

Micropower, Dual, Single
Supply Precision Op Amp

DESCRIPTION

The RH1078M is a micropower dual op amp in the standard 8-pin configuration. This device is optimized for single supply operation at 5V. Specifications for $\pm 15V$ are also provided.

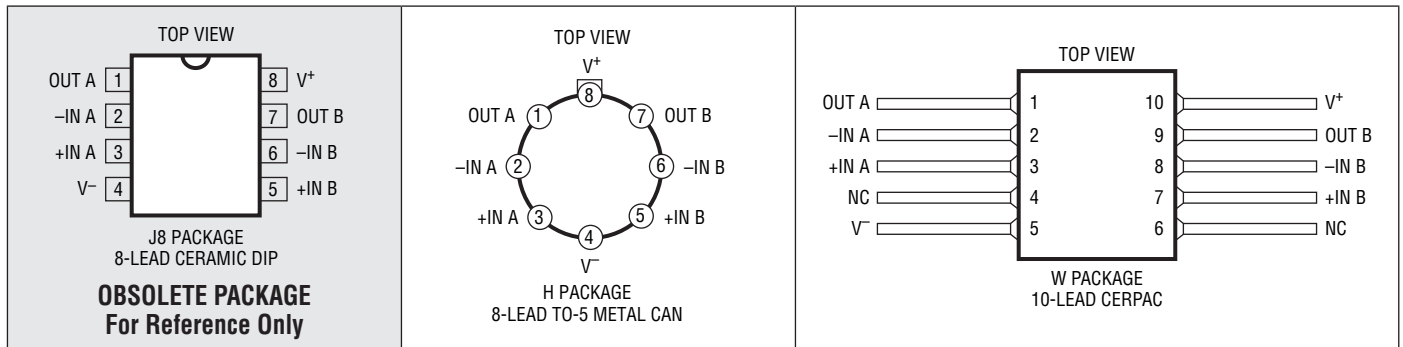
The wafer lots are processed to Analog Devices' in-house Class S flow to yield circuits usable in stringent military applications.

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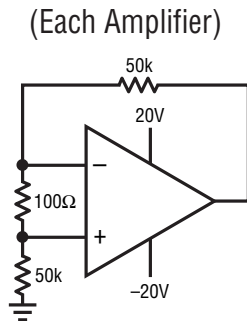
ABSOLUTE MAXIMUM RATINGS

Supply Voltage.....	$\pm 22V$
Differential Input Voltage	$\pm 30V$
Input Voltage.....	Equal to Positive Supply Voltage 0.5V Below Negative Supply Voltage
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	$-55^{\circ}C$ to $125^{\circ}C$
Storage Temperature Range	$-55^{\circ}C$ to $150^{\circ}C$
Lead Temperature (Soldering, 10 sec).....	$300^{\circ}C$

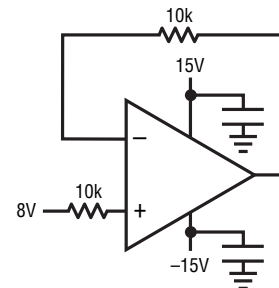
PACKAGE/ORDER INFORMATION



BURN-IN CIRCUIT



TOTAL DOSE BIAS CIRCUIT



Note: For ordering information contact Analog Devices.

RH1078M

TABLE 1: ELECTRICAL CHARACTERISTICS (Preirradiation)

$V_S = 5V$, $V_{CM} = 0.1V$, $V_{OUT} = 1.4V$ unless otherwise specified. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	NOTES	$T_A = 25^\circ C$			SUB-GROUP	$-55^\circ C \leq T_A \leq 125^\circ C$			SUB-GROUP	UNITS
				MIN	TYP	MAX		MIN	TYP	MAX		
V_{OS}	Input Offset Voltage					120	4			370	2, 3	μV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Tempco of Offset Voltage								0.5			$\mu V/^\circ C$
$\frac{\Delta V_{OS}}{\Delta Time}$	Long-Term V_{OS} Stability					0.5						$\mu V/$ Month
I_{OS}	Input Offset Current					0.8	1			1.5	2, 3	nA
I_B	Input Bias Current					15	1			18	2, 3	nA
e_n	Input Noise Voltage	0.1Hz to 10Hz	1			0.5						μV_{P-P}
	Input Noise Voltage Density	$f_0 = 10Hz$ $f_0 = 1kHz$	1 1			25 24						nV/\sqrt{Hz} nV/\sqrt{Hz}
i_n	Input Noise Current	0.1Hz to 10Hz	1			2.6						pA_{P-P}
	Input Noise Current Density	$f_0 = 10Hz$ $f_0 = 1kHz$	1 1			0.07 0.025						pA/\sqrt{Hz} pA/\sqrt{Hz}
R_{IN}	Input Resistance Differential		2			600						$M\Omega$
	Common Mode		2			5						$G\Omega$
	Input Voltage Range		2 2			3.5 0	1 1		3.20 0.05		2, 3 2, 3	V V
CMRR	Common Mode Rejection Ratio	$V_{CM} = 0V$ to 3.5V				94	1					dB
		$V_{CM} = 0.05V$ to 3.2V							88		2, 3	dB
PSRR	Power Supply Rejection Ratio	$V_S = 2.3V$ to 12V				100	1					dB
		$V_S = 3.1V$ to 12V							94		2, 3	dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = 0.03V$ to 4V, No Load				150	1					V/mV
		$V_O = 0.03V$ to 3.5V, $R_L = 50k$				120	1					V/mV
		$V_O = 0.05V$ to 4V, No Load							80		2, 3	V/mV
		$V_O = 0.05V$ to 3.5V, $R_L = 50k$							60		2, 3	V/mV
V_{OUT}	Output Voltage Swing	Output Low, No Load								8	5, 6	mV
		Output Low, 2k to GND										mV
		Output Low, $I_{SINK} = 100\mu A$								170	5, 6	mV
		Output High, No Load			4.2					3.9	5, 6	V
		Output High, 2k to GND			3.5					3.0	5, 6	V
SR	Slew Rate	$A_V = 1$, $V_S = \pm 2.5V$				0.04	4					V/ μs
GBW	Gain-Bandwidth Product	$f_0 \leq 20kHz$				200						kHz
I_S	Supply Current	per Amplifier				75	1			95	2, 3	μA
	Channel Separation	$\Delta V_{IN} = 3V$, $R_L = 10k$				130						dB
	Minimum Supply Voltage		3			2.3						V

TABLE 1: ELECTRICAL CHARACTERISTICS (Preirradiation) $V_S = \pm 15V$ unless otherwise specified. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	NOTES	$T_A = 25^\circ\text{C}$			SUB-GROUP	$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$			SUB-GROUP	UNITS
				MIN	TYP	MAX		MIN	TYP	MAX		
V_{OS}	Input Offset Voltage					350	4			600	2, 3	μV
$\frac{\Delta V_{OS}}{\Delta \text{Temp}}$	Average Tempco of Offset Voltage									0.6		$\mu\text{V}/^\circ\text{C}$
I_{OS}	Input Offset Current					0.8	1			1.5	2, 3	nA
I_B	Input Bias Current					15				18	2, 3	nA
	Input Voltage Range					13.5 -15.0	1 1					V V
CMRR	Common Mode Rejection Ratio	$V_{CM} = 13.5V, -15V$				97	1			90	2, 3	dB
		$V_{CM} = 13V, -14.9V$										dB
PSRR	Power Supply Rejection Ratio	$V_S = 5V, 0V$ to $\pm 18V$				100	1			94	2, 3	dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = \pm 10V, R_L = 50k$				1000	1					V/mV
		$V_O = \pm 10V, R_L = 2k$				300	1					V/mV
		$V_O = \pm 10V, R_L = 5k$								150	2, 3	V/mV
V_{OUT}	Output Voltage Swing	$R_L = 50k$				± 13	4					V
		$R_L = 2k$				± 11	4					V
		$R_L = 5k$								± 11	5, 6	V
SR	Slew Rate				0.06		4				V/ μs	
I_S	Supply Current	per Amplifier				100	1			125	2, 3	μA

Note 1: All noise parameters are for $V_S = \pm 2.5V$, $V_O = 0V$.**Note 2:** This parameter is guaranteed by design, characterization or correlation to other tested parameters.**Note 3:** Power supply rejection ratio is measured at the minimum supply voltage. The op amps actually work at 1.8V supply but with a typical offset skew of $-300\mu\text{V}$.

TABLE 1A: ELECTRICAL CHARACTERISTICS (Postirradiation)

$V_S = 5V$, $0V$, $V_{CM} = 0.1V$, $V_{OUT} = 1.4V$, $T_A = 25^\circ C$, unless otherwise specified. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	10KRAD(Si)		25KRAD(Si)		50KRAD(Si)		75KRAD(Si)		100KRAD(Si)		UNITS	
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
V_{OS}	Input Offset Voltage			120		175		250		500			μV	
I_{OS}	Input Offset Current			2		8		13		18			nA	
I_B	Input Bias Current			20		40		80		100			nA	
	Input Voltage Range		3.5		3.5		3.5		3.5				V	
CMRR	Common Mode Rejection Ratio	$V_{CM} = 0V$ to $3.5V$	91		89		87		85				dB	
PSRR	Power Supply Rejection Ratio	$V_S = 2.3V$ to $12V$	100		100		98		88				dB	
A_{VOL}	Large-Signal Voltage Gain	$V_O = 0.03V$ to $4V$, No Load $V_O = 0.03V$ to $3.5V$, $R_L = 50k$	150		150		100		50				V/mV V/mV	
V_{OUT}	Output Voltage Swing	Output Low, No Load		6		9		13		20			mV	
		Output Low, 2k to GND		2		2		2		2			mV	
		Output Low, $I_{SINK} = 100\mu A$			130		140		150		160			mV
		Output High, No Load	4.2		4.2		4.2		4.2		4.2			V
		Output High, 2k to GND	3.5		3.5		3.5		3.5		3.5			V
SR	Slew Rate	$A_V = 1$, $V_S = \pm 2.5V$	0.04		0.03		0.02		0.01				V/ μs	
I_S	Supply Current	per Amplifier		75		75		75		75			μA	

TABLE 1A: ELECTRICAL CHARACTERISTICS (Postirradiation) $V_S = \pm 15V$ unless otherwise specified. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	10KRAD(Si)		25KRAD(Si)		50KRAD(Si)		75KRAD(Si)		100KRAD(Si)		UNITS
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
V_{OS}	Input Offset Voltage		350		500		650		800		1000		μV
I_{OS}	Input Offset Current		2		8		13		18		23		nA
I_B	Input Bias Current		20		40		80		100		120		nA
	Input Voltage Range		13.5	-15.0	13.5	-15.0	13.5	-15.0	13.5	-15.0	13.5	-15.0	V V
CMRR	Common Mode Rejection Ratio	$V_{CM} = 13.5V, -15V$	94		92		90		88		86		dB
PSRR	Power Supply Rejection Ratio	$V_S = 5V, 0V$ to $\pm 18V$	100		100		98		88		78		dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = 10V, R_L = 50k$ $V_O = 10V, R_L = 2k$	1000	300	700	200	400	120	150	45	50	15	V/mV V/mV
V_{OUT}	Output Voltage Swing	$R_L = 50k$ $R_L = 2k$	± 13	± 11	± 13	± 11	± 13	± 11	± 13	± 11	± 13	± 10	V V
SR	Slew Rate		0.05		0.04		0.03		0.02		0.01		V/ μs
I_S	Supply Current	per Amplifier	100		100		100		100		100		μA

TABLE 2: ELECTRICAL TEST REQUIREMENTS

MIL-PRF-38535 TEST REQUIREMENTS	SUBGROUP
Final Electrical Test Requirements	1*, 2, 3, 4, 5, 6
Group A Test Requirements	1, 2, 3, 4, 5, 6
Group C End Point Electrical Parameters	1, 2, 3
Group D End Point Electrical Parameters	1, 2, 3
Group E End Point Electrical Parameters	1

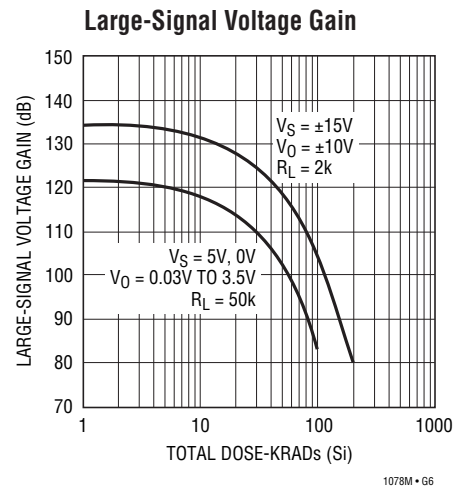
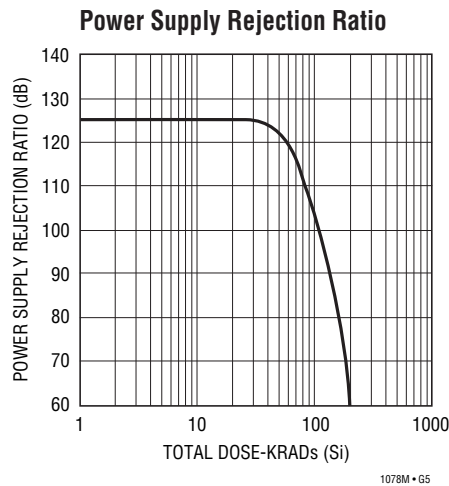
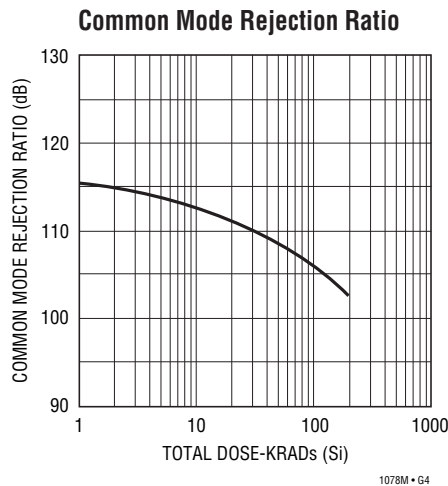
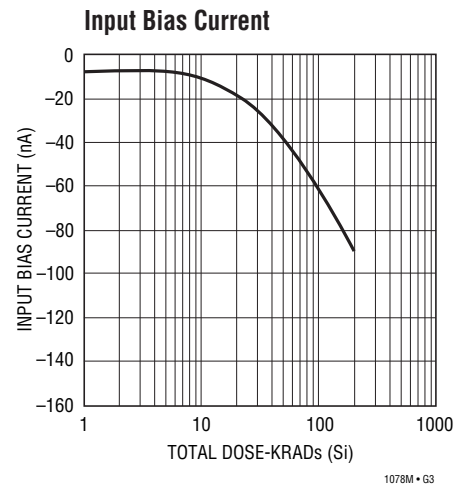
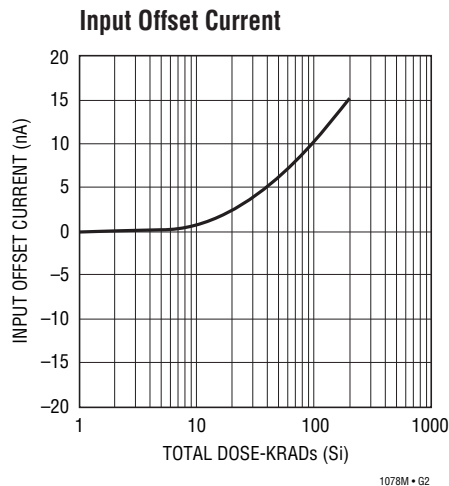
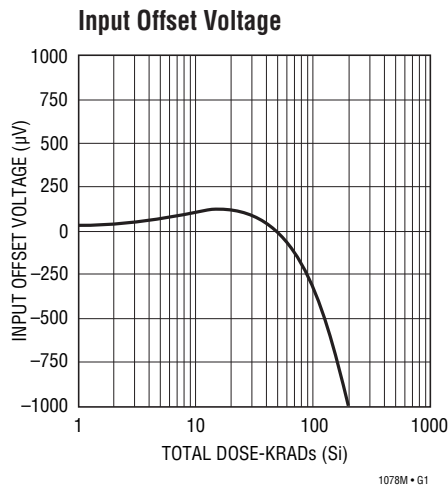
*PDA Applies to subgroup 1. See PDA Test Notes.

PDA Test Notes

The PDA is specified as 5% based on failures from group A, subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883 Class B. The verified failures of group A, subgroup 1, after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent for the lot.

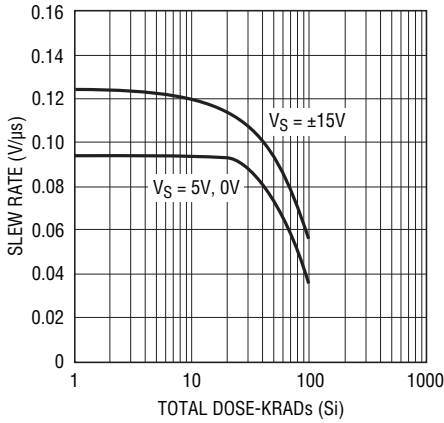
Analog Devices, Inc. reserves the right to test to tighter limits than those given.

TYPICAL APPLICATIONS



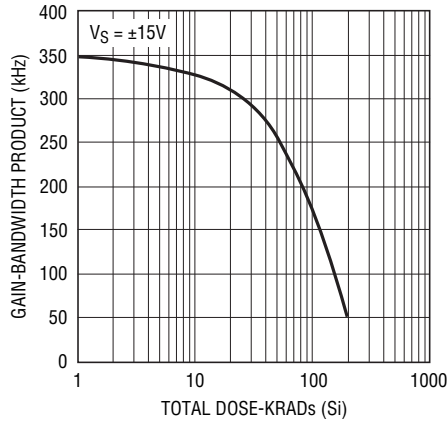
TYPICAL APPLICATIONS

Slew Rate



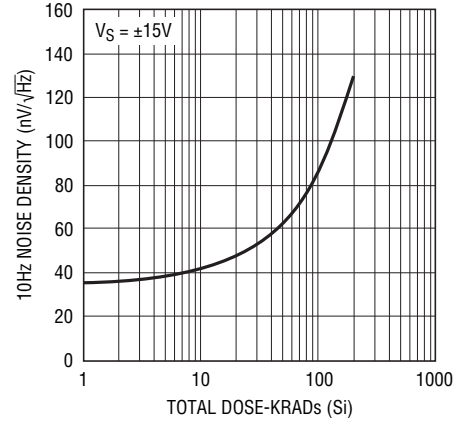
1078M • G7

Gain-Bandwidth Product



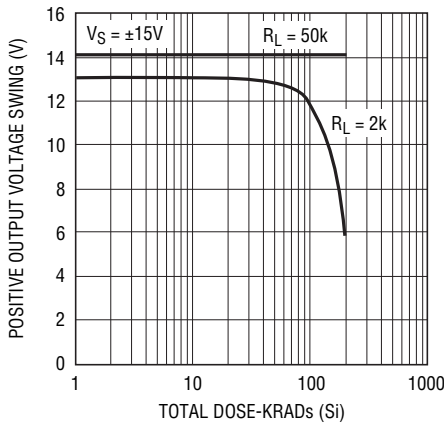
1078M • G8

10Hz Noise Density



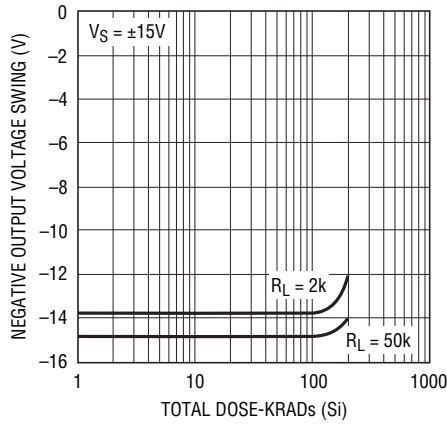
1078M • G9

Positive Output Voltage Swing



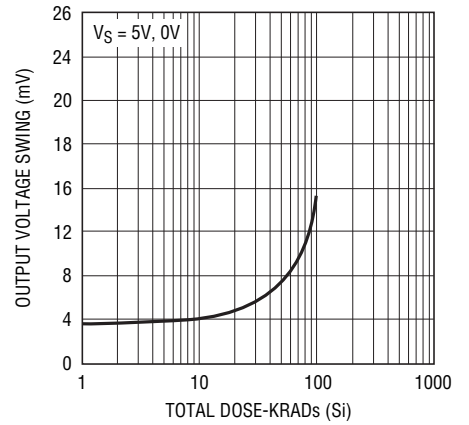
1078M • G10

Negative Output Voltage Swing



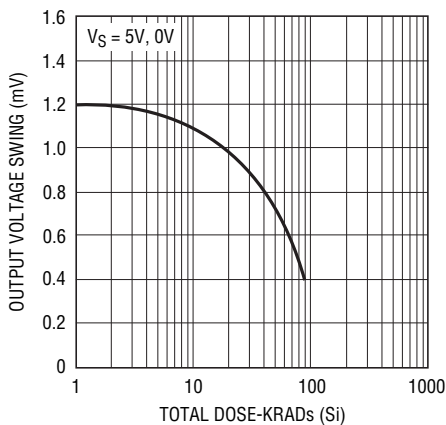
1078M • G11

Output Voltage Swing Low, No Load



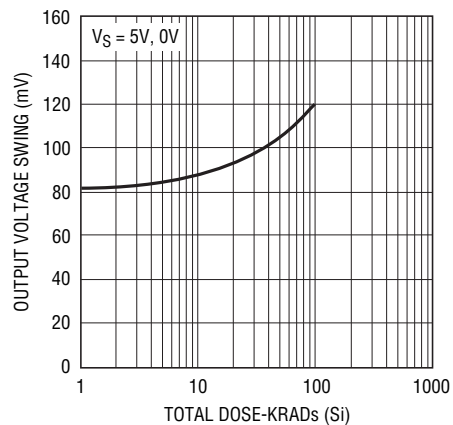
1078M • G12

Output Voltage Swing Low, 2k to GND



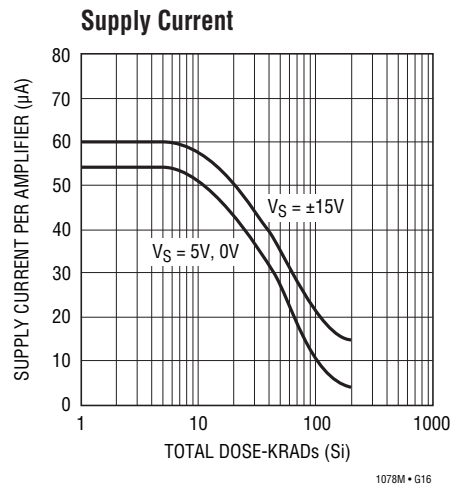
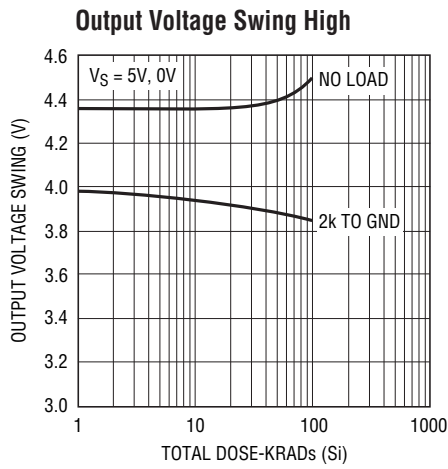
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Output Voltage Swing Low, ISINK = 100mA



1078M • G14

TYPICAL APPLICATIONS



REVISION HISTORY (Revision history begins at Rev F)

REV	DATE	DESCRIPTION	PAGE NUMBER
F	05/10	Added J8 and W Packages	1
G	03/19	Obsoleting J8 package and updating document to ADI format	All Pages
H	07/23	Updated art title in the Electrical Characteristics section	2-5
I	07/24	Updated Table 2: Electrical Test Requirements	6