

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

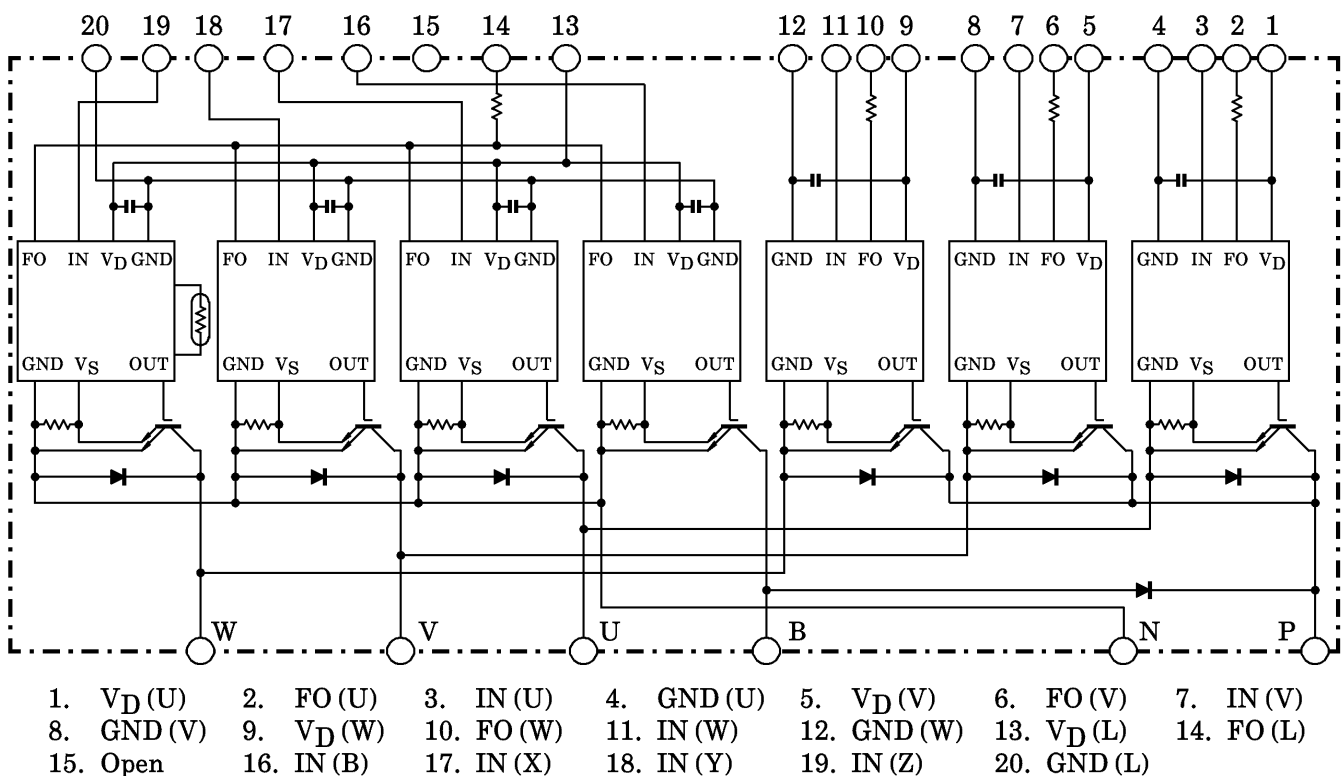
**MIG150J7CSA0A (600V / 150A 7in1)**

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Brake Power Circuit & Control Circuits (IGBT drive unit, Protection units for Short-Current, Over-Current, Under-Voltage & Over Temperature) in One Package.
- The Electrodes are Isolated from Case.
- High Speed, Low Saturation Type IGBT  
:  $V_{CE(sat)} = 1.8\text{ V (Typ.)}$

## EQUIVALENT CIRCUIT

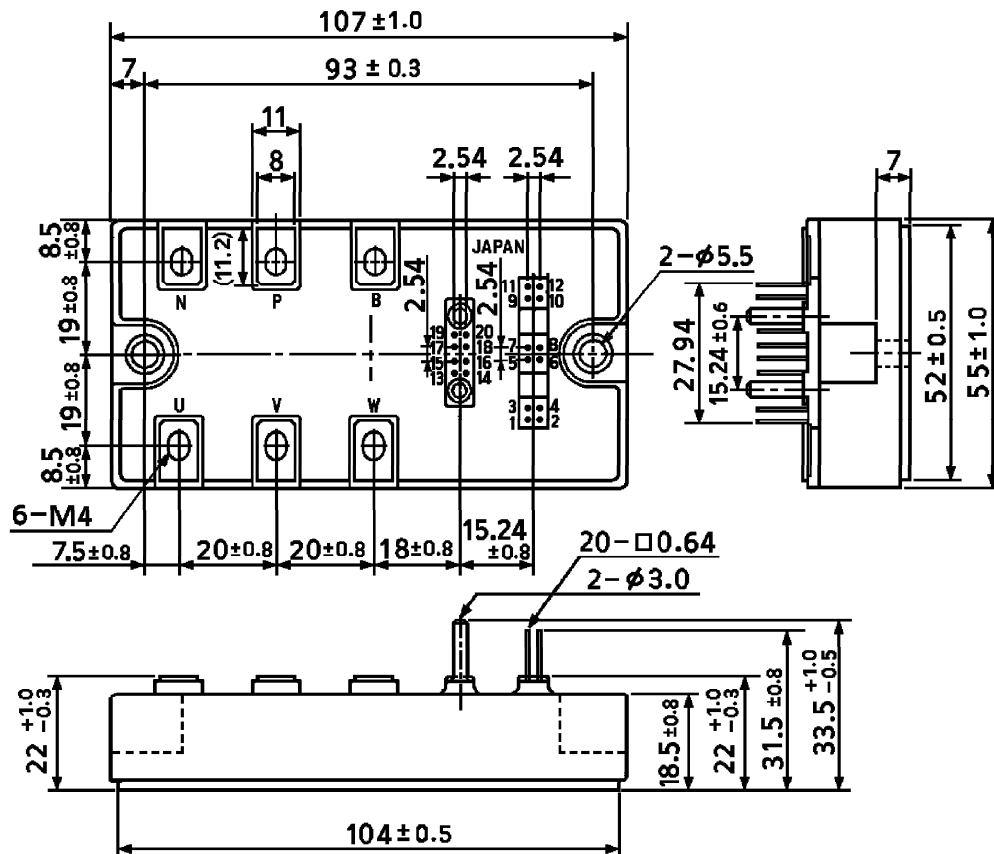


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OUTLINE : TOSHIBA 2-108G1A

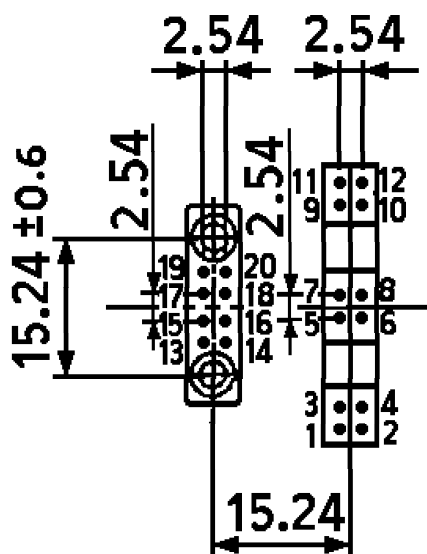
Unit : mm



- |               |             |              |            |              |             |
|---------------|-------------|--------------|------------|--------------|-------------|
| 1. $V_D$ (U)  | 2. FO (U)   | 3. IN (U)    | 4. GND (U) | 5. $V_D$ (V) | 6. FO (V)   |
| 7. IN (V)     | 8. GND (V)  | 9. $V_D$ (W) | 10. FO (W) | 11. IN (W)   | 12. GND (W) |
| 13. $V_D$ (L) | 14. FO (L)  | 15. Open     | 16. IN (B) | 17. IN (X)   | 18. IN (Y)  |
| 19. IN (Z)    | 20. GND (L) |              |            |              |             |

Weight : 278 g (Typ.)

## Unit : mm



- |              |              |             |             |             |              |
|--------------|--------------|-------------|-------------|-------------|--------------|
| 1. $V_D(U)$  | 2. $FO(U)$   | 3. $IN(U)$  | 4. $GND(U)$ | 5. $V_D(V)$ | 6. $FO(V)$   |
| 7. $IN(V)$   | 8. $GND(V)$  | 9. $V_D(W)$ | 10. $FO(W)$ | 11. $IN(W)$ | 12. $GND(W)$ |
| 13. $V_D(L)$ | 14. $FO(L)$  | 15. Open    | 16. $IN(B)$ | 17. $IN(X)$ | 18. $IN(Y)$  |
| 19. $IN(Z)$  | 20. $GND(L)$ |             |             |             |              |

## MAXIMUM RATINGS

STAGE	CHARACTERISTIC	CONDITION	SYMBOL	RATING	UNIT
Inverter	Supply Voltage	P-N Power Terminal	$V_{CC}$	450	V
	Collector-Emitter Voltage	—	$V_{CES}$	600	V
	Collector Current	$T_c = 25^\circ\text{C}$ , DC	$I_C$	150	A
	Forward Current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	150	A
	Collector Power Dissipation	$T_c = 25^\circ\text{C}$	$P_C$	420	W
	Junction Temperature	—	$T_j$	150	$^\circ\text{C}$
Break	Supply Voltage	P-N Power Terminal	$V_{CC}$	450	V
	Collector-Emitter Voltage	—	$V_{CES}$	600	V
	Collector Current	$T_c = 25^\circ\text{C}$ , DC	$I_C$	75	A
	Reverse Voltage	—	$V_R$	600	V
	Forward Current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	50	A
	Collector Power Dissipation	$T_c = 25^\circ\text{C}$	$P_C$	220	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 Terminal	$V_{FO}$	20	V
	Fault Output Current	FO Sink Current	$I_{FO}$	14	mA
Module	Operating Temperature	—	$T_c$	$-20 \sim +100$	$^\circ\text{C}$
	Storage Temperature Range	—	$T_{stg}$	$-40 \sim +125$	$^\circ\text{C}$
	Isolation Voltage	AC 1 min	$V_{ISO}$	2500	V
	Screw Torque	M4 (Terminal) / M5 (Mounting)	—	2 / 3	Nm

## ELECTRICAL CHARACTERISTICS

a. Inverter Stage ( $T_j = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN	TYP.	MAX	UNIT
Collector Cut-Off Current	$I_{CEX}$	$V_{CE} = 600\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{ V}$ , $I_C = 150\text{ A}$ , $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	1.5	1.8	2.2	V
			$T_j = 125^\circ\text{C}$	—	1.8	—	
Forward Voltage	$V_F$	$I_F = 150\text{ A}$		1.6	2.1	2.6	V
Switching Time	$t_{on}$	$V_{CC} = 300\text{ V}$ , $I_C = 150\text{ A}$ $V_D = 15\text{ V}$ , $V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$ Inductive Load (Note 1)		—	1.5	2.4	$\mu\text{s}$
	$t_c(\text{on})$			—	0.4	1.0	
	$t_{rr}$			—	0.2	0.6	
	$t_{off}$			—	1.7	3.0	
	$t_c(\text{off})$			—	0.4	0.8	

b. Brake Stage ( $T_j = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN	TYP.	MAX	UNIT
Collector Cut-Off Current	I <sub>CEX</sub>	V <sub>CE</sub> = 600 V	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> = 75 A, V <sub>IN</sub> = 15 V → 0 V	T <sub>j</sub> = 25°C	—	1.6	2.0	V
			T <sub>j</sub> = 125°C	—	1.6	—	
Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 600 V	T <sub>j</sub> = 25°C	—	—	1	mA
			T <sub>j</sub> = 125°C	—	—	10	
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 50 A		1.5	1.9	2.3	V
Switching Time	t <sub>on</sub>	V <sub>CC</sub> = 300 V, I <sub>C</sub> = 75 A V <sub>D</sub> = 15 V, V <sub>IN</sub> = 15 V ↔ 0 V Inductive Load <div>(Note 1)</div>		—	1.4	2.6	μs
	t <sub>c (on)</sub>			—	0.65	1.2	
	t <sub>rr</sub>			—	0.45	0.9	
	t <sub>off</sub>			—	1.85	3.2	
	t <sub>c (off)</sub>			—	0.4	0.7	

c. Control Stage ( $T_j = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Control Circuit Current	High Side	$I_D(H)$	$V_D = 15\text{ V}$	—	8	mA
	Low Side			—	42	
Input On Signal Voltage	$V_{IN(on)}$	$V_D = 15\text{ V}, I_C = 50\text{ mA}$	1.4	1.6	1.8	V
Input Off Signal Voltage	$V_{IN(off)}$	—	2.2	2.5	2.8	
Fault Output Current	Protection	$I_{FO(on)}$	$V_D = 15\text{ V}$	—	10	mA
	Normal			—	—	
Over Current Protection Trip Level	Inverter	OC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	240	—	A
	Brake			120	—	
Short Circuit Protection Trip Level	Inverter	SC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	300	—	A
	Brake			150	—	
Over Current Cut-Off Time	$t_{off(OC)}$	$V_D = 15\text{ V}$	—	5	—	$\mu\text{s}$
Over Temperature Protection	Trip Level	OT	Case Temperature	110	118	$^\circ\text{C}$
	Reset Level			—	98	
Control Supply Under Voltage Protection	Trip Level	UV	—	11.0	12.0	V
	Reset Level			12.0	12.5	
Fault Output Pulse Width	$t_{FO}$	$V_D = 15\text{ V}$	1	2	3	ms

d. Thermal Resistance (Tc = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Junction to Case Thermal Resistance	$R_{th(j-c)}$	Inverter IGBT Stage	—	—	0.3	°C / W
		Inverter FRD Stage	—	—	0.63	
		Brake IGBT Stage	—	—	0.56	
		Brake FRD Stage	—	—	1.0	

(Note 1) : Switching time test circuit & timing chart

