

## General purpose JFET quad operational amplifiers

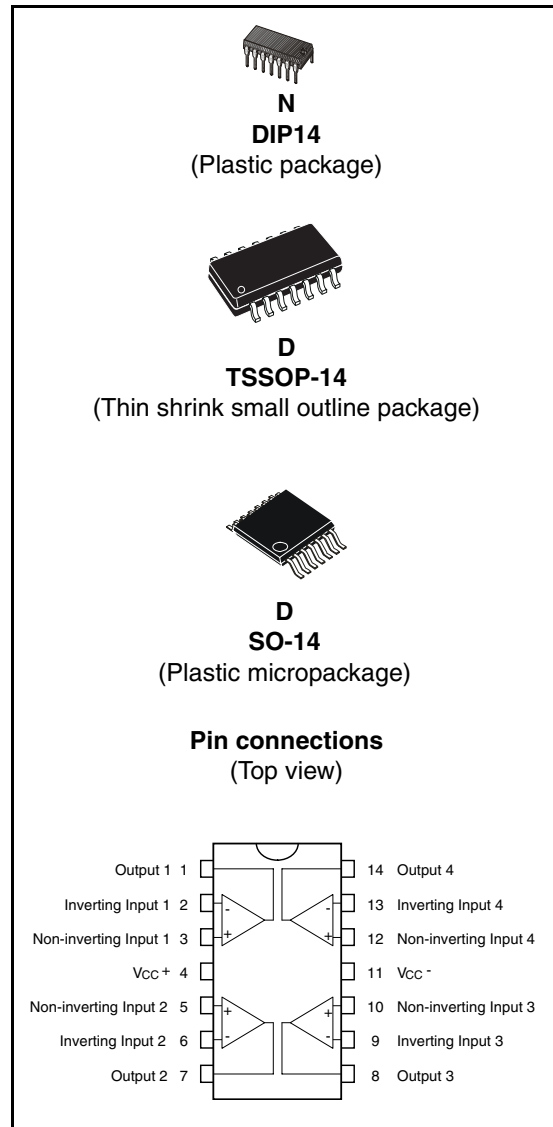
### Features

- Wide common-mode (up to  $V_{CC^+}$ ) and differential voltage range
- Low input bias and offset current
- Output short-circuit protection
- High input impedance JFET input stage
- Internal frequency compensation
- Latch up free operation
- High slew rate: 16 V/ $\mu$ s (typical)

### Description

The TL084, TL084A and TL084B are high-speed JFET input quad operational amplifiers incorporating well matched, high voltage JFET and bipolar transistors in a monolithic integrated circuit.

The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient.



## 2 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TL084I, AI, BI	TL084C, AC, BC	
$V_{CC}$	Supply voltage <sup>(1)</sup>	±18		V
$V_{in}$	Input voltage <sup>(2)</sup>	±15		V
$V_{id}$	Differential input voltage <sup>(3)</sup>	±30		V
$R_{thja}$	Thermal resistance junction to ambient <sup>(4)</sup> <sup>(5)</sup>			°C/W
	SO-14	105		
	DIP14	80		
	TSSOP14	100		
$R_{thjc}$	Thermal resistance junction to case <sup>(4)</sup> <sup>(5)</sup>			°C/W
	SO-14	31		
	DIP14	33		
	TSSOP14	32		
$P_{tot}$	Power dissipation	680		mW
	Output short-circuit duration <sup>(6)</sup>	Infinite		
$T_{oper}$	Operating free-air temperature range	-40 to +105	0 to +70	°C
$T_{stg}$	Storage temperature range	-65 to +150		°C
ESD	HBM: human body model <sup>(7)</sup>	1000		V
	MM: machine model <sup>(8)</sup>	150		
	CDM: charged device model <sup>(9)</sup>	1500		

1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between  $V_{CC}^+$  and  $V_{CC}^-$ .
2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
3. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
4. Short-circuits can cause excessive heating and destructive dissipation.
5.  $R_{th}$  are typical values.
6. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.
7. Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
8. Machine model: a 200 pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.
9. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.

**Table 2. Operating conditions**

Symbol	Parameter	TL084I, AI, BI	TL084C, AC, BC	Unit
$V_{CC}$	Supply voltage range	6 to 36		V
$T_{oper}$	Operating free-air temperature range	-40 to +105	0 to +70	°C

### 3 Electrical characteristics

Table 3.  $V_{CC} = \pm 15V$ ,  $T_{amb} = +25^{\circ}C$  (unless otherwise specified)

Symbol	Parameter	TL084I,AC,AI, BC,BI			TL084C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_{io}$	Input offset voltage ( $R_S = 50\Omega$ ) $T_{amb} = +25^{\circ}C$ TL084 TL084A TL084B		3 3 1	10 6 3		3	10	mV
	$T_{min} \leq T_{amb} \leq T_{max}$ TL084 TL084A TL084B			13 7 5			13	
$DV_{io}$	Input offset voltage drift		10			10		$\mu V/^{\circ}C$
$I_{io}$	Input offset current $T_{amb} = +25^{\circ}C$		5	100		5	100	pA nA
	$T_{min} \leq T_{amb} \leq T_{max}$			4			4	
$I_{ib}$	Input bias current <sup>(1)</sup> $T_{amb} = +25^{\circ}C$		20	200		30	200	pA nA
	$T_{min} \leq T_{amb} \leq T_{max}$			20			20	
$A_{vd}$	Large signal voltage gain ( $R_L = 2k\Omega$ , $V_o = \pm 10V$ ) $T_{amb} = +25^{\circ}C$	50 25	200		25 15	200		V/mV
	$T_{min} \leq T_{amb} \leq T_{max}$							
SVR	Supply voltage rejection ratio ( $R_S = 50\Omega$ ) $T_{amb} = +25^{\circ}C$	80 80	86		70 70	86		dB
	$T_{min} \leq T_{amb} \leq T_{max}$							
$I_{CC}$	Supply current, no load $T_{amb} = +25^{\circ}C$		1.4	2.5		1.4	2.5	mA
	$T_{min} \leq T_{amb} \leq T_{max}$			2.5			2.5	
$V_{icm}$	Input common mode voltage range	$\pm 11$	+15 -12		$\pm 11$	+15 -12		V
CMR	Common mode rejection ratio ( $R_S = 50\Omega$ ) $T_{amb} = +25^{\circ}C$	80 80	86		70 70	86		dB
	$T_{min} \leq T_{amb} \leq T_{max}$							
$I_{os}$	Output short-circuit current $T_{amb} = +25^{\circ}C$	10 10	40	60	10 10	40	60	mA
	$T_{min} \leq T_{amb} \leq T_{max}$			60			60	
$\pm V_{opp}$	Output voltage swing $T_{amb} = +25^{\circ}C$ $R_L = 2k\Omega$	10	12		10	12		V
	$R_L = 10k\Omega$	12	13.5		12	13.5		
	$T_{min} \leq T_{amb} \leq T_{max}$ $R_L = 2k\Omega$	10			10			
	$R_L = 10k\Omega$	12			12			
SR	Slew rate $V_{in} = 10V$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain	8	16		8	16		V/ $\mu s$

Table 3.  $V_{CC} = \pm 15V$ ,  $T_{amb} = +25^{\circ}C$  (unless otherwise specified) (continued)

Symbol	Parameter	TL084I,AC,AI, BC,BI			TL084C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$t_r$	Rise time $V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain		0.1			0.1		$\mu s$
$K_{ov}$	Overshoot $V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain		10			10		%
GBP	Gain bandwidth product $V_{in} = 10mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $F = 100kHz$	2.5	4		2.5	4		MHz
$R_i$	Input resistance		$10^{12}$			$10^{12}$		$\Omega$
THD	Total harmonic distortion $F = 1kHz$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $A_v = 20dB$ , $V_o = 2V_{pp}$ )		0.01			0.01		%
$e_n$	Equivalent input noise voltage $R_S = 100\Omega$ , $F = 1kHz$		15			15		$\frac{nV}{\sqrt{Hz}}$
$\phi_m$	Phase margin		45			45		degrees
$V_{o1}/V_{o2}$	Channel separation $A_v = 100$		120			120		dB

1. The input bias currents are junction leakage currents which approximately double for every  $10^{\circ}C$  increase in the junction temperature.

## 6.2 DIP14 package information

Figure 27. DIP14 package mechanical drawing

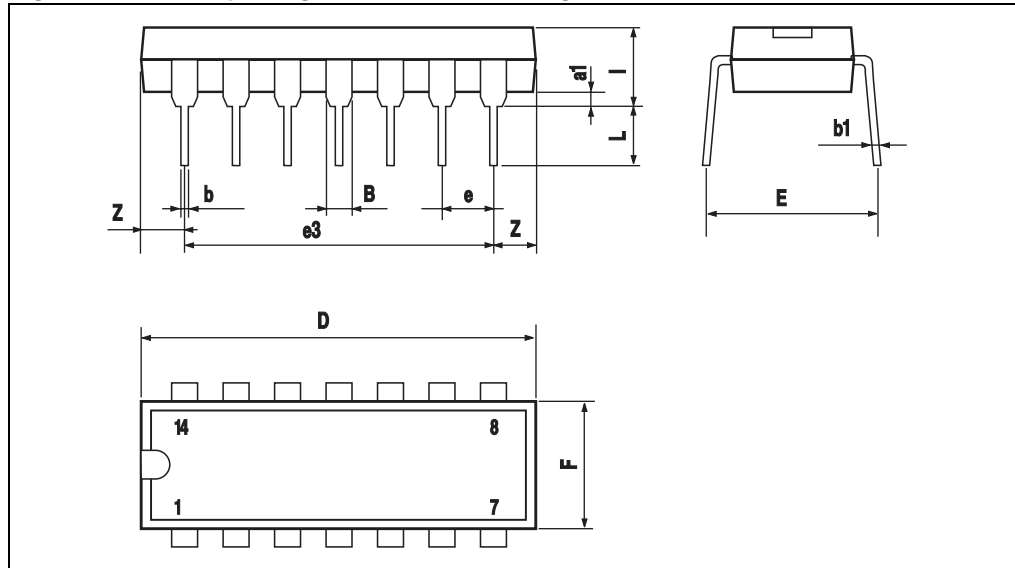


Table 4. DIP14 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
l			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

## 7 Ordering information

Table 6. Order codes

Order code	Temperature range	Package	Packing	Marking
TL084IN TL084AIN TL084BIN	-40°C, +105°C	DIP14	Tube	TL084IN TL084AIN TL084BIN
TL084ID/IDT TL084AID/AIDT TL084BID/BIDT		SO-14	Tube or tape & reel	084I 084AI 084BI
TL084IYD/DT <sup>(1)</sup> TL084AIYD/DT <sup>(1)</sup> TL084BIYD/DT <sup>(1)</sup>		SO-14 (Automotive grade)	Tube or tape & reel	084IY 084AIY 084BIY
TL084IP/IPT TL084AIP/AIPT TL084BIP/BIPT		TSSOP14	Tube or tape & reel	084I 084AI 084BI
TL084CN TL084ACN TL084BCN	0°C, +70°C	DIP14	Tube	TL084CN TL084ACN TL084BCN
TL084CD/CDT TL084ACD/ACDT TL084BCD/BCDT		SO-14	Tube or tape & reel	084C 084AC 084BC
TL084CP/CPT TL084ACP/ACPT TL084BCP/BCPT		TSSOP14	Tube or tape & reel	084C 084AC 084BC

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent.