TOSHIBA

Power Devices

Selection Guide 2021

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1. Diodes

SiC Schottky Barrier Diodes

Package Dimensions (unit: mm)

TO-220-2L	TO-220F-2L	TO-247	DFN8x8
			
10.05 x 15.3	10.0 x 15.0	15.94 x 20.95	8.0 x 8.0

Package	Part Number	V_{RRM} (V)	$I_{F(DC)}$ (A)	I_{FSM} (A)	V_F max (V)	@I_F (A)	C_j typ. (pF)	I_R max (μA)	T_j max (°C)
DFN8x8	TRS8V65G ★	650	8	50	1.5	8	29	80	175
TO-220-2L	TRS2E65F	650	2	21	1.6	2	8.7	20	
	TRS3E65F	650	3	27	1.6	3	12	20	
	TRS4E65F	650	4	39	1.6	4	16	20	
	TRS6E65F	650	6	55	1.6	6	22	30	
	TRS8E65F	650	8	69	1.6	8	28	40	
	TRS10E65F	650	10	83	1.6	10	36	50	
	TRS12E65F ☆	650	12	97	1.6	12	44	60	
TO-220F-2L	TRS4A65F	650	4	37	1.6	4	16	20	
	TRS6A65F	650	6	52	1.6	6	22	30	
	TRS8A65F	650	8	65	1.6	8	28	40	
	TRS10A65F	650	10	79	1.6	10	36	50	
	TRS12A65F ☆	650	12	92	1.6	12	44	60	
TO-247 (Center Tap)	TRS12N65FB ☆	650	12**	52*	1.6*	6	23*	30*	
	TRS16N65FB ☆	650	16**	65*	1.6*	8	30*	40*	
	TRS20N65FB ☆	650	20**	79*	1.6*	10	38*	50*	
	TRS24N65FB ☆	650	24**	92*	1.6*	12	46*	60*	

☆ New Products, * Per Leg, **Both Legs
★ Under Development (The specification is subject to change without notice.)

Schottky Barrier Diodes (SBDs)

Package Dimensions (unit: mm)

S-FLAT

1.6 x 3.5

Package	Part Number	V_{RRM} (V)	$I_{F(AV)}$ max (A)	V_{FM} max (V)		I_{RRM} max (mA)		C_j typ. (pF)
					@I_{FM} (A)		@V_{RRM} (V)	
S-FLAT	CRS06	20	1	0.36	1	1	20	60
	CRS01	30	1	0.37	0.7	1.5	30	40
	CRS03 #	30	1	0.45	0.7	0.1	30	40
	CRS05 #	30	1	0.45	1	0.2	30	60
	CRS10I30A #	30	1	0.39	0.7	0.06	30	50
	CRS10I30B #	30	1	0.42	1	0.06	30	50
	CRS10I30C #	30	1	0.36	1	0.1	30	82
	CRS11	30	1	0.36	1	1.5	30	60
	CRS08	30	1.5	0.36	1.5	1	30	90
	CRS09 #	30	1.5	0.46	1.5	0.05	30	90
	CRS15I30A #	30	1.5	0.46	1.5	0.06	30	50
	CRS15I30B #	30	1.5	0.4	1.5	0.1	30	82
	CRS14 #	30	2	0.49	2	0.05	30	90
	CRS20I30A #	30	2	0.49	2	0.06	30	50
	CRS20I30B #	30	2	0.45	2	0.1	30	82
	CRS15 #	30	3	0.52	3	0.05	30	90
	CRS30I30A #	30	3	0.49	3	0.1	30	82
	CRS04 #	40	1	0.49	0.7	0.1	40	47
	CRS10I40A #	40	1	0.49	0.7	0.06	40	35
	CRS10I40B #	40	1	0.45	1	0.1	40	62
	CRS15I40A #	40	1.5	0.55	1.5	0.06	40	35
	CRS20I40A #	40	2	0.6	2	0.06	40	35
	CRS20I40B #	40	2	0.52	2	0.1	40	62
	CRS30I40A #	40	3	0.55	3	0.1	40	62
	CRS12 #	60	1	0.58	1	0.1	60	40
	CRS13 #	60	1	0.55	1	0.05	60	40

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Package Dimensions (unit: mm)

M-FLAT

2.4 x 4.7

Package	Part Number	V_{RRM} (V)	$I_{F(AV)}$ max (A)	V_{FM} max (V)		I_{RRM} max (mA)		C_j typ. (pF)
					@I_{FM} (A)		@V_{RRM} (V)	
M-FLAT	CMS08	30	1	0.37	1	1.5	30	70
	CMS09 #	30	1	0.45	1	0.5	30	70
	CMS10I30A #	30	1	0.36	1	0.1	30	82
	CMS06	30	2	0.37	2	3	30	130
	CMS07 #	30	2	0.45	2	0.5	30	130
	CMS17 #	30	2	0.48	2	0.1	30	90
	CMS20I30A #	30	2	0.45	2	0.1	30	82
	CMS01	30	3	0.37	3	5	30	190
	CMS03 #	30	3	0.45	3	0.5	30	190
	CMS30I30A #	30	3	0.49	3	0.1	30	82
	CMS04	30	5	0.37	5	8	30	330
	CMS05	30	5	0.45	5	0.8	30	330
	CMS10 #	40	1	0.55	1	0.5	40	50
	CMS10I40A #	40	1	0.45	1	0.1	40	62
	CMS15I40A #	40	1.5	0.49	1.5	0.1	40	62
	CMS11 #	40	2	0.55	2	0.5	40	95
	CMS20I40A #	40	2	0.52	2	0.1	40	62
	CMS16 #	40	3	0.55	3	0.2	40	95
	CMS30I40A #	40	3	0.55	3	0.1	40	62
	CMS14 #	60	2	0.58	2	0.2	60	77
	CMS15 #	60	3	0.58	3	0.3	60	102

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Rectifier Diodes

Package Dimensions (unit: mm)

S-FLAT	M-FLAT
	
1.6 x 3.5	2.4 x 4.7

General-Purpose Diodes

Package	Part Number	V_{RRM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	V_{FM} (V)		
					typ.	max	@I_{FM} (A)
S-FLAT	CRG07 #	400	0.7	15	1	1.1	0.7
	CRG09A #	400	1	15	0.95	1.1	0.7
	CRG09B # ★	400	1	10	0.95	1.1	0.7
	CRG10A #	600	0.7	15	0.95	1.1	0.7
	CRG04A #	600	1	20	0.98	1.1	1
	CRG05 # !	800	1	15	1.05	1.2	1
M-FLAT	CMG06A #	600	1	20	0.98	1.1	1
	CMG03A #	600	2	80	0.87	1.1	2

Super Fast-Recovery Diodes

Package	Part Number	V_{RRM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	V_{FM} (V)			t_{rr} max (ns)
					typ.	max	@I_{FM} (A)	
S-FLAT	CRF03A #	600	0.7	10	1.4	2	0.7	100
	CRF02 # !	800	0.5	10	2.2	3	0.5	100
M-FLAT	CMF02A #	600	1	10	1.5	2	1	100
	CMF01A #	600	2	30	1.2	2	2	100
	CMF04 # !	800	0.5	10	-	2.5	0.5	100
	CMF03 # !	900	0.5	10	-	2.5	0.5	100
	CMF05 # !	1000	0.5	10	-	2.7	0.5	100

High Efficiency Diodes (HEDs)

Package	Part Number	V_{RRM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	V_{FM} (V)			t_{rr} max (ns)
					typ.	max	@I_{FM} (A)	
S-FLAT	CRH02 #	200	0.5	10	0.86	0.95	0.5	35
	CRH01 #	200	1	15	0.9	0.98	1	35
M-FLAT	CMH04 #	200	1	20	0.87	0.98	1	35
	CMH07 #	200	2	40	0.91	0.98	2	35
	CMH01 #	200	3	40	0.9	0.98	3	35

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! Please contact our Sales department or Technical department when considering this products.
★ Under Development (The specification is subject to change without notice.)

Zener Diodes

Package Dimensions (unit: mm)

M-FLAT

2.4 x 4.7

Package	Part Number	P (W)	V_Z (V)				r_d (Ω)		αT (mV/ °C)	
			min	typ.	max	@I_Z (mA)	max	@I_Z (mA)	typ.	max
M-FLAT	CMZ12 !	2	10.8	12	13.2	10	30	10	8	13
	CMZ13 !		11.7	13	14.3	10	30	10	9	14
	CMZ15 !		13.5	15	16.5	10	30	10	11	17
	CMZ16 !		14.4	16	17.6	10	30	10	12	19
	CMZ18 !		16.2	18	19.8	10	30	10	14	23
	CMZ20 !		18	20	22	10	30	10	16	26
	CMZ24 !		21.6	24	26.4	10	30	10	20	32
	CMZ27 !		24.3	27	29.7	10	30	10	23	36
	CMZ30 !		27	30	33	10	30	10	25	40
	CMZ33 !		29.7	33	36.3	10	30	10	26	41
	CMZ36 !		32.4	36	39.6	9	30	9	28	45
	CMZ39 !		35.1	39	42.9	8	35	8	30	48
	CMZ43 !		38.7	43	47.3	7	40	7	33	53
	CMZ47 !		42.3	47	51.7	6	65	6	38	60
	CMZ51 !		45.9	51	56.1	6	65	6	43	68
	CMZB12 # !	1	10.8	12	13.2	10	30	10	8	13
	CMZB13 # !		11.7	13	14.3	10	30	10	9	14
	CMZB15 # !		13.5	15	16.5	10	30	10	11	17
	CMZB18 # !		16.2	18	19.8	10	30	10	14	23
	CMZB20 # !		18	20	22	10	30	10	16	26
	CMZB24 # !		21.6	24	26.4	10	30	10	20	32
	CMZB27 # !		24.3	27	29.7	10	30	10	23	36
	CMZB30 # !		27	30	33	10	30	10	25	40
	CMZB33 # !		29.7	33	36.3	10	30	10	26	41
	CMZB36 # !		32.4	36	39.6	9	30	9	28	45
	CMZB39 # !		35.1	39	42.9	8	35	8	30	48
	CMZB43 # !		38.7	43	47.3	7	40	7	33	53
	CMZB47 # !		42.3	47	51.7	6	65	6	38	60
	CMZB51 # !		45.9	51	56.1	6	65	6	43	68
	CMZB68 # !		61.2	68	74.8	4	120	4	57	90
	CMZB75 # !		67.5	75	82.5	4	150	4	66	104
	CMZB82 # !		73.8	82	90.2	3	170	3	71	113

AEC-Q101 qualified
! Please contact our Sales department or Technical department when considering this products.

Package Dimensions (unit: mm)

S-FLAT

1.6 x 3.5

Package	Part Number	P (W)	V_Z (V)				r_d (Ω)		αT (mV/ °C)	
			min	typ.	max	@I_Z (mA)	max	@I_Z (mA)	typ.	max
S-FLAT	CRY62 #	0.7	5.6	6.2	6.8	10	60	10	2	3
	CRY68 #		6.2	6.8	7.4	10	60	10	3	4
	CRY82 #		7.4	8.2	9	10	30	10	4	6
	CRZ10 #		9	10	11	10	30	10	6	9
	CRZ12 #		10.8	12	13.2	10	30	10	8	13
	CRZ13 #		11.7	13	14.3	10	30	10	9	14
	CRZ15 #		13.5	15	16.5	10	30	10	11	17
	CRZ16 #		14.4	16	17.6	10	30	10	12	19
	CRZ18 #		16.2	18	19.8	10	30	10	14	23
	CRZ20 #		18	20	22	10	30	10	16	26
	CRZ24 #		21.6	24	26.4	10	30	10	20	32
	CRZ27 #		24.3	27	29.7	10	30	10	23	36
	CRZ30 #		27	30	33	10	30	10	25	40
	CRZ33 #		29.7	33	36.3	10	30	10	26	41
	CRZ36 #		32.4	36	39.6	9	30	9	28	45
	CRZ39 #		35.1	39	42.9	8	35	8	30	48

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Part Naming Conventions

SiC Schottky Barrier Diodes

Ex) TRS 10 A 65 F _
① ② ③ ④ ⑤ ⑥

① SiC Schottky Barrier Diodes
② Current rating $I_{F(DC)}$
Ex.) 10: $I_{F(DC)}$ = 10 A
③ Package
A: TO-220F-2L
E: TO-220-2L
J: TO-3P(N)
P: DPAK
N: TO-247
V: DFN8×8
④ Voltage Rating V_{RRM}
Display value×10 = V_{RRM}
Ex.) 65: V_{RRM} = "65"×10 = 650 V
⑤ Generation
C, D: 1st Generation
F, G: 2nd Generation
⑥ Connection
None: 1 chip
B : 2 chips & Center tap type

Schottky Barrier Diodes

New Naming Conventions

Ex) CR S 10 I 30 A
① ② ③ ④ ⑤ ⑥

① Schottky barrier diode/package type
CM: M-Flat Package
CR: S-Flat Package
② Number of pins / Internal Connection
S: 2pins / Single
③ Average forward current,$I_{F(AV)}$
Example: 08: 0.8A, 10: 1.0A
④ Product feature
I: Low forward voltage & low leakage current
(New SBD series)
⑤ Reverse voltage, V_{RRM}
Example: 30: 30 V
⑥ Suffix that indicates an additional feature

Old Naming Conventions

Ex) CR S 01
① ② ③

① Package type
CM: M-Flat Package
CR: S-Flat Package
② Diode type
S: Schottky barrier diode
③ Serial number

Rectifier Diodes

Ex) CR G 01
① ② ③

① Package type
CM: M-Flat Package
CR: S-Flat Package
② Diode type
G: General-purpose diode
F: Super fast-recovery diode(S-FRDs)
H: High efficiency diode (HEDs)
C: For Strobe Discharge Circuit
③ Serial number

Zener Diodes

Ex) CR Z 12
① ② ③

① Package type
CM: M-Flat Package
CR: S-Flat Package
② Diode type
Y: Zener Diode (V_Z < 10 V)
Z, ZB: Zener Diode (V_Z ≧ 10 V)
③ Zener Voltage
12: V_Z=12 V
62: V_Z=6.2 V

2. Bipolar Transistors

Package Dimensions (unit: mm)

TSM	PS-8	PW-Mini	New PW-Mold
			
2.9 x 2.8	2.9 x 2.8	4.6 x 4.2	6.5 x 9.5

PNP

Package	Part Number	V_{CEO} (V)	I_C (A)	h_{FE}				$V_{CE(sat)}$ max (V)			f_T typ. (MHz)	Complementary Product	Note
				min	max	@V_{CE} (V)	@I_C (A)		@I_C (A)	@I_B (A)			
TSM	2SA2061	-20	-2.5	200	500	-2	-0.5	-0.19	-1.6	-0.053	-	-	Low Saturation
	2SA2065	-20	-1.5	200	500	-2	-0.15	-0.14	-0.5	-0.017	-	-	Low Saturation
	2SA2056	-50	-2	200	500	-2	-0.3	-0.2	-1	-0.033	-	-	Low Saturation
	TTA007	-50	-1	200	500	-2	-0.1	-0.2	-0.3	-0.01	-	-	Low Saturation
PS-8	TPCP8601	-20	-4	200	500	-2	-0.6	-0.19	-2	-0.067	-	-	Low Saturation
	TPCP8602	-50	-2.5	200	500	-2	-0.3	-0.2	-1	-0.033	-	-	Low Saturation
	TPCP8604	-400	-0.3	140	400	-5	-0.1	-1	-0.1	-0.01	35	-	
PW-Mini	2SA2069 #	-20	-1.5	200	500	-2	-0.15	-0.14	-0.5	-0.017	-	-	Low Saturation
	2SA2059 #	-20	-3	200	500	-2	-0.5	-0.19	-1.6	-0.053	-	-	Low Saturation
	2SA2070 #	-50	-1	200	500	-2	-0.1	-0.2	-0.3	-0.01	-	-	Low Saturation
	2SA1213 #	-50	-2	70	240	-2	-0.5	-0.5	-1	-0.05	120	2SC2873	Low Saturation
	2SA2060 #	-50	-2	200	500	-2	-0.3	-0.2	-1	-0.033	-	-	Low Saturation
	2SA2206 #	-80	-2	100	200	-2	-0.5	-0.3	-0.5	-0.05	100	2SC6124	Low Saturation
	2SA1201 #	-120	-0.8	80	240	-5	-0.1	-1	-0.5	-0.05	120	2SC2881	Power Amps Driver
	2SA1971 #	-400	-0.5	140	400	-5	-0.1	-1	-0.1	-0.01	35	-	
	TTA010 ☆ #	-500	-0.1	100	300	-10	-0.02	-0.3	-0.02	-0.002	-	TTC018	Low Saturation
New PW-Mold	2SA1241 #	-50	-2	70	240	-2	-0.5	-0.5	-1	-0.05	100	2SC3076	Low Saturation
	2SA1244 #	-50	-5	70	240	-1	-1	-0.4	-3	-0.15	60	2SC3074	Low Saturation
	2SA2097 #	-50	-5	200	500	-2	-0.5	-0.27	-1.6	-0.053	-	-	Low Saturation
	TTA005 #	-50	-5	200	500	-2	-0.5	-0.27	-1.6	-0.053	-	-	Low Saturation
	2SB906 #	-60	-3	60	200	-5	-0.5	-1.7	-3	-0.3	9	2SD1221	
	TTB002 #	-60	-3	100	250	-5	-0.5	-0.5	-0.6	-0.06	9	-	Low Saturation
	TTA003 #	-80	-3	100	200	-2	-0.5	-0.5	-1	-0.1	100	-	Low Saturation
	TTA009 #	-80	-3	100	200	-2	-0.5	-0.5	-1	-0.1	100	-	Low Saturation
	2SA1225 #	-160	-1.5	70	240	-5	-0.1	-1.5	-0.5	-0.05	100	2SC2983	
	2SA2034 #	-400	-2	80	240	-5	-0.1	-1	-0.5	-0.1	-	-	
	2SA2184 #	-550	-1	80	300	-5	-0.1	-0.7	-0.3	-0.06	27	-	
	2SA2142 #	-600	-0.5	100	400	-5	-0.05	-1	-0.1	-0.01	35	-	

☆ New Products, # AEC-Q101 qualified

Package Dimensions (unit: mm)

TO-126N	TO-220SIS	TO-3P(N)	TO-3P(L)
			
8.0 x 11.0	10.0 x 15.5	15.5 x 20.0	20.0 x 26.0

Package	Part Number	V_{CEO} (V)	I_C (A)	h_{FE}				$V_{CE(sat)}$ max (V)			f_T typ. (MHz)	Complementary Product	Note
				min	max	@V_{CE} (V)	@I_C (A)		@I_C (A)	@I_B (A)			
TO-126N	TTA008B	-80	-2	100	200	-2	-0.5	-0.5	-1	-0.1	100	TTC015B	Low Saturation
	TTB1067B %	-80	-2	2000	-	-2	-1	-1.5	-1	-0.001	50	TTD1509B	
	TTA004B	-160	-1.5	140	280	-5	-0.1	-0.5	-0.5	-0.05	100	TTC004B	Power Amps Driver
	TTA006B	-230	-1	100	320	-5	-0.1	-1.5	-0.5	-0.05	70	TTC011B	Power Amps Driver
TO-220SIS	TTA1452B	-80	-12	120	240	-1	-1	-0.4	-6	-0.3	50	TTC3710B	Low Saturation
	TTB1020B %	-100	-7	2000	15000	-3	-3	-1.5	-3	-0.006	-	TTD1415B	
TO-3P(N)	2SA1941	-140	-10	55	160	-5	-1	-2	-7	-0.7	30	2SC5198	Power Amps Output
	TTA0001	-160	-18	80	160	-5	-1	-2	-9	-0.9	30	TTC0001	Power Amps Output
	2SA2120	-200	-12	55	160	-5	-1	-3	-8	-0.8	25	2SC5948	Power Amps Output
	2SA1943N	-230	-15	80	160	-5	-1	-3	-8	-0.8	30	2SC5200N	Power Amps Output
	2SA1962	-230	-15	55	160	-5	-1	-3	-8	-0.8	30	2SC5242	
	2SA1986	-230	-15	55	160	-5	-1	-3	-8	-0.8	30	2SC5358	
TO-3P(L)	2SA1942	-160	-12	55	160	-5	-1	-2.5	-8	-0.8	30	2SC5199	Power Amps Output
	TTA0002	-160	-18	80	160	-5	-1	-2	-9	-0.9	30	TTC0002	Power Amps Output
	2SA2121	-200	-15	55	160	-5	-1	-3	-10	-1	25	2SC5949	Power Amps Output
	2SA1943	-230	-15	55	160	-5	-1	-3	-8	-0.8	30	2SC5200	
	2SA1987	-230	-15	55	160	-5	-1	-3	-8	-0.8	30	2SC5359	Power Amps Output
	TTA1943	-230	-15	80	160	-5	-1	-3	-8	-0.8	30	TTC5200	Power Amps Output

% : Darlington

Package Dimensions (unit: mm)

TSM	PS-8	PW-Mini
		
2.9 x 2.8	2.9 x 2.8	4.6 x 4.2

NPN

Package	Part Number	V_{CEO} (V)	I_C (A)	h_{FE}				$V_{CE(sat)}$ max (V)			f_T typ. (MHz)	Complementary Product	Note
				min	max	@V_{CE} (V)	@I_C (A)		@I_C (A)	@I_B (A)			
TSM	2SC5784	20	1.5	400	1000	2	0.15	0.12	0.5	0.01	-	-	Low Saturation
	2SC5738	20	3.5	400	1000	2	0.5	0.15	1.6	0.032	-	-	Low Saturation
	2SC5976	30	3	250	400	2	0.3	0.14	1	0.033	-	-	Low Saturation
	TTC007	50	1	400	1000	2	0.1	0.12	0.3	0.006	-	-	Low Saturation
	2SC5692	50	2.5	400	1000	2	0.3	0.14	1	0.02	-	-	Low Saturation
	2SC6033	50	2.5	250	400	2	0.3	0.18	1	0.033	-	-	Low Saturation
	2SC5703	50	4	400	1000	2	0.5	0.12	1.6	0.032	-	-	Low Saturation
	2SD2719 % $	60±10	0.8	2000	-	2	1	1.2	0.5	0.001	-	-	
	2SC6061	120	1	120	300	2	0.1	0.14	0.3	0.01	-	-	Low Saturation
PS-8	TPCP8701 &	50	3	400	1000	2	0.3	0.14	1	0.02	-	-	Low Saturation
	TPCP8505	50	3	400	1000	2	0.3	0.14	1	0.02	-	-	Low Saturation
	TPCP8511	50	3	250	400	2	0.3	0.18	1	0.033	-	-	Low Saturation
	TPCP8507	120	1	120	300	2	0.1	0.14	0.3	0.01	-	-	Low Saturation
	TPCP8510	120	1	120	300	2	0.1	0.14	0.3	0.01	-	-	Low Saturation
PW-Mini	2SC5819 #	20	1.5	400	1000	2	0.15	0.12	0.5	0.01	-	-	Low Saturation
	2SC5714 #	20	4	400	1000	2	0.5	0.15	1.6	0.032	-	-	Low Saturation
	2SC5810 #	50	1	400	1000	2	0.1	0.17	0.3	0.006	-	-	Low Saturation
	2SC2873 #	50	2	70	240	2	0.5	0.5	1	0.05	120	2SA1213	Low Saturation
	2SC5712 #	50	3	400	1000	2	0.3	0.14	1	0.02	-	-	Low Saturation
	2SC6126 #	50	3	250	400	2	0.3	0.18	1	0.033	-	-	Low Saturation
	2SD2686 % $ #	60±10	1	2000	-	2	1	1.5	1	0.001	-	-	
	2SC6124 #	80	2	100	200	2	0.5	0.5	1	0.1	150	2SA2206	Low Saturation
	2SC2881 #	120	0.8	80	240	5	0.1	1	0.5	0.05	120	2SA1201	Power Amps Driver
	TTC005 #	285	1	100	200	5	0.1	1	0.6	0.075	-	-	
	TTC013 #	350	0.5	100	200	5	0.05	0.3	0.16	0.02	-	-	Low Saturation
	TTC018 ☆ #	500	0.1	100	300	10	0.02	0.3	0.02	0.002	-	TTA010	Low Saturation

% : Darlington, $: Built-in Active Clamp Zener, & : NPN + NPN, ☆ New Products, # AEC-Q101 qualified

Package Dimensions (unit: mm)

New PW-Mold	TO-126N	New PW-Mold2	TO-220SIS	TO-3P(N)	TO-3P(L)
					
6.5 x 9.5	8.0 x 11.0	6.5 x 5.5	10.0 x 15.0	15.5 x 20.0	20.0 x 26.0

Package	Part Number	V_{CEO} (V)	I_C (A)	h_{FE}				$V_{CE(sat)}$ max (V)			f_T typ. (MHz)	Complementary Product	Note
				min	max	@V_{CE} (V)	@I_C (A)		@I_C (A)	@I_B (A)			
New PW-Mold	2SC3076 #	50	2	70	240	2	0.5	0.5	1	0.05	80	2SA1241	Low Saturation
	2SC5886A #	50	5	400	1000	2	0.5	0.22	1.6	0.032	-	-	Low Saturation
	TTC016 #	50	5	400	1000	2	0.5	0.22	1.6	0.032	-	-	Low Saturation
	2SC6076 #	80	3	180	450	2	0.5	0.5	1	0.1	150	-	Low Saturation
	TTC017 #	80	3	180	450	2	0.5	0.5	1	0.1	150	-	Low Saturation
	2SD1223 % #	80	4	2000	-	2	1	1.5	3	0.006	-	2SB908	
	2SC3303 #	80	5	70	240	1	1	0.4	3	0.15	120	-	Low Saturation
	2SC5548A #	400	2	40	100	5	0.2	1	0.8	0.1	-	-	
	2SC6127 #	800	0.05	15	-	5	0.007	1	0.02	0.004	15	-	
	TTC014 #	800	1	100	200	5	0.1	1	0.5	0.05	-	-	
TO-126N	TTC015B	80	2	100	200	2	0.5	0.5	1	0.1	150	TTA008B	Low Saturation
	TTD1509B %	80	2	2000	-	2	1	1.5	1	0.001	100	TTB1067B	
	TTC004B	160	1.5	140	280	5	0.1	0.5	0.5	0.05	100	TTA004B	Power Amps Driver
	TTC011B	230	1	100	320	5	0.1	1.5	0.5	0.05	100	TTA006B	Power Amps Driver
	TTC5460B	800	0.05	15	-	5	0.007	1	0.02	0.004	5.5	-	
New PW-Mold2	TTC008 #	285	1.5	100	200	5	0.3	1	0.5	0.0625	-	-	
	2SC6142 #	375	1.5	100	200	5	0.1	0.9	0.8	0.1	-	-	
TO-220SIS	TTC3710B	80	12	120	240	1	1	0.4	6	0.3	80	TTA1452B	Low Saturation
	TTD1415B %	100	7	2000	15000	3	3	1.5	3	0.006	-	TTB1020B	
	TTD1410B %	250	6	2000	-	2	2	2	4	0.04	-	-	
	TTD1409B %	400	6	600	-	2	2	2	4	0.04	-	-	
TO-3P(N)	2SC5198	140	10	55	160	5	1	2	7	0.7	30	2SA1941	Power Amps Output
	TTC0001	160	18	80	160	5	1	2	9	0.9	30	TTA0001	Power Amps Output
	2SC5948	200	12	55	160	5	1	2	8	0.8	30	2SA2120	Power Amps Output
	2SC5200N	230	15	80	160	5	1	3	8	0.8	30	2SA1943N	Power Amps Output
	2SC5242	230	15	55	160	5	1	3	8	0.8	30	2SA1962	Power Amps Output
	2SC5358	230	15	55	160	5	1	3	8	0.8	30	2SA1986	Power Amps Output
	2SC5354	800	5	15	60	5	0.5	1	2	0.4	-	-	
TO-3P(L)	2SC5199	160	12	55	160	5	1	2.5	8	0.8	30	2SA1942	Power Amps Output
	TTC0002	160	18	80	160	5	1	2	9	0.9	30	TTA0002	Power Amps Output
	2SC5949	200	15	55	160	5	1	3	10	1	30	2SA2121	Power Amps Output
	2SC5200	230	15	55	160	5	1	3	8	0.8	30	2SA1943	Power Amps Output
	2SC5359	230	15	55	160	5	1	3	8	0.8	30	2SA1987	Power Amps Output
	TTC5200	230	15	80	160	5	1	3	8	0.8	30	TTA1943	Power Amps Output

% : Darlington, # AEC-Q101 qualified

Package Dimensions (unit: mm)

PS-8	SMV (SOT-25)
	
2.9 x 2.8	2.9 x 2.8

PNP + NPN

Package	Part Number	Polarity	V_{CEO} (V)	I_C (A)	h_{FE}				$V_{CE(sat)}$ max (V)			f_T typ. (MHz)	Note
					min	max	@V_{CE} (V)	@I_C (A)		@I_C (A)	@I_B (A)		
SMV	HN4B101J	PNP	-30	-1	200	500	-2	-0.12	-0.2	-0.4	-0.013	-	Low Saturation
		NPN	30	1.2	200	500	2	0.12	0.17	0.4	0.013	-	
	HN4B102J	PNP	-30	-1.8	200	500	-2	-0.2	-0.2	-0.6	-0.02	-	Low Saturation
		NPN	30	2	200	500	2	0.2	0.14	0.6	0.02	-	
PS-8	TPCP8901	PNP	-50	-0.8	200	500	-2	-0.1	-0.2	-0.3	-0.01	-	Low Saturation
		NPN	50	1	400	1000	2	0.1	0.17	0.3	0.006	-	
	TPCP8902	PNP	-30	-2	200	500	-2	-0.2	-0.2	-0.6	-0.02	-	Low Saturation
		NPN	30	2	200	500	2	0.2	0.14	0.6	0.02	-	

NPN + N-ch MOSFET

Package	Part Number	Component Devices	V_{CEO} / V_{DSS} (V)	I_C / I_D (A)	h_{FE}				$V_{CE(sat)}$ max (V) / $R_{DS(ON)}$ max (Ω)			f_T typ. (MHz)	Note
					min	max	@V_{CE} (V)	@I_C (A)		@I_C (A) / V_{GS} (V)	@I_B (A) / I_D (A)		
PS-8	TPCP8H02	NPN	30	3	250	400	2	0.3	0.14	1	0.033	-	Low Saturation
		MOSFET	20	0.1	-	-	-	-	3	4	0.01	-	

NPN + HED

Package	Part Number	Component Devices	V_{CEO} / V_{RRM} (V)	I_C / $I_{F(AV)}$ (A)	h_{FE}				$V_{CE(sat)}$ max (V) / V_{FM} max (V)			t_{rr} max (ns)	Note
					min	max	@V_{CE} (V)	@I_C (A)		@I_C / I_{FM} (A)	@I_B (A)		
PS-8	TPCP8L01 %	NPN	120	0.9	2000	9000	2	1	1.5	1	0.001	-	
		HED	200	1	-	-	-	-	0.98	1	-	60	

% : Darlington

Part Naming Conventions

Bipolar Transistors

JEITA registration Item Series

Ex) 2 S A ※※※※ B

① ② ③ ④ ⑤

① The value that subtracted 1 from he total number of terminals.
② S stands for Semiconductor
③ The kind of circuit
This section shows the kind of the circuit of a product. It is classified into form A to D by the circuit of a product.
A : a transistor of high-frequency and PNP structure
B : a transistor of low-frequency and PNP structure
C : a transistor of high-frequency and NPN structure
D : a transistor of low-frequency and NPN structure
④ Serial number
JEITA registration numbers.
⑤ Changes
The additional symbol which shows some changes.

TPCP8※※※ Series

Ex) TPCP8 5 04

① ② ③

① Package : PS-8 Series
② The kind of circuit
5 : NPN transistor, Single
6 : PNP transistor, Single
7 : NPN transistor, Dual
8 : PNP transistor, Dual
9 : PNP transistor + NPN transistor
C : NPN transistor + SBD
D : PNP transistor + SBD
F : PNP transistor + N-ch MOSFET
G : PNP transistor + P-ch MOSFET
H : NPN transistor + N-ch MOSFET
J : NPN transistor + P-ch MOSFET
L : NPN transistor + HED
M : PNP transistor + HED
N : NPN transistor + Diode
P : NPN transistor + Diode
③ Serial number

TT※※※※ Series

Ex) TT A ※※※※ B

① ② ③ ④

① Bipolar Transistor
② The kind of circuit
This section shows the kind of the circuit of a product. It is classified into form A to D by the circuit of a product.
A : a transistor of high-frequency and PNP structure
B : a transistor of low-frequency and PNP structure
C : a transistor of high-frequency and NPN structure
D : a transistor of low-frequency and NPN structure
③ Serial number
④ Changes
The additional symbol which shows some changes.

HN※※※※ Series

Ex) HN 4 B 101 J

① ② ③ ④ ⑤

① HN means Multi Chip Device
② Internal connection
1 : Point symmetrical arrangement
2 : Parallel arrangement
3 : Cascade arrangement
4 : Common use of emitter or source or base
7 : Different types of transistors are arrangement
③ The kind of the devices being loaded
A: PNP transistor x 2
B: PNP transistor + NPN transistor
C: NPN transistor x 2
D: general SW diode
E: transistor + diode
G: different types of transistors
S: SBD
④ Serial number
⑤ Package type
JE: ESV FU: US6, USV
JU: USV F: SM6
J: SMV FS: fS6
FE: ES6, ESV

3. Discrete IGBTs

Package Dimensions (unit: mm)

TO-220SIS	TO-3P(N)	TO-247
		
10.0 x 15.0	15.5 x 20.0	15.94 x 20.95

Package	Part Number	V_{CES} (V)	I_C (A)	$V_{CE(sat)}$ typ. (V)			t_f typ. (μs)				t_{rr} typ. (μs)	Note
					@V_{GE} (V)	@I_C (A)		@V_{CC} (V)	@I_C (A)	Load Condition		
TO-220SIS	GT15J341 ◆	600	15	1.5	15	15	0.08	300	15	Inductive	0.08	Hard switching
	GT20J121	600	20	1.25	15	20	0.27	300	20	Resistive	-	Hard switching
	GT20J341 ◆	600	20	1.5	15	20	0.05	300	20	Inductive	0.09	Hard switching
TO-3P(N)	GT30J121	600	30	2	15	30	0.05	300	30	Inductive	-	Hard switching
	GT30J122A	600	30	1.7	15	50	0.2	300	50	Resistive	-	Hard switching
	GT40J322 ◆	600	40	1.7	15	40	0.2	300	40	Resistive	0.2 max	Current resonant
	GT50J341 ◆	600	50	1.6	15	50	0.15	300	50	Resistive	0.1	Current resonant
	GT50JR21 ◆	600	50	1.45	15	50	0.08	300	50	Resistive	0.35	Current resonant
	GT50JR22 ◆	600	50	1.55	15	50	0.05	300	50	Resistive	0.35	Current resonant
	GT30J341 ◆	600	59	1.5	15	30	0.04	300	30	Inductive	0.05	Hard switching
	GT50J123 ☆	600	59	1.9	15	50	0.04	300	30	Inductive	-	Hard switching
	GT50MR21 ◆	900	50	1.7	15	50	0.18	600	50	Resistive	0.45	Voltage resonant
	GT50N322A ◆	1000	50	2.2	15	60	0.1	600	60	Resistive	0.8	Voltage resonant
	GT50N324 ◆	1000	50	1.9	15	60	0.11	600	60	Resistive	0.8	Voltage resonant
	GT50NR21 ◆	1050	50	1.8	15	50	0.2	600	50	Resistive	0.5	Voltage resonant
	GT30J110SRA ☆ ◆	1100	60	1.6	15	30	0.17	600	60	Resistive	-	Voltage resonant
	GT60PR21 ◆	1100	60	2	15	60	0.16	600	60	Resistive	0.6	Voltage resonant
	GT40QR21 ◆	1200	40	1.9	15	40	0.2	600	40	Resistive	0.6	Voltage resonant
	GT40RR21 ◆	1350	40	2.05	15	40	0.21	600	40	Resistive	0.6	Voltage resonant
	GT40WR21 ◆	1800	40	2.9	15	40	0.15	600	40	Resistive	1	Voltage resonant
TO-247	GT20N135SRA ☆ ◆	1350	40	2	15	40	0.25	600	40	Resistive	-	Voltage resonant

◆ Built-in Diode, ☆ New Products

Part Naming Conventions

Discrete IGBTs

New Naming Conventions

(New products after 2019)

Ex) GT 20 N 135 S R A
① ② ③ ④ ⑤ ⑥ ⑦

① Discrete IGBT
② Maximum DC Collector Current
I_C max @ Tc=100°C
(note: this rating is defined relative to the equivalent class of non-isolated packages in case of isolation packages.)
③ Package
A: TO-220SIS E: TO-220
J: TO-3P(N) N: TO-247
P: DPAK / New PW-Mold
④ Maximum Collector-emitter Voltage V_{CES}
V_{CES} Divided by 10
e.g. 65: 650 V (=65×10)
110: 1100 V (=110×10)
135: 1350 V (=135×10)
⑤ Major application
H: for hard switching application
S: for soft switching application
M: other or special application
⑥ Type (Structure)
1: Single die of IGBT
2: Co-pack of IGBT and Diode (FWD)
R: RC-IGBT
⑦ Generation or Die design rule
A: 6^{th} & 6.5^{th} generation
B: next generation

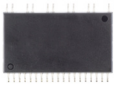
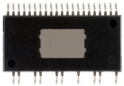
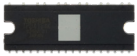
Conventional Naming

Ex) GT 60 M 3 03 A
① ② ③ ④ ⑤ ⑥

① Discrete IGBT
② Collector current rating (I_C)
③ Voltage rating (V_{CES})
C: 150 (V) D: 200 (V) E: 250 (V)
F: 300 (V) G: 400 (V) H: 500 (V)
J: 600 (V) K: 700 (V) L: 800 (V)
M: 900 (V) N: 1000 (V) P: 1100 (V)
Q: 1200 (V) R: 1300 (V) S: 1400 (V)
T: 1500 (V) U: 1600 (V) V: 1700 (V)
W: 1800 (V)
④ Type
1: N-ch
2: P-ch
3: N-ch with built-in freewheeling diode
R: N-ch RC-IGBT with built-in freewheeling diode
⑤ Serial number
⑥ Version

4. Three-Phase Brushless DC Motor Driver ICs (with Built-in Power Device)

Package Dimensions (unit: mm)

SSOP30	HSSOP31	HDIP30
		
20.0 x 14.2	17.5 x 11.93	32.8 x 13.5

Square-wave PWM control type

Package	Part Number	V_{BB} (V)	I_{out} (A)	V_{CEsat} max(V)		Hall sensor input	FGC Rotate Pulse Select	Forward Reverse select	Protection Functions			
				High Side	Low Side				Current Limit	Over Current	TSD	UVLO
HSSOP31	TPD4152F	600	0.7	3	3	✓	-	✓	✓	-	✓	✓
	TPD4162F ☆	600	0.7	3	3	✓	✓	-	✓	✓	✓	✓
	TPD4166F ☆	600	1	3	3	✓	✓	-	✓	✓	✓	✓

Sine-wave PWM control type

Package	Part Number	V_{BB} (V)	I_{out} (A)	V_{CEsat} max (V)		R_{DSON} max (Ω)		Protection Functions			Diagnosis Functions
				High Side	Low Side	High Side	Low Side	Over Current	TSD	UVLO	
SSOP30	TPD4206F	500	2.5	-	-	2.3	2.3	✓	✓	✓	✓
	TPD4213F ★	600	1.5	-	-	TBD	TBD	✓	✓	✓	✓
	TPD4213AF ★	600	1.5	-	-	TBD	TBD	✓	✓	✓	✓
	TPD4204F	600	2.5	-	-	3.2	3.2	✓	✓	✓	✓
	TPD4214F ★	600	2.5	-	-	3.2	3.2	✓	✓	✓	✓
	TPD4214AF ★	600	2.5	-	-	3.2	3.2	✓	✓	✓	✓
	TPD4207F	600	5	-	-	0.56	0.56	✓	✓	✓	✓
	TPD4217F ★	600	5	-	-	0.56	0.56	✓	✓	✓	✓
	TPD4217AF ★	600	5	-	-	0.56	0.56	✓	✓	✓	✓
HSSOP31	TPD4163F ★	600	1	3	3	-	-	✓	✓	✓	✓
	TPD4164F ★	600	2	3	3	-	-	✓	✓	✓	✓
HDIP30	TPD4163K ★	600	1	3	3	-	-	✓	✓	✓	✓
	TPD4164K ★	600	2	3	3	-	-	✓	✓	✓	✓
	TPD4165K ★	600	3	3	3	-	-	✓	✓	✓	✓

☆ New Products, ★ Under Development (The specification is subject to change without notice.)

Part Naming Conventions

Three-Phase Brushless DC Motor Driver ICs (with Built-in Power Device)

Ex) TPD 41 52 F

① ② ③ ④

① TPD means intelligent power device [Three-Phase Brushless DC Motor Driver(with Built-in Power Device)]

② Three-phase brushless DC motor driver

41: Monolithic type

42: Multi-Chip module type

③ Serial number

④ Package

F: HSSOP31 or SSOP30

K: HDIP30

5. Automotive IPDs (Intelligent Power Devices)

Package Dimensions (unit: mm)

PS-8	WSON10	WSON10A	SSOP16	SSOP30	WQFN32
	Bottom View 	Bottom View 			Bottom View 
2.9 x 2.8	3.0 x 3.0	3.0 x 3.0	5.0 x 6.4	9.7 x 7.6	5.0 x 5.0

High-side Switches

Package	Part Number	V_{DD} (V)	I_O / I_{OUT} (A)	$R_{DS(ON)}$ max (Ω)	$V_{DD(opr)}$ (V)	T_{opr} (°C)	Protective Functions			Diagnosis Functions		
							Over Current	TSD	Active Clamp	Over Current	TSD	Open load
PS-8	TPD1052F	-0.3 to 25	0.8	0.8	5 to 18	-40 to 125	✓	✓	-	✓	✓	-
WSON10	TPD1055FA #	-0.3 to 25	3	0.12	5 to 18	-40 to 125	✓	✓	-	✓	✓	✓

Low-side Switches

Package	Part Number	V_{DS} / V_{OUT} (V)	I_D / I_{OUT} (A)	$R_{DS(ON)}$ max (Ω)	$V_{DD(opr)}$ (V)	T_{opr} (°C)	Protection Functions			Diagnosis Functions		
							Over Current	TSD	Active Clamp	Over Current	TSD	Open load
PS-8	TPD1044F #	41	1	0.6	Up to 41	-40 to 125	✓	✓	✓	-	-	-
	TPD1054F #	40	1	0.8	4.5 to 5.5	-40 to 125	✓	✓	✓	✓	✓	✓
WSON10	TPD1058FA #	40	6	0.1	4.5 to 5.5	-40 to 125	✓	✓	✓	✓	✓	✓

AEC-Q100 qualified

MOSFET Gate Drivers

Package	Part Number	V_{DD} (V)	I_{OUT} (A)	$V_{DD(opr)}$ (V)	T_{opr} (°C)	Protect Function and Features	Topology
PS-8	TPD7104AF #	-0.3 to 24	Source: Internal capacity Sink: 5 mA	5 to 18	-40 to 125	•Built in charge pump circuit •Over current protection and diagnostic output •Reverse battery protection	High-Side Switch
SSOP16	TPD7106F # ☆	-18 to 27	Source : 10 mA Sink: 10 mA/ 0.4 A	4.5 to 27	-40 to 150	•Built in charge pump circuit •Diagnosis output for under voltage of charge pump circuit •Reverse battery protection •Rapidly shut down by control pin (+400 mA)	
WSON10A	TPD7107F #	-0.3 to 26	Source: Internal capacity Sink: 5 mA	5.75 to 26	-40 to 125	•Built in charge pump circuit •Power supply voltage unusual protection and diagnostic output (Under voltage, Over voltage, Reverse battery) •Load current sensing •Over current protection and diagnostic output •Thermal protection and diagnostic output •Abnormalities in Drain-source voltage of external FET •Protection for disconnection of GND terminal •V_{DD} short of load line (Short circuit between source of external FET and V_{DD}) •Disconnection of load line.	
PS-8	TPD7211F	-0.5 to 35	±0.5	5 to 18	-40 to 125	•High side P-ch MOSFET drive	Half-Bridge
WQFN32	TPD7212F #	-0.3 to 25	+1.5/ -1	4.5 to 18	-40 to 150	•Built in charge pump circuit •Power supply unusual protection and diagnostic output •Output voltage unusual protection and diagnostic output	Three-Phase Full-Bridge
SSOP30	TPD7212FN # @	-0.3 to 25	+1.5/ -1	4.5 to 18	-40 to 150	•Built in charge pump circuit •Power supply unusual protection and diagnostic output •Output voltage unusual protection and diagnostic output	

AEC-Q100 qualified, ☆ New Products
@ Dry-packed

Part Naming Conventions

Automotive IPDs

Ex) TPD 10 55 F A
① ② ③ ④ ⑤

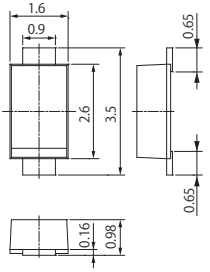
① TPD means intelligent power device
② The type of topology
10: Single or dual switch
20: Multi output switch
71: High-side MOSFET gate driver
72: Bridge MOSFET gate driver
③ Serial number
④ Package
F: Surface mount type
⑤ Changes
The additional symbol which shows some changes.

6. Device Package

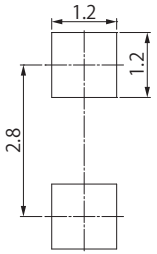
Surface Mount Type

S-FLAT™ (1.6x3.5)

Package dimension unit : mm

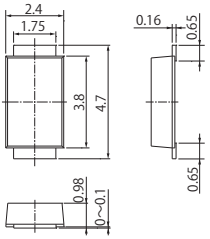


Land pattern example unit : mm

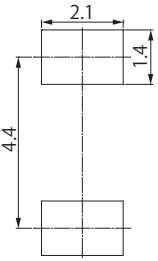


M-FLAT™ (2.4x4.7)

Package dimension unit : mm

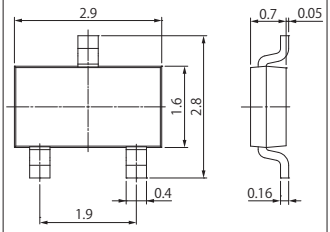


Land pattern example unit : mm

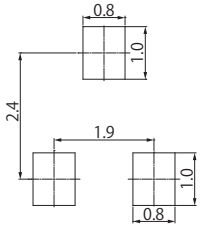


TSM (2.9x2.8)

Package dimension unit : mm

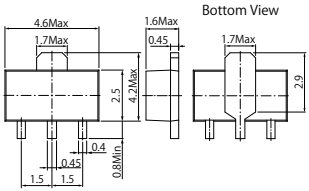


Land pattern example unit : mm

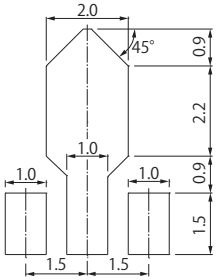


PW-Mini (4.6x4.2)

Package dimension unit : mm

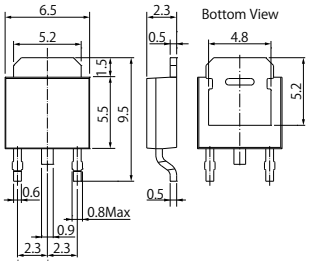


Land pattern example unit : mm

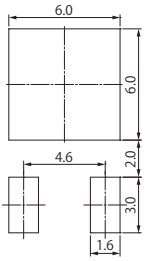


New PW-Mold (6.5x9.5)

Package dimension unit : mm

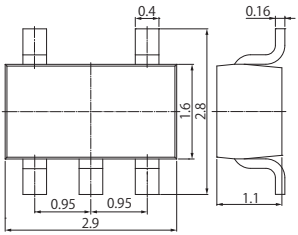


Land pattern example unit : mm

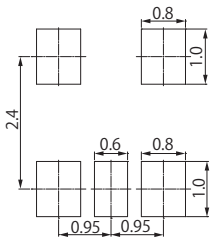


SMV (SOT-25) (2.9x2.8)

Package dimension unit : mm

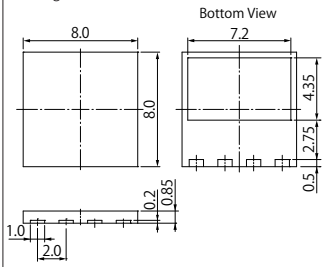


Land pattern example unit : mm

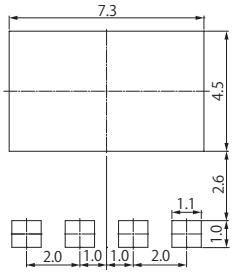


DFN8X8 (8.0x8.0)

Package dimension unit : mm

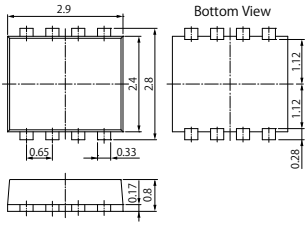


Land pattern example unit : mm

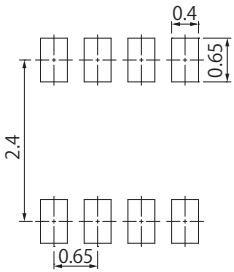


PS-8 (2.9x2.8)

Package dimension unit : mm

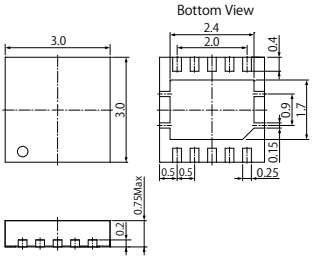


Land pattern example unit : mm

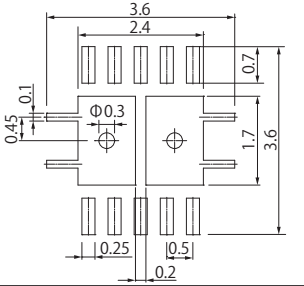


WSON10 (3.0x3.0)

Package dimension unit : mm

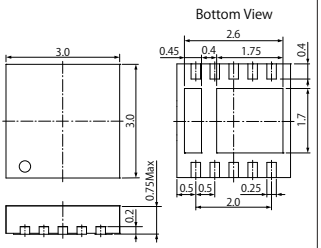


Land pattern example unit : mm

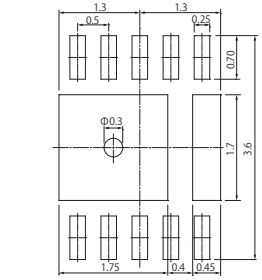


WSON10A (3.0x3.0)

Package dimension unit : mm

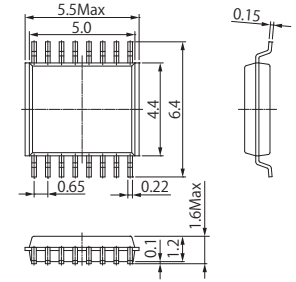


Land pattern example unit : mm

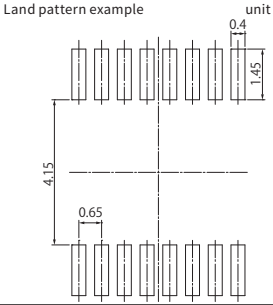


SSOP16 (5.0x6.4)

Package dimension unit : mm

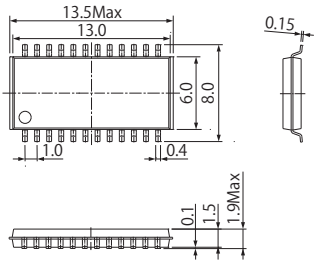


Land pattern example unit : mm

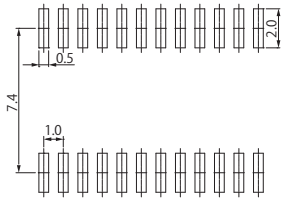


SSOP24 (13.0x8.0)

Package dimension unit : mm

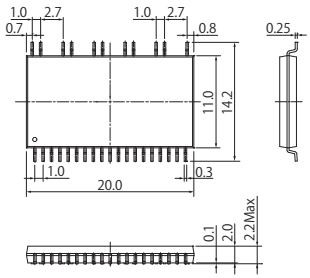


Land pattern example unit : mm

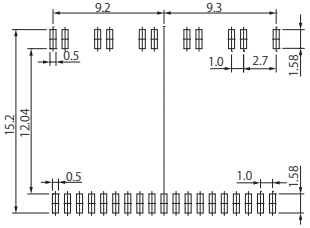


SSOP30 (20.0x14.2)

Package dimension unit : mm

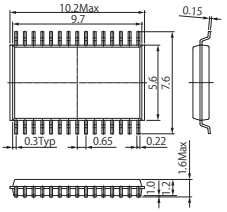


Land pattern example unit : mm

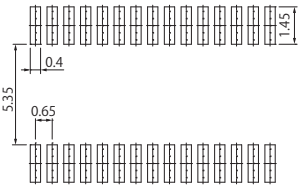


SSOP30 (9.7x7.6)

Package dimension unit : mm

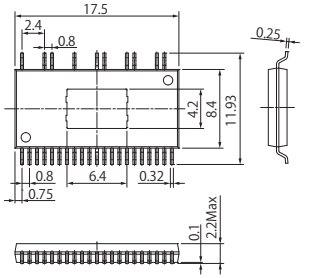


Land pattern example unit : mm



HSSOP31 (17.5x11.93)

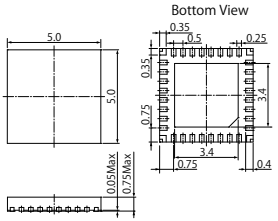
Package dimension unit : mm



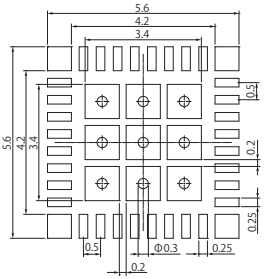
Land pattern example unit : mm

WQFN32 (5.0x5.0)

Package dimension unit : mm



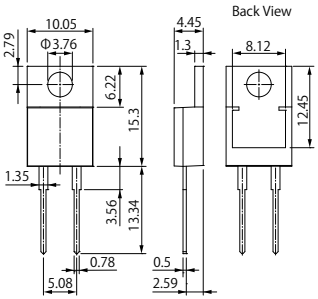
Land pattern example unit : mm



Through Hole Type

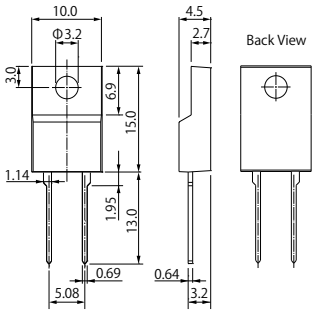
TO-220-2L (10.05x15.3)

Package dimension unit : mm



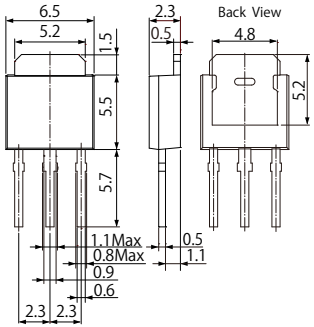
TO-220F-2L (10.0x15.0)

Package dimension unit : mm



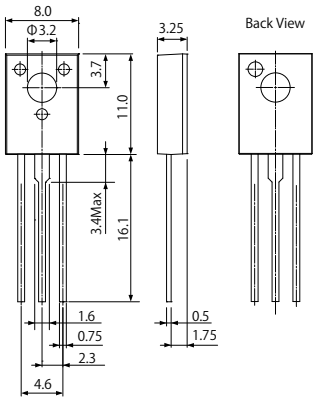
New PW-Mold2 (6.5x5.5)

Package dimension unit : mm



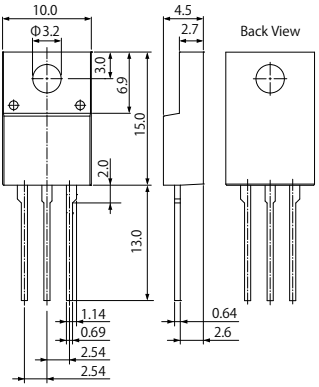
TO-126N (8.0x11.0)

Package dimension unit : mm



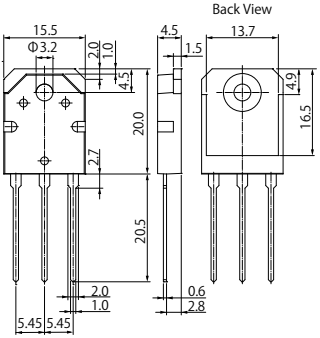
TO-220SIS (SC-67) (10.0x15.0)

Package dimension unit : mm



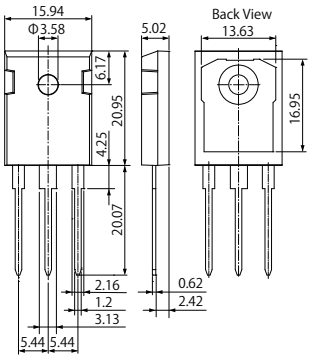
TO-3P(N) (SC-65) (15.5x20.0)

Package dimension unit : mm



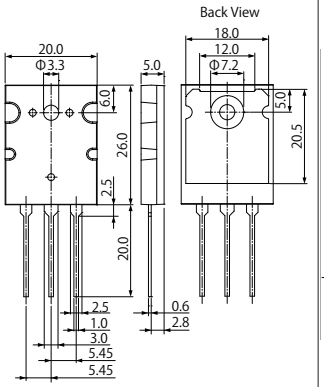
TO-247 (15.94x20.95)

Package dimension unit : mm



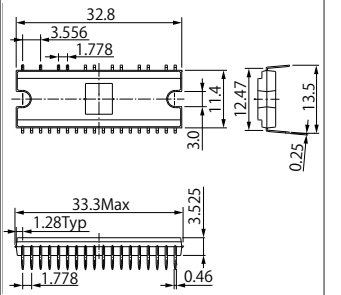
TO-3P(L) (20.0x26.0)

Package dimension unit : mm



HDIP30 (32.8x13.5)

Package dimension unit : mm



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2021 Rev. 2.0