

TOSHIBA

Small-Signal Multi-Chip Discrete Devices (Transistors and Diodes)

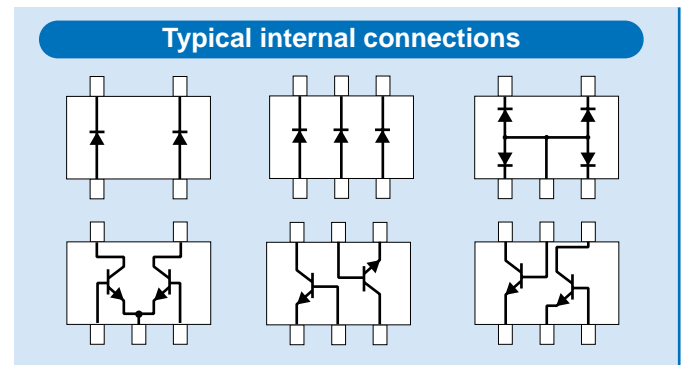
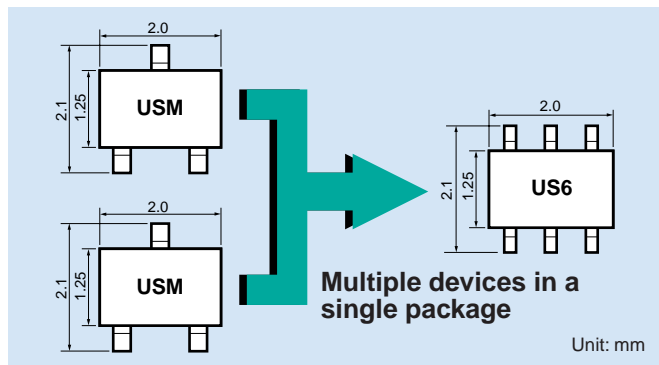
PRODUCT GUIDE

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What Is a Multi-Chip Discrete Device?

A multi-chip discrete device is a product which incorporates multiple small-signal transistors or small-signal diodes in a single package.



Multi-Chip Discrete Device Totals

The line-up is comprised of 324 different products (including products under development).

Product category	Number of products	Typical product number
Small-signal transistors	26 products	HN1C01FU
J-FETs	2 products	2SK3320
Small-signal MOSFETs	15 products	HN1K02FU
Bias resistor built-in transistors	202 products	RN1901
Small-signal diodes	31 products	HN2D01FU
Schottky barrier diodes	19 products	HN2S01FU
Zener diodes for protection against ESD	21 products	DF5A6.8FU
Mixed small-signal devices	8 products	HN7G01FU

Features of Multi-Chip Discrete Devices

- Reduced part counts yield reduced mounting costs.
- Toshiba can tailor device configurations to customer needs.
- Several devices can be combined in a single package.
- A single package containing several devices has a smaller mounting area than an equivalent array of separately packaged devices.
- The incorporation of peripheral components into the package reduces costs.

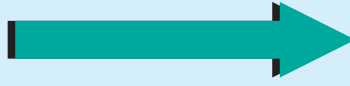
Part count can be reduced.

1 Mounting area can be reduced.

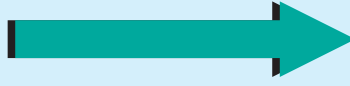


Cost of board can be reduced.

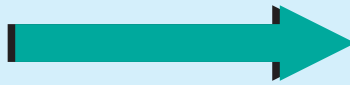
2 Cost of mounting can be reduced.



Enables high-density mounting.

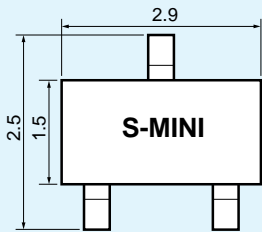
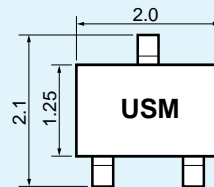
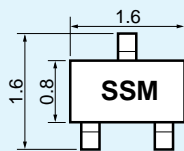
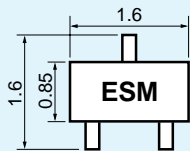


Allows manufacture of products which are both cheap and highly functional.

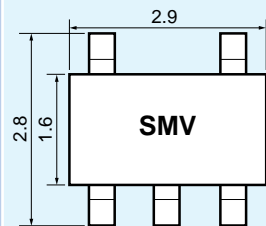
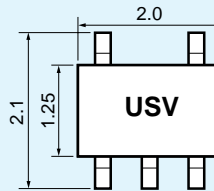
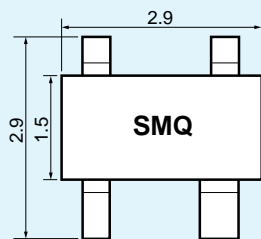
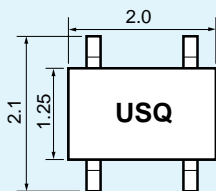


Typical Packages

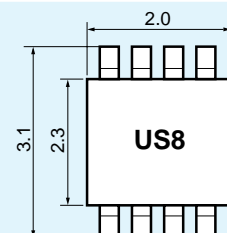
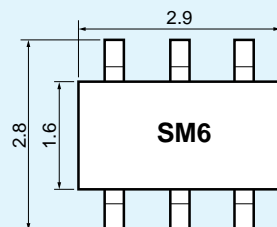
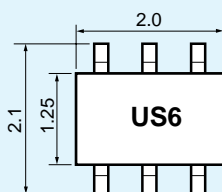
★ 3-pin series: 1 or 2 diodes, 1 transistor, 1 S-MOS device



★ 4-pin to 5-pin series: 2~4 diodes, 1 or 2 transistors, 1 or 2 S-MOS devices



★ 6-pin to 8-pin series: 3 or 4 diodes, 2 or 3 transistors, 2 or 3 S-MOS devices



Unit: mm

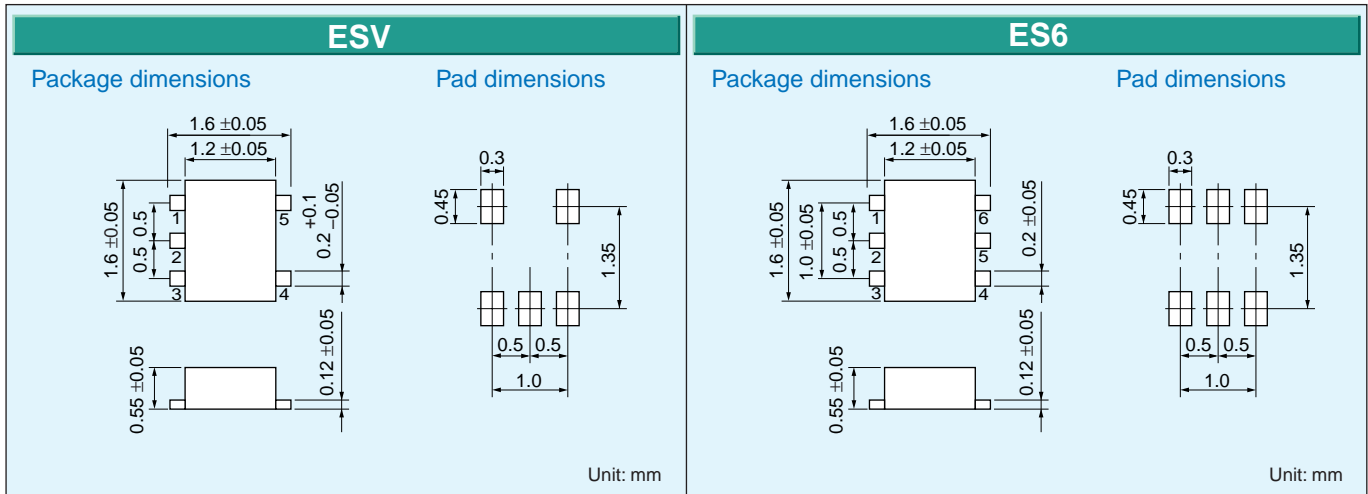
New Product News

Small-signal devices housed in ultra-compact ESV and ES6 packages

ESV and ES6 package outlines

Package size: 1.6 mm x 1.6 mm; smallest 5-pin/6-pin mold package in the World capable of incorporating multi-chip devices Board footprint is approximately 60% of that of USV and US6 (2 mm x 2.1 mm).
Thickness is as little as 0.55 mm.
Product line-up is identical to that housed in USV and US6 packages.

ESV and ES6 package dimensions and reference pad dimensions



NEW ES6 package line-up

Initial line-up

- Multi-chip transistors housed in ES6 packages

Internal Connections	Component Transistors	Product No.
Point-symmetrical array type	PNP x 2	HN1A01FE
	NPN + PNP	HN1B04FE
	NPN x 2	HN1C01FE

Internal Connections	Component Transistors	Product No.
Mirror-image array type	PNP x 2	HN2A01FE
	NPN x 2	HN2C01FE

- Transistors with built-in bias resistors housed in ES6 packages

Internal Connections	Component Transistors	Product No.	Built-in Bias Resistors	
			R1 (kΩ)	R2 (kΩ)
Point-symmetrical array type	NPN x 2	RN1904FE	47	47
		RN1910FE	4.7	–
	PNP x 2	RN2902FE	10	10
		RN2904FE	47	47
	PNP + NPN	RN4902FE	10	10
	NPN + PNP	RN4982FE	10	10

Internal Connections	Component Transistors	Product No.	Built-in Bias Resistors	
			R1 (kΩ)	R2 (kΩ)
Mirror-image array type	NPN x 2	RN1962FE	10	10
		RN1963FE	22	22
		RN1964FE	47	47
		RN1970FE	4.7	–
		RN1971FE	10	–
	PNP x 2	RN2962FE	10	10
		RN2963FE	22	22
		RN2964FE	47	47
		RN2970FE	4.7	–

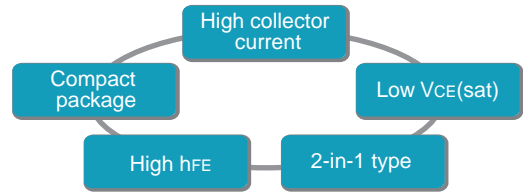
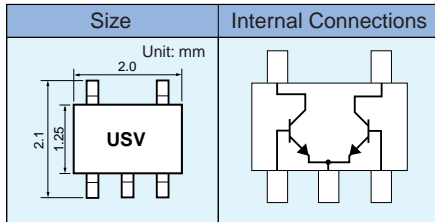
New release

Low- $V_{CE(sat)}$, 400-mA, compact 2-in-1 HN4C05JU

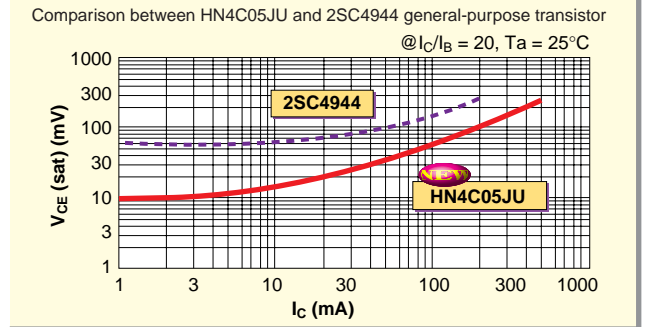
The HN4C05JU is the smallest 2-in-1 400-mA transistor available today. Two NPN transistors are housed in a low- $V_{CE(sat)}$, 400mA, compact 2.0 x 1.25-mm, 5-pin USV package. This device is suitable for muting switch circuits and compact dual current drivers.

Features

- High collector current: 400 mA (max)
- Low $V_{CE(sat)}$: 15 mV ($I_C = 10$ mA, $I_B = 0.5$ mA)
- High h_{FE} : greater than or equal to 500 (for B rank products)
- 2-in-1 type: emitter-common connection
- Compact package: 2.0 x 1.25-mm, 5-pin USV package



$V_{CE(sat)}$ - I_C characteristic



Characteristic list

Product No.	Maximum Ratings			h _{FE}		* @ V_{CE} (V) @ I_C (mA)		$V_{CE(sat)}$ (V)				f _T (MHz)		C _{ob} (pF)	
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	Min	Max	Typ.	Max	@ I_C (mA)	@ I_B (mA)	Min	@ V_{CE} (V)	@ I_C (mA)	Typ.	@ V_{CB} (V)	
	HN4C05JU	15	12	400	300	1000	0.015	0.03	10	0.5	80	2	10	4.2	10

*: Classified into two ranks; rank A: $h_{FE} = 300$ to 600 ; rank B: $h_{FE} = 500$ to 1000

Included transistors: 2SC5233 x 2

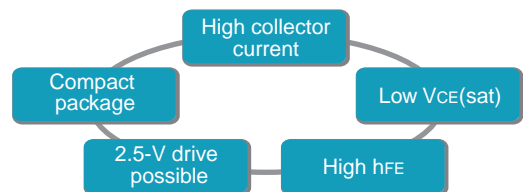
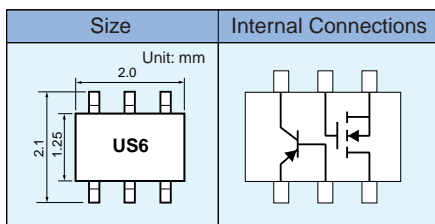
New release

HN7G01FU comprising a low- $V_{CE(sat)}$ transistor and a MOSFET

The HN7G01FU incorporates a transistor and a power MOSFET in a single package. The device comprises a low- $V_{CE(sat)}$, 400-mA PNP-type transistor and a general-purpose, 2.5-V drive voltage, 1.5-V $V_{th(max)}$ MOSFET. This device is housed in a compact 2.0 x 1.25-mm, 6-pin US6 package and is suitable for power management applications such as use in power supply switches.

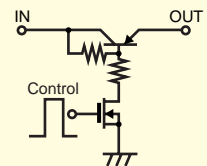
Features

- High collector current: -400 mA (max)
- Low $V_{CE(sat)}$: -110 mV ($I_C = -200$ mA, $I_B = -10$ mA)
- High h_{FE} : greater than or equal to 500 (B rank products)
- 2.5-V drive possible
- Compact package: 2.0 x 1.25-mm, 6-pin US6 package



Application circuit example

External resistors are used. When selecting a resistor, please take into account the output current and current consumption levels.



Transistor characteristics

Polarity	Maximum Ratings			h _{FE}		* @ V_{CE} (V) @ I_C (mA)		$V_{CE(sat)}$ (V)				f _T (MHz)		C _{ob} (pF)	
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	Min	Max	Typ.	Max	@ I_C (mA)	@ I_B (mA)	Min	@ V_{CE} (V)	@ I_C (mA)	Typ.	@ V_{CB} (V)	
	PNP	-15	-12	-400	300	1000	-0.015	-0.03	-10	-0.5	80	-2	-10	4.2	-10

*: Classified into two ranks; rank A: $h_{FE} = 300$ - 600 ; rank B: $h_{FE} = 500$ - 1000

Transistor: 2SA1954

MOSFET characteristics

Polarity	Maximum Ratings			$R_{DS(ON)}$ (Ω)		@ V_{GS} (V) @ I_D (mA)		V_{th} (V)		t_{on} (ns)		t_{off} (ns)	
	V_{DS} (V)	V_{GS} (V)	I_D (mA)	Typ.	Max	Min	Max	@ V_{DS} (V)	@ I_D (mA)	Typ.	Typ.	@ V_{GS} (V)	@ I_D (mA)
	Nch	20	10	50	20	40	0.5	1.5	3	0.1	140	140	3

MOSFET: 2SK1829

Product Line-up

Multi-chip transistors

5-pin packages: ESV, USV and SMV

Internal Connections		Product No.			Component Devices		Ratings		Features
		ESV package (1.6 x 1.6 mm)	USV package (2.0 x 2.1 mm)	SMV package (2.9 x 2.8 mm)			V _{CEO} (V)	I _c (mA)	
		Q1	Q2	Q1	Q2	V _{CEO} (V)	I _c (mA)		
Emitter-common type PNP 2-in-1			2SA1873	2SA1618	2SA1586	2SA1586	-50	-150	General-purpose type
Emitter-common type NPN 2-in-1			2SC4944	2SC4207	2SC4116	2SC4116	50	150	General-purpose type
			HN4C05JU	—	2SC5233	2SC5233	12	400	Low-saturation-voltage type Muting switch
			—	HN4C06J	2SC4117	2SC4117	120	100	High withstand capability

: New products

6-pin packages: ES6, US6 and SM6

Internal Connections		Product No.			Component Devices		Ratings		Features	
		ES6 package (1.6 x 1.6 mm)	US6 package (2.0 x 2.1 mm)	SM6 package (2.9 x 2.8 mm)			V _{CEO} (V)	I _c (mA)		
		Q1	Q2	Q1	Q2	V _{CEO} (V)	I _c (mA)			
Point-symmetrical array type PNP 2-in-1		HN1A01FE	HN1A01FU	HN1A01F	2SA1586	2SA1586	-50	-150	General-purpose type	
			—	HN1A02F	2SA1362	2SA1362	-15	-800	Low-saturation-voltage type	
Point-symmetrical array type PNP + NPN		HN1B01FE	HN1B01FU	HN1B01F	2SA1586	2SC4116	Q1	-50	-150	General-purpose type
							Q2	50	150	General-purpose type
Point-symmetrical array type NPN + PNP		HN1B04FE	HN1B04FU	—	2SC4116	2SA1586	Q1	50	150	General-purpose type
							Q2	-50	-150	General-purpose type
Point-symmetrical array type NPN 2-in-1		HN1C01FE	HN1C01FU	HN1C01F	2SC4116	2SC4116	50	150	General-purpose type	
							HN1C03FU	HN1C03F	2SC4213	2SC4213
Mirror-image array type PNP 2-in-1		HN2A01FE	HN2A01FU	—	2SA1586	2SA1586	-50	-150	General-purpose type	
Mirror-image array type NPN 2-in-1		HN2C01FE	HN2C01FU	—	2SC4116	2SC4116	50	150	General-purpose type	
Cascade type NPN + PNP			—	HN3B01F	2SC4116	2SA1586	Q1	50	150	General-purpose type
							Q2	-50	-150	General-purpose type
Cascade type PNP + NPN			HN3B02FU	—	2SA1586	2SC4116	Q1	-50	-150	General-purpose type
							Q2	50	150	General-purpose type
Cascade type NPN 2-in-1				HN3C51F	2SC4117	2SC4117	120	100	High withstand capability	

: New products

Multi-chip J-FETs

5-pin packages: ESV, USV and SMV

Internal Connections	Product No.			Component Devices		Ratings		Features	
	ESV package (1.6 x 1.6 mm)	USV package (2.0 x 2.1 mm)	SMV package (2.9 x 2.8 mm)			V _{GDS} (V)	I _G (mA)		
	Q1		Q2						
Source-common type PNP 2-in-1					2SK880	2SK880	-50	10	General-purpose type I _{SS} = 1.2 ~ 14 mA

: New product

Multi-chip S-MOS devices (small-signal MOSFETs)

5-pin packages: ESV, USV and SMV

Internal Connections	Product No.			Component Devices		Ratings		Features	
	ESV package (1.6 x 1.6 mm)	USV package (2.0 x 2.1 mm)	SMV package (2.9 x 2.8 mm)			V _{DS} (V)	I _D (mA)		
	Q1		Q2						
Source-common type PNP 2-in-1					SSM3J05FU	SSM3J05FU	-20	-200	2.5V drive voltage (V _{th} = -1.1 V max), Ron = 3.2 Ω typ.
Source-common type PNP 2-in-1					2SK2034	2SK2034	20	100	2.5V drive voltage (V _{th} = 1.5 V max), Ron = 8 Ω typ.
					SSM3K05FU	SSM3K05FU	20	400	2.5V drive voltage (V _{th} = 1.1 V max), Ron = 0.85 Ω typ.

: New products

6-pin packages: ES6, US6, and SM6

Internal Connections	Product No.			Component Devices		Ratings		Features	
	ES6 package (1.6 x 1.6 mm)	US6 package (2.0 x 2.1 mm)	SM6 package (2.9 x 2.8 mm)			V _{DS} (V)	I _D (mA)		
	Q1		Q2						
Point-symmetrical array type PNP 2-in-1					2SJ346	2SJ346	-20	-50	2.5V drive voltage (V _{th} = -1.5 V max), Ron = 20 Ω typ.
					SSM3J05FU	SSM3J05FU	-20	-200	2.5V drive voltage (V _{th} = -1.1 V max), Ron = 3.2 Ω typ.
Point-symmetrical array type PNP 2-in-1					2SK1829	2SK1829	20	50	2.5V drive voltage (V _{th} = 1.5 V max), Ron = 20 Ω typ.
					2SK2034	2SK2034	20	100	2.5V drive voltage (V _{th} = 1.5 V max), Ron = 8 Ω typ.
					2SK1827	2SK1827	50	50	4V drive voltage (V _{th} = 2.5 V max), Ron = 20 Ω typ.
					2SK2824	2SK2824	20	100	1.5V drive voltage (V _{th} = 1.0 V max), Ron = 10 Ω typ.
					2SK2037	2SK2037	20	100	2.5V drive voltage (V _{th} = 1.5 V max), Ron = 4 Ω typ.
					SSM3K04FU	SSM3K04FU	20	100	R _{GS} = 1M Ω built-in 2.5V drive voltage (V _{th} = 1.5 V max), Ron = 4 Ω typ.
					SSM3K05FU	SSM3K05FU	20	400	2.5V drive voltage (V _{th} = 1.1 V max), Ron = 0.85 Ω typ.
Point-symmetrical array type Nch + Pch					2SK1829	2SJ346	20	50	2.5V drive voltage (V _{th} = 1.5V max), Ron = 20 Ω typ.
					2SK1829	2SJ346	-20	-50	2.5V drive voltage (V _{th} = -1.5V max), Ron = 20 Ω typ.
					2SK1827	2SJ346	50	50	4V drive voltage (V _{th} = 2.5V max), Ron = 20 Ω typ.
					2SK1827	2SJ346	-20	-50	2.5V drive voltage (V _{th} = -1.5V max), Ron = 20 Ω typ.
					SSM3K05FU	SSM3J05FU	20	400	2.5V drive voltage (V _{th} = 1.1V max), Ron = 0.85 Ω typ.
					SSM3K05FU	SSM3J05FU	-20	-200	2.5V drive voltage (V _{th} = -1.1V max), Ron = 3.2 Ω typ.

: New products

Product Line-up

Multi-chip BRTs (bias resistor built-in transistors)

5-pin packages: ESV, USV and SMV

Internal Connections		Product No.			Component Devices		Ratings		Features		
		ESV package (1.6 x 1.6 mm)	USV package (2.0 x 2.1 mm)	SMV package (2.9 x 2.8 mm)			V _{CEO} (V)	I _c (mA)			
					Q1	Q2					
Emitter-common type PNP 2-in-1		RN1701JE	RN1701	RN1501	RN1301	RN1301	50	100	R1 = 4.7 kΩ, R2 = 4.7 kΩ		
		RN1702JE	RN1702	RN1502	RN1302	RN1302			R1 = 10 kΩ, R2 = 10 kΩ		
		RN1703JE	RN1703	RN1503	RN1303	RN1303			R1 = 22 kΩ, R2 = 22 kΩ		
		RN1704JE	RN1704	RN1504	RN1304	RN1304			R1 = 47 kΩ, R2 = 47 kΩ		
		RN1705JE	RN1705	RN1505	RN1305	RN1305			R1 = 2.2 kΩ, R2 = 47 kΩ		
		RN1706JE	RN1706	RN1506	RN1306	RN1306			R1 = 4.7 kΩ, R2 = 47 kΩ		
		RN1707JE	RN1707	RN1507	RN1307	RN1307			R1 = 10 kΩ, R2 = 47 kΩ		
		RN1708JE	RN1708	RN1508	RN1308	RN1308			R1 = 22 kΩ, R2 = 47 kΩ		
		RN1709JE	RN1709	RN1509	RN1309	RN1309			R1 = 47 kΩ, R2 = 22 kΩ		
		RN1710JE	RN1710	RN1510	RN1310	RN1310			R1 = 4.7 kΩ, R2 = ∞		
		RN1711JE	RN1711	RN1511	RN1311	RN1311			R1 = 10 kΩ, R2 = ∞		
		-	-	RN1544	RN1444	RN1444			20	300	Muting switch R1 = 2.2 kΩ, R2 = ∞
		Emitter-common type PNP 2-in-1		RN2701JE	RN2701	RN2501			RN2301	RN2301	-50
RN2702JE	RN2702			RN2502	RN2302	RN2302	R1 = 10 kΩ, R2 = 10 kΩ				
RN2703JE	RN2703			RN2503	RN2303	RN2303	R1 = 22 kΩ, R2 = 22 kΩ				
RN2704JE	RN2704			RN2504	RN2304	RN2304	R1 = 47 kΩ, R2 = 47 kΩ				
RN2705JE	RN2705			RN2505	RN2305	RN2305	R1 = 2.2 kΩ, R2 = 47 kΩ				
RN2706JE	RN2706			RN2506	RN2306	RN2306	R1 = 4.7 kΩ, R2 = 47 kΩ				
RN2707JE	RN2707			RN2507	RN2307	RN2307	R1 = 10 kΩ, R2 = 47 kΩ				
RN2708JE	RN2708			RN2508	RN2308	RN2308	R1 = 22 kΩ, R2 = 47 kΩ				
RN2709JE	RN2709			RN2509	RN2309	RN2309	R1 = 47 kΩ, R2 = 22 kΩ				
RN2710JE	RN2710			RN2510	RN2310	RN2310	R1 = 4.7 kΩ, R2 = ∞				
RN2711JE	RN2711			RN2511	RN2311	RN2311	R1 = 10 kΩ, R2 = ∞				
-	RN2714			-	RN2314	RN2314	R1 = 1 kΩ, R2 = 10 kΩ				
Collector and base connection NPN + PNP				RN47A1JE	RN47A1	-	RN1310	RN2310	50 / -50	100 / -100	
		RN47A2JE	RN47A2	-	RN1303	RN2303	Q1: NPN(R1 = 22 kΩ, R2 = 22 kΩ) Q2: PNP(R1 = 22 kΩ, R2 = 22 kΩ)				
		RN47A3JE	RN47A3	-	RN1302	RN2302	Q1: NPN(R1 = 10 kΩ, R2 = 10 kΩ) Q2: PNP(R1 = 10 kΩ, R2 = 10 kΩ)				
		RN47A4JE	RN47A4	-	RN1304	RN2307	Q1: NPN(R1 = 47 kΩ, R2 = 47 kΩ) Q2: PNP(R1 = 10 kΩ, R2 = 47 kΩ)				
		RN47A5JE	RN47A5	-	RN1304	RN2316	Q1: NPN(R1 = 47 kΩ, R2 = 47 kΩ) Q2: PNP(R1 = 4.7 kΩ, R2 = 10 kΩ)				

: New products

: Under development

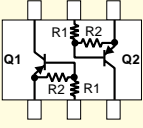



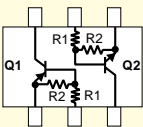



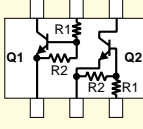



6-pin packages: ES6, US6 and SM6


Internal Connections		Product No.			Component Devices		Ratings		Features
		ES6 package (1.6 x 1.6 mm)	US6 package (2.0 x 2.1 mm)	SM6 package (2.9 x 2.8 mm)			V _{CEO} (V)	I _c (mA)	
					Q1	Q2			
Point-symmetrical array type PNP 2-in-1		RN1901FE	RN1901	RN1601	RN1301	RN1301	50	100	R1 = 4.7 kΩ, R2 = 4.7 kΩ
		RN1902FE	RN1902	RN1602	RN1302	RN1302			R1 = 10 kΩ, R2 = 10 kΩ
		RN1903FE	RN1903	RN1603	RN1303	RN1303			R1 = 22 kΩ, R2 = 22 kΩ
		RN1904FE	RN1904	RN1604	RN1304	RN1304			R1 = 47 kΩ, R2 = 47 kΩ
		RN1905FE	RN1905	RN1605	RN1305	RN1305			R1 = 2.2 kΩ, R2 = 47 kΩ
		RN1906FE	RN1906	RN1606	RN1306	RN1306			R1 = 4.7 kΩ, R2 = 47 kΩ
		RN1907FE	RN1907	RN1607	RN1307	RN1307			R1 = 10 kΩ, R2 = 47 kΩ
		RN1908FE	RN1908	RN1608	RN1308	RN1308			R1 = 22 kΩ, R2 = 47 kΩ
		RN1909FE	RN1909	RN1609	RN1309	RN1309			R1 = 47 kΩ, R2 = 22 kΩ
		RN1910FE	RN1910	RN1610	RN1310	RN1310			R1 = 4.7 kΩ, R2 = ∞
		RN1911FE	RN1911	RN1611	RN1311	RN1311			R1 = 10 kΩ, R2 = ∞

: New products

Product Line-up

6-pin packages: ES6, US6 and SM6 (continued)

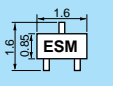
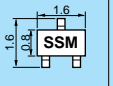
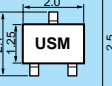

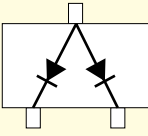
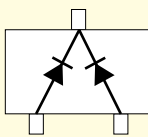
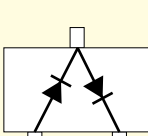
Internal Connections	Product No.			Component Devices		Ratings		Features	
	ES6 package (1.6 x 1.6 mm)	US6 package (2.0 x 2.1 mm)	SM6 package (2.9 x 2.8 mm)			V _{CEO} (V)	I _c (mA)		
	Q1	Q2							
Point-symmetrical array type NPN 2-in-1 				RN2901FE	RN2901	RN2601	RN2301	RN2301	-50 -100 R1 = 4.7 kΩ, R2 = 4.7 kΩ R1 = 10 kΩ, R2 = 10 kΩ R1 = 22 kΩ, R2 = 22 kΩ R1 = 47 kΩ, R2 = 47 kΩ R1 = 2.2 kΩ, R2 = 47 kΩ R1 = 4.7 kΩ, R2 = 47 kΩ R1 = 10 kΩ, R2 = 47 kΩ R1 = 22 kΩ, R2 = 47 kΩ R1 = 47 kΩ, R2 = 22 kΩ R1 = 4.7 kΩ, R2 = ∞ R1 = 10 kΩ, R2 = ∞
				RN2902FE	RN2902	RN2602	RN2302	RN2302	
				RN2903FE	RN2903	RN2603	RN2303	RN2303	
				RN2904FE	RN2904	RN2604	RN2304	RN2304	
				RN2905FE	RN2905	RN2605	RN2305	RN2305	
				RN2906FE	RN2906	RN2606	RN2306	RN2306	
				RN2907FE	RN2907	RN2607	RN2307	RN2307	
				RN2908FE	RN2908	RN2608	RN2308	RN2308	
				RN2909FE	RN2909	RN2609	RN2309	RN2309	
				RN2910FE	RN2910	RN2610	RN2310	RN2310	
				RN2911FE	RN2911	RN2611	RN2311	RN2311	
				RN4901FE	RN4901	RN4601	RN2301	RN1301	
				RN4902FE	RN4902	RN4602	RN2302	RN1302	
RN4903FE	RN4903	RN4603	RN2303	RN1303					
RN4904FE	RN4904	RN4604	RN2304	RN1304					
RN4905FE	RN4905	RN4605	RN2305	RN1305					
RN4906FE	RN4906	RN4606	RN2306	RN1306					
RN4907FE	RN4907	RN4607	RN2307	RN1307					
RN4908FE	RN4908	RN4608	RN2308	RN1308					
RN4909FE	RN4909	RN4609	RN2309	RN1309					
RN4910FE	RN4910	RN4610	RN2310	RN1310					
RN4911FE	RN4911	RN4611	RN2311	RN1311					
-	-	RN4612	RN2312	RN1312					
RN49A1	-	-	RN2305	RN1308					
RN49A2	-	-	RN2305	RN1304					
-	-	RN46A1	RN2303	RN1302					
Point-symmetrical array type NPN 2-in-1 				RN4981FE	RN4981	-	RN1301	RN2301	-50 / 50 -100 / 100 R1 = 4.7 kΩ, R2 = 4.7 kΩ R1 = 10 kΩ, R2 = 10 kΩ R1 = 22 kΩ, R2 = 22 kΩ R1 = 47 kΩ, R2 = 47 kΩ R1 = 2.2 kΩ, R2 = 47 kΩ R1 = 4.7 kΩ, R2 = 47 kΩ R1 = 10 kΩ, R2 = 47 kΩ R1 = 22 kΩ, R2 = 47 kΩ R1 = 47 kΩ, R2 = 22 kΩ R1 = 4.7 kΩ, R2 = ∞ R1 = 10 kΩ, R2 = ∞ R1 = 22 kΩ, R2 = ∞ Q1: R1 = 2.2 kΩ, R2 = 47 kΩ Q2: R1 = 22 kΩ, R2 = 47 kΩ Q1: R1 = 2.2 kΩ, R2 = 47 kΩ Q2: R1 = 47 kΩ, R2 = 47 kΩ Q1: R1 = 22 kΩ, R2 = 22 kΩ Q2: R1 = 10 kΩ, R2 = 10 kΩ
				RN4982FE	RN4982	-	RN1302	RN2302	
				RN4983FE	RN4983	-	RN1303	RN2303	
				RN4984FE	RN4984	-	RN1304	RN2304	
				RN4985FE	RN4985	-	RN1305	RN2305	
				RN4986FE	RN4986	-	RN1306	RN2306	
				RN4987FE	RN4987	-	RN1307	RN2307	
				RN4988FE	RN4988	-	RN1308	RN2308	
				RN4989FE	RN4989	-	RN1309	RN2309	
				RN4990FE	RN4990	-	RN1310	RN2310	
				RN4991FE	RN4991	-	RN1311	RN2311	
				RN1961FE	RN1961	-	RN1301	RN1301	
				RN1962FE	RN1962	-	RN1302	RN1302	
RN1963FE	RN1963	-	RN1303	RN1303					
RN1964FE	RN1964	-	RN1304	RN1304					
RN1965FE	RN1965	-	RN1305	RN1305					
RN1966FE	RN1966	-	RN1306	RN1306					
RN1967FE	RN1967	-	RN1307	RN1307					
RN1968FE	RN1968	-	RN1308	RN1308					
RN1969FE	RN1969	-	RN1309	RN1309					
RN1970FE	RN1970	-	RN1310	RN1310					
RN1971FE	RN1971	-	RN1311	RN1311					
-	RN1973	-	RN1313	RN1313					
Mirror-image array type PNP 2-in-1 				RN2961FE	RN2961	-	RN2301	RN2301	-50 -100 R1 = 4.7 kΩ, R2 = 4.7 kΩ R1 = 10 kΩ, R2 = 10 kΩ R1 = 22 kΩ, R2 = 22 kΩ R1 = 47 kΩ, R2 = 47 kΩ R1 = 2.2 kΩ, R2 = 47 kΩ R1 = 4.7 kΩ, R2 = 47 kΩ R1 = 10 kΩ, R2 = 47 kΩ R1 = 22 kΩ, R2 = 47 kΩ R1 = 47 kΩ, R2 = 22 kΩ R1 = 4.7 kΩ, R2 = ∞ R1 = 10 kΩ, R2 = ∞ R1 = 22 kΩ, R2 = ∞ R1 = 4.7 kΩ, R2 = ∞ R1 = 10 kΩ, R2 = ∞ R1 = 2.2 kΩ, R2 = 10 kΩ
				RN2962FE	RN2962	-	RN2302	RN2302	
				RN2963FE	RN2963	-	RN2303	RN2303	
				RN2964FE	RN2964	-	RN2304	RN2304	
				RN2965FE	RN2965	-	RN2305	RN2305	
				RN2966FE	RN2966	-	RN2306	RN2306	
				RN2967FE	RN2967	-	RN2307	RN2307	
				RN2968FE	RN2968	-	RN2308	RN2308	
				RN2969FE	RN2969	-	RN2309	RN2309	
				RN2970FE	RN2970	-	RN2310	RN2310	
				RN2971FE	RN2971	-	RN2311	RN2311	
				-	RN2975	-	RN2315	RN2315	

 : New products

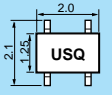

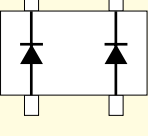
Product Line-up

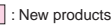
Multiple SBDs and switching diodes (schottky-barrier type and PN-junction type)

3-pin packages: (ESM, SSM, USM and S-MINI)

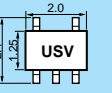
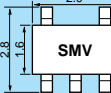
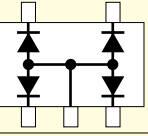
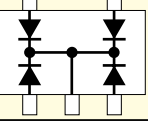
Internal Connections		Product No.				Component Devices	Ratings			Features
		ESM package (1.6 x 1.6 mm) 	SSM package (1.6 x 1.6 mm) 	USM package (2.0 x 2.1 mm) 	S-MINI package (2.9 x 2.5 mm) 		V _{RM} (V)	I _{FM} (mA)	I _O (mA)	
Anode common 2-in-1 		1SS360F	1SS360	1SS300	1SS181	1SS352	85	300	100	General-purpose, high-speed switching type
		—	—	—	1SS336	—	85	600	200	General-purpose, high-current type
Cathode common 2-in-1 		1SS361F	1SS361	1SS301	1SS184	1SS352	85	300	100	General-purpose, high-speed switching type
		—	—	—	1SS337	—	85	600	200	General-purpose, high-current type
		1SS385F	1SS385	1SS378	1SS377	1SS367	15	200	100	Low-V _F SBDs V _F = 0.18 V @ 1 mA, V _F = 0.35 V @ 100 mA
		—	—	1SS393	1SS392	1SS357	45	300	100	Standard SBDs V _F = 0.28 V @ 1 mA, V _F = 0.54 V @ 100 mA
Series connection 2-in-1 		—	1SS362 *	1SS302	1SS226	1SS352	85	300 *240	100 *80	General-purpose, high-speed switching type
		—	—	—	1SS379	1SS307	85	300	100	Low leak current, I _r = 0.01 μA
		—	—	—	1SS398	1SS397	420	300	100	High withstand capability
		—	—	1SS372	1SS374	1SS367	15	200	100	Low-V _F SBDs V _F = 0.18 V @ 1 mA, V _F = 0.35 V @ 100 mA
		—	—	—	1SS396	1SS357	45	300	100	Standard SBDs V _F = 0.28 V @ 1 mA, V _F = 0.54 V @ 100 mA

4-pin packages: (USQ and SMQ)

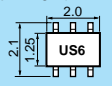
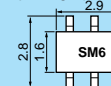
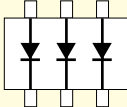
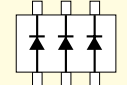
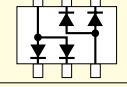
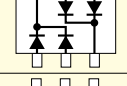
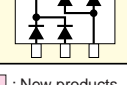
Internal Connections		Product No.		Component Devices	Ratings			Features	
		USQ package (2.0 x 2.1 mm) 	SMQ package (2.9 x 2.9 mm) 		V _{RM} (V)	I _{FM} (mA)	I _O (mA)		
No common pins 2-in-1 		1SS382	1SS272	1SS352	85	300	100	General-purpose, high-speed switching type	
		—	1SS306	1SS370	250	300	100	High withstand capability	
		—	1SS399	1SS399	1SS397	420	300	100	High withstand capability
		1SS384	1SS391	1SS367	15	200	100	Low-V _F SBDs V _F = 0.18 V @ 1 mA, V _F = 0.35 V @ 100 mA	
		1SS383	1SS319	1SS357	45	300	100	Standard SBDs V _F = 0.28 V @ 1 mA, V _F = 0.54 V @ 100 mA	
		1SS402	—	—	—	25	100	50	Low-voltage, high-speed, low-leak-current SBDs I _r = 0.5 μA max, V _F = 0.33 V @ 1 mA, C _T = 3.9 pF

 : New products

5-pin packages: (SMV)

Internal Connections		Product No.		Component Devices	Ratings			Features
		USV package (2.0 x 2.1 mm) 	SMV package (2.9 x 2.8 mm) 		V _{RM} (V)	I _{FM} (mA)	I _O (mA)	
Anode common 4-in-1 		—	1SS308	1SS352	85	300	100	General-purpose, high-speed switching type
Cathode common 4-in-1 		—	1SS309	1SS352	85	300	100	General-purpose, high-speed switching type

6-pin packages: (US6 and SM6)





Internal Connections		Product No.		Component Devices	Ratings			Features
		US6 package (2.0 x 2.1 mm) 	SM6 package (2.9 x 2.8 mm) 		V_{RM} (V)	I_{FM} (mA)	I_o (mA)	
No common pins 3-in-1 		HN2D01FU	HN2D01F	1SS352	85	240	80	General-purpose, high-speed switching type
		–	HN2D03F	1SS397	420	300	100	High withstand capability
		HN2S01FU	HN2S01F	1SS367	15	200	100	Low- V_f SBDs $V_f = 0.18$ V @ 1 mA, $V_f = 0.35$ V @ 100 mA
		HN2S02FU	–	1SS357	45	300	100	Standard SBDs $V_f = 0.28$ V @ 1 mA, $V_f = 0.54$ V @ 100 mA
		HN2S03FU	–	1SS402	25	100	50	Low-voltage, high-speed, low-leak-current SBDs $I_R = 0.5$ μ A max., $V_f = 0.33$ V @ 1 mA, $C_T = 3.9$ pF
No common pins 3-in-1 (reverse) 		HN2D02FU	–	1SS352	85	240	80	General-purpose, high-speed switching type
Anode common x 2 4-in-1 		HN1D01FU	HN1D01F	1SS352	85	300	100	General-purpose, high-speed switching type
Cathode common x 2 4-in-1 		HN1D02FU	HN1D02F	1SS352	85	300	100	General-purpose, high-speed switching type
Cathode common + Anode common 4-in-1 		HN1D03FU	HN1D03F	1SS352	85	300	100	General-purpose, high-speed switching type

 : New products



 : Under development

Multiple diodes for protecting against ESD

Standard type





Type	2-in-1		4-in-1		V_Z (V)			I_R (μ A)		
	ESM 	USM 	USV 	SMV 	Min	Typ.	Max	@ I_Z (mA)	Max	@ V_R (V)
Product No.	DF3A2.2FE	DF3A2.2FU	DF5A2.2FU	DF5A2.2F	2.05	2.2	2.38	5	120	1
	DF3A3.3FE	DF3A3.3FU	DF5A3.3FU	DF5A3.3F	3.1	3.3	3.5	5	20	1
	DF3A3.6FE	DF3A3.6FU	DF5A3.6FU	DF5A3.6F	3.4	3.6	3.8	5	10	1
	DF3A5.6FE	DF3A5.6FU	DF5A5.6FU	DF5A5.6F	5.3	5.6	6.0	5	1	2.5
	DF3A6.2FE	DF3A6.2FU	DF5A6.2FU	DF5A6.2F	5.8	6.2	6.6	5	1	3
	DF3A6.8FE	DF3A6.8FU	DF5A6.8FU	DF5A6.8F	6.4	6.8	7.2	5	0.5	5
	DF3A8.2FE	DF3A8.2FU	DF5A8.2FU	DF5A8.2F	7.7	8.2	8.7	5	0.5	6.5

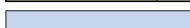
 : Under development

Type	4-in-1	7-in-1	V_Z (V)			I_R (μ A)		
	US6 	US8 	Min	Typ.	Max	@ I_Z (mA)	@ V_R (V)	
Product No.	DF6A6.8FU	DF8A6.8FK	6.4	6.8	7.2	5	0.5	5

 : Under development

High-speed-signal type

Type	2-in-1		4-in-1		V_Z (V)			C_T (pF)		
	ESM 	USM 	USV 	SMV 	Min	Typ.	Max	@ I_Z (mA)	Typ.	@ V_Z (V)
Product No.	DF3A6.2LFE	DF3A6.2LFU	DF5A6.2LFU	DF5A6.2LF	5.8	6.2	6.6	5	6.5	0
	DF3A6.8LFE	DF3A6.8LFU	DF5A6.8LFU	DF5A6.8LF	6.4	6.8	7.2	5	6	0
	DF3A8.2LFE	DF3A8.2LFU	DF5A8.2LFU	DF5A8.2LF	7.7	8.2	8.7	5	6	0

 : Under development

Product Line-up

Mixed small-signal devices

6-pin packages (US6 and SM6)

Internal Connections		Product No.		Component Devices	Ratings				Features	
		US6 package (2.0 x 2.1 mm)	SM6 package (2.9 x 2.8 mm)		Voltage (V)		Current (mA)			
Point-symmetrical array type PNP + Nch				Q1	2SA1954	V_{CE0}	-12	I_c	-400	PNP low-saturation-voltage and power supply switches 2.5 V drive voltage ($V_{th} = 1.5$ V max), $R_{on} = 20\Omega$ typ.
				Q2	2SK1829	V_{DS}	20	I_D	50	
Point-symmetrical array type PNP(BRT) + Nch				Q1	2SA1954	V_{CE0}	-12	I_c	-400	PNP low-saturation-voltage and power supply switches RGS = 1 M Ω built-in 2.5 V drive voltage ($V_{th} = 1.3$ V max), $R_{on} = 4\Omega$ typ.
				Q2	SSM3K04FU	V_{DS}	20	I_D	100	
Point-symmetrical array type PNP + NPN(BRT)				Q1	RN2310	V_{CE0}	-50	I_c	-100	Resistor built-in PNP transistors $R_1 = 10$ k Ω , $R_2 = 47$ k Ω 2.5 V drive voltage ($V_{th} = 1.5$ V max), $R_{on} = 20\Omega$ typ.
				Q2	2SK1829	V_{DS}	20	I_D	50	
Small-signal diodes + NPN				Q1	1SS352	V_R	80	I_o	100	General-purpose, high-speed switching type
				Q2	2SC4666	V_{CE0}	50	I_c	150	
Zener diodes for protecting against ESD + PNP				Q1	DF3A6.8FU	-	-	-	-	6.8-V, anode-common zener diodes for protecting against ESD
				Q2	2SA1587	V_{CE0}	-120	I_c	-100	
Small-signal diodes + PNP				Q1	2SA1587	V_{CE0}	-120	I_c	-100	High- V_{CE0} PNP transistors
				Q2	1SS352	V_R	80	I_o	100	

: New products

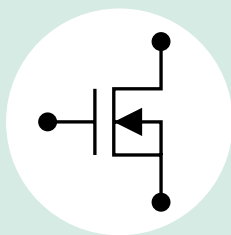
: Under development

Semi-custom small-signal multi-chip devices

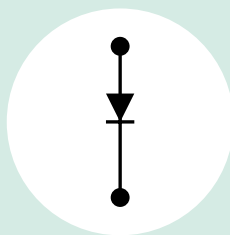
In response to customer demands, Toshiba are producing semi-custom units which incorporate multiple devices such as transistors, small-signal MOSFETs and L-MOS devices into a single package. For more details, please ask your nearest Toshiba distributor.

Example

Conventional Toshiba chip



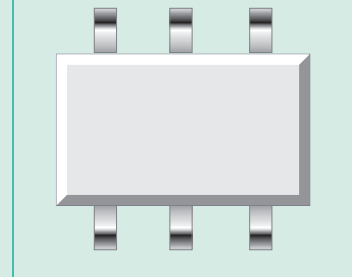
Conventional Toshiba chip



Incorporated into a single package



New product



Package Dimensions and Tape Packing Specifications

3-pin packages

Unit: mm

	Package	Reference Pad Dimensions	Standard Tape Packing Specification			
	Package dimensions		Tape type suffix	Tape dimensions	Reel dimensions	Packing quantity
ESM	<p>Weight: 2.3 mg</p>	<p>*Same package dimensions as SSM package</p>	TPL3			8000/reel
SSM	<p>Weight: 2.4 mg</p>		TE85L			3000/reel
USM	<p>Weight: 0.006 g</p>		TE85L			3000/reel
S-MINI	<p>Weight: 0.012 g</p>		TE85L			3000/reel

Package Dimensions and Tape Packing Specifications

4-pin packages

Unit: mm

	Package	Reference Pad Dimensions	Standard Tape Packing Specification			
	Package dimensions		Tape type suffix	Tape dimensions	Reel dimensions	Packing quantity
USQ	<p>Weight: 0.006 g</p>		TE85L			3000/reel
SMQ	<p>Weight: 0.013 g</p>		TE85L			3000/reel

5-pin packages

Unit: mm

	Package	Reference Pad Dimensions	Standard Tape Packing Specification			
	Package dimensions		Tape type suffix	Tape dimensions	Reel dimensions	Packing quantity
ESV	<p>Weight: 0.003 g</p>		TE85L			4000/reel
USV	<p>Weight: 6.2 mg</p>		TE85L			3000/reel
SMV	<p>Weight: 0.014 g</p>		TE85L			3000/reel

6-pin packages

Unit: mm

	Package	Reference Pad Dimensions	Standard Tape Packing Specification			
	Package dimensions		Tape type suffix	Tape dimensions	Reel dimensions	Packing quantity
ES6	<p>Weight: 0.003 g</p>		TE85L			4000/reel
US6	<p>Weight: 6.8 mg</p>		TE85L			3000/reel
SM6	<p>Weight: 0.015 g</p>		TE85L			3000/reel

8-pin packages

Unit: mm

	Package	Reference Pad Dimensions	Standard Tape Packing Specification			
	Package dimensions		Tape type suffix	Tape dimensions	Reel dimensions	Packing quantity
US8	<p>Weight: 0.01 g</p>		TE85L			3000/reel
SM8	<p>Weight: 0.021 g</p>		TE12L			3000/reel
FM8	<p>Weight: 0.05 g</p>		TE12L			1000/reel

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