TOSHIBA Intelligent Power Module Silicon N Channel IGBT

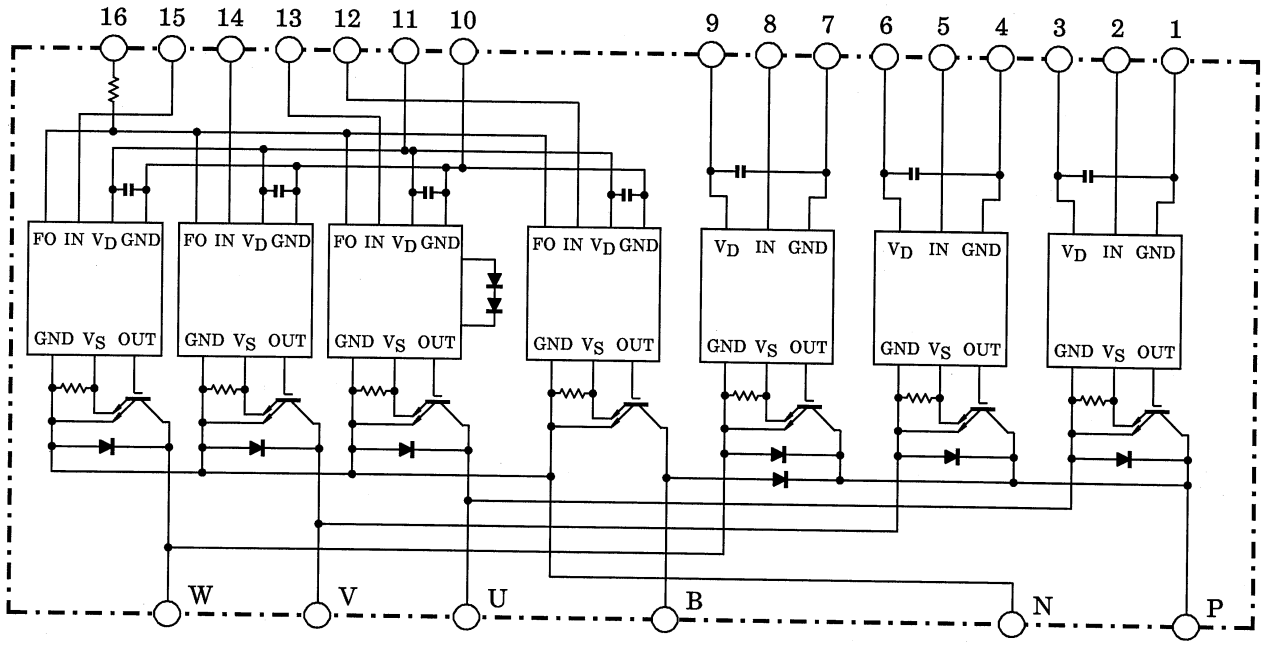
MIG100J201H

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 : $V_{CE\ (sat)}$ = 2.5 V (max)
  t_{off} = 3.0 μs (max)
  t_{rr} = 0.30 μs (max)
- Package dimensions : TOSHIBA 2-110A1A
- Weight : 520g

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		

Maximum Ratings (T_j = 25°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	Tc = 25°C, DC	I_C	100	A
	Forward current	Tc = 25°C, DC	I_F	100	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}	450	V
	Collector-emitter voltage	—	V_{CES}	600	V
	Collector current	Tc = 25°C, DC	I_C	30	A
	Reverse voltage	—	V_R	600	V
	Forward current	Tc = 25°C, DC	I_F	30	A
	Collector power dissipation	Tc = 25°C	P_C	80	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	M5	—	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_{CEX}	V_{CE} = 600 V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	20	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	V_D = 15 V, I_C = 100 A V_{IN} = 15 V → 0 V	T_j = 25°C	—	2.0	2.5	V
			T_j = 125°C	—	2.0	—	
Forward voltage	V_F	I_F = 100 A		—	2.1	3.3	V
Switching time	t_{on}	V_{CC} =300 V, I_C = 100 A V_D = 15 V, V_{IN} = 15 V ↔ 0 V Inductive load (Note 1)		—	1.0	2.0	μs
	t_{off}			—	1.7	3.0	
	t_f			—	0.2	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°C	—	—	1	mA
			T_j = 125°C	—	—	20	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	V_D = 15V, I_C = 30A V_{IN} = 15V → 0V	T_j = 25°C	—	1.7	2.7	V
			T_j = 125°C	—	1.6	—	
Reverse current	I_R	V_R = 600V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	20	
Forward voltage	V_F	I_F = 30A		—	2.0	2.5	V
Switching time	t_{on}	V_{CC} = 300V, I_C = 30A V_D = 15V, V_{IN} = 15V ↔ 0V Inductive load (Note 1)		—	0.9	2.0	μs
	t_{off}			—	1.7	3.0	
	t_f			—	0.25	0.5	
	t_{rr}			—	0.15	0.3	

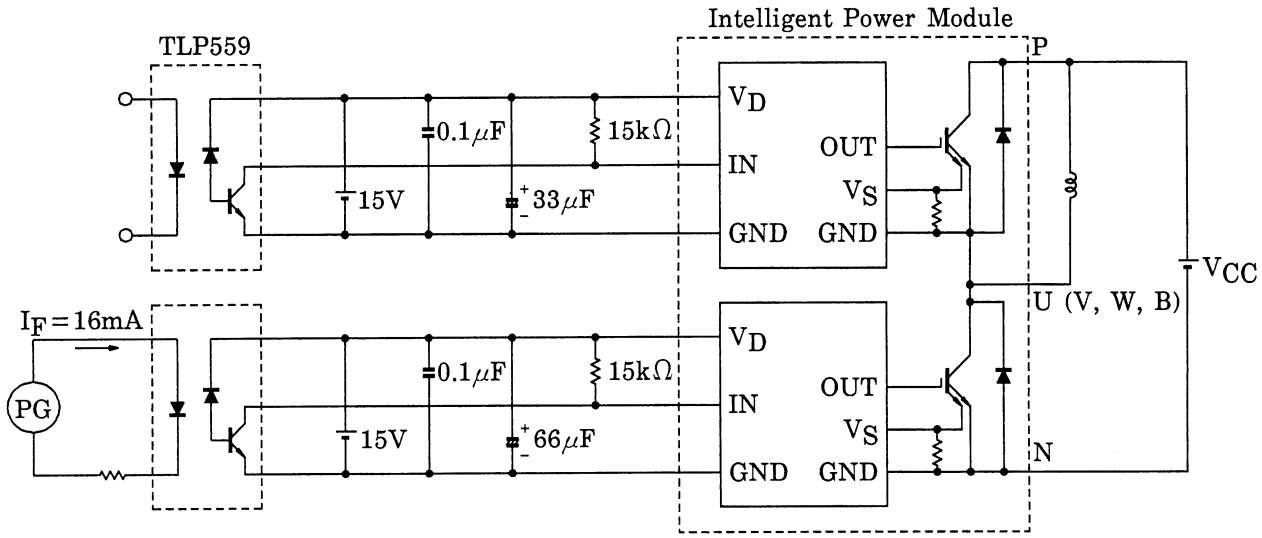
c. Control Stage (T_j = 25°C)

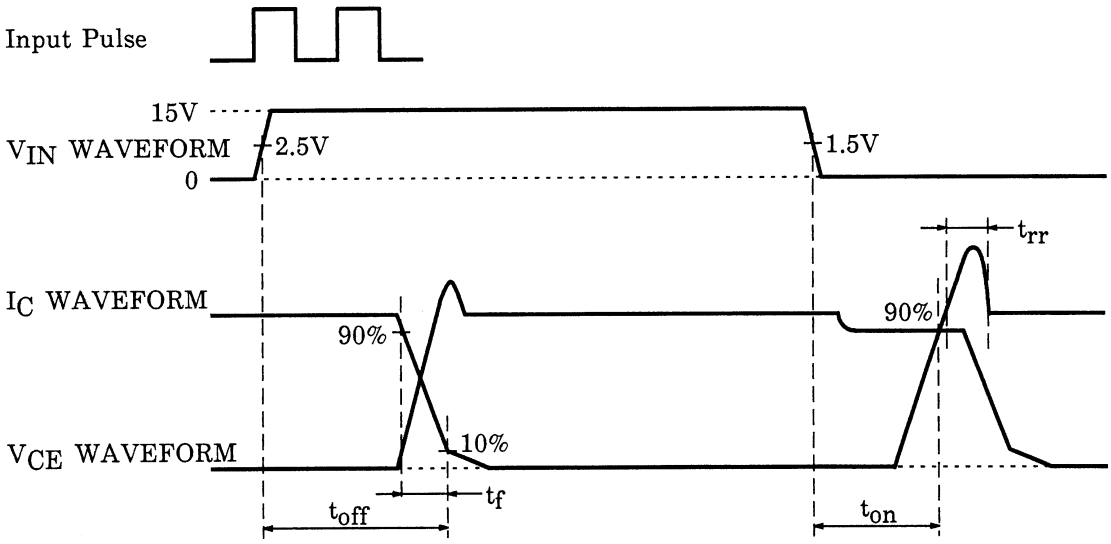
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current	High side	$I_{D\ (H)}$	V_D = 15 V	—	8	—	mA
	Low side	$I_{D\ (L)}$		—	32	—	
Input-on signal voltage		$V_{IN\ (on)}$	V_D = 15 V, I_C = 100 mA	1.3	1.5	1.7	V
Input-off signal voltage		$V_{IN\ (off)}$	V_D = 15 V, I_C = 100 mA	2.2	2.5	2.8	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	Inverter	OC	V_D = 15 V, T_j = 125°C	160	200	—	A
	Brake			40	—	—	
Short current protection trip level	Trip level	SC	V_D = 15 V, T_j = 125°C	240	300	—	A
	Reset level			60	—	—	
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		—	12.5	—	
Fault output pulse width		t_{FO}	V_D = 15 V	1	2	3	ms

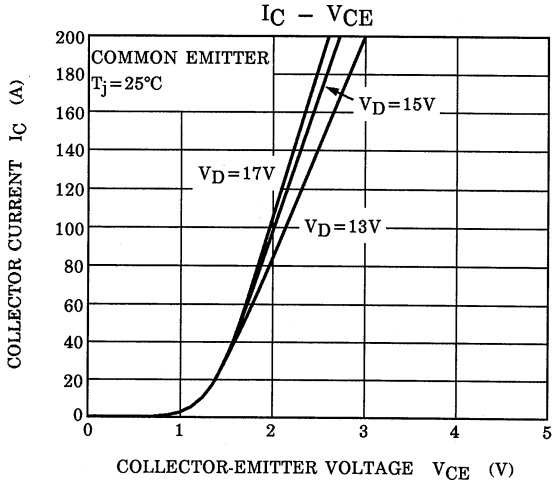
d. Thermal Resistance (T_j = 25°C)

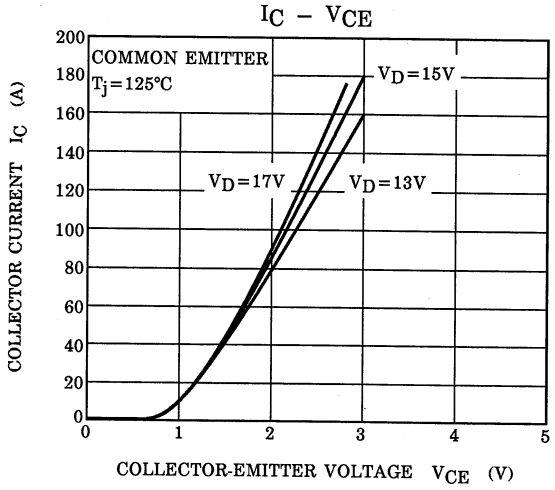
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th\ (j-c)}$	Inverter IGBT stage	—	—	0.418	°C / W
		Inverter FRD stage	—	—	1.000	
		Brake IGBTstage	—	—	1.562	
		Brake FRD stage	—	—	2.000	
Case to fin thermal resistance	$R_{th\ (c-f)}$	Compound is applied	—	0.05	—	°C / W

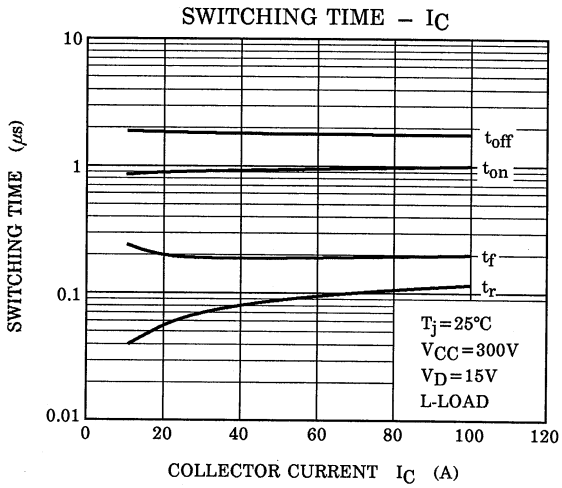
Note 1: Switching time test circuit & timing chart

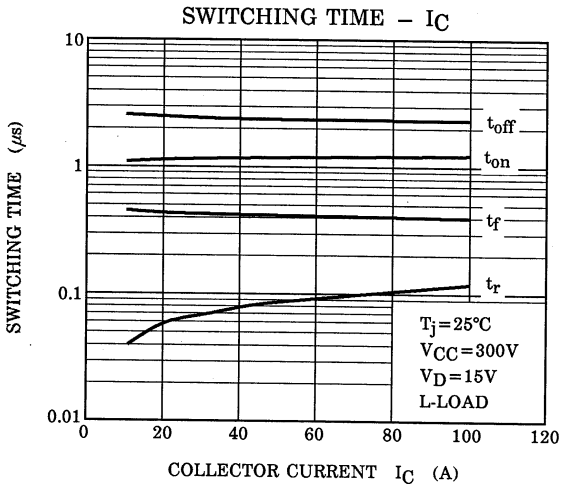


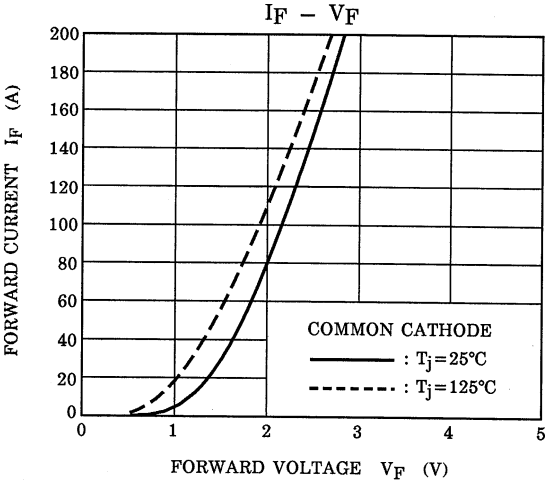


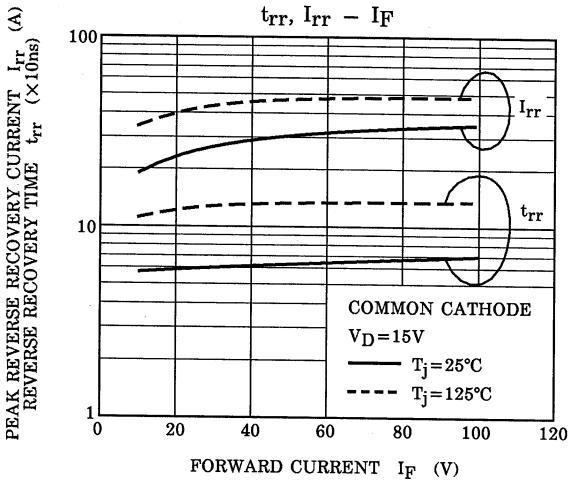

I_C – V_{CE}
COMMON EMITTER
T_j=25°C
V_D=15V
V_D=17V
V_D=13V
COLLECTOR CURRENT I_C (A)
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)


I_C – V_{CE}
COMMON EMITTER
T_j=125°C
V_D=15V
V_D=17V
V_D=13V
COLLECTOR CURRENT I_C (A)
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)

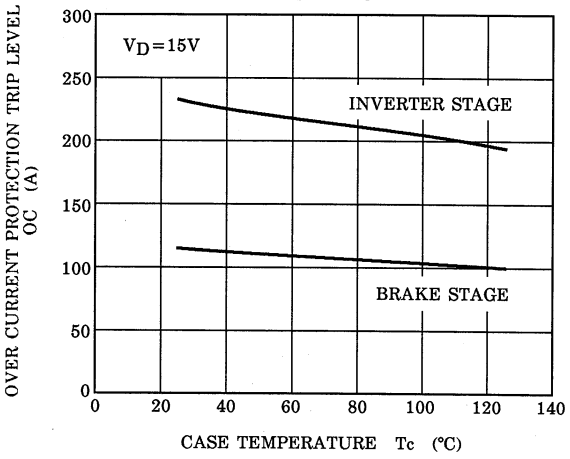

SWITCHING TIME – I_C
t_{off}
t_{on}
t_f
t_r
T_j=25°C
V_{CC}=300V
V_D=15V
L-LOAD
SWITCHING TIME (μs)
COLLECTOR CURRENT I_C (A)


SWITCHING TIME – I_C
t_{off}
t_{on}
t_f
t_r
T_j=25°C
V_{CC}=300V
V_D=15V
L-LOAD
SWITCHING TIME (μs)
COLLECTOR CURRENT I_C (A)

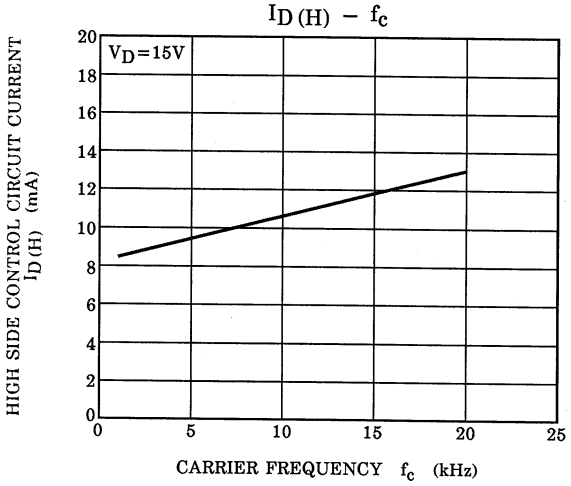

I_F – V_F
COMMON CATHODE
: T_j=25°C
: T_j=125°C
FORWARD CURRENT I_F (A)
FORWARD VOLTAGE V_F (V)


t_{rr}, I_{rr} – I_F
I_{rr}
t_{rr}
COMMON CATHODE
V_D=15V
T_j=25°C
T_j=125°C
PEAK REVERSE RECOVERY CURRENT I_{rr} (A)
REVERSE RECOVERY TIME t_{rr} (×10ns)
FORWARD CURRENT I_F (A)

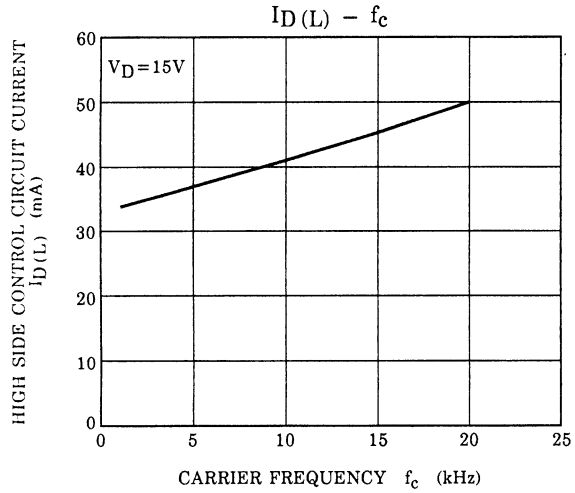
OC – Tc



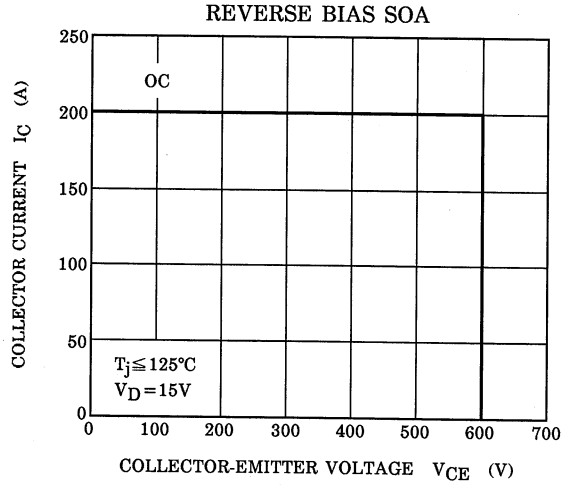
$I_{D(H)}$ – f_c



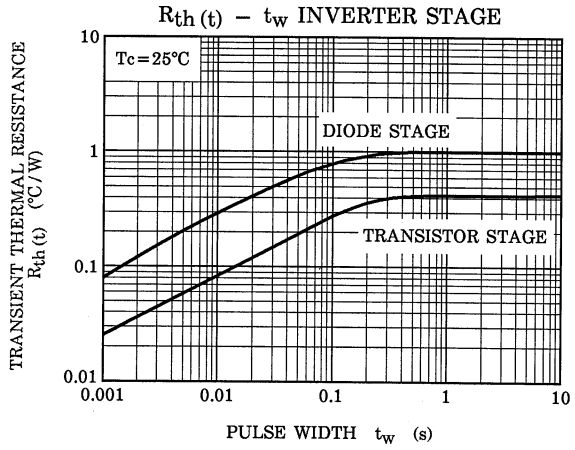
$I_{D(L)}$ – f_c



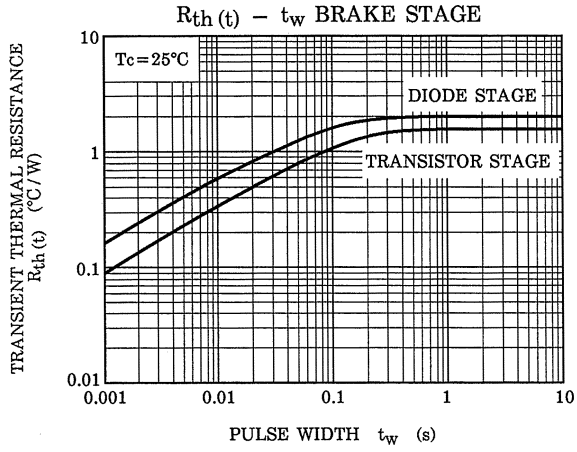
REVERSE BIAS SOA



$R_{th(t)}$ – t_w INVERTER STAGE

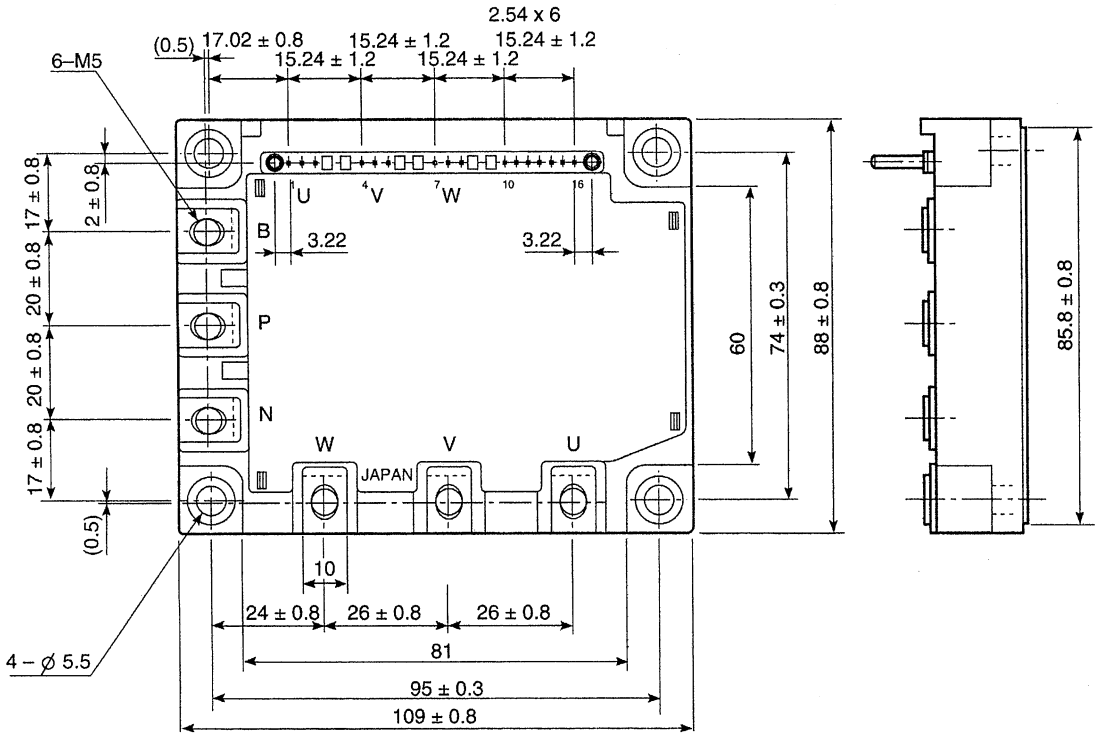


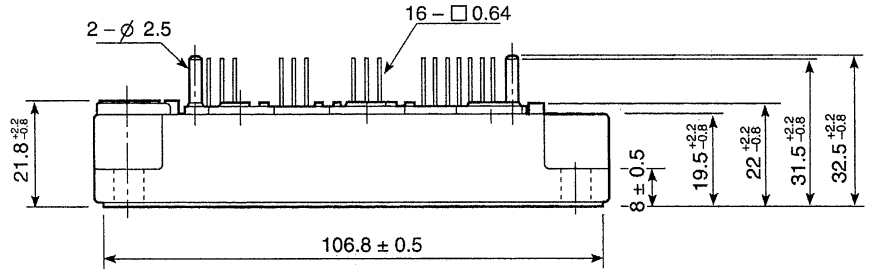
$R_{th(t)}$ – t_w BRAKE STAGE

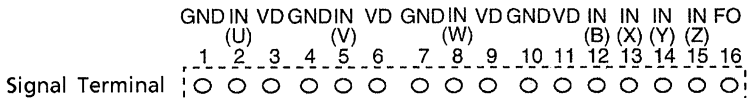


Package Dimensions: TOSHIBA 2-110A1A

Unit: mm







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