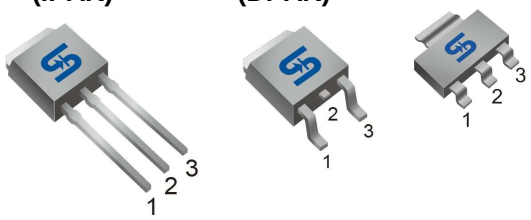
TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TSM1NB60

600V N-Channel Power MOSFET

TO-251 (IPAK) **TO-252 (DPAK)** **SOT-223**



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

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$(Ω)	I_D (A)
600	10 @ V_{GS} =10V	0.5

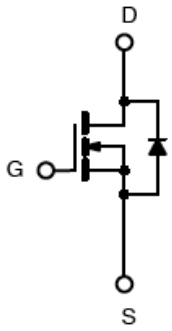
General Description

The TSM1NB60 N-Channel Power MOSFET is produced by new advance planar process. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

Features

- Low $R_{DS(ON)}$ 8Ω (Typ.)
- Low gate charge typical @ 6.1nC (Typ.)
- Low Crss typical @ 4.2pF (Typ.)

Block Diagram



N-Channel MOSFET

Ordering Information

Part No.	Package	Packing
TSM1NB60CH C5G	TO-251	75pcs / Tube
TSM1NB60CP ROG	TO-252	2.5Kpcs / 13” Reel
TSM1NB60CW RPG	SOT-223	2.5Kpcs / 13” Reel

Note: “G” denotes for Halogen Free

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

Parameter		Symbol	Limit			Unit
			IPAK	DPAK	SOT-223	
Drain-Source Voltage		V_{DS}	600			V
Gate-Source Voltage		V_{GS}	±30			V
Continuous Drain Current	Tc = 25ºC	I_D	1			A
	Tc = 100ºC		0.7			A
Pulsed Drain Current *		I_{DM}	4			A
Single Pulse Avalanche Energy (Note 2)		E_{AS}	5			mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5			V/ns
Total Power Dissipation @ T_C = 25°C		P_{TOT}	39	39	2.1	W
Operating Junction Temperature		T_J	150			ºC
Storage Temperature Range		T_{STG}	-55 to +150			°C

Note: Limited by maximum junction temperature

Thermal Performance

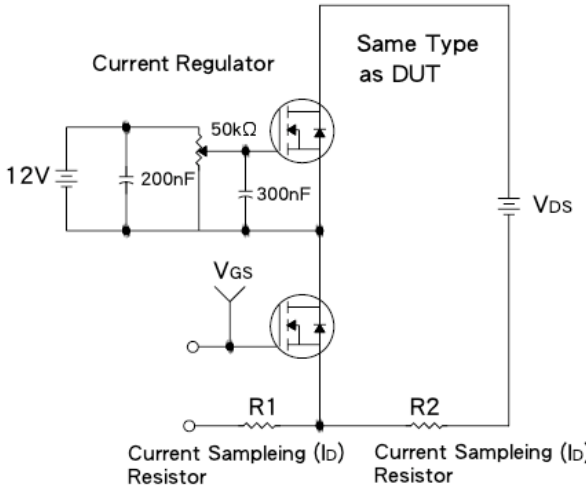
Parameter	Symbol	Limit			Unit
		IPAK	DPAK	SOT-223	
Thermal Resistance - Junction to Case	$R\Theta_{JC}$	2.87	2.87	--	°C/W
Thermal Resistance - Junction to Ambient	$R\Theta_{JA}$	110	110	60	°C/W

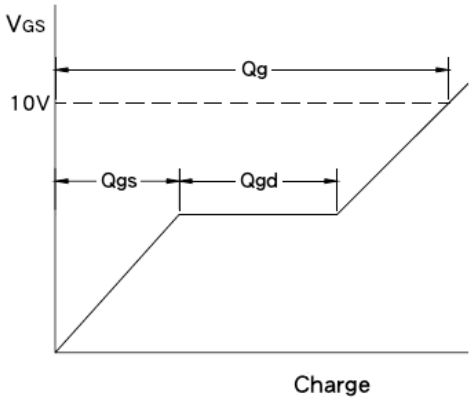
Electrical Specifications (Ta = 25°C unless otherwise noted)

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 = 0.5A	$R_{DS(ON)}$	--	8	10	Ω
Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250uA	$V_{GS(TH)}$	2.5	3.5	4.5	V
Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0V	I_{DSS}	--	--	10	uA
Gate Body Leakage	V_{GS} = ±30V, V_{DS} = 0V	I_{GSS}	--	--	±100	nA
Forward Transfer Conductance	V_{DS} = 10V, I_D = 0.5A	g_{fs}	--	0.8	--	S
Dynamic						
Total Gate Charge	V_{DS} = 480V, I_D = 1A, V_{GS} = 10V (Note 4,5)	Q_g	--	6.1	--	nC
Gate-Source Charge		Q_{gs}	--	1.4	--	
Gate-Drain Charge		Q_{gd}	--	3.3	--	
Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	C_{iss}	--	138	--	pF
Output Capacitance		C_{oss}	--	17.1	--	
Reverse Transfer Capacitance		C_{rss}	--	4.2	--	
Switching						
Turn-On Delay Time	V_{GS} = 10V, I_D = 1A, V_{DD} = 300V, R_G =25Ω (Note 4,5)	$t_{d(on)}$	--	7.7	--	nS
Turn-On Rise Time		t_r	--	6.8	--	
Turn-Off Delay Time		$t_{d(off)}$	--	15.3	--	
Turn-Off Fall Time		t_f	--	14.9	--	
Source-Drain Diode Ratings and Characteristic						
Source Current	Integral reverse diode in the MOSFET	I_S	--	--	1	A
Source Current (Pulse)		I_{SM}	--	--	4	A
Diode Forward Voltage	I_S = 1A, V_{GS} = 0V	V_{SD}	--	0.9	1.4	V

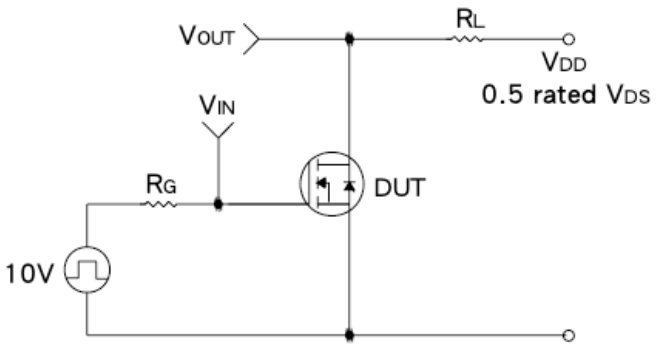
Note 1: Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
Note 2: V_{DD} = 50V, I_{AS}=1A, L=10mH, R_G =25Ω, Starting T_J=25ºC
Note 3: I_{SD}≤1A, di/dt≤200A/uS, V_{DD}≤BV_{DSS}, Starting T_J=25ºC
Note 4: Pulse test: pulse width ≤300uS, duty cycle ≤2%
Note 5: Essentially Independent of Operating Temperature

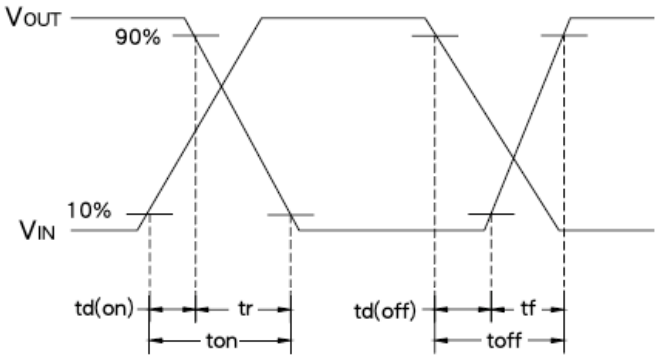
Gate Charge Test Circuit & Waveform



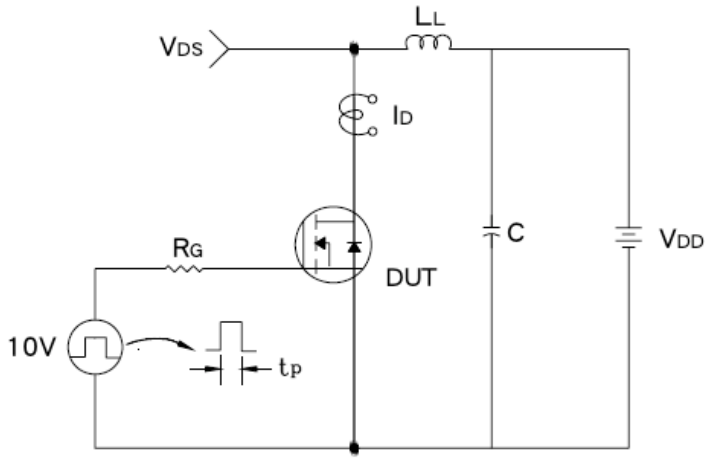


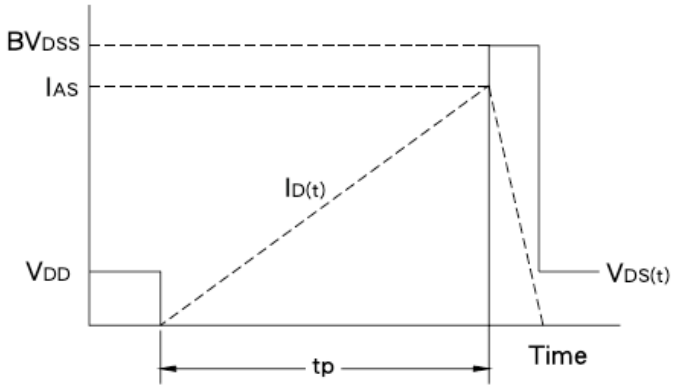
Resistive Switching Test Circuit & Waveform



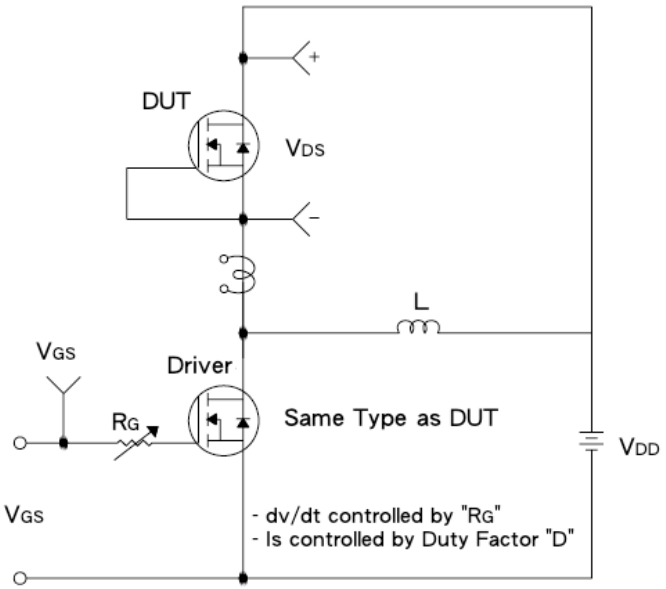


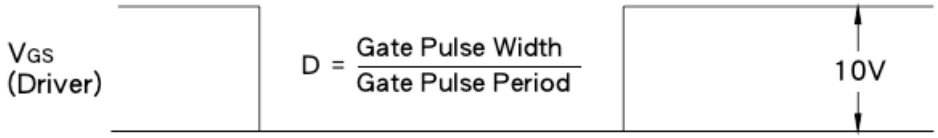
E_{AS} Test Circuit & Waveform

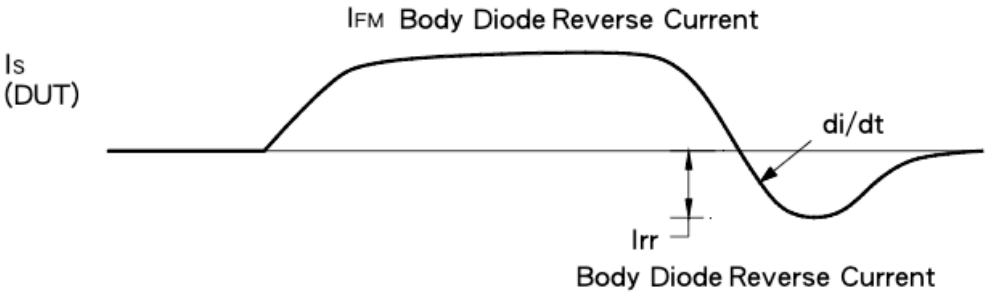


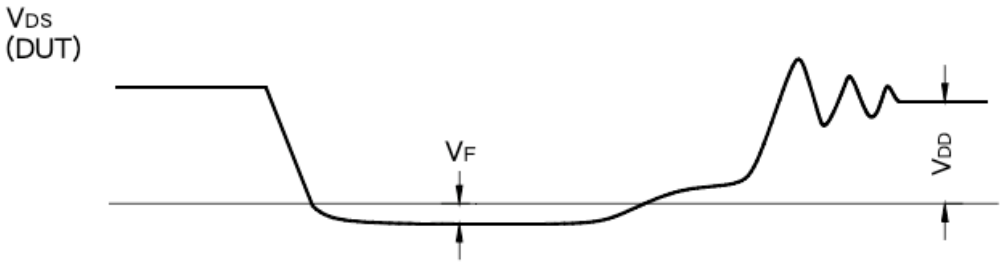


Diode Reverse Recovery Time Test Circuit & Waveform

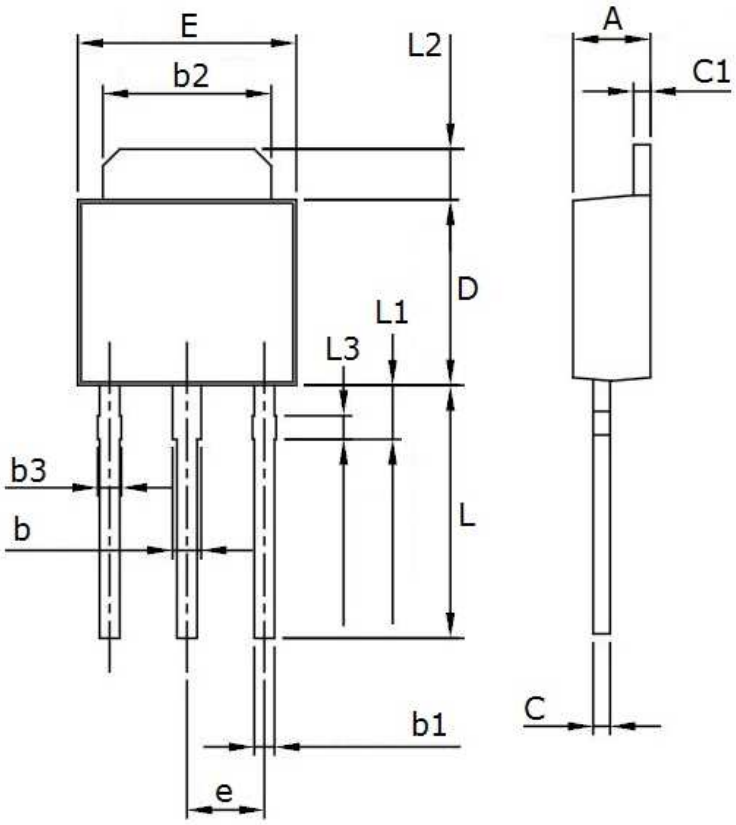






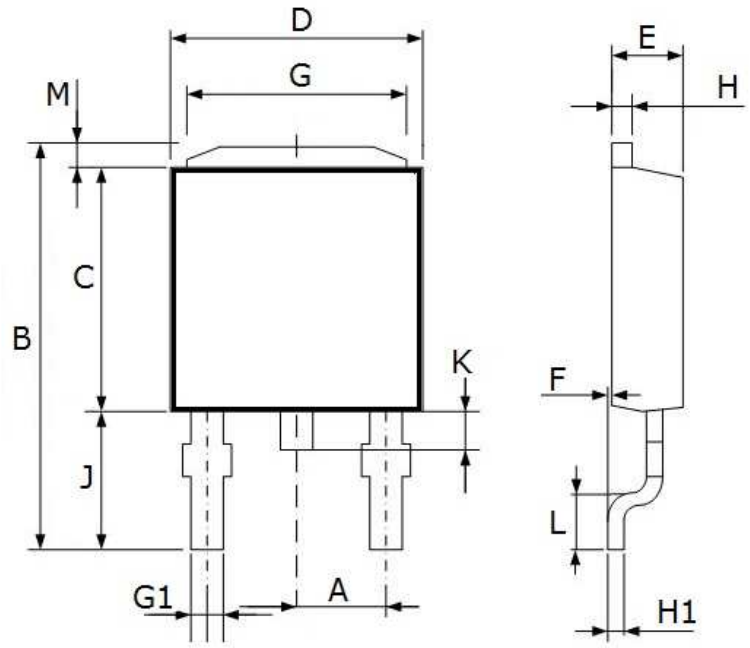


TO-251 Mechanical Drawing



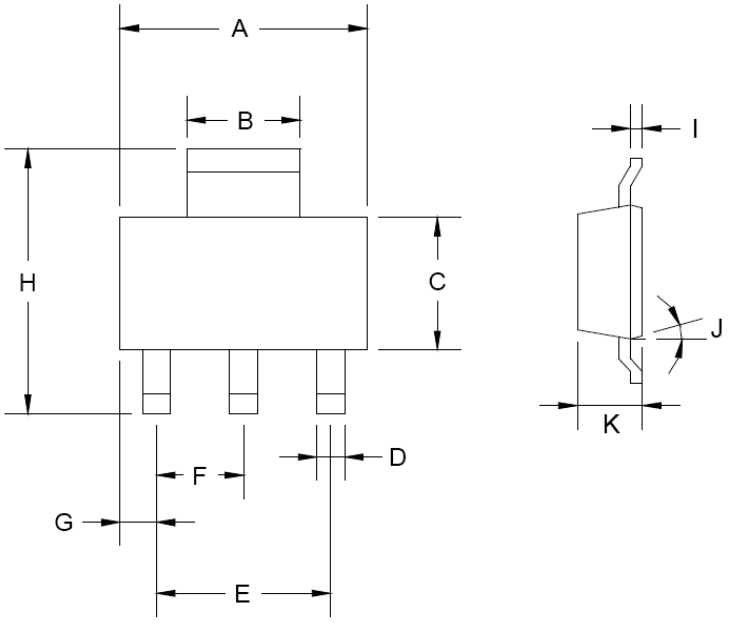
TO-251 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.10	2.50	0.083	0.098
b	0.65	1.05	0.026	0.041
b1	0.58	0.62	0.023	0.024
b2	4.80	5.20	0.189	0.205
b3	0.68	0.72	0.027	0.028
C	0.35	0.65	0.014	0.026
C1	0.40	0.60	0.016	0.024
D	5.30	5.70	0.209	0.224
E	6.30	6.70	0.248	0.264
e	2.30 BSC		0.09 BSC	
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

TO-252 Mechanical Drawing



TO-252 DIMENSION				
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

SOT-223 Mechanical Drawing



SOT-223 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.350	6.850	0.250	0.270
B	2.900	3.100	0.114	0.122
C	3.450	3.750	0.136	0.148
D	0.595	0.635	0.023	0.025
E	4.550	4.650	0.179	0.183
F	2.250	2.350	0.088	0.093
G	0.835	1.035	0.032	0.041
H	6.700	7.300	0.263	0.287
I	0.250	0.355	0.010	0.014
J	10°	16°	10°	16°
K	1.550	1.800	0.061	0.071

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