

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

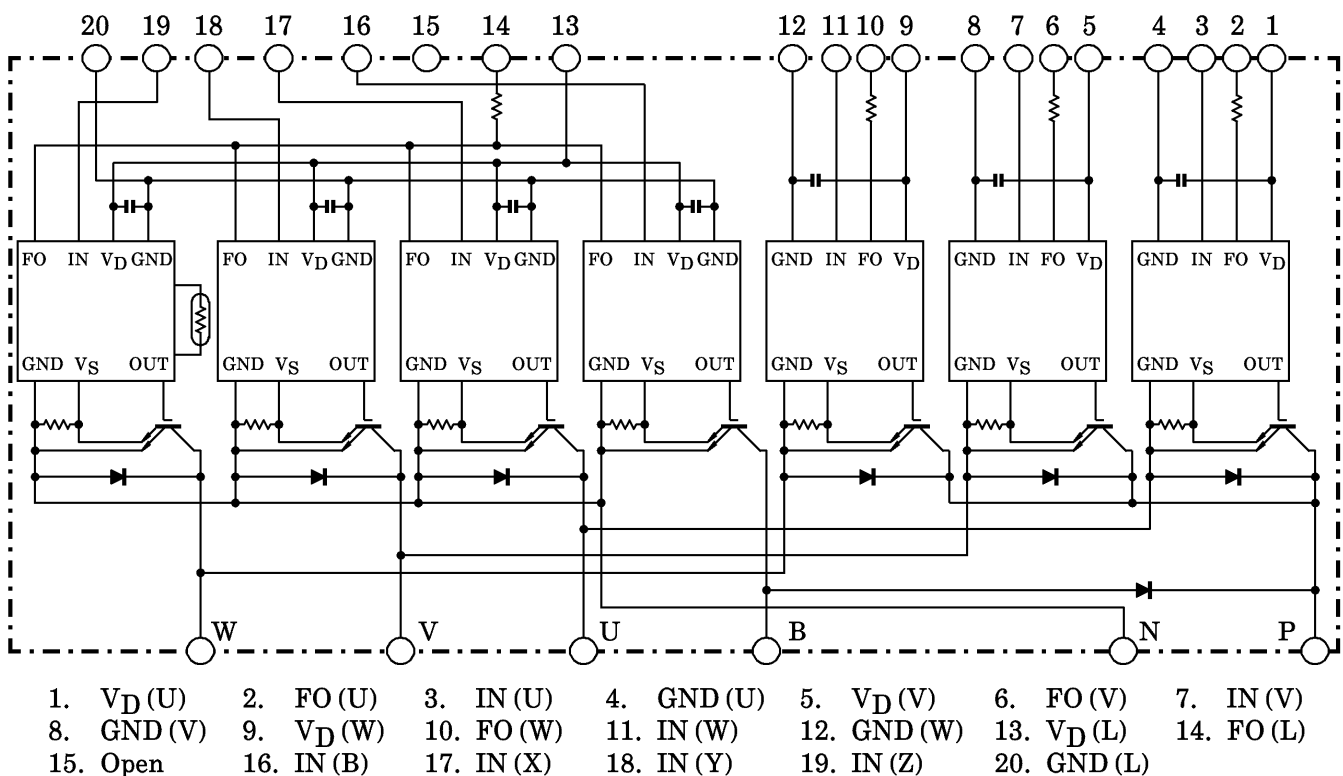
MIG150J7CSA0A (600V / 150A 7in1)

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

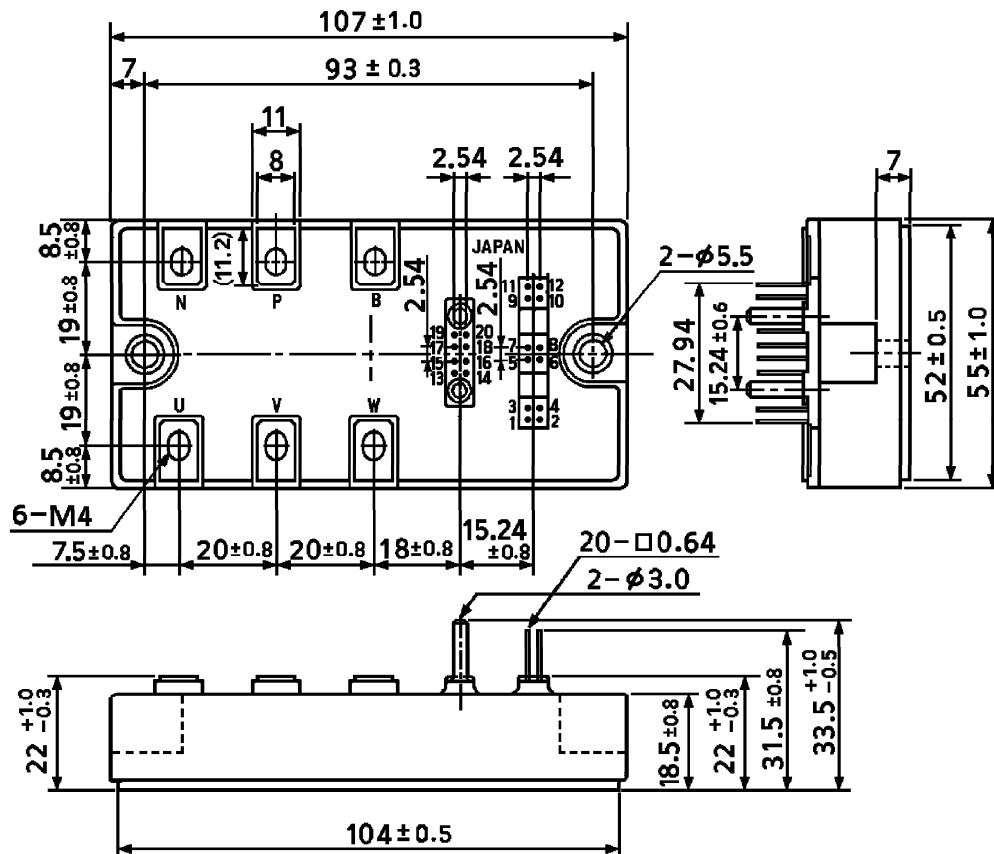


961001EAA2

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

OUTLINE : TOSHIBA 2-108G1A

Unit : mm

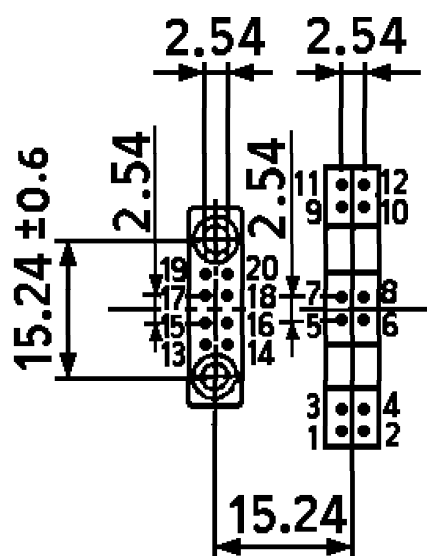


- | | | | | | |
|---------------|-------------|--------------|------------|--------------|-------------|
| 1. V_D (U) | 2. FO (U) | 3. IN (U) | 4. GND (U) | 5. V_D (V) | 6. FO (V) |
| 7. IN (V) | 8. GND (V) | 9. V_D (W) | 10. FO (W) | 11. IN (W) | 12. GND (W) |
| 13. V_D (L) | 14. FO (L) | 15. Open |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

Weight : 278 g (Typ.)

SIGNAL TERMINAL LAYOUT

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	μs
	$t_c(\text{on})$			—	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_{CEX}	$V_{CE} = 600\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1
			$T_j = 125^\circ\text{C}$	—	—	10
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{ V},$ $I_C = 75\text{ A},$ $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	1.6	2.0
			$T_j = 125^\circ\text{C}$	—	1.6	—
Reverse Current	I_R	$V_R = 600\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1
			$T_j = 125^\circ\text{C}$	—	—	10
Forward Voltage	V_F	$I_F = 50\text{ A}$	1.5	1.9	2.3	V
Switching Time	t_{on}	$V_{CC} = 300\text{ V}, I_C = 75\text{ A}$ $V_D = 15\text{ V}, V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$ Inductive Load (Note 1)	—	1.4	2.6	μs
	$t_{c(on)}$		—	0.65	1.2	
	t_{rr}		—	0.45	0.9	
	t_{off}		—	1.85	3.2	
	$t_{c(off)}$		—	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	—	μs
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

