

Q1 The BSIM4 spice parameters have been extracted for the process simulated NMOS transistor and is as shown in the following table The spice parameters were extracted twice once using all the specified parameters in the *physics* section while another time by eliminating “temperature, htemperature and areafactor” and adding RHS min in the *math* section for converging DESSIS simulations. In the former case correct waveforms for the two stage inverter was not obtained nor the I_d - V_g characteristics were matching to sufficient degree of accuracy.

Previous Extracted Models		Newer Extracted Models	
	PSET usermodel		dvt1w = 5300000
	PARAMETERS		u0 = 4.999995e-01
	mobmod = 0		ua = 1.971433e-08
	rdsmod = 1		ub = 4.713033e-18
	igcmod = 1		uc = -1.030790e-17
	igbmod = 0		eu = 1.670000e+00
	capmod = 2		vsat = 6.679086e+04
	rgatemod = 3		a0 = 9.182037e-05
	rbodymod = 1		ags = 6.561404e-07
	diomod = 2		b0 = 0
	permod = 1		b1 = 0
	geomod = 0		keta = -6.400253e-01
	epsrox = 3.900000e+00		a1 = 0
	toxe = 2.500000e-09		a2 = 1
	toxp = 2.000000e-09		wint = 0
	toxm = 2.000000e-09		lint = 0
	xj = 1.000000e-07		dwg = 0
	ndep = 1.700000e+18		dwb = 0
	ngate = 9.800000e+19		voff = -3.000000e-01
	nsd = 2.000000e+20		voffl = 0
	rsh = 100		minv = -1.597604e+00
	rshg = 1.000000e-03		Nfactor = 4.999995e+00
	vth0 = 6.775495e-01		eta0 = 2.391520e-01
	phin = 0		etab = -1.264527e+00
	k1 = 4.083350e-01		dsub = 5.600000e-01
	k2 = -4.762956e-02		cit = 0
	k3 = 0		cdsc = 0
	k3b = 0		cdscb = 5.000000e-02
	w0 = 2.500000e-06		cdscd = -5.000000e-02
	lpe0 = 0		pclm = 1.311282e+00
	lpeb = 0		pdiblc1 = 0
	vbm = -1.200000e+00		pdiblc2 = 1.000001e-05
	dvt0 = 0		Pdiblcb = 4.989773e-01
	dvt1 = 5.300000e-01		drout = 5.600000e-01

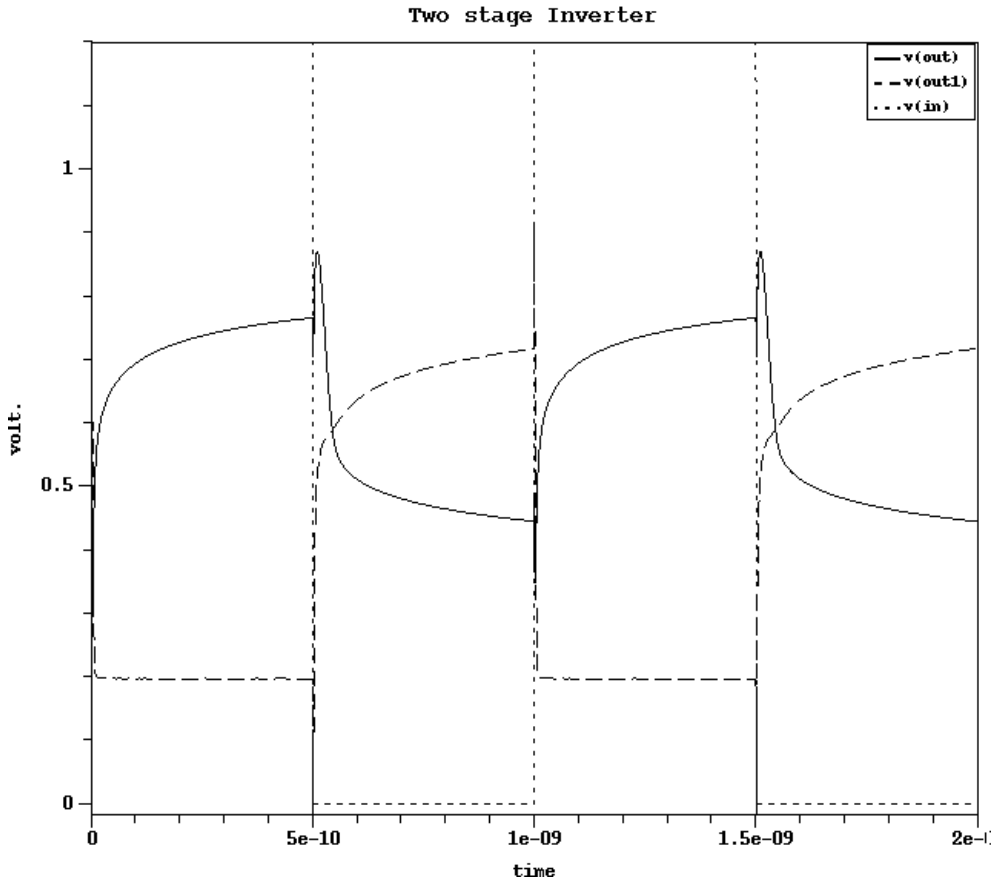
dvt2 = 0	pscbe1 = 424000000
dvtp0 = 0	pscbe2 = 0
dvtp1 = 1.000000e-05	pvag = 2.270683e-01
dvt0w = 0	delta = 1.988510e-03
fprout = 0	ntox = 1
pdits = 0	toxref = 3.000000e-09
pditsl = 0	xpart = 0
pditsd = 0	cgso = 8.596910e-11
rdsw = 200	cgdo = 8.596910e-11
rdswmin = 1	cgbo = 0
rdw = 4.821033e+01	cgsl = 2.609212e-10
rdwmin = 5.020942e+01	cgdl = 2.609212e-10
rsw = 4.821033e+01	ckappas = 1.000000e-01
rswmin = 5.020942e+01	ckappad = 1.000000e-01
prwg = 1.064831e-02	Cf = 8.640690e-13
prwb = 4.162146e-02	clc = 0
wr = 1	cle = 6.000000e-01
alpha0 = 9.808055e-10	dlc = 3.118553e-08
alpha1 = 0	dwc = 0
beta0 = 50	vfbcv = -1
agidl = 9.474011e-07	noff = 1.367692e+00
bgidl = 7.690218e+09	voffcv = -3.356234e-01
cgidl = 10	acde = 8.424424e-01
egidl = -5	moin = 1
aigbacc = 4.300000e-01	xrcrg1 = 1.311850e+01
bigbacc = 5.400000e-02	xrcrg2 = 2.222310e+02
cigbacc = 7.500000e-02	rbpb = 4.762139e+01
nigbacc = 1	rbpd = 4.965907e+01
aigbinv = 3.500000e-01	rbps = 4.944505e+01
bigbinv = 3.000000e-02	rbdb = 5.039511e+01
cigbinv = 6.000000e-03	rbsb = 4.958295e+01
eigbinv = 1.100000e+00	gbmin = 1.000000e-12
nigbinv = 3	xgw = 0
aigc = 1.632353e-02	xgl = 0
bigc = -3.649748e-03	ngcon = 1
cigc = -2.165130e-01	ljthsrev = 1.000000e-01
aigsd = 1.555609e-02	ljthdrev = 1.000000e-01
bigsd = 8.956954e-04	ijthsfwd = 1.000000e-01
cigsd = -5.738245e-02	ijthdfwd = 1.000000e-01
dlcig = 8.168364e-09	xjbvs = 1

nigc = 6.530388e+00	xjbvd = 1
poxedge = 1.256791e+00	bvs = 2
pigcd = 1	bvd = 2
jss = 3.967152e-07	tpbsw = 0
jsd = 3.967152e-07	Tpbswg = 0
jsws = 0	tcj = 0
jswd = 0	tcjsw = 0
jswgs = 0	tcjswg = 0
jswgd = 0	wl = 0
cjs = 6.581814e-03	wln = 1
cjd = 6.581814e-03	ww = 0
mjs = 1.922207e-01	wwn = 1
mjd = 1.922207e-01	wwl = 0
mjsws = 3.300000e-01	ll = 0
mjswd = 3.300000e-01	lln = 1
cjsws = 0	lw = 0
cjswd = 0	lwn = 1
cjswgs = 0	lwl = 0
cjswgd = 0	llc = 0
mjswgs = 3.300000e-01	lwc = 0
mjswgd = 3.300000e-01	lwlc = 0
pbs = 1.713058e-01	wlc = 0
pbd = 1.713058e-01	wwc = 0
pbsws = 1	wwlc = 0
pbswd = 1	END PSET
pbswgs = 1	
pbswgd = 1	
tnom = 27	
ute = -1.500000e+00	
kt1 = -1.100000e-01	
kt1l = 0	
kt2 = 2.200000e-02	
ua1 = 1.000000e-09	
ub1 = -1.000000e-18	
uc1 = -5.600000e-11	
at = 33000	
prt = 0	
njs = 1.043002e+00	
njd = 1.043002e+00	
xtis = 3	

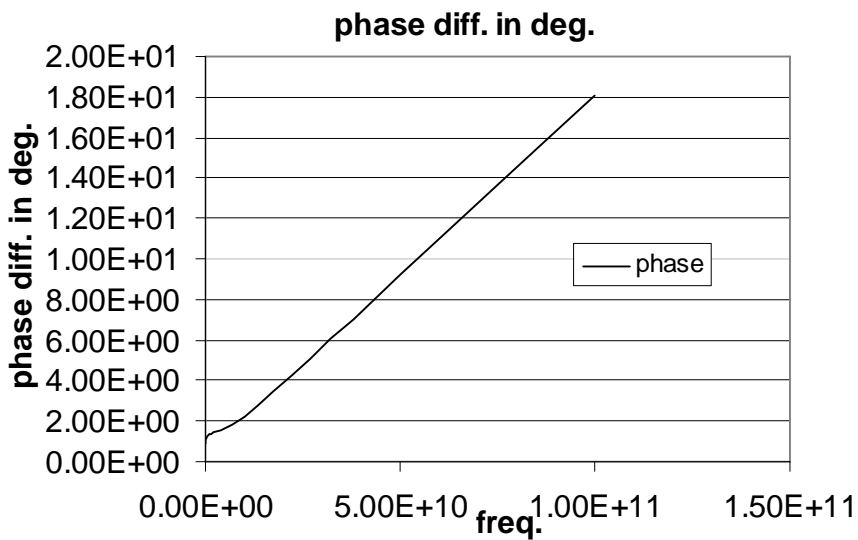
	xtid = 3
	tpb = 0

Q2)

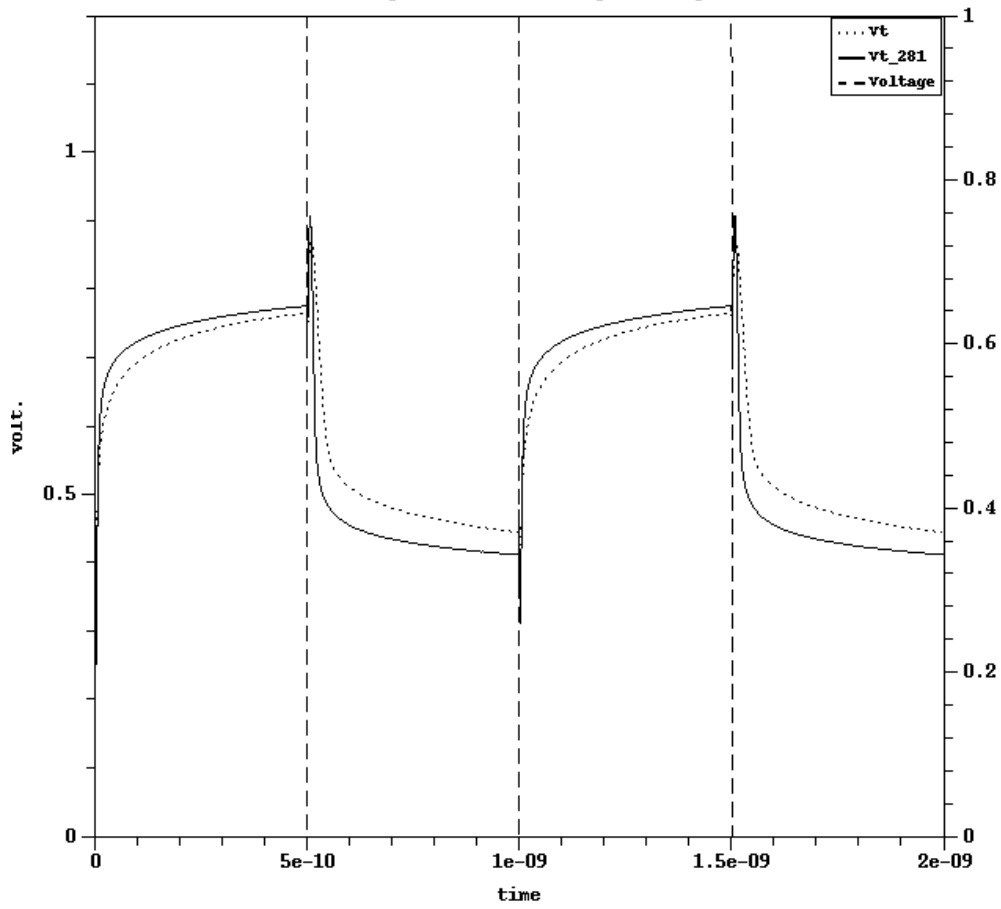
Q3) The propagation delay, t_{pd} is found to be 56.4 psec. for pulse with width 0.5nsec.



Q4) Following fig. Shows phase difference in degree vs. the freq.



2 stage Inverter output Graph



2 stage Inverter output for 0.1um transistor

