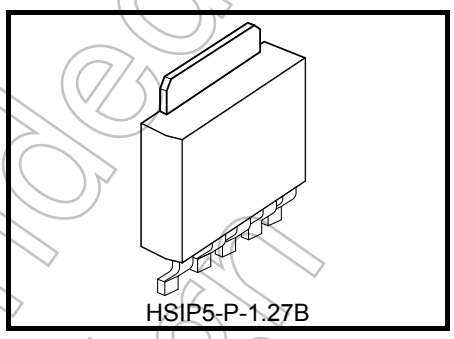
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA58MS033F,TA58MS05F, TA58MS06F, TA58MS08F,TA58MS09F, TA58MS12F

500-mA Low Dropout Voltage Regulators with ON/OFF Control Switch

The TA58MS**F are small surface-mount low-dropout voltage regulators that provide up to 500mA of output current and an on/off control switch. The EN input can be used to turn on and off the device as necessary and thus helps save system power. The TA58MS**F are suitable for applications requiring low power consumption due to low-dropout voltage and low standby current.

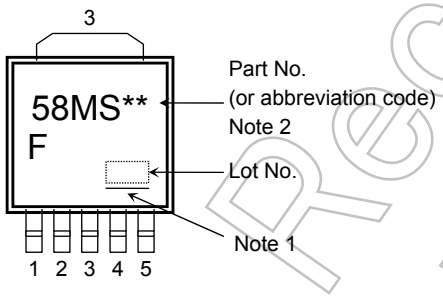


Weight : 0.36 g (Typ.)

Features

- Active-High on/off switch
- Up to 500-mA output current
- Output voltages: 3.3 / 5 / 6 / 8 / 9 / 12 V
- Output voltage accuracy: V_{OUT} ± 3% (@T_j = 25°C)
- Low quiescent current: 2.5 mA typ. (@I_{OUT} = 0 A)
- Low standby current (output OFF mode): 1.0μA (max)
- Low-dropout voltage: 0.7 V (max) (@I_{OUT} = 500 mA) except the TA58MS033F
- Overcurrent protection / thermal shutdown / 60V load dump protection / overvoltage protection
- Package: 5-pin New PW-Mold (surface-mount)

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 2011/65/EU of the European Parliament and of the Council of 8 June 2011 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.

Start of commercial production
2007-10

Pin Description

Pin No.	Symbol	Description
1	IN	Input terminal. Connect a capacitor (C_{IN}) from this pin to ground.
2	EN	Output on/off control. The output turns on when EN is set High and turns off when it is open (undriven) or set Low.
3	GND	Ground
4	NC	No-connect (Note3)
5	OUT	Output terminal. Connected by capacitor (C_{OUT}) to GND.

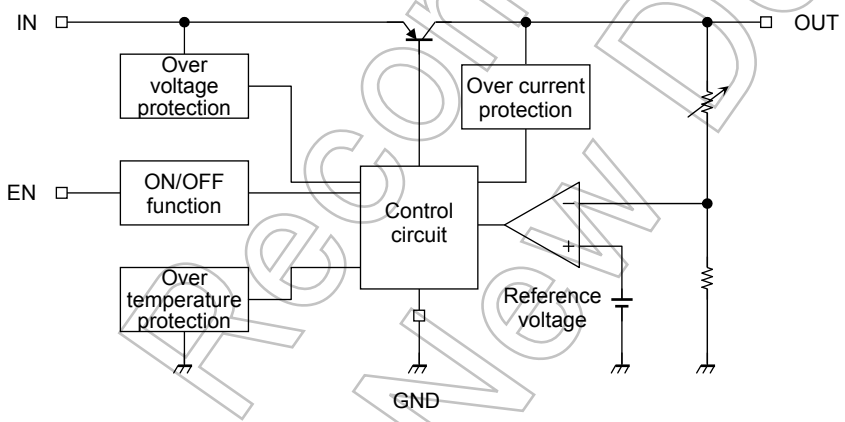
Note 3: Do not apply current and voltage (including reverse polarity) to the NC pin that is not specified.

How to Order

Part Number	Package	Shipping
TA58MS**F (TE16L1,Q (Note4)	5-pin New PW-Mold (surface-mount)	Tape (2000 pcs/reel)
TA58MS033F (TE16L1Q	5-pin New PW-Mold (surface-mount)	Tape (2000 pcs/reel)

Note 4: The "**" in part numbers represents the output voltage except the TA58M0033F.

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 =200ms, once)	V
EN Input voltage		V_{EN}	$V_{IN\ (DC)}$	V
Output current		I_{OUT}	500	mA
Operating junction temperature		$T_{j\,opr}$	−40 to150	°C
Junction temperature		T_j	150	°C
Storage temperature		T_{stg}	−55 to150	°C
Power dissipation	Ta = 25°C	P_D	1	W
	Tc= 25°C		10	

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 (033 to 06F) / 16 V (08 to 09F) /18 V (12F), I_{OUT} = 5 mA	—	175	—	°C
Peak output current	I_{PEAK}	V_{IN} = 14 V (033 to 06F) / 16 V (08 to 09F) / 18 V (12F), T_j = 25°C	—	1	—	A
Short-circuit current	I_{SC}	V_{IN} = 14 V (033 to 06F) / 16 V (08 to 09F) / 18 V (12F), T_j = 25°C	—	0.1	—	A
Overvoltage protection (Note 7)	V_{OV}	T_j = 25°C	29	45	—	V

Note 6: Protection features do not guarantee that the device will be kept below the absolute maximum rated conditions. Ensure that the device will not be exposed to conditions exceeding the absolute maximum ratings.

Note 7: The overvoltage protection circuit shuts down the voltage output.

TA58MS033F

Electrical Characteristics (unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 14 V, I_{OUT} = 10 mA	3.201	3.3	3.399	V
		5 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA, -40°C ≦ T_j ≤ 105°C	3.168	3.3	3.432	
Line regulation	Reg·line	4.5 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA	—	3	20	mV
Load regulation	Reg·load	V_{IN} = 14 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	10	30	mV
Quiescent current	I_B	4.5 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	2.5	5.0	mA
		4.5 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	30	50	
Quiescent current (Off mode)	$I_{B(OFF)}$	4.5 V ≤ V_{IN} ≤ 26 V, V_{EN} = 0.4 V	—	0.1	1.0	μA
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.9	1.3	V
		I_{OUT} = 500 mA	—	0.9	1.3	
Output control voltage (ON)	$V_{EN(ON)}$	—	2	—	—	V
Output control voltage (OFF)	$V_{EN(OFF)}$	—	—	—	0.8	V
Output control current (ON)	$I_{EN(ON)}$	V_{IN} = 14 V, V_{EN} = 5 V	—	125	175	μA

TA58MS05F

Electrical Characteristics (unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 14 V, I_{OUT} = 10 mA	4.85	5.00	5.15	V
		6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA, -40°C ≤ T_j ≤ 105°C	4.8	5.0	5.2	
Line regulation	Reg·line	6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA	—	3	20	mV
Load regulation	Reg·load	V_{IN} = 14 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	10	30	mV
Quiescent current	I_B	6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	2.5	5.0	mA
		6 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	30	50	
Quiescent current (Off mode)	$I_{B(OFF)}$	6 V ≤ V_{IN} ≤ 26 V, V_{EN} = 0.4 V	—	0.1	1.0	μA
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.3	0.4	V
		I_{OUT} = 500 mA	—	0.5	0.7	
Output control voltage (ON)	$V_{EN(ON)}$	—	2	—	—	V
Output control voltage (OFF)	$V_{EN(OFF)}$	—	—	—	0.8	V
Output control current (ON)	$I_{EN(ON)}$	V_{IN} = 14 V, V_{EN} = 5 V	—	125	175	μA

TA58MS06F

Electrical Characteristics (unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 14 V, I_{OUT} = 10 mA	5.82	6.00	6.18	V
		7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA, -40°C ≤ T_j ≤ 105°C	5.76	6.00	6.24	
Line regulation	Reg·line	7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA	—	3	20	mV
Load regulation	Reg·load	V_{IN} = 14 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	10	30	mV
Quiescent current	I_B	7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	2.5	5.0	mA
		7 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	30	50	
Quiescent current (Off mode)	$I_{B(OFF)}$	7 V ≤ V_{IN} ≤ 26 V, V_{EN} = 0.4 V	—	0.1	1.0	μA
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.3	0.4	V
		I_{OUT} = 500 mA	—	0.5	0.7	
Output control voltage (ON)	$V_{EN(ON)}$	—	2	—	—	V
Output control voltage (OFF)	$V_{EN(OFF)}$	—	—	—	0.8	V
Output control current (ON)	$I_{EN(ON)}$	V_{IN} = 14 V, V_{EN} = 5 V	—	125	175	μA

TA58MS08F

Electrical Characteristics (unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 16 V, I_{OUT} = 10 mA	7.76	8.00	8.24	V
		9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA, -40°C ≤ T_j ≤ 105°C	7.68	8.00	8.32	
Line regulation	Reg·line	9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA	—	3	20	mV
Load regulation	Reg·load	V_{IN} = 16 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	10	30	mV
Quiescent current	I_B	9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	2.5	5.0	mA
		9 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	30	50	
Quiescent current (Off mode)	$I_{B(OFF)}$	9 V ≤ V_{IN} ≤ 26 V, V_{EN} = 0.4 V	—	0.1	1.0	μA
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.3	0.4	V
		I_{OUT} = 500 mA	—	0.5	0.7	
Output control voltage (ON)	$V_{EN(ON)}$	—	2	—	—	V
Output control voltage (OFF)	$V_{EN(OFF)}$	—	—	—	0.8	V
Output control current (ON)	$I_{EN(ON)}$	V_{IN} = 16 V, V_{EN} = 5 V	—	125	175	μA

TA58MS09F

Electrical Characteristics (unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 16 V, I_{OUT} = 10 mA	8.73	9.00	9.27	V
		10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA, -40°C ≤ T_j ≤ 105°C	8.64	9.00	9.36	
Line regulation	Reg·line	10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA	—	3	20	mV
Load regulation	Reg·load	V_{IN} = 16 V, 5 mA ≦ I_{OUT} ≦ 500 mA	—	10	30	mV
Quiescent current	I_B	10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	2.5	5.0	mA
		10 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	30	50	
Quiescent current (Off mode)	$I_{B(OFF)}$	10 V ≤ V_{IN} ≤ 26 V, V_{EN} = 0.4 V	—	0.1	1.0	μA
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.3	0.4	V
		I_{OUT} = 500 mA	—	0.5	0.7	
Output control voltage (ON)	$V_{EN(ON)}$	—	2	—	—	V
Output control voltage (OFF)	$V_{EN(OFF)}$	—	—	—	0.8	V
Output control current (ON)	$I_{EN(ON)}$	V_{IN} = 16 V, V_{EN} = 5 V	—	125	175	μA

TA58MS12F

Electrical Characteristics (unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 1$ μF, $C_{OUT} = 10$ μF, $T_j = 25°C$)

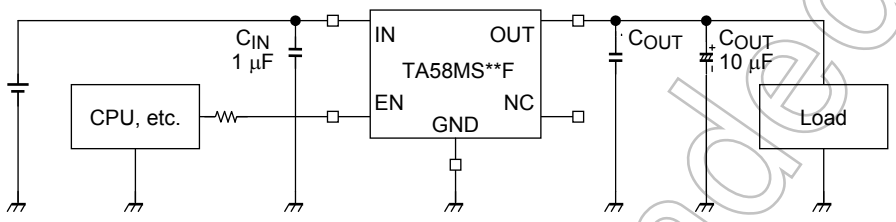
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 18 V, I_{OUT} = 10 mA	11.64	12.00	12.36	V
		13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA, -40°C ≤ T_j ≤ 105°C	11.52	12.00	12.48	
Line regulation	Reg·line	13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 10 mA	—	3	20	mV
Load regulation	Reg·load	V_{IN} = 18 V, 5 mA ≤ I_{OUT} ≤ 500 mA	—	10	30	mV
Quiescent current	I_B	13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 0 A	—	2.5	5.0	mA
		13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 500 mA	—	30	50	
Quiescent current (Off mode)	$I_{B(OFF)}$	13 V ≤ V_{IN} ≤ 26 V, V_{EN} = 0.4 V	—	0.1	1.0	μA
Dropout voltage	V_D	I_{OUT} = 250 mA	—	0.3	0.4	V
		I_{OUT} = 500 mA	—	0.5	0.7	
Output control voltage (ON)	$V_{EN(ON)}$	—	2	—	—	V
Output control voltage (OFF)	$V_{EN(OFF)}$	—	—	—	0.8	V
Output control current (ON)	$I_{EN(ON)}$	V_{IN} = 18 V, V_{EN} = 5 V	—	125	175	μA

Note on Electrical Characteristics

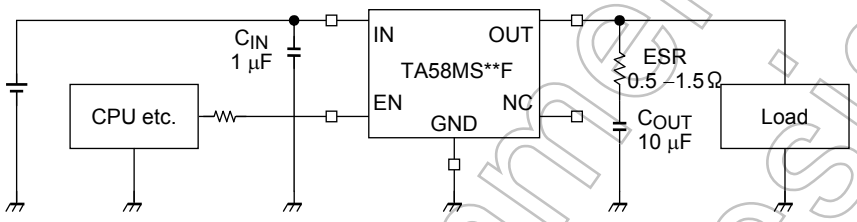
The test condition T_j = 25°C means a state where any drifts in electrical characteristics incurred by an increase in the chip's junction temperature can be ignored during pulse testing.

Standard Application Circuit

< Example using an electrolytic capacitor for C_{OUT} >



< Example using only a single ceramic capacitor for C_{OUT} >



- Connect input and output capacitors (C_{IN} and C_{OUT}) from the IN and OUT pins to ground respectively. Place these capacitors as close as possible to the device pins. C_{OUT} is used to prevent output oscillation and stabilize operation over load variations. However, in a cold environment, the output might oscillate due to a decrease in its capacitance and/or an increase in ESR (equivalent series resistance). It is therefore recommended to use a capacitor whose capacitance and ESR values do not vary greatly with environmental conditions or hours of use. A ceramic capacitor with very small ESR might cause output oscillation if used alone, depending on usage conditions. To reduce the risk of oscillation, electrolytic and ceramic capacitors should be connected in parallel, or a resistor equivalent to the ESR should be connected in series with a ceramic capacitor, as shown above. The output might still oscillate, depending on external conditions such as the capacitor and ESR values, input voltage, output current, temperature and so on. Therefore, appropriate capacitor(s) and resistor should be selected through experimentation using an actual board in which the TA58MS**F will be used.

Precautions for use

- Note that, depending on the load conditions, an abrupt change in the input voltage (V_{IN}) may cause a transient rise in output voltage (V_{OUT}) even if the EN (enable) pin is Low.

- 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.

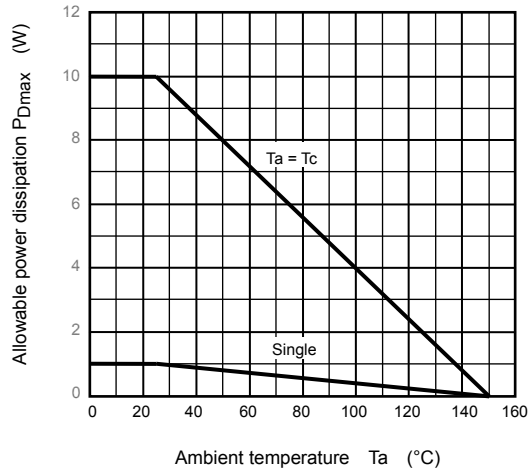
- Overheating Protection

  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.

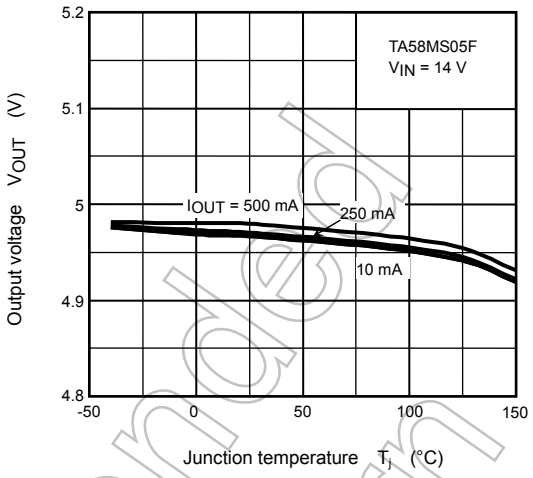
- Overvoltage Protection

  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.

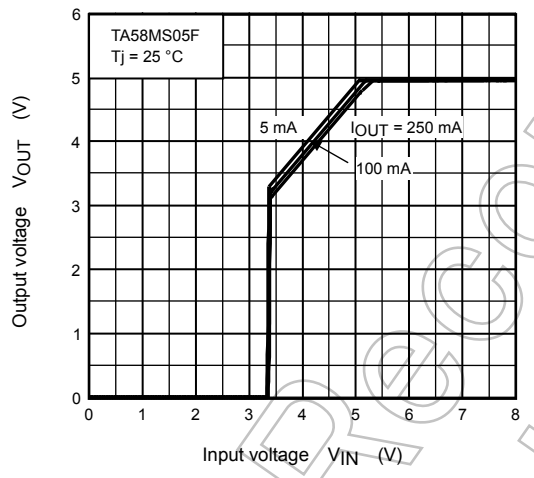
$P_D$max. – Ta



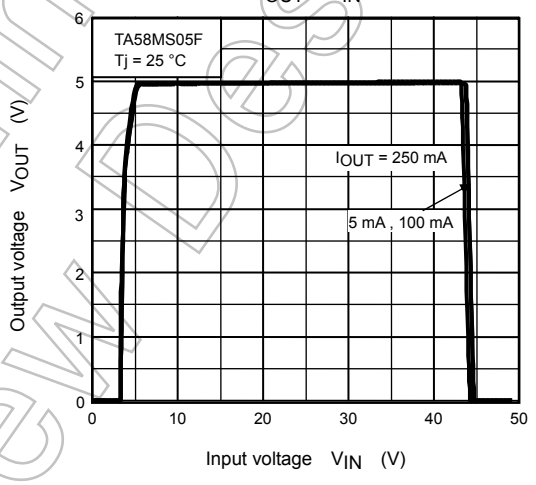
V_{OUT} – T_j



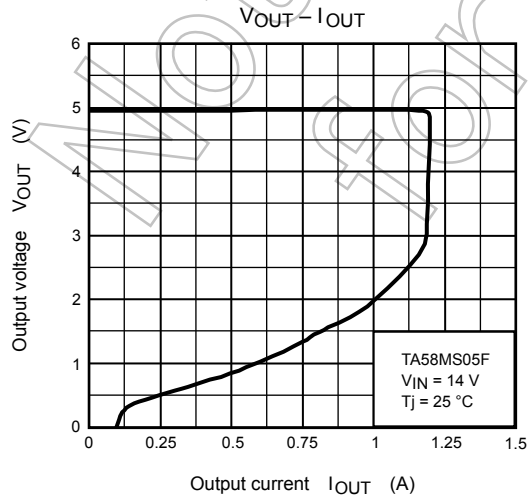
V_{OUT} – V_{IN}



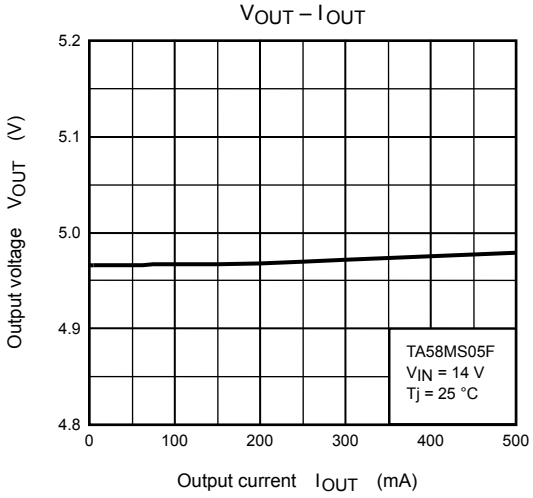
V_{OUT} – V_{IN}



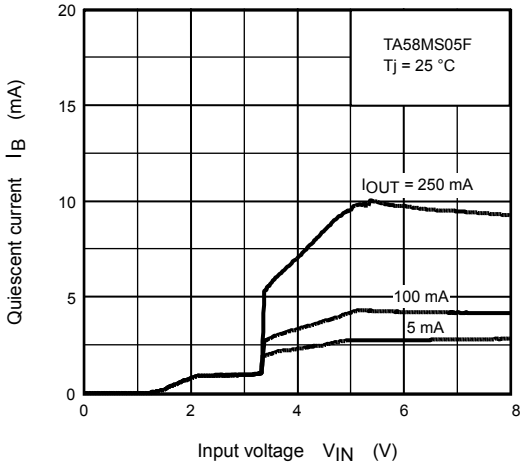
V_{OUT} – I_{OUT}



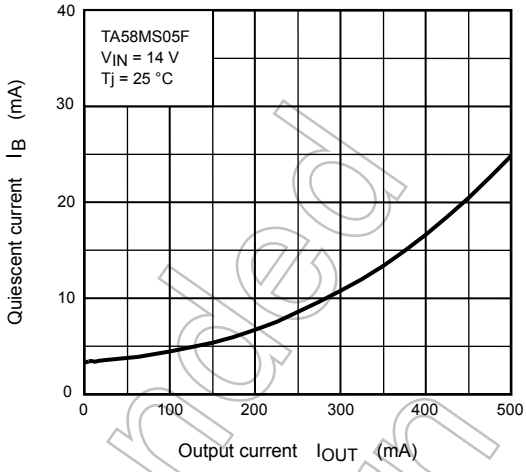
V_{OUT} – I_{OUT}



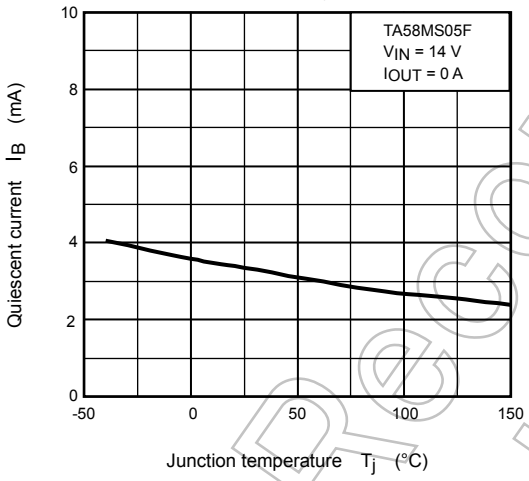
$I_B - V_{IN}$



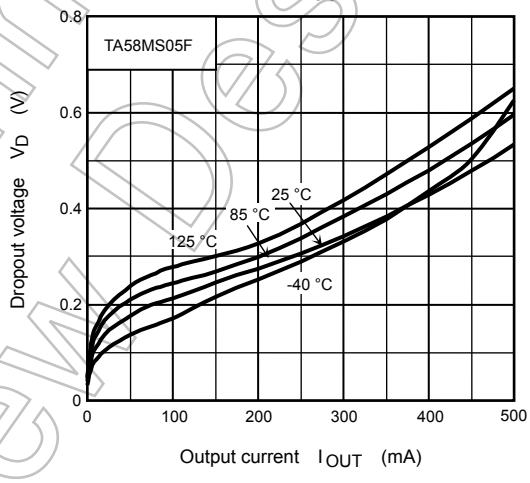
$I_B - I_{OUT}$



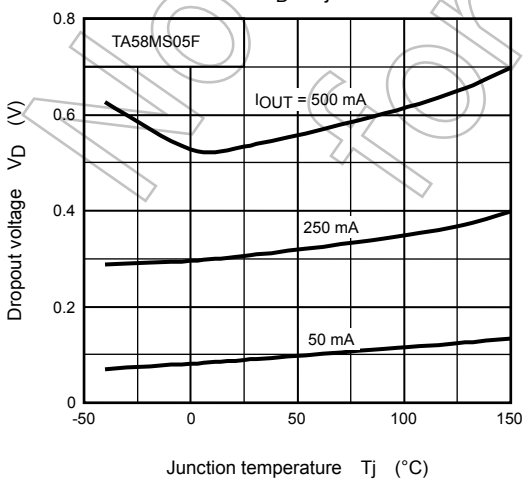
$I_B - T_j$



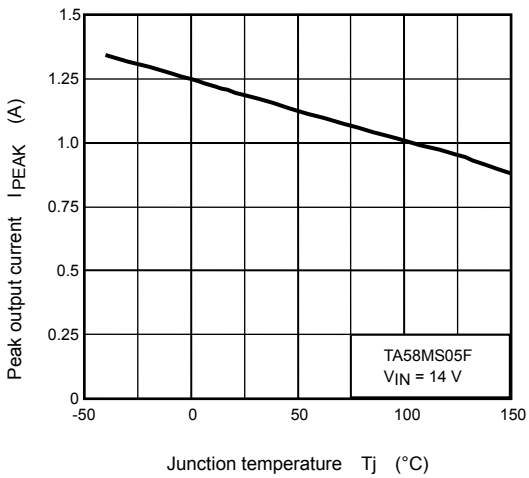
$V_D - I_{OUT}$



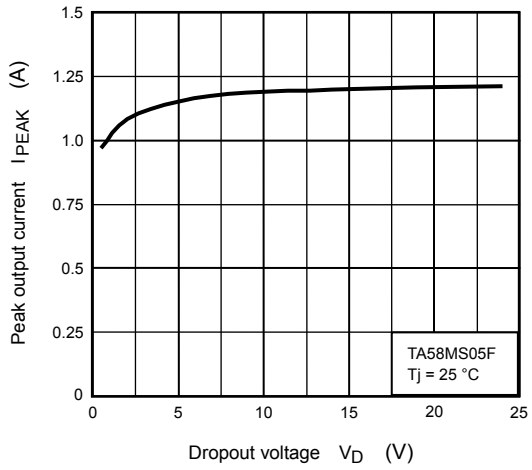
$V_D - Tj$



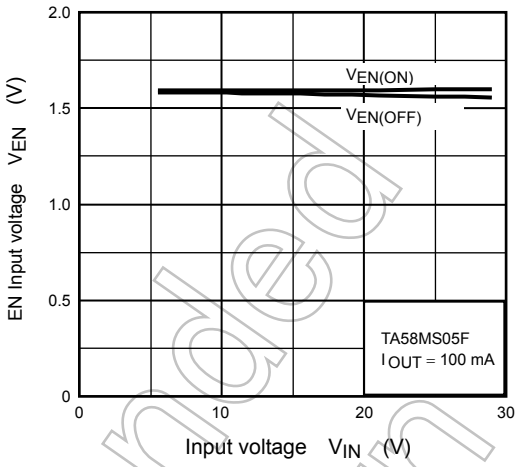
$I_{PEAK} - Tj$



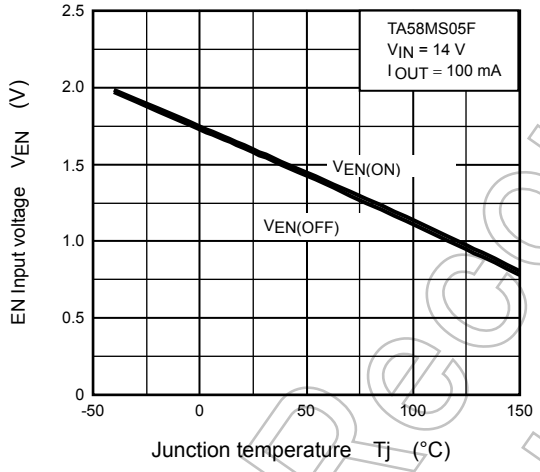
$I_{PEAK} - V_D$



$V_{EN} - V_{IN}$

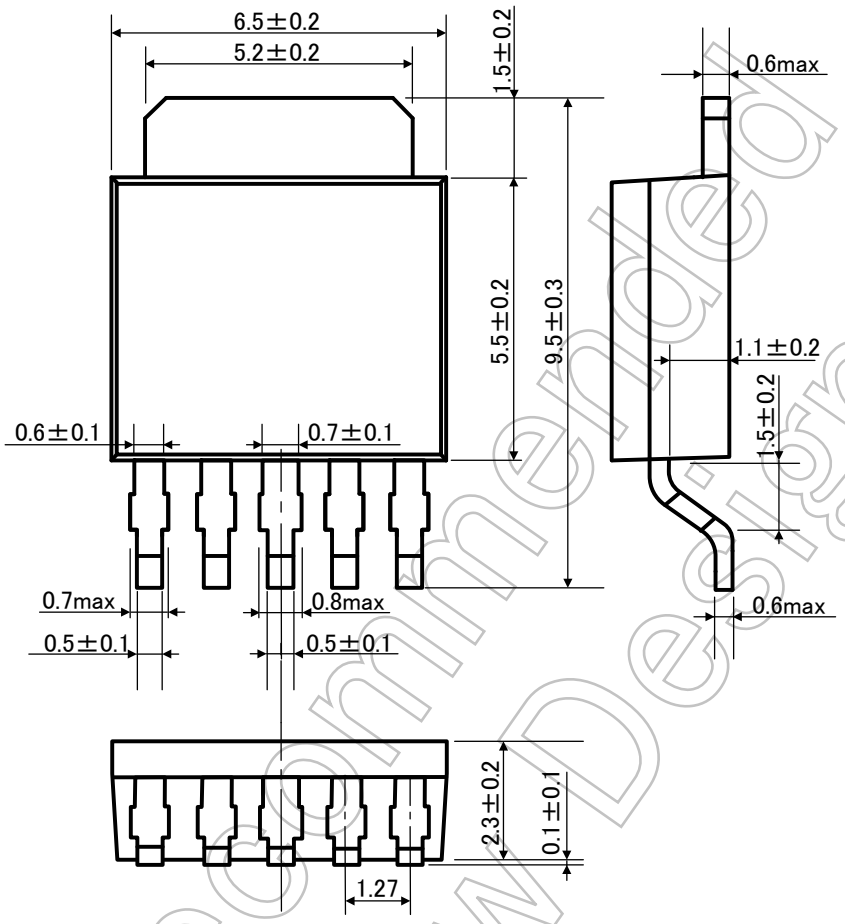


$V_{EN} - Tj$



Package Dimensions

HSIP5-P-1.27B Unit: mm



Weight: 0.36 g (Typ.)

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