

NJM78L00

The NJM78L00 series of 3-Terminal Positive Voltage Regulators is constructed using the New JRC Planar epitaxial process. These regulators employ internal current-limiting and thermal-shutdown, making them essentially indestructible. If adequate heat sinking is provided, they can deliver up to 100mA output current. They are intended as fixed voltage regulators in a wide range of applications including local or on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power pass elements to make high-current voltage regulators. The NJM78L00 series used as a Zener diode/resistor combination replacement, offers an effective output impedance improvement of typically two orders of magnitude, along with lower quiescent current and lower noise.

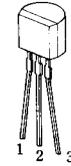
■ Absolute Maximum Ratings (Ta=25°C)

Input Voltage	V _{IN} (78L02A~78L09A)	30V
"	V _{IN} (78L12A~78L15A)	35V
"	V _{IN} (78L18A~78L24A)	40V
Output Current	I _O	100mA
Power Dissipation	P _D TO-92 (SOT-89)	500mW (350mW)
Operating Temperature Range	T _{OPR}	-30~+75°C
Storage Temperature Range	T _{STR}	-40~+125°C

■ Package Outline

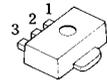
(TO-92)

(SOT-89)



NJM78LXXA

- 1. OUT
- 2. GND
- 3. IN



NJM78LXXUA

- 1. OUT
- 2. GND
- 3. IN

■ Electrical Characteristics (T_j=25°C, C_{IN}=0.33μF, C_O=0.1μF)

Measurement is to be conducted in pulse testing.

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
NJM78L02A						
Output Voltage	V _O	V _{IN} =9V, I _O =40mA	2.47	2.6	2.73	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =4.75~20V, I _O =40mA	—	—	125	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =5~20V, I _O =40mA	—	—	100	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =9V, I _O =1~40mA	—	—	25	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =9V, I _O =1~100mA	—	—	50	mV
Quiescent Current	I _O	V _{IN} =9V, I _O =0mA	—	—	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =9V, I _O =1mA	—	-1	—	mV/°C
Ripple Rejections	RR	6V<V _{IN} <16V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	43	51	—	dB
Output Noise Voltage	V _{NO}	BW=10Hz~100kHz, V _{IN} =9V, I _O =40mA	—	30	—	μV
NJM78L05A						
Output Voltage	V _O	V _{IN} =10V, I _O =40mA	4.75	5	5.25	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =7~20V, I _O =40mA	—	—	200	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =8~20V, I _O =40mA	—	—	150	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =10V, I _O =1~40mA	—	—	30	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =10V, I _O =1~100mA	—	—	60	mV
Quiescent Current	I _O	V _{IN} =10V, I _O =0mA	—	—	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =10V, I _O =1mA	—	-1	—	mV/°C
Ripple Rejections	RR	8V<V _{IN} <18V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	40	49	—	dB
Output Noise Voltage	V _{NO}	BW=10Hz~100kHz, V _{IN} =10V, I _O =40mA	—	40	—	μV

■ **Electrical Characteristics** ($C_{IN}=0.33\mu F$, $C_O=0.1\mu F$, $T_I=25^\circ C$)

Measurement is to be conducted in pulse testing.

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
NJM78L06A						
Output Voltage	V_O	$V_{IN}=12V, I_O=40mA$	5.7	6	6.3	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=8.5\sim 20V, I_O=40mA$	—	—	200	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=9\sim 20V, I_O=40mA$	—	—	150	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=12V, I_O=1\sim 40mA$	—	—	40	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=12V, I_O=1\sim 100mA$	—	—	80	mV
Quiescent Current	I_O	$V_{IN}=12V, I_O=0mA$	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=12V, I_O=1mA$	—	-1	—	mV/°C
Ripple Rejections	RR	$9V < V_{IN} < 20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	40	46	—	dB
Output Noise Voltage	V_{NO}	$BW=10Hz\sim 100kHz, V_{IN}=12V, I_O=40mA$	—	120	—	μV
NJM78L08A						
Output Voltage	V_O	$V_{IN}=14V, I_O=40mA$	7.6	8	8.4	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=10.5\sim 23V, I_O=40mA$	—	—	225	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=11\sim 23V, I_O=40mA$	—	—	175	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=14V, I_O=1\sim 40mA$	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=14V, I_O=1\sim 100mA$	—	—	100	mV
Quiescent Current	I_O	$V_{IN}=14V, I_O=0mA$	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=14V, I_O=1mA$	—	-1	—	mV/°C
Ripple Rejections	RR	$11V < V_{IN} < 20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	39	45	—	dB
Output Noise Voltage	V_{NO}	$BW=10Hz\sim 100kHz, V_{IN}=14V, I_O=40mA$	—	120	—	μV
NJM78L09A						
Output Voltage	V_O	$V_{IN}=15V, I_O=40mA$	8.55	9	9.45	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=11.5\sim 23V, I_O=40mA$	—	—	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=12\sim 23V, I_O=40mA$	—	—	200	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=15V, I_O=1\sim 40mA$	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=15V, I_O=1\sim 100mA$	—	—	100	mV
Quiescent Current	I_O	$V_{IN}=15V, I_O=0mA$	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=15V, I_O=1mA$	—	-1	—	mV/°C
Ripple Rejections	RR	$12V < V_{IN} < 21V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	38	44	—	dB
Output Noise Voltage	V_{NO}	$BW=10Hz\sim 100kHz, V_{IN}=15V, I_O=40mA$	—	180	—	μV
NJM78L12A						
Output Voltage	V_O	$V_{IN}=19V, I_O=40mA$	11.4	12	12.6	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=14.5\sim 27V, I_O=40mA$	—	—	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=16\sim 27V, I_O=40mA$	—	—	200	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=19V, I_O=1\sim 40mA$	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=19V, I_O=1\sim 100mA$	—	—	100	mV
Quiescent Current	I_O	$V_{IN}=19V, I_O=0mA$	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=19V, I_O=1mA$	—	-1.5	—	mV/°C
Ripple Rejections	RR	$15V < V_{IN} < 25V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	37	42	—	dB
Output Noise Voltage	V_{NO}	$BW=10Hz\sim 100kHz, V_{IN}=19V, I_O=40mA$	—	240	—	μV

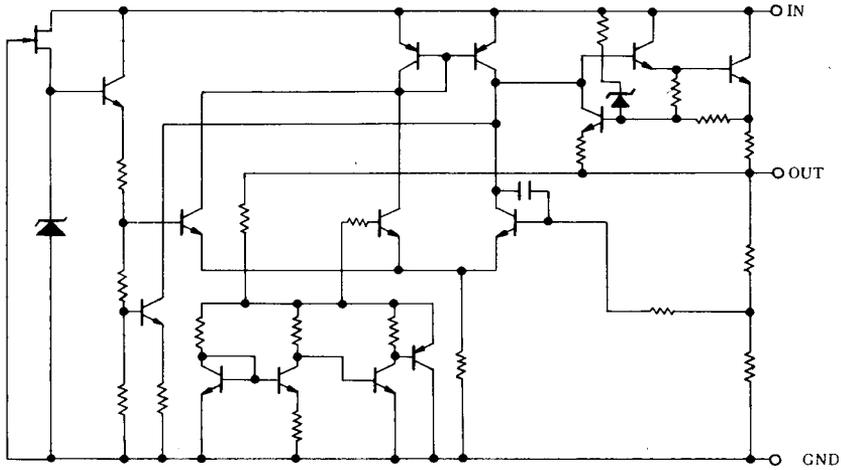
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■ **Electrical Characteristics** ($T_i=25^\circ\text{C}$, $C_{IN}=0.33\mu\text{F}$, $C_O=0.1\mu\text{F}$)

Measurement is to be conducted in pulse testing.

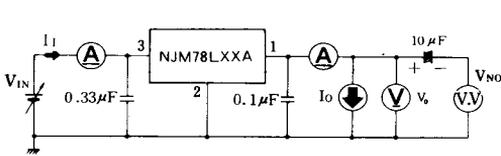
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
NJM78L15A						
Output Voltage	V_O	$V_{IN}=23\text{V}$, $I_O=40\text{mA}$	14.3	15	15.7	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=17.5\sim 30\text{V}$, $I_O=40\text{mA}$	—	—	300	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=20\sim 30\text{V}$, $I_O=40\text{mA}$	—	—	250	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=23\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	75	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=23\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	150	mV
Quiescent Current	I_O	$V_{IN}=23\text{V}$, $I_O=0\text{mA}$	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=23\text{V}$, $I_O=1\text{mA}$	—	-1.5	—	mV/°C
Ripple Rejections	RR	$18.5\text{V}<V_{IN}<28.5\text{V}$, $I_O=40\text{mA}$, $e_{IN}=1V_{P-P}$, $f=120\text{Hz}$	34	39	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=23\text{V}$, $I_O=40\text{mA}$	—	250	—	μV
NJM78L18A						
Output Voltage	V_O	$V_{IN}=27\text{V}$, $I_O=40\text{mA}$	17.1	18	18.9	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=22\sim 33\text{V}$, $I_O=40\text{mA}$	—	—	320	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=23\sim 33\text{V}$, $I_O=40\text{mA}$	—	—	270	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=27\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	80	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=27\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	160	mV
Quiescent Current	I_O	$V_{IN}=27\text{V}$, $I_O=0\text{mA}$	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=27\text{V}$, $I_O=1\text{mA}$	—	-2	—	mV/°C
Ripple Rejections	RR	$23\text{V}<V_{IN}<33\text{V}$, $I_O=40\text{mA}$, $e_{IN}=1V_{P-P}$, $f=120\text{Hz}$	33	38	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=27\text{V}$, $I_O=40\text{mA}$	—	310	—	μV
NJM78L20A						
Output Voltage	V_O	$V_{IN}=29\text{V}$, $I_O=40\text{mA}$	19.0	20	21.0	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=23\sim 34\text{V}$, $I_O=40\text{mA}$	—	—	330	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=24\sim 34\text{V}$, $I_O=40\text{mA}$	—	—	280	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=29\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	90	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=29\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	180	mV
Quiescent Current	I_O	$V_{IN}=29\text{V}$, $I_O=1\text{mA}$	—	—	7	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=29\text{V}$, $I_O=1\text{mA}$	—	-2	—	mV/°C
Ripple Rejections	RR	$24\text{V}<V_{IN}<34\text{V}$, $I_O=40\text{mA}$, $e_{IN}=1V_{P-P}$, $f=120\text{Hz}$	32	37	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=29\text{V}$, $I_O=40\text{mA}$	—	340	—	μV
NJM78L24A						
Output Voltage	V_O	$V_{IN}=33\text{V}$, $I_O=40\text{mA}$	22.8	24	25.2	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=27\sim 38\text{V}$, $I_O=40\text{mA}$	—	—	350	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=28\sim 38\text{V}$, $I_O=40\text{mA}$	—	—	300	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=33\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	100	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=33\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	200	mV
Quiescent Current	I_O	$V_{IN}=33\text{V}$, $I_O=0\text{mA}$	—	—	7	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=33\text{V}$, $I_O=1\text{mA}$	—	-2	—	mV/°C
Ripple Rejections	RR	$27.5\text{V}<V_{IN}<37.5\text{V}$, $I_O=40\text{mA}$, $e_{IN}=1V_{P-P}$, $f=120\text{Hz}$	32	37	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=33\text{V}$, $I_O=40\text{mA}$	—	420	—	μV

■ Equivalent Circuit

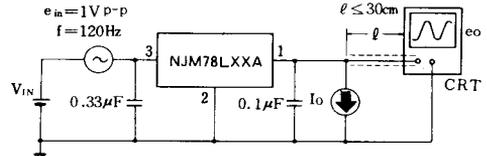


■ Test Circuit

- 1. Output Voltage, Line Regulation, Load Regulation, Quiescent Current, Average Temperature Coefficient of Output Voltage, Output Noise Voltage, Peak Output/Short-Circuit Current
- 2. Ripple Rejection

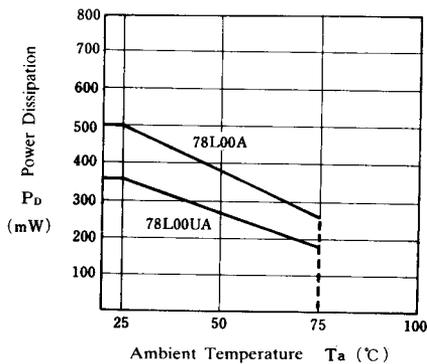


○ Measurement is to be conducted in pulse testing.
 ○ $I_Q = I_I - I_O$

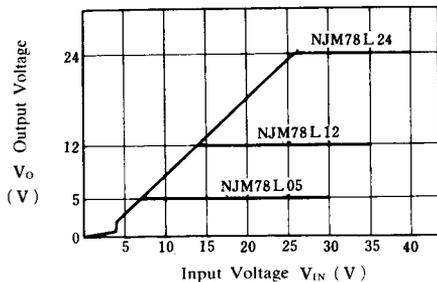


$$RR = 20 \log_{10} \left(\frac{e_m}{e_o} \right) \text{ (dB)}$$

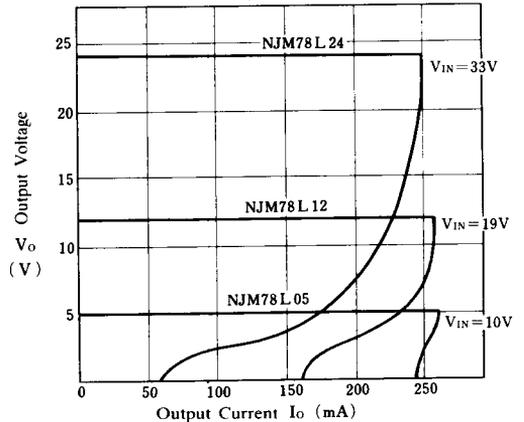
■ Ambient Temperature vs. Power Dissipation



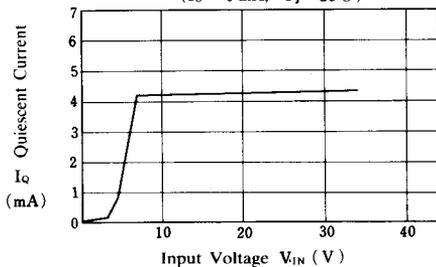
**NJM78L05/L12/L24
Output Characteristics**
($I_o = 0\text{ mA}$, $T_j = 25^\circ\text{C}$)



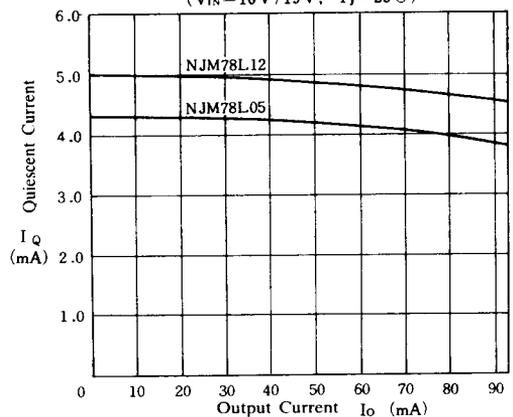
**NJM78L05/L12/L24
Load Characteristics**
($T_j = 25^\circ\text{C}$)



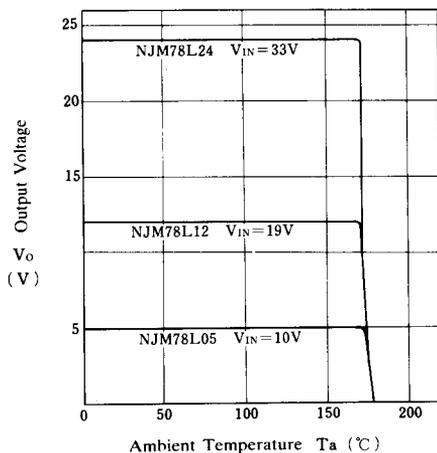
**NJM78L05 Quiescent Voltage
vs.
Input Voltage**
($I_o = 0\text{ mA}$, $T_j = 25^\circ\text{C}$)



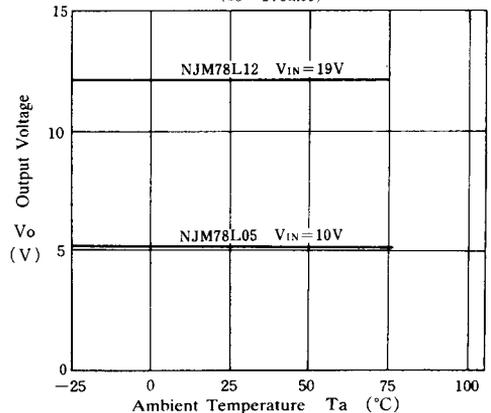
**NJM78L05/L12 Quiescent Current
vs. Output Current**
($V_{IN} = 10\text{ V} / 19\text{ V}$, $T_j = 25^\circ\text{C}$)



**NJM78L05/L12/L24
Thermal Shutdown Characteristics**
($V_{IN} = 10\text{ V} / 19\text{ V} / 33\text{ V}$, $I_o = 0\text{ mA}$)

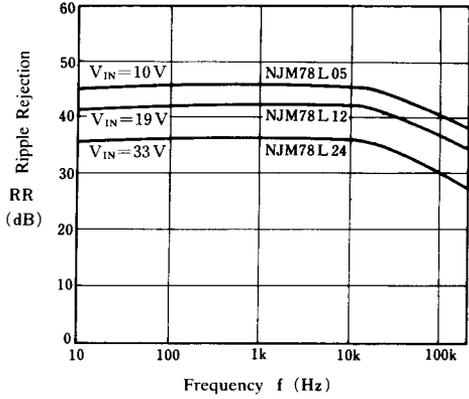


**NJM78L05/L12 Output Voltage
vs. Ambient Temperature**
($I_o = 1.0\text{ mA}$)



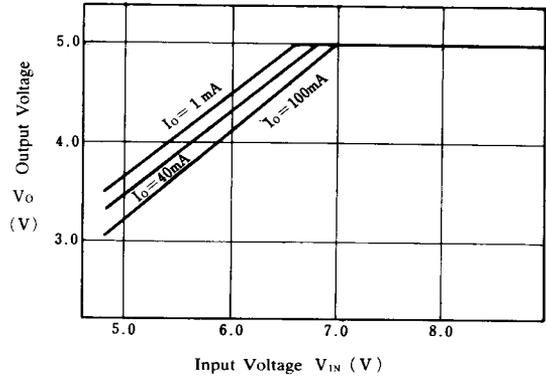
NJM78L05/L12/L24 Ripple Rejection

($I_o = 40\text{mA}$, $T_j = 25^\circ\text{C}$)



NJM78L05 Dropout Characteristics

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



NJM78L00 Series Short Circuit Output Current

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

