

TOSHIBA Intelligent Power Module Silicon N Channel IGBT

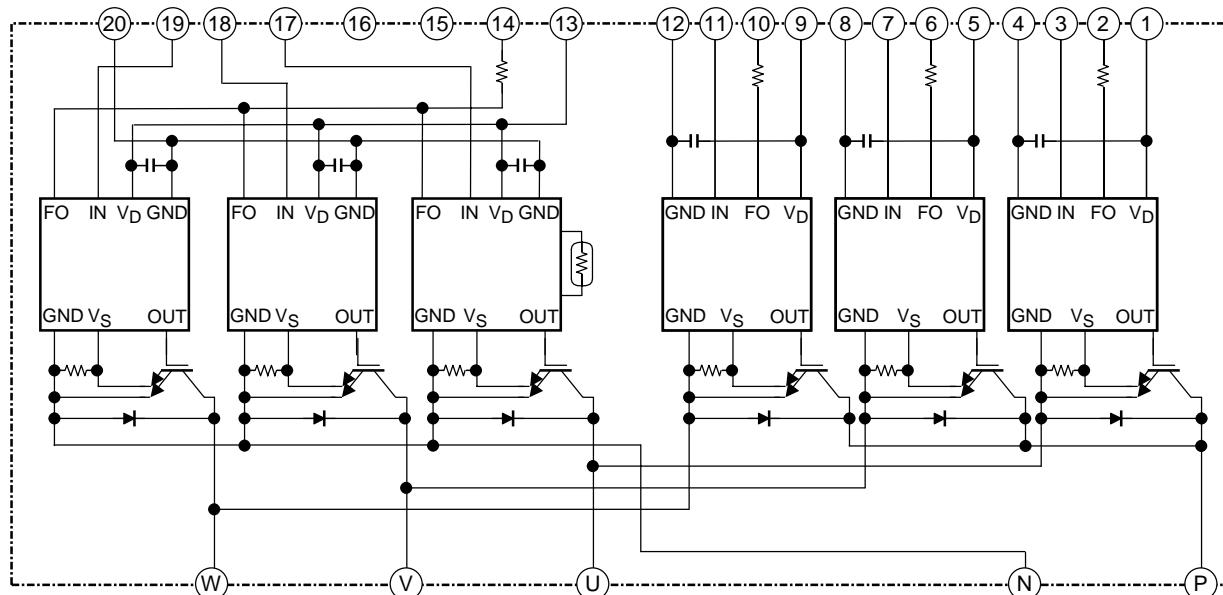
MIG150Q6CMB1X (1200V/150A 6in1)

High Power Switching Applications

Motor Control Applications

- Integrates inverter power circuits and control circuits (IGBT drive units, and units for protection against short-circuit current, overcurrent, undervoltage and overtemperature) into a single package.
- The electrodes are isolated from the case.
- Low thermal resistance
- $V_{CE}(\text{sat}) = 2.4 \text{ V (typ.)}$
- UL recognized: File No.E87989
- Weight: 385 g (typ.)

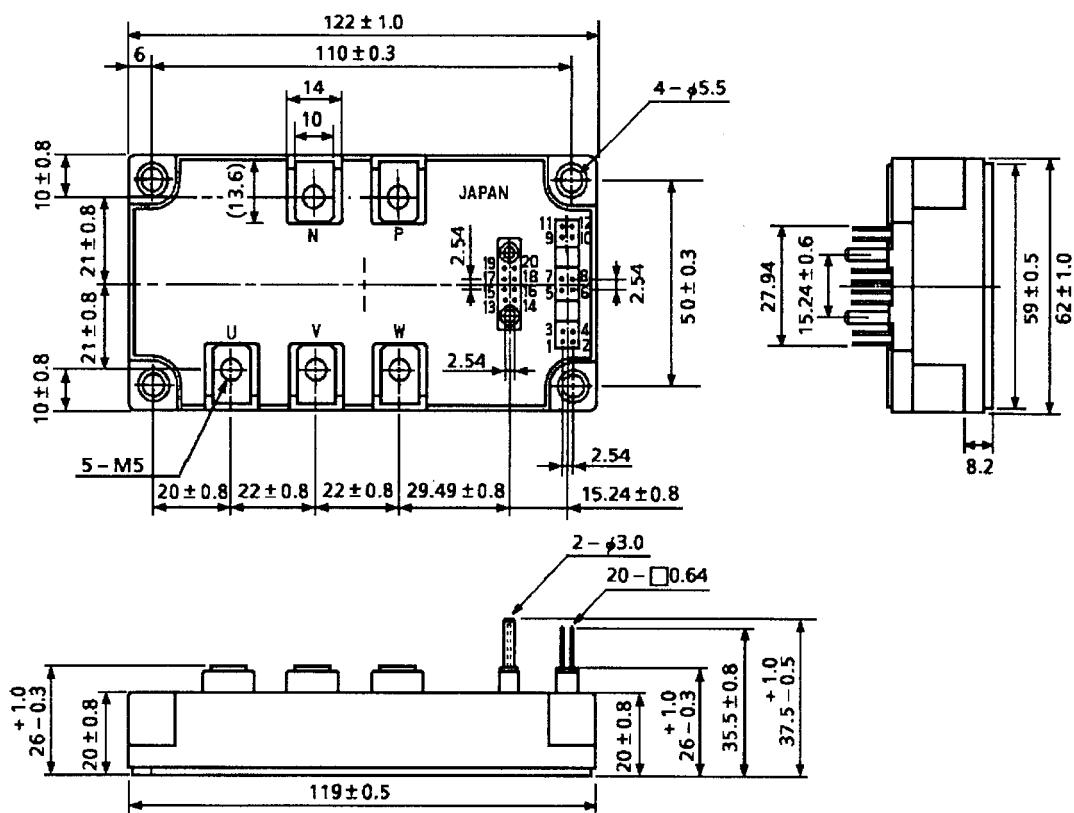
Equivalent Circuit



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

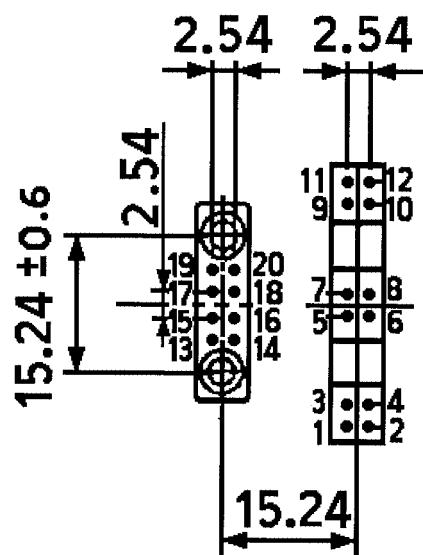
Unit: mm



- | | | | | | | |
|--------------|--------------|------------|------------|--------------|---------------|------------|
| 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. 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 ($T_j = 25^\circ\text{C}$)

Stage	Characteristics	Condition	Symbol	Rating	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	150	A
	Forward current	$T_c = 25^\circ\text{C}$, DC	I_F	150	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	P_C	1400	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 min	V_{ISO}	2500	V
	Screw torque	M5	—	3	N·m

Electrical Characteristics**1. Inverter stage**

Characteristics	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)	$V_D = 15 \text{ V}$ $I_C = 150 \text{ A}$ $V_{IN} = 15 \text{ V} \rightarrow 0 \text{ V}$	$T_j = 25^\circ\text{C}$	—	2.4	2.8	V
			$T_j = 125^\circ\text{C}$	—	2.8	—	
Forward voltage	V_F	$I_F = 150 \text{ A}$, $T_j = 25^\circ\text{C}$	—	2.4	2.8	—	V
Switching time	t_{on}	$V_{CC} = 600 \text{ V}$, $I_C = 150 \text{ A}$ $V_D = 15 \text{ V}$, $V_{IN} = 15 \text{ V} \leftrightarrow 0 \text{ V}$ $T_j = 25^\circ\text{C}$, Inductive load	(Note 1)	—	2.0	3.0	μs
	t_c (on)			—	0.6	—	
	t_{rr}			—	0.3	—	
	t_{off}			—	1.0	2.0	
	t_c (off)			—	0.3	—	

Note 1: Switching time test circuit & timing chart

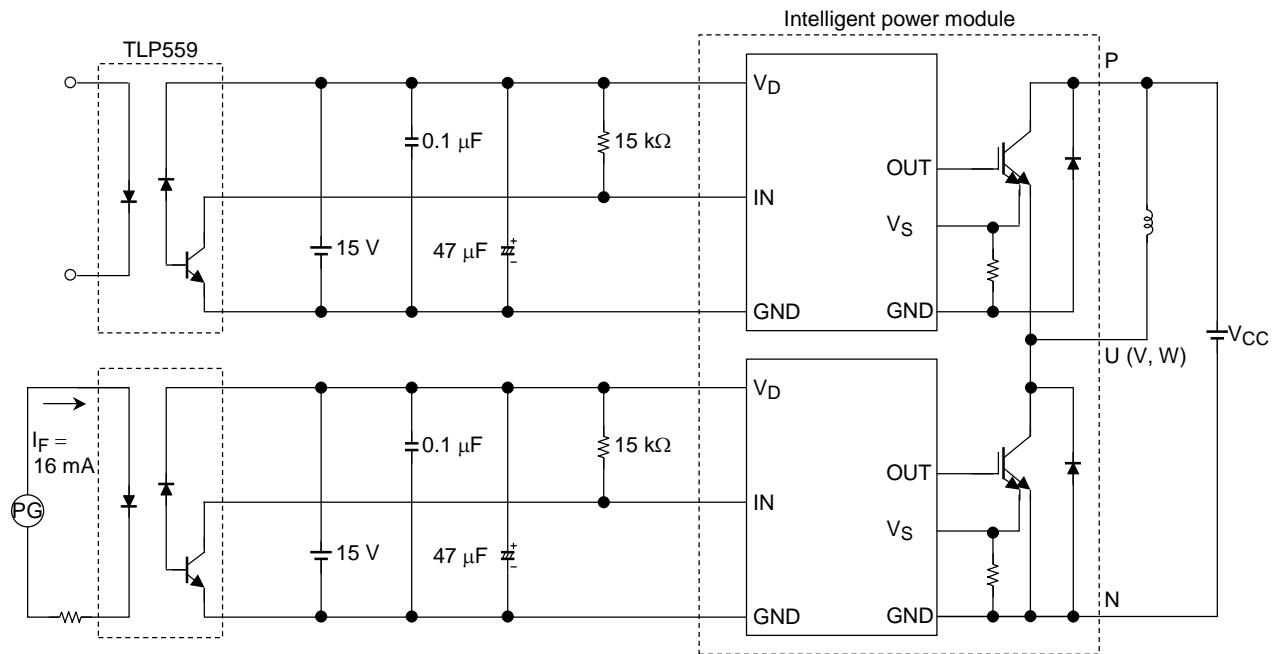
2. Control stage ($T_j = 25^\circ\text{C}$)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current	High side	$I_D(\text{H})$	$V_D = 15 \text{ V}$	—	13	17	mA
	Low side	$I_D(\text{L})$		—	39	51	
Input on signal voltage		$V_{IN}(\text{on})$	$V_D = 15 \text{ V}$	1.4	1.6	1.8	V
Input off signal voltage		$V_{IN}(\text{off})$		2.2	2.5	2.8	
Fault output current	Protection	$I_{FO}(\text{on})$	$V_D = 15 \text{ V}$	—	10	12	mA
	Normal	$I_{FO}(\text{off})$		—	—	0.1	
Overcurrent protection trip level	Inverter	OC	$V_D = 15 \text{ V}, T_j \leq 125^\circ\text{C}$	240	—	—	A
Short-circuit protection trip level	Inverter	SC	$V_D = 15 \text{ V}, T_j \leq 125^\circ\text{C}$	240	—	—	A
Overcurrent cut-off time		$t_{off}(\text{OC})$	$V_D = 15 \text{ V}$	—	5	—	μs
Overtemperature 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

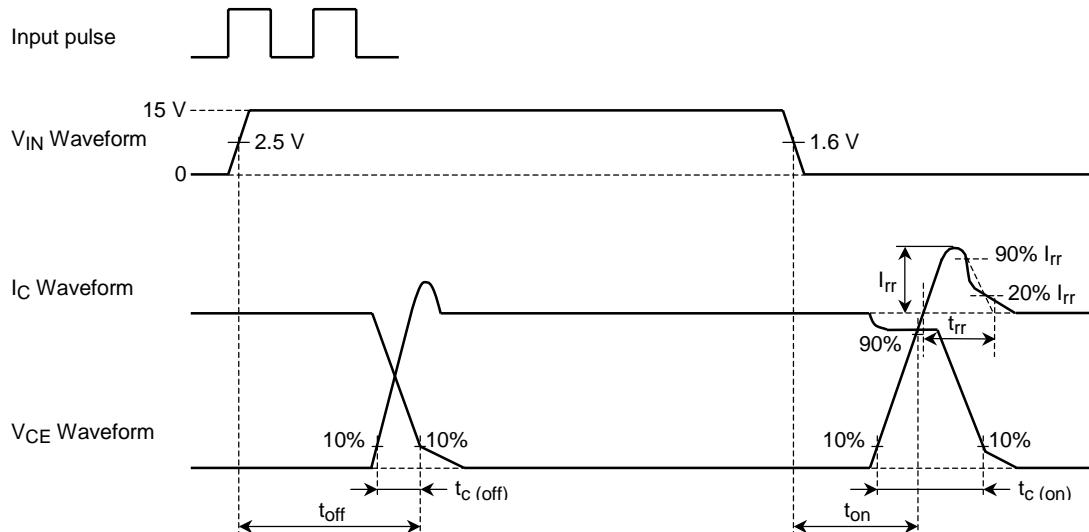
3. Thermal resistance ($T_c = 25^\circ\text{C}$)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	IGBT	—	—	—	0.089	$^\circ\text{C/W}$
		FRD		—	—	0.19	
Case to fin thermal resistance	$R_{th(c-f)}$	Compound is applied	—	0.013	—	—	$^\circ\text{C/W}$

Switching Time Test Circuit



Timing Chart

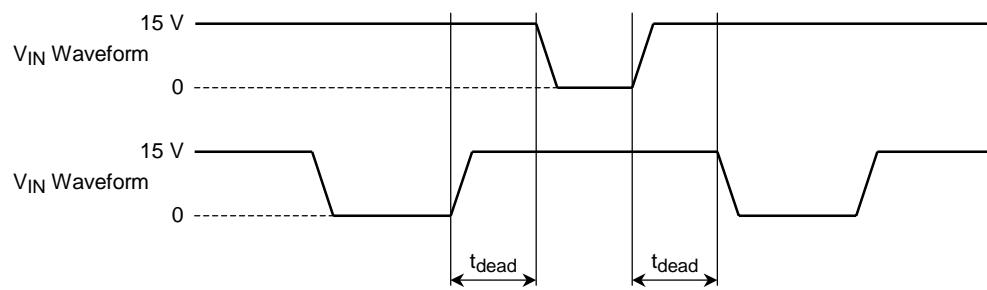


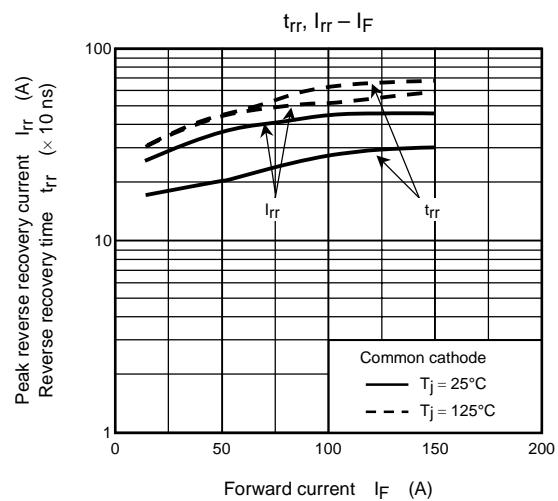
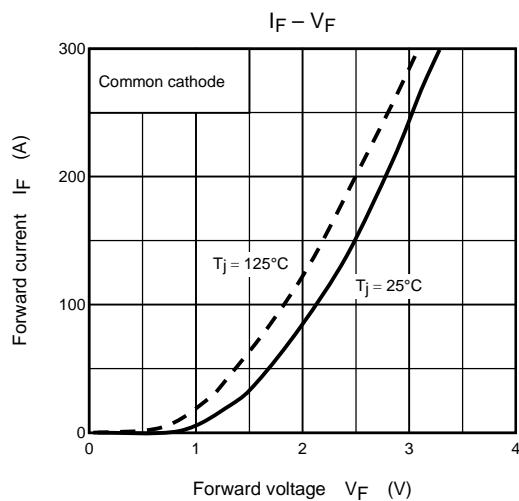
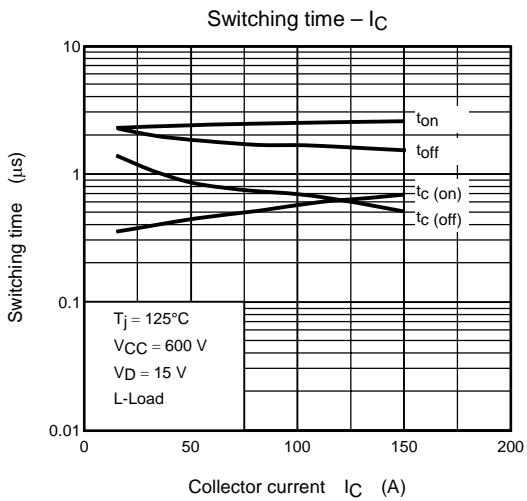
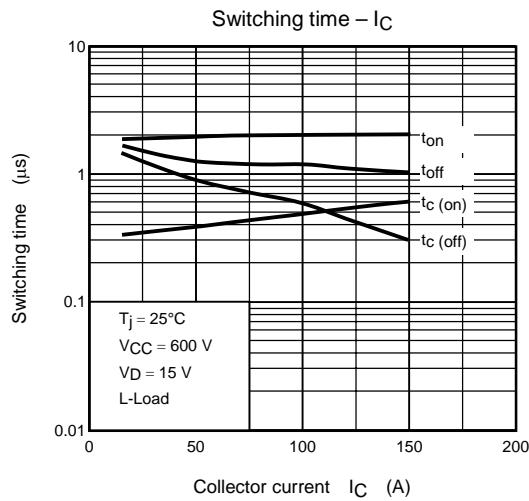
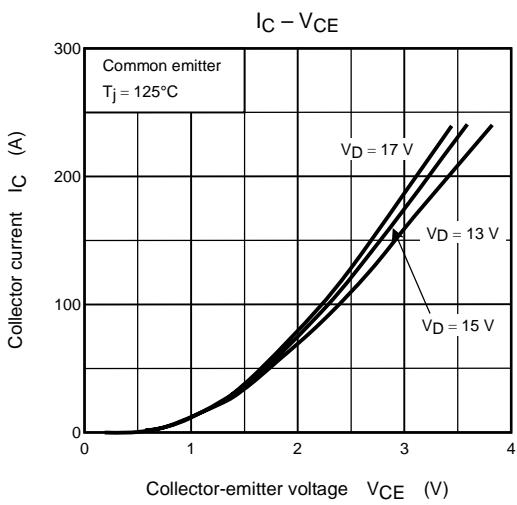
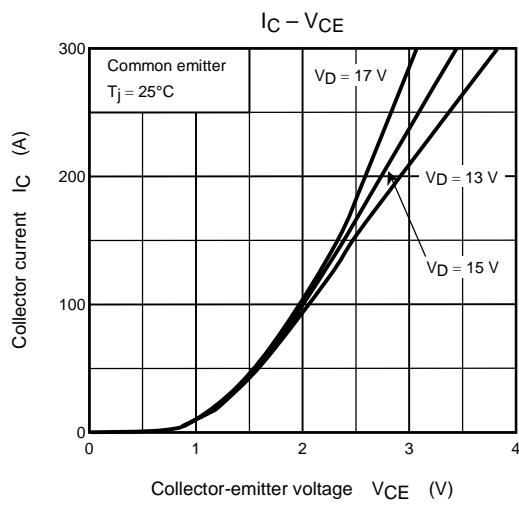
4. Recommended conditions for application

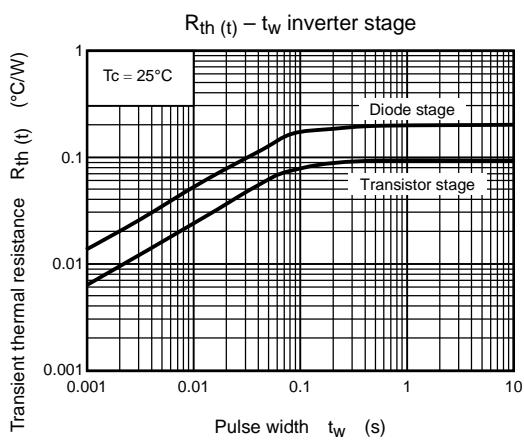
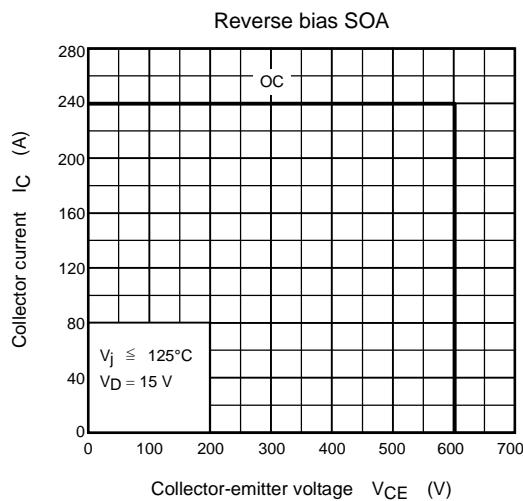
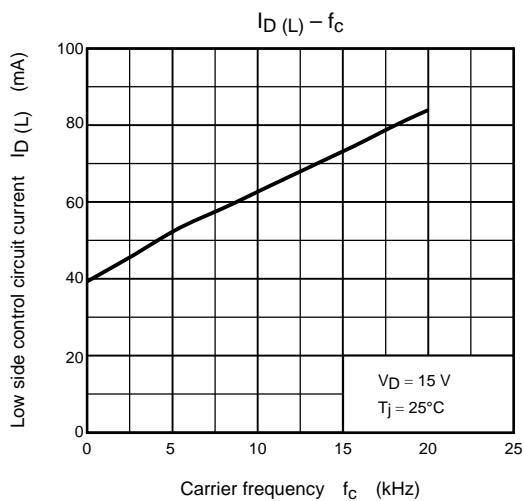
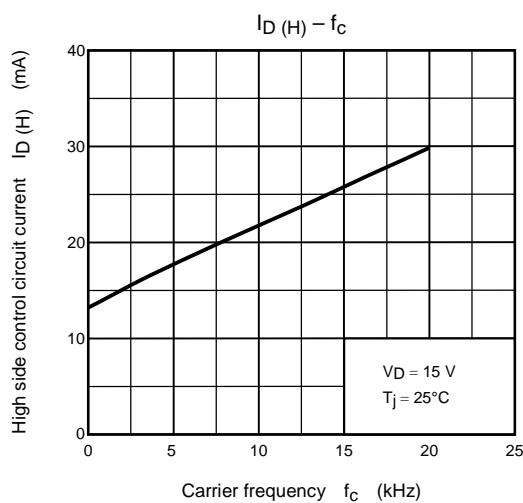
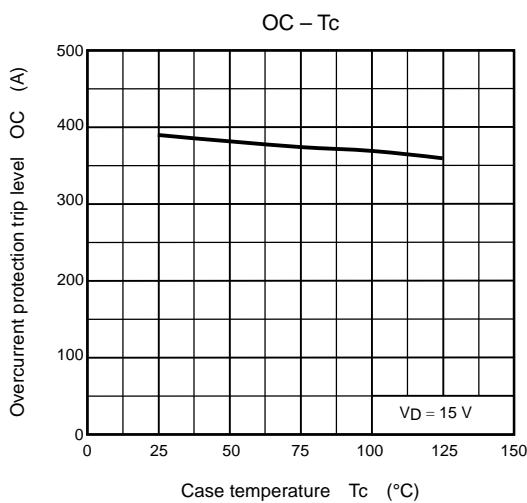
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage	V _{CC}	P-N power terminal	—	600	800	V
Control supply voltage	V _D	V _D -GND signal terminal	13.5	15	16.5	V
Carrier frequency	f _C	PWM control	—	—	20	kHz
Dead time	t _{dead}	Switching time test circuit (Note 2)	5	—	—	μs

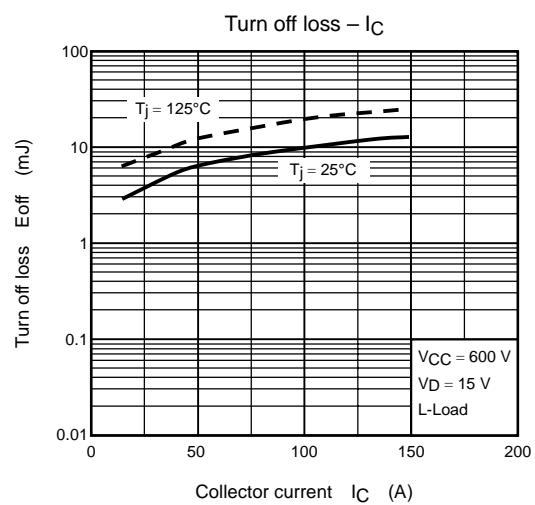
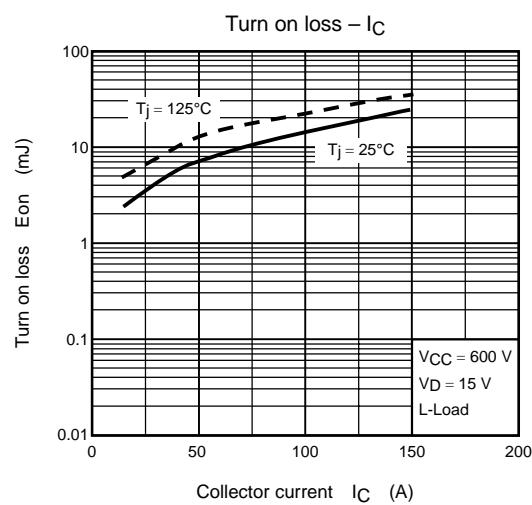
Note 2: The table lists Dead time requirements for the module input, excluding photocoupler delays. When specifying dead time requirements for the photocoupler input, please add photocoupler delays to the dead time given above.

Dead Time Timing Chart









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