TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

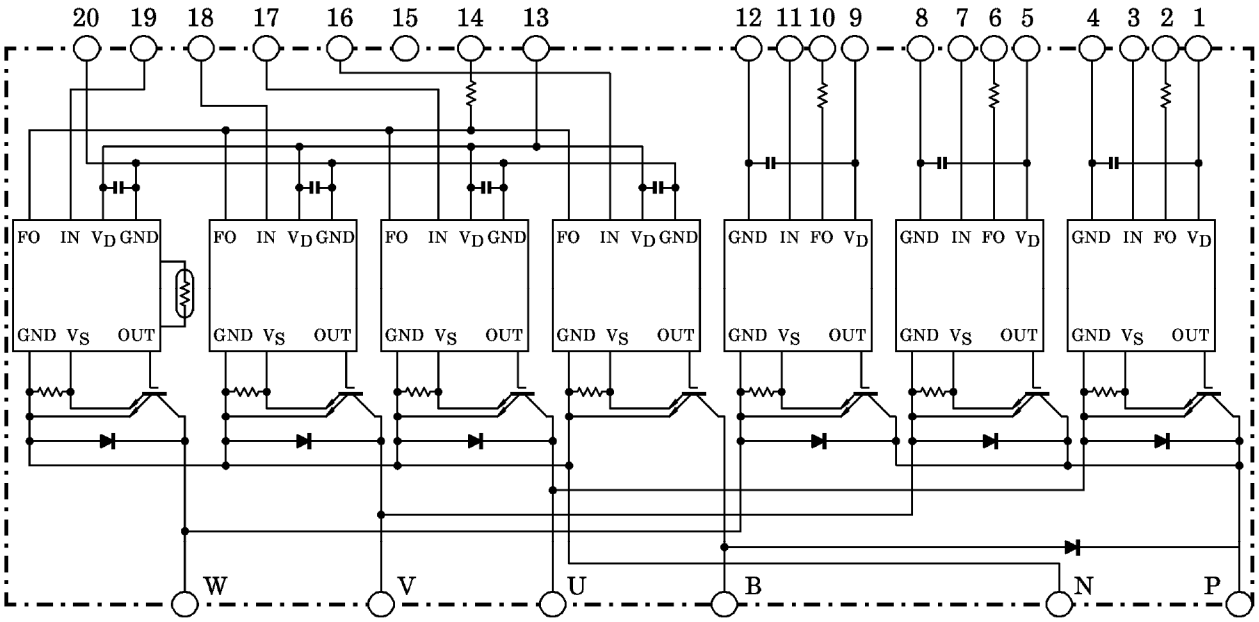
MIG50Q7CSA0X (1200V / 50A 7in1)

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

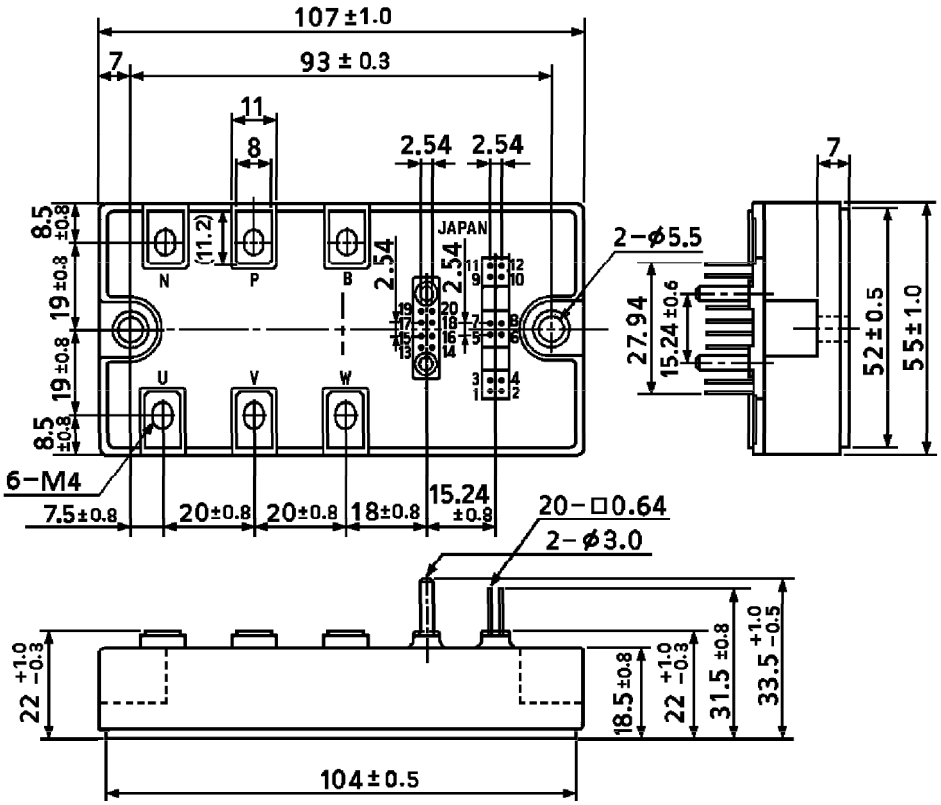
- Integrates Inverter, Brake Power Circuits & Control Circuits (IGBT drive unit, Protection units for Short-Current, Over-Current, Under-Voltage & Over Temperature) in One Package.
- The Electrodes are Isolated from Case.
- $V_{CE\ (sat)}$ = 2.2 V (Typ.)

EQUIVALENT CIRCUIT



1. V_D (U)	2. FO (U)	3. IN (U)	4. GND (U)	5. V_D (V)	6. FO (V)	7. IN (V)
8. GND (V)	9. V_D (W)	10. FO (W)	11. IN (W)	12. GND (W)	13. V_D (L)	14. FO (L)
15. Open	16. IN (B)	17. IN (X)	18. IN (Y)	19. IN (Z)	20. GND (L)	

OUTLINE : TOSHIBA 2-108G1A Unit : mm

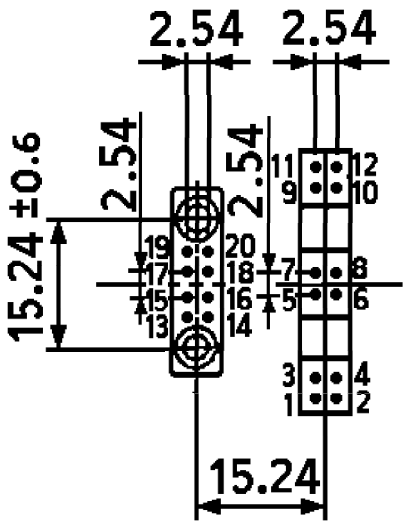


1. V_D (U)	2. FO (U)	3. IN (U)	4. GND (U)	5. V_D (V)	6. FO (V)
7. IN (V)	8. GND (V)	9. V_D (W)	10. FO (W)	11. IN (W)	12. GND (W)
13. V_D (L)	14. FO (L)	15. Open	16. IN (B)	17. IN (X)	18. IN (Y)
19. IN (Z)	20. GND (L)				

Weight : 278 g (Typ.)

SIGNAL TERMINAL LAYOUT

Unit : mm



1. V_D (U)	2. FO (U)	3. IN (U)	4. GND (U)	5. V_D (V)	6. FO (V)
7. IN (V)	8. GND (V)	9. V_D (W)	10. FO (W)	11. IN (W)	12. GND (W)
13. V_D (L)	14. FO (L)	15. Open	16. IN (B)	17. IN (X)	18. IN (Y)
19. IN (Z)	20. GND (L)				

MAXIMUM RATINGS

STAGE	CHARACTERISTIC	CONDITION	SYMBOL	RATING	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	350	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	200	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 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 min	V_{ISO}	2500	V
	Screw Torque (Terminal)	M4	—	2	Nm
	Screw Torque (Mounting)	M5	—	3	Nm

ELECTRICAL CHARACTERISTICS

a. Inverter Stage (T_j = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Collector Cut-Off Current	I_{CEX}	V_{CE} = 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	—	2.2	2.6	V
			T_j = 125°C	—	—	3.0	
Forward Voltage	V_F	I_F = 50 A		—	2.5	3.1	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	2.0	μs
	$t_{c\ (on)}$			—	0.6	1.2	
	t_{rr}			—	0.3	0.6	
	t_{off}			—	2.0	3.0	
	$t_{c\ (off)}$			—	0.4	0.8	

b. Brake Stage (T_j = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Collector Cut-Off Current	I_{CEX}	V_{CE} = 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	—	2.2	2.6	V
			T_j = 125°C	—	—	3.0	
Reverse Current	I_R	V_R = 1200 V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	10	
Forward Voltage	V_F	I_F = 25 A		—	1.7	2.5	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)		—	1.0	2.0	μs
	$t_{c\ (on)}$			—	0.6	1.2	
	t_{rr}			—	0.5	1.0	
	t_{off}			—	2.0	3.0	
	$t_{c\ (off)}$			—	0.3	0.8	

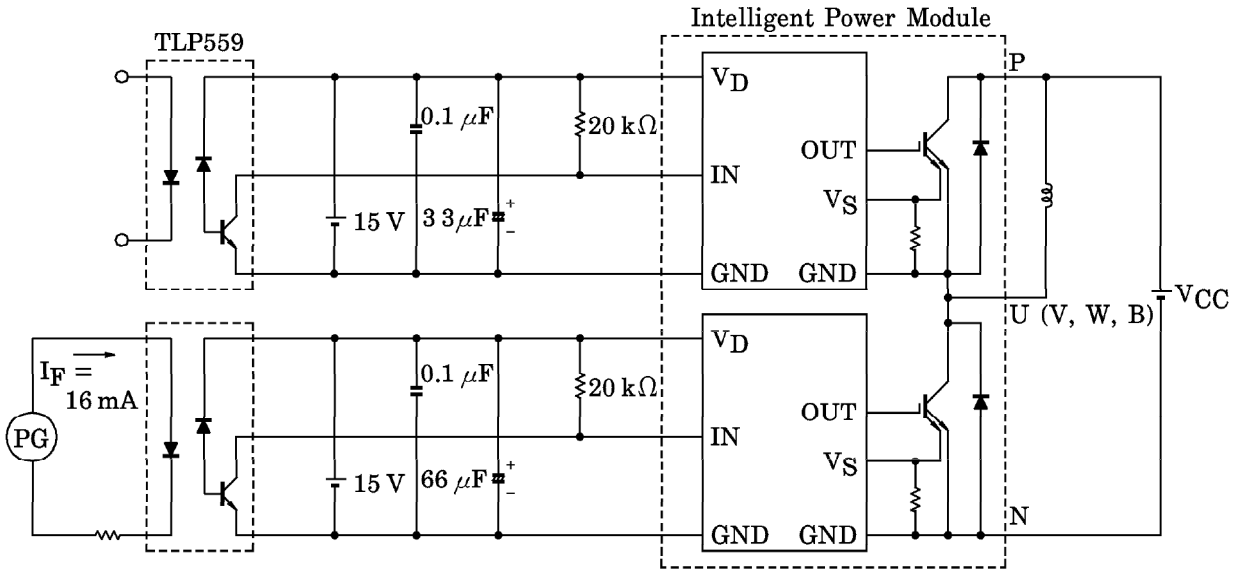
c. Control Stage (T_j = 25°C)

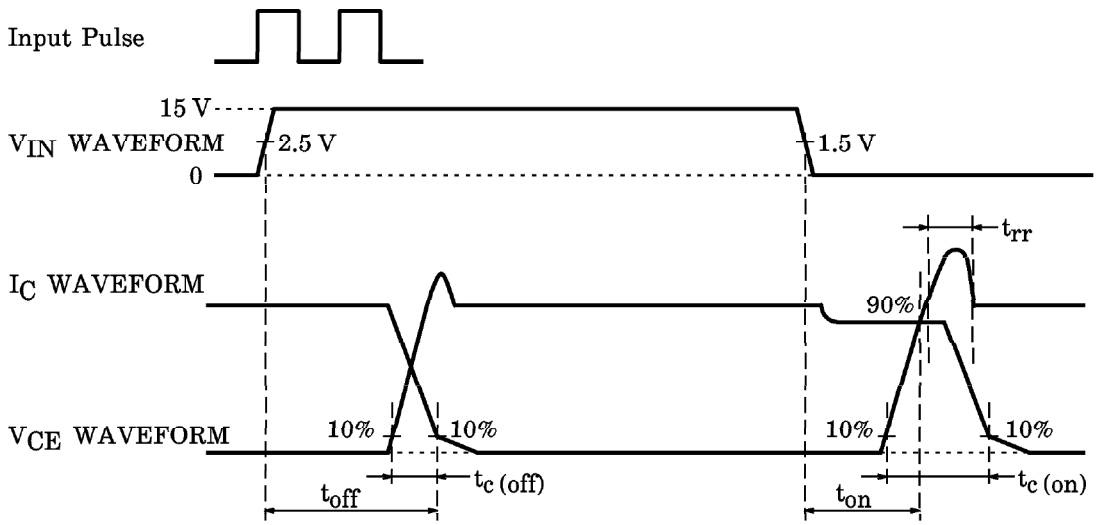
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Control Circuit Current	High Side	$I_{D\ (H)}$	V_D = 15 V	—	8	12	mA
	Low Side	$I_{D\ (L)}$		—	42	60	
Input On Signal Voltage		$V_{IN\ (on)}$	—	1.4	1.6	1.8	V
Input Off Signal Voltage		$V_{IN\ (off)}$	—	2.2	2.5	2.8	
Fault Output Current	Protection	$I_{FO\ (on)}$	V_D = 15 V	8	10	12	mA
	Normal	$I_{FO\ (off)}$		—	—	0.1	
Over Current Protection Trip Level	Inverter	OC	V_D = 15 V, $T_j \leqq$ 125°C	80	—	—	A
	Brake			40	—	—	
Short Circuit Protection Trip Level	Inverter	SC	V_D = 15 V, $T_j \leqq$ 125°C	100	—	—	A
	Brake			50	—	—	
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 (Tc = 25°C)

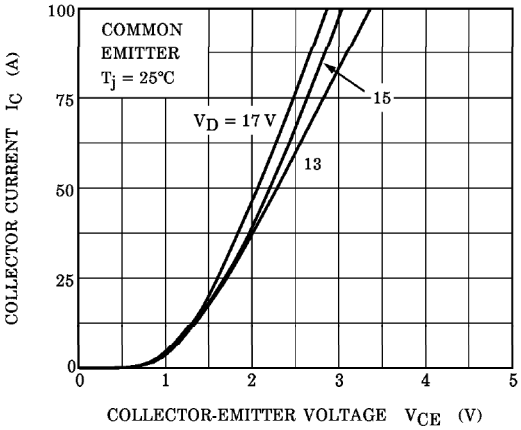
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Junction to Case Thermal Resistance	$R_{th\ (j\text{-}c)}$	Inverter IGBT Stage	—	—	0.36	°C / W
		Inverter FRD Stage	—	—	0.84	
		Brake IGBT Stage	—	—	0.6	
		Brake FRD Stage	—	—	1.5	

(Note 1) : Switching time test circuit & timing chart

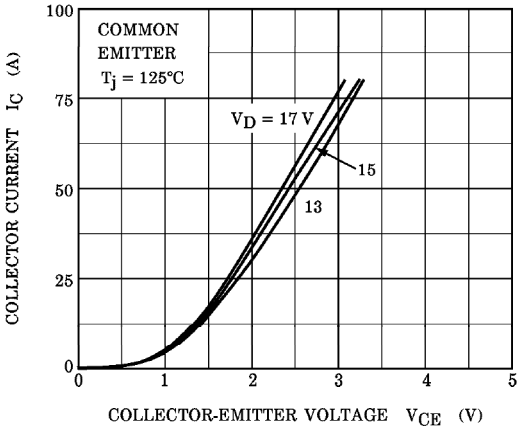




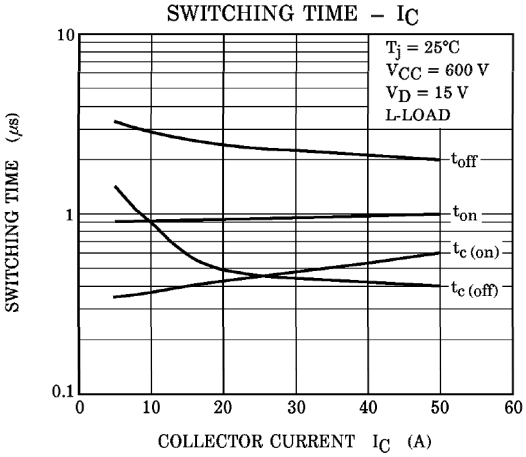
I_C – V_{CE}



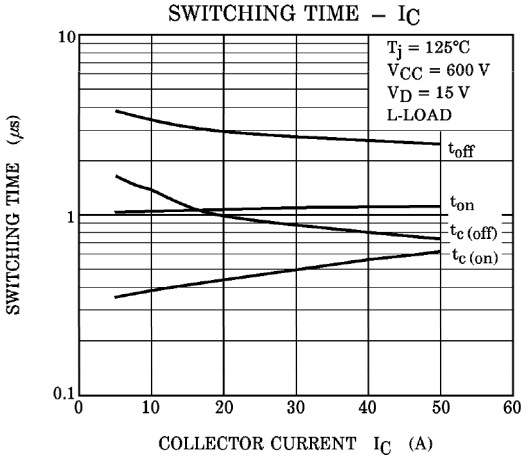
I_C – V_{CE}



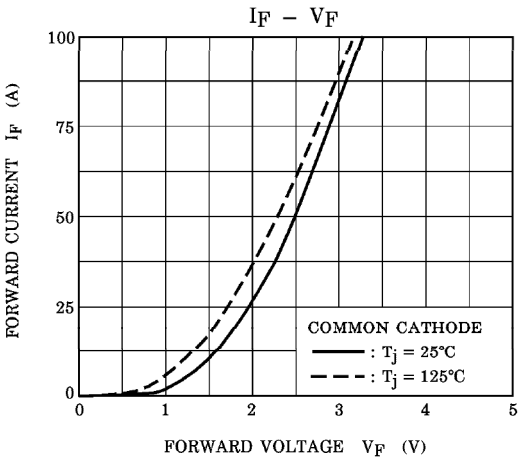
SWITCHING TIME – I_C



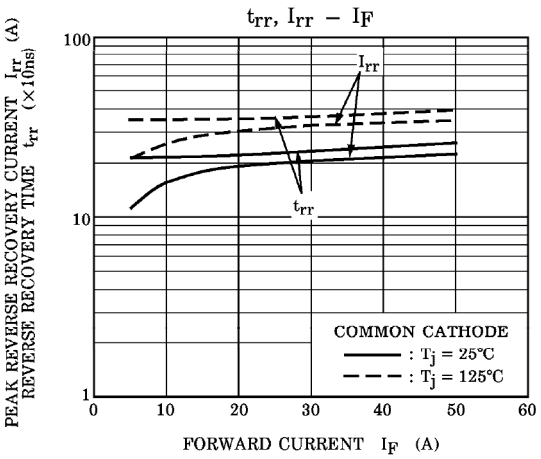
SWITCHING TIME – I_C



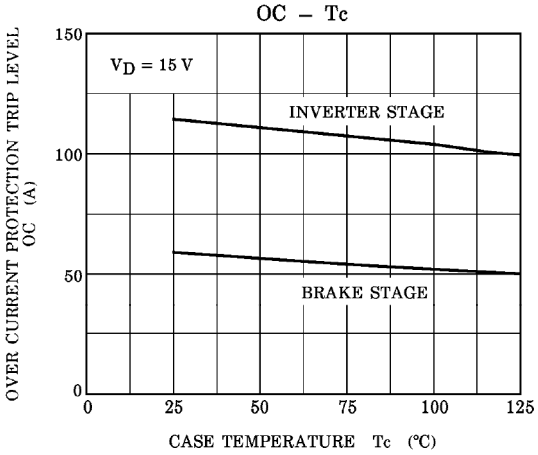
I_F – V_F



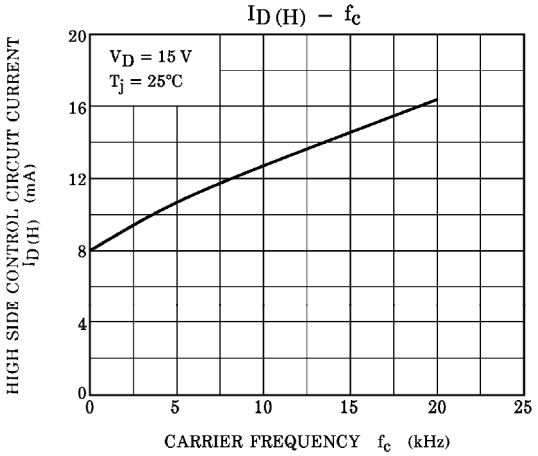
t_{rr}, I_{rr} – I_F



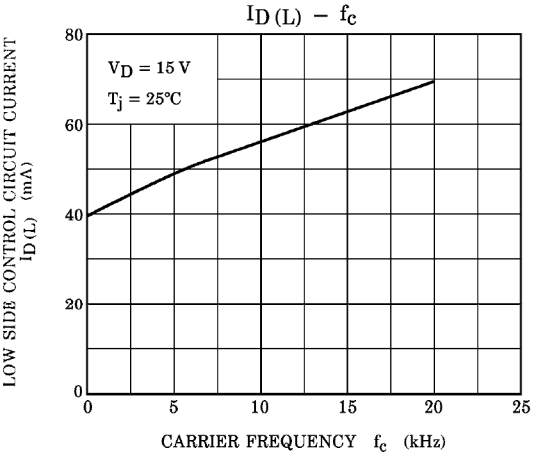
OC – Tc



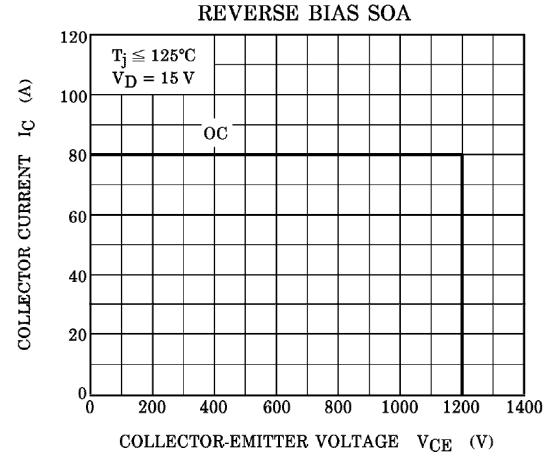
$I_{D(H)}$ – f_c



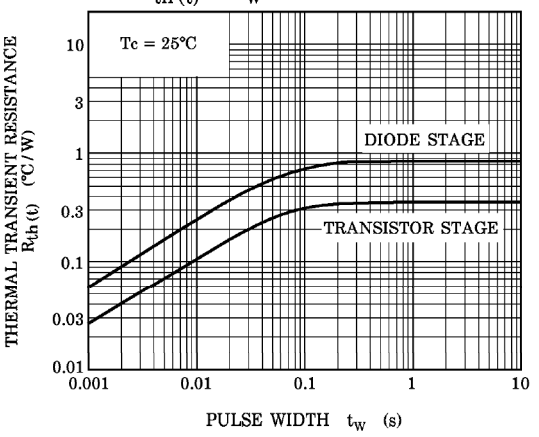
$I_{D(L)}$ – f_c



REVERSE BIAS SOA



$R_{th(t)}$ – t_w INVERTER STAGE



$R_{th(t)}$ – t_w BRAKE STAGE