# ESD Protection Diode Array, 5-Line

# SMS05C, SMS12C, SMS15C, SMS24C

This 5−line surge protection array is designed for application requiring transient voltage protection capability. It is intended for use in over−transient voltage and ESD sensitive equipment such as computers, printers, automotive electronics, networking communication and other applications. This device features a monolithic common anode design which protects five independent lines in a single TSOP−6 package.

## Features

- Protects up to 5 Lines in a Single TSOP−6 Package
- Peak Power Dissipation − 350 W (8 × 20 μs Waveform)
- ESD Rating of Class 3B (Exceeding 8.0 kV) per Human Body Model and Class C (Exceeding 400 V) per Machine Model
- Compliance with IEC 61000−4−2 (ESD) 15 kV (Air), 8.0 kV (Contact)
- Flammability Rating of UL 94 V−0
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These are Pb−Free Devices

## Applications

- Hand−Held Portable Applications
- Networking and Telecom
- Automotive Electronics
- Serial and Parallel Ports
- Notebooks, Desktops, Servers

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise specified)

| Symbol | Rating | Value | Unit |
|---|---|---|---|
| $P_{PK}$ 1 | Peak Power Dissipation 8 × 20 μs Double Exponential Waveform (Note 1) | 350 | W |
| $T_J$ | Operating Junction Temperature Range | −40 to 150 | °C |
| $T_{STG}$ | Storage Temperature Range | −55 to 150 | °C |
| $T_L$ | Lead Solder Temperature (10 s) | 260 | °C |
| ESD | Human Body Model ( HBM) Machine Model (MM) IEC 61000−4−2 Air (ESD) IEC 61000−4−2 Contact (ESD) | >8000 >400 >15000 >8000 | V |

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.
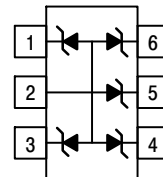1. Non−repetitive current pulse per Figure 3.

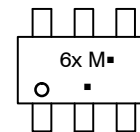## TSOP−6 FIVE SURGE PROTECTION 350 W PEAK POWER

### PIN ASSIGNMENT



**TSOP−6**
**CASE 318G**
**SCALE 2:1**

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

### MARKING DIAGRAM



6x M∎

x = SMS05C:J
= SMS12C:K
= SMS15C:L
= SMS24C:M
M = Date Code
∎ = Pb−Free Package
(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| SMS05CT1G | TSOP−6 (Pb−Free) | 3000 / Tape & Reel |
| SMS12CT1G | | |
| SMS15CT1G | | |
| SMS24CT1G SZSMS24CT1G | | |

†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.

# SMS05C, SMS12C, SMS15C, SMS24C

**SMS05C ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Reverse Working Voltage | $V_{RWM}$ | (Note 2) | | | 5.0 | V |
| Breakdown Voltage | $V_{BR}$ | $I_T$ = 1.0 mA (Note 3) | 6.2 | | 7.2 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 5.0 V | | | 5.0 | μA |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 5.0 A (8 × 20 μs Waveform) | | | 9.8 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 24 A (8 × 20 μs Waveform) | | | 14.5 | V |
| Maximum Peak Pulse Current | $I_{PP}$ | 8 × 20 μs Waveform | | | 24 | A |
| Capacitance | $C_J$ | $V_R$ = 0 V, f = 1.0 MHz (Line to GND) | | 260 | 400 | pF |

**SMS12C ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Reverse Working Voltage | $V_{RWM}$ | (Note 2) | | | 12 | V |
| Breakdown Voltage | $V_{BR}$ | $I_T$ = 1.0 mA (Note 3) | 13.3 | | 15 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 12 V | | 0.001 | 1.0 | μA |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 5.0 A (8 × 20 μs Waveform) | | | 19 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 15 A (8 × 20 μs Waveform) | | | 23 | V |
| Maximum Peak Pulse Current | $I_{PP}$ | 8 × 20 μs Waveform | | | 15 | A |
| Capacitance | $C_J$ | $V_R$ = 0 V, f = 1.0 MHz (Line to GND) | | 120 | 150 | pF |

**SMS15C ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C, unless otherwise specified) (See Note 4)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Reverse Working Voltage | $V_{RWM}$ | (Note 2) | | | 15 | V |
| Breakdown Voltage | $V_{BR}$ | $I_T$ = 1.0 mA (Note 3) | 17 | | 19 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 15 V | | 0.05 | 1.0 | μA |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 5.0 A (8 × 20 μs Waveform) | | | 24 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 12 A (8 × 20 μs Waveform) | | | 29 | V |
| Maximum Peak Pulse Current | $I_{PP}$ | 8 × 20 μs Waveform | | | 12 | A |
| Capacitance | $C_J$ | $V_R$ = 0 V, f = 1.0 MHz (Line to GND) | | 95 | 125 | pF |

**SZ/SMS24C ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C, unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Reverse Working Voltage | $V_{RWM}$ | (Note 2) | | | 24 | V |
| Breakdown Voltage | $V_{BR}$ | $I_T$ = 1.0 mA (Note 3) | 26.7 | | 32 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 24 V | | 0.001 | 1.0 | μA |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 5.0 A (8 × 20 μs Waveform) | | | 40 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 8 A (8 × 20 μs Waveform) | | | 44 | V |
| Maximum Peak Pulse Current | $I_{PP}$ | 8 × 20 μs Waveform | | | 8.0 | A |
| Capacitance | $C_J$ | $V_R$ = 0 V, f = 1.0 MHz (Line to GND) | | 60 | 75 | pF |

2. Surge protection devices are normally selected according to the working peak reverse voltage ($V_{RWM}$), which should be equal or greater than the DC or continuous peak operating voltage level.
3. $V_{BR}$ is measured at pulse test current $I_T$.
4. Parametrics are the same for the Pb−Free packages, which are suffixed with a "G".

# SMS05C, SMS12C, SMS15C, SMS24C

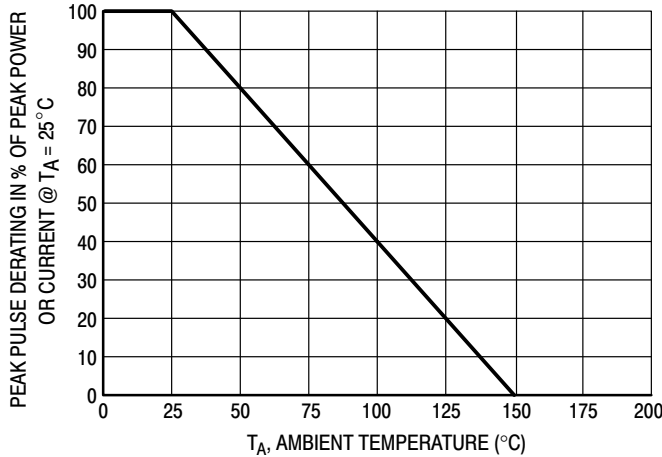**TYPICAL PERFORMANCE CURVES** ($T_J$ = 25°C unless otherwise specified)
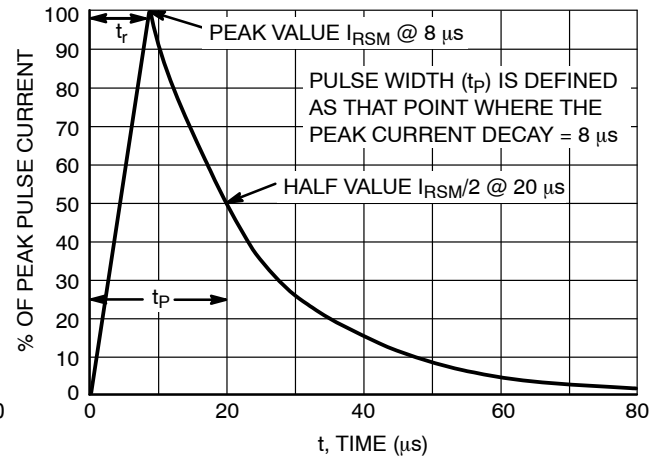


**Figure 1. Pulse Derating Curve**


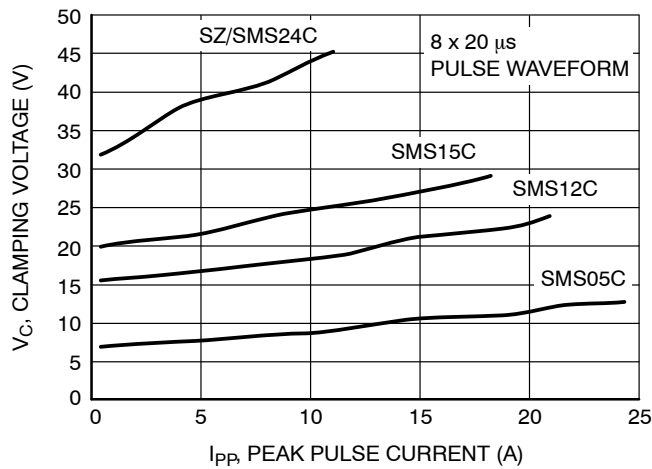
**Figure 2. 8 × 20 μs Pulse Waveform**



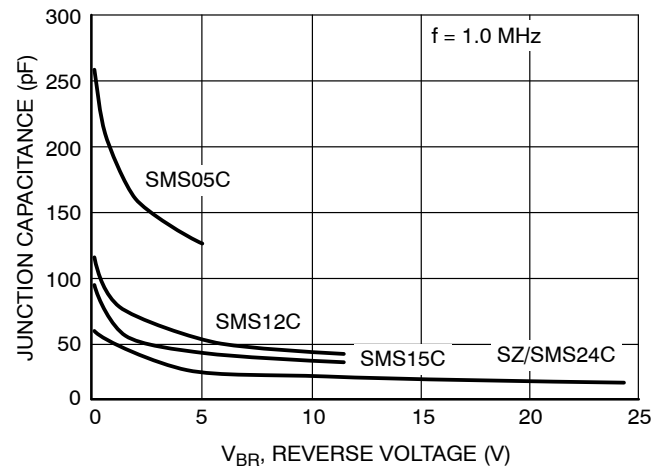**Figure 3. Clamping Voltage vs. Peak Pulse Current**



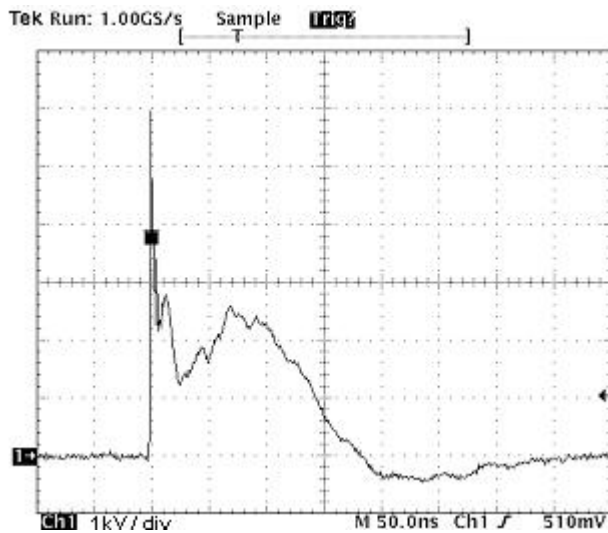**Figure 4. Junction Capacitance vs. Reverse Voltage**
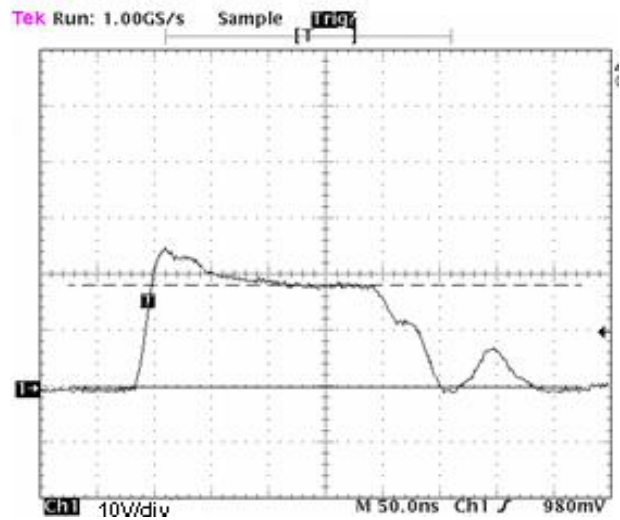


**Figure 5. ESD Pulse IEC 61000−4−2
(8.0 kV Contact)**



**Figure 6. SMS15CT1 ESD Response for IEC
61000−4−2 (+8.0 kV Contact)**

# SMS05C, SMS12C, SMS15C, SMS24C

## TYPICAL COMMON ANODE APPLICATIONS

A 5 surge protection junction common anode design in a TSOP−6 package protects four separate lines using only one package. This adds flexibility and creativity to PCB design especially when board space is at a premium. A simplified example of SMS05C Series Device applications is illustrated below.
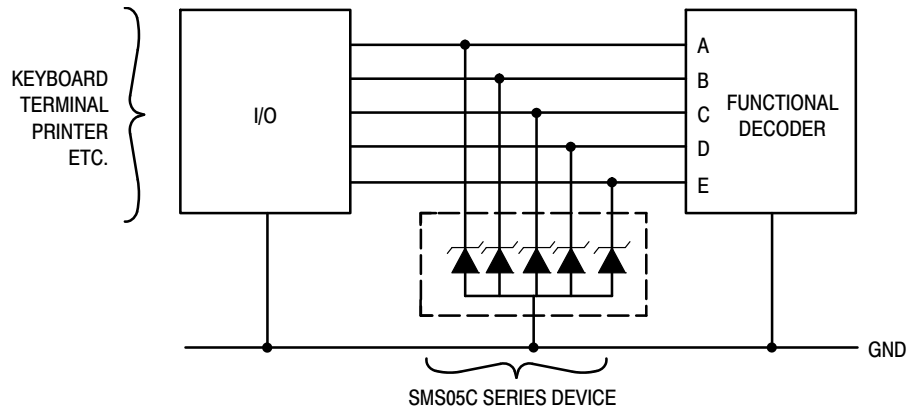
**Figure 7. Computer Interface Protection**
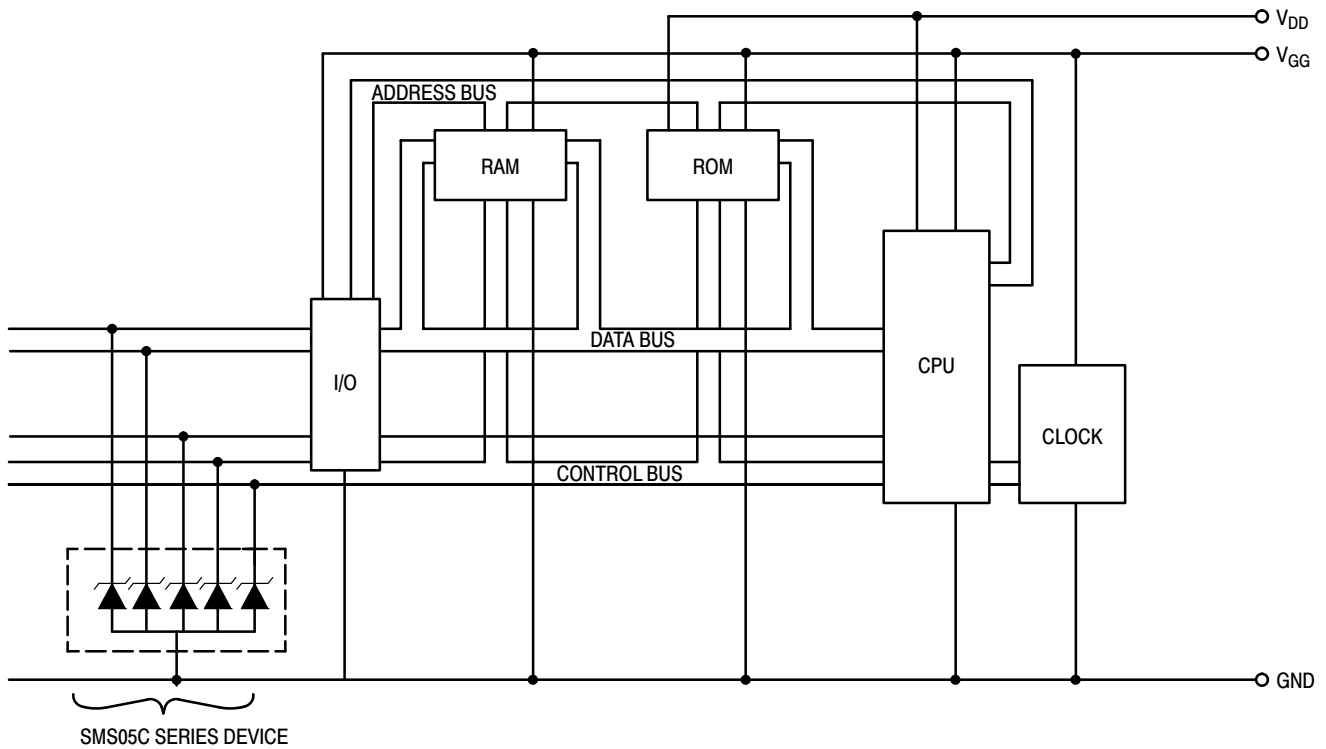
**Figure 8. Microprocessor Protection**

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

**onsemi**™

**TSOP−6**
CASE 318G−02
ISSUE V

DATE 12 JUN 2012

**SCALE 2:1**

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
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 ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

**DETAIL Z**

| DIM | MILLIMETERS | | |
|-----|------|------|------|
|     | MIN  | NOM  | MAX  |
| A   | 0.90 | 1.00 | 1.10 |
| A1  | 0.01 | 0.06 | 0.10 |
| 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° |

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

## RECOMMENDED SOLDERING FOOTPRINT*

6X 0.60
3.20
6X 0.95
0.95 PITCH
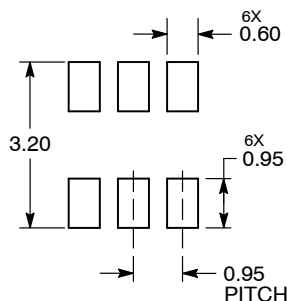
DIMENSIONS: MILLIMETERS

*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*

XXXAYW■

XXX M■

**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.

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|---|---|---|---|
| DESCRIPTION: | TSOP−6 | | PAGE 1 OF 1 |

## ADDITIONAL INFORMATION

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