Features

- Low power consumption
- Low voltage drop
- Low temperature coefficient
- High input voltage (up to 40V)
- Output voltage accuracy: tolerance ±1.5%
- Soft start function
- Over current protection
- Over temperature protection
- Package types: 3-pin SOT89, 5-pin SOT23

Applications

- Industrial/Automotive Application
- Power Meter, Water Meter, Smart Meter
- Portable/Battery-Powered Equipment

General Description

The HT73Hxx series is a set of low power consumption high voltage regulator implemented in a BCD technology, which ensures low voltage drop and low quiescent current. They allow input voltages as high as 40V. They are available with several fixed output voltages ranging from 2.1V to 5.0V.

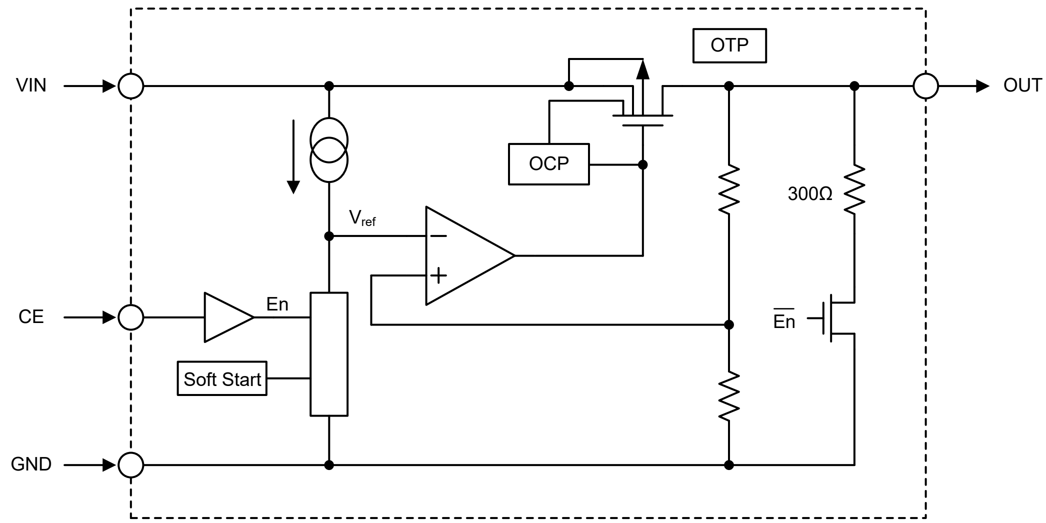
The soft start function controls the output slew rate to prevent the overshooting phenomenon when power on. The enable pin, CE, accepts CMOS level as logic input. When CE goes low, a fast discharging path pulls output voltage low a via 300Ω resistor. The internally output over current protection prevents the HT73Hxx from being burned even if the output node shorts to ground. The over temperature protection ensures that the junction temperature will not exceed 150°C. The soft start function inhibits the output overshooting when power on.

Selection Table

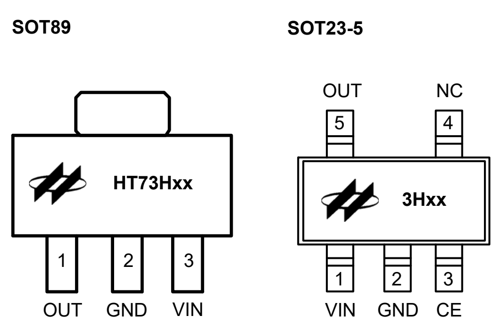
Part No.	Output Voltage	Package	Marking
HT73H21	2.1V	SOT89 SOT23-5	HT73Hxx (for SOT89) 3Hxx (for SOT23-5)
HT73H23	2.3V		
HT73H25	2.5V		
HT73H27	2.7V		
HT73H30	3.0V		
HT73H33	3.3V		
HT73H36	3.6V		
HT73H40	4.0V		
HT73H44	4.4V		
HT73H50	5.0V		

Note: “xx” stands for output voltages.

Block Diagram



Pin Assignment



Pin Descriptions

Pin No.		Pin Name	Pin Description
SOT89	SOT23-5		
3	1	VIN	Input pin
2	2	GND	Ground pin
1	5	OUT	Output pin
—	3	CE	Chip enable pin, high enable
—	4	NC	No connection

Absolute Maximum Ratings

<table>
<tr><th colspan="2">Parameter</th><th>Value</th><th>Unit</th></tr>
<tr><td colspan="2">V_{IN}</td><td>-0.3 to +48</td><td>V</td></tr>
<tr><td colspan="2">V_{CE}</td><td>-0.3 to (V_{IN}+0.3)</td><td>V</td></tr>
<tr><td colspan="2">Operating Temperature Range, Ta</td><td>-40 to +85</td><td>°C</td></tr>
<tr><td colspan="2">Maximum Junction Temperature, $T_{J(MAX)}$</td><td>+150</td><td>°C</td></tr>
<tr><td colspan="2">Storage Temperature Range</td><td>-60 to +150</td><td>°C</td></tr>
<tr><td rowspan="2">ESD Susceptibility</td><td>Human Body Model</td><td>±5000</td><td>V</td></tr>
<tr><td>Machine Model</td><td>±400</td><td>V</td></tr>
<tr><td rowspan="2">Junction-to-Ambient Thermal Resistance, θ_{JA}</td><td>SOT89</td><td>200</td><td>°C/W</td></tr>
<tr><td>SOT23-5</td><td>500</td><td>°C/W</td></tr>
<tr><td rowspan="2">Power Dissipation, P_D</td><td>SOT89</td><td>0.625</td><td>W</td></tr>
<tr><td>SOT23-5</td><td>0.25</td><td>W</td></tr>
</table>

Note: P_D is measured at Ta=25°C.

Recommended Operating Range

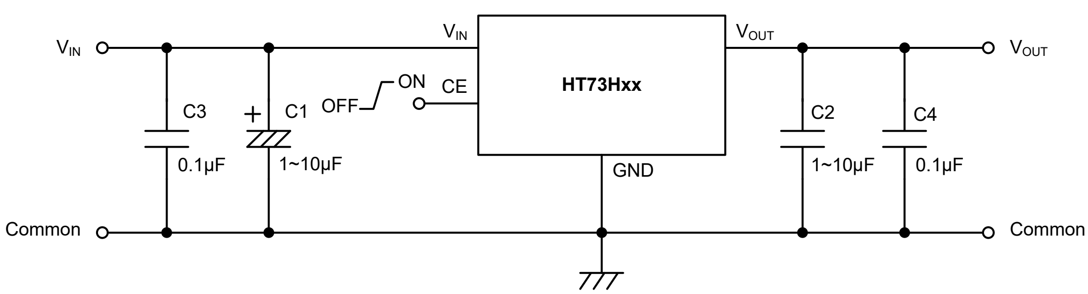
Parameter	Value	Unit
V_{IN}	(V_{OUT}+2) to 40	V
V_{CE}	0 to V_{IN}	V

Electrical Characteristics

V_{IN}=V_{OUT}+2V, V_{CE}=V_{IN}, Ta=25°C and C_{IN}=C_{OUT}=1μF, unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage	—	—	—	40	V
V_{OUT}	Output Voltage Range	—	2.1	—	5.0	V
V_O	Output Voltage Accuracy	I_{OUT}=10mA	-1.5	—	1.5	%
I_{OUT}	Output Current	V_{OUT}=2.1V to 3.0V	180	—	—	mA
		V_{OUT}=3.3V to 5.0V	250	—	—	
ΔV_{OUT}	Load Regulation	1mA≤I_{OUT}≤100mA	—	45	90	mV
V_{DIF}	Dropout Voltage	I_{OUT}=1mA, V_{OUT} Change=2% (Note)	—	5	15	mV
		I_{OUT}=30mA, V_{OUT} Change=2% (Note)	—	80	300	mV
I_{SS}	Quiescent Current	I_{OUT}=0mA	—	2.5	4.0	μA
		V_{CE}=2.2V, V_{IN}=40V, I_{OUT}=0mA	—	3.0	5.0	μA
I_{SHD}	Shutdown Current	V_{CE}=0V	—	0.1	1.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times \Delta V_{OUT}}$	Line Regulation	(V_{OUT}+1V)≤V_{IN}≤40V, I_{OUT}=1mA	—	0.1	0.2	%/V
$\frac{\Delta V_{OUT}}{\Delta Ta \times \Delta V_{OUT}}$	Temperature Coefficient	I_{OUT}=10mA, -40°C<Ta<85°C	—	±100	—	ppm/°C
I_{OCP1}	OCP1 Current Threshold	V_{IN}=24V	350	—	—	mA
I_{OCP2}	OCP2 Current Threshold	V_{IN}=24V, force V_{OUT}=0V	—	300	—	mA
V_{OCP_TH}	OCP1/OCP2 Current Threshold	Observe at V_{OUT} terminal	—	0.7	—	V
T_{SHD}	Shutdown Temperature	—	—	150	—	°C
T_{REC}	Recovery Temperature	—	—	120	—	°C
V_{IH}	Enable High Threshold	CE pin, (V_{OUT}+1V)≤V_{IN}≤40V	2	—	—	V
V_{IL}	Enable Low Threshold	CE pin, (V_{OUT}+1V)≤V_{IN}≤40V	—	—	0.6	V
R_{DIS}	Discharge Resistor	V_{IN}=24V, CE=0V, measure at V_{OUT}	—	300	—	Ω
PSRR	Power Supply Rejection Ratio	V_{IN}=24V, V_{OUT}=5V, I_{OUT}=10mA, f=1kHz	—	60	—	dB
Noise	Output Voltage Noise	V_{OUT}=5V, I_{OUT}=10mA, BW=10Hz~100kHz	—	75	—	μV_{RMS}

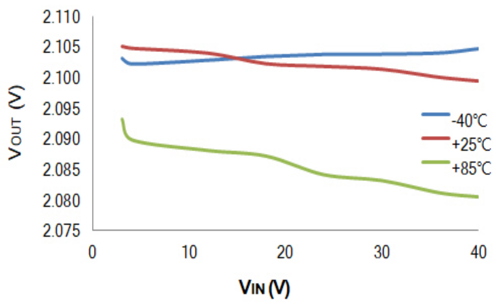
Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN}=V_{OUT}+2V with a fixed load.



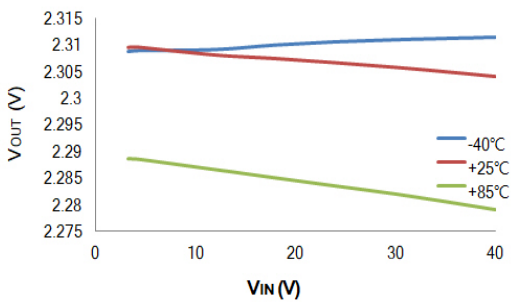
Typical Performance Characteristic

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25ºC, unless otherwise noted.

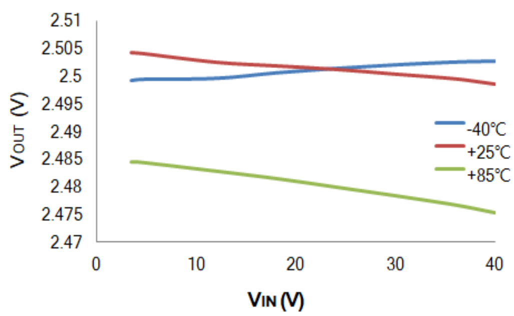
Output Voltage vs Input Voltage



Line Regulation: HT73H21 (I_{OUT}=10mA)

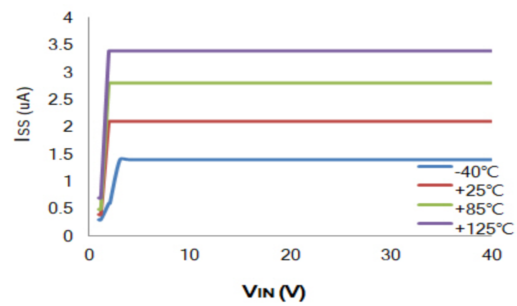


Line Regulation: HT73H23 (I_{OUT}=10mA)

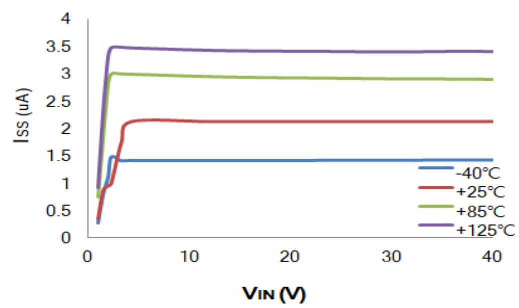


Line Regulation: HT73H25 (I_{OUT}=10mA)

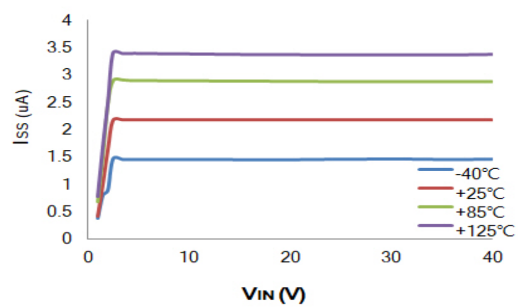
Quiescent Current vs Input Voltage



I_{SS} vs V_{IN}: HT73H21 (I_{OUT}=0mA)

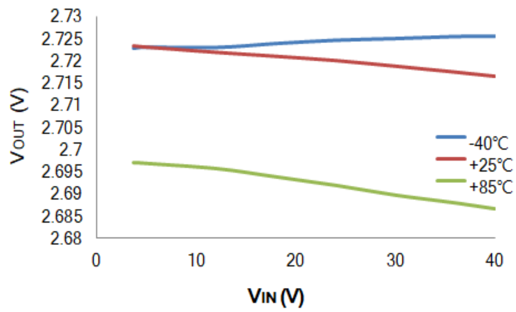


I_{SS} vs V_{IN}: HT73H23 (I_{OUT}=0mA)

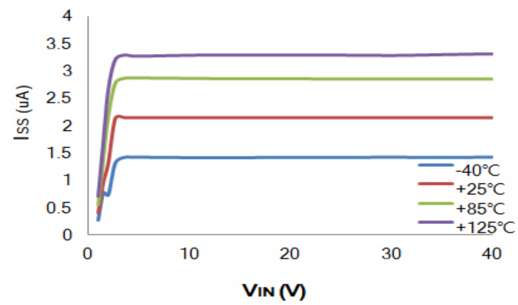


I_{SS} vs V_{IN}: HT73H25 (I_{OUT}=0mA)

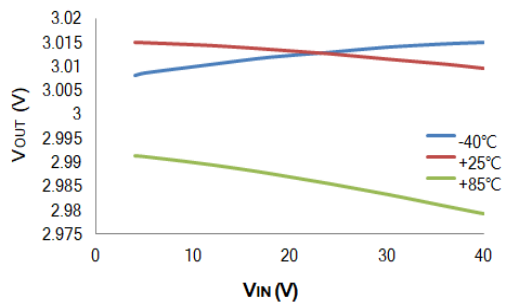
Output Voltage vs Input Voltage	Quiescent Current vs Input Voltage



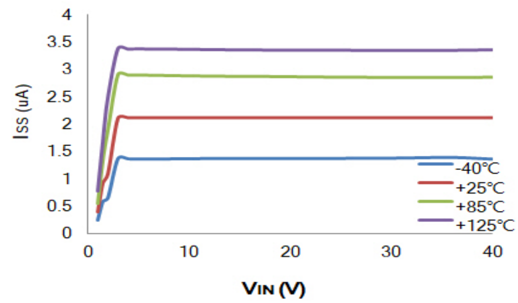
Line Regulation: HT73H27 (I_{OUT}=10mA)



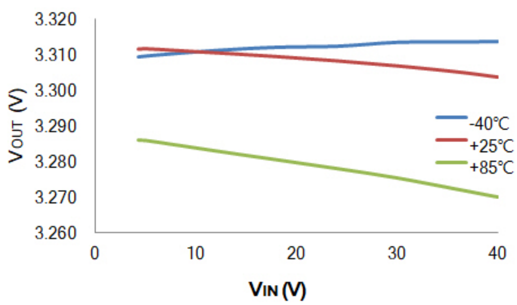
I_{SS} vs V_{IN}: HT73H27 (I_{OUT}=0mA)



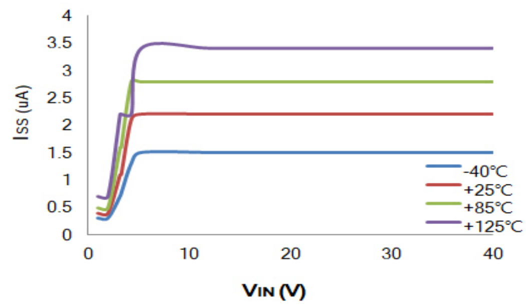
Line Regulation: HT73H30 (I_{OUT}=10mA)



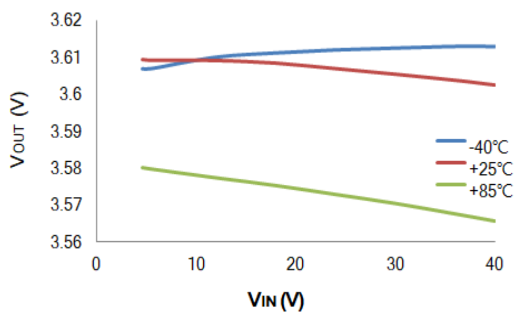
I_{SS} vs V_{IN}: HT73H30 (I_{OUT}=0mA)



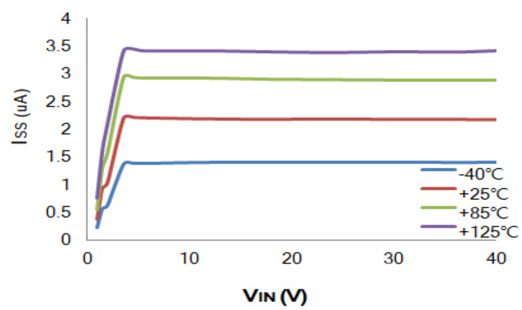
Line Regulation: HT73H33 (I_{OUT}=10mA)



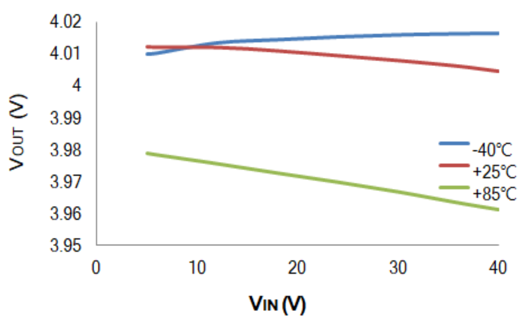
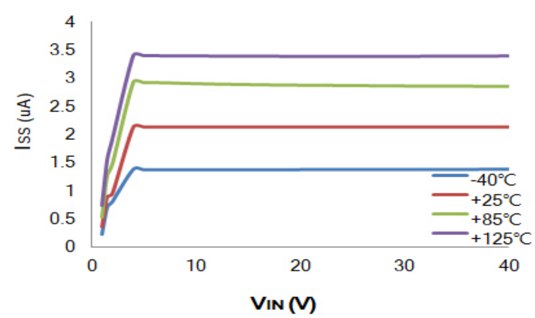
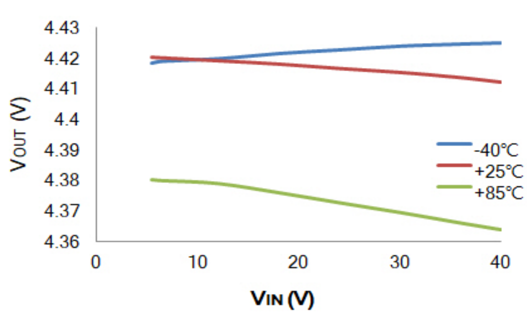
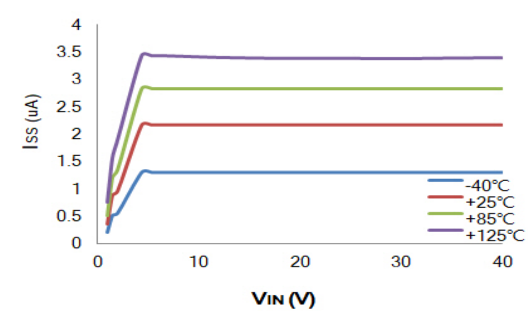
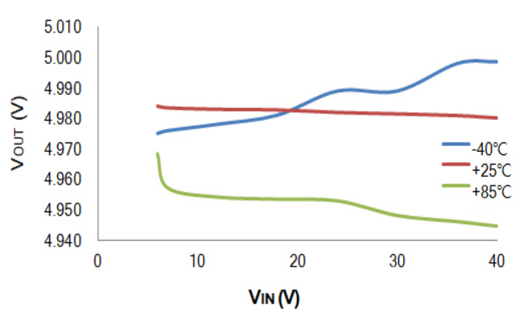
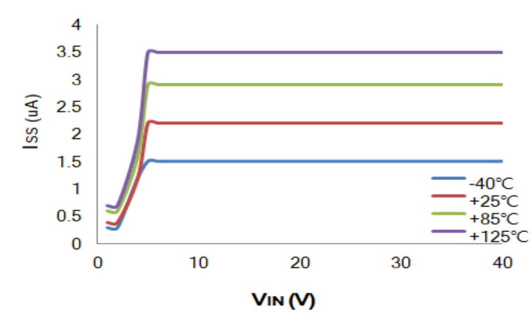
I_{SS} vs V_{IN}: HT73H33 (I_{OUT}=0mA)



Line Regulation: HT73H36 (I_{OUT}=10mA)

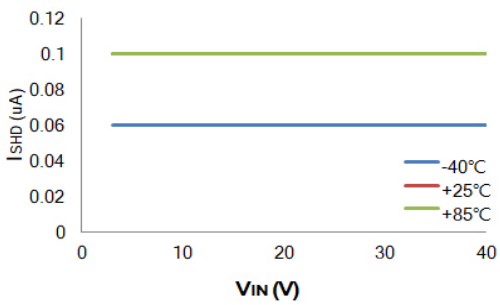


I_{SS} vs V_{IN}: HT73H36 (I_{OUT}=0mA)

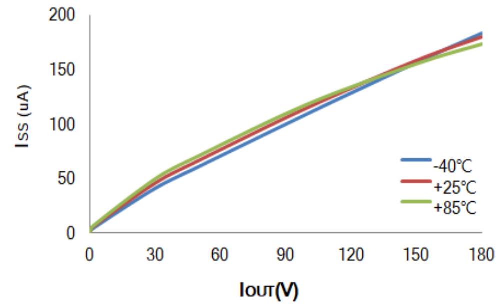
Output Voltage vs Input Voltage	Quiescent Current vs Input Voltage
 Line Regulation: HT73H40 (I_{OUT}=10mA)	 I_{SS} vs V_{IN}: HT73H40 (I_{OUT}=0mA)
 Line Regulation: HT73H44 (I_{OUT}=10mA)	 I_{SS} vs V_{IN}: HT73H44 (I_{OUT}=0mA)
 Line Regulation: HT73H50 (I_{OUT}=10mA)	 I_{SS} vs V_{IN}: HT73H50 (I_{OUT}=0mA)

Test Condition: V_{IN}=V_{OUT}+2V, V_{CE}=V_{IN}, I_{OUT}=10mA, C_{IN}=1μF, C_{OUT}=1μF and Ta=25ºC, unless otherwise noted.

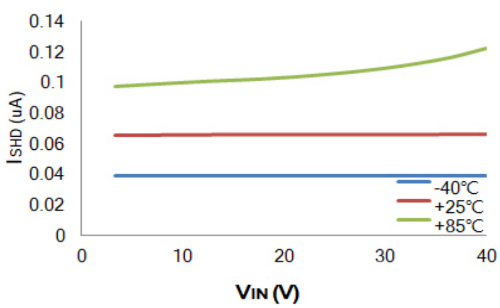
Shutdown Current vs Input Voltage | **Quiescent Current vs Output Current**



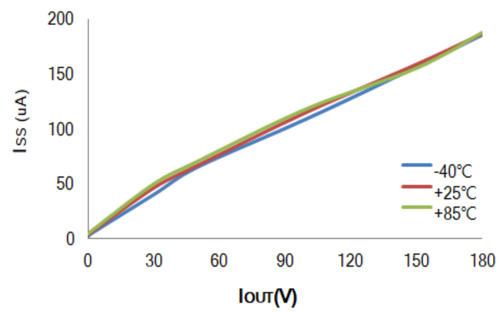
I_{SHD} vs V_{IN}: HT73H21 (I_{OUT}=0mA, V_{CE}=0V)



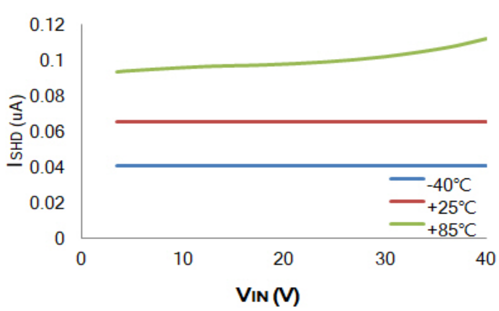
I_{SS} vs I_{OUT}: HT73H21 (V_{IN}=4.1V)



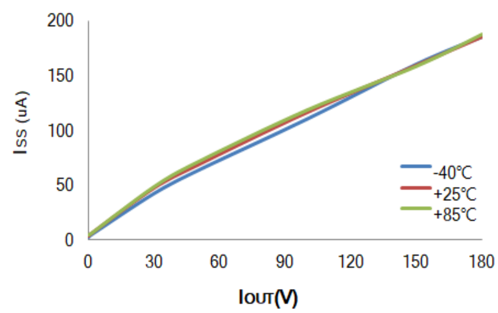
I_{SHD} vs V_{IN}: HT73H23 (I_{OUT}=0mA, V_{CE}=0V)



I_{SS} vs I_{OUT}: HT73H23 (V_{IN}=4.3V)

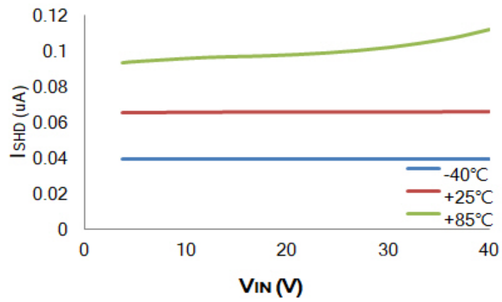


I_{SHD} vs V_{IN}: HT73H25 (I_{OUT}=0mA, V_{CE}=0V)

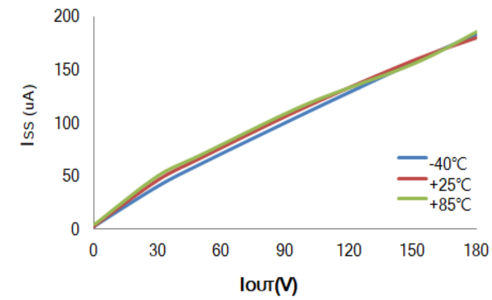


I_{SS} vs I_{OUT}: HT73H25 (V_{IN}=4.5V)

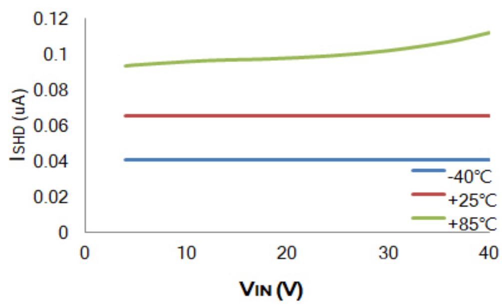
Shutdown Current vs Input Voltage	Quiescent Current vs Output Current



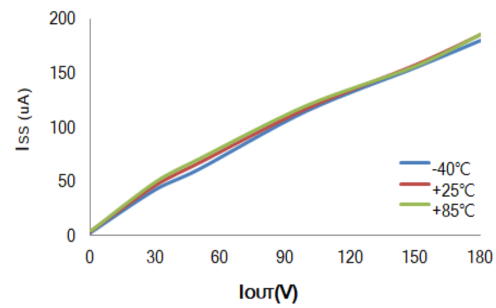
I_{SHD} vs V_{IN}: HT73H27 (I_{OUT}=0mA, V_{CE}=0V)



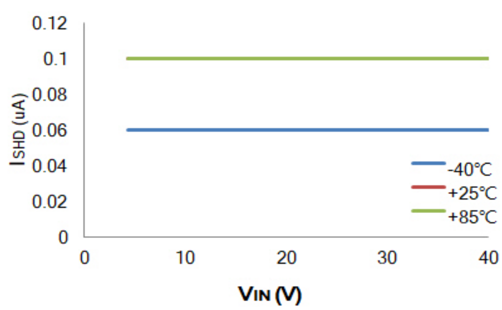
I_{SS} vs I_{OUT}: HT73H27 (V_{IN}=4.7V)



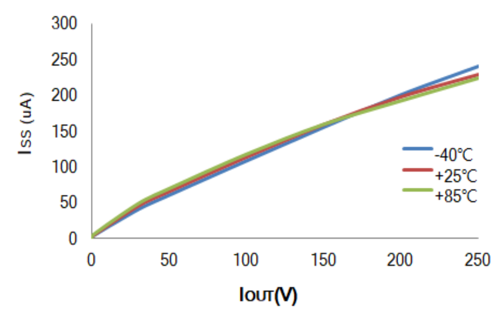
I_{SHD} vs V_{IN}: HT73H30 (I_{OUT}=0mA, V_{CE}=0V)



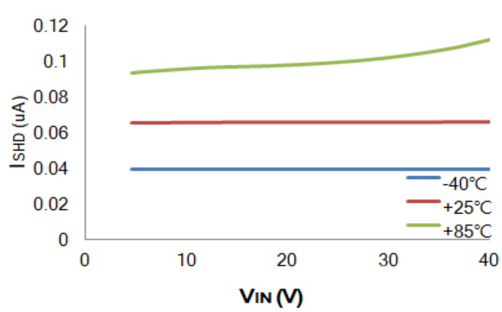
I_{SS} vs I_{OUT}: HT73H30 (V_{IN}=5V)



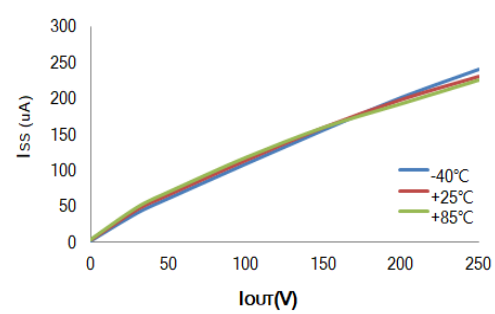
I_{SHD} vs V_{IN}: HT73H33 (I_{OUT}=0mA, V_{CE}=0V)



I_{SS} vs I_{OUT}: HT73H33 (V_{IN}=5.3V)

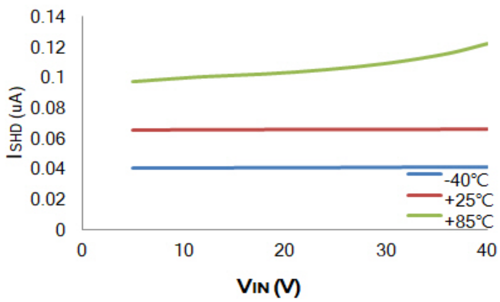


I_{SHD} vs V_{IN}: HT73H36 (I_{OUT}=0mA, V_{CE}=0V)

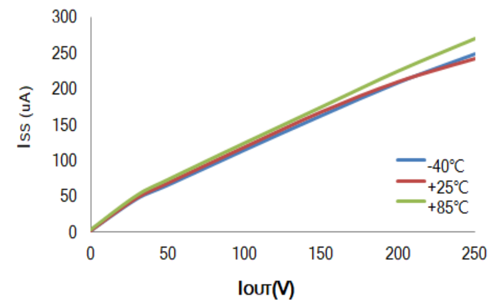


I_{SS} vs I_{OUT}: HT73H36 (V_{IN}=5.6V)

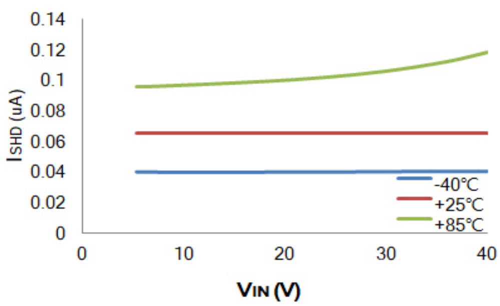
Shutdown Current vs Input Voltage	Quiescent Current vs Output Current



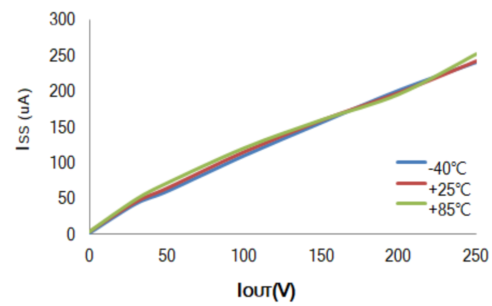
I_{SHD} vs V_{IN}: HT73H40 (I_{OUT}=0mA, V_{CE}=0V)



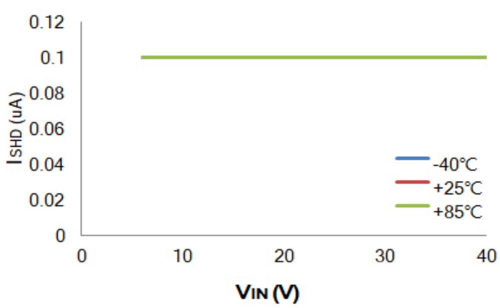
I_{SS} vs I_{OUT}: HT73H40 (V_{IN}=6V)



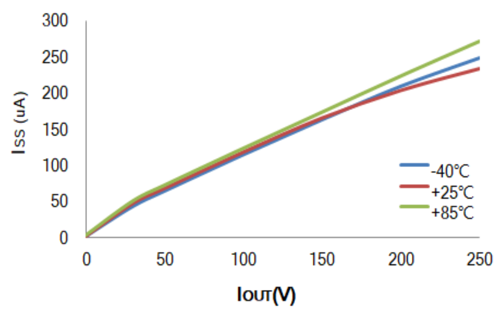
I_{SHD} vs V_{IN}: HT73H44 (I_{OUT}=0mA, V_{CE}=0V)



I_{SS} vs I_{OUT}: HT73H44 (V_{IN}=6.4V)



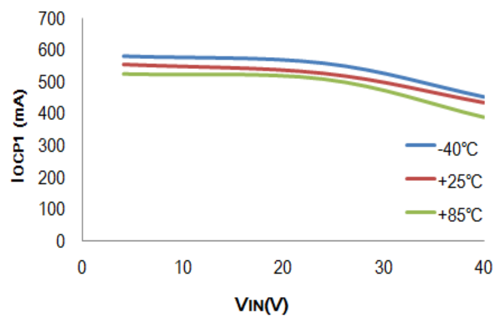
I_{SHD} vs V_{IN}: HT73H50 (I_{OUT}=0mA, V_{CE}=0V)



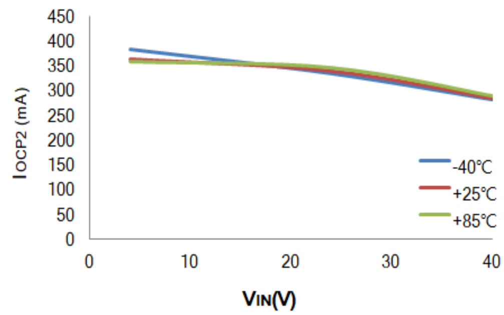
I_{SS} vs I_{OUT}: HT73H50 (V_{IN}=7V)

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25ºC, unless otherwise noted.

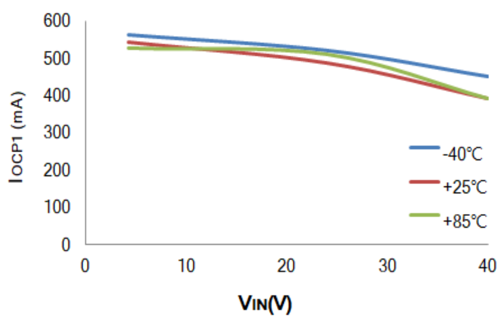
I_{OCP1} vs Input Voltage	I_{OCP2} vs Input Voltage



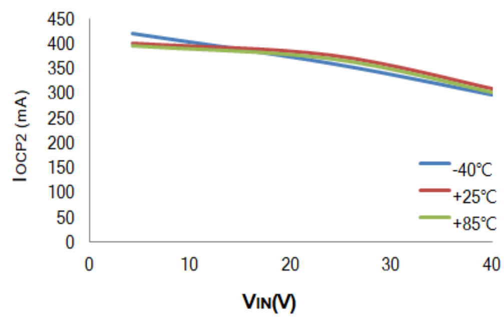
I_{OCP1} vs V_{IN}: HT73H21



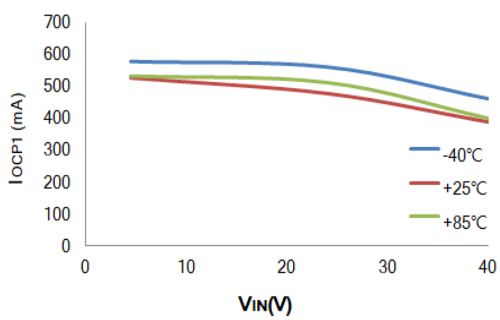
I_{OCP2} vs V_{IN}: HT73H21 (V_{OUT}=0V)



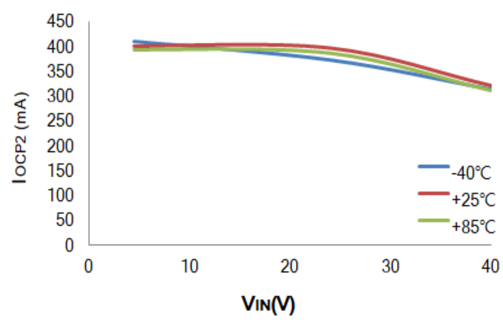
I_{OCP1} vs V_{IN}: HT73H23



I_{OCP2} vs V_{IN}: HT73H23 (V_{OUT}=0V)



I_{OCP1} vs V_{IN}: HT73H25



I_{OCP2} vs V_{IN}: HT73H25 (V_{OUT}=0V)

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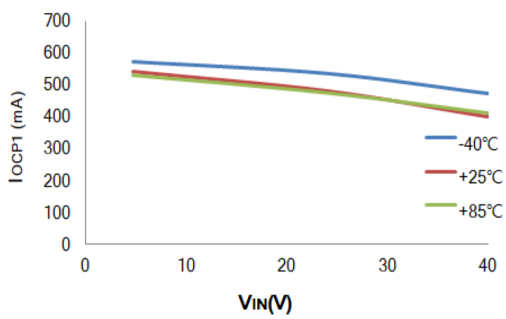

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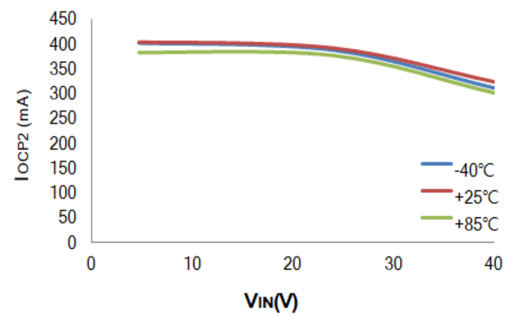

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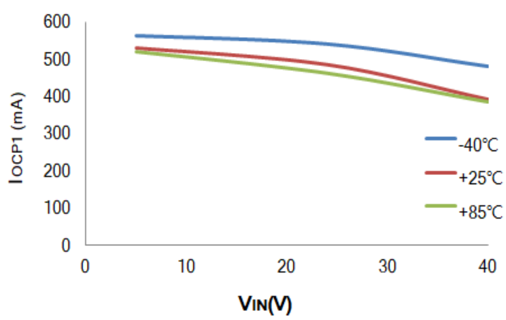

I_{OCP1} vs V_{IN}: HT73H30
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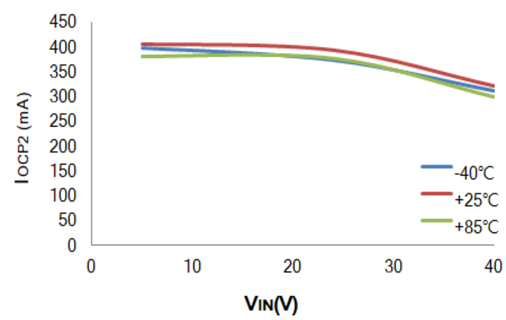

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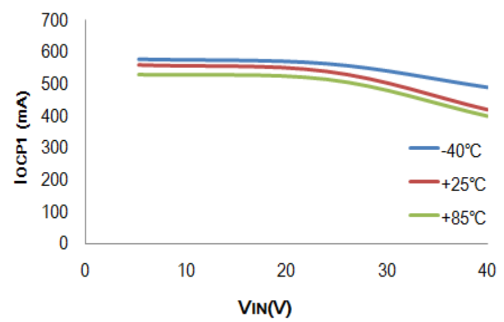

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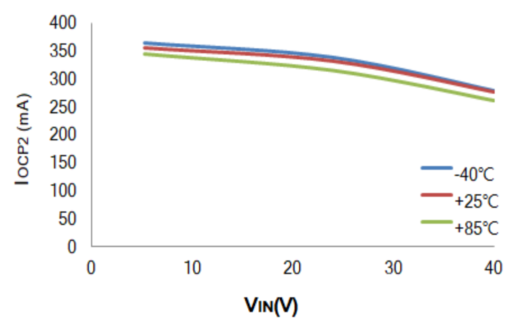

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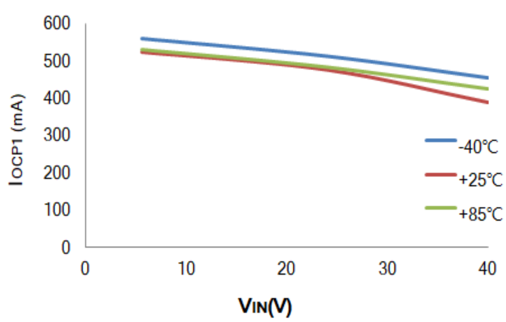

I_{OCP1} vs V_{IN}: HT73H36
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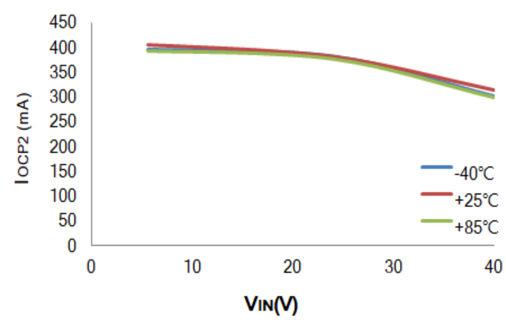

I_{OCP2} vs V_{IN}: HT73H36 (V_{OUT}=0V)
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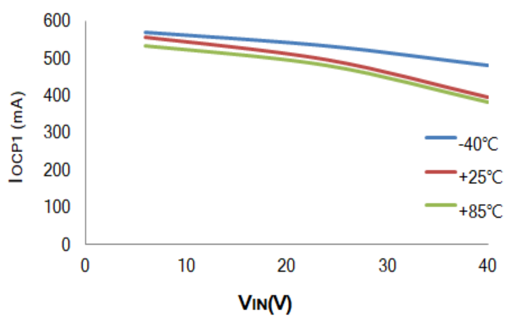
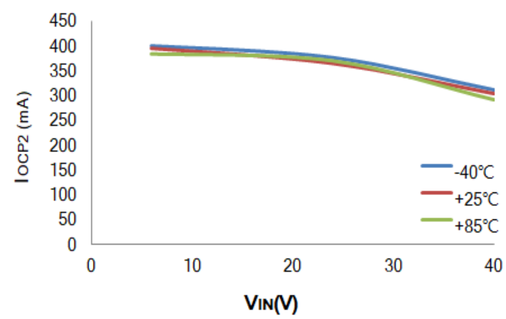
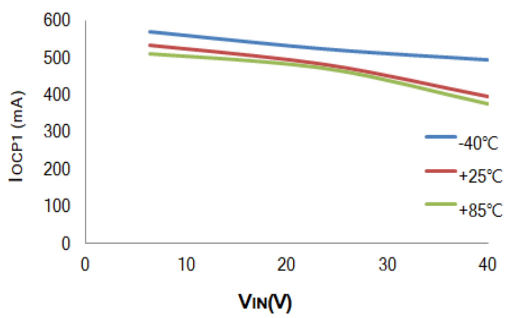
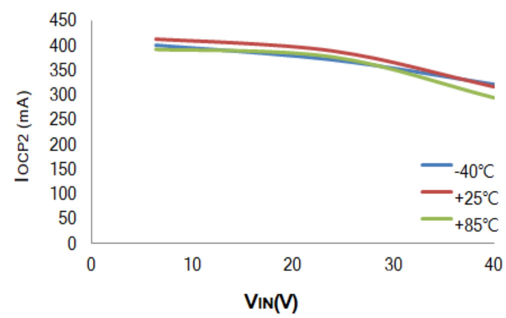
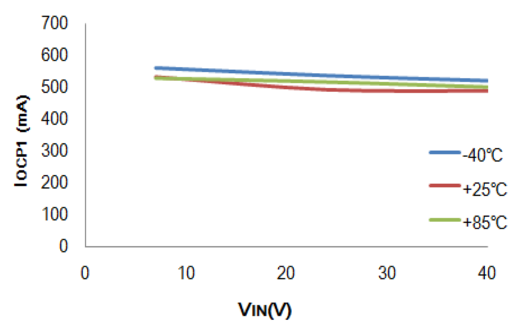
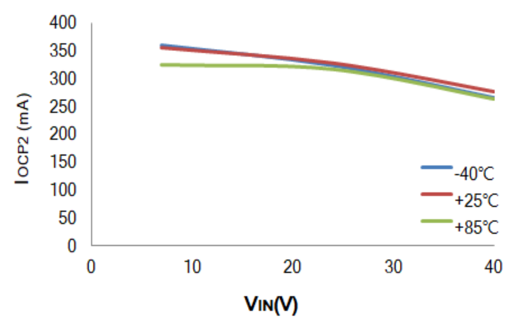
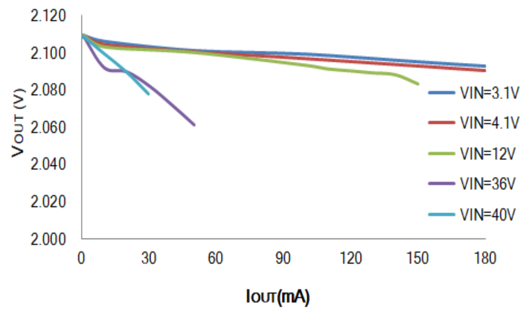
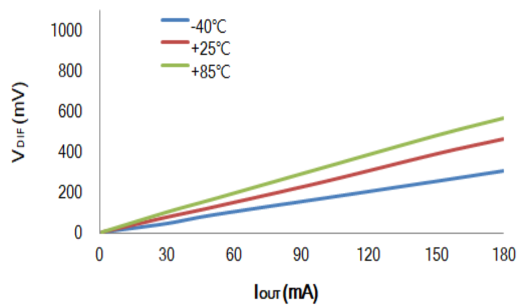
I_{OCP1} vs Input Voltage	I_{OCP2} vs Input Voltage
 I_{OCP1} vs V_{IN}: HT73H40	 I_{OCP2} vs V_{IN}: HT73H40 (V_{OUT}=0V)
 I_{OCP1} vs V_{IN}: HT73H44	 I_{OCP2} vs V_{IN}: HT73H44 (V_{OUT}=0V)
 I_{OCP1} vs V_{IN}: HT73H50	 I_{OCP2} vs V_{IN}: HT73H50 (V_{OUT}=0V)

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25°C, unless otherwise noted.

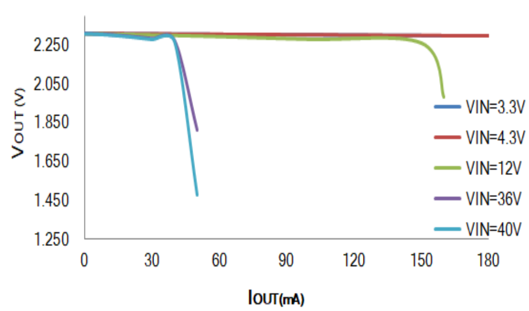
Output Voltage vs Output Current (RMS) | **Dropout Voltage vs Output Current**



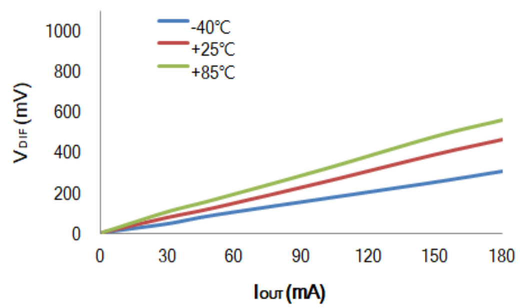
V_{OUT} vs I_{OUT}: HT73H21



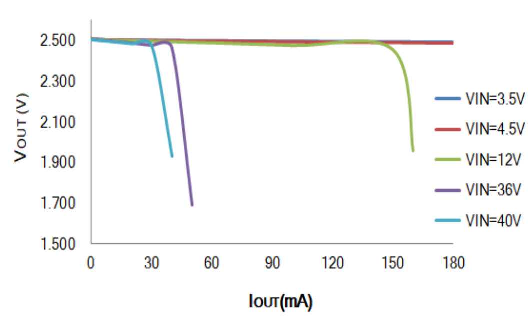
Dropout Voltage: HT73H21



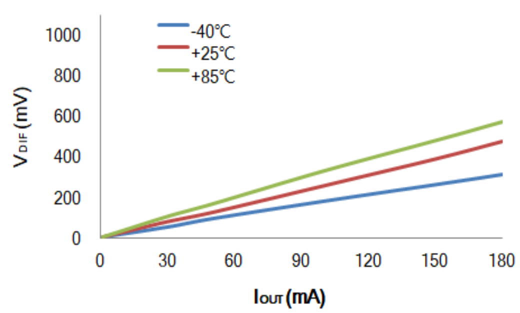
V_{OUT} vs I_{OUT}: HT73H23



Dropout Voltage: HT73H23

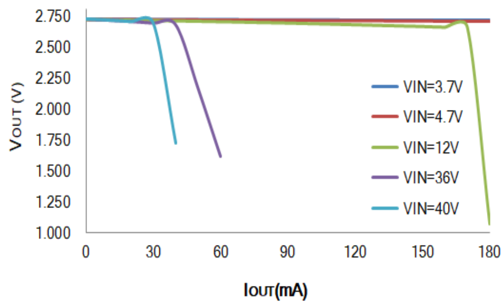


V_{OUT} vs I_{OUT}: HT73H25

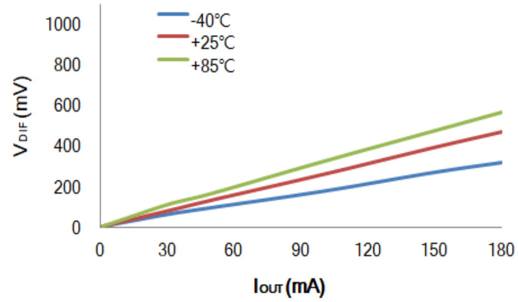


Dropout Voltage: HT73H25

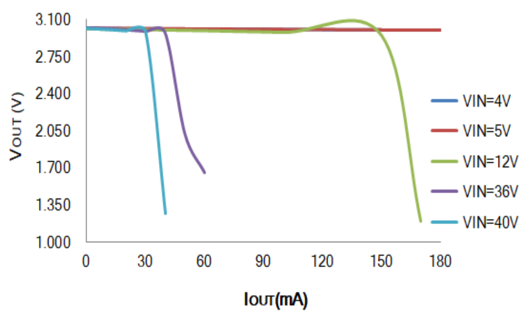
Output Voltage vs Output Current (RMS)	Dropout Voltage vs Output Current



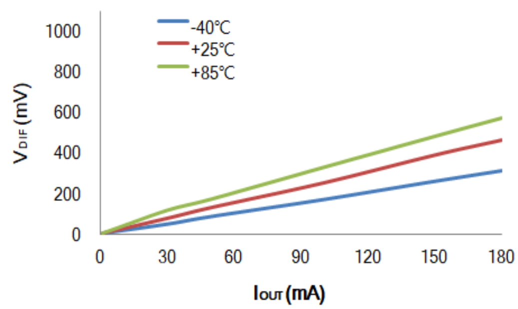
V_{OUT} vs I_{OUT}: HT73H27



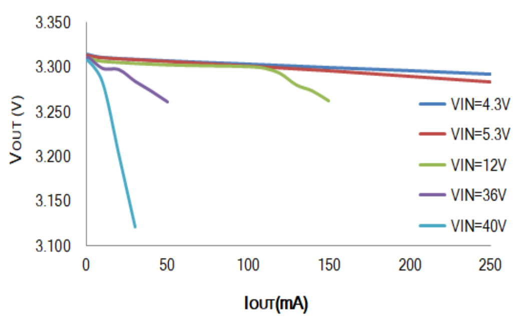
Dropout Voltage: HT73H27



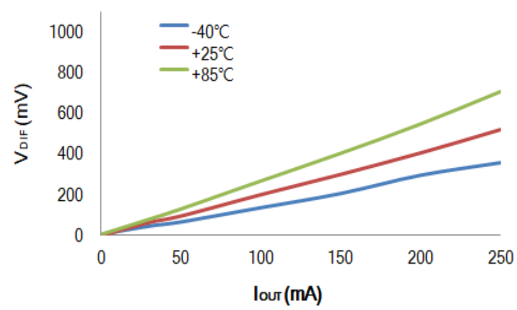
V_{OUT} vs I_{OUT}: HT73H30



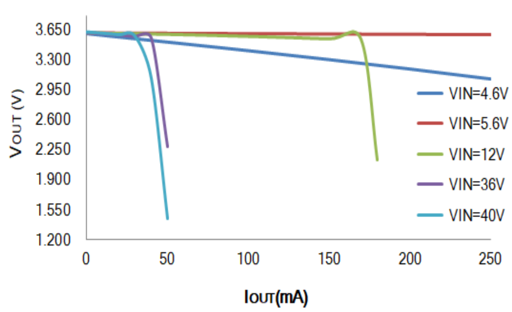
Dropout Voltage: HT73H30



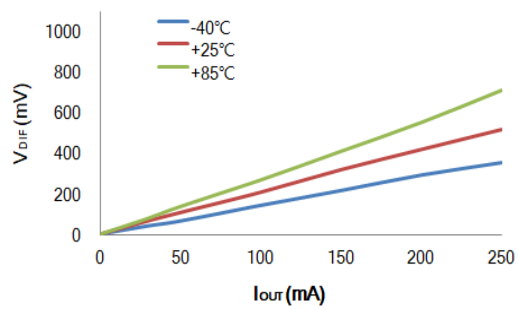
V_{OUT} vs I_{OUT}: HT73H33



Dropout Voltage: HT73H33

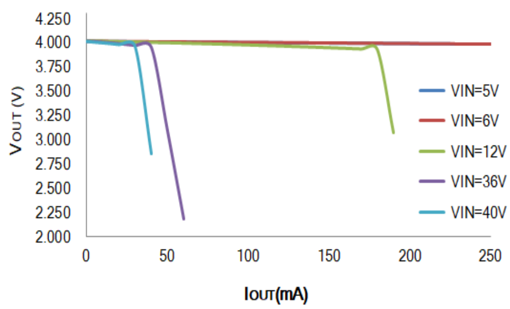


V_{OUT} vs I_{OUT}: HT73H36

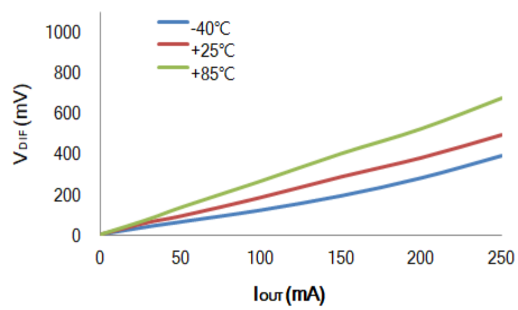


Dropout Voltage: HT73H36

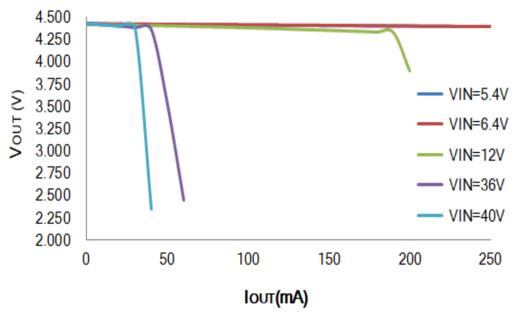
Output Voltage vs Output Current (RMS)	Dropout Voltage vs Output Current



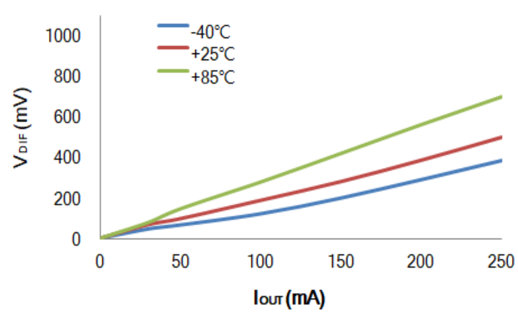
V_{OUT} vs I_{OUT}: HT73H40



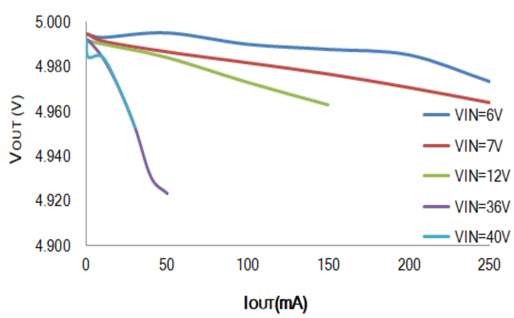
Dropout Voltage: HT73H40



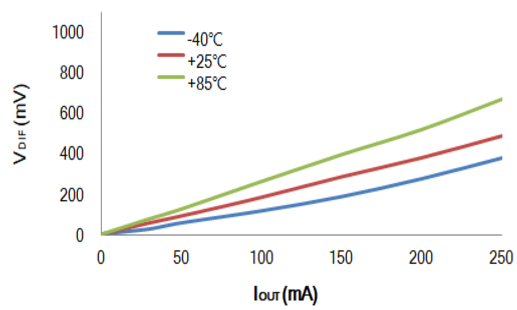
V_{OUT} vs I_{OUT}: HT73H44



Dropout Voltage: HT73H44

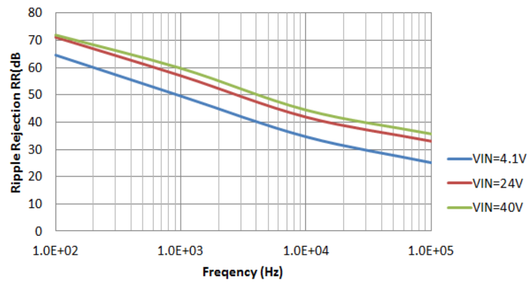
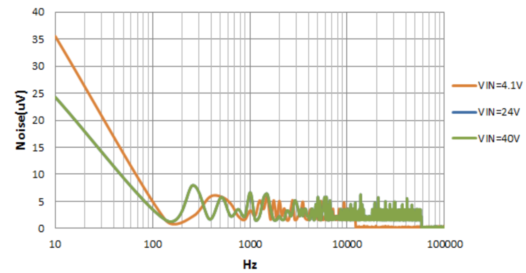
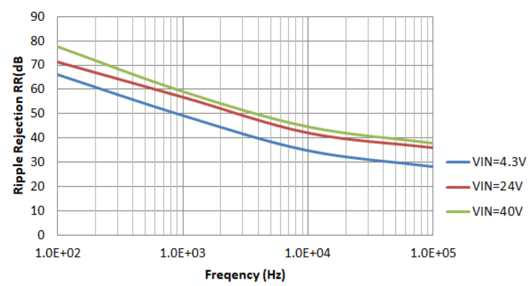
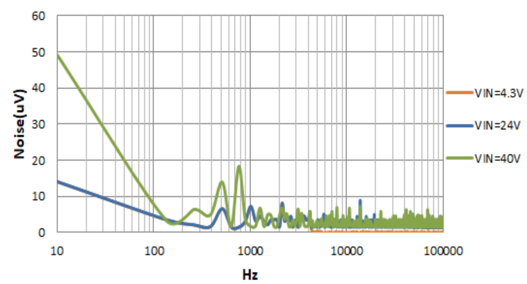
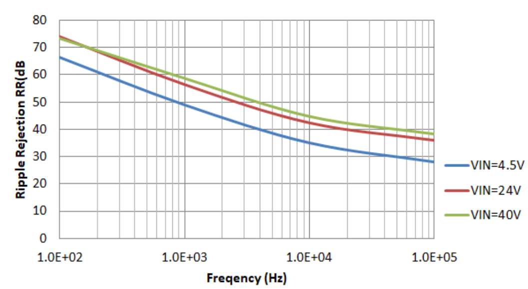
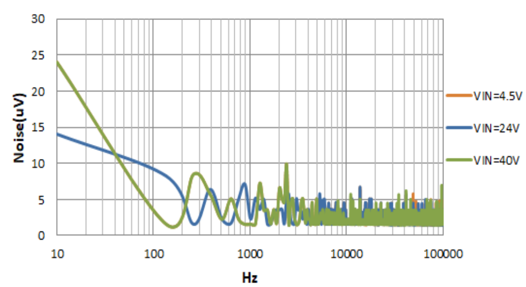


V_{OUT} vs I_{OUT}: HT73H50

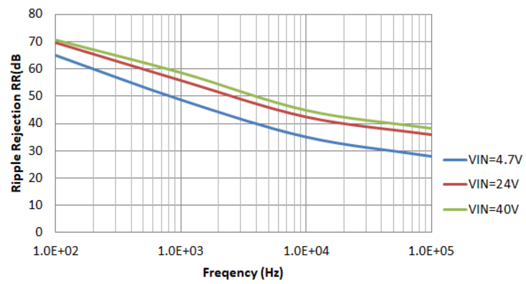


Dropout Voltage: HT73H50

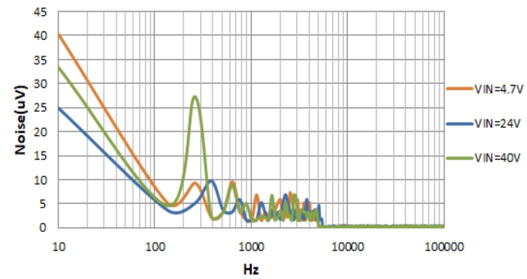
Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25°C, unless otherwise noted.

PSRR	Output Noise vs Frequency
 **PSRR: HT73H21** **(I_{OUT}=10mA, f=100Hz~100kHz)**	 **Output Noise: HT73H21** **(I_{OUT}=10mA, f=10Hz~100kHz)**
 **PSRR: HT73H23** **(I_{OUT}=10mA, f=100Hz~100kHz)**	 **Output Noise: HT73H23** **(I_{OUT}=10mA, f=10Hz~100kHz)**
 **PSRR: HT73H25** **(I_{OUT}=10mA, f=100Hz~100kHz)**	 **Output Noise: HT73H25** **(I_{OUT}=10mA, f=10Hz~100kHz)**

PSRR	Output Noise vs Frequency



PSRR: HT73H27
(I_{OUT}=10mA, f=100Hz~100kHz)



Output Noise: HT73H27
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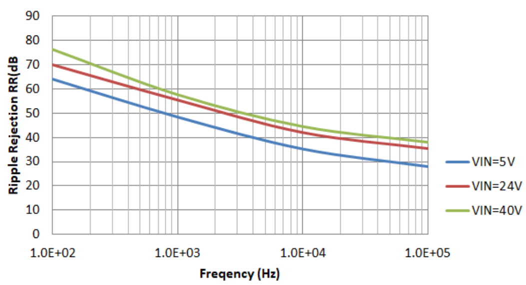
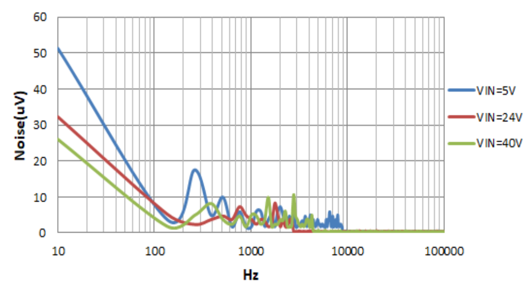
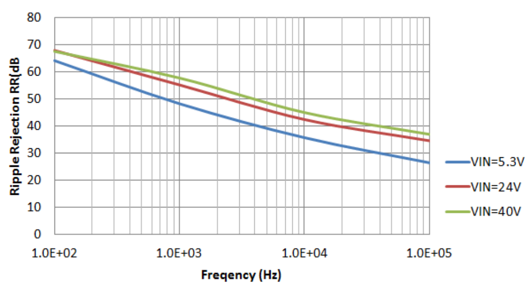


PSRR: HT73H30
(I_{OUT}=10mA, f=100Hz~100kHz)



Output Noise: HT73H30
(I_{OUT}=10mA, f=10Hz~100kHz)



PSRR: HT73H33
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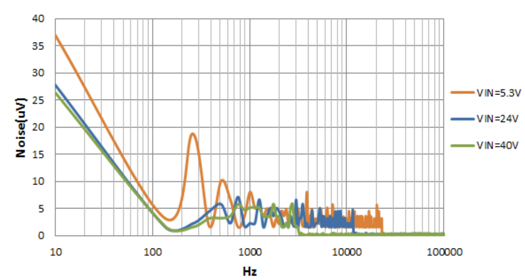
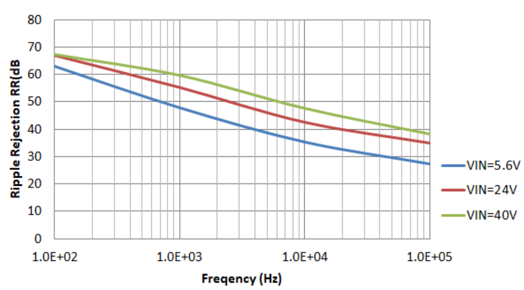


Output Noise: HT73H33
(I_{OUT}=10mA, f=10Hz~100kHz)



PSRR: HT73H36
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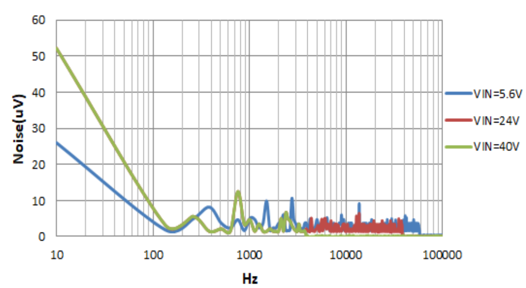
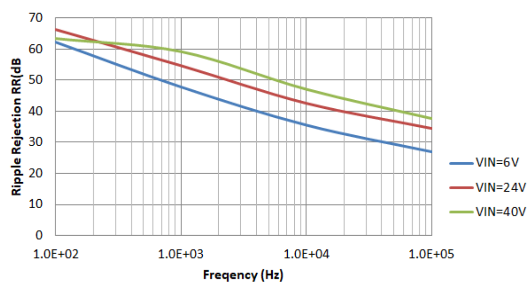


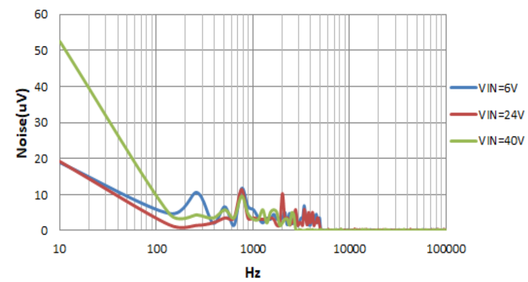
Output Noise: HT73H36
(I_{OUT}=10mA, f=10Hz~100kHz)

PSRR	Output Noise vs Frequency



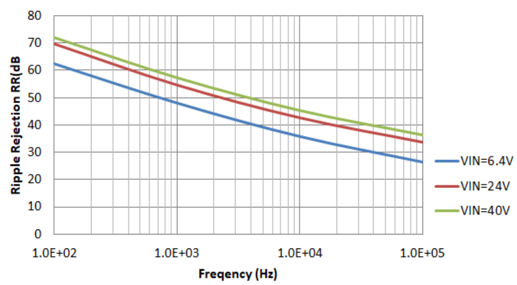
PSRR: HT73H40

(I_{OUT}=10mA, f=100Hz~100kHz)



Output Noise: HT73H40

(I_{OUT}=10mA, f=10Hz~100kHz)



PSRR: HT73H44

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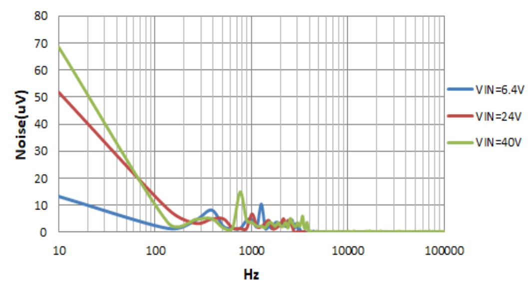
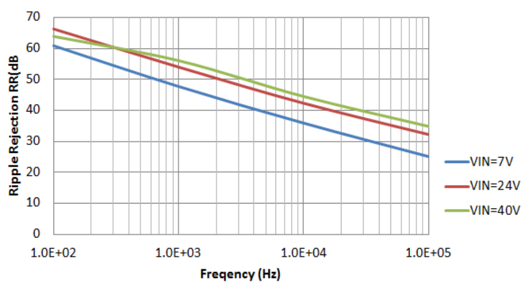


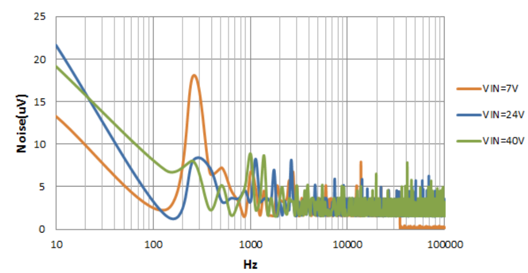
Output Noise: HT73H44

(I_{OUT}=10mA, f=10Hz~100kHz)



PSRR: HT73H50

(I_{OUT}=10mA, f=100Hz~100kHz)

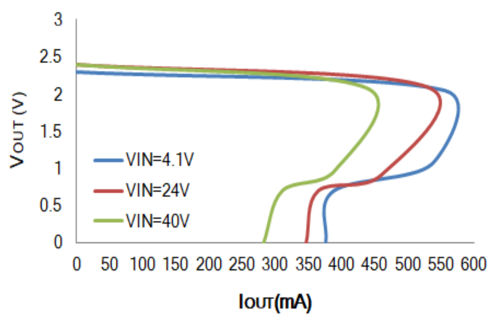


Output Noise: HT73H50

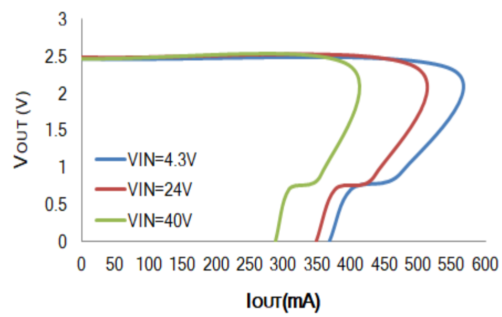
(I_{OUT}=10mA, f=10Hz~100kHz)

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25ºC, unless otherwise noted.

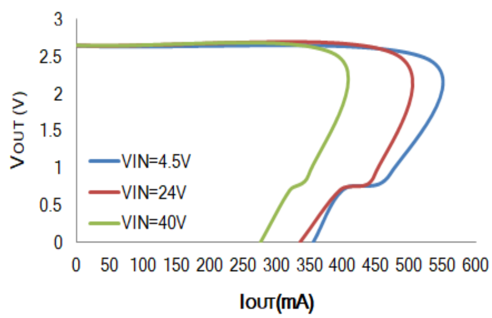
Output Voltage vs. Output Current (Pulse)



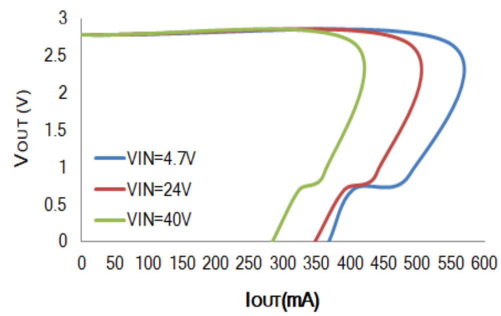
I_{OCP1}/I_{OCP2}: HT73H21



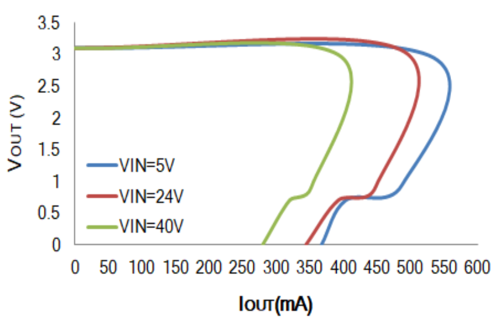
I_{OCP1}/I_{OCP2}: HT73H23



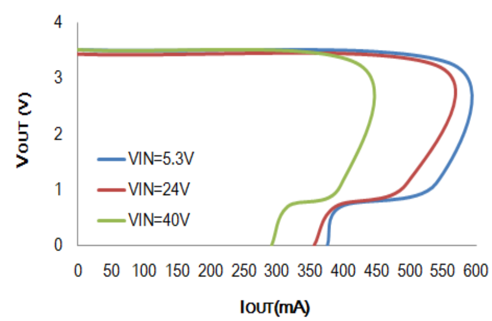
I_{OCP1}/I_{OCP2}: HT73H25



I_{OCP1}/I_{OCP2}: HT73H27

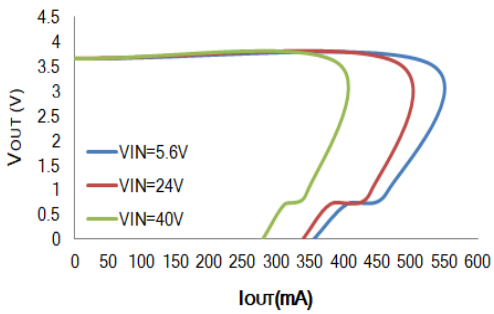


I_{OCP1}/I_{OCP2}: HT73H30

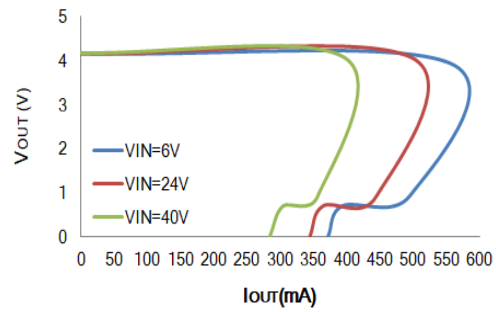


I_{OCP1}/I_{OCP2}: HT73H33

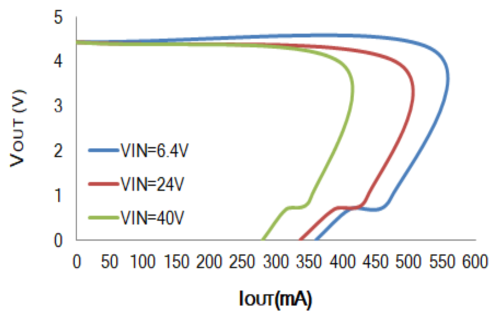
Output Voltage vs. Output Current (Pulse)



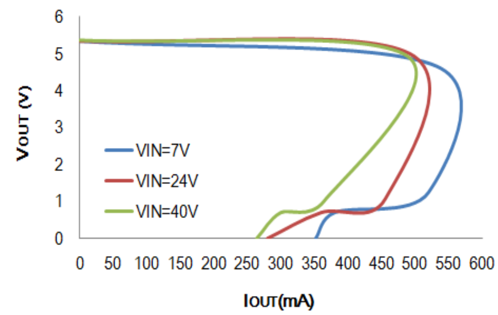
I_{OCP1}/I_{OCP2}: HT73H36



I_{OCP1}/I_{OCP2}: HT73H40

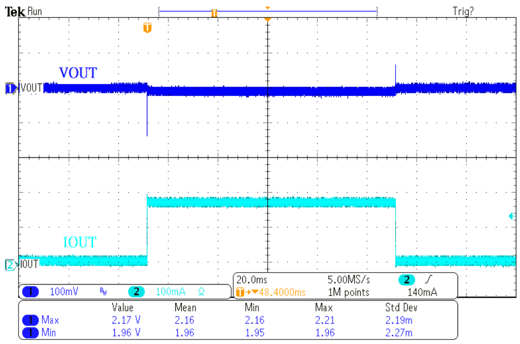
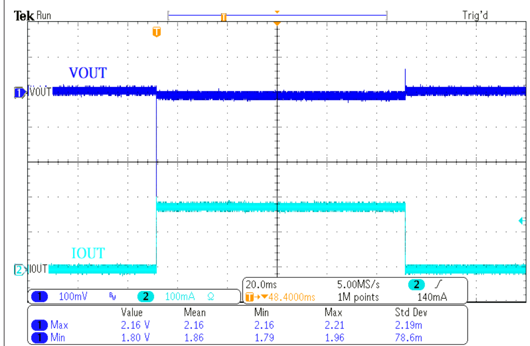
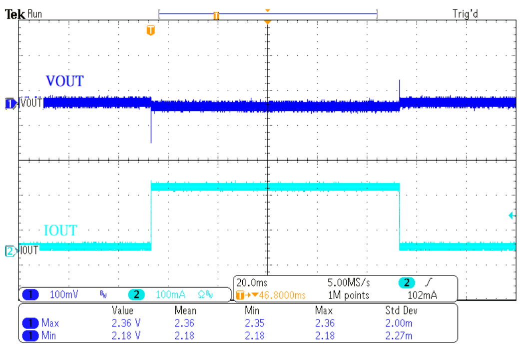
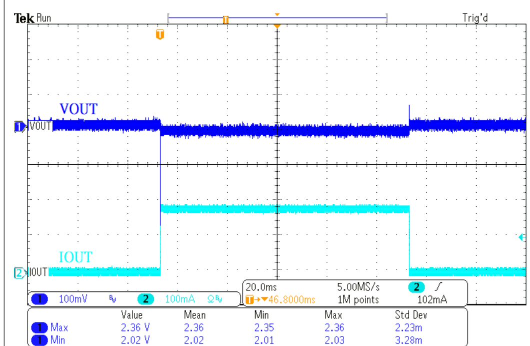
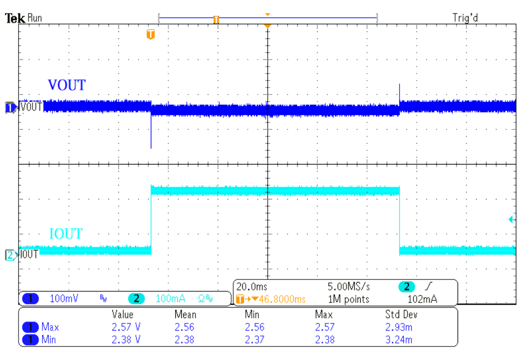
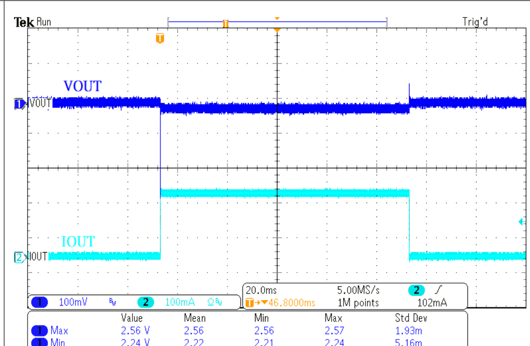


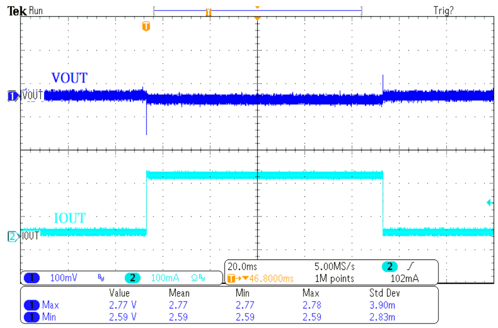
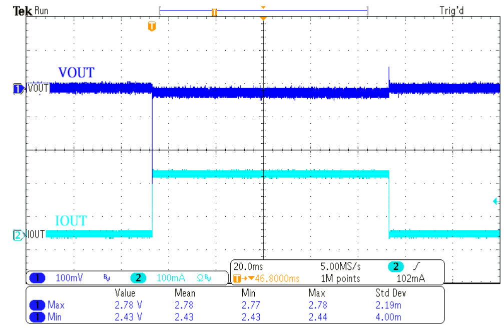
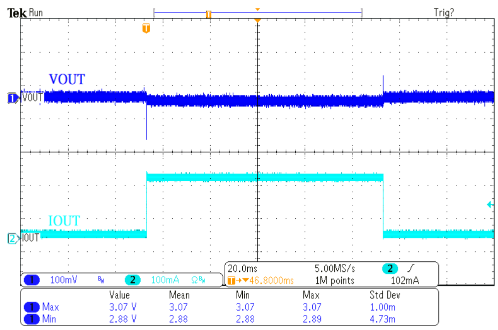
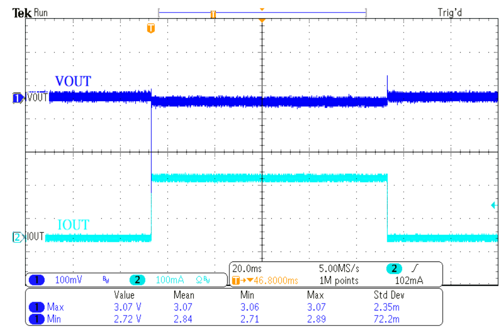
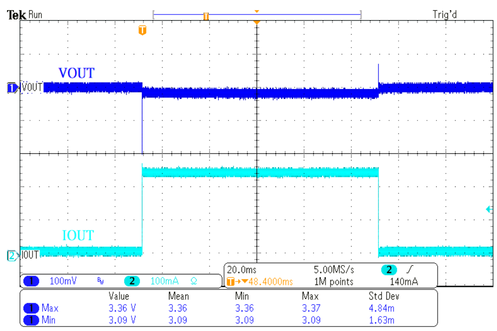
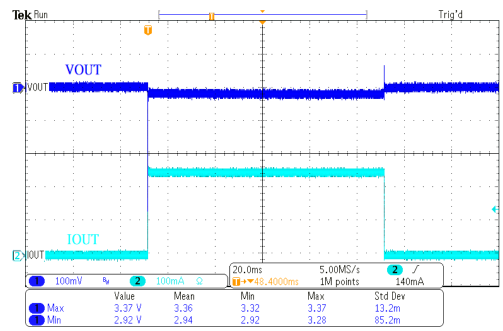
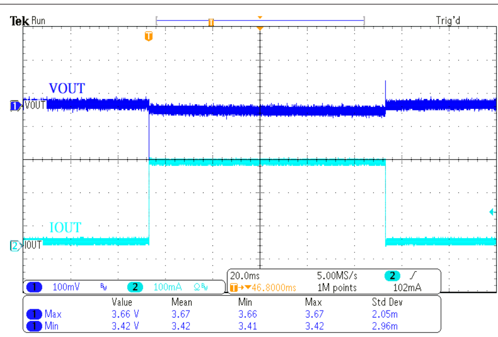
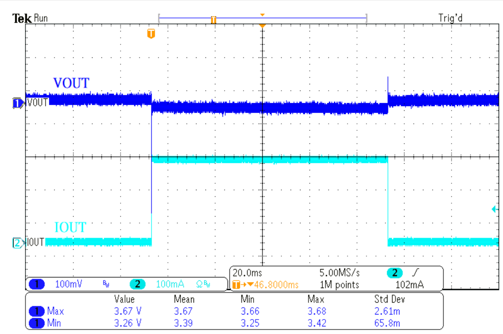
I_{OCP1}/I_{OCP2}: HT73H44



I_{OCP1}/I_{OCP2}: HT73H50

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25ºC, unless otherwise noted.

Load Transeint Response 1	Load Transeint Response 2
 **Load Transient Response: HT73H21** **(V_{IN}=4.1V, I_{OUT}=10mA to180mA)**	 **Load Transient Response: HT73H21** **(V_{IN}=4.1V, I_{OUT}=0mA to180mA)**
 **Load Transient Response: HT73H23** **(V_{IN}=4.3V, I_{OUT}=10mA to180mA)**	 **Load Transient Response: HT73H23** **(V_{IN}=4.3V, I_{OUT}=0mA to180mA)**
 **Load Transient Response: HT73H25** **(V_{IN}=4.5V, I_{OUT}=10mA to180mA)**	 **Load Transient Response: HT73H25** **(V_{IN}=4.5V, I_{OUT}=0mA to180mA)**

Load Transeint Response 1	Load Transeint Response 2
 Load Transient Response: HT73H27 (V_{IN}=4.7V, I_{OUT}=10mA to180mA)	 Load Transient Response: HT73H27 (V_{IN}=4.7V, I_{OUT}=0mA to180mA)
 Load Transient Response: HT73H30 (V_{IN}=5V, I_{OUT}=10mA to180mA)	 Load Transient Response: HT73H30 (V_{IN}=5V, I_{OUT}=0mA to180mA)
 Load Transient Response: HT73H33 (V_{IN}=5.3V, I_{OUT}=10mA to250mA)	 Load Transient Response: HT73H33 (V_{IN}=5.3V, I_{OUT}=0mA to250mA)
 Load Transient Response: HT73H36 (V_{IN}=5.6V, I_{OUT}=10mA to250mA)	 Load Transient Response: HT73H36 (V_{IN}=5.6V, I_{OUT}=0mA to250mA)

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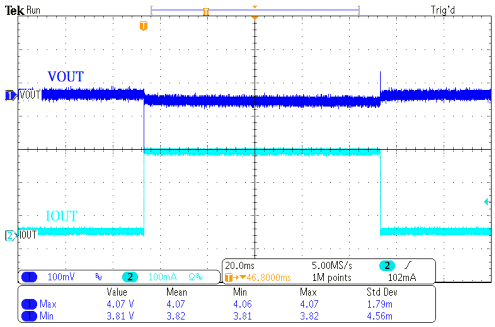

Load Transient Response: HT73H40
(V_{IN}=6V, I_{OUT}=10mA to250mA)
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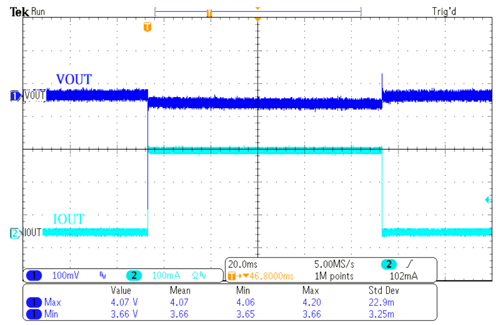

Load Transient Response: HT73H40
(V_{IN}=6V, I_{OUT}=0mA to250mA)
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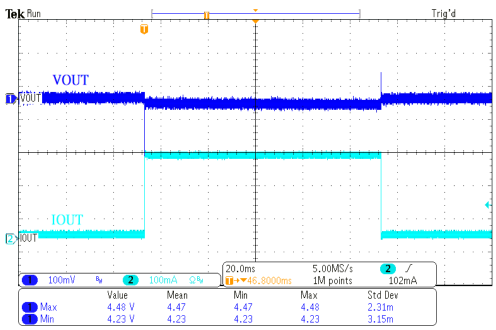

Load Transient Response: HT73H44
(V_{IN}=6.4V, I_{OUT}=10mA to250mA)
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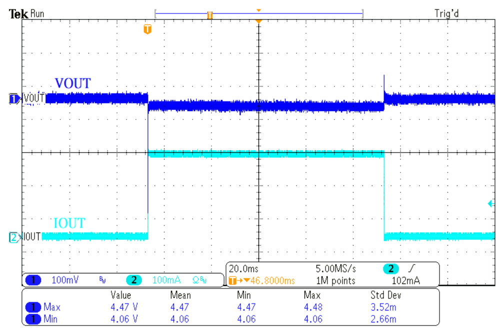

Load Transient Response: HT73H44
(V_{IN}=6.4V, I_{OUT}=0mA to250mA)
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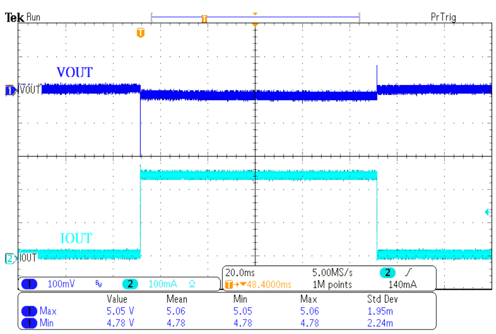

Load Transient Response: HT73H50
(V_{IN}=7V, I_{OUT}=10mA to250mA)
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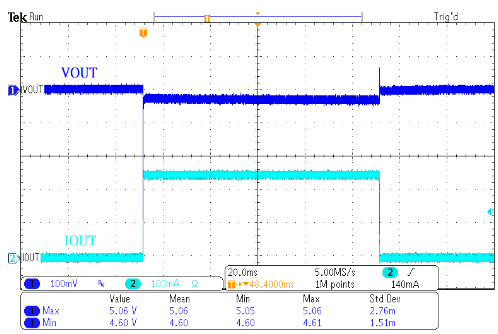

Load Transient Response: HT73H50
(V_{IN}=7V, I_{OUT}=0mA to250mA)
</td></tr>
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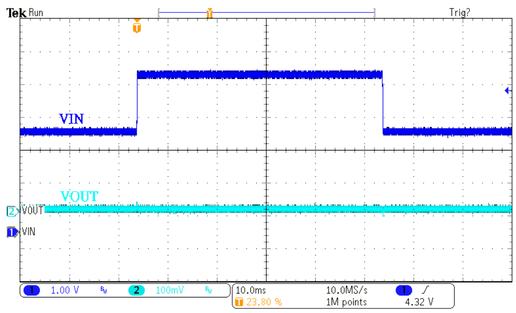
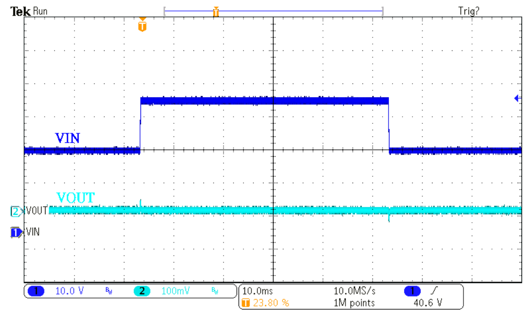
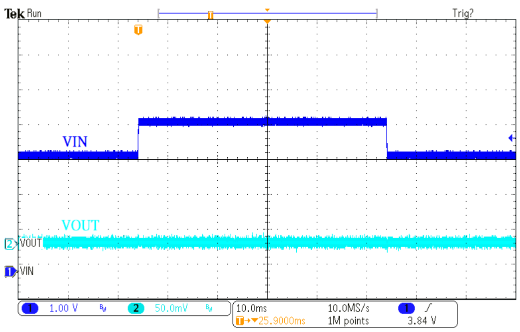
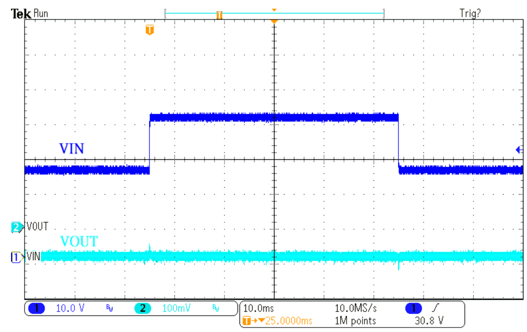
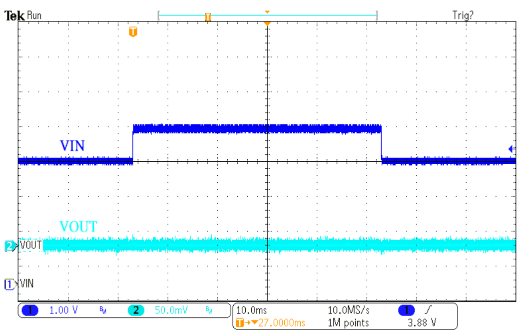
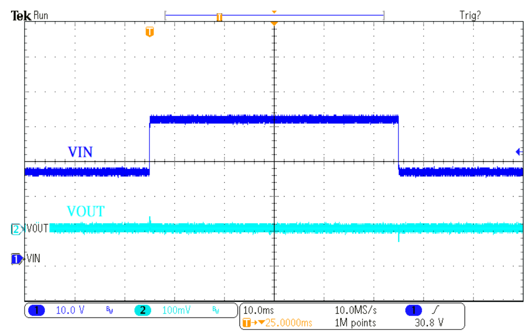
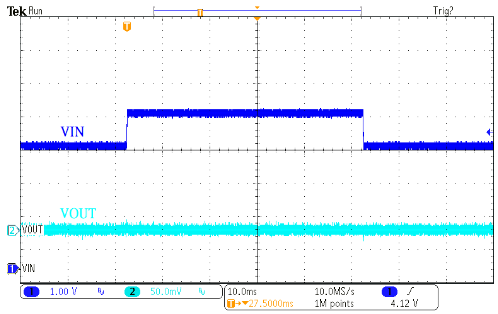
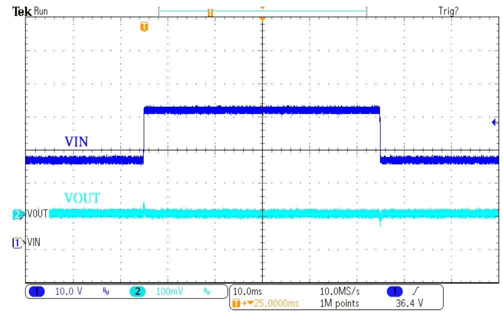
Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25°C, unless otherwise noted.

Line Transeint Response1	Line Transeint Response2
 **Line Transeint Response: HT73H21** **(V_{IN}=3.1V to 4.1V, I_{OUT}=10mA)**	 **Line Transeint Response: HT73H21** **(V_{IN}=24V to 40V, I_{OUT}=10mA)**
 **Line Transeint Response: HT73H23** **(V_{IN}=3.3V to 4.3V, I_{OUT}=10mA)**	 **Line Transeint Response: HT73H23** **(V_{IN}=24V to 40V, I_{OUT}=10mA)**
 **Line Transeint Response: HT73H25** **(V_{IN}=3.5V to 4.5V, I_{OUT}=10mA)**	 **Line Transeint Response: HT73H25** **(V_{IN}=24V to 40V, I_{OUT}=10mA)**

Line Transeint Response1	Line Transeint Response2



Line Transeint Response: HT73H27
(V_{IN}=3.7V to 4.7V, I_{OUT}=10mA)



Line Transeint Response: HT73H27
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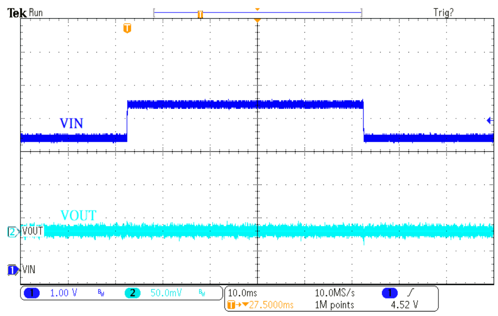
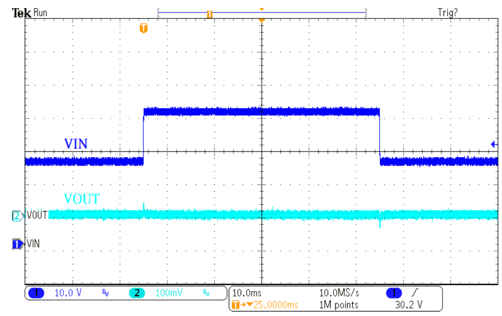
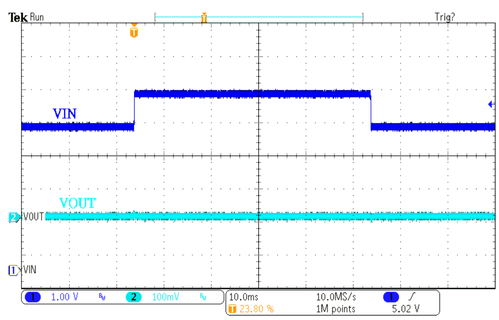


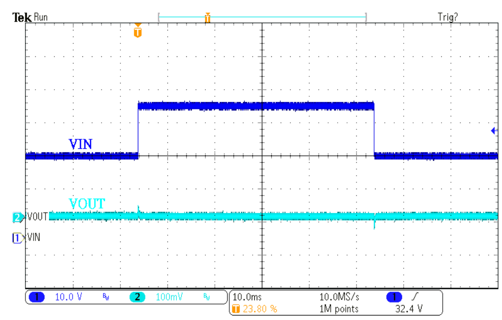
Line Transeint Response: HT73H30
(V_{IN}=4V to 5V, I_{OUT}=10mA)



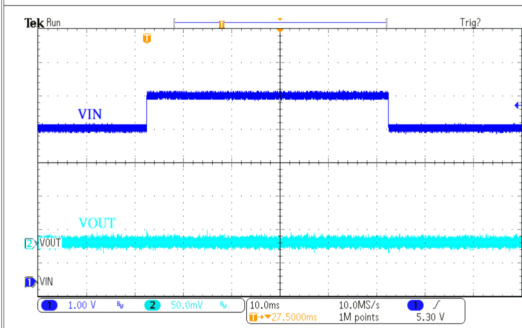
Line Transeint Response: HT73H30
(V_{IN}=24V to 40V, I_{OUT}=10mA)



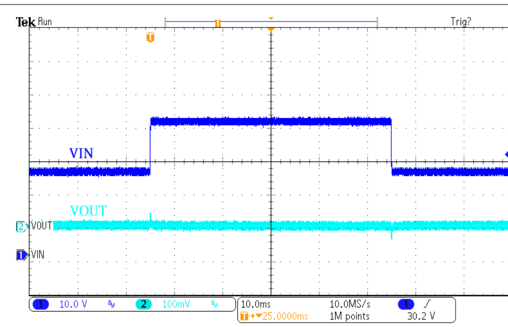
Line Transeint Response: HT73H33
(V_{IN}=4.3V to 5.3V, I_{OUT}=10mA)



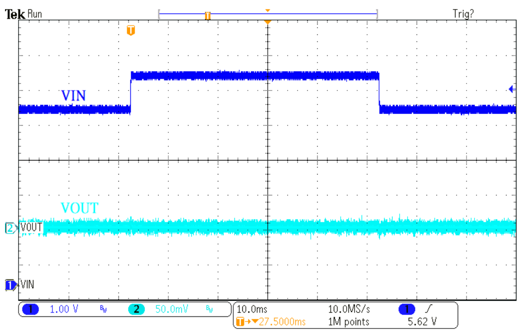
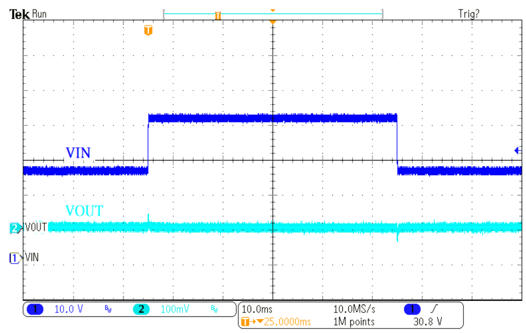
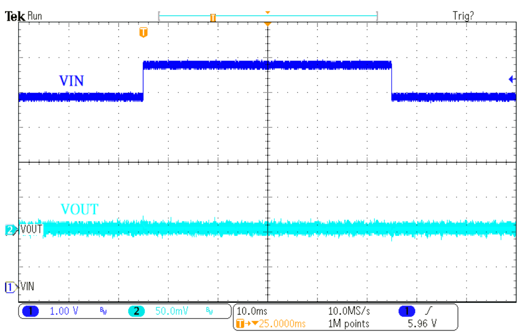
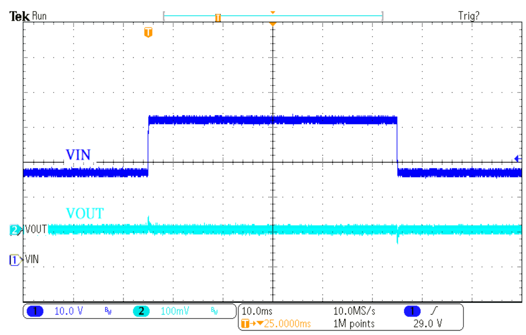
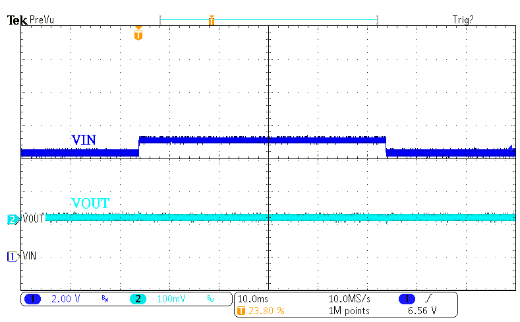
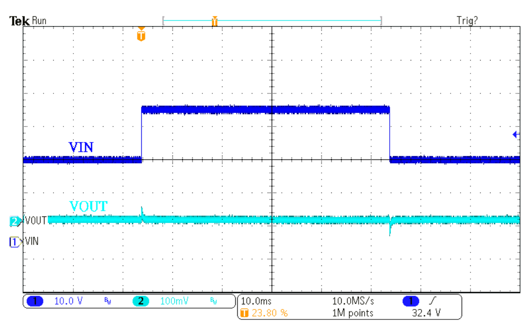
Line Transeint Response: HT73H33
(V_{IN}=24V to 40V, I_{OUT}=10mA)



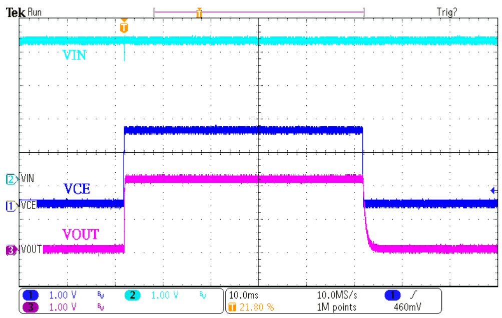
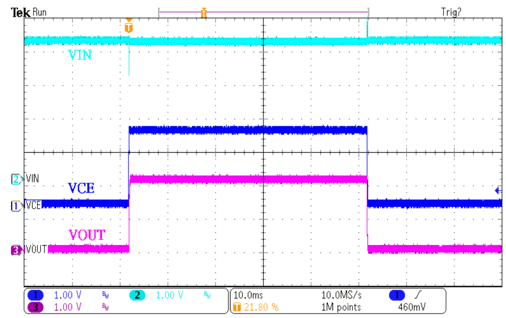
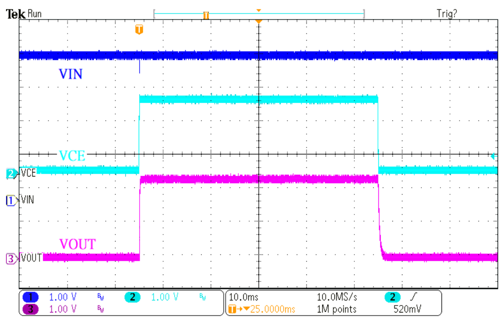
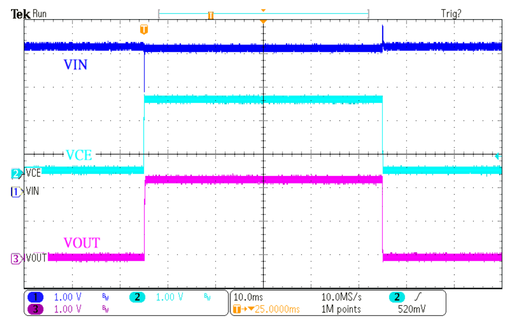
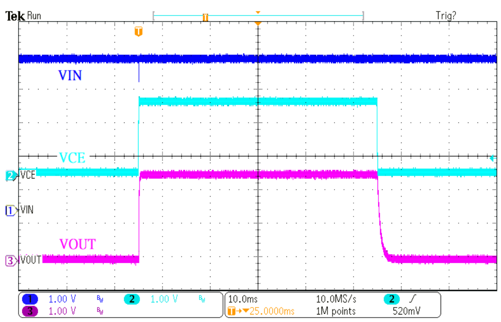
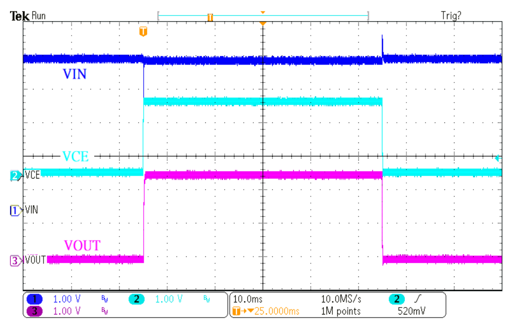
Line Transeint Response: HT73H36
(V_{IN}=5.6V to 6.6V, I_{OUT}=10mA)

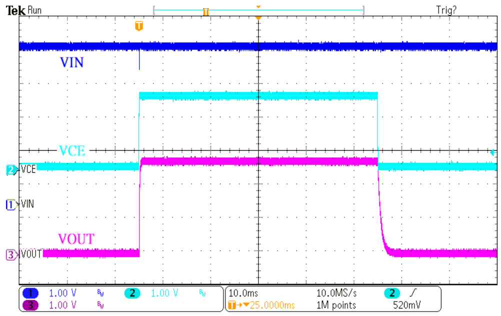
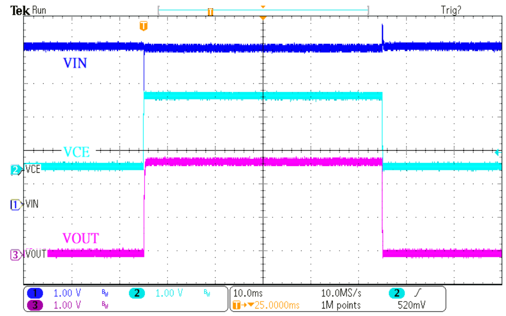
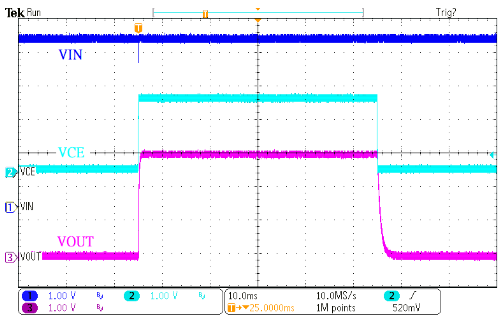
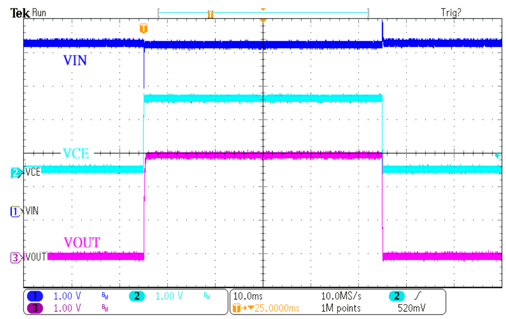
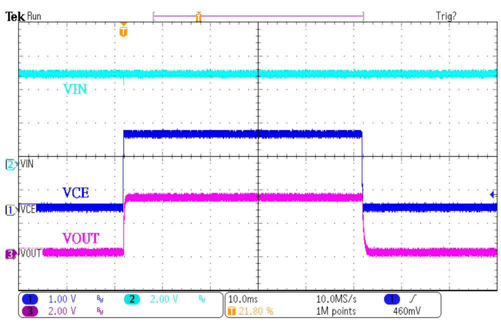
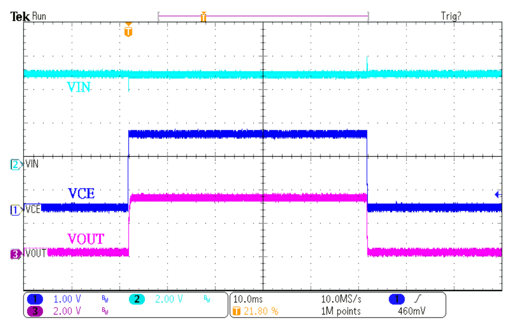
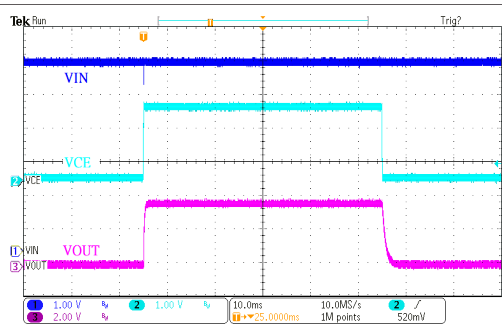
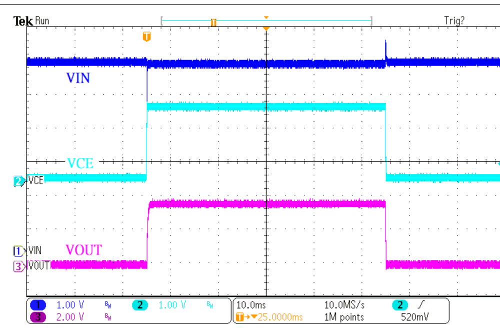


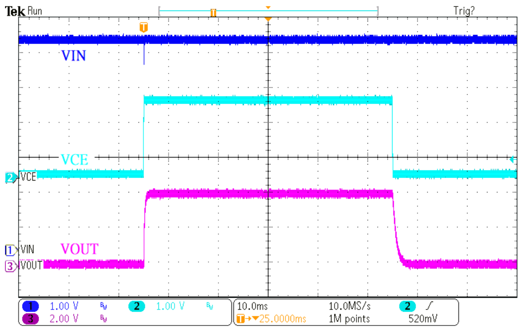
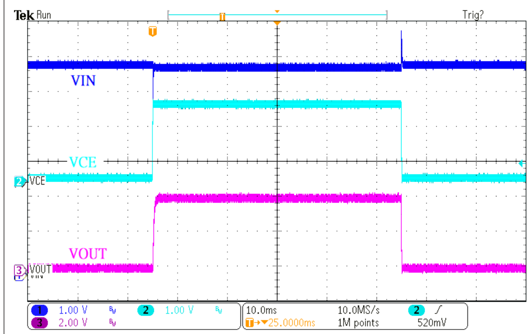
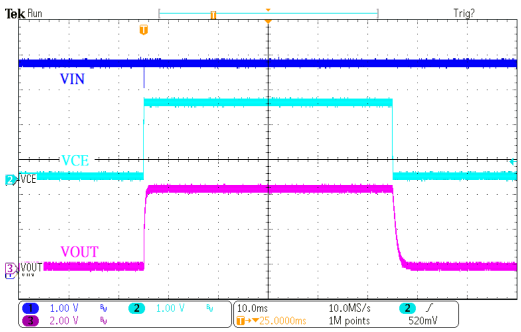
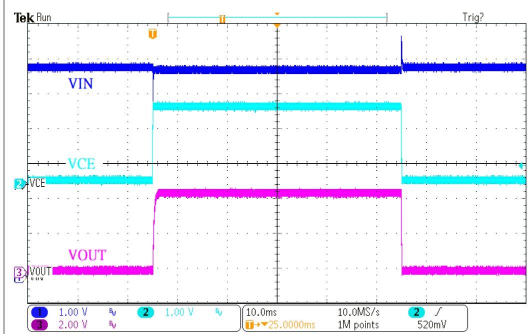
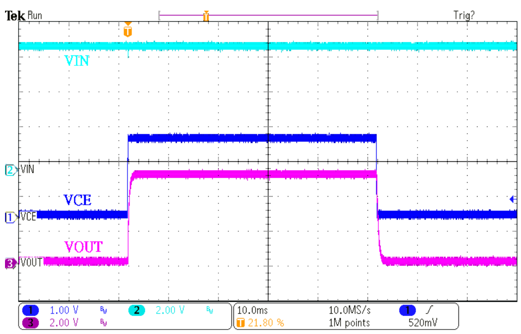
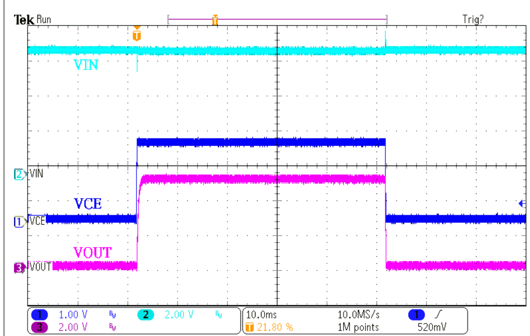
Line Transeint Response: HT73H36
(V_{IN}=24V to 40V, I_{OUT}=10mA)

Line Transeint Response1	Line Transeint Response2
 Line Transeint Response: HT73H40 (V_{IN}=5V to 6V, I_{OUT}=10mA)	 Line Transeint Response: HT73H40 (V_{IN}=24V to 40V, I_{OUT}=10mA)
 Line Transeint Response: HT73H44 (V_{IN}=5.4V to 6.4V, I_{OUT}=10mA)	 Line Transeint Response: HT73H44 (V_{IN}=24V to 40V, I_{OUT}=10mA)
 Line Transeint Response: HT73H50 (V_{IN}=6V to 7V, I_{OUT}=10mA)	 Line Transeint Response: HT73H50 (V_{IN}=24V to 40V, I_{OUT}=10mA)

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25ºC, unless otherwise noted.

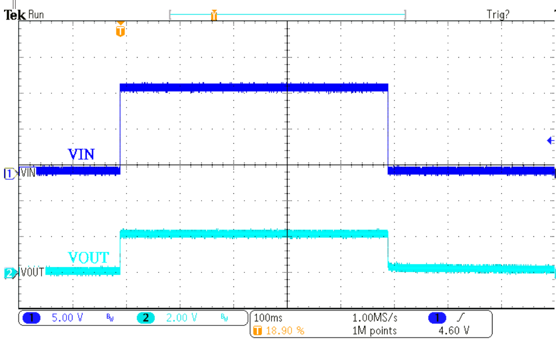
Power On/Off with Enable (I_{OUT}=0mA)	Power On/Off with Enable (I_{OUT}=250mA)
 **ON/OFF Response: HT73H21** **(V_{IN}=4.1V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H21** **(V_{IN}=4.1V, I_{OUT}=180mA, V_{CE}=0V to 2.2V)**
 **ON/OFF Response: HT73H23** **(V_{IN}=4.3V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H23** **(V_{IN}=4.3V, I_{OUT}=180mA, V_{CE}=0V to 2.2V)**
 **ON/OFF Response: HT73H25** **(V_{IN}=4.5V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H25** **(V_{IN}=4.5V, I_{OUT}=180mA, V_{CE}=0V to 2.2V)**

Power On/Off with Enable (I_{OUT}=0mA)	Power On/Off with Enable (I_{OUT}=250mA)
 **ON/OFF Response: HT73H27** **(V_{IN}=4.7V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H27** **(V_{IN}=4.7V, I_{OUT}=180mA, V_{CE}=0V to 2.2V)**
 **ON/OFF Response: HT73H30** **(V_{IN}=5V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H30** **(V_{IN}=5V, I_{OUT}=180mA, V_{CE}=0V to 2.2V)**
 **ON/OFF Response: HT73H33** **(V_{IN}=5.3V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H33** **(V_{IN}=5.3V, I_{OUT}=250mA, V_{CE}=0V to 2.2V)**
 **ON/OFF Response: HT73H36** **(V_{IN}=5.6V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H36** **(V_{IN}=5.6V, I_{OUT}=250mA, V_{CE}=0V to 2.2V)**

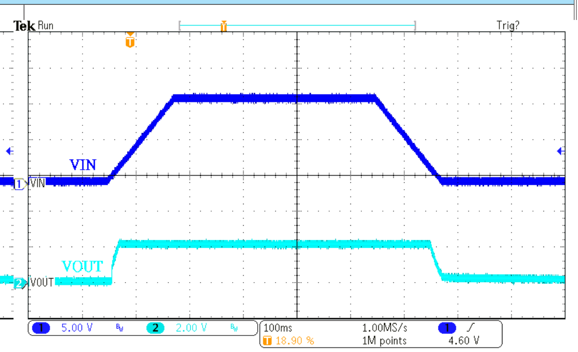
Power On/Off with Enable (I_{OUT}=0mA)	Power On/Off with Enable (I_{OUT}=250mA)
 **ON/OFF Response: HT73H40** **(V_{IN}=6V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H40** **(V_{IN}=6V, I_{OUT}=250mA, V_{CE}=0V to 2.2V)**
 **ON/OFF Response: HT73H44** **(V_{IN}=6.4V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H44** **(V_{IN}=6.4V, I_{OUT}=250mA, V_{CE}=0V to 2.2V)**
 **ON/OFF Response: HT73H50** **(V_{IN}=7V, I_{OUT}=0mA, V_{CE}=0V to 2.2V)**	 **ON/OFF Response: HT73H50** **(V_{IN}=7V, I_{OUT}=250mA, V_{CE}=0V to 2.2V)**

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25ºC, unless otherwise noted.

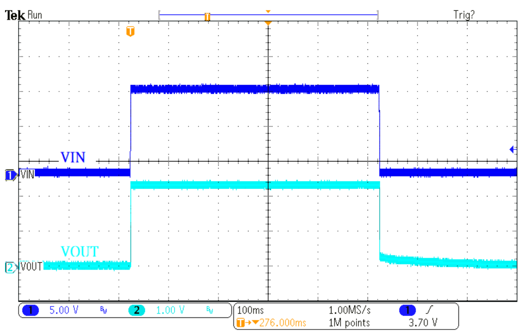
Power On/Off Response (I_{OUT}=0mA)



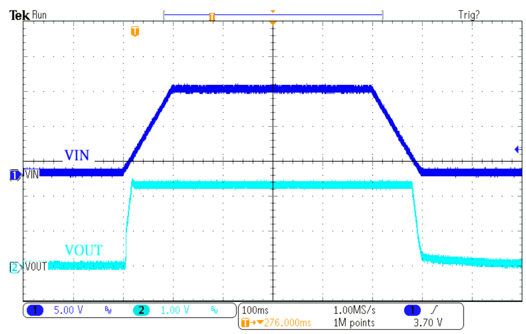
Power On/OFF Response: HT73H21
(V_{IN}=12V, I_{OUT}=0mA, $T_{RISE}=T_{FALL}$=0.1ms)



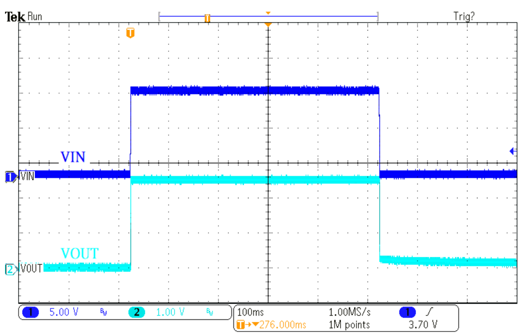
Power On/OFF Response: HT73H21
(V_{IN}=12V, I_{OUT}=0mA, $T_{RISE}=T_{FALL}$=100ms)



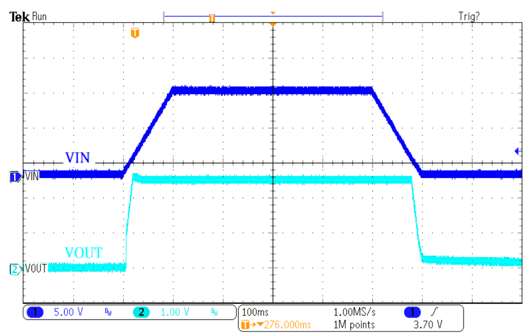
Power On/OFF Response: HT73H23
(V_{IN}=12V, I_{OUT}=0mA, $T_{RISE}=T_{FALL}$=0.1ms)



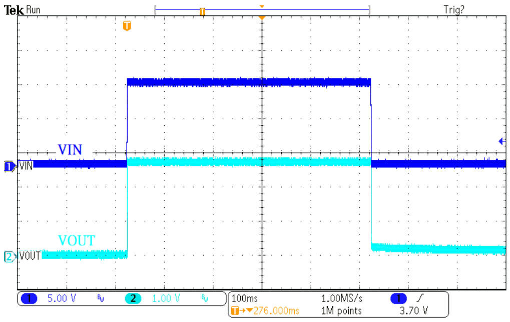
Power On/OFF Response: HT73H23
(V_{IN}=12V, I_{OUT}=0mA, $T_{RISE}=T_{FALL}$=100ms)



Power On/OFF Response: HT73H25
(V_{IN}=12V, I_{OUT}=0mA, $T_{RISE}=T_{FALL}$=0.1ms)

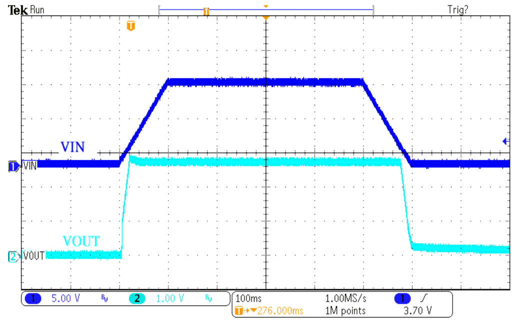


Power On/OFF Response: HT73H25
(V_{IN}=12V, I_{OUT}=0mA, $T_{RISE}=T_{FALL}$=100ms)



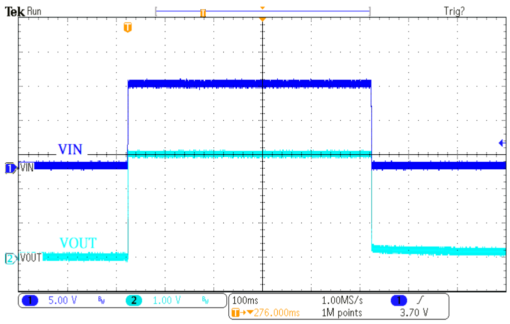
Power On/OFF Response: HT73H27

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=0.1ms)



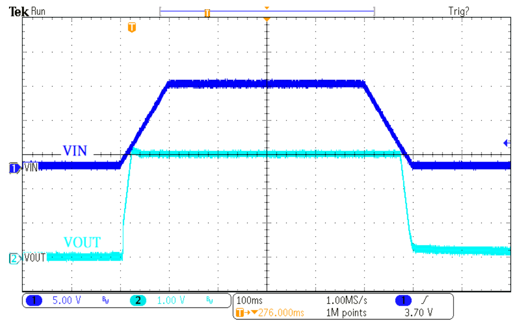
Power On/OFF Response: HT73H27

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=100ms)



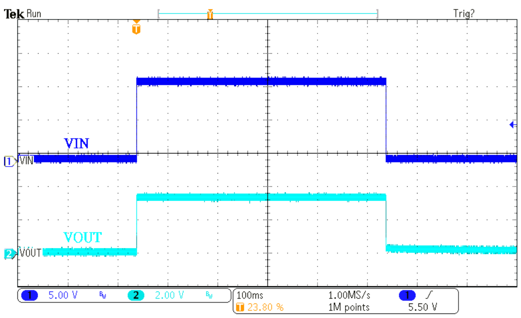
Power On/OFF Response: HT73H30

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=0.1ms)



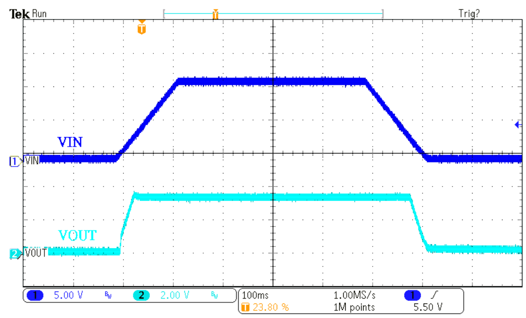
Power On/OFF Response: HT73H30

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=100ms)



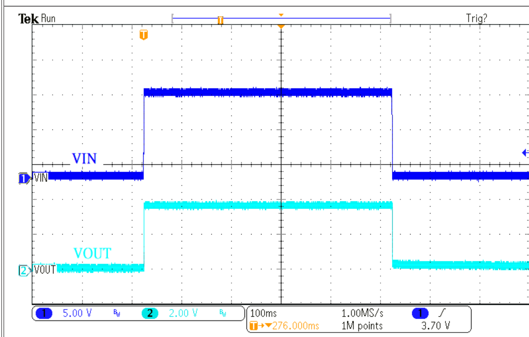
Power On/OFF Response: HT73H33

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=0.1ms)



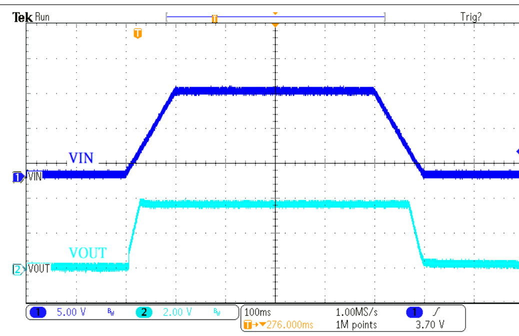
Power On/OFF Response: HT73H33

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=100ms)



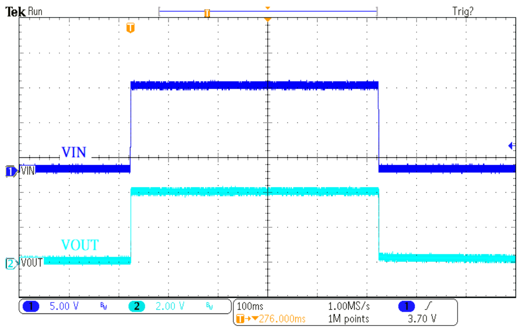
Power On/OFF Response: HT73H36

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=0.1ms)



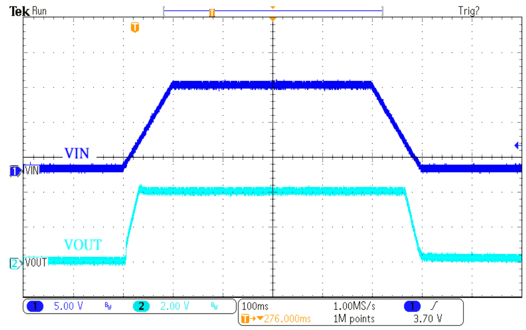
Power On/OFF Response: HT73H36

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=100ms)



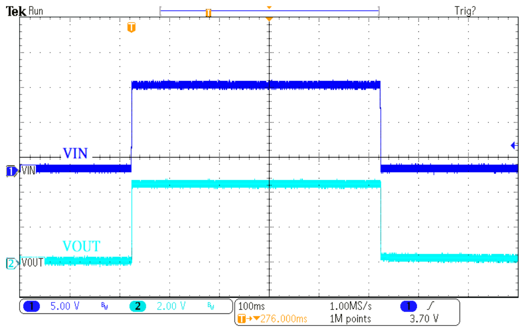
Power On/OFF Response: HT73H40

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=0.1ms)



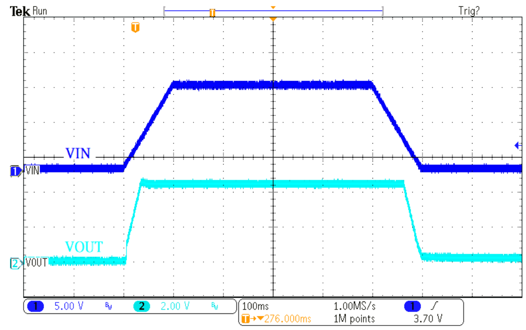
Power On/OFF Response: HT73H40

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=100ms)



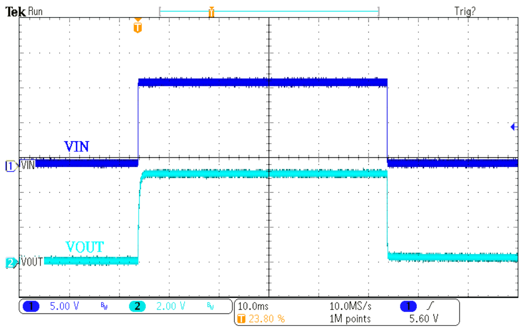
Power On/OFF Response: HT73H44

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=0.1ms)



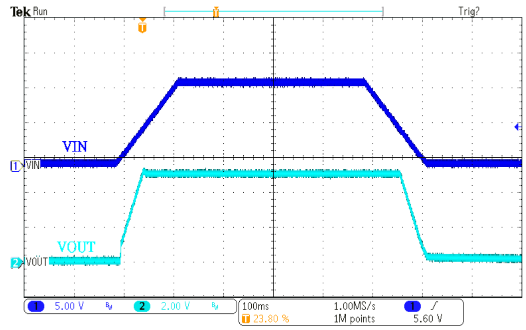
Power On/OFF Response: HT73H44

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=100ms)



Power On/OFF Response: HT73H50

(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=0.1ms)

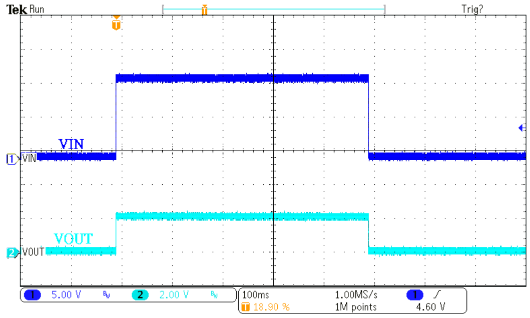


Power On/OFF Response: HT73H50

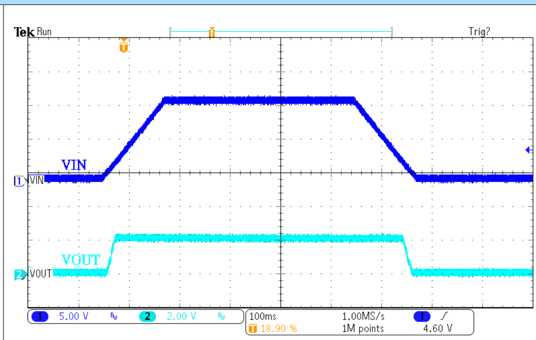
(V_{IN}=12V, I_{OUT}=0mA, T_{RISE}=T_{FALL}=100ms)

Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}=10mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$ and Ta=25ºC, unless otherwise noted.

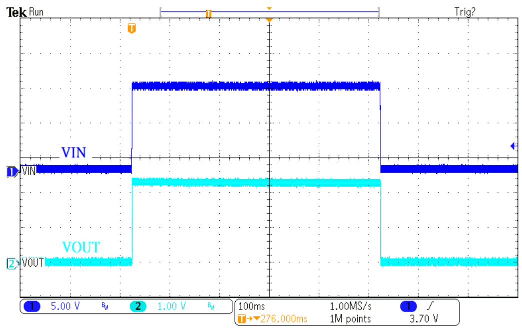
Power On/Off Response (I_{OUT}=250mA)



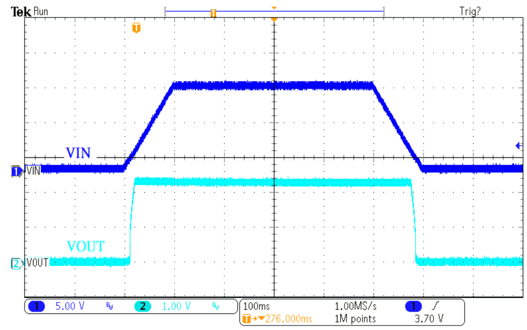
Power On/OFF Response: HT73H21
(V_{IN}=12V, I_{OUT}=180mA, $T_{RISE}=T_{FALL}$=0.1ms)



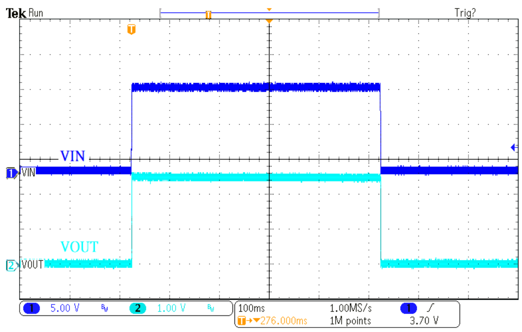
Power On/OFF Response: HT73H21
(V_{IN}=12V, I_{OUT}=180mA, $T_{RISE}=T_{FALL}$=100ms)



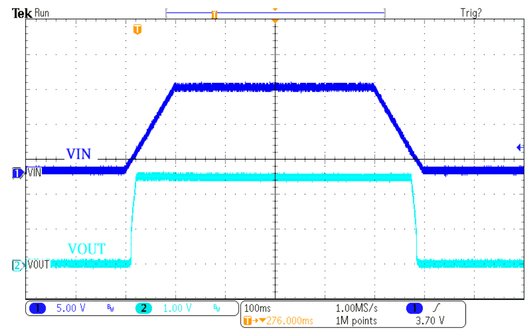
Power On/OFF Response: HT73H23
(V_{IN}=12V, I_{OUT}=180mA, $T_{RISE}=T_{FALL}$=0.1ms)



Power On/OFF Response: HT73H23
(V_{IN}=12V, I_{OUT}=180mA, $T_{RISE}=T_{FALL}$=100ms)

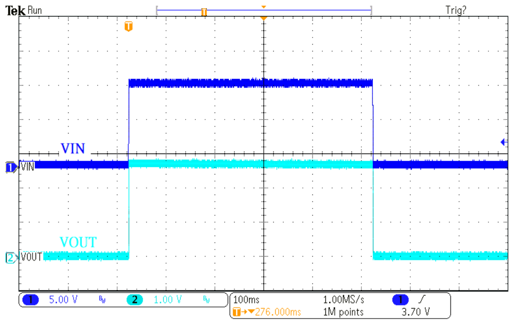


Power On/OFF Response: HT73H25
(V_{IN}=12V, I_{OUT}=180mA, $T_{RISE}=T_{FALL}$=0.1ms)

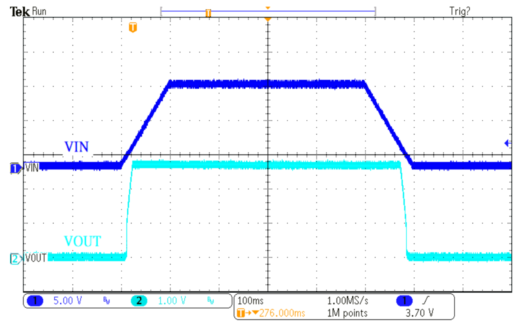


Power On/OFF Response: HT73H25
(V_{IN}=12V, I_{OUT}=180mA, $T_{RISE}=T_{FALL}$=100ms)

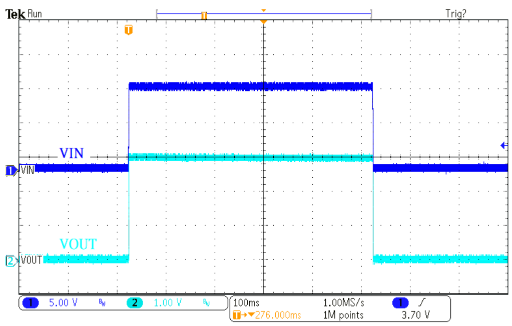
Power On/Off Response (I_{OUT}=250mA)



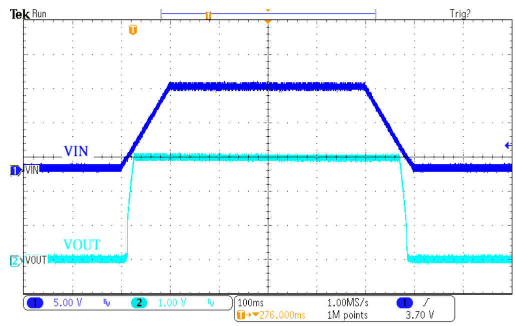
Power On/OFF Response: HT73H27
(V_{IN}=12V, I_{OUT}=180mA, T_{RISE}=T_{FALL}=0.1ms)



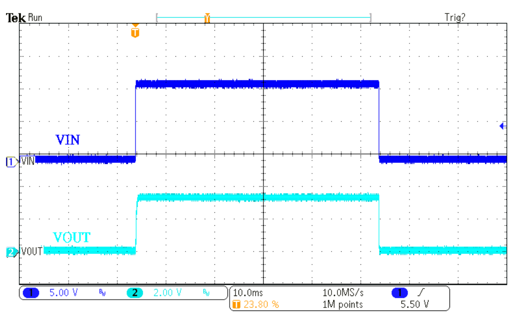
Power On/OFF Response: HT73H27
(V_{IN}=12V, I_{OUT}=180mA, T_{RISE}=T_{FALL}=100ms)



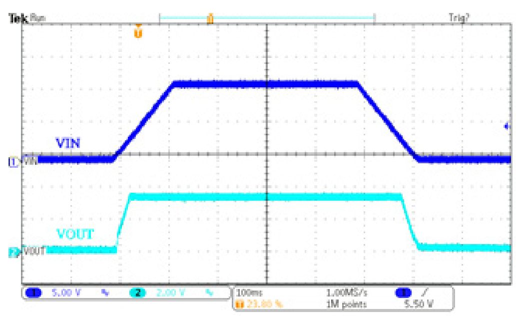
Power On/OFF Response: HT73H30
(V_{IN}=12V, I_{OUT}=180mA, T_{RISE}=T_{FALL}=0.1ms)



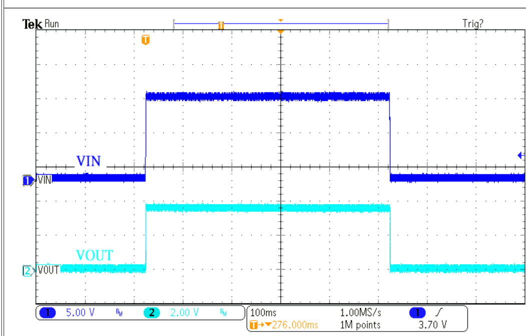
Power On/OFF Response: HT73H30
(V_{IN}=12V, I_{OUT}=180mA, T_{RISE}=T_{FALL}=100ms)



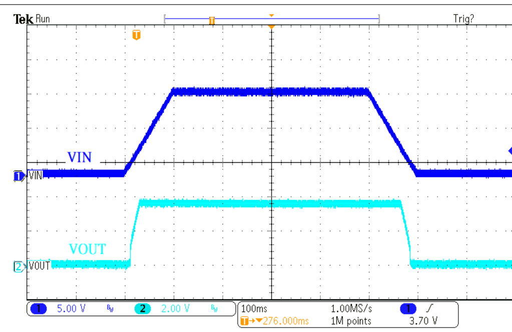
Power On/OFF Response: HT73H33
(V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=0.1ms)



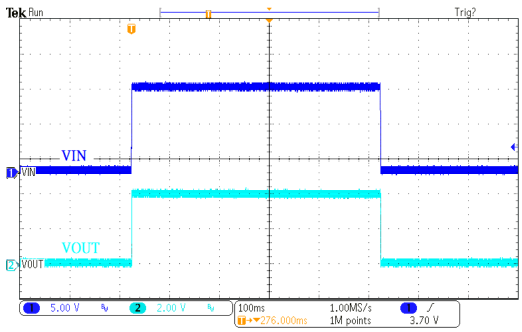
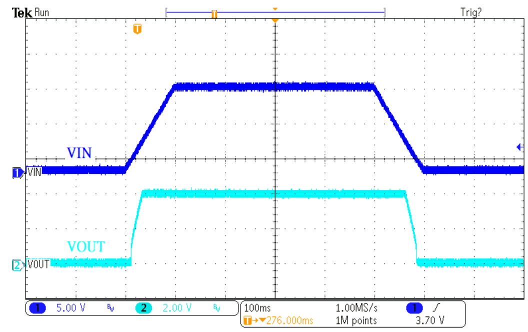
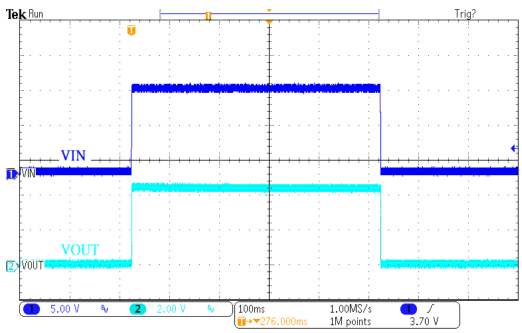
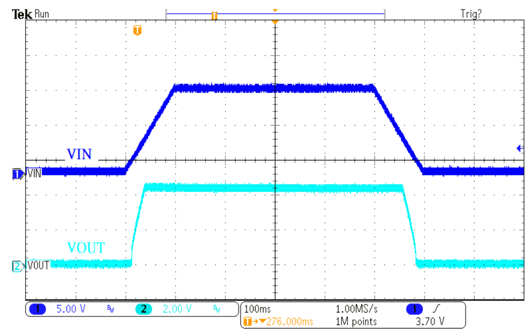
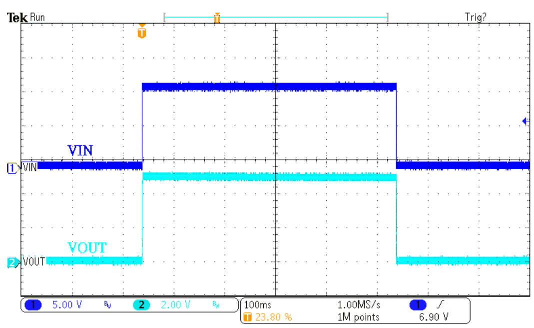
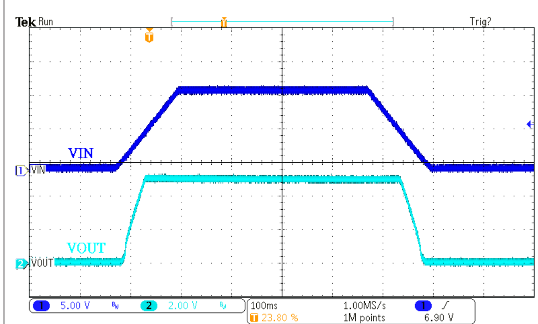
Power On/OFF Response: HT73H33
(V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=100ms)



Power On/OFF Response: HT73H36
(V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=0.1ms)



Power On/OFF Response: HT73H36
(V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=100ms)

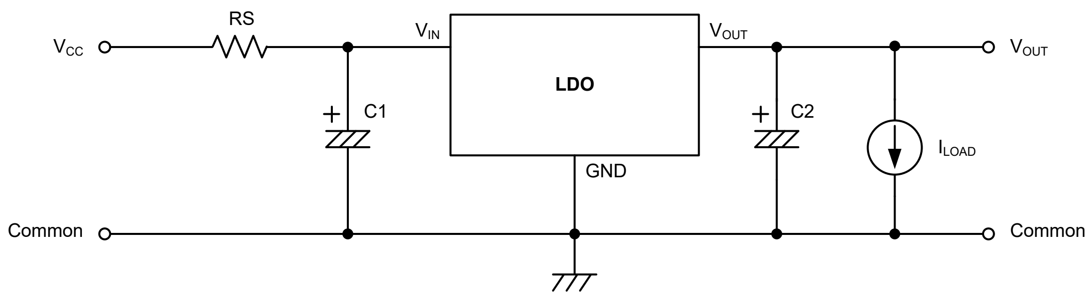
Power On/Off Response (I_{OUT}=250mA)	
 Power On/OFF Response: HT73H40 (V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=0.1ms)	 Power On/OFF Response: HT73H40 (V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=100ms)
 Power On/OFF Response: HT73H44 (V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=0.1ms)	 Power On/OFF Response: HT73H44 (V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=100ms)
 Power On/OFF Response: HT73H50 (V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=0.1ms)	 Power On/OFF Response: HT73H50 (V_{IN}=12V, I_{OUT}=250mA, T_{RISE}=T_{FALL}=100ms)

Application Information

When using the HT73Hxx regulators, it is important that the following application points are noted if correct operation is to be achieved.

Power-on Considerations

In order to suppress the output overshooting phenomenon, the rising time of input supply is suggested greater than 1ms. Adding an input resistor RS which is acting like a low-pass filter, it can slow down the rising time of the input supply in the V_{IN} terminal, as shown below.



The maximum RS is limited by $I_{LOAD(MAX)}$ and $V_{DROPOUT}$. It be calculated by the following equation.

$$RS \le \frac{V_{CC} - V_{DROPOUT}}{I_{LOAD(MAX)}}$$

Once the RS value is selected, the minimum value of C1 can be calculated by the following equation:

$$C1 \ge \frac{1ms}{2.2RS}$$

OCP and OTP Protections

The HT73Hxx implements the over current protection and over junction temperature protection to prevent IC damage even if the output is shorted to ground. When the output is shorted to ground, the output current will be clamped to I_{OCP2} and the junction temperature will rise. Once the junction temperature exceeds 150°C, the HT73Hxx will shut down the power component to prevent thermal damage. The protection will be released when the junction temperature falls to 120°C.

There are 2 levels of over current protection threshold existing in the HT73Hxx. Once the output voltage is greater than 0.7V, the OCP limit current is set to I_{OCP1}. Otherwise then the output voltage is less than 0.7V, the OCP current folds back to I_{OCP2} in order to slow down the junction temperature rises even if the output terminal is shorted to ground.

Fast Output Discharging Function

When CE=‘L’, the output voltage will be fast discharged to 0V via an internal 300Ω resistor. This discharging path doesn’t use protections such as OCP/OTP.

Input Capacitor C_{IN} Consideration

It is recommended that the input capacitor should be at least 1μF and be ceramic type for better temperature coefficient and lower ESR (Equivalent Series Resistance).

Output Capacitor C_{OUT} Considerations

The output capacitance plays an important role in keeping the output voltage stable. For the ceramic type capacitor, the capacitance should be at least 1μF. For the E-cap type capacitor, the capacitance should be at least 2.2μF.

Thermal Considerations

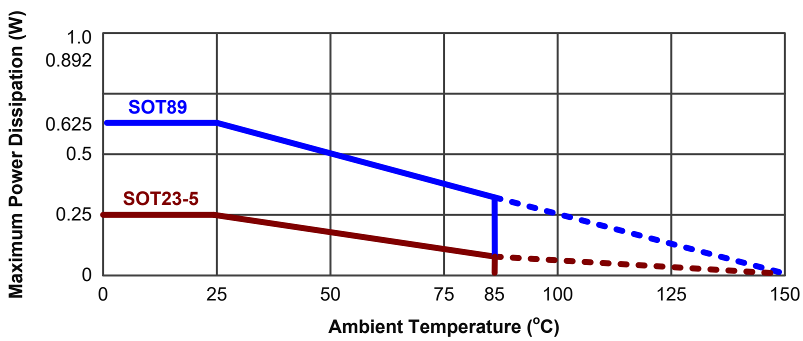
The maximum power dissipation depends on the thermal resistance of the package, the PCB layout, the rate of the surrounding airflow and the difference between the junction and ambient temperature. The maximum power dissipation can be calculated using the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - Ta) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, Ta is the ambient temperature and θ_{JA} is the junction-to-ambient thermal resistance of the IC package in degrees per watt. The following table shows the θ_{JA} values for various package types.

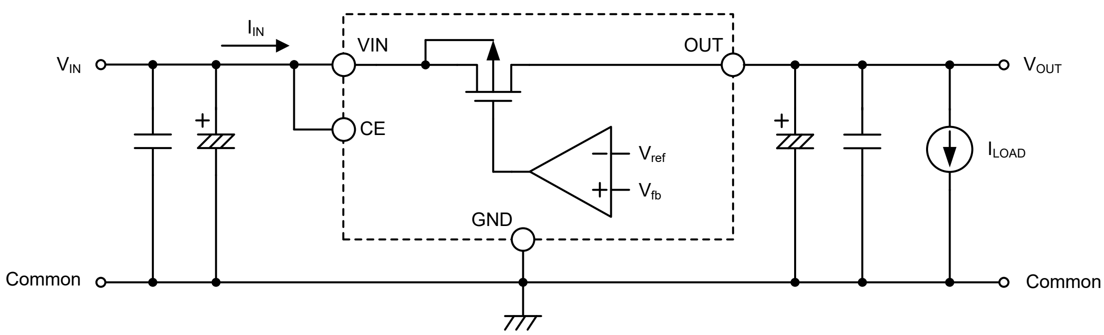
Package Type	θ_{JA} (°C/W)
SOT89	200 °C/W
SOT23-5	500 °C/W

For maximum operating rating conditions, the maximum junction temperature is 150°C. However, it is recommended that the maximum junction temperature does not exceed 125°C during normal operation to maintain an adequate margin for device reliability. The derating curves of different packages for maximum power dissipation are as follows:

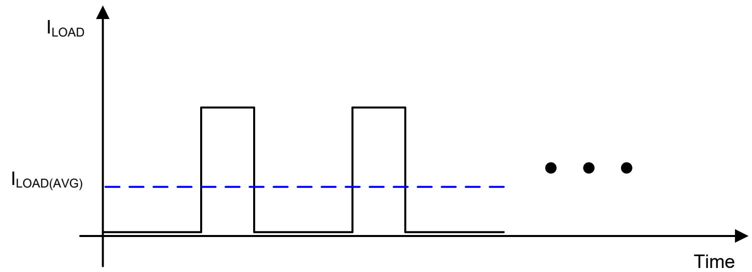


Power Dissipation Calculation

In order to keep the device within its operating limits and to maintain a regulated output voltage, the power dissipation of the device, given by P_D, must not exceed the Maximum Power Dissipation, given by $_{PD(MAX)}$. Therefore, $P_D \le P_{D(MAX)}$. From the diagram it can be seen that almost all of this power is generated across the pass transistor which is acting like a variable resistor in series with the load to keep the output voltage constant. This generated power which will appear as heat, must never allow the device to exceed its maximum junction temperature.



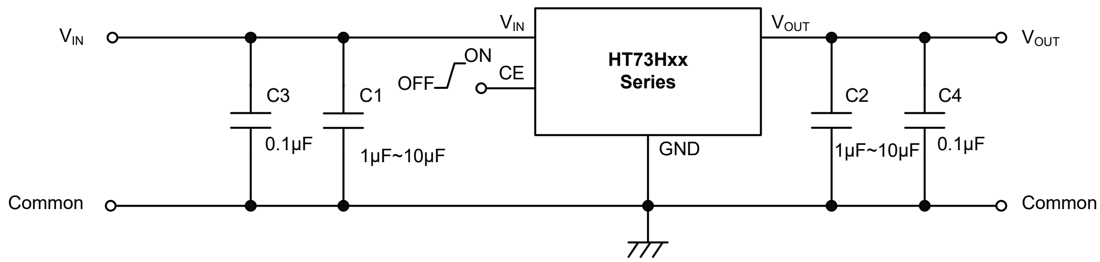
In practical applications the regulator may be called upon to provide both steady state and transient currents due to the transient nature of the load. Although the device may be working well within its limits with its steady state current, care must be taken with transient loads which may cause the current to rise close to its maximum current value. Care must be taken with transient loads and currents as this will result in device junction temperature rises which must not exceed the maximum junction temperature. With both steady state and transient currents, the important current to consider is the average or more precisely the RMS current which is the value of current that will appear as heat generated in the device. The following diagram shows how the average current relates to the transient currents.



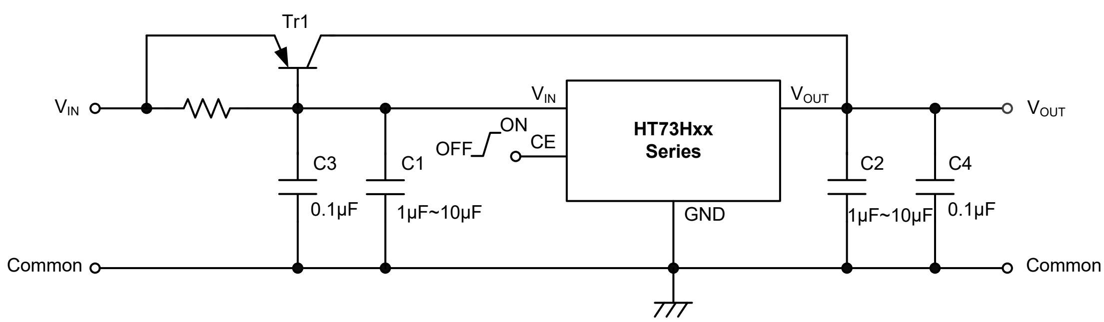
As the quiescent current of the device is very small it can generally be ignored and as a result the input current can be assumed to be equal to the output current. Therefore the power dissipation of the device, P_D, can be calculated as the voltage drop across the input and output multiplied by the current, given by the equation, $P_D=(V_{IN}-V_{OUT})\times I_{IN}$. As the input current is also equal to the load current the power dissipation $P_D=(V_{IN}-V_{OUT})\times I_{LOAD}$. However, with transient load currents, $P_D=(V_{IN}-V_{OUT})\times I_{LOAD(AVG)}$ as shown in the figure.

Application Circuits

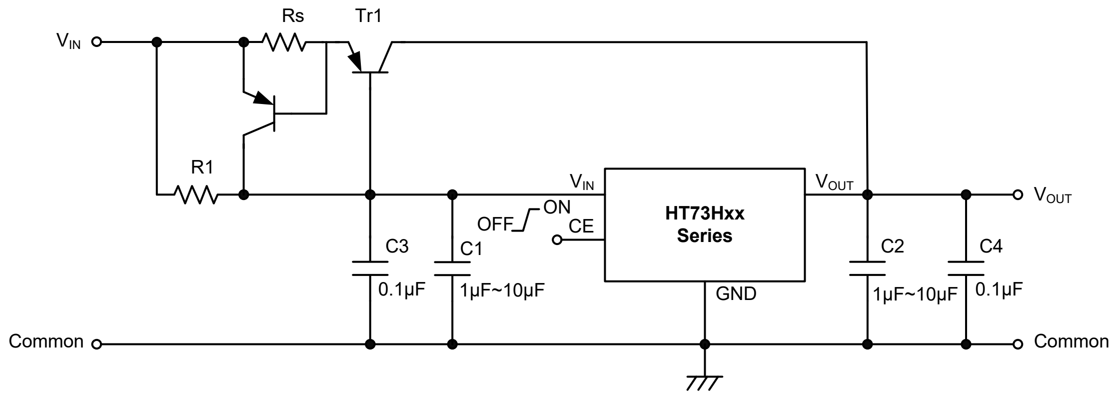
Basic Circuits



High Output Current Positive Voltage Regulator

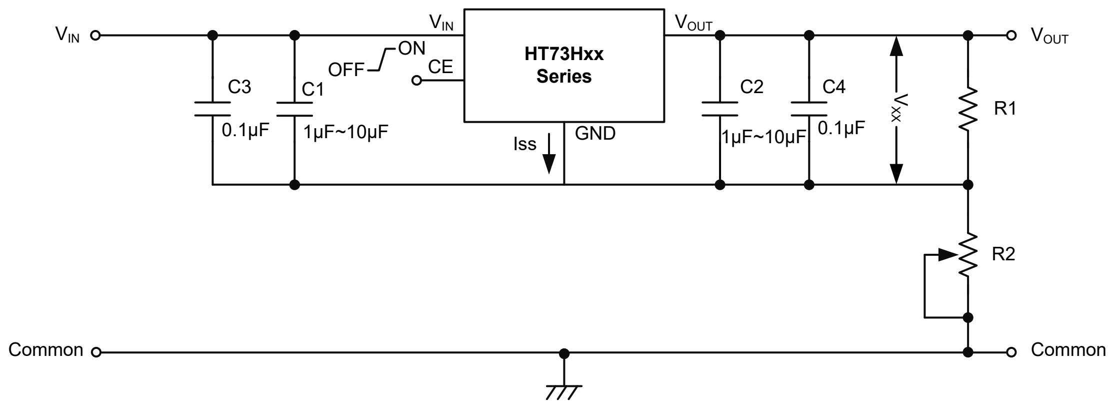


Short-Circuit Protection by Tr1

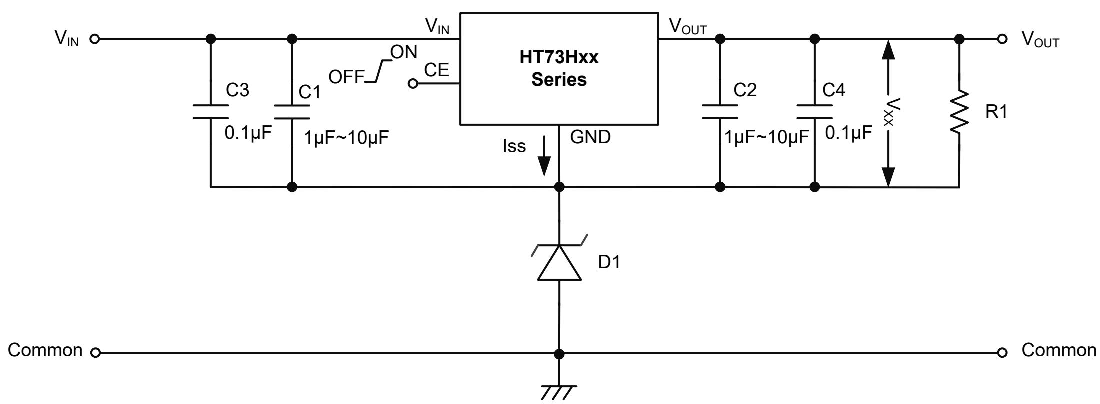


Increasing Output Voltage Circuits

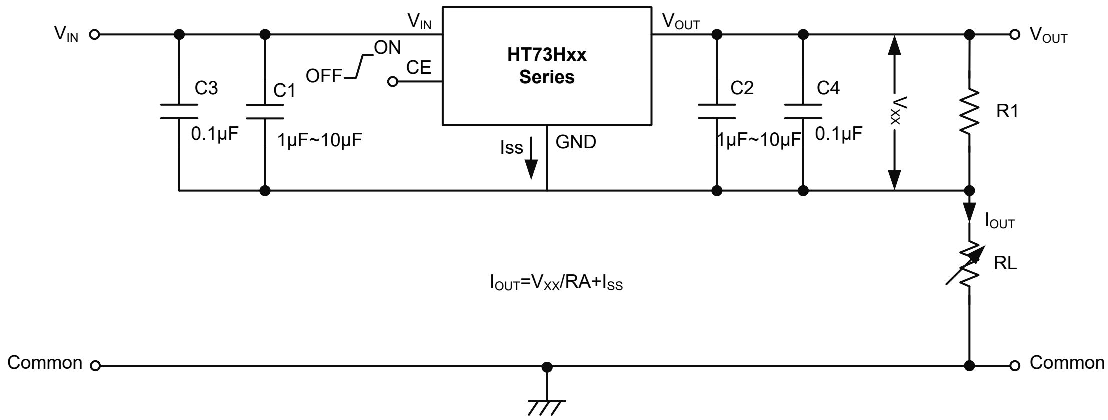
$V_{OUT} = V_{XX} \times (1+R2/R1) + I_{SS} \times R2$



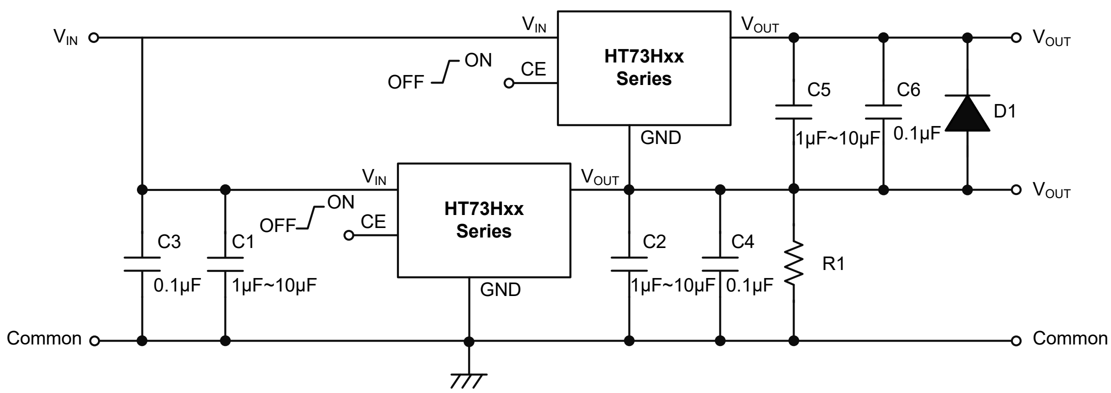
$V_{OUT} = V_{XX} + V_{D1}$



Constant Current Regulator



Dual Supply



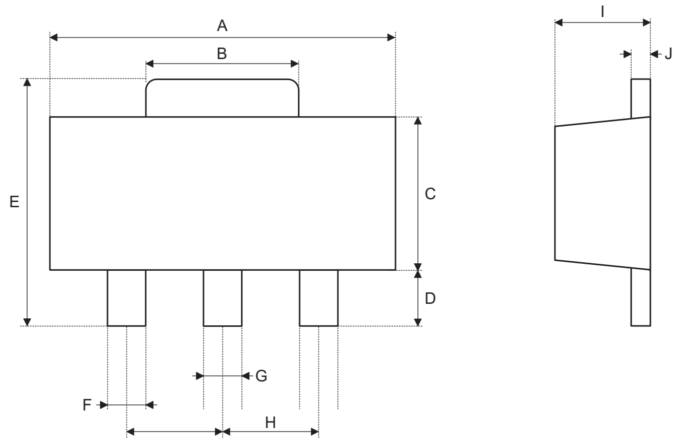
Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the Holtek website for the latest version of the package information.

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- Further Package Information (include Outline Dimensions, Product Tape and Reel Specifications)
- Packing Meterials Information
- Carton information

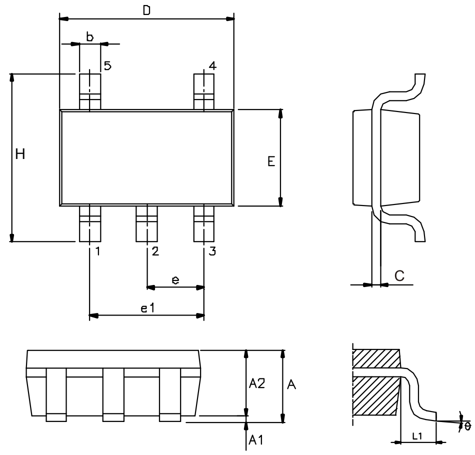
3-pin SOT89 Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.173	—	0.185
B	0.053	—	0.072
C	0.090	—	0.106
D	0.031	—	0.047
E	0.155	—	0.173
F	0.014	—	0.019
G	0.017	—	0.022
H	—	0.059 BSC	—
I	0.055	—	0.063
J	0.014	—	0.017

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	4.40	—	4.70
B	1.35	—	1.83
C	2.29	—	2.70
D	0.80	—	1.20
E	3.94	—	4.40
F	0.36	—	0.48
G	0.44	—	0.56
H	—	1.50 BSC	—
I	1.40	—	1.60
J	0.35	—	0.44

5-pin SOT23 Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	—	—	0.057
A1	—	—	0.006
A2	0.035	0.045	0.051
b	0.012	—	0.020
C	0.003	—	0.009
D	—	0.114 BSC	—
E	—	0.063 BSC	—
e	—	0.037 BSC	—
e1	—	0.075 BSC	—
H	—	0.110 BSC	—
L1	—	0.024 BSC	—
θ	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	—	—	1.45
A1	—	—	0.15
A2	0.90	1.15	1.30
b	0.30	—	0.50
C	0.08	—	0.22
D	—	2.90 BSC	—
E	—	1.60 BSC	—
e	—	0.95 BSC	—
e1	—	1.90 BSC	—
H	—	2.80 BSC	—
L1	—	0.60 BSC	—
θ	0°	—	8°