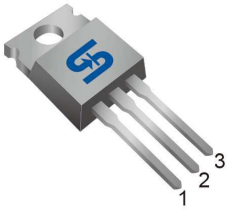
TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TSM4NB65

650V N-Channel Power MOSFET

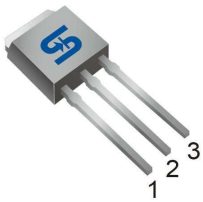
TO-220



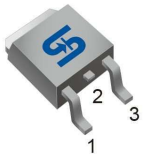
ITO-220

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

TO-251 (IPAK)



TO-252 (DPAK)



PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$(Ω)(max)	I_D (A)
650	3.37 @ V_{GS} =10V	4

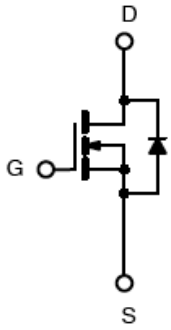
General Description

The TSM4NB60 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 $R_{DS(ON)}$ 2.7Ω (Typ.)
- Low gate charge typical @ 14.5nC (Typ.)
- Low Crss typical @ 7.0pF (Typ.)
- 100% Avalanche Tested

Block Diagram



N-Channel MOSFET

Ordering Information

Part No.	Package	Packing
TSM4NB65CH C5G	TO-251	75pcs / Tube
TSM4NB65CP ROG	TO-252	2.5Kpcs / 13” Reel
TSM4NB65CZ C0	TO-220	50pcs / Tube
TSM4NB65CI C0	ITO-220	50pcs / Tube

Note: “G” denotes for Halogen Free

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

Parameter		Symbol	Limit			Unit
			IPAK/DPAK	ITO-220	TO-220	
Drain-Source Voltage		V_{DS}	650			V
Gate-Source Voltage		V_{GS}	±30			V
Continuous Drain Current	Tc = 25ºC	I_D	4			A
	Tc = 100ºC		2.4			A
Pulsed Drain Current *		I_{DM}	16			A
Single Pulse Avalanche Energy (Note 2)		E_{AS}	31.2			mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5			V/ns
Total Power Dissipation @ T_C = 25°C		P_{TOT}	50	25	70	W
Operating Junction Temperature		T_J	150			ºC
Storage Temperature Range		T_{STG}	-55 to +150			°C

Note: Limited by maximum junction temperature

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Thermal Performance

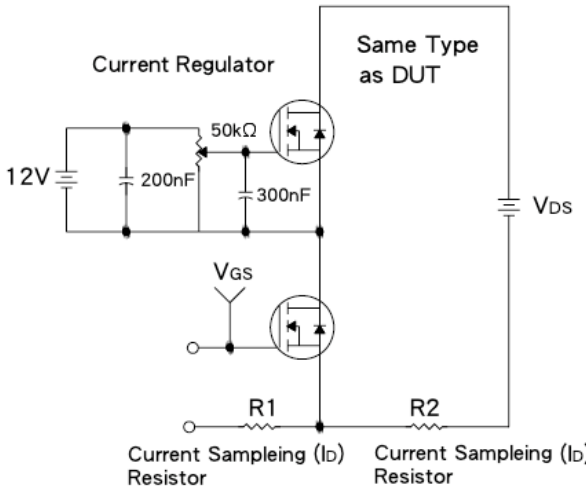
Parameter	Symbol	Limit			Unit
		IPAK/DPAK	ITO-220	TO-220	
Thermal Resistance - Junction to Case	$R\Theta_{JC}$	2.5	5	1.78	°C/W
Thermal Resistance - Junction to Ambient	$R\Theta_{JA}$	83	62.5	62.5	°C/W

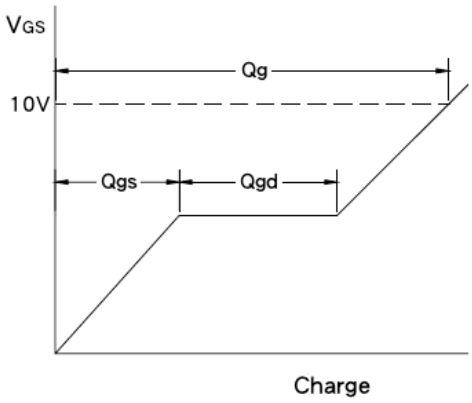
Electrical Specifications (Ta = 25°C unless otherwise noted)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250uA	BV_{DSS}	650	--	--	V
Drain-Source On-State Resistance	V_{GS} = 10V, I_D = 2A	$R_{DS(ON)}$	--	2.7	3.37	Ω
Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250uA	$V_{GS(TH)}$	2.5	3.6	4.5	V
Zero Gate Voltage Drain Current	V_{DS} = 650V, V_{GS} = 0V	I_{DSS}	--	--	1	uA
Gate Body Leakage	V_{GS} = ±30V, V_{DS} = 0V	I_{GSS}	--	--	±100	nA
Forward Transfer Conductance	V_{DS} = 40V, I_D = 2A	g_{fs}	--	2.6	--	S
Dynamic						
Total Gate Charge	V_{DS} = 480V, I_D = 4A, V_{GS} = 10V (Note 4,5)	Q_g	--	14.5	--	nC
Gate-Source Charge		Q_{gs}	--	3.4	--	
Gate-Drain Charge		Q_{gd}	--	7	--	
Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	C_{iss}	--	500	--	pF
Output Capacitance		C_{oss}	--	53.2	--	
Reverse Transfer Capacitance		C_{rss}	--	7	--	
Switching						
Turn-On Delay Time	V_{GS} = 10V, I_D = 4A, V_{DD} = 300V, R_G =25Ω (Note 4,5)	$t_{d(on)}$	--	11	--	nS
Turn-On Rise Time		t_r	--	20	--	
Turn-Off Delay Time		$t_{d(off)}$	--	30	--	
Turn-Off Fall Time		t_f	--	19	--	
Source-Drain Diode Ratings and Characteristic						
Source Current	Integral reverse diode in the MOSFET	I_S	--	--	4	A
Source Current (Pulse)		I_{SM}	--	--	16	A
Diode Forward Voltage	I_S = 4A, V_{GS} = 0V	V_{SD}	--	--	1.13	V
Reverse Recovery Time	V_{GS} = 0V, I_S =4A, dI_F/dt = 100A/us	t_{fr}	--	522	--	nS
Reverse Recovery Charge		Q_{fr}	--	1.6	--	uC

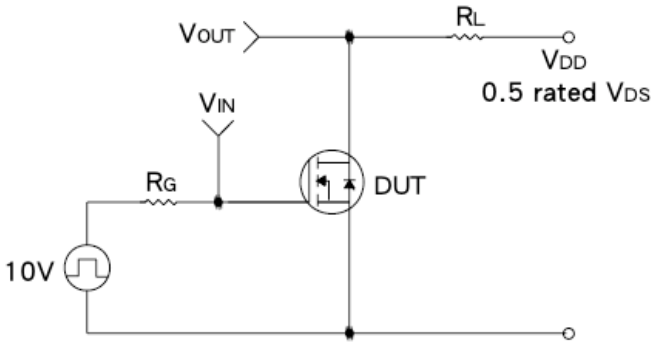
Note 1: Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
Note 2: V_{DD} = 50V, I_{AS}=2.4A, L=10mH, R_G =25Ω, Starting T_J=25ºC
Note 3: I_{SD}≤4A, di/dt≤200A/uS, V_{DD}≤BV_{DSS}, Starting T_J=25ºC
Note 4: Pulse test: pulse width ≤300uS, duty cycle ≤2%
Note 5: Essentially Independent of Operating Temperature

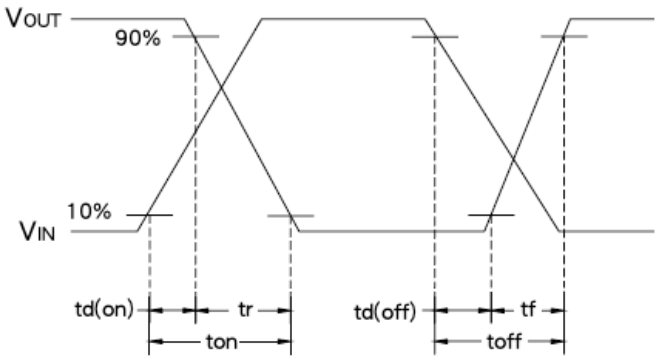
Gate Charge Test Circuit & Waveform



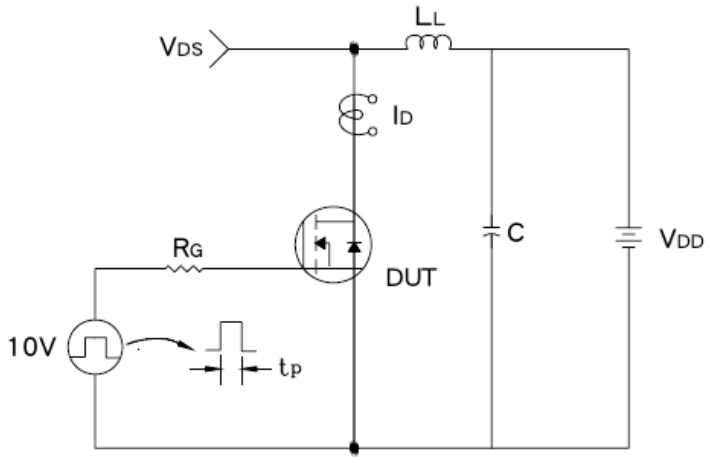


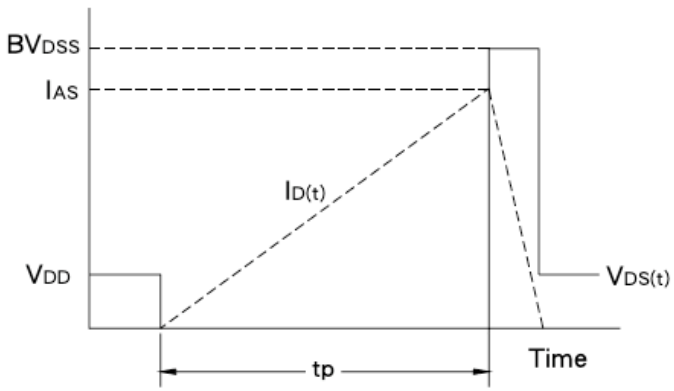
Resistive Switching Test Circuit & Waveform



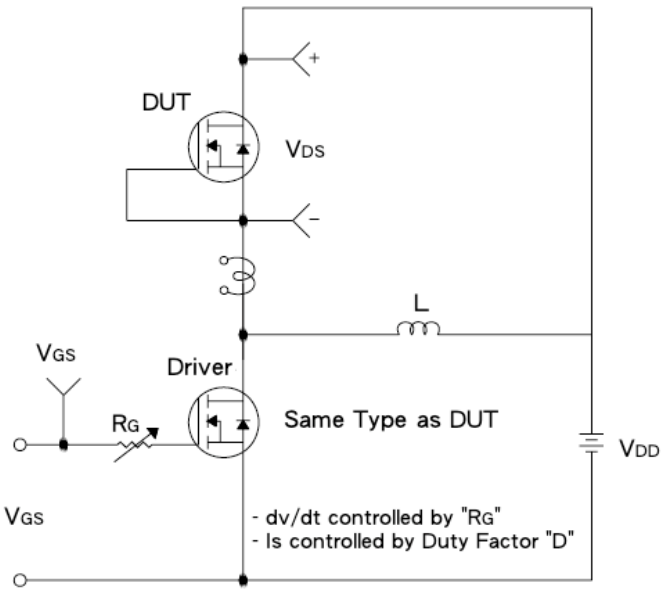


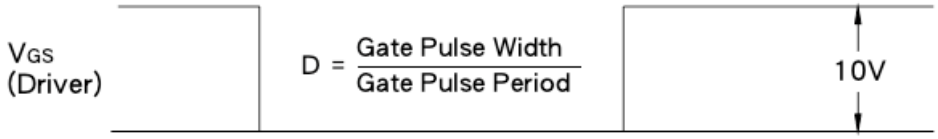
E_{AS} Test Circuit & Waveform

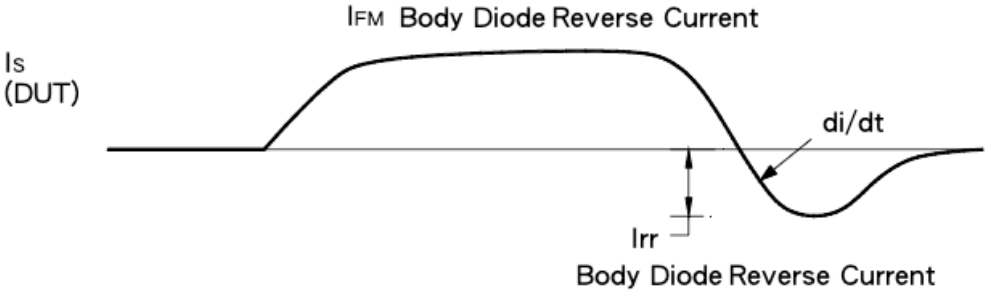


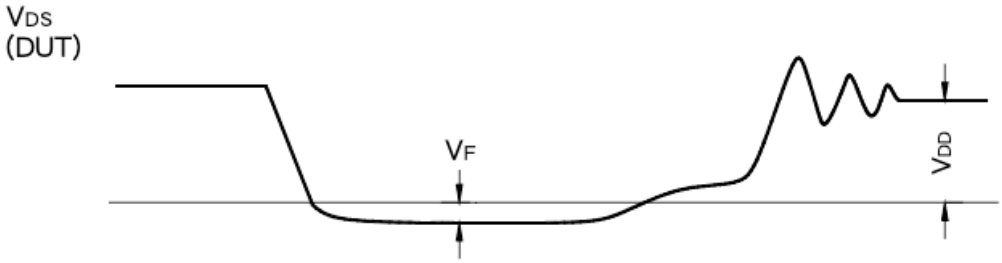


Diode Reverse Recovery Time Test Circuit & Waveform









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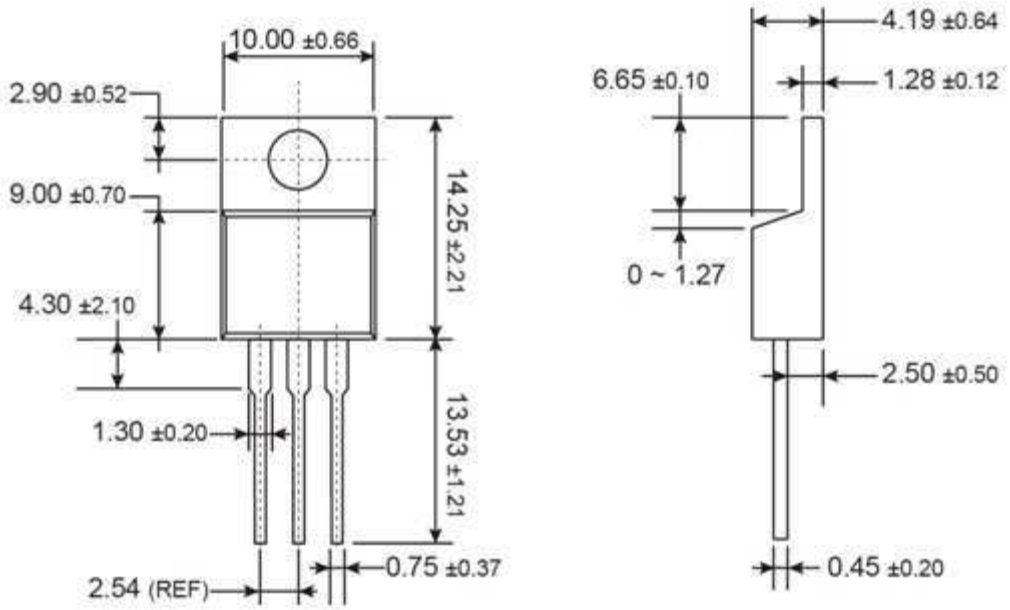
TO-220 Mechanical Drawing

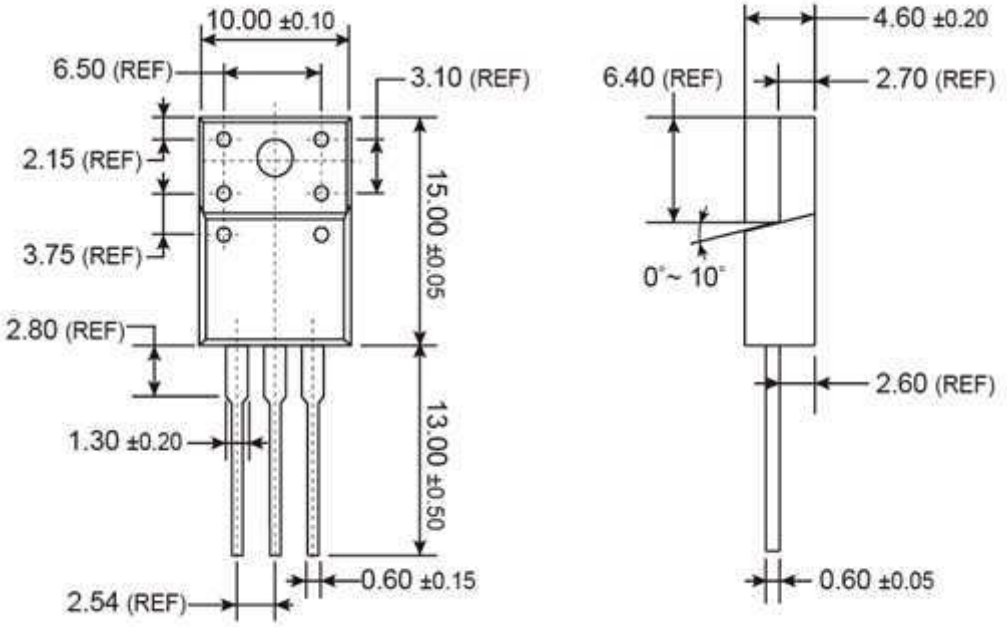


Unit: Millimeters

Marking Diagram

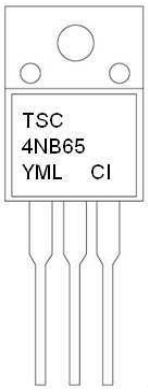
Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code

ITO-220 Mechanical Drawing



Unit: Millimeters

Marking Diagram



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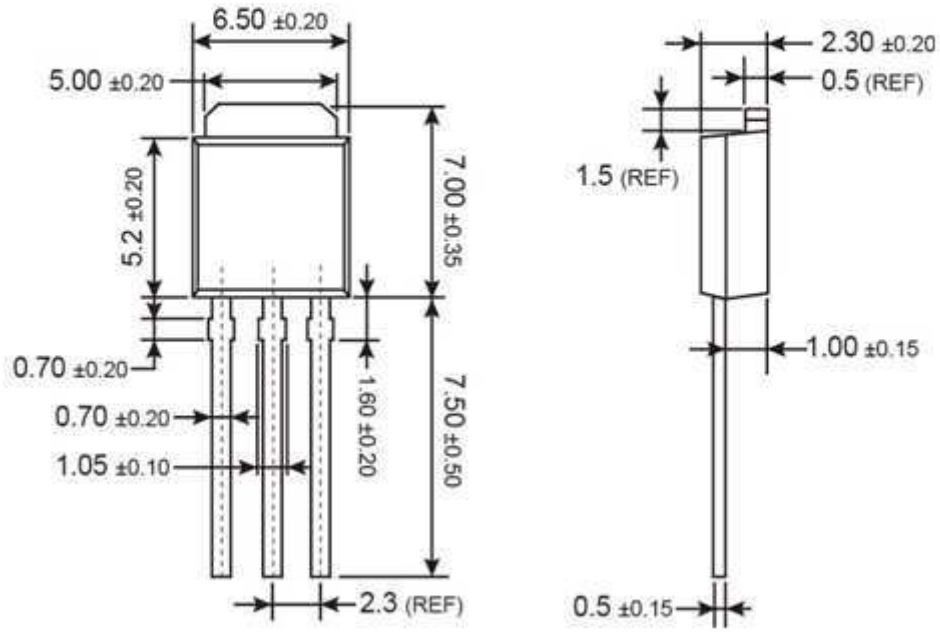
TO-251 Mechanical Drawing



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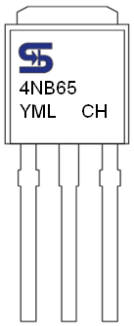

Y = Year Code
M = Month Code for Halogen Free Product
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apl, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct, **Y**=Nov, **Z**=Dec)
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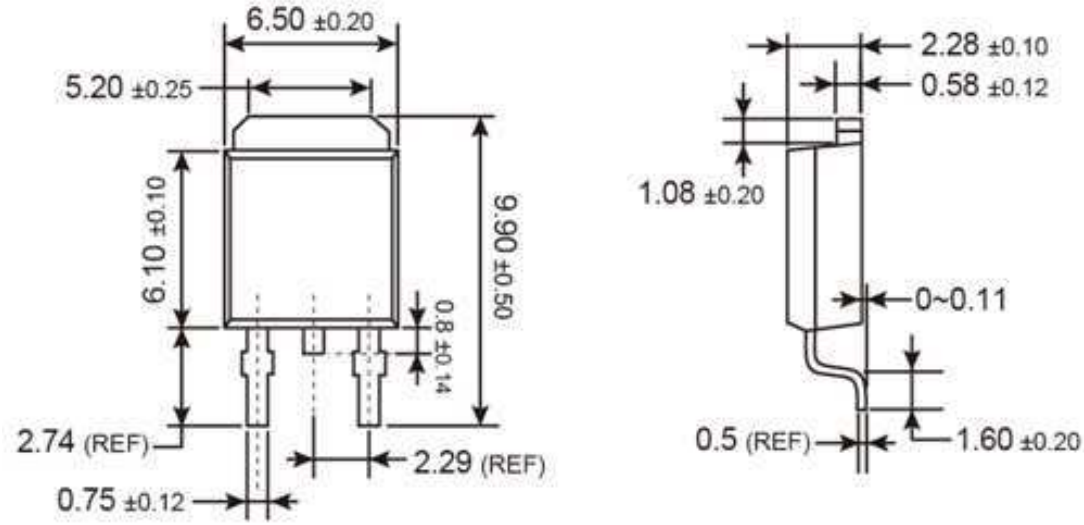
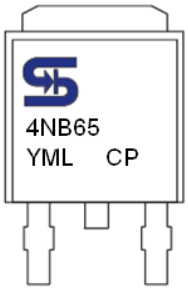
TO-252 Mechanical Drawing



Unit: Millimeters

Marking Diagram



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