TOSHIBA

Power Devices

Selection Guide 2019

Contents

1. Diodes 3 - 9

- SiC Schottky Barrier Diodes
- Schottky Barrier Diodes (SBDs)
- Rectifier Diodes
- Zener Diodes

2. Bipolar Transistors 10 - 15

3. Discrete IGBTs 16 - 17

4. Three-Phase Brushless DC Motor Driver ICs (with Built-in Power Device) 18 - 19

- Square-wave PWM control type
- Sine-wave PWM control type

5. Automotive IPDs (Intelligent Power Devices) 20 - 21

- High-side Switches
- Low-side Switches
- MOSFET Gate Drivers

6. Device Packages 22 - 25

1. Diodes

SiC Schottky Barrier Diodes

Package Dimensions (unit: mm)

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

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)
TO-220-2L	TRS2E65F	650	2	21	1.6	2	8.7	20	175
	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	100	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	(55)*	1.6	6	22*	30*	
	TRS16N65FB ★	650	16	(69)*	1.6	8	28*	40*	
	TRS20N65FB ★	650	20	(83)*	1.6	10	36*	50*	
	TRS24N65FB ★	650	24	(100)*	1.6	12	44*	60*	

★ Under Development (The specification is subject to change without notice.), * Per Leg

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

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

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
	CRG10A #	600	0.7	15	0.95	1.1	0.7
	CRG04 #	600	1	15	0.98	1.1	1
	CRG04A #	600	1	15	0.98	1.1	1
	CRG05 #	800	1	15	1.05	1.2	1
M-FLAT	CMC02	400	1	30	0.88	1	1
	CMG05 #	400	1	15	0.94	1.1	1
	CMG07 #	400	1	30	0.94	1.1	1
	CMG02 #	400	2	80	0.9	1.1	2
	CMG06 #	600	1	15	0.94	1.1	1
	CMG08 #	600	1	30	0.94	1.1	1
	CMG03 #	600	2	80	0.92	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	CRF03 #	600	0.7	10	1.5	2	0.7	100
	CRF02 #	800	0.5	10	2.2	3	0.5	100
M-FLAT	CMF02 #	600	1	10	-	2	1	100
	CMF01 #	600	2	30	1.4	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

AEC-Q101qualified

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

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

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 : 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: 2pin 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	2SA2058	-10	-1.5	200	500	-2	-0.2	-0.19	-0.6	-0.02	-	-	Low Saturation
	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	2SA2066	-10	-2	200	500	-2	-0.2	-0.19	-0.6	-0.02	-	-	Low Saturation
	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
	2SA1483	-45	-0.2	40	240	-1	-0.01	-0.3	-0.1	-0.01	200	-	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	-	
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	-	

% : Darlington

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	2SC5755	10	2	400	1000	2	0.2	0.12	0.6	0.012	-	-	Low Saturation
	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
	2SC5906	30	4	200	500	2	0.5	0.2	1.6	0.053	-	-	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	TPCP8504	10	2	400	1000	2	0.2	0.12	0.6	0.012	-	-	Low Saturation
	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	2SC5785	10	2	400	1000	2	0.2	0.12	0.6	0.012	-	-	Low Saturation
	2SC5713	10	4	400	1000	2	0.5	0.15	1.6	0.032	-	-	Low Saturation
	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
	2SC6125	20	4	180	390	2	0.5	0.2	1.6	0.053	-	-	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

% : Darlington, $: Built-in Active Clamp Zener, & : NPN + NPN

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
	2SC6000	50	7	250	400	2	2.5	0.18	2.5	0.083	-	-	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	-	-	
	TTC012	375	2	100	200	5	0.3	0.5	0.5	0.0625	-	-	Low Saturation
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

Package Dimensions (unit: mm)

PS-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)		
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.

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.

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

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
	GT30J341 ◆	600	59	1.5	15	30	0.04	300	30	Inductive	0.05	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
	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
	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, ★ Under Development (The specification is subject to change without notice.)

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

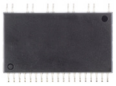
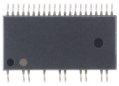
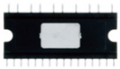
Conventional Naming

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	DIP26
		
20.0 x 14.2	17.5 x 11.93	32.0 x 16.6

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	Protection Functions			
				High Side	Low Side			Current Limit	Over Current	TSD	UVLO
HSSOP31	TPD4151F	250	1	3	3	✔	-	✔	-	✔	✔
	TPD4152F	600	0.7	3	3	✔	-	✔	-	✔	✔
	TPD4162F ★	600	0.7	3	3	✔	✔	✔	✔	✔	✔
DIP26	TPD4151K	250	1	2.8	2.8	✔	-	✔	-	✔	✔
	TPD4142K	500	1	2.7	2.7	✔	-	✔	-	✔	✔
	TPD4146K	500	1	2.7	2.7	✔	✔	✔	-	✔	✔

Sine-wave PWM control type

Package	Part Number	V_{BB} (V)	I_{out} (A)	V_{CEsat} max (V)		R_{DSON} max (Ω)		Input of External Current Protection	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	✔	✔	✔	✔	✔
	TPD4204F	600	2.5	-	-	3.2	3.2	✔	✔	✔	✔	✔
	TPD4207F	600	5	-	-	0.56	0.56	✔	✔	✔	✔	✔
DIP26	TPD4123K	500	1	3	3	-	-	-	✔	✔	✔	✔
	TPD4123AK	500	1	3	3	-	-	✔	-	✔	✔	✔
	TPD4144K	500	2	3.2	3.2	-	-	-	✔	✔	✔	✔
	TPD4144AK	500	2	3.2	3.2	-	-	✔	-	✔	✔	✔
	TPD4135K	500	3	2.8	2.8	-	-	-	✔	✔	✔	✔
	TPD4135AK	500	3	2.8	2.8	-	-	✔	-	✔	✔	✔

★ 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: DIP26

5. Automotive IPDs (Intelligent Power Devices)

Package Dimensions (unit: mm)

PS-8	SOP-8	WSON10	SSOP24	WQFN32
		Bottom View		Bottom View
				
2.9 x 2.8	4.9 x 6.0	3.0 x 3.0	13.0 x 8.0	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	✔	✔	-	✔	✔	✔
SOP-8	TPD1060F #	-0.3 to 25	3	0.12	4 to 18	-40 to 125	✔	✔	-	✔	✔	✔
	TPD1053F	-0.5 to 25	3	0.12	5 to 18	-40 to 125	✔	✔	✔	✔	✔	✔
SSOP24	TPD2005F	45	1	1.2	8 to 40	-40 to 85	✔	✔	-	-	-	-

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	✔	✔	✔	✔	✔	✔
SOP-8	TPD1039F	45	1.5	0.25	Up to 45	-40 to 85	✔	✔	✔	-	-	-
WSON10	TPD1058FA	40	6	0.1	4.5 to 5.5	-40 to 125	✔	✔	✔	✔	✔	✔
SOP-8	TPD1030F	40	1	0.6	Up to 40	-40 to 110	✔	✔	✔	-	-	-
	TPD1036F	30	1.5	0.5	Up to 30	-40 to 110	✔	✔	✔	-	-	-
	TPD1032F	20	3	0.4	Up to 20	-40 to 110	✔	✔	✔	-	-	-
	TPD1046F	40	3	0.2	Up to 20	-40 to 125	✔	✔	✔	-	-	-
SSOP24	TPD2007F	40	1	1.4	Up to 40	-40 to 85	✔	✔	✔	-	-	-

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
VSOP-16	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)	
WSON10	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
VSOP-30	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, ★ Under Development (The specification is subject to change without notice.)
@ 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

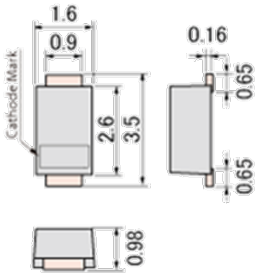
The additional symbol which shows some changes.

6. Device Package

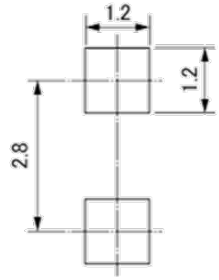
Surface Mount Type

S-FLAT™ (1.6x3.5)

Package dimension unit : mm

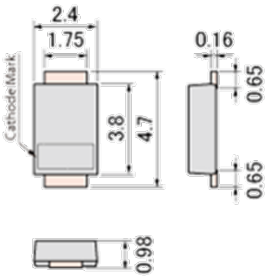


Land pattern example unit : mm

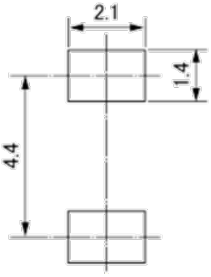


M-FLAT™ (2.4x4.7)

Package dimension unit : mm

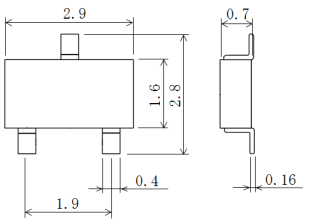


Land pattern example unit : mm

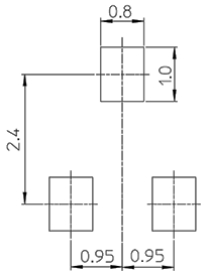


TSM (2.9x2.8)

Package dimension unit : mm

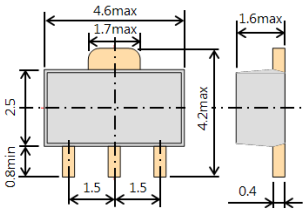


Land pattern example unit : mm

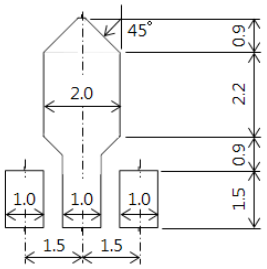


PW-Mini (4.6x4.2)

Package dimension unit : mm

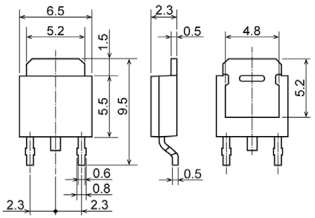


Land pattern example unit : mm

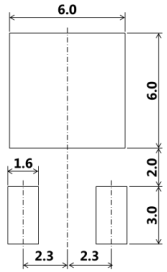


New PW-Mold (6.5x9.5)

Package dimension unit : mm

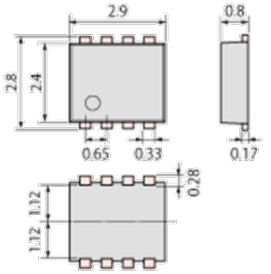


Land pattern example unit : mm

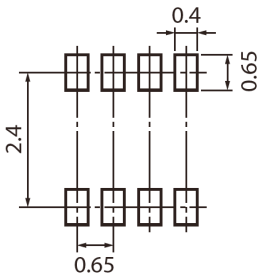


PS-8 (2.9x2.8)

Package dimension unit : mm

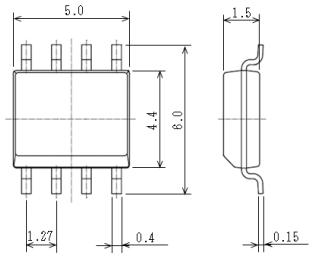


Land pattern example unit : mm

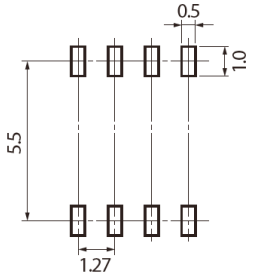


SOP-8 P-1.27A (5.0x6.0)

Package dimension unit : mm

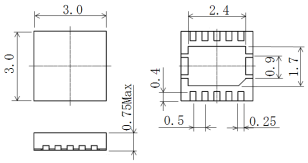


Land pattern example unit : mm

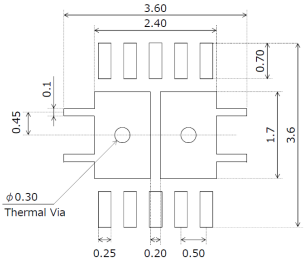


WSON10 (3.0x3.0)

Package dimension unit : mm

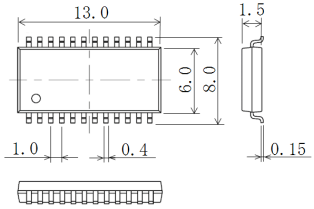


Land pattern example unit : mm

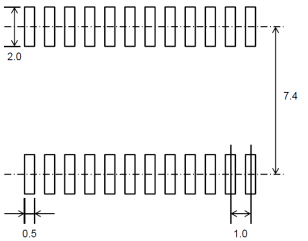


SSOP24 (13.0x8.0)

Package dimension unit : mm

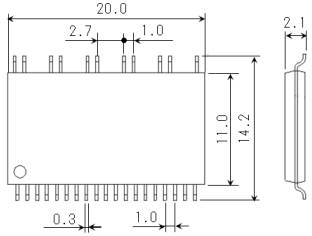


Land pattern example unit : mm

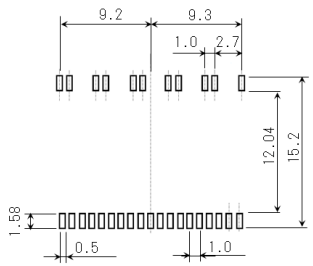


SSOP30 (20.0x14.2)

Package dimension unit : mm

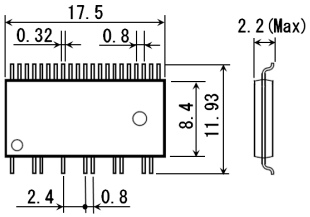


Land pattern example unit : mm



HSSOP31 (17.5x11.93)

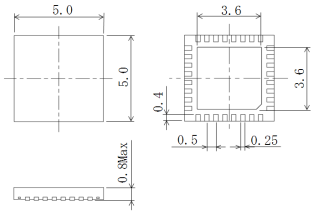
Package dimension unit : mm



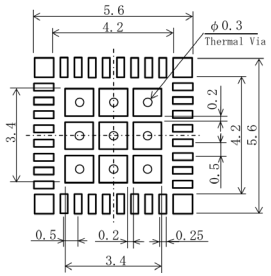
Land pattern example unit : mm

WQFN32 (5.0x5.0)

Package dimension unit : mm



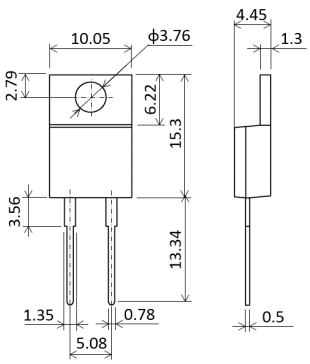
Land pattern example unit : mm



Through Hole Type

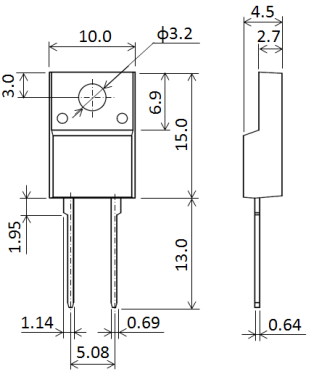
TO-220-2L (10.05x15.3)

Package dimension unit : mm



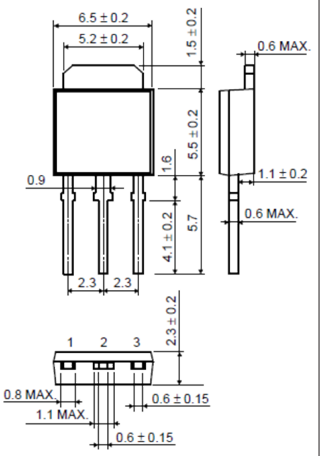
TO-220F-2L (10.0x15.0)

Package dimension unit : mm



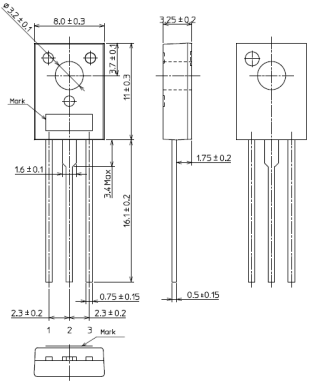
New PW-Mold2 (6.5x5.5)

Package dimension unit : mm



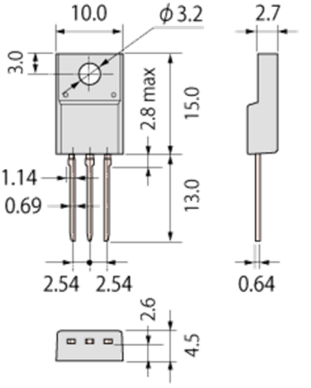
TO-126N (8.0x11.0)

Package dimension unit : mm



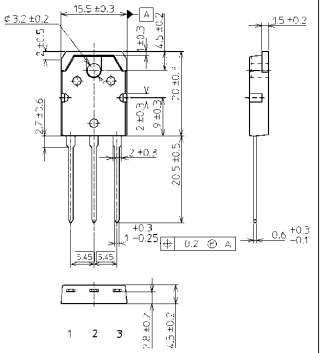
TO-220SIS (SC-67) (10.0x15.0)

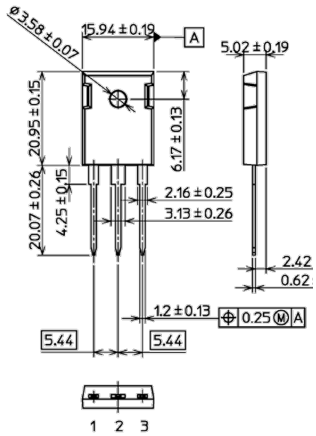
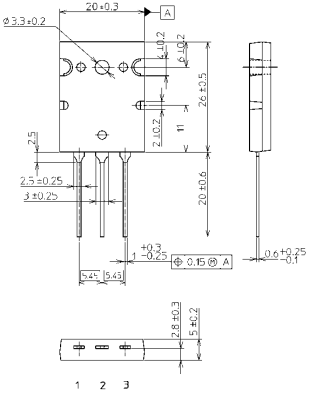
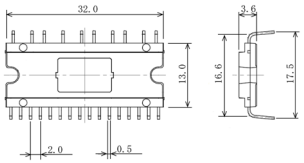
Package dimension unit : mm



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

Package dimension unit : mm



TO-247 (15.94x20.95)	TO-3P(L) (20.0x26.0)	DIP26 (32.0x16.6)
Package dimension unit : mm	Package dimension unit : mm	Package dimension unit : mm
		

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