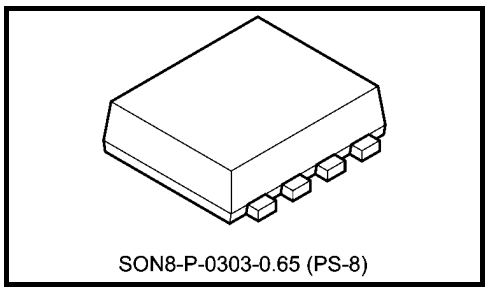
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA48LS015F,TA48LS018F,TA48LS025F,TA48LS033F,TA48LS05F

300 mA Output Current and Low Dropout Voltage Regulator with ON/OFF Control Switch

The TA48LS***F series consists of small-surface mount type low-dropout regulators with an output current of 300 mA (maximum) and an ON/OFF control switch. Control by an EN (ON/OFF) terminal enables the regulator to be operated only when required (output ON).
Therefore these newly developed regulators are suitable for use in the power supply circuits of AV, OA and other digital devices equipped with a stand-by function, and of battery-operated portable data devices of various types, where they will contribute to energy saving. Moreover, the regulators have an output voltage line-up starting from 1.5 V, corresponding to the lower voltage of various devices.


SON8-P-0303-0.65 (PS-8)

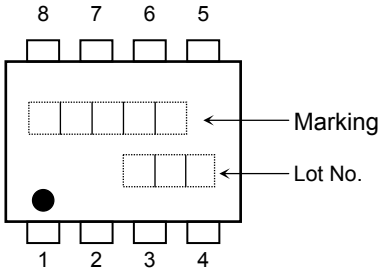
Weight: 0.08 g (typ.)

Features

- Built-in ON/OFF control function (active high)
- Maximum output current : 300 mA
- Low output voltage : 1.5 / 1.8 / 2.5 / 3.3 / 5.0 V
- Output voltage accuracy : V_{OUT} ± 2.5 % (@T_j = 25°C)
- Low quiescent current : 1 mA (Typ.) (@I_{OUT} = 0 A)
- Low standby current (output OFF mode): 0.2 μA (Typ.)
- Low-dropout voltage : 0.5 V (Max) (@V_{OUT} ≥ 1.8 V, I_{OUT} = 150 mA)
- Protection function : Overcurrent protection / overheat protection
- Package type : PS-8

Pin Assignment

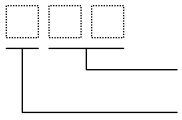
Product No.	Marking
TA48LS015F	LS015
TA48LS018F	LS018
TA48LS025F	LS025
TA48LS033F	LS033
TA48LS05F	LS05



1 : N.C.
2 to 4 : GND
5 : IN
6 : EN
7 : N.C.
8 : OUT

Note 1: In the actual product number, "***" is replaced by the output voltage of the product.

* Weekly code: (Three digits)



Week of manufacture
(01 for the first week of the year, continuing up to 52 or 53)

Year of manufacture
(Lowest-order digit of the calendar year)

Pin Description

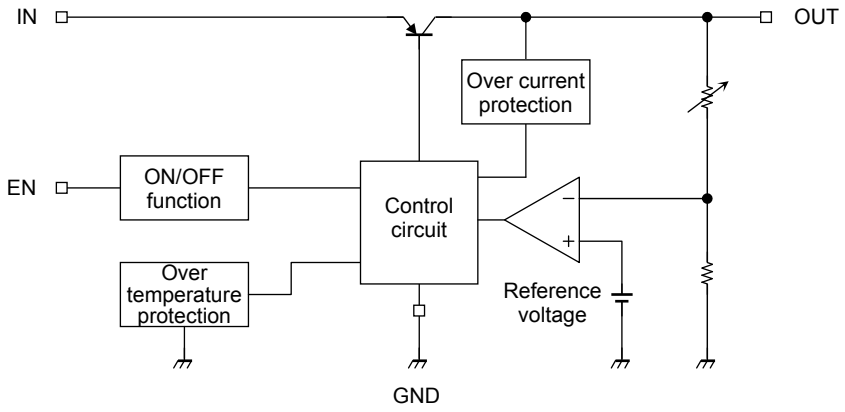
Pin No.	Symbol	Description
1	N.C.	Non-connection
2 to 4	GND	Ground terminal
5	IN	Input terminal. Connected by capacitor (C_{IN}) to GND.
6	EN	Output ON/OFF control terminal. Output is ON when this pin is set to “High”, OFF when this pin is open or set to “Low”.
7	N.C.	Non-connection
8	OUT	Output terminal. Connected by capacitor (C_{OUT}) to GND.

How to Order

Product No.	Package Type and Capacity
TA48LS***F(TE85L, F)	Tape (3000 pcs/reel)

Note 2: 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		V_{IN}	14	V
EN Input voltage		V_{EN}	14	V
Output current		I_{OUT}	300	mA
Operating junction temperature		T_{jopr}	-40 to 150	°C
Junction temperature		T_j	150	°C
Storage temperature		T_{stg}	−55 to 150	°C
Power dissipation(Note 5)	Ta = 25°C	P_D	1.2	W

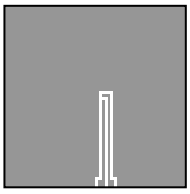
Note 3: Do not apply current and voltage (including reverse polarity) to any pin that is not specified.

Note 4: 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	$R_{th\ (j-a)}$	102	°C/ W

Note 5: Glass epoxy board



Material: FR-4
25.4 × 25.4 × 1.6
Unit: (mm)
Cu base thickness: 35 μm

Operating Input Voltage Range

Characteristic		Symbol	Min	Typ.	Max	Unit
Input voltage	$V_{OUT} \leq 1.8V$	V_{IN}	2.5(Note6)	—	14.0	V
	$V_{OUT} \geq 2.5V$		$V_{OUT} + V_D$	—	14.0	

Note 6: This is the voltage at which the IC begins operating. V_D must be considered when determining the best input voltage for the application.

Protection Function (Reference)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Thermal shutdown	T_{SD}	V_{IN} = 2.5 V (015F) / 2.8 V (018F) / 3.5 V (025F) / 4.3 V (033F) / 6.0 V (05F)	150	170	—	°C
Thermal shutdown hysteresis width	$T_{SD(hys)}$		—	15	—	°C
Peak circuit current	I_{PEAK}	$V_{IN} = V_{OUT}$ + 2 V, T_j = 25°C	300	500	—	mA
		$V_{IN} = V_{OUT}$ + 5 V, T_j = 25°C	300	500	—	
Short circuit current	I_{SC}	$V_{IN} = V_{OUT}$ + 2 V, T_j = 25°C	—	300	—	mA
		V_{IN} = 14V , T_j = 25°C	—	300	—	

Note 7: Ensure that the devices operate within the limits of the maximum rating when in actual use.

TA48LS015F
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 1\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 3.5 V, I_{OUT} = 150 mA	1.462	1.500	1.538	V
Line regulation	Reg·line	2.5 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 150 mA	—	1	20	mV
Load regulation	Reg·load	V_{IN} = 3.5V, 5 mA ≤ I_{OUT} ≤ 300 mA	—	2	20	mV
Quiescent current	I_B	2.5V ≤ V_{IN} ≤ 6.5V, I_{OUT} = 0 A	—	1.0	1.7	mA
		2.5 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 300 mA	—	5	10	
Quiescent current (OFF mode)	$I_{B(OFF)}$	2.5 V ≤ V_{IN} ≤ 6.5 V, V_{EN} = 0.4 V	—	0.2	5.0	μA
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	1.00	2.3	mA
		V_{IN} = 2.2 V, I_{OUT} = 300 mA	—	5.3	18.0	
Output noise voltage	V_{NO}	V_{IN} = 3.5 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	45	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 3.5 V, I_{OUT} = 50 mA, f = 120 Hz	—	75	—	dB
Dropout voltage	V_D	I_{OUT} = 150 mA	—	0.5	0.7	V
		I_{OUT} = 300 mA	—	0.7	1.0	
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} = V_{EN} = 3.5 V	—	32	50	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 3.5 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.14	—	mV/°C

TA48LS018F
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 1\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 3.8 V, I_{OUT} = 150 mA	1.755	1.800	1.845	V
Line regulation	Reg·line	2.8 V ≤ V_{IN} ≤ 6.8V, I_{OUT} = 150 mA	—	1	20	mV
Load regulation	Reg·load	V_{IN} = 3.8 V, 5 mA ≤ I_{OUT} ≤ 300 mA	—	2	20	mV
Quiescent current	I_B	2.8 V ≤ V_{IN} ≤ 6.8 V, I_{OUT} = 0 A	—	1.0	1.7	mA
		2.8 V ≤ V_{IN} ≤ 6.8 V, I_{OUT} = 300 mA	—	5	10	
Quiescent current (OFF mode)	$I_{B(OFF)}$	2.8 V ≤ V_{IN} ≤ 6.8 V, V_{EN} = 0.4 V	—	0.2	5.0	μA
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	1.00	2.3	mA
		V_{IN} = 2.3 V, I_{OUT} = 300 mA	—	5.6	18.0	
Output noise voltage	V_{NO}	V_{IN} = 3.8 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	45	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 3.8 V, I_{OUT} = 50 mA, f = 120 Hz	—	75	—	dB
Dropout voltage	V_D	I_{OUT} = 150 mA	—	0.23	0.50	V
		I_{OUT} = 300 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} = V_{EN} = 3.8 V	—	35	55	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 3.8 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.15	—	mV/°C

TA48LS025F
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 1\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 4.5 V, I_{OUT} = 150 mA	2.437	2.500	2.563	V
Line regulation	Reg·line	3.5 V ≤ V_{IN} ≤ 7.5 V, I_{OUT} = 150 mA	—	1	20	mV
Load regulation	Reg·load	V_{IN} = 4.5 V, 5 mA ≤ I_{OUT} ≤ 300 mA	—	2	20	mV
Quiescent current	I_B	3.5 V ≤ V_{IN} ≤ 7.5V, I_{OUT} = 0 A	—	1.0	1.7	mA
		3.5 V ≤ V_{IN} ≤ 7.5V, I_{OUT} = 300 mA	—	5	10	
Quiescent current (OFF mode)	$I_{B(OFF)}$	3.5 V ≤ V_{IN} ≤ 7.5 V, V_{EN} = 0.4 V	—	0.2	5.0	μA
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	1.20	3.5	mA
		V_{IN} = 2.2 V, I_{OUT} = 300 mA	—	7.2	18.0	
Output noise voltage	V_{NO}	V_{IN} = 4.5 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	55	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 4.5 V, I_{OUT} = 50 mA, f = 120 Hz	—	70	—	dB
Dropout voltage	V_D	I_{OUT} = 150 mA	—	0.2	0.5	V
		I_{OUT} = 300 mA	—	0.4	0.6	
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} = V_{EN} = 4.5 V	—	44	65	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 4.5 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.2	—	mV/°C

TA48LS033F
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 1\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 5.3 V, I_{OUT} = 150 mA	3.217	3.300	3.383	V
Line regulation	Reg·line	4.3 V ≤ V_{IN} ≤ 8.3 V, I_{OUT} = 150 mA	—	2	20	mV
Load regulation	Reg·load	V_{IN} = 5.3 V, 5 mA ≤ I_{OUT} ≤ 300 mA	—	3	20	mV
Quiescent current	I_B	4.3 V ≤ V_{IN} ≤ 8.3 V, I_{OUT} = 0 A	—	1.0	1.7	mA
		4.3 V ≤ V_{IN} ≤ 8.3 V, I_{OUT} = 300 mA	—	5	10	
Quiescent current (OFF mode)	$I_{B(OFF)}$	4.3 V ≤ V_{IN} ≤ 8.3 V, V_{EN} = 0.4 V	—	0.2	5.0	μA
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	1.4	4.0	mA
		V_{IN} = 2.8 V, I_{OUT} = 300 mA	—	8.3	18.0	
Output noise voltage	V_{NO}	V_{IN} = 5.3 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	60	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 5.3 V, I_{OUT} = 50 mA, f = 120 Hz	—	70	—	dB
Dropout voltage	V_D	I_{OUT} = 150 mA	—	0.2	0.5	V
		I_{OUT} = 300 mA	—	0.3	0.6	
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} = V_{EN} = 5.3 V	—	53	75	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 5.3 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.3	—	mV/°C

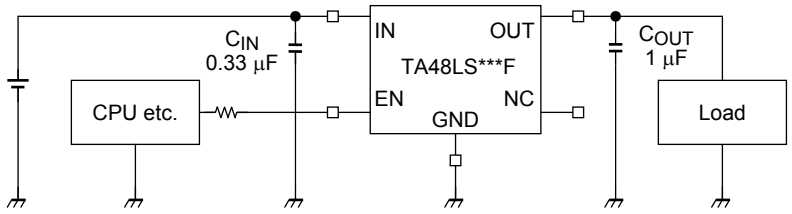
TA48LS05F
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 1\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 7 V, I_{OUT} = 150 mA	4.875	5.000	5.125	V
Line regulation	Reg·line	6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 150 mA	—	3	20	mV
Load regulation	Reg·load	V_{IN} = 7 V, 5 mA ≤ I_{OUT} ≤ 300 m A	—	4	20	mV
Quiescent current	I_B	6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 0 A	—	1.0	1.7	mA
		6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 300 mA	—	5	10	
Quiescent current (OFF mode)	$I_{B(OFF)}$	6 V ≤ V_{IN} ≤ 10 V, V_{EN} = 0.4 V	—	0.2	5.0	μA
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	1.3	4.2	mA
		V_{IN} = 3.0 V, I_{OUT} = 300 mA	—	8.5	18.0	
Output noise voltage	V_{NO}	V_{IN} = 7 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	70	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 7 V, I_{OUT} = 50 mA, f = 120 Hz	—	70	—	dB
Dropout voltage	V_D	I_{OUT} = 150 mA	—	0.2	0.5	V
		I_{OUT} = 300 mA	—	0.3	0.6	
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} = V_{EN} = 7 V	—	73	100	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 7 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.45	—	mV/°C

Electrical Characteristics Common to All Products

- T_j = 25°C in the measurement conditions of each item is 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.

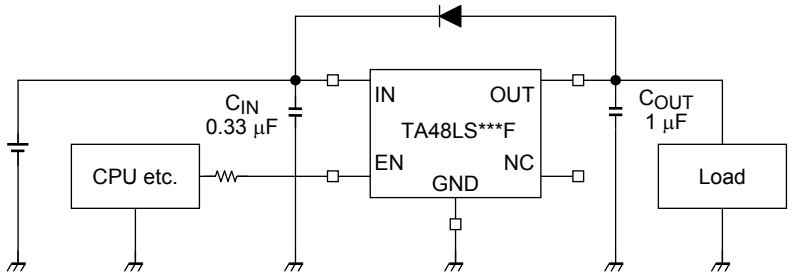
Standard Application Circuit



- Be sure to connect a capacitor near the input terminal and output terminal between both terminals and GND. The use of a monolithic ceramic capacitor (B Characteristic or X7R) of low ESR (equivalent series resistance) is recommended. 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

- The IC might be destroyed if a voltage greater than the input terminal voltage is applied to the output terminal, or if the input terminal is connected to GND during operation. To prevent such an occurrence, connect a diode as in the following diagram.



- There is a possibility that internal parasitic devices may be generated when momentary transients cause a terminal's potential to fall below that of the GND terminal. In such case, that the device could be destroyed. The voltage of each terminal and any state must therefore never fall below the GND potential.

- Depending on the load conditions, a steep increase in the input voltage applied (V_{IN}) may cause a momentary rise in output voltage (V_{OUT}) even if the EN (enable) pin is Low. Treat with care.

- 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.

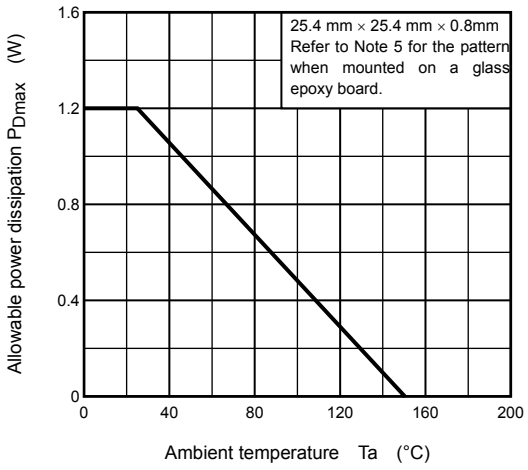
- Overcurrent Protection

  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.

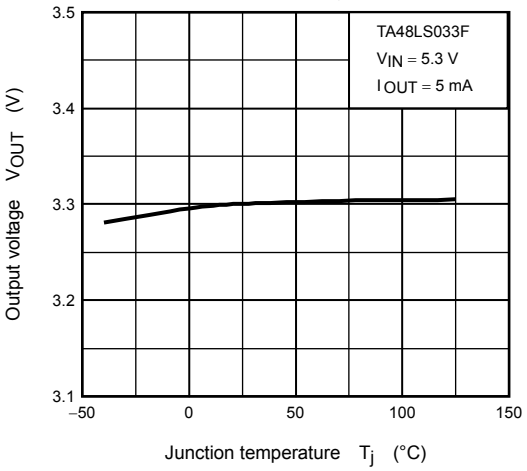
- Overheating Protection

  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.

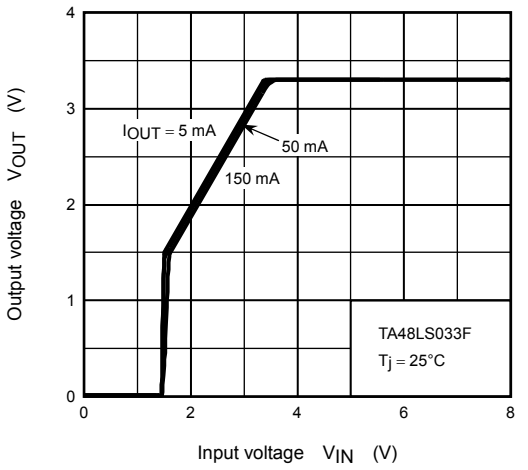
P_{Dmax} – Ta



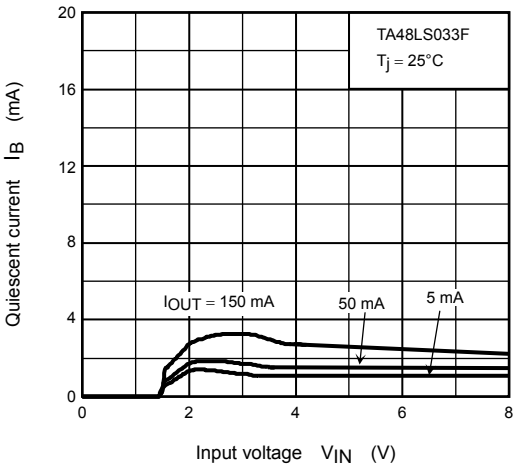
V_{OUT} – T_j



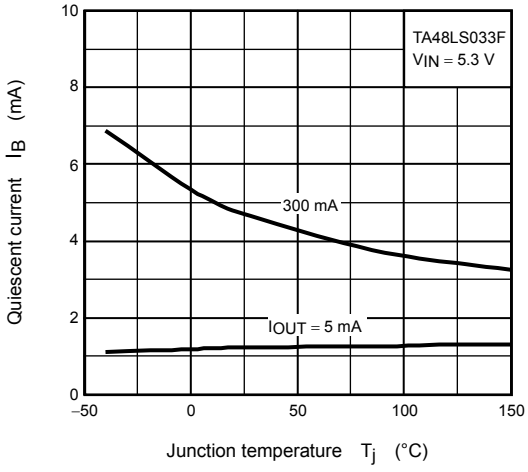
V_{OUT} – V_{IN}



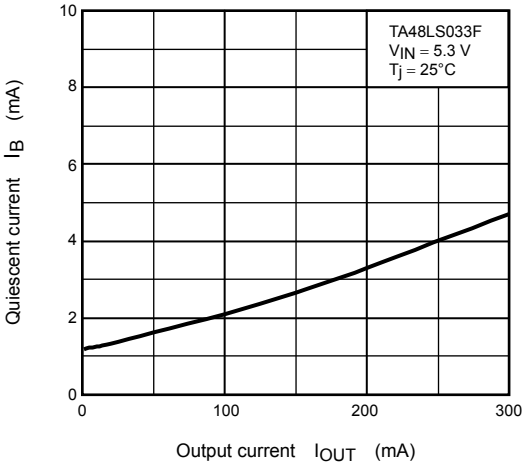
I_B – V_{IN}



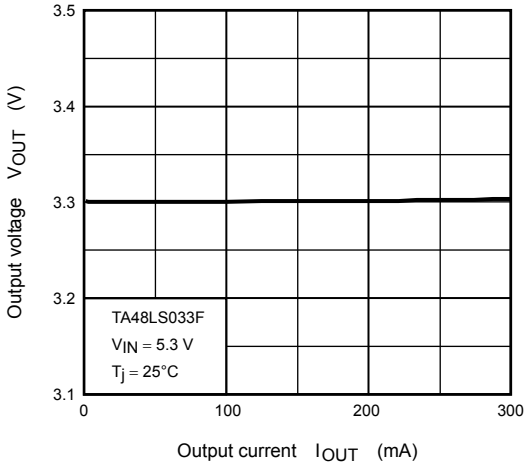
I_B – Tj



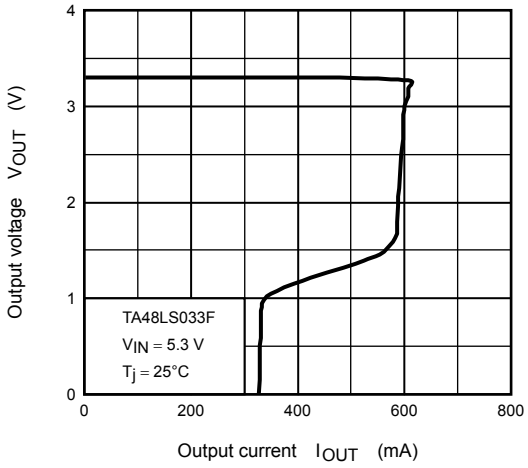
I_B – I_{OUT}



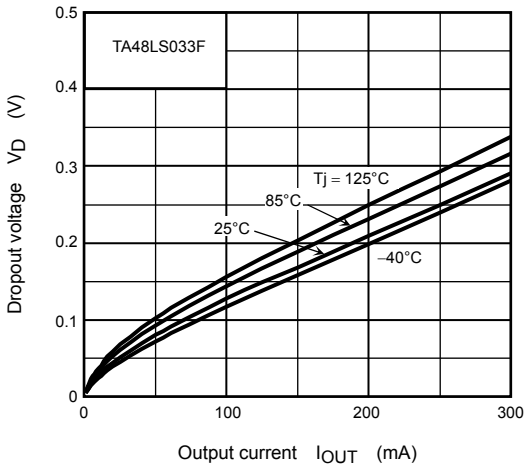
$V_{OUT} - I_{OUT}$



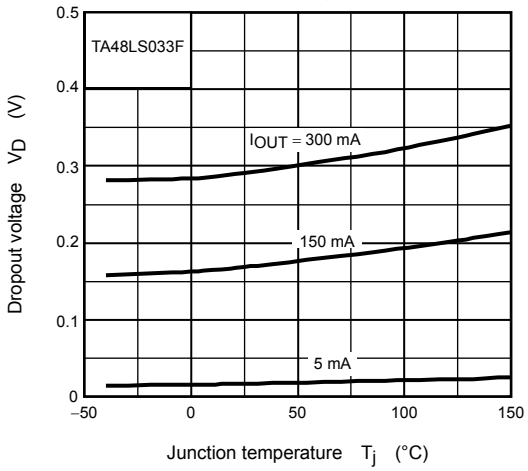
$V_{OUT} - I_{OUT}$



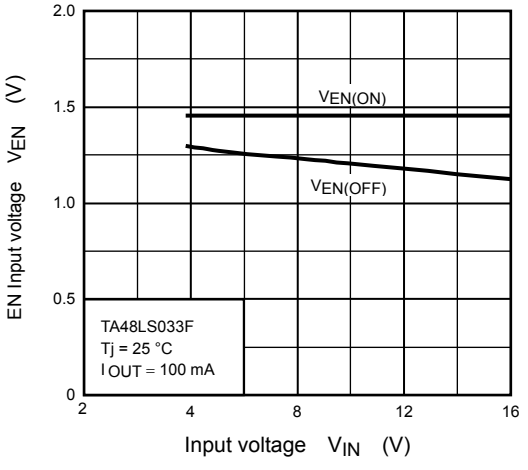
$V_D - I_{OUT}$



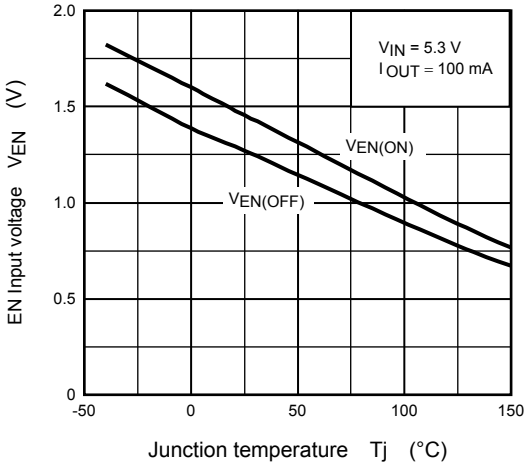
$V_D - T_j$



$V_{EN} - V_{IN}$

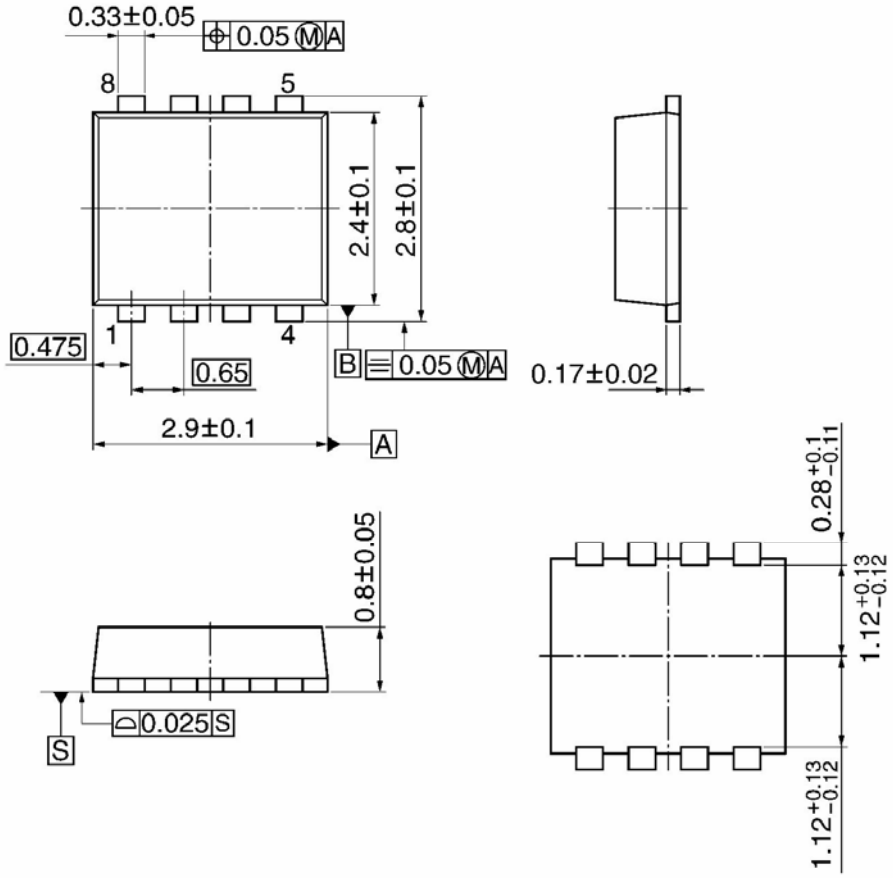


$V_{EN} - Tj$



Package Dimensions

SON8-P-0303-0.65 (PS-8) Unit: mm



Weight: 0.08 g (typ.)

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