

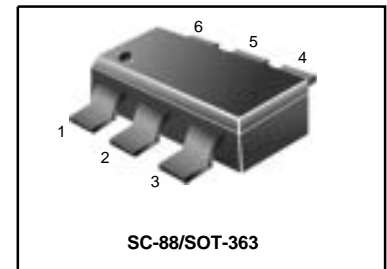
# Dual Bias Resistor Transistors

## NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the LMUN5211DW1T1 series, two BRT devices are housed in the SOT-363 package which is ideal for low power surface mount applications where board space is at a premium.

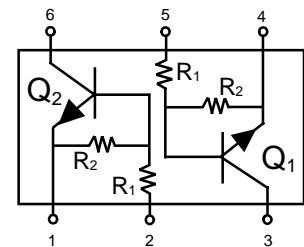
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- We declare that the material of product compliance with RoHS requirements.

### LMUN5211DW1T1G Series



#### MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>)

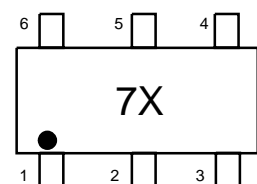
Rating	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CBO</sub>	50	Vdc
Collector-Emitter Voltage	V <sub>CEO</sub>	50	Vdc
Collector Current	I <sub>C</sub>	100	mAdc



#### THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation T <sub>A</sub> = 25°C	P <sub>D</sub>	187 (Note 1.) 256 (Note 2.)	mW
Derate above 25°C		1.5 (Note 1.) 2.0 (Note 2.)	mW/°C
Thermal Resistance – Junction-to-Ambient	R <sub>θJA</sub>	670 (Note 1.) 490 (Note 2.)	°C/W
Characteristic (Both Junctions Heated)	Symbol	Max	Unit
Total Device Dissipation T <sub>A</sub> = 25°C	P <sub>D</sub>	250 (Note 1.) 385 (Note 2.)	mW
Derate above 25°C		2.0 (Note 1.) 3.0 (Note 2.)	mW/°C
Thermal Resistance – Junction-to-Ambient	R <sub>θJA</sub>	493 (Note 1.) 325 (Note 2.)	°C/W
Thermal Resistance – Junction-to-Lead	R <sub>θJL</sub>	188 (Note 1.) 208 (Note 2.)	°C/W
Junction and Storage Temperature	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

#### MARKING DIAGRAM



7X = Device Marking  
(See Page 2)

#### DEVICE MARKING INFORMATION

See specific marking information in the device marking table on page 2 of this data sheet.

1. FR-4 @ Minimum Pad      2. FR-4 @ 1.0 x 1.0 inch Pad

**LMUN5211DW1T1G Series**

**DEVICE MARKING , RESISTOR VALUES AND ORDERING INFORMATION**

Device	Package	Marking	R1(K)	R2(K)	Shipping
LMUN5211DW1T1G	SOT-363	7A	10	10	3000/Tape&Reel
LMUN5211DW1T3G	SOT-363	7A	10	10	10000/Tape&Reel
LMUN5212DW1T1G	SOT-363	7B	22	22	3000/Tape&Reel
LMUN5212DW1T3G	SOT-363	7B	22	22	10000/Tape&Reel
LMUN5213DW1T1G	SOT-363	7C	47	47	3000/Tape&Reel
LMUN5213DW1T3G	SOT-363	7C	47	47	10000/Tape&Reel
LMUN5214DW1T1G	SOT-363	7D	10	47	3000/Tape&Reel
LMUN5214DW1T3G	SOT-363	7D	10	47	10000/Tape&Reel
LMUN5215DW1T1G	SOT-363	7E	10	∞	3000/Tape&Reel
LMUN5215DW1T3G	SOT-363	7E	10	∞	10000/Tape&Reel
LMUN5216DW1T1G	SOT-363	7F	4.7	∞	3000/Tape&Reel
LMUN5216DW1T3G	SOT-363	7F	4.7	∞	10000/Tape&Reel
LMUN5230DW1T1G	SOT-363	7G	1	1	3000/Tape&Reel
LMUN5230DW1T3G	SOT-363	7G	1	1	10000/Tape&Reel
LMUN5231DW1T1G	SOT-363	7H	2.2	2.2	3000/Tape&Reel
LMUN5231DW1T3G	SOT-363	7H	2.2	2.2	10000/Tape&Reel
LMUN5232DW1T1G	SOT-363	7J	4.7	4.7	3000/Tape&Reel
LMUN5232DW1T3G	SOT-363	7J	4.7	4.7	10000/Tape&Reel
LMUN5233DW1T1G	SOT-363	7K	4.7	47	3000/Tape&Reel
LMUN5233DW1T3G	SOT-363	7K	4.7	47	10000/Tape&Reel
LMUN5234DW1T1G	SOT-363	7L	22	47	3000/Tape&Reel
LMUN5234DW1T3G	SOT-363	7L	22	47	10000/Tape&Reel
LMUN5235DW1T1G	SOT-363	7M	2.2	47	3000/Tape&Reel
LMUN5235DW1T3G	SOT-363	7M	2.2	47	10000/Tape&Reel
LMUN5236DW1T1G	SOT-363	7N	100	100	3000/Tape&Reel
LMUN5236DW1T3G	SOT-363	7N	100	100	10000/Tape&Reel
LMUN5237DW1T1G	SOT-363	7P	47	22	3000/Tape&Reel
LMUN5237DW1T3G	SOT-363	7P	47	22	10000/Tape&Reel

**LMUN5211DW1T1G Series**

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>)

Characteristic	Symbol	Min	Typ	Max	Unit
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**OFF CHARACTERISTICS**

Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)	I <sub>CBO</sub>	–	–	100	nAdc	
Collector-Emitter Cutoff Current (V <sub>CE</sub> = 50 V, I <sub>B</sub> = 0)	I <sub>CEO</sub>	–	–	500	nAdc	
Emitter-Base Cutoff Current (V <sub>EB</sub> = 6.0 V, I <sub>C</sub> = 0)	LMUN5211DW1T1G	I <sub>EBO</sub>	–	–	0.5	mAdc
	LMUN5212DW1T1G		–	–	0.2	
	LMUN5213DW1T1G		–	–	0.1	
	LMUN5214DW1T1G		–	–	0.2	
	LMUN5215DW1T1G		–	–	0.9	
	LMUN5216DW1T1G		–	–	1.9	
	LMUN5230DW1T1G		–	–	4.3	
	LMUN5231DW1T1G		–	–	2.3	
	LMUN5232DW1T1G		–	–	1.5	
	LMUN5233DW1T1G		–	–	0.18	
	LMUN5234DW1T1G		–	–	0.13	
	LMUN5235DW1T1G		–	–	0.2	
	LMUN5236DW1T1G		–	–	0.05	
	LMUN5237DW1T1G		–	–	0.13	
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	–	–	Vdc	
Collector-Emitter Breakdown Voltage(Note 4.)(I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	50	–	–	Vdc	

4. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%

**LMUN5211DW1T1G Series**

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>.) (Continued)

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>ON CHARACTERISTICS</b> (Note 5.)						
DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)	LMUN5211DW1T1G	h <sub>FE</sub>	35	60	–	
	LMUN5212DW1T1G		60	100	–	
	LMUN5213DW1T1G		80	140	–	
	LMUN5214DW1T1G		80	140	–	
	LMUN5215DW1T1G		160	350	–	
	LMUN5216DW1T1G		160	350	–	
	LMUN5230DW1T1G		3.0	5.0	–	
	LMUN5231DW1T1G		8.0	15	–	
	LMUN5232DW1T1G		15	30	–	
	LMUN5233DW1T1G		80	200	–	
	LMUN5234DW1T1G		80	150	–	
	LMUN5235DW1T1G		80	140	–	
	LMUN5236DW1T1G		80	150	–	
LMUN5237DW1T1G		80	140	–		
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10mA, I <sub>B</sub> = 0.3 mA) (I <sub>C</sub> = 10mA, I <sub>B</sub> = 5mA) (I <sub>C</sub> = 10mA, I <sub>B</sub> = 1mA)	V <sub>CE(sat)</sub>	–	–	0.25	Vdc	
LMUN5230DW1T1G/LMUN5231DW1T1G						
LMUN5215DW1T1G/LMUN5216DW1T1G						
LMUN5232DW1T1G/LMUN5233DW1T1G/LMUN5234DW1T1G						
Output Voltage (on) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OL</sub>	–	–	0.2	Vdc	
LMUN5211DW1T1G						
LMUN5212DW1T1G				0.2		
LMUN5214DW1T1G				0.2		
LMUN5215DW1T1G				0.2		
LMUN5216DW1T1G				0.2		
LMUN5230DW1T1G				0.2		
LMUN5231DW1T1G				0.2		
LMUN5232DW1T1G				0.2		
LMUN5233DW1T1G				0.2		
LMUN5234DW1T1G				0.2		
LMUN5235DW1T1G				0.2		
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ)				0.2		
LMUN5213DW1T1G				0.2		
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 5.5 V, R <sub>L</sub> = 1.0 kΩ)				0.2		
LMUN5236DW1T1G				0.2		
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 4.0 V, R <sub>L</sub> = 1.0 kΩ)				0.2		
LMUN5237DW1T1G				0.2		
Output Voltage (off) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OH</sub>	4.9	–	–	Vdc	
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.05 V, R <sub>L</sub> = 1.0 kΩ)						
LMUN5230DW1T1G						
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.25 V, R <sub>L</sub> = 1.0 kΩ)						
LMUN5215DW1T1G						
LMUN5216DW1T1G						
LMUN5233DW1T1G						

5. Pulse Test: Pulse Width < 300 ms, Duty Cycle < 2.0%

**LMUN5211DW1T1G Series**

**ELECTRICAL CHARACTERISTICS**

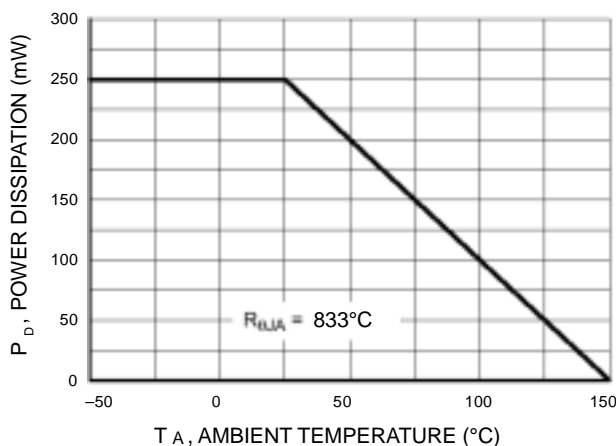
(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>,) (Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
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**ON CHARACTERISTICS**(Note 6.)

Input Resistor	LMUN5211DW1T1G	R <sub>1</sub>	7.0	10	13	kΩ
	LMUN5212DW1T1G		15.4	22	28.6	
	LMUN5213DW1T1G		32.9	47	61.1	
	LMUN5214DW1T1G		7.0	10	13	
	LMUN5215DW1T1G		7.0	10	13	
	LMUN5216DW1T1G		3.3	4.7	6.1	
	LMUN5230DW1T1G		0.7	1.0	1.3	
	LMUN5231DW1T1G		1.5	2.2	2.9	
	LMUN5232DW1T1G		3.3	4.7	6.1	
	LMUN5233DW1T1G		3.3	4.7	6.1	
	LMUN5234DW1T1G		15.4	22	28.6	
	LMUN5235DW1T1G		1.54	2.2	2.86	
	LMUN5236DW1T1G		70	100	130	
	LMUN5237DW1T1G		32.9	47	61.1	
Resistor Ratio	LMUN5211DW1T1G/LMUN5212DW1T1G	R <sub>1</sub> /R <sub>2</sub>				
	LMUN5213DW1T1G/LMUN5236DW1T1G		0.8	1.0	1.2	
	LMUN5214DW1T1G/LMUN5215DW1T1G		0.17	0.21	0.25	
	LMUN5216DW1T1G/LMUN5230DW1T1G		—	—	—	
	LMUN5231DW1T1G/LMUN5232DW1T1G		0.8	1.0	1.2	
	LMUN5233DW1T1G		0.055	0.1	0.185	
	LMUN5234DW1T1G		0.38	0.47	0.56	
	LMUN5235DW1T1G		0.038	0.047	0.056	
LMUN5237DW1T1G		1.7	2.1	2.6		

6. Pulse Test: Pulse Width < 300 ms, Duty Cycle < 2.0%



**Figure 1. Derating Curve**

LMUN5211DW1T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5211DW1T1

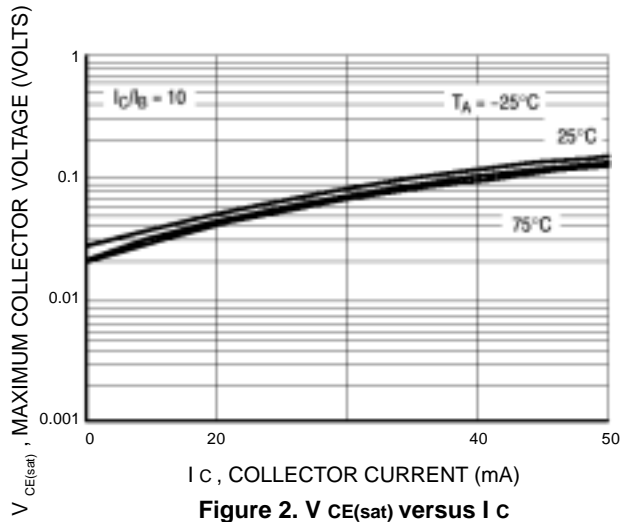


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

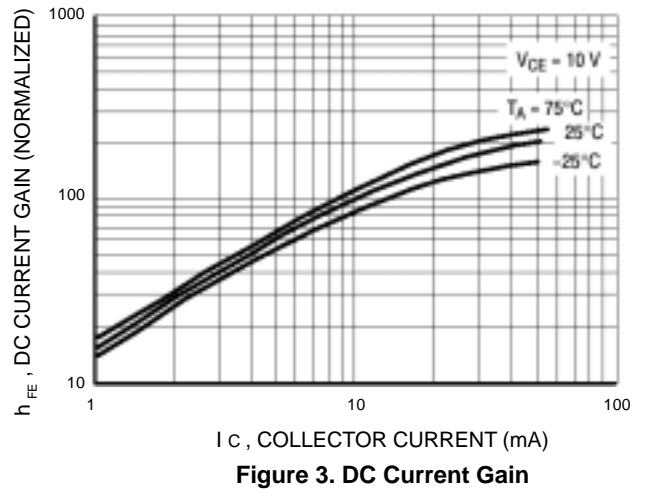


Figure 3. DC Current Gain

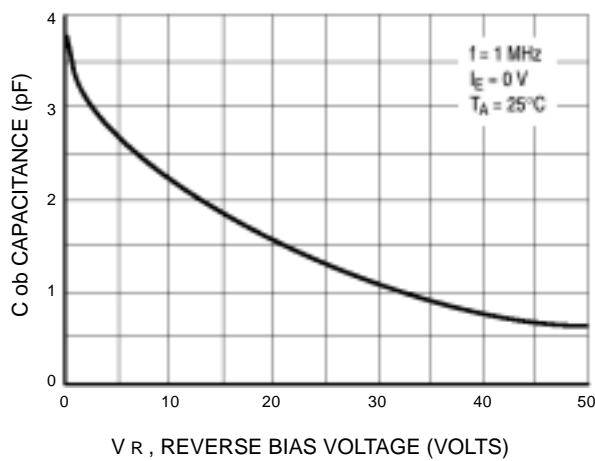


Figure 4. Output Capacitance

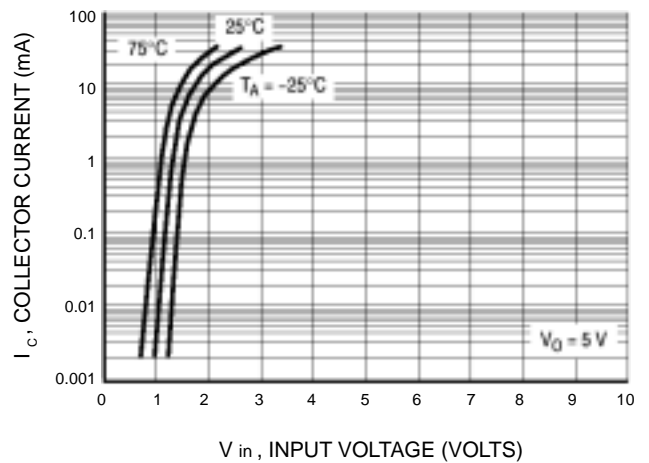


Figure 5. Output Current versus Input Voltage

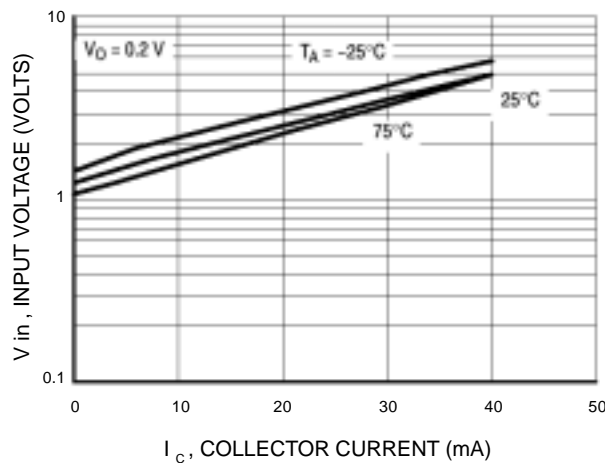
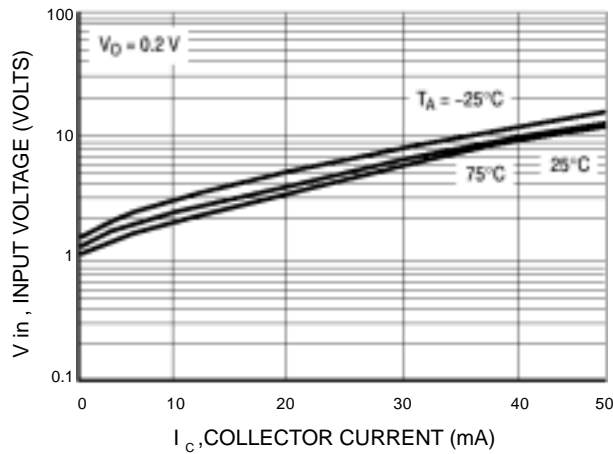
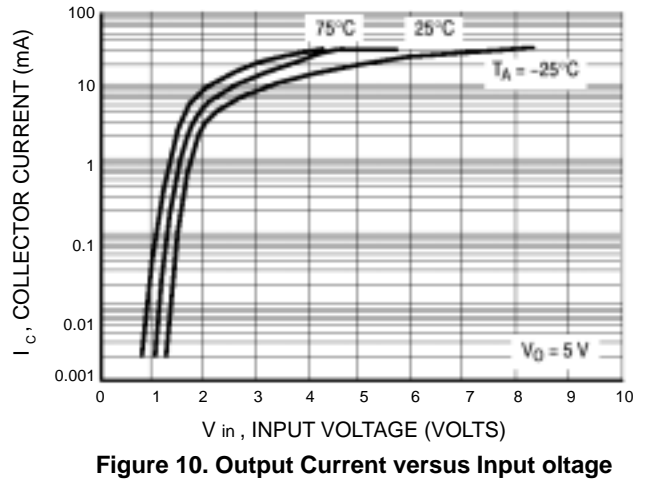
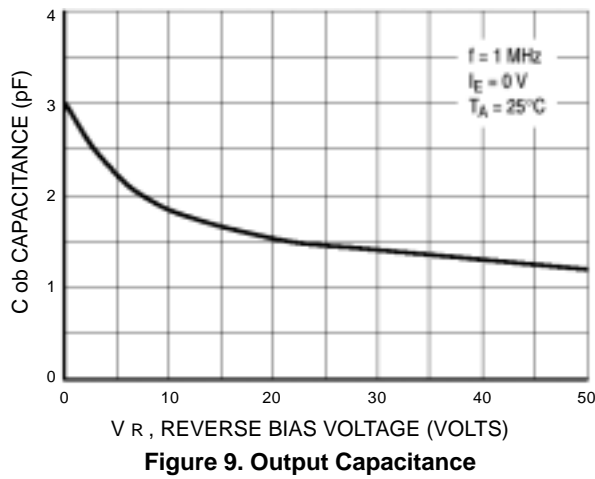
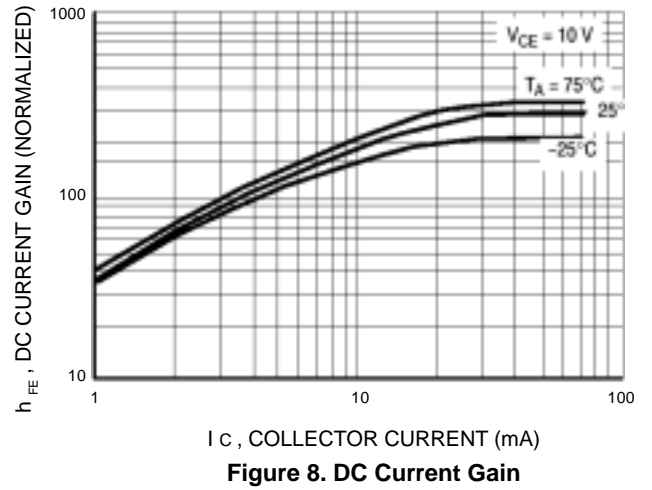
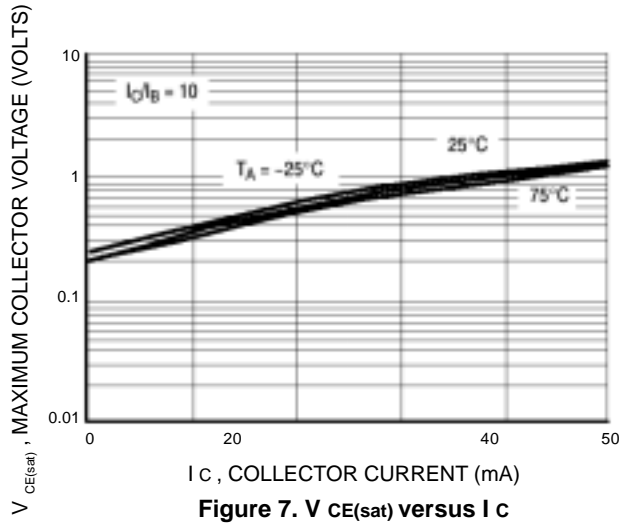


Figure 6. Input Voltage versus Output Current

LMUN5211DW1T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5212DW1T1



LMUN5211DW1T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5213DW1T1

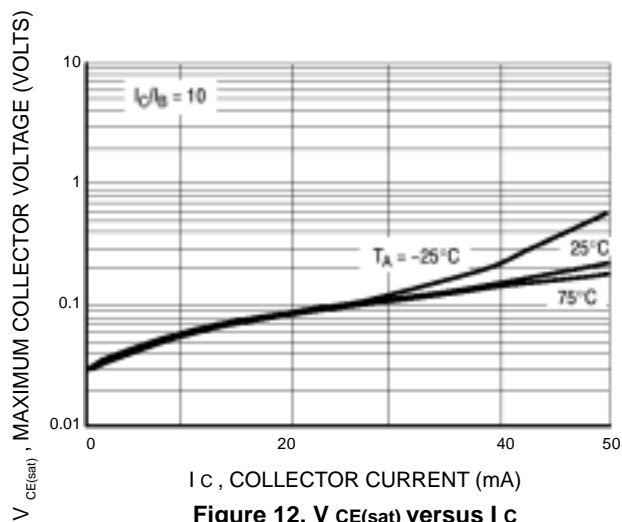


Figure 12.  $V_{CE(sat)}$  versus  $I_c$

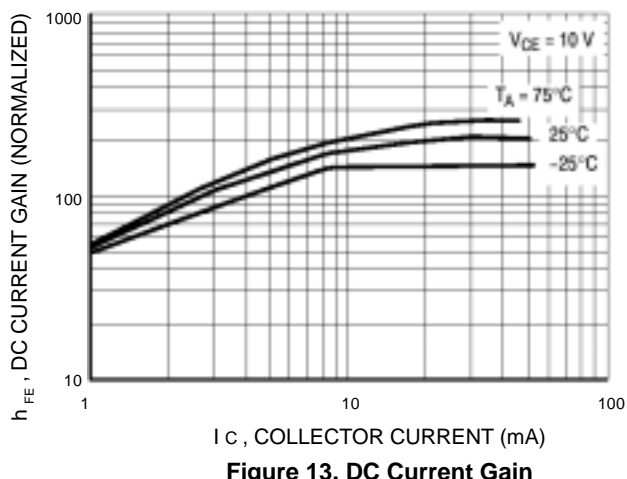


Figure 13. DC Current Gain

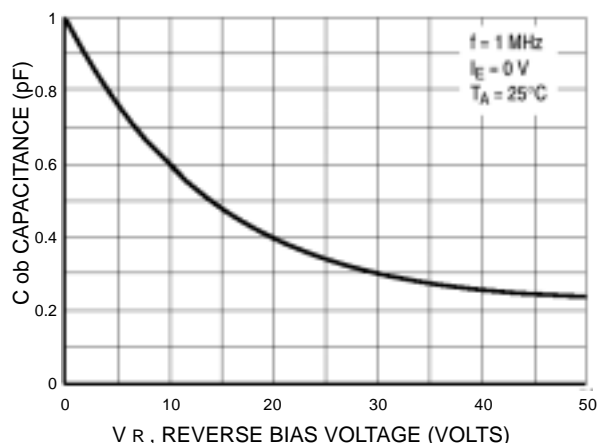


Figure 14. Output Capacitance

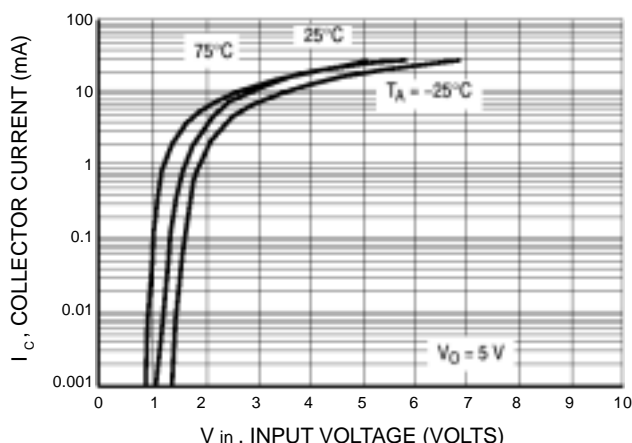


Figure 15. Output Current versus Input Voltage

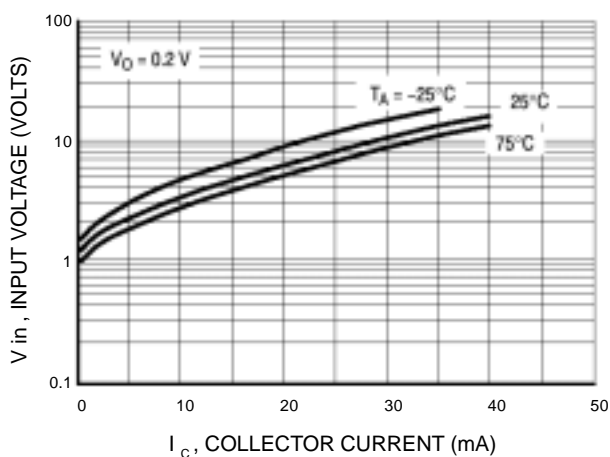


Figure 16. Input Voltage versus Output Current



LMUN5211DW1T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5214DW1T1

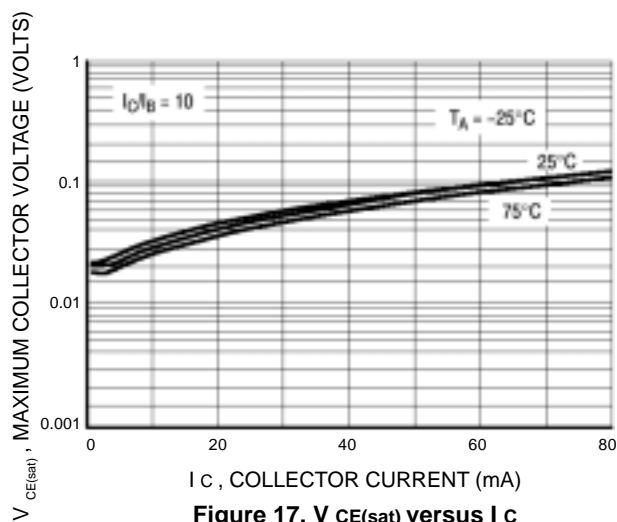


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

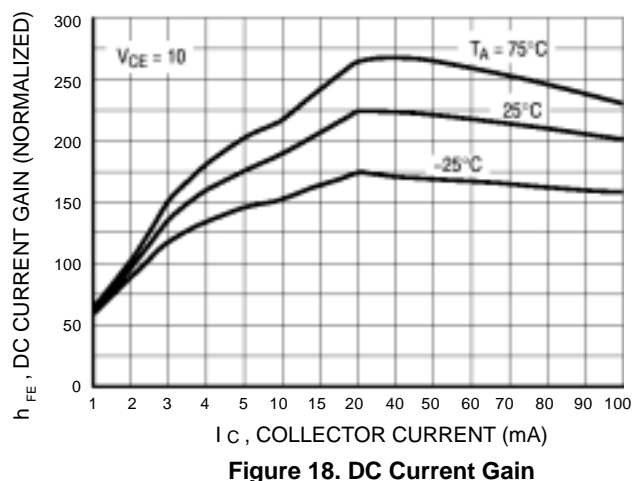


Figure 18. DC Current Gain

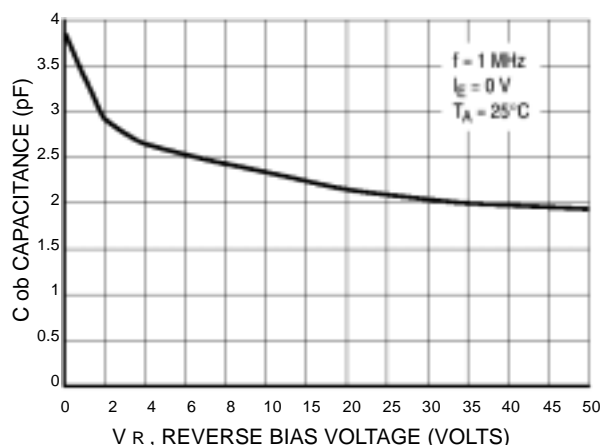


Figure 19. Output Capacitance

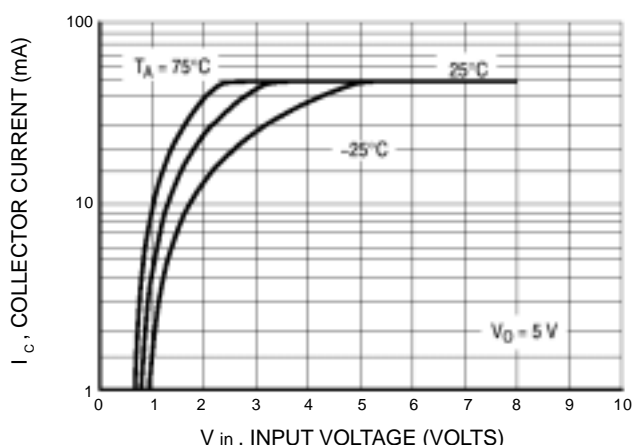


Figure 20. Output Current versus Input Voltage

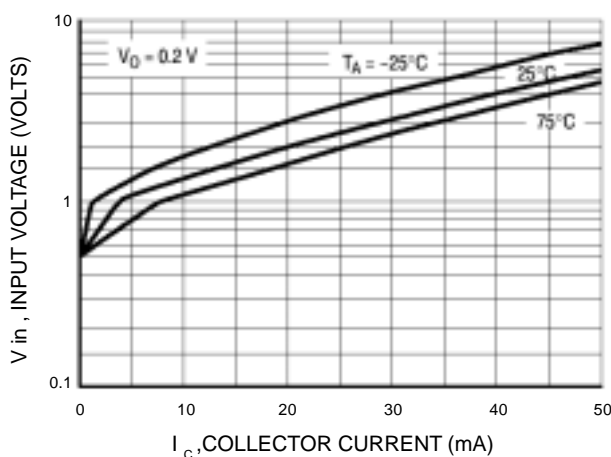
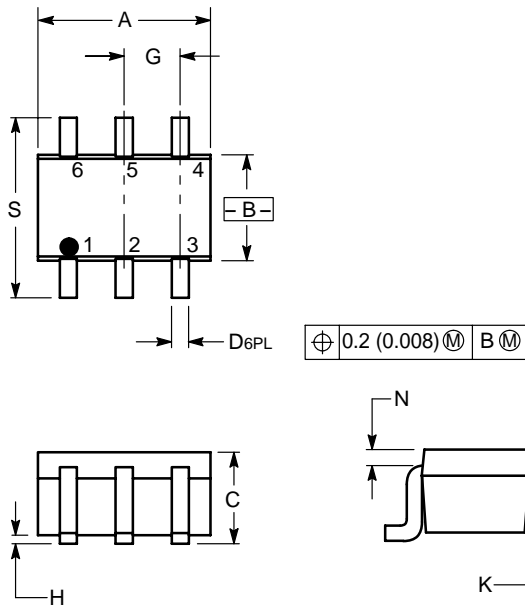


Figure 21. Input Voltage versus Output Current

**LMUN5211DW1T1G Series**

**SC-88/SOT-363**



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

- PIN 1. EMITTER 2  
 2. BASE 2  
 3. COLLECTOR 1  
 4. EMITTER 1  
 5. BASE 1  
 6. COLLECTOR 2

