

特性

- 芯片钳位电压: **5V** (典型)
- 静态工作电流: **190 μ A** (典型)
- 电磁干扰 (EMC) 防护能力:
 - $\geq 10\text{V/m}$ (无外部滤波)
 - $\geq 18\text{V/m}$ (有外部滤波)
- 高输入灵敏度: **$V_T = 4.95\text{mV}$** (典型)
- 适用于检测 **A 型和 AC 型** 漏电信号
- 输出驱动:
 - **SCR 驱动电流: $>400\mu\text{A}@0.8\text{V}$** (典型)
- 不能跳闸时, **OS** 输出 **4 个 30ms: 100ms** 占空比的脉冲驱动信号
- 各种类型的漏电信号的跳闸一致性好
- 符合国标 **GB16916**, **GB16917** 和 **GB14048** 标准
- 宽的温度范围 ($T_a = -40 \sim +125^\circ\text{C}$)
- **8-lead SOP** (**端口兼容 FM2147**)

应用

- 塑壳式断路器
- 高速漏电保护装置
- 防漏电插座
- 带有漏电保护的小家电

概述

OS2147 具有低功耗和极佳高频漏电流抑制特性的高可靠 A 型和 AC 型漏电保护器专用芯片, 用于检测火线和零线上的漏电信号。当有漏电信号产生时, 零电流互感器 (ZCT) 检测到电信号, 漏电信号可以是直流、AC 型和 A 型 (包括 0° 、 90° 和 135° 漏电信号), 漏电信号经过差动放大器放大, 并经过精密整流后, 获得完整的正负半波的波形。当漏电流的 RMS 值大于规定的额定电流 (RMS) 阈值时, 芯片输出引脚快速输出高电平信号驱动外部可控硅, 使电网与用户端断开连接, 从而实现漏电保护; 当断路器不能正常跳闸时, 内部数字处理器将输出占空比为 30ms: 100ms 的脉冲控制信号, 从而保证断路器彻底断开, 有效地保护触电危险。

本芯片可稳定通过 GB14048 中 10V/m 电磁干扰、5KHz/100KHz EFT 群脉冲、雷击浪涌、周波跌落、工频磁场等可靠性实验。

功能电路

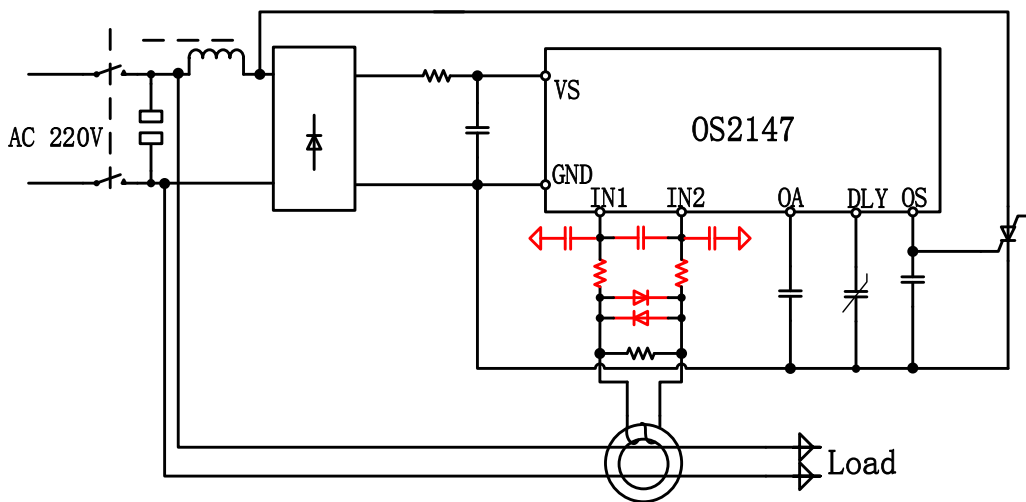


图 1. 功能电路

Rev. A

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电气特性参数

T_A = 25° C，除非另有说明.

表 1. 电特性

参数	符号	条件	最小值	典型值	最大值	单位
电源端稳压电压	V _S	钳位二极管电压@钳位电流 I _S =1mA	4.7	5	5.3	V
供电电流（功耗 1）	I _{S1}	V _S = 5V; 常温	150	190	230	μA
供电电流（功耗 2）	I _{S2}	V _S = 5V; 全温区	125		280	μA
OS 输出驱动电流 1	I _{OS1}	OS = 0.8V; IN1 - IN2 = 25mV; 常温	400	500	600	μA
OS 输出驱动电流 2	I _{OS2}	OS = 0.8V; IN1 - IN2 = 25mV; 全温区	340		700	μA
OS 输出驱动电压	V _{OS}	V _S =5V			V _S	V
漏电动作电压（比较阈值）	V _T	IN1 - IN2 ; C _{0A} = 4.7nF, Ta = 25° C	4.75	4.95	5.25	mV
漏电比较电压	V _{REFSC}			1.5		V
DLY 上拉电流	I _{DLY_U}	IN1 - IN2 = 25mV	54	60	66	μA
DLY 下拉电流	I _{DLY_D}	IN1 - IN2 = 0mV	5.4	6	6.6	μA
漏电信号锁存时间	T _{ON}	IN1 - IN2 = 25mV	28			ms
OS 脉冲个数		V _S = 5V; IN1 - IN2 = 25mV			4	

* 遵守国标 GB16916 标准要求

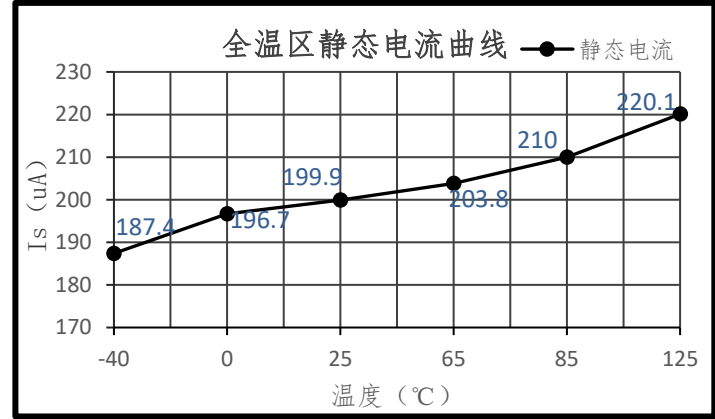


图 2. I_S 曲线 -40°C~125°C

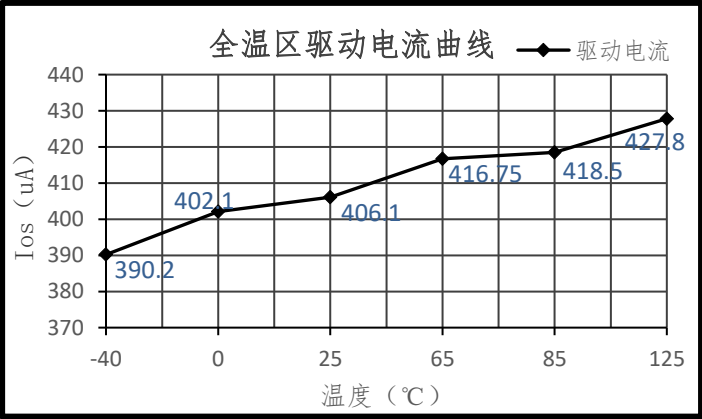


图 3. I_{OS} 曲线 -40°C~125°C

绝对最大额定值

表 2.

参数	额定值
I _{SMAX}	8mA
VS to GND	-0.3V to +7.2V
OS to GND	-0.3V to +6V
Input Voltage to GND	-0.3V to +6V
Output Voltage to GND	-0.3V to +6V
Storage Temperature Range	- 65° C to +150° C
Operating Junction Temperature Range	- 40° C to +125° C
Operating Ambient Temperature Range	- 40° C to +85° C
Soldering Conditions	JEDEC J-STD-020

注意，超出上述绝对最大额定值可能会导致器件永久性损坏。这只是额定应力值，不涉及器件在这些或任何其他条件下超出本技术规格指标的功能性操作。长期在绝对最大额定值条件下工作会影响器件的可靠性。

THERMAL DATA

绝对最大额定值仅适合单独应用，但不适合组合使用。结温高于限制值时，会损坏芯片。监控环境温度并不能保证T_J不会超出额定温度限值。在功耗高、热阻差的应用中，可能必须降低最大环境温度。

在功耗适中、PCB 热阻较低的应用中，只要结温处于额定限值以内，最大环境温度可以超过最大限值。器件的结温（T_J）取决于环境温度（T_A）、器件的功耗（P_D）和封装的结到环境热阻（θ_{JA}）。

最高结温（T_J）由环境温度（T_A）和功耗（P_D）通过下式计算：

$$T_J = T_A + (P_D \times \theta_{JA})$$

封装的结到环境热阻（θ_{JA}）基于使用 4 层板的建模和计算方法，主要取决于应用和板布局。在功耗较高的应用

中，需要特别注意热板设计。θ_{JA} 的值可能随 PCB 材料、布局和环境条件不同而异。θ_{JA} 的额定值基于 4" × 3" 的 4 层电路板。有关板结构的详细信息，请参考 JESD 51-7 和 JESD 51-9。

Ψ_{JB} 是结到板热特性参数，单位为 °C/W。封装的 Ψ_{JB} 基于使用 4 层板的建模和计算方法。JESD51-12——“报告和使用电子封装热信息指南”中声明，热特性参数和热阻不是一回事。Ψ_{JB} 衡量沿多条热路径流动的器件功率，而 θ_{JB} 只涉及一条路径。因此，Ψ_{JB} 热路径包括来自封装顶部的对流和封装的辐射，这些因素使得 Ψ_{JB} 在现实应用中更有用。最高结温（T_J）由板温度（T_B）和功耗（P_D）通过下式计算：

$$T_J = T_B + (P_D \times \Psi_{JB})$$

有关 Ψ_{JB} 的详细信息，请参考 JESD51-8 和 JESD51-12。

THERMAL RESISTANCE

θ_{JA} 和 Ψ_{JB} 针对最差条件，即器件焊接在电路板上以实现表贴封装。

表 3. 热阻

Package Type	θ _{JA}	θ _{JC}	Unit
8-Lead SOP	96	55	°C /W

ESD CAUTION



ESD (electrostatic discharge) sensitive device.
Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

引脚配置以及功能描述

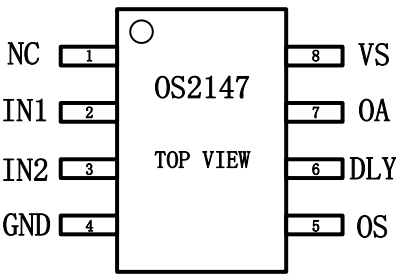
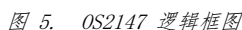


图 4. 引脚配置

表 4. 引脚功能描述

引脚	符号	描述
1	NC	悬空
2	IN1	运放同相输入管脚
3	IN2	运放反相输入管脚
4	GND	芯片地
5	OS	可控硅触发输出管脚
6	DLY	触发延时可调输出管脚
7	OA	放大器滤波输出管脚
8	VS	电源管脚

OS2147 是一款高性能、高可靠 A 型漏电保护器专用芯片,用于检测火线和零线上的漏电信号。采用小于 5V 电源供电,最小 SCR 驱动电流 400 μ A。在无驱动时静态电流典型值低至 190 μ A,因此 OS2147 可使用小功率分流电阻,降低了系统成本。



当有漏电信号产生时，零电流互感器(ZCT)检测到电信号，漏电信号可以是直流、AC型和A型（包括0°、90°和135°漏电信号），漏电信号经过差动放大器放大，并经过精密整流后，获得完整的正负半波的波形。当漏电流的RMS值大于规定的额定电流(RMS)阈值时，芯片输出引脚快速输出高电平信号驱动外部可控硅，使电网与用户端断开连接，从而实现漏电保护；当断路器不能正常跳闸时，内部数字处理器将输出占空比为30ms:100ms的脉冲控制信号，从而保证断路器彻底关断，有效地保护触电危险。

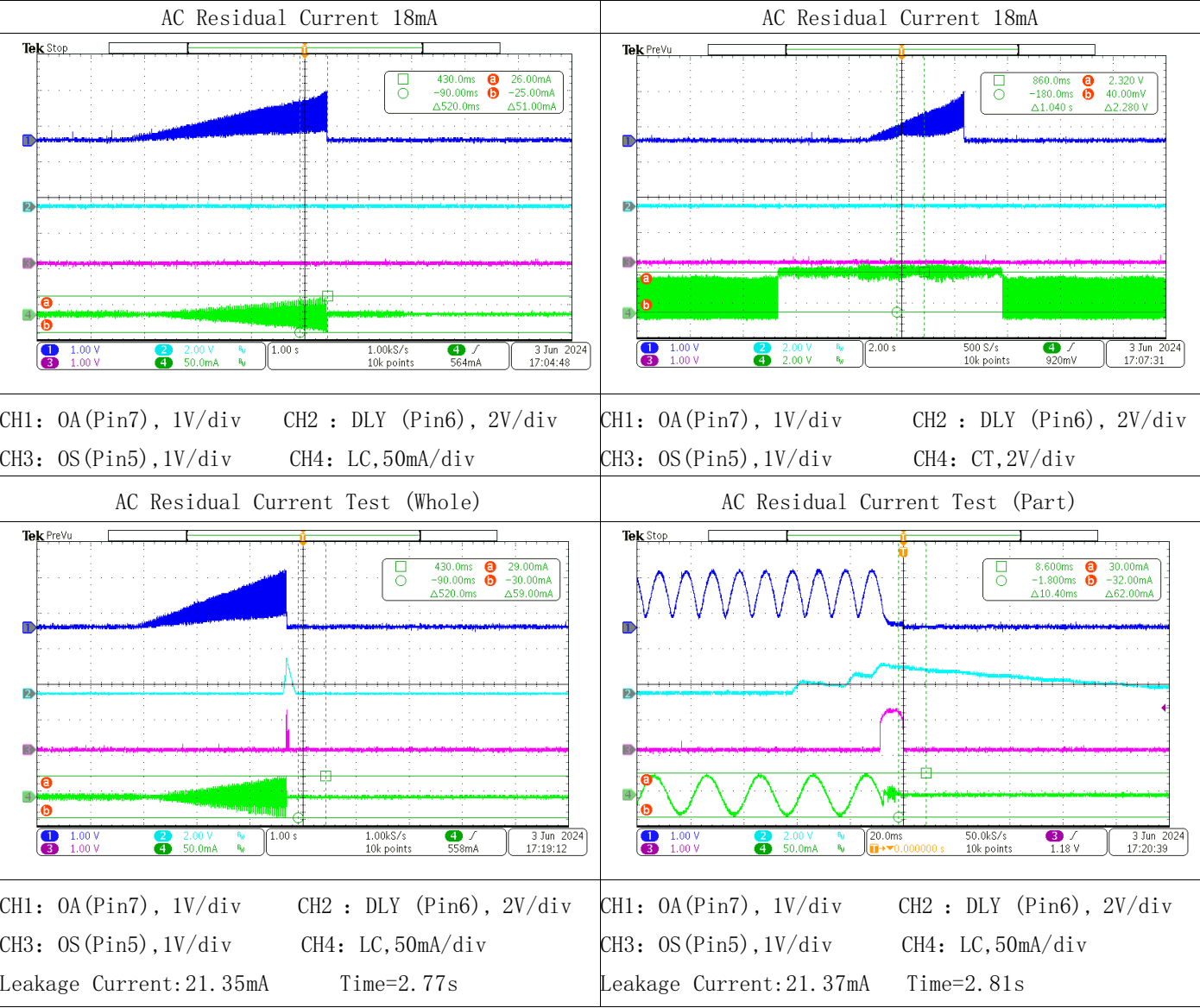
图 6. OS2147 典型应用电路

表 5. 一般 A 型无延时电路参数

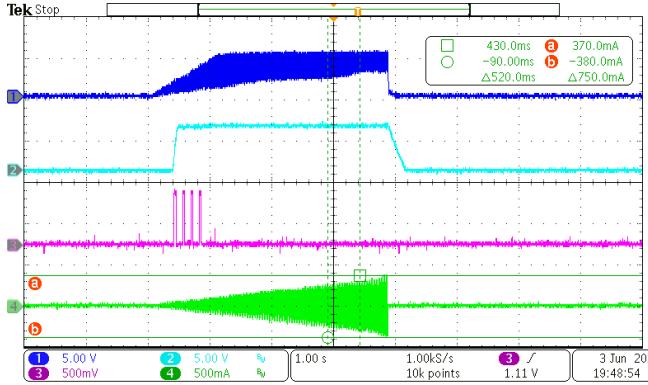
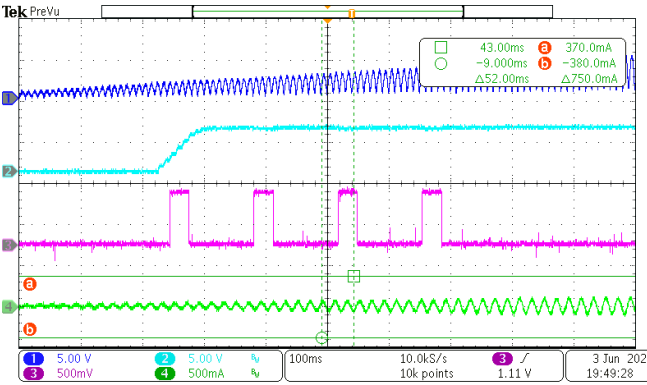
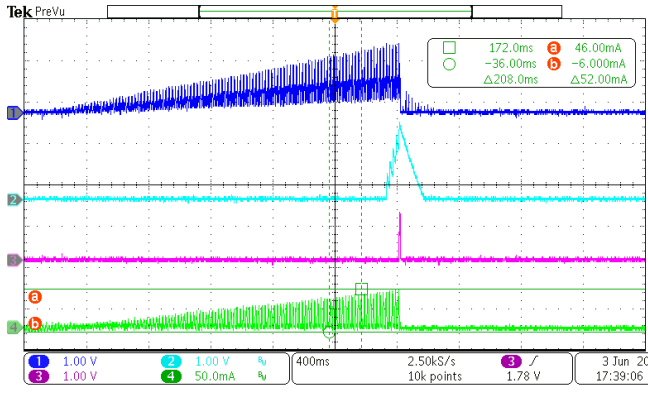
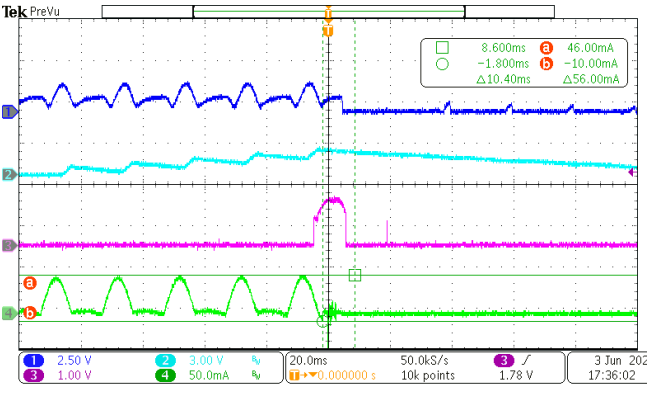
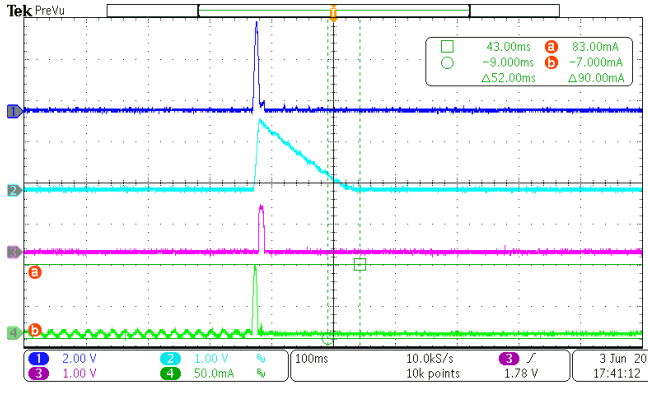
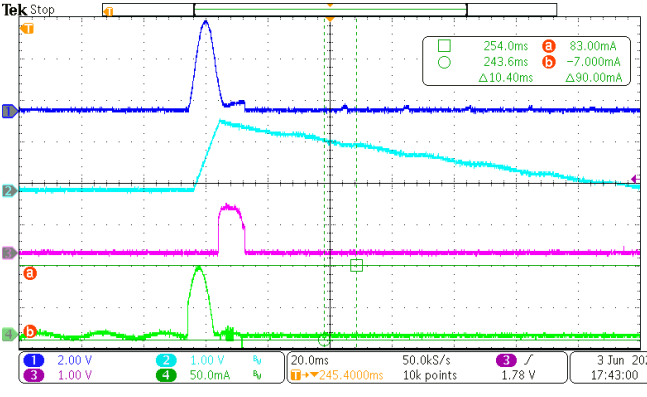
电容参数	
C _{OA} (图 6 中的 C7)	4.7nF
C _{DLY} (图 6 中的 C4)	330nF
采样电阻参数 (N=500)	
I Δ n=30mA	100R (图 6 中的 R2)

典型应用电路波形

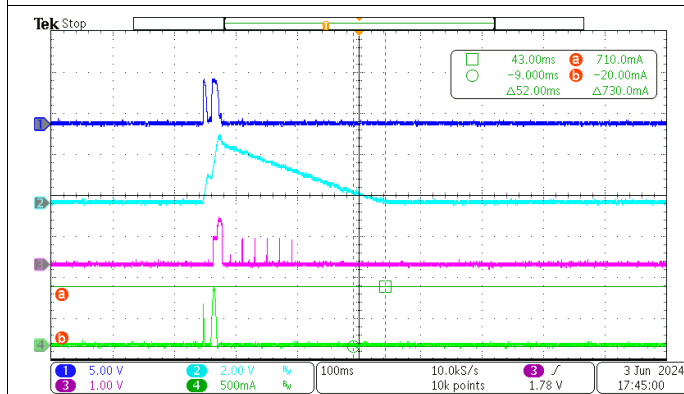
一般 A 型漏电功能测试波形，外围参数参考表 5，T_A = 25℃



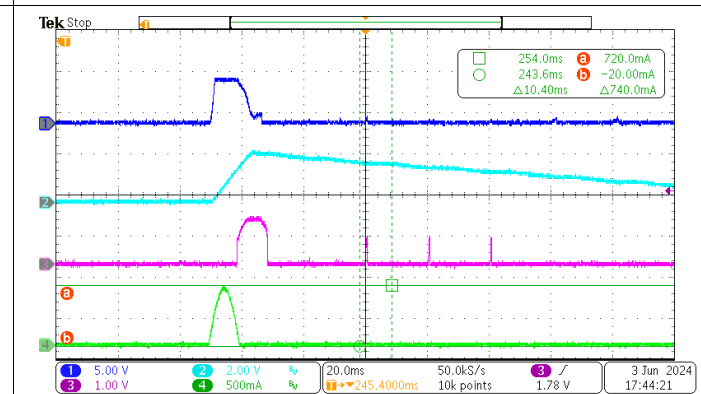
AC Release Time Test Residual Current 30mA(Whole) CH1: OA(Pin7), 1V/div CH2 : DLY (Pin6), 2V/div CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div Release Time: 20.9ms	AC Release Time Test Residual Current 30mA(Part) CH1: OA(Pin7), 1V/div CH2 : DLY (Pin6), 2V/div CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div Release Time: 16.7ms
AC Release Time Test Residual Current 250mA(Whole) CH1: OA(Pin7), 2.5V/div CH2 : DLY (Pin6), 3V/div CH3: OS(Pin5), 1V/div CH4: LC, 400mA/div Release Time: 21.7ms	AC Release Time Test Residual Current 250mA(Part) CH1: OA(Pin7), 2.5V/div CH2 : DLY (Pin6), 3V/div CH3: OS(Pin5), 1V/div CH4: LC, 400mA/div Release Time: 9.0ms
AC 断开可控硅 Release Current 30mA(Whole) CH1: OA(Pin7), 2V/div CH2 : DLY (Pin6), 5V/div CH3: OS(Pin5), 0.5V/div CH4: LC, 50mA/div	AC 断开可控硅 Release Current 30mA(Part) CH1: OA(Pin7), 2V/div CH2 : DLY (Pin6), 5V/div CH3: OS(Pin5), 0.5V/div CH4: LC, 50mA/div

AC 断开可控硅 Release Current 250mA(Whole)  CH1: OA(Pin7), 5V/div CH2: DLY (Pin6), 5V/div CH3: OS(Pin5), 0.5V/div CH4: LC, 500mA/div	AC 断开可控硅 Release Current 250mA(Part)  CH1: OA(Pin7), 5V/div CH2: DLY (Pin6), 5V/div CH3: OS(Pin5), 0.5V/div CH4: LC, 500mA/div
A0 Residual Current Test(Whole)  CH1: OA(Pin7), 1V/div CH2: DLY (Pin6), 1V/div CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div Leakage Current: 23.65mA Time=2.21s	A0 Residual Current Test(Part)  CH1: OA(Pin7), 2.5V/div CH2: DLY (Pin6), 3V/div CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div Leakage Current: 23.35mA Time=2.21s
A0 Release Time Test Residual Current 42mA(Whole)  CH1: OA(Pin7), 2V/div CH2: DLY (Pin6), 1V/div CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div Release Time: 11.6ms	A0 Release Time Test Residual Current 42mA(Part)  CH1: OA(Pin7), 2V/div CH2: DLY (Pin6), 1V/div CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div Release Time: 10.5ms

A0 Release Time Test Residual Current 350mA(Whole)



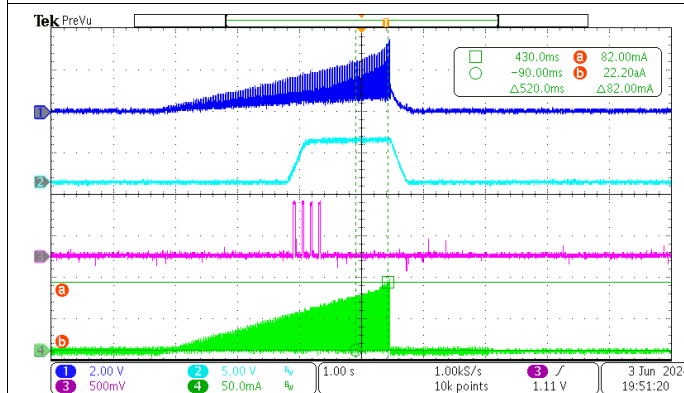
A0 Release Time Test Residual Current 350mA(Whole)



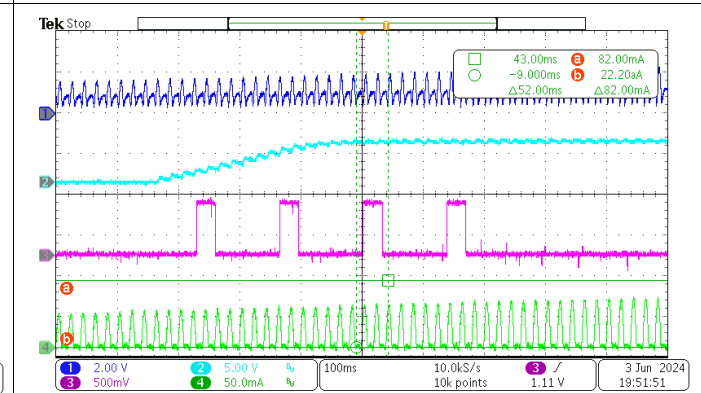
CH1: OA(Pin7), 5V/div
CH2: DLY (Pin6), 2V/div
CH3: OS(Pin5), 1V/div
CH4: LC, 500mA/div
Release Time: 24.2ms

CH1: OA(Pin7), 5V/div
CH2: DLY (Pin6), 2V/div
CH3: OS(Pin5), 1V/div
CH4: LC, 500mA/div
Release Time: 11.4ms

A0 断开可控硅 Release Current 42mA(Whole)



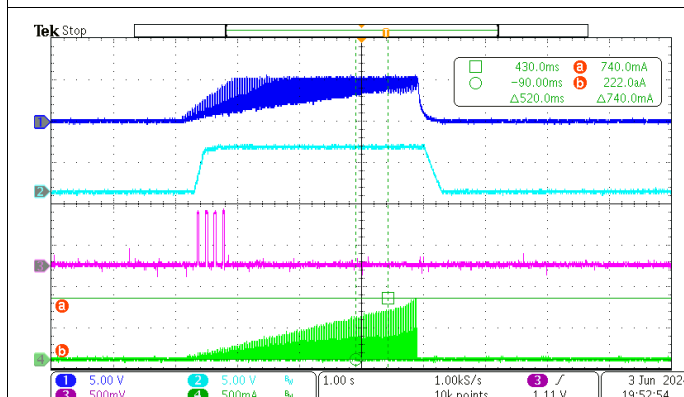
A0 断开可控硅 Release Current 42mA(Part)



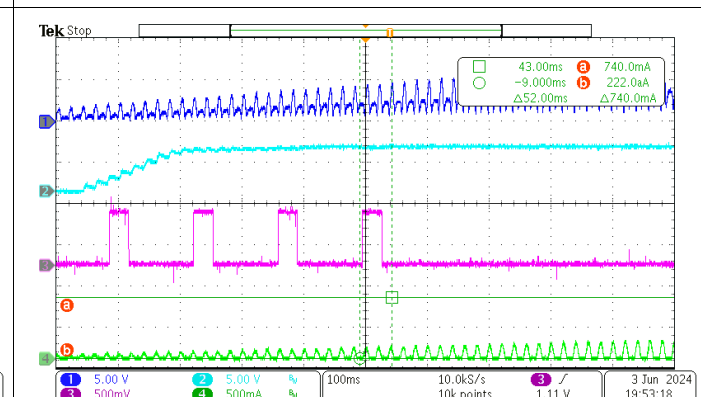
CH1: OA(Pin7), 2V/div
CH2: DLY (Pin6), 5V/div
CH3: OS(Pin5), 0.5V/div
CH4: LC, 50mA/div

CH1: OA(Pin7), 2V/div
CH2: DLY (Pin6), 5V/div
CH3: OS(Pin5), 0.5V/div
CH4: LC, 50mA/div

A0 断开可控硅 Release Current 350mA(Whole)



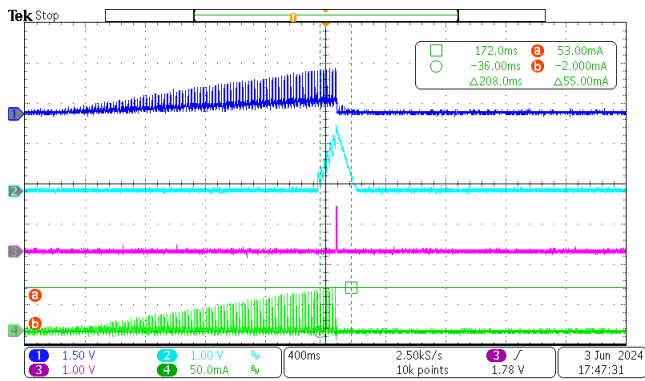
A0 断开可控硅 Release Current 350mA(Part)



CH1: OA(Pin7), 5V/div
CH2: DLY (Pin6), 5V/div
CH3: OS(Pin5), 0.5V/div
CH4: LC, 500mA/div

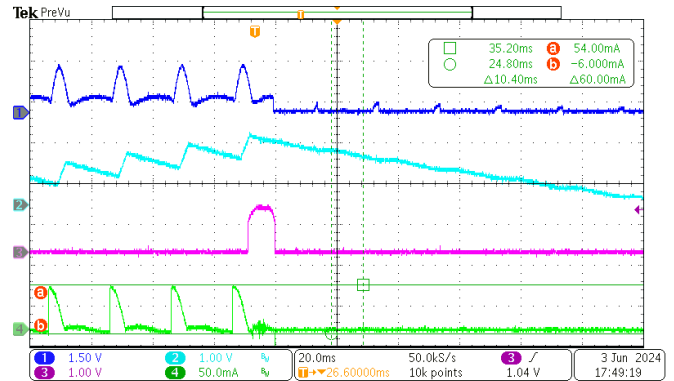
CH1: OA(Pin7), 5V/div
CH2: DLY (Pin6), 5V/div
CH3: OS(Pin5), 0.5V/div
CH4: LC, 500mA/div

A90 Residual Current Test(Whole)



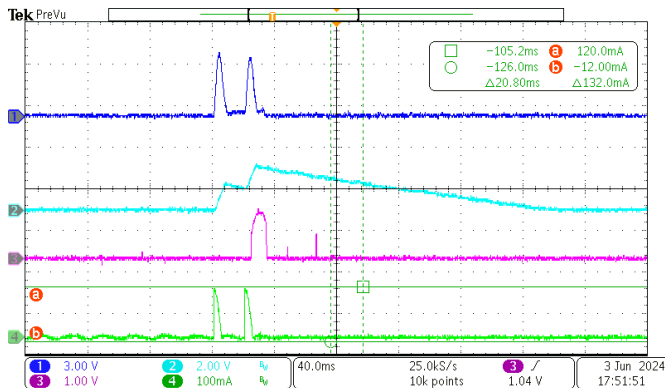
CH1: 0A(Pin7), 1.5V/div CH2 : DLY (Pin6), 1V/div
 CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div
 Leakage Current: 19.57mA Time=1.87s

A90 Residual Current Test(Part)



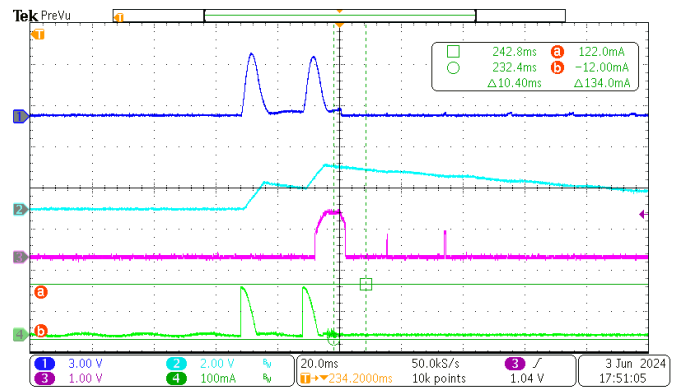
CH1: 0A(Pin7), 1.5V/div CH2 : DLY (Pin6), 1V/div
 CH3: OS(Pin5), 1V/div CH4: LC, 50mA/div
 Leakage Current: 19.67mA Time=1.87s

A90 Release Time Test Residual Current 42mA(Whole)



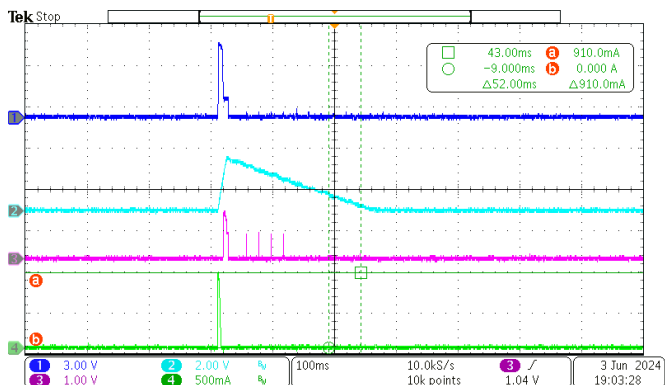
CH1: 0A(Pin7), 3V/div CH2 : DLY (Pin6), 2V/div
 CH3: OS(Pin5), 1V/div CH4: LC, 100mA/div
 Release Time: 26.4ms

A90 Release Time Test Residual Current 42mA(Part)



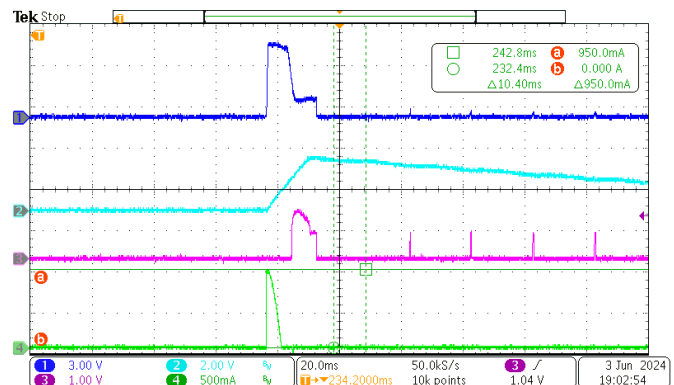
CH1: 0A(Pin7), 3V/div CH2 : DLY (Pin6), 2V/div
 CH3: OS(Pin5), 1V/div CH4: LC, 100mA/div
 Release Time: 26.4ms

A90 Release Time Test Residual Current 350mA(Whole)

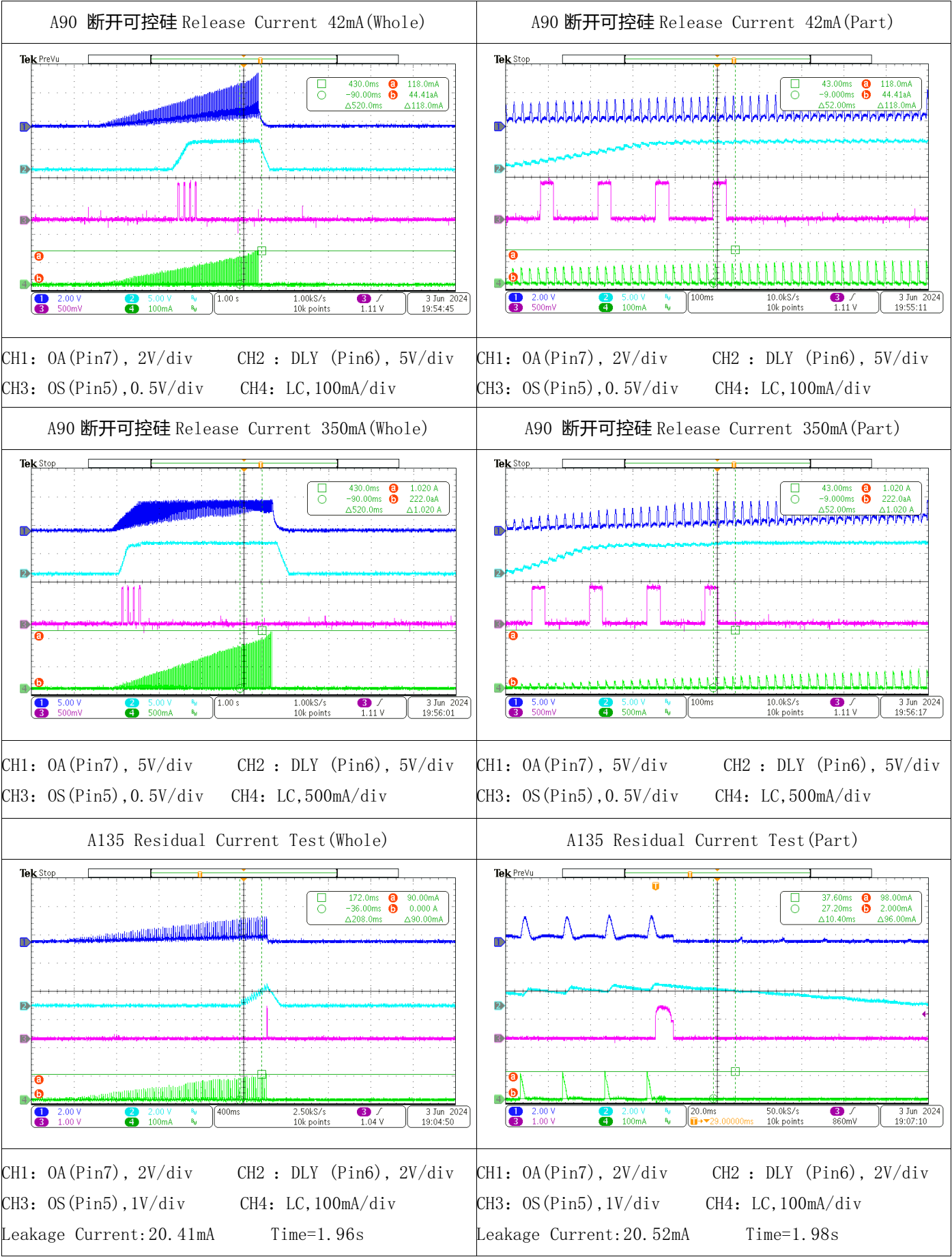


CH1: 0A(Pin7), 3V/div CH2 : DLY (Pin6), 2V/div
 CH3: OS(Pin5), 1V/div CH4: LC, 500mA/div
 Release Time: 8.6ms

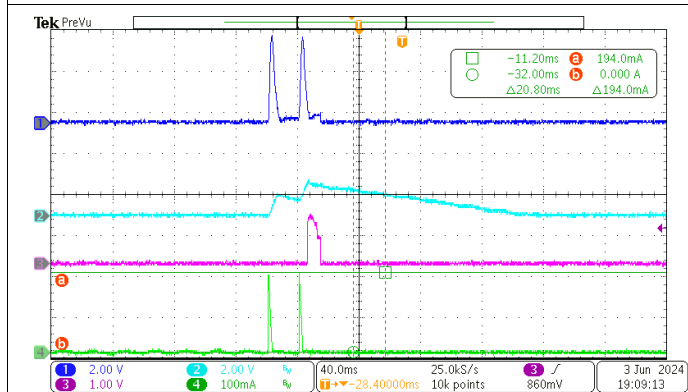
A90 Release Time Test Residual Current 350mA(Whole)



CH1: 0A(Pin7), 3V/div CH2 : DLY (Pin6), 2V/div
 CH3: OS(Pin5), 1V/div CH4: LC, 500mA/div
 Release Time: 8.7ms

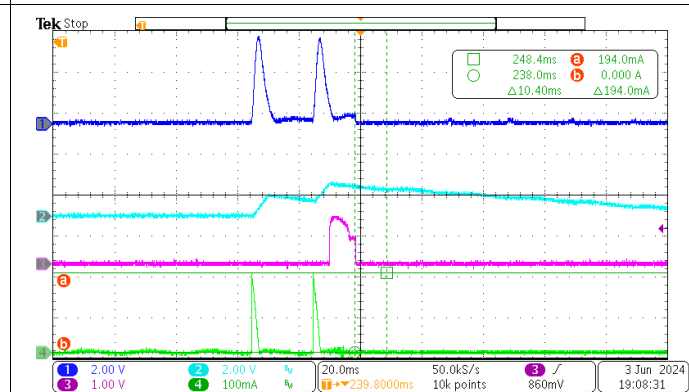


A135 Release Time Test Residual Current 42mA(Whole)



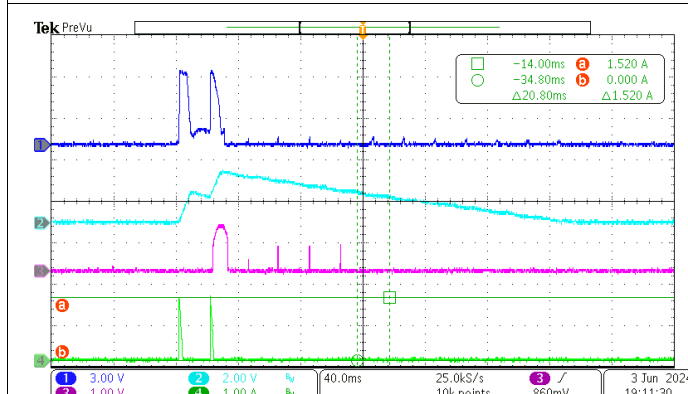
CH1: OA(Pin7), 2V/div CH2 : DLY (Pin6), 2V/div
CH3: OS(Pin5), 1V/div CH4: LC, 100mA/div
Release Time: 25.7ms

A135 Release Time Test Residual Current 42mA(Part)



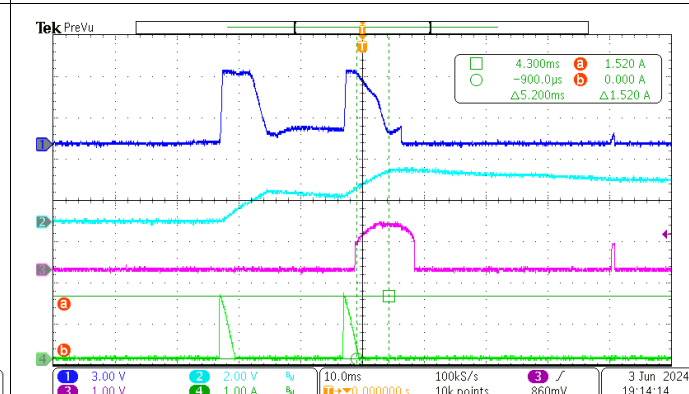
CH1: OA(Pin7), 2V/div CH2 : DLY (Pin6), 2V/div
CH3: OS(Pin5), 1V/div CH4: LC, 100mA/div
Release Time: 25.7ms

A135 Release Time Test Residual Current 350mA(Whole)



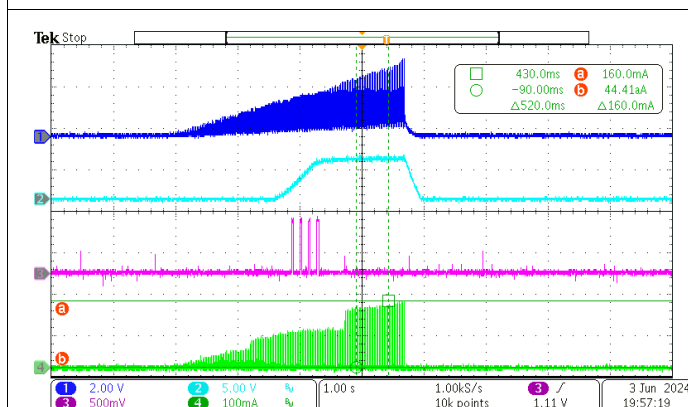
CH1: OA(Pin7), 3V/div CH2 : DLY (Pin6), 2V/div
CH3: OS(Pin5), 1V/div CH4: LC, 1A/div
Release Time: 24ms

A135 Release Time Test Residual Current 350mA(Whole)



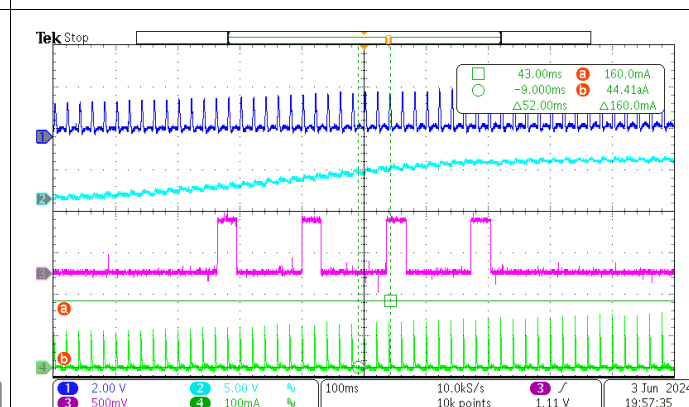
CH1: OA(Pin7), 3V/div CH2 : DLY (Pin6), 2V/div
CH3: OS(Pin5), 1V/div CH4: LC, 1A/div
Release Time: 24ms

A135 断开可控硅 Release Current 42mA(Whole)

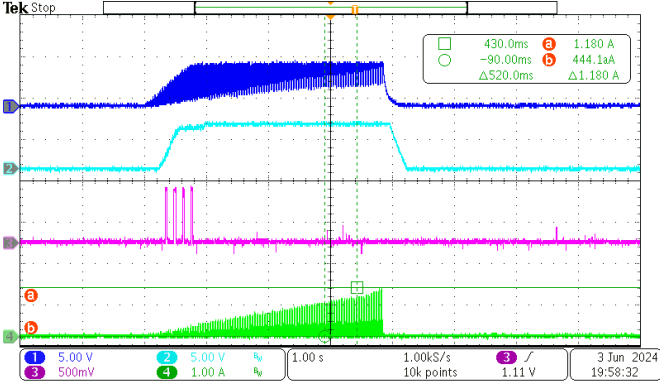
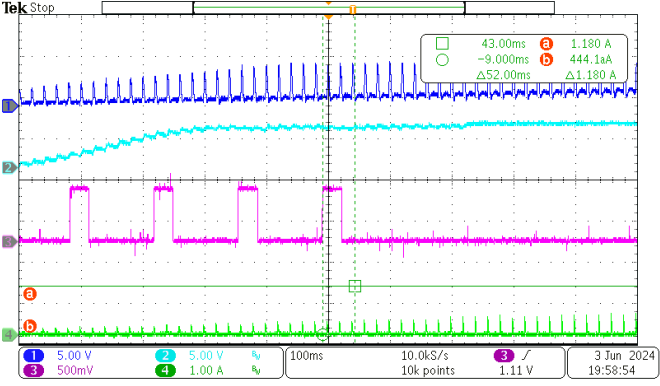


CH1: OA(Pin7), 2V/div CH2 : DLY (Pin6), 5V/div
CH3: OS(Pin5), 0.5V/div CH4: LC, 100mA/div

A135 断开可控硅 Release Current 42mA(Part)



CH1: OA(Pin7), 2V/div CH2 : DLY (Pin6), 5V/div
CH3: OS(Pin5), 0.5V/div CH4: LC, 100mA/div

A135 断开可控硅 Release Current 350mA(Whole)		A135 断开可控硅 Release Current 350mA(Part)	
			
CH1: OA(Pin7), 5V/div	CH2 : DLY (Pin6), 5V/div	CH1: OA(Pin7), 5V/div	CH2 : DLY (Pin6), 5V/div
CH3: OS(Pin5), 0.5V/div	CH4: LC, 1A/div	CH3: OS(Pin5), 0.5V/div	CH4: LC, 1A/div
Note1 : 断开可控硅测试是指断开供电与可控硅之间连接通路			

封装描述

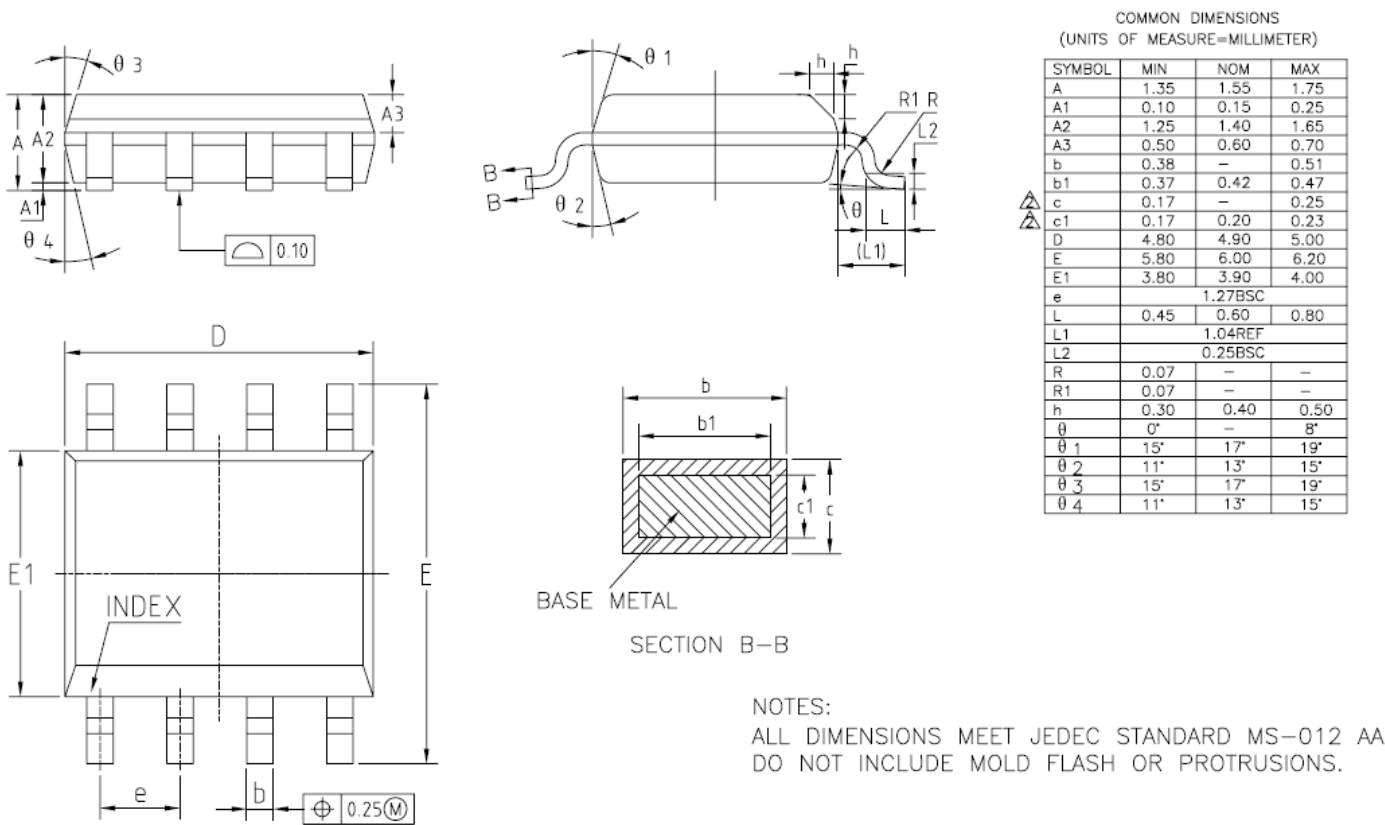
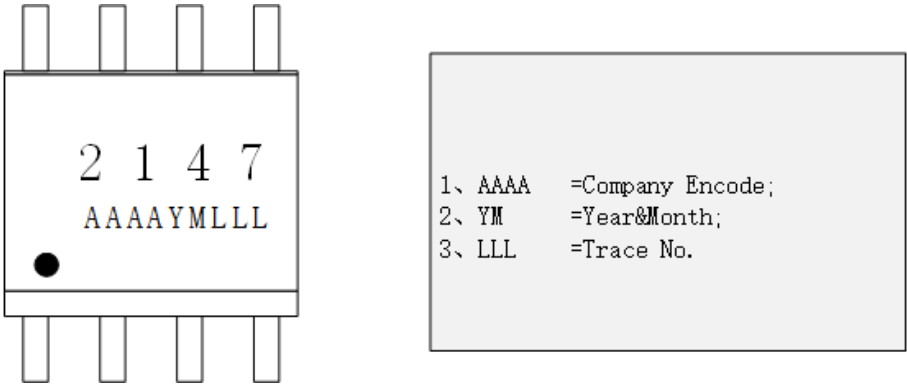


图 7. 封装图纸 (SOP8)

订购信息

型号	封装形式	温度范围	MK code	包装方式	卷盘尺寸
OS2147	SOP8	-40° Cto +125 ° C	2147 AAAAYMLLL	3000/盘	13 寸卷盘



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版本更新

版本号	发布日期	页数	章节或图表	更改说明
1.0	2025.3	15		首次发布