

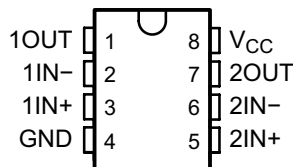
## Dual Operational Amplifiers

Check for Samples: [LM158](#), [LM258](#), [LM258A](#), [LM358](#), [LM358A](#), [LM2904](#), [LM2904V](#)

### FEATURES

- **Wide Supply Ranges**
  - **Single Supply:** 3 V to 32 V (26 V for LM2904)
  - **Dual Supplies:**  $\pm 1.5$  V to  $\pm 16$  V ( $\pm 13$  V for LM2904)
- **Low Supply-Current Drain, Independent of Supply Voltage:** 0.7 mA Typ
- **Wide Unity Gain Bandwidth:** 0.7MHz
- **Common-Mode Input Voltage Range Includes Ground, Allowing Direct Sensing Near Ground**
- **Low Input Bias and Offset Parameters**
  - **Input Offset Voltage:** 3 mV Typ  
A Versions: 2 mV Typ
  - **Input Offset Current:** 2 nA Typ
  - **Input Bias Current:** 20 nA Typ  
A Versions: 15 nA Typ
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage:** 32 V (26 V for LM2904)
- **Open-Loop Differential Voltage Gain:** 100dB Typ
- **Internal Frequency Compensation**
- **On Products Compliant to MIL-PRF-38535, All Parameters Are Tested Unless Otherwise Noted. On All Other Products, Production Processing Does Not Necessarily Include Testing of All Parameters.**

LM158, LM158A . . . JG Package  
LM258, LM258A . . . D, DGK, or P Package  
LM358 . . . D, DGK, P, PS, or PW Package  
LM358A . . . D, DGK, P, or PW Package  
LM2904 . . . D, DGK, P, PS, or PW Package  
(Top View)

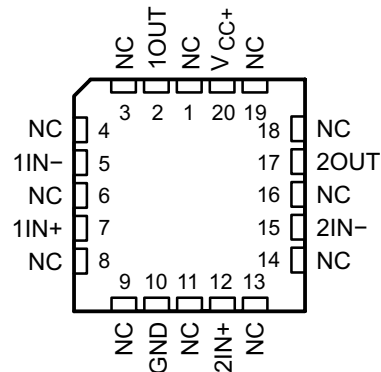


### DESCRIPTION

These devices consist of two independent, high-gain frequency-compensated operational amplifiers designed to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3 V to 32 V (3 V to 26 V for the LM2904), and  $V_{CC}$  is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.

Applications include transducer amplifiers, dc amplification blocks, and all the conventional operational amplifier circuits that now can be implemented more easily in single-supply-voltage systems. For example, these devices can be operated directly from the standard 5-V supply used in digital systems and easily can provide the required interface electronics without additional  $\pm 5$ -V supplies.

**LM158, LM158A . . . FK Package  
(Top View)**



NC – No internal connection



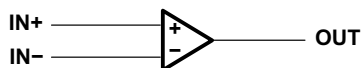
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



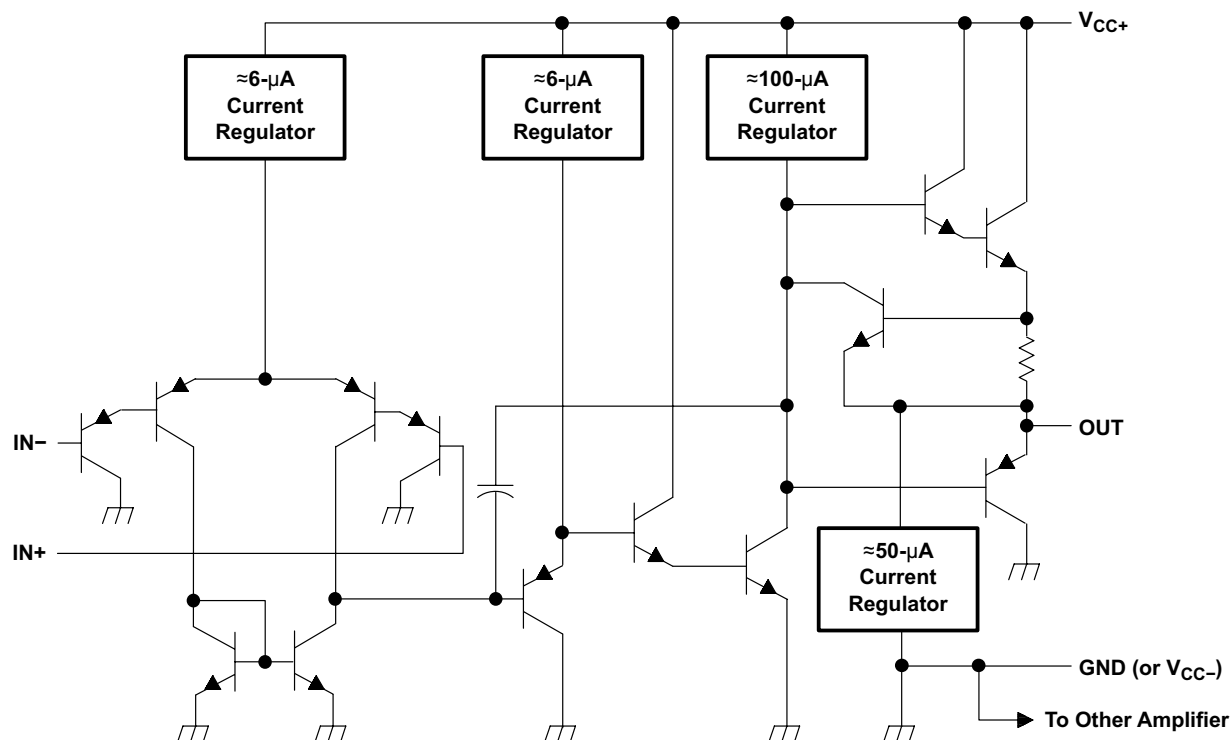
This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### Symbol (Each Amplifier)



### Schematic (Each Amplifier)



COMPONENT COUNT	
Epi-FET	1
Diodes	2
Resistors	7
Transistors	51
Capacitors	2

## Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		LM158, LM158A LM258, LM258A LM358, LM358A LM2904V	LM2904	UNIT
Supply voltage, $V_{CC}$ <sup>(2)</sup>		±16 or 32	±13 or 26	V
Differential input voltage, $V_{ID}$ <sup>(3)</sup>		±32	±26	V
Input voltage, $V_I$ (either input)		–0.3 to 32	–0.3 to 26	V
Duration of output short circuit (one amplifier) to ground at (or below) $T_A = 25^\circ\text{C}$ , $V_{CC} \leq 15\text{ V}$ <sup>(4)</sup>		Unlimited	Unlimited	
Package thermal impedance, $\theta_{JA}$ <sup>(4)(5)</sup>	D package	97	97	$^\circ\text{C/W}$
	DGK package	172	172	
	P package	85	85	
	PS package	95	95	
	PW package	149	149	
Package thermal impedance, $\theta_{JC}$ <sup>(6)(7)</sup>	D package	72.2		$^\circ\text{C/W}$
	FK package	5.61		
	JG package	14.5		
Operating free air temperature range, $T_A$	LM158, LM158A	–55 to 125		$^\circ\text{C}$
	LM258, LM258A	–25 to 85		
	LM358, LM358A	0 to 70		
	LM2904	–40 to 125	–40 to 125	
Operating virtual junction temperature, $T_J$		150	150	$^\circ\text{C}$
Case temperature for 60 seconds	FK package	260		$^\circ\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG package	300	300	$^\circ\text{C}$
Storage temperature range, $T_{stg}$		–65 to 150	–65 to 150	$^\circ\text{C}$

- (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 and  $V_{CC}$  specified for the measurement of  $I_{OS}$ ) are with respect to the network GND.
- (3) Differential voltages are at IN+, with respect to IN–.
- (4) Short circuits from outputs to  $V_{CC}$  can cause excessive heating and eventual destruction.
- (5) Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of  $150^\circ\text{C}$  can affect reliability.
- (6) Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JC}$ , and  $T_C$ . The maximum allowable power dissipation at any allowable case temperature is  $P_D = (T_J(\text{max}) - T_C)/\theta_{JC}$ . Operating at the absolute maximum  $T_J$  of  $150^\circ\text{C}$  can affect reliability.
- (7) The package thermal impedance is calculated in accordance with MIL-STD-883.

## Electrical Characteristics

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER			TEST CONDITIONS <sup>(1)</sup>	T <sub>A</sub> <sup>(2)</sup>	LM158 LM258			LM358			UNIT	
					MIN	TYP <sup>(3)</sup>	MAX	MIN	TYP <sup>(3)</sup>	MAX		
V <sub>IO</sub>	Input offset voltage		V <sub>CC</sub> = 5 V to MAX, V <sub>IC</sub> = V <sub>ICR</sub> min, V <sub>O</sub> = 1.4 V	25°C	3			5	3		7	mV
			Full range				7			9		
αV <sub>IO</sub>	Average temperature coefficient of input offset voltage			Full range	7				7			μV/°C
I <sub>IO</sub>	Input offset current		V <sub>O</sub> = 1.4 V	25°C	2			30	2		50	nA
				Full range				100			150	
αI <sub>IO</sub>	Average temperature coefficient of input offset current			Full range	10				10			pA/°C
I <sub>IB</sub>	Input bias current		V <sub>O</sub> = 1.4 V	25°C	–20			–150	–20		–250	nA
				Full range				–300			–500	
V <sub>ICR</sub>	Common-mode input voltage range		V <sub>CC</sub> = 5 V to MAX	25°C	0 to V <sub>CC</sub> – 1.5				0 to V <sub>CC</sub> – 1.5			V
				Full range	0 to V <sub>CC</sub> – 2				0 to V <sub>CC</sub> – 2			
V <sub>OH</sub>	High-level output voltage		R <sub>L</sub> ≥ 2 kΩ	25°C	V <sub>CC</sub> – 1.5				V <sub>CC</sub> – 1.5			V
			R <sub>L</sub> ≥ 10 kΩ	25°C								
			V <sub>CC</sub> = MAX	R <sub>L</sub> = 2 kΩ	Full range	26		26				
				R <sub>L</sub> ≥ 10 kΩ	Full range	27	28	27	28			
V <sub>OL</sub>	Low-level output voltage		R <sub>L</sub> ≤ 10 kΩ	Full range		5	20		5	20	mV	
A <sub>VD</sub>	Large-signal differential voltage amplification		V <sub>CC</sub> = 15 V V <sub>O</sub> = 1 V to 11 V, R <sub>L</sub> ≥ 2 kΩ	25°C	50	100		25	100		V/mV	
				Full range	25			15				
CMRR	Common-mode rejection ratio		V <sub>CC</sub> = 5 V to MAX, V <sub>IC</sub> = V <sub>ICR</sub> (min)	25°C	70	80		65	80		dB	
k <sub>SVR</sub>	Supply-voltage rejection ratio (ΔV <sub>DD</sub> /ΔV <sub>IO</sub> )		V <sub>CC</sub> = 5 V to MAX	25°C	65	100		65	100		dB	
V <sub>O1</sub> / V <sub>O2</sub>	Crosstalk attenuation		f = 1 kHz to 20 kHz	25°C	120				120			dB
I <sub>O</sub>	Output current		V <sub>CC</sub> = 15 V, V <sub>ID</sub> = 1 V, V <sub>O</sub> = 0	Source	25°C	–20	–30		–20	–30		mA
					Full range	–10			–10			
			V <sub>CC</sub> = 15 V, V <sub>ID</sub> = –1 V, V <sub>O</sub> = 15 V	Sink	25°C	10	20		10	20		
					Full range	5			5			
			V <sub>ID</sub> = –1 V, V <sub>O</sub> = 200 mV	25°C	12	30		12	30		μA	
I <sub>OS</sub>	Short-circuit output current		V <sub>CC</sub> at 5 V, V <sub>O</sub> = 0, GND at –5 V	25°C		±40	±60		±40	±60	mA	
I <sub>CC</sub>	Supply current (two amplifiers)		V <sub>O</sub> = 2.5 V, No load	Full range		0.7	1.2		0.7	1.2	mA	
			V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5 V <sub>CC</sub> , No load	Full range		1	2		1	2		

- (1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 26 V for LM2902 and 30 V for the others.
- (2) Full range is –55°C to 125°C for LM158, –25°C to 85°C for LM258, and 0°C to 70°C for LM358, and –40°C to 125°C for LM2904.
- (3) All typical values are at  $T_A = 25^\circ\text{C}$

## Electrical Characteristics

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>		$T_A$ <sup>(2)</sup>	LM2904			UNIT
				MIN	TYP <sup>(3)</sup>	MAX	
$V_{IO}$ Input offset voltage	$V_{CC} = 5\text{ V to MAX,}$ $V_{IC} = V_{ICR(min)},$ $V_O = 1.4\text{ V}$	Non-A-suffix devices	25°C		3	7	mV
			Full range			10	
		A-suffix devices	25°C		1	2	
			Full range			4	
$\alpha V_{IO}$ Average temperature coefficient of input offset voltage			Full range		7		$\mu\text{V}/^\circ\text{C}$
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	Non-V device	25°C		2	50	nA
			Full range			300	
		V-suffix device	25°C		2	50	
			Full range			150	
$\alpha I_{IO}$ Average temperature coefficient of input offset current			Full range		10		$\text{pA}/^\circ\text{C}$
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		25°C		–20	–250	nA
			Full range			–500	
$V_{ICR}$ Common-mode input voltage range	$V_{CC} = 5\text{ V to MAX}$		25°C		0 to $V_{CC} - 1.5$		V
			Full range		0 to $V_{CC} - 2$		
$V_{OH}$ High-level output voltage	$R_L \geq 10\text{ k}\Omega$ $V_{CC} = \text{MAX,}$ Non-V device	$R_L = 2\text{ k}\Omega$	25°C		$V_{CC} - 1.5$		V
			Full range		22		
		$R_L \geq 10\text{ k}\Omega$	Full range		23	24	
			Full range		26		
			Full range		27	28	
$V_{OL}$ Low-level output voltage	$R_L \leq 10\text{ k}\Omega$		Full range		5	20	mV
$A_{VD}$ Large-signal differential voltage amplification	$V_{CC} = 15\text{ V,}$ $V_O = 1\text{ V to } 11\text{ V,}$ $R_L \geq 2\text{ k}\Omega$		25°C		25	100	V/mV
			Full range		15		
CMRR Common-mode rejection ratio	$V_{CC} = 5\text{ V to MAX,}$ $V_{IC} = V_{ICR(min)}$	Non-V device	25°C		50	80	dB
		V-suffix device	25°C		65	80	
$k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC}/\Delta V_{IO}$ )	$V_{CC} = 5\text{ V to MAX}$		25°C		65	100	dB
$V_{O1}/V_{O2}$ Crosstalk attenuation	$f = 1\text{ kHz to } 20\text{ kHz}$		25°C		120		dB
$I_O$ Output current	$V_{CC} = 15\text{ V,}$ $V_{ID} = 1\text{ V,}$ $V_O = 0$	Source	25°C		–20	–30	mA
			Full range		–10		
	$V_{CC} = 15\text{ V,}$ $V_{ID} = -1\text{ V,}$ $V_O = 15\text{ V}$	Sink	25°C		10	20	
			Full range		5		
	$V_{ID} = -1\text{ V, } V_O = 200\text{ mV}$	Non-V device	25°C			30	$\mu\text{A}$
		V-suffix device	25°C		12	40	
$I_{OS}$ Short-circuit output current	$V_{CC}$ at 5 V, $V_O = 0$ , GND at –5 V		25°C		$\pm 40$	$\pm 60$	mA
$I_{CC}$ Supply current (four amplifiers)	$V_O = 2.5\text{ V, No load}$		Full range		0.7	1.2	mA
	$V_{CC} = \text{MAX, } V_O = 0.5 V_{CC}, \text{ No load}$		Full range		1	2	

- (1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 26 V for LM2902 and 32 V for LM2902V.
- (2) Full range is –55°C to 125°C for LM158, –25°C to 85°C for LM258, 0°C to 70°C for LM358, and –40°C to 125°C for LM2904.
- (3) All typical values are at  $T_A = 25^\circ\text{C}$ .

## Electrical Characteristics

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>		T <sub>A</sub> <sup>(1)</sup>	LM158A			LM258A			UNIT		
				MIN	TYP <sup>(2)</sup>	MAX	MIN	TYP <sup>(2)</sup>	MAX			
V <sub>IO</sub>	Input offset voltage	V <sub>CC</sub> = 5 V to 30 V, V <sub>IC</sub> = V <sub>ICR(min)</sub> , V <sub>O</sub> = 1.4 V	25°C	2			2			3	mV	
			Full range	4			4			4		
αV <sub>IO</sub>	Average temperature coefficient of input offset voltage		Full range	7			15 <sup>(3)</sup>			7	15	μA/°C
I <sub>IO</sub>	Input offset current	V <sub>O</sub> = 1.4 V	25°C	2			10			2	15	nA
			Full range	30			30			30		
αI <sub>IO</sub>	Average temperature coefficient of input offset current		Full range	10			200			10	200	pA/°C
I <sub>IB</sub>	Input bias current	V <sub>O</sub> = 1.4 V	25°C	–15			–50			–15	–80	nA
			Full range	–100			–100			–100		
V <sub>ICR</sub>	Common-mode input voltage range	V <sub>CC</sub> = 30 V	25°C	0 to V <sub>CC</sub> – 1.5			0 to V <sub>CC</sub> – 1.5					V
			Full range	0 to V <sub>CC</sub> – 2			0 to V <sub>CC</sub> – 2					
V <sub>OH</sub>	High-level output voltage	R <sub>L</sub> ≥ 2 kΩ	25°C	V <sub>CC</sub> – 1.5			V <sub>CC</sub> – 1.5					V
		V <sub>CC</sub> = 30 V										
		R <sub>L</sub> = 2kΩ	Full range	26			26					
		R <sub>L</sub> ≥ 10kΩ	Full range	27			28			27	28	
V <sub>OL</sub>	Low-level output voltage	R <sub>L</sub> ≤ 10 kΩ	Full range	5			20			5	20	mV
A <sub>VD</sub>	Large-signal differential voltage amplification	V <sub>CC</sub> = 15 V, V <sub>O</sub> = 1 V to 11 V, R <sub>L</sub> ≥ 2 kΩ	25°C	50			100			50	100	V/mV
			Full range	25			25					
CMRR	Common-mode rejection ratio		25°C	70			80			70	80	dB
k <sub>SVR</sub>	Supply-voltage rejection ratio (ΔV <sub>D</sub> /ΔV <sub>IO</sub> )		25°C	65			100			65	100	dB
V <sub>O1</sub> / V <sub>O2</sub>	Crosstalk attenuation	f = 1 kHz to 20 kHz	25°C	120			120					dB
I <sub>O</sub>	Output current	V <sub>CC</sub> = 15 V, V <sub>ID</sub> = 1 V, V <sub>O</sub> = 0	Source	25°C	–20	–30	–60	–20	–30	–60	mA	
				Full range	–10			–10				
		V <sub>CC</sub> = 15 V, V <sub>ID</sub> = –1 V, V <sub>O</sub> = 15 V	Sink	25°C	10	20		10	20			
				Full range	5			5				
		V <sub>ID</sub> = –1 V, V <sub>O</sub> = 200 mV		25°C	12	30		12	30		μA	
I <sub>OS</sub>	Short-circuit output current	V <sub>CC</sub> at 5 V, GND at –5 V, V <sub>O</sub> = 0	25°C	±40			±60			±40	±60	mA
I <sub>CC</sub>	Supply current (four amplifiers)	V <sub>O</sub> = 2.5 V, No load	Full range	0.7			1.2			0.7	1.2	mA
		V <sub>CC</sub> = MAX V, V <sub>O</sub> = 0.5 V, No load	Full range	1			2			1	2	

- (1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 26 V for LM2904 and 30 V for others.
- (2) All typical values are at  $T_A = 25^\circ\text{C}$ .
- (3) On products compliant to MIL-PRF-38535, this parameter is not production tested.

## Electrical Characteristics

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>	$T_A$ <sup>(2)</sup>	LM358A			UNIT
			MIN	TYP <sup>(3)</sup>	MAX	
$V_{IO}$ Input offset voltage	$V_{CC} = 5\text{ V to }30\text{ V}$ , $V_{IC} = V_{ICR(min)}$ , $V_O = 1.4\text{ V}$	25°C		2	3	mV
		Full range			5	
$\alpha V_{IO}$ Average temperature coefficient of input offset voltage		Full range		7	20	$\mu\text{A}/^\circ\text{C}$
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		2	30	nA
		Full range			75	
$\alpha I_{IO}$ Average temperature coefficient of input offset current		Full range		10	300	$\text{pA}/^\circ\text{C}$
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		–15	–100	nA
		Full range			–200	
$V_{ICR}$ Common-mode input voltage range	$V_{CC} = 30\text{ V}$	25°C		0 to $V_{CC} - 1.5$		V
		Full range		0 to $V_{CC} - 2$		
$V_{OH}$ High-level output voltage	$R_L \geq 2\text{ k}\Omega$ $V_{CC} = 30\text{ V}$	25°C		$V_{CC} - 1.5$		V
		Full range		26		
		Full range		27	28	
$V_{OL}$ Low-level output voltage	$R_L \leq 10\text{ k}\Omega$	Full range		5	20	mV
$A_{VD}$ Large-signal differential voltage amplification	$V_{CC} = 15\text{ V}$ , $V_O = 1\text{ V to }11\text{ V}$ , $R_L \geq 2\text{ k}\Omega$	25°C		25	100	V/mV
		Full range		15		
CMRR Common-mode rejection ratio		25°C		65	80	dB
$k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{DD}/\Delta V_{IO}$ )		25°C		65	100	dB
$V_{O1}/V_{O2}$ Crosstalk attenuation	$f = 1\text{ kHz to }20\text{ kHz}$	25°C		120		dB
$I_O$ Output current	$V_{CC} = 15\text{ V}$ , $V_{ID} = 1\text{ V}$ , $V_O = 0$	25°C		–20	–30	mA
		Full range		–10		
	$V_{CC} = 15\text{ V}$ , $V_{ID} = -1\text{ V}$ , $V_O = 15\text{ V}$	25°C		10	20	
		Full range		5		
	$V_{ID} = -1\text{ V}$ , $V_O = 200\text{ mV}$	25°C		30		
$I_{OS}$ Short-circuit output current	$V_{CC}$ at 5 V, GND at –5 V, $V_O = 0$	25°C		$\pm 40$	$\pm 60$	mA
$I_{CC}$ Supply current (four amplifiers)	$V_O = 2.5\text{ V}$ , No load	Full range		0.7	1.2	mA
	$V_{CC} = \text{MAX V}$ , $V_O = 0.5\text{ V}$ , No load	Full range		1	2	

- (1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 26 V for LM2904 and 30 V for others.
- (2) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 26 V for LM2904 and 30 V for others.
- (3) All typical values are at  $T_A = 25^\circ\text{C}$ .

## Operating Conditions, $V_{CC} = \pm 15\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
SR Slew rate at unity gain	$R_L = 1\text{ M}\Omega$ , $C_L = 30\text{ pF}$ , $V_I = \pm 10\text{ V}$ (see <a href="#">Figure 1</a> )	0.3	V/ $\mu\text{s}$
$B_1$ Unity-gain bandwidth	$R_L = 1\text{ M}\Omega$ , $C_L = 20\text{ pF}$ (see <a href="#">Figure 1</a> )	0.7	MHz
$V_n$ Equivalent input noise voltage	$R_S = 100\text{ }\Omega$ , $V_I = 0\text{ V}$ , $f = 1\text{ kHz}$ (see <a href="#">Figure 2</a> )	40	nV/ $\sqrt{\text{Hz}}$

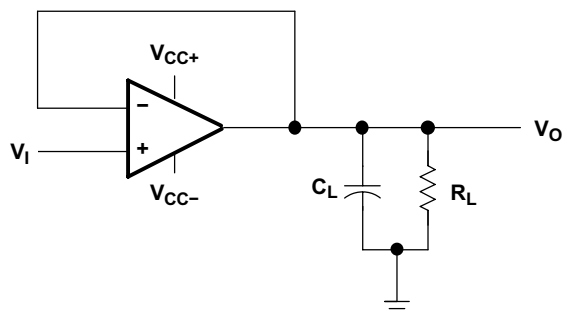


Figure 1. Unity-Gain Amplifier

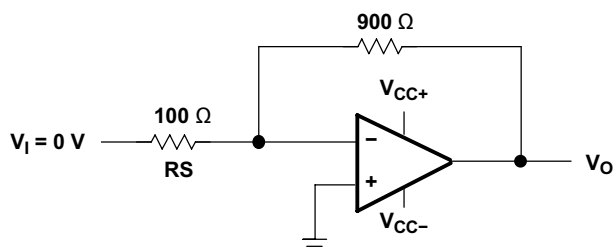


Figure 2. Noise-Test Circuit



## Typical Characteristics

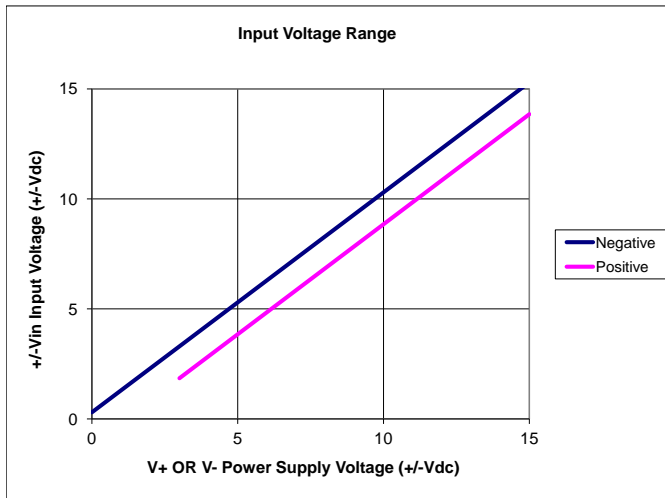


Figure 3.

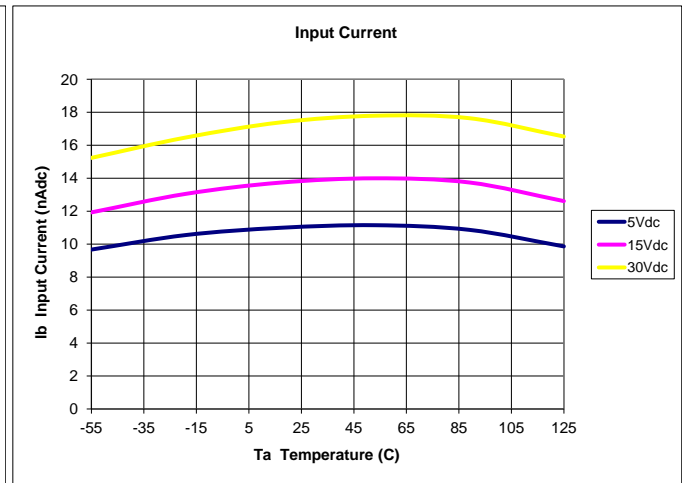


Figure 4.

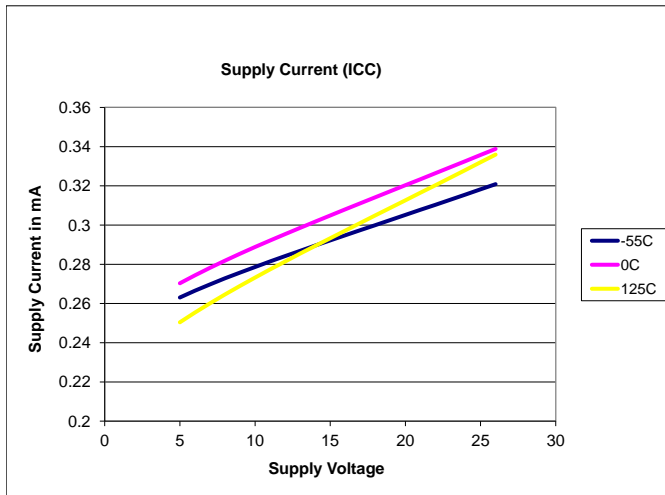


Figure 5.

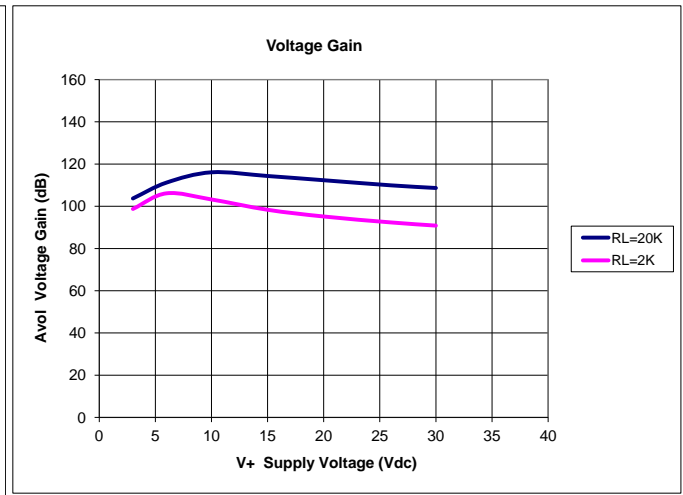


Figure 6.

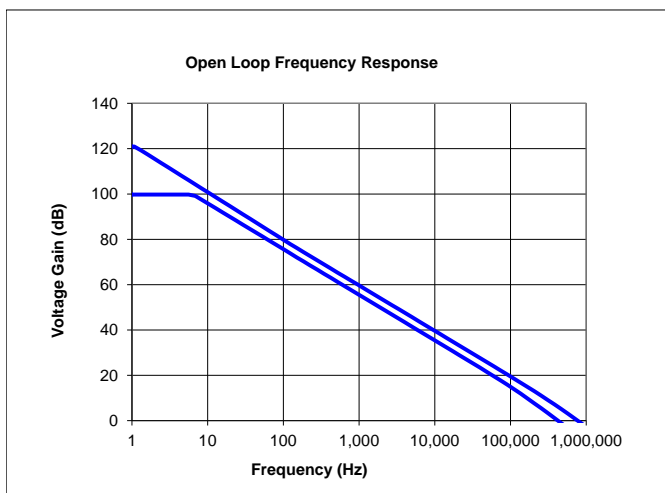


Figure 7. Min & Max Gain Over Temperature Range

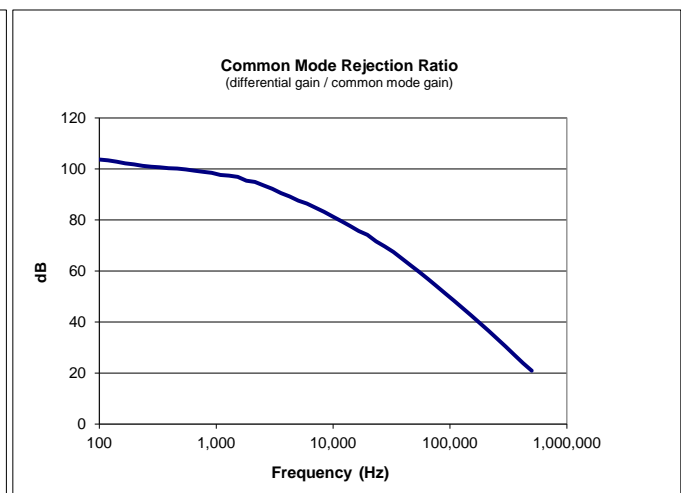


Figure 8.

## Typical Characteristics (continued)

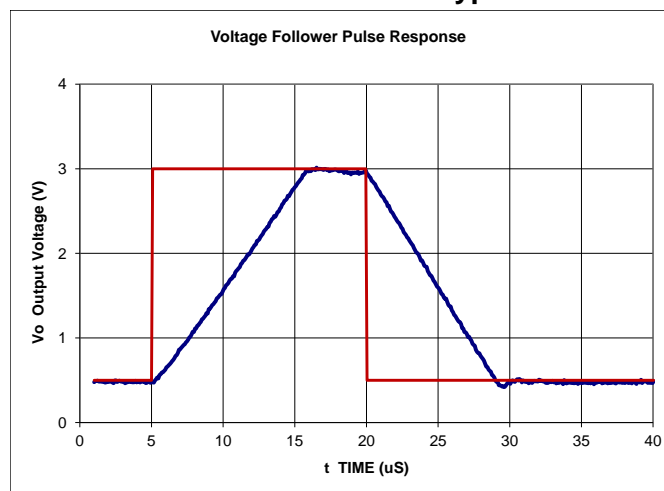


Figure 9.

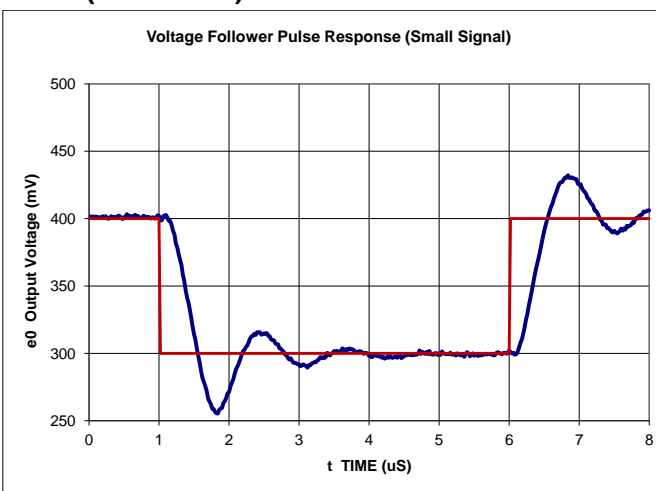


Figure 10.

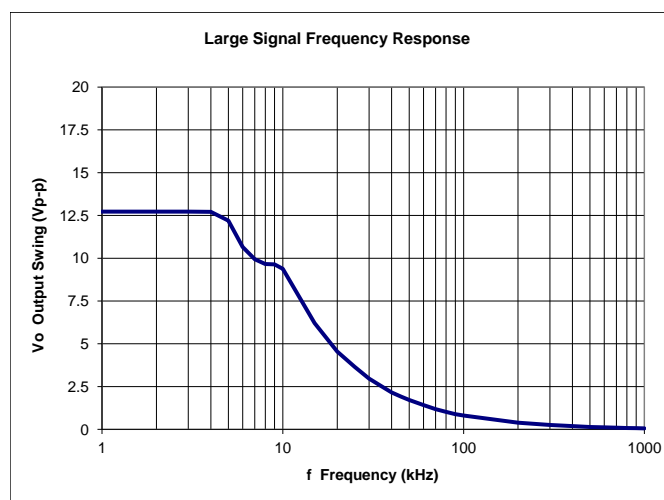


Figure 11.

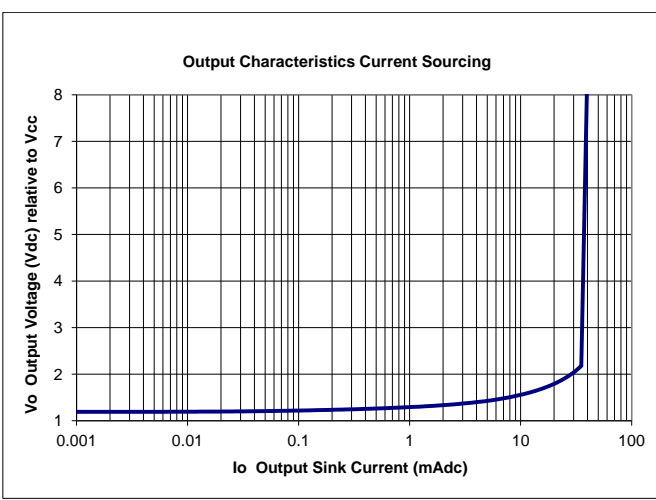


Figure 12.

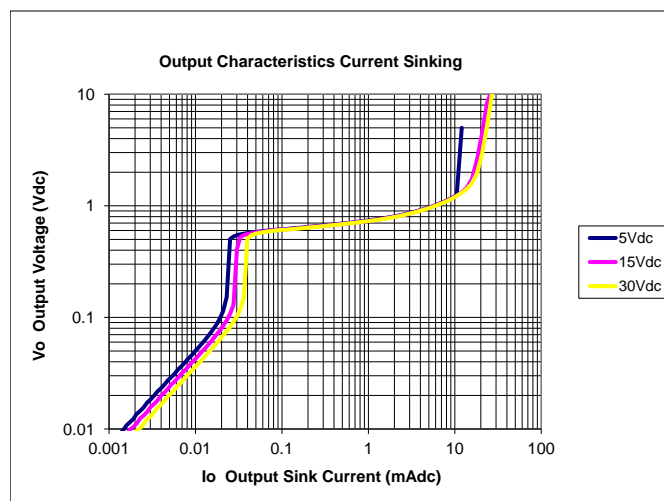


Figure 13.

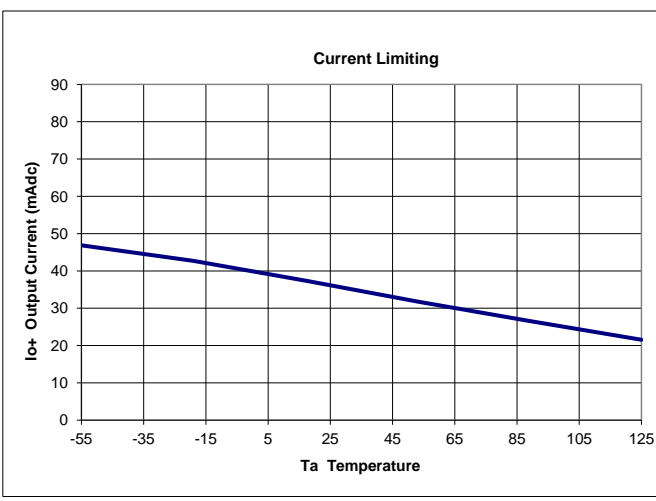


Figure 14.

## Typical Characteristics (continued)

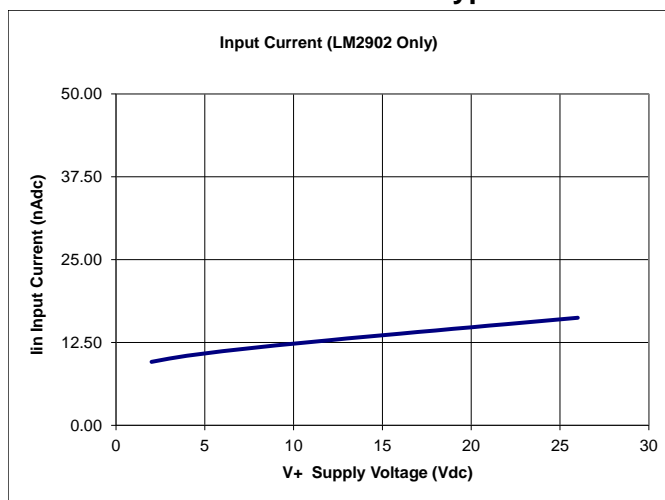


Figure 15.

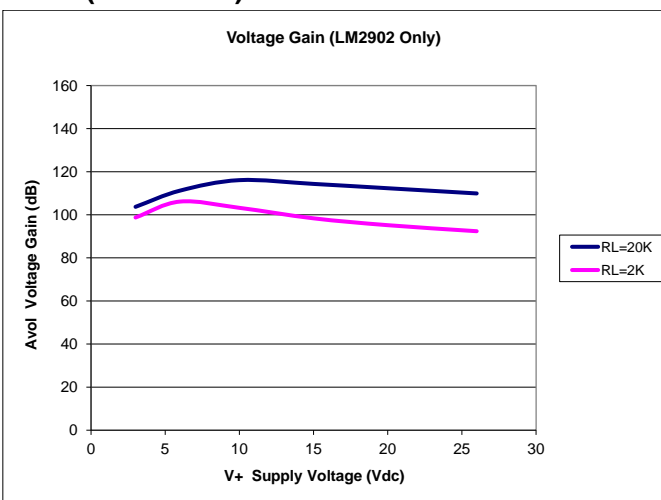


Figure 16.

## REVISION HISTORY

Changes from Revision R (July 2010) to Revision S	Page
• Converted this data sheet from the QS format to DocZone using the PDF on the web. ....	1
• Updated Features. ....	1
• Added ESD warning. ....	2
• Deleted Ordering Information table. ....	2
• Added Package thermal impedance information, $\theta_{JC}$ for D package. ....	3
• Added Typical Characteristics Section ....	9

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-87710012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 87710012A LM158FKB	<a href="#">Samples</a>
5962-8771001PA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	8771001PA LM158	<a href="#">Samples</a>
5962-87710022A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 87710022A LM158AFKB	<a href="#">Samples</a>
5962-8771002PA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	8771002PA LM158A	<a href="#">Samples</a>
LM158AFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 87710022A LM158AFKB	<a href="#">Samples</a>
LM158AJG	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	LM158AJG	<a href="#">Samples</a>
LM158AJGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	8771002PA LM158A	<a href="#">Samples</a>
LM158FKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 87710012A LM158FKB	<a href="#">Samples</a>
LM158JG	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	LM158JG	<a href="#">Samples</a>
LM158JGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	8771001PA LM158	<a href="#">Samples</a>
LM258AD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258A	<a href="#">Samples</a>
LM258ADE4	ACTIVE	SOIC	D	8		TBD	Call TI	Call TI	-25 to 85		<a href="#">Samples</a>
LM258ADG4	ACTIVE	SOIC	D	8		TBD	Call TI	Call TI	-25 to 85		<a href="#">Samples</a>
LM258ADGKR	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU NIPDAUAG	Level-1-260C-UNLIM	-25 to 85	(M3L ~ M3P ~ M3S ~ M3U)	<a href="#">Samples</a>
LM258ADGKRG4	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	(M3L ~ M3P ~ M3S ~ M3U)	<a href="#">Samples</a>
LM258ADR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	-25 to 85	LM258A	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM258ADRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258A	<a href="#">Samples</a>
LM258ADRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258A	<a href="#">Samples</a>
LM258AP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-25 to 85	LM258AP	<a href="#">Samples</a>
LM258APE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-25 to 85	LM258AP	<a href="#">Samples</a>
LM258D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258	<a href="#">Samples</a>
LM258DE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258	<a href="#">Samples</a>
LM258DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258	<a href="#">Samples</a>
LM258DGKR	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU NIPDAUAG	Level-1-260C-UNLIM	-25 to 85	(M2L ~ M2P ~ M2S ~ M2U)	<a href="#">Samples</a>
LM258DGKRG4	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	(M2L ~ M2P ~ M2S ~ M2U)	<a href="#">Samples</a>
LM258DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	-25 to 85	LM258	<a href="#">Samples</a>
LM258DRE4	ACTIVE	SOIC	D	8		Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258	<a href="#">Samples</a>
LM258DRG3	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-25 to 85	LM258	<a href="#">Samples</a>
LM258DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258	<a href="#">Samples</a>
LM258P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-25 to 85	LM258P	<a href="#">Samples</a>
LM258PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-25 to 85	LM258P	<a href="#">Samples</a>
LM2904AVQDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904AV	<a href="#">Samples</a>
LM2904AVQDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904AV	<a href="#">Samples</a>
LM2904AVQPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904AV	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM2904AVQPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904AV	<a href="#">Samples</a>
LM2904D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM2904	<a href="#">Samples</a>
LM2904DE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM2904	<a href="#">Samples</a>
LM2904DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM2904	<a href="#">Samples</a>
LM2904DGKR	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(MBL ~ MBP ~ MBS ~ MBU)	<a href="#">Samples</a>
LM2904DGKRG4	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(MBL ~ MBP ~ MBS ~ MBU)	<a href="#">Samples</a>
LM2904DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	-40 to 125	LM2904	<a href="#">Samples</a>
LM2904DRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM2904	<a href="#">Samples</a>
LM2904DRG3	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LM2904	<a href="#">Samples</a>
LM2904DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM2904	<a href="#">Samples</a>
LM2904P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 125	LM2904P	<a href="#">Samples</a>
LM2904PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 125	LM2904P	<a href="#">Samples</a>
LM2904PSR	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904	<a href="#">Samples</a>
LM2904PSRE4	ACTIVE	SO	PS	8		TBD	Call TI	Call TI	-40 to 125		<a href="#">Samples</a>
LM2904PSRG4	ACTIVE	SO	PS	8		TBD	Call TI	Call TI	-40 to 125		<a href="#">Samples</a>
LM2904PW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904	<a href="#">Samples</a>
LM2904PWE4	ACTIVE	TSSOP	PW	8		TBD	Call TI	Call TI	-40 to 125		<a href="#">Samples</a>
LM2904PWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904	<a href="#">Samples</a>
LM2904PWLE	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI	-40 to 125		

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM2904PWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	-40 to 125	L2904	<a href="#">Samples</a>
LM2904PWRG3	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L2904	<a href="#">Samples</a>
LM2904QD	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 125		
LM2904QDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	2904Q1	<a href="#">Samples</a>
LM2904QDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	2904Q1	<a href="#">Samples</a>
LM2904QP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI	-40 to 125		
LM2904VQDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904V	<a href="#">Samples</a>
LM2904VQDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904V	<a href="#">Samples</a>
LM2904VQPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904V	<a href="#">Samples</a>
LM2904VQPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	L2904V	<a href="#">Samples</a>
LM358AD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358A	<a href="#">Samples</a>
LM358ADE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358A	<a href="#">Samples</a>
LM358ADG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358A	<a href="#">Samples</a>
LM358ADGKR	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU NIPDAUAG	Level-1-260C-UNLIM	0 to 70	(M6L ~ M6P ~ M6S ~ M6U)	<a href="#">Samples</a>
LM358ADGKRG4	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	(M6L ~ M6P ~ M6S ~ M6U)	<a href="#">Samples</a>
LM358ADR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	0 to 70	LM358A	<a href="#">Samples</a>
LM358ADRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358A	<a href="#">Samples</a>
LM358ADRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358A	<a href="#">Samples</a>
LM358AP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	LM358AP	<a href="#">Samples</a>



Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM358APE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	LM358AP	<a href="#">Samples</a>
LM358APW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	L358A	<a href="#">Samples</a>
LM358APWE4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	L358A	<a href="#">Samples</a>
LM358APWG4	ACTIVE	TSSOP	PW	8		TBD	Call TI	Call TI	0 to 70		<a href="#">Samples</a>
LM358APWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	0 to 70	L358A	<a href="#">Samples</a>
LM358APWRE4	ACTIVE	TSSOP	PW	8		TBD	Call TI	Call TI	0 to 70		<a href="#">Samples</a>
LM358APWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	L358A	<a href="#">Samples</a>
LM358D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358	<a href="#">Samples</a>
LM358DE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358	<a href="#">Samples</a>
LM358DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358	<a href="#">Samples</a>
LM358DGKR	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU NIPDAUAG	Level-1-260C-UNLIM	0 to 70	(M5L ~ M5P ~ M5S ~ M5U)	<a href="#">Samples</a>
LM358DGKRG4	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	(M5L ~ M5P ~ M5S ~ M5U)	<a href="#">Samples</a>
LM358DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	0 to 70	LM358	<a href="#">Samples</a>
LM358DRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358	<a href="#">Samples</a>
LM358DRG3	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM358	<a href="#">Samples</a>
LM358DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LM358	<a href="#">Samples</a>
LM358P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU   CU SN	N / A for Pkg Type	0 to 70	LM358P	<a href="#">Samples</a>
LM358PE3	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM358P	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM358PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	LM358P	<a href="#">Samples</a>
LM358PSLE	OBSOLETE	SO	PS	8		TBD	Call TI	Call TI	0 to 70		
LM358PSR	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	L358	<a href="#">Samples</a>
LM358PSRE4	ACTIVE	SO	PS	8		TBD	Call TI	Call TI	0 to 70		<a href="#">Samples</a>
LM358PSRG4	ACTIVE	SO	PS	8		TBD	Call TI	Call TI	0 to 70		<a href="#">Samples</a>
LM358PW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	L358	<a href="#">Samples</a>
LM358PWE4	ACTIVE	TSSOP	PW	8		TBD	Call TI	Call TI	0 to 70		<a href="#">Samples</a>
LM358PWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	L358	<a href="#">Samples</a>
LM358PWLE	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI	0 to 70		
LM358PWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	0 to 70	L358	<a href="#">Samples</a>
LM358PWRE4	ACTIVE	TSSOP	PW	8		TBD	Call TI	Call TI	0 to 70		<a href="#">Samples</a>
LM358PWRG3	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	L358	<a href="#">Samples</a>
LM358PWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	L358	<a href="#">Samples</a>

(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.

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**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) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device 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 Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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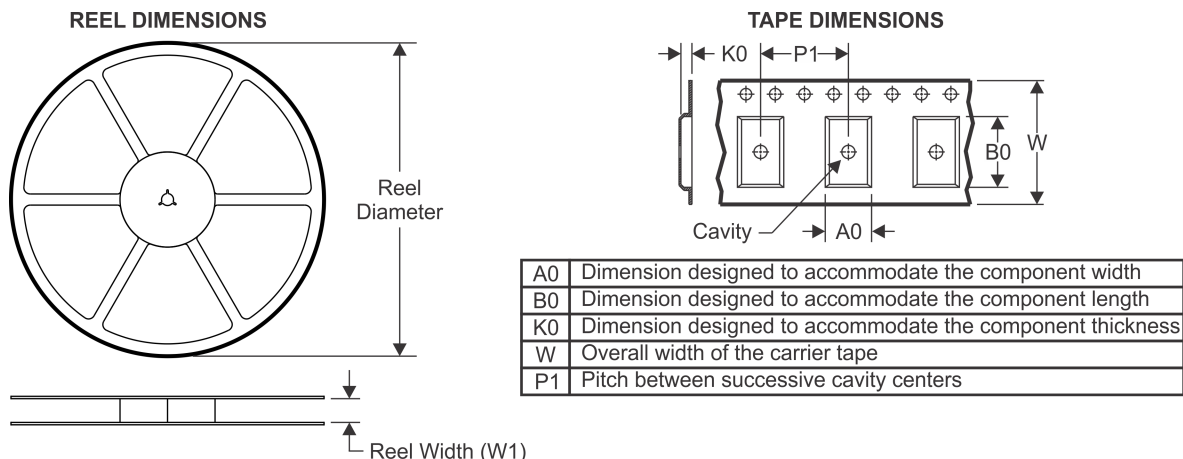
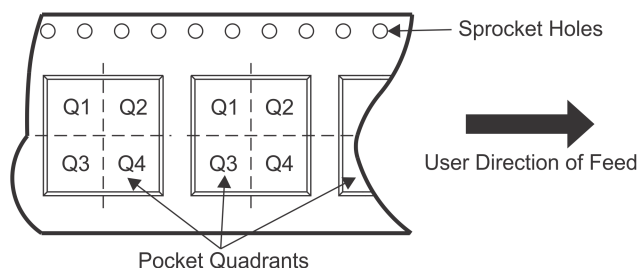
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF LM258A, LM2904 :**

- Automotive: [LM2904-Q1](#)
- Enhanced Product: [LM258A-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM258ADGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM258ADGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM258ADR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM258ADR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM258ADRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM258ADRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM258DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM258DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM258DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM258DR	SOIC	D	8	2500	330.0	12.8	6.4	5.2	2.1	8.0	12.0	Q1
LM258DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM258DRG3	SOIC	D	8	2500	330.0	12.8	6.4	5.2	2.1	8.0	12.0	Q1
LM258DRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM2904AVQPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM2904AVQPWRG4	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM2904DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM2904DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM2904DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM2904DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM2904DRG3	SOIC	D	8	2500	330.0	12.8	6.4	5.2	2.1	8.0	12.0	Q1
LM2904DRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM2904DRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM2904PSR	SO	PS	8	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
LM2904PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM2904PWRG3	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM2904QDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM2904VQPWRG4	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM358ADGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM358ADGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM358ADR	SOIC	D	8	2500	330.0	12.8	6.4	5.2	2.1	8.0	12.0	Q1
LM358ADR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM358ADRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM358ADRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM358APWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM358APWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM358DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM358DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM358DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM358DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM358DRG3	SOIC	D	8	2500	330.0	12.8	6.4	5.2	2.1	8.0	12.0	Q1
LM358DRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM358DRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM358PSR	SO	PS	8	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
LM358PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
LM358PWRG3	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1

## TAPE AND REEL BOX DIMENSIONS



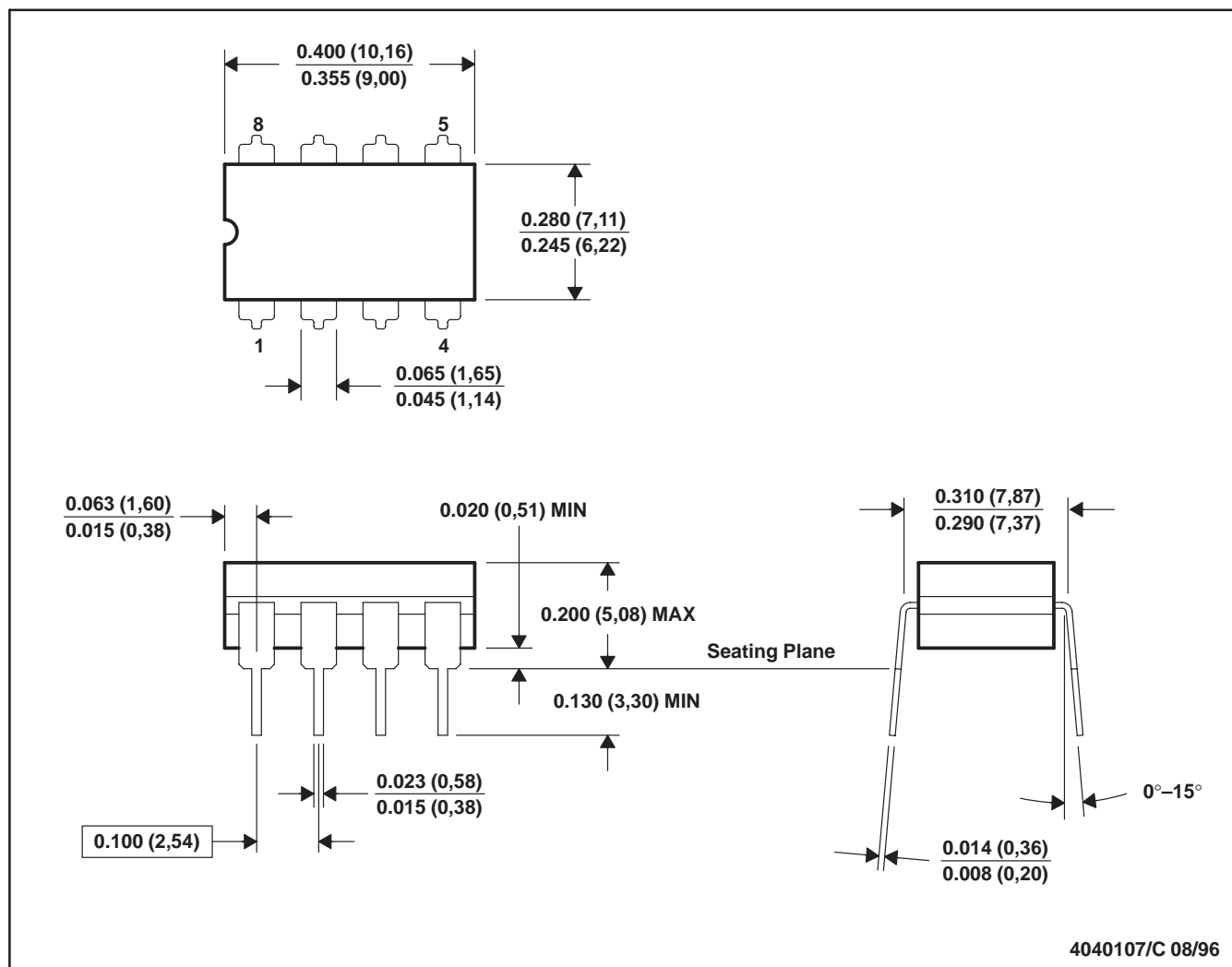
\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM258ADGKR	VSSOP	DGK	8	2500	364.0	364.0	27.0
LM258ADGKR	VSSOP	DGK	8	2500	332.0	358.0	35.0
LM258ADR	SOIC	D	8	2500	367.0	367.0	35.0
LM258ADR	SOIC	D	8	2500	340.5	338.1	20.6
LM258ADRG4	SOIC	D	8	2500	367.0	367.0	35.0
LM258ADRG4	SOIC	D	8	2500	340.5	338.1	20.6
LM258DGKR	VSSOP	DGK	8	2500	332.0	358.0	35.0
LM258DGKR	VSSOP	DGK	8	2500	364.0	364.0	27.0
LM258DR	SOIC	D	8	2500	367.0	367.0	35.0
LM258DR	SOIC	D	8	2500	364.0	364.0	27.0
LM258DR	SOIC	D	8	2500	340.5	338.1	20.6
LM258DRG3	SOIC	D	8	2500	364.0	364.0	27.0
LM258DRG4	SOIC	D	8	2500	367.0	367.0	35.0
LM2904AVQPWR	TSSOP	PW	8	2000	367.0	367.0	35.0
LM2904AVQPWRG4	TSSOP	PW	8	2000	367.0	367.0	35.0
LM2904DGKR	VSSOP	DGK	8	2500	364.0	364.0	27.0
LM2904DGKR	VSSOP	DGK	8	2500	332.0	358.0	35.0
LM2904DR	SOIC	D	8	2500	340.5	338.1	20.6
LM2904DR	SOIC	D	8	2500	367.0	367.0	35.0
LM2904DRG3	SOIC	D	8	2500	364.0	364.0	27.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM2904DRG4	SOIC	D	8	2500	340.5	338.1	20.6
LM2904DRG4	SOIC	D	8	2500	367.0	367.0	35.0
LM2904PSR	SO	PS	8	2000	367.0	367.0	38.0
LM2904PWR	TSSOP	PW	8	2000	364.0	364.0	27.0
LM2904PWRG3	TSSOP	PW	8	2000	364.0	364.0	27.0
LM2904QDR	SOIC	D	8	2500	367.0	367.0	35.0
LM2904VQPWRG4	TSSOP	PW	8	2000	367.0	367.0	35.0
LM358ADGKR	VSSOP	DGK	8	2500	364.0	364.0	27.0
LM358ADGKR	VSSOP	DGK	8	2500	332.0	358.0	35.0
LM358ADR	SOIC	D	8	2500	364.0	364.0	27.0
LM358ADR	SOIC	D	8	2500	340.5	338.1	20.6
LM358ADRG4	SOIC	D	8	2500	340.5	338.1	20.6
LM358ADRG4	SOIC	D	8	2500	367.0	367.0	35.0
LM358APWR	TSSOP	PW	8	2000	367.0	367.0	35.0
LM358APWR	TSSOP	PW	8	2000	364.0	364.0	27.0
LM358DGKR	VSSOP	DGK	8	2500	332.0	358.0	35.0
LM358DGKR	VSSOP	DGK	8	2500	364.0	364.0	27.0
LM358DR	SOIC	D	8	2500	367.0	367.0	35.0
LM358DR	SOIC	D	8	2500	340.5	338.1	20.6
LM358DRG3	SOIC	D	8	2500	364.0	364.0	27.0
LM358DRG4	SOIC	D	8	2500	340.5	338.1	20.6
LM358DRG4	SOIC	D	8	2500	367.0	367.0	35.0
LM358PSR	SO	PS	8	2000	367.0	367.0	38.0
LM358PWR	TSSOP	PW	8	2000	364.0	364.0	27.0
LM358PWRG3	TSSOP	PW	8	2000	364.0	364.0	27.0

## JG (R-GDIP-T8)

## CERAMIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. This package can be hermetically sealed with a ceramic lid using glass frit.  
 D. Index point is provided on cap for terminal identification.  
 E. Falls within MIL STD 1835 GDIP1-T8



FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001 variation BA.

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.

DGK (S-PDSO-G8)

PLASTIC SMALL OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

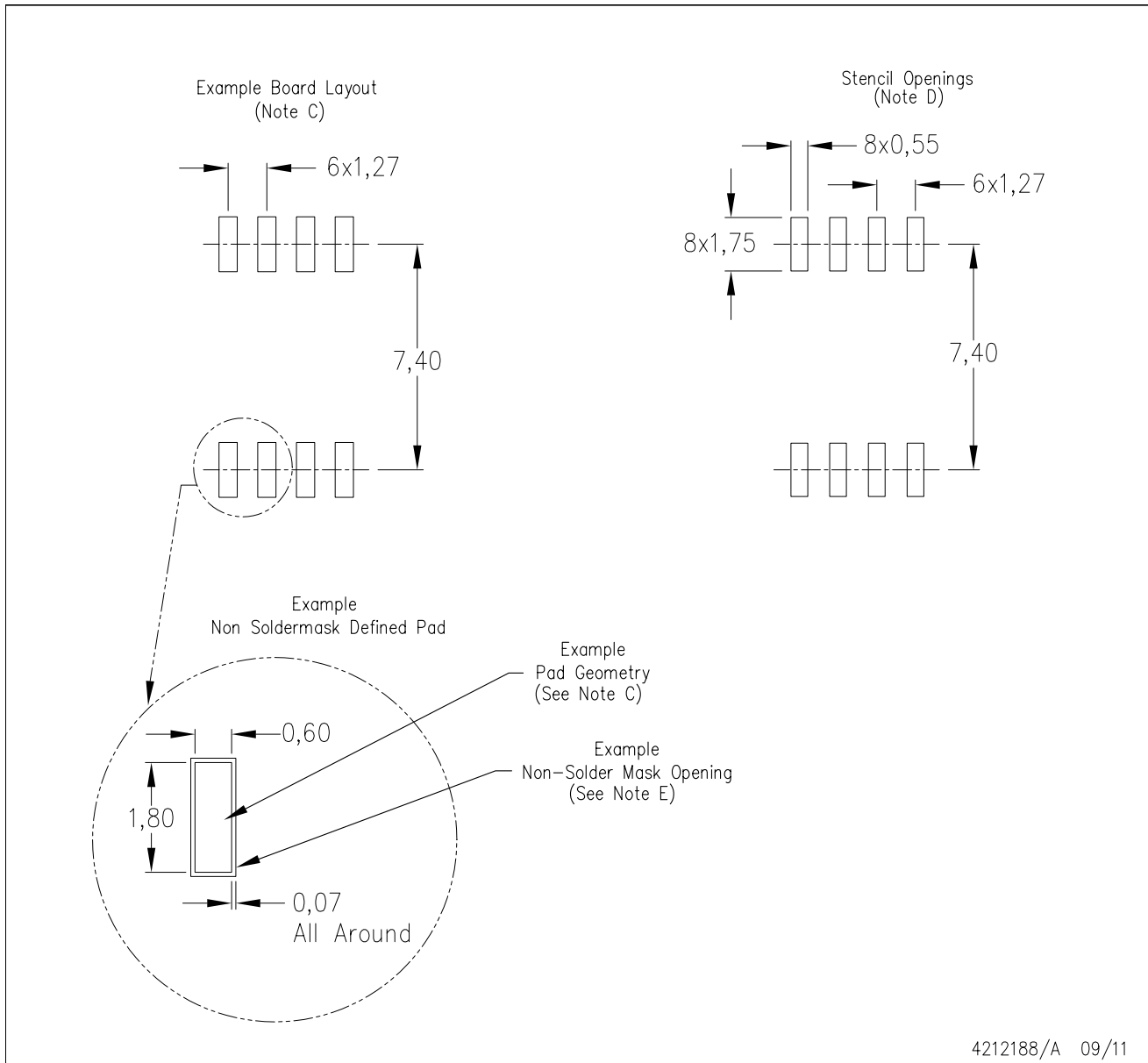


4040063/C 03/03

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PS (R-PDSO-G8)

PLASTIC SMALL OUTLINE

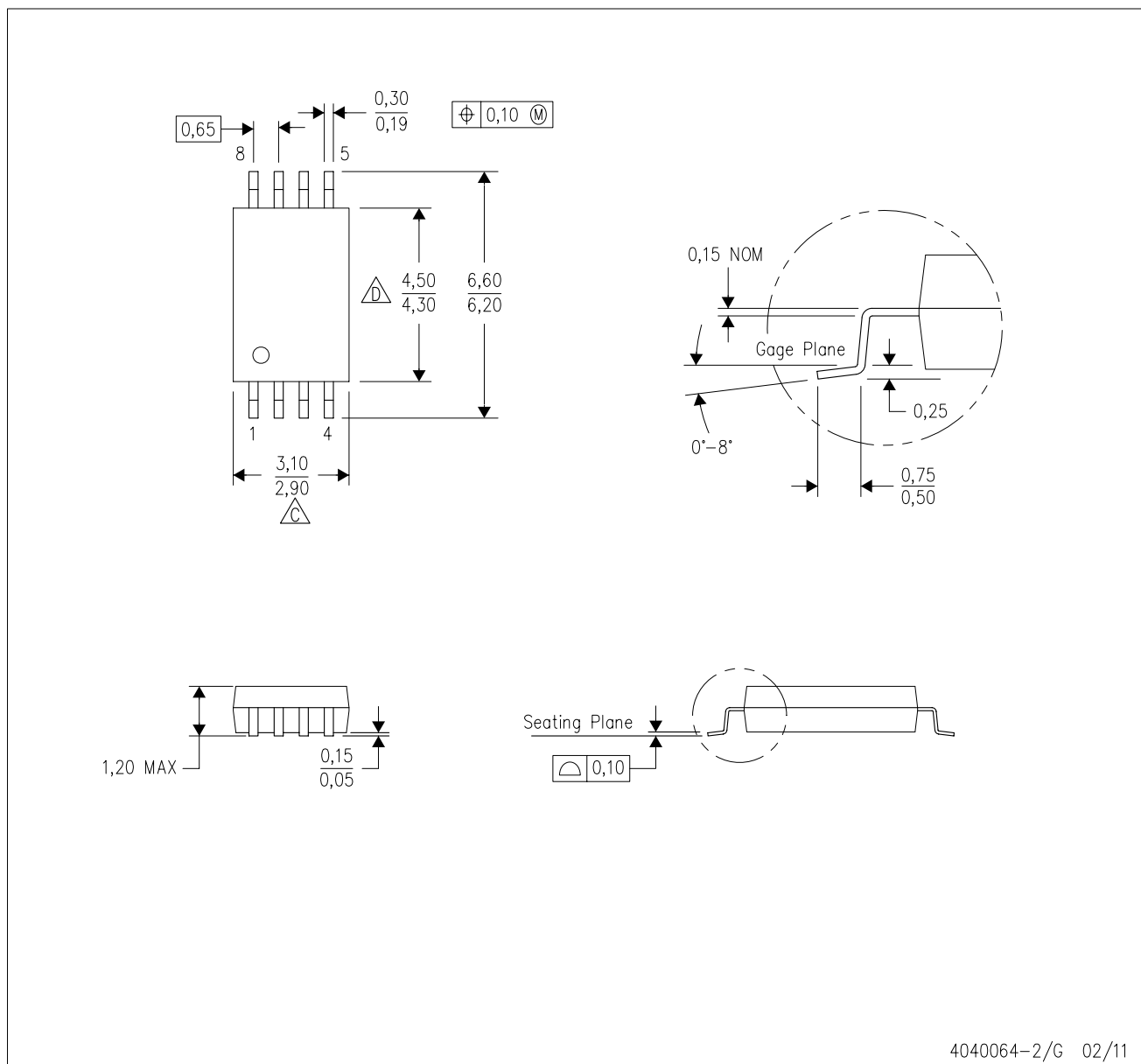


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



PW (R-PDSO-G8)

PLASTIC SMALL OUTLINE



4040064-2/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - 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 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

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Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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