Description

The SC1563 is a high performance positive voltage regulator designed for use in applications requiring very low dropout voltage at up to 500mA. Since it has superior dropout characteristics compared to regular LDOs, it can be used to supply 2.5V on motherboards or 2.8V on peripheral cards from the 3.3V supply with no heatsink. Additionally, the SC1563 has a shutdown pin to further reduce power dissipation while shut down. The SC1563 provides excellent regulation over variations in line, load and temperature.

A wide range of fixed output voltage options are available. In addition, the output voltage of every device can be adjusted between 1.2V and 4.8V using external resistors. The SC1563 comes in the space saving 5-pin SOT-23 package.

Features

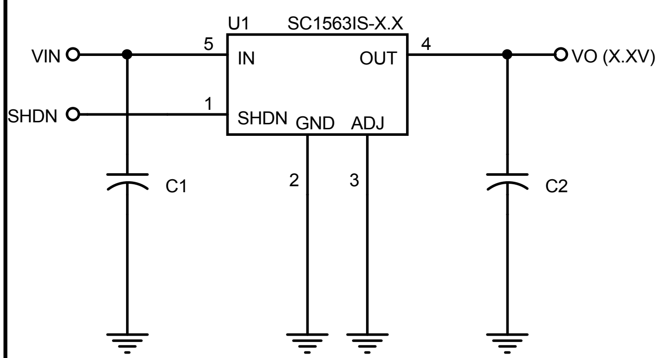
- 350mV dropout @ 500mA
- Designed to operate with ceramic capacitors
- Adjustable output from 1.2V to 4.8V
- Multiple output voltage options (all parts also adjustable externally using resistors)
- Over current and over temperature protection
- 2µA quiescent current in shutdown
- No minimum load current requirement
- Low reverse leakage (output to input)
- Full industrial temperature range
- 5-pin SOT-23 surface mount package. Also available in Lead-free, fully WEEE and RoHS compliant

Applications

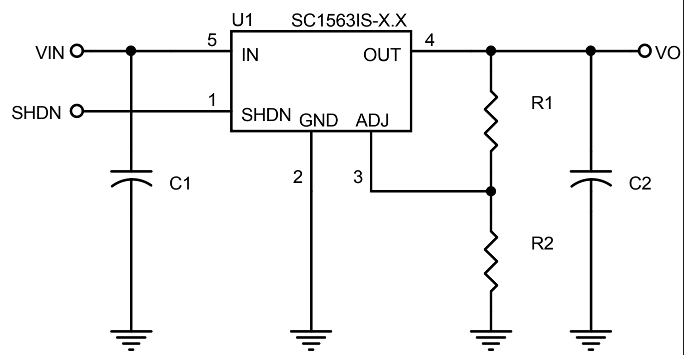
- Personal Digital Assistants
- Battery powered systems
- Motherboards
- Peripheral cards
- PCMCIA cards

Typical Application Circuits

Internally Preset Output Voltage



Externally Set Output Voltage



$$V_{OUT} = \frac{1.200\,(R1+R2)}{R2}\text{Volts}$$

Absolute Maximum Ratings

Exceeding the specifications below may result in permanent damage to the device, or device malfunction. Operation outside of the parameters specified in the Electrical Characteristics section is not implied.

Parameter	Symbol	Maximum	Units
Input Voltage	V_{IN}	-0.3 to 7	V
Shutdown Voltage	V_{SHDN}	-0.3 to V_{IN}	V
Power Dissipation	P_D	Internally Limited	W
Thermal Resistance Junction to Ambient(1)	θ_{JA}	175	°C/W
Operating Ambient Temperature Range	T_A	-40 to 85	°C
Operating Junction Temperature Range	T_J	-40 to 150	°C
Storage Temperature Range	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering) 10 sec	T_{LEAD}	300	°C
ESD Rating	V_{ESD}	2	kV

Note:
(1) Minimum pad size.

Electrical Characteristics

Unless specified: V_{SHDN} = 0V, Adjustable mode (V_{ADJ} > $V_{TH(ADJ)}$): V_{IN} = 2.2V to 5.5V and I_{OUT} = 0A to 500mA, Fixed mode (V_{ADJ} = GND): V_{IN} = (V_{OUT} + 0.7V) to 5.5V and I_{OUT} = 0A to 500mA. Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
IN						
Supply Voltage Range	V_{IN}		**2.2**		**6.5**	V
Quiescent Current	I_Q	V_{IN} = 3.3V		85	**150**	µA
		V_{IN} = 6.5V, V_{SHDN} = Open		0.01	**2.00**	µA
OUT						
Output Voltage (1)	V_{OUT}	V_{IN} = V_{OUT} + 0.7V, I_{OUT} = 10mA	-1%	V_{OUT}	+1%	V
(Internal Fixed Voltage)			**-2%**		**+2%**	
Line Regulation(1)	$REG_{(LINE)}$	V_{IN} = (V_{OUT} + 0.25V) to 5.5V, I_{OUT} = 10mA		0.1	**0.4**	%
Load Regulation(1)	$REG_{(LOAD)}$	V_{IN} = V_{OUT} + 0.7V		0.15	**0.40**	%

Electrical Characteristics

Unless specified: V_{SHDN} = 0V, Adjustable mode (V_{ADJ} > $V_{TH(ADJ)}$): V_{IN} = 2.2V to 5.5V and I_{OUT} = 0A to 500mA, Fixed mode (V_{ADJ} = GND): V_{IN} = (V_{OUT} + 0.7V) to 5.5V and I_{OUT} = 0A to 500mA. Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
OUT (Cont.)						
Dropout Voltage[(1)(2)]	V_D	I_{OUT} = 2mA		1	5	mV
					10	
		I_{OUT} = 100mA		70	100	mV
					150	
		I_{OUT} = 250mA		175	250	mV
					350	
		I_{OUT} = 500mA		350	500	mV
					700	
Current Limit	I_{LIM}		**0.5**		**1.0**	A
ADJ						
Reference Voltage[(1)]	V_{REF}	V_{IN} = 2.2V, V_{ADJ} = V_{OUT}, I_{OUT} = 10mA	1.188	1.200	1.212	V
			1.176		**1.224**	
Adjust Pin Current[(3)]	I_{ADJ}	V_{ADJ} = V_{REF}		65	**150**	nA
Adjust Pin Threshold[(4)]	$V_{TH(ADJ)}$		**0.10**	0.25	**0.40**	V
SHDN						
Shutdown Pin Current	I_{SHDN}	V_{SHDN} = 0V, V_{IN} = 3.3V		1.5	**5.0**	µA
Shutdown Pin Threshold	V_{IH}	V_{IN} = 3.3V	**1.8**			V
	V_{IL}	V_{IN} = 3.3V			**0.4**	
Over Temperature Protection						
High Trip Level	T_{HI}			170		°C
Hysteresis	T_{HYST}			10		°C

Notes:

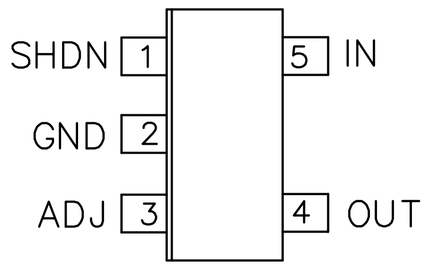
(1) Low duty cycle pulse testing with Kelvin connections required.

(2) Defined as the input to output differential at which the output voltage drops to 1% below the value measured at a differential of 0.7V for 2.5V ≤ V_{OUT} ≤ 3.4V. Not measurable on outputs less than 2.2V due to minimum V_{IN} constraints. See typical characteristics curves.

(3) Guaranteed by design.

(4) When V_{ADJ} exceeds this threshold, the “Sense Select” switch disconnects the internal feedback chain from the error amplifier and connects V_{ADJ} instead.

Pin Configurations



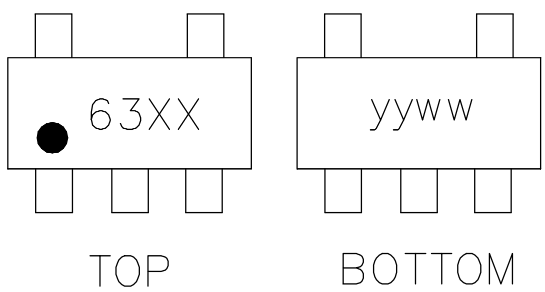
Ordering Information

Part Number[(1)(2)(3)]	Package
SC1563ISK-X.XTR	SOT-23-5
SC1563ISK-X.XTRT[(4)]	

Notes:
(1) Where -X.X denotes voltage options. Available voltages are: 1.8V, 2.5V, 2.8V, 3.0V, 3.1V and 3.3V.
(2) Output voltage can be adjusted using external resistors, see Pin Descriptions.
(3) Only available in tape and reel packaging. A reel contains 3000 devices.
(4) Lead free product. This product is fully WEEE and RoHS compliant.

Marking Information

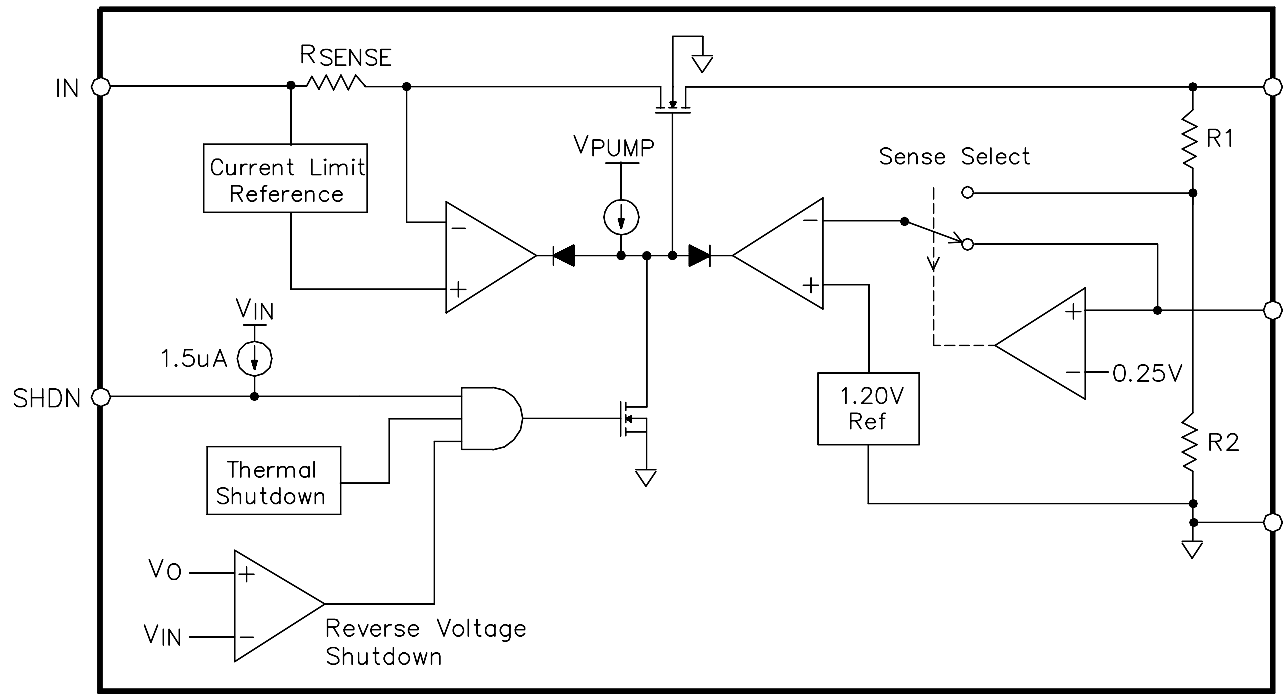
SOT-23-5



63XX = SC1563, voltage option (example: 6318 for 1.8V option)
yyww = Date code (example: 0008 for week 8 of 2000)

POWER MANAGEMENT

Block Diagram



Pin Descriptions

Pin #	Pin Name	Pin Function
1	SHDN	Shutdown Input. Leaving this pin open turns the regulator off, reducing the quiescent current to a fraction of its operating value (typically < 300nA). The device will be enabled if this pin is pulled below 0.4V. Connect to GND if not being used.
2	GND	Reference ground. This pin may be used for heatsinking purposes.
3	ADJ	This pin, when grounded, sets the output voltage to that set by the internal feedback resistors. If external feedback resistors are used, the output voltage will be (See Application Circuit on page 1): $$V_{OUT} = \frac{1.200\,(R1+R2)}{R2}\,\text{Volts}$$
4	OUT	This pin is the power output of this device, sourcing up to 500mA.
5	IN	Input voltage. For regulation at full load, the input to this pin must be between (V_{OUT} + 0.7V) and 6.5V. Minimum V_{IN} = 2.2V.

Applications Information

Introduction

The SC1563 is intended for applications such as graphics cards where high current capability and very low dropout voltage are required. It provides a very simple, low cost solution that uses little pcb real estate. Additional features include a shutdown pin to allow for a very low power consumption standby mode, and a fully adjustable output.

Component Selection

Input capacitor - a 1µF ceramic capacitor is recommended. This allows for the device being some distance from any bulk capacitance on the rail. Additionally, input droop due to load transients is reduced, improving load transient response. Additional capacitance may be added if required by the application.

Output capacitor - a minimum bulk capacitance of 1µF, along with a 0.1µF ceramic decoupling capacitor is recommended. Increasing the bulk capacitance will improve the overall transient response. The use of multiple lower value ceramic capacitors in parallel to achieve the desired bulk capacitance will not cause stability issues. Although designed for use with ceramic output capacitors, the SC1563 is extremely tolerant of output capacitor ESR values and thus will also work comfortably with tantalum output capacitors.

Noise immunity - in very electrically noisy environments, it is recommended that 0.1µF ceramic capacitors be placed from IN to GND and OUT to GND as close to the device pins as possible.

External voltage selection resistors - the use of 1% resistors, and designing for a current flow ≥ 10µA is recommended to ensure a well regulated output (thus R2 ≤ 120kΩ).

Thermal Considerations

The power dissipation in the SC1563 is approximately equal to the product of the output current and the input to output voltage differential:

$$P_D \approx (V_{IN} - V_{OUT}) \bullet I_{OUT}$$

The absolute worst-case dissipation is given by:

$$P_{D(MAX)} = (V_{IN(MAX)} - V_{OUT(MIN)}) \bullet I_{OUT(MAX)} + V_{IN(MAX)} \bullet I_{Q(MAX)}$$

For a typical scenario, V_{IN} = 3.3V ± 5%, V_{OUT} = 2.5V and I_{OUT} = 500mA, therefore:

$V_{IN(MAX)}$ = 3.465V,
$V_{OUT(MIN)}$ = 2.450V and
$I_{Q(MAX)}$ = 150µA,

Thus $P_{D(MAX)}$ = 0.508W.

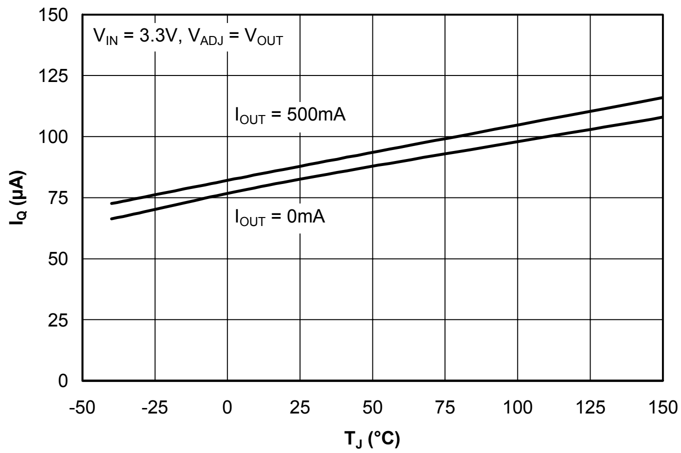
Using this figure, and assuming $T_{A(MAX)}$ = 70°C, we can calculate the maximum thermal impedance allowable to maintain T_J ≤ 150°C:

$$R_{TH(J-A)(MAX)} = \frac{(T_{J(MAX)} - T_{A(MAX)})}{P_{D(MAX)}} = \frac{(150 - 70)}{0.508} = 157°C/W$$

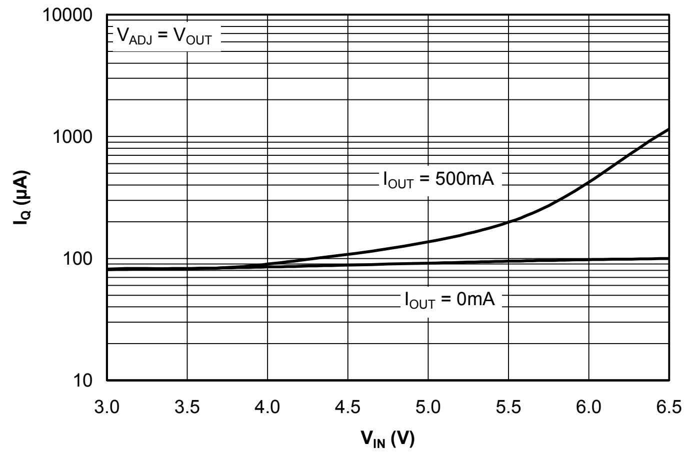
This should be achievable with the SOT-23-5 package using pcb copper area to aid in conducting the heat away from the device. Internal ground/power planes and air flow will also assist in removing heat.

Typical Characteristics

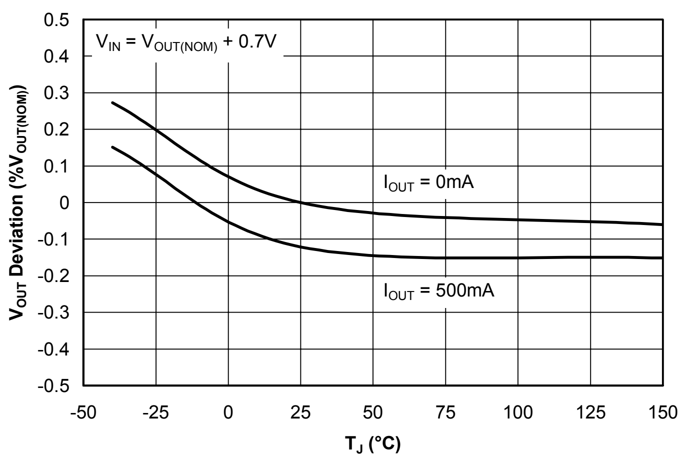
Quiescent Current vs. Junction Temperature vs. Output Current



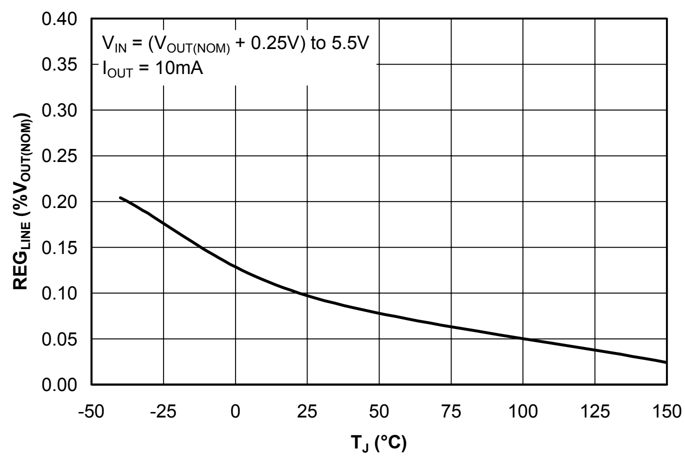
Quiescent Current vs. Input Voltage vs. Output Current



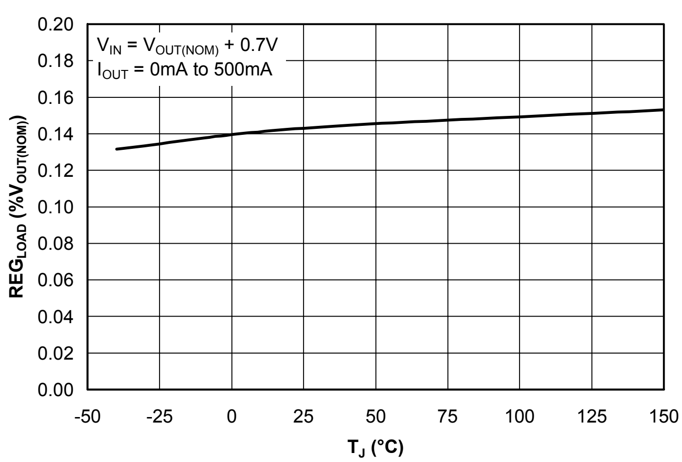
Output Voltage vs. Junction Temperature vs. Output Current



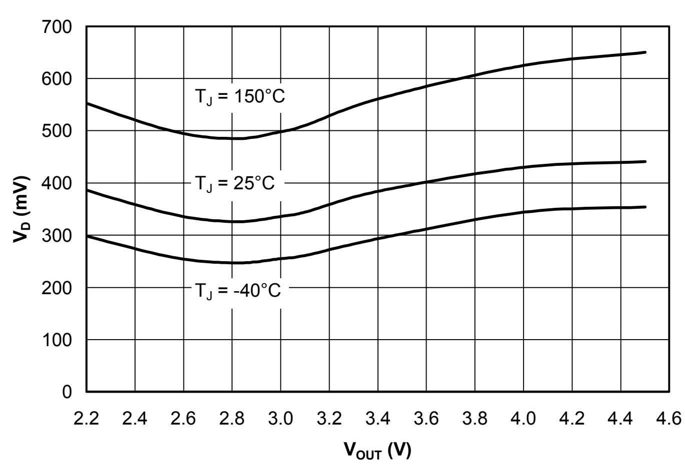
Line Regulation vs. Junction Temperature vs. Input Voltage Change



Load Regulation vs. Junction Temperature

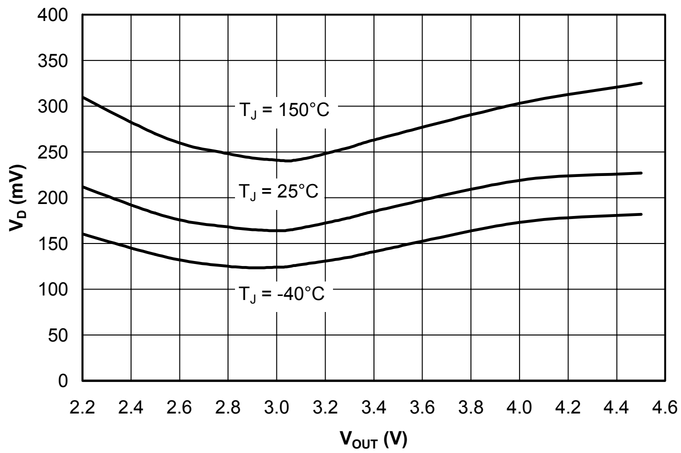


Dropout Voltage (I_{OUT} = 0.5A) vs. Output Voltage vs. Junction Temperature

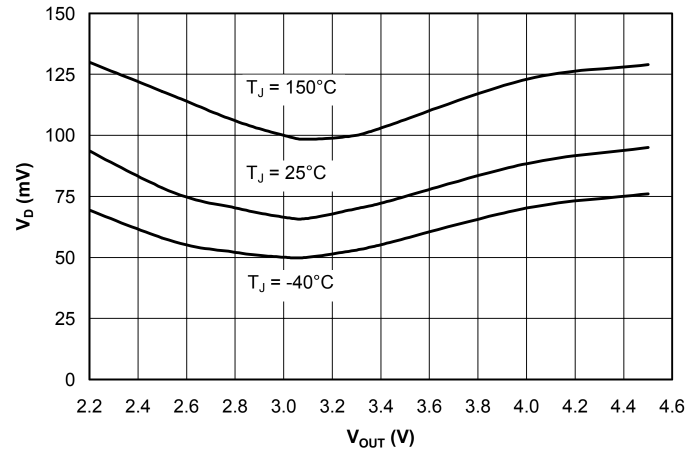


Typical Characteristics (Cont.)

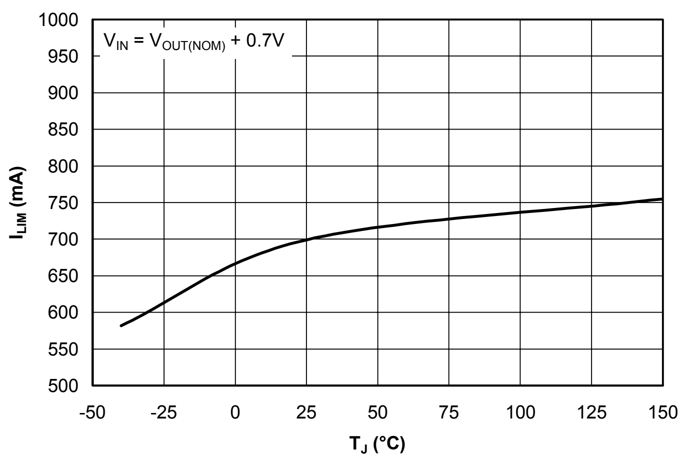
Dropout Voltage (I_{OUT} = 0.25A) vs. Output Voltage vs. Junction Temperature



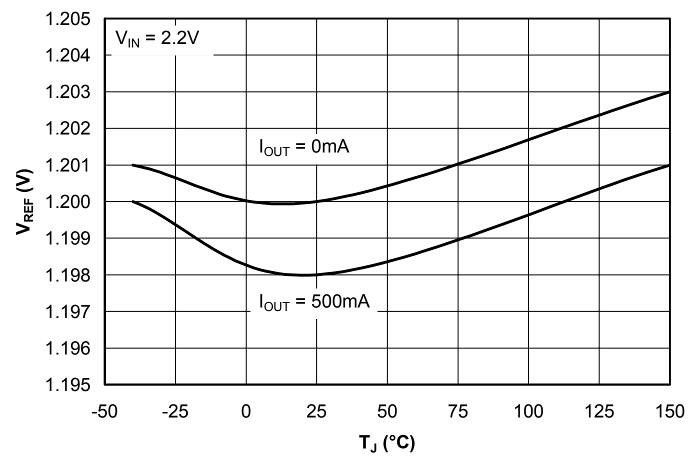
Dropout Voltage (I_{OUT} = 0.1A) vs. Output Voltage vs. Junction Temperature



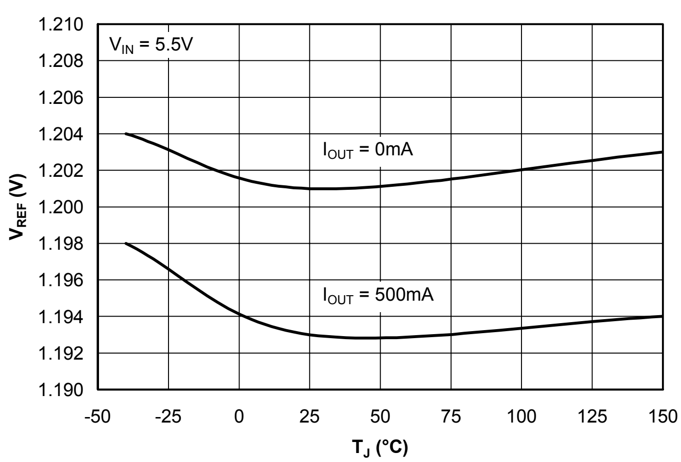
Current Limit vs. Junction Temperature



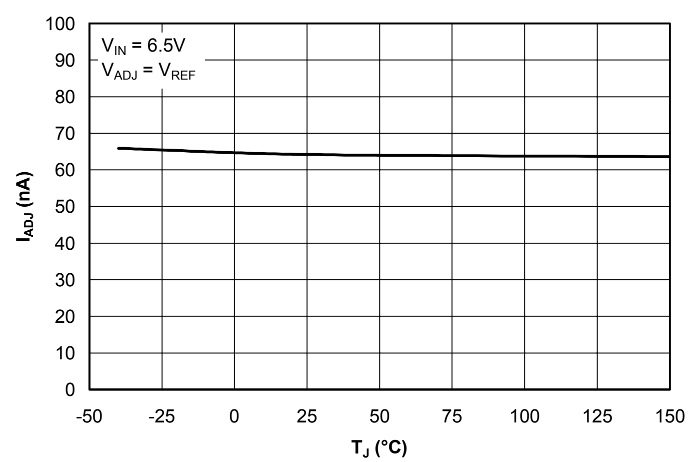
Reference Voltage (V_{IN} = 2.2V) vs. Junction Temperature vs. Output Current



Reference Voltage (V_{IN} = 5.5V) vs. Junction Temperature vs. Output Current

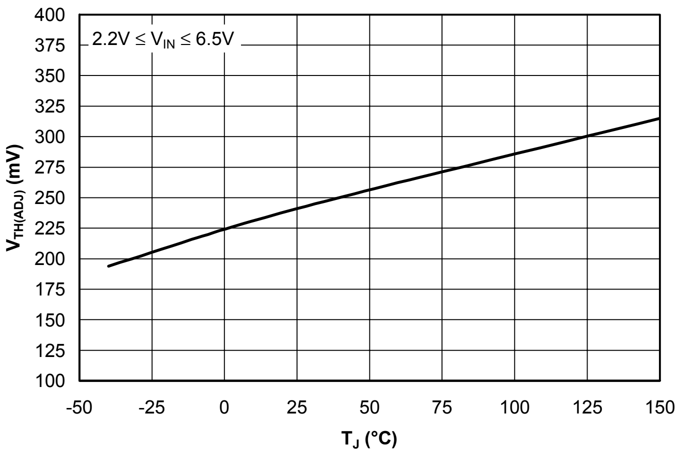


Adjust Pin Current vs. Junction Temperature

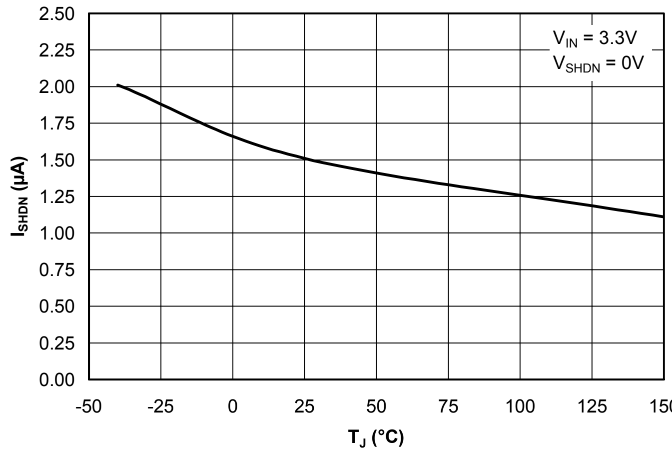


Typical Characteristics (Cont.)

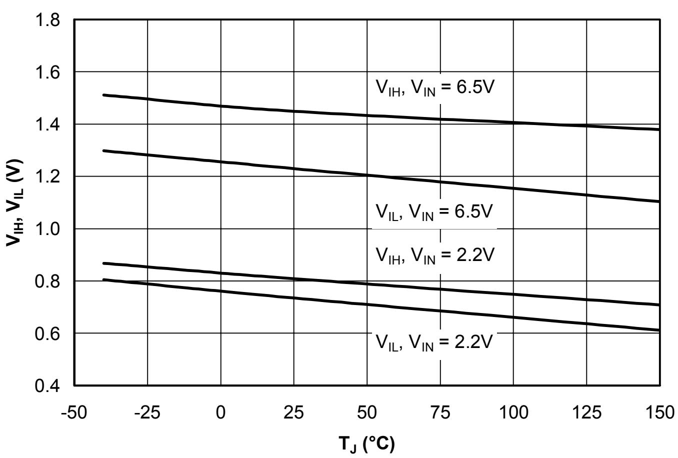
Adjust Pin Threshold Voltage vs. Junction Temperature



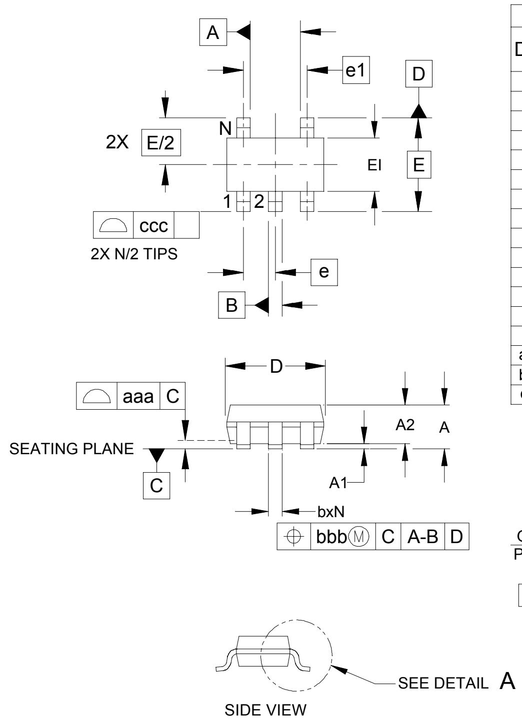
Shutdown Pin Current vs. Junction Temperature



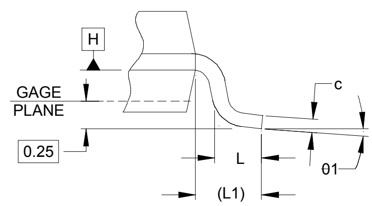
Shutdown Pin Threshold Voltage vs. Junction Temperature vs. Input Voltage



Outline Drawing - SOT-23-5



DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.035	-	.057	0.90	-	1.45
A1	.000	-	.006	0.00	-	0.15
A2	.035	.045	.051	.90	1.15	1.30
b	.010	-	.020	0.25	-	0.50
c	.003	-	.009	0.08	-	0.22
D	.110	.114	.118	2.80	2.90	3.00
E1	.060	.063	.069	1.50	1.60	1.75
E	.110 BSC			2.80 BSC		
e	.037 BSC			0.95 BSC		
e1	.075 BSC			1.90 BSC		
L	.012	.018	.024	0.30	0.45	0.60
L1	(.024)			(0.60)		
N	5			5		
θ1	0°	-	10°	0°	-	10°
aaa	.004			0.10		
bbb	.008			0.20		
ccc	.008			0.20		

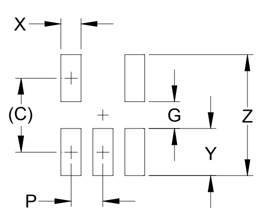


DETAIL A

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-
3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

Land Pattern - SOT-23-5



DIM	INCHES	MILLIMETERS
C	(.098)	(2.50)
G	.055	1.40
P	.037	0.95
X	.024	0.60
Y	.043	1.10
Z	.141	3.60

NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

Contact Information

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