



# Automotive Applications

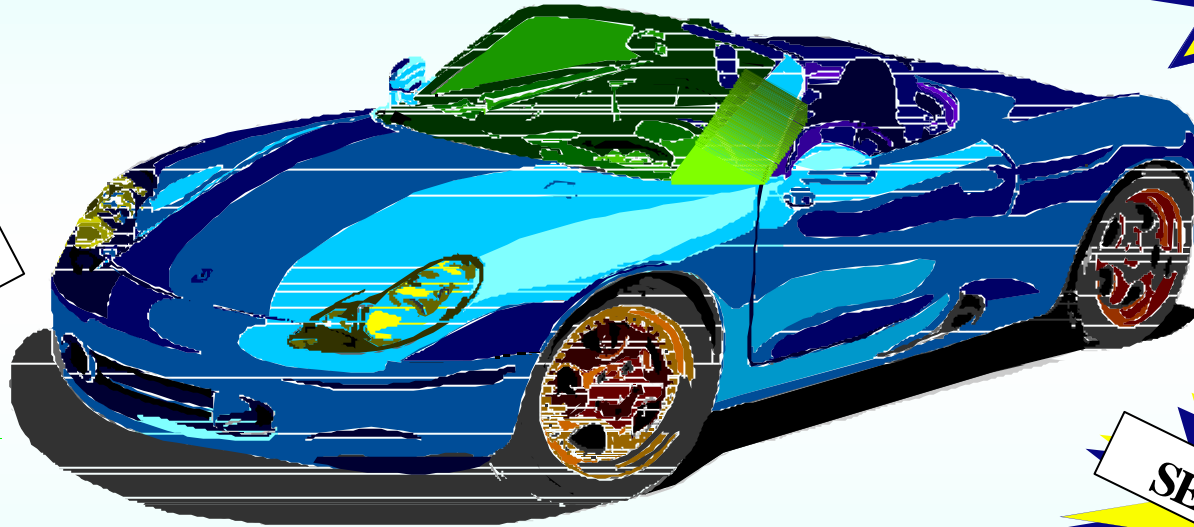
# ROHM

## Automotive Target Application

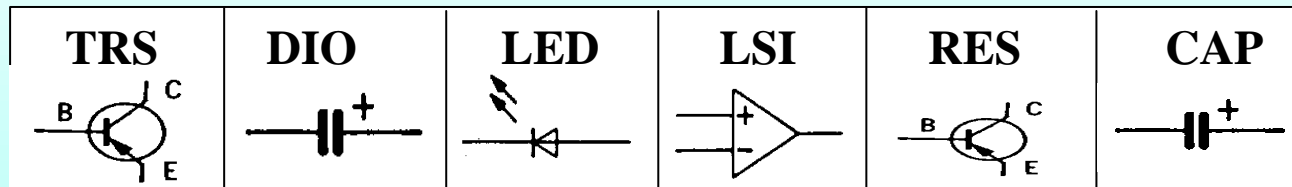
Comfort

CENTRAL CONTROL

COMMUNICATION



SECURITY





# Approved products at automotive applications

	RES	CAP	TRS	DIO	LED	LSI
Key Lock (Immobilizer)	MCR03J		UMX3NTR UMT2NTR UMG10TR IMZ3AT108	DAN222TL UDZ - Zener Di. PTZ - Zener Di.	SML310VTT86 SML010VTT86 SLA570VT3F	BR9010FV BR24C01AF
Car Alarm	MCR10J/F MCR18JF		DTA114EKAT146 DTC114EKT146 UMX3/UMT2NTR IMZ3AT108 DTA144EKT146 DTD123YKT146	1SR154-400 PTZ5,6A UMN10	SML010LTT86 SML-020MLTT86	BR9010FV BR24C01AF
Electr. Window	MCR25/50J MCR100J		FMC3/ IMD3 DTC114EK/DTA114EKA DTB/DTD113ZKT146 DTC124TKAT	1SR154-400	SML211DTT86 SLR37 series SLA370LT SLR342PC	BR9010FV BR24C01AF
Electr.Wiper	MCR10		FMC3 DTC114EK/DTA114EKA DTB/DTD113ZKT146 DTC124TKAT			
Dashboard/ Backlight	MCR03,MCR10 MNR14		DTA,DTC114EKA,UMX1, BCX53/56,2SB1184,2SD1760	IMN10, 1SR154, PTZ 1SR156-200		BR9010FV BR24C01AF
Climate Control	MCR10J/F MCR18J/F		2SC1740T93R 2SD1292T103Q DTA114EU(A)T106 DTC114EUAT106 DTDS14GPAT100	1SR139-400TTD31 1SS139-TT72 DAN202UAT106		BR9010FV BR24C01AF BX6531
Engine Control	MCR10J/F MCR18J/F MCR50/100		DTA/DTC114EK IMX1/IMD10A/IMD6A FMA4A/FMW5/FMG5A 2SA1870	1SR154-400		
Navigation Syst.	MCR01/03 MNR14	MCH18	DTA/DTC-Digital Tr. BC848BT116	DA227	SML210YTT86	BA6395AFP BA5970,BU9730
Air Bag	MCR10FZHMJ/FX MCR18FZHMJ MCR25LZHMFX	MCH21 MCH31	DTB, DTD-Digital Tr.	1SR154-400TE25 DAN/DAP202KT146 RLRC9386TE21D RLSC5066TE11D RLZC9398/9401/9405/ 9415TE11D		
Car Stereo	MCR03,10,100	MCH21,31	DTA, DTC,in SOT323,SOT416	IMN10, DAP, DAN, UDZ	SML-211DT, SML-010	BA4558F-DXE2,BA10393
CDC	MCR03, 10					BA6848, BU9314 BA5900 BA6795FP-E2
Electr.Mirror						BA6247

**ROHM**

**ROHM**

**TRANSISTORS**





# ISO9000, QS9000, ISO14001 SERIES APPROVAL

**COMPANY MISSION: QUALITY is our top PRIORITY at all times**

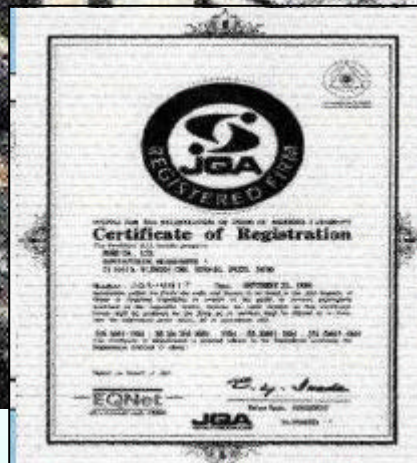


Apollo Electronics

QS9000 series

ISO9000 series

ISO14001 series



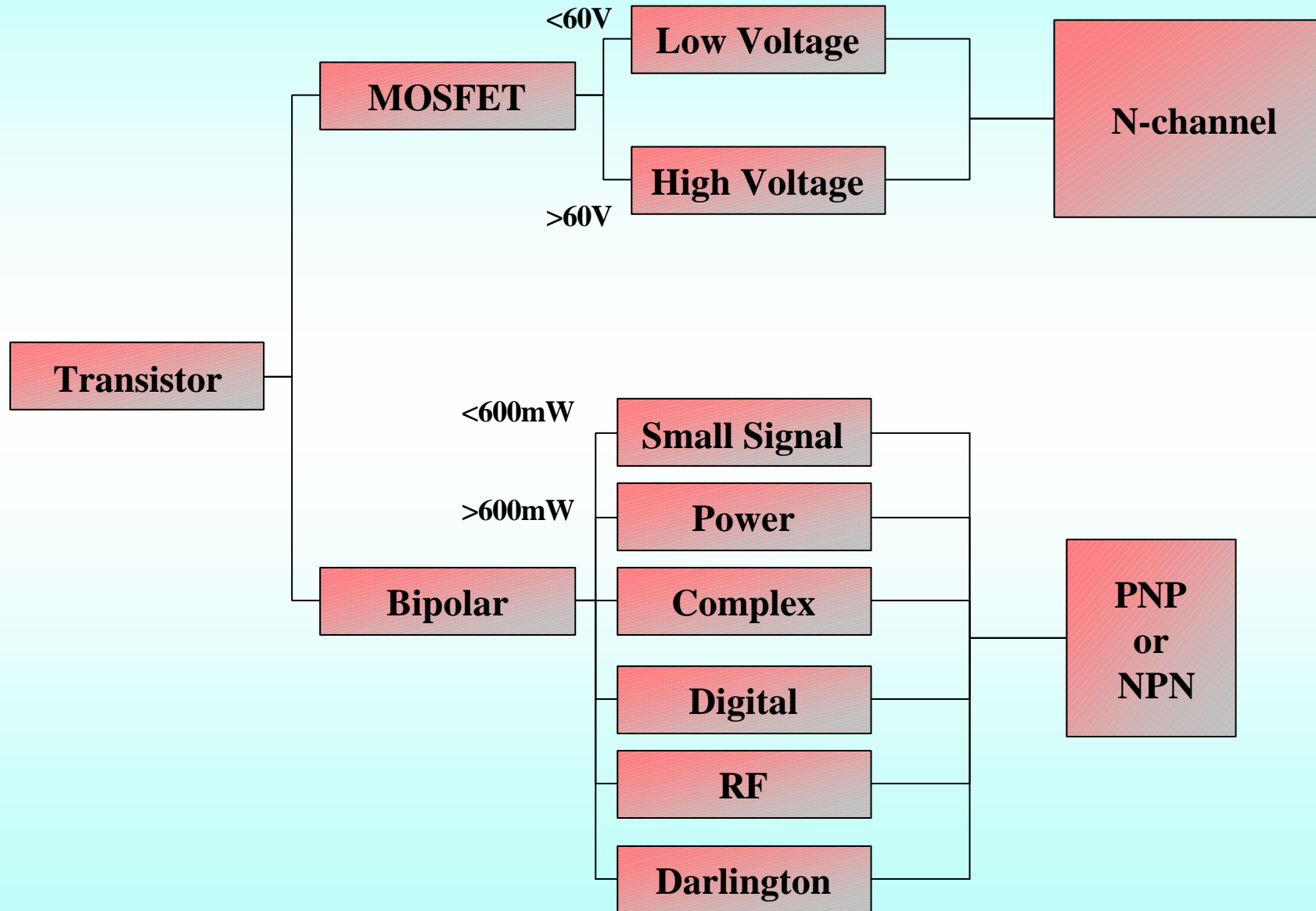
QS9000 Oct.1997  
QS9000 Feb.1998

ROHM Transistor ISO9001 Sep.1994  
Apollo Electronics ISO9002 Nov.1994  
ROHM Apollo Electr. ISO9002 Nov.1995  
(Thailand)  
ROHM Korea ISO9002 Mar.1995  
ROHM Headquarters ISO14001 May1998

ISO14001 Dec.1998



# ROHM Transistor Categories



## Small Signal Transistors

- Packages



EMT3  
SC-75A



UMT3  
SOT-323



SMT3  
SC-59



SST3  
SOT-23



SPT  
SC-72



TO-92  
TO-92

- Application Types

- G.P. Amp.
- Low  $V_{CE(sat)}$
- High  $h_{FE}$
- Switching
- Darlingtion
- Pre Amp
- RF Amp
- RF Switch
- H.V. Switch
- Driver
- Mixer Osc.
- TV Tuner
- Telephone
- FM IF / AM RF



## Mosfet Products

- Packages



EMT3  
SC-75A



UMT3  
SC-70/SOT323



UMT5  
SC-88A



UMT6  
SC-88



SST3  
SOT23



SMT3  
SC-59



MPT3  
SOT89/SC-62



CPT  
SC-63

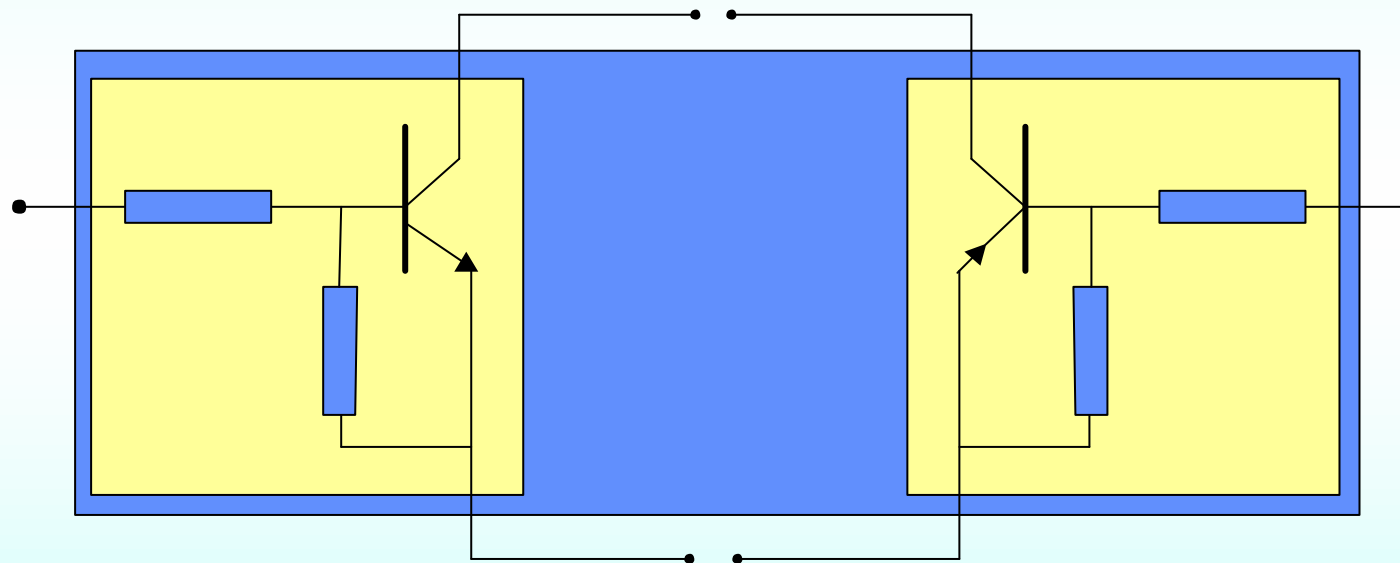


SOP8  
-

- MOSFET Technology

- actually N-ch.
- Double diffusion planar process.
- Trench process (as low as 9mΩ).
- Single & Dual Die configurations.

## Integration: success with Digital Transistor



NPN:  
DTC...  
DTD...  
Series

Complex:  
UM.. (SOT353/363)  
IM..(SC-74)  
FM..(SC-74A)  
Series

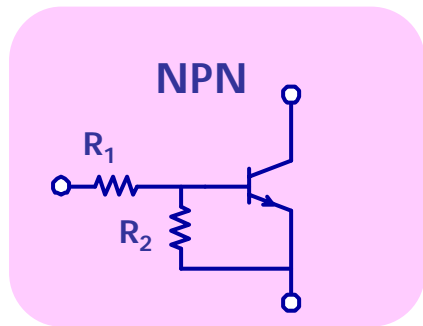
PNP:  
DTA...  
DTB...  
Series



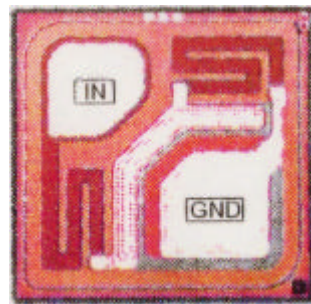
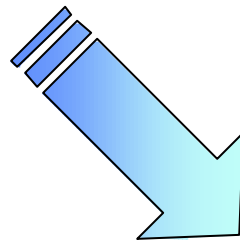
# Digital Transistor Technology & Shares

One Bipolar transistor and one or two resistors on one silicon substrate.

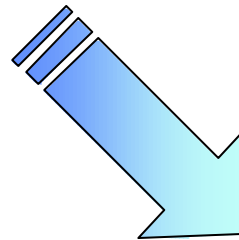
Silicon oxide Resistors in thin film process



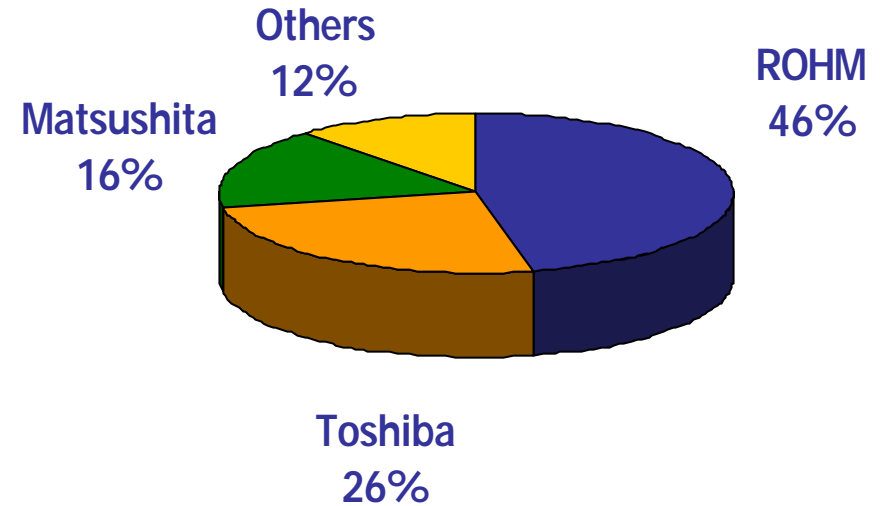
Schematic



Digital Transistor Die

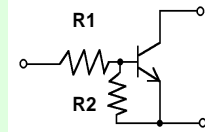


Digital Transistor in SOT-323 Pkg.

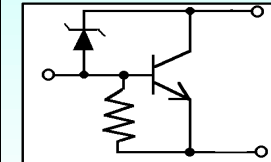


## Digital Transistor Line Up

Digital transistor Recommendable P/N Table



R1(kOhm)/R2(kOhm)	nothing	2,2	4,7	10	22	47
nothing				DTDG14GP		
1				DTB113Z• DTD113Z•		
2,2	DTB123TK DTD123TK DTC323T•			DTB123Y• DTD123Y•		DTA123J• A DTC123J• A
4,7	DTA143T• A DTC143T• A DTB143TK DTD143TK DTC343TK		DTB143E• DTD143E•			DTA143Z• A DTC143Z• A
10	DTA114T• A DTC114T• A DTC314T•			DTA114E• A DTC114E• A DTB114E• DTD114E•		DTA114Y• A DTC114Y• A
22					DTA124E• A DTC124E• A	
47						DTA144E• A DTC144E• A
100						



DTDG14GP

**Ic -classes**

- °100mA(50V/100mA)
- °500mA(50V/500mA)
- °Muting(15V/600mA)
- °1A(60+/-10V/1A)



Note <PACKAGE TYPE>

Character, to be inserted into?

- : SC59 (SMT3) : K
- SOT23 (SST3) : C
- SOT323 (UMT3) : U
- SOT416 (EMT3) : E
- SPT (loaded) : S









# Complex Bipolar Transistors

Package	Application	$V_{CEO}$ (V)	$I_C$ (mA)	$h_{FE}$
UMT5/6 SOT 353 / 363 	Amplifier	-50~50	-150~150	120~560
	Inverter Driver		-50~50	
	Pre Amp	-50~80	-150~150	
	TV Tuner, Mix. Osc.	11~18	50~200	27~270
SMT5/6 SOT23 size 	Amplifier	-120~120	-500~500	120~560
	Inverter Driver	-50~50	-150~150	
	Pre Amp	-120~120	-500~500	
	TV Tuner, Mix. Osc.	11~18	50	27~270



# Automotive Suitable Transistors

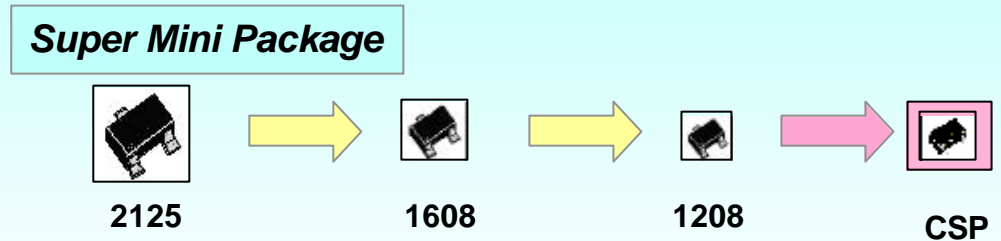
<u>Package</u>		<u>P/N</u>	<u>Feature</u>	<u>Comment</u>	
	SOT323	2SA1576A	PNP (50V, 150mA)	BC857W replacement	
	(UMT3)	2SC4081	NPN (50V, 150mA)	BC847W replacement	
	[SC70]	RHU002N06	Mosfet (60V, 200mA)		
	SOT363/	UMX1N	2x NPN (50V, 150mA)	double BC847	
	SOT353	UMT1N	2x PNP (50V, 150mA)	double BC857	
	(UMT5/6)	UM6K1N	Mosfet (30V, 100mA)	double RK7002	
		UMT5/6 series	PNP/NPN (100mA)	double Digitrans	
	SOT323	DTA/DTC	PNP/NPN (100mA)	Digitrans	
	SC-59	DTB/DTD	PNP/NPN (500mA)	Digitrans	
	SOT89 (MPT3)	DTDG	(1A)Digital Tr.	for Motorcontrol (Mirror, Aircondition)	
	SOP8	RK4410	30V, 10A	Rdson 0,012	Power Mosfet for DC/DC Converter
		RK9410	30V, 7A	Rdson 0,023	Power Mosfet for DC/DC Converter
	SOT428 (CPT3)	RK3055E	60V, 8A,	Rdson 0,15	Mosfet In D-Pack-size

**Transistor  
latest developments &  
Package Trends**

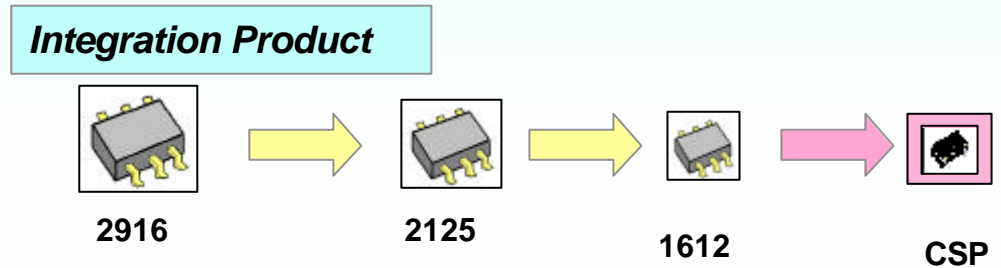
# Transistor R&D Roadmap

## 1. Space Saving

‡ Smaller & Thinner



‡ Higher Density Mounting



## 2. Energy Saving

‡ Low energy consumption

‡ High efficiency

Low  $R_{ds(on)}$  MOSFET  
 Low  $V_{ce(sat)}$  Bipolar Transistors  
 fast switching speed

## 3. High Reliability

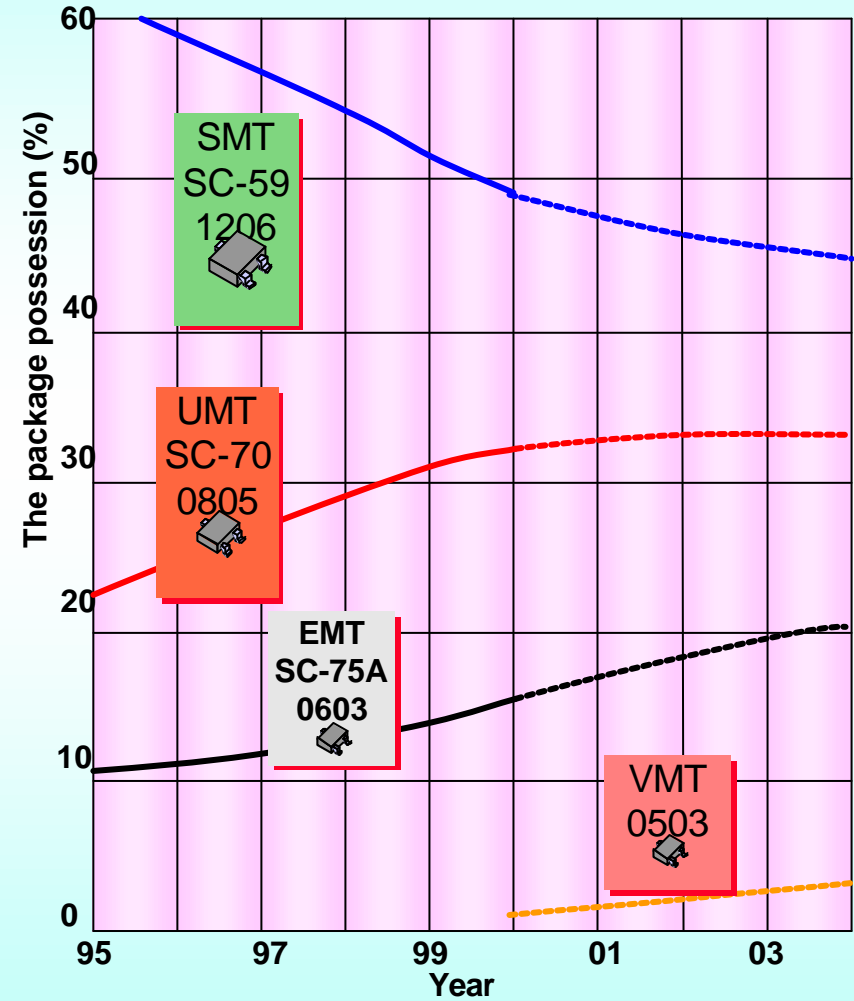
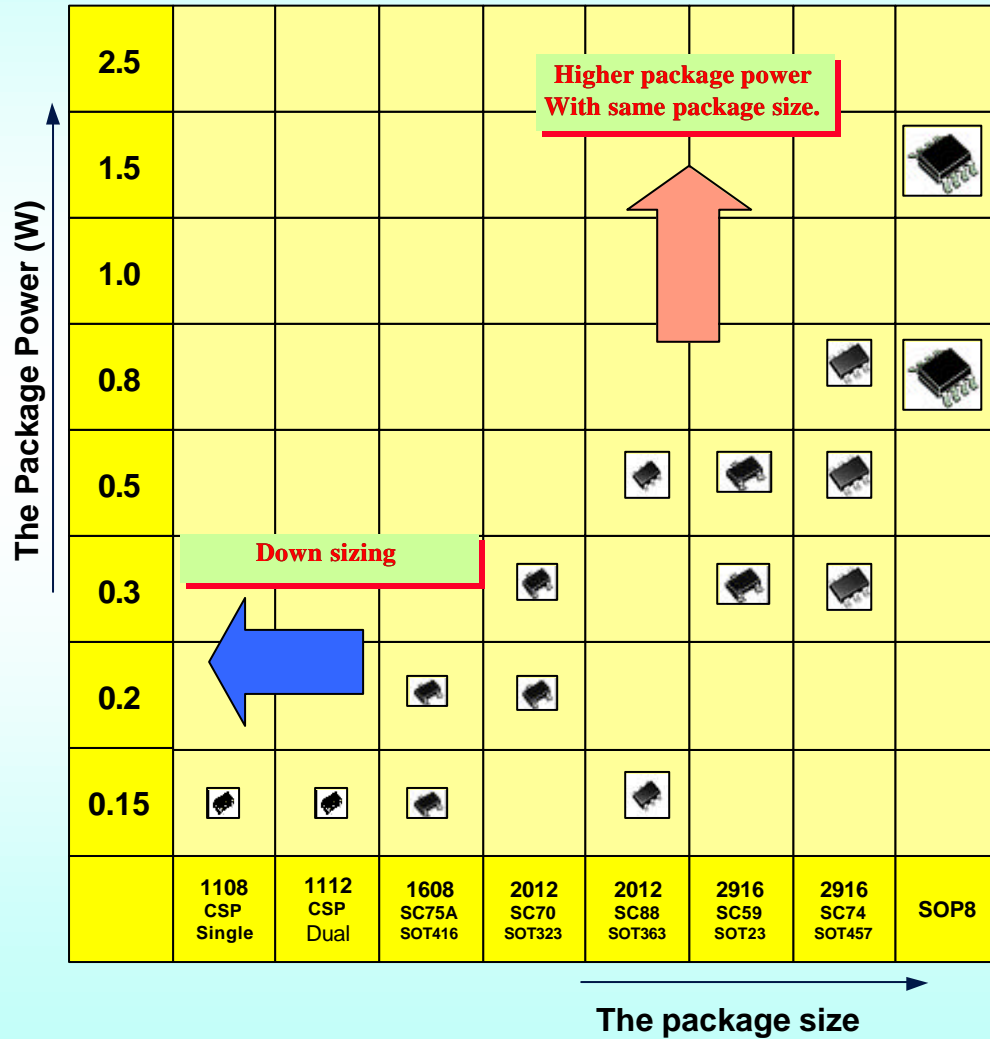
‡ Strong voltage discharge (wide SOA)

‡ High break down for ESD at MOSFET



# Strategy & Package Trend Transistors

## Transistor





# Package comparison

Example DTA114E / DTC114E

		SC-59 (ROHM SMT3)	SC-70 (ROHM UMT3)	SC75A (ROHM EMT3)	COMMENT
Space consumption		2,8mm x 2,9mm	2mm x 2,1mm	1,6mm x 1,6mm	on PCB
operation temperature	ta	-55° ~ +150°C	-55° ~ +150°C	-55° ~ +150°C	considering derating
junction temperature	tj (max)	150°C	150°C	150°C	
power dissipation	Pmax	200mW	200mW	150mW	
derating	P/Pmax at t(ambient)	100% by 25° C 50% at 87,5° C 0% at 150° C	100% by 25° C 50% at 87,5° C 0% at 150° C	100% by 25° C 50% at 87,5° C 0% at 150° C	
human body model	ESD	>800V	>800V	>800V	
Machine model	ESD	>500V	>500V	>500V	



# Wide SOA & Highspeed Transistors

## Description

By using new technology, We now have  
**Strong voltage discharge**, **High speed switching**  
 Transistors in **small surface mount packages** !

## Features

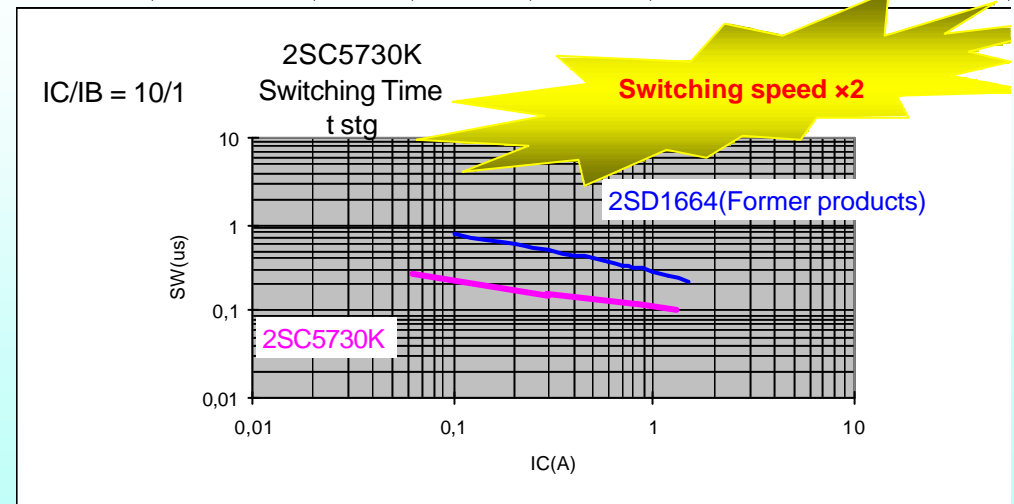
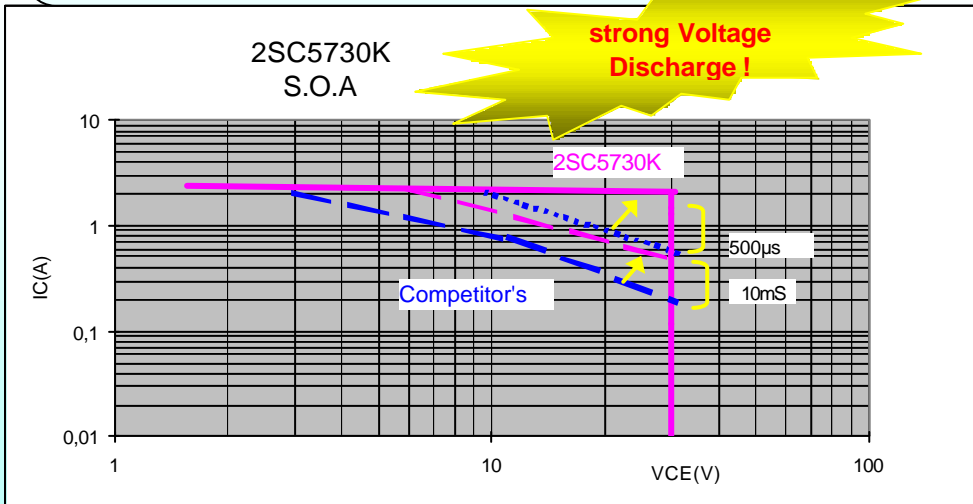
Better than former products  
 \*Strong voltage discharge Wide SOA **5Times**  
 \*High speed switching **2 Times**  
 \*High avalanche energy **4 Times**

## Applications

\*DC/DC Converter  
 \*Motor Drive  
 \*Strobo

## Line-up

Part No.	Package	Type	Voltage (V)	Current (A)	Note
2SA2047	MT3(SOT323)	PNP	30	0,5	2SA1577(32V/0.5A/UMT3)
2SC5729		NPN			2SC4097(32V/0.5A/UMT3)
2SA2048K	SMT3 (SC59)	PNP	30	1	2SB1132(32V/1A/MPT3)
2SC5730K		NPN			2SD1664(32V/1A/MPT3)
2SA2054K		PNP	90	0,5	SSTA56(80V/0.5A/SST3)
2SC5734K		NPN			SSTA06(80V/0.5A/SST3)
2SA2049	MPT3 (SOT-89)	PNP	30	2	2SB1188(32V/2A/MPT3)
2SC5731		NPN			2SD1766(32V/2A/MPT3)
2SA2071		PNP	60	3	2SA1797(50V/2A/MPT3)
2SC5824		NPN			2SB1184(50V/3A/CPT3)
2SA2051		PNP	90	1	2SC4672(50V/2A/MPT3)
2SC5733		NPN			2SD1760(50V/3A/CPT3)
2SA2050	CPT3(D-pack)	PNP	30	5	2SB1260(80V/1A/MPT3)
2SC5732		NPN			2SD1898(80V/1A/MPT3)
					2SB1412(20V/5A/CPT3)
					2SD2118(20V/5A/CPT3)





# Low VCE(sat) Transistors

**NEW PRODUCTS**

- small surface mountable packages
- Low Energy Consumption.
- High Collector Current.
- PNP = possible replacement for P-Channel MOSFET

## Applications

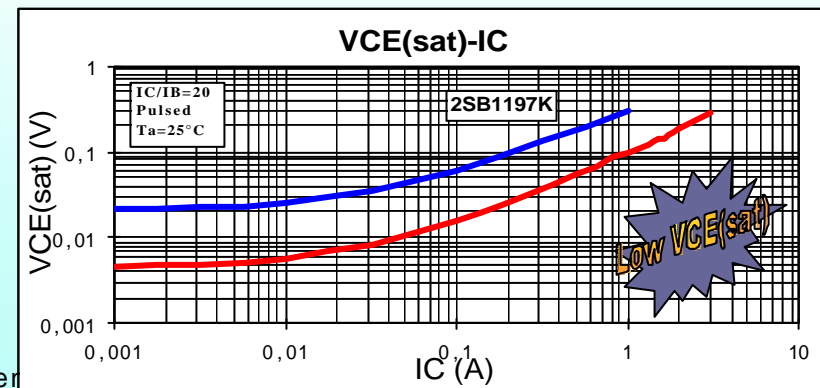
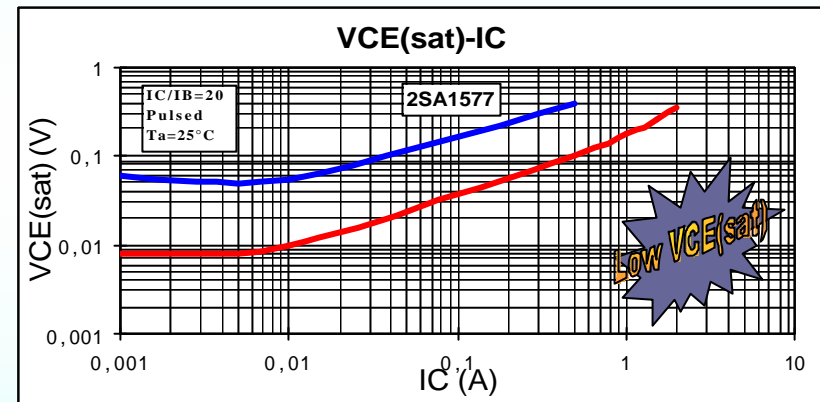
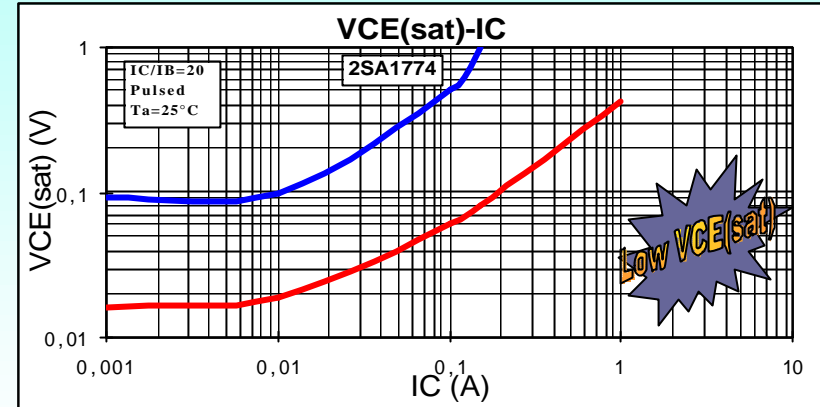
- Switching purpose
- DC/DC converter
- For Portable Equipments
- e.g. Cellular phone, MD, CD-ROM, DVD-ROM, Note PC etc.



## Electrical Characteristics

P/N	2SA2030 2SC5663	2SA2018 2SC5585	2SB1689 2SD2652	2SB1690K 2SD2653K	2SB1694* 2SD2656*	2SB1695K* 2SD2657K*
Package	VMT3	EMT3 SC-75A SOT-416	UMT3 SC-70 SOT-323	SMT3 SC-59 SOT-346	UMT3 SC-70 SOT-323	SMT3 SC-59 SOT-346
VCE0	12V			30V		
Ic	500mA	1,5A	2A	1A	1,5A	
hFE	270~680					
Pc	150mW	200mW				

\* Under Development





# 30-50V Powermanagement Transistor

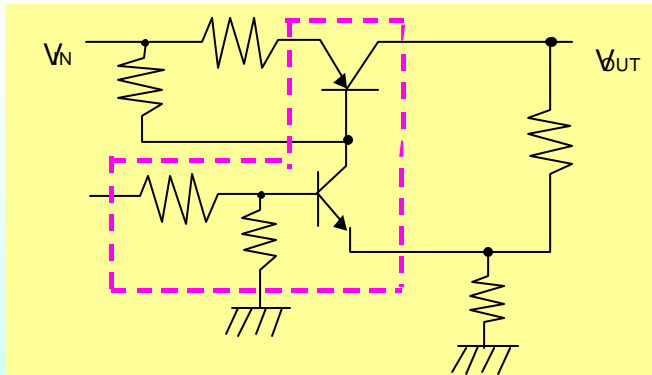
**NEW products**


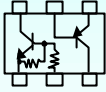
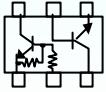
**Line-up**


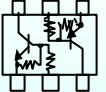
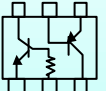
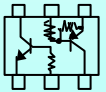
**Applications**

Suitable for :

**POWER MANAGEMENT applications with Supply line Transistors  $V_{ce} > 12V$**



SOT363 UMT6 	Line- Transistor Tr.1	Control Transistor (all NPN) Tr.2	Circuit
UMF17N	2SA1774 (PNP, -50V, -0.15A)	DTC123E (50V, 0.1A) 2,2K/2, 2KOhm	
UMF18N		DTC144E (50V, 0.1A) 47K / 47KOhm	
UMF23N		DTC114E (50V, 0.1A) 10K / 10KOhm	
UMF19N	2SC4617 (NPN, 50V, 0.15A)	DTC123E (50V, 0.1A) 2,2K / 2,2KOhm	
UMF20N		DTC144E (50V, 0.1A) 47K / 47KOhm	
UMF24N		DTC114E (50V, 0.1A) 10K / 10KOhm	

SOT23/6 SMT6 	Line- Transistor Tr. 1	Control Transistor (all NPN) Tr. 2	Circuit
IMD23	DTB113Z (PNP, -50V, -0.5A) 1K/10KOhm	DTC114E (50V, 0.1A) 10K/10KOhm	
IMD10A	2SA1036K (PNP, -32V, -0,5A)	DTC114T (50V, 0,1A) R1= 10KOhm	
IMD16A	DTB123E (PNP, -50V, -0,5A) 2,2K /2,2KOhm	DTC115T (50V, 0,1A) R1 =100KOhm	

**ROHM**

**ROHM**

**DIODES**



For Internal use only  
- No Handouts !

# Diode

## Supplier Revenue From Shipments of *Semiconductors Worldwide, 2000*

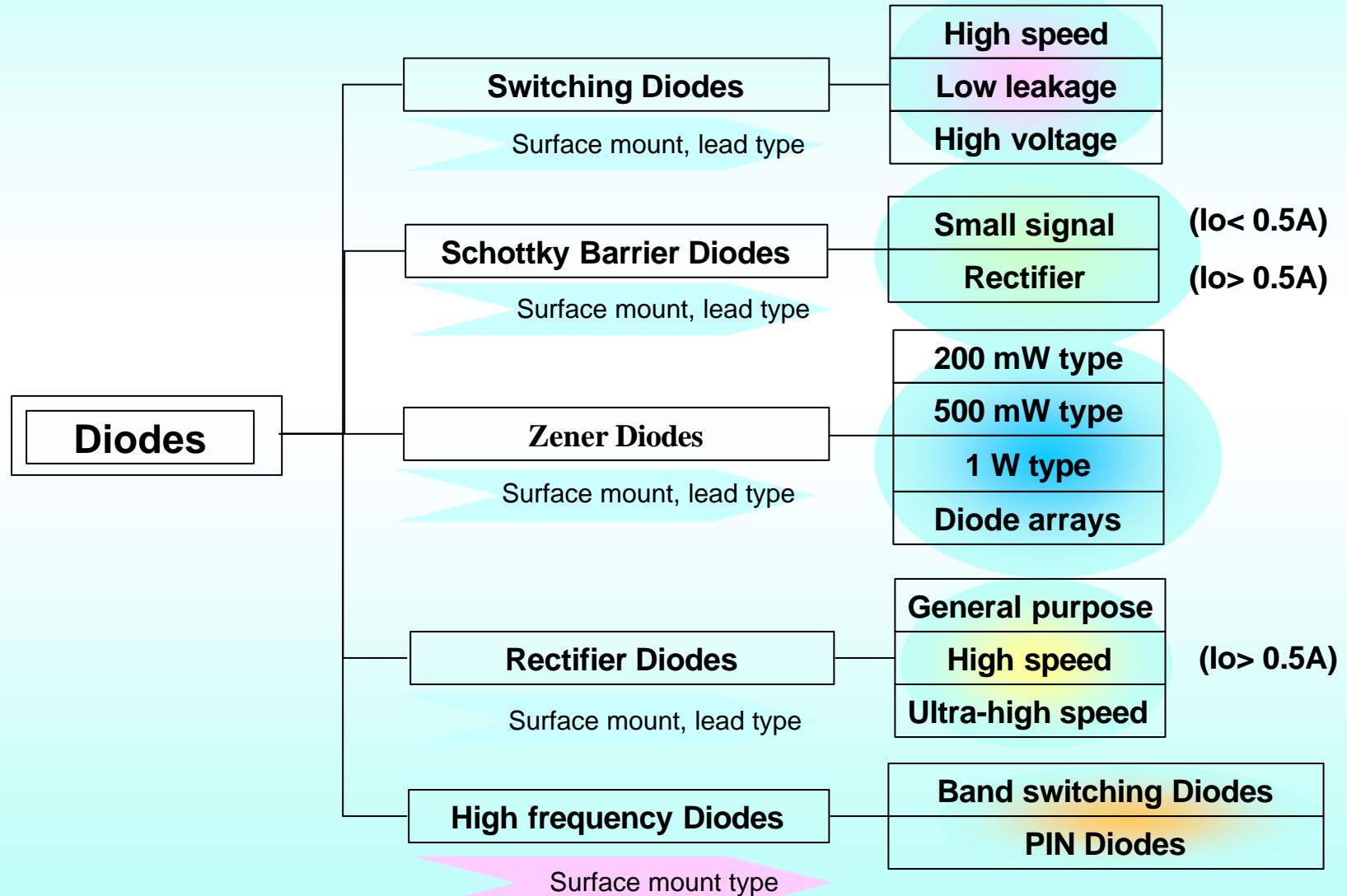
(Millions USDollars)

1999 Rank	2000 Rank	Company	Final Revenue		Growth	Market Share 2000
			1999	2000		
2	1	ROHM	403	497	23,3%	9,9%
1	2	General Semiconductor	410	488	19,0%	9,7%
3	3	ON Semiconductor	354	394	11,3%	7,9%
4	4	Toshiba	309	389	25,9%	7,8%
6	5	Hitachi	265	344	29,8%	6,9%
5	6	Philips Semiconductor	285	337	18,3%	6,7%
8	7	STMicroelectronics	209	277	32,5%	5,5%
10	8	Matsushita	181	233	28,7%	4,6%
7	9	Sanken	210	224	6,7%	4,5%
9	10	Shindengen Electric	183	220	20,2%	4,4%
Total Market			4.136	5.015	21,3%	100,0%

Source: Gartner (Mar 2001 )









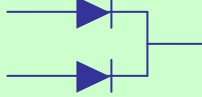
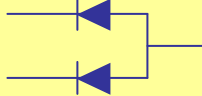
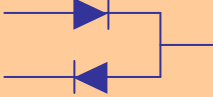
# ROHM Diodes Categories







# Popular Switching Diodes





EMD2	EMD3	UMD2	UMD3	SMD3	Config	Euro/US Style Part No.
						
SC-79	SC-75A	SOD-323	SOT-323	SC-59		
1SS400		1SS355				1N4148
	DAN222		DAN202U	DAN202K		BAV70
	DAP222		DAP202U	DAP202K		BAW56
	DA221*		DAN217U	DA204K		BAV99

V = 80 ~ 100V

I<sub>O</sub> = 100mA

\* V = 20V

# Rectifier Diodes

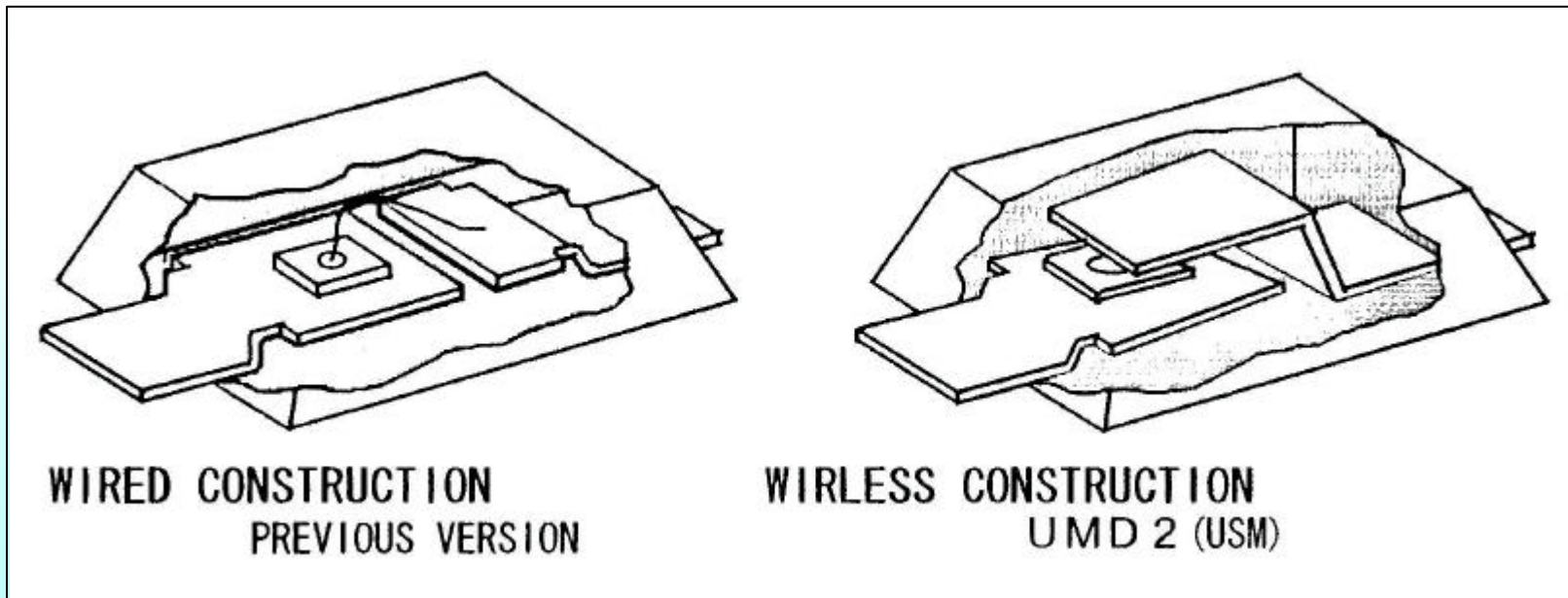
Parameter			PMDS  SMA SOD-106	LLDL  LL-41	MSR  DO-41 (mini)	GSR  DO-41
Speed	$V_{RM}$ (V)	$I_O$ (A)				
Std	400 600	0.8~1 1.0	1SR154-400 (S1G) 1SR154-600 (S1J)	<b>RLR4004</b>	1SR139-400 1SR139-600	<b>1N4004A</b>
50ns High 400ns	200 400	1.0 1.0	1SR159-200 (ES1D) 1SR156-400 (RS1G)		1SR153-400	1SR124-400A

( ) Competitors Partnumber



## Wireless Diode Construction







- Available at SOD323 and SMA Package size
- Improved ESD characteristics
- Increased surge current proove (up to factor 2)
- Improved thermal resistance  $R_{th}$

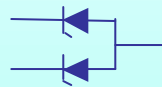




# Zener Diode Product Offering





## ~ Common Products ~

Pkg.	EMD2  SC-79	UMD2  SOD323	SMD3  SC59 Z-Array	LLDS  LL-34	MSD  DO-34	PMDS  SMA
P/N	EDZ	UDZS	STZ	RLZ	MTZJ	PTZ
Power (mW)	150	200	200	500	500	1000
Volt. (V)	4.7~6.8	3,6~36	5,6~6,8	3.6~39	3.6~39	3.6~36











# Schottky Rectifier Diodes

Current	PMDS  SMA	SMD3  SC-59	UMD3  SOT-323	UMD2  SOD-323
0.5~0.7A		RB411D RB400D	RB461F	RB551V
1A	RB160L-60 RB160L-40 RB161L-40	RB491D		
2A	RB060L-40			
3A	RB050L-40 RB051L-40			
5A	RB081L-20			



## Automotive Suitable Diodes

	<u>Package</u>	<u>P/N</u>	<u>Features</u>
	<b>SOD323 (UMD2)</b>	<b>1SS355 1SS376 1SS380 UDZS</b>	<b>switching (80V, 100mA) switching (250V, 300mA) switching low leakage Zener Diode</b>
	<b>SOT323 (UMD3)</b>	<b>DAN217U DAN202U DAP202U</b>	<b>switching (2 di.series con.) switching (2 diodes C.C.) switching (2 diodes C.A.)</b>
	<b>SOT343 (UMD4)</b>	<b>DA227</b>	<b>switching (2 diodes indep.)</b>
	<b>SOT363 (UMD6)</b>	<b>UMN11N UMP11N UMR12N</b>	<b>double BAV70 double BAW56 double BAV99</b>
	<b>SOT23-6</b>	<b>IMN10</b>	<b>tripple BAS 16</b>
	<b>SOD106 [SMA] (PSM)</b>	<b>1SR154-400 RB160L-60 RB160L-40 RB051L-40 RB081L-20 PTZ</b>	<b>rectifier (400V) Schottky barrier (60V, 1A) Schottky barrier (40V, 1A) Schottky barrier (40V, 3A) Schottky barrier (25V, 5A) Zener (1W)</b>



# Diodes latest Developments & Package Trends

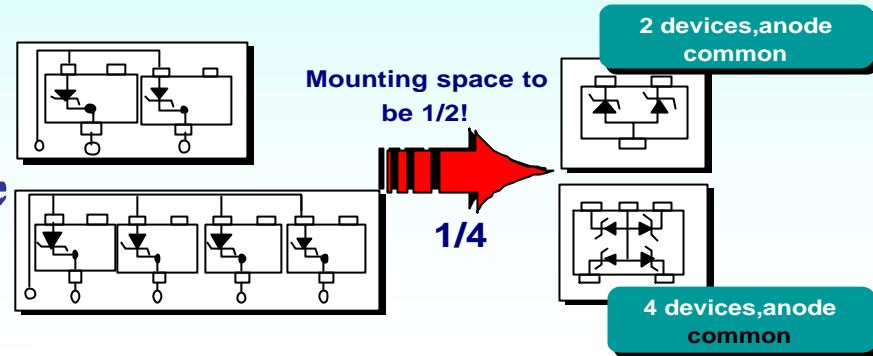


# Complex Zener Diodes

They are suitable to protect against ESD at highspeed data communication bus with low capacitance.

**NEW PRODUCTS**  
Reducing costs and PCB space

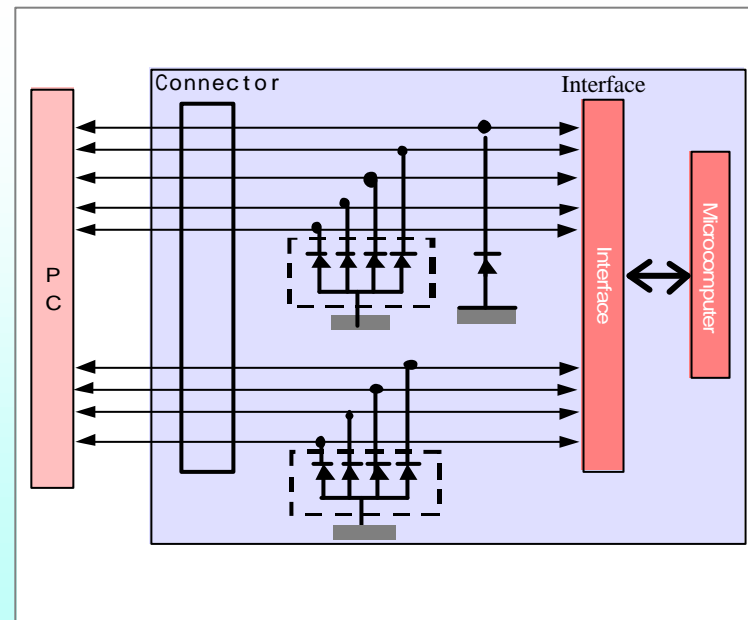
1. Protecting IC data-bus from external ESD surge
2. Reducing required space to 1/4
3. Design with low cost.



## Line up

	Part number	Internal circuit	Package
U/D	UMZ5.6E		UMD5 (SOT353)
	UMZ6.8E		SMD5 (SC59-size)
	FTZ5.6E		
	FTZ6.8E		
	FTZ12E		SMD3 (SC-59)
	STZ5.6N		EMD3(SOT416/SC75A)
	STZ6.2N		
	STZ6.8N		
U/D	EMZ5.6N		UMD3(SOT323)
	EMZ6.8N		SMD3(SC59)
U/D	UMZ5.6N		
	UMZ6.8N		UMD3(SOT323)
	UMZ8.2N		SMD3(SC59)
	UMZ12N		UMD3(SOT323)
	STZ6.8T		
	UMZ8.2T		

## Application example



These products guarantee more than 8KV against ESD based on ESD test (IEC1000-4-2)





# Next Generation of Schottky Barrier Diodes

Coming Up Product!

There used to be of trade-off relation between VF and IR; it is a difficult task to achieve both low VF and low IR.

With ROHM's original technology, we have been able to achieve best characteristics of both low VF and low IR

Changing the device structure, the characteristics has been improved!



Increase the effectiveness of power supply when this device is used at power supply and/or its surrounding circuit!

Extend the battery life time!

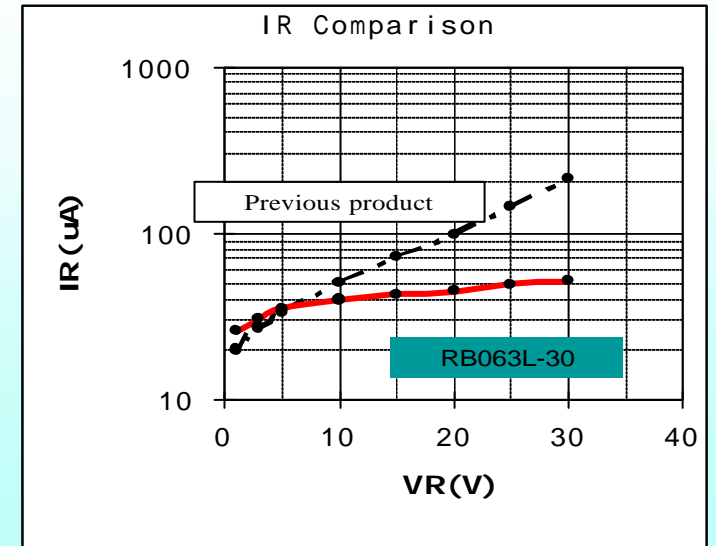
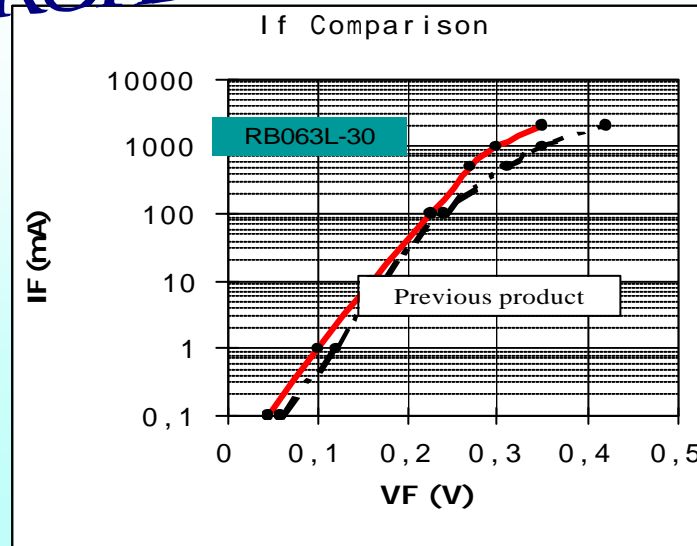
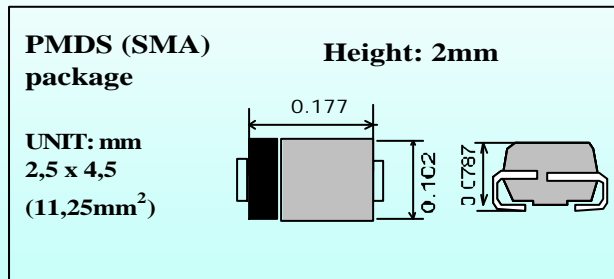


Reduce the problem of the heat radiation at the high temperature!

Specification/Characteristics comparison

TYPE	Package	Io	Vrm	VF(at Io/2)	Ir (at Vrm)
RB063L-30	PMDS	2A	30V	0.30 V	50uA
RB053L-30	[SMA]	3A	30V	0.34 V	50uA
RB083L-20	(SOD106)	5A	20V	0.33 V	150uA

## Evolution of ROHM's Schottky Barrier Diode





# SOD123 Schottky & Rectifier Diodes

less than 1mm of height (thickness)

## SOD123

PMDU package

*Feature: Super slim 0,8 mm of typical*

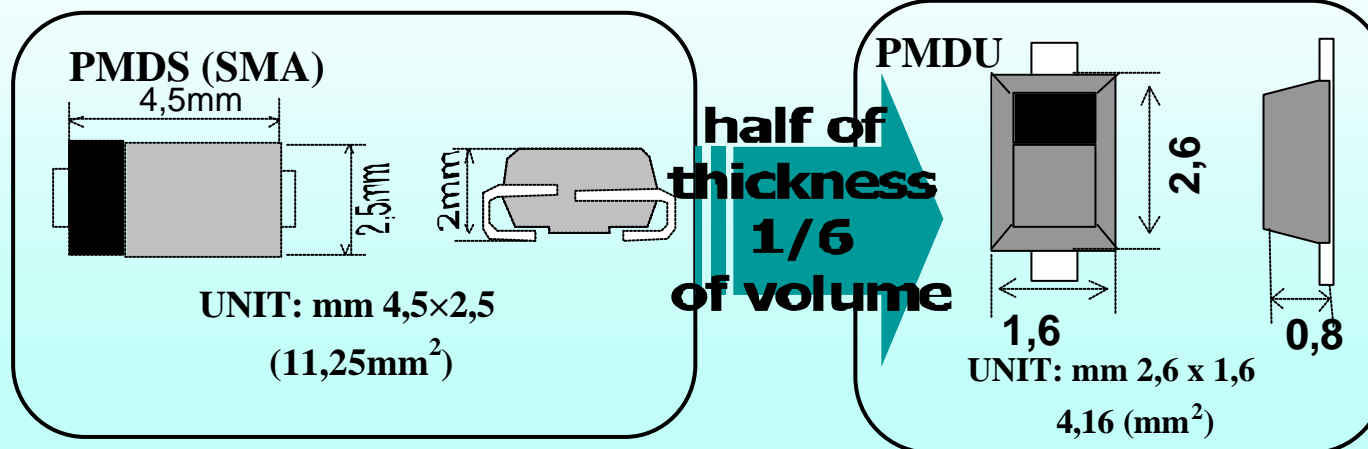
*Applications:*

*PC , Mobile Phone, Small size DC-DC converter*

*Power supply of products that needs to be miniaturized.*

Part Number	Category	VRM(V)	IO(A)	VF@IO
RB161M-20	Low VF Schottky	20	1	0.31Vtyp
RB160M-30	30V Low IR Schottky	30	1	0.43Vtyp
RR264M-400	Rectifier	400	0,7	0.90Vtyp

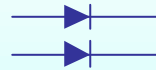
future product->



## Switching diode arrays independent

<u>P/N</u>	<u>Package</u>	<u>VR</u>	<u>Io</u>	<u>Ifm</u>	<u>trr</u>	<u>config</u>
DA227	SOT343	80V	0,1A	0,3A	4ns	double
IMN10	SOT457(SC-59 6pin)	80V	0,1A	0,3A	4ns	tripple

**Double  
configuration**



**Tripple  
configuration**

