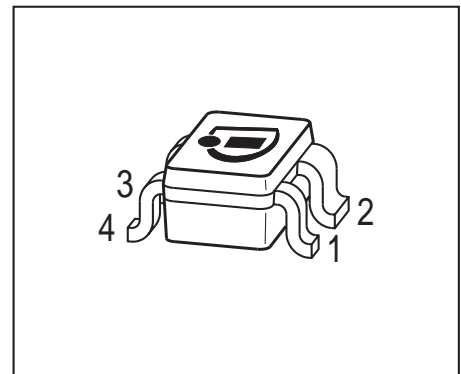


NPN Silicon Germanium RF Transistor*

- For high power amplifiers
- Ideal for low phase noise oscillators
- Maxim. available Gain $G_{ma} = 21$ dB at 1.8 GHz
Noise figure $F = 0.8$ dB at 1.8 GHz
- Gold metallization for high reliability
- 70 GHz f_T - Silicon Germanium technology
- Pb-free (RoHS compliant) package¹⁾
- Qualified according AEC Q101



* Short term description



ESD (Electrostatic discharge) sensitive device, observe handling precaution!

Type	Marking	Pin Configuration						Package
BFP650	R5s	1=B	2=E	3=C	4=E	-	-	SOT343

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}		V
$T_A > 0$ °C		4	
$T_A \leq 0$ °C		3.7	
Collector-emitter voltage	V_{CES}	13	
Collector-base voltage	V_{CBO}	13	
Emitter-base voltage	V_{EBO}	1.2	
Collector current	I_C	150	mA
Base current	I_B	10	
Total power dissipation ²⁾	P_{tot}	500	mW
$T_S \leq 75$ °C			
Junction temperature	T_j	150	°C
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

¹Pb-containing package may be available upon special request

² T_S is measured on the collector lead at the soldering point to the pcb

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point ¹⁾	R_{thJS}	≤ 140	K/W

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

DC Characteristics

Collector-emitter breakdown voltage $I_C = 3 \text{ mA}, I_B = 0$	$V_{(BR)CEO}$	4	4.5	-	V
Collector-emitter cutoff current $V_{CE} = 13 \text{ V}, V_{BE} = 0$	I_{CES}	-	-	100	μA
Collector-base cutoff current $V_{CB} = 5 \text{ V}, I_E = 0$	I_{CBO}	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 0.5 \text{ V}, I_C = 0$	I_{EBO}	-	-	10	μA
DC current gain $I_C = 80 \text{ mA}, V_{CE} = 3 \text{ V}$, pulse measured	h_{FE}	110	180	270	-

¹⁾For calculation of R_{thJA} please refer to Application Note Thermal Resistance

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Transition frequency $I_C = 80\text{ mA}$, $V_{CE} = 3\text{ V}$, $f = 1\text{ GHz}$	f_T	28	37	-	GHz
Collector-base capacitance $V_{CB} = 3\text{ V}$, $f = 1\text{ MHz}$, $V_{BE} = 0$, emitter grounded	C_{cb}	-	0.26	0.4	pF
Collector emitter capacitance $V_{CE} = 3\text{ V}$, $f = 1\text{ MHz}$, $V_{BE} = 0$, base grounded	C_{ce}	-	0.45	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$, $V_{CB} = 0$, collector grounded	C_{eb}	-	1.1	-	
Noise figure $I_C = 10\text{ mA}$, $V_{CE} = 3\text{ V}$, $f = 1.8\text{ GHz}$, $Z_S = Z_{Sopt}$ $I_C = 10\text{ mA}$, $V_{CE} = 3\text{ V}$, $f = 6\text{ GHz}$, $Z_S = Z_{Sopt}$	F	-	0.8	-	dB
		-	1.9	-	
Power gain, maximum available ¹⁾ $I_C = 80\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 1.8\text{ GHz}$ $f = 6\text{ GHz}$	G_{ma}	-	21.5	-	
		-	10.5	-	
Transducer gain $I_C = 80\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_L = 50\ \Omega$, $f = 1.8\text{ GHz}$ $f = 6\text{ GHz}$	$ S_{21e} ^2$	15	17.5	-	dB
		-	6	-	
Third order intercept point at output ²⁾ $V_{CE} = 3\text{ V}$, $I_C = 80\text{ mA}$, $f = 1.8\text{ GHz}$, $Z_S = Z_L = 50\ \Omega$	IP_3	-	29.5	-	dBm
1dB Compression point at output $I_C = 80\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_L = 50\ \Omega$, $f = 1.8\text{ GHz}$	P_{-1dB}	-	18	-	

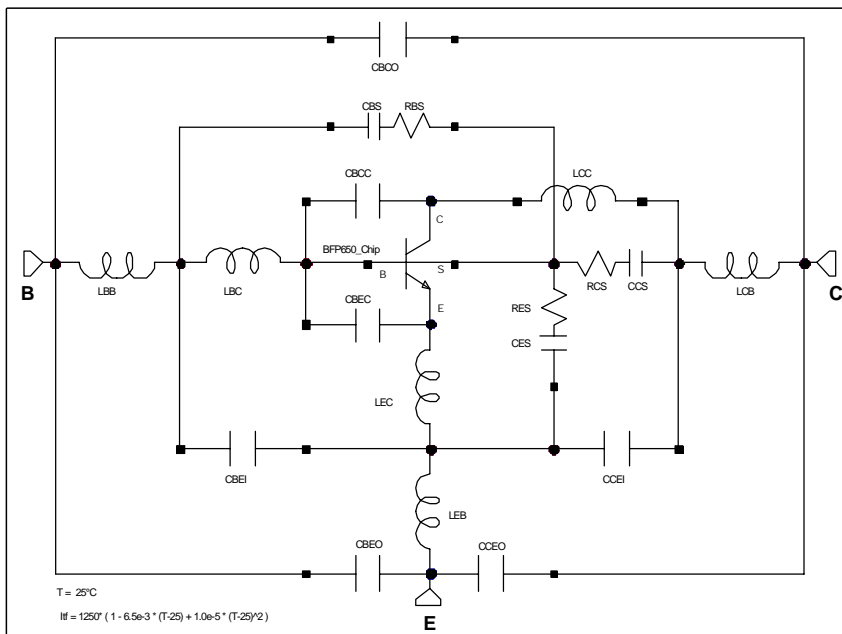
$$^1 G_{ma} = |S_{21e} / S_{12e}| (k - (k^2 - 1)^{1/2})$$

²⁾IP3 value depends on termination of all intermodulation frequency components.
Termination used for this measurement is $50\ \Omega$ from 0.1 MHz to 6 GHz

SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):
Transistor Chip Data:

IS =	0.61	fA	BF =	450	-	NF =	1.025	-
VAF =	1000	V	IKF =	0.47	A	ISE =	62	fA
NE =	2	-	BR =	42	-	NR =	1	-
VAR =	2	V	IKR =	18	mA	ISC =	700	fA
NC =	1.8	-	RB =	1.036	Ω	IRB =	4.548	mA
RBM =	0.895	Ω	RE =	0.2	-	RC =	1.006	Ω
CJE =	682.5	fF	VJE =	0.8	V	MJE =	0.3	-
TF =	1.9	ps	XTF =	10	-	VTF =	1.5	V
ITF =	1.25	A	PTF =	0	deg	CJC =	204.6	fF
VJC =	0.6	V	MJC =	0.5	-	XCJC =	1	-
TR =	0.2	ns	CJS =	294.9	fF	VJS =	0.6	V
MJS =	0.27	-	XTB =	-1.42	-	EG =	1.078	eV
XTI =	3	-	FC =	0.8	-	TNOM	298	K
AF =	2	-	KF =	2.441E-11	-			
TITF1	-0.0065	-	TITF2	1.0E-5	-			

All parameters are ready to use, no scaling is necessary.

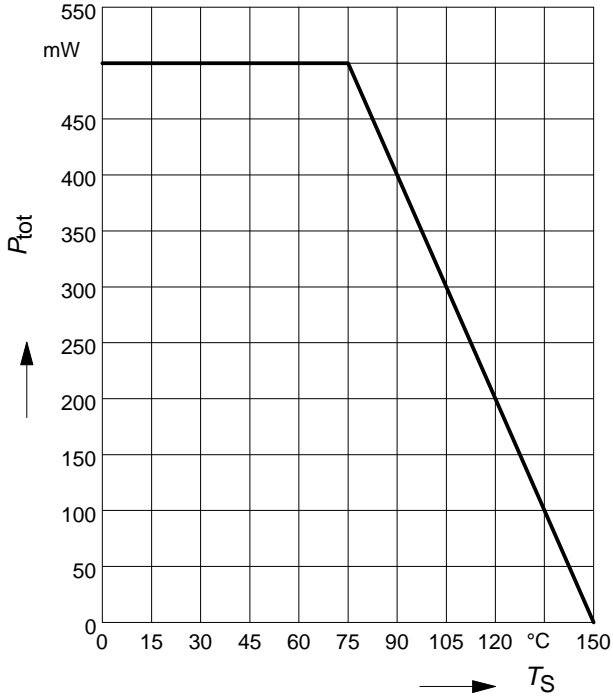
Package Equivalent Circuit:


LBC =	50	pH
LCC =	50	pH
LEC =	4	pH
LBB =	554.6	pH
LCB =	606.9	pH
LEB =	138.7	pH
CBEC =	327.6	fF
CBCC =	171.4	fF
CES =	490	fF
CBS =	120	fF
CCS =	135	fF
CBCO =	7.5	fF
CCEO =	112.6	fF
CBEI =	121.5	fF
CCEI =	5.7	fF
CBEI =	6.9	Ω
RBS =	710	Ω
RCS =	710	Ω
RES =	140	Ω

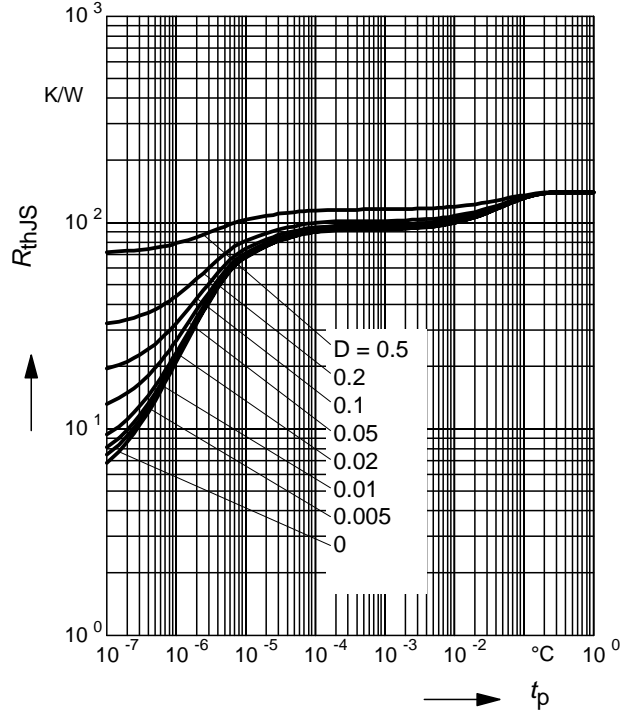
For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: <http://www.infineon.com>

Valid up to 6GHz

Total power dissipation $P_{tot} = f(T_S)$

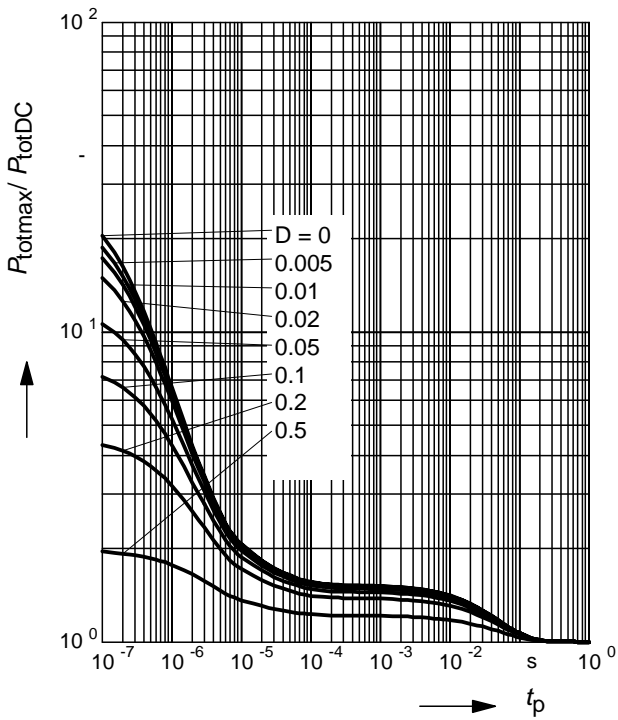


Permissible Pulse Load $R_{thJS} = f(t_p)$



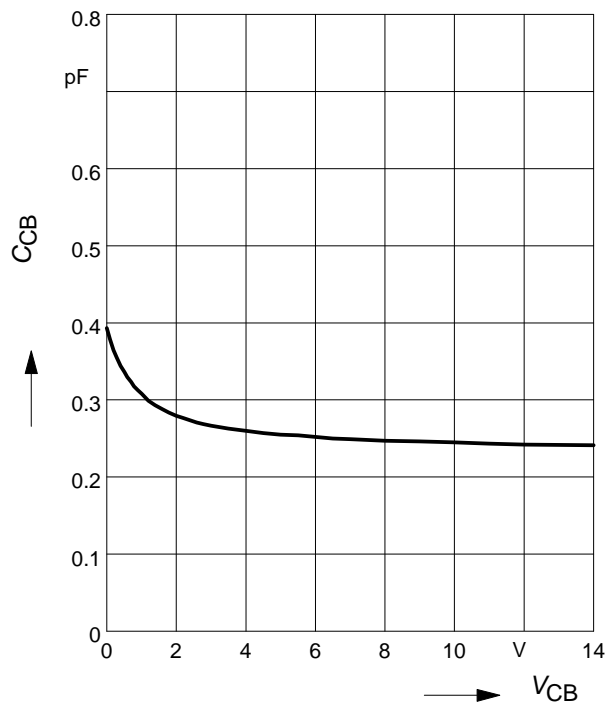
Permissible Pulse Load

$P_{totmax}/P_{totDC} = f(t_p)$



Collector-base capacitance $C_{cb} = f(V_{CB})$

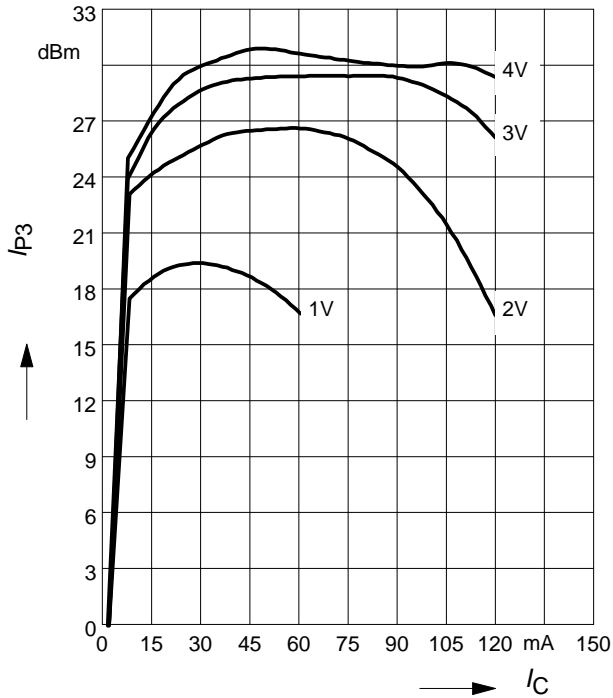
$f = 1\text{MHz}$



Third order Intercept Point $IP_3=f(I_C)$

(Output, $Z_S=Z_L=50\Omega$)

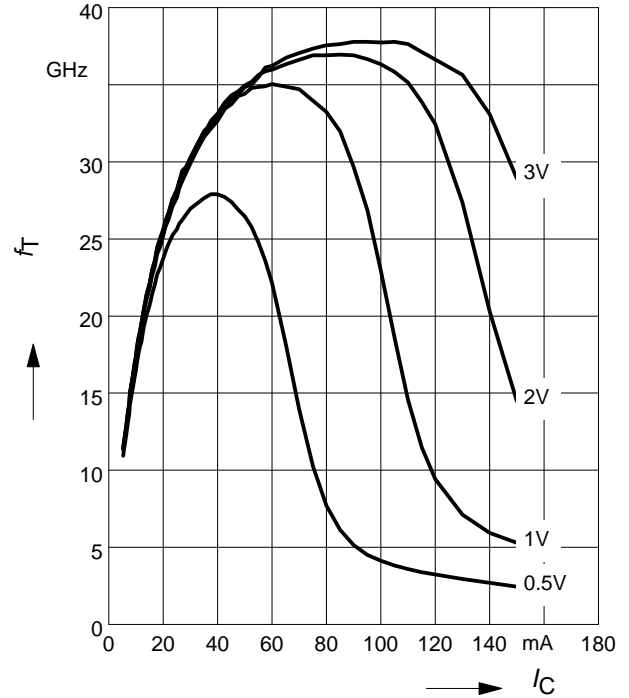
V_{CE} = parameter, $f = 1.8\text{ GHz}$



Transition frequency $f_T=f(I_C)$

$f = 1\text{ GHz}$

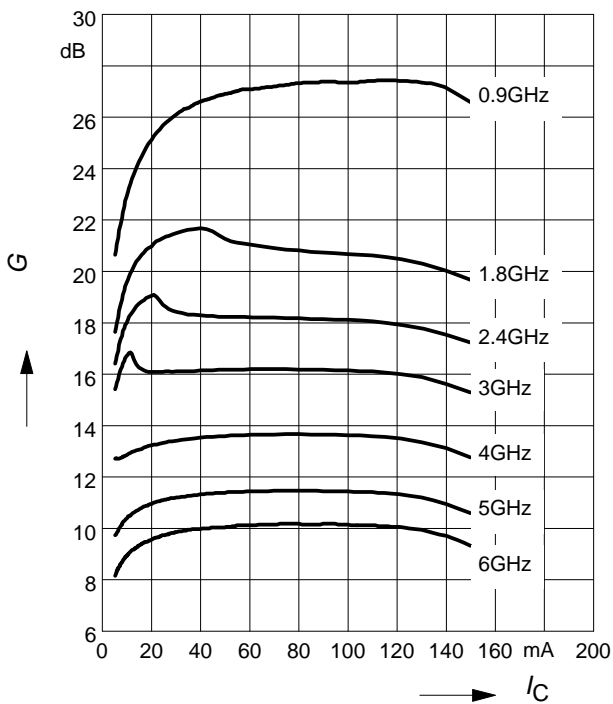
V_{CE} = parameter



Power gain $G_{ma}, G_{ms} = f(I_C)$

$V_{CE} = 3\text{ V}$

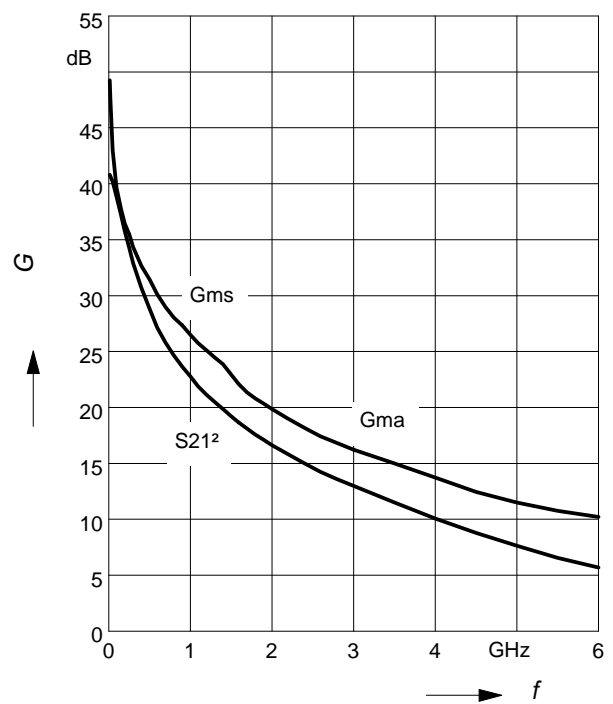
f = parameter



Power Gain $G_{ma}, G_{ms} = f(f)$

$|S_{21}|^2 = f(f)$

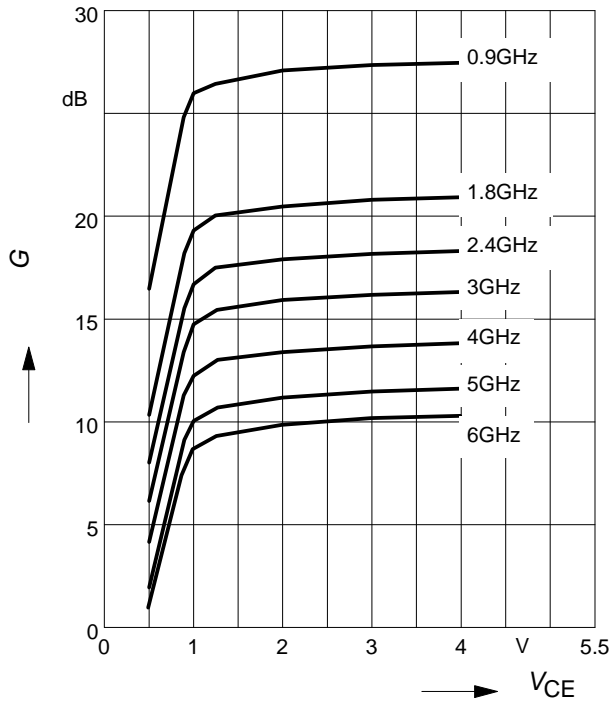
$V_{CE} = 3\text{ V}, I_C = 80\text{ mA}$



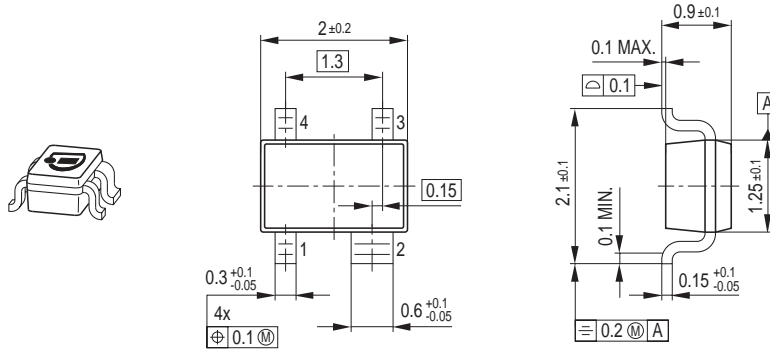
Power gain G_{ma} , $G_{ms} = f(V_{CE})$

$I_C = 80\text{mA}$

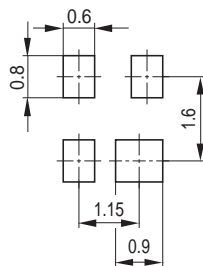
$f = \text{parameter}$



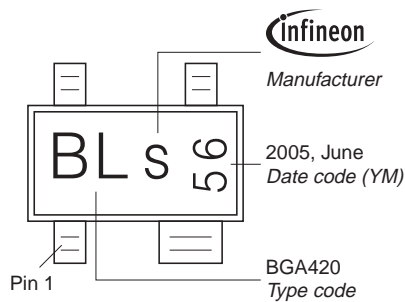
Package Outline



Foot Print

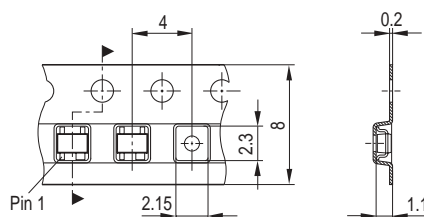


Marking Layout (Example)



Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel
 Reel ø330 mm = 10.000 Pieces/Reel



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