H02N60S Series

N-Channel Power Field Effect Transistor

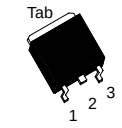
Description

This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degratding performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and saafety margin against unexpected voltage transients.

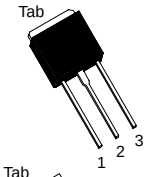
Features

- Robust High Voltage Termination
- Avalanc he Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- I_{DSS} and $V_{DS(on)}$ Specified at Elevated Temperature

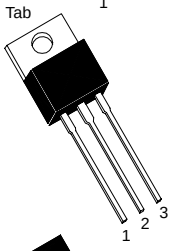
H02N60S Series Pin Assignment



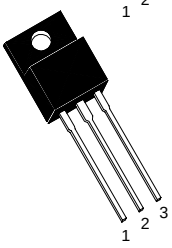
3-Lead Plastic **TO-252**
Package Code: J
Pin 1: Gate
Pin 2 & Tab: Drain
Pin 3: Source



3-Lead Plastic **TO-251**
Package Code: I
Pin 1: Gate
Pin 2 & Tab: Drain
Pin 3: Source

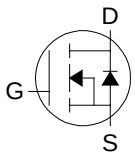


3-Lead Plastic **TO-220AB**
Package Code: E
Pin 1: Gate
Pin 2 & Tab: Drain
Pin 3: Source



3-Lead Plastic **TO-220FP**
Package Code: F
Pin 1: Gate
Pin 2: Drain
Pin 3: Source

H02N60S Series Symbol:



Absolute Maximum Ratings

Symbol	Parameter	Value	Units
I_D	Drain to Current (Continuous)	2	A
I_{DM}	Drain to Current (Pulsed)	8	A
V_{GS}	Gate-to-Source Voltage (Continue)	±30	V
P_D	Total Power Dissipation (T_C=25°C) H02N60SI (TO-251) / H02N60SJ (TO-252) H02N60SE (TO-220AB) H02N60SF (TO-220FP)	 50 50 25	W
	Derate above 25°C H02N60SI (TO-251) / H02N60SJ (TO-252) H02N60SE (TO-220AB) H02N60SF (TO-220FP)	 0.4 0.4 0.33	W/°C
T_j, T_{stg}	Operating and Storage Temperature Range	-55 to 150	°C
E_{AS}	Single Pulse Drain-to-Source Avalanche Enrgy-Tj=25°C (V_{DD}=100V, V_{GS}=10V, I_L=2A, L=10mH, R_G=25Ω)	35	mJ
T_L	Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	260	°C

Thermal Characteristics

Symbol	Parameter	Value		Units
$R_{\theta JC}$	Thermal Resistance Junction to Case Max.	TO-251 / TO-252	2	°C/W
		TO-220AB	2	
		TO-220FP	3.3	
$R_{\theta JA}$	Thermal Resistance Junction to Ambient Max.	62.5		°C/W

ELectrical Characteristics (Tj=25°C, unless otherwise specified)

Symbol	Characteristic		Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage (V_{GS}=0V, I_D=250uA)		600	-	-	V
I_{DSS}	Drain-Source Leakage Current (V_{DS}=600V, V_{GS}=0V)		-	-	1	uA
	Drain-Source Leakage Current (V_{DS}=480V, V_{GS}=0V, T_j=125°C)		-	-	50	uA
I_{GSSF}	Gate-Source Leakage Current-Forward (V_{gsf}=30V, V_{DS}=0V)		-	-	100	nA
I_{GSSR}	Gate-Source Leakage Current-Reverse (V_{gsr}=-30V, V_{DS}=0V)		-	-	-100	nA
$V_{GS(th)}$	Gate Threshold Voltage (V_{DS}=V_{GS}, I_D=250uA)		2	-	4	V
$R_{DS(on)}$	Static Drain-Source On-Resistance (V_{GS}=10V, I_D=1A)*		-	-	5	Ω
g_{FS}	Forward Transconductance (V_{DS}≥50V, I_D=1A)*		1	-	-	mhos
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	435	-	pF
C_{oss}	Output Capacitance		-	56	-	
C_{rss}	Reverse Transfer Capacitance		-	9.2	-	
$t_{d(on)}$	Turn-on Delay Time	(V_{DD}=300V, I_D=2A, R_G=18Ω, V_{GS}=10V)*	-	12	-	ns
t_r	Rise Time		-	21	-	
$t_{d(off)}$	Turn-off Delay Time		-	30	-	
t_f	Fall Time		-	24	-	
Q_g	Total Gate Charge	(V_{DS}=300V, I_D=6A, V_{GS}=10V)*	-	13	22	nC
Q_{gs}	Gate-Source Charge		-	2	-	
Q_{gd}	Gate-Drain Charge		-	6	-	
L_D	Internal Drain Inductance (Measured from the drain lead 0.25” from package to center of die)		-	4.5	-	nH
L_S	Internal Drain Inductance (Measured from the drain lead 0.25” from package to source bond pad)		-	7.5	-	nH

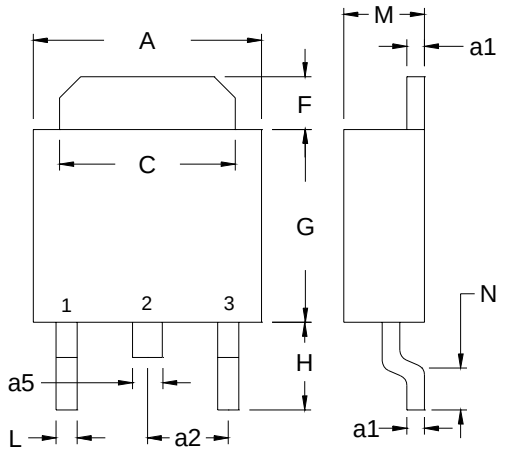
*: Pulse Test: Pulse Width ≤300us, Duty Cycle≤2%

Source-Drain Diode

Symbol	Characteristic		Min.	Typ.	Max.	Units
V_{SD}	Forward On Voltage(1)	I_S=2A, V_{GS}=0V, T_J=25°C	-	-	1.6	V
t_{on}	Forward Turn-On Time	I_S=2A, V_{GS}=0V, d_{IS}/d_t=100A/us	-	**	-	ns
t_{rr}	Reverse Recovery Time		-	340	-	ns

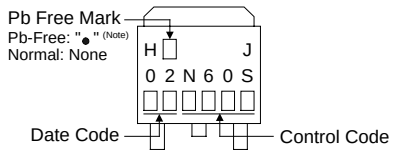
**: Negligible, Dominated by circuit inductance

TO-252 Dimension



3-Lead TO-252 Plastic
Surface Mount Package
HSMC Package Code: J

Marking:



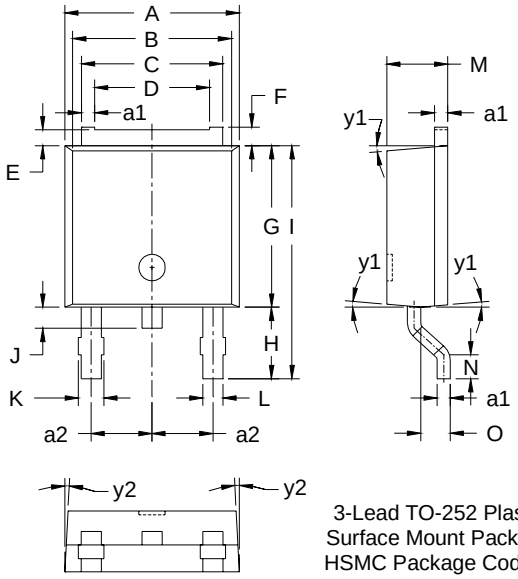
Note: Green label is used for pb-free packing

Pin Style: 1.Gate 2.Drain 3.Source

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

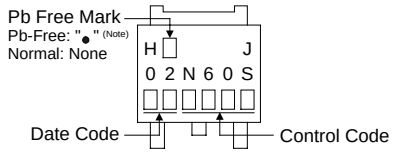
DIM	Min.	Max.
A	6.35	6.80
C	4.80	5.50
F	1.30	1.70
G	5.40	6.25
H	2.20	3.00
L	0.40	0.90
M	2.20	2.40
N	0.90	1.50
a1	0.40	0.65
a2	-	*2.30
a5	0.65	1.05

*: Typical, Unit: mm



3-Lead TO-252 Plastic
Surface Mount Package
HSMC Package Code: J

Marking:



Note: Green label is used for pb-free packing

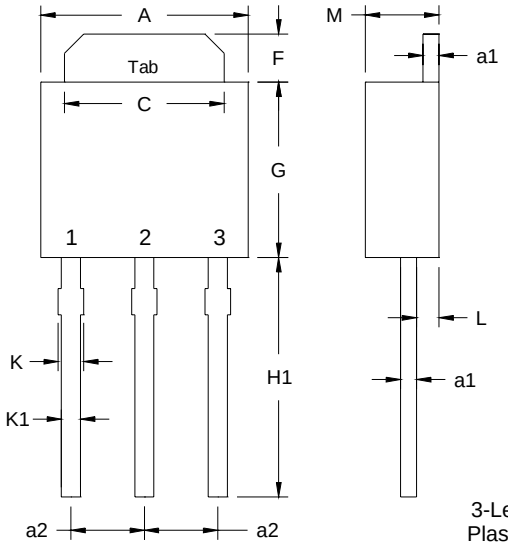
Pin Style: 1.Gate 2.Drain 3.Source

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

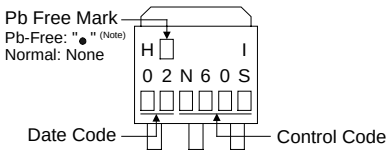
DIM	Min.	Max.
A	6.40	6.80
B	-	6.00
C	5.04	5.64
D	-	*4.34
E	0.40	0.80
F	0.50	0.90
G	5.90	6.30
H	2.50	2.90
I	9.20	9.80
J	0.60	1.00
K	-	0.96
L	0.66	0.86
M	2.20	2.40
N	0.70	1.10
O	0.82	1.22
a1	0.40	0.60
a2	2.10	2.50
y1	-	5°
y2	-	3°

*: Typical, Unit: mm

TO-251 Dimension



Marking:



Note: Green label is used for pb-free packing

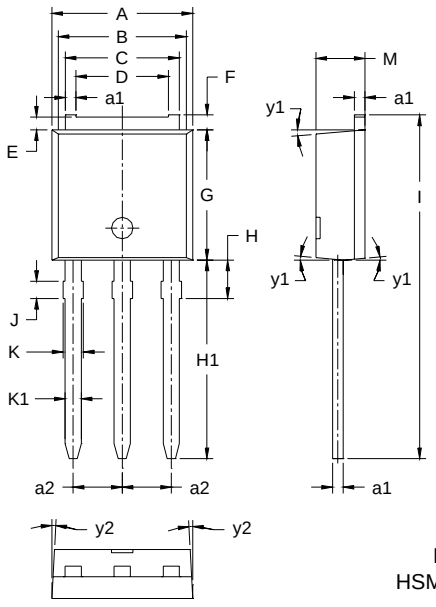
Pin Style: 1.Gate 2.Drain 3.Source

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

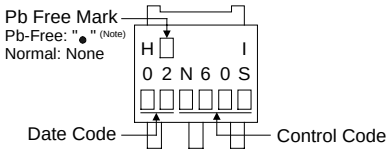
DIM	Min.	Max.
A	6.35	6.80
C	4.80	5.50
F	1.30	1.70
G	5.40	6.25
H1	6.75	8.00
K	0.50	0.90
K1	0.40	0.90
L	0.90	1.50
M	2.20	2.40
a1	0.40	0.65
a2	-	*2.30

*: Typical, Unit: mm

3-Lead TO-251
Plastic Package
HSMC Package Code: I



Marking:



Note: Green label is used for pb-free packing

Pin Style: 1.Gate 2.Drain 3.Source

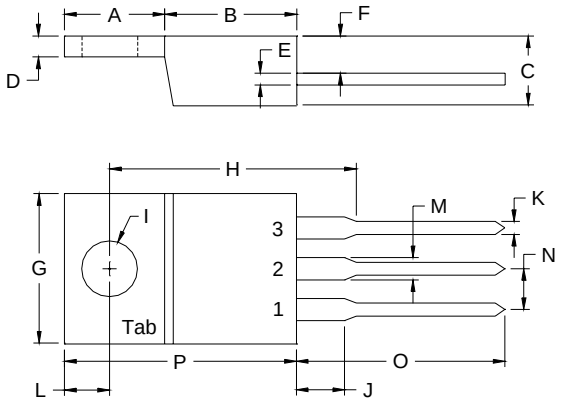
Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	6.40	6.80
B	-	6.00
C	5.04	5.64
D	-	*4.34
E	0.40	0.80
F	0.50	0.90
G	5.90	6.30
H	-	*1.80
H1	-	*9.30
I	-	*16.10
J	-	*0.80
K	-	0.96
K1	-	*0.76
M	2.20	2.40
a1	0.40	0.60
a2	2.10	2.50
y1	-	5°
y2	-	3°

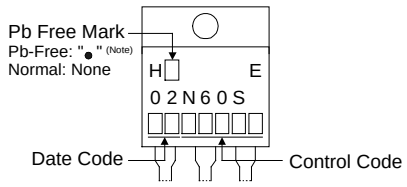
*: Typical, Unit: mm

3-Lead TO-251
Plastic Package
HSMC Package Code: I

TO-220AB Dimension



Marking:



Note: Green label is used for pb-free packing

Pin Style: 1.Gate 2 & Tab.Drain 3.Source

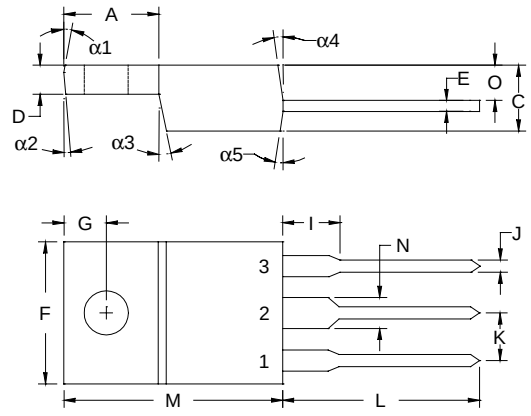
Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	5.58	7.49
B	8.38	8.90
C	4.40	4.70
D	1.15	1.39
E	0.35	0.60
F	2.03	2.92
G	9.66	10.28
H	-	*16.25
I	-	*3.83
J	3.00	4.00
K	0.75	0.95
L	2.54	3.42
M	1.14	1.40
N	-	*2.54
O	12.70	14.27
P	14.48	15.87

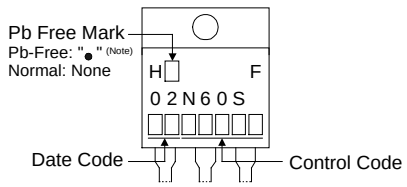
*: Typical, Unit: mm

3-Lead TO-220AB
Plastic Package
HSMC Package Code: E

TO-220FP Dimension



Marking:



Note: Green label is used for pb-free packing

Pin Style: 1.Gate 2.Drain 3.Source

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	6.48	7.40
C	4.40	4.90
D	2.34	3.00
E	0.45	0.80
F	9.80	10.36
G	3.10	3.60
I	2.70	3.43
J	0.60	1.00
K	2.34	2.74
L	12.48	13.60
M	15.67	16.20
N	0.90	1.47
O	2.00	2.96
α1/2/4/5	-	*5°
α3	-	*27°

*: Typical, Unit: mm

3-Lead TO-220FP
Plastic Package
HSMC Package Code: F

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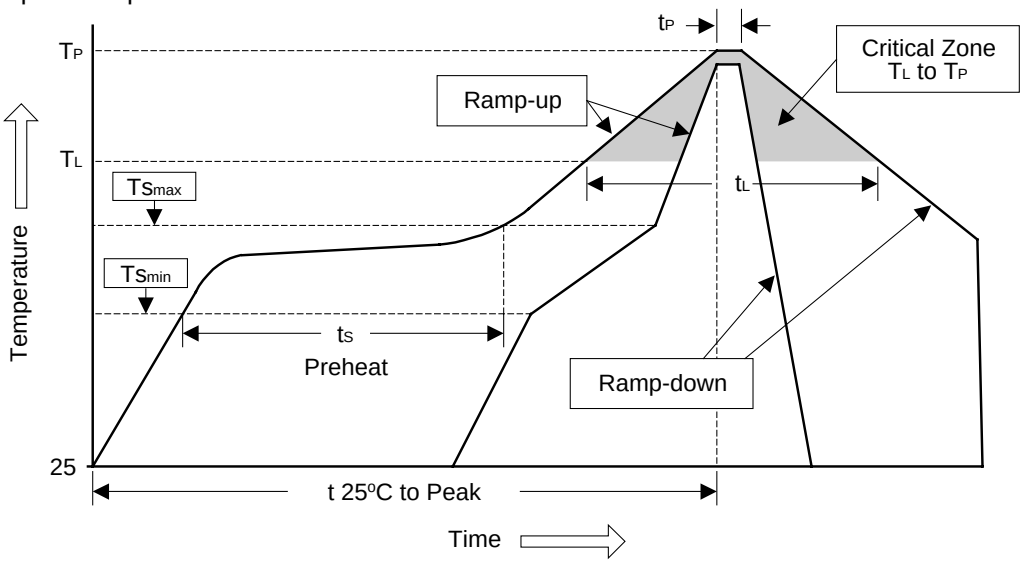
Head Office And Factory:
- **Head Office** (Hi-Sincerity Microelectronics Corp.): 10F.,No. 61, Sec. 2, Chung-Shan N. Rd. Taipei Taiwan R.O.C.
  Tel: 886-2-25212056 Fax: 886-2-25632712, 25368454
- **Factory 1:** No. 38, Kuang Fu S. Rd., Fu-Kou Hsin-Chu Industrial Park Hsin-Chu Taiwan. R.O.C
  Tel: 886-3-5983621~5 Fax: 886-3-5982931

Soldering Methods for HSMC's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat - Temperature Min (Ts_{min}) - Temperature Max (Ts_{max}) - Time (min to max) (ts)	 100°C 150°C 60~120 sec	 150°C 200°C 60~180 sec
Tsmax to T_L - Ramp-up Rate	 <3°C/sec	 <3°C/sec
Time maintained above: - Temperature (T_L) - Time (t_L)	 183°C 60~150 sec	 217°C 60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec