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TRANSISTORS, MATCHED DUAL, PNP

BASED ON TYPE 2N3810

ESCC Detail Specification No. 5207/005

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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
447, 508	Specification up issued to incorporate editorial and technical changes per DCRs.

TABLE OF CONTENTS

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2 APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

(a) ESCC Generic Specification No. 5000
(b) MIL-STD-750, Test Methods and Procedures for Semiconductor Devices

1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply.

1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

Example: 520700501

- Detail Specification Reference: 5207005
- Component Type Variant Number: 01 (as required)

1.4.2 Component Type Variants

The component type variants applicable to this specification are as follows:

Variant Number	Based on Type	Case	Lead/Terminal Material and/or Finish	Weight max g
01	2N3810	TO-78	D2	0.95
02	2N3810	TO-78	D3 or D4	0.95
05	2N3810	TO-78	D7	0.95
07	2N3810	CCP	2	0.2
09	2N3810	CCP	4	0.2

The lead/terminal material and/or finish shall be in accordance with the requirements of ESCC Basic Specification No. 23500.

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

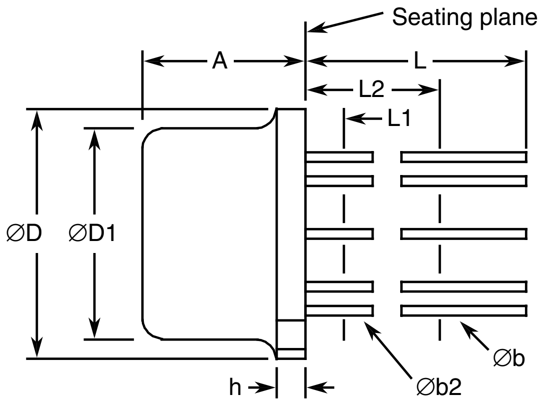
Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Collector-Base Voltage	V_{CBO}	-60	V	Over entire operating temperature range
Collector-Emitter Voltage	V_{CEO}	-60	V	
Emitter-Base Voltage	V_{EBO}	-5	V	
Collector Current	I_C	50	mA	Continuous
Power Dissipation (One Section)				
For TO-78 and CCP	P_{totO1}	0.5	W	At $T_{amb} \leq +25^{o}C$
For TO-78	P_{totO2}	0.5	W	At $T_{case} \leq +25^{o}C$
Power Dissipation (Both Sections)				
For TO-78 and CCP	P_{totB1}	0.6	W	At $T_{amb} \leq +25^{o}C$
For TO-78	P_{totB2}	0.6	W	At $T_{case} \leq +25^{o}C$
Thermal Resistance, Junction-to-Ambient	$R_{th(j-a)}$	350 291.7	$^{o}C/W$	For one section For both sections
Thermal Resistance, Junction-to-Case	$R_{th(j-c)}$	350 291.7	$^{o}C/W$	For one section For both sections Note 1
Operating Temperature Range	T_{op}	-55 to +200	^{o}C	Note 2
Storage Temperature Range	T_{stg}	-65 to +200	^{o}C	Note 2
Soldering Temperature	T_{sol}		^{o}C	
For TO-78		+260		Note 3
For CCP		+245		Note 4

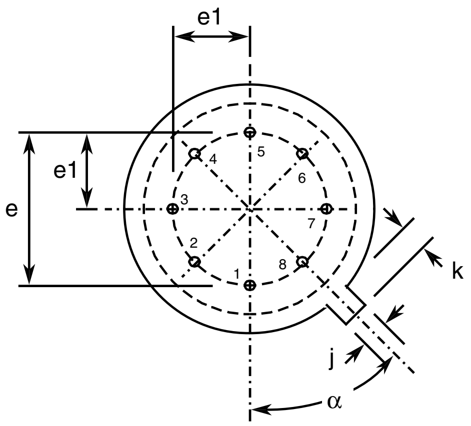
NOTES:

1. Thermal Resistance, Junction-to-Case only applies to TO-78 packaged Variants.
2. For Variants with tin-lead plating or hot solder dip lead finish all testing, and any handling, performed at $T_{amb} > +125^{o}C$ shall be carried out in a 100% inert atmosphere.
3. Duration 10 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.
4. Duration 5 seconds maximum and the same terminal shall not be resoldered until 3 minutes have elapsed.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.6.1 Metal Can Package (TO-78) - 6 lead





Symbols	Dimensions mm		Notes
	Min	Max	
A	4.19	4.7	
Øb	0.406	0.533	2, 3
Øb2	0.406	0.483	2, 3
ØD	8.51	9.4	
ØD1	7.75	8.51	
e	5.08 BSC		4
e1	2.54 BSC		4
h	-	1.02	
j	0.711	0.864	
k	0.737	1.14	5
L	12.7	-	2
L1	-	1.27	3
L2	6.35	-	3
α	45° BSC		1, 4, 6

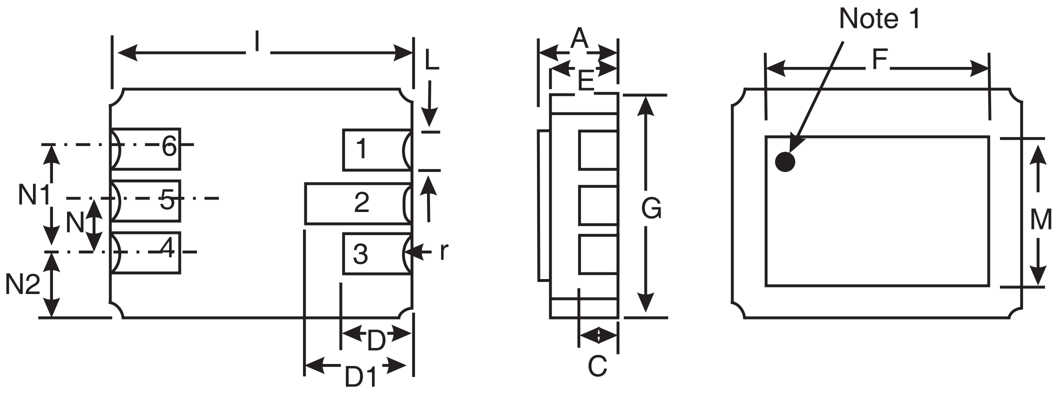
NOTES:

1. Terminal identification is specified by reference to the tab position where lead 1 = collector 1, lead 2 = base 1, lead 3 = emitter 1, lead 5 = emitter 2, lead 6 = base 2 and lead 7 = collector 2. Lead numbers 4 and 8 are not present on the actual package; they are shown in the drawing for information only.
2. Applies to all leads.
3. Øb2 applies between L1 and L2. Øb applies between L2 and 12.7mm from the seating plane. Diameter is uncontrolled within L1 and beyond 12.7mm from the seating plane.
4. Leads having maximum diameter 0.483mm measured in the gauging plane 1.37(+0.025, -0)mm

below the seating plane of the device shall be within 0.178mm of their true position relative to a maximum-width-tab.

5. Measured from the maximum diameter of the actual device.
6. Tab centreline.

1.6.2 Chip Carrier Package (CCP) - 6 terminal

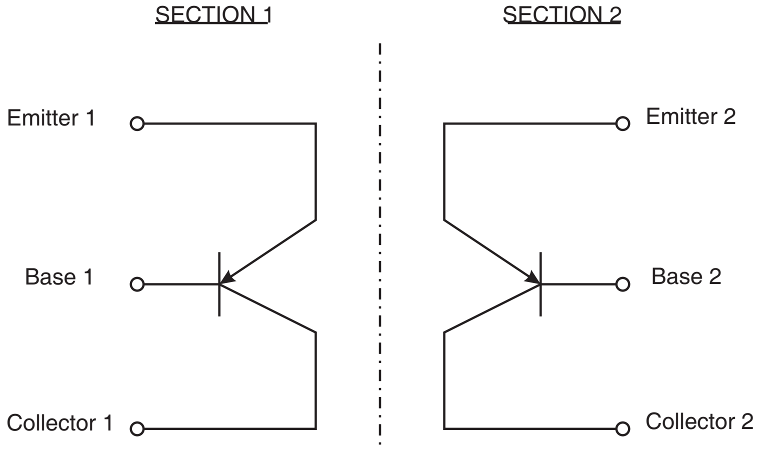


Symbols	Dimensions mm		Notes
	Min	Max	
A	1.53	1.96	
C	0.89 TYPICAL		2
D	1.52	1.78	
D1	2.08	2.49	
E	1.24	1.55	
F	5.76	5.92	
G	4.19	4.45	
I	6.1	6.35	
L	0.55	0.71	2
M	3.86	4.01	
N	1.14	1.4	
N1	2.41	2.67	
N2	0.89 TYPICAL		
r	0.23 TYPICAL		2

NOTES:

1. Terminal identification is specified, when viewing the top side of the package, by reference to a black ink dot adjacent to terminal 1 = base 2. Terminal 2 = collector 2, terminal 3 = emitter 2, terminal 4 = emitter 1, terminal 5 = collector 1 and terminal 6 = base 1.
2. Applies to all terminals.

1.7 FUNCTIONAL DIAGRAM



NOTES:

1. For TO-78, the case is not connected to any lead.
2. For CCP, the lid is not connected to any terminal.

1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

a) Case
For the metal can package the case shall be hermetically sealed and have a metal body with hard glass seals.
For the chip carrier package the case shall be hermetically sealed and have a ceramic body with a Kovar lid.

b) Leads/Terminals
As specified in Component Type Variants.

2. REQUIREMENTS

2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

None

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

(a) Terminal identification (CCP package only).
(b) The ESCC qualified components symbol (for ESCC qualified components only).
(c) The ESCC Component Number.
(d) Traceability information.

2.3 TERMINAL STRENGTH

The test conditions for terminal strength, tested as specified in the ESCC Generic Specification, shall be as follows:

For TO-78, Test Condition: E, lead fatigue.

2.4 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures.

2.4.1 Room Temperature Electrical Measurements

The measurements shall be performed at T_{amb}=+22 ±3°C.

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	I_C =-10μA, Bias condition D	-60	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	I_C =-10mA, Bias condition D, Note 1	-60	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	I_E =-10μA, Bias condition D	-5	-	V
Collector-Base Cut-off Current	I_{CBO}	3036	V_{CB} =-50V, Bias condition D	-	-10	nA
Emitter-Base Cut-off Current	I_{EBO}	3061	V_{EB} =-4V, Bias condition D	-	-20	nA

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$	3071	I_C=-100µA I_B=-10µA Note 1	-	-200	mV
	$V_{CE(sat)2}$	3071	I_C=-1mA I_B=-100µA Note 1	-	-250	mV
Base-Emitter Saturation Voltage	$V_{BE(sat)1}$	3066	I_C=-100µA I_B=-10µA Test Condition A Note 1	-	-700	mV
	$V_{BE(sat)2}$	3066	I_C=-1mA I_B=-100µA Test Condition A Note 1	-	-800	mV
Forward-Current Transfer Ratio	h_{FE1}	3076	V_{CE}=-5V ; I_C =-10µA	100	-	-
	h_{FE2}	3076	V_{CE}=-5V ; I_C =-100 µA	150	450	-
	h_{FE3}	3076	V_{CE}=-5V ; I_C =-500µA	150	450	-
	h_{FE4}	3076	V_{CE}=-5V ; I_C =-1mA	150	450	-
	h_{FE5}	3076	V_{CE}=-5V ; I_C =-10mA	125	-	-
Forward-Current Transfer Ratio Comparison	h_{FE2-1}/ h_{FE2-2}	3076	V_{CE} =-5V; I_C=-100µA	0.9	1.1	-
Base-Emitter Voltage Differential	$\lvert V_{BE1}-V_{BE2}\rvert 1$	3066	I_C=-10µA V_{CE}=-5V Test Condition B Note 2	-	5	mV
	$\lvert V_{BE1}-V_{BE2}\rvert 2$	3066	I_C=-100µA V_{CE}=-5V Test Condition B Note 2	-	3	mV
	$\lvert V_{BE1}-V_{BE2}\rvert 3$	3066	I_C=-10mA V_{CE}=-5V Test Condition B Note 2	-	5	mV
Leakage Current Between Sections	$I_{LS(e-e)}$	-	-50V to Emitter 2 0V to Emitter 1	-	5	µA
	$I_{LS(b-b)}$	-	-50V to Base 2 0V to Base 1	-	5	µA
	$I_{LS(c-c)}$	-	-50V to Collector 2 0V to Collector 1	-	5	µA
Current Gain Bandwidth Product	f_T	3206	V_{CE}=-5V, I_C=-1mA f=100MHz Note 3	80	500	MHz

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Small-Signal Short-Circuit Forward-Current Transfer Ratio	h_{fe}	3206	I_C=-1mA, V_{CE}=-10V f=1kHz Note 3	150	600	-
Spot Noise Figure	NF1	3246	V_{CE}=-5V I_C=-200µA R_s=2kΩ f=100Hz BW=20Hz Note 3	-	7	dB
	NF2	3246	V_{CE}=-5V I_C=-200µA R_s=2kΩ f=1kHz BW=200Hz Note 3	-	3	dB
Wide-Band Noise Figure	NF_w	3246	V_{CE}=-5V I_C=-200µA R_s=2kΩ 10Hz≤f≤15.7kHz Note 3	-	3.5	dB
Output Capacitance	C_{obo}	3236	V_{CB}=-5V, I_E=0A 100kHz≤f≤1MHz Note 3	-	6	pF
Input Capacitance	C_{ibo}	3240	V_{EB}=-500mV, I_C=0A 100kHz≤f≤1MHz Note 3	-	15	pF
Small-Signal Input Impedance	h_{ie}	3201	V_{CE}=-10V I_C=-1mA f=1kHz Note 3	3	30	kΩ

NOTES:

1. Pulsed measurement: Pulse Width ≤ 300µs, Duty Cycle ≤ 2%.
2. Any device whose measurement values exceed the specified limits shall be removed from the lot, but only count for PDA when such values exceed twice the specified limits (i.e. > 10mV or > 6mV).
3. For AC characteristics read and record measurements shall be performed on a sample of 32 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Collector-Base Cut-off Current	I_{CBO}	3036	T_{amb}=+150(+0-5)°C V_{CB}=-50V, Bias Condition D	-	-10	µA
Forward-Current Transfer Ratio 2	h_{FE2}	3076	T_{amb}=-55(+5-0)°C V_{CE}=-5V I_C=-100µA	60	-	-
Forward-Current Transfer Ratio Comparison	h_{FE2-1}/ h_{FE2-2}	3076	T_{amb}=-55 to + 125°C V_{CE}=-5V, I_C=-100µA	0.85	1.18	-
Base-Emitter Voltage Differential Change	$\lvert\Delta(V_{BE1}-V_{BE2})\Delta T\ amb\rvert 1$	3066	T_{amb}=-55(+5-0)°C to +25±3°C V_{CE}=-5V I_C=-100µA Test condition B	-	800	µV
	$\lvert\Delta(V_{BE1}-V_{BE2})\Delta T\ amb\rvert 2$	3066	T_{amb}=+25±3°C to +125(+0 -5)°C V_{CE}=-5V I_C=-100µA Test condition B	-	1000	µV

NOTES:

1. Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

2.5 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at T_{amb}=+22 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits			Units
		Drift Value Δ	Absolute		
			Min	Max	
Collector-Base Cut-off Current	I_{CBO}	±2 or (1) ±100%	-	-10	nA
Collector-Emitter Saturation Voltage 2	$V_{CE(sat)2}$	±15 or (1) ±10%	-	-250	mV
Forward-Current Transfer Ratio 2	h_{FE2}	±15%	150	450	-

NOTES:

1. Whichever is the greater referred to the initial value.

2.6 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb}=+22 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in either Room Temperature Electrical Measurements or High and Low Temperatures Electrical Measurements, as applicable.

The limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits		Units
		Min	Max	
Collector-Base Cut-off Current	I_{CBO}	-	-20	nA
Collector-Emitter Saturation Voltage 2	$V_{CE(sat)2}$	-	-250	mV
Forward-Current Transfer Ratio 2	h_{FE2}	150	450	-
Forward-Current Transfer Ratio Comparison	h_{FE2-1}/h_{FE2-2}	0.85	1.18	-
Base-Emitter Voltage Differential 2	$|V_{BE1}-V_{BE2}|2$	-	6	mV
Base-Emitter Voltage Differential Change (Note 1)	$|\Delta(V_{BE1}-V_{BE2})\Delta T_{amb}|1$	-	1	mV
	$|\Delta(V_{BE1}-V_{BE2})\Delta T_{amb}|2$	-	1.2	mV

NOTES:

1. Measured after Operating Life test only.

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+150(+0 -5)	^{o}C
Collector-Base Voltage (Note 1)	V_{CB}	-45	V
Duration	t	72 Minimum	hrs

NOTES:

1. On completion of High Temperature Reverse Bias Burn-in, the collector-base voltage shall continue to be applied until $T_{case} < +30^{o}C$.

2.8 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+25 to +50	^{o}C
Power Dissipation (Both Sections)	P_{totB}	As per Maximum Ratings. Derate P_{totB1} at the chosen T_{amb} using the specified $R_{th(j-a)}$.	W
Collector-Base Voltage	V_{CB}	-45	V

2.9 OPERATING LIFE CONDITIONS

The conditions shall be as specified for Power Burn-in.

APPENDIX ‘A’

AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Deviations from Production Control-Chart F2	Special In-Process Controls - Internal Visual Inspection. For CCP packages the criteria specified for voids in the fillet and minimum die mounting material around the visible die perimeter for die mounting defects may be omitted providing that a radiographic inspection to verify the die-attach process is performed on a sample basis in accordance with STMicroelectronics procedure 0076637.
Deviations from Room Temperature Electrical Measurements	All AC characteristics (Room Temperature Electrical Measurement Note 3) may be considered guaranteed but not tested if successful pilot lot testing has been performed on the wafer lot which includes AC characteristic measurements per the Detail Specification. A summary of the pilot lot testing shall be provided if required by the Purchase Order.
Deviations from High and Low Temperatures Electrical Measurements	All characteristics specified may be considered guaranteed but not tested if successful pilot lot testing has been performed on the wafer lot which includes characteristic measurements at high and low temperatures per the Detail Specification. A summary of the pilot lot testing shall be provided if required by the Purchase Order.
Deviations from Screening Tests - Chart F3	Solderability is not applicable unless specifically stipulated in the Purchase Order.