

# NTZD5110N

## MOSFET – Dual, N-Channel with ESD Protection, Small Signal, SOT-563 60 V, 310 mA

### Features

- Low  $R_{DS(on)}$  Improving System Efficiency
- Low Threshold Voltage
- ESD Protected Gate
- Small Footprint 1.6 x 1.6 mm
- These are Pb-Free Devices

### Applications

- Load/Power Switches
- Driver Circuits: Relays, Lamps, Displays, Memories, etc.
- Battery Management/Battery Operated Systems
- Cell Phones, Digital Cameras, PDAs, Pagers, etc.

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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		$V_{DS}$	60	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current (Note 1)	Steady State	$I_D$	$T_A = 25^\circ\text{C}$	294	mA
			$T_A = 85^\circ\text{C}$	212	
Power Dissipation (Note 1)	Steady State	$P_D$	250	mW	
Continuous Drain Current (Note 1)	$t \leq 5 \text{ s}$	$I_D$	$T_A = 25^\circ\text{C}$	310	mA
			$T_A = 85^\circ\text{C}$	225	
Power Dissipation (Note 1)	$t \leq 5 \text{ s}$	$P_D$	280	mW	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	590	mA	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	350	mA	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	
Gate-Source ESD Rating (HBM, Method 3015)		ESD	1800	V	

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	500	$^\circ\text{C/W}$
Junction-to-Ambient – $t \leq 5 \text{ s}$ (Note 1)		447	

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.

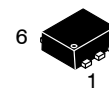
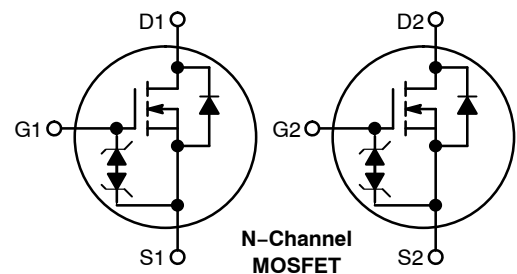
1. Surface mounted on FR4 board using 1 in sq pad size (Cu. area = 1.127 in sq [1 oz] including traces).



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$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ Max
60	1.6 $\Omega$ @ 10 V	310 mA
	2.5 $\Omega$ @ 4.5 V	



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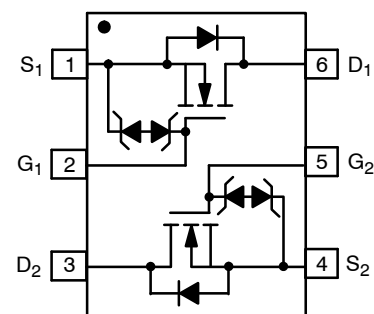
### MARKING DIAGRAM



S7 = Specific Device Code  
M = Date Code

(Note: Microdot may be in either location)

### PINOUT: SOT-563



Top View

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# NTZD5110N

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
<b>OFF CHARACTERISTICS</b>							
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60	-	-	V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	-	-	71	-	mV/°C	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}$ $V_{DS} = 60\text{ V}$	$T_J = 25^\circ\text{C}$	-	-	1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$	-	-	500	
		$V_{GS} = 0\text{ V}$ $V_{DS} = 50\text{ V}$	$T_J = 25^\circ\text{C}$	-	-	100	$\text{nA}$
			$T_J = 85^\circ\text{C}$	-	-	100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$	-	-	450	$\text{nA}$	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 5.0\text{ V}$	-	-	150	$\text{nA}$	

## ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.0	-	2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$	-	-	4.0	-	mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	-	1.19	1.6	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 200\text{ mA}$	-	1.33	2.5	
Forward Transconductance	$g_{FS}$	$V_{DS} = 5.0\text{ V}, I_D = 200\text{ mA}$	-	80	-	S

## CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$ $V_{DS} = 20\text{ V}$	-	24.5	-	$\text{pF}$
Output Capacitance	$C_{OSS}$		-	4.2	-	
Reverse Transfer Capacitance	$C_{RSS}$		-	2.2	-	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V};$ $I_D = 200\text{ mA}$	-	0.7	-	$\text{nC}$
Threshold Gate Charge	$Q_{G(TH)}$		-	0.1	-	
Gate-to-Source Charge	$Q_{GS}$		-	0.3	-	
Gate-to-Drain Charge	$Q_{GD}$		-	0.1	-	

## SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DD} = 30\text{ V},$ $I_D = 200\text{ mA}, R_G = 10\ \Omega$	-	12	-	$\text{ns}$
Rise Time	$t_r$		-	7.3	-	
Turn-Off Delay Time	$t_{d(OFF)}$		-	63.7	-	
Fall Time	$t_f$		-	30.6	-	

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V},$ $I_S = 200\text{ mA}$	$T_J = 25^\circ\text{C}$	-	0.8	1.2	V
			$T_J = 85^\circ\text{C}$	-	0.7	-	

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.

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

3. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

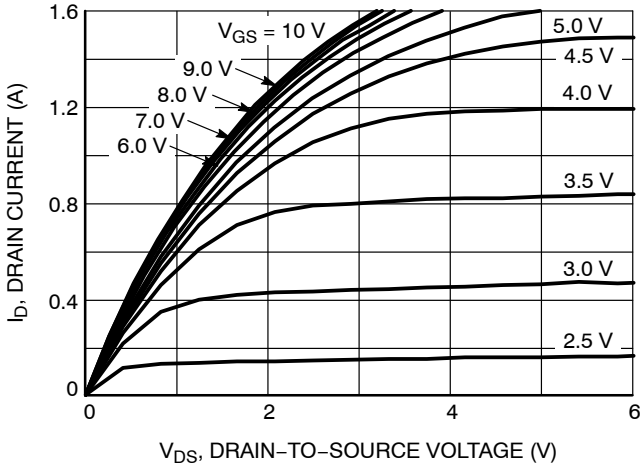


Figure 1. On-Region Characteristics

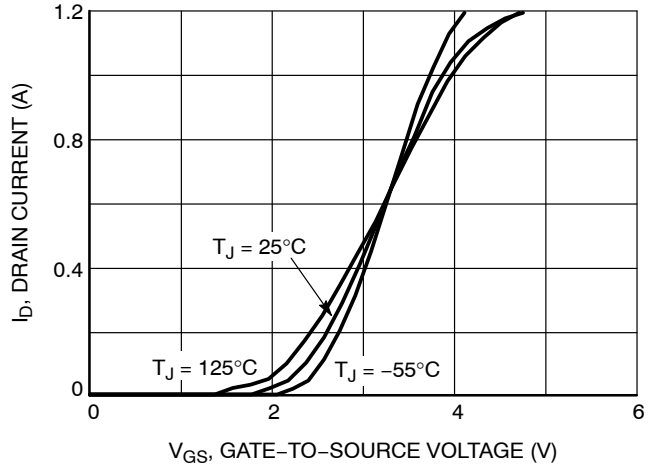


Figure 2. Transfer Characteristics

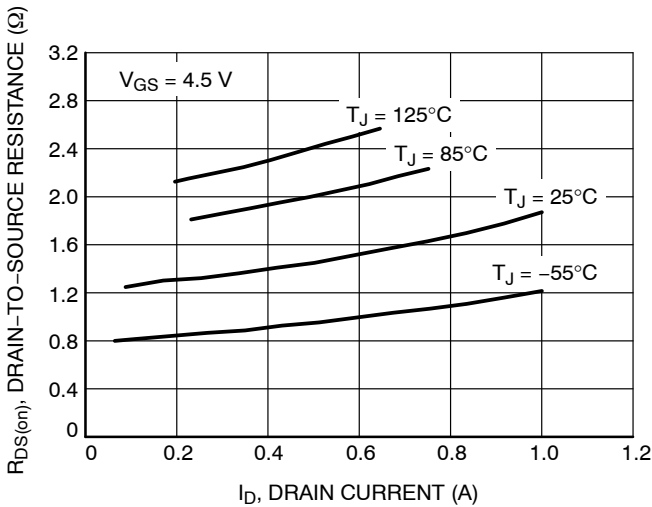


Figure 3. On-Resistance vs. Drain Current and Temperature

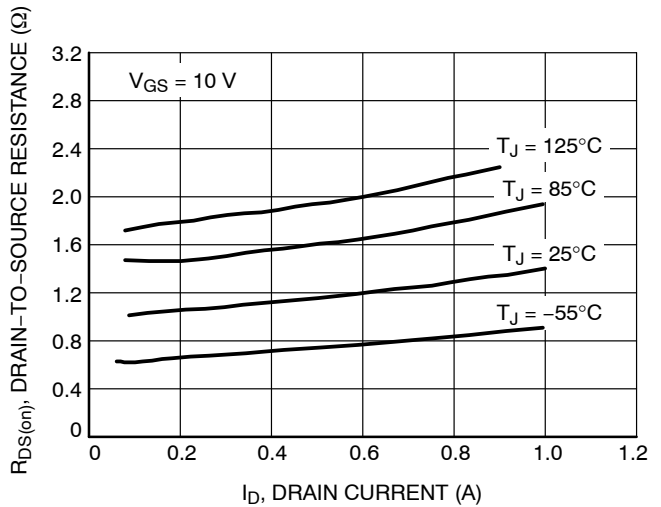


Figure 4. On-Resistance vs. Drain Current and Temperature

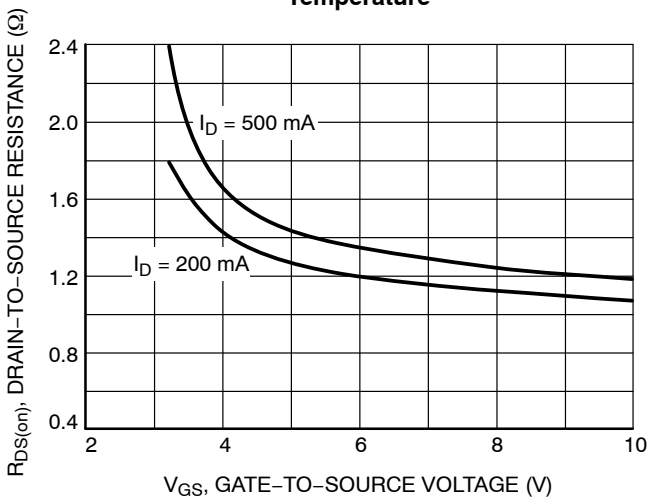


Figure 5. On-Resistance vs. Gate-to-Source Voltage

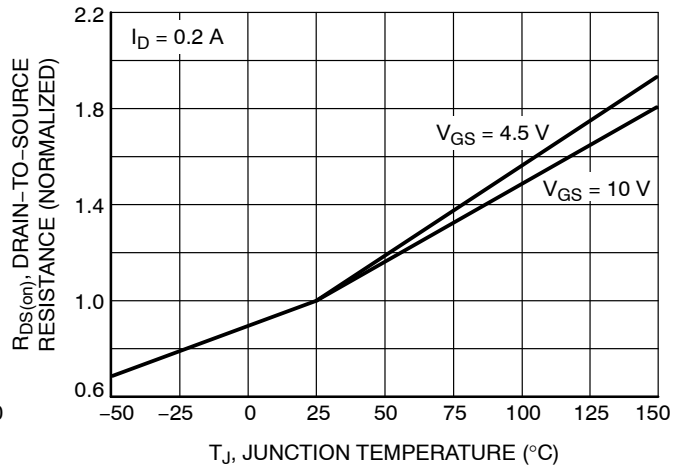
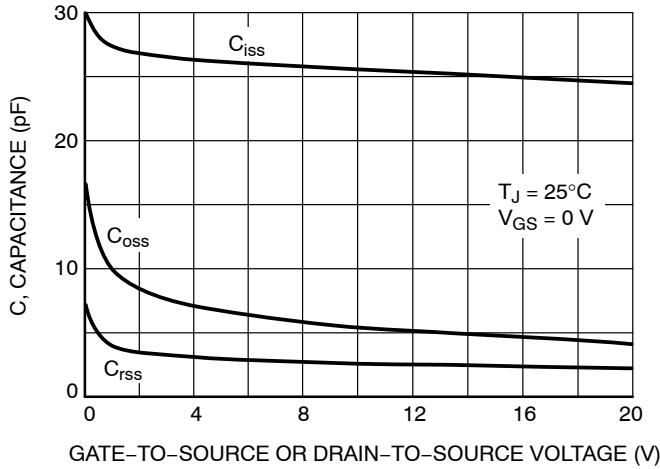


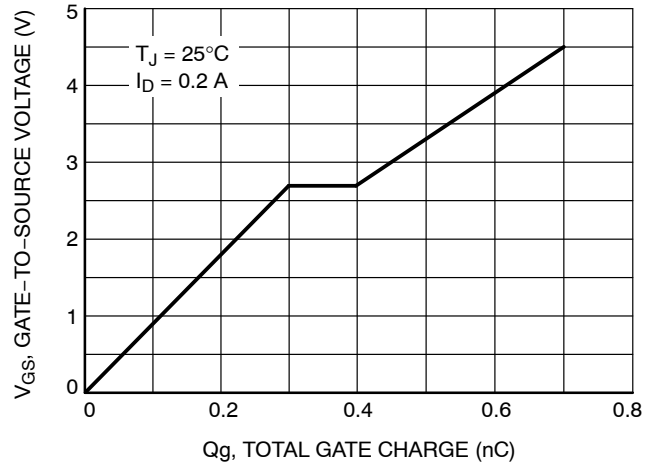
Figure 6. On-Resistance Variation with Temperature

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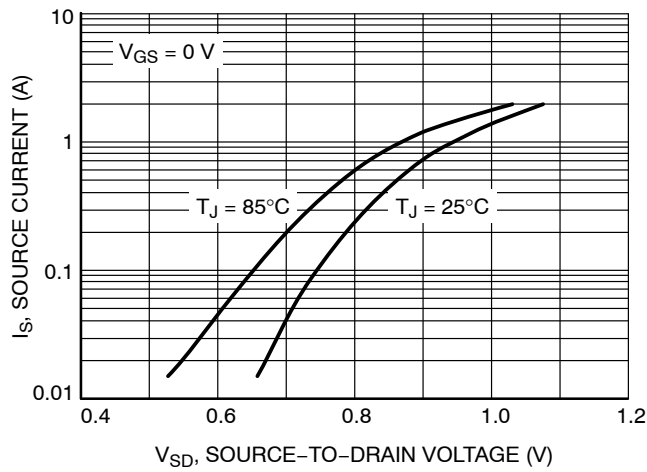
## TYPICAL CHARACTERISTICS



**Figure 7. Capacitance Variation**



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



**Figure 9. Diode Forward Voltage vs. Current**

### ORDERING INFORMATION

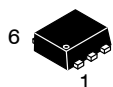
Device	Package	Shipping
NTZD5110NT1G	SOT-563 (Pb-Free)	4000 / Tape & Reel
NTZD5110NT5G	SOT-563 (Pb-Free)	8000 / Tape & Reel

†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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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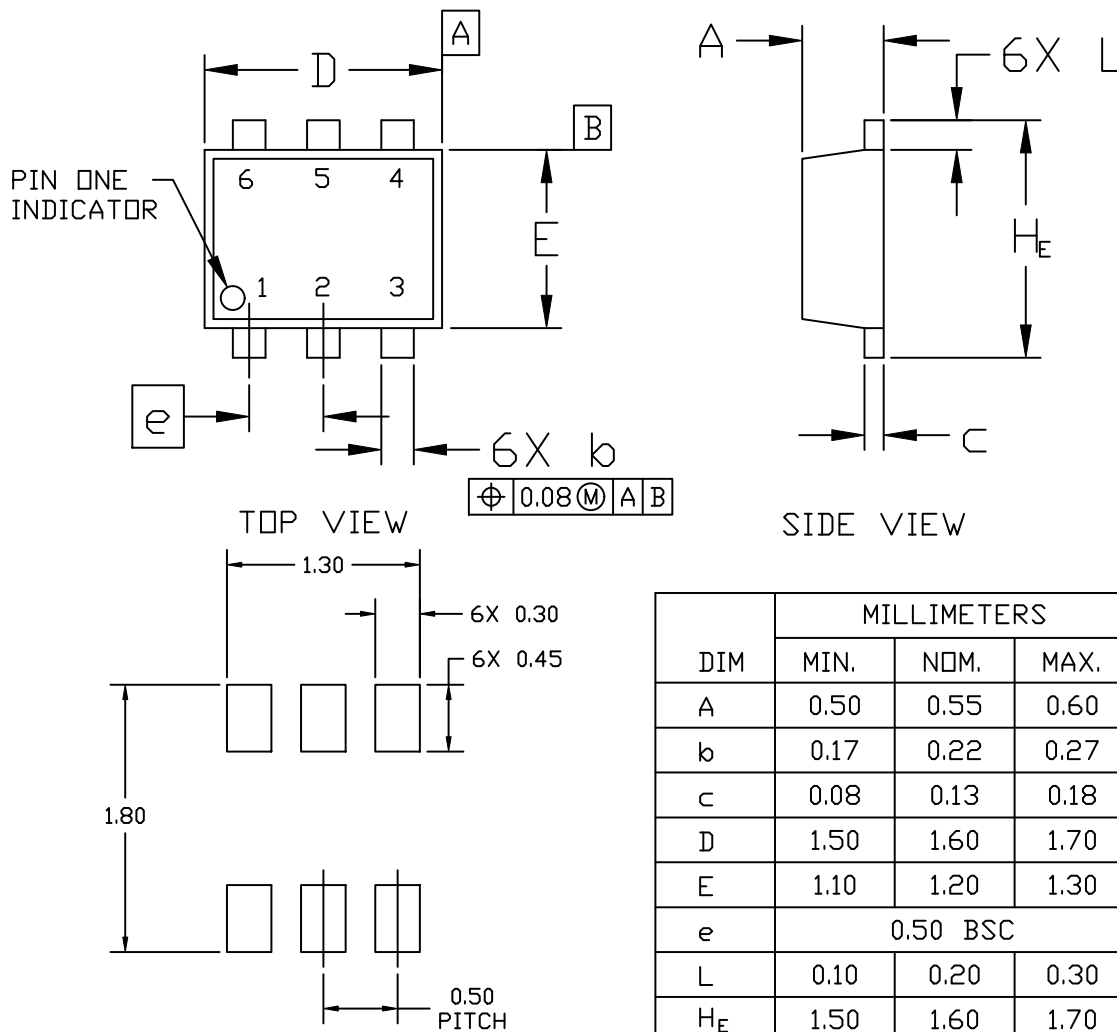
SCALE 4:1

**SOT-563, 6 LEAD**  
CASE 463A  
ISSUE H

DATE 26 JAN 2021

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.50	0.55	0.60
b	0.17	0.22	0.27
c	0.08	0.13	0.18
D	1.50	1.60	1.70
E	1.10	1.20	1.30
e	0.50 BSC		
L	0.10	0.20	0.30
H <sub>E</sub>	1.50	1.60	1.70

**RECOMMENDED MOUNTING FOOTPRINT\***

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

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

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

STYLE 3:  
PIN 1. CATHODE 1  
2. CATHODE 1  
3. ANODE/ANODE 2  
4. CATHODE 2  
5. CATHODE 2  
6. ANODE/ANODE 1

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

STYLE 5:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. CATHODE  
6. CATHODE

STYLE 6:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. CATHODE  
5. CATHODE  
6. CATHODE

STYLE 7:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. CATHODE  
5. ANODE  
6. CATHODE

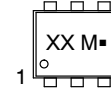
STYLE 8:  
PIN 1. DRAIN  
2. DRAIN  
3. GATE  
4. SOURCE  
5. DRAIN  
6. DRAIN

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

STYLE 10:  
PIN 1. CATHODE 1  
2. N/C  
3. CATHODE 2  
4. ANODE 2  
5. N/C  
6. ANODE 1

STYLE 11:  
PIN 1. EMITTER 2  
2. BASE 2  
3. COLLECTOR 1  
4. EMITTER 1  
5. BASE 1  
6. COLLECTOR 2

**GENERIC  
MARKING DIAGRAM\***



XX = Specific Device Code  
M = Month 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.

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