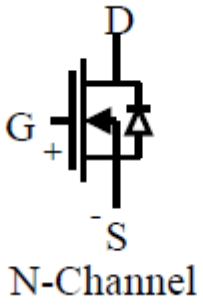
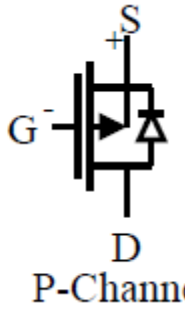
Niko-sem MOSFET Introduce

What is a MOSFET ?

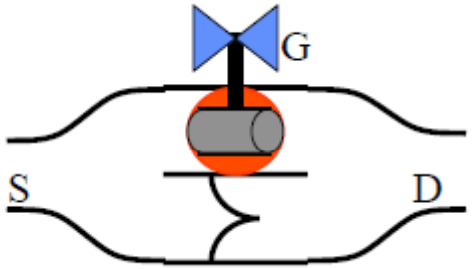
- A MOSFET is an electrical switch
- It has three terminals - Drain (D), Source (S), and Gate(G)
- The switch is closed (turned on) by applying **Voltage** on the Gate relative to the Source
  - N-Channel - Gate positive with respect to the source
  - P-Channel - Gate negative with respect to Source
- It can be turned slightly on by applying a small Voltage from Gate to Source
- The Channel (connection between the Drain and Source when the switch is turned on) can conduct **Current** in either direction
- A **Diode** bypasses the switch in one direction



N-Channel



P-Channel

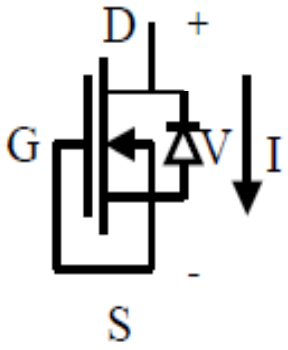


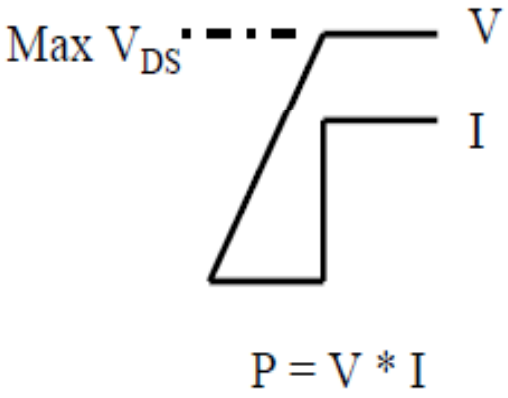
Major MOSFET Parameter

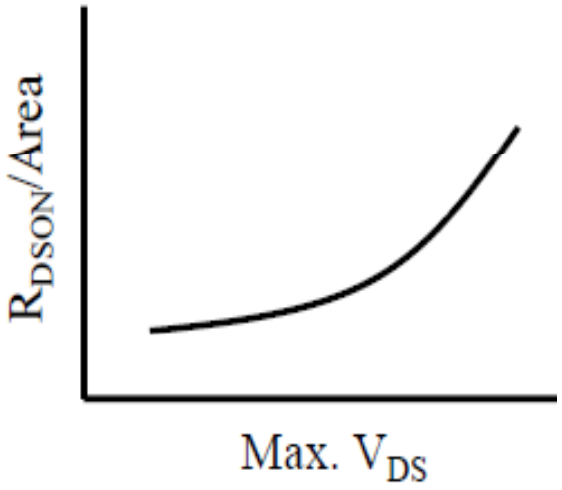
1. **Package**
2. **Channel Tpye**
3. **Vds**
4. **Vgs**
5. **Id**
6. **Rds(on)**

Maximum Drain-Source Voltage - Vds

- Maximum V_{DS} is the highest drain to source voltage a MOSFET can block
- As the voltage on the drain (relative to the source) rises, it is blocked until the Maximum V_{DS} rating is exceeded, then Avalanche occurs
- Maximum V_{DS} is the first consideration in designing in a MOSFET
- The lower the breakdown voltage, the more cost efficient the MOSFET is.







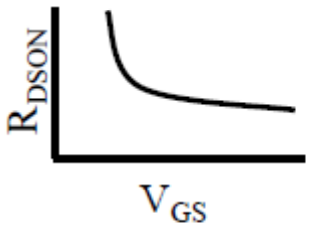
Maximum Drain Current - Id

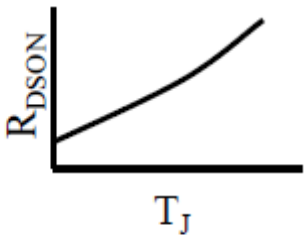
- Maximum Drain Current (I_D) is the most current a MOSFET can handle through it between Drain and Source when it is turned on without risking failure
  - It is based on the current which will drive the junction temperature (T_J) to its maximum, 150 °C usually
- It is specified at:
  - Ambient Temperature (T_A) = 25°C, the I_D spec will be lower
  - Case Temperature (T_C) = 25°C, the I_D spec will be higher

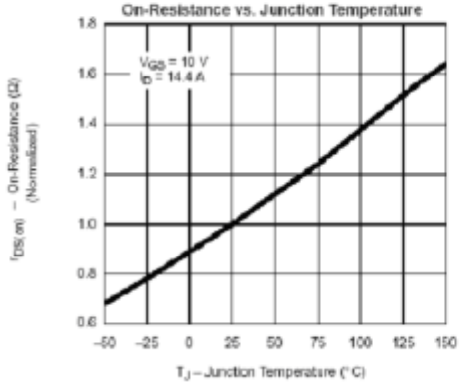
More argument on this spec due to specified at different condition!

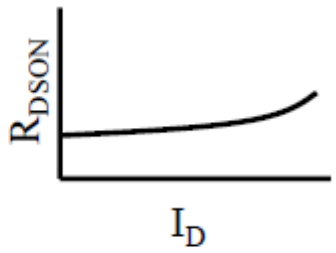
MOSFET turn on Resistance

- R_{DSON} is the Resistance through a MOSFET when it is on
- R_{DSON} is important because it determines the:
  - Voltage drop across the MOSFET at a particular Current: $V = I * R$
  - Power dissipated (heat generated) by the MOSFET in the on state: $P = I^2 * R$
- The R_{DSON} is dependent on Gate to Source Voltage (V_{GS}), Junction Temperature (T_J), and Drain Current (I_D)
  - R_{DSON} is specified as typical and maximum at several Gate to source voltages
  - R_{DSON} is specified at $T_J = 25°C$. It increases roughly 1.6 times from 25 to 150 °C
  - R_{DSON} is specified at maximum I_D





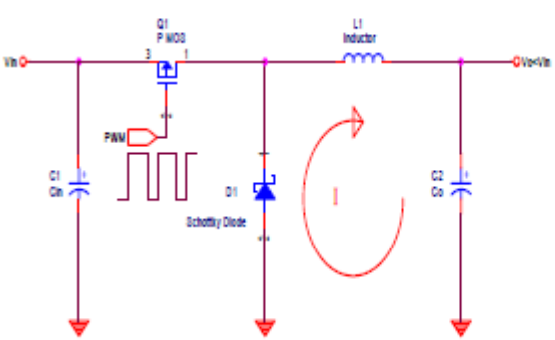


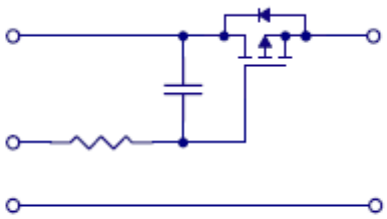


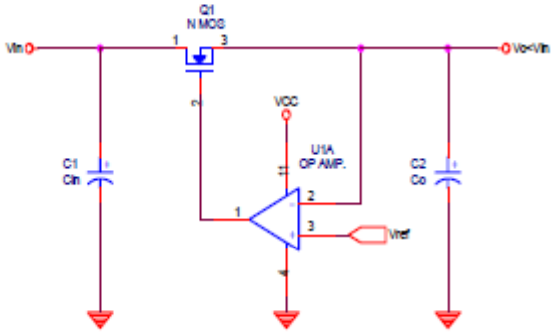
Where to look for MOSFET business

Whether the system is Computer, Telecom, Portables…, there are only 3 basic applications

- **Switching Application** (like Buck, boost… converter)
  - Key Parameters – $V_{DS,}$ $V_{GS,}$ $R_{DSon,}$ $Q_{g,}$, $Q_{gd,}$ R_G
- **Load Switch Application**
  - Key Parameters - $V_{DS,}$ $V_{GS,}$ R_{DSon}, I_{DMax}, V_{GSth}
- **Linear Mode Application** (linear regulator, linear amplifier…)
  - Key Parameters - $R_{\theta JC}$

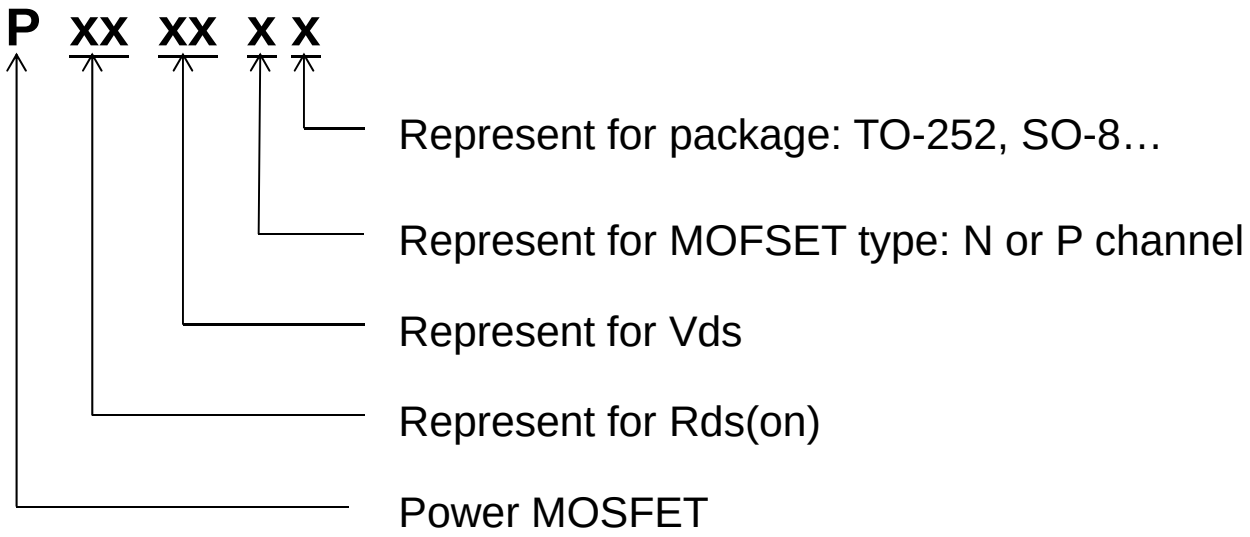






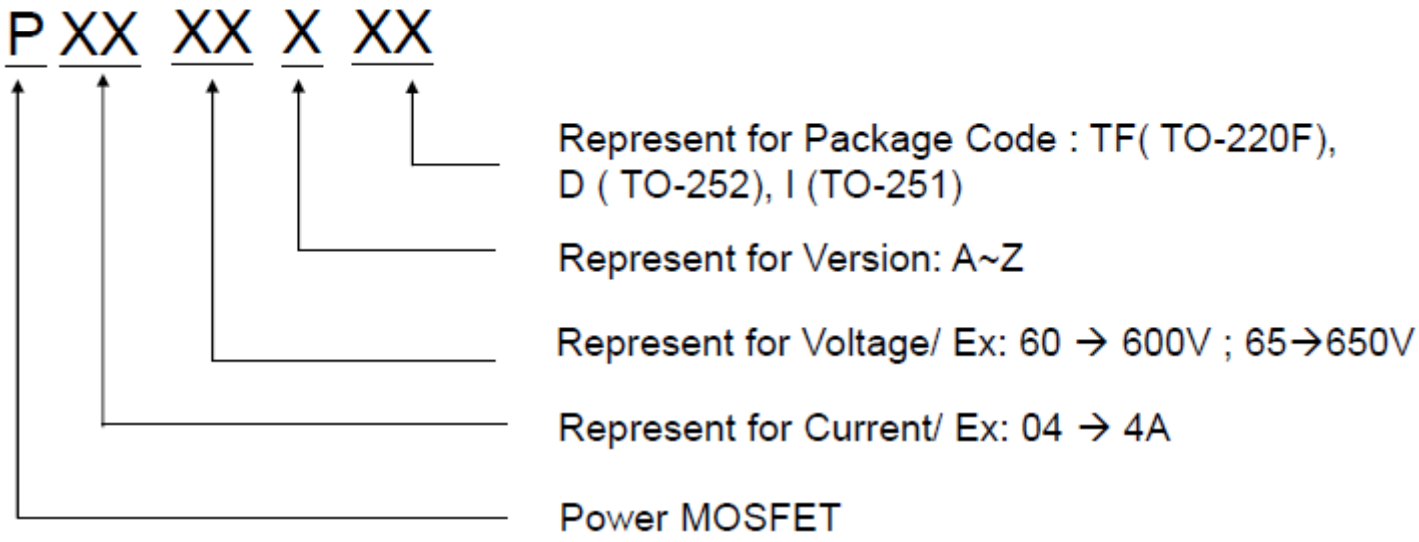
LV/MV MOSFET P/N Definition

P2003BDG: MOSFET 20m ohm, 30V, TO-252



HV MOSFET P/N Definition

P0460ATF : MOSFET 600V 4A TO-220F



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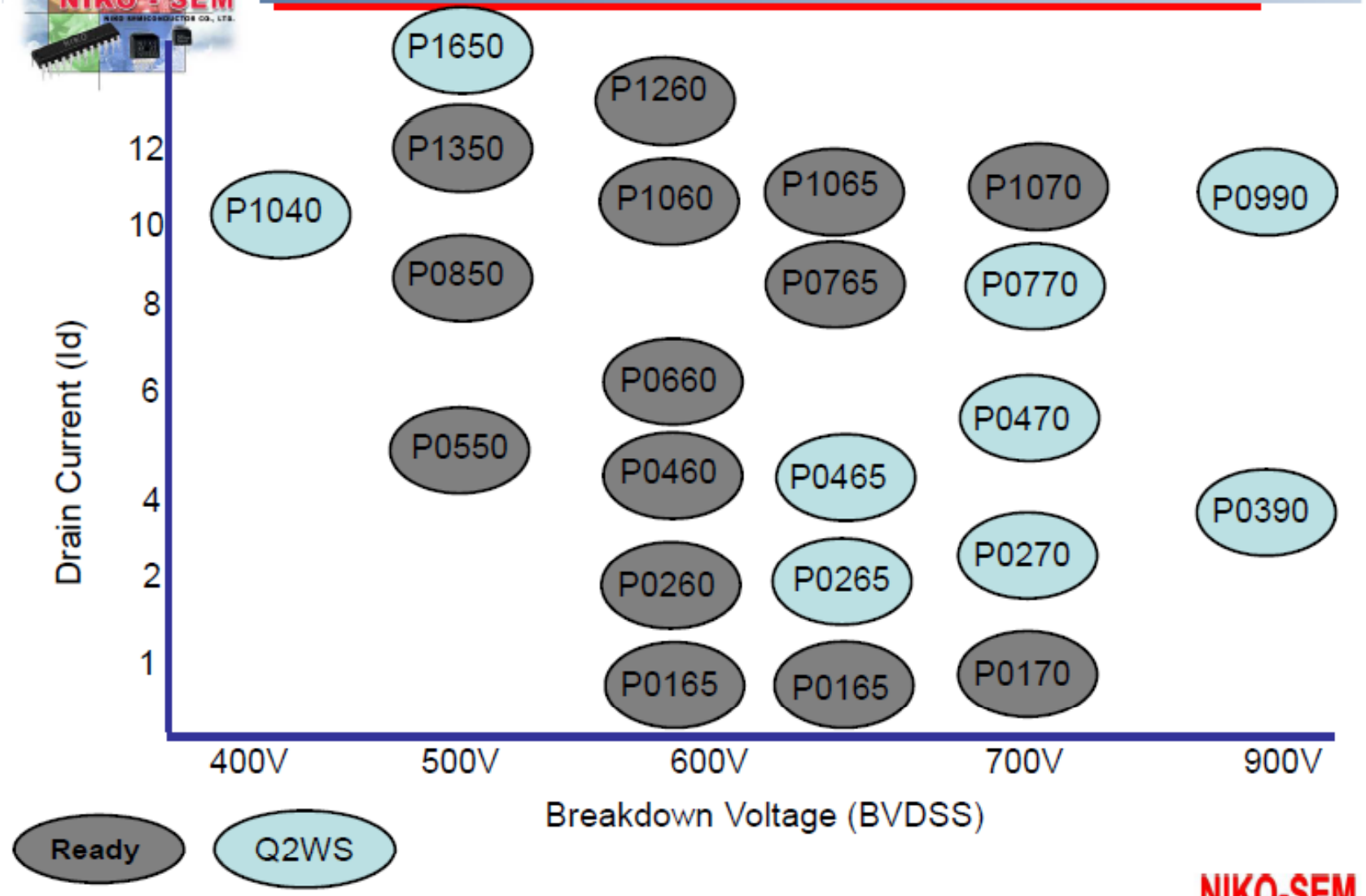

400V~700V part list

Part NO.	VDS (V)	ID (A)	RDS(on)Ω max 10V (Id=50%)	MP Schedule	Package								Remark
					TO-92	TO-252	TO-251	TO-262	TO-263	TO-220	TO-220F	TO-3P/247	
P0640	400	6	1	Q2		V▲					V▲		
P1040	400	10	0.55	Q2							V▲		
P0550	500	5	1.5	Now		V▲	V▲			V▲	V▲		
P0550B	500	5	1.75	Q1		V▲	V▲			V▲	V▲		
P0850	500	8	0.85	Now						V▲	V▲		
P1350	500	13	0.52	Now							V▲		
P1650	500	16	0.38	Q2						V▲	V▲	V▲	PFC Switch
P0160	600	1	12	Now	V▲	V▲	V▲						
P0260	600	2	4.4	Now		V▲	V▲				V▲		
P0460	600	4	2	Now		V▲	V▲			V▲	V▲		
P0460B	600	4	2.6	Q1		V▲	V▲				V▲		Rds-on 2.5 Ohm
P0660	600	6	1.25	Now						V▲	V▲		
P0660B	600	6	1.5	Q1		V▲	V▲				V▲		Possible for TO-252
P1060B	600	10	1	Q2							V▲		
P1060	600	10	0.75	Now						V▲	V▲		
P1260	600	12	0.65	Now						V▲	V▲		
P0165	650	1	14	Now		V▲	V▲				V▲		
P0265	650	2	5.5	Q1		V▲	V▲				V▲		
P0465	650	4	2.5	Q1		V▲	V▲				V▲		
P0765	650	7	1.5	Now							V▲		
P1065	650	10	0.75	Now							V▲		
P0170	700	1	15	Now	V▲	V▲	V▲						
P0270	700	2	6	Q1		V▲	V▲				V▲		
P0470	700	4	2.8	Q1		V▲	V▲				V▲		
P0770	700	7	1.7	Q1							V▲		
P1070	700	10	0.85	Now							V▲		