



Test Damage
Stress during testing

Manufacturing
Building PCB's

Low Yield Rate
Fox-1 MPPT's
Rev 1.1

LM6144
Op-Amp

TL1451A
PWM Controller

Sourcing too much current during startup

Plausible. 50mA total maximum at supply input pin. It's possible the diode array in error amp circuit allow s more current with MPPT and VREG error amps combined shorting. Replacing D8 with 2KΩ resistor array limits current to 3.25mA maximum per op-amp channel in 6.5V system.

Oscillator > 500KHz causes some units error amplifier/PWM circuits to not work correctly

Plausible. Replace RC timing components with correct values to operate at 500KHz. Within specification operation is desirable

Current into pin 3 from LM6144 error amplifiers high enough to cause damage

Input Error amp pin 3 and pin 4 are pulled apart ~ 3V during startup

Plausible. Replacing error amp diode array with 2KΩ resistor array limits current to 3.25mA maximum in 6.5V system.
< 5mA desirable

Hot-plugging/Turn-on voltage spike

Unlikely. LM723 solar simulator hotplug testing showed no ringing/overshoot voltages on panel voltage. Also, LM6144's rated to 35V and TL1451 rated to 50V

Plausible. Mandatory ESD protection at all times when handling MPPT's. This includes ESD safe soldering tools and cleaning tools (conductive brushes, buckets, etc)

ESD Damage

Short Circuit Output Brownout

Unlikely. MPPT keeps LM6144 & TL1451 at no less than 4.2V if operating correctly. Test setup ensures 100Ω RTD. Also, no known damage from operating devices at less than minimum voltage.

Unlikely. Both hand built and Advanced Circuits built PCBA's showed failed MPPT's. Advanced Circuits is a very experienced manufacturer.

Soldering profile damaging