

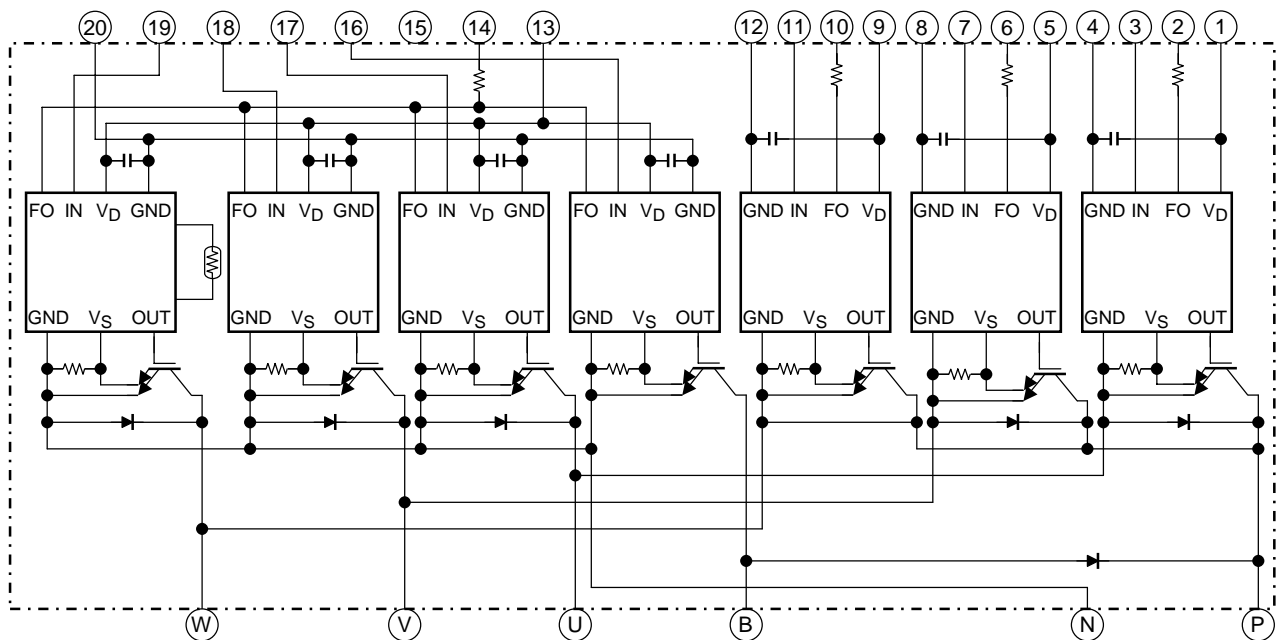
TOSHIBA Intelligent Power Module Silicon N Channel IGBT

MIG50Q7CSB1X (1200V/50A 7in1)

High Power Switching Applications
 Motor Control Applications

- Integrates inverter, brake power circuits and control circuits (IGBT drive units, protection units for short-circuit current, over current, under voltage and over temperature) in one package.
- The electrodes are isolated from case.
- $V_{CE(sat)} = 2.2\text{ V (typ.)}$
- UL recognized File No. E87989
- Weight: 278 g (typ.)

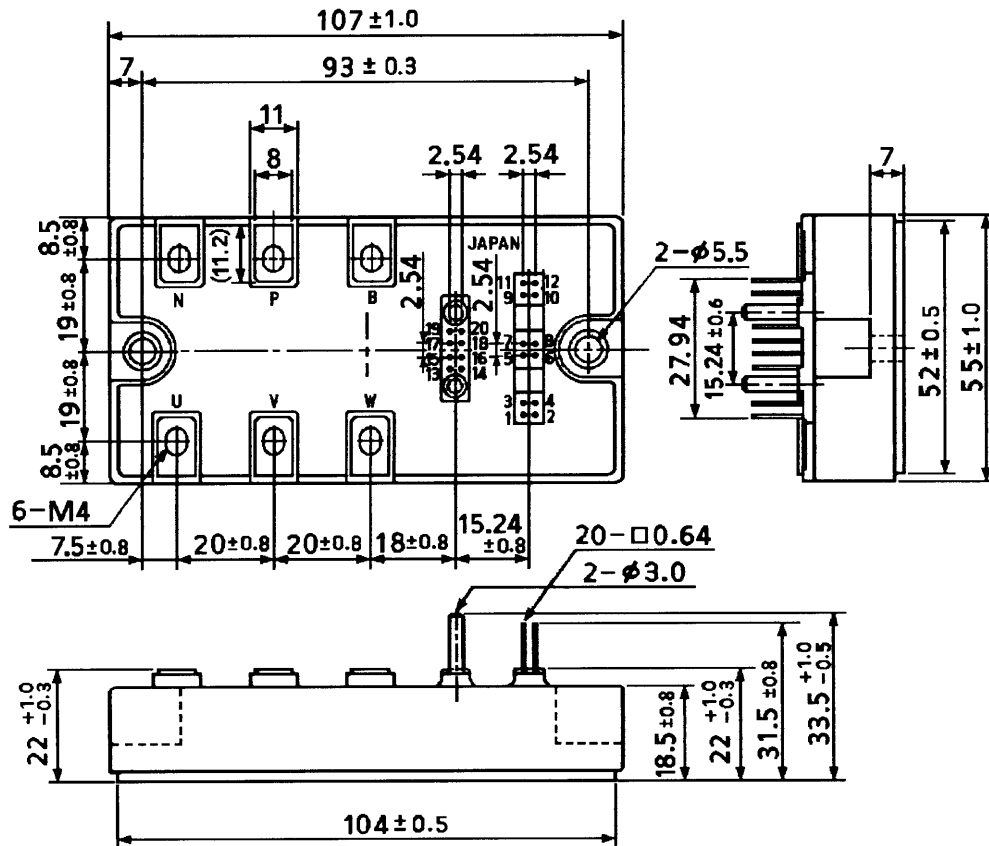
Equivalent Circuit



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

Package Dimensions: TOSHIBA 2-108G1A

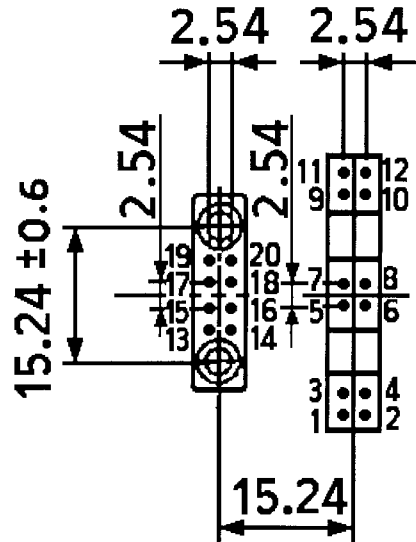
Unit: mm



- | | | | | | |
|---------------|-------------|--------------|------------|--------------|-------------|
| 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) | | | | |

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 (unless otherwise specified, $T_j = 25^\circ\text{C}$)

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	$T_c = 25^\circ\text{C}$, DC	I_C	50	A
	Forward current	$T_c = 25^\circ\text{C}$, DC	I_F	50	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	P_C	580	W
	Junction temperature	—	T_j	150	$^\circ\text{C}$
Brake	Supply voltage	P-N power terminal	V_{CC}	900	V
	Collector-emitter voltage	—	V_{CES}	1200	V
	Collector current	$T_c = 25^\circ\text{C}$, DC	I_C	40	A
	Reverse voltage	—	V_R	1200	V
	Forward current	$T_c = 25^\circ\text{C}$, DC	I_F	40	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	P_C	500	W
	Junction temperature	—	T_j	150	$^\circ\text{C}$
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	—	T_c	-20~+100	$^\circ\text{C}$
	Storage temperature range	—	T_{stg}	-40~+125	$^\circ\text{C}$
	Isolation voltage	AC 1 minute	V_{ISO}	2500	V
	Screw torque (terminal)	M4	—	2	N·m
	Screw torque (mounting)	M5	—	3	N·m

Electrical Characteristics

1. Inverter Stage

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	I_{CEX}	$V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_D = 15\text{ V}$, $I_C = 50\text{ A}$, $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.2	2.6	V
			$T_j = 125^\circ\text{C}$	—	—	3.0	
Forward voltage	V_F	$I_F = 50\text{ A}$, $T_j = 25^\circ\text{C}$	—	2.4	2.8	V	
Switching time	t_{on}	$V_{CC} = 600\text{ V}$, $I_C = 50\text{ A}$, $V_D = 15\text{ V}$, $V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$, $T_j = 25^\circ\text{C}$, Inductive load (Note 1)	—	2.0	3.0	μs	
	$t_{c(on)}$		—	0.3	—		
	t_{rr}		—	0.3	—		
	t_{off}		—	1.5	2.5		
	$t_{c(off)}$		—	0.4	—		

Note 1: Switching time test circuit and timing chart.

2. Brake Stage

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	I_{CEX}	$V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_D = 15\text{ V}, I_C = 40\text{ A}, V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.2	2.6	V
			$T_j = 125^\circ\text{C}$	—	—	3.0	
Reverse current	I_R	$V_R = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	10	
Forward voltage	V_F	$I_F = 40\text{ A}, T_j = 25^\circ\text{C}$	—	1.7	2.1	V	
Switching time	t_{on}	$V_{CC} = 600\text{ V}, I_C = 40\text{ A}, V_D = 15\text{ V}, V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}, T_j = 25^\circ\text{C}, \text{Inductive load}$ (Note 1)	—	2.0	3.0	μs	
	$t_{c(on)}$		—	0.75	—		
	t_{rr}		—	0.7	—		
	t_{off}		—	1.5	2.5		
	$t_{c(off)}$		—	0.3	—		

Note 1: Switching time test circuit and timing chart.

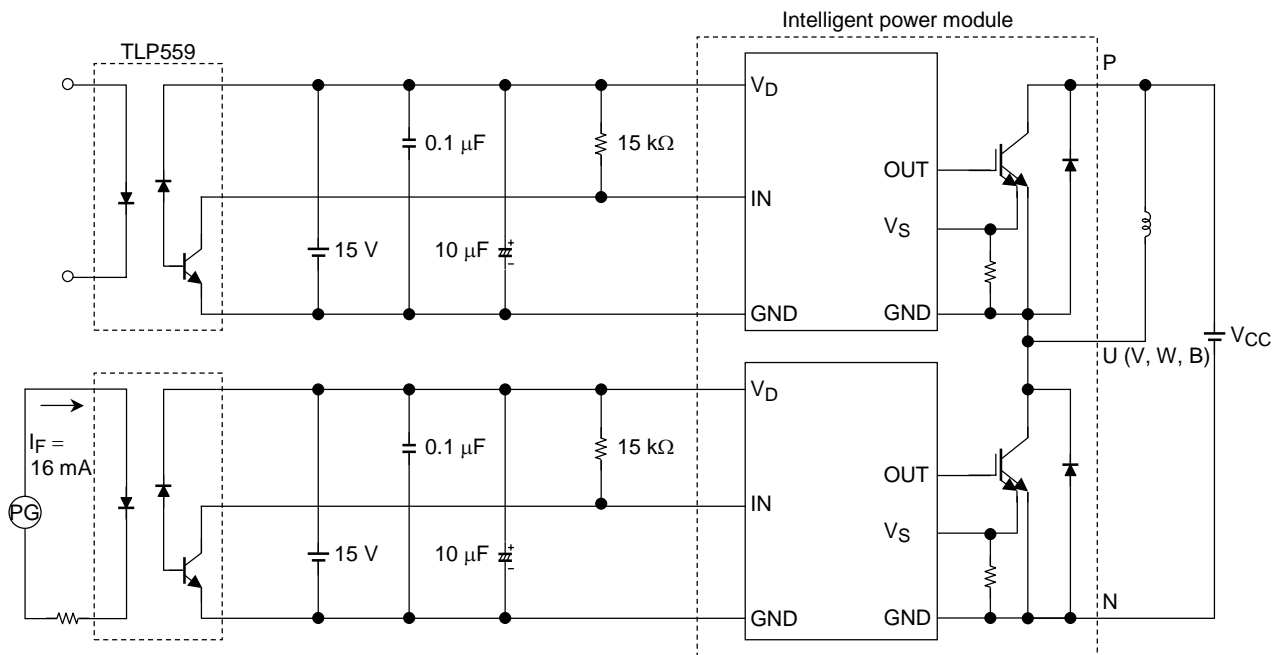
3. Control Stage ($T_j = 25^\circ\text{C}$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current	High side	$V_D = 15\text{ V}$	—	13	17	mA
	Low side		—	52	68	
Input-on signal voltage	$V_{IN(on)}$	$V_D = 15\text{ V}$	1.4	1.6	1.8	V
Input-off signal voltage	$V_{IN(off)}$	$V_D = 15\text{ V}$	2.2	2.5	2.8	V
Fault output current	Protection	$V_D = 15\text{ V}$	8	10	12	mA
	Normal		—	—	0.1	
Over current protection trip level	Inverter	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	80	—	—	A
	Brake		65	—	—	
Short-circuit current protection trip level	Inverter	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	80	—	—	A
	Brake		65	—	—	
Over current cut-off time	$t_{off(OC)}$	$V_D = 15\text{ V}$	—	5	—	μs
Over temperature protection	Trip level	Case temperature	110	118	125	$^\circ\text{C}$
	Reset level		—	98	—	
Control supply under voltage protection	Trip level	—	11.0	12.0	12.5	V
	Reset level		12.0	12.5	13.0	
Fault output pulse width	t_{FO}	$V_D = 15\text{ V}$	1	2	3	ms

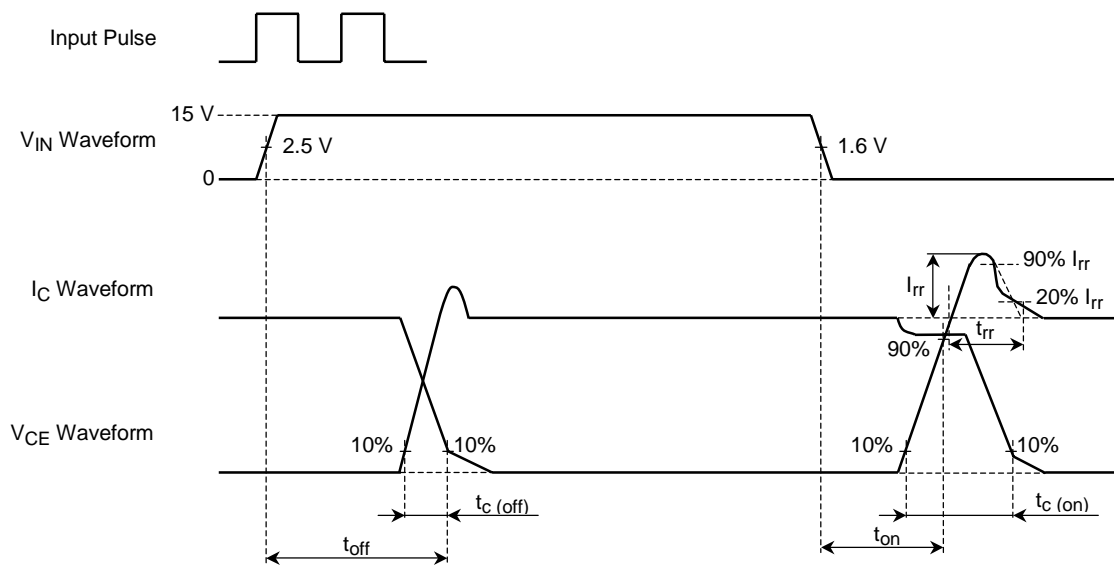
4. Thermal Resistance ($T_c = 25^\circ\text{C}$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	Inverter IGBT stage	—	—	0.215	$^\circ\text{C/W}$
		Inverter FRD stage	—	—	0.464	
		Brake IGBT stage	—	—	0.25	
		Brake FRD stage	—	—	0.6	
Case to fin thermal resistance	$R_{th(c-f)}$	Compound is applied	—	0.017	—	$^\circ\text{C/W}$

Switching Time Test Circuit



Timing Chart

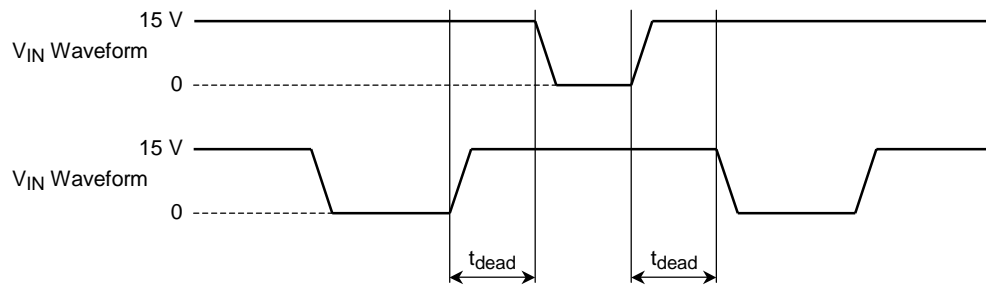


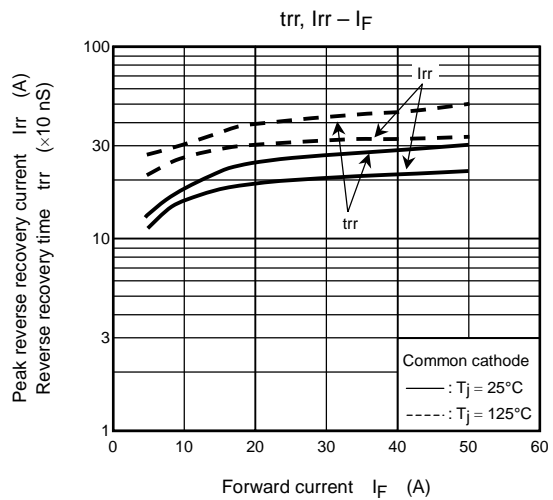
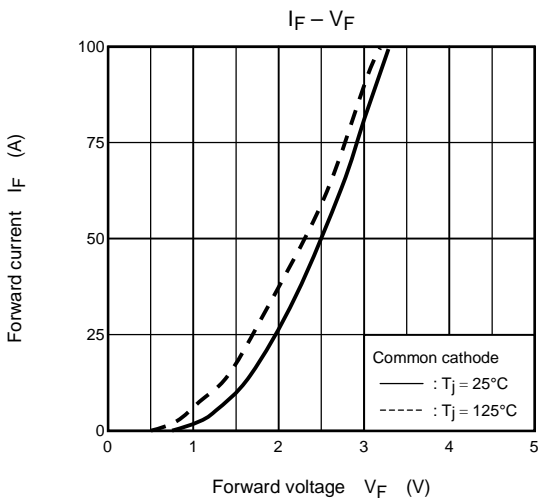
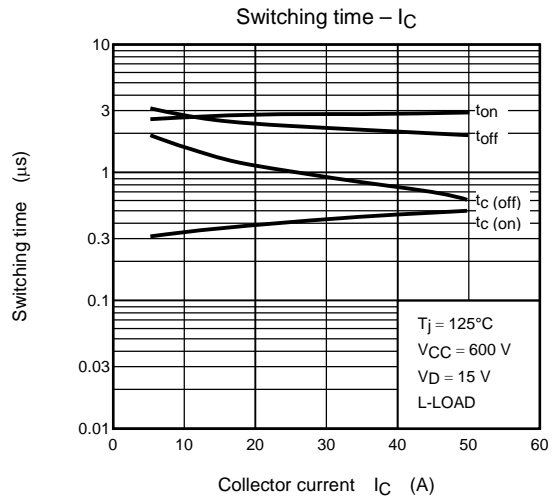
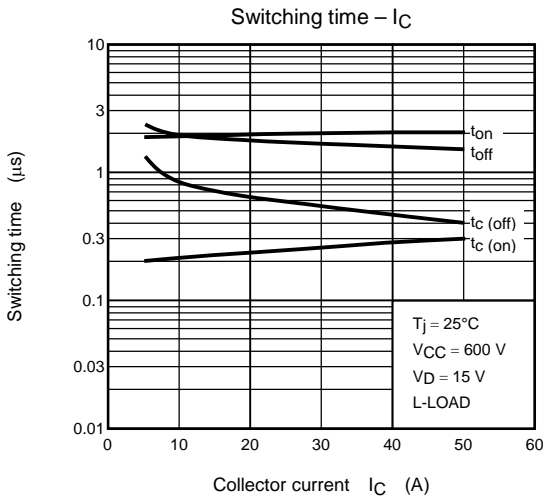
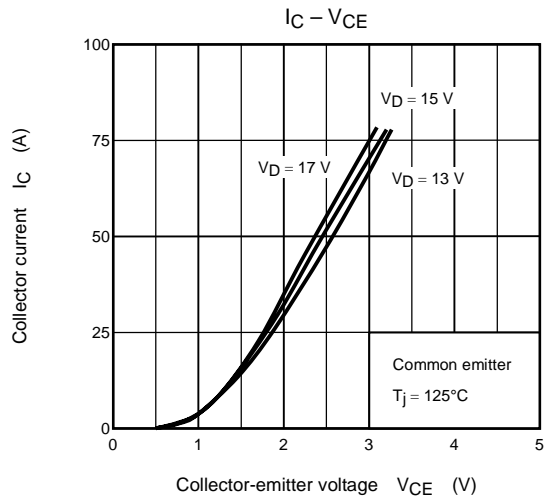
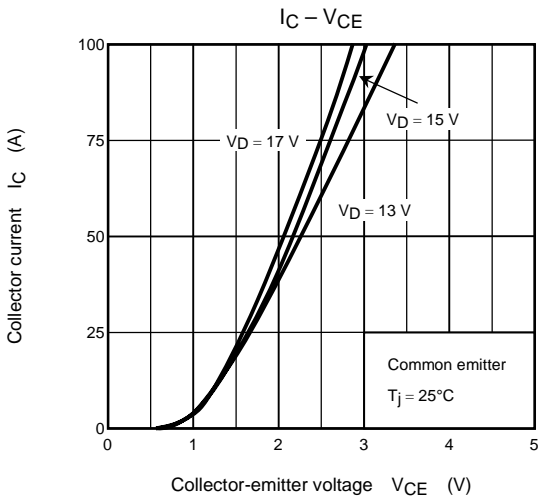
5. Recommended conditions for application

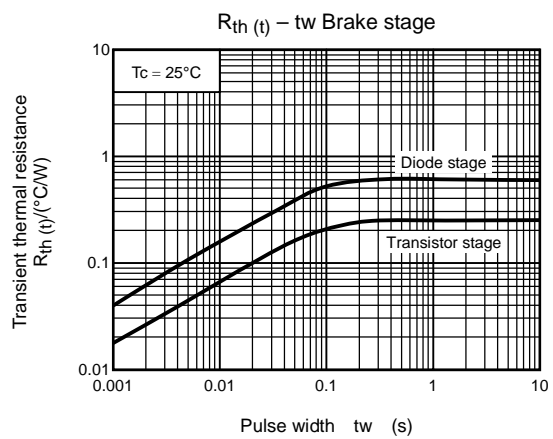
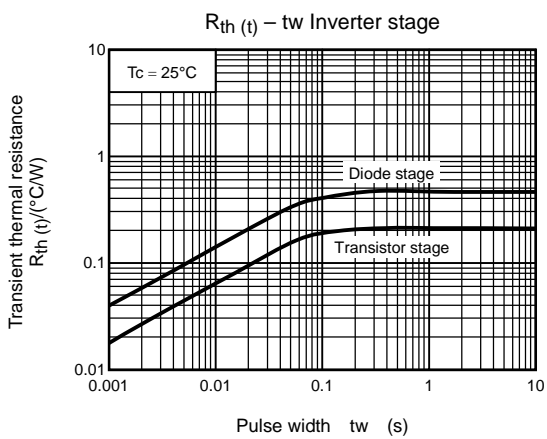
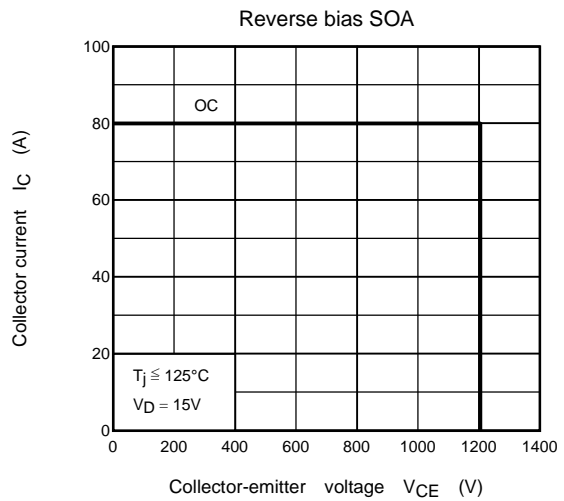
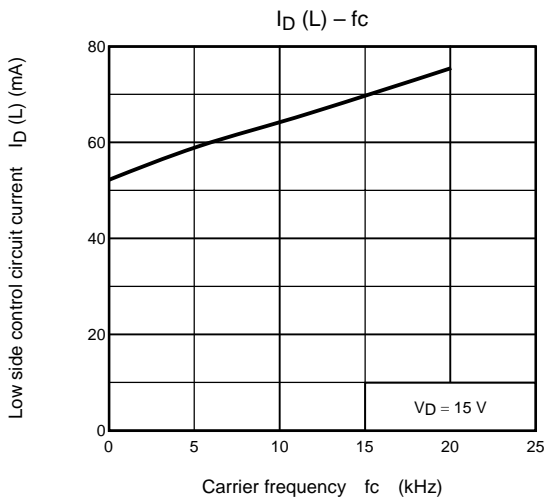
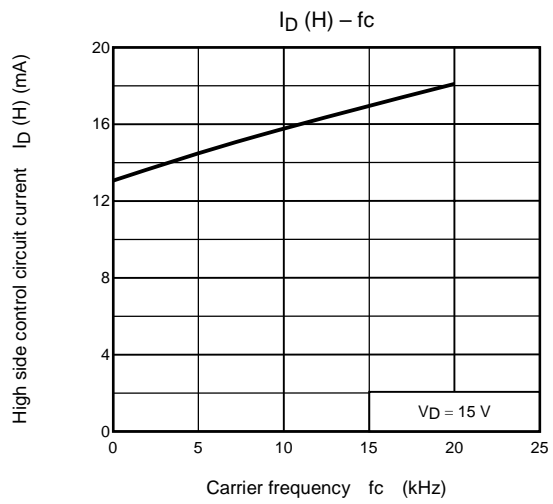
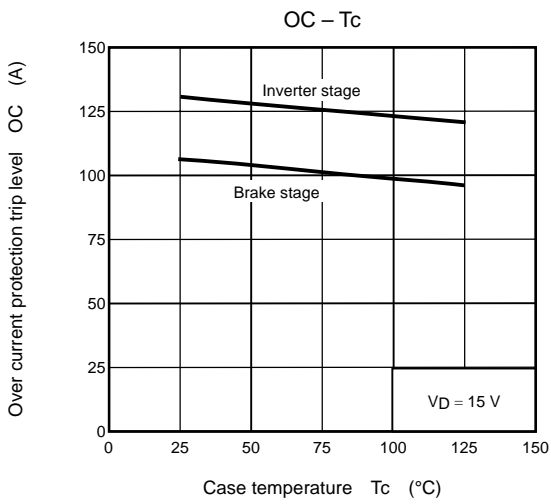
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage	V_{CC}	P-N Power terminal	—	600	800	V
Control supply voltage	V_D	V_D -GND Signal terminal	13.5	15	16.5	V
Carrier frequency	f_c	PWM Control	—	—	20	kHz
Dead time	t_{dead}	Switching time test circuit (see page.6) (Note 2)	3	—	—	μ s

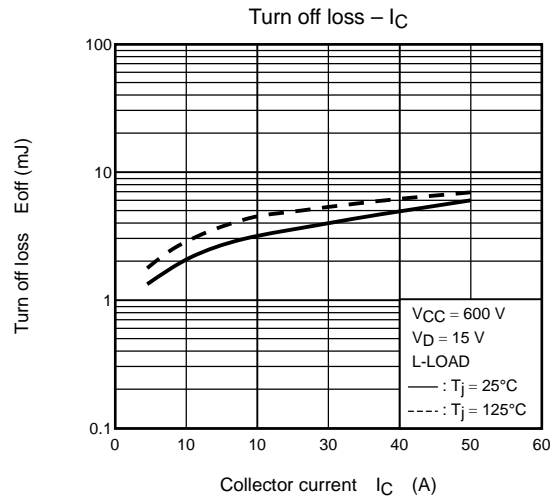
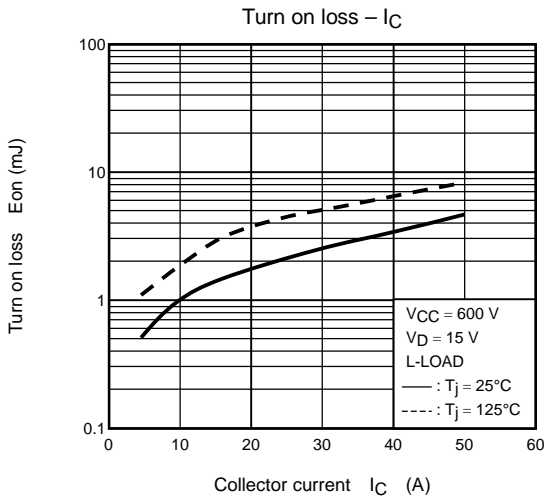
Note 2: The table lists Dead time requirements for the module input, excluding photocoupler delays. When specifying dead time requirements for the photocoupler input, please add photocoupler delays to the dead time given above.

Dead Time Timing Chart









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