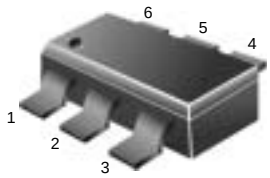
Dual Bias ResistorTransistors

NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

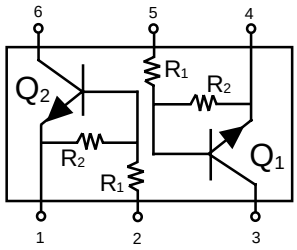
LMUN5211DW1T1 Series

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
- Pb-Free Package is available



SC-88/SOT-363



MAXIMUM RATINGS (T_A = 25°C unless otherwise noted, common for Q_1 and Q_2)

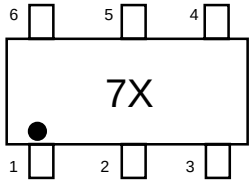
Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	50	Vdc
Collector-Emitter Voltage	V_{CEO}	50	Vdc
Collector Current	I_C	100	mAdc

THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation T_A = 25°C	P_D	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	$R_{\theta JA}$	670 (Note 1.) 490 (Note 2.)	°C/W
Characteristic (Both Junctions Heated)	**Symbol**	**Max**	**Unit**
Total Device Dissipation T_A = 25°C	P_D	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	$R_{\theta JA}$	493 (Note 1.) 325 (Note 2.)	°C/W
Thermal Resistance – Junction-to-Lead	$R_{\theta JL}$	188 (Note 1.) 208 (Note 2.)	°C/W
Junction and Storage Temperature	T_J, T_{stg}	–55 to +150	°C

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

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.

LMUN5211DW1T1 Series

DEVICE MARKING , RESISTOR VALUES AND ORDERING INFORMATION

Device	Package	Marking	R1(K)	R2(K)	Shipping
LMUN5211DW1T1	SOT-363	7A	10	10	3000/Tape&Reel
LMUN5211DW1T1G	SOT-363	7A(Pb-Free)	10	10	3000/Tape&Reel
LMUN5212DW1T1	SOT-363	7B	22	22	3000/Tape&Reel
LMUN5212DW1T1G	SOT-363	7B(Pb-Free)	22	22	3000/Tape&Reel
LMUN5213DW1T1	SOT-363	7C	47	47	3000/Tape&Reel
LMUN5213DW1T1G	SOT-363	7C(Pb-Free)	47	47	3000/Tape&Reel
LMUN5214DW1T1	SOT-363	7D	10	47	3000/Tape&Reel
LMUN5214DW1T1G	SOT-363	7D(Pb-Free)	10	47	3000/Tape&Reel
LMUN5215DW1T1	SOT-363	7E	10	∞	3000/Tape&Reel
LMUN5215DW1T1G	SOT-363	7E(Pb-Free)	10	∞	3000/Tape&Reel
LMUN5216DW1T1	SOT-363	7F	4.7	∞	3000/Tape&Reel
LMUN5216DW1T1G	SOT-363	7F(Pb-Free)	4.7	∞	3000/Tape&Reel
LMUN5230DW1T1	SOT-363	7G	1	1	3000/Tape&Reel
LMUN5230DW1T1G	SOT-363	7G(Pb-Free)	1	1	3000/Tape&Reel
LMUN5231DW1T1	SOT-363	7H	2.2	2.2	3000/Tape&Reel
LMUN5231DW1T1G	SOT-363	7H(Pb-Free)	2.2	2.2	3000/Tape&Reel
LMUN5232DW1T1	SOT-363	7J	4.7	4.7	3000/Tape&Reel
LMUN5232DW1T1G	SOT-363	7J(Pb-Free)	4.7	4.7	3000/Tape&Reel
LMUN5233DW1T1	SOT-363	7K	4.7	47	3000/Tape&Reel
LMUN5233DW1T1G	SOT-363	7K(Pb-Free)	4.7	47	3000/Tape&Reel
LMUN5234DW1T1	SOT-363	7L	22	47	3000/Tape&Reel
LMUN5234DW1T1G	SOT-363	7L(Pb-Free)	22	47	3000/Tape&Reel
LMUN5235DW1T1	SOT-363	7M	2.2	47	3000/Tape&Reel
LMUN5235DW1T1G	SOT-363	7M(Pb-Free)	2.2	47	3000/Tape&Reel
LMUN5236DW1T1	SOT-363	7N	100	100	3000/Tape&Reel
LMUN5236DW1T1G	SOT-363	7N(Pb-Free)	100	100	3000/Tape&Reel
LMUN5237DW1T1	SOT-363	7P	47	22	3000/Tape&Reel
LMUN5237DW1T1G	SOT-363	7P(Pb-Free)	47	22	3000/Tape&Reel

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted, common for Q_1 and Q_2)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Base Cutoff Current	(V_{CB} = 50 V, I_E = 0)	I_{CBO}	–	–	100	nAdc
Collector-Emitter Cutoff Current	(V_{CE} = 50 V, I_B = 0)	I_{CEO}	–	–	500	nAdc
Emitter-Base Cutoff Current	LMUN5211DW1T1	I_{EBO}	–	–	0.5	mAdc
(V_{EB} = 6.0 V, I_C = 0)	LMUN5212DW1T1		–	–	0.2	
	LMUN5213DW1T1		–	–	0.1	
	LMUN5214DW1T1		–	–	0.2	
	LMUN5215DW1T1		–	–	0.9	
	LMUN5216DW1T1		–	–	1.9	
	LMUN5230DW1T1		–	–	4.3	
	LMUN5231DW1T1		–	–	2.3	
	LMUN5232DW1T1		–	–	1.5	
	LMUN5233DW1T1		–	–	0.18	
	LMUN5234DW1T1		–	–	0.13	
	LMUN5235DW1T1		–	–	0.2	
	LMUN5236DW1T1		–	–	0.05	
	LMUN5237DW1T1		–	–	0.13	
Collector-Base Breakdown Voltage (I_C = 10 µA, I_E = 0)		$V_{(BR)CBO}$	50	–	–	Vdc
Collector-Emitter Breakdown Voltage(Note 4.)(I_C = 2.0 mA,I_B=0)		$V_{(BR)CEO}$	50	–	–	Vdc

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

LMUN5211DW1T1 Series

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted, common for Q_1 and Q_2,) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS(Note 5.)						
DC Current Gain	LMUN5211DW1T1	h_{FE}	35	60	–	
(V_{CE} = 10 V, I_C = 5.0 mA)	LMUN5212DW1T1		60	100	–	
	LMUN5213DW1T1		80	140	–	
	LMUN5214DW1T1		80	140	–	
	LMUN5215DW1T1		160	350	–	
	LMUN5216DW1T1		160	350	–	
	LMUN5230DW1T1		3.0	5.0	–	
	LMUN5231DW1T1		8.0	15	–	
	LMUN5232DW1T1		15	30	–	
	LMUN5233DW1T1		80	200	–	
	LMUN5234DW1T1		80	150	–	
	LMUN5235DW1T1		80	140	–	
	LMUN5236DW1T1		80	150	–	
	LMUN5237DW1T1		80	140	–	
Collector-Emitter Saturation Voltage (I_C= 10mA,I_B= 0.3 mA)		$V_{CE(sat)}$	–	–	0.25	Vdc
(I_C= 10mA, I_B= 5mA) LMUN5230DW1T1/LMUN5231DW1T1						
(I_C= 10mA, I_B= 1mA) LMUN5215DW1T1/LMUN5216DW1T1						
LMUN5232DW1T1/LMUN5233DW1T1/LMUN5234DW1T1						
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ)	LMUN5211DW1T1		–	–	0.2	
	LMUN5212DW1T1		–	–	0.2	
	LMUN5214DW1T1		–	–	0.2	
	LMUN5215DW1T1		–	–	0.2	
	LMUN5216DW1T1		–	–	0.2	
	LMUN5230DW1T1		–	–	0.2	
	LMUN5231DW1T1		–	–	0.2	
	LMUN5232DW1T1		–	–	0.2	
	LMUN5233DW1T1		–	–	0.2	
	LMUN5234DW1T1		–	–	0.2	
	LMUN5235DW1T1		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 kΩ)	LMUN5213DW1T1		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 5.5 V, R_L = 1.0 kΩ)	LMUN5236DW1T1		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 4.0 V, R_L = 1.0 kΩ)	LMUN5237DW1T1		–	–	0.2	
Output Voltage (off) (V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 kΩ)		V_{OH}	4.9	–	–	Vdc
(V_{CC} = 5.0 V, V_B = 0.05 V, R_L = 1.0 kΩ)	LMUN5230DW1T1					
(V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	LMUN5215DW1T1					
	LMUN5216DW1T1					
	LMUN5233DW1T1					

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

LMUN5211DW1T1 Series

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted, common for Q_1 and Q_2,) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS(Note 6.)						
Input Resistor	LMUN5211DW1T1	R_1	7.0	10	13	kΩ
	LMUN5212DW1T1		15.4	22	28.6	
	LMUN5213DW1T1		32.9	47	61.1	
	LMUN5214DW1T1		7.0	10	13	
	LMUN5215DW1T1		7.0	10	13	
	LMUN5216DW1T1		3.3	4.7	6.1	
	LMUN5230DW1T1		0.7	1.0	1.3	
	LMUN5231DW1T1		1.5	2.2	2.9	
	LMUN5232DW1T1		3.3	4.7	6.1	
	LMUN5233DW1T1		3.3	4.7	6.1	
	LMUN5234DW1T1		15.4	22	28.6	
	LMUN5235DW1T1		1.54	2.2	2.86	
	LMUN5236DW1T1		70	100	130	
	LMUN5237DW1T1		32.9	47	61.1	
Resistor Ratio	LMUN5211DW1T1/LMUN5212DW1T1	R_1/R_2				
	LMUN5213DW1T1/LMUN5236DW1T1		0.8	1.0	1.2	
	LMUN5214DW1T1/LMUN5215DW1T1		0.17	0.21	0.25	
	LMUN5216DW1T1/LMUN5230DW1T1		–	–	–	
	LMUN5231DW1T1/LMUN5232DW1T1		0.8	1.0	1.2	
	LMUN5233DW1T1		0.055	0.1	0.185	
	LMUN5234DW1T1		0.38	0.47	0.56	
	LMUN5235DW1T1		0.038	0.047	0.056	
	LMUN5237DW1T1		1.7	2.1	2.6	

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

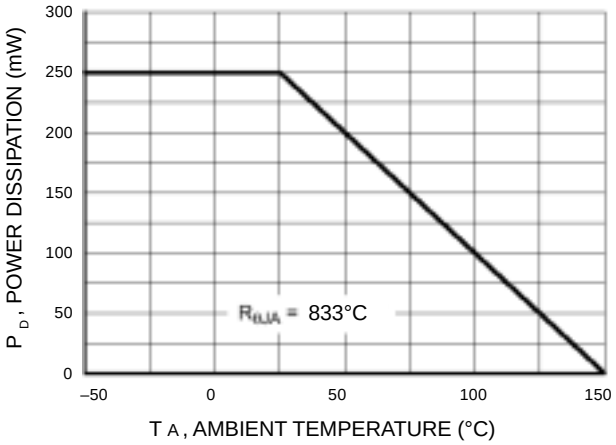


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5211DW1T1

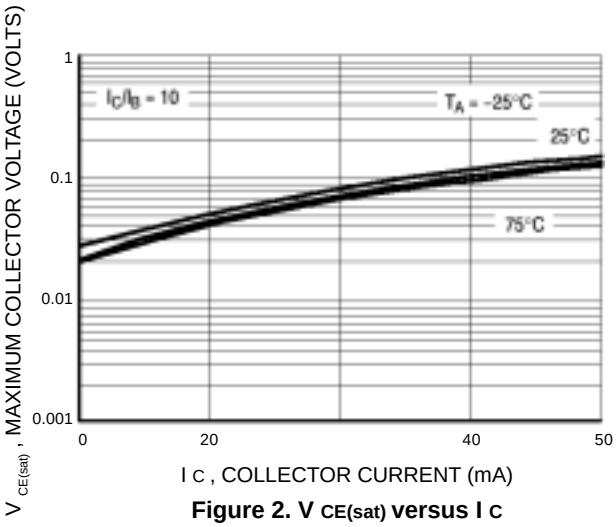


Figure 2. $V_{CE(sat)}$ versus I_C

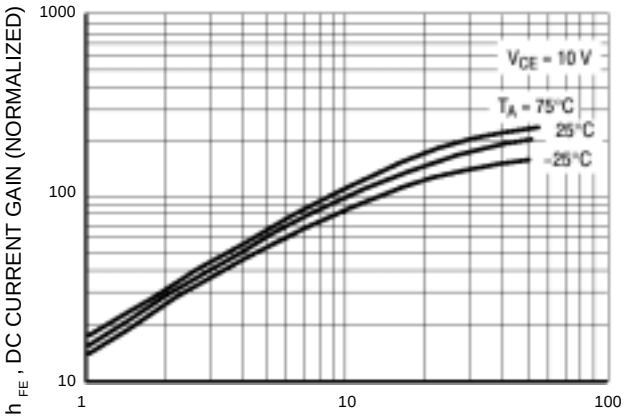


Figure 3. DC Current Gain

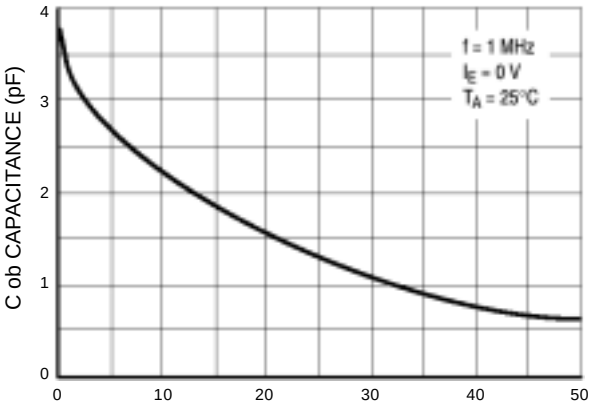


Figure 4. Output Capacitance

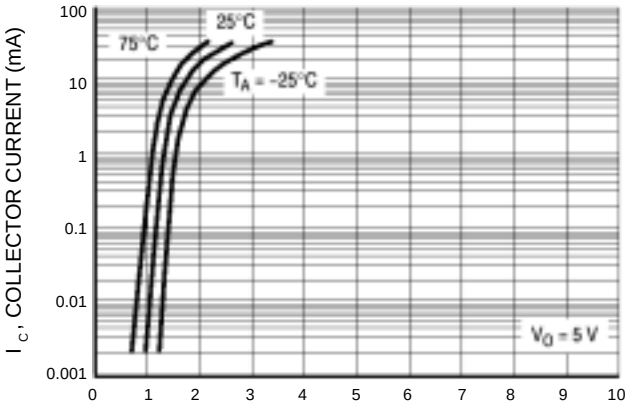


Figure 5. Output Current versus Input Voltage

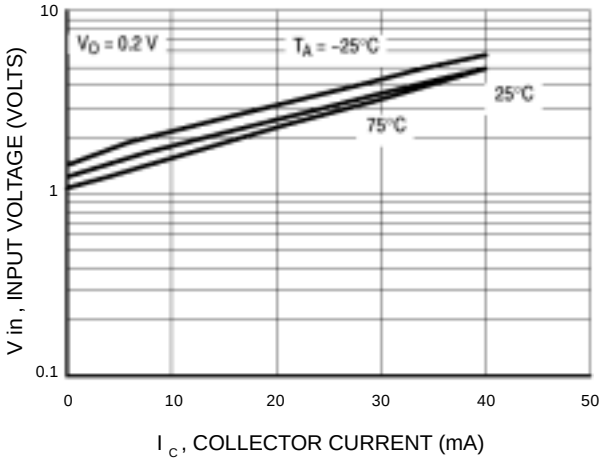


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5212DW1T1

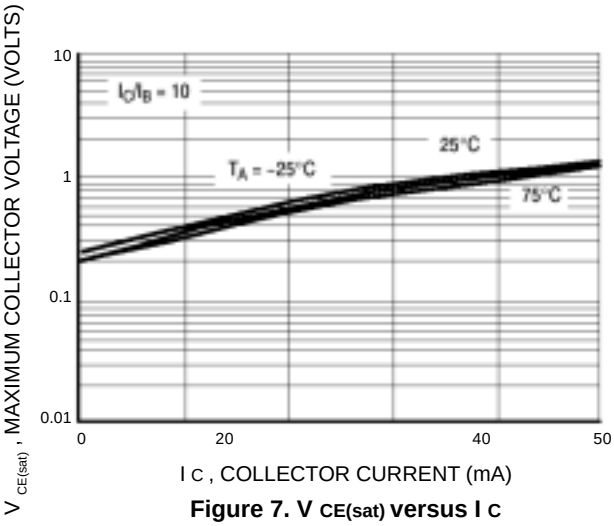


Figure 7. $V_{CE(sat)}$ versus I_C

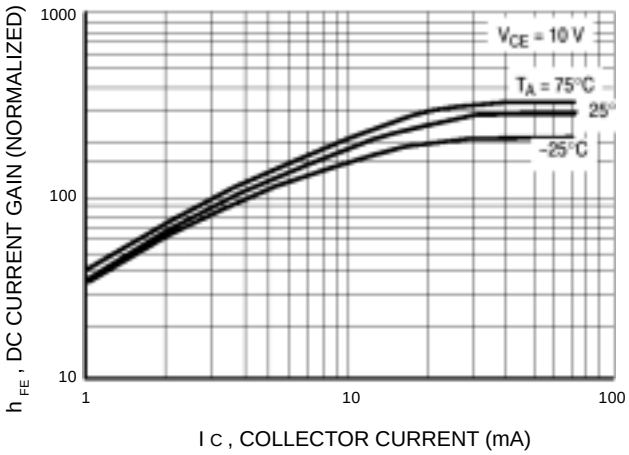


Figure 8. DC Current Gain

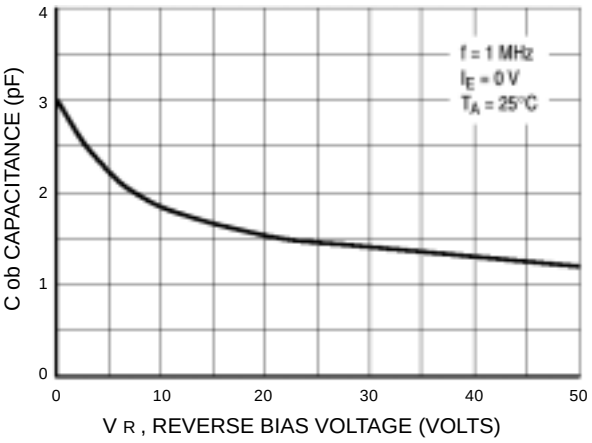


Figure 9. Output Capacitance

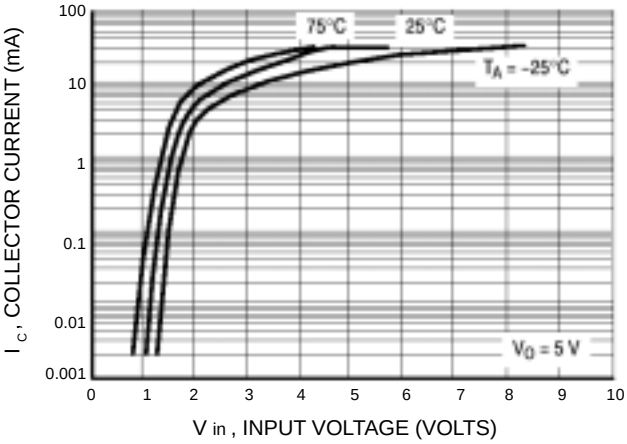


Figure 10. Output Current versus Input oltage

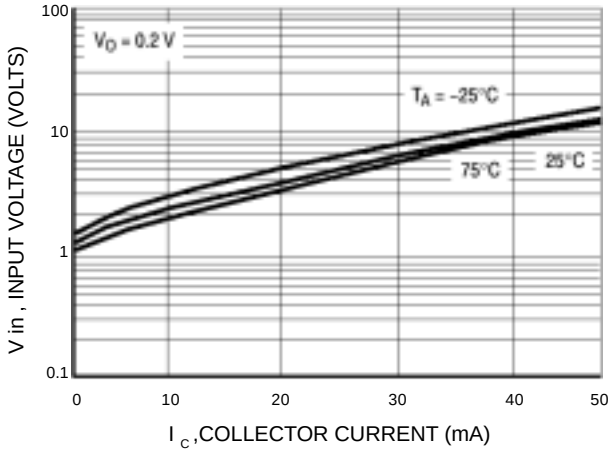


Figure 11. Input Voltage versus Output Current

LMUN5211DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5213DW1T1

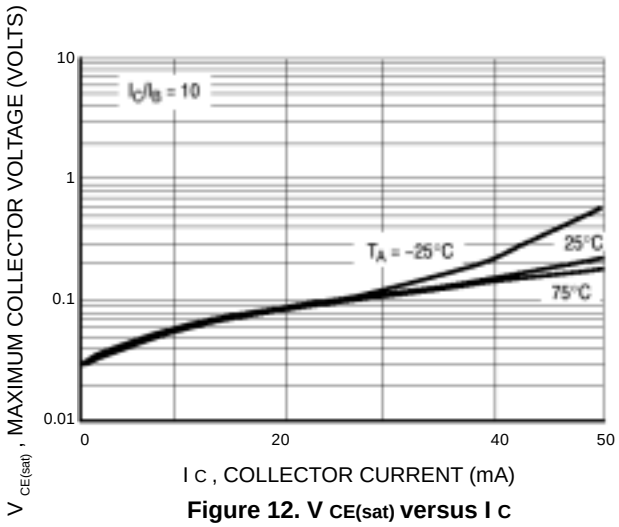


Figure 12. $V_{CE(sat)}$ versus I_C

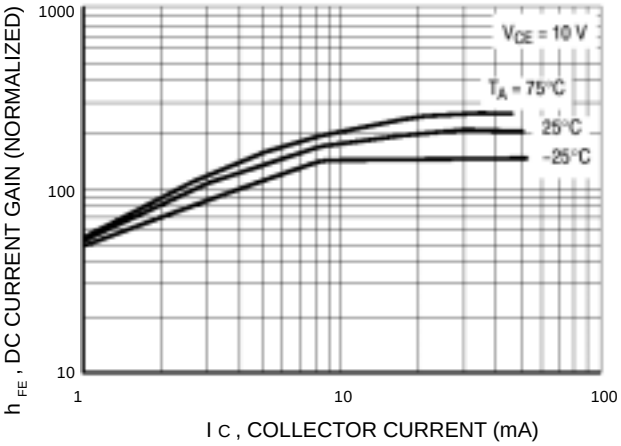


Figure 13. DC Current Gain

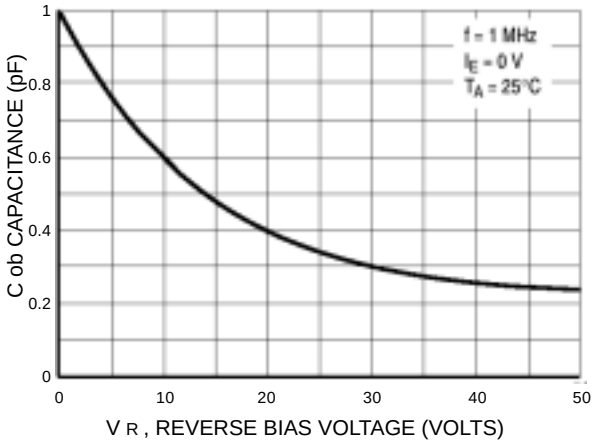


Figure 14. Output Capacitance

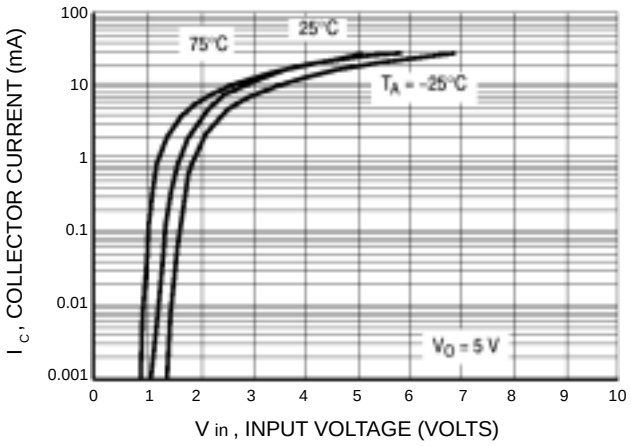


Figure 15. Output Current versus Input oltage

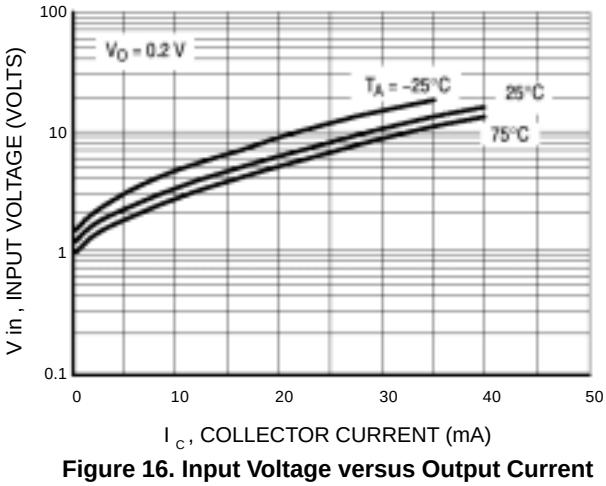


Figure 16. Input Voltage versus Output Current

LMUN5211DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5214DW1T1

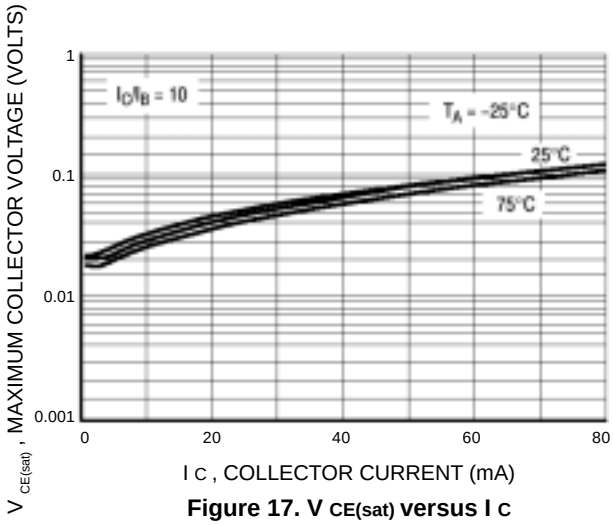


Figure 17. $V_{CE(sat)}$ versus I_C

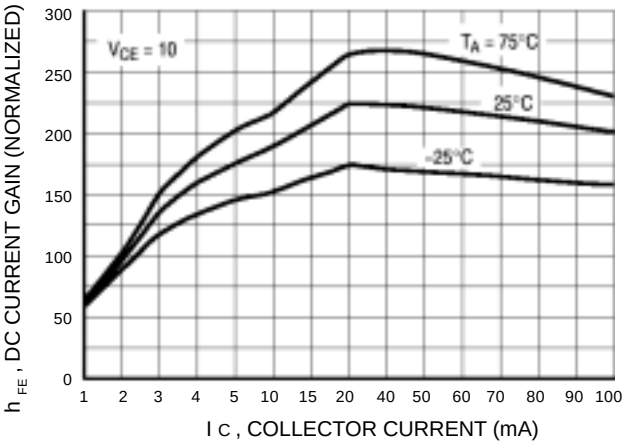


Figure 18. DC Current Gain

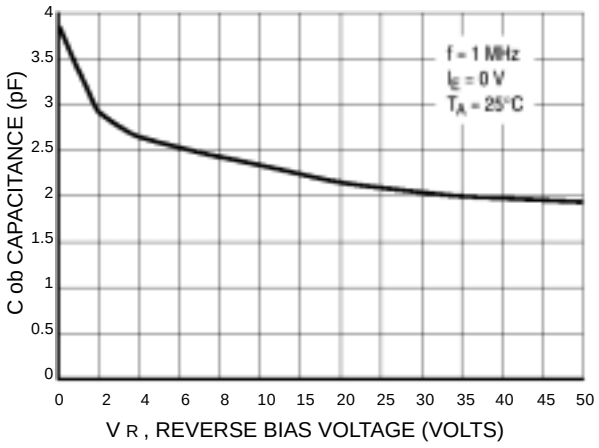


Figure 19. Output Capacitance

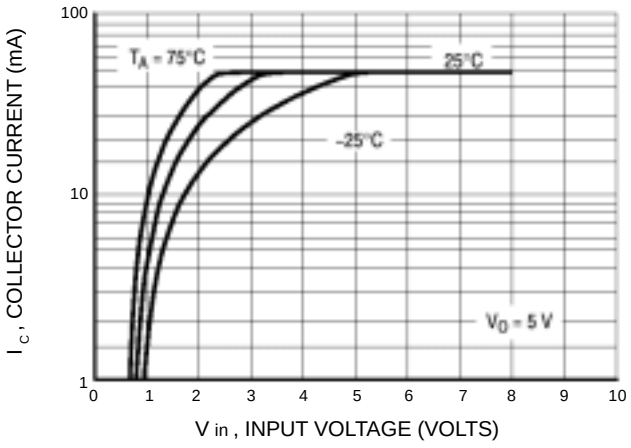


Figure 20. Output Current versus Input oltage

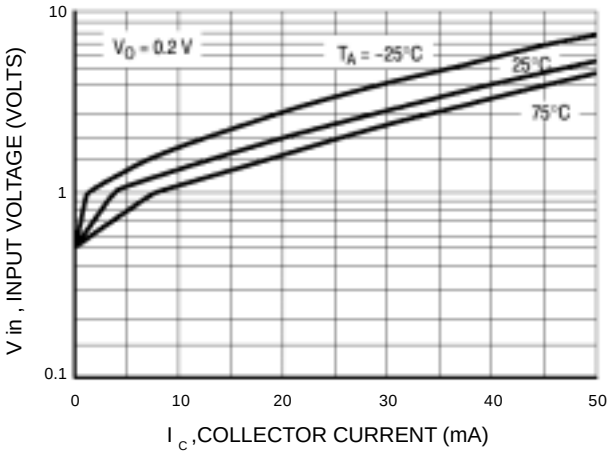
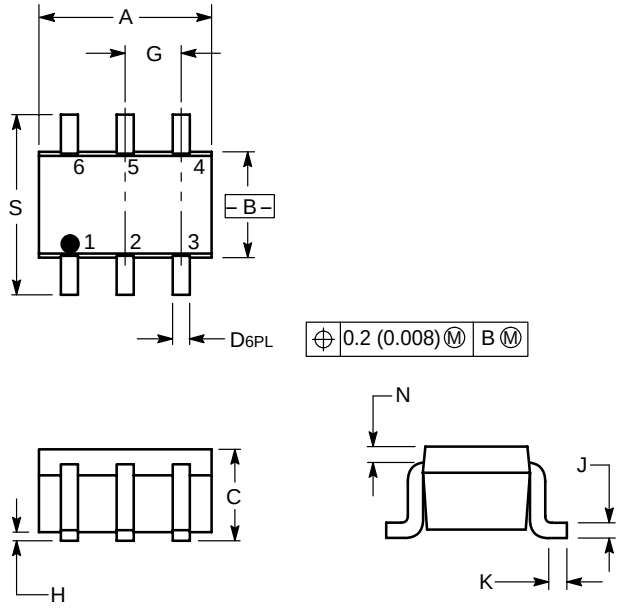


Figure 21. Input Voltage versus Output Current

LMUN5211DW1T1 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