



概述

M3157 是一款基于 CMOS 工艺的模拟开关。具有低功耗、低传输延迟和低输出阻抗的良好特性。模拟信号和数字信号的电压输出范围可从 V_{CC} 至 GND。Select 输入端有过压保护，允许输入电压高过 V_{CC} ，最高可达 7V 而管脚不会被烧毁。

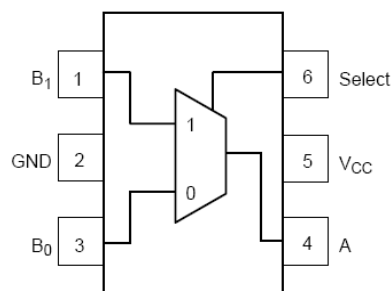
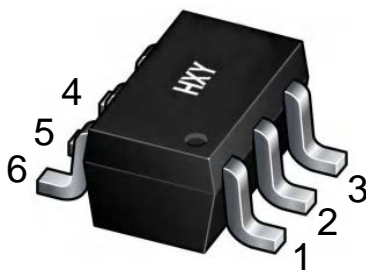
功能特点

- 低功耗
- 高传输速度
- 标准 CMOS 的逻辑电平翻转
- 高带宽，线性度高
- 可用于 NTSC/PAL 视频，音频，SPDIF 和 HDTV 的开关
- 可用于时钟开关和数据选择开关
- 低输出阻抗
- 先断后开保护,防止短路
- 工作温度 $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$
- 封装形式 SO-70-6(SOT-363)

应用场景

- 移动电话
- 便携式设备
- 电池供电
- 计算机外围设备
- 模拟集成电路设计
- 音频和视频信号路由

管脚排列图



SC-70-6(SOT-363)

管脚说明

管脚	I/O	功能
A, B ₀ , B ₁	I/O	数据端口
Select	I	控制选择
V _{CC}	—	电源端
GND	—	地



极限参数

参数	符号	范围	单位
电源电压	V_{CC}	-0.5~+7.0	V
开关电压 (注释 1)	V_S	-0.5~ $V_{CC}+0.5$	V
输入电压 (注释 1)	V_{IN}	-0.5~+7.0	V
输入钳位二极管电流@ $V_{IN}<0V$	I_{IK}	-50	mA
输出电流	I_{out}	128	mA
电源到地电流	I_{CC}/I_{GND}	100	mA
存储温度范围	T_{stg}	-65~+150	°C
最高结点温度	T_J	150	°C
导线温度 (焊接, 10 秒内)	T_L	260	°C
总功耗(85°C)	P_D	180	mW

超过 DC 极限参数的最大值可能造成电路的不可修复的损坏。如无特殊情况，确保整个工作系统下的电源电压，工作温度，输入/输出的负载特性在上述范围内。

注释 1：输入/输出的负电压可根据输入/输出的钳位二极管电流范围有所超出。

工作环境(注释 2)

参数	符号	最小	最大	单位
电源电压	V_{CC}	1.65	5.5	V
Select 端输入电压	V_{IN}	0	V_{CC}	V
开关端输入电压	V_{IN}	0	V_{CC}	V
输出电压	V_{OUT}	0	V_{CC}	V
工作温度	T_A	-55	+125	°C
输入上升和下降时间	t_r, t_f			ns/V
输入电压 $V_{CC}=2.3V-3.6V$		0	10	
输入电压 $V_{CC}=4.5V-5.5V$		0	5.0	

注释 2：Select 端输入电压必须设为高电平或低电平，不能悬空。

热阻数据

参数	符号	数值	单位
热阻	θ_{JA}	270	°C/W

功能说明

Select 输入端	功能
L	B_0 连接到 A
H	B_1 连接到 A



电参数

参数	标识	测试条件	V _{CC}	T _A =25℃			T _A =-40℃~+85℃		单位
				最小	标准	最大	最小	最大	
DC 特性									
V _{IH}	高电平输入		1.65-1.95				0.75V _{CC}		V
			2.3-2.8				1.5		
			3-4.2				2.4		
			4.5-5.5				0.6 V _{CC}		
V _{IL}	低电平输入		1.65-1.95				0.25V _{CC}		V
			2.3-2.8				0.4		
			3-5.5				0.3 V _{CC}		
I _{IN}	输入漏电流	0 < V _{IN} < 5.5V	0-5.5		±0.05	±0.1		±1	uA
I _{OFF}	关闭状态漏电流	0 < A, B < V _{CC}	1.65-5.5		±0.05	±0.1		±1	uA
I _{CC}	静态电流	V _{IN} =V _{CC} or GND I _{OUT} =0	5.5			1.0		10	uA
	模拟电平输入范围		V _{CC}	0		V _{CC}	0	V _{CC}	V
R _{ON}	开关导通电阻 (注释3)	V _{IN} =0V, I _O =30mA	4.5		3.0			7.0	Ω
		V _{IN} =2.4V, I _O =-30mA			5.0			12	Ω
		V _{IN} =4.5V, I _O =-30mA			7.0			15	Ω
		V _{IN} =0V, I _O =24mA	3.0		4.0			9.0	Ω
		V _{IN} =3V, I _O =-24mA			10			20	Ω
		V _{IN} =0V, I _O =8mA	2.3		5.0			12	Ω
		V _{IN} =2.3V, I _O =-8mA			13			30	Ω
		V _{IN} =0V, I _O =4mA	1.65		6.5			20	Ω
V _{IN} =1.65V, I _O =-4mA		17				50	Ω		
R _{RANGE}	全信号范围导通电阻 (注释3)(注释7)	I _A =-30mA 0 ≤ V _{Bn} ≤ V _{CC}	4.5					25	Ω
		I _A =-24mA 0 ≤ V _{Bn} ≤ V _{CC}	3					50	Ω
		I _A =-8mA 0 ≤ V _{Bn} ≤ V _{CC}	2.3					100	Ω
		I _A =-4mA 0 ≤ V _{Bn} ≤ V _{CC}	1.65					300	Ω



ΔR_{ON}	通道间导通电阻匹配(注释3)(注释4)(注释5)	$I_A=-30mA$ $V_{Bn}=3.15$	4.5	0.15				Ω
		$I_A=-24mA$ $V_{Bn}=2.1$	3	0.2				Ω
		$I_A=-8mA$ $V_{Bn}=1.6$	2.3	0.5				Ω
		$I_A=-4mA$ $V_{Bn}=1.15$	1.65	0.5				Ω
R_{FLAT}	导通电阻平坦度(注释3)(注释4)(注释6)	$I_A=-30mA$ $0 \leq V_{Bn} \leq V_{CC}$	5	6.0				Ω
		$I_A=-24mA$ $0 \leq V_{Bn} \leq V_{CC}$	3.3	12				Ω
		$I_A=-8mA$ $0 \leq V_{Bn} \leq V_{CC}$	2.5	28				Ω
		$I_A=-4mA$ $0 \leq V_{Bn} \leq V_{CC}$	1.8	125				Ω
AC 特性								
t_{PHL} t_{PLH}	传输延迟(注释8)	图1 $V_I=OPEN$	1.65-1.95					nS
			2.3-2.7				1.2	nS
			3.0-3.5				0.8	nS
			4.5-5.5				0.3	nS
t_{PZL} t_{PZH}	打开时间(A到Bn)	图1 $V_I=2*V_{CC}$ for t_{PZL} , $V_I=0V$ for t_{PZH}	1.65-1.95		23	7.0	24	nS
			2.3-2.7		13	3.5	14	nS
			3.0-3.5		6.9	2.5	7.6	nS
			4.5-5.5		5.2	1.7	5.7	nS
t_{PLZ} t_{PHZ}	关闭时间(A端口到B端口)	图1 $V_I=2*V_{CC}$ for t_{PLZ} , $V_I=0V$ for t_{PHZ}	1.65-1.95		12.5	3.0	13	nS
			2.3-2.7		7.0	2.0	7.5	nS
			3.0-3.5		5.0	1.5	5.3	nS
			4.5-5.5		3.5	0.8	3.8	nS
t_{B-M}	先断后通时间(注释7)	图2, $C_L=50pF$, $R_L=600\Omega$	1.65-1.95			0.5		nS
			2.3-2.7			0.5		nS
			3.0-3.5			0.5		nS
			4.5-5.5			0.5		nS
Q	电荷注入(注释7)	图3, $C_L=0.1nF$, $V_{GEN}=0V$, $R_{GEN}=0\Omega$	5.0	7.0				pC
			3.3	3.0				pC
OIRR	关闭隔离(注释9)	图4, $R_L=50\Omega$, $f=10MHz$	1.65-5.5	-57				dB
Xtalk	串扰	图5, $R_L=50\Omega$, $f=$	1.65-5.5	-54				dB



		10MHz						
BW	-3dB 带宽	图 8, $R_L=50\Omega$	1.65-5.5		350M			Hz
THD	总谐波失真 (注释 7)	$R_L=600\Omega$, $0.5V_{P-P}$ $f=600\text{Hz}-20\text{k Hz}$	5.0		0.011			%
C_{IN}	输入端电容 (注释 10)		0		2.3			pF
C_{IO-B}	B 端口关断时的 断开电容 (注释 10)	图 6	5.0		5.0			pF
C_{IOA-ON}	A 端口打开时的 导通电容 (注释 10)	图 7	5.0		15.5			pF

注释 3: 通过测量 A, B 两端口之间的电压差与流过两端口的电流之比来获得。导通电阻由 A, B 两端口上电压较低的端口决定。

注释 4: 不包含因封装而引入的负载特性。

注释 5: 在给定的 V_{CC} , 温度和电平范围下 $\Delta R_{ON} = R_{ON\ max} - R_{ON\ min}$ 。

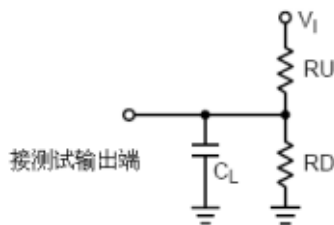
注释 6: 导通电阻平坦度是指在规定条件范围下, 导通电阻的最大值与最小值之差。

注释 7: 设计仿真值。

注释 8: 该项参数是设计仿真值而非实测值。在理想电压源 (零输出负载) 情况下, 传输延迟将好于负载为 50pF 的负载电容的情况。

注释 9: 关闭隔离= $20\log_{10}[V_A/V_B]$ 。

注释 10: $T_A=+25^\circ\text{C}$, $f=1\text{MHz}$, 不包含因封装而引入的负载电容。



电阻都为 50Ω , C_L 包括负载电容和杂散电容
输入 PRR = 1.0 MHz; $t_W = 500\text{ ns}$



测试电路

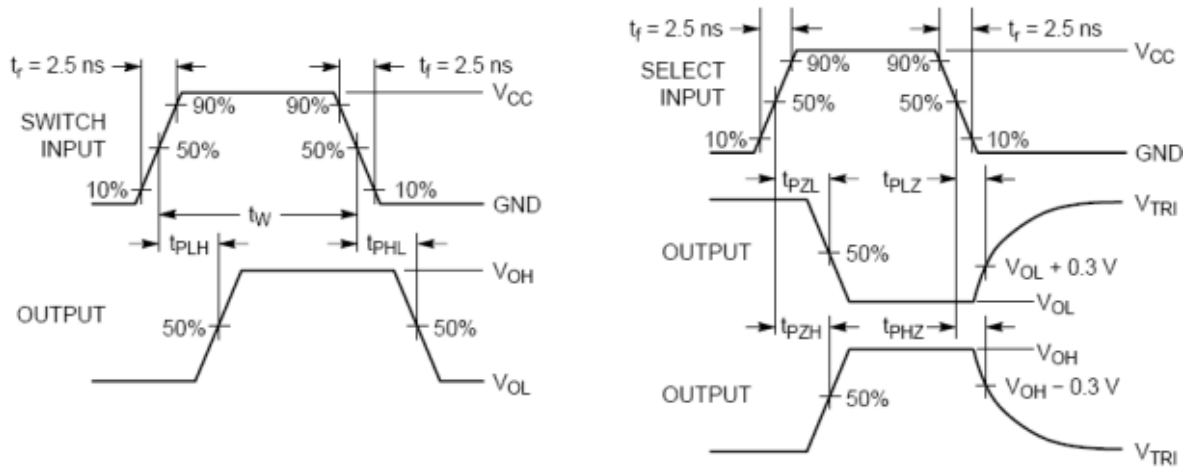


图 1 传输延时、打开时间、关闭时间



图 2 先断后开时间

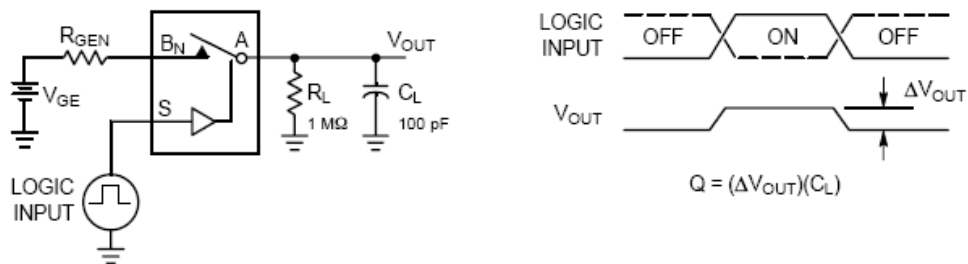


图 3 电荷注入测试

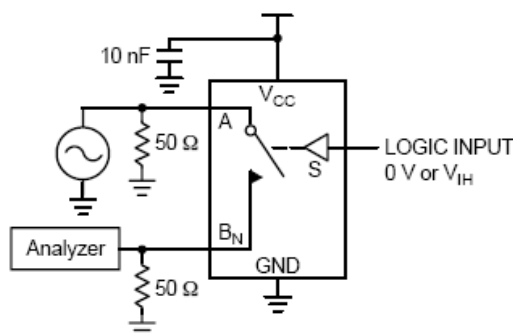


图 4 关闭隔离

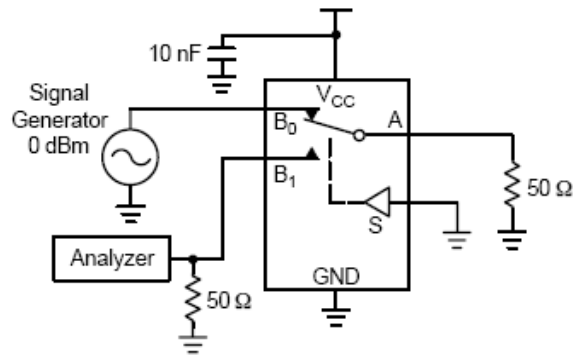


图 5 串扰

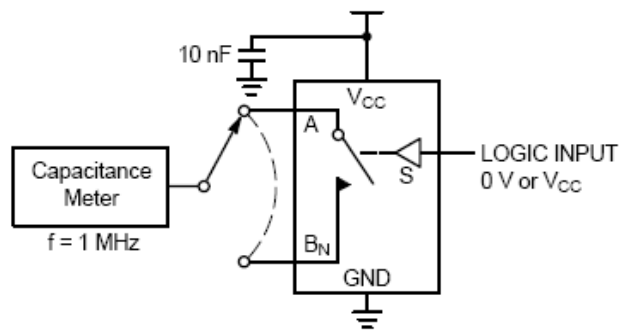


图 6 通道关闭时的输出电容

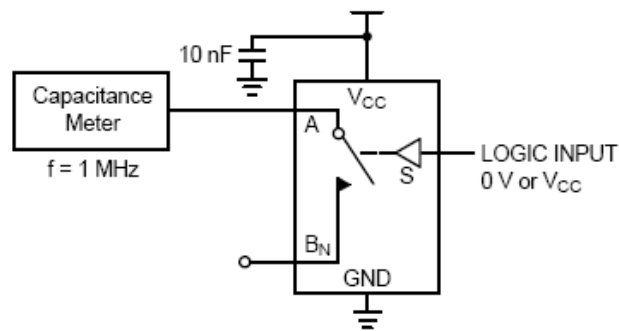


图 7 通道打开时的输出电容

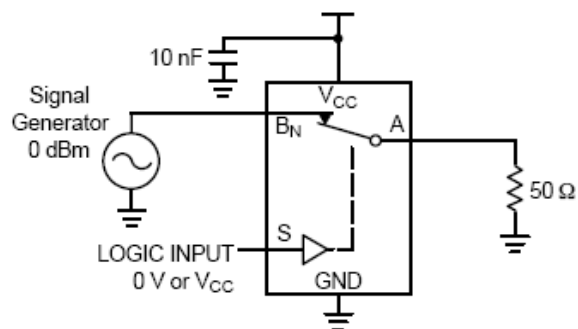
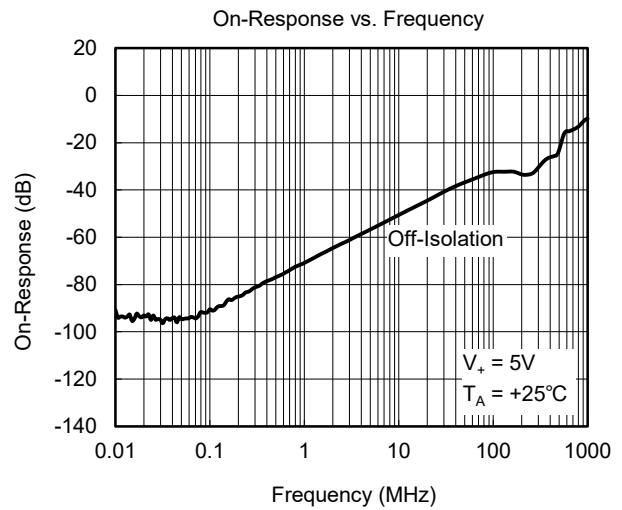
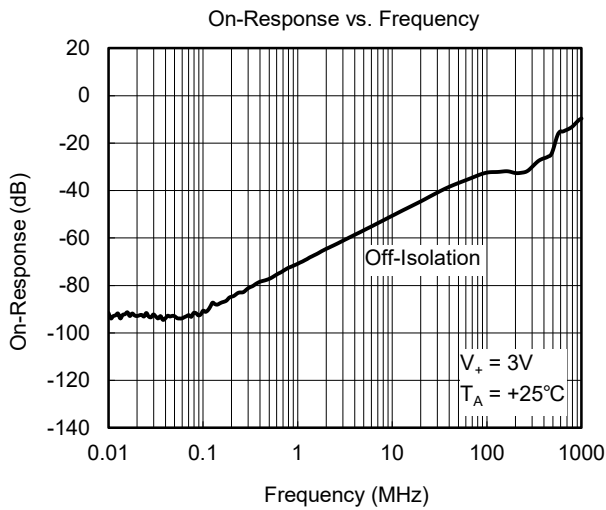
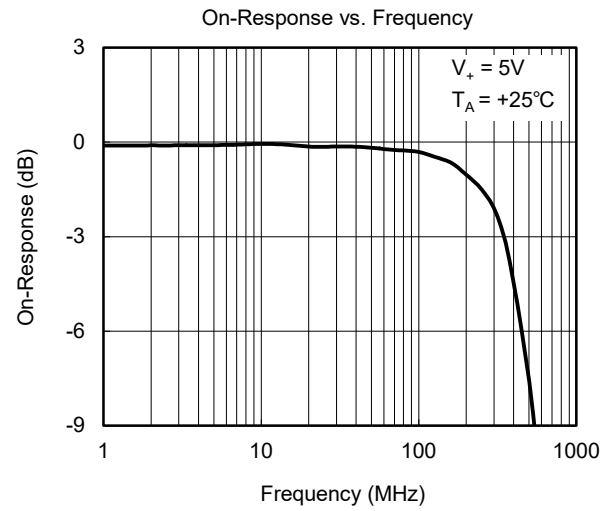
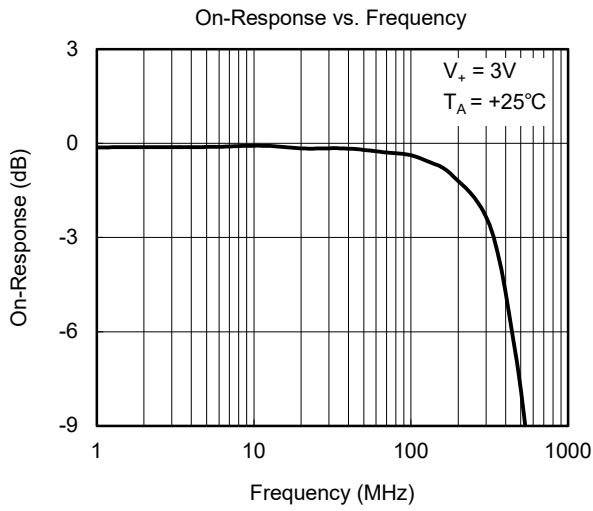


图 8 带宽



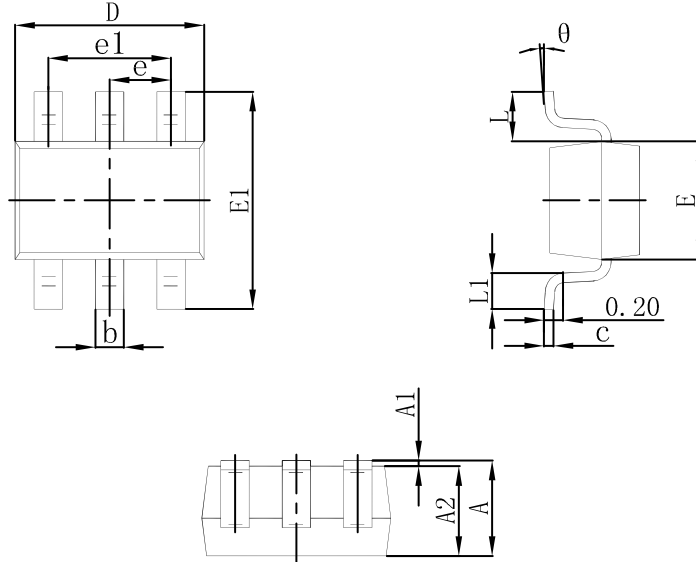
典型性能曲线图





封装尺寸

SC-70-6(SOT-363)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.100	0.150	0.004	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.400	0.085	0.094
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°



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