

TOSHIBA Intelligent Power Module Silicon N Channel IGBT

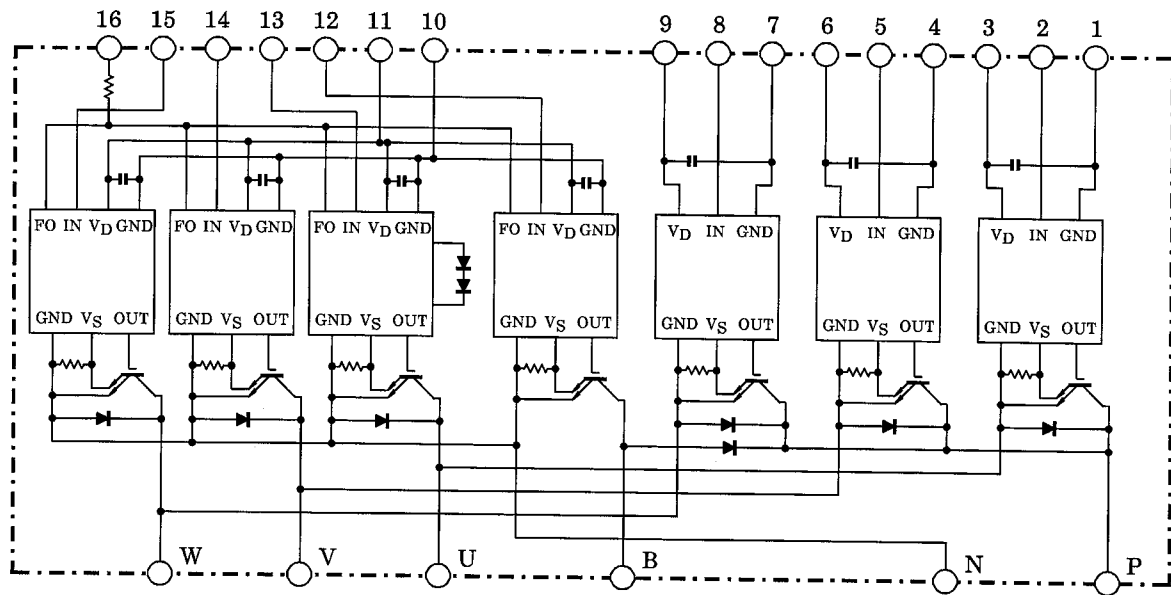
# MIG150J202H

High Power Switching Applications

Motor Control Applications

- Integrates inverter, brake power circuits & control circuits (IGBT drive units, protection units for over-current, under-voltage & over-temperature) in one package.
- The electrodes are isolated from case.
- High speed type IGBT :  $V_{CE(sat)} = 2.8V$  (max)  
 $t_{off} = 3.0 \mu s$  (max)  
 $t_{rr} = 0.30 \mu s$  (max)
- Package dimensions : TOSHIBA 2-110A1A
- Weight : 520g

## Equivalent Circuit



- |            |            |                       |             |                        |                       |
|------------|------------|-----------------------|-------------|------------------------|-----------------------|
| 1. GND (U) | 2. IN (U)  | 3. V <sub>D</sub> (U) | 4. GND (V)  | 5. IN (V)              | 6. V <sub>D</sub> (V) |
| 7. GND (W) | 8. IN (W)  | 9. V <sub>D</sub> (W) | 10. GND (L) | 11. V <sub>D</sub> (L) | 12. IN (B)            |
| 13. IN (X) | 14. IN (Y) | 15. IN (Z)            | 16. FO      |                        |                       |

## Maximum Ratings ( $T_j = 25^\circ\text{C}$ )

Stage	Characteristic	Condition	Symbol	Ratings	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	$T_c = 25^\circ\text{C}$	$P_C$	320	W
	Junction temperature	—	$T_j$	150	$^\circ\text{C}$
Brake	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	$I_C$	50	A
	Reverse voltage	—	$V_R$	600	V
	Forward current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	50	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	$P_C$	120	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 (L) terminal	$V_{FO}$	20	V
	Fault output current	FO sink current	$I_{FO}$	14	mA
Module	Operating temperature	—	TC	-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	N·m

## Electrical Characteristics ( $T_j = 25^\circ\text{C}$ )

### a. Inverter Stage

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
			$T_j = 125^\circ\text{C}$	—	—	20	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_D = 15\text{ V}$ , $I_C = 150\text{ A}$ $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.2	2.8	V
			$T_j = 125^\circ\text{C}$	—	2.3	—	
Forward voltage	$V_F$	$I_F = 150\text{ A}$	—	2.5	3.5	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)	—	1.2	2.0	$\mu\text{s}$	
	$t_{off}$		—	2.0	3.0		
	$t_f$		—	0.25	0.5		
	$t_{rr}$		—	0.1	0.3		

**b. Brake Stage**

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	$I_{CEX}$	$V_{CE} = 600V$	$T_j = 25^\circ C$	—	—	1	mA
			$T_j = 125^\circ C$	—	—	20	
Collector-emitter saturation voltage	$V_{CE (sat)}$	$V_D = 15V, I_C = 50A$ $V_{IN} = 15V \rightarrow 0V$	$T_j = 25^\circ C$	—	2.0	3.0	V
			$T_j = 125^\circ C$	—	2.0	—	
Reverse current	$I_R$	$V_R = 600V$	$T_j = 25^\circ C$	—	—	1	mA
			$T_j = 125^\circ C$	—	—	20	
Forward voltage	$V_F$	$I_F = 50A$	—	2.2	2.5	V	
Switching time	$t_{on}$	$V_{CC} = 300V, I_C = 50A$ $V_D = 15V, V_{IN} = 15V \leftrightarrow 0V$ Inductive load  (Note 1)	—	1.0	2.0	$\mu s$	
	$t_{off}$		—	2.0	3.0		
	$t_f$		—	0.25	0.5		
	$t_{rr}$		—	0.15	0.3		

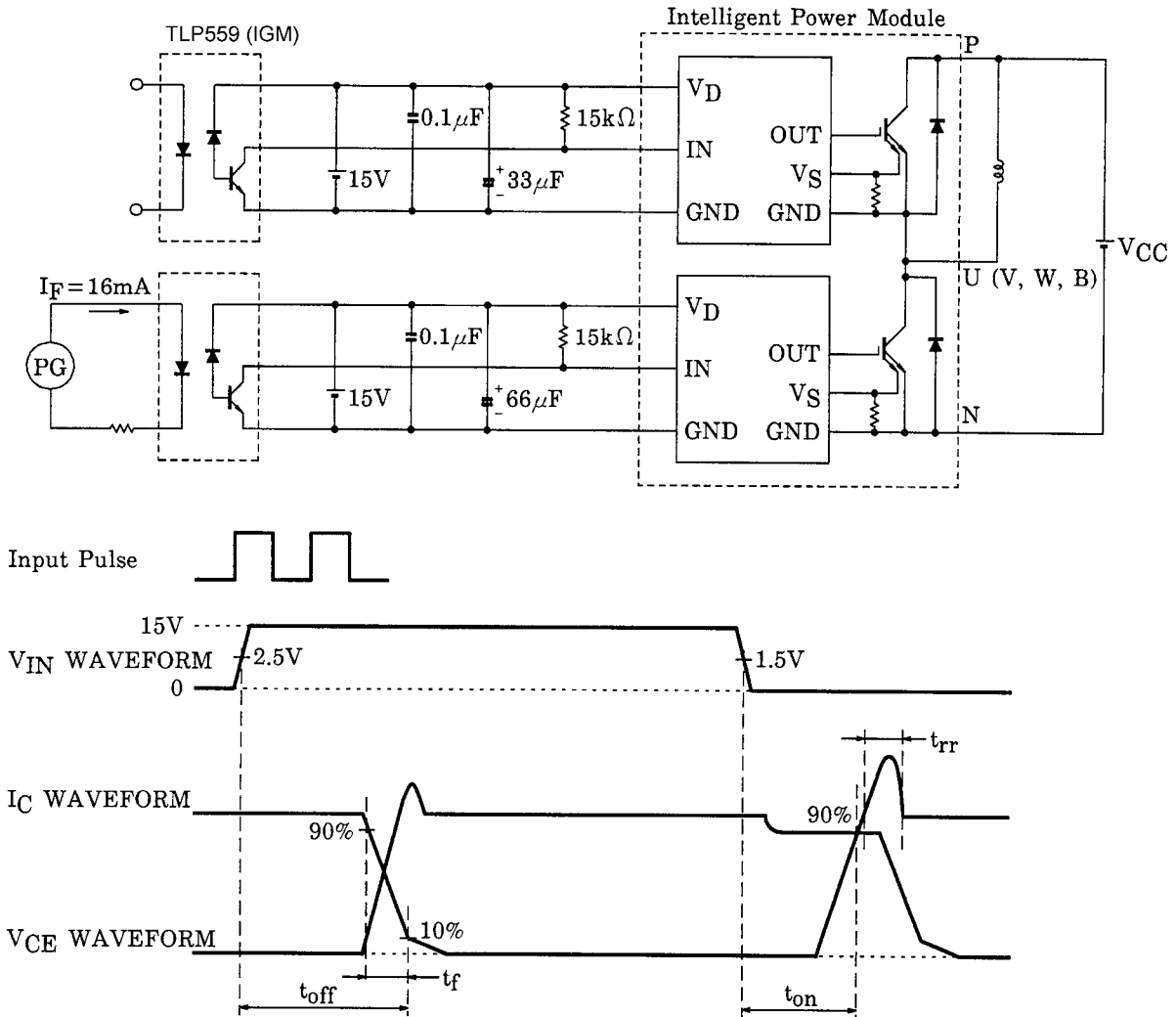
**c. Control Stage ( $T_j = 25^\circ C$ )**

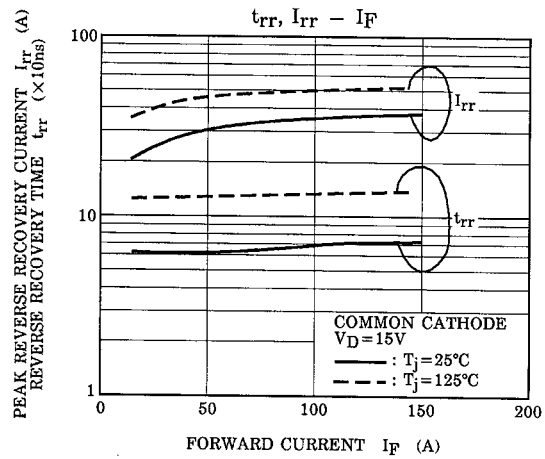
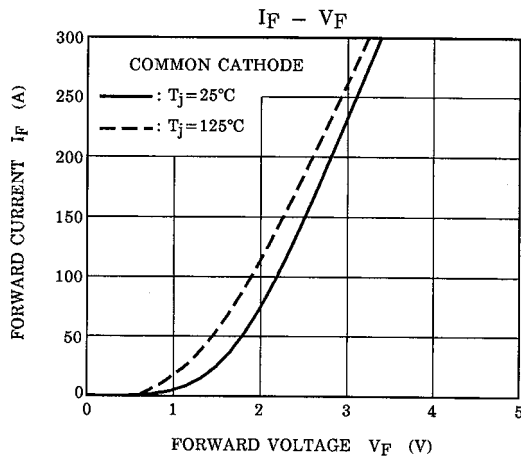
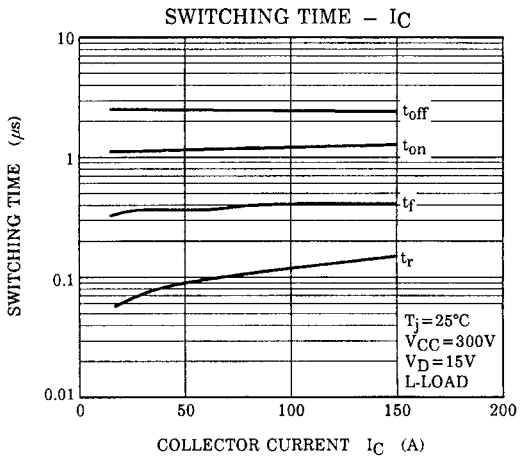
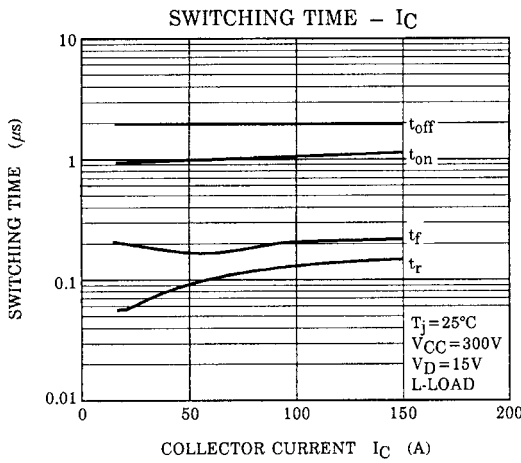
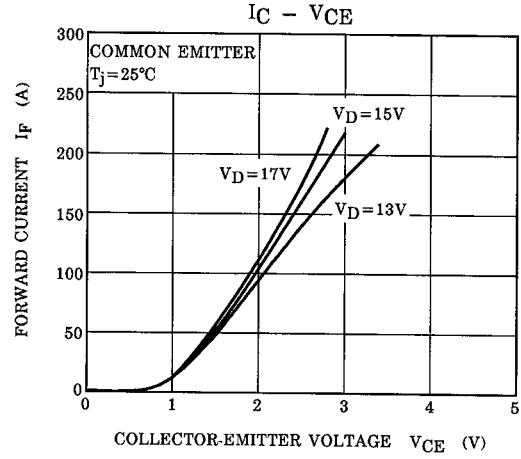
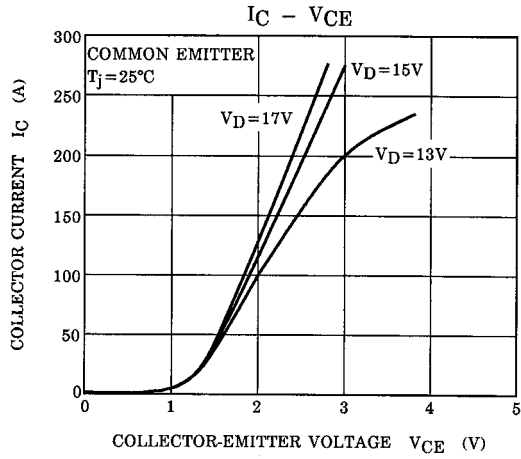
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Control circuit current	High side	$I_D (H)$	$V_D = 15V$	—	8	—	mA
	Low side			$I_D (L)$	—	32	
Input-on signal voltage	$V_{IN (on)}$	$V_D = 15V, I_C = 150mA$	1.3	1.5	1.7	V	
Input-off signal voltage	$V_{IN (off)}$	$V_D = 15V, I_C = 150mA$	2.2	2.5	2.8	V	
Fault output current	Protection	$I_{FO (on)}$	$V_D = 15V$	8	10	12	mA
	Normal			$I_{FO (off)}$	—	—	
Over current protection trip level	Inverter	OC	$V_D = 15V, T_j = 125^\circ C$	190	300	—	A
	Brake			60	—	—	
Short current protection trip level	Inverter	SC	$V_D = 15V, T_j = 125^\circ C$	285	450	—	A
	Brake			90	—	—	
Over current cut-off time	$t_{off (OC)}$	$V_D = 15V$	—	5	—	$\mu s$	
Over temperature protection	Trip level	OT	Case temperature	110	118	125	$^\circ C$
	Reset level			OTr	—	98	
Control supply under voltage protection	Trip level	UV	—	11.0	12.0	12.5	V
	Reset level			UVr	—	12.5	
Fault output pulse width	$t_{FO}$	$V_D = 15V$	1	2	3	ms	

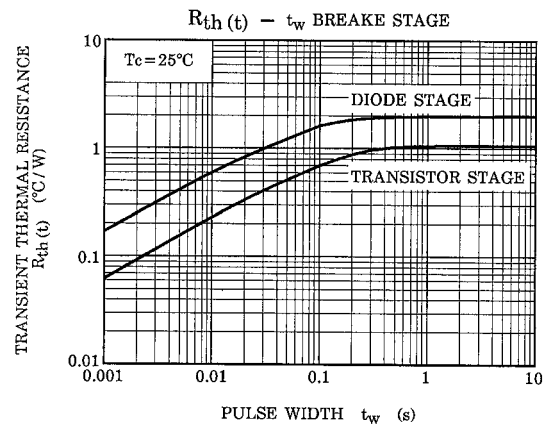
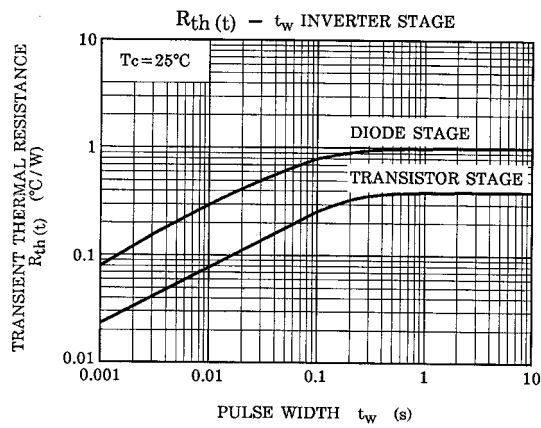
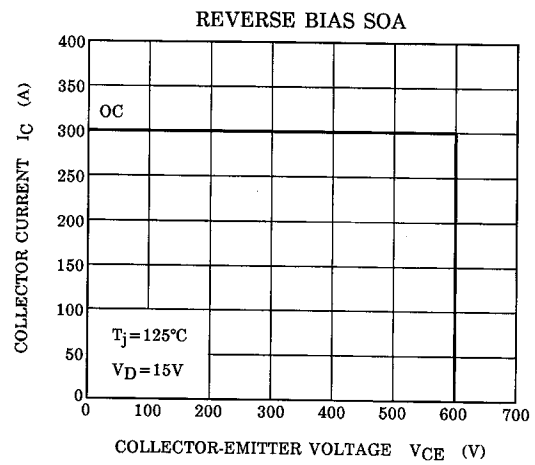
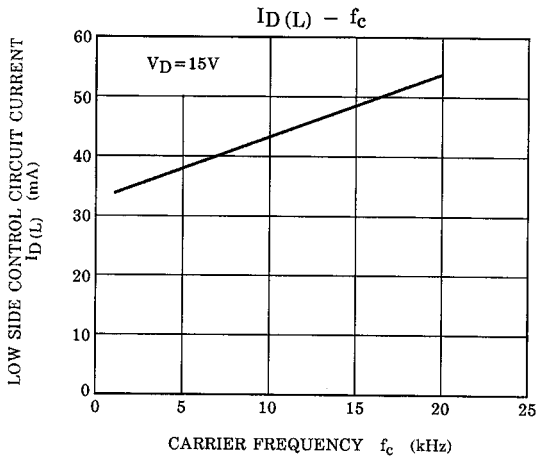
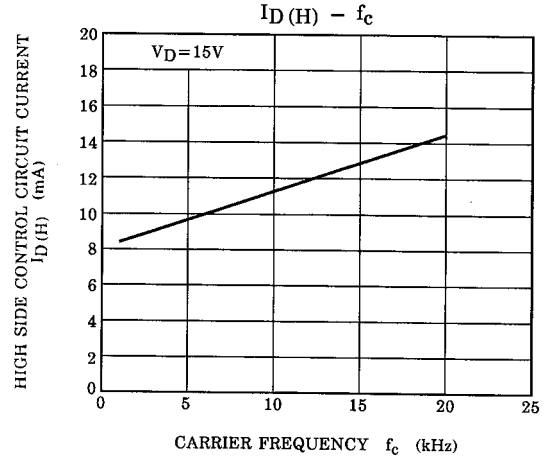
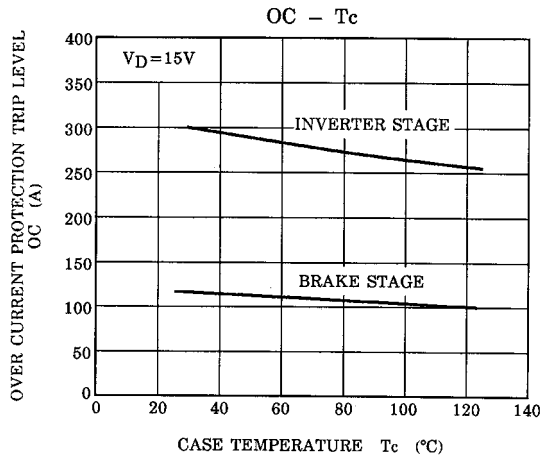
### d. Thermal Resistance ( $T_j = 25^\circ\text{C}$ )

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	Inverter IGBT	—	—	0.390	$^\circ\text{C} / \text{W}$
		Inverter FRD	—	—	1.041	
		Brake IGBT	—	—	1.041	
		Brake FRD	—	—	2.000	
Case to fin thermal resistance	$R_{th(c-f)}$	Compound is applied	—	0.05	—	$^\circ\text{C} / \text{W}$

Note 1 : Switching time test circuit & timing chart









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