XC2164 series is Discontinued.

XC2164 Series

TOREX

ETR14004_005a

ICs for use with Crystal Oscillators

■GENERAL DESCRIPTION

The XC2164 series are high frequency, low current consumption CMOS ICs with built-in crystal oscillator and divider circuits. For fundamental oscillation, output is selectable from any one of the following values for f0: f0/1, f0/2, f0/4, and f0/8. With oscillation capacitors and a feedback resistor built-in, it is possible to configure a stable fundamental oscillator or 3rd overtone oscillator using only an external crystal. Also the series has stand-by function built-in and the type, which suspends the oscillation completely (XC2164A~D type) or the type suspends only an output (XC2164K~N type) are available. The XC2164 series are integrated into SOT-26 package.

■APPLICATIONS

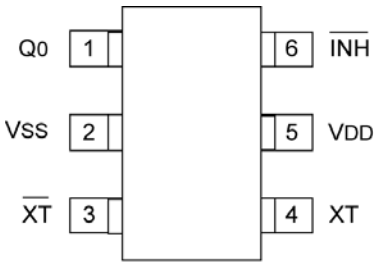
- Crystal oscillation modules
- Clocks for micro computer, DSPs
- Communication equipment
- Various system clocks

■FEATURES

Oscillation Frequency : 4MHz ~ 30MHz (Fundamental)
20MHz ~ 125MHz (3rd Overtone)
Divider Ratio : f0/1, f0/2, f0/4,f0/8(Fundamental)
f0/1(3rd Overtone)
: 3-State
Output : 3.3V±10%, 5.0V±10%
Operating Voltage Range : Stand-by function included
Low Power Consumption Selectable from Chip Enable type and Output Enable type

CMOS
Built-in Oscillation Feedback Resistor
Built- in Oscillation Capacitors Cg, Cd
Operating Ambient Temperature : - 40℃ ~ + 85℃
Package : SOT-26
Environmentally Friendly : EU RoHS Compliant, Pb Free

■PIN CONFIGURATION



SOT-26
(TOP VIEW)

■PIN ASSIGNMENT

PIN NUMBER	PIN NAME	FUNCTION
1	Q_0	Clock Output
2	V_{SS}	Ground
3	/XT	Crystal Oscillator Connection (Output)
4	XT	Crystal Oscillator Connection (Input)
5	V_{DD}	Power Supply
6	/INH	Stand-by Control*

*Stand-by control pin has a pull-up resistor built-in.

■/INH, Q_0 PIN FUNCTION

$/I_{NH}$	Q_0
“H” or OPEN	Clock Output
“L”	High impedance

H = High level
L = Low level

■ PRODUCT CLASSIFICATION

●Ordering Information

XC2164 ①②③④⑤⑥-⑦(*1)

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Divider Ratio & Stand-by mode	A	Chip Enable: f0/1
		B	Chip Enable: f0/2(Fundamental only)
		C	Chip Enable: f0/4(Fundamental only)
		D	Chip Enable: f0/8(Fundamental only)
		K	Output Enable: f0/1
		L	Output Enable: f0/2 (Fundamental only)
		M	Output Enable: f0/4 (Fundamental only)
		N	Output Enable: f0/8(Fundamental only)
②③	Duty Level	51	CMOS (V_{DD}/2) *TTL: Fundamental 4MHz to 30MHz
④	Frequency Range & Rf, Cg, Cd Values	(Table 1)	3rd Overtone, built-in type
		(Table 2)	Fundamental, built-in type
⑤⑥-⑦(*1)	Packages (Order Unit)	MR	SOT-26(3,000/Reel)
		MR-G	SOT-26(3,000/Reel)

(*1) The “-G” suffix denotes Halogen and Antimony free as well as being fully RoHS compliant.

Table 1: 3rd Overtone, Built-In Type

SYMBOL	FREQUENCY RANGE		Rf (kΩ)	Cg (pF)	Cd (pF)
	3.3V ±10%	5.0V ±10%			
A	—	20MHz to 30MHz	9.0	21.5	21.5
B	20MHz to 30MHz	30MHz to 40MHz	6.5	20.0	20.0
C	30MHz to 40MHz	40MHz to 50MHz	5.0	16.0	16.0
D	40MHz to 50MHz	50MHz to 65MHz	3.5	14.0	14.0
E	50MHz to 65MHz	65MHz to 80MHz	2.8	12.5	12.5
F	65MHz to 80MHz	80MHz to 95MHz	2.5	10.0	10.0
H	80MHz to 95MHz	95MHz to 110MHz	2.2	8.0	8.0
K	95MHz to 110MHz	110MHz to 125MHz	2.0	7.0	7.0
L	110MHz to 125MHz	—	2.3	5.5	5.5

Table 2: Fundamental, Built-In Type

SYMBOL	FREQUENCY RANGE		Rf (kΩ)	Cg (pF)	Cd (pF)
	3.3V ±10%	5.0V ±10%			
M, V	4MHz to 30MHz	4MHz to 30MHz	3.5/7.0	20.0	20.0
T	4MHz to 30MHz	4MHz to 30MHz	3.5/7.0	35.0	35.0

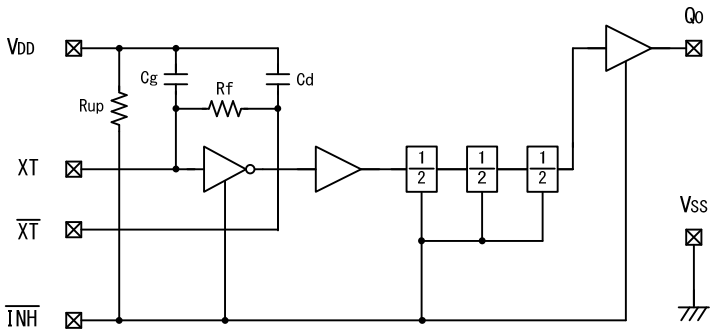
(*)Rf = 3.5MΩ@V_{DD} = 5.0V Operation
Rf = 7.0 MΩ@V_{DD} =3.3V Operation

Comparative Chart of Oscillation Frequency vs. Supply Voltage, and Negative Resistance Value

SYMBOL	OSCILLATION FREQUENCY vs. SUPPLY VOLTAGE		NEGATIVE RESISTANCE VALUE	
	V_{DD}=3.3V±10%	V_{DD}=5.0V±10%	V_{DD}=3.3V	V_{DD}=5.0V
M	±4.3ppm	±4.5ppm	- 130Ω	- 220Ω
V	±1.2ppm	±2.1ppm	- 150Ω	- 250Ω
T	±9.4ppm	±7.0ppm	- 660Ω	- 760Ω

(The designed value when 30MHz crystal is used.)

■BLOCK DIAGRAM



■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	UNITS
Supply Voltage	V_{DD}	V_{SS} - 0.3 ~ V_{SS} + 7.0	V
Input Voltage	V_{IN}	V_{SS} - 0.3 ~ V_{DD} + 0.3	V
Power Dissipation	Pd	250	mW
		600(PCB mounted)*1	
Operating Ambient Temperature	Topr	- 40 ~ + 85	℃
Storage Temperature	Tstg	- 55 ~ + 125	℃

(*) The power dissipation figure shown is PCB mounted and is for reference only. Please refer to page 19 for details.

■ELECTRICAL CHARACTERISTICS

XC2164x51Vx DC DC Electrical Characteristics

5.0V
●Recommended Operating Condition

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP.	MAX.	UNITS
Operating Voltage	V_{DD}		4.5	5.0	5.5	V
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V
Operating Ambient Temperature	Topr		-30		+80	℃

(unless otherwise stated, V_{DD}=5.0V, No Load, Ta=-30 ～ +80℃)
fosc=4MHz to 30MHz (Fundamental)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
"H" Level Input Voltage	V_{IH}	/I_{NH} Pin	2.4			V	1
"L" Level Input Voltage	V_{IL}	/I_{NH} Pin			0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 4.5V, I_{OH}=-16mA	3.9	4.2		V	2
"L" Level Output Voltage	V_{OL}	CMOS : 4.5V, I_{OH}=16mA		0.3	0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open, f=30MHz		{E1}		mA	3
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open, f=30MHz		{E2-1}		{E2-2}	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'	0.5	1.0	2.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}	25	50	100	kΩ	4
Internal Oscillation Capacitance	Cg			35(*)		pF	-
	Cd			35(*)		pF	-
Internal Oscillation Feedback Resistance	Rf			3.5		MΩ	5
Output Disable Leakage Current	Ioz	/I_{NH}='L', V_{OH}=5.0V			10	μA	6

(*)Design Value

3.3V
●Recommended Operating Condition

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating Voltage	V_{DD}		2.50	3.30	3.63	V
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V
Operating Ambient Temperature	Topr		-30		+80	℃

(unless otherwise stated, V_{DD}=3.3V, No Load, Ta=-30～+80℃)
fosc=4MHz to 30MHz (Fundamental)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
"H" Level Input Voltage	V_{IH}	/I_{NH} Pin	2.4			V	1
"L" Level Input Voltage	V_{IL}	/I_{NH} Pin			0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 2.97V, I_{OH}=-8mA	2.5			V	2
"L" Level Output Voltage	V_{OL}	CMOS : 2.97V, I_{OH}=8mA			0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open, f=30MHz		{E3}		mA	3
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open, f=30MHz		{E4-1}		{E4-2}	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'	1.0	2.0	4.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}	35	70	140	kΩ	4
Internal Oscillation Capacitance	Cg			35 (*)		pF	-
	Cd			35 (*)		pF	-
Internal Oscillation Feedback Resistance	Rf			7.0		MΩ	5
Output Disable Leakage Current	Ioz	/I_{NH}='L', V_{OH}=3.3V			10	μA	6

(*)Design Value

■ELECTRICAL CHARACTERISTICS(Continued)

XC2164x51Tx Switching Characteristics

fogs=4MHz to 30MHz (Fundamental), Ta=-30 ～ +80℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Rise Time	tr	CMOS: C_L=15pF, 0.1V_{DD}→0.9V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 0.4V→2.4V		1.5(*)		ns	-
Output Fall Time	tf	CMOS: C_L=15pF, 0.9V_{DD}→0.1V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 2.4V→0.4V		1.5(*)		ns	-
Output Duty Cycle	DUTY	CMOS: C_L=15pF @0.5V_{DD}	45		55	%	7
		TTL: Load=10TTL @1.4V	45		55	%	8

(*)Design Value

XC2164x51Tx Electrical Characteristics

SYMBOL	E1	E2-1	E2-2	E3	E4-1	E4-2
PARAMETER	Supply Current 1	Supply Current 2	Supply Current 2	Supply Current 1	Supply Current 2	Supply Current 2
	5.0V	5.0V	5.0V	3.3V	3.3V	3.3V
PRODUCT SERIES	I_{DD1}	I_{DD2}	I_{DD2}	I_{DD1}	I_{DD2}	I_{DD2}
XC2164xxx	TYP	TYP	UNITS	TYP	TYP	UNITS
A51T	11.0	5.0	μA	5.0	2.0	μA
B51T	9.0	5.0	μA	4.0	2.0	μA
C51T	8.0	5.0	μA	3.0	2.0	μA
D51T	8.0	5.0	μA	3.0	2.0	μA
K51T	11.0	6.0	mA	5.0	2.5	mA
L51T	9.0	6.0	mA	4.0	2.5	mA
M51T	8.0	6.0	mA	3.0	2.5	mA
N51T	8.0	6.0	mA	3.0	2.5	mA

Note) The symbol is as same as that in the chart of electrical characteristics.

■ELECTRICAL CHARACTERISTICS

XC2164x51Vx DC Electrical Characteristics
5.0V
●Recommended Operating Condition

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating Voltage	V_{DD}		4.5	5.0	5.5	V
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V
Operating Ambient Temperature	Topr		-30		+80	℃

(unless otherwise stated, V_{DD}=5.0V, No Load, Ta=-30 ～ +80℃)
fosc=4MHz to 30MHz (Fundamental)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
"H" Level Input Voltage	V_{IH}	/I_{NH} Pin	2.4			V	1
"L" Level Input Voltage	V_{IL}	/I_{NH} Pin			0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 4.5V, I_{OH}=-16mA	3.9	4.2		V	2
"L" Level Output Voltage	V_{OL}	CMOS : 4.5V, I_{OH}=16mA		0.3	0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open, f=30MHz		{E1}		mA	3
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open, f=30MHz		{E2-1}		{E2-2}	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'	0.5	1.0	2.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}	25	50	100	kΩ	4
Internal Oscillation Capacitance	Cg			35(*)		pF	-
	Cd			35(*)		pF	-
Internal Oscillation Feedback Resistance	Rf			3.5		MΩ	5
Output Disable Leakage Current	Ioz	/I_{NH}='L', V_{OH}=5.0V			10	μA	6

(*)Design Value

3.3V
●Recommended Operating Condition

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating Voltage	V_{DD}		2.50	3.30	3.63	V
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V
Operating Ambient Temperature	Topr		-30		+80	℃

(unless otherwise stated, V_{DD}=3.3V, No Load, Ta=-30～+80℃)
fosc=4MHz to 30MHz (Fundamental)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
"H" Level Input Voltage	V_{IH}	/I_{NH} Pin	2.4			V	1
"L" Level Input Voltage	V_{IL}	/I_{NH} Pin			0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 2.97V, I_{OH}=-8mA	2.5			V	2
"L" Level Output Voltage	V_{OL}	CMOS : 2.97V, I_{OH}=8mA			0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open, f=30MHz		{E3}		mA	3
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open, f=30MHz		{E4-1}		{E4-2}	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'	1.0	2.0	4.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}	35	70	140	kΩ	4
Internal Oscillation Capacitance	Cg			35(*)		pF	-
	Cd			35(*)		pF	-
Internal Oscillation Feedback Resistance	Rf			7.0		MΩ	5
Output Disable Leakage Current	Ioz	/I_{NH}='L', V_{OH}=3.3V			10	μA	6

(*)Design Value

■ELECTRICAL CHARACTERISTICS

XC2164x51Vx Switching Characteristics
fosc=4MHz to 30MHz (Fundamental), Ta=-30～+80℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Rise Time	tr	CMOS: C_L=15pF, 0.1V_{DD}→0.9V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 0.4V→2.4V		1.5(*)		ns	-
Output Fall Time	tf	CMOS: C_L=15pF, 0.9V_{DD}→0.1V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 2.4V→0.4V		1.5(*)		ns	-
Output Duty Cycle	DUTY	CMOS: C_L=15pF @0.5V_{DD}	45		55	%	7
		TTL: Load=10TTL @1.4V	45		55	%	8

(*)Design Value

XC2164x51Vx Electrical Characteristics

SYMBOL	E1	E2-1	E2-2	E3	E4-1	E4-2
PARAMETER	Supply Current 1	Supply Current 2	Supply Current 2	Supply Current 1	Supply Current 2	Supply Current 2
	5.0V	5.0V	5.0V	3.3V	3.3V	3.3V
PRODUCT SERIES	I_{DD1}	I_{DD2}	I_{DD2}	I_{DD1}	I_{DD2}	I_{DD2}
XC2164xxx	TYP.	TYP.	UNITS	TYP.	TYP.	UNITS
A51V	11.0	5.0	μA	5.0	2.0	μA
B51V	9.0	5.0	μA	4.0	2.0	μA
C51V	8.0	5.0	μA	3.0	2.0	μA
D51V	8.0	5.0	μA	3.0	2.0	μA
K51V	*	*	mA	*	*	mA
L51V	*	*	mA	*	*	mA
M51V	*	*	mA	*	*	mA
N51V	*	*	mA	*	*	mA

Note) The symbol is as same as that in the chart of electrical characteristics.

■ELECTRICAL CHARACTERISTICS

XC2164x51Mx DC Electrical Characteristics
5.0V
●Recommended Operating Condition

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating Voltage	V_{DD}		4.5	5.0	5.5	V
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V
Operating Ambient Temperature	Topr		-30		+80	℃

(unless otherwise stated, V_{DD}=5.0V, No Load, Ta=-30 ～ +80℃)
fosc=4MHz to 30MHz (Fundamental)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
"H" Level Input Voltage	V_{IH}	/I_{NH} Pin	2.4			V	1
"L" Level Input Voltage	V_{IL}	/I_{NH} Pin			0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 4.5V, I_{OH}=-16mA	3.9	4.2		V	2
"L" Level Output Voltage	V_{OL}	CMOS : 4.5V, I_{OH}=16mA		0.3	0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open, f=30MHz		{E1}		mA	3
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open, f=30MHz		{E2-1}		{E2-2}	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'	0.5	1.0	2.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}	25	50	100	kΩ	4
Internal Oscillation Capacitance	Cg			35(*)		pF	-
	Cd			35(*)		pF	-
Internal Oscillation Feedback Resistance	Rf			3.5		MΩ	5
Output Disable Leakage Current	Ioz	/I_{NH}='L', V_{OH}=5.0V			10	μA	6

(*)Design Value

3.3V
●Recommended Operating Condition

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating Voltage	V_{DD}		2.97	3.30	3.63	V
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V
Operating Ambient Temperature	Topr		-30		+80	℃

(unless otherwise stated, V_{DD}=3.3V, No Load, Ta=-30 ～ +80℃)
fosc=4MHz to 30MHz (Fundamental)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
"H" Level Input Voltage	V_{IH}	/I_{NH} Pin	2.4			V	1
"L" Level Input Voltage	V_{IL}	/I_{NH} Pin			0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 2.97V, I_{OH}=-8mA	2.47			V	2
"L" Level Output Voltage	V_{OL}	CMOS : 2.97V, I_{OH}=8mA			0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open, f=30MHz		{E3}		mA	3
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open, f=30MHz		{E4-1}		{E4-2}	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'	1.0	2.0	4.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}	35	70	140	kΩ	4
Internal Oscillation Capacitance	Cg			35(*)		pF	-
	Cd			35(*)		pF	-
Internal Oscillation Feedback Resistance	Rf			7.0		MΩ	5
Output Disable Leakage Current	Ioz	/I_{NH}='L', V_{OH}=3.3V			10	μA	6

(*)Design Value

■ELECTRICAL CHARACTERISTICS (Continued)

XC2164x51Mx Switching Characteristics

fosc=4MHz to 30MHz (Fundamental), Ta=-30～+80℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Rise Time	tr	CMOS: C_L=15pF, 0.1V_{DD}→0.9V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 0.4V→2.4V		1.5(*)		ns	-
Output Fall Time	tf	CMOS: C_L=15pF, 0.9V_{DD}→0.1V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 2.4V→0.4V		1.5(*)		ns	-
Output Duty Cycle	DUTY	CMOS: C_L=15pF @0.5V_{DD}	45		55	%	7
		TTL: Load=10TTL @1.4V	45		55	%	8

(*)Design Value

XC2164x51Mx Electrical Characteristics

SYMBOL	E1	E2-1	E2-2	E3	E4-1	E4-2
PARAMETER	Supply Current 1	Supply Current 2	Supply Current 2	Supply Current 1	Supply Current 2	Supply Current 2
	5.0V	5.0V	5.0V	3.3V	3.3V	3.3V
PRODUCT SERIES	I_{DD1}	I_{DD2}	I_{DD2}	I_{DD1}	I_{DD2}	I_{DD2}
XC2164xxx	TYP.	TYP.	UNITS	TYP.	TYP.	UNITS
A51M	11.0	5.0	μA	5.0	2.0	μA
B51M	9.0	5.0	μA	4.0	2.0	μA
C51M	8.0	5.0	μA	3.0	2.0	μA
D51M	8.0	5.0	μA	3.0	2.0	μA
K51M	11.0	6.0	mA	5.0	2.5	mA
L51M	9.0	6.0	mA	4.0	2.5	mA
M51M	8.0	6.0	mA	3.0	2.5	mA
N51M	8.0	6.0	mA	3.0	2.5	mA

Note) The symbol is as same as that in the chart of electrical characteristics.

■ELECTRICAL CHARACTERISTICS (Continued)

3rd Overtone(XC2164A51A ～ XC2164A51L) DC Electrical Characteristics
5.0V (unless otherwise stated, V_{DD}=5.0V, No Load, Ta=-30～+80℃)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUIT
Operating Voltage	V_{DD}			4.5	5.0	5.5	V	
"H" Level Input Voltage	V_{IH}			2.4			V	1
"L" Level Input Voltage	V_{IL}					0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 4.5V, I_{OH}=-16mA		3.9	4.2		V	2
"L" Level Output Voltage	V_{OL}	CMOS : 4.5V, I_{OH}=16mA			0.3	0.4	V	2
Supply Current 1	I_{DD1}	/INH=Open, Q0=Open	XC2164A51A,f0=30MHz		17.0	(23)	mA	3
			XC2164A51B,f0=40MHz		17.0	(23)		
			XC2164A51C,f0=55MHz		19.0	(26)		
			XC2164A51D,f0=70MHz		23.0	(32)		
			XC2164A51E,f0=85MHz		24.0	(32)		
			XC2164A51F,f0=100MHz		30.0	(40)		
			XC2164A51H,f0=110MHz		30.0	(40)		
			XC2164A51K,f0=125MHz		30.0	(40)		
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open			5.0	(8)	μA	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'		0.5	1.0	2.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}		25	50	100	kΩ	4
Internal Oscillation Feedback Resistance	Rf	XC2164A51A			9.0		kΩ	5
		XC2164A51B			6.5			
		XC2164A51C			5.0			
		XC2164A51D			3.5			
		XC2164A51E			2.8			
		XC2164A51F			2.5			
		XC2164A51H			2.2			
		XC2164A51K			2.0			
Output Disable Leakage Current	Ioz	/I_{NH}='L'				10	μA	6

■ELECTRICAL CHARACTERISTICS (Continued)

3.3V (unless otherwise stated, V_{DD}=3.3V, No Load, Ta=-30～+80℃)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUIT
Operating Voltage	V_{DD}			2.97	3.3	3.63	V	
"H" Level Input Voltage	V_{IH}			2.4			V	1
"L" Level Input Voltage	V_{IL}					0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 2.97V, I_{OH}=-8mA		2.5			V	2
"L" Level Output Voltage	V_{OL}	CMOS : 2.97V, I_{OH}=8mA				0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open	XC2164A51B,f0=30MHz		4.5	(7)	mA	3
			XC2164A51C,f0=40MHz		5.0	(8)		
			XC2164A51E,f0=70MHz		8.0	(13)		
			XC2164A51F,f0=85MHz		8.5	(13)		
			XC2164A51H,f0=100MHz		9.5	(15)		
			XC2164A51K,f0=110MHz		10.0	(15)		
			XC2164A51L,f0=125MHz		10.5	(15)		
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open			2.0		μA	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'		1.0	2.0	4.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}		35	70	140	kΩ	4
Internal Oscillation Feedback Resistance	Rf	XC2164A51B			6.5		kΩ	5
		XC2164A51C			5.0			
		XC2164A51E			2.8			
		XC2164A51F			2.5			
		XC2164A51H			2.2			
		XC2164A51K			2.0			
		XC2164A51L			2.3			
Output Disable Leakage Current	Ioz	/I_{NH}='L'				10	μA	6

※XC2164A51D

3.3V (unless otherwise stated, V_{DD}=3.3V, Oscillation Frequency f0＝48MHz, No Load, Ta=-30 ～ +80℃)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUIT
Operating Voltage	V_{DD}			2.70	3.30	3.63	V	
"H" Level Input Voltage	V_{IH}			2.4			V	1
"L" Level Input Voltage	V_{IL}					0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 2.97V, I_{OH}=-8mA		2.5			V	2
"L" Level Output Voltage	V_{OL}	CMOS : 2.97V, I_{OH}=8mA				0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open	XC2164A51D,f0=55MHz		6.5	(10)	mA	3
Supply Current 2	I_{DD2}	/I_{NH}='L', Q0=Open			2.0		μA	3
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'		1.00	2.0	4.00	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}		35	70	140	kΩ	4
Internal Oscillation Return Resistance	Rf	XC2164A51D			3.5		kΩ	5
Output Disable Leakage Current	Ioz	/I_{NH}='L'				10	μA	6

■ELECTRICAL CHARACTERISTICS (Continued)

3rd Overtone (XC2164K51A ～ XC2164K51L) DC Electrical Characteristics

5.0V (unless otherwise stated, V_{DD}=5.0V, No Load, Ta=-30～+80℃)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUIT
Operating Voltage	V_{DD}			4.5	5.0	5.5	V	
"H" Level Input Voltage	V_{IH}			2.4			V	1
"L" Level Input Voltage	V_{IL}					0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 4.5V, I_{OH}=-16mA		3.9	4.2		V	2
"L" Level Output Voltage	V_{OL}	CMOS : 4.5V, I_{OH}=16mA			0.3	0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open	XC2164A51A,f0=30MHz		17.0	(23)	mA	3
			XC2164A51B,f0=40MHz		17.0	(23)		
			XC2164A51C,f0=55MHz		19.0	(26)		
			XC2164A51D,f0=70MHz		23.0	(32)		
			XC2164A51E,f0=85MHz		24.0	(32)		
			XC2164A51F,f0=100MHz		30.0	(40)		
			XC2164A51H,f0=110MHz		30.0	(40)		
			XC2164A51K,f0=125MHz		30.0	(40)		
Supply Current 2	I_{DD2}	/I_{NH}='L' Q0=Open	XC2164A51A,f0=30MHz		15.0		mA	3
			XC2164A51B,f0=40MHz		15.0			
			XC2164A51C,f0=55MHz		15.0			
			XC2164A51D,f0=70MHz		17.0			
			XC2164A51E,f0=85MHz		17.0			
			XC2164A51F,f0=100MHz		20.0			
			XC2164A51H,f0=110MHz		20.0			
			XC2164A51K,f0=125MHz		20.0			
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'		0.5	1.0	2.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}		25	50	100	kΩ	4
Internal Oscillation Feedback Resistance	Rf	XC2164A51A			9.0		kΩ	5
		XC2164A51B			6.5			
		XC2164A51C			5.0			
		XC2164A51D			3.5			
		XC2164A51E			2.8			
		XC2164A51F			2.5			
		XC2164A51H			2.2			
		XC2164A51K			2.0			
Output Disable Leakage Current	Ioz	/I_{NH}='L'				10	μA	6

■ELECTRICAL CHARACTERISTICS (Continued)

3.3V (unless otherwise stated, V_{DD}=3.3V, No Load, Ta=-30～+80℃)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUIT
Operating Voltage	V_{DD}			3.0	3.3	3.6	V	
"H" Level Input Voltage	V_{IH}			2.4			V	1
"L" Level Input Voltage	V_{IL}					0.4	V	1
"H" Level Output Voltage	V_{OH}	CMOS : 2.97V, I_{OH}=-8mA		2.5			V	2
"L" Level Output Voltage	V_{OL}	CMOS : 2.97V, I_{OH}=8mA				0.4	V	2
Supply Current 1	I_{DD1}	/I_{NH}=Open, Q0=Open	XC2164A51B,f0=30MHz		4.5	(7)	mA	3
			XC2164A51C,f0=40MHz		5.0	(8)		
			XC2164A51D,f0=55MHz		6.5	(10)		
			XC2164A51E,f0=70MHz		8.0	(13)		
			XC2164A51F,f0=85MHz		8.5	(13)		
			XC2164A51H,f0=100MHz		9.5	(15)		
			XC2164A51K,f0=110MHz		10.0	(15)		
			XC2164A51L,f0=125MHz		10.5	(15)		
Supply Current 2	I_{DD2}	/I_{NH}='L' Q0=Open	XC2164A51B,f0=30MHz		3.0		mA	3
			XC2164A51C,f0=40MHz		3.5			
			XC2164A51D,f0=55MHz		4.0			
			XC2164A51E,f0=70MHz		4.5			
			XC2164A51F,f0=85MHz		4.5			
			XC2164A51H,f0=100MHz		5.0			
			XC2164A51K,f0=110MHz		5.0			
			XC2164A51L,f0=125MHz		5.5			
Input Pull-Up Resistance 1	Rup1	/I_{NH}='L'		1.0	2.0	4.0	MΩ	4
Input Pull-Up Resistance 2	Rup2	/I_{NH}=0.7V_{DD}		35	70	140	kΩ	4
Internal Oscillation Feedback Resistance	Rf	XC2164A51B			6.5		kΩ	5
		XC2164A51C			5.0			
		XC2164A51D			3.5			
		XC2164A51E			2.8			
		XC2164A51F			2.5			
		XC2164A51H			2.2			
		XC2164A51K			2.0			
		XC2164A51L			2.3			
Output Disable Leakage Current	Ioz	/I_{NH}='L'				10	μA	6

■ELECTRICAL CHARACTERISTICS (Continued)

Fundamental(XC2164A51M) AC Electrical Characteristics

(unless otherwise stated, V_{DD}=3.3V, V_{DD}=5.0V, Ta=-30～+80℃)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Rise Time	tr	CMOS: C_L=15pF, 0.1V_{DD}→0.9V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 0.4V→2.4V		1.5(*)		ns	
Output Fall Time	tf	CMOS: CL=15pF, 0.9V_{DD}→0.1V_{DD}		1.5(*)		ns	-
		TTL: Load=10TTL, 2.4V→0.4V		1.5(*)		ns	
Output Duty Cycle	DUTY	CMOS: CL=15pF @0.5V_{DD}	45.0		55.0	%	7
		TTL: Load=10TTL @1.4V	45.0		55.0	%	

(*)Design Value

3rd Overtone (XC2164A51A ～ XC2164A51L) AC Electrical Characteristics

(unless otherwise stated, V_{DD}=3.3V, V_{DD}=5.0V, Ta=-30 ～ +80℃)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Rise Time	tr	CMOS: C_L=15pF, 0.1V_{DD}→0.9V_{DD}		1.5(*)		ns	-
Output Fall Time	tf	CMOS: C_L=15pF, 0.9V_{DD}→0.1V_{DD}		1.5(*)		ns	-
Output Duty Cycle	DUTY	CMOS: C_L=15pF @0.5V_{DD}	45		55	%	7

(*)Design Value

3rd Overtone (XC2164K51A ～ XC2164K51L) AC Electrical Characteristics

(unless otherwise stated, V_{DD}=3.3V, V_{DD}=5.0V, Ta=-30～+80℃)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Rise Time	tr	CMOS: C_L=15pF, 0.1V_{DD}→0.9V_{DD}		1.5(*)		ns	-
Output Fall Time	tf	CMOS: C_L=15pF, 0.9V_{DD}→0.1V_{DD}		1.5(*)		ns	-
Output Duty Cycle	DUTY	CMOS: C_L=15pF @0.5V_{DD}	45		55	%	7
Output Disable Delay Time	tplz	C_L=15pF			100.0(*)	ns	-
Output Enable Delay Time	tpzl	C_L=15pF			10.0(*)	μs	-

(*)Design Value

■SWITCHING WAVEFORMS

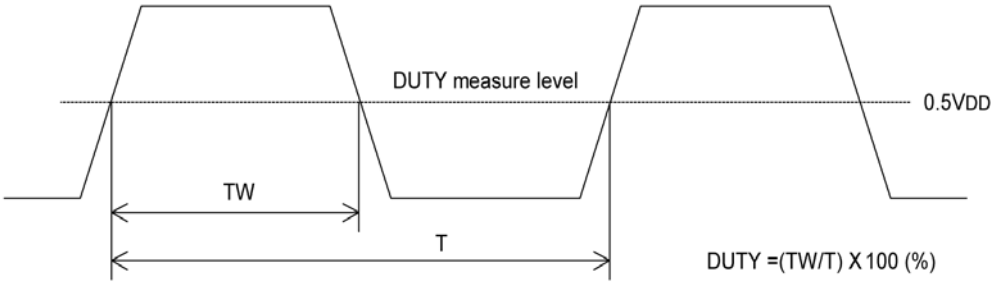
● Switching Time

(1) CMOS Output

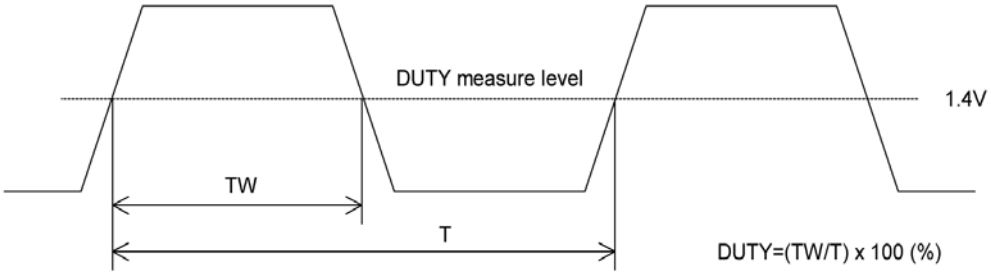
(2) TTL Output

● Duty Cycle

(1) CMOS Output

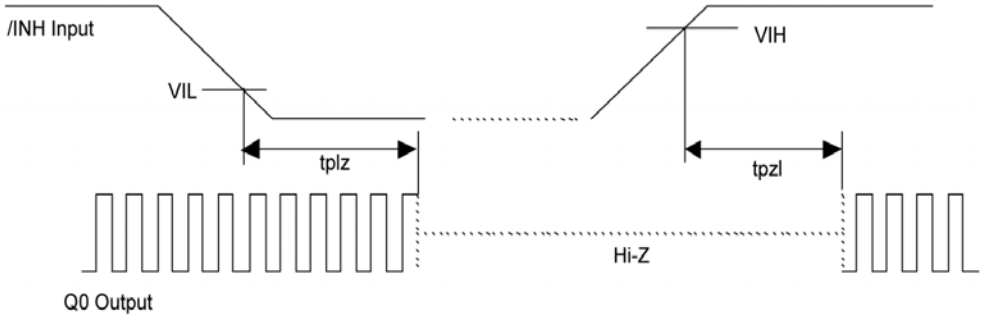


(2) TTL Output



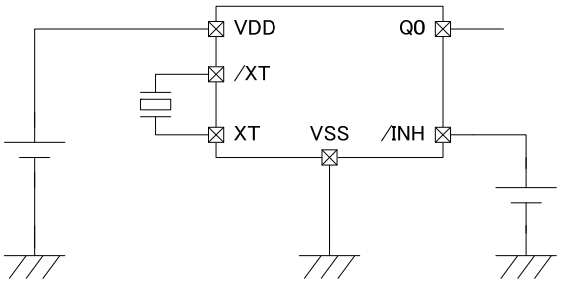
■SWITCHING WAVEFORMS (Continued)

(3) Output Disable Delay Time, Output Enable Delay Time *)The /INH pin input waveform: less than tr=tf=10ns, V_{DD} input

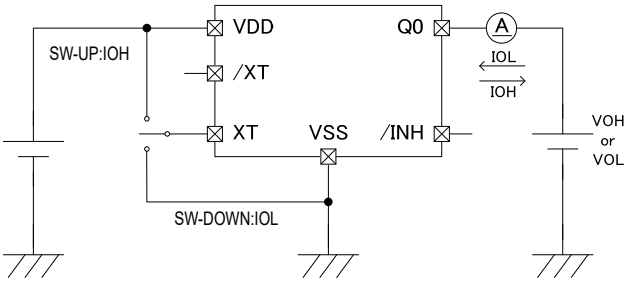


■TEST CIRCUITS

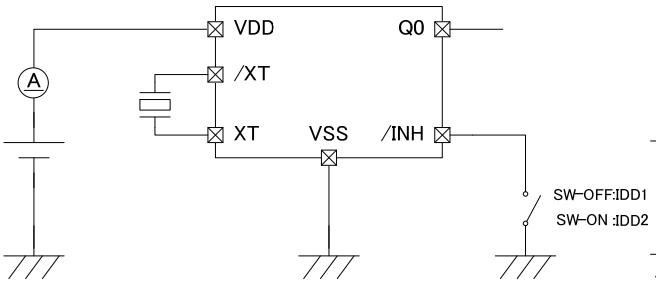
1) CIRCUIT①



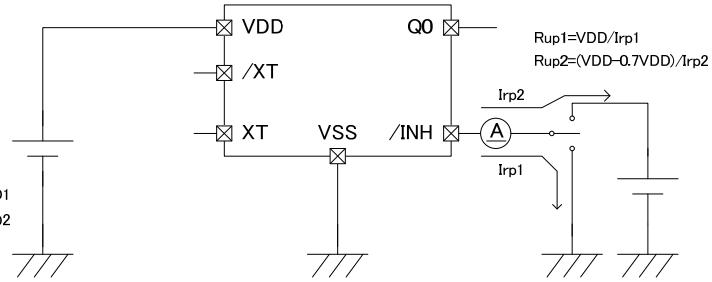
2) CIRCUIT②



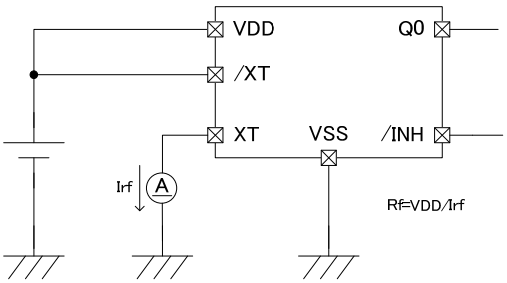
3) CIRCUIT③



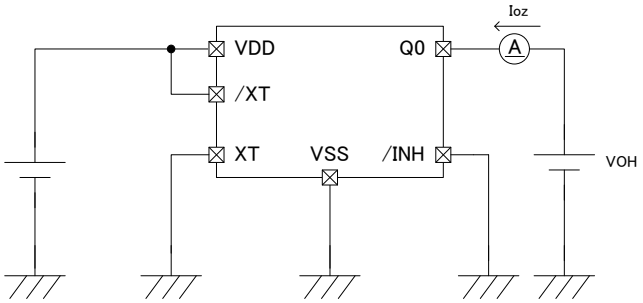
4) CIRCUIT④



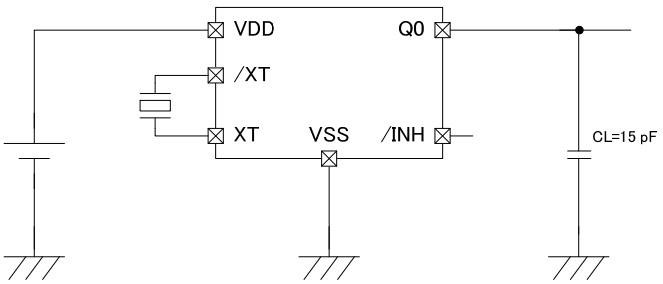
5) CIRCUIT⑤



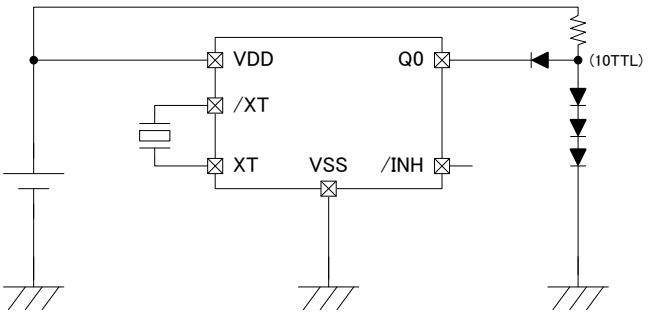
6) CIRCUIT⑥



7) CIRCUIT⑦

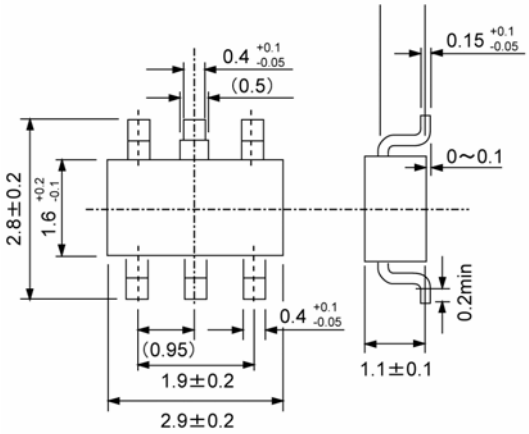


8) CIRCUIT⑧



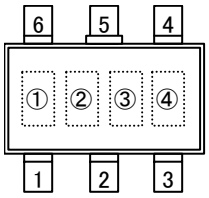
■ PACKAGING INFORMATION

●SOT-26



■ MARKING RULE

●SOT-26



SOT-26
(TOP VIEW)

① represents product series

MARK
4

② represents divider ratio

<Chip Enable>

MARK	RATIO	MARK	RATIO
A	f0/1	C	f0/4
B	f0/2	D	f0/8

*B, C, D: fundamental only

<Output Enable>

MARK	RATIO	MARK	RATIO
K	f0/1	M	f0/4
L	f0/2	N	f0/8

*L, M, N: fundamental only

③ represents recommended frequency & Rf, Cg &Cd values
* Please refer to the ordering information, SYMBOL ① to ④

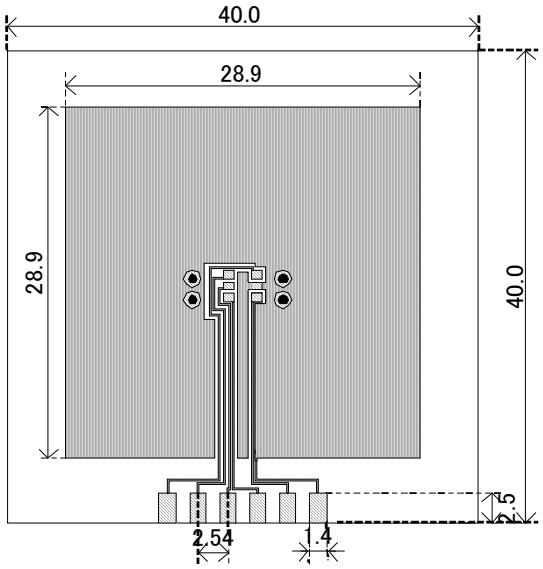
④ represents assembly lot number
(Based on internal standards)

● SOT-26 Power Dissipation

Power dissipation data for the SOT-26 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

Condition:Mount on a board
Ambient:Natural convection
Soldering:Lead (Pb) free
Board:Dimensions 40 x 40 mm (1600 mm2 in one side)
Copper (Cu) traces occupy 50% of the board area
In top and back faces
Package heat-sink is tied to the copper traces
Material:Glass Epoxy (FR-4)
Thickness:1.6 mm
Through-hole:4 x 0.8 Diameter

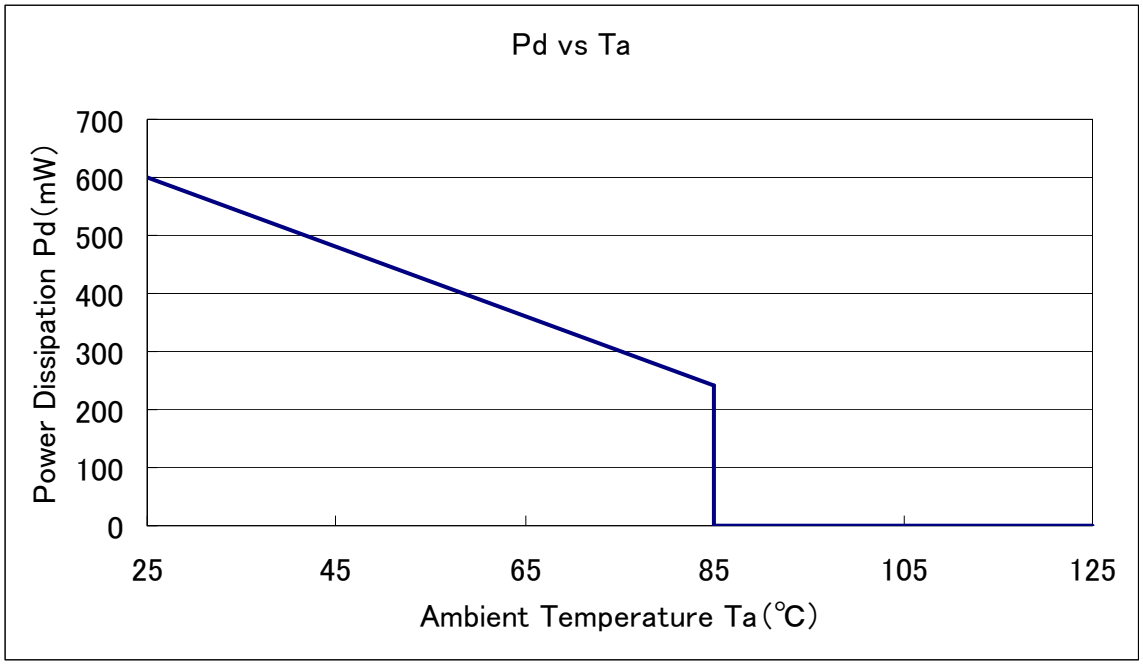


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient temperature

Board Mount (Tj max = 125℃)

Ambient Temperature（℃）	Power Dissipation Pd（mW）	Thermal Resistance(℃/W)
25	600	166.67
85	240	



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3. Please ensure suitable shipping controls (including fail-safe designs and aging protection) are in force for equipment employing products listed in this datasheet.
4. The products in this datasheet are not developed, designed, or approved for use with such equipment whose failure of malfunction can be reasonably expected to directly endanger the life of, or cause significant injury to, the user.
   (e.g. Atomic energy; aerospace; transport; combustion and associated safety equipment thereof.)
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