TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

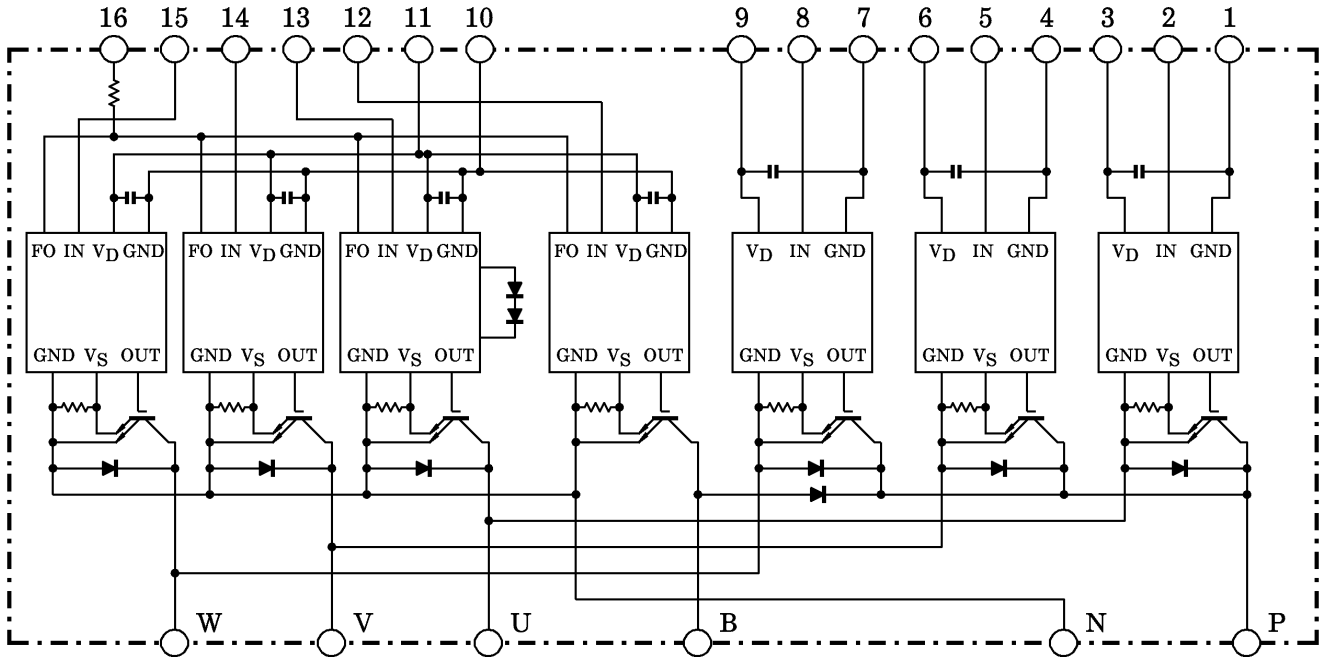
MIG50Q201H

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Brake Power Circuits & Control Circuits (IGBT drive units, Protection units for Over-Current, Realtime-Current-Control (RTC), 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} = 2.6 μs (MAX.)
  t_{rr} = 0.21 μs (MAX.)
- Outline : 2-110A1A
- Weight : 520 g

EQUIVALENT CIRCUIT



1. GND (U)	2. IN (U)	3. V_D (U)	4. GND (V)	5. IN (V)	6. V_D (V)
7. GND (W)	8. IN (W)	9. V_D (W)	10. GND (L)	11. V_D (L)	12. IN (B)
13. IN (X)	14. IN (Y)	15. IN (Z)	16. FO		

961001EAA1

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	50	A
	Forward Current	Tc = 25°C, DC	I_F	50	A
	Collector Power Dissipation	Tc = 25°C	P_C	300	W
	Junction Temperature	—	T_j	150	°C
Brake	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	25	A
	Reverse Voltage	—	V_R	1200	V
	Forward Current	Tc = 25°C, DC	I_F	25	A
	Collector Power Dissipation	Tc = 25°C	P_C	140	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}	10	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	M5	—	3	Nm

ELECTRICAL CHARACTERISTICS

a. Inverter stage

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Collector Cut-Off Current	I_{CEX}	V_{CEX} = 1200 V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	10	
Collector-Emitter Saturation Voltage	$V_{CE\ (sat)}$	V_D = 15 V, I_C = 50 A, V_{IN} = 15 V → 0 V	T_j = 25°C	—	2.6	3.5	V
			T_j = 125°C	—	2.5	—	
Forward Voltage	V_F	I_F = 50 A		—	2.0	2.8	V
Switching Time	t_{on}	V_{CC} = 600 V, I_C = 50 A, V_D = 15 V, V_{IN} = 15V ↔ 0 V, Inductive load (Note 1)			1.0	1.7	μs
	$t_{c\ (on)}$			—	0.4	0.8	
	t_{rr}			—	0.16	0.21	
	t_{off}			—	1.9	2.6	
	$t_{c\ (off)}$			—	0.35	0.6	

b. Brake stage

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Cellector Cut-Off Current	I_{CEX}	V_{CEX} = 1200 V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	10	
Collector-Emitter Saturation Voltage	$V_{CE\ (sat)}$	V_D = 15 V, I_C = 25 A, V_{IN} = 15 V → 0 V	T_j = 25°C	—	2.6	3.5	V
			T_j = 125°C	—	2.5	—	
Reverse Voltage	I_R	V_R = 1200 V		—	—	1	mA
				—	—	10	
Forward Voltage	V_F	I_F = 25 A		—	1.4	2.2	V
Switching Time	t_{on}	V_{CC} = 600 V, I_C = 25 A, V_D = 15 V, V_{IN} = 15 V ↔ 0 V, Inductive load (Note 1)		—	1.3	1.9	μs
	$t_{c\ (on)}$			—	0.85	1.6	
	t_{rr}			—	0.42	0.50	
	t_{off}			—	1.9	2.6	
	$t_{c\ (off)}$			—	0.3	0.6	

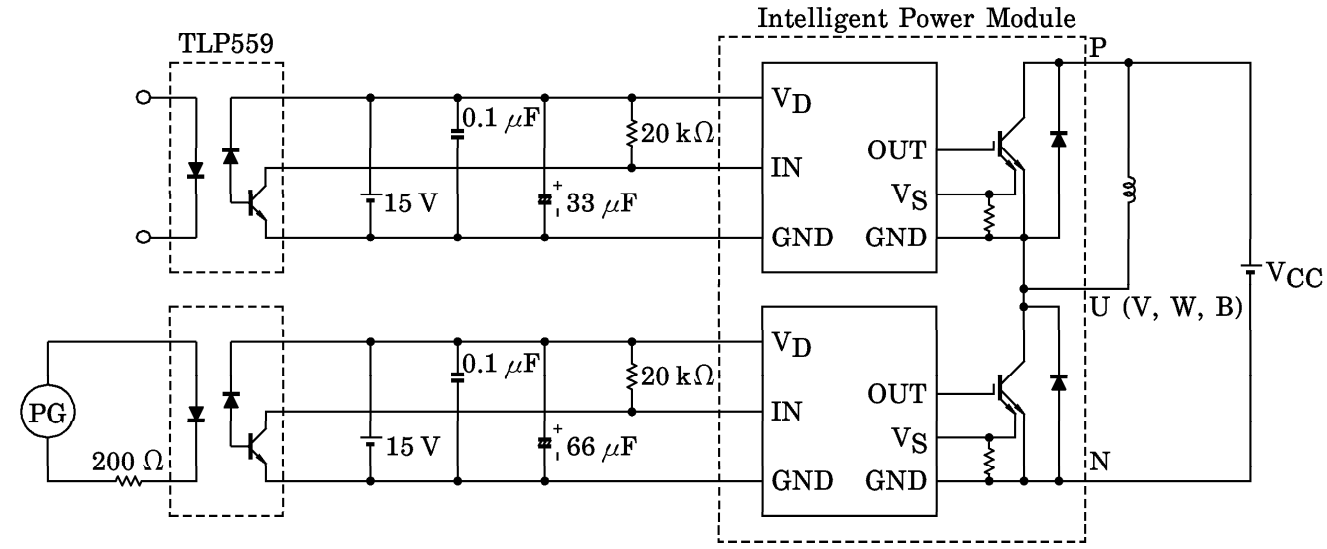
c. Control stage (T_j = 25°C)

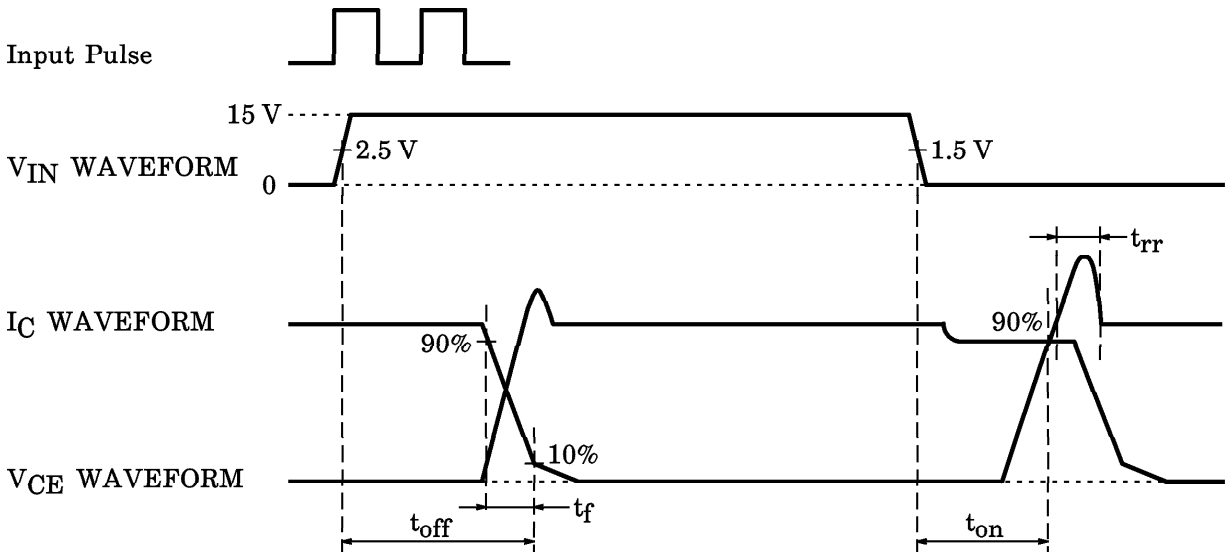
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Control Circuit Current	High Side	$I_{D\ (H)}$	V_D = 15 V	—	8	12	mA
	Low Side	$I_{D\ (L)}$		—	32	48	
Input On Signal Voltage		$V_{IN\ (on)}$	V_D = 15 V, I_C = 50 mA	1.4	1.6	1.8	V
Input Off Signal Voltage		$V_{IN\ (off)}$	—	2.2	2.5	2.8	mA
Fault Output Current	Protection	$I_{FO\ (on)}$	V_D = 15 V	5.4	6.0	6.6	
	Normal	$I_{FO\ (off)}$		—	—	0.1	
Over Current Protection Trip Level	Inverter	OC	V_D = 15 V, T_j = 125°C	85	100	—	A
	Brake			40	50	—	
Short Circuit Protection Trip Level	Inverter	SC	V_D = 15 V, T_j = 125°C	120	150	—	A
	Brake			60	75	—	
Over Current Cut-Off Time		t_{off} (OC)	V_D = 15 V	—	5	—	μs
Over Temperature Protection	Trip Level	OT	Case temperature	110	118	125	°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 V	1	2	3	ms

d. Thermal resistance (T_j = 25°C)

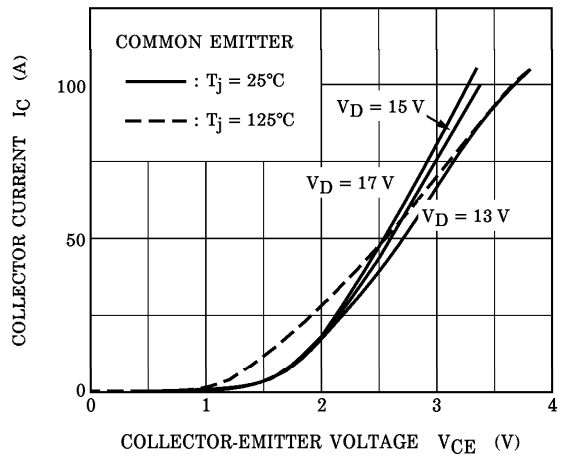
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Junction to Case Thermal Resistance	$R_{th\ (j\text{-}c)}$	Inverter IGBT stage	—	—	0.417	°C / W
		Inverter FRD stage	—	—	1.000	
		Brake IGBT stage	—	—	0.892	
		Brake FRD stage	—	—	2.000	
Case to Fin Thermal Resistance	$R_{th\ (c\text{-}f)}$	Compound is applied	—	0.05	—	°C / W

Note 1 : Switching time test circuit & timing chart

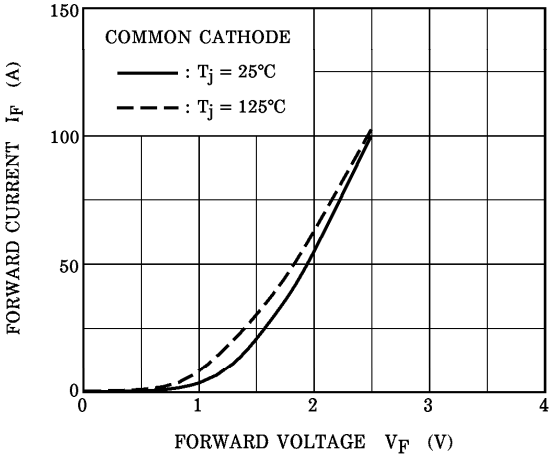




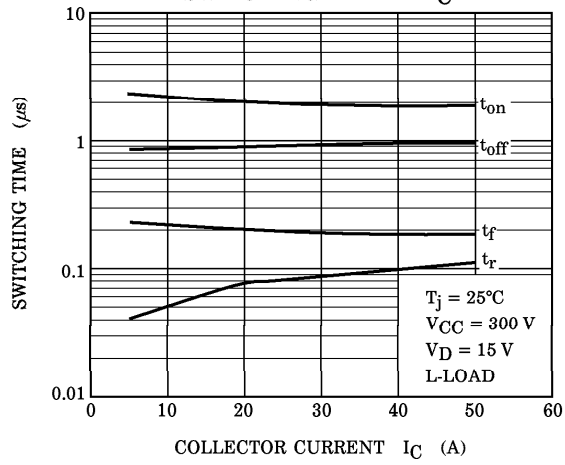
I_C – V_{CE}



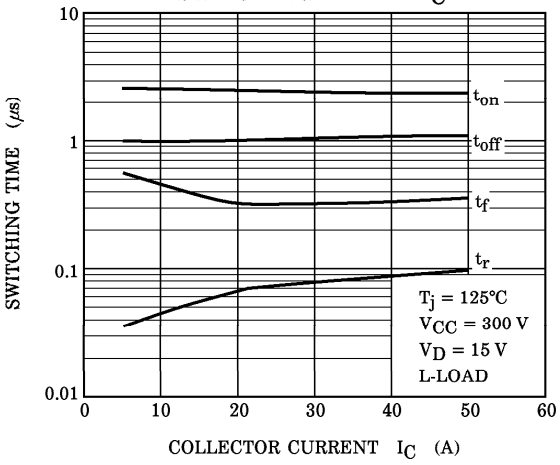
I_F – V_F



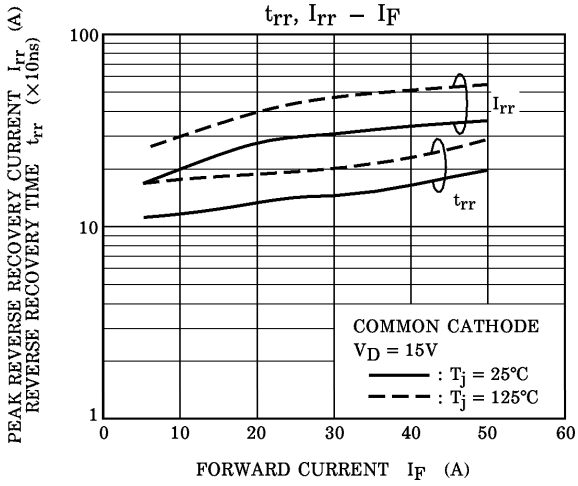
SWITCHING TIME – I_C



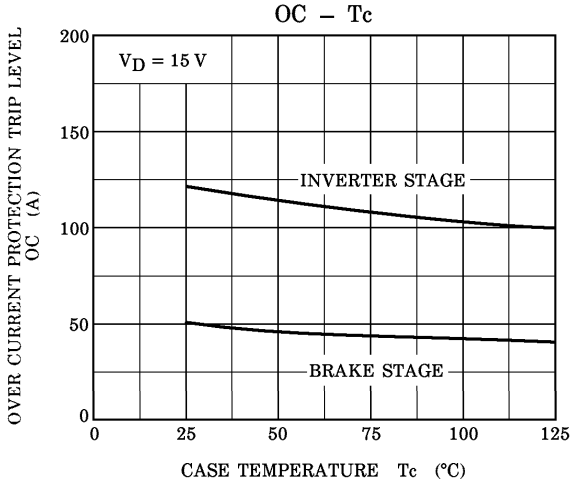
SWITCHING TIME – I_C



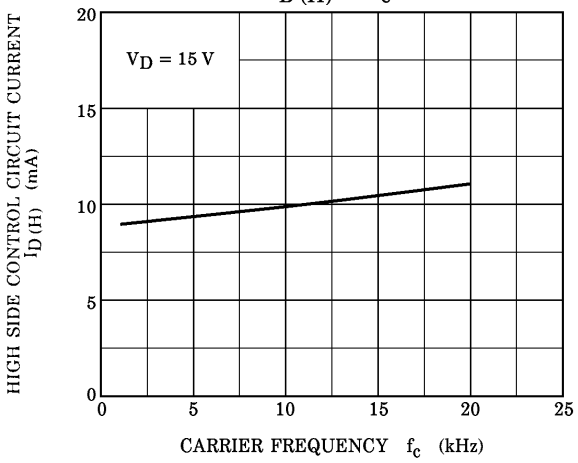
t_{rr}, I_{rr} – I_F



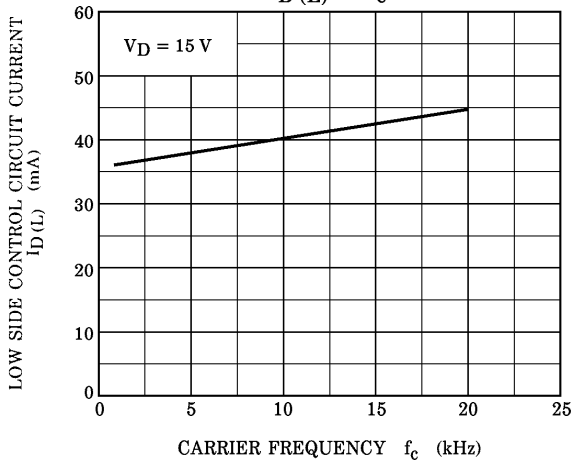
OC – Tc



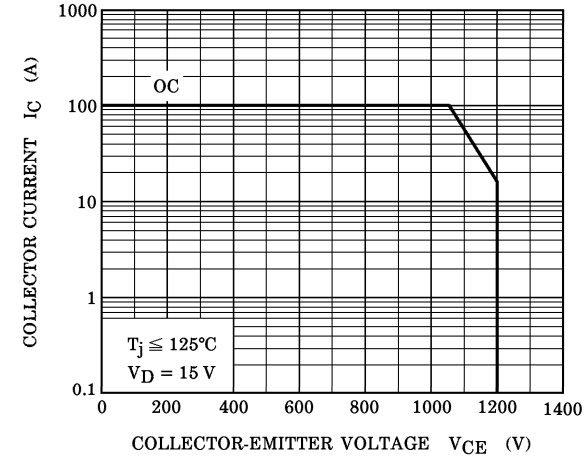
$I_{D\,(H)}$ – f_c



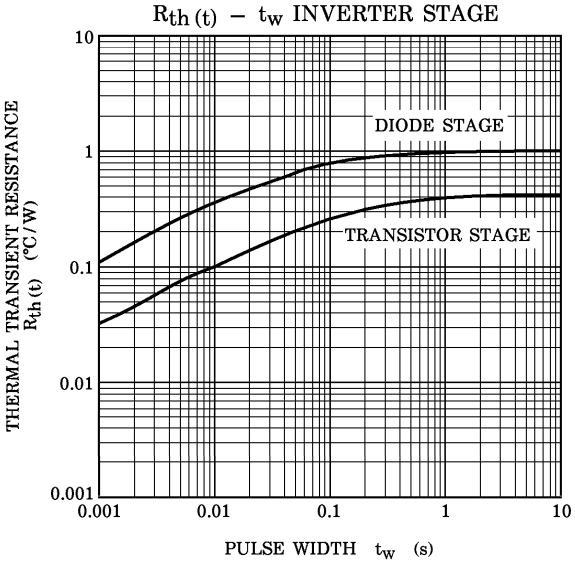
$I_{D\,(L)}$ – f_c



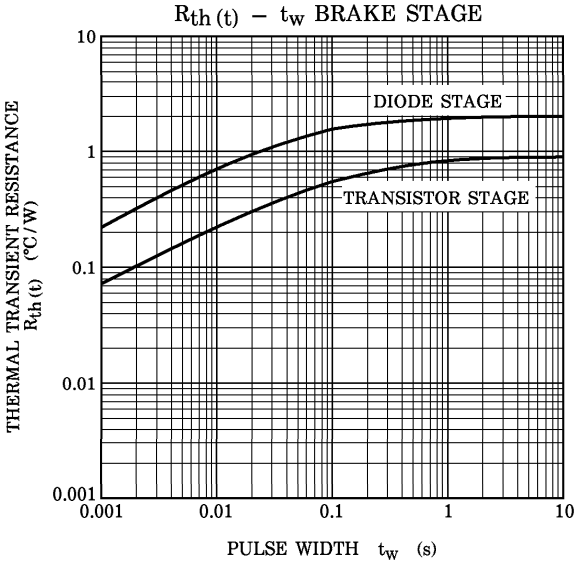
REVERSE BIAS SOA



$R_{th\,(t)}$ – t_w INVERTER STAGE



$R_{th\,(t)}$ – t_w BRAKE STAGE



OUTLINE

Unit : mm