

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

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

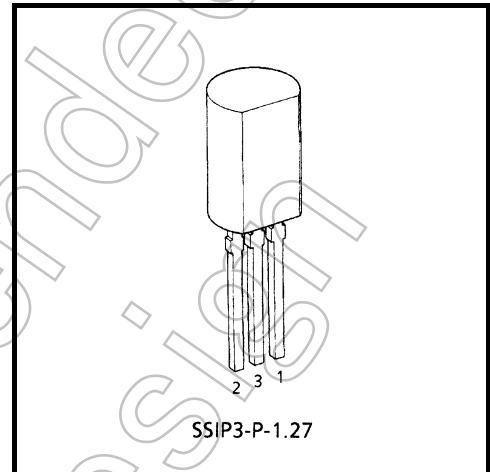
5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V

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 overcurrent protection, overheating protection, overvoltage protection, input fault protection and excessive transient protection circuits.

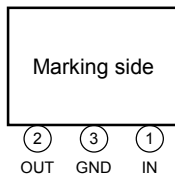
### Features

- 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, overheating protection and overcurrent protection.
- Available in the plastic TO-92 MOD package.

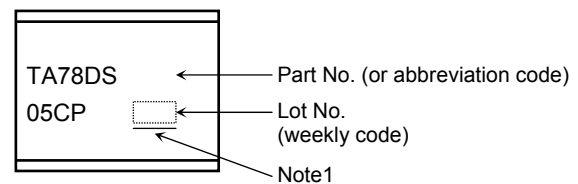
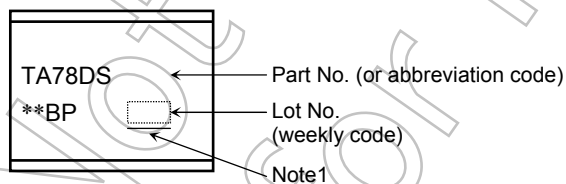


Weight: 0.36 g (Typ.)

### Pin Assignment



### Marking



Note 1: A line under a Lot No. identifies the indication of product Labels.

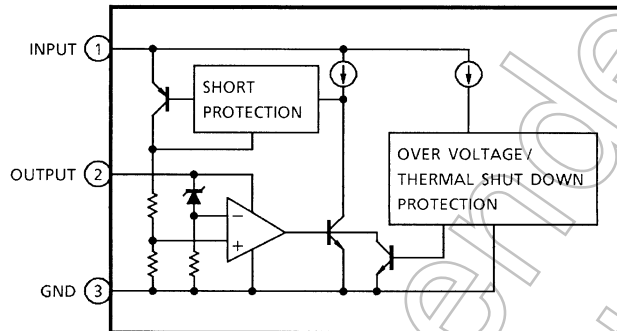
Not underlined: [[Pb]]/INCLUDES > MCV

Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The product(s) in this document ("Product") contain functions intended to protect the Product from temporary small overloads such as minor short-term overcurrent, overvoltage, or overheating. The protective functions do not necessarily protect Product under all circumstances. When incorporating Product into your system, please design the system (1) to avoid such overloads upon the Product, and (2) to shut down or otherwise relieve the Product of such overload conditions immediately upon occurrence. For details, please refer to the notes appearing below in this document and other documents referenced in this document.

## 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
Output current	$I_{OUT}$	0.03	A
Power dissipation	$P_D$	800	mW
Operating temperature	$T_{opr}$	-40 to 85	°C
Storage temperature	$T_{stg}$	-55 to 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,  $V_{IN} = 18\text{ V}$ ,  $I_{OUT} = 5\text{ mA}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 3.3\text{ }\mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

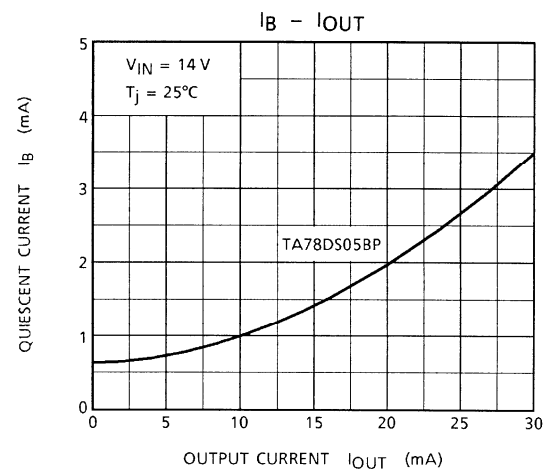
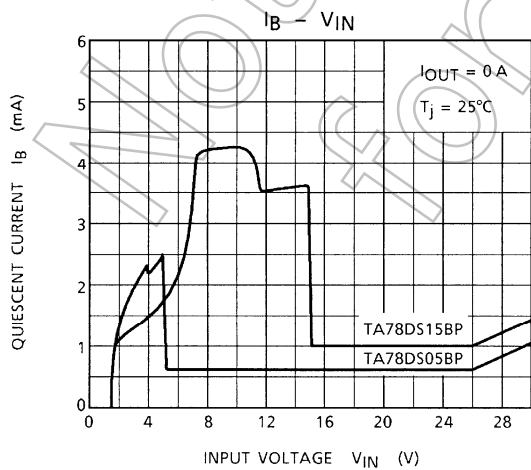
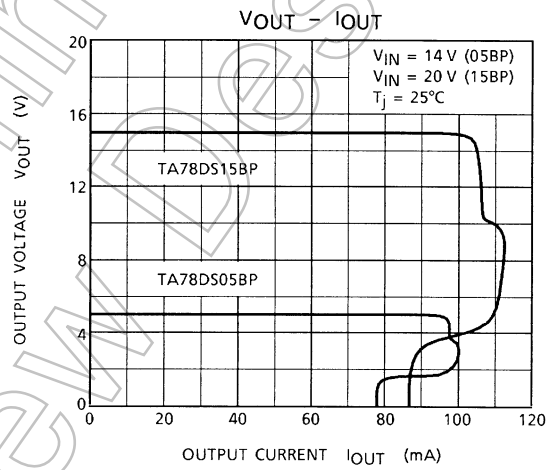
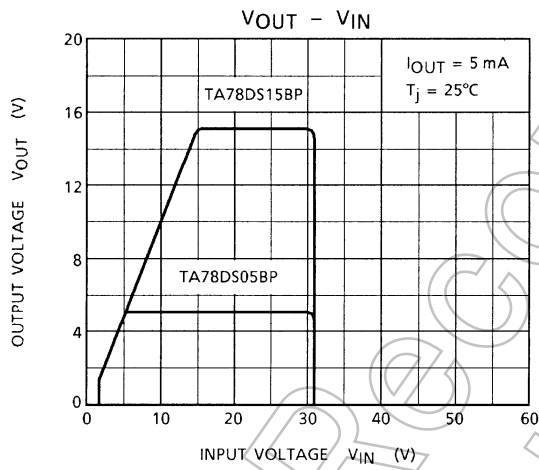
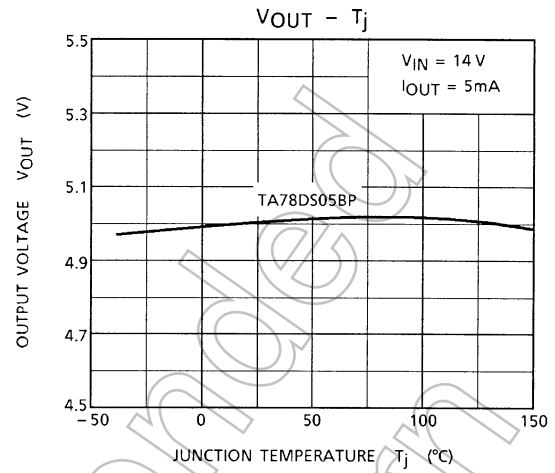
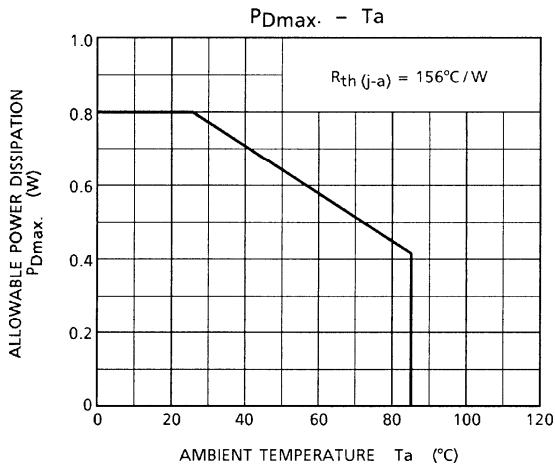
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	11.4	12.0	12.6	V
			$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	10.8	12.0	13.2	
Line regulation	Reg-line	—	$16\text{ V} \leq V_{IN} \leq 23\text{ V}$	—	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

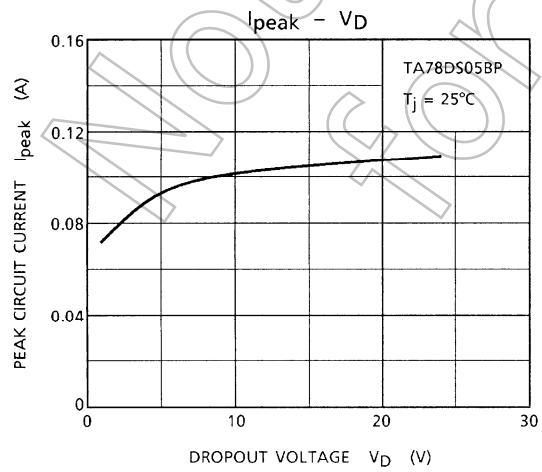
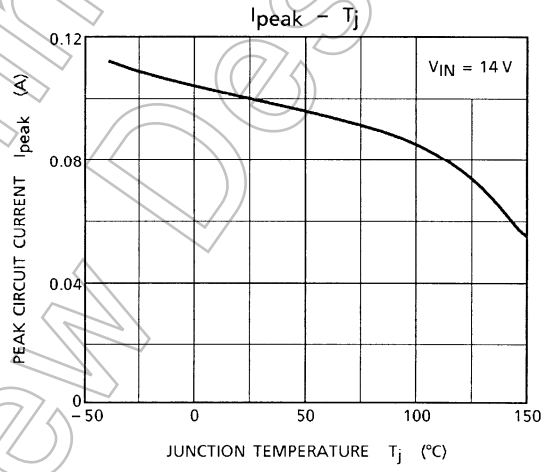
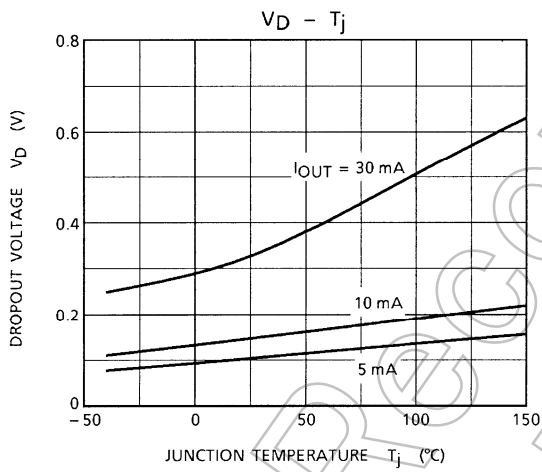
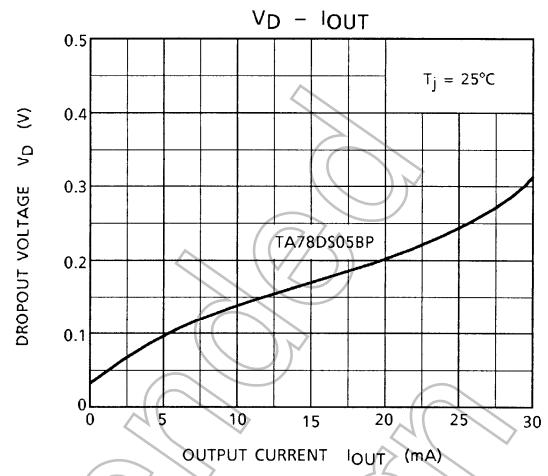
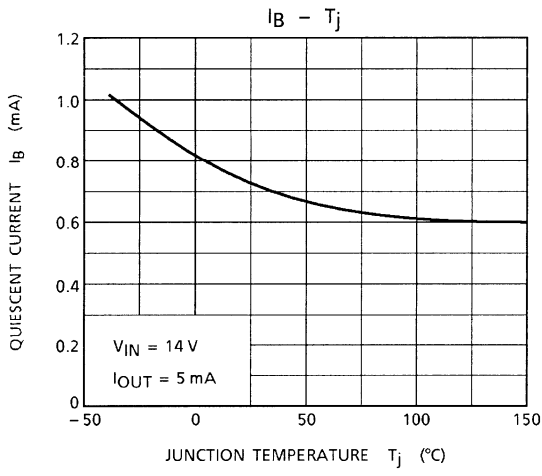
## TA78DS15BP

### Electrical Characteristics

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

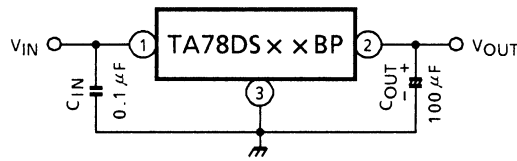
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	$V_{OUT}$	—	$15.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	14.25	15.0	15.75	V
			$15.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ , $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	13.5	15.0	16.5	
Line regulation	Reg-line	—	$19\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	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.

## Usage Precautions

- Low voltage

Do not apply voltage to the Product that is lower than the minimum operating voltage, or the Product's protective functions will not operate properly and the Product may be permanently damaged.

- Overcurrent Protection

The overcurrent protection circuits in the Product are designed to temporarily protect Product from minor overcurrent of brief duration. When the overcurrent protective function in the Product activates, immediately cease application of overcurrent to Product. Improper usage of Product, such as application of current to Product exceeding the absolute maximum ratings, could cause the overcurrent protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.

- Overheating Protection

The thermal shutdown circuits in the Product are designed to temporarily protect Product from minor overheating of brief duration. When the overheating protective function in the Product activates, immediately correct the overheating situation. Improper usage of Product, such as the application of heat to Product exceeding the absolute maximum ratings, could cause the overheating protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.

- Overvoltage Protection

The overvoltage protection circuits in the Product are designed to temporarily protect Product from minor overvoltage of brief duration. When the overvoltage protective function in the Product activates, immediately cease application of overvoltage to Product. Improper usage of Product, such as application of voltage to Product exceeding the absolute maximum ratings, could cause the overvoltage protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.



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