TOSHIBA Intelligent Power Module Silicon N Channel IGBT

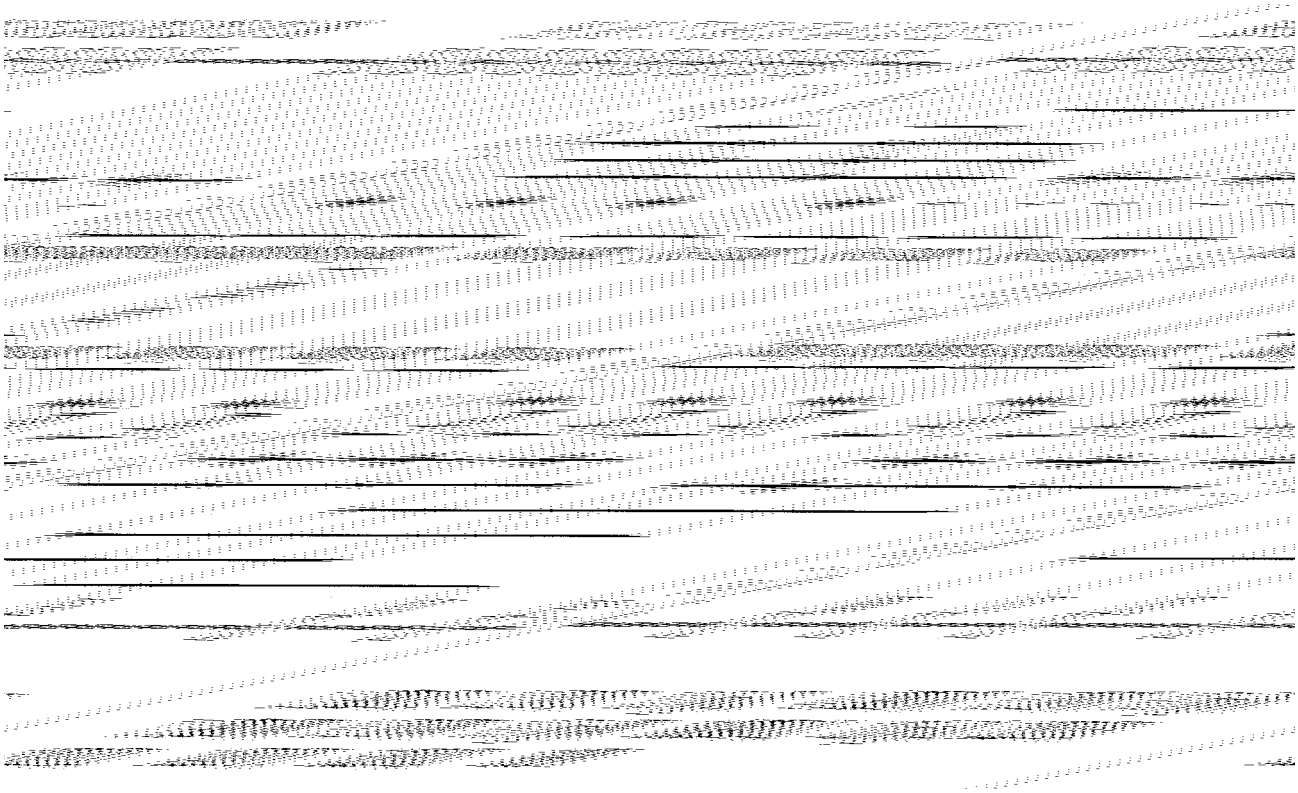
MIG50Q201H

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



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}	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	Nm

Electrical Characteristics

a. Inverter Stage

Characteristic	Symbol	Test Condition		Min	Typ.	Max	Unit
Collector cut−off current	I_{CEX}	V_{CE} = 1200V	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 = 50A		—	2.0	2.8	V
Switching time	t_{on}	V_{CC} = 600 V, I_C = 50 A, V_D = 15 V, V_{IN} = 15 V ↔ 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
Collector cut−off current	I_{CEX}	V_{CE} = 1200V	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 current	I_R	V_R = 1200 V		—	—	1	mA
				—	—	10	
Forward voltage	V_F	I_F = 25A		—	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	

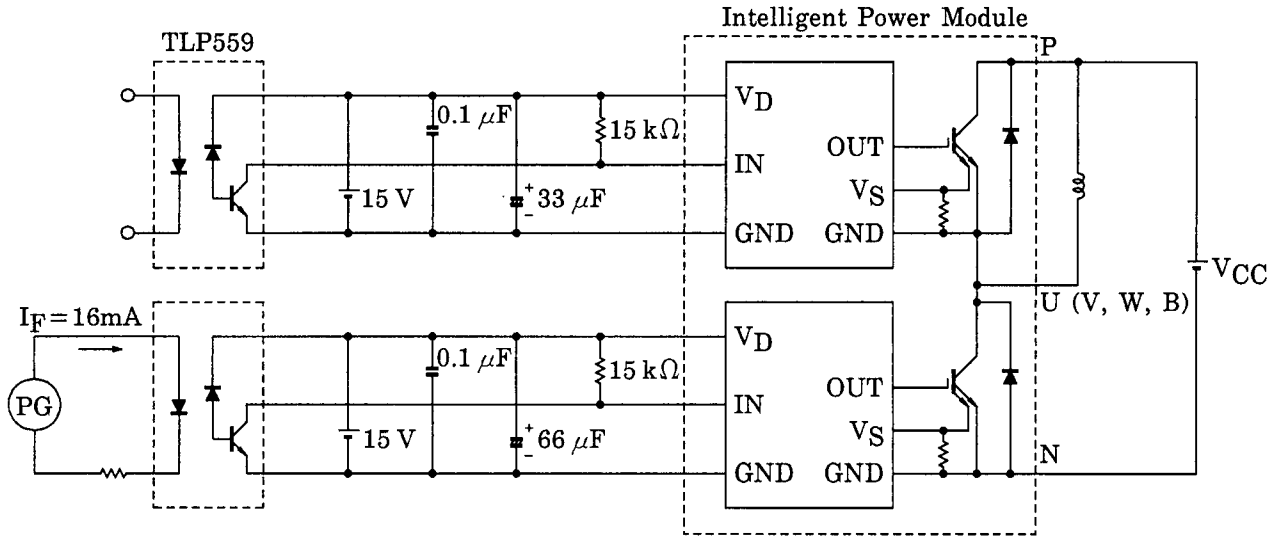
c. Control Stage (T_j = 25°C)

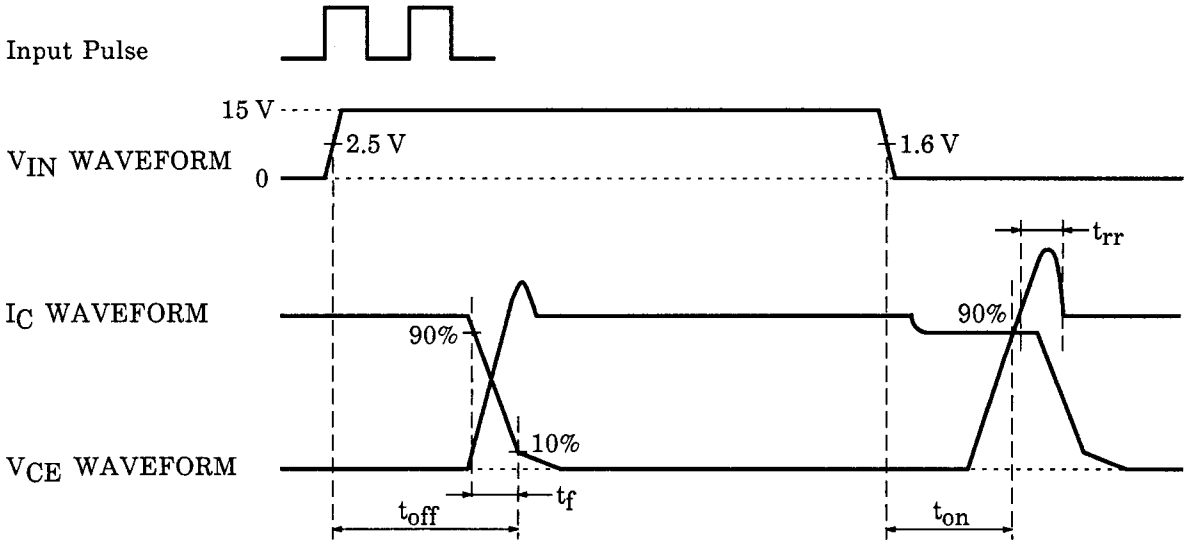
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current	High side	$I_{D\ (H)}$	V_D = 15 V	—	8	12	mA
	Low side	$I_{D\ (L)}$		—	32	48	
Input−on signal voltage		$V_{IN\ (on)}$	V_D = 15 V, I_C = 50 mA	1.4	1.6	1.8	V
Input−off signal voltage		$V_{IN\ (off)}$	—	2.2	2.5	2.8	V
Fault output current	Protection	$I_{FO\ (on)}$	V_D = 15 V	5.4	6.0	6.6	mA
	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)

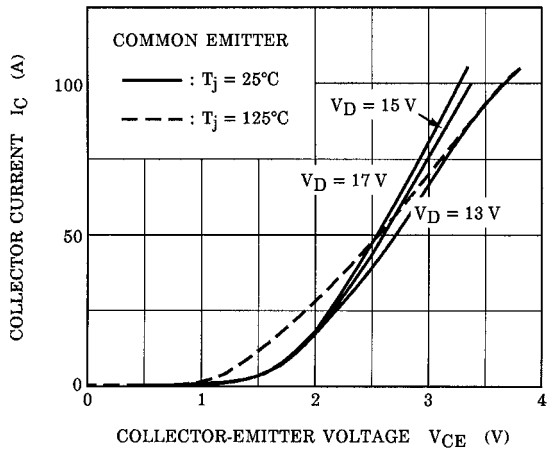
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th\ (j-c)}$	Inverter IGBT stage	—	—	0.417	°C / W
		Inverter FRD stage	—	—	1.000	
		Brake IGBT stage	—	—	0.892	
		Brake FRD stage	—	—	2.000	
Case to fin thermal resistance	$R_{th\ (c-f)}$	Compound is applied	—	0.05	—	°C / W

Note 1: Switching time test circuit & timing chart

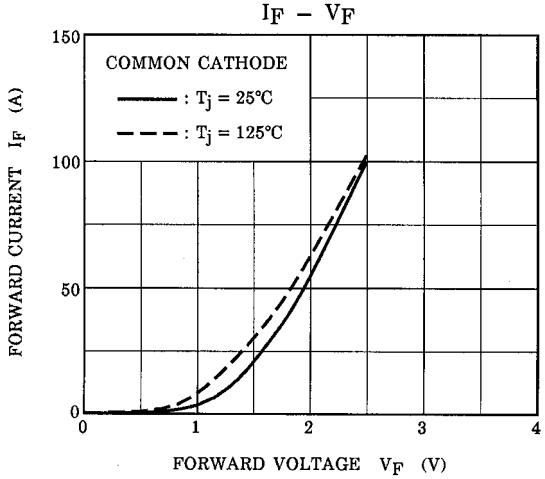




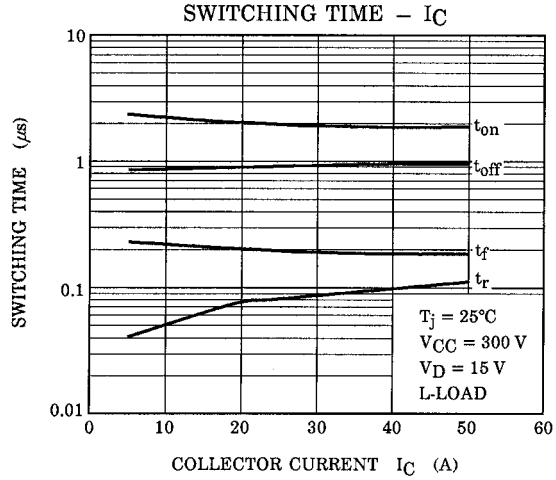
I_C – V_{CE}



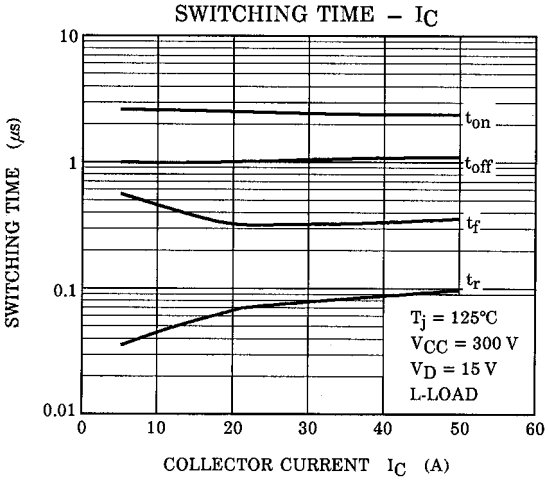
I_F – V_F



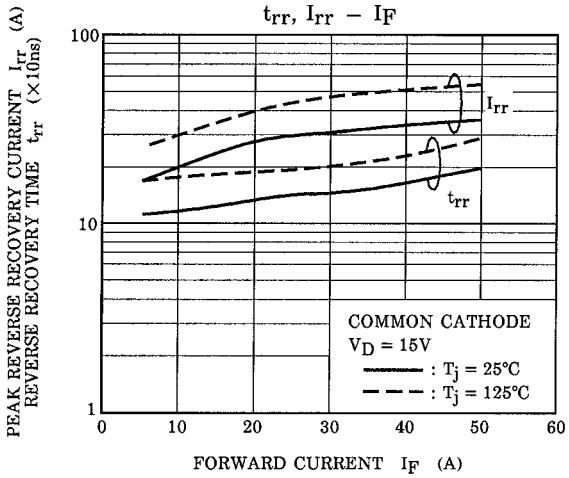
SWITCHING TIME – I_C



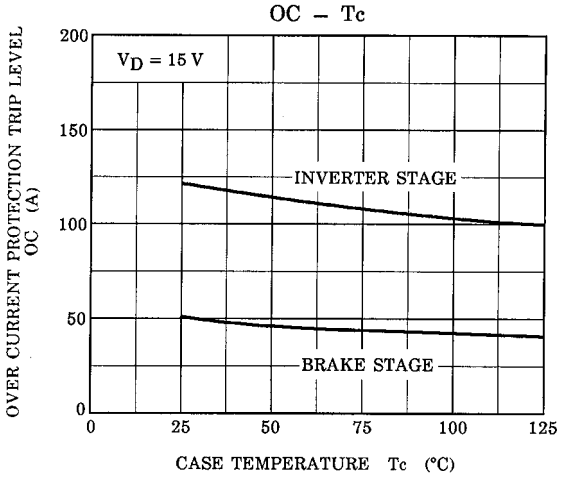
SWITCHING TIME – I_C



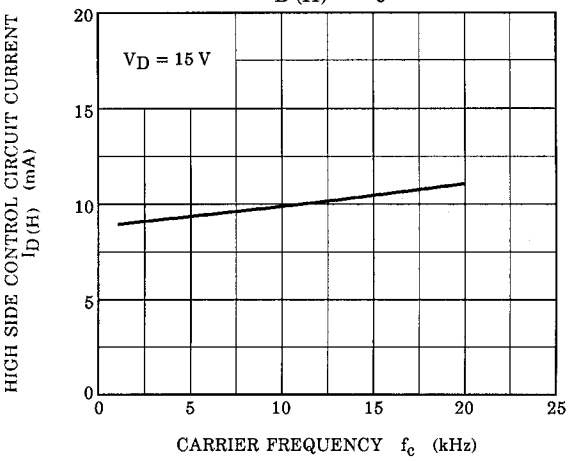
t_{rr}, I_{rr} – I_F



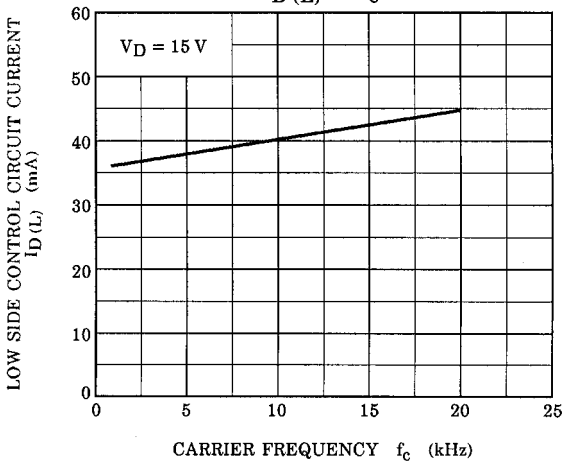
OC – Tc



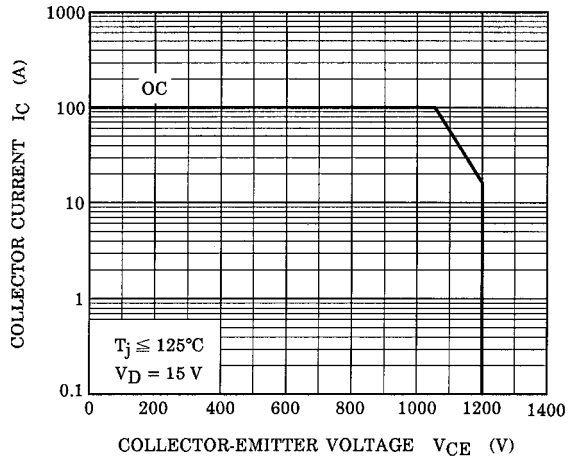
$I_{D(H)}$ – f_c



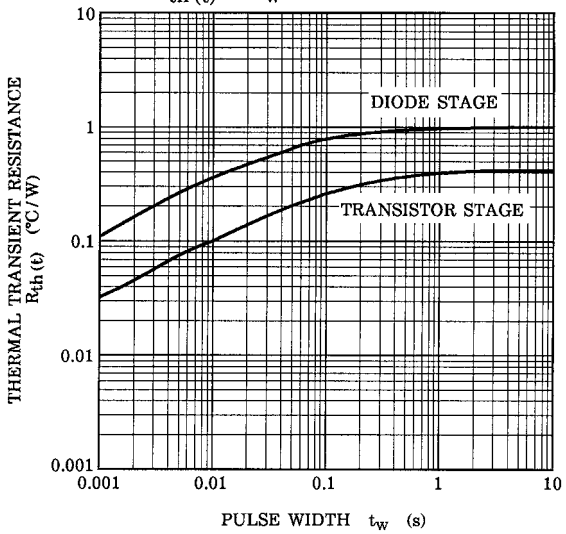
$I_{D(L)}$ – f_c



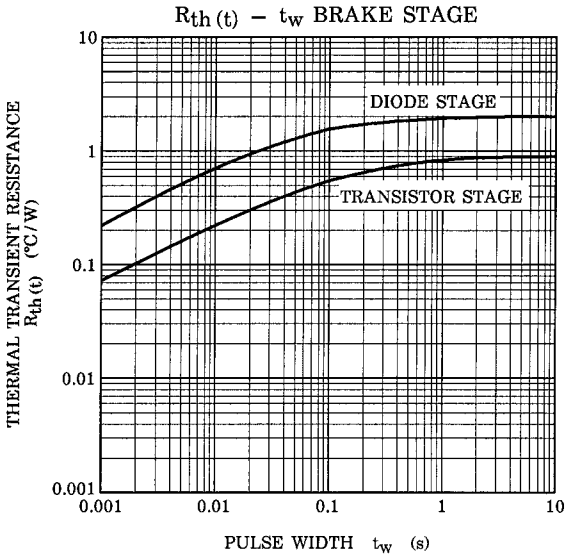
REVERSE BIAS SOA



$R_{th}(t)$ – t_w INVERTER STAGE

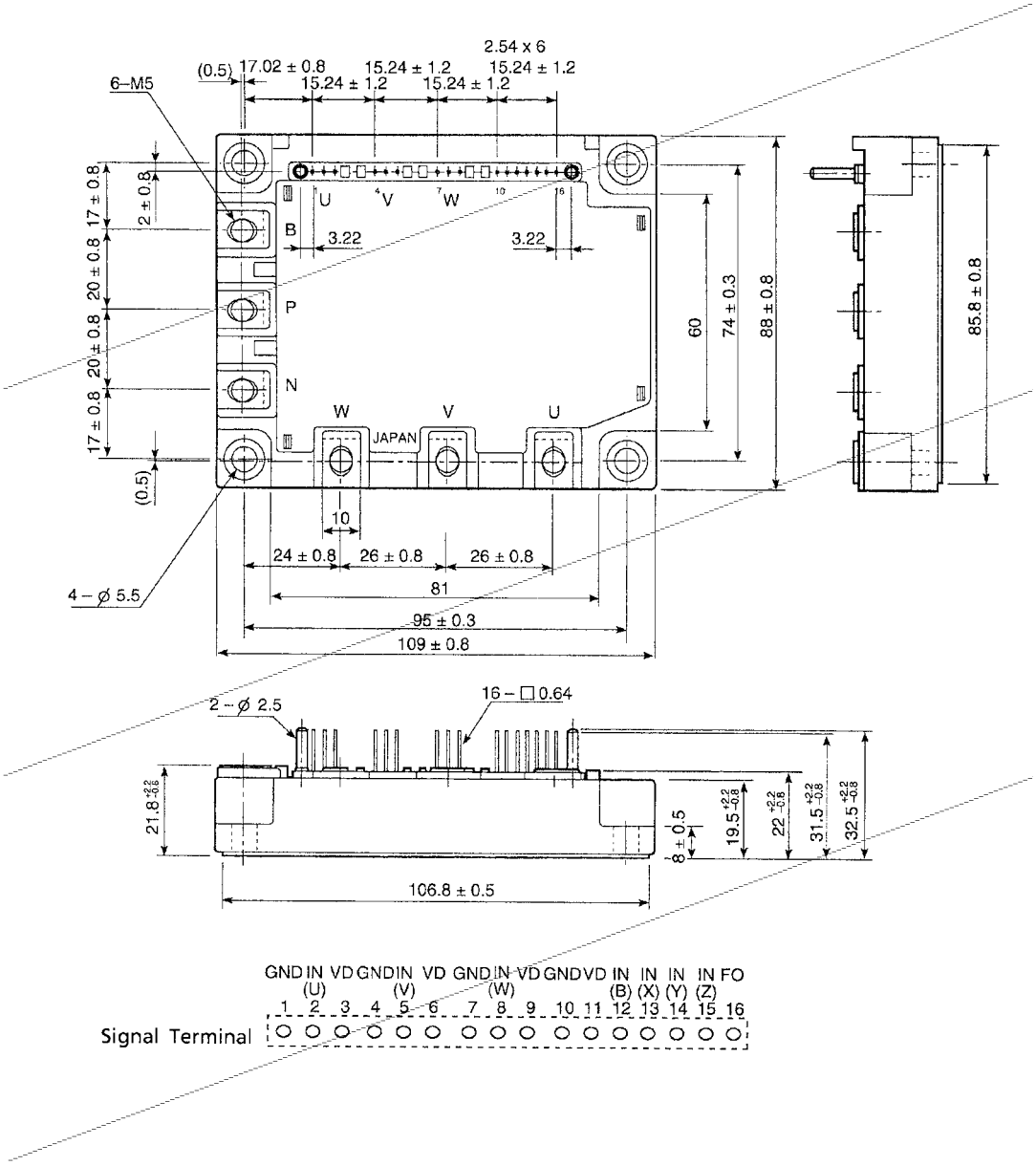


$R_{th}(t)$ – t_w BRAKE STAGE



Package Dimensions: TOSHIBA 2-110A1A

Unit: mm



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