HL50Exx

CMOS Voltage Regulator With ON/OFF Switch

HL50Exx is ultra-low power consumption low dropout voltage regulator (LDO) manufactured in CMOS processes. It can deliver up to 200mA of current while consuming only 50nA of quiescent current. It is designed specifically for applications where very-low quiescent current is a critical parameter. It maintains low I_Q consumption even in dropout mode to further increase battery life. When in shutdown or disabled mode, the device consumes ultra-low, 5nA IQ that helps increase the shelf life of the battery.

The HL50Exx features a smart enable circuit with an internally controlled pulldown resistor that keeps the LDO disabled even when the EN pin is left floating and helps minimize the external components used to pulldown the EN pin. This circuit also helps minimize the current drawn through the external pulldown circuit when the device is enabled.

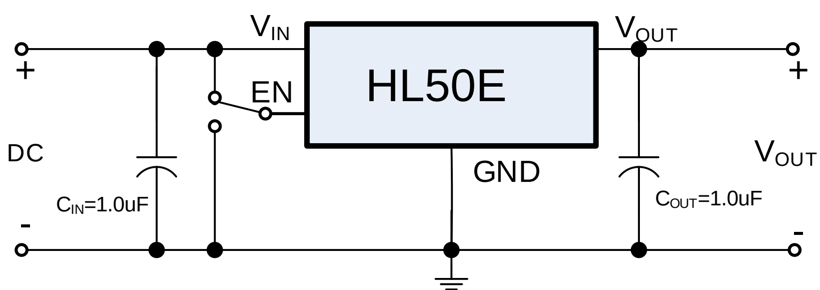
Features:

- Ultra-low Quiescent Current: 0.05uA
- Highly Accurate: ±2%
- Dropout Voltage: 200mV@I_{OUT}=200mA
- Maximum Output Current: 200mA
- Input Voltage Range: 2V~6.0V
- Temperature Stability: ±30ppm/℃
- ON/OFF Logic = Enable High
- Shutdown Current: 5nA
- Protections Circuits: Current Limiter, Short Circuit, Thermal shutdown
- Output Capacitor: Low ESR Ceramic Capacitor Compatible

Applications:

- Wearables electronics
- Thermostats, smoke and heat detectors
- Gas, heat, and water meters
- Blood glucose monitors and pulse oximeters
- Residential circuit breakers and fault indicators
- Building security and video surveillance devices
- EPOS card readers

Typical Applications:



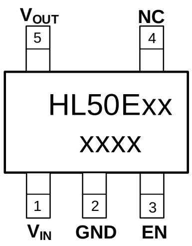
Notes on Use:

Input Capacitor (C_{IN}): 1.0µF above

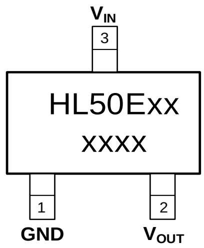
Output Capacitor (C_{OUT}):1.0µF above

Pin Configuration:

SOT23-5L
Top View



SOT23-3L
Top View



Product Selections:

Product Name	V_{OUT} (V)	Package	Ordering Name	Marking	Package Information
HL50E18	1.8	SOT23-5L	HL50E18M5R	50xxE18 XXXX	Tape and Reel, 3000pcs
HL50E25	2.5	SOT23-5L	HL50E25M5R	50xxE25 XXXX	
HL50E33	3.3	SOT23-5L	HL50E33M5R	50xxE33 XXXX	
HL50E30	3.0	SOT23-3L	HL50E30MR	50xxE30 XXXX	

Notes: 1* Customer can request to customize the output voltage ranged from 1.2V to 5V if desired voltage is not found in the selections.

2* Customer can request customization of package choice.

3* The characters "XXXX" in the second line of the Marking represents the internal lot.

Absolute Maximum Ratings: (Unless otherwise indicated: T_a=25℃)

PARAMETER	SYMBOL	RATINGS		UNITS
Input Voltage	V_{IN}	-0.3 ~ 7		V
Output Voltage	V_{OUT}	Vss-0.3 ~ VIN+0.3V		
Power Dissipation	P_D	SOT23-5	250	mW
		SOT23-3	250	
Thermal Resistance	$R_{\theta JA}$	SOT23-5	180	℃/W
		SOT23-3	200	
Operating Ambient Temperature	T_{opr}	-40 ~ +85		℃
Storage Temperature	T_{stg}	-40 ~ +125		
ESD Protection	ESD HBM	8000		V

Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

Electrical Characteristics:

HL50Exx

(Unless otherwise indicated：T_a=25℃)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage*1	$V_{OUT(S)}$	$V_{IN}=V_{EN}=V_{OUT(S)}+1.0$,I_{OUT}=10mA	$V_{OUT(S)}$ ×0.98	$V_{OUT(S)}$	$V_{OUT(S)}$ ×1.02	V
VIN UVLO	V_{uvlo}	Rising		1.23		V
		Failling		1.06		V
Line Regulation	ΔV_{OUT1}	$V_{OUT(S)}+0.5V \le V_{IN}=V_{EN} \le 6V$ I_{OUT}=10mA		1		mV
Load Regulation	ΔV_{OUT2}	$V_{IN}=V_{EN}=V_{OUT(S)}+1.0V$ $1mA \le I_{OUT} \le 200mA$		14		mV
GND Current ($V_{EN}=V_{IN}$)	I_{GND}	no load		50		nA
		Iout=5uA		0.12		uA
		Iout=1mA		1.44		
		Iout=100mA		165		
		Iout=200mA		290		
GND current in Dropout	$I_{GND(DO)}$	Iout=0mA, Vin=95%*Vout(nom)		45		nA
Shutdown Current (V_{EN}=0)	I_{SHDN}	$V_{IN} \le 5V$, $V_{EN}=0$		5		nA
		$V_{IN}=6V$, $V_{EN}=0$		26		nA
Current Limit*2	I_{LIM}	$V_{IN}=V_{EN}=V_{OUT(S)}+1.0V$ $V_{OUT} = 0.95 \times V_{OUT(S)}$		460		mA
Short Circuit Current	I_{SHORT}	$V_{IN}=V_{EN}=V_{OUT(S)}+1.0V$ $V_{OUT}=0V$		65		mA
Dropout Voltage*3	V_{DROP}	$V_{EN}=V_{IN}$, V_{OUT}=3V I_{OUT}=0mA		75		mV
		$V_{EN}=V_{IN}$, V_{OUT}=3V I_{OUT}=200mA		200		
Power Supply Rejection Ratio	PSRR	f=1KHz, I_{OUT}=30mA		50		dB
Output voltage noise	V_N	BW = 10 Hz to 100 kHz , VOUT = 3.3 V, IOUT = 30 mA		340		uV_{RMS}
Temperature Stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \bullet V_{OUT(s)}}$	$V_{IN}=V_{EN}=V_{OUT(S)}+1.0V$ I_{OUT}=1mA $-40℃ \le T_a \le 125℃$		40		ppm/℃
UVLO hysteresis	$V_{UVLO(HYST)}$	V_{IN} hysteresis		170		mV
EN 'H' Level Voltage	V_{ENH}		1.5			V
EN 'L' Level Voltage	V_{ENL}				0.5	V
EN pin leakage current	I_{EN}	$V_{EN}=V_{IN}$ = 6.0 V		5		nA
Smart enable pulldown resistor	$R_{EN(PULLDOWN)}$	V_{EN} = 0.3 V		550		KΩ
Pulldown resistor	$R_{PULLDOWN}$	V_{IN} = 3.3 V, device disabled		60		Ω
Thermal shutdown temperature	$T_{SD(shutdown)}$	Shutdown, temperature increasing		155		°C
Thermal shutdown reset temperature	$T_{SD(reset)}$	Reset, temperature decreasing		145		
Start-up time	t_{STR}	From EN assertion to V_{OUT} = 90% × $V_{OUT(nom)}$ VOUT=3.0V		850		uS

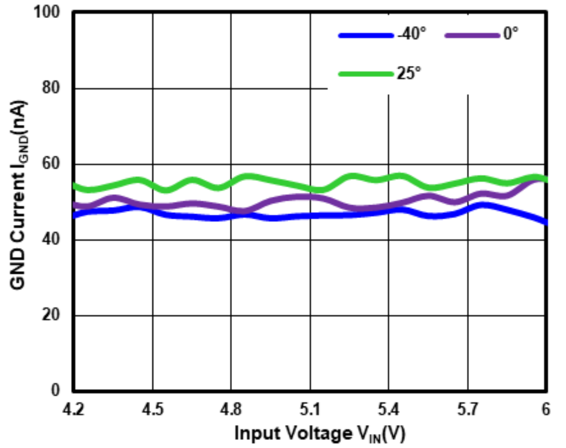
Notes： 1: $V_{OUT(S)}$: Output voltage when $V_{IN}=V_{OUT}$+1V, I_{OUT}=10 mA.

2: I_{LIM}: Output current when $V_{IN}=V_{OUT(S)}$+1V and V_{OUT} = 0.95*$V_{OUT(S)}$.

3: $V_{DROP}=V_{IN1}$ - （$V_{OUT(S)}$× 0.98）where V_{IN1} is the input voltage when V_{OUT} = $V_{OUT(S)}$× 0.98.

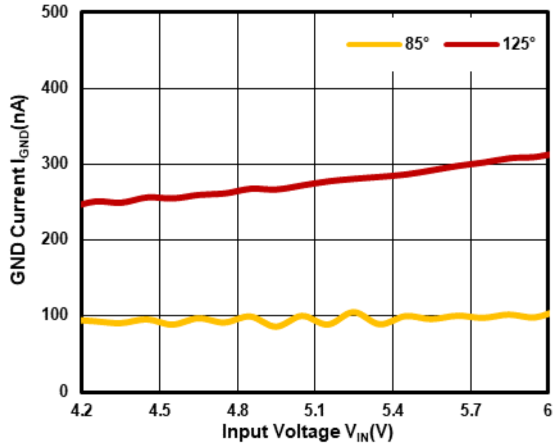
■ Typical Performance Characteristics:

Test Conditions: $V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, $T_a=25℃$, unless otherwise indicated.



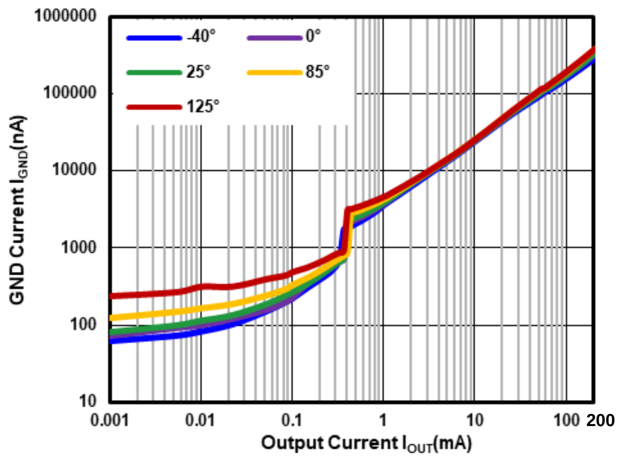
I_Q vs V_{IN}. Temperature at $V_{OUT}=3.3V$

($I_{OUT}=0mA$ $V_{IN}=V_{EN}$)



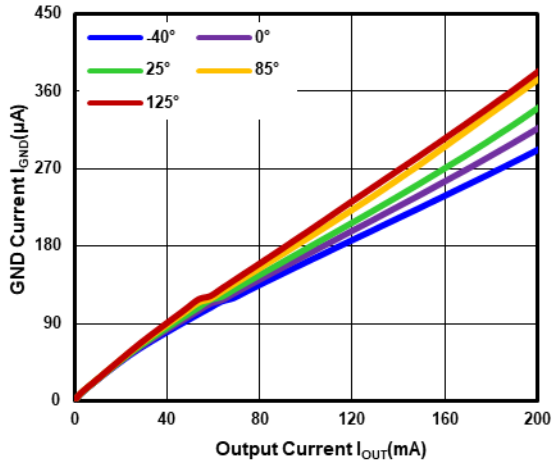
I_Q vs V_{IN}. Temperature at VOUT=3.3V

($I_{OUT}=0mA$ $V_{IN}=V_{EN}$)



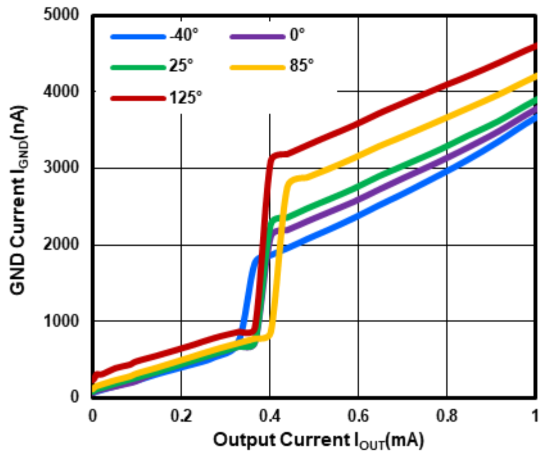
I_Q vs I_{OUT}. Temperature up to 200mA at

$V_{OUT}=3.3V(V_{IN}=V_{EN})$



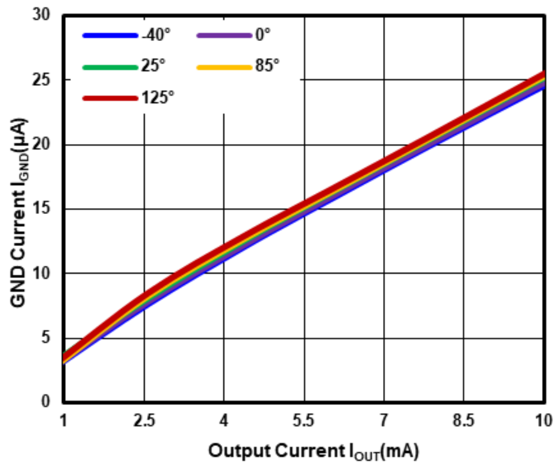
I_Q vs I_{OUT}. Temperature up to 200mA at

$V_{OUT}=3.3V$



I_Q vs I_{OUT}. Temperature up to 1mA at

$V_{OUT}=3.3V$

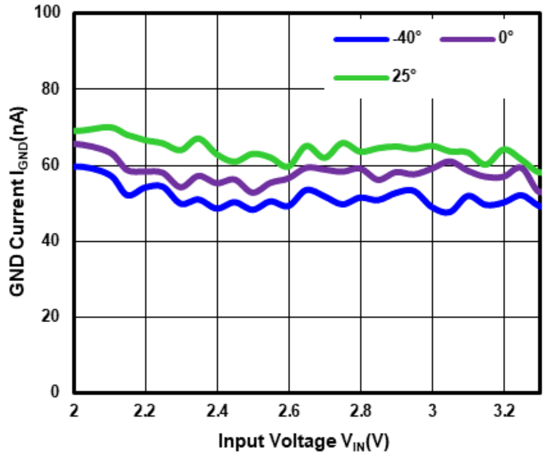


I_Q vs I_{OUT}. Temperature for 1mA to 10mA at

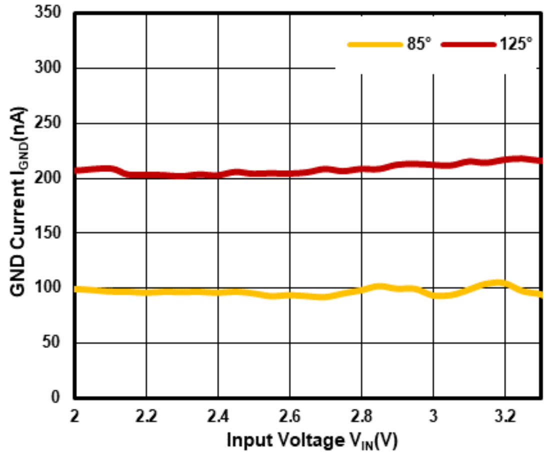
$V_{OUT}=3.3V$

■ Typical Performance Characteristics (Continued):

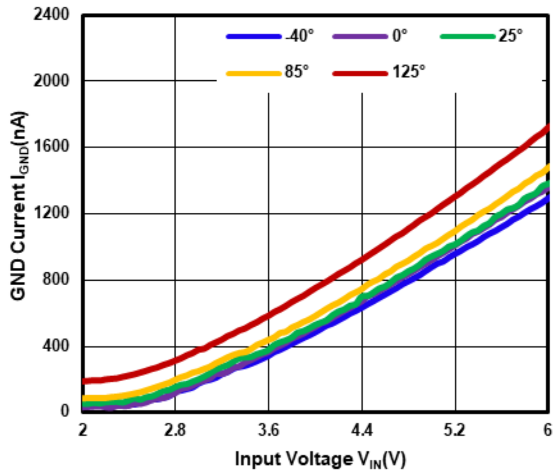
Test Conditions: V_{IN}=V_{OUT}+1.0V, C_{IN}=1.0μF, C_{OUT}=1.0μF, T_a=25℃, unless otherwise indicated.



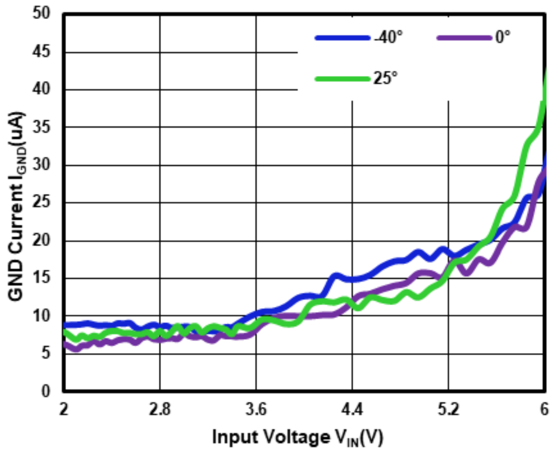
I_Q in Dropout vs V_{IN}. And Temperature at V_{OUT}=3.3V(V_{IN}=V_{EN})



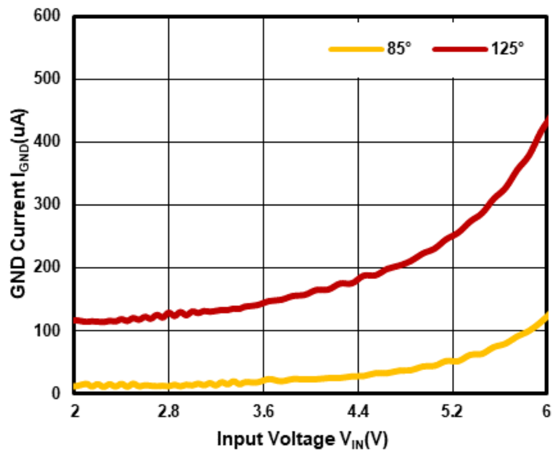
I_Q in Dropout vs V_{IN}. And Temperature at V_{OUT}=3.3V(V_{IN}=V_{EN})



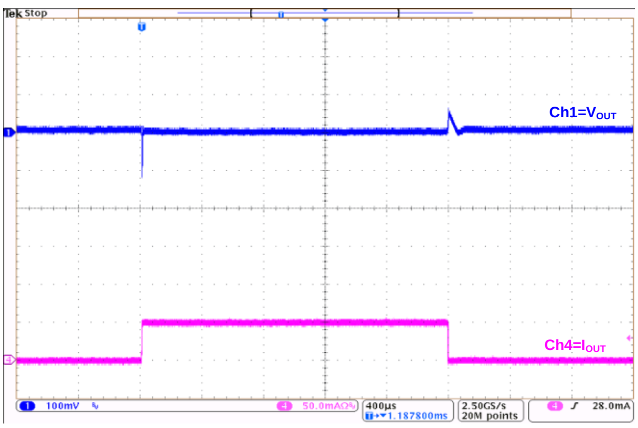
I_Q vs V_{IN}. Temperature at V_{OUT}=3.3V (I_{OUT}=0mA V_{EN}=1.5V)



I_{SHDN} vs V_{IN}. Temperature at V_{OUT}=3.3V (V_{EN}=0V)



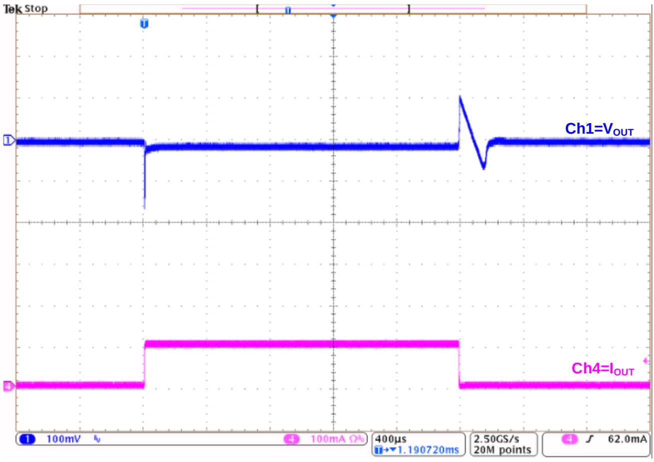
I_{SHDN} vs V_{IN}. Temperature at V_{OUT}=3.3V (V_{EN}=0V)



Load Transient at V_{OUT}=3.3V: (I_{OUT}=1mA~50mA~1mA)

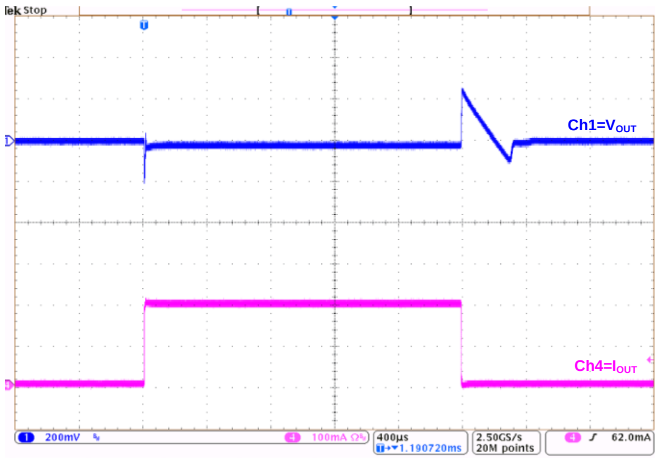
■ Typical Performance Characteristics (Continued):

Test Conditions: $V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, $T_a=25℃$, unless otherwise indicated.



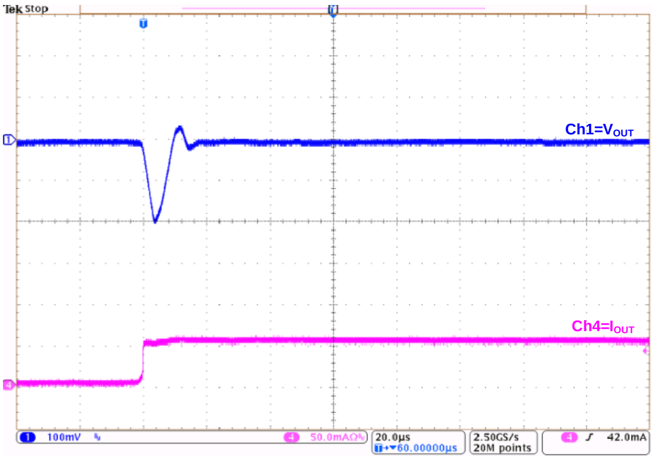
Load Transient at V_{OUT}=3.3V:

(I_{OUT}=1mA~100mA~1mA)



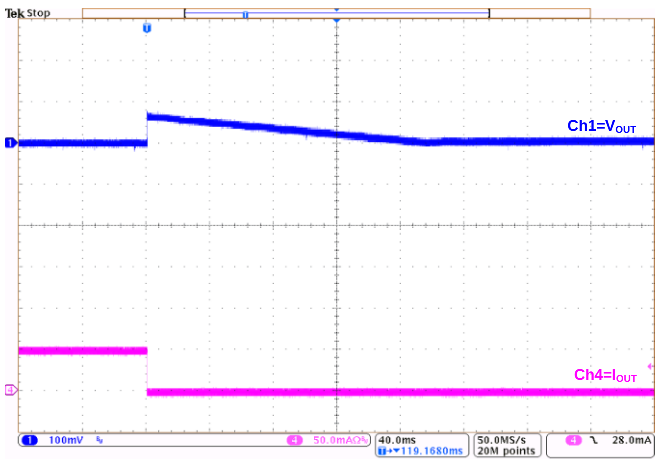
Load Transient at V_{OUT}=3.3V:

(I_{OUT}=1mA~200mA~1mA)



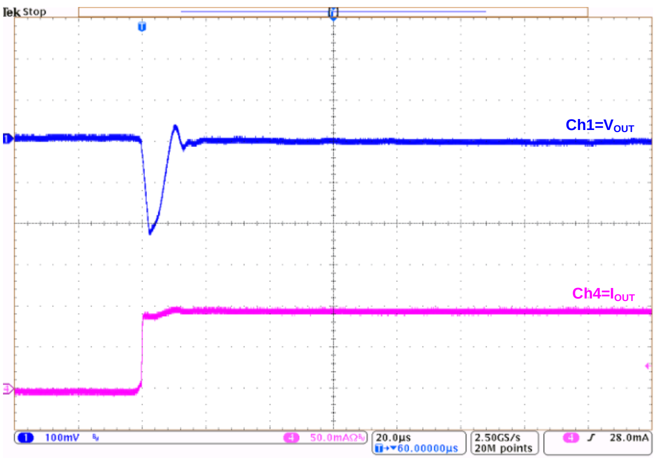
Load Transient at V_{OUT}=3.3V:

(I_{OUT}=0mA~50mA)



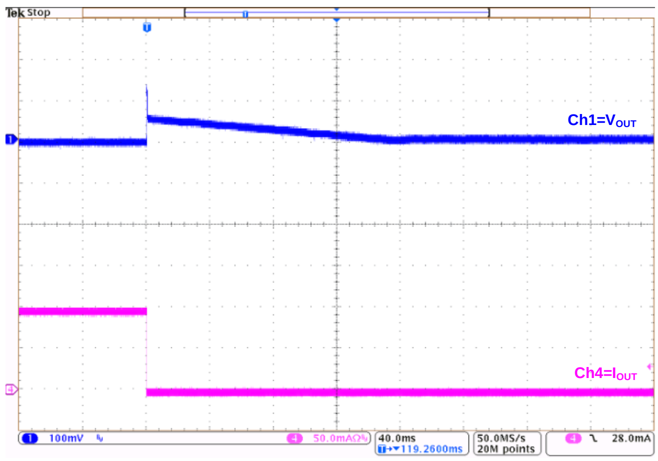
Load Transient at V_{OUT}=3.3V:

(I_{OUT}=50mA~0mA)



Load Transient at V_{OUT}=3.3V:

(I_{OUT}=0mA~100mA)

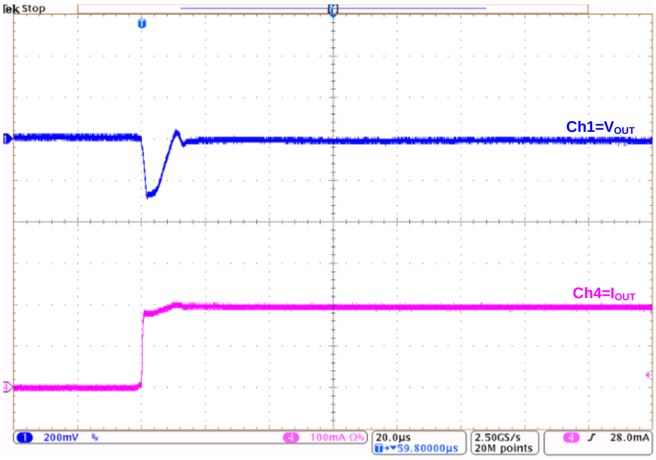


Load Transient at V_{OUT}=3.3V:

(I_{OUT}=100mA~0mA)

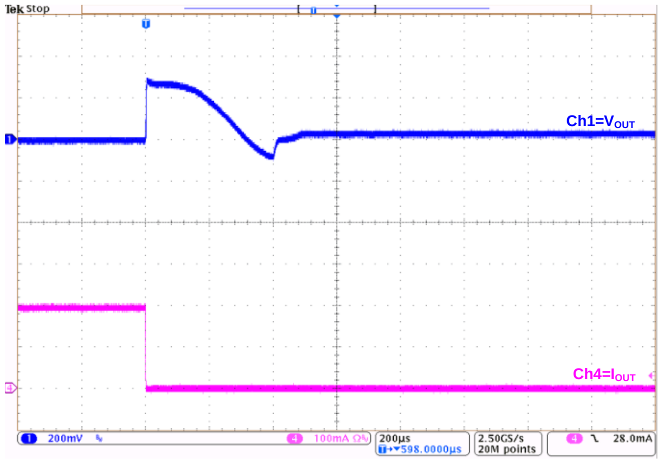
■ Typical Performance Characteristics (Continued):

Test Conditions: $V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, $T_a=25℃$, unless otherwise indicated.



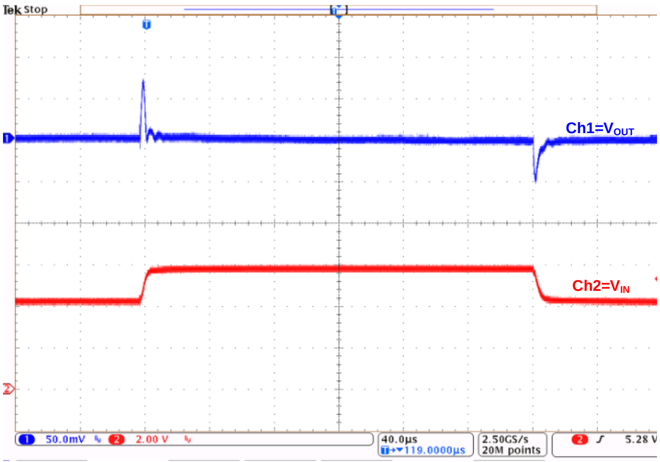
Load Transient at $V_{OUT}=3.3V$:

(I_{OUT}=0mA~200mA)



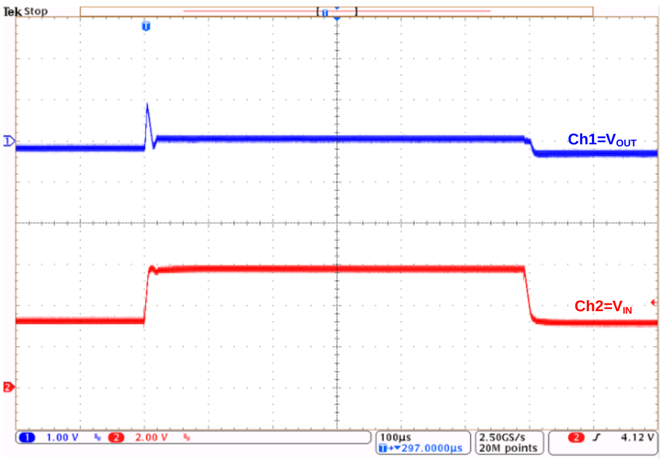
Load Transient at $V_{OUT}=3.3V$:

(I_{OUT}=200mA~0mA)



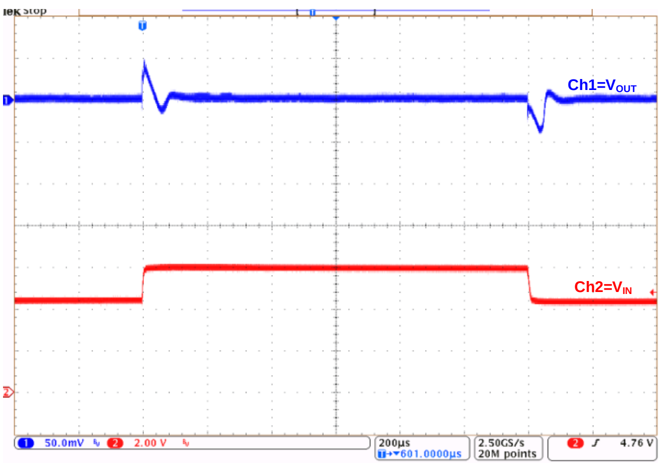
Line Transient at $V_{OUT}=3.3V$:

(I_{OUT}=200mA ,V_{IN} from 4.3V to 6V)



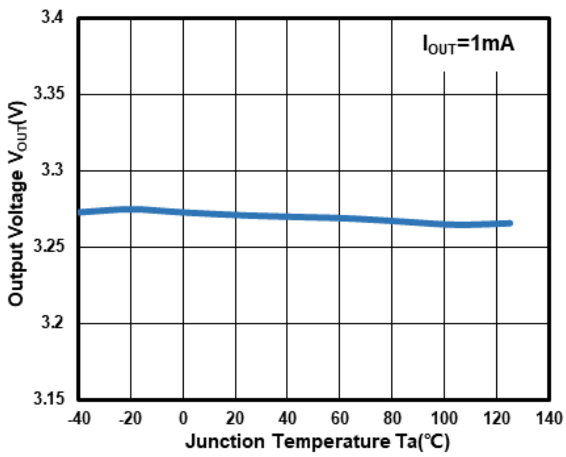
Line Transient at $V_{OUT}=3.3V$:

(I_{OUT}=100mA ,V_{IN} from 3V to 6V)



Line Transient at $V_{OUT}=3.3V$:

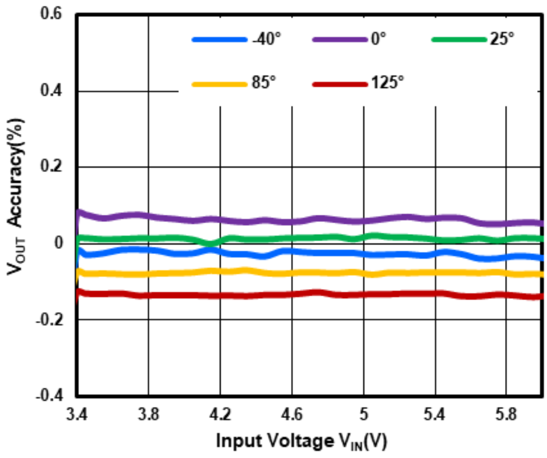
(I_{OUT}=1mA ,V_{IN} from 4.3V to 6V)



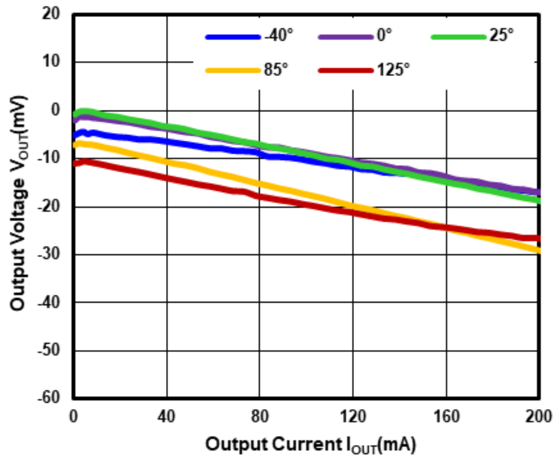
Output Voltage vs. Temperature at $V_{OUT}=3.3V$

■ Typical Performance Characteristics:

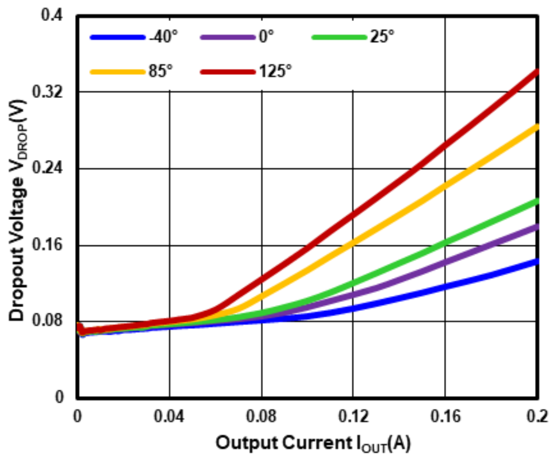
Test Conditions: $V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, $T_a=25℃$, unless otherwise indicated.



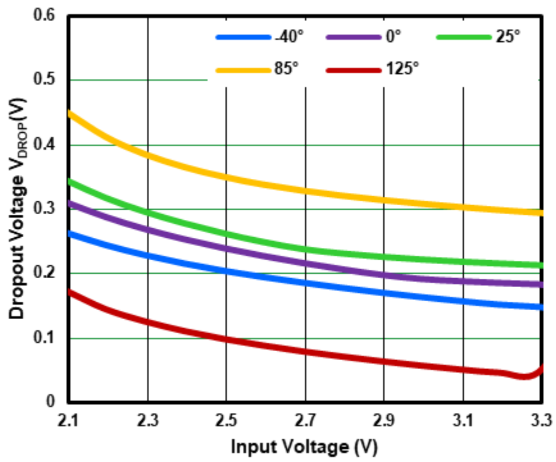
Output Accuracy vs V_{IN}. Temperature at $V_{OUT}=3.3V$



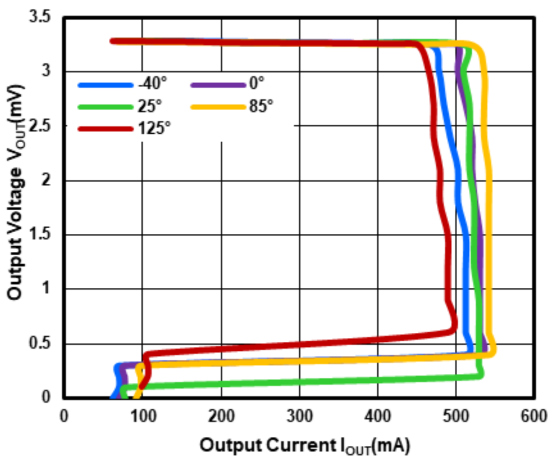
Load Regulation vs V_{IN}.Temperature at $V_{OUT}=3.3V$



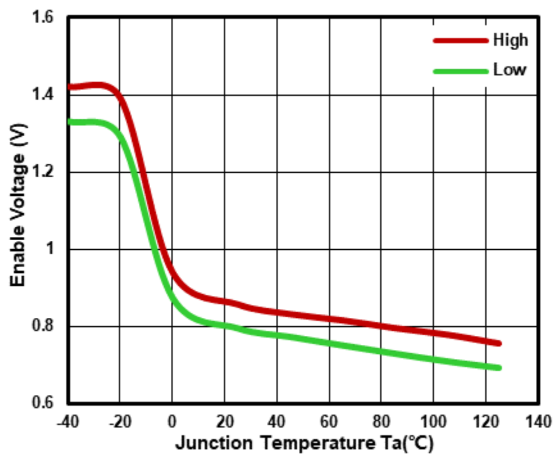
Dropout vs I_{OUT}. Temperature at $V_{OUT}=3.3V$



Dropout vs V_{IN}. Temperature at $V_{OUT}=3.3V(I_{OUT}=200mA)$



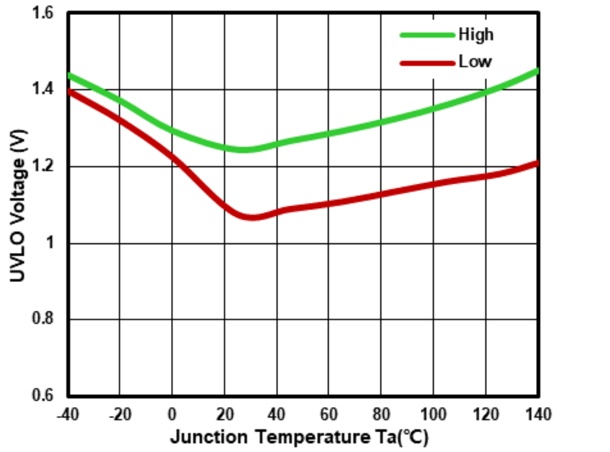
Output Current Fold-back. Temperature at $V_{OUT}=3.3V$



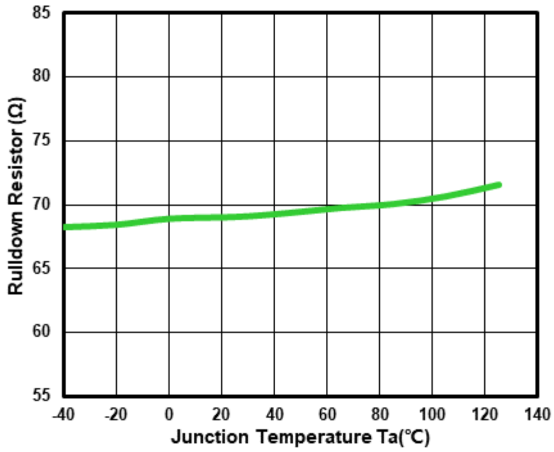
EN High and Low Threshold vs Temperature at $V_{OUT}=3.3V$

■ Typical Performance Characteristics:

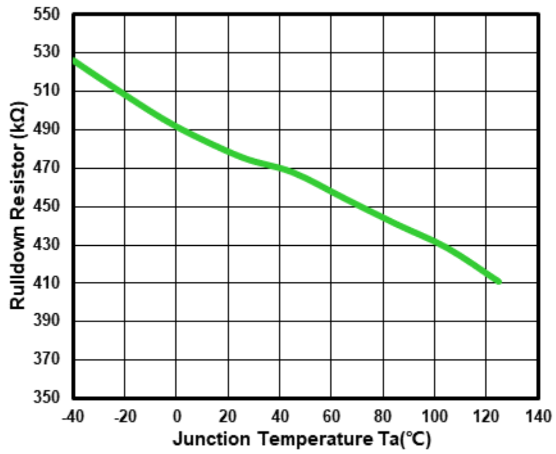
Test Conditions: $V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, $T_a=25℃$, unless otherwise indicated.



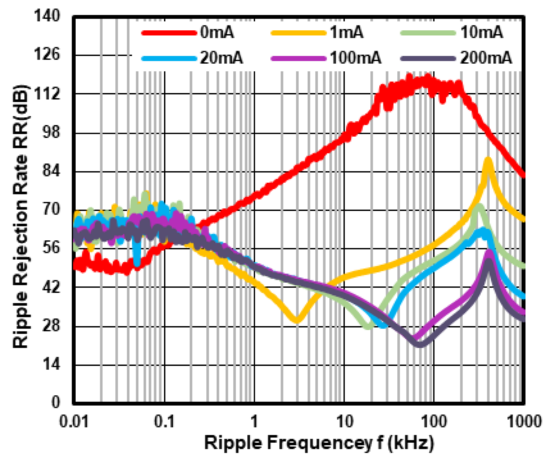
UVLO Rising and Falling Threshold vs. Temperature at V_{OUT}=3.3V



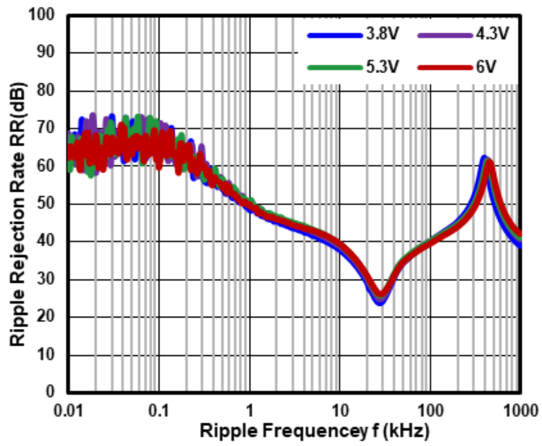
Pulldown Resistor vs. Temperature at V_{OUT}=3.3V



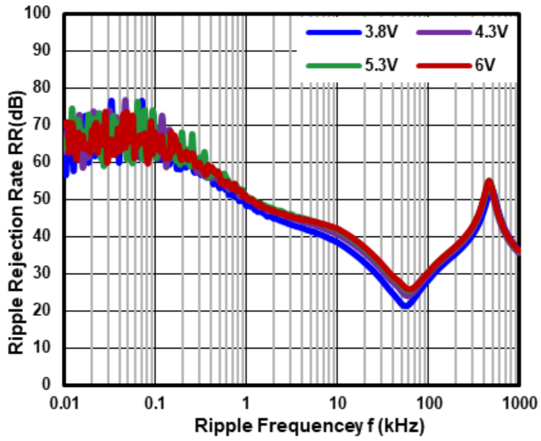
Smart Enable Pulldown Resistor vs. Temperature at V_{OUT}=3.3V



PSRR vs Frequency and I_{OUT} at V_{OUT}=3.3V(VIN=4.3V)



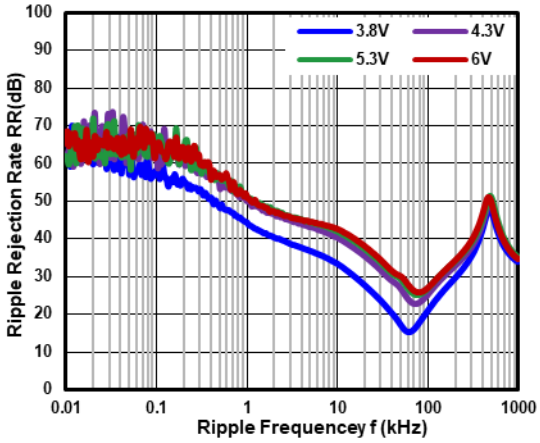
PSRR vs Frequency and V_{IN} at V_{OUT}=3.3V(I_{OUT}=20mA)



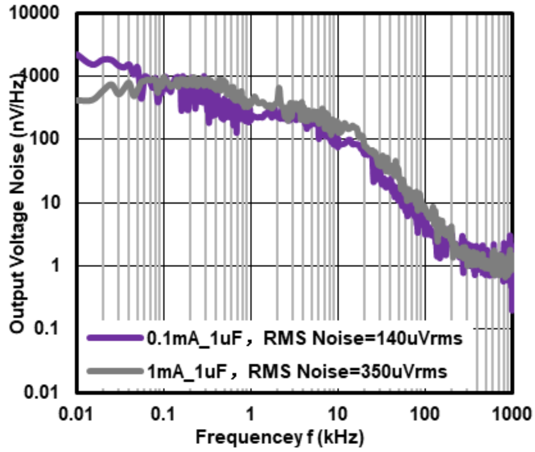
PSRR vs Frequency and V_{IN} at V_{OUT}=3.3V(I_{OUT}=100mA)

■ Typical Performance Characteristics:

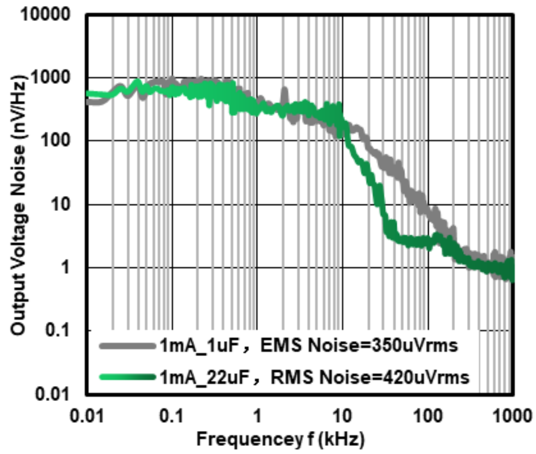
Test Conditions: $V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1.0μF$, $C_{OUT}=1.0μF$, $T_a=25℃$, unless otherwise indicated.



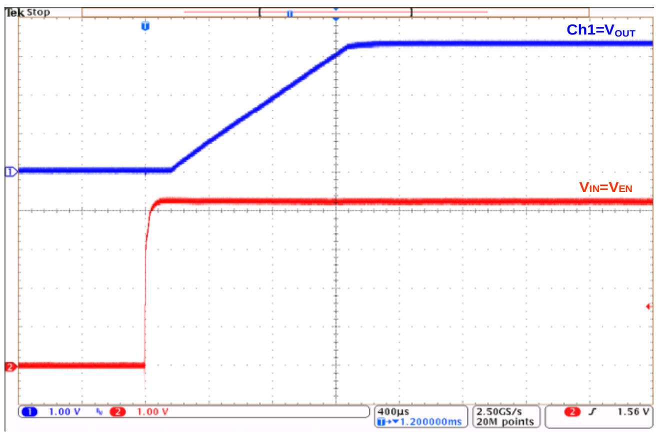
PSRR vs Frequency and V_{IN} at V_{OUT}=3.3V(I_{OUT}=200mA)



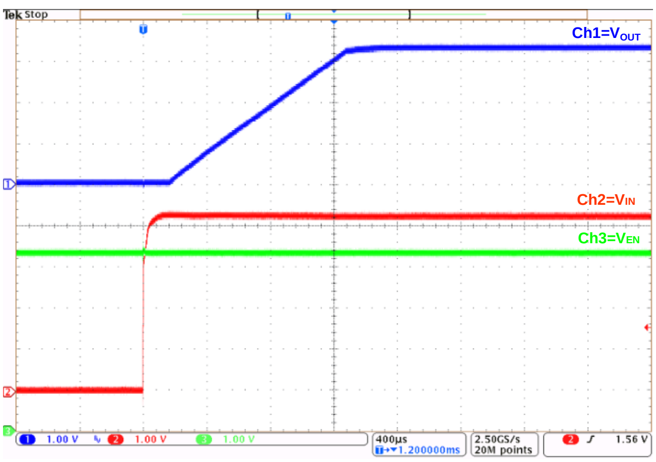
Output Noise vs Frequency and I_{OUT} at V_{OUT}=3.3V



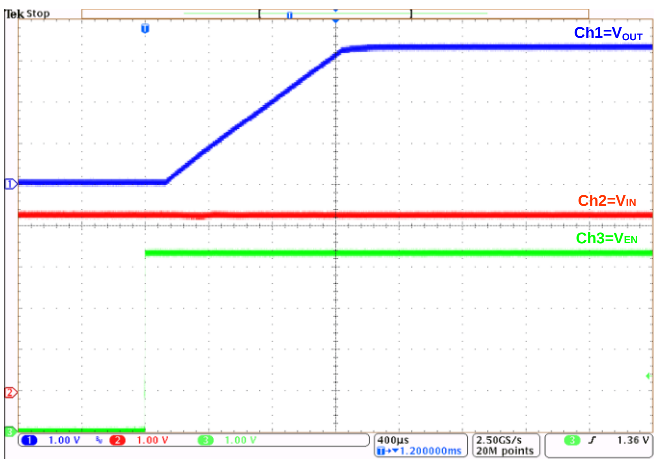
Output Noise vs Frequency and C_{OUT} at V_{OUT}=3.3V



Power Up With $V_{EN}=V_{IN}$ at V_{OUT}=3.3V: (I_{OUT}=200mA)



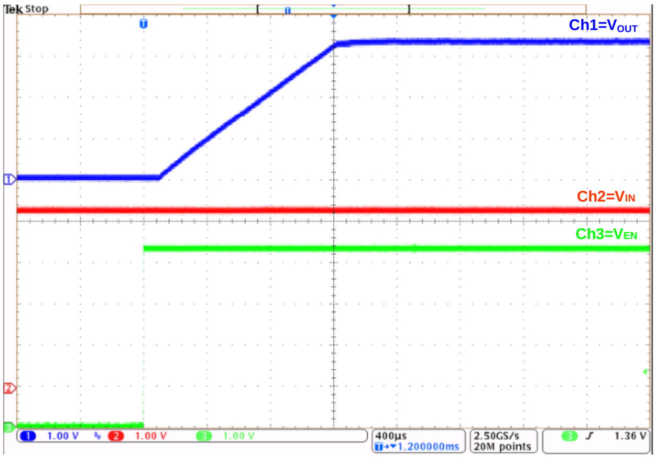
Power Up Through V_{IN} at V_{OUT}=3.3V: (I_{OUT}=200mA)



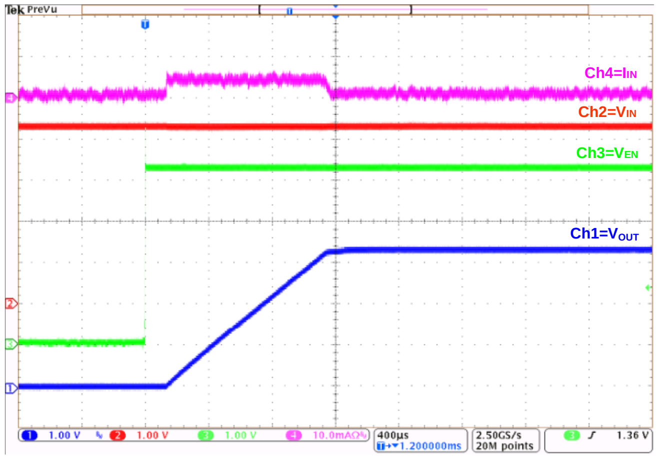
Power Up Through V_{EN} at V_{OUT}=3.3V: (I_{OUT}=200mA)

■ Typical Performance Characteristics (Continued):

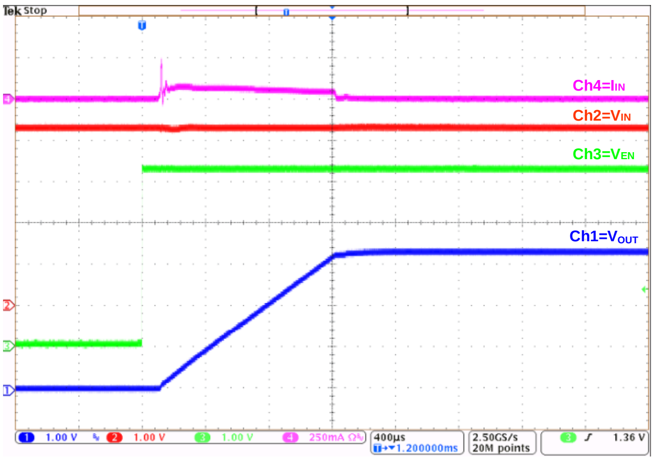
Test Conditions: V_{IN}=V_{OUT}+1.0V, C_{IN}=1.0μF, C_{OUT}=1.0μF, T_a=25℃, unless otherwise indicated.



Power Up Through V_{EN} at V_{OUT}=3.3V:
(I_{OUT}=0mA)



Startup Inrush Current With C_{OUT}= 1 μF:
(I_{OUT}=0mA)



Startup Inrush Current With C_{OUT}= 22 μF:
(I_{OUT}=0mA)

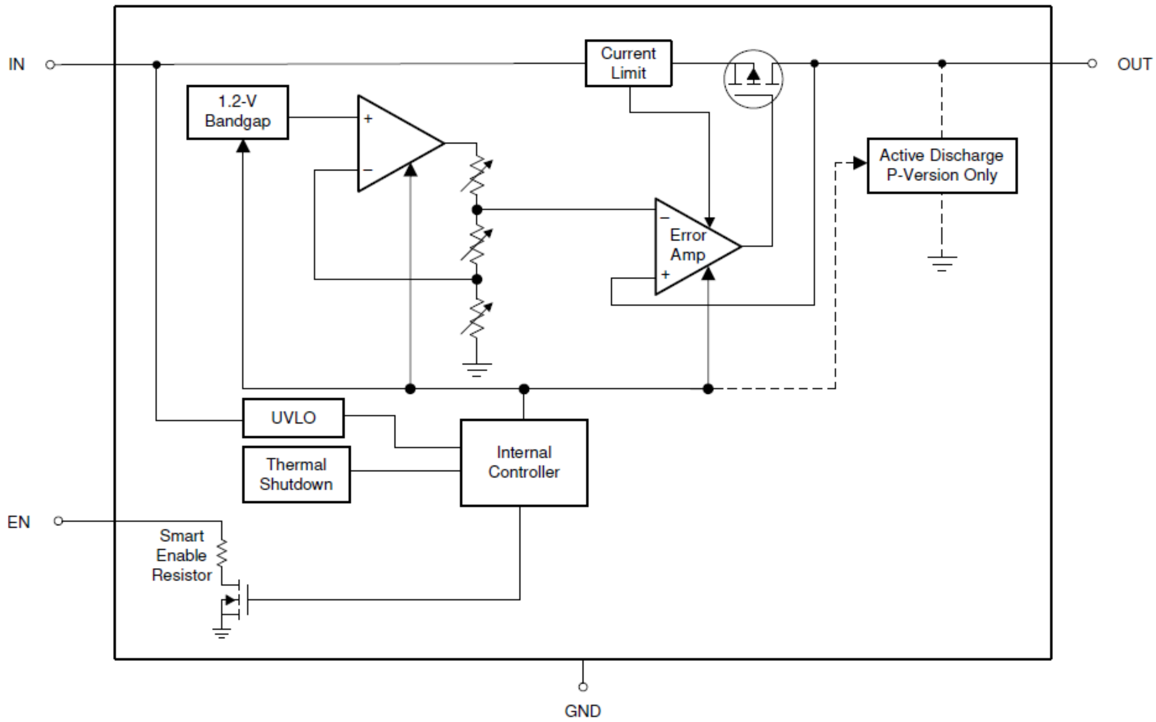
■ Detailed Description:

1.Overview

The HL50Exx is a ultra-low IQ linear voltage regulator that is optimized for excellent transient performance.These characteristics make the device ideal for most battery-powered applications.

This low-dropout linear regulator (LDO) offers active discharge, foldback current limit, shutdown, and thermal protection capability.

2.Functional Block Diagram



3. Feature Description

3.1 Excellent Transient Response

The HL50Exxincludes several innovative circuits to ensure excellent transient response. Dynamic biasing increases the I_Q for a short duration during transients to extend the closed-loop bandwidth and improve the output response time to transients.

Adaptive biasing increases the I_Q as the DC load current increases, extending the bandwidth of the loop. The response time across the output voltage range is constant because a buffered reference topology is used, which keeps the control loop in unity gain at any output voltage.

These features give the device a wide loop bandwidth during transients that ensures excellent transient response while maintaining low I_Q in steady-state conditions.

3.2 Active Discharge

The device has an internal pulldown MOSFET that connects a R PULLDOWN resistor to ground when the device is disabled to actively discharge the output voltage. The active discharge circuit is activated by the enable pin or by the undervoltage lockout (UVLO).

Do not rely on the active discharge circuit for discharging a large amount of output capacitance after the input supply has collapsed because reverse current can possibly flow from the output to the input. This reverse current flow can cause damage to the device. Limit reverse current to no more than 5% of the device rated current for a short period of time.

3.3 Low I_Q in Dropout

In most LDOs the I_Q significantly increases when the device is placed into dropout, which is especially true for low I_Q LDOs. The HL50Exx helps to reduce the battery discharge by detecting when the device is operating in dropout conditions and maintaining a low I_Q.

3.4 Smart Enable

The enable (EN) input polarity is active high. The output voltage is enabled when the voltage of the enable input is greater than $V_{EN(HI)}$ and disabled when the enable input voltage is less than $V_{EN(LOW)}$. If independent control of the output voltage is not needed, connect EN to IN.

This device has a smart enable circuit to reduce quiescent current. When the voltage on the enable pin is driven above $V_{EN(HI)}$, as listed in the Electrical Characteristics table, the device is enabled and the smart enable internal pulldown resistor ($R_{EN(PULLDOWN)}$) is disconnected. When the enable pin is floating, the $R_{EN(PULLDOWN)}$ is connected and pulls the enable pin low to disable the device. The $R_{EN(PULLDOWN)}$ value is listed in the Electrical Characteristics table.

This device has an internal pulldown circuit that activates when the device is disabled to actively discharge the output voltage.

3.5 Dropout Voltage

Dropout voltage (V_{DO}) is defined as the input voltage minus the output voltage (V_{IN} – V_{OUT}) at the rated output current (I_{RATED}), where the pass transistor is fully on. I_{RATED} is the maximum I_{OUT} listed in the Recommended Operating Conditions table. The pass transistor is in the ohmic or triode region of operation, and acts as a switch. The dropout voltage indirectly specifies a minimum input voltage greater than the nominal programmed output voltage at which the output voltage is expected to stay in regulation. If the input voltage falls to less than the nominal output regulation, then the output voltage falls as well.

For a CMOS regulator, the dropout voltage is determined by the drain-source on-state resistance ($R_{DS(ON)}$) of the pass transistor. Therefore, if the linear regulator operates at less than the rated current, the dropout voltage for that current scales accordingly. The following equation calculates the $R_{DS(ON)}$ of the device.

$$R_{DS(ON)} = \frac{V_{DO}}{I_{RATED}}$$

3.6 Foldback Current Limit

The device has an internal current limit circuit that protects the regulator during transient high-load current faults or shorting events. The current limit is a hybrid brick-wall-foldback scheme. The current limit transitions from a brick-wall scheme to a foldback scheme at the foldback voltage ($V_{FOLDBACK}$). In a high-load current fault with the output voltage above $V_{FOLDBACK}$, the brick-wall scheme limits the output current to the current limit (I_{CL}). When the voltage drops below $V_{FOLDBACK}$, a foldback current limit activates that scales back the current as theoutput voltage approaches GND. When the output is shorted, the device supplies a typical current called the short-circuit current limit (I_{SC}). I_{CL} and I_{SC} are listed in the Electrical Characteristics table.For this device, $V_{FOLDBACK}$ = 0.5 V.

The output voltage is not regulated when the device is in current limit. When a current limit event occurs, the device begins to heat up because of the increase in power dissipation. When the device is in brick-wall current limit, the pass transistor dissipates power [(V_{IN} – V_{OUT}) × I_{CL}]. When the device output is shorted and the output is below $V_{FOLDBACK}$, the pass transistor dissipates power [(V_{IN} – V_{OUT}) × I_{SC}]. If thermal shutdown is triggered,the device turns off. After the device cools down, the internal thermal shutdown circuit turns the device back on. If the output current fault condition continues, the device cycles between current limit and thermal shutdown. shows a diagram of the foldback current limit.

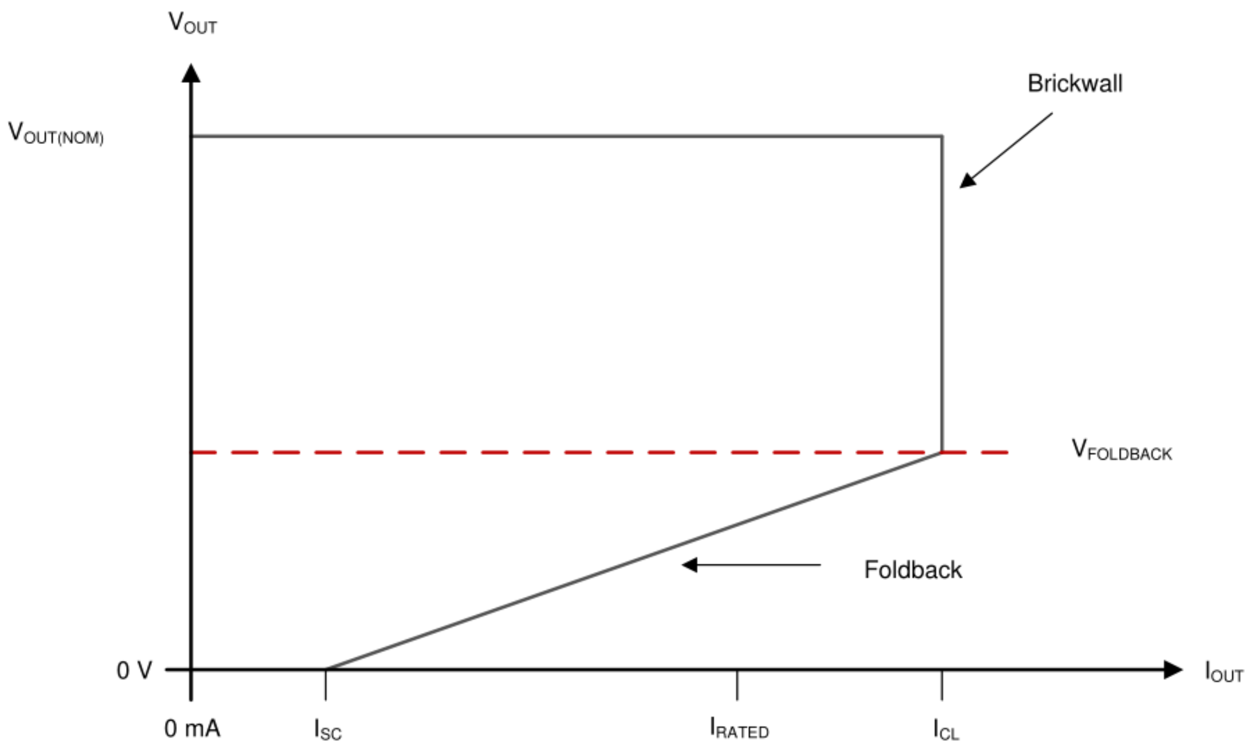


Figure 3-1. Foldback Current Limit

3.7 Undervoltage Lockout (UVLO)

The device has an independent undervoltage lockout (UVLO) circuit that monitors the input voltage, allowing a controlled and consistent turn on and off of the output voltage. To prevent the device from turning off if the input drops during turn on, the UVLO has hysteresis as specified in the Electrical Characteristics table.

3.8 Thermal Shutdown

The device contains a thermal shutdown protection circuit to disable the device when the junction temperature (TJ) of the pass transistor rises to TSD(shutdown) (typical). Thermal shutdown hysteresis assures that the device resets (turns on) when the temperature falls to TSD(reset) (typical).

The thermal time-constant of the semiconductor die is fairly short, thus the device may cycle on and off when thermal shutdown is reached until power dissipation is reduced. Power dissipation during start up can be high from large V IN – V OUT voltage drops across the device or from high inrush currents charging large output capacitors. Under some conditions, the thermal shutdown protection disables the device before start up completes.

For reliable operation, limit the junction temperature to the maximum listed in the Recommended Operating Conditions table. Operation above this maximum temperature causes the device to exceed operational specifications. Although the internal protection circuitry of the device is designed to protect against thermal overall conditions, this circuitry is not intended to replace proper heat sinking. Continuously running the device into thermal shutdown or above the maximum recommended junction temperature reduces long-term reliability.

4.Device Functional Modes

4.1 Device Functional Mode Comparison

Shows the conditions that lead to the different modes of operation. See the Electrical Characteristics table for parameter values.

Device Functional Mode Comparison

OPERATING MODE	PARAMETER			
	V_{IN}	V_{EN}	I_{OUT}	T_J
Normal operation	$V_{IN} > V_{OUT(nom)} + V_{DO}$ and $V_{IN} > V_{IN(min)}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{OUT(max)}$	$T_J < T_{SD(shutdown)}$
Dropout operation	$V_{IN(min)} < V_{IN} < V_{OUT(nom)} + V_{DO}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{OUT(max)}$	$T_J < T_{SD(shutdown)}$
Disabled (any true condition disables the device)	$V_{IN} < V_{UVLO}$	$V_{EN} < V_{EN(LOW)}$	Not applicable	$T_J > T_{SD(shutdown)}$

4.2 Normal Operation

The device regulates to the nominal output voltage when the following conditions are met:

- The input voltage is greater than the nominal output voltage plus the dropout voltage ($V_{OUT(nom)} + V_{DO}$)
- The output current is less than the current limit ($I_{OUT} < I_{CL}$)
- The device junction temperature is less than the thermal shutdown temperature (TJ < TSD)
- The enable voltage has previously exceeded the enable rising threshold voltage and has not yet decreased to less than the enable falling threshold

4.3 Dropout Operation

If the input voltage is lower than the nominal output voltage plus the specified dropout voltage, but all other conditions are met for normal operation, the device operates in dropout mode. In this mode, the output voltage tracks the input voltage. During this mode, the transient performance of the device becomes significantly degraded because the pass transistor is in the ohmic or triode region, and acts as a switch. Line or load transients in dropout can result in large output-voltage deviations.

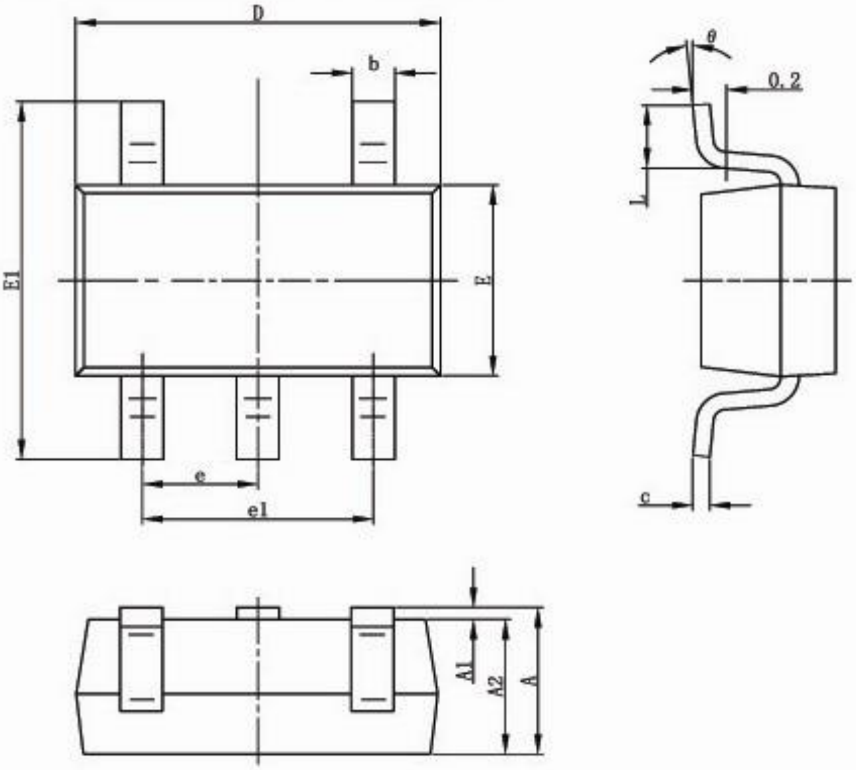
When the device is in a steady dropout state (defined as when the device is in dropout, $V_{IN} < V_{OUT(NOM)} + V_{DO}$, directly after being in a normal regulation state, but not during start-up), the pass transistor is driven into the ohmic or triode region. When the input voltage returns to a value greater than or equal to the nominal output voltage plus the dropout voltage ($V_{OUT(NOM)} + V_{DO}$), the output voltage can overshoot for a short period of time while the device pulls the pass transistor back into the linear region.

4.4 Disabled

The output of the device can be shutdown by forcing the voltage of the enable pin to less than the maximum EN pin low-level input voltage (see the Electrical Characteristics table). When disabled, the pass transistor is turned off, internal circuits are shutdown, and the output voltage is actively discharged to ground by an internal discharge circuit from the output to ground.

■ Packaging Information:

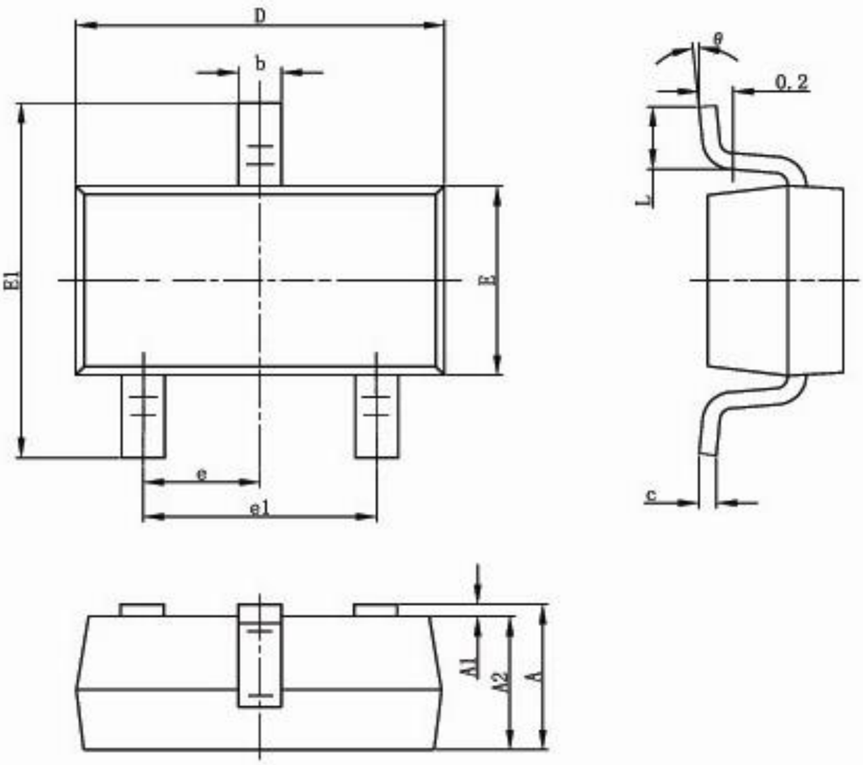
SOT-23-5L PACKAGE OUTLINE DIMENSIONS



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°

PACKAGING INFORMATION(Continued):

SOT-23-3L PACKAGE OUTLINE DIMENSIONS



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L	0.300	0.600	0.012	0.024
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