

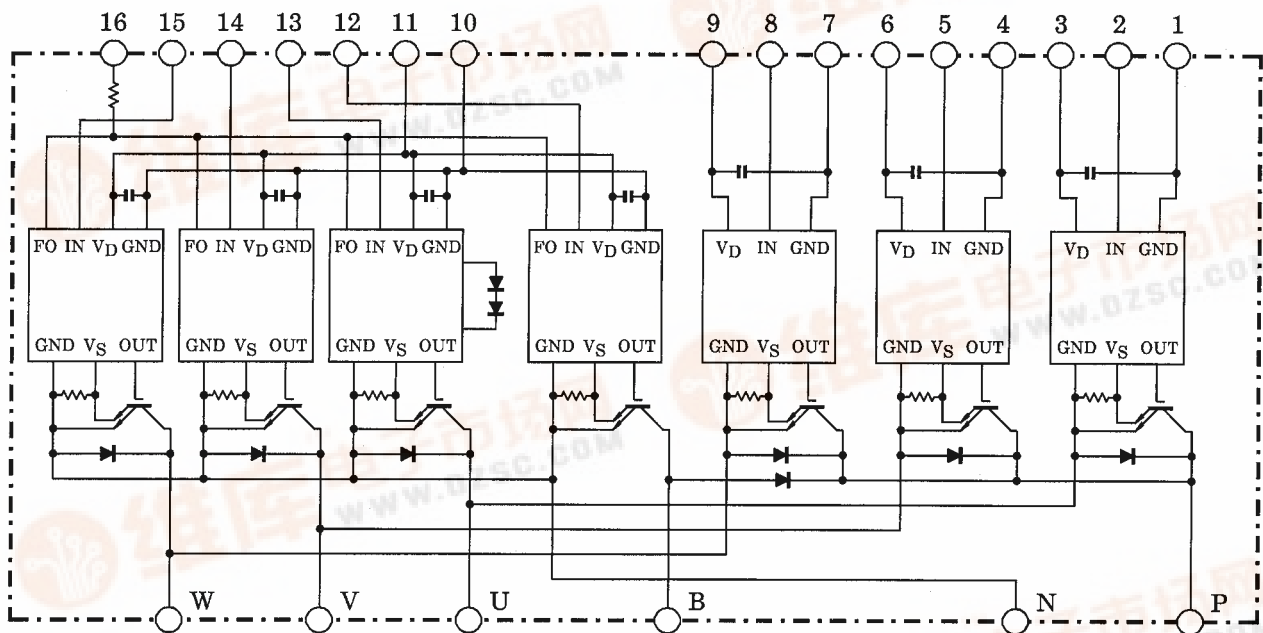
TOSHIBA Intelligent Power Module Silicon N Channel IGBT

# 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. $V_D$ (U) | 4. GND (V)  | 5. IN (V)     | 6. $V_D$ (V) |
| 7. GND (W) | 8. IN (W)  | 9. $V_D$ (W) | 10. GND (L) | 11. $V_D$ (L) | 12. IN (B)   |
| 13. IN (X) | 14. IN (Y) | 15. IN (Z)   | 16. FO      |               |              |

## Maximum Ratings ( $T_j = 25^\circ\text{C}$ )

Stage	Characteristic	Condition	Symbol	Ratings	Unit
Inverter	Supply voltage	P-N power terminal	$V_{CC}$	900	V
	Collector-emitter voltage	—	$V_{CES}$	1200	V
	Collector current	$T_c = 25^\circ\text{C}$ , DC	$I_C$	50	A
	Forward current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	50	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	$P_C$	300	W
	Junction temperature	—	$T_j$	150	$^\circ\text{C}$
Brake	Supply voltage	P-N power terminal	$V_{CC}$	900	V
	Collector-emitter voltage	—	$V_{CES}$	1200	V
	Collector current	$T_c = 25^\circ\text{C}$ , DC	$I_C$	25	A
	Reverse voltage	—	$V_R$	1200	V
	Forward current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	25	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	$P_C$	140	W
	Junction temperature	—	$T_j$	150	$^\circ\text{C}$
Control	Control supply voltage	$V_D$ -GND terminal	$V_D$	20	V
	Input voltage	IN-GND terminal	$V_{IN}$	20	V
	Fault output voltage	FO-GND (L) terminal	$V_{FO}$	20	V
	Fault output current	FO sink current	$I_{FO}$	14	mA
Module	Operating temperature	—	TC	-20 ~ +100	$^\circ\text{C}$
	Storage temperature range	—	$T_{stg}$	-40 ~ +125	$^\circ\text{C}$
	Isolation voltage	AC 1 minute	$V_{ISO}$	2500	V
	Screw torque	M5	—	3	Nm

## Electrical Characteristics

### a. Inverter Stage

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	$I_{CEX}$	$V_{CE} = 1200\text{V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Collector-emitter saturation voltage	$V_{CE}(\text{sat})$	$V_D = 15\text{V}$ , $I_C = 50\text{A}$ $V_{IN} = 15\text{V} \rightarrow 0\text{V}$	$T_j = 25^\circ\text{C}$	—	2.6	3.5	V
			$T_j = 125^\circ\text{C}$	—	2.5	—	
Forward voltage	$V_F$	$I_F = 50\text{A}$	—	2.0	2.8	V	
Switching time	$t_{on}$	$V_{CC} = 600\text{V}$ , $I_C = 50\text{A}$ $V_D = 15\text{V}$ , $V_{IN} = 15\text{V} \leftrightarrow 0\text{V}$ Inductive load  (Note 1)	—	1.0	1.7	$\mu\text{s}$	
	$t_c(\text{on})$		—	0.4	0.8		
	$t_{rr}$		—	0.16	0.21		
	$t_{off}$		—	1.9	2.6		
	$t_c(\text{off})$		—	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	$V_{CE(sat)}$	$V_D = 15 V,$ $I_C = 25 A$ $V_{IN} = 15 V \rightarrow 0 V$	$T_j = 25^\circ C$	—	2.6	3.5	V
			$T_j = 125^\circ C$	—	2.5	—	
Reverse current	$I_R$	$V_R = 1200 V$		—	—	1	mA
				—	—	10	
Forward voltage	$V_F$	$I_F = 25A$	—	1.4	2.2	V	
Switching time	$t_{on}$	$V_{CC} = 600 V, I_C = 25 A$ $V_D = 15 V, V_{IN} = 15 V \leftrightarrow 0 V$ 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	

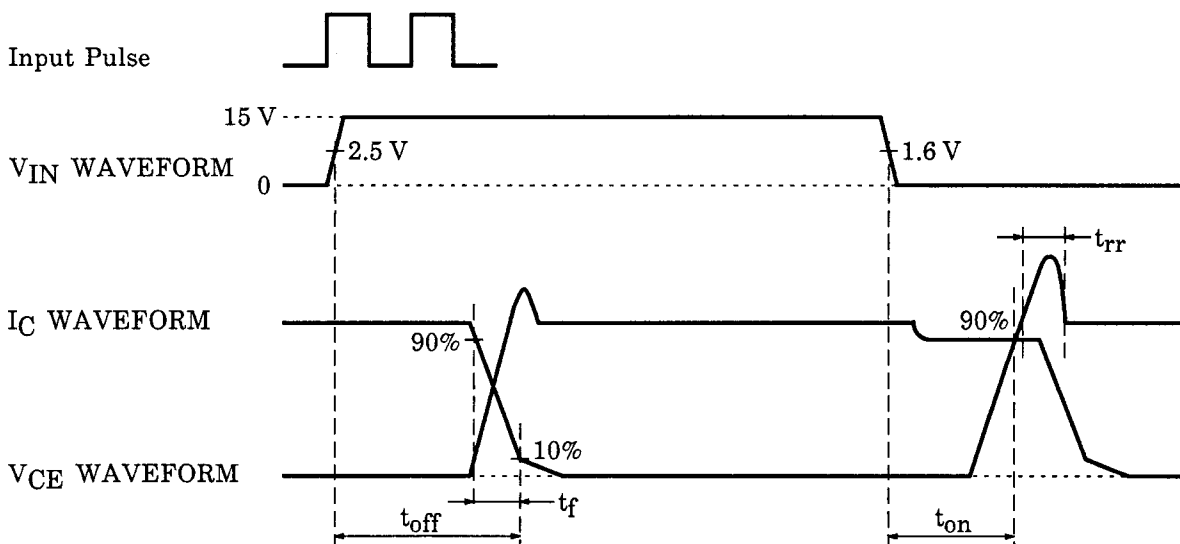
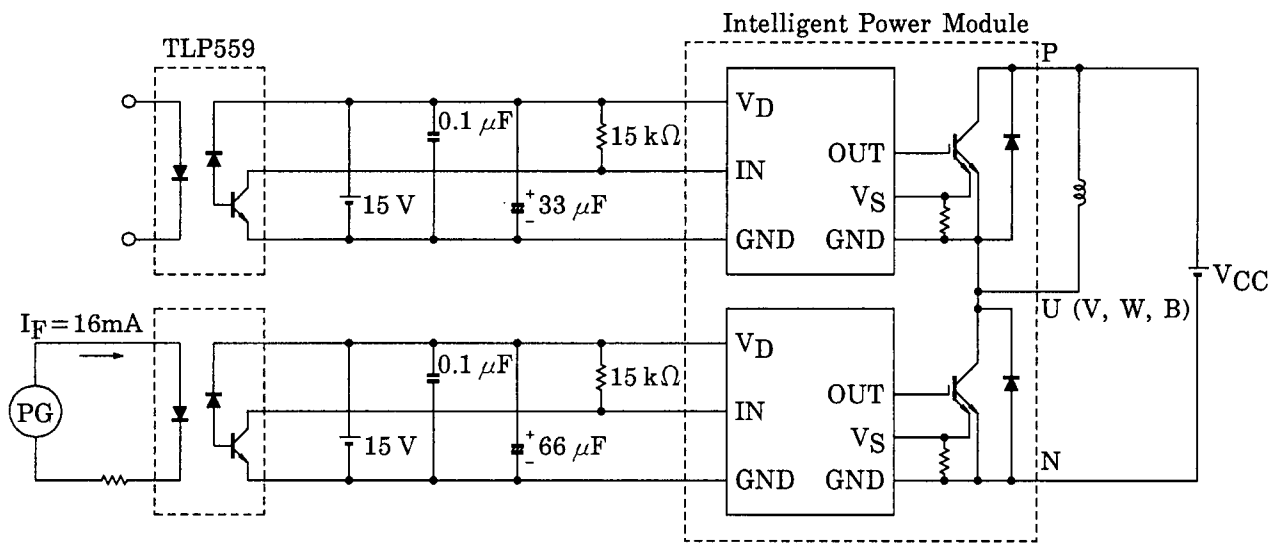
## c. Control Stage ( $T_j = 25^\circ C$ )

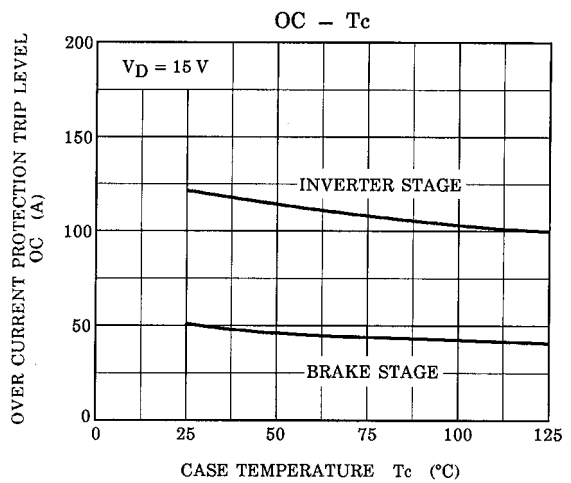
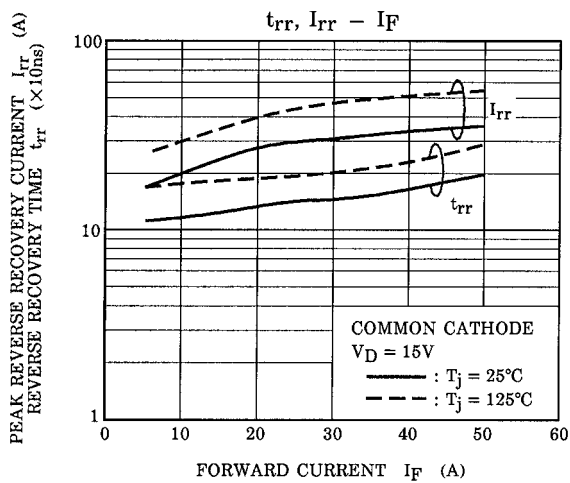
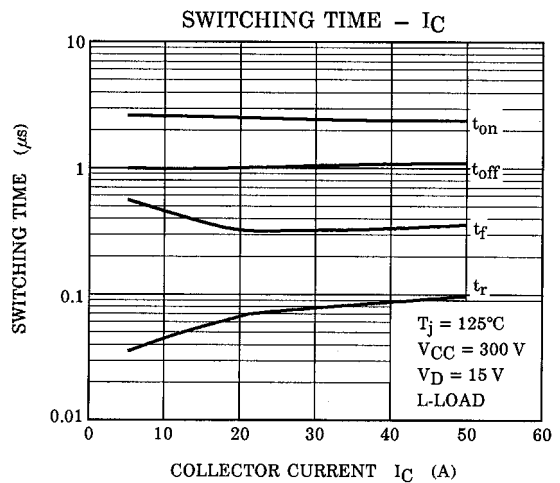
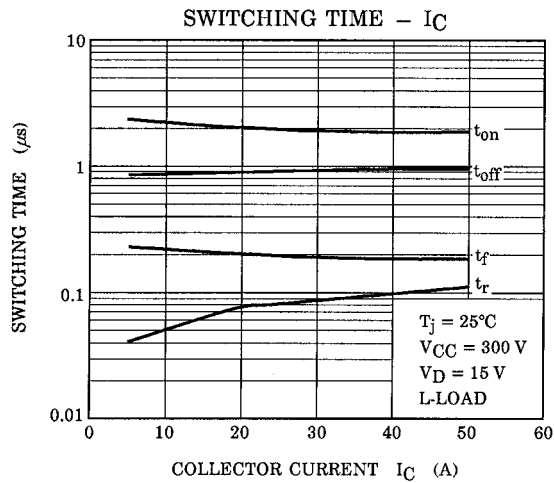
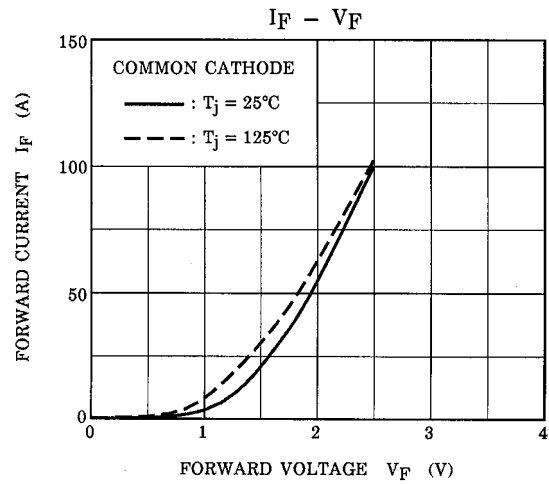
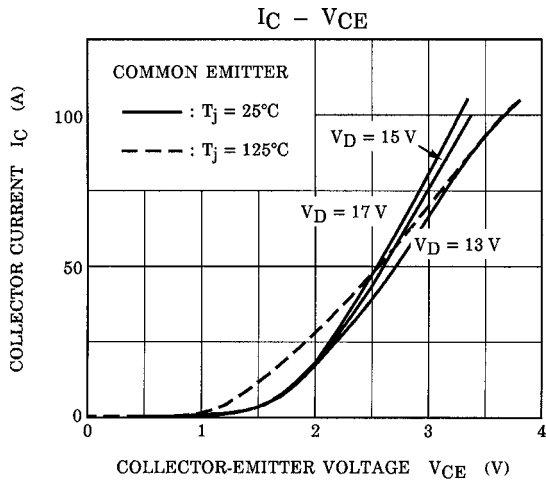
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Control circuit current	High side	$V_D = 15 V$	$I_D(H)$	—	8	12	mA
	Low side		$I_D(L)$	—	32	48	
Input-on signal voltage	$V_{IN(on)}$	$V_D = 15 V, I_C = 50 mA$	1.4	1.6	1.8	V	
Input-off signal voltage	$V_{IN(off)}$	—	2.2	2.5	2.8	V	
Fault output current	Protection	$V_D = 15 V$	$I_{FO(on)}$	5.4	6.0	6.6	mA
	Normal		$I_{FO(off)}$	—	—	0.1	
Over current protection trip level	Inverter	$V_D = 15 V, T_j = 125^\circ C$	OC	85	100	—	A
	Brake			40	50	—	
Short circuit protection trip level	Inverter	$V_D = 15 V, T_j = 125^\circ C$	SC	120	150	—	A
	Brake			60	75	—	
Over current cut-off time	$t_{off(OC)}$	$V_D = 15 V$	—	5	—	$\mu s$	
Over temperature protection	Trip level	Case temperature	OT	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	13.0	
Fault output pulse width	$t_{FO}$	$V_D = 15 V$	1	2	3	ms	

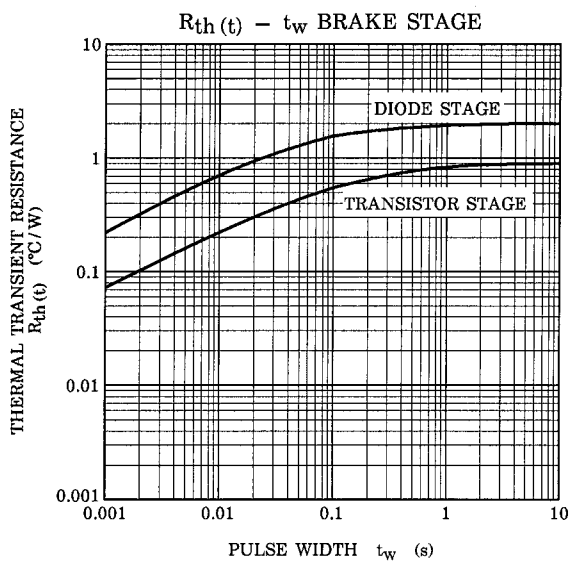
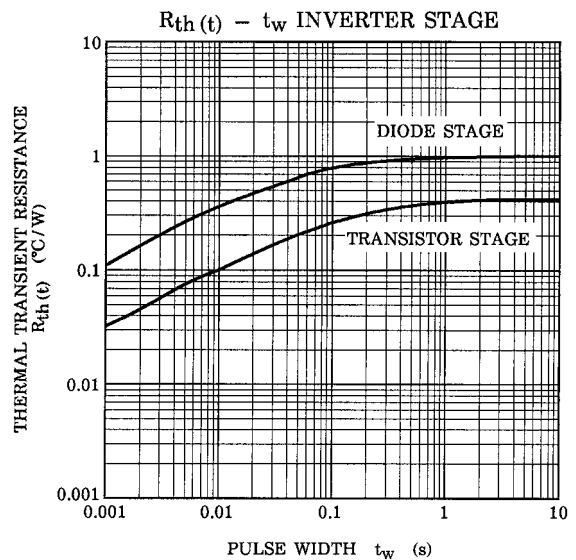
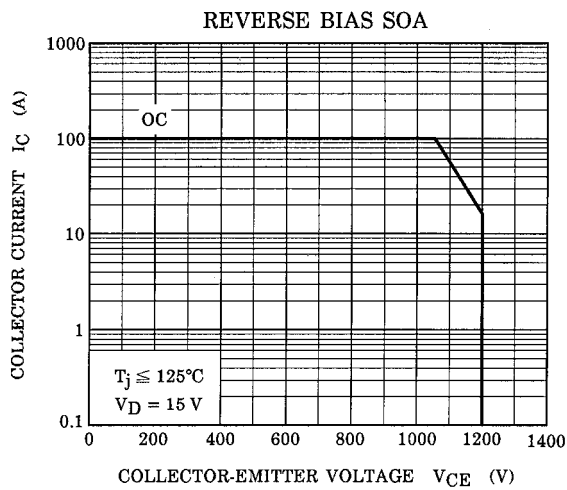
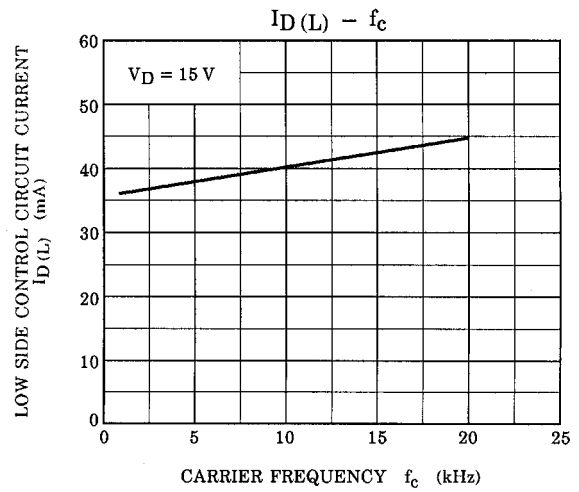
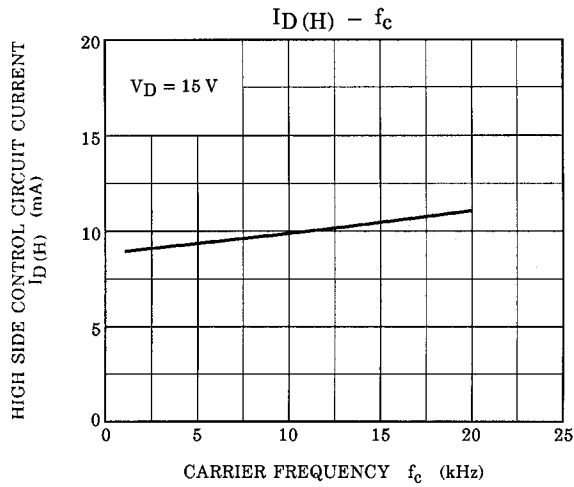
**d. Thermal Resistance ( $T_j = 25^\circ\text{C}$ )**

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

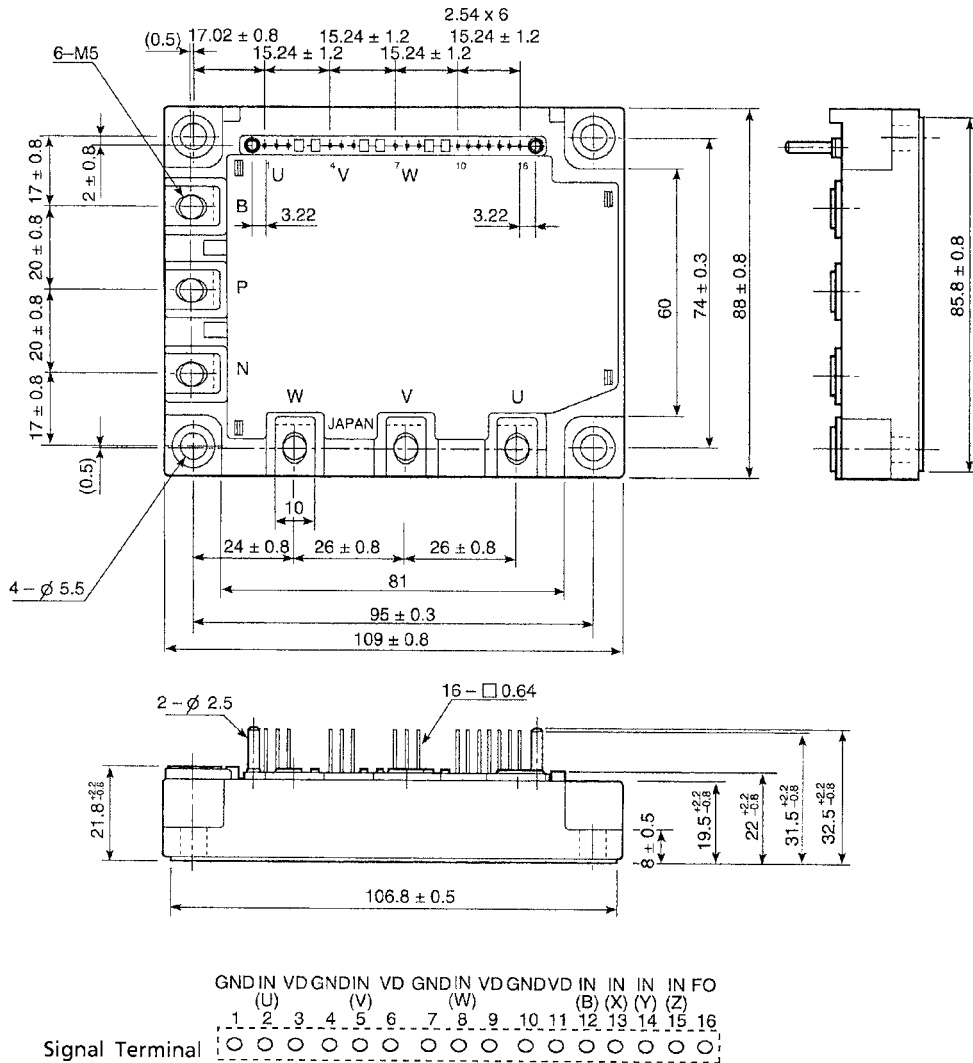






## Package Dimensions: TOSHIBA 2-110A1A

Unit: mm



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