

# NTZD3152P

## MOSFET – Dual, P-Channel with ESD Protection, Small Signal, SOT-563

**-20 V, -430 mA**



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### Features

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

### Applications

- Load/Power Switches
- Power Supply Converter Circuits
- Battery Management
- 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		$V_{DSS}$	-20	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 6.0$	V	
Continuous Drain Current (Note 1)	Steady State	$I_D$	$T_A = 25^\circ\text{C}$	-430	mA
			$T_A = 85^\circ\text{C}$	-310	
Power Dissipation (Note 1)	Steady State	$P_D$	250	mW	
Continuous Drain Current (Note 1)	$t \leq 5 \text{ s}$	$I_D$	$T_A = 25^\circ\text{C}$	-455	mA
			$T_A = 85^\circ\text{C}$	-328	
Power Dissipation (Note 1)	$t \leq 5 \text{ s}$	$P_D$	280	mW	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	-750	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	$^\circ\text{C}$	

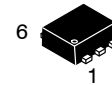
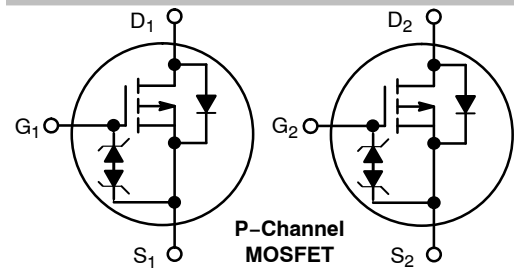
### THERMAL RESISTANCE RATINGS

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

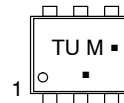
1. Surface mounted on FR4 board using 1 in. sq. pad size (Cu. area = 1.127 in. sq. [1 oz.] including traces).

$V_{(BR)DSS}$	$R_{DS(on)}$ Typ	$I_D$ Max
-20 V	0.5 $\Omega$ @ -4.5 V	-430 mA
	0.6 $\Omega$ @ -2.5 V	
	1.0 $\Omega$ @ -1.8 V	



SOT-563-6  
CASE 463A

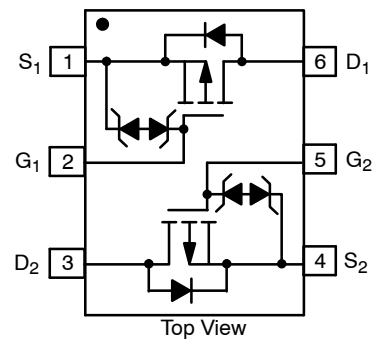
### MARKING DIAGRAM



TU = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### PINOUT: SOT-563



### ORDERING INFORMATION

Device	Package	Shipping†
NTZD3152PT1G	SOT-563	4000 / Tape & Reel
NTZD3152PT1H	(Pb-Free)	
NTZD3152PT5H	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.

# NTZD3152P

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			18		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}$	$T_J = 25^\circ\text{C}$		-1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		-2.0	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$			$\pm 2.0$	$\mu\text{A}$

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-0.45		-1.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-1.9		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -430\text{ mA}$		0.5	0.9	$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -300\text{ mA}$		0.6	1.2	
		$V_{GS} = -1.8\text{ V}, I_D = -150\text{ mA}$		1.0	2.0	
Forward Transconductance	$g_{FS}$	$V_{DS} = -10\text{ V}, I_D = -430\text{ mA}$		1.0		S

### CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -16\text{ V}$		105	175	pF
Output Capacitance	$C_{OSS}$			15	30	
Reverse Transfer Capacitance	$C_{RSS}$			10	20	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}, I_D = -215\text{ mA}$		1.7	2.5	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.1		
Gate-to-Source Charge	$Q_{GS}$			0.3		
Gate-to-Drain Charge	$Q_{GD}$			0.4		

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V}, I_D = -215\text{ mA}, R_G = 10\ \Omega$		10		ns
Rise Time	$t_r$			12		
Turn-Off Delay Time	$t_{d(off)}$			35		
Fall Time	$t_f$			19		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -350\text{ mA}$	$T_J = 25^\circ\text{C}$		-0.8	-1.2	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_{SD}/dt = 100\text{ A}/\mu\text{s}, I_S = -350\text{ mA}$			13		ns

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

3. Switching characteristics are independent of operating junction temperatures.

# NTZD3152P

## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

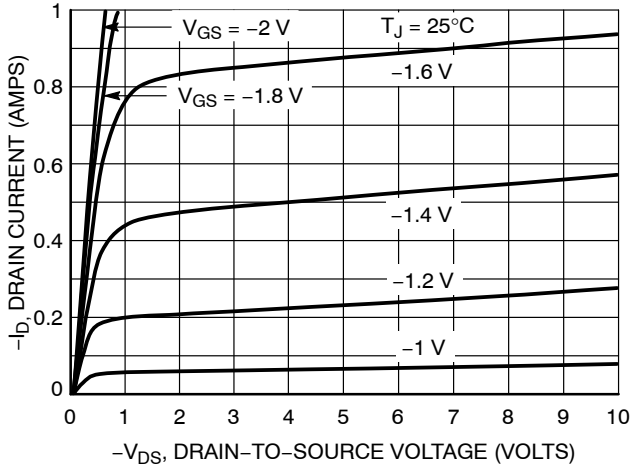


Figure 1. On-Region Characteristics

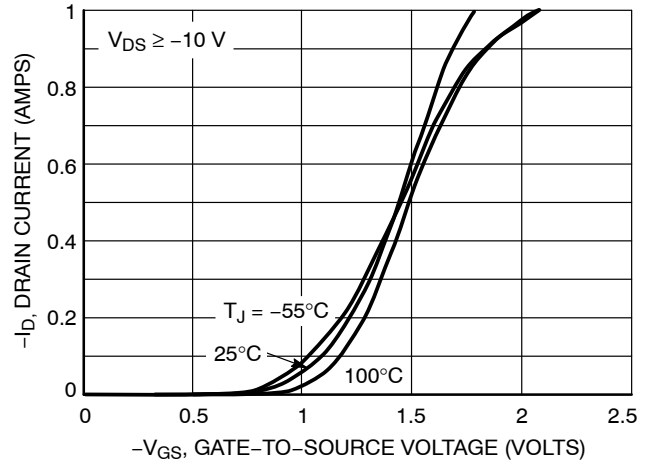


Figure 2. Transfer Characteristics

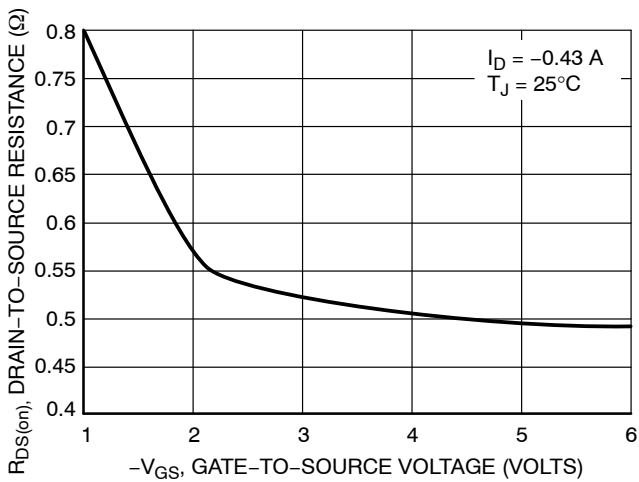


Figure 3. On-Resistance vs. Gate-to-Source Voltage

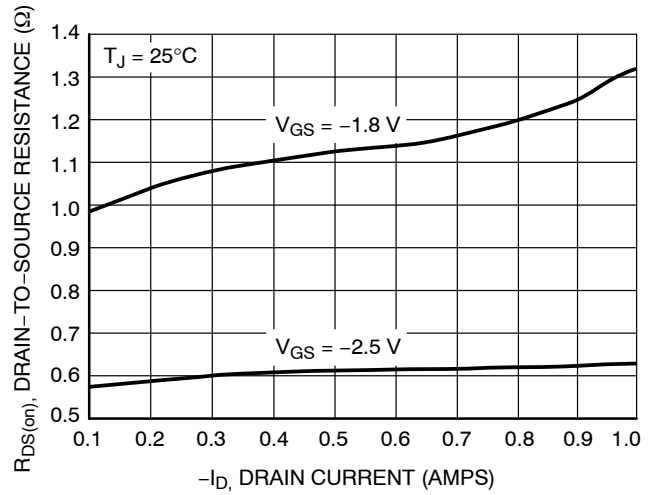


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

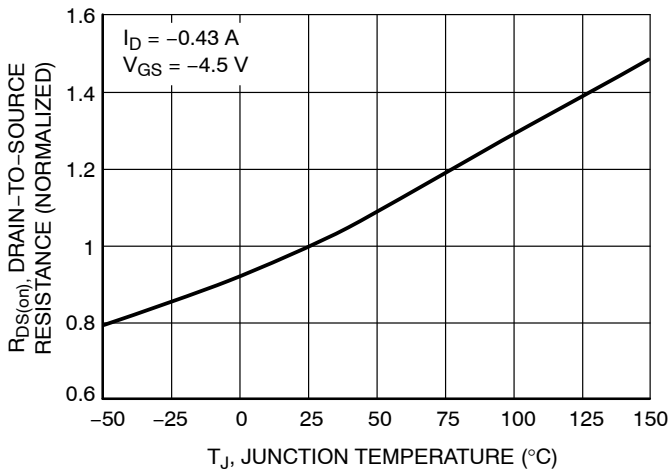


Figure 5. On-Resistance Variation with Temperature

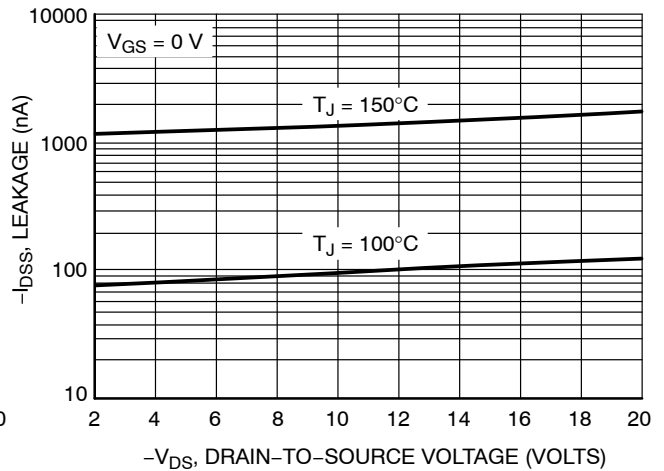
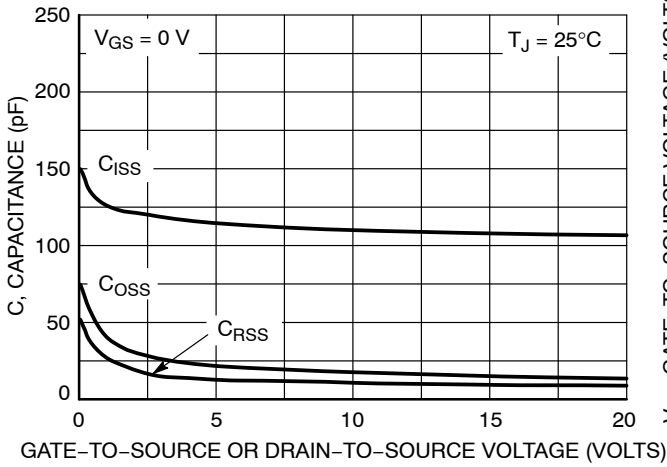


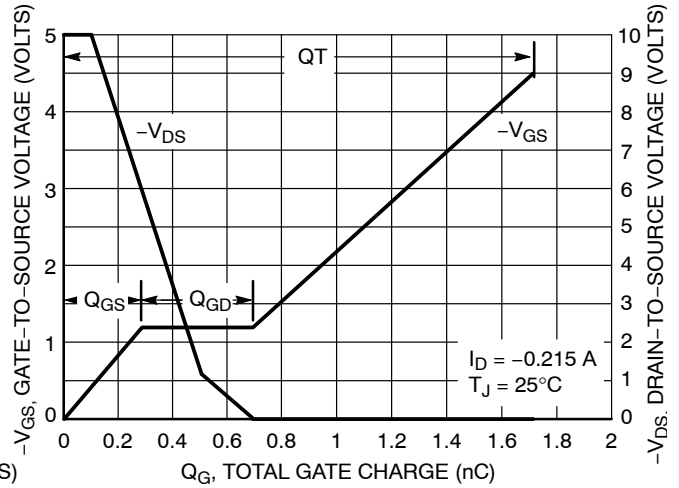
Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTZD3152P

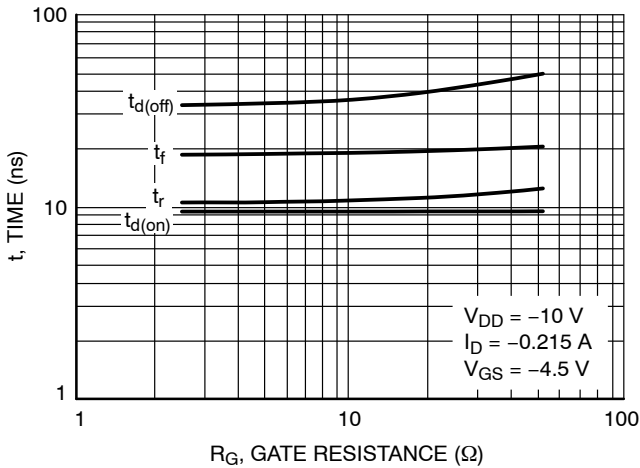
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



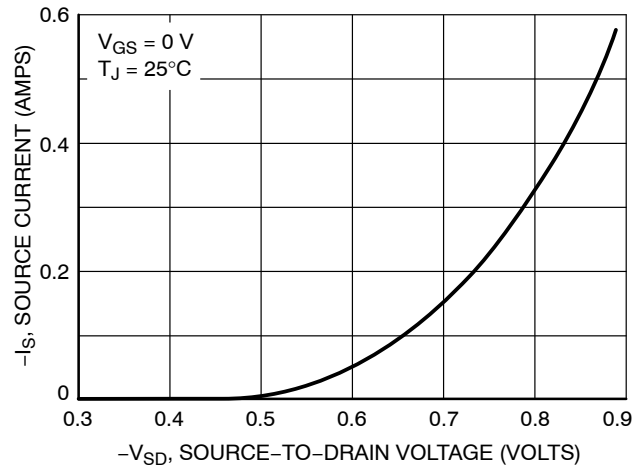
**Figure 7. Capacitance Variation**



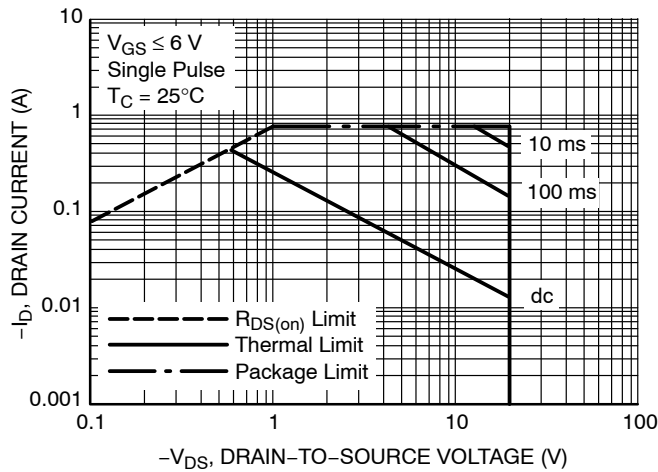
**Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**



**Figure 10. Diode Forward Voltage vs. Current**



**Figure 11. Safe Operating Area**

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

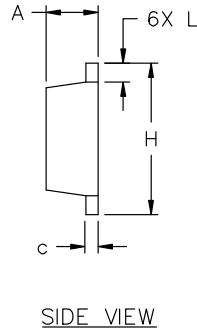
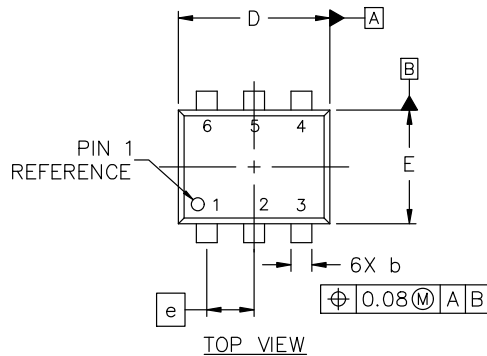


**SOT-563-6 1.60x1.20x0.55, 0.50P**  
**CASE 463A**  
**ISSUE J**

DATE 15 FEB 2024

**NOTES:**

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN 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		
H	1.50	1.60	1.70
L	0.10	0.20	0.30

**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

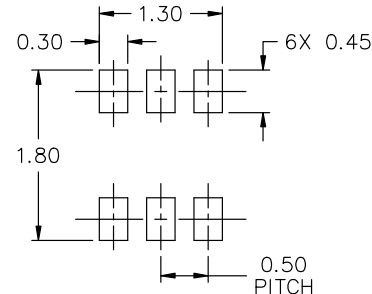
**STYLE 7:**  
 PIN 1. CATHODE  
 2. ANODE  
 3. CATHODE  
 4. CATHODE  
 5. ANODE  
 6. CATHODE

**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

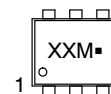
**STYLE 10:**  
 PIN 1. CATHODE 1  
 2. N/C  
 3. CATHODE 2  
 4. ANODE 2  
 5. N/C  
 6. ANODE 1

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



\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

**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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