TOSHIBA Intelligent Power Module Silicon N Channel IGBT

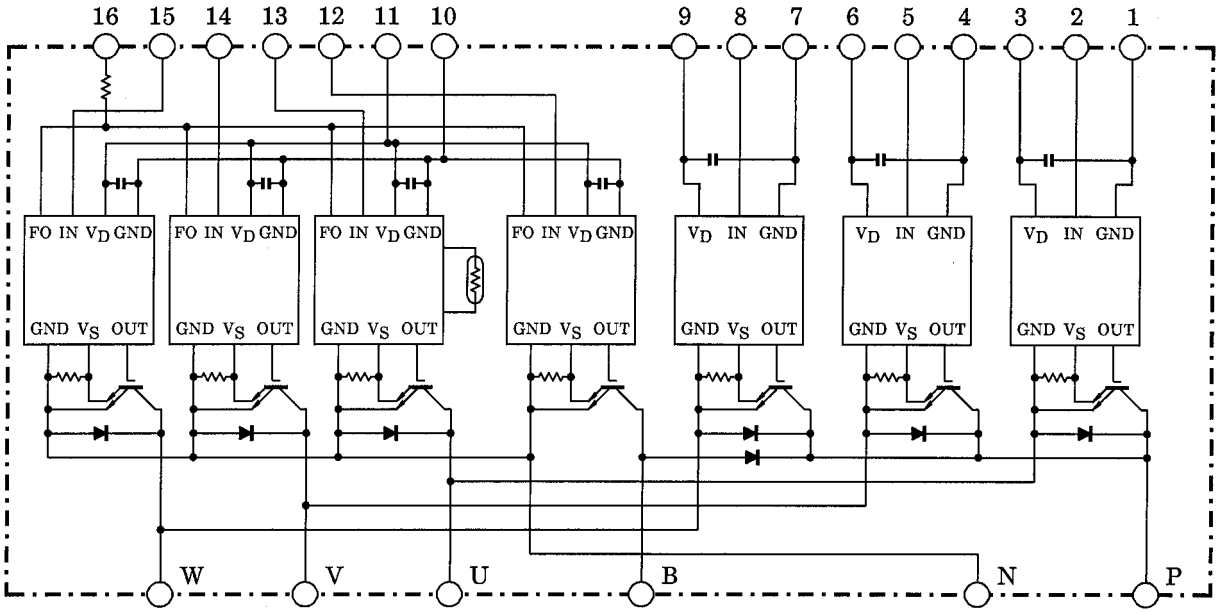
MIG200J201H

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 : $V_{CE\ (sat)}$ = 2.5V (max)
  t_{off} = 2.0μs (max)
  t_{rr} = 0.15μs (max)
- Package dimensions : TOSHIBA 2−136A1A
- Weight :

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	200	A
	Forward current	Tc = 25°C, DC	I_F	200	A
	Collector power dissipation	Tc = 25°C	P_C	800	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	100	A
	Reverse voltage	—	V_R	600	V
	Forward current	Tc = 25°C, DC	I_F	100	A
	Collector power dissipation	Tc = 25°C	P_C	400	W
	Junction temperature	—	T_j	150	°C
Control	Control supply voltage	VD−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	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} = 600V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	10	
Collector−emitter saturation voltage	$V_{CE\ (sat)}$	V_D = 15V, I_C = 200A V_{IN} = 3V → 0V	T_j = 25°C	—	2.0	2.5	V
			T_j = 125°C	—	2.0	—	
Forward voltage	V_F	I_F = 200A		—	2.1	2.7	V
Switching time	t_{on}	V_{CC} = 300V, I_C = 200A 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}			—	0.08	0.15	
	t_{off}			—	1.2	2.0	
	$t_{c\ (off)}$			—	0.3	0.6	

b. Brake stage

Characteristic	Symbol	Test Condition		Min	Typ.	Max	Unit
Cellector cut−off current	I_{CEX}	V_{CE} = 600V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	10	
Collector−emitter saturation voltage	$V_{CE\ (sat)}$	V_D = 15V, I_C = 100A V_{IN} = 3V→0V	T_j = 25°C	—	2.0	2.5	V
			T_j = 125°C	—	2.0	—	
Reverse current	I_R	V_R = 600V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	10	
Forward voltage	V_F	I_F = 100A		—	2.1	3.0	V
Switching time	t_{on}	V_{CC} = 300V, I_C = 100A 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}			—	0.30	0.50	
	t_{off}			—	1.2	2.0	
	$t_{c\ (off)}$			—	0.3	0.6	

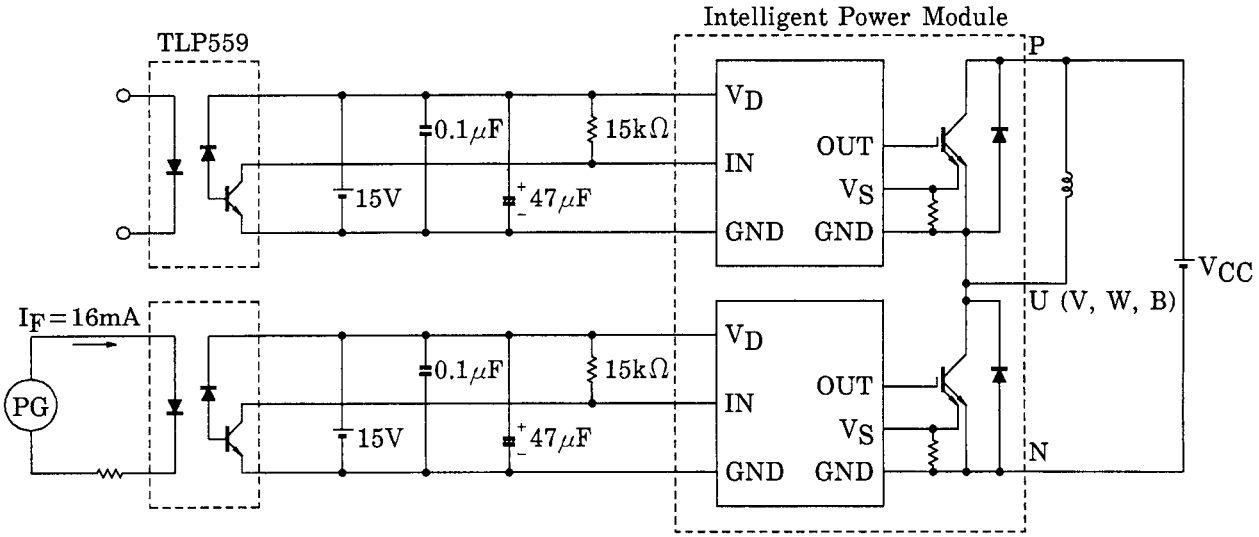
c. Control stage (T_j = 25°C)

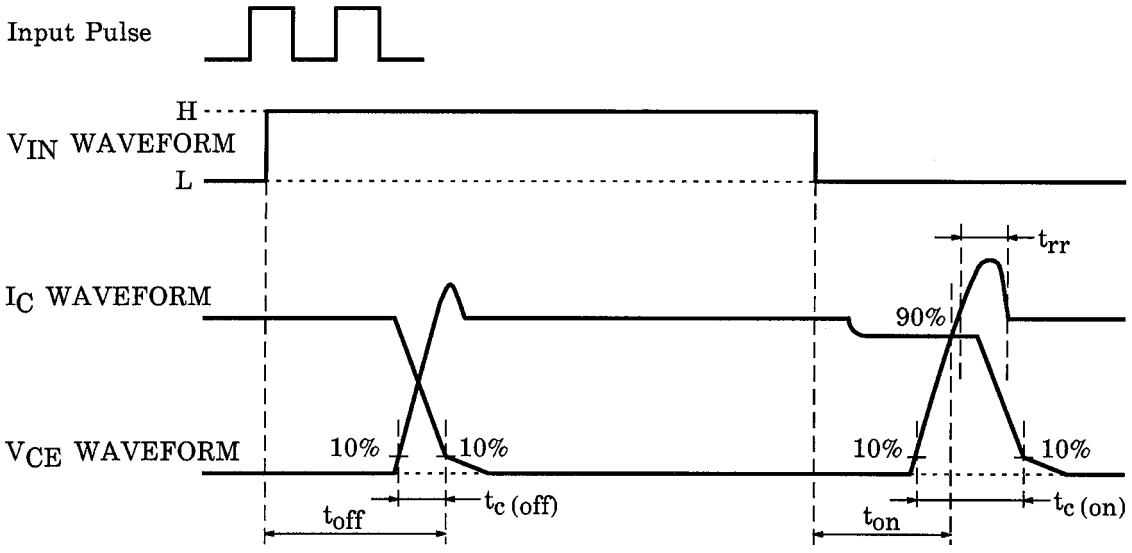
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current	High side	$I_{D\ (H)}$	V_D = 15V	—	20	30	mA
	Low side	$I_{D\ (L)}$		—	80	120	
Input on signal voltage		$V_{IN\ (on)}$	V_D = 15V, I_C = 200mA	0.9	1.1	1.3	V
Fault output current	Protection	$I_{FO\ (on)}$	V_D = 15V	8	10	12	mA
	Normal	$I_{FO\ (off)}$		—	—	1	
Over current protection trip level	Inverter	OC	V_D = 15V, Tj = 125°C	320	400	—	A
	Brake			210	300	—	
Short circuit protection trip level	Inverter	SC	V_D = 15V, T_j = 125°C	480	600	—	A
	Brake			315	450	—	
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 leevel	OTr		93	100	107	
Control supply under voltage protection	Trip level	UV	—	11.3	12.0	12.7	V
	Reset leevel	UVr		11.8	12.5	13.2	
Fault output pulse width		t_{FO}	V_D = 15V	1	2	3	ms

d. Thermal resistance (T_j = 25°C)

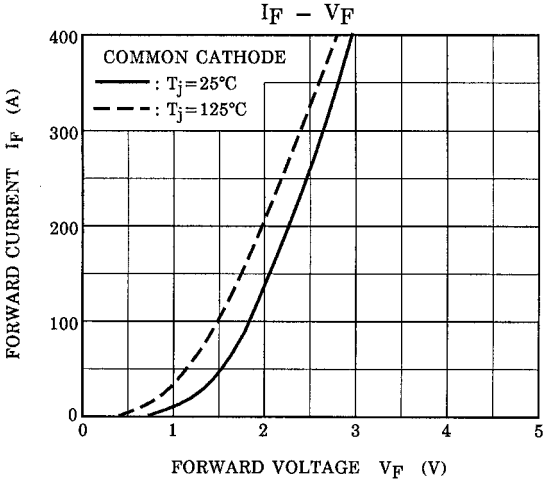
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	Rth (j-c)	Inverter IGBT	—	—	0.156	°C / W
		Inverter FRD	—	—	0.416	
		Brake IGBT	—	—	0.312	
		Brake FRD	—	—	1.00	
Case to fin thermal resistance	Rth (c-f)	Compound is applied	—	0.04	—	°C / W

Note 1: Switching time test circuit & timing char

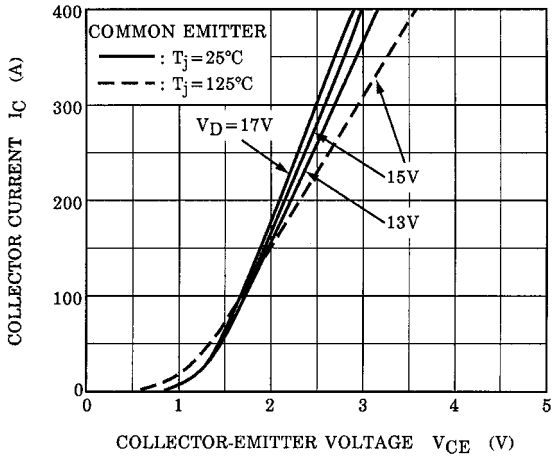




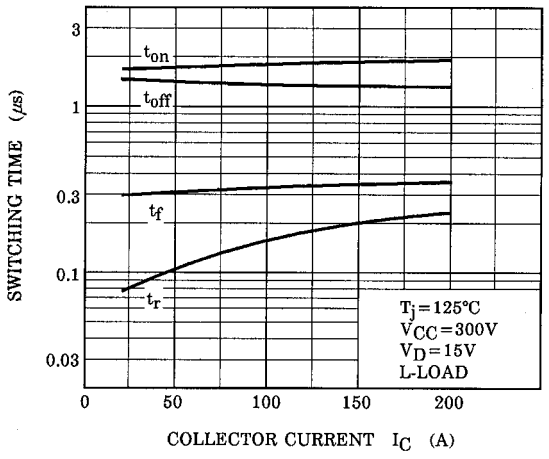
I_F – V_F



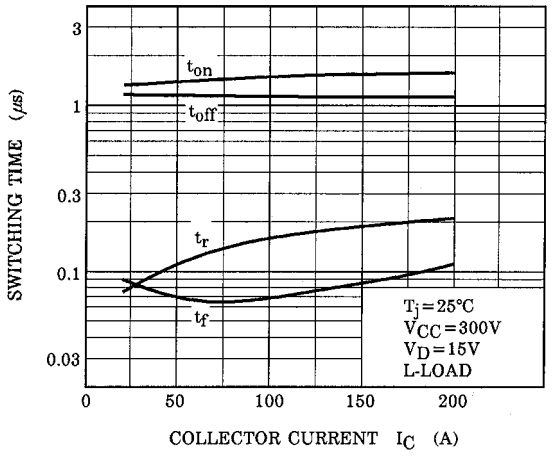
I_C – V_{CE}



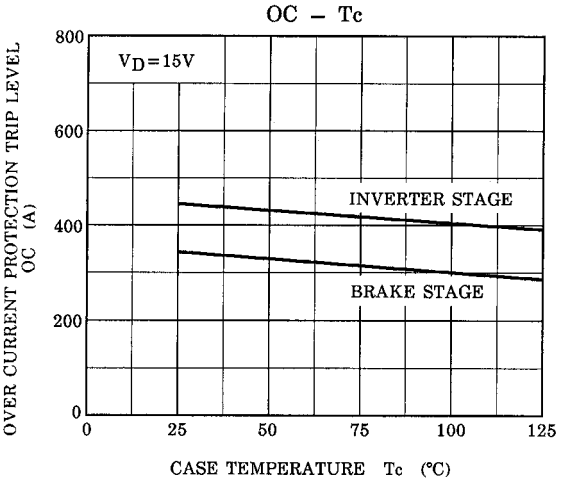
SWITCHING TIME – I_C



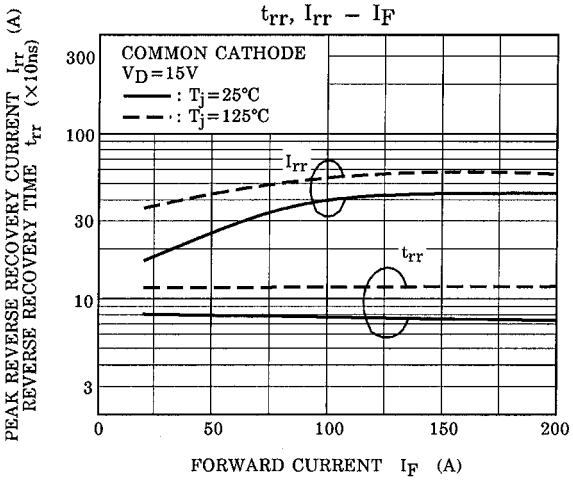
SWITCHING TIME – I_C

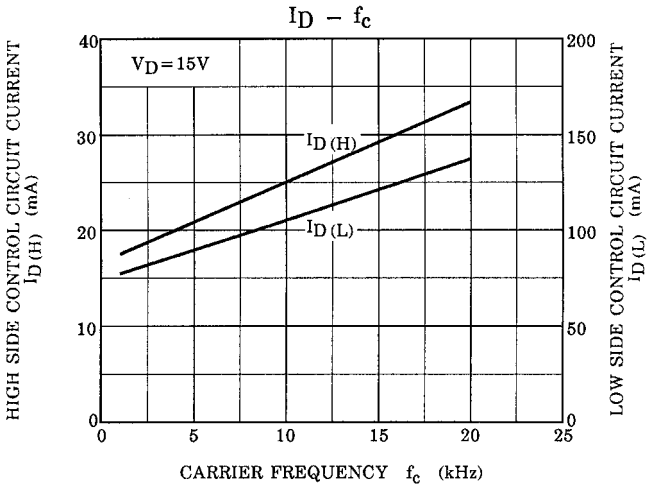


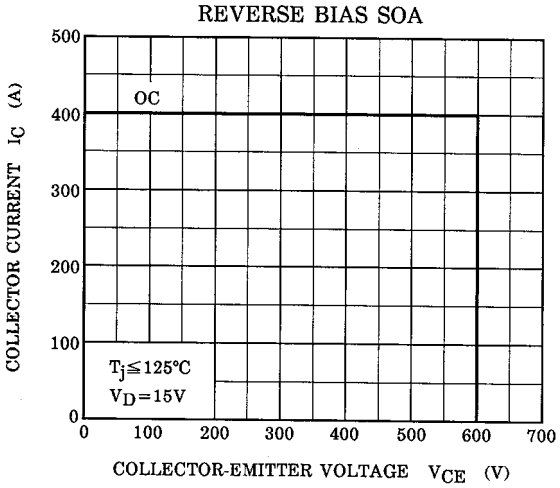
OC – Tc

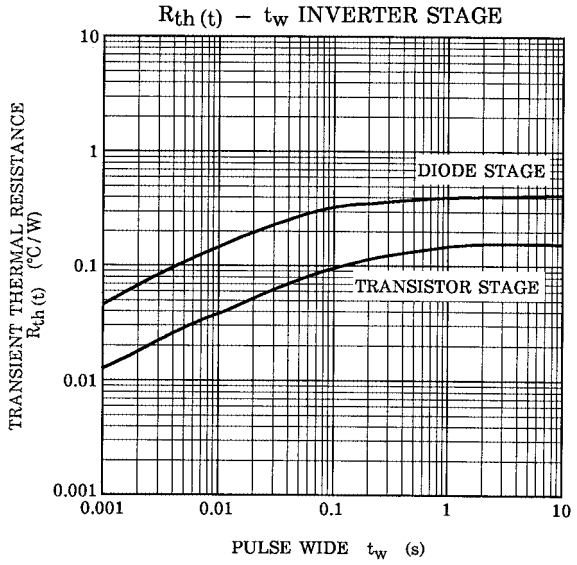


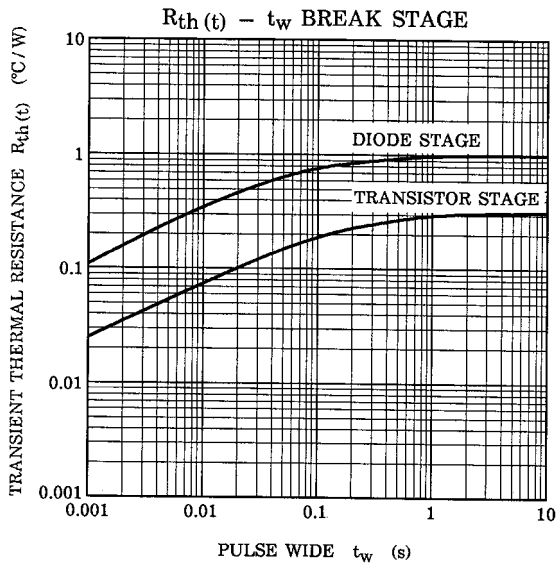
t_{rr}, I_{rr} – I_F




I_D – f_c
V_D=15V
$I_{D(H)}$
$I_{D(L)}$
HIGH SIDE CONTROL CIRCUIT CURRENT $I_{D(H)}$ (mA)
LOW SIDE CONTROL CIRCUIT CURRENT $I_{D(L)}$ (mA)
CARRIER FREQUENCY f_c (kHz)

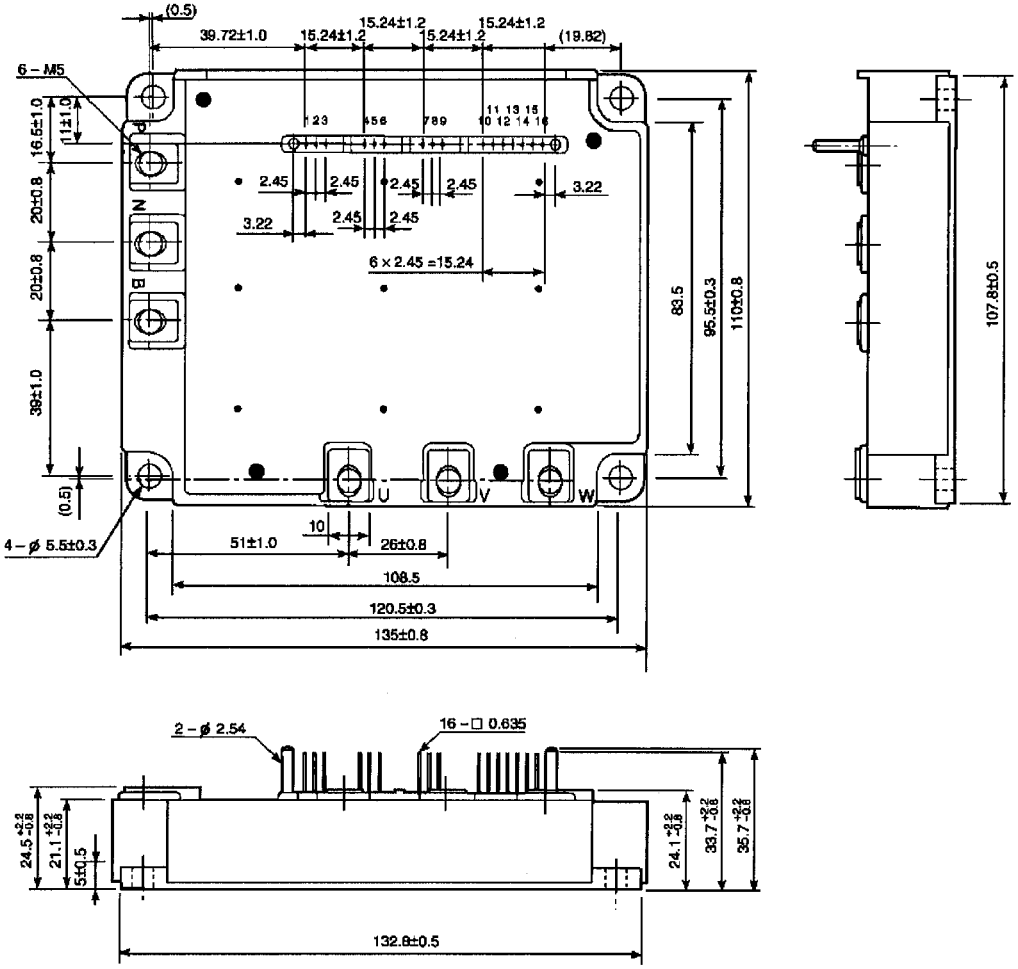

REVERSE BIAS SOA
OC
$T_j \leqq 125°C$
V_D=15V
COLLECTOR CURRENT I_C (A)
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)


$R_{th}(t)$ – t_w INVERTER STAGE
DIODE STAGE
TRANSISTOR STAGE
TRANSIENT THERMAL RESISTANCE $R_{th}(t)$ (°C/W)
PULSE WIDE t_w (s)


$R_{th}(t)$ – t_w BREAK STAGE
DIODE STAGE
TRANSISTOR STAGE
TRANSIENT THERMAL RESISTANCE $R_{th}(t)$ (°C/W)
PULSE WIDE t_w (s)

Package Dimensions: TOSHIBA 2-136A1A

Unit: mm



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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		

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