

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

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

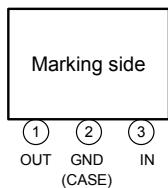
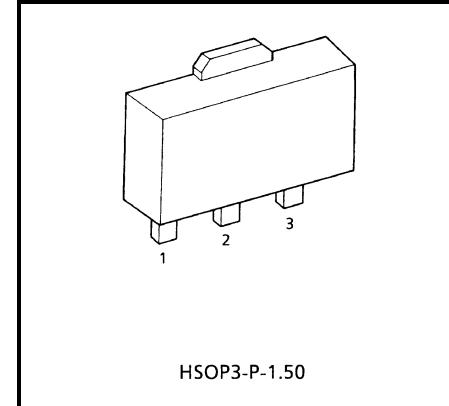
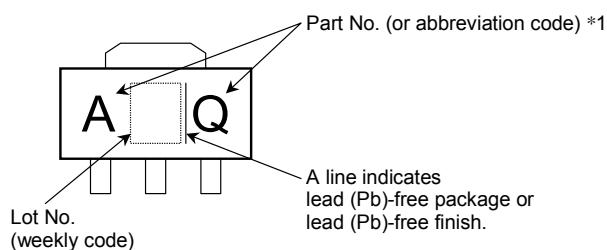
5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V

Low Dropout Voltage Regulator

The TA78DSxxF 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

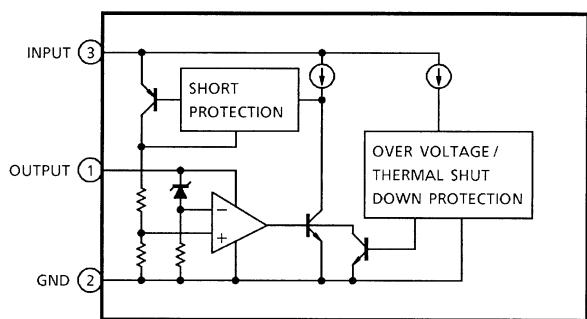
- Low standby current of 600 μ A typical.
- Maximum output current of 30 mA.
- Low dropout voltage of less than 0.3 V.
- Multi-protection:
Reverse connection of power supply, 60V load dump, thermal shut down and current limiting.
- Packaged in POWER MINI (SOT-89).

Pin Assignment**Marking**

HSOP3-P-1.50

Weight: 0.05 g (Typ.)

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

Block Diagram

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

Type	Marking
TA78DS05F	AP
TA78DS06F	BP
TA78DS08F	CP
TA78DS09F	DP
TA78DS10F	EP
TA78DS12F	FP
TA78DS15F	GP
TA78DS05AF	AQ

TA78DS05F**Electrical Characteristics**(Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 5 mA, C_{IN} = 0.1 µF, C_{OUT} = 3.3 µF, T_j = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V _{OUT}	—	5.35 V ≤ V _{IN} ≤ 26 V	4.75	5.0	5.25	V
			5.35 V ≤ V _{IN} ≤ 26 V, -40°C ≤ Ta ≤ 85°C	4.5	5.0	5.5	
Line regulation	Reg-line	—	9.0 V ≤ V _{IN} ≤ 16 V	—	1	10	mV
			6.0 V ≤ V _{IN} ≤ 26 V	—	4	30	
Load regulation	Reg-load	—	5.0 mA ≤ I _{OUT} ≤ 30 mA	—	1	50	mV
Quiescent current	I _B	—	I _{OUT} = 0 mA	—	0.6	1	mA
			6 V ≤ V _{IN} ≤ 26 V, I _{OUT} = 5 mA	—	0.7	1	
Dropout voltage	V _D	—	I _{OUT} = 5 mA	—	0.1	0.2	V
			I _{OUT} = 10 mA	—	0.2	0.3	
Max operating voltage	V _{IN}	—	—	29	33	—	V

TA78DS05AF**Electrical Characteristics**(Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 5 mA, C_{IN} = 0.1 µF, C_{OUT} = 3.3 µF, T_j = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V _{OUT}	—	5.35 V ≤ V _{IN} ≤ 26 V	4.8	5.0	5.2	V
			5.35 V ≤ V _{IN} ≤ 26 V, -40°C ≤ Ta ≤ 85°C	4.75	5.0	5.25	
Line regulation	Reg-line	—	9.0 V ≤ V _{IN} ≤ 16 V	—	1	10	mV
			6.0 V ≤ V _{IN} ≤ 26 V	—	4	30	
Load regulation	Reg-load	—	5.0 mA ≤ I _{OUT} ≤ 30 mA	—	1	50	mV
Quiescent current	I _B	—	I _{OUT} = 0 mA	—	0.6	1	mA
			6 V ≤ V _{IN} ≤ 26 V, I _{OUT} = 5 mA	—	0.7	1	
Dropout voltage	V _D	—	I _{OUT} = 5 mA	—	0.1	0.2	V
			I _{OUT} = 10 mA	—	0.2	0.3	
Max operating voltage	V _{IN}	—	—	29	33	—	V

TA78DS06F**Electrical Characteristics**(Unless otherwise specified, $V_{IN} = 14$ V, $I_{OUT} = 5$ mA, $C_{IN} = 0.1$ μ F, $C_{OUT} = 3.3$ μ F, $T_j = 25^\circ\text{C}$)

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

TA78DS08F**Electrical Characteristics**(Unless otherwise specified, $V_{IN} = 14$ V, $I_{OUT} = 5$ mA, $C_{IN} = 0.1$ μ F, $C_{OUT} = 3.3$ μ F, $T_j = 25^\circ\text{C}$)

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

TA78DS09F**Electrical Characteristics**(Unless otherwise specified, $V_{IN} = 14 \text{ V}$, $I_{OUT} = 5 \text{ mA}$, $C_{IN} = 0.1 \mu\text{F}$, $C_{OUT} = 3.3 \mu\text{F}$, $T_j = 25^\circ\text{C}$)

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

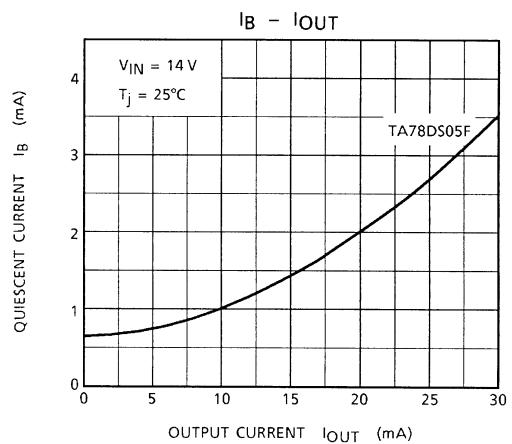
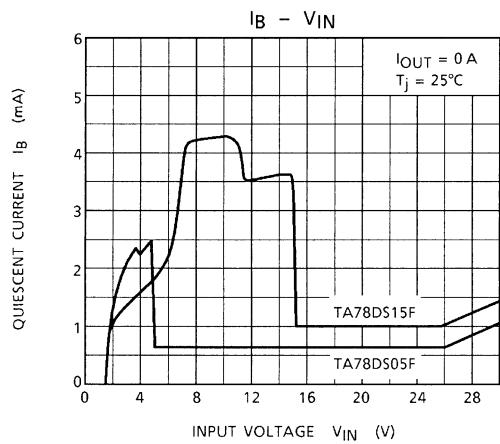
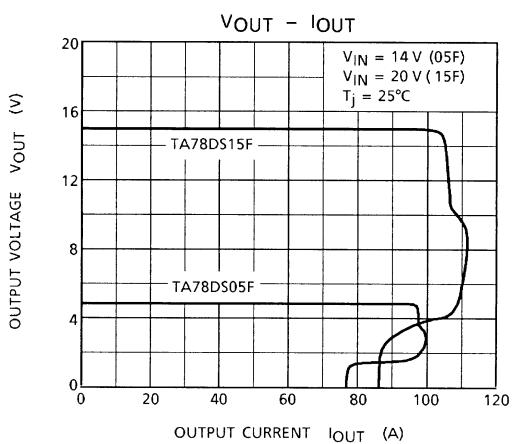
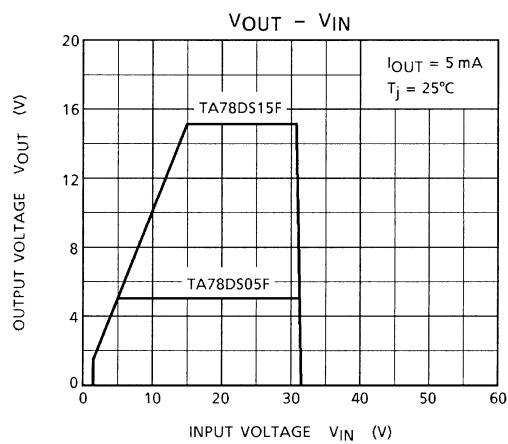
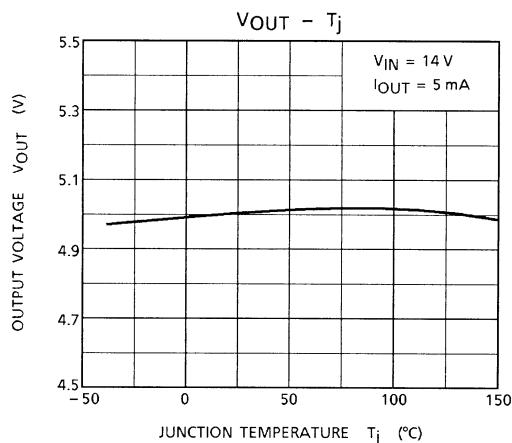
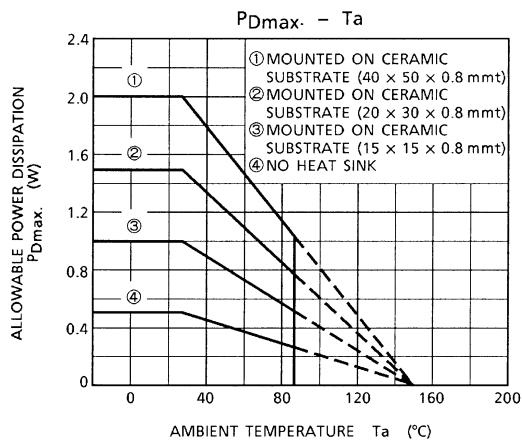
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	$10.35 \text{ V} \leq V_{IN} \leq 26 \text{ V}$	9.5	10.0	10.5	V
			$10.35 \text{ V} \leq V_{IN} \leq 26 \text{ V}, -40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	9.0	10.0	11.0	
Line regulation	Reg-line	—	$14 \text{ V} \leq V_{IN} \leq 21 \text{ V}$	—	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

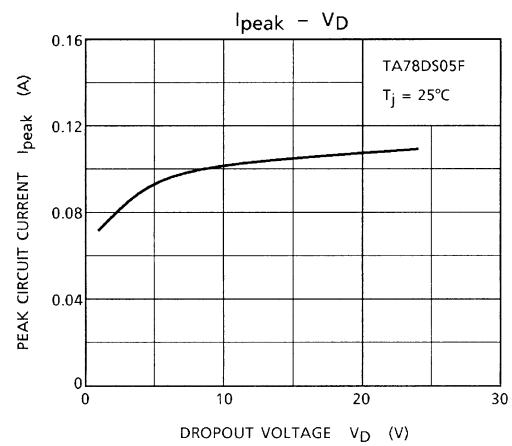
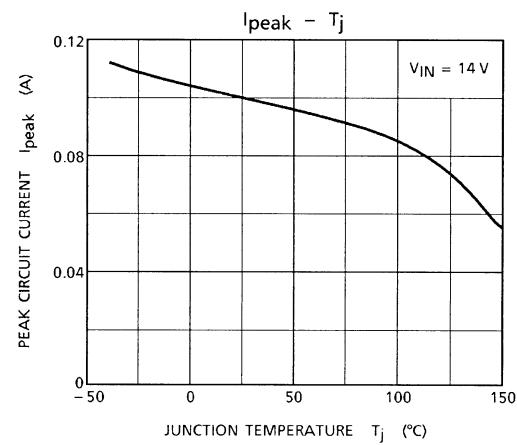
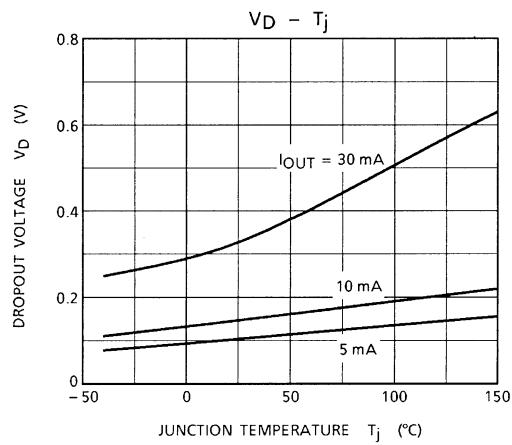
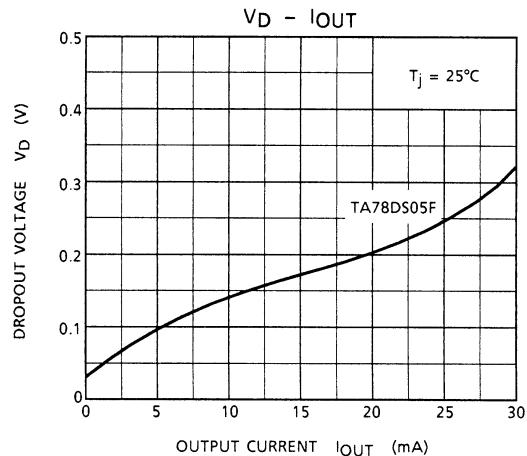
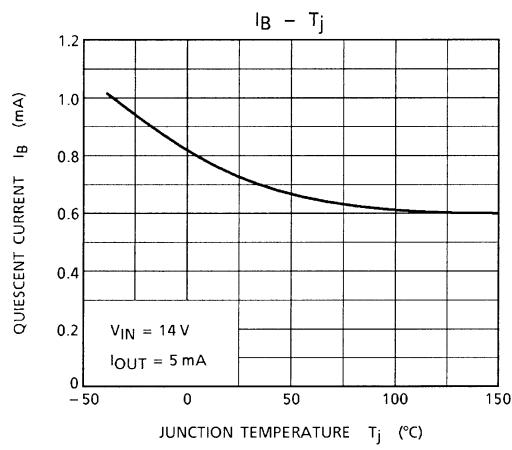
TA78DS12F**Electrical Characteristics**(Unless otherwise specified, $V_{IN} = 18\text{ V}$, $I_{OUT} = 5\text{ mA}$, $C_{IN} = 0.1\text{ }\mu\text{F}$, $C_{OUT} = 3.3\text{ }\mu\text{F}$, $T_j = 25^\circ\text{C}$)

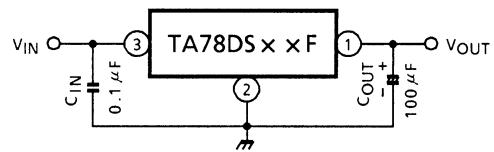
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$	11.4	12.0	12.6	V
			$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}, -40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	10.8	12.0	13.2	
Line regulation	Reg-line	—	$16\text{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

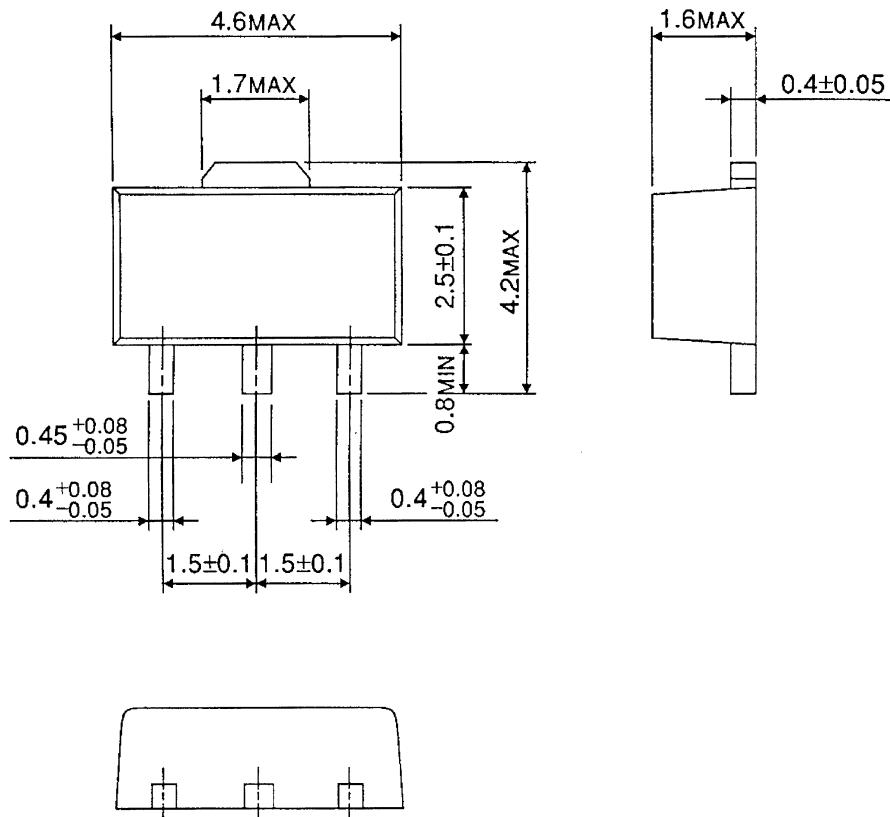
The capacitors C_{IN}/C_{OUT} must be guaranteed to operate within the temperature range in which the regulator operates correctly.

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

030619EBA

- The information contained herein is subject to change without notice.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others.
- 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.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- TOSHIBA products should not be embedded to the downstream products which are prohibited to be produced and sold, under any law and regulations.