

DIO3581/1A_3582_3584

1.4 MHz, 60 μ A, Rail-to-Rail I/O CMOS Amplifier

Features

- Rail-to-rail input and output
 - Max offset (V_{OS}): ± 3 mV
 - Unity gain stable
 - Gain bandwidth product: 1.4 MHz
 - Very low input bias currents: 5 pA
 - Wide supply range: 2 V to 5.5 V
 - Input voltage range:
-0.1 V to +5.6 V with $V^+ = 5.5$ V
 - Ultra low power: 60 μ A per channel
 - Compact package best for portable applications
- DIO3581/1A: SOT23-5 and SC70-5
DIO3582: SOIC-8, MSOP-8 and DFN2*2-8
DIO3584: SOIC-14 and TSSOP-14

Applications

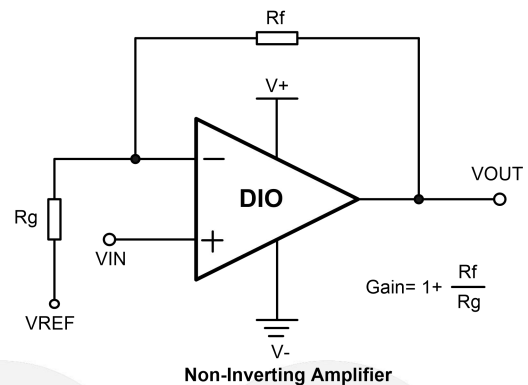
- ASIC input or output amplifiers
- Sensor interface
- Piezo electric transducer amplifiers
- Medical instrumentation
- Audio output
- Portable systems
- Smoke detectors
- Notebook PCs
- Battery-powered equipment

Descriptions

The DIO3581/1A (single), DIO3582 (dual) and DIO3584 (quad) are rail-to-rail CMOS operational amplifiers with an ultra-low offset. Features include wide input common-mode voltage range and broad output voltage swing with operating supply voltage from 2 V to 5.5 V. Products are fully specified over the extended -40 to 125°C temperature range.

The DIO3581/1A_3582_3584 provide 1.4 MHz bandwidth consuming an ultra-low current of 60 μ A per channel. Very low input bias currents of 5 pA make them ideal for integrators, photodiode amplifiers, and piezoelectric sensors.

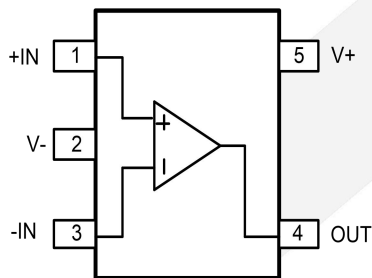
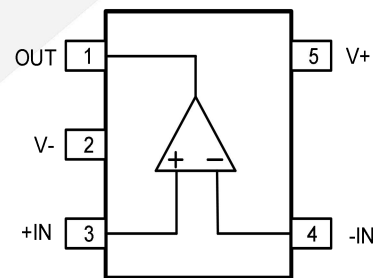
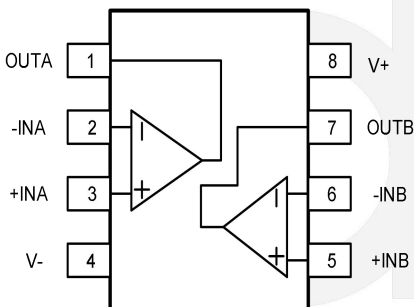
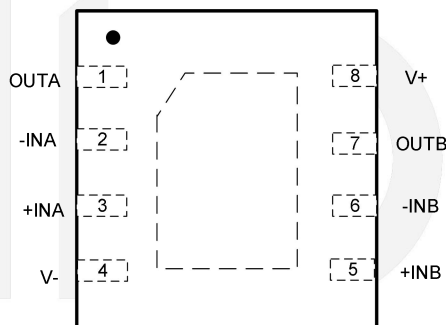
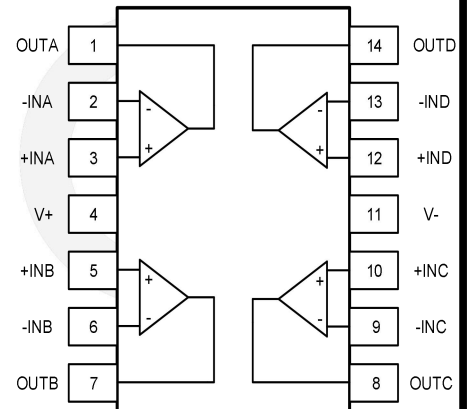
Typical Application



Ordering Information

Order Part Number	Top Marking		T _A	Package	
DIO3581ST5	YWXS	RoHS or Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO3581SC5	YWXS	RoHS or Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO3581AST5	YW1A	RoHS or Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO3581ASC5	YW1A	RoHS or Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO3582MP8	DIO358	RoHS or Green	-40 to 125°C	MSOP-8	Tape & Reel, 3000
DIO3582SO8	DIO358	RoHS or Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO3582CN8	3582	RoHS or Green	-40 to 125°C	DFN2*2-8	Tape & Reel, 3000
DIO3584TP14	DIO3584	RoHS or Green	-40 to 125°C	TSSOP-14	Tape & Reel, 2500
DIO3584SO14	DIO3584	RoHS or Green	-40 to 125°C	SOIC-14	Tape & Reel, 2500

Pin Assignments

SOT23-5/SC70-5
DIO3581

SOT23-5/SC70-5
DIO3581A

SOIC-8/MSOP-8
DIO3582

DFN2*2-8
DIO3582

TSSOP-14/SOIC-14
DIO3584

Figure 1. Pin Assignment

Pin Description

Pin name	Description
V+	Positive supply
V-	Negative supply
+INX	Positive input
-INX	Negative input
OUTX	Output

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Rating	Unit
V _{CC}	Supply voltage	7	V
V _{IN}	Input voltage	(V-) - 0.5 to 7	V
T _{STG}	Storage temperature range	-65 to 150	°C
T _J	Junction temperature	150	°C
T _L	Lead temperature range	260	°C
ESD	HBM, JEDEC: JESD22-A114	8	kV
	CDM, JEDEC: JESD22-C101	2	

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating	Unit
V _{CC}	Supply voltage	2.0 to 5.5	V
V _{IN}	Input voltage	-0.1 to (V+) + 0.1	V
T _A	Operating temperature range	-40 to 125	°C

Electrical Characteristics

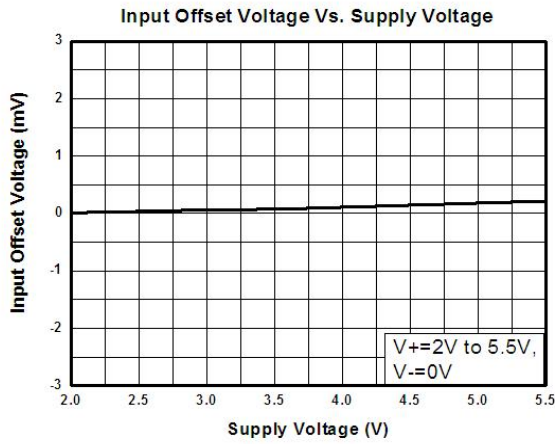
Typical value: $V_+ = 5\text{ V}$, $R_L = 100\text{ k}\Omega$ to $V_+/2$, $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Input characteristics						
V_{OS}	Input offset voltage	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, $V_+ = 2\text{ V to } 5\text{ V}$	-3	0.5	3	mV
I_B	Input bias current	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, $V_+ = 2\text{ V to } 5\text{ V}$		5		pA
I_{OS}	Input offset current	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, $V_+ = 2\text{ V to } 5\text{ V}$		5		pA
V_{CM}	Common mode voltage range		-0.1		(V_+) +0.1	V
CMRR	Common mode rejection ratio	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, $V_{CM} = -0.1\text{ to } (V_+) + 0.1$	65	75		dB
A_{OL}	Open loop voltage gain	$R_L = 5\text{ k}\Omega$, $V_O = 0.1\text{ to } (V_+) - 0.1$	80	100		dB
		$R_L = 200\text{ k}\Omega$, $V_O = 0.1\text{ to } (V_+) - 0.1$	90	110		
$\Delta V_{OS}/\Delta T$	Input offset voltage drift	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$			5	$\mu\text{V}/^\circ\text{C}$
Output characteristics						
V_{OH}	Output voltage high	$R_L = 100\text{ k}\Omega$, $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		4.998		V
V_{OL}	Output voltage low	$R_L = 100\text{ k}\Omega$, $-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		2.5		mV
I_{SC}	Output short circuit current	Source I_{SC} , $V_+ = 5\text{ V}$		40		mA
		Sink I_{SC} , $V_+ = 5\text{ V}$		40		
Power supply						
PSRR	Power supply rejection ration		65	85		dB
I_S	Supply current per channel/Amp	$-40^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		60		μA
Dynamic performance						
GBP	Gain bandwidth product	$R_L = 100\text{ K}$, $C_L = 100\text{ pF}$		1.4		MHz
SR	Slew rate	$G = 1, 2\text{ V output step}$		0.6		$\text{V}/\mu\text{s}$
t_s	Setting time	$G = 1, 2\text{ V output step}$		2.4		μs
Noise performance						
THD	Total harmonic distortion	$f = 10\text{ kHz}$, 2 V output step , $R_L = 10\text{ k}\Omega$		0.019		%
e_n	Voltage noise density	$f = 1\text{ kHz}$		45		$\text{nV}/\sqrt{\text{Hz}}$
		$f = 10\text{ kHz}$		35		

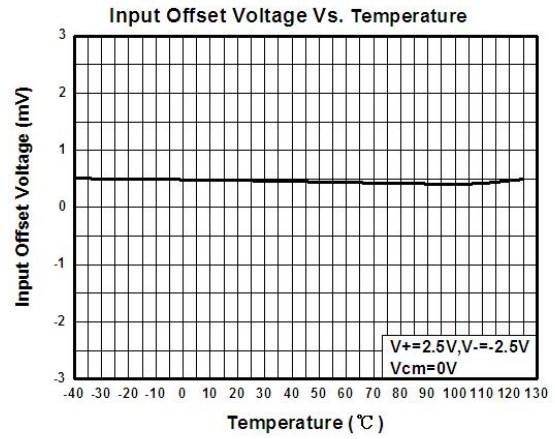
Specifications subject to change without notice.

Typical Performance Characteristics

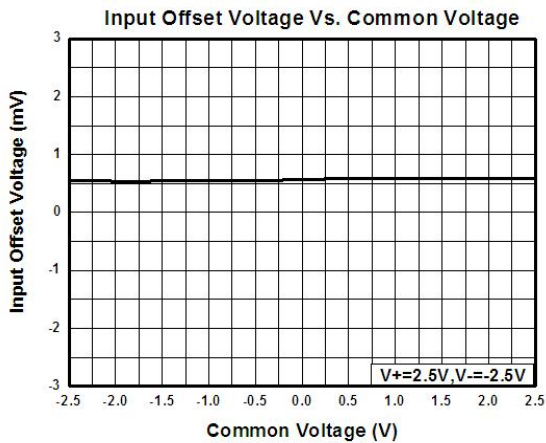
All typical value are at $V_+ = 2.5\text{ V}$, $V_- = -2.5\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise specified.



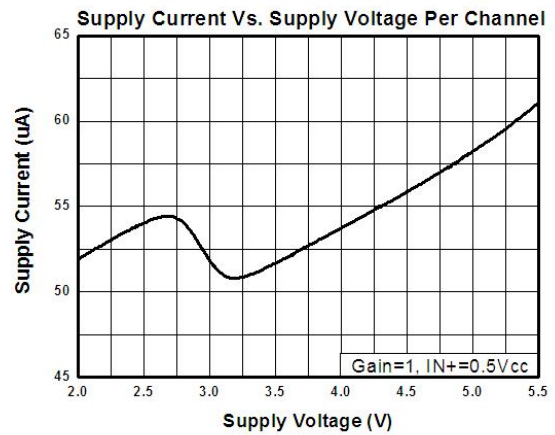
Input offset voltage vs. Supply voltage



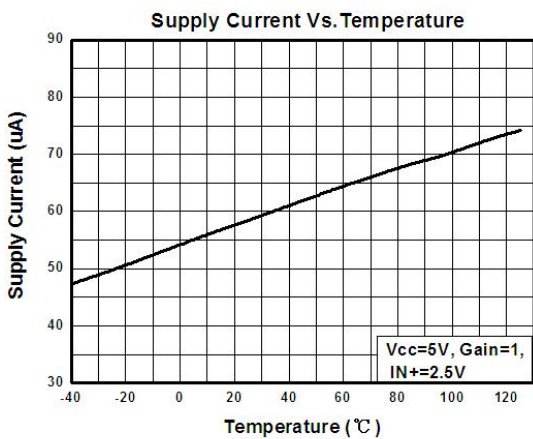
Input offset voltage vs. Temperature



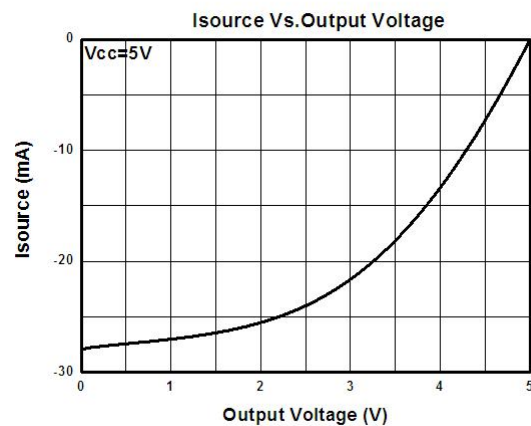
Input offset voltage vs. Common voltage



Supply current vs. Supply voltage per channel



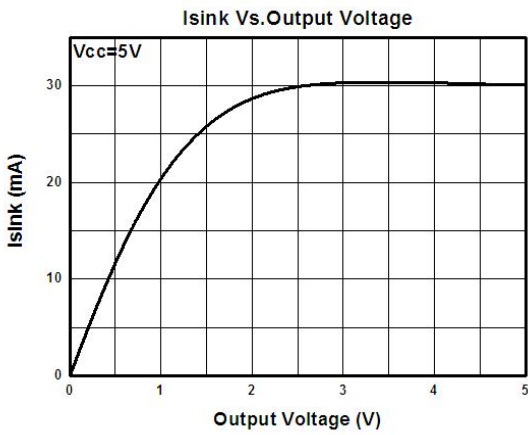
Supply current vs. Temperature



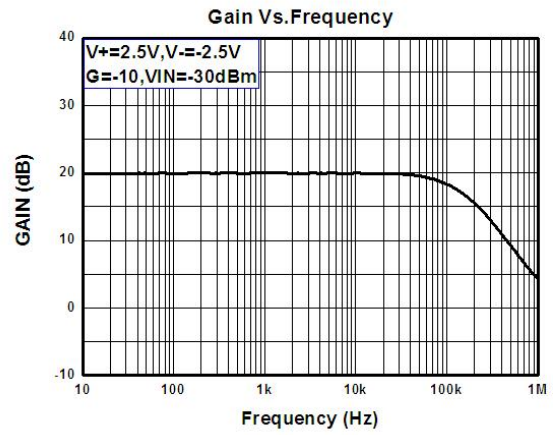
ISOURCE vs. Output voltage

Typical Performance Characteristics(continued)

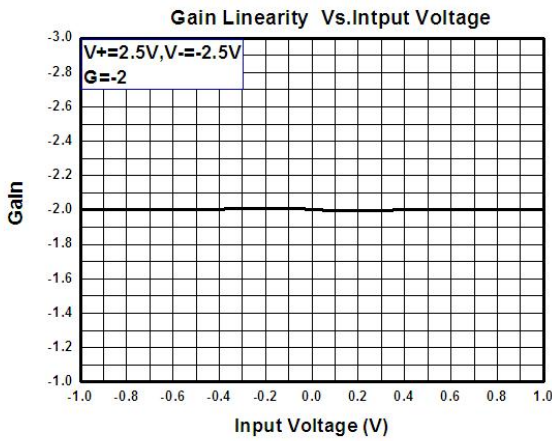
All typical value are at $V_+ = 2.5\text{ V}$, $V_- = -2.5\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise specified.



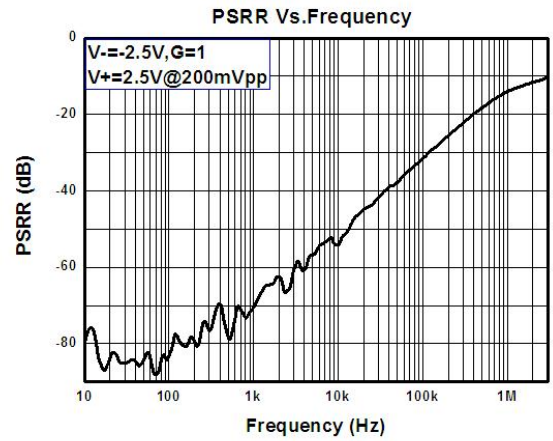
ISINK vs. Output voltage



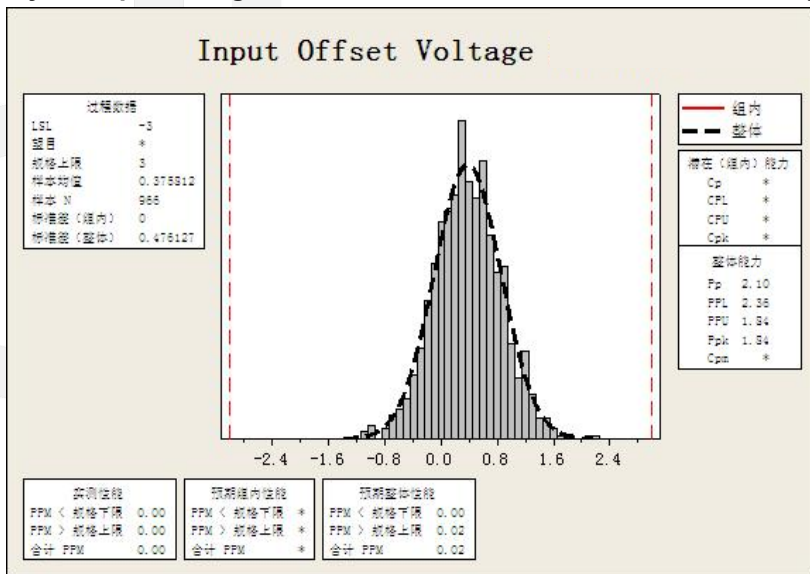
Gain vs. Frequency



Gain linearity vs. Input voltage



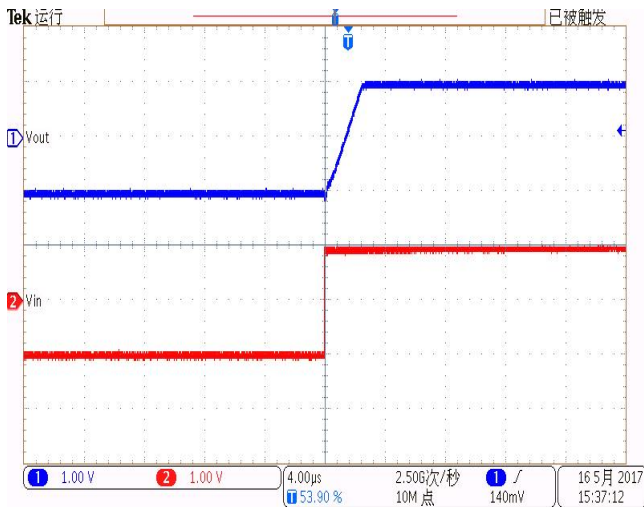
PSRR vs. Frequency



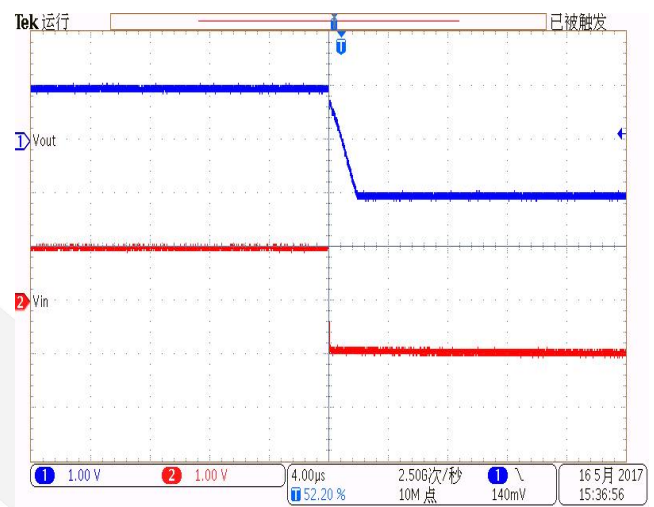
Input offset voltage statistics

Typical Performance Characteristics(continued)

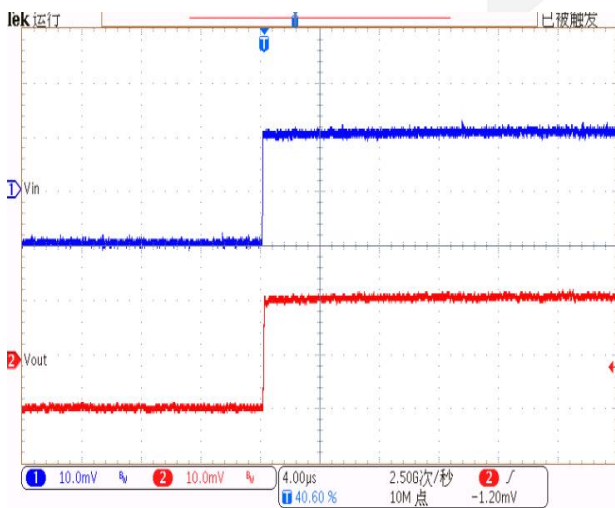
All typical value are at $V_+ = 2.5$ V, $V_- = -2.5$ V, $G = 1$, $R_L = 1$ M Ω , $T_A = 25^\circ$ C, unless otherwise specified.



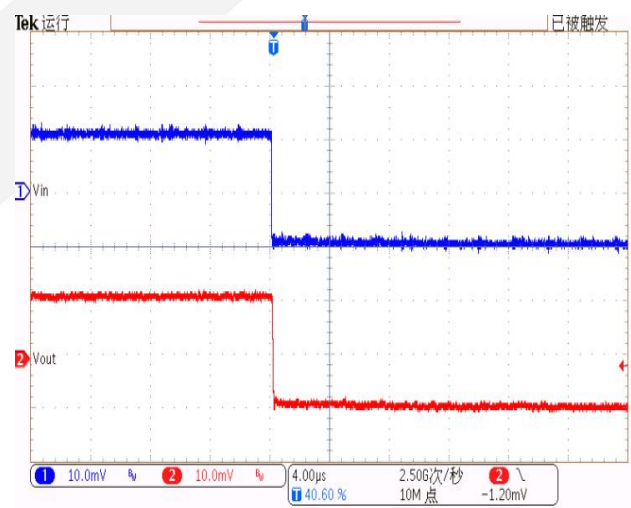
Slew rate (+)



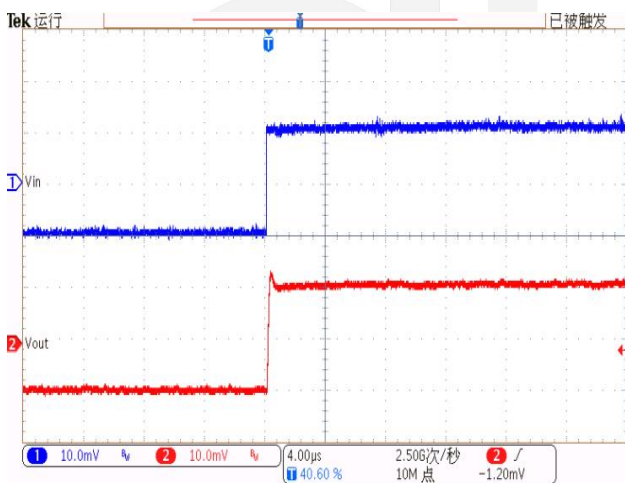
Slew rate (-)



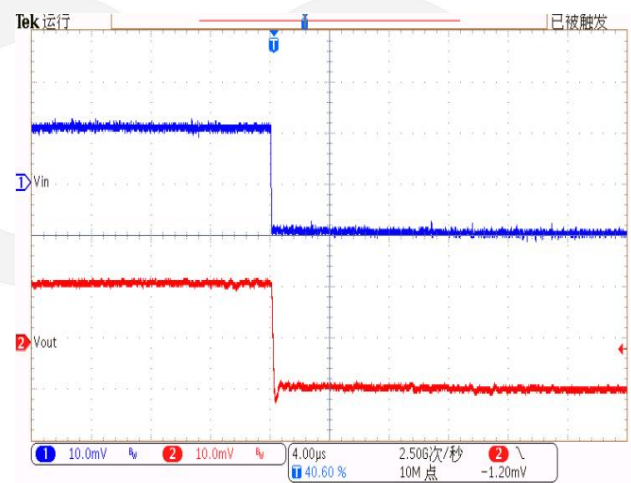
Small-signal response rise ($C_L = \text{No load}$)



Small-signal response fall ($C_L = \text{No load}$)

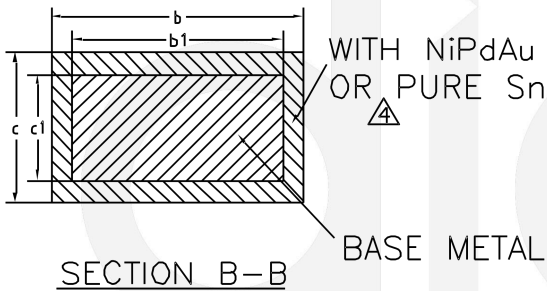
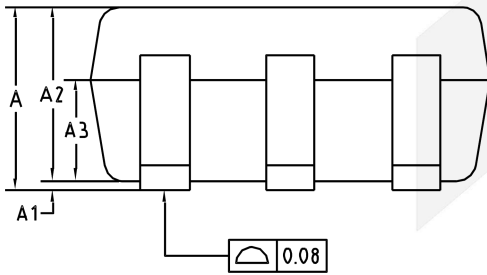
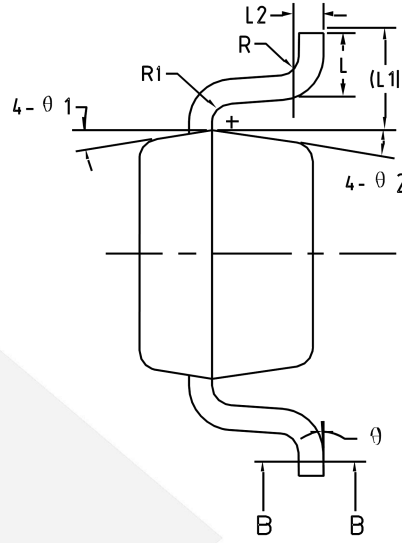
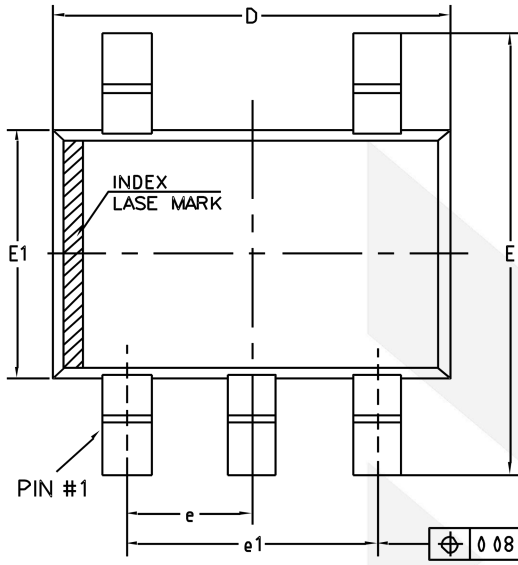


Small-signal response rise ($C_L = 200$ pF)



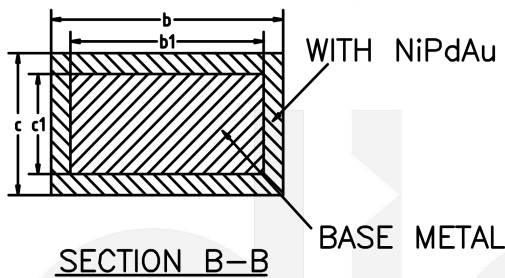
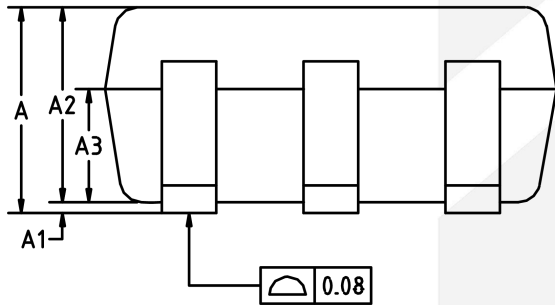
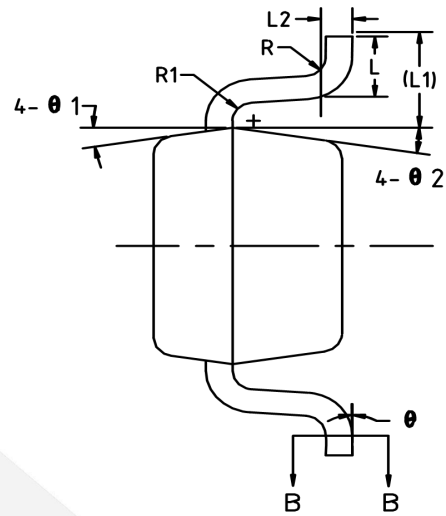
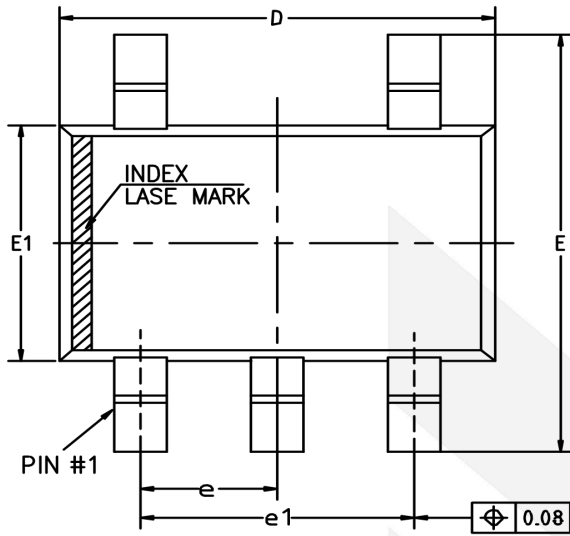
Small-signal response fall ($C_L = 200$ pF)

Physical Dimensions: SC70-5



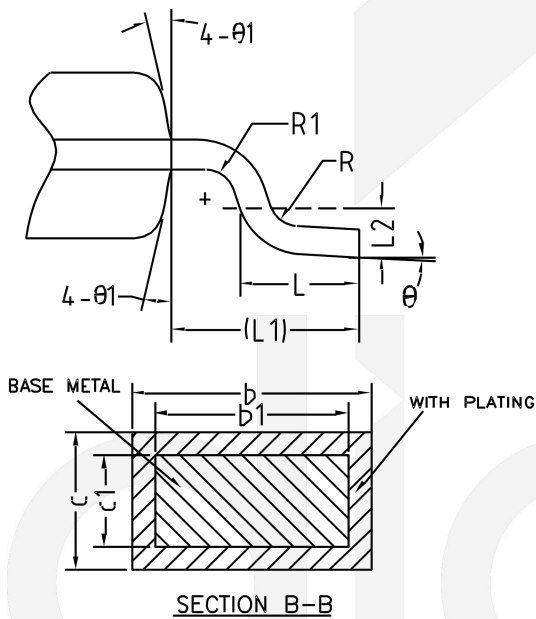
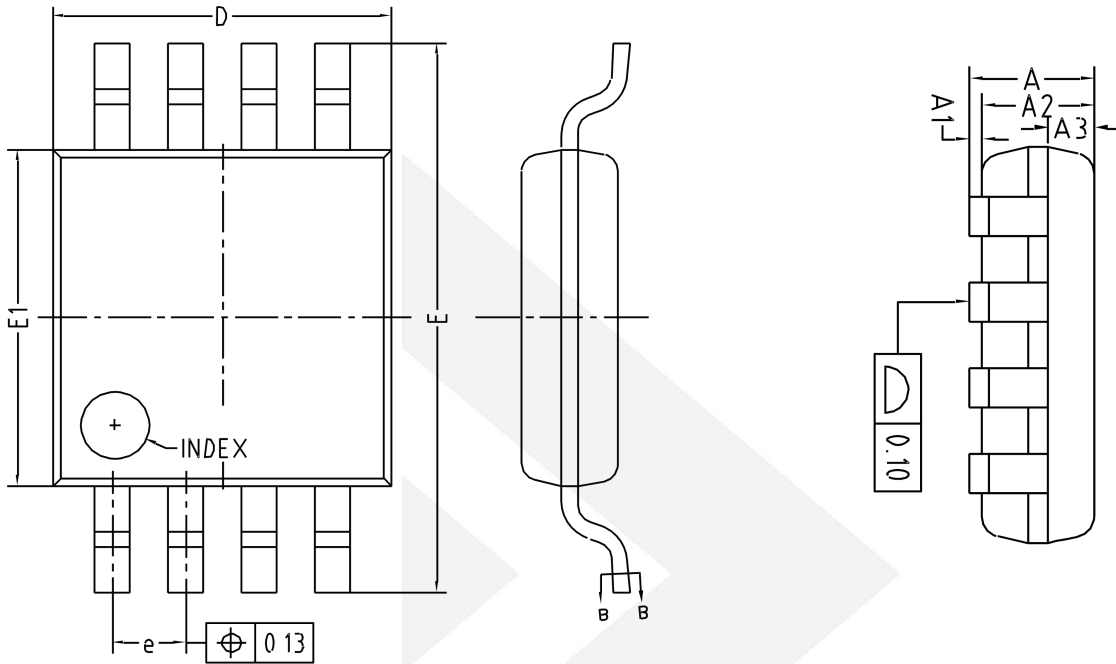
Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	0.85	-	1.05
A1	0	-	0.10
A2	0.80	0.90	1.00
A3	0.47	0.52	0.57
b	0.22	-	0.29
b1	0.22	0.25	0.28
c	0.115	-	0.15
c1	0.115	0.13	0.14
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.25	1.30	1.35
e	0.65BSC		
e1	1.30BSC		
L	0.28	0.33	0.38
L1	0.50REF		
L2	0.15BSC		
R	0.10	-	-
R1	0.10	-	0.25
θ	0°	-	8°
θ1	6°	9°	12°
θ2	6°	9°	12°

Physical Dimensions: SOT23-5



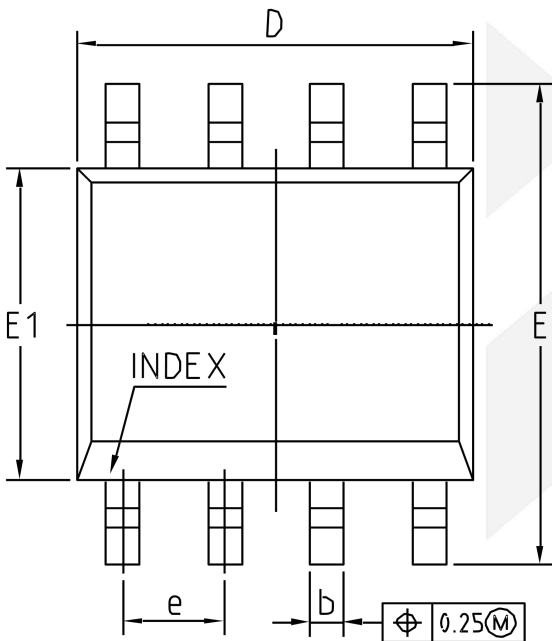
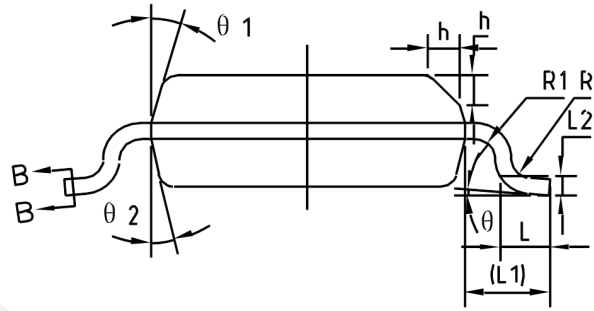
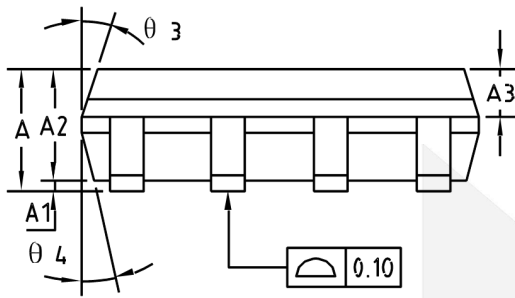
Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.50
b1	0.36	0.38	0.45
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
L1	0.59REF		
L2	0.25BSC		
R	0.10	-	-
R1	0.10	-	0.25
θ	0°	-	8°
θ 1	3°	5°	7°
θ 2	6°	-	14°

Physical Dimensions: MSOP-8

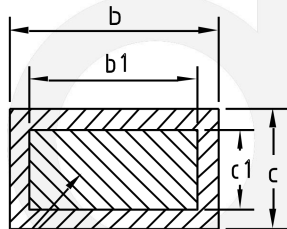


Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	-	-	1.10
A1	0	-	0.15
A2	0.75	0.85	0.95
A3	0.25	0.35	0.39
b	0.28	-	0.37
b1	0.27	0.30	0.33
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.55	0.65	0.75
L	0.45	0.60	0.80
L1	0.95REF		
L2	0.25BSC		
R	0.07	-	-
R1	0.07	-	-
θ	0°	-	8°
θ1	9°	12°	15°

Physical Dimensions: SOIC-8



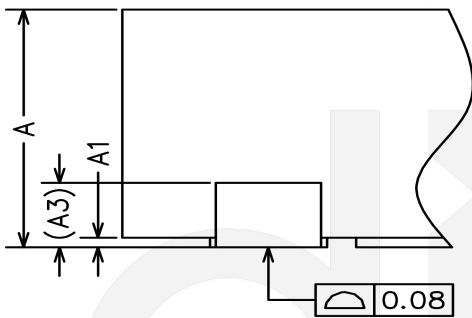
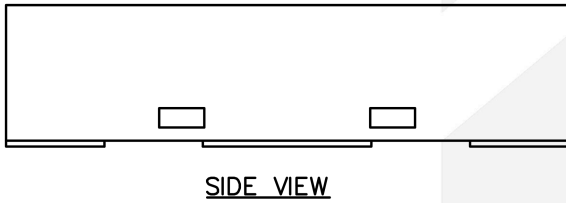
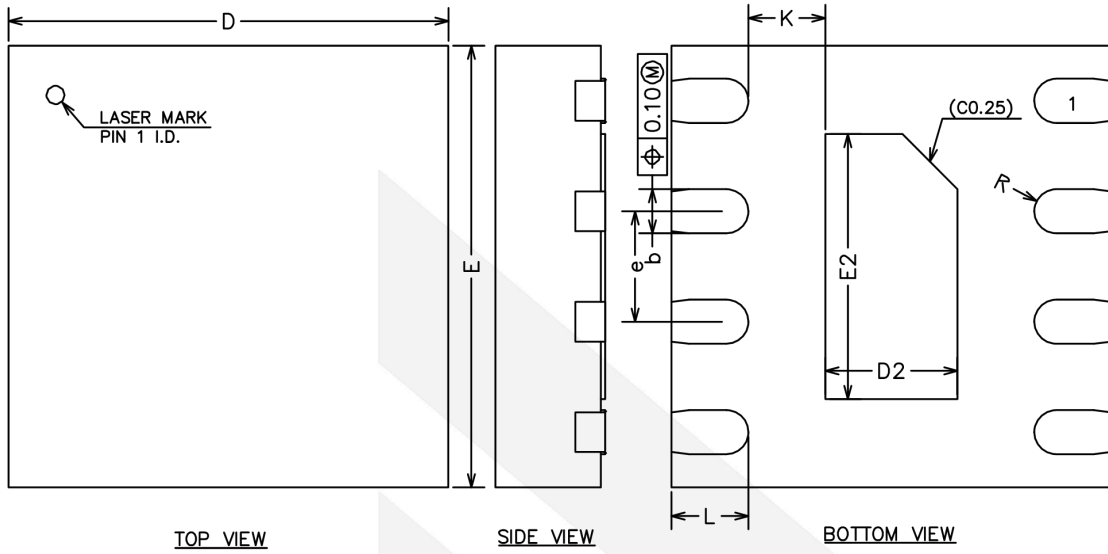
Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
θ	0°	-	8°
θ 1	15°	17°	19°
θ 2	11°	13°	15°
θ 3	15°	17°	19°
θ 4	11°	13°	15°



BASE METAL

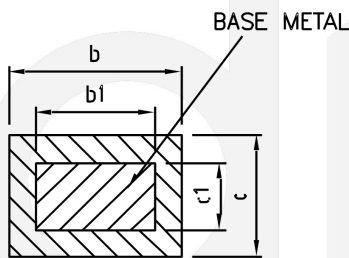
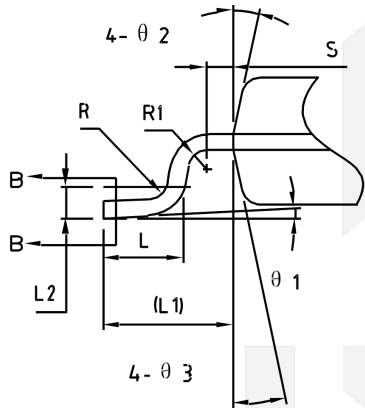
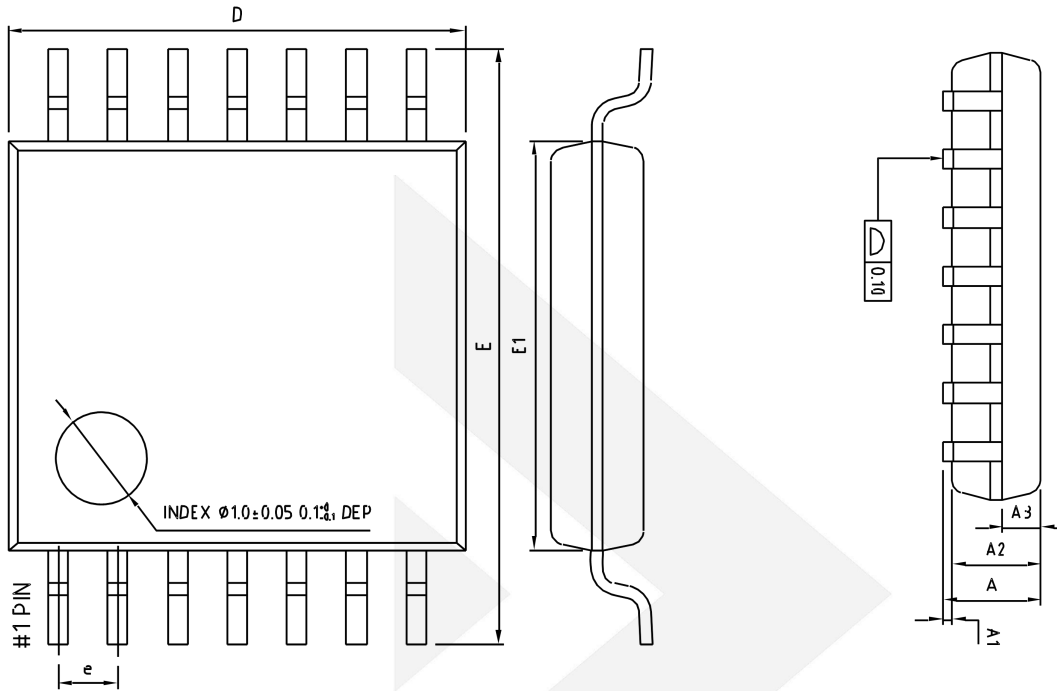
SECTION B-B

Physical Dimensions: DFN 2*2-8



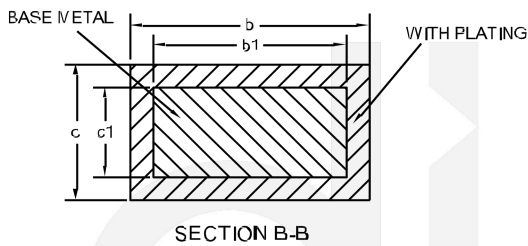
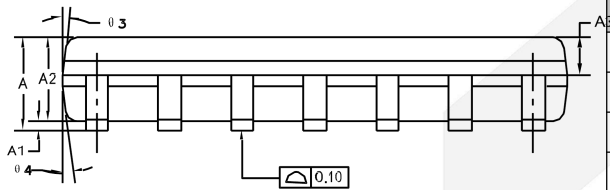
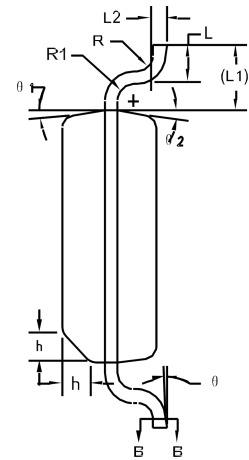
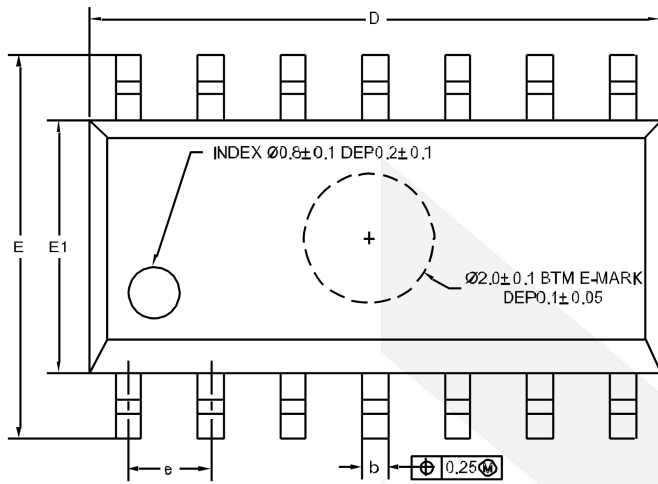
Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	0.70	0.75	0.80
A1	0	0.02	0.05
A3	0.20REF		
b	0.15	0.20	0.25
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.50	0.60	0.70
E2	1.10	1.20	1.30
e	0.40	0.50	0.60
K	0.20	-	-
L	0.30	0.35	0.40
R	0.09	-	-

Physical Dimensions: TSSOP-14



Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	-	0.28
b1	0.20	0.22	0.24
c	0.10	-	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00REF		
L2	0.25BSC		
R	0.09	-	-
R1	0.09	-	-
S	0.20	-	-
$\theta 1$	0°	-	8°
$\theta 2$	10°	12°	14°
$\theta 3$	10°	12°	14°

Physical Dimensions: SOIC-14



Common Dimensions (Units of measure = mm)			
Symbol	Min	Nom	Max
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36	-	0.49
b1	0.35	0.40	0.45
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 (BSC)		
L	0.45	0.60	0.80
L1	1.04 (RFE)		
L2	0.25 (BSC)		
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
θ	0°	-	8°
$\theta 1$	6°	8°	10°
$\theta 2$	6°	8°	10°
$\theta 3$	5°	7°	9°
$\theta 4$	5°	7°	9°

CONTACT US

Dioo is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as cell phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to <http://www.dioo.com> for a complete list of Dioo product families.

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