TOSHIBA Intelligent Power Module Silicon N Channel IGBT

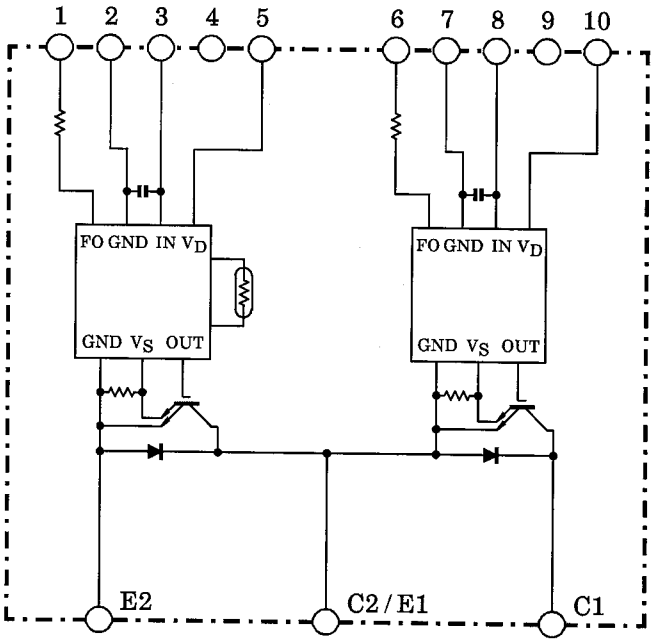
MIG150Q101H

High Power Switching Applications

Motor Control Applications

- Integrates inverter power & 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 : $V_{CE\ (sat)}$ = 3.5 V (Max.)
  t_{off} = 3.8 μs (Max.)
  t_{rr} = 0.24 μs (Max.)
- Package Dimensions : TOSHIBA 2-121A1A
- Weight : 510 g

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	150	A
	Forward current	Tc = 25°C, DC	I_F	150	A
	Collector power dissipation	Tc = 25°C	P_C	1200	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	—	TC	−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.	Max	Unit
Collector cut-off current	I_{CE}	V_{CE} = 1200 V	T_j = 25°C	—	—	2	mA
			T_j = 125°C	—	—	40	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	V_D = 15 V, I_C = 150 A V_{IN} = 3 V → 0 V	T_j = 25°C	—	2.7	3.5	V
			T_j = 125°C	—	2.6	—	
Forward voltage	V_F	I_F = 150 A		—	2.0	2.5	V
Switching time	t_{on}	V_{CC} = 600 V, I_C = 150 A V_D = 15 V, V_{IN} = 3 V ↔ 0 V Inductive load (Attached 1)		0.8	1.5	2.2	μs
	$t_{c(on)}$			—	0.5	1.0	
	t_{rr}			—	0.16	0.24	
	t_{off}			—	3.3	3.8	
	$t_{c(off)}$			—	0.4	0.8	

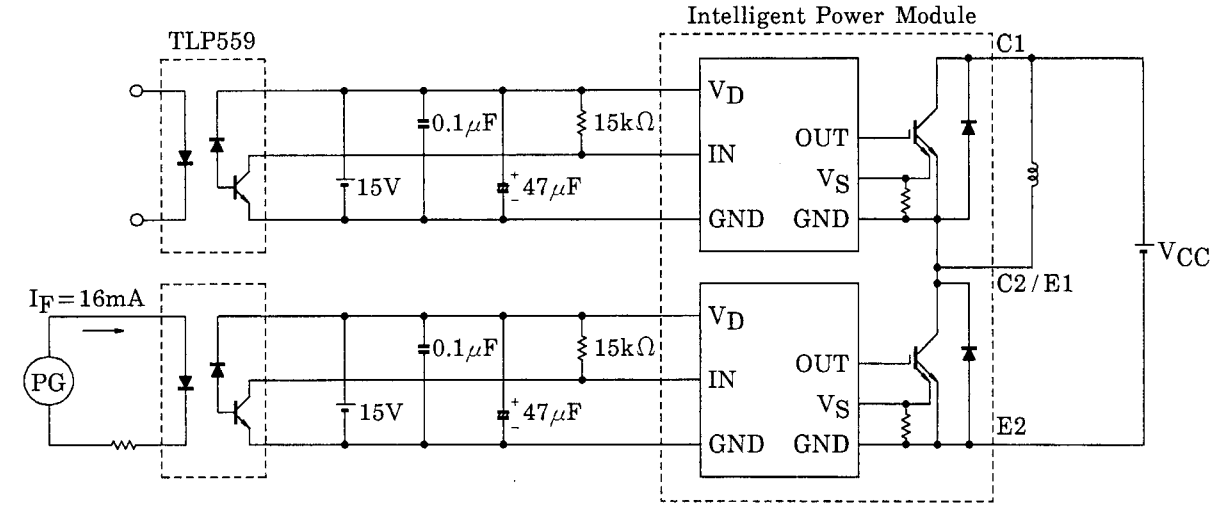
b. Control Stage (T_j = 25°C)

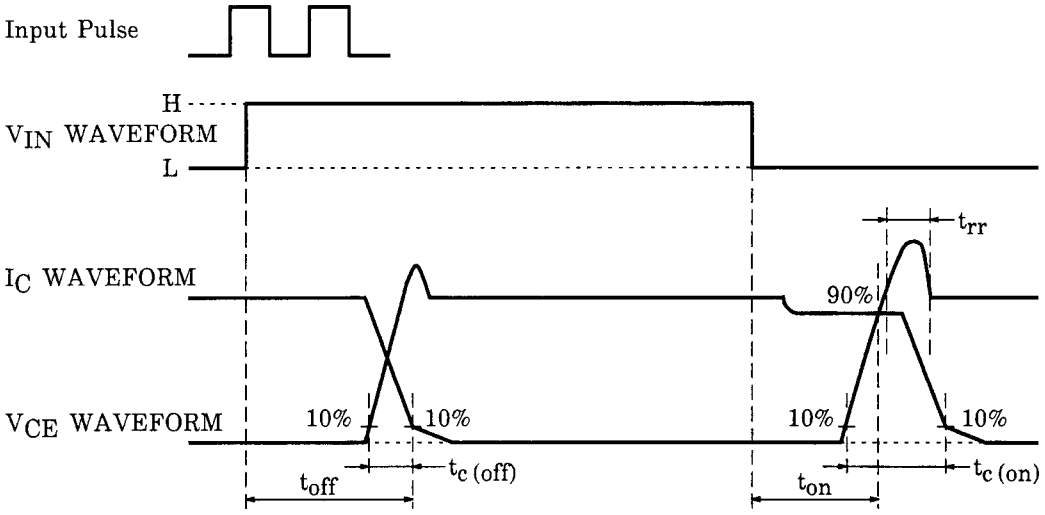
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current		I_D	V_D = 15 V	—	20	30	mA
Input-on signal voltage		$V_{IN\ (on)}$	V_D = 15 V, I_C = 150 mA	0.9	1.1	1.3	V
Fault output current	Protection	$I_{FO\ (on)}$	V_D = 15 V	8	10	12	mA
	Normal	$I_{FO\ (off)}$		—	—	1	
Over current protection trip level		OC	V_D = 15 V, T_j = 125°C	210	300	—	A
Short current protection trip level		SC	V_D = 15 V, T_j = 125°C	315	450	—	A
Over current cut-off time		$t_{off\ (OC)}$	V_D = 15 V	—	10	—	μs
Over temperature protection	Trip level	OT	Case temperature	111	118	125	°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 V	1	2	3	ms

c. Thermal Resistance (T_j = 25°C)

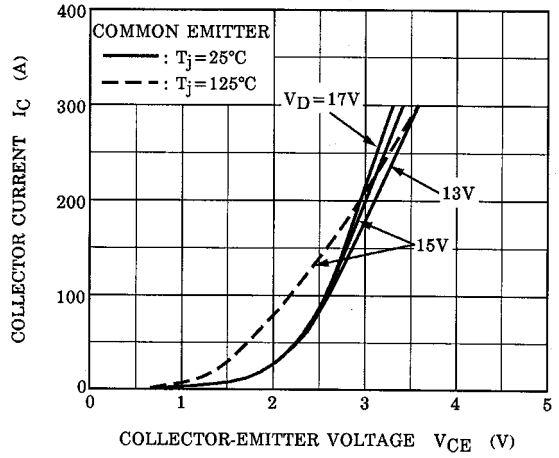
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th\ (j-c)}$	IGBT	—	—	0.104	°C / W
		FRD	—	—	0.25	
Case to fin thermal resistance	$R_{th\ (c-f)}$	Compound is applied	—	0.05	—	°C / W

Note 1: Switching time test circuit & timing chart

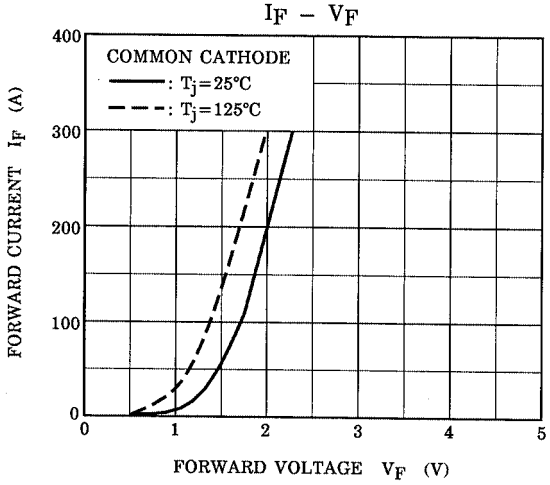




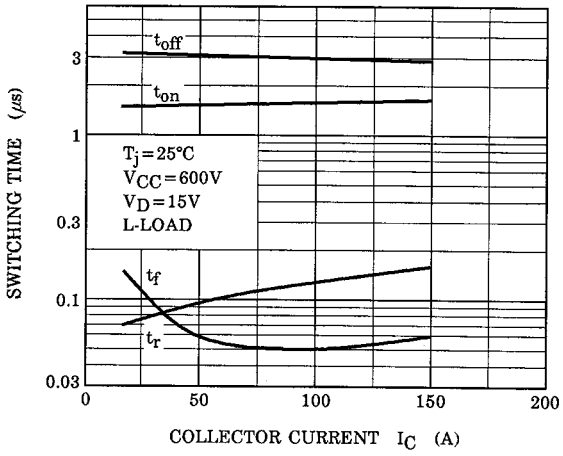
I_C – V_{CE}



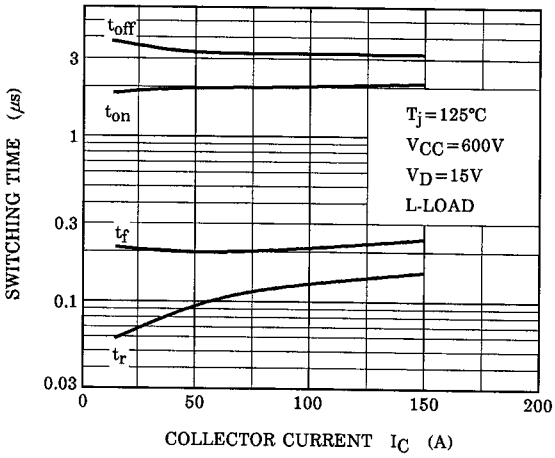
I_F – V_F



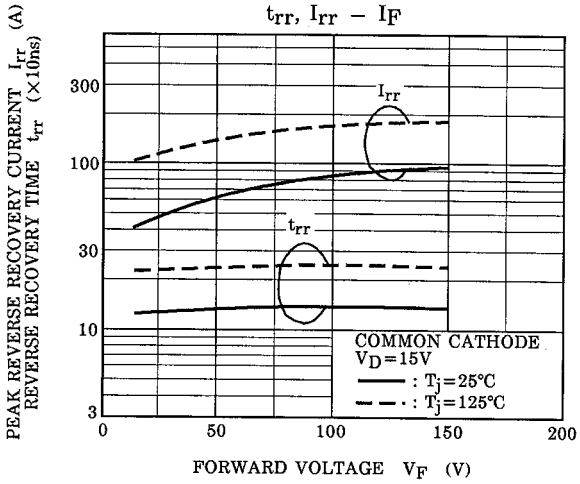
SWITCHING TIME – I_C



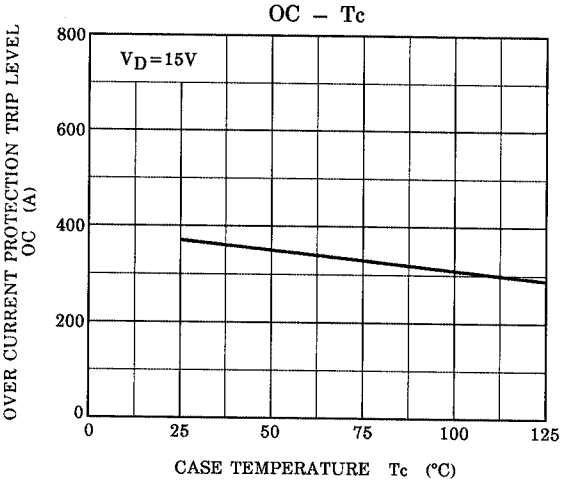
SWITCHING TIME – I_C

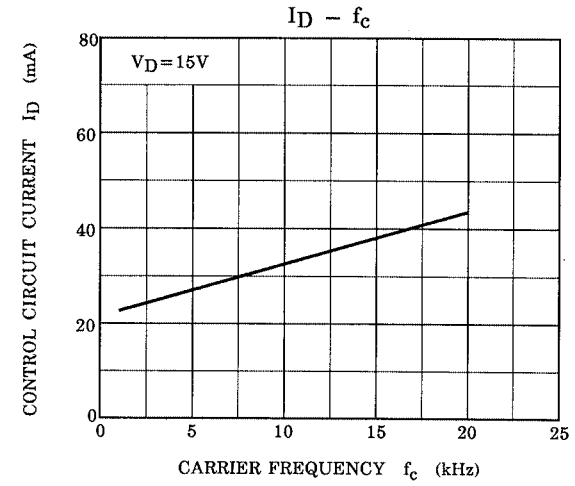


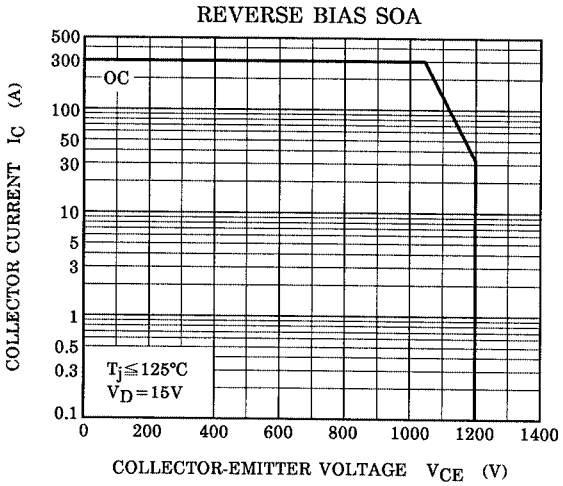
t_{rr}, I_{rr} – I_F

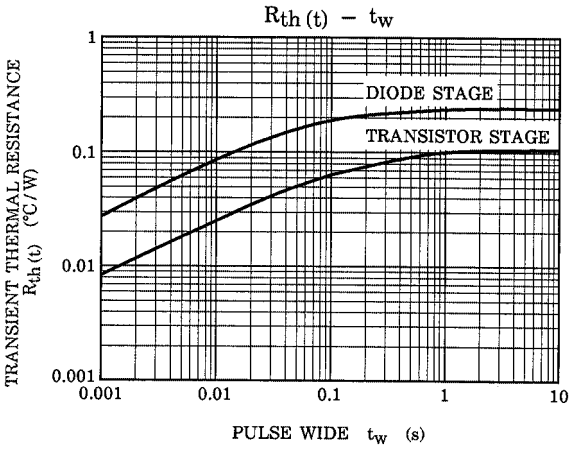


OC – Tc



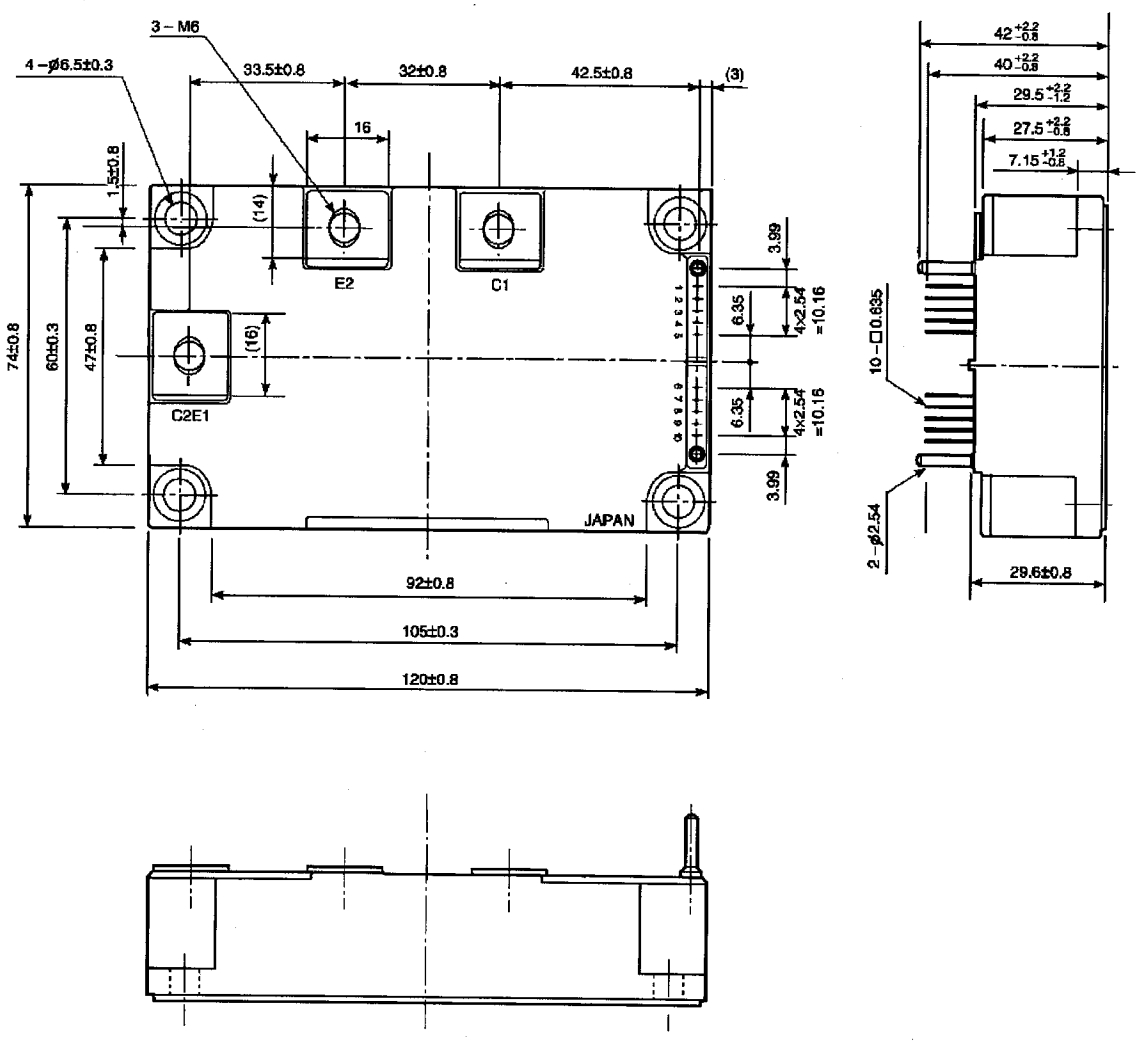

I_D – f_c
V_D=15V
CONTROL CIRCUIT CURRENT I_D (mA)
CARRIER FREQUENCY f_c (kHz)
0
20
40
60
80
0
5
10
15
20
25


REVERSE BIAS SOA
OC
$T_j \leqq 125°C$
V_D=15V
COLLECTOR CURRENT I_C (A)
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)
0.1
0.3
0.5
1
3
5
10
30
50
100
300
500
0
200
400
600
800
1000
1200
1400


$R_{th\,(t)}$ – t_w
DIODE STAGE
TRANSISTOR STAGE
TRANSIENT THERMAL RESISTANCE $R_{th\,(t)}$ (°C/W)
PULSE WIDE t_w (s)
0.001
0.01
0.1
1
0.001
0.01
0.1
1
10

Package Dimensions: TOSHIBA 2-121A1A

Unit: mm



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)

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