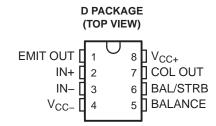
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FEATURES

- Controlled Baseline
 - One Assembly/Test Site, One Fabrication Site
- Extended Temperature Performance of -55°C to 125°C
- Enhanced Diminishing Manufacturing Sources (DMS) Support
- Enhanced Product Change Notification
- Qualification Pedigree (1)
- Fast Response Times
- Strobe Capability
- (1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold-compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

- Maximum Input Bias Current . . . 300 nA
- Maximum Input Offset Current . . . 70 nA
- Can Operate From Single 5-V Supply



DESCRIPTION/ORDERING INFORMATION

The LM211-EP is a single high-speed voltage comparator. This device is designed to operate from a wide range of power-supply voltages, including ± 15 -V supplies for operational amplifiers and 5-V supplies for logic systems. The output levels are compatible with most TTL and MOS circuits. This comparator is capable of driving lamps or relays and switching voltages up to 50 V at 50 mA. All inputs and outputs can be isolated from system ground. The outputs can drive loads referenced to ground, V_{CC+} or V_{CC-} . Offset balancing and strobe capabilities are available, and the outputs can be wired-OR connected. If the strobe is low, the output is in the off state, regardless of the differential input.

ORDERING INFORMATION

T _A	V _{IO} max AT 25°C	PACE	(AGE ⁽¹⁾	ORDERABLE PART NUMBER	TOP-SIDE MARKING		
-40°C to 125°C	3 mV	SOIC - D	Tape and reel	LM211QDREP	LM211E		
-55°C to 125°C	3 mV	SOIC - D	Tape and reel	LM211MDREP	LM211M		

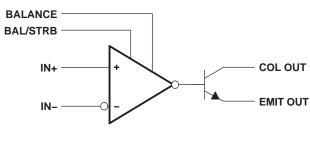
 Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



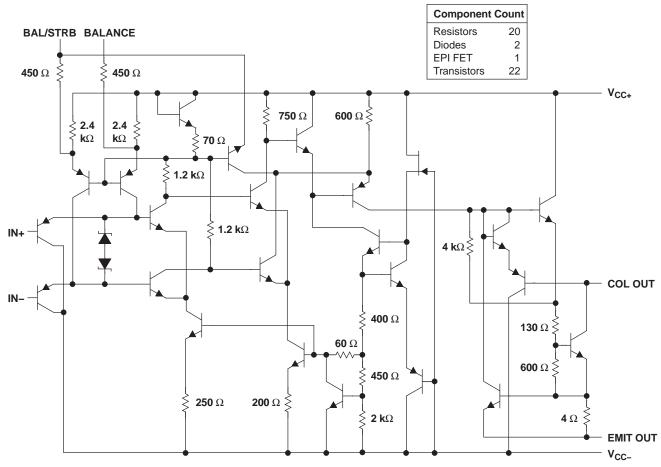
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



FUNCTIONAL BLOCK DIAGRAM



SCHEMATIC



All resistor values shown are nominal.



DIFFERENTIAL COMPARATOR WITH STROBES

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Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT
V _{CC+}			18	
V _{CC} -	Supply voltage ⁽²⁾		-18	V
V _{CC+} - V _{CC-}			36	
V _{ID}	Differential input voltage (3)		±30	V
V _I	Input voltage, either input ⁽²⁾⁽⁴⁾		±15	V
	Voltage from emitter output to V _{CC} -		30	V
	Voltage from collector output to V _{CC} -		50	V
	Duration of output short circuit ⁽⁵⁾		10	S
TJ	Junction temperature		148	°C
θ_{JA}	Package thermal impedance (6)		97	°C/W
	Lead temperature 1,6 mm (1/16 in) from case for 10 s		260	°C
T _{stg}	Storage temperature range ⁽⁷⁾	-65	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.

All voltage values, unless otherwise noted, are with respect to the midpoint between V_{CC+} and V_{CC-}.

Differential voltages are at IN+ with respect to IN-.

The magnitude of the input voltage must never exceed the magnitude of the supply voltage or ±15 V, whichever is less.

The output may be shorted to ground or either power supply.

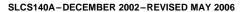
The package thermal impedance is calculated in accordance with JESD 51-7.

Long-term high-temperature storage and/or extended use at maximum recommended operating conditions may result in a reduction of overall device life. See http://www.ti.com/ep_quality for additional information on enhanced plastic packaging.

Recommended Operating Conditions

		MIN	MAX	UNIT
$V_{CC+} - V_{CC-}$	Supply voltage	3.5	30	>
V_{I}	Input voltage ($ V_{CC+} \le 15 \text{ V}$)	$V_{CC-} + 0.5$	V _{CC+} – 1.5	V
T _A	Operating free-air temperature range for Q temp	-40	125	°C
T _A	Operating free-air temperature range for M temp	- 55	125	°C

LM211-EP **DIFFERENTIAL COMPARATOR WITH STROBES**





Electrical Characteristics

at specified free-air temperatures of Q and M temp ranges, V_{CC+} = ± 15 V (unless otherwise noted)

	PARAMETER	TEST COM	NDITIONS	T _A ⁽¹⁾	MIN	TYP ⁽²⁾	MAX	UNIT	
V	Input offset voltage (3)			25°C		0.7	3	mV	
V _{IO}	input onset voitage (*)		Full range			4	IIIV		
L	Input offset current ⁽³⁾			25°C		4	10	nA	
I _{IO}	input onset current.			Full range			20	ПА	
	Input bias current	V _O = 1 V to 14 V		25°C		75	100	nA	
I _{IB}	input bias current	V _O = 1 V to 14 V	Full range			150	ПА		
$I_{IL(S)}$	Low-level strobe current ⁽⁴⁾	$V_{(strobe)} = 0.3 V,$	$V_{ID} \le -10 \text{ mV}$	25°C		-3		mA	
V_{ICR}	Common-mode input voltage range			Full range	13 to -14.5	13.8 to -14.7		V	
A _{VD}	Large-signal differential voltage amplification	$V_0 = 5 \text{ V to } 35 \text{ V},$	$R_L = 1 k\Omega$	25°C	40	200		V/mV	
	High-level (collector)	$I_{(strobe)} = -3 \text{ mA},$ $V_{ID} = 5 \text{ mV}$	$V_{OH} = 35 V$,	25°C		0.2	10	nA	
I _{OH}	output leakage current	$V_{ID} = 5 \text{ mV}$		Full range			0.5	μΑ	
	Low level (collector to emitter)	I _{OL} = 50 mA,	$V_{ID} = -5 \text{ mV}$	25°C		0.75	1.5		
	Low-level (collector-to-emitter) output voltage	$V_{CC+} = 4.5 \text{ V},$ $I_{OL} = 8 \text{ mA},$	$V_{CC-} = 0,$ $V_{ID} = -6 \text{ mV}$	Full range		0.23	0.4	V	
I _{CC+}	Supply current from V _{CC+} , output low	$V_{ID} = -10 \text{ mV},$	No load	25°C		5.1	6	mA	
I _{CC} _	Supply current from V _{CC} -, output high	V _{ID} = 10 mV,	No load	25°C		-4.1	- 5	mA	

⁽¹⁾ Unless otherwise noted, all characteristics are measured with BALANCE and BAL/STRB open and EMIT OUT grounded. Full range is -40°C to 125°C for Q temp and -55°C to 125°C for M temp.

Switching Characteristics

 $V_{CC+} = \pm 15 \text{ V}, T_A = 25^{\circ}\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
Response time, low-to-high-level output	$R_C = 500 \Omega \text{ to 5 V},$ $C_L = 5 \text{ pF}^{(1)}$	115	ns
Response time, high-to-low-level output	$R_C = 500 \Omega \text{ to 5 V},$ $C_L = 5 \text{ pF}^{(1)}$	165	ns

⁽¹⁾ The response time specified is for a 100-mV input step with 5-mV overdrive and is the interval between the input step function and the instant when the output crosses 1.4 V.

 ⁽²⁾ All typical values are at T_A = 25°C.
 (3) The offset voltages and offset currents given are the maximum values required to drive the collector output up to 14 V or down to 1 V with a pullup resistor of 7.5 k Ω to V_{CC+}. These parameters actually define an error band and take into account the worst-case effects of voltage gain and input impedance.

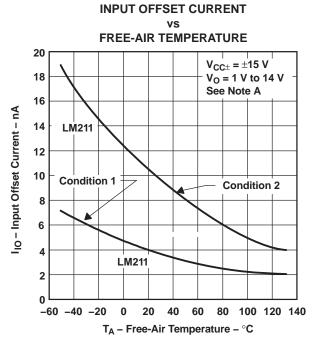
⁽⁴⁾ The strobe should not be shorted to ground; it should be current driven at -3 mA to -5 mA (see Figure 13 and Figure 27).

INPUT BIAS CURRENT

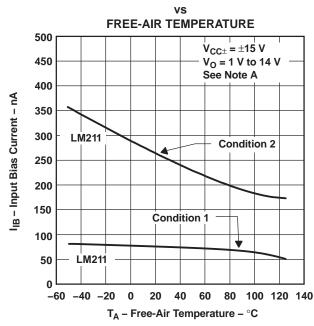
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TYPICAL CHARACTERISTICS

Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



NOTE A: Condition 1 is with BALANCE and BAL/STRB open. Condition 2 is with BALANCE and BAL/STRB connected to $V_{\text{CC+}}$.

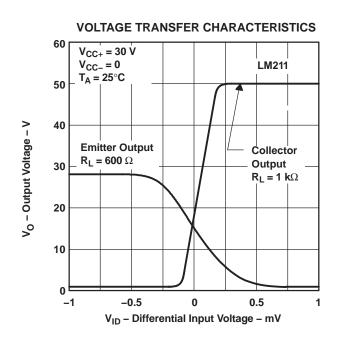


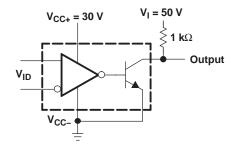
NOTE A: Condition 1 is with BALANCE and BAL/STRB open. Condition 2 is with BALANCE and BAL/STRB connected to V_{CC+} .

Figure 1. Figure 2.

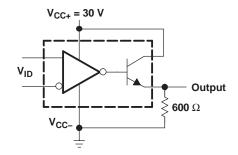


Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.





COLLECTOR OUTPUT TRANSFER CHARACTERISTIC TEST CIRCUIT FOR FIGURE 3

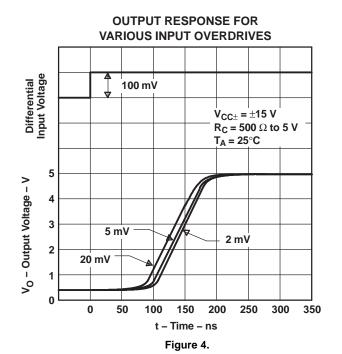


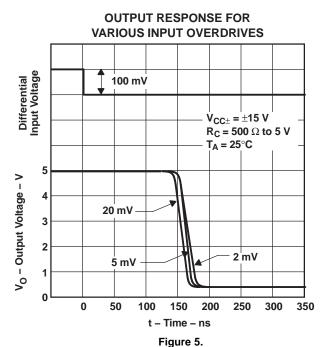
EMITTER OUTPUT TRANSFER CHARACTERISTIC TEST CIRCUIT FOR FIGURE 3

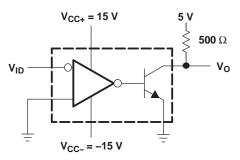
Figure 3.



Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



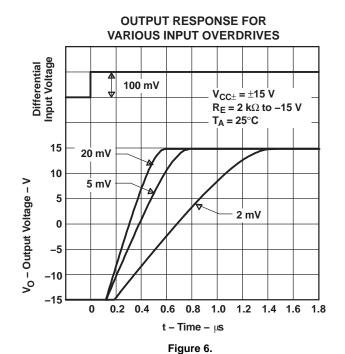




TEST CIRCUIT FOR FIGURES 4 AND 5



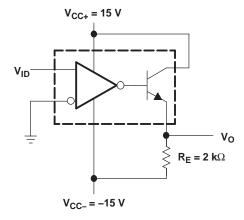
Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



OUTPUT RESPONSE FOR VARIOUS INPUT OVERDRIVES Differential Input Voltage 100 mV $V_{CC\pm} = \pm 15$ V R_E = 2 $k\Omega$ to –15 VT_A = 25°C 15 5 mV 10 Vo - Output Voltage - V 5 2 mV 0 -5 20 mV -10 -15 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6

Figure 7.

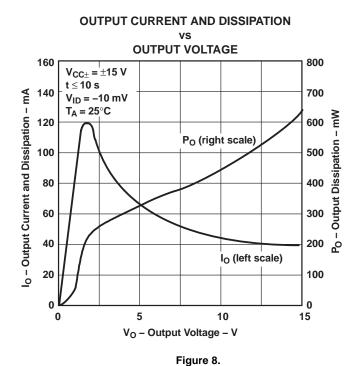
t - Time - μs

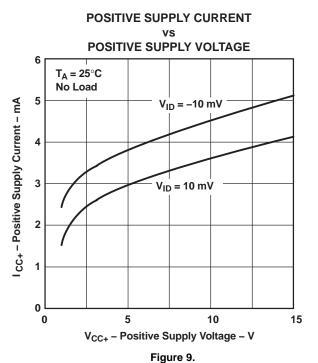


TEST CIRCUIT FOR FIGURES 6 AND 7



Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.





NEGATIVE SUPPLY CURRENT

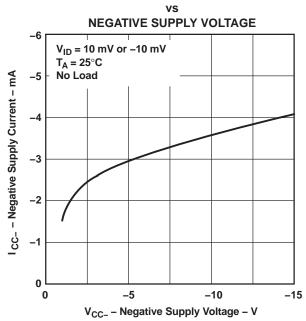


Figure 10.



APPLICATION INFORMATION

Figure 11 through Figure 29 show various applications for the LM211-EP comparator.

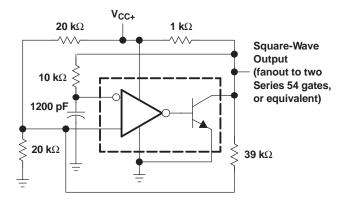
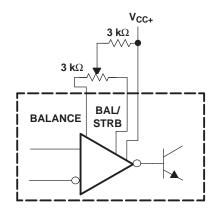


Figure 11. 100-kHz Free-Running Multivibrator



NOTE: If offset balancing is not used, the BALANCE and BAL/STRB pins should be shorted together.

Figure 12. Offset Balancing

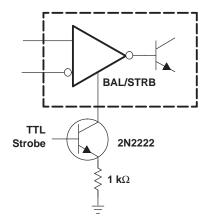


Figure 13. Strobing



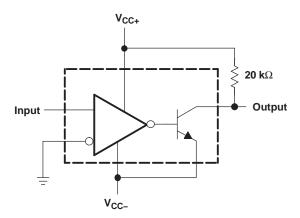
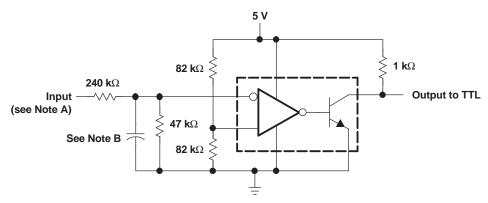


Figure 14. Zero-Crossing Detector



- A. Resistor values shown are for a 0-to-30-V logic swing and a 15-V threshold.
- B. May be added to control speed and reduce susceptibility to noise spikes

Figure 15. TTL Interface With High-Level Logic

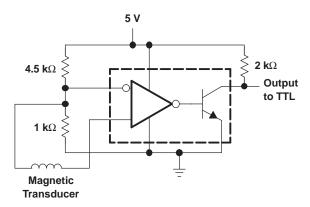


Figure 16. Detector for Magnetic Transducer



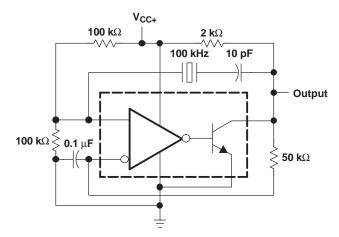


Figure 17. 100-kHz Crystal Oscillator

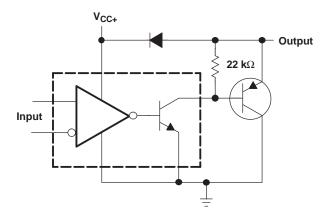
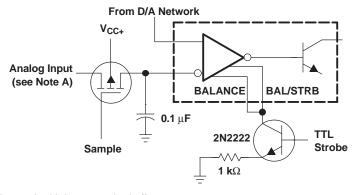


Figure 18. Comparator and Solenoid Driver



A. Typical input current is 50 pA with inputs strobed off.

Figure 19. Strobing Both Input and Output Stages Simultaneously



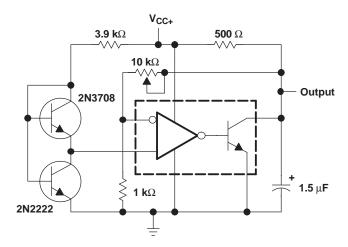


Figure 20. Low-Voltage Adjustable Reference Supply

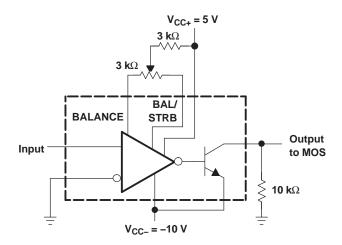
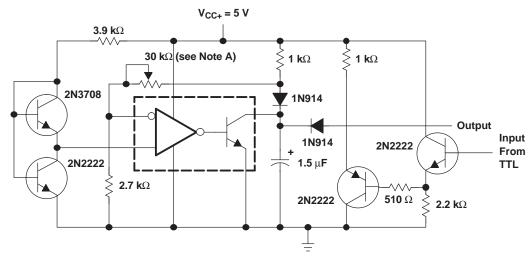


Figure 21. Zero-Crossing Detector Driving MOS Logic



A. Adjust to set clamp level

Figure 22. Precision Squarer



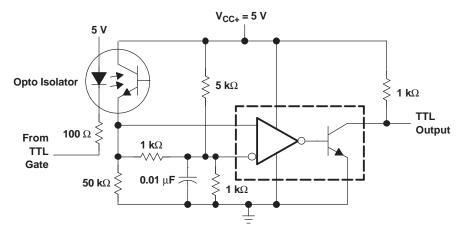


Figure 23. Digital Transmission Isolator

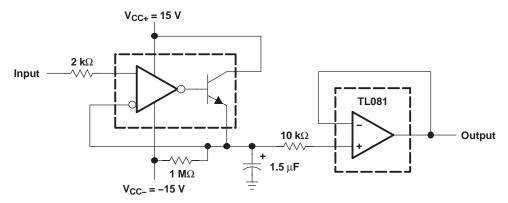


Figure 24. Positive-Peak Detector

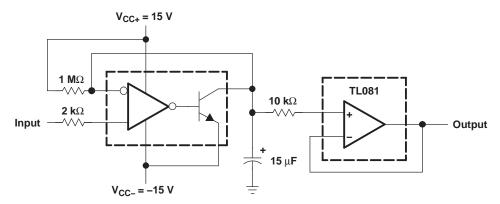
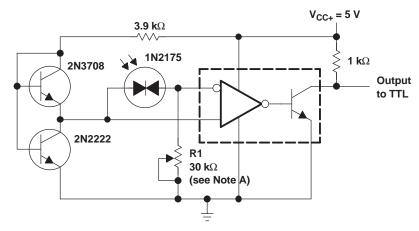


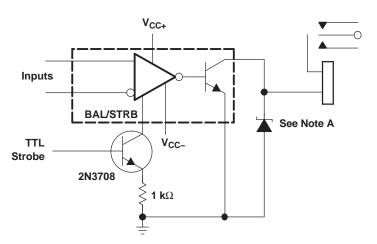
Figure 25. Negative-Peak Detector





A. R1 sets the comparison level. At comparison, the photodiode has less than 5 mV across it, decreasing dark current by an order of magnitude.

Figure 26. Precision Photodiode Comparator



A. Transient voltage and inductive kickback protection

Figure 27. Relay Driver With Strobe



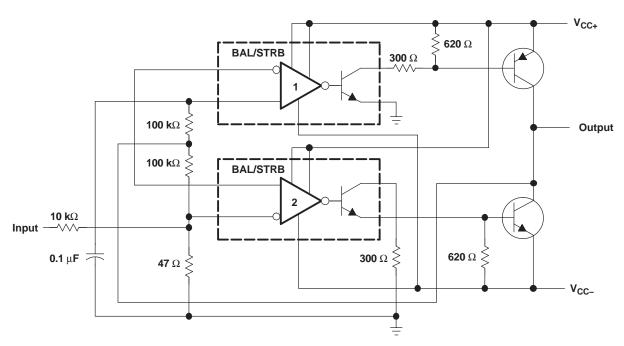


Figure 28. Switching Power Amplifier

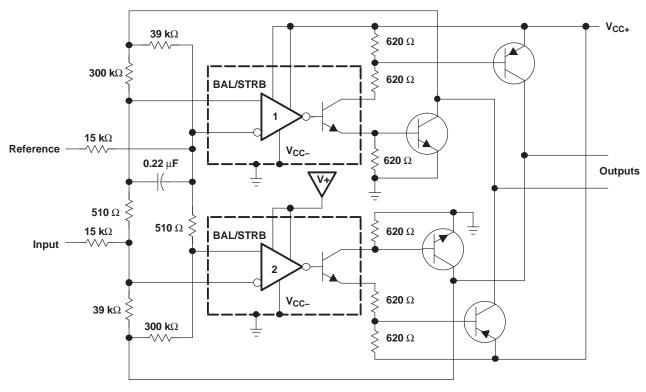


Figure 29. Switching Power Amplifiers

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PACKAGING INFORMATION

Orderable part number	Status	Material type	Package Pins	Package qty Carrier	RoHS	Lead finish/	MSL rating/	Op temp (°C)	Part marking
	(1)	(2)			(3)	Ball material	Peak reflow		(6)
						(4)	(5)		
LM211MDREP	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	LM211M
LM211MDREP.A	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	LM211M
LM211QDREP	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM211E
LM211QDREP.A	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM211E
V62/03638-01XE	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LM211E
V62/03638-02XE	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	LM211M

⁽¹⁾ Status: For more details on status, see our product life cycle.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

⁽²⁾ Material type: When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ RoHS values: Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

⁽⁴⁾ Lead finish/Ball material: Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

PACKAGE OPTION ADDENDUM

www.ti.com 11-Nov-2025

OTHER QUALIFIED VERSIONS OF LM211-EP:

• Automotive : LM211-Q1

NOTE: Qualified Version Definitions:

- Catalog TI's standard catalog product
- Automotive Q100 devices qualified for high-reliability automotive applications targeting zero defects

PACKAGE MATERIALS INFORMATION

www.ti.com 25-Sep-2024

TAPE AND REEL INFORMATION





A0	Dimension designed to accommodate the component width
В0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

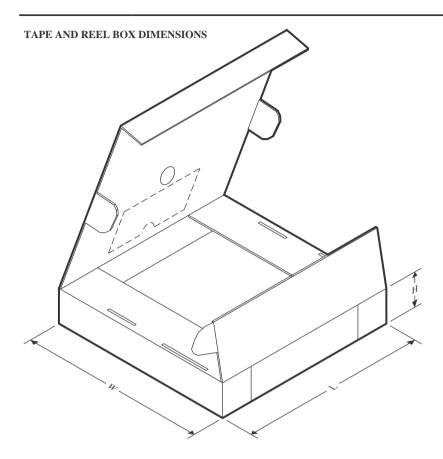


*All dimensions are nominal

Device	Package Type	Package Drawing			Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM211MDREP	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM211QDREP	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1



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*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM211MDREP	SOIC	D	8	2500	353.0	353.0	32.0
LM211QDREP	SOIC	D	8	2500	340.5	338.1	20.6



SMALL OUTLINE INTEGRATED CIRCUIT



NOTES:

- 1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- 2. This drawing is subject to change without notice.
- 3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
- 4. This dimension does not include interlead flash.
- 5. Reference JEDEC registration MS-012, variation AA.



SMALL OUTLINE INTEGRATED CIRCUIT



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.



SMALL OUTLINE INTEGRATED CIRCUIT



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.



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