

### GENERAL DESCRIPTION

The LM2596HVS series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 3A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3V, 5V, 12V, and an adjustable output version. Available in a standard 5-lead TO-220 package and a 5-lead TO-263 surface mount package. External shutdown is included, featuring typically 30  $\mu$ A standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown, and protection from output short for full protection under fault conditions.

### Features

- 3.3V, 5V, 12V and Adjustable output versions
- Adjustable version output voltage range, 1.23V to 57V
- $\pm 4\%$  max over line and load condition
- Available in TO-263
- Guaranteed 3A output load current
- Input voltage range up to 60V
- Requires only 4 external components
- Excellent line and load regulation specifications
- 150kHz fixed frequency internal oscillator
- Low power standby mode,  $I_{STB}$  typically 30 $\mu$ A
- High efficiency
- Thermal shutdown and current limit protection
- Output short protection by reduction of frequency by 3 times

### Applications


- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators

### TYPICAL APPLICATION


OUTPUT VOLTAGE	PART NO.	PACKAGE	PACKING
3.3V	LM2596HVS-3.3	TO-263-5L(D <sup>2</sup> PAK)	800pcs / 13" Reel
5.0V	LM2596HVS-5.0	TO-263-5L(D <sup>2</sup> PAK)	800pcs / 13" Reel
12V	LM2596HVS-12	TO-263-5L(D <sup>2</sup> PAK)	800pcs / 13" Reel
ADJ	LM2596HVS-ADJ	TO-263-5L(D <sup>2</sup> PAK)	800pcs / 13" Reel

### Marking:


LM2596HVS-3.3

	TECH PUBLIC
LM2596HVS	
-3.3	P+


LM2596HVS-5.0

	TECH PUBLIC
LM2596HVS	
-5.0	P+

LM2596HVS-12

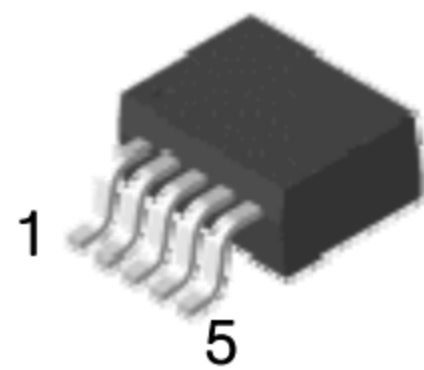
	TECH PUBLIC
LM2596HVS	
-12	P+

LM2596HVS-ADJ

	TECH PUBLIC
LM2596HVS	
-ADJ	P+

### PIN CONFIGURATION

TO-263-5L (D<sup>2</sup>PAK)



**Pin Definition:**

1. Input
2. SW Output
3. Ground
4. Feedback
5. Enable

### ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	$V_{IN}$	-	63	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3	60 (or $V_{IN}$ )	V
FB pin voltage	$V_{FB}$	-0.3	25 (or $V_{IN}$ )	V
Output voltage to GND	$V_{OUT}$	-1		V
Storage Temperature Range	$T_{STG}$	-65	150	°C
Maximum Junction Temperature Range	$T_{J,MAX}$	-	150	°C

### Operating Ratings

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	$V_{IN}$	4.5	60	V
Load Current	$I_{LOAD}$	-	3.0	A
Temperature Range	$T_J$	-40	125	

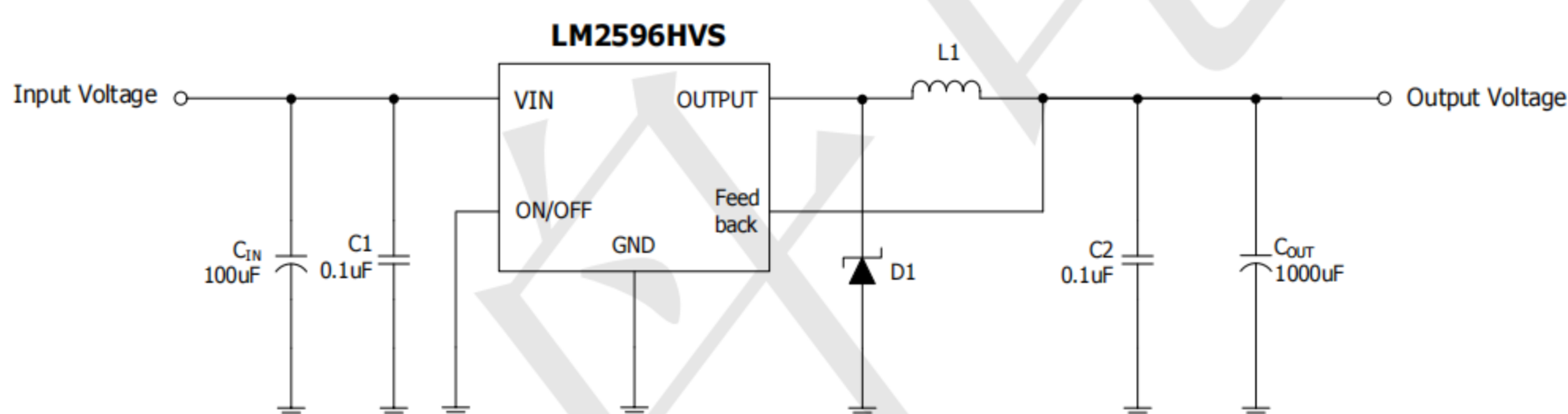
### Electrical Characteristics (T<sub>A</sub>=25 C unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITION (Note 2)	MIN.	TYP.	MAX.	UNIT
<b>SYSTEM PARAMETERS (Note 3)</b>						
Feedback Voltage	V <sub>FB</sub>	LM2596HVS-ADJ 8V ≤ V <sub>IN</sub> ≤ 60V, 0.2A ≤ I <sub>LOAD</sub> ≤ 3A	1.193	1.230	1.273	V
			<b>1.180</b>		<b>1.285</b>	
Output Voltage	V <sub>O</sub>	LM2596HVS-3.3 5.5V ≤ V <sub>IN</sub> ≤ 60V, 0.2A ≤ I <sub>LOAD</sub> ≤ 3A	3.185	3.30	3.432	V
			<b>3.152</b>		<b>3.465</b>	
		LM2596HVS-5.0 8V ≤ V <sub>IN</sub> ≤ 60V, 0.2A ≤ I <sub>LOAD</sub> ≤ 3A	4.825	5.00	5.20	V
			<b>4.775</b>		<b>5.25</b>	
LM2596HVS-12 15V ≤ V <sub>IN</sub> ≤ 60V, 0.2A ≤ I <sub>LOAD</sub> ≤ 3A	11.58	12.00	12.48	V		
	<b>11.46</b>		<b>12.60</b>			
Line Regulation	Line Reg	8 ≤ V <sub>IN</sub> ≤ 60V, I <sub>LOAD</sub> = 0.2A		0.3		%
Load Regulation	Load Reg	10mA ≤ I <sub>LOAD</sub> ≤ 3A, V <sub>IN</sub> = 12V		0.3		%
Efficiency	η	LM2596HVS-ADJ V <sub>IN</sub> = 12V, I <sub>LOAD</sub> = 3A, V <sub>OUT</sub> = 5V		79		%
		LM2596HVS-3.3 V <sub>IN</sub> = 12V, I <sub>LOAD</sub> = 3A		77		%
		LM2596HVS-5.0 V <sub>IN</sub> = 12V, I <sub>LOAD</sub> = 3A		79		%
		LM2596HVS-12 V <sub>IN</sub> = 15V, I <sub>LOAD</sub> = 3A		83		%
<b>DEVICE PARAMETERS</b>						
Quiescent Current	I <sub>Q</sub>	V <sub>FB</sub> =12V force driver off (Note 6)		5	8	mA
Feedback Bias Current	I <sub>FB</sub>	V <sub>FB</sub> =1.3V (Adjustable version only)	-250	-70		nA
			<b>-450</b>			
Shutdown Supply Current	I <sub>STB</sub>	V <sub>ON/OFF</sub> =5V, V <sub>IN</sub> =60V		30	220	uA
					<b>280</b>	
Oscillator Frequency	F <sub>OSC</sub>	(Note 8)	133	150	168	KHz
			<b>120</b>		<b>180</b>	
Oscillator Frequency of short Circuit Protect	F <sub>SCP</sub>	When V <sub>OUT</sub> < 40% from nominal, I <sub>OUT</sub> =CL (Note 8)		50		KHz
Max. duty Cycle	DC <sub>(MAX.)</sub>	V <sub>FB</sub> =0V force driver on (Note 5)	<b>100</b>			%
Min. duty Cycle	DC <sub>(MIN.)</sub>	V <sub>FB</sub> =12V force driver off (V <sub>FB</sub> =15V, For 12V Version)			<b>0</b>	

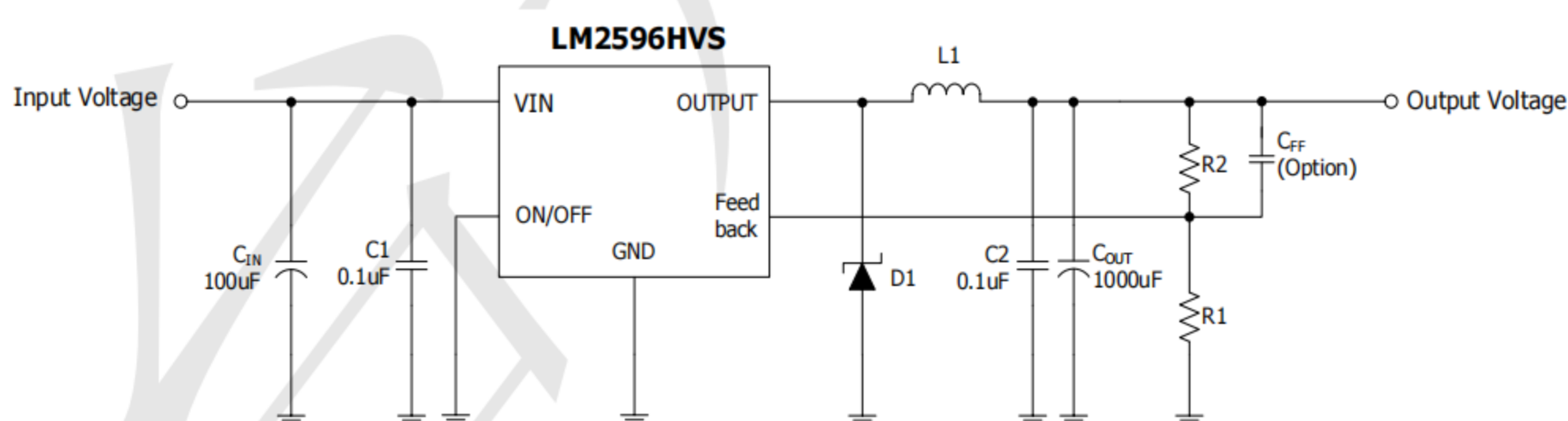
Current Limit	CL	Peak Current. No outside circuit. $V_{FB}=0V$ (Note 4, 8)	4.1	5.3	6.7	A
			<b>3.8</b>		<b>7.0</b>	
Saturation Voltage	$V_{SAT}$	$I_{OUT}=3A$ . No outside circuit. $V_{FB}=0V$ (Note 4)		1.35	1.50	V
					<b>1.70</b>	
Output Leakage Current	$I_L$	$V_{OUT}=0V$ . No outside circuit. $V_{FB}=12V$ (Note 6, 7)	-300	-50		uA
Output Leakage Current	$I_{L1}$	$V_{OUT}=-1V$ . No outside circuit. $V_{FB}=12V$ (Note 6, 7)	-30	-3		mA
ON/OFF Input Threshold	$V_{TH}$		<b>0.6</b>	<b>1.3</b>	<b>2.0</b>	V
ON/OFF Input Current	$I_H$	$V_{ON/OFF}=2.5V$	-5	-0.1	5	uA
	$I_L$	$V_{ON/OFF}=0.5V$	-1	-0.01	1	uA
Thermal Shutdown Temperature	$T_{SD}$	$T_J$		160		

## TYPICAL APPLICATION

### - Fixed Output Voltage Version



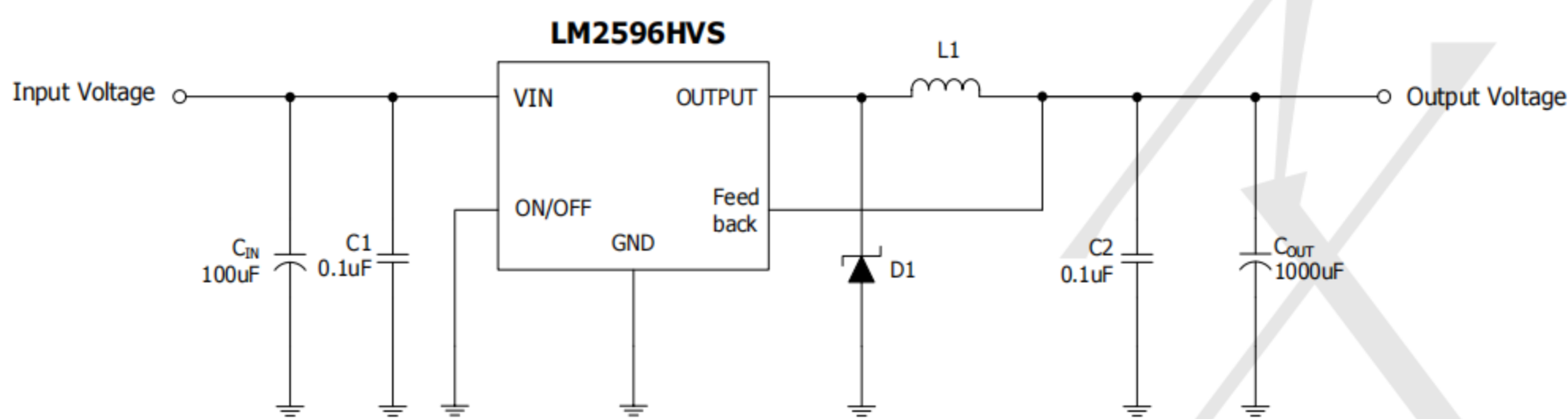
### - Adjustable Output Voltage Version



### APPLICATION INFORMATION

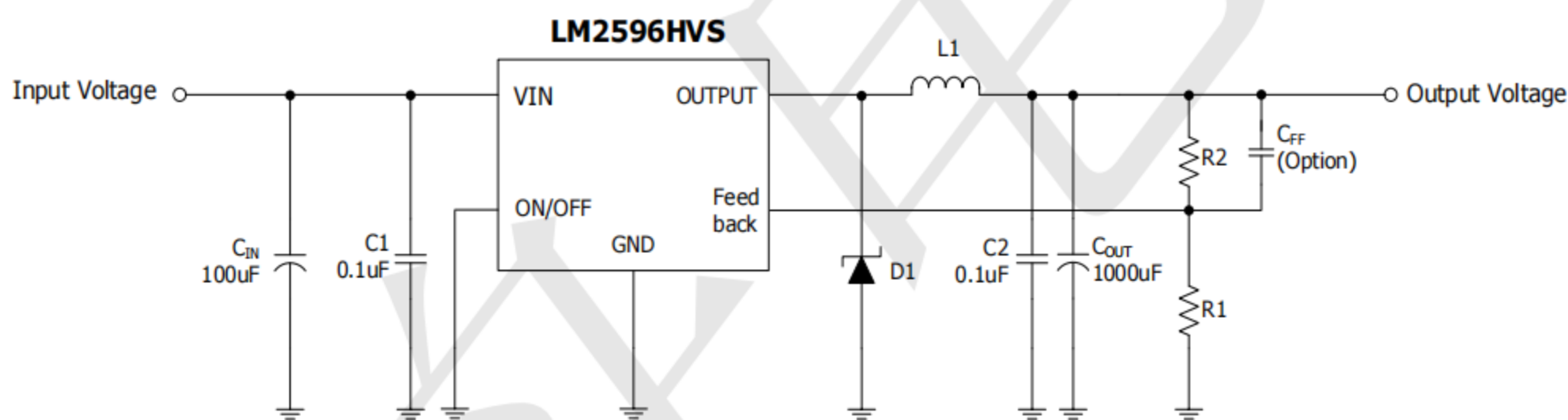
As in any switching regulator, layout is very important. Rapidly switching currents associated with wiring inductance generate voltage transients which can cause problems. For minimal inductance and ground loops, the length of the wires should be kept as short as possible. Single-point grounding or ground plane construction should be used for best results. Keep the feedback wiring away from the inductor flux

#### - Fixed Output Voltage Version



[Figure 1]

#### - Adjustable Output Voltage Version



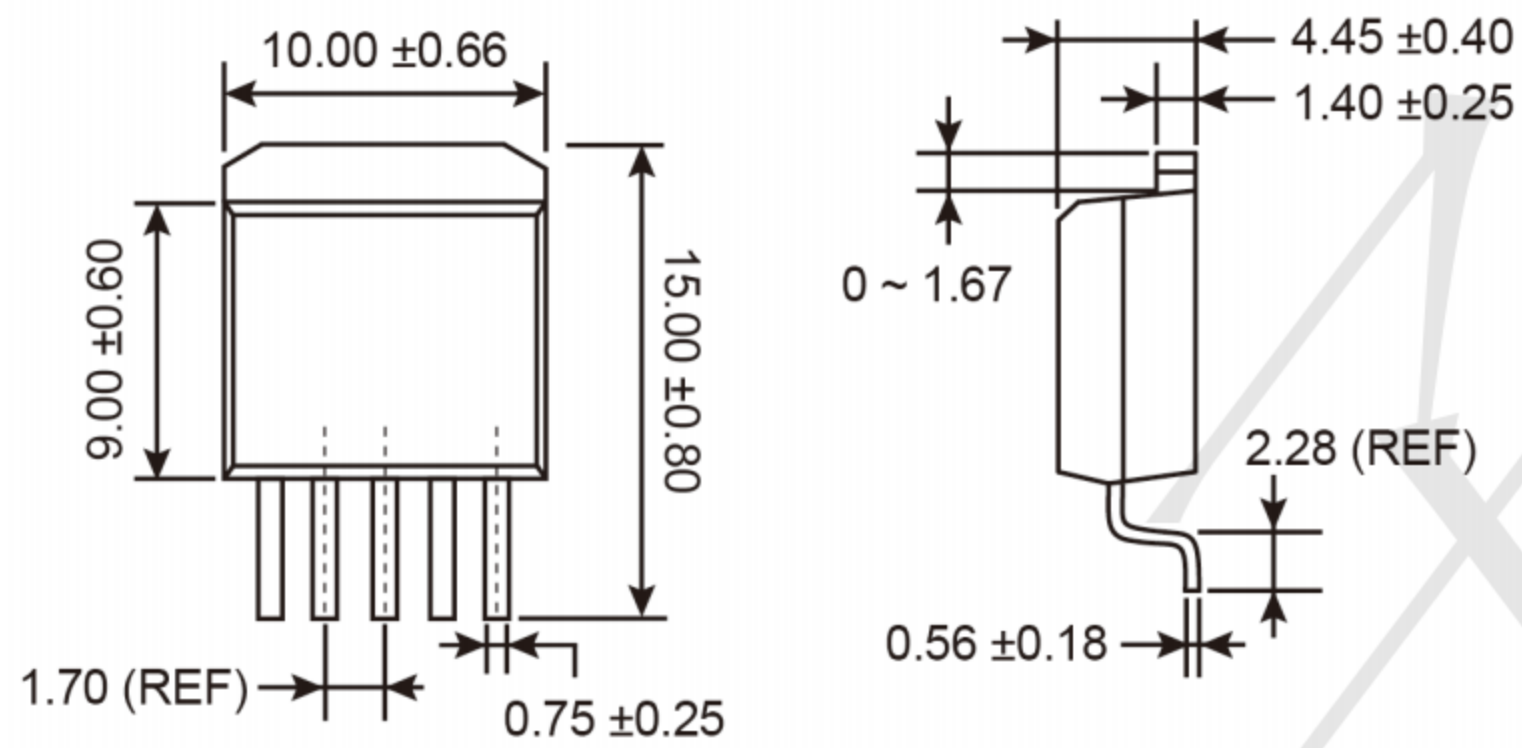
[Figure 2]

$$* V_{OUT} = V_{FB} \left(1 + \frac{R2}{R1}\right)$$

where  $V_{FB} = 1.23V$ ,  $R1$  between  $1K\Omega$  and  $5K\Omega$ .

### PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

#### TO-263-5L (D<sup>2</sup>PAK)



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