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High Voltage 3-Phase Motor Driver IC

SLA6845MZ

March, 2015

General Description

The SLA6845MZ provides a highly-integrated solution by incorporating key components into one package – IGBTs in a 3-phase full-bridge configuration, built-in protection functions such as UVLO (undervoltage lockout) and TD (thermal detection) circuits, and pre-driver ICs with 7.5 V regulator output. The SLA6845MZ employs three LS terminals to configure a 3-shunt current detection system. The product is supplied in a SIP package with Al heatsink.

Applications

Include motor control for:

- Air conditioner fan
- Air purifier fan
- Washer-dryer fan
- Dishwasher pump

Features and Benefits

- CMOS-compatible input (3.3 or 5 V)
- Built-in protection circuit for controlling power supply voltage drop (UVLO)
- Built-in overheat detection circuit (TD)
- Regulator output: 7.5 V, 35 mA
- Small SIP (SLA, 24 pins)
- 3-shunt current detection

Package

- Package Name: SLA
- Pin Pitch: 1.27 mm
- External Size: 31 × 16 × 4.8 mm

Leadform 2171

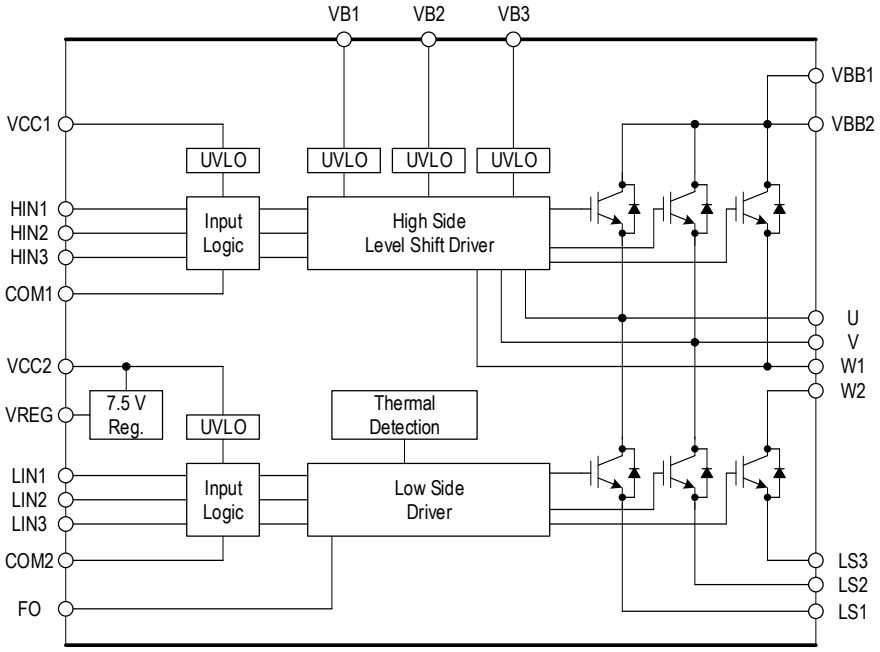
Leadform 2175

Not to scale

Product Specifications

Part Number	IGBT Breakdown Voltage, V_{CES} (V)	Output Current (Continuous), I_O (A)	IGBT Saturation Voltage, $V_{CE(sat)}$ (V Typ.)	Package
SLA6845MZ	600	3.0	1.75	Al heatsink

Functional Block Diagram



1. Scope

The specifications described in this document shall apply to the SLA6845MZ, a high-voltage 3-phase motor driver IC.

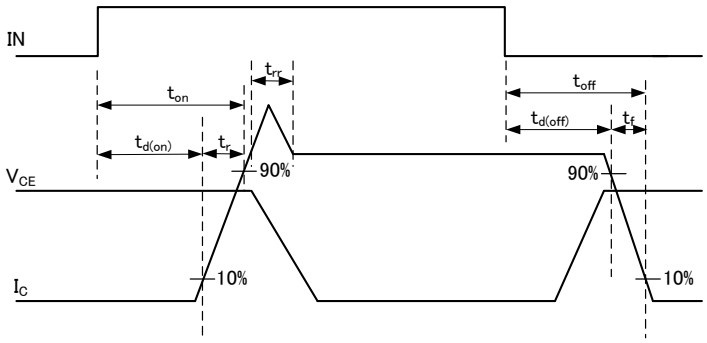
2. Absolute Maximum Ratings, valid at T_A = 25°C

Characteristics	Symbol	Remarks	Ratings	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 phase U, V, or W	20	V
Output Current (Continuous)	I_O	T_C = 25°C	3.0	A
Output Current (Pulsed)	I_{OP}	T_C = 25°C, $P_W \leq$ 100 µs	4.5	A
Output Current for Regulator	I_{REG}		35	mA
Input Voltage	V_{IN}	HIN and LIN pins	−0.5 to 7	V
Allowable Power Dissipation	P_D	T_C = 25°C	32.8	W
Thermal Resistance (Junction-to-Case)	$R_{(j-c)\,Q}$	All elements operating (IGBT)	3.8	°C/W
	$R_{(j-c)\,F}$	All elements operating (FWD)	4.2	°C/W
Thermal Resistance (Junction-to-Ambient)	R_{j-a}	All elements operating (IGBT and FWD)	25	°C/W
Case Operating Temperature	$T_{C(OP)}$		−20 to 100	°C
Junction Temperature	T_j		150	°C
Storage Temperature	T_{stg}		−40 to 150	°C

3. Electrical Characteristics

3-1. Electrical Characteristics, valid at T_a = 25°C, V_{CC} = 15 V

Characteristics	Symbol	Remarks	Ratings			Unit
			Min.	Typ.	Max.	
Logic Supply Current	I_{CC}	I_{REG} = 0 A	—	4	6	mA
Bootstrap Supply Current	I_{BS}	V_{BS} = 15 V, HIN = 5 V	—	135	380	µA
Input Voltage	V_{IH}	Output ON	—	2.0	2.5	V
	V_{IL}	Output OFF	1.0	1.5	—	V
	V_{HYS}	Hysteresis	—	0.5	—	V
Input Current	I_{IH}	V_{IN} = 5 V	—	50	100	µA
Undervoltage Lockout (Bootstrap)	V_{UVHL}	Between VB and U, V, or W	9.0	10.0	11.0	V
	V_{UVHH}	Between VB and U, V, or W	9.5	10.5	11.5	V
	V_{UVhys}	Between VB and U, V, or W; hysteresis	—	0.5	—	V
Undervoltage Lockout (Logic Supply)	V_{UVLL}	Between VCC and COM	10.0	11.0	12.0	V
	V_{UVLH}	Between VCC and COM	10.5	11.5	12.5	V
	V_{UVhys}	Between VCC and COM; hysteresis	—	0.5	—	V
FO Terminal Output Voltage	V_{FOL}	V_{CC} = 15 V, I_{FO} = −1 mA	0	—	1.0	V
	V_{FOH}	V_{CC} = 15 V, I_{FO} = 1.6 mA	4.0	—	5.5	V
IGBT Leakage Current	I_{CES}	V_{CE} = 600 V, V_{IN} = 0 V, V_{CC} = 15 V	—	—	1	mA
IGBT Saturation Voltage	$V_{CE(sat)}$	V_{CC} = 15 V, I_{CE} = 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
Switching Time, High Side	$t_{d(on)}$	V_{BB} = 300 V, V_{CC} = 15 V, I_C = 3 A, HIN = 0→5 V or 5→0 V, inductive load	—	315	—	ns
	t_r		—	50	—	
	t_{rr}		—	80	—	
	$t_{d(off)}$		—	375	—	
	t_f		—	165	—	
Switching Time, Low Side	$t_{d(on)}$	V_{BB} = 300 V, V_{CC} = 15 V, I_C = 3 A, LIN = 0→5 V or 5→0 V, inductive load	—	395	—	ns
	t_r		—	60	—	
	t_{rr}		—	75	—	
	$t_{d(off)}$		—	395	—	
	t_f		—	170	—	



Switching Characteristics Definitions

3-2. Recommended Operating Conditions

Characteristics	Symbol	Remarks	Ratings			Unit
			Min.	Typ.	Max.	
Main Supply Voltage	V_{DC}	Between VBB and LS	—	300	450	V
Logic Supply Voltage	V_{CC}	Between VCC and COM	13.5	—	16.5	V
Dead Time	t_{dead}		1.5	—	—	µs
Minimum Input Pulse Width	$t_{INmin(on)}$		0.5	—	—	µs
	$t_{INmin(off)}$		0.5	—	—	µs

3-3. Truth Table

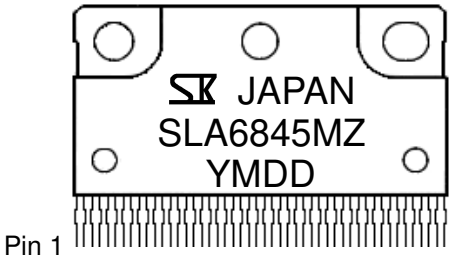
Mode	HIN	LIN	High-Side IGBT	Low-Side IGBT
Normal[1)]	L	L	OFF	OFF
	H	L	ON	OFF
	L	H	OFF	ON
	H	H	ON	ON
OCP	L	L	OFF	OFF
	H	L	ON	OFF
	L	H	OFF	OFF
	H	H	ON	OFF
UVLO (VCC)[2)]	L	L	OFF	OFF
	H	L	OFF	OFF
	L	H	OFF	OFF
	H	H	OFF	OFF
UVLO (VB)[3)]	L	L	OFF	OFF
	H	L	OFF	OFF
	L	H	OFF	ON
	H	H	OFF	ON

[1)] An arm short-circuit may occur when inputs on the HIN and LIN pins for the same phase are all logic high. Therefore, extra attention should be paid to prevent a condition in which the pins for the same phase are fully ON at once.

[2)] When returning to the Normal operation mode from a V_{CC} UVLO state, high-side and low-side IGBTs resume switching on the rising edge of an HIN input (positive edge triggering).

[3)] When returning to the Normal operation mode from a V_B UVLO state, a high-side IGBT resumes switching on the rising edge of an HIN input (positive edge triggering).

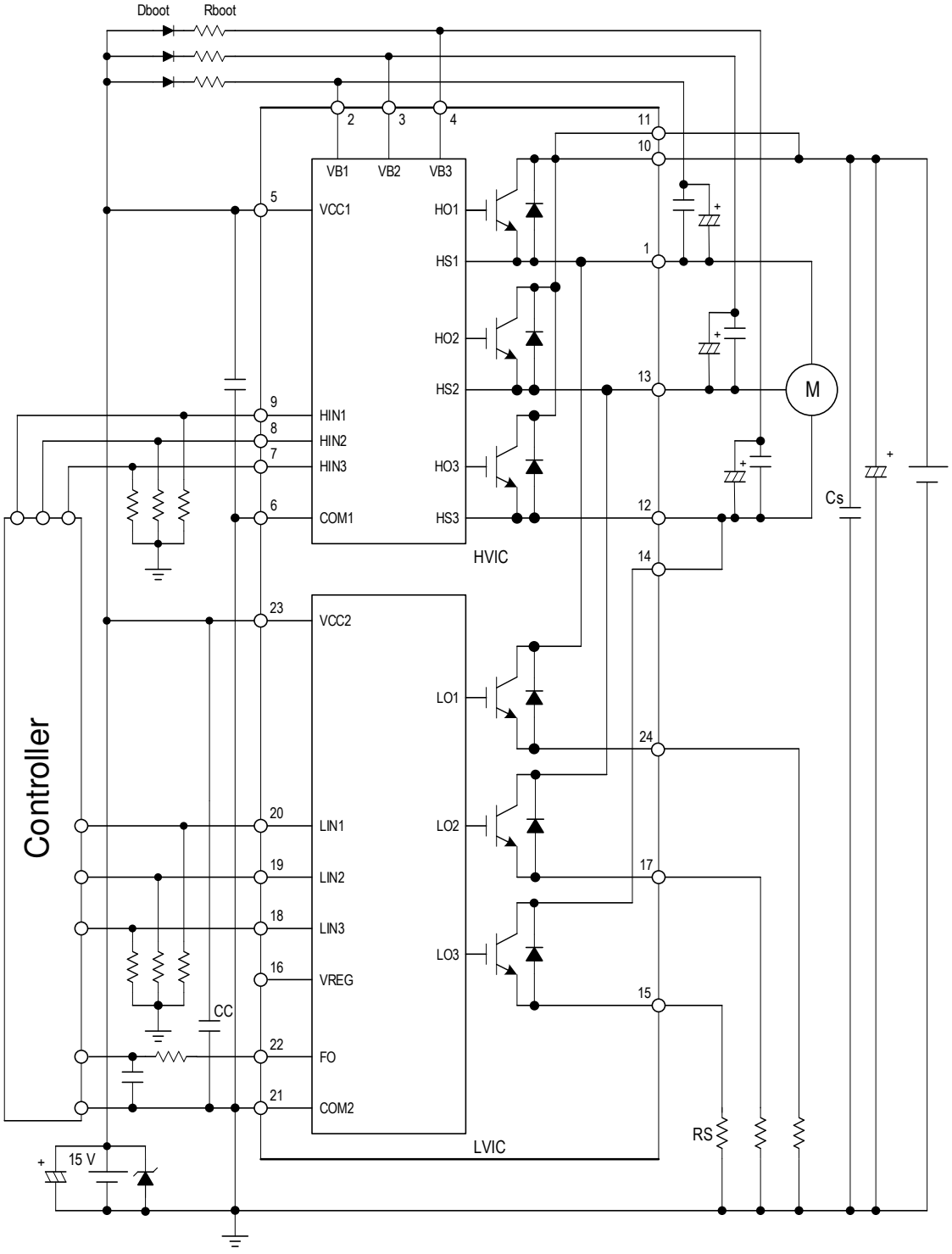
4. Pin-out Diagram



Terminal List Table

Pin Number	Pin Name	Functions	I/O
1	U	Phase U output	Output
2	VB1	High-side bootstrap (phase U)	—
3	VB2	High-side bootstrap (phase V)	—
4	VB3	High-side bootstrap (phase W)	—
5	VCC1	High-side logic supply voltage	—
6	COM1	High-side logic GND	—
7	HIN3	High-side input (phase W)	Input
8	HIN2	High-side input (phase V)	Input
9	HIN1	High-side input (phase U)	Input
10	VBB1	Main supply voltage 1 (connected to VBB2 externally)	—
11	VBB2	Main supply voltage 2 (connected to VBB1 externally)	—
12	W1	Phase W output (connected to W2 externally)	Output
13	V	Phase V output	Output
14	W2	Phase W output (connected to W1 externally)	Output
15	LS3	Low-side emitter (phase W)	—
16	VREG	Internal regulator output	Output
17	LS2	Low-side emitter (phase V)	—
18	LIN3	Low-side input (phase W)	Input
19	LIN2	Low-side input (phase V)	Input
20	LIN1	Low-side input (phase U)	Input
21	COM2	Low-side logic GND	—
22	FO	Overheat detection and UVLO protection fault-signal output	Output
23	VCC2	Low-side logic supply voltage	—
24	LS1	Low-side emitter (phase U)	—

5. Application Example

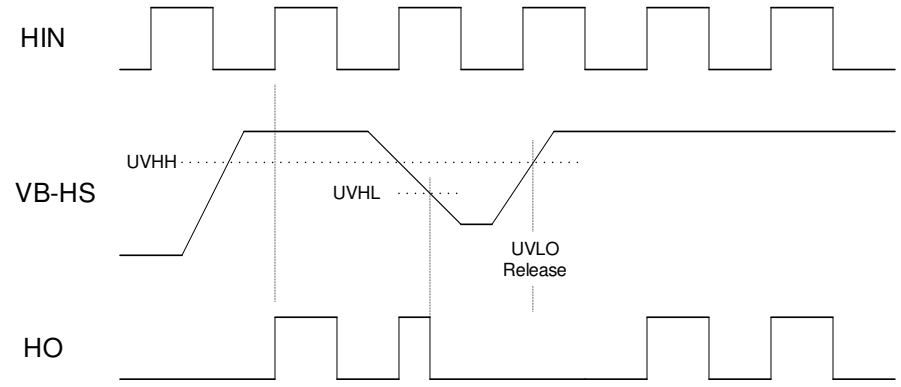


NOTES:

- 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.
- 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.

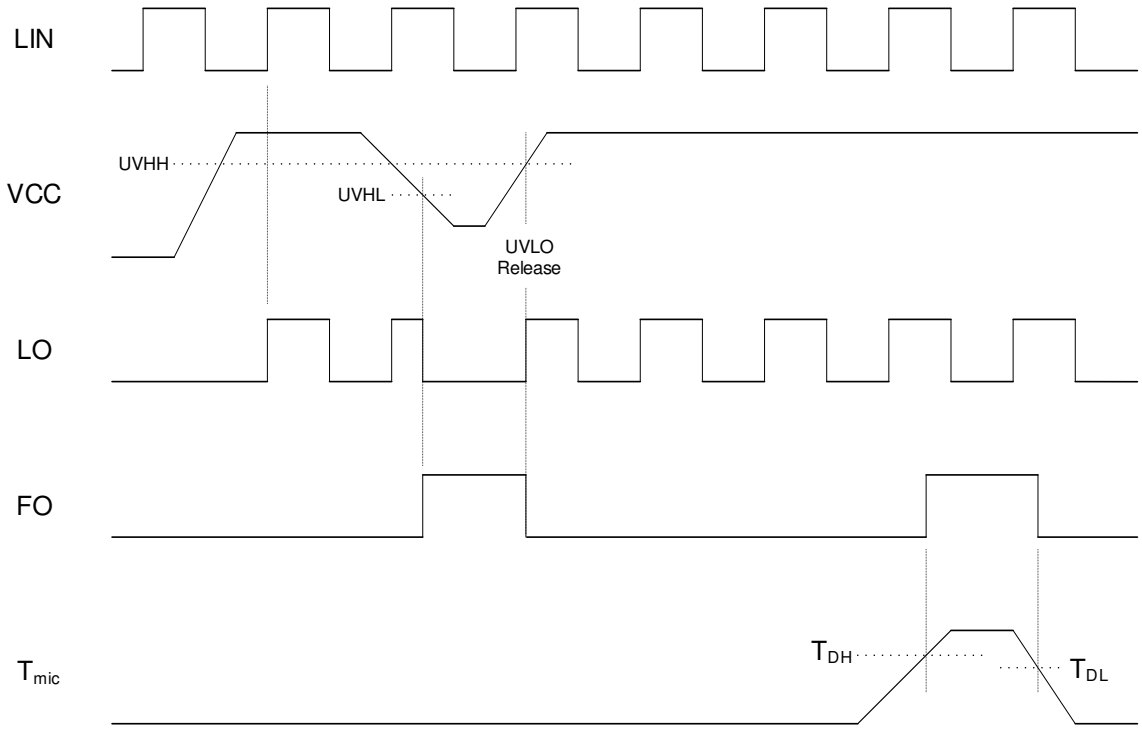
6. Timing Diagrams for Protection Operations

High-Side Input/Output



High-side turn-on at the next rising edge on HIN signal after UVLO release.

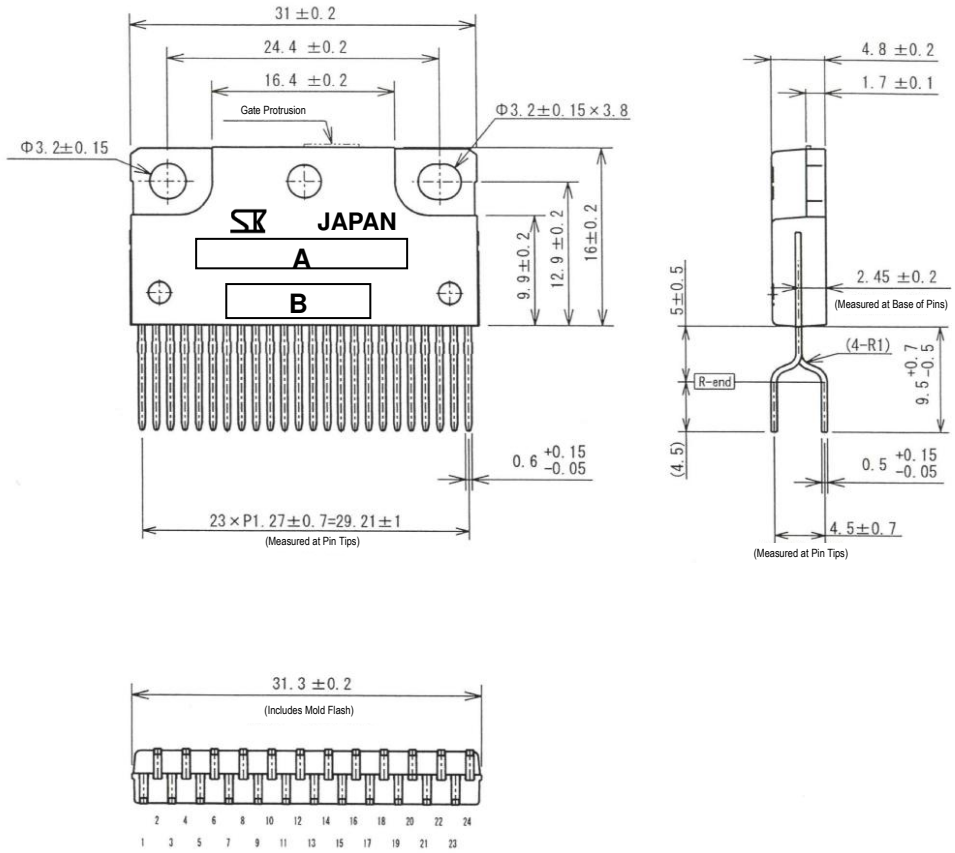
Low-Side Input/Output



Low-side turn-on in accordance with LIN signal level after UVLO release.

7. Package Outline Drawing

7-1. Leadform 2171 (Dimensions in Millimeters)



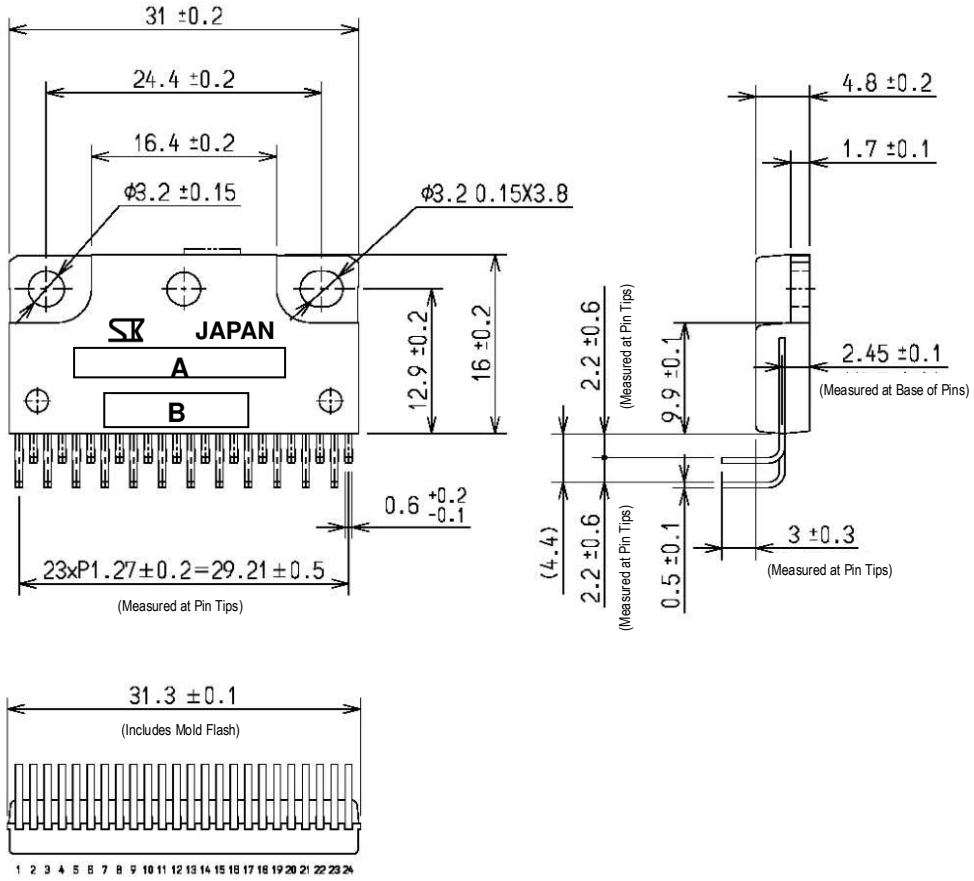
■ Branding Codes

A. Part number: *SLA6845MZ*

B. Lot number: *YMDD#*

- *Y* is the last digit of the year of manufacture
- *M* is the month of the year manufactured (1 to 9, O, N, or D)
- *DD* is the day of the month manufactured (01 to 31)
- *#* is the Sanken control number

7-2. Leadform 2175 (Dimensions in Millimeters)



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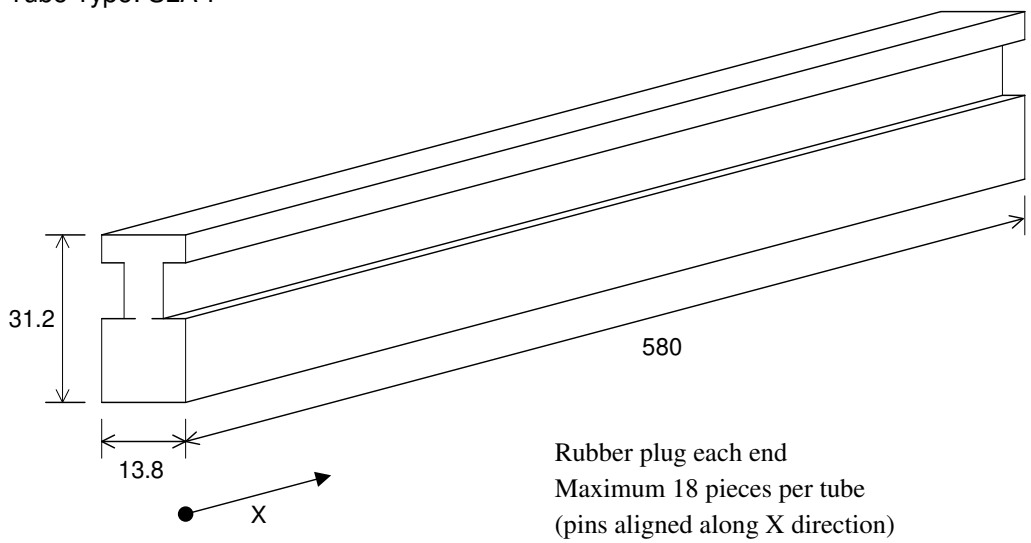
8. Packing Specifications

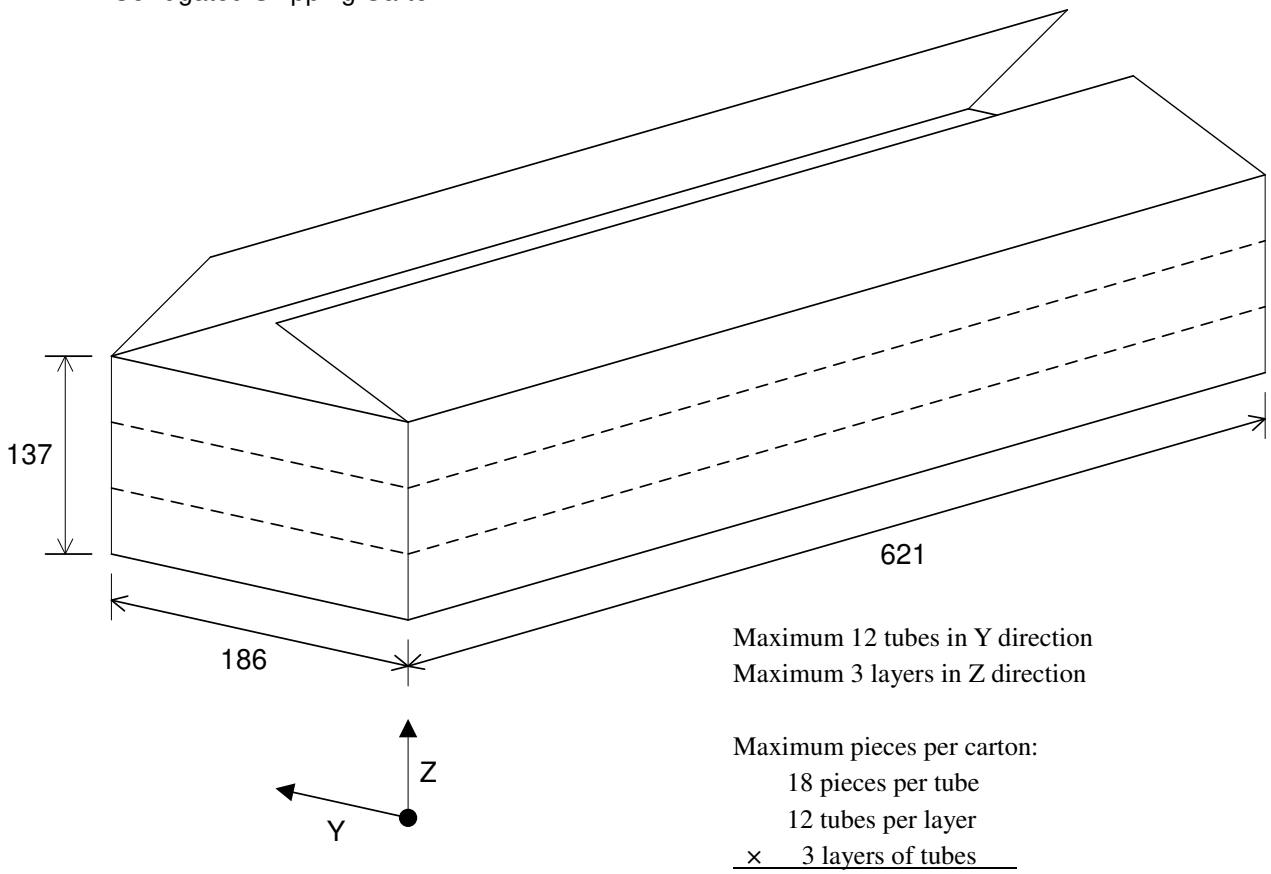
8-1. Leadform 2171 (Dimensions in Millimeters)

■ Tube Type: SLA-F



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

■ Corrugated Shipping Carton

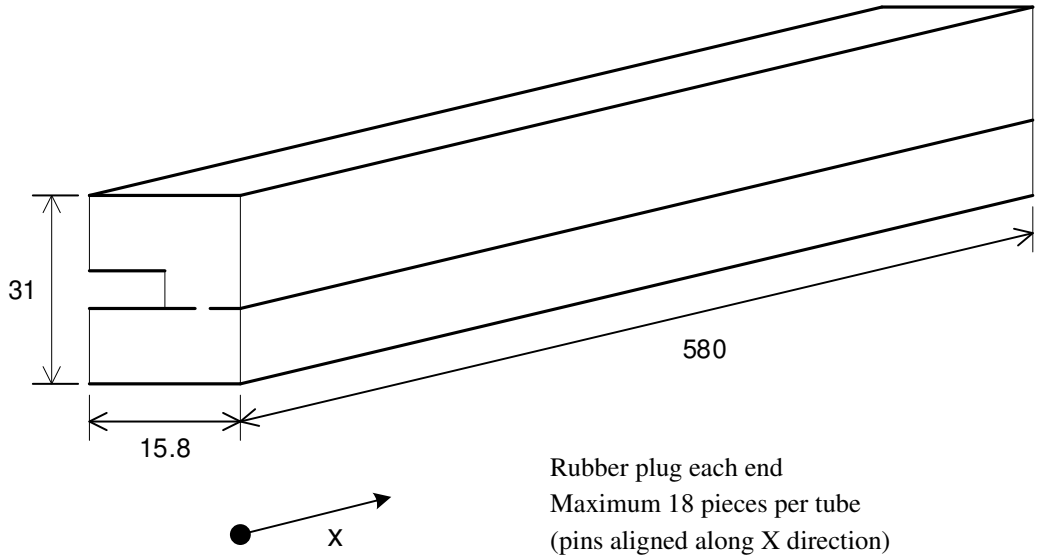


Maximum 12 tubes in Y direction
Maximum 3 layers in Z direction

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

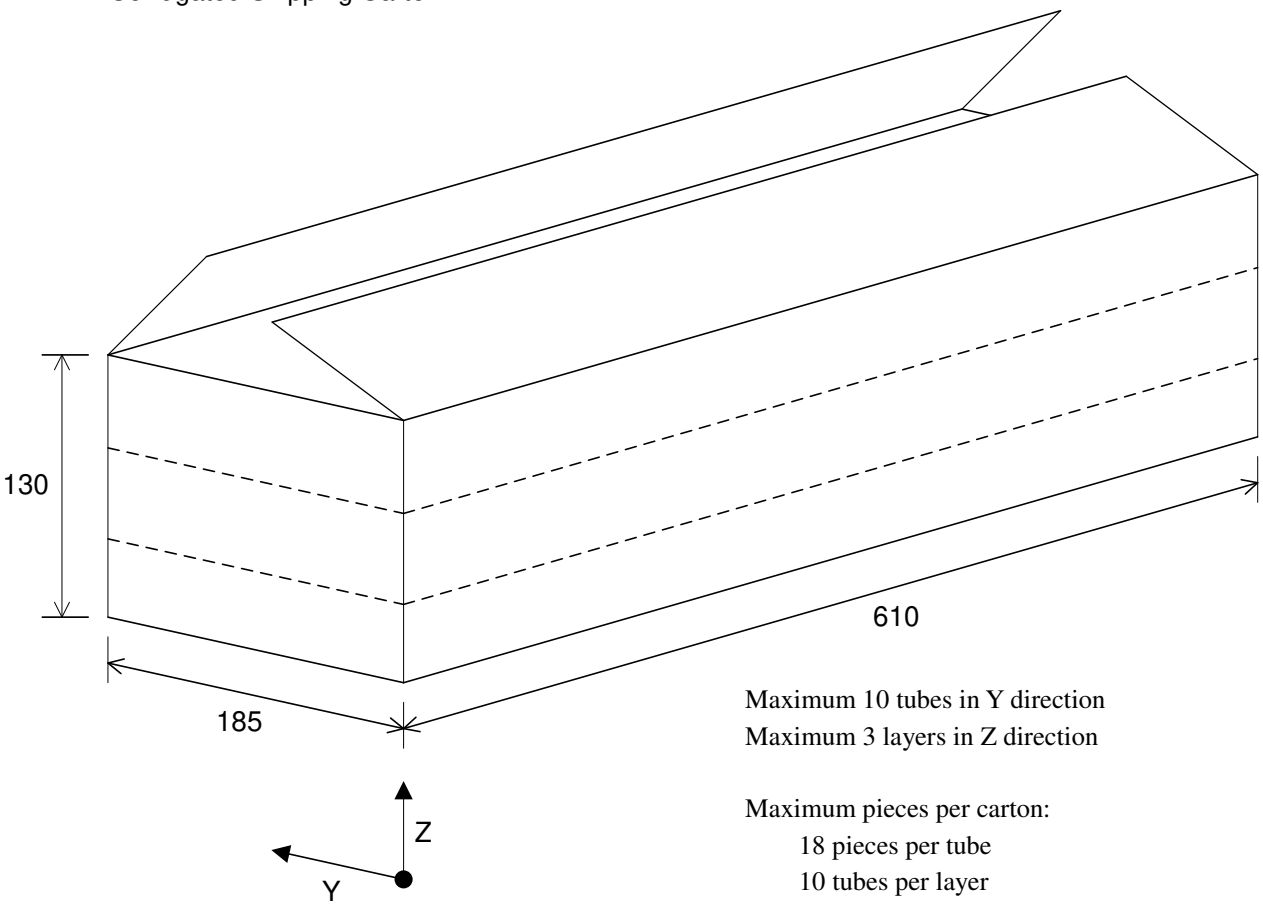
8-2. Leadform 2175 (Dimensions in Millimeters)

■ Tube Type: SLA-E



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

■ Corrugated Shipping Carton



Maximum 10 tubes in Y direction
Maximum 3 layers in Z direction

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

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