

# PowerMOSFETs



RoHS, ELV & Co.



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# Introduction

- Use of hazardous substances are subject to restrictions due to several legal directives
  - RoHS (EU Directive 2002/95/EC) –  
Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
  - ELV Annex II (EU Directive 2000/53/EC) –  
End-of Life Vehicles
  - WEEE (EU Directive 2002/96/EC) –  
Waste Electrical and Electrical and Electronic Equipment
  
- Content of devices has to be declared
  - REACH (EU Directive 1907/2006 )

# Prohibited substances according to ...

	... RoHS	... ELV Annex II	... WEEE
	EU Directive 2002/95/EC	EU Directive 2000/53/EC	EU Directive 2002/96/EC
Lead and its compounds	yes <sup>note 1</sup>	yes <sup>note 2</sup>	-
Mercury and its compounds	yes	yes	-
Cadmium and its compounds	yes	yes	-
Hexavalent chromium	yes	yes	-
PBB (Polybrominated biphenyls)	yes	-	-
PBDE (Polybrominated diphenyl ethers)	yes	-	-
Devices with halogenated flame retardents	-	-	have to be removed from seperately collected WEEE

**note 1** High melting solders (>85% Pb) are exempt from RoHS directive, e.g. for die attach in PowerMOSFETs

**note 2** High melting solders (>85% Pb) are exempt from ELV Annex II directive, e.g. for die attach in PowerMOSFETs; according to latest version (august 2008) exemption will expire for vehicle types approved after 31 December 2010 (review of exemption in 2009)

# All but lead

- Cadmium, mercury, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers are not present in PowerMOSFETs in quantities exceeding the following concentrations defined in RoHS and ELV directives:
  - 0.1% (by weight of homogeneous material) mercury, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers
  - 0.01% (by weight of homogeneous material) cadmium
  
- Halogens in mold compound
  - Currently mold compound contains halogens
  - NEC is in the transition phase to offer packages with halogen free mold compound, e.g. new DPAK for NP90N03VUG/NP90N04VUG/NP90N055VUG

# Lead inside PowerMOSFETs

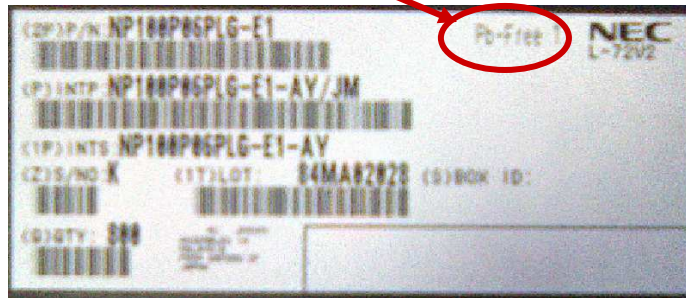
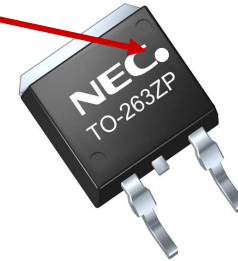
- Lead in external pins (plating)
  - NEC's PowerMOSFETs are available with Pb-free plating
  - Pb-free solders require reflow soldering temperatures up to 260°C
  - NEC's PowerMOSFETs can sustain Pb-free soldering profiles and still comply to AEC-Q101 qualification and keep MSL1
  
- Lead in die attach for automotive devices
  - Currently there is no appropriate replacement for high melting solders containing more than 85% of Pb in order to
    - sustain 260 °C reflow soldering peak temperature
    - comply to AEC-Q101 qualification after soldering
    - confirm today's highest reliable interconnection/die attach
  - NEC is investigating different alternatives to Pb-based die attach solders to ban Pb completely from PowerMOSFETs and to be prepared for changes in legal directives (ELV Annex II)



**NEC's PowerMOSFETs are fully  
RoHS and ELV compliant**

# Pb-free marking (RoHS and ELV conform)

- Pb-free devices are marked with a dot:
- Package/reel lable:



- Part number:
  - Suffix -A/-AT/-AZ/AY, e.g. NP83P04PDG-E1-AY

Lead-free suffix	Plating material	Lead in die attach
-A	Sn-Bi	No
-AZ	Sn-Bi <sup>note 1</sup> /Sn <sup>note 2</sup>	Yes <sup>note 3</sup>
-AT	Sn	No
-AY	Sn	Yes <sup>note 3</sup>

**note 1** Sn-Bi to be phased out e/o 2010  
**note 2** Pure Sn plating for NP-Series products  
**note 3** High melting solder in accordance with RoHS and ELV

# Product Content Sheet for WEEE compliance

- Product content sheets are available that list all substances , e.g. for NP83P04PDG-E1-AY:



## Product's Material Data Sheet

Product Name	NP83P04PDG-E1-AY				
RoHS Compliance	OK	RoHS Exemption	Annex 7	PKG ID	DMP25P0TDBCA08
Product Weight (g)	1,48	Date	2008.12.12		

Composition Part	Part Weight (mg)	Materials	CAS No.	Weight (mg)	Weight /Total (ppm)	Weight /Part (%)	Weight /Part (ppm)	Purpose of use
Chip (Die)	18,155	Silicon	7440-21-3	18	12162	99,1462	991462	Semiconductor
		Aluminum	7429-90-5	0,14	95	0,7711	7711	Electric and Electronic materials
		Arsenic	7440-38-2	0,015	10	0,0826	826	Dopant
Bonding wires	8,11	Aluminum	7429-90-5	8,11	5480	100,0000	1000000	Electric and Electronic materials
Lead frame	483,76	Copper	7440-50-8	475,28	321132	98,2471	982471	Electric and Electronic materials
		Nickel	7440-02-0	8	5405	1,6537	16537	Alloy
		Iron	7439-89-6	0,48	324	0,0992	992	Metal alloy
Diepad plating	2,05	Silver	7440-22-4	2,05	1385	100,0000	1000000	Electric and Electronic materials
Encapsulation	949,91	Silica	7631-86-9	648,76	438347	68,2970	682970	Filler
		Epoxy resin		190	128377	20,0019	200019	Resin
		Phenolic resin		71,25	48141	7,5007	75007	Resin
		Antimony-trioxide	1309-64-4	19	12838	2,0002	20002	Flame retardant
		Brominated epoxy resin		19	12838	2,0002	20002	Flame retardant
Die Attachment	15,24	Carbon black	1333-86-4	1,9	1284	0,2000	2000	Pigment
		Lead	7439-92-1	14,1	9527	92,5197	925197	high-melting Solder
		Tin	7440-31-5	0,76	514	4,9869	49869	Metal alloy
Lead finish	2,79	Silver	7440-22-4	0,38	257	2,4934	24934	Electric and Electronic materials
		Tin	7440-31-5	2,79	1885	100,0000	1000000	Metal alloy
Total				1480,015	1000000			

**NEC**

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