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

Check for Samples: LM8262

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**

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 VSSOP package.

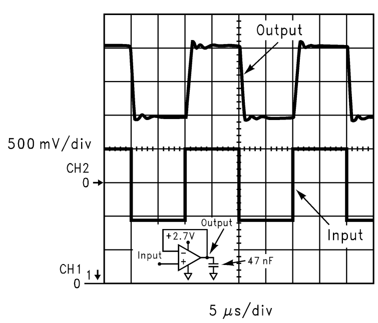


Figure 1. Output Response with Heavy Capacitive Load

Connection Diagram

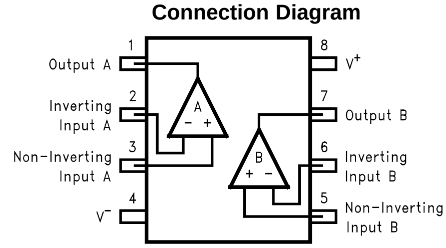


Figure 2. 8-Pin VSSOP (Top View)

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings [1][2]

ESD Tolerance		2KV [3] 200V [4]
V_{IN} Differential		+/−10V
Output Short Circuit Duration		See [5] [6]
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 [7]		+150°C
Soldering Information:	Infrared or Convection (20 sec.)	235°C
	Wave Soldering (10 sec.)	260°C

(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.
(2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/ Distributors for availability and specifications.
(3) Human body model, 1.5kΩ in series with 100pF.
(4) Machine Model, 0Ω is series with 200pF.
(5) 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.
(6) 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.
(7) 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.

Operating Ratings

Supply Voltage (V^+ - V^-)		2.5V to 22V
Junction Temperature Range [1]		−40°C to +85°C
Package Thermal Resistance, θ_{JA}, [1]	8-Pin VSSOP	235°C/W

(1) 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.

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 [1]	Typ [2]	Max [1]	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 [3]	–	+/−2	–	µV/C
I_B	Input Bias Current	V_{CM} = 0.5V [4]	–	−1.20	−2.00 **−2.70**	µA
		V_{CM} = 2.2V [4]	–	+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

(1) All limits are guaranteed by testing or statistical analysis.
(2) Typical Values represent the most likely parametric norm.
(3) Offset voltage average drift determined by dividing the change in V_{OS} at temperature extremes into the total temperature change.
(4) Positive current corresponds to current flowing into the device.

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 (1)	Typ (2)	Max (1)	Units
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	–	V
	Output Swing Low	R_L = 10k to V^-	–	90	100 **120**	mV
I_{SC}	Output Short Circuit Current	Sourcing to V^- V_{ID} = 200mV (5)(6)	30 **20**	48	–	mA
		Sinking to V^+ V_{ID} = −200mV (5)(6)	50 **30**	65	–	mA
I_S	Supply Current (both amps)	No load, V_{CM} = 0.5V	–	2.0	2.5 **3.0**	mA
SR	Slew Rate (7)	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 || 10kΩ) to V^+/2	–	1	–	MHz

(5) Short circuit test is a momentary test. See Note 6.
(6) Output short circuit duration is infinite for V_S ≤ 6V at room temperature and below. For V_S > 6V, allowable short circuit duration is 1.5ms.
(7) Slew rate is the slower of the rising and falling slew rates. Connected as a Voltage Follower.

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 [1]	Typ [2]	Max [1]	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 [3]	–	+/−2	–	µV/°C
I_B	Input Bias Current	V_{CM} = 1V [4]	–	−1.18	−2.00 **−2.70**	µA
		V_{CM} = 4.5V [4]	–	+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
I_{SC}	Output Short Circuit Current	Sourcing to V^- V_{ID} = 200mV [5][6]	35 **20**	53	–	mA
		Sinking to V^+ V_{ID} = −200mV [5][6]	60 **50**	75	–	
I_S	Supply Current (both amps)	No load, V_{CM} = 1V	–	2.3	2.8 **3.5**	mA
SR	Slew Rate [7]	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/ √Hz
i_n	Input-Referred Current Noise	f = 2KHz	–	1	–	pA/ √Hz

(1) All limits are guaranteed by testing or statistical analysis.
(2) Typical Values represent the most likely parametric norm.
(3) Offset voltage average drift determined by dividing the change in V_{OS} at temperature extremes into the total temperature change.
(4) Positive current corresponds to current flowing into the device.
(5) Short circuit test is a momentary test. See Note 6.
(6) Output short circuit duration is infinite for V_S ≤ 6V at room temperature and below. For V_S > 6V, allowable short circuit duration is 1.5ms.
(7) Slew rate is the slower of the rising and falling slew rates. Connected as a Voltage Follower.

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 (1)	Typ (2)	Max (1)	Units
f_{max}	Full Power Bandwidth	Z_L = (20pF || 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 (1)	Typ (2)	Max (1)	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 (3)	–	+/−2	–	µV/°C
I_B	Input Bias Current	V_{CM} = −10.5V (4)	–	−1.05	−2.00 **−2.80**	µA
		V_{CM} = 10.5V (4)	–	+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
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**	

(1) All limits are guaranteed by testing or statistical analysis.
(2) Typical Values represent the most likely parametric norm.
(3) Offset voltage average drift determined by dividing the change in V_{OS} at temperature extremes into the total temperature change.
(4) Positive current corresponds to current flowing into the device.

+/−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 (1)	Typ (2)	Max (1)	Units
I_{SC}	Output Short Circuit Current	Sourcing to ground V_{ID} = 200mV (5)(6)	40 **25**	60	–	mA
		Sinking to ground V_{ID} = 200mV (5)(6)	65 **55**	100	–	
I_S	Supply Current	No load, V_{CM} = 0V	–	2.5	4 **5**	mA
SR	Slew Rate (7)	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/ √Hz
i_n	Input-Referred Current Noise	f = 2KHz	–	1	–	pA/ √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

(5) Short circuit test is a momentary test. See Note 6.
(6) Output short circuit duration is infinite for V_S ≤ 6V at room temperature and below. For V_S > 6V, allowable short circuit duration is 1.5ms.
(7) Slew rate is the slower of the rising and falling slew rates. Connected as a Voltage Follower.

Typical Performance Characteristics

T_A = 25°C, Unless Otherwise Noted

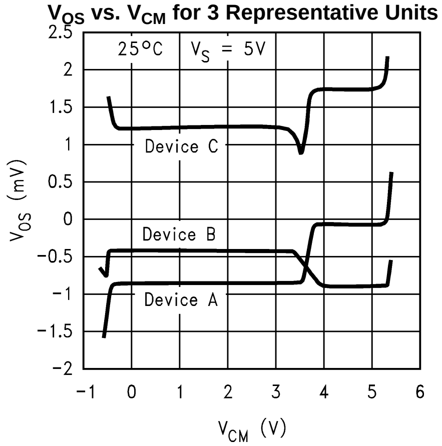


Figure 3.

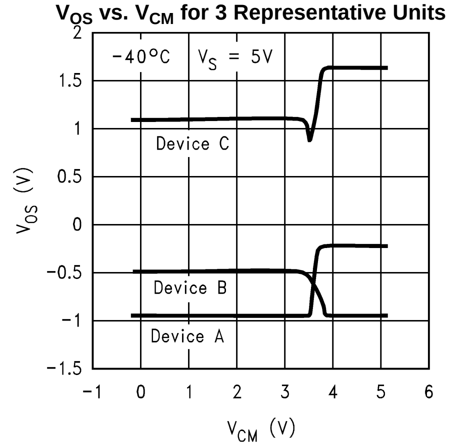


Figure 4.

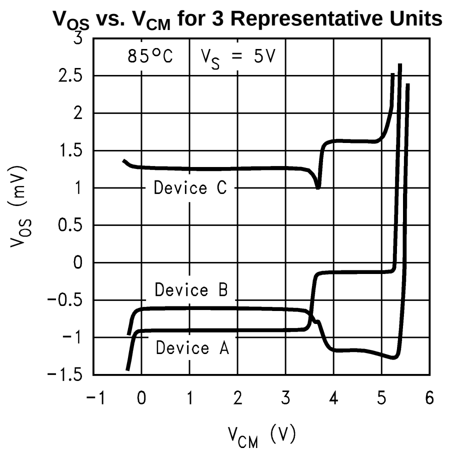


Figure 5.

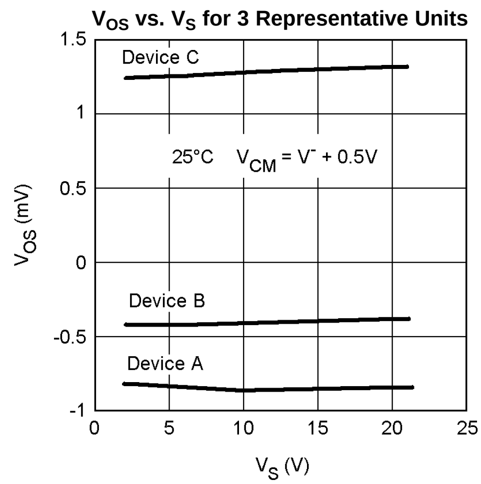


Figure 6.

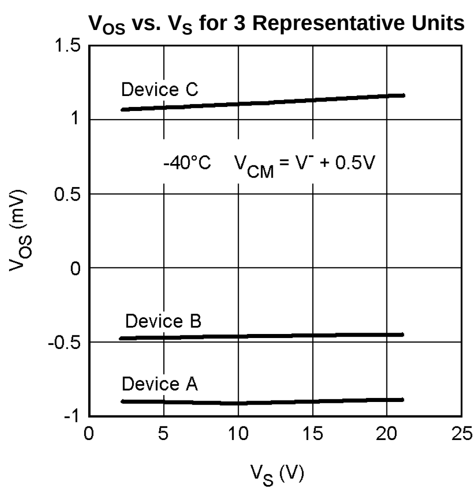


Figure 7.

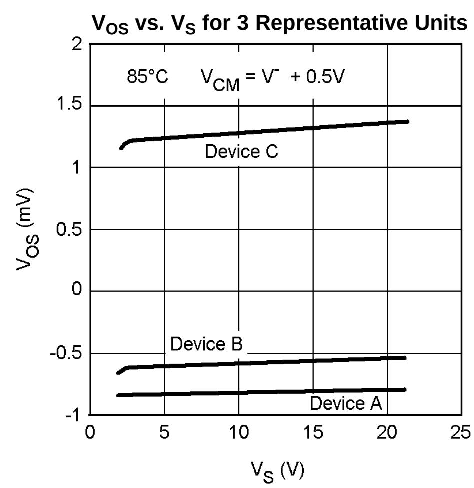


Figure 8.

Typical Performance Characteristics (continued)

T_A = 25°C, Unless Otherwise Noted

I_B vs. V_{CM}

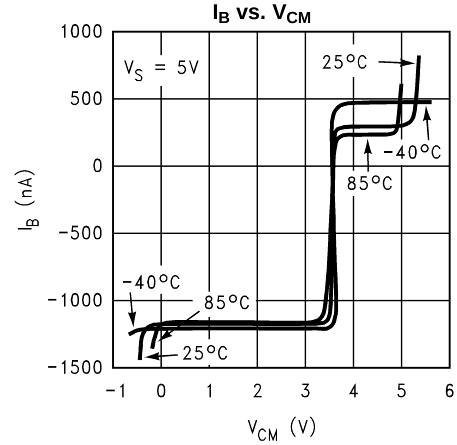


Figure 9.

I_B vs. V_S

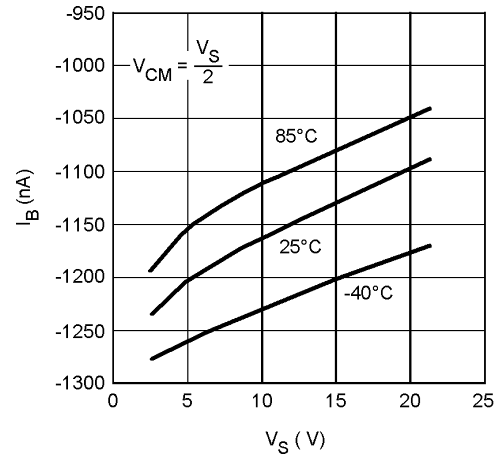


Figure 10.

I_S vs. V_{CM}

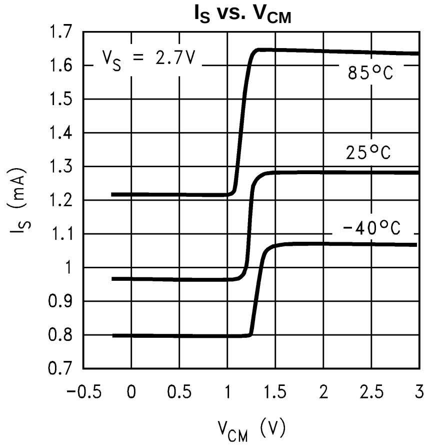


Figure 11.

I_S vs. V_{CM}

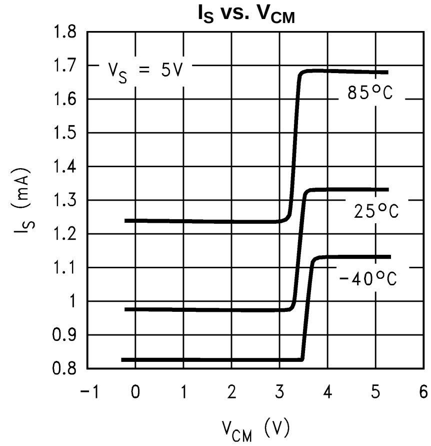


Figure 12.

I_S vs. V_{CM}

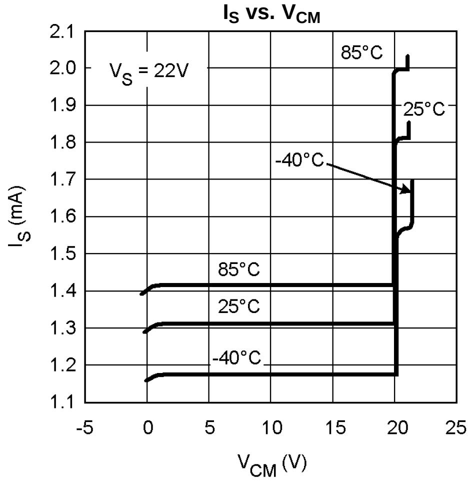


Figure 13.

I_S vs. V_S (PNP side)

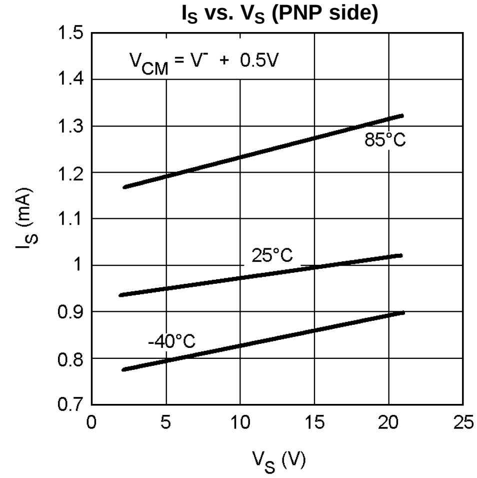


Figure 14.

Typical Performance Characteristics (continued)

T_A = 25°C, Unless Otherwise Noted

I_S vs. V_S (NPN side)

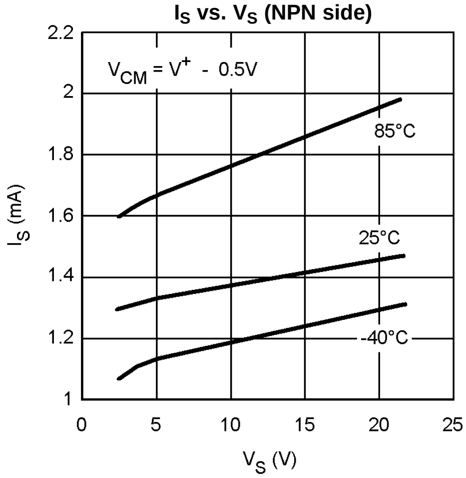


Figure 15.

Gain/Phase vs. Frequency

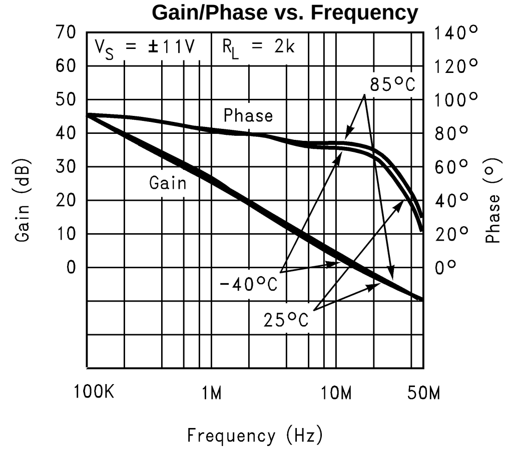


Figure 16.

Unity Gain Frequency vs. V_S

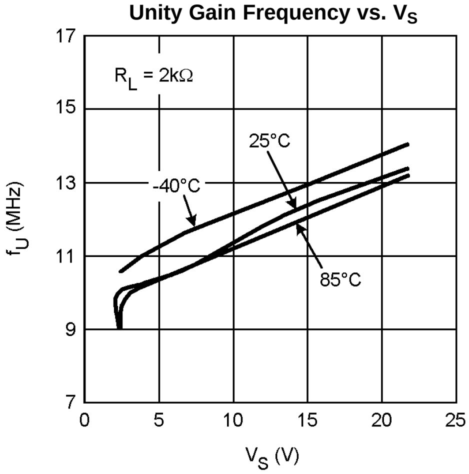


Figure 17.

Phase Margin vs. V_S

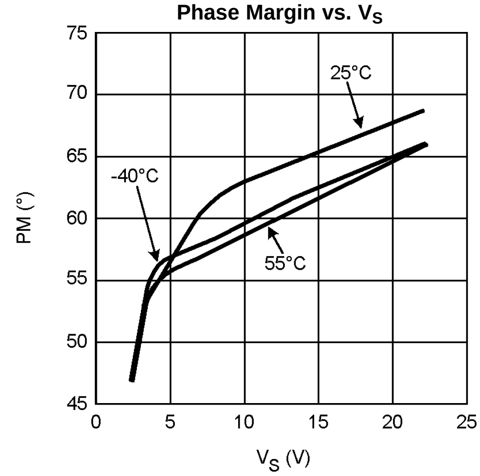


Figure 18.

Unity Gain Freq. and Phase Margin vs. V_S

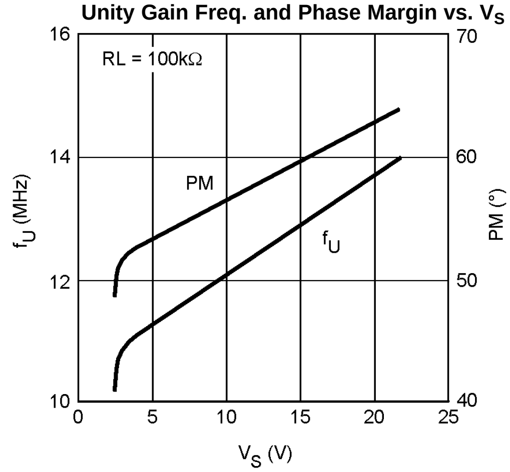


Figure 19.

REVISION HISTORY

Changes from Revision D (April 2013) to Revision E	Page
• Changed layout of National Data Sheet to TI format	9

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM8262MM	ACTIVE	VSSOP	DGK	8	1000	TBD	Call TI	Call TI	-40 to 85	A46	Samples
LM8262MM/NOPB	ACTIVE	VSSOP	DGK	8	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	A46	Samples
LM8262MMX	ACTIVE	VSSOP	DGK	8	3500	TBD	Call TI	Call TI	-40 to 85	A46	Samples
LM8262MMX/NOPB	ACTIVE	VSSOP	DGK	8	3500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	A46	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

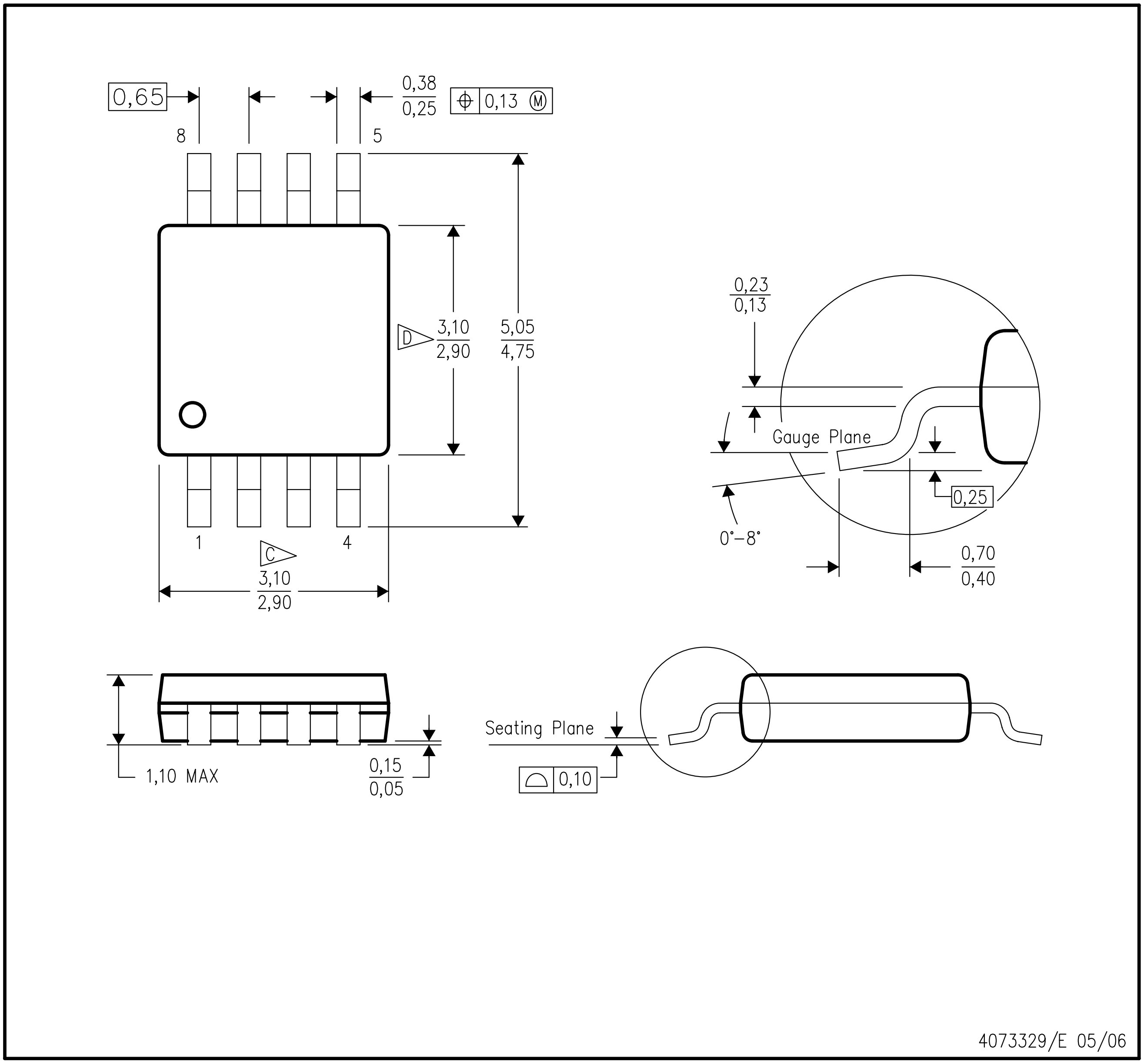
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

DGK (S-PDSO-G8) PLASTIC SMALL-OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
E. Falls within JEDEC MO-187 variation AA, except interlead flash.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265