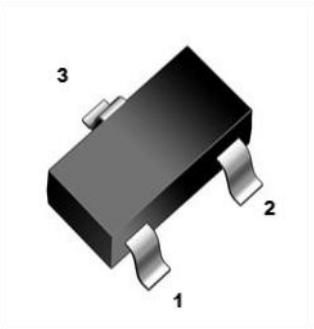
# MMUN2211 THRU MMUN2241

**NPN Plastic-Encapsulate Transistors**

## 1. Features

SOT-23

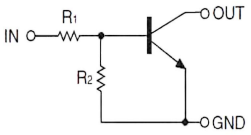
- for switching and interface circuit and drive circuit applications




## 2. Mechanical Data

- Case:Molded Plastic,SOT-23 .
- Epoxy:UL 94V-0 rate flame retardant.
- Terminals:Plated Leads Solderable per MIL-STD-750,Method-2026.
- Mounting Position : Any.

1 base(IN)
2 emitter(GND)
3 collector(OUT)




## 3. Maximum Ratings

Electrical Characteristics Rating at 25℃ ambient temperature unless otherwise specified.

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $BV_{CBO}$ | 50 | V |
| Collector-Emitter Voltage | $BV_{CEO}$ | 50 | V |
| Collector Current | $I_C$ | 100 | mA |
| Total Power Dissipation | $P_{tot}$ | 200 | mW |
| Junction Temperature | $T_j$ | -55～+150 | ℃ |
| Storage Temperature | $T_{stg}$ | -55～+150 | ℃ |

**Resistor Values**

| Type | Marking | R1 (KΩ) | R2 (KΩ) |
|---|---|---|---|
| MMUN2211 | A8A | 10 | 10 |
| MMUN2212 | A8B | 22 | 22 |
| MMUN2213 | A8C | 47 | 47 |
| MMUN2214 | A8D | 10 | 47 |
| MMUN2215 | A8E | 10 | ∞ |
| MMUN2216 | A8F | 4.7 | ∞ |
| MMUN2230 | A8G | 1 | 1 |
| MMUN2231 | A8H | 2.2 | 2.2 |
| MMUN2232 | A8J | 4.7 | 4.7 |
| MMUN2233 | A8K | 4.7 | 47 |
| MMUN2234 | A8L | 22 | 47 |
| MMUN2235 | A8M | 2.2 | 47 |
| MMUN2238 | A8R | 2.2 | ∞ |
| MMUN2241 | A8U | 100 | ∞ |

## 4. Electrical Characteristics ($T_a$=25℃ unless otherwise noted)

| Characteristics | | Symbol | Condition | Min | TYP | Max | Unit |
|---|---|---|---|---|---|---|---|
| Collector cut-off current | | $I_{CBO}$ | $V_{CB}$=50V | - | - | 100 | nA |
| Collector Emitter Cutoff Current | | $I_{CEO}$ | $V_{CE}$=50V | - | - | 500 | nA |
| DC current gain | MMUN2211 | $h_{FE}$ | $V_{CE}$=10V，$I_C$=5mA | 35 | - | - | - |
| | MMUN2212 | | | 60 | - | - | - |
| | MMUN2213 | | | 80 | - | - | - |
| | MMUN2214 | | | 80 | - | - | - |
| | MMUN2215 | | | 160 | - | - | - |
| | MMUN2216 | | | 160 | - | - | - |
| | MMUN2230 | | | 3 | - | - | - |
| | MMUN2231 | | | 8 | - | - | - |
| | MMUN2232 | | | 15 | - | - | - |
| | MMUN2233 | | | 80 | - | - | - |
| | MMUN2234 | | | 80 | - | - | - |
| | MMUN2235 | | | 80 | - | - | - |
| | MMUN2238 | | | 160 | - | - | - |
| | MMUN2241 | | | 160 | - | - | - |
| Emitter Base Cutoff Current | MMUN2211 | $I_{EBO}$ | $V_{EB}$ = 6 V | - | - | 0.5 | mA |
| | MMUN2212 | | | - | - | 0.2 | mA |
| | MMUN2213 | | | - | - | 0.1 | mA |
| | MMUN2214 | | | - | - | 0.2 | mA |
| | MMUN2215 | | | - | - | 0.9 | mA |
| | MMUN2216 | | | - | - | 1.9 | mA |
| | MMUN2230 | | | - | - | 4.3 | mA |
| | MMUN2231 | | | - | - | 2.3 | mA |
| | MMUN2232 | | | - | - | 1.5 | mA |
| | MMUN2233 | | | - | - | 0.18 | mA |
| | MMUN2234 | | | - | - | 0.13 | mA |
| | MMUN2235 | | | - | - | 0.2 | mA |
| | MMUN2238 | | | - | - | 4 | mA |
| | MMUN2241 | | | - | - | 0.1 | mA |
| Collector Base Breakdown Voltage | | $V_{(BR)CBO}$ | $I_C$=10μA | 50 | - | - | V |
| Collector Emitter Breakdown Voltage | | $V_{(BR)CEO}$ | $I_C$=2mA | 50 | - | - | V |
| Collector Emitter Saturation Voltage | | $V_{CE(sat)}$ | $I_C$=10mA，$I_B$=0.3mA | - | - | 0.25 | V |
| | MMUN2230 | | $I_C$=10mA，$I_B$=5mA | - | - | 0.25 | V |
| | MMUN2231 | | | - | - | 0.25 | V |
| | MMUN2215 | | $I_C$=10mA，$I_B$=1mA | - | - | 0.25 | V |
| | MMUN2216 | | | - | - | 0.25 | V |
| | MMUN2232 | | | - | - | 0.25 | V |
| | MMUN2233 | | | - | - | 0.25 | V |
| | MMUN2234 | | | - | - | 0.25 | V |
| | MMUN2235 | | | - | - | 0.25 | V |
| | MMUN2238 | | | - | - | 0.25 | V |

| Characteristics | | Symbol | Condition | Min | TYP | Max | Unit |
|---|---|---|---|---|---|---|---|
| Output Voltage (on) | MMUN2211 | $V_{OL}$ | $V_{CC}$=5V,$V_B$=2.5V,$R_L$=1KΩ | - | - | 0.2 | V |
| | MMUN2212 | | | - | - | 0.2 | V |
| | MMUN2214 | | | - | - | 0.2 | V |
| | MMUN2215 | | | - | - | 0.2 | V |
| | MMUN2216 | | | - | - | 0.2 | V |
| | MMUN2230 | | | - | - | 0.2 | V |
| | MMUN2231 | | | - | - | 0.2 | V |
| | MMUN2232 | | | - | - | 0.2 | V |
| | MMUN2233 | | | - | - | 0.2 | V |
| | MMUN2234 | | | - | - | 0.2 | V |
| | MMUN2235 | | | - | - | 0.2 | V |
| | MMUN2238 | | | - | - | 0.2 | V |
| | MMUN2213 | | $V_{CC}$=5V,$V_B$=3.5V,$R_L$=1KΩ | - | - | 0.2 | V |
| | MMUN2241 | | $V_{CC}$=5V,$V_B$=5V,$R_L$=1KΩ | - | - | 0.2 | V |
| Output Voltage (off) | | $V_{OH}$ | $V_{CC}$=5V,$V_B$=0.5V,$R_L$=1KΩ | 4.9 | - | - | V |
| | MMUN2230 | | $V_{CC}$=5V,$V_B$=0.05V,$R_L$=1KΩ | 4.9 | - | - | V |
| | MMUN2215 | | $V_{CC}$=5V,$V_B$=0.25V,$R_L$=1KΩ | 4.9 | - | - | V |
| | MMUN2216 | | | 4.9 | - | - | V |
| | MMUN2233 | | | 4.9 | - | - | V |
| | MMUN2238 | | | 4.9 | - | - | V |
| Input Resistor | MMUN2211 | $R_1$ | - | 7 | - | 13 | KΩ |
| | MMUN2212 | | | 15.4 | - | 28.6 | KΩ |
| | MMUN2213 | | | 32.9 | - | 61.1 | KΩ |
| | MMUN2214 | | | 7 | - | 13 | KΩ |
| | MMUN2215 | | | 7 | - | 13 | KΩ |
| | MMUN2216 | | | 3.3 | - | 6.1 | KΩ |
| | MMUN2230 | | | 0.7 | - | 1.3 | KΩ |
| | MMUN2231 | | | 1.5 | - | 2.9 | KΩ |
| | MMUN2232 | | | 3.3 | - | 6.1 | KΩ |
| | MMUN2233 | | | 3.3 | - | 6.1 | KΩ |
| | MMUN2234 | | | 15.4 | - | 28.6 | KΩ |
| | MMUN2235 | | | 1.54 | - | 2.86 | KΩ |
| | MMUN2238 | | | 1.54 | - | 2.88 | KΩ |
| | MMUN2241 | | | 70 | - | 130 | KΩ |
| Resistor Ratio | MMUN2211/MMUN2212/MMUN2213 | R1/R2 | - | 0.8 | - | 1.2 | - |
| | MMUN2214 | | | 0.17 | - | 0.25 | - |
| | MMUN2215/MMUN2216/MMUN2238 | | | - | - | - | - |
| | MMUN2241 | | | - | - | - | - |
| | MMUN2230/MMUN2231/MMUN2232 | | | 0.8 | - | 1.2 | - |
| | MMUN2233 | | | 0.055 | - | 0.185 | - |
| | MMUN2234 | | | 0.38 | - | 0.56 | - |
| | MMUN2235 | | | 0.038 | - | 0.056 | - |

## 5. Rating And Characteristic Curves

**MMUN2211**

Figure 1. Derating Curve

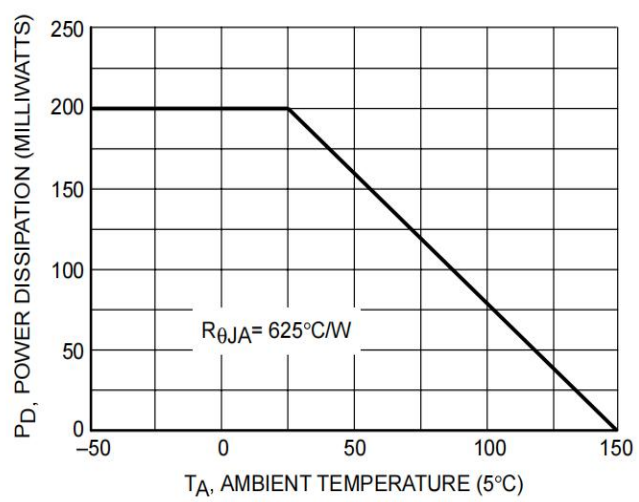



Figure 2. VCE(sat) vs. IC

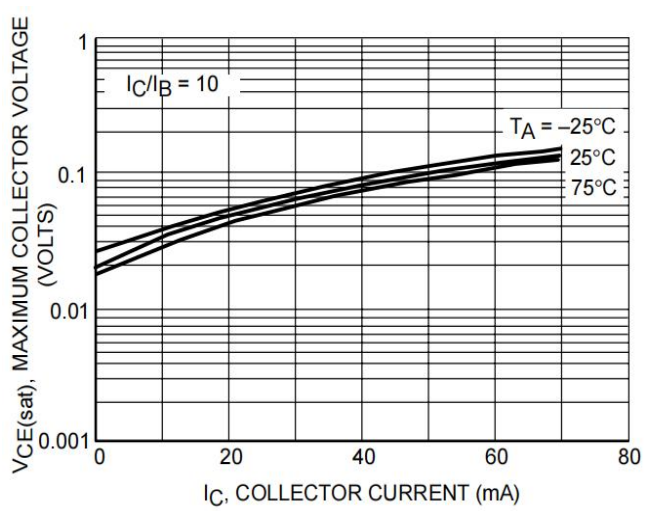



Figure 3. DC Current Gain

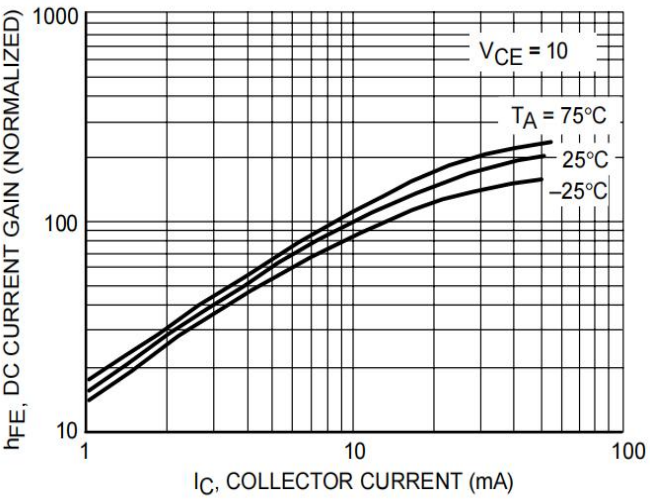



Figure 4. Output Capcitance

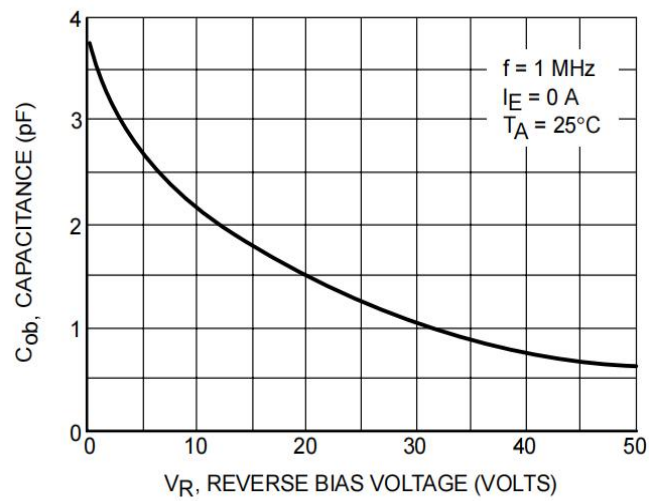



Figure 5. Output Current vs. Input Voltage

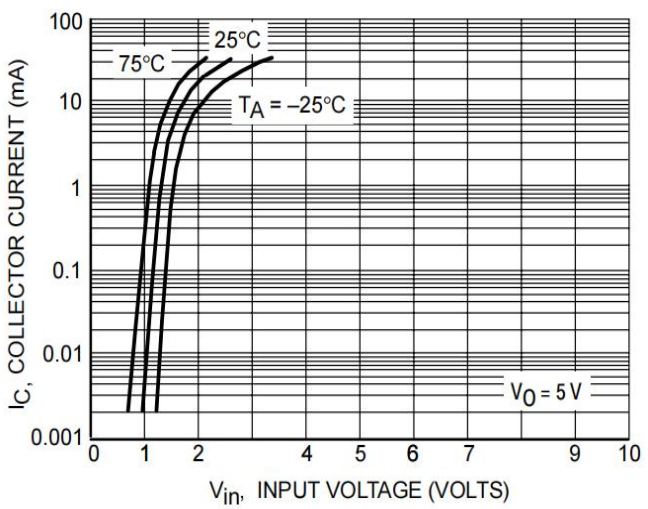
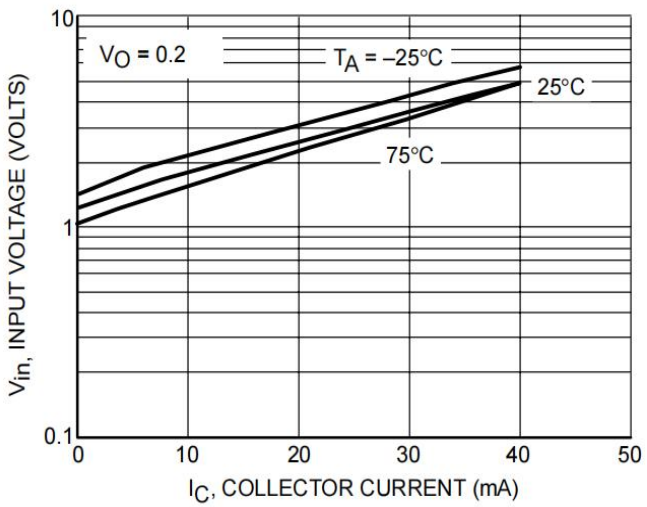



Figure 6. Input Voltage vs. Output Current



**MMUN2212**

Figure 7. VCE(sat) vs. IC

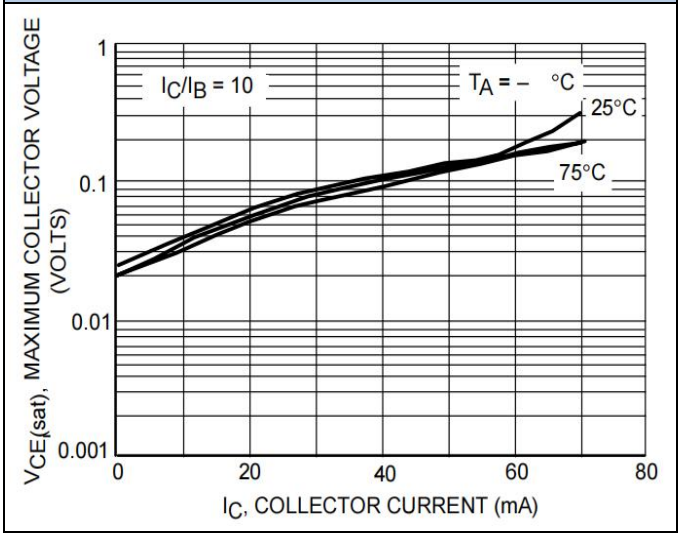



Figure 8. DC Current Gain

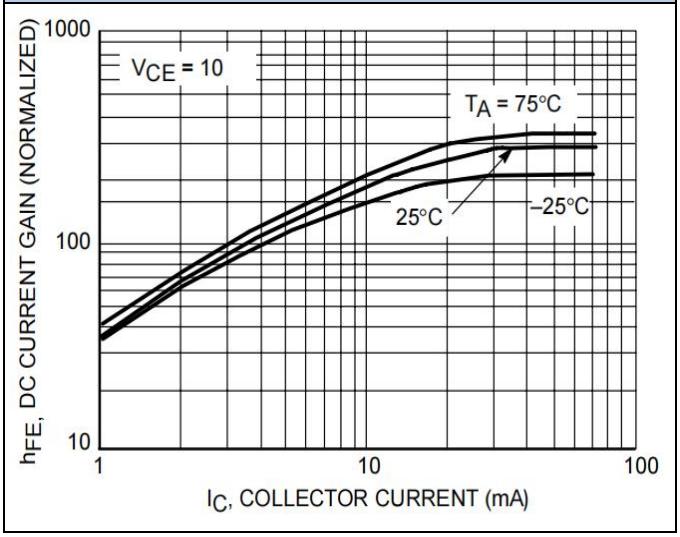



Figure 9. Output Capacitance

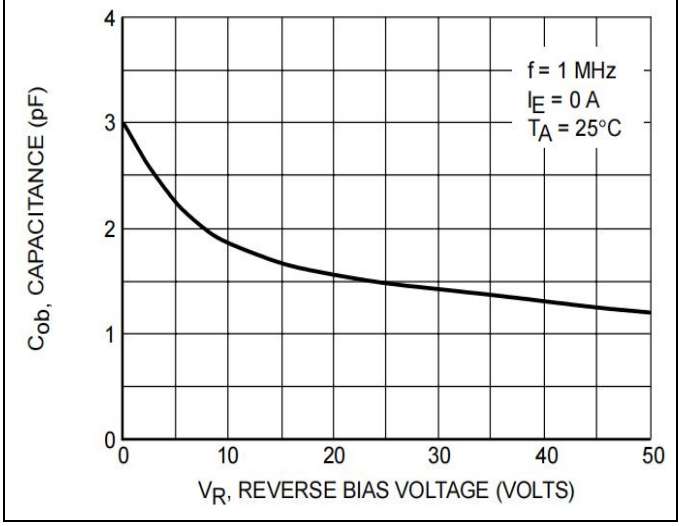



Figure 10. Output Current vs. Input Voltage

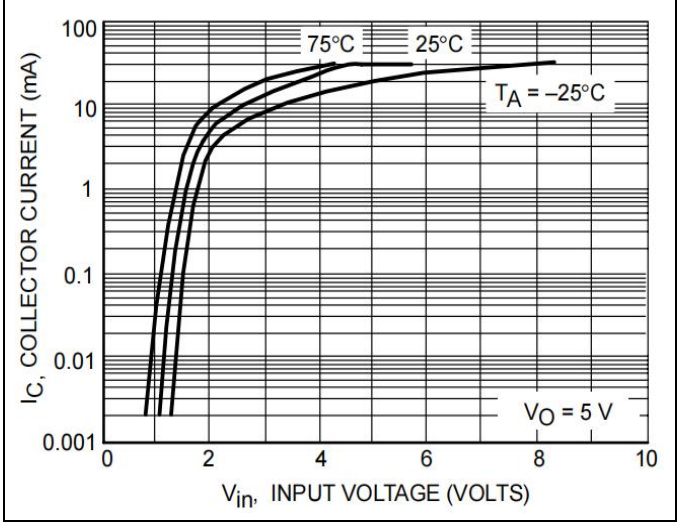
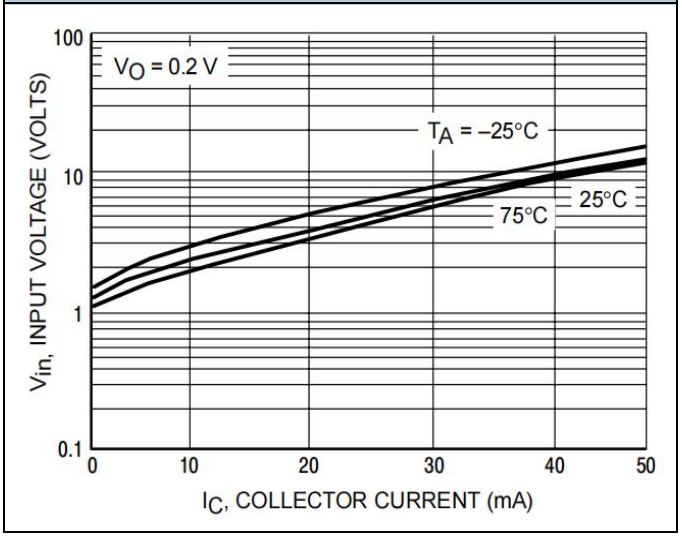



Figure 11. Input Voltage vs. Output Current



**MMUN2213**

Figure 12. VCE(sat) vs. IC

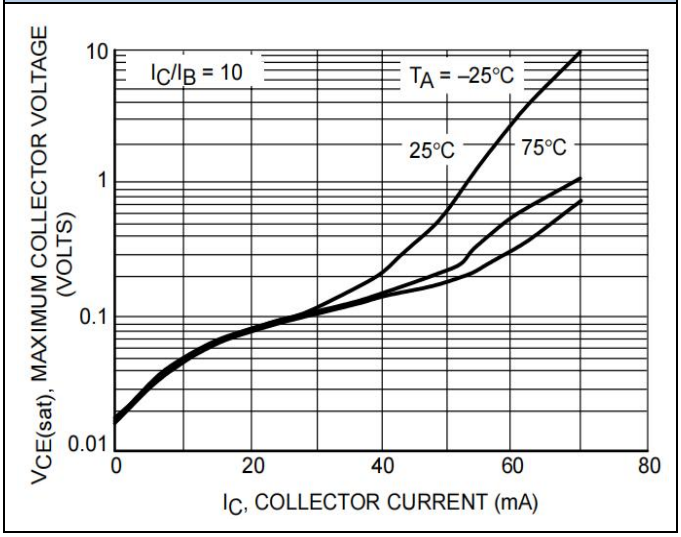



Figure 13. DC Current Gain

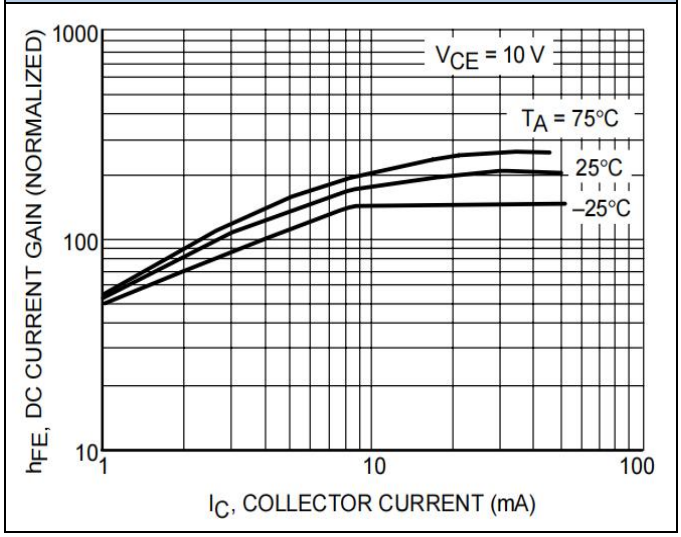



Figure 14. Output Capacitance

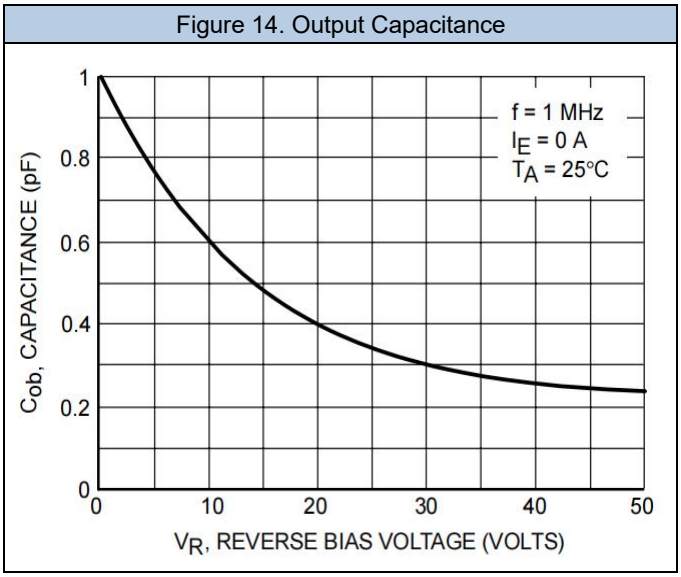



Figure 15. Output Current vs. Input Voltage

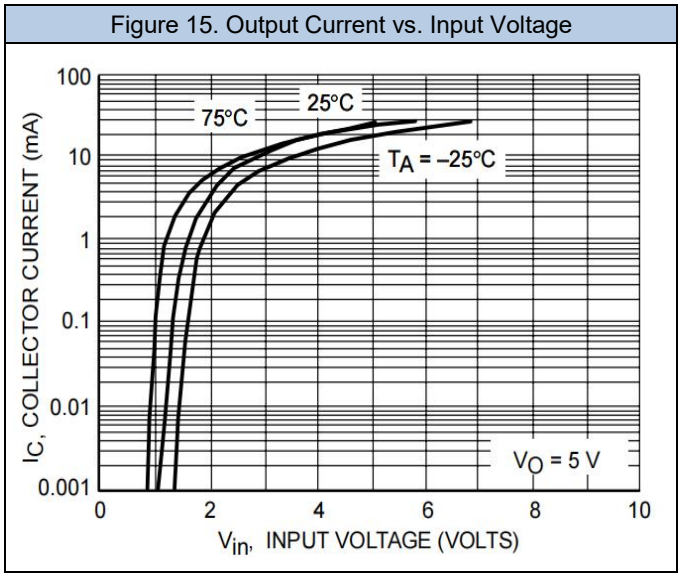
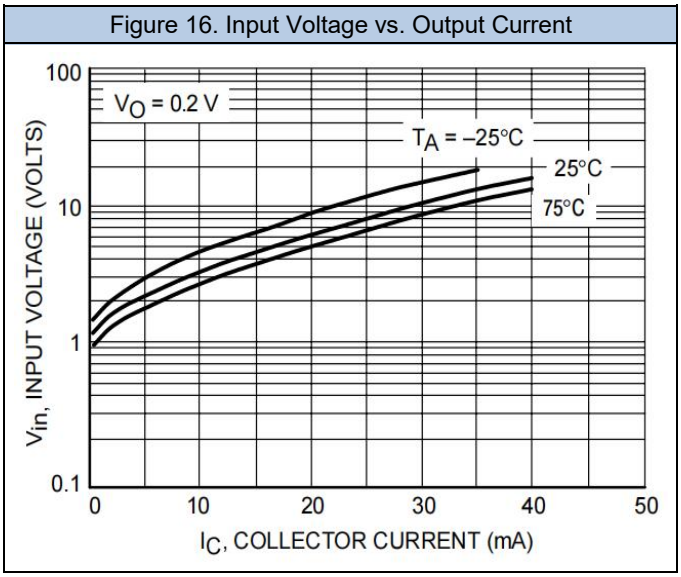



Figure 16. Input Voltage vs. Output Current



**MMUN2214**

Figure 17. VCE(sat) vs. IC

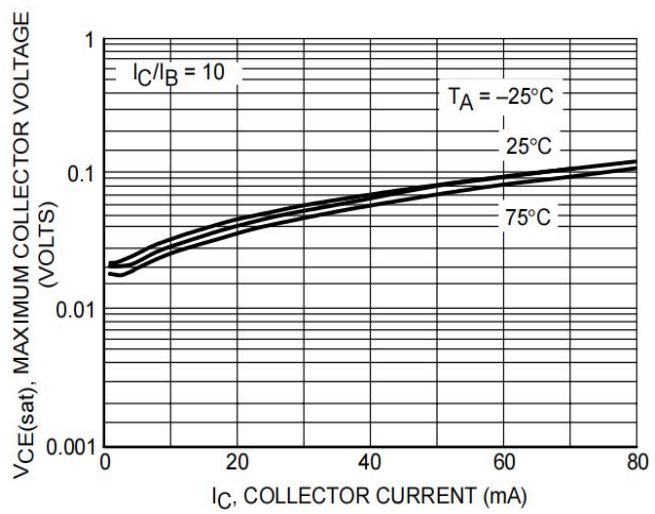



Figure 18. DC Current Gain

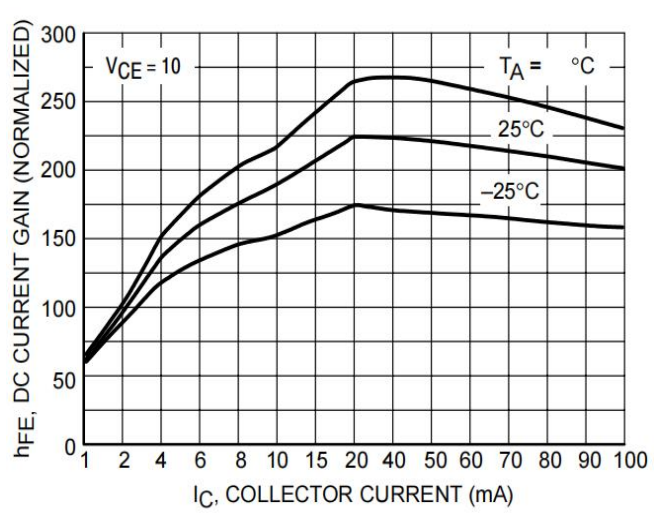



Figure 19. Output Capacitance

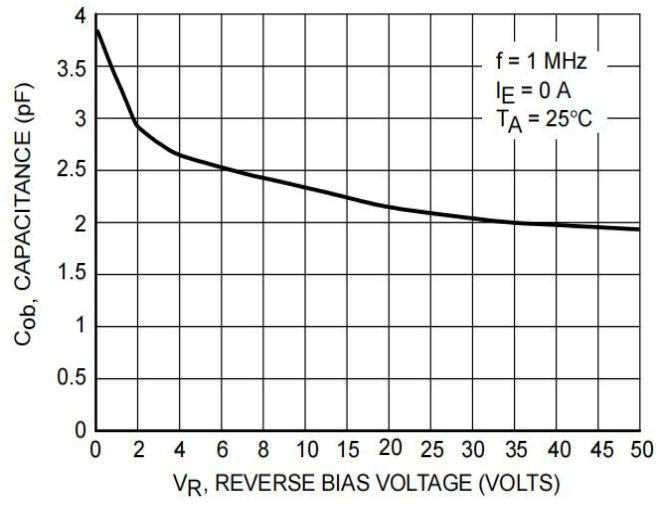



Figure 20. Output Current vs. Input Voltage

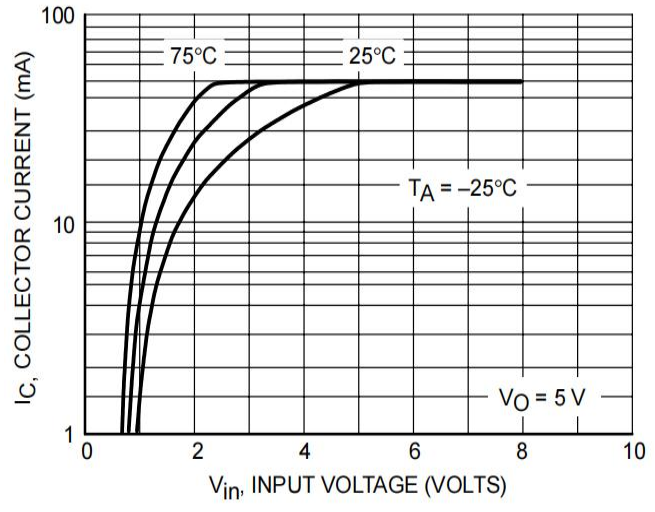
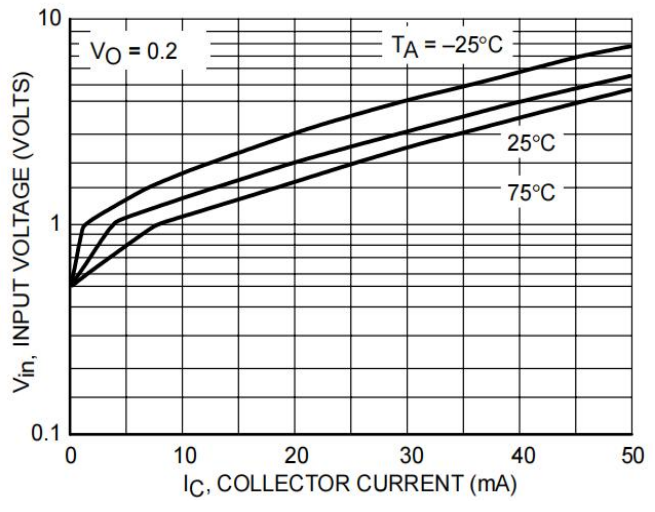



Figure 21. Input Voltage vs. Output Current



**MMUN2232**

Figure 22. VCE(sat) vs. IC

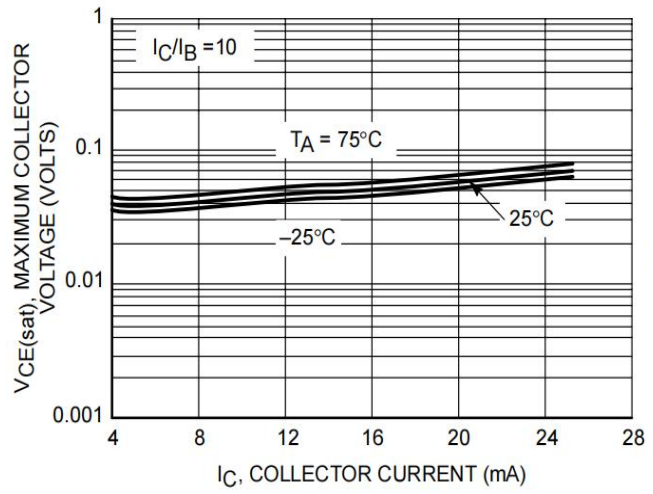



Figure 23. DC Current Gain

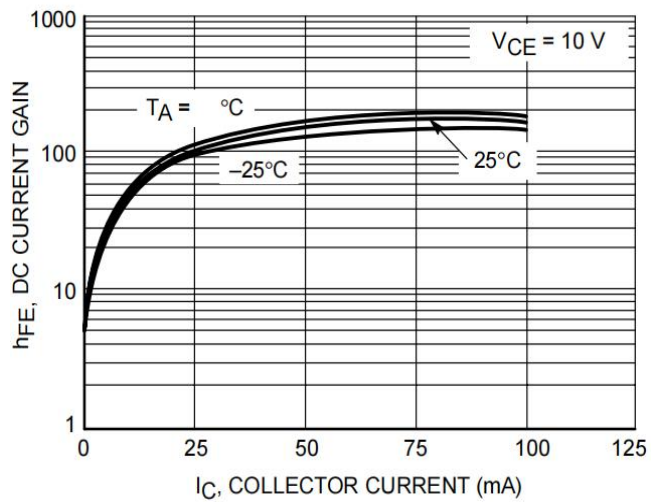



Figure 24. Output Capacitance

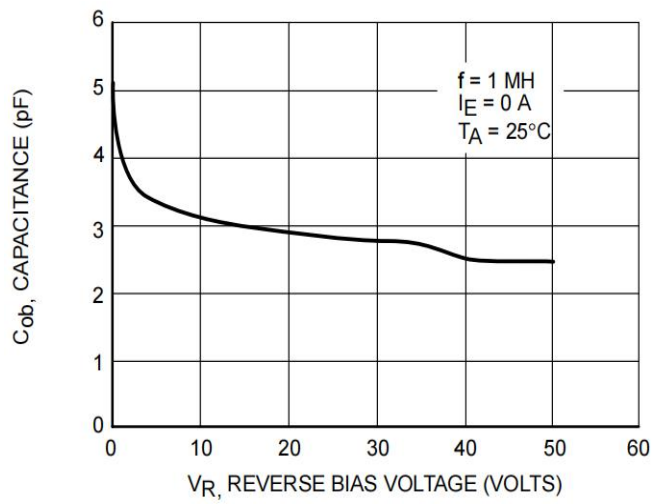



Figure 25. Output Current vs. Input Voltage

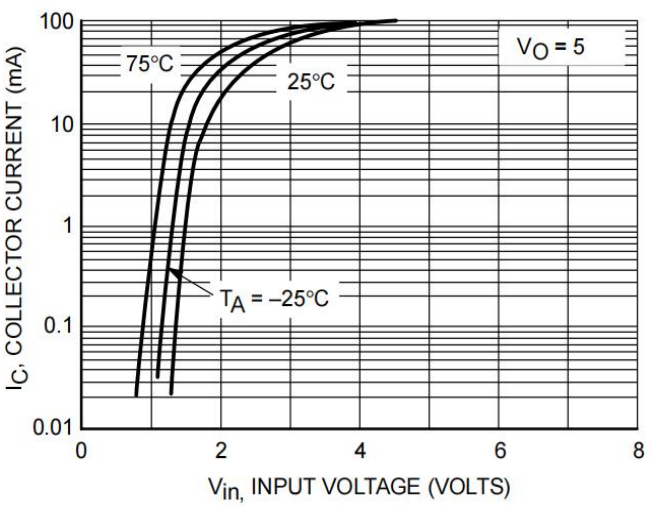
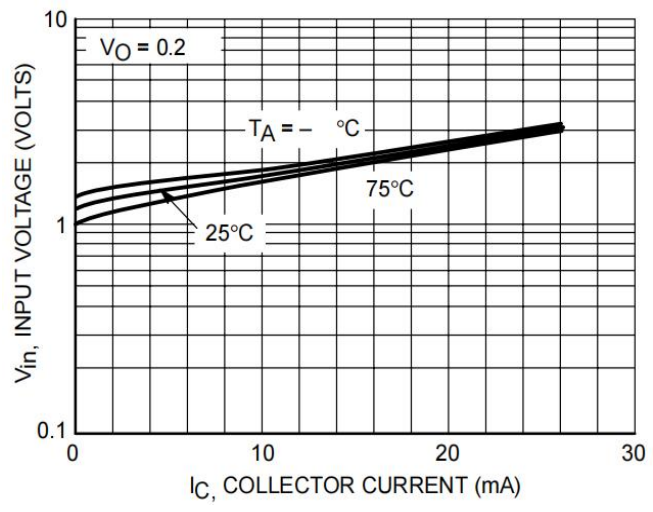



Figure 26. Output Voltage vs. Input Current



**MMUN2233**

Figure 27. VCE(sat) vs. IC

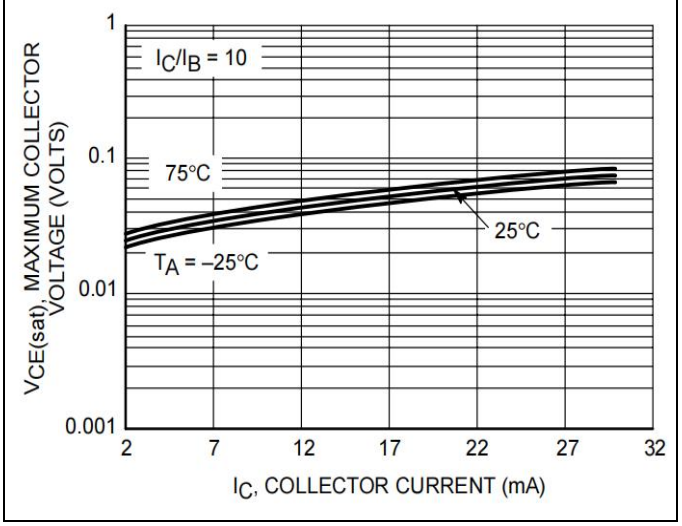



Figure 28. DC Current Gain

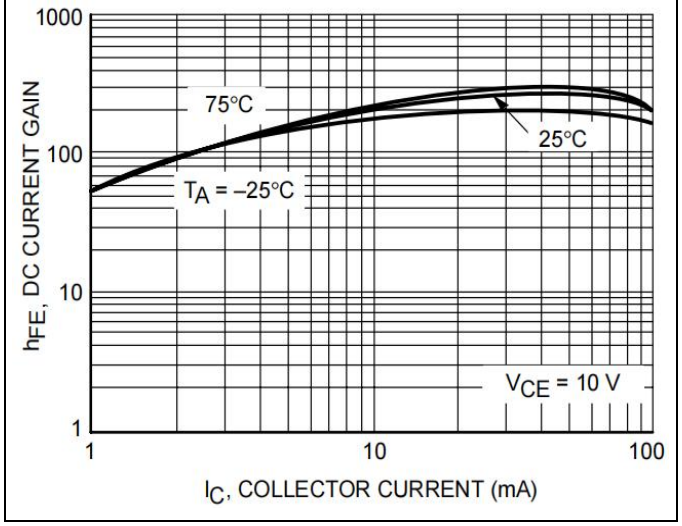



Figure 29. Output Capacitance

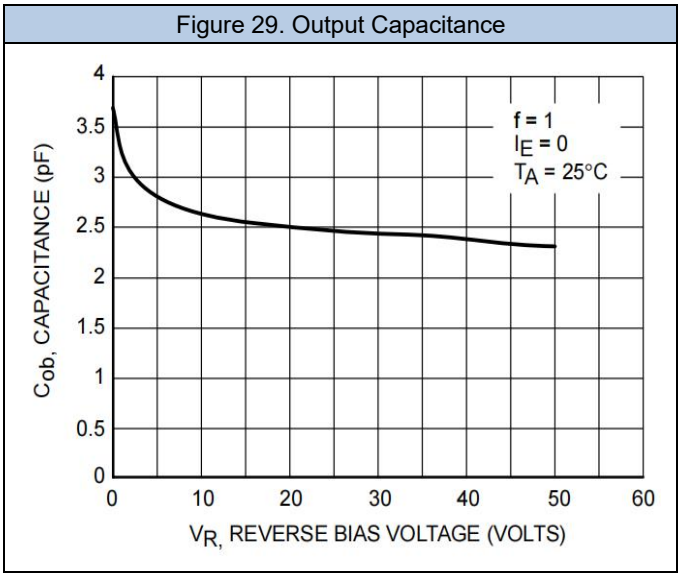



Figure 30. Output Current vs. Input Voltage

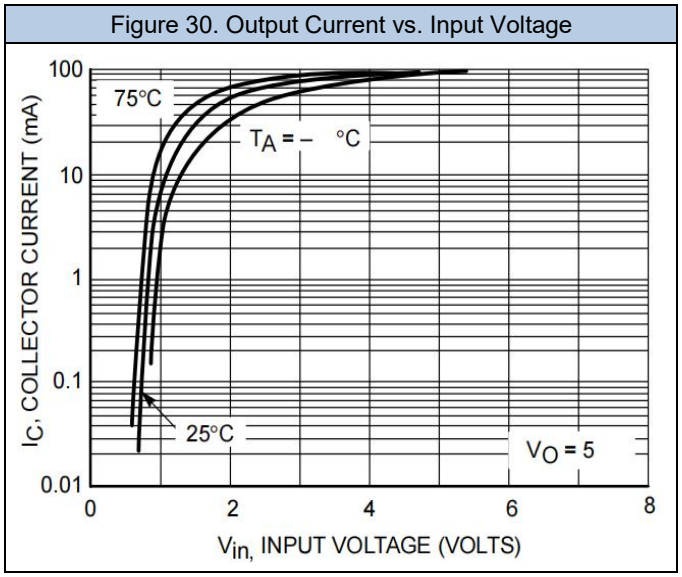
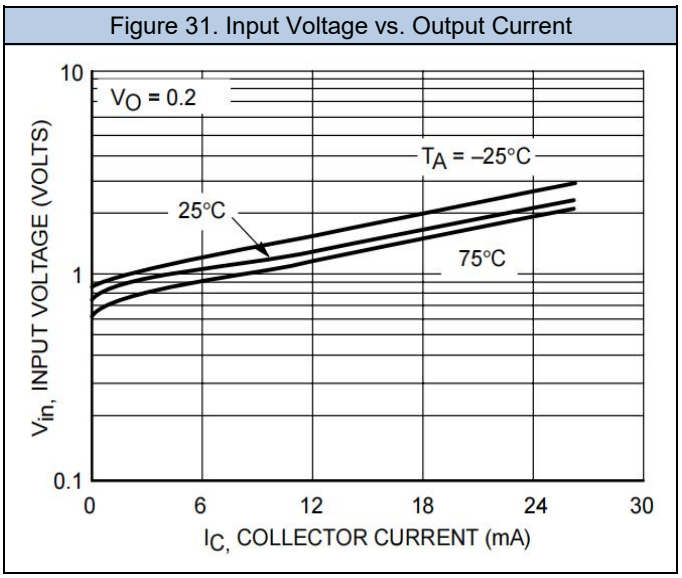



Figure 31. Input Voltage vs. Output Current



**MMUN2211 Series TYPICAL APPLICATIONS FOR NPN BRTs**

Figure32.Level Shifter:Connects 12or24 Volt Circuits to Logic

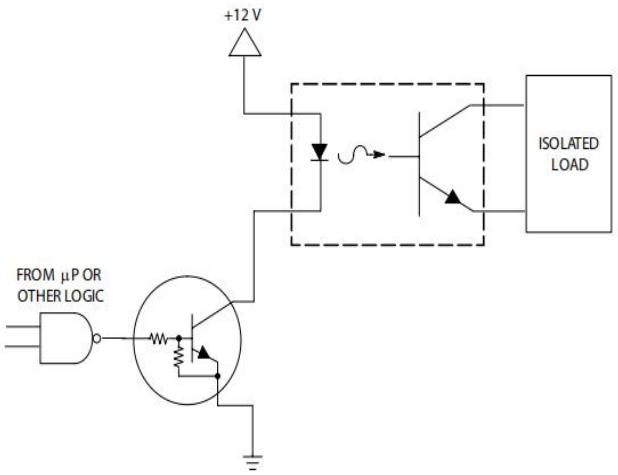



Figure 33. Open Collector Inverter: Inverts the Input Signal

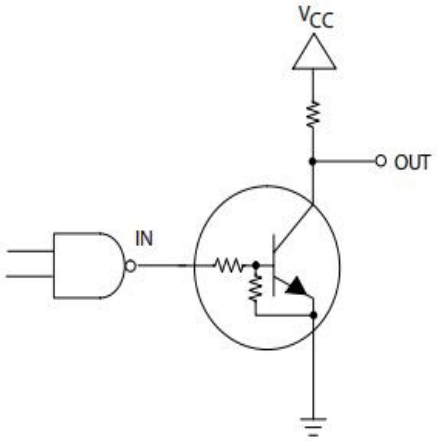
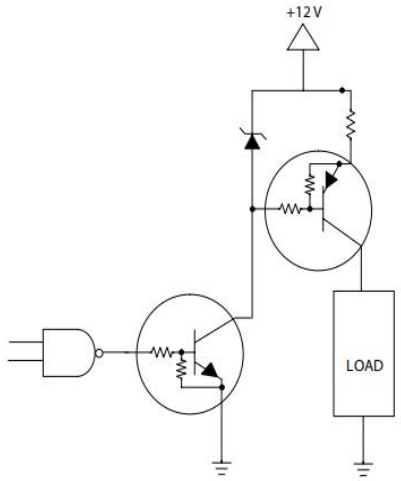
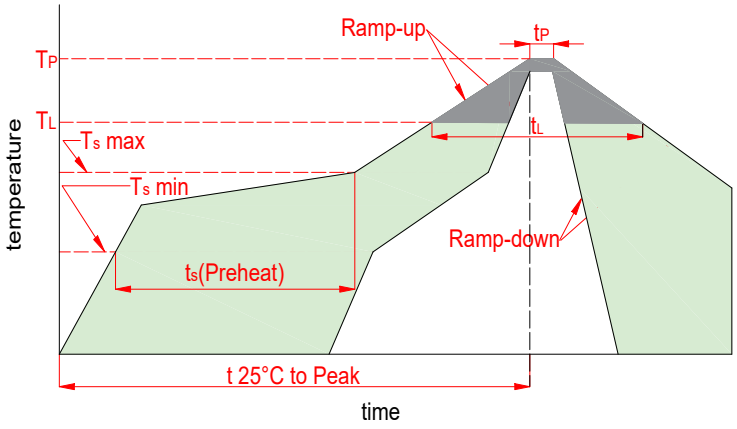



Figure 34. Inexpensive, Unregulated Current Source

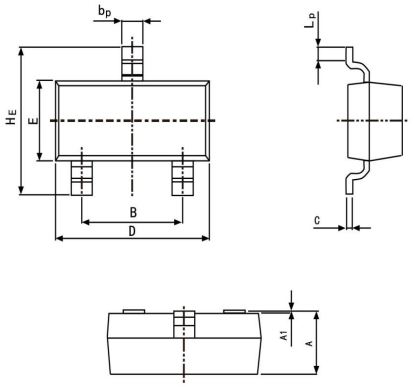


## 6. Soldering Parameters



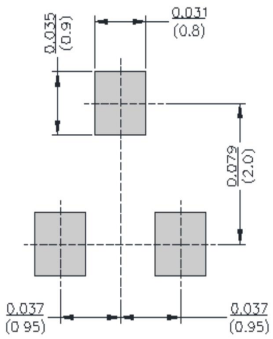

| Reflow Condition | | Lead-free |
|---|---|---|
| Pre Heat | Temp. min($T_s$(min)) | 150℃ |
| | Temp. max($T_s$(min)) | 200℃ |
| | Time(min to max)($t_s$) | 60~120s |
| Aver. ramp up rate(Liquidus Temp.)($T_L$)to peak | | 3℃/s max |
| $T_S$(max) to $T_L$-Ramp-up Rate | | 3℃/s max |
| Reflow | Temp.($T_L$)(Liquidus) | 217℃ |
| | Temp.($t_L$)(Liquidus) | 60~150s |
| Peak Temp.($T_P$) | | $260^{+0/-5}$℃ |
| Time within actual peak Temp.($t_p$) | | 30s max |
| Ramp-down Rate | | 6℃/s max |
| Time 25℃ to peak Tempe.($T_p$) | | 8 minutes max |
| Do not exceed | | 260℃ |

## 7. Dimensions

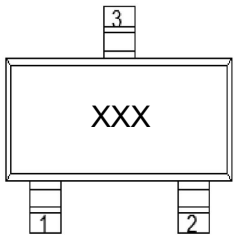



| Dimensions | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.035 | 0.045 | 0.90 | 1.15 |
| B | 0.070 | 0.081 | 1.78 | 2.05 |
| bp | 0.012 | 0.020 | 0.30 | 0.51 |
| C | 0.003 | 0.007 | 0.08 | 0.18 |
| D | 0.110 | 0.118 | 2.80 | 3.00 |
| E | 0.047 | 0.055 | 1.20 | 1.40 |
| HE | 0.087 | 0.110 | 2.20 | 2.80 |
| A1 | 0.000 | 0.004 | 0.00 | 0.10 |
| LP | 0.008 | 0.020 | 0.20 | 0.50 |

Mounting PAD Layout




## 8. Part Marking System




## 9. Package Information

| Package | Type | Tape Width (mm) | Quantity(pcs) |
|---|---|---|---|
| SOT-23 | MMUN2211 THRU MMUN2241 | 8 | 3000 |

# Important Notice and Disclaimer

- Reproducing and modifying information of the document is prohibited without from XINNUO.
- XINNUO reserves the right to make changes to this document and its products and specifications.
- XINNUO disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- XINNUO does not assume any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.
- Applications shown on the here in document are examples of standard use and operation. Customers are responsible in comprehending the suitable use in particular applications.XINNUO makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.
- The products shown her are not designed and authorized for equipments requiring high level of reliability or relating to human life and for any applications concerning life-saving or life-sustaining, such as medical instruments, transportation equipment, aerospace machinery et cetera. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify XINNUO for any damages resulting from such improper use or sale.
- Since XINNUO uses lot number as the tracking base, please provide the lot number for tracking when complaining.