

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

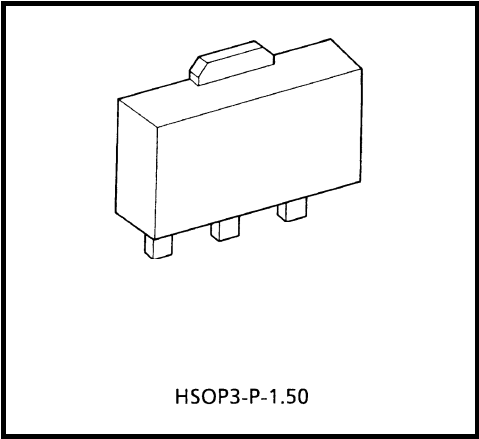
**TA78DS05F, TA78DS06F, TA78DS08F, TA78DS09F,
TA78DS10F, TA78DS12F, TA78DS15F, TA78DS05AF**

5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V
Low Dropout Voltage Regulator

The TA78DS××F series consists of 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.

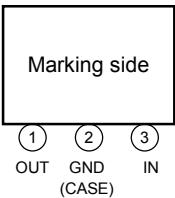
Features

- Low standby current of 600 μ 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.
- Packaged in PW-Mini (SOT-89).

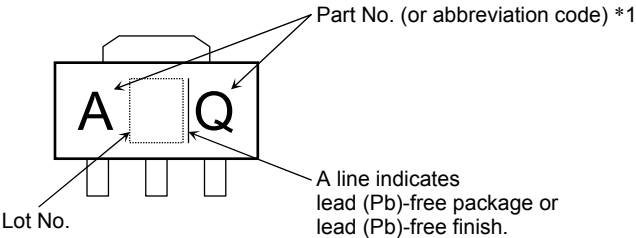


Weight: 0.05 g (Typ.)

Pin Assignment

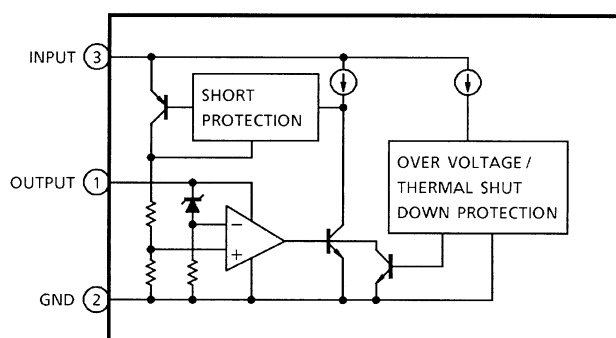


Marking



*1	Part No. (or abbreviation code)	Part No.
	AQ	TA78DS05AF
	AP	TA78DS05F
	BP	TA78DS06F
	CP	TA78DS08F
	DP	TA78DS09F
	EP	TA78DS10F
	FP	TA78DS12F
	GP	TA78DS15F

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	500	mW
Operating temperature	T_{opr}	-40~85	°C
Storage temperature	T_{stg}	-55~150	°C
Junction temperature	T_j	150	°C
Thermal resistance	$R_{th(j-a)}$	250	°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).

TA78DS05F
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

TA78DS05AF
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

TA78DS06F
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

TA78DS08F
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

TA78DS09F
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

TA78DS10F
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

TA78DS12F
Electrical Characteristics

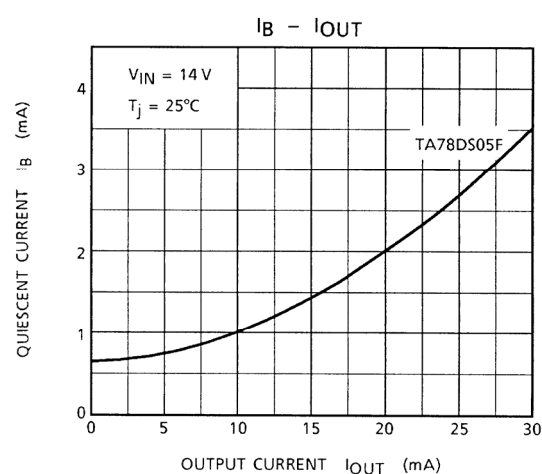
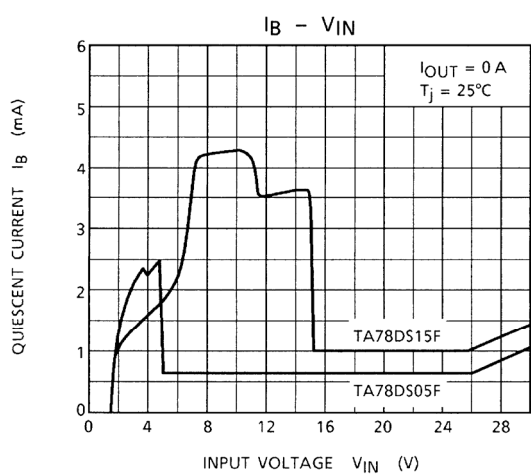
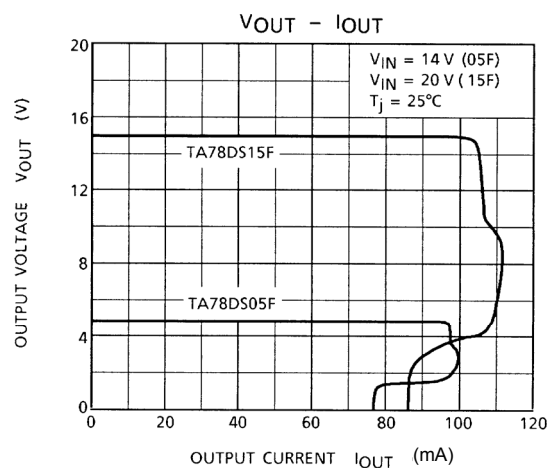
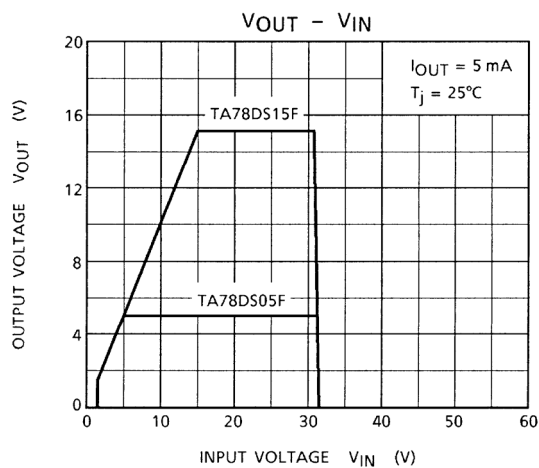
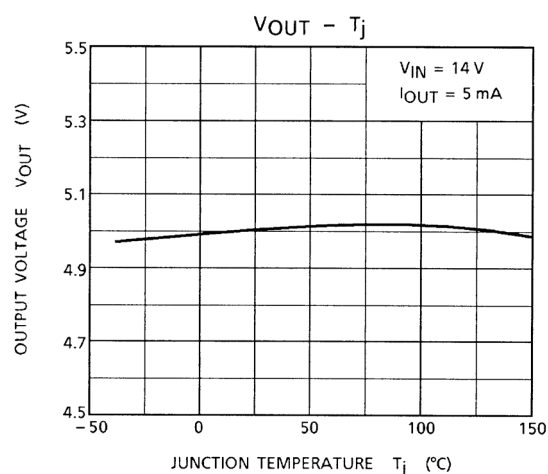
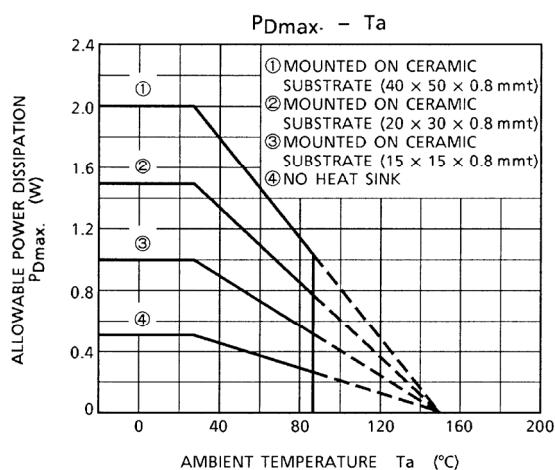
 (Unless otherwise specified, $V_{IN} = 18\text{ V}$, $I_{OUT} = 5\text{ mA}$, $C_{IN} = 0.1\text{ }\mu\text{F}$, $C_{OUT} = 3.3\text{ }\mu\text{F}$, $T_j = 25^\circ\text{C}$)

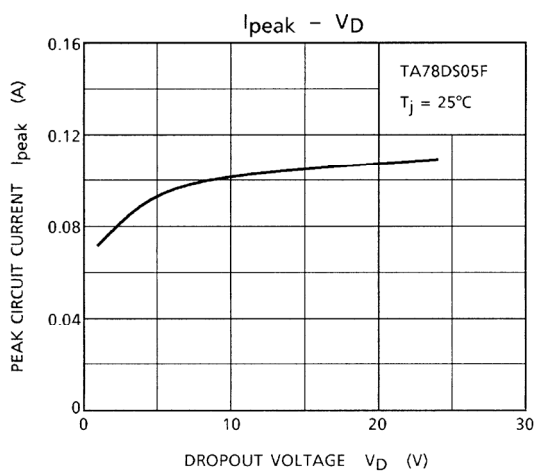
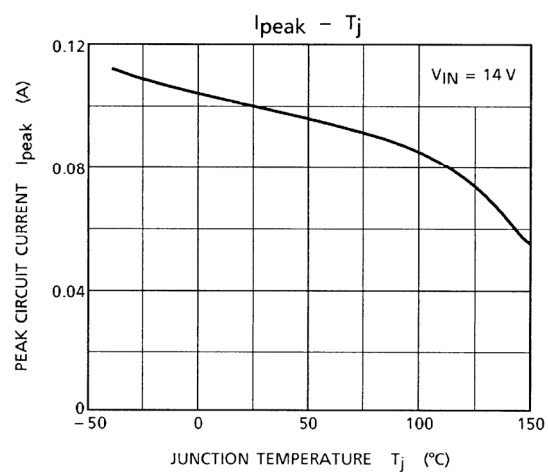
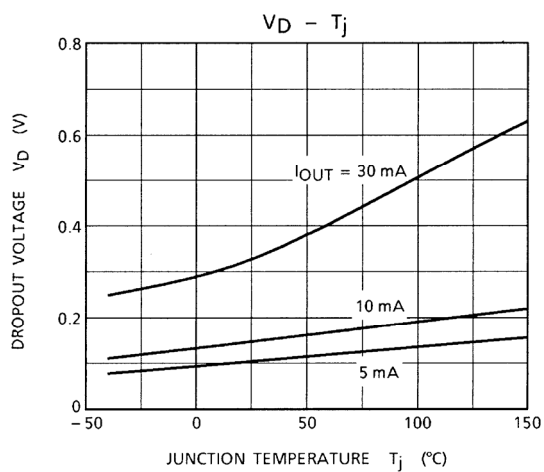
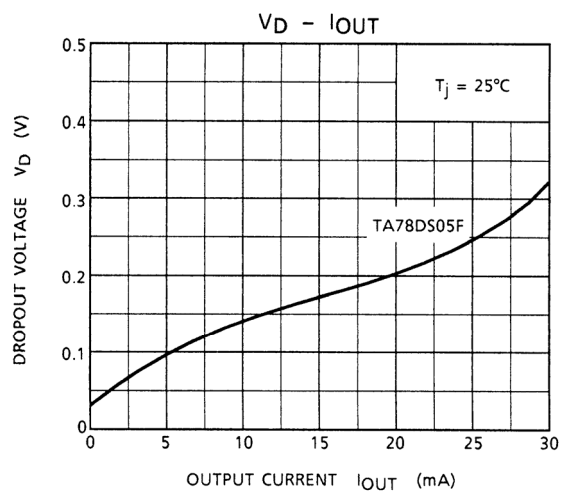
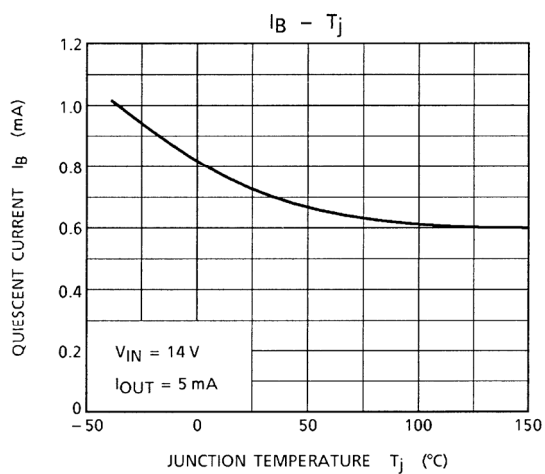
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	11.4	12.0	12.6	V
			$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$, $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	10.8	12.0	13.2	
Line regulation	Reg-line	—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

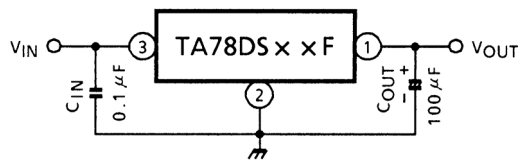
TA78DS15F
Electrical Characteristics

 (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

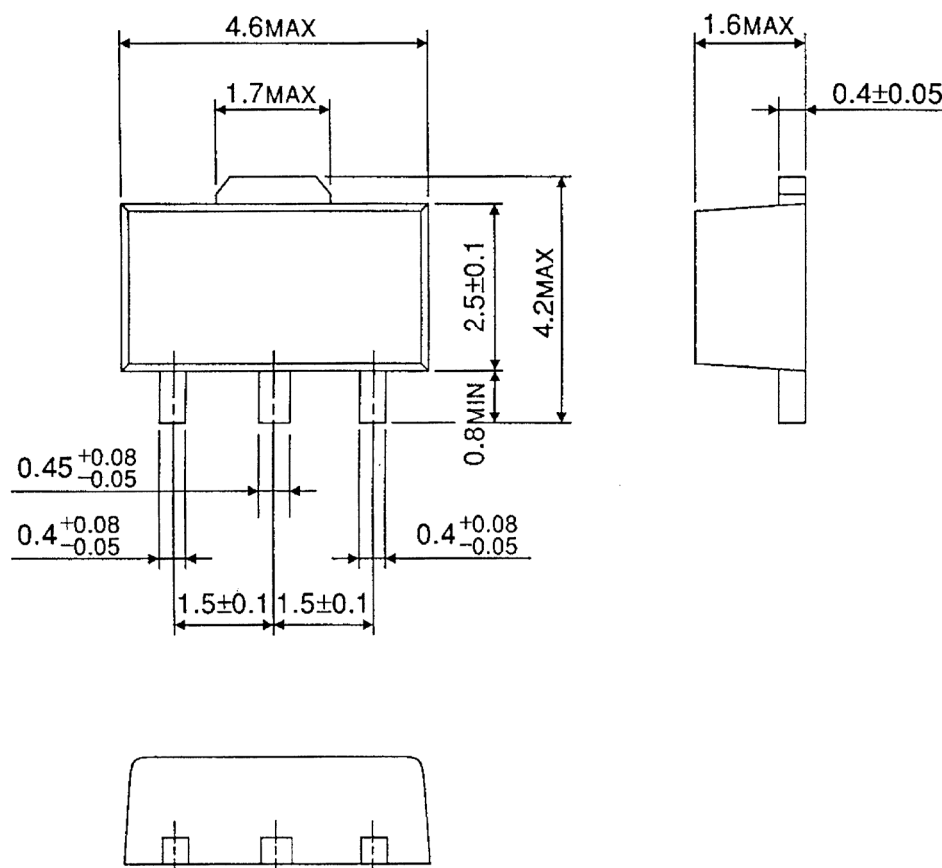
The capacitors C_{IN}/C_{OUT} must be guaranteed to operate within the temperature range in which the regulator operates correctly.

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

Package Dimensions

HSOP3-P-1.50

Unit : mm



Weight : 0.05 g (Typ.)

RESTRICTIONS ON PRODUCT USE

20070701-EN

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- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
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