

Power Distribution Switch

Features

- 67mΩ High-Side MOSFET (G509xxxT11G, G509xxSDBT1G)
- 120mΩ High-Side MOSFET (G509N02DT73G)
- 37mΩ High-Side MOSFET (G509x3xxxx1G)
- 56mΩ High-Side MOSFET (G509x30DP81U)
- Available with 9 Versions of Current Limits with Fold-back.
- Operating Range: 2.7V to 5.5V
- 2mS Typical Rise Time
- Fast Over Current Response 1.5μs (TYPICAL)
- Under Voltage Lockout
- 130μA Quiescent Supply Current
- 1μA Maximum Shutdown Supply Current
- Logic Level Enable Pin. Available with Active-High, Active-Low, or Enable Selection Versions
- No Reverse Current when Power Off
- Deglitched Open-Drain Over-Current Flag Output (OC)
- Available with or without Output Shutdown Pull-low Resistor
- Output Reverse Protection when Power ON
- SOT-23-5, TSOT-23-6, SOT-23-6, SOT-23-3, TSOT-23-5 FC, TSOT-23-6 FC, SOT-563 FC, and MSOP-8 Packages
- UL 2367 Recognition-File NO. E232223
- IEC 62368-1 Certified

Applications

- High-Side Power Protection Switch
- USB Power Management
- USB Host and Self-Powered Hubs
- USB Bus-Powered Hubs
- Hot Plug-In Power Supplies
- Battery-Charger Circuits

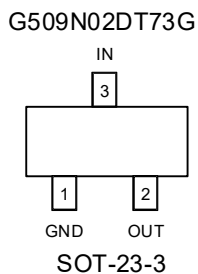
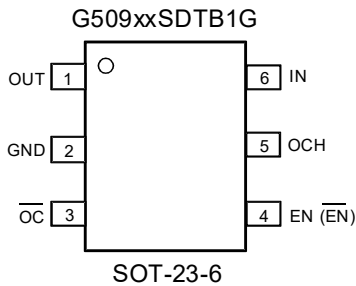
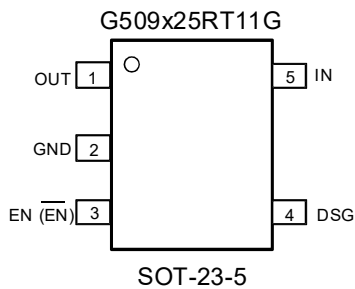
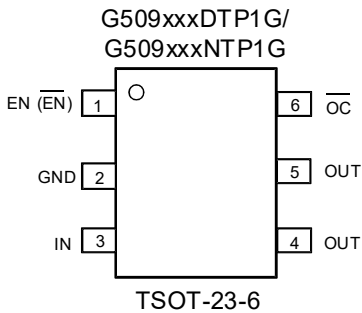
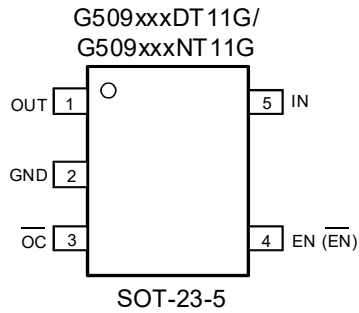
General Description

The G509 is an integrated power switch for self-powered and bus-powered Universal Serial Bus (USB) applications. G509xxxT11G and G509x25DTB1G are 67mΩ $R_{DS(ON)}$. In addition, G509N02DT73G is 120mΩ $R_{DS(ON)}$. Moreover, G509x3xxxx1G is 37mΩ $R_{DS(ON)}$. Furthermore, G509x30DP81U is 56mΩ $R_{DS(ON)}$.

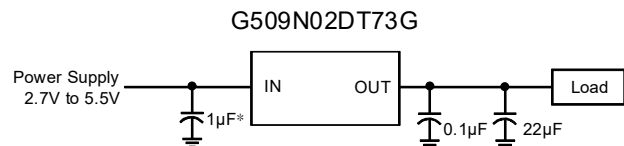
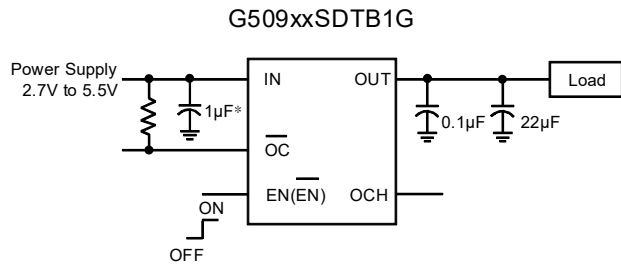
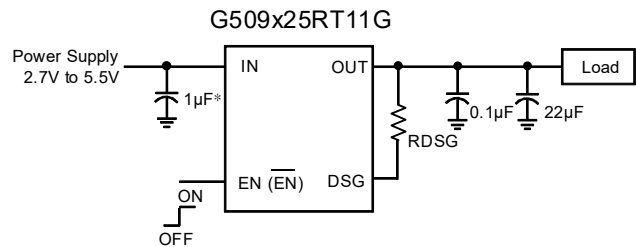
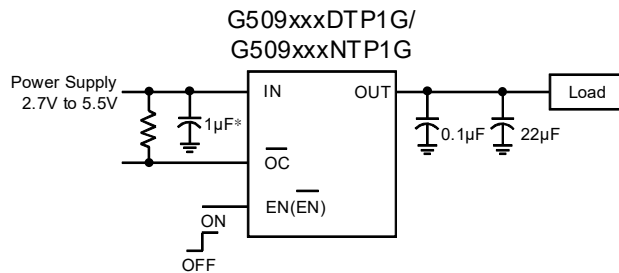
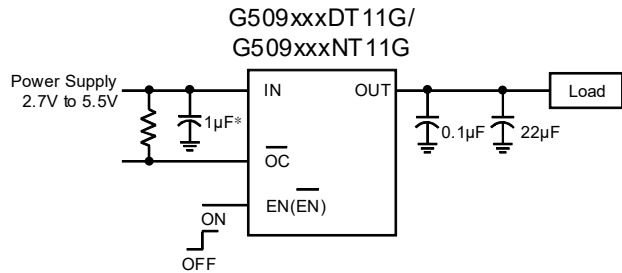
Several Protection features include current limiting and thermal shutdown to prevent catastrophic switch failure caused by increasing power dissipation when continuous heavy loads or short circuit occurs. A built-in charge pump is used to drive the N-channel MOSFET that is free of parasitic body diode to eliminate any reversed current flow across the switch when it is powered off. When the output voltage is higher than input voltage, the power switch is turned off by internal output reverse protection comparator.

$\overline{OC}$ is an open-drain output report over-current or over-temperature event and has typical 9ms deglitch timeout period. In addition, output reverse protection occurs with typical 5ms (1.25ms) deglitch timeout period in G509xxxT11G, G509xxSDBT1G, G509N02DT73G (G509x3xxxx1G), and G509x30DP81U.

Pin Configuration

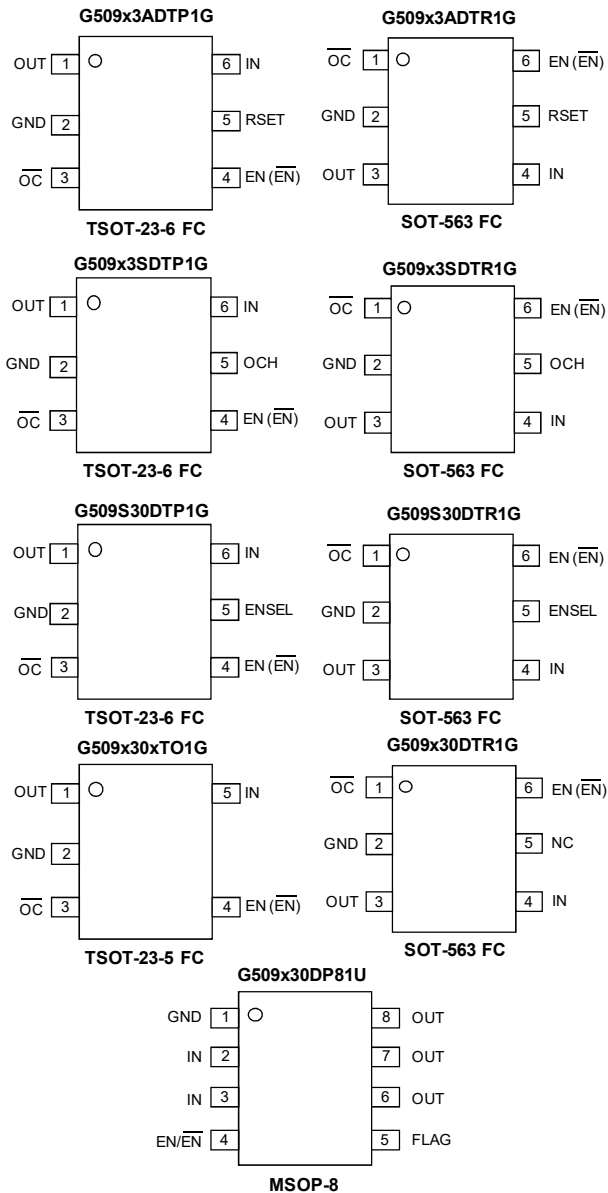


Typical Application Circuit

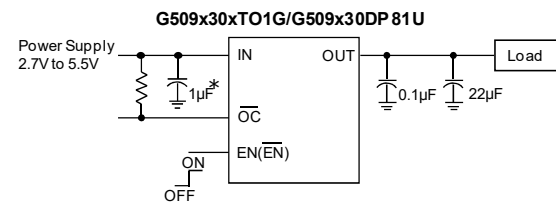
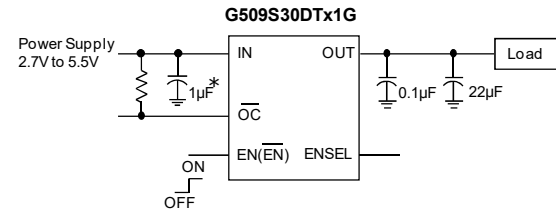
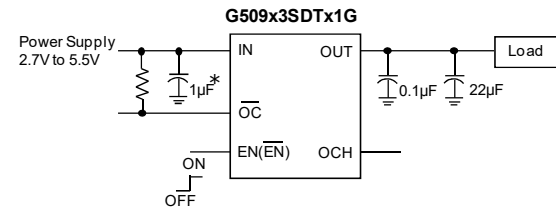
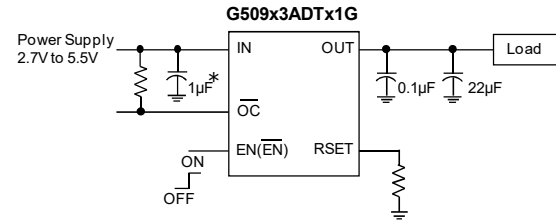


*: 1μF of input capacitor is enough in most application cases.
If the PCB trace of power rail to IN is long, larger input capacitor is necessary.

Pin Configuration



Typical Application Circuit



*:1 μ F of input capacitor is enough in most application cases.
 If the PCB trace of power rail to IN is long, larger input capacitor is necessary.

Ordering Information

ORDER NUMBER	MARKING	ENABLE	Cont. Current	Output MOS $R_{DS(ON)}$	Output Shutdown Resistor	TEMP. RANGE	PACKAGE (Green)
G509H25DT11G	509Ax	Active High	2.6A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509L25DT11G	509Bx	Active Low	2.6A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509H25NT11G	509Cx	Active High	2.6A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509L25NT11G	509Dx	Active Low	2.6A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509H20DT11G	509Ex	Active High	2.1A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509L20DT11G	509Fx	Active Low	2.1A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509H20NT11G	509Gx	Active High	2.1A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509L20NT11G	509Hx	Active Low	2.1A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509H10DT11G	509Ix	Active High	1.0A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509L10DT11G	509Jx	Active Low	1.0A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509H10NT11G	509Kx	Active High	1.0A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509L10NT11G	509Lx	Active Low	1.0A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509H05DT11G	509Mx	Active High	0.5A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509L05DT11G	509Nx	Active Low	0.5A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509H05NT11G	509Ox	Active High	0.5A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509L05NT11G	509Px	Active Low	0.5A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509H02DT11G	509Qx	Active High	0.2A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509L02DT11G	509Rx	Active Low	0.2A	67m Ω	Yes	-40°C to +85°C	SOT-23-5
G509H02NT11G	509Sx	Active High	0.2A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509L02NT11G	509Tx	Active Low	0.2A	67m Ω	No	-40°C to +85°C	SOT-23-5
G509H25DTP1G	509Ax	Active High	2.6A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509L25DTP1G	509Bx	Active Low	2.6A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509H25NTP1G	509Cx	Active High	2.6A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509L25NTP1G	509Dx	Active Low	2.6A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509H20DTP1G	509Ex	Active High	2.1A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509L20DTP1G	509Fx	Active Low	2.1A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509H20NTP1G	509Gx	Active High	2.1A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509L20NTP1G	509Hx	Active Low	2.1A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509H10DTP1G	509Ix	Active High	1.0A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509L10DTP1G	509Jx	Active Low	1.0A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509H10NTP1G	509Kx	Active High	1.0A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509L10NTP1G	509Lx	Active Low	1.0A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509H05DTP1G	509Mx	Active High	0.5A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509L05DTP1G	509Nx	Active Low	0.5A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509H05NTP1G	509Ox	Active High	0.5A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509L05NTP1G	509Px	Active Low	0.5A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509H02DTP1G	509Qx	Active High	0.2A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509L02DTP1G	509Rx	Active Low	0.2A	67m Ω	Yes	-40°C to +85°C	TSOT-23-6
G509H02NTP1G	509Sx	Active High	0.2A	67m Ω	No	-40°C to +85°C	TSOT-23-6
G509L02NTP1G	509Tx	Active Low	0.2A	67m Ω	No	-40°C to +85°C	TSOT-23-6

Ordering Information (Continued)

ORDER NUMBER	MARKING	ENABLE	Cont. Current	Output MOS $R_{DS(ON)}$	Output Shutdown Resistor	TEMP. RANGE	PACKAGE (Green)
G509H25RT11G	509Ux	Active High	2.6A	67m Ω	DSG	-40°C to +85°C	SOT-23-5
G509L25RT11G	509Vx	Active Low	2.6A	67m Ω	DSG	-40°C to +85°C	SOT-23-5
G509H1SDTB1G	509Wx	Active High	1.0A	67m Ω	Yes	-40°C to +85°C	SOT-23-6
G509L1SDTB1G	509Xx	Active Low	1.0A	67m Ω	Yes	-40°C to +85°C	SOT-23-6
G509H2SDTB1G	509ix	Active High	2.1A	67m Ω	Yes	-40°C to +85°C	SOT-23-6
G509L2SDTB1G	509jx	Active Low	2.1A	67m Ω	Yes	-40°C to +85°C	SOT-23-6
G509N02DT73G	509Yx	Default Ena.	0.2A	120m Ω	Yes	-40°C to +85°C	SOT-23-3
G509H30DTP1G	509ax	Active High	3.0A	37m Ω	Yes	-40°C to +85°C	TSOT-23-5 FC
G509L30DTP1G	509bx	Active Low	3.0A	37m Ω	Yes	-40°C to +85°C	TSOT-23-5 FC
G509H30DTR1G	509cx	Active High	3.0A	37m Ω	No	-40°C to +85°C	TSOT-23-5 FC
G509S30DTP1G	509dx	Selection	3.0A	37m Ω	Yes	-40°C to +85°C	TSOT-23-6 FC
G509H3SDTP1G	509ex	Active High	3.0A	37m Ω	Yes	-40°C to +85°C	TSOT-23-6 FC
G509L3SDTP1G	509fx	Active Low	3.0A	37m Ω	Yes	-40°C to +85°C	TSOT-23-6 FC
G509H3ADTP1G	509gx	Active High	ADJ	37m Ω	Yes	-40°C to +85°C	TSOT-23-6 FC
G509L3ADTP1G	509hx	Active Low	ADJ	37m Ω	Yes	-40°C to +85°C	TSOT-23-6 FC
G509H30DTR1G	5ax	Active High	3.0A	37m Ω	Yes	-40°C to +85°C	SOT-563 FC
G509L30DTR1G	5bx	Active Low	3.0A	37m Ω	Yes	-40°C to +85°C	SOT-563 FC
G509S30DTR1G	5dx	Selection	3.0A	37m Ω	Yes	-40°C to +85°C	SOT-563 FC
G509H3SDTR1G	5ex	Active High	3.0A	37m Ω	Yes	-40°C to +85°C	SOT-563 FC
G509L3SDTR1G	5fx	Active Low	3.0A	37m Ω	Yes	-40°C to +85°C	SOT-563 FC
G509H3ADTR1G	5gx	Active High	ADJ	37m Ω	Yes	-40°C to +85°C	SOT-563 FC
G509L3ADTR1G	5hx	Active Low	ADJ	37m Ω	Yes	-40°C to +85°C	SOT-563 FC
G509H30DP81U	509H30D	Active High	3.0A	56m Ω	Yes	-40°C to +85°C	MSOP-8
G509L30DP81U	509L30D	Active Low	3.0A	56m Ω	Yes	-40°C to +85°C	MSOP-8

Note: H: Active High, L: Active Low, N: Default Enable, S: Enable Selection

IOUT Classified and Function: 25 & 20 & 10 & 05 & 02 & 1S & 2S & 30 & 3S & 3A

D: VOUT with Discharge R, N: VOUT without Discharge R, R: External Discharge R

T1: SOT-23-5, TB: SOT-23-6, T7: SOT-23-3, TO: TSOT-23-5 FC, TP: TSOT-23-6 & TSOT-23-6 FC, TR: SOT-563 FC,

P8: MSOP-8

1 & 3: Bonding Code

G & U: Tape & Reel

Green : Lead Free / Halogen Free.

Absolute Maximum Ratings

IN Pin Voltage, V_{IN}	-0.3V to 6V
OUT Pin Voltage, V_{OUT}	-0.3V to 6V
Output Current, I_{OUT}	Internally Limited
EN Pin Voltage, V_{EN}	-0.3V to 6V
$\overline{OC}$ Pin Voltage, $V_{\overline{OC}}$	-0.3V to 6V
DSG Pin Voltage, V_{DSG}	-0.3V to 6V
OCH Pin Voltage, V_{OCH}	-0.3V to 6V
REST Pin Voltage, V_{RSET}	-0.3V to 6V
ENSEL Pin Voltage, V_{ENSEL}	-0.3V to 6V
Thermal Resistance Junction to Ambient, (θ_{JA})	
SOT-23-3	280°C/W
SOT-23-5/6	250°C/W
TSOT-23-5/6 FC	125°C/W
SOT-563 FC	130°C/W
MSOP-8	200°C/W
Continuous Power Dissipation ($T_A = +25^\circ\text{C}$)	
SOT-23-3	0.4W
SOT-23-5/6	0.5W
TSOT-23-5/6 FC	0.9W

SOT-563 FC	0.9W
MSOP-8	0.6W
Thermal Resistance Junction to Case, (θ_{JC})	
SOT-23-3	90°C/W
SOT-23-5/6	60°C/W
TSOT-23-5/6 FC	33°C/W
SOT-563 FC	60°C/W
MSOP-8	55°C/W
Junction Temperature	150°C
Storage Temperature (T_s)	-65°C to +150°C
Reflow Temperature (soldering, 10sec)	260°C
ESD (HBM)	2KV
ESD (CDM)	1KV
Output ESD Protection	4KV

Operating Ratings

Supply Voltage (V_{IN})	2.7V to 5.5V
Operating Temperature (T_A)	-40°C to +85°C

Electrical Characteristics

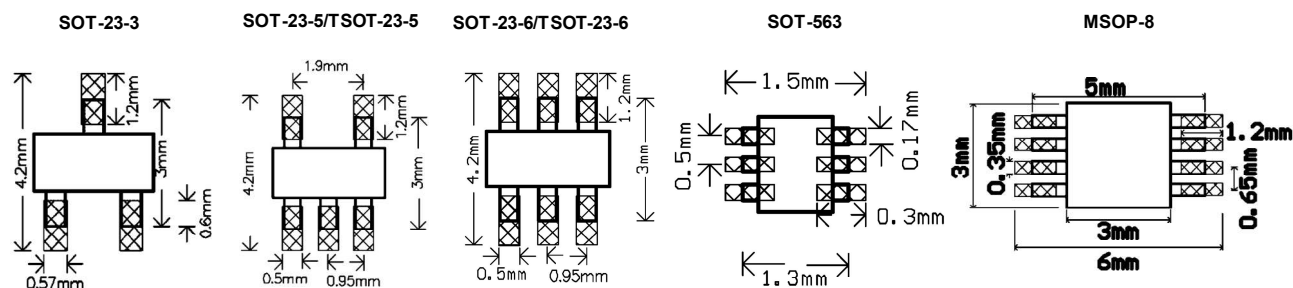
$V_{IN} = 5V$, $C_{IN} = 1\mu F$, $C_{OUT} = 1\mu F$, $R_L = 10\Omega$, $T_A = 25^\circ\text{C}$.

The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

PARAMETER	CONDITION	MIN	TYP	MAX	UNIT
Input Voltage Range		2.7	---	5.5	V
Output MOS $R_{DS(ON)}$	G509x25D / G509x25N, $I_{OUT} = 2.6A$	---	67	85	mΩ
	G509x20D / G509x20N, $I_{OUT} = 2.1A$				
	G509x10D / G509x10N, $I_{OUT} = 1A$				
	G509x05D / G509x05N, $I_{OUT} = 0.5A$				
	G509x02D / G509x02N, $I_{OUT} = 0.2A$				
	G509x25R, $I_{OUT} = 2.6A$				
	G509x1SD, OCH=High, $I_{OUT} = 1A$				
	G509x2SD, OCH=High, $I_{OUT} = 2.1A$				
	G509N02D, $I_{OUT} = 0.2A$	---	120	140	
	G509x3xD / G509x3xN, $I_{OUT} = 3A$	---	37	55	
	G509x30DP81, $I_{OUT} = 3A$	---	56	68	
Supply Current	EN=Enable, $V_{OUT} = V_{IN} = 5V$ @ $I_{OUT} = 0A$	---	130	190	μA
Output Turn-on Rising Time	10%~90% Settling	$V_{IN} = 5V$	1	1.5	ms
		$V_{IN} = 3.3V$	1	1.5	
Over Current Trigger Point	G509x25D / G509x25N	2.7	3.2	3.7	A
	G509x20D / G509x20N	2.2	2.5	2.8	
	G509x10D / G509x10N	1.2	1.4	1.6	
	G509x05D / G509x05N	0.6	0.8	1	
	G509x02D / G509x02N	0.3	0.4	0.5	
	G509x25R	2.7	3.2	3.7	
	G509x2SD, OCH=High	2.2	2.5	2.8	
	G509x2SD, OCH=Low	1.2	1.4	1.6	
	G509x1SD, OCH=High	1.1	1.3	1.5	
	G509x1SD, OCH=Low	0.6	0.7	0.8	
	G509N02D	0.3	0.4	0.5	
	G509x3SD, OCH=High / G509x30x	3.1	3.4	4	
	G509x3SD, OCH=Low	1.55	1.8	2	
	G509x3AD, Rset=2.0kΩ	3.06	3.4	3.74	
	G509x3AD, Rset=3.6kΩ	1.71	1.9	2.09	
	G509x3AD, Rset=6.8kΩ	0.9	1	1.1	
	G509x3AD, Rset=10kΩ	0.578	0.68	0.782	

Electrical Characteristics (Continued)

PARAMETER	CONDITION	MIN	TYP	MAX	UNIT
Fold-Back Current	G509x25D / G509x25N, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.9	1.3	1.6	A
	G509x20D / G509x20N, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.6	1.0	1.3	
	G509x10D / G509x10N, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.35	0.5	0.95	
	G509x05D / G509x05N, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.07	0.3	0.77	
	G509x02D / G509x02N, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.07	0.2	0.4	
	G509x25R, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.9	1.3	1.6	
	G509x2SD, OCH=High, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.6	1.0	1.3	
	G509x1SD, OCH=High, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.35	0.5	0.95	
	G509N02D, $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.07	0.2	0.4	
	G509x3SD, OCH=High / G509x30x, $V_{IN}>3.5V$ and $V_{OUT}<1V$	1.0	1.6	2.2	
	G509x3AD, Rset=6.8k Ω , $V_{IN}>3.5V$ and $V_{OUT}<1V$	0.15	0.6	0.75	
EN Input Threshold-High V_{IH}		1.2	---	---	V
EN Input Threshold-Low V_{IL}		---	---	0.6	V
OCH Input Threshold-High V_{IH}		1.2	---	---	V
OCH Input Threshold-Low V_{IL}		---	---	0.6	V
Shutdown Supply Current	EN=Disable, V_{OUT} ="OPEN"	---	0.1	1	μA
Shutdown Pull Low Resistance	EN=Disable, G509xxxx / G509xxSD G509x30x / G509x3SD	---	150	225	Ω
	EN=Disable, G509N02D	---	300	400	
	EN=Disable, G509x3AD	---	75	120	
VIN Under Voltage Lockout		2.0	---	2.6	V
Thermal Limit		---	140	---	$^{\circ}C$
Thermal Limit Hysteresis		---	20	---	$^{\circ}C$
OC Deglitch	OC assertion or deassertion	4	9	15	ms
Output Reverse Protection Threshold		200	500	---	mA
Output Reverse Protection De-glitch Time	G509xxxx / G509xxSD / G509N02D	---	5	---	ms
	G509x30x / G509x3SD / G509x3AD	---	1.25	---	
t_{IOS} Response Time to Short Circuit	See Figure 1,2	---	1.5	3.5	μs
$\overline{OC}$ Output Low Voltage	G509xxSD / G509x3SD, $I_{\overline{OC}}=10mA$	---	---	0.4	V
$\overline{OC}$ Off-state Leakage	G509xxSD / G509x3SD, $V_{\overline{OC}}=5V$	---	---	1	μA
Resistance Between DSG to GND	G509x25R	---	15	---	Ω

Minimum Footprint PCB Layout Section


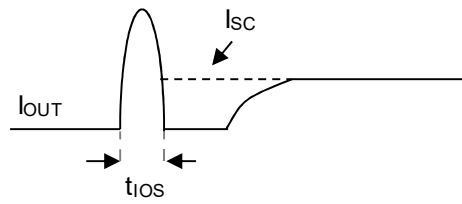


Figure 1

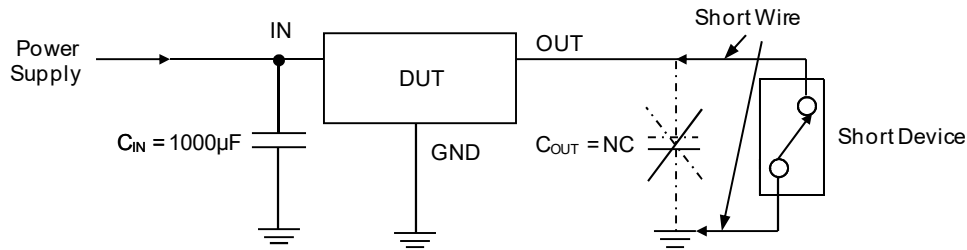


Figure 2

Note:

To exactly identify the short circuit characteristic of IC, avoid the test result interfered by parasitic inductor, output capacitor, and contact resistor. It is necessary to follow the recommendation as follows.

Please,

1. Add 1000μF of capacitor between V_{IN} and GND, and close to IC.
2. Remove output capacitor.
3. Shorter the short circuit device wire.
4. Measure output current (I_{OUT}).

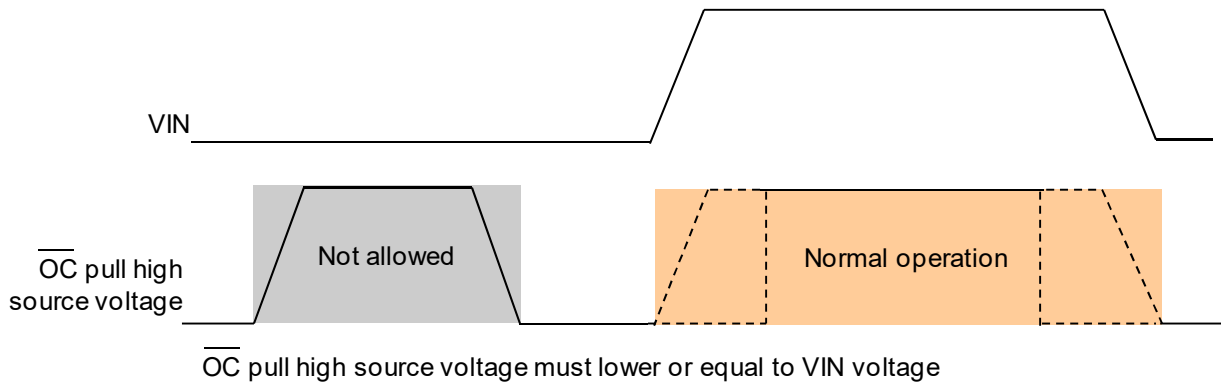
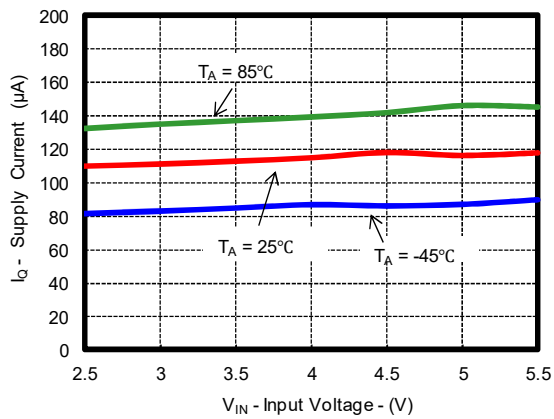


Figure 3. Power Sequence Recommendation

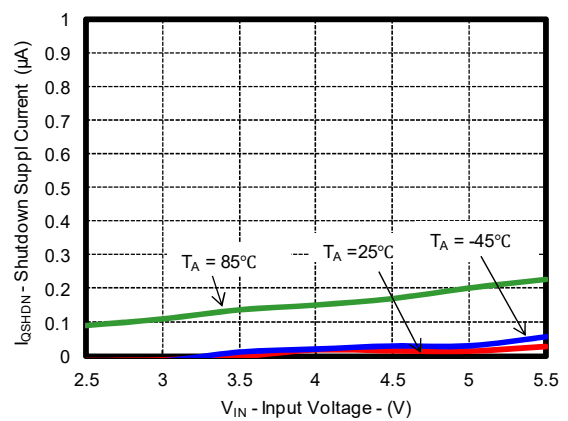
Typical Performance Characteristics

($V_{IN}=5V$, $C_{IN}=1\mu F$, $C_{OUT}=22\mu F$, $T_A=25^\circ C$, unless otherwise noted.)

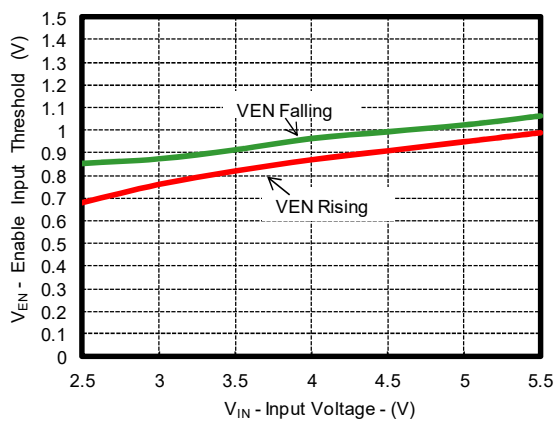
Supply Current vs. Input Voltage



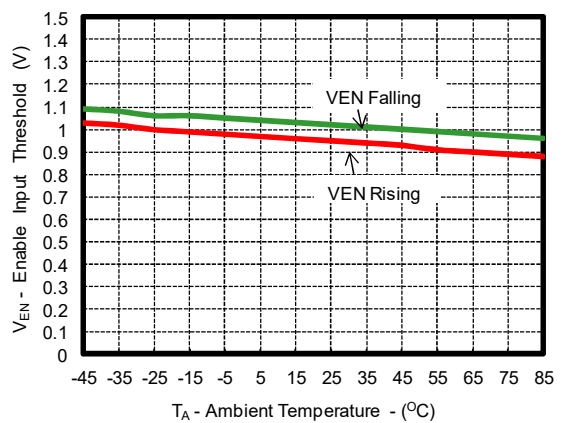
Shutdown Supply Current vs. Input Voltage



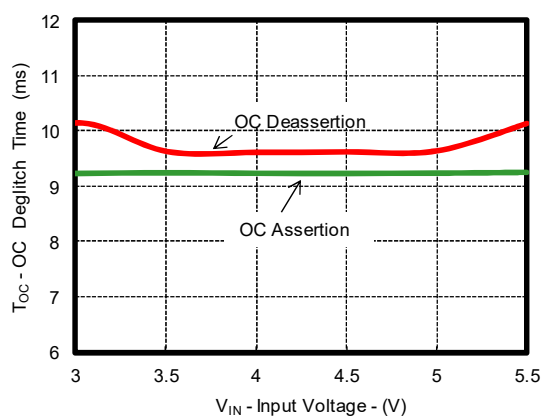
Enable Input Threshold vs. Input Voltage



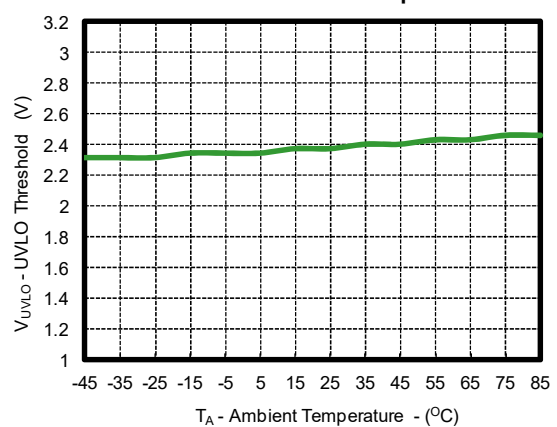
Enable Input Threshold vs. Temperature



OC Deglitch Time vs. Input Voltage

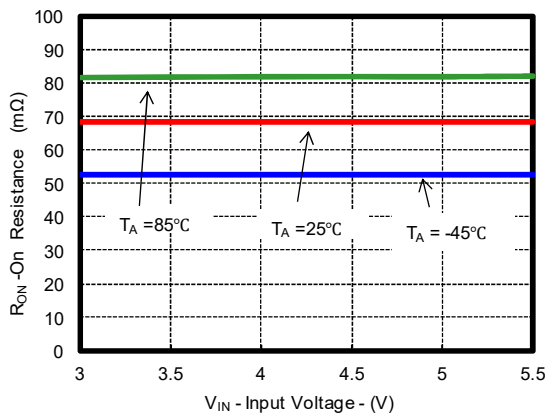


UVLO Threshold vs. Temperature

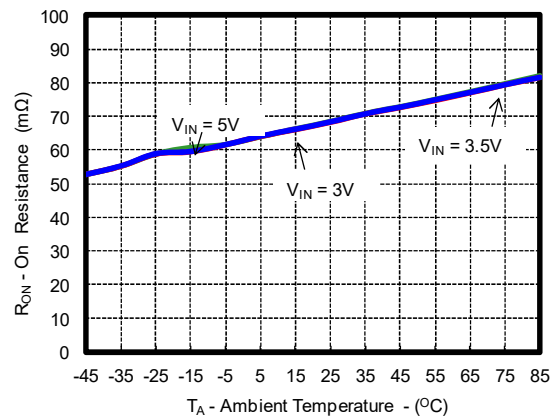


Typical Performance Characteristics (continued)

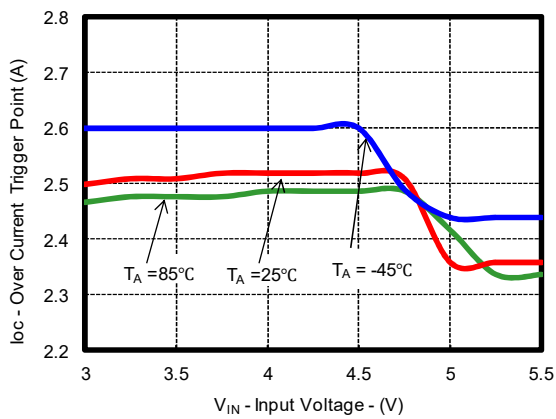
ON-Resistance vs. Input Voltage



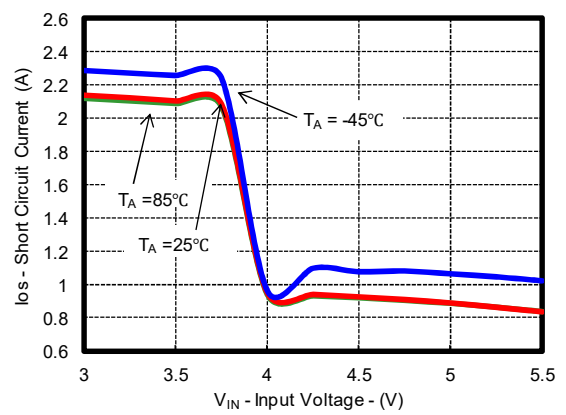
ON-Resistance vs. Temperature



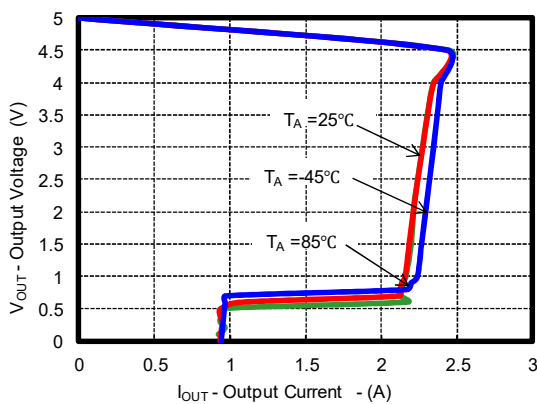
Over Current Trigger Point vs. Input Voltage



Short Circuit Current vs. Input Voltage

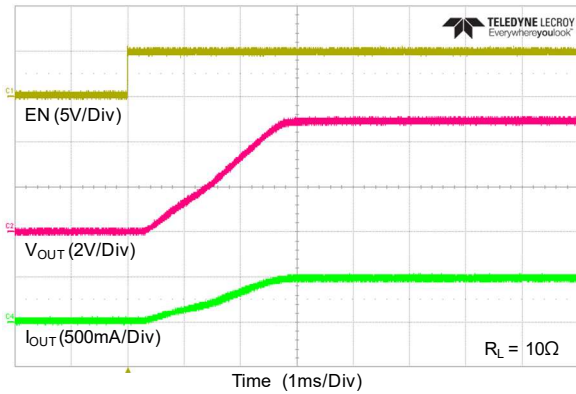


Overcurrent Protection Characteristics

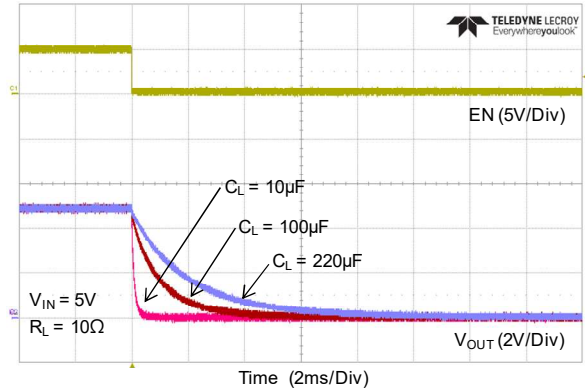


Typical Performance Characteristics (continued)

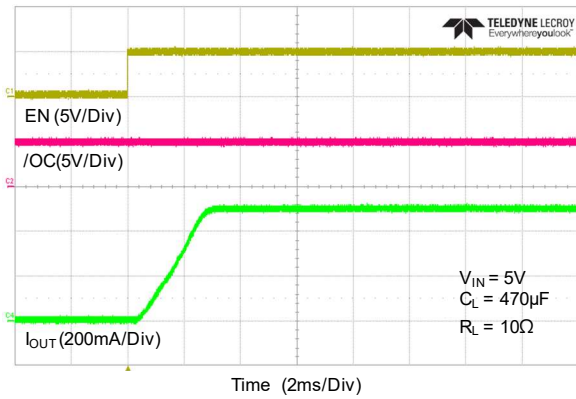
Turn on Delay Time and Rise Time



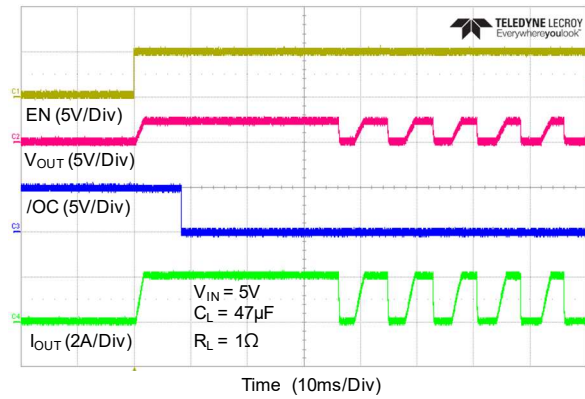
Turn off Delay Time and Fall Time



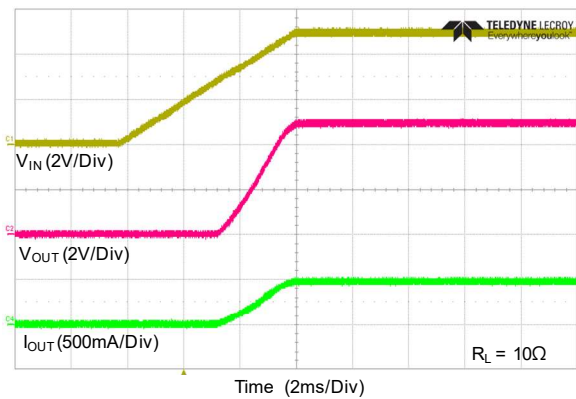
Inrush Current with Load Capacitance



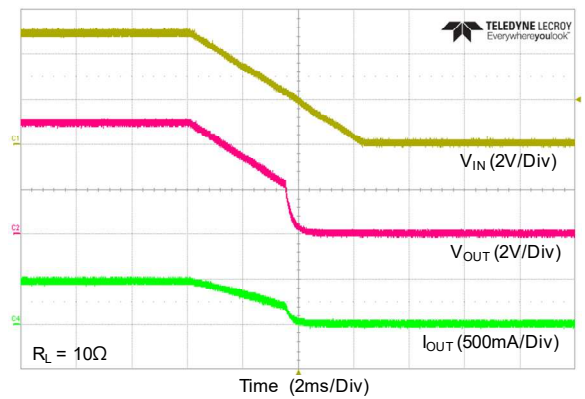
Thermal Shutdown Response



UVLO Protection at Rising

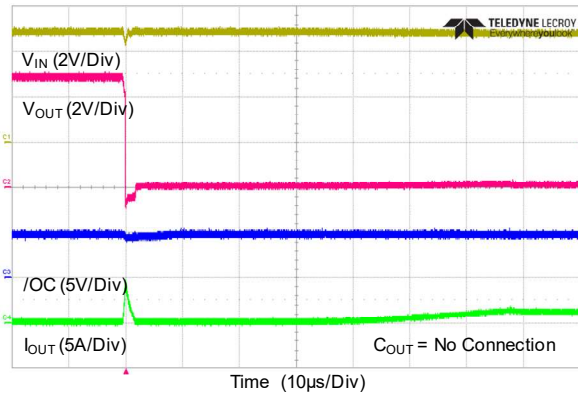


UVLO Protection at Falling

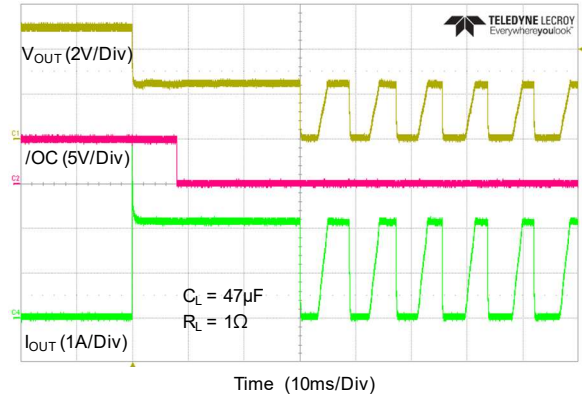


Typical Performance Characteristics (continued)

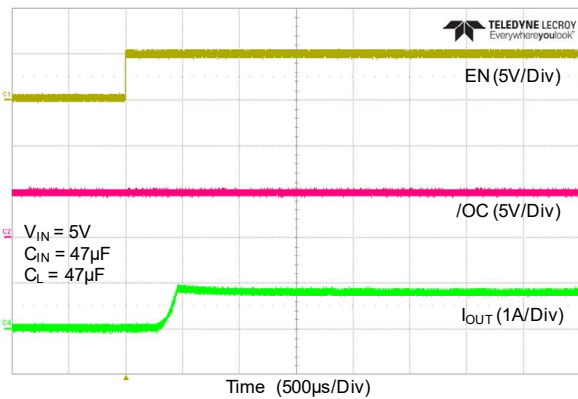
Inrush Short Circuit Response



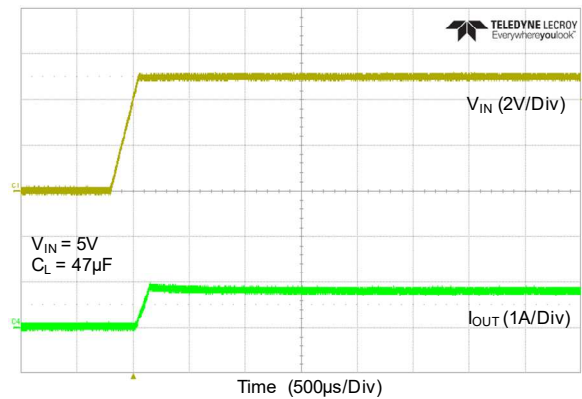
Resistance Load Inrush Response



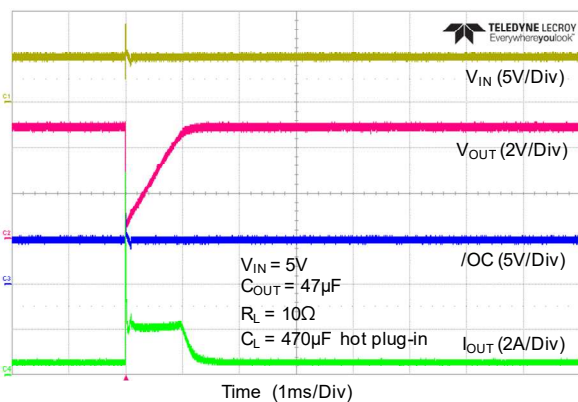
Short-Circuit Current, Device Enable into Short



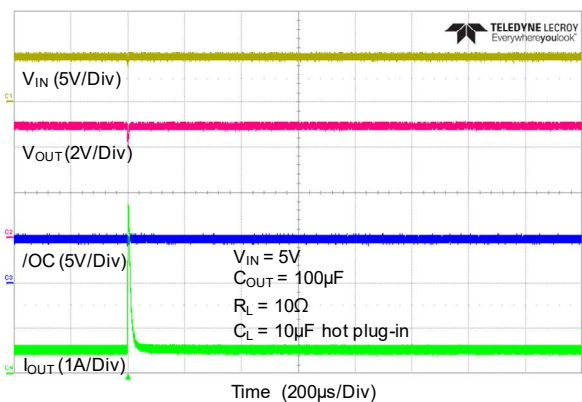
Short Circuit Response at Start up



Capacitance Load Inrush Response

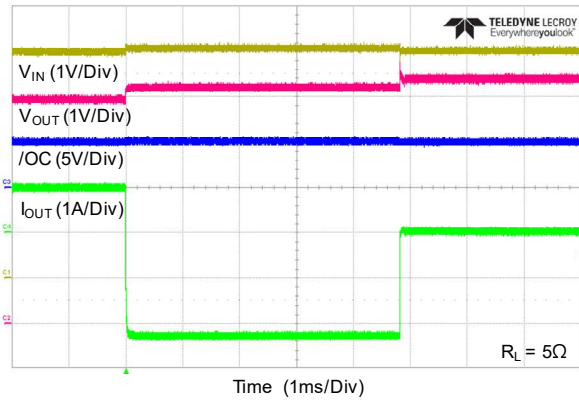


Capacitance Load Inrush Response

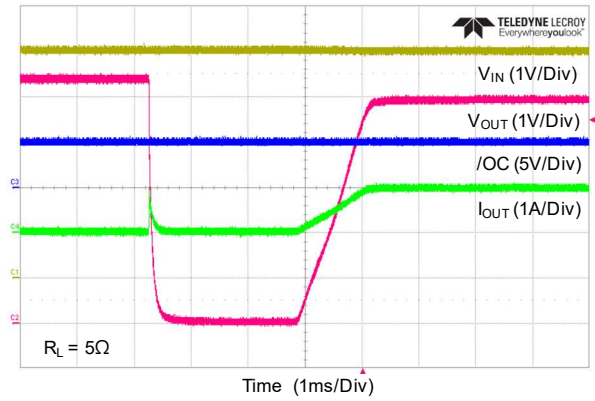


Typical Performance Characteristics (continued)

Reverse Current Protection



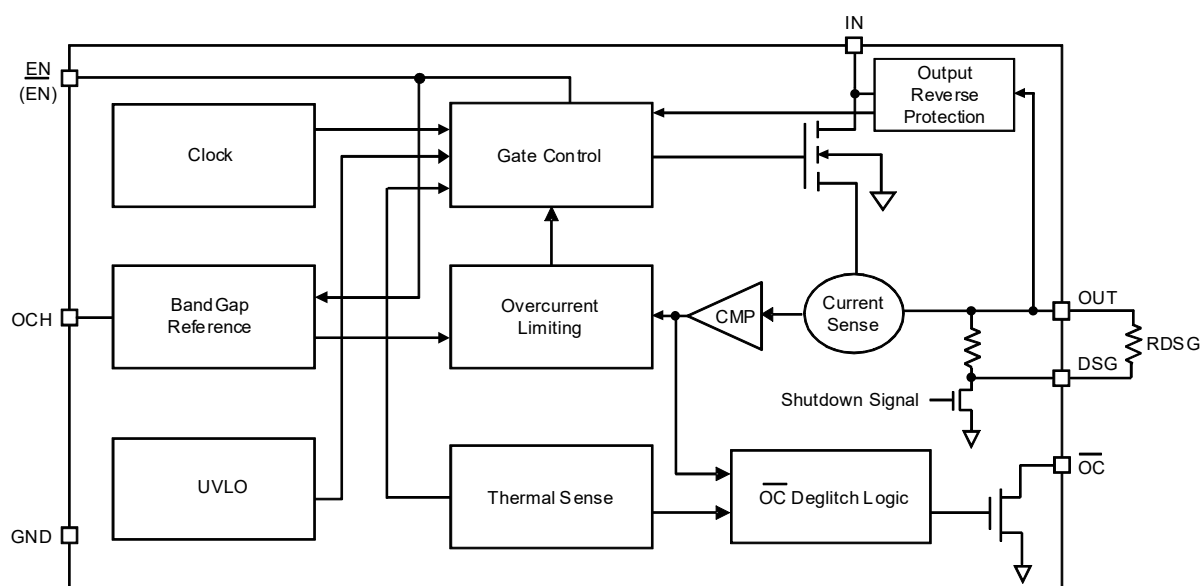
Reverse Current Recovery



Pin Description

PIN						NAME	PIN FUNCTION
SOT-23-5 G509xxxDT11G/ G509xxxNT11G	TSOT-23-6 G509xxxDTP1G/ G509xxxNTP1G	SOT-23-5 G509x25RT11G	SOT-23-6 G509xxSDTB1G	SOT-23-3 G509N02DT73G	MSOP-8 G509x30DP81U		
1	4,5	1	1	2	6,7,8	OUT	Switch Output: Output MOSFET Source of Switch. Typically connect to switched side of load.
2	2	2	2	1	1	GND	Ground
3	6	---	3	---	5	$\overline{\text{OC}}$	Over-Current: Open-Drain $\overline{\text{OC}}$ Output.
4	1	3	4	---	4	EN($\overline{\text{EN}}$)	Enable: Logic Level Enable Input. Make sure EN pin never floating.
5	3	5	6	3	2,3	IN	Input Supply: Output MOSFET Drain, which also supplies IC's internal circuit. Connect to positive supply.
---	---	4	---	---	---	DSG	External resistor utilized to set output discharge current
---	---	---	5	---	---	OCH	OC Select: Large OC if connected to IN or floating. Small OC if connected to GND.

Block Diagram



* Output Shutdown Pull low Resistor is available in G509xxxDT11G/G509N02DT73G

* DSG is available in G509x25RT11G Pulllow Resistor is removed

* OCH is available in G509xxSDTB1G

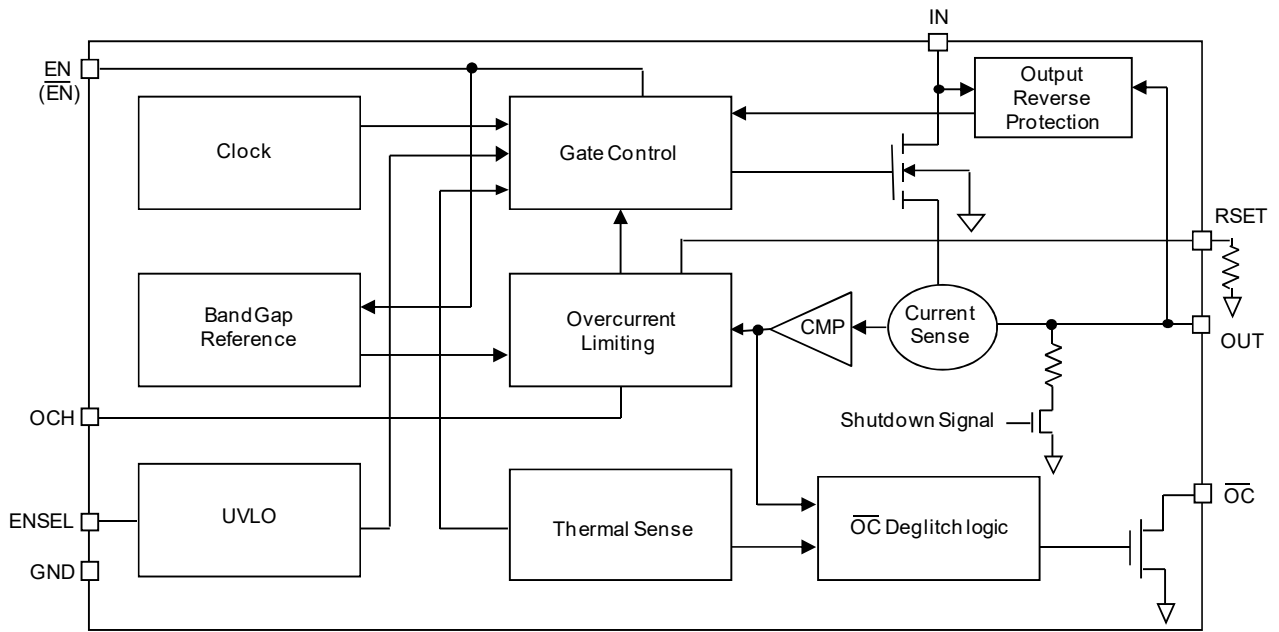
Pin Description (Flip-chip package)
TSOT-23-5 FC/TSOT-23-6 FC

PIN				NAME	PIN FUNCTION
TSOT-23-5 FC G509x30xTO1G	TSOT-23-6 FC G509x3ADTP1G	TSOT-23-6 FC G509x3SDTP1G	TSOT-23-6 FC G509S30DTP1G		
1	1	1	1	OUT	Switch Output: Output MOSFET Source of Switch. Typically connect to switched side of load.
2	2	2	2	GND	Ground
3	3	3	3	$\overline{OC}$	Over-Current: Open-Drain $\overline{OC}$ Output.
4	4	4	4	EN($\overline{EN}$)	Enable: Logic Level Enable Input. Make sure EN pin never floating.
5	6	6	6	IN	Input Supply: Output MOSFET Drain, which also supplies IC's internal circuit. Connect to positive supply.
---	---	---	5	ENSEL	EN Select: Enable active high if connect to IN or floating. Enable active low if connect to GND. The threshold of EN Select is about half IN.
---	5	---	---	RSET	Current limit programming pin. Connect a resistor R_{SET} from this pin to GND to program the current limit: $I_{OC} (A) = 6800/R_{SET} (\Omega)$
---	---	5	---	OCH	OC Select: Large OC if connected to IN or floating. Small OC if connected to GND.

SOT-563 FC

PIN				NAME	PIN FUNCTION
SOT-563 FC G509x3ADTR1G	SOT-563 FC G509x3SDTR1G	SOT-563 FC G509S30DTR1G	SOT-563 FC G509x30DTR1G		
3	3	3	3	OUT	Switch Output: Output MOSFET Source of Switch. Typically connect to switched side of load.
2	2	2	2	GND	Ground
1	1	1	1	$\overline{OC}$	Over-Current: Open-Drain $\overline{OC}$ Output.
6	6	6	6	EN($\overline{EN}$)	Enable: Logic Level Enable Input. Make sure EN pin never floating.
4	4	4	4	IN	Input Supply: Output MOSFET Drain, which also supplies IC's internal circuit. Connect to positive supply.
---	---	5	---	ENSEL	EN Select: Enable active high if connect to IN or floating. Enable active low if connect to GND. The threshold of EN Select is about half IN.
5	---	---	---	RSET	Current limit programming pin. Connect a resistor R_{SET} from this pin to GND to program the current limit: $I_{OC} (A) = 6800/R_{SET} (\Omega)$
---	5	---	---	OCH	OC Select: Large OC if connected to IN or floating. Small OC if connected to GND.
---	---	---	5	NC	No Connect

Block Diagram (Flip-chip package)



*OCH is available in G509x3SDxx1G
 *RSET is available in G509x3ADxx1G
 *ENSEL is available in G509S30Dxx1G

Functional Description

Input and Output

IN (input) is the power supply connection to the logic circuitry and the drain of the output MOSFET. OUT (output) is the source of the output MOSFET. In a typical application, current flows through the switch from IN to OUT toward the load. OUT pin must be connected to load.

Thermal Shutdown

Thermal shutdown protects G509 from excessive power dissipation. If the die temperature exceeds 140°C, the MOSFETS switch is shut off. 20°C of hysteresis prevents the switch from turning on until the die temperature drops to 120°C. Thermal shutdown circuit functions only when the switch is enabled.

Under Voltage Lockout

UVLO (under voltage lockout) prevents the output MOSFET from turning on until IN (input voltage) exceeds 2.4V typically. After the switch turns on, if the voltage drops below 2.2V typically, UVLO shuts off the output MOSFET.

Over Current Trigger Point

The typical over current trigger point of G509 is 3.4A, 3.2A, 2.5A, 1.3A, 0.8A, 0.4A. G509x3ADxx1G supports current limit programming, connecting a resistor R_{SET} from RSET pin to GND in order to program the current limit: $I_{OC} (A) = 6.8 / R_{SET} (K\Omega)$. The minimum current limit is 0.4A. Current limit beyond 4A is not recommended. There is a fold-back current limit when $V_{IN} > 3.5V$ and $V_{OUT} < 1V$. (See Typical Performance Characteristics)

Table 1. Current Limit RSET Value for G509x3A

$R_{SET} (K\Omega)$	Current Limit (A)
2.0	3.4
3.6	1.9
6.8	1.0
10	0.68

Note: The Relationship between $R_{SET} (K\Omega)$ and Typical Current Limit (A) is about Current Limit = $6.8 / R_{SET}$.

Output Reverse Protection

The output reverse protection turns off the MOSFET switch whenever the reverse output current is higher than 500mA (typ) for 5ms / 1.25ms (typ) and the MOSFET switch turns on 5ms / 1.25ms (typ) after the output reverse protection is successfully released.

OC Function

The $\overline{OC}$ open-drain output is asserted (active low) when an over current condition is encountered after a 9-ms deglitch timeout. The output remains asserted until the over current condition is removed. Over temperature condition is also reported immediately by $\overline{OC}$ open-drain output.

Applications Information

Supply Filtering

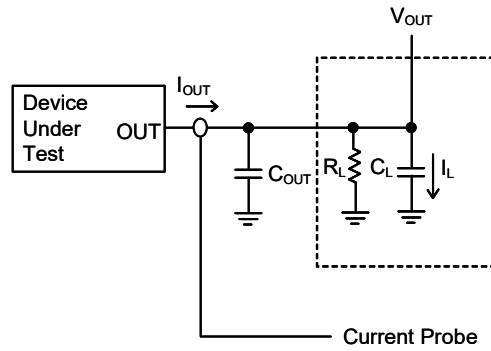
A 1 μ F bypass capacitor from IN to GND, located near the G509, is strongly recommended to control supply transients. Without a bypass capacitor, an output short may cause sufficient ringing on the input (from supply lead inductance) to damage internal control circuitry.

Input transients must not exceed the absolute maximum supply voltage ($V_{IN\ max} = 6V$) even for a short duration.

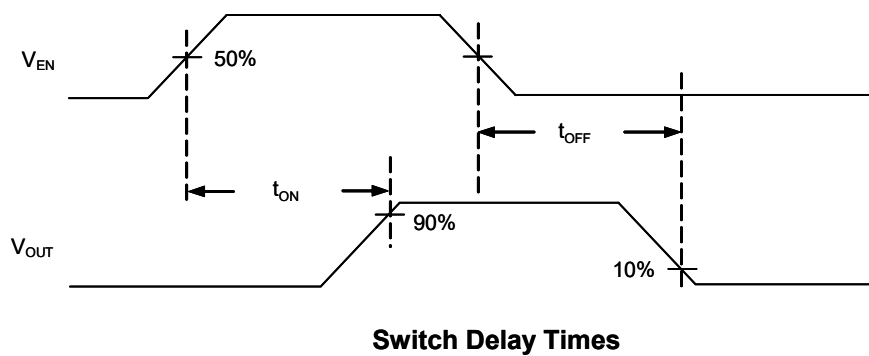
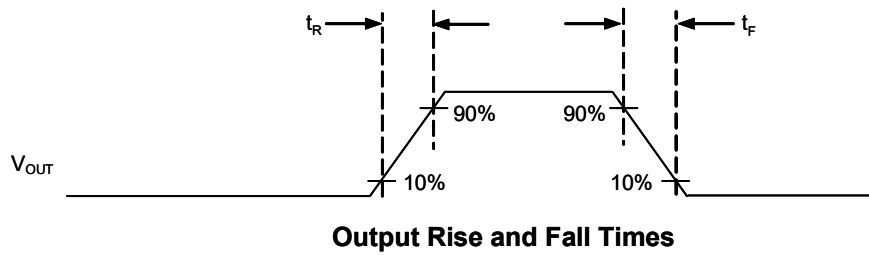
EN, the Enable Input

EN must be driven logic high or logic low for a clearly defined input. Floating the input may cause unpredictable operation. EN should not be allowed to go negative with respect to GND.

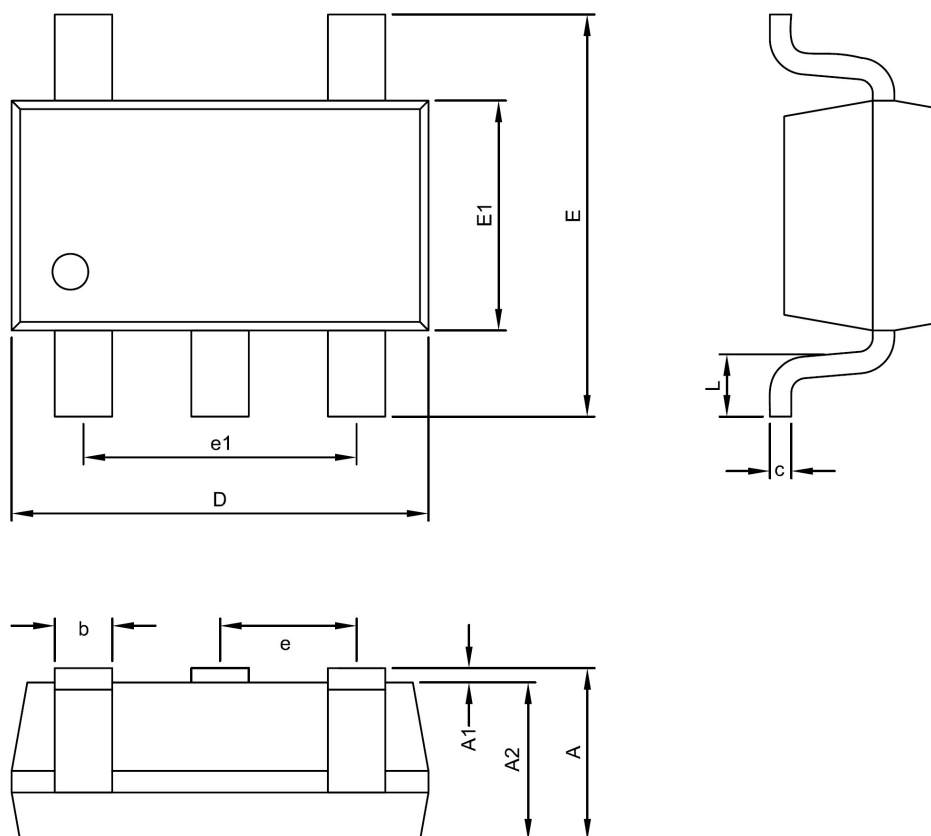
Test Circuit



Timing Diagrams



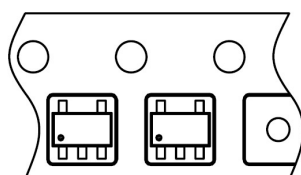
Package Information



SOT-23-5 Package

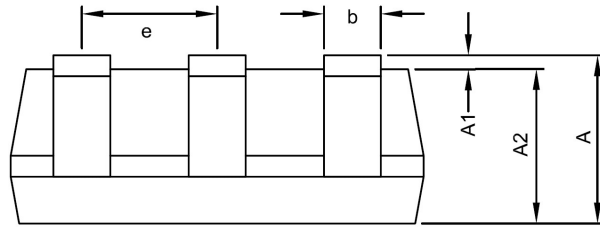
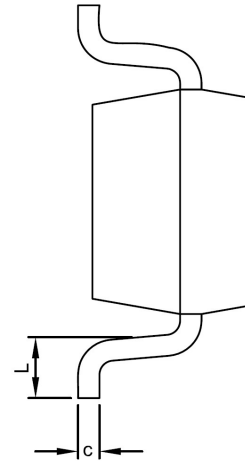
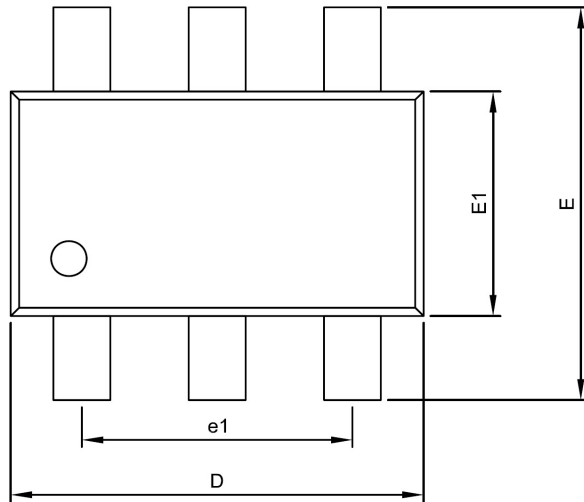
Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.10	1.45	0.037	0.043	0.057
A1	0.00	---	0.15	0.000	---	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



Feed Direction

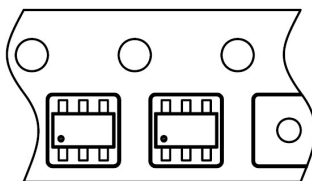
PACKAGE	Q'TY/REEL
SOT-23-5	3,000 ea



SOT-23-6 Package

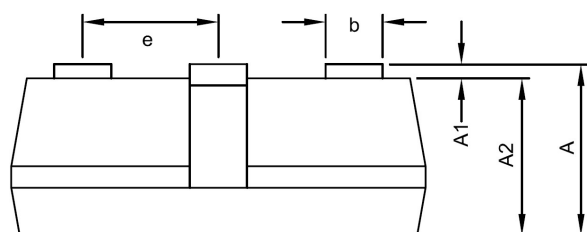
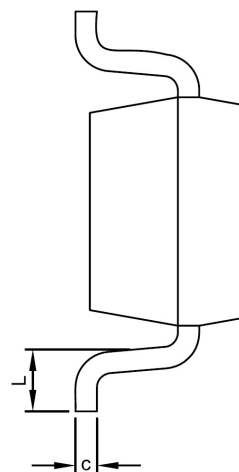
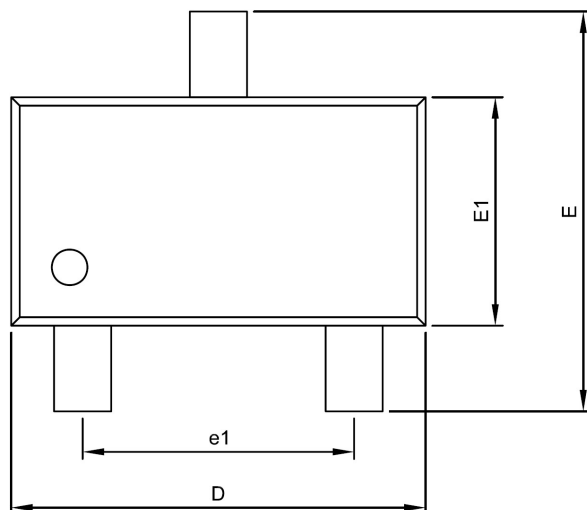
Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.10	1.45	0.037	0.043	0.057
A1	0.00	---	0.15	0.000	---	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



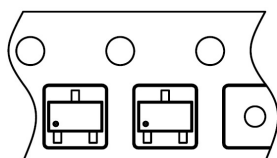
Feed Direction

PACKAGE	Q'TY/REEL
SOT-23-6	3,000 ea


SOT-23-3 Package

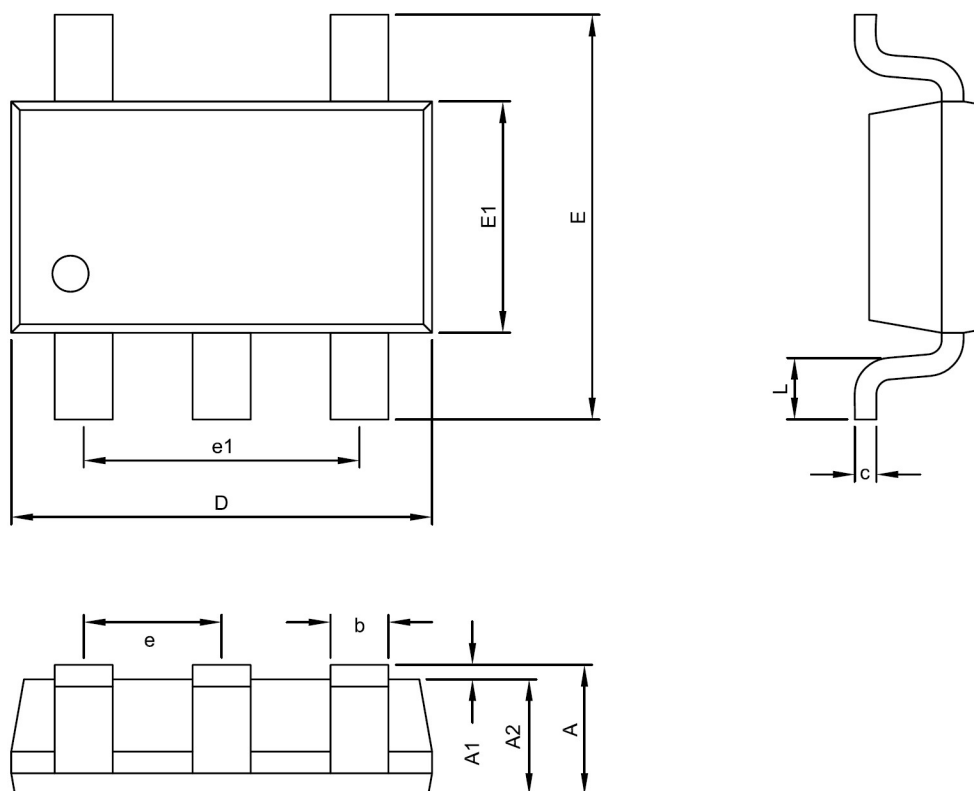
Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.10	1.45	0.037	0.043	0.057
A1	0.00	---	0.15	0.000	---	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



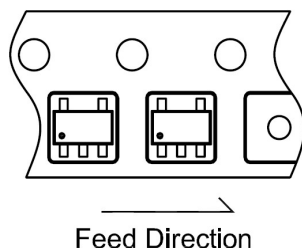
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Feed Direction

PACKAGE	Q'TY/REEL
SOT-23-3	3,000 ea

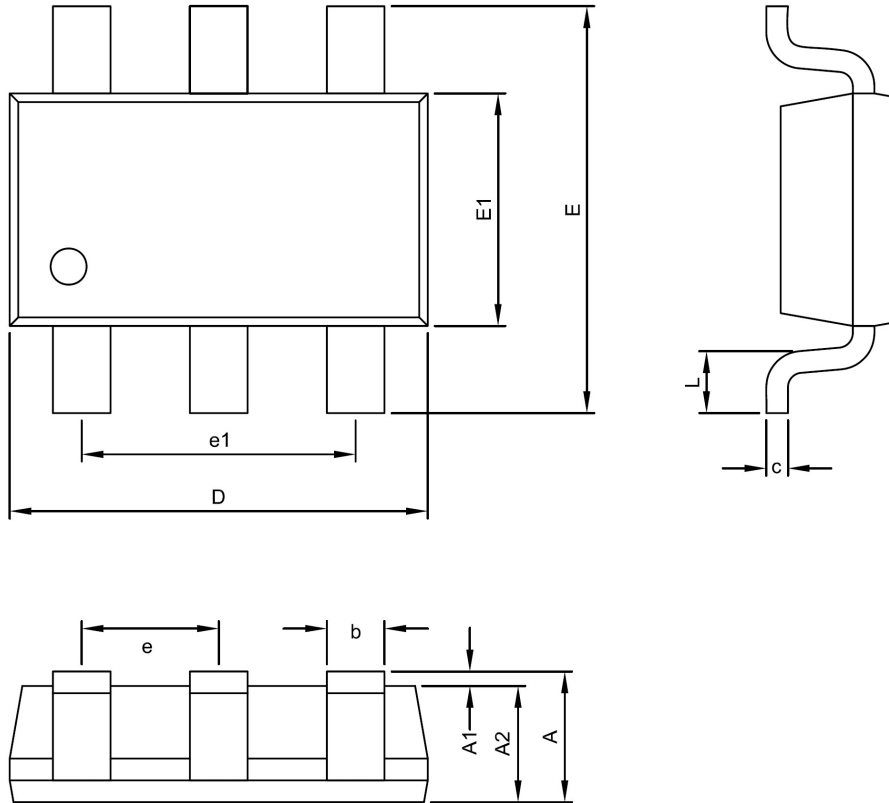

TSOT-23-5 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	---	---	0.90	---	---	0.035
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2	0.70	0.75	0.80	0.028	0.030	0.031
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.15 REF			0.006 REF		
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



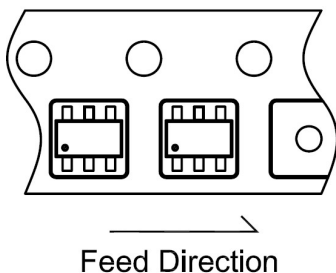
PACKAGE	Q'TY/REEL
TSOT-23-5	3,000 ea



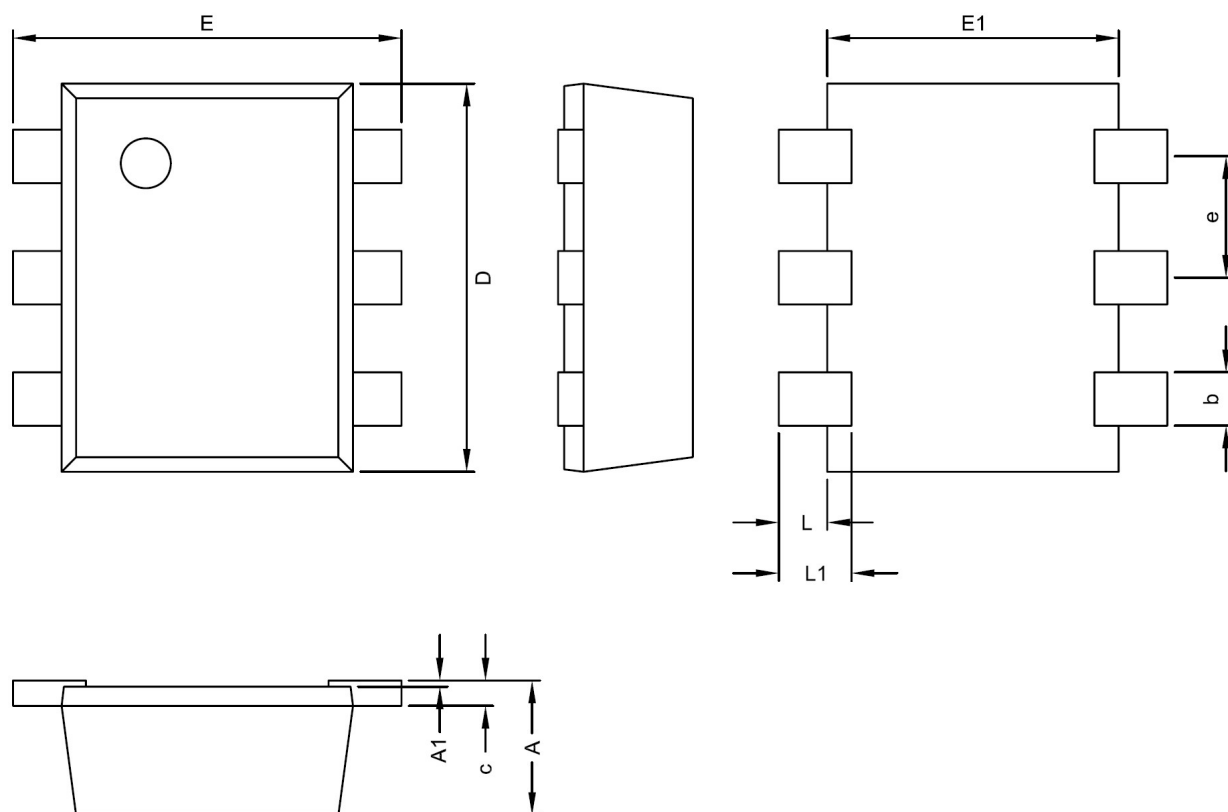
TSOT-23-6 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	---	---	0.90	---	---	0.035
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2	0.70	0.75	0.80	0.028	0.030	0.031
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.15 REF			0.006 REF		
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



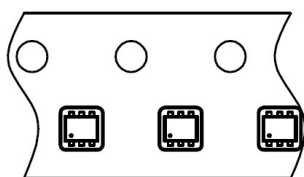
PACKAGE	Q'TY/REEL
TSOT-23-6	3,000 ea



SOT-563 Package

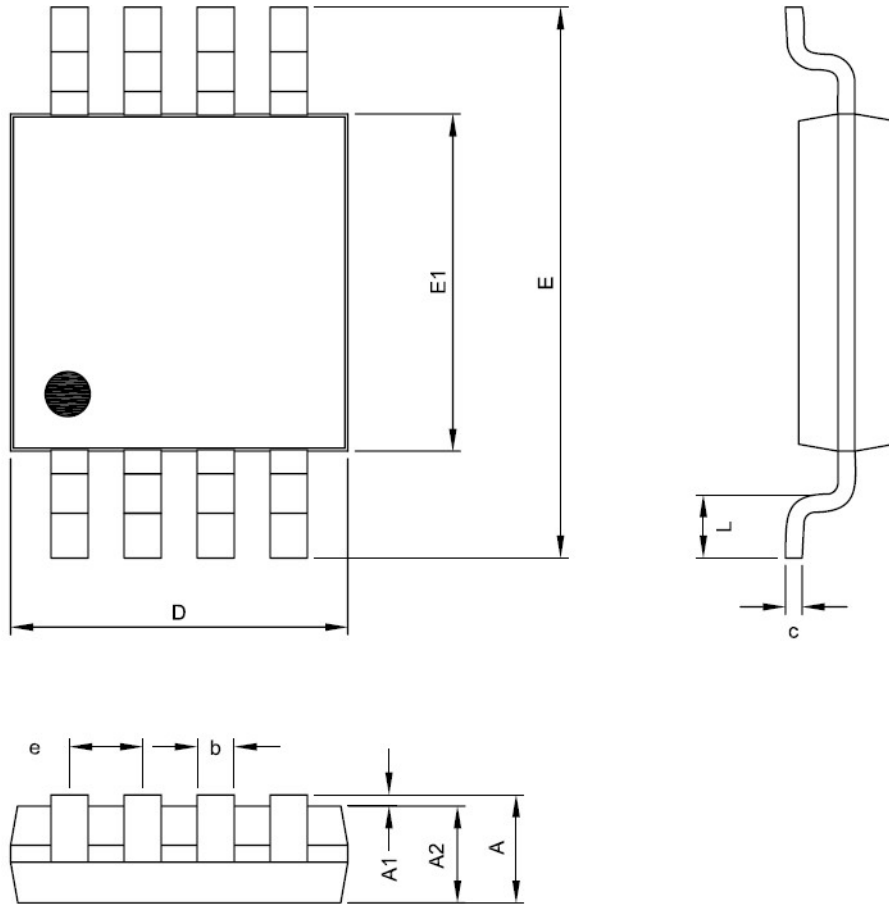
Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.525	---	0.600	0.021	---	0.024
A1	0.00	---	0.05	0.000	---	0.002
e	0.500 BSC			0.0197 BSC		
c	0.090	---	0.180	0.004	---	0.007
D	1.500	1.600	1.700	0.059	0.063	0.067
b	0.170	0.220	0.270	0.007	0.009	0.011
E1	1.100	1.200	1.300	0.043	0.047	0.051
E	1.500	1.600	1.700	0.059	0.063	0.067
L	0.100	0.200	0.300	0.004	0.008	0.012
L1	0.200	0.300	0.400	0.008	0.012	0.016

Taping Specification



Feed Direction

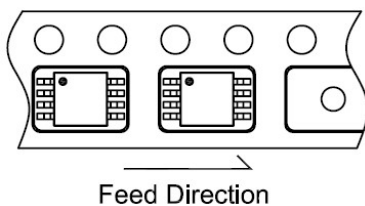
PACKAGE	Q'TY/REEL
SOT-563	3,000 ea



MSOP-8 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.81	0.95	1.10	0.032	0.037	0.043
A1	0.00	---	0.15	0.000	---	0.006
A2	0.75	0.86	0.96	0.030	0.034	0.038
D	2.85	3.00	3.15	0.112	0.118	0.124
E	4.75	4.90	5.05	0.187	0.193	0.199
E1	2.85	3.00	3.15	0.112	0.118	0.124
b	0.22	0.30	0.38	0.009	0.012	0.015
c	0.15 REF			0.006 REF		
e	0.65 BSC			0.026 BSC		
L	0.4	0.53	0.8	0.016	0.021	0.031

Taping Specification



PACKAGE	Q'TY/REEL
MSOP-8	3,000 ea