



大电流VCOM驱动运算放大器， 用于TFT LCD

MAX9650/MAX9651

概述

MAX9650/MAX9651为单通道和双通道VCOM放大器，带满摆幅输入和输出。MAX9650/MAX9651可向每路通道提供高达1300mA的峰值电流驱动，且可工作于高达20V电源。

MAX9650/MAX9651设计用于快速源出和吸收大电流，以便保持大TFT-LCD面板中的VCOM电压稳定。

MAX9650/MAX9651具有40V/ μ s摆率和35MHz带宽，可为120Hz帧速率和全HD电视快速设置输出。

MAX9650/MAX9651具有输出短路保护和热关断功能。这两款器件采用带裸焊盘的封装，具有极佳的散热效果。

应用

TFT-LCD面板
仪表控制电压源

特性

- ◆ 1300mA峰值输出电流
- ◆ 满摆幅输入和输出
- ◆ 工作于高达20V电源
- ◆ 40V/ μ s电压摆率
- ◆ 35MHz带宽
- ◆ 每通道5mA静态电流
- ◆ 极佳的散热性能(裸焊盘)

订购信息

PART	AMPS PER PACKAGE	PIN-PACKAGE	TOP MARK
MAX9650AZK+	1	5 SOT23	ADSI
MAX9650AZK/V+	1	5 SOT23	ADSK
MAX9650AUA+	1	8 μ MAX-EP*	AABI
MAX9650ATA+	1	8 TDFN-EP*	BKX
MAX9651AUA+	2	8 μ MAX-EP*	AABH
MAX9651ATA+	2	8 TDFN-EP*	BKY

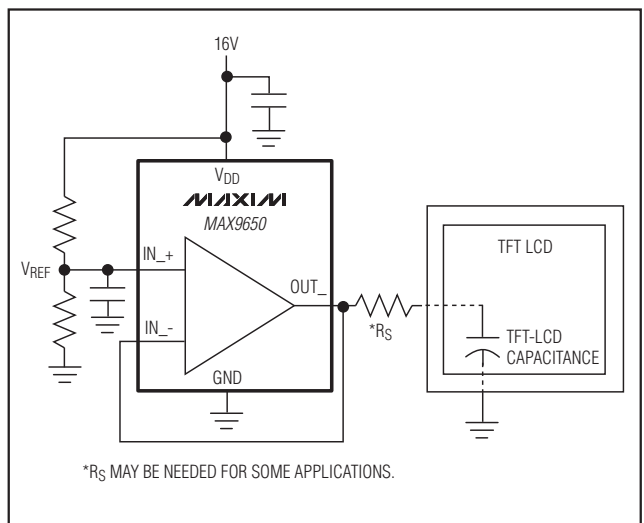
注：所有器件均工作在-40°C至+125°C温度范围内。

+表示无铅(Pb)/符合RoHS标准的封装。

/V表示通过汽车标准认证的器件。

*EP = 裸焊盘。

典型工作电路



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ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V _{DD} to GND)	-0.3V to +22V
Any Other Pin to GND	-0.3V to (V _{DD} + 0.3V)
IN ₊ /IN ₋ (current)	±20mA
OUT ₋ (current)	1.3A
Continuous Power Dissipation (T _A = +70°C)	
5-Pin SOT23 (derate 3.7mW/°C above +70°C)	297.4mW
8-Pin μ MAX-EP (derate 12.9mW/°C above +70°C)	1030.9mW
8-Pin TDFN-EP (derate 23.8mW/°C above +70°C)	1951.2mW

Operating Temperature Range	-40°C to +125°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Soldering Temperature (reflow)	+260°C

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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V_{DD} = 19V, V_{GND} = 0V, V_{CM} = V_{OUT} = V_{DD}/2, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage Range	V _{DD}	Guaranteed by PSRR	6		20	V
Quiescent Current	I _{DD}	Per channel		3.7	8	mA
High Output Voltage	V _{OH}	I _H = +5mA, V _{IN} = V _{DD}	V _{DD} - 0.30	V _{DD} - 0.05		V
Low Output Voltage	V _{OL}	I _L = -5mA, V _{IN} = 0V		0.05	0.30	V
Input Offset Voltage	V _{OS}	T _A = +25°C	-14	3.5	+14	mV
		T _A = -40°C to +125°C	-17		+17	
Load Regulation	LR	I _{OUT} = 0 to -80mA		+0.2		mV/mA
		I _{OUT} = 0 to +80mA		-0.2		
Input Bias Current	I _{FB}	At V _{IN} = 9.5V		0.01	1	μ A
Voltage Gain	A _V	R _L = 10k Ω , C _L = 50pF	0.99		1.01	V/V
Power-Supply Rejection Ratio	PSRR	V _{DD} = 6V to 20V, V _{CM} = V _{OUT} = 3V	70	95		dB
Common-Mode Input Voltage Range	CMVR	Inferred from CMRR test	0.5		V _{DD} - 0.5	V
Common-Mode Rejection Ratio	CMRR	0.5V \leq V _{CM} \leq V _{DD} - 0.5V	60	80		dB
Continuous Output Current	I _O	V _{OUT} = 9.5V (Note 2)	MAX9650AZK+	20		mA
			MAX9650AUA+	80		
		V _{DD} = 15V, V _{OUT} = 7.5V	MAX9650ATA+		\pm 350	
Transient Peak Output Current	I _{PK}	(Note 3)		\pm 1.3		A
Bandwidth	BW	-3dB		35		MHz
Slew Rate	SR	4V step, C _L = 50pF, R _L = 10k Ω , A _V = +1V/V		40		V/ μ s
Settling Time	t _S	Settling to 0.1% of V _{OUT} , I _L = 0 to 1000mA, R _S = 2.2 Ω , C _S = 0.1 μ F (Figure 1)		2.0		μ s

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ELECTRICAL CHARACTERISTICS (continued)

($V_{DD} = 19V$, $V_{GND} = 0V$, $V_{CM} = V_{OUT} = V_{DD}/2$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A = +25^\circ C$.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Maximum Load Capacitance	C_{LOAD}	(Note 4)		150		nF
Noninverting Input Resistance	R_{IN+}	(Note 5)		100		$M\Omega$
Inverting Input Resistance	R_{IN-}	(Note 5)		100		$M\Omega$
Input Capacitance	C_{IN}			3		pF
Thermal Shutdown				+170		$^\circ C$
Thermal Shutdown Hysteresis				15		$^\circ C$

Note 1: All devices are 100% production tested at $T_A = +25^\circ C$. All temperature limits are guaranteed by design.

Note 2: Continuous output current is tested with one output at a time.

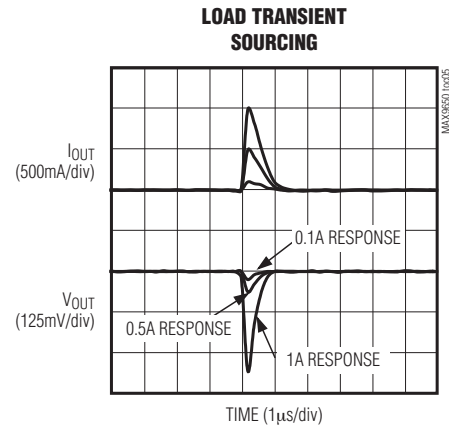
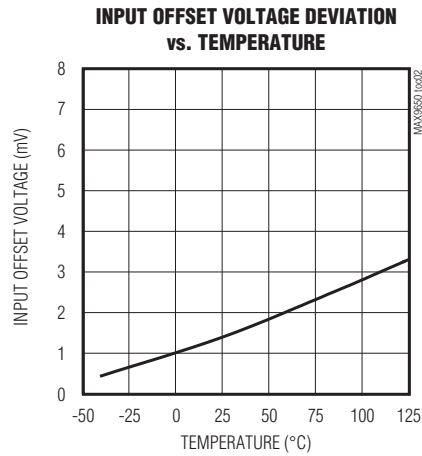
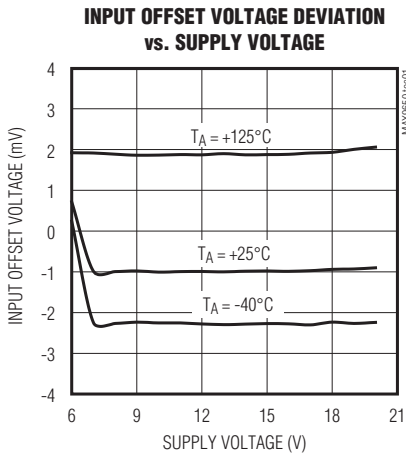
Note 3: See the *Thermal Shutdown with Temperature Hysteresis* section.

Note 4: A series resistor can extend load capacitance range. The settling time can be optimized by a small series resistance. See the *Applications Information* section for more information.

Note 5: Inputs are protected by back-to-back diodes.

典型工作特性

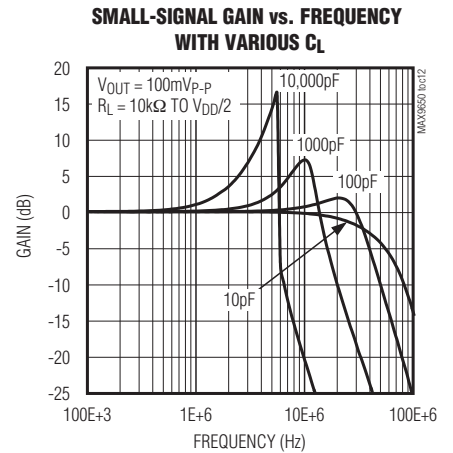
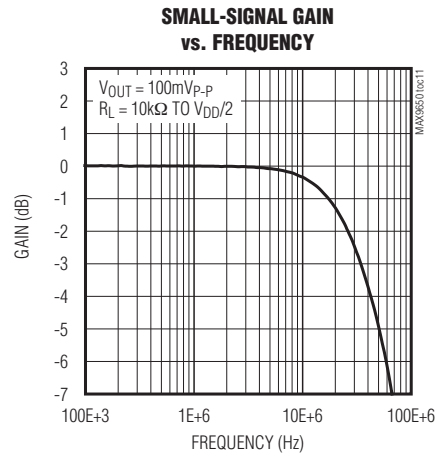
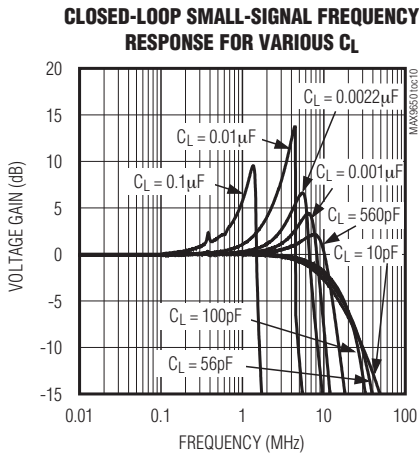
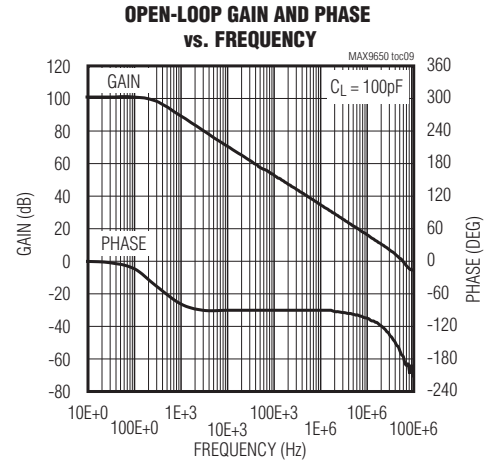
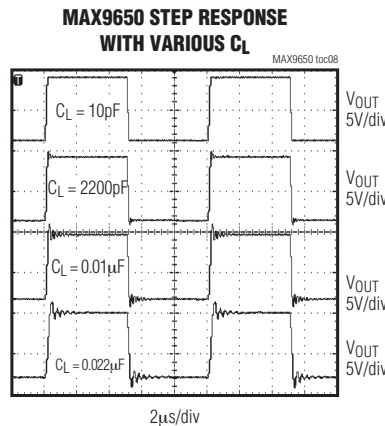
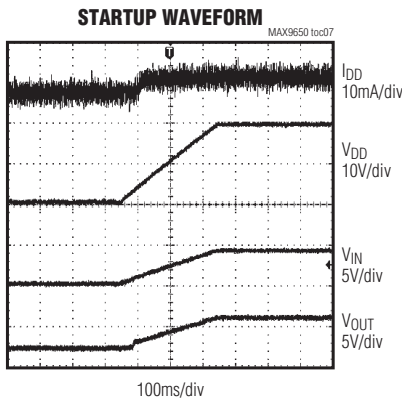
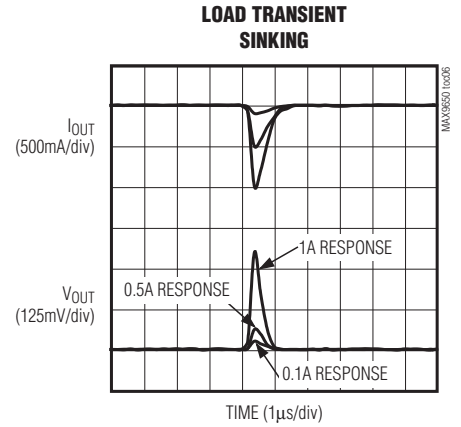
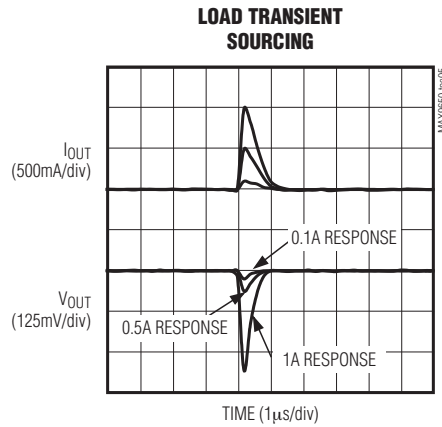
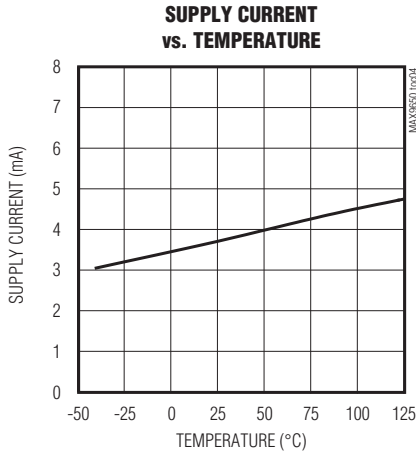
($V_{DD} = 19V$, $GND = 0$, $V_{CM} = V_{OUT} = V_{DD}/2$, $T_A = +25^\circ C$, unless otherwise specified.)



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典型工作特性(续)

($V_{DD} = 19V$, $GND = 0$, $V_{CM} = V_{OUT} = V_{DD}/2$, $T_A = +25^\circ C$, unless otherwise specified.)



大电流VCOM驱动运算放大器， 用于TFT LCD

引脚说明

MAX9650/MAX9651

引脚			名称	功能
MAX9650		MAX9651		
SOT23	μMAX-EP, TDFN-EP	(μMAX-EP, TDFN-EP)		
1	6	1	OUTA	VCOM输出端A。
2	4	4	GND	地。
3	3	3	INA+	同相输入端A。
4	2	2	INA-	反相输入端A。
5	7	8	VDD	电源输入正端。采用一个0.1μF陶瓷电容将V _{DD} 旁路至GND，并尽可能靠近器件放置。
—	—	5	INB+	同相输入端B。
—	—	6	INB-	反相输入端B。
—	—	7	OUTB	VCOM输出端B。
—	1, 5, 8	—	N.C.	无连接。无内部连接。
—	—	—	EP	裸焊盘(μMAX和TDFN封装)。EP内部连接至GND，连接EP至GND。

详细说明

MAX9650/MAX9651为带满摆幅输入和输出的运算放大器，可保持VCOM电压稳定，同时可向容性负载(如TFT-LCD面板的背板)提供快速源出和吸收大电流(1.3A)。

带温度滞回的热关断

MAX9650/MAX9651可提供大输出电流并具有热关断保护功能，带温度滞回。当结温达到+170°C时，器件关断。当结温冷却下降15°C后，器件再次开启。在TFT-LCD应用中，占空比极低。即便是在高电压和大电流情况下，功耗也极低且器件不会关断。

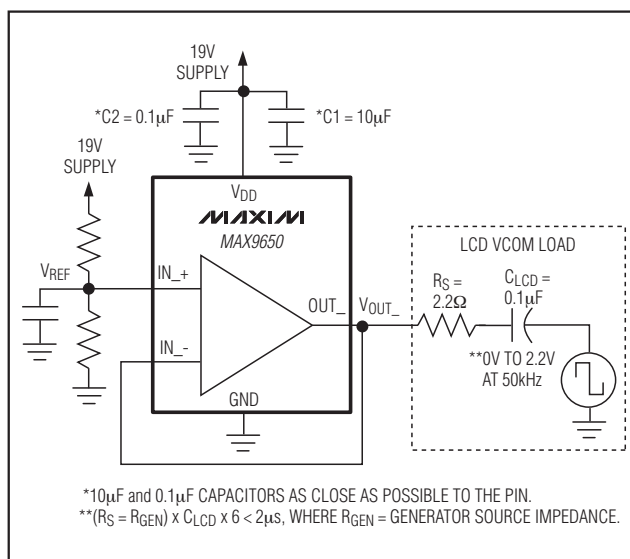


图1. 建立时间测试电路

大电流VCOM驱动运算放大器， 用于TFT LCD

应用信息

输出负载

MAX9650/MAX9651设计用于驱动容性负载。小的串联阻抗提高了器件性能，可在驱动极大或极小容性负载时确保稳定性和快速建立时间。多数情况下，由于线缆具有连接阻抗，所以该阻抗已经存在，无需连接额外的电阻元件。驱动容性负载时，确保稳定所需的最小串联电阻值请参见图2。

电源和旁路电容

MAX9650/MAX9651工作于6V至20V单电源或 $\pm 4.5\text{V}$ 至 $\pm 10\text{V}$ 双电源。适当的电源旁路可在驱动大瞬变负载时确保稳

定性。MAX9650/MAX9651需要一个最小值为 $10\mu\text{F}$ (C1) 和一个 $0.1\mu\text{F}$ (C2)电源旁路电容，并尽可能靠近电源引脚(V_{DD})放置。参见图3。双电源供电时，在两路电源输入端(V_{DD} 和GND)均使用 $10\mu\text{F}$ 和 $0.1\mu\text{F}$ 旁路电容，每个电容尽可能靠近 V_{DD} 和GND放置。

布局和接地

$\mu\text{MAX}^{\circledR}$ 和TDFN封装上的裸焊盘提供低热阻，用于散热。将裸焊盘连接至地层，可实现最佳散热特性。不要在封装下面布线。双电源工作时，裸焊盘(EP)可电气连接至负电源或者将其悬空。

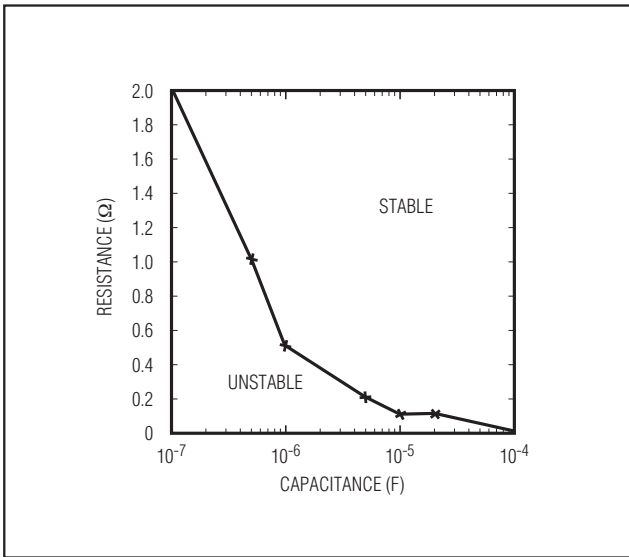


图2. MAX9650驱动容性负载时，为确保稳定所需的最小ESR/串联/引线电阻值

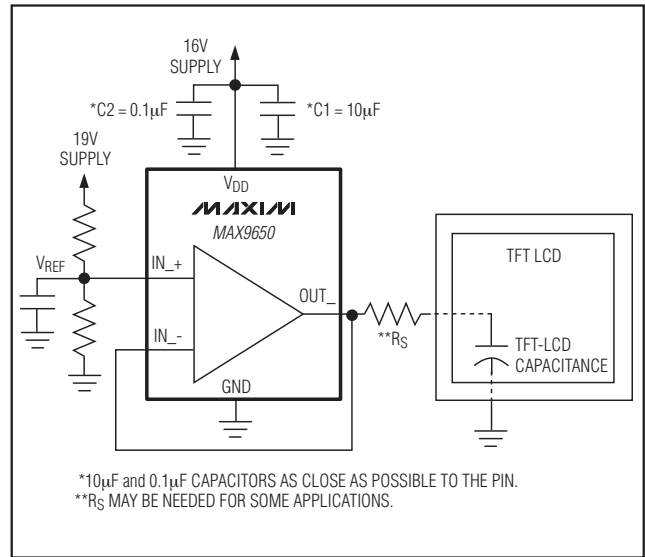


图3. 典型的TFT-LCD背板驱动电路

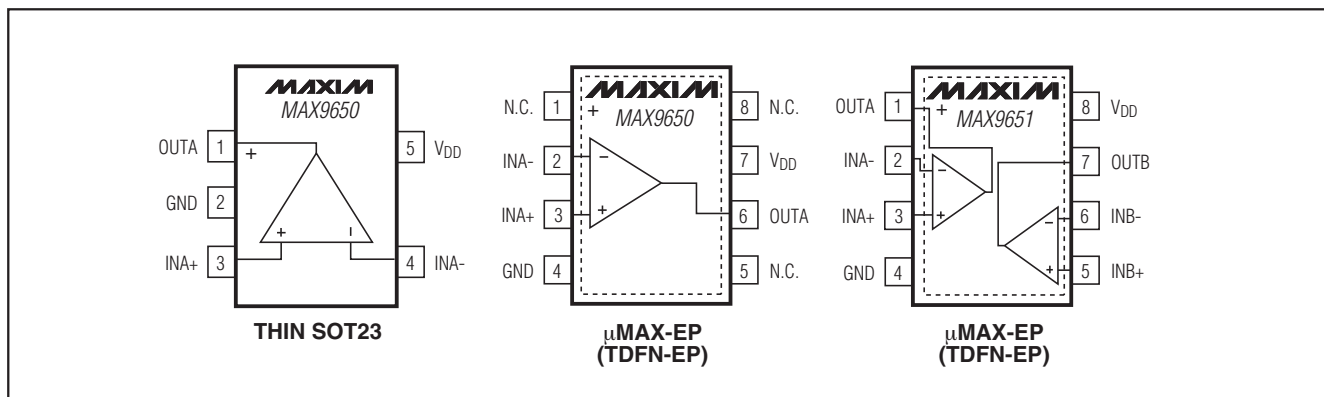
芯片信息

PROCESS: BiCMOS

μMAX 是Maxim Integrated Products, Inc.的注册商标。

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引脚配置



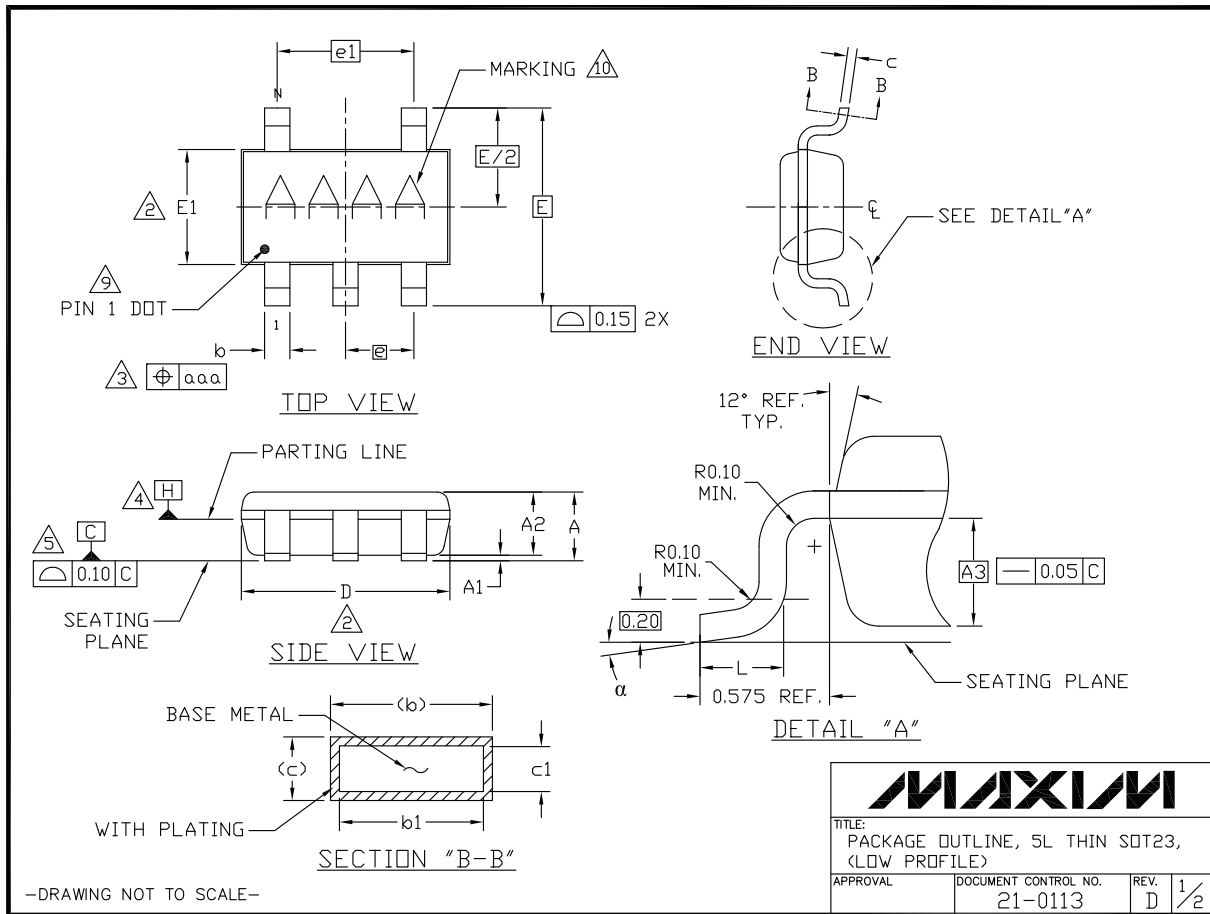
MAX9650/MAX9651

大电流 VCOM 驱动运算放大器， 用于 TFT LCD

封装信息

如需最近的封装外形信息和焊盘布局，请查询 china.maxim-ic.com/packages。请注意，封装编码中的“+”、“#”或“-”仅表示RoHS状态。封装图中可能包含不同的尾缀字符，但封装图只与封装有关，与RoHS状态无关。

封装类型	封装编码	外形编号	焊盘布局编号
5 SOT23	Z5+2	21-0113	90-0241
8 μ MAX	U8E+2	21-0107	90-0145
8 TDFN-EP	T833+2	21-0137	90-0058



-DRAWING NOT TO SCALE-

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封装信息(续)

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MAX9650/MAX9651

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- ② 'D' AND 'E1' ARE REFERENCE DATUM AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS, AND ARE MEASURED AT THE BOTTOM PARTING LINE. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED 0.15mm ON 'D' AND 0.25mm ON 'E' PER SIDE.
- ③ THE LEAD WIDTH DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.07mm TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION.
- ④ DATUM PLANE \overline{EH} LOCATED AT MOLD PARTING LINE AND COINCIDENT WITH LEAD, WHERE LEAD EXITS PLASTIC BODY AT THE BOTTOM OF PARTING LINE.
- ⑤ THE LEAD TIPS MUST LINE WITHIN A SPECIFIED TOLERANCE ZONE. THIS TOLERANCE ZONE IS DEFINED BY TWO PARALLEL LINES. ONE PLANE IS THE SEATING PLANE, DATUM \overline{EC} AND THE OTHER PLANE IS AT THE SPECIFIED DISTANCE FROM \overline{EC} IN THE DIRECTION INDICATED. FORMED LEADS SHALL BE PLANAR WITH RESPECT TO ONE ANOTHER WITH 0.10mm AT SEATING PLANE.
6. THIS PART IS COMPLIANT WITH JEDEC SPECIFICATION MO-193 EXCEPT FOR THE 'e' DIMENSION WHICH IS 0.95mm INSTEAD OF 1.00mm. THIS PART IS IN FULL COMPLIANCE TO EIAJ SPECIFICATION SC-74.
7. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.08mm.
8. WARPAGE SHALL NOT EXCEED 0.10mm.
- ⑨ THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JEDEC 95-1 PP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
- ⑩ MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
11. MATERIAL MUST COMPLY WITH BANNED AND RESTRICTED SUBSTANCES SPEC # 10-0131.
12. ALL DIMENSIONS APPLY TO BOTH LEADED (-) AND LEAD FREE (+) PACKAGE CODES.

DIMENSIONS			
	MIN	NOM	MAX
A	-	-	1.10
A1	0.00	0.075	0.10
A2	0.85	0.88	0.90
A3	0.50 BSC		
b	0.30	-	0.45
b1	0.25	0.35	0.40
c	0.15	-	0.20
c1	0.12	0.127	0.15
D	2.80	2.90	3.00
E	2.75 BSC		
E1	1.55	1.60	1.65
L	0.30	0.40	0.50
e1	1.90 BSC		
e	0.95 BSC		
α	0°	4°	8°
aaa	0.20		
PKG CODE	Z5-1, Z5-2, Z5-3		

-DRAWING NOT TO SCALE-

MAXIM

TITLE:
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(LOW PROFILE)

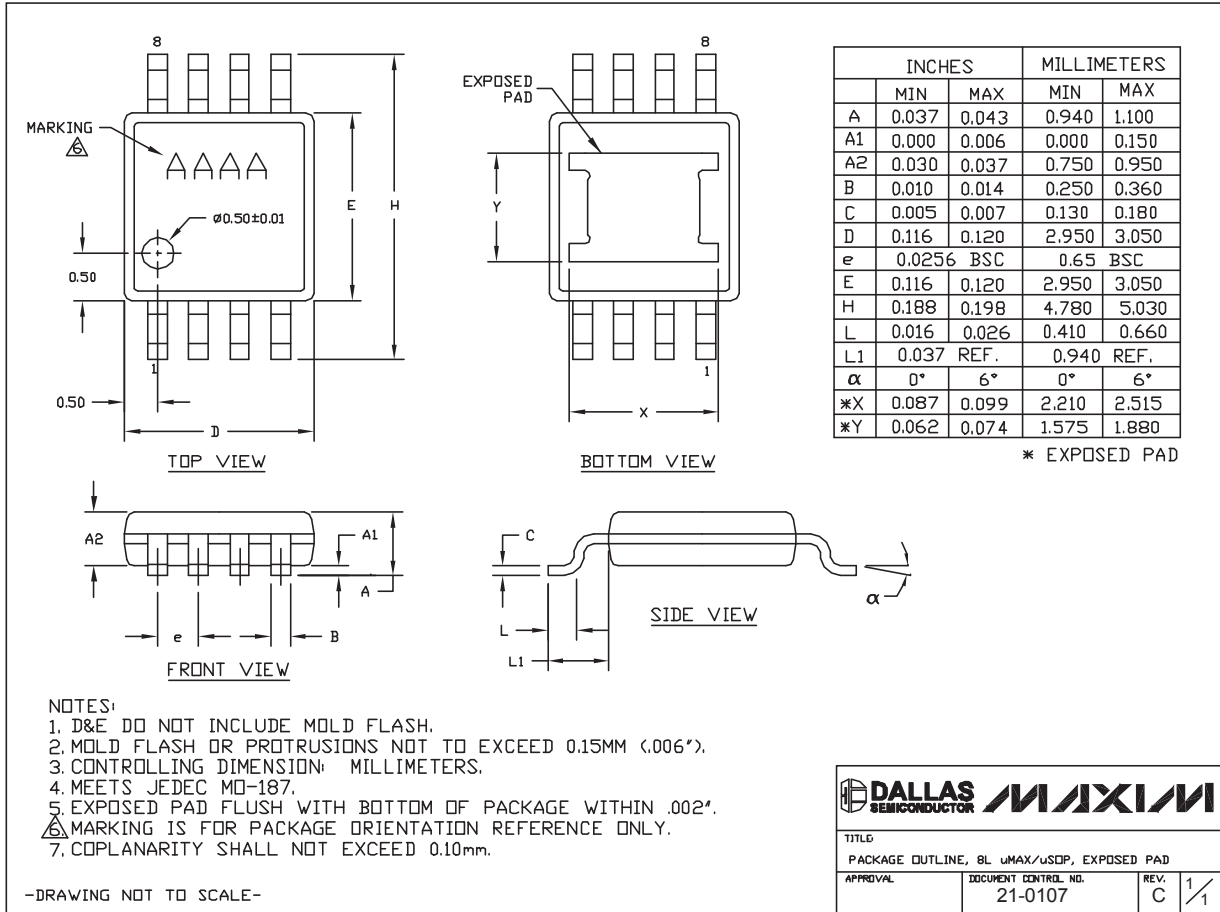
APPROVAL	DOCUMENT CONTROL NO. 21-0113	REV. D	2/2
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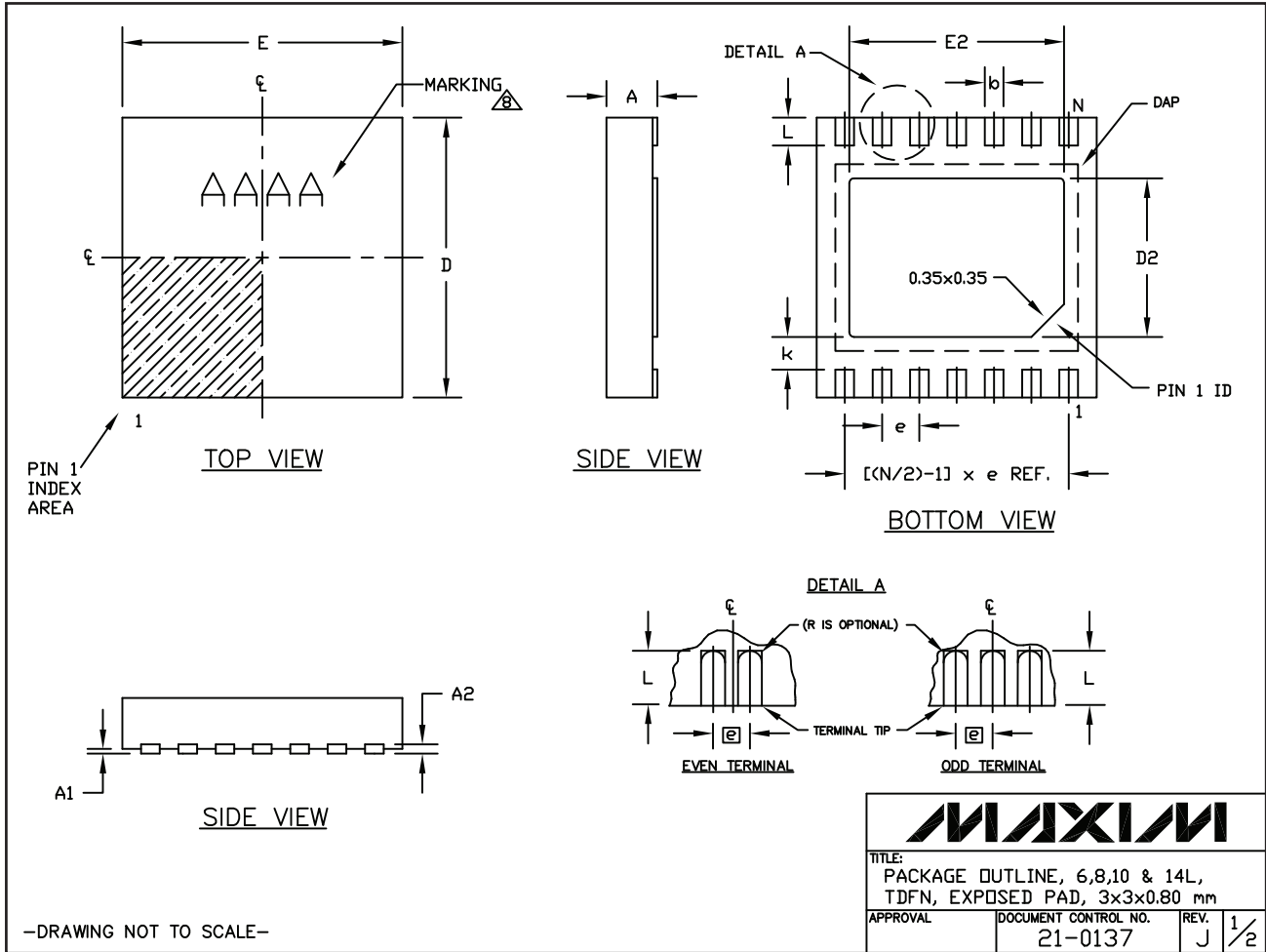


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COMMON DIMENSIONS		
SYMBOL	MIN.	MAX.
A	0.70	0.80
D	2.90	3.10
E	2.90	3.10
A1	0.00	0.05
L	0.20	0.40
k	0.25 MIN.	
A2	0.20 REF.	

PACKAGE VARIATIONS								
PKG. CODE	N	D2	E2	e	JEDEC SPEC	b	[(N/2)-1] x e	
T633-2	6	1.50±0.10	2.30±0.10	0.95 BSC	MO229 / WEEA	0.40±0.05	1.90 REF	
T833-2	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	
T833-3	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	
T1033-1	10	1.50±0.10	2.30±0.10	0.50 BSC	MO229 / WEED-3	0.25±0.05	2.00 REF	
T1033MK-1	10	1.50±0.10	2.30±0.10	0.50 BSC	MO229 / WEED-3	0.25±0.05	2.00 REF	
T1033-2	10	1.50±0.10	2.30±0.10	0.50 BSC	MO229 / WEED-3	0.25±0.05	2.00 REF	
T1433-1	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	
T1433-2	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	
T1433-3F	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	

NOTES:

- ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
- COPLANARITY SHALL NOT EXCEED 0.08 mm.
- WARPAGE SHALL NOT EXCEED 0.10 mm.
- PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).
- DRAWING CONFORMS TO JEDEC MO229, EXCEPT DIMENSIONS "D2" AND "E2", AND T1433-1 & T1433-2.
- "N" IS THE TOTAL NUMBER OF LEADS.
- NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
-  MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
- ALL DIMENSIONS APPLY TO BOTH LEADED (-) AND PbFREE (+) PKG. CODES.

-DRAWING NOT TO SCALE-

		
TITLE: PACKAGE OUTLINE, 6,8,10 & 14L, TDFN, EXPOSED PAD, 3x3x0.80 mm		
APPROVAL	DOCUMENT CONTROL NO. 21-0137	REV. J 2/2

大电流VCOM驱动运算放大器， 用于TFT LCD

修订历史

修订号	修订日期	说明	修改页
0	7/08	首次发布。	—
1	10/08	更新摆率并增加了TDFN-EP封装。	1, 2, 6, 10, 11
2	5/09	更新了连续输出电流指标。	2
3	2/10	在订购信息中增加了汽车应用的器件，修正了输入失调电压的单位，增加了最小串联电阻相关的图。	1, 2, 5, 6
4	7/10	删除了 <i>Electrical Characteristics</i> 表中无关的信息，更正了典型工作特性部分图5中的小错误。	2, 4

MAX9650/MAX9651

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