



## DESCRIPTION

This new series of digital transistors is designed to replace a single device and its external resistor bias 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. The BRT eliminates these individual components by integrating them into a single device. The use of a BRT can reduce both system cost and board space. The device is housed in the SC-70 package which is designed for low power surface mount applications.

The MUN5211~MUN5237 are available in SC-70 package.

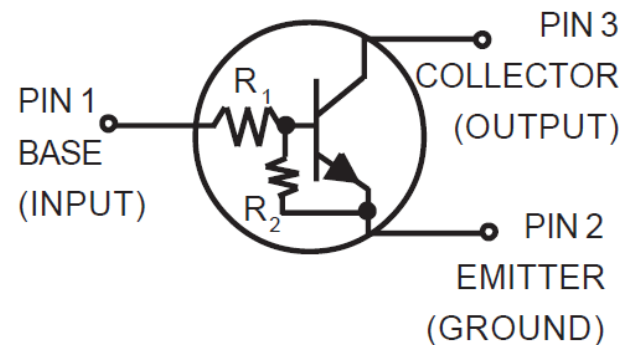
## ORDERING INFORMATION

Package Type	Part Number
SC-70	MUN5211
	MUN5212
	MUN5213
	MUN5214
	MUN5215
	MUN5216
	MUN5230
	MUN5231
	MUN5232
	MUN5233
	MUN5234
	MUN5235
	MUN5236
	MUN5237
Note	SPQ: 3,000pcs/Reel
AiT provides all RoHS Compliant Products	

## FEATURES

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SC-70 package can be soldered using wave or reflow. The modified gull-winged leads absorb thermal stress during soldering eliminating the possibility of damage to the die.
- Available in SC-70 package

## PIN DESCRIPTION





## ABSOLUTE MAXIMUM RATINGS

T<sub>A</sub> = 25°C unless otherwise noted.

V <sub>CBO</sub> , Collector-Base Voltage	50Vdc
V <sub>CEO</sub> , Collector-Emitter Voltage	50Vdc
I <sub>C</sub> , Collector Current	100mA <sub>dc</sub>

Stresses above 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 in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Total Device Dissipation T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	202 <sup>NOTE1</sup>	mW
		310 <sup>NOTE2</sup>	
		1.6 <sup>NOTE1</sup>	mW/°C
		2.5 <sup>NOTE2</sup>	
Thermal Resistance Junction-to-Ambient	R <sub>θJA</sub>	618 <sup>NOTE1</sup>	°C/W
		403 <sup>NOTE2</sup>	
Thermal Resistance Junction-to-Lead	R <sub>θJL</sub>	280 <sup>NOTE1</sup>	°C/W
		332 <sup>NOTE2</sup>	
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

NOTE1: FR-4 @ Minimum Pad

NOTE2: FR-4 @ 1.0 x 1.0 inch Pad



## ELECTRICAL CHARACTERISTICS

T<sub>A</sub> = 25°C, unless otherwise noted

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>OFF CHARACTERISTICS</b>							
Collector-Base Cutoff Current	I <sub>CB0</sub>	V <sub>CB</sub> = 50V, I <sub>E</sub> = 0	-	-	100	nAdc	
Collector-Emitter Cutoff Current	I <sub>CEO</sub>	V <sub>CE</sub> = 50V, I <sub>B</sub> = 0	-	-	500	nAdc	
Emitter-Base Cutoff Current	I <sub>EBO</sub>	V <sub>EB</sub> = 6.0V, I <sub>C</sub> = 0	-	-	MUN5211	0.5	mAdc
					MUN5212	0.2	
					MUN5213	0.1	
					MUN5214	0.2	
					MUN5215	0.9	
					MUN5216	1.9	
					MUN5230	4.3	
					MUN5231	2.3	
					MUN5232	1.5	
					MUN5233	0.18	
					MUN5234	0.13	
					MUN5235	0.2	
					MUN5236	0.05	
MUN5237	0.13						
Collector-Base Breakdown Voltage	V <sub>(BR)CBO</sub>	I <sub>C</sub> = 10μA, I <sub>E</sub> = 0	50	-	-	Vdc	
Collector-Emitter Breakdown Voltage <sup>NOTE3</sup>	V <sub>(BR)CEO</sub>	I <sub>C</sub> = 2.0mA, I <sub>B</sub> = 0	50	-	-	Vdc	



Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>ON CHARACTERISTICS</b> <small>NOTE3</small>							
DC Current Gain	$h_{FE}$	$V_{CE}=10V, I_C=5.0mA$	MUN5211	35	60	-	-
			MUN5212	60	100		
			MUN5213	80	140		
			MUN5214	80	140		
			MUN5215	160	350		
			MUN5216	160	350		
			MUN5230	3.0	5.0		
			MUN5231	8.0	15		
			MUN5232	15	30		
			MUN5233	80	200		
			MUN5234	80	150		
			MUN5235	80	140		
			MUN5236	80	150		
MUN5237	80	140					
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=10mA, I_B=0.3mA$	-	-	0.25	Vdc	
		$I_C=10mA, I_B=5mA$					
		$I_C=10mA, I_B=1mA$					
		MUN5215					
		MUN5216					
		MUN5232					
		MUN5233					
MUN5234							



Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit			
<b>ON CHARACTERISTICS</b> <small>NOTES</small>									
Output Voltage (on)	V <sub>OL</sub>	V <sub>CC</sub> =5.0V, V <sub>B</sub> =2.5V, R <sub>L</sub> =1.0kΩ	MUN5211	-	-	0.2	Vdc		
			MUN5212						
			MUN5214						
			MUN5215						
			MUN5216						
			MUN5230						
			MUN5231						
			MUN5232						
			MUN5233						
			MUN5234						
		MUN5235							
				V <sub>CC</sub> =5.0V, V <sub>B</sub> =3.5V, R <sub>L</sub> =1.0kΩ	MUN5213				
				V <sub>CC</sub> =5.0V, V <sub>B</sub> =5.5V, R <sub>L</sub> =1.0kΩ	MUN5236				
		V <sub>CC</sub> =5.0V, V <sub>B</sub> =4.0V, R <sub>L</sub> =1.0kΩ	MUN5237						
Output Voltage (off)	V <sub>OH</sub>	V <sub>CC</sub> =5.0V, V <sub>B</sub> =0.5V, R <sub>L</sub> =1.0kΩ	MUN5230	4.9	-	-	Vdc		
		V <sub>CC</sub> =5.0V, V <sub>B</sub> =0.050V, R <sub>L</sub> =1.0kΩ							
		V <sub>CC</sub> =5.0V, V <sub>B</sub> =0.25V, R <sub>L</sub> =1.0kΩ							
		MUN5233							
Input Resistor	R <sub>I</sub>		MUN5211	7.0	10	13	kΩ		
			MUN5212	15.4	22	28.6			
			MUN5213	32.9	47	61.1			
			MUN5214	7.0	10	13			
			MUN5215	7.0	10	13			
			MUN5216	3.3	4.7	6.1			
			MUN5230	0.7	1.0	1.3			
			MUN5231	1.5	2.2	2.9			
			MUN5232	3.3	4.7	6.1			
			MUN5233	3.3	4.7	6.1			
			MUN5234	15.4	22	28.6			
			MUN5235	1.54	2.2	2.86			
			MUN5236	70	100	130			
			MUN5237	32.9	47	61.1			



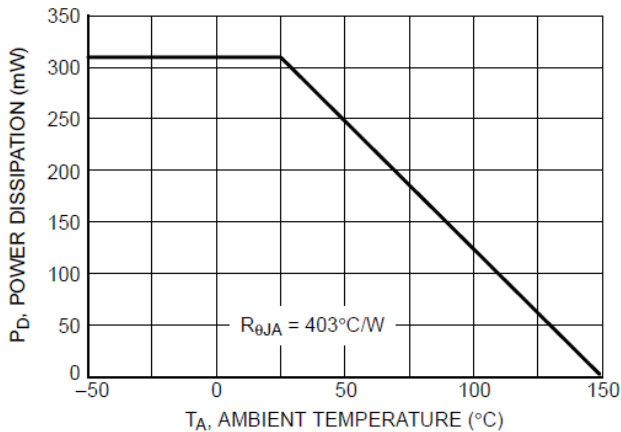
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>ON CHARACTERISTICS</b> <small>NOTE3</small>							
	R <sub>2</sub>		MUN5211		10		kΩ
			MUN5212		22		
			MUN5213		47		
			MUN5214		47		
			MUN5215		∞		
			MUN5216		∞		
			MUN5230	-	1	-	
			MUN5231		2.2		
			MUN5232		4.7		
			MUN5233		47		
			MUN5234		47		
			MUN5235		47		
			MUN5236		100		
			MUN5237		22		
Resistor Ratio	R <sub>1</sub> /R <sub>2</sub>		MUN5211	0.8	1.0	1.2	-
			MUN5212				
			MUN5213				
			MUN5236				
			MUN5214	0.17	0.21	0.25	
			MUN5215	-	-	-	
			MUN5216				
			MUN5230				
			MUN5231	0.8	1.0	1.2	
			MUN5232				
			MUN5233	0.055	0.1	0.185	
			MUN5234	0.38	0.47	0.56	
			MUN5235	0.038	0.047	0.056	
MUN5237	1.7	2.1	2.6				

NOTE3: Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%



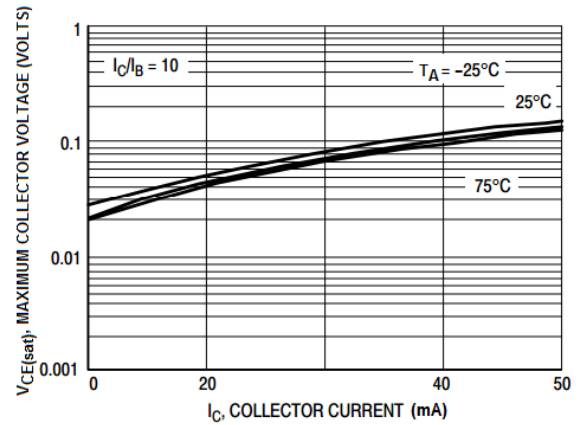
## TYPICAL CHARACTERISTICS

### 1. Derating Curve

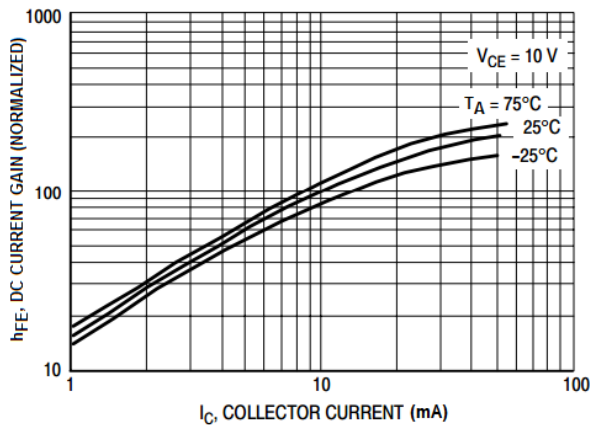


### MUN5211

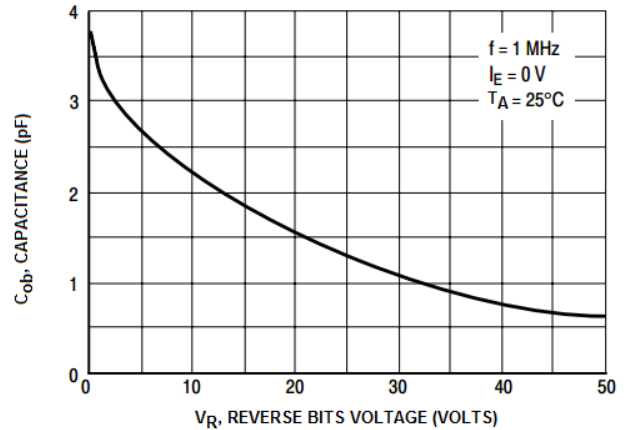
### 2. $V_{CE(sat)}$ vs. $I_C$



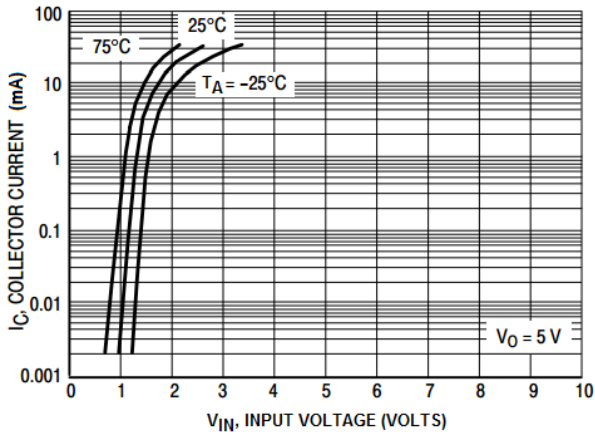
### 3. DC Current Gain



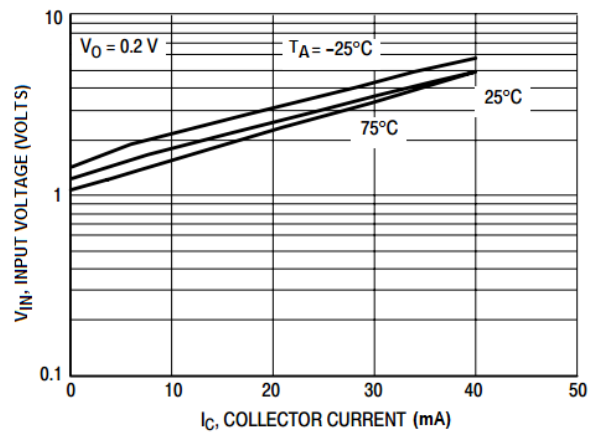
### 4. Output Capacitance



### 5. Output Current vs. Input Voltage



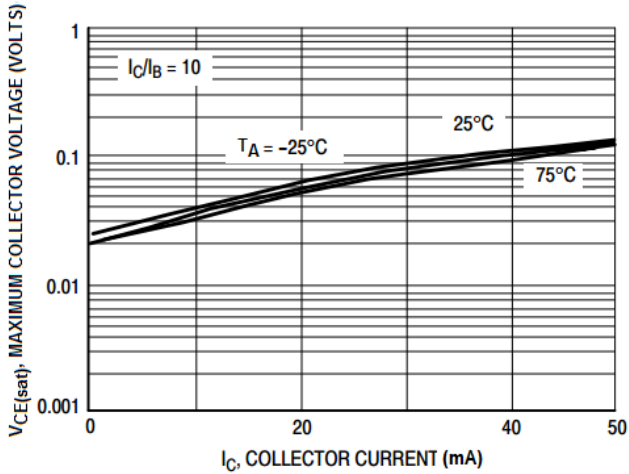
### 6. Input Voltage vs. Output Current



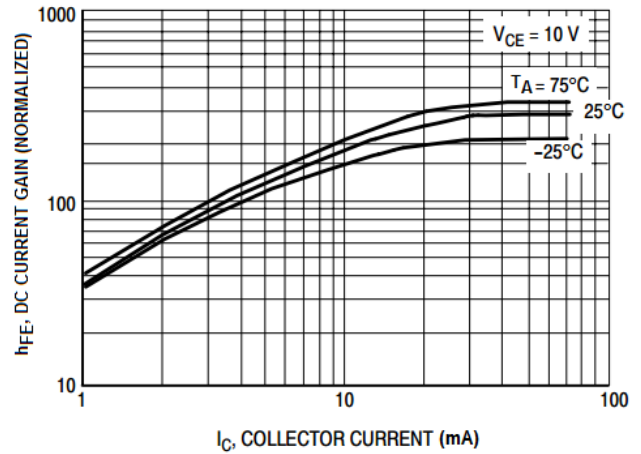


### MUN5212

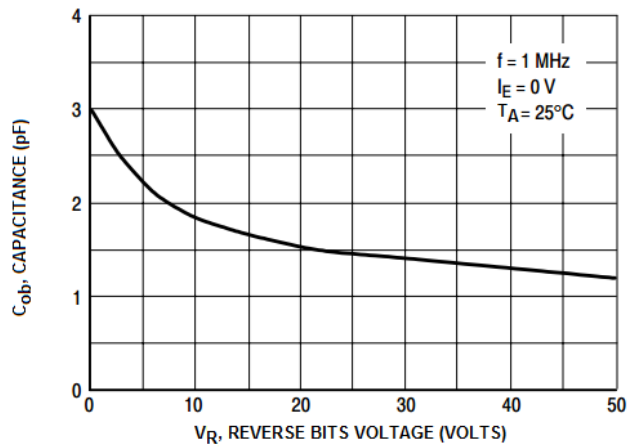
#### 7. $V_{CE(sat)}$ vs. $I_C$



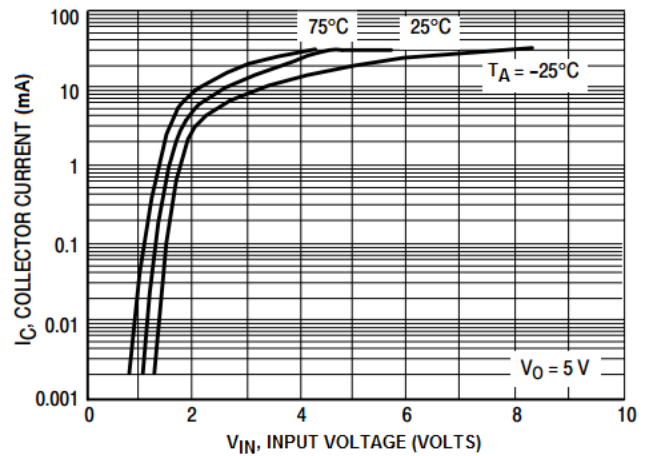
#### 8. DC Current Gain



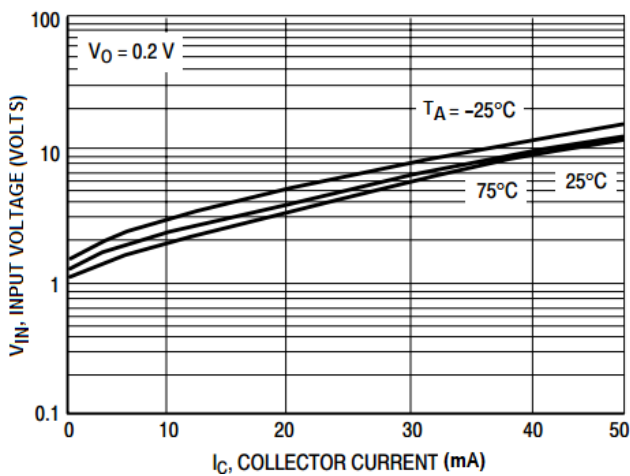
#### 9. Output Capacitance



#### 10. Output Current vs. Input Voltage



#### 11. Input Voltage vs. Output Current

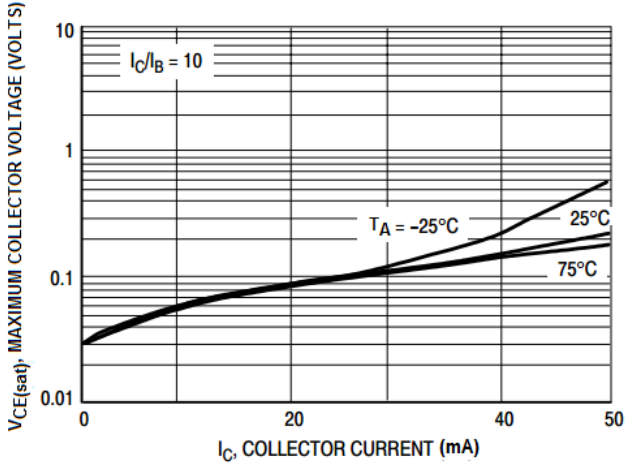




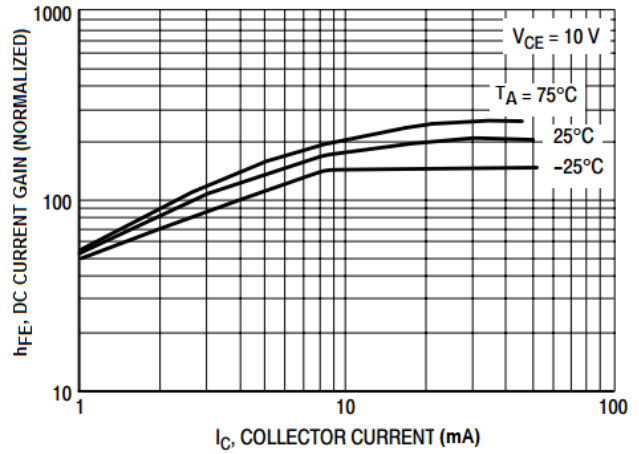


**MUN5213**

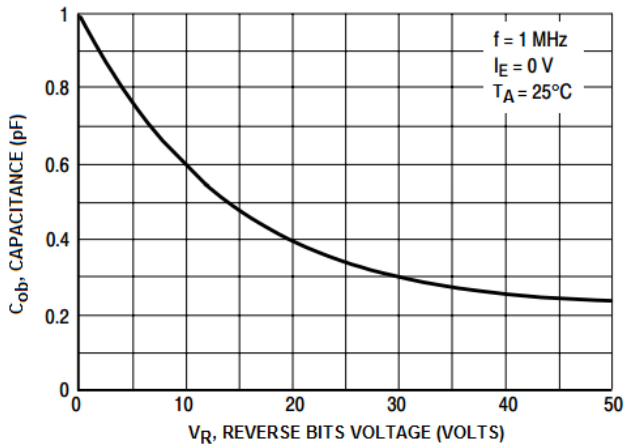
12.  $V_{CE(sat)}$  vs.  $I_C$



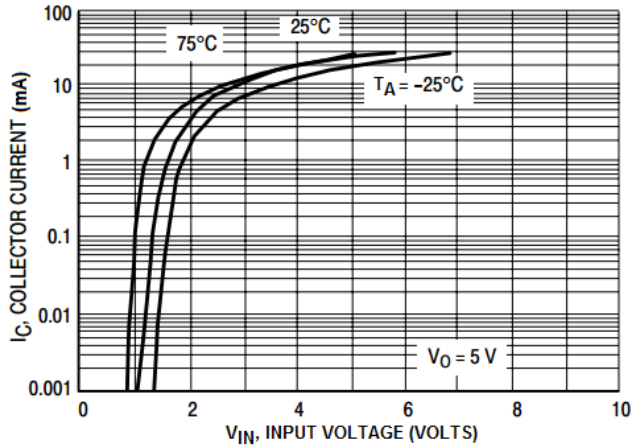
13. DC Current Gain



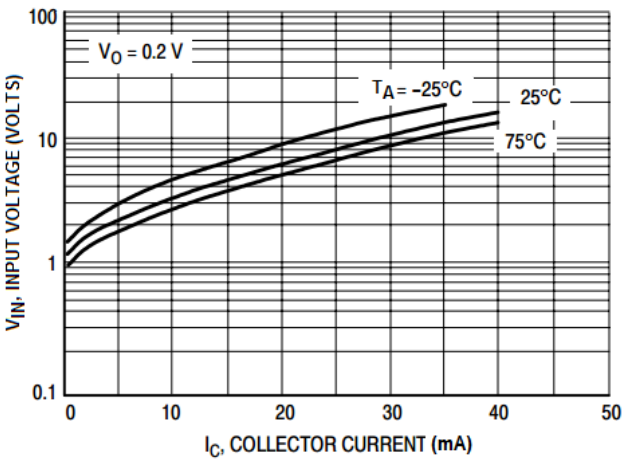
14. Output Capacitance



15. Output Current vs. Input Voltage



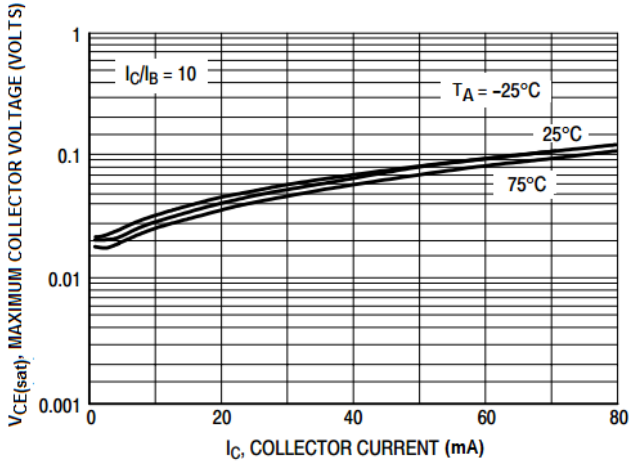
16. Input Voltage vs. Output Current



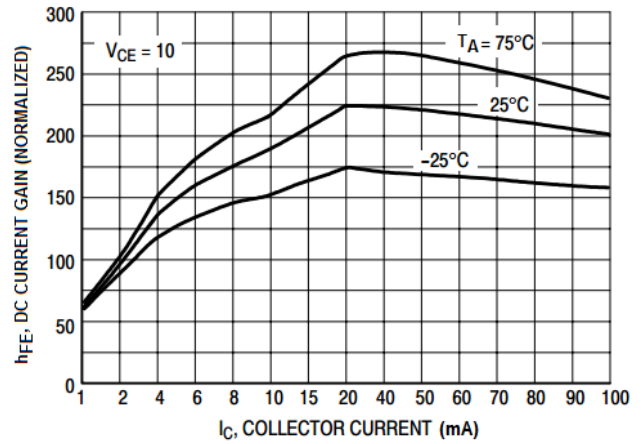


**MUN5214**

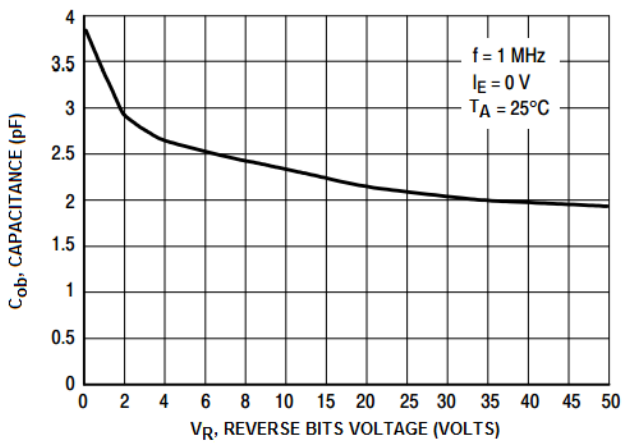
17.  $V_{CE(sat)}$  vs.  $I_C$



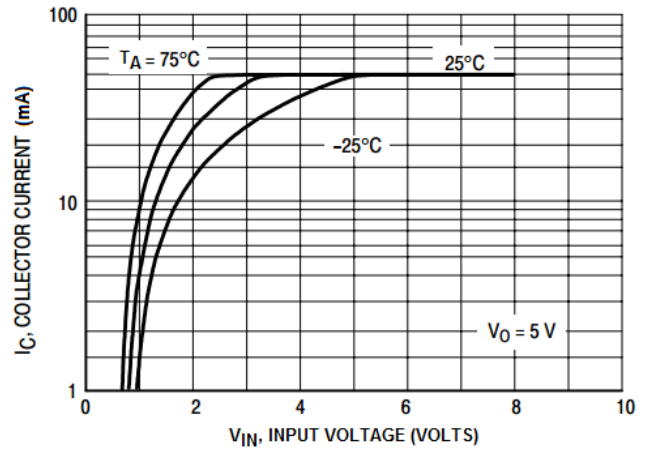
18. DC Current Gain



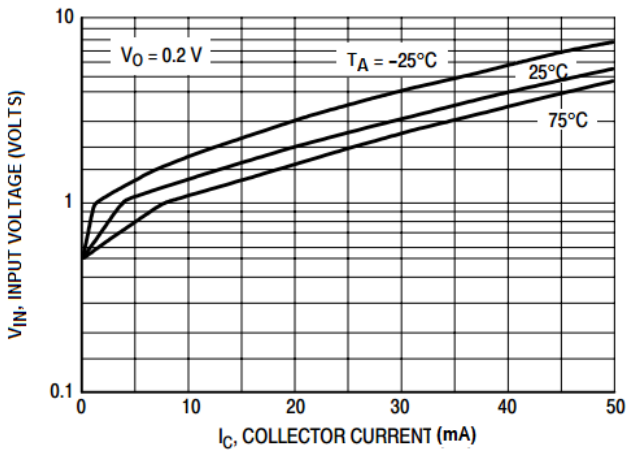
19. Output Capacitance



20. Output Current vs. Input Voltage



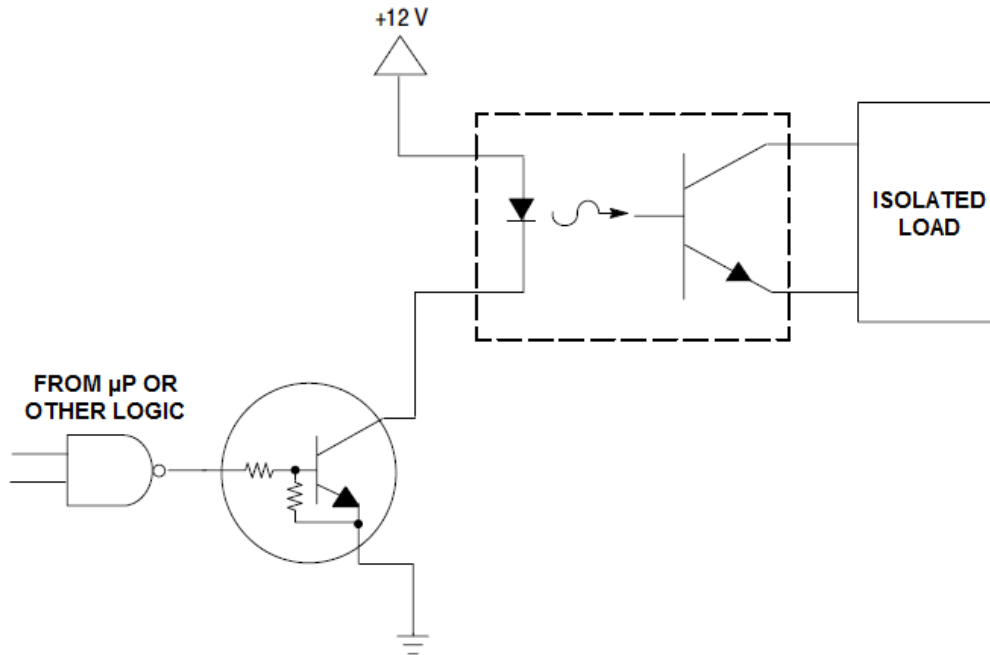
21. Input Voltage vs. Output Current



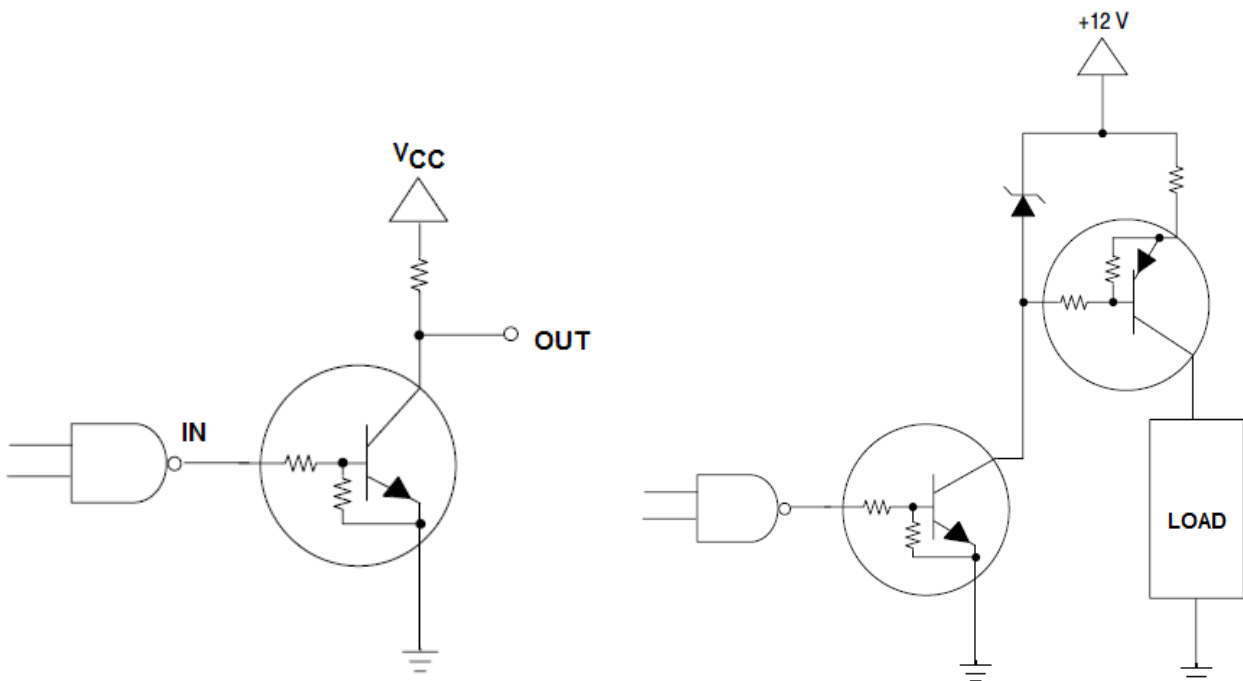


## TYPICAL APPLICATIONS FOR NPN BRTs

22. Level Shifter: Connects 12 or 24 Volt Circuits to Logic



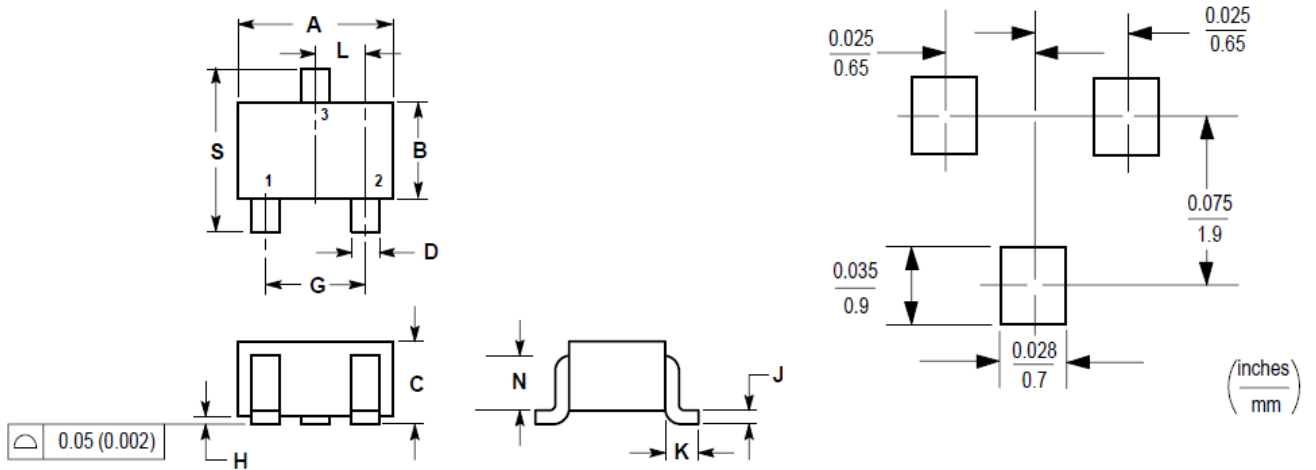
23. Open Collector Inverter: Inverts the Input Signal    24. Inexpensive, Unregulated Current Source





**PACKAGE INFORMATION**

Dimension in SC-70 Package (Unit: mm)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.80	2.20	0.071	0.087
B	1.15	1.35	0.045	0.053
C	0.80	1.00	0.032	0.040
D	0.30	0.40	0.012	0.016
G	1.20	1.40	0.047	0.055
H	0.00	0.10	0.000	0.004
J	0.10	0.25	0.004	0.010
K	0.425REF		0.017REF	
L	0.650BSC		0.026BSC	
N	0.700REF		0.028REF	
S	2.00	2.40	0.079	0.095



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