

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

## TA78DS05BP, TA78DS06BP, TA78DS08BP, TA78DS09BP, TA78DS10BP, TA78DS12BP, TA78DS15BP, TA78DS05CP

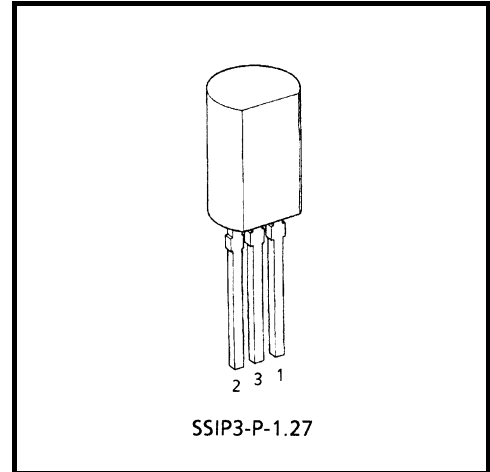
5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V

Low Dropout Voltage Regulator

The TA78DS××BP series consists fixed-positive-output voltage regulator ICs capable of sourcing current up to 30 mA. Due to the features of low dropout voltage and low standby current, these devices are useful for battery-powered equipment. This series includes built-in current limiting, thermal shutdown, over voltage protection, input fault protection and excessive transient protection circuits.

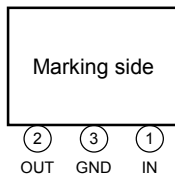
### Features

- Low standby current of 600  $\mu$ A typical.
- Maximum output current of 30 mA.
- Low dropout voltage of less than 0.3 V.
- Multi-protection:  
Reverse connection of power supply, 60V load dump, thermal shut down and current limiting.
- Available in the plastic TO-92 MOD package.

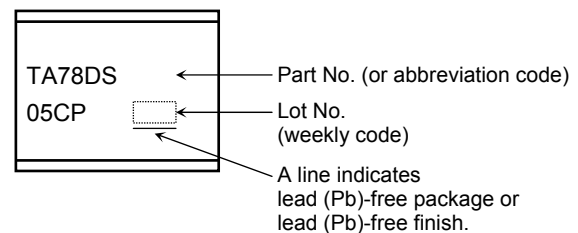
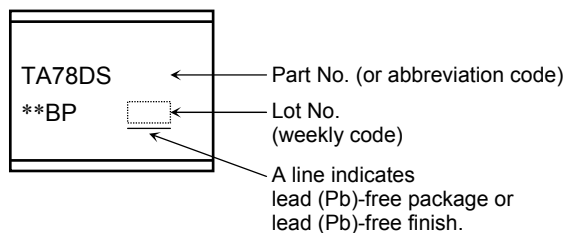


Weight: 0.36 g (Typ.)

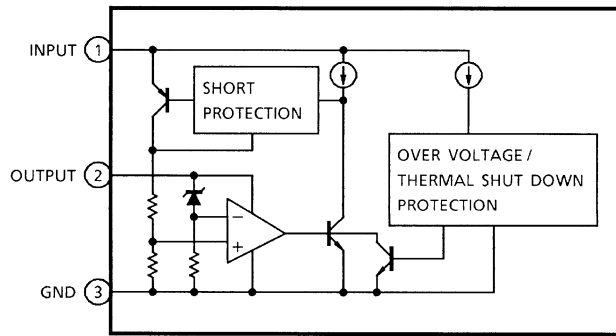
### Pin Assignment



### Marking



## Block Diagram



## Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Operating input voltage	$V_{IN}$	29	V
Input voltage of surge	$V_{IN}$	60	V
Power dissipation (Ta = 25°C)	$P_D$	800	mW
Operating temperature	$T_{opr}$	-40~85	°C
Storage temperature	$T_{stg}$	-55~150	°C
Junction temperature	$T_j$	150	°C
Thermal resistance	$R_{th(j-a)}$	156	°C/W
Soldering temperature time	$T_{sol}$	260 (10 s)	°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).

## TA78DS05BP

### Electrical Characteristics

(Unless otherwise specified,  $V_{IN} = 14\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$5.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	4.75	5.0	5.25	V
			$5.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	4.5	5.0	5.5	
Line regulation	Reg-line	—	$9.0\text{ V} \leq V_{IN} \leq 16\text{ V}$	—	1	10	mV
			$6.0\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	4	30	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	1	50	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	0.6	1	mA
			$6\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	0.7	1	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V

## TA78DS05CP

### Electrical Characteristics

(Unless otherwise specified,  $V_{IN} = 14\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$5.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	4.8	5.0	5.2	V
			$5.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	4.75	5.0	5.25	
Line regulation	Reg-line	—	$9.0\text{ V} \leq V_{IN} \leq 16\text{ V}$	—	1	10	mV
			$6.0\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	4	30	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	1	50	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	0.6	1	mA
			$6\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	0.7	1	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V

## TA78DS06BP

### Electrical Characteristics

(Unless otherwise specified,  $V_{IN} = 14\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$6.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	5.7	6.0	6.3	V
			$6.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	5.4	6.0	6.6	
Line regulation	Reg-line	—	$10\text{ V} \leq V_{IN} \leq 17\text{ V}$	—	1	20	mV
			$7.0\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	4	40	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	1	60	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	0.6	1.1	mA
			$7\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	0.7	1.1	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V

## TA78DS08BP

### Electrical Characteristics

(Unless otherwise specified,  $V_{IN} = 14\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$8.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	7.6	8.0	8.4	V
			$8.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	7.2	8.0	8.8	
Line regulation	Reg-line	—	$12\text{ V} \leq V_{IN} \leq 19\text{ V}$	—	2	30	mV
			$9.0\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	5	60	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	4	80	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	0.7	1.2	mA
			$9\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	0.8	1.2	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V

## TA78DS09BP

### Electrical Characteristics

(Unless otherwise specified,  $V_{IN} = 14\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$9.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	8.55	9.0	9.45	V
			$9.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	8.1	9.0	9.9	
Line regulation	Reg-line	—	$13\text{ V} \leq V_{IN} \leq 20\text{ V}$	—	2	35	mV
			$10\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	5	70	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	4	90	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	0.7	1.3	mA
			$10\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	0.8	1.3	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V

## TA78DS10BP

### Electrical Characteristics

(Unless otherwise specified,  $V_{IN} = 14\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$10.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	9.5	10.0	10.5	V
			$10.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	9.0	10.0	11.0	
Line regulation	Reg-line	—	$14\text{ V} \leq V_{IN} \leq 21\text{ V}$	—	3	40	mV
			$11\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	7	80	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	6	100	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	0.7	1.4	mA
			$11\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	0.8	1.4	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V

## TA78DS12BP

### Electrical Characteristics

(Unless otherwise specified,  $V_{IN} = 18\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

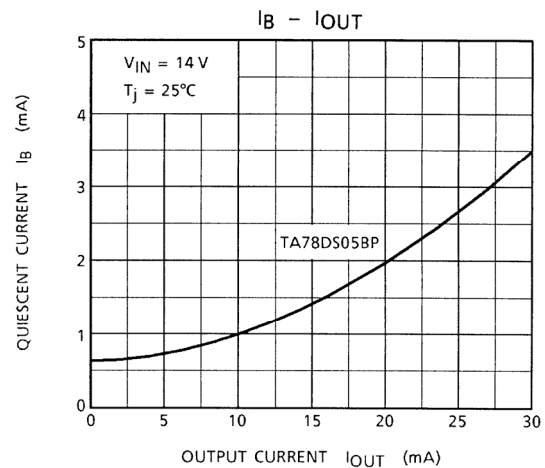
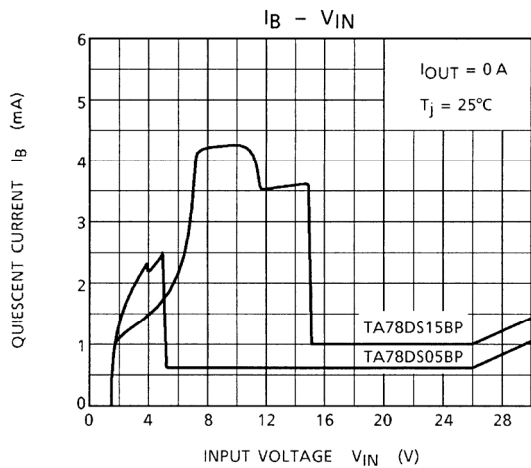
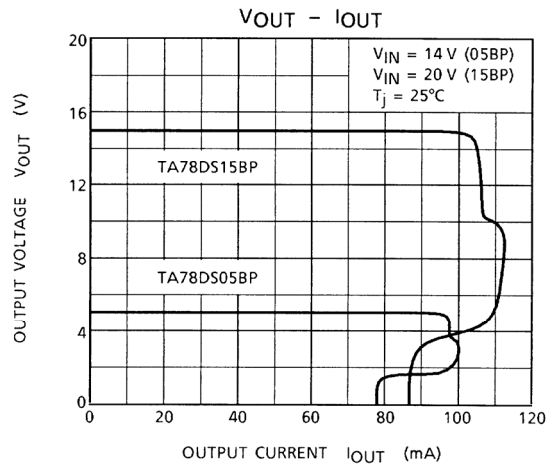
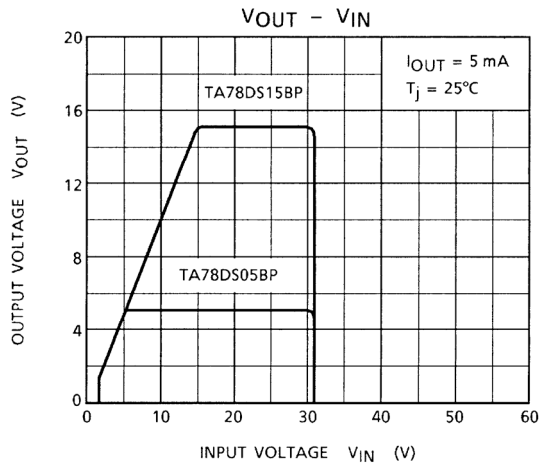
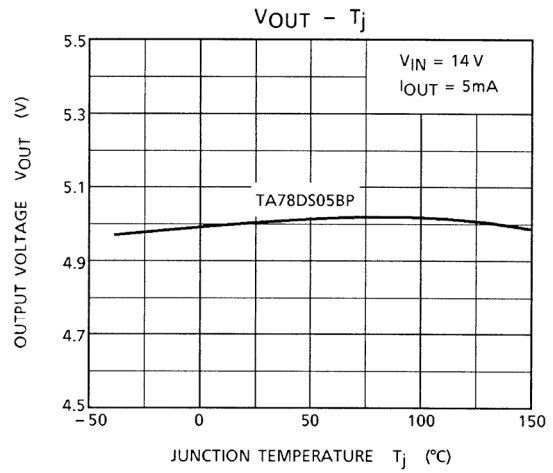
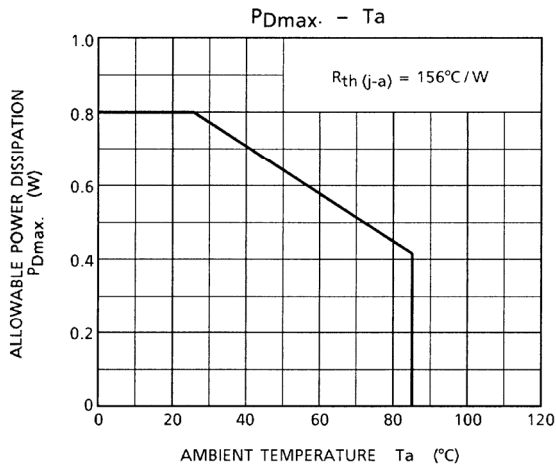
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	11.4	12.0	12.6	V
			$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	10.8	12.0	13.2	
Line regulation	Reg-line	—	$16\text{ V} \leq V_{IN} \leq 23\text{ V}$	—	4	50	mV
			$13\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	8	100	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	2	120	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	0.8	1.5	mA
			$13\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	1.0	1.5	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V

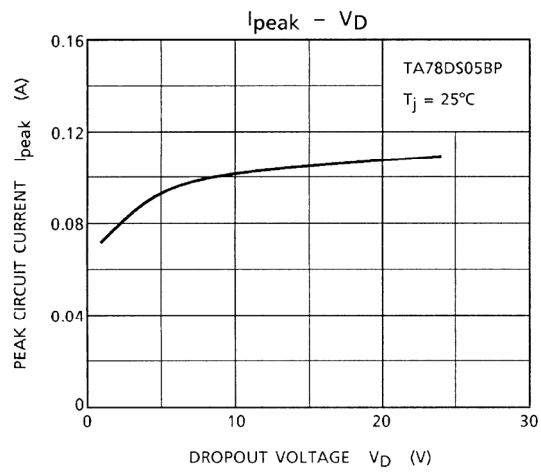
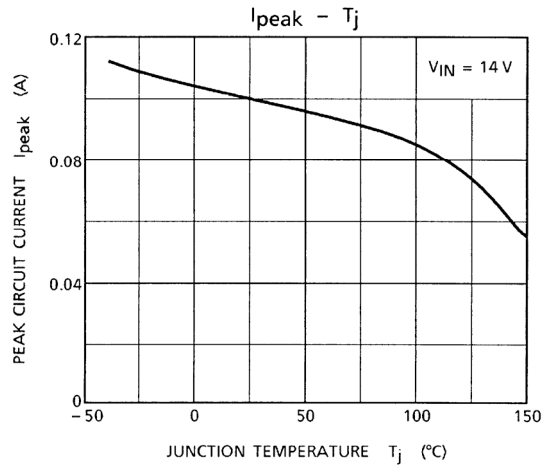
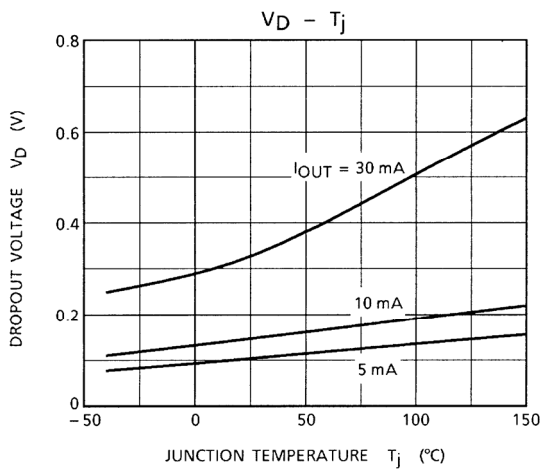
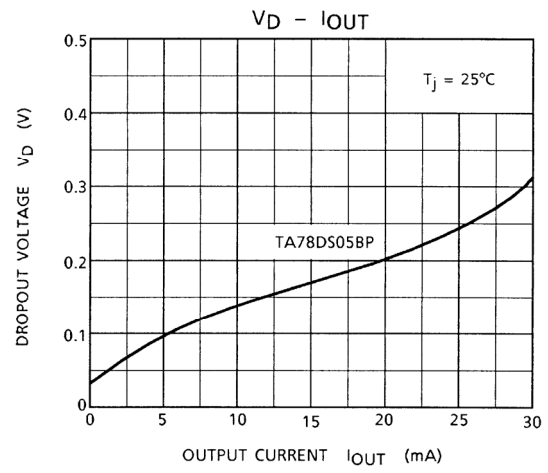
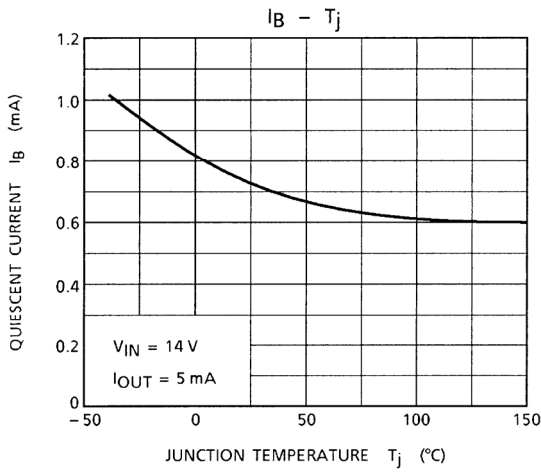
## TA78DS15BP

### Electrical Characteristics

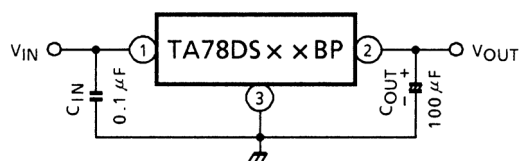
(Unless otherwise specified,  $V_{IN} = 20\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$15.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	14.25	15.0	15.75	V
			$15.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	13.5	15.0	16.5	
Line regulation	Reg-line	—	$19\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	5	60	mV
			$16\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	8	130	
Load regulation	Reg-load	—	$5.0\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$	—	1	150	mV
Quiescent current	$I_B$	—	$I_{OUT} = 0\text{ mA}$	—	1.0	1.6	mA
			$16\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $I_{OUT} = 5\text{ mA}$	—	1.2	1.6	
Dropout voltage	$V_D$	—	$I_{OUT} = 5\text{ mA}$	—	0.1	0.2	V
			$I_{OUT} = 10\text{ mA}$	—	0.2	0.3	
Max operating voltage	$V_{IN}$	—	—	29	33	—	V







**Application Circuit**

The capacitors  $C_{IN}/C_{OUT}$  must be guaranteed to operate within the temperature range in which the regulator operates correctly.

The equivalent series resistance (ESR) of  $C_{OUT}$  must be less than  $1 \Omega$  inside the operating temperature range.



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20070701-EN

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