
Fast Start-up, Ultra Low Noise, High PSRR, 400mA LDO

FEATURES

- Ultra-Low Noise for RF Application
- Ultra-Fast Response in Line/Load Transient
- Quick Start-Up (Typically 25 μ S)
- Low Quiescent Current: 65 μ A
- Less than 0.1 μ A Standby Current When Shutdown
- Low Dropout Voltage: 100mV @ 100mA, 420mV @ 400mA ($V_{out}=2.8V$)
- Wide Operating Voltage Ranges : 2.5V to 6V
- TTL-Logic-Controlled Shutdown Input
- Low Temperature Coefficient
- Current Limiting Protection
- Only 1 μ F Output Capacitor Required
- High Power Supply Rejection Ratio
- ROHS Compliant and 100% Lead (Pb)-Free
- Custom Voltage Available
- Custom Options for CE Logic and Build-in Pull-up/down Available

DESCRIPTION

The FT533xx is designed for portable RF and wireless applications with demanding performance and space requirements. The FT533xx performance is optimized for battery powered systems to deliver ultra low noise and low quiescent current. Regulator ground current increases only slightly in dropout, further prolonging the battery life.

The FT533xx also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The FT533xx consumes less than 0.1 μ A in shutdown mode and has fast turn-on time less than 25 μ S. The other features include low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio. The FT533xx is available in the 5-lead of SOT-23-5(L), SC-70 and the 3-lead of SOT-23-3(L), SOT-89-3(L), SOT-23 packages.

APPLICATIONS

- CDMA/GSM Cellular Handsets
- Battery-Powered Equipment
- Laptop, Palmtops, Notebook Computers
- Hand-Held Instruments
- PCMCIA Cards
- Portable Information Appliances

TYPICAL APPLICATION CIRCUIT

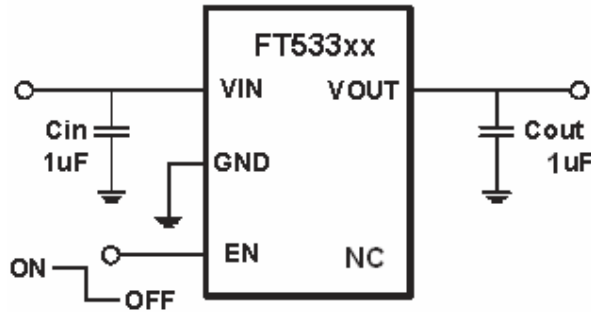


Figure 1: Typical Application Circuit

ABSOLUTE MAXIMUM RATINGS

- ◆ Supply Input Voltage ----- 6V
- ◆ Power Dissipation, PD@ TA=27 °C
 - SOT-23-5(L) ----- 400mW
 - SOT-23-3(L) ----- 400mW
 - SOT-89-3(L) ----- 600mW
 - SC-70 ----- 300mW
 - SOT-23 ----- 250mW
- ◆ Package Thermal Resistance
 - SOT-23-5(L) ----- 250°C/W
 - SOT-23-3(L) ----- 250°C/W
 - SOT-89-3(L) ----- 170°C/W
 - SC-70 ----- 330°C/W
 - SOT-23 ----- 380°C/W
- Lead Temperature (Soldering, 10sec.) ----- 260°C
- ◆ Storage Temperature Range ----- -60°C to 150°C
- ◆ ESD Susceptibility
 - HBM (Human Body Mode) -----4kV
 - MM (Machine Mode) -----200V

* Stresses exceed those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. Functional operation of the device at conditions beyond those listed in the specification is not guaranteed. Prolonged exposure to extreme conditions may affect device reliability or functionality.

PIN CONFIGURATION

Top View

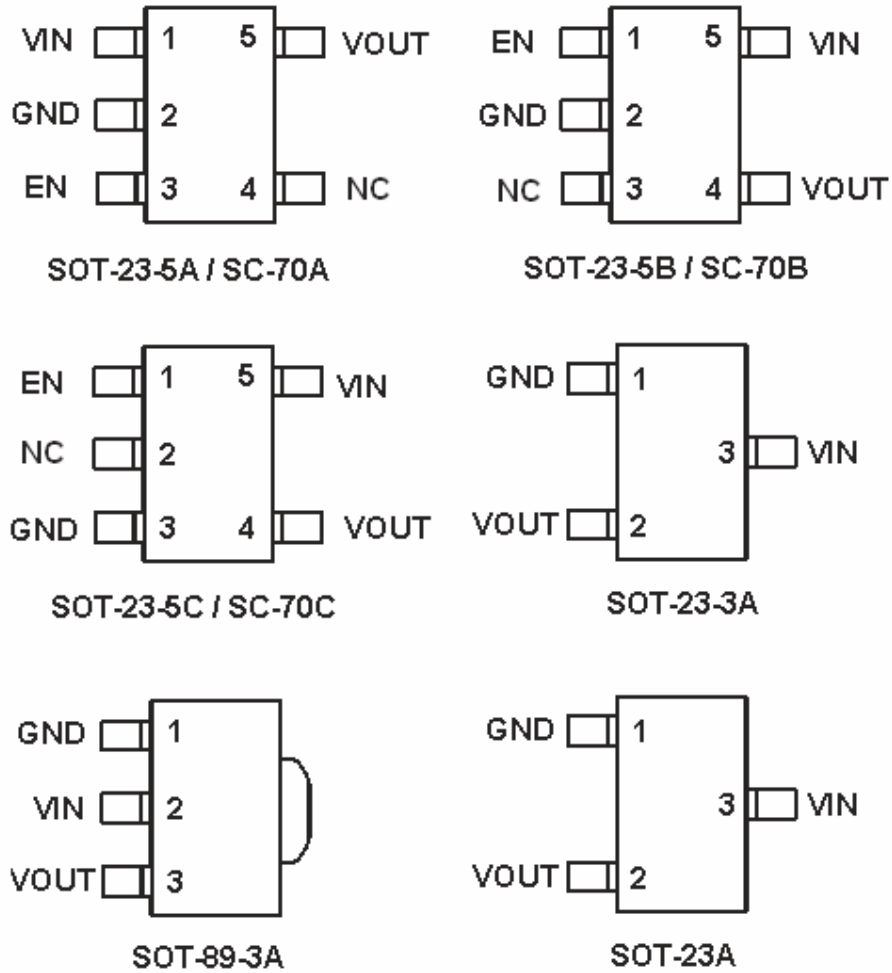


Figure 2: Pin Configuration

TERMINAL FUNCTION

Pin Name	Function
EN	Chip Enable (Active High). No Pull-Down Resistor Build-in For packages SOT-23-3(L) ,SOT-89-3(L) and SOT-23, the EN is internally connected to VIN
VIN	Power Input Voltage
VOUT	Output Voltage
NC	No Connection
GND	Ground

Table 1

ORDERING INFORMATION

FT533①②

Designator	Symbol	Output Voltage
①	D	1.8V
	E	2.5V
	F	2.7V
	G	2.8V
	H	2.85V
	I	3.0V
	J	3.3V
	K	3.6V
	L	4.2V

Table 2

Designator	Symbol	Pin Configuration	Package Type
②	a	SOT-23-5A	SOT-23-5(L)
	b	SOT-23-5B	
	c	SOT-23-5C	
	d	SC-70A	SC-70 / SOT-353
	e	SC-70B	
	f	SC-70C	
	g	SOT-23-3A	SOT-23-3(L)
	h	SOT-23A	SOT-23
	i	SOT-89-3A	SOT-89-3(L)

Table 3

MARKING RULE

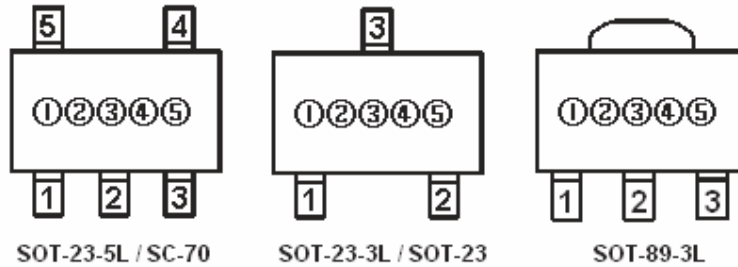


Figure 3: Top View

- ① Represent Product Series

Symbol	Product Series
5	FT533xx

- ② Represent Output Voltage and operating temperature range

G represent the output voltage is 2.8V, operating temperature is $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$.

- ③④⑤ for internal reference.

BLOCK DIAGRAM

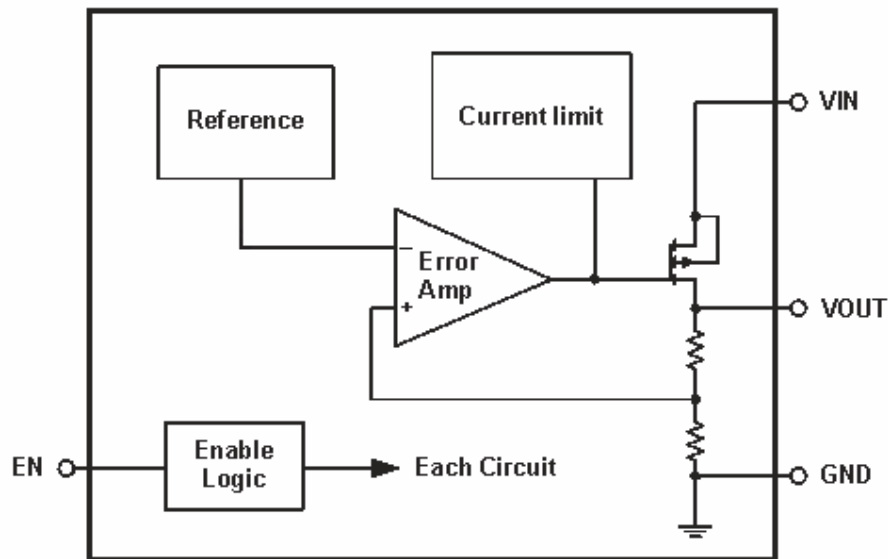


Figure 4: Block Diagram

ELECTRICAL CHARACTERISTICS

Vout=1.8V; En=Vin=(Vout+1)V; Cout=1μF unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	Vout	Iout=1mA	-2	---	+2	%
Current Limiter	I _{max}	Vin=Vout+1V	500	700	---	mA
	I _{short}	Vin=Vout+1V	---	80	---	mA
Line Regulations	ΔV _{line}	(Vout+1.0V)~6V	---	0.01	0.3	%/V
Load Regulation	ΔV _{load}	1mA≤Iout≤100mA	---	10	---	mV
		1mA≤Iout≤400mA	---	40	---	
Dropout Voltage	V _{drop}	Iout=100mA	---	150	---	mV
		Iout=400mA	---	650	---	
Supply Current	I _q	Vin=(Vout+1)V, Iout=0mA	---	65	---	μA
Standby Current	I _{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	ΔVout/ (ΔTemp* Vout)	Iout=30mA -40°C≤Temp≤85°C	---	100	---	ppm/°C
Output Noise Voltage	e _{NO}	10Hz~100kHz	---	30	---	μV _{rms}
Ripple Rejection Rate	PSRR@1k	Vin=Vout+1VDC+1Vp-pAC	---	75	---	dB
	PSRR@10k	Iout=30mA		75		
EN Input Bias Current	I _{en}		---	0	100	nA
EN Threshold	VL	---	---	---	0.3	V
	VH	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

$V_{out}=2.5V$; $E_n=V_{in}=(V_{out}+1)V$; $C_{out}=1\mu F$ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_{out}	$I_{out}=1mA$	-2	---	+2	%
Current Limiter	I_{max}	$V_{in}=V_{out}+1V$	500	700	---	mA
	I_{short}	$V_{in}=V_{out}+1V$	---	80	---	mA
Line Regulations	ΔV_{line}	$(V_{out}+1.0V)\sim 6V$	---	0.01	0.3	%/V
Load Regulation	ΔV_{load}	$1mA \leq I_{out} \leq 100mA$	---	10	---	mV
		$1mA \leq I_{out} \leq 400mA$	---	40	---	
Dropout Voltage	V_{drop}	$I_{out}=100mA$	---	100	---	mV
		$I_{out}=400mA$	---	450	---	
Supply Current	I_q	$V_{in}=(V_{out}+1)V, I_{out}=0mA$	---	65	---	μA
Standby Current	I_{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	$\Delta V_{out} / (\Delta Temp^* V_{out})$	$I_{out}=30mA$ $-40^\circ C \leq Temp \leq 85^\circ C$	---	100	---	ppm/ $^\circ C$
Output Noise Voltage	e_{NO}	10Hz~100kHz	---	30	---	μV_{rms}
Ripple Rejection Rate	PSRR@1k	$V_{in}=V_{out}+1V_{DC}+1V_{p-pAC}$	---	75	---	dB
	PSRR@10k	$I_{out}=30mA$	---	75	---	
EN Input Bias Current	I_{en}		---	0	100	nA
EN Threshold	VL	---	---	---	0.3	V
	VH	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

$V_{out}=2.7V$; $E_n=V_{in}=(V_{out}+1)V$; $C_{out}=1\mu F$ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_{out}	$I_{out}=1mA$	-2	---	+2	%
Current Limiter	I_{max}	$V_{in}=V_{out}+1V$	500	700	---	mA
	I_{short}	$V_{in}=V_{out}+1V$	---	80	---	mA
Line Regulations	ΔV_{line}	$(V_{out}+1.0V)\sim 6V$	---	0.01	0.3	%/V
Load Regulation	ΔV_{load}	$1mA \leq I_{out} \leq 100mA$	---	10	---	mV
		$1mA \leq I_{out} \leq 400mA$	---	40	---	
Dropout Voltage	V_{drop}	$I_{out}=100mA$	---	100	---	mV
		$I_{out}=400mA$	---	420	---	
Supply Current	I_q	$V_{in}=(V_{out}+1)V, I_{out}=0mA$	---	65	---	μA
Standby Current	I_{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	$\Delta V_{out} / (\Delta Temp^* V_{out})$	$I_{out}=30mA$ $-40^\circ C \leq Temp \leq 85^\circ C$	---	100	---	ppm/ $^\circ C$
Output Noise Voltage	e_{NO}	10Hz~100kHz	---	30	---	μV_{rms}
Ripple Rejection Rate	PSRR@1k	$V_{in}=V_{out}+1V_{DC}+1V_{p-pAC}$	---	75	---	dB
	PSRR@10k	$I_{out}=30mA$	---	75	---	
EN Input Bias Current	I_{en}		---	0	100	nA
EN Threshold	VL	---	---	---	0.3	V
	VH	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

$V_{out}=2.8V$; $E_n=V_{in}=(V_{out}+1)V$; $C_{out}=1\mu F$ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_{out}	$I_{out}=1mA$	-2	---	+2	%
Current Limiter	I_{max}	$V_{in}=V_{out}+1V$	500	700	---	mA
	I_{short}	$V_{in}=V_{out}+1V$	---	80	---	mA
Line Regulations	ΔV_{line}	$(V_{out}+1.0V)\sim 6V$	---	0.01	0.3	%/V
Load Regulation	ΔV_{load}	$1mA \leq I_{out} \leq 100mA$	---	10	---	mV
		$1mA \leq I_{out} \leq 400mA$	---	40	---	
Dropout Voltage	V_{drop}	$I_{out}=100mA$	---	100	---	mV
		$I_{out}=400mA$	---	420	---	
Supply Current	I_q	$V_{in}=(V_{out}+1)V, I_{out}=0mA$	---	65	---	μA
Standby Current	I_{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	$\Delta V_{out} / (\Delta Temp^* V_{out})$	$I_{out}=30mA$ $-40^\circ C \leq Temp \leq 85^\circ C$	---	100	---	ppm/ $^\circ C$
Output Noise Voltage	e_{NO}	10Hz~100kHz	---	30	---	μV_{rms}
Ripple Rejection Rate	PSRR@1k	$V_{in}=V_{out}+1V_{DC}+1V_{p-pAC}$	---	75	---	dB
	PSRR@10k	$I_{out}=30mA$	---	75	---	
EN Input Bias Current	I_{en}		---	0	100	nA
EN Threshold	VL	---	---	---	0.3	V
	VH	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

$V_{out}=2.85V$; $E_n=V_{in}=(V_{out}+1)V$; $C_{out}=1\mu F$ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_{out}	$I_{out}=1mA$	-2	---	+2	%
Current Limiter	I_{max}	$V_{in}=V_{out}+1V$	500	700	---	mA
	I_{short}	$V_{in}=V_{out}+1V$	---	80	---	mA
Line Regulations	ΔV_{line}	$(V_{out}+1.0V)\sim 6V$	---	0.01	0.3	%/V
Load Regulation	ΔV_{load}	$1mA \leq I_{out} \leq 100mA$	---	10	---	mV
		$1mA \leq I_{out} \leq 400mA$	---	40	---	
Dropout Voltage	V_{drop}	$I_{out}=100mA$	---	100	---	mV
		$I_{out}=400mA$	---	420	---	
Supply Current	I_q	$V_{in}=(V_{out}+1)V, I_{out}=0mA$	---	65	---	μA
Standby Current	I_{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	$\Delta V_{out} / (\Delta Temp^* V_{out})$	$I_{out}=30mA$ $-40^\circ C \leq Temp \leq 85^\circ C$	---	100	---	ppm/ $^\circ C$
Output Noise Voltage	e_{NO}	10Hz~100kHz	---	30	---	μV_{rms}
Ripple Rejection Rate	PSRR@1k	$V_{in}=V_{out}+1V_{DC}+1V_{p-pAC}$	---	75	---	dB
	PSRR@10k	$I_{out}=30mA$	---	75	---	
EN Input Bias Current	I_{en}		---	0	100	nA
EN Threshold	VL	---	---	---	0.3	V
	VH	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

Vout=3.0V; En=Vin=(Vout+1)V; Cout=1μF unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	Vout	Iout=1mA	-2	---	+2	%
Current Limiter	I _{max}	V _{in} =V _{out} +1V	500	700	---	mA
	I _{short}	V _{in} =V _{out} +1V	---	80	---	mA
Line Regulations	ΔV _{line}	(V _{out} +1.0V)~6V	---	0.01	0.3	%/V
Load Regulation	ΔV _{load}	1mA ≤ I _{out} ≤ 100mA	---	10	---	mV
		1mA ≤ I _{out} ≤ 400mA	---	40	---	
Dropout Voltage	V _{drop}	I _{out} =100mA	---	100	---	mV
		I _{out} =400mA	---	420	---	
Supply Current	I _q	V _{in} =(V _{out} +1)V, I _{out} =0mA	---	65	---	μA
Standby Current	I _{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	ΔV _{out} / (ΔTemp* V _{out})	I _{out} =30mA -40°C ≤ Temp ≤ 85°C	---	100	---	ppm/°C
Output Noise Voltage	e _{NO}	10Hz~100kHz	---	30	---	μV _{rms}
Ripple Rejection Rate	PSRR@1k	V _{in} =V _{out} +1VDC+1Vp-pAC	---	75	---	dB
	PSRR@10k	I _{out} =30mA	---	75	---	
EN Input Bias Current	I _{en}		---	0	100	nA
EN Threshold	V _L	---	---	---	0.3	V
	V _H	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

$V_{out}=3.3V$; $E_n=V_{in}=(V_{out}+1)V$; $C_{out}=1\mu F$ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_{out}	$I_{out}=1mA$	-2	---	+2	%
Current Limiter	I_{max}	$V_{in}=V_{out}+1V$	500	700	---	mA
	I_{short}	$V_{in}=V_{out}+1V$	---	80	---	mA
Line Regulations	ΔV_{line}	$(V_{out}+1.0V)\sim 6V$	---	0.01	0.3	%/V
Load Regulation	ΔV_{load}	$1mA \leq I_{out} \leq 100mA$	---	10	---	mV
		$1mA \leq I_{out} \leq 400mA$	---	40	---	
Dropout Voltage	V_{drop}	$I_{out}=100mA$	---	100	---	mV
		$I_{out}=400mA$	---	420	---	
Supply Current	I_q	$V_{in}=(V_{out}+1)V, I_{out}=0mA$	---	65	---	μA
Standby Current	I_{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	$\Delta V_{out} / (\Delta Temp^* V_{out})$	$I_{out}=30mA$ $-40^\circ C \leq Temp \leq 85^\circ C$	---	100	---	ppm/ $^\circ C$
Output Noise Voltage	e_{NO}	10Hz~100kHz	---	30	---	μV_{rms}
Ripple Rejection Rate	PSRR@1k	$V_{in}=V_{out}+1V_{DC}+1V_{p-pAC}$	---	75	---	dB
	PSRR@10k	$I_{out}=30mA$	---	75	---	
EN Input Bias Current	I_{en}		---	0	100	nA
EN Threshold	VL	---	---	---	0.3	V
	VH	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

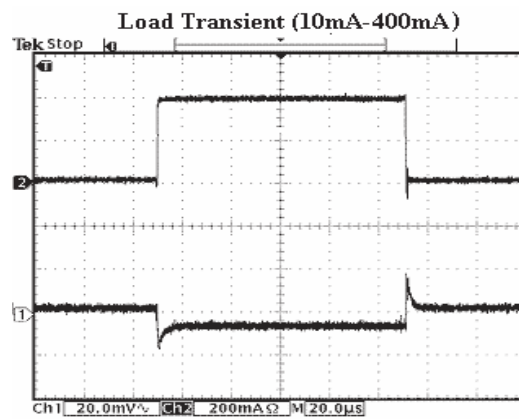
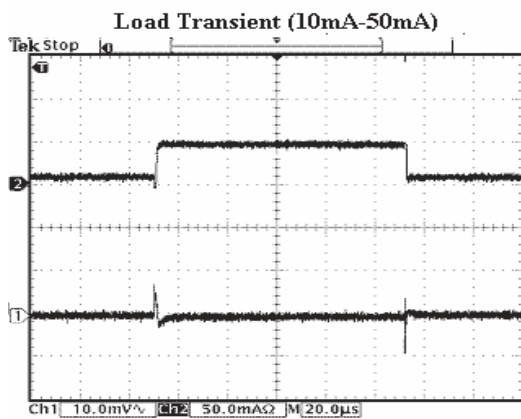
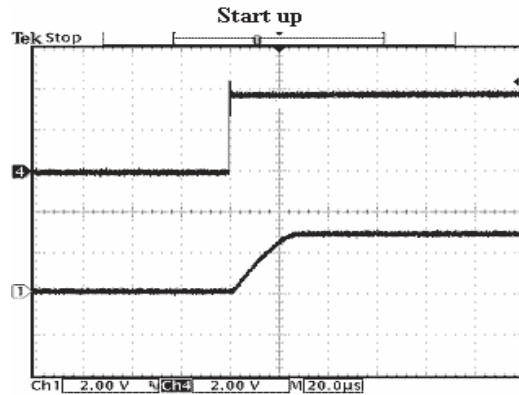
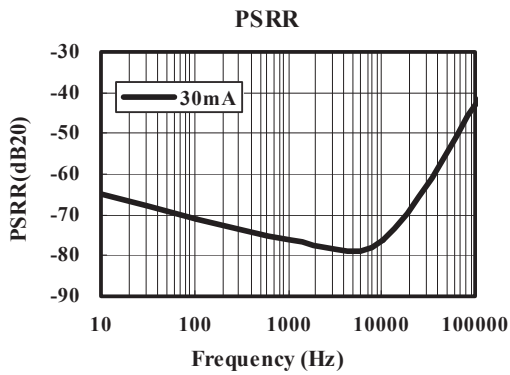
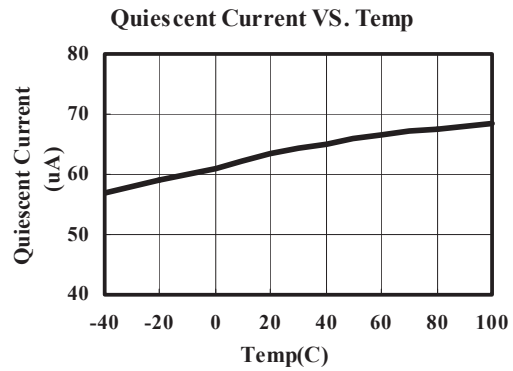
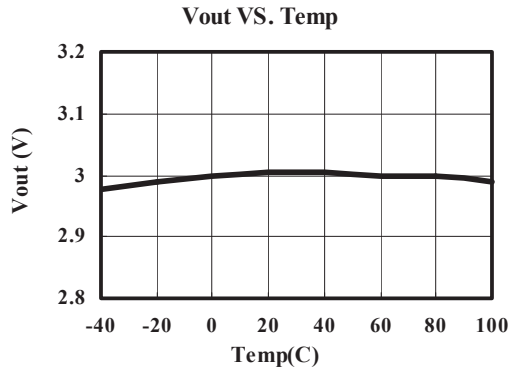
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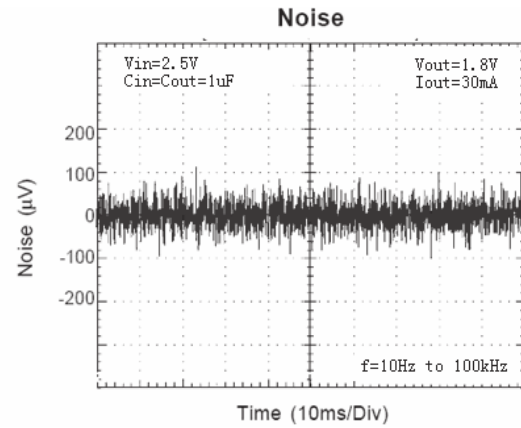
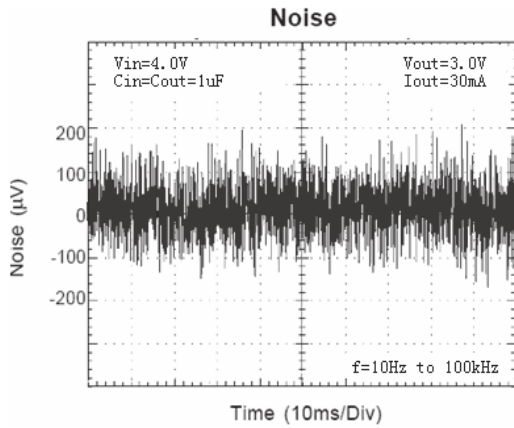
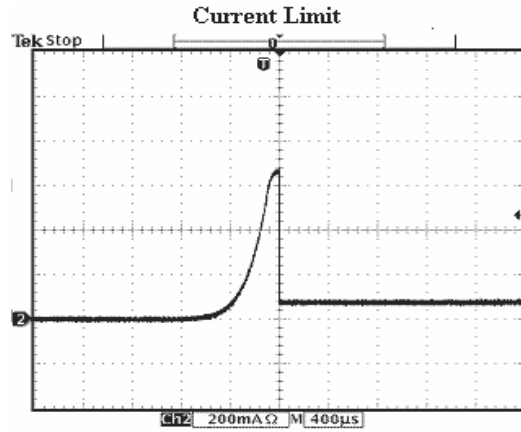
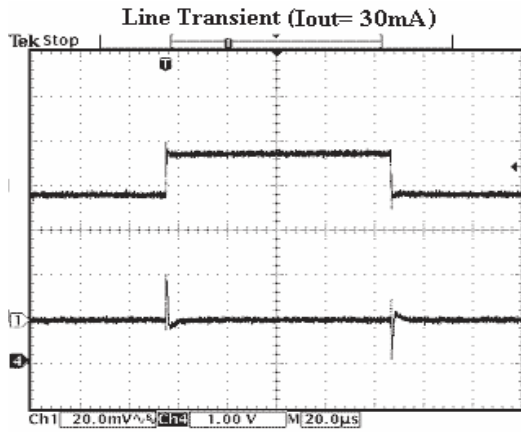
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_{out}	$I_{out}=1mA$	-2	---	+2	%
Current Limiter	I_{max}	$V_{in}=V_{out}+1V$	500	700	---	mA
	I_{short}	$V_{in}=V_{out}+1V$	---	80	---	mA
Line Regulations	ΔV_{line}	$(V_{out}+1.0V)\sim 6V$	---	0.01	0.3	%/V
Load Regulation	ΔV_{load}	$1mA \leq I_{out} \leq 100mA$	---	10	---	mV
		$1mA \leq I_{out} \leq 400mA$	---	40	---	
Dropout Voltage	V_{drop}	$I_{out}=100mA$	---	100	---	mV
		$I_{out}=400mA$	---	420	---	
Supply Current	I_q	$V_{in}=(V_{out}+1)V, I_{out}=0mA$	---	65	---	μA
Standby Current	I_{stby}	Shut down	---	0.01	1	μA
Temperature Coefficient	$\Delta V_{out} / (\Delta Temp^* V_{out})$	$I_{out}=30mA$ $-40^\circ C \leq Temp \leq 85^\circ C$	---	100	---	ppm/ $^\circ C$
Output Noise Voltage	e_{NO}	10Hz~100kHz	---	30	---	μV_{rms}
Ripple Rejection Rate	PSRR@1k	$V_{in}=V_{out}+1V_{DC}+1V_{p-pAC}$	---	75	---	dB
	PSRR@10k	$I_{out}=30mA$	---	75	---	
EN Input Bias Current	I_{en}		---	0	100	nA
EN Threshold	VL	---	---	---	0.3	V
	VH	---	1.2	---	6	V

* Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

TYPICAL PERFORMANCE CHARACTERISTICS FT533I

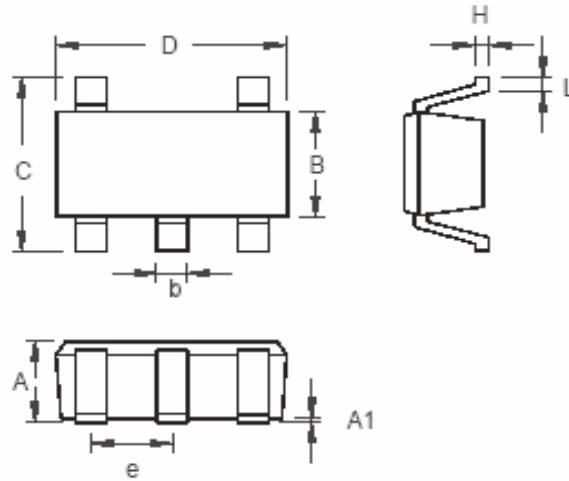
Vin=4.0V, Vout=3.0V, Co=1μF, temp=27°C unless otherwise noted





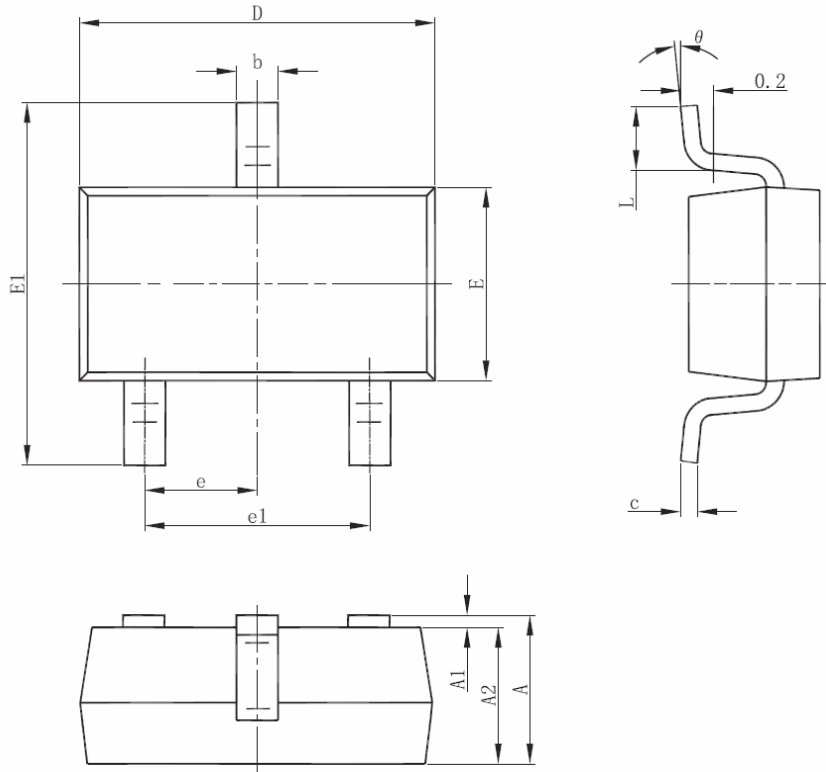
PAKAGING INFORMATION

SOT-23-5L



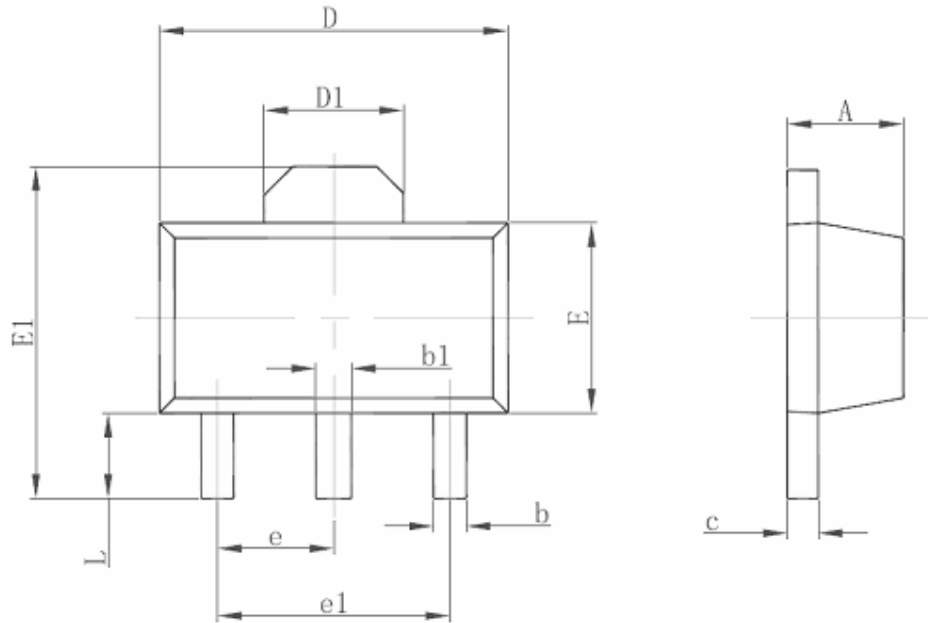
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-3L



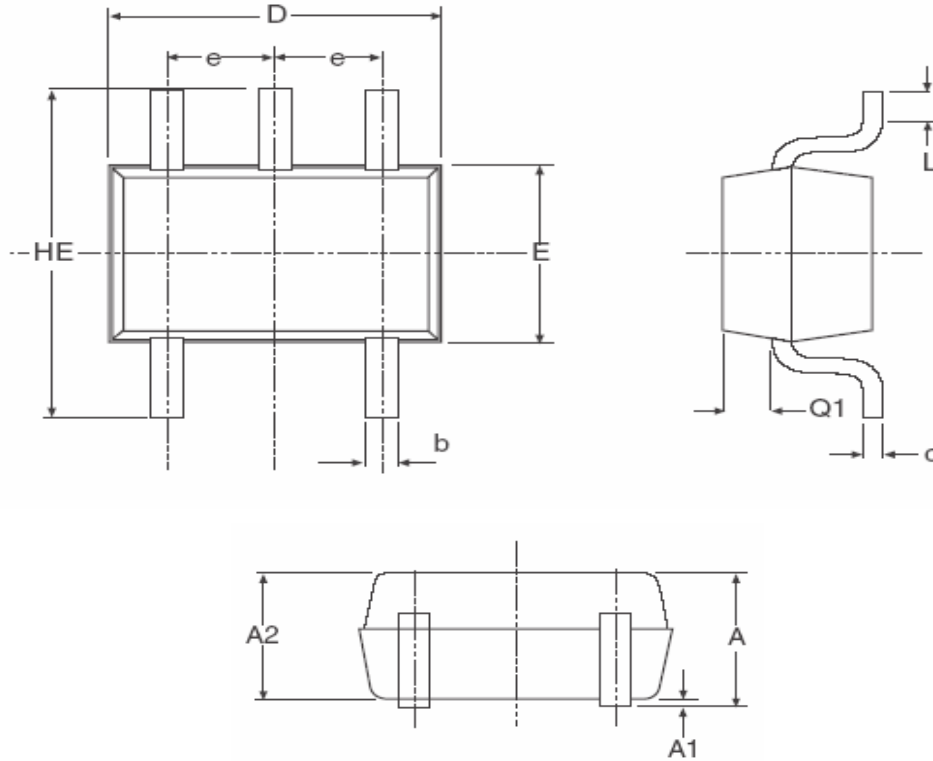
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT-89-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047

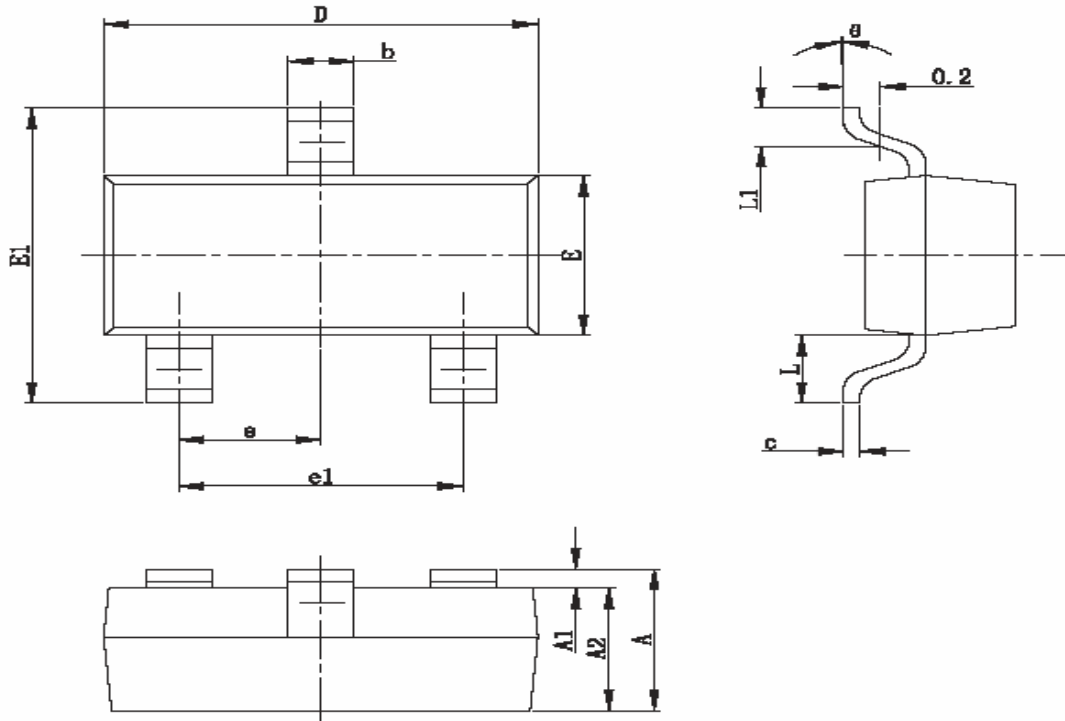
SC-70



- Note: 1. All dimensions are in inches/ (millimeters)
 2. Dimensions are inclusive of plating
 3. Dimensions are exclusive of mold flash & metal burr
 4. All specifications comply to EIAJ SC70

Symbol	Min	Max
e	0.026BSC/ (0.65 BSC)	
D	0.071/(1.80)	0.067/(2.20)
b	0.006/(0.15)	0.012/(0.30)
E	0.045/(1.15)	0.053/(1.35)
HE	0.071/(1.80)	0.094/(2.40)
Q1	0.004/(0.10)	0.016/(0.40)
A2	0.031/(0.80)	0.039/(1.00)
A1	0.000/(0.00)	0.004/(0.10)
A	0.031/(0.80)	0.043/(1.10)
c	0.004/(0.10)	0.007/(0.18)
L	0.004/(0.10)	0.012/(0.30)

SOT-23



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°



APPENDIX A: REVISION HISTORY

**Revision A1: Added Typical Performance Characteristics of FT533I;
Revised some Electrical Characteristics.**

Version A0: Original data sheet for the FT53xx.

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