M81049P/SP/FP

OCTAL D-TYPE FLIP-FLOP DRIVER WITH CLEAR

DESCRIPTION

M81049 is octal D-type flip-flop driver by 20-pin package. It has 8 same circuit units which is composed of D-type flip-flop logic circuit and high voltage NchMOS output transistor. M81049 has a common direct clear input and a common clock input.

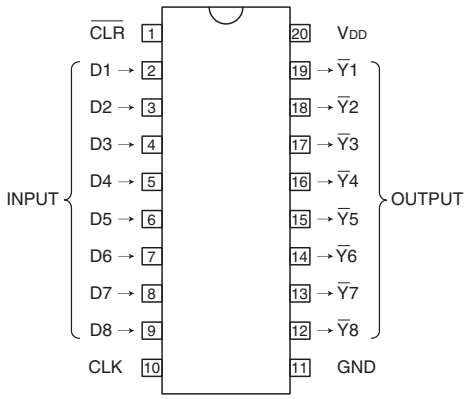
FEATURES

- Lineup with three packages
- High breakdown voltage ($BV_{DSX} \geq 40V$)
- Drain output current ($I_{DS(max)} = 200mA$)
- With input protection diodes
- Pin assignment of input-output flow through
- Wide operating temperature range (Ta = –40 to +85°C)

APPLICATION

LED drive

PIN CONFIGURATION (TOP VIEW)



Package type 20P4(P)
20P4B(SP)
20P2N(FP)

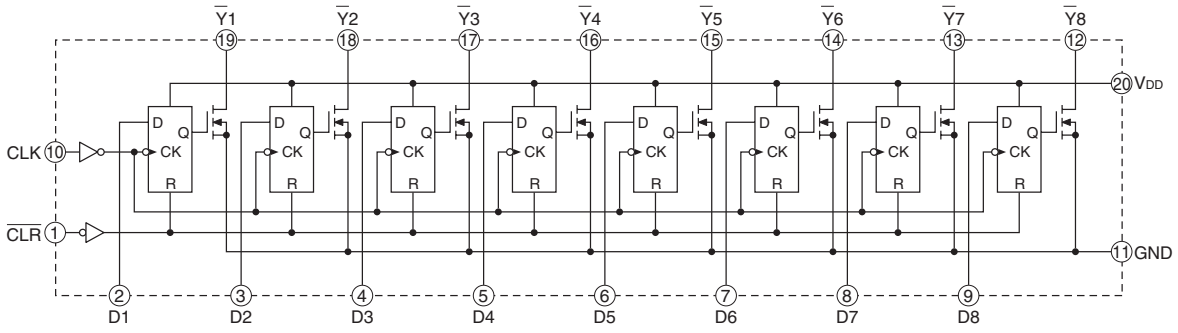
FUNCTION

The common direct clear input and common clock input are connected to every circuit unit by the same way. Signal at the D inputs is transferred to $\overline{Y}$ outputs by D-type flip-flops on the positive-going edge of the clock pulse.

If $\overline{CLR}$ is set to "L", outputs $\overline{Y}1$-$\overline{Y}8$ will be altogether set to "H" regardless of D1-D8 and CLK.

The maximum drain current of an output is 200mA. The maximum between drain-source is 40V.

LOGIC DIAGRAM (POSITIVE LOGIC)



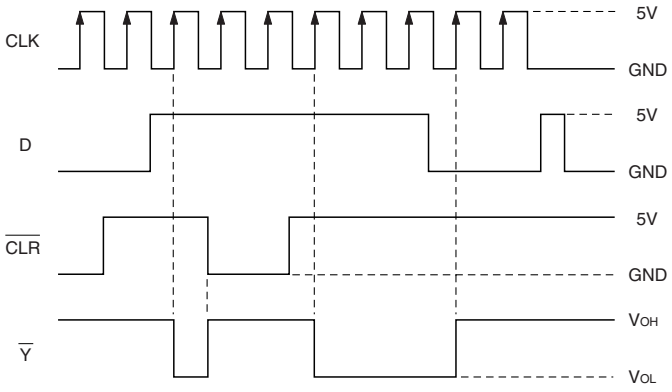
MITSUBISHI ELECTRIC

FUNCTION TABLE (EACH CHANNEL)

INPUT			OUTPUT : $\overline{Y}$
$\overline{CLR}$	CLK	D	
L	X	X	H
H	↑	L	H
H	↑	H	L
H	L	X	Latched
H	↓	X	Latched

↑ : "L" to "H"
↓ : "H" to "L"
H : High level
L : Low level
X : Irrelevant

TIMING DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Unless otherwise noted, Ta = –40 ~ +85°C)

Symbol	Parameter	Conditions		Ratings	Unit
V_{DD}	Supply voltage			7	V
V_{DS}	Drain-to-source voltage	Output, H		–0.5 ~ +40	V
V_I	Input voltage			–0.5 ~ V_{DD}	V
I_{DS}	Drain output current	Current per circuit output, L		200	mA
P_d	Power dissipation	Ta = 25°C, when mounted on board	M81049P	1.79	W
			M81049SP	1.47	
			M81049FP	1.10	
T_{opr}	Operating temperature			–40 ~ +85	°C
T_{stg}	Storage temperature			–55 ~ +125	°C

RECOMMENDED OPERATING CONDITIONS (Unless otherwise noted, Ta = –40 ~ +85°C)

Symbol	Parameter		Conditions	Limits			Unit
				min	typ	max	
V_{DD}	Supply voltage			4.5	5.0	5.5	V
V_{DS}	Drain-to-source voltage			0	—	40	V
V_{IH}	"H" input voltage			0.7V_{DD}	—	V_{DD}	V
V_{IL}	"L" input voltage			0	—	0.3V_{DD}	V
I_{DS}	Drain output current (Current per 1 circuit when 8 circuits are coming on simultaneously)	P	Duty Cycle no more than 48%	0	—	200	mA
			Duty Cycle no more than 100%	0	—	140	
		SP	Duty Cycle no more than 40%	0	—	200	
			Duty Cycle no more than 100%	0	—	125	
		FP	Duty Cycle no more than 33%	0	—	200	
			Duty Cycle no more than 100%	0	—	115	
V_{IN}	Input voltage			0	—	V_{DD}	V
t_r,t_f	Rise time, Fall time, drain output		V_{DD} = 4.5V	0	—	500	ns
t_{su}	Setup time before CLK ↑		V_{DD} = 4.5V	20	—	—	ns
t_h	Hold time, data after CLK ↑		V_{DD} = 4.5V	5	—	—	ns
t_w	Pulse duration		V_{DD} = 4.5V	40	—	—	ns
f	Clock frequency		V_{DD} = 4.5V	—	—	20	MHz

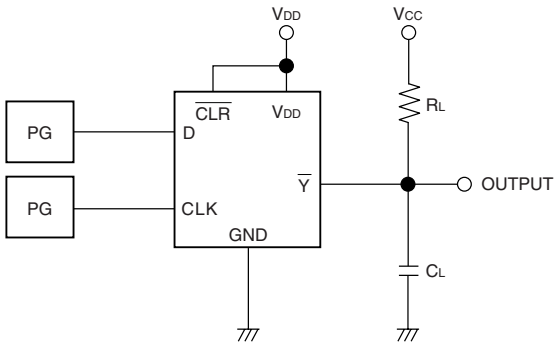
ELECTRICAL CHARACTERISTICS (Unless otherwise noted, V_{DD} = 5V, Ta = 25°C)

Symbol	Parameter	Test conditions		Limits			Unit
				min	typ	max	
$V_{(BR)DSX}$	Drain-source breakdown voltage	I_{DS} = 1mA		40	—	—	V
I_{DSX}	Drain-source leakage current	V_{DS} = 40V		—	0.002	5	μA
I_{IH}	"H" input current	V_{DD} = 5.5V, V_I = 5.5V		—	0.005	1	μA
I_{IL}	"L" input current	V_{DD} = 5.5V, V_I = 0V		—	0.005	–1	μA
I_{CC}	Supply current	V_{DD} = 5.5V	All outputs off	—	0.005	5	μA
		V_I = 5.5V or 0V	All outputs on	—	0.005	5	
V_{DS}	"L" output voltage	I_{DS} = 100mA, V_{DD} = 4.5V		—	0.29	0.44	V
		I_{DS} = 200mA, V_{DD} = 4.5V		—	0.59	0.88	
$R_{DS(on)}$	Drain-source on-state resistance	I_{DS} = 100mA, V_{DD} = 4.5V		—	2.9	4.4	Ω

SWITCHING CHARACTERISTICS (V_{DD} = 5V, Ta = 25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			min	typ	max	
t_{TLH}	Low-level to high-level and high-level to low-level output transition time	C_L = 30pF (Note 1)	—	11	—	ns
t_{THL}			—	3	—	ns
t_{PLH}	Low-level to high-level and high-level to low-level output propagation time (CLK-$\overline{Y}$)		—	32	—	ns
t_{PHL}			—	26	—	ns
$t_{PLH(R)}$	Low-level to high-level output propagation time ($\overline{CLR}$-$\overline{Y}$)		—	32	—	ns

NOTE 1 TEST CIRCUIT

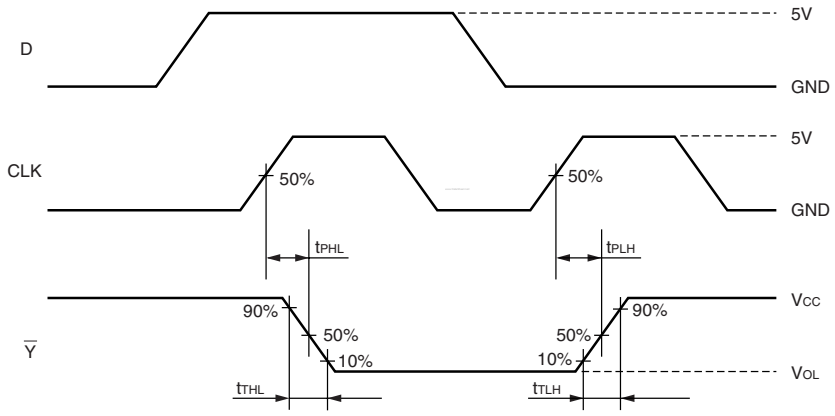


(1) Pulse generator (PG) characteristics : PRR = 1MHz, Duty Cycle = 50%, t_r = 6ns, t_f = 6ns, Zo = 50Ω, V_I = 5V

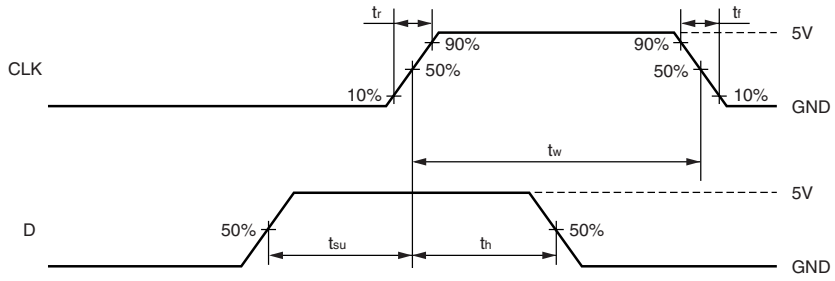
(2) Output conditions : R_L = 240Ω, V_{CC} = 24V, V_{DD} = 5V

(3) Electrostatic capacity C_L includes floating capacitance at connections and input capacitance at probes.

TIMING DIAGRAM



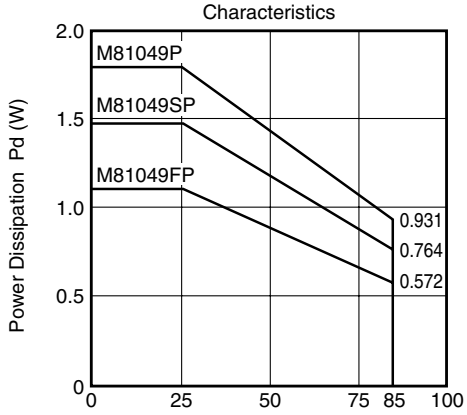
SWITCHING TIMES



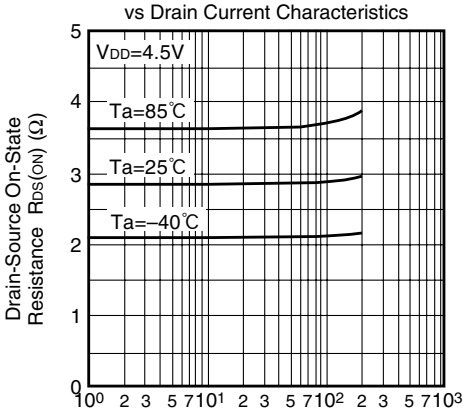
INPUT SETUP AND HOLD WAVEFORMS

TYPICAL CHARACTERISTICS

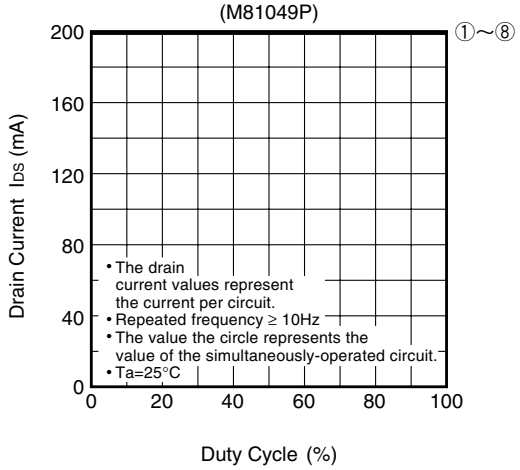
Thermal Derating Factor Characteristics



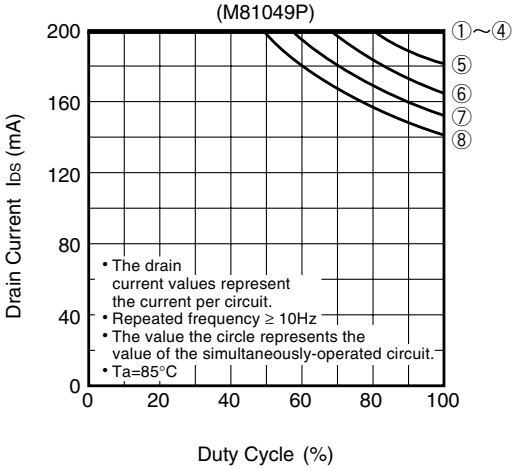
Drain-Source On-State Resistance vs Drain Current Characteristics



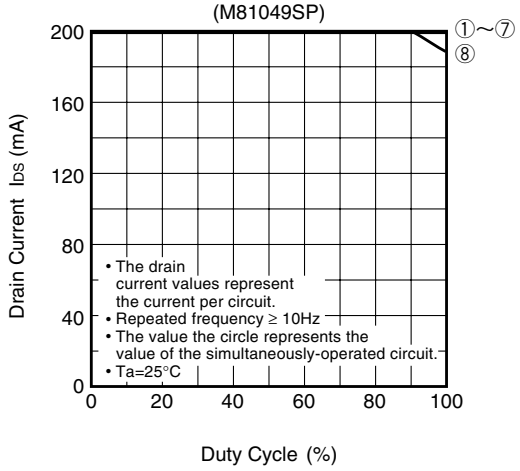
Duty Cycle-Drain Current Characteristics (M81049P)



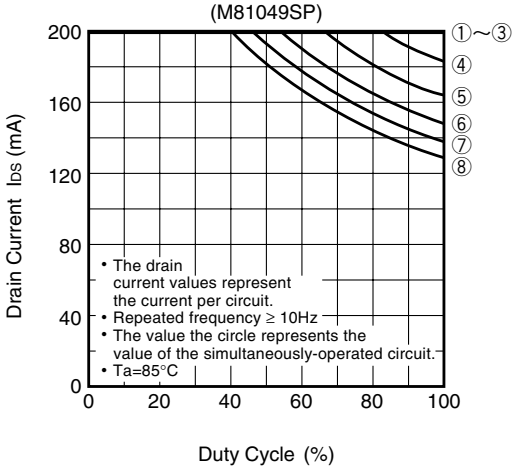
Duty Cycle-Drain Current Characteristics (M81049P)



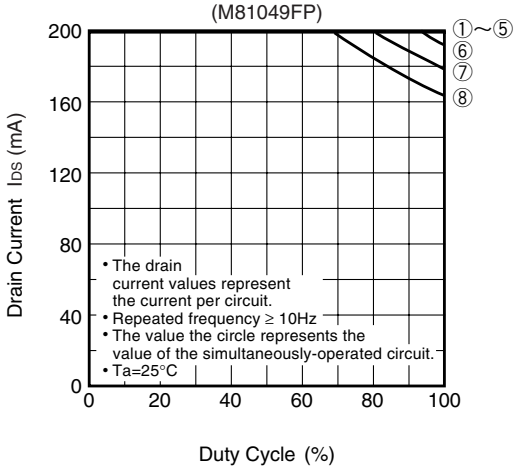
Duty Cycle-Drain Current Characteristics (M81049SP)



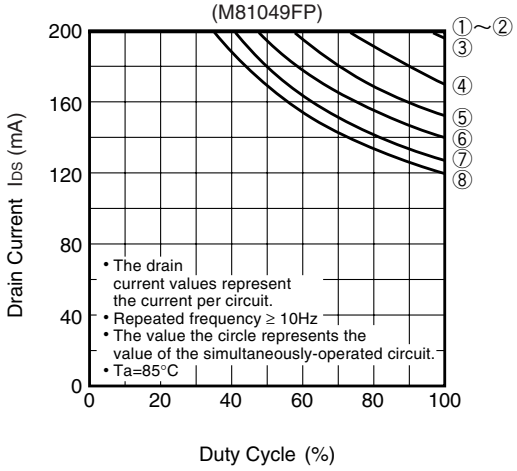
Duty Cycle-Drain Current Characteristics (M81049SP)



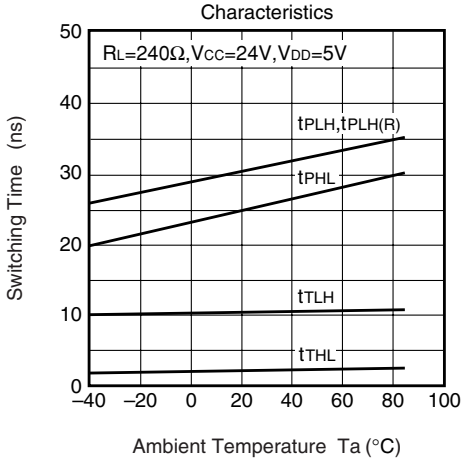
Duty Cycle-Drain Current Characteristics (M81049FP)



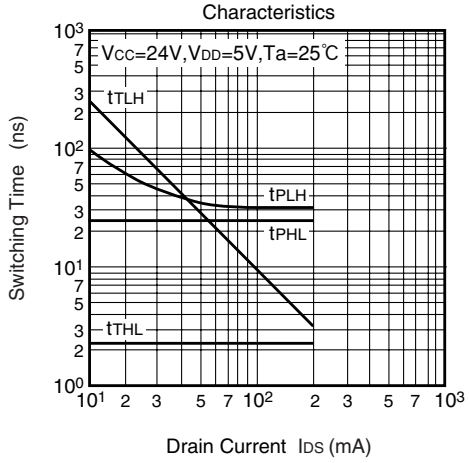
Duty Cycle-Drain Current Characteristics (M81049FP)



Switching Time-Ambient Temperature Characteristics



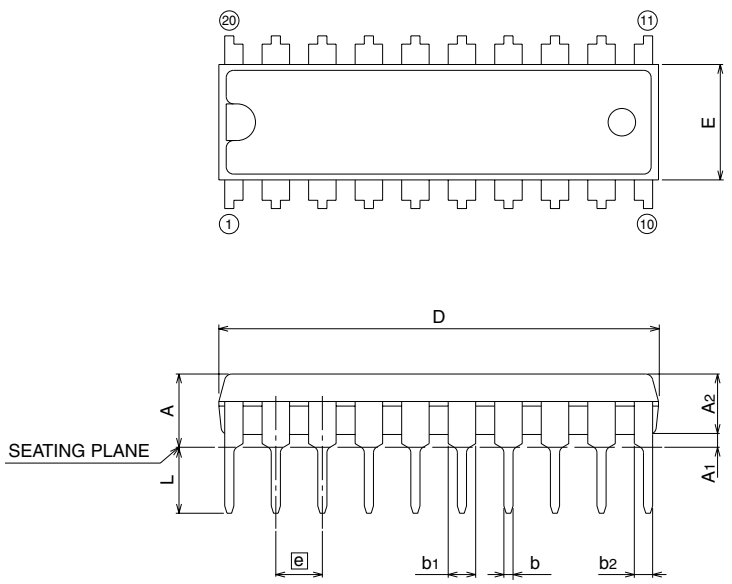
Switching Time-Drain Current Characteristics



20P4

Plastic 20pin 300mil DIP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
DIP20-P-300-2.54	–	1.3	Alloy 42/Cu Alloy

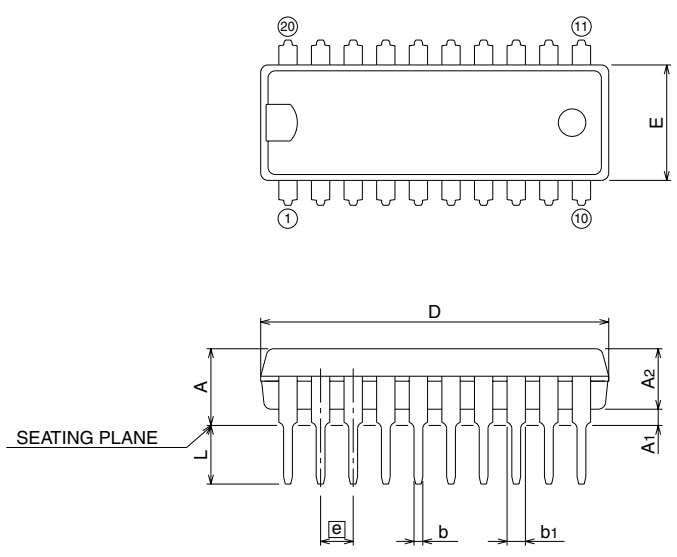


Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	–	–	4.5
A_1	0.51	–	–
A_2	–	3.3	–
b	0.4	0.5	0.6
b_1	1.4	1.5	1.8
b_2	0.9	1.0	1.3
c	0.22	0.27	0.34
D	23.8	24.0	24.2
E	6.15	6.3	6.45
e	–	2.54	–
e1	–	7.62	–
L	3.0	–	–
θ	0°	–	15°

20P4B

Plastic 20pin 300mil SDIP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SDIP20-P-300-1.78	–	1.0	Alloy 42/Cu Alloy

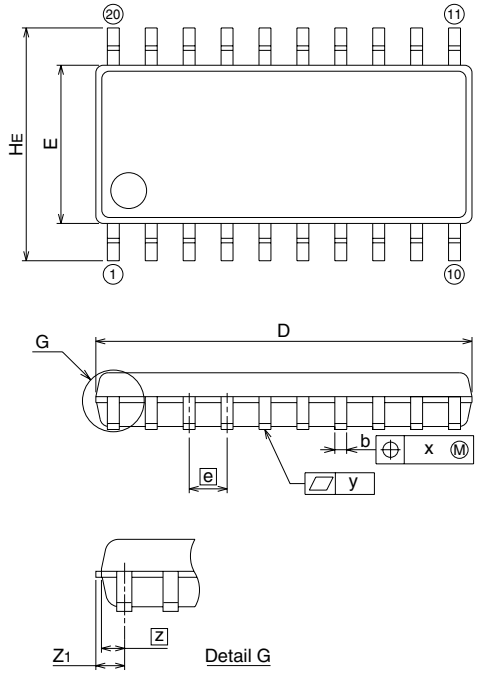


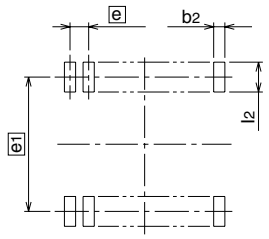
Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	–	–	4.5
A_1	0.51	–	–
A_2	–	3.3	–
b	0.38	0.48	0.58
b_1	0.9	1.0	1.3
c	0.22	0.27	0.34
D	18.8	19.0	19.2
E	6.15	6.3	6.45
e	–	1.778	–
e1	–	7.62	–
L	3.0	–	–
θ	0°	–	15°

20P2N-A

Plastic 20pin 300mil SOP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SOP20-P-300-1.27	–	0.26	Cu Alloy





Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	–	–	2.1
A1	0	0.1	0.2
A2	–	1.8	–
b	0.35	0.4	0.5
c	0.18	0.2	0.25
D	12.5	12.6	12.7
E	5.2	5.3	5.4
e	–	1.27	–
HE	7.5	7.8	8.1
L	0.4	0.6	0.8
L1	–	1.25	–
z	–	0.585	–
Z1	–	–	0.735
x	–	–	0.25
y	–	–	0.1
θ	0°	–	8°
b2	–	0.76	–
e1	–	7.62	–
l2	1.27	–	–