Power MOSFET 20 V, 5.1 A Single N-Channel, TSOP6

NTGS3446

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
20 V	36 mΩ @ 4.5 V	5.1 A

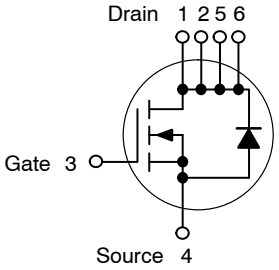
Features

- Ultra Low $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Diode Exhibits High Speed, Soft Recovery
- Avalanche Energy Specified
- I_{DSS} Specified at Elevated Temperature
- Pb-Free Package is Available

Applications

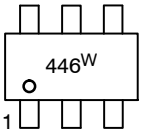
- Power Management in portable and battery-powered products, i.e. computers, printers, PCMCIA cards, cellular and cordless
- Lithium Ion Battery Applications
- Notebook PC

N−Channel



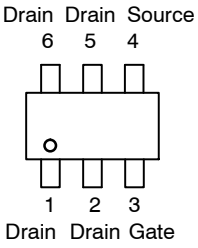
MARKING DIAGRAM

TSOP−6
CASE 318G
STYLE 1



446 = Device Code
W = Work Week

PIN ASSIGNMENT



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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	20	V
Gate-to-Source Voltage	V_{GS}	±12	V
Thermal Resistance Junction-to-Ambient (Note 1) Total Power Dissipation @ T_A = 25°C Drain Current – Continuous @ T_A = 25°C – Pulsed Drain Current (t_p < 10 μs)	 $R_{\theta JA}$ P_d I_D I_{DM}	 244 0.5 2.5 10	 °C/W W A A
Thermal Resistance Junction-to-Ambient (Note 2) Total Power Dissipation @ T_A = 25°C Drain Current – Continuous @ T_A = 25°C – Pulsed Drain Current (t_p < 10 μs)	 $R_{\theta JA}$ P_d I_D I_{DM}	 128 1.0 3.6 14	 °C/W W A A
Thermal Resistance Junction-to-Ambient (Note 3) Total Power Dissipation @ T_A = 25°C Drain Current – Continuous @ T_A = 25°C – Pulsed Drain Current (t_p < 10 μs)	 $R_{\theta JA}$ P_d I_D I_{DM}	 62.5 2.0 5.1 20	 °C/W W A A
Source Current (Body Diode)	I_S	5.1	A
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to 150	°C
Maximum Lead Temperature for Soldering Purposes for 10 seconds	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.

1. Minimum FR-4 or G-10PCB, operating to steady state.
2. Mounted onto a 2” square FR-4 board (1” sq. 2 oz. cu. 0.06” thick single-sided), operating to steady state.
3. Mounted onto a 2” square FR-4 board (1” sq. 2 oz. cu. 0.06” thick single-sided), t < 5.0 seconds.

ORDERING INFORMATION

Device	Package	Shipping†
NTGS3446T1G	TSOP−6 (Pb−Free)	3000/Tape & Reel

DISCONTINUED (Note 1)

NTGS3446T1	TSOP−6	3000/Tape & Reel

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

1. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-to-Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 0.25 mAdc) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	20 –	– 22	– –	Vdc mV/°C
Zero Gate Voltage Collector Current (V_{DS} = 20 Vdc, V_{GS} = 0 Vdc) (V_{DS} = 20 Vdc, V_{GS} = 0 Vdc, T_J = 85°C)	I_{DSS}	 – –	 – –	 1.0 25	μAdc
Gate-Body Leakage Current (V_{GS} = ±12 Vdc, V_{DS} = 0)	$I_{GSS(f)}$ $I_{GSS(r)}$	– –	– –	100 –100	nAdc
ON CHARACTERISTICS (Note 4)					
Gate Threshold Voltage I_D = 0.25 mA, V_{DS} = V_{GS} Temperature Coefficient (Negative)	$V_{GS(th)}$	0.6 –	0.85 –2.5	1.2 –	Vdc mV/°C
Static Drain-to-Source On-Resistance (V_{GS} = 4.5 Vdc, I_D = 5.1 Adc) (V_{GS} = 2.5 Vdc, I_D = 4.4 Adc)	$R_{DS(on)}$	 – –	 36 44	 45 55	mΩ
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 5.1 Adc)	g_{FS}	–	12	–	mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	(V_{DS} = 10 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	–	510	750	pF
Output Capacitance		C_{oss}	–	200	350	
Transfer Capacitance		C_{rss}	–	60	100	
SWITCHING CHARACTERISTICS (Note 5)					
Turn-On Delay Time	(V_{DD} = 10 Vdc, I_D = 1.0 Adc, V_{GS} = 4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	–	9.0	16	ns
Rise Time		t_r	–	12	20	
Turn-Off Delay Time		$t_{d(off)}$	–	35	60	
Fall Time		t_f	–	20	35	
Gate Charge	(V_{DS} = 10 Vdc, I_D = 5.1 Adc, V_{GS} = 4.5 Vdc)	Q_T	–	8.0	15	nC
		Q_{gs}	–	2.0	–	
		Q_{gd}	–	2.0	–	
SOURCE-DRAIN DIODE CHARACTERISTICS					
Forward On-Voltage (Note 4)	(I_S = 1.7 Adc, V_{GS} = 0 Vdc) (I_S = 1.7 Adc, V_{GS} = 0 Vdc, T_J = 85°C)	V_{SD}	 – –	 0.74 0.66	 1.1 –	Vdc
Reverse Recovery Time	(I_S = 1.7 Adc, V_{GS} = 0 Vdc, di_S/dt = 100 A/μs)	t_{rr}	–	20	–	ns
		t_a	–	11	–	
		t_b	–	9.0	–	
Reverse Recovery Stored Charge		Q_{RR}	–	0.01	–	μC

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.

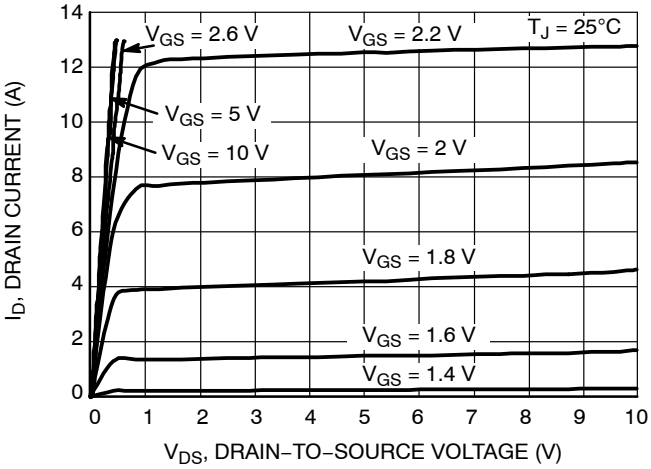


Figure 1. On−Region Characteristics

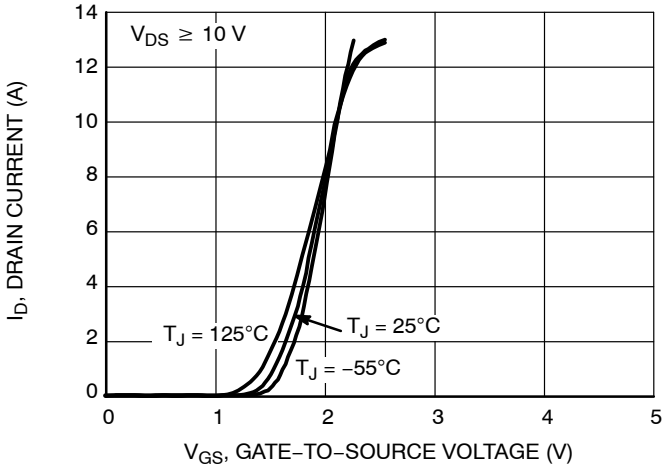


Figure 2. Transfer Characteristics

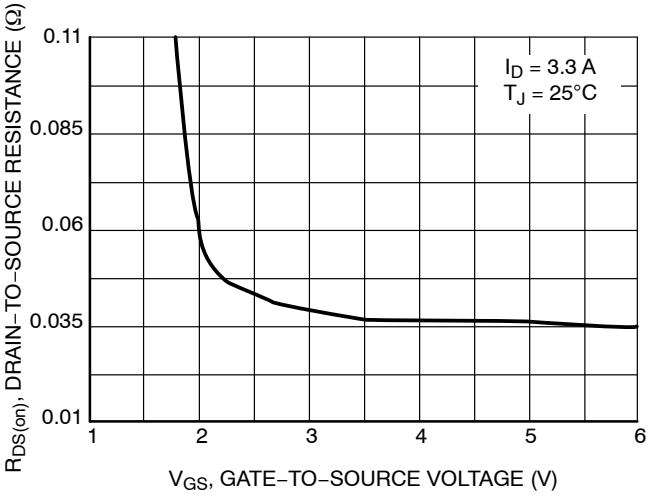


Figure 3. On−Resistance versus Gate−To−Source Voltage

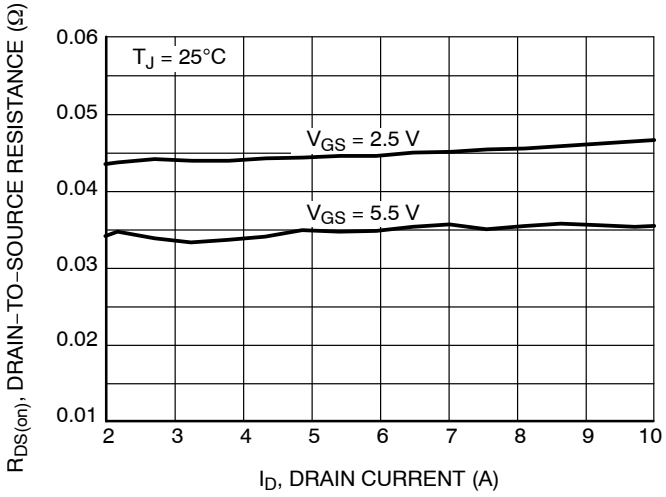


Figure 4. On−Resistance versus Drain Current and Gate Voltage

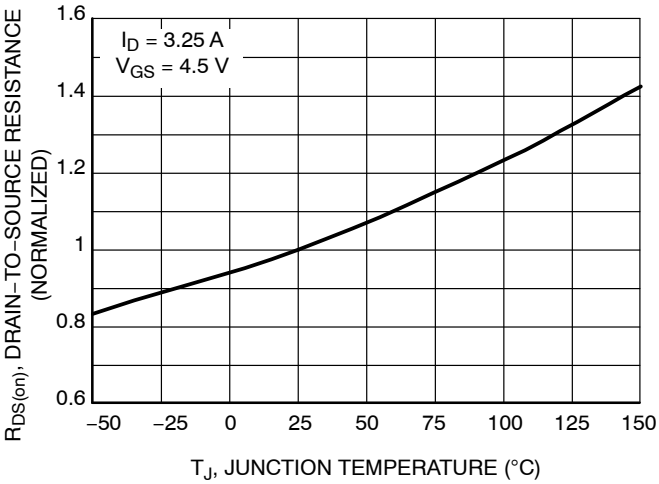


Figure 5. On−Resistance Variation with Temperature

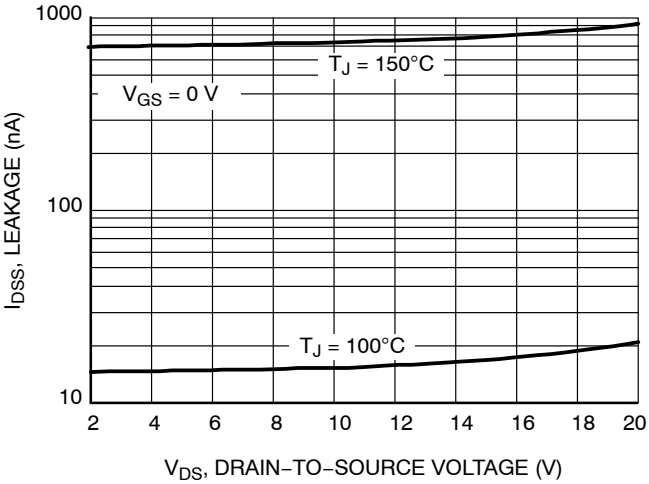


Figure 6. Drain−to−Source Leakage Current versus Voltage

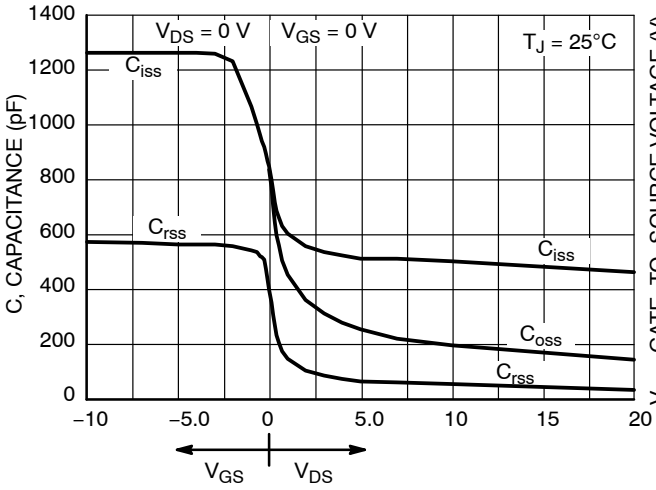


Figure 7. Capacitance Variation

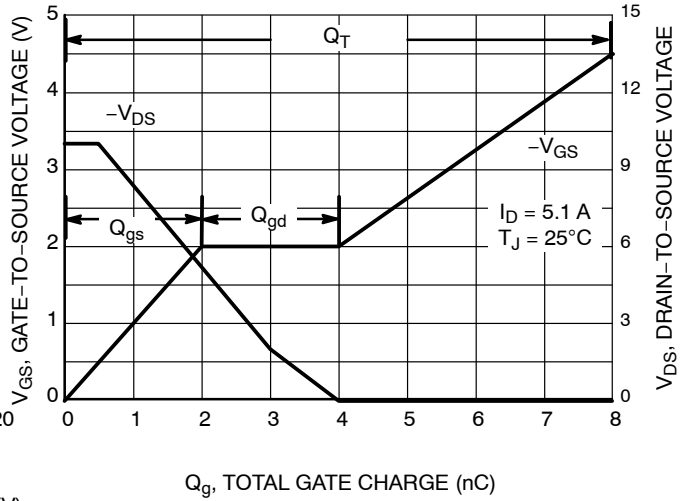


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

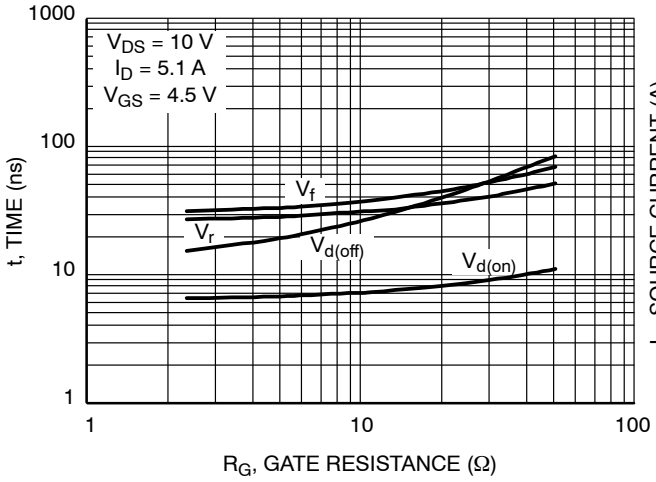


Figure 9. Resistive Switching Time Variation versus Gate Resistance

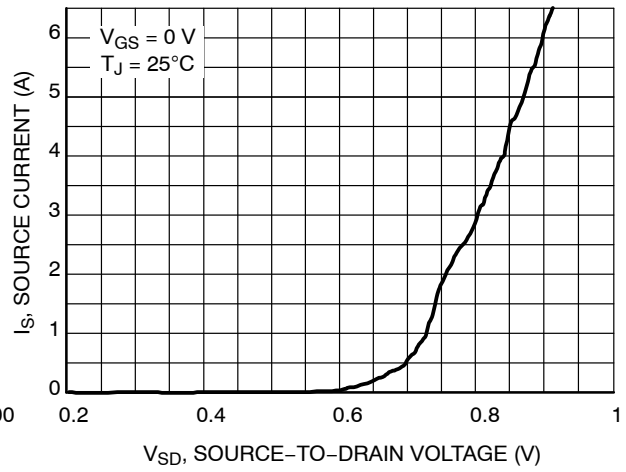
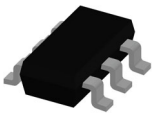
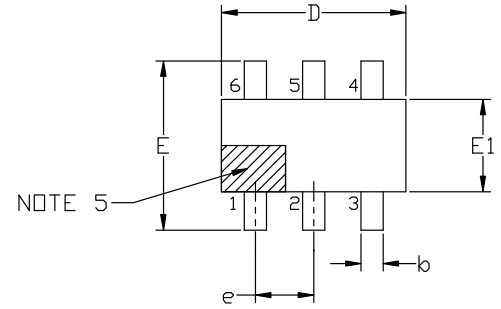


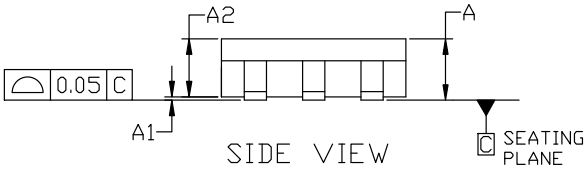
Figure 10. Diode Forward Voltage versus Current

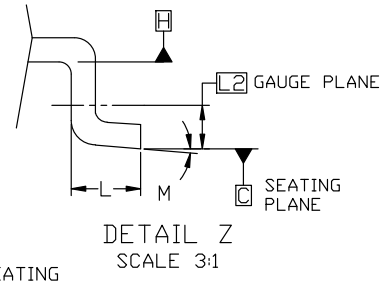


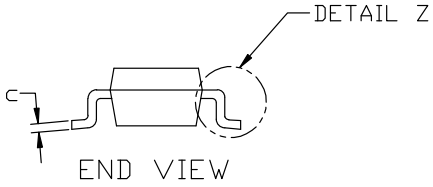
TSOP−6 3.00x1.50x0.90, 0.95P
CASE 318G
ISSUE W

DATE 26 FEB 2024



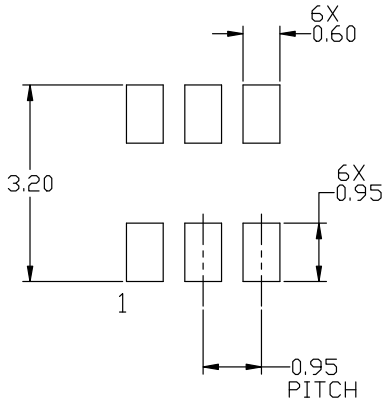






NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN 1 INDICATOR MUST BE LOCATED IN THE INDICATED ZONE

MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
A2	0.80	0.90	1.00
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.90	3.00	3.10
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e	0.85	0.95	1.05
L	0.20	0.40	0.60
L2	0.25 BSC		
M	0°	---	10°



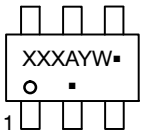
RECOMMENDED MOUNTING FOOTPRINT

*For additional information on our Pb-Free strategy and soldering details, please download th e ON Semiconductor Soldering and Mounting Techniques Reference manual, SOLDERRM/D.

TSOP−6 3.00x1.50x0.90, 0.95P
CASE 318G
ISSUE W

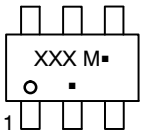
DATE 26 FEB 2024

GENERIC MARKING DIAGRAM*



IC

XXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package



STANDARD

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.

STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN

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

STYLE 3:
PIN 1. ENABLE
2. N/C
3. R BOOST
4. Vz
5. V in
6. V out

STYLE 4:
PIN 1. N/C
2. V in
3. NOT USED
4. GROUND
5. ENABLE
6. LOAD

STYLE 5:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

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

STYLE 7:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. N/C
5. COLLECTOR
6. EMITTER

STYLE 8:
PIN 1. Vbus
2. D(in)
3. D(in)+
4. D(out)+
5. D(out)
6. GND

STYLE 9:
PIN 1. LOW VOLTAGE GATE
2. DRAIN
3. SOURCE
4. DRAIN
5. DRAIN
6. HIGH VOLTAGE GATE

STYLE 10:
PIN 1. D(OUT)+
2. GND
3. D(OUT)−
4. D(IN)−
5. VBUS
6. D(IN)+

STYLE 11:
PIN 1. SOURCE 1
2. DRAIN 2
3. DRAIN 2
4. SOURCE 2
5. GATE 1
6. DRAIN 1/GATE 2

STYLE 12:
PIN 1. I/O
2. GROUND
3. I/O
4. I/O
5. VCC
6. I/O

STYLE 13:
PIN 1. GATE 1
2. SOURCE 2
3. GATE 2
4. DRAIN 2
5. SOURCE 1
6. DRAIN 1

STYLE 14:
PIN 1. ANODE
2. SOURCE
3. GATE
4. CATHODE/DRAIN
5. CATHODE/DRAIN
6. CATHODE/DRAIN

STYLE 15:
PIN 1. ANODE
2. SOURCE
3. GATE
4. DRAIN
5. N/C
6. CATHODE

STYLE 16:
PIN 1. ANODE/CATHODE
2. BASE
3. EMITTER
4. COLLECTOR
5. ANODE
6. CATHODE

STYLE 17:
PIN 1. EMITTER
2. BASE
3. ANODE/CATHODE
4. ANODE
5. CATHODE
6. COLLECTOR

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

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