# MC10SX1190

# Fibre Channel Coaxial Cable Driver and Loop Resiliency Circuit

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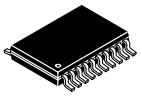
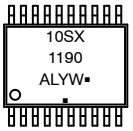


**TSSOP−20 WB**
**DT SUFFIX**
**CASE 948E**

### MARKING DIAGRAM




A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package
(Note: Microdot may be in either location)

*For additional marking information, refer to Application Note AND8002/D.

### Description

The MC10SX1190 is a differential receiver, differential transmitter specifically designed to drive coaxial cables. It incorporates the output cable drive capability of the MC10EP89 Coaxial Cable Driver with additional circuitry to multiplex the output cable drive source between the cable receiver or the local transmitter inputs. The multiplexer control circuitry is TTL compatible for ease of operation.

The MC10SX1190 is useful as a bypass element for Fibre Channel-Arbitrated Loop (FC-AL) or Serial Storage Architecture (SSA) applications, to create loop style interconnects with fault tolerant, active switches at each device node. This device is particularly useful for back panel applications where small size is desirable.

The EP89 style drive circuitry produces swings approximately 70% larger than a standard PECL output. When driving a coaxial cable, proper termination is required at both ends of the line to minimize reflections. The 1.4 V output swings allow for proper termination at both ends of the cable, while maintaining the required swing at the receiving end of the cable. Because of the larger output swings, the QT, $\overline{QT}$ outputs are terminated into the thevenin equivalent of 50 Ω to $V_{CC}$ − 3.0 V instead of 50 Ω to $V_{CC}$ − 2.0 V.

### Features

- 2.5 Gb/s Operation
- 425 ps Propagation Delay
- 1.4 V Output Swing on the Cable Driving Output
- Single Positive Supply Operation Ranges:
  $V_{CC}$ = 3.0 V to 3.6 V, $V_{EE}$ = 0 V
  $V_{CC}$ = 4.5 V to 5.5 V, $V_{EE}$ = 0 V
- 75 kΩ Internal Input Pull Down Resistors
- ESD Protection:
  - 2000 V Human Body Model
  - >100 V Machine Model
- This Device is Pb-Free, Halogen Free and is RoHS Compliant

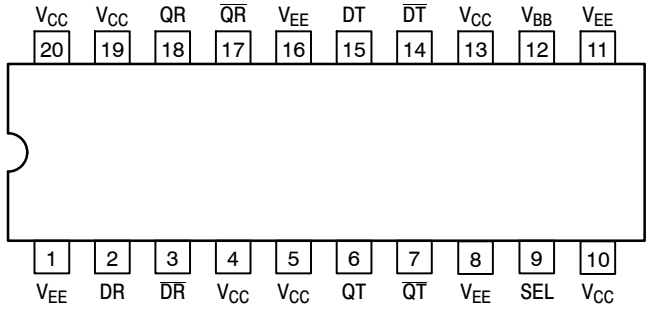



**Figure 1. 20-Lead TSSOP Pinout:** (Top View)

### PIN DESCRIPTION

| PIN | FUNCTION |
|---|---|
| DR/$\overline{DR}$ | ECL Diff. Inputs from Receive Cable |
| QR/$\overline{QR}$ | ECL Buffered Differential Outputs from Receive Cable |
| DT/$\overline{DT}$ | ECL Differential Input to Transmit Cable |
| QT/$\overline{QT}$ | ECL Buffered Differential Output to Transmit Cable |
| SEL | TTL Multiplexer Control Signal |
| $V_{BB}$ | Reference Voltage Output |
| $V_{CC}$ | ECL Positive Supply |
| $V_{EE}$ | ECL Negative, 0 Supply |

### TRUTH TABLE

| SEL | Function |
|---|---|
| L | DR → QT |
| H | DT → QT |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

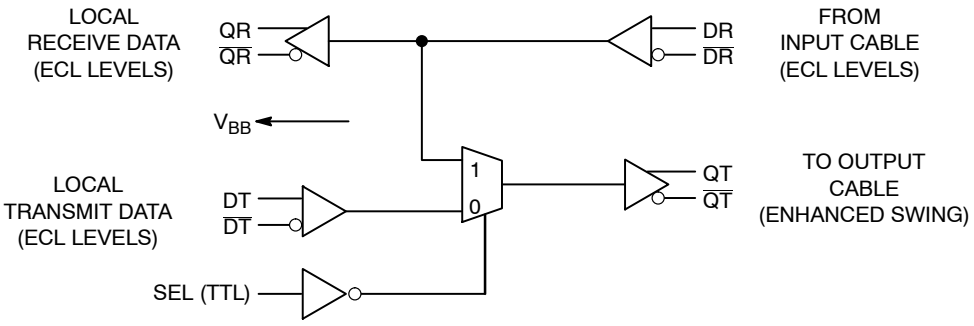



**Figure 2. Logic Diagram**

**Table 1. ABSOLUTE MAXIMUM RATINGS**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | Power Supply Voltage ($V_{EE}$ = 0 V) | 0 to +6.0 | Vdc |
| $V_{EE}$ | Power Supply Voltage ($V_{CC}$ = 0 V) | −6.0 to 0 | Vdc |
| $V_{IN}$ | Input Voltage ($V_{EE}$ = 0 V, $V_{IN}$ not more positive than $V_{CC}$) | 0 to +6.0 | Vdc |
| $V_{IN}$ | Input Voltage ($V_{CC}$ = 0 V, $V_{IN}$ not more negative than $V_{EE}$) | −6.0 to 0 | Vdc |
| $I_{OUT}$ | Output Current<br>Continuous<br>Surge | <br>50<br>100 | mA |
| $\theta_{JA}$ | Thermal Resistance (Junction-to-Ambient)<br>Still Air<br>500 lfpm | <br>90<br>60 | °C/W |
| $\theta_{JC}$ | Thermal Resistance (Junction-to-Case) | 30 to 35 | °C/W |
| $T_A$ | Operating Temperature Range | −40 to +85 | °C |
| $T_{STG}$ | Storage Temperature Range | −50 to +150 | °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.

**Table 2. DC CHARACTERISTICS** ($V_{CC}$ = 3.3 V, $V_{EE}$ = 0 V) (Note 1))

| Symbol | Characteristic | -40°C | | | 25°C | | | 85°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| $V_{OH}$ | Output Voltage High (QR,$\overline{QR}$) (Note 2) | 2.22 | 2.35 | 2.52 | 2.27 | 2.39 | 2.57 | 2.30 | 2.40 | 2.60 | V |
| $V_{OL}$ | Output Voltage Low (QR,$\overline{QR}$) (Note 2) | 1.35 | 1.54 | 1.65 | 1.37 | 1.57 | 1.67 | 1.40 | 1.57 | 1.71 | V |
| $V_{OH}$ | Output Voltage High (QT,$\overline{QT}$) (Note 3) | 2.13 | 2.29 | 2.40 | 2.18 | 2.33 | 2.46 | 2.20 | 2.34 | 2.48 | V |
| $V_{OL}$ | Output Voltage Low (QT,$\overline{QT}$) (Note 3) | 0.50 | 0.67 | 1.10 | 0.48 | 0.64 | 1.06 | 0.44 | 0.63 | 1.06 | V |
| $I_{CC}$ | Quiescent Supply Current (Note 4) | 30 | 60 | 90 | 30 | 60 | 90 | 30 | 60 | 90 | mA |
| $V_{IH}$ | Input Voltage High | 2070 | | 2410 | 2170 | | 2490 | 2240 | | 2580 | mV |
| $V_{IL}$ | Input Voltage Low | 1350 | | 1800 | 1350 | | 1820 | 1350 | | 1860 | mV |
| $V_{IH}$ | Input Voltage High SEL (Note 5) | 2.0 | | | 2.0 | | | 2.0 | | | V |
| $V_{IL}$ | Input Voltage Low SEL (Note 5) | | | 0.8 | | | 0.8 | | | 0.8 | V |
| $V_{BB}$ | Output Reference Voltage (Note 1) | 1.80 | 1.90 | 2.05 | 1.80 | 1.90 | 2.05 | 1.85 | 1.95 | 2.05 | V |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

1. Input and output parameters will track 1:1 $V_{CC}$. $V_{EE}$ can vary +0.3 V to −0.3 V.
2. QR outputs loaded with 50 Ω to $V_{CC}$ − 2.0 V
3. QT outputs loaded with 50 Ω to $V_{CC}$ − 3.0 V
4. Outputs open circuited.
5. TTL signal threshold is 1.5 V above $V_{EE}$.

**Table 3. DC CHARACTERISTICS** ($V_{CC}$ = 5.0 V, $V_{EE}$ = 0 V) (Note 1))

| Symbol | Characteristic | -40°C | | | 25°C | | | 85°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| $V_{OH}$ | Output Voltage High (QR,$\overline{QR}$) (Note 2) | 3.92 | 4.05 | 4.22 | 3.97 | 4.09 | 4.27 | 4.0 | 4.10 | 4.30 | V |
| $V_{OL}$ | Output Voltage Low (QR,$\overline{QR}$) (Note 2) | 3.05 | 3.24 | 3.35 | 3.07 | 3.27 | 3.37 | 3.10 | 3.27 | 3.41 | V |
| $V_{OH}$ | Output Voltage High (QT,$\overline{QT}$) (Note 3) | 3.83 | 3.99 | 4.11 | 3.88 | 4.03 | 4.16 | 3.90 | 4.04 | 4.18 | V |
| $V_{OL}$ | Output Voltage Low (QT,$\overline{QT}$) (Note 3) | 1.90 | 2.14 | 2.50 | 1.85 | 2.09 | 2.45 | 1.85 | 2.08 | 2.45 | V |
| $I_{CC}$ | Quiescent Supply Current (Note 4) | 30 | 60 | 90 | 30 | 60 | 90 | 30 | 60 | 90 | mA |
| $V_{IH}$ | Input Voltage High | 3770 | | 4110 | 3870 | | 4190 | 3940 | | 4280 | mV |
| $V_{IL}$ | Input Voltage Low | 3050 | | 3500 | 3050 | | 3520 | 3050 | | 3560 | mV |
| $V_{IH}$ | Input Voltage High SEL (Note 5) | 2.0 | | | 2.0 | | | 2.0 | | | V |
| $V_{IL}$ | Input Voltage Low SEL (Note 5) | | | 0.8 | | | 0.8 | | | 0.8 | V |
| $V_{BB}$ | Output Reference Voltage (Note 1) | 3.50 | 3.60 | 3.75 | 3.50 | 3.60 | 3.75 | 3.55 | 3.65 | 3.75 | V |
| $I_{IL}$ | Input High Current | | | 150 | | | 150 | | | 150 | μA |
| $I_{IH}$ | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | μA |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

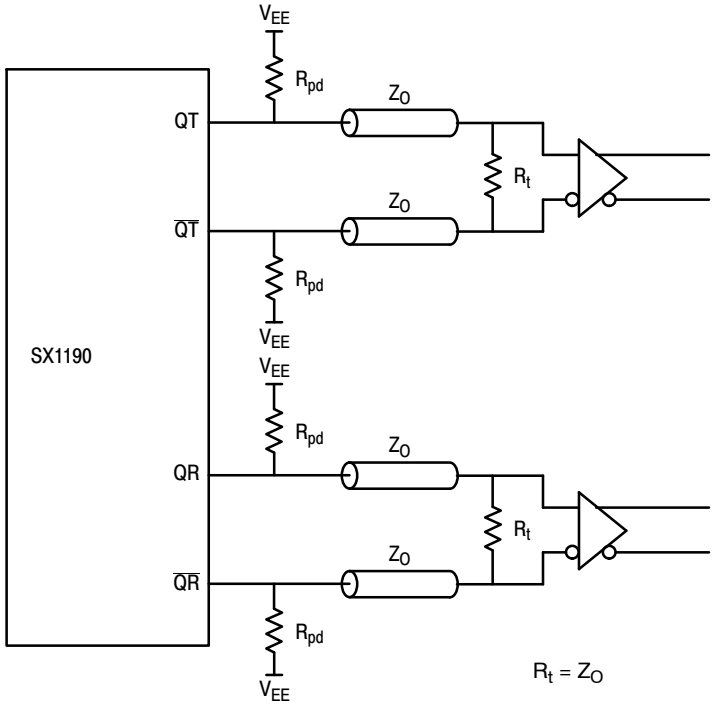
1. Input and output parameters will track 1:1 $V_{CC}$. $V_{EE}$ can vary +0.5 V to −0.5 V.
2. QR outputs loaded with 50 Ω to $V_{CC}$ − 2.0 V
3. QT outputs loaded with 50 Ω to $V_{CC}$ − 3.0 V
4. Outputs open circuited.
5. TTL signal threshold is 1.5 V above $V_{EE}$.

**Table 4. AC CHARACTERISTICS** ($V_{CC}$ = 3.0 V to 5.5 V, $V_{EE}$ = 0 V) (Note 1))

| Symbol | Characteristic | –40°C | | | 25°C to 85°C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| $t_{pd}$ | Propagation Delay-to-Output | | | | | | | ps |
| | DR → QR (Diff) (Notes 2 and 3) | 140 | 240 | 340 | 180 | 280 | 380 | |
| | DR → QT (Diff) | 300 | 400 | 500 | 350 | 470 | 650 | |
| | DT → QT (Diff) | 280 | 380 | 480 | 350 | 440 | 650 | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay SEL → QT,$\overline{QT}$ (1.5 V to 50% Pt) | 400 | 700 | 1000 | 400 | 700 | 1000 | ps |
| $t_r$, $t_f$ | Rise Time (20% to 80%) QR,$\overline{QR}$ Fall Time (80% to 20%) | 70 | 140 | 200 | 90 | 155 | 250 | ps |
| $t_r$, $t_f$ | Rise Time (20% to 80%) QT,$\overline{QT}$ Fall Time 80% to 20% | 150 | 200 | 280 | 150 | 230<br>230 | 500 | ps |
| $t_{skew}$ | Within Device Skew (Note 4) | | 15 | | | 15 | | ps |
| $V_{PP}$ | Input Swing (Differential Configuration) | 200 | | 1000 | 200 | | 1000 | mV |
| $V_{CMR}$ | Common Mode Range (Note 5) | 3.0 | | 4.35 | 3.0 | | 4.35 | V |
| $f_{max}$ | Maximum Operation Frequency | 2.5 | | | 2.5 | | | Gb/s |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

1. $V_{EE}$ can vary +0.3 V to −0.3 V
2. The differential propagation delay is defined as the delay from the crossing points of the differential input signals to the crossing point of the differential output signals.
3. The single-ended propagation delay is defined as the delay from the 50% point of the input signal to the 50% point of the output signal.
4. Duty cycle skew is the difference between $t_{PLH}$ and $t_{PHL}$ propagation delay through a device.
5. The CMR range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between $V_{PP\ Min}$ and 1.0 V.




Typical value for $R_{pd}$ is 160 Ω to 260 Ω, depending on the application. The minimum value of $R_{pd}$ should not be less than 50 Ω.

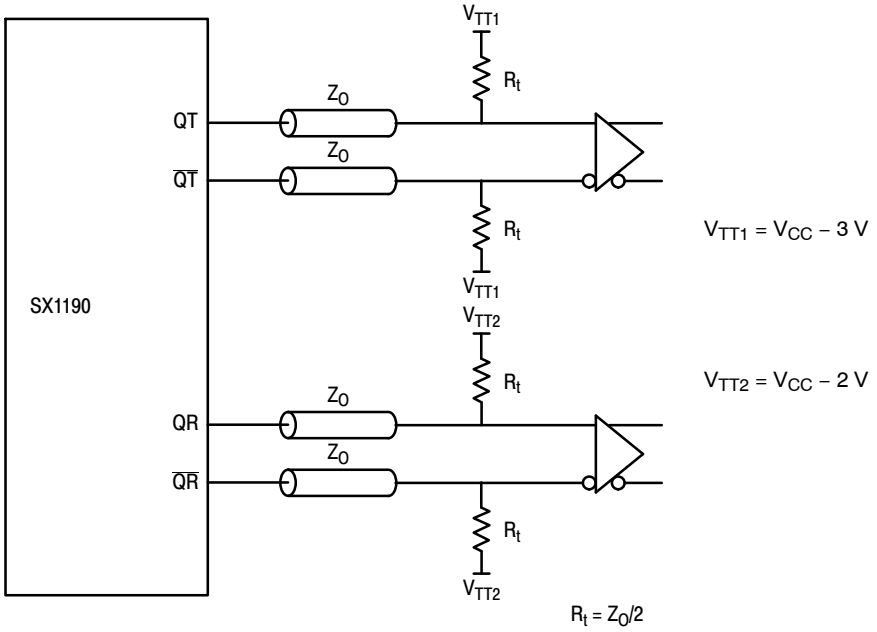



**Figure 3. SX1190 Termination Configuration**

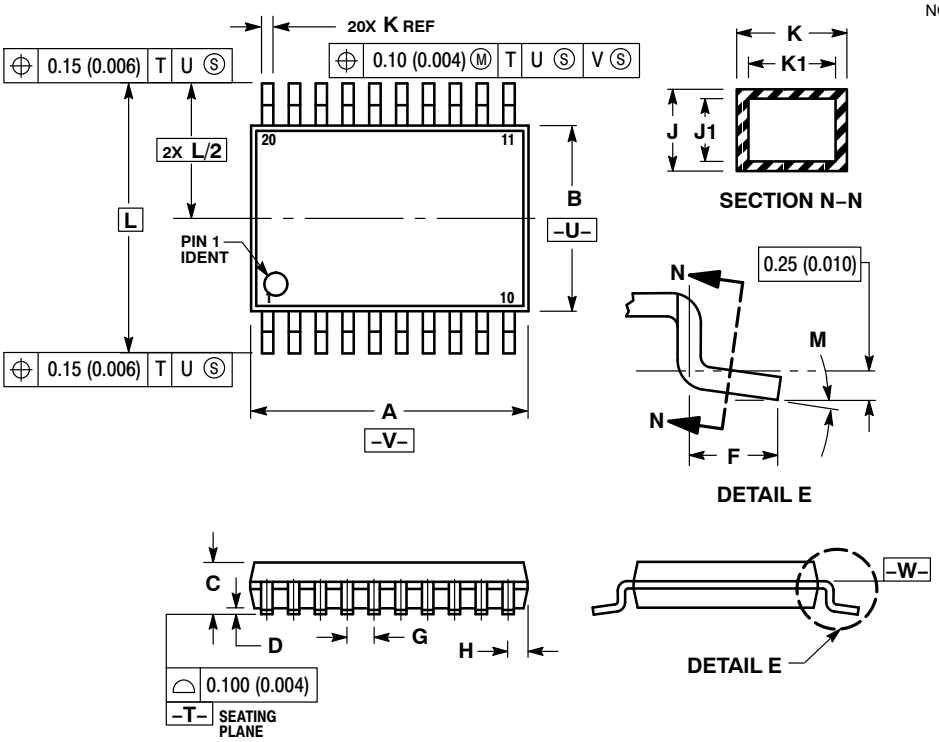
## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| MC10SX1190DTG | TSSOP−20 WB (Pb-Free) | 75 Units / Tube |
| MC10SX1190DTR2G | TSSOP−20 WB (Pb-Free) | 2500 / 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.

## PACKAGE DIMENSIONS

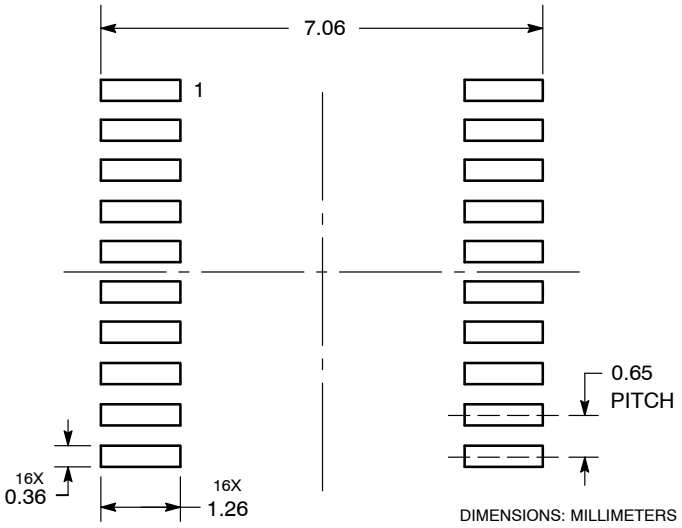
**TSSOP−20 WB**
**DT SUFFIX**
CASE 948E
ISSUE D




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 6.40 | 6.60 | 0.252 | 0.260 |
| B | 4.30 | 4.50 | 0.169 | 0.177 |
| C | --- | 1.20 | --- | 0.047 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.65 BSC | | 0.026 BSC | |
| H | 0.27 | 0.37 | 0.011 | 0.015 |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.19 | 0.30 | 0.007 | 0.012 |
| K1 | 0.19 | 0.25 | 0.007 | 0.010 |
| L | 6.40 BSC | | 0.252 BSC | |
| M | 0° | 8° | 0° | 8° |

**SOLDERING FOOTPRINT**




DIMENSIONS: MILLIMETERS

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