

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

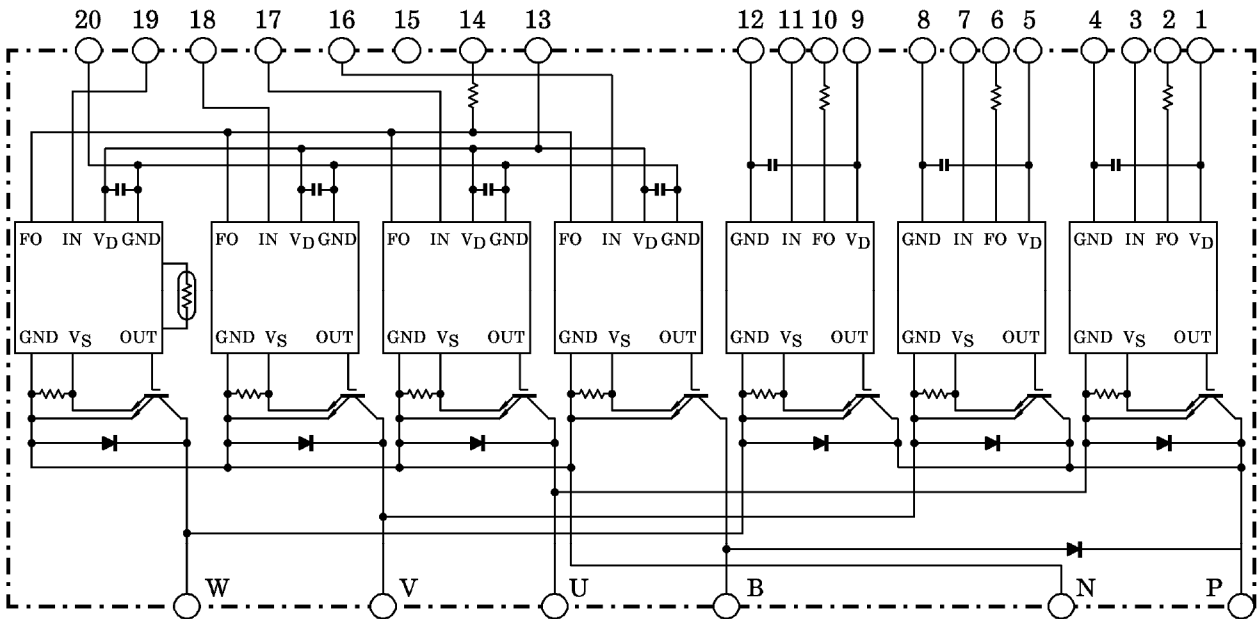
# MIG50Q7CSA0X (1200V / 50A 7in1)

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



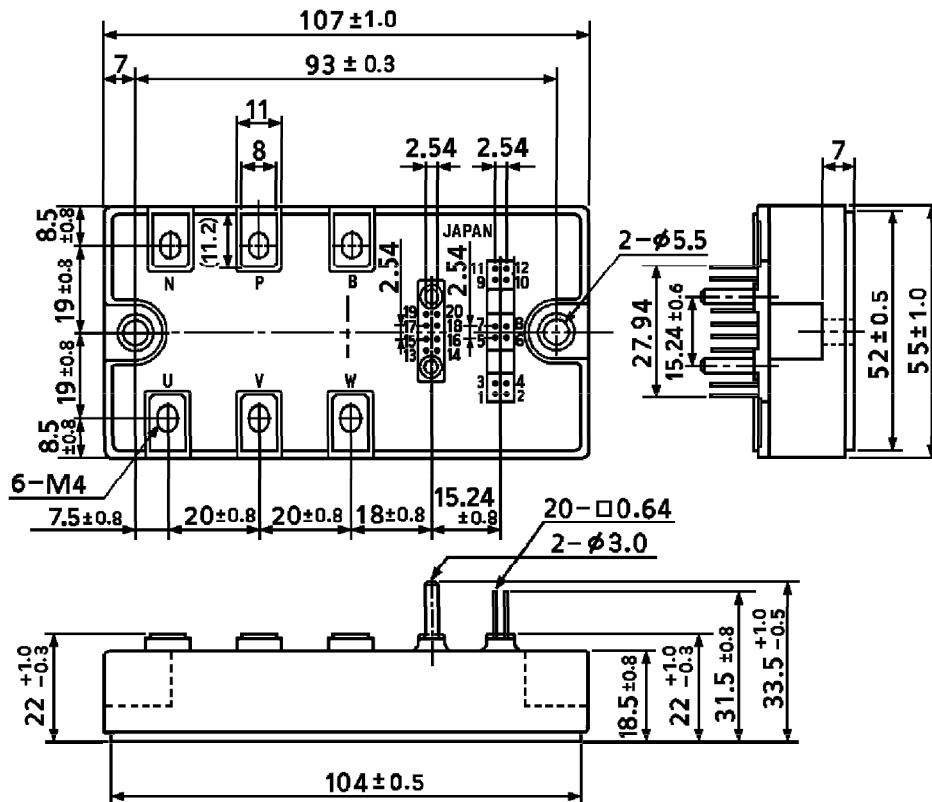
- |              |              |            |            |              |               |            |
|--------------|--------------|------------|------------|--------------|---------------|------------|
| 1. $V_D$ (U) | 2. FO (U)    | 3. IN (U)  | 4. GND (U) | 5. $V_D$ (V) | 6. FO (V)     | 7. IN (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)   |            |

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OUTLINE : TOSHIBA 2-108G1A

Unit : mm

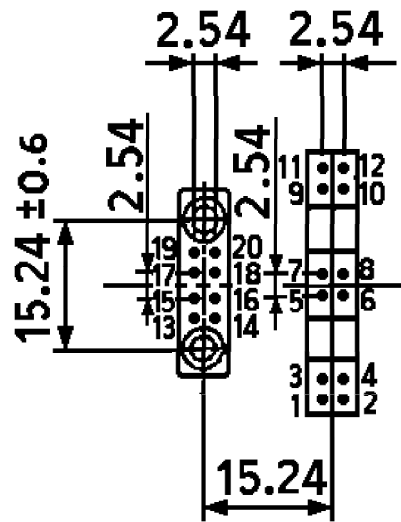


- |               |             |              |            |              |             |
|---------------|-------------|--------------|------------|--------------|-------------|
| 1. $V_D$ (U)  | 2. FO (U)   | 3. IN (U)    | 4. GND (U) | 5. $V_D$ (V) | 6. FO (V)   |
| 7. IN (V)     | 8. GND (V)  | 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.)

SIGNAL TERMINAL LAYOUT

Unit : mm



- |                        |            |                       |           |                       |            |
|------------------------|------------|-----------------------|-----------|-----------------------|------------|
| 1. V <sub>D</sub> (U)  | 2. FO(U)   | 3. IN(U)              | 4. GND(U) | 5. V <sub>D</sub> (V) | 6. FO(V)   |
| 7. IN(V)               | 8. GND(V)  | 9. V <sub>D</sub> (W) | 10. FO(W) | 11. IN(W)             | 12. GND(W) |
| 13. V <sub>D</sub> (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 <sub>CC</sub>	900	V
	Collector-Emitter Voltage	—	V <sub>CES</sub>	1200	V
	Collector Current	T <sub>c</sub> = 25°C, DC	I <sub>C</sub>	50	A
	Forward Current	T <sub>c</sub> = 25°C, DC	I <sub>F</sub>	50	A
	Collector Power Dissipation	T <sub>c</sub> = 25°C	P <sub>C</sub>	350	W
	Junction Temperature	—	T <sub>j</sub>	150	°C
Brake	Supply Voltage	P-N Power Terminal	V <sub>CC</sub>	900	V
	Collector-Emitter Voltage	—	V <sub>CES</sub>	1200	V
	Collector Current	T <sub>c</sub> = 25°C, DC	I <sub>C</sub>	25	A
	Reverse Voltage	—	V <sub>R</sub>	1200	V
	Forward Current	T <sub>c</sub> = 25°C, DC	I <sub>F</sub>	25	A
	Collector Power Dissipation	T <sub>c</sub> = 25°C	P <sub>C</sub>	200	W
Control	Junction Temperature	—	T <sub>j</sub>	150	°C
	Control Supply Voltage	V <sub>D</sub> -GND Terminal	V <sub>D</sub>	20	V
	Input Voltage	IN-GND Terminal	V <sub>IN</sub>	20	V
	Fault Output Voltage	FO-GND Terminal	V <sub>FO</sub>	20	V
Module	Fault Output Current	FO Sink Current	I <sub>FO</sub>	14	mA
	Operating Temperature	—	T <sub>c</sub>	-20~+100	°C
	Storage Temperature Range	—	T <sub>stg</sub>	-40~+125	°C
	Isolation Voltage	AC 1 min	V <sub>ISO</sub>	2500	V
	Screw Torque (Terminal)	M4	—	2	Nm
Screw Torque (Mounting)	M5	—	3	Nm	

## ELECTRICAL CHARACTERISTICS

a. Inverter Stage (T<sub>j</sub> = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Collector Cut-Off Current	I <sub>CEX</sub>	V <sub>CE</sub> = 1200 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> = 50 A, V <sub>IN</sub> = 15 V → 0 V	T <sub>j</sub> = 25°C	—	2.2	2.6	V
			T <sub>j</sub> = 125°C	—	—	3.0	
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 50 A	—	2.5	3.1	V	
Switching Time	t <sub>on</sub>	V <sub>CC</sub> = 600 V, I <sub>C</sub> = 50 A V <sub>D</sub> = 15 V, V <sub>IN</sub> = 15 V ↔ 0 V Inductive Load (Note 1)	—	1.0	2.0	μs	
	t <sub>c (on)</sub>		—	0.6	1.2		
	t <sub>rr</sub>		—	0.3	0.6		
	t <sub>off</sub>		—	2.0	3.0		
	t <sub>c (off)</sub>		—	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	$I_{CEX}$	$V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{ V},$ $I_C = 25\text{ A},$ $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.2	2.6	V
			$T_j = 125^\circ\text{C}$	—	—	3.0	
Reverse Current	$I_R$	$V_R = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Forward Voltage	$V_F$	$I_F = 25\text{ A}$	—	1.7	2.5	V	
Switching Time	$t_{on}$	$V_{CC} = 600\text{ V}, I_C = 25\text{ A}$ $V_D = 15\text{ V}, V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$ Inductive Load (Note 1)	—	1.0	2.0	$\mu\text{s}$	
	$t_c(on)$		—	0.6	1.2		
	$t_{rr}$		—	0.5	1.0		
	$t_{off}$		—	2.0	3.0		
	$t_e(off)$		—	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	$V_D = 15\text{ V}$	—	8	12	mA
	Low Side		—	42	60	
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	V
Fault Output Current	Protection	$V_D = 15\text{ V}$	8	10	12	mA
	Normal		—	—	0.1	
Over Current Protection Trip Level	Inverter	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	80	—	—	A
	Brake		40	—	—	
Short Circuit Protection Trip Level	Inverter	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	100	—	—	A
	Brake		50	—	—	
Over Current Cut-Off Time	$t_{off(OC)}$	$V_D = 15\text{ V}$	—	5	—	$\mu\text{s}$
Over Temperature Protection	Trip Level	Case Temperature	110	118	125	$^\circ\text{C}$
	Reset Level		—	98	—	
Control Supply Under Voltage Protection	Trip Level	—	11.0	12.0	12.5	V
	Reset Level		12.0	12.5	13.0	
Fault Output Pulse Width	$t_{FO}$	$V_D = 15\text{ V}$	1	2	3	ms

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

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Junction to Case Thermal Resistance	$R_{th(j-c)}$	Inverter IGBT Stage	—	—	0.36	$^\circ\text{C/W}$
		Inverter FRD Stage	—	—	0.84	
		Brake IGBT Stage	—	—	0.6	
		Brake FRD Stage	—	—	1.5	

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

