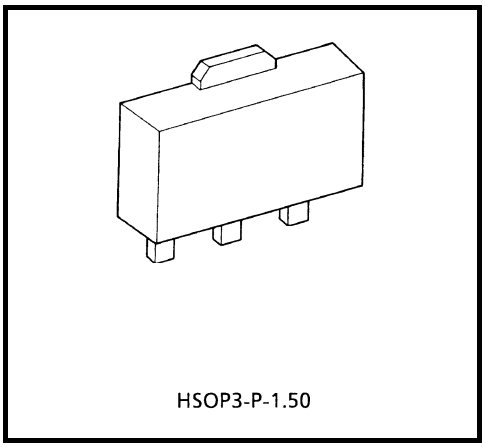
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

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.

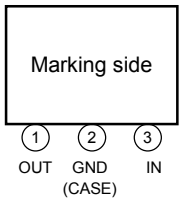


Weight: 0.05 g (Typ.)

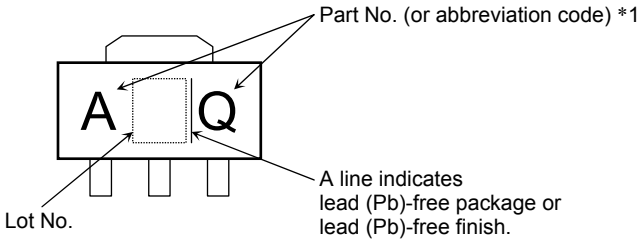
Features

- Low standby current of 600 μA 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).

Pin Assignment

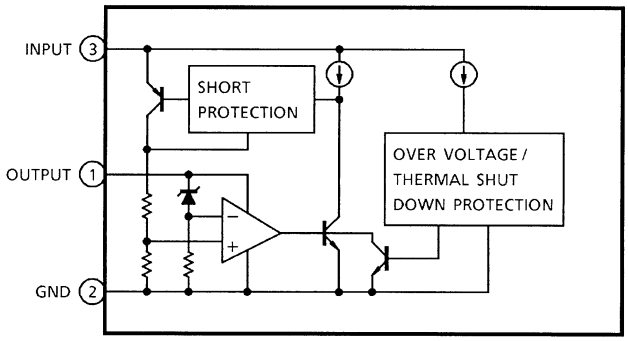


Marking



	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



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		$R_{th\ (j\text{-}a)}$	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 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 μF, C_{OUT} = 3.3 μF, T_j = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	6.35 V ≤ V_{IN} ≤ 26 V	5.7	6.0	6.3	V
			6.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	5.4	6.0	6.6	
Line regulation	Reg·line	—	10 V ≤ V_{IN} ≤ 17 V	—	1	20	mV
			7.0 V ≤ V_{IN} ≤ 26 V	—	4	40	
Load regulation	Reg·load	—	5.0 mA ≤ I_{OUT} ≤ 30 mA	—	1	60	mV
Quiescent current	I_B	—	I_{OUT} = 0 mA	—	0.6	1.1	mA
			7 V ≤ V_{IN} ≤ 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 μF, C_{OUT} = 3.3 μF, T_j = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	8.35 V ≤ V_{IN} ≤ 26 V	7.6	8.0	8.4	V
			8.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	7.2	8.0	8.8	
Line regulation	Reg·line	—	12 V ≤ V_{IN} ≤ 19 V	—	2	30	mV
			9.0 V ≤ V_{IN} ≤ 26 V	—	5	60	
Load regulation	Reg·load	—	5.0 mA ≤ I_{OUT} ≤ 30 mA	—	4	80	mV
Quiescent current	I_B	—	I_{OUT} = 0 mA	—	0.7	1.2	mA
			9 V ≤ V_{IN} ≤ 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 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}	—	9.35 V ≤ V_{IN} ≤ 26 V	8.55	9.0	9.45	V
			9.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	8.1	9.0	9.9	
Line regulation	Reg·line	—	13 V ≤ V_{IN} ≤ 20 V	—	2	35	mV
			10 V ≤ V_{IN} ≤ 26 V	—	5	70	
Load regulation	Reg·load	—	5.0 mA ≤ I_{OUT} ≤ 30 mA	—	4	90	mV
Quiescent current	I_B	—	I_{OUT} = 0 mA	—	0.7	1.3	mA
			10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 5 mA	—	0.8	1.3	
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

TA78DS10F
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}	—	10.35 V ≤ V_{IN} ≤ 26 V	9.5	10.0	10.5	V
			10.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	9.0	10.0	11.0	
Line regulation	Reg·line	—	14 V ≤ V_{IN} ≤ 21 V	—	3	40	mV
			11 V ≤ V_{IN} ≤ 26 V	—	7	80	
Load regulation	Reg·load	—	5.0 mA ≤ I_{OUT} ≤ 30 mA	—	6	100	mV
Quiescent current	I_B	—	I_{OUT} = 0 mA	—	0.7	1.4	mA
			11 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 5 mA	—	0.8	1.4	
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

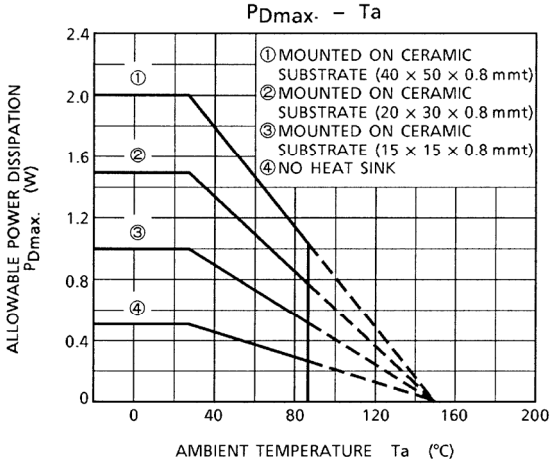
TA78DS12F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 18 V, I_{OUT} = 5 mA, C_{IN} = 0.1 μF, C_{OUT} = 3.3 μF, T_j = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	12.35 V ≤ V_{IN} ≤ 26 V	11.4	12.0	12.6	V
			12.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	10.8	12.0	13.2	
Line regulation	Reg·line	—	16 V ≤ V_{IN} ≤ 23 V	—	4	50	mV
			13 V ≤ V_{IN} ≤ 26 V	—	8	100	
Load regulation	Reg·load	—	5.0 mA ≤ I_{OUT} ≤ 30 mA	—	2	120	mV
Quiescent current	I_B	—	I_{OUT} = 0 mA	—	0.8	1.5	mA
			13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 5 mA	—	1.0	1.5	
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

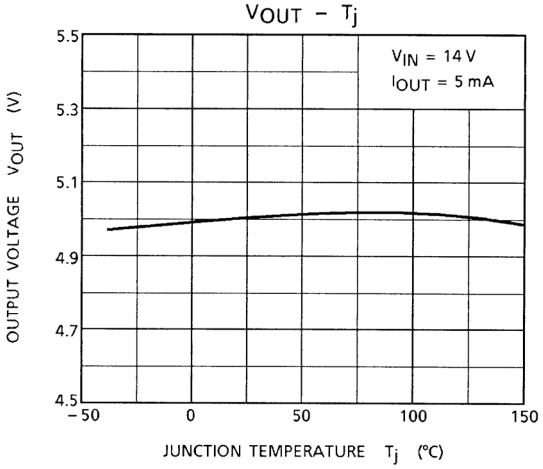
TA78DS15F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 20 V, I_{OUT} = 5 mA, C_{IN} = 0.1 μF, C_{OUT} = 3.3 μF, T_j = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	15.35 V ≤ V_{IN} ≤ 26 V	14.25	15.0	15.75	V
			15.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	13.5	15.0	16.5	
Line regulation	Reg·line	—	19 V ≤ V_{IN} ≤ 26 V	—	5	60	mV
			16 V ≤ V_{IN} ≤ 26 V	—	8	130	
Load regulation	Reg·load	—	5.0 mA ≤ I_{OUT} ≤ 30 mA	—	1	150	mV
Quiescent current	I_B	—	I_{OUT} = 0 mA	—	1.0	1.6	mA
			16 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 5 mA	—	1.2	1.6	
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

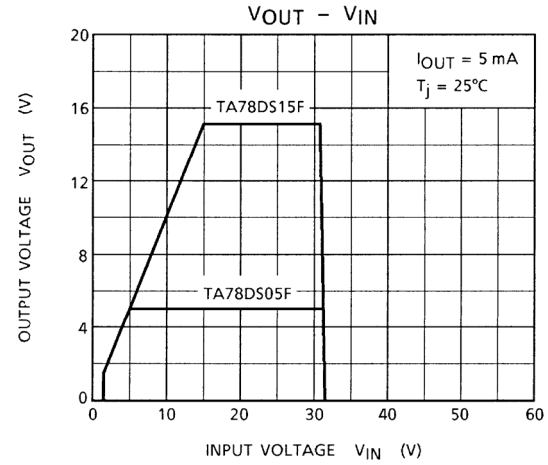
P_{Dmax} – Ta



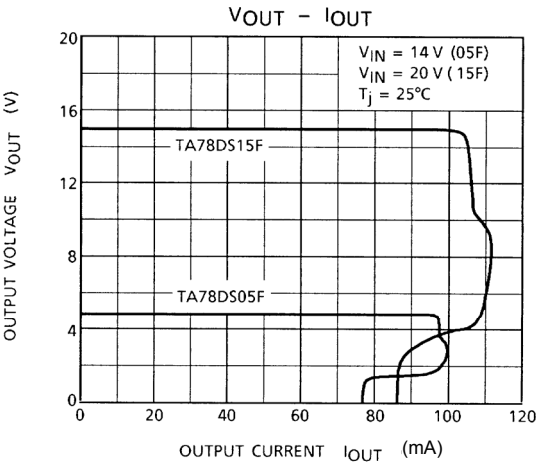
V_{OUT} – T_j



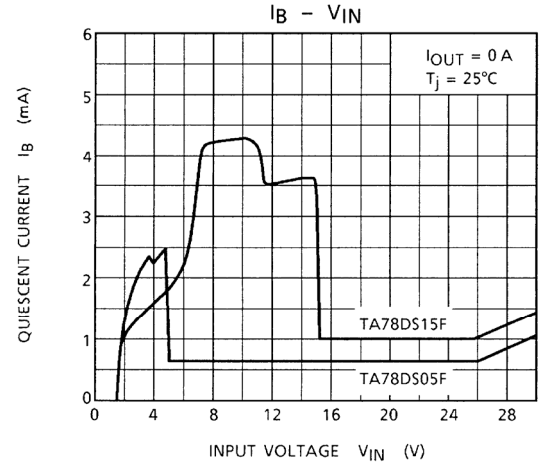
V_{OUT} – V_{IN}



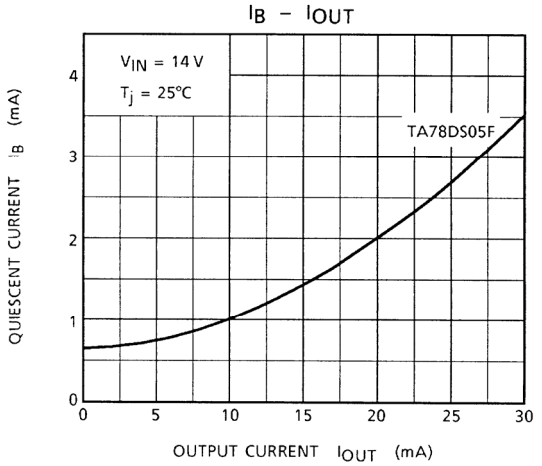
V_{OUT} – I_{OUT}



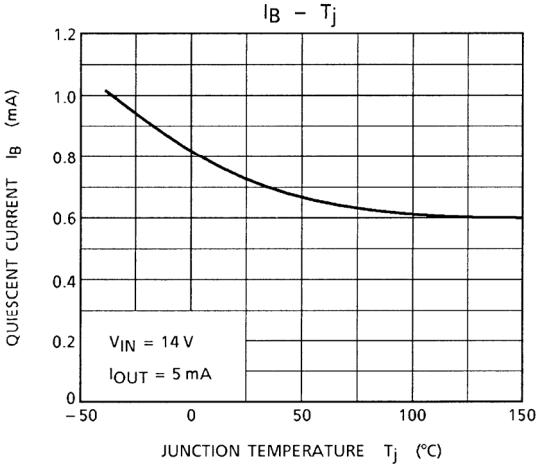
I_B – V_{IN}



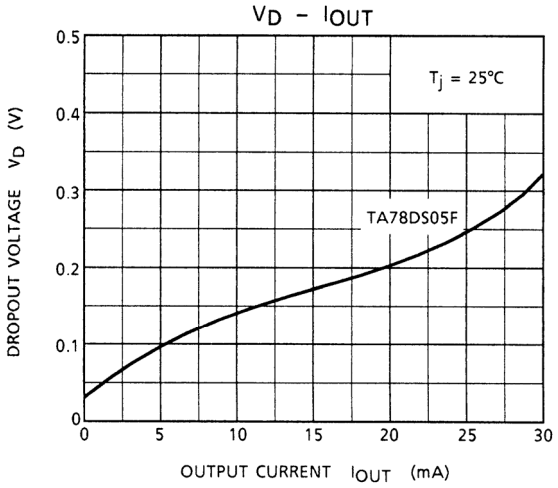
I_B – I_{OUT}



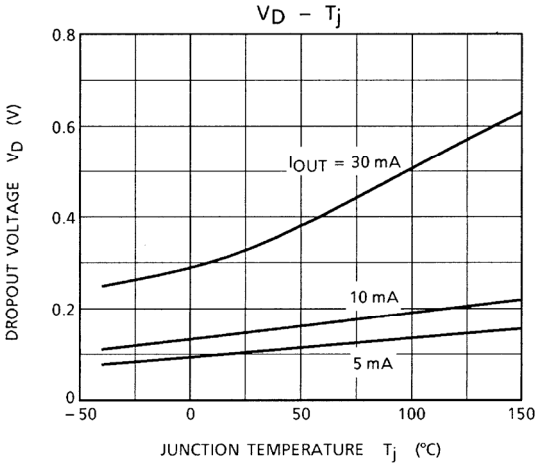
$I_B - T_j$



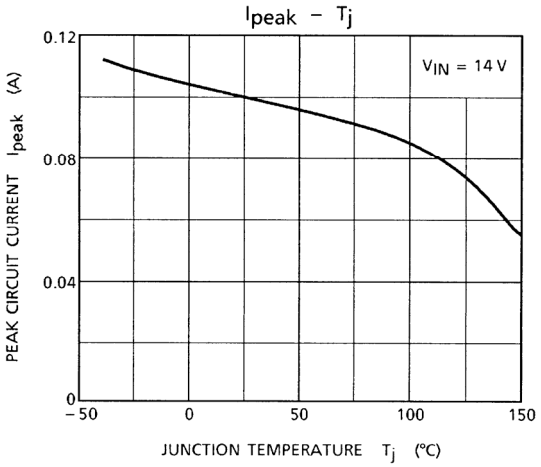
$V_D - I_{OUT}$



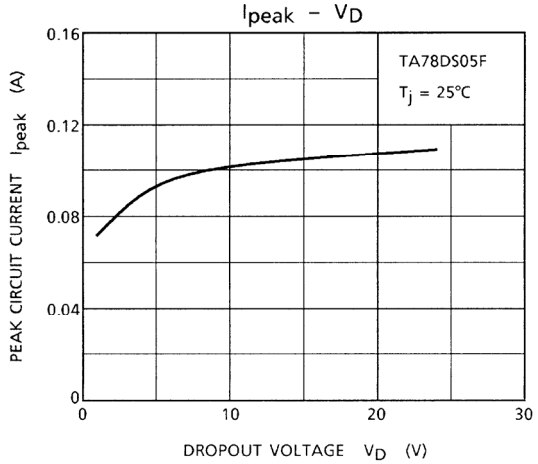
$V_D - T_j$



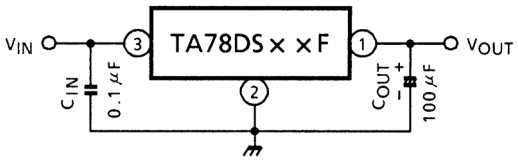
$I_{peak} - T_j$



$I_{peak} - V_D$



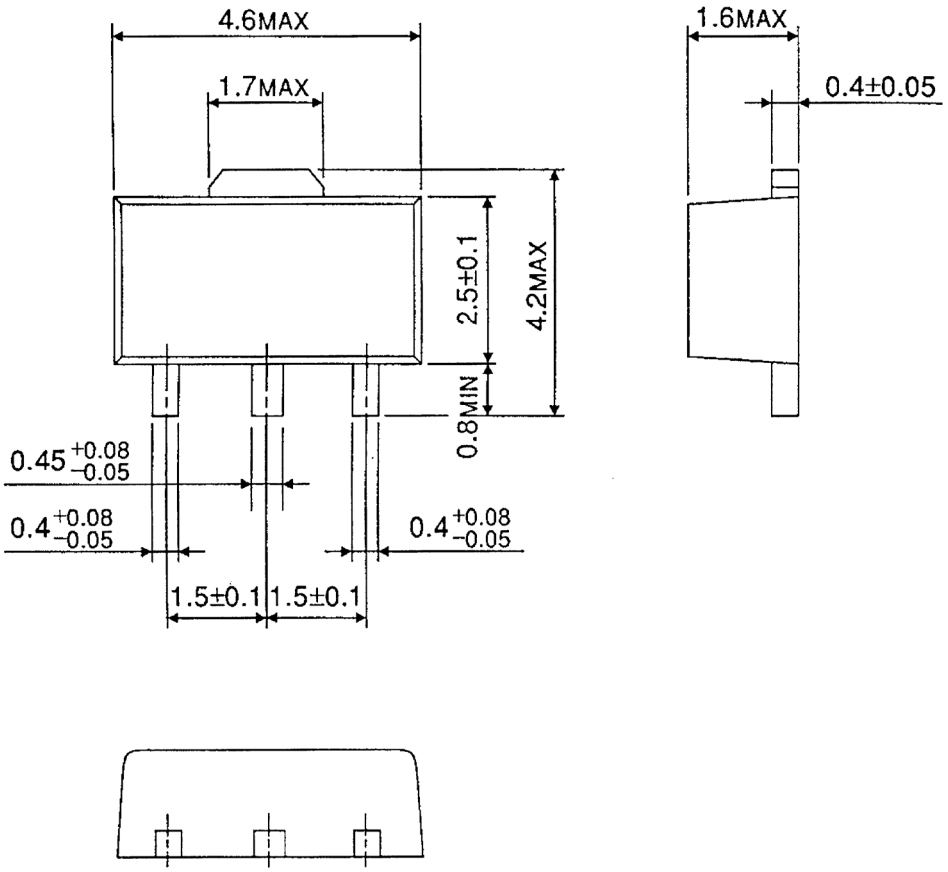
Application Circuit



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.)

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20070701-EN

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