

Internal 45V MOSFET Switching Regulator IC for Capacitor Charge Boost Converter

■FEATURES

- Current Mode Control
- External Clock Synchronization
- Operating Voltage Range 4.5V to 40V
- Switching Current 1.75A min.
- PWM Control
- Built-in Compensation Circuit
- Correspond to Ceramic Capacitor (MLCC)
- Oscillating Frequency 2MHz typ. (C ver.)
- Soft Start Function 10ms typ.
- UVLO (Under Voltage Lockout)
- Over Current Protection (Pulse-by-Pulse type)
- Thermal Shutdown Protection
- Standby Function
- Package Outline SOT-89-5-2

■GENERAL DESCRIPTION

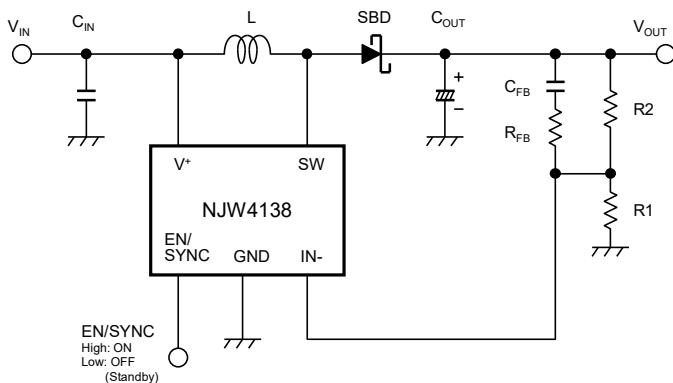
The NJW4138 is a step up switching regulator with 45V, 1.75A power MOSFET. The NJW4138 has a current mode control, a high frequency oscillating over a wide operating voltage range and an internal phase compensation circuit, so that it provides boost applications with a few external parts.

The NJW4138 has built-in overcurrent protection for Pulse-by-Pulse, it is suitable for charging the backup capacitor.

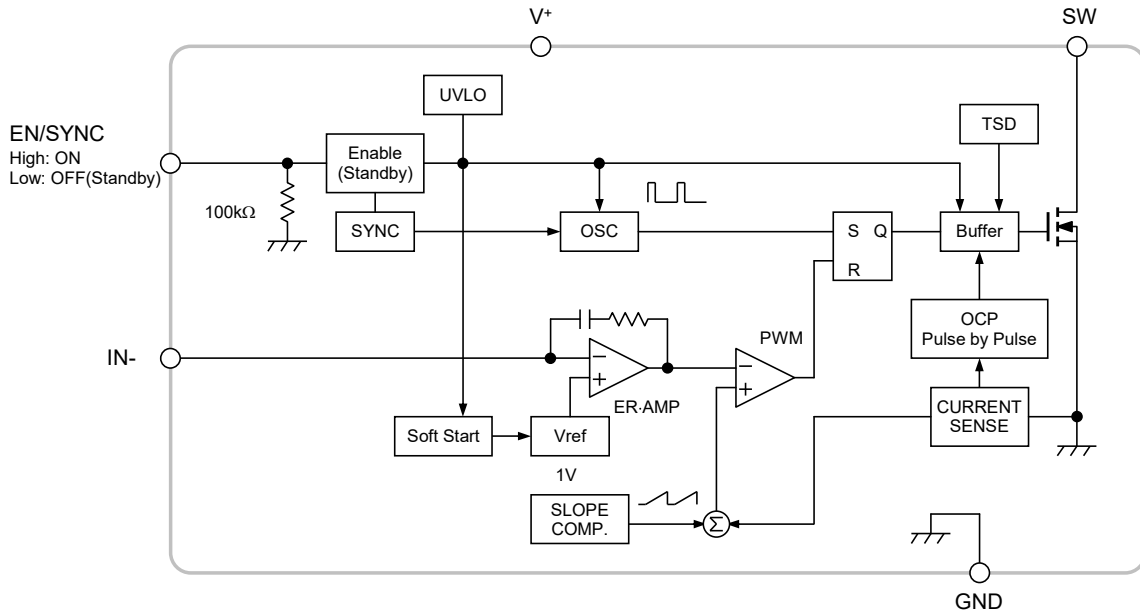
■APPLICATION

- Capacitor Charge
- Power supply for VFD
- Low power boost application

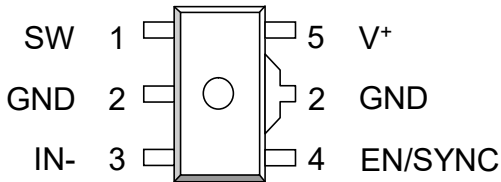
■TYPICAL APPLICATION



■BLOCK DIAGRAM

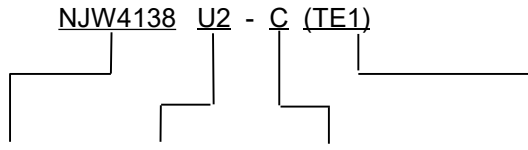


■PIN CONFIGURATION



PIN NO.	SYMBOL	DESCRIPTION
1	SW	Switch output
2	GND	Ground
3	IN-	Feedback input
4	EN/SYNC	Enable control and external clock synchronization
5	V+	Power supply for IC

■PRODUCT NAME INFORMATION



Part Number Package Version Taping Form
 U2:SOT-89-5-2 C: f_{OSC}=2.0MHz

■ORDERING INFORMATION

PRODUCT NAME	PACKAGE OUTLINE	OSCILLATING FREQUENCY	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ(pcs)
NJW4138U2-C (TE1)	SOT-89-5-2	2.0MHz	yes	yes	Sn2Bi	451	61	1,000

■ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	-0.3 to +45	V
SW pin Voltage	V_{SW}	-0.3 to +45	V
IN- pin Voltage	V_{IN-}	-0.3 to +6	V
EN/SYNC pin Voltage	$V_{EN/SYNC}$	-0.3 to +45	V
Power Dissipation($T_a=25^{\circ}C$) SOT-89-5-2	P_D	(2-layer / 4-layer) 625 ⁽¹⁾ / 2,400 ⁽²⁾	mW
Junction Temperature	T_j	-40 to +150	$^{\circ}C$
Operating Temperature	T_{opr}	-40 to +125	$^{\circ}C$
Storage Temperature	T_{stg}	-50 to +150	$^{\circ}C$

(1): Mounted on glass epoxy board. (76.2×114.3×1.6mm:based on EIA/JEDEC standard, 2Layers)

(2): Mounted on glass epoxy board. (76.2×114.3×1.6mm:based on EIA/JEDEC standard, 4Layers)

(For 4Layers: Applying 74.2×74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

■RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	4.5 to 40	V
External Clock Input C version	f_{SYNC}	1,800 to 2,400	kHz

■ ELECTRICAL CHARACTERISTICS

 (Unless otherwise noted, $V^+=V_{\text{ENSYNC}}=12\text{V}$, $T_a=25^\circ\text{C}$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
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Under Voltage Lockout Block

ON Threshold Voltage	V_{T_ON}	$V^+=L \rightarrow H$	4.2	4.35	4.5	V
OFF Threshold Voltage	V_{T_OFF}	$V^+=H \rightarrow L$	4.1	4.25	4.4	V
Hysteresis Voltage	V_{HYS}		70	100	–	mV

Soft Start Block

Soft Start Time	t_{SS}	$V_B=0.95\text{V}$	5	10	15	ms
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Oscillator Block

Oscillating Frequency	f_{OSC}	C version, $V_{IN}=0.9\text{V}$	1.82	2.0	2.2	MHz
Oscillating Frequency deviation (Supply voltage)	f_{DV}	$V^+=4.5\text{V to }40\text{V}$	–	1	–	%
Oscillating Frequency deviation (Temperature)	f_{DT}	$T_a=-40^\circ\text{C to }+85^\circ\text{C}$	–	5	–	%

Error Amplifier Block

Reference Voltage	V_B		-1.0%	1.0	+1.0%	V
Input Bias Current	I_B		-0.1	–	0.1	μA

PWM Compare Block

Maximum Duty Cycle	M_{AXDUTY}	$V_{IN}=0.9\text{V}$	80	85	–	%
Minimum ON Time1 (Use Built-in Oscillator)	$t_{ON\text{-}min1}$	C version	–	80	120	ns
Minimum ON Time2 (Use Ext CLK)	$t_{ON\text{-}min2}$	C version, $f_{SYNC}=2.2\text{MHz}$	–	80	120	ns

Output Block

Output ON Resistance	R_{ON}	$I_{SW}=1\text{A}$	–	0.4	0.65	Ω
Switching Current Limit	I_{LIM}		1.75	2.1	2.25	A
SW Leak Current	I_{LEAK}	$V_{ENSYNC}=0\text{V}$, $V_{SW}=45\text{V}$	–	–	1	μA

Standby Control / Sync Block

ON Control Voltage	V_{ON}	$V_{ENSYNC}=L \rightarrow H$	1.6	–	V^+	V
OFF Control Voltage	V_{OFF}	$V_{ENSYNC}=H \rightarrow L$	0	–	0.5	V
Input Bias Current (EN/SYNC pin)	I_{EN}	$V_{ENSYNC}=12\text{V}$	–	250	400	μA

General Characteristics

Quiescent Current	I_{DD}	C version, $R_L=\text{no load}$, $V_{IN}=0.9\text{V}$	–	3.5	4.0	mA
Standby Current	I_{DD_STB}	$V_{ENSYNC}=0\text{V}$	–	–	1	μA

■ THERMAL CHARACTERISTICS

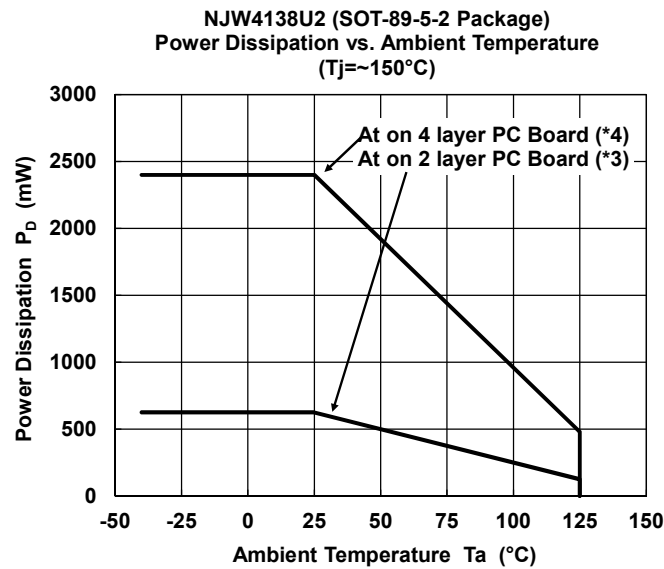
PARAMETER	SYMBOL	VALUE	UNIT
Junction-to-ambient thermal resistance	θ_{ja}	SOT-89-5-2 200 ⁽³⁾ 52 ⁽⁴⁾	$^{\circ}\text{C/W}$
Junction-to-Top of package characterization parameter	ψ_{jt}	SOT-89-5-2 43 ⁽³⁾ 19 ⁽⁴⁾	$^{\circ}\text{C/W}$

(3): Mounted on glass epoxy board. (76.2×114.3×1.6mm:based on EIA/JEDEC standard, 2Layers)

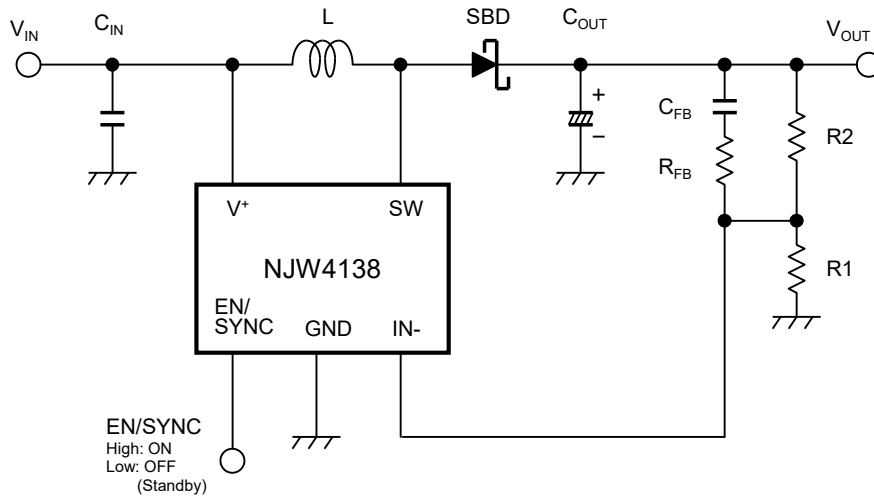
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(For 4Layers: Applying 74.2×74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

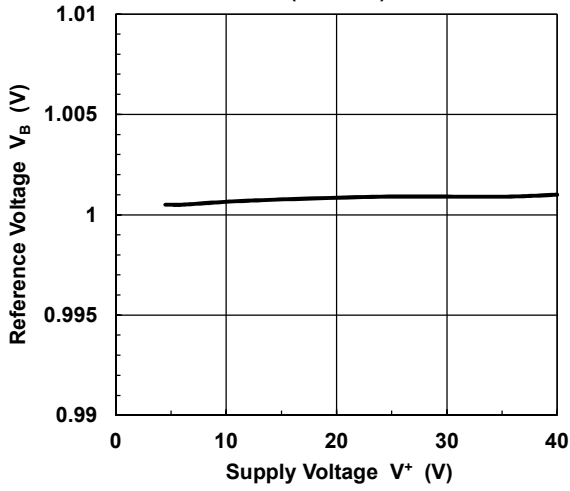


■TYPICAL APPLICATION

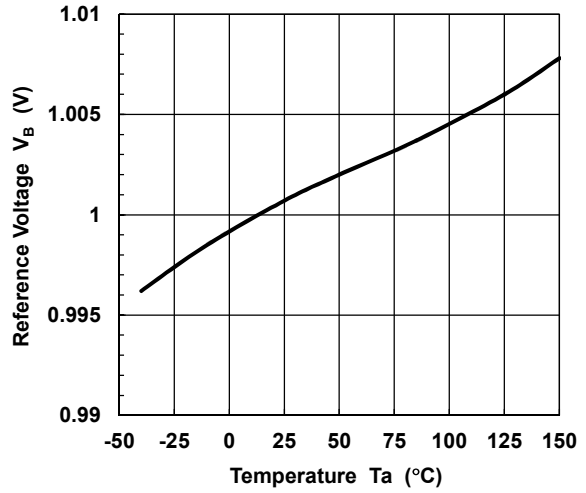


■ TYPICAL CHARACTERISTICS

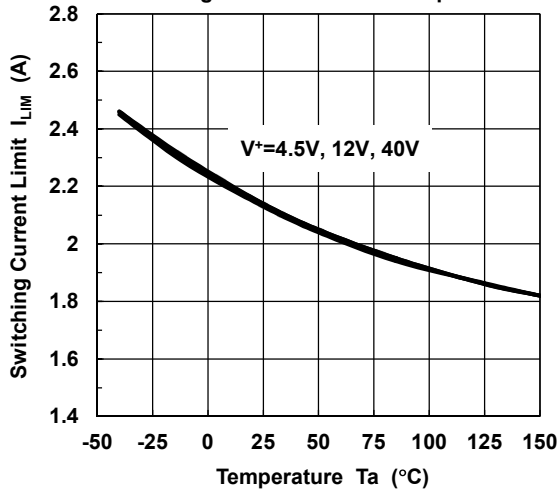
Reference Voltage vs. Supply Voltage
($T_a=25^\circ\text{C}$)



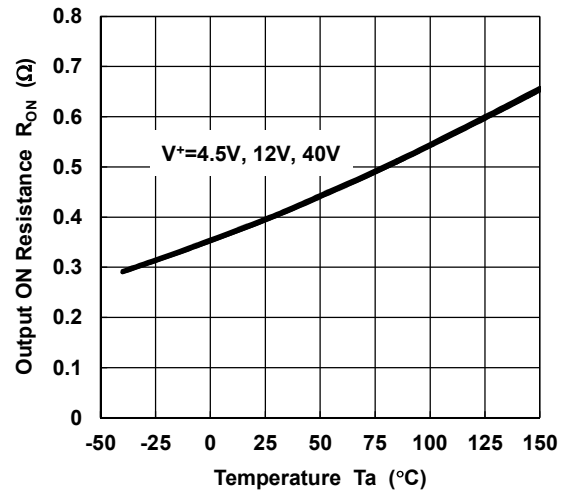
Reference Voltage vs. Temperature
($V^+=12\text{V}$)



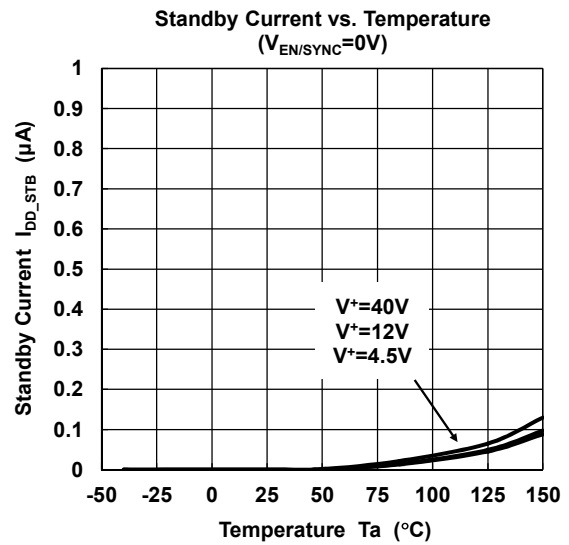
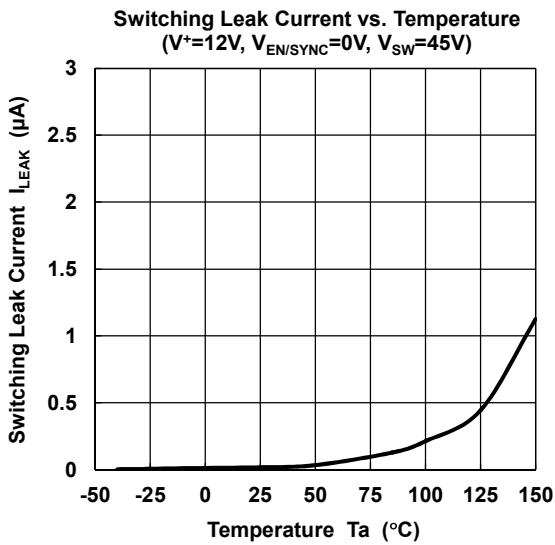
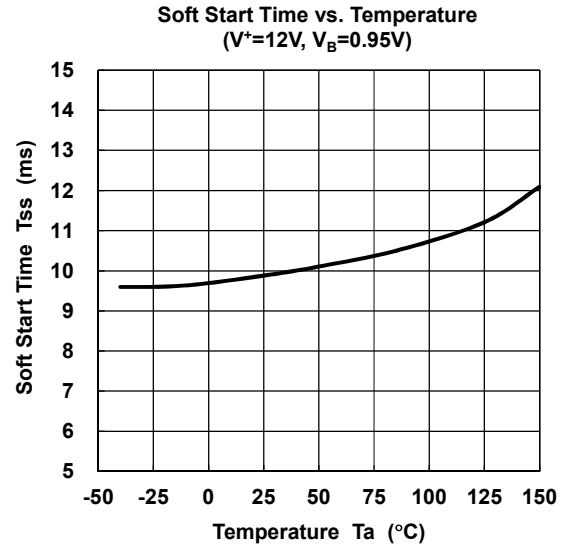
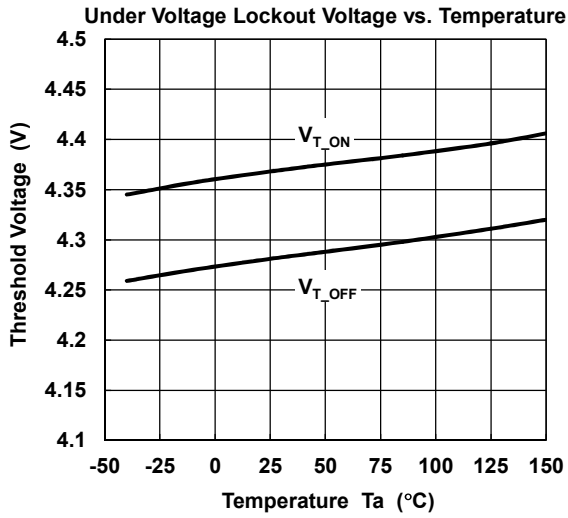
Switching Current Limit vs. Temperature



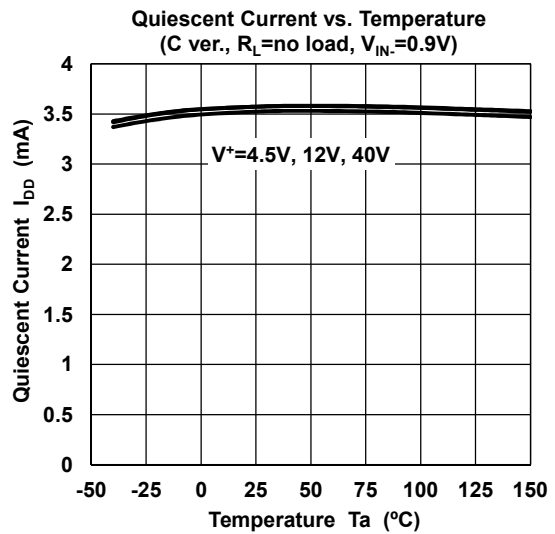
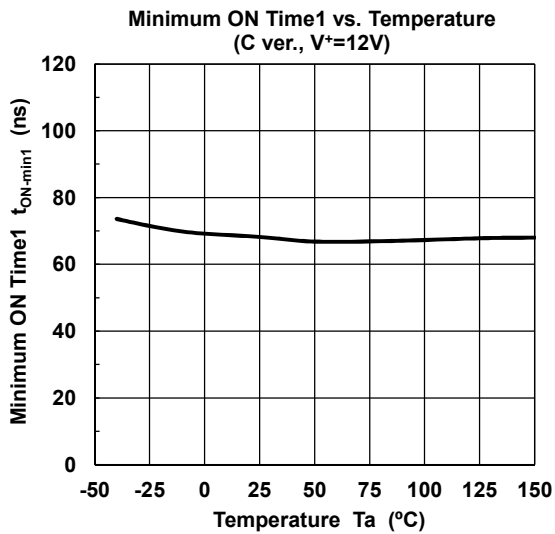
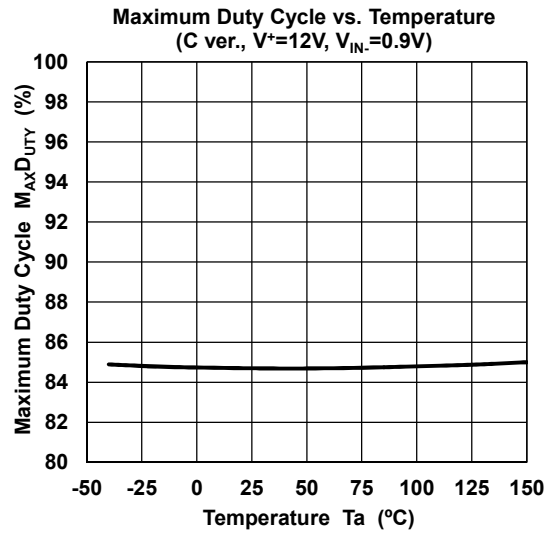
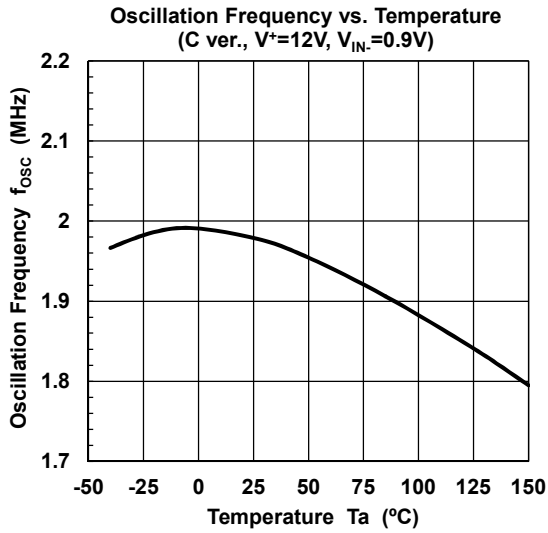
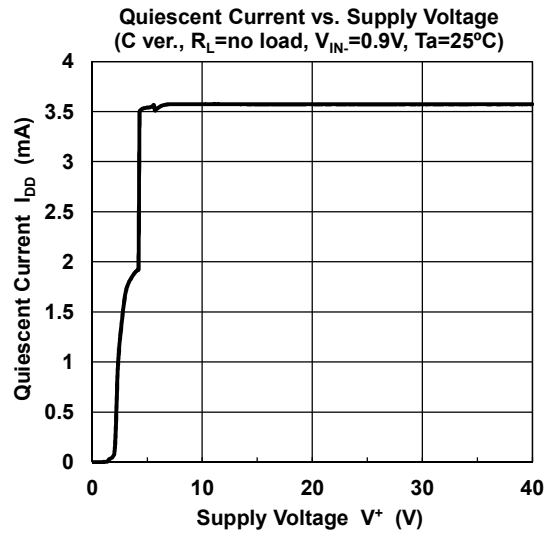
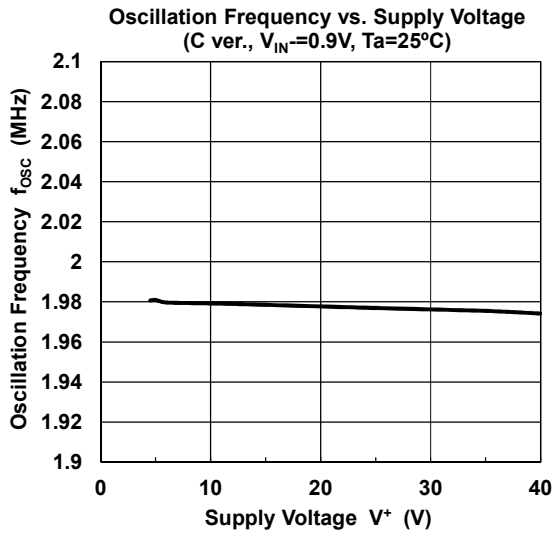
Output ON Resistance vs. Temperature
($I_{SW}=1\text{A}$)



■ TYPICAL CHARACTERISTICS



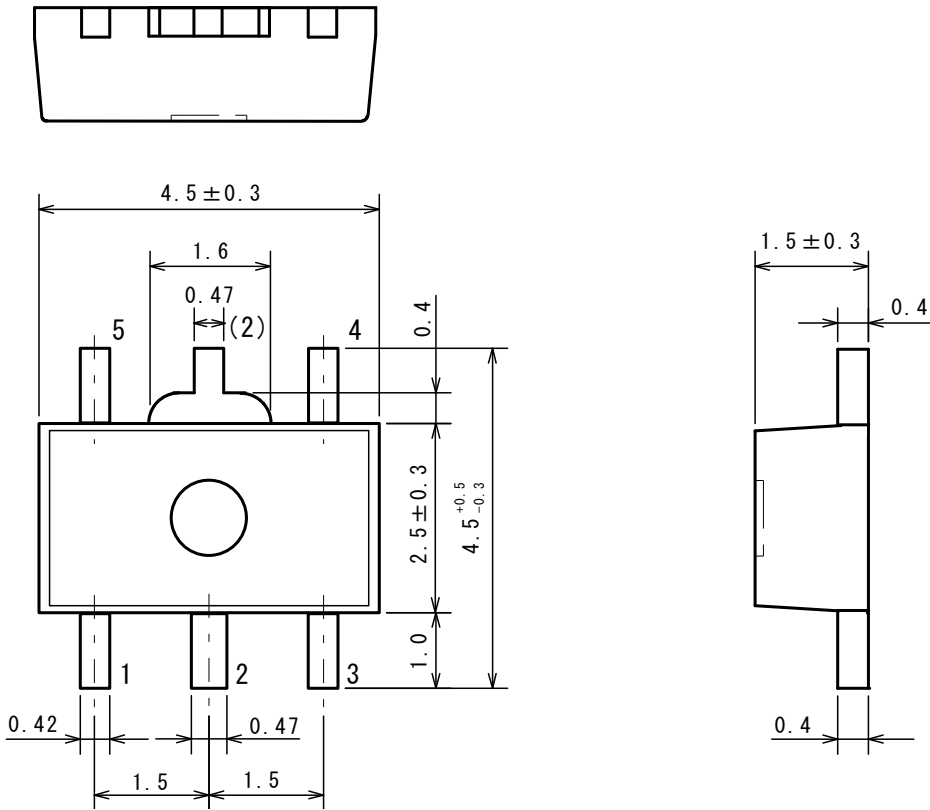
■ TYPICAL CHARACTERISTICS



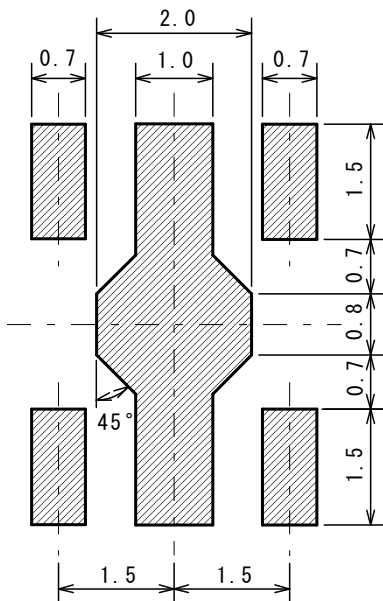
■ PIN DESCRIPTIONS

PIN NAME	PIN NUMBER	FUNCTION
SW	1	Switch Output pin of Power MOSFET
GND	2	GND pin
IN-	3	Output Voltage Detecting pin Connects output voltage through the resistor divider tap to this pin in order to voltage of the IN- pin become 1.0V.
EN/SYNC	4	Standby Control pin The EN/SYNC pin internally pulls down with 100kΩ. Normal Operation at the time of High Level. Standby Mode at the time of Low Level or OPEN. Moreover, it operates by inputting clock signal at the oscillatory frequency that synchronized with the input signal.
V ⁺	5	Power Supply pin for IC control. Insert a bypass capacitor close to the V ⁺ pin – the GND pin connection in order to lower high frequency impedance.

■ PACKAGE DIMENSIONS



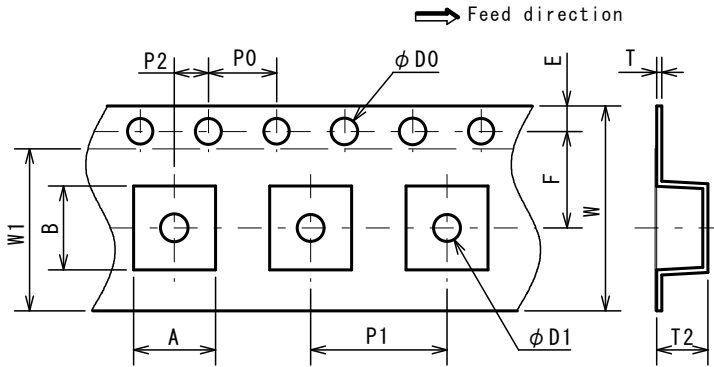
■ EXAMPLE OF SOLDER PADS DIMENSIONS



PACKING SPEC

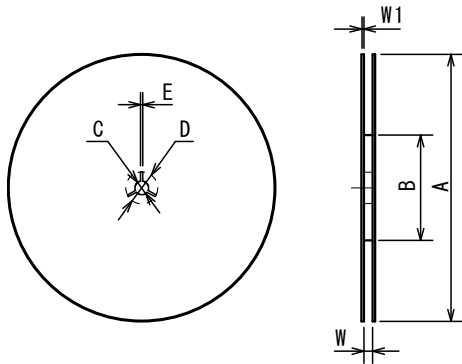
Unit: mm

TAPING DIMENSIONS



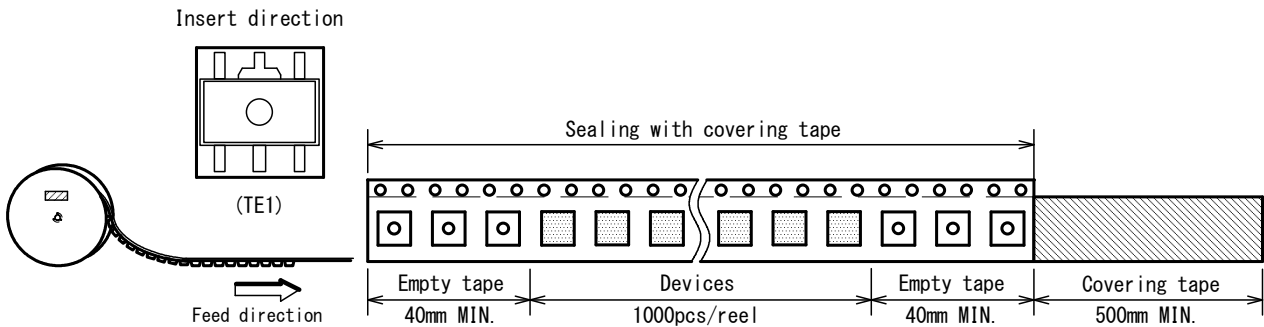
SYMBOL	DIMENSION	REMARKS
A	4.8±0.1	BOTTOM DIMENSION
B	4.9±0.1	BOTTOM DIMENSION
D0	1.5 ^{+0.1} ₀	
D1	1.6	
E	1.5±0.1	
F	5.65±0.1	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.1	
T	0.30±0.05	
T2	2.0±0.1	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1MAX

REEL DIMENSIONS

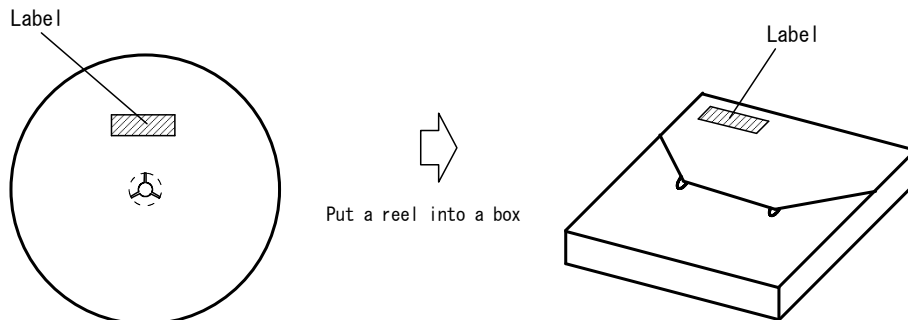


SYMBOL	DIMENSION
A	φ 180±1
B	φ 60±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13±0.5
W1	1.2±0.2

TAPING STATE

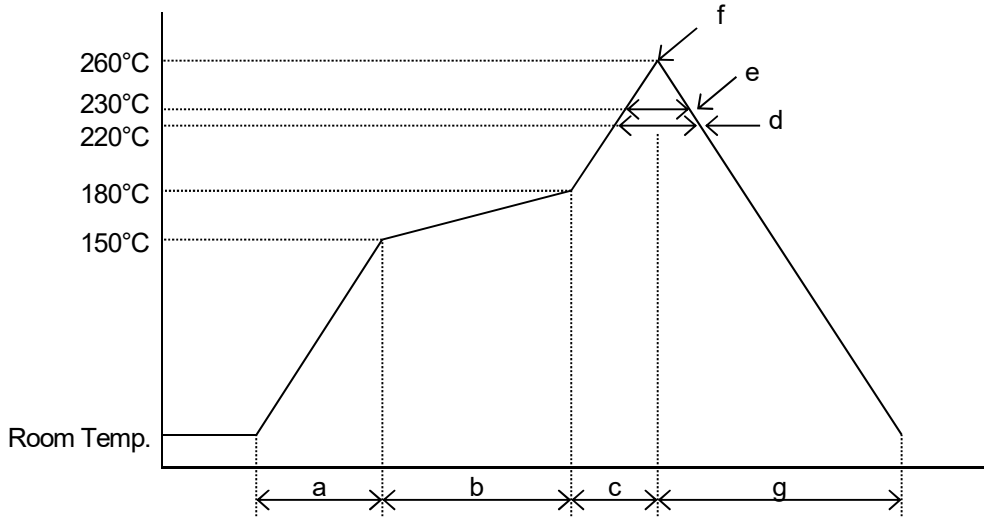


PACKING STATE



■MOUNTING METHOD
INFRARED REFLOW SOLDERING METHOD

Recommended reflow soldering procedure



- | | |
|---------------------------------|-----------------------------|
| a: Temperature ramping rate | : 1 to 4°C/s |
| b: Pre-heating temperature time | : 150 to 180°C : 60 to 120s |
| c: Temperature ramp rate | : 1 to 4°C/s |
| d: 220°C or higher time | : Shorter than 60s |
| e: 230°C or higher time | : Shorter than 40s |
| f: Peak temperature | : Lower than 260°C |
| g: Temperature ramping rate | : 1 to 6°C/s |

The temperature indicates at the surface of mold package.

■REVISION HISTORY

DATE	REVISION	CHANGES
26.Jun.2018	Ver.1.0	New Release

[CAUTION]

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