1. DESCRIPTION

The XD/XL833 is a dual operational amplifier with high-performance specifications for use in quality audio and data-signal applications. This device operates over a wide range of single- and dual-supply voltage with low noise, high-gain bandwidth, and high slew rate. Additional features include low total harmonic distortion, excellent phase and gain margins, large output voltage swing with no deadband crossover distortions, and symmetrical sink/source performance.

The dual amplifiers are utilized widely in circuit of audio optimized for all preamp and high level stages in PCM and HiFi systems. XD/XL833 is pin-for-pin compatible with industry-standard dual operation amplifiers' pin assignments. With addition of a preamplifier, the gain of the power stage can be greatly reduced to improve performance.

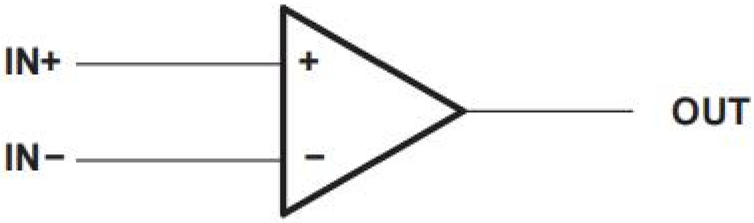
2. FEATURES.

- Dual-Supply Operation: ±5V to ±18V
- Low Noise Voltage:4.5 nVHz
- Low Input Offset Voltage:0.15 mV
- Low Total Harmonic Distortion:0.002%
- High Slew Rate:7V/μs
- High-Gain Bandwidth Product:16 MHz
- High Open-Loop AC Gain:800 at 20 kHz
- Large Output-Voltage Swing: 14.1 V to-14.6V
- Excellent Gain and Phase Margins

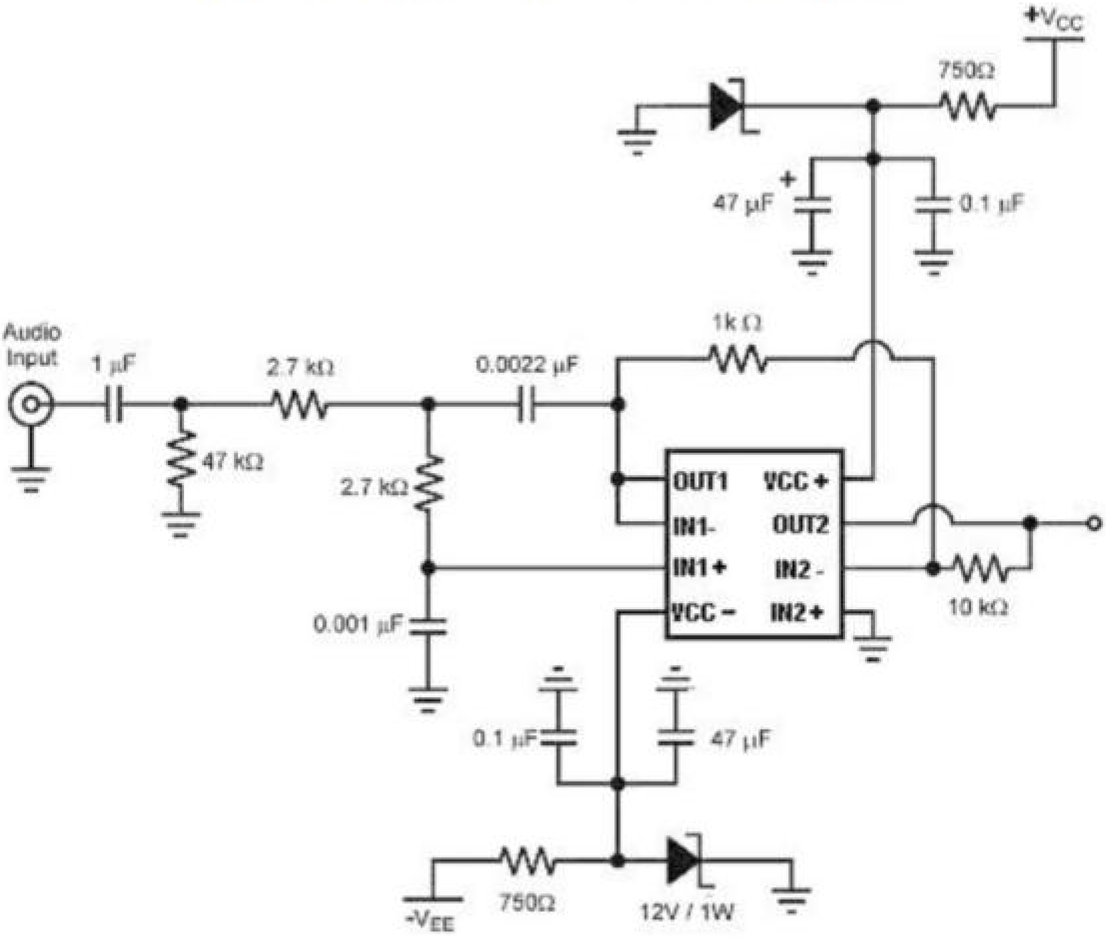
3. APPLICATIONS

- HiFi Audio System Equipment
- Preamplification and Filtering
- Set Top Box
- Microphone PreAmplifier Circuit
- General-Purpose Amplifier Applications

Symbol (Each Amplifier)



Typical Design Example Audio Pre-Amplifier



4. ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V_{CC+}	Supply voltage(2)			18	V
V_{CC-}	Supply voltage(2)			-18	V
V_{CC+} - V_{CC-}	Supply voltage			36	V
	Input voltage, either input (2) (3)			V_{CC+} or V_{CC-}	V
	Input current (4)			±10	mA
	Duration of output short circuit (5)			Unlimited	
θ_{JA}	Package thermal impedance, junction to free air(6) (7)	D package		97	°C/W
		DGK package		172	
		P package		85	
T_J	Operating virtual junction temperature			150	°C
T_{stg}	Storage temperature range		-65	150	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltage values, except differential voltages, are with respect to the midpoint between VCC+ and VCC–.
(3) The magnitude of the input voltage must never exceed the magnitude of the supply voltage.
(4) Excessive input current will flow if a differential input voltage in excess of approximately 0.6 V is applied between the inputs, unless some limiting resistance is used.
(5) The output may be shorted to ground or either power supply. Temperature and/or supply voltages must be limited to ensure the maximum dissipation rating is not exceeded.
(6) Maximum power dissipation is a function of TJ (max), qJA, and TA. The maximum allowable power dissipation at any allowable ambient temperature is PD = (TJ (max) – TA)/qJA. Operating at the absolute maximum TJ of 150°C can affect reliability.
(7) The package thermal impedance is calculated in accordance with JESD 51-7.

5. ELECTROSTATIC DISCHARGE RATINGS

		MIN	MAX	UNIT
ESD	Human-Body Model (HBM)		2.5	kV
	Charged-Device Model (CDM)		1.5	

6. RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
V_{CC-}	Supply voltage	-5	-18	V
V_{CC+}		5	18	
TA	Operating free-air temperature range	-40	85	°C

7. ELECTRICAL CHARACTERISTICS

V_{CC-} = –15 V, V_{CC+} = 15 V, T_A = 25°C (unless otherwise noted)

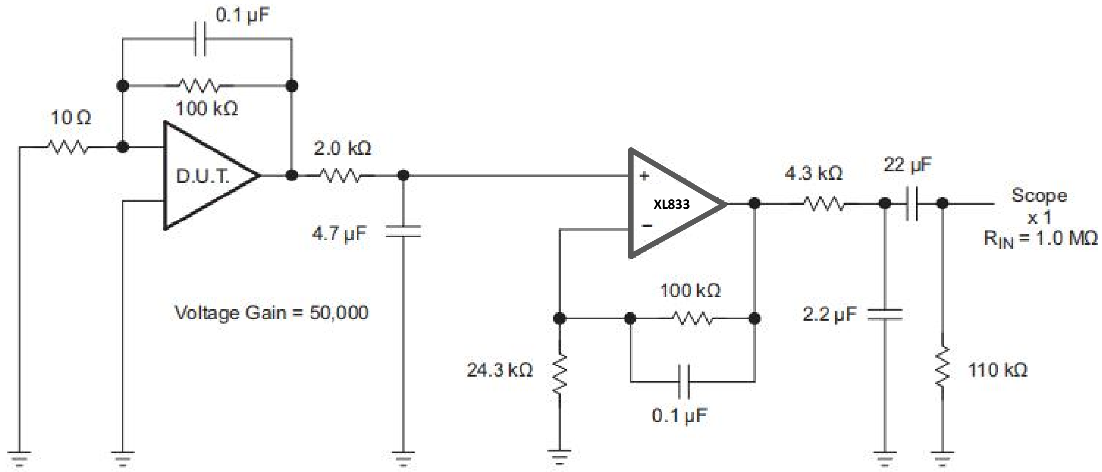
PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	Vo = 0,Rs = 10 Ω,Vcm=0		T_A = 25°C		0.15	2	mV
				T_A = –40°C to 85°C			3	
aV_{IO}	Input offset voltage temperature coefficient	Vo =0,Rs =10 Ω,Vcm=0		T_A = –40°C to 85°C		2		mV/°C
I_{IB}	Input bias current	Vo =0,Vcm =0		T_A = 25°C		300	750	nA
				T_A = –40°C to 85°C			800	
I_{IO}	Input offset current	Vo =0,Vcm =0		T_A = 25°C		25	150	nA
				T_A = –40°C to 85°C			175	
V_{ICR}	Common-mode input voltage range	△V_{IO} = 5 mV, Vo=0			±13	±14		V
A_{VD}	Large-signal differential voltage amplification	RL ≥ 2 kΩ, Vo=±10V		T_A = 25°C	90	110		dB
				T_A = –40°C to 85°C	85			
V_{OM}	Maximum output voltage swing	V_{ID} = ±1 V	R_L = 600 Ω	V_{OM+}		10.7		V
				V_{OM-}		-11.9		
			R_L = 2k Ω	V_{OM+}	13.2	13.8		
				V_{OM-}	-13.2	-13.7		
			R_L = 10k Ω	V_{OM+}	13.5	14.1		
				V_{OM-}	-14	-14.6		
CMMR	Common-mode rejection ratio	V_{IN} = ±13 V			80	100		dB
K_{SVR}(1)	Supply-voltage rejection ratio	V_{CC+} = 5 V to 15 V, V_{CC-} = –5 V to –15 V			80	105		dB
I_{OS}	Output short-circuit current	|V_{ID}| = 1 V, Output to GND		Source current	15	29		mA
				Sink current	-20	-37		
I_{CC}	Supply current (per channel	Vo = 0		T_A = 25°C		2.05	2.5	mA
				T_A = –40°C to 85°C			2.75	

(1) Measured with VCC± differentially varied at the same time

8. OPERATING CHARACTERISTICS

VCC– = –15 V, VCC+ = 15 V, TA = 25°C (unless otherwise noted)

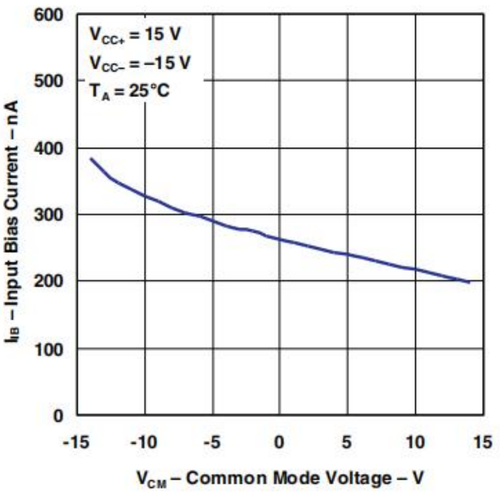
PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	A_{VD} = 1, V_{IN} = –10 V to 10 V, R_L = 2 kΩ, CL = 100 pF		5	7		V/ms
GBW	Gain bandwidth product	f = 100 kHz		10	16		MHz
B_1	Unity gain frequency	Open loop			9		MHz
G_m	Gain margin	R_L = 2 kΩ	C_L = 0 pF		-11		dB
			C_L = 100 pF		-6		
$Φ_m$	Phase margin	R_L = 2 kΩ	C_L = 0 pF		55		deg
			C_L = 100 pF		40		
	Amp-to-amp isolation	f = 20 Hz to 20 kHz			-120		dB
	Power bandwidth	V_O = 27 $V_{(PP)}$, R_L = 2 kΩ, THD ≤ 1%			120		kHz
THD	Total harmonic distortion	V_O = 3 V_{rms}, A_{VD} = 1, R_L = 2 kΩ, f = 20 Hz to 20 kHz			0.002		%
z_o	Open-loop output impedance	V_O = 0, f = 9 MHz			37		Ω
r_{id}	Differential input resistance	V_{CM} = 0			175		kΩ
C_{id}	Differential input capacitance	V_{CM} = 0			12		pF
V_n	Equivalent input noise voltage	f = 1 kHz, R_S = 100 Ω			4.5		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz			0.5		pA/√Hz



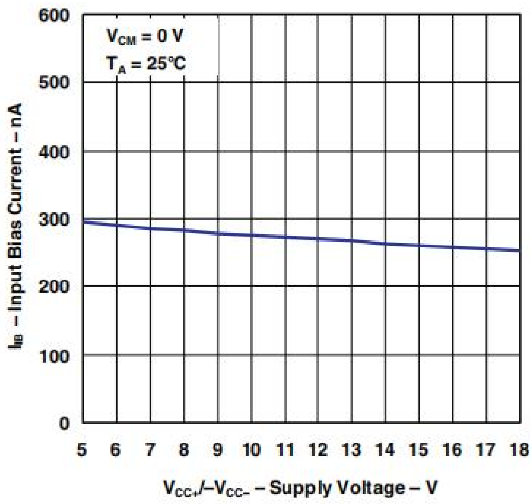
NOTE: All capacitors are non-polarized.

Figure 1. Voltage Noise Test Circuit (0.1 Hz to 10 Hz)

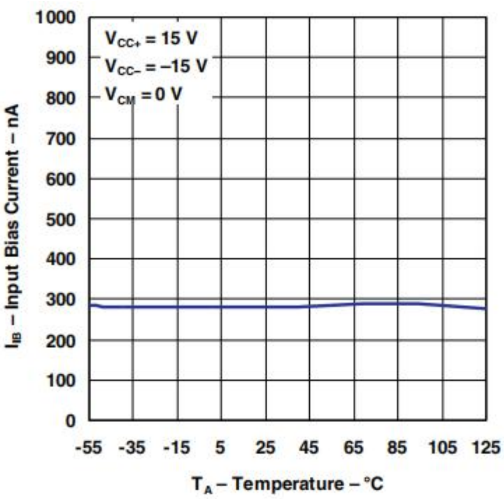
9. TYPICAL CHARACTERISTICS



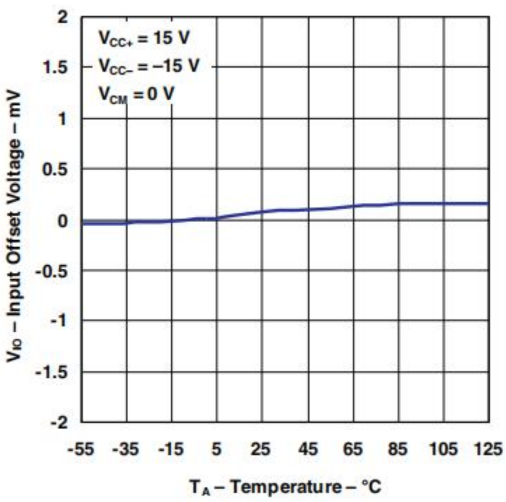
INPUT BIAS CURRENT
VS
COMMON-MODE VOLTAGE



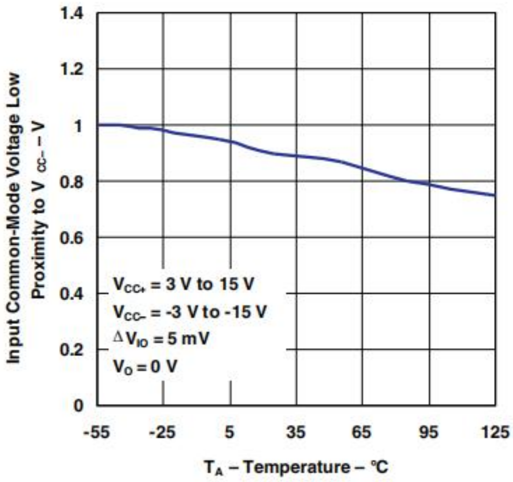
INPUT BIAS CURRENT
VS
SUPPLY VOLTAGE



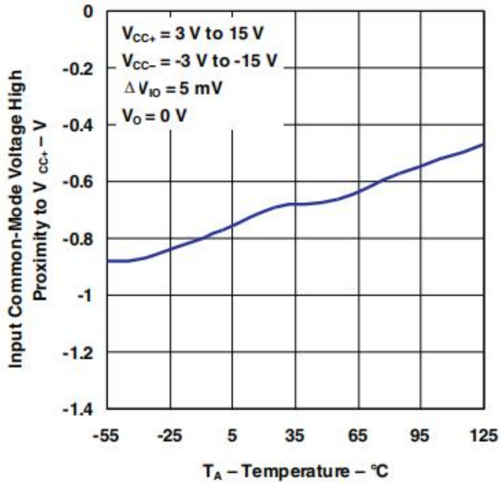
INPUT BIAS CURRENT
VS
TEMPERATURE



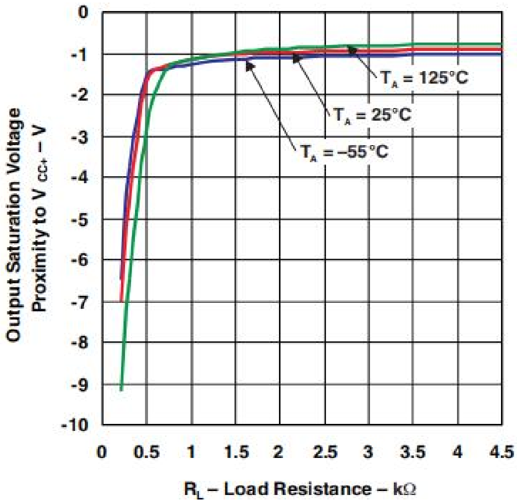
INPUT OFFSET VOLTAGE
VS
TEMPERATURE



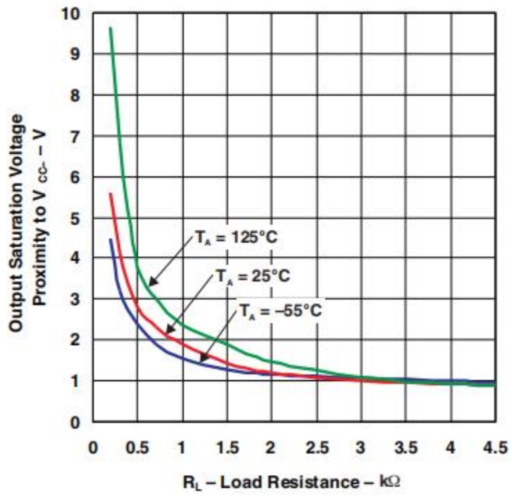
NPUT COMMON-MODE VOLTAGE
LOW PROXIMITY TO V_{CC-}
VS
TEMPERATURE



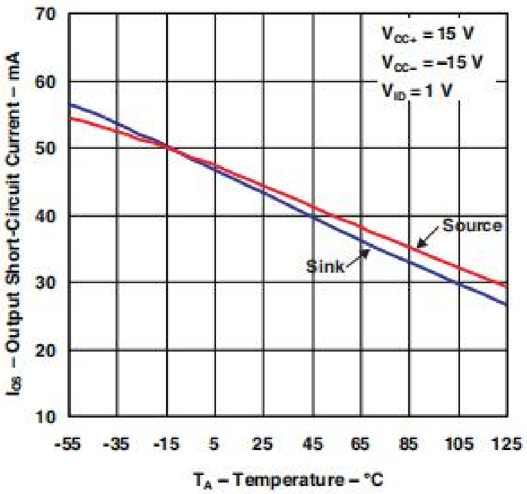
INPUT COMMON-MODE VOLTAGE
HIGH PROXIMITY TO V_{CC+}
VS
TEMPERATURE



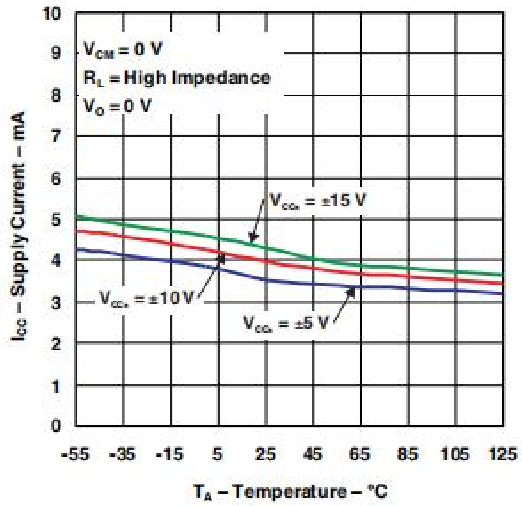
OUTPUT SATURATION VOLTAGE
PROXIMITY TO V_{CC+}
VS
LOAD RESISTANCE



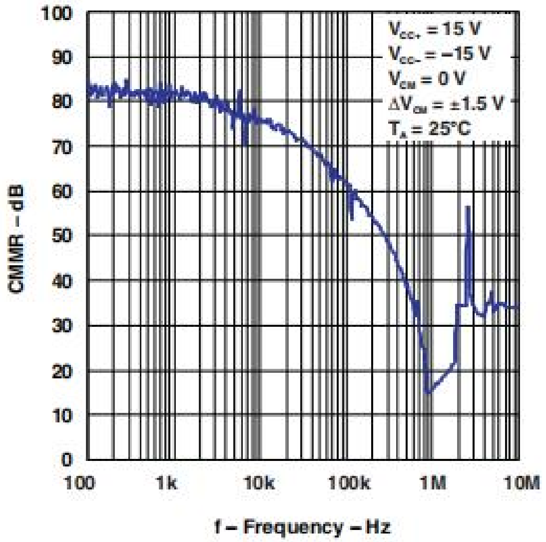
OUTPUT SATURATION VOLTAGE
PROXIMITY TO V_{CC-}
VS
LOAD RESISTANCE



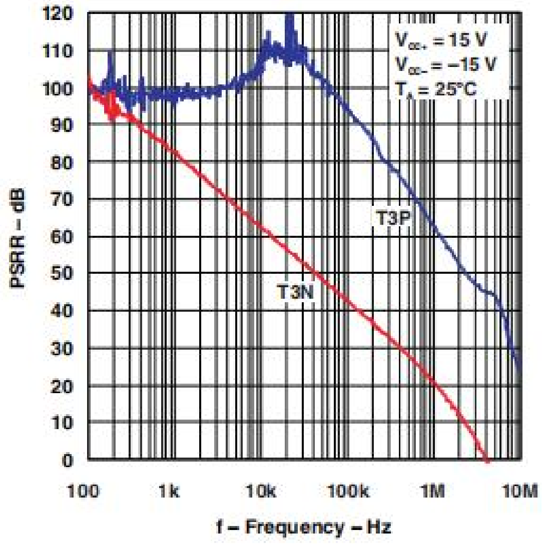
OUTPUT SHORT-CIRCUIT CURRENT
VS
TEMPERATURE



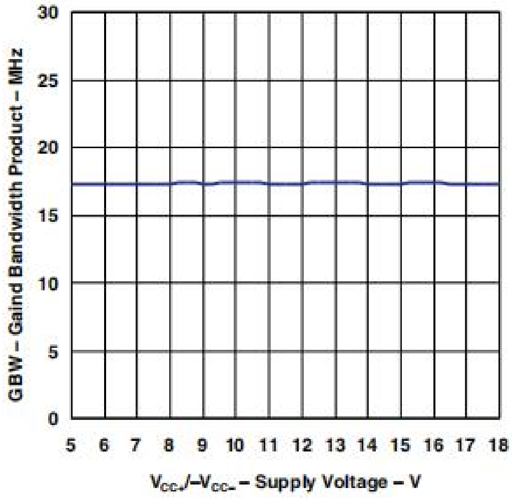
SUPPLY CURRENT
VS
TEMPERATURE



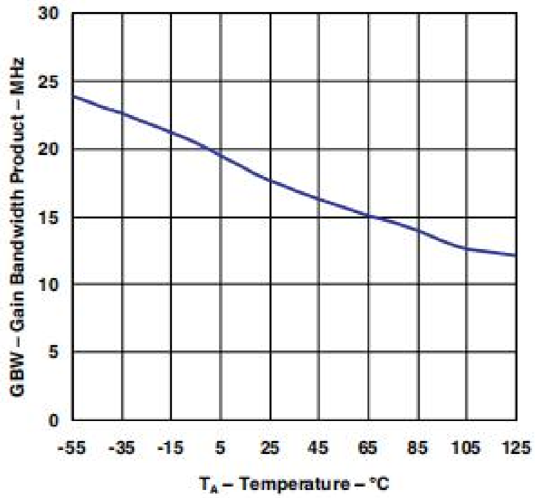
CMRR
VS
FREQUENCY



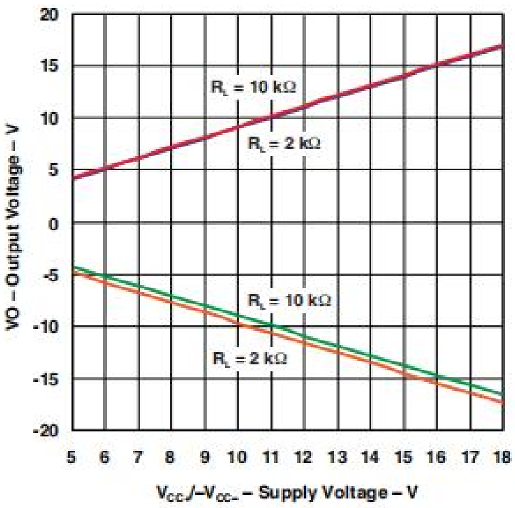
PSSR
VS
FREQUENCY



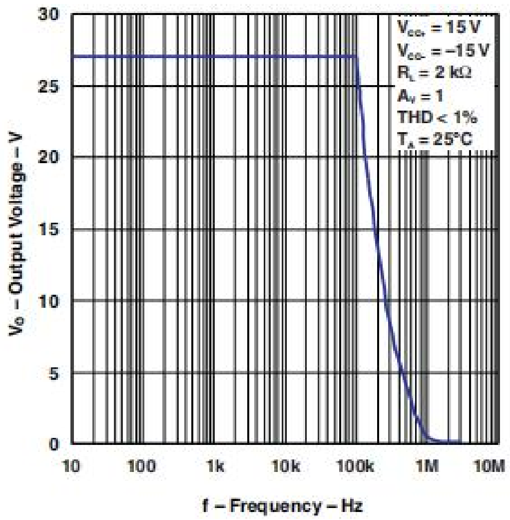
GAIN BANDWIDTH PRODUCT
VS
SUPPLY VOLTAGE



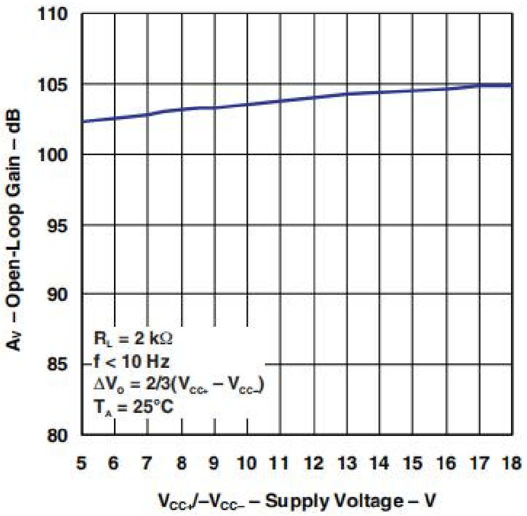
GAIN BANDWIDTH PRODUCT
VS
TEMPERATURE



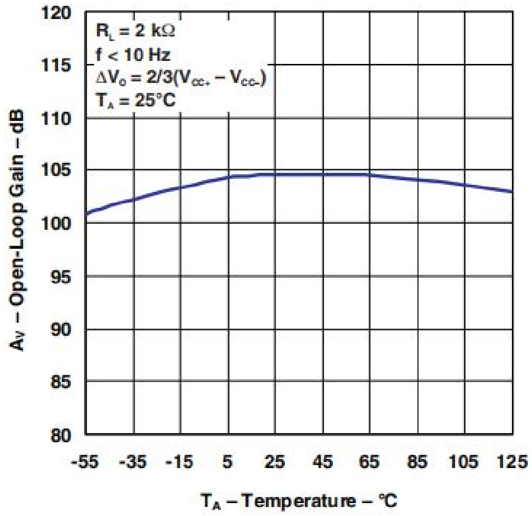
OUTPUT VOLTAGE
VS
SUPPLY VOLTAGE



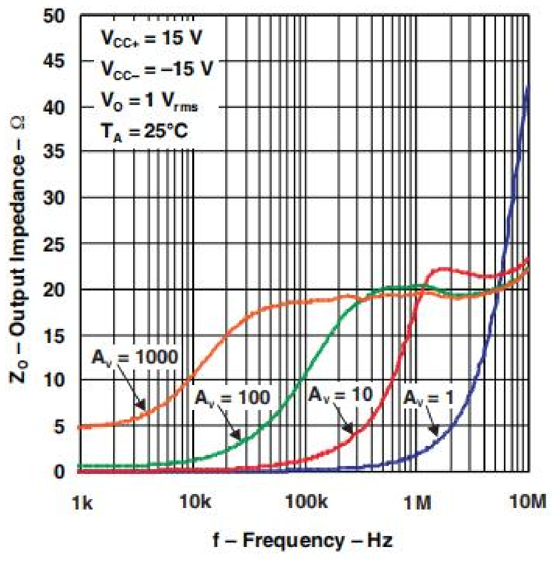
OUTPUT VOLTAGE
VS
FREQUENCY



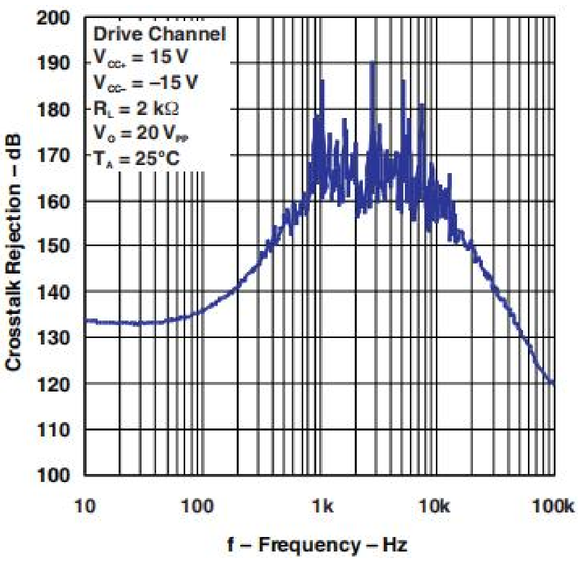
OPEN-LOOP GAIN
VS
SUPPLY VOLTAGE



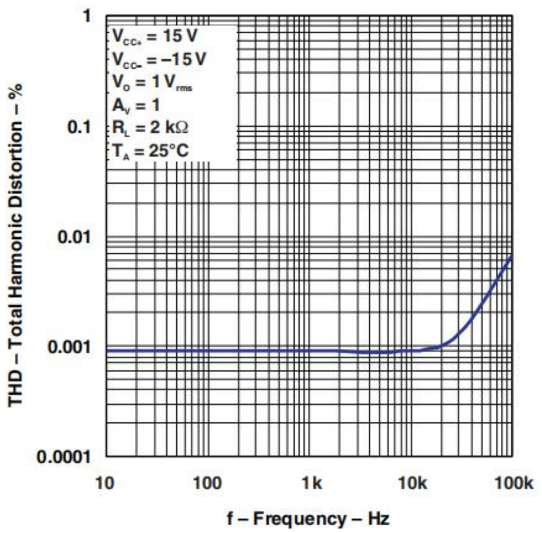
OPEN-LOOP GAIN
VS
TEMPERATURE



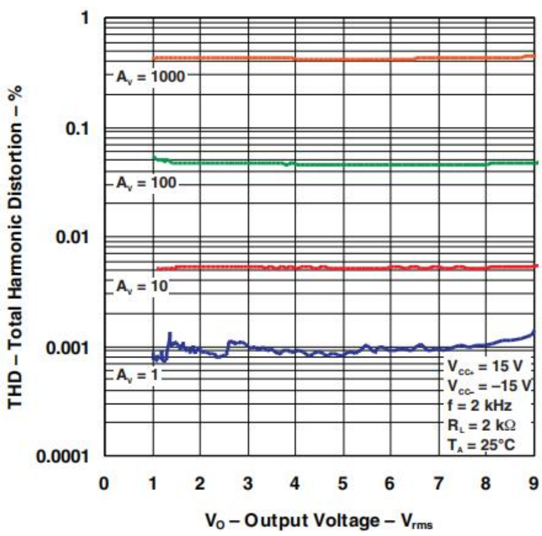
OUTPUT IMPEDANCE
VS
FREQUENCY



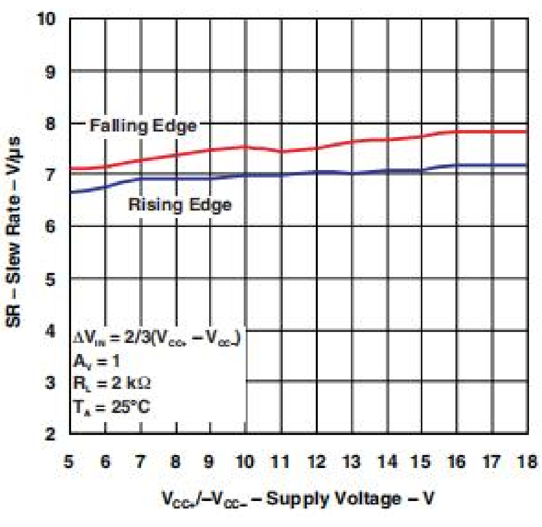
CROSSTALK REJECTION
VS
FREQUENCY



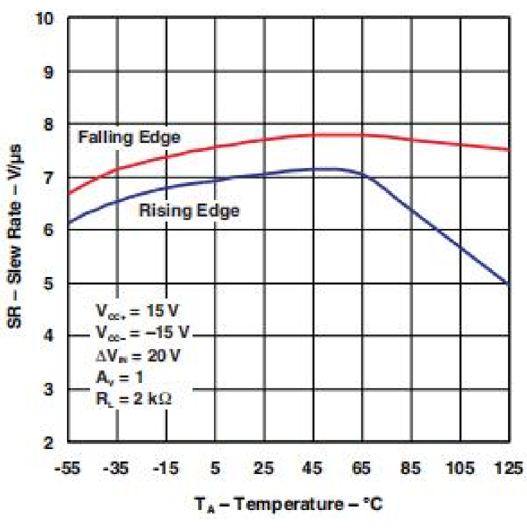
TOTAL HARMONIC DISTORTION
VS
FREQUENCY



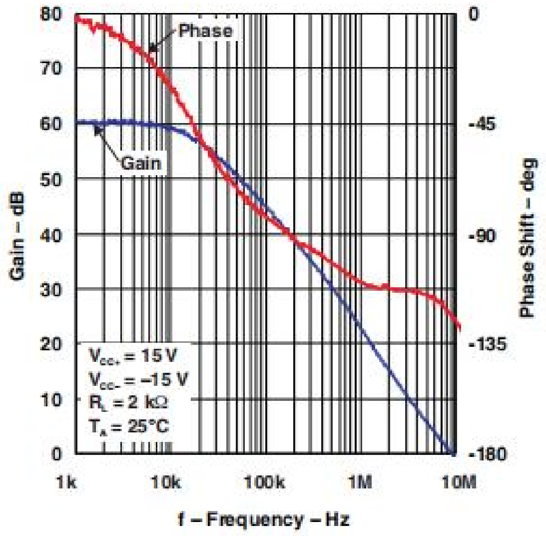
TOTAL HARMONIC DISTORTION
VS
OUTPUT VOLTAGE



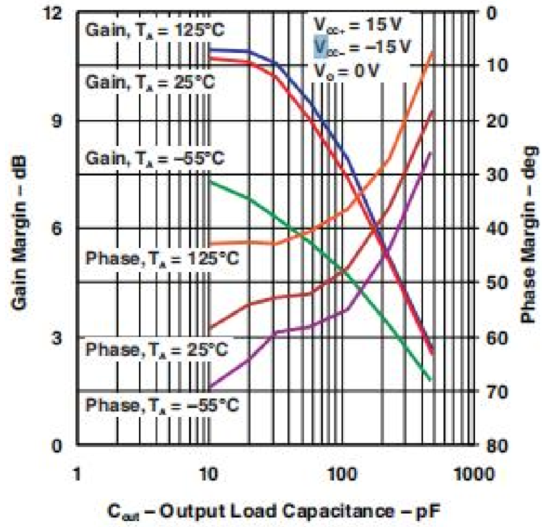
SLEW RATE
VS
SUPPLY VOLTAGE



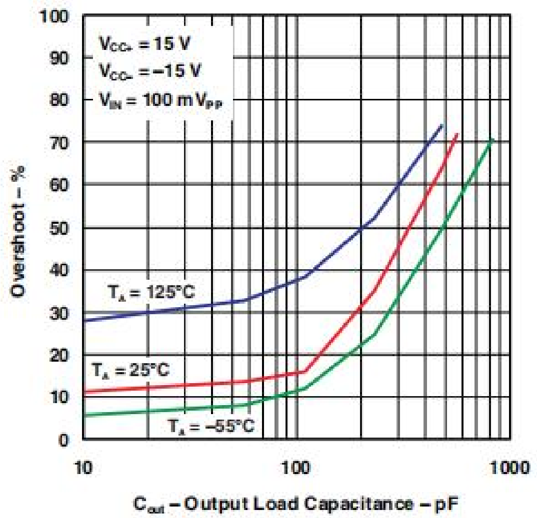
SLEW RATE
VS
TEMPERATURE



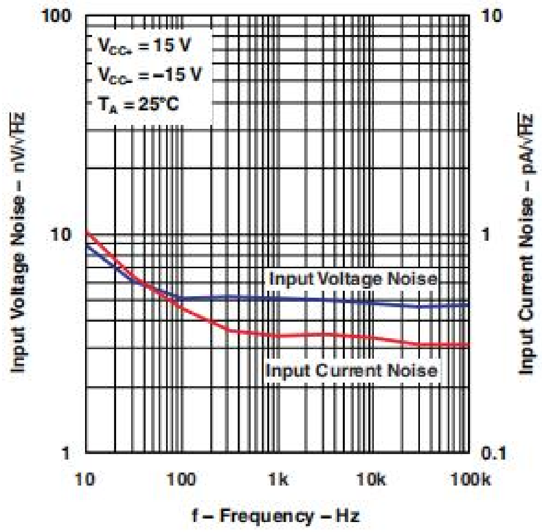
GAIN AND PHASE
VS
FREQUENCY



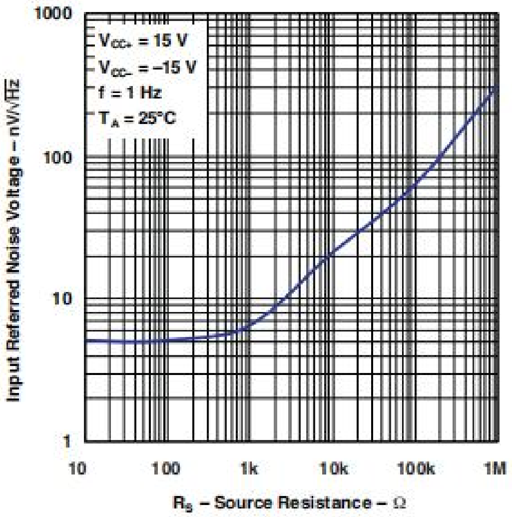
GAIN AND PHASE MARGIN
VS
OUTPUT LOAD CAPACITANCE



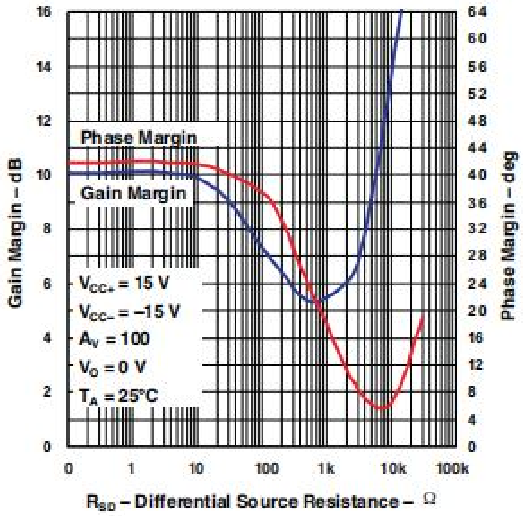
OVERSHOOT
VS
OUTPUT LOAD CAPACITANCE



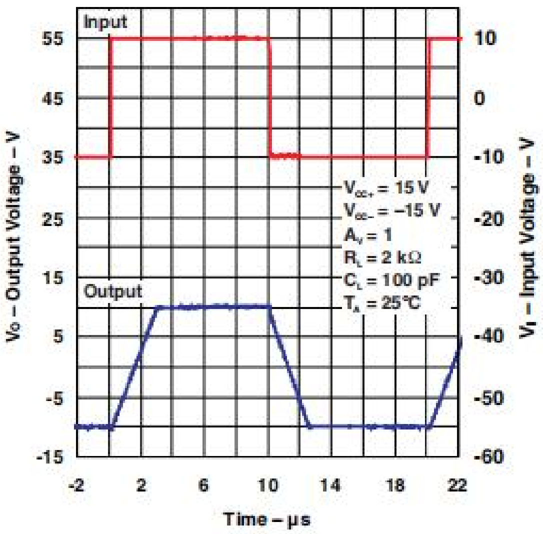
INPUT VOLTAGE AND CURRENT NOISE
VS
FREQUENCY



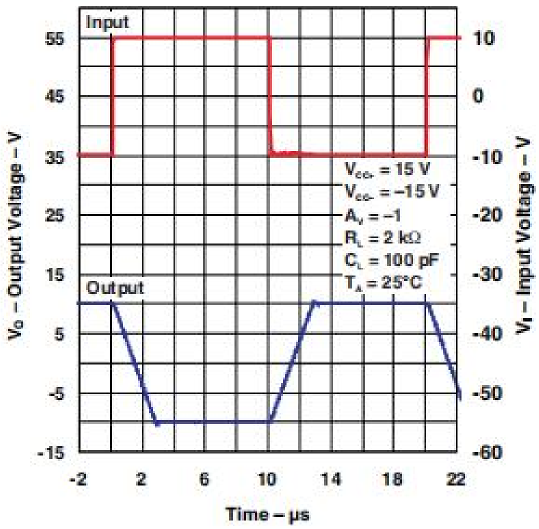
INPUT REFERRED NOISE VOLTAGE
VS
SOURCE RESISTANCE



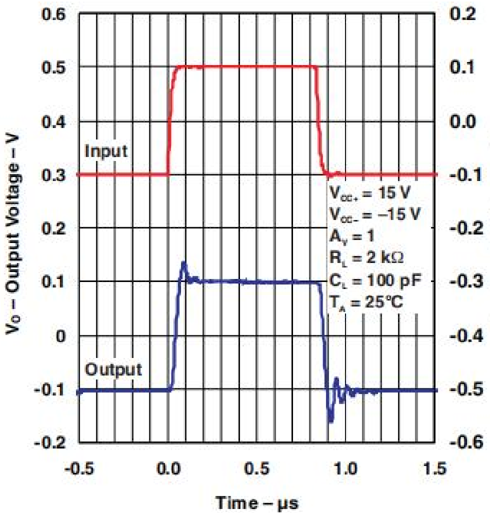
GAIN AND PHASE MARGIN
VS
DIFFERENTIAL SOURCE RESISTANCE



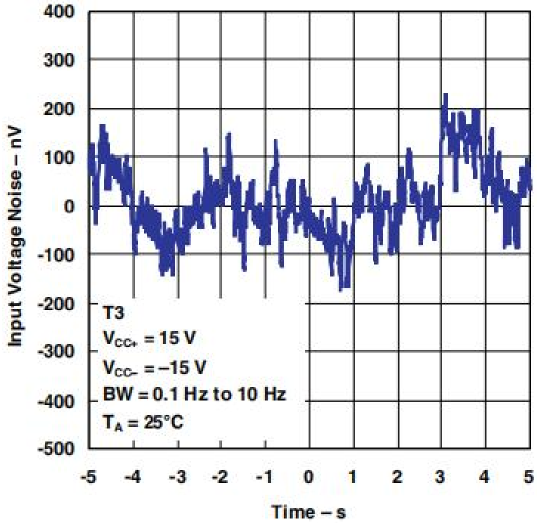
LARGE SIGNAL TRANSIENT RESPONSE
(A_V=1)



LARGE SIGNAL TRANSIENT RESPONSE
(Av=-1)



SMALL SIGNAL TRANSIENT RESPONSE



LOW_FREQUENCY NOISE

10. APPLICATION INFORMATION

All operating characteristics are specified with 100-pF load capacitance. The XL833 can drive higher capacitanceloads. However, as the load capacitance increases, the resulting response pole occurs at lower frequencies,causing ringing, peaking, or oscillation. The value of the load capacitance at which oscillation occurs varies fromlot to lot. If an application appears to be sensitive to oscillation due to load capacitance, adding a small resistance in series with the load should alleviate the problem (see Figure 2)

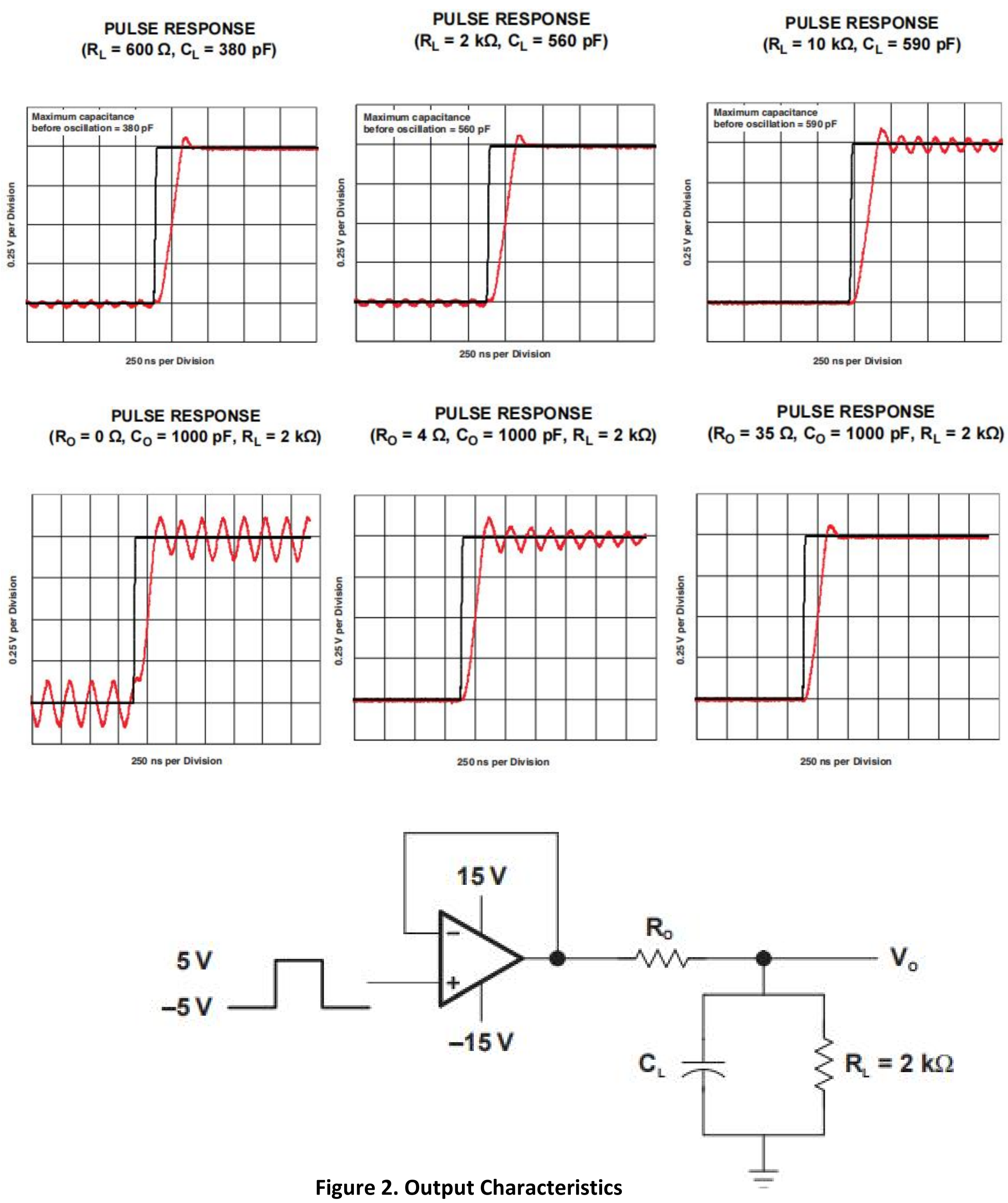


Figure 2. Output Characteristics

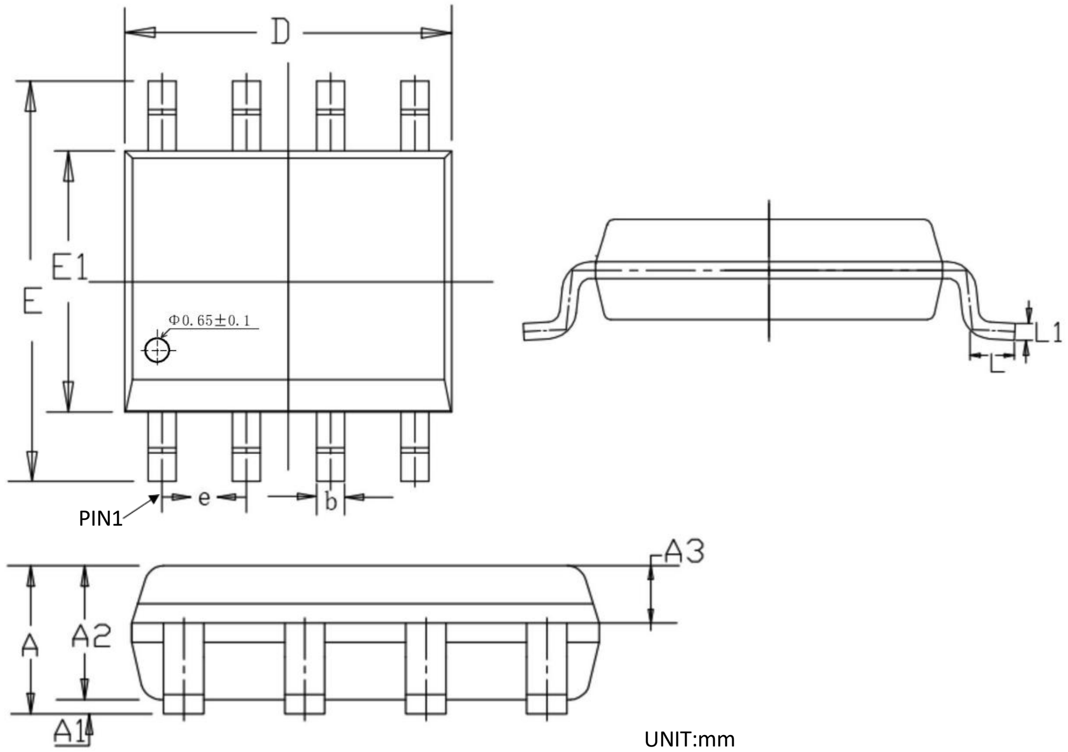
11. ORDERING INFORMATION

Ordering Information

Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
XL833	XL833	SOP8	4.90 ∗ 3.90	- 40 to 85	MSL3	T&R	2500
XD833	XD833	DIP8	9.25 ∗ 6.38	- 40 to 85	MSL3	Tube 50	2000

12. DIMENSIONAL DRAWINGS

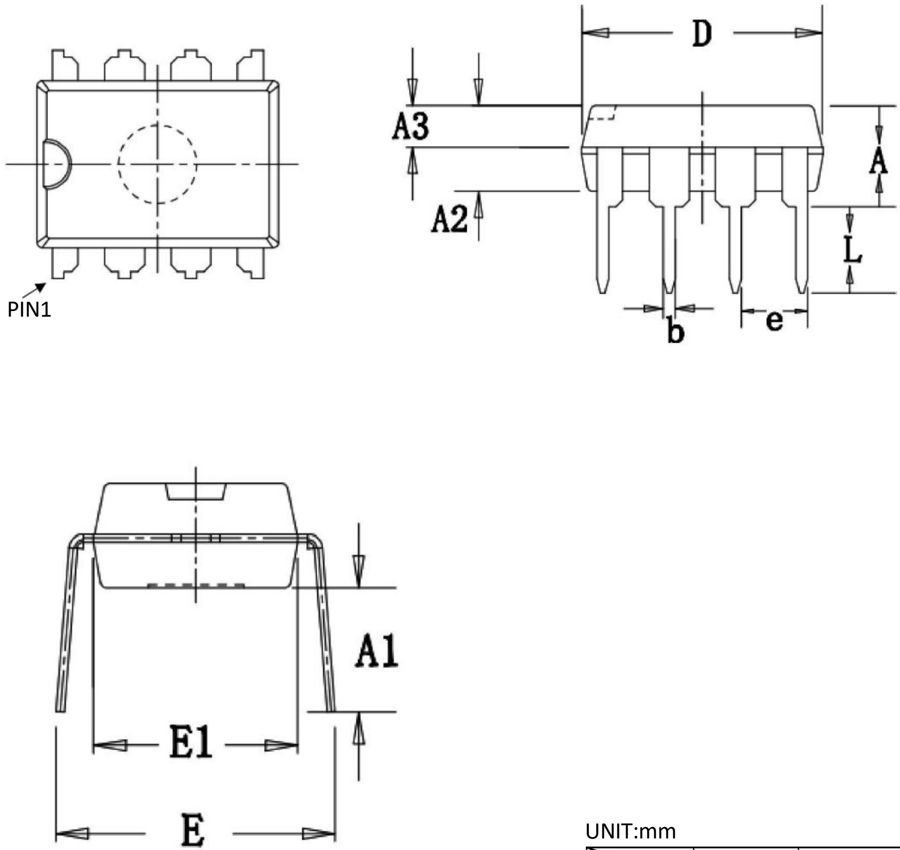
SOP8



UNIT:mm

	MIN	NOM	MAX
A	1.450	1.550	1.650
A1	0.100	0.150	0.200
A2	1.300	1.400	1.500
A3	0.600	0.650	0.700
b	0.380	–	0.510
e	1.240	1.270	1.300
D	4.800	4.900	5.000
E	5.800	6.000	6.200
E1	3.800	3.900	4.000
L	0.450	0.600	0.750
L1	—	0.25BSC	—

DIP8



UNIT:mm

	MIN	NOM	MAX
A	3.600	3.800	4.000
A1	3.786	3.886	3.986
A2	3.200	3.300	3.400
A3	1.550	1.600	1.650
b	0.440	–	0.490
e	2.510	2.540	2.570
D	9.150	9.250	9.350
E	7.800	8.500	9.200
E1	6.280	6.380	6.480
L	3.000	–	–