

# CND0333A

## Infrared Optical Module (IrDA)

Infrared data link for cellular phones, peripheral devices

### ■ Features

- Compliant with IrDA Ver.1.4
- Light emitting function for remote controller
- Corresponding low I/O (interface) voltage: 1.5 V
- Corresponding reflow solder (260°C)
- Ultra-small top view package (1.5 mm × 8.2 mm × 1.7 mm)

### ■ Type

- GaAlAs LED + IC + PIN Photodiode

### ■ Absolute Maximum Ratings $T_a = 25^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Parameter	Symbol	Rating	Unit
Operating supply voltage	$V_{CC}$	-0.5 to +3.8	V
LED operating supply voltage	$V_{LEDA}$	-0.5 to +7.0	V
Input/output supply voltage	$V_{IO}$	-0.5 to +3.8	V
TX Input voltage	$V_{TX}$	-0.5 to +3.8	V
Shutdown input voltage	$V_{SD}$	-0.5 to +3.8	V
LED operating supply current *	$I_{LEDA}$	300	mA
Operating ambient temperature	$T_{opr}$	-20 to +70	°C
Storage temperature	$T_{stg}$	-30 to +85	°C

Note) \*:  $t_w \leq 90 \mu\text{s}$ , Duty  $\leq 25\%$

### ■ Operating Condition

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating supply voltage	$V_{CC}$		2.5	2.85	3.3	V
LED operating supply voltage	$V_{LEDA}$		3.0		4.5	V
Input/output supply voltage	$V_{IO}$		1.5	1.85	$V_{CC}$	V

**Electrical-Optical Characteristics**  $V_{LEDA} = 3.0 \text{ V to } 4.5 \text{ V}$ ,  $V_{CC} = 2.85 \text{ V}$ ,  $V_{IO} = 1.85 \text{ V}$ ,  $T_a = 25^\circ\text{C} \pm 3^\circ\text{C}$ 

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Shut down supply current *Fig. 1	$I_{CCSD}$	$V_{TXD} = 0.5 \text{ V}$ , $V_{IO} \geq V_{SD} \geq V_{IO} - 0.5 \text{ V}$ (SD = High)	—	0.01	0.2	$\mu\text{A}$
High level supply current (Idle) *Fig. 1	$I_{CCH}$	(FIR mode / RC mode) $E_I = 0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	—	580	800	$\mu\text{A}$
		(SIR mode) $E_I = 0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	—	300	400	
Low level supply current (Active) *Fig. 1	$I_{CCL}$	(FIR mode / RC mode) $E_I = 9.0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	—	980	1270	$\mu\text{A}$
		(SIR mode) $E_I = 9.0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	—	350	460	
TX High level supply current (Active) *Fig. 1	$I_{CCTXH}$	(FIR mode / RC mode) $V_{IO} \geq V_{TXD} \geq V_{IO} - 0.5 \text{ V}$ (TXD = High) $E_I = 0 \text{ mW/cm}^2$ , $V_{SD} \leq 0.5 \text{ V}$	—	1200	1560	$\mu\text{A}$
		(SIR mode) $V_{IO} \geq V_{TXD} \geq V_{IO} - 0.5 \text{ V}$ (TXD = High) $E_I = 0 \text{ mW/cm}^2$ , $V_{SD} \leq 0.5 \text{ V}$	—	600	780	
High level input/output supply current (Idle) *Fig. 1	$I_{IOH}$	(FIR mode / RC mode) $E_I = 0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	0	0	5	$\mu\text{A}$
		(SIR mode) $E_I = 0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	0	0	5	
Low level input/output supply current (Active) *Fig. 1	$I_{IOL}$	(FIR mode / RC mode) $E_I = 9.0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	—	360	470	$\mu\text{A}$
		(SIR mode) $E_I = 9.0 \text{ mW/cm}^2$ , $V_{TXD} = 0.5 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$	—	100	130	
TX High level input/output supply current (Active) *Fig. 1	$I_{IOTXH}$	(FIR mode / RC mode) $V_{IO} \geq V_{TXD} \geq V_{IO} - 0.5 \text{ V}$ (TXD = High) $E_I = 0 \text{ mW/cm}^2$ , $V_{SD} \leq 0.5 \text{ V}$	—	80	120	$\mu\text{A}$
		(SIR mode) $V_{IO} \geq V_{TXD} \geq V_{IO} - 0.5 \text{ V}$ (TXD = High) $E_I = 0 \text{ mW/cm}^2$ , $V_{SD} \leq 0.5 \text{ V}$	—	40	60	
SD High level input voltage	$V_{IHSD}$		$V_{IO} - 0.5$	—	$V_{IO} + 0.3$	V
SD Low level input voltage	$V_{ILSD}$		0 -0.3	—	0.5	V
Maximum reception distance *Fig. 1, 4	$L_{\text{max}}$	$V_{SD} \leq 0.5 \text{ V}$ $\theta_T = 0^\circ \pm 15^\circ$ LEDie = 3.6 mW/sr (SIR mode) LEDie = 9 mW/sr (FIR mode)	21.8	—	—	cm
RC maximum reception distance *Fig. 1	$L_{\text{maxR}}$	$V_{LEDA} = 3.0 \text{ V}$ , $V_{SD} \leq 0.5 \text{ V}$ $\theta_T = 0^\circ \pm 15^\circ$ , RC Receiver sensitivity *2 = 0.05 $\mu\text{W/cm}^2$	5.0	—	—	m
Data Rates *1	—		0.0096	—	4.0	Mbps

Note) \*1: Fully Compliant to IrDA1.4 Low Power Specification from 9.6 kbps to 115.2 kbps, 4 Mbps.

\*2: Definition of RC receiver sensitivity

RC receiver sensitivity is adjusted so that RC transfer distance is 4 m at transmitter LED radiant intensity = 8 mW/sr, peak wave length = 940 nm and duty = 50 %, where irradiance is 0.05  $\mu\text{W/cm}^2$ .

**■ Electrical-Optical Characteristics (continued)**  $V_{LEDA} = 3.0\text{ V to }4.5\text{ V}$ ,  $V_{CC} = 2.85\text{ V}$ ,  $V_{IO} = 1.85\text{ V}$ ,  $T_a = 25^\circ\text{C} \pm 3^\circ\text{C}$ 

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Transmitter</b>						
Peak emission wavelength *Fig. 1	$\lambda_p$	(FIR mode / RC mode) $V_{LEDA} = 3.2\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty1/4	880	890	900	nm
		(SIR mode) $V_{LEDA} = 3.2\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty3/16	875	885	900	
LED operating supply current *Fig. 1	$I_{LEDA}$	(FIR Mode/RC Mode) $V_{LEDA} = 4.3\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty1/4	165	207	248	mA
		(FIR Mode/RC Mode) $V_{LEDA} = 3.0\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty1/4	160	200	240	
		(SIR Mode) $V_{LEDA} = 4.3\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty3/16	70	91	109	
		(SIR Mode) $V_{LEDA} = 3.0\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty3/16	69	90	108	
Center radiant intensity *3	$\theta_T = 0$ *Fig. 1, 2	(FIR Mode/RC Mode) $V_{LEDA} = 3.0\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty1/4	27	55	83	mW/sr
		(SIR Mode) $V_{LEDA} = 3.0\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty3/16	13	27	40	
	$\theta_T = \pm 15$ *Fig. 1, 2, 10	(FIR Mode/RC Mode) $V_{LEDA} = 3.0\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty1/4	23	38	57	mW/sr
		(SIR Mode) $V_{LEDA} = 3.0\text{ V}$ , $V_{SD} \leq 0.5\text{ V}$ , Duty3/16	7	19	28	
TX high level input voltage	$V_{IH(TX)}$		$V_{IO} - 0.5$	—	$V_{CC} + 0.3$	V
TX low level input voltage	$V_{IL(TX)}$		0 -0.3	—	0.5	V
TX pulse width (SIR) *Fig. 1, 8	$t_{WT(SIR)}$	Bit Rate = 115.2 kbps, $V_T = 1/2 \times V_{IO}$	—	1.6	—	$\mu\text{s}$
TX pulse width (FIR) *Fig. 1, 8	$t_{WT(FIR)}$	Bit Rate = 4.0 Mbps, $V_T = 1/2 \times V_{IO}$	—	125	—	ns
Optical pulse width (FIR1) *Fig. 1, 3	$t_{WO(FIR1)}$	$V_{SD} \leq 0.5\text{ V}$ , TXD $t_r / t_f \leq 20\text{ ns}$ , $t_w = 125\text{ ns} \pm 1\text{ ns}$ , (Single pulse)	115	125	135	ns
Optical pulse width (FIR2) *Fig. 1, 3	$t_{WO(FIR2)}$	$V_{SD} \leq 0.5\text{ V}$ , TXD $t_r / t_f \leq 20\text{ ns}$ , $t_w = 250\text{ ns} \pm 1\text{ ns}$ , (Double pulse)	240	250	260	ns
TX half-angle	$\theta_T$		$\pm 15$	—	—	$^\circ$
Rise time *Fig. 1, 3	$t_r$	$R_L = 50\ \Omega$	—	—	40	ns
Fall time *Fig. 1, 3	$t_f$	$R_L = 50\ \Omega$	—	—	40	ns
TX wake up time *Fig. 5	$t_{TWU}$		200	—	1000	$\mu\text{s}$
Intensity delay time *Fig. 1, 3	$I_{DT}$		—	—	200	ns
Maximum pulse width	$t_{WLEDmax}$	TXD = Low $\rightarrow$ High	20	50	100	$\mu\text{s}$
Overshoot	$O_S$		—	—	25	%

Note) \*3: Eye-Safety IEC60825-1 Class1 Eye safe

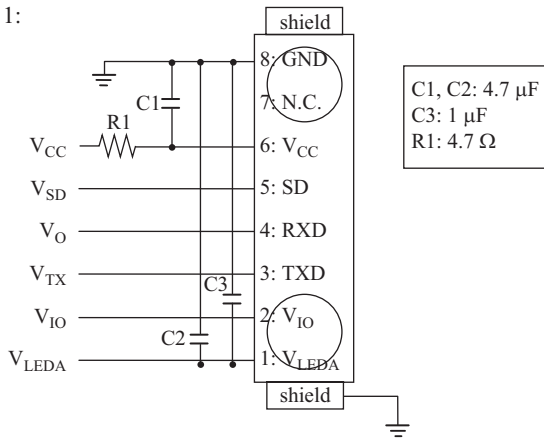
**■ Electrical-Optical Characteristics (continued)**  $V_{LEDA} = 3.0 \text{ V to } 4.5 \text{ V}$ ,  $V_{CC} = 2.85 \text{ V}$ ,  $V_{IO} = 1.85 \text{ V}$ ,  $T_a = 25^\circ\text{C} \pm 3^\circ\text{C}$ 

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Receiver</b>						
Minimum input irradiance *Fig. 1	$E_{I\min1}$	(SIR mode) Bit Rate = 115.2 kbps, $V_{SD} \leq 0.5 \text{ V}$ , $\theta_T = 0^\circ \pm 15^\circ$	—	—	7.6	$\mu\text{W}/\text{cm}^2$
	$E_{I\min2}$	(FIR Mode) Bit Rate = 4.0 Mbps, $V_{SD} \leq 0.5 \text{ V}$ , $\theta_T = 0^\circ \pm 15^\circ$	—	—	19.0	
Maximum input irradiance *Fig. 1	$E_{I\text{mix}}$	$V_{SD} \leq 0.5 \text{ V}$ , $\theta_T = 0^\circ \pm 15^\circ$	500	—	—	$\text{mW}/\text{cm}^2$
RX high level output voltage *Fig. 1	$V_{OH(RX)}$	Non signal condition $E_I = 0$ $I_{OH} = -200 \mu\text{A}$ , $V_{SD} \leq 0.5 \text{ V}$	$V_{IO} - 0.3$	—	$V_{IO}$	V
RX low level output voltage *Fig. 1	$V_{OL(RX)}$	$I_{OL} = 1.8 \text{ mA}$ , $V_{SD} \leq 0.5 \text{ V}$	0	—	0.5	V
RX half angle	$\theta_R$		$\pm 15$	—	—	°
Output pulse width (SIR) *Fig. 1, 9	$t_{WR(SIR)}$	$V_{SD} \leq 0.5 \text{ V}$ , $C_L = 15 \text{ pF}$ , 9.6 kbps to 115.2 kbps	1.0	—	4.0	$\mu\text{s}$
Output pulse width (FIR1) *Fig. 1, 9	$t_{WR(FIR1)}$	$V_{SD} \leq 0.5 \text{ V}$ , $C_L = 15 \text{ pF}$ , 4 Mbps, $t_W = 125 \text{ ns}$ (Single pulse)	85	—	165	ns
Output pulse width (FIR2) *Fig. 1, 9	$t_{WR(FIR2)}$	$V_{SD} \leq 0.5 \text{ V}$ , $C_L = 15 \text{ pF}$ , 4 Mbps, $t_W = 250 \text{ ns}$ (Double pulse)	195	—	290	ns
RX wake up time *Fig. 1, 6	$t_{Rwu}$	$V_{SD} \leq 0.5 \text{ V}$ , $E_I = 19.0 \mu\text{W}/\text{cm}^2$	—	100	200	$\mu\text{s}$
Receiver latency time *Fig. 1, 7	$t_L$	$V_{SD} \leq 0.5 \text{ V}$ , $E_I = 19.0 \mu\text{W}/\text{cm}^2$	—	100	200	$\mu\text{s}$
Rise time *Fig. 1, 9	$t_r$	$V_{SD} \leq 0.5 \text{ V}$ , $C_L = 15 \text{ pF}$	—	10	—	ns
Fall time *Fig. 1, 9	$t_f$	$V_{SD} \leq 0.5 \text{ V}$ , $C_L = 15 \text{ pF}$	—	10	—	ns

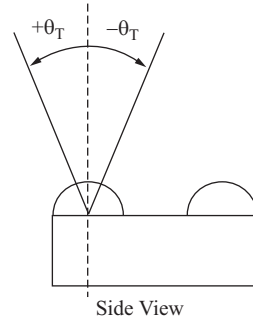
Electrical-Optical Characteristics (continued)

Note) Measurement circuit

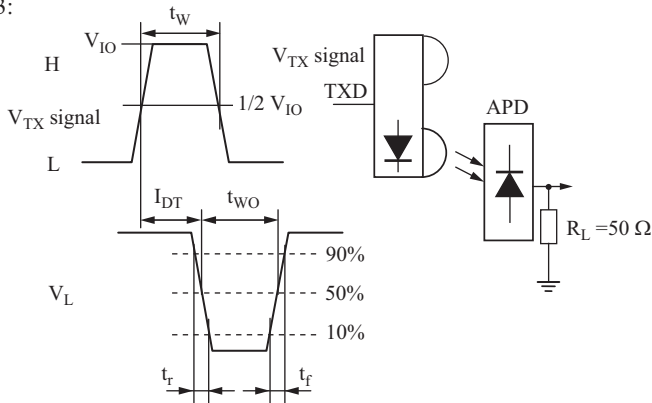
\*Fig. 1:



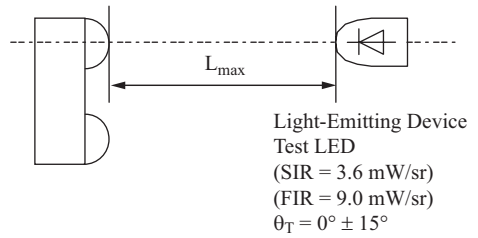
\*Fig. 2:



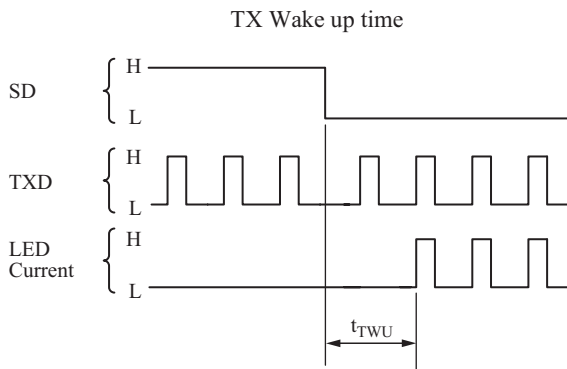
\*Fig. 3:



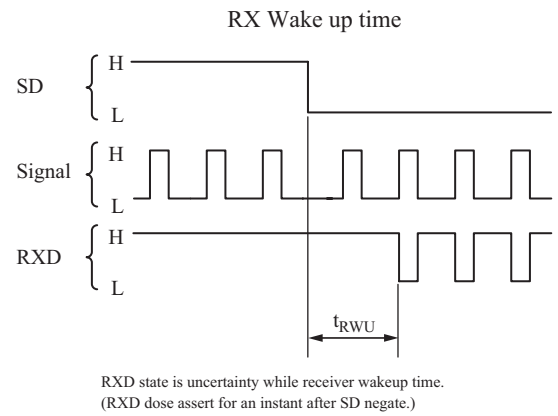
\*Fig. 4:



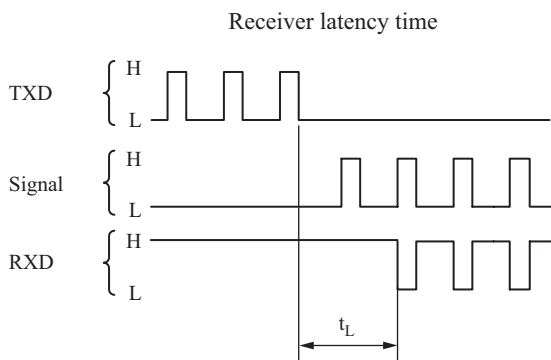
\*Fig. 5:



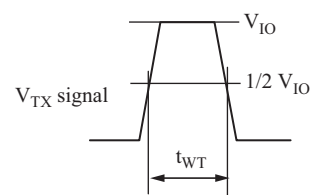
\*Fig. 6:



\*Fig. 7:



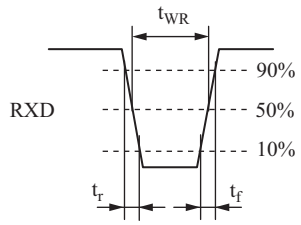
\*Fig. 8:



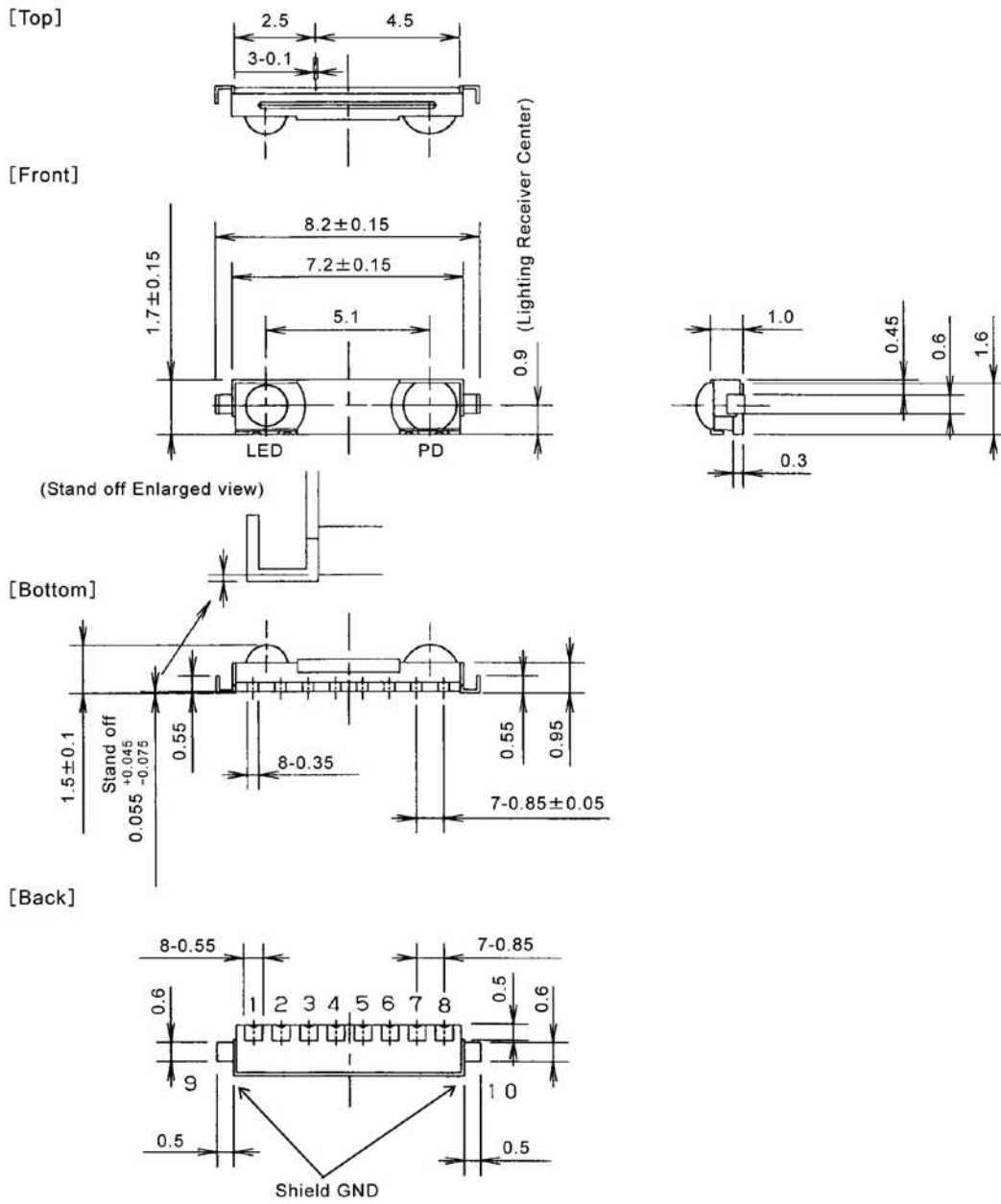
## ■ Electrical-Optical Characteristics (continued)

Note) Measurement circuit (continued)

\*Fig. 9:



■ Package (Unit: mm)



• Pin name

- |                      |                    |
|----------------------|--------------------|
| 1. V <sub>LEDA</sub> | 6. V <sub>CC</sub> |
| 2. V <sub>IO</sub>   | 7. N.C.            |
| 3. TXD               | 8. GND             |
| 4. RXD               | 9. Shield GND      |
| 5. SD                | 10. Shield GND     |

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