

TOSHIBA Intelligent Power Module Silicon N Channel IGBT

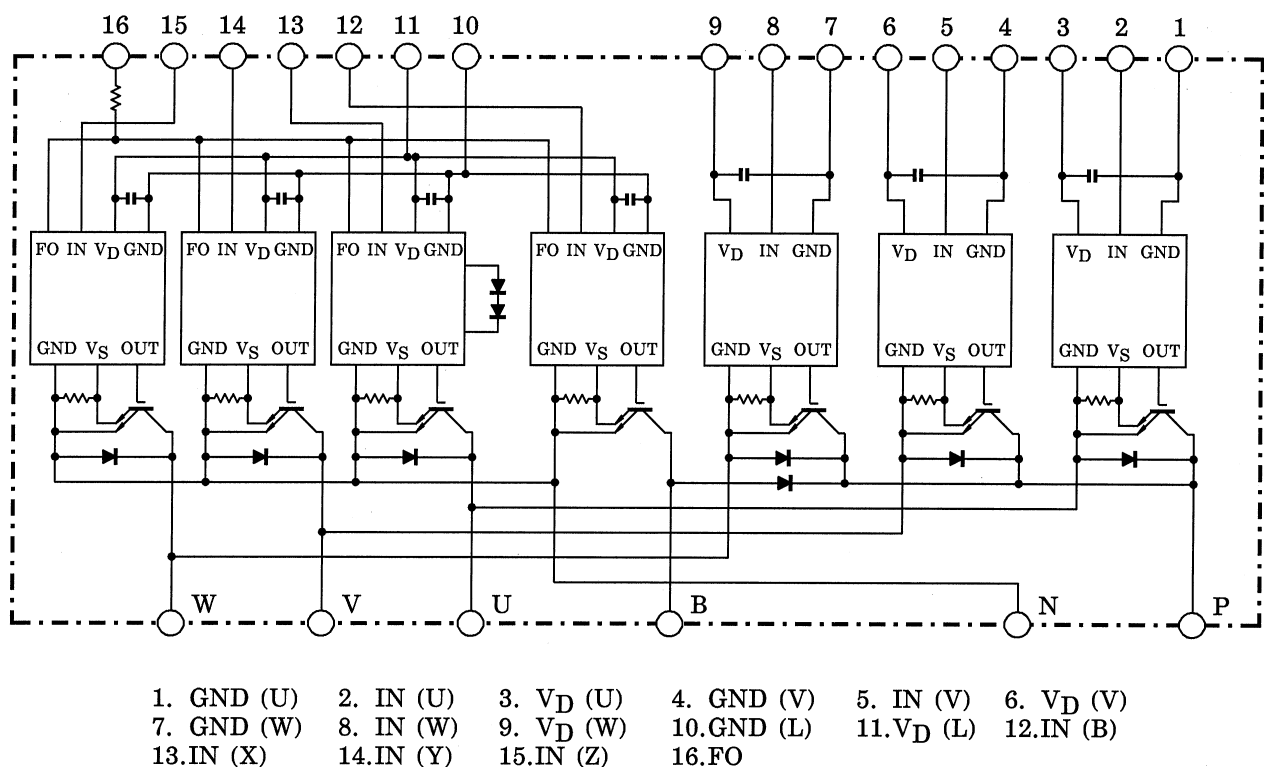
MIG50Q201H

High Power Switching Applications

Motor Control Applications

- Integrates inverter, brake power circuits & control circuits (IGBT drive units, protection units for over-current, realtime-current-control (RTC), under-voltage & over-temperature) in one package.
- The electrodes are isolated from case.
- High speed type IGBT : $V_{CE(sat)} = 3.5 \text{ V (Max.)}$
 $t_{off} = 2.6 \mu\text{s (Max.)}$
 $t_{rr} = 0.21 \mu\text{s (Max.)}$
- Outline : 2-110A1A
- Weight : 520 g

Equivalent Circuit



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

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	300	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	25	A
	Reverse voltage	—	V_R	1200	V
	Forward current	$T_c = 25^\circ\text{C}$, DC	I_F	25	A
	Collector power dissipation	$T_c = 25^\circ\text{C}$	P_C	140	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	—	T_C	$-20 \sim +100$	$^\circ\text{C}$
	Storage temperature range	—	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$
	Isolation voltage	AC 1 minute	V_{ISO}	2500	V
	Screw torque	M5	—	3	Nm

Electrical Characteristics

a. 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	$V_{CE(sat)}$	$V_D = 15\text{V}$, $I_C = 50\text{A}$ $V_{IN} = 15\text{V} \rightarrow 0\text{V}$	$T_j = 25^\circ\text{C}$	—	2.6	3.5	V
			$T_j = 125^\circ\text{C}$	—	2.5	—	
Forward voltage	V_F	$I_F = 50\text{A}$		—	2.0	2.8	V
Switching time	t_{on}	$V_{CC} = 600\text{V}$, $I_C = 50\text{A}$ $V_D = 15\text{V}$, $V_{IN} = 15\text{V} \leftrightarrow 0\text{V}$ Inductive load (Note 1)		—	1.0	1.7	μs
	$t_{c(on)}$			—	0.4	0.8	
	t_{rr}			—	0.16	0.21	
	t_{off}			—	1.9	2.6	
	$t_{c(off)}$			—	0.35	0.6	

b. Brake Stage

Characteristic	Symbol	Test Condition		Min	Typ.	Max	Unit
Collector cut-off current	I_{CEX}	$V_{CE} = 1200V$	$T_j = 25^{\circ}C$	—	—	1	mA
			$T_j = 125^{\circ}C$	—	—	10	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_D = 15V$, $I_C = 25A$ $V_{IN} = 15V \rightarrow 0V$	$T_j = 25^{\circ}C$	—	2.6	3.5	V
			$T_j = 125^{\circ}C$	—	2.5	—	
Reverse current	I_R	$V_R = 1200V$		—	—	1	mA
				—	—	10	
Forward voltage	V_F	$I_F = 25A$		—	1.4	2.2	V
Switching time	t_{on}	$V_{CC} = 600V$, $I_C = 25A$ $V_D = 15V$, $V_{IN} = 15V \leftrightarrow 0V$ Inductive load (Note 1)		—	1.3	1.9	μs
	$t_c(on)$			—	0.85	1.6	
	t_{rr}			—	0.42	0.50	
	t_{off}			—	1.9	2.6	
	$t_c(off)$			—	0.3	0.6	

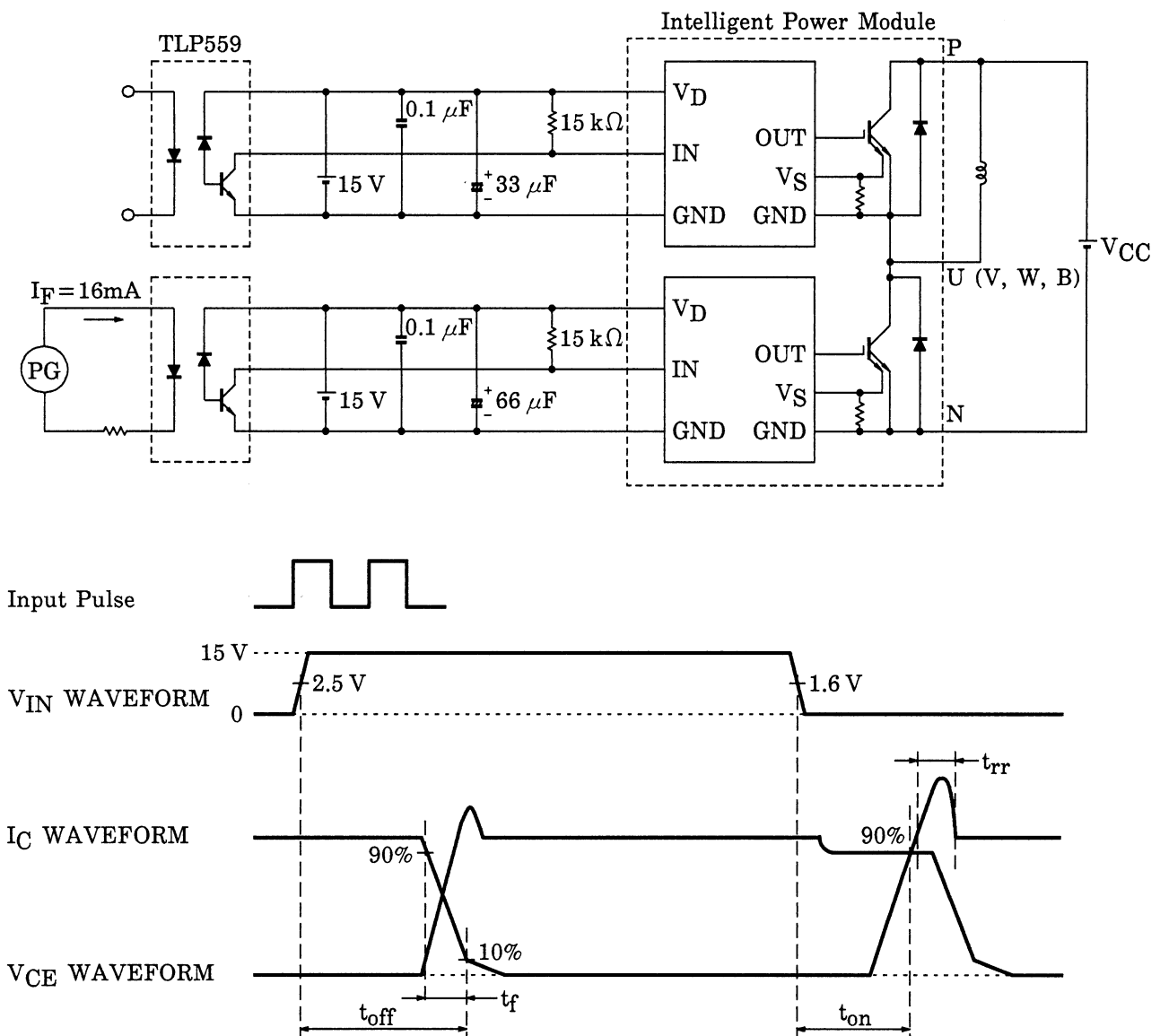
c. Control Stage ($T_j = 25^{\circ}C$)

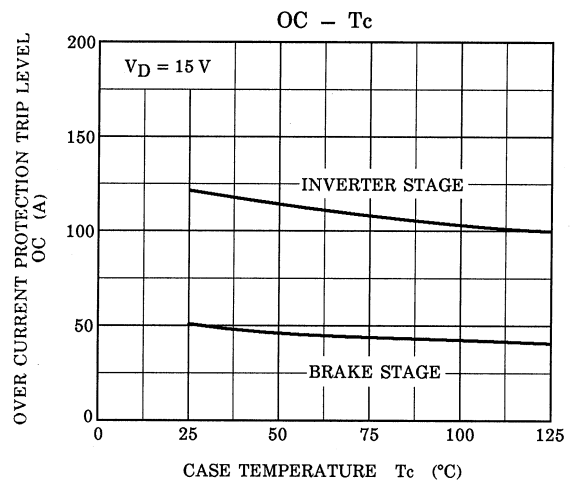
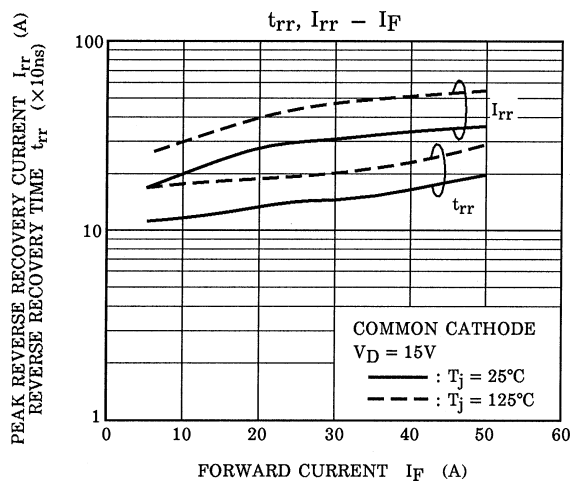
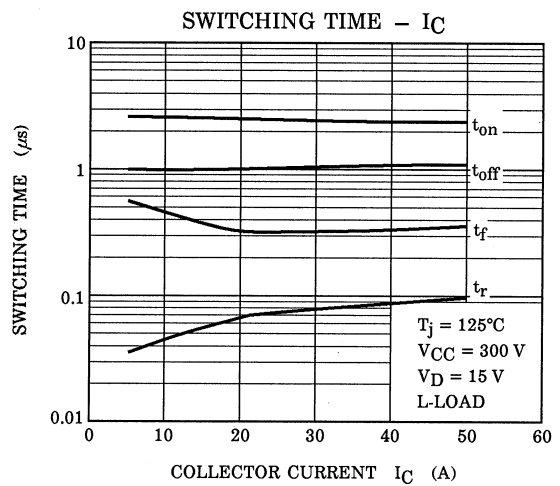
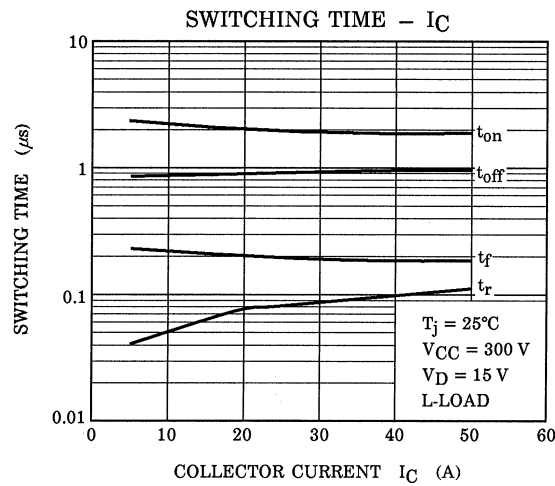
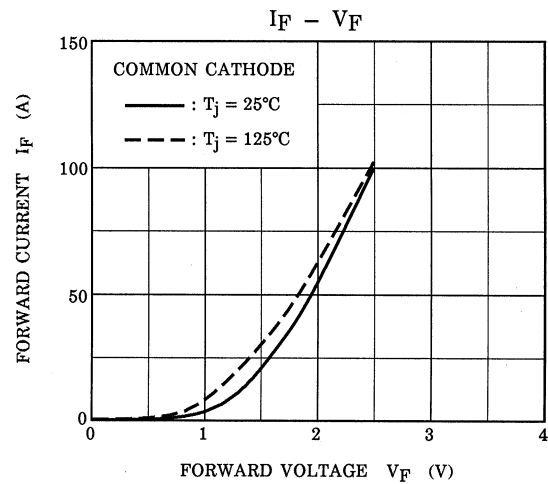
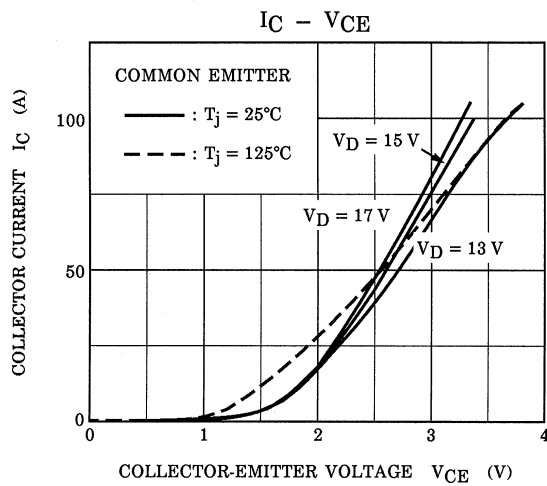
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Control circuit current	High side	$I_D(H)$	$V_D = 15V$	—	8	12	mA
	Low side	$I_D(L)$		—	32	48	
Input-on signal voltage		$V_{IN(on)}$	$V_D = 15V$, $I_C = 50mA$	1.4	1.6	1.8	V
Input-off signal voltage		$V_{IN(off)}$	—	2.2	2.5	2.8	V
Fault output current	Protection	$I_{FO(on)}$	$V_D = 15V$	5.4	6.0	6.6	mA
	Normal	$I_{FO(off)}$		—	—	0.1	
Over current protection trip level	Inverter	OC	$V_D = 15V$, $T_j = 125^{\circ}C$	85	100	—	A
	Brake			40	50	—	
Short circuit protection trip level	Inverter	SC	$V_D = 15V$, $T_j = 125^{\circ}C$	120	150	—	A
	Brake			60	75	—	
Over current cut-off time		$t_{off(OC)}$	$V_D = 15V$	—	5	—	μs
Over temperature protection	Trip level	OT	Case temperature	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		12.0	12.5	13.0	
Fault output pulse width		t_{FO}	$V_D = 15V$	1	2	3	ms

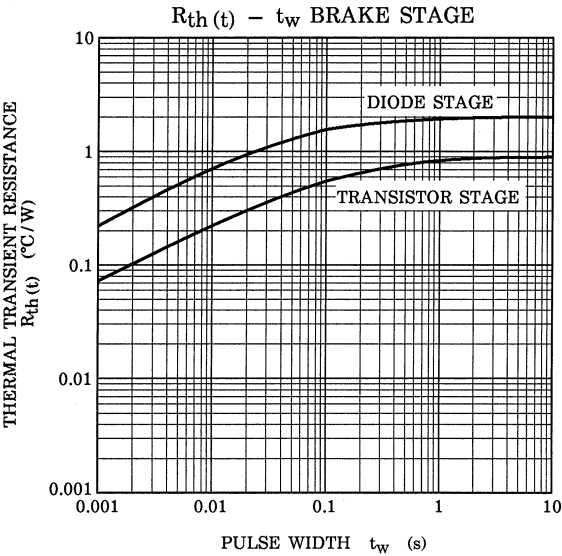
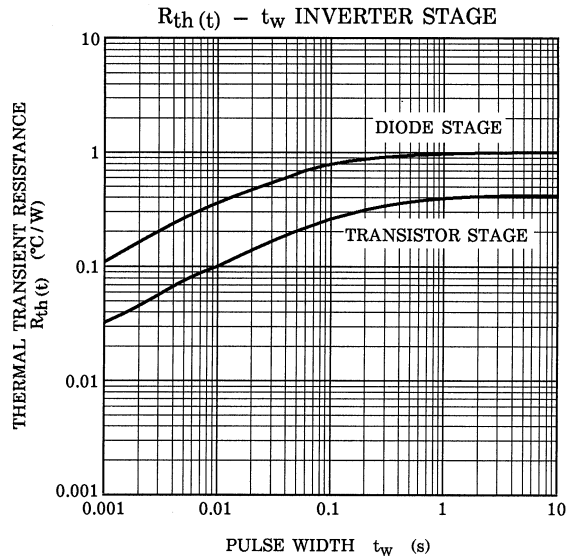
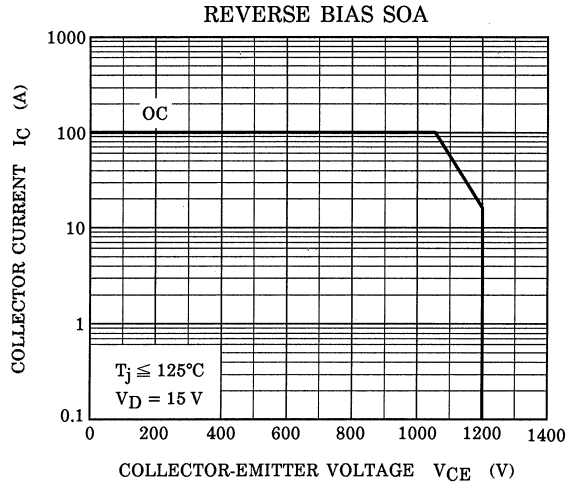
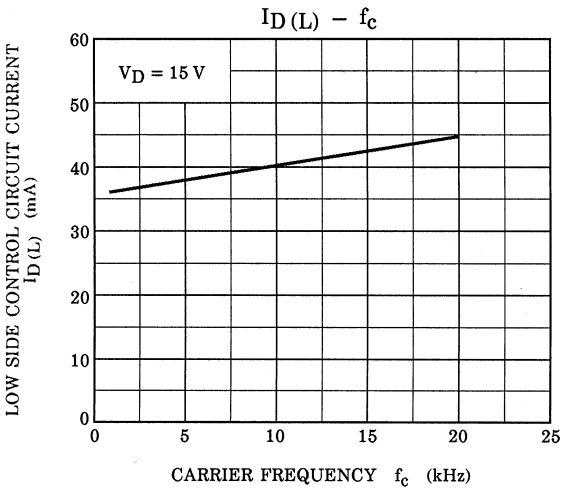
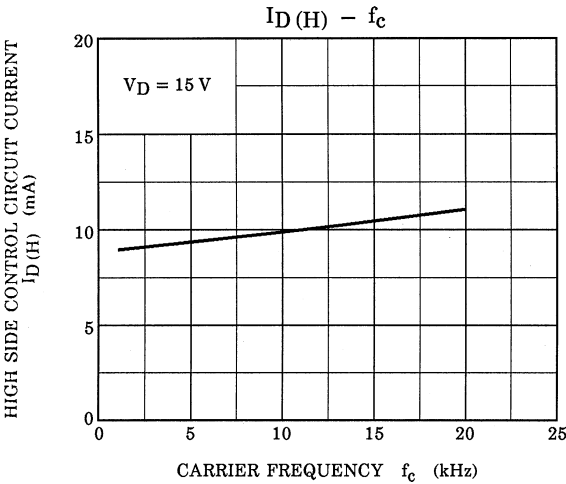
d. Thermal Resistance ($T_j = 25^\circ\text{C}$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	Inverter IGBT stage	—	—	0.417	$^\circ\text{C} / \text{W}$
		Inverter FRD stage	—	—	1.000	
		Brake IGBT stage	—	—	0.892	
		Brake FRD stage	—	—	2.000	
Case to fin thermal resistance	$R_{th(c-f)}$	Compound is applied	—	0.05	—	$^\circ\text{C} / \text{W}$

Note 1: Switching time test circuit & timing chart







Unit: mm



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