TOSHIBA Intelligent Power Module Silicon N Channel IGBT

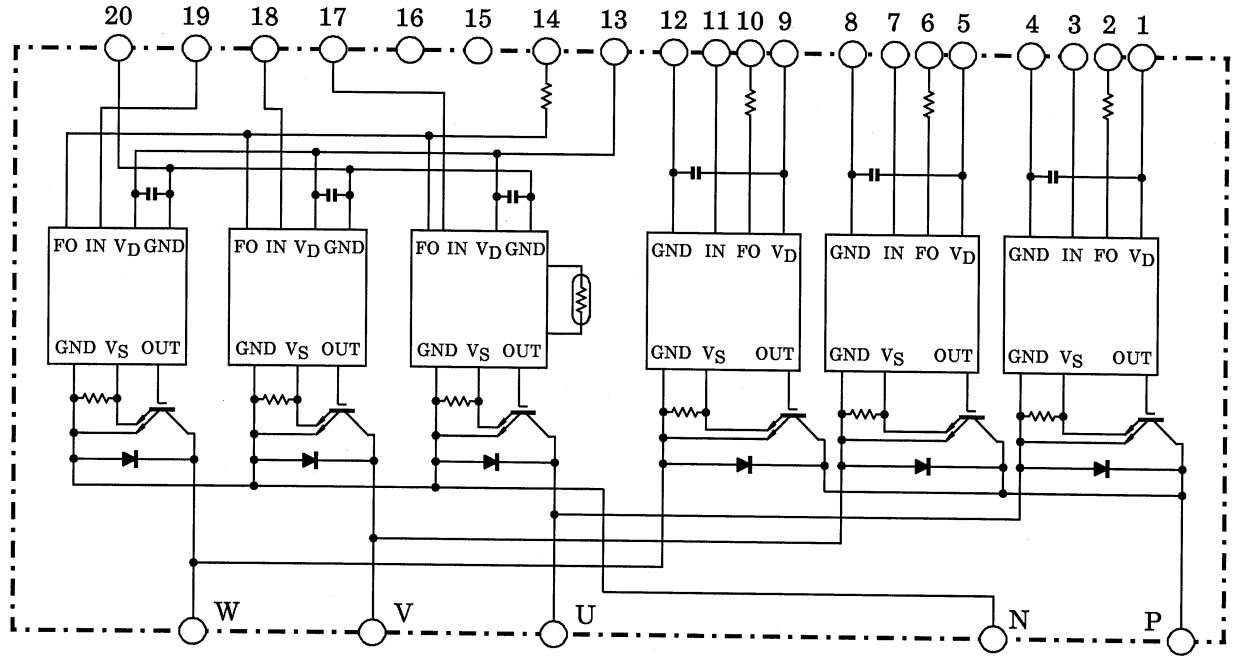
MIG100Q6CMA0X(1200V/100A 6in1)

High Power Switching Application

Motor ControL Application

- Integrates inverter, brake power circuits & control circuits (IGBT drive units, protection units for short-circuit current, overcurrent, undervoltage & overtemperature) in one package.
- The electrodes are isolated from case.
- $V_{CE\,(sat)}$ = 2.4 V (typ.)
- UL recognized File No. E87989
- Weight: 385 g (typ.)

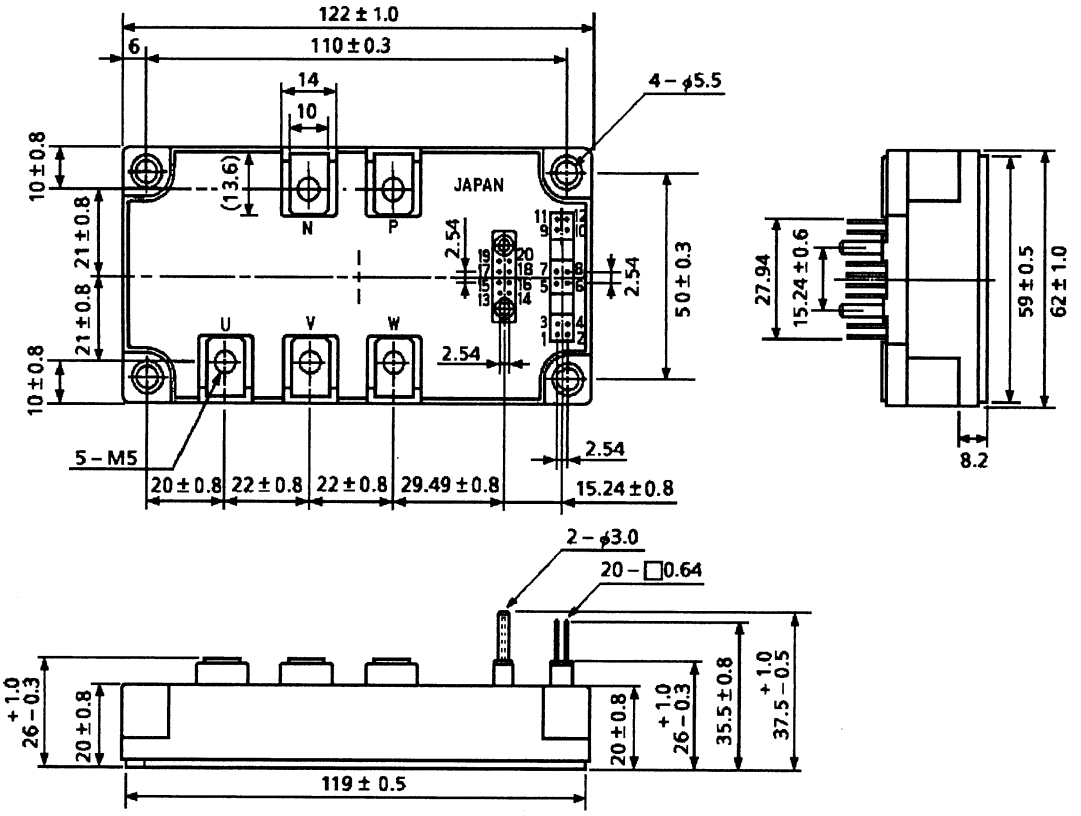
Equivalent Circuit



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. Open	17. IN (X)	18. IN (Y)	19. IN (Z)	20. GND (L)	

Package Dimensions

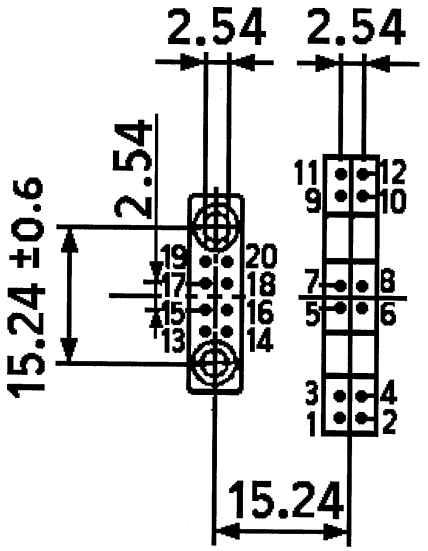
TOSHIBA 2-123A1A Unit: mm



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.Open	17. IN (X)	18. IN (Y)
19. IN (Z)	20. GND (L)				

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. VD (W)	10. FO (W)	11. IN (W)	12. GND (W)
13. VD (L)	14. FO (L)	15. Open	16.Open	17. IN (X)	18. IN (Y)
19. IN (Z)	20. GND (L)				

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	100	A
	Forward current	Tc = 25°C, DC	I_F	100	A
	Collector power dissipation	Tc = 25°C	P_C	600	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

1. Inverter Stage

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 = 100 A V_{IN} = 15 V → 0 V	T_j = 25°C	—	2.4	2.8	V
			T_j = 125°C	—	—	3.2	
Forward voltage	V_F	I_F = 100 A, T_j = 25°C		—	2.5	3.1	V
Switching time	t_{on}	V_{CC} = 600 V, I_C = 100 A V_D = 15 V, V_{IN} = 15 V ↔ 0 V, T_j = 25°C, 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	
	$t_{c(off)}$			—	0.3	0.7	

Note 1: Switching time test circuit & timing chart.

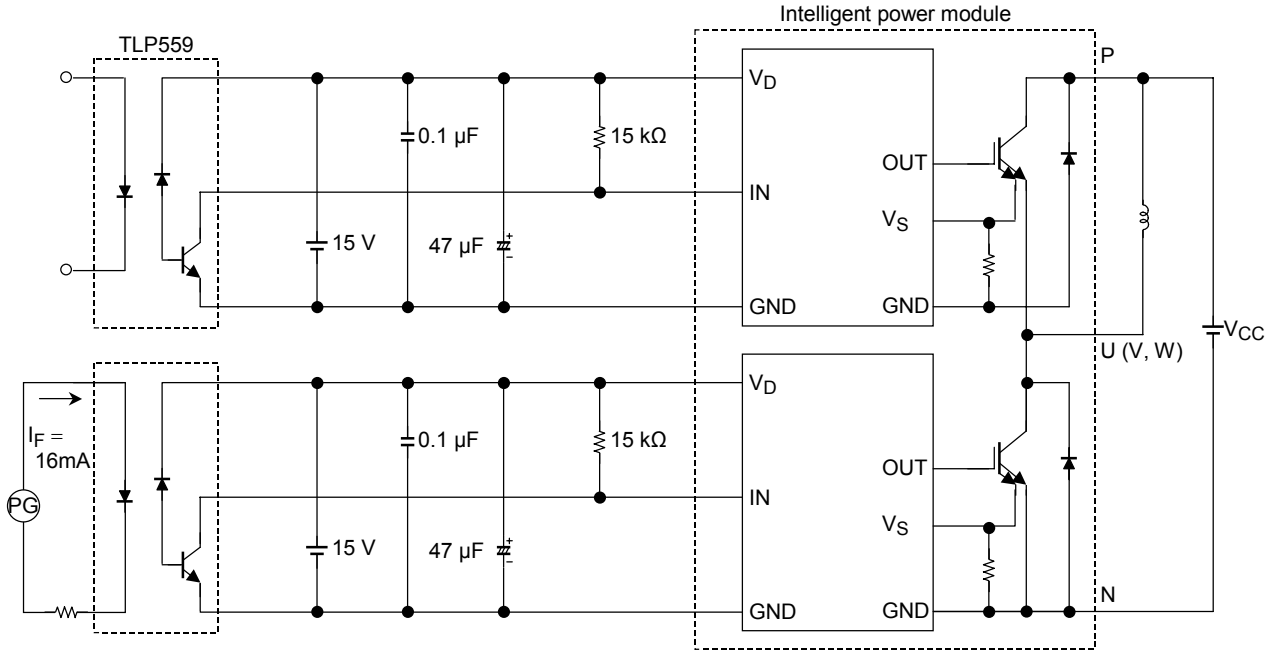
2. Control Stage (T_j = 25°C)

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	$I_{D\ (L)}$		—	34	50	
Input-on signal voltage		$V_{IN\ (on)}$	V_D = 15 V	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 ,$T_j \leq$ 125°C	—	10	12	mA
	Normal	$I_{FO\ (off)}$		—	—	0.1	
Overcurrent protection trip level	Inverter	OC	V_D = 15 V, $T_j \leq$ 125°C	160	—	—	A
Short-circuit current protection trip level	Inverter	SC	V_D = 15 V, $T_j \leq$ 125°C	200	—	—	A
Overcurrent cut-off time		$t_{off\ (OC)}$	V_D = 15 V	—	5	—	μs
Overtemperature 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

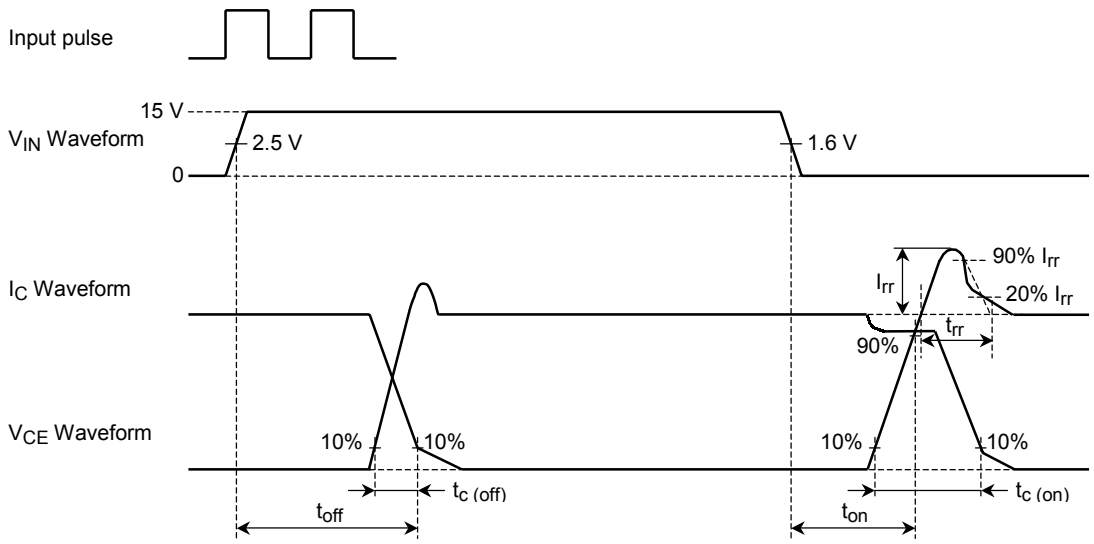
3. Thermal Resistance (T_C = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th\ (j\text{-}c)}$	IGBT	—	—	0.208	°C / W
		FRD	—	—	0.50	
Case to fin thermal resistance	$R_{th\ (c\text{-}f)}$	Compound is applied	—	0.013	—	°C / W

Switching Time Test Circuit



Timing Chart

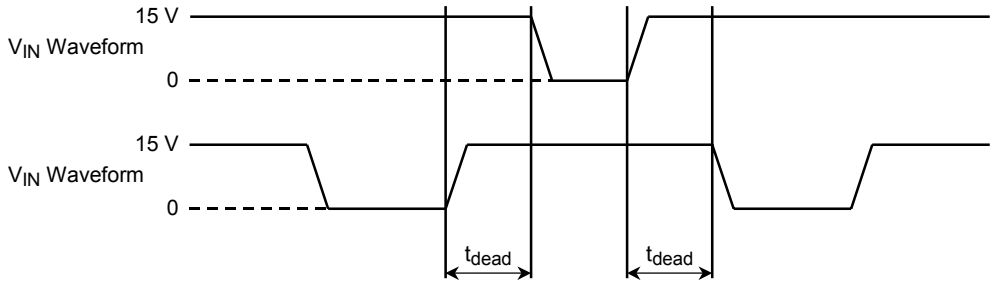


4. Recommended conditions for application

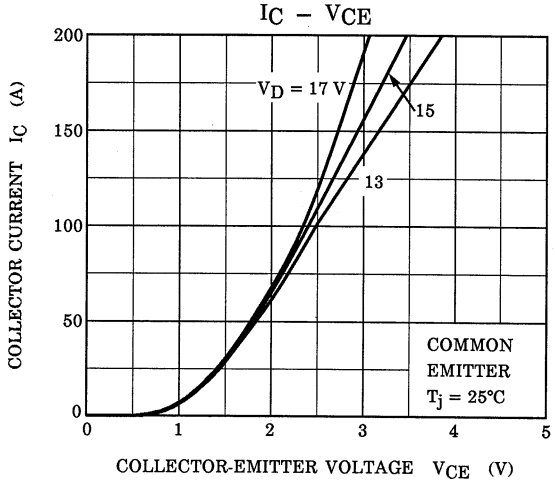
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage	V_{CC}	P-N Power terminal	—	600	800	V
Control supply voltage	V_D	V_D-GND Signal terminal	13.5	15	16.5	V
Carrier frequency	fc	PWM Control	—	—	20	kHz
Dead time	tdead	Switching time test circuit (See page.6) (Note 2)	4	—	—	μs

Note 2: The table lists Dead time requirements for the module input, excluding photocoupler delays. When specifying dead time requirements for the photocoupler input, please add photocoupler delays to the dead time given above.

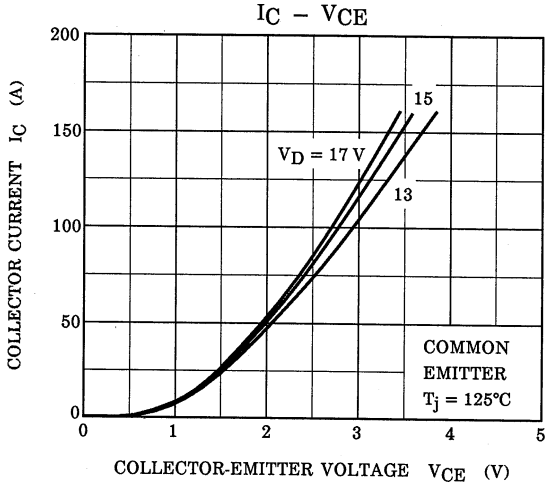
Dead Time Timing Chart



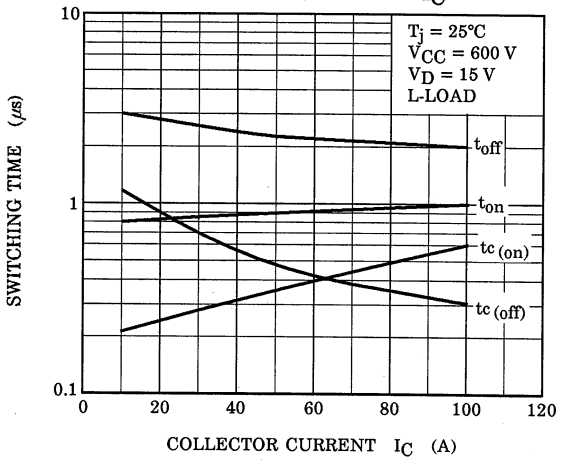
I_C – V_{CE}



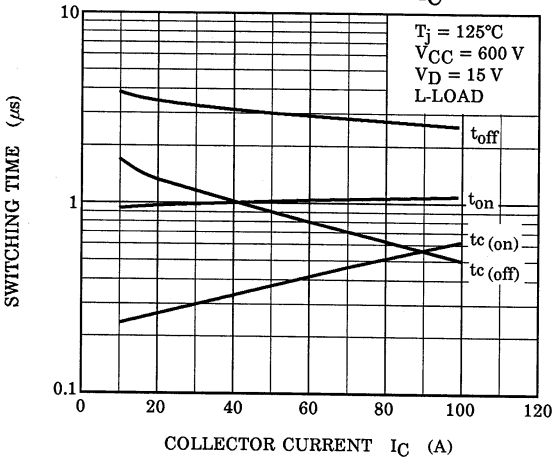
I_C – V_{CE}



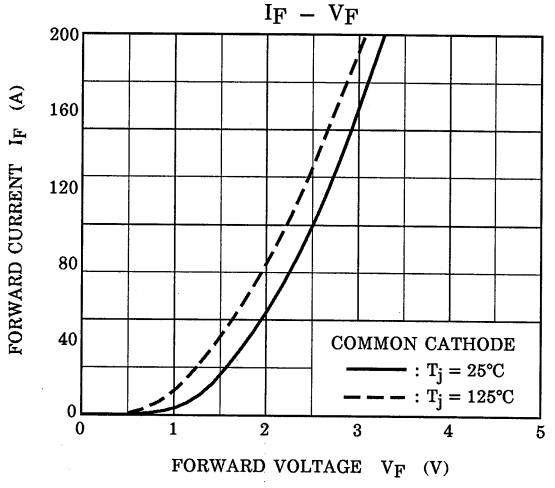
SWITCHING TIME – I_C



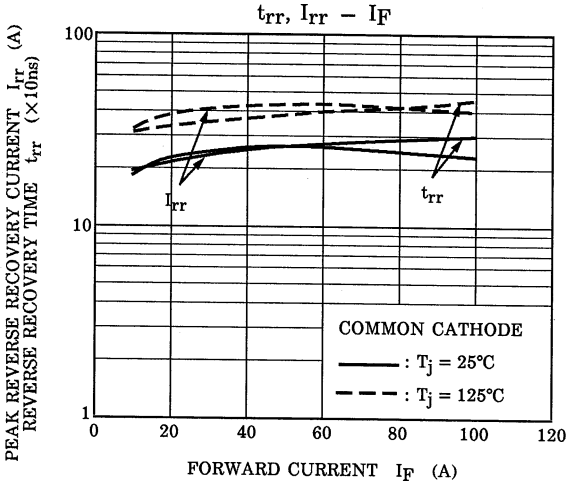
SWITCHING TIME – I_C



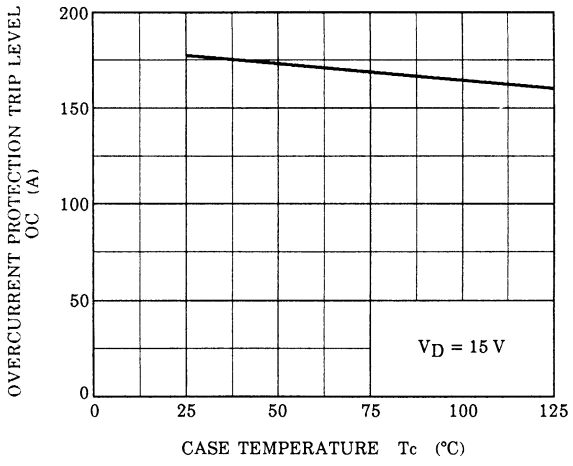
I_F – V_F



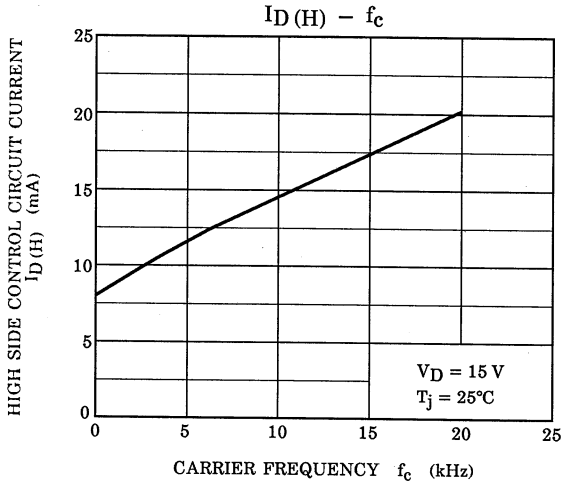
t_{rr}, I_{rr} – I_F



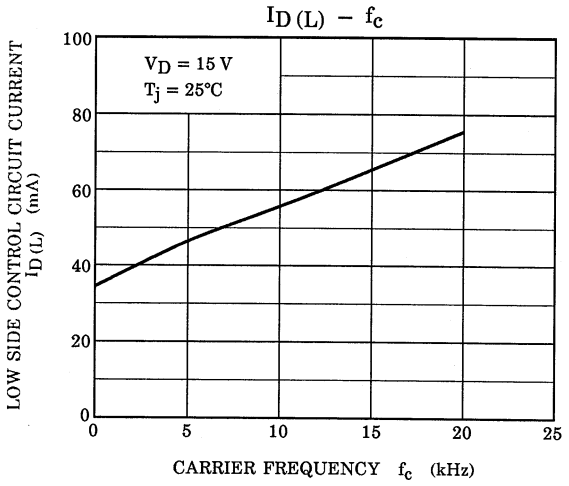
OC – Tc



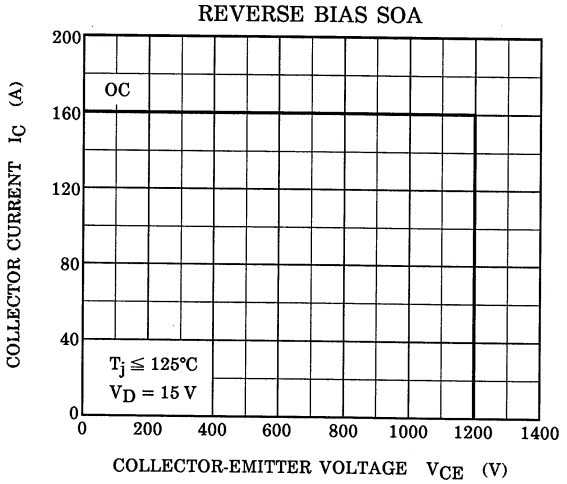
$I_{D(H)}$ – f_c



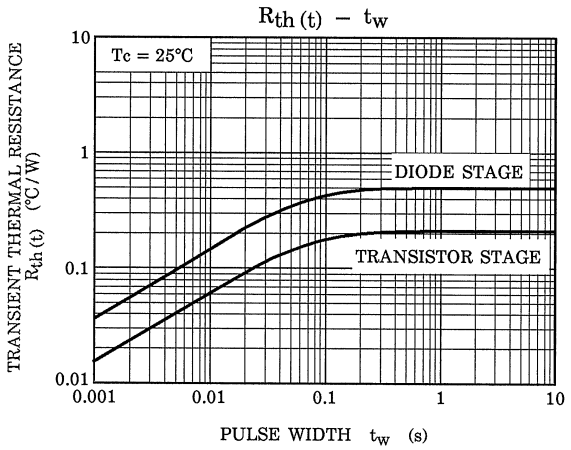
$I_{D(L)}$ – f_c



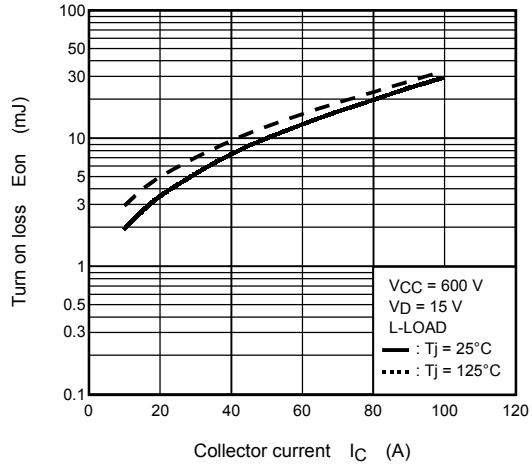
REVERSE BIAS SOA



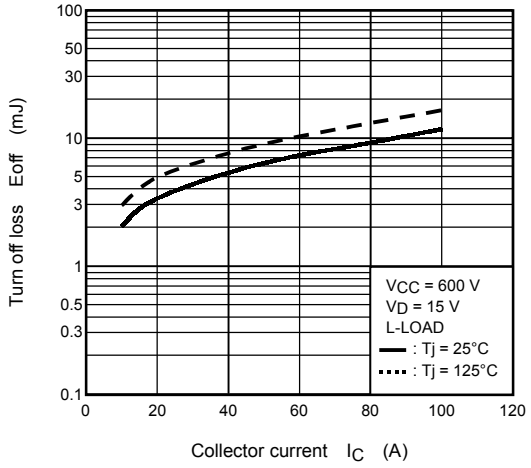
$R_{th(t)}$ – t_w



Turn on loss – I_C



Turn off loss – I_C



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