CS6707

200Mbps Fiber-Optic LED Driver

GENERAL DESCRIPTION

The CS6707 is a high-speed fiber optic LED driver ideally suited for applications up to 200Mbps. The CS6707 accepts differential PECL inputs which can be shaped, if desired, by pins PWAI (Pulse Width Adjust Increase) or PWAD (Pulse Width Adjust Decrease).

Simply leave these two pins unconnected if no adjustment is needed, then default mark/space ratio is about 42/58. To improve LED “on and off” time, a peaking and clamp circuit is included in the CS6707 which may be set via a RC network.

The temperature independent drive current of the CS6707 can be set via an external resistor between the RMOD pin and the ground. An external resistor between pins RMOD and RMOD1 is used to compensate the drive current for temperature changes. Normally the CS6707 is direct coupled to PECL inputs, however if AC coupling is desired, a 1/3V_{DD} bias point is recommended. Please refer to the application circuit schematic for more details.

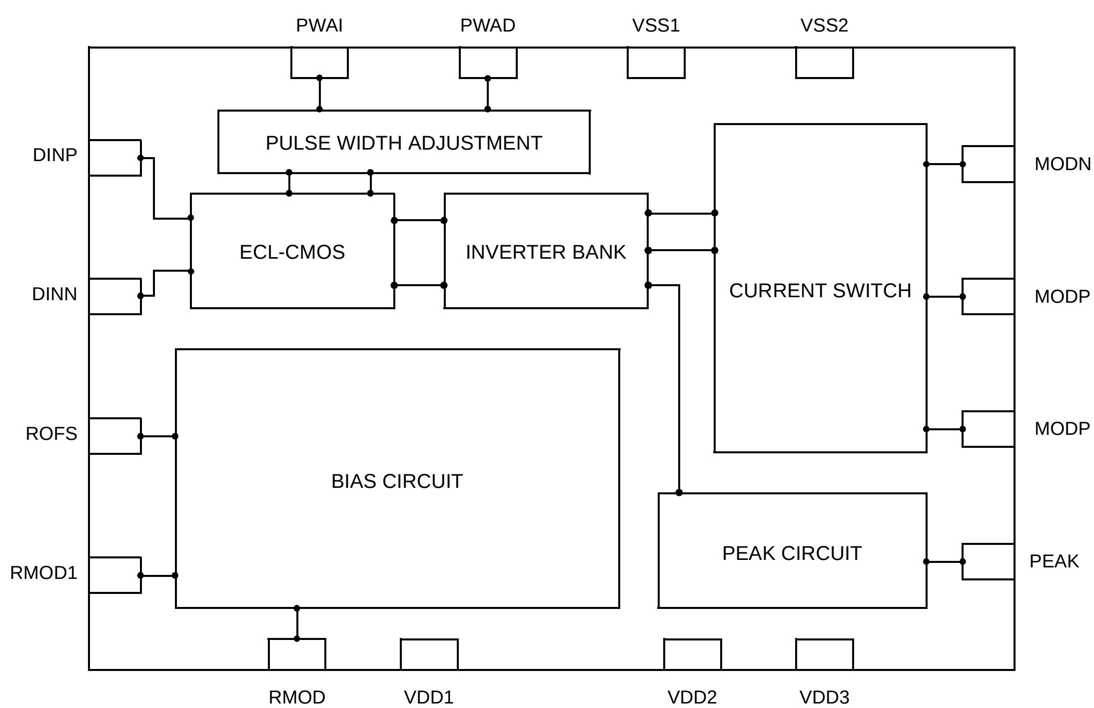
FEATURES

- Rise/fall time < 1ns, suited for applications up to 200Mbps.
- Maximum programmable 100mA LED drive current.
- Maximum 2V LED forward voltage drop.
- Differential PECL inputs with optional pulse width adjust feature.
- Temperature compensation of the LED driving current.
- Supports both 3.3 and 5 Volt operation.
- Available as die or in QSOP-16/TSSOP-20 packages.

APPLICATIONS

- FDDI
- SDH STM-1
- SONET OC-3
- Fiber Channel
- 100BaseF Ethernet
- LED Driver Transmitters

BLOCK DIAGRAM



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DIE CONNECTION DIAGRAM

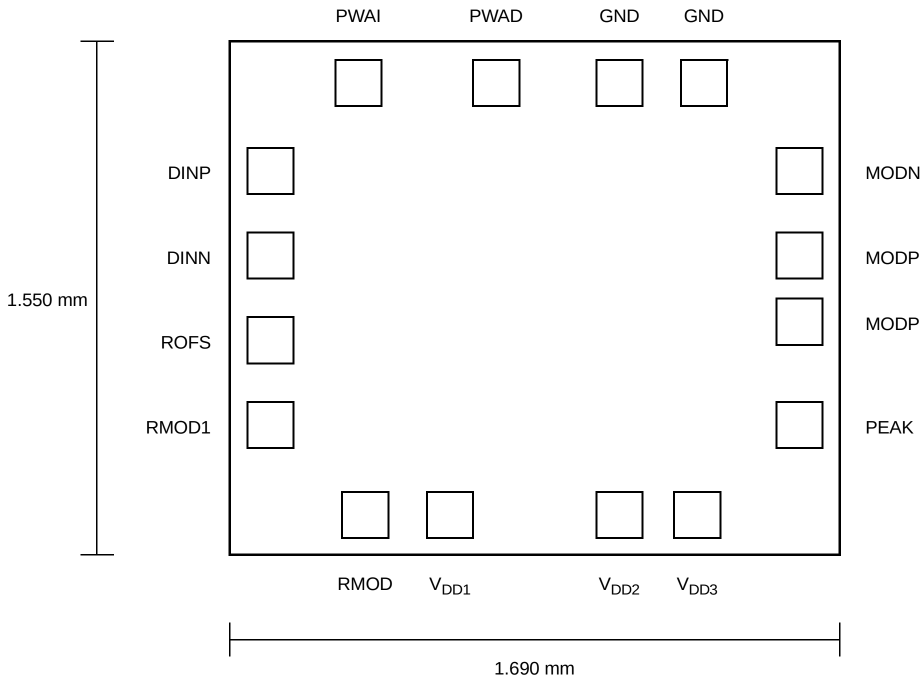


Figure-1

PIN CONNECTION DIAGRAM

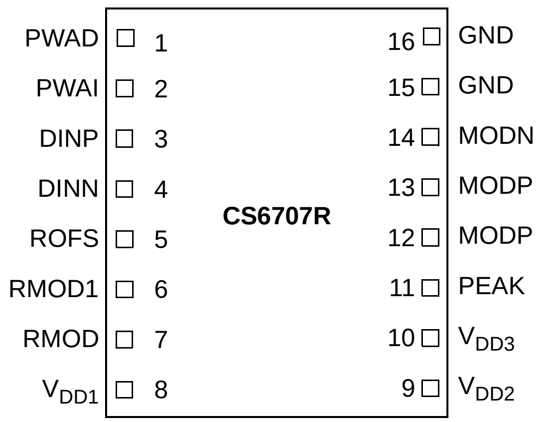


Figure-1 QSOP-16

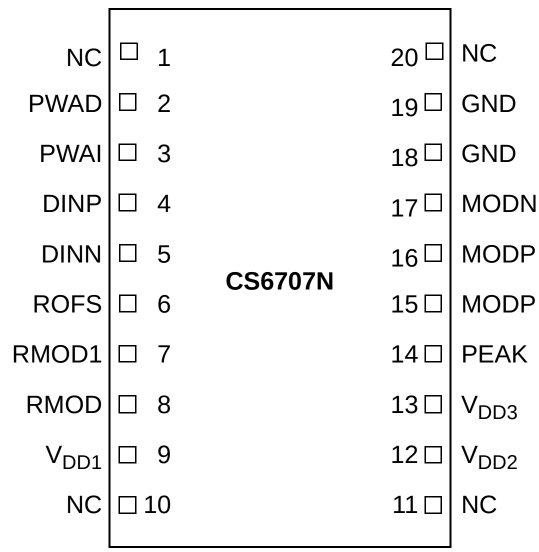


Figure-2 TSSOP-20

PIN DESCRIPTION

Name	Pin QSOP-16	Pin TSSOP-20	Die Pad	Description
PWAD	1	2	1	Pulse width adjustment decrease pin.
PWAI	2	3	2	Pulse width adjustment increase pin.
DINP	3	4	3	Differential data input pin. Complementary to DINN.
DINN	4	5	4	Inverse differential data input pin. Complementary to DINP.
ROFS	5	6	5	ECL to CMOS bias current set pin.
RMOD1	6	7	6	Temperature compensation adjustment pin.
RMOD	7	8	7	Temperature independent drive current set pin.
V_{DD1}	8	9	8	Analog power Pin. Connect to most positive supply voltage.
V_{DD2}	9	12	9	Digital power pin. Connect to most positive supply voltage.
V_{DD3}	10	13	10	LED pin. Connect to most positive supply voltage to speed 'off' time of LED if clamping circuit is not used.
PEAK	11	14	11	Connection for peaking circuit. Please refer to the application schematic.
MODP	12	15	12	Driver output pin. Connect LED between this pin and V_{DD}.
MODP	13	16	13	Driver output pin. Connect LED between this pin and V_{DD}.
MODN	14	17	14	Logical inverse of pins MODP. Connect a resistor of approximately the same value as LED between this pin and V_{DD}.
GND	15	18	15	Ground Pin. Connect to the most negative supply voltage.
GND	16	19	16	Ground Pin. Connect to the most negative supply voltage.
N.C.		1,10, 11,20		No connection.

PRODUCT DESCRIPTION

The CS6707 consists of a modulation current drive with temperature compensation, the pulse width adjustment circuit, the peaking and clamping circuit.

Modulation Current Drive With Temperature Compensation

A. Temperature Independent

The modulation current (Imod) can be set by connecting a resistor Rset bwtween the Rmod pin and the ground. One can set Imod by choicing the unique Rset from the figure -4 or figure-5 depending on Vdd=3.3V or Vdd=5V. The figure-4 and figure-5 show the relation between Imod and Rset independent of temperature compensation. The approximation relation between Imod and Rset is

$$\mathbf{Imod = K1 \times \frac{Vref}{Rset}}$$

Vref is the voltage at the Rmod pin about 1.13V, K1 is 1100±100.

B. Temperature Dependent

If the temperature compensation of the LED current is desired. One can use the Table-1, Figure-6, Figure-4, Figure-5 to implement the temperature compensation feature. The Table-1 and Figure-6 show the internal diode threshold voltage (Vth) via the various R_{TCM} value at different temperature, which R_{TCM} is a resistor between the Rmod pin and the Rmod1 pin. One can use the formula below to set the R_{TCM}.

$$\mathbf{R_{TCM} \doteq K1 \times \frac{Vth\ (T1) - Vth\ (T2)}{Imod\ (T2) - Imod\ (T1)}}$$

T2 and T1 are the different termperature, T2 >T1. Then use

$$\mathbf{Imod\ (T1) = K1 \times \left[\frac{Vref}{Rset} + \frac{Vref - Vth\ (T1)}{R_{TCM}}\right]}$$

to set the Rset value.

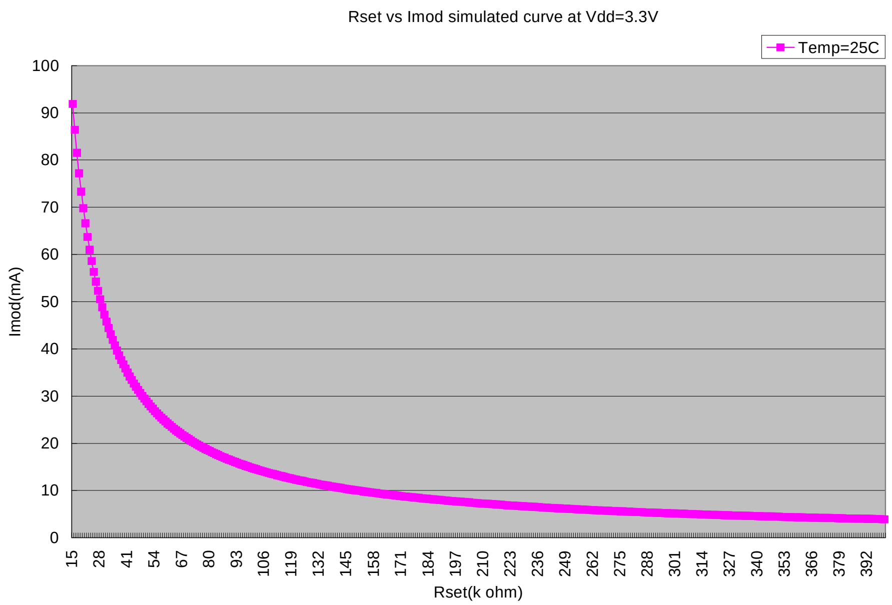
The pulse width adjustment

The pulse width of the LED ON/OFF time can be set with connecting the PWAI and PWAD pins to the ground by a resistor Rpwai and Rpwad individually. If let Rpwad floating and Rpwai connect, the LED ON time will increase. If let Rpwai floating and Rpwad connect, the LED ON time will decrease. Refer to the Fingure-7, Fingure-8, Fingure-9 and Fingure-10 to get the Rpwai and Rpwad setting.

The peaking and clamping circuit

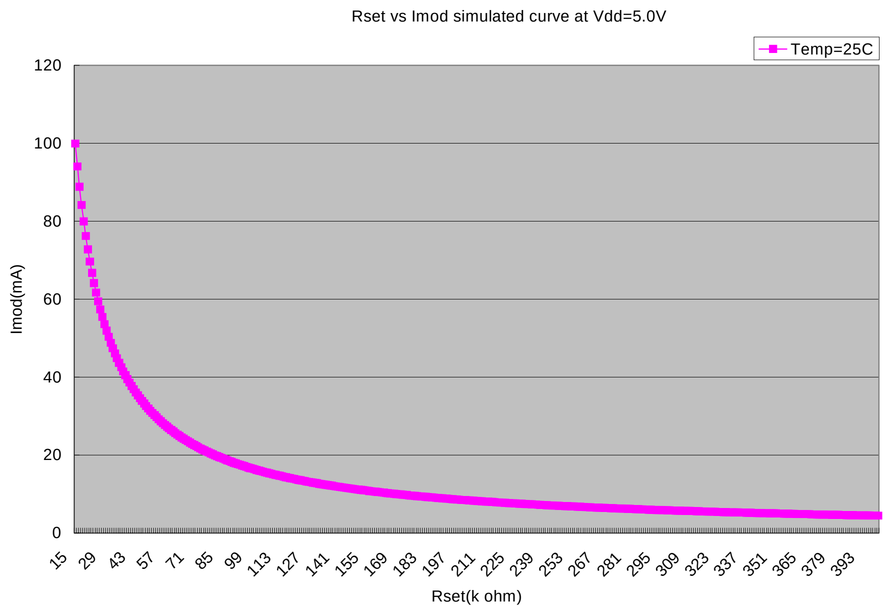
Generally. The turn-off time of the LED is longer than the turn-on time. One can use the clamping circuit to improve this situation. The clamping feature can get by the V_{DD3} pin connection. If the V_{DD3} pin is floating, then the clamping feature is off. The clamping circuit will delay the turn-on time of the LED. It becomes noticeable when the LED driving current is low. One can connect a RC network between the MODP and PEAK pins to slove this problem. See the application ciucuits to get the detail information.

TYPICAL OPERATING CURVE



- Both MODP and MODN pins connect a 20Ω resistor to Vdd.
- Rofs pin is floating.

Figure-4



- Both MODP and MODN pins connect a 20Ω resistor to Vdd.
- Rofs pin is floating.

Figure-5

Table 1. Vth vs R_{TCM} At Different Temperature

Vth(mV) \ R_{TCM} / T	0.4K	0.5K	0.6K	0.7K	0.8K	0.9K	1.0K	1.1K	1.2K	1.3K	1.4K	1.5K
-40°C	876	873	871	865	863	862	860	858	857	856	854	853
-20°C	852	848	845	838	836	833	832	830	829	828	825	825
0°C	824	820	813	810	808	806	803	801	800	798	797	795
25°C	791	781	778	774	772	769	767	765	763	761	760	758
50°C	751	747	742	739	736	734	731	729	727	725	724	722
70°C	727	721	716	712	708	705	702	700	698	697	697	697
85°C	706	699	695	690	687	685	685	685	685	685	684	684

Vth(mV) \ R_{TCM} / T	1.6K	1.8K	2.0K	2.2K	2.4K	2.6K	2.8K	3.0K	3.5K	4.0K	4.5K	5.0K
-40°C	852	849	847	846	844	843	841	839	836	833	830	826
-20°C	824	822	820	818	816	815	813	812	809	807	805	803
0°C	794	792	790	787	786	785	783	782	779	777	775	774
25°C	757	755	752	750	748	747	745	745	743	741	740	738
50°C	721	719	718	718	717	716	715	714	712	710	709	708
70°C	696	696	695	694	693	692	691	690	687	685	683	681
85°C	684	684	683	682	681	680	679	678	676	673	671	669

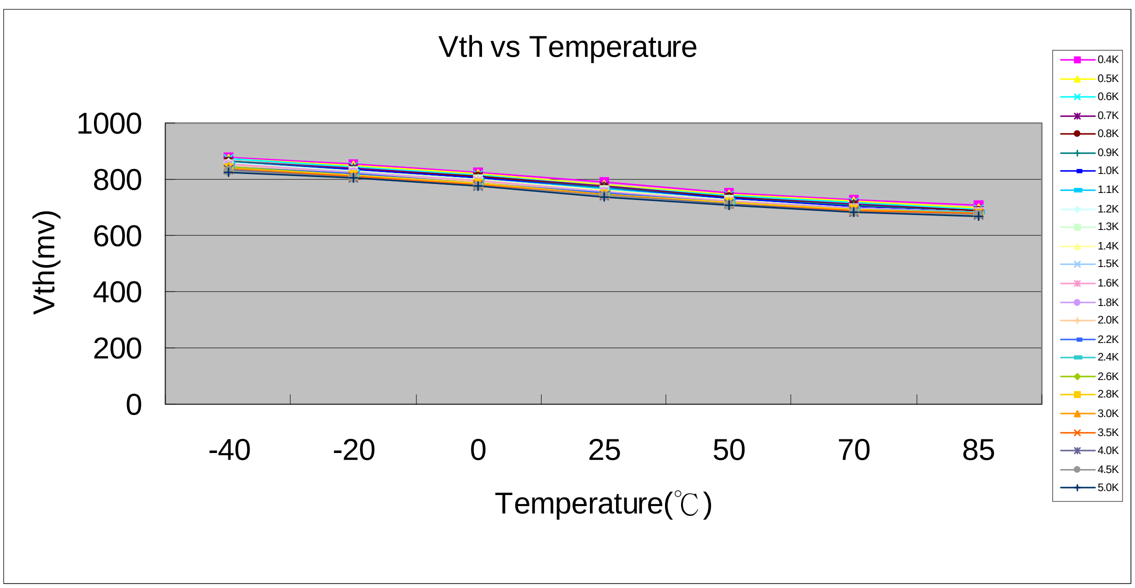
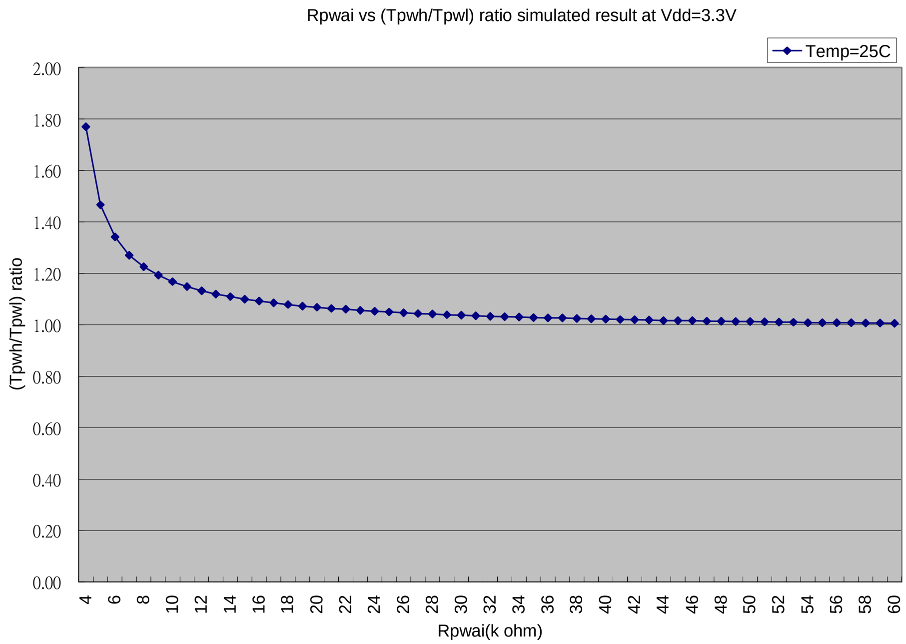
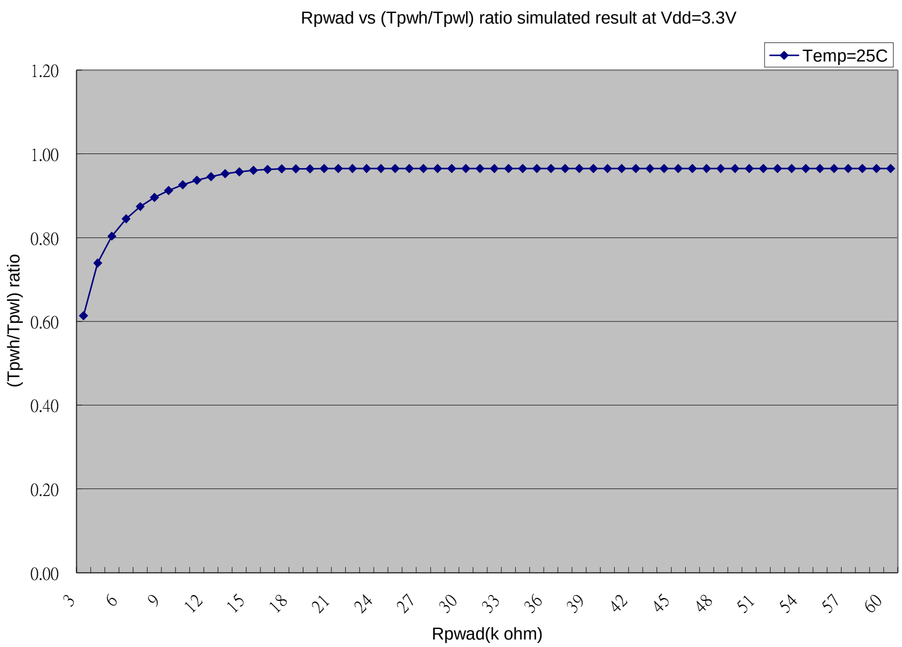


Figure-6



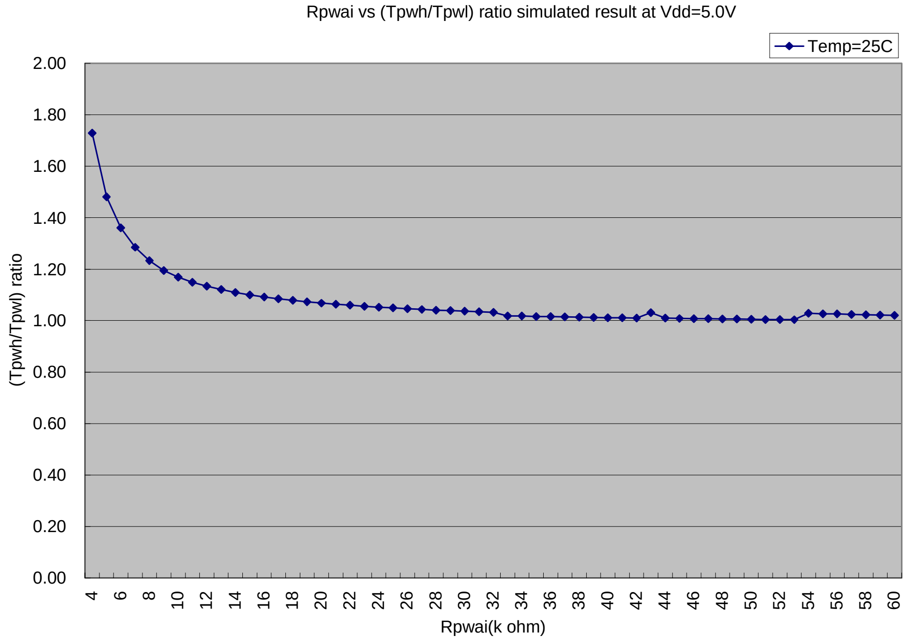
- Both MODP and MODN pins connect a 20Ω resistor to Vdd.
- Rofs and Rpwad pins are floating.
- Rset=20KΩ.
- The fix frequency of the input signal is 50MHz.
- Tpwh is the ON time interval.
- TpwL is the OFF time interval.

Figure-7



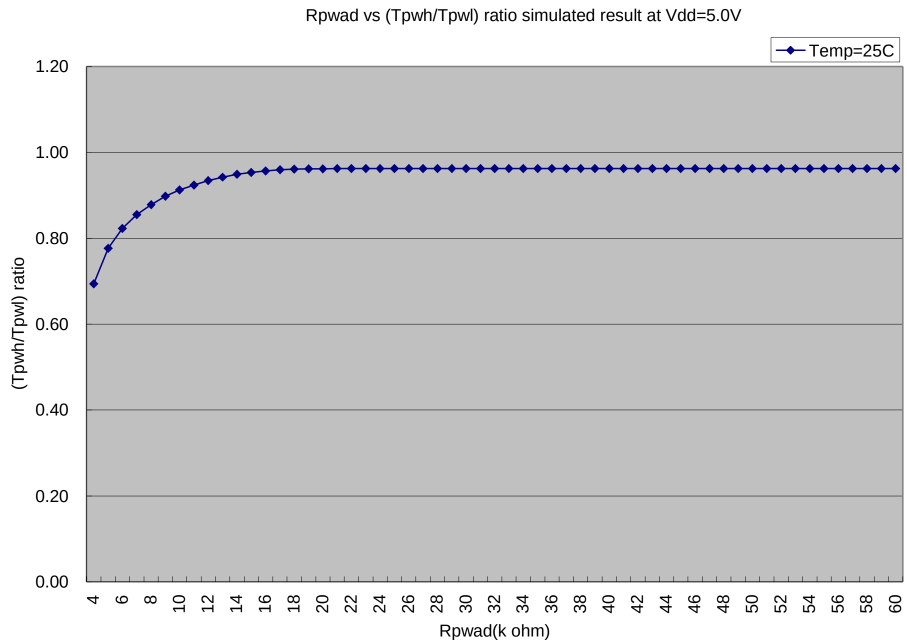
- Both MODP and MODN pins connect a 20Ω resistor to Vdd.
- Rofs and Rpwai pins are floating.
- Rset=20KΩ.
- The fix frequency of the input signal is 50MHz.
- Tpwh is the ON time interval.
- TpwL is the OFF time interval.

Figure-8



- Both MODP and MODN pins connect a 20Ω resistor to Vdd.
- Rofs and Rpwad pins are floating.
- Rset=20KΩ.
- The fix frequency of the input signal is 50MHz.
- Tpwh is the ON time interval.
- TpwL is the OFF time interval.

Figure-9



- Both MODP and MODN pins connect a 20Ω resistor to Vdd.
- Rofs and Rpwai pins are floating.
- Rset=20KΩ.
- The fix frequency of the input signal is 50MHz.
- Tpwh is the ON time interval.
- TpwL is the OFF time interval.

Figure-10

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
$V_{DD1, 2, 3}$	Power supply ($V_{DD1, 2, 3}$ - Gnd)	6	V
T_a	Operating ambient	-40 to +85	°C
T_{stg}	Storage temperature	-65 to +150	°C

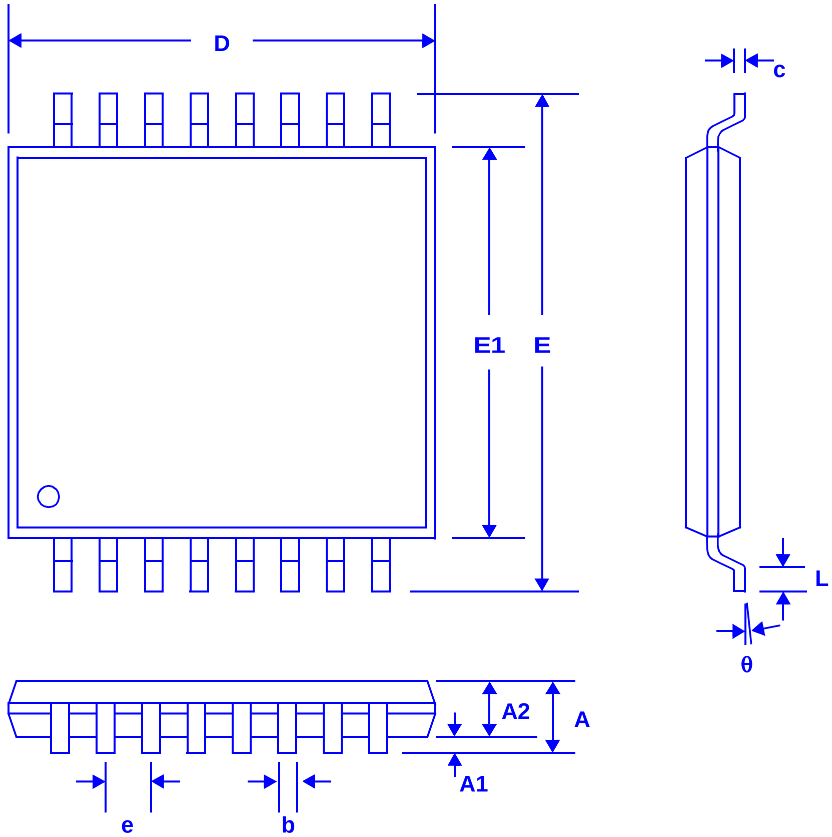
RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Rating	Unit
$V_{DD1, 2, 3}$	Power supply ($V_{DD1, 2, 3}$ - Gnd)	3 to 5.5	V
T_a	Operating ambient temperature	-40 to +85	°C

ELECTRICAL CHARACTERISTICS

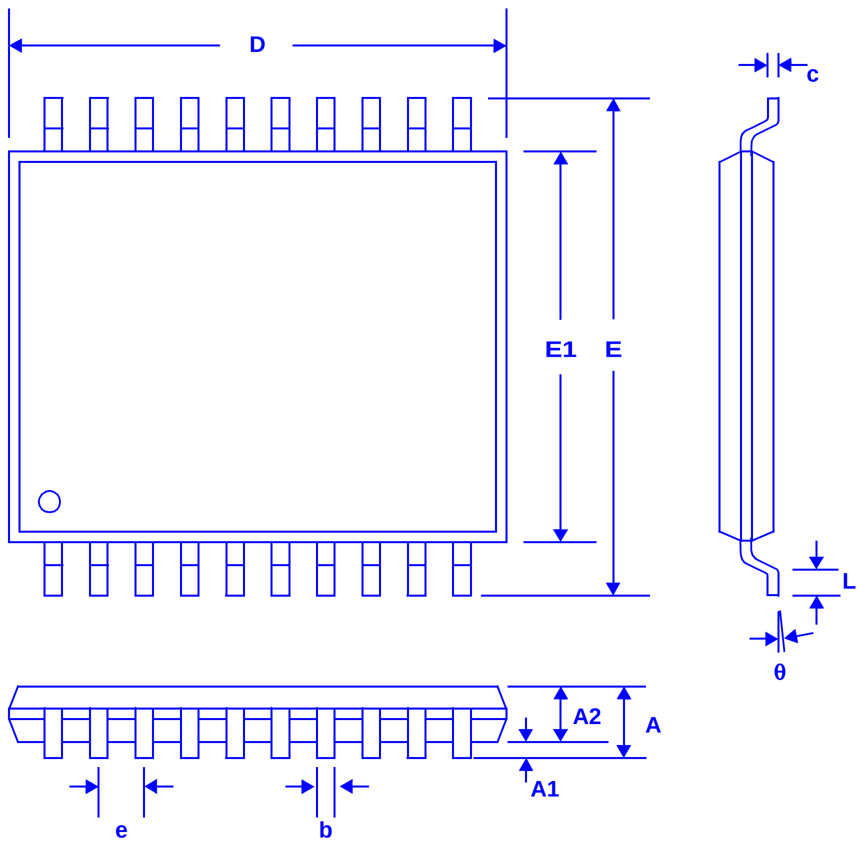
Symbol	Parameter	Min	Typ	Max	Unit
Imod	Range of programmable drive current @200MHz	40	-	110	mA
ViL	PECL input low	-	V_{DD} - 1.75	V_{DD} - 1.6	V
Vih	PECL input high	V_{DD} - 1.05	V_{DD} - 0.95	-	V
I_{DD}	Supply current without modulation current	-	25	45	mA
Vled	LED forward voltage	-	-	2	V
Tr/Tf	Rise/fall time	-	700	1000	ps
Jr	Jitter	-	400	800	ps

PACKAGE OUTLINE (16-pin QSOP)



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.346	1.626	1.753	0.053	0.064	0.069
A1	0.102	0.152	0.254	0.004	0.006	0.010
A2	-	-	1.499	-	-	0.059
b	0.203	-	0.305	0.008	-	0.012
c	0.178	-	0.254	0.007	-	0.010
D	4.801	4.902	5.004	0.189	0.193	0.197
E	5.791	5.994	6.198	0.228	0.236	0.244
E1	3.810	3.912	3.988	0.150	0.154	0.157
e	-	0.635	-	-	0.025	-
L	0.406	0.635	1.270	0.016	0.025	0.050
θ	0°	-	8°	0°	-	8°

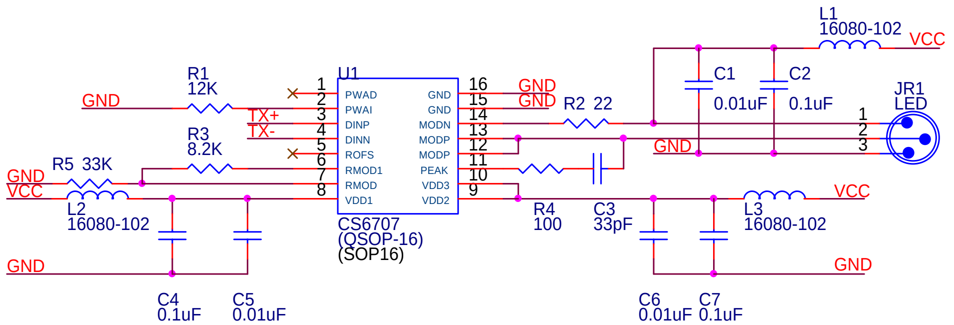
PACKAGE OUTLINE (20-pin TSSOP)



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	MIN	NOM	MAX	MIN	NOM	MAX
A	-	-	1.2	-	-	0.48
A1	0.05	-	0.15	0.002	-	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	-	0.30	0.007	-	0.012
c	0.09	-	0.20	0.004	-	0.008
D	6.40	6.50	6.60	0.252	0.256	0.260
E	-	6.40	-	-	0.252	-
E1	4.30	4.40	4.50	0.169	0.173	0.177
e	-	0.65	-	-	0.026	-
L	0.45	0.60	0.75	0.018	-	0.030
θ	0°	-	8°	0°	-	8°

APPLICATION CIRCUIT SCHEMATICS

VCC=5V APPLICATION CIRCUIT



VCC=3.3V APPLICATION CIRCUIT

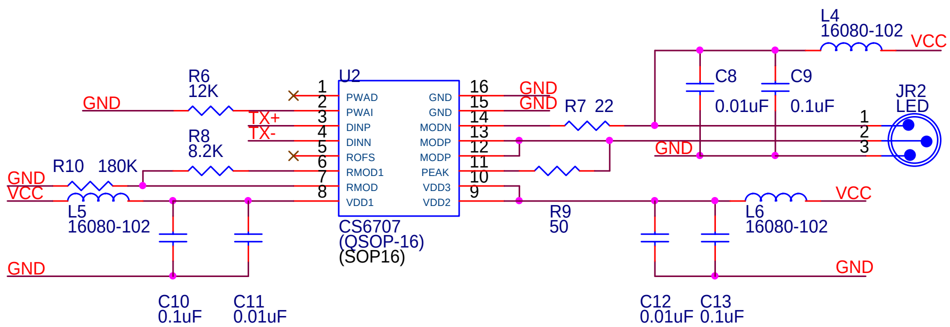
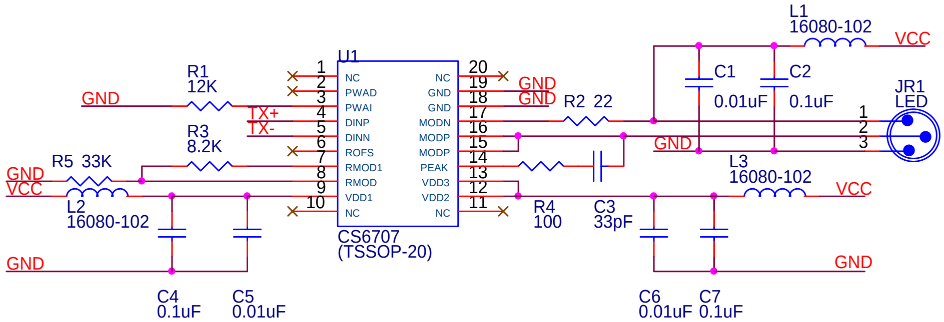


Figure-11 Using QSOP-16 and SOP-16 packages

APPLICATION CIRCUIT SCHEMATICS (continued)

VCC=5V APPLICATION CIRCUIT



VCC=3.3V APPLICATION CIRCUIT

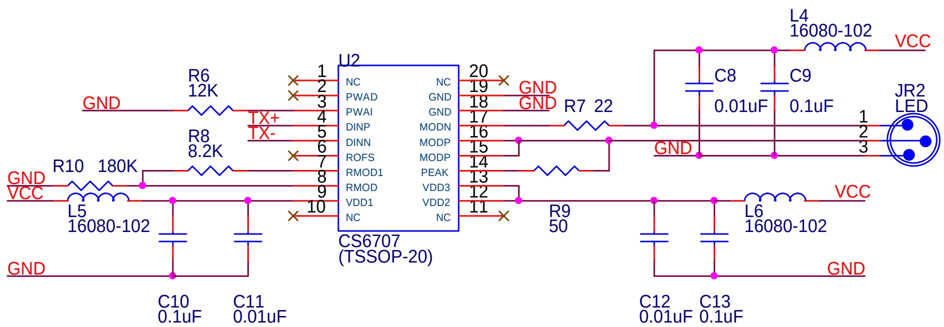


Figure-12 Using TSSOP-20 package

ORDERING INFORMATION

Part Number

Prefix	Part Type	Package Type
CS	6707	Z: Die
CS	6707	R: QSOP
CS	6707	N: TSSOP