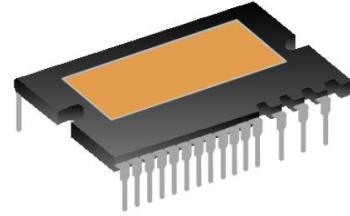## Features:

- 650V 15A Three-Phase IGBT inverter with control ICs inside
- Integrated OC SC protection & temperature output
- Very low thermal resistance
- High efficiency due to very low losses
- Integrated bootstrap diodes
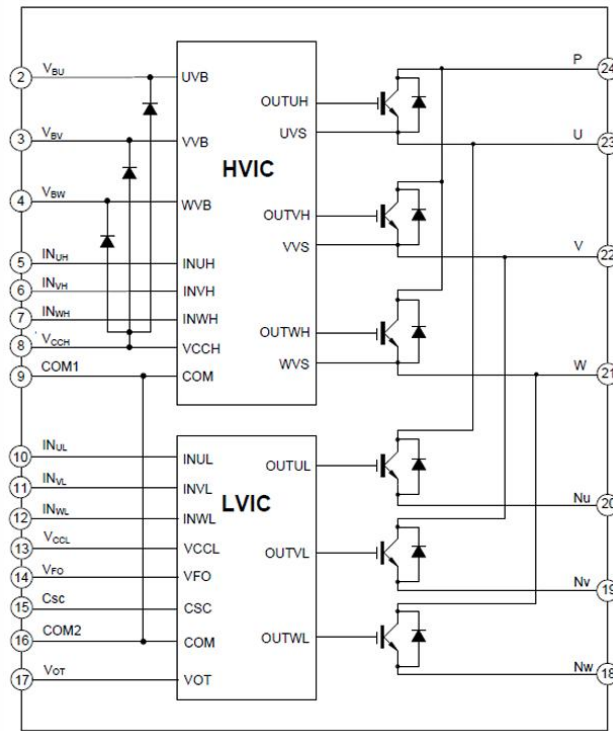- High reliability & strong SC withstand ability

DIP25

Applications:
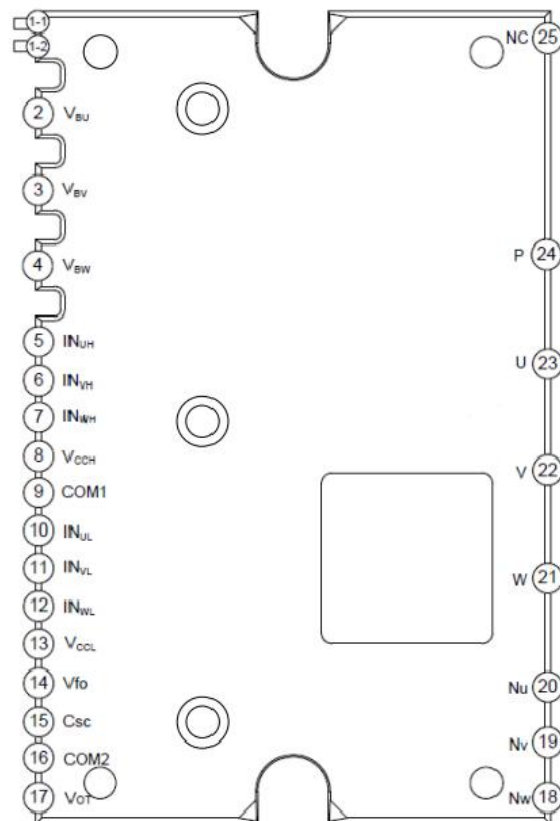
- Home appliances
- Motor drives
- General inverter

Package Parameters

Type	Marking	Package	Packaging method
JM15Z07DL1	JM15Z07DL1	DIP25	Tube

Internal Electrical Schematic

Pin Configuration

Pin Description

Pin	Name	Descriptions
1-1	NC	No Connection
1-2	NC	No Connection
2	V_{BU}	U-phase high side floating IC supply voltage
3	V_{BV}	V-phase high side floating IC supply voltage
4	V_{BW}	W-phase high side floating IC supply voltage
5	IN_{UH}	U-phase high side gate driver input
6	IN_{VH}	V-phase high side gate driver input
7	IN_{WH}	W-phase high side gate driver input
8	V_{CCH}	High side gate drive supply voltage
9	COM1	Module common ground
10	IN_{UL}	U-phase low side gate driver input
11	IN_{VL}	V-phase low side gate driver input
12	IN_{WL}	W-phase low side gate driver input
13	V_{CCL}	Low side gate drive supply voltage
14	V_{FO}	Fault Output
15	C_{SC}	External capacitor for short-circuit current detection input and low-pass filtering
16	COM2	Module common ground
17	V_{OT}	Temperature output terminal
18	N_W	W-phase DC negative terminal
19	N_V	V-phase DC negative terminal
20	N_U	U-phase DC negative terminal
21	W	Output for W Phase
22	V	Output for V Phase
23	U	Output for U Phase
24	P	Positive DC−Link Input
25	NC	No Connection

Absolute Maximum Ratings (T_{vj} = 25ºC, unless otherwise noted)

Symbol	Parameter	Values	Unit
Inverter Part			
V_{PN}	Supply voltage	450	V
$V_{PN(surge)}$	Supply voltage (surge)	500	V
V_{CES}	Collector − Emitter voltage	600	V
I_C	Each IGBT collector current, T_C = 25℃, $T_{vj} \le$ 150℃	15	A
I_{CP}	Each IGBT collector current (Peak),T_C= 25℃, $T_{vj} \le$ 150℃	30	A
P_D	Power dissipation per 1 chip , T_C=25℃	41	W
Control Part			
V_{CC}	Control supply voltage	20	V
V_{BS}	High−Side control bias voltage	20	V
V_{IN}	Input signal voltage	-0.3~V_{CC}+0.3	V
V_{FO}	Fault output supply voltage	-0.3~V_{CC}+0.3	V
T_{vj}	Operating junction temperature	-40 to 150	℃
T_{STG}	Storage temperature range	-40 to 150	℃
R_{thjc}-IGBT	Single IGBT thermal resistance, junction-case	3.0	℃/W
R_{thjc}-FRD	Single FRD thermal resistance, junction-case	3.6	℃/W
V_{ISO}	Isolation test voltage (1min, RMS, f = 60Hz)	1500	Vrms

Recommended Operation Conditions ($T_{vj} = 25ºC$, unless otherwise noted)

Symbol	Parameter	Values			Unit
		Min.	Typ.	Max.	
V_{PN}	Supply voltage	-	300	400	V
V_{CC}	Control supply voltage	13.2	-	20	V
V_{BS}	High side control voltage	13.0	-	20	V
V_{HO}	High side driver output voltage	V_{SS}	-	V_{BS}	V
V_{LO}	Low side driver output voltage	V_{SS}	-	V_{CC}	V

Electrical Characteristics ($T_{vj} = 25°C$, unless otherwise noted)

Inverter Part

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
V_{CEsat}	Collector − Emitter saturation voltage	$V_{CC}=V_{BS}=15V$ $V_{IN}=5V, I_C=15A$	-	1.6	-	V
V_F	FRD forward voltage	$V_{IN}=0V, I_F=15A$	-	1.5	-	V
t_{on}	High side switching & recovery time	$V_{PN} = 300V$ $V_{CC} = V_{BS} = 15V$ $I_C = 15A, V_{IN} = 0V$ to $5V$ Inductive load	-	575	-	ns
t_r			-	20	-	ns
t_{off}			-	483	-	ns
t_f			-	74	-	ns
t_{rr}			-	104	-	ns
t_{on}	Low side switching & recovery time		-	670	-	ns
t_r			-	68	-	ns
t_{off}			-	545	-	ns
t_f			-	55	-	ns
t_{rr}			-	142	-	ns
I_{CES}	Collector−Emitter leakage current	$V_{CE}=600V$	-	-	10	uA

Control Part

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
I_{QCC}	Quiescent V_{CC} supply current	V_{CC}=15V,V_{IN}=0V	-	-	1.3	mA
I_{QBS}	Quiescent V_{BS} supply current	V_{BS}=15V, V_{IN}=0V	-	-	300	uA
V_{FOH}	Fault output voltage	V_{SC}=0V V_{FO} Circuit: 10kΩ to 5V	4.9	-	-	V
V_{FOL}		V_{SC}=1V, I_{FO}=1mA	-	-	0.95	V
t_{FO}	Fault output pulse width	Fault duration	40	-	200	us
$V_{SC(ref)}$	Short-circuit trip level	V_{CC}=15V	0.455	0.48	0.505	V
OT_t	Over temperature protection trip	LVIC temperature	100	120	140	°C
OT_{rh}	Over temperature protection hysteresis	LVIC temperature Hysteresis	-	10	-	°C
V_{OT}	Temperature output	LVIC temperature=25°C	1.06	1.2	1.39	V
		LVIC temperature=90°C	2.63	2.77	2.91	V
UV_{CCt}	Low side undervoltage protection	Trip level	9.0	10.0	11.0	V
UV_{CCr}		Reset level	10.0	11.0	12.0	V
UV_{BSt}	High side undervoltage protection	Trip level	9.0	10.0	11.0	V
UV_{BSr}		Reset level	10.0	11.0	12.0	V
V_{IH}	On threshold voltage	Applied among inputs and COM	-	-	2.5	V
V_{IL}	Off threshold voltage		0.8	-	-	V

Temperature Output Function Description

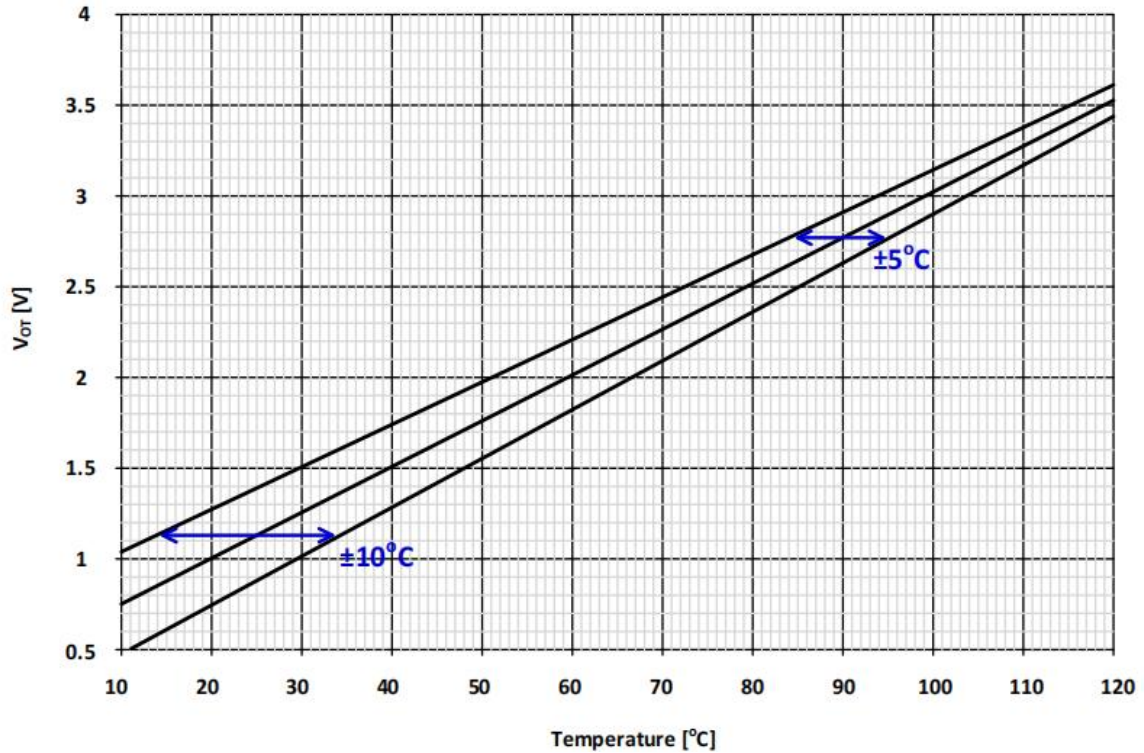**Figure 1.   V$_{OT}$ temperature characteristics**

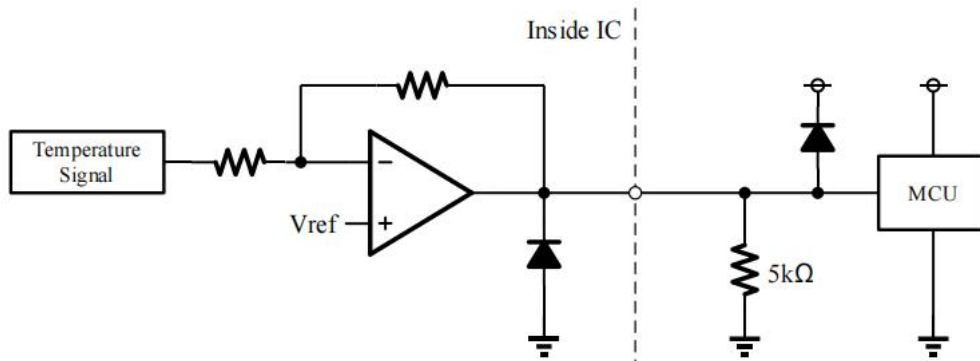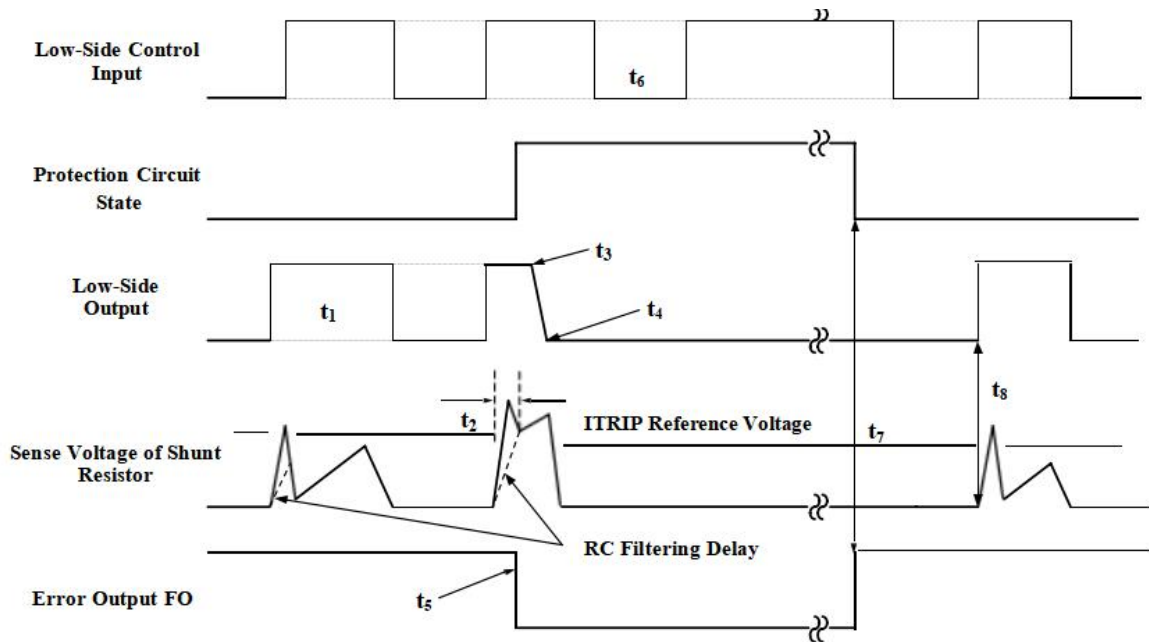**Figure 2.   V$_{OT}$ output circuit**

(1)   Connect 5kΩ to V$_{OT}$ pin if temperature monitoring function is used, and then the internal OTP function is omitted. Leave the V$_{OT}$ pin open (no connect) if internal over-temperature shutdown function is used. However, the V$_{OT}$ is also operated, but with inferior accuracy.

(2)   In the case of using V$_{OT}$ with low voltage controller like 3.3V MCU, V$_{OT}$ output might exceed control supply voltage 3.3V when temperature rises excessively. If system useslow voltage controller, it is recommended to insert a clamp diode between control supply of the controller and V$_{OT}$ output for preventing over voltage destruction.

Short-Circuit Protection Function Description

Figure 2.   Short-circuit protection

t1 : Normal operation, Low-Side output.

t2 : Short circuit current detection (I_{TRIP} trigger).

(It is recommended to set RC time constant 1.5-2.0us so that IGBT shunt down within 2.0us when I_{TRIP} be triggered.) t3 : All low-side outputs are hard interrupted.

t4 : All low-side outputs turn off.
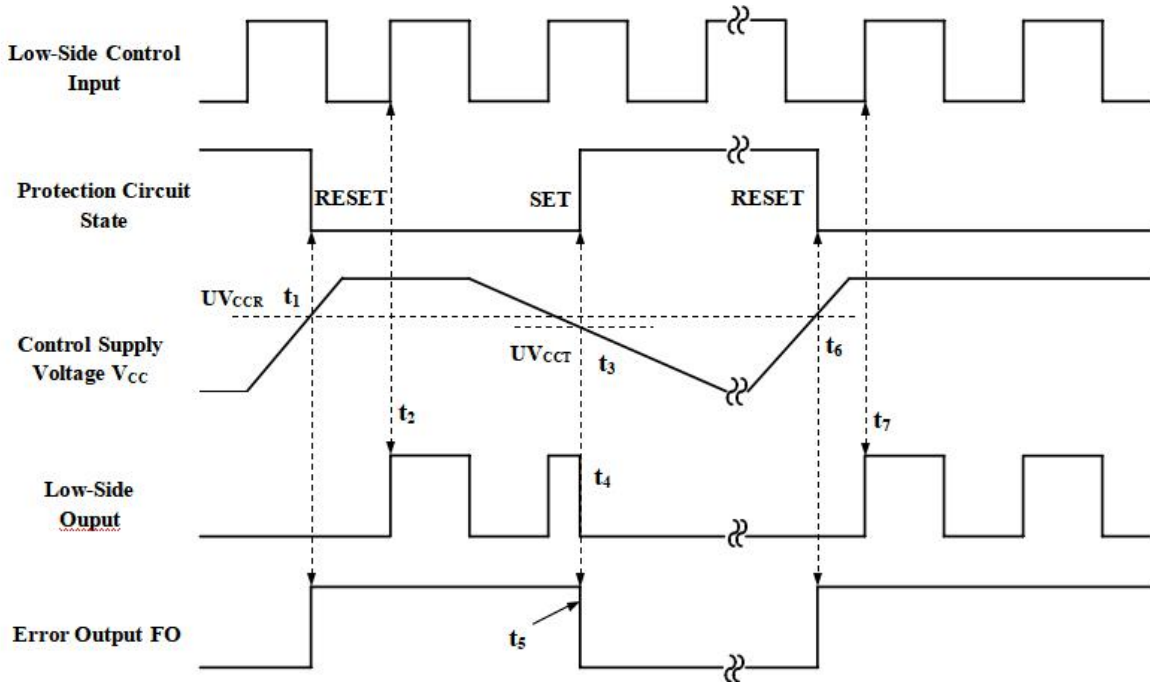
t5 : FO outputs for t_{FO}=40us (min).

t6 : Input is low, outputs turn off.

t7 : FO rise to high, but outputs don't turn on until input signal change low to high.

t8 : Normal operation, outputs on.

Low-side Under-Voltage Protection Description

Figure 3.   Under-voltage protection(low side)

t1 : Control supply voltage V_{CC} exceeds under voltage reset level (UV_{CCR}), but output turns on until next high level signal.

t2 : Normal operation, outputs turn on.

t3 : V_{CC} level drops to under voltage trip level. (UV_{CCT})

t4 : All low side outputs turn off in spite of control input condition.

t5 : FO outputs for t_{FO}=40us (Min), but output is extended during V_{CC} keeps below UV_{CCR}.

t6 : V_{CC} level reaches UV_{CCR}.

t7 : Normal operation, outputs turn on.

Over Temperature Protection Description
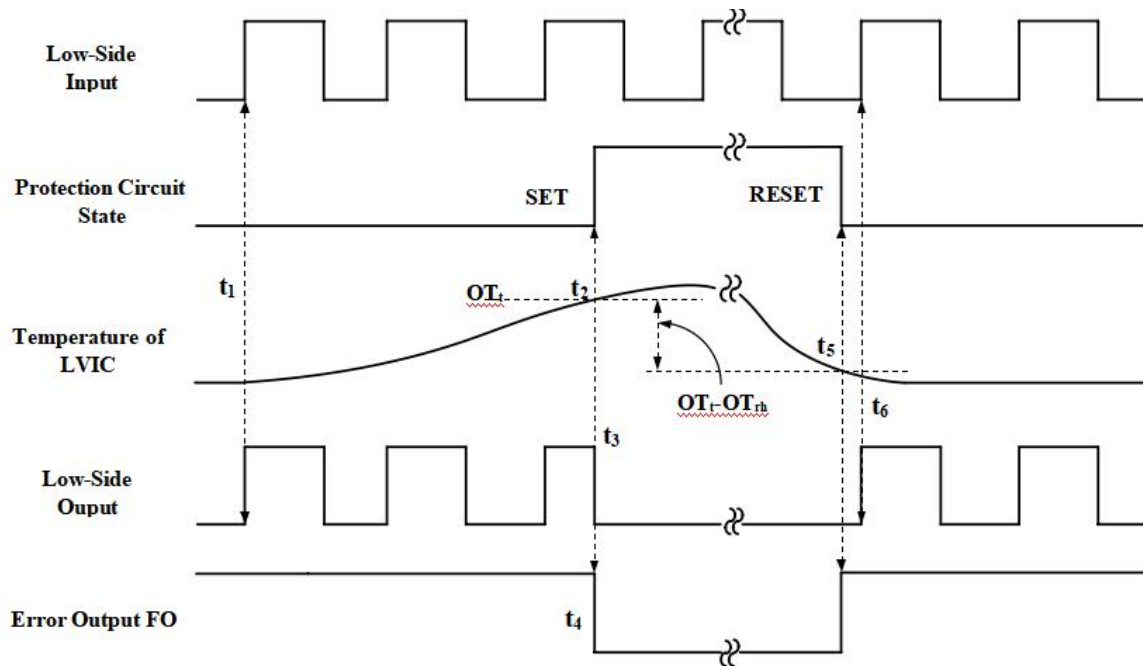
Figure 4.　Over temperature protection

t1 : Normal operation, low side outputs turn on.

t2 : LVIC temperature exceeds over temperature trip level (OTt).

t3 : All low side outputs turn off in spite of control input condition.

t4 : FO outputs for t_{FO}=40us (Min), but output is extended during LVIC temperature higher than OTt.

t5 : LVIC temperature drops to over temperature reset level.

t6 : Normal operation, low side outputs turn on by next high level signal.

Package dimension

DIP-25
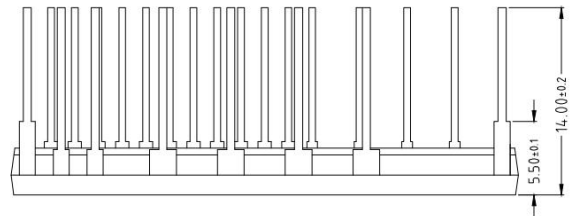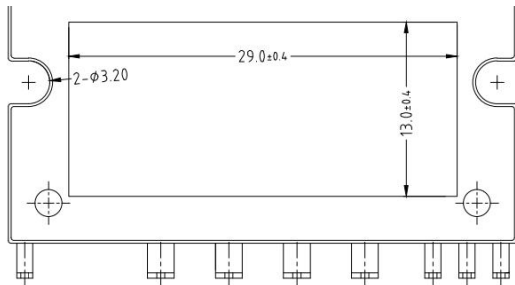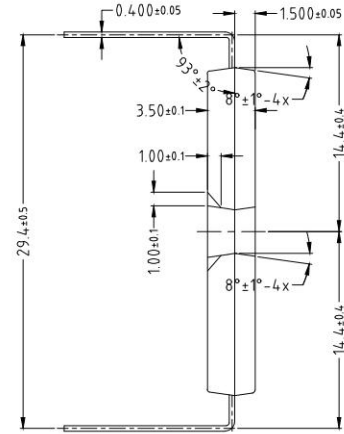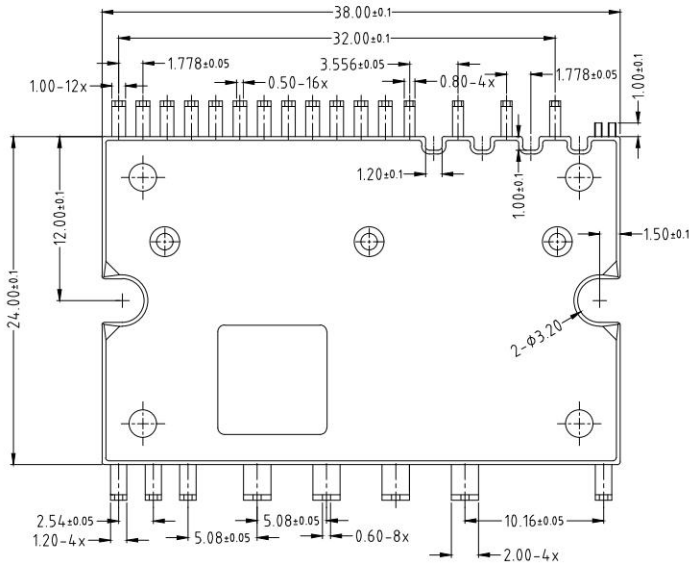
Revision history

Date	Revision	Changes
2023-12-23	Rev 1.0	Release of the datasheet.

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