SUL6001 Low Noise High PSRR 1 Ch 500mA/1A Ultra Low Dropout LDO

FUNCTIONAL DESCRIPTION

The SUL6001 series is a CMOS-based positive low-dropout linear regulator (LDO) featuring 500 mA/ 1.0A that provides high PSRR, high output voltage accuracy, low-noise and low supply current.

It consists of a voltage reference, an error amplifier, a resistor-ladder for output voltage setting. It also has under-voltage lockout (UVLO), over current/short circuit protection circuit and over temperature shutdown circuit.

The SUL6001 typically has 85mV dropout voltage (DFN1216-8, Iout=1A, Vout=3.3V) and 140mA dropout voltage (DFN1216-8, Iout=1A, Vout=1.8V) and chip enable function (EN) for long battery life.

Excellent ripple rejection, load transient and line transient response make it ideal for the power sources of mobile communication devices or camera modules in low light condition. It can also turn on under full load condition, making it suitable for harsh system environment.

The SUL6001 series LDOs have option for output current limit between 1.0A or 500mA by alternating the LCON pin between “H” or “L” for DFN1216-8 package version.

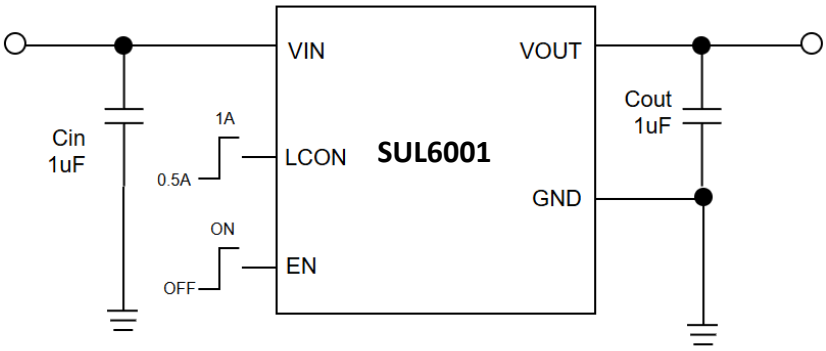
FEATURES

- Supply Current (no load): 85μA (typ.)
- Supply Current (Standby): 0.1μA (typ.)
- Low Dropout Voltage: 85mV @1A,
  50mV @500mA, when Vout=3.3V
- High-PSRR: 85dB @1kHz
- Ultra Low Output Noise: 10μVrms
  (10-100KHz, 0.85V output voltage settings, typ.)
- Line Regulation: 0.01%/V
- Fixed Mode Voltage Range: 0.85V to 4.3V with 0.05V step.
- Adjustable Mode Voltage Range: 0.85V to 4.3V.
- Built-in Short Current Protection Limit: 120mA (LCON=’H’, 1.0A, typ.)
- Bulit-in Peak Current Protection Limit: 1.7A (LCON=’H’, 1.0A, typ.)
- Over Temperature Protection and Auto Recover
- Built-in Soft-Start and Inrush Current Limit
- Fast Auto Discharge Function for Power Down

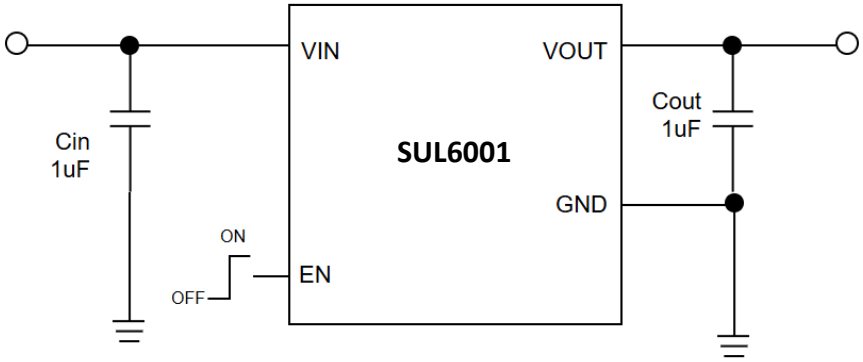
APPLICATIONS

- Portable Device , Tablets and Smartphone
- Cameras, VCRs and Car Dash Cameras
- Low Light & Low Noise Cam Application
- Communications and Infrastructure
- AR or VR Application
- DDR Application

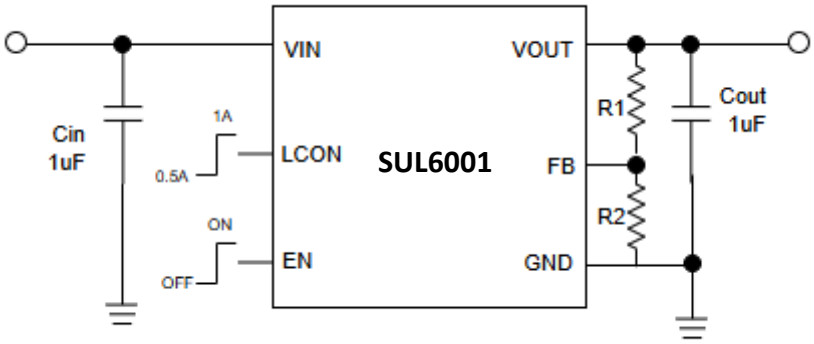
TYPICAL APPLICATION CIRCUITS



DFN1216-8 package fixed version

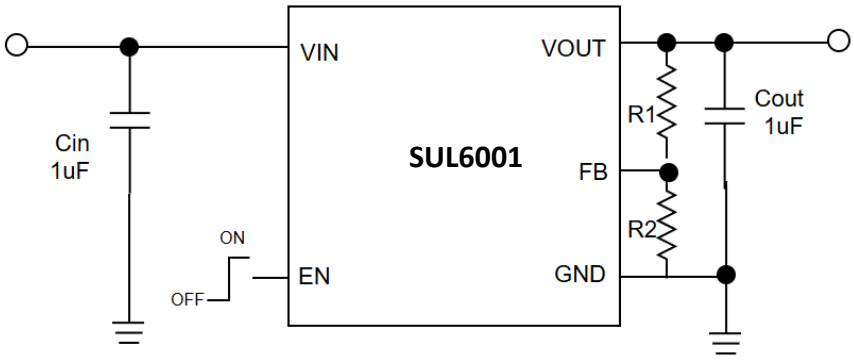


SOT23-5 / DFN2x2-6 / DFN3x3-8 package fixed version



DFN1216-8 package adjustable version

TYPICAL APPLICATION CIRCUITS (Continued)



SOT23-5 / DFN2x2-6 / DFN3x3-8 package adjustbale version

The adjustable-version device requires external feedback divider resistors to set the output voltage. V_{OUT} is set using the feedback divider resistors, R1 and R2 , according to the following equation:

$$V_{OUT} = V_{FB} \times (1 + R1 / R2)$$

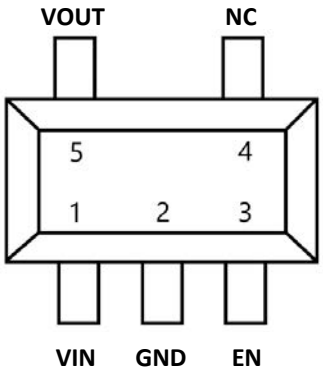
For this device, V_{FB} = 0.85V.

To ignore the FB pin current error term in the VOUT equation, set the feedback divider current to 100x the FB pin current listed in the Electrical Characteristics table. This setting provides the maximum feedback divider series resistance, as shown in the following equation:

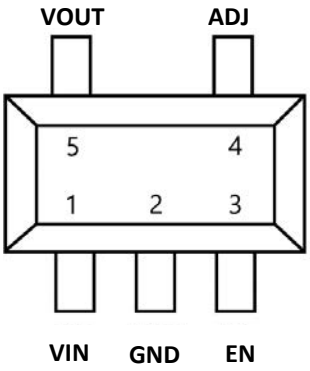
$$R1 + R2 \leq V_{OUT} / (I_{FB} \times 100)$$

For this device, I_{FB} = 10nA.

PIN CONFIGURATION



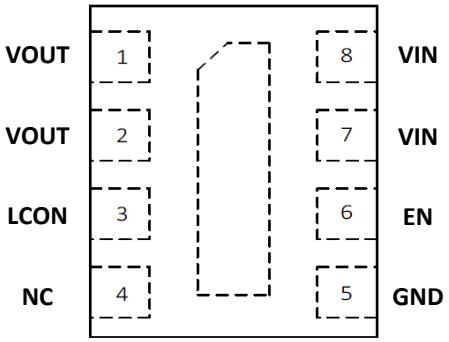
SOT23-5 (Fixed Mode)



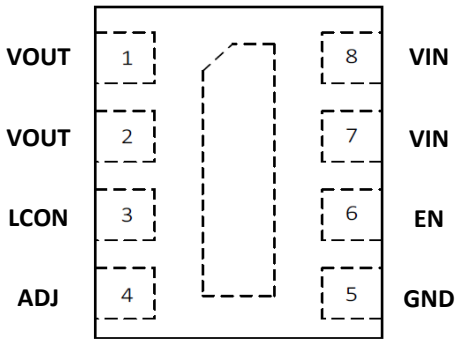
SOT23-5 (Adjustable Mode)

PIN No	Symbol	Pin Description
1	VIN	Input of supply voltage pin
2	GND	Ground pin
3	EN	Enable pin, active high
4	NC/ADJ	No connection / Adjustable output pin
5	VOUT	LDO output voltage pin

Note: It is not recommended to use the 1A version of the SOT-23-5 package.



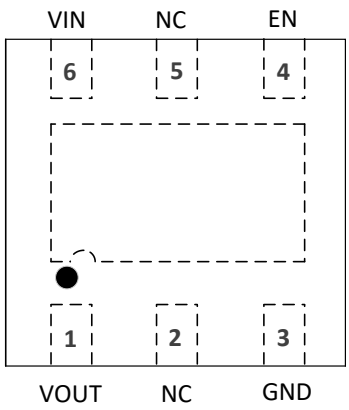
DFN1216-8 (Fixed Mode)



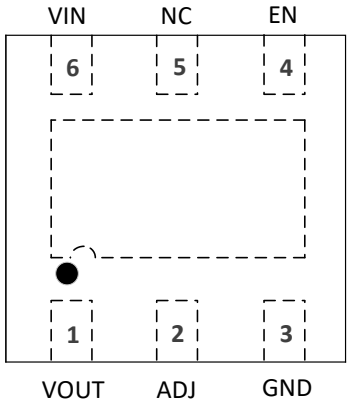
DFN1216-8 (Adjustable Mode)

PIN No	Symbol	Pin Description
1	VOUT	LDO output voltage pin
2	VOUT	LDO output voltage pin
3	LCON	Output current limit alternate pin
4	NC/ADJ	No connection / Adjustable output pin
5	GND	Ground pin
6	EN	Enable pin, active high
7	VIN	Input of supply voltage
8	VIN	Input of supply voltage

PIN CONFIGURATION (Continued)

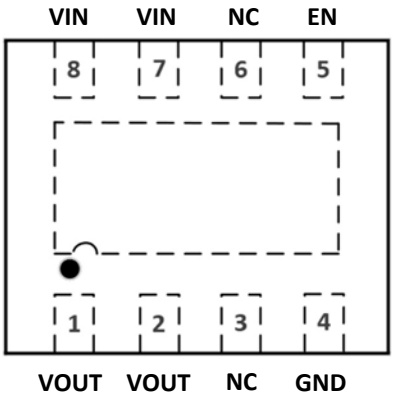


DFN2x2-6 (Fixed Mode)

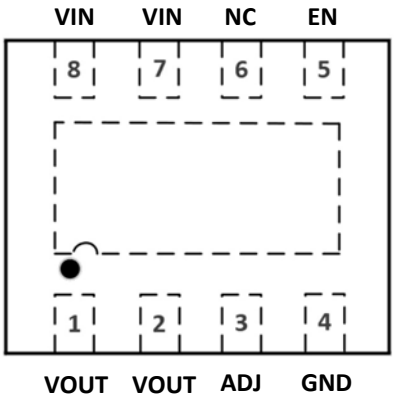


DFN2x2-6 (Adjustable Mode)

PIN No	Symbol	Pin Description
1	VOUT	LDO output voltage pin
2	NC/ADJ	No connection / Adjustable output pin
3	GND	Ground pin
4	EN	Enable pin, active high
5	NC	No connection
6	VIN	Input of supply voltage



DFN3x3-8 (Fixed Mode)



DFN3x3-8 (Adjustable Mode)

PIN No	Symbol	Pin Description
1	VOUT	LDO output voltage pin
2	VOUT	LDO output voltage pin
3	NC/ADJ	No connection / Adjustable output pin
4	GND	Ground pin
5	EN	Enable pin, active high
6	NC	No connection
7	VIN	Input of supply voltage
8	VIN	Input of supply voltage

Note: Connect exposed pad (heat sink on the back) to GND.

ORDERING INFORMATION

Part Number	Package	Tape/Reel
SUL6001S5-XX	SOT23-5	3000
SUL6001D6-XX	DFN2x2-6	3000
SUL6001-DRB	DFN3x3-8	5000
SUL6001D8-XX	DFN1216-8	3000

Note:

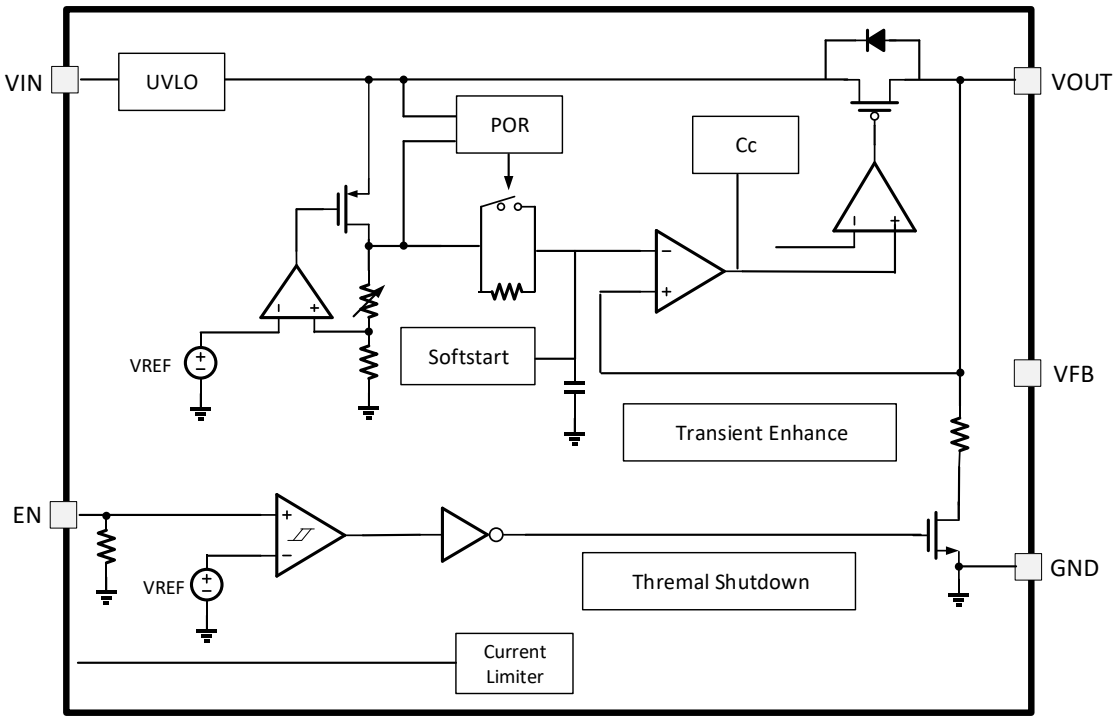
(1)"XX" Indicates output voltage. For example, 28 means product outputs 2.8V, ADJ means adjustable output voltage.

(2)SUL6001-DRB is for adjustable output voltage.

SUL6001 devices are Pb-free and RoHS compliant.

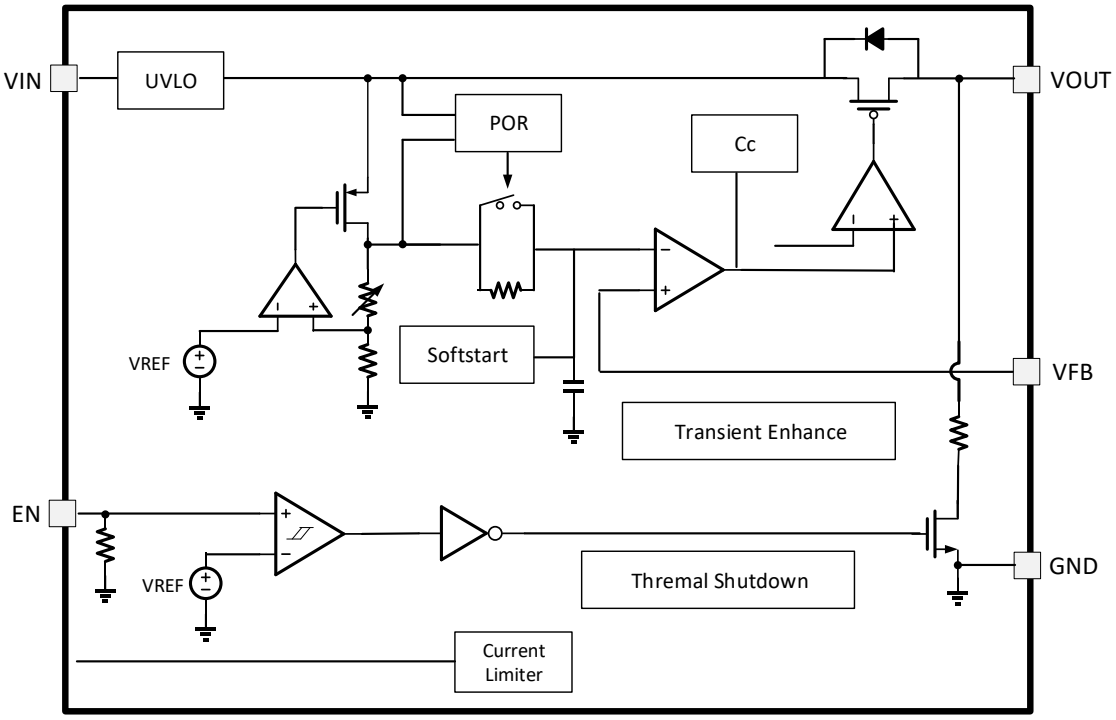
BLOCK DIAGRAMS

SOT-23-5 Fixed Mode

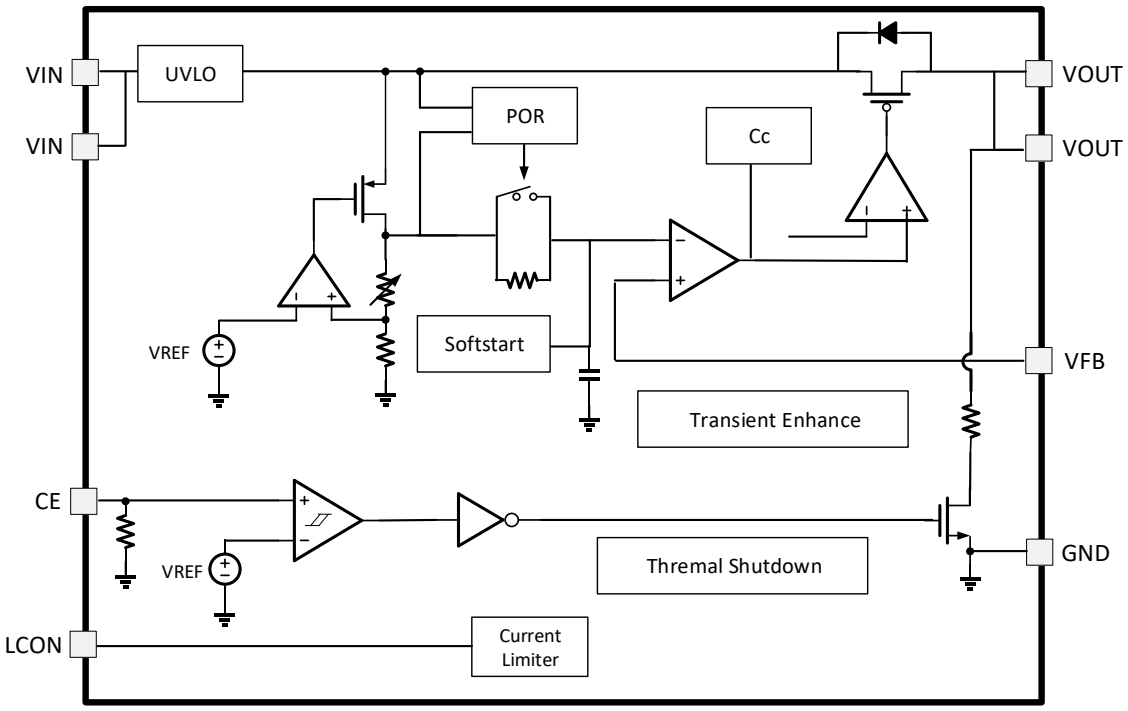


BLOCK DIAGRAMS (Continued)

SOT-23-5 ADJ Mode



DFN1216-8 (8 PIN)



ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating		Unit
V_{IN}	Input Voltage	6.0		V
V_{CE}	Input Voltage (CE Pin)	-0.3 to 6.0		V
V_{LCON}	Input Voltage (LCON Pin)	-0.3 to 6.0		V
V_{OUT}	Output Voltage	-0.3 to 6.0		V
P_D	Power Dissipation (Standard Land Pattern)	SOT23-5	500	mW
		DFN2x2-6	1100	
		DFN3X3-8	1400	
		DFN1216-8	900	
T_{OP}	Junction Temperature Range	−40 to 125		℃
T_{STG}	Storage Temperature Range	−55 to 125		℃

ESD RATINGS

Symbol	Parameter	Value	Unit
ESD	Human Body Mode	± 4	kV
	Machine Mode	± 250	V
	Charge Device Mode	± 1000	V

RECOMMENDED OPERATING CONDITIONS

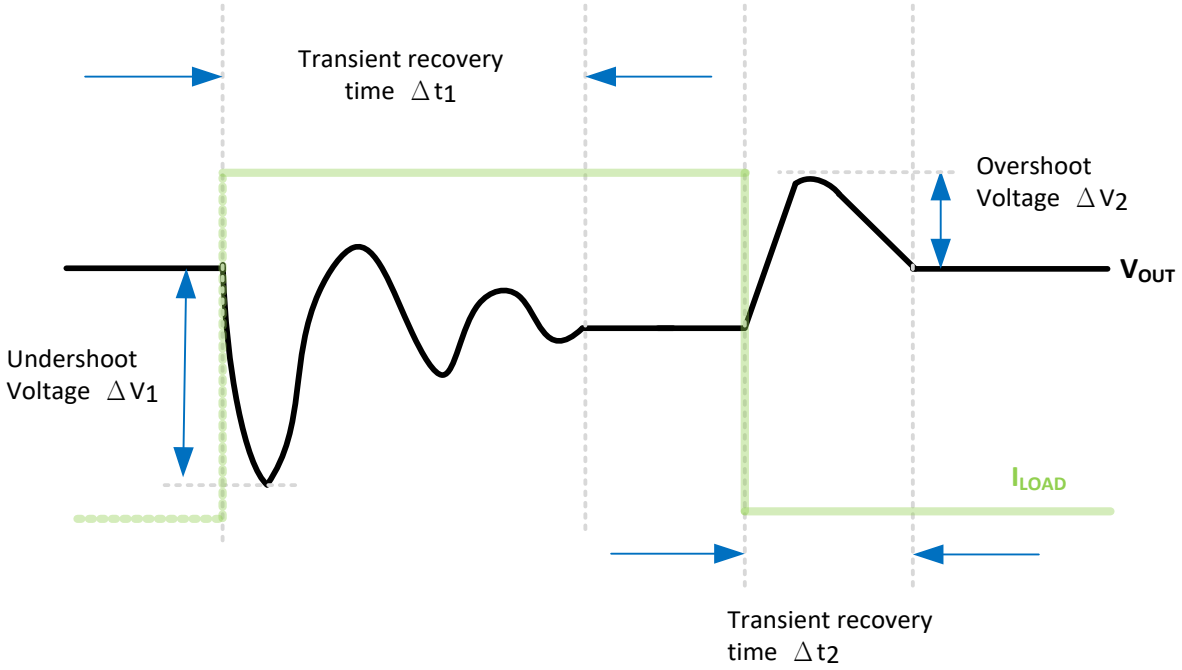
Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	1.32 to 5.5	V
V_{OUT}	Output Voltage	0.85 to 4.3	V
T_A	Operating Temperature Range	-40 to 85	℃
C_{IN}/C_{OUT}	Input/Output Capacitance	1/1	uF

ELECTRICAL CHARACTERISTICS

V_{IN} = V_{OUT} + 1.0V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0µF, typical values are at T_A = 25 °C, unless otherwise noted.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage			1.32		5.50	V
V_{OUT}	V_{OUT} accuracy	V_{OUT}+0.5V ≤ V_{IN} ≤ 5.5V	V_{OUT} ≥ 1.75V	-1.0		+1.0	%
			V_{OUT} ＜ 1.75V	-20		+20	mV
V_{FB}	V_{FB} accuracy	V_{IN} = 2.0V, I_{LOAD} = 1mA		0.8415	0.85	0.8585	V
ΔV_{OUT}	Static line regulation				0.01		%/V
ΔV_{OUT}	Static load regulation	I_{OUT} = 10mA to 500mA			1	2л	mV
		I_{OUT} = 10mA to 1000mA				40	
V_{DROP}	Dropout voltage	I_{OUT} = 1A	V_{OUT}=1.2V		245	340	mV
			V_{OUT}=1.8V		140	235	
			V_{OUT}=2.5V		105	175	
			V_{OUT}=3.3V		85	150	
			V_{OUT}=4.3V		60	130	
		I_{OUT} = 500mA For SOT-23-5	V_{OUT}=1.2V		150	210	
			V_{OUT}=1.8V		80	135	
			V_{OUT}=2.5V		60	100	
			V_{OUT}=3.3V		p0	105	
			V_{OUT}=4.3V		п0	85	
I_Q	Quiescent current	IOUT = 0mA			y5	1п0	µA
$I_{Standby}$	Standby current	VIN input current in OFF MODE: VEN = GND			0.1	3	µA
I_{LIM}	Output current limit	I_{OUT} = 500mA		0.6	0.78		A
		I_{OUT} = 1A			1.7		
I_{SC}	Short-circuit current	V_{OUT} = 0 V	I_{OUT} = 500mA			186	mA
			I_{OUT} = 1A			150	
I_{FB}	Feedback pin current				0.01	0.1	µA
e_N	Output noise voltage				1л		µVrms
PSRR	Power Supply Rejection Ratio	V_{IN}=3.3V, V_{OUT}=1.8V, I_{OUT}=60mA, C_{OUT}=1uF, f=1KHz			8p		dB
T_{TSD}	Thermal shutdown	Shutdown, temperature increasing			165		°C
		Reset, temperature decreasing			135		
CE	Enable input logic low	V_{IN} = 1.32 V to 5.5 V				0.4	V
	Enable input logic high	V_{IN} = 1.32 V to 5.5 V		1			
LCON	LCON input logic low	V_{IN} = 1.32 V to 5.5 V				0.4	V
	LCON input logic high	V_{IN} = 1.32 V to 5.5 V		1			

Load Regulation (Dynamic)



Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
ΔV_1	Undershoot Voltage	I_{LOAD}=1mA~250mA		30		mV
		I_{LOAD}=1mA~500mA		40		
		I_{LOAD}=1mA~1A		62		
		I_{LOAD}=0mA~300mA		50		
		I_{LOAD}=0mA~1A		90		
ΔV_2	Overshoot Voltage	I_{LOAD}=1mA~250mA		28		mV
		I_{LOAD}=1mA~500mA		40		
		I_{LOAD}=1mA~1A		60		
		I_{LOAD}=0mA~300mA		35		
		I_{LOAD}=0mA~1A		65		

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
Δt_1	Transient recovery time	I_{LOAD}=1mA~250mA		10		µS
		I_{LOAD}=1mA~500mA		16		
		I_{LOAD}=1mA~1A		18		
		I_{LOAD}=0mA~300mA		60		
		I_{LOAD}=0mA~1A		80		
Δt_2	Transient recovery time	I_{LOAD}=1mA~250mA		12		µS
		I_{LOAD}=1mA~500mA		12		
		I_{LOAD}=1mA~1A		16		
		I_{LOAD}=0mA~300mA		90		
		I_{LOAD}=0mA~1A		300		

Note: This table is SUL6001D8-33 measurement data. For detail load regulation information about other SUL6001 series LDOs, please contact SUNTEK.

FUNCTIONS DESCRIPTION

Short-Circuit Protect and Current Limitation

The SUL6001 series LDOs can protect internal circuit under short-circuit condition on the output. When the load current increases above 1.7A, the current limit and current fold back mechanism starts to restrict the I_{LIM} value. If the load resistance decreases even more then the fold back, circuit starts limiting the current to 0.2 A when V_{OUT} = 0.

Over Temperature Protection and Auto Recover

In order to prevent over thermal condition from damaging the device, the SUL6001 series LDOs have internal thermal limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during over temperature condition.

Current Foldback

The current limiting / current fold back circuit plays an important role by controlling any excessive output current. The SUL6001 series LDOs provide a current fold back circuit that can detect accurately when an over-current condition occurs.

Fast Transient Response

In addition to the main feedback loop, the SUL6001 series LDOs contain a fast-transient loop that allows the LDO to respond faster to large-output transients. The SUL6001 series LDOs that contain this loop are better able to minimize the effects of a load transient even the output capacitance is small. The recommended output capacitance value is 1μF. It's small size greatly reduce the cost and save PCB area.

Ultra High PSRR and Extreme Low Noise

The SUL6001 series high-performance LDO regulators feature remarkable power supply rejection ratio characteristics (up to 104 dB at 10 kHz) and extreme-low noise operation (as low as 10μVRMS with A-wt) resulting in cleaner and stable output voltages. Our LDO is very suitable for ultra-sensitive loads like camera module and security monitor, especially in low light condition.

Start-Up at Full Load

The SUL6001 series LDOs can start-up at full load, make it very suitable for heavy load start up condition and severe system timing constraint.

Auto Discharge Function

The SUL6001 series LDOs have an auto discharge function to quickly force the output voltage to zero. When the LDO is disabled, the auto discharge function quickly discharge the output capacitor, thereby reducing the output voltage to nearly zero. This function is very useful for quickly ON/OFF application.

Low Quiescent Current

The SUL6001 series LDOs consume only 85μA (typical) while operating with no load condition. By reducing the quiescent current, your application can stay in standby/sleep mode much longer than leading low quiescent current LDOs in the market.

Under Voltage Lock OUT (UVLO)

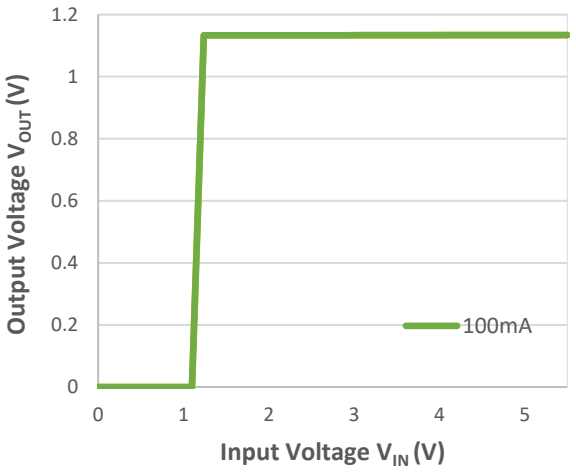
The SUL6001 has an undervoltage lockout (UVLO) function to make sure that whole circuit does nothing until the power supply voltage is high enough. When power supply voltage is high enough, reference circuit can generate right voltage, logic function can generate correct control signals. This UVLO function can guarantee robust system performance.

TYPICAL PERFORMANCE CHARACTERISTICS

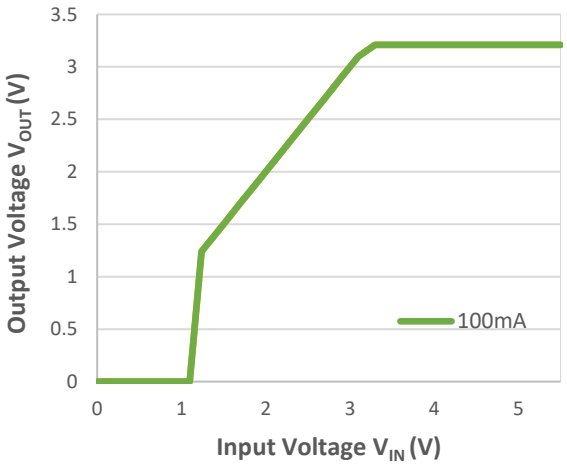
V_{IN} = V_{SET}[(1)] + 1V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, LCON="H", typical values are at T_J = 25 °C, unless otherwise noted.

Output Voltage vs. Input Voltage

SUL6001D8-12

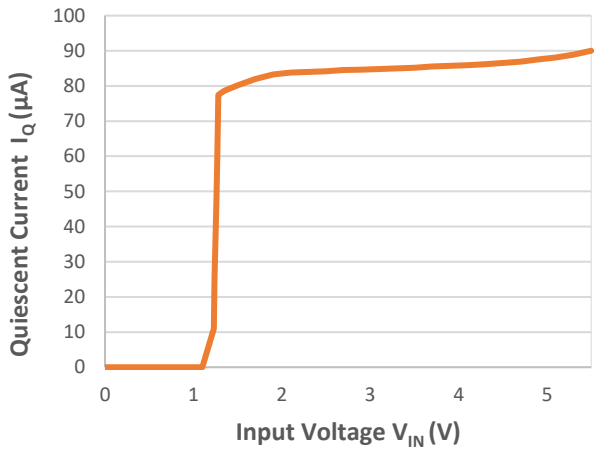


SUL6001D8-33

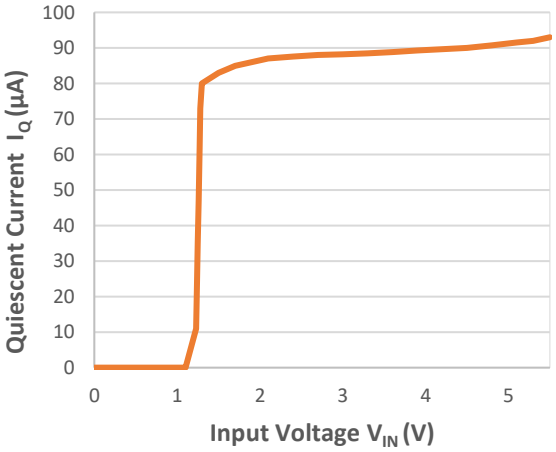


Quiescent Current vs. Input Voltage

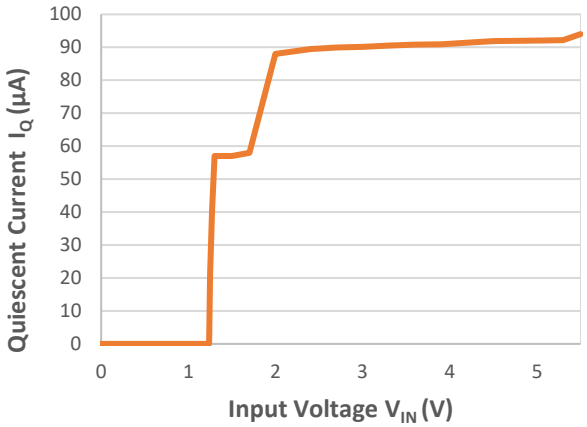
SUL6001D8-09



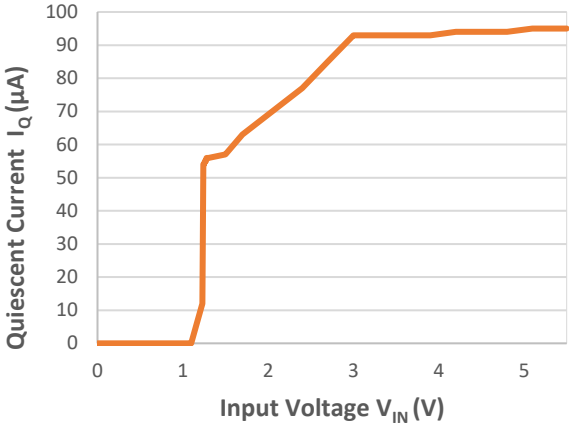
SUL6001D8-12



SUL6001D8-18



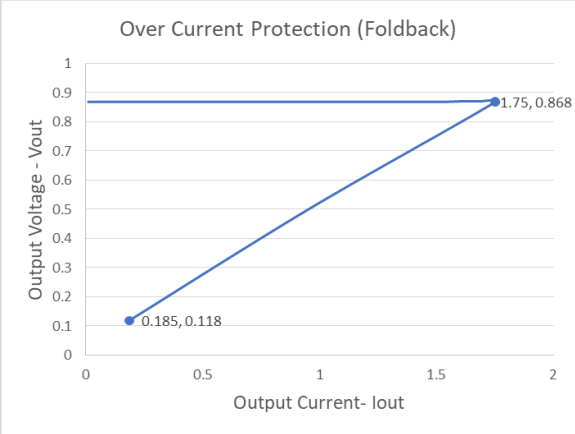
SUL6001D8-33



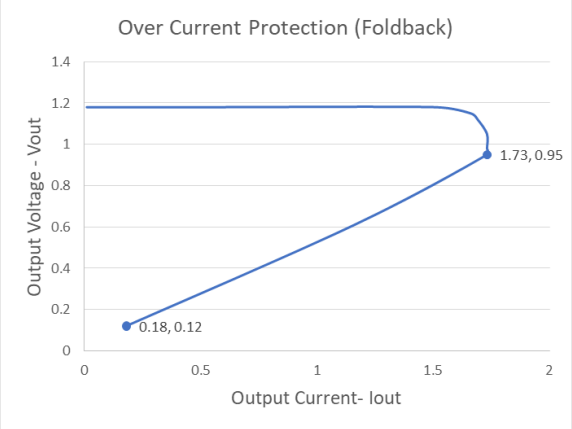
Over Current Protect Foldback Characteristic

(L_{CON} = V_{IN}, C_{IN} = C_{OUT} = 1μF, T_A= 25°C)

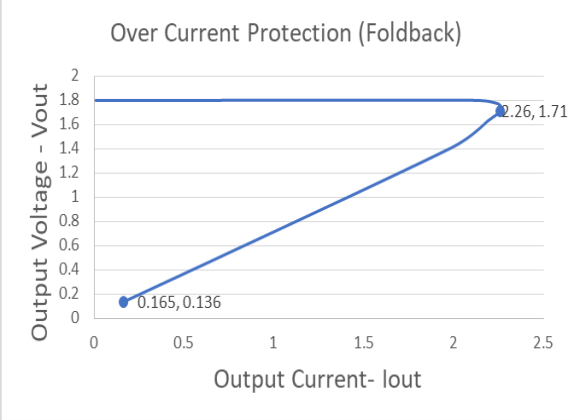
SUL6001D8-09



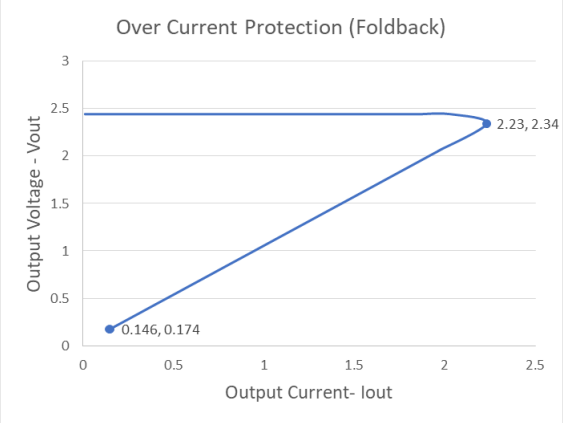
SUL6001D8-12



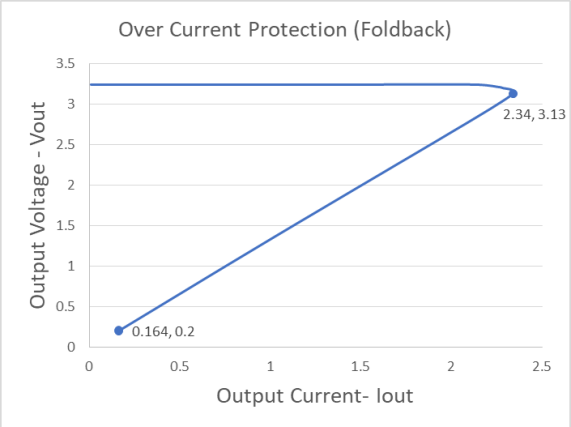
SUL6001D8-18



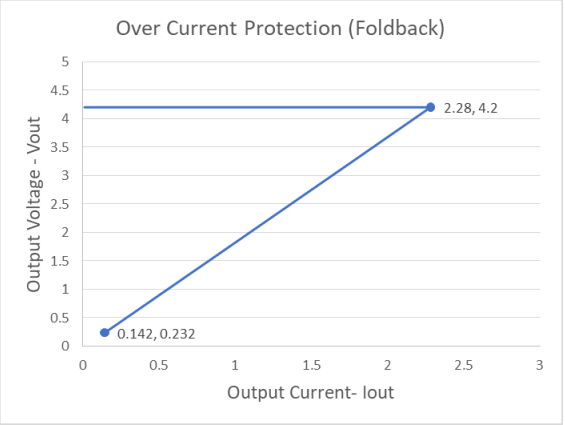
SUL6001D8-25



SUL6001D8-33



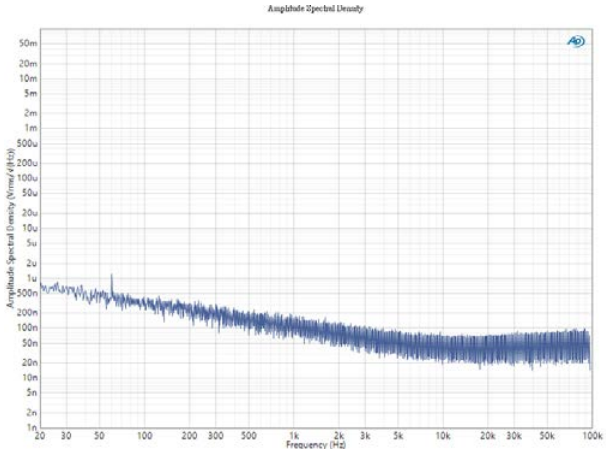
SUL6001D8-43



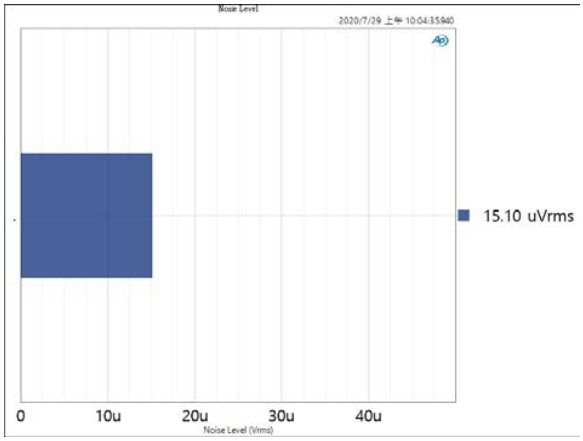
Output Noise Voltage (10Hz to 100kHz, C_{IN} = C_{OUT} = 1.0μF, T_A = 25°C)

SUL6001D8-09, I_{OUT} = 100mA

Amplitude Spectral Density

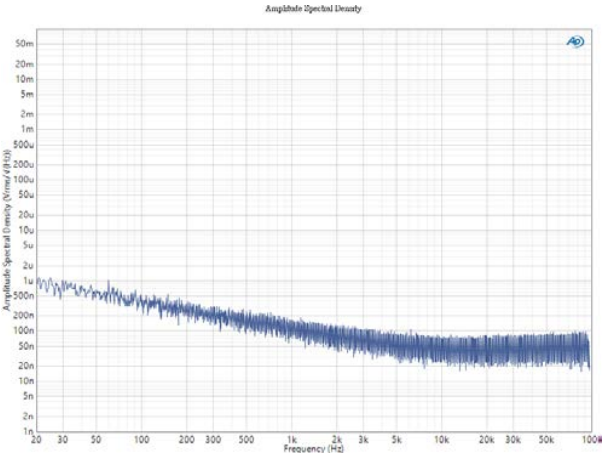


VRMS from 10 Hz to 100 kHz

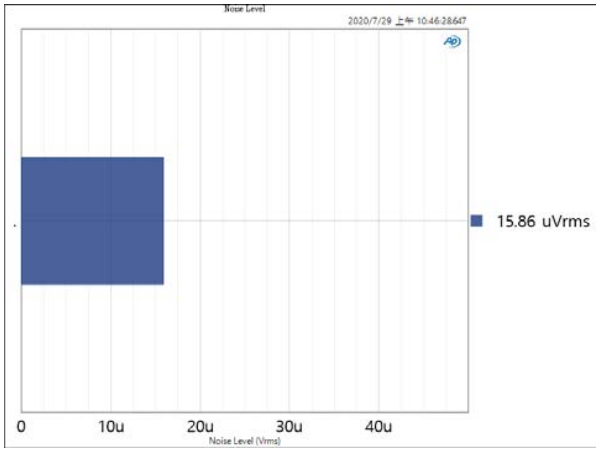


SUL6001D8-12, I_{OUT} = 100mA

Amplitude Spectral Density

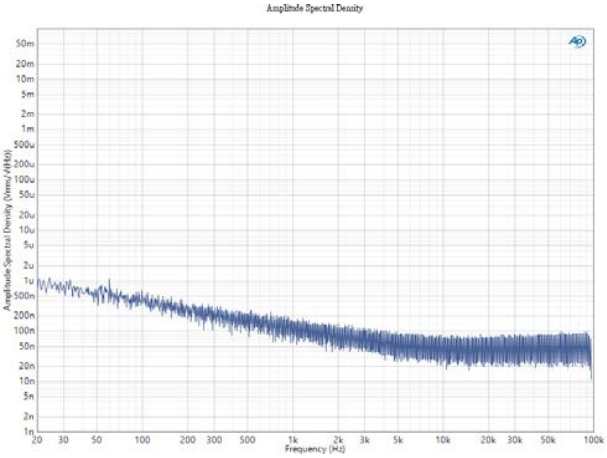


VRMS from 10 Hz to 100 kHz

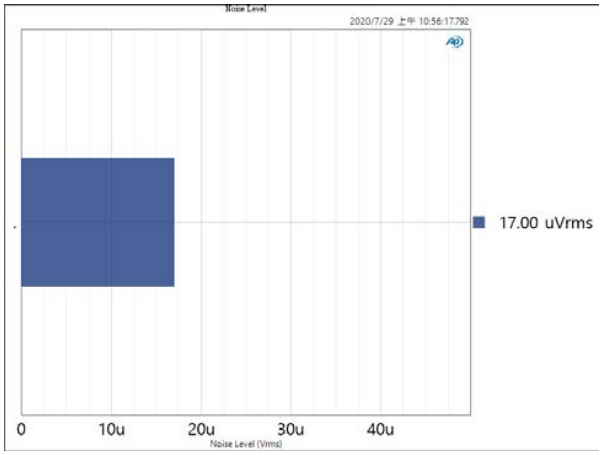


SUL6001D8-33, I_{OUT} = 100mA

Amplitude Spectral Density



VRMS from 10 Hz to 100 kHz

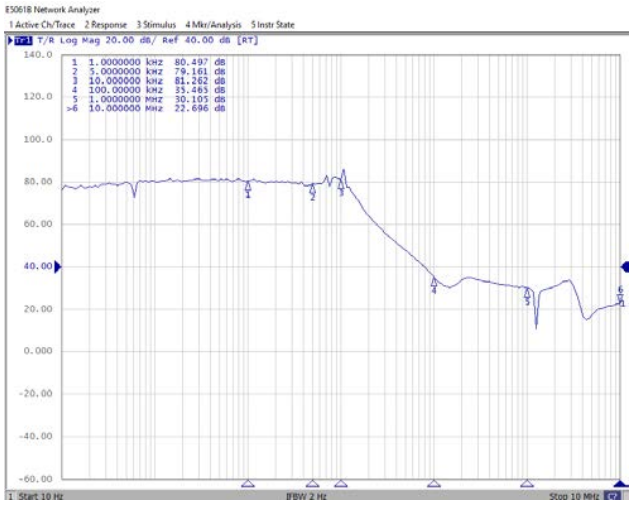


Power Supply Ripple Rejection vs. Frequency

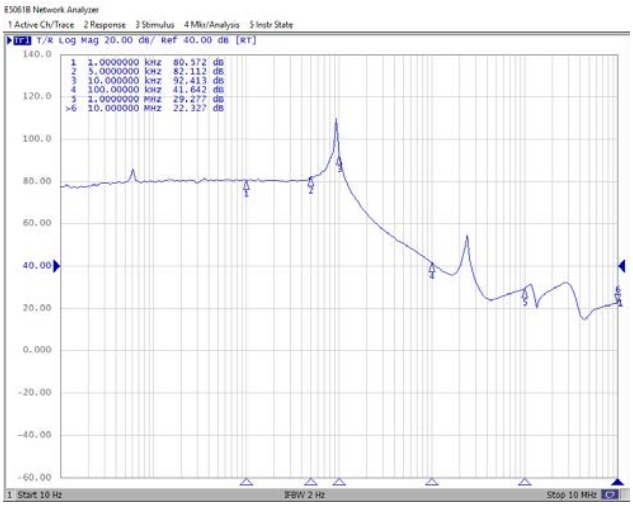
(V_{IN}=V_{OUT}+1V , C_{IN} = C_{OUT} = 1.0μF, Ripple = 0.2Vp-p, T_A=25°C)

SUL6001D8-09

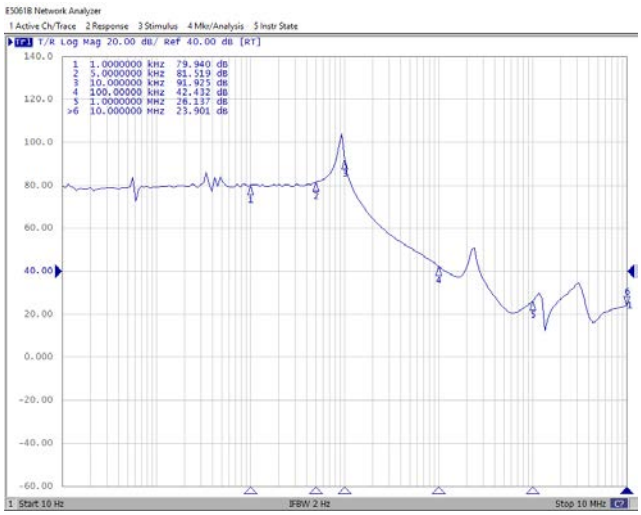
I_{Load}=1mA



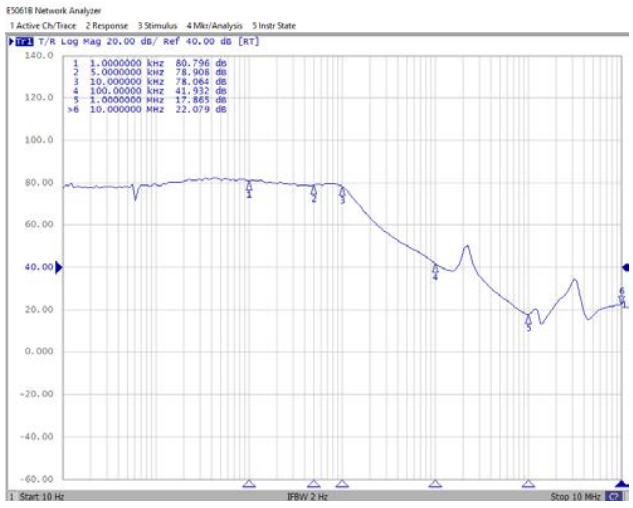
I_{Load}=10mA



I_{Load}=30mA



I_{Load}=150mA

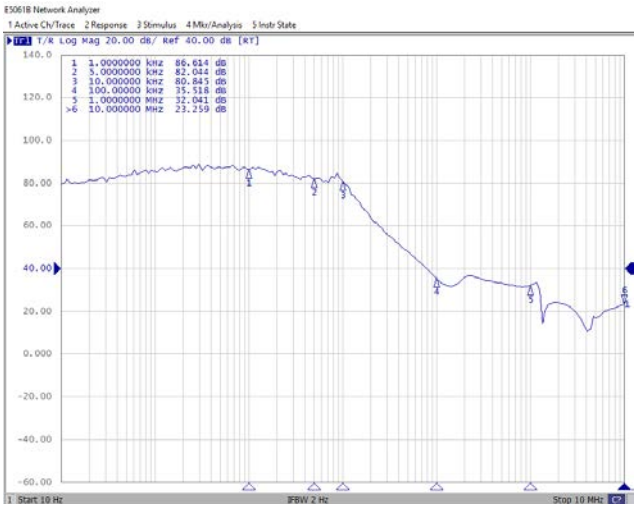


Power Supply Ripple Rejection vs. Frequency (Continued)

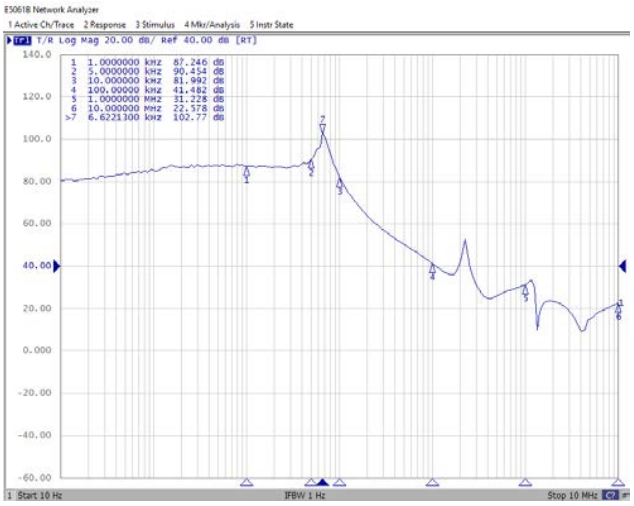
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1.0µF, Ripple = 0.2Vp-p, T_A=25°C)

SUL6001D8-12

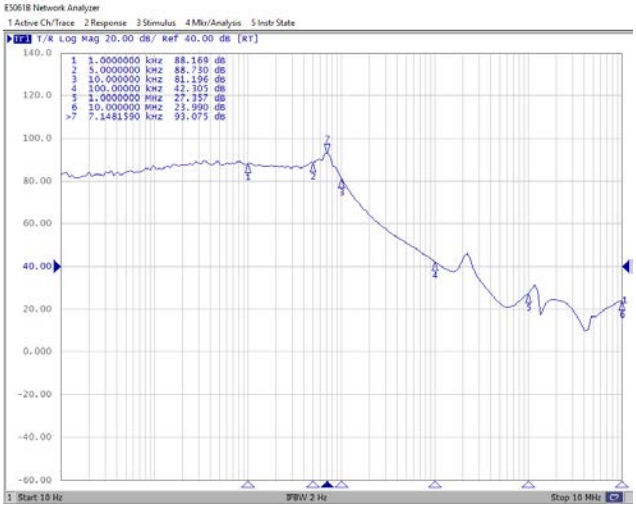
I_{Load}=1mA



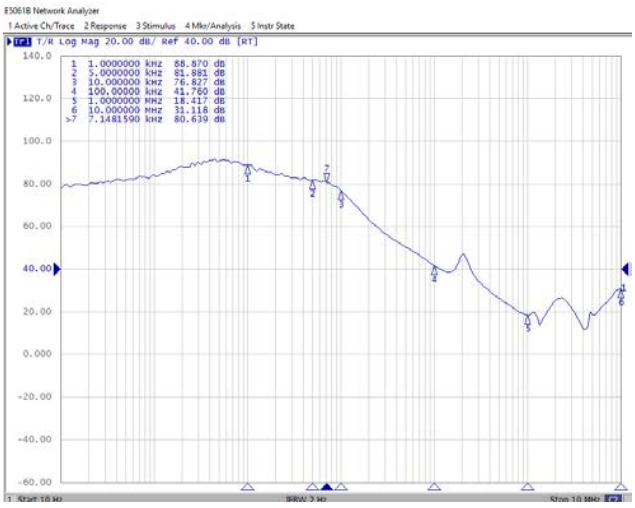
I_{Load}=10mA



I_{Load}=30mA



I_{Load}=150mA

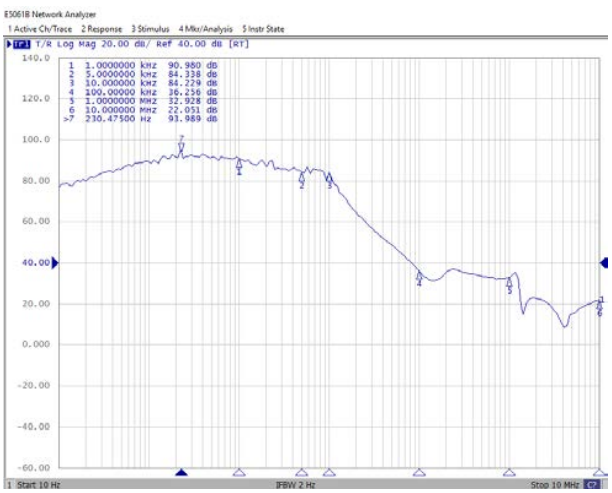


Power Supply Ripple Rejection vs. Frequency (Continued)

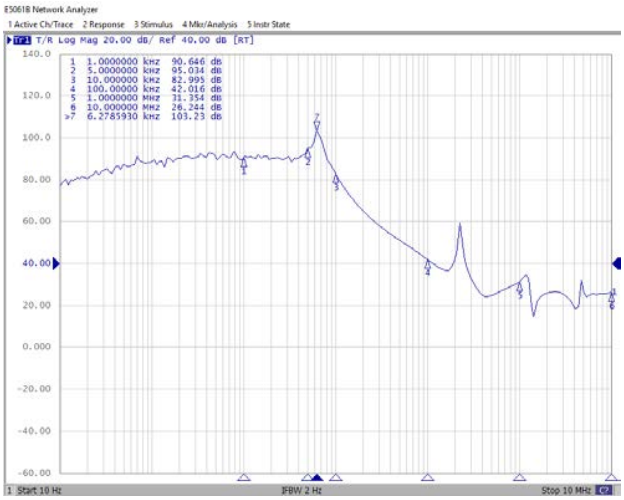
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1.0µF, Ripple = 0.2Vp-p, T_A=25°C)

SUL6001D8-18

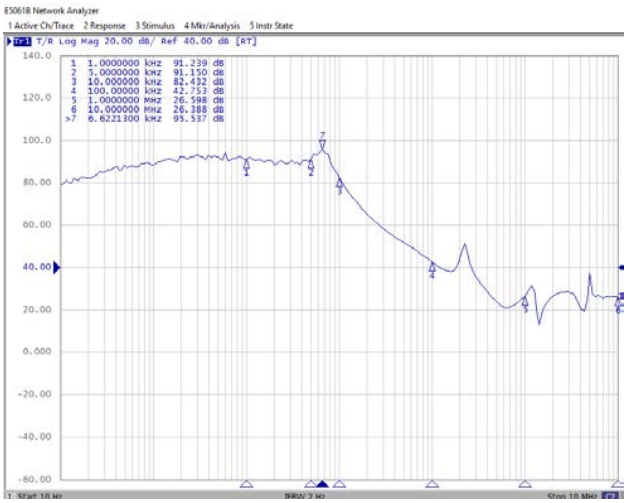
I_{Load}=1mA



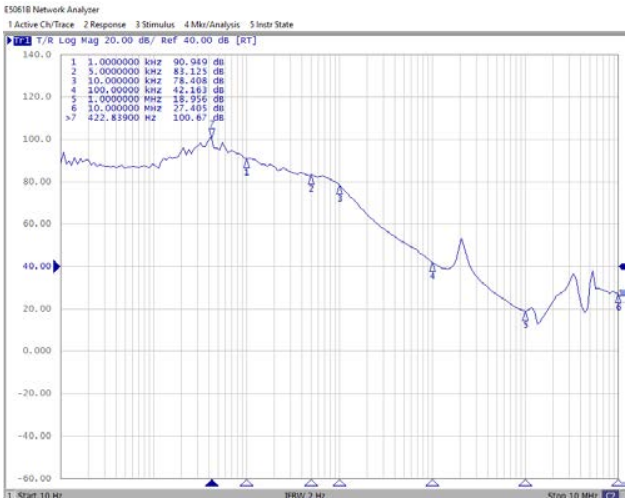
I_{Load}=10mA



I_{Load}=30mA



I_{Load}=150mA

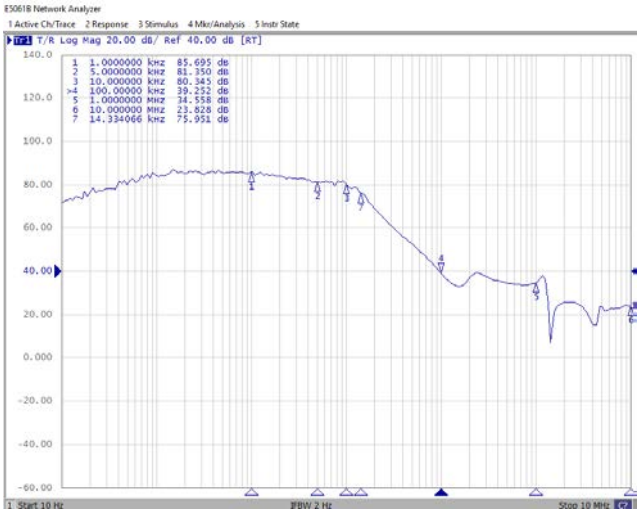


Power Supply Ripple Rejection vs. Frequency (Continued)

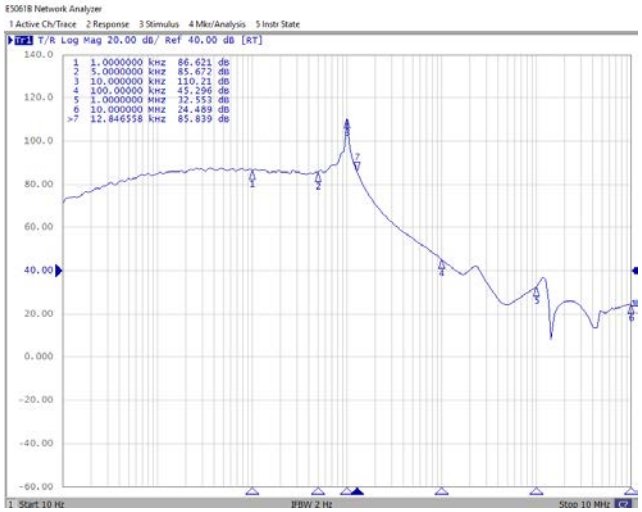
(V_{IN}=V_{OUT}+1V , C_{IN} = C_{OUT} = 1.0μF, Ripple = 0.2Vp-p, T_A=25°C)

SUL6001D8-25

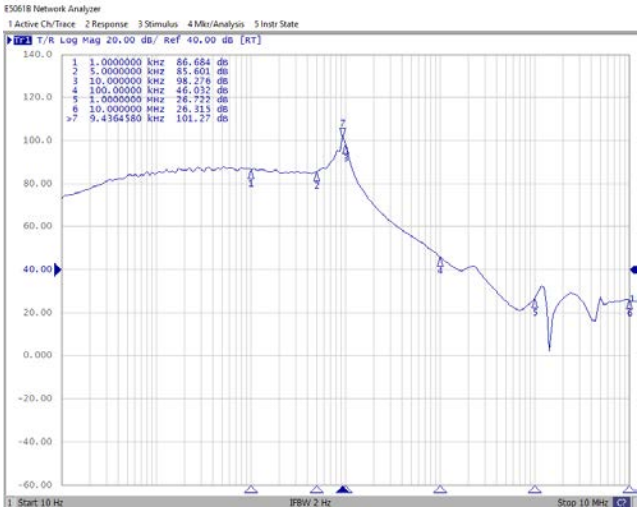
I_{Load}=1mA



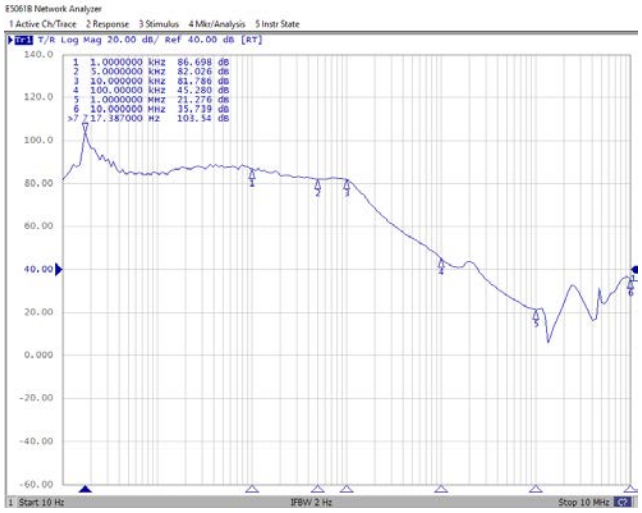
I_{Load}=10mA



I_{Load}=30mA



I_{Load}=150mA

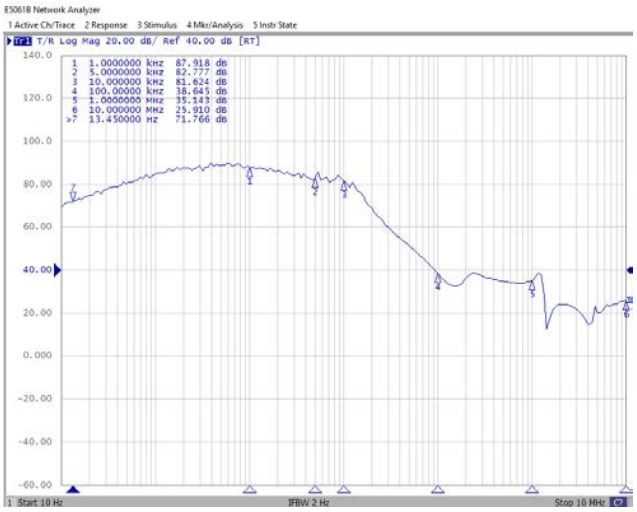


Power Supply Ripple Rejection vs. Frequency (Continued)

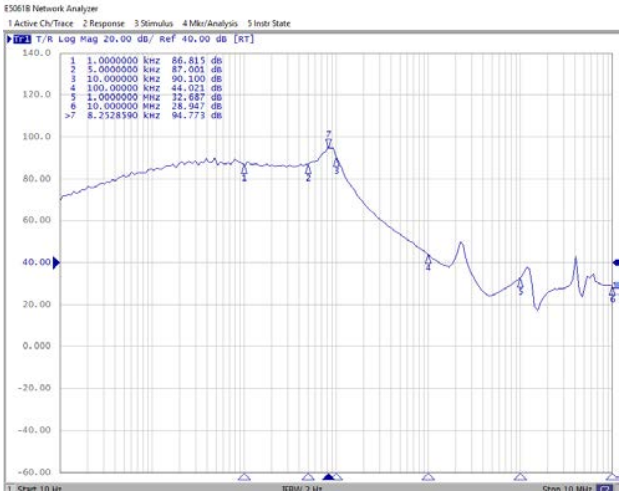
(V_{IN}=V_{OUT}+1V , C_{IN} = C_{OUT} = 1.0µF, Ripple = 0.2Vp-p, T_A=25°C)

SUL6001D8-33

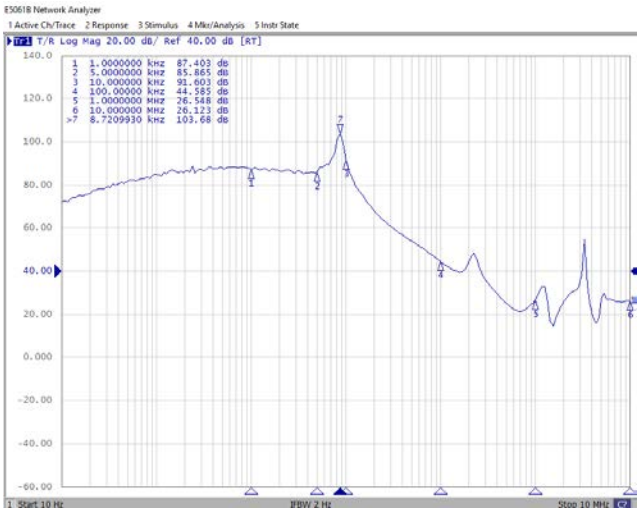
I_{Load}=1mA



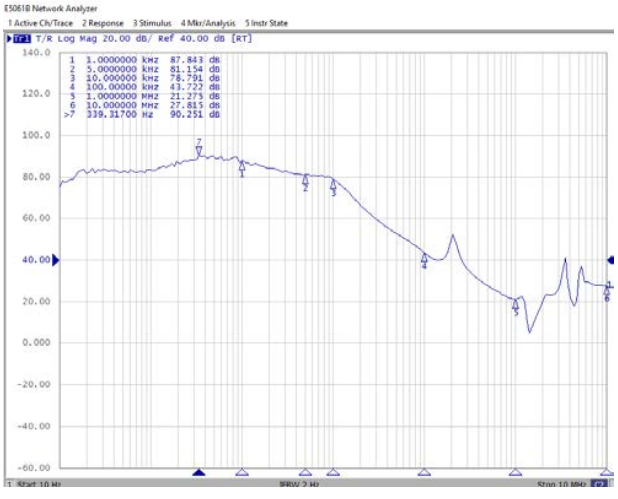
I_{Load}=10mA



I_{Load}=30mA



I_{Load}=150mA

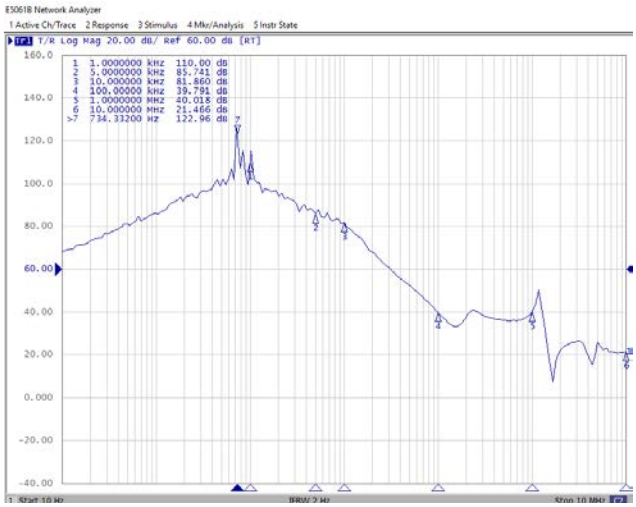


Power Supply Ripple Rejection vs. Frequency (Continued)

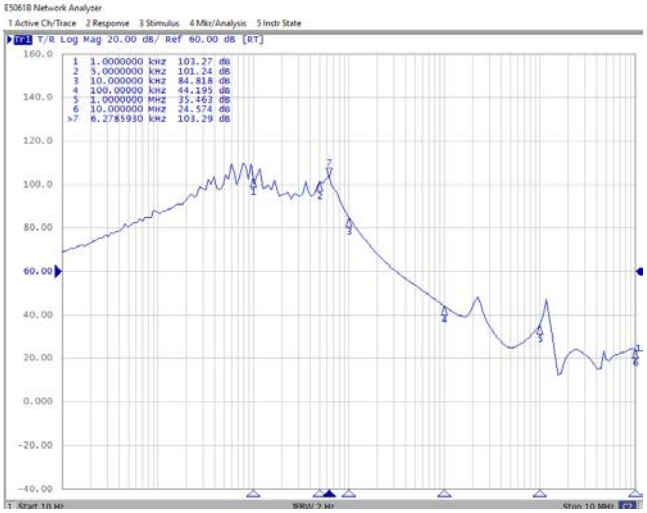
(V_{IN}=V_{OUT}+1V , C_{IN} = C_{OUT} = 1.0µF, Ripple = 0.2Vp-p, T_A=25°C)

SUL6001D8-43

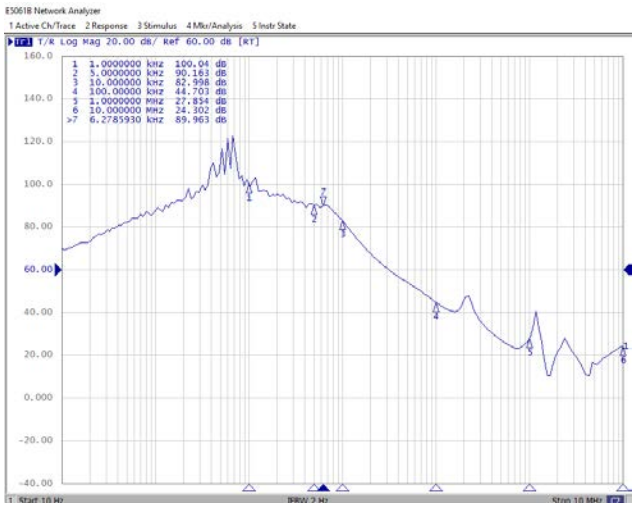
I_{Load}=1mA



I_{Load}=10mA



I_{Load}=30mA



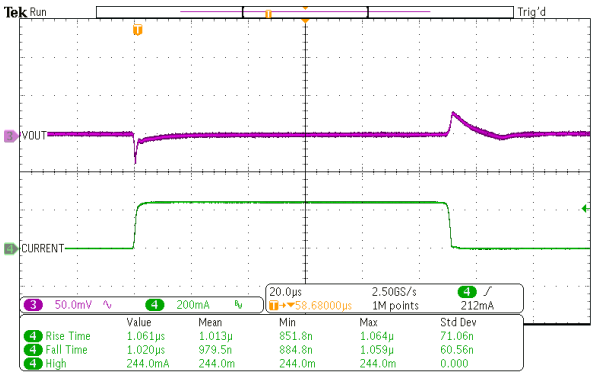
I_{Load}=150mA

Load Transient Response

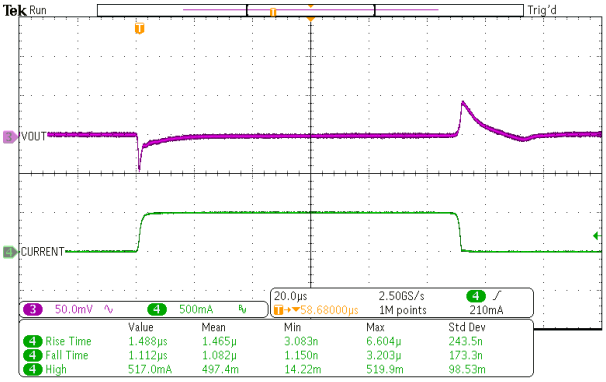
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1μF, tr = tf = 1μs, T_A = 25°C)

SUL6001D8-09

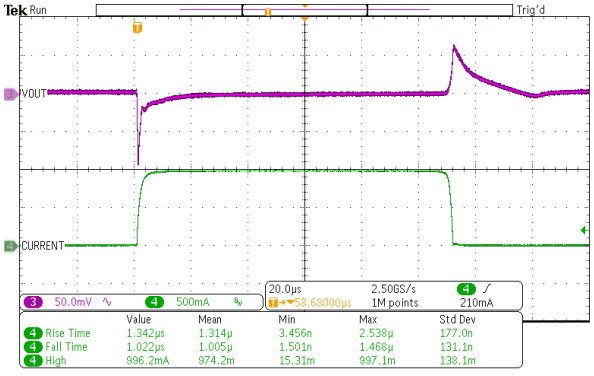
1mA → 250mA



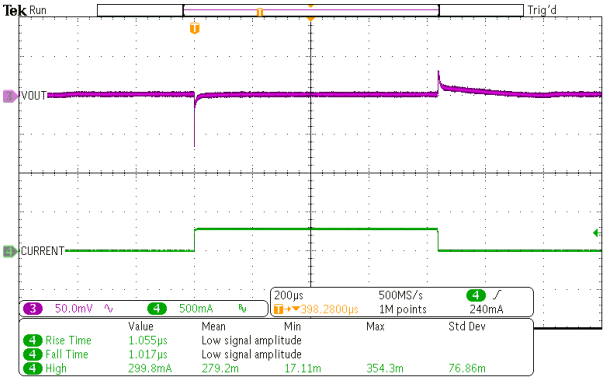
1mA → 500mA



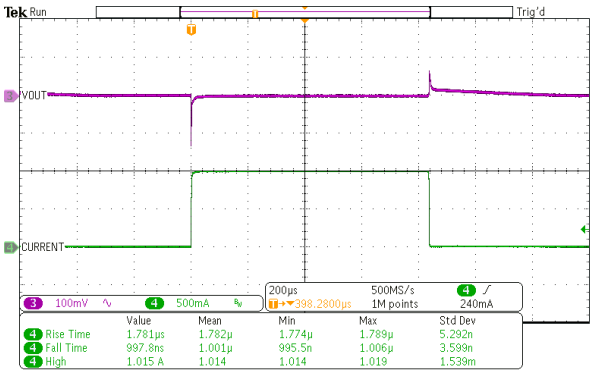
1mA → 1000mA



0mA → 300mA



0mA → 1000mA

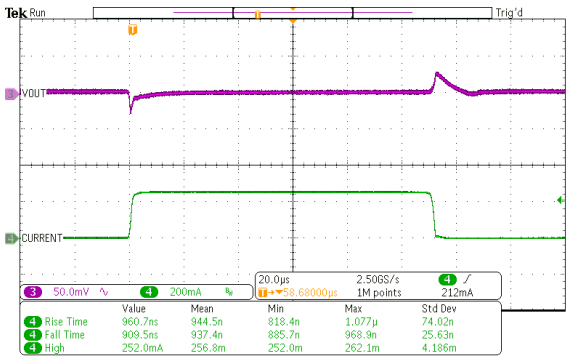


Load Transient Response (Continued)

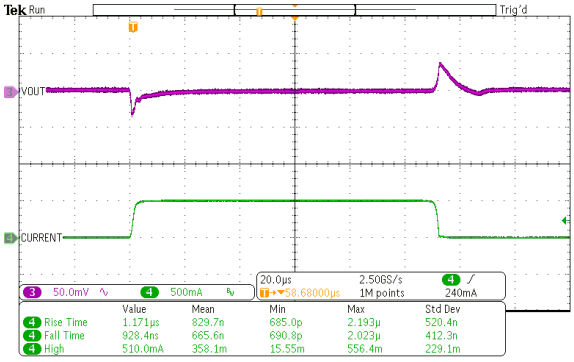
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1µF, tr = tf = 1µs, T_A = 25°C)

SUL6001D8-12

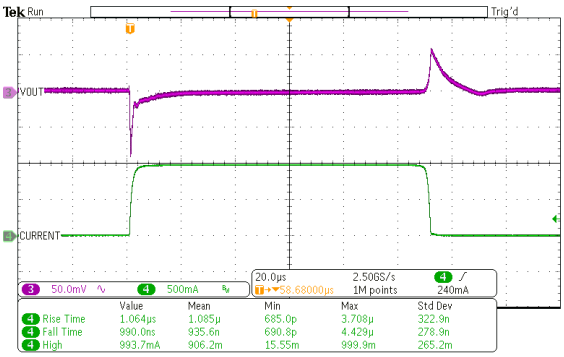
1mA → 250mA



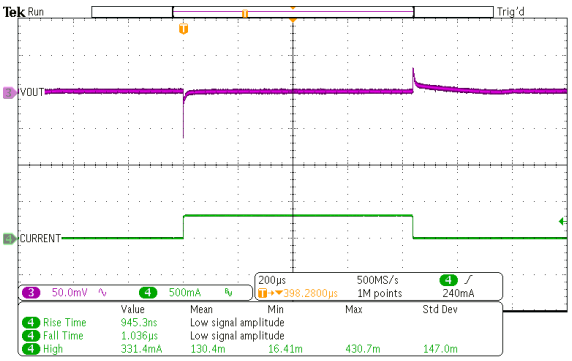
1mA → 500mA



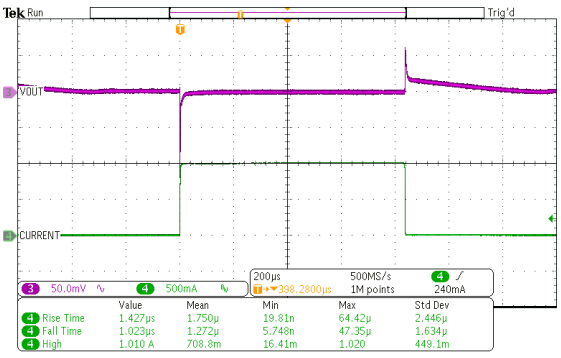
1mA → 1000mA



0mA → 300mA



0mA → 1000mA

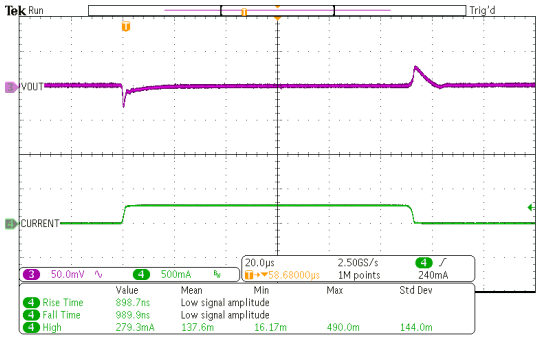


Load Transient Response (Continued)

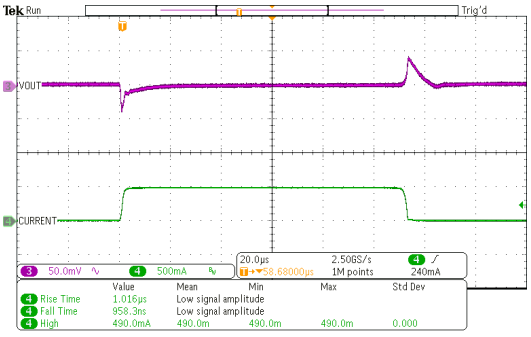
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1µF, tr = tf = 1µs, T_A = 25°C)

SUL6001D8-18

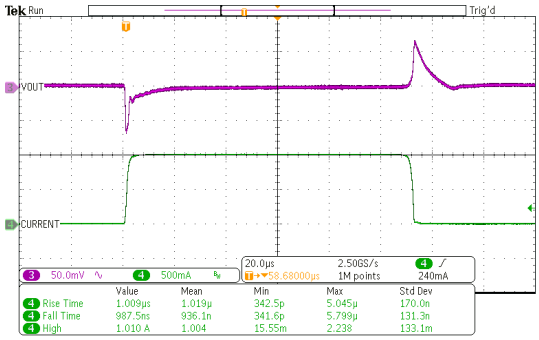
1mA → 250mA



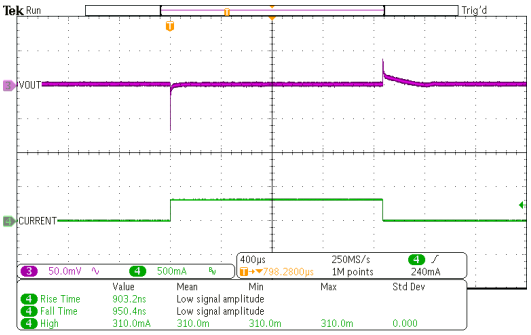
1mA → 500mA



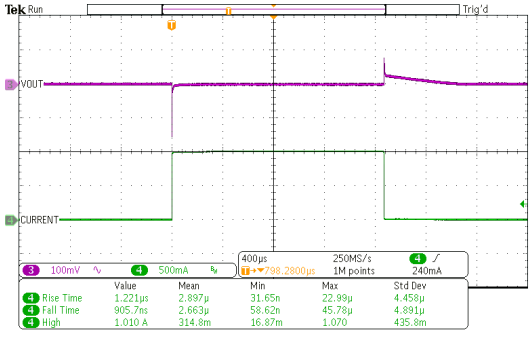
1mA → 1000mA



0mA → 300mA



0mA → 1000mA

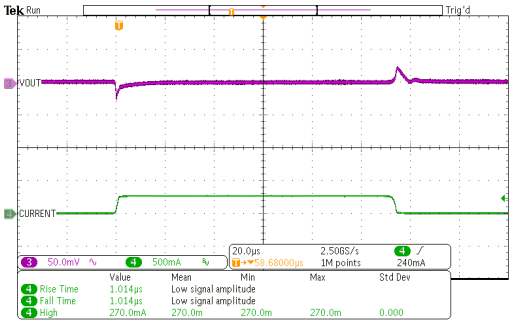


Load Transient Response (Continued)

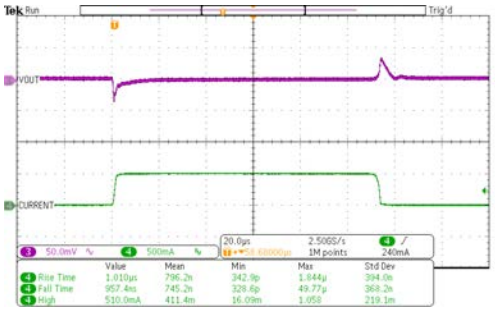
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1µF, tr = tf = 1µs, T_A = 25°C)

SUL6001D8-25

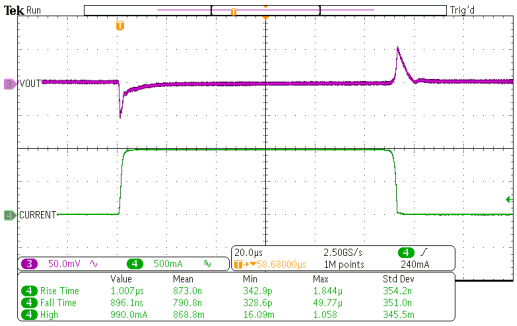
1mA → 250mA



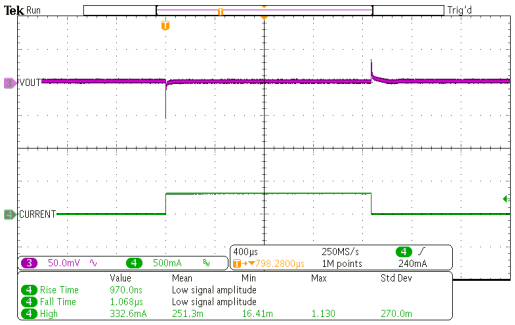
1mA → 500mA



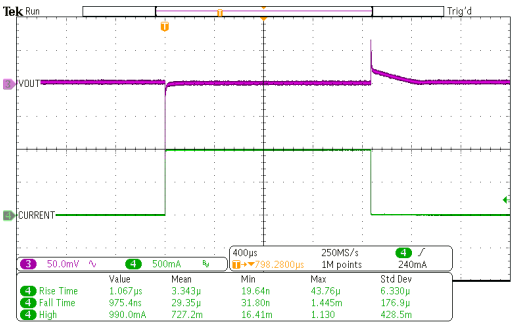
1mA → 1000mA



0mA → 300mA



0mA → 1000mA

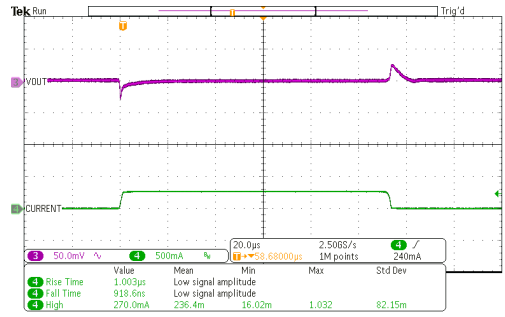


Load Transient Response (Continued)

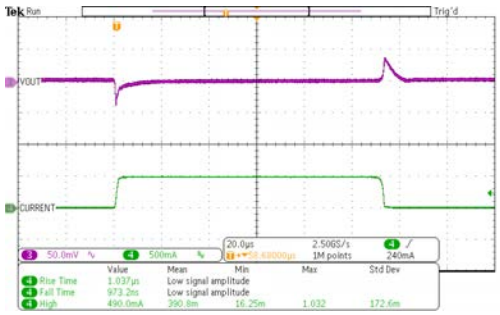
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1µF, tr = tf = 1µs, T_A = 25°C)

SUL6001D8-33

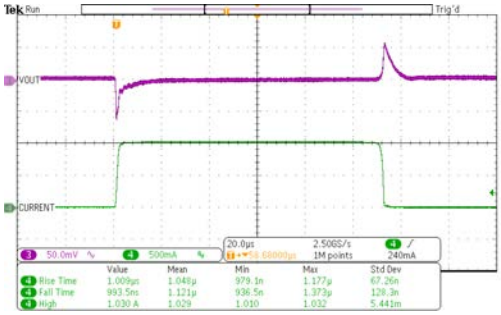
1mA -> 250mA



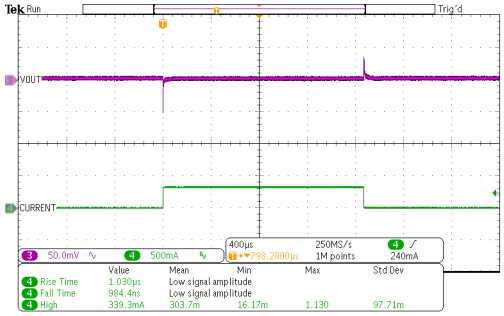
1mA -> 500mA



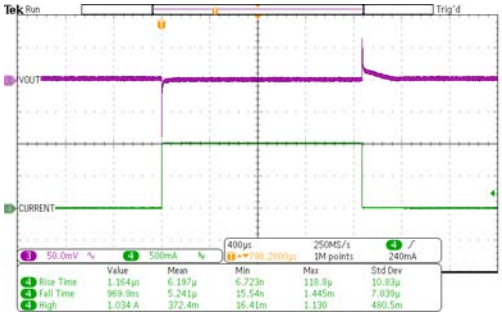
1mA -> 1000mA



0mA -> 300mA



0mA -> 1000mA

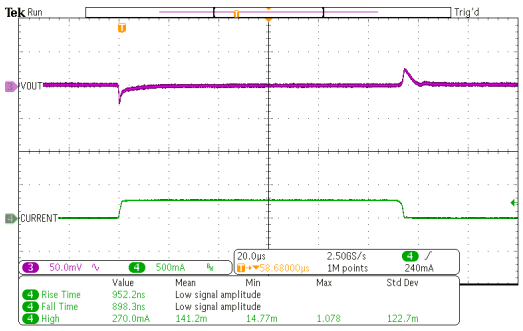


Load Transient Response (Continued)

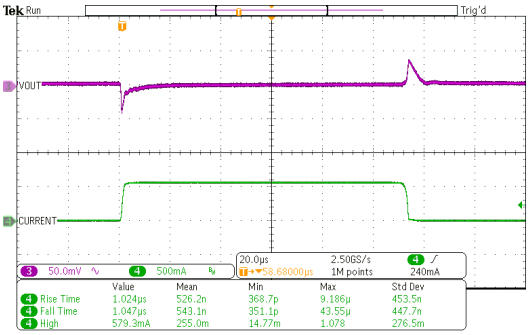
(V_{IN}=V_{OUT}+1V, C_{IN} = C_{OUT} = 1µF, tr = tf = 1µs, T_A = 25°C)

SUL6001D8-43

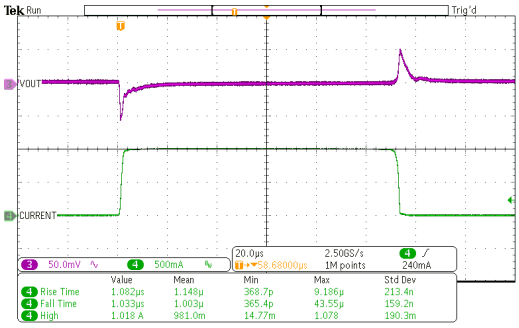
1mA -> 250mA



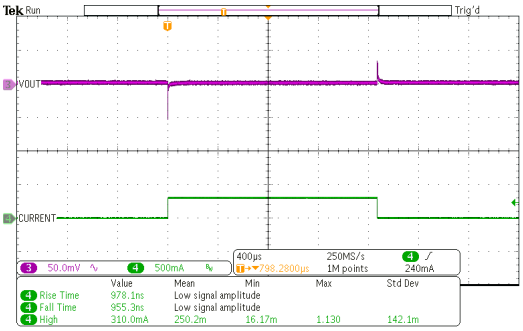
1mA -> 500mA



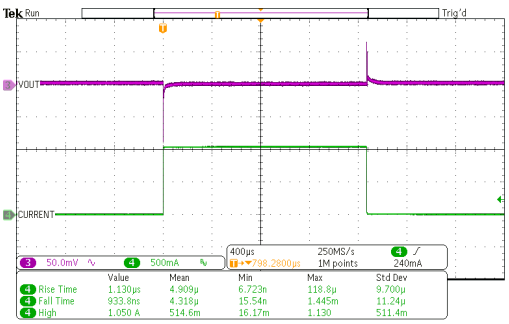
1mA -> 1000mA



0mA -> 300mA



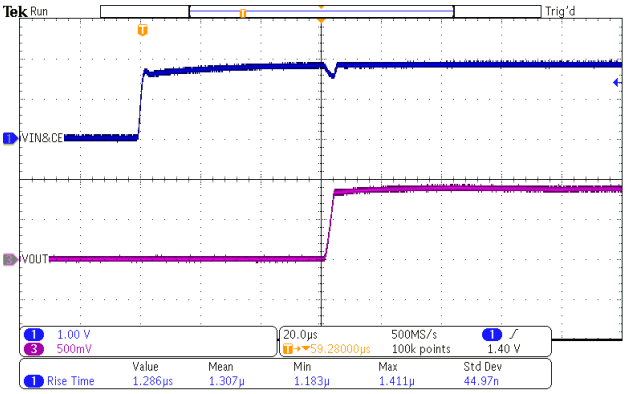
0mA -> 1000mA



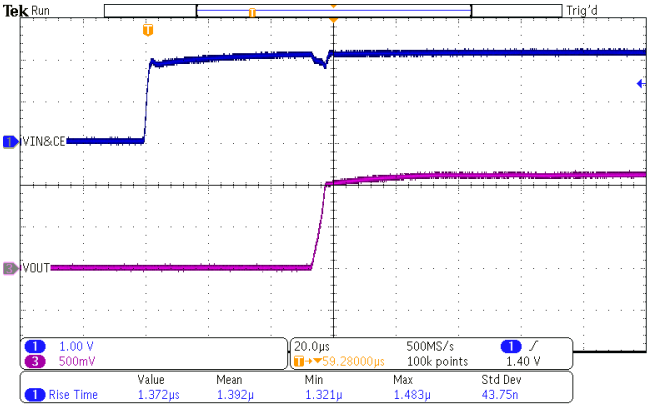
Turn-on waveform by V_{IN} & CE @ light load

(V_{IN} = CE = 0V to V_{OUT}+1V, C_{IN} = C_{OUT} = 1.0μF, T_A = 25°C, I_{OUT} = 1mA)

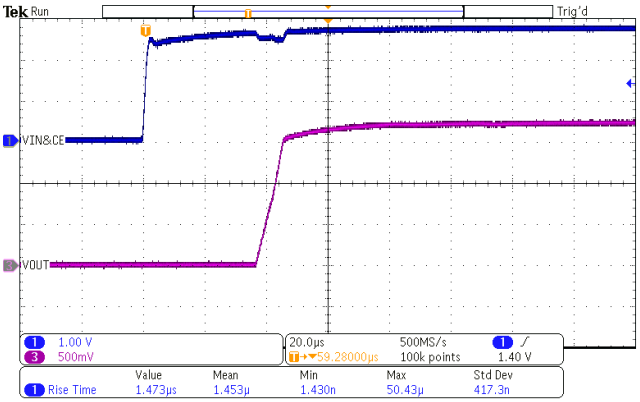
SUL6001D8-09



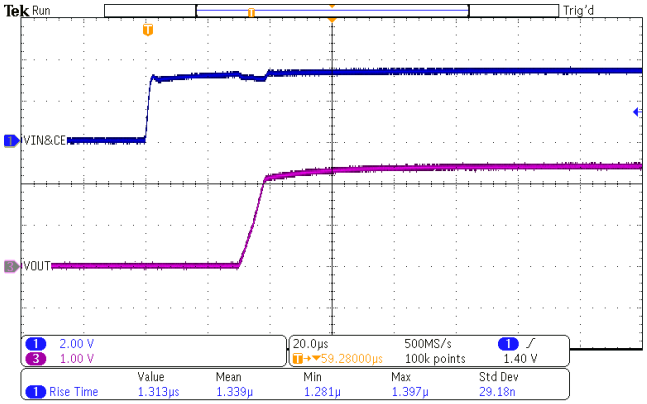
SUL6001D8-12



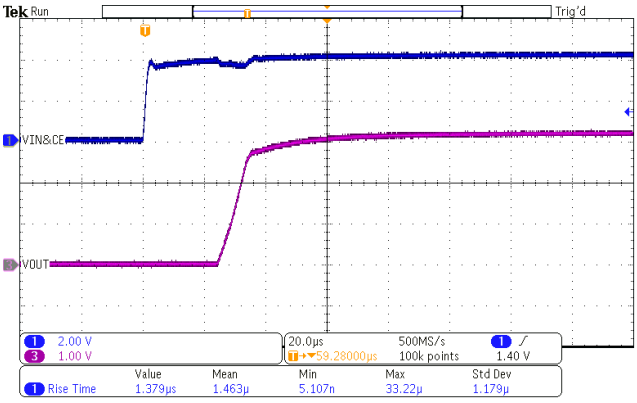
SUL6001D8-18



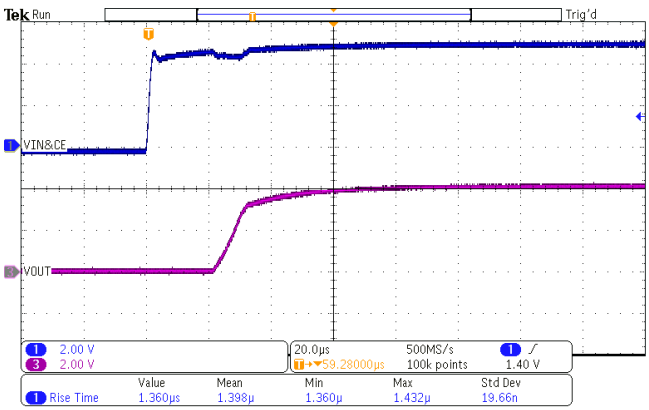
SUL6001D8-25



SUL6001D8-33



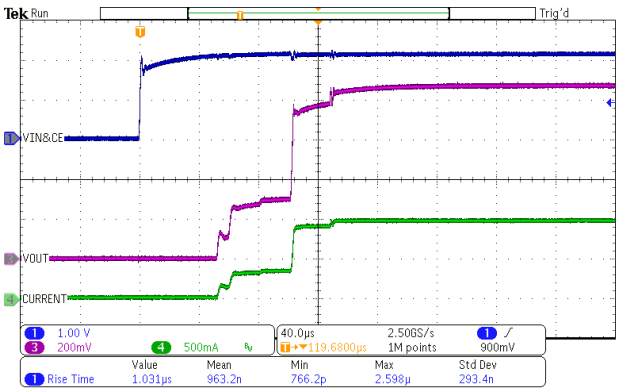
SUL6001D8-43



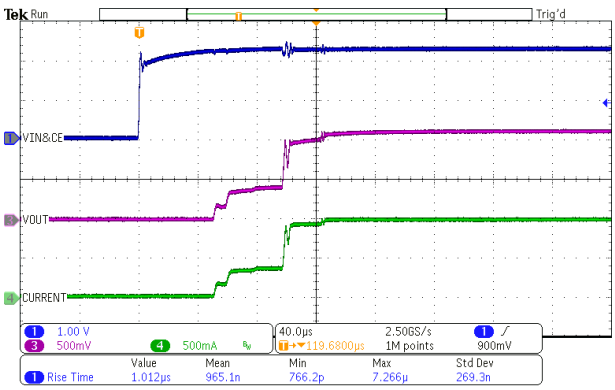
Turn-on waveform by V_{IN} & CE @ full load

(V_{IN} = CE = 0V to V_{OUT}+1V, C_{IN} = C_{OUT} = 1.0μF, T_A= 25°C, I_{OUT}=1A)

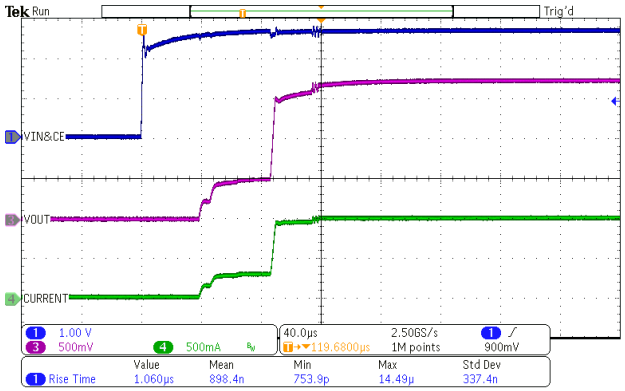
SUL6001D8-09



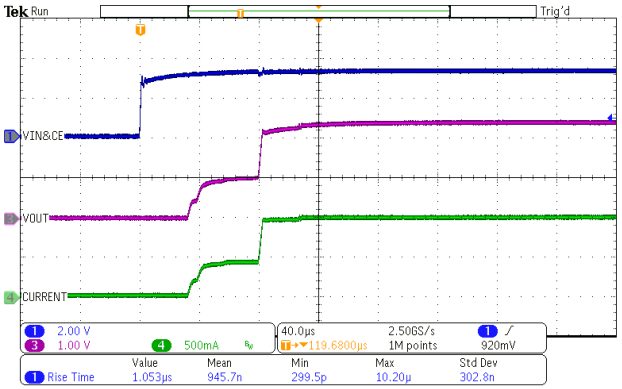
SUL6001D8-12



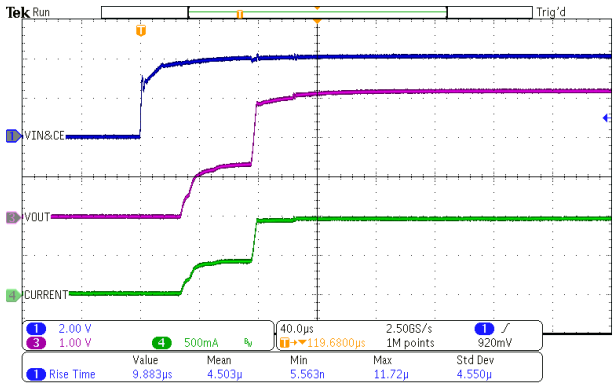
SUL6001D8-18



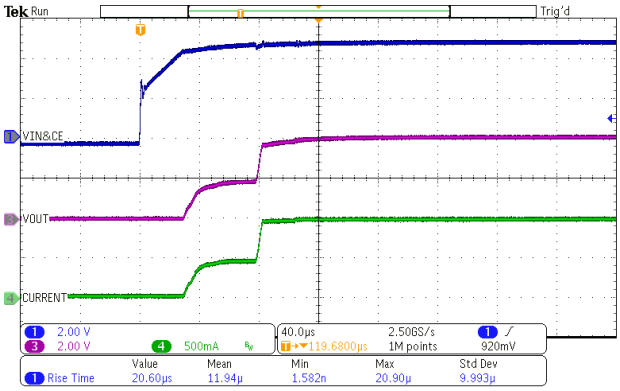
SUL6001D8-25



SUL6001D8-33



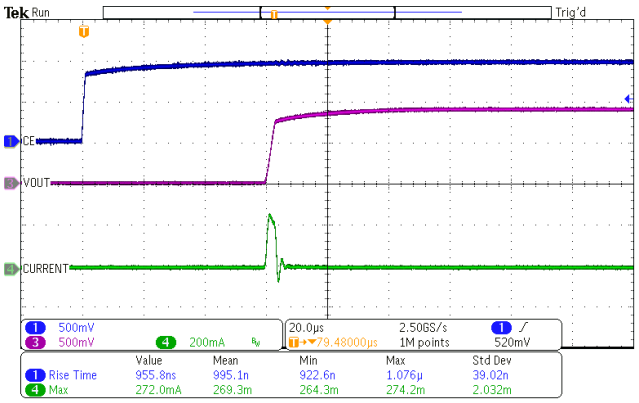
SUL6001D8-43



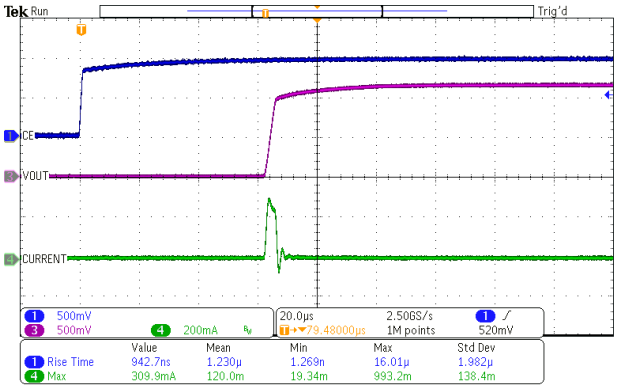
Turn-on by CE pin & Inrush current @ no load

(V_{IN} = V_{OUT}+1V, CE = 0V to 1V, C_{IN} = C_{OUT} = 1.0μF, T_A = 25°C, I_{OUT}=0mA)

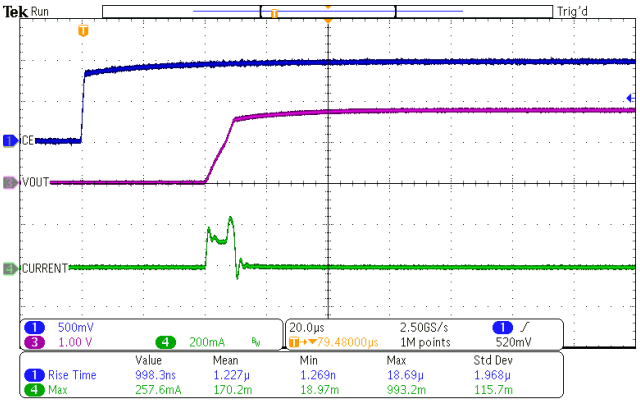
SUL6001D8-09



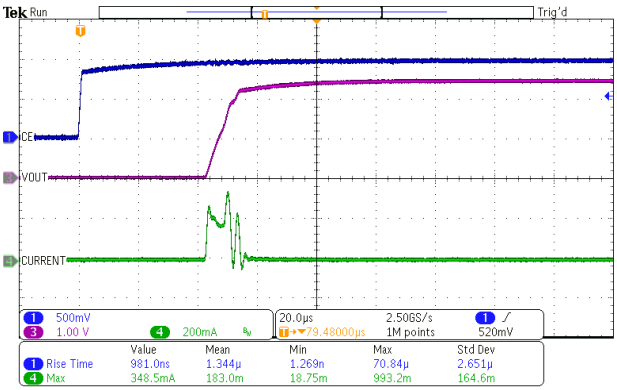
SUL6001D8-12



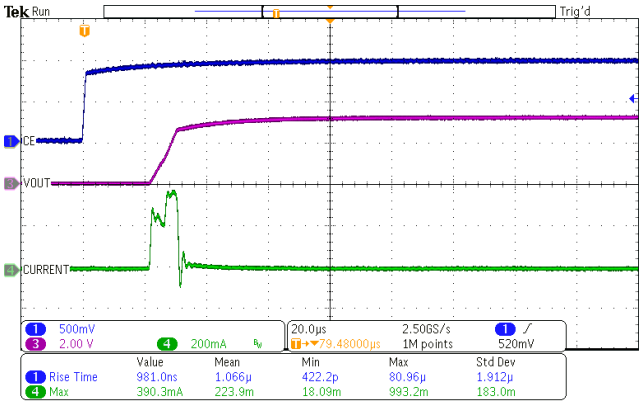
SUL6001D8-18



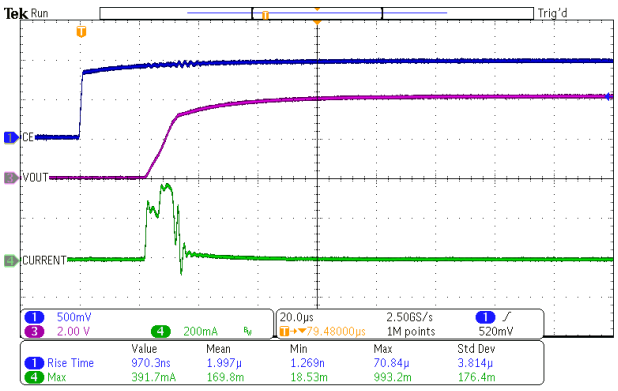
SUL6001D8-25



SUL6001D8-33



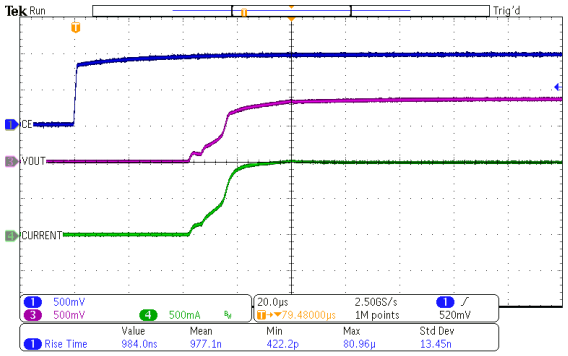
SUL6001D8-43



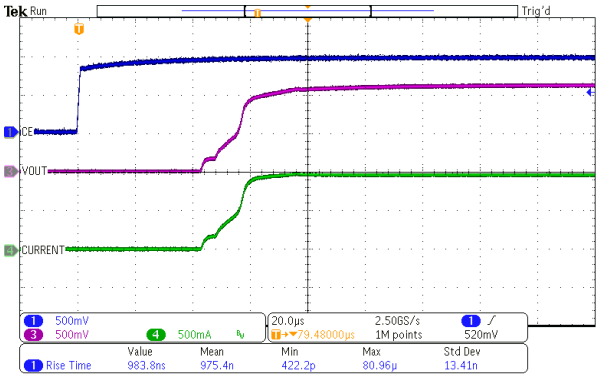
Turn-on by CE pin @ full load

(V_{IN} = V_{OUT}+1V , CE = 0V to 1V, C_{IN} = C_{OUT} = 1.0μF, T_A = 25°C, I_{OUT}=1A)

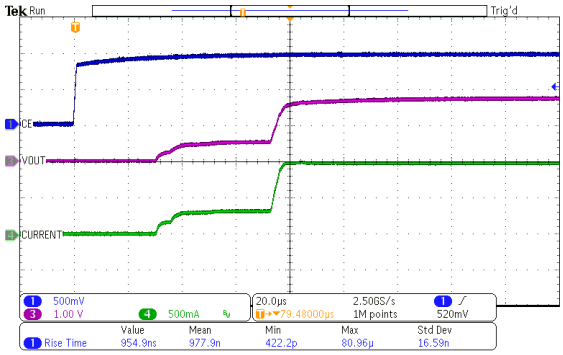
SUL6001D8-09



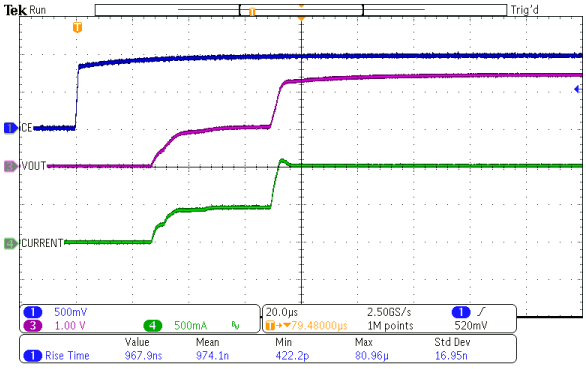
SUL6001D8-12



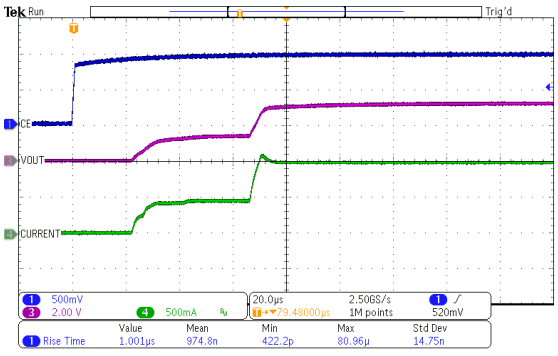
SUL6001D8-18



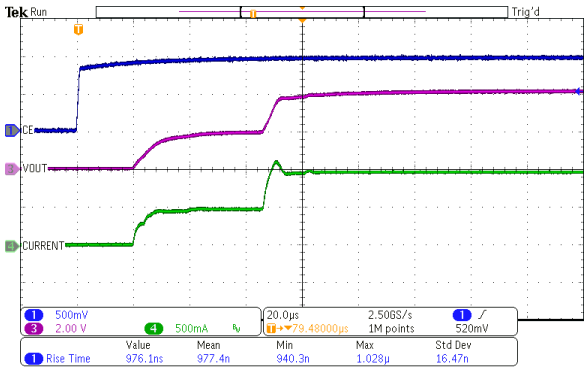
SUL6001D8-25



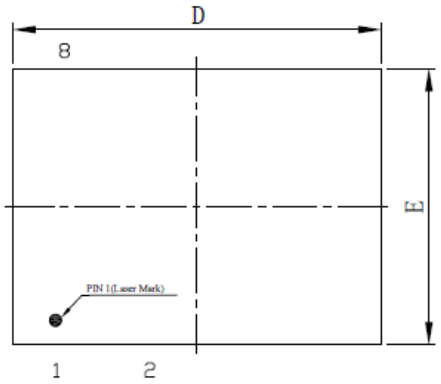
SUL6001D8-33



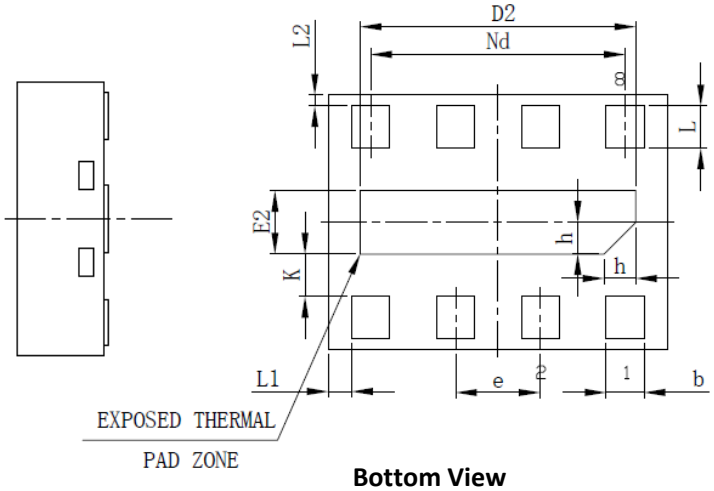
SUL6001D8-43



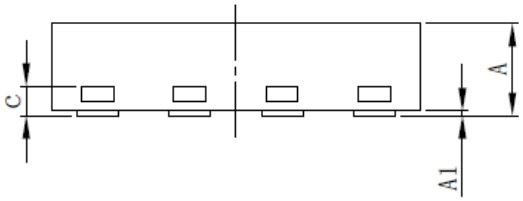
PACKAGE DIMENSIONS: DFN1216-8L (#1)



Top View



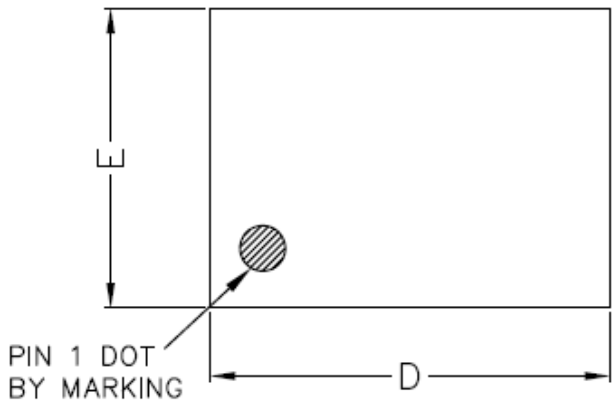
Bottom View



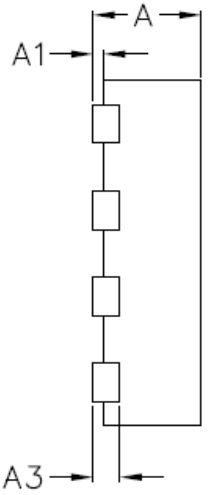
Side View

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.35	-	0.40
A1	0	0.02	0.05
b	0.13	0.18	0.23
c	0.127REF		
D	1.55	1.60	1.65
D2	1.25	1.30	1.35
e	0.40BSC		
Nd	1.20BSC		
E	1.15	1.20	1.25
E2	0.25	0.30	0.35
L	0.15	0.20	0.25
L1	0.06	0.11	0.16
L2	0.05REF		
h	0.10	0.15	0.20
K	0.15	0.20	0.25

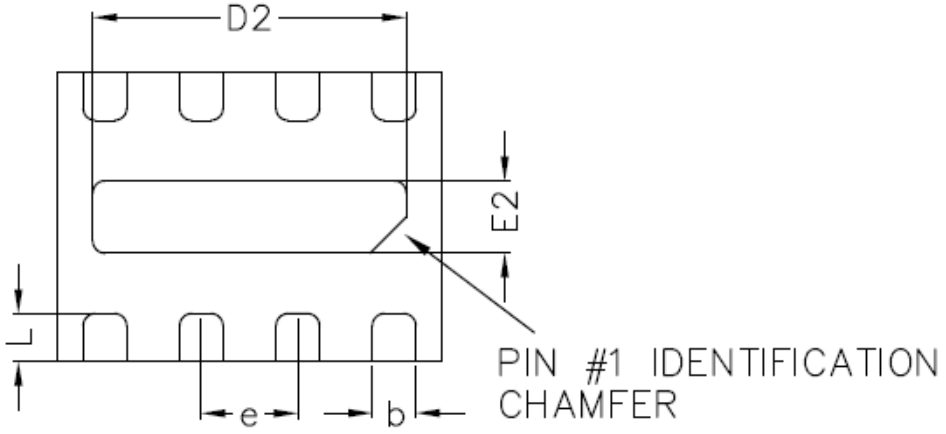
PACKAGE DIMENSIONS: DFN1216-8L (#2)



Top View



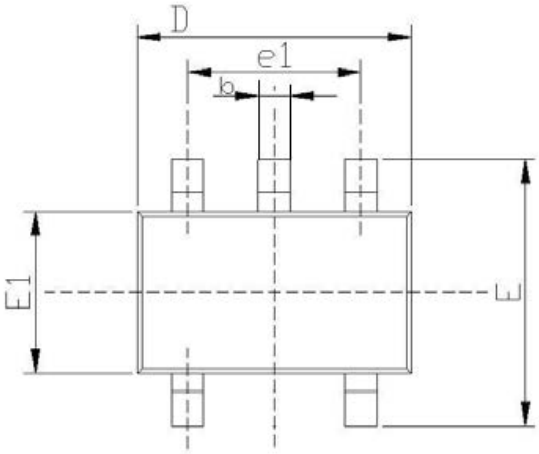
Side View

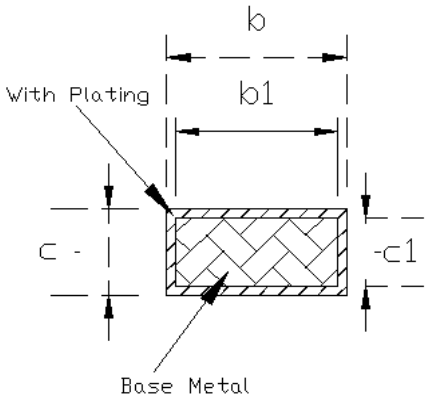


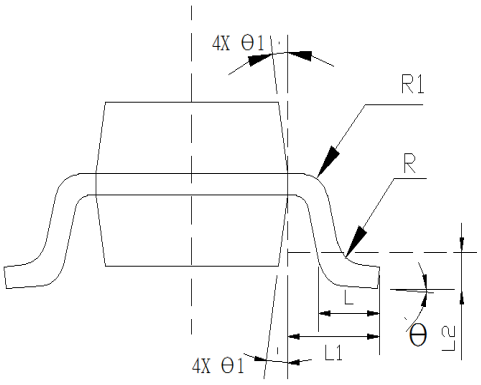
Bottom View

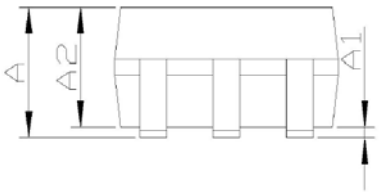
COMMON DIMENSIONS(MM)			
PKG.	X1: EXTREME THIN		
REF.	MIN.	NOM.	MAX
A	0.40	–	0.50
A1	0.00	–	0.05
A3	0.125 REF		
D	1.55	1.60	1.65
E	1.15	1.20	1.25
D2	1.25	1.30	1.35
E2	0.25	0.30	0.35
L	0.15	0.20	0.25
b	0.13	0.18	0.23
e	0.40 BSC		

PACKAGE DIMENSIONS: SOT23-5L







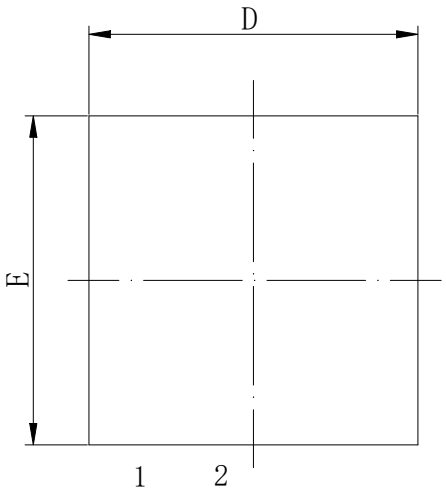


Common Dimensions (Units of Measure=Millimeter)			
SYMBOL	MINIMUM	NOMINAL	MAXIMUM
A	-	-	1.35
A1	0	-	0.15
A2	1.00	1.10	1.20
b	0.35	-	0.45
b1	0.32	-	0.38
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
L1	0.6 REF		
L2	0.25 REF		
R	0.10	-	-
R1	0.10	-	0.25
θ	0°	4°	8°
θ 1	5°	10°	15°

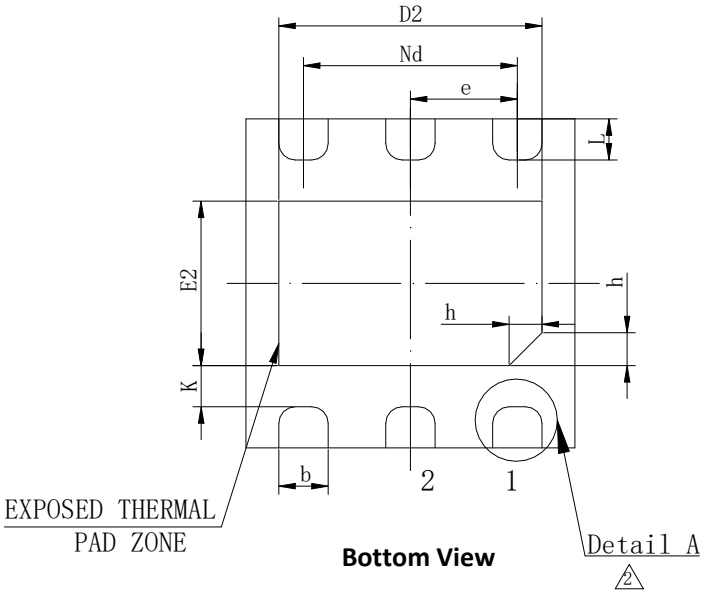
NOTES:

1. All dimensions refer to standard.
2. Dimensions D does not include mold FLASH.
3. Dimensions E1 does not include mold FLASH.
4. FLASH or protrusion shall not exceed 0.25mm per side.

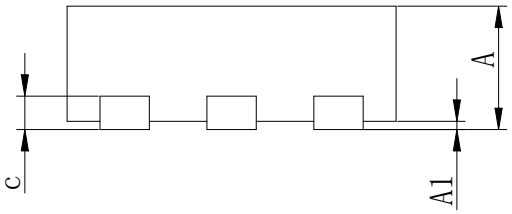
PACKAGE DIMENSIONS: DFN2X2-6L



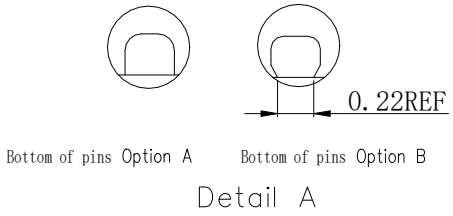
Top View



Bottom View

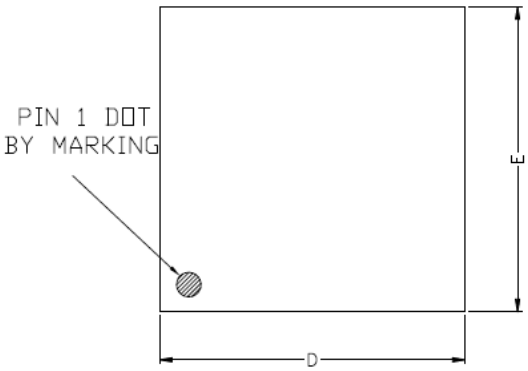


Side View

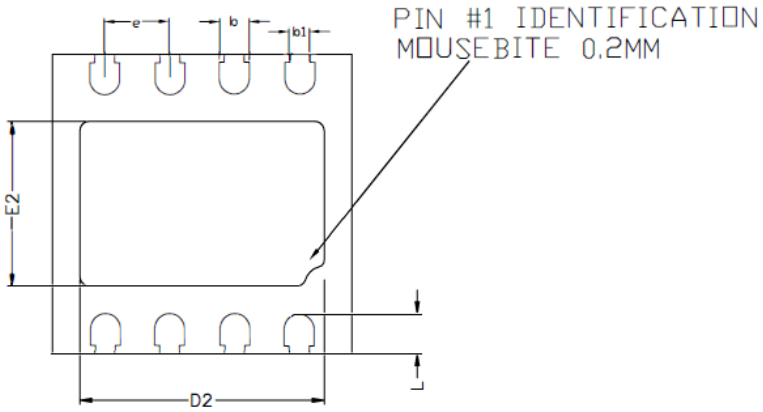


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.25	0.30	0.35
c	0.18	0.20	0.25
D	1.90	2.00	2.10
D2	1.50	1.60	1.70
e	0.65BSC		
Nd	1.30BSC		
E	1.90	2.00	2.10
E2	0.90	1.00	1.10
K	0.20	–	–
L	0.20	0.25	0.30
h	0.15	0.20	0.25

PACKAGE DIMENSIONS: DFN3X3-8L



Top View



Bottom View

Side View

COMMON DIMENSIONS(MM)			
PKG.	W:VERY VERY THIN		
REF.	MIN.	NOM.	MAX
A	0.70	0.75	0.80
A1	0.00	–	0.05
A3	0.2 REF.		
D	2.95	3.00	3.05
E	2.95	3.00	3.05
b	0.25	0.30	0.35
L	0.30	0.40	0.50
D2	2.40	2.45	2.50
E2	1.60	1.65	1.70
e	0.65 BSC		
b1	0.20		