High PSRR 500mA LDO Regulator

Features

- Output Voltage: 1.5V/1.8V/2.5V/2.8V/ 3.0V/3.3V/5V
- High Output Voltage Accuracy: ±2%
- HT78B25 Low Voltage Drop: 0.64V (Typ.) (V_{OUT}=2.5V @ I_{OUT}=500mA)
- Maximum Input Voltage: 7.0V
- Guaranteed Output Current: 500mA
- Low Power Consumption: 18μA (Typ.)
- High Ripple Rejection: 70dB (1kHz@I_{OUT}=30mA)
- Power-Saving Shutdown Mode
- Over Temperature Protection
- Current Limiting
- SOT-23-5, SOT223, SOT89 Package

Applications

- Portable communication equipment
- Portable music player
- Electrical appliances such as cameras, VCRs and camcorders
- Battery-powered equipment

General Description

The HT78Bxx series are CMOS-based voltage regulator ICs with high output voltage accuracy, low quiescent current, low on Resistance, and high ripple rejection. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit, a chip enable circuit, and so on.

The HT78Bxx's current limiters' fold back circuit also operates as a short circuit protect function for the output current limiter.

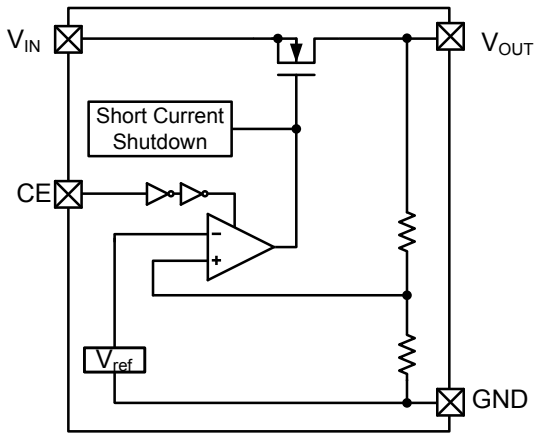
These ICs perform with low dropout voltage and the chip-enable function. The quiescent current of this IC is only 18μA, and the line transient response and the load transient response of HT78Bxx are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment.

The space-saving SOT23-5, SOT223 and SOT89 package will be an attractive additional feature for pocket and hand-held applications.

Selection Table

Part No.	Output Voltage	Tolerance	Package
HT78B15	1.5V	±2%	SOT23-5 SOT223 SOT89
HT78B18	1.8V		
HT78B25	2.5V		
HT78B28	2.8V		
HT78B30	3.0V		
HT78B33	3.3V		
HT78B50	5.0V		

Block Diagram



Absolute Maximum Ratings (Note 1)

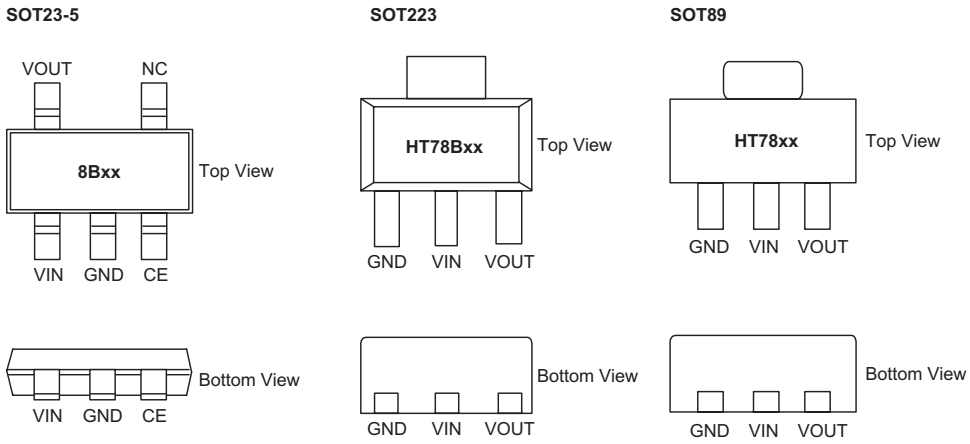
Maximum Input Supply Voltage.....7.5V
Ambient Temperature Range.....-40°C~+85°C

Thermal Information

Symbol	Parameter	Package	Max.	Unit
θ_{JA}	Thermal Resistance (Junction to Ambient) (Assume no ambient airflow, no heat sink)	SOT23-5	500	°C/W
		SOT223	134	°C/W
		SOT89	200	°C/W
P_D	Power Dissipation	SOT23-5	0.20	W
		SOT223	0.75	W
		SOT89	0.50	W

Note: P_D is measured at Ta= 25°C

Pin Assignment



Pin Descriptions

SOT23-5 Pin Descriptions		
Pin No.	**Symbol**	**Description**
1	VIN	Input Pin
2	GND	Ground Pin
3	CE	Chip Enable Pin, high enable
4	NC	No Connection
5	VOUT	Output Pin

SOT223 Pin Descriptions		
Pin No.	**Symbol**	**Description**
1	GND	Ground Pin
2	VIN	Input Pin
3	VOUT	Output Pin

SOT89 Pin Descriptions		
Pin No.	**Symbol**	**Description**
1	GND	Ground Pin
2	VIN	Input Pin
3	VOUT	Output Pin

Electrical Characteristics

Ta=25°C, $V_{IN}=V_{OUT}+1V$, $I_{OUT}=30mA$, unless otherwise specified(Note 2)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage	$1.5V \le V_{OUT} \le 5.0V$		2.5	—	7	V
ΔV_{OUT}	Output Voltage Tolerance	$1mA \le I_{OUT} \le 30mA$		-2	—	+2	%
ΔV_{LINE}	Line Regulation	$V_{OUT}+0.5V \le V_{IN} \le 7V$, $I_{OUT}=10mA$		—	0.02	0.1	%/V
ΔV_{LOAD}	Load Regulation(Note 3)	$1mA \le I_{OUT} \le 500mA$	$1.5V \le V_{OUT} \le 1.8V$	—	28	55	mV
			$2.5V \le V_{OUT} \le 3.0V$	—	33	66	
			$V_{OUT} \ge 3.3V$	—	35	80	
V_{DROP}	Dropout Voltage(Note 4)	ΔV_{OUT}= 2%, $I_{OUT}=500mA$	$1.5V \le V_{OUT} \le 1.8V$	—	1	1.3	V
			$2.5V \le V_{OUT} \le 5.0V$	—	0.64	0.94	
I_{SHORT}	Short Current Limit	$V_{OUT}=0V$		—	90	—	mA
I_{SS}	Supply Current	$I_{OUT}=0mA$		—	18	30	μA
I_{SD}	Shutdown Current	CE=GND		—	0.1	1	μA
V_{IH}	CE Input High Threshold	$V_{OUT}+1V \le V_{IN} \le 7V$		1	—	7	V
V_{IL}	CE Input Low Threshold	$V_{OUT}+1V \le V_{IN} \le 7V$		0	—	0.3	V
RR	Ripple Rejection	$I_{OUT}=30mA$	f=1kHz	—	70	—	dB
			f=10kHz	—	53	—	
V_{NOISE}	Output Noise	Bandwidth=10Hz to 100KHz		—	30	—	μVrms
T_C	Temperature Coefficient	$T_C=\frac{\Delta V_{OUT}}{\Delta T_a \bullet V_{OUT}}$, $I_{OUT}=30mA$, $-40°C \le Ta \le 85°C$		—	±100	—	ppm/°C
T_{SD}	Thermal Shutdown Temperature	—		—	150	—	°C

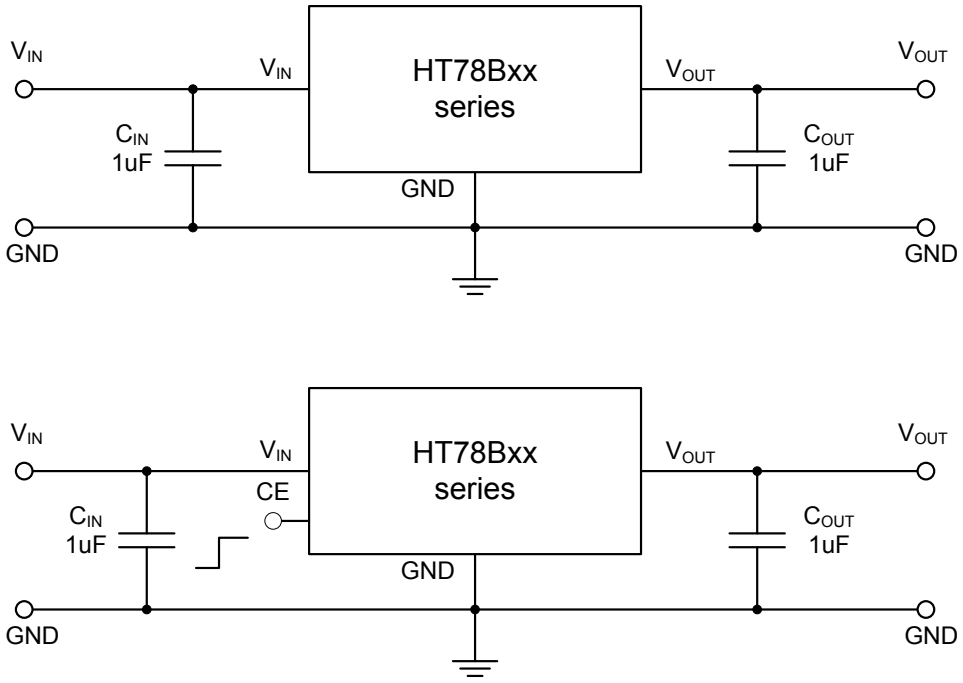
Note: 1. Absolute maximum ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. The guaranteed specifications apply only for the test conditions listed.

2. Specifications are production tested at T_A=room temperature. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

3. Load regulation is measured at constant junction temperature, using pulse testing with a short ON time. Guaranteed up to the maximum power dissipation. Power dissipation is determined by the input/output differential voltage and the output current. Guaranteed maximum power dissipation will not be available over the full input/output range. The maximum allowable power dissipation at any ambient temperature is $P_D=(T_{J(MAX)}-T_A)/\theta_{JA}$.

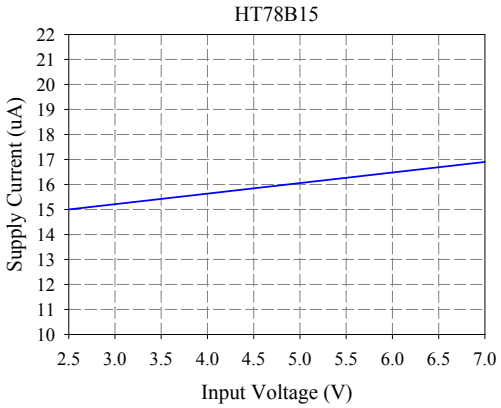
4. Dropout voltage is the minimum input to output voltage differential needed to maintain regulation at a specified output current. In dropout, the output voltage will be equal to: $V_{IN}-V_{DROP}$.

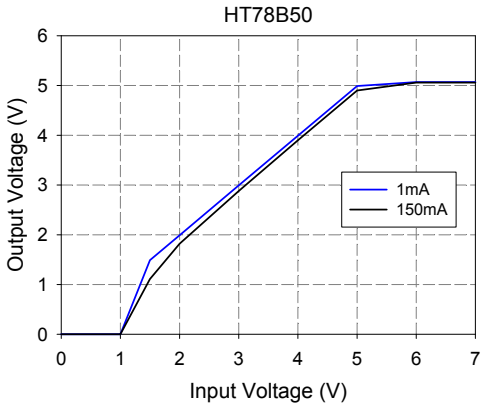
Application Circuit

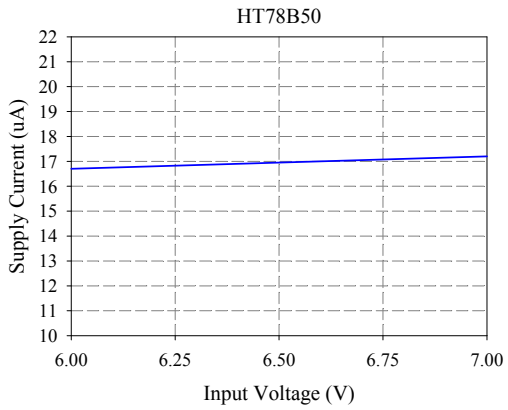


Typical Characteristics

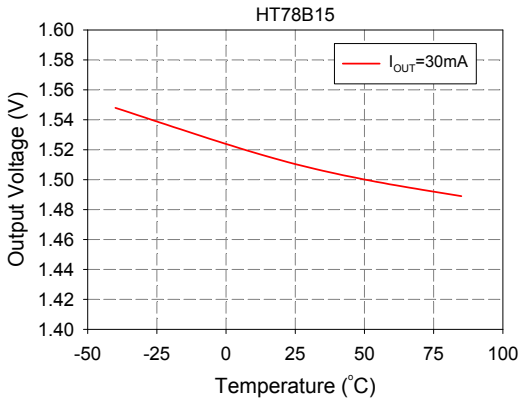
Supply Current vs. Input Current



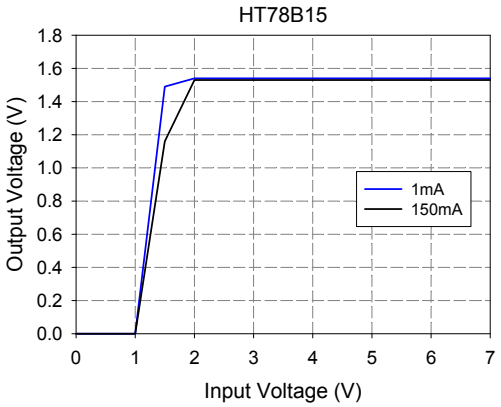


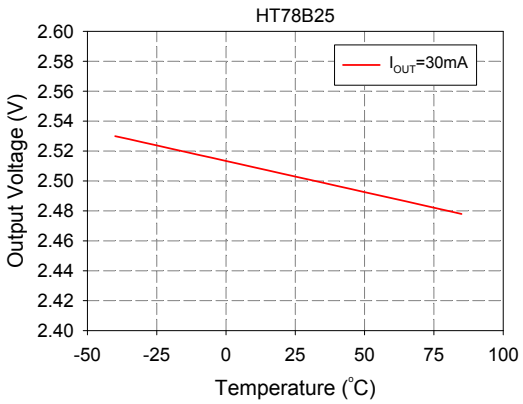


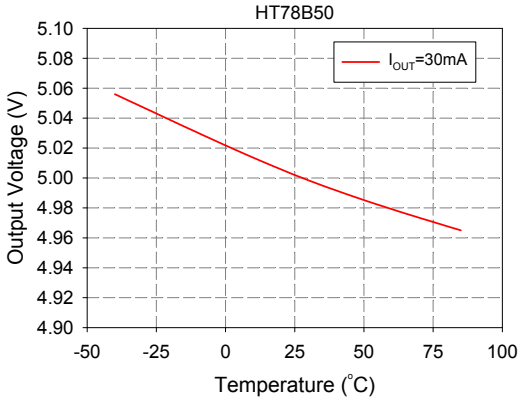
Output Voltage vs. Temperature

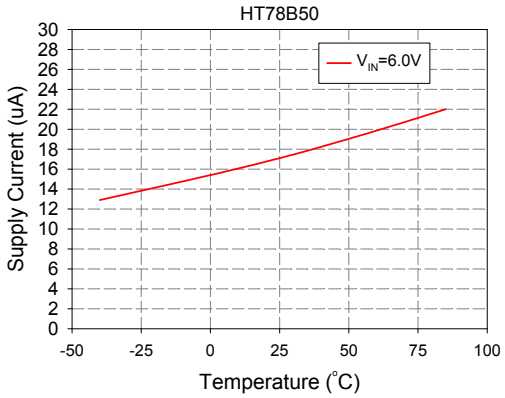


Output Voltage vs. Input Voltage

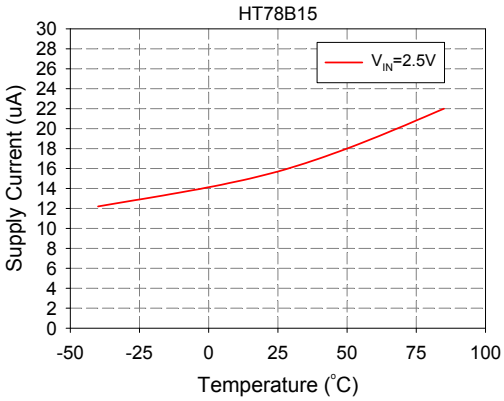




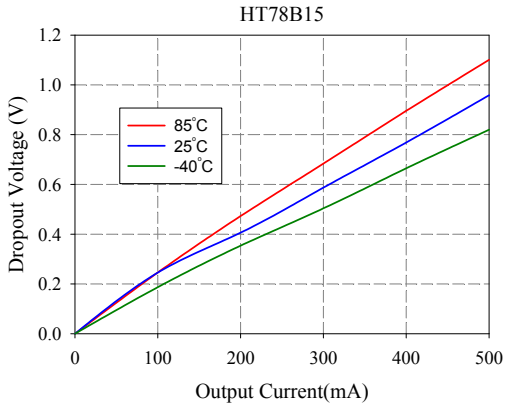


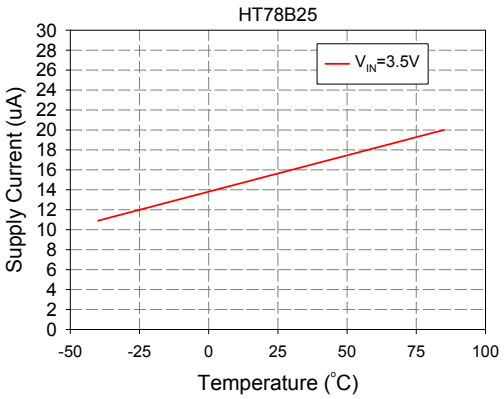


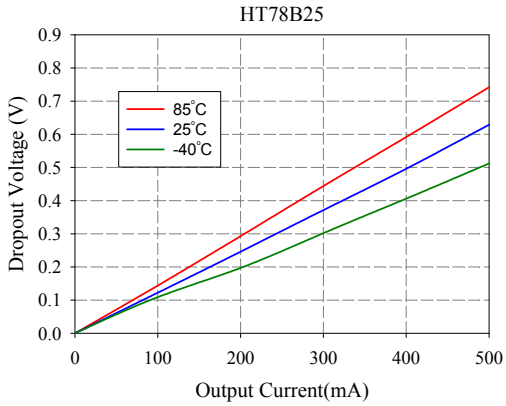
Supply Current vs. Temperature

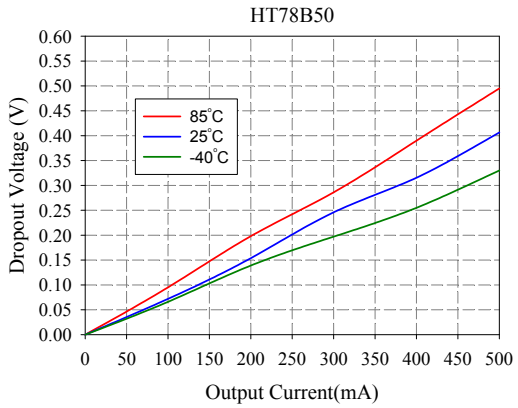


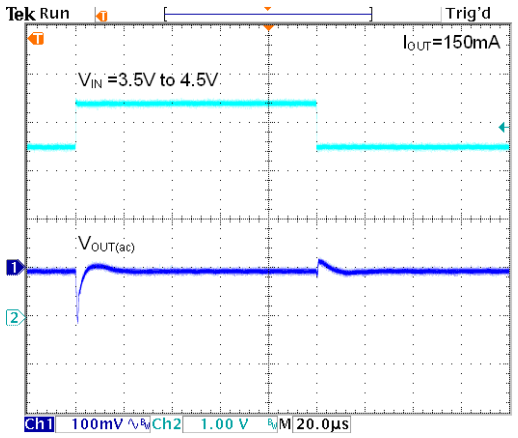
Dropout Voltage vs. Output Current





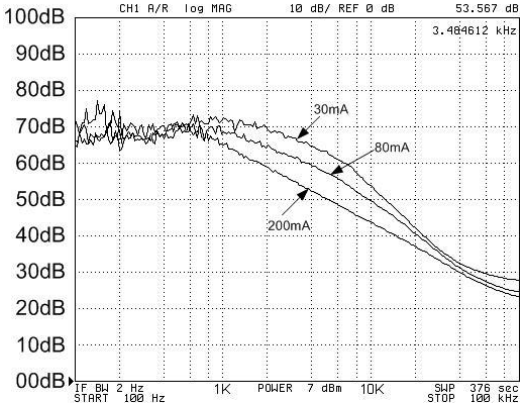




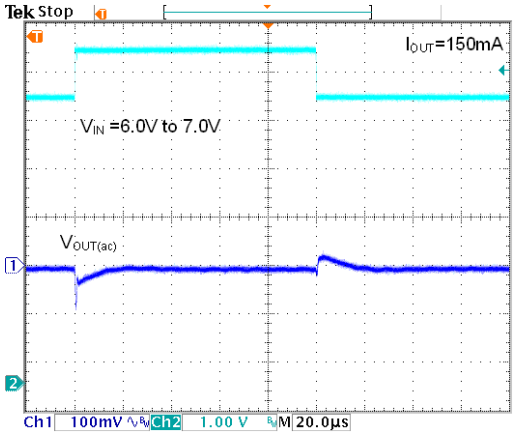


HT78B25 C_{IN}=0µF, C_{OUT} =1µF, CH1=$V_{OUT(ac)}$, CH2=V_{IN}

Ripple Rejection vs. Frequency

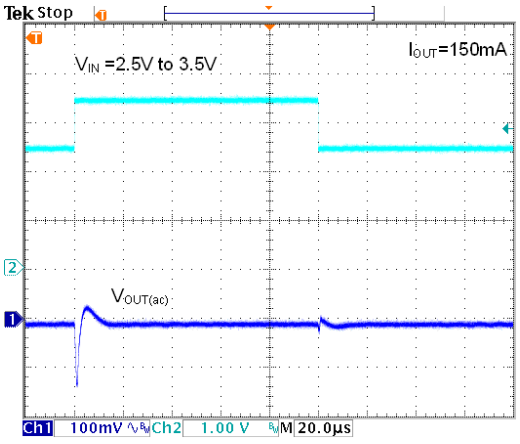


HT78B15 V_{OUT}=1.5V, V_{IN}=2.5V (I_{OUT}=30, 80, 200mA)



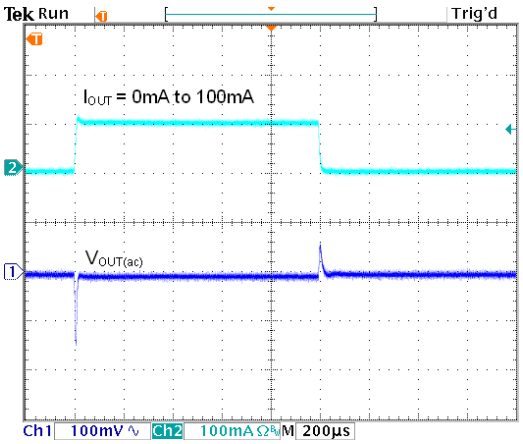
HT78B50 C_{IN}=0µF, C_{OUT}=1µF, CH1=$V_{OUT(ac)}$, CH2=V_{IN}

Input Transient Response

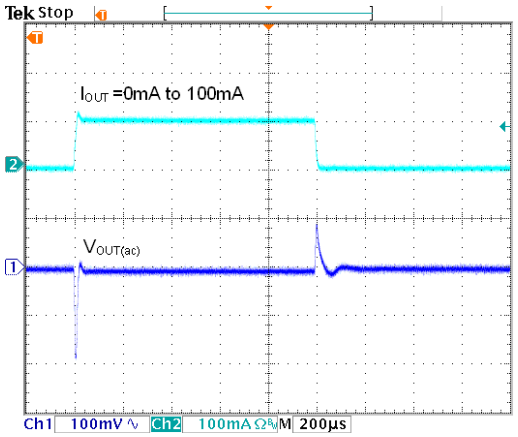


HT78B15 C_{IN}=0µF, C_{OUT} =1µF, CH1=$V_{OUT(ac)}$, CH2=V_{IN}

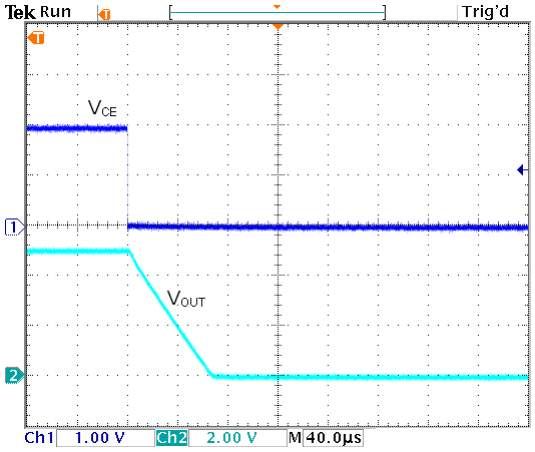
Load Transient Response



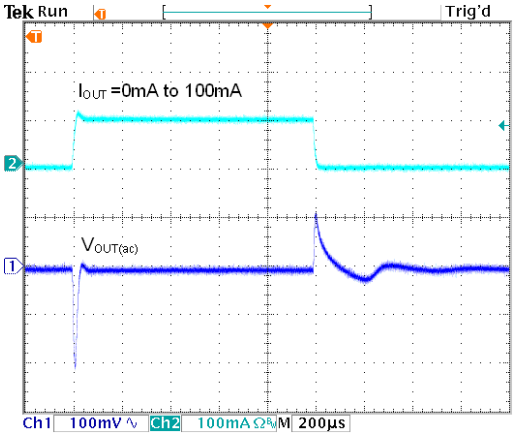
HT78B15 V_{IN}=2.5V, C_{IN}=C_{OUT}=1µF, CH1=$V_{OUT(ac)}$, CH2=I_{OUT}



HT78B25 V_{IN}=3.5V, C_{IN}=C_{OUT}=1µF, CH1=$V_{OUT(ac)}$, CH2=I_{OUT}

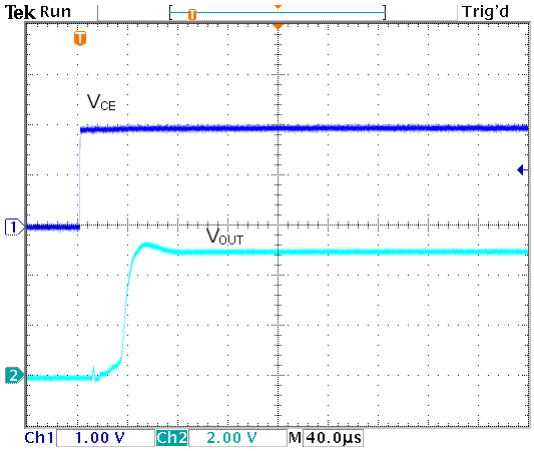


HT78B50 I_{OUT}=150mA, V_{IN}=6.0V, C_{IN}=C_{OUT}=1µF, CH1=V_{CE}, CH2=V_{OUT}



HT78B50 V_{IN}=6.0V, C_{IN}=C_{OUT}=1µF, CH1=$V_{OUT(ac)}$, CH2=I_{OUT}

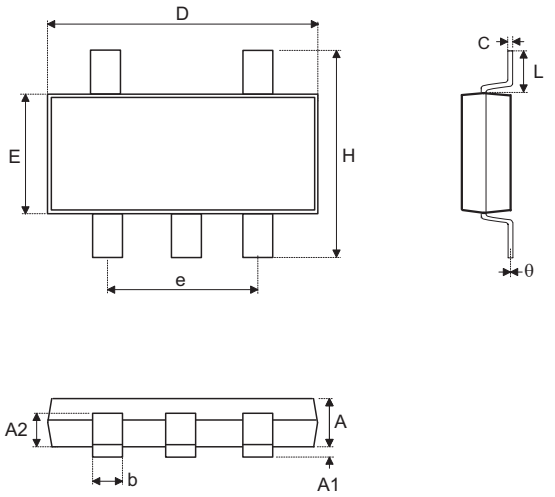
Turn-on/off speed with CE pin



HT78B50 I_{OUT}=150mA, V_{IN}=6.0V, C_{IN}=C_{OUT}=1µF, CH1=V_{CE}, CH2=V_{OUT}

Package Information

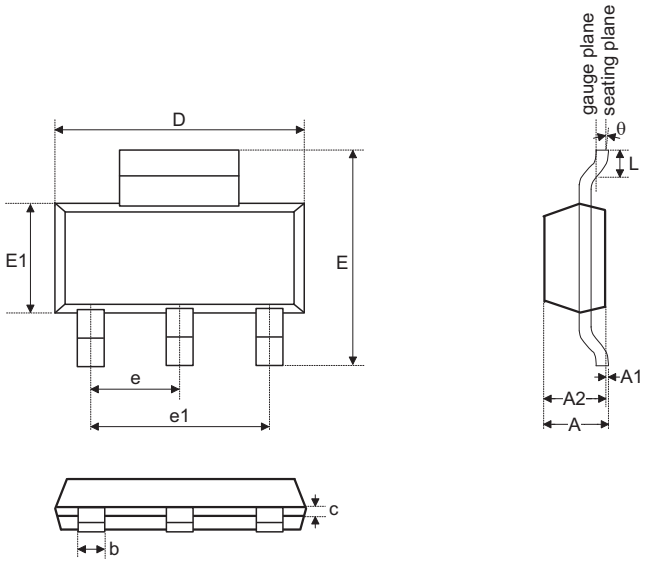
5-pin SOT23-5 Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.039	—	0.051
A1	—	—	0.004
A2	0.028	—	0.035
b	0.014	—	0.020
C	0.004	—	0.010
D	0.106	—	0.122
E	0.055	—	0.071
e	—	0.075	—
H	0.102	—	0.118
L	0.015	—	—
θ	0°	—	9°

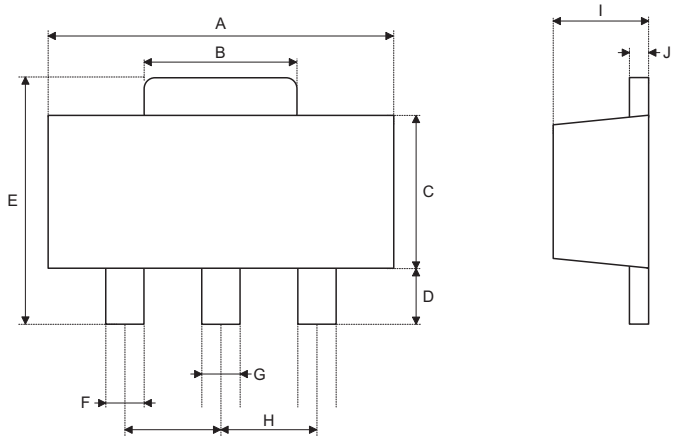
Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	1.00	—	1.30
A1	—	—	0.10
A2	0.70	—	0.90
b	0.35	—	0.50
C	0.10	—	0.25
D	2.70	—	3.10
E	1.40	—	1.80
e	—	1.90	—
H	2.60	—	3.0
L	0.37	—	—
θ	0°	—	9°

3-pin SOT223 Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	—	—	1.8
A1	0.02	—	0.1
A2	1.5	—	1.7
b	0.66	—	0.84
C	0.23	—	0.35
D	6.3	—	6.7
E	6.7	—	7.3
E1	3.3	—	3.7
e	—	2.3	—
e1	—	4.6	—
L	0.75	—	—
θ	0°	—	10°

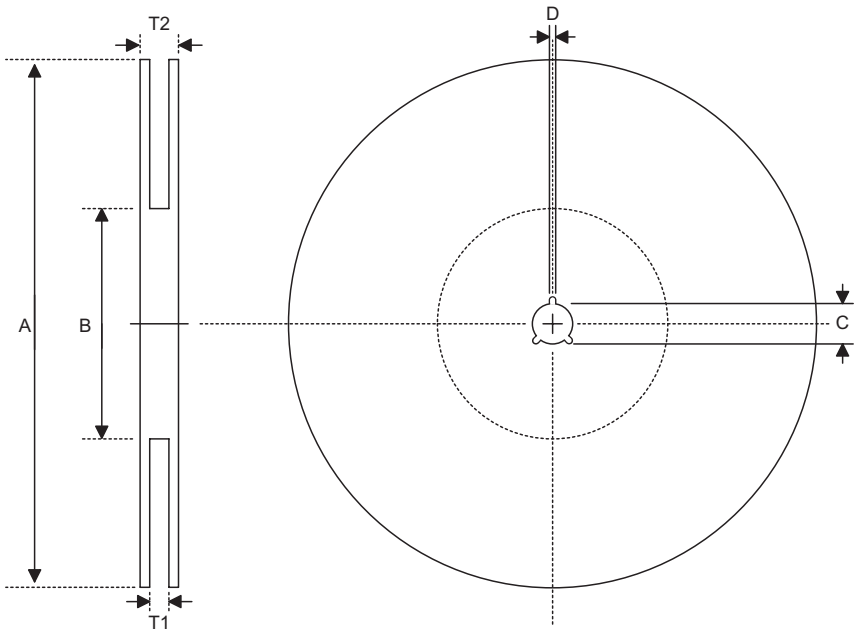
3-pin SOT89 Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.173	—	0.181
B	0.059	—	0.072
C	0.090	—	0.102
D	0.035	—	0.047
E	0.155	—	0.167
F	0.014	—	0.019
G	0.017	—	0.022
H	—	0.059	—
I	55	—	63
J	14	—	17

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	4.39	—	4.60
B	1.50	—	1.83
C	2.29	—	2.59
D	0.89	—	1.19
E	3.94	—	4.24
F	0.36	—	0.48
G	0.43	—	0.56
H	—	1.50	—
I	1.40	—	1.60
J	0.36	—	0.43

Reel Dimensions



SOT23-5

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	178.0±1.0
B	Reel Inner Diameter	62.0±1.0
C	Spindle Hole Diameter	13.0±0.2
D	Key Slit Width	2.50±0.25
T1	Space Between Flang	$8.4^{+1.5/-0.0}$
T2	Reel Thickness	$11.4^{+1.5/-0.0}$

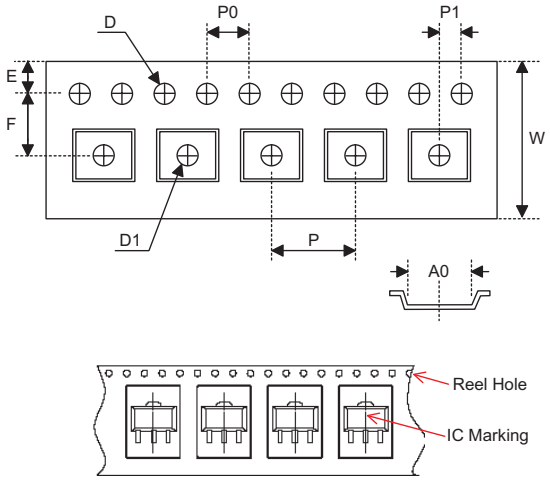
SOT223

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	330±1
B	Reel Inner Diameter	62±1.5
C	Spindle Hole Diameter	12.75±0.15
D	Key Slit Width	2+0.6
T1	Space Between Flang	12.4+0.2
T2	Reel Thickness	16.4−0.4

SOT89-3

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	180.0±1.0
B	Reel Inner Diameter	62.0±1.5
C	Spindle Hole Diameter	$12.75^{+0.15/-0.00}$
D	Key Slit Width	1.9±0.15
T1	Space Between Flang	$12.4^{+0.2/-0.0}$
T2	Reel Thickness	$17.0^{+0.0/-0.4}$

Carrier Tape Dimensions



SOT23-5

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	8.0±0.3
P	Cavity Pitch	4.0±0.1
E	Perforation Position	1.75±0.10
F	Cavity to Perforation(Width Direction)	3.50±0.05
D	Perforation Diameter	$1.5^{+0.1/-0.0}$
D1	Cavity Hole Diameter	$1.5^{+0.1/-0.0}$
P0	Perforation Pitch	4.0±0.1
P1	Cavity to Perforation(Length Direction)	2.00±0.05
A0	Cavity Length	3.15±0.10
B0	Cavity Width	3.2±0.1
K0	Cavity Depth	1.4±0.1
t	Carrier Tape Thickness	0.20±0.03
C	Cover Tape Width	5.3±0.1

SOT223

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	12±0.3
P	Cavity Pitch	8±0.1
E	Perforation Position	1.75±0.1
F	Cavity to Perforation (Width Direction)	5.5±0.05
D	Perforation Diameter	1.5+0.1
D1	Cavity Hole Diameter	1.5+0.1
P0	Perforation Pitch	4±0.1
P1	Cavity to Perforation (Length Direction)	2±0.05
A0	Cavity Length	6.9±0.1
B0	Cavity Width	7.5±0.1
K0	Cavity Depth	2.1±0.1
t	Carrier Tape Thickness	0.3±0.05
C	Cover Tape Width	9.3

SOT89-3

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	12.0 $^{+0.3/-0.1}$
P	Cavity Pitch	8.0±0.1
E	Perforation Position	1.75±0.10
F	Cavity to Perforation(Width Direction)	5.50±0.05
D	Perforation Diameter	1.5+0.1
D1	Cavity Hole Diameter	1.5+0.1
P0	Perforation Pitch	4.0±0.1
P1	Cavity to Perforation(Length Direction)	2.0±0.1
A0	Cavity Length	4.8±0.1
B0	Cavity Width	4.5±0.1
K0	Cavity Depth	1.8±0.1
t	Carrier Tape Thickness	0.300±0.013
C	Cover Tape Width	9.3±0.1

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