

TOSHIBA Integrated IGBT Module Silicon N Channel IGBT

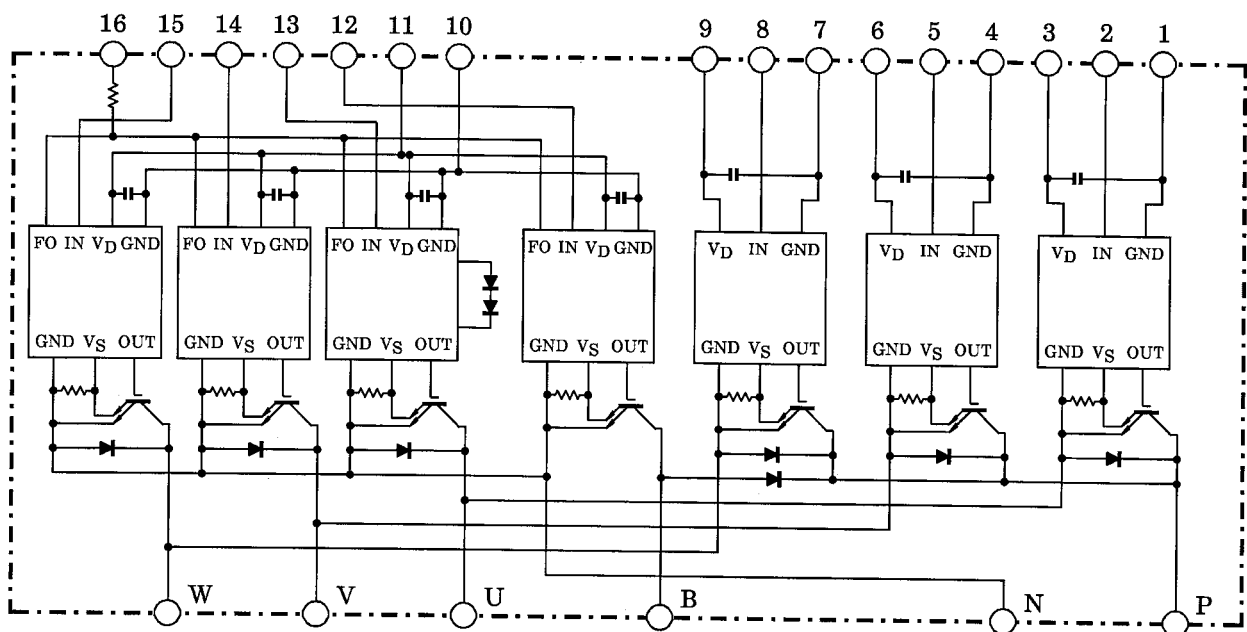
MIG150J202H

High Power Switching Applications

Motor Control Applications

- Integrates inverter, brake power circuits & control circuits (IGBT drive units, protection units for over-current, under-voltage & over-temperature) in one package.
- The electrodes are isolated from case.
- High speed type IGBT : $V_{CE(sat)} = 2.8V$ (max)
 $t_{off} = 3.0 \mu s$ (max)
 $t_{rr} = 0.30 \mu s$ (max)
- Package dimensions : TOSHIBA 2-110A1A
- Weight : 520g

Equivalent Circuit



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

Maximum Ratings ($T_j = 25^\circ\text{C}$)

Stage	Characteristic	Condition	Symbol	Ratings	Unit
Inverter	Supply voltage	P-N power terminal	V_{CC}	450	V
	Collector-emitter voltage	—	V_{CES}	600	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	320	W
	Junction temperature	—	T_j	150	$^\circ\text{C}$
Brake	Supply voltage	P-N power terminal	V_{CC}	450	V
	Collector-emitter voltage	—	V_{CES}	600	V
	Collector current	$T_c = 25^\circ\text{C}$, DC	I_C	50	A
	Reverse voltage	—	V_R	600	V
	Forward current	$T_c = 25^\circ\text{C}$, DC	I_F	50	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	P_C	120	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 (L) terminal	V_{FO}	20	V
	Fault output current	FO sink current	I_{FO}	14	mA
Module	Operating temperature	—	TC	-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	M5	—	3	N·m

Electrical Characteristics ($T_j = 25^\circ\text{C}$)

a. Inverter Stage

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	I_{CEX}	$V_{CE} = 600\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	20	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_D = 15\text{ V}$, $I_C = 150\text{ A}$ $V_{IN} = 15\text{ V} \rightarrow 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.2	2.8	V
			$T_j = 125^\circ\text{C}$	—	2.3	—	
Forward voltage	V_F	$I_F = 150\text{ A}$	—	2.5	3.5	V	
Switching time	t_{on}	$V_{CC} = 300\text{ V}$, $I_C = 150\text{ A}$ $V_D = 15\text{ V}$, $V_{IN} = 15\text{ V} \leftrightarrow 0\text{ V}$ Inductive load (Note 1)	—	1.2	2.0	μs	
	t_{off}		—	2.0	3.0		
	t_f		—	0.25	0.5		
	t_{rr}		—	0.1	0.3		

b. Brake Stage

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	I_{CEX}	$V_{CE} = 600V$	$T_j = 25^\circ C$	—	—	1	mA
			$T_j = 125^\circ C$	—	—	20	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_D = 15V, I_C = 50A$ $V_{IN} = 15V \rightarrow 0V$	$T_j = 25^\circ C$	—	2.0	3.0	V
			$T_j = 125^\circ C$	—	2.0	—	
Reverse current	I_R	$V_R = 600V$	$T_j = 25^\circ C$	—	—	1	mA
			$T_j = 125^\circ C$	—	—	20	
Forward voltage	V_F	$I_F = 50A$	—	2.2	2.5	V	
Switching time	t_{on}	$V_{CC} = 300V, I_C = 50A$ $V_D = 15V, V_{IN} = 15V \leftrightarrow 0V$ Inductive load (Note 1)	—	1.0	2.0	μs	
	t_{off}		—	2.0	3.0		
	t_f		—	0.25	0.5		
	t_{rr}		—	0.15	0.3		

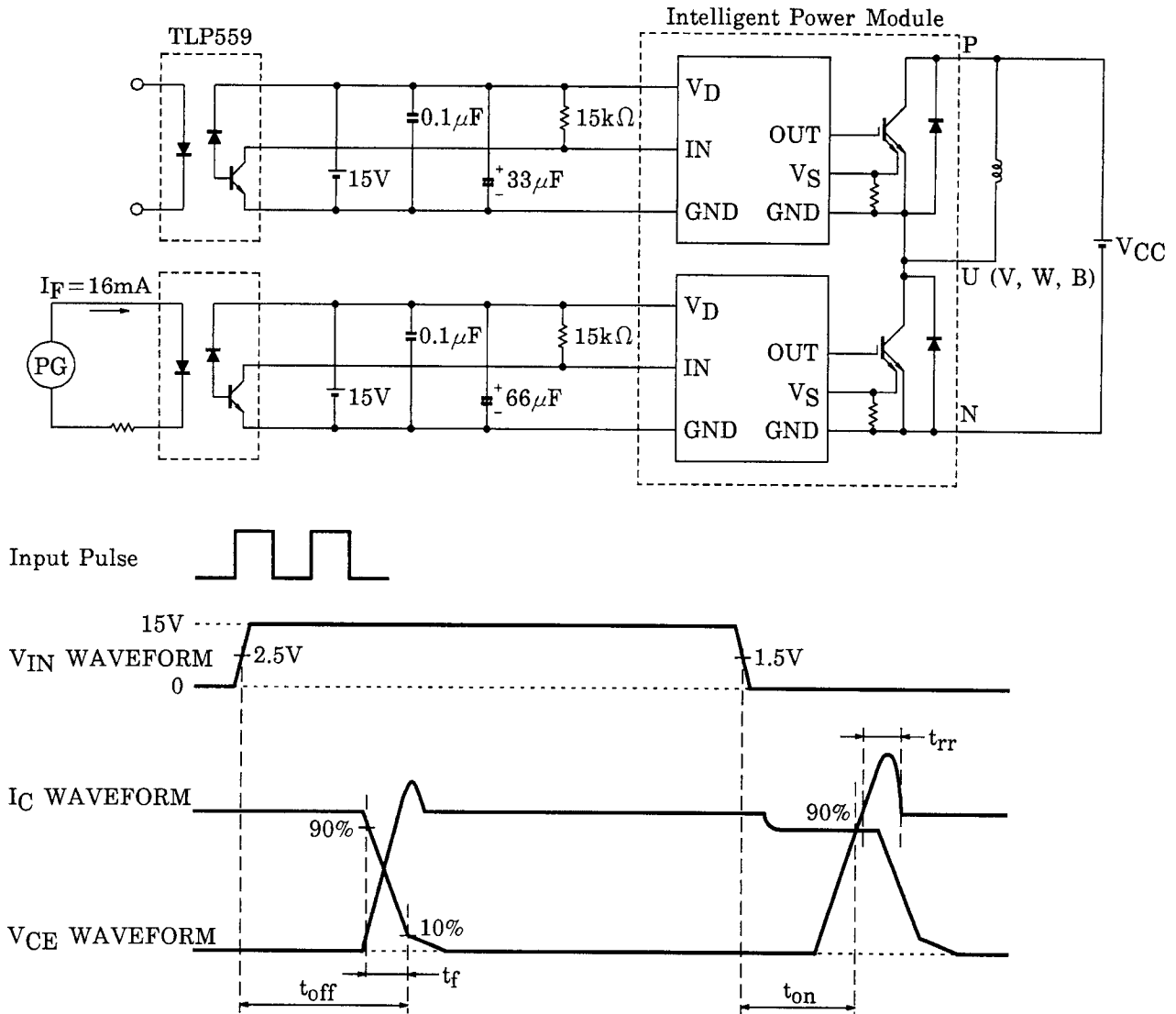
c. Control Stage ($T_j = 25^\circ C$)

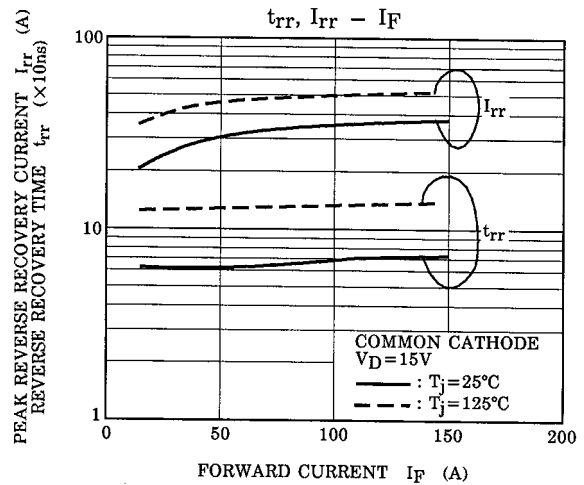
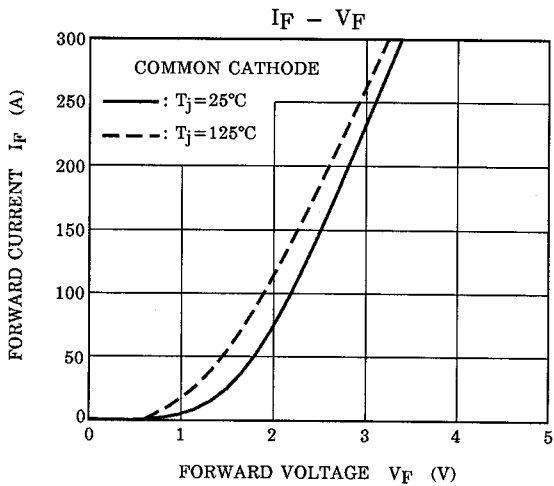
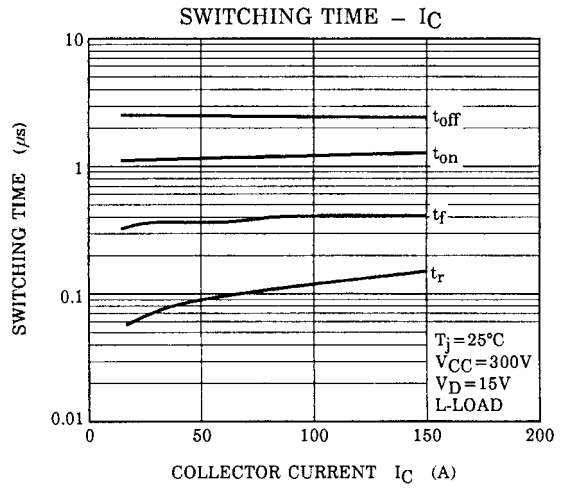
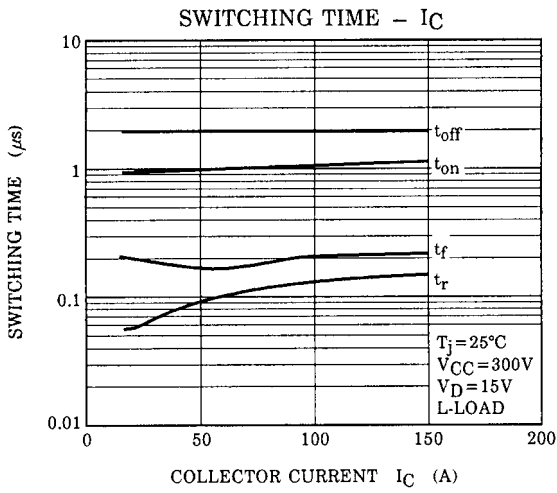
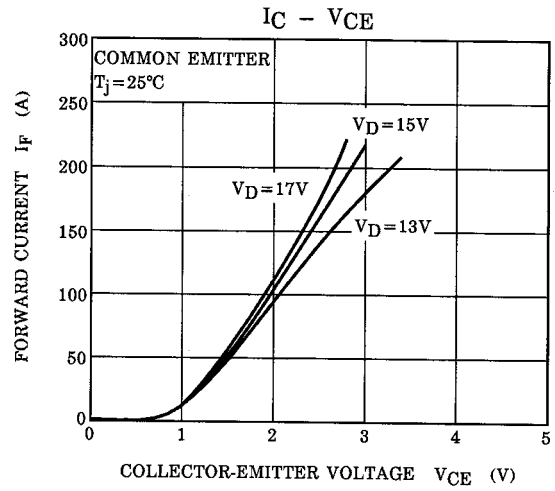
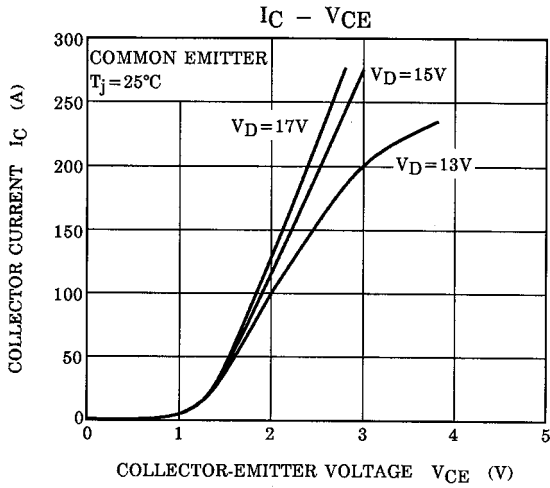
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit	
Control circuit current	High side	$V_D = 15V$	—	8	—	mA	
	Low side		$I_D(L)$	—	32		—
Input-on signal voltage	$V_{IN(on)}$	$V_D = 15V, I_C = 150mA$	1.3	1.5	1.7	V	
Input-off signal voltage	$V_{IN(off)}$	$V_D = 15V, I_C = 150mA$	2.2	2.5	2.8	V	
Fault output current	Protection	$V_D = 15V$	$I_{FO(on)}$	8	10	12	mA
	Normal		$I_{FO(off)}$	—	—	1	
Over current protection trip level	Inverter	$V_D = 15V, T_j = 125^\circ C$	OC	190	300	—	A
	Brake			60	—	—	
Short current protection trip level	Inverter	$V_D = 15V, T_j = 125^\circ C$	SC	285	450	—	A
	Brake			90	—	—	
Over current cut-off time	$t_{off(OC)}$	$V_D = 15V$	—	5	—	μs	
Over temperature protection	Trip level	Case temperature	OT	110	118	125	$^\circ C$
	Reset level			OTr	—	98	
Control supply under voltage protection	Trip level	—	UV	11.0	12.0	12.5	V
	Reset level			UVr	—	12.5	
Fault output pulse width	t_{FO}	$V_D = 15V$	1	2	3	ms	

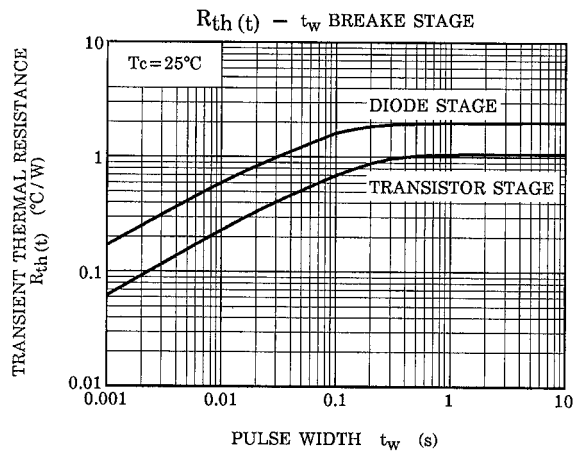
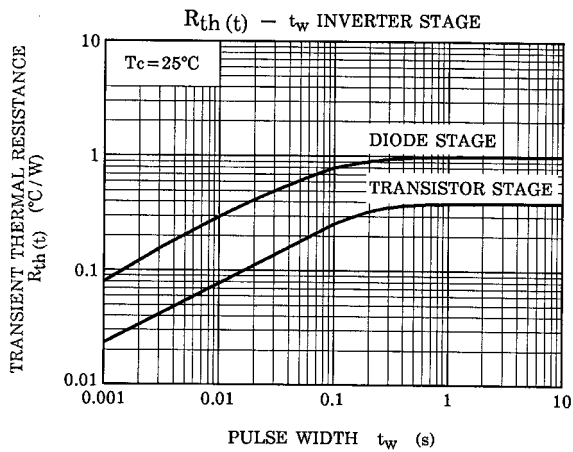
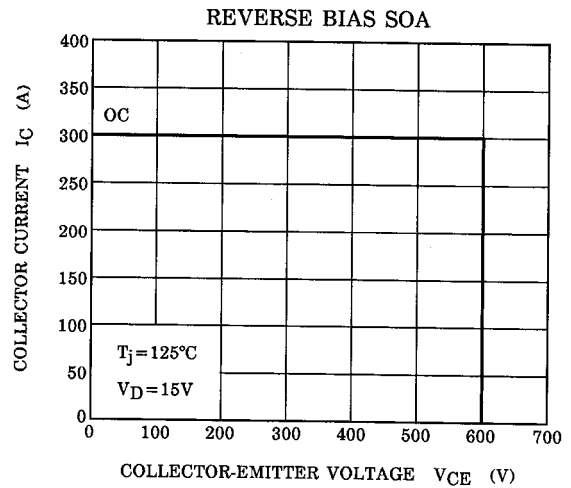
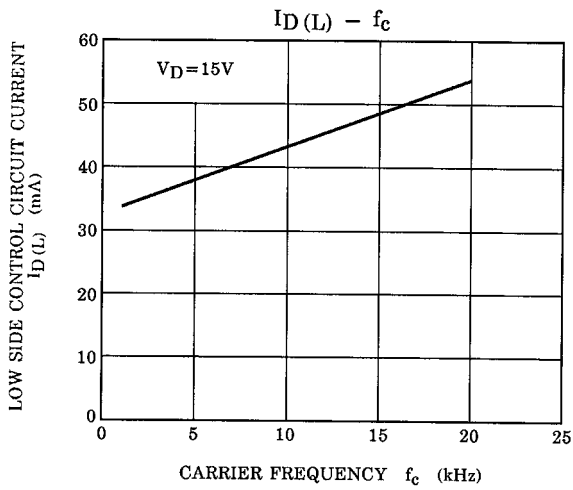
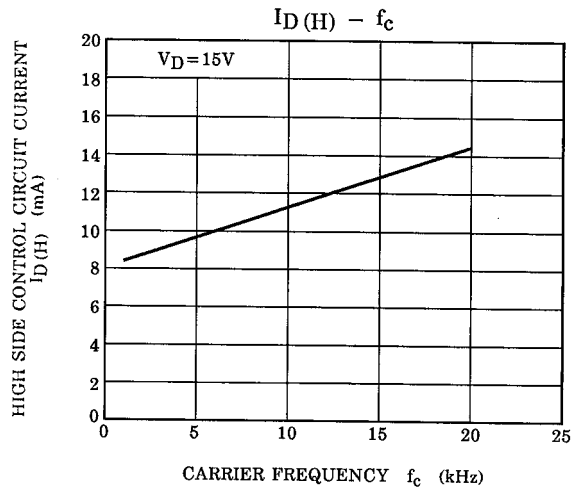
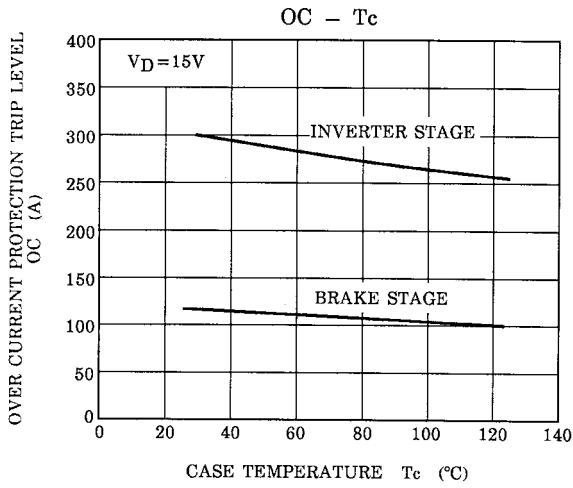
d. Thermal Resistance ($T_j = 25^\circ\text{C}$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	Inverter IGBT	—	—	0.390	$^\circ\text{C/W}$
		Inverter FRD	—	—	1.041	
		Brake IGBT	—	—	1.041	
		Brake FRD	—	—	2.000	
Case to fin thermal resistance	$R_{th(c-f)}$	Compound is applied	—	0.05	—	$^\circ\text{C/W}$

Note 1 : Switching time test circuit & timing chart







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