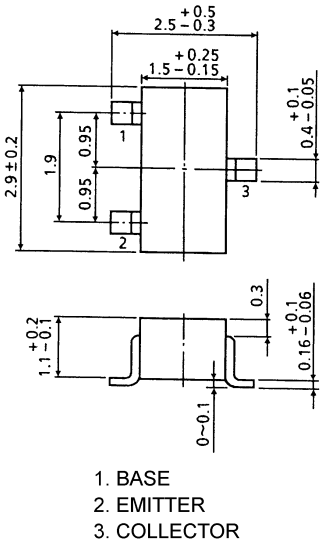
TOSHIBA Transistor Silicon NPN Epitaxial Planar Type (PCT process)

2SC2715

High Frequency Amplifier Applications

- High power gain: Gpe = 30dB (typ.) (f = 10.7 MHz)
- Recommended for FM IF, OSC stage and AM CONV. IF stage.

Unit: mm



USM	
JEDEC	—
JEITA	SC-59
TOSHIBA	2-3F1A

Weight: 0.012 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	35	V
Collector-emitter voltage	V_{CEO}	30	V
Emitter-base voltage	V_{EBO}	4	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Collector power dissipation	P_C	150	mW
Junction temperature	T_j	125	°C
Storage temperature range	T_{stg}	−55~125	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = 35 V, I_E = 0	—	—	0.1	μA
Emitter cut-off current	I_{EBO}	V_{EB} = 4 V, I_C = 0	—	—	1.0	μA
DC current gain	h_{FE} (Note)	V_{CE} = 12 V, I_C = 2 mA	40	—	240	
Collector-emitter saturation voltage	V_{CE} (sat)	I_C = 10 mA, I_B = 1 mA	—	—	0.4	V
Base-emitter voltage	V_{BE}	I_C = 10 mA, I_B = 1 mA	—	—	1.0	V
Transition frequency	f_T	V_{CE} = 10 V, I_C = 1 mA	100	—	400	MHz
Collector output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz	—	2.0	3.2	pF
Collector-base time constant	C_c.rbb’	V_{CE} = 10 V, I_E = −1 mA, f = 30 MHz	—	—	50	ps
Power gain	G_{pe}	V_{CC} = 6 V, I_E = −1 mA, f = 10.7 MHz (Figure 1)	27	30	33	dB

Note: h_{FE} classification R: 40~80, O: 70~140, Y: 120~240

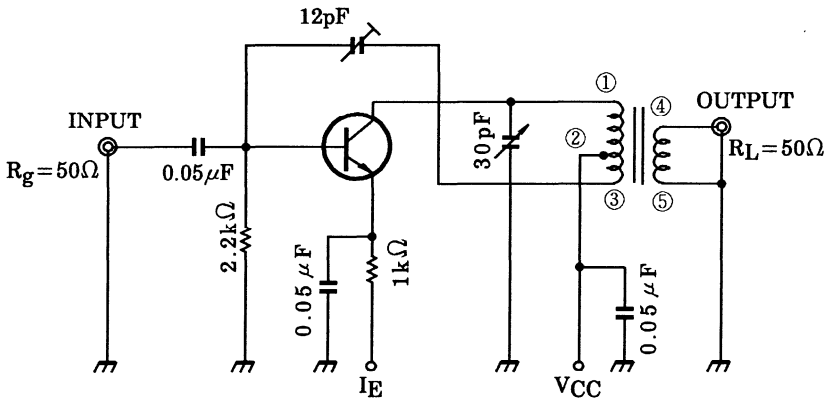
y Parameter (typ.)

(1) (common emitter f = 455 kHz, Ta = 25°C)

Characteristics	Symbol	2SC2715-R	2SC2715-O	2SC2715-Y	Unit
Collector-emitter voltage	V_{CE}	6	6	6	V
Emitter current	I_E	−1	−1	−1	mA
Input conductance	g_{ie}	0.58	0.41	0.26	mS
Input capacitance	C_{ie}	53	46	38	pF
Output conductance	g_{oe}	1.9	2.7	4.8	μS
Output capacitance	C_{oe}	2.6	2.8	3.6	pF
Forward transfer admittance	$\|y_{fe}\|$	38	38	38	mS
Phase angle of forward transfer admittance	θ_{fe}	−0.79	−0.83	−0.92	°
Reverse transfer admittance	$\|y_{re}\|$	5.7	5.7	6.2	μS
Phase angle of reverse transfer admittance	θ_{re}	−90	−90	−90	°

(2) (common emitter f = 10.7 MHz, Ta = 25°C)

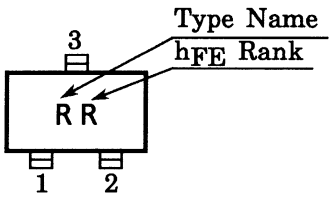
Characteristics	Symbol	2SC2715-R	2SC2715-O	2SC2715-Y	Unit
Collector-emitter voltage	V_{CE}	6	6	6	V
Emitter current	I_E	−1	−1	−1	mA
Input conductance	g_{ie}	1.04	0.85	0.65	mS
Input capacitance	C_{ie}	49	43	36	pF
Output conductance	g_{oe}	10	15	28	μS
Output capacitance	C_{oe}	2.7	2.9	3.6	pF
Forward transfer admittance	$\|y_{fe}\|$	37	37	37	mS
Phase angle of forward transfer admittance	θ_{fe}	−9.6	−10.4	−11.5	°
Reverse transfer admittance	$\|y_{re}\|$	120	120	140	μS
Phase angle of reverse transfer admittance	θ_{re}	−90	−90	−90	°



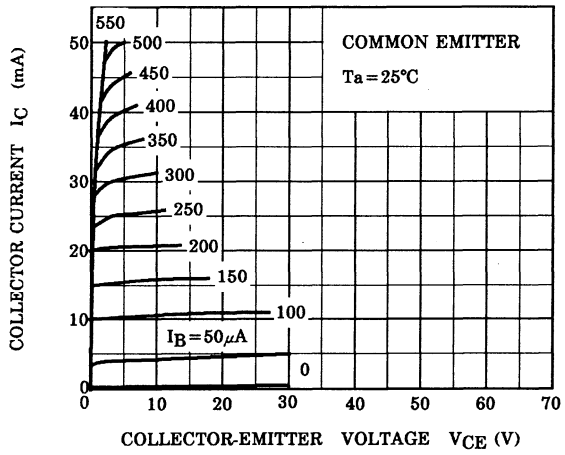
T : ①–② 0.1mmϕ UEW 20T
②–③ 0.1mmϕ UEW 8T
④–⑤ 0.1mmϕ UEW 2T

Figure 1 NF, Gpe Test Circuit

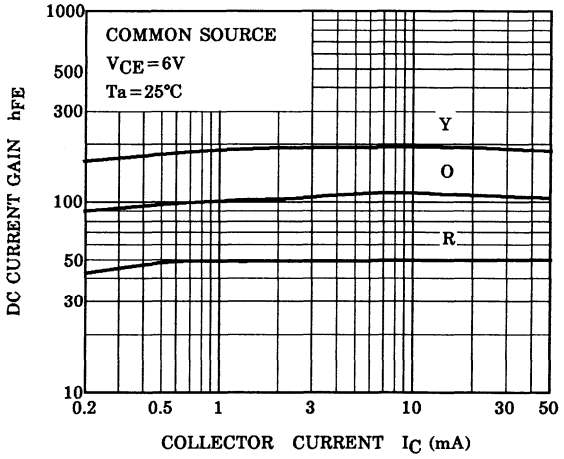
Marking



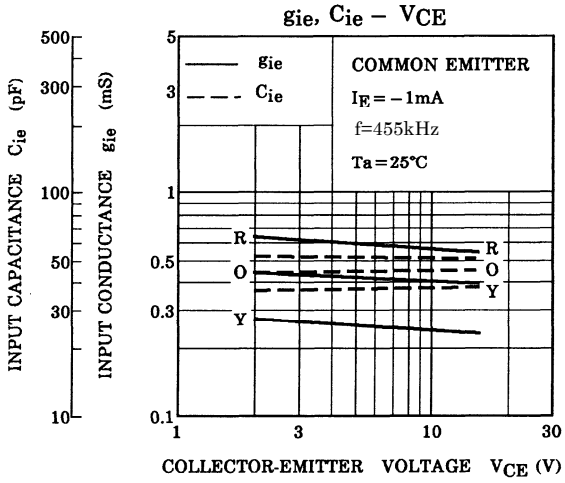
$I_C - V_{CE}$



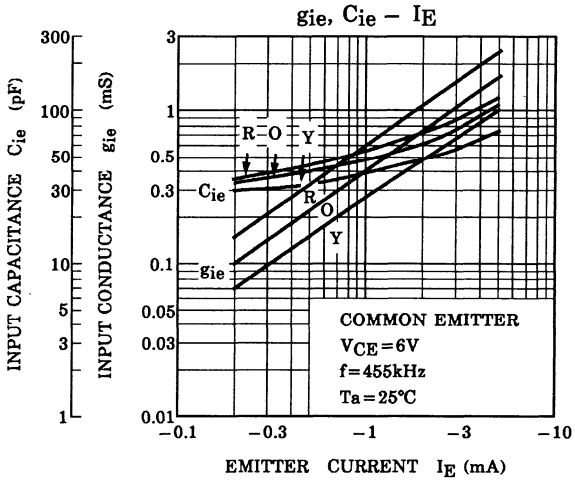
$h_{FE} - I_C$



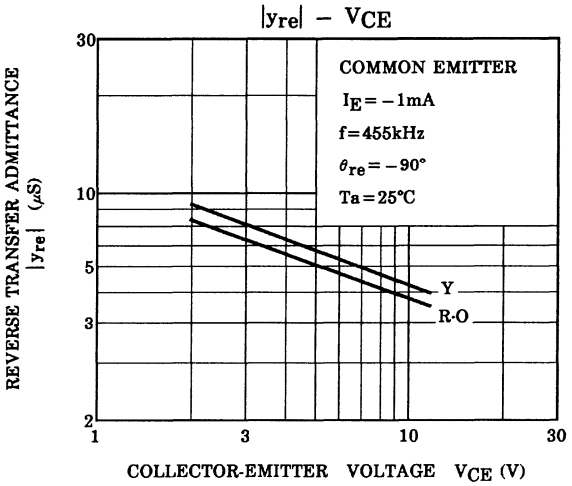
g_{ie}, $C_{ie} - V_{CE}$



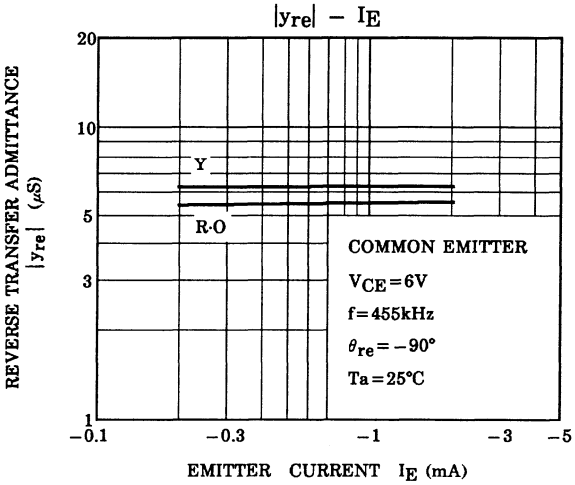
g_{ie}, $C_{ie} - I_E$

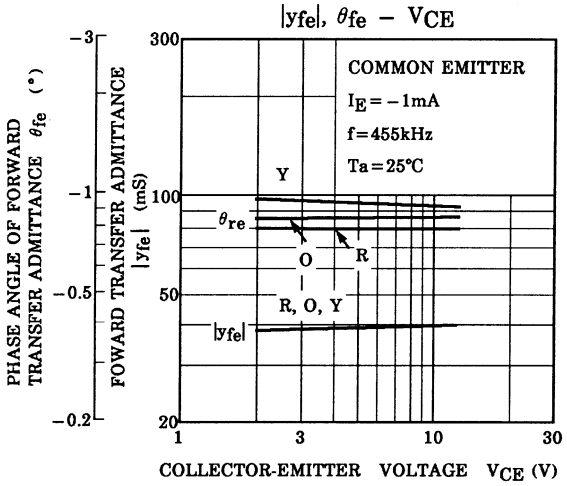


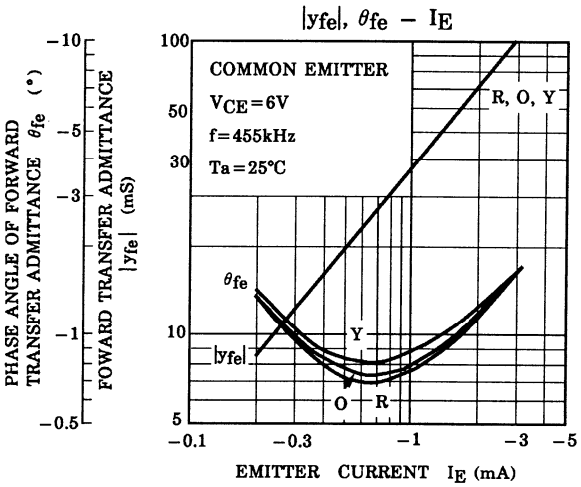
$|y_{re}| - V_{CE}$

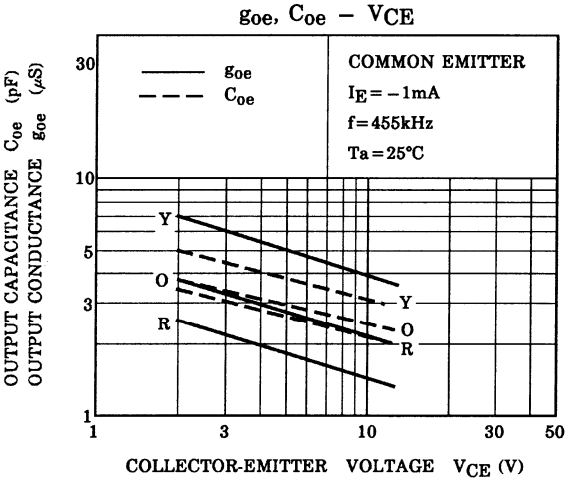


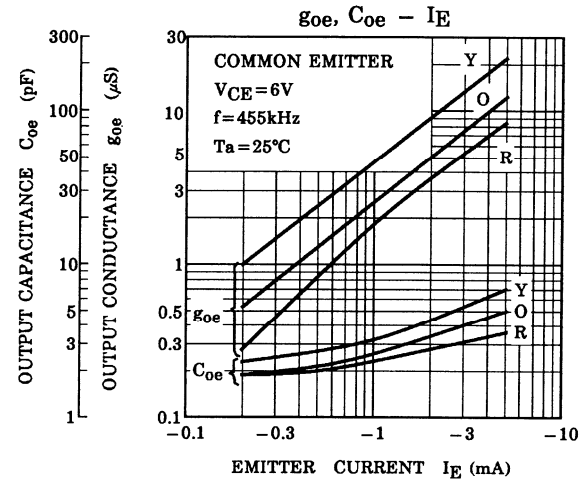
$|y_{re}| - I_E$

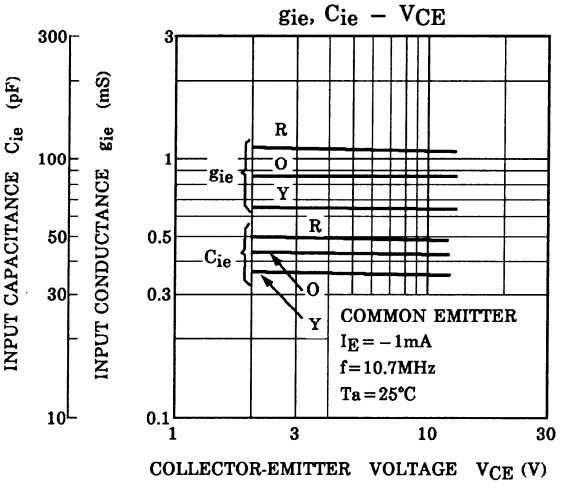


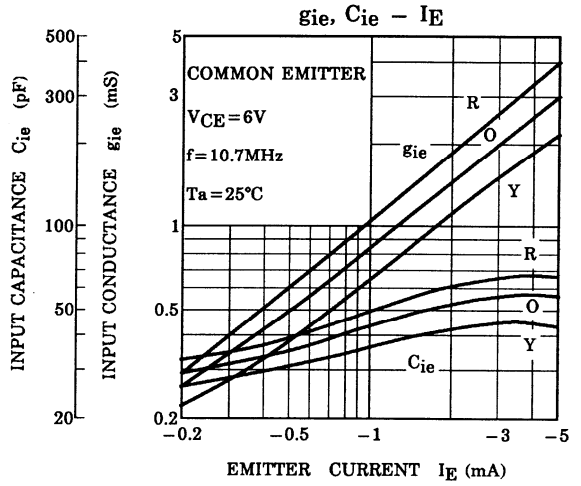

|yfe|, θfe – VCE
COMMON EMITTER
IE = –1mA
f = 455kHz
Ta = 25°C
Y
θre
O
R
R, O, Y
|yfe|
PHASE ANGLE OF FORWARD TRANSFER ADMITTANCE θfe (°)
FOWARD TRANSFER ADMITTANCE |yfe| (mS)
COLLECTOR-EMITTER VOLTAGE VCE (V)

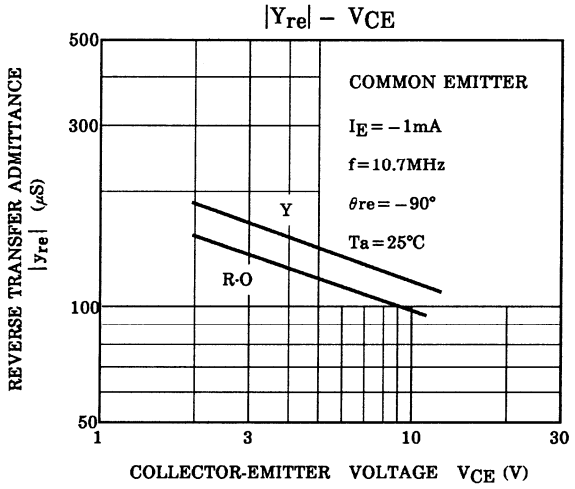

|yfe|, θfe – IE
COMMON EMITTER
VCE = 6V
f = 455kHz
Ta = 25°C
R, O, Y
θfe
|yfe|
Y
O
R
PHASE ANGLE OF FORWARD TRANSFER ADMITTANCE θfe (°)
FOWARD TRANSFER ADMITTANCE |yfe| (mS)
EMITTER CURRENT IE (mA)

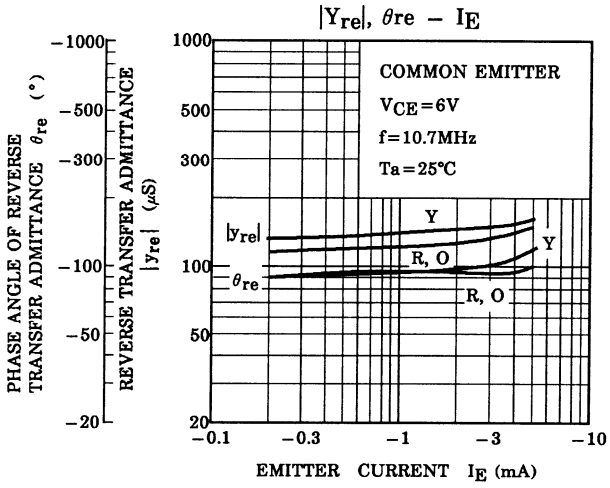

goe, Coe – VCE
goe
Coe
COMMON EMITTER
IE = –1mA
f = 455kHz
Ta = 25°C
Y
O
R
OUTPUT CAPACITANCE Coe (pF)
OUTPUT CONDUCTANCE goe (μS)
COLLECTOR-EMITTER VOLTAGE VCE (V)

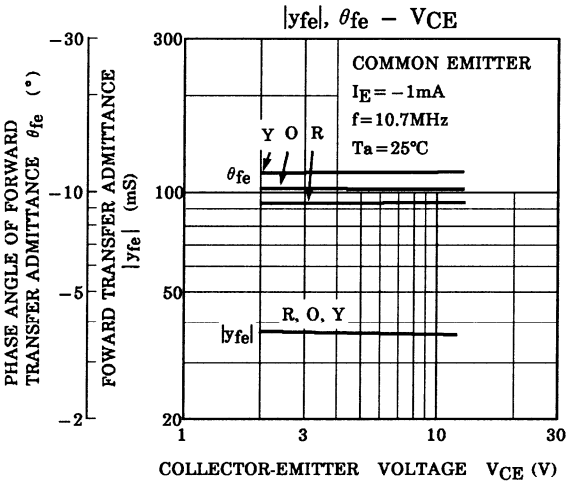

goe, Coe – IE
COMMON EMITTER
VCE = 6V
f = 455kHz
Ta = 25°C
Y
O
R
goe
Coe
OUTPUT CAPACITANCE Coe (pF)
OUTPUT CONDUCTANCE goe (μS)
EMITTER CURRENT IE (mA)

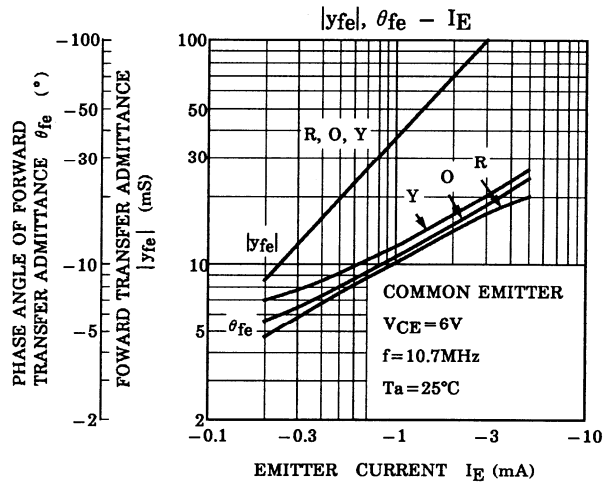

gie, Cie – VCE
COMMON EMITTER
IE = –1mA
f = 10.7MHz
Ta = 25°C
R
O
Y
gie
Cie
INPUT CAPACITANCE Cie (pF)
INPUT CONDUCTANCE gie (mS)
COLLECTOR-EMITTER VOLTAGE VCE (V)

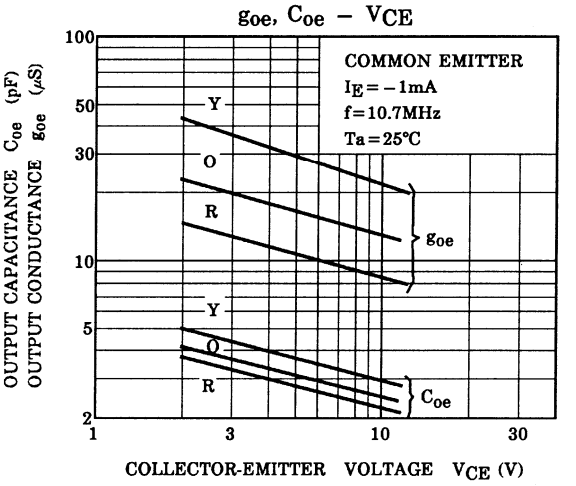

gie, Cie – IE
COMMON EMITTER
VCE = 6V
f = 10.7MHz
Ta = 25°C
R
O
Y
gie
Cie
INPUT CAPACITANCE Cie (pF)
INPUT CONDUCTANCE gie (mS)
EMITTER CURRENT IE (mA)

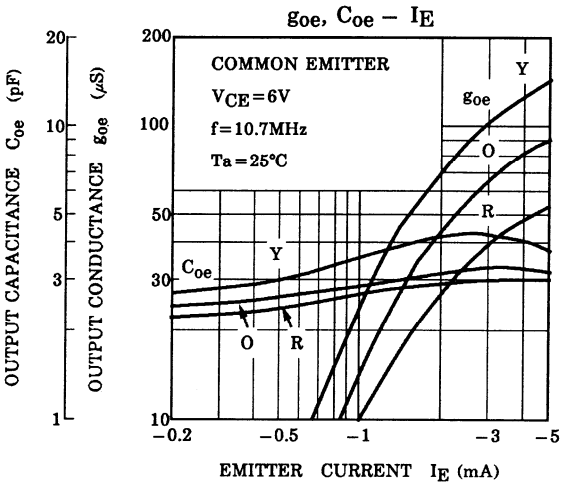

|Yre| – VCE
COMMON EMITTER
IE = −1mA
f = 10.7MHz
θre = −90°
Ta = 25°C
Y
R-O
REVERSE TRANSFER ADMITTANCE |yre| (μS)
COLLECTOR-EMITTER VOLTAGE VCE (V)

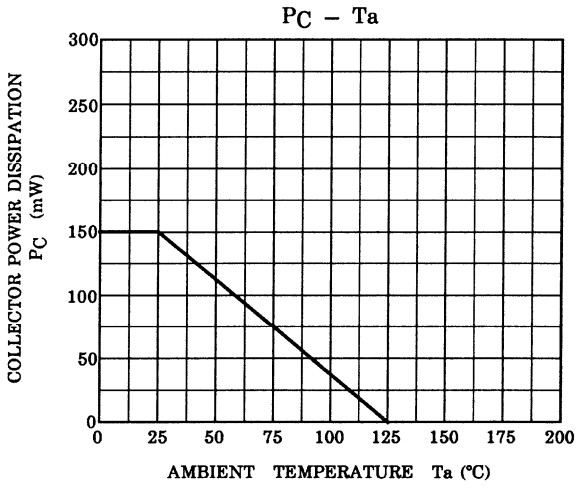

|Yre|, θre – IE
COMMON EMITTER
VCE = 6V
f = 10.7MHz
Ta = 25°C
|yre|
θre
Y
R, O
PHASE ANGLE OF REVERSE TRANSFER ADMITTANCE θre (°)
REVERSE TRANSFER ADMITTANCE |yre| (μS)
EMITTER CURRENT IE (mA)


|yfe|, θfe – VCE
COMMON EMITTER
IE = −1mA
f = 10.7MHz
Ta = 25°C
θfe
Y O R
|yfe|
R, O, Y
PHASE ANGLE OF FORWARD TRANSFER ADMITTANCE θfe (°)
FOWARD TRANSFER ADMITTANCE |yfe| (mS)
COLLECTOR-EMITTER VOLTAGE VCE (V)


|yfe|, θfe – IE
COMMON EMITTER
VCE = 6V
f = 10.7MHz
Ta = 25°C
R, O, Y
|yfe|
θfe
PHASE ANGLE OF FORWARD TRANSFER ADMITTANCE θfe (°)
FOWARD TRANSFER ADMITTANCE |yfe| (mS)
EMITTER CURRENT IE (mA)


goe, Coe – VCE
COMMON EMITTER
IE = −1mA
f = 10.7MHz
Ta = 25°C
goe
Coe
OUTPUT CAPACITANCE Coe (pF)
OUTPUT CONDUCTANCE goe (μS)
COLLECTOR-EMITTER VOLTAGE VCE (V)


goe, Coe – IE
COMMON EMITTER
VCE = 6V
f = 10.7MHz
Ta = 25°C
goe
Coe
OUTPUT CAPACITANCE Coe (pF)
OUTPUT CONDUCTANCE goe (μS)
EMITTER CURRENT IE (mA)


PC – Ta
COLLECTOR POWER DISSIPATION PC (mW)
300
250
200
150
100
50
0
0
25
50
75
100
125
150
175
200
AMBIENT TEMPERATURE Ta (°C)

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