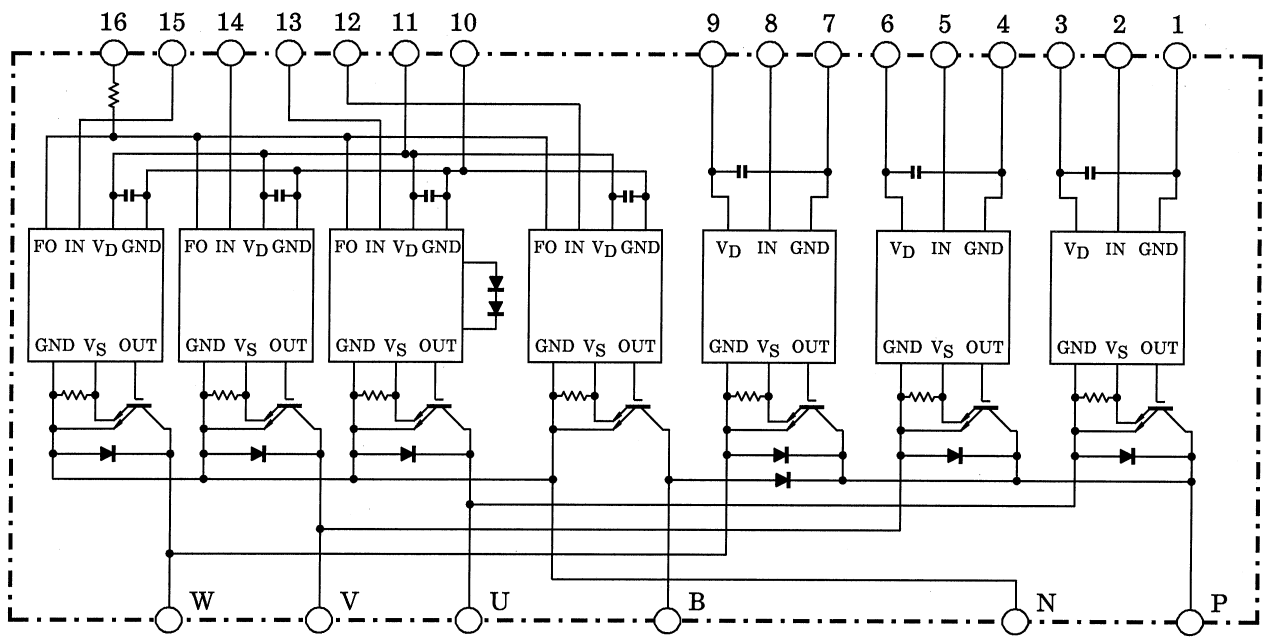


# MIG50Q201H

High Power Switching Applications  
 Motor Control Applications

- Integrates inverter, brake power circuits & control circuits (IGBT drive units, protection units for over-current, realtime-current-control (RTC), under-voltage & over-temperature) in one package.
- The electrodes are isolated from case.
- High speed type IGBT :  $V_{CE(sat)} = 3.5 \text{ V (Max.)}$   
 $t_{off} = 2.6 \mu\text{s (Max.)}$   
 $t_{rr} = 0.21 \mu\text{s (Max.)}$
- Outline : 2-110A1A
- Weight : 520 g

## Equivalent Circuit



- |            |            |                       |             |                        |                       |
|------------|------------|-----------------------|-------------|------------------------|-----------------------|
| 1. GND (U) | 2. IN (U)  | 3. V <sub>D</sub> (U) | 4. GND (V)  | 5. IN (V)              | 6. V <sub>D</sub> (V) |
| 7. GND (W) | 8. IN (W)  | 9. V <sub>D</sub> (W) | 10. GND (L) | 11. V <sub>D</sub> (L) | 12. IN (B)            |
| 13. IN (X) | 14. IN (Y) | 15. IN (Z)            | 16. FO      |                        |                       |

## Maximum Ratings (T<sub>j</sub> = 25°C)

Stage	Characteristic	Condition	Symbol	Ratings	Unit
Inverter	Supply voltage	P-N power terminal	V <sub>CC</sub>	900	V
	Collector-emitter voltage	—	V <sub>CES</sub>	1200	V
	Collector current	T <sub>c</sub> = 25°C, DC	I <sub>C</sub>	50	A
	Forward current	T <sub>c</sub> = 25°C, DC	I <sub>F</sub>	50	A
	Collector power dissipation	T <sub>c</sub> = 25°C	P <sub>C</sub>	300	W
	Junction temperature	—	T <sub>j</sub>	150	°C
Brake	Supply voltage	P-N power terminal	V <sub>CC</sub>	900	V
	Collector-emitter voltage	—	V <sub>CES</sub>	1200	V
	Collector current	T <sub>c</sub> = 25°C, DC	I <sub>C</sub>	25	A
	Reverse voltage	—	V <sub>R</sub>	1200	V
	Forward current	T <sub>c</sub> = 25°C, DC	I <sub>F</sub>	25	A
	Collector power dissipation	T <sub>c</sub> = 25°C	P <sub>C</sub>	140	W
	Junction temperature	—	T <sub>j</sub>	150	°C
Control	Control supply voltage	V <sub>D</sub> -GND terminal	V <sub>D</sub>	20	V
	Input voltage	IN-GND terminal	V <sub>IN</sub>	20	V
	Fault output voltage	FO-GND (L) terminal	V <sub>FO</sub>	20	V
	Fault output current	FO sink current	I <sub>FO</sub>	14	mA
Module	Operating temperature	—	TC	-20 ~ +100	°C
	Storage temperature range	—	T <sub>stg</sub>	-40 ~ +125	°C
	Isolation voltage	AC 1 minute	V <sub>ISO</sub>	2500	V
	Screw torque	M5	—	3	Nm

## Electrical Characteristics

### a. Inverter Stage

Characteristic	Symbol	Test Condition		Min	Typ.	Max	Unit
Collector cut-off current	I <sub>CEX</sub>	V <sub>CE</sub> = 1200V	T <sub>j</sub> = 25°C	—	—	1	mA
			T <sub>j</sub> = 125°C	—	—	10	
Collector-emitter saturation voltage	V <sub>CE (sat)</sub>	V <sub>D</sub> = 15 V, I <sub>C</sub> = 50 A V <sub>IN</sub> = 15 V → 0 V	T <sub>j</sub> = 25°C	—	2.6	3.5	V
			T <sub>j</sub> = 125°C	—	2.5	—	
Forward voltage	V <sub>F</sub>	I <sub>F</sub> = 50A		—	2.0	2.8	V
Switching time	t <sub>on</sub>	V <sub>CC</sub> = 600 V, I <sub>C</sub> = 50 A V <sub>D</sub> = 15 V, V <sub>IN</sub> = 15 V ↔ 0 V Inductive load	(Note 1)	—	1.0	1.7	μs
	t <sub>c (on)</sub>			—	0.4	0.8	
	t <sub>rr</sub>			—	0.16	0.21	
	t <sub>off</sub>			—	1.9	2.6	
	t <sub>c (off)</sub>			—	0.35	0.6	

## b. Brake Stage

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	$I_{CEX}$	$V_{CE} = 1200V$	$T_j = 25^\circ C$	—	—	1	mA
			$T_j = 125^\circ C$	—	—	10	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_D = 15V,$ $I_C = 25A$ $V_{IN} = 15V \rightarrow 0V$	$T_j = 25^\circ C$	—	2.6	3.5	V
			$T_j = 125^\circ C$	—	2.5	—	
Reverse current	$I_R$	$V_R = 1200V$		—	—	1	mA
				—	—	10	
Forward voltage	$V_F$	$I_F = 25A$	—	1.4	2.2	V	
Switching time	$t_{on}$	$V_{CC} = 600V, I_C = 25A$ $V_D = 15V, V_{IN} = 15V \leftrightarrow 0V$ Inductive load  (Note 1)		—	1.3	1.9	$\mu s$
	$t_c(on)$			—	0.85	1.6	
	$t_{rr}$			—	0.42	0.50	
	$t_{off}$			—	1.9	2.6	
	$t_c(off)$			—	0.3	0.6	

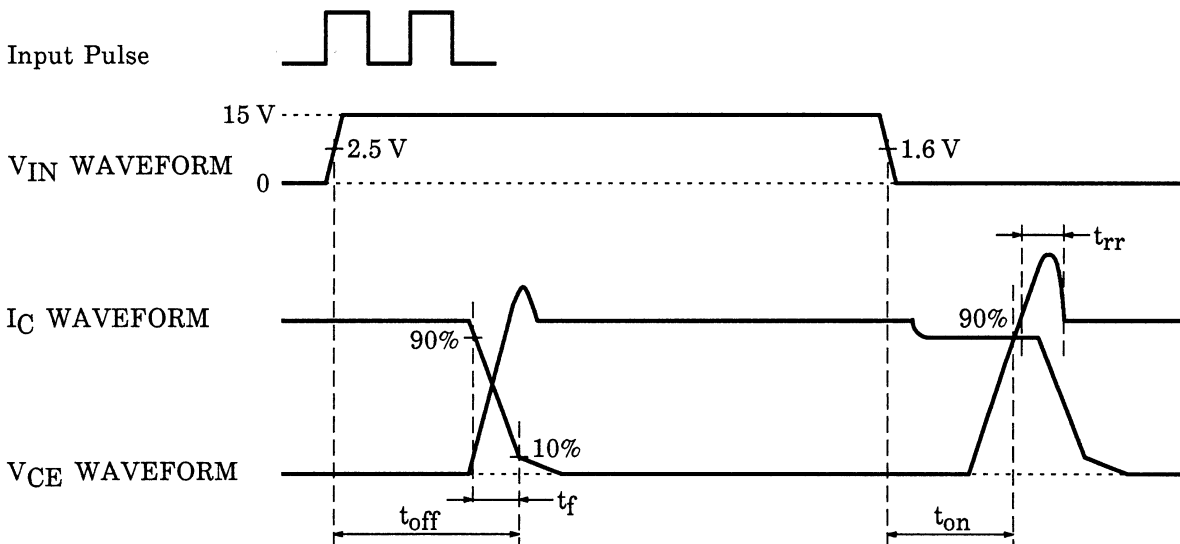
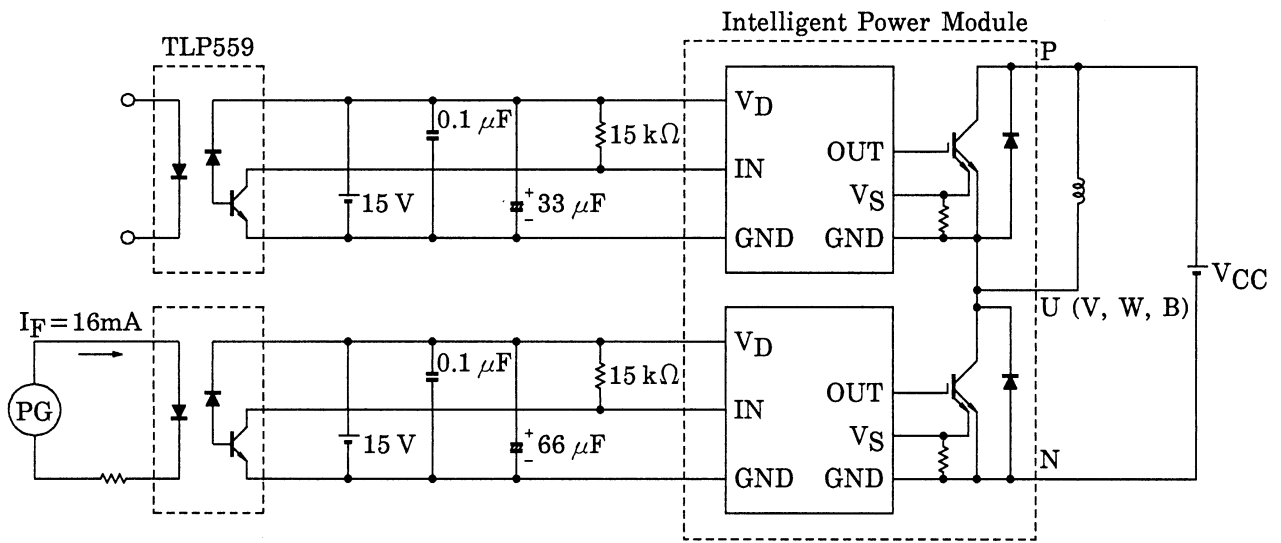
## c. Control Stage ( $T_j = 25^\circ C$ )

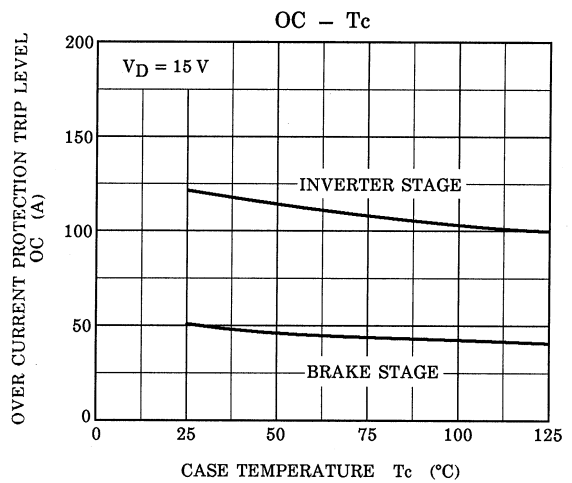
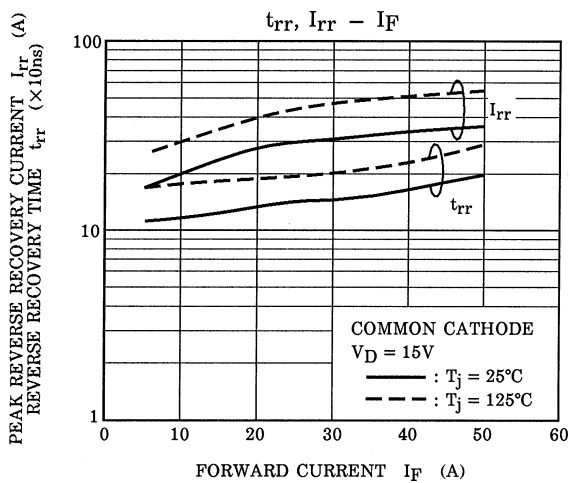
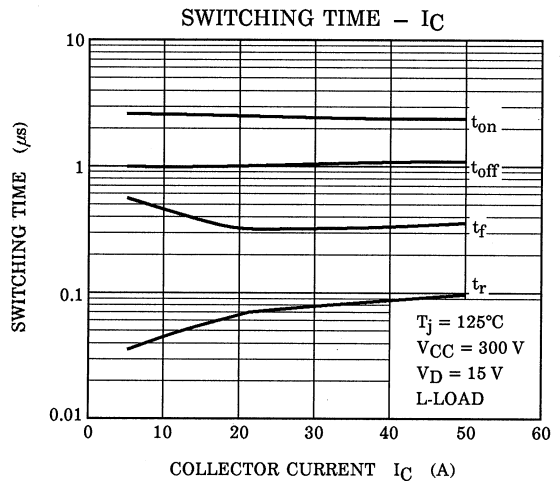
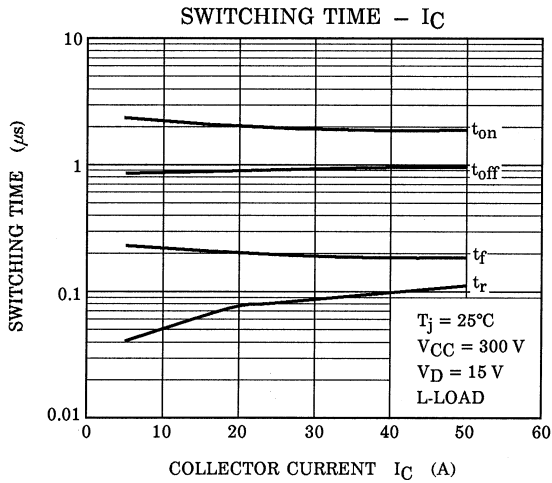
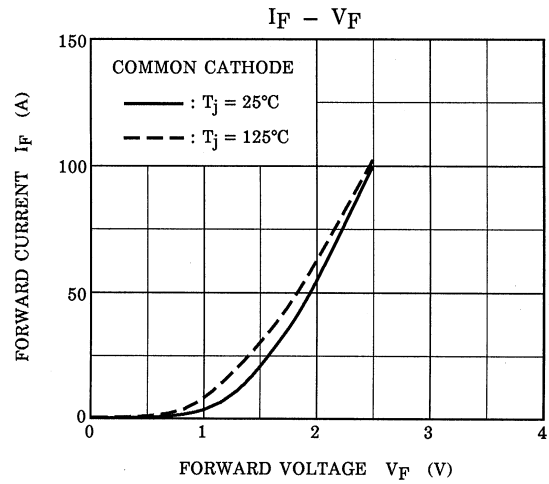
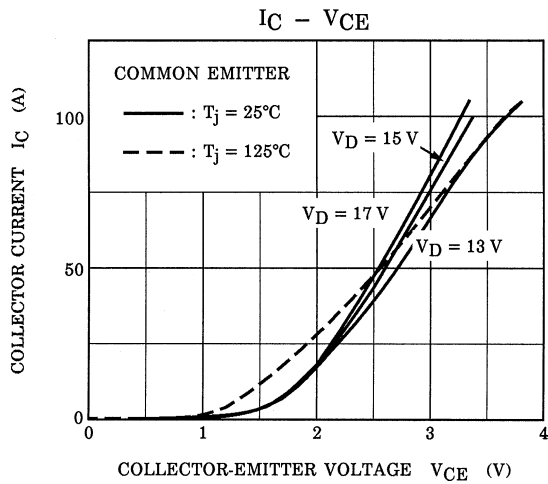
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Control circuit current	High side	$I_D(H)$	$V_D = 15V$	—	8	12	mA
	Low side			$I_D(L)$	—	32	
Input-on signal voltage	$V_{IN(on)}$	$V_D = 15V, I_C = 50mA$	1.4	1.6	1.8	V	
Input-off signal voltage	$V_{IN(off)}$	—	2.2	2.5	2.8	V	
Fault output current	Protection	$I_{FO(on)}$	$V_D = 15V$	5.4	6.0	6.6	mA
	Normal			$I_{FO(off)}$	—	—	
Over current protection trip level	Inverter	OC	$V_D = 15V, T_j = 125^\circ C$	85	100	—	A
	Brake			40	50	—	
Short circuit protection trip level	Inverter	SC	$V_D = 15V, T_j = 125^\circ C$	120	150	—	A
	Brake			60	75	—	
Over current cut-off time	$t_{off(OC)}$	$V_D = 15V$	—	5	—	$\mu s$	
Over temperature protection	Trip level	OT	Case temperature	110	118	125	$^\circ C$
	Reset level			OTr	—	98	
Control supply under voltage protection	Trip level	UV	—	11.0	12.0	12.5	V
	Reset level			UVr	12.0	12.5	
Fault output pulse width	$t_{FO}$	$V_D = 15V$	1	2	3	ms	

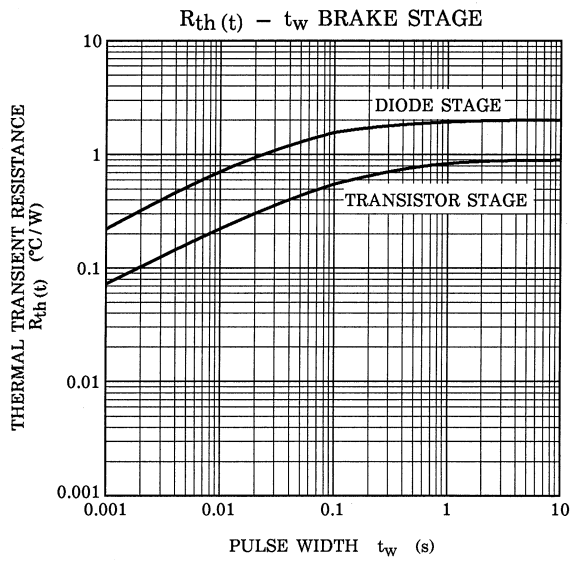
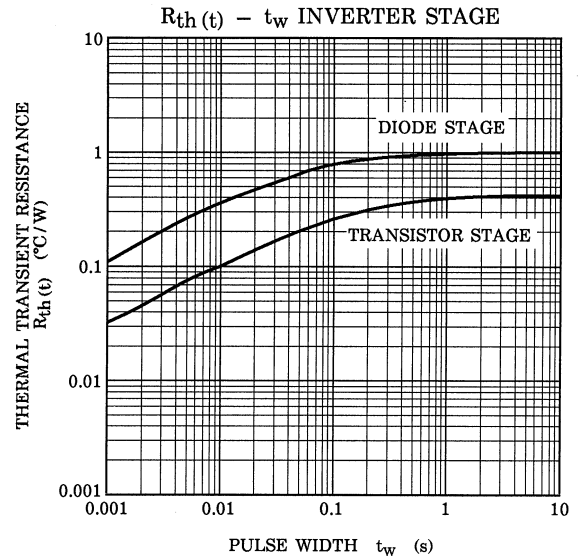
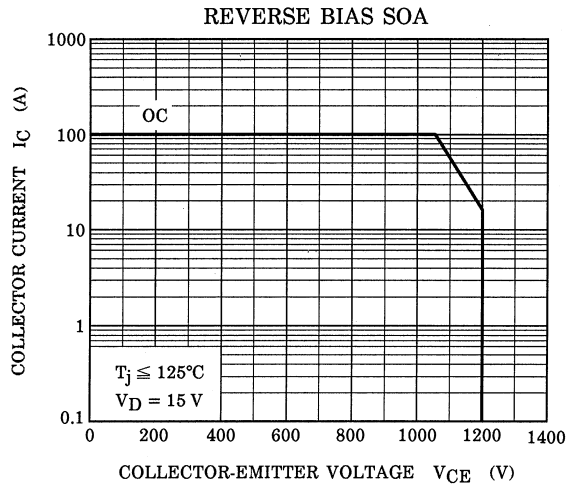
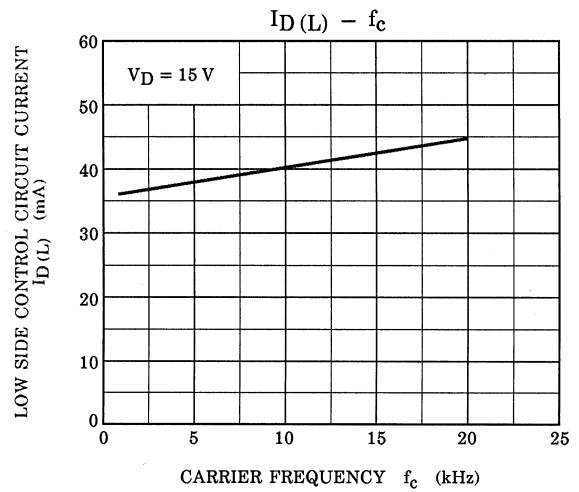
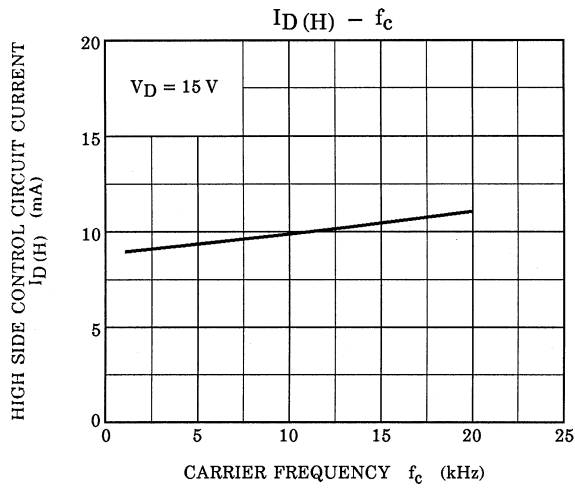
**d. Thermal Resistance ( $T_j = 25^\circ\text{C}$ )**

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	Inverter IGBT stage	—	—	0.417	$^\circ\text{C} / \text{W}$
		Inverter FRD stage	—	—	1.000	
		Brake IGBT stage	—	—	0.892	
		Brake FRD stage	—	—	2.000	
Case to fin thermal resistance	$R_{th(c-f)}$	Compound is applied	—	0.05	—	$^\circ\text{C} / \text{W}$

Note 1: Switching time test circuit & timing chart

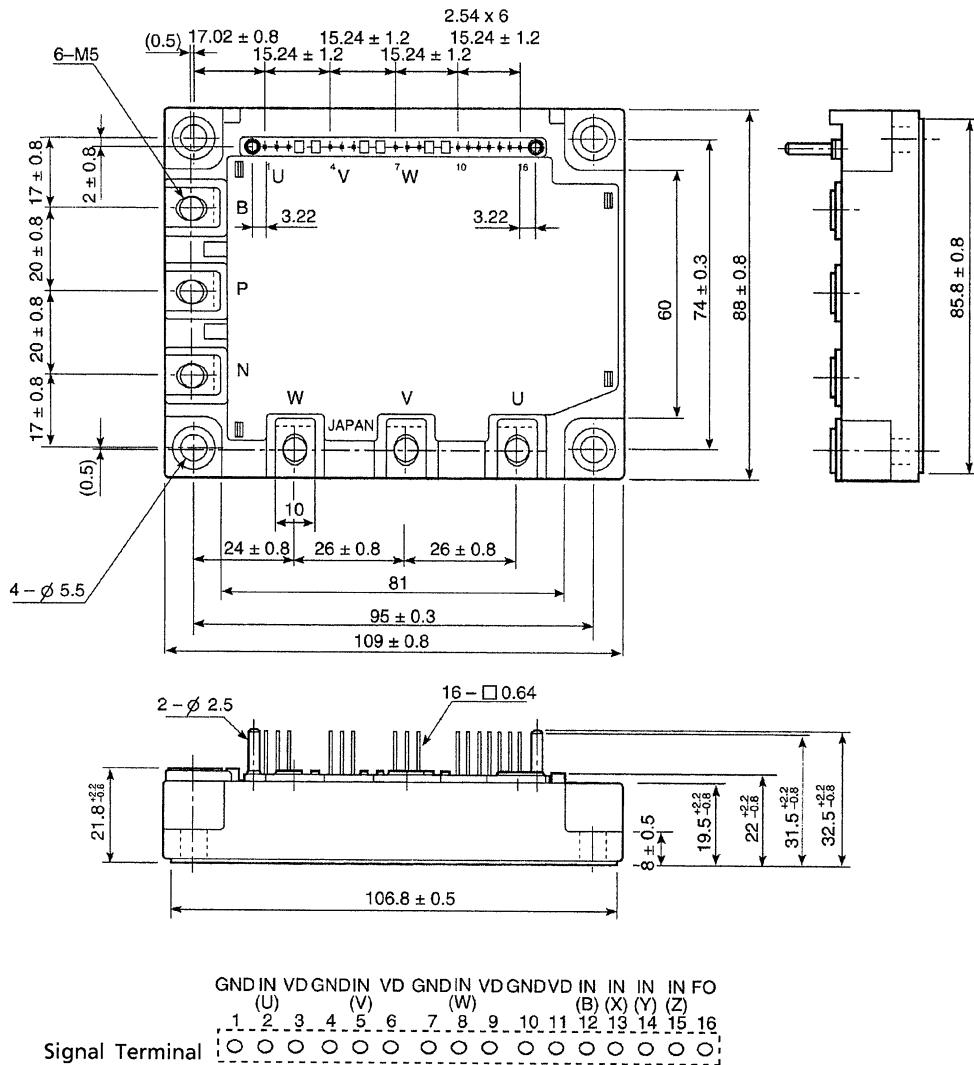






## Package Dimensions: TOSHIBA 2-110A1A

Unit: mm



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