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# Transistors

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# Small Signal FETs

## MOS FETs (For Small Signa)

Application	Polarity	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)				Package					
		V <sub>DSS</sub> (V <sub>DS</sub> ) (V)	I <sub>D</sub> (A)	R <sub>DS(on)</sub>		t <sub>on</sub> typ. (ns)	t <sub>off</sub> typ. (ns)	ML3-N2		SSSMini3-F1 SSSMini3-F2●		SSMini3-F1 SSMini3-F3●	
				typ. (Ω)	V <sub>GS</sub> (V)			P <sub>D</sub> (mW)		P <sub>D</sub> (mW)	P <sub>D</sub> (mW)		
Digital/ analog switching	Pch	-30	-0.1	9.0	-4.0	300	400			2SJ0674	100		
				13	-2.5					2SJ0674G●	100		
	Nch	20	0.1	3.0	4.0	250	480			2SK3973	100		
				6.0	1.8					2SK3973G●	100		
		(20)		50*	5.0	1.0 μs*	1.0 μs*						
		25	1.0	0.26	4.0	8.0	30						
				0.35	2.5								
		30	0.1	30	5.0	150	35						
				5.0	4.0	350	350	2SK3939	100	2SK3938	100		
				7.0	2.5					2SK3938G●	100		
	1.0	0.35	10	12	60								
	0.48	4.0											
50	0.1	50*	5.0	10	20								
(50)	0.05	27	2.5	200	200								
	0.1	6.0	4.0	200	200			2SK3547	100	2SK3546J	125		
	0.1	8.0	2.5					2SK3547G●	100	2SK3546G●	125		
80	0.5	2.0	10	15	20								

\* mark: Max. rating    ● : Recommended products (Global package products)

## MOS FETs (For Power Management)

Application/ Function	Polarity	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)			Electrical Characteristics (T <sub>a</sub> = 25°C)					Package			
		V <sub>DSS</sub> (V)	V <sub>GSS</sub> (V)	I <sub>D</sub> (A)	R <sub>DS(on)</sub> typ.		C <sub>iss</sub> (pF)	t <sub>on</sub> typ. (ns)	t <sub>off</sub> typ. (ns)	WSSMini6-F1		WSMini6-F1	
					(mΩ)	V <sub>GS</sub> (V)				P <sub>D</sub> (W)		P <sub>D</sub> (W)	
Load S/W	Pch	-12	±8	-4.0	30	-4.0	1 200	30	300			MTM76110	0.7
					45	-1.8							
					26	-4.5				1 400	20	430	
		36	-1.8										
		-20	±10	-3.0	36	-4.0	1 000	30	250			MTM76123	0.7
					42	-2.5							
DC-DC Converter	Pch	-20	±10	-2.0	100	-4.0	400	15	100			MTM86124	0.54
					130	-2.5							
					80	-4.0				300	14	112	
			140	-1.8									
			±12	-1.0	300	-4.0	80	18	27		△ MTM86128	0.54	
					420	-2.5							
	Nch	20	±10	2.2	80	4.0	280	13	38		MTM86227	0.54	
					170	1.8							
Lithium battery protection circuit	Nch	30	±20	18	3.0	10	6 000	50	820				
					6.5	4.5							
Backlight inverter	Pch	-40	±20	-7.0	19	-10	2 700	33	300				
					28	-4.5							
	Nch	40		7.0	16	10	1 750	26	127				
					29	5.0							

△: Tentative

# Small Signal FETs

## MOS FETs (For Small Signa) (continued)

Application	Polarity	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)				Package					
		V <sub>DSS</sub> (V <sub>DS</sub> ) (V)	I <sub>D</sub> (A)	R <sub>DS(on)</sub>		t <sub>on</sub> typ. (ns)	t <sub>off</sub> typ. (ns)	SMINI3-G1 SMINI3-F2●		Mini3-G1		MiniP3-F2●	
				typ. (Ω)	V <sub>GS</sub> (V)			P <sub>D</sub> (mW)	P <sub>D</sub> (mW)	P <sub>D</sub> (mW)	P <sub>D</sub> (mW)		
Digital/ analog switching	Pch	-30	-0.1	9.0 13	-4.0 -2.5	300	400						
				50	-5.0	100 μs	25 μs	2SJ0536 2SJ0536G●	150 150				
	Nch	20	0.1	3.0 6.0	4.0 1.8	250	480						
				(20)	50*	5.0	1.0 μs*	1.0 μs*	2SK0665 2SK0665G●	150 150			
		25	1.0	0.26 0.35	4.0 2.5	8.0	30	2SK4029	150				
		30	0.1	30	5.0	150	35	2SK3064 2SK3064G●	150 150				
				5.0 7.0	4.0 2.5	350	350						
			1.0	0.35 0.48	10 4.0	12	60					2SK2211G●	1 W
		50	0.1	50*	5.0	10	20	2SK0664 2SK0664G●	150 150				
		(50)	0.05	27	2.5	200	200	2SK1374 2SK1374G●	150 150	2SK1228	150		
	0.1		6.0 8.0	4.0 2.5	200	200	2SK3539 2SK3539G●	150 150					
	80	0.5	2.0	10	15	20					2SK0601G●	1 W	

\* mark: Max. rating    ● : Recommended products (Global package products)

## MOS FETs (For Power Management) (continued)

Application/ Function	Polarity	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)			Electrical Characteristics (T <sub>a</sub> = 25°C)					Package		
		V <sub>DSS</sub> (V)	V <sub>GSS</sub> (V)	I <sub>D</sub> (A)	R <sub>DS(on)</sub> typ.		C <sub>iss</sub> (pF)	t <sub>on</sub> typ. (ns)	t <sub>off</sub> typ. (ns)	WMini8-F1		SO8-F1
					(mΩ)	V <sub>GS</sub> (V)				P <sub>D</sub> (W)	P <sub>D</sub> (W)	
Load S/W	Pch	-12	±8	-4.0	30 45	-4.0 -1.8	1 200	30	300			
					26 36	-4.5 -1.8	1 400	20	430			
		-20	±10	-3.0	36 42	-4.0 -2.5	1 000	30	250	△ MTM68123	1.0	
DC-DC Converter	Pch	-20	±10	-2.0	100 130	-4.0 -2.5	400	15	100			
					80 140	-4.0 -1.8	300	14	112			
					300 420	-4.0 -2.5	80	18	27			
	Nch	20	±10	2.2	80 170	4.0 1.8	280	13	38			
Lithium battery protection circuit	Nch	30	±20	18	3.0 6.5	10 4.5	6 000	50	820		MTMF8231	1.0
Backlight inverter	Pch	-40	±20	-7.0	19 28	-10 -4.5	2 700	33	300		MTM98140	2.0
	Nch	40		7.0	16 29	10 5.0	1 750	26	127		△ MTM98240	2.0

△: Tentative

# Small Signal FETs

## Junction FETs

Application	Polarity	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)			Package					
		V <sub>DGO</sub> *V <sub>GDS</sub> (V)	I <sub>D</sub> (mA)	I <sub>DSS</sub> max. (mA)	GV *NF typ. (dB)	NV max. (μV)	TSSMini3-F1 TSSMini3-F2●		SSMini3-F1 SSMini3-F2●		SSMini3-F1 SSMini3-F3●	
							P <sub>D</sub> (mW)	P <sub>D</sub> (mW)	P <sub>D</sub> (mW)	P <sub>D</sub> (mW)		
Analog switch	Nch	*-65	20	6	—	—						
	Pch	*65	-20	-6	—	—						
Low-frequency, low-noise amplifier	Nch	30	20	12	—	typ. 60 mV						
Low-frequency amplifier	Nch	55	30	12	*2.5	—						
				6.5	*2.5	—				2SK2593J 2SK2593G●	150 150	
Capacitor microphone	Nch	20	2	0.46	-1.5	4			2SK3372 2SK3372G●	100 100		
				0.47	-1.5	10			2SK3426 2SK3426G●	100 100		
				0.46	3	4	2SK3862 2SK3862G●	100 100				
				0.31	-3	8	2SK3866 2SK3866G●	100 100				
				0.45	3	10	2SK4206 2SK4206G●	100 100				
				0.45	3	8	2SK3948 2SK3948G●	100 100				
				0.45	3	4	2SK4083 2SK4083G●	100 100				
Pyroelectric sensor	Nch	*-40	10	4.7	—	—						

● : Recommended products (Global package products)

## Composite FETs

Application/ Function	Absolute Maximum Rating (T <sub>a</sub> = 25°C)			Electrical Characteristics (T <sub>a</sub> = 25°C)				Package				Basic Type		
	V <sub>DSS</sub> (V)	I <sub>D</sub> (mA)	P <sub>T</sub> (mW)	R <sub>DS(ON)</sub> (Ω)			t <sub>on</sub> (ns)	t <sub>off</sub> (ns)	XN: Mini5-G1 XP: SMini5-G1 UP: SSMi5-F2 UP: SSMi5-F3●		XP: SMini6-G1 UP: SSMi6-F1 UP: SSMi6-F2●			
				V <sub>GS</sub> = 4.0 V	V <sub>GS</sub> = 2.5 V	V <sub>GS</sub> = 1.8 V			XN	XP•UP	XP•UP			XP•UP
Switching circuit	20	100	125	3.0	4.0	6.0	250	480			UP0487C UP0487CG●			2SK3973
	-30/ 30	-100/ 150	125	9.0/5.0	13/7.0	—	300/ 350	400/ 350		UP0187B UP0187BG●	UP0487B UP0487BG●	XP0497A UP0497A UP0497AG●	2SJ0674	2SK3938
	-30/ 50	100	125	15/6.0	25/8.0	—	850/ 200	850/ 200		XP01878 UP01878	XP04878 UP04878 UP04878G●	UP04979 UP04979G●	2SJ0672	2SK3539
	50	100	300	50	—	—	max. 1.0 μs	max. 1.0 μs	XN01872					2SK0665

● : Recommended products (Global package products)

# Small Signal FETs

## Junction FETs (continued)

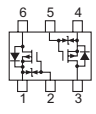
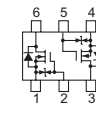
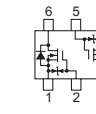
Application	Polarity	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)			Package					
		V <sub>DGO</sub> *V <sub>GDS</sub> (V)	I <sub>D</sub> (mA)	I <sub>DSS</sub> max. (mA)	GV *NF typ. (dB)	NV max. (μV)	SMini3-G1 SMini3-F2●		Mini3-G1		NS-A1 NS-B1	
								P <sub>D</sub> (mW)		P <sub>D</sub> (mW)		P <sub>D</sub> (mW)
Analog switch	Nch	*-65	20	6	—	—			2SK1103	150		
	Pch	*65	-20	-6	—	—	2SJ0364 2SJ0364G●	150 150	2SKJ0163	150	2SJ0164	300
Low-frequency, low-noise amplifier	Nch	30	20	12	—	typ. 60 mV	2SK0662 2SK0662G●	150 150	2SK0198	150		
Low-frequency amplifier	Nch	55	30	12	*2.5	—	2SK0663 2SK0663G●	150 150				
				6.5	*2.5	—						
Capacitor microphone	Nch	20	2	0.46	-1.5	4						
				0.47	-1.5	10						
				0.46	3	4						
				0.31	-3	8						
				0.45	3	10						
				0.45	3	8						
				0.45	3	4						
Pyroelectric sensor	Nch	*-40	10	4.7	—	—			2SK2751	200		

● : Recommended products (Global package products)



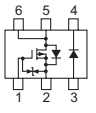
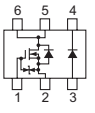
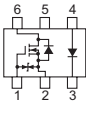
# Small Signal FETs

## Composite FETs (For Power Management)

Application	Absolute Maximum Rating (T <sub>a</sub> = 25°C)				Electrical Characteristics (T <sub>a</sub> = 25°C)					Package		
	V <sub>DSS</sub> (V)	V <sub>GSS</sub> (V)	I <sub>D</sub> (A)	P <sub>D</sub> (W)	R <sub>DS(on)</sub> typ.		C <sub>iss</sub> (pF)	t <sub>on</sub> typ. (ns)	t <sub>off</sub> typ. (ns)	WSMini6-F1		
					(mΩ)	V <sub>GS</sub> (V)						
Load S/W	-12	±8	-4.8	1.0	32 50	-4.0 -1.8	1 200	19	320			
	-12	±8	-4.8		23 36	-5.0 -1.8	1 400	20	430			
	-20	±10	-4.2		40 45	-4.0 -2.5	1 000	50	190			
DC-DC Converter	-20	±10	-1.2	0.7	100 150	-4.0 -1.8	440	35	100	MTM76420		
	-20/ 20	±10/ ±10	-1.2/ 1.9		130/ 100	-2.5/ 2.5	440/ 280	35/ 12	100/ 50			MTM76320
	-20/ 20	±10/ ±12	-1.6/ 0.1		100/ 7 000	-2.5/ 2.5	300/ 12	14/ 350	112/ 350			△ MTM76321
	20	±10	2.2		80 170	4.0 1.8	280	12	50		△ MTM76520	
Lithium battery protection circuit	20	±10	7.0	2.0	15 22	4.5 2.5	1 500	32	210			
	20	±12	7.0		15 22	4.5 2.5	1 450	1 030	6 000			

△: Tentative

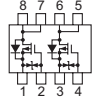
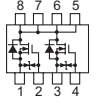
## MOS FET + SBD (For Power Management)

Application	FET Polarity	MOS FET							SBD				Package						
		Absolute Maximum Rating (T <sub>a</sub> = 25°C)			Electrical Characteristics (T <sub>a</sub> = 25°C)				Absolute Maximum Rating (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)								
		V <sub>DSS</sub> (V)	V <sub>GSS</sub> (V)	I <sub>D</sub> (A)	R <sub>DS(on)</sub> typ. (mΩ)	V <sub>GS</sub> (V)	C <sub>iss</sub> (pF)	t <sub>on</sub> typ. (ns)	t <sub>off</sub> typ. (ns)	V <sub>R</sub> (V)	I <sub>F</sub> (A)	V <sub>F</sub> max. (V)	I <sub>R</sub> max. (μA)		PD (W)		PD (W)		PD (W)
DC-DC Converter	Pch	-20	±10	-2.0	80	-4.0	300	14	112	15	0.7	0.45	250	MTM86627	0.54				
					100	-2.5				20	0.8	0.47	80	△ MTM86627A	0.54				
	Nch	20	±10	2.2	80	4.0	280	13	38	20	0.8	0.47	80			MTM86727	0.54		
				100	2.5													MTM76720	0.7

△: Tentative

# Small Signal FETs

## Composite FETs (For Power Management) (continued)

Application	Absolute Maximum Rating (T <sub>a</sub> = 25°C)				Electrical Characteristics (T <sub>a</sub> = 25°C)					Package		
	V <sub>DSS</sub> (V)	V <sub>GSS</sub> (V)	I <sub>D</sub> (A)	P <sub>D</sub> (W)	R <sub>DS(on)</sub> typ.		C <sub>iss</sub> (pF)	t <sub>on</sub> typ. (ns)	t <sub>off</sub> typ. (ns)	WMini8-F1		
					(mΩ)	V <sub>GS</sub> (V)						
Load S/W	-12	±8	-4.8	1.0	32 50	-4.0 -1.8	1 200	19	320	MTM68410		
	-12	±8	-4.8		23 36	-5.0 -1.8	1 400	20	430	MTM68411		
	-20	±10	-4.2		40 45	-4.0 -2.5	1 000	50	190	△ MTM68423		
DC-DC Converter	-20	±10	-1.2	0.7	100 150	-4.0 -1.8	440	35	100			
	-20/ 20	±10/ ±10	-1.2/ 1.9		130/ 100	-2.5/ 2.5	440/ 280	35/ 12	100/ 50			
	-20/ 20	±10/ ±12	-1.6/ 0.1		100/ 7 000	-2.5/ 2.5	300/ 12	14/ 350	112/ 350			
	20	±10	2.2		80 170	4.0 1.8	280	12	50			
Lithium battery protection circuit	20	±10	7.0	2.0	15 22	4.5 2.5	1 500	32	210		MTMC8E28	
	20	±12	7.0		15 22	4.5 2.5	1 450	1 030	6 000			MTMC8EA

△: Tentative



# Small Signal Bipolar Transistors

## Low-Frequency Amplifiers and Others

Application/ Function	Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )				Package											
	$V_{CEO}$ (V)	$I_C$ (mA)	$V_{CE(sat)}$ (V) ⊗NV (mV)	Condition	$h_{FE}$	Condition	ML3-N2		SSSMini3-F1 SSSMini3-F2●		SSMini3-F1 SSMini3-F3●		SMini3-G1 SMini3-F2●					
				$I_C$ (mA)		$I_C$ (mA)	$P_C$ (mW)	$P_C$ (mW)	$P_C$ (mW)	$P_C$ (mW)								
General-purpose	50	100	< 0.5 < 0.3	100	160 to 460	2	( 2SA2079 2SC5848	100 100	( 2SA2078 2SC5846 2SA2078G● 2SC5846G●	100 100 100 100	( 2SA2174J 2SC6054J 2SA2174G● 2SC6054G●	125 125 125 125	( 2SB1218A 2SD1819A 2SB1218G● 2SD1819G●	150 150 150 150				
					180 to 390										( 2SA2122 2SC5950 2SA2122G● 2SC5950G●	150 150 150 150		
	500	< 0.6	300	85 to 340	150	( 2SB1219A 2SD1820A 2SB1219G● 2SD1820G●	150 150 150 150											
High- $h_{FE}$ (High $V_{EBO}$ )	40	50	< 0.2	10	600 to 2 000	2					2SD2345J 2SD2345G●	125 125	2SD1823 2SD1823G●	150 150				
	100	20			400 to 1 200										2SD2621 2SD2621G●	100 100	2SD2620J 2SD2620G●	125 125
Low freq. low noise amplifier	120	20	⊗130	1	180 to 700	2					2SB1722J ( $V_{CEO}$ 100 V)	125	2SA2009	150				
	150	50	⊗150		130 to 330	10					( 2SB1463J 2SD2240J	125 125	2SB1220	150				
	185				180 to 700	2							2SD1821A 2SD1821G●	150 150				
	55												2SC3929A	150				
Low $V_{CE(sat)}$	10	500	< 0.3	400	130 to 350	500							2SB1679 2SB1679G●	150 150				
	12		< 0.25	200	270 to 680	10							( 2SA2162 2SC6036 2SA2162G● 2SC6036G●	100 100 100 100	( 2SA2161J 2SC6037J 2SA2161G● 2SC6037G●	125 125 125 125		
			< 0.4	500	200 to 800	500											2SD2623 2SD2623G●	150 150
	20	300	< 0.1	30	550 to 2 500	4							2SD1979 2SD1979G●	150 150				
		1 A		200	160 to 560	100					( 2SA2028 2SC5654 2SA2028G● 2SC5654G●	150 150 150 150						

( : Complementary pair    ● : Recommended products (Global package products)



# Small Signal Bipolar Transistors

## Low-Frequency Amplifiers and Others (continued)

Application/ Function	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)				Package											
	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	V <sub>CE(sat)</sub> (V) ⊗NV (mV) ▲f <sub>T</sub> (MHz)	Condition	h <sub>FE</sub>	Condition	Mini3-G1		NS-A1 NS-B1		TO-92-A1 TO-92-B1		MT-1-A1					
				I <sub>C</sub> * I <sub>E</sub> (mA)		I <sub>C</sub> (mA)	P <sub>C</sub> (mW)	P <sub>C</sub> (mW)	P <sub>C</sub> (mW)	P <sub>C</sub> (mW)								
General-purpose	50	100	< 0.3	100	160 to 460	2	( 2SB0709A 2SD0601A	200 200	( 2SA1309A 2SC3311A	300 300			( 2SB1320A 2SD1991A	400 400				
					180 to 390										( 2SA2077 2SC5845	200 200		
	50	500	< 0.6	300	160 to 460	150			( 2SB1030A 2SD1423A	300 300	( 2SA0720 2SC1318	625 625	( 2SB1321A 2SD1992A	600 600				
															200	< 0.3	100	85 to 500
	70	500	< 0.6	300	85 to 340	150					( 2SA0720A 2SC1318A	625 625						
															25	1 A	< 0.4	500
	50	100	< 0.5	100	210 to 460	2						2SB0774	400					
																20	500	< 0.3
High-h <sub>FE</sub>	40	50	< 0.2	10	400 to 2 000	2	2SD1030	200					2SD1995	400				
	50	700	< 0.4	500	400 to 1 200	150					2SC2925	750						
	100	20	< 0.2	10	400 to 1 200	2	2SD1149	200										
Low freq. low noise amplifier	150	50	⊗150	1	130 to 450	10					( 2SA1123 2SC2631	750 750						
	185				130 to 330										( 2SB0792A 2SD0814A	200 200		
	35				180 to 700	2												
	55				100											( 2SA1034 2SC2405	200 200	
										( 2SA1310 2SC3312	300 300	( 2SA1127 2SC2634	400 400	2SD1993	400			
Low V <sub>CE(sat)</sub>	20	500	< 0.4	500	200 to 800	500		200	2SD1450	300	2SD1302	600	2SD1996	600				
		300	< 0.1	30	500 to 2 500	4	2SD1938F	600 <sup>1)</sup>										
	15	2 A	< 0.28	1.5 A	200 to 800	100												
		2.5 A	< 0.32	2.5 A	200 to 560										2SA2010	600 <sup>1)</sup>		
	20	1.5 A	< 0.15	500	160 to 560													
															80	2 A	< 0.5	1 A
	10	5 A	< 1.0	3 A	230 to 600	500				2SD2321	400	2SB0976 2SD0965	750 750					
					300 to 800											2SD2504	750	
TV Chroma output	200	70	▲80	*10	60 to 220	5					( 2SA1018 2SC1473	750 750						
	300		▲50		30 to 150										2SA2084	200	2SA1767	750
			▲30		60 to 220										2SC5863	200	2SC1473A	750

( : Complementary pair

Mini3-G1 1): Measured on a ceramic substrate (15 × 15 × 0.6 mm)

△: Tentative

# Small Signal Bipolar Transistors

## High-speed Switch · VCO and High Freq.

Application/ Function	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)	Package							
	V <sub>CEO</sub> V <sub>CES</sub> <sup>1)</sup> (V)	I <sub>C</sub> (mA)	t <sub>s</sub> (ns)	ML3-N2	P <sub>C</sub> (mW)	SSMini3-F1 SSMini3-F3●	P <sub>C</sub> (mW)	SMini3-G1 SMini3-F2●	P <sub>C</sub> (mW)	Mini3-G1	P <sub>C</sub> (mW)
High speed switch	15	50	19	2SA2082	100	2SA1806J 2SA1806G●	125 125	2SA1739 2SA1739G●	150 150	2SA1738	200
VCO and high freq. type	40 <sup>1)</sup>	100	10			2SC4691J 2SC4691G●	125 125	2SC3938 2SC3938G●	150 150	2SC3757	200
	8	80	—			2SC5379G●	125				

## High-frequency Amplifiers and Others

Function	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)		Package										
	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	f <sub>T</sub> (Hz)	Condition I <sub>E</sub> *I <sub>C</sub> (mA)	ML3-N2	P <sub>C</sub> (mW)	SSMini3-F1 SSMini3-F2●	P <sub>C</sub> (mW)	SSMini3-F1 SSMini3-F3●	P <sub>C</sub> (mW)	SMini3-G1 SMini3-F2●	P <sub>C</sub> (mW)	Mini3-G1	P <sub>C</sub> (mW)	
AM • FM Amp.	20	30	230 M	1					2SC4655J 2SC4655G●	125 125	2SC3936 2SC3936G●	150 150	2SC2778	200	
			300 M		2SA2163	100	2SA2164 2SA2164G●	100 100	( 2SA1790J 2SC4626J 2SA1790G● 2SC4626G●	125 125 125 125	( 2SA1532 2SC3930 2SA1532G● 2SC3930G●	150 150 150 150	( 2SA1022 2SC2295	200 200	
RF Amp.	50	50	250 M	2					( 2SA1791J 2SC4656J 2SA1791G● 2SC4656G●	125 125 125 125	( 2SA1748 2SC4562 2SA1748G● 2SC4562G●	150 150 150 150			
Video IF FM RF Amp.	20	15	650 M	1					2SC4627J 2SC4627G●	125 125	2SC3931 2SC3931G●	150 150	2SC2404	150	
	8	50	1.1 G	*15							2SC5632 2SC5632G●	150 150			
VHF OSC. Amp.	20	50	1.3 G	15			2SC5946 2SC5946G●	100 100			2SC3932 2SC3932G●	150 150	2SC2480	150	
UHF OSC.	10	50	1.9 G	5	2SC6050	100	2SC5939 2SC5939G●	100 100	2SC4809J 2SC4809G●	125 125	2SC3935 2SC3935G●	150 150	2SC3130	150	
1V RF Amp.	7	10	4.0 G	*1	2SC5829	50					2SC4410 2SC4410G●	50 50	2SC3707	50	
Wide Band Amp. SHF IF Amp.	12	30	4.5 G	*10							2SC3934 2SC3934G●	150 150			
	10	80	6.0 G	*20								2SC3937 2SC3937G●	150 150	2SC3704	200
				*15			2SC6045 2SC6045G●	100 100	2SC4808J 2SC4808G●	125 125	2SC4835 2SC4835G●	150 150	2SC3829	200	
				*20										2SC5556	300
				*15					2SC5295J 2SC5295G●	125 125	2SC4805 2SC4805G●	150 150			

( : Complementary pair    ● : Recommended products (Global package products)

# Small Signal Bipolar Transistors

## SiGe HBT

Function	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)					Package	
	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub>	f <sub>T</sub> (GHz)	Cob (pF)	S <sub>21e</sub>   <sup>2</sup> (dB)	NF (dB)	ML3-N2 P <sub>C</sub> = 100 mW	SSSMini3-F1 P <sub>C</sub> = 100 mW
High-frequency Amplifiers	6	30	100 to 220	19	0.3	11.0	1.4	MSG43001	MSG33001
		60			0.4	10.5		MSG43002	MSG33002
		100			0.5	10.0		MSG43003	MSG33003
	17		0.6	9.0	MSG43004	MSG33004			
	16		0.8	8.0	MSG430C4	MSG330C4			
	14		1.0	6.0	MSG430D4	MSG330D4			

## SiGe HBT (Combined Products)

Function	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)					Package	Basic Type		Equivalent Circuit
	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub>	f <sub>T</sub> (GHz)	Cob (pF)	S <sub>21e</sub>   <sup>2</sup> (dB)	NF (dB)	SSSMini6-F1 P <sub>T</sub> = 125 mW	Tr1 (OSC)	Tr2 (Buffer)	
High-frequency Amplifiers	6	30	100 to 220	19	0.3	11.0	1.4	MSG36E11	MSG33001		
		100			0.5	10.0		MSG36E33	MSG33003		
		100/30			0.5/0.3	10.0/11.0		MSG36E31	MSG33003	MSG33001	
	100/60	17/19	0.6/0.3	9.0/11.0	MSG36E41	MSG33004	MSG33001				
		16/19	0.8/0.4	8.0/10.5	MSG36C42	MSG330C4	MSG33002				
		14/19	1.0/0.4	6.0/10.5	MSG36D42	MSG330D4	MSG33002				
					1.6/1.4						

## SiGe HBT LNA (with built-in bias circuit)

Function	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Electrical Characteristics (T <sub>a</sub> = 25°C)					Package	Equivalent Circuit
	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	f (opr) (GHz)	Gp (dB)	NF (dB)	ML6-N6 PT = 60 mW	
Low-noise high-frequency amplifier (LNA)	3.8	18	2.2 to 3.6*1	< 18*2	0.1 to 6*3	10.5 (f = 5.2 GHz)	1.5 (f = 5.2 GHz)	MSG56BBA	
		9		< 9*2		11.5 (f = 5.2 GHz)	1.6 (f = 5.2 GHz)	MSG56BBB	

\*1: Recommended voltage range

\*2: Maximum value (adjustable using external resistance)

\*3: Adjustable using input/output adjustment circuit

# Small Signal Bipolar Transistors

## Composite Bipolar Transistors

Application	Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Main Characteristics (T <sub>a</sub> = 25°C)	XN: Mini5-G1 XP: SMini5-G1								XN: Mini6-G1 XP: SMini6-G1 UP: SSMini6-F1 UP: SSMini6-F2● NP: SSSMini6-F1	
	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)		h <sub>FE</sub>	XN	XN	XN	XN	XN	XN	XN	XN	XN
					XP	XP	XP	XP	XP	XP	XP	XP•UP•NP	XP•UP•NP
				PNP × 2	NPN × 2	PNP + NPN	PNP + NPN	PNP + NPN	PNP × 2	NPN × 2	PNP × 2	NPN × 2	
General-use	±50	±100	160 to 460	XN01401 XP01401	XN01501 XP01501	XN01601 XP01601	XN0B301 XP0B301	XN0C301 XP0C301	XN02401 XP02401	XN02501 XP02501	XN04401 XP04401 UP04401 UP04401G● NP04401	XN04501 XP04501 UP04501 UP04501G● NP04501	
		±500	85 to 340			XN01602					XN04402	XN04502	
	-50	-100/ -500	160 to 460/ 85 to 340									XN04482	
Low V <sub>CE(sat)</sub>	-10/20	-500/ 500	100 to 350/ 200 to 800									XN04404	XN04504
	20	300 500	500 to 2 500 200 to 800		XN01504 XP01504 XN01558								XN04506 XP04506
General-use + Low V <sub>CE(sat)</sub>	-10/50	-500/ 100	100 to 350/ 160 to 400										
	-50/20	-100/ 500	160 to 460/ 200 to 800										
	50/20	100/500											XN04505
High frequency	10	50	75 to 400		XN01531 XP01531								
	12	30	40 ≤										
	20		50 to 220										
	15	40 to 260											UP04534 UP04534G●
	10	65	50 to 300										
	50	50	200 to 500		XN01509								XN04509
	7	10	10 to 200										
15	50	50 to 150											
High freq. + General-use	20/50	15/100	65 to 260/ 160 to 460										UP04598 UP04598G●
		50/100	25 to 250/ 160 to 460										UP04599 UP04599G●
High-h <sub>FE</sub>	100	20	400 to 2 000										XN04556
High-speed switching	-15/40	-50/100	50 to 150/ 60 to 320		XP01554								

● : Recommended products (Global package products)

# Small Signal Bipolar Transistors

Mini5/6-G1:  $P_T = 300$  mW, SMini 5/6-G1:  $P_T = 150$  mW, SSMini6-F1:  $P_T = 125$  mW, SSSMini6-F1:  $P_T = 125$  mW

XN: Mini6-G1 XP: SMini6-G1 UP: SSMini6-F1 UP: SSMini6-F2● NP: SSSMini6-F1								Basic Type		Remarks
XN	XN	XN			XN	XN	XN	PNP	NPN	
XP•UP•NP	XP	XP	NP	NP	XP	XP				
PNP + NPN	NPN × 2	PNP + NPN	PNP × 2	NPN × 2	PNP × 2	NPN × 2	NPN × 2			
XN04601 XP04601 UP04601 UP04601G● NP04601	XN05501 XP05501	XN05601 XP05601		NP0A501	XN06401 XP06401	XN06501 XP06501 △UP06501G●		2SB0709A	2SD0601A	
XN04602								2SB0710A	2SD0602A	
								2SB0709A/ 2SB0710A	—	
XN04604								2SB0970	2SD1328	$V_{CE(sat)} = -0.16/0.13$ V
								—	2SD1938(F)	$V_{CE(sat)} = \max 0.1$ V
								—	2SD2623	$V_{CE(sat)} = 0.4$ V
XN04608								2SB0970	2SD0601A	$V_{CE(sat)} = -0.16/0.3$ V
XN04609								2SB0709A	2SD1328	$V_{CE(sat)} = -0.3/-0.13$ V
								—	2SD2216J 2SD1328	$V_{CE(sat)} = 0.3/0.13$ V
	XN05531 XP05531							—	2SC3130	$f_T = 1\ 900$ MHz
						XN06537		—	2SC3934	$f_T = 4\ 500$ MHz
					XN06435 XP06435			2SA1022	—	$f_T = 150$ MHz
	XP05534					XN06534 XP06534		—	2SC2404	$f_T = 650$ MHz
						XN06543 XP06543		—	2SC3904	$f_T = 8\ 500$ MHz
				NP0A547				—	2SC4562	$f_T = 250$ MHz
			NP0A456					—	2SC5829	$f_T = 4\ 000$ MHz
								2SA2082	—	$f_T = 1\ 500$ MHz
								—	2SC2404 2SD2216J	
								—	2SC3932 2SD2216J	
	XN05553 XP05553							—	2SD1149	
XP04654	XP05554						XN0A554	2SA1738	2SC3757	$t_{on} = 17$ ns, $t_{off} = 17$ ns

△: Tentative ●: Recommended products (Global package products)

# Transistor with Built-in Resistors

$I_C = 80$  mA Series

Resistor value (k $\Omega$ )		Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )	Package				
					ML3-N2		SSSMini3-F1 SSSMini3-F2 <sup>•</sup>		
$R_1$	$R_2$	$V_{CE0}$ (V)	$I_C$ (mA)	$h_{FE}$	PNP	NPN	PNP	NPN	
0.51	5.1	-50 50	-80 80	$20 \leq$	—	UNRF2A8	UNR31A8 UNR31A8G <sup>•</sup>	UNR32A8 UNR32A8G <sup>•</sup>	
1	10			$30 \leq$	UNRF1A9	UNRF2A9	UNR31A9 UNR31A9G <sup>•</sup>	UNR32A9 UNR32A9G <sup>•</sup>	
2.2	2.2			$6 \text{ to } 20$	—	UNRF2AV	UNR31AV UNR31AVG <sup>•</sup>	UNR32AV UNR32AVG <sup>•</sup>	
	10			$30 \leq$	UNRF1AH	—	UNR31AH UNR31AHG <sup>•</sup>	—	
	47			$80 \leq$	UNRF1AM	UNRF2AM	UNR31AM UNR31AMG <sup>•</sup>	UNR32AM UNR32AMG <sup>•</sup>	
4.7	4.7			$20 \leq$	UNRF1AL	UNRF2AL	UNR31AL UNR31ALG <sup>•</sup>	UNR32AL UNR32ALG <sup>•</sup>	
	10			$30 \leq$	UNRF1AF	UNRF2AF	UNR31AF UNR31AFG <sup>•</sup>	UNR32AF UNR32AFG <sup>•</sup>	
	47			$80 \text{ to } 400$	UNRF1AN	UNRF2AN	UNR31AN UNR31ANG <sup>•</sup>	UNR32AN UNR32ANG <sup>•</sup>	
	—			$160 \text{ to } 460$	UNRF1A6	UNRF2A6	UNR31A6 UNR31A6G <sup>•</sup>	UNR32A6 UNR32A6G <sup>•</sup>	
10	4.7			$20 \leq$	—	UNRF2AK	—	—	
	10			$35 \leq$	UNRF1A1	UNRF2A1	UNR31A1 UNR31A1G <sup>•</sup>	UNR32A1 UNR32A1G <sup>•</sup>	
	47			$80 \leq$	UNRF1A4	UNRF2A4	UNR31A4 UNR31A4G <sup>•</sup>	UNR32A4 UNR32A4G <sup>•</sup>	
	—			$160 \text{ to } 460$	UNRF1A5	UNRF2A5	UNR31A5 UNR31A5G <sup>•</sup>	UNR32A5 UNR32A5G <sup>•</sup>	
22	22			$60 \leq$	UNRF1A2	UNRF2A2	UNR31A2 UNR31A2G <sup>•</sup>	UNR32A2 UNR32A2G <sup>•</sup>	
	47			$80 \text{ to } 400$	UNRF1AT	UNRF2AT	UNR31AT UNR31ATG <sup>•</sup>	UNR32AT UNR32ATG <sup>•</sup>	
	—			$160 \text{ to } 460$	UNRF1A7	UNRF2A7	UNR31A7 UNR31A7G <sup>•</sup>	UNR32A7 UNR32A7G <sup>•</sup>	
47	22			$60 \leq$	—	—	UNR31AE UNR31AEG <sup>•</sup>	UNR32AE UNR32AEG <sup>•</sup>	
	47			$80 \leq$	UNRF1A3	UNRF2A3	UNR31A3 UNR31A3G <sup>•</sup>	UNR32A3 UNR32A3G <sup>•</sup>	
	—			$160 \text{ to } 460$	UNRF1A0	UNRF2A0	UNR31A0 UNR31A0G <sup>•</sup>	UNR32A0 UNR32A0G <sup>•</sup>	
100	100			$80 \leq$	UNRF1AA	—	UNR31AA UNR31AAG <sup>•</sup>	UNR32AA UNR32AAG <sup>•</sup>	
Equivalent circuit		(PNP Type)				(NPN Type)			

<sup>•</sup> : Recommended products (Global package products)

# Transistor with Built-in Resistors

$I_C = 80$  mA Series (continued)

Resistor value (k $\Omega$ )		Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )	Package						
					SSMini3-F1 SSMini3-F3 <sup>•</sup>		SMini3-F2 <sup>•</sup>				
$R_1$	$R_2$	$V_{CE0}$ (V)	$I_C$ (mA)	$h_{FE}$	PNP	NPN	PNP	NPN			
0.51	5.1	-50 50	-80 80	20 $\leq$	—	UNR92A8J UNR92A8G <sup>•</sup>	UNR51A8G <sup>•</sup>	UNR52A8G <sup>•</sup>			
1	10			30 $\leq$	UNR91A9J UNR91A9G <sup>•</sup>	UNR92A9J UNR92A9G <sup>•</sup>	UNR51A9G <sup>•</sup>	UNR52A9G <sup>•</sup>			
2.2	2.2			6 to 20	UNR91AVJ UNR91AVG <sup>•</sup>	UNR92AVJ UNR92AVG <sup>•</sup>	UNR51AVG <sup>•</sup>	UNR52AVG <sup>•</sup>			
	10			30 $\leq$	UNR91AHJ UNR91AHG <sup>•</sup>	—	UNR51AHG <sup>•</sup>	—			
4.7	10			80 $\leq$	UNR91AMJ UNR91AMG <sup>•</sup>	UNR92AMJ UNR92AMG <sup>•</sup>	UNR51AMG <sup>•</sup>	UNR52AMG <sup>•</sup>			
	4.7			20 $\leq$	UNR91ALJ UNR91ALG <sup>•</sup>	UNR92ALJ UNR92ALG <sup>•</sup>	UNR51ALG <sup>•</sup>	UNR52ALG <sup>•</sup>			
4.7	10			30 $\leq$	UNR91AFJ UNR91AFG <sup>•</sup>	UNR92AFJ UNR92AFG <sup>•</sup>	UNR51AFG <sup>•</sup>	UNR52AFG <sup>•</sup>			
	4.7			80 to 400	UNR91ANJ UNR91ANG <sup>•</sup>	UNR92ANJ UNR92ANG <sup>•</sup>	UNR51ANG <sup>•</sup>	UNR52ANG <sup>•</sup>			
	—			160 to 460	UNR91A6J UNR91A6G <sup>•</sup>	UNR92A6J UNR92A6G <sup>•</sup>	UNR51A6G <sup>•</sup>	UNR52A6G <sup>•</sup>			
10	4.7			20 $\leq$	—	—	—	—			
	10			35 $\leq$	UNR91A1J UNR91A1G <sup>•</sup>	UNR92A1J UNR92A1G <sup>•</sup>	UNR51A1G <sup>•</sup>	UNR52A1G <sup>•</sup>			
	4.7			80 $\leq$	UNR91A4J UNR91A4G <sup>•</sup>	UNR92A4J UNR92A4G <sup>•</sup>	UNR51A4G <sup>•</sup>	UNR52A4G <sup>•</sup>			
	—			160 to 460	UNR91A5J UNR91A5G <sup>•</sup>	UNR92A5J UNR92A5G <sup>•</sup>	UNR51A5G <sup>•</sup>	UNR52A5G <sup>•</sup>			
22	22			60 $\leq$	UNR91A2J UNR91A2G <sup>•</sup>	UNR92A2J UNR92A2G <sup>•</sup>	UNR51A2G <sup>•</sup>	UNR52A2G <sup>•</sup>			
	4.7			80 to 400	UNR91ATJ UNR91ATG <sup>•</sup>	UNR92ATJ UNR92ATG <sup>•</sup>	UNR51ATG <sup>•</sup>	UNR52ATG <sup>•</sup>			
	—			160 to 460	UNR91A7J UNR91A7G <sup>•</sup>	UNR92A7J UNR92A7G <sup>•</sup>	UNR51A7G <sup>•</sup>	UNR52A7G <sup>•</sup>			
47	22			60 $\leq$	UNR91AEJ UNR91AEG <sup>•</sup>	UNR92AEJ UNR92AEG <sup>•</sup>	UNR51AEG <sup>•</sup>	UNR52AEG <sup>•</sup>			
	4.7			80 $\leq$	UNR91A3J UNR91A3G <sup>•</sup>	UNR92A3J UNR92A3G <sup>•</sup>	UNR51A3G <sup>•</sup>	UNR52A3G <sup>•</sup>			
	—			160 to 460	UNR91A0J UNR91A0G <sup>•</sup>	UNR92A0J UNR92A0G <sup>•</sup>	UNR51A0G <sup>•</sup>	UNR52A0G <sup>•</sup>			
100	100			80 $\leq$	UNR91AAJ UNR91AAG <sup>•</sup>	UNR92AAJ UNR92AAG <sup>•</sup>	UNR51AAG <sup>•</sup>	UNR52AAG <sup>•</sup>			
Equivalent circuit				(PNP Type)				(NPN Type)			

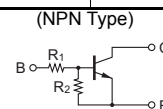
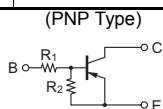
<sup>•</sup> : Recommended products (Global package products)

# Transistor with Built-in Resistors

$I_C = 100$  mA Series

Resistor value (k $\Omega$ )		Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )	Package					
					SSMini3-F1 SSMini3-F3 <sup>•</sup>		SMini3-G1 SMini3-F2 <sup>•</sup>			
$R_1$	$R_2$	$V_{CE0}$ (V)	$I_C$ (mA)	$h_{FE}$	PNP	NPN	PNP	NPN		
0.51	5.1	-50 50	-100 100	20 $\leq$	UNR9118J UNR9118G <sup>•</sup>	UNR9218J UNR9218G <sup>•</sup>	UNR5118 UNR5118G <sup>•</sup>	UNR5218 UNR5218G <sup>•</sup>		
1	10			30 $\leq$	UNR9119J UNR9119G <sup>•</sup>	UNR9219J UNR9219G <sup>•</sup>	UNR5119 UNR5119G <sup>•</sup>	UNR5219 UNR5219G <sup>•</sup>		
2.2	2.2			6 to 20	UNR911VJ UNR911VG <sup>•</sup>	UNR921VJ UNR921VG <sup>•</sup>	UNR511V UNR511VG <sup>•</sup>	UNR521V UNR521VG <sup>•</sup>		
	10			30 $\leq$	UNR911HJ UNR911HG <sup>•</sup>	—	UNR511H UNR511HG <sup>•</sup>	—		
4.7	10			80 $\leq$	UNR911MJ UNR911MG <sup>•</sup>	UNR921MJ UNR921MG <sup>•</sup>	UNR511M UNR511MG <sup>•</sup>	UNR521M UNR521MG <sup>•</sup>		
	4.7			20 $\leq$	UNR911LJ UNR911LG <sup>•</sup>	UNR921LJ UNR921LG <sup>•</sup>	UNR511L UNR511LG <sup>•</sup>	UNR521L UNR521LG <sup>•</sup>		
	10			30 $\leq$	UNR911FJ UNR911FG <sup>•</sup>	UNR921FJ UNR921FG <sup>•</sup>	UNR511F UNR511FG <sup>•</sup>	UNR521F UNR521FG <sup>•</sup>		
	22			60 to 200	—	—	UNR511Z UNR511ZG <sup>•</sup>	UNR521Z UNR521ZG <sup>•</sup>		
10	4.7			80 to 400	UNR911NJ UNR911NG <sup>•</sup>	UNR921NJ UNR921NG <sup>•</sup>	UNR511N UNR511NG <sup>•</sup>	UNR521N UNR521NG <sup>•</sup>		
	10			160 to 460	UNR9116J UNR9116G <sup>•</sup>	UNR9216J UNR9216G <sup>•</sup>	UNR5116 UNR5116G <sup>•</sup>	UNR5216 UNR5216G <sup>•</sup>		
	4.7			20 $\leq$	—	UNR921KJ UNR921KG <sup>•</sup>	—	UNR521K UNR521KG <sup>•</sup>		
	47			35 $\leq$	UNR9111J UNR9111G <sup>•</sup>	UNR9211J UNR9211G <sup>•</sup>	UNR5111 UNR5111G <sup>•</sup>	UNR5211 UNR5211G <sup>•</sup>		
22	10			80 $\leq$	UNR9114J UNR9114G <sup>•</sup>	UNR9214J UNR9214G <sup>•</sup>	UNR5114 UNR5114G <sup>•</sup>	UNR5214 UNR5214G <sup>•</sup>		
	22			160 to 460	UNR9115J UNR9115G <sup>•</sup>	UNR9215J UNR9215G <sup>•</sup>	UNR5115 UNR5115G <sup>•</sup>	UNR5215 UNR5215G <sup>•</sup>		
	47			60 $\leq$	UNR9112J UNR9112G <sup>•</sup>	UNR9212J UNR9212G <sup>•</sup>	UNR5112 UNR5112G <sup>•</sup>	UNR5212 UNR5212G <sup>•</sup>		
	100			80 to 400	UNR911TJ UNR911TG <sup>•</sup>	UNR921TJ UNR921TG <sup>•</sup>	UNR511T UNR511TG <sup>•</sup>	UNR521T UNR521TG <sup>•</sup>		
47	10			160 to 460	UNR9117J UNR9117G <sup>•</sup>	UNR9217J UNR9217G <sup>•</sup>	UNR5117 UNR5117G <sup>•</sup>	UNR5217 UNR5217G <sup>•</sup>		
	22			30 $\leq$	UNR911DJ UNR911DG <sup>•</sup>	UNR921DJ UNR921DG <sup>•</sup>	UNR511D UNR511DG <sup>•</sup>	UNR521D UNR521DG <sup>•</sup>		
	47			60 $\leq$	UNR911EJ UNR911EG <sup>•</sup>	UNR921EJ UNR921EG <sup>•</sup>	UNR511E UNR511EG <sup>•</sup>	UNR521E UNR521EG <sup>•</sup>		
	100			80 $\leq$	UNR9113J UNR9113G <sup>•</sup>	UNR9213J UNR9213G <sup>•</sup>	UNR5113 UNR5113G <sup>•</sup>	UNR5213 UNR5213G <sup>•</sup>		
100	100			160 to 460	UNR9110J UNR9110G <sup>•</sup>	UNR9210J UNR9210G <sup>•</sup>	UNR5110 UNR5110G <sup>•</sup>	UNR5210 UNR5210G <sup>•</sup>		
	—			80 $\leq$	UNR911AJ UNR911AG <sup>•</sup>	UNR921AJ UNR921AG <sup>•</sup>	—	—		
—	47			160 to 460	UNR911BJ UNR911BG <sup>•</sup>	UNR921BJ UNR921BG <sup>•</sup>	—	—		
—	100			80 $\leq$	UNR911CJ UNR911CG <sup>•</sup>	UNR921CJ UNR921CG <sup>•</sup>	—	—		
0.27	5			80 $\leq$	—	—	—	UNR521W UNR521WG <sup>•</sup>		
2.2	2.2			-30 -50	-100	20 $\leq$	—	—	—	—
	10					40 $\leq$	—	—	—	—
3.1	4.6					60 $\leq$	—	—	—	—
	4.7	50 $\leq$	—			—	—	—		
10	10	60 $\leq$	—			—	—	—		
	47	80 $\leq$	—			—	UNR5154 UNR5154G <sup>•</sup>	—		
4.7	—	80 $\leq$	—			—	UNR5174 UNR5174G <sup>•</sup>	UNR5274 UNR5274G <sup>•</sup>		
6.8	6.8	100 to 600	—			—	—	UNR5226 UNR5226G <sup>•</sup>		
10	—	6 to 20	—			—	—	—		
—	—	100 to 600	—			—	—	UNR5225 UNR5225G <sup>•</sup>		

Equivalent circuit



<sup>•</sup> : Recommended products (Global package products)

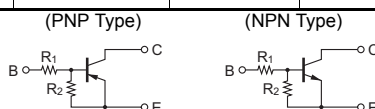


# Transistor with Built-in Resistors

$I_C = 100$  mA Series (continued)

Resistor value (k $\Omega$ )		Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )	Package				
					Mini3-G1		NS-A1 NS-B1		
$R_1$	$R_2$	$V_{CE0}$ (V)	$I_C$ (mA)	$h_{FE}$	PNP	NPN	PNP	NPN	
0.51	5.1	-50 50	-100 100	$20 \leq$	UNR2118	UNR2218	UNR4118	UNR4218	
1	10			$30 \leq$	UNR2119	UNR2219	UNR4119	UNR4219	
2.2	2.2			6 to 20	UNR211V	UNR221V	—	—	
	10			$30 \leq$	UNR211H	—	UNR411H	—	
4.7	47			$80 \leq$	UNR211M	UNR221M	UNR411M	—	
	4.7			$20 \leq$	UNR211L	UNR221L	UNR411L	UNR421L	
	10			$30 \leq$	UNR211F	UNR221F	UNR411F	UNR421F	
	22			60 to 200	UNR211Z	UNR212Z	—	—	
10	47			80 to 400	UNR211N	UNR221N	UNR411N	—	
	10			160 to 460	UNR2116	UNR2216	UNR4116	UNR4216	
	47			$20 \leq$	—	UNR221K	—	UNR421K	
	—			$35 \leq$	UNR2111	UNR2211	UNR4111	UNR4211	
22	22			$80 \leq$	UNR2114	UNR2214	UNR4114	UNR4214	
	47			160 to 460	UNR2115	UNR2215	UNR4115	UNR4215	
	—			60 to 400	UNR2112	UNR2212	UNR4112	UNR4212	
47	10			80 to 400	UNR211T	UNR221T	—	—	
	22			160 to 460	UNR2117	UNR2217	UNR4117	UNR4217	
	47			$30 \leq$	UNR211D	UNR221D	UNR411D	UNR421D	
	—			$60 \leq$	UNR211E	UNR221E	UNR411E	UNR421E	
100	100			$80 \leq$	UNR2113	UNR2213	UNR4113	UNR4213	
	—	160 to 460	UNR2110	UNR2210	UNR4110	UNR4210			
—	47	$80 \leq$	—	—	—	—			
—	100	$80 \leq$	UNR211W	UNR221W	—	—			
0.27	5	-50 50	-500 500	$20 \leq$	UNR212X	—	—	—	
2.2	2.2			$40 \leq$	UNR2121	UNR2221	UNR4121	UNR4221	
3.1	10			$60 \leq$	UNR2124	UNR2224	UNR4124	UNR4224	
	4.6			$50 \leq$	UNR212Y	—	—	—	
4.7	4.7			$50 \leq$	UNR2122	UNR2222	UNR4122	UNR4222	
10	10			$60 \leq$	UNR2123	UNR2223	UNR4123	UNR4223	
	47			$80 \leq$	UNR2154	—	—	—	
4.7	—			-30	-100	$80 \leq$	—	—	—
—	—			-50		$80 \leq$	—	—	—
6.8	6.8			20	600	100 to 600	—	UNR2226	—
10	—	6 to 20	—			UNR2227	—	—	
—	—	—	—	100 to 600	—	UNR2225	—	—	

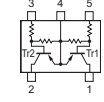
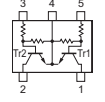

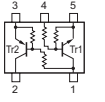
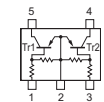
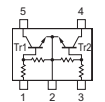
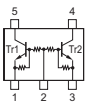
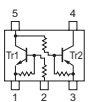
Equivalent circuit



• : Recommended products (Global package products)

# Transistor with Built-in Resistors

## Composite Transistor with Built-in Resistors

Application	Resistance (kΩ)		Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Main Characteristics (T <sub>a</sub> = 25°C)	XN: Mini5-G1 XP: SMini5-G1 UP: SSMini5-F2 UP: SSMini5-F3●			
	R <sub>1</sub>	R <sub>2</sub>	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> (min.)	 XN	 XN	 XP	 XN
						 XP•UP	 XP•UP	 XP	 XP•UP
						PNP × 2	NPN × 2	NPN × 2	PNP + NPN
General-use switching	10	10	50	100 80 <sup>*1</sup>	35 ≤	XN01111 XP01111	XN01211 XP01211	XP02211	XN0A311 XP03311
	22	22			60 ≤	XN01112 XP01112	XN01212 XP01212 UP01212 UP01212G●		XN0A312 XP03312 UP03312 UP03312G●
	47	47			80 ≤	XN01113 XP01113 UP01113 UP01113G●	XN01213 XP01213 UP01213 UP01213G●		
	10				XN01114 XP01114	XN01214 XP01214 UP01214 UP01214G●			
	4.7	—			160 to 460	* XN01115 * XP01115	* XN01215 * XP01215	* XP02215	
	22				* XN01116 * XP01116	* XN01216 * XP01216		* XP03316	
					* XP01117	* XP01217			
	0.51	5.1			20 ≤	XP01118			
	1	10			30 ≤	XN01119 XP01119			

\*1: NP0XXXX series value    ●: Recommended products (Global package products)

Note) \*: With no resistor between Emitter and Base, R<sub>2</sub> (e.g., only base resistor, R<sub>1</sub>)

# Transistor with Built-in Resistors

Mini5P/6P:  $P_T = 300$  mW, SMini 5P/6P:  $P_T = 150$  mW, SSMini5P/6P:  $P_T = 125$  mW, SSSMini6P:  $P_T = 125$  mW

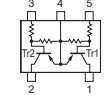
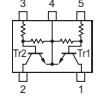
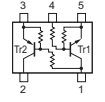
XN: Mini6-G1 XP: SMini6-G1 UP: SSMini6-F1 UP: SSMini6-F2● NP: SSSMini6-F1							Basic Type	
XP•UP•NP	XP•UP•NP	NP	NP	XP•UP•NP	XP•NP	XP•NP		
PNP × 2	NPN × 2	PNP+NPN	PNP × 2	PNP + NPN	PNP × 2	NPN × 2	PNP	NPN
XN04111 XP04111 UP04111 UP04111G●	XN04211 XP04211 UP04211 UP04211G●			XN04311 XP04311 UP04311 UP04311G●	XP06111	XN06211 XP06211	UNR2111	UNR2211
NP041A1	NP042A1			NP043A1	NP061A1	NP062A1	UNR31A1	UNR32A1
XN04112 XP04112 UP04112 UP04112G●	XN04212 XP04212 UP04212 UP04212G●			XN04312 XP04312 UP04312 UP04312G●	XP06112	XP06212	UNR2112	UNR2212
NP041A2	NP042A2			NP043A2	NP061A2		UNR31A2	UNR32A2
XN04113 XP04113 UP04113 UP04113G●	XN04213 XP04213 UP04213 UP04213G●			XP04313 UP04313 UP04313G●	XN06113 XP06113	XN06213 XP06213	UNR2113	UNR2213
NP041A3	NP042A3	NP0G3A3		NP043A3	NP061A3	NP062A3	UNR31A3	UNR32A3
XN04114 XP04114	XN04214 XP04214 UP04214 UP04214G●			XN04314 XP04314 UP04314 UP04314G●	XP06114	XN06214 XP06214	UNR2114	UNR2214
NP041A4	NP042A4			NP043A4			UNR31A4	UNR32A4
* XN04115 * XP04115	* XN04215 * XP04215 * UP04215 * UP04215G●			* XN04315 * XP04315 * UP04315 * UP04315G●	* XP06115	* XN06215 * XP06215	UNR2115	UNR2215
* NP041A5	* NP042A5	* NP0G3A5		* NP043A5	* NP061A5		UNR31A5	UNR32A5
* XN04116 * XP04116 * UP04116 * UP04116G●	* XN04216 * XP04216 * UP04216 * UP04216G●			* XN04316 * XP04316 * UP04316 * UP04316G●	* XP06116	* XN06216 * XP06216	UNR2116	UNR2216
* NP041A6	* NP042A6			* NP043A6			UNR31A6	UNR32A6
* XP04117 * UP04117G●	* XP04217 * UP04217 * UP04217G●						UNR2117	UNR2217
* NP041A7	* NP042A7						UNR31A7	UNR32A7
							UNR2118	UNR2218
							UNR2119	UNR2219

● : Recommended products (Global package products)



# Transistor with Built-in Resistors

## Composite Transistor with Built-in Resistors (continued)

Application	Resistance (kΩ)		Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Main Characteristics (T <sub>a</sub> = 25°C)	XN: Mini5-G1 XP: SMini5-G1			
	R <sub>1</sub>	R <sub>2</sub>	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> (min.)	XN	XN		XN
									
XP•UP	XP•UP	XP	XP•UP						
General-use switching	47	—	50	100 80*1	160 to 460	* XN01110 * XP01110	* XN01210 * XP01210	* XP02210	
		22			60 ≤		XN0121E XP0121E		
	4.7	10			30 ≤	XN0111F XP0111F			
	2.2	47			80 ≤	XN0111H XP0111H			
	4.7				80 to 400				
								PNP × 2	NPN × 2

\*1: NPOXXXX series value

Note) \*: With no resistor between Emitter and Base, R<sub>2</sub> (e.g., only base resistor, R<sub>1</sub>)

# Transistor with Built-in Resistors

Mini5P/6P:  $P_T = 300 \text{ mW}$ , SMini 5P/6P:  $P_T = 150 \text{ mW}$ , SSMini5P/6P:  $P_T = 125 \text{ mW}$ , SSSMini6P:  $P_T = 125 \text{ mW}$

XN: Mini6-G1 XP: SMini6-G1 UP: SSMini6-F1 UP: SSMini6-F2● NP: SSSMini6-F1							Basic Type	
XN	XN			XN	XN	XN		
XP•UP•NP	XP•UP•NP	NP	NP	XP•UP•NP	XP•NP	XP•NP	PNP	NPN
PNP × 2	NPN × 2	PNP+NPN	PNP × 2	PNP + NPN	PNP × 2	NPN × 2		
	* XN04210 * XP04210 * UP04210 * UP04210G●					* XP06210	UNR2110	UNR2210
* NP041A0	* NP042A0	* NP0G3A0				* NP062A0	UNR31A0	UNR32A0
							UNR211E	UNR221E
			NP0G1AE				UNR31AE	—
	XN0421F						UNR211F	UNR221F
							UNR211H	—
					NP061AM	NP062AM	UNR31AM	UNR32AM
				NP043AN	NP061AN	NP062AN	UNR31AN	UNR32AN

● : Recommended products (Global package products)



# Transistor with Built-in Resistors

## Composite Transistor with Built-in Resistors (continued)

Application	Resistance (kΩ)		Absolute Maximum Ratings (T <sub>a</sub> = 25°C)		Main Characteristics (T <sub>a</sub> = 25°C)	XN: Mini5-G1 XP: SMini5-G1 UP: SSMini5-F2 UP: SSMini5-F3●			
	R <sub>1</sub>	R <sub>2</sub>	V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> min.	XN 	XP 	XP•UP 	XP•UP 
General-use switching	2.2	47	50	-0.1/0.1	80 ≤	XN0111M XP0111M	XP0121M UP0121M UP0121MG●		
	4.7					4.7	-0.5/0.5	50 ≤	
	—	10	15	0.5	80 to 280				
	4.7/47	4.7/47	50	-0.5/0.1	50 ≤/80 ≤				XP03383 UP03383 UP03383G●
		1/4.7				10/47	-0.1/0.1	30 ≤/80 ≤	
	1/47								
	—	4.7/—	50/60		20 ≤/150 to 460				
	4.7	4.7	50	0.1	20		XP0121L		
	0.51/10	5.1/10		-0.1/0.1	20 ≤/30 ≤			XP03389	
	10/47	47/47		80 ≤			XP03390 UP03390 UP03390G●		
-0.08/0.08									
For muting	4.7	—	20	0.6	100 to 600				
	3.3								
	0.27								
For digital circuits	47/47	47/47	50	0.08	80 ≤				
	47/4.7	47/4.7			80 to 400				
	22/4.7	47/4.7			80 ≤				
	47/22	47/47							
	4.7/4.7	47/—	0.1	80 to 400/ 160 to 460		XP03391			
	10/47	—	0.08	160 to 460					
	47/0.51	47/5.1	-30/50	0.1	80 ≤/20 ≤		UP03394 UP03394G●		
	10/22	10/47			35 ≤/80 to 400		UP03396 UP03396G●		
10/10	80 ≤/35 ≤					UP03397 UP03397G●			

Note) \*: With no resistor between Emitter and Base, R<sub>2</sub> (e.g., only base resistor, R<sub>1</sub>)

●: Recommended products (Global package products)

# Transistor with Built-in Resistors

Mini5P/6P:  $P_T = 300 \text{ mW}$ , SMini 5P/6P:  $P_T = 150 \text{ mW}$ , SSMini5P/6P:  $P_T = 125 \text{ mW}$ , SSSMini6P:  $P_T = 125 \text{ mW}$

XN: Mini6-G1 XP: SMini6-G1 UP: SSMini6-F1 UP: SSMini6-F2● NP: SSSMini6-F1								Basic Type	
XN	XN				XN	XN			
	XP•UP	NP	NP	NP	XP•UP	XP•UP•NP	NP	PNP	NPN
NPN × 2	PNP × 2	PNP + NPN	PNP × 2	PNP + NPN	NPN × 2	PNP + NPN	PNP + NPN		
	XP0411M UP0411M UP0411MG●				XP0421M	XP0431M		UNR211M	UNR221M
					UP0421N UP0421NG●	XP0431N UP0431N UP0431NG●		UNR211N	UNR221N
	* XN04130					XN04322		UNR2122	UNR2222
						XN04381		—	—
						UP04383G●		UNR2122	UNR2213
								UNR211F	UNR2213
					XP04286			UNR2119	UNR221N
						XP04387 UP04387 UP04387G●		UNR2119	UNR2213
						* XN04A88		UNR211S	2SD0601A
					XN0421L			—	UNR221L
								UNR2118	UNR2211
						UP04390 UP04390G●		UNR2114	UNR2213
						NP04390		UNR31A4	UNR32A3
* XN0F256								—	UNR2226
* XN0F261								—	—
* XN0F262								—	—
* XN0F263								—	—
			NP0J1A3	NP0H3A3				UNR31A3	UNR32A3
		NP0G3D1						UNR31A3	UNR32AL
		NP0G3D2						UNR31AT	UNR32AL
		NP0G3D3						UNR31A3	UNR32AT
								UNR211N	UNR2216
							* NP063D3	UNR31A0	UNR32A5
								UNR2118	UNR2213
								UNR211T	UNR2211
								UNR2154	UNR2211

● : Recommended products (Global package products)



# Bipolar Power Transistors

## Low-Frequency Amplifiers and Others

Application/ Function	Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_C = 25^\circ\text{C}$ )					Package						
	$V_{CEO}$ (V)	$I_C$ (A)	$V_{CE(sat)}$ (V)	Condition		$h_{FE}$ $f_T$ (MHz)	Condition $I_C$ $*I_E$ (A)	U-G2	$P_C$ (W)	TO-126B-A1	$P_C$ (W)	MT-3-A1	$P_C$ (W)	
				$I_C$ (A)	$I_B$ (mA)									
General-purpose	35	1	< 0.5	0.5	50	85 to 340	0.5			( 2SA0885 2SC1846	1.2 1.2	2SD2133 ( $V_{CEO} = 50\text{V}$ )	1.5	
	40	1.5	< 1.0	-1.5 2	-150 200	80 to 220	1	( 2SB0968 2SD1295	20 20	( 2SA0886 2SC1847	1.2 1.2			
	50	2/1.5		1.5	150			( 2SA1096 2SC2497	1.2 1.2					
	60		< 0.3	1.0	50	120 to 340	0.2	2SB1574	10	( 2SA1096A 2SC2497A	1.2 1.2			
	50		< 0.3	1.0	50	120 to 340	0.2	2SB1574	10			( 2SB1435 2SD2178	1.5 1.5	
	60	3	< 1.2	3.0	375	40 to 250	1					( 2SB1416 2SD2136	1.5 1.5	
	100	0.5	< 0.4	0.5	50	65 to 330	0.15			( 2SA0794 2SC1567	1.2 1.2			
	120							( 2SA0794A 2SC1567A	1.2 1.2					
Low $V_{CE(sat)}$	18	1	0.3	1.0	50	90 to 280	0.5			2SC1568	1.2			
	20	3		2.6	40	100 to 450	2.6						2SB1593	1.5
High- $h_{FE}$	60	3	< 1.0	2.0	50	0.5k to 2.5k	0.5						2SD2573	1.5
		2						2SD2453	10					
Darlington	50	1	< 1.8	1.0	1	4k to 40k	1			2SD0946A	1.2			
	80							2SD0946B	1.2	2SD2220	1.5			
	100							2	< 1.5	1.0	1	1	2SD1640	1.2
Audio drive	150	1	< 2.0	0.5	50	90 to 330	0.15					( 2SB1414 2SD2134	1.5 1.5	
High breakdown voltage	400	0.1	< 2.5	0.05	5	$30 \leq$	0.03			2SB1011	1.2			
Display	$V_{CBO}$ 110	0.15	< 0.5	0.15	15	$\odot 350$	*0.11			2SC3611	1.2			
TV	Chroma input	250	0.1	< 1.2	0.05	5	$\odot 100$	*0.01			2SC2258	1.2		
		300		< 1.5	0.03	3	$\odot 140$	*0.02			2SC3063	1.2		
	Horizontal drive	300	0.2	< 1.0	0.05	5	$\odot 80$	*0.01			2SC4212	1.2		

( : Complementary pair  $P_C: T_C = 25^\circ\text{C}$



# Bipolar Power Transistors

## Low-Frequency Amplifiers and Others (continued)

Application/ Function	Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )				Package							
	$V_{CE0}$ (V)	$I_C$ (A)	$V_{CE(sat)}$ (V)	Condition	$h_{FE}$	Condition	MiniP3-F2●	$P_C$ (W)	MT-2-A1	$P_C$ (W)	TO-92NL-A1	$P_C$ (W)	TO-92L-A1	$P_C$ (W)
				$I_C$ (mA)		$I_C$ (mA)								
General-purpose	25	0.5	< 0.6	300	85 to 340	150					2SC4208	1.0		
	50									2SC4208A	1.0			
	80						( 2SB0767G● 2SD0875G●	1.0 1.0		( 2SA1533 2SC3939	1.0 1.0	( 2SA0777 2SC1509	1.0 0.75	
	25	1.0	< 0.4	500	85 to 340	500					2SC3940	1.0	2SA0683	1.0
	50						( 2SB0766G● 2SD0874G●	1.0 1.0	( 2SB1322A 2SD1994A	1.0 1.0	2SC3940A	1.0	( 2SA0684 2SC1384	1.0 1.0
	40	1.5	< 1.0	1.5 A	80 to 220	1 A	( 2SB1599G● 2SD2457G●	1.0 1.0						
	50	2.0	< 0.3	1 A	120 to 340	200	( 2SB1440G● 2SD2185G●	1.0 1.0	( 2SB1434 2SD2177	1.0 1.0				
	60							2SD2177A	1.0					
	50	5.0		2 A		500			( 2SB1446 2SD2179	1.0 1.0				
	80	1.0		500		100	( 2SA1890G● 2SC5026G●	1.0 1.0	( 2SA1674 2SC4391	1.0 1.0				
	100	2.0		1 A		200			2SB1438	1.0				
	150	1.0		500		100	2SD2459G●	1.0	2SD2184	1.0				
High- $h_{FE}$	20	0.7	< 0.4	500	1k to 2.5k	150				2SD2259	1.0			
Low $V_{CE(sat)}$	20	0.5	< 0.4	500	200 to 800	500	2SD2210G●	1.0						
	10	1.0	< 0.15				100			2SD2358	1.0			
	20		< 0.5	1.0 A	130 to 280	500	( 2SB0956G● 2SD1280G●	1.0 1.0						
	25	3.0	< 0.22	1.4 A	130 to 450	1.4 A					2SB1592	1.0		
	20	5.0	< 1.0	3.0 A	120 to 315	2 A	2SB1073G● 2SD1119G●	1.0 1.0	2SB1398 2SD2249	1.0 1.0			2SB0873	1.0
Darlington	80	1.0	< 1.8	1 A	4k to 40k	1 A	2SD1511G●	1.0						
	50	0.5	< 2.5	500	4k to 20k	500				2SD2598	1.0			
		1.0	< 1.8						2SD2258	1.0				
	100	2.0	< 1.5	1 A	4k to 40k	1 A				2SD2067	1.0			

( : Complementary pair    ● : Recommended products (Global package products)



# Bipolar Power Transistors

## Low-Frequency Amplifiers and Others (continued)

Application/ Function	Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )				Package											
	$V_{\text{CEO}}$ (V)	$I_{\text{C}}$ (A)	$V_{\text{CE(sat)}}$ (V) ▲ $f_{\text{T}}$ (MHz)	Condition	$h_{\text{FE}}$	Condition	MiniP3-F2●	$P_{\text{C}}$ (W)	MT-2-A1	$P_{\text{C}}$ (W)	TO-92NL-A1	$P_{\text{C}}$ (W)	TO-92L-A1	$P_{\text{C}}$ (W)				
				$I_{\text{C}}$ * $I_{\text{E}}$ (mA)		$I_{\text{C}}$ (mA)												
High breakdown voltage	100	0.5	< 0.6	500	130 to 330	150	( 2SB0789G● 2SD0968G●	1.0										
	120		< 1.0	300	90 to 330			2SD2225	1.0									
	400	0.1	< 1.5	50	30 ≤	30	2SD2413G●	1.0										
		0.5		250			2SD2565	1.0										
Display	50	0.15	▲350	*100	20 ≤	100						2SC3526H	1.0					
TV Chroma output	200	0.07	▲80	*10	30 to 220	5					2SB1221	1.0	2SA0879	1.0				
																2SC1573	1.0	
	300																2SC1573A	1.0
	400																2SC1573B	1.0
	300											2SC5419	1.0	2SC3941	1.0			

( : Complementary pair    ● : Recommended products (Global package products)

# Bipolar Power Transistors

## For Power Amplification

Application/ Function	Absolute Maximum Ratings (T <sub>C</sub> = 25°C)		Electrical Characteristics (T <sub>C</sub> = 25°C)			Package													
	V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	V <sub>CE(sat)</sub> (V)	Condition		TO-220F-A1				TO-220D-A1				N-A1 N-G1					
				I <sub>C</sub> (A)	I <sub>B</sub> (mA)	PNP	P <sub>C</sub> (W)	NPN	P <sub>C</sub> (W)	PNP	P <sub>C</sub> (W)	NPN	P <sub>C</sub> (W)	PNP	P <sub>C</sub> (W)	NPN	P <sub>C</sub> (W)		
General-use	60	4	< 1.5	4	400			2SD2000	35										
						2SB0942	40	2SD1267	40			2SB0930	40	2SD1253	40				
	80		< 1.2	3	375					2SB1548A	25	2SD2374A	25			2SB0930A	40	2SD1253A	40
										2SB1724	30	2SD2693	25						
	60	3	< 0.8	3	375					2SB1724A	30	2SD2693A	25						
	80																		
	80	10	< 0.5	6	300			2SD2151	30										
	100					5	< 2	3			2SD1499	40							
	150	2	< 1	0.5	50									2SB0928	30	2SD1250	30		
	180										2SA2118	25	2SC5935	25	2SB0928A	30	2SD1250A	30	
250	0.75		1	200			2SD1263	35									2SD1249	35	
300							2SD1263A	35											2SD1249A
Low V <sub>CE(sat)</sub>	20	10	< 0.6	10	330	2SB0948	40							2SB0936	40				
	40					2SB0948A	40					2SB0936A	40						
	50	3	< 0.5	5	250					2SA2064	25	2SC5779	25						
	60					3	375			2SA2057	20	2SC5739	20						
	80	4		2	100									2SB0931	30				
						3	150	2SB0944	35	2SD1269	35								
						5	125	2SB0945	40					2SB0933	40				
	100	7		5	250	2SB0946	40	2SD1271	40					2SB0934	40	2SD1257	40		
								2SD1271A	40							2SD1257A	40		
	180	1.5		1	100					2SA2140	20	2SC5993	20						
High-h <sub>FE</sub>	60	6	< 0.5	5	100			2SD1474	40								2SD1719	40	
						3	< 1	2	50	2SB1299	40			2SD2375	25			2SD1259	40
						5	< 0.3	4	100					2SD2528	40				
	150	1	< 1	0.5	20			2SD1272	40							2SD1258	40		
Darlington	60	2	< 2.5	2	8			2SD1275	35					2SB0937	35	2SD1260	35		
	80							2SD1275A	35					2SB0937A	35	2SD1260A	35		
	60	4	< 2	3	12					2SB1623	30	2SD2420	30	2SB0938	40	2SD1261	40		
	80									2SB1623A	30	2SD2420A	30	2SB0938A	40	2SD1261A	40		
	60	8	< 1.5	4	8	2SB0951	45	2SD1277	45					2SB0939	45	2SD1262	45		
	80					2SB0951A	45	2SD1277A	45					2SB0939A	45	2SD1262A	45		
	120					2SB1193	50												
	400	6			3	60											2SD1611	40	
		7	< 2	7	70			2SD1535	50										
	100	5	< 1.5	3	3			2SD1633	30										

P<sub>C</sub>: T<sub>C</sub> = 25°C



# Bipolar Power Transistors

## For Power Amplification (continued)

Application/ Function	Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_C = 25^\circ\text{C}$ )			Package							
	$V_{CEO}$ (V)	$I_C$ (A)	$V_{CE(sat)}$ (V)	Condition		I-A1 I-G1				MT-4-A1			
				$I_C$ (A)	$I_B$ (mA)	PNP	$P_C$ (W)	NPN	$P_C$ (W)	PNP	$P_C$ (W)	NPN	$P_C$ (W)
General-use	60	1	< 1	1	125	2SB1169	15						
	80					2SB1169A	15						
	60	3	< 1.2	3	375	2SB1172	15	2SD1742	15				
	80					2SB1172A	15	2SD1742A	15	2SB1417A	15	2SD2137A	15
	150	2	< 1	0.5	50			2SD1741	15				
	180							2SD1741A	15				
Low $V_{CE(sat)}$	20	10	< 0.6	10	330	2SB1148	15						
	40					2SB1148A	15						
	60	3	< 0.8	3	375					2SA2067	15	2SC5788	15
	80					2	100	2SB1174	15				
		3	150	2SB1175	15	2SD1745	15						
		4	125	2SB1176	15								
	100	7	< 0.5	5	250			2SD1747	15				
	180					1.5	1	100			2SD1747A	15	
High- $h_{FE}$		60	6	< 0.5	5	100			2SD1755	15			
	80							2SD1754	15				
	60	3	< 1	2	50			2SD1754A	15				
	80										2SD2139	15	
Darlington	60	2	< 2.5	2	8					2SB1418	15	2SD2138	15
	80									2SB1418A	15	2SD2138A	15
	60	4	< 2	3	12	2SB1179	15	2SD1749	15				
	80					2SB1179A	15	2SD1749A	15				
	60	8	< 1.5	4	8			2SD1750	15				
	80							2SD1750A	15				

$P_C$ :  $T_C = 25^\circ\text{C}$

## For Large-power Amplification

Application/ Function	Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ )		$P_C$ (W) $T_C = 25^\circ\text{C}$	Electrical Characteristics ( $T_C = 25^\circ\text{C}$ )			Package
	$V_{CEO}$ (V)	$I_C$ (A)		$V_{CE(sat)}$ (V)	Condition		TOP-3F-A1
					$I_C$ (A)	$I_B$ (mA)	NPN
General-use	100	5	60	< 2	3	300	2SD1485
Low $V_{CE(sat)}$	80	10	70	< 0.5	6	300	2SD1705

# Bipolar Power Transistors

## For Switching

Application	Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ )			Electrical Characteristics ( $T_C = 25^\circ\text{C}$ )				Package									
	$V_{CB0}$ (V)	$V_{CEO}$ (V)	$I_C$ (A)	$V_{CE(sat)}$ (V)	Condition		$t_f$ ( $\mu\text{s}$ )	TO-220F-A1		TO-220D-A1		N-A1 N-G1		I-A1 I-G1		TOP-3F-A1	
					$I_C$ (A)	$I_B$ (mA)		$P_C$ (W)	$P_C$ (W)	$P_C$ (W)	$P_C$ (W)	$P_C$ (W)	$P_C$ (W)				
Switching	900	800	1	< 1.5	0.2	40	1	2SC4004	30			2SC3496	30	2SC3824	15	2SC4960	40
	900	900	1	< 1.5	0.2	40	1					2SC3496A	30	2SC3824A	15		
	900	800	3	< 0.6	0.8	160	1	2SC3743	40							2SC4359	70
	1 000	800	5	< 1.5	3	600	0.5									2SC3507	80
High-speed switching	500	400	3	< 1	1.5	300	0.3			2SC4953	30	2SC5104	30				
	500	400	7	< 1	3	600	0.3	2SC4559	40								
	900	800	3	< 1.5	0.8	160	0.3	2SC3979	40							2SC4420	70
	1 000	800	3	< 1.5	0.8	160	0.3	2SC3979A	40								

$P_C$ :  $T_C = 25^\circ\text{C}$

## For TV and CRT Monitor

Application	Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ )		Electrical Characteristics ( $T_C = 25^\circ\text{C}$ )		Package	
	$V_{CB0}$ (V)	$I_C$ (A)	$V_{CE(sat)}$ (V)	$t_{f\max}$ ( $\mu\text{s}$ )	TO-220D-A1	$P_C$ (W)
VM circuit	-180	-1.5	< -0.5	0.1(typ)	2SA2140	20
	180	1.5	< 0.5		2SC5993	20

$P_C$ :  $T_C = 25^\circ\text{C}$

H

# Power MOS FETs

## Power MOS FETs

Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ )			$P_D$ (W)	Electrical Characteristics ( $T_C = 25^\circ\text{C}$ )					Package				
$V_{DSS}$ (V)	$V_{GSS}$ (V)	$I_D$ (A)		$T_C = 25^\circ\text{C}$	$R_{DS(on)}$ max. ( $\Omega$ )	$ Y_{fs} $ typ. (S)	$t_{d(on)}$ typ. (ns)	$t_f$ typ. (ns)	$t_{d(off)}$ typ. (ns)	N-A1	TO-220C-G1	TO-220D-A1	TOP-3F-A1
-200		2	10	2	1.7	12	25	50					2SJ0582
		5		0.135	4.0	15	170	550					2SK3022
		20	20	0.05	12	20	500	1 500					2SK3024
		30	25	0.04	18	10	140	350					2SK3025
80 ± 10	±15	10	30	0.23	5.5	$t_{on}$ 500	900	1 900	2SK2339				
100	±20	15	20	0.1	11	15	35	65					2SK3268
		25	50							2SK3269			
200		22	40	0.062	15	54	39	194			2SK3892		
		30	50	0.052	22	32	88	170		2SK3995			
230		20	100	0.085	14	35	36	220				2SK3628	
450	±30	5	35	1.3	2.5	25	35	80			2SK3043		
500		2.5	30	4.0	1.5	15	30	55			2SK3045		
600		3	35	2.5	2.5		40	90			2SK3048		
800		2	30	7.0	1.1		25	60			2SK3047		
		3	35	4.0	2.4	35	50	160			2SK3636		

# IGBT

## IGBT

Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )				Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )		Package	
$V_{CES}$ (V)	$I_C$ (A)	$I_{CP}$ (A)	$P_C$ (W)	$V_{CE(sat)}$ max. (V)	$t_f$ typ. (ns)	TO-220F-A1	TO-220D-A1
300	30	120	40	2.5	150	2PG001	△ 2PG004
		200			170		△ 2PG005
400	40	160		2.4	190	2PG002	
430			200		200	2PG003	
			200		175		

△: Tentative