# NPN Transistor with Dual Series Switching Diode

#### **Features**

 These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### **Typical Applications**

- LCD Control Board
- High Speed Switching
- High Voltage Switching

#### **MAXIMUM RATINGS - PNP TRANSISTOR**

Rating	Symbol	Value	Unit
Collector - Emitter Voltage	V <sub>CEO</sub>	80	Vdc
Collector - Base Voltage	V <sub>CBO</sub>	80	Vdc
Emitter - Base Voltage	V <sub>EBO</sub>	6.0	Vdc
Collector Current - Continuous	Ic	500	mAdc

#### **MAXIMUM RATINGS - SWITCHING DIODE**

Rating	Symbol	Value	Unit
Reverse Voltage	$V_R$	100	V
Forward Current	I <sub>F</sub>	200	mA
Non-Repetitive Peak Forward Current (Square Wave, $T_J$ = 25°C prior to surge) $t < 1$ sec $t = 1$ $\mu$ sec	I <sub>FSM</sub>	1.0 20	Α
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### **ESD RATINGS**

Rating		Class	Value
Electrostatic Discharge	HBM	3A	4000 V ≤ Failure < 8000 V
	MM	M4	Failure > 400 V

#### THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Total Device Dissipation FR-5 Board, (Note 1) @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	400	mW mW/°C
Thermal Resistance from Junction-to-Ambient (Note 1)	$R_{\theta JA}$	313	°C/W
Total Device Dissipation FR-5 Board (Note 2) T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	270	mW mW/°C
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{ heta JA}$	463	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

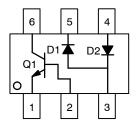
- 1.  $FR-5 = 650 \text{ mm}^2 \text{ pad}$ , 2.0 oz Cu.
- 2.  $FR-5 = 10 \text{ mm}^2 \text{ pad}$ , 2.0 oz Cu.



#### ON Semiconductor®

http://onsemi.com

## NPN Transistor with Dual Series Switching Diode





SC-74 CASE 318F

#### **MARKING DIAGRAM**



3NP = Device Code M = Date Code\* ■ Pb-Free Package

(Note: Microdot may be in either location)
\*Date Code orientation may vary depending upon manufacturing location.

#### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>		
NSM80101MT1G	SC-74 (Pb-Free)	3000 / Tape & Reel		

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

### Q1: NPN TRANSISTOR ELECTRICAL CHARACTERISTICS ( $T_A = 25^{\circ}$ C unless otherwise noted)

Characte	Symbol	Min	Max	Unit	
OFF CHARACTERISTICS					
Collector - Emitter Breakdown Voltage (Note	$(I_C = 1.0 \text{ mA}, I_B = 0)$	V <sub>(BR)CEO</sub>	80	-	V
Emitter - Base Breakdown Voltage	$(I_E = 100 \ \mu A, \ I_C = 0)$	V <sub>(BR)EBO</sub>	6.0	-	V
Collector Cutoff Current	(V <sub>CE</sub> = 60 V, I <sub>B</sub> = 0)	I <sub>CES</sub>	-	0.1	μΑ
Collector Cutoff Current	(V <sub>CB</sub> = 80 V, I <sub>E</sub> = 0)	I <sub>CBO</sub>	-	0.1	μΑ
ON CHARACTERISTICS (Note 3)					
DC Current Gain	(I <sub>C</sub> = 10 mA, V <sub>CE</sub> = 1.0 V)	h <sub>FE</sub>	120	-	-
Collector - Emitter Saturation Voltage	(I <sub>C</sub> = 100 mA, I <sub>B</sub> = 10 mA)	V <sub>CE(sat)</sub>	-	0.3	V
Base - Emitter Saturation Voltage	(I <sub>C</sub> = 10 mA, V <sub>CE</sub> = 5.0 Vdc)	V <sub>BE(sat)</sub>	_	1.2	V
SMALL-SIGNAL CHARACTERISTICS					
Current - Gain - Bandwidth Product	(I <sub>C</sub> = 10 mA, V <sub>CE</sub> = 5.0 V, f = 100 MHz)	f <sub>T</sub>	150	-	MHz

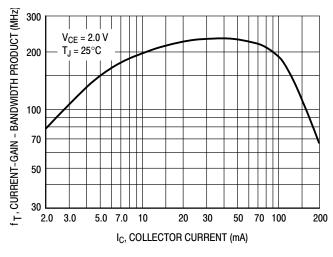
<sup>3.</sup> Pulse Test: Pulse Width  $\leq 300~\mu\text{s},~\text{Duty Cycle} \leq 2.0\%.$ 

#### **D1, D2: SWITCHING DIODE** ( $T_A = 25^{\circ}C$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS		•	•	
Reverse Breakdown Voltage	V <sub>(BR)</sub>	75	-	V
Reverse Voltage Leakage Current $ (V_R = 75 \text{ V}) \\ (V_R = 20 \text{ V}, T_J = 150^{\circ}\text{C}) \\ (V_R = 75 \text{ V}, T_J = 150^{\circ}\text{C}) \\ $	I <sub>R</sub>	- - -	1.0 30 100	μΑ
Diode Capacitance $(V_{R}=0\;V,f=1.0\;MHz)$	C <sub>D</sub>	-	2.0	pF
Forward Voltage $\begin{array}{c} (I_F=1.0\text{ mA})\\ (I_F=10\text{ mA})\\ (I_F=50\text{ mA})\\ (I_F=50\text{ mA}) \end{array}$	V <sub>F</sub>	- - - -	715 855 1000 1250	mV
Reverse Recovery Time $(I_F=I_R=10~\text{mA},i_{R(REC)}=1.0~\text{mA},R_L=100~\Omega)$	t <sub>rr</sub>	-	6.0	ns
Forward Recovery Voltage $ (I_F = 10 \text{ mA, } t_r = 20 \text{ ns)} $	V <sub>FR</sub>	-	1.75	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

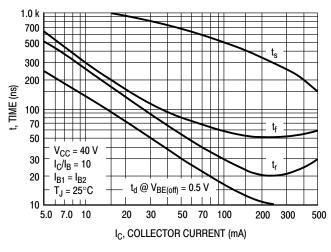
#### **TYPICAL CHARACTERISTICS**



80 60 40 C, CAPACITANCE (pF) Cibo 20 10 8.0 6.0 0.2 0.5 1.0 2.0 5.0 10 50 100 0.1 V<sub>R</sub>, REVERSE VOLTAGE (VOLTS)

Figure 1. Current-Gain — Bandwidth Product

Figure 2. Capacitance



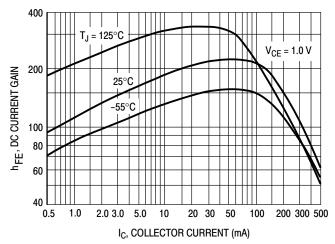
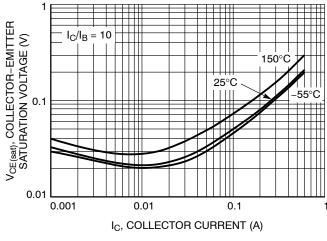


Figure 3. Switching Time

Figure 4. DC Current Gain



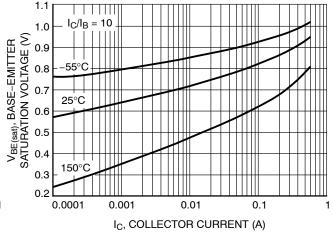


Figure 5. Collector Emitter Saturation Voltage vs. Collector Current

Figure 6. Base Emitter Saturation Voltage vs.
Collector Current

#### **TYPICAL CHARACTERISTICS**

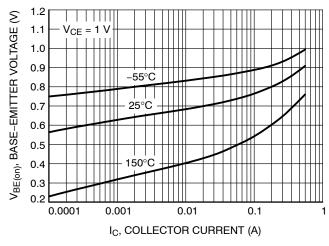


Figure 7. Base Emitter Voltage vs. Collector Current

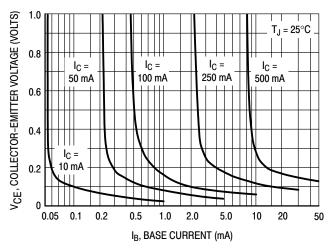
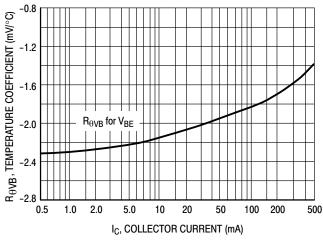


Figure 8. Collector Saturation Region





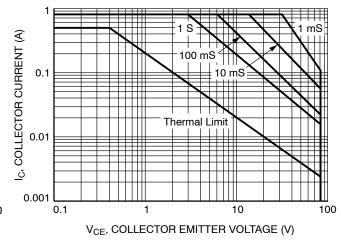


Figure 10. Safe Operating Area

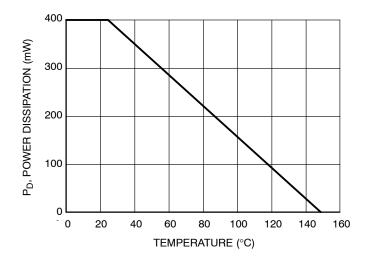
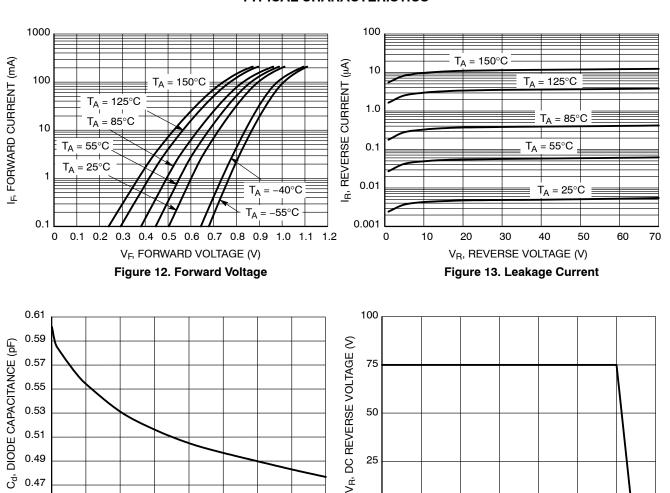


Figure 11. Operating Temperature Derating

#### **TYPICAL CHARACTERISTICS**



25

0 6

7

25

V<sub>R</sub>, REVERSE VOLTAGE (V) Figure 14. Capacitance

4

5

3

0.51 0.49

0.47

0.45

0

1

T<sub>A</sub>, DERATED AMBIENT TEMPERATURE (°C) Figure 15. Diode Power Dissipation Curve

100

125

150

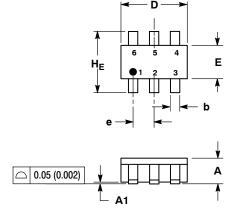
175

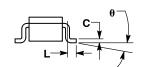
75

50

#### PACKAGE DIMENSIONS

#### SC-74 CASE 318F-05 ISSUE N



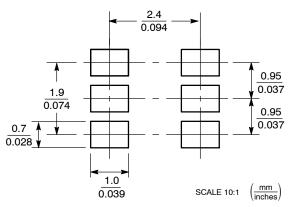


#### NOTES

- 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
   MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
- 318F-01, -02, -03 OBSOLETE. NEW STANDARD 318F-04.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.25	0.37	0.50	0.010	0.015	0.020
С	0.10	0.18	0.26	0.004	0.007	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
Е	1.30	1.50	1.70	0.051	0.059	0.067
е	0.85	0.95	1.05	0.034	0.037	0.041
L	0.20	0.40	0.60	0.008	0.016	0.024
HE	2.50	2.75	3.00	0.099	0.108	0.118
θ	0°	-	10°	0°	-	10°

#### **SOLDERING FOOTPRINT\***



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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