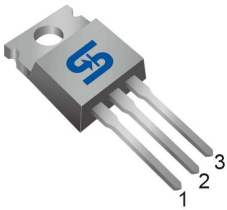


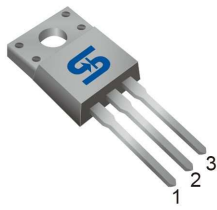
TSM4NB65

650V N-Channel Power MOSFET

TO-220



ITO-220



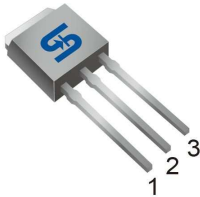
Pin Definition:

1. Gate
2. Drain
3. Source

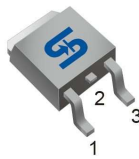
Key Parameter Performance

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on)}$ (max)	3.37	Ω
Q_g	13.46	nC

TO-251
(IPAK)



TO-252
(DPAK)



Application

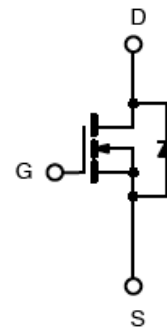
- Power Supply.
- Lighting

Ordering Information

Part No.	Package	Packing
TSM4NB65CZ C0G	TO-220	50pcs / Tube
TSM4NB65CI C0G	ITO-220	50pcs / Tube
TSM4NB65CH C5G	TO-251	75pcs / Tube
TSM4NB65CP ROG	TO-252	2.5kpcs / 13" Reel

Note: "G" denotes for Halogen- and Antimony-free as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds

Block Diagram



N-Channel MOSFET

Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$ 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 ^(Note 1)	I_D	4			A
		2.4			A
Pulsed Drain Current ^(Note 2)	I_{DM}	16			A
Single Pulse Avalanche Energy ^(Note 3)	E_{AS}	31.2			mJ
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	P_{TOT}	50	25	70	W
Operating Junction Temperature	T_J	-55 to +150			$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-55 to +150			$^\circ\text{C}$

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	$^{\circ}\text{C/W}$
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	83	62.5	62.5	$^{\circ}\text{C/W}$

Electrical Specifications ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

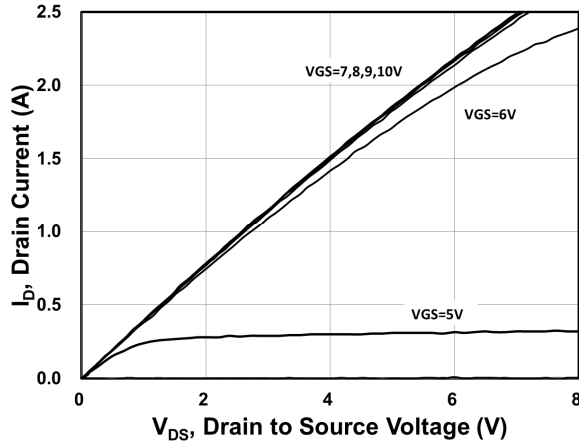
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	BV_{DSS}	650	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 2A$	$R_{DS(ON)}$	--	2.7	3.37	Ω
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	2.5	3.6	4.5	V
Zero Gate Voltage Drain Current	$V_{DS} = 650V, V_{GS} = 0V$	I_{DSS}	--	--	1	μA
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	I_{GSS}	--	--	± 100	nA
Forward Transfer Conductance	$V_{DS} = 40V, I_D = 2A$	g_{fs}	--	2.6	--	S
Dynamic (Note 5)						
Total Gate Charge	$V_{DS} = 480V, I_D = 4A,$ $V_{GS} = 10V$	Q_g	--	13.46	--	nC
Gate-Source Charge		Q_{gs}	--	2.98	--	
Gate-Drain Charge		Q_{gd}	--	6.66	--	
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$	C_{iss}	--	549	--	pF
Output Capacitance		C_{oss}	--	75	--	
Reverse Transfer Capacitance		C_{rss}	--	18	--	
Switching (Note 6)						
Turn-On Delay Time	$V_{GS} = 10V, I_D = 4A,$ $V_{DD} = 300V, R_G = 25\Omega$	$t_{d(on)}$	--	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 (Note 4)						
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

Notes:

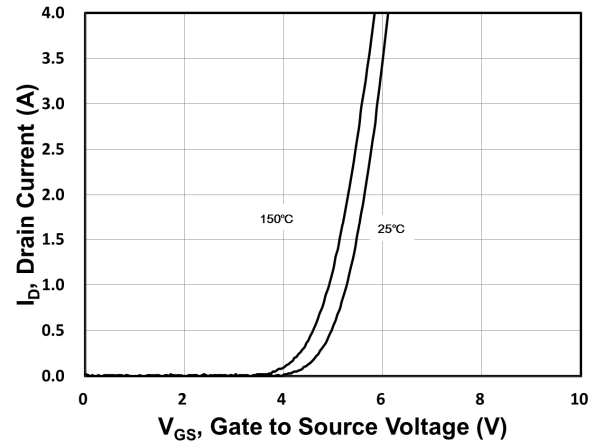
1. Current limited by package
2. Pulse width limited by the maximum junction temperature
3. $L = 10\text{mH}, I_{AS} = 2.4\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$
4. Pulse test: $PW \leq 300\mu\text{s}$, duty cycle $\leq 2\%$
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

Electrical Characteristics Curves

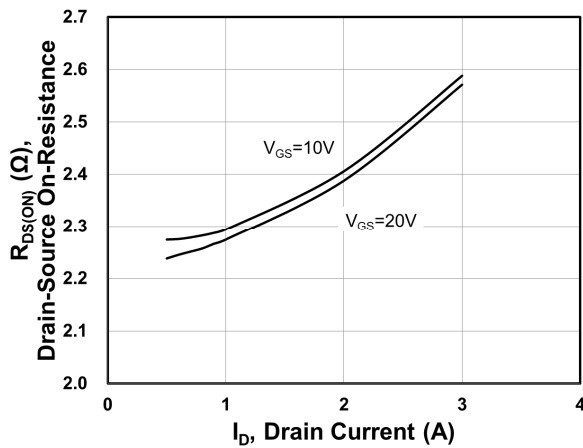
Output Characteristics



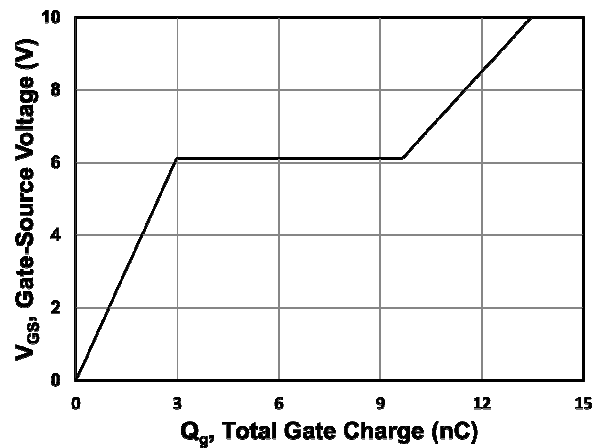
Transfer Characteristics



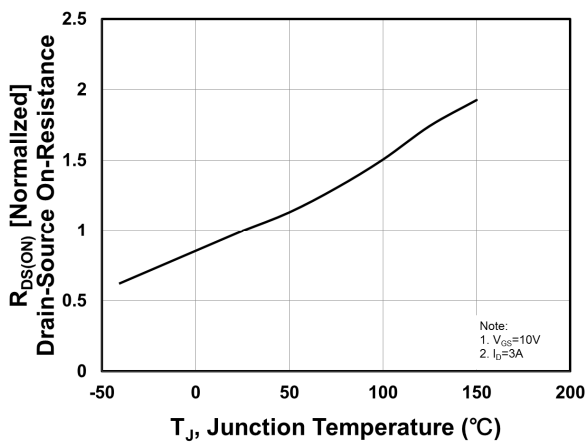
On-Resistance vs. Drain Current



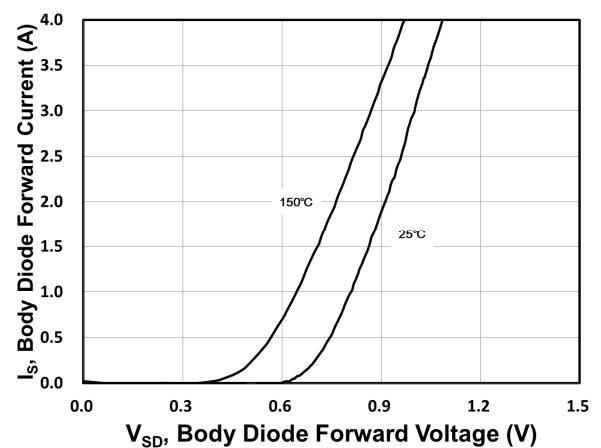
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature

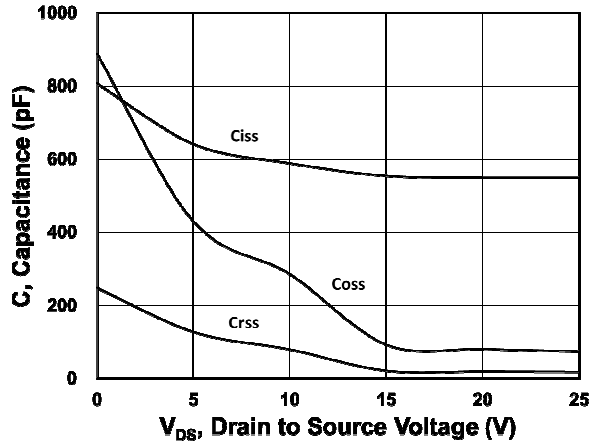


Source-Drain Diode Forward Current vs. Voltage

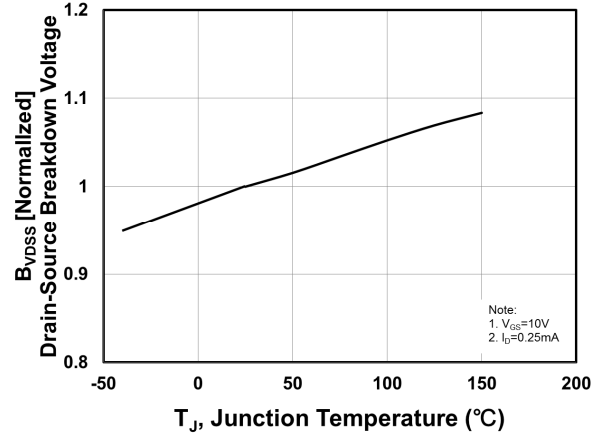


Electrical Characteristics Curves

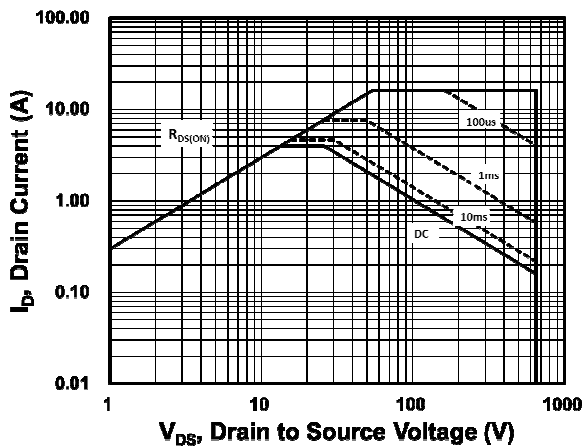
Capacitance vs. Drain-Source Voltage



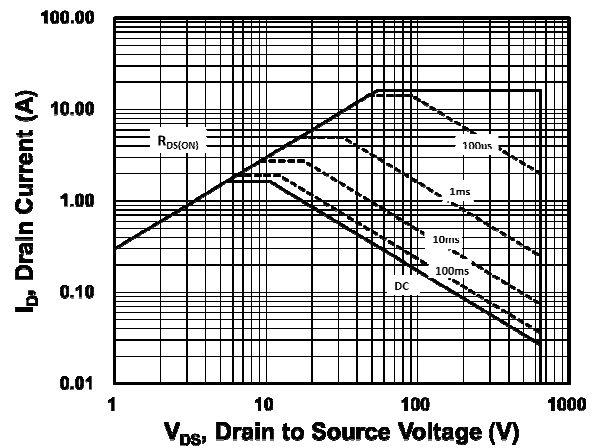
BV_{DSS} vs. Junction Temperature



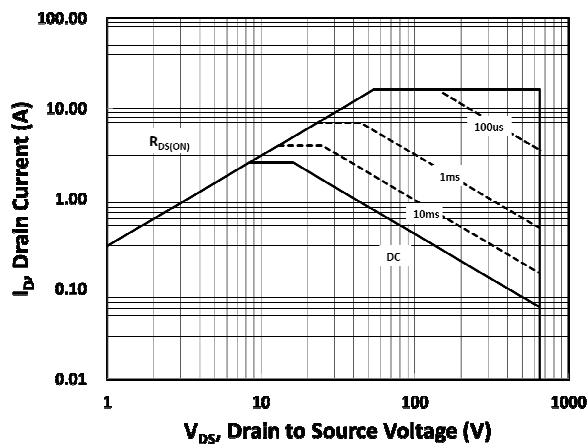
Maximum Safe Operating Area (TO-220)



Maximum Safe Operating Area (ITO-220)

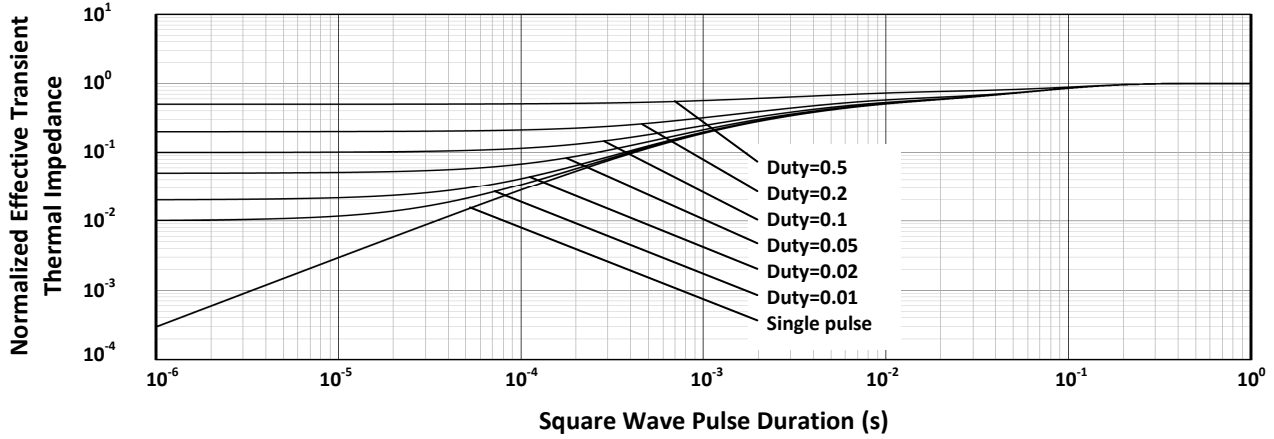


Maximum Safe Operating Area (DPAK/IPAK)

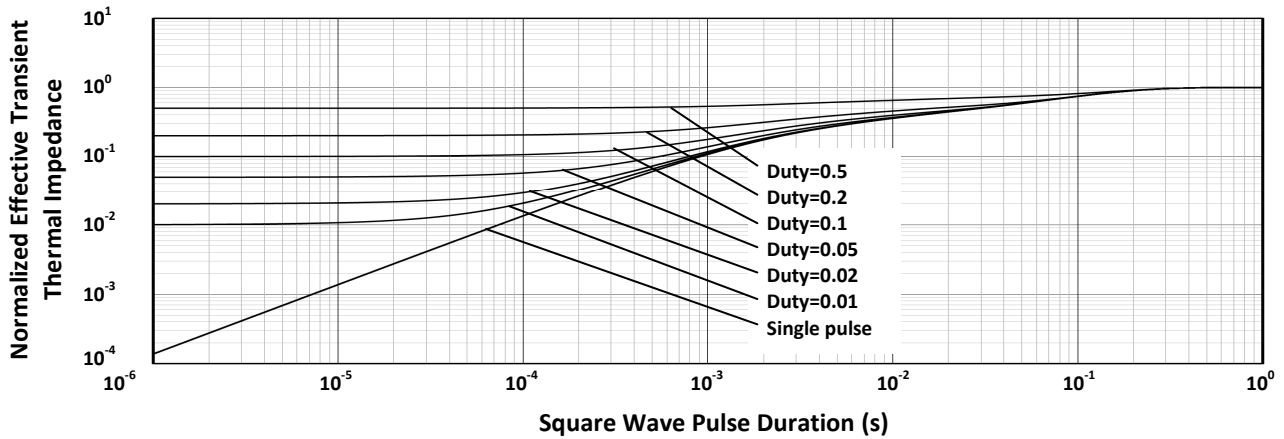


Electrical Characteristics Curves

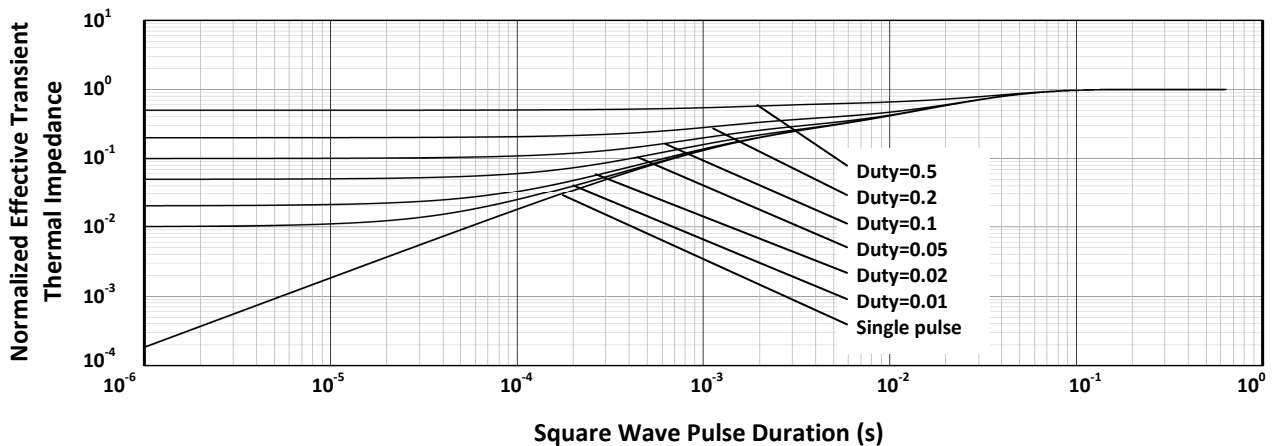
Normalized Thermal Transient Impedance, Junction-to-Case (TO-220)



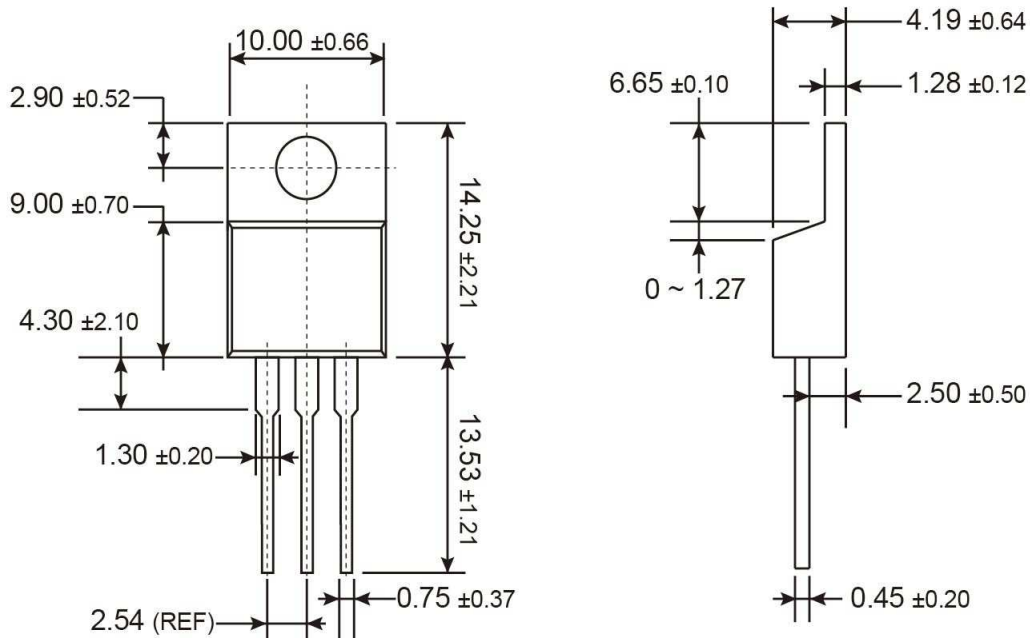
Normalized Thermal Transient Impedance, Junction-to-Case (ITO-220)



Normalized Thermal Transient Impedance, Junction-to-Case (DPAK/IPAK)

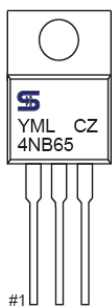


TO-220 Mechanical Drawing



Unit: Millimeters

Marking Diagram



Y = Year Code

M = Month Code for Halogen Free Product

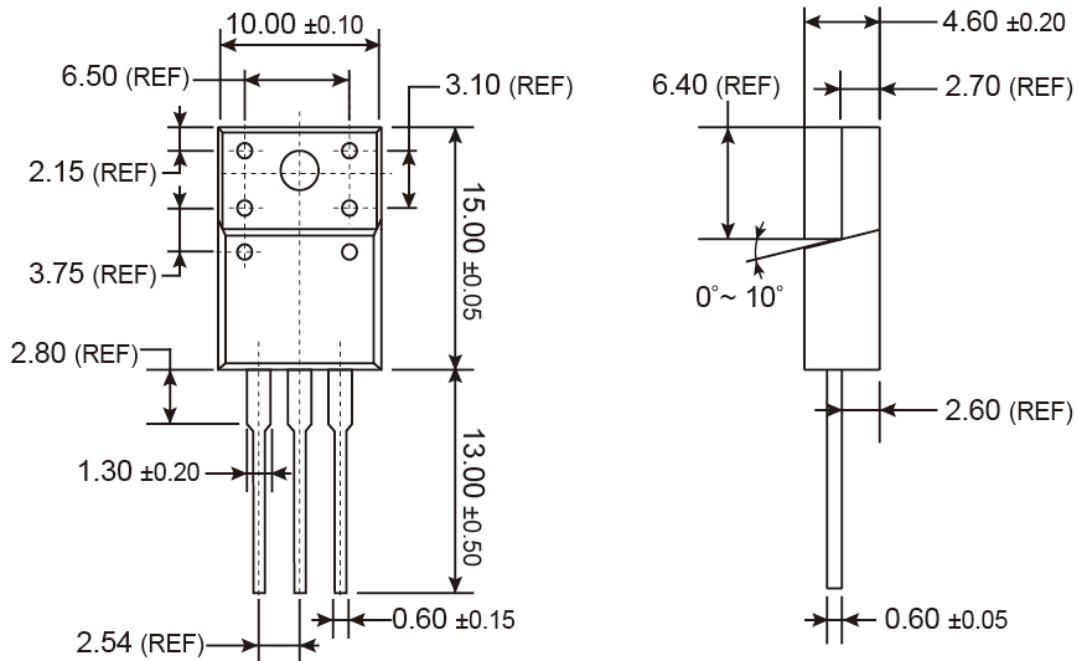
O =Jan **P** =Feb **Q** =Mar **R** =Apr

S =May **T** =Jun **U** =Jul **V** =Aug

W =Sep **X** =Oct **Y** =Nov **Z** =Dec

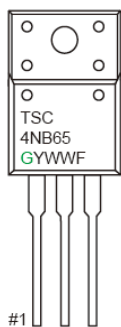
L = Lot Code

ITO-220 Mechanical Drawing



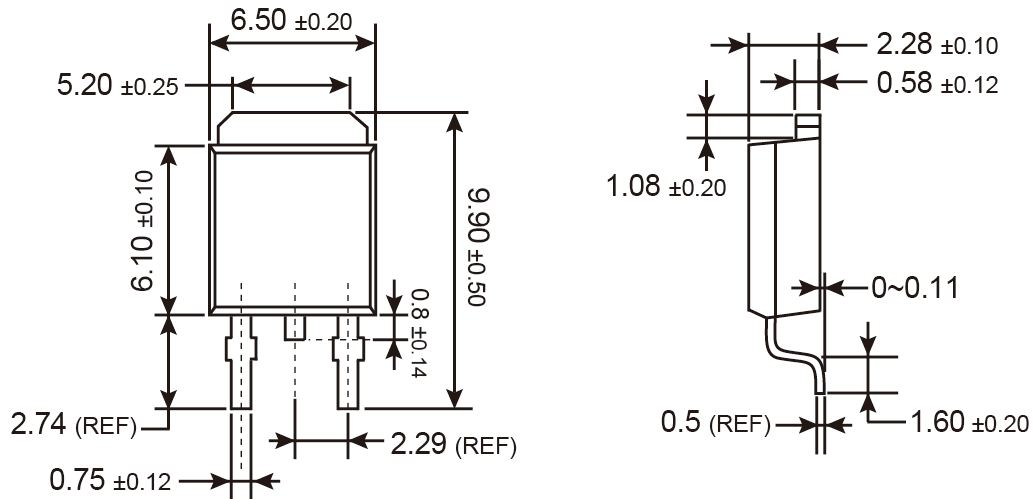
Unit: Millimeters

Marking Diagram



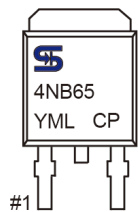
- G** = Halogen Free
- Y** = Year Code
- WW** = Week Code (01~52)
- F** = Factory Code

TO-252 (DPAK) Mechanical Drawing



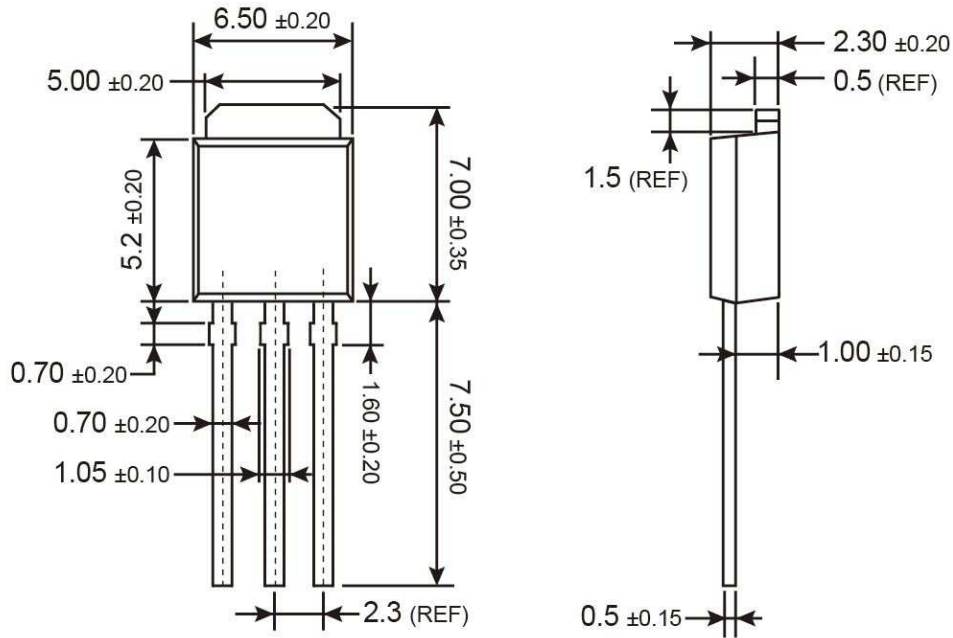
Unit: Millimeters

Marking Diagram



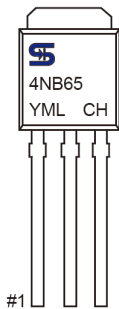
Y = Year Code
M = Month Code for Halogen Free Product
O =Jan **P** =Feb **Q** =Mar **R** =Apr
S =May **T** =Jun **U** =Jul **V** =Aug
W =Sep **X** =Oct **Y** =Nov **Z** =Dec
L = Lot Code

TO-251 (IPAK) Mechanical Drawing



Unit: Millimeters

Marking Diagram



Y = Year Code
M = Month Code for Halogen Free Product
O = Jan P = Feb Q = Mar R = Apr
S = May T = Jun U = Jul V = Aug
W = Sep X = Oct Y = Nov Z = Dec
L = Lot Code

TSM4NB65

650V N-Channel Power MOSFET

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