HIGH-SPEED SWITCHING N-P-N & P-N-P POWER TYPES

f_T to 250 MHz . . . I_C to 60 A . . . P_T to 140 W

i_c = 1 A max. P_T = 5 W max. (TO-39) *	i_c = −1 A max. P_T = 7 W max. (TO-39) *	i_c = 2 A max. P_T = 10 W max. (TO-39) *	i_c = −2 A max. P_T = 10 W max. (TO-39) *	i_c = 2 A max. P_T = 25 W max. (Plastic TO-5)	i_c = −2 A max. P_T = 25 W max. (Plastic TO-5)	i_c = 7 A max. P_T = 35 W max. (TO-66) * *	i_c = 15 A max. P_T = 85 - 117 W max. (Radial)	i_c = 20 A max. P_T = 140 W max. (TO-3)	i_c = 20 A max. P_T = 175W max. (TO-3)	i_c = 25 A max. P_T = 80–125 W max. (TO-63)	i_c = 30 A max. P_T = 140 W max. (TO-3)	i_c = 50 A max. P_T = 140 W max. (Modified TO-3)
30 x 30▲	30 x 30	42 x 42	42 x 42	42 x 42	42 x 42	103 x 103	155 x 155	180 x 180	146 x 183	215 x 222	220 x 220	220 x 220 [2 CHIPS]
Family Designation												
2N2102 [N-P-N]	**2N4036** [P-N-P]	**2N5320** [N-P-N]	**2N5322** [P-N-P]	**2N6178** [N-P-N]	**2N6180** [P-N-P]	**2N3879** [N-P-N]	**2N6482** [N-P-N]	**2N6354** **2N5038** [N-P-N]	**41012** [N-P-N]	**2N3263** [N-P-N]	**2N5672** [N-P-N]	**2N6033** [N-P-N]
2N3053 $V_{CER}(SUS)$ = 50 V h_{FE} = 50-250 @ 150 mA = 100 MHz min. CT File No. 432E	**2N4037** $V_{CER}(SUS)$ = −60 V h_{FE} = 50-250 @ −150 mA f_T = 60 MHz min. CT File No. 216E	**2N5321** $V_{CER}(SUS)$ = 65 V h_{FE} = 40-250 @ 500 mA f_T = 50 MHz min. t_{on} = 80 ns max. t_{off} = 800 ns max. CT File No. 325E	**2N5323** $V_{CER}(SUS)$ = −65 V h_{FE} = 40-250 @ −500 mA f_T = 50 MHz min. CT File No. 325E	**2N6179** "Plastic 2N5321" $V_{CER}(SUS)$ = 65 V h_{FE} = 40-250 @ 500 mA f_T = 50 MHz min. t_{on} = 80 ns max. t_{off} = 800 ns max. CT File No. 562	**2N6181** "Plastic 2N5323" $V_{CER}(SUS)$ = −65 V h_{FE} = 40-250 @ −500 mA f_T = 50 MHz min. CT File No. 562	**2N3878‡** $V_{CER}(SUS)$ = 60 V h_{FE} = 20 min. @ 4 A h_{FE} = 50-200 @ 0.5 A f_T = 60 MHz min. t_r = 400 ns max. t_f = 400 ns max. File No. 766	**2N6479** (Isolated Collector) **2N6481** (Non Isolated Coll.) $V_{CER}(sus)$=80V h_{FE} = 20 min. @ 12 A f_T = 100 MHz typ. Radiation Hard File No. 702	**2N5039** $V_{CER}(SUS)$ = 95 V h_{FE} = 20 min. @ 10 A h_{FE} = 30- 250 @ 2 A f_T 60 MHz min. t_{on} = 0.5 μs max. t_{off} = 2 μs max. File No. 698	**41012** P_T = 175 W I_c = 30A peak $V_{CEO}(sus)$ = 80 V h_{FE} =20-60 @ 10 A File No. 660	**2N3266** **2N3264**■ $V_{CER}(SUS)$ = 80 V h_{FE} = 20-80 @ 15 A f_T 20 MHz min. t_{on} = 0.5 μs max. t_{off} = 2 μs max. File No. 54	**2N5671** $V_{CER}(SUS)$ = 110 V h_{FE} = 20 min. @ 20 A h_{FE} = 20-100 @ 15 A f_T 50 MHz min. t_{on} = 0.5 μs max. t_{off} = 2 μs max. File No. 383	**2N6032** $V_{CER}(SUS)$ = 110 V h_{FE} = 10-50 @ 50 A f_T = 50 MHz min. t_r = 1 μs max. t_f = 0.5 μs max. File No. 462
2N2102 $V_{CER}(SUS)$ = 80 V h_{FE} = 40-120 @ 150 mA f_T = 120 MHz min. CT 106E	**2N4036** $V_{CER}(SUS)$ = −85 V h_{FE} = 40-140 @ 150 mA f_T = 60 MHz min. CT 216E	**2N5320** $V_{CER}(SUS)$ = 90 V h_{FE} = 30-130 @500 mA f_T = 50 MHz min. t_{on} = 80 ns max. t_{off} = 800 ns max. CT 325E	**2N5322** $V_{CER}(SUS)$ = −90 V h_{FE} = 30-130 @-500 mA h_{FE} = 10 min. @ −1 A f_T = 50 MHz min. CT 325E	**2N6178** "Plastic 2N5320" $V_{CER}(SUS)$ = 90 V h_{FE} = 30-130 @ 500 mA f_T = 50 MHz min. t_{on} = 80 ns max. t_{off} = 800 ns max. CT 562	**2N6180** "Plastic 2N5322" $V_{CER}(SUS)$ = −90V h_{FE} = 30-130 @ −500 mA h_{FE} = 10 min. @ −1 A f_T = 50 MHz min. CT 562	**2N3879** $V_{CER}(SUS)$ = 90 V h_{FE} = 40 min. @ 0. 5A h_{FE} = 20-80 @ 4 A f_T = 60 MHz min. t_r = 400 ns max. t_f = 400 ns max. 766	**2N6480** (Isolated Collector) **2N6482** (Non Isolated Coll.) $V_{CER}(sus)$ = 80V h_{FE} = 20 min. @ 12A f_T = 100 MHz typ. Radiation Hard 702	**2N5038** $V_{CER}(SUS)$ = 110 V h_{FE} = 20 min. @ 12 A h_{FE} = 50 250 @ 2 A f_T = 60 MHz min. t_{on} = 0.5 μs max. t_{off} = 2 μs max. 698	**41013** P_T = 175 W I_c = 30A peak $V_{CEO}(sus)$ = 125 V h_{FE} = 20-60 @ 10A 660	**2N3265** **2N3263**■ $V_{CER}(SUS)$ = 110 V h_{FE} = 25-75 @ 15 A f_T = 20 MHz min. t_{on} = 0.5 μs max. t_{off} = 2 μs max. 54	**2N5672** $V_{CER}(SUS)$ = 140 V h_{FE} = 20 min. @ 20 A h_{FE} = 20-100 @ 15 A f_T = 50 MHz min. t_{on} = 0.5 μs max. t_{off} = 2 μs max. 383	**2N6033** $V_{CER}(SUS)$ = 140 V h_{FE} = 10-50 @ 40 A f_T = 50 MHz min. t_r = 1 μs max. t_f = 0.5 μs max. 462
	2N4314 $V_{CER}(SUS)$ = −85 V h_{FE} = 50-250 @ −150 mA f_T = 60 MHz min. 216E					**2N5202** $V_{CER}(SUS)$ = 75 V h_{FE} = 10-100 @ 4 A f_T = 60 MHz min. t_r = 400 ns max. t_f = 400 ns max. 766		**2N6354** $V_{CER}(sus)$ = 130 V h_{FE} = 20-150 @ 5 A h_{FE} = 10-100 @ 10 A f_T = 80 MHz min. t_r = 0.3 μs max. t_f = 0.2 μs max. I_c = 12 A peak 582				
						2N6500 $V_{CER}(SUS)$ = 110 V h_{FE} =15 -60 @ 3A f_T = 60 MHz min. t_r = 400 ns max. t_f = 500 ns max. 766		**2N6496** $V_{CER}(sus)$ =130V h_{FE} =12 - 100 @ 8A f_T = 50 MHz min. t_r = 0.5 us max. t_f = 0.5 us max. I_c = 30A peak 698				

▲Pellet size—values shown are edge dimensions in thousands-of-an-inch (mils).

* Types available out of this family with
a. flange for easy heat sinking $R_{\theta JC}$ = 15° C/W
b. free-air radiator $R_{\theta JA}$ = 50° C/W

Type available out of this family with free-air radiator $R_{\theta JA}$ = 30° C/W

‡Also available with heat radiator (40375).

■Flat radial lead version.

File No. (e.g. File No. 432), where shown, relates to the data bulletin.

CT—Complementary Type available, see matrix on Complementary-Pair Power Types.

COMPLEMENTARY-PAIR POWER TYPES

Hometaxial-Base/Epitaxial-Base

I_C 1.5 to 2 A		I_C = 2.5 A		I_C 3 to 3.5 A		I_C 4 to 6 A		I_C 12 to 17 A	
N-P-N	**P-N-P**	**N-P-N**	**P-N-P**	**N-P-N**	**P-N-P**	**N-P-N**	**P-N-P**	**N-P-N**	**P-N-P**
2N5293 **2N5294** $V_{CER}(SUS)$ = 75 V I_C = 1.5 A VERSAWATT (TO-220) **File No. 322**	**2N6106** **2N6107** $V_{CER}(SUS)$ = −80 V I_C = −1.5 A VERSAWATT (TO-220) File No.676	**2N5786** $V_{CER}(SUS)$ = 45 V I_C = 2.5 A (TO-39) File No.413E	**2N5783** $V_{CER}(SUS)$ = −45 V I_C = −2.5 A (TO-39) 413E	**2N3054** $V_{CER}(SUS)$ = 60 V I_C = 3 A (TO-66) **File No. 527**	**2N5955** $V_{CER}(SUS)$ = −65 V I_C = −3 A (TO-66) 675	**2N5495** **2N5494** $V_{CER}(SUS)$ = 50 V I_C = 4 A VERSAWATT (TO-220) **File No. 353**	**2N6110** **2N6111** $V_{CER}(SUS)$ = −40 V I_C = −4 A VERSAWATT TO-220) File No.676	**2N3055** $V_{CER}(SUS)$ = 70 V I_C = 12 A (TO-3) **File No. 524**	**2N6247** $V_{CER}(SUS)$ = −90V I_C = −12 A (TO-3) File No.677
2N5295 **2N5296** $V_{CER}(SUS)$ = 50 V I_C = 2 A VERSAWATT (TO-220) **322**	**2N6106** **2N6107** $V_{CER}(SUS)$ = −80 V I_C = −2 A VERSAWATT (TO-220) 676	**2N5297** **2N5298** $V_{CER}(SUS)$ = 70 V I_C = 2.5 A VERSAWATT (TO-220) **322**	**2N6106** **2N6107** $V_{CER}(SUS)$ = −80 V I_C = −2.5 A VERSAWATT (TO-220) 676	**2N5491** **2N5490** $V_{CER}(SUS)$ = 50 V I_C = 3 A VERSAWATT (TO-220) **353**	**2N6106** **2N6107** $V_{CER}(SUS)$ = −80 V I_C = −3 A VERSAWATT (TO-220) 676	**2N4347** $V_{CEV}(SUS)$ = 140 V I_C = 4 A (TO-3) **528**	**2N5954*** $V_{CER}(SUS)$ = −85 V I_C = −4 A (TO-66) 675	**2N4348** $V_{CEV}(SUS)$ = 140 V I_C = 14 A (TO-3) **526**	**2N6248** $V_{CER}(SUS)$ = −110 V I_C = −14 A (TO-3) 677
2N3441 $V_{CER}(SUS)$ = 150 V I_C = 2 A (TO-66) **529**	**(2N6468)†** $V_{CER}(SUS)$ = −125 V I_C = −2 A (TO-66)	**2N5785** $V_{CER}(SUS)$ = 65 V I_C = 2.5 A (TO-39) **413 E**	**2N5782** $V_{CER}(SUS)$ = −65 V I_C = −2.5 A (TO-39) **413 E**	**40250** $V_{CER}(SUS)$ = 50 V I_C = 3.5 A (TO-66) **112**	**2N5956** $V_{CER}(SUS)$ = −45 V I_C = −3.5 A (TO-66) **435**	**2N6371** $V_{CEV}(SUS)$ = 50 V I_C = 6 A (TO-3) **607**	**2N5956** $V_{CER}(SUS)$ = −45 V I_C = −6 A (TO-66) 675	**2N3772** $V_{CER}(SUS)$ = 70 V I_C = 17 A (TO-3) **525**	**2N6247** $V_{CER}(SUS)$ = −90 V I_C = −17 A (TO-3) 677
		2N5784 $V_{CER}(SUS)$ = 80 V I_C = 2.5 A (TO-39) **413 E**	**2N5781** $V_{CER}(SUS)$ = −80 V I_C = −2.5 A (TO-39) **413 E**	**2N5493** **2N5492** $V_{CER}(SUS)$ = 65 V I_C = 3.5 A VERSAWATT (TO-220) **353**	**2N6108** **2N6109** $V_{CER}(SUS)$ = −60 V I_C = −3.5 A VERSAWATT (TO-220) 676	**2N3055** $V_{CER}(SUS)$ = 70 V I_C = 6 A (TO-3) **524**	**2N5955** $V_{CER}(SUS)$ = −65 V I_C = −6 A (TO-66) 675		

* Or higher voltage type 2N6248.

High-Voltage

I_C = 0.2 A		I_C = 2 A	
N-P-N	**P-N-P**	**N-P-N**	**P-N-P**
2N3440 $V_{CEO}(SUS)$ = 250 V I_C = 0.2 A (TO-39) File No.64E	**2N5415** $V_{CEO}(SUS)$ = −200 V I_C = −0.2 A (TO-39) File No.336E	**2N3584** $V_{CER}(SUS)$ = 350 V I_C = 2 A (TO-66) **File No. 138**	**2N6212** $V_{CER}(SUS)$ = −325 V I_C = −2 A (TO-66) **File No. 507**
2N6175 $V_{CER}(SUS)$ = 300 V I_C = 0.2 A (Plastic TO-5) 508 E	**BFT19A** $V_{CER}(sus)$ = −300 V I_C = −0.2 A (TO-39) 683	**2N3585** $V_{CER}(SUS)$ = 400 V I_C = 2 A (TO-66) 138	**2N6213** $V_{CER}(SUS)$ = −375 V I_C = −2 A (TO-66) 507
2N3439 $V_{CEO}(SUS)$ = 350 V I_C = 0.2 A (TO-39) 64 E	**2N5416** $V_{CER}(SUS)$ = −350 V I_C = −0.2 A (TO-39) 336	**BUX67** $V_{CER}(sus)$ = 175V I_C = 2A (TO−66) 871	**BUX66** $V_{CER}(sus)$ = −175V I_C = −2A (TO−66) 870
2N6176 $V_{CER}(SUS)$ = 350 V I_C = 0.2 A (Plastic TO-5) 508 E	**BFT19B** $V_{CER}(SUS)$ = −400V I_C = −0.2 A (TO-39) 683	**BUX67A** $V_{CER}(sus)$ = 275V I_C = 2A (TO−66) 871	**BUX66A** $V_{CER}(sus)$ = −275V I_C = −2A (TO−66) 870
		BUX67B $V_{CER}(sus)$ = 350V I_C = 2A (TO−66) 871	**BUX66B** $V_{CER}(sus)$ = −350V I_C = −2A (TO−66) 870
		BUX67C $V_{CER}(sus)$ = 400V I_C = 2A (TO−66) 871	**BUX66C** $V_{CER}(sus)$ = −400V I_C = −2A (TO−66) 870

Note: The collector current (I_C) value shown is for h_{FE} of 10 min.

High-Speed

I_C = 1 A			
N-P-N	**P-N-P**	**N-P-N**	**P-N-P**
2N3053 $V_{CER}(SUS)$ = 50 V I_C = 1 A (TO-39) **File No. 432 E**	**2N4037** $V_{CER}(SUS)$ = −60 V I_C = −1 A (TO-39) File No.216E	**2N6179** $V_{CER}(SUS)$ = 65 V I_C = 1 A (Plastic TO-5) **File No. 562**	**2N6181** $V_{CER}(SUS)$ = −65 V I_C = −1 A (Plastic TO-5) 562
2N2102 $V_{CER}(SUS)$ = 80 V I_C = 1 A (TO-39) 106E	**2N4036** $V_{CER}(SUS)$ = −85 V I_C = −1 A (TO-39) 216 E	**2N6178** $V_{CER}(SUS)$ = 90 V I_C = 1 A (Plastic TO-5) 562	**2N6180** $V_{CER}(SUS)$ = −90 V I_C = −1 A (Plastic TO-5) 562
2N5321 $V_{CER}(SUS)$ = 65 V I_C = 1 A (TO-39) 325 E	**2N5323** $V_{CER}(SUS)$ = −65 V I_C = −1 A (TO-39) 325 E		
2N5320 $V_{CER}(SUS)$ = 90 V I_C = 1 A (TO-39) 325 E	**2N5322** $V_{CER}(SUS)$ = −90 V I_C = −1A (TO-39) 325 E		

File No. (e.g. File No. 322), where shown, relates to data bulletin.

See Epitaxial-Base and Monolithic Darlington Matrices for additional Complementary-Pair Power Types.

APPLICATION INFORMATION. . .

Power Types [N-P-N & P-N-P] for Inverter/Switching Regulator Service

Frequency Range	Peak Voltage Required	Peak Primary Current Requirement				
		Up to 0.2 A	0.2 to 1 A	1 to 4 A	4 to 20 A	>20 A
60 Hz to 50 kHz	10 to 60V	2N3053 2N4037	2N5321 2N5323 2N6179 2N6181	2N3054 2N5497▲	2N3055 2N3772	-
	60 to 150V	2N1486 2N2102 2N4036	2N1486 2N3441 2N5298 2N5781 2N5784	2N3442 2N3879 2N5293▲ 2N5954●	2N3265 2N3773 2N5039 2N5672 2N6248● 41012 41013	2N5671 2N6032
	150 to 450V	2N3440 2N5416 BFT 19 A,B,C	-	2N3585 2N6212● 40850 40851	2N5805 2N5840 2N6251 410 411 413 423 40852 431 40853 2N6514 40854 BUX 18	-
		BFT 28 A,B,C 2N6177▲				
	Off Line 220V (Rectifier 400-800V)				TA8764 2N5240 TA8900 BUX 16,A,B,C 2N6513 BUX 18,C	

●P-N-P types
▲Plastic-packaged types

$V_{PEAK} = V_{CEX}$ value

V_{PEAK} = 2.2 V (V_{CC}) for push-pull inverters
= 1.1 V (V_{CC}) for bridge inverters
= 1.1 V (Source) for switching regulators

DESCRIPTION

2N3771 FAMILY [n-p-n] (silicon)

f_T = 0.8 MHz min; P_T up to 250 W max

2N TYPES

2N6257 High-Current, General Purpose
2N3771■ High-Current, General Purpose
2N3772■ High-Current, General Purpose
BDY29 High-Current, General Purpose

AUDIO TYPES

40411 Output, 70-W Class AB Amplifier

$V_{CEO(sus)}$ V	$V_{CER(sus)}$ V	$V_{CEV(sus)}$ V	h_{FE}	I_C A	V_{CE} V	I_{CEV}–mA Temp.–°C 25	150	V_{CE} V	$V_{CE(sat)}$–V	I_C A	I_B A	V_{BE}–V	I_C A
40	45	50	15-75	8	4	4	20▲	45	1.5	8	0.8	2.2	8
40	45	50	15-60	15	4	2	10▲	50	2	15	1.5	2.7	15
60	70	80	15-60	10	4	5	10▲	100	1.4	10	1	2.2	10
75	–	90	15-60	15	2	1●	10▲	100	1.2	15	1.5	3.5	30
–	90	–	35-100	4	4	0.5●	2●	80	0.8	4	0.4	1.2	4

▲ At V_{CE} = 30 V

■JAN & JAN TX types available. ●I_{CER}

TO-3

2N3773 FAMILY [n-p-n] (silicon)

f_T = 0.7 MHz typ; P_T up to 250 W max

2N TYPES

2N4348 High-Current High Voltage, General Purpose
2N3773 High-Current High Voltage, General Purpose
2N6259 High-Current High Voltage, General Purpose
BDY37 High-Current High Voltage, General Purpose

120	140	140	15-60	5	4	2	10	120	1	5	0.5	2	5
140	150	160	15-60	8	4	2	10	140	1.4	8	0.8	2.2	8
150	160	170	15-60	8	2	0.2	4	150	1	8	0.8	2	8
140	–	160	15-60	8	4	2●	10●	140	1.4	8	0.8	2.2	8

2N3879 FAMILY [n-p-n] (silicon)

f_T = 60 MHz min; P_T = 35 W max

2N TYPES

2N3878 Audio, Ultrasonic Amplifiers and RF
2N3879 High-Current High-Speed Switch
2N5202 High-Current High-Speed Switch
2N6500 High-Current High-Speed Switch

AUDIO TYPES

40364 Output, 20-W Class AB Amplifier

OTHER TYPES

40375 2N3878 with Heat Radiator*

50	65	–	50-200	0.5	5	4	4	100	2	4	0.5	2.5	4
75	90	–	20-80	4	5	4	4	100	1.2	4	0.4	1.8	4
–	75	–	10-100	4	1.2	10	10	100	1.2	4	0.4	1.9	4
90	110	–	15-60	3	2	5	10	110	1.5	3	0.3	2.5	3
–	70	–	35-175	0.5	5	0.5●	2●	50	2	2.5	0.25	1.8	2.5
50	65	–	50-200	0.5	5	4	4	100	2	4	0.5	2.5	4

* Radiator improves $R_{\theta JA}$ from 70°C/W to 30°C/W

TO-66

2N4036 FAMILY [p-n-p] (silicon)

f_T = 60 MHz min; P_T up to 7 W max

● I_{CER}

2N TYPES

2N4036 PNP Complement of 2N2102
2N4037 PNP Complement of 2N3053
2N4314 Low Cost, High Voltage

-65	-85	-85	40-140	-0.15	-10	-0.02●	–	-60	-0.65	-0.15	-0.015	-1.1	-0.15
-40	-60	-60	50-250	-0.15	-10	-0.25●	–	-60	-1.4	-0.15	-0.015	-1.5	-0.15
-65	-85	-85	50-250	-0.15	-10	-0.25●	–	-60	-1.4	-0.15	-0.015	-1.5	-0.15

TO-39