

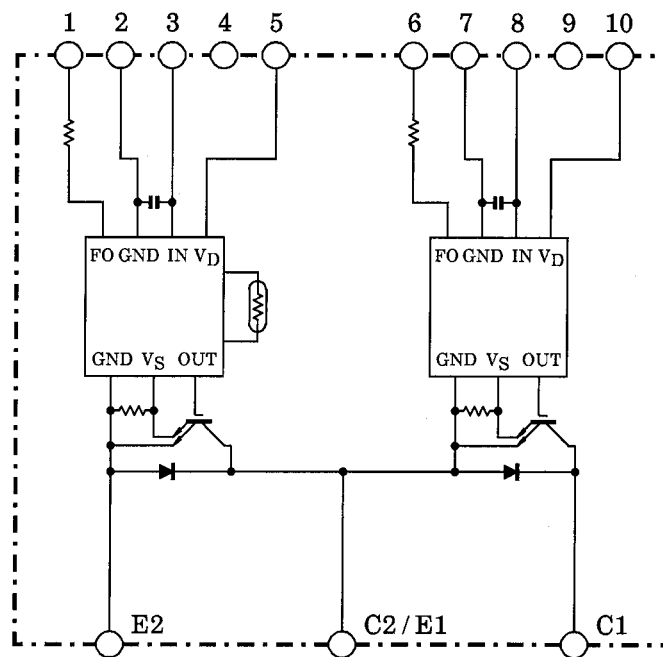
# MIG400J101H

High Power Switching Applications

Motor Control Applications

- Integrates inverter 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 :  $V_{CE(sat)} = 2.5V$  (max)  
 $t_{off} = 2.0\mu s$  (max)  
 $t_{rr} = 0.15\mu s$  (max)
- Package dimensions : TOSHIBA 2-121A1A
- Weight : 510g

## Equivalent Circuit



- |           |            |           |         |               |
|-----------|------------|-----------|---------|---------------|
| 1. FO (L) | 2. GND (L) | 3. IN (L) | 4. Open | 5. $V_D$ (L)  |
| 6. FO (H) | 7. GND (H) | 8. IN (H) | 9. Open | 10. $V_D$ (H) |

## 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	$I_C$	400	A
	Forward current	$T_c = 25^\circ\text{C}$ , DC	$I_F$	400	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	$P_C$	1600	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	—	$T_C$	-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	M6	—	3	Nm

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

### a. Inverter Stage

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	$I_{CEX}$	$V_{CE} = 600\text{V}$	$T_j = 25^\circ\text{C}$	—	—	2	mA
			$T_j = 125^\circ\text{C}$	—	—	40	
Collector-emitter saturation voltage	$V_{CE (sat)}$	$V_D = 15\text{V}$ , $I_C = 400\text{A}$ $V_{IN} = 3\text{V} \rightarrow 0\text{V}$	$T_j = 25^\circ\text{C}$	—	2.0	2.5	V
			$T_j = 125^\circ\text{C}$	—	2.0	—	
Forward voltage	$V_F$	$I_F = 400\text{A}$	—	2.1	2.7	V	
Switching time	$t_{on}$	$V_{CC} = 300\text{V}$ , $I_C = 400\text{A}$ $V_D = 15\text{V}$ , $V_{IN} = 3\text{V} \leftrightarrow 0\text{V}$ Inductive load  (Note 1)	1.4	2.1	2.8	$\mu\text{s}$	
	$t_{c (on)}$		—	1.2	1.8		
	$t_{rr}$		—	0.08	0.15		
	$t_{off}$		—	1.2	2.0		
	$t_{c (off)}$		—	0.3	0.6		

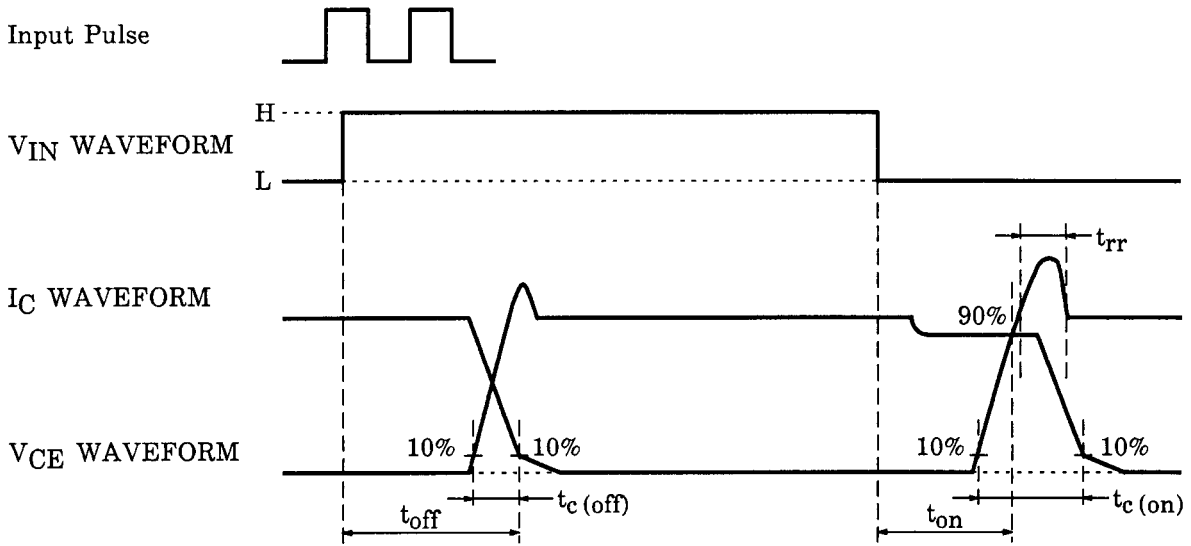
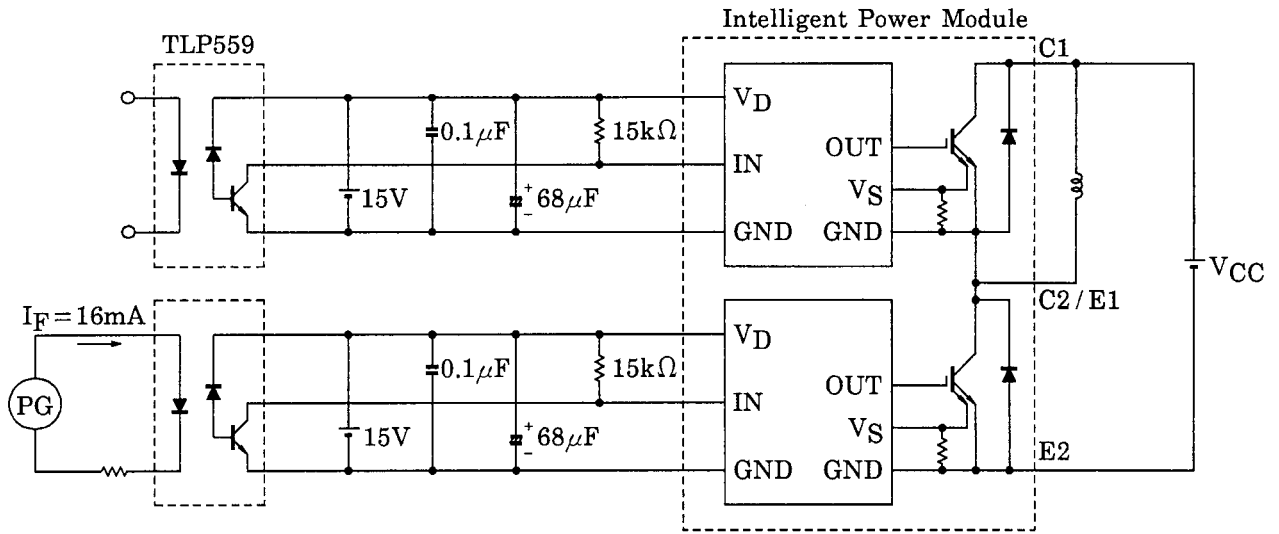
## b. Control Stage ( $T_j = 25^\circ\text{C}$ )

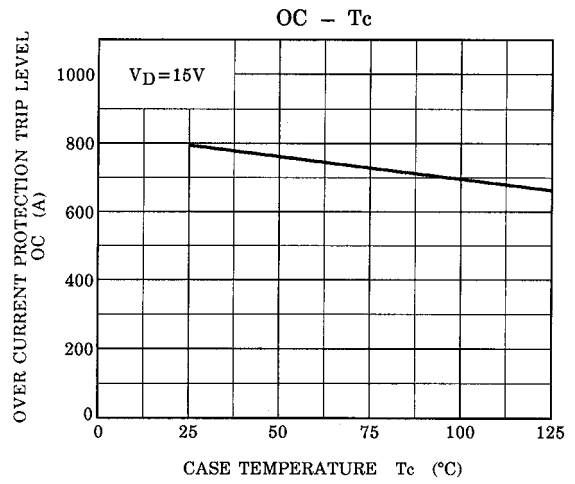
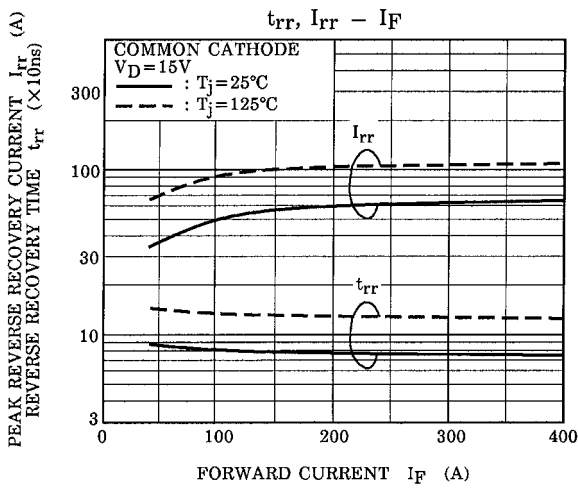
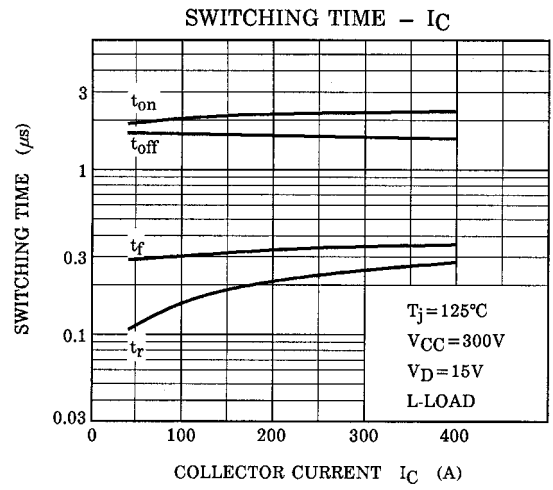
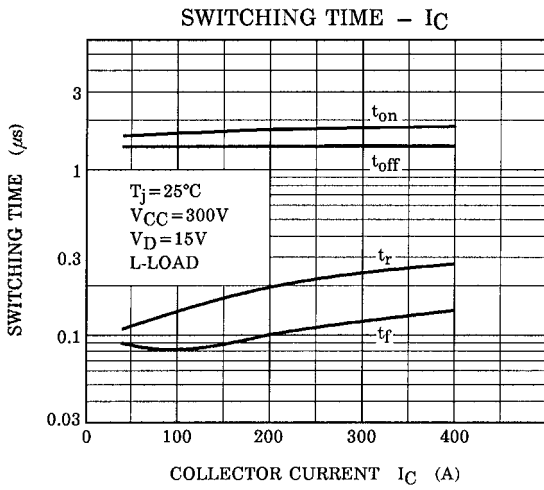
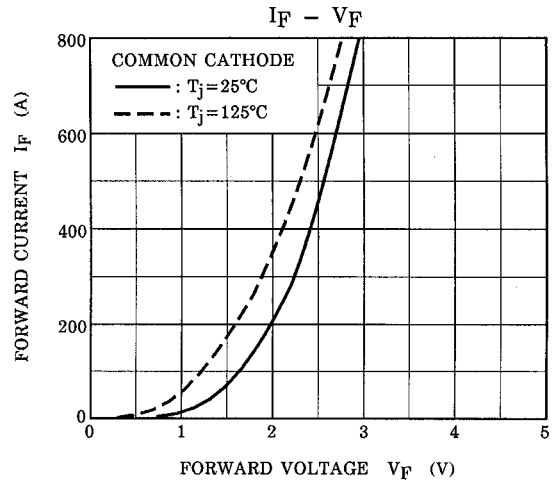
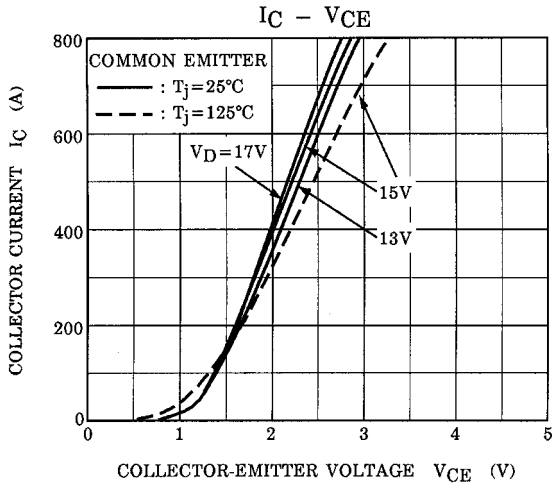
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current		$I_D$	$V_D = 15\text{V}$	—	20	30	mA
Input on signal voltage		$V_{IN (on)}$	$V_D = 15\text{V}, I_C = 400\text{mA}$	0.9	1.1	1.3	V
Fault output current	Protection	$I_{FO (on)}$	$V_D = 15\text{V}$	8	10	12	mA
	Normal	$I_{FO (off)}$		—	—	1	
Over current protection trip level		OC	$V_D = 15\text{V}, T_j = 125^\circ\text{C}$	560	640	—	A
Short circuit protection trip level		SC	$V_D = 15\text{V}, T_j = 125^\circ\text{C}$	840	960	—	A
Over current cut-off time		$t_{off (OC)}$	$V_D = 15\text{V}$	—	10	—	$\mu\text{s}$
Over temperature protection	Trip level	OT	Case temperature	111	118	125	$^\circ\text{C}$
	Reset level	OTr		93	100	107	
Control supply under voltage protection	Trip level	UV	—	11.3	12.0	12.7	V
	Reset level	UVr		11.8	12.5	13.2	
Fault output pulse width		$t_{FO}$	$V_D = 15\text{V}$	1	2	3	ms

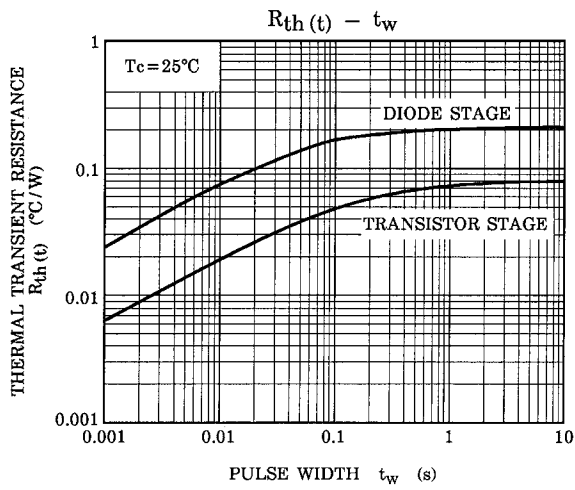
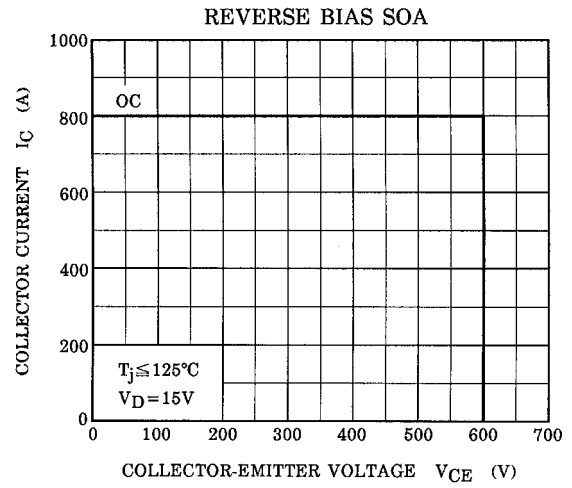
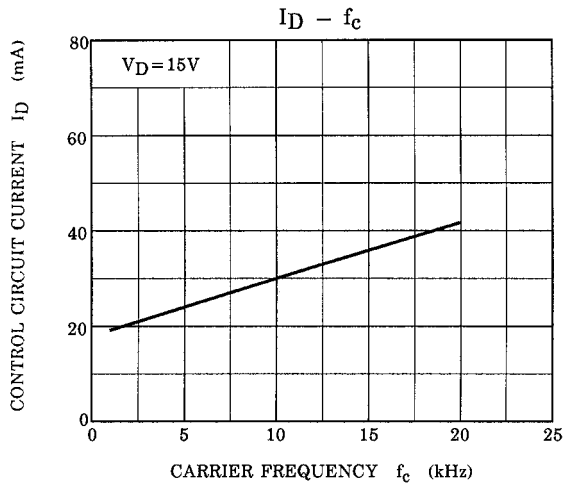
## c. Thermal Resistance ( $T_j = 25^\circ\text{C}$ )

Characteristic	Symbol	Test Condition	MIN	TYP.	MAX	Unit
Junction to case thermal resistance	$R_{th (j-c)}$	IGBT	—	—	0.078	$^\circ\text{C} / \text{W}$
		FRD	—	—	0.208	
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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