FAIRCHILD SEMICONDUCTOR®

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SSTV16857 • SSTVN16857
14-Bit Register with SSTL-2 Compatible I/O and Reset

General Description

The SSTV16857 is a 14-bit register designed for use with 184 and 232 pin PC1600, 2100, and 2700 DDR DIMM applications. The SSTVN16857 is a 14-bit register designed for use with 184 and 232 pin PC3200 DDR DIMM applications. These devices have a differential input clock, SSTL-2 compatible data inputs and a LVCMOS compatible $\overline{\text{RESET}}$ input. These devices have been designed for compliance with the JEDEC DDR module and register specifications.

The devices are fabricated on an advanced submicron CMOS process and are designed to operate at power supplies of less than 3.6V's.

Features

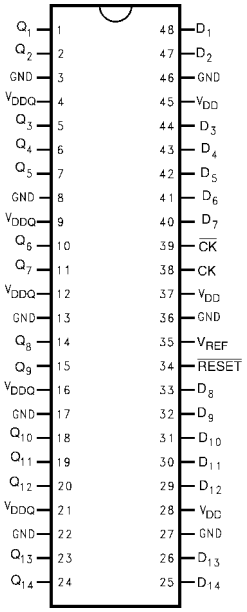
- Compliant with DDR-I registered module specifications
- Operates at 2.5V ± 0.2V V_{DD}
- SSTL-2 compatible input and output structure
- Differential SSTL-2 compatible clock inputs
- Low power mode when device is reset
- Industry standard 48 pin TSSOP package

Ordering Code:

Order Number	Package Number	Package Description
SSTV16857MTD	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
SSTVN16857MTD (Preliminary)	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Pin Descriptions

Pin Name	Description
Q_1-Q_{14}	SSTL-2 Compatible Output
D_1-D_{14}	SSTL-2 Compatible Inputs
$\overline{\text{RESET}}$	Asynchronous LVCMOS Reset Input
CK	Positive Master Clock Input
$\overline{\text{CK}}$	Negative Master Clock Input
V_{REF}	Voltage Reference Pin for SSTL Level Inputs
V_{DDQ}	Power Supply Voltage for Output Signals
V_{DD}	Power Supply Voltage for Inputs

Truth Table

$\overline{\text{RESET}}$	D_n	CK	$\overline{\text{CK}}$	Q_n
L	X or Floating	X or Floating	X or Floating	L
H	L	↑	↓	L
H	H	↑	↓	H
H	X	L	H	Q_n
H	X	H	L	Q_n

L = Logic LOW
H = Logic HIGH
X = Don't Care, but not floating unless noted
↑ = LOW-to-HIGH Clock Transition
↓ = HIGH-to-LOW Clock Transition

Functional Description

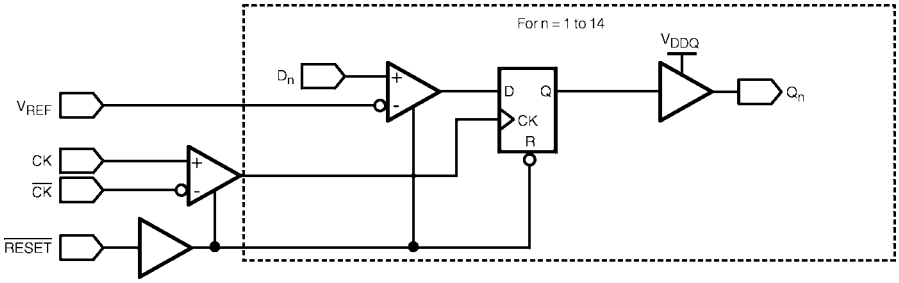
The SSTV16857 and SSTVN16587 are 14-bit registers with SSTL-2 compatible inputs and outputs. Input data is captured by the register on the positive edge crossing of the differential clock pair.

When the LV-CMOS $\overline{\text{RESET}}$ signal is asserted LOW, all outputs and internal registers are asynchronously placed into the LOW logic state. In addition, the clock and data differential comparators are disabled for power savings. Output glitches are prevented by disabling the internal registers more quickly than the input comparators. When $\overline{\text{RESET}}$ is removed, the system designer must insure the clock and data inputs to the device are stable during the rising transition of the $\overline{\text{RESET}}$ signal.

The SSTL-2 data inputs transition based on the value of V_{REF}. V_{REF} is a stable system reference used for setting the trip point of the input buffers of the SSTV16857/ SSTVN16857 and other SSTL-2 compatible devices.

The $\overline{\text{RESET}}$ signal is a standard CMOS compatible input and is not referenced to the V_{REF} signal.

Logic Diagram



Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{DDQ})	−0.5V to +3.6V
Supply Voltage (V_{DD})	−0.5V to +3.6V
Reference Voltage (V_{REF})	−0.5V to +3.6V
Input Voltage (V_I)	−0.5V to V_{DD} + 0.5V
Output Voltage (V_O)	
Outputs Active (Note 2)	−0.5V to V_{DDQ} + 0.5V
DC Input Diode Current (I_{IK})	
V_I < 0V	−50 mA
V_I > V_{DD}	+50 mA
DC Output Diode Current (I_{OK})	
V_O < 0V	−50 mA
V_O > V_{DD}	+50 mA
DC Output Source/Sink Current (I_{OH}/I_{OL})	±50 mA
DC V_{DD} or Ground Current per Supply Pin (I_{DD} or Ground)	±100 mA
Storage Temperature Range (T_{stg})	−65°C to +150°C

Recommended Operating Conditions (Note 3)

Power Supply (V_{DDQ})		
SSTV16857		2.3V to 2.7V
SSTVN16857		2.5V to 2.7V
Power Supply (V_{DD})		
Operating Range		V_{DDQ} to 2.7V
Reference Supply (V_{REF} = V_{DDQ}/2)		
SSTV16857		1.15 to 1.35
SSTVN16857		1.25 to 1.35
Termination Voltage (V_{TT})		V_{REF} ± 40 mV
Input Voltage		0V to V_{DD}
Output Voltage (V_O)		
Output in Active States		0V to V_{DDQ}
Output Current I_{OH}/I_{OL}		
V_{DD} = 2.3V to 2.7V	SSTV16857	±20 mA
V_{DD} = 2.5V to 2.7V	SSTVN16857	±20 mA
Free Air Operating Temperature (T_A)		0°C to +70°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: IO Absolute Maximum Rating must be observed.

Note 3: The $\overline{\text{RESET}}$ input of the device must be held at V_{DD} or GND to ensure proper device operation. The differential inputs must not be floating, unless $\overline{\text{RESET}}$ is asserted LOW.

DC Electrical Characteristics (SSTV16857) (2.3V ≤ V_{DD} ≤ 2.7V)

Symbol	Parameter	Conditions	V_{DD} (V)	Min	Max	Units
V_{IKL}	Input LOW Clamp Voltage	I_I = −18 mA	2.3		−1.2	V
V_{IKH}	Input HIGH Clamp Voltage	I_I = +18 mA	2.3		3.5	V
V_{IH-AC}	AC HIGH Level Input Voltage	Data Inputs		V_{REF}+310mV		V
V_{IL-AC}	AC LOW Level Input Voltage	Data Inputs			V_{REF}−310mV	V
V_{IH-DC}	DC HIGH Level Input Voltage	Data Inputs		V_{REF}+150mV		V
V_{IL-DC}	DC LOW Level Input Voltage	Data Inputs			V_{REF}−150mV	V
V_{IH}	HIGH Level Input Voltage	$\overline{\text{RESET}}$		1.7		V
V_{IL}	LOW Level Input Voltage	$\overline{\text{RESET}}$			0.7	V
V_{ICR}	Common Mode Input Voltage Range	CLK, $\overline{\text{CLK}}$		0.97	1.53	V
$V_{I(PP)}$	Peak to Peak Input Voltage	CLK, $\overline{\text{CLK}}$		360		mV
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 μA I_{OH} = −16 mA	2.3 to 2.7 2.3	V_{DD} − 0.2 1.95		V
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 μA I_{OL} = 16 mA	2.3 to 2.7 2.3		0.2 0.35	V
I_I	Input Leakage Current	V_I = V_{DD} or GND	2.7		±5.0	μA
I_{DD}	Static Standby	$\overline{\text{RESET}}$ = GND, I_O = 0	2.7		10	μA
	Static Operating	$\overline{\text{RESET}}$ = V_{DD}, I_O = 0 V_I = $V_{IH(AC)}$ or $V_{IL(AC)}$			25	mA

DC Electrical Characteristics (SSTV16857) (Continued)

Symbol	Parameter	Conditions	V_{DD} (V)	Min	Max	Units
I_{DDD}	Dynamic Operating Current Clock Only	$\overline{RESET}$ = V_{DD}, I_O = 0 V_I = $V_{IH(AC)}$ or $V_{IL(AC)}$ CK, $\overline{CK}$ Duty Cycle 50%	2.7		90	μA/MHz
	Dynamic Operating Current per Data Input	$\overline{RESET}$ = V_{DD}, I_O = 0 V_I = $V_{IH(AC)}$ or $V_{IL(AC)}$ CK, $\overline{CK}$ Duty Cycle 50% Data Input = ½ Clock Rate 50% Duty Cycle			15	μA/MHz
R_{OH}	Output HIGH On Resistance	I_{OH} = −20 mA	2.3 to 2.7	7	20	Ω
R_{OL}	Output LOW On Resistance	I_{OL} = 20 mA	2.3 to 2.7	7	20	Ω
$R_{O\Delta}$	$\lvert R_{OH} - R_{OL} \rvert$	I_O = 20 mA, T_A = 25°C	2.5		4	Ω

DC Electrical Characteristics (SSTVN16857) (2.5V ≤ V_{DD} ≤ 2.7V)

Symbol	Parameter	Conditions	V_{DD} (V)	Min	Max	Units
V_{IKL}	Input LOW Clamp Voltage	I_I = −18 mA	2.5		−1.2	V
V_{IKH}	Input HIGH Clamp Voltage	I_I = +18 mA	2.5		3.5	V
V_{IH-AC}	AC HIGH Level Input Voltage	Data Inputs		V_{REF}+310mV		V
V_{IL-AC}	AC LOW Level Input Voltage	Data Inputs			V_{REF}–310mV	V
V_{IH-DC}	DC HIGH Level Input Voltage	Data Inputs		V_{REF}+150mV		V
V_{IL-DC}	DC LOW Level Input Voltage	Data Inputs			V_{REF}–150mV	V
V_{IH}	HIGH Level Input Voltage	$\overline{RESET}$		1.7		V
V_{IL}	LOW Level Input Voltage	$\overline{RESET}$			0.7	V
V_{ICR}	Common Mode Input Voltage Range	CLK, $\overline{CLK}$		0.97	1.53	V
$V_{I(PP)}$	Peak to Peak Input Voltage	CLK, $\overline{CLK}$		360		mV
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 μA I_{OH} = −16 mA	2.5 to 2.7 2.5	V_{DD} − 0.2 1.95		V
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 μA I_{OL} = 16 mA	2.5 to 2.7 2.5		0.2 0.35	V
I_I	Input Leakage Current	V_I = V_{DD} or GND	2.7		±5.0	μA
I_{DD}	Static Standby	$\overline{RESET}$ = GND, I_O = 0	2.7		10	μA
	Static Operating	$\overline{RESET}$ = V_{DD}, I_O = 0 V_I = $V_{IH(AC)}$ or $V_{IL(AC)}$			25	mA
I_{DDD}	Dynamic Operating Current Clock Only	$\overline{RESET}$ = V_{DD}, I_O = 0 V_I = $V_{IH(AC)}$ or $V_{IL(AC)}$ CK, $\overline{CK}$ Duty Cycle 50%	2.7		90	μA/MHz
	Dynamic Operating Current per Data Input	$\overline{RESET}$ = V_{DD}, I_O = 0 V_I = $V_{IH(AC)}$ or $V_{IL(AC)}$ CK, $\overline{CK}$ Duty Cycle 50% Data Input = ½ Clock Rate 50% Duty Cycle			15	μA/MHz
R_{OH}	Output HIGH On Resistance	I_{OH} = −20 mA	2.5 to 2.7	7	20	Ω
R_{OL}	Output LOW On Resistance	I_{OL} = 20 mA	2.5 to 2.7	7	20	Ω
$R_{O\Delta}$	$\lvert R_{OH} - R_{OL} \rvert$	I_O = 20 mA, T_A = 25°C	2.5		4	Ω

AC Electrical Characteristics (SSTV16857) (Note 4)

Symbol	Parameter	$T_A = 0°C$ to $+70°C$, $C_L = 30$ pF, $R_L = 50\Omega$; $V_{DD} = 2.5V \pm 0.2V$; $V_{DDQ} = 2.5V \pm 0.2V$		Units
		Min	Max	
f_{MAX}	Maximum Clock Frequency	200		MHz
t_W	Pulse Duration, CK, $\overline{CK}$ HIGH or LOW (Figure 2)	2.5		ns
t_{ACT} (Note 5)	Differential Inputs Activation Time, data inputs must be LOW after $\overline{RESET}$ HIGH (Figure 3)	22		ns
t_{INACT} (Note 5)	Differential Inputs De-activation Time, data and clock inputs must be held at valid levels (not floating) after $\overline{RESET}$ LOW	22		ns
t_S	Setup Time, Fast Slew Rate (Note 6)(Note 7) (Figure 5)	0.65		ns
	Setup Time, Slow Slew Rate (Note 7)(Note 8) (Figure 5)	0.9		
t_H	Hold Time, Fast Slew Rate (Note 6)(Note 8) (Figure 5)	0.75		ns
	Hold Time, Slow Slew Rate (Note 7)(Note 8) (Figure 5)	0.9		
t_{REM}	Reset Removal Time (Figure 7)	10		ns
t_{PHL}, t_{PLH}	Propagation Delay CLK, CLK to Q_n (Figure 4)	1.1	2.8	ns
t_{PHL}	Propagation Delay $\overline{RESET}$ to Q_n (Figure 6)		5.0	ns
$t_{SK(Pn-Pn)}$	Output to Output Skew		200	ps

Note 4: Refer to Figure 1 through Figure 7.

Note 5: This parameter is not production tested.

Note 6: For data signal input slew rate ≥ 1 V/ns.

Note 7: For data signal input slew rate ≥ 0.5 V/ns and < 1 V/ns.

Note 8: For CK, $\overline{CK}$ signals input slew rates are ≥ 1 V/ns.

AC Electrical Characteristics (SSTVN16857) (Note 9)

Symbol	Parameter	$T_A = 0°C$ to $+70°C$, $C_L = 30$ pF, $R_L = 50\Omega$; $V_{DD} = 2.5V \pm 0.2V$; $V_{DDQ} = 2.5V \pm 0.2V$		Units
		Min	Max	
f_{MAX}	Maximum Clock Frequency	220		MHz
t_W	Pulse Duration, CK, $\overline{CK}$ HIGH or LOW (Figure 2)	2.5		ns
t_{ACT} (Note 5)	Differential Inputs Activation Time, data inputs must be LOW after $\overline{RESET}$ HIGH (Figure 3)	22		ns
t_{INACT} (Note 5)	Differential Inputs De-activation Time, Data and Clock Inputs must be held at valid levels (not floating) after $\overline{RESET}$ LOW	22		ns
t_S	Setup Time, Fast Slew Rate (Note 9)(Note 12) (Figure 5)	0.65		ns
	Setup Time, Slow Slew Rate (Note 12)(Note 13) (Figure 5)	0.75		
t_H	Hold Time, Fast Slew Rate (Note 11)(Note 13) (Figure 5)	0.75		ns
	Hold Time, Slow Slew Rate (Note 12)(Note 13) (Figure 5)	0.9		
t_{REM}	Reset Removal Time (Figure 7)	10		ns
t_{PHL}, t_{PLH}	Propagation Delay CLK, CLK to Q_n (Figure 4)	1.1	2.4	ns
t_{PSS}	Propagation Delay Simultaneous Switching CLK, CLK to Q_n (Note 14)		2.7	ns
t_{PHL}	Propagation Delay $\overline{RESET}$ to Q_n (Figure 6)		5.0	ns
$t_{SK(Pn-Pn)}$	Output to Output Skew		200	ps

Note 9: Refer to Figure 1 through Figure 7.

Note 10: This parameter is not production tested.

Note 11: For data signal input slew rate ≥ 1 V/ns.

Note 12: For data signal input slew rate ≥ 0.5 V/ns and < 1 V/ns.

Note 13: For CK, $\overline{CK}$ signals input slew rates are ≥ 1 V/ns.

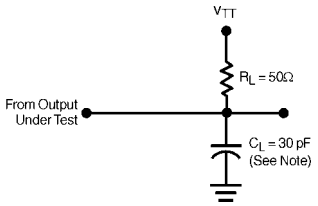
Note 14: Simultaneous Switching is guaranteed by characterization.

Capacitance (Note 15)

Symbol	Parameter	Min	Typ	Max	Units	Conditions
C_{IN}	Data Pin Input Capacitance	2.0		3.0	pF	V_{DD} = 2.5V, $V_I = V_{REF} \pm 350$ mV
	CK, $\overline{CK}$ - Input Capacitance	2.5		3.5	pF	V_{DD} = 2.5V, V_{ICR} = 1.25V, $V_{I(PP)}$ = 360 mV
	$\overline{RESET}$	2.5		3.5	pF	V_{DD} = 2.5V, $V_I = V_{DD}$ to GND

Note 15: $T_A = +25°C$, f = 1 MHz, Capacitance is characterized but not tested.

AC Loading and Waveforms (See Notes A through F below)



Note: C_L includes probe and jog capacitance

FIGURE 1. AC Test Circuit

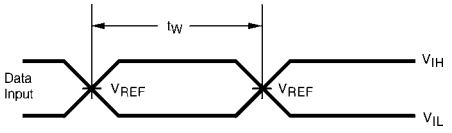
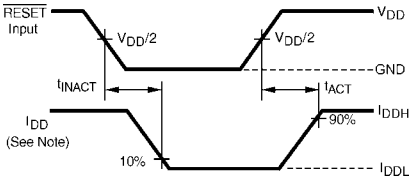


FIGURE 2. Voltage Waveforms - Pulse Duration



Note: I_{DD} tested with clock and data inputs held at V_{DD} or GND, and I_O = 0 mA.

FIGURE 3. Voltage and Current Waveforms Inputs Active and Inactive Times

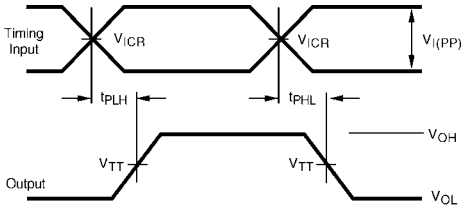


FIGURE 4. Voltage Waveforms - Propagation Delay Times

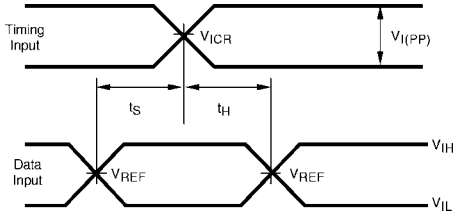


FIGURE 5. Voltage Waveforms - Setup and Hold Times

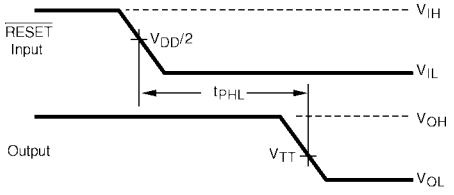


FIGURE 6. Voltage Waveforms - RESET Propagation Delay Times

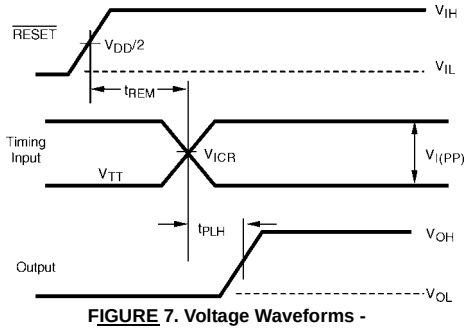


FIGURE 7. Voltage Waveforms - RESET Removal Delay Times

Note A: All input pulses are supplied by generators having the following characteristics:
PRR ≤ 10 MHz, Z_0 = 50Ω, input slew rate = 1V/ns ± 20% (unless otherwise specified).

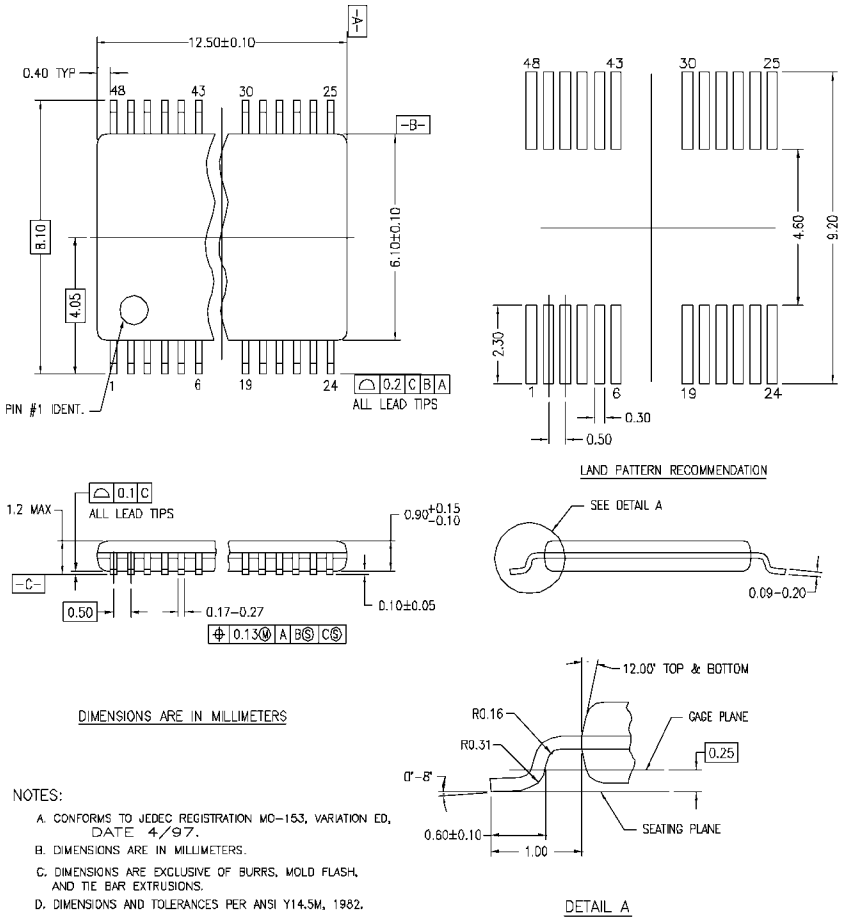
Note B: The outputs are measured one at a time with one transition per measurement.

Note C: $V_{TT} = V_{REF} = V_{DD}/2$.

Note D: $V_{IH} = V_{REF}$ +310 mV (AC voltage levels) for differential inputs. $V_{IH} = V_{DD}$ for LVCMOS input.

Note E: $V_{IL} = V_{REF}$ −310 mV (AC voltage levels) for differential inputs. V_{IL} = GND for LVCMOS input.

Note F: Removal time (t_{REM}) is tested with one data input held active HIGH. The propagation time from CK to the corresponding output must meet valid timing specifications for the measurement to be accurate.



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO–153, VARIATION ED, DATE 4/97.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTD48REVC

48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
Package Number MTD48

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