

# PBL 403 05

## Multiband GSM Power Amplifier

### Description.

The PBL 403 05 is a dual line-up GaAs MMIC power amplifier intended for use in multiband GSM terminals. Powered of a 3.2V supply it delivers more than 34.5 dBm output power at GSM900 and more than 31.5 dBm output power at DCS1800 or PCS1900 frequencies.

The circuit uses an analog control signal to control the output power level. The circuit is housed in a specially designed QSOP28 (150 mil body) package with no special mounting requirements.

The circuit is manufactured in a high performance MESFET process that ensures ruggedness for environmental variations.

### Key features.

- One IC handles GSM900, DCS 1800 and PCS1900 bands.
- Low cost solution.
- Inputs matched to 50 Ω
- Digital band select function.
- Analog gain control.
- Proven GaAs MESFET-reliability.
- Tape and Reel.
- SMD QSOP 28 package.

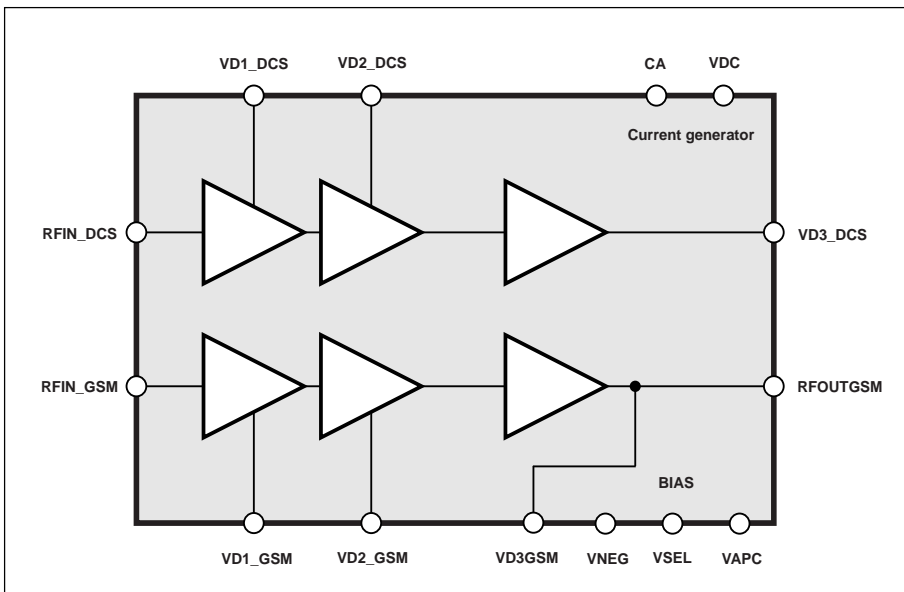


Figure 1. Block diagram.



Figure 2. Package outlook.

**Maximum Ratings:**

$T_{AMB} = +25^{\circ}\text{C}$  unless otherwise stated.

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	short supply spike	$V_{DD}$			6.0	V
Supply voltage		$V_{DD}$			5.0	V
Power control voltage		$V_{APC}$			4.2	V
Operating Case Temperature		$T_{CASE}$	-25		+80	$^{\circ}\text{C}$
Storage Temperature Range		$T_{STORAGE}$	-30		+100	$^{\circ}\text{C}$

**Electrical Characteristics for PA in GSM 900 mode:**

$V_{CC} = 3.2\text{ V}$ ,  $T_{AMB} = +25^{\circ}\text{C}$ ,  $Z = 50\ \Omega$ ,  $P_{IN} = 10\text{ dBm}$ ,  $f = 880 - 915\text{ MHz}$  and  $V_{APC}$  adjusted to give  $P_{OUT} = 34.5\text{ dBm}$  unless otherwise noted. Pulsed operation with pulse width of  $577\mu\text{s}$  and a duty cycle of 1:8.  $V_{NEG} = -4.0\text{ V}$ ,  $V_{SEL} = 0.0\text{ V}$ .

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Output Power	$V_{APC} = 3.15\text{ V}$	$P_{OUT}$	34.5	34.7		dBm
Power added efficiency		$P_{AE}$	50	53		%
2 <sup>nd</sup> harmonic	$-0\text{ dBm} < P_{OUT} < 34.5\text{ dBm}$	$2f_o$		-7.0	0	dBm
3 <sup>rd</sup> harmonic	$-0\text{ dBm} < P_{OUT} < 34.5\text{ dBm}$	$3f_o$		-27	0	dBm
Isolation	$P_{IN} = 11.5\text{ dBm}$ , $V_{APC} \leq 0.5\text{ V}$ $T_{AMB} = -25^{\circ}\text{C}$ to $+75^{\circ}\text{C}$			-30	-20	dBm
Power degradation	$P_{IN} = 8.5\text{ dBm}$ , $V_{SEL} = 0.6\text{ V}$ , $V_{APC} = 2.8\text{ V}$ , $T_{AMB} = -25^{\circ}\text{C}$ to $+75^{\circ}\text{C}$		33			dBm
Stability and leakage spurious	Output VSWR = 6:1 all phases All combinations of following parameters: $P_{OUT} = 5$ to $34.5\text{ dBm}$ ( $50\ \Omega$ ) $V_{DD} = 2.7\text{ V}$ to $5.1\text{ V}$ $T_{AMB} = -25^{\circ}\text{C}$ to $+75^{\circ}\text{C}$			No parasitic oscillations when $I_{DD} < 2.2\text{ A}$ All spurious $< -36\text{ dBm}$		
Noise power	935 - 960 MHz 925 - 935 MHz	RBW = 30 kHz			-90 -78	dBm dBm
Input S11	$V_{APC} = 0.5\text{ V}$ ,			-5.2	-5.0	dBm
Input S11	$P_{OUT} = 34.5\text{ dBm}$			-12	-6.0	dBm

**Electrical Characteristics for PA in DCS 1800 mode:**

$V_{CC} = 3.2\text{ V}$ ,  $T_{AMB} = +25^{\circ}\text{C}$ ,  $Z = 50\ \Omega$ ,  $P_{IN} = 9\text{ dBm}$ ,  $f = 1710 - 1785\text{ MHz} / 1850 - 1910\text{ MHz}$  and  $V_{APC}$  adjusted to give  $P_{OUT} = 31.5\text{ dBm}$  unless otherwise noted. Pulsed operation with pulse width of  $577\mu\text{s}$  and a duty cycle of 1:8.  $V_{NEG} = -4.0\text{ V}$ ,  $V_{SEL} = 2.0\text{ V}$ .

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Output Power	$V_{APC} = 3.15\text{ V}$	$P_{OUT}$	31.5	31.7		dBm
Power added efficiency	$P_{OUT} = 31.5\text{ dBm}$	$P_{AE}$	37	41		%
2 <sup>nd</sup> harmonic	$-0\text{ dBm} < P_{OUT} < 31.5\text{ dBm}$	$2f_o$		-8.0	0	dBm
3 <sup>rd</sup> harmonic	$-0\text{ dBm} < P_{OUT} < 31.5\text{ dBm}$	$3f_o$		-15	0	dBm
Isolation	$P_{IN} = 10.5\text{ dBm}$ , $V_{APC} = 0.5\text{ V}$ $T_{AMB} = -25^{\circ}\text{C}$ to $+75^{\circ}\text{C}$			-35	-30	dBm
Power degradation	$P_{IN} = 7.5\text{ dBm}$ , $V_{DD} = 2.85\text{ V}$ $V_{APC} = 2.8\text{ V}$ , $T_{AMB} = -25^{\circ}\text{C}$ to $+75^{\circ}\text{C}$		30	30.5		dBm

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Stability and leakage spurious	Output VSWR = 6:1 all phases All combinations of following parameters: $P_{OUT}=5$ to 31.5dBm(50 $\Omega$ ) $V_{DD}= 2.7$ V to 5.1 V $T_{AMB} = -25$ °C to +75 °C		No parasitic oscillations when $I_{DD} < 2.20$ A All spurious < -36 dBm RBW = 3 MHz			
Noise power	1805 - 1880 MHz 935 - 960 MHz 925 - 935 MHz	RBW = 30 kHz			-76 -82 -70	dBm dBm dBm
Input S11	$V_{APC} = 0.5$ V,			-5.0	-4.0	dBm
Input S11	$P_{OUT} = 31.5$ dBm			-14	-6.0	dBm

**Common specifications:**

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Isolation at GSM RF output when DCS is active	$f = f_0$				-20	dBm
	$f = 2 \cdot f_0, f_0 = 1750 - 1785$ MHz				-30	dBm
Isolation at DCS RF output when GSM is active	$f = 2 \cdot f_0$			-18	-15	dBm
	$f = 3 \cdot f_0, f_0 = 880 - 915$ MHz			-30	-25	dBm

**Power regulation characteristics:**

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Power control range	GSM: $V_{APC} = 0.5 - 3.15$ V		-20		34.5	dBm
	DCS: $V_{APC} = 0.5 - 3.15$ V		-30		31.5	dBm
Power control slope	$V_{APC} = 0.5 - 3.15$ V				150	dB/V
Switching time	Step in $V_{ref}$ giving $P_{OUT} = -15$ to 32.5 dBm, up and down				2	$\mu$ s
Power control current consumption	$V_{APC} \leq 3.15$ V $V_{SEL} = 0 - 3$ V	$I_{APC}$		4	5	mA
Band select current consumption	$V_{SEL} = 0 - 3$ V, $V_{APC} \leq 3.15$ V	$I_{SEL}$		0.01	0.1	mA
Negative supply current consumption	$V_{SEL} = 0$ V, $V_{APC} \leq 3.15$ V	$I_{NEG}$		5.5	7.0	mA

**Current generator:**

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Input resistance	$V_{DC} - V_{CA} < 0.8$ V	$R_{ON}$		100	150	$\Omega$
Charge current	$V_{DC} = 1.5 - 5.0$ V, $V_{CA} = 0$ V	$I_{GSAT}$		6.7	10	mA

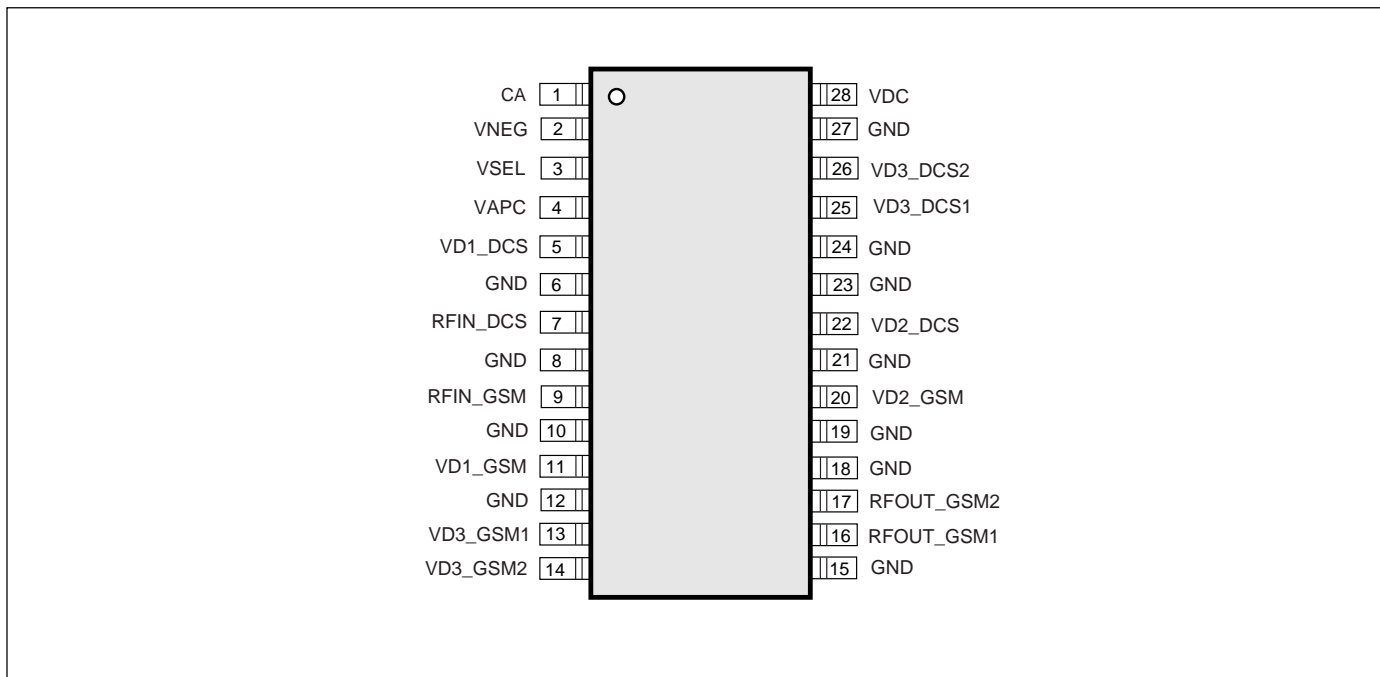


Figure 3. Pin configuration.

<i>Terminal</i>	<i>Symbol</i>	<i>Function</i>
1	CA	Separate Current Source +terminal
2	VNEG	Negative supply
3	VSEL	Digital band select function
4	VAPC	Analog output power control
5	VD1_DCS	Power supply for 1st stage of high band chain
6,8,10,12,15, 18,19,21,23, 24,27	GND	
7	RFIN_DCS	AC coupled 50ohm input
9	RFIN_GSM	AC coupled 50ohm input
11	VD1_GSM	Power supply for 1st stage of low band chain
13, 14	VD3_GSM	Power supply for output stage stage of low band chain
16,17	RFOUT_GSM	
20	VD2_GSM	Power supply for 2nd stage of low band chain
22	VD2_DCS	Power supply for 2nd stage of high band chain
25,26	VD3_DCS	RF output and power supply for output stage of high band chain
28	VDC	Separate Current Source -terminal

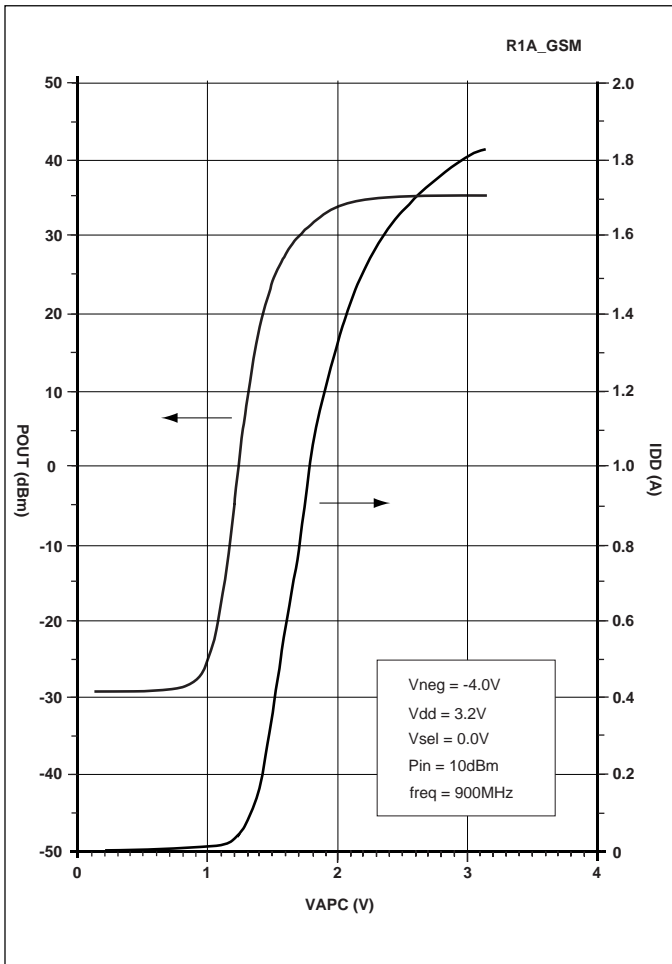


Figure 4. Pout and IDD versus VAPC at 900 MHz.

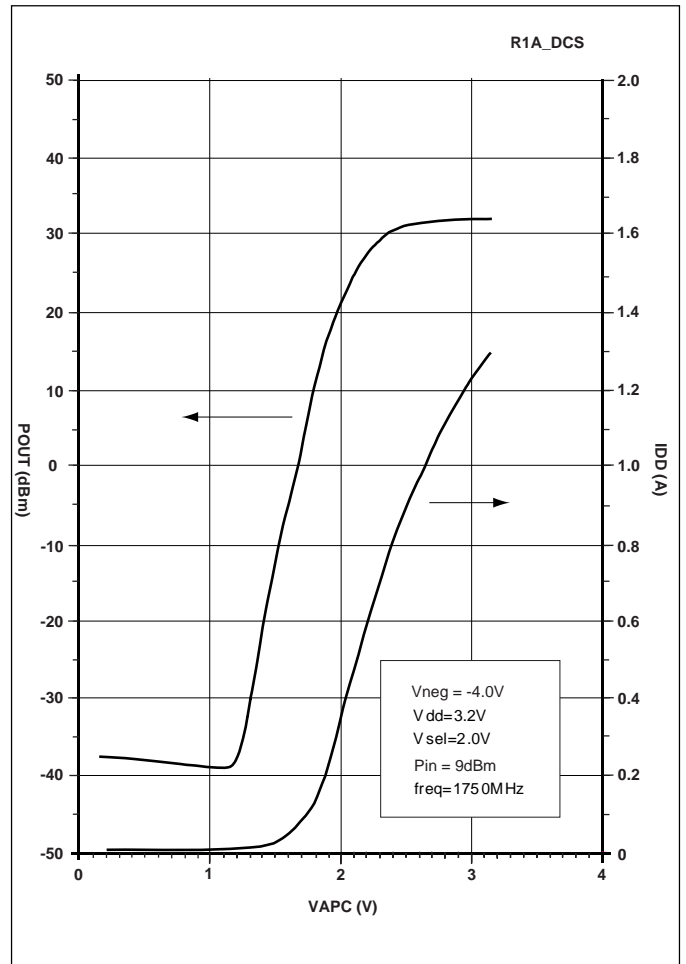


Figure 5. Pout and IDD versus VAPC at 1750 MHz.

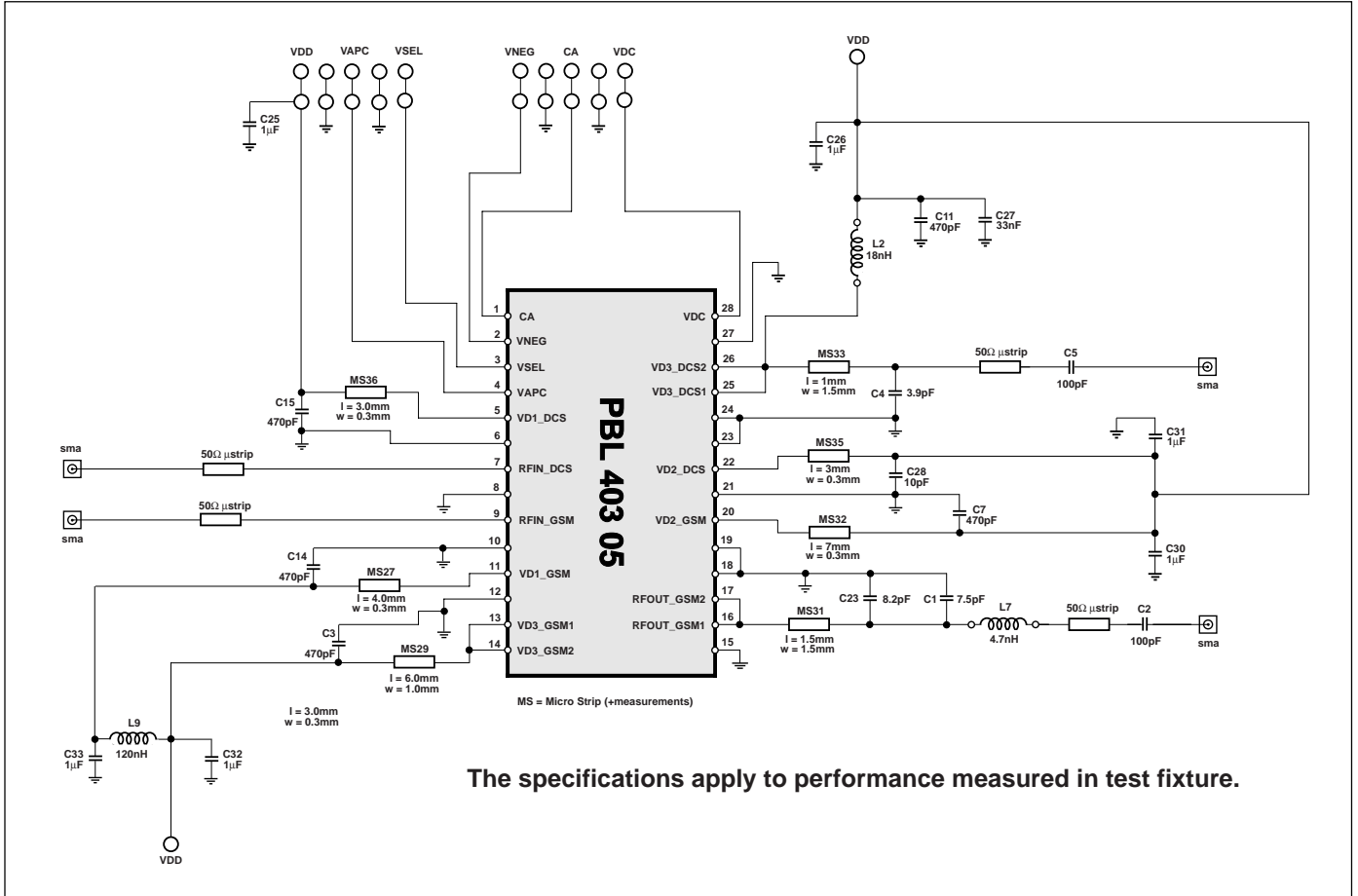


Figure 6. Verification board schematic.

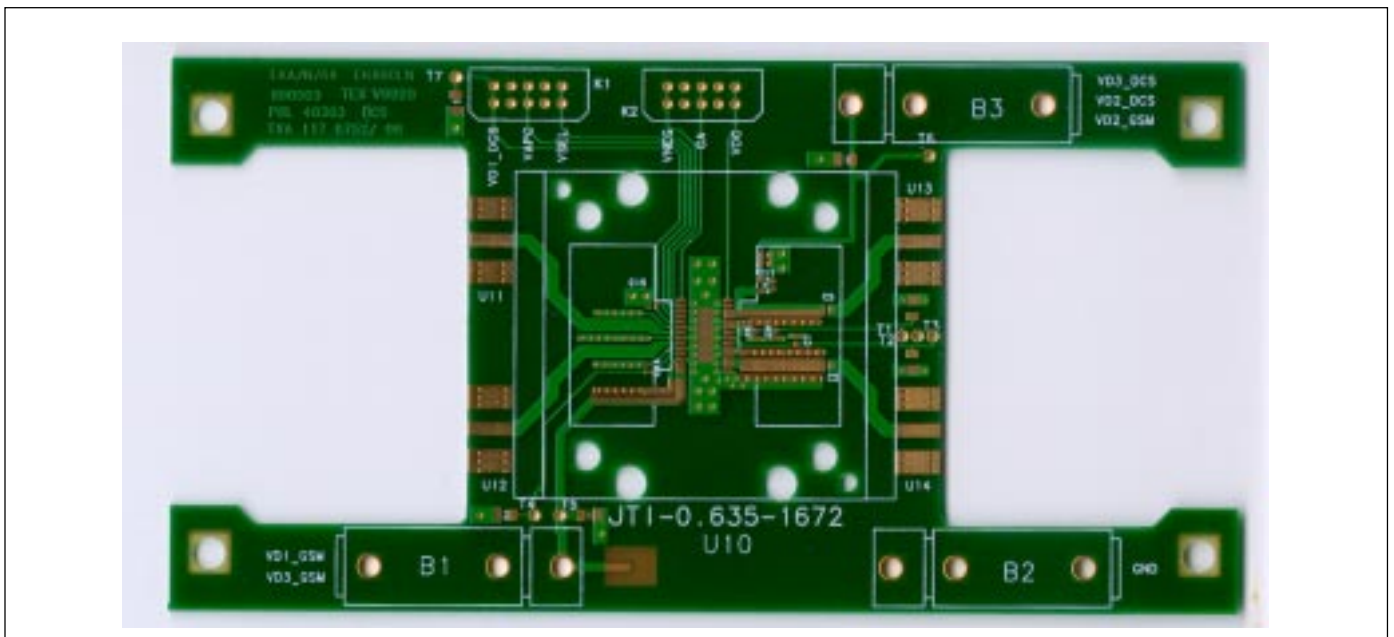
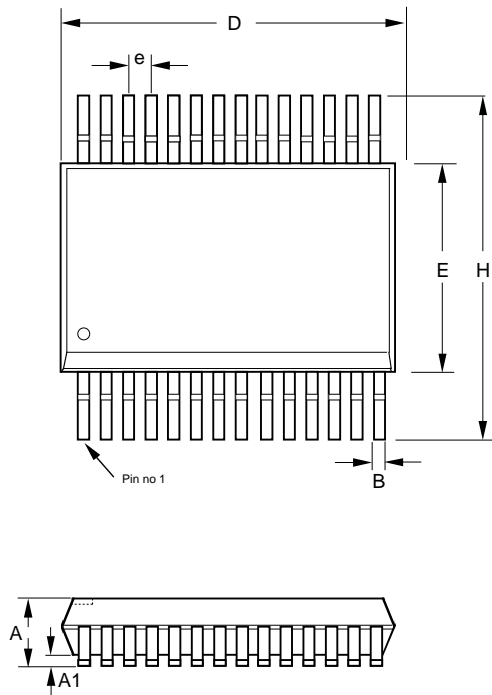
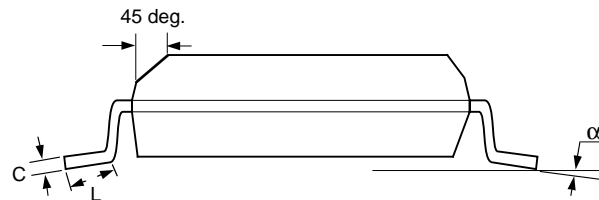


Figure 7. Verification board layout.

**Package drawing, QSOP 28**



Dim.	millimeters		inches	
	min.	max.	min.	max.
A	1.35	1.75	0.532	0.688
A1	0.10	0.25	0.004	0.0098
B	0.21	0.31	0.008	0.012
C	0.19	0.25	0.0075	0.0098
D	9.80	9.98	0.386	0.393
E	3.81	3.99	0.150	0.157
e	0.635mm		0.025 inch ref.	
H	5.80	6.20	0.2284	0.2240
L	0.41	1.27	0.016	0.050
$\alpha = 0-8 \text{ deg.}$				



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1522-PBL 403 10 Uen Rev.A  
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 January 2001