

SLG55550 SLG55550A



USB Host Charger Identification Analog Switches

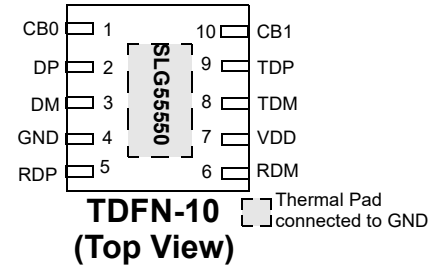
General Description

The SLG55550/SLG55550A is a USB device that combines high speed USB switches with a USB host charger (dedicated charger) identification circuit. The device supports both the latest USB Battery Charging Specification Revision 1.1 including data contact detection and a set resistor bias for Apple compliant devices as well as legacy USB D+/D- short detection using data line pull-up.

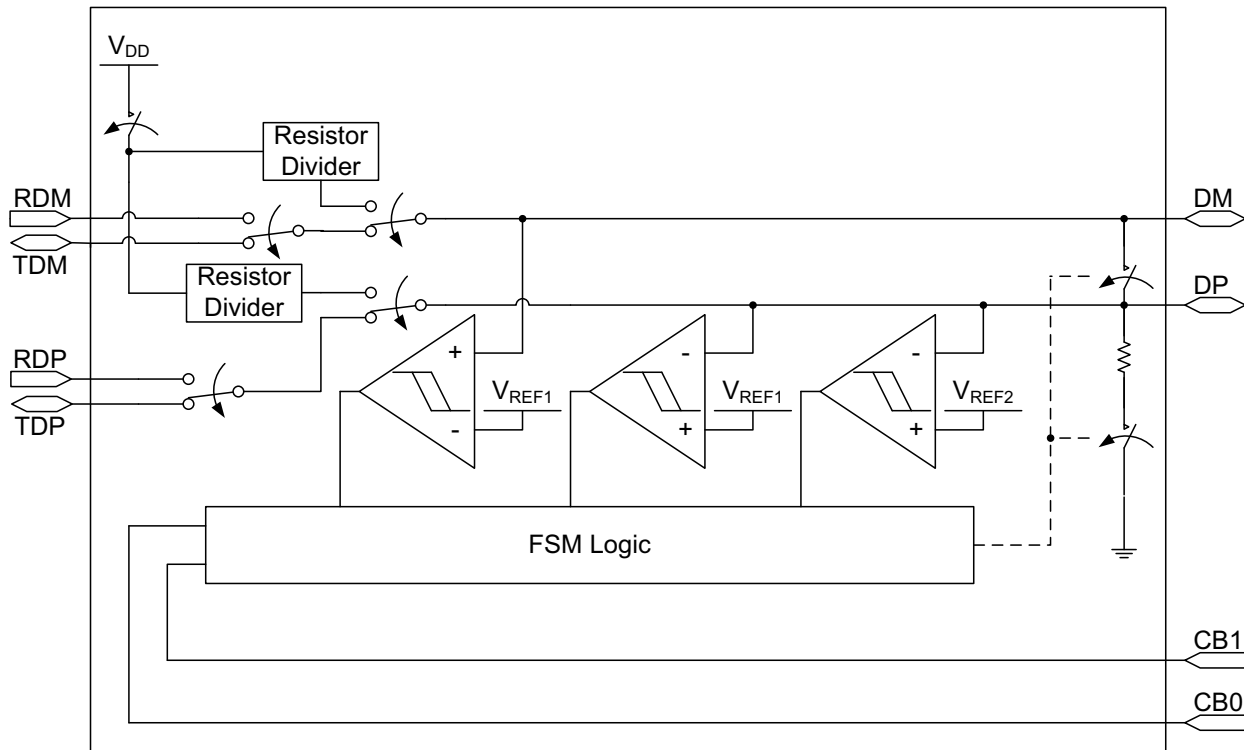
Features

- High Speed USB Switching
- Low 4.0 pF (typ) On Capacitance
- Low 4.0 Ω (typ) On Resistance
- Low 0.5 Ω (typ) On Resistance Flatness
- 2.8 V to 5.5 V Supply Range
- Low 8 μ A (typ) Supply Current
- Automatic USB Charger Identification Circuit
- USB Battery Charging Specification 1.2 compliant
- Pb-Free / RoHS Compliant
- Halogen-Free
- 3 x 3 mm TDFN-10 Package

Pin Configuration



Block Diagram



Pin Description

| Pin # | Name | Type | Description |
|-------|-------------|--------------|--|
| 1 | CB0 | Input | Switch Control Bit See Digital Input States Table on page 6 |
| 2 | DP | Input/Output | USB Connector D+ |
| 3 | DM | Input/Output | USB Connector D- |
| 4 | GND | GND | Ground |
| 5 | RDP | Input | External Resistor Bias Input for D+ and Selection for External Resistors in RDP and RDM |
| 6 | RDM | Input | External Resistor Bias Input for D- |
| 7 | VDD | PWR | Power Supply. Connect a 0.1 μ F capacitor between VDD and GND as close as possible to the device |
| 8 | TDM | Input/Output | Host USB Transceiver D- Connection |
| 9 | TDP | Input/Output | Host USB Transceiver D+ Connection |
| 10 | CB1 | Input | Switch Control Bit See Digital Input States Table on page 6 |
| 11 | Thermal Pad | GND | Ground |

Ordering Information

| Part Number | Type |
|--------------|-------------------------|
| SLG55550V | TDFN-10 |
| SLG55550AV | TDFN-10 |
| SLG55550VTR | TDFN-10 - Tape and Reel |
| SLG55550AVTR | TDFN-10 - Tape and Reel |

Absolute Maximum Conditions

| Parameter | Min. | Max. | Unit |
|--------------------------------------|------|------|------|
| Supply Voltage | -0.3 | 6.0 | V |
| Continuous Current into any terminal | -30 | +30 | mA |
| Continuous Power Dissipation | -- | 1951 | mW |
| Operating Temperature Range | -40 | 85 | °C |
| Junction Temperature | | 150 | °C |
| Storage Temperature Range | -65 | 150 | °C |
| Lead Temperature (Soldering, 10s) | | 260 | °C |

Electrical Characteristics - Power Supply

$V_{DD} = 2.8V$ to $5.5V$, $T_A = 25^\circ C$ (unless specified otherwise)

| Symbol | Parameter | Condition/Note | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|---|------|------|------|---------|
| V_{DD} | Power Supply Range | $V_{CB} > V_{IH}$ | 2.8 | -- | 5.5 | V |
| I_{DD} | Supply Current $V_{DD} = 3.3$ | $V_{CB0} = V_{CB1} = V_{DD}$ | -- | 1 | -- | μA |
| | | $V_{CB0} = 0V, V_{CB1} = V_{DD}$ | -- | 7 | -- | μA |
| | | External Resistors used. $V_{CB0} = V_{CB1} = 0V$ or $V_{CB0} = V_{DD} \& V_{CB1} = 0V$ | -- | 7 | -- | μA |
| | | Internal Resistors used. $V_{CB0} = V_{CB1} = 0V$ or $V_{CB0} = V_{DD} \& V_{CB1} = 0V$ | -- | 75 | -- | μA |
| | Supply Current $V_{DD} = 5.5$ | $V_{CB0} = V_{CB1} = V_{DD}$ | -- | 2 | -- | μA |
| | | $V_{CB0} = 0V, V_{CB1} = V_{DD}$ | -- | 9 | -- | μA |
| | | External Resistors used. $V_{CB0} = V_{CB1} = 0V$ or $V_{CB0} = V_{DD} \& V_{CB1} = 0V$ | -- | 9 | -- | μA |
| | | Internal Resistors used. $V_{CB0} = V_{CB1} = 0V$ or $V_{CB0} = V_{DD} \& V_{CB1} = 0V$ | -- | 120 | -- | μA |
| ΔI_{DD} | Supply Current Increase | $0 \leq V_{CB} \leq V_{IL}$ or $V_{IH} \leq V_{CB} \leq V_{DD}$ | -- | -- | 2 | μA |

Electrical Characteristics - Analog Switch

$V_{DD} = 2.8V$ to $5.5V$, $T_A = 25^\circ C$ (unless specified otherwise)

| Symbol | Parameter | Condition/Note | Min. | Typ. | Max. | Unit |
|------------------|---|---|------|------|----------|----------|
| V_{DP}, V_{DM} | Analog signal Range | | 0 | -- | V_{DD} | V |
| R_{ON} | On Resistance TDP/TDM Switch | $V_{DD} = -0.4V$ to $0.4V, I = 10mA$ | -- | 4 | -- | Ω |
| | | $V_{DP} = V_{DM} = 0V$ to V_{DD} $V_{DD} = 5V$ | -- | -- | 10 | Ω |
| ΔR_{ON} | On Resistance Match between channels TDP/TDM Switch | $V_{DD} = 5.0V$ $V_{DP} = V_{DM} = 400mV$ $I_{DP} = I_{DM} = 10mA$ | -- | 0.1 | -- | Ω |
| R_{FLAT} | On Resistance flatness TDP/TDM Switch | $V_{DD} = 5.0V$ $V_{DP} = V_{DM} = 0V$ to V_{DD} $I_{DP} = I_{DM} = 10mA$ | -- | 0.5 | -- | Ω |

Electrical Characteristics - Analog Switch

$V_{DD} = 2.8V$ to $5.5V$, $T_A = 25^\circ C$ (unless specified otherwise)

| Symbol | Parameter | Condition/Note | Min. | Typ. | Max. | Unit |
|--------------------------------|--------------------------------|--|------|------|------|----------|
| R_{SHORT} | On Resistance of TDP/TDM Short | $V_{CB} = 0V$ $V_{DP} = 1V$ $I_{DP} = I_{DM} = 10mA$ | -- | 50 | 70 | Ω |
| I_{TDPOFF} , I_{TDMOFF} | Off-Leakage Current | $V_{DD} = 3.6V$ $V_{DP} = V_{DM} = 0.3V$ to $3.3V$ $V_{TDP} = V_{TDM} = 3.3V$ to $0.3V$ $V_{CB} = 0V$ | -250 | -- | 250 | nA |
| I_{DPON} , I_{DMON} | Off-Leakage Current | $V_{DD} = 3.6V$ $V_{DP} = V_{DM} = 3.3V$ to $0.3V$ $V_{CB} = V_{DD}$ | -250 | -- | 250 | nA |

Electrical Characteristics - Dynamic Performance

$V_{DD} = 2.8V$ to $5.5V$, $T_A = 25^\circ C$ (unless specified otherwise)

| Symbol | Parameter | Condition/Note | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------------|--|------|------|------|---------|
| T_{ON} | Turn On Time | V_{TDP} or $V_{TDM} = 1.5V$ $R_L = 300\Omega$ $C_L = 35pF$ | --' | 20 | 100 | μs |
| T_{OFF} | Turn Off Time | V_{TDP} or $V_{TDM} = 1.5V$ $R_L = 300\Omega$ $C_L = 35pF$ | --' | 1 | 5 | μs |
| T_{PLH} , T_{PHL} | TDP/TDM Switch Propagation Delay | $R_L = R_S = 50\Omega$ | -- | 60 | -- | ps |
| T_{SKEW} | Output Skew | Skew between DP and DM when connected to TDP and TDM $R_L = R_S = 50\Omega$ | -- | 40 | -- | ps |
| C_{OFF} | TDP/TDM Off-Capacitance | $f = 1MHz$ | --' | 2.0 | -- | pF |
| C_{ON} | DP/DM On-Capacitance | $f = 240MHz$ | --' | 4.0 | 5.5 | pF |
| BW | -3dB Bandwidth | $R_L = R_S = 50\Omega$ | -- | 1000 | -- | MHz |
| V_{ISO} | Off-Isolation | V_{TDP} , $V_{DP} = 0dBm$ $R_L = R_S = 50\Omega$ $f = 250MHz$ | -- | -20 | -- | dB |
| V_{CT} | Crosstalk | V_{TDP} , $V_{DP} = 0dBm$ $R_L = R_S = 50\Omega$ $f = 250MHz$ | -- | -25 | -- | dB |

Electrical Characteristics - Internal Resistors

$V_{DD} = 2.8V$ to $5.5V$, $T_A = 25^\circ C$ (unless specified otherwise)

| Symbol | Parameter | Condition/Note | Min. | Typ. | Max. | Unit |
|-----------|-----------------------|----------------|--------|-------|--------|-----------|
| R_{PD} | DP/DM Short Pull-down | | 350 | 500 | 700 | $k\Omega$ |
| RT_{RP} | RP1/RP2 Ratio | | 1.485 | 1.5 | 1.515 | Ratio |
| R_{RP} | RP1 + RP2 Resistance | | 93.75 | 125.0 | 156.25 | $k\Omega$ |
| RT_{RM} | RM1/RM2 Ratio | | 0.8544 | 0.863 | 0.872 | Ratio |
| R_{RM} | RM1 + RM2 Resistance | | 69.75 | 93.0 | 115.18 | $k\Omega$ |

Electrical Characteristics - Logic Input

$V_{DD} = 2.8V$ to $5.5V$, $T_A = 25^\circ C$ (unless specified otherwise)

| Symbol | Parameter | Condition/Note | Min. | Typ. | Max. | Unit |
|----------|--------------------------|--|------|------|------|---------|
| V_{IH} | CB Input Logic High | | 1.4 | -- | -- | V |
| V_{IL} | CB Input Logic Low | | -- | -- | 0.4 | V |
| I_{IN} | CB Input Leakage Current | $V_{DD} = 5.5V$ $0 \leq V_{CB} \leq V_{IL}$ or $V_{IH} \leq V_{CB} \leq V_{DD}$ | -1 | -- | 1 | μA |

Electrical Characteristics - ESD Protection

$V_{DD} = 2.8V$ to $5.5V$, $T_A = 25^\circ C$ (unless specified otherwise)

| Symbol | Parameter | Condition/Note | Min. | Typ. | Max. | Unit |
|-----------|--|------------------|------|---------|------|------|
| V_{ESD} | ESD Protection Level (DP and DM Only) | Human Body Model | -- | ± 8 | -- | kV |
| V_{ESD} | ESD Protection Level (All other pins) | Human Body Model | -- | ± 2 | -- | kV |

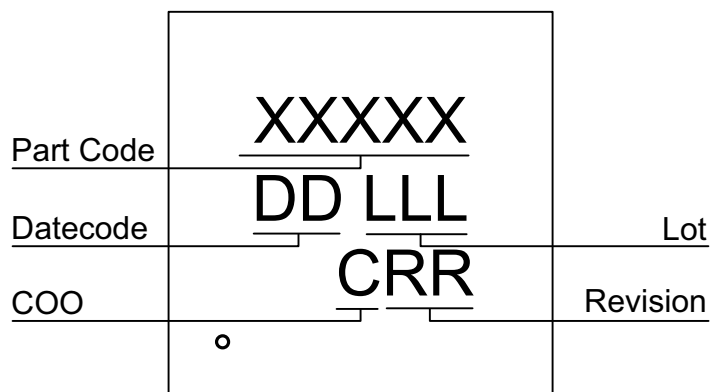
Digital Input States - SLG55550

| V _{DD} | RDP <0.4V = Internal Resistor >0.4V = External Resistor | CB0 | CB1 | DP/DM Position | Internal or External Resis- tor Connected to DP/DM | Comment |
|-----------------|---|-----|-----|-----------------------------------|---|-----------------------|
| 3.3V | RDP < 0.4V | X | X | -- | -- | Not Recommended |
| | RDP > 0.4V | 0 | 0 | Autodetection Circuit Active | External Resistor | Auto Mode |
| | | 0 | 1 | Shorted | Not Connected | Auto Mode Disabled |
| | | 1 | 0 | Connected to Resistor- Divider | External Resistor | Auto Mode Disabled |
| | | 1 | 1 | Connected to TDP/TDM | Not Connected | USB Traffic Active |
| 5.0V | RDP < 0.4V | 0 | 0 | Autodetection Circuit Active | Internal Resistor | Auto Mode |
| | | 0 | 1 | Shorted | Not Connected | Auto Mode Disabled |
| | | 1 | 0 | Connected to Resistor- Divider | Internal Resistor | Auto Mode Disabled |
| | | 1 | 1 | Connected to TDP/TDM | Not Connected | USB Traffic Active |
| | RDP > 0.4V | 0 | 0 | Autodetection Circuit Active | External Resistor | Auto Mode |
| | | 0 | 1 | Shorted | Not Connected | Auto Mode Disabled |
| | | 1 | 0 | Connected to Resistor- Divider | External Resistor | Auto Mode Disabled |
| | | 1 | 1 | Connected to TDP/TDM | Not Connected | USB Traffic Active |

Digital Input States - SLG55550A

| V _{DD} | RDP | CB0 | CB1 | DP/DM Position | Internal or External Resis- tor Connected to DP/DM | Comment |
|-----------------|-----|-----|-----|-----------------------------------|---|-----------------------|
| 5.0V | X | 0 | 0 | Autodetection Circuit Active | Internal Resistor | Auto Mode |
| | X | 0 | 1 | Shorted | Not Connected | Auto Mode Disabled |
| | X | 1 | 0 | Connected to Resistor- Divider | External Resistor | Auto Mode Disabled |
| | X | 1 | 1 | Connected to TDP/TDM | Not Connected | USB Traffic Active |

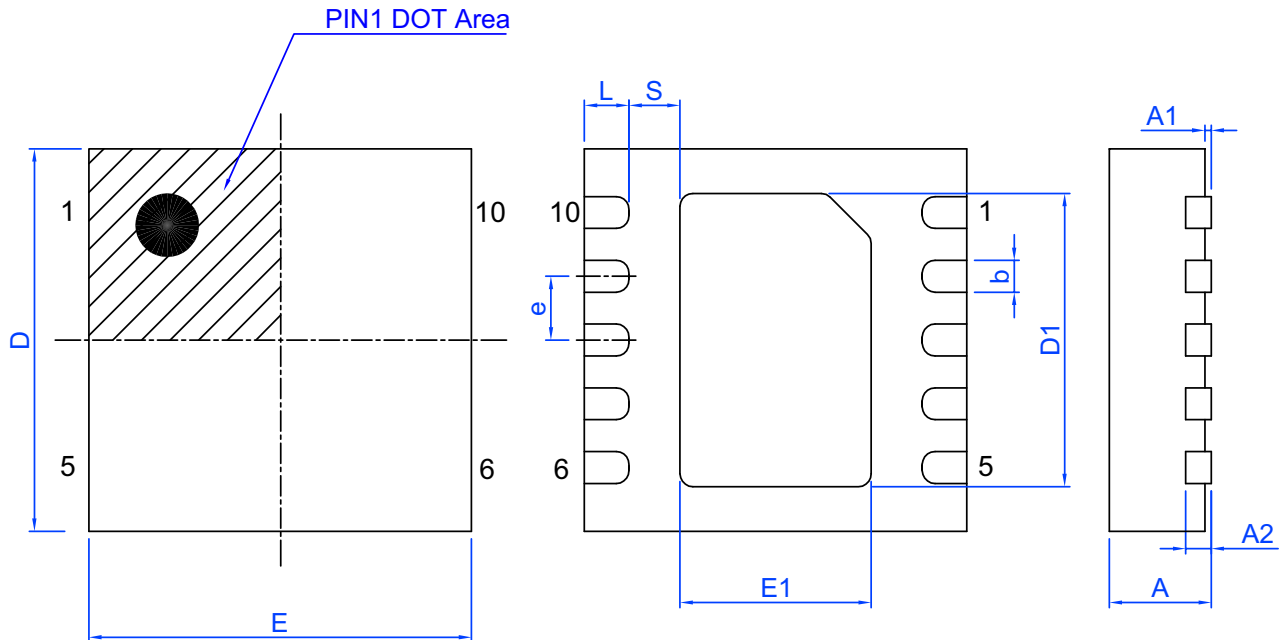
Package Top Marking System Definition



- XXXXX – Part ID Field: identifies the specific device configuration
- DD – Date Code Field: Coded date of manufacture
- LLL – Lot Code: Designates Lot #
- C – Assembly Site/COO: Specifies Assembly Site/Country of Origin
- RR – Revision Code: Device Revision

Package Drawing and Dimensions

10 Lead TDFN Package



Unit: mm

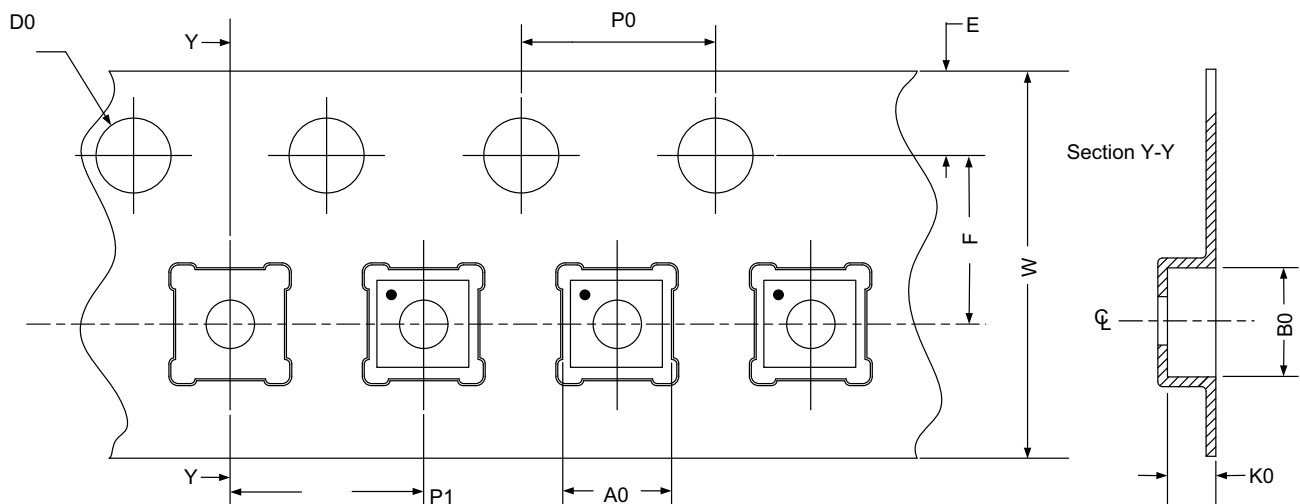
| Symbol | Min | Nom. | Max | Symbol | Min | Nom. | Max |
|--------|----------|------|-------|--------|----------|------|------|
| A | 0.70 | 0.75 | 0.80 | D | 2.95 | 3.00 | 3.05 |
| A1 | 0.005 | - | 0.060 | E | 2.95 | 3.00 | 3.05 |
| A2 | 0.15 | 0.20 | 0.25 | D1 | 2.20 | 2.30 | 2.40 |
| b | 0.20 | 0.25 | 0.30 | E1 | 1.40 | 1.50 | 1.60 |
| C | 0.35 REF | | | e | 0.50 BSC | | |
| S | 0.25 | - | - | L | 0.30 | 0.35 | 0.40 |

Tape and Reel Specifications

| Package Type | # of Pins | Nominal Package Size [mm] | Max Units | | Reel & Hub Size [mm] | Leader (min) | | Trailer (min) | | Tape Width [mm] | Part Pitch [mm] |
|----------------|-----------|---------------------------|-----------|---------|----------------------|--------------|-------------|---------------|-------------|-----------------|-----------------|
| | | | per Reel | per Box | | Pockets | Length [mm] | Pockets | Length [mm] | | |
| TDFN 10L Green | 10 | 3 x 3 x 0.75 | 3,000 | 3,000 | 178 / 60 | 100 | 400 | 100 | 400 | 8 | 4 |

Carrier Tape Drawing and Dimensions

| Package Type | Pocket BTM Length | Pocket BTM Width | Pocket Depth | Index Hole Pitch | Pocket Pitch | Index Hole Diameter | Index Hole to Tape Edge | Index Hole to Pocket Center | Tape Width |
|----------------|-------------------|------------------|--------------|------------------|--------------|---------------------|-------------------------|-----------------------------|------------|
| | A0 | B0 | K0 | P0 | P1 | D0 | E | F | W |
| TDFN 10L Green | 3.25 | 3.25 | 1.1 | 4 | 4 | 1.55 | 1.75 | 3.5 | 8 |



Refer to EIA-481 specification

Recommended Reflow Soldering Profile

Please see IPC/JEDEC J-STD-020: latest revision for reflow profile based on package volume of 6.75 mm³ (nominal). More information can be found at www.jedec.org.

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