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National Semiconductor

LM8262 Dual RRIO, High Output Current & Unlimited Cap Load Op Amp in MSOP

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General Description

The LM8262 is a Rail-to-Rail input and output Op Amp which can operate with a wide supply voltage range. This device has high output current drive, greater than Rail-to-Rail input common mode voltage range, unlimited capacitive load drive capability, and provides tested and guaranteed high speed and slew rate. It is specifically designed to handle the requirements of flat panel TFT panel V_{COM} driver applications as well as being suitable for other low power, and medium speed applications which require ease of use and enhanced performance over existing devices.

Greater than Rail-to-Rail input common mode voltage range with 50dB of Common Mode Rejection, allows high side and low side sensing, among many applications, without having any concerns over exceeding the range and no compromise in accuracy. In addition, most device parameters are insensitive to power supply variations; this design enhancement is yet another step in simplifying its usage. The output stage has low distortion (0.05% THD+N) and can supply a respectable amount of current (15mA) with minimal headroom from either rail (300mV).

The LM8262 is offered in the space saving MSOP package.

Features

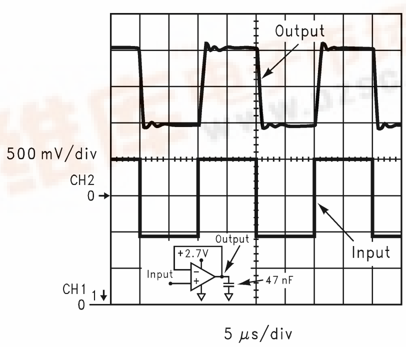
(V_S = 5V, T_A = 25˚C, Typical values unless specified).

- GBWP 21MHz
- Wide supply voltage range 2.5V to 22V
- Slew rate 12V/μs
- Supply current/channel 1.15 mA
- Cap load limit Unlimited
- Output short circuit current +53mA/−75mA
- +/−5% Settling time 400ns (500pF, 100mV_{PP} step)
- Input common mode voltage 0.3V beyond rails
- Input voltage noise $15nV/\sqrt{Hz}$
- Input current noise $1pA/\sqrt{Hz}$
- THD+N < 0.05%

Applications

- TFT-LCD flat panel V_{COM} driver
- A/D converter buffer
- High side/low side sensing
- Headphone amplifier

Output Response with Heavy Capacitive Load



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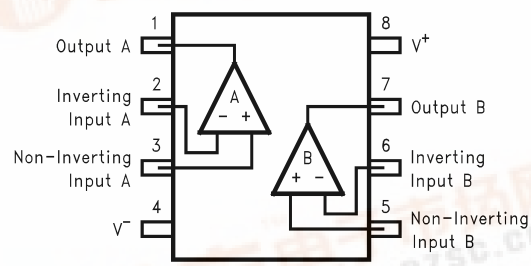
Connection Diagram

8-Pin MSOP



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Top View

Ordering Information

Package	Part Number	Package Marking	Media Transport	NSC Drawing
8-Pin MSOP	LM8262MM	A46	1k Units Tape and Reel	MUA08A
	LM8262MMX		3.5k Units Tape and Reel	

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

ESD Tolerance	2KV (Note 2) 200V(Note 9)
V_{IN} Differential	+/−10V
Output Short Circuit Duration	(Notes 3, 11)
Supply Voltage (V^+ - $V^−$)	24V
Voltage at Input/Output pins	V^+ +0.8V, $V^−$ −0.8V
Storage Temperature Range	−65˚C to +150˚C
Junction Temperature (Note 4)	+150˚C

Soldering Information:

Infrared or Convection (20 sec.)	235˚C
Wave Soldering (10 sec.)	260˚C

Operating Ratings

Supply Voltage (V^+ - $V^−$)	2.5V to 22V
Junction Temperature Range(Note 4)	−40˚C to +85˚C
Package Thermal Resistance, θ_{JA},(Note 4)	
8-Pin MSOP	235˚C/W

2.7V Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T_J = 25˚C, V^+ = 2.7V, $V^−$ = 0V, V_{CM} = 0.5V, V_O = V^+/2, and R_L > 1MΩ to $V^−$. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Condition	Min (Note 6)	Typ (Note 5)	Max (Note 6)	Units
V_{OS}	Input Offset Voltage	V_{CM} = 0.5V & V_{CM} = 2.2V	–	+/−0.7	+/−5 **+/−7**	mV
TC V_{OS}	Input Offset Average Drift	V_{CM} = 0.5V & V_{CM} = 2.2V (Note 12)	–	+/−2	–	μV/C
I_B	Input Bias Current	V_{CM} = 0.5V (Note 7)	–	−1.20	−2.00 **−2.70**	μA
		V_{CM} = 2.2V (Note 7)	–	+0.49	+1.00 **+1.60**	
I_{OS}	Input Offset Current	V_{CM} = 0.5V & V_{CM} = 2.2V	–	20	250 **400**	nA
CMRR	Common Mode Rejection Ratio	V_{CM} stepped from 0V to 1.0V	76 **60**	100	–	dB
		V_{CM} stepped from 1.7V to 2.7V	–	100	–	
		V_{CM} stepped from 0V to 2.7V	58 **50**	70	–	
+PSRR	Positive Power Supply Rejection Ratio	V^+ = 2.7V to 5V	78 **74**	104	–	dB
CMVR	Input Common-Mode Voltage Range	CMRR > 50dB	–	−0.3	−0.1 **0.0**	V
			2.8 **2.7**	3.0	–	V
A_{VOL}	Large Signal Voltage Gain	V_O = 0.5 to 2.2V, R_L = 10k to $V^−$	70 **67**	78	–	dB
		V_O = 0.5 to 2.2V, R_L = 2k to $V^−$	67 **63**	73	–	dB
V_O	Output Swing High	R_L = 10k to $V^−$	2.49 **2.46**	2.59	–	V
		R_L = 2k to $V^−$	2.45 **2.41**	2.53	–	
	Output Swing Low	R_L = 10k to $V^−$	–	90	100 **120**	mV
I_{SC}	Output Short Circuit Current	Sourcing to $V^−$ V_{ID} = 200mV (Note 10)	30 **20**	48	–	mA
		Sinking to V^+ V_{ID} = −200mV (Note 10)	50 **30**	65	–	

2.7V Electrical Characteristics (Continued)

Unless otherwise specified, all limits guaranteed for T_J = 25˚C, V^+ = 2.7V, V^- = 0V, V_{CM} = 0.5V, V_O = V^+/2, and R_L > 1MΩ to V^-. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Condition	Min (Note 6)	Typ (Note 5)	Max (Note 6)	Units
I_S	Supply Current (both amps)	No load, V_{CM} = 0.5V	–	2.0	2.5 **3.0**	mA
SR	Slew Rate (Note 8)	A_V = +1, V_I = 2V_{PP}	–	9	–	V/µs
f_u	Unity Gain-Frequency	V_I = 10mV, R_L = 2kΩ to V^+/2	–	10	–	MHz
GBWP	Gain Bandwidth Product	f = 50KHz	15.5 **14**	21	–	MHz
Phi_m	Phase Margin	V_I = 10mV	–	50	–	Deg
e_n	Input-Referred Voltage Noise	f = 2KHz, R_S = 50Ω	–	15	–	nV/$\sqrt{Hz}$
i_n	Input-Referred Current Noise	f = 2KHz	–	1	–	pA/$\sqrt{Hz}$
f_{max}	Full Power Bandwidth	Z_L = (20pF ǁ 10kΩ) to V^+/2	–	1	–	MHz

5V Electrical Characteristics

Unless otherwise specified, all limited guaranteed for T_J = 25˚C, V^+ = 5V, V^- = 0V, V_{CM} = 1V, V_O = V^+/2, and R_L > 1MΩ to V^-. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Condition	Min (Note 6)	Typ (Note 5)	Max (Note 6)	Units
V_{OS}	Input Offset Voltage	V_{CM} = 1V & V_{CM} = 4.5V	–	+/–0.7	+/–5 **+/– 7**	mV
TC V_{OS}	Input Offset Average Drift	V_{CM} = 1V & V_{CM} = 4.5V (Note 12)	–	+/–2	–	µV/˚C
I_B	Input Bias Current	V_{CM} = 1V (Note 7)	–	–1.18	–2.00 **–2.70**	µA
		V_{CM} = 4.5V (Note 7)	–	+0.49	+1.00 **+1.60**	
I_{OS}	Input Offset Current	V_{CM} = 1V & V_{CM} = 4.5V	–	20	250 **400**	nA
CMRR	Common Mode Rejection Ratio	V_{CM} stepped from 0V to 3.3V	84 **72**	110	–	dB
		V_{CM} stepped from 4V to 5V	–	100	–	
		V_{CM} stepped from 0V to 5V	64 **61**	80	–	
+PSRR	Positive Power Supply Rejection Ratio	V^+ = 2.7V to 5V, V_{CM} = 0.5V	78 **74**	104	–	dB
CMVR	Input Common-Mode Voltage Range	CMRR > 50dB	–	–0.3	–0.1 **0.0**	V
			5.1 **5.0**	5.3	–	V
A_{VOL}	Large Signal Voltage Gain	V_O = 0.5 to 4.5V, R_L = 10k to V^-	74 **70**	84	–	dB
		V_O = 0.5 to 4.5V, R_L = 2k to V^-	70 **66**	80	–	
V_O	Output Swing High	R_L = 10k to V^-	4.75 **4.72**	4.87	–	V
		R_L = 2k to V^-	4.70 **4.66**	4.81	–	
	Output Swing Low	R_L = 10k to V^-	–	86	125 **135**	mV

5V Electrical Characteristics (Continued)

Unless otherwise specified, all limited guaranteed for T_J = 25˚C, V^+ = 5V, V^- = 0V, V_{CM} = 1V, V_O = V^+/2, and R_L > 1MΩ to V^-. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Condition	Min (Note 6)	Typ (Note 5)	Max (Note 6)	Units
I_{SC}	Output Short Circuit Current	Sourcing to V^- V_{ID} = 200mV (Note 10)	35 **20**	53	–	mA
		Sinking to V^+ V_{ID} = −200mV (Note 10)	60 **50**	75	–	
I_S	Supply Current (both amps)	No load, V_{CM} = 1V	–	2.3	2.8 **3.5**	mA
SR	Slew Rate (Note 8)	A_V = +1, V_I = $5V_{PP}$	10 **7**	12	–	V/μs
f_u	Unity Gain Frequency	V_I = 10mV, R_L = 2kΩ to V^+/2	–	10.5	–	MHz
GBWP	Gain-Bandwidth Product	f = 50KHz	16 **15**	21	–	MHz
Phi_m	Phase Margin	V_I = 10mV	–	53	–	Deg
e_n	Input-Referred Voltage Noise	f = 2KHz, R_S = 50Ω	–	15	–	$nV/\sqrt{Hz}$
i_n	Input-Referred Current Noise	f = 2KHz	–	1	–	$pA/\sqrt{Hz}$
f_{max}	Full Power Bandwidth	Z_L = (20pF ǁ 10kΩ) to V^+/2	–	900	–	KHz
t_S	Settling Time (+/−5%)	$100mV_{PP}$ Step, 500pF load	–	400	–	ns
THD+N	Total Harmonic Distortion + Noise	R_L = 1kΩ to V^+/2 f = 10KHz to A_V= +2, $4V_{PP}$ swing	–	0.05	–	%

+/−11V Electrical Characteristics

Unless otherwise specified, all limited guaranteed for T_J = 25˚C, V^+ = 11V, V^- = −11V, V_{CM} = 0V, V_O = 0V, and R_L > 1MΩ to 0V. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Condition	Min (Note 6)	Typ (Note 5)	Max (Note 6)	Units
V_{OS}	Input Offset Voltage	V_{CM} = −10.5V & V_{CM} = 10.5V	–	+/−0.7	+/−7 **+/− 9**	mV
TC V_{OS}	Input Offset Average Drift	V_{CM} = −10.5V & V_{CM} = 10.5V (Note 12)	–	+/−2	–	μV/˚C
I_B	Input Bias Current	V_{CM} = −10.5V (Note 7)	–	−1.05	−2.00 **−2.80**	μA
		V_{CM} = 10.5V (Note 7)	–	+0.49	+1.00 **+1.50**	
I_{OS}	Input Offset Current	V_{CM} = −10.5V & V_{CM} = 10.5V	–	30	275 **550**	nA
CMRR	Common Mode Rejection Ratio	V_{CM} stepped from −11V to 9V	84 **80**	100	–	dB
		V_{CM} stepped from 10V to 11V	–	100	–	
		V_{CM} stepped from −11V to 11V	74 **72**	88	–	
+PSRR	Positive Power Supply Rejection Ratio	V^+ = 9V to 11V	70 **66**	100	–	dB
−PSRR	Negative Power Supply Rejection Ratio	V^- = −9V to −11V	70 **66**	100	–	dB

+/–11V Electrical Characteristics (Continued)

Unless otherwise specified, all limited guaranteed for T_J = 25˚C, V^+ = 11V, V^- = –11V, V_{CM} = 0V, V_O = 0V, and R_L > 1MΩ to 0V. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Condition	Min (Note 6)	Typ (Note 5)	Max (Note 6)	Units
CMVR	Input Common-Mode Voltage Range	CMRR > 50dB	–	–11.3	–11.1 **–11.0**	V
			11.1 **11.0**	11.3	–	V
A_{VOL}	Large Signal Voltage Gain	V_O = 0V to +/–9V, R_L = 10kΩ	78 **74**	85	–	dB
		V_O = 0V to +/–9V, R_L = 2kΩ	72 **66**	79	–	
V_O	Output Swing High	R_L = 10kΩ	10.65 **10.61**	10.77	–	V
		R_L = 2kΩ	10.6 **10.55**	10.69	–	
	Output Swing Low	R_L = 10kΩ	–	–10.98	–10.75 **–10.65**	V
		R_L = 2kΩ	–	–10.91	–10.65 **–10.6**	
I_{SC}	Output Short Circuit Current	Sourcing to ground V_{ID} = 200mV (Note 10)	40 **25**	60	–	mA
		Sinking to ground V_{ID} = 200mV (Note 10)	65 **55**	100	–	
I_S	Supply Current	No load, V_{CM} = 0V	–	2.5	4 **5**	mA
SR	Slew Rate (Note 8)	A_V = +1, V_I = 16V_{PP}	10 **8**	15	–	V/μs
f_U	Unity Gain Frequency	V_I = 10mV, R_L = 2kΩ	–	13	–	MHz
GBWP	Gain-Bandwidth Product	f = 50KHz	18 **16**	24	–	MHz
Phi_m	Phase Margin	V_I = 10mV	–	58	–	Deg
e_n	Input-Referred Voltage Noise	f = 2KHz, R_S = 50Ω	–	15	–	$nV/\sqrt{Hz}$
i_n	Input-Referred Current Noise	f = 2KHz	–	1	–	$pA/\sqrt{Hz}$
t_S	Settling Time (+/–1%, A_V = +1)	Positive Step, 5V_{PP}	–	320	–	ns
		Negative Step, 5V_{PP}	–	600	–	
THD+N	Total Harmonic Distortion +Noise	R_L = 1kΩ, f = 10KHz, A_V = +2, 15V_{PP} swing	–	0.01	–	%
CT_{REJ}	Cross-Talk Rejection	f = 5MHz, Driver R_L = 10kΩ	–	68	–	dB

+/−11V Electrical Characteristics (Continued)

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Rating indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Characteristics.

Note 2: Human body model, 1.5kΩ in series with 100pF.

Note 3: Applies to both single-supply and split-supply operation. Continuous short circuit operation at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150˚C.

Note 4: The maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_J(max) - T_A)/ \theta_{JA}$. All numbers apply for packages soldered directly onto a PC board.

Note 5: Typical Values represent the most likely parametric norm.

Note 6: All limits are guaranteed by testing or statistical analysis.

Note 7: Positive current corresponds to current flowing into the device.

Note 8: Slew rate is the slower of the rising and falling slew rates. Connected as a Voltage Follower.

Note 9: Machine Model, 0Ω is series with 200pF.

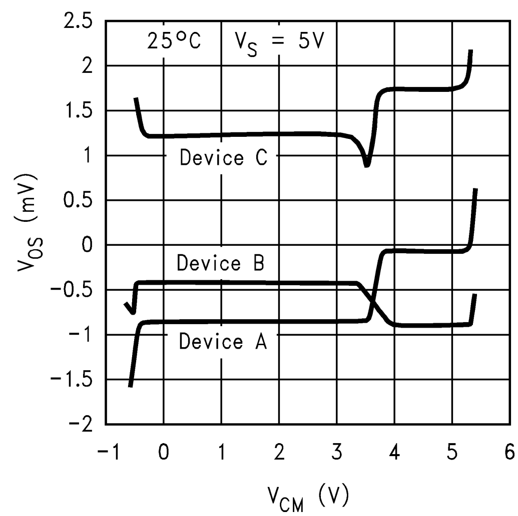
Note 10: Short circuit test is a momentary test. See Note 11.

Note 11: Output short circuit duration is infinite for $V_S \leq 6V$ at room temperature and below. For $V_S > 6V$, allowable short circuit duration is 1.5ms.

Note 12: Offset voltage average drift determined by dividing the change in V_{OS} at temperature extremes into the total temperature change.

Typical Performance Characteristics T_A = 25˚C, Unless Otherwise Noted

V_{OS} vs. V_{CM} for 3 Representative Units



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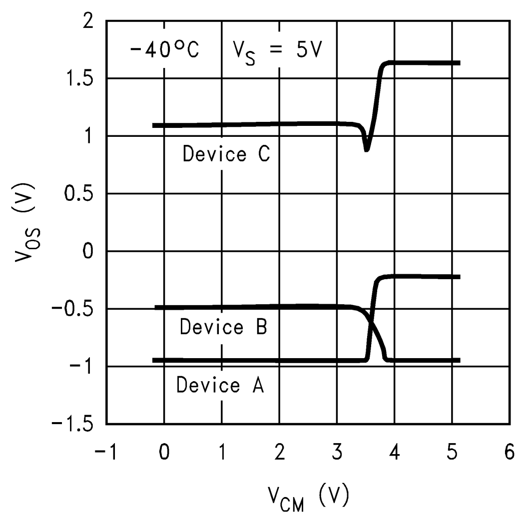
V_{OS} vs. V_{CM} for 3 Representative Units



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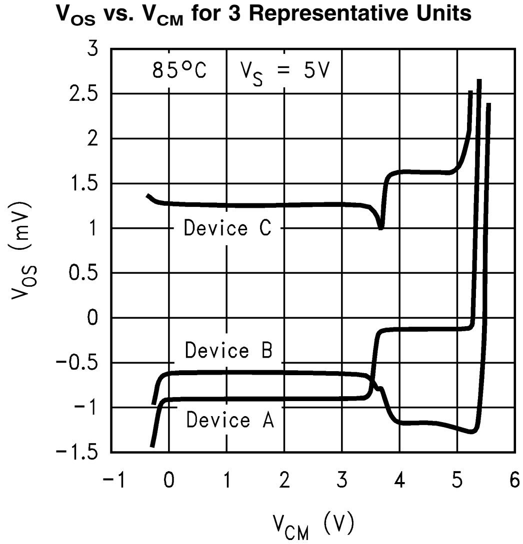
V_{OS} vs. V_{CM} for 3 Representative Units



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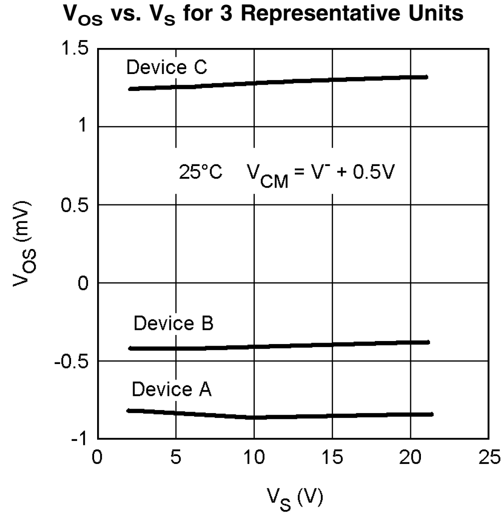
V_{OS} vs. V_S for 3 Representative Units



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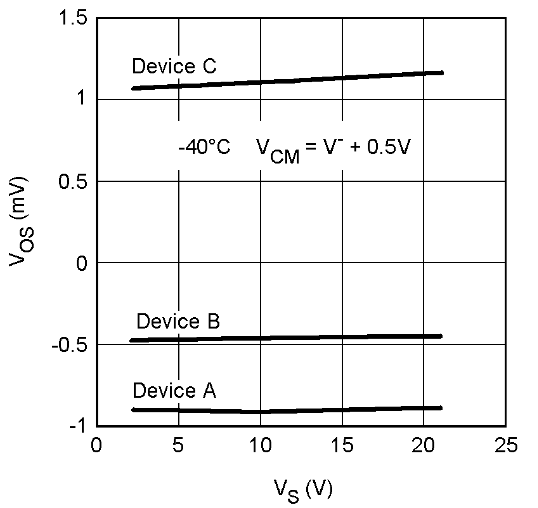
Typical Performance Characteristics T_A = 25˚C, Unless Otherwise Noted (Continued)

V_{OS} vs. V_S for 3 Representative Units



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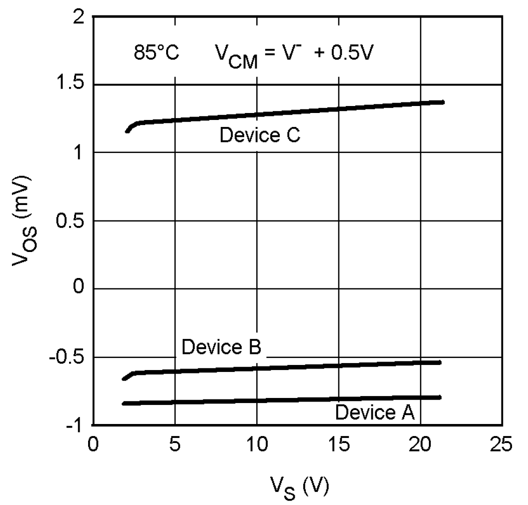
V_{OS} vs. V_S for 3 Representative Units



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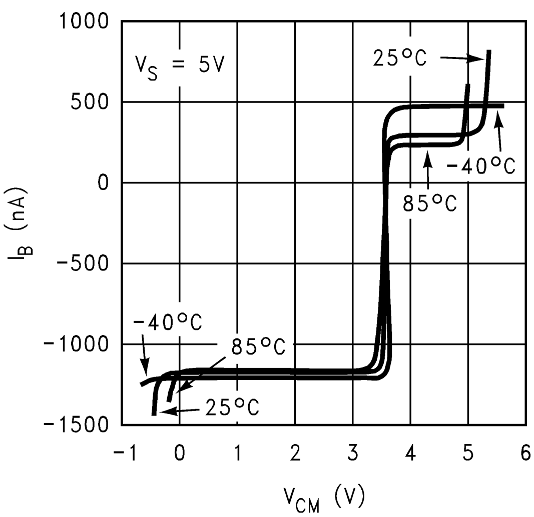
I_B vs. V_{CM}



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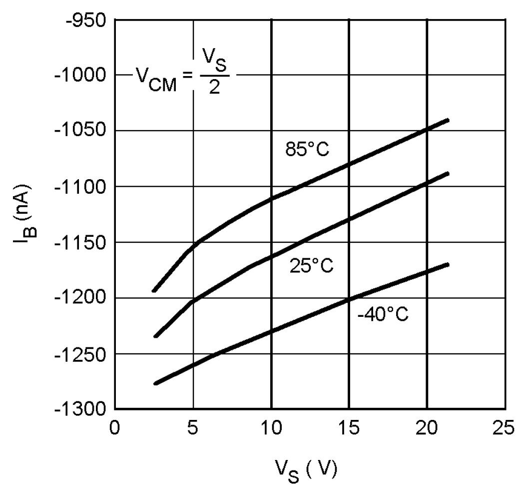
I_B vs. V_S



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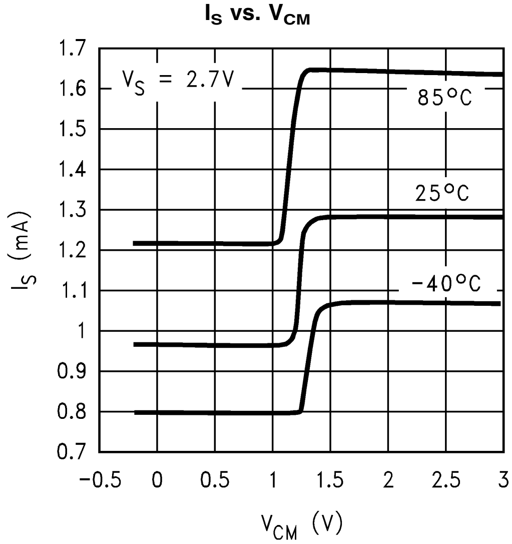
I_S vs. V_{CM}



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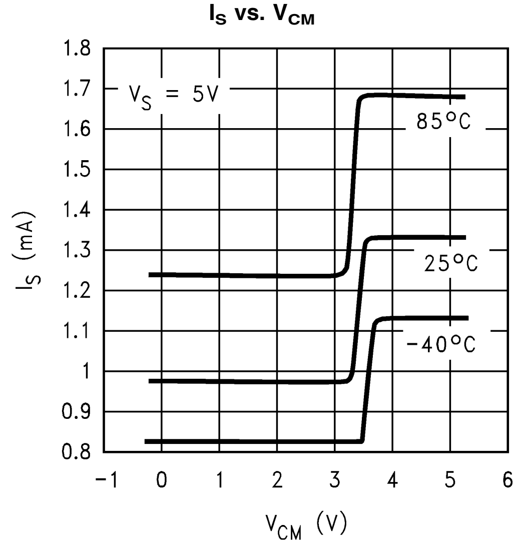
I_S vs. V_{CM}



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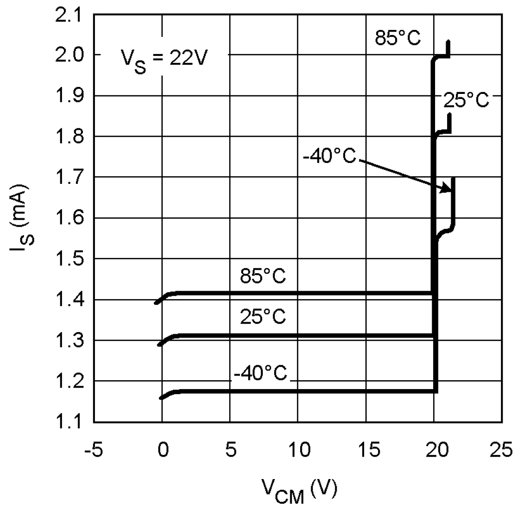
Typical Performance Characteristics T_A = 25°C, Unless Otherwise Noted (Continued)

I_S vs. V_{CM}



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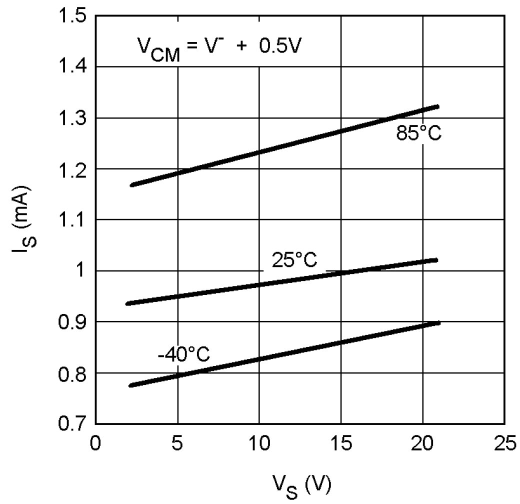
I_S vs. V_S (PNP side)



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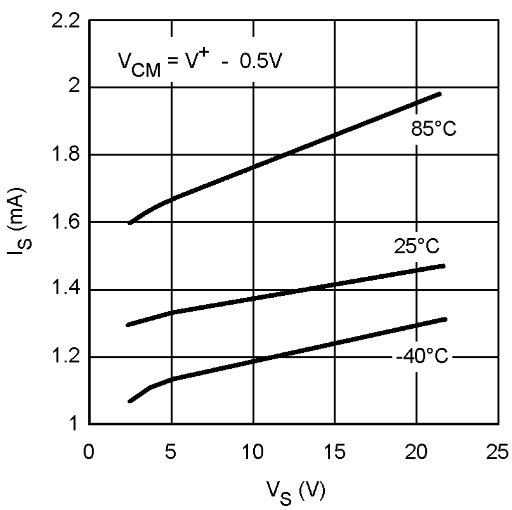
I_S vs. V_S (NPN side)



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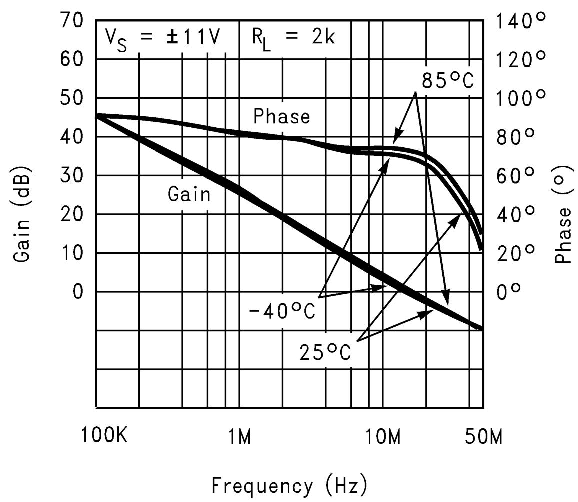
Gain/Phase vs. Frequency



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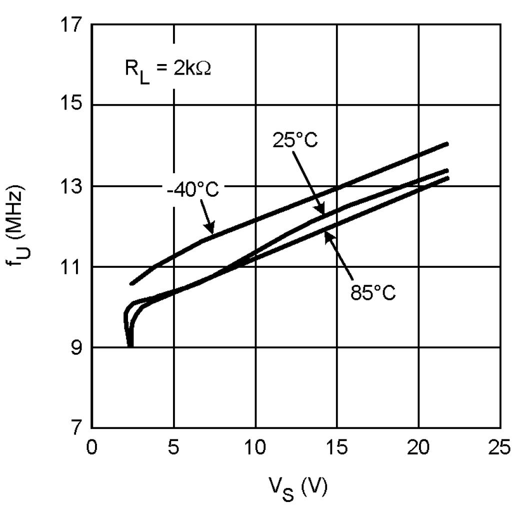
Unity Gain Frequency vs. V_S



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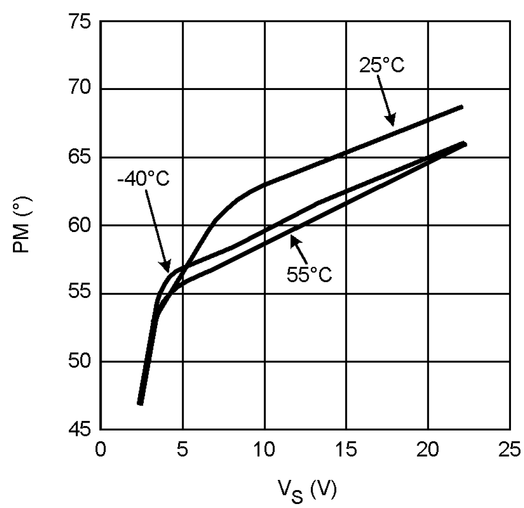
Phase Margin vs. V_S



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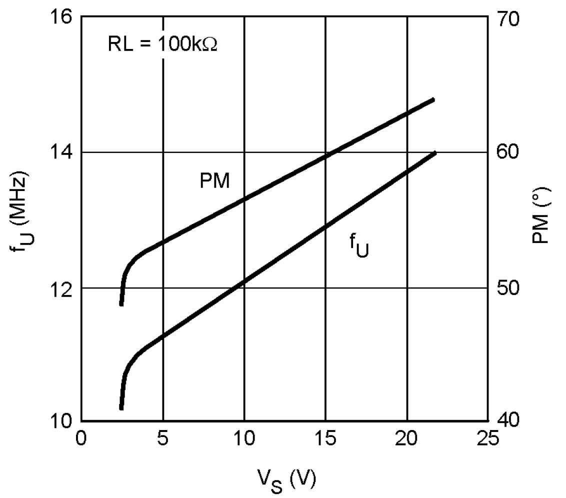
Typical Performance Characteristics T_A = 25˚C, Unless Otherwise Noted (Continued)

Unity Gain Freq. and Phase Margin vs. V_S



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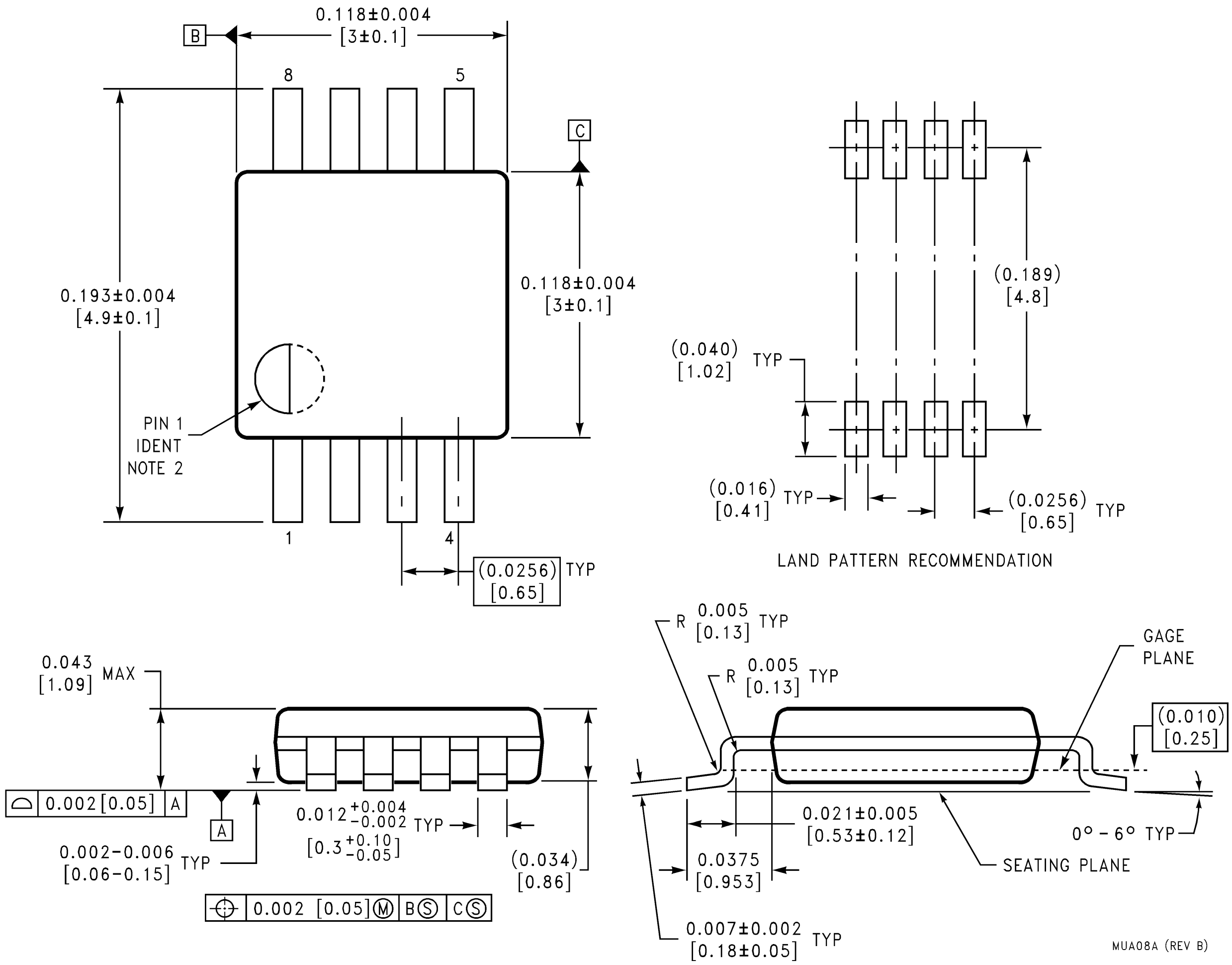
Physical Dimensions inches (millimeters) unless otherwise noted



8-Pin MSOP
NS Package Number MUA08A

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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