TOSHIBA Intelligent Power Module Silicon N Channel IGBT

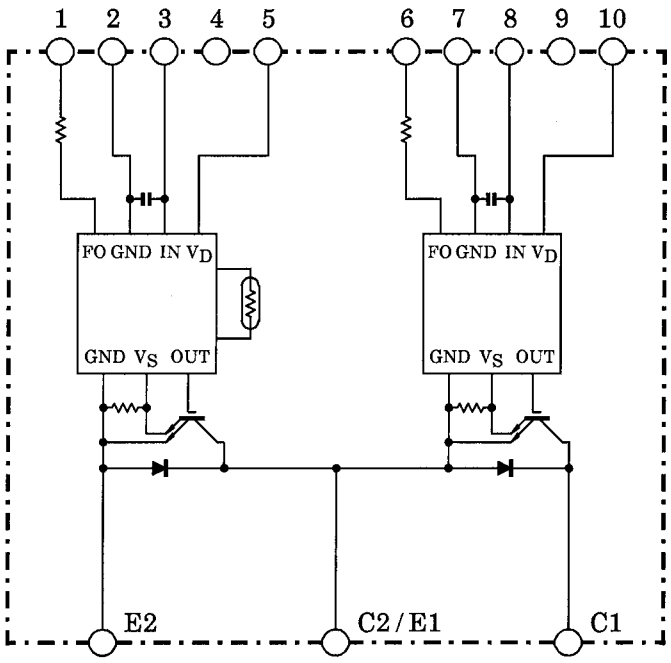
MIG300Q101H

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.
- Outline : 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°C)

Stage	Characteristic	Condition	Symbol	Ratings	Unit
Inverter	Supply voltage	P−N power terminal	V_{CC}	900	V
	Collector−emitter voltage	—	V_{CES}	1200	V
	Collector current	Tc = 25°C, DC	I_C	300	A
	Forward current	Tc = 25°C, DC	I_F	300	A
	Collector power dissipation	Tc = 25°C	P_C	1600	W
	Junction temperature	—	T_j	150	°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	°C
	Storage temperature range	—	T_{stg}	−40~+125	°C
	Isolation voltage	AC 1 minute,	V_{ISO}	2500	V
	Screw torque	M6	—	3	N·m

Electrical Characteristics (T_j = 25°C)

a. Inverter Stage

Characteristic	Symbol	Test Condition		Min	Typ.	Ma.	Unit
Collector cut−off current	I_{CEX}	V_{CE} = 1200V	T_j = 25°C	—	—	2	mA
			T_j = 125°C	—	—	40	
Collector−emitter saturation voltage	$V_{CE\ (sat)}$	V_D = 15V, I_C = 300A V_{IN} = 3V→0V	T_j = 25°C	—	2.7	2.5	V
			T_j = 125°C	—	2.6	—	
Forward voltage	V_F	I_F = 300A		—	2.0	3.0	V
Switching time	t_{on}	V_{CC} = 600V, I_C = 300A V_D = 15V, V_{IN} = 3V ↔ 0V Inductive load (Note 1)		0.8	1.5	2.2	μs
	$t_{c\ (on)}$			—	0.5	1.0	
	t_{rr}			—	0.2	0.3	
	t_{off}			—	3.3	3.8	
	$t_{c\ (off)}$			—	0.4	0.8	

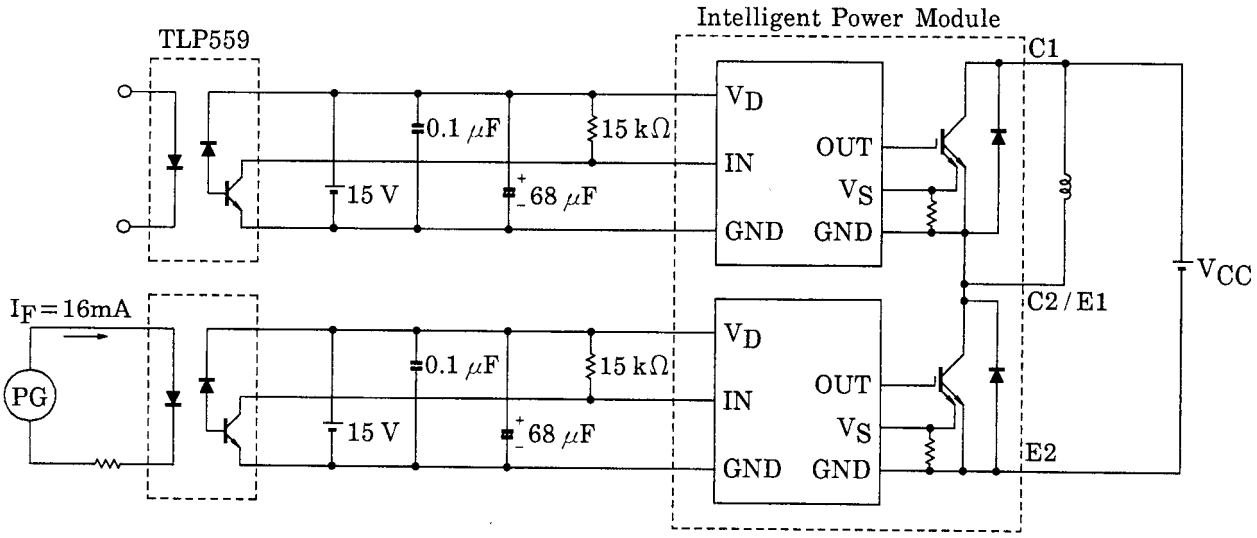
b. Control Stage (T_j = 25°C)

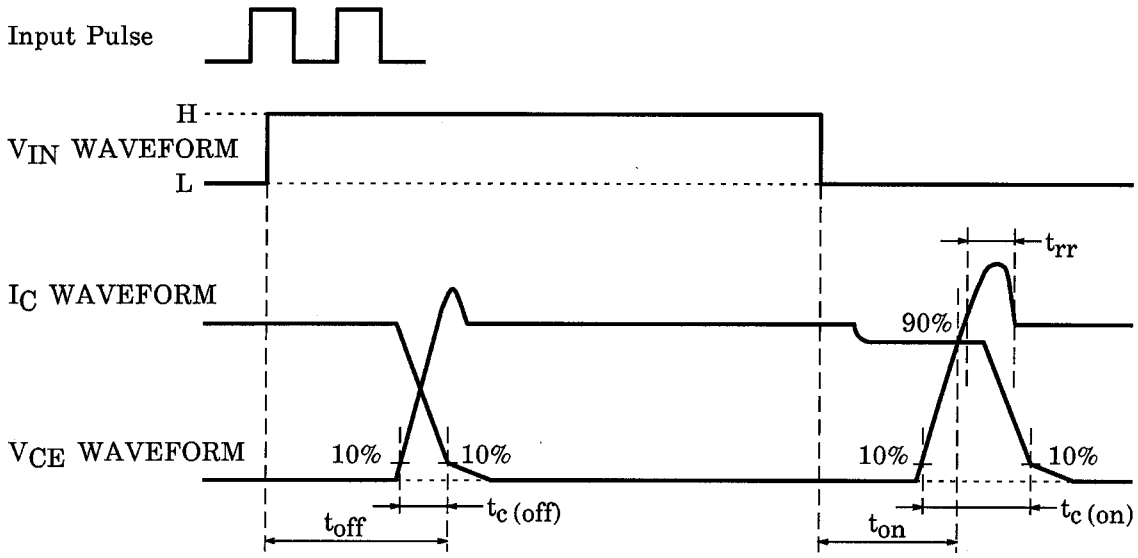
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current		I_D	V_D = 15V	—	20	30	mA
Input on signal voltage		$V_{IN\ (on)}$	V_D = 15V, I_C = 300mA	0.9	1.1	1.3	V
Fault output current	Protection	$I_{FO\ (on)}$	V_D = 15V	8	10	12	mA
	Normal	$I_{FO\ (off)}$		—	—	1	
Over current protection trip level		OC	V_D = 15V, T_j = 125°C	420	600	—	A
Short circuit protection trip level		SC	V_D = 15V, T_j = 125°C	630	900	—	A
Over current cut−off time		$t_{off\ (OC)}$	V_D = 15V	—	10	—	μs
Over temperature protection	Trip level	OT	Case temperature	111	118	125	°C
	Reset level	OTr		—	100	—	
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 = 15V	1	2	3	ms

c. Thermal Resistance (T_j = 25°C)

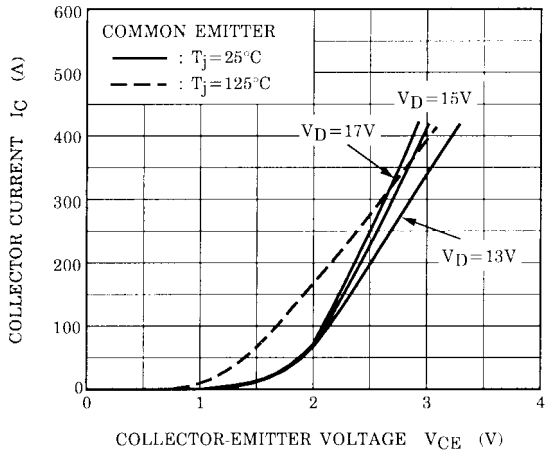
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th\ (j-c)}$	IGBT	—	—	0.078	°C / W
		FRD	—	—	0.25	
Case to fin thermal resistance	$R_{th\ (c-f)}$	Compound is applied	—	0.05	—	°C / W

Note 1: Switching time test circuit & timing chart

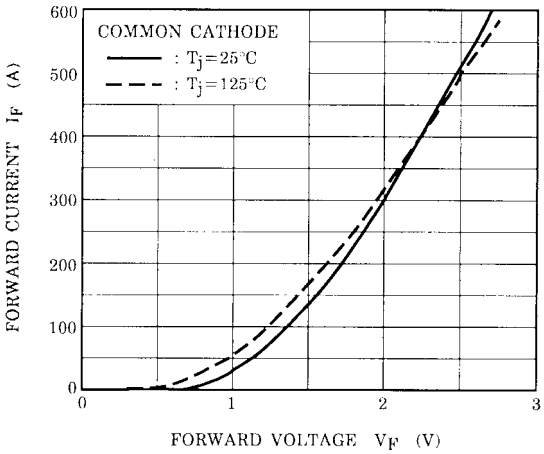




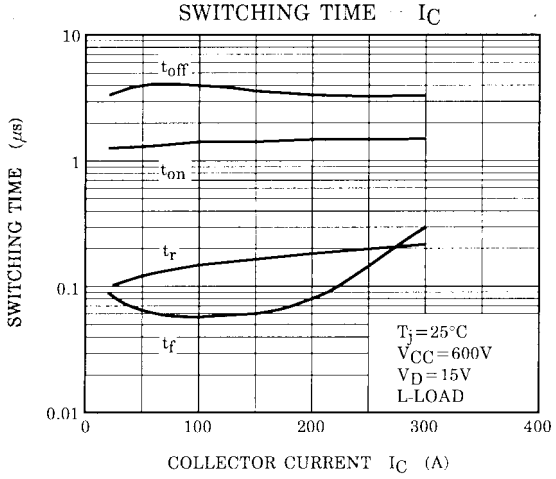
I_C – V_{CE}



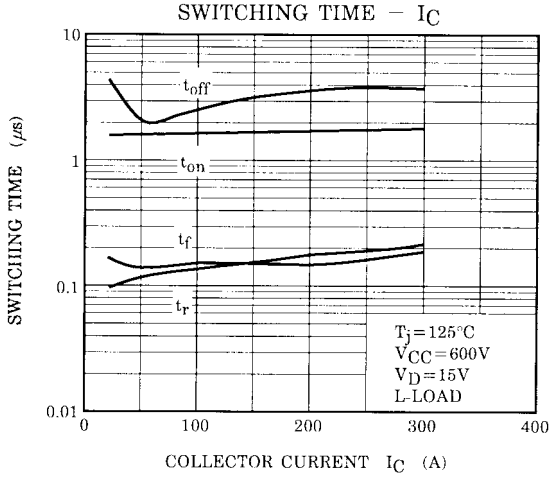
I_F – V_F



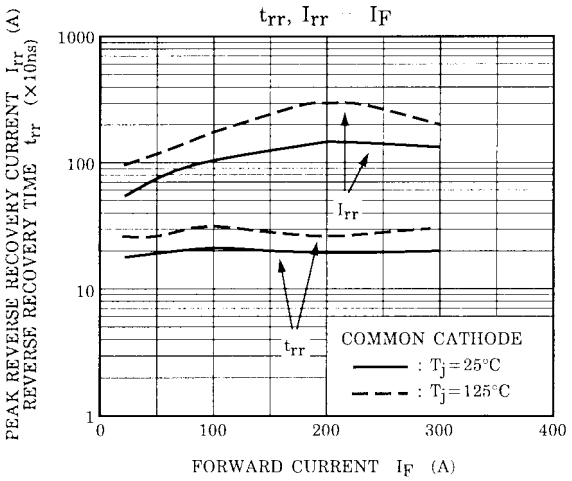
SWITCHING TIME – I_C



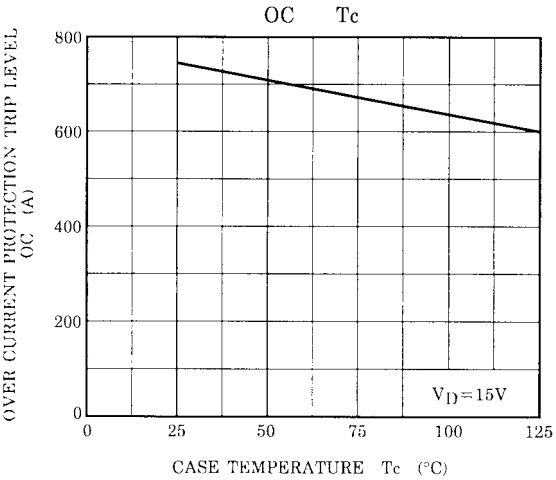
SWITCHING TIME – I_C

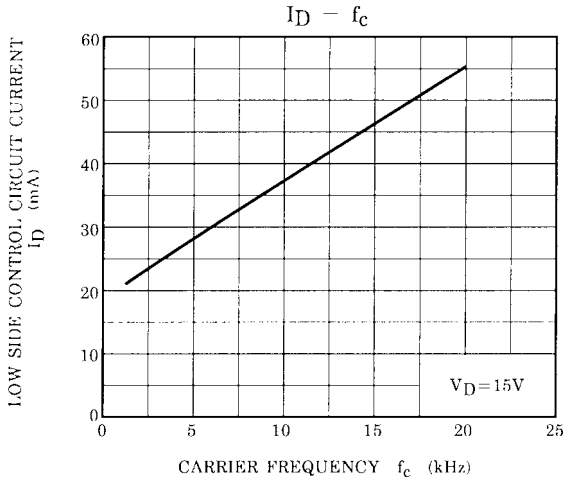


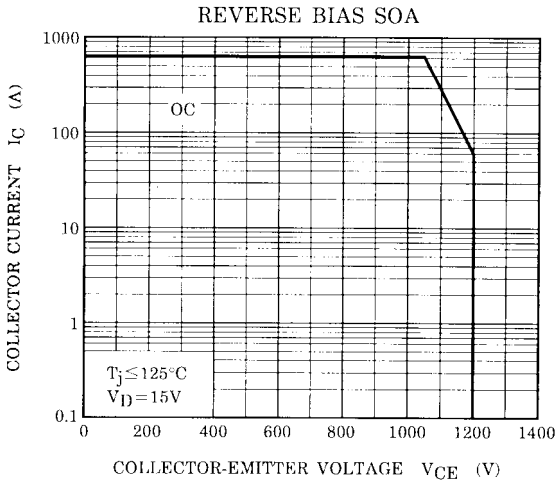
t_{rr}, I_{rr} – I_F

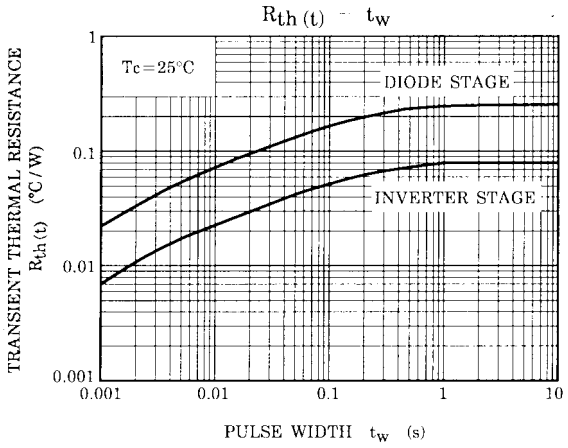


OC – Tc



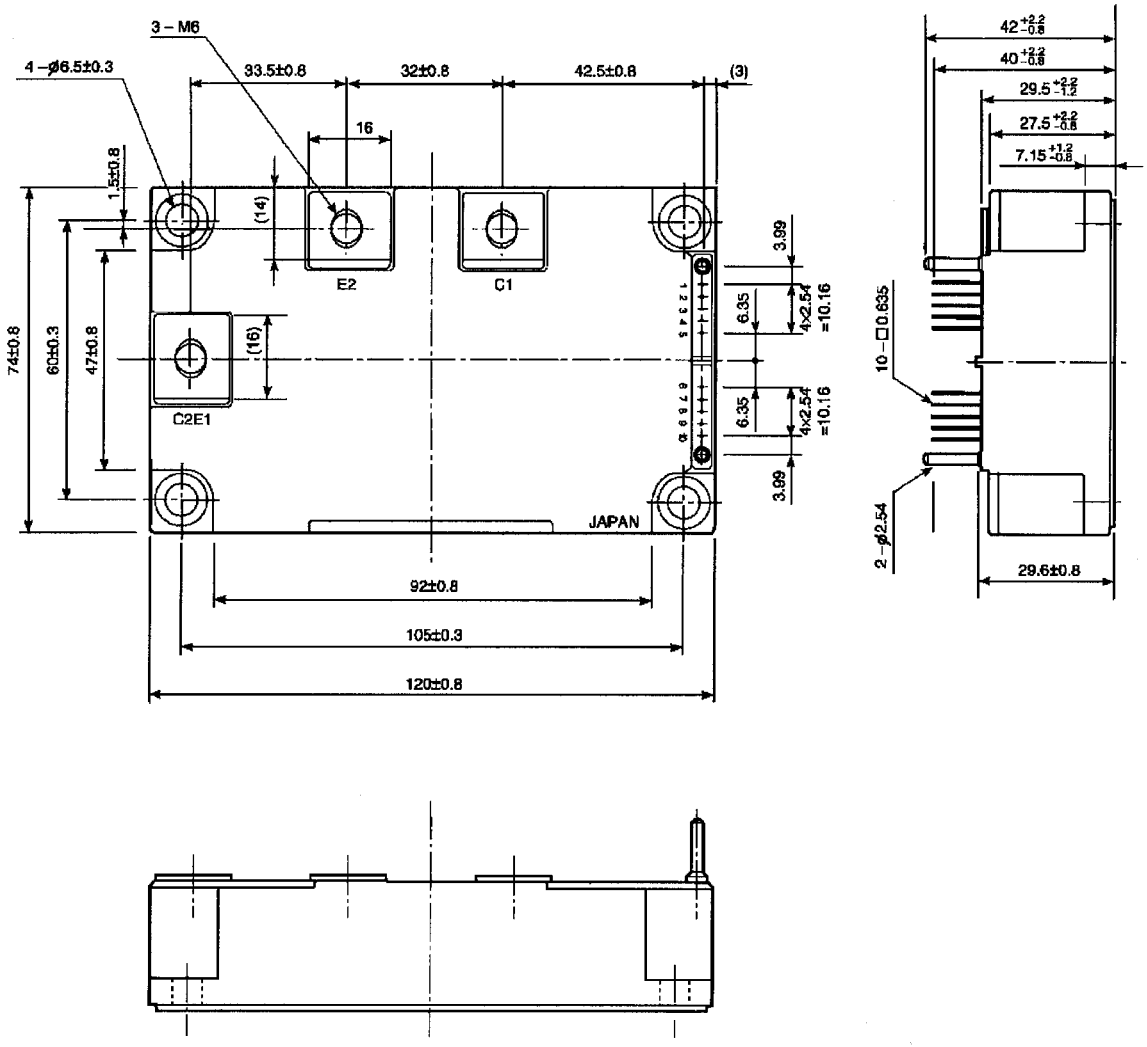

I_D – f_c
LOW SIDE CONTROL CIRCUIT CURRENT I_D (mA)
60
50
40
30
20
10
0
0
5
10
15
20
25
V_D=15V
CARRIER FREQUENCY f_c (kHz)


REVERSE BIAS SOA
COLLECTOR CURRENT I_C (A)
1000
100
10
1
0.1
OC
$T_j \leq 125°C$
V_D=15V
0
200
400
600
800
1000
1200
1400
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)


R_{th} (t) – t_w
TRANSIENT THERMAL RESISTANCE R_{th} (t) (°C/W)
1
0.1
0.01
0.001
Tc=25°C
DIODE STAGE
INVERTER STAGE
0.001
0.01
0.1
1
10
PULSE WIDTH t_w (s)

Package Dimensions: TOSHIBA 2-121A1A

Unit: mm



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