TAIWAN SEMICONDUCTOR

TSM2N60
600V N-Channel Power MOSFET

TO-220 **TO-251 (IPAK)** **TO-252 (DPAK)**

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

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}(\Omega)$	I_D (A)
600	5 @ V_{GS} =10V	1
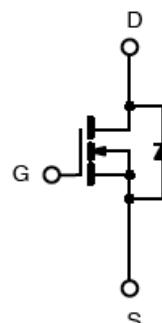
General Description

The TSM2N60 is used an advanced termination scheme to provide enhanced voltage-blocking capability without degrading 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 safety margin against unexpected voltage transients.

Features

- Robust high voltage termination
- Avalanche energy specified
- Diode is characterized for use in bridge circuits
- Source to Drain diode recovery time comparable to a discrete fast recovery diode.

Block Diagram

N-Channel MOSFET

Ordering Information

Part No.	Package	Packing
TSM2N60CP RO	TO-252	2.5Kpcs/ 13" Reel
TSM2N60CH C5	TO-251	75pcs / Tube
TSM2N60CZ C0	TO-220	50pcs / Tube

Absolute Maximum Rating (Ta = 25°C unless otherwise noted)

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current		I_D	2	A
Pulsed Drain Current		I_{DM}	9	A
Continuous Source Current (Diode Conduction)[a,b]		I_S	1	A
Single Pulse Drain to Source Avalanche Energy (V_{DD} = 100V, V_{GS}=10V, I_{AS}=2A, L=10mH, R_G=25Ω)		EAS	20	mJ
Maximum Power Dissipation @ Tc = 25°C	TO-251 / TO-252	P_{DTOT}	70	W
	TO-220		70	
Operating Junction Temperature		T_J	+150	^{o}C
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 to +150	^{o}C

Version: E11

Thermal Performance

| Parameter		Symbol	Limit	Unit
Thermal Resistance - Junction to Case	TO-251 / TO-252	$R\Theta_{JC}$	2.87	^{o}C/W
	TO-220		2.32	
Thermal Resistance - Junction to Ambient	TO-251 / TO-252	$R\Theta_{JA}$	110	^{o}C/W
	TO-220		62.5	
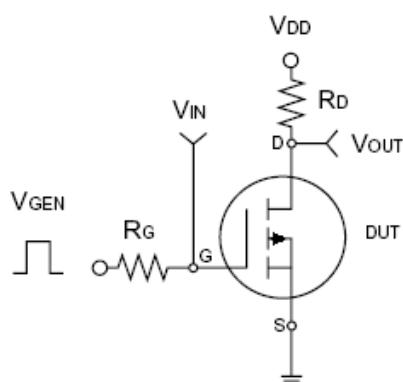
Notes: Surface mounted on FR4 board t ≤ 10sec

Electrical Specifications (Ta = 25°C unless otherwise noted)
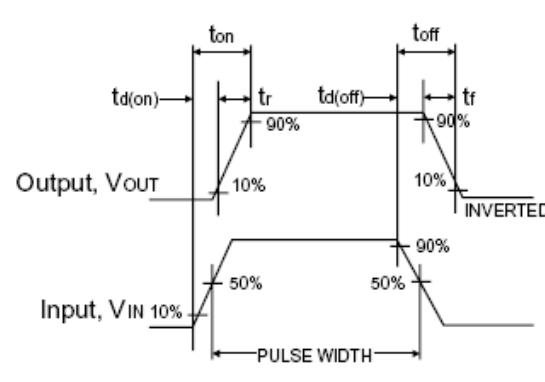
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250uA$	BV_{DSS}	600	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V$, $I_D = 1A$	$R_{DS(ON)}$	--	4.4	5	Ω
Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250uA$	$V_{GS(TH)}$	2.0	--	4.0	V
Zero Gate Voltage Drain Current	$V_{DS} = 600V$, $V_{GS} = 0V$	I_{DSS}	--	--	10	uA
Gate Body Leakage	$V_{GS} = \pm20V$, $V_{DS} = 0V$	I_{GSS}	--	--	± 100	nA
Forward Transconductance	$V_{DS} = 40V$, $I_D = 1A$	g_{fs}	--	5	--	S
Diode Forward Voltage	$I_S = 2A$, $V_{GS} = 0V$	V_{SD}	--	--	1.6	V
Dynamic [b]						
Total Gate Charge	$V_{DS} = 400V$, $I_D = 2A$, $V_{GS} = 10V$	Q_g	--	13	22	nC
Gate-Source Charge		Q_{gs}	--	2	--	
Gate-Drain Charge		Q_{gd}	--	6	--	
Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1.0MHz	C_{iss}	--	435	--	pF
Output Capacitance		C_{oss}	--	56	--	
Reverse Transfer Capacitance		C_{rss}	--	9.2	--	
Switching [c]						
Turn-On Delay Time	$V_{GS} = 10V$, $I_D = 2A$, $V_{DD} = 300V$, $R_G = 18Ω$	$t_{d(on)}$	--	12	--	nS
Turn-On Rise Time		t_r	--	21	--	
Turn-Off Delay Time		$t_{d(off)}$	--	30	--	
Turn-Off Fall Time		t_f	--	24	--	

Notes:
a. Pulse test: pulse width <=300uS, duty cycle <=2%
b. For design reference only, not subject to production testing.
c. Switching time is essentially independent of operating temperature.
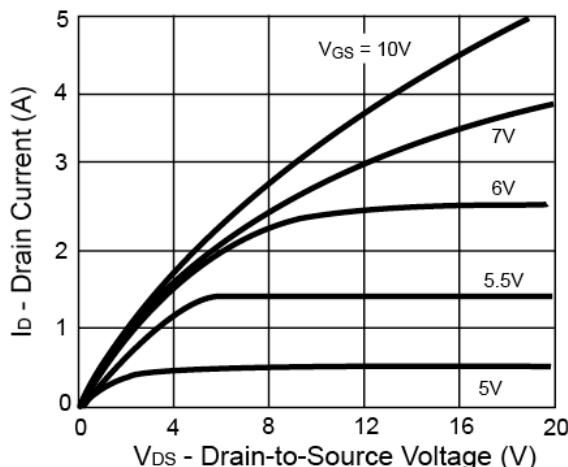

Switching Test Circuit
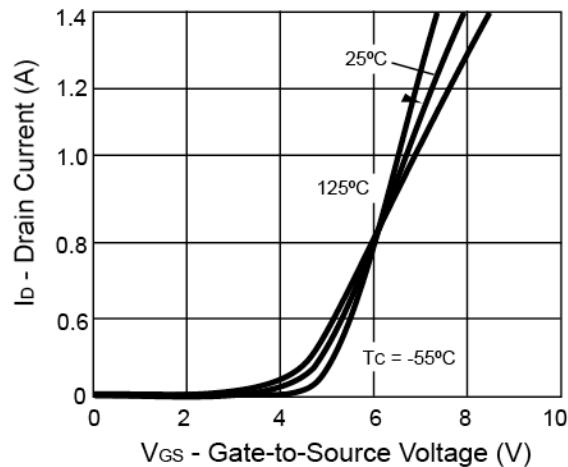
Switchin Waveforms

Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)
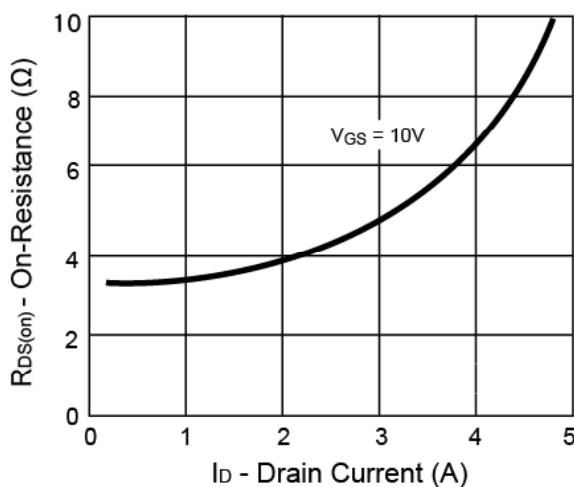
Output Characteristics
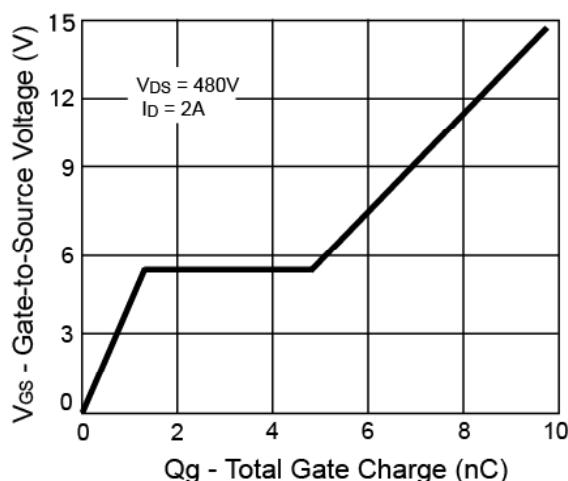

Transfer Characteristics
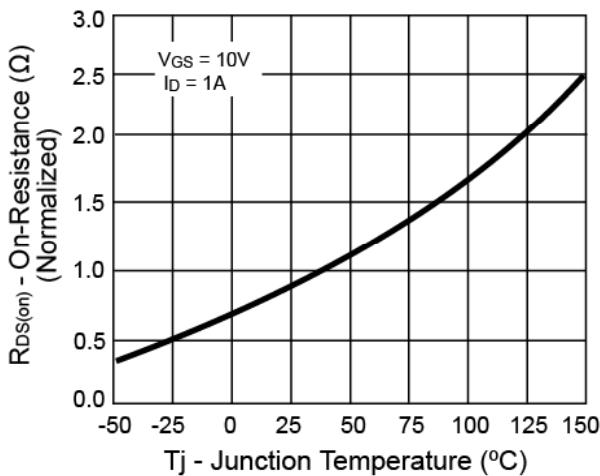


On-Resistance vs. Drain Current
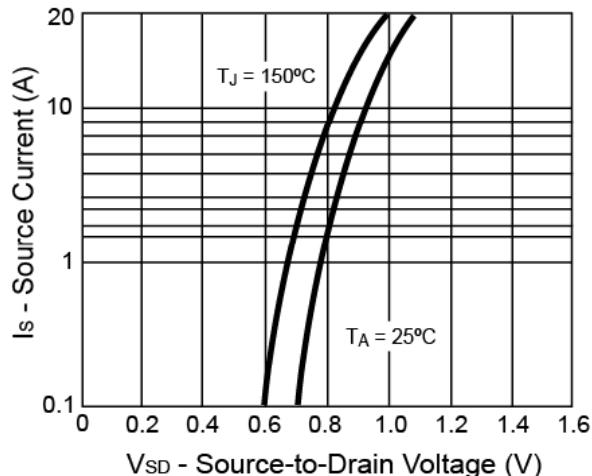
Gate Charge

On-Resistance vs. Junction Temperature
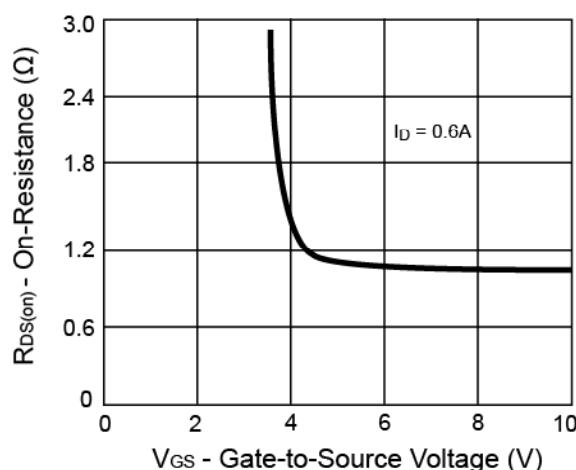
Source-Drain Diode Forward Voltage

RoHS COMPLIANCE

## Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)
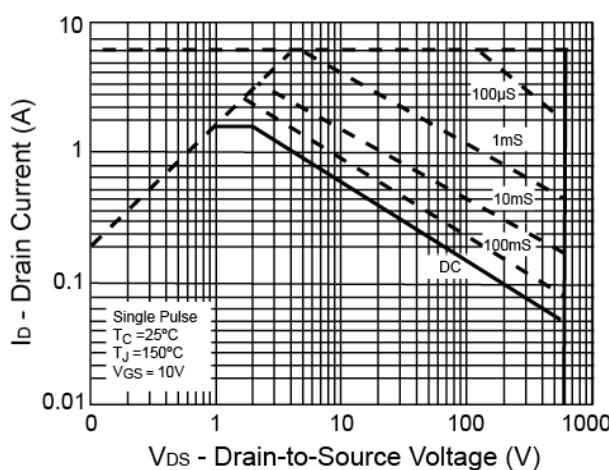
On-Resistance vs. Gate-Source Voltage

$I_D = 0.6A$

Threshold Voltage

$I_D = 250\mu A$
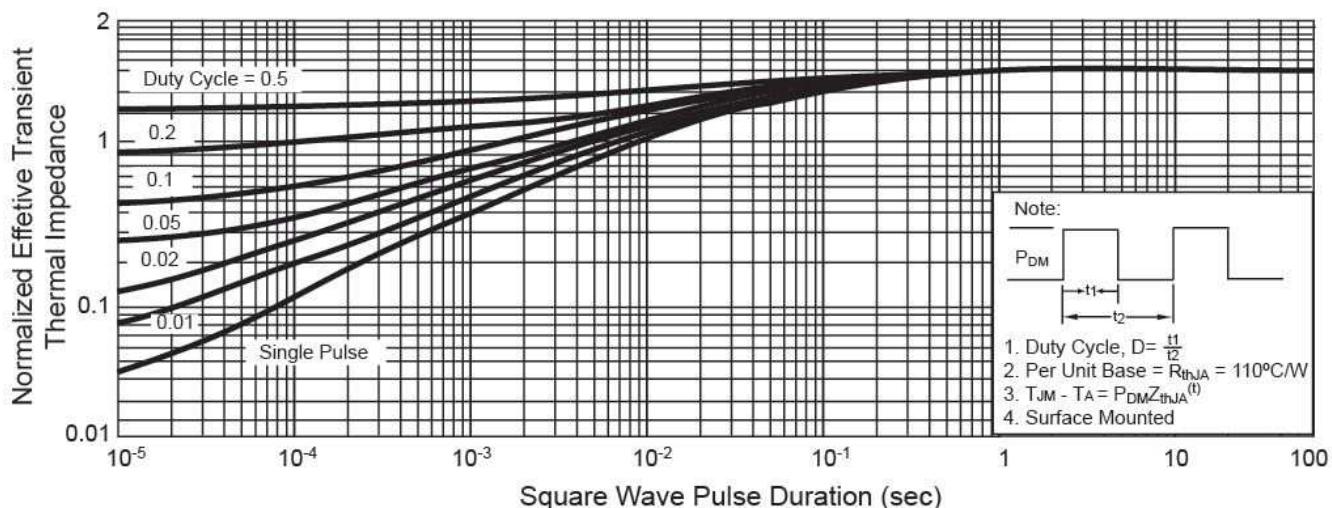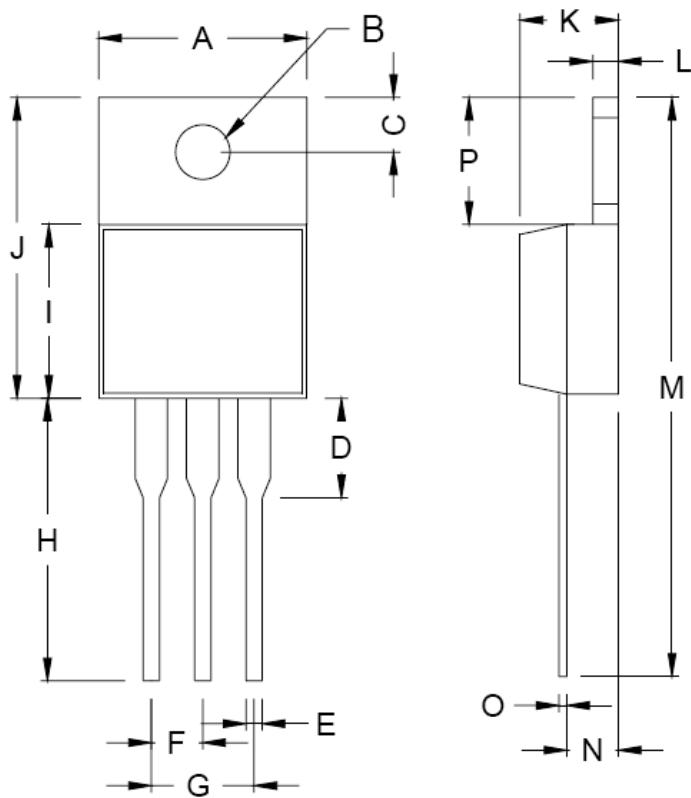
Maximum Safe Operating Area

Single Pulse
$T_C = 25^{o}C$
$T_J = 150^{o}C$
$V_{GS} = 10V$

100µS
1mS
10mS
100mS
DC

Normalized Thermal Transient Impedance, Junction-to-Ambient

Duty Cycle = 0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse

Note:

P_{DM}

t1
t2

1. Duty Cycle, D= $\frac{t1}{t2}$
2. Per Unit Base = R_{thJA} = 110°C/W
3. T_{JM} - T_A = $P_{DM}Z_{thJA}^{(t)}$
4. Surface Mounted
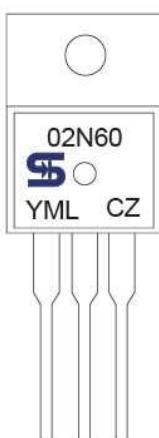
TO-220 Mechanical Drawing

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.000	10.500	0.394	0.413
B	3.740	3.910	0.147	0.154
C	2.440	2.940	0.096	0.116
D	-	6.350	-	0.250
E	0.381	1.106	0.015	0.040
F	2.345	2.715	0.092	0.058
G	4.690	5.430	0.092	0.107
H	12.700	14.732	0.500	0.581
J	14.224	16.510	0.560	0.650
K	3.556	4.826	0.140	0.190
L	0.508	1.397	0.020	0.055
M	27.700	29.620	1.060	1.230
N	2.032	2.921	0.080	0.115
O	0.255	0.610	0.010	0.024
P	5.842	6.858	0.230	0.270
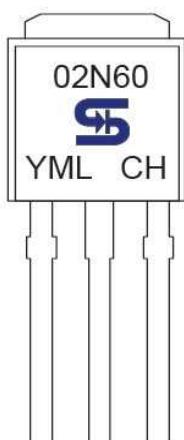
TO-220 DIMENSION

Marking Diagram

Y = Year Code

M = Month Code

   (**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug,
    I=Sep, **J**=Oct, **K**=Nov, **L**=Dec)

L = Lot Code

TO-251 Mechanical Drawing
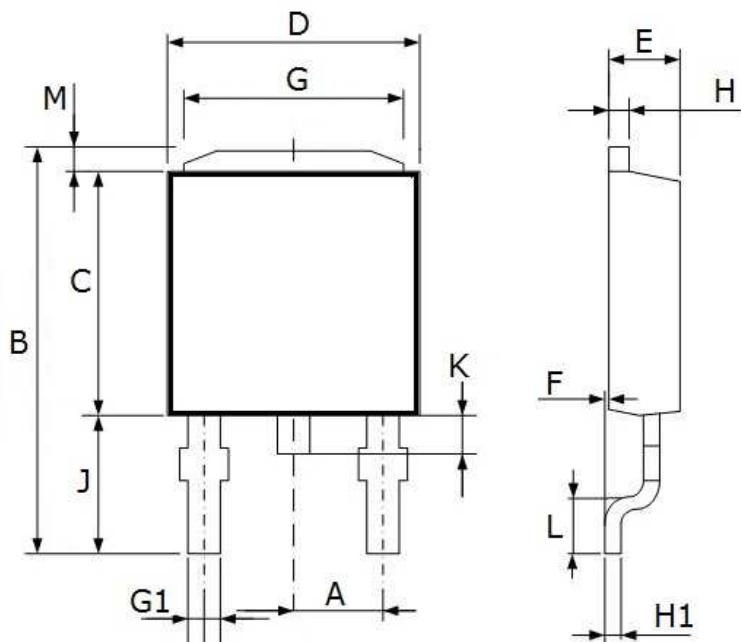
TO-251 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.10	2.50	0.083	0.098
b	0.65	1.05	0.026	0.041
b1	0.58	0.62	0.023	0.024
b2	4.80	5.20	0.189	0.205
b3	0.68	0.72	0.027	0.028
C	0.35	0.65	0.014	0.026
C1	0.40	0.60	0.016	0.024
D	5.30	5.70	0.209	0.224
E	6.30	6.70	0.248	0.264
e	2.30 BSC		0.09 BSC	
L	7.00	8.00	0.276	0.315
L1	1.40	1.80	0.055	0.071
L2	1.30	1.70	0.051	0.067
L3	0.50	0.90	0.020	0.035

Marking Diagram
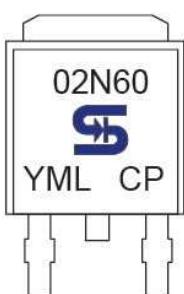
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**L** = Lot Code

TO-252 Mechanical Drawing

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.30 BSC		0.090 BSC	
B	10.20	10.80	0.402	0.425
C	5.30	5.70	0.209	0.224
D	6.30	6.70	0.248	0.264
E	2.10	2.50	0.083	0.098
F	0.00	0.20	0.000	0.008
G	4.80	5.20	0.189	0.205
G1	0.40	0.80	0.016	0.031
H	0.40	0.60	0.016	0.024
H1	0.35	0.65	0.014	0.026
J	3.35	3.65	0.132	0.144
K	0.50	1.10	0.020	0.043
L	0.90	1.50	0.035	0.059
M	1.30	1.70	0.051	0.067

TO-252 DIMENSION

Marking Diagram

02N60

YML CP

Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug,
I=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code

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