

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

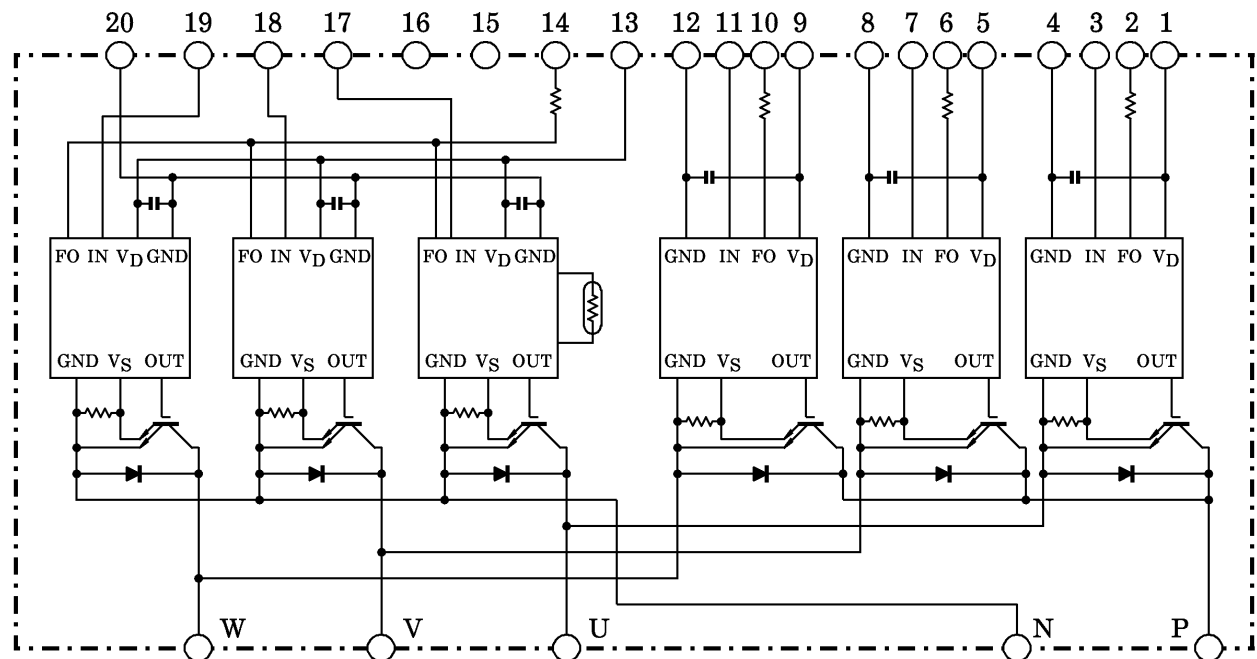
# MIG150Q6CMA0X (1200V / 150A 6in1)

HIGH POWER SWITCHING APPLICATION

MOTOR CONTROL APPLICATION

- Integrates Inverter Power Circuits & Control Circuits (IGBT drive units, Protection units for Short-Current, Over-Current, Under-Voltage & Over Temperature) in One Package.
- The Electrode are Isolated from Case.
- $V_{CE(sat)} = 2.4\text{ V (Typ.)}$

## EQUIVALENT CIRCUIT



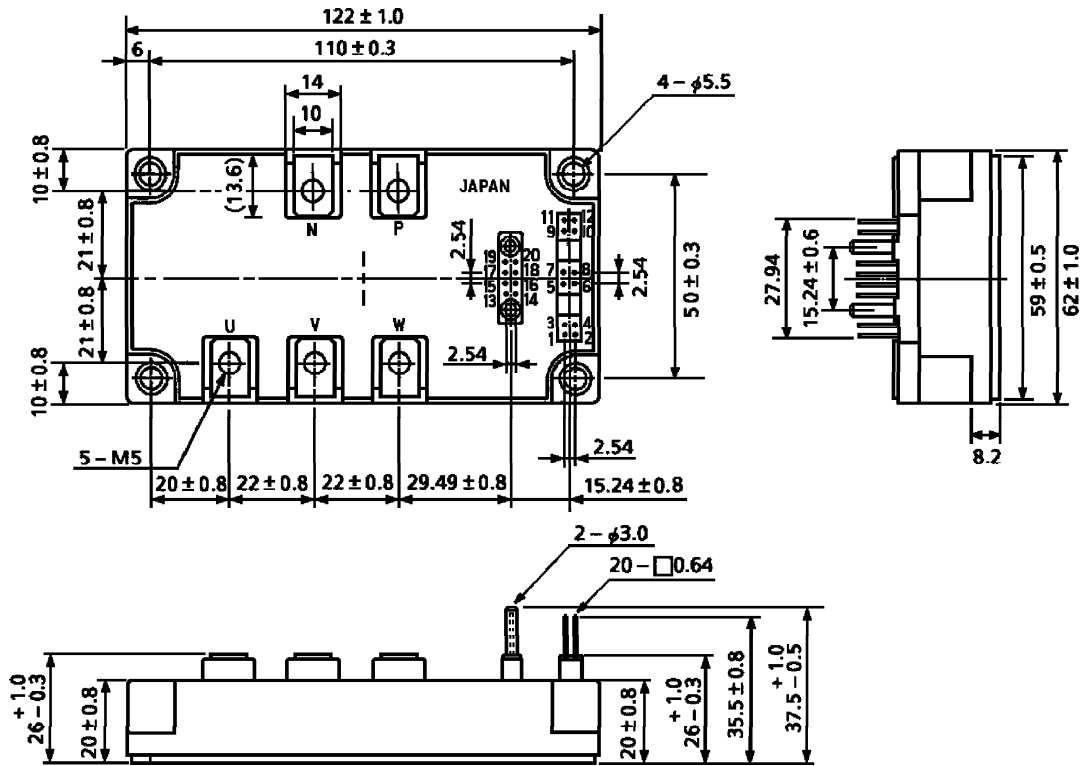
- |             |             |           |           |             |              |           |
|-------------|-------------|-----------|-----------|-------------|--------------|-----------|
| 1. $V_D(U)$ | 2. FO(U)    | 3. IN(U)  | 4. GND(U) | 5. $V_D(V)$ | 6. FO(V)     | 7. IN(V)  |
| 8. GND(V)  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

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OUTLINE : TOSHIBA 2-123A1A

Unit : mm

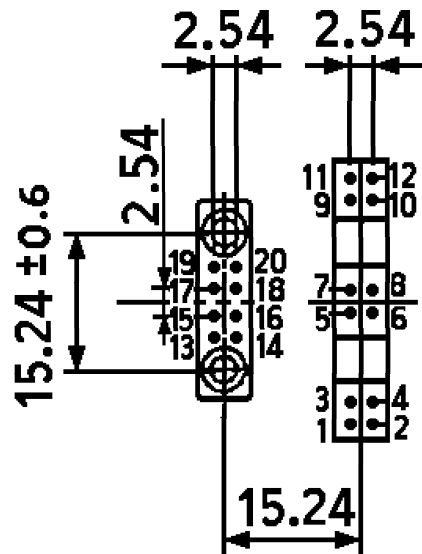


- |               |             |              |            |              |             |
|---------------|-------------|--------------|------------|--------------|-------------|
| 1. $V_D$ (U)  | 2. FO (U)   | 3. IN (U)    | 4. GND (U) | 5. $V_D$ (V) | 6. FO (V)   |
| 7. IN (V)     | 8. GND (V)  |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

Weight : 375 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. Open  | 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	$I_C$	150	A
	Forward Current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	150	A
	Collector Power Dissipation	$T_c = 25^\circ\text{C}$	$P_C$	1000	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~+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

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	$V_{CE}(\text{sat})$	$V_D = 15\text{ V}$ , $I_C = 150\text{ A}$ , $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.4	2.8	V
			$T_j = 125^\circ\text{C}$	—	—	3.2	
Forward Voltage	$V_F$	$I_F = 150\text{ A}$	—	2.5	3.1	V	
Switching Time	$t_{on}$	$V_{CC} = 600\text{ V}$ , $I_C = 150\text{ A}$ $V_D = 15\text{ V}$ , $V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$ Inductive Load (Note 1)	—	1.0	2.0	$\mu\text{s}$	
	$t_c(\text{on})$		—	0.6	1.2		
	$t_{rr}$		—	0.3	0.6		
	$t_{off}$		—	2.0	3.0		
	$t_c(\text{off})$		—	0.3	0.7		

b. 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	12	mA
	Low Side	$I_D(L)$		—	34	50	
Input On Signal Voltage		$V_{IN(on)}$	$V_D = 15\text{ V}$	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	12	mA
	Normal	$I_{FO(off)}$		—	—	0.1	
Over Current Protection Trip Level	Inverter	OC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	240	—	—	A
Short Circuit Protection Trip Level	Inverter	SC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	300	—	—	A
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	125	$^\circ\text{C}$
	Reset Level	OTr		—	98	—	
Control Supply Under Voltage Protection	Trip Level	UV	—	11.0	12.0	12.5	V
	Reset Level	UVr		12.0	12.5	13.0	
Fault Output Pulse Width		$t_{FO}$	$V_D = 15\text{ V}$	1	2	3	ms

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

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Junction to Case Thermal Resistance	$R_{th(j-c)}$	IGBT	—	—	0.125	$^\circ\text{C} / \text{W}$
		FRD	—	—	0.357	

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

