

**LR9113****CMOS IC****LOW NOISE 300mA LDO
REGULATOR****■ DESCRIPTION**

The UTC **LR9113** is a typical LDO (linear regulator) with the features of high output voltage accuracy, low supply current, low ON-resistance, and high ripple rejection.

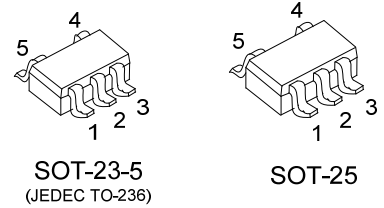
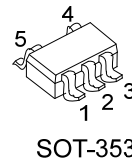
During operation of the UTC **LR9113**, the dropout voltage is very low and the response of line transient and load transient are very well.

Internally, there're many functions of UTC **LR9113** which can be seen in the block figure. There are a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit, and a chip enable circuit in each UTC **LR9113**.

The UTC **LR9113** can be used as an ideal of the power supply for hand-held communication equipment, such as: power source for portable communication equipment, power source for electrical appliances, for example, cameras, VCRs and camcorders and power source for battery-powered equipment.

■ FEATURES

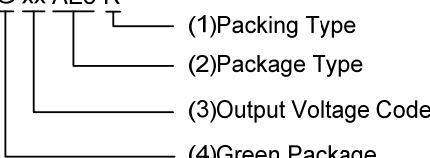
- * Ultra Supply Current: 42 μ A (Typ.)
- * Standby Mode: 0.1 μ A (Typ.)
- * Very Low Dropout Voltage: 0.23V (Typ.) @ $I_{OUT}=300mA$, $V_{OUT}=2.8V$
- * Power-Supply Ripple Rejection: 72dB (Typ.) @ $f=100Hz$, $V_{OUT}=1.8V$
- * Temperature-Drift Coefficient of Output Voltage: $\pm 50ppm/^{\circ}C$ (Typ.)
- * Well Line Regulation: 0.02%/ V (Typ.)
- * Output Voltage Accuracy: $\pm 1.0\%$
- * Internal Fold Back Protection Circuit: 50mA (Typ.) (Current at short mode)
- * $C_{IN}=C_{OUT}=1.0\mu F$ or more (Ceramic capacitors) are recommended to be used with this IC
- * ESD Susceptibility (Human Body Mode): $\pm 2kV$

**SOT-553****SOT-353****DFN1010-4**

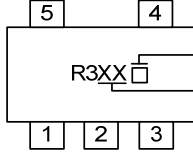
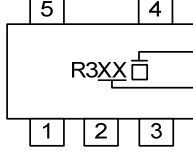
ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
LR9113L-xx-AE5-R	LR9113G-xx-AE5-R	SOT-23-5	Tape Reel
LR9113L-xx-AF5-R	LR9113G-xx-AF5-R	SOT-25	Tape Reel
LR9113L-xx-AL5-R	LR9113G-xx-AL5-R	SOT-353	Tape Reel
LR9113L-AN5-R	LR9113G-AN5-R	SOT-553	Tape Reel
LR9113L-xx-K04-1010-R	LR9113G-xx-K04-1010-R	DFN1010-4	Tape Reel

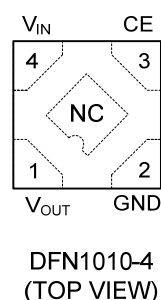
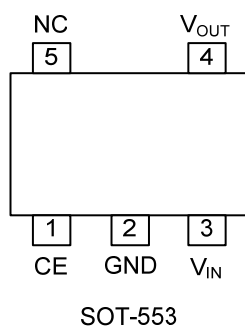
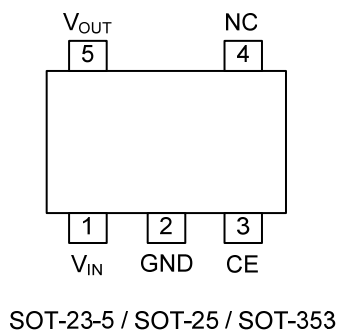
Note: xx: Output Voltage.

LR9113G-xx-AE5-R  (1) Packing Type (2) Package Type (3) Output Voltage Code (4) Green Package	(1) R: Tape Reel (2) AE5: SOT-23-5, AF5: SOT-25, AL5: SOT-353 AN5: SOT-553, K04-1010: DFN1010-4 (3) xx: 11: 1.1V, 12: 1.2V... 50: 5.0V (4) G: Halogen Free and Lead Free, L: Lead Free
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MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-23-5 SOT-25 SOT-353	11: 1.1V 12: 1.2V 15: 1.5V 18: 1.8V 20: 2.0V	 L: Lead Free G: Halogen Free Voltage Code
SOT-553	25: 2.5V 28: 2.8V 30: 3.0V 33: 3.3V 50: 5.0V	 L: Lead Free G: Halogen Free Voltage Code
DFN1010-4	A: 1.1V B: 1.2V C: 1.5V D: 1.8V E: 2.5V G: 2.8V J: 3.0V K: 3.3V P: 3.5V	 Voltage Code

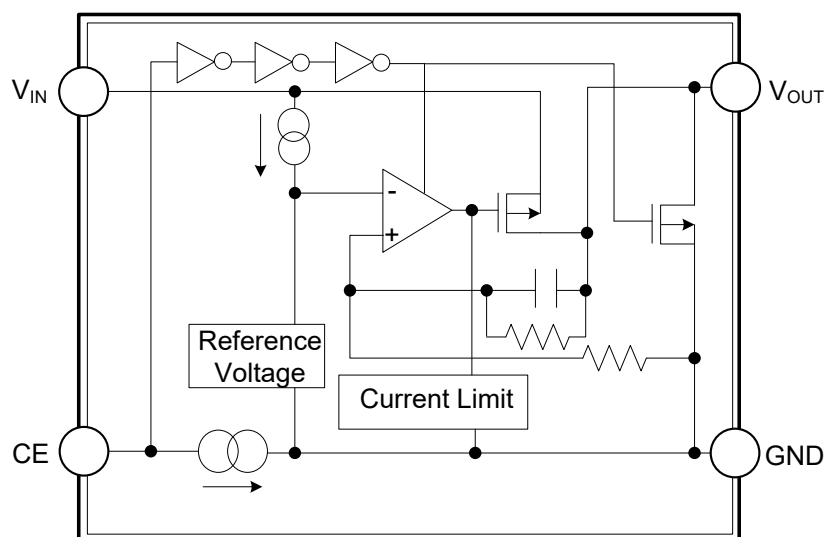
PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.			PIN NAME	DESCRIPTION
SOT-23-5 SOT-25 SOT-353	SOT-553	DFN1010-4		
1	3	4	V_{IN}	Input Pin
2	2	2	GND	Ground Pin
3	1	3	CE	Chip Enable Pin. Active when this Pin is high.
4	5	-	NC	No Connection
5	4	1	V_{OUT}	Output Pin
-	-	Exposed Pad	NC	Thermal pad

BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage		V_{IN}	6	V
Input Voltage (CE Pin)		V_{CE}	6	V
Output Voltage		V_{OUT}	$-0.3 \sim V_{IN}+0.3$	V
Output Current		I_{OUT}	300	mA
Power Dissipation	SOT-23-5	P_D	380	mW
	SOT-25			
	SOT-353		250	mW
	SOT-553		200	mW
	DFN1010-4		550 (Note 2)	mW
Junction Temperature		T_J	+125	°C
Operating Temperature		T_{OPR}	-40 ~ +125	°C
Storage Temperature		T_{STG}	-55 ~ +125	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Heat Sink Area of PCB for DFN1x1-4 is recommended at least 2.5mmx4mm.

■ THERMAL DATA

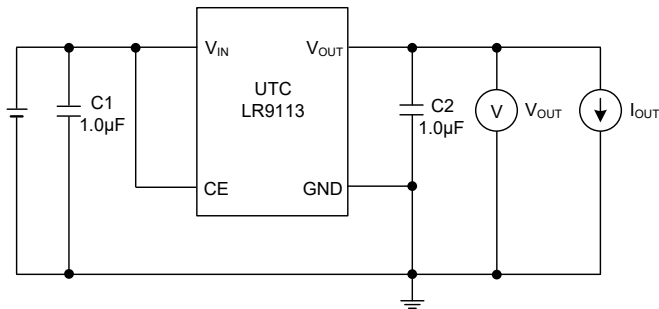
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-23-5	θ_{JA}	263	°C/W
	SOT-25			
	SOT-353		400	°C/W
	SOT-553		500	°C/W
	DFN1010-4		181	°C/W
Junction to Case	SOT-23-5	θ_{JC}	90	°C/W
	SOT-25			
	SOT-353		130	°C/W
	SOT-553		150	°C/W
	DFN1010-4		38	°C/W

■ ELECTRICAL CHARACTERISTICS

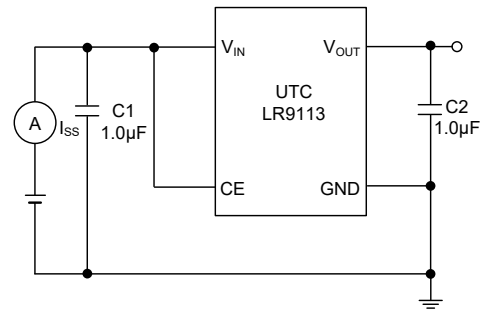
($T_A=25^{\circ}\text{C}$, $V_{IN}=V_{OUT}+1\text{V}$ for $V_{OUT} > 1.5\text{V}$, $V_{IN}=2.5\text{V}$ for $V_{OUT} \leq 1.5\text{V}$, $I_{OUT}=1\text{mA}$, $C_I=C_O=1.0\mu\text{F}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage		V_{OUT}	$V_{IN} = \text{Set}$ $V_{OUT}+1\text{V}$	$V_{OUT} > 2.0\text{V}$	$\times 0.99$	$\times 1.01$	V
				$V_{OUT} \leq 2.0\text{V}$	-20	+20	mV
Input Voltage		V_{IN}				6	V
Load Regulation		ΔV_{OUT}	$1\text{mA} \leq I_{OUT} \leq 300\text{mA}$		20	50	mV
Output Current		I_{OUT}		300			mA
Supply Current		I_{SS}	$I_{OUT}=0\text{A}$		42	60	μA
Supply Current (Standby)		I_{ST-BY}	$V_{CE}=0\text{V}$		0.1	2	μA
Short Current Limit		I_{LIMIT}	$V_{OUT}=0\text{V}$		50		mA
CE Pull-down Current		I_{PD}			0.3		μA
CE Input Voltage	High	V_{CEH}		1			V
	Low	V_{CEL}				0.3	V
Output Noise		eN	$B_W=10\text{Hz to } 100\text{kHz}$, $I_{OUT}=30\text{mA}$		30		μVrms
Power-Supply Ripple Rejection		PSRR	Ripple $0.2V_{P-P}$ $V_{IN}=\text{Set}$ $V_{OUT}+1\text{V}$, $I_{OUT}=10\text{mA}$ (In case that $V_{OUT}=1.8\text{V}$, $V_{IN}=2.8\text{V}$)	$f=100\text{Hz}$		72	dB
				$f=1\text{kHz}$		63	dB
				$f=10\text{kHz}$		44	dB
				$f=100\text{kHz}$		32	dB
				$f=1\text{MHz}$		52	dB
'Dropout Voltage		V_D	$I_{OUT}=300\text{mA}$	$1.1\text{V} \leq V_{OUT} < 1.2\text{V}$		0.80	V
				$1.2\text{V} \leq V_{OUT} < 1.5\text{V}$		0.70	
				$1.5\text{V} \leq V_{OUT} < 1.7\text{V}$		0.43	
				$1.7\text{V} \leq V_{OUT} < 2.0\text{V}$		0.37	
				$2.0\text{V} \leq V_{OUT} < 2.5\text{V}$		0.30	
				$2.5\text{V} \leq V_{OUT} < 2.8\text{V}$		0.25	
				$2.8\text{V} \leq V_{OUT} \leq 5.0\text{V}$		0.23	
Line Regulation		$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$1.1\text{V} \leq V_{OUT} \leq 4.0\text{V}$, $V_{SET}+0.5\text{V} \leq V_{IN} \leq 5\text{V}$		0.02	0.10	%V
			$4.0\text{V} < V_{OUT} \leq 5.0\text{V}$, $V_{SET}+0.5\text{V} \leq V_{IN} \leq 6.5\text{V}$				
Output Voltage Temperature Coefficient		$\frac{\Delta V_{OUT}}{\Delta T}$	$-40^{\circ}\text{C} \leq T_{OPR} \leq 85^{\circ}\text{C}$		± 50		ppm/ $^{\circ}\text{C}$
Low Output Nch Tr. ON Resistance		R_{LOW}	$V_{IN}=4.0\text{V}$, $V_{CE}=0\text{V}$		70		Ω

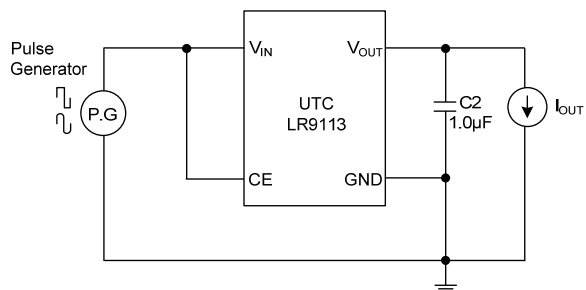
■ TEST CIRCUIT



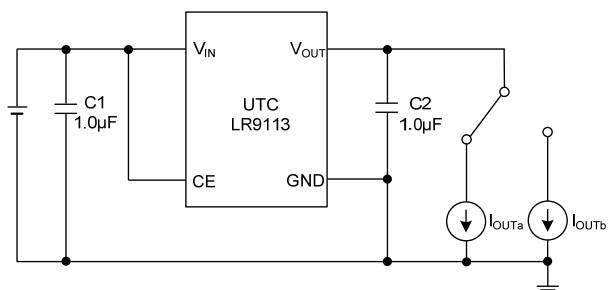
Basic Test Circuit



Test Circuit for Supply Current

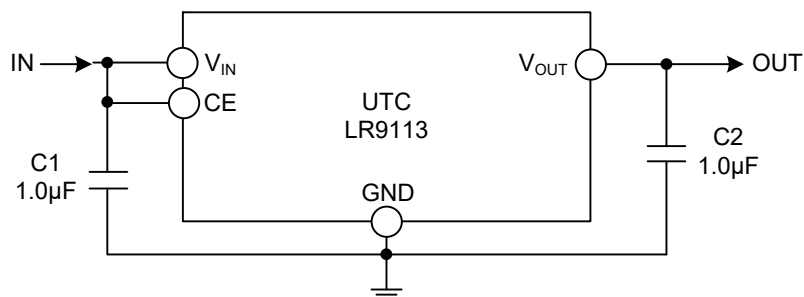


Test Circuit for Ripple Rejection



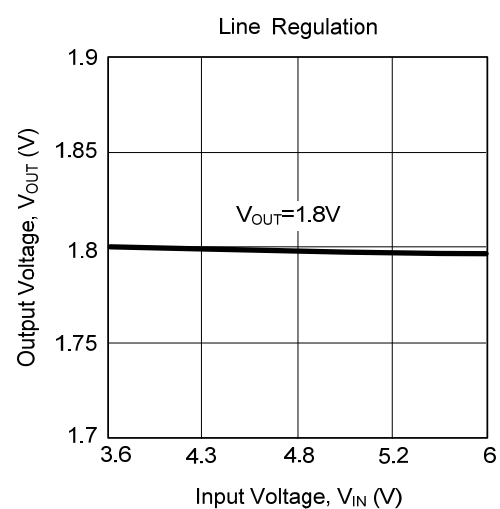
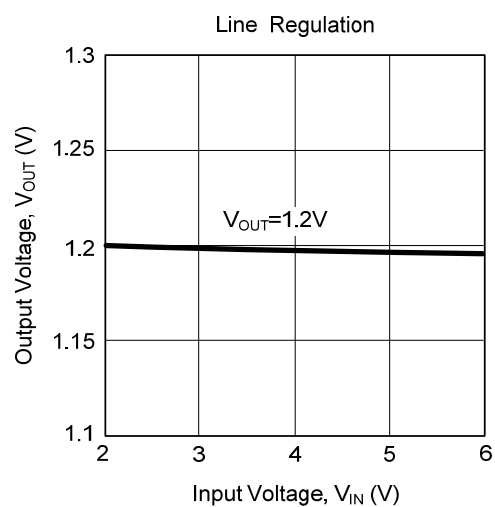
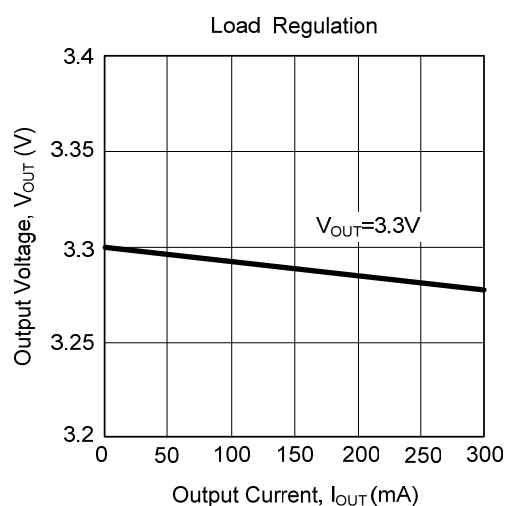
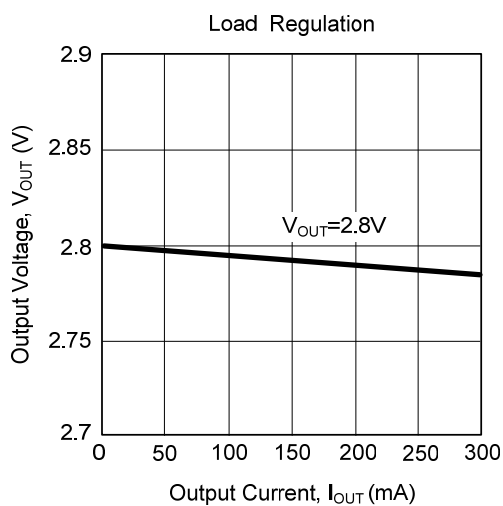
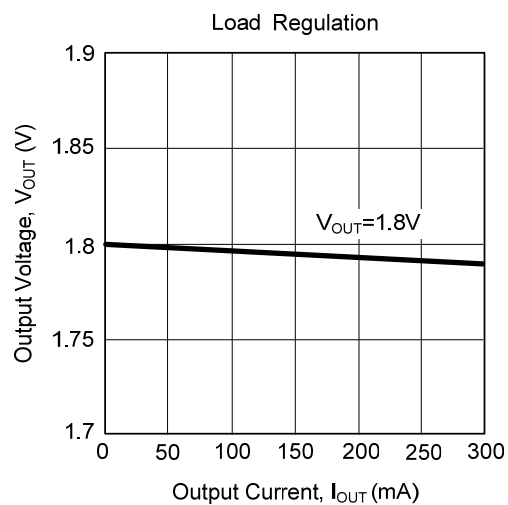
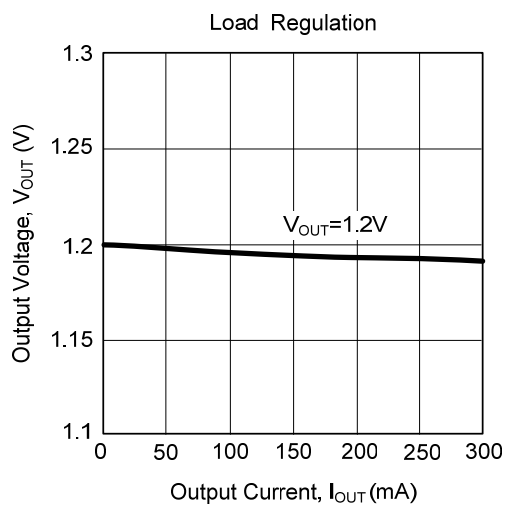
Test Circuit for Load Transient Response

■ TYPICAL APPLICATION CIRCUIT

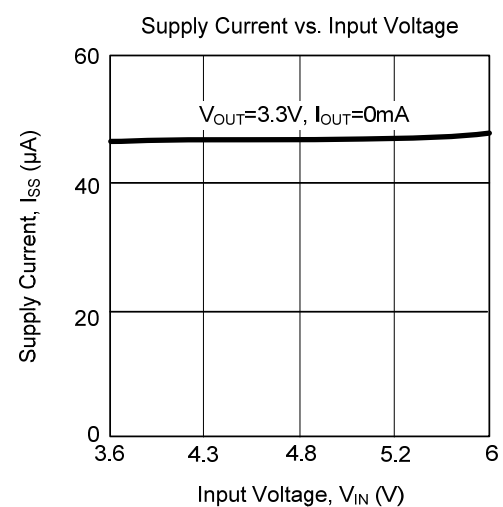
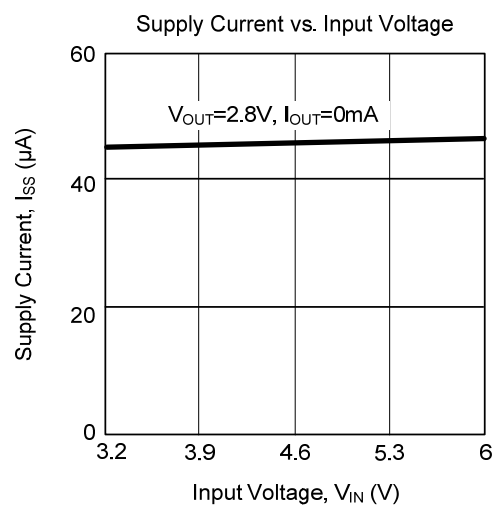
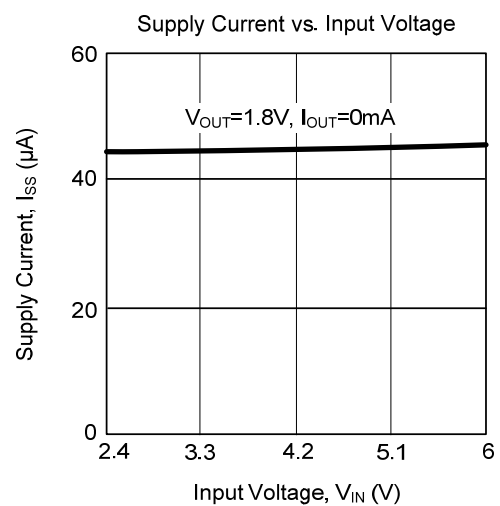
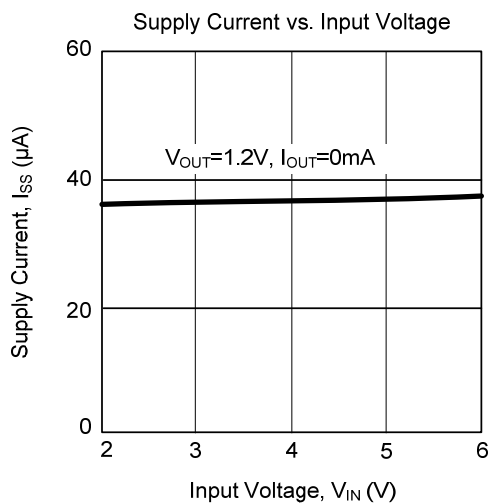
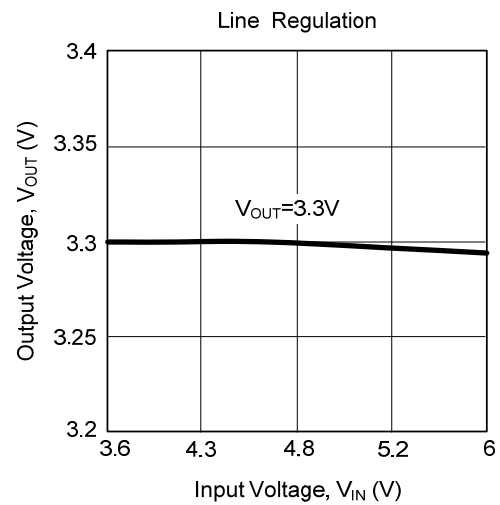
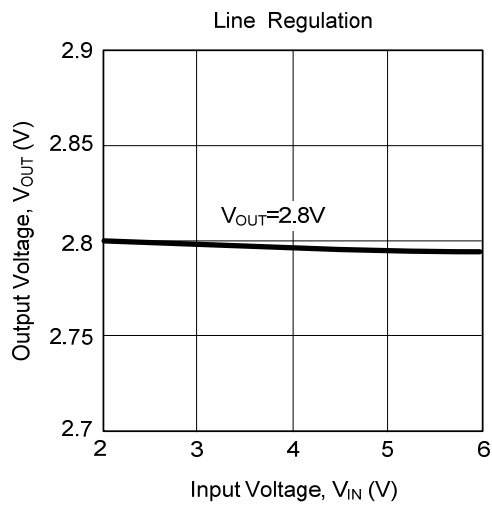


■ TYPICAL CHARACTERISTICS

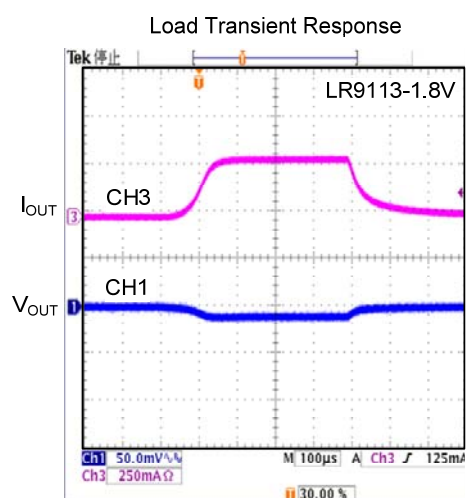
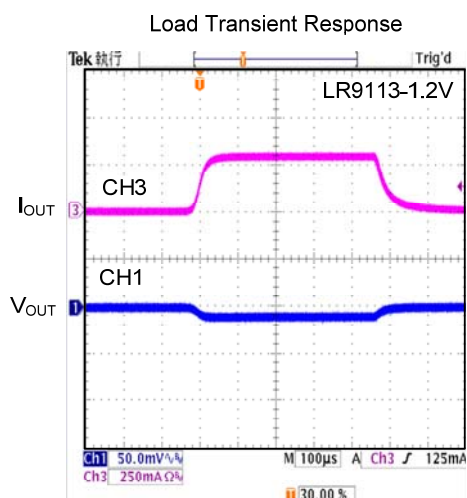
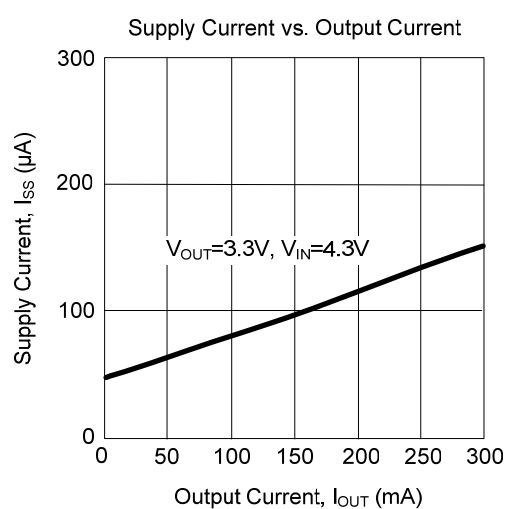
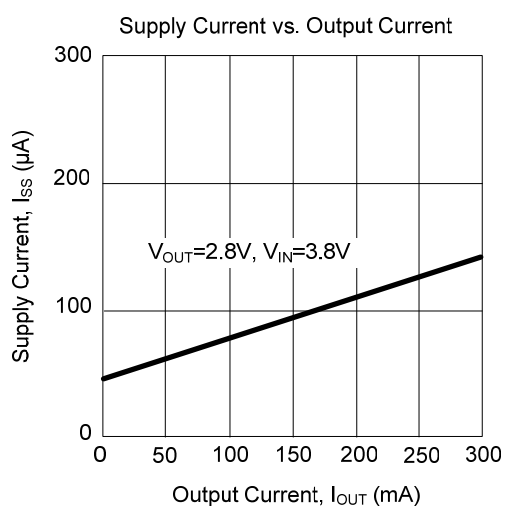
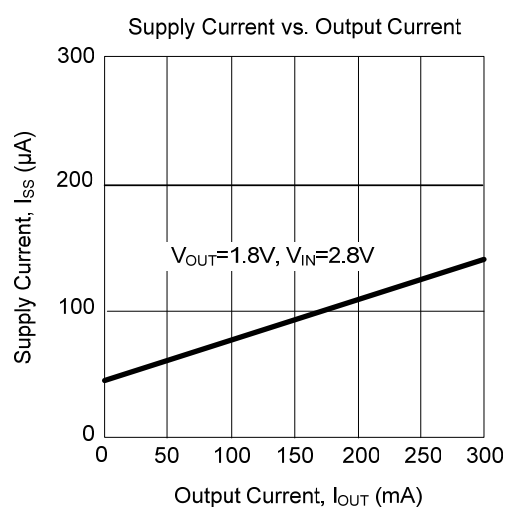
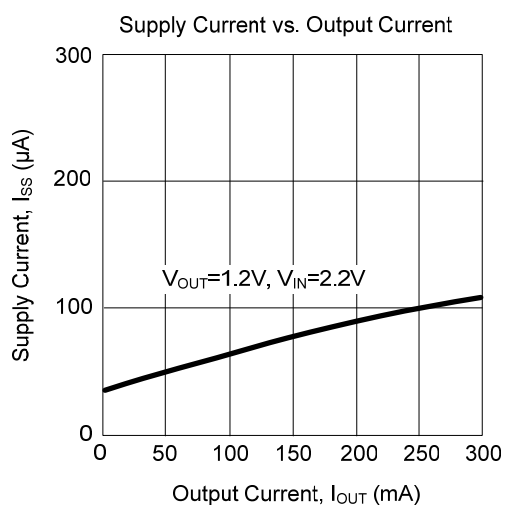
($T_J=25^{\circ}\text{C}$, $V_J=\text{Set } V_{\text{OUT}}+1\text{V}$, $I_O=10\text{mA}$, $C_J=1\mu\text{F}$, unless otherwise specified)



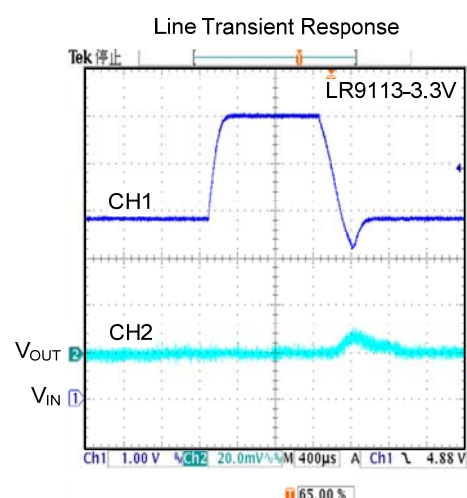
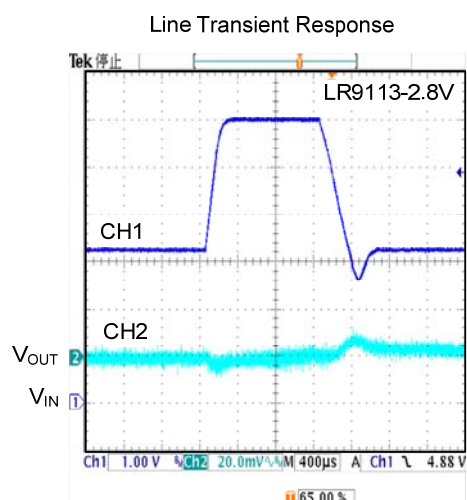
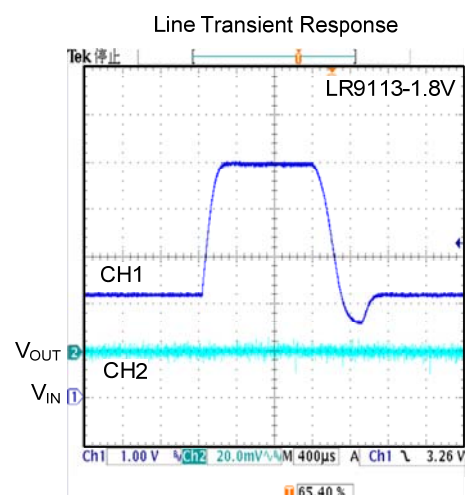
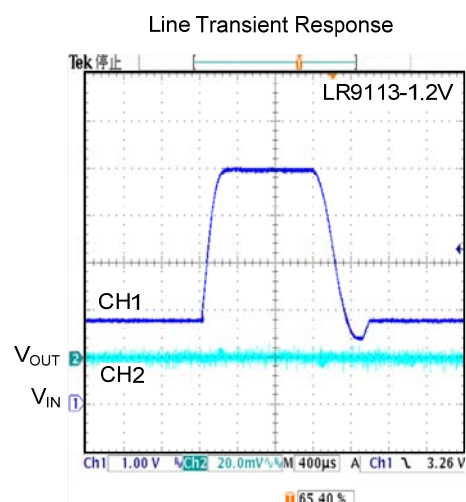
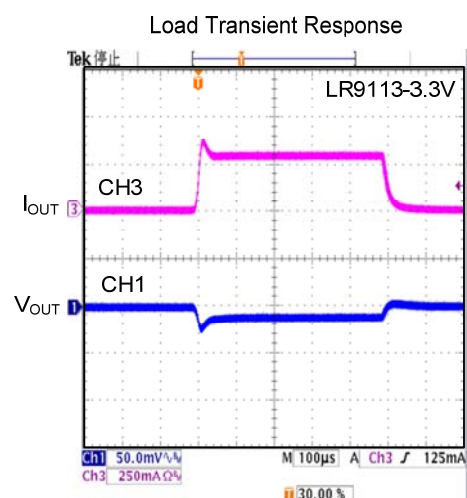
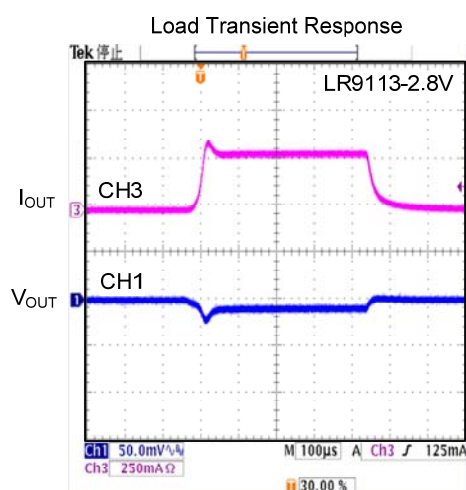
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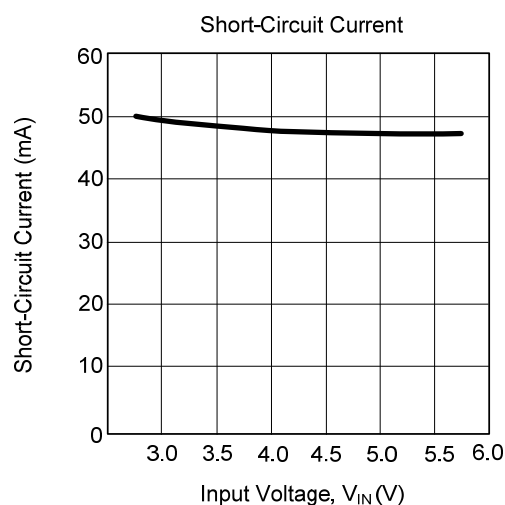
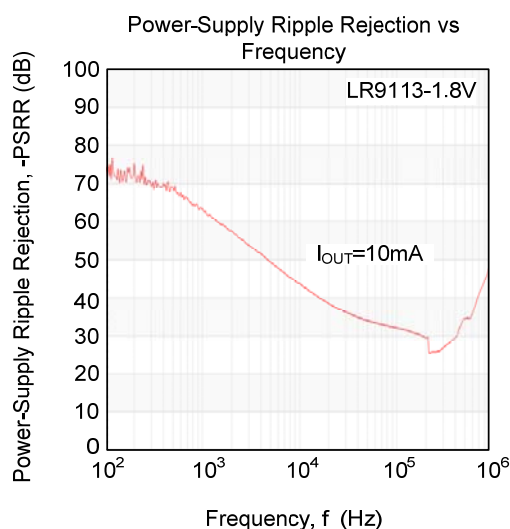
■ TYPICAL CHARACTERISTICS (Cont.)



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■ TYPICAL CHARACTERISTICS (Cont.)



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