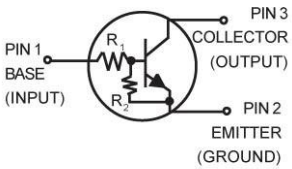
NPN Silicon Surface Mount Transistor

Bias Resistor Transistor

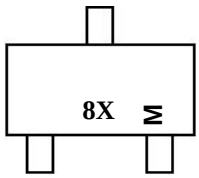
NPN Silicon Surface Mount Transistor with Monolithic Bias Resistor Network

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/SOT–323 package which is designed for low power surface mount applications.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SC–70/SOT–323 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 8 mm embossed tape and reel
  Use the Device Number to order the 7 inch/3000 unit reel.
- Pb-Free package is available



MARKING DIAGRAM



8x = Specific Device Code
x = (See Marking Table)
M= Date Code

DEVICE MARKING INFORMATION

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

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

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	Symbol	Max	Unit
Total Device Dissipation T_A = 25°C Derate above 25°C	P_D	202 (Note 1.) 310 (Note 2.) 1.6 (Note 1.) 2.5 (Note 2.)	mW mW/°C
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	618 (Note 1.) 403 (Note 2.)	°C/W
Thermal Resistance – Junction-to-Lead	$R_{\theta JL}$	280 (Note 1.) 332 (Note 2.)	°C/W
Junction and Storage Temperature Range	T_J, T_{stg}	–55 to +150	°C

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

NPN Silicon Surface Mount Transistor

DEVICE MARKING RESISTOR VALUES AND ORDERING INFORMATION

Device	Package	Marking	R1(K)	R2(K)	Shipping
METR5211	SC-70/SOT-323	8A	10	10	3000/Tape&Reel
METR5212	SC-70/SOT-323	8B	22	22	3000/Tape&Reel
METR5213	SC-70/SOT-323	8C	47	47	3000/Tape&Reel
METR5214	SC-70/SOT-323	8D	10	47	3000/Tape&Reel
METR5215(Note 3)	SC-70/SOT-323	8E	10	∞	3000/Tape&Reel
METR5216(Note 3)	SC-70/SOT-323	8F	4.7	∞	3000/Tape&Reel
METR5230(Note 3)	SC-70/SOT-323	8G	1	1	3000/Tape&Reel
METR5231(Note 3)	SC-70/SOT-323	8H	2.2	2.2	3000/Tape&Reel
METR5232(Note 3)	SC-70/SOT-323	8J	4.7	4.7	3000/Tape&Reel
METR5233(Note 3)	SC-70/SOT-323	8K	4.7	47	3000/Tape&Reel
METR5234(Note 3)	SC-70/SOT-323	8L	22	47	3000/Tape&Reel
METR5235(Note 3)	SC-70/SOT-323	8M	2.2	47	3000/Tape&Reel
METR5236(Note 3)	SC-70/SOT-323	8N	100	100	3000/Tape&Reel
METR5237(Note 3)	SC-70/SOT-323	8P	47	22	3000/Tape&Reel

3. New devices. Updated curves to follow in subsequent data sheets.

NPN Silicon Surface Mount Transistor

METR52xx Series

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

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)	METR5211	I_{EBO}	–	–	0.5	mAdc
	METR5212		–	–	0.2	
	METR5213		–	–	0.1	
	METR5214		–	–	0.2	
	METR5215		–	–	0.9	
	METR5216		–	–	1.9	
	METR5230		–	–	4.3	
	METR5231		–	–	2.3	
	METR5232		–	–	1.5	
	METR5233		–	–	0.18	
	METR5234		–	–	0.13	
	METR5235		–	–	0.2	
	METR5236		–	–	0.05	
	METR5237		–	–	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
ON CHARACTERISTICS (Note 4.)						
DC Current Gain (V_{CE} = 10 V, I_C = 5.0 m	METR5211	h_{FE}	35	60	–	
	METR5212		60	100	–	
	METR5213		80	140	–	
	METR5214		80	140	–	
	METR5215		160	350	–	
	METR5216		160	350	–	
	METR5230		3.0	5.0	–	
	METR5231		8.0	15	–	
	METR5232		15	30	–	
	METR5233		80	200	–	
	METR5234		80	150	–	
	METR5235		80	140	–	
	METR5236		80	150	–	
	METR5237		80	140	–	
Collector-Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.3 mA) (I_C = 10 mA, I_B = 5 mA) METR5230/METR5231 (I_C = 10 mA, I_B = 1 mA) METR5215/METR5216/ METR5232/METR5233/METR5234		$V_{CE(sat)}$	–	–	0.25	Vdc
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ)	METR5211		–	–	0.2	
	METR5212		–	–	0.2	
	METR5214		–	–	0.2	
	METR5215		–	–	0.2	
	METR5216		–	–	0.2	
	METR5230		–	–	0.2	
	METR5231		–	–	0.2	
	METR5232		–	–	0.2	
	METR5233		–	–	0.2	
	METR5234		–	–	0.2	
	METR5235		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 kΩ)	METR5213		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 5.5 V, R_L = 1.0 kΩ)	METR5236		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 4.0 V, R_L = 1.0 kΩ)	METR5237		–	–	0.2	

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

NPN Silicon Surface Mount Transistor

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 5.) (Continued)						
Output Voltage (off) (V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 kΩ) (V_{CC} = 5.0 V, V_B = 0.050 V, R_L = 1.0 kΩ) (V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	METR5230 METR5215 METR5216 METR5233	V_{OH}	4.9	–	–	Vdc
Input Resistor	METR5211	R_1	7.0	10	13	kΩ
	METR5212		15.4	22	28.6	
	METR5213		32.9	47	61.1	
	METR5214		7.0	10	13	
	METR5215		7.0	10	13	
	METR5216		3.3	4.7	6.1	
	METR5230		0.7	1.0	1.3	
	METR5231		1.5	2.2	2.9	
	METR5232		3.3	4.7	6.1	
	METR5233		3.3	4.7	6.1	
	METR5234		15.4	22	28.6	
	METR5235		1.54	2.2	2.86	
	METR5236		70	100	130	
	METR5237		32.9	47	61.1	
Resistor Rati	METR5211/METR5212/METR5213/	R_1/R_2				
	METR5236		0.8	1.0	1.2	
	METR5214		0.17	0.21	0.25	
	METR5215/METR5216		–	–	–	
	METR5230/METR5231/METR5232		0.8	1.0	1.2	
	METR5233		0.055	0.1	0.185	
	METR5234		0.38	0.47	0.56	
	METR5235		0.038	0.047	0.056	
	METR5237		1.7	2.1	2.6	

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

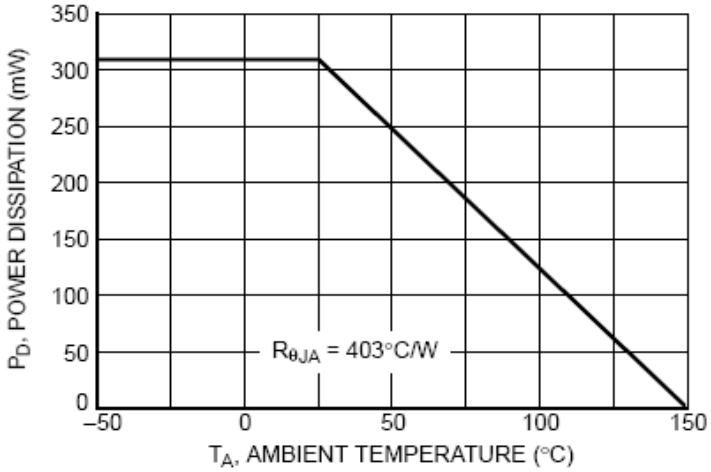


Figure 1. Derating Curve

NPN Silicon Surface Mount Transistor

TYPICAL ELECTRICAL CHARACTERISTICS – METR5211

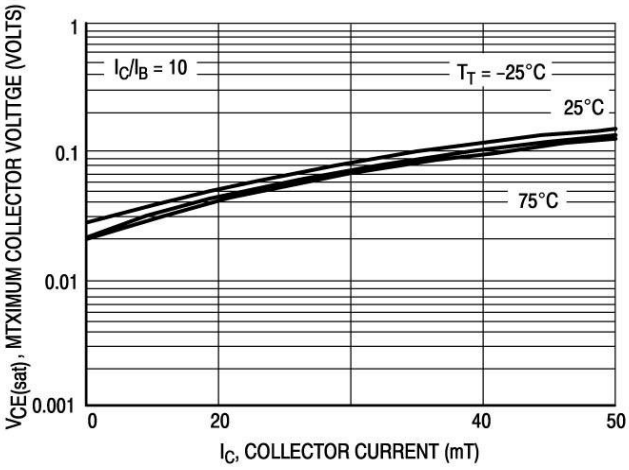


Figure 2. $V_{CE(sat)}$ versus I_C

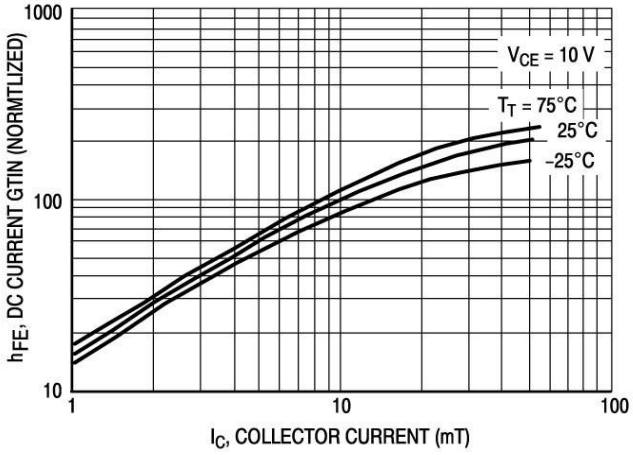


Figure 3. DC Current Gain

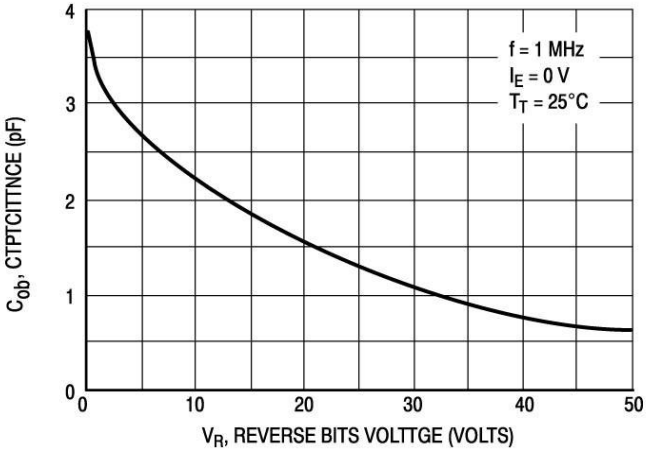


Figure 4. Output Capacitance

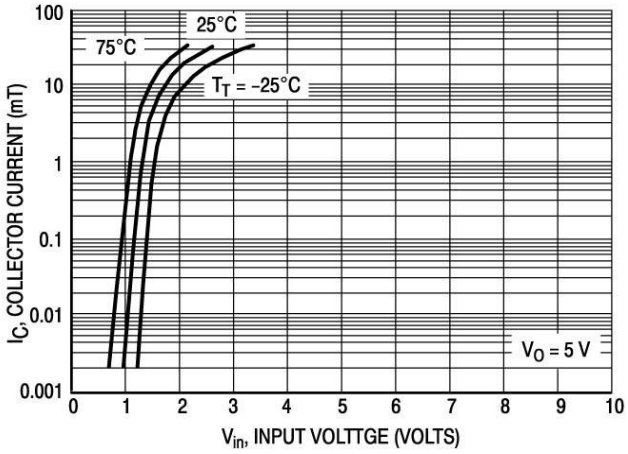


Figure 5. Output Current versus Input Voltage

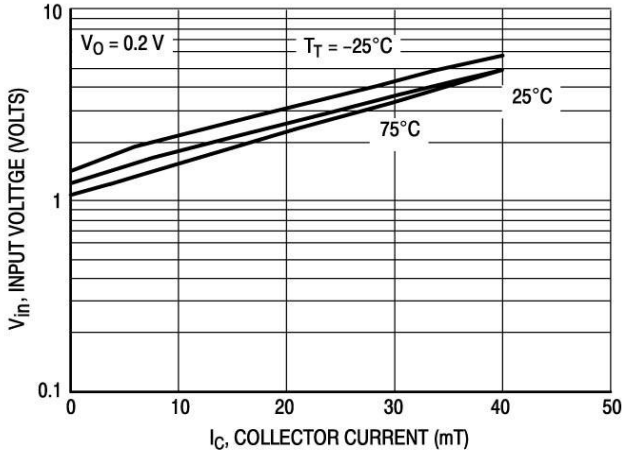


Figure 6. Input Voltage versus Output Current

NPN Silicon Surface Mount Transistor

TYPICAL ELECTRICAL CHARACTERISTICS – METR5212

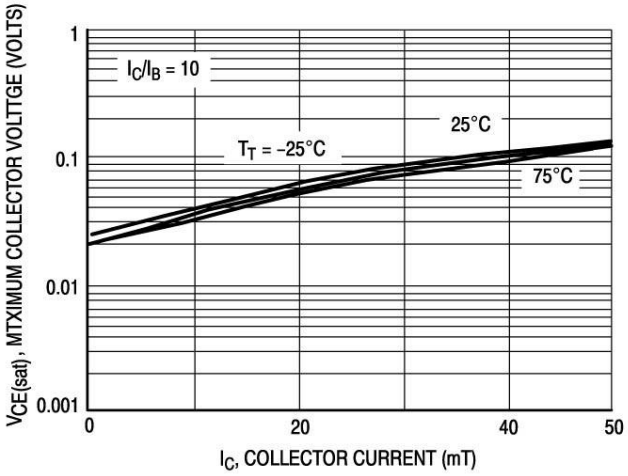


Figure 7. $V_{CE(sat)}$ versus I_C

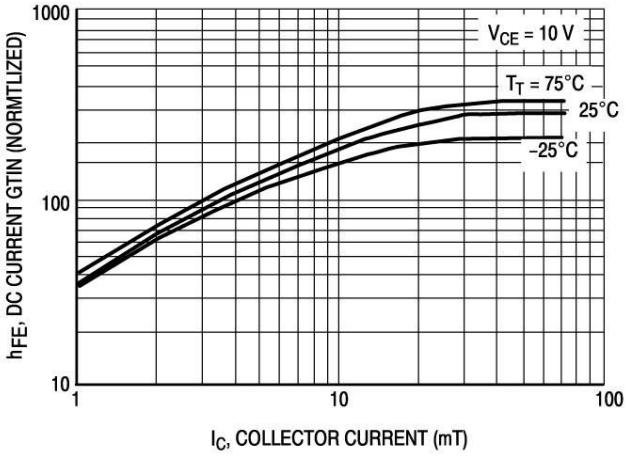


Figure 8. DC Current Gain

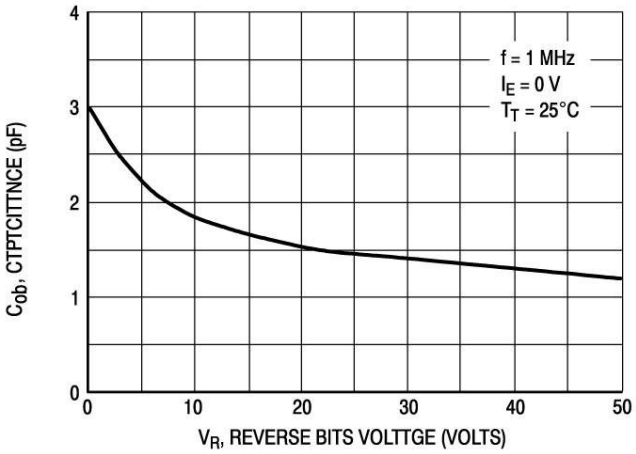


Figure 9. Output Capacitance

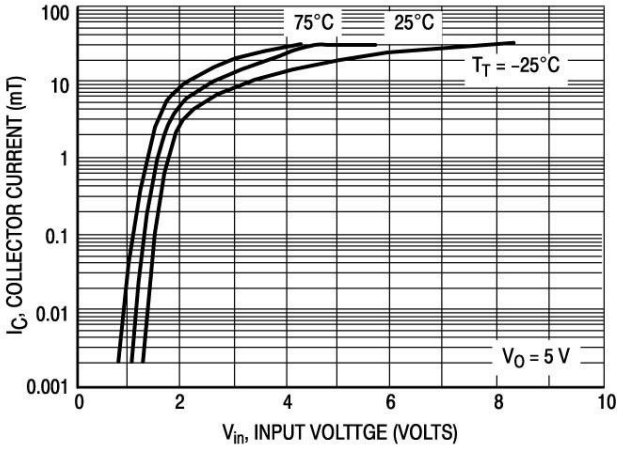


Figure 10. Output Current versus Input Voltage

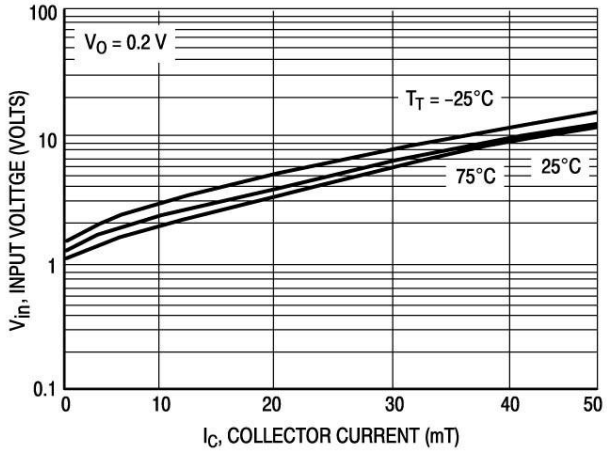


Figure 11. Input Voltage versus Output Current

NPN Silicon Surface Mount Transistor

METR52xx Series

TYPICAL ELECTRICAL CHARACTERISTICS – METR5213

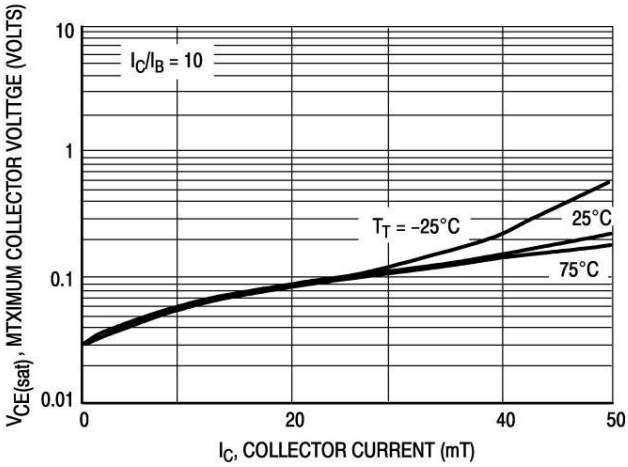


Figure 12. $V_{CE(sat)}$ versus I_C

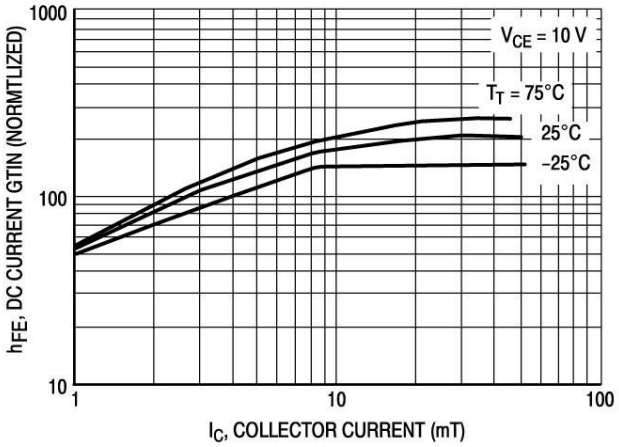


Figure 13. DC Current Gain

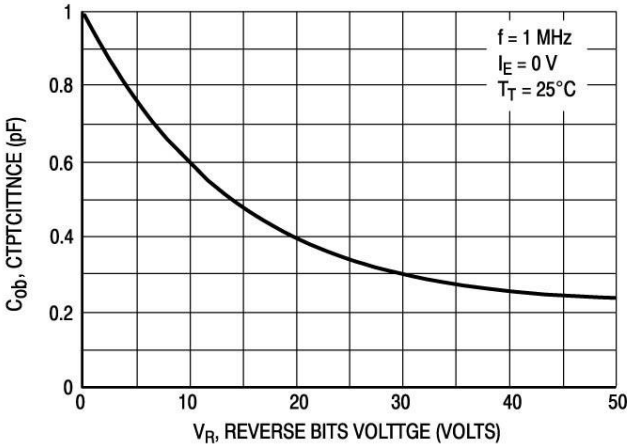


Figure 14. Output Capacitance

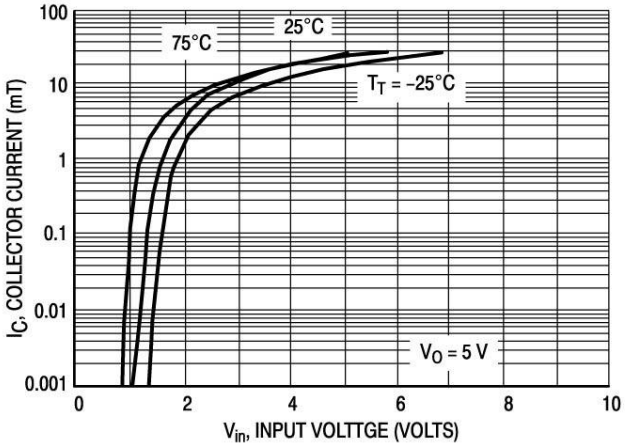


Figure 15. Output Current versus Input Voltage

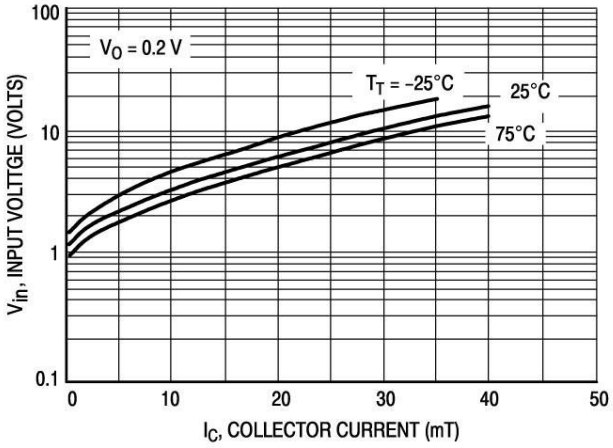


Figure 16. Input Voltage versus Output Current

NPN Silicon Surface Mount Transistor

TYPICAL ELECTRICAL CHARACTERISTICS – METR5214

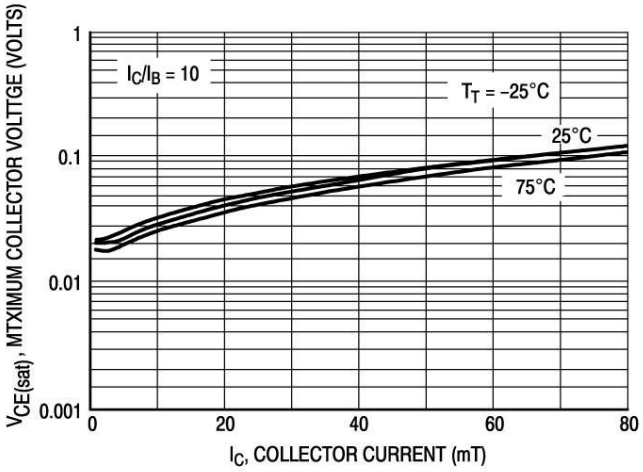


Figure 17. $V_{CE(sat)}$ versus I_C

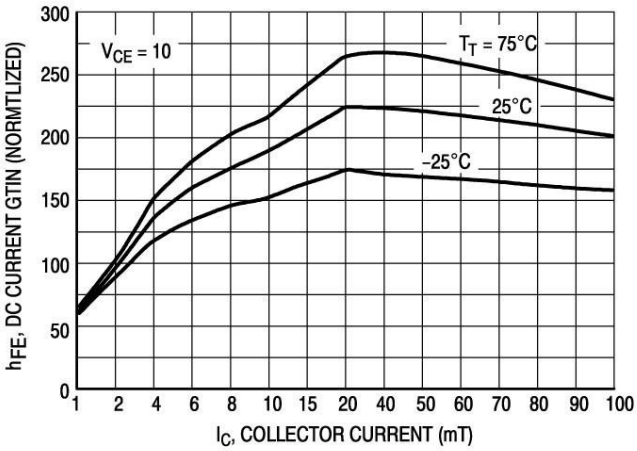


Figure 18. DC Current Gain

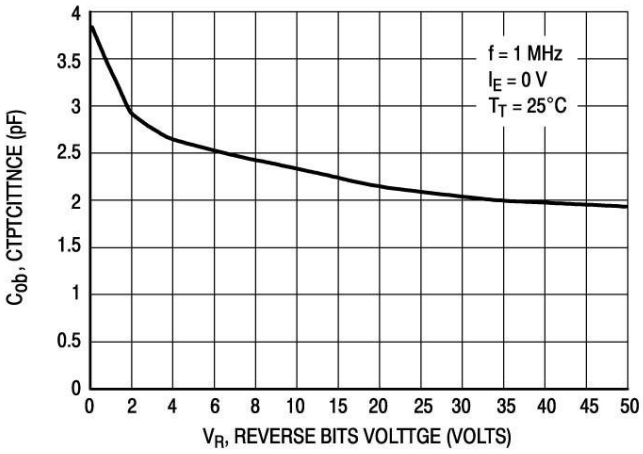


Figure 19. Output Capacitance

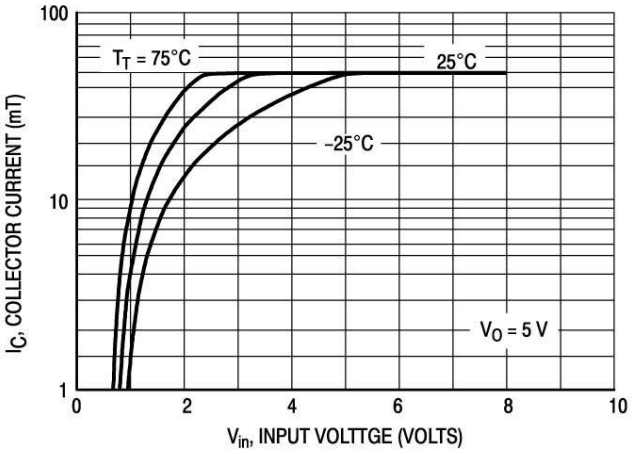


Figure 20. Output Current versus Input Voltage

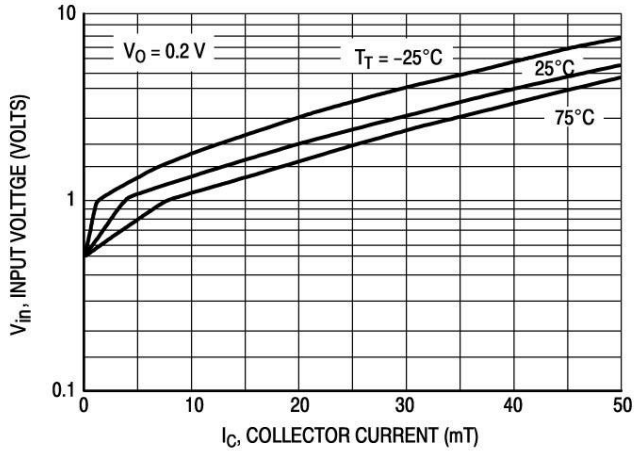


Figure 21. Input Voltage versus Output Current

NPN Silicon Surface Mount Transistor

TYPICAL APPLICATIONS FOR NPN BRTs

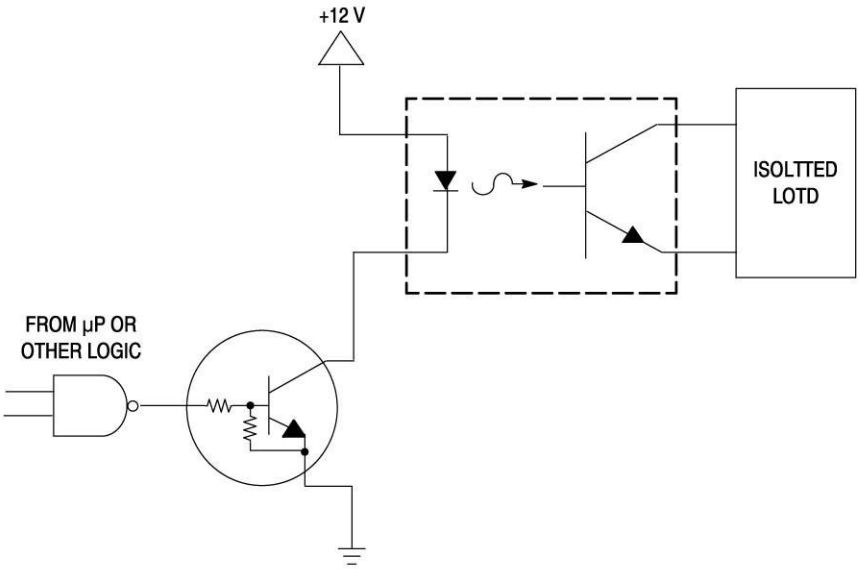


Figure 22. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

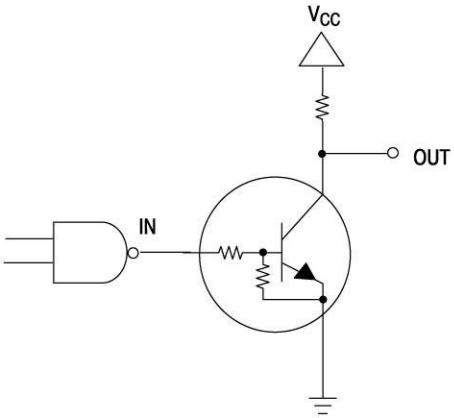


Figure 23. Open Collector Inverter: Inverts the Input Signal

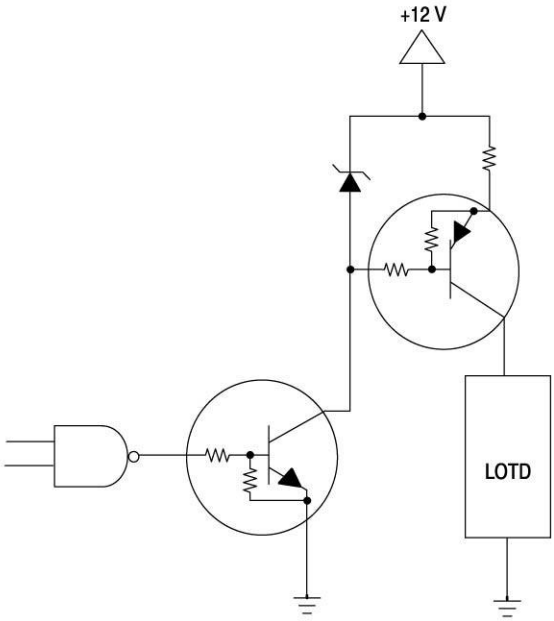
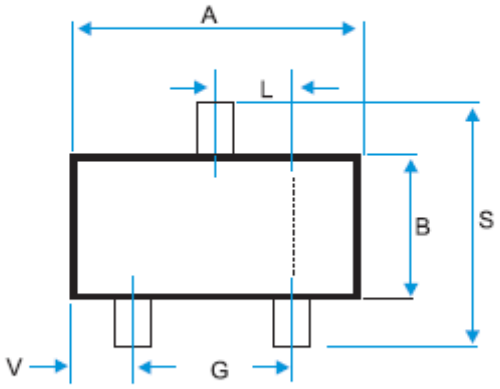
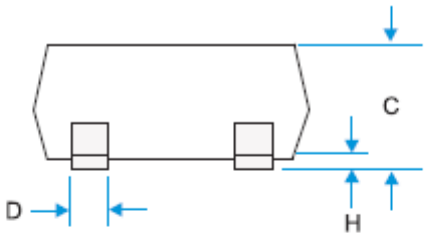


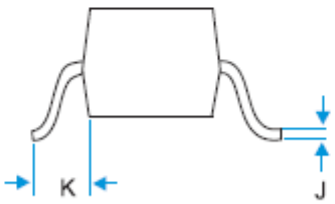
Figure 24. Inexpensive, Unregulated Current Source

NPN Silicon Surface Mount Transistor

SOT-323 Package Outline



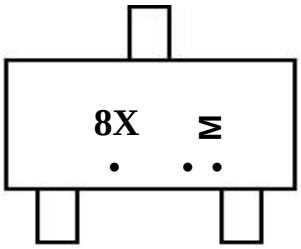




DIM	MILLIMETERS	
	MIN	MAX
A	1.80	2.20
B	1.15	1.35
C	0.80	1.10
D	0.20	0.40
G	1.20	1.40
H	0.00	0.10
J	0.05	0.25
K	0.425 REF	
L	0.650 BSC	
S	2.00	2.45
V	0.30	0.40

NPN Silicon Surface Mount Transistor

Device name:METR52xx-G
Package:SOT-323
Marking Code:



8X: Device Marking Code
M: Date Code

MONTH CODE

ODD YEARS(2007,2009)

Jan	1
Feb	2
Mar	3
Apr	4
May	5
Jun	6
Jul	7
Aug	8
Sep	9
Oct	T
Nov	V
Dec	C

EVEN YEARS(2008,2010)

Jan	E
Feb	F
Mar	H
Apr	J
May	K
Jun	L
Jul	N
Aug	P
Sep	U
Oct	X
Nov	Y
Dec	Z