

Dual Differential Comparators

 Check for Samples: [LM193](#), [LM293](#), [LM293A](#), [LM393](#), [LM393A](#), [LM2903](#), [LM2903V](#)

FEATURES

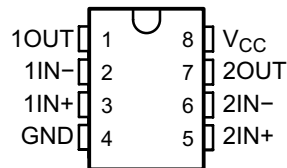
- **Single Supply or Dual Supplies**
- **Wide Range of Supply Voltage**
 - Max Rating: 2 V to 36 V
 - Tested to 30 V: Non-V Devices
 - Tested to 32 V: V-Suffix Devices
- **Low Supply-Current Drain Independent of Supply Voltage: 0.4 mA (Typ) Per Comparator**
- **Low Input Bias Current: 25 nA (Typ)**
- **Low Input Offset Current: 3 nA (Typ) (LM139)**
- **Low Input Offset Voltage: 2 mV (Typ)**
- **Common-Mode Input Voltage Range Includes Ground**
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage: ± 36 V**
- **Low Output Saturation Voltage**
- **Output Compatible With TTL, MOS, and CMOS**
- **On Products Compliant to MIL-PRF-38535, All Parameters Are Tested Unless Otherwise Noted. On All Other Products, Production Processing Does Not Necessarily Include Testing of All Parameters.**

DESCRIPTION

These devices consist of two independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible as long as the difference between the two supplies is 2 V to 36 V, and V_{CC} is at least 1.5 V more positive than the input common-mode voltage. Current drain is independent of the supply voltage. The outputs can be connected to other open-collector outputs to achieve wired-AND relationships.

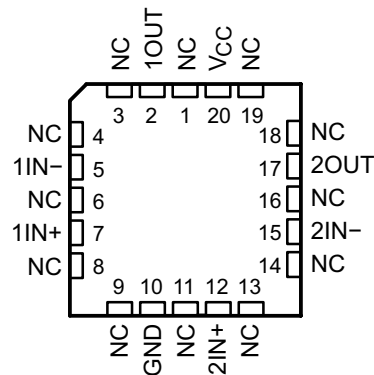
The LM193 is characterized for operation from -55°C to 125°C . The LM293 and LM293A are characterized for operation from -25°C to 85°C . The LM393 and LM393A are characterized for operation from 0°C to 70°C . The LM2903 is characterized for operation from -40°C to 125°C .

LM193 . . . D OR JG PACKAGE
LM293 . . . D, DGK, OR P PACKAGE
LM293A . . . DOR DGK PACKAGE
LM393, LM393A . . . D, DGK, P, PS, OR PW PACKAGE
LM2903 . . . D, DGK, P, PS, OR PW PACKAGE
(TOP VIEW)



NC – No internal connection

LM193 . . . FK PACKAGE
(TOP VIEW)



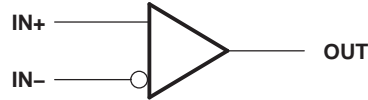
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



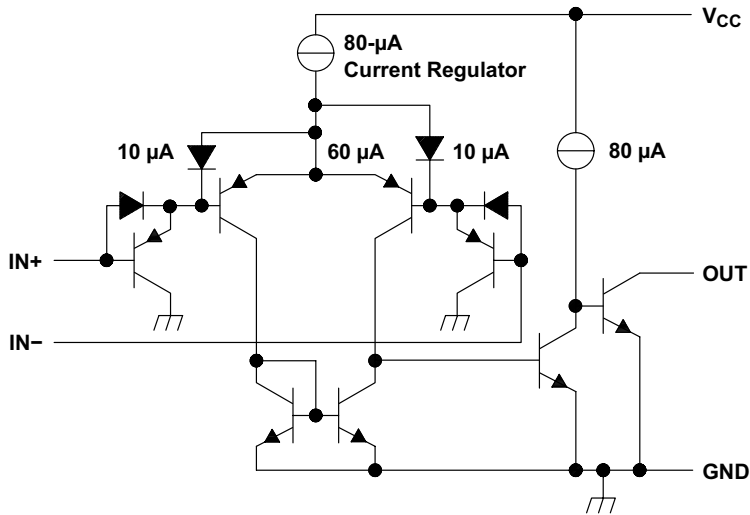
This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Symbol (Each Comparator)



Schematic (Each Comparator)



| COMPONENT COUNT | |
|-----------------|----|
| Epi-FET | 1 |
| Diodes | 2 |
| Resistors | 2 |
| Transistors | 30 |

Current values shown are nominal.

Absolute Maximum Ratings⁽¹⁾

over operating free-air temperature range (unless otherwise noted)

| | | VALUE | UNIT |
|--|-------------|------------|------|
| Supply voltage, V_{CC} ⁽²⁾ | | 36 | V |
| Differential input voltage, V_{ID} ⁽³⁾ | | ±36 | V |
| Input voltage range (either input), V_I | | –0.3 to 36 | V |
| Output voltage, V_O | | 36 | V |
| Output current, I_O | | 20 | mA |
| Duration of output short circuit to ground ⁽⁴⁾ | | Unlimited | |
| Package thermal impedance, junction to free air, θ_{JA} ⁽⁵⁾⁽⁶⁾ | D package | 97 | °C/W |
| | DGK package | 172 | |
| | P package | 85 | |
| | PS package | 95 | |
| | PW package | 149 | |
| Package thermal impedance, junction to case, θ_{JC} ⁽⁷⁾⁽⁸⁾ | FK package | 5.61 | °C/W |
| | JG package | 14.5 | |
| Operating virtual-junction temperature, T_J | | 150 | °C |
| Case temperature for 60 s | FK package | 260 | °C |
| Lead temperature 1,6 mm (1/16 in) from case for 60 s | J package | 300 | °C |
| Storage temperature range, T_{stg} | | –65 to 150 | °C |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values, except differential voltages, are with respect to network ground.
- (3) Differential voltages are at IN+ with respect to IN–.
- (4) Short circuits from outputs to V_{CC} can cause excessive heating and eventual destruction.
- (5) Maximum power dissipation is a function of T_J (max), θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J \text{ (max)} - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
- (6) The package thermal impedance is calculated in accordance with JESD 51-7.
- (7) Maximum power dissipation is a function of T_J (max), θ_{JC} , and T_C . The maximum allowable power dissipation at any allowable case temperature is $P_D = (T_J \text{ (max)} - T_C)/\theta_{JC}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
- (8) The package thermal impedance is calculated in accordance with MIL-STD-883.

Electrical Characteristics

at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_A ⁽¹⁾ | LM193 | | | LM293 LM393 | | | UNIT | |
|--|--|------------------------|------------|------------------------|------|------------------------|------|------|---------------|----|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V_{IO} Input offset voltage | $V_{CC} = 5\text{ V to }30\text{ V}$, $V_{IC} = V_{ICR\text{ min}}$, $V_O = 1.4\text{ V}$ | 25°C | | 2 | 5 | | 2 | 5 | mV | |
| | | Full range | | | 9 | | 9 | | | |
| I_{IO} Input offset current | $V_O = 1.4\text{ V}$ | 25°C | | 3 | 25 | | 5 | 50 | nA | |
| | | Full range | | | 100 | | 250 | | | |
| I_{IB} Input bias current | $V_O = 1.4\text{ V}$ | 25°C | | -25 | -100 | | -25 | -250 | nA | |
| | | Full range | | | -300 | | -400 | | | |
| V_{ICR} Common-mode input-voltage range ⁽²⁾ | | 25°C | | 0 to $V_{CC} - 1.5$ | | 0 to $V_{CC} - 1.5$ | | | V | |
| | | Full range | | 0 to $V_{CC} - 2$ | | 0 to $V_{CC} - 2$ | | | | |
| A_{VD} Large-signal differential-voltage amplification | $V_{CC} = 15\text{ V}$, $V_O = 1.4\text{ V to }11.4\text{ V}$, $R_L \geq 15\text{ k}\Omega\text{ to }V_{CC}$ | 25°C | | 50 | 200 | | 50 | 200 | V/mV | |
| I_{OH} High-level output current | $V_{OH} = 5\text{ V}$ | $V_{ID} = 1\text{ V}$ | 25°C | | 0.1 | | 0.1 | 50 | nA | |
| | $V_{OH} = 30\text{ V}$ | $V_{ID} = 1\text{ V}$ | Full range | | | 1 | | 1 | μA | |
| V_{OL} Low-level output voltage | $I_{OL} = 4\text{ mA}$, $V_{ID} = -1\text{ V}$ | 25°C | | 150 | 400 | | 150 | 400 | mV | |
| | | Full range | | | 700 | | 700 | | | |
| I_{OL} Low-level output current | $V_{OL} = 1.5\text{ V}$, $V_{ID} = -1\text{ V}$ | 25°C | | 6 | | | 6 | | mA | |
| I_{CC} Supply current | $R_L = \infty$ | $V_{CC} = 5\text{ V}$ | 25°C | | 0.8 | 1 | | 0.8 | 1 | mA |
| | | $V_{CC} = 30\text{ V}$ | Full range | | | 2.5 | | 2.5 | | |

- (1) Full range (MIN or MAX) for LM193 is -55°C to 125°C , for LM293 is 25°C to 85°C , and for LM393 is 0°C to 70°C . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (2) The voltage at either input or common-mode should not be allowed to go negative by more than 0.3 V. The upper end of the common-mode voltage range is $V_{CC+} - 1.5\text{ V}$ for the inverting input (-), and the non-inverting input (+) can exceed the V_{CC} level; the comparator provides a proper output state. Either or both inputs can go to 30 V without damage.

Electrical Characteristics

 at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_A ⁽¹⁾ | LM293A LM393A | | | UNIT |
|--|--|----------------------|------------------|------------------------|------|---------------|
| | | | MIN | TYP | MAX | |
| V_{IO} Input offset voltage | $V_{CC} = 5\text{ V to }30\text{ V}$, $V_O = 1.4\text{ V}$ $V_{IC} = V_{ICR(min)}$ | 25°C | | 1 | 2 | mV |
| | | Full range | | | 4 | |
| I_{IO} Input offset current | $V_O = 1.4\text{ V}$ | 25°C | | 5 | 50 | nA |
| | | Full range | | | 150 | |
| I_{IB} Input bias current | $V_O = 1.4\text{ V}$ | 25°C | | -25 | -250 | nA |
| | | Full range | | | -400 | |
| V_{ICR} Common-mode input-voltage range ⁽²⁾ | | 25°C | | 0 to $V_{CC} - 1.5$ | | V |
| | | Full range | | 0 to $V_{CC} - 2$ | | |
| A_{VD} Large-signal differential-voltage amplification | $V_{CC} = 15\text{ V}$, $V_O = 1.4\text{ V to }11.4\text{ V}$, $R_L \geq 15\text{ k}\Omega$ to V_{CC} | 25°C | | 50 | 200 | V/mV |
| I_{OH} High-level output current | $V_{OH} = 5\text{ V}$, $V_{ID} = 1\text{ V}$ | 25°C | | 0.1 | 50 | nA |
| | $V_{OH} = 30\text{ V}$, $V_{ID} = 1\text{ V}$ | Full range | | | 1 | μA |
| V_{OL} Low-level output voltage | $I_{OL} = 4\text{ mA}$, $V_{ID} = -1\text{ V}$ | 25°C | | 150 | 400 | mV |
| | | Full range | | | 700 | |
| I_{OL} Low-level output current | $V_{OL} = 1.5\text{ V}$, $V_{ID} = -1\text{ V}$, | 25°C | | 6 | | mA |
| I_{CC} Supply current (four comparators) | $R_L = \infty$ | 25°C | | 0.8 | 1 | mA |
| | | Full range | | | 2.5 | |

- (1) Full range (MIN or MAX) for LM293A is 25°C to 85°C, and for LM393A is 0°C to 70°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (2) The voltage at either input or common-mode should not be allowed to go negative by more than 0.3 V. The upper end of the common-mode voltage range is $V_{CC+} - 1.5\text{ V}$, but either or both inputs can go to 30 V without damage.

Electrical Characteristics

at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_A ⁽¹⁾ | LM2903 | | | LM2903A | | | UNIT | |
|--|---|-----------------------|------------|------------------------|------|---------|------------------------|------|------|---------------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V_{IO} Input offset voltage | $V_{CC} = 5\text{ V to MAX}^{(2)}$, $V_O = 1.4\text{ V}$, $V_{IC} = V_{ICR(min)}$ | 25°C | | 2 | 7 | | 1 | 2 | mV | |
| | | Full range | | | 15 | | | 4 | | |
| I_{IO} Input offset current | $V_O = 1.4\text{ V}$ | 25°C | | 5 | 50 | | 5 | 50 | nA | |
| | | Full range | | | 200 | | | 200 | | |
| I_{IB} Input bias current | $V_O = 1.4\text{ V}$ | 25°C | | -25 | -250 | | -25 | -250 | nA | |
| | | Full range | | | -500 | | | -500 | | |
| V_{ICR} Common-mode input-voltage range ⁽³⁾ | | 25°C | | 0 to $V_{CC} - 1.5$ | | | 0 to $V_{CC} - 1.5$ | | V | |
| | | Full range | | 0 to $V_{CC} - 2$ | | | 0 to $V_{CC} - 2$ | | | |
| A_{VD} Large-signal differential-voltage amplification | $V_{CC} = 15\text{ V}$, $V_O = 1.4\text{ V to } 11.4\text{ V}$, $R_L \geq 15\text{ k}\Omega$ to V_{CC} | 25°C | | 25 | 100 | | 25 | 100 | V/mV | |
| I_{OH} High-level output current | $V_{OH} = 5\text{ V}$, $V_{ID} = 1\text{ V}$ $V_{OH} = V_{CC} \text{ MAX}^{(2)}$, $V_{ID} = 1\text{ V}$ | 25°C | | | 0.1 | 50 | | 0.1 | 50 | nA |
| | | Full range | | | | 1 | | | 1 | μA |
| V_{OL} Low-level output voltage | $I_{OL} = 4\text{ mA}$, $V_{ID} = -1\text{ V}$ | 25°C | | | 150 | 400 | | 150 | 400 | mV |
| | | Full range | | | | 700 | | | 700 | |
| I_{OL} Low-level output current | $V_{OL} = 1.5\text{ V}$, $V_{ID} = -1\text{ V}$ | 25°C | | 6 | | | 6 | | mA | |
| I_{CC} Supply current | $R_L = \infty$ | $V_{CC} = 5\text{ V}$ | | | 0.8 | 1 | | 0.8 | 1 | mA |
| | | $V_{CC} = \text{MAX}$ | Full range | | | 2.5 | | | 2.5 | |

- (1) Full range (MIN or MAX) for LM2903 is -40°C to 125°C . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (2) $V_{CC} \text{ MAX} = 30\text{ V}$ for non-V devices and 32 V for V-suffix devices.
- (3) The voltage at either input or common-mode should not be allowed to go negative by more than 0.3 V . The upper end of the common-mode voltage range is $V_{CC+} - 1.5\text{ V}$, but either or both inputs can go to 30 V (32 V for V-suffix devices) without damage.

Switching Characteristics

$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | LM2901, LM293, LM293A LM393, LM393A LM2903 | | UNIT |
|---------------|---|---|-----|---------------|
| | | TYP | | |
| Response time | R_L connected to 5 V through $5.1\text{ k}\Omega$, $C_L = 15\text{ pF}^{(1)(2)}$ | 100-mV input step with 5-mV overdrive | 1.3 | μs |
| | | TTL-level input step | 0.3 | |

- (1) C_L includes probe and jig capacitance.
- (2) The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V .

REVISION HISTORY

| Changes from Revision W (July 2010) to Revision X | Page |
|---|-------------|
| • Updated document to new TI data sheet format - no specification changes. | 1 |
| • Updated Features. | 1 |
| • Added ESD warning. | 2 |
| • Removed Ordering Information table. | 2 |

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|----------------------------|----------------------|--------------|---------------------------------|-------------------------|
| 5962-9452601Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | -55 to 125 | 5962- 9452601Q2A LM193FKB | Samples |
| 5962-9452601QPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 9452601QPA LM193 | Samples |
| JM38510/11202BPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | JM38510 /11202BPA | Samples |
| LM193DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | LM193 | Samples |
| LM193DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | LM193 | Samples |
| LM193FKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | -55 to 125 | 5962- 9452601Q2A LM193FKB | Samples |
| LM193JG | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | LM193JG | Samples |
| LM193JGB | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 9452601QPA LM193 | Samples |
| LM2903AVQDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903AV | Samples |
| LM2903AVQDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903AV | Samples |
| LM2903AVQPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903AV | Samples |
| LM2903AVQPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903AV | Samples |
| LM2903D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LM2903 | Samples |
| LM2903DE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LM2903 | Samples |
| LM2903DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LM2903 | Samples |
| LM2903DGKR | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | (MAP ~ MAS ~ MAU) | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| LM2903DGKRG4 | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (MAP ~ MAS ~ MAU) | Samples |
| LM2903DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | -40 to 125 | LM2903 | Samples |
| LM2903DRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LM2903 | Samples |
| LM2903DRG3 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 125 | LM2903 | Samples |
| LM2903DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LM2903 | Samples |
| LM2903P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | -40 to 125 | LM2903P | Samples |
| LM2903PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | -40 to 125 | LM2903P | Samples |
| LM2903PSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903 | Samples |
| LM2903PSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903 | Samples |
| LM2903PWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI | -40 to 125 | | |
| LM2903PWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | -40 to 125 | L2903 | Samples |
| LM2903PWRE4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903 | Samples |
| LM2903PWRG3 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 125 | L2903 | Samples |
| LM2903PWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903 | Samples |
| LM2903QD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 2903Q | Samples |
| LM2903QDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 2903Q | Samples |
| LM2903QDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 2903Q | Samples |
| LM2903QP | OBSOLETE | PDIP | P | 8 | | TBD | Call TI | Call TI | -40 to 125 | | |
| LM2903VQDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903V | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|----------------------------|----------------------|--------------|-------------------------|-------------------------|
| LM2903VQDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903V | Samples |
| LM2903VQPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903V | Samples |
| LM2903VQPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | L2903V | Samples |
| LM293AD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293A | Samples |
| LM293ADE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293A | Samples |
| LM293ADG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293A | Samples |
| LM293ADGKR | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU NIPDAUAG | Level-1-260C-UNLIM | -25 to 85 | (MDP ~ MDS ~ MDU) | Samples |
| LM293ADGKRG4 | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | (MDP ~ MDS ~ MDU) | Samples |
| LM293ADR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | -25 to 85 | LM293A | Samples |
| LM293ADRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293A | Samples |
| LM293D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293 | Samples |
| LM293DE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293 | Samples |
| LM293DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293 | Samples |
| LM293DGKR | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU NIPDAUAG | Level-1-260C-UNLIM | -25 to 85 | (MCP ~ MCS ~ MCU) | Samples |
| LM293DGKRG4 | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | (MCP ~ MCS ~ MCU) | Samples |
| LM293DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | -25 to 85 | LM293 | Samples |
| LM293DRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293 | Samples |
| LM293DRG3 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -25 to 85 | LM293 | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| LM293DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | LM293 | Samples |
| LM293P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU CU SN | N / A for Pkg Type | -25 to 85 | LM293P | Samples |
| LM293PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | -25 to 85 | LM293P | Samples |
| LM393AD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393A | Samples |
| LM393ADE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393A | Samples |
| LM393ADG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393A | Samples |
| LM393ADGKR | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU NIPDAUAG | Level-1-260C-UNLIM | 0 to 70 | (M8P ~ M8S ~ M8U) | Samples |
| LM393ADGKRG4 | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | (M8P ~ M8S ~ M8U) | Samples |
| LM393ADR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | 0 to 70 | LM393A | Samples |
| LM393ADRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393A | Samples |
| LM393ADRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393A | Samples |
| LM393AP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU CU SN | N / A for Pkg Type | 0 to 70 | LM393AP | Samples |
| LM393APE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | LM393AP | Samples |
| LM393APSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393A | Samples |
| LM393APSRE4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393A | Samples |
| LM393APSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393A | Samples |
| LM393APWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI | 0 to 70 | | |
| LM393APWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | 0 to 70 | L393A | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|----------------------------|----------------------|--------------|-------------------------|-------------------------|
| LM393APWRE4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393A | Samples |
| LM393APWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393A | Samples |
| LM393D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393 | Samples |
| LM393DE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393 | Samples |
| LM393DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393 | Samples |
| LM393DGKR | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU NIPDAUAG | Level-1-260C-UNLIM | 0 to 70 | (M9P ~ M9S ~ M9U) | Samples |
| LM393DGKRG4 | ACTIVE | VSSOP | DGK | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | (M9P ~ M9S ~ M9U) | Samples |
| LM393DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | 0 to 70 | LM393 | Samples |
| LM393DRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393 | Samples |
| LM393DRG3 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | 0 to 70 | LM393 | Samples |
| LM393DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LM393 | Samples |
| LM393P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU CU SN | N / A for Pkg Type | 0 to 70 | LM393P | Samples |
| LM393PE3 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | 0 to 70 | LM393P | Samples |
| LM393PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | LM393P | Samples |
| LM393PSLE | OBSOLETE | SO | PS | 8 | | TBD | Call TI | Call TI | 0 to 70 | | |
| LM393PSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393 | Samples |
| LM393PSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393 | Samples |
| LM393PW | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393 | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| LM393PWG4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393 | Samples |
| LM393PWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI | 0 to 70 | | |
| LM393PWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | 0 to 70 | L393 | Samples |
| LM393PWRG3 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | 0 to 70 | L393 | Samples |
| LM393PWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | L393 | Samples |
| M38510/11202BPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | JM38510 /11202BPA | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF LM2903, LM293 :

- Automotive: [LM2903-Q1](#)
- Enhanced Product: [LM293-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM193DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903DGKR | VSSOP | DGK | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| LM2903DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903DR | SOIC | D | 8 | 2500 | 330.0 | 12.8 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903DRG3 | SOIC | D | 8 | 2500 | 330.0 | 12.8 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903DRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903DRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903PSR | SO | PS | 8 | 2000 | 330.0 | 16.4 | 8.2 | 6.6 | 2.5 | 12.0 | 16.0 | Q1 |
| LM2903PWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| LM2903PWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| LM2903PWRG3 | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| LM2903QDRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM2903VQPWRG4 | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| LM293ADGKR | VSSOP | DGK | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| LM293ADR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293ADR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293ADRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM293ADRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293DGKR | VSSOP | DGK | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| LM293DR | SOIC | D | 8 | 2500 | 330.0 | 12.8 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293DRG3 | SOIC | D | 8 | 2500 | 330.0 | 12.8 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293DRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM293DRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393ADGKR | VSSOP | DGK | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| LM393ADR | SOIC | D | 8 | 2500 | 330.0 | 12.8 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393ADR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393ADR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393ADRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393ADRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393APSR | SO | PS | 8 | 2000 | 330.0 | 16.4 | 8.2 | 6.6 | 2.5 | 12.0 | 16.0 | Q1 |
| LM393APWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| LM393DGKR | VSSOP | DGK | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| LM393DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393DRG3 | SOIC | D | 8 | 2500 | 330.0 | 12.8 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393DRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393DRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| LM393PSR | SO | PS | 8 | 2000 | 330.0 | 16.4 | 8.2 | 6.6 | 2.5 | 12.0 | 16.0 | Q1 |
| LM393PWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| LM393PWRG3 | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM193DR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM2903DGKR | VSSOP | DGK | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM2903DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM2903DR | SOIC | D | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM2903DR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM2903DRG3 | SOIC | D | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM2903DRG4 | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM2903DRG4 | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM2903PSR | SO | PS | 8 | 2000 | 367.0 | 367.0 | 38.0 |
| LM2903PWR | TSSOP | PW | 8 | 2000 | 367.0 | 367.0 | 35.0 |
| LM2903PWR | TSSOP | PW | 8 | 2000 | 364.0 | 364.0 | 27.0 |
| LM2903PWRG3 | TSSOP | PW | 8 | 2000 | 364.0 | 364.0 | 27.0 |
| LM2903QDRG4 | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM2903VQPWRG4 | TSSOP | PW | 8 | 2000 | 367.0 | 367.0 | 35.0 |
| LM293ADGKR | VSSOP | DGK | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM293ADR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM293ADR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM293ADRG4 | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM293ADRG4 | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM293DGKR | VSSOP | DGK | 8 | 2500 | 364.0 | 364.0 | 27.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM293DR | SOIC | D | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM293DR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM293DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM293DRG3 | SOIC | D | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM293DRG4 | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM293DRG4 | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM393ADGKR | VSSOP | DGK | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM393ADR | SOIC | D | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM393ADR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM393ADR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM393ADRG4 | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM393ADRG4 | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM393APSR | SO | PS | 8 | 2000 | 367.0 | 367.0 | 38.0 |
| LM393APWR | TSSOP | PW | 8 | 2000 | 364.0 | 364.0 | 27.0 |
| LM393DGKR | VSSOP | DGK | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM393DR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM393DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM393DRG3 | SOIC | D | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| LM393DRG4 | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| LM393DRG4 | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| LM393PSR | SO | PS | 8 | 2000 | 367.0 | 367.0 | 38.0 |
| LM393PWR | TSSOP | PW | 8 | 2000 | 364.0 | 364.0 | 27.0 |
| LM393PWRG3 | TSSOP | PW | 8 | 2000 | 364.0 | 364.0 | 27.0 |

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. This package can be hermetically sealed with a ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification.
 E. Falls within MIL STD 1835 GDIP1-T8

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF TERMINALS ** | A | | B | |
|---------------------|------------------|------------------|------------------|------------------|
| | MIN | MAX | MIN | MAX |
| 20 | 0.342 (8,69) | 0.358 (9,09) | 0.307 (7,80) | 0.358 (9,09) |
| 28 | 0.442 (11,23) | 0.458 (11,63) | 0.406 (10,31) | 0.458 (11,63) |
| 44 | 0.640 (16,26) | 0.660 (16,76) | 0.495 (12,58) | 0.560 (14,22) |
| 52 | 0.740 (18,78) | 0.761 (19,32) | 0.495 (12,58) | 0.560 (14,22) |
| 68 | 0.938 (23,83) | 0.962 (24,43) | 0.850 (21,6) | 0.858 (21,8) |
| 84 | 1.141 (28,99) | 1.165 (29,59) | 1.047 (26,6) | 1.063 (27,0) |



4040140/D 01/11

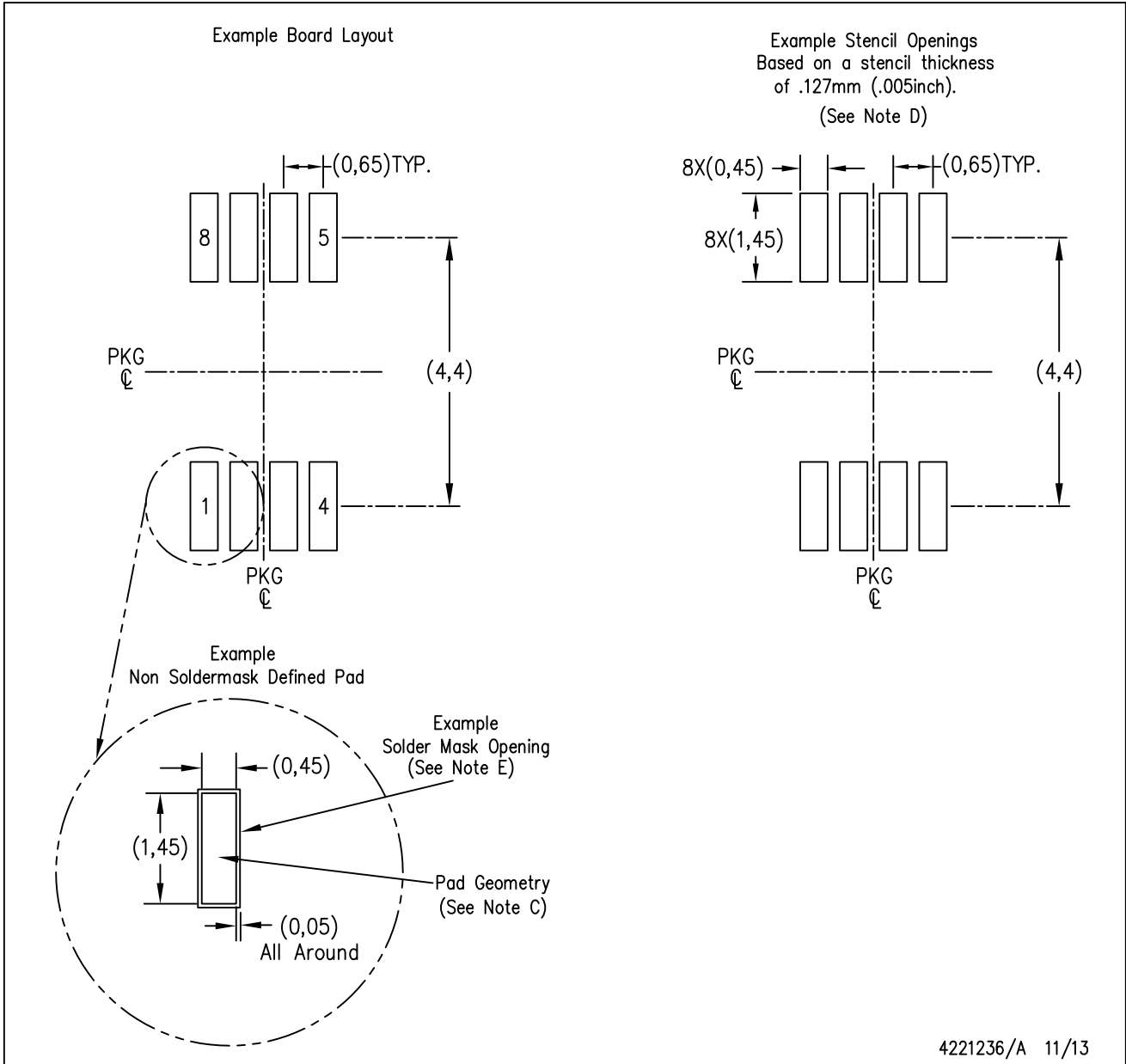
- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - Falls within JEDEC MS-004

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-001 variation BA.



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW0008A



PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4221848/A 02/2015

NOTES:

- All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
- This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
- Reference JEDEC registration MO-153, variation AA.

EXAMPLE BOARD LAYOUT

PW0008A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:10X



SOLDER MASK DETAILS
NOT TO SCALE

4221848/A 02/2015

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0008A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:10X

4221848/A 02/2015

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



4040047-3/M 06/11

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PS (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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