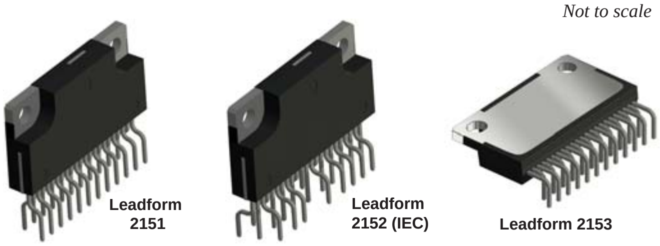
High Voltage 3-Phase Motor Driver

Features and Benefits

- Built-in pre-drive IC
- IGBT power element
- CMOS compatible input (5 V)
- High-side gate driver using bootstrap circuit or floating power supply
- Built-in protection circuit for controlling power supply voltage drop
- Overcurrent protection circuit (OCP)
- Output of fault signal during operation of protection circuit
- Output current 3 A
- Small SIP (SLA 23-pin)

Packages: Power SIP

Not to scale



Description

The SLA6805MP inverter power module (IPM) device provides a robust, highly-integrated solution for optimally controlling 3-phase motor power inverter systems and variable speed control systems used in energy-conserving designs to drive motors of residential and commercial appliances. These ICs take 230 VAC input voltage, and 3 A (continuous) output current. They can withstand voltages of up to 600 V (IGBT breakdown voltage).

The SMA6800MP power package includes an IC with all of the necessary power elements (six IGBTs), pre-driver ICs (two), and flyback diodes (six), needed to configure the main circuit of an inverter. This enables the main circuit of the inverter to be configured with fewer external components than traditional designs.

Applications include residential white goods (home applications) and commercial appliance motor control:

- Air conditioner fan
- Refrigerator compressor
- Dishwasher pump

Functional Block Diagram

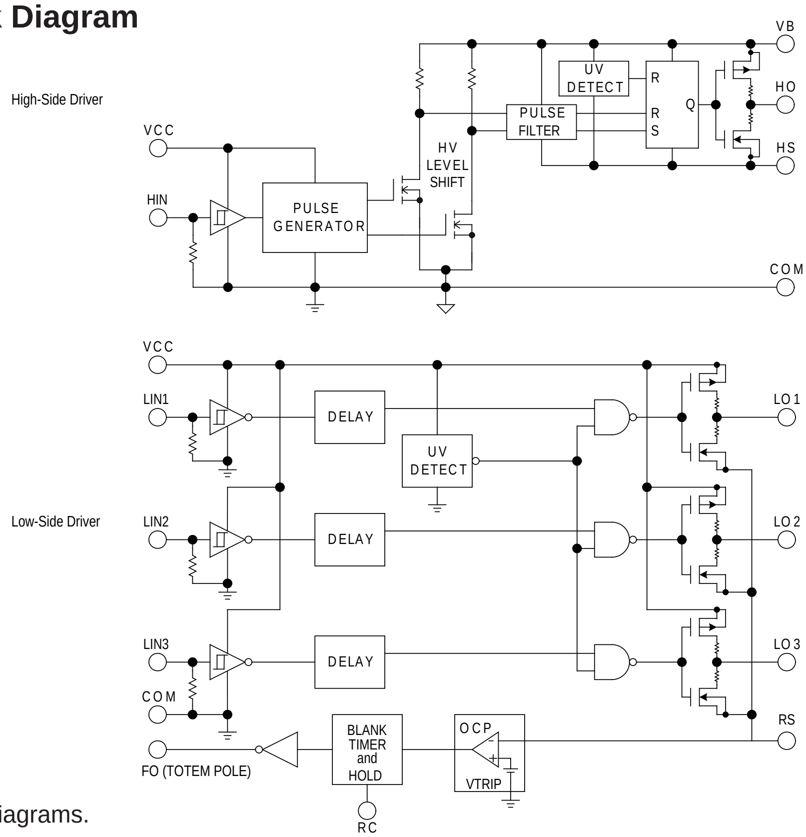


Figure 1. Driver block diagrams.

Selection Guide

Part Number	Packing	IGBT Breakdown Voltage, V_{CES}(min) (V)	IGBT Saturation Voltage, $V_{CE(sat)}$(typ) (V)	Output Current	
				Continuous, I_O(max) (A)	Pulsed, I_{OP} (max) (A)
SLA6805MP	18 pieces per tube	600	1.75	3	6

Absolute Maximum Ratings, valid at T_A = 25°C

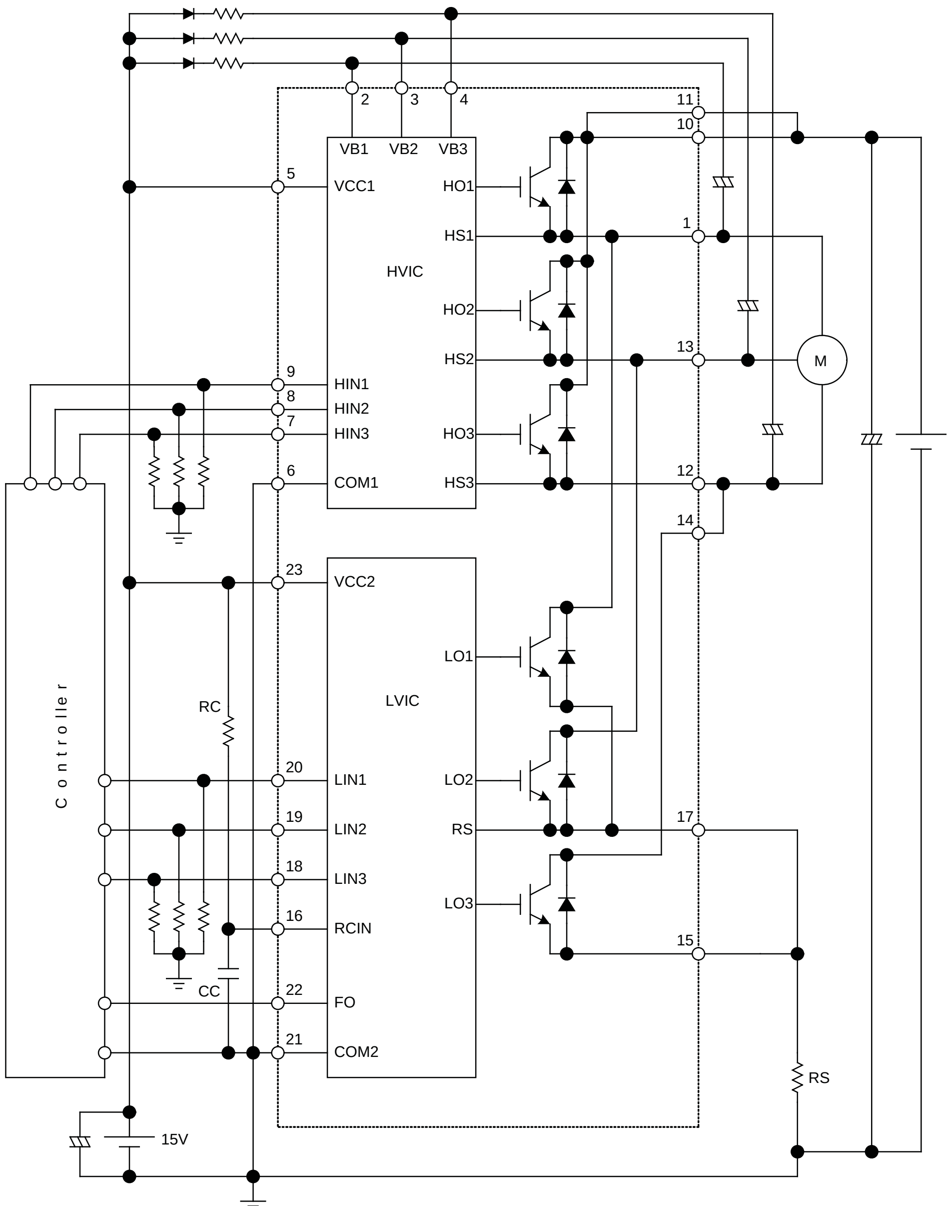
Characteristic	Symbol	Remarks	Rating	Unit
IGBT Breakdown Voltage	V_{CES}	V_{CC} = 15 V, I_C = 1 mA, V_{IN} = 0 V	600	V
Logic Supply Voltage	V_{CC}	Between VCC and COM	20	V
Bootstrap Voltage	V_{BS}	Between VB and HS (U,V, and W phases)	20	V
Output Current, Continuous	I_O	T_C = 25°C	3	A
Output Current, Pulsed	I_{OP}	PW ≤ 1 ms, duty cycle = 50%	6	A
Input Voltage	V_{IN}		–0.5 to 7	V
RC Pin Input Voltage	V_{RC}	Between RC and COM; C_C ≤ 2200 pF	20	V
Allowable power dissipation	P_D	T_C = 25°C, all elements operating	32	W
Thermal resistance (Junction to Case)	$R_{\theta JC}$	All elements operating (IGBT)	3.8	°C/W
		All elements operating (FWD)	5.4	°C
Case Operating Temperature	T_{COP}		–20 to 100	°C
Junction Temperature (MOSFET)	T_J		150	°C
Storage Temperature	T_{stg}		–40 to 150	°C

Recommended Operating Conditions

Characteristic	Symbol	Remarks	Min.	Typ.	Max.	Units
Main Supply Voltage	V_{BB}	Between VBB and LS, I_{BB} ≤ 2 A	–	300	450	V
Logic Supply Voltage	V_{CC}	Between VCC and COM	13.5	–	16.5	V
Dead Time	t_{dead}		1.5	–	–	μs
Junction Temperature	T_J		–	–	125	°C

All performance characteristics given are typical values for circuit or system baseline design only and are at the nominal operating voltage and an ambient temperature, T_A, of 25°C, unless otherwise stated.

Typical Application Diagram



NOTE:

- All of the input pins are connected to GND with internal pull-down resistors rated at 100 kΩ, however, an external pull-down resistor may be required to secure stable condition of the inputs if high impedance conditions are applied to them.
- To use the OCP circuit, an external shunt resistor, RS, is needed. The RS value can be obtained from the formula:

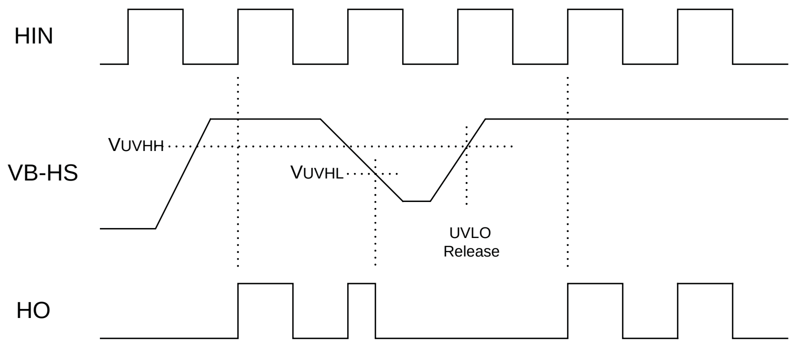
$$R_S(\Omega) = 0.5\text{ V / Overcurrent Detection Set Current (A)}$$

- A blanking timer is built-in to mask the noise generated on RS at turn-on.
- The external electrolytic capacitors should be placed as close to the IC as possible, in order to avoid malfunctions from external noise interference. Put a ceramic capacitor in parallel with the electrolytic capacitor if further reduction of noise susceptibility is necessary.

ELECTRICAL CHARACTERISTICS, valid at T_A=25°C, C_C ≤ 2200 pF, unless otherwise noted

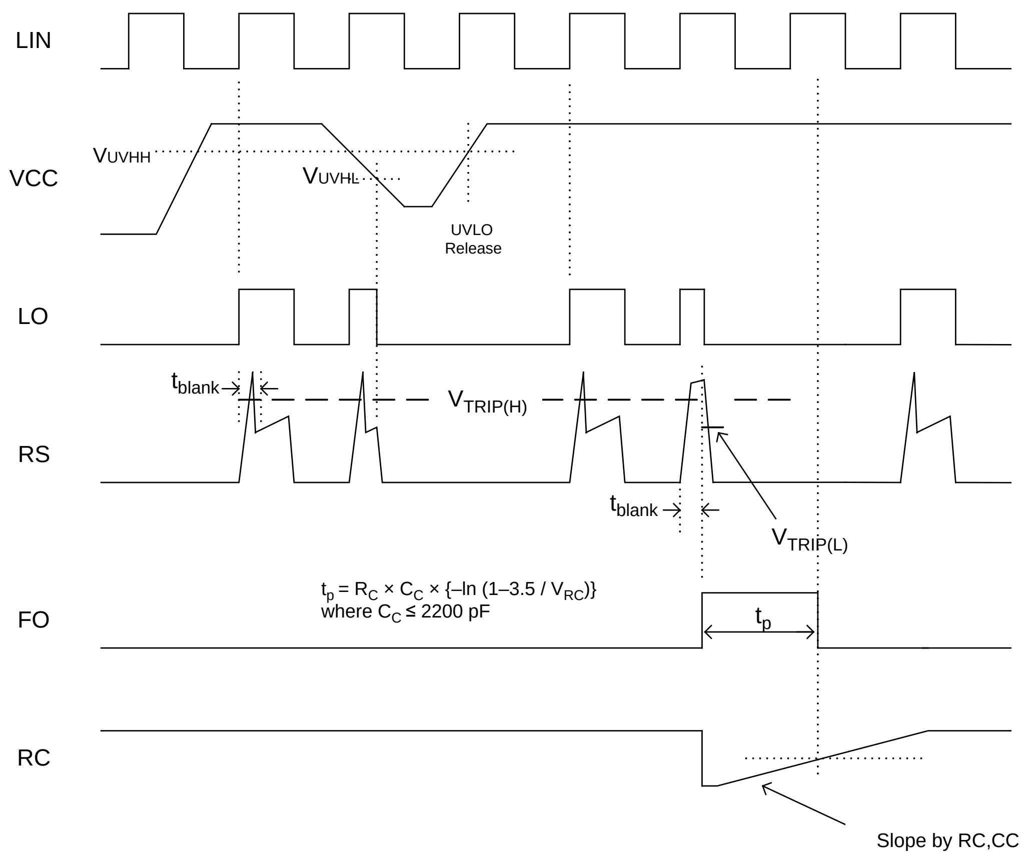
Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Logic Supply Voltage	V_{CC}	Between VCC and COM	13.5	15	16.5	V
Logic Supply Current	I_{CC}	V_{CC} = 15 V	–	4	6	mA
Input Voltage	V_{IH}	V_{CC} = 15 V, output on	–	2.0	2.5	V
	V_{IL}	V_{CC} = 15 V, output off	1.0	1.5	–	V
Input Voltage Hysteresis	V_{Ihys}	V_{CC} = 15 V	–	0.5	–	V
Input Current	I_{IH}	High side, V_{CC} = 15 V, V_{IN} = 5 V	–	50	100	μA
	I_{IL}	Low side, V_{CC} = 15 V, V_{IN} = 0 V	–	–	2	μA
Undervoltage Lock Out	V_{UVHL}	High side, between VB and U, V, or W	9.0	10.0	11.0	V
	V_{UVHH}		9.5	10.5	11.5	V
	V_{UVHhys}	High side, hysteresis	–	0.5	–	V
	V_{UVLL}	Low side, between VB and U, V, or W	10.0	11.0	12.0	V
	V_{UVLH}		10.5	11.5	12.5	V
	V_{UVLhys}	Low side, hysteresis	–	0.5	–	V
FO Terminal Output Voltage	V_{FOL}	V_{CC} = 15 V	0	–	1.0	V
	V_{FOH}		4.0	–	5.5	V
Overcurrent Protection Trip Voltage	V_{TRIP}	V_{CC} = 15 V	0.45	0.50	0.55	V
Overcurrent Protection Hold Time	t_{p1}	V_{RC} = 15 V, R_C = 1 MΩ, C_C = 1000 pF	–	260	–	μs
	t_{p2}	V_{RC} = 5 V, R_C = 330 kΩ, C_C = 2200 pF	–	870	–	μs
Blanking Time	t_{blank}	V_{CC} = 15 V	–	2	–	μs
IGBT Breakdown Voltage	V_{CES}	V_{CC} = 15 V, I_C = 1 mA, V_{IN} = 0 V	600	–	–	V
IGBT Leakage Current	I_{CES}	V_{CC} = 15 V, V_{CE} = 600 V, V_{IN} = 0 V	–	–	1	mA
IGBT Saturation Voltage	$V_{CE(sat)}$	V_{CC} = 15 V, I_C = 3 A, V_{IN} = 5 V	–	1.75	2.1	V
Diode Forward Voltage	V_F	V_{CC} = 15 V, I_F = 3 A, V_{IN} = 0 V	–	1.65	2.0	V
Diode Recovery Time	t_{rr}	I_F = 3 A, di/dt = 100 A/μs	–	50	–	ns
Switching Time, High Side	$t_{dH(on)}$	V_{BB} = 300 V, V_{CC} = 15 V, I_C = 3 A, 0 V ≤ V_{IN} ≤ 5 V, inductive load	–	315	–	ns
	t_{rH}		–	55	–	ns
	$t_{dH(off)}$		–	455	–	ns
	t_{fH}		–	175	–	ns
Switching Time, Low Side	$t_{dL(on)}$		–	430	–	ns
	t_{rL}		–	100	–	ns
	$t_{dL(off)}$		–	410	–	ns
	t_{fL}		–	190	–	ns

High Side Driver Input/Output Timing Diagrams



After UVLO is released, IC operation is started by the first rising edge of input

Low Side Driver Input/Output Timing Diagrams

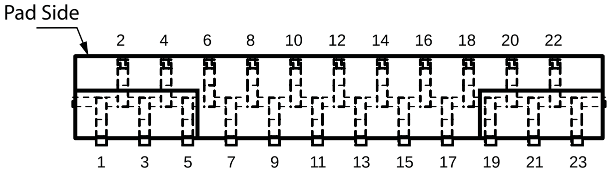


After UVLO is released, IC operation is started by the first rising edge of input

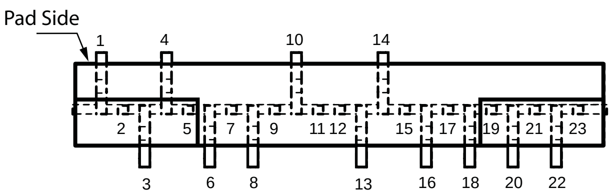
After RC charging and releasing, the OCP operation is started by the first rising edge of input

Pin-out Diagrams

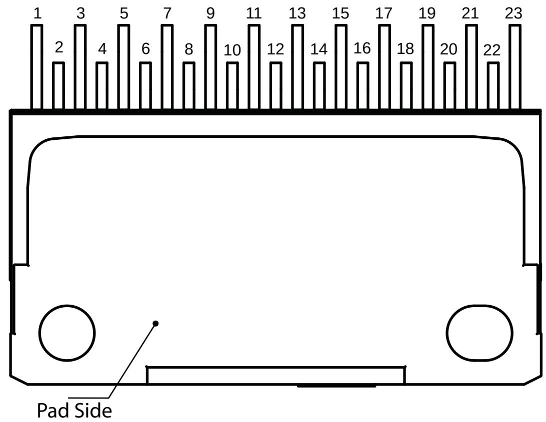
Leadform 2151



Leadform 2152



Leadform 2153



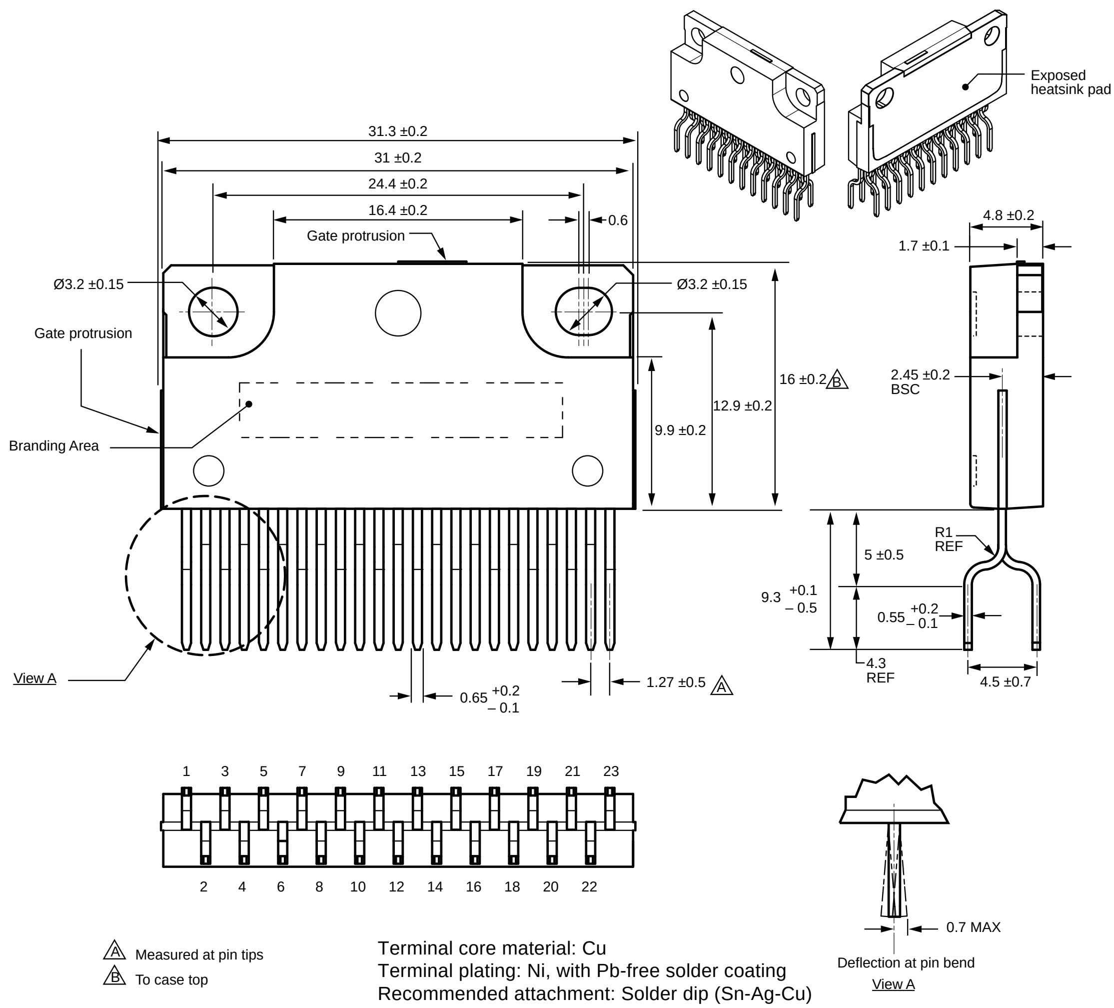
Terminal List Table

Number	Name	Function
1	U	Output of U phase
2	VB1	High side bootstrap terminal (U phase)
3	VB2	High side bootstrap terminal (V phase)
4	VB3	High side bootstrap terminal (W phase)
5	VCC1	High side logic supply voltage
6	COM1	High side logic GND terminal
7	HIN3	High side input terminal (W phase)
8	HIN2	High side input terminal (V phase)
9	HIN1	High side input terminal (U phase)
10	VBB1	Main supply voltage 1 (connect to VBB2 externally)
11	VBB2	Main supply voltage 2 (connect to VBB1 externally)
12	W1	Output of W phase (connect to W2 externally)
13	V	Output of V phase
14	W2	Output of W phase (connect to W1 externally)
15	LS2	Low side emitter terminal (connect to LS1 externally)
16	RCIN	Overcurrent protection hold time adjustment terminal
17	LS1	Low side emitter terminal (connect to LS1 externally)
18	LIN3	Low side input terminal (W phase)
19	LIN2	Low side input terminal (V phase)
20	LIN1	Low side input terminal (U phase)
21	COM2	Low side GND terminal
22	FO	Overcurrent protection fault-signal output terminal
23	VCC2	Low side logic supply voltage

Package Outline Drawing

Leadform 2151

Dual rows, 23 alternating pins; vertical case mounting; pin #1 opposite tab side



A Measured at pin tips
B To case top

Terminal core material: Cu
Terminal plating: Ni, with Pb-free solder coating
Recommended attachment: Solder dip (Sn-Ag-Cu)

Dimensions in millimeters

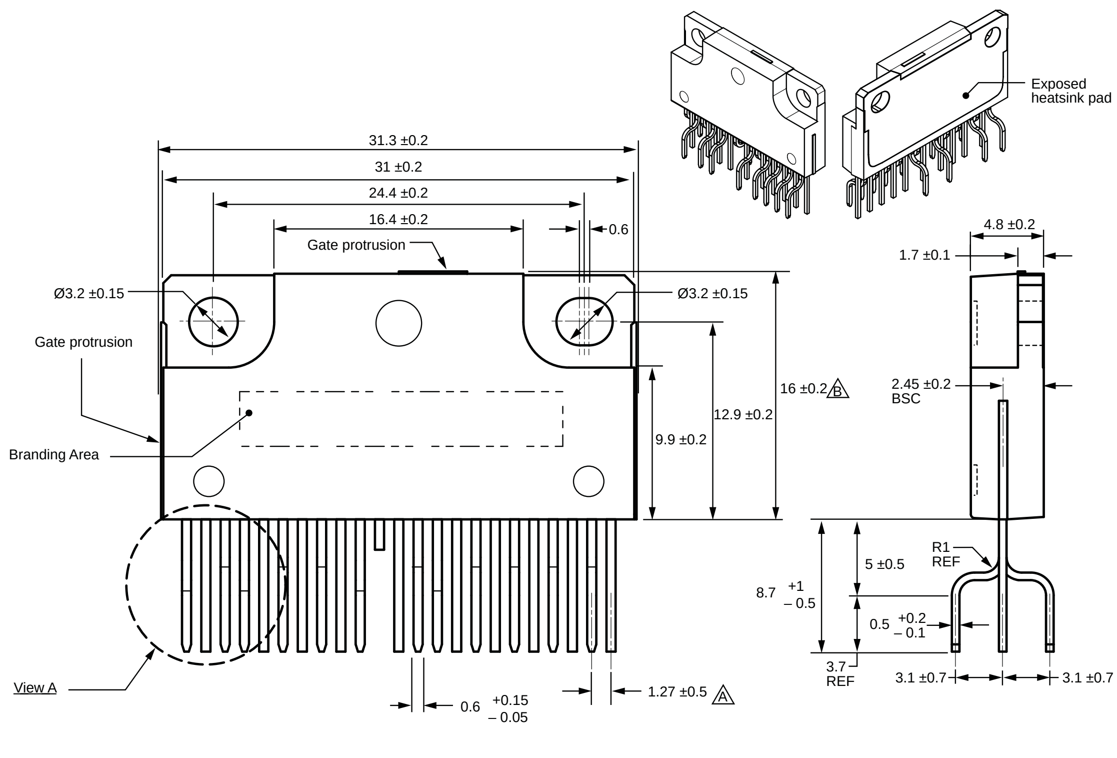
Branding codes (exact appearance at manufacturer discretion):
1st line, type: SLA708xMR
2nd line, protection: P (if present)
3rd line, lot: *YMDD*
Where: Y is the last digit of the year of manufacture
M is the month (*1* to *9, O, N, D*)
DD is the date

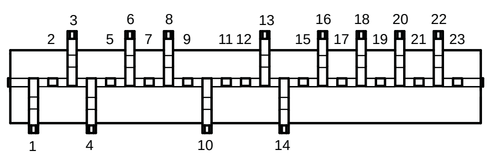
Leadframe plating Pb-free. Device composition complies with the RoHS directive.

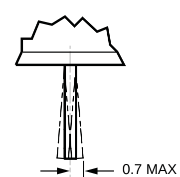
Package Outline Drawing

Leadform 2152

Triple rows (IEC compliant), 23 alternating pins; vertical case mounting; pin #1 on tab side







Deflection at pin bend
View A

A Measured at pin tips
B To case top

Leadform: 2152
Terminal core material: Cu
Terminal plating: Ni
Recommended attachment: Solder dip (Sn-Ag-Cu)

Dimensions in millimeters

Branding codes (exact appearance at manufacturer discretion):
1st line, type: SLA6805MP

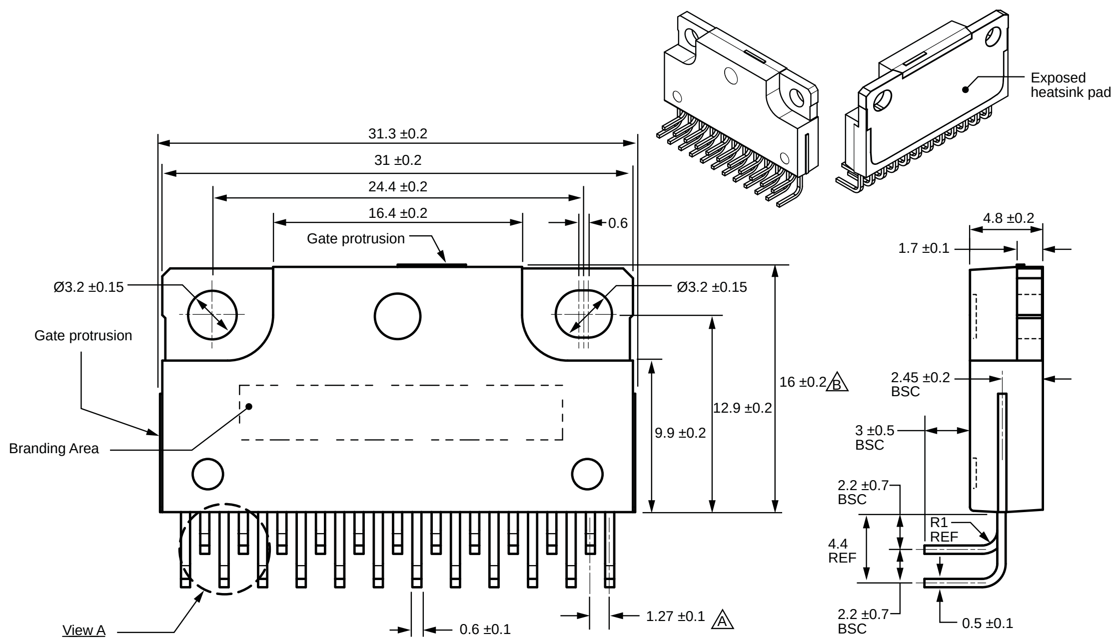
2nd line, lot: *YMDDT*
Where: Y is the last digit of the year of manufacture
M is the month (*1* to *9, O, N, D*)
DD is the date
T is the tracking letter

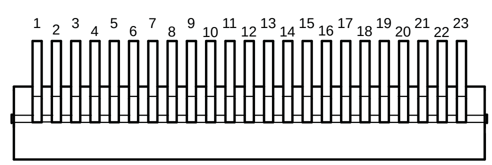
Leadframe plating Pb-free. Device composition complies with the RoHS directive.

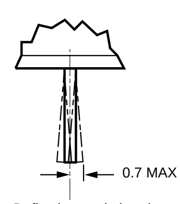
Package Outline Drawing

Leadform 2153

Dual rows, 23 alternating pins; pins bent 90° for horizontal case mounting; pin #1 in outer row







Deflection at pin bend
View A

A Measured at pin exit from case
B To case top

Leadform: 2153
Terminal core material: Cu
Terminal plating: Ni
Recommended attachment: Solder dip (Sn-Ag-Cu)

Dimensions in millimeters

Branding codes (exact appearance at manufacturer discretion):
1st line, type: SLA6805MP

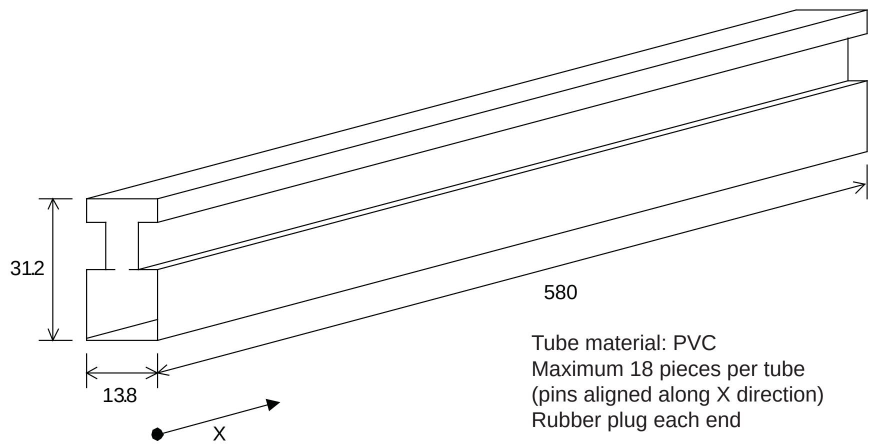
2nd line, lot: *YMDDT*
Where: Y is the last digit of the year of manufacture
M is the month (*1* to *9, O, N, D*)
DD is the date
T is the tracking letter

Leadframe plating Pb-free. Device composition complies with the RoHS directive.

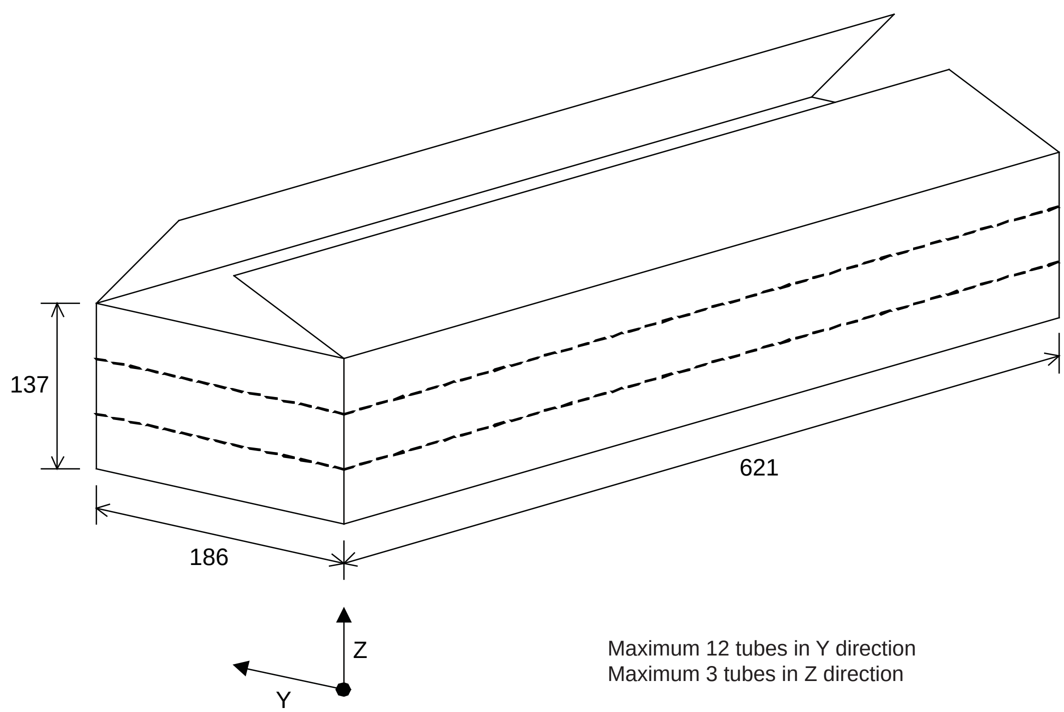
Packing Specification

Leadforms 2151 and 2152

Dimensions in millimeters



Tube material: PVC
Maximum 18 pieces per tube
(pins aligned along X direction)
Rubber plug each end



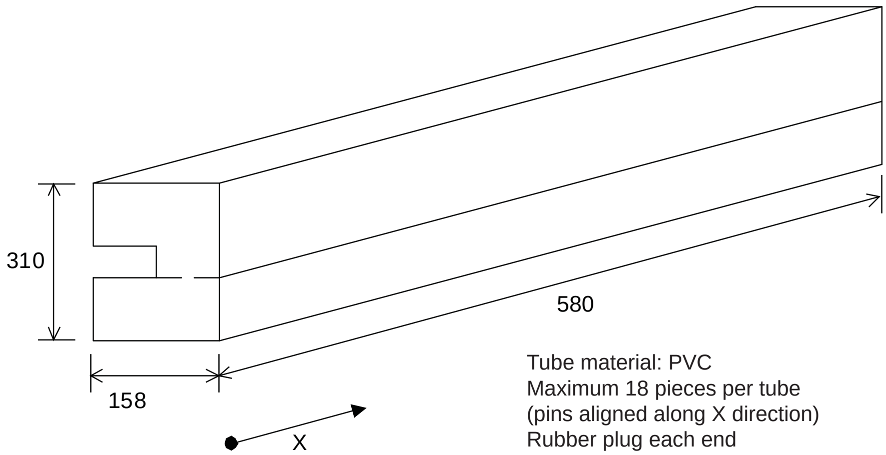
Maximum 12 tubes in Y direction
Maximum 3 tubes in Z direction

Maximum pieces per carton:
18 pieces per tube
12 tubes per layer
x 3 layers of tubes
648 pieces per carton

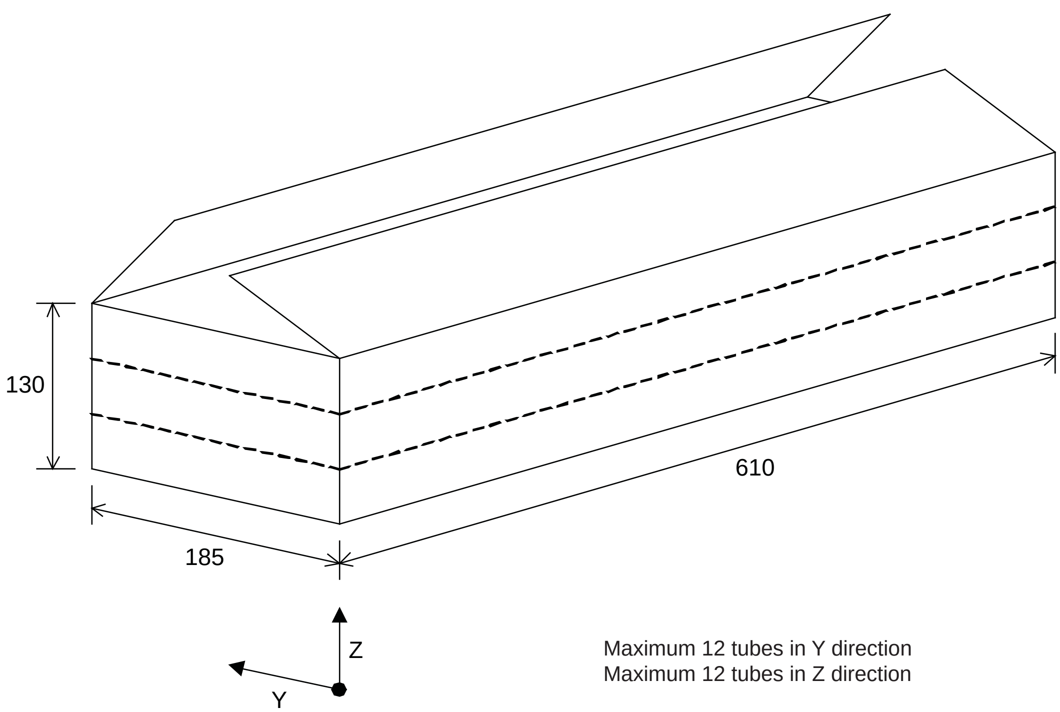
Packing Specification

Leadform 2153

Dimensions in millimeters



Tube material: PVC
Maximum 18 pieces per tube
(pins aligned along X direction)
Rubber plug each end



Maximum 12 tubes in Y direction
Maximum 12 tubes in Z direction

Maximum pieces per carton:
18 pieces per tube
10 tubes per layer
x 3 layers of tubes
540 pieces per carton

WARNING — These devices are designed to be operated at lethal voltages and energy levels. Circuit designs that embody these components must conform with applicable safety requirements. Precautions must be taken to prevent accidental contact with power-line potentials. Do not connect grounded test equipment.

The use of an isolation transformer is recommended during circuit development and breadboarding.

Because reliability can be affected adversely by improper storage environments and handling methods, please observe the following cautions.

Cautions for Storage

- Ensure that storage conditions comply with the standard temperature (5°C to 35°C) and the standard relative humidity (around 40 to 75%); avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect for rust on leads and solderability of products that have been stored for a long time.

Cautions for Testing and Handling

When tests are carried out during inspection testing and other standard test periods, protect the products from power surges from the testing device, shorts between adjacent products, and shorts to the heatsink.

Remarks About Using Silicone Grease with a Heatsink

- When silicone grease is used in mounting this product on a heatsink, it shall be applied evenly and thinly. If more silicone grease than required is applied, it may produce stress.
- Volatile-type silicone greases may permeate the product and produce cracks after long periods of time, resulting in reduced heat radiation effect, and possibly shortening the lifetime of the product.
- Our recommended silicone greases for heat radiation purposes, which will not cause any adverse effect on the product life, are indicated below:

Type	Suppliers
G746	Shin-Etsu Chemical Co., Ltd.
YG6260	Momentive Performance Materials, Inc.
SC102	Dow Corning Toray Silicone Co., Ltd.

Heatsink Mounting Method

Torque When Tightening Mounting Screws. The recommended tightening torque for this product package type is: 58.8 to 78.4 N•cm (6.0 to 8.0 kgf•cm).

Soldering

- When soldering the products, please be sure to minimize the working time, within the following limits:

  260±5°C 10 s

  380±5°C 5 s

- Soldering iron should be at a distance of at least 1.5 mm from the body of the products

Electrostatic Discharge

- When handling the products, operator must be grounded. Grounded wrist straps worn should have at least 1 MΩ of resistance to ground to prevent shock hazard.
- Workbenches where the products are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should be grounded.
- When soldering the products, the head of soldering irons or the solder bath must be grounded in other to prevent leak voltages generated by them from being applied to the products.
- The products should always be stored and transported in our shipping containers or conductive containers, or be wrapped in aluminum foil.

The products described herein are manufactured in Japan by Sanken Electric Co., Ltd. for sale by Allegro MicroSystems, Inc.

Sanken and Allegro reserve the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the performance, reliability, or manufacturability of its products. Therefore, the user is cautioned to verify that the information in this publication is current before placing any order.

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The use of Sanken products without the written consent of Sanken in applications where extremely high reliability is required (aerospace equipment, nuclear power-control stations, life-support systems, etc.) is strictly prohibited.

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This datasheet is based on Sanken datasheet SSJ-03405.

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