

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

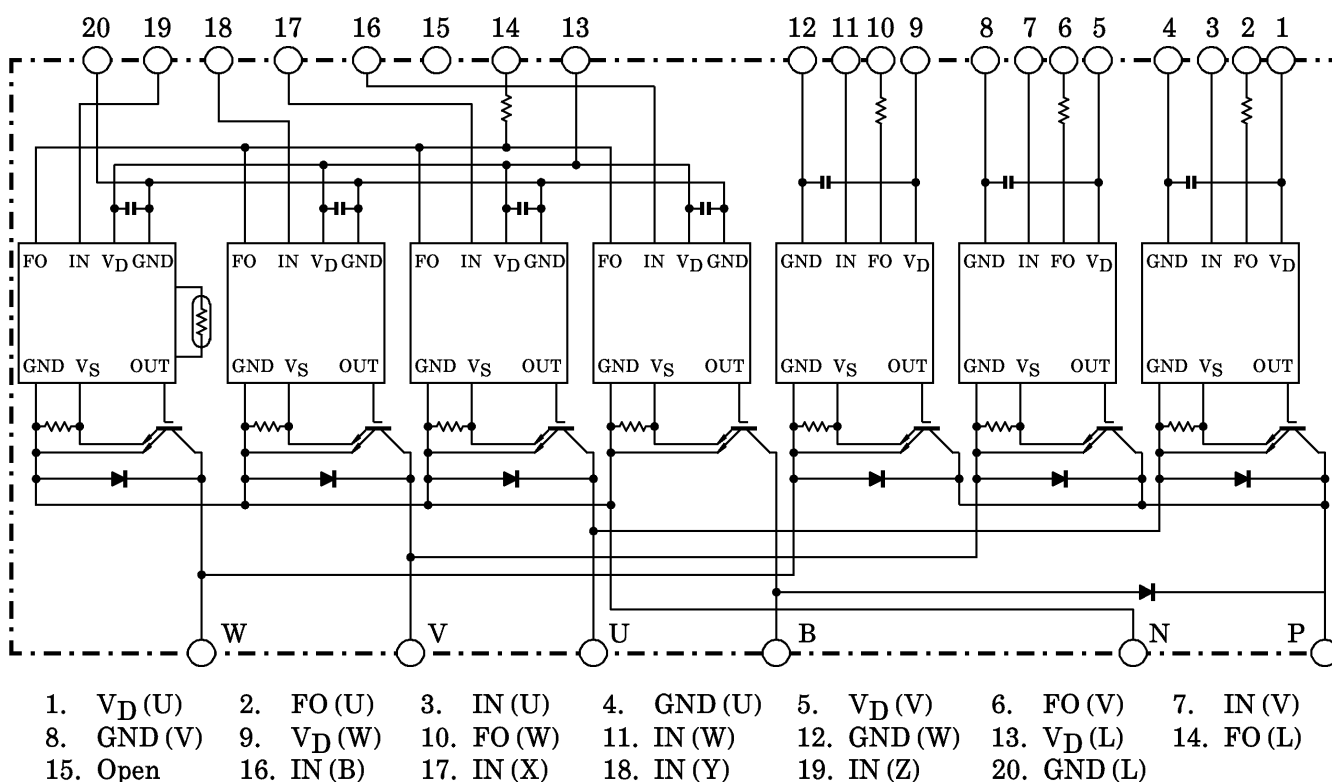
MIG50Q7CSA0X (1200V / 50A 7in1)

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Brake Power Circuits & 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.
- $V_{CE(sat)} = 2.2\text{ V (Typ.)}$

EQUIVALENT CIRCUIT

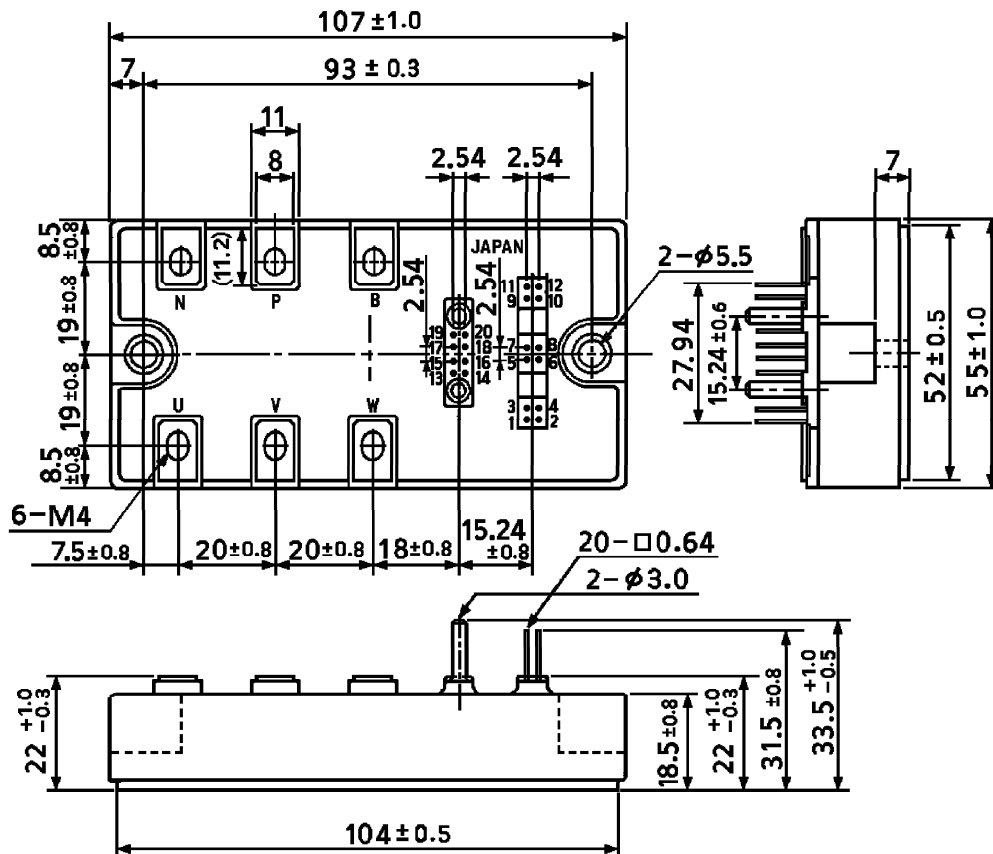


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OUTLINE : TOSHIBA 2-108G1A

Unit : mm

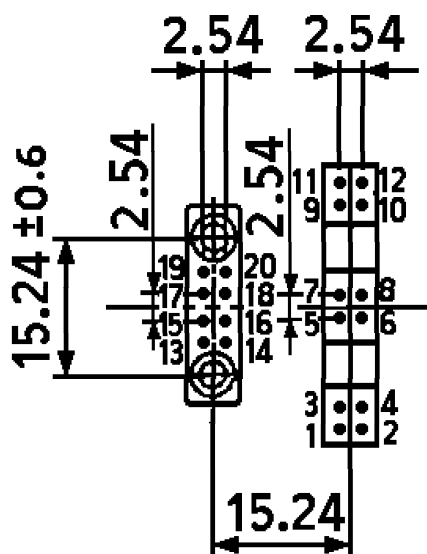


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|---------------|-------------|--------------|------------|--------------|-------------|
| 1. V_D (U) | 2. FO (U) | 3. IN (U) | 4. GND (U) | 5. V_D (V) | 6. FO (V) |
| 7. IN (V) | 8. GND (V) | 9. V_D (W) | 10. FO (W) | 11. IN (W) | 12. GND (W) |
| 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}	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	350	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	200	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 (Terminal)	M4	—	2	Nm
	Screw Torque (Mounting)	M5	—	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}	$V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{ V}$, $I_C = 50\text{ A}$, $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.2	2.6	V
			$T_j = 125^\circ\text{C}$	—	—	3.0	
Forward Voltage	V_F	$I_F = 50\text{ A}$		—	2.5	3.1	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	2.0	μs
	$t_c(\text{on})$			—	0.6	1.2	
	t_{rr}			—	0.3	0.6	
	t_{off}			—	2.0	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} = 1200 V	T _j = 25°C	—	—	1	mA
			T _j = 125°C	—	—	10	
Collector-Emitter Saturation Voltage	V _{CE (sat)}	V _D = 15 V, I _C = 25 A, V _{IN} = 15 V → 0 V	T _j = 25°C	—	2.2	2.6	V
			T _j = 125°C	—	—	3.0	
Reverse Current	I _R	V _R = 1200 V	T _j = 25°C	—	—	1	mA
			T _j = 125°C	—	—	10	
Forward Voltage	V _F	I _F = 25 A		—	1.7	2.5	V
Switching Time	t _{on}	V _{CC} = 600 V, I _C = 25 A V _D = 15 V, V _{IN} = 15 V ↔ 0 V Inductive Load (Note 1)		—	1.0	2.0	μs
	t _{c (on)}			—	0.6	1.2	
	t _{rr}			—	0.5	1.0	
	t _{off}			—	2.0	3.0	
	t _{c (off)}			—	0.3	0.8	

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	$V_{IN(on)}$	—	1.4	1.6	1.8	V
Input Off Signal Voltage	$V_{IN(off)}$	—	2.2	2.5	2.8	
Fault Output Current	Protection	$I_{FO(on)}$	$V_D = 15\text{ V}$	8	10	mA
	Normal			—	—	
Over Current Protection Trip Level	Inverter	OC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	80	—	A
	Brake			40	—	
Short Circuit Protection Trip Level	Inverter	SC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	100	—	A
	Brake			50	—	
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	—	—	0.36	°C / W
		Inverter FRD Stage	—	—	0.84	
		Brake IGBT Stage	—	—	0.6	
		Brake FRD Stage	—	—	1.5	

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

