n-channel JFETs current regulator diodes *designed for . . .*

Siliconix

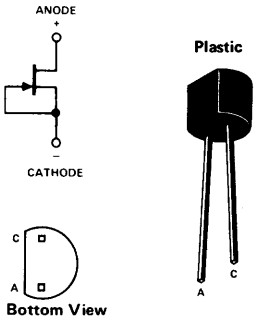
- **Current Regulation**
- **Current Limiting**
- **Biasing**
- **Linear Ramp and Staircase Generator**

Performance Curves NCL See Section 4

BENEFITS

- Low Cost
- Simple Two Lead Current Source
- Simplifies Floating Current Sources No Power Supplies Required
- Good Operating Current Tolerance ±20%

TO-92 (MODIFIED)
See Section 6



ABSOLUTE MAXIMUM RATINGS (25°C)

Peak Operating Voltage . . . . . 50 V
Forward Current . . . . . 20 mA
Reverse Current . . . . . 50 mA
Total Device Dissipation at 25°C Ambient
(Derate 3.27 mW/°C) . . . . . 360 mW
Operating Temperature Range . . . . . −55 to 135°C
Storage Temperature Range . . . . . −55 to 150°C
Lead Temperature Range
(1/16″ from case for 10 seconds) . . . . . 300°C

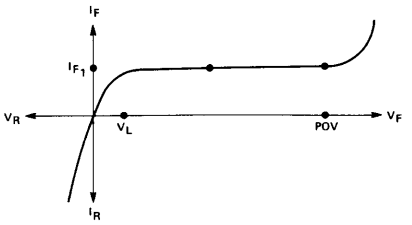
ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

		Characteristic			J500	J501	J502	J503	J504	J505	Unit	Test Conditions
1	STATIC	I_{FI}	Forward Current (Note 1)	Min	0.192	0.264	0.344	0.448	0.600	0.800	mA	V_F = 25 V
2	STATIC	I_{FI}	Forward Current (Note 1)	Nominal	0.240	0.330	0.430	0.560	0.750	1.000	mA	V_F = 25 V
3	STATIC	I_{FI}	Forward Current (Note 1)	Max	0.288	0.396	0.516	0.672	0.900	1.200	mA	V_F = 25 V
4	STATIC	POV	Peak Operating Voltage (Notes 1 and 2)	Min	50	50	50	50	50	50	V	$I_F = 1.1\ I_{FI}$ (Max)
5	STATIC	V_L	Limiting Voltage (Note 3)	Max	1.2	1.3	1.5	1.7	1.9	2.1	V	$I_F = 0.9\ I_{FI}$ (Min)
6	STATIC	V_L	Limiting Voltage (Note 3)	Typ	0.8	0.9	1.1	1.2	1.4	1.5	V	$I_F = 0.9\ I_{FI}$ (Min)
7	DYN	Z_{FI}	Small-Signal Dynamic Impedance (Note 1)	Min	4.0	2.2	1.5	1.2	0.8	0.5	MΩ	V_F = 25 V, f = 1 kHz
8	DYN	Z_{FI}	Small-Signal Dynamic Impedance (Note 1)	Typ	8.0	6.0	4.4	3.4	2.5	1.9	MΩ	V_F = 25 V, f = 1 kHz
9	DYN	C_F	Anode-Cathode Capacitance	Typ	2	2	2	2	2	2	pF	V_F = 25 V, f = 1 MHz

NOTES:
1. Pulse test duration = 2 ms.
2. Maximum V_F where $I_F < 1.1\ I_{FI(Max)}$ is guaranteed.
3. Minimum V_F required to insure $I_F > 0.9\ I_{FI(Min)}$.

NCL

Current-Limiter Diode
V-I Characteristic



2

J506 J507 J508 J509 J510 J511

n-channel JFETs current regulator diodes *designed for . . .*

Siliconix

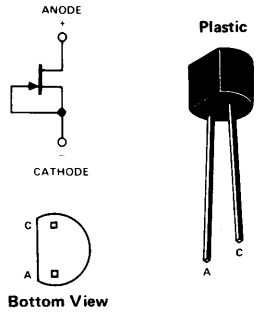
- **Current Regulation**
- **Current Limiting**
- **Biasing**
- **Linear Ramp and Staircase Generator**

Performance Curves NCL See Section 4

BENEFITS

- Low Cost
- Simple Two Lead Current Source
- Simplifies Floating Current Sources No Power Supplies Required
- Good Operating Current Tolerance ±20%

TO-92 (MODIFIED)
See Section 6



ABSOLUTE MAXIMUM RATINGS (25°C)

Peak Operating Voltage . . . . . 50 V
Forward Current . . . . . 20 mA
Reverse Current . . . . . 50 mA
Total Device Dissipation at 25°C Ambient
(Derate 3.27 mW/°C) . . . . . 360 mW
Operating Temperature Range . . . . . –55 to 135°C
Storage Temperature Range . . . . . –55 to 150°C
Lead Temperature Range
(1/16" from case for 10 seconds) . . . . . 300°C

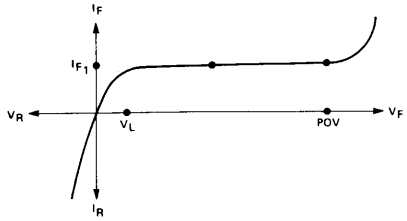
ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

		Characteristic			J506	J507	J508	J509	J510	J511	Unit	Test Conditions
1	STATIC	I_{FI}	Forward Current (Note 1)	Min	1.120	1.440	1.9	2.4	2.9	3.8	mA	V_F = 25 V
2				Nominal	1.400	1.800	2.4	3.0	3.6	4.7		
3				Max	1.680	2.160	2.9	3.6	4.3	5.6		
4		POV	Peak Operating Voltage (Notes 1 and 2)	Min	50	50	50	50	50	50	V	$I_F = 1.1\ I_{FI}$ (Max)
5		V_L	Limiting Voltage (Note 3)	Max	2.5	2.8	3.1	3.5	3.9	4.2		$I_F = 0.9\ I_{FI}$ (Min)
6				Typ	1.8	2.0	2.2	2.5	2.8	3.0		
7	DYN	Z_{FI}	Small-Signal Dynamic Impedance (Note 1)	Min	0.33	0.2	0.2	0.15	0.15	0.12	MΩ	V_F = 25 V, f = 1 kHz
8				Typ	1.4	1.0	0.70	0.60	0.50	0.30		
9		C_F	Anode-Cathode Capacitance	Typ	2	2	2	2	2	2	pF	V_F = 25 V, f = 1 MHz

NOTES:
1. Pulse test duration = 2 ms.
2. Maximum V_F where $I_F < 1.1\ I_{FI(Max)}$ is guaranteed.
3. Minimum V_F required to insure $I_F > 0.9\ I_{FI(Min)}$.

NCL

Current-Limiter Diode
V-I Characteristic



n-channel JFETs current regulator diodes *designed for . . .*

Siliconix

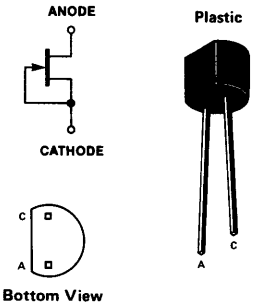
Performance Curves NKL, VRMA
See Section 4

BENEFITS

- Low Cost
- Simple Two Lead Current Source
- Simplifies Floating Current Sources
  No Power Supplies Required

- **Current Regulation**
- **Current Limiting**
- **Biasing**
- **Linear Ramp and Staircase Generator**

TO-92 (MODIFIED)
See Section 6



ABSOLUTE MAXIMUM RATINGS (25°C)

Peak Operating Voltage 100V
Forward Current . . . . . 20 mA
Reverse Current . . . . . 50 mA
Total Device Dissipation
(25°C Free Air Temperature) . . . . . 350 mW
Power Derating (to +125°C) . . . . . 3.27 mW/°C
Storage Temperature Range . . . . . –55 to 135°C
Operating Temperature Range . . . . . –55 to 135°C
Lead Temperature Range
(1/16" from case for 10 seconds) . . . . . 300°C

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

		Characteristic		Min	Typical	Max	Unit	Test Conditions
1	STATIC	I_{F1}	Forward Current (Note 1)			770	μA	V_F = 100 V
2	STATIC	I_{F1}	Forward Current (Note 1)	250		700	μA	V_F = 25 V
3	STATIC	I_{F1}	Forward Current (Note 1)	200		—	μA	V_F = 1.0 V
4	STATIC	POV	Peak Operating Voltage (Notes 1 and 2)	100			V	$I_F = 1 \bullet d\ I_{F1}$ (Max)
5	STATIC	V_L	Limiting Voltage (Note 3)		1.1	1.5	V	$I_F = 0.9\ I_{F1}$ (Min)
6	STATIC	V_L	Limiting Voltage (Note 3)		1.1	1.5	V	$I_F = 0.9\ I_{F1}$ (Min)
7	DYN	Z_{F1}	Small-Signal Dynamic Impedance (Note 1)	1.0	4.4		MΩ	V_F = 25 V, f = 1 kHz
8	DYN	Z_{F1}	Small-Signal Dynamic Impedance (Note 1)	1.0	4.4		MΩ	V_F = 25 V, f = 1 kHz
9	DYN	C_F	Anode-Cathode Capacitance		2		pF	V_F = 25 V, f = 1 MHz

NOTES:
1. Pulse test duration = 2 ms.
2. Maximum V_F where $I_F < 1.1\ I_{F1(Max)}$ is guaranteed.
3. Minimum V_F required to insure $I_F > 0.9\ I_{F1(Min)}$.

NKL, VRMA

J553 J554 J555 J556 J557

current regulator diodes designed for . . .

Siliconix

- **Current Regulation**
- **Current Limiting**
- **Biasing**
- **Low Voltage References**

Performance Curves NCL
See Section 4

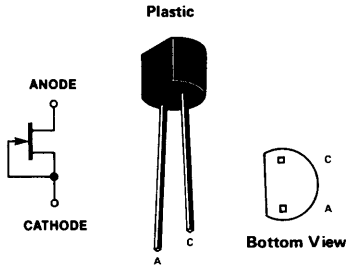
BENEFITS

- Simple Two Lead Current Source
- In Low Cost Plastic Package
- Simplifies Floating Current Sources
  No Power Supplies Required

ABSOLUTE MAXIMUM RATINGS (25°C)

Peak Operating Voltage . . . . . 50 V
Forward Current . . . . . 20 mA
Reverse Current . . . . . 50 mA
Total Device Dissipation at 25°C Ambient
(Derate 3.27 mW/°C) . . . . . 360 mW
Operating Temperature Range . . . . . –55 to 135°C
Storage Temperature Range . . . . . –55 to 150°C
Lead Temperature Range
(1/16" from case for 10 seconds) . . . . . 300°C

TO-92 (MODIFIED)
See Section 6

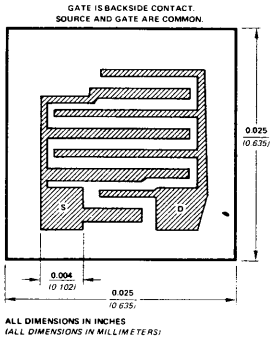


ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

	Regulator Current			Limiting Voltage		Peak op Volt	Dynamic Impedance	Knee Impedance
	V_F=25V			I_F=0.8 $I_{FI(min)}$ I_{FF} 1.1				
PART NUMBER	I_F NOM	I_F MIN	I_F MAX	V_L	V_L	V_{OP}	'ZD	'ZK
	Nominal mA	Min mA	Max mA	Max Volts	Typical	I_{FI} (Max) Min Volts	Typical Megohms	Typical Megohms
J553	0.5	0.18	0.75	1.3	0.75	50	10	2
J554	1.0	0.6	1.6	1.75	0.55	50	1	1
J555	2.0	1.4	2.6	2.15	0.75	50	.88	0.25
J556	3.0	2.4	3.8	2.6	0.75	50	.6	0.14
J557	4.5	3.6	5.3	3.0	1.5	50	.48	0.09

NCL

NOTES:
1. Pulse test—steady state currents may vary.
2. Pulse test—steady state impedance may vary.
3. Min V_F required to insure I_F>0.8 I_{F1} (min).
4. Max V_F where I_F < 1.1 $I_{F1(max)}$ is guaranteed.



n-channel JFET current regulator diode *designed for . . .*

Siliconix

- Current Regulation
- Current Limiting
- Biasing

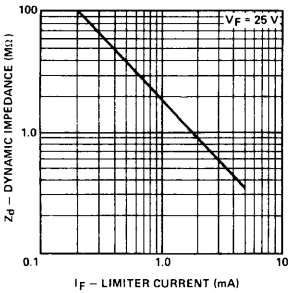
BENEFITS:

- Simple Two Lead Current Source
- Simplifies Floating Current Sources No Power Supplies Required
- Low Cost

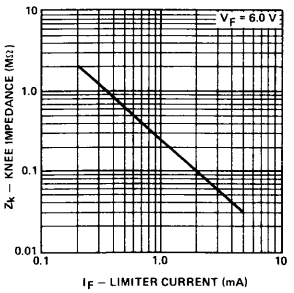
TYPE	PACKAGE	PRINCIPAL DEVICES
Single	TO-92	J500-505, J506-511, J553-7
Single	Chip	J500CHP-505CHP, J506CHP-511 CHP

PERFORMANCE CURVES (25°C unless otherwise noted)

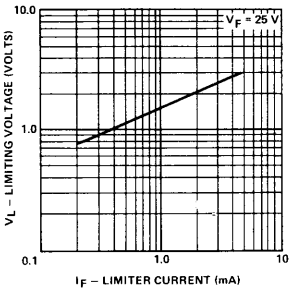
Dynamic Impedance vs Limiter Current



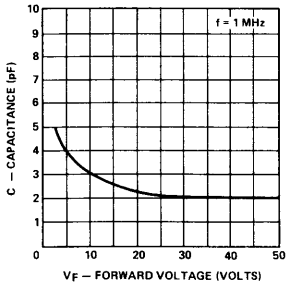
Knee Impedance vs Limiter Current



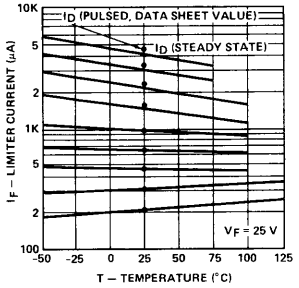
Limiting Voltage at 0.9 I_D vs Limiter Current

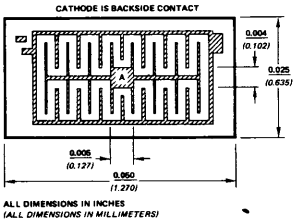


Capacitance vs Forward Voltage



Typical Variation of I_D with Temperature Steady State and Pulsed Value





n-channel JFET current regulator diode *designed for . . .*

Siliconix

- Current Regulation
- Current Limiting
- Biasing
- Low Voltage References

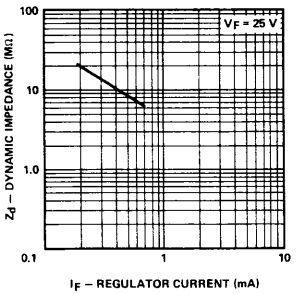
BENEFITS:

- Simple Two Lead Current Source
- Current Insensitive to Temperature Changes. Temperature Coefficient Better Than 0.15%/°C On All Devices
- TO-18 Package for Improved Current Control
- Simplifies Floating Current Sources No Power Supplies Required

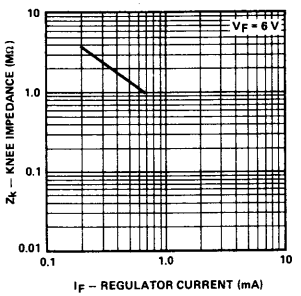
TYPE	PACKAGE	PRINCIPAL DEVICES
Single	TO-18 (2-lead)	CR022 Thru CR062 CRR0240 Thru CRR0560
Single	Chip	All of above

PERFORMANCE CURVES (25°C unless otherwise noted)

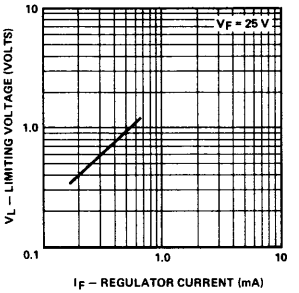
Dynamic Impedance vs Regulator Current



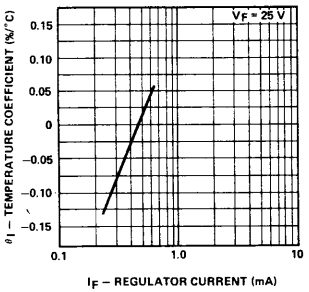
Knee Impedance vs Regulator Current



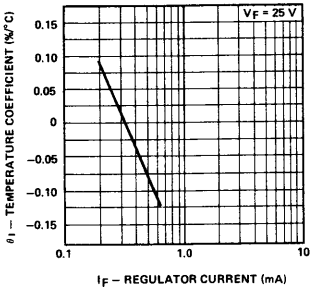
Limiting Voltage @ 0.8 I_F vs Regulator Current



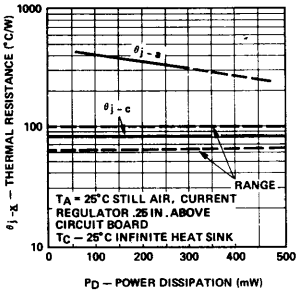
Temperature Coefficient $-55°C \leqslant T_j \leqslant 25°C$ vs Regulator Current



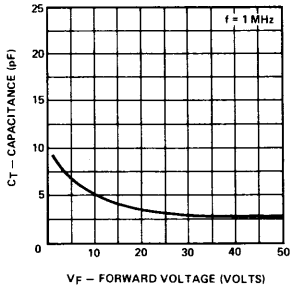
Temperature Coefficient $25°C \leqslant T_j \leqslant 125°C$ vs Regulator Current



Thermal Resistance vs Power Dissipation



Capacitance vs Forward Voltage



NOTE: I_F, Regulator Current is specified under pulse conditions. In operation, final current will be a function of junction temperature. I_F (steady state) = $I_F \times [1 + \theta_I (T_j - 25°C)]$ where θ_I is the temperature coefficient of I_F and T_j is the junction temperature.

T_j may be found by $T_j = T_{amb} + \theta_{j-a}P_D = T_{case} + \theta_{j-c}P_D$. T_j must not exceed 150°C. $\frac{1}{\theta_{j-c}}$ or $\frac{1}{\theta_{j-a}}$ is the derating factor for all devices.