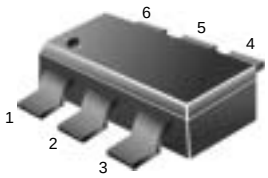
Dual Bias ResistorTransistors

NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

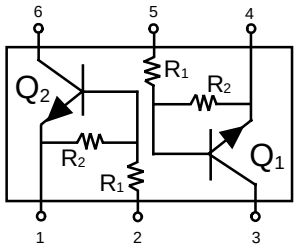
LMUN5211DW1T1G Series

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
- We declare that the material of product compliance with RoHS requirements.



SC-88/SOT-363



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

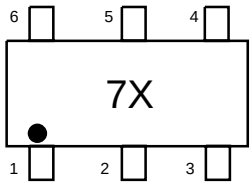
Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	50	Vdc
Collector-Emitter Voltage	V_{CEO}	50	Vdc
Collector Current	I_C	100	mAdc

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.

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

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 (V_{EB} = 6.0 V, I_C = 0)	MUN5211DW1T1, G	I_{EBO}	–	–	0.5	mAdc
	MUN5212DW1T1, G		–	–	0.2	
	MUN5213DW1T1, G		–	–	0.1	
	MUN5214DW1T1, G		–	–	0.2	
	MUN5215DW1T1, G		–	–	0.9	
	MUN5216DW1T1, G		–	–	1.9	
	MUN5230DW1T1, G		–	–	4.3	
	MUN5231DW1T1, G		–	–	2.3	
	MUN5232DW1T1, G		–	–	1.5	
	MUN5233DW1T1, G		–	–	0.18	
	MUN5234DW1T1, G		–	–	0.13	
	MUN5235DW1T1, G		–	–	0.2	
	MUN5236DW1T1, G		–	–	0.05	
	MUN5237DW1T1, G		–	–	0.13	
Collector-Base Breakdown Voltage (I_C = 10 μA, I_E = 0)		$V_{(BR)CBO}$	50	–	–	Vdc
Collector-Emitter Breakdown Voltage (Note 3) (I_C = 2.0 mA, I_B = 0)		$V_{(BR)CEO}$	50	–	–	Vdc

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

ON CHARACTERISTICS (Note 4)

DC Current Gain (V_{CE} = 10 V, I_C = 5.0 mA)	MUN5211DW1T1, G	h_{FE}	35	60	–	
	MUN5212DW1T1, G		60	100	–	
	MUN5213DW1T1, G		80	140	–	
	MUN5214DW1T1, G		80	140	–	
	MUN5215DW1T1, G		160	350	–	
	MUN5216DW1T1, G		160	350	–	
	MUN5230DW1T1, G		3.0	5.0	–	
	MUN5231DW1T1, G		8.0	15	–	
	MUN5232DW1T1, G		15	30	–	
	MUN5233DW1T1, G		80	200	–	
	MUN5234DW1T1, G		80	150	–	
	MUN5235DW1T1, G		80	140	–	
	MUN5236DW1T1, G		80	150	–	
	MUN5237DW1T1, G		80	140	–	

ELECTRICAL CHARACTERISTICS

Collector-Emitter Saturation Voltage		$V_{CE(sat)}$				Vdc
(I_C = 10 mA, I_B = 0.3 mA)	MUN5211DW1T1, G		–	–	0.25	
	MUN5212DW1T1, G		–	–	0.25	
	MUN5213DW1T1, G		–	–	0.25	
	MUN5214DW1T1, G		–	–	0.25	
	MUN5235DW1T1, G		–	–	0.25	
	MUN5236DW1T1, G		–	–	0.25	
(I_C = 10 mA, I_B = 5 mA)	MUN5230DW1T1, G		–	–	0.25	
	MUN5231DW1T1, G		–	–	0.25	
	MUN5237DW1T1, G		–	–	0.25	
(I_C = 10 mA, I_B = 1 mA)	MUN5215DW1T1, G		–	–	0.25	
	MUN5216DW1T1, G		–	–	0.25	
	MUN5232DW1T1, G		–	–	0.25	
	MUN5233DW1T1, G		–	–	0.25	
	MUN5234DW1T1, G		–	–	0.25	
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ)	MUN5211DW1T1, G		–	–	0.2	
	MUN5212DW1T1, G		–	–	0.2	
	MUN5214DW1T1, G		–	–	0.2	
	MUN5215DW1T1, G		–	–	0.2	
	MUN5216DW1T1, G		–	–	0.2	
	MUN5230DW1T1, G		–	–	0.2	
	MUN5231DW1T1, G		–	–	0.2	
	MUN5232DW1T1, G		–	–	0.2	
	MUN5233DW1T1, G		–	–	0.2	
	MUN5234DW1T1, G		–	–	0.2	
	MUN5235DW1T1, G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 kΩ)	MUN5213DW1T1, G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 5.5 V, R_L = 1.0 kΩ)	MUN5236DW1T1, G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 4.0 V, R_L = 1.0 kΩ)	MUN5237DW1T1, G		–	–	0.2	

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

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) (Continued)						
Output Voltage (off)		V_{OH}				Vdc
(V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 kΩ)	MUN5211DW1T1, G		4.9	–	–	
	MUN5212DW1T1, G		4.9	–	–	
	MUN5213DW1T1, G		4.9	–	–	
	MUN5214DW1T1, G		4.9	–	–	
	MUN5233DW1T1, G		4.9	–	–	
	MUN5234DW1T1, G		4.9	–	–	
	MUN5235DW1T1, G		4.9	–	–	
(V_{CC} = 5.0 V, V_B = 0.050 V, R_L = 1.0 kΩ)	MUN5230DW1T1, G		4.9	–	–	
(V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	MUN5215DW1T1, G		4.9	–	–	
	MUN5216DW1T1, G		4.9	–	–	
	MUN5231DW1T1, G		4.9	–	–	
	MUN5232DW1T1, G		4.9	–	–	
	MUN5236DW1T1, G		4.9	–	–	
	MUN5237DW1T1, G		4.9	–	–	
Input Resistor	MUN5211DW1T1, G	R1	7.0	10	13	k Ω
	MUN5212DW1T1, G		15.4	22	28.6	
	MUN5213DW1T1, G		32.9	47	61.1	
	MUN5214DW1T1, G		7.0	10	13	
	MUN5215DW1T1, G		7.0	10	13	
	MUN5216DW1T1, G		3.3	4.7	6.1	
	MUN5230DW1T1, G		0.7	1.0	1.3	
	MUN5231DW1T1, G		1.5	2.2	2.9	
	MUN5232DW1T1, G		3.3	4.7	6.1	
	MUN5233DW1T1, G		3.3	4.7	6.1	
	MUN5234DW1T1, G		15.4	22	28.6	
	MUN5235DW1T1, G		1.54	2.2	2.86	
	MUN5236DW1T1, G		70	100	130	
	MUN5237DW1T1, G		32.9	47	61.1	
Resistor Ratio	MUN5211DW1T1, G/MUN5212DW1T1, G/	R1/R2				
	MUN5213DW1T1, G/MUN5236DW1T1, G		0.8	1.0	1.2	
	MUN5214DW1T1, G		0.17	0.21	0.25	
	MUN5215DW1T1, G/MUN5216DW1T1, G		–	–	–	
	MUN5230DW1T1, G/MUN5231DW1T1, G/MUN5232DW1T1, G		0.8	1.0	1.2	
	MUN5233DW1T1, G		0.055	0.1	0.185	
	MUN5234DW1T1, G		0.38	0.47	0.56	
	MUN5235DW1T1, G		0.038	0.047	0.056	
	MUN5237DW1T1, G		1.7	2.1	2.6	

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

ALL MUN5211DW1T1 SERIES DEVICES

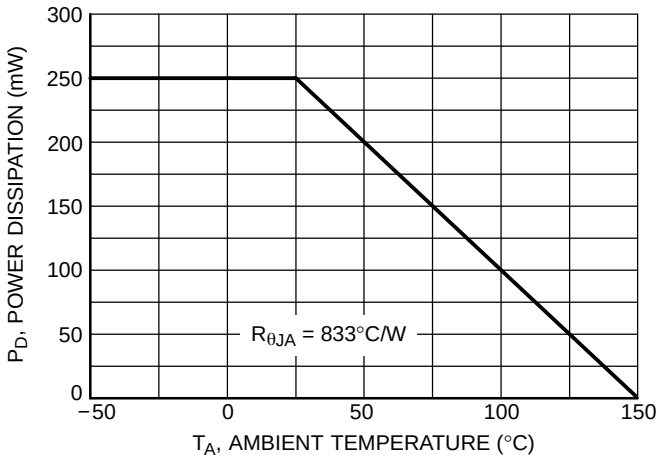


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5211DW1T1

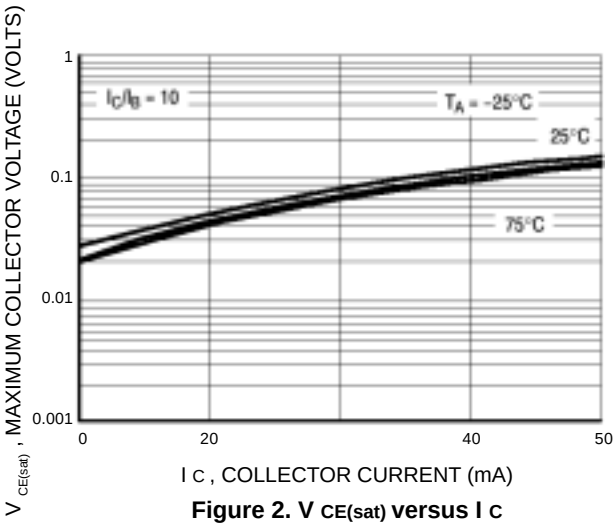


Figure 2. $V_{CE(sat)}$ versus I_C

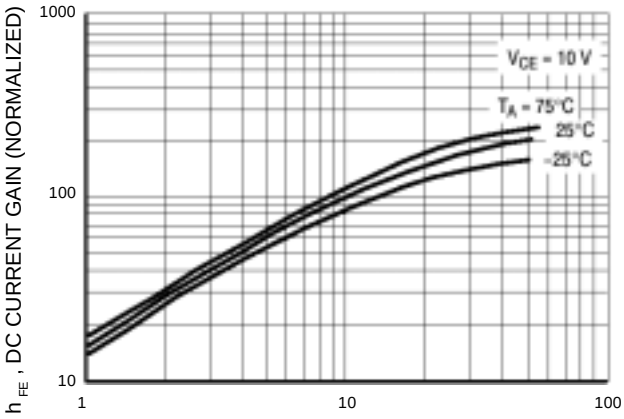


Figure 3. DC Current Gain

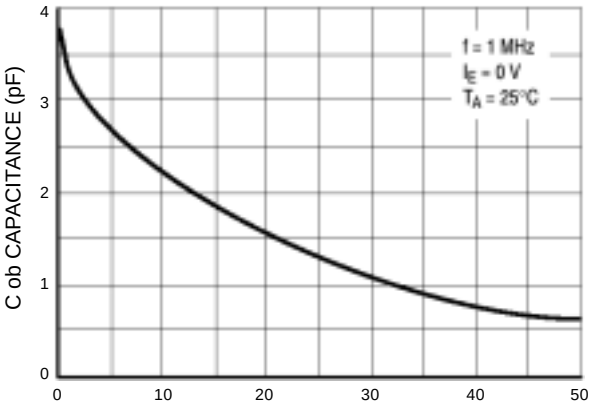


Figure 4. Output Capacitance

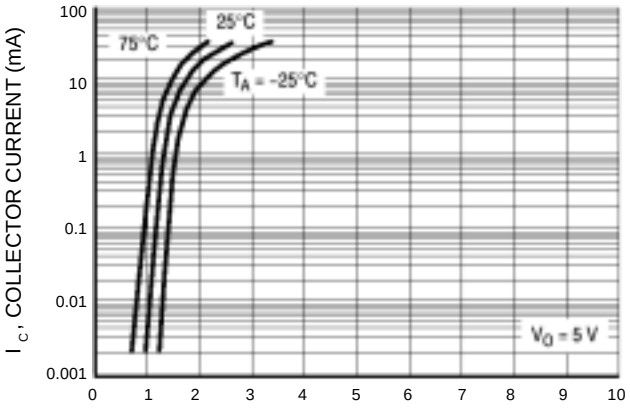


Figure 5. Output Current versus Input Voltage

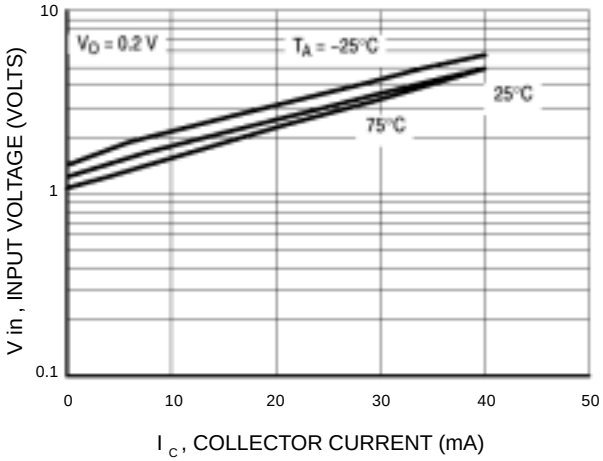


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5212DW1T1

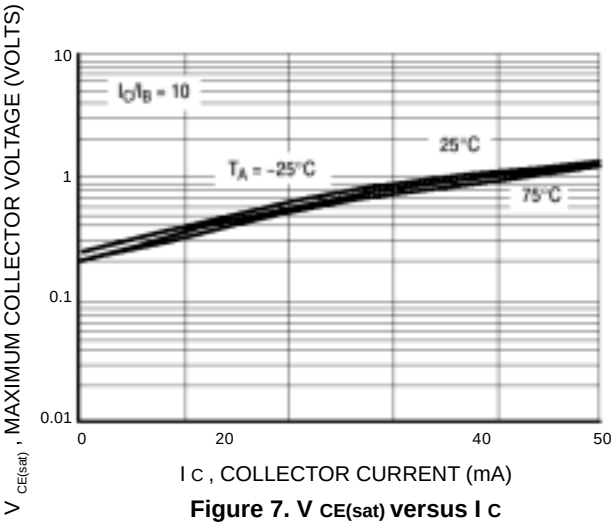


Figure 7. $V_{CE(sat)}$ versus I_C

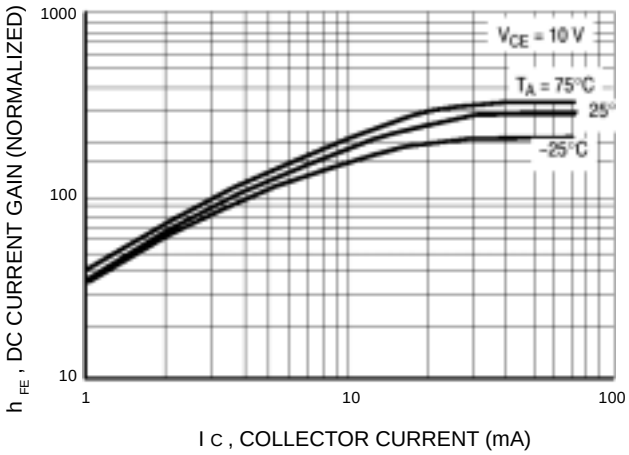


Figure 8. DC Current Gain

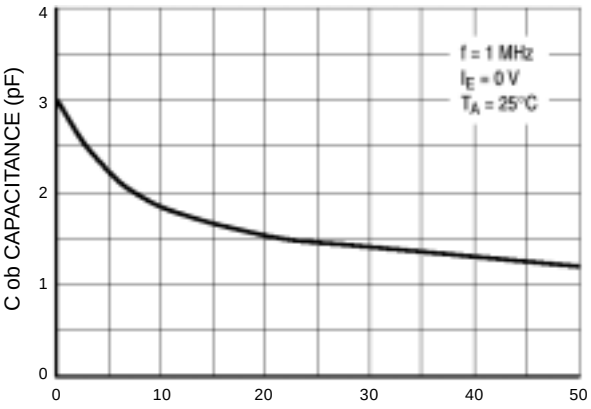


Figure 9. Output Capacitance

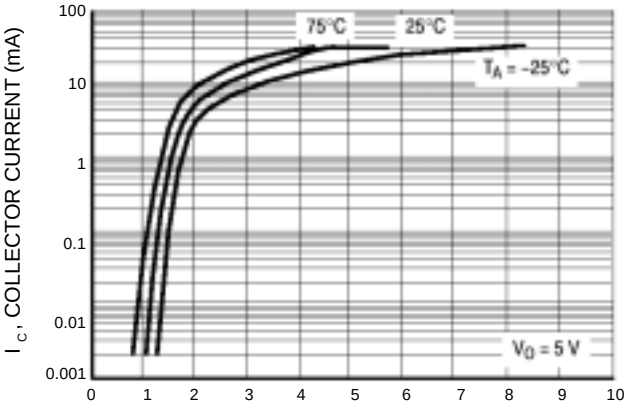


Figure 10. Output Current versus Input oltage

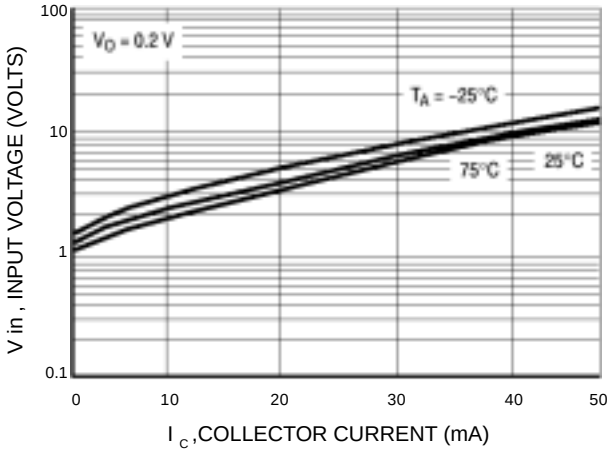


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5213DW1T1

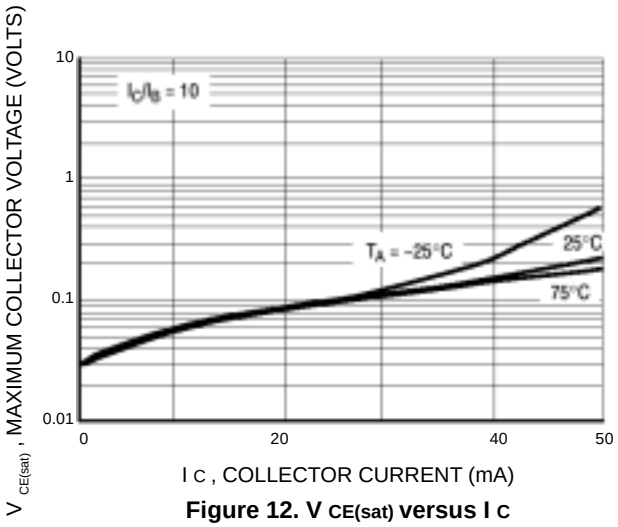


Figure 12. $V_{CE(sat)}$ versus I_C

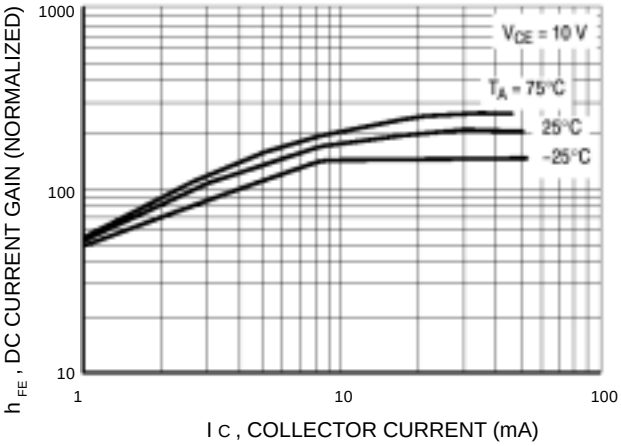


Figure 13. DC Current Gain

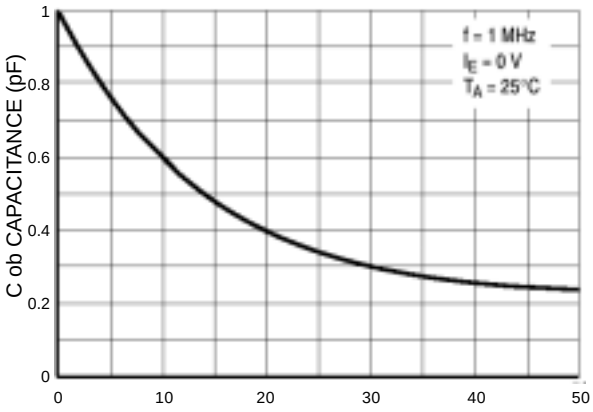


Figure 14. Output Capacitance

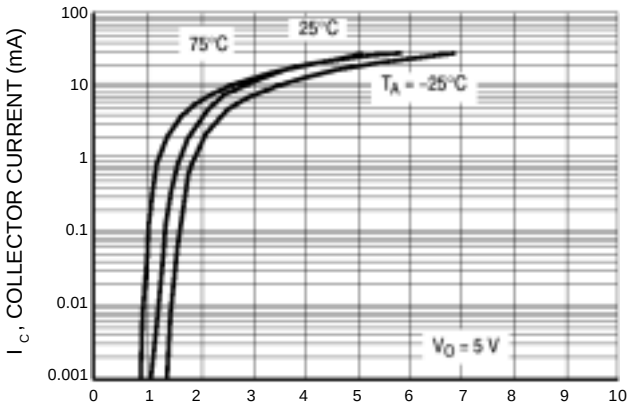


Figure 15. Output Current versus Input oltage

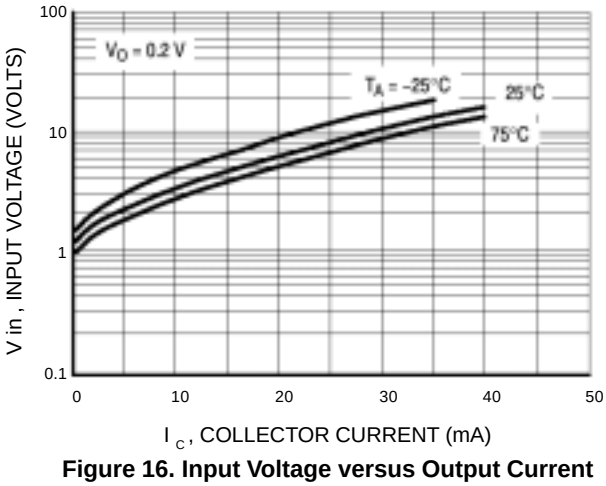


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5214DW1T1

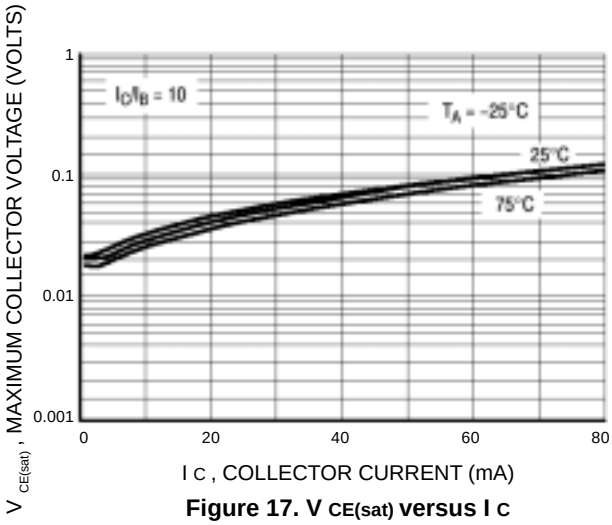


Figure 17. $V_{CE(sat)}$ versus I_C

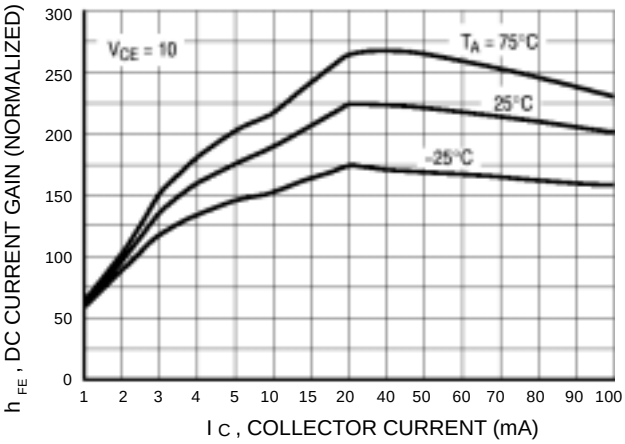


Figure 18. DC Current Gain

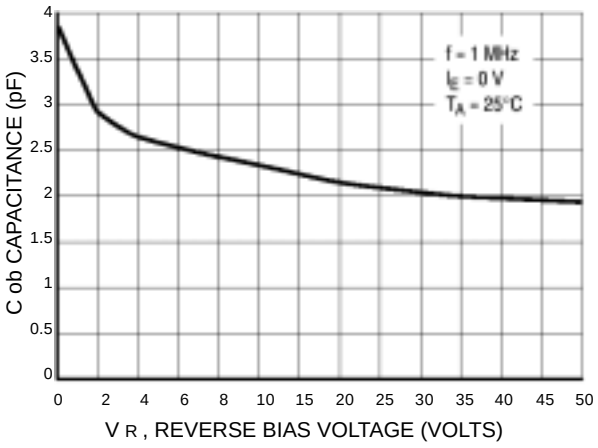


Figure 19. Output Capacitance

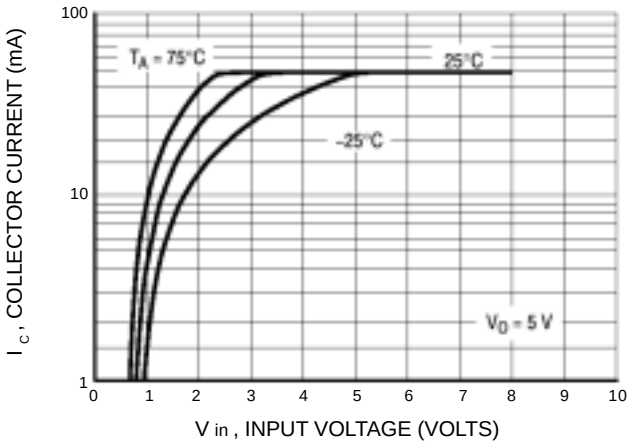


Figure 20. Output Current versus Input oltage

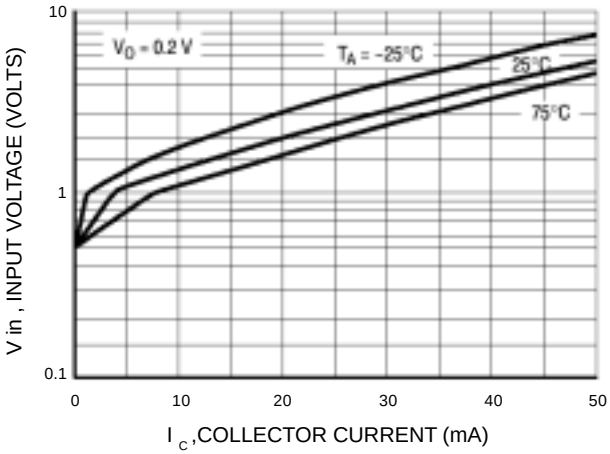
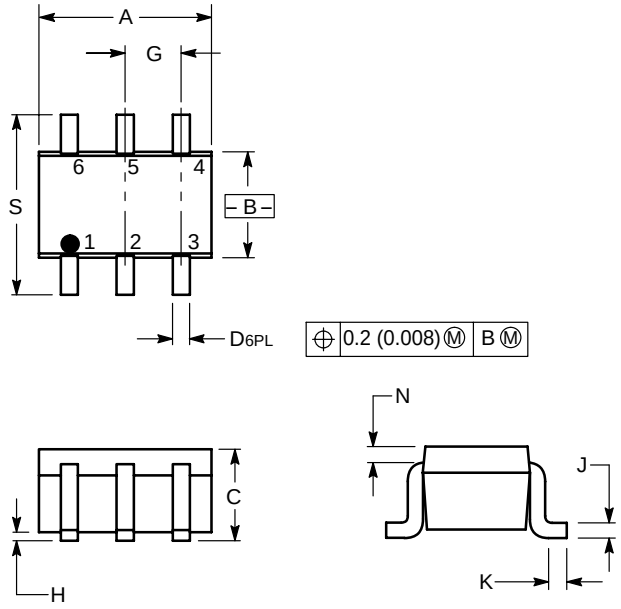


Figure 21. Input Voltage versus Output Current

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