NTR4101P, NTRV4101P

MOSFET – Power, Single P-Channel, Trench, SOT-23 -20 V

ON Semiconductor®

www.onsemi.com

Features

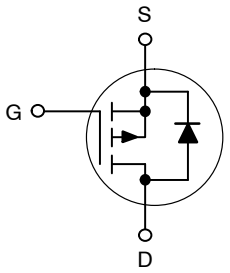
- Leading −20 V Trench for Low $R_{DS(on)}$
- −1.8 V Rated for Low Voltage Gate Drive
- SOT−23 Surface Mount for Small Footprint
- NTRV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Load/Power Management for Portables
- Load/Power Management for Computing
- Charging Circuits and Battery Protection

$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX
−20 V	70 mΩ @ −4.5 V	−3.2 A
	90 mΩ @ −2.5 V	
	112 mΩ @ −1.8 V	

P−Channel MOSFET

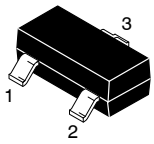


MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

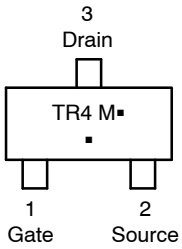
Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	−20	V
Gate−to−Source Voltage			V_{GS}	±8.0	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	−2.4	A
		T_A = 85°C		−1.7	
	t ≤ 10 s	T_A = 25°C		−3.2	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	0.73	W
	t ≤ 10 s			1.25	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	−1.8	A
		T_A = 85°C		−1.3	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.42	W
Pulsed Drain Current	tp = 10 μs		I_{DM}	−18	A
ESD Capability (Note 3)	C = 100 pF, RS = 1500 Ω		ESD	225	V
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	−2.4	A
Single Pulse Drain−to−Source Avalanche Energy (V_{GS} = −8 V, I_L = −1.8 Apk, L = 10 mH, R_G = 25 Ω)			EAS	16	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°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.

MARKING DIAGRAM & PIN ASSIGNMENT



SOT−23
CASE 318
STYLE 21



TR4 = Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTR4101PT1G	SOT−23 (Pb−Free)	3000 / Tape & Reel
NTRV4101PT1G		

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	170	°C/W
Junction−to−Ambient − t < 10 s (Note 1)	$R_{\theta JA}$	100	
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	300	

1. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces)
2. Surface−mounted on FR4 board using the minimum recommended pad size.
3. ESD Rating Information: HBM Class 0

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain−to−Source Breakdown Voltage (Note 4) (V_{GS} = 0 V, I_D = −250 μA)	$V_{(BR)DSS}$	−20			V
Zero Gate Voltage Drain Current (Note 4) (V_{GS} = 0 V, V_{DS} = −16 V)	I_{DSS}			−1.0	μA
Gate−to−Source Leakage Current (V_{GS} = ±8.0 V, V_{DS} = 0 V)	I_{GSS}			±100	nA
ON CHARACTERISTICS					
Gate Threshold Voltage (Note 4) (V_{GS} = V_{DS}, I_D = −250 μA)	$V_{GS(th)}$	−0.4	−0.72	−1.2	V
Drain−to−Source On−Resistance (V_{GS} = −4.5 V, I_D = −1.6 A) (V_{GS} = −2.5 V, I_D = −1.3 A) (V_{GS} = −1.8 V, I_D = −0.9 A)	$R_{DS(on)}$		70 90 112	85 120 210	mΩ
Forward Transconductance (V_{DS} = −5.0 V, I_D = −2.3 A)	g_{FS}		7.5		S
CHARGES, CAPACITANCES & GATE RESISTANCE					
Input Capacitance	C_{iss}		675		pF
Output Capacitance (V_{GS} = 0 V, f = 1 MHz, V_{DS} = −10 V)	C_{oss}		100		
Reverse Transfer Capacitance	C_{rss}		75		
Total Gate Charge (V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −1.6 A)	$Q_{G(tot)}$		7.5	8.5	nC
Gate−to−Source Gate Charge (V_{DS} = −10 V, I_D = −1.6 A)	Q_{GS}		1.2		nC
Gate−to−Drain “Miller” Charge (V_{DS} = −10 V, I_D = −1.6 A)	Q_{GD}		2.2		nC
Gate Resistance	R_G		6.5		Ω
SWITCHING CHARACTERISTICS (Note 5)					
Turn−On Delay Time	$t_{d(on)}$		7.5		ns
Rise Time (V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −1.6 A, R_G = 6.0 Ω)	t_r		12.6		
Turn−Off Delay Time	$t_{d(off)}$		30.2		
Fall Time	t_f		21.0		
DRAIN−SOURCE DIODE CHARACTERISTICS					
Forward Diode Voltage (V_{GS} = 0 V, I_S = −2.4 A)	V_{SD}		−0.82	−1.2	V
Reverse Recovery Time	t_{rr}		12.8	15	ns
Charge Time (V_{GS} = 0 V, dI_{SD}/dt = 100 A/μs, I_S = −1.6 A)	t_a		9.9		ns
Discharge Time	t_b		3.0		ns
Reverse Recovery Charge	Q_{rr}		1008		nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperature.

TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

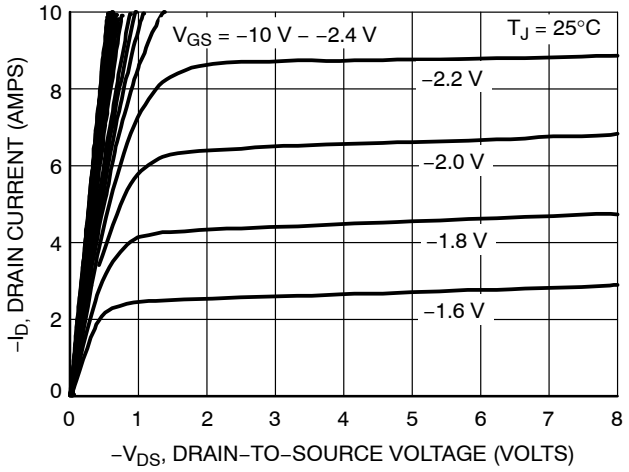


Figure 1. On−Region Characteristics

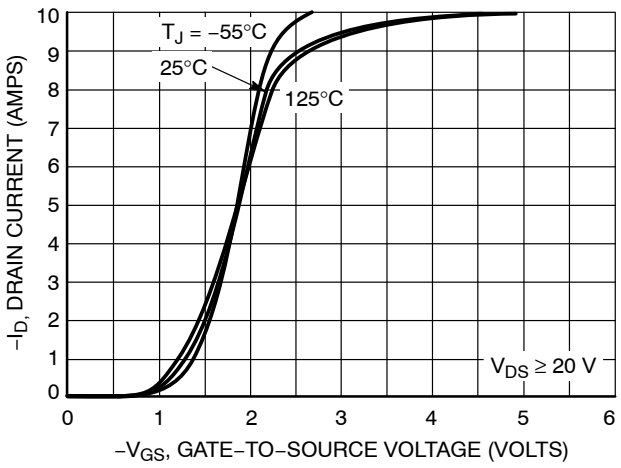


Figure 2. Transfer Characteristics

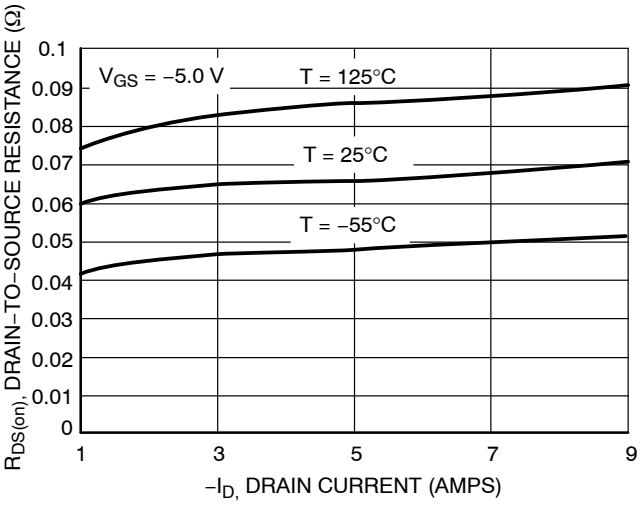


Figure 3. On−Resistance vs. Drain Current and Temperature

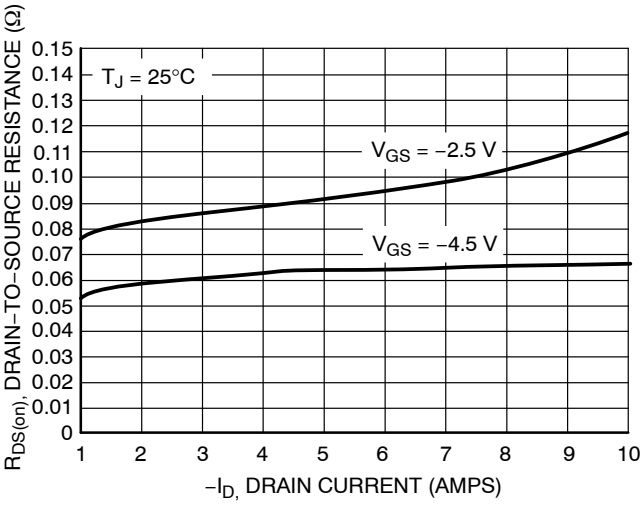


Figure 4. On−Resistance vs. Drain Current and Temperature

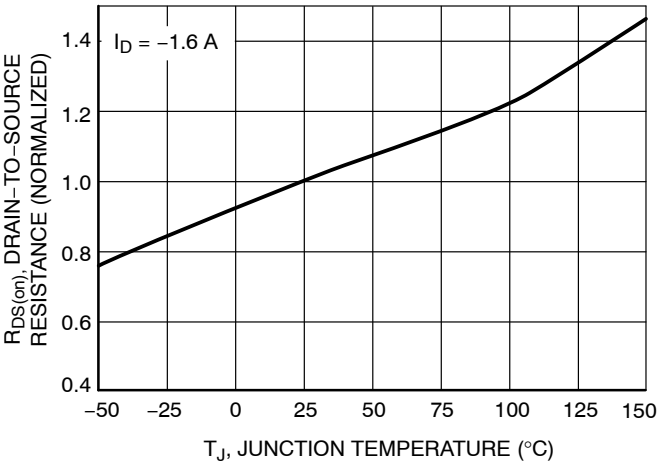


Figure 5. On−Resistance Variation with Temperature

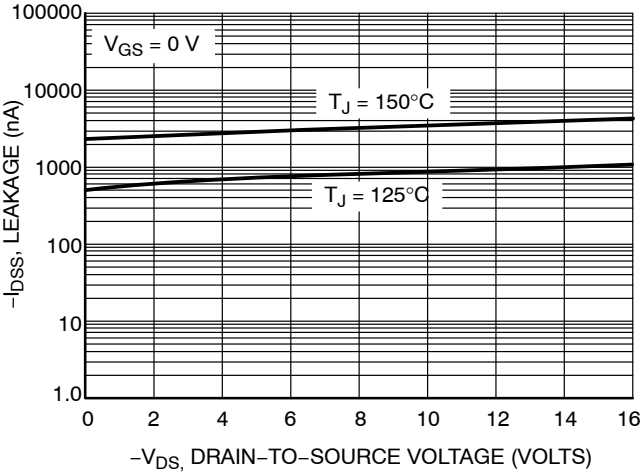


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

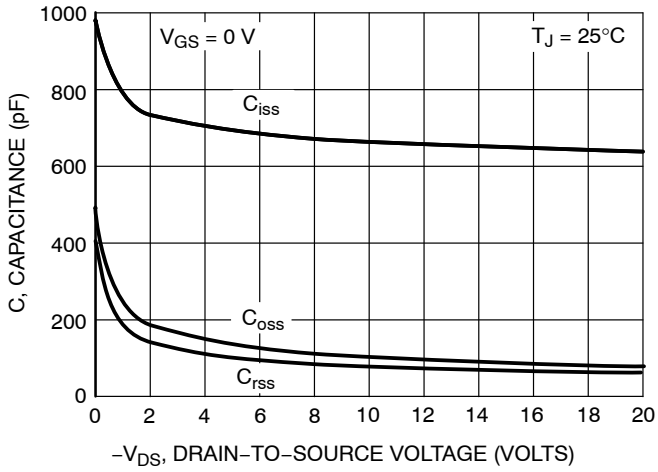


Figure 7. Capacitance Variation

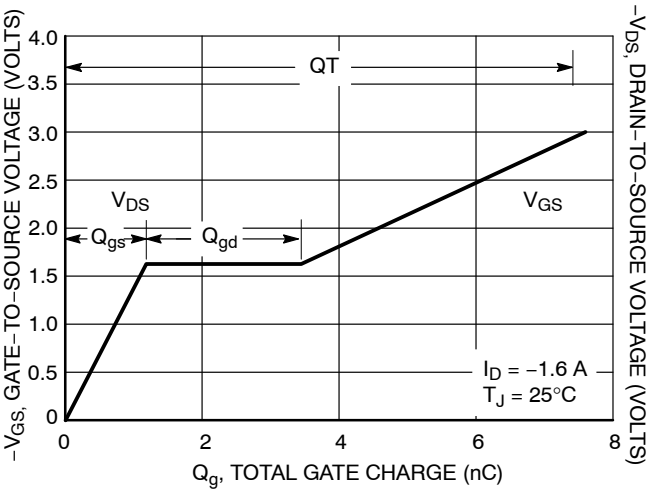


Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Gate Charge

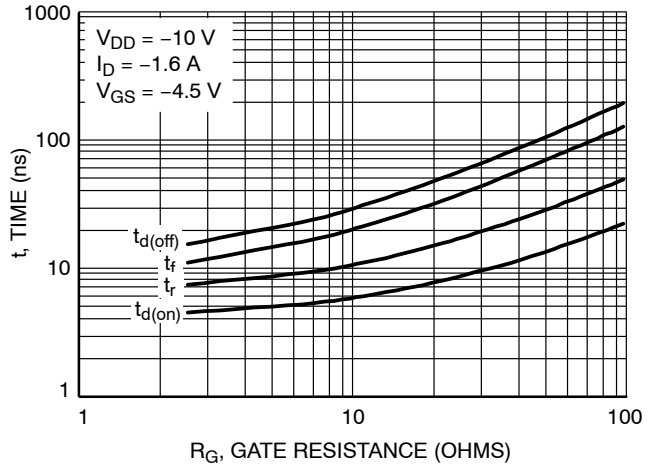


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

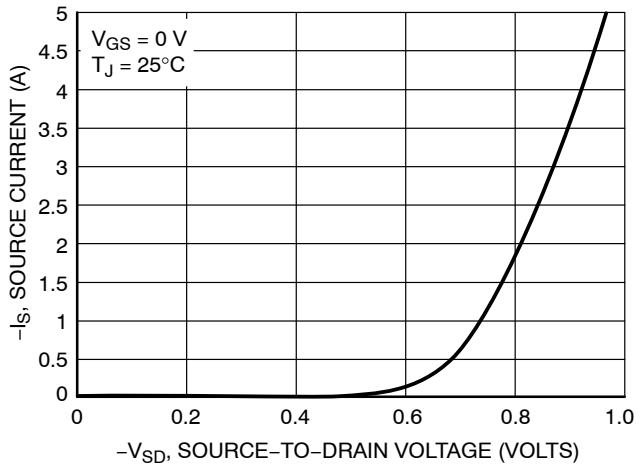


Figure 10. Diode Forward Voltage vs. Current

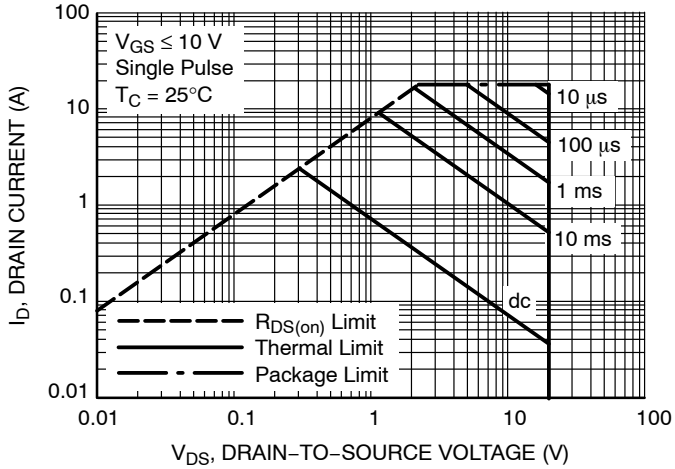
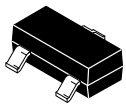


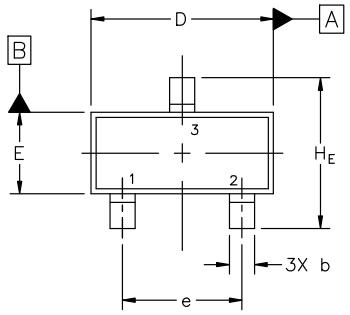
Figure 11. Maximum Rated Forward Biased Safe Operating Area



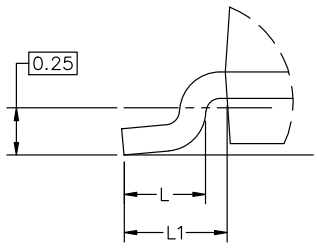
SCALE 4:1

SOT−23 (TO−236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

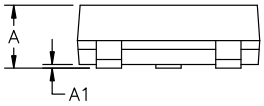
DATE 14 AUG 2024



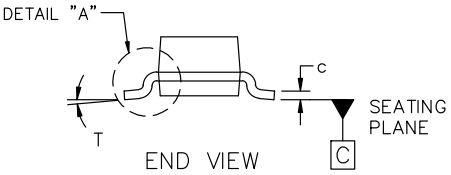
TOP VIEW



DETAIL "A"
Scale 3:1



SIDE VIEW

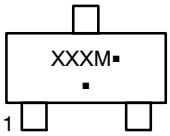


END VIEW

MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
H_E	2.10	2.40	2.64
T	0°	−−−	10°

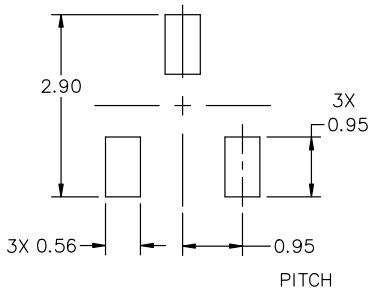
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

GENERIC
MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



RECOMMENDED
MOUNTING FOOTPRINT

* For additional information on our Pb−Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

DOCUMENT NUMBER:	**98ASB42226B**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	**SOT−23 (TO−236) 2.90x1.30x1.00 1.90P**		**PAGE 1 OF 2**

SOT−23 (TO−236) 2.90x1.30x1.00 1.90P
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ISSUE AU

DATE 14 AUG 2024

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

ADDITIONAL INFORMATION

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