TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TSM1N60L

600V N-Channel Power MOSFET

TO-252

TO-251

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

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$(Ω)	I_D (A)
600	12 @ V_{GS}=10V	1

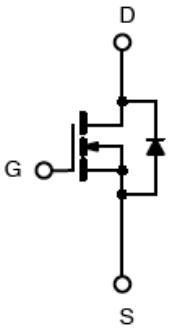
General Description

The TSM1N60L 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.
- I_{DSS} and $V_{DS(on)}$ specified at elevated temperature

Block Diagram



N-Channel MOSFET

Ordering Information

Part No.	Package	Packing
TSM1N60LCP RO	TO-252	2.5Kpcs / 13” Reel
TSM1N60LCH C5	TO-251	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	1	A
Pulsed Drain Current	I_{DM}	4	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 @T_C=25°C	P_{DTOT}	30	W
Peak Diode Recovery Voltage Slope	dv/dt	3	V/ns
Operating Junction Temperature	T_J	+150	°C
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C

Notes:
1. Pulse width limited by safe operating area
2. ISD≤1A, di/dt≤100A/us, VDD≤BV_{DSS}, T_J<=T_{JMAX}

Thermal Performance

Parameter	Symbol	Limit	Unit
Lead Temperature (1/8" from case)	T_L	10	S
Thermal Resistance – Junction to Case	$R\Theta_{JC}$	4.16	°C/W
Thermal Resistance - Junction to Ambient	$R\Theta_{JA}$	100	°C/W

Notes: Surface mounted on FR4 board of 1 in^2, 2oz Cu, t ≤ 10sec

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

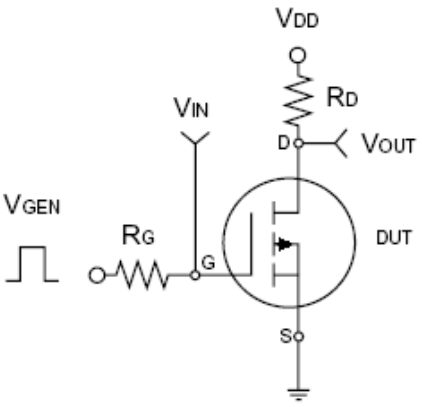
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250uA	BV_{DSS}	600	--	--	V
Drain-Source On-State Resistance	V_{GS} = 10V, I_D = 0.6A	$R_{DS(ON)}$	--	10.5	12	Ω
Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250uA	$V_{GS(TH)}$	2.0	--	4.0	V
Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0V	I_{DSS}	--	--	10	uA
Gate Body Leakage	V_{GS} = ±20V, V_{DS} = 0V	I_{GSS}	--	--	± 100	nA
Forward Transconductance	V_{DS} ≧50V, I_D = 0.5A	g_{fs}	--	10	--	S
Diode Forward Voltage	I_S = 1A, V_{GS} = 0V	V_{SD}	--	--	1.5	V
Dynamic [b]						
Total Gate Charge	V_{DS} = 400V, I_D = 1A, V_{GS} = 10V	Q_g	--	8.5	14	nC
Gate-Source Charge		Q_{gs}	--	1.8	--	
Gate-Drain Charge		Q_{gd}	--	4	--	
Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	C_{iss}	--	210	--	pF
Output Capacitance		C_{oss}	--	28	--	
Reverse Transfer Capacitance		C_{rss}	--	4.2	--	
Switching [b,c]						
Turn-On Delay Time	V_{GS} = 10V, I_D = 1A, V_{DS} = 300V, R_G = 6Ω	$t_{d(on)}$	--	8	--	nS
Turn-On Rise Time		t_r	--	21	--	
Turn-Off Delay Time		$t_{d(off)}$	--	18	--	
Turn-Off Fall Time		t_f	--	24	--	

Notes:

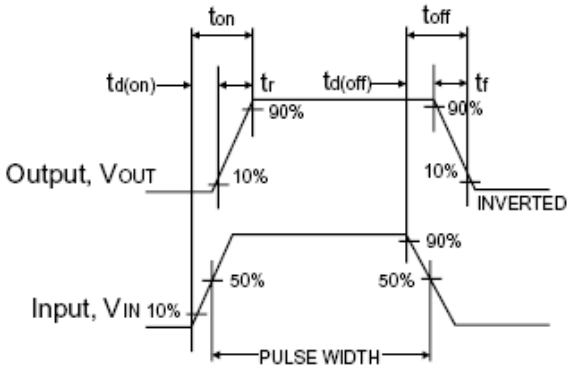
a. Pulse test: pulse width <=300uS, duty cycle <=2%

b. For design reference only, not subject to production testing.

c. Switching time is essentially independent of operating temperature.



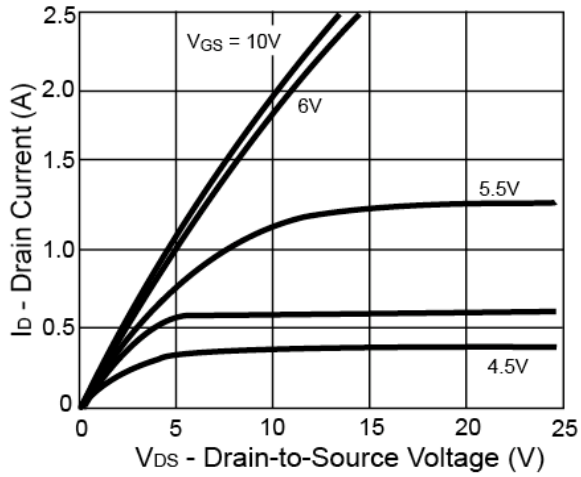
Switching Test Circuit



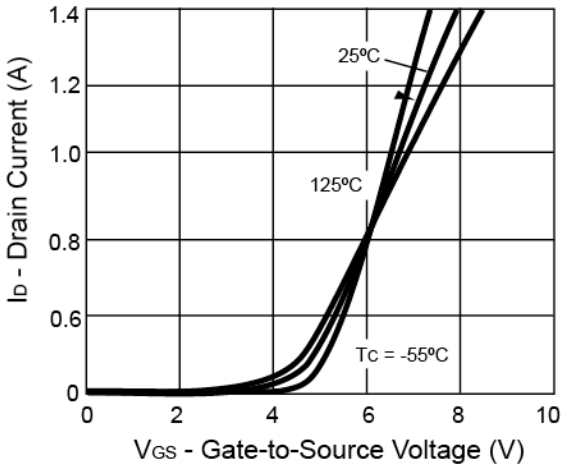
Switchin Waveforms

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

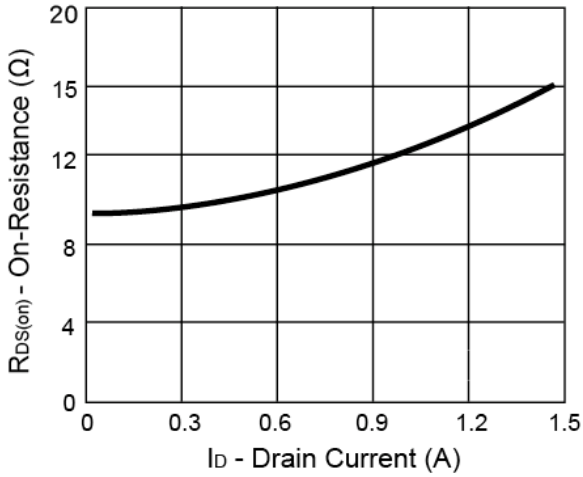
Output Characteristics



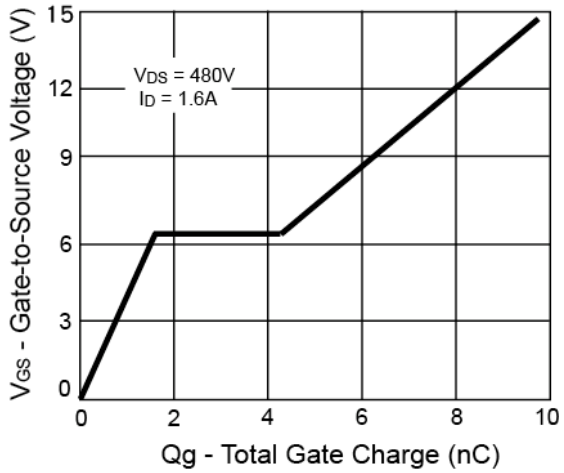
Transfer Characteristics



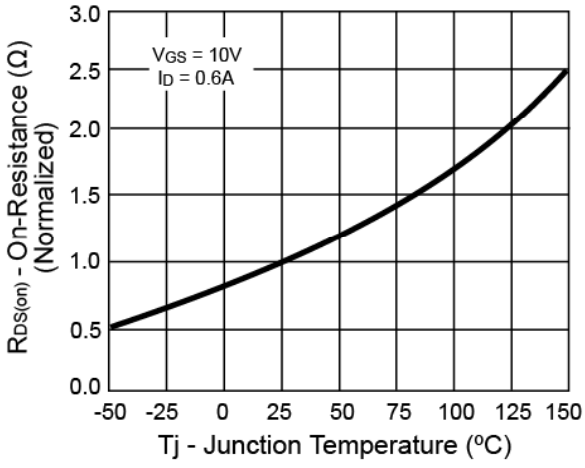
On-Resistance vs. Drain Current



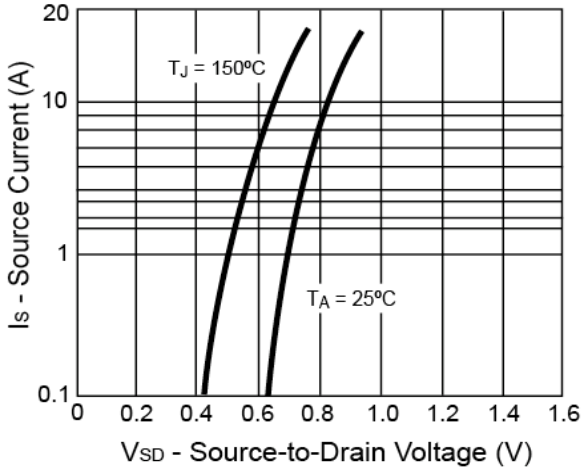
Gate Charge



On-Resistance vs. Junction Temperature

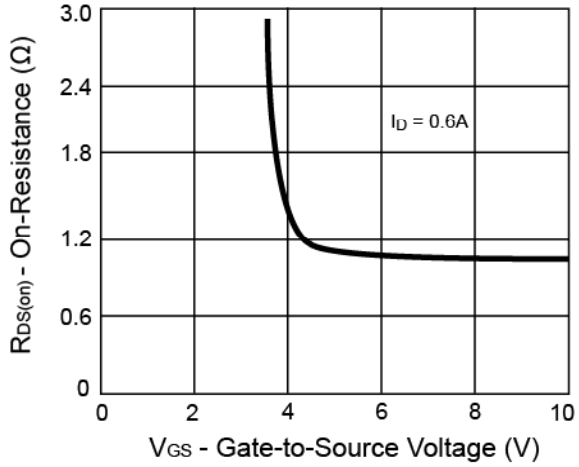


Source-Drain Diode Forward Voltage

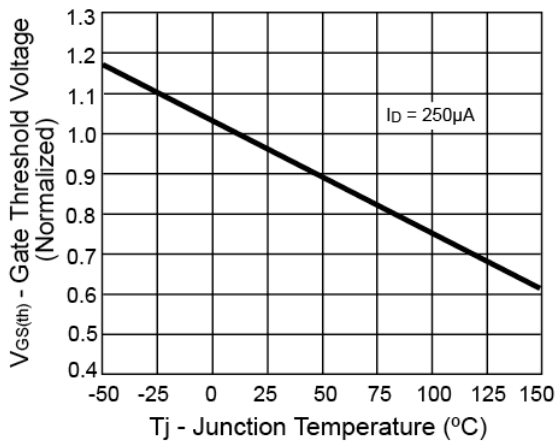


Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

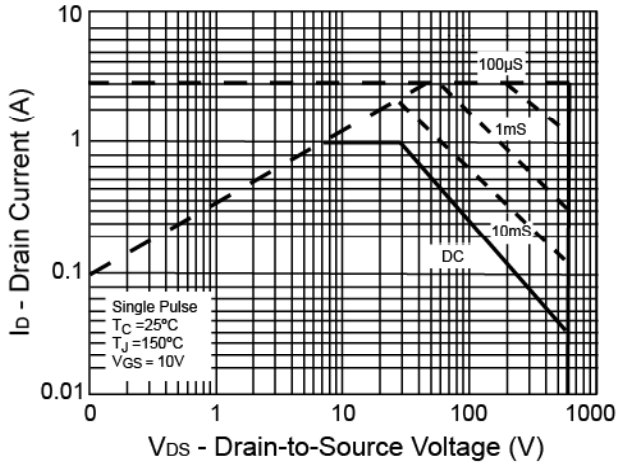
On-Resistance vs. Gate-Source Voltage



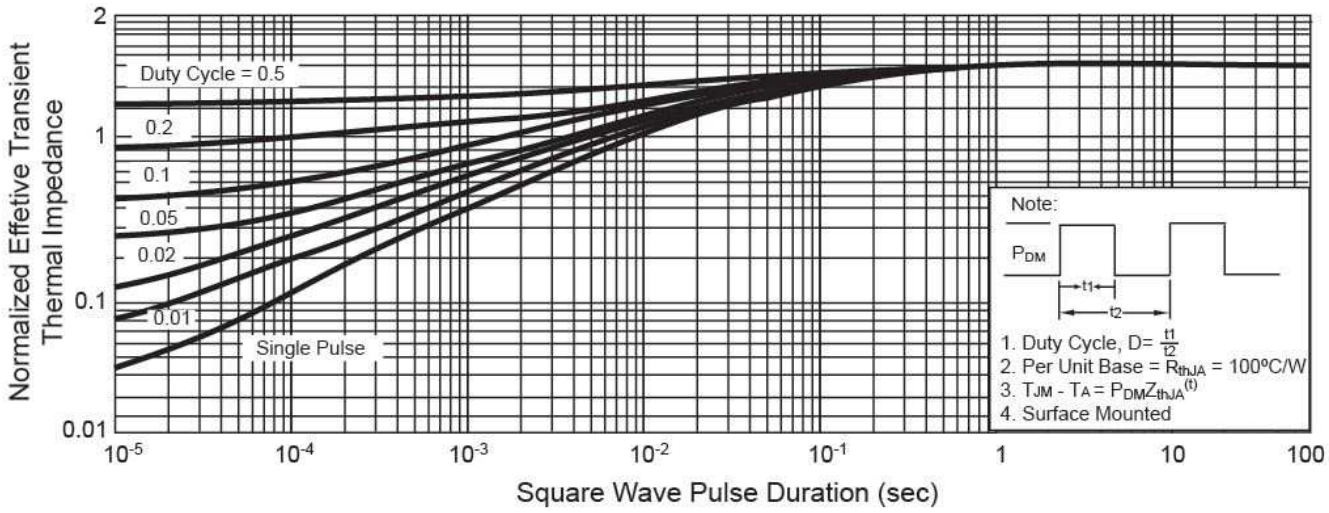
Threshold Voltage



Maximum Safe Operating Area



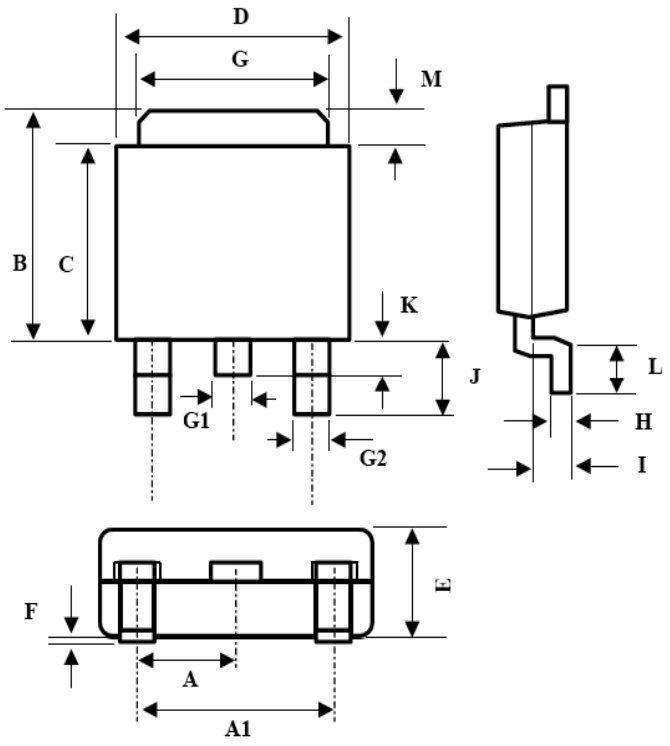
Normalized Thermal Transient Impedance, Junction-to-Ambient



TSM1N60L

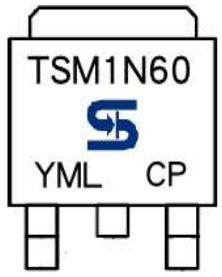
600V N-Channel Power MOSFET

TO-252 Mechanical Drawing



TO-252 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.290 BSC		0.090 BSC	
A1	4.600 BSC		0.180 BSC	
B	7.000	7.200	0.275	0.283
C	6.000	6.200	0.236	0.244
D	6.400	6.604	0.252	0.260
E	2.210	2.387	0.087	0.094
F	0.010	0.127	0.000	0.005
G	5.232	5.436	0.206	0.214
G1	0.666	0.889	0.026	0.035
G2	0.633	0.889	0.025	0.035
H	0.508 REF		0.020 REF	
I	0.900	1.500	0.035	0.059
J	2.743 REF		0.108 REF	
K	0.660	0.940	0.026	0.037
L	1.397	1.651	0.055	0.065
M	1.100 REF		0.043 REF	

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)
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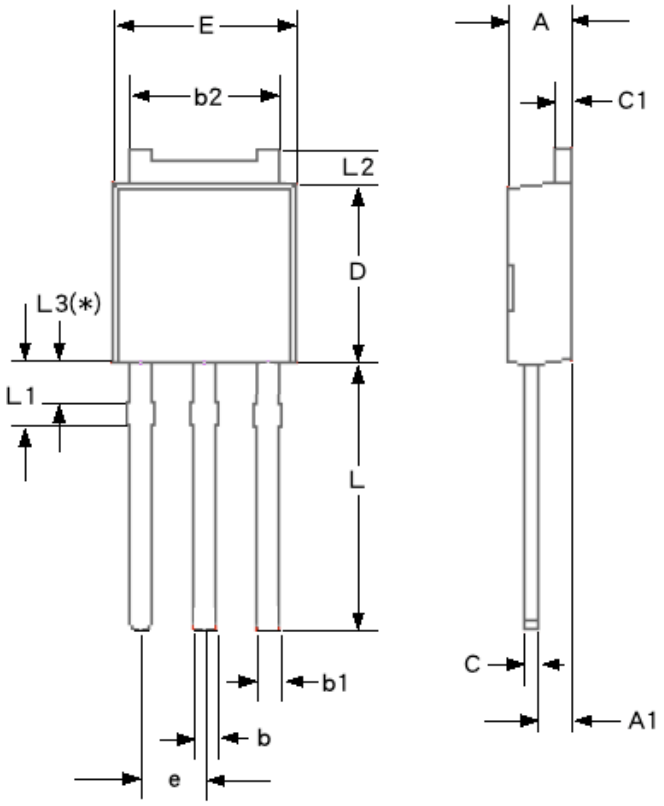
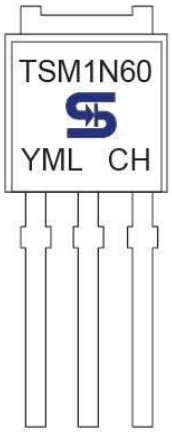
TO-251 Mechanical Drawing



TO-251 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.190	2.380	0.0862	0.0937
A1	0.890	1.140	0.0350	0.0449
b	0.640	0.890	0.0252	0.0350
b1	0.760	1.140	0.0299	0.0449
b2	5.210	5.460	0.2051	0.2150
C	0.460	0.580	0.0181	0.0228
C1	0.460	0.580	0.0181	0.0228
D	5.970	6.100	0.2350	0.2402
E	6.350	6.730	0.2500	0.2650
e	2.280 BSC		0.0898 BSC	
L	8.890	9.650	0.3500	0.3799
L1	1.910	2.280	0.0752	0.0898
L2	0.890	1.270	0.0350	0.0500
L3	1.150	1.520	0.0453	0.0598

Marking Diagram



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