AT5231/AT5231T

300mA Low Dropout Voltage Linear Regulators

Immense Advance Tech.

FEATURES

- V_{IN} Range: 2.0V to 6.0V
- Low Dropout Voltage: 0.22V (Typ)
- (V_{OUT}= 3.3V, I_{OUT}= 150mA)
- Output Current: 300mA
- High Ripple Rejection: 65dB (Typ)(f= 10kHz)
- Excellent Line Regulation: 0.01% / V(Typ)
- Output Voltage Accuracy: ±2.0%
- Low Supply Current: 70μA (Typ)
- Standby Mode: 0.01μA (Typ)
- Over Current Protection
- Ceramic Capacitors are Recommend to be Used with this IC: C_{IN} = C_{OUT} = 1μF
- Built-In Over Shoot Protection Circuit
- Ultra Fast Transient Response

APPLICATION

- Power Source for Portable Communication Equipment
- Power Source for Battery-Powered Equipment

DESCRIPTION

The AT5231/AT5231T Series are CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current, low ON-resistance. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor-

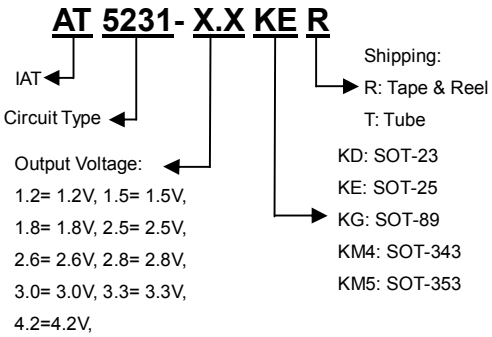
net for voltage setting, a current limit circuit and a chip enable circuit.

These ICs perform with low dropout voltage and a chip enable function (SOT-25 and SOT-343/353 package only). The line transient response and load transient response of the AT5231/AT5231T Series are excellent, thus these ICs are very suitable for the power supply for handheld communication equipment.

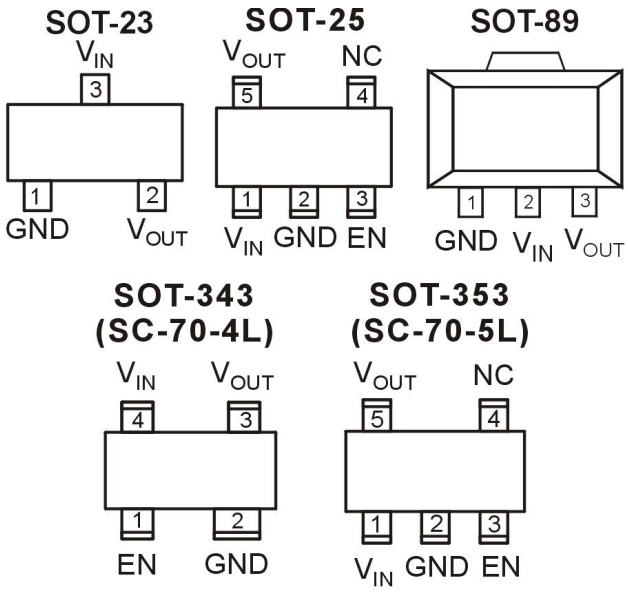
AT5231 are available in the SOT-23, SOT-25, SOT-343, SOT-353 and SOT-89 packages.

AT5231T is available in the SOT-89 package.

ORDER INFORMATION



PIN CONFIGURATIONS (TOP VIEW)



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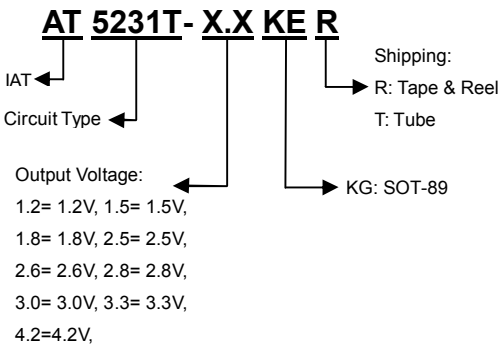
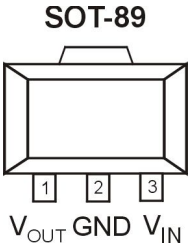


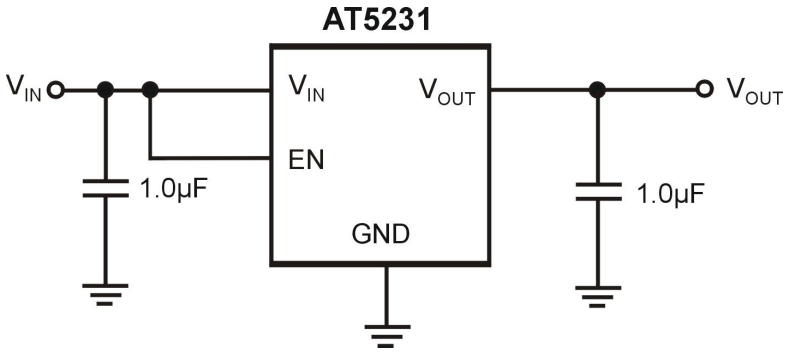
PIN CONFIGURATIONS (TOP VIEW)

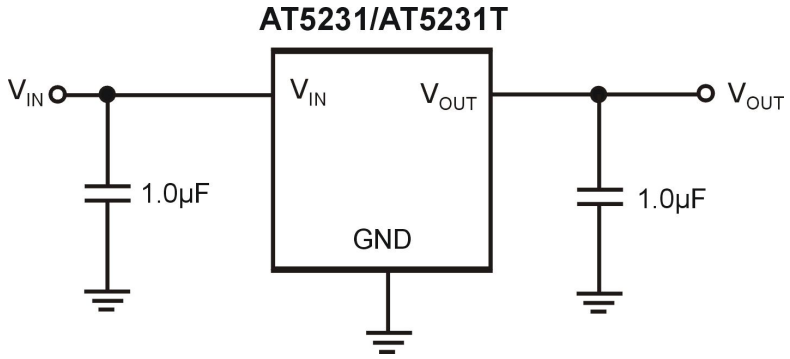


PIN DESCRIPTIONS

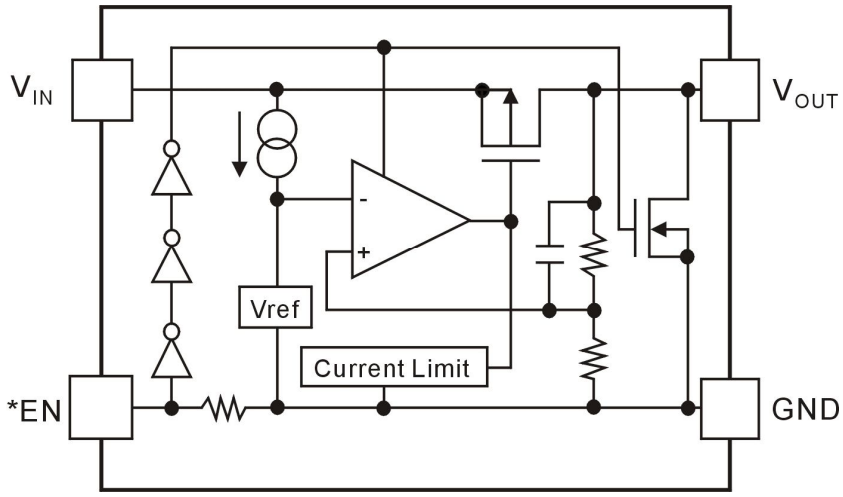
Pin Name	Pin Description
V_{IN}	Input Pin
GND	Ground Pin
EN	Chip Enable Pin, Active High
NC	No Connection
V_{OUT}	Output Pin.

TYPICAL APPLICATION CIRCUITS





BLOCK DIAGRAM



*** Not available in AT5231T**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter		Symbol	Max Value	Unit
Power Supply Voltage		V_{IN}	-0.3 to 6.5	V
Enable Voltage		V_{EN}	-0.3 to V_{IN}	V
Maximum Junction Temperature		T_J	125	°C
Storage Temperature Range		T_{STG}	-65 to +150	°C
Lead Temperature(Soldering) 5 Sec.		T_{LEAD}	260	°C
Power Dissipation P_D @ T_A=25°C (Note 2)	SOT-23	P_D	280	mW
	SOT-25		300	
	SOT-89		640	
	SOT-343		250	
	SOT-353		250	
Thermal Resistance Junction to Ambient	SOT-23	Θ_{JA}	357	°C/W
	SOT-25 (Note 3)		333	
	SOT-89		156	
	SOT-343		400	
	SOT-353		400	
Thermal Resistance Junction to Case	SOT-23	Θ_{JC}	106.6	°C/W
	SOT-25		106.6	
	SOT-89		100	
	SOT-343(SC-70-4L)		120	
	SOT-353(SC-70-5L)		120	
ESD Rating (Human Body Model) (Note 4)		V_{ESD}	2	kV

RECOMMENDED OPERATING CONDITIONS (Note 5)

Parameter	Symbol	Operation Conditions	Unit
Supply Voltage	V_{IN}	6.0	V
Enable Voltage	V_{EN}	-0.3 to V_{IN}	V
Operating Junction Temperature Range	T_J	-40 to +125	°C
Operating Ambient Temperature Range	T_{OPA}	-40 to +85	°C

Note 1: Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2: Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at T_A=25°C.

Note 3: Thermal Resistance is specified with approximately 1 square of 1 oz copper.

Note 4: Devices are ESD sensitive. Handling precaution recommended.

Note 5: The device is not guaranteed to function outside its operating conditions.

ELECTRICAL CHARACTERISTICS

T_J =25°C, unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage (Note 6)	V_{OUT}	V_{IN}=Set V_{OUT} +1V 1mA ≤ I_{OUT} ≤ 30mA	V_{OUT} x0.980		V_{OUT} x1.020	V
Output Current	I_{OUT}	V_{IN} -V_{OUT} =1.0V	300			mA
Load Regulation (Note 6)	Reg_load	V_{IN}=Set V_{OUT} +1V, V_{OUT} = 2V 1mA ≤ I_{OUT} ≤ 150mA		0.005	0.015	%/mA
Line Regulation (Note 6)	Reg_line	V_{OUT}> 1.7V Set V_{OUT} + 0.5V ≤ V_{IN} ≤ 6V (V_{OUT} ≤ 1.7V, 2.2V ≤ V_{IN} ≤ 6V) I_{OUT} =30mA		0.01	0.20	%/V
Dropout Voltage (Note 6, 7)	V_{DROP}	I_{OUT} <1.5V V_{OUT} =1.5V V_{OUT} =1.6V, I_{OUT}= 150mA V_{OUT} =1.7V 1.8V ≤ V_{OUT} ≤ 2.0V 2.1V ≤ V_{OUT} ≤ 2.7V 2.8V ≤ V_{OUT} ≤ 4.8V		 0.48 0.46 0.44 0.42 0.28 0.22	1.00 0.70 0.65 0.60 0.55 0.50 0.35	V
Ripple Rejection	RR	f = 10kHz Ripple 0.5Vp-p V_{OUT} >1.7V, V_{IN} - V_{OUT} =1.0V V_{OUT} ≤ 1.7V, V_{IN} - V_{OUT} =1.2V I_{OUT} = 10mA		65		dB

ELECTRICAL CHARACTERISTICS (CONTINUED)

T_J =25°C, unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Current	I_{SS}	V_{IN}= Set V_{OUT} +1V, I_{OUT} =0mA		70		μA
Supply Current (Standby)	Istandby	V_{IN}= Set V_{OUT} +1V, V_{EN} =GND		0.01	0.1	μA
Input Voltage	V_{IN}		2.0		6.0	V
Output Voltage Temperature Coefficient	$\triangle V_{OUT}/\triangle T$	I_{OUT} = 30mA -40°C ≤ T_J ≤ 85°C		±100		ppm/°C
Current Limit	I_{LIM}			400		mA
EN Pull-Down Resistance	R_{PD}		0.7	2.0	8.0	MΩ
EN Input Voltage “H”	V_{ENH}		1.5		V_{IN}	V
EN Input Voltage “L”	V_{ENL}		0		0.3	V
Output Noise	en	BW 10Hz to 100kHz		30		μVrms
On Resistance for Auto-Discharge	R_{LOW}	V_{EN} =0V		60		Ω
Startup Time (Note 8)	T_{STR}	V_{IN} = V_{OUT}+1V, V_{OUT}= 2.8V, C_{IN}= C_{OUT}=1μF		30		μs

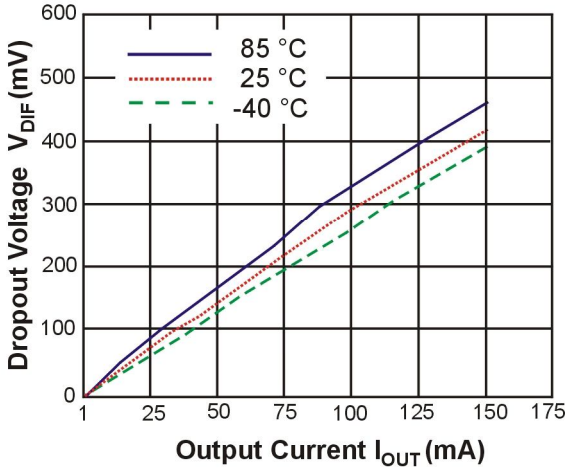
Note 6: Low duty cycle pulse testing with Kelvin connections repaired.

Note 7: Defined as the input to output differential at which the output voltage drops to 2% below the value measured at a differential of 1V.

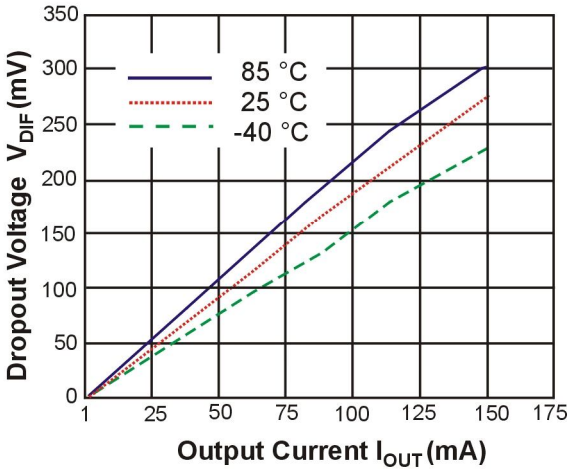
Note 8: Time from V_{EN}= 1.5V to V_{OUT}= 95% ($V_{OUT(NOM)}$).

TYPICAL CHARACTERISTICS

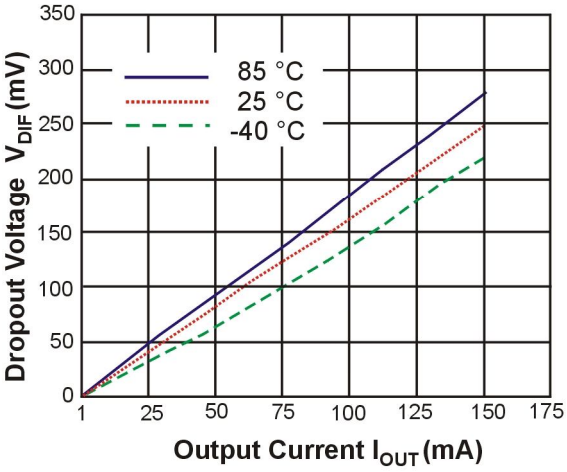
(1) Dropout Voltage VS. Temperature
AT5231/AT5231T-1.5V



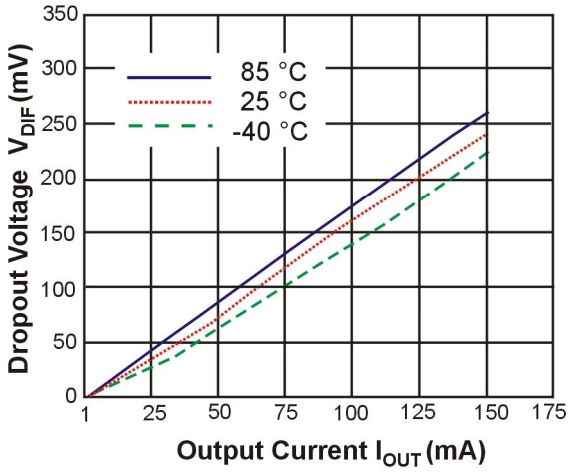
(2) Dropout Voltage VS. Temperature
AT5231/AT5231T-2.5V



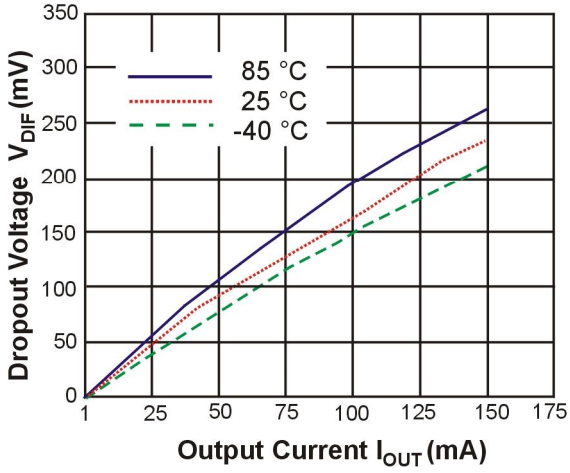
(3) Dropout Voltage VS. Temperature
AT5231/AT5231T-2.8V



(4) Dropout Voltage VS. Temperature
AT5231/AT5231T-3.0V

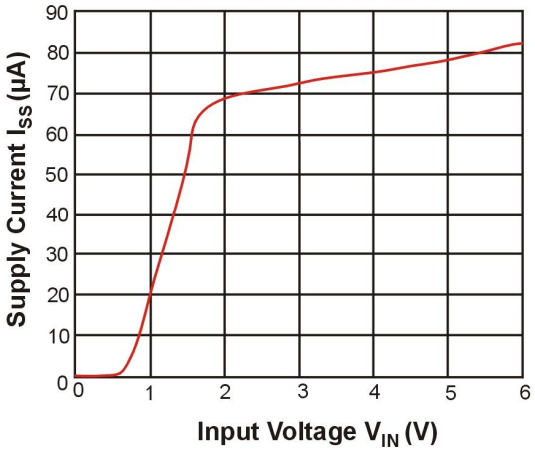


(5) Dropout Voltage VS. Temperature
AT5231/AT5231T-3.3V

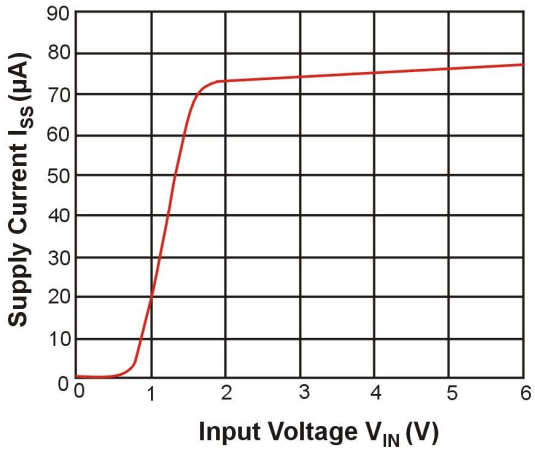


TYPICAL CHARACTERISTICS (CONTINUED)

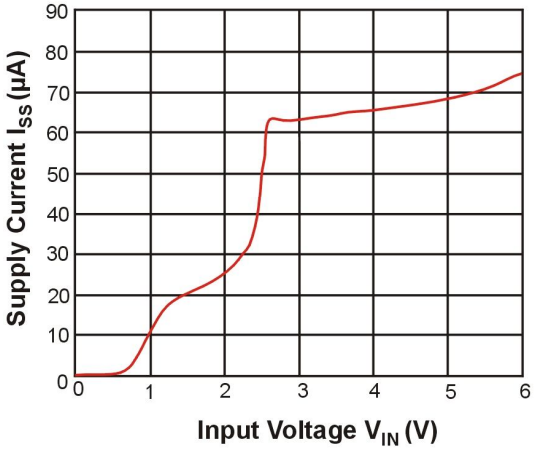
(6) Supply Current VS. Input Voltage (T_J =25°C)
AT5231/AT5231T-1.2V



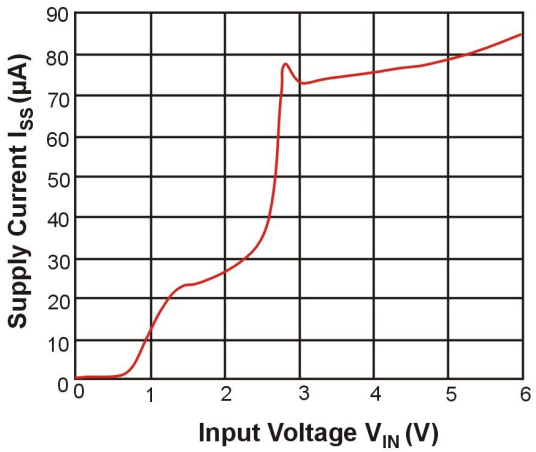
(7) Supply Current VS. Input Voltage (T_J =25°C)
AT5231/AT5231T-1.5V



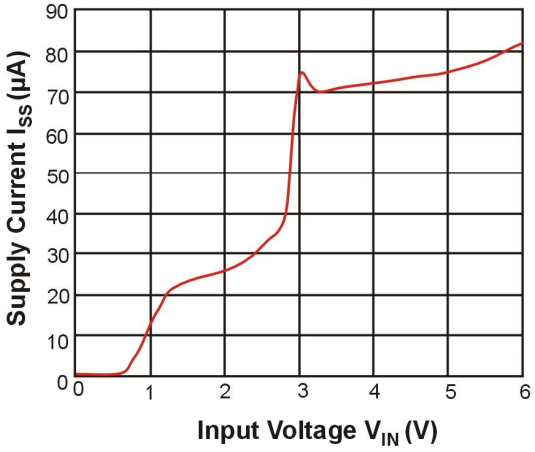
(8) Supply Current VS. Input Voltage (T_J =25°C)
AT5231/AT5231T-2.5V



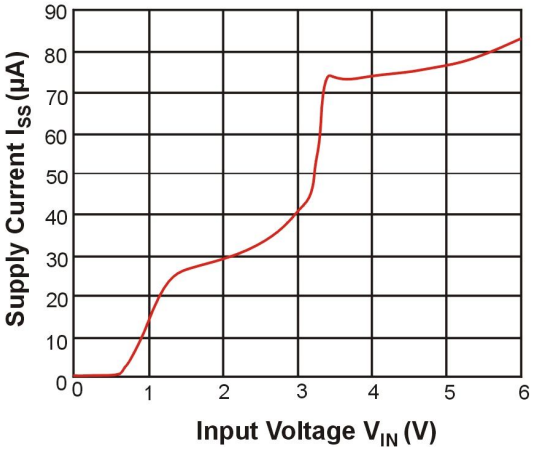
(9) Supply Current VS. Input Voltage (T_J =25°C)
AT5231/AT5231T-2.8V



(10) Supply Current VS. Input Voltage (T_J =25°C)
AT5231/AT5231T-3.0V

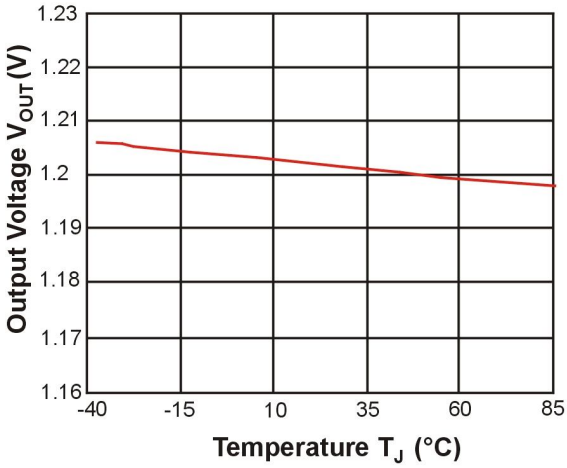


(11) Supply Current VS. Input Voltage (T_J =25°C)
AT5231/AT5231T-3.3V

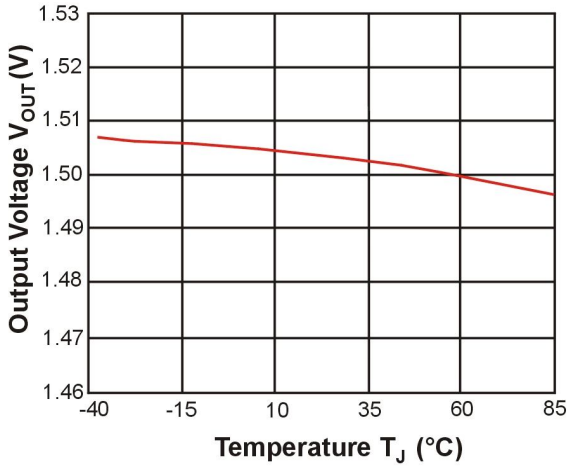


TYPICAL CHARACTERISTICS (CONTINUED)

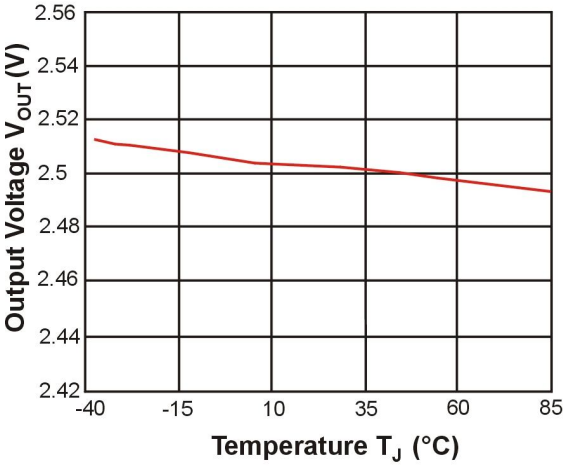
(12) Output Voltage VS. Temperature
AT5231/AT5231T-1.2V



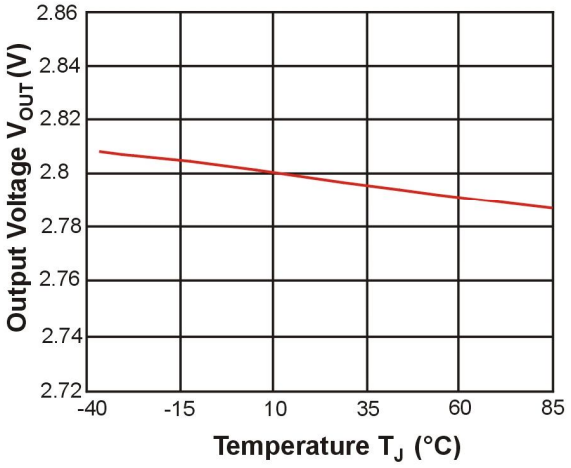
(13) Output Voltage VS. Temperature
AT5231/AT5231T-1.5V



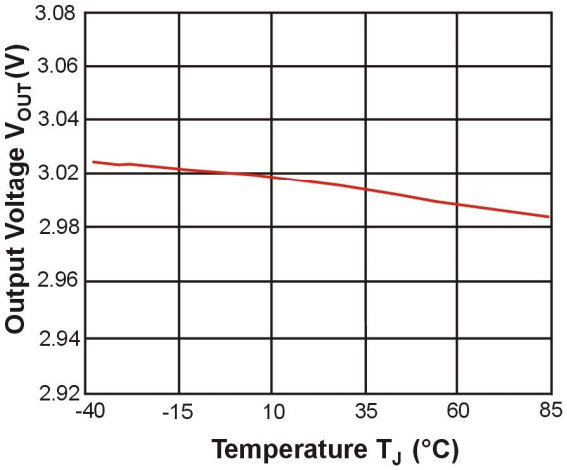
(14) Output Voltage VS. Temperature
AT5231/AT523AT-2.5V



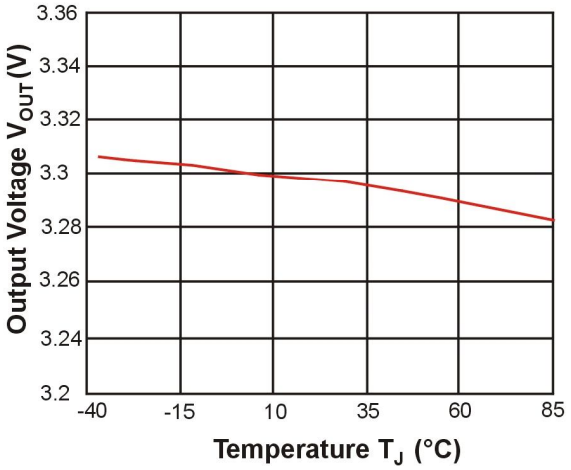
(15) Output Voltage VS. Temperature
AT5231/AT5231T-2.8V



(16) Output Voltage VS. Temperature
AT5231/AT5231T-3.0V

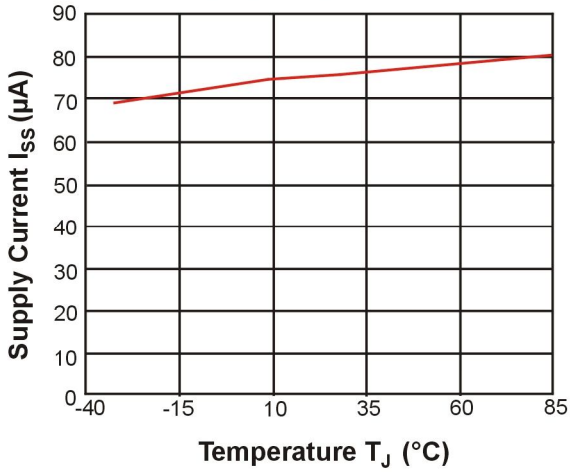


(17) Output Voltage VS. Temperature
AT5231/AT5231T-3.3V

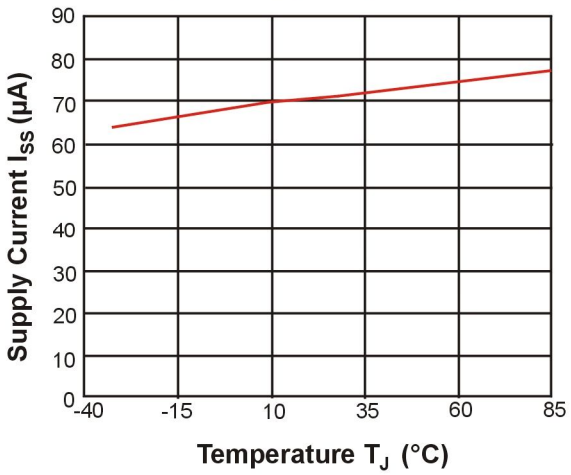


TYPICAL CHARACTERISTICS (CONTINUED)

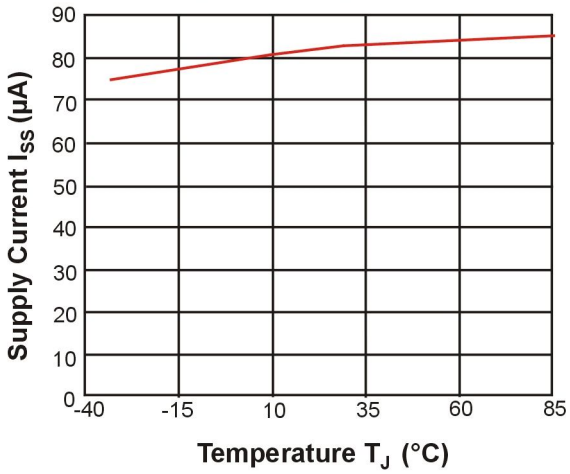
(18) Supply Current VS. Temperature
AT5231/AT5231T-1.2V



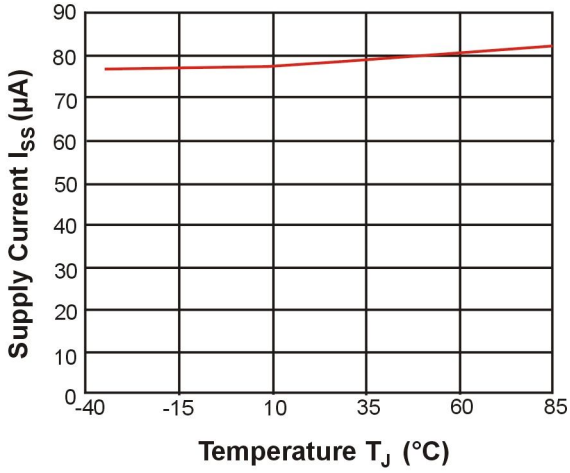
(19) Supply Current VS. Temperature
AT5231/AT5231T-1.5V



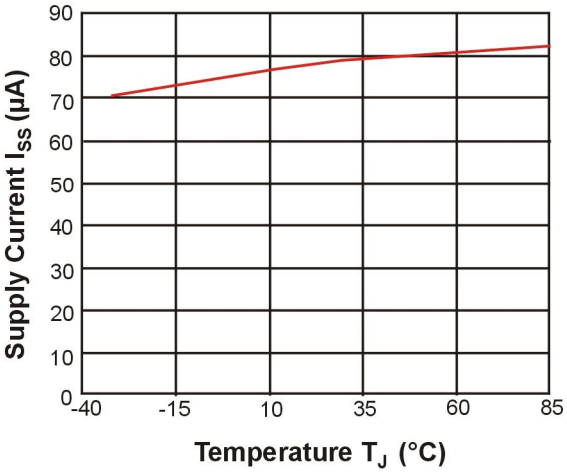
(20) Supply Current VS. Temperature
AT5231/AT5231T-2.5V



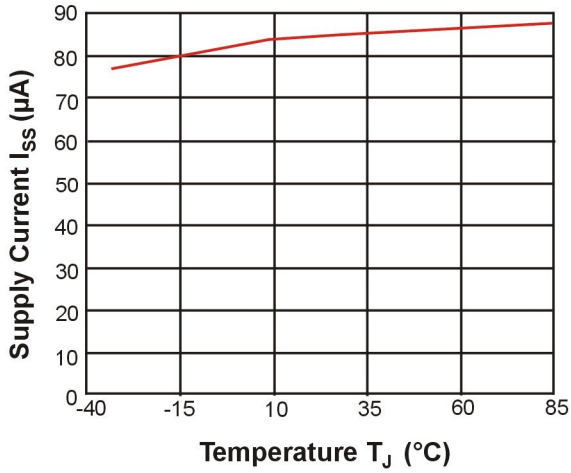
(21) Supply Current VS. Temperature
AT5231/AT5231T-2.8V



(22) Supply Current VS. Temperature
AT5231/AT5231T-3.0V

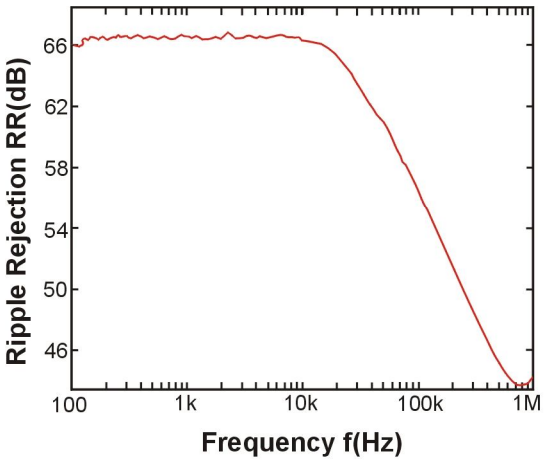


(23) Supply Current VS. Temperature
AT5231/AT5231T-3.3V

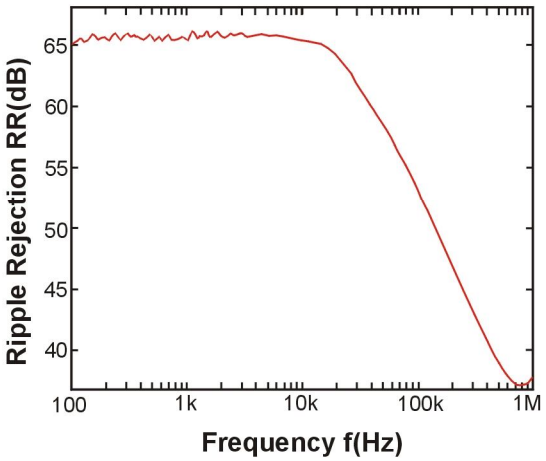


TYPICAL CHARACTERISTICS (CONTINUED)

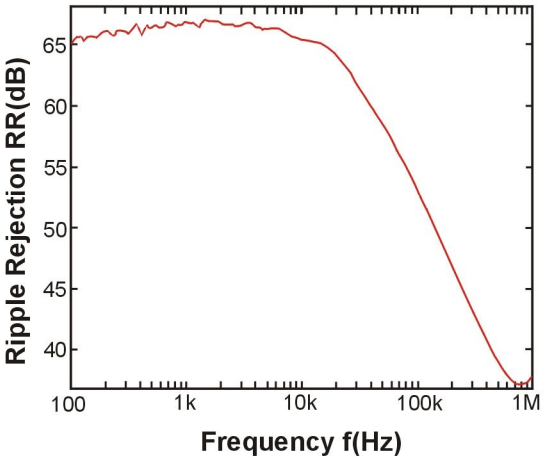
(24) Ripple Rejection VS. Frequency
(V_{OUT}=1.5V, C_{OUT}=Ceramic 1.0 µF)



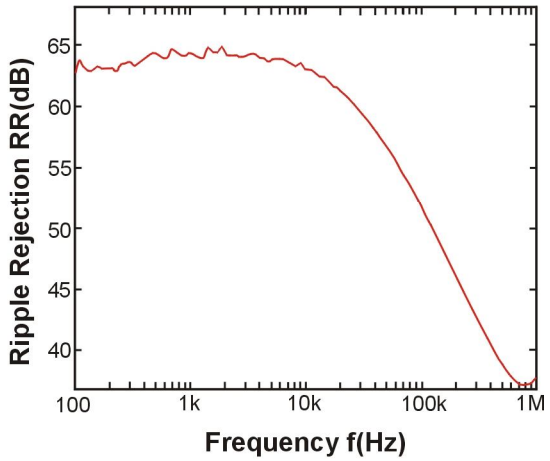
(25) Ripple Rejection VS. Frequency
(V_{OUT}=1.8V, C_{OUT}=Ceramic 1.0 µF)



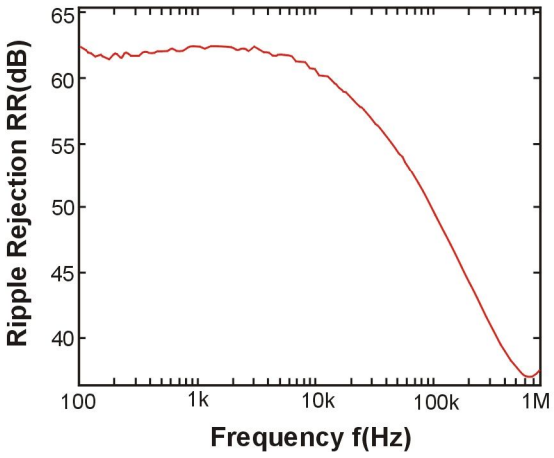
(26) Ripple Rejection VS. Frequency
(V_{OUT}=2.5V, C_{OUT}=Ceramic 1.0 µF)



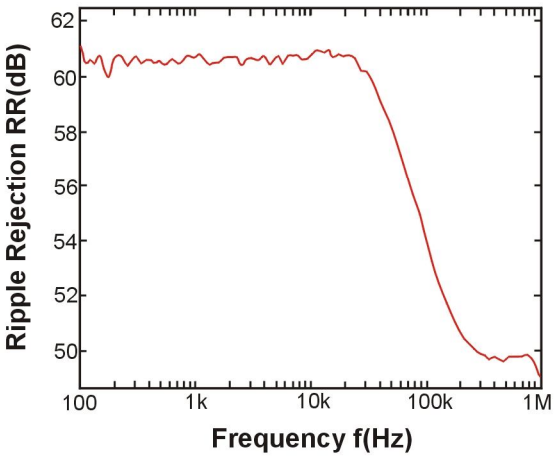
(27) Ripple Rejection VS. Frequency
(V_{OUT}=2.8V, C_{OUT}=Ceramic 1.0 µF)



(28) Ripple Rejection VS. Frequency
(V_{OUT}=3.0V, C_{OUT}=Ceramic 1.0 µF)

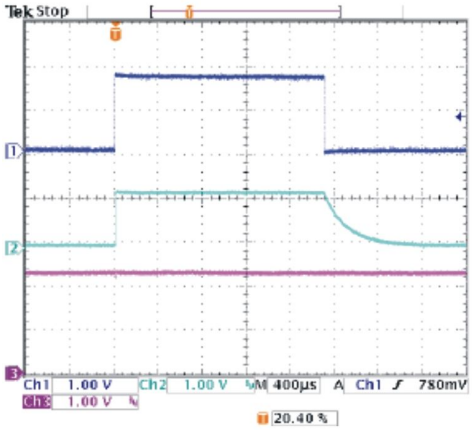


(29) Ripple Rejection VS. Frequency
(V_{OUT}=3.3V, C_{OUT}=Ceramic 1.0 µF)

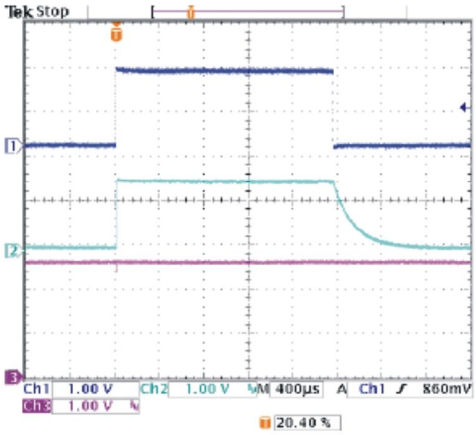


TYPICAL CHARACTERISTICS (CONTINUED)

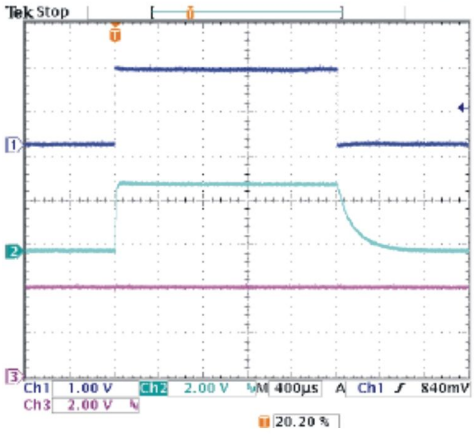
(30) V_{EN} Turn ON/OFF
(V_{IN} = V_{OUT} +1V, V_{OUT} = 1.2V
CH1= V_{EN}, CH2= V_{OUT}, CH3= V_{IN})



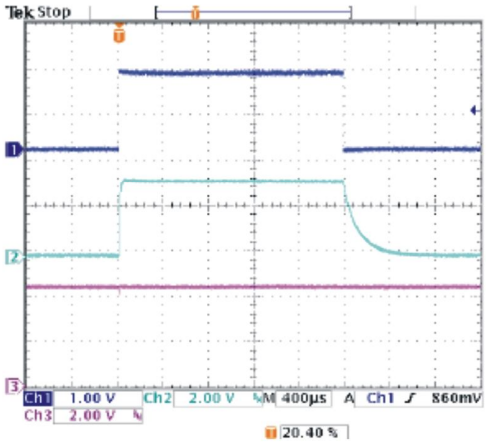
(31) V_{EN} Turn ON/OFF
(V_{IN} = V_{OUT} +1V, V_{OUT} = 1.5V
CH1= V_{EN}, CH2= V_{OUT}, CH3= V_{IN})



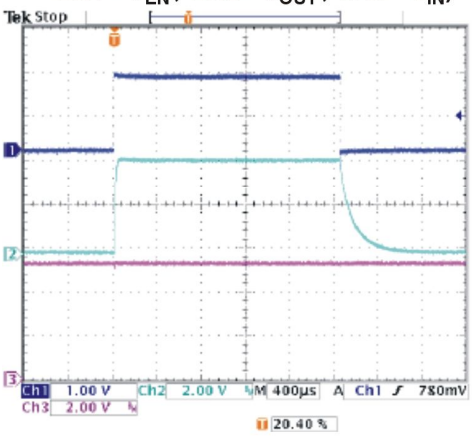
(32) V_{EN} Turn ON/OFF
(V_{IN} = V_{OUT} +1V, V_{OUT} = 3.0V
CH1= V_{EN}, CH2= V_{OUT}, CH3= V_{IN})



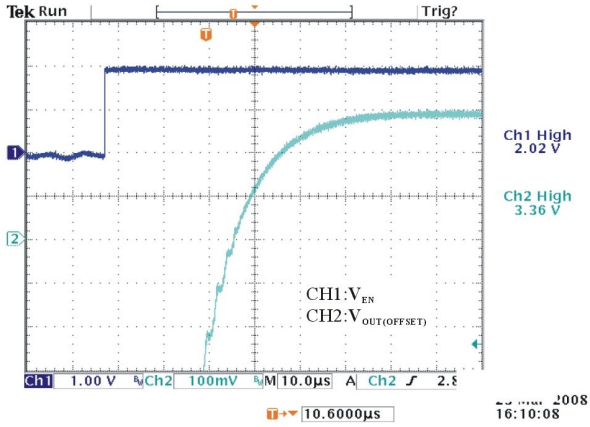
(33) V_{EN} Turn ON/OFF
(V_{IN} = V_{OUT} +1V, V_{OUT} = 3.3V
CH1= V_{EN}, CH2= V_{OUT}, CH3= V_{IN})



(34) V_{EN} Turn ON/OFF
(V_{IN} = V_{OUT} +1V, V_{OUT} = 4.2V
CH1= V_{EN}, CH2= V_{OUT}, CH3= V_{IN})



(35) Over-Shoot Response
(V_{IN} =4.3V, V_{EN} =2V, C_{IN} =C_{OUT} =Ceramic 1.0µF
$V_{OVER-SHOOT}$ =0V)
AT5231/AT5231T-3.3V



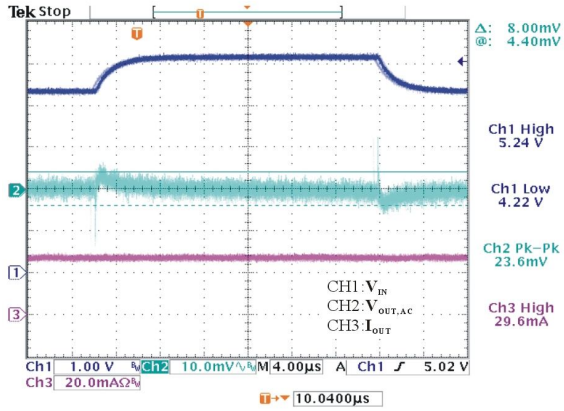
TYPICAL CHARACTERISTICS (CONTINUED)

(36) Input Transient Response

(I_{OUT} =30mA, C_{IN} =Ceramic 1.0 µF, tr=tf=5 µs, C_{OUT} =Ceramic 1.0 µF)

V_{IN} =4.3V~5.3V, △=$V_{OUT, TRANSIENT, P-P}$ =8mV

AT5231/AT5231T-3.3V

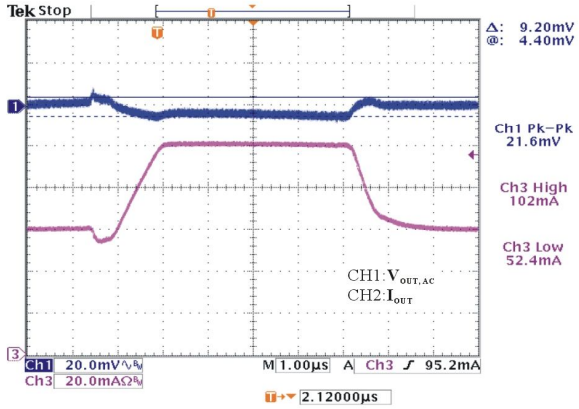


(37) Load Transient Response

(V_{IN} =4.3V, C_{IN} =Ceramic 1.0 µF, tr=tf=1 µs, C_{OUT} =Ceramic 1.0 µF)

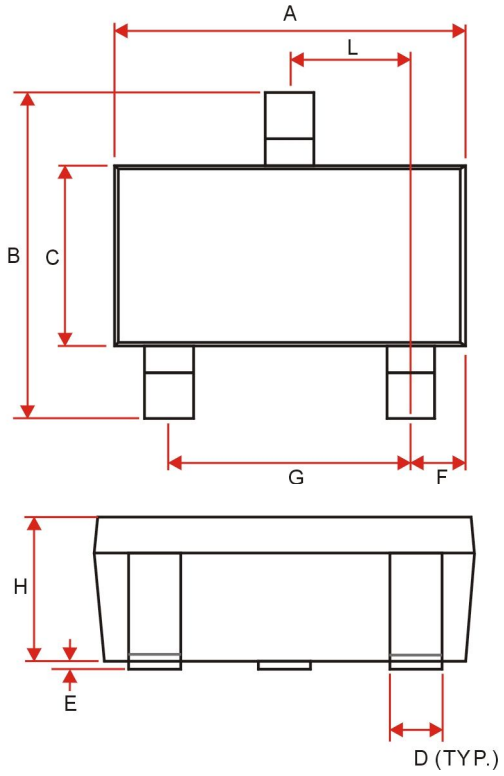
I_{OUT} =50mA~100mA, △=$V_{OUT, TRANSIENT, P-P}$ =9.2mV

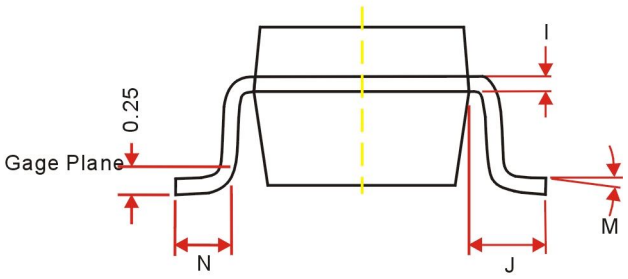
AT5231/AT5231T-3.3V



PACKAGE OUTLINE DIMENSIONS

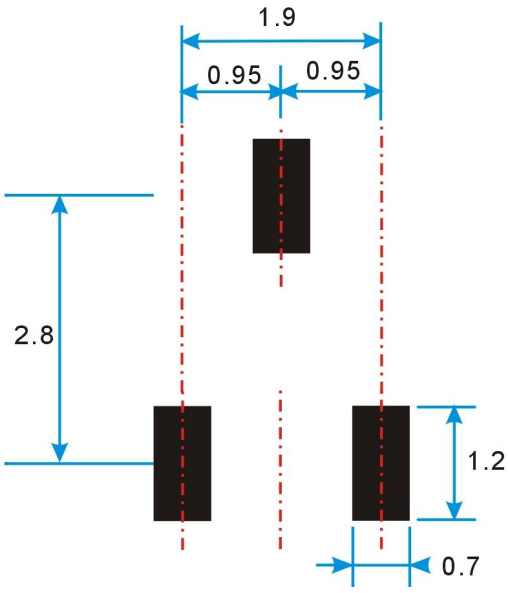
SOT-23 PACKAGE OUTLINE DIMENSIONS





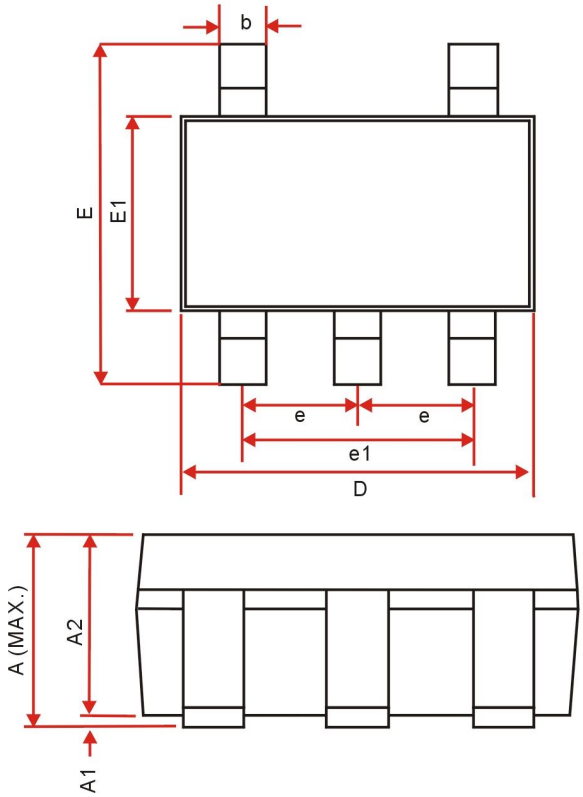
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	2.70	3.10
B	2.10	2.95
C	1.20	1.70
D	0.30	0.50
E	0	0.15
F	0.45	0.55
N	0.30	0.60
G	2.10 REF.	
H	0.70	1.30
I	0.10	0.20
J	0.54 REF.	
L	0.95 REF.	
M	0°	10°

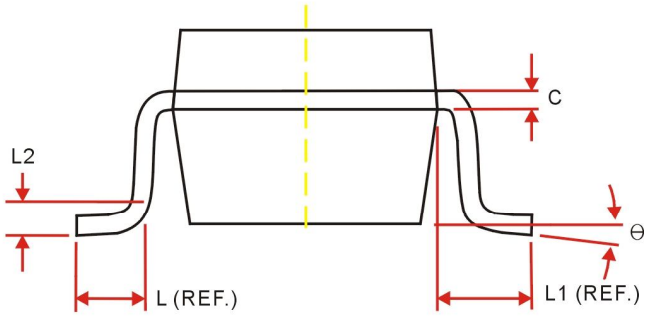
SOT-23 PACKAGE FOOTPRINT (mm)



PACKAGE OUTLINE DIMENSIONS

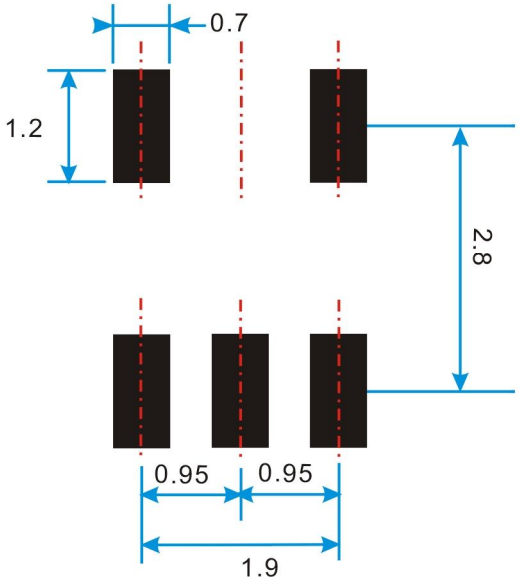
SOT-25 PACKAGE OUTLINE DIMENSIONS





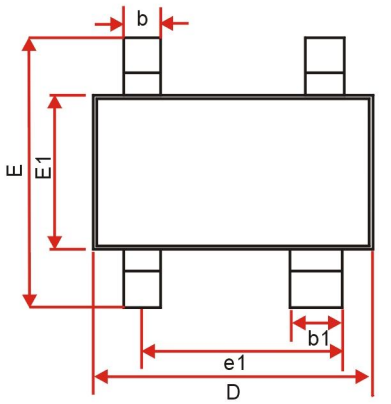
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.45 MAX.	
A1	0	0.15
A2	0.90	1.30
C	0.08	0.22
D	2.90 BSC.	
E	2.80 BSC.	
E1	1.60 BSC.	
L	0.30	0.60
L1	0.60BSC.	
L2	0.25BSC.	
Θ	0°	10°
b	0.30	0.50
e	0.95BSC.	
e1	1.90BSC.	

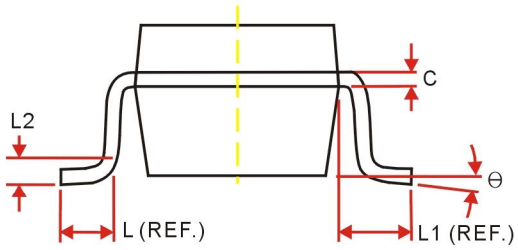
SOT-25 PACKAGE FOOTPRINT (mm)

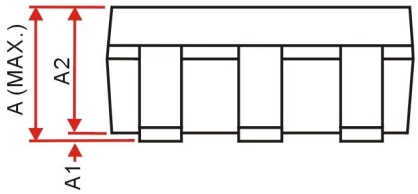


PACKAGE OUTLINE DIMENSIONS

SOT-343 PACKAGE OUTLINE DIMENSIONS

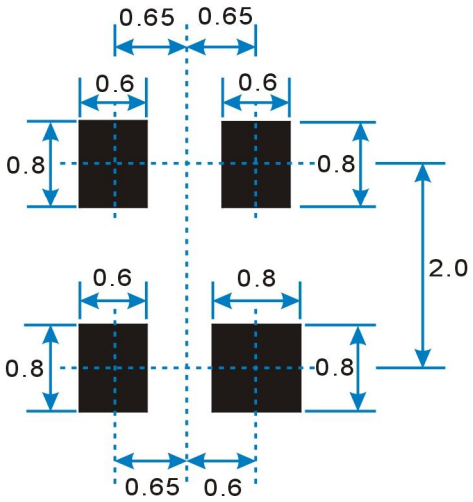






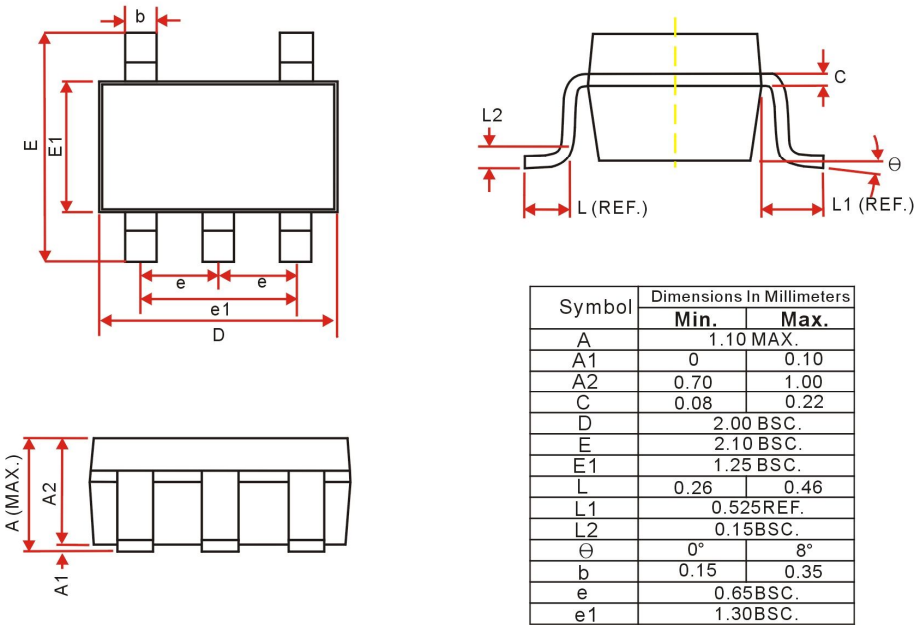
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.10 MAX.	
A1	0	0.10
A2	0.70	1.00
C	0.08	0.22
D	2.10 BSC.	
E	2.30 BSC.	
E1	1.30 BSC.	
L	0.26	0.46
L1	0.525REF.	
L2	0.20BSC.	
Θ	0°	8°
b	0.15	0.35
b1	0.30	0.50
e1	1.30BSC.	

SOT-343 PACKAGE FOOTPRINT (mm)



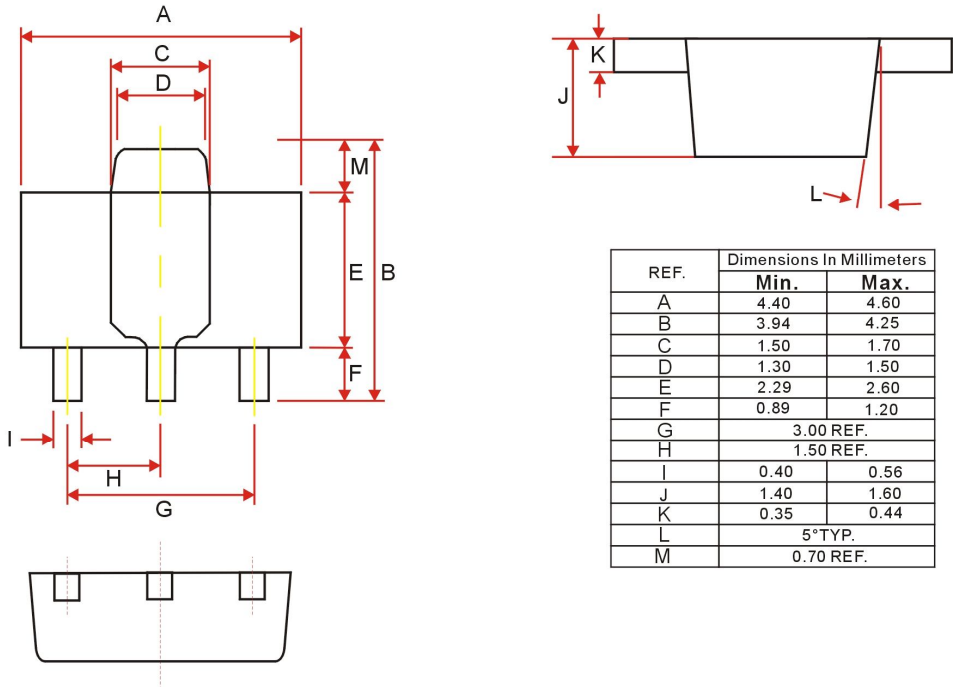
PACKAGE OUTLINE DIMENSIONS

SOT-353 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.10 MAX.	
A1	0	0.10
A2	0.70	1.00
C	0.08	0.22
D	2.00 BSC.	
E	2.10 BSC.	
E1	1.25 BSC.	
L	0.26	0.46
L1	0.525REF.	
L2	0.15BSC.	
θ	0°	8°
b	0.15	0.35
e	0.65BSC.	
e1	1.30BSC.	

SOT-89 PACKAGE OUTLINE DIMENSIONS



REF.	Dimensions In Millimeters	
	Min.	Max.
A	4.40	4.60
B	3.94	4.25
C	1.50	1.70
D	1.30	1.50
E	2.29	2.60
F	0.89	1.20
G	3.00 REF.	
H	1.50 REF.	
I	0.40	0.56
J	1.40	1.60
K	0.35	0.44
L	5°TYP.	
M	0.70 REF.	

Note :

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