

# NTP5864N

## MOSFET – Power 60 V, 63 A, 12.4 mΩ

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- Avalanche Energy Specified
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter		Symbol	Value	Units	
Drain-to-Source Voltage		$V_{DSS}$	60	V	
Gate-to-Source Voltage – Continuous		$V_{GS}$	$\pm 20$	V	
Gate-to-Source Voltage – Non-Repetitive ( $t_p = 10 \mu\text{s}$ )		$V_{GS}$	$\pm 30$	V	
Continuous Drain Current – $R_{\theta JC}$ (Note 1)	Steady State	$I_D$	$T_C = 25^\circ\text{C}$	63	A
			$T_C = 100^\circ\text{C}$	45	
Power Dissipation – $R_{\theta JC}$ (Note 1)	Steady State	$P_D$	$T_C = 25^\circ\text{C}$	107	W
			$T_C = 100^\circ\text{C}$	54	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	252	A	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$	
Source Current (Body Diode) Pulsed		$I_S$	63	A	
Single Pulse Drain-to-Source Avalanche Energy – ( $L = 0.1 \text{ mH}$ )		EAS	80	mJ	
		IAS	40	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Units
Junction-to-Case (Drain) – Steady State (Note 1)	$R_{\theta JC}$	1.4	$^\circ\text{C/W}$
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	33	$^\circ\text{C/W}$

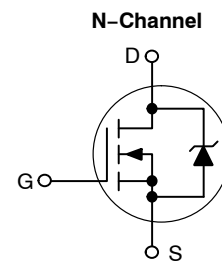
1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).



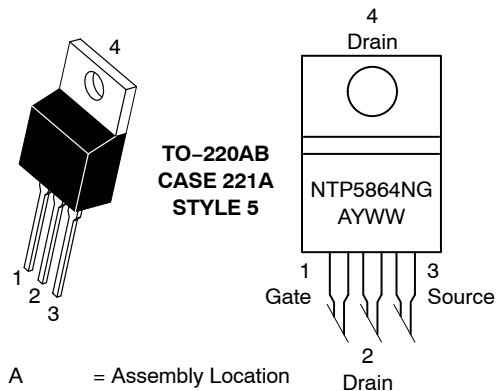
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$V_{(BR)DSS}$	$R_{DS(ON) MAX}$	$I_D MAX$ (Note 1)
60 V	12.4 mΩ @ 10 V	63 A



### MARKING DIAGRAM & PIN ASSIGNMENT



- A = Assembly Location
- Y = Year
- WW = Work Week
- G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping
NTP5864NG	TO-220 (Pb-Free)	50 Units / Rail

# NTP5864N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			58		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 60 V			1.0	μA
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2.0		4.0	V
Gate Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			-10		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		10.2	12.4	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		10		S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 25 V		1680		pF
Output Capacitance	C <sub>OSS</sub>			189		
Reverse Transfer Capacitance	C <sub>RSS</sub>			124		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48 V, I <sub>D</sub> = 20 A		31		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			2.0		
Gate-to-Source Charge	Q <sub>GS</sub>			7.3		
Gate-to-Drain Charge	Q <sub>GD</sub>			10		
Gate Resistance	R <sub>g</sub>			0.5		Ω

### SWITCHING CHARACTERISTICS, V<sub>GS</sub> = 10 V (Note 3)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 48 V, I <sub>D</sub> = 20 A, R <sub>g</sub> = 2.5 Ω		10		ns
Rise Time	t <sub>r</sub>			6.4		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			18		
Fall Time	t <sub>f</sub>			4.6		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 40 A	T <sub>J</sub> = 25°C	0.94	1.2	V
			T <sub>J</sub> = 125°C	0.84		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>SD</sub> /dt = 100 A/μs, I <sub>S</sub> = 20 A		24		ns
Charge Time	t <sub>a</sub>			16		
Discharge Time	t <sub>b</sub>			7.9		
Reverse Recovery Charge	Q <sub>RR</sub>			20		

2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

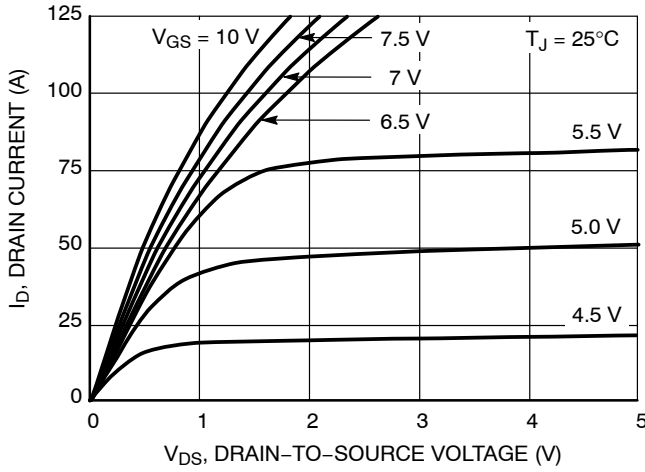


Figure 1. On-Region Characteristics

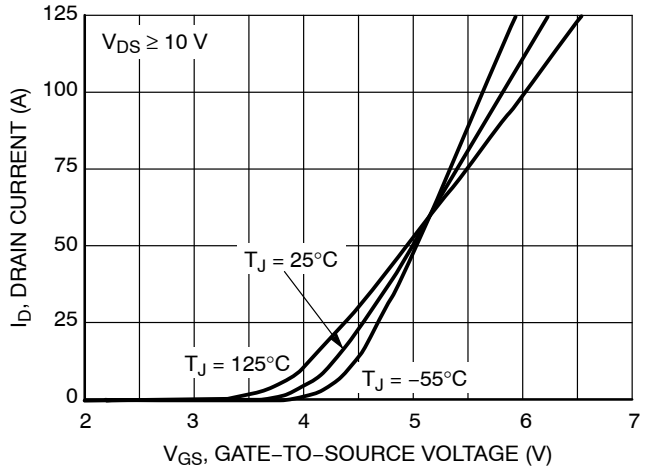


Figure 2. Transfer Characteristics

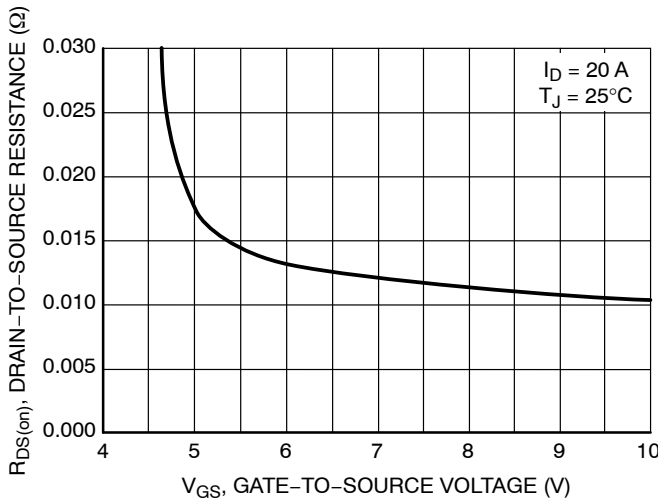


Figure 3. On-Resistance vs. Gate Voltage

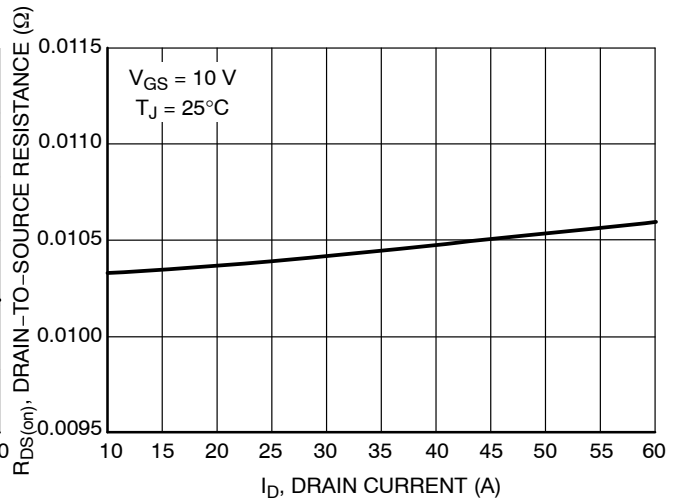


Figure 4. On-Resistance vs. Drain Current

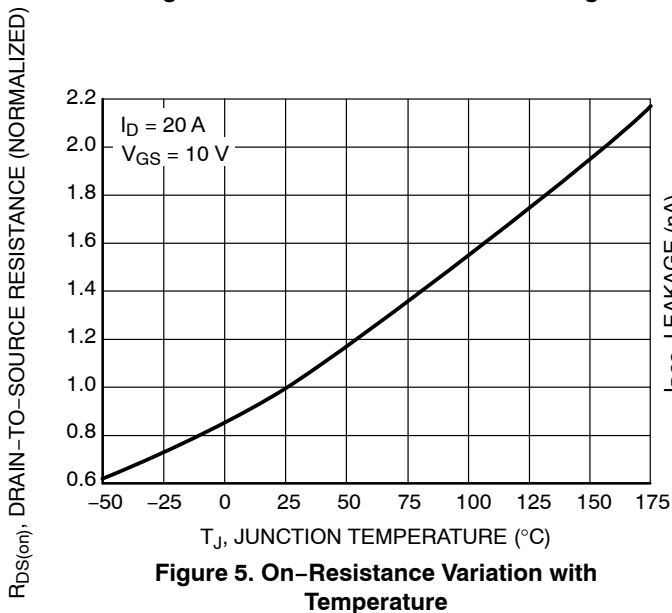


Figure 5. On-Resistance Variation with Temperature

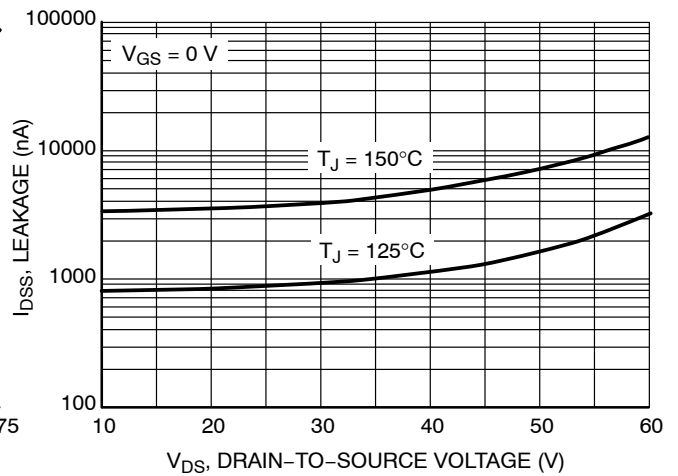


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS

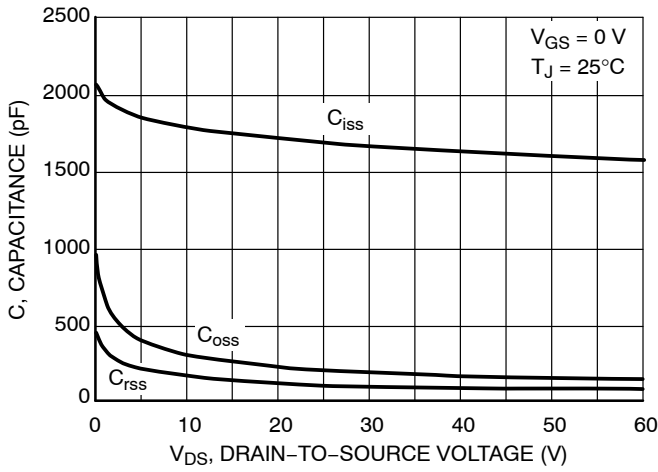


Figure 7. Capacitance Variation

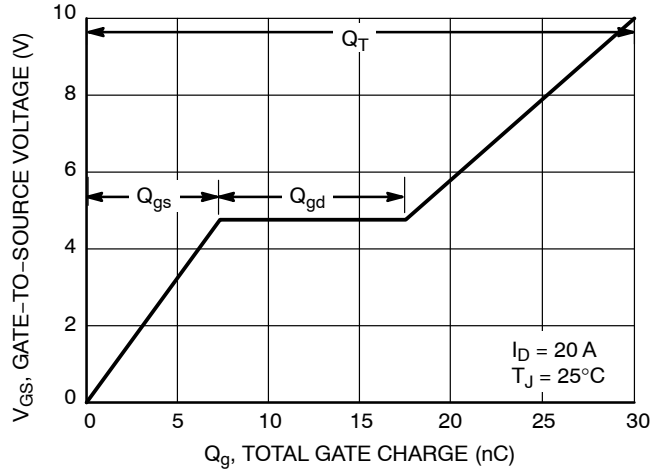


Figure 8. Gate-to-Source vs. Total Charge

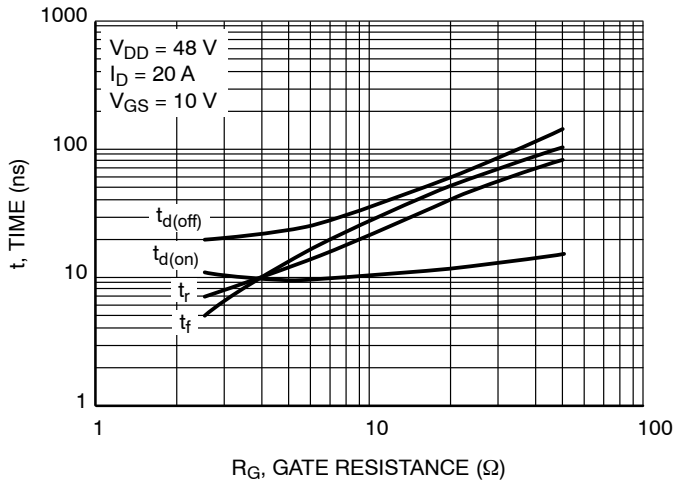


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

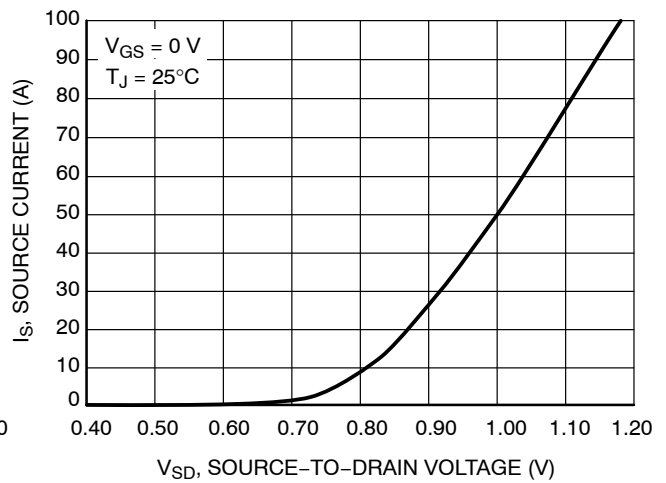


Figure 10. Diode Forward Voltage vs. Current

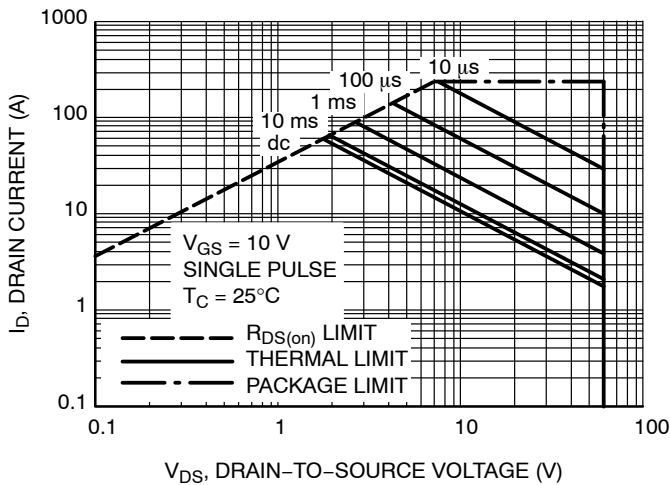


Figure 11. Maximum Rated Forward Biased Safe Operating Area

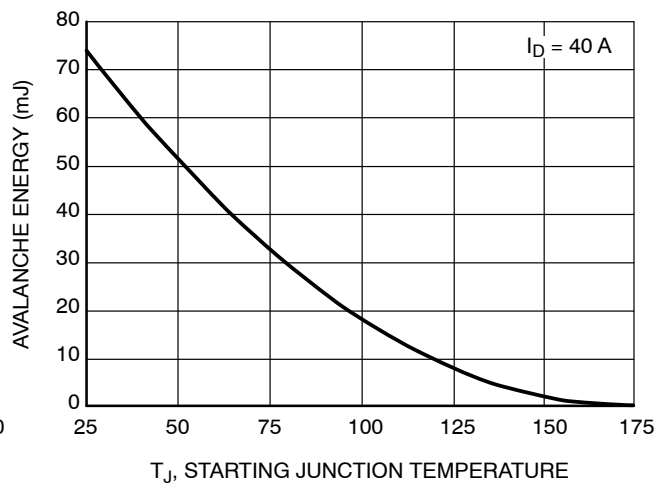


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

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## TYPICAL CHARACTERISTICS

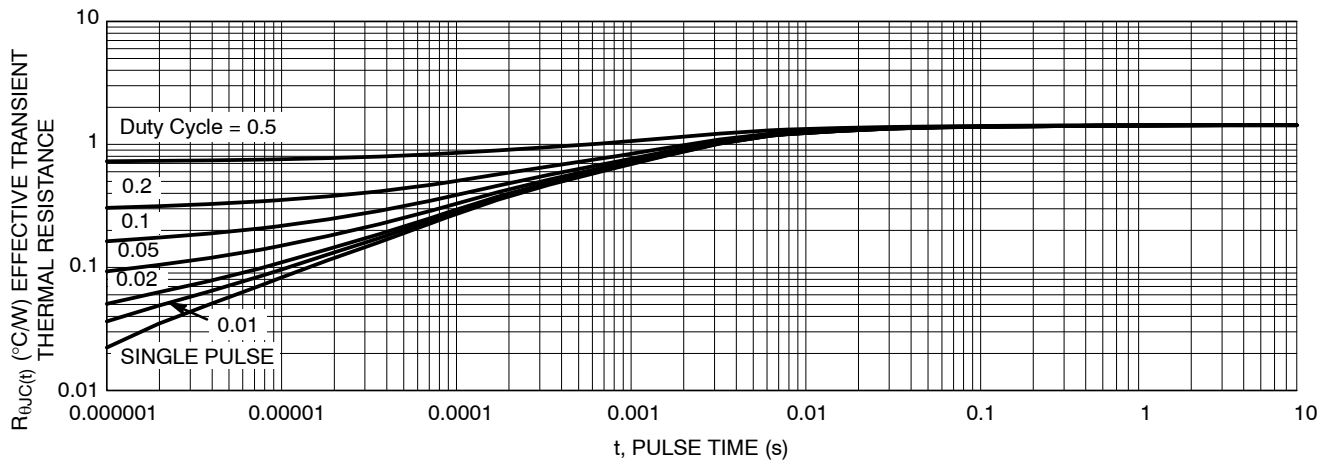


Figure 13. Thermal Response

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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SCALE 1:1

### TO-220 CASE 221A-09 ISSUE AJ

DATE 05 NOV 2019



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.
4. MAX WIDTH FOR F102 DEVICE = 1.35MM

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.570	0.620	14.48	15.75
B	0.380	0.415	9.66	10.53
C	0.160	0.190	4.07	4.83
D	0.025	0.038	0.64	0.96
F	0.142	0.161	3.60	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.024	0.36	0.61
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.41
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 1:

- PIN 1. BASE
- 2. COLLECTOR
- 3. EMITTER
- 4. COLLECTOR

STYLE 2:

- PIN 1. BASE
- 2. EMITTER
- 3. COLLECTOR
- 4. EMITTER

STYLE 3:

- PIN 1. CATHODE
- 2. ANODE
- 3. GATE
- 4. ANODE

STYLE 4:

- PIN 1. MAIN TERMINAL 1
- 2. MAIN TERMINAL 2
- 3. GATE
- 4. MAIN TERMINAL 2

STYLE 5:

- PIN 1. GATE
- 2. DRAIN
- 3. SOURCE
- 4. DRAIN

STYLE 6:

- PIN 1. ANODE
- 2. CATHODE
- 3. ANODE
- 4. CATHODE

STYLE 7:

- PIN 1. CATHODE
- 2. ANODE
- 3. CATHODE
- 4. ANODE

STYLE 8:

- PIN 1. CATHODE
- 2. ANODE
- 3. EXTERNAL TRIP/DELAY
- 4. ANODE

STYLE 9:

- PIN 1. GATE
- 2. COLLECTOR
- 3. EMITTER
- 4. COLLECTOR

STYLE 10:

- PIN 1. GATE
- 2. SOURCE
- 3. DRAIN
- 4. SOURCE

STYLE 11:

- PIN 1. DRAIN
- 2. SOURCE
- 3. GATE
- 4. SOURCE

STYLE 12:

- PIN 1. MAIN TERMINAL 1
- 2. MAIN TERMINAL 2
- 3. GATE
- 4. NOT CONNECTED

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