TOSHIBA Bipolar Linear Integrated Circuit　Silicon Monolithic

TA58M05F,TA58M06F,TA58M08F,TA58M09F
TA58M10F,TA58M12F,TA58M15F

500 mA Low Dropout Voltage Regulator

The TA58M**F Series consists of fixed-positive-output, low-dropout regulators with an output current of 500 mA (max) that utilize PNP transistors for the output stage. Low dropout voltage and standby current make the TA58M**F Series suitable for applications requiring low power consumption.


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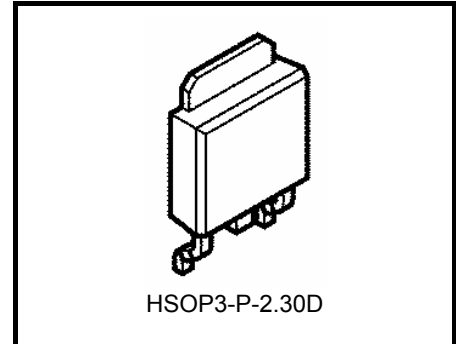
Weight: 0.36 g (typ.)

Features

- Maximum output current　: 500 mA
- Output voltage　: 5 / 6 / 8 / 9 / 10 / 12 / 15 V
- Output voltage accuracy　: $V_{OUT} \pm 3\%$ (@T_j = 25°C)
- Low-dropout voltage　: 0.65 V (Max) (@I_{OUT} = 500 mA)
- Protection function　: Overcurrent protection / overheating protection / Reverse connection of power supply / 60 V load dump
- Package type　: Surface-mount New PW-Mold

Pin Assignment

Mark

①	③	②
IN	GND	OUT
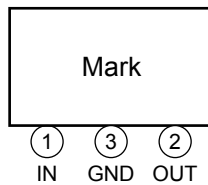
Marking
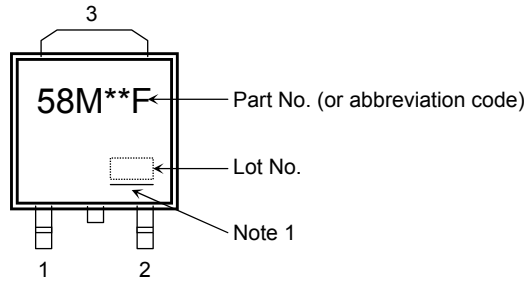
Note 1: A line under a Lot No. identifies the indication of product Labels.
Not underlined: [[Pb]]/INCLUDES > MCV
Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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.

Note 2: The "**" in each product name is replaced with the output voltage of each product.

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.

Pin Description

Pin No.	Symbol	Description
1	IN	Input terminal. Connected by capacitor (C_{IN}) to GND.
3	GND	Ground terminal
2	OUT	Output terminal. Connected by capacitor (C_{OUT}) to GND.

How to Order

Product No.	Package	Package Type and Capacity
TA58M**F(TE16L1,NQ) (Note3)	New PW-Mold: Surface-mount	Tape (2000 pcs/reel)

Note 3: The "**" in each product number is replaced with the output voltage of each product.

Block Diagram
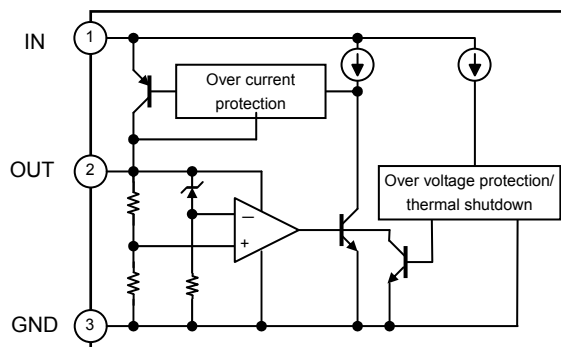
Absolute Maximum Rating (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Input voltage	DC	$V_{IN (DC)}$	29	V
	Pulse	$V_{IN (Pulse)}$	60 (τ =200 ms)	V
Output current		I_{OUT}	500	mA
Operating temperature		T_{opr}	−40 to 105	°C
Junction temperature		T_j	150	°C
Storage temperature		T_{stg}	−55 to 150	°C
Power dissipation	Ta = 25°C	P_D	1	W
	Tc = 25°C		10	

Note 4: Do not apply current and voltage (including reverse polarity) to any pin that is not specified.

Note 5: 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).

Thermal Characteristics

Characteristic	Symbol	Max	Unit
Thermal resistance, junction to ambient	$R_{th (j-a)}$	125	°C/ W
Thermal resistance, junction to case	$R_{th (j-c)}$	12.5	°C/ W

Protection Function (Reference)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Thermal shutdown	T_{SD}	V_{IN} = 14 V (05 to 06F)/ 16 V (08 to 10F)/ 18 V (12F)/ 20 V (15F)	—	170	—	°C
Thermal shutdown hysteresis width	$T_{SD(hys)}$		—	20	—	°C
Peak circuit current	I_{PEAK}	V_{IN} = 14 V (05 to 06F)/ 16 V (08 to 10F)/ 18 V (12F)/ 20 V (15F), T_j = 25°C	—	1	—	A
Short circuit current	I_{SC}	V_{IN} = 14 V (05 to 06F)/ 16 V (08 to 10F)/ 18 V (12F)/ 20 V (15F), T_j = 25°C	—	600	—	mA
Overvoltage protection	V_{IN}	T_j = 25°C	29	33	—	V

Note 6: Ensure that the devices operate within the limits of the maximum rating when in actual use.

Note 7: When the input voltage exceeds 29 V, the overvoltage protection circuit is activated to turn off the output voltage.

TA58M05F
Electrical Characteristics (unless otherwise specified, T_j = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 14 V, I_{OUT} = 250 mA	4.85	5.00	5.15	V
		6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA, -40°C ≤ T_j ≤ 105°C	4.8	5.0	5.2	
Line regulation	Reg·line	9 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 250 mA	—	2	20	mV
		6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	5	30	
Load regulation	Reg·load	V_{IN} = 14 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	20	60	mV
Quiescent current	I_B	6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	0.5	1.0	mA
		6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	35	80	
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.22	0.35	V
		I_{OUT} = 500 mA	—	0.42	0.65	

TA58M06F
Electrical Characteristics (unless otherwise specified, T_j = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 14 V, I_{OUT} = 250 mA	5.82	6.00	6.18	V
		7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA, -40°C ≤ T_j ≤ 105°C	5.76	6.00	6.24	
Line regulation	Reg·line	10 V ≤ V_{IN} ≤ 17 V, I_{OUT} = 250 mA	—	2	20	mV
		7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	5	30	
Load regulation	Reg·load	V_{IN} = 14 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	20	60	mV
Quiescent current	I_B	7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	0.5	1.0	mA
		7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	35	80	
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.22	0.35	V
		I_{OUT} = 500 mA	—	0.42	0.65	

TA58M08F
Electrical Characteristics (unless otherwise specified, T_j = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 16 V, I_{OUT} = 250 mA	7.76	8.00	8.24	V
		9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA, -40°C ≤ T_j ≤ 105°C	7.68	8.00	8.32	
Line regulation	Reg·line	12 V ≤ V_{IN} ≤ 19 V, I_{OUT} = 250 mA	—	2	20	mV
		9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	5	30	
Load regulation	Reg·load	V_{IN} = 16 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	20	70	mV
Quiescent current	I_B	9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	0.5	1.0	mA
		9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	35	80	
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.22	0.35	V
		I_{OUT} = 500 mA	—	0.42	0.65	

TA58M09F
Electrical Characteristics (unless otherwise specified, T_j = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 16 V, I_{OUT} = 250 mA	8.73	9.00	9.27	V
		10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA, -40°C ≤ T_j ≤ 105°C	8.64	9.00	9.36	
Line regulation	Reg·line	13 V ≤ V_{IN} ≤ 20 V, I_{OUT} = 250 mA	—	2	20	mV
		10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	5	30	
Load regulation	Reg·load	V_{IN} = 16 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	20	70	mV
Quiescent current	I_B	10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	0.6	1.0	mA
		10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	35	80	
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.22	0.35	V
		I_{OUT} = 500 mA	—	0.42	0.65	

TA58M10F
Electrical Characteristics (unless otherwise specified, T_j = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 16 V, I_{OUT} = 250 mA	9.7	10.0	10.3	V
		11 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA, -40°C ≤ T_j ≤ 105°C	9.6	10.0	10.4	
Line regulation	Reg·line	14 V ≤ V_{IN} ≤ 21 V, I_{OUT} = 250 mA	—	2	30	mV
		11 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	5	40	
Load regulation	Reg·load	V_{IN} = 16 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	20	80	mV
Quiescent current	I_B	11 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	0.6	1.2	mA
		11 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	35	80	
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.22	0.35	V
		I_{OUT} = 500 mA	—	0.42	0.65	

TA58M12F
Electrical Characteristics (unless otherwise specified, T_j = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 18 V, I_{OUT} = 250 mA	11.64	12.00	12.36	V
		13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA, -40°C ≤ T_j ≤ 105°C	11.52	12.00	12.48	
Line regulation	Reg·line	16 V ≤ V_{IN} ≤ 23 V, I_{OUT} = 250 mA	—	2	30	mV
		13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	5	40	
Load regulation	Reg·load	V_{IN} = 18 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	20	80	mV
Quiescent current	I_B	13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	0.7	1.2	mA
		13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	35	80	
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.22	0.35	V
		I_{OUT} = 500 mA	—	0.42	0.65	

TA58M15F
Electrical Characteristics (unless otherwise specified, T_j = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 20 V, I_{OUT} = 250 mA	14.55	15.00	15.45	V
		16 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA, -40°C ≤ T_j ≤ 105°C	14.4	15.0	15.6	
Line regulation	Reg·line	19 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	2	30	mV
		16 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 250 mA	—	5	40	
Load regulation	Reg·load	V_{IN} = 20 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	30	100	mV
Quiescent current	I_B	16 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	0.7	1.4	mA
		16 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	35	80	
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.22	0.35	V
		I_{OUT} = 500 mA	—	0.42	0.65	

Electrical Characteristics Common to All Products

- $T_j = 25°C$ in the measurement conditions of each item is a regulation for where the standard condition when a pulse test is carried out, and any drift in the electrical characteristic due to a rise in the junction temperature of the chip may be disregarded.
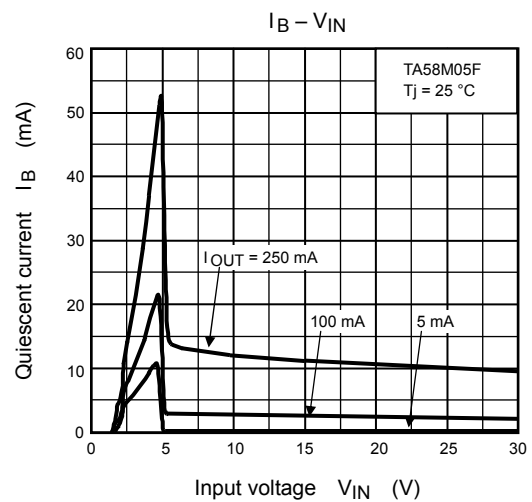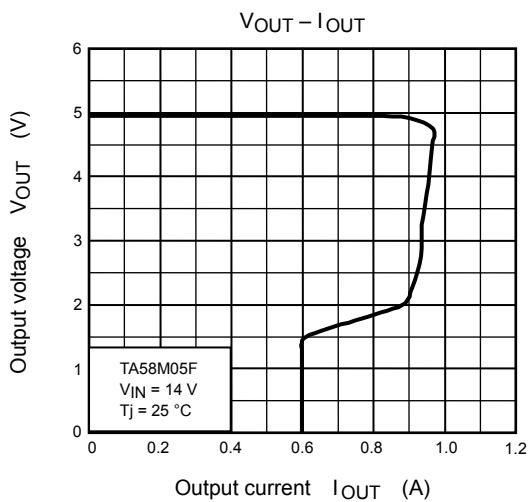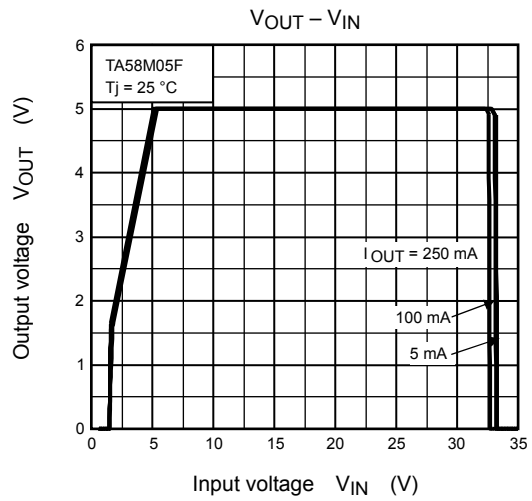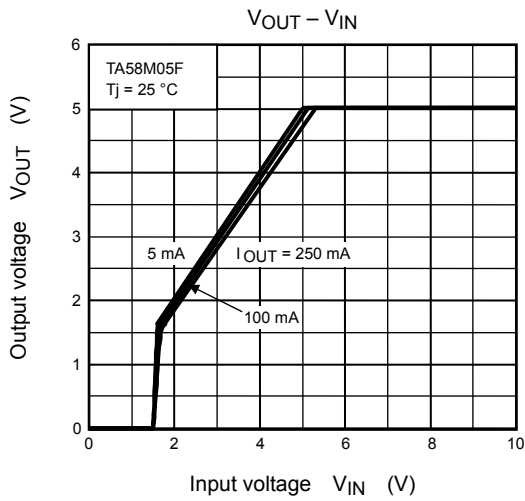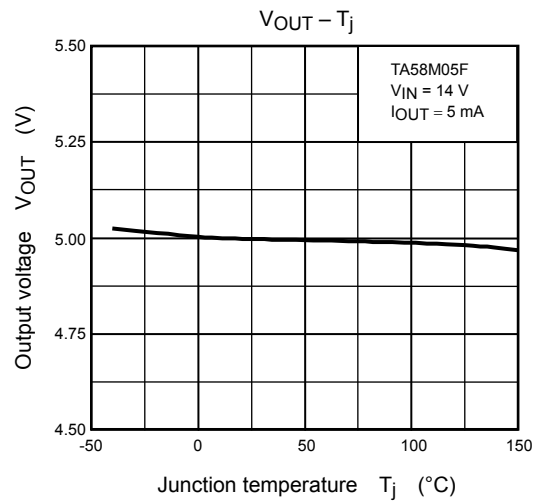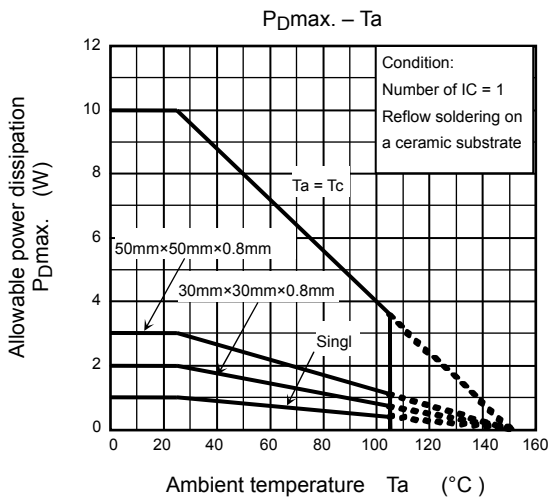
Standard Application Circuit
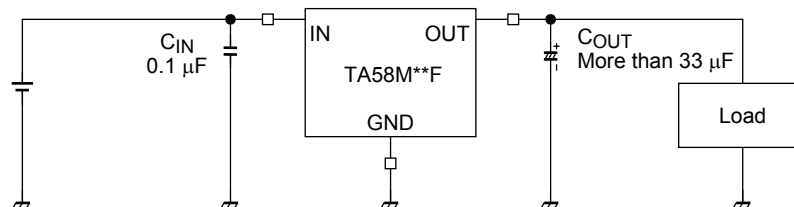
- Place C_{IN} as close as possible to the input terminal and GND. Place C_{OUT} as close as possible to the output terminal and GND. Although capacitor C_{OUT} acts to smooth the dc output voltage during suspension of output oscillation or load change, it might cause output oscillation in a cold environment due to increased capacitor ESR. It is therefore recommended to use a capacitor with small variations temperature sensitivity. The IC may oscillate due to external conditions (output current, temperature, or the type of the capacitor used). The type of capacitor required must be determined by the actual application circuit in which the IC is used.

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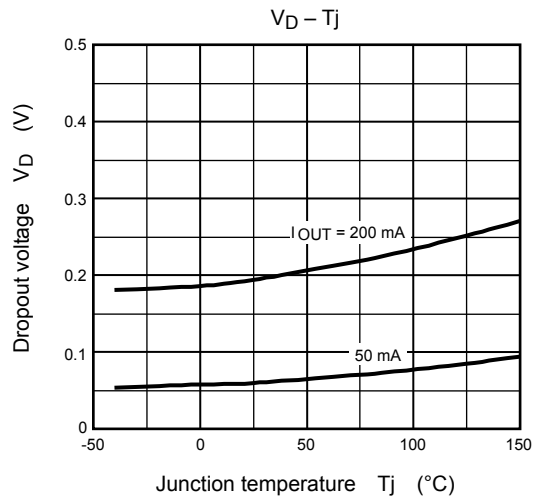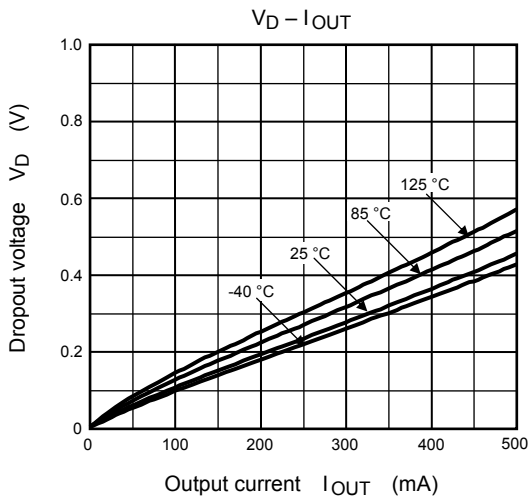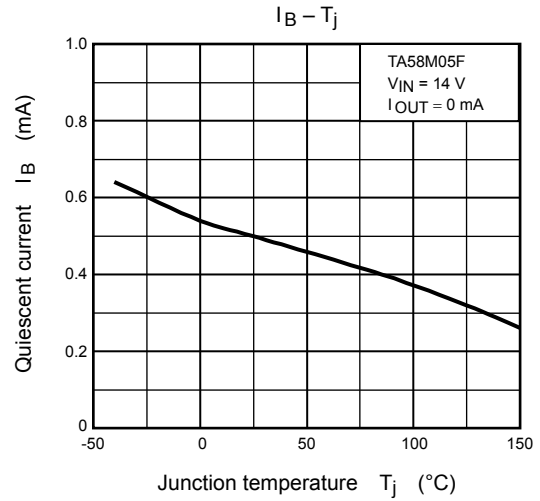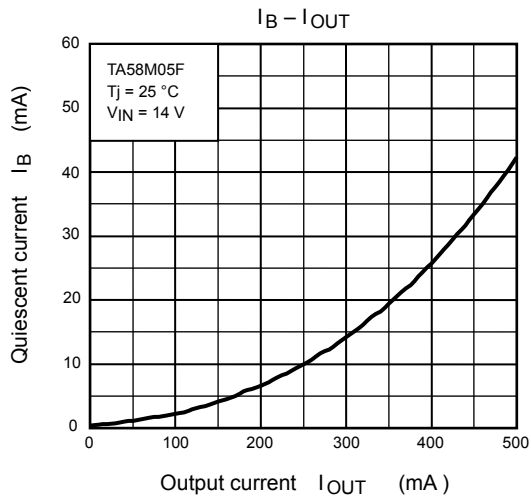 activates, immediately cease application of overcurrent to Product. Improper usage of Product, such as application of current to Product exceeding the absolute maximum ratings, could cause the overcurrent protection circuit not to operate properly and/or damage Product permanently even before the protection 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.

$P_D$max. – Ta

Allowable power dissipation $P_D$max. (W) vs Ambient temperature Ta (°C)

Condition:
Number of IC = 1
Reflow soldering on a ceramic substrate

Ta = Tc

50mm×50mm×0.8mm

30mm×30mm×0.8mm

Singl

$V_{OUT} – T_j$

Output voltage V_{OUT} (V) vs Junction temperature T_j (°C)

TA58M05F
V_{IN} = 14 V
I_{OUT} = 5 mA

$V_{OUT} – V_{IN}$

Output voltage V_{OUT} (V) vs Input voltage V_{IN} (V)

TA58M05F
T_j = 25 °C

5 mA I_{OUT} = 250 mA

100 mA

$V_{OUT} – V_{IN}$

Output voltage V_{OUT} (V) vs Input voltage V_{IN} (V)

TA58M05F
T_j = 25 °C

I_{OUT} = 250 mA

100 mA

5 mA

$V_{OUT} – I_{OUT}$

Output voltage V_{OUT} (V) vs Output current I_{OUT} (A)

TA58M05F
V_{IN} = 14 V
T_j = 25 °C

$I_B – V_{IN}$

Quiescent current I_B (mA) vs Input voltage V_{IN} (V)

TA58M05F
T_j = 25 °C

I_{OUT} = 250 mA

100 mA   5 mA

$I_B - I_{OUT}$

TA58M05F
Tj = 25 °C
V_{IN} = 14 V

Quiescent current I_B (mA) vs Output current I_{OUT} (mA)

$I_B - T_j$

TA58M05F
V_{IN} = 14 V
I_{OUT} = 0 mA

Quiescent current I_B (mA) vs Junction temperature T_j (°C)

$V_D - I_{OUT}$

125 °C
85 °C
25 °C
-40 °C

Dropout voltage V_D (V) vs Output current I_{OUT} (mA)

$V_D - T_j$

I_{OUT} = 200 mA
50 mA

Dropout voltage V_D (V) vs Junction temperature T_j (°C)

$I_{PEAK} - T_j$

TA58M05F
V_{IN} = 14 V

Peak output current I_{PEAK} (A) vs Junction temperature T_j (°C)

$I_{PEAK} - V_D$

TA58M05F
Tj = 25 °C

Peak output current I_{PEAK} (A) vs Dropout voltage V_D (V)

2009-09-30

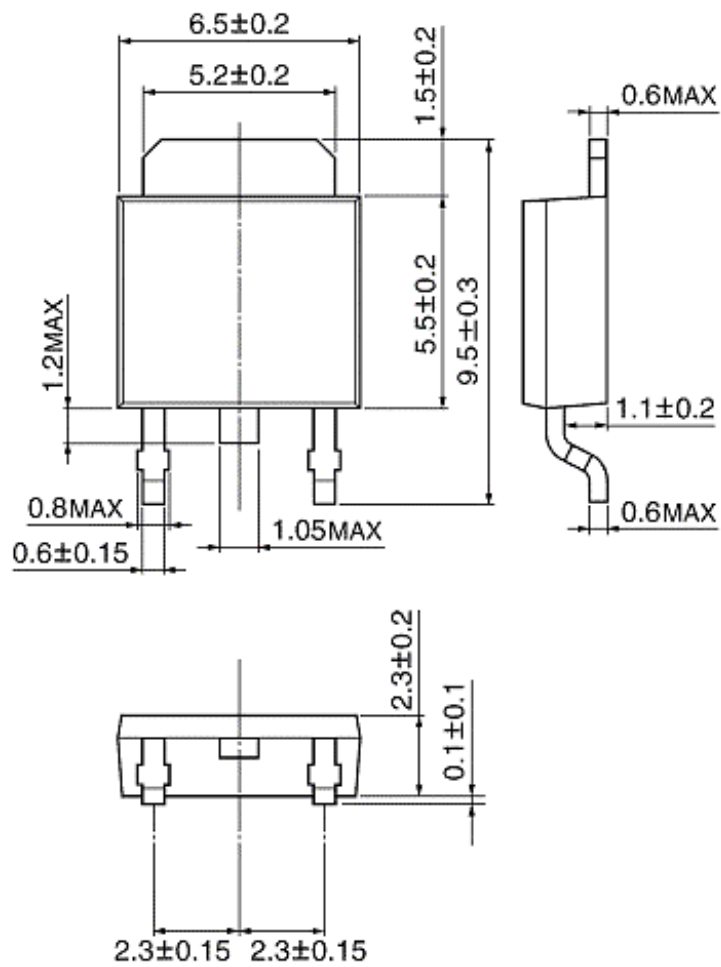## Package Dimensions

HSOP-3-P-2.30D   Unit: mm

Weight: 0.36 g (typ.)

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