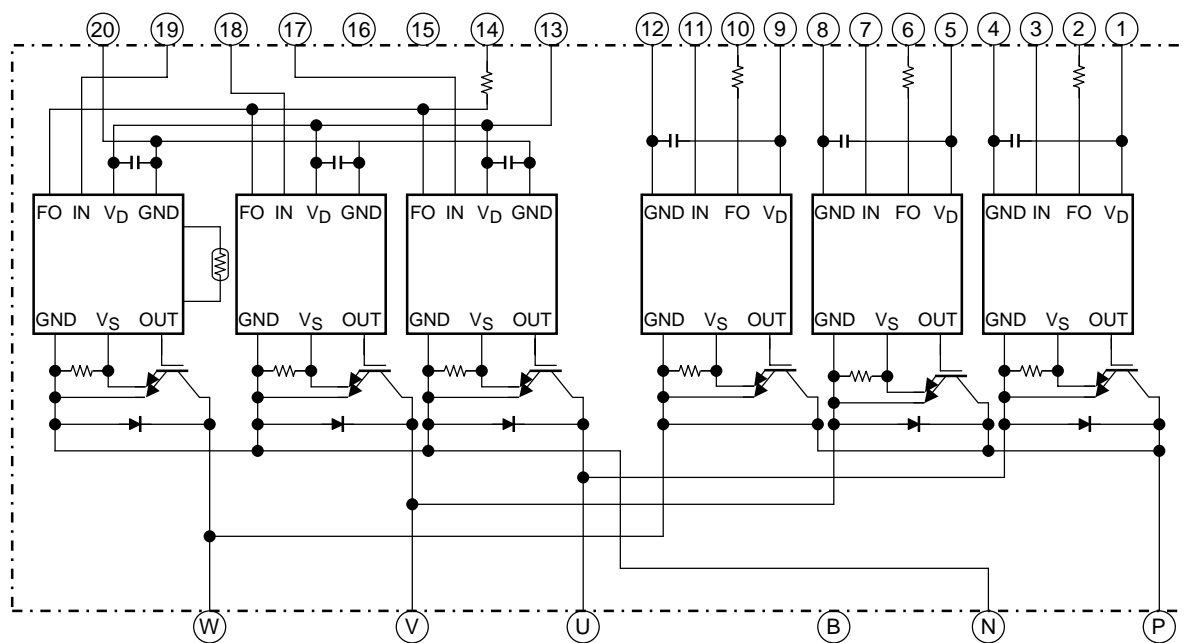


MIG50Q6CSB1X (1200V/50A 6in1)

High Power Switching Applications
 Motor Control Applications

- Integrates inverter 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

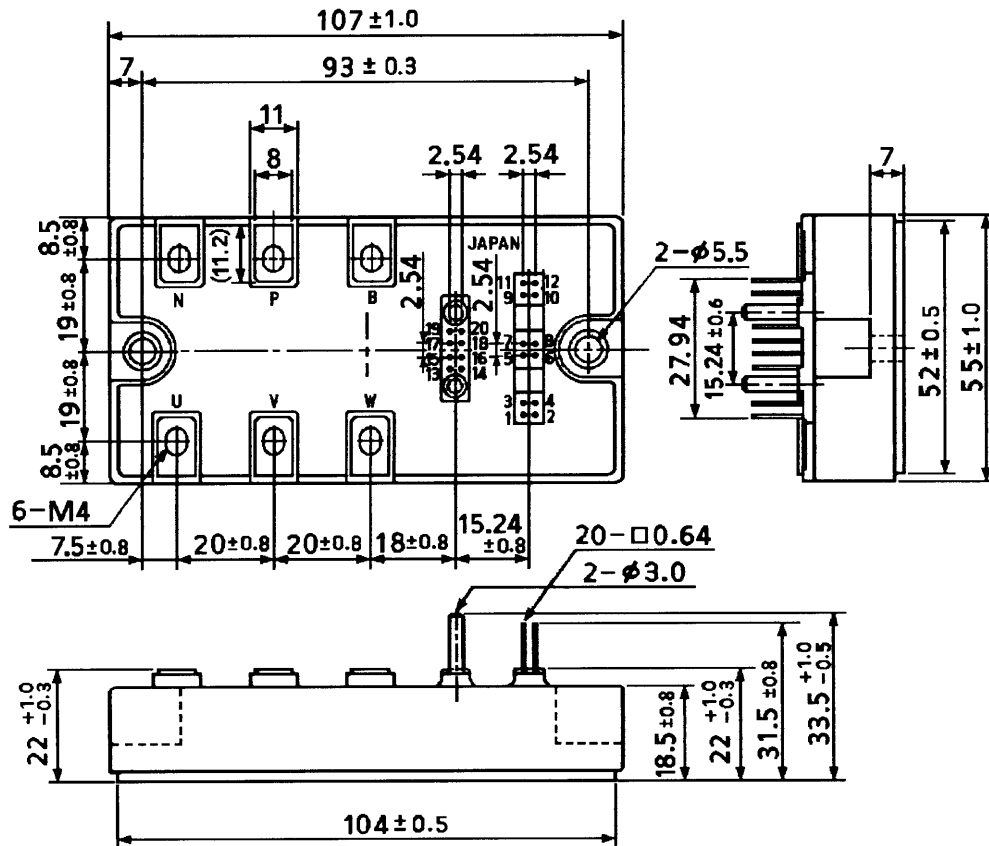
Equivalent Circuit



- | | | | | | | |
|--------------|--------------|------------|------------|--------------|---------------|------------|
| 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 2-108G1D

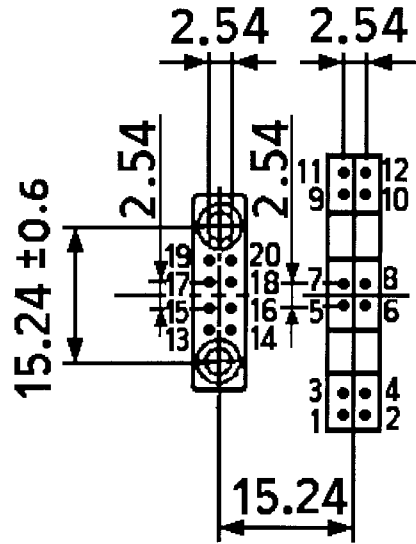
Unit: mm



- | | | | | | |
|---------------|-------------|--------------|------------|--------------|-------------|
| 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.	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)								

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

Stage	Characteristic	Condition	Symbol	Rated	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	$^\circ\text{C}$
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 to 100	$^\circ\text{C}$
	Storage temperature range	—	T_{stg}	-40 to 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	$V_{CE(sat)}$	$V_D = 15\text{ V}$, $I_C = 50\text{ A}$, $V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	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.

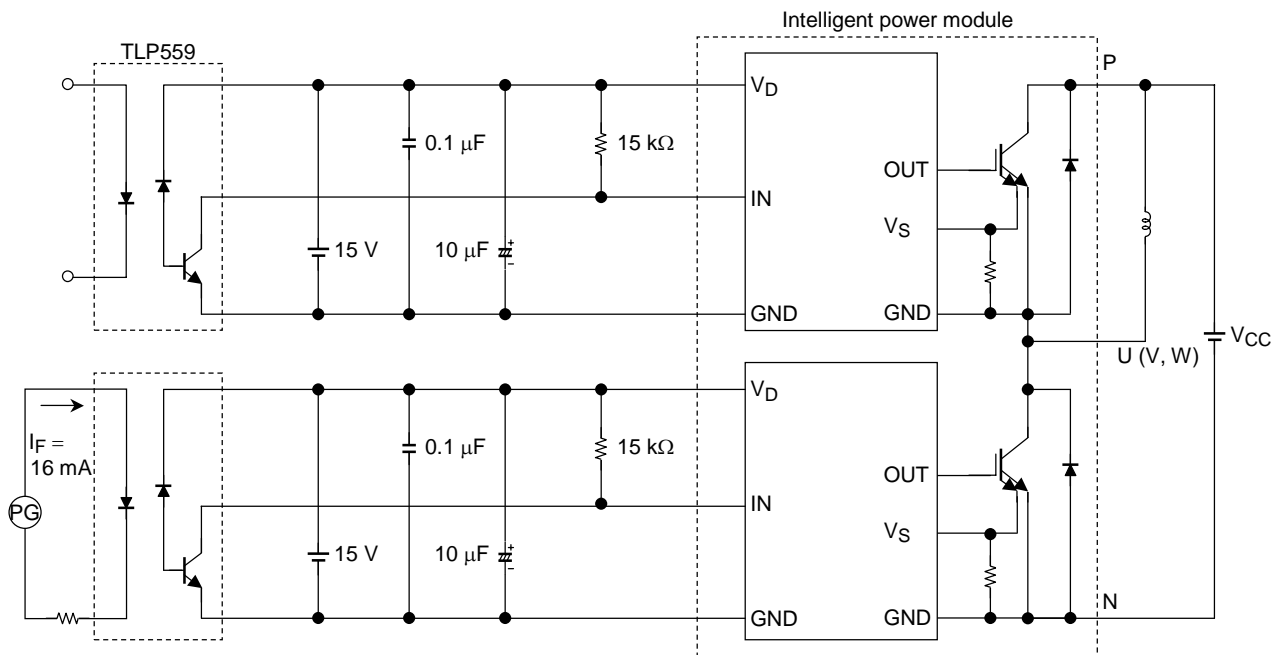
2. Control Stage ($T_j = 25^\circ\text{C}$)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current	High side	I_D (H)	$V_D = 15\text{ V}$	—	13	17	mA
	Low side	I_D (L)		—	39	51	
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	I_{FO} (on)	$V_D = 15\text{ V}$	8	10	12	mA
	Normal	I_{FO} (off)		—	—	0.1	
Over current protection trip level	Inverter	OC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	80	—	—	A
Short-circuit current protection trip level	Inverter	SC	$V_D = 15\text{ V}, T_j \leq 125^\circ\text{C}$	80	—	—	A
Over current cut-off time		t_{off} (OC)	$V_D = 15\text{ V}$	—	5	—	μs
Over temperature protection	Trip level	OT	Case temperature	110	118	125	$^\circ\text{C}$
	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}	$V_D = 15\text{ V}$	1	2	3	ms

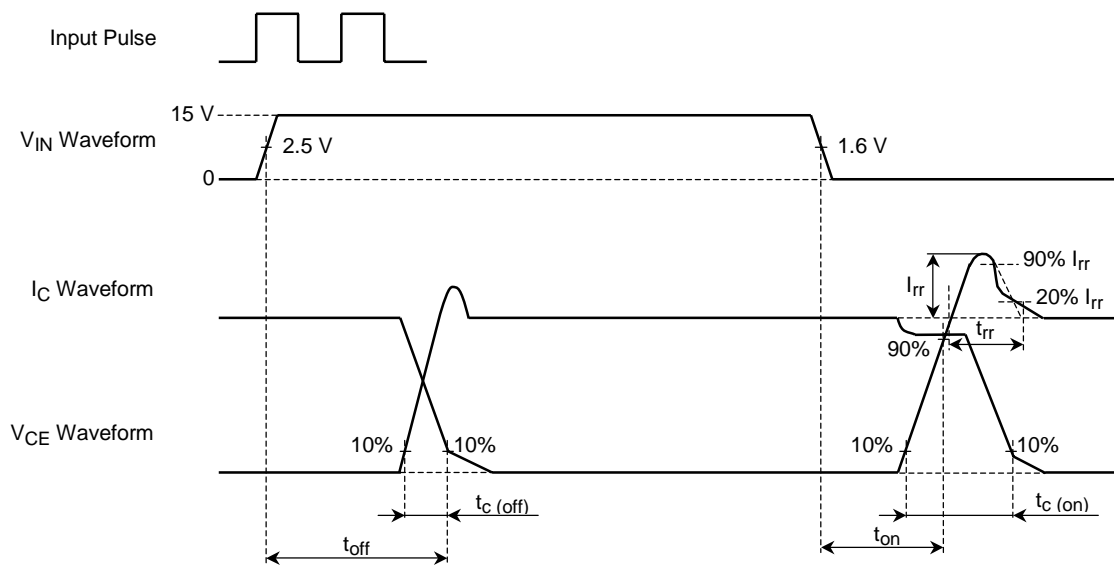
3. Thermal Resistance ($T_c = 25^\circ\text{C}$)

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	
Case to fin thermal resistance	R_{th} (c-f)	Compound is applied	—	0.017	—	$^\circ\text{C/W}$

Switching Time Test Circuit



Timing Chart

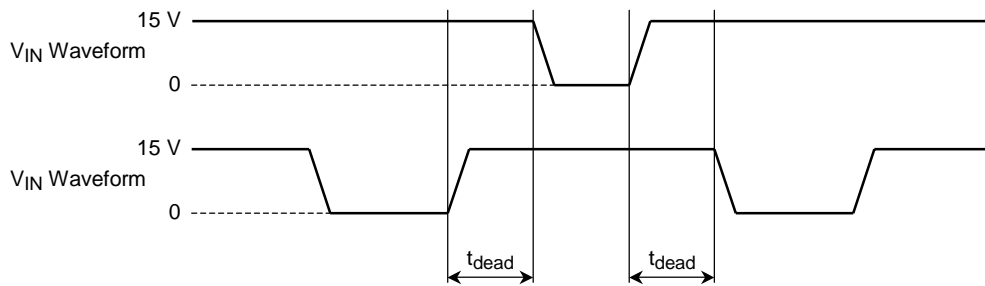


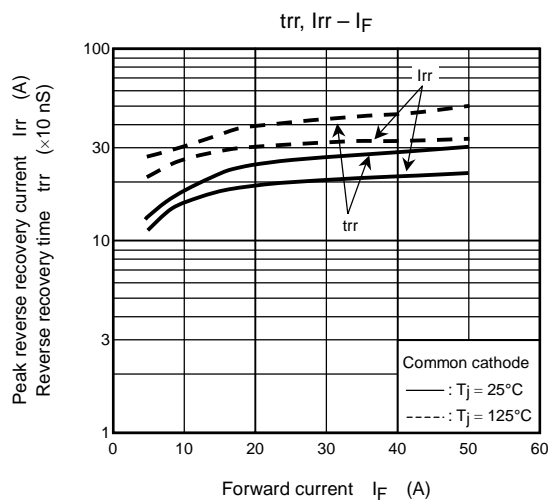
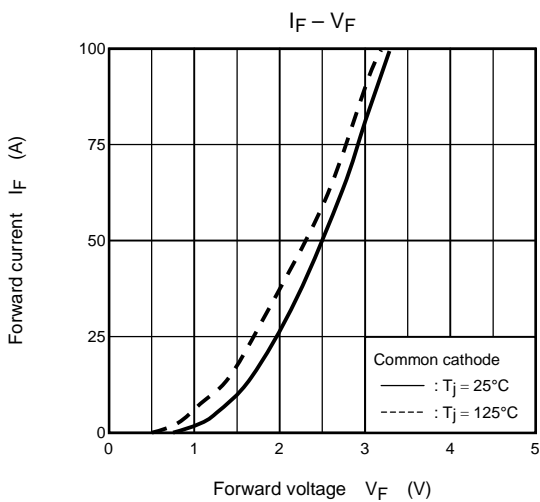
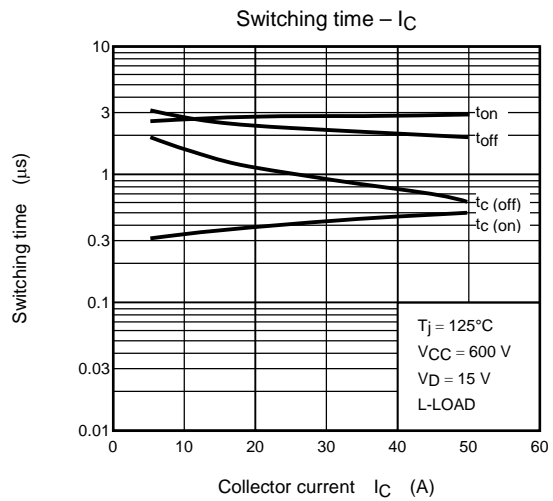
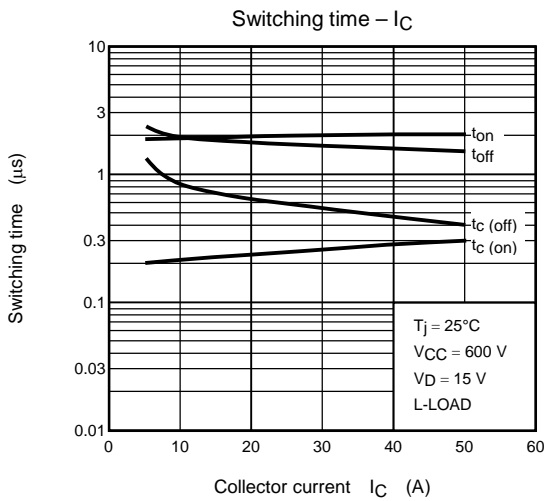
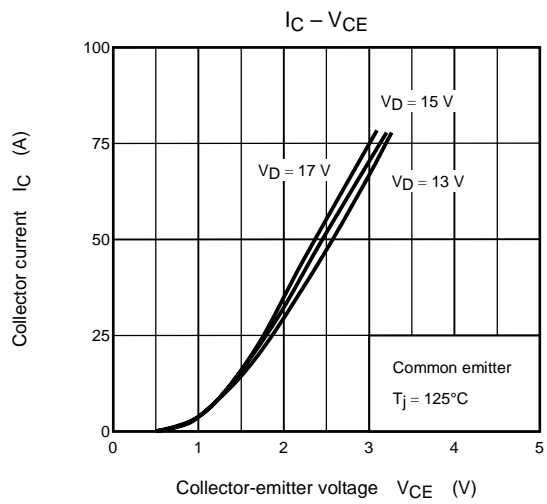
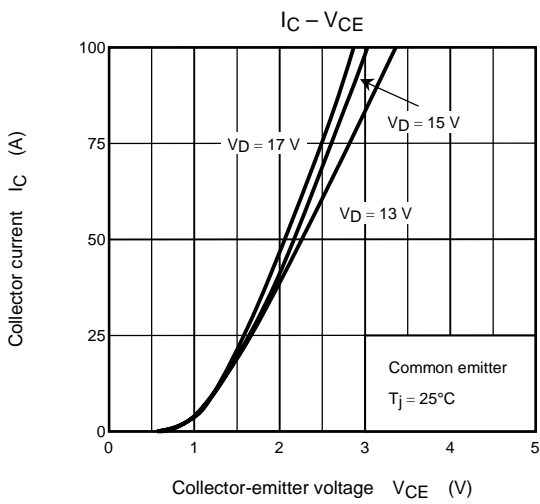
4. Recommended conditions for application

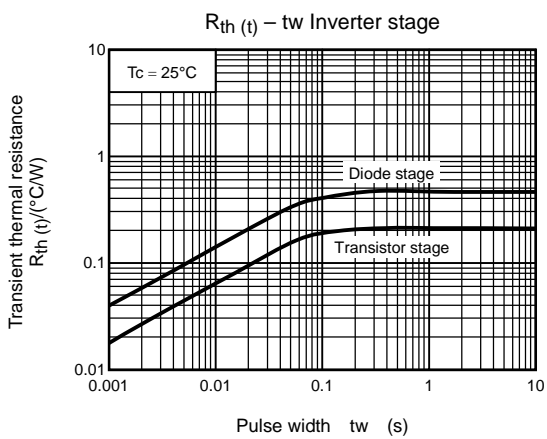
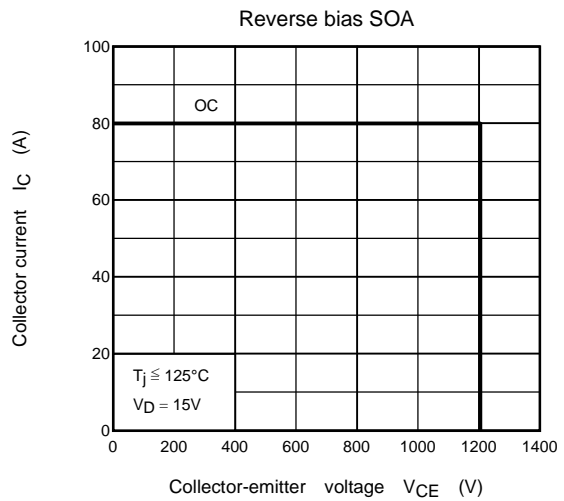
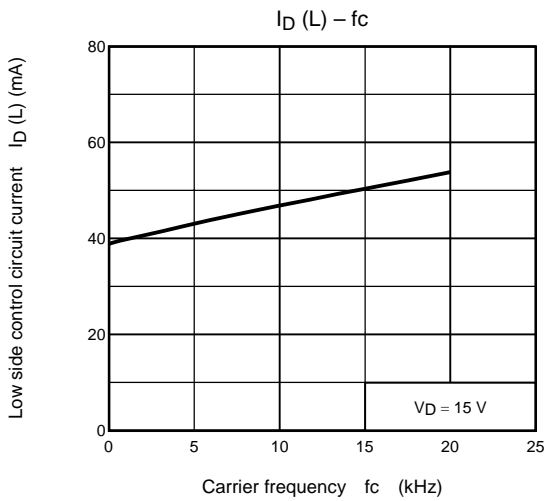
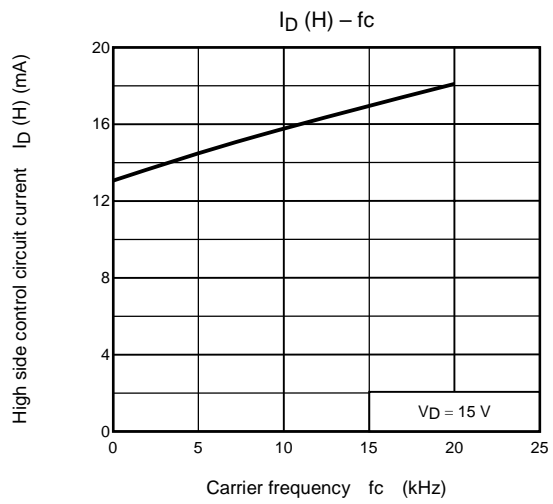
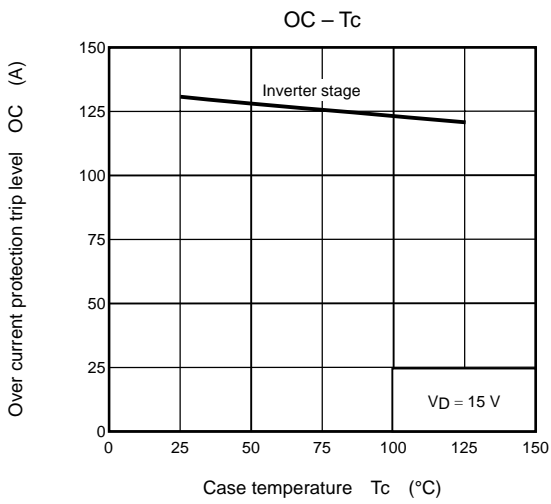
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage	V _{CC}	P-N Power terminal	—	600	800	V
Control supply voltage	V _D	V _D -GND Signal terminal	13.5	15	16.5	V
Carrier frequency	f _c	PWM Control	—	—	20	kHz
Dead time	t _{dead}	Switching time test circuit (see page.6) (Note 2)	3	—	—	μs

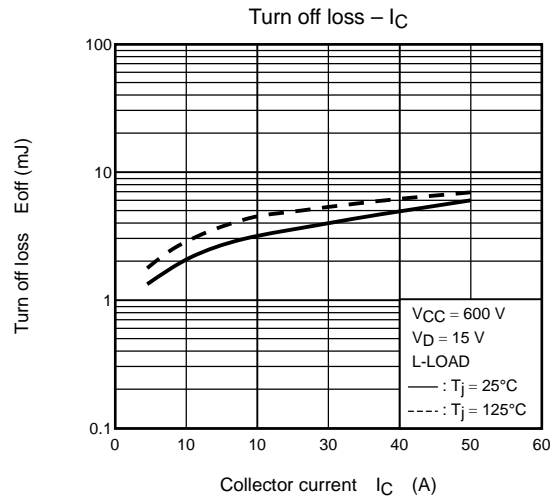
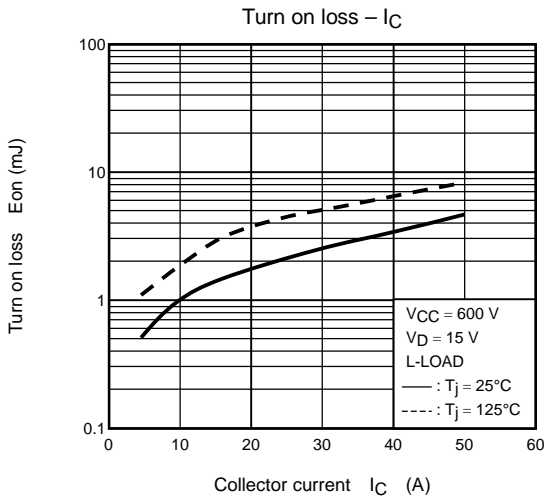
Note 2: The table lists Dead time requirements for the module input, excluding photocoupler delays. When specifying dead time requirements for the photocoupler input, please add photocoupler delays to the dead time given above.

Dead Time Timing Chart









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