

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

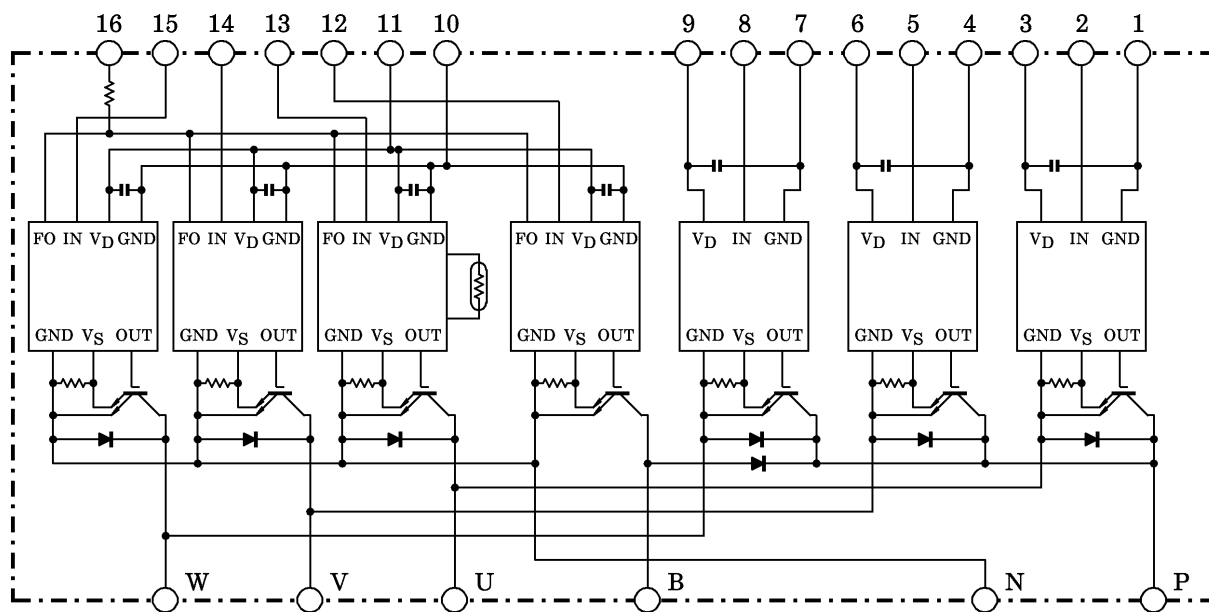
# MIG100Q201H

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Brake Power Circuits & Control Circuits (IGBT drive units, Protection units for Over-Current, Under-Voltage & Over-Temperature) in One Package.
- The Electrodes are Isolated from Case.
- High Speed Type IGBT :  $V_{CE(sat)}=3.5V$  (Max.)  
 $t_{off}=2.5\mu s$  (Max.)  
 $t_{rr}=0.21\mu s$  (Max.)
- Outline : TOSHIBA 2-136A1A
- Weight :

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      |                        |                       |

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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	$I_C$	100	A
	Forward Current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	100	A
	Collector Power Dissipation	$T_c = 25^\circ\text{C}$	$P_C$	800	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	$I_C$	50	A
	Reverse Voltage	—	$V_R$	1200	V
	Forward Current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	50	A
	Collector Power Dissipation	$T_c = 25^\circ\text{C}$	$P_C$	400	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 ( $T_j = 25^\circ\text{C}$ )

a. Inverter stage

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Collector Cut-Off Current	$I_{CEX}$	$V_{CEX} = 1200\text{V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	20	
Collector-Emitter Saturation Voltage	$V_{CE}(\text{sat})$	$V_D = 15\text{V}$ , $I_C = 100\text{A}$ $V_{IN} = 3\text{V} \rightarrow 0\text{V}$	$T_j = 25^\circ\text{C}$	—	2.7	3.5	V
			$T_j = 125^\circ\text{C}$	—	2.6	—	
Forward Voltage	$V_F$	$I_F = 100\text{A}$	—	2.0	2.7	V	
Switching Time	$t_{on}$	$V_{CC} = 600\text{V}$ , $I_C = 100\text{A}$ $V_D = 15\text{V}$ , $V_{IN} = 3\text{V} \leftrightarrow 0\text{V}$ Inductive load (Note 1)	—	0.8	1.5	2.2	$\mu\text{s}$
	$t_{c(\text{on})}$		—	0.5	1.0		
	$t_{rr}$		—	0.14	0.21		
	$t_{off}$		—	1.5	2.5		
	$t_{c(\text{off})}$		—	0.3	0.6		

## b. Brake stage

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Collector Cut-Off Current	I <sub>CEX</sub>	V <sub>CEX</sub> = 1200V	T <sub>j</sub> = 25°C	—	—	1	mA
			T <sub>j</sub> = 125°C	—	—	20	
Collector-Emitter Saturation Voltage	V <sub>CE (sat)</sub>	V <sub>D</sub> = 15V, I <sub>C</sub> = 50A V <sub>IN</sub> = 3V → 0V	T <sub>j</sub> = 25°C	—	2.7	3.5	V
			T <sub>j</sub> = 125°C	—	2.6	—	
Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 1200V	T <sub>j</sub> = 25°C	—	—	1	mA
			T <sub>j</sub> = 125°C	—	—	20	
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 50A	—	2.0	2.7	V	
Switching Time	t <sub>on</sub>	V <sub>CC</sub> = 600V, I <sub>C</sub> = 50A V <sub>D</sub> = 15V, V <sub>IN</sub> = 3V ↔ 0V Inductive load (Note 1)	0.8	1.5	2.2	μs	
	t <sub>c (on)</sub>		—	0.5	1.0		
	t <sub>rr</sub>		—	0.30	0.45		
	t <sub>off</sub>		—	1.5	2.5		
	t <sub>c (off)</sub>		—	0.3	0.6		

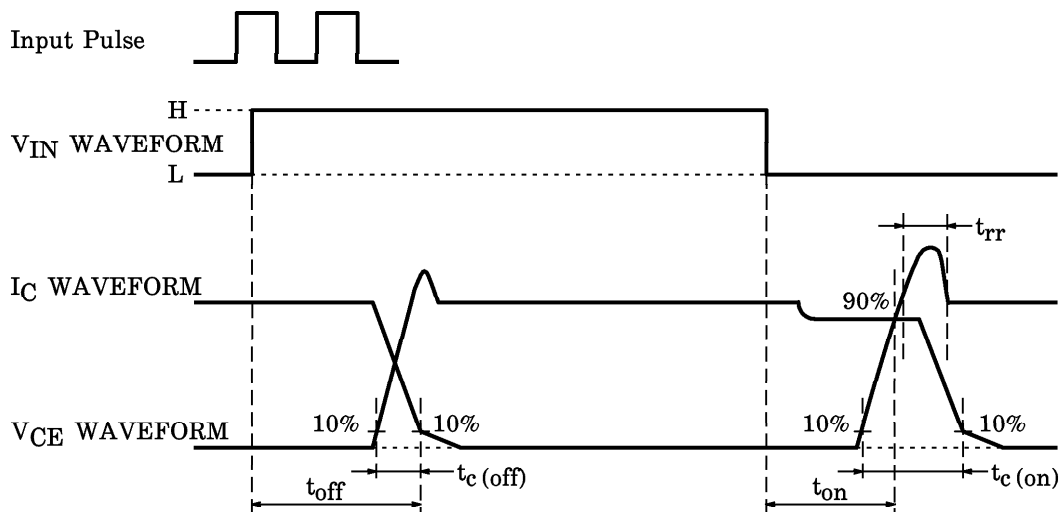
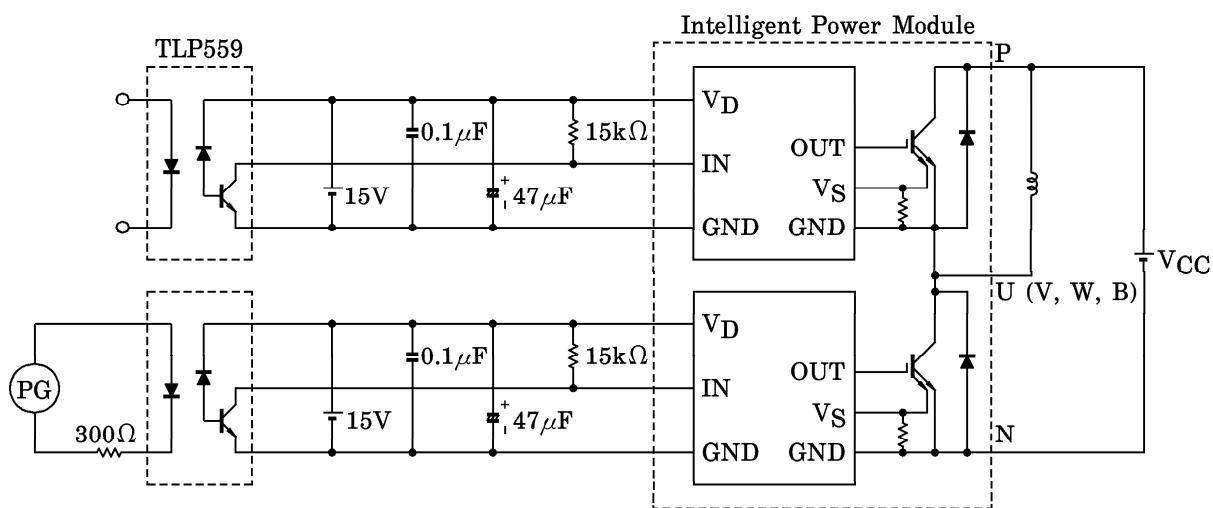
c. Control stage (T<sub>j</sub> = 25°C)

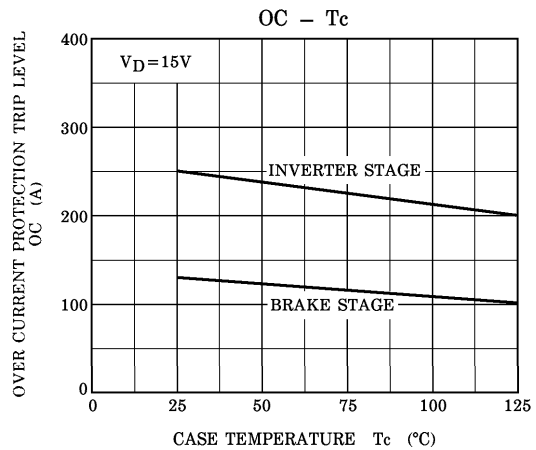
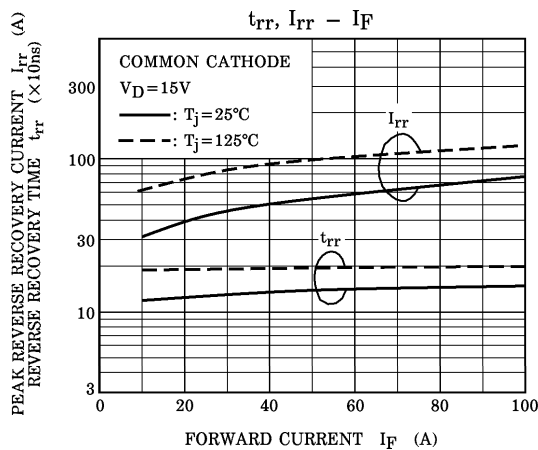
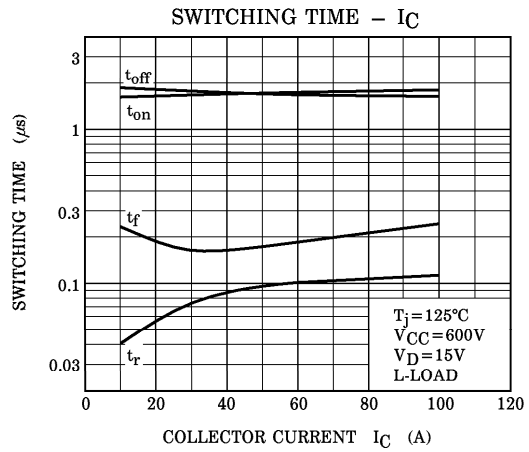
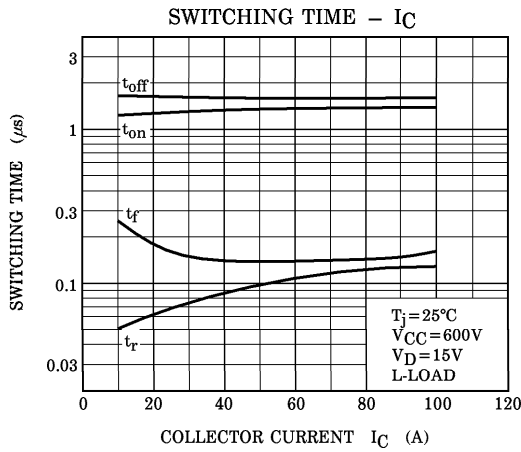
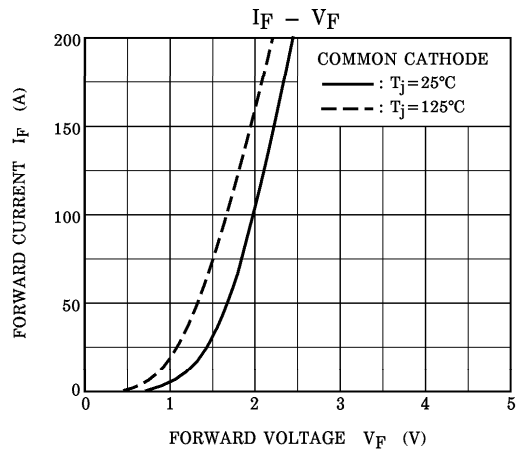
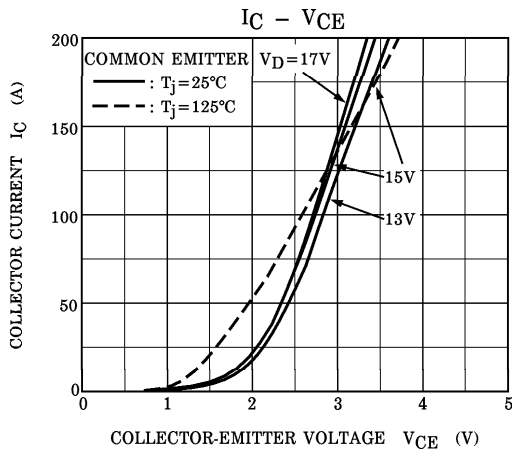
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Control Circuit Current	High Side	I <sub>D (H)</sub>	V <sub>D</sub> = 15V	—	20	30	mA
	Low Side			I <sub>D (L)</sub>	—	80	
Input On Signal Voltage	V <sub>IN (on)</sub>	V <sub>D</sub> = 15V, I <sub>C</sub> = 100mA	0.9	1.1	1.3	V	
Fault Output Current	Protection	I <sub>FO (on)</sub>	V <sub>D</sub> = 15V	8	10	12	mA
	Normal			I <sub>FO (off)</sub>	—	—	
Over Current Protection Trip Level	Inverter	OC	V <sub>D</sub> = 15V, T <sub>j</sub> = 125°C	160	200	—	A
	Brake			70	100	—	
Short Circuit Protection Trip Level	Inverter	SC	V <sub>D</sub> = 15V, T <sub>j</sub> = 125°C	240	300	—	A
	Brake			105	150	—	
Over Current Cut-Off Time	t <sub>off (OC)</sub>	V <sub>D</sub> = 15V	—	10	—	μs	
Over Temperature Protection	Trip Level	OT	Case temperature	111	118	125	°C
	Reset Level			OTr	93	100	
Control Supply Under Voltage Protection	Trip Level	UV	—	11.3	12.0	12.7	V
	Reset Level			UVr	11.8	12.5	
Fault Output Pulse Width	t <sub>FO</sub>	V <sub>D</sub> = 15V	1	2	3	ms	

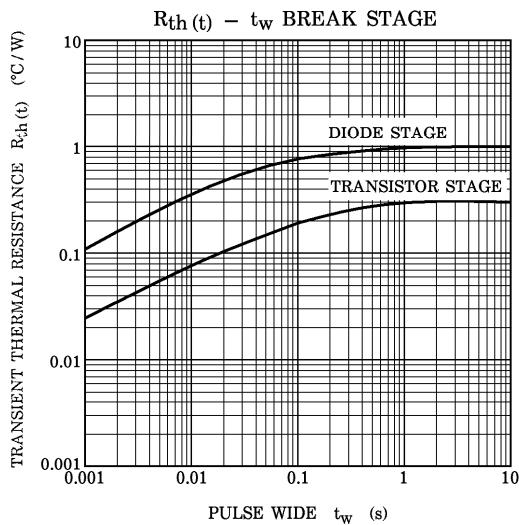
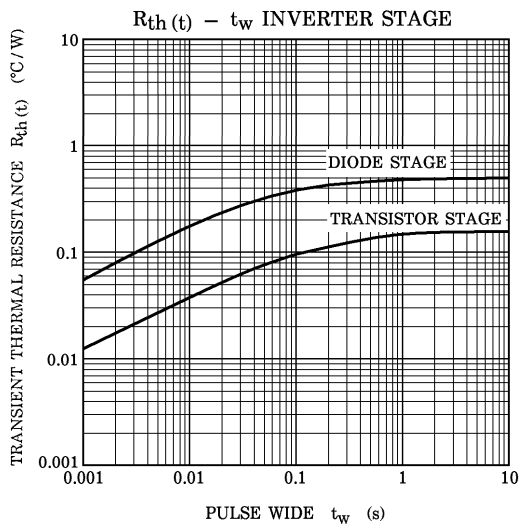
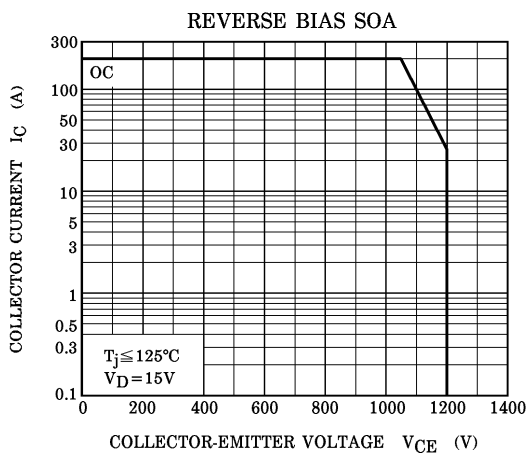
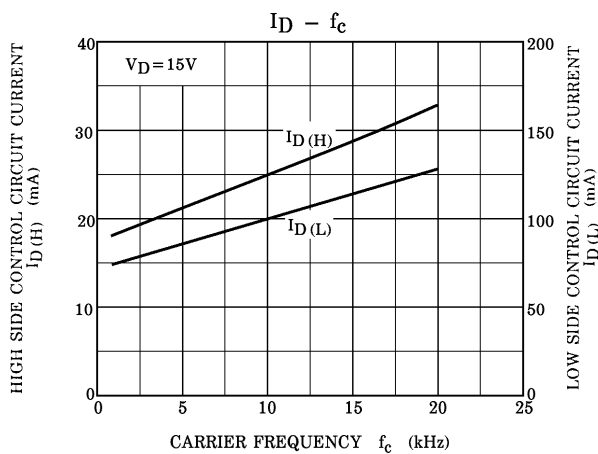
d. Thermal resistance ( $T_j = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Junction to Case Thermal Resistance	$R_{th(j-c)}$	Inverter IGBT	—	—	0.156	$^\circ\text{C/W}$
		Inverter FRD	—	—	0.50	
		Brake IGBT	—	—	0.312	
		Brake FRD	—	—	1.00	
Case to Fin Thermal Resistance	$R_{th(c-f)}$	Compound is applied	—	0.04	—	$^\circ\text{C/W}$

Attached 1 : Switching time test circuit & timing chart

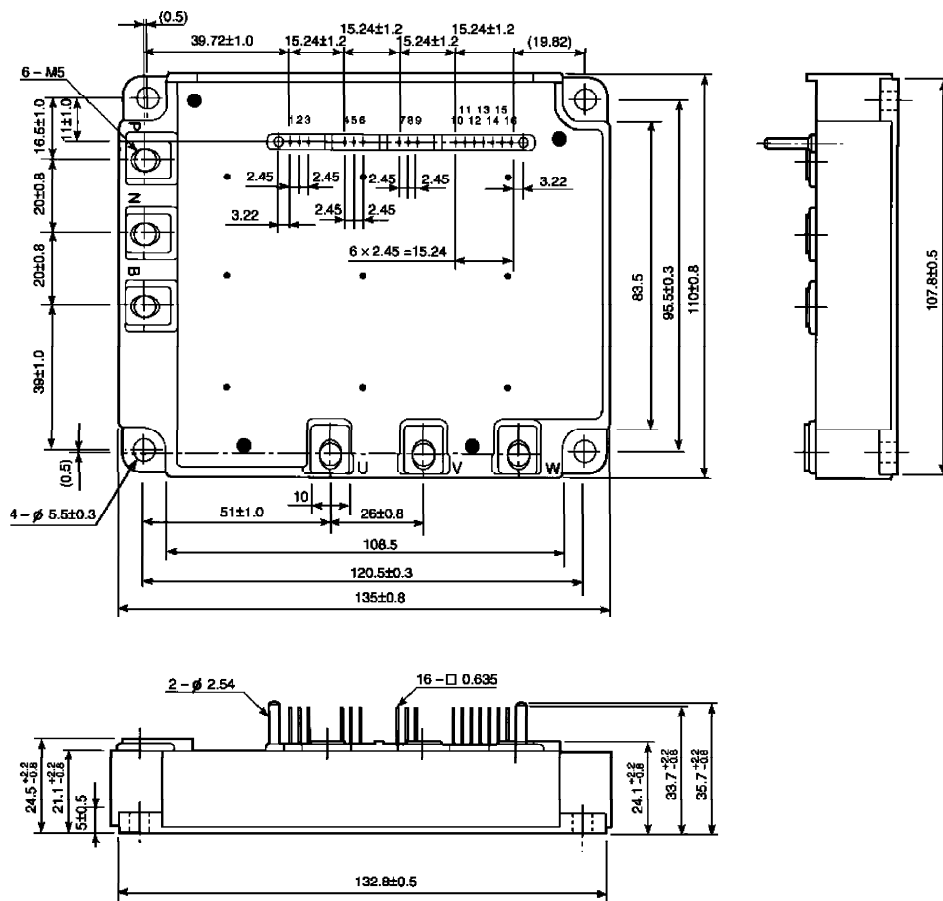






OUTLINE : TOSHIBA

Unit : mm



- |            |            |                       |             |                        |                       |
|------------|------------|-----------------------|-------------|------------------------|-----------------------|
| 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      |                        |                       |