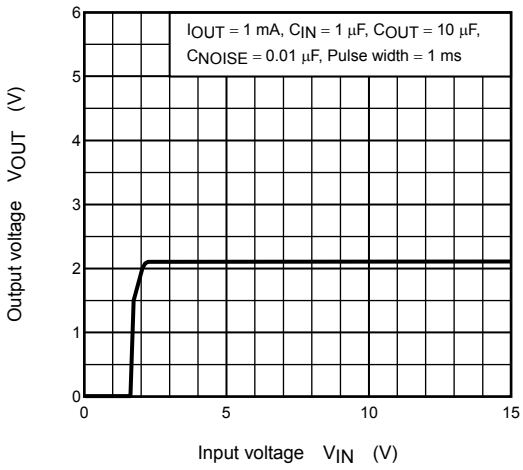
(TAR5SB18) $V_{OUT} - V_{IN}$



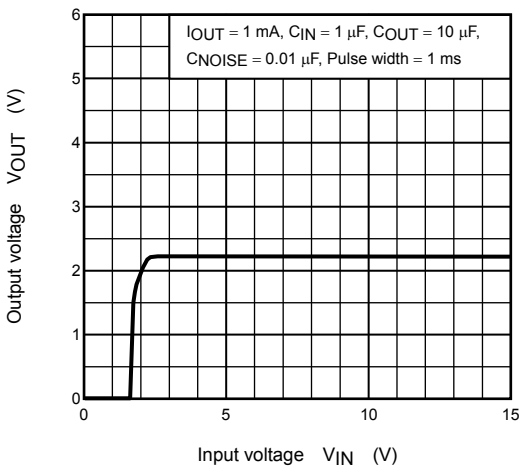
(TAR5SB20) $V_{OUT} - V_{IN}$



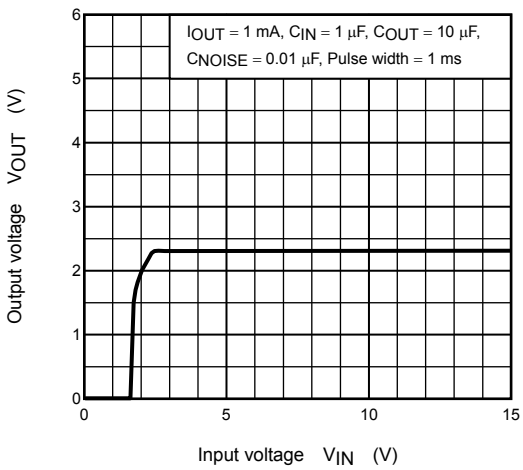
(TAR5SB21) $V_{OUT} - V_{IN}$



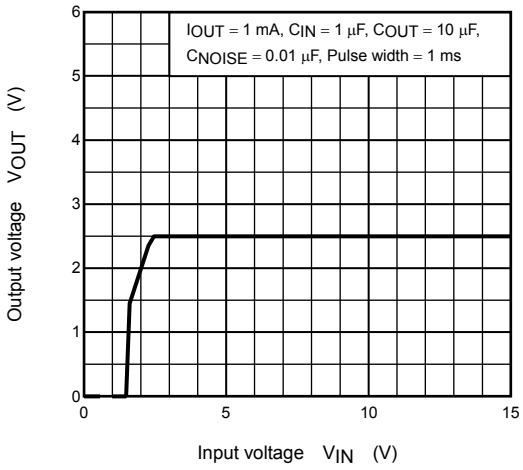
(TAR5SB22) $V_{OUT} - V_{IN}$



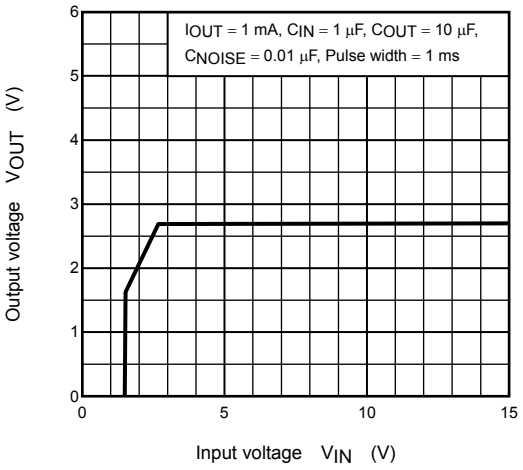
(TAR5SB23) $V_{OUT} - V_{IN}$



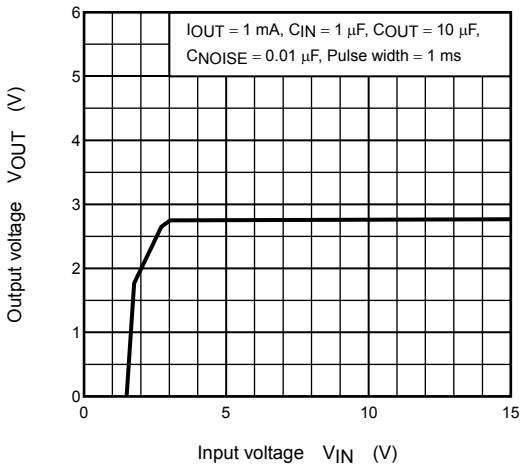
(TAR5SB25) $V_{OUT} - V_{IN}$



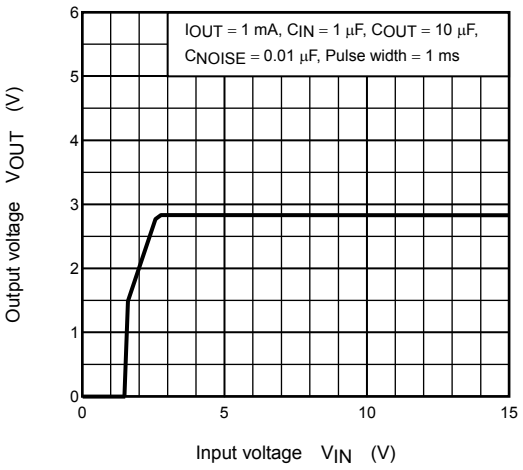
(TAR5SB27) $V_{OUT} - V_{IN}$



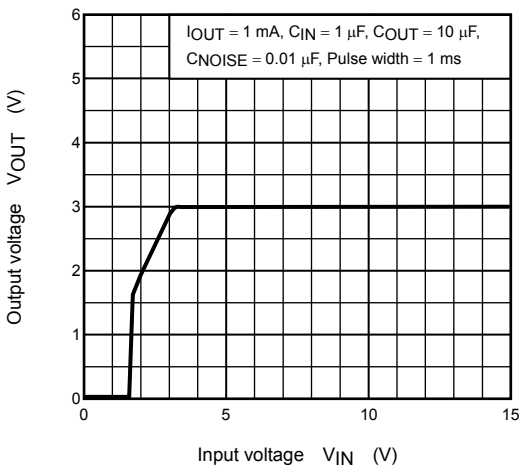
(TAR5SB28) $V_{OUT} - V_{IN}$



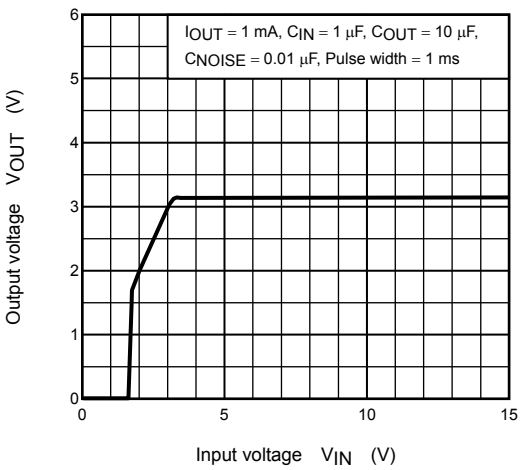
(TAR5SB29) $V_{OUT} - V_{IN}$



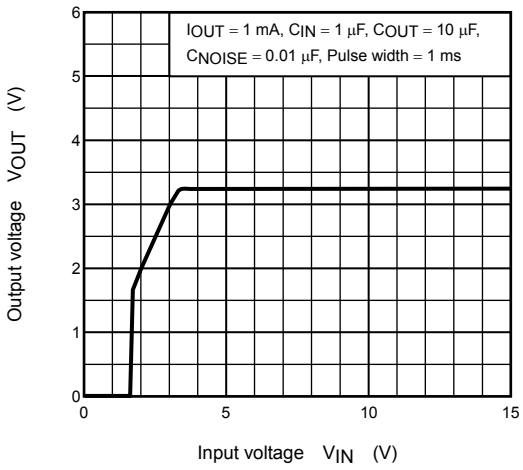
(TAR5SB30) $V_{OUT} - V_{IN}$



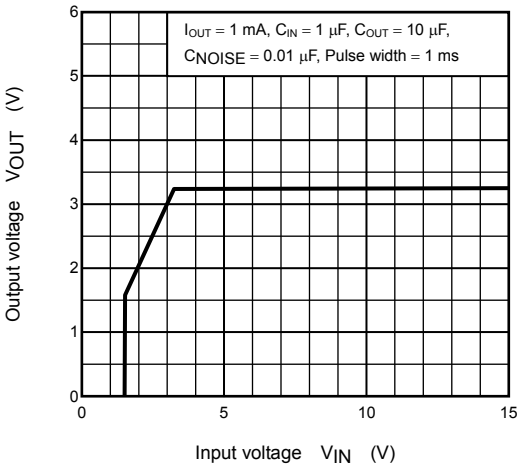
(TAR5SB31) $V_{OUT} - V_{IN}$



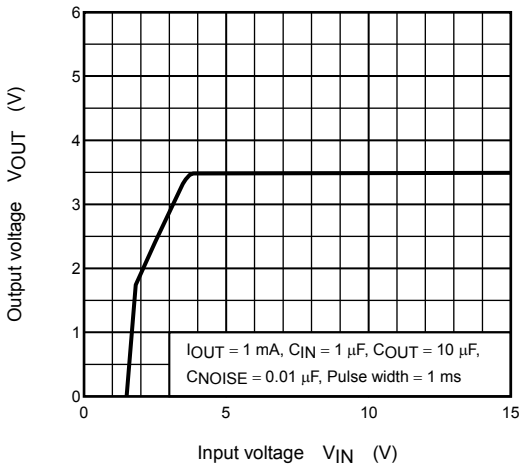
(TAR5SB32) $V_{OUT} - V_{IN}$



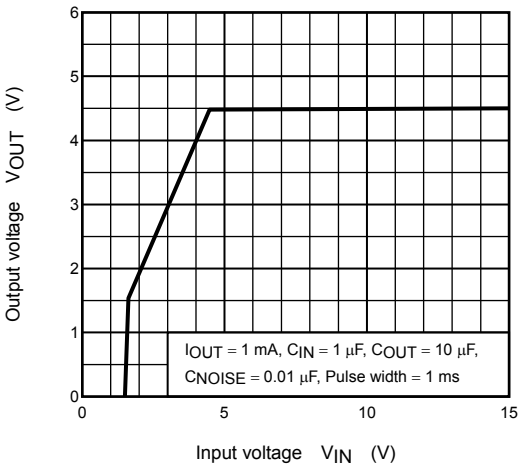
(TAR5SB33) $V_{OUT} - V_{IN}$



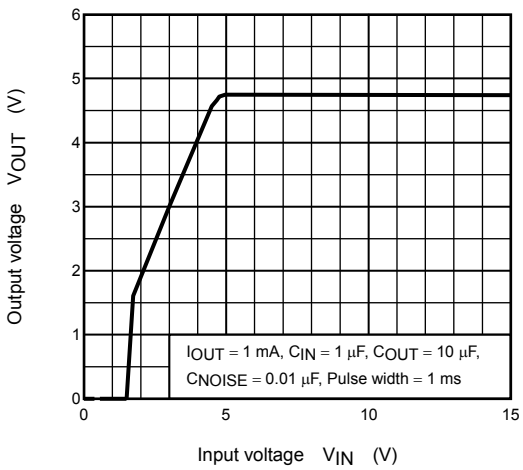
(TAR5SB35) $V_{OUT} - V_{IN}$



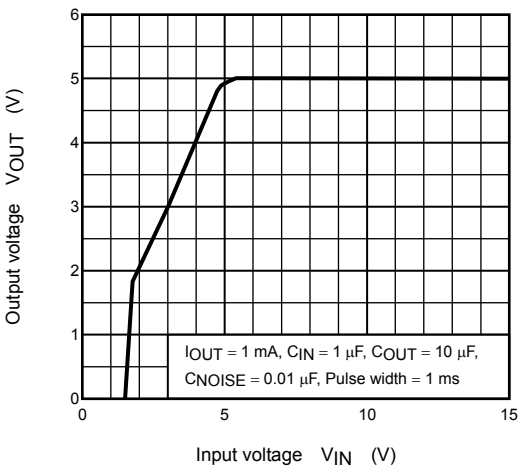
(TAR5SB45) $V_{OUT} - V_{IN}$



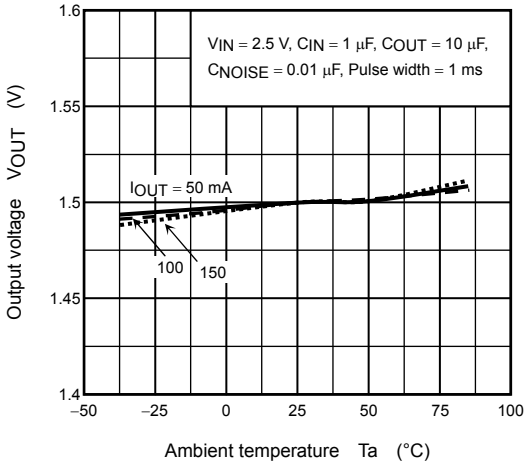
(TAR5SB48) $V_{OUT} - V_{IN}$



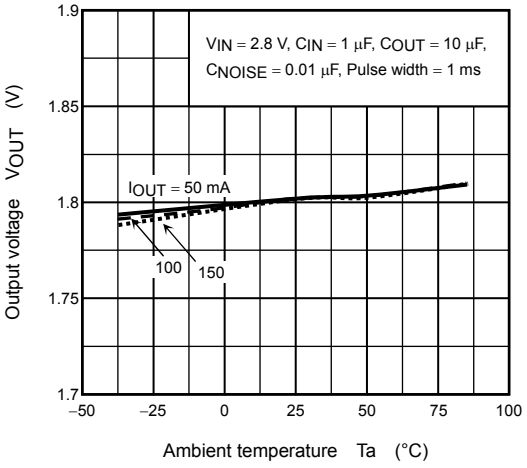
(TAR5SB50) $V_{OUT} - V_{IN}$



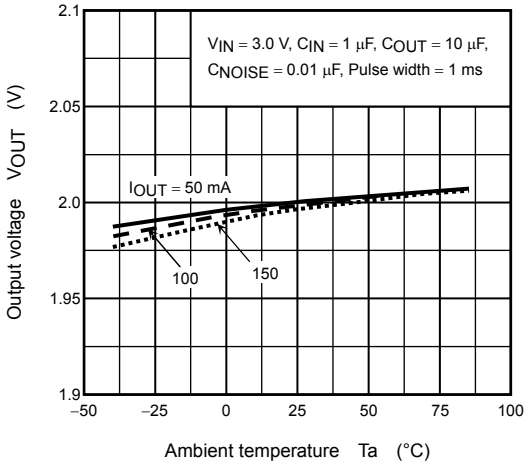
(TAR5SB15) V_{OUT} – Ta



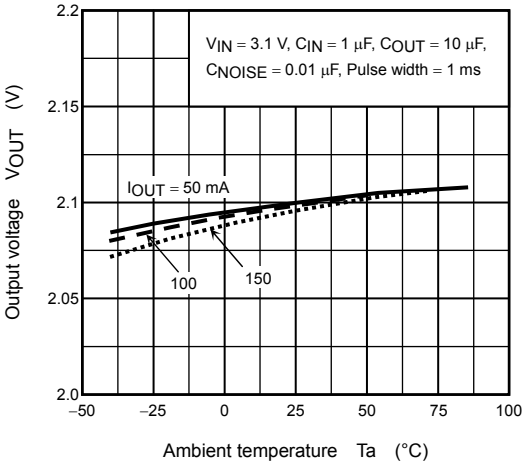
(TAR5SB18) V_{OUT} – Ta



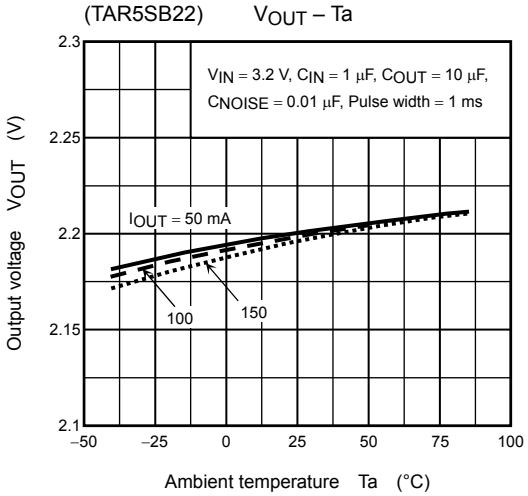
(TAR5SB20) V_{OUT} – Ta



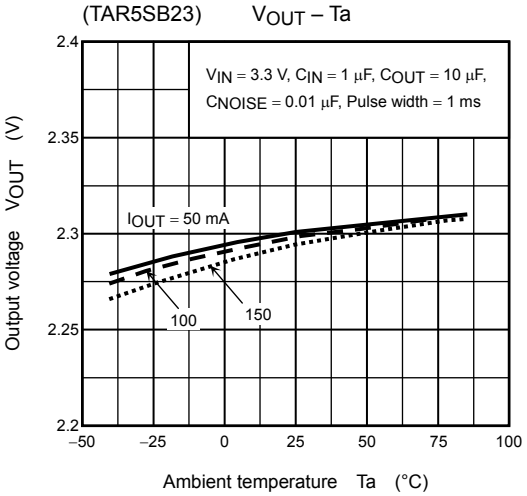
(TAR5SB21) V_{OUT} – Ta



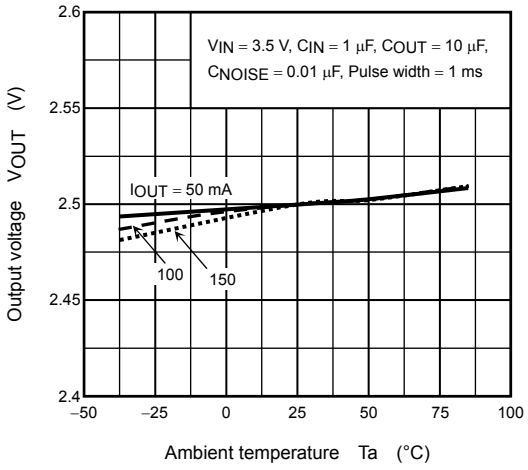
(TAR5SB22) V_{OUT} – Ta



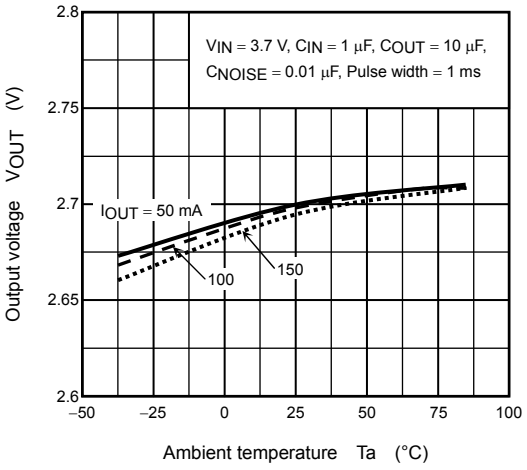
(TAR5SB23) V_{OUT} – Ta



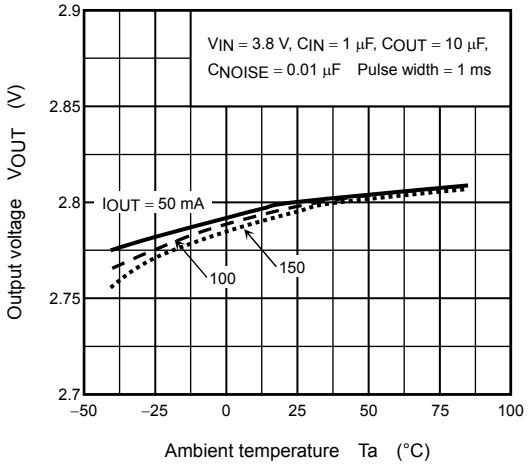
(TAR5SB25) V_{OUT} – Ta



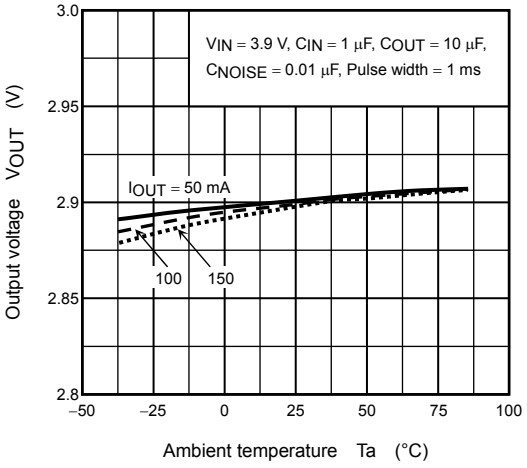
(TAR5SB27) V_{OUT} – Ta



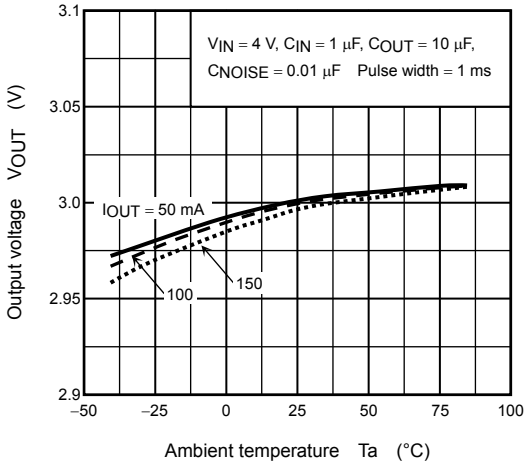
(TAR5SB28) V_{OUT} – Ta



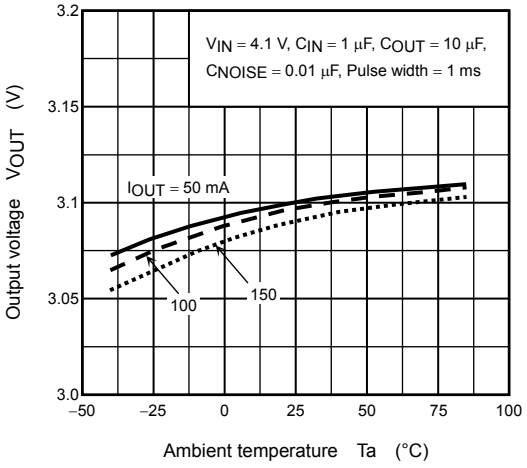
(TAR5SB29) V_{OUT} – Ta



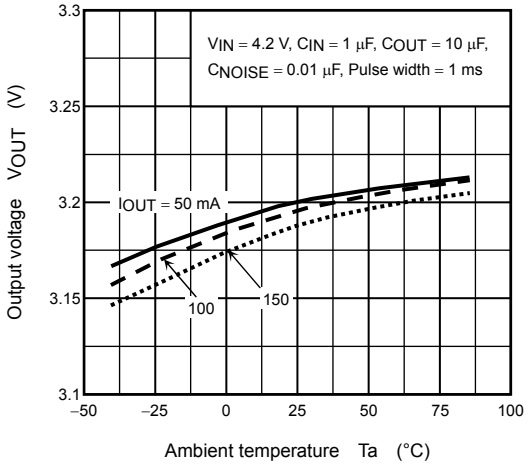
(TAR5SB30) V_{OUT} – Ta



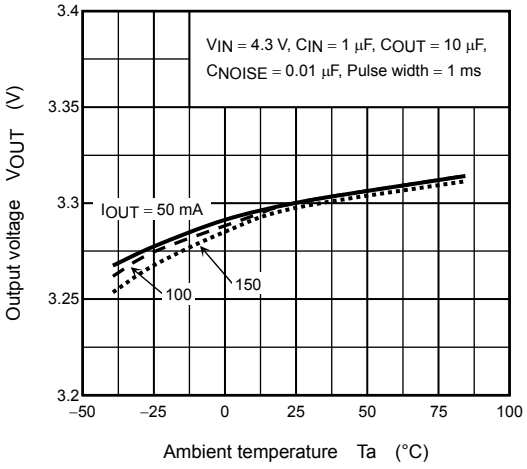
(TAR5SB31) V_{OUT} – Ta



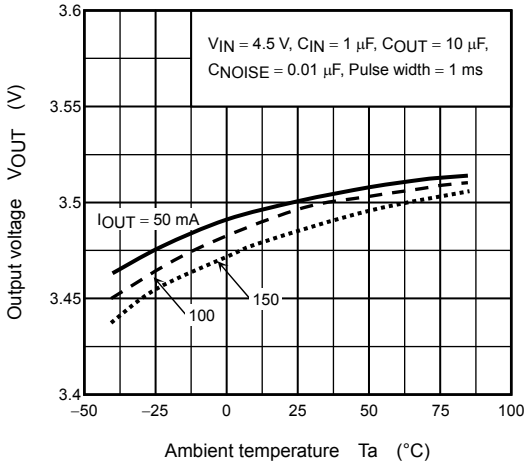
(TAR5SB32) V_{OUT} – Ta



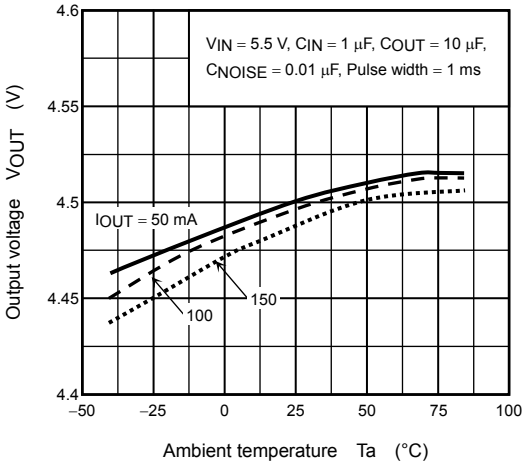
(TAR5SB33) V_{OUT} – Ta



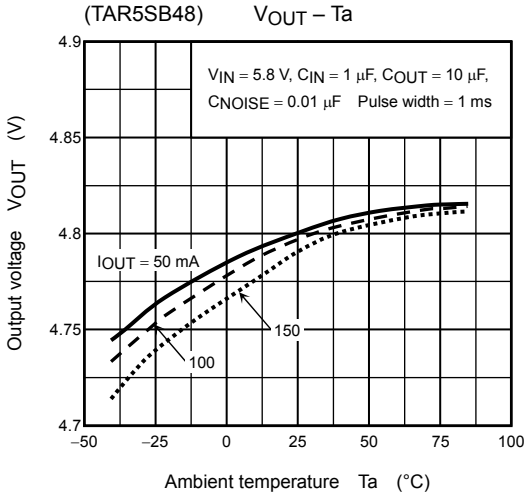
(TAR5SB35) V_{OUT} – Ta



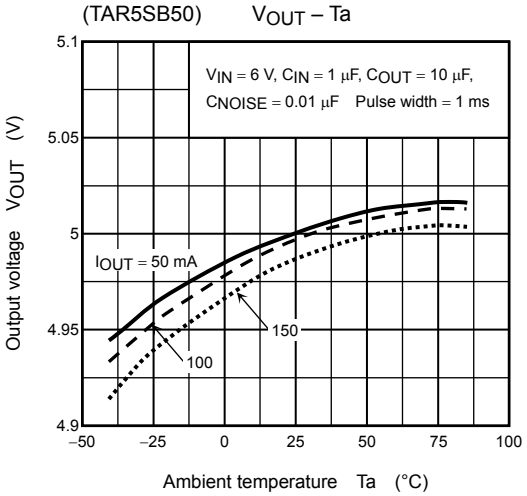
(TAR5SB45) V_{OUT} – Ta



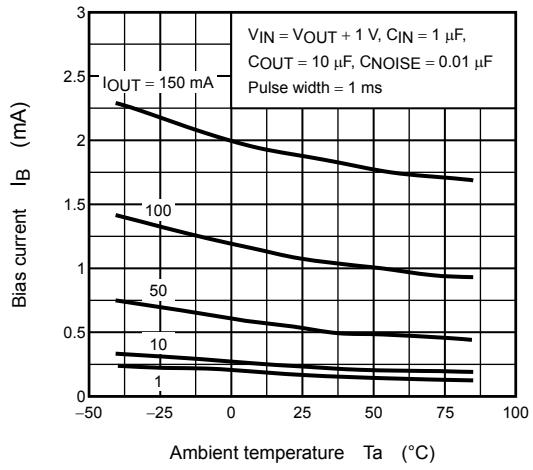
(TAR5SB48) V_{OUT} – Ta



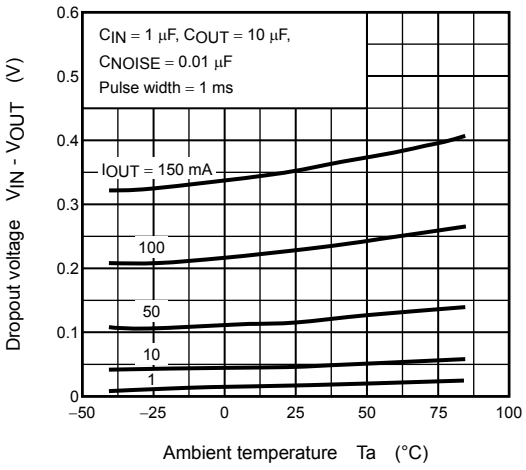
(TAR5SB50) V_{OUT} – Ta



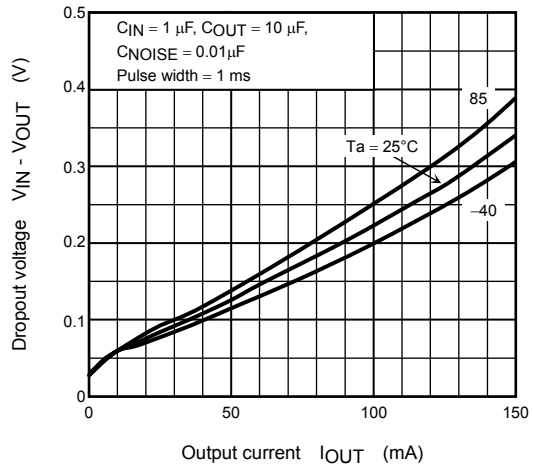
I_B – Ta



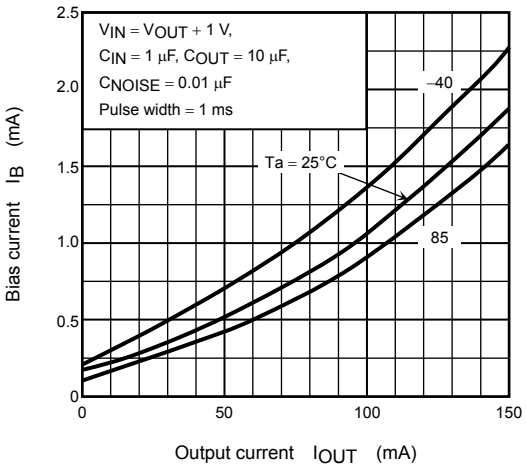
(TAR5SB23~TAR5SB50) V_{IN} - V_{OUT} – Ta



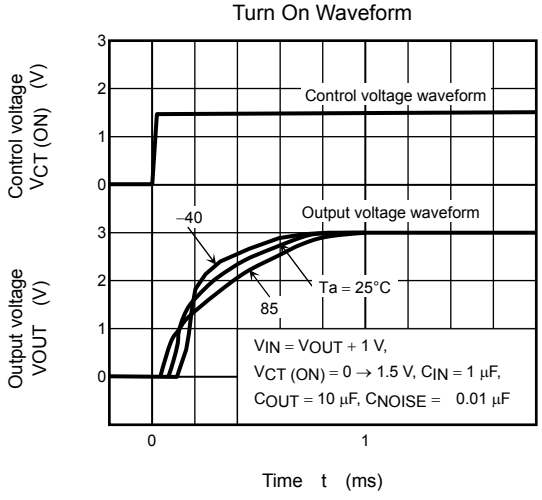
(TAR5SB23~TAR5SB50) V_{IN} - V_{OUT} – I_{OUT}



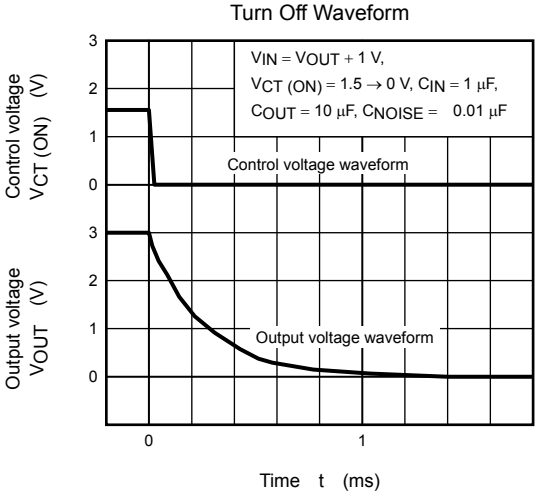
I_B – I_{OUT}



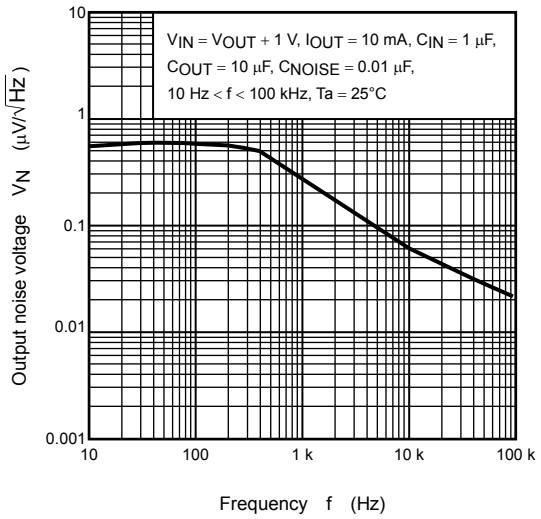
Turn On Waveform



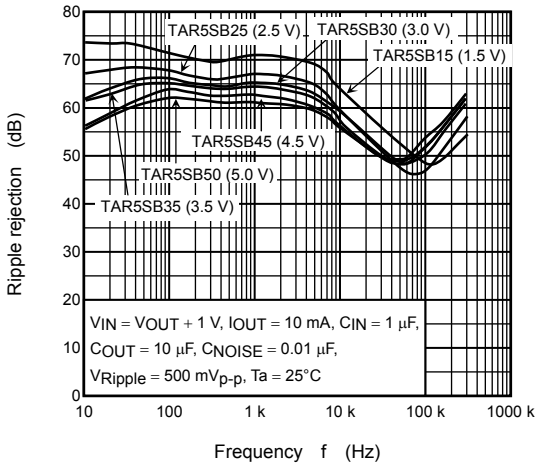
Turn Off Waveform



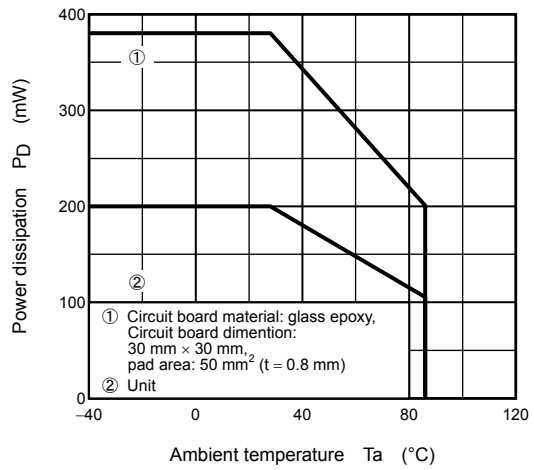
V_N – f



Ripple Rejection – f

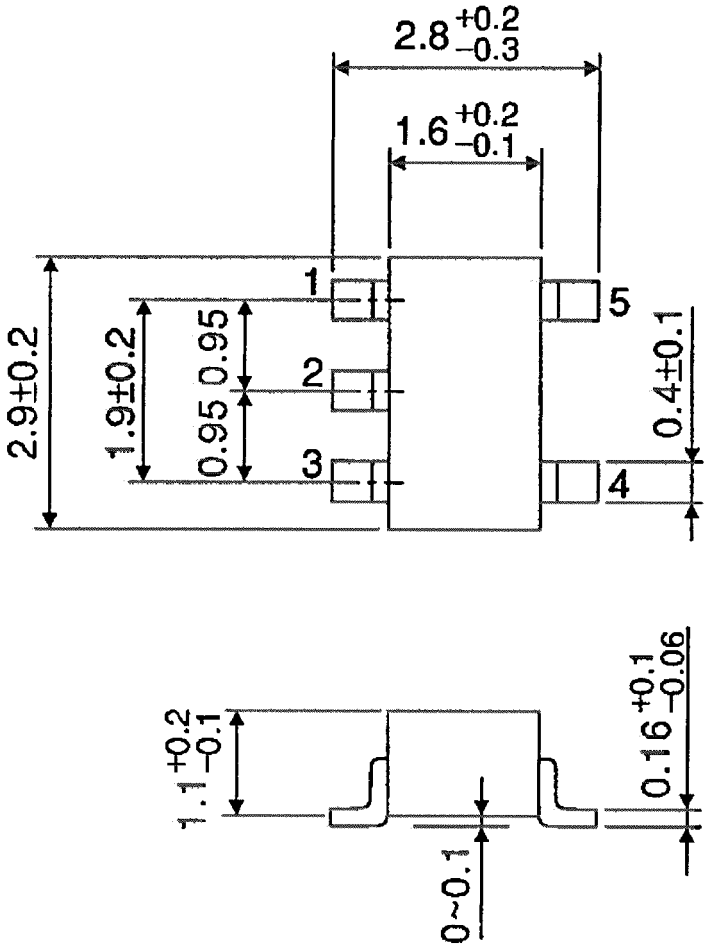


P_D – Ta



Package Dimensions

SSOP5-P-0.95 Unit : mm



Weight: 0.014 g (typ.)

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