

N-Channel Power MOSFET

600V, 2A, 4.4Ω

FEATURES

- Advanced planar process
- 100% avalanche tested
- Pb-free plating
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

KEY PERFORMANCE PARAMETERS

PARAMETER	VALUE	UNIT
V_{DS}	600	V
$R_{DS(on)}$ (max)	4.4	Ω
Q_g	9.4	nC

APPLICATION

- Power Supply
- Lighting



Notes: MSL 3 (Moisture Sensitivity Level) per J-STD-020

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	LIMIT			UNIT
		IPAK/DPAK	ITO-220	TO-220	
Drain-Source Voltage	V_{DS}	600			V
Gate-Source Voltage	V_{GS}	±30			V
Continuous Drain Current ^(Note 1)	I_D	$T_C = 25^\circ\text{C}$			A
		$T_C = 100^\circ\text{C}$			
Pulsed Drain Current ^(Note 2)	I_{DM}	8			A
Single Pulsed Avalanche Energy ^(Note 3)	E_{AS}	55			mJ
Single Pulsed Avalanche Current ^(Note 3)	I_{AS}	2			A
Repetitive Avalanche Energy ^(Note 2)	E_{AR}	4.4			mJ
Peak Diode Recovery dv/dt ^(Note 4)	dv/dt	4.5			V/ns
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_{D(TOT)}$	44	25	70	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	- 55 to +150			°C

THERMAL PERFORMANCE

PARAMETER	SYMBOL	LIMIT			UNIT
		IPAK/DPAK	ITO-220	TO-220	
Junction to Case Thermal Resistance	$R_{\theta JC}$	2.87	5	1.78	$^{\circ}\text{C/W}$
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	110	62.5	62.5	$^{\circ}\text{C/W}$

Notes: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistances. The case thermal reference is defined at the solder mounting surface of the drain pins. $R_{\theta JA}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design. $R_{\theta JA}$ shown below for single device operation on FR-4 PCB in still air

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

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static (Note 5)						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	BV_{DSS}	600	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	2.5	3.6	4.5	V
Gate Body Leakage	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	I_{GSS}	--	--	± 100	nA
Zero Gate Voltage Drain Current	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$	I_{DSS}	--	--	10	μA
Drain-Source On-State Resistance	$V_{GS} = 10\text{V}, I_D = 1\text{A}$	$R_{DS(ON)}$	--	3.9	4.4	Ω
Forward Transfer Conductance	$V_{DS} = 40\text{V}, I_D = 1\text{A}$	g_{fs}	--	1.5	--	S
Dynamic (Note 6)						
Total Gate Charge	$V_{DS} = 480\text{V}, I_D = 2\text{A},$ $V_{GS} = 10\text{V}$	Q_g	--	9.4	--	nC
Gate-Source Charge		Q_{gs}	--	2.2	--	
Gate-Drain Charge		Q_{gd}	--	4.7	--	
Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$	C_{iss}	--	249	--	pF
Output Capacitance		C_{oss}	--	30.7	--	
Reverse Transfer Capacitance		C_{rss}	--	5	--	
Gate Resistance	$F = 1\text{MHz}, \text{open drain}$	R_g	--	8.5	--	Ω
Switching (Note 7)						
Turn-On Delay Time	$V_{GS} = 10\text{V}, I_D = 2\text{A},$ $V_{DD} = 300\text{V}, R_G = 25\Omega$	$t_{d(on)}$	--	9.1	--	ns
Turn-On Rise Time		t_r	--	9.8	--	
Turn-Off Delay Time		$t_{d(off)}$	--	17.4	--	
Turn-Off Fall Time		t_f	--	12.4	--	

ELECTRICAL SPECIFICATIONS ($T_A = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Source-Drain Diode (Note 5)						
Diode Forward Voltage	$I_S = 2\text{A}, V_{GS} = 0\text{V}$	V_{SD}	--	0.9	1.4	V
Reverse Recovery Time	$V_{GS} = 0\text{V}, I_S = 2\text{A},$ $dI_F/dt = 100\text{A}/\mu\text{s}$	t_{rr}	--	490	--	ns
Reverse Recovery Charge		Q_{rr}	--	0.8	--	μC
Source Current	Integral reverse diode in the MOSFET	I_S	--	--	2	A
Source Current (Pulse)		I_{SM}	--	--	8	A

Notes:

1. Current limited by package.
2. Pulse width limited by the maximum junction temperature.
3. $L = 25\text{mH}, I_{AS} = 2\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$.
4. $I_{SD} \leq 2\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$.
5. Pulse test: $PW \leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
6. For DESIGN AID ONLY, not subject to production testing.
7. Switching time is essentially independent of operating temperature.

TSM2NB60C1
 TSM2NB60CZ
 Not Recommended

ORDERING INFORMATION

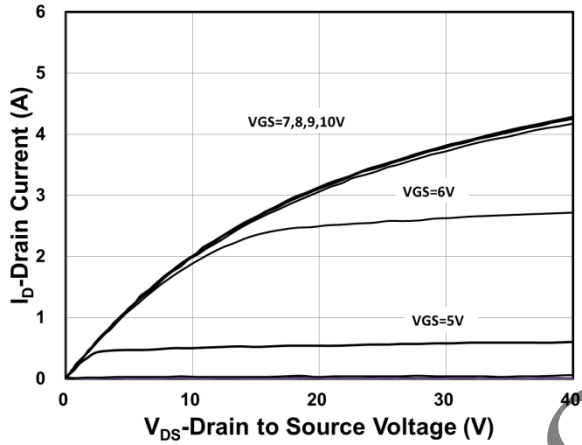
PART NO.	PACKAGE	PACKING
TSM2NB60CZ C0G	TO-220	50pcs / Tube
TSM2NB60CI C0G	ITO-220	50pcs / Tube
TSM2NB60CH C5G	TO-251 (IPAK)	75pcs / Tube
TSM2NB60CP ROG	TO-252 (DPAK)	2,500pcs / 13" Reel

TSM2NB60CI
TSM2NB60CZ
Not Recommended

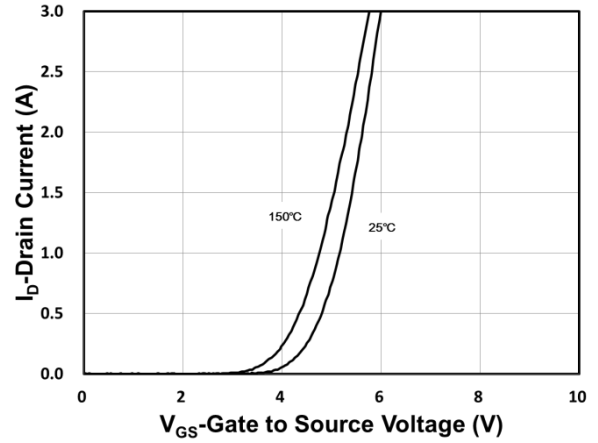
CHARACTERISTICS CURVES

($T_C = 25^\circ\text{C}$ unless otherwise noted)

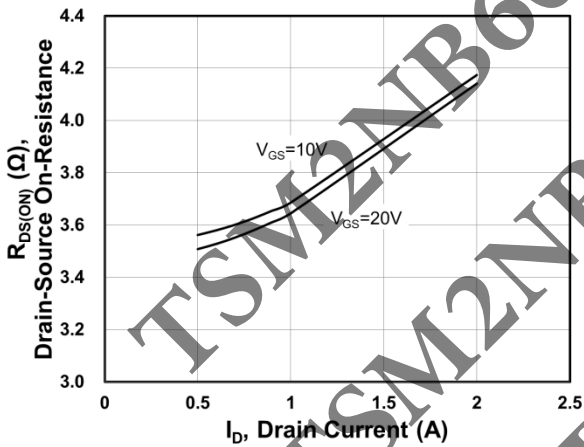
Output Characteristics



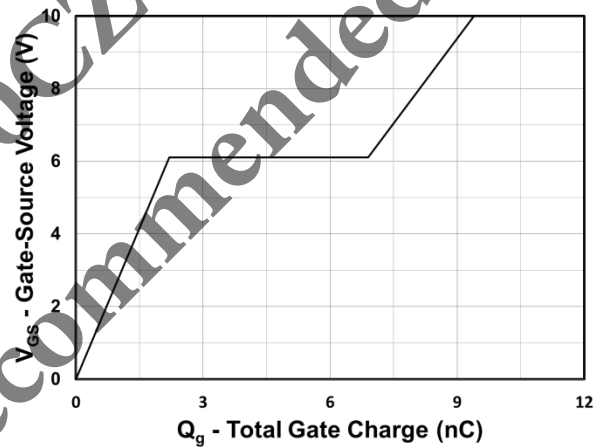
Transfer Characteristics



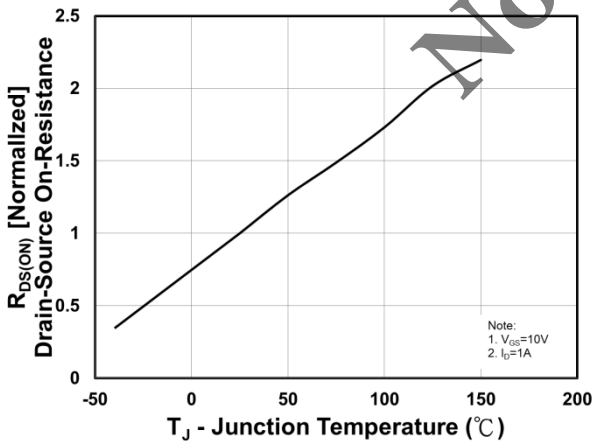
On-Resistance vs. Drain Current



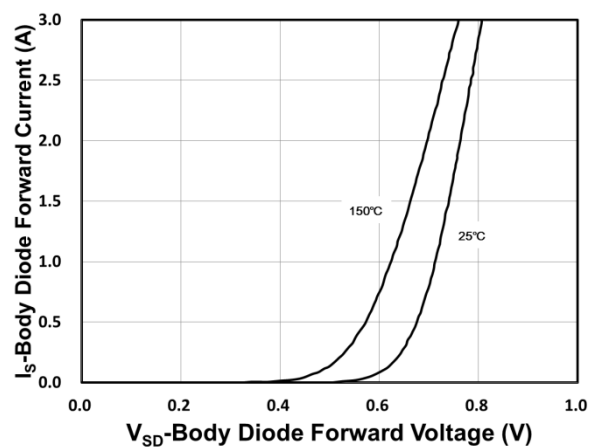
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



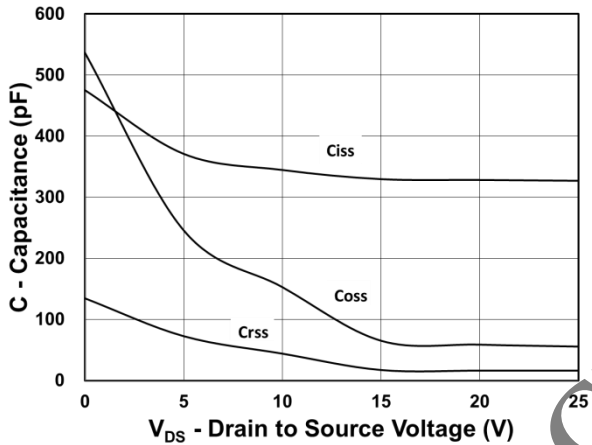
Source-Drain Diode Forward Current vs. Voltage



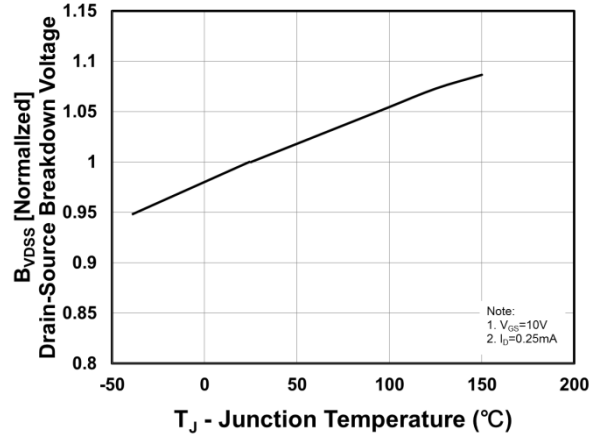
CHARACTERISTICS CURVES

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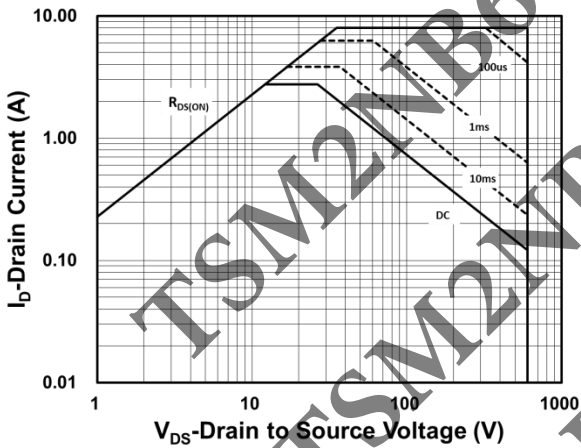
Capacitance vs. Drain-Source Voltage



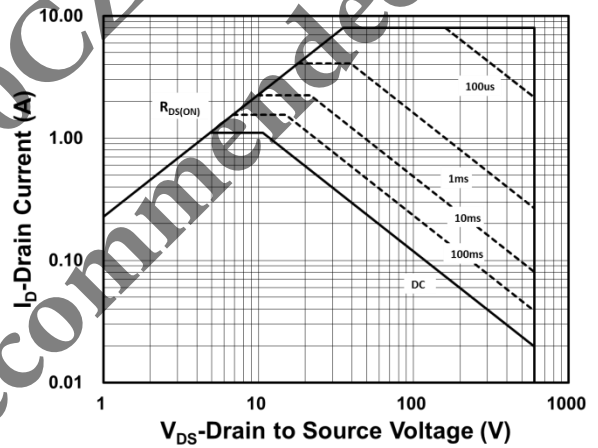
BV_{DSS} vs. Junction Temperature



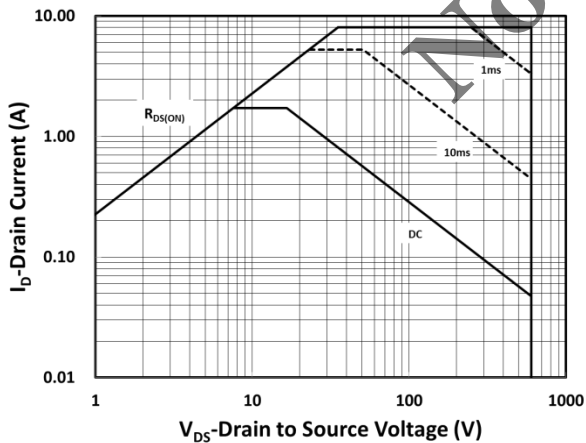
Maximum Safe Operating Area (TO-220)



Maximum Safe Operating Area (ITO-220)



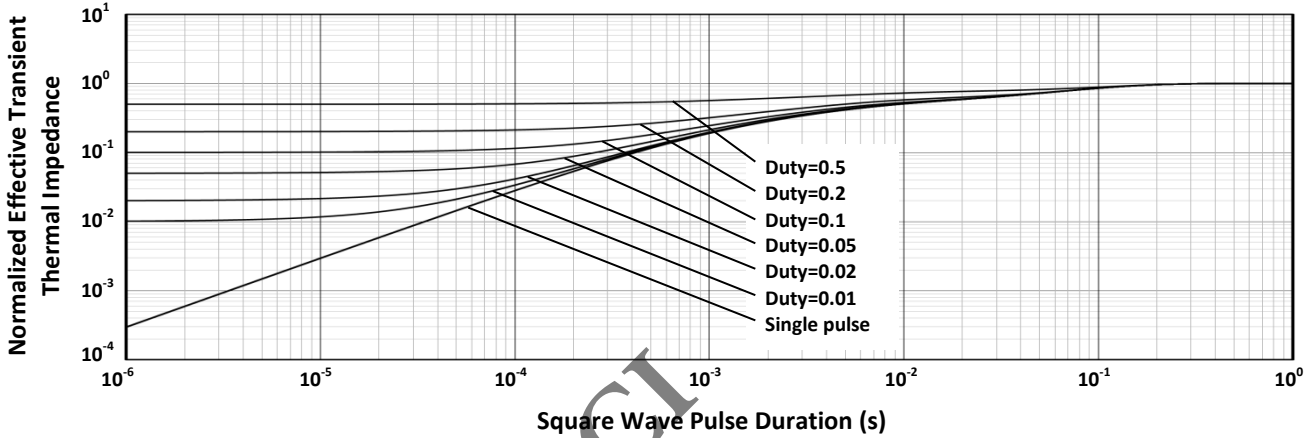
Maximum Safe Operating Area (DPAK/IPAK)



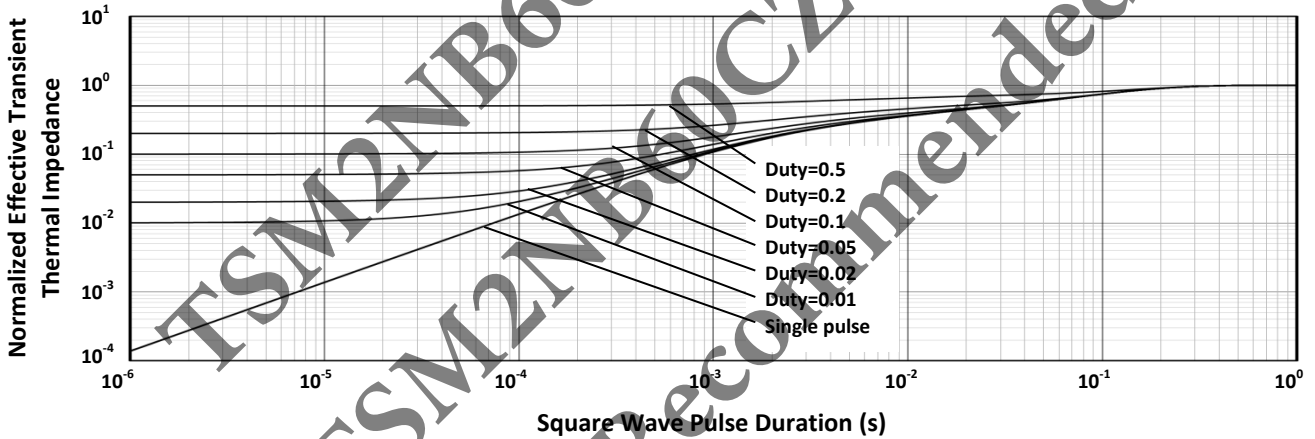
Electrical Characteristics Curves

($T_C = 25^\circ\text{C}$ unless otherwise noted)

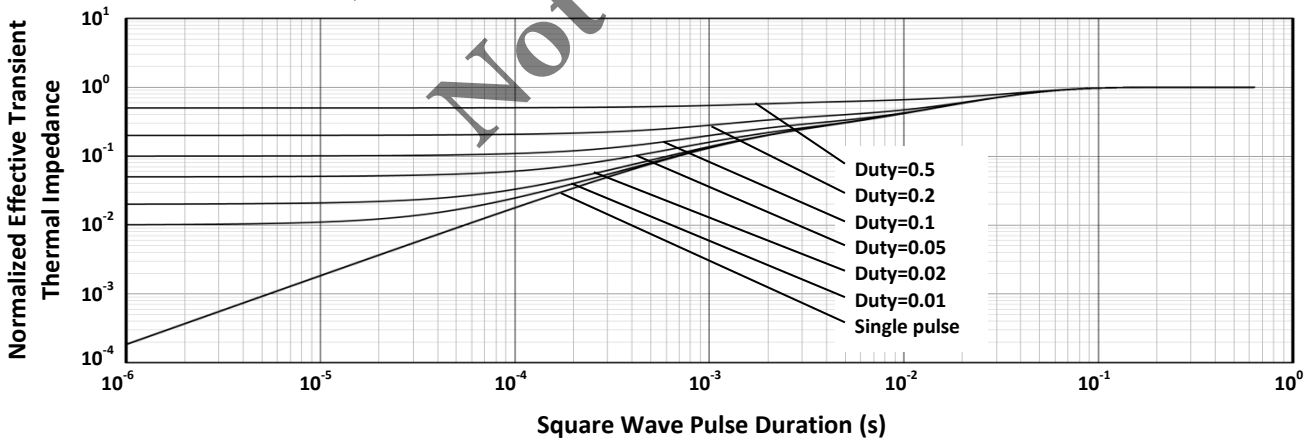
Normalized Thermal Transient Impedance, Junction-to-Case (TO-220)



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

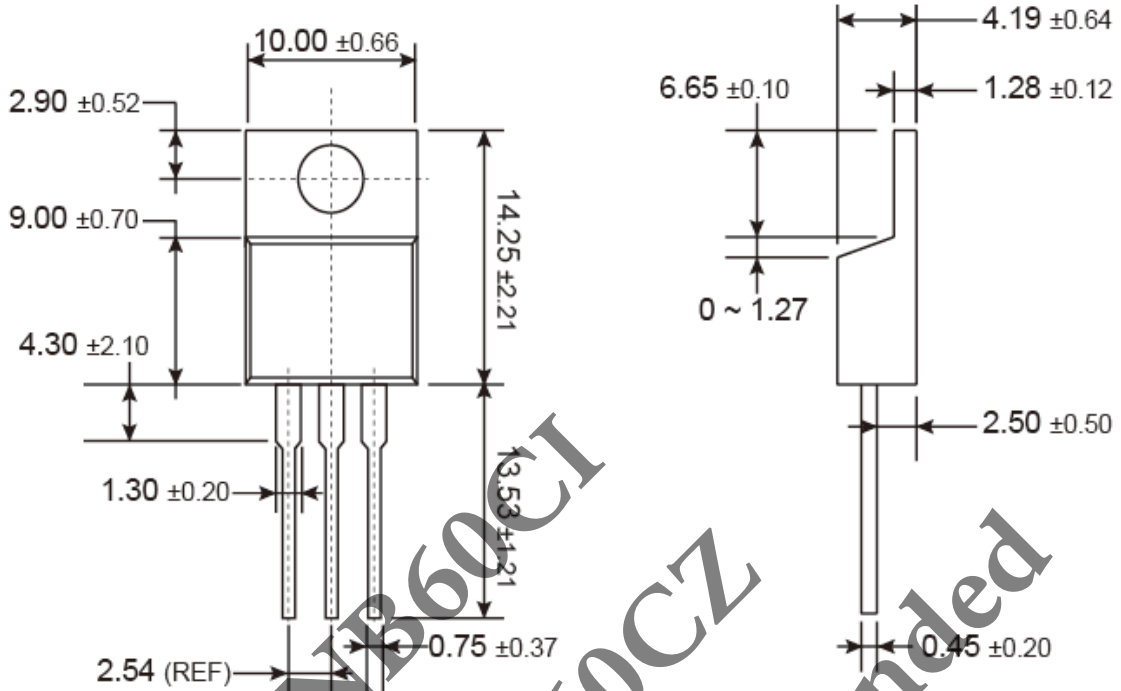


Normalized Thermal Transient Impedance, Junction-to-Case (DPAK/IPAK)

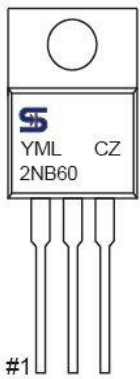


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-220



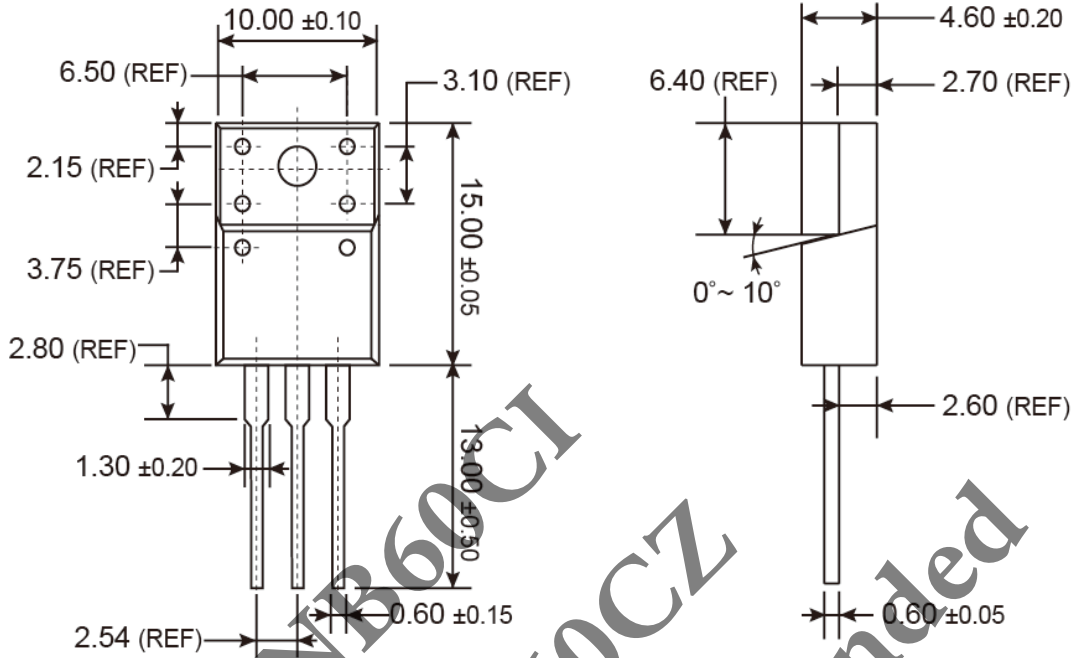
MARKING DIAGRAM



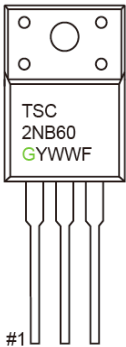
- Y = Year Code
- M = Month Code for Halogen Free Product
- O =Jan P =Feb Q =Mar R =Apr
- S =May T =Jun U =Jul V =Aug
- W =Sep X =Oct Y =Nov Z =Dec
- L = Lot Code (1~9, A~Z)

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

ITO-220



MARKING DIAGRAM

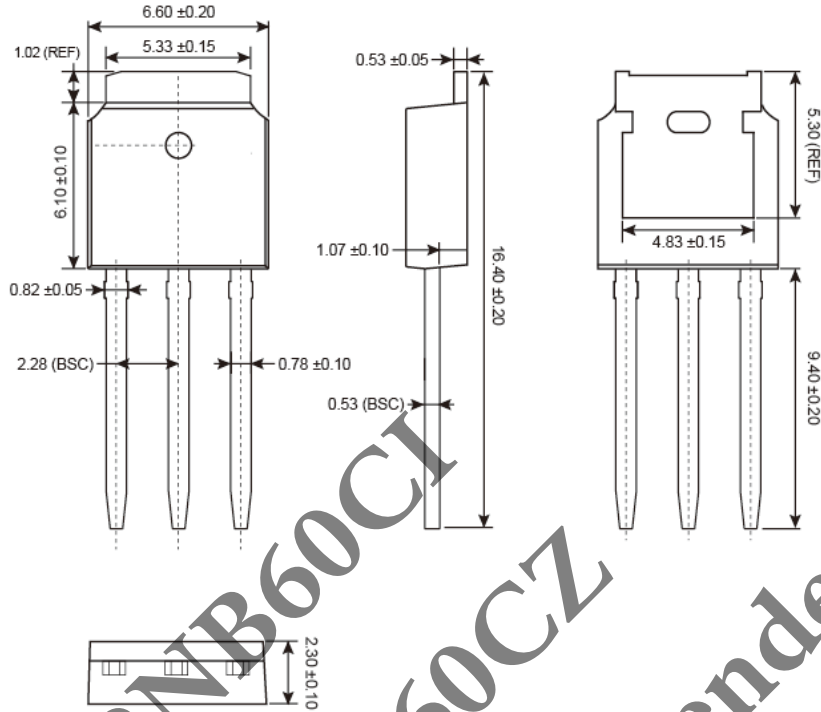


- G** = Halogen Free
- Y** = Year Code
- WW** = Week Code (01~52)
- F** = Factory Code

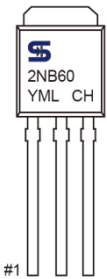
TSM2NB60C1
TSM2NB60CZ
Not Recommended

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-251(IPAK)

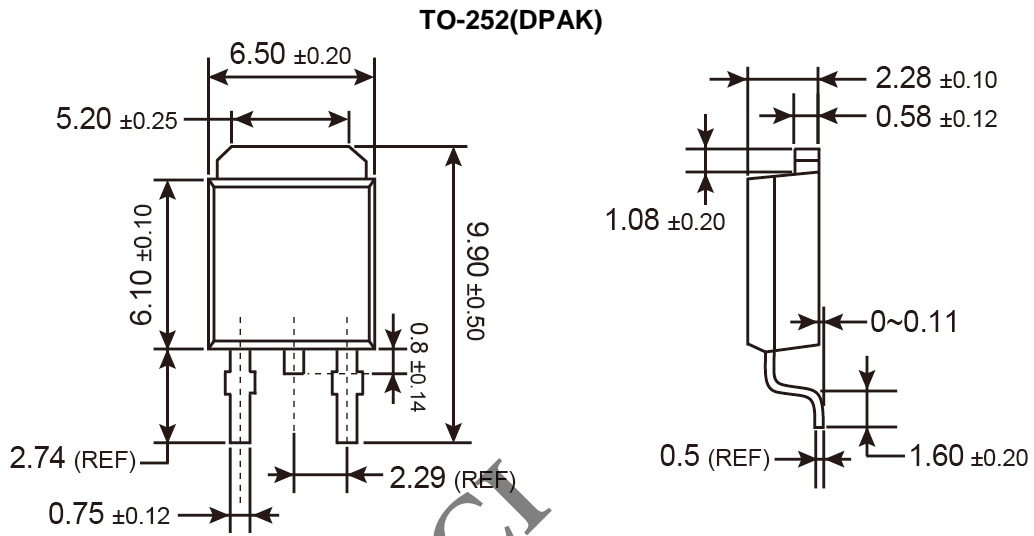


MARKING DIAGRAM

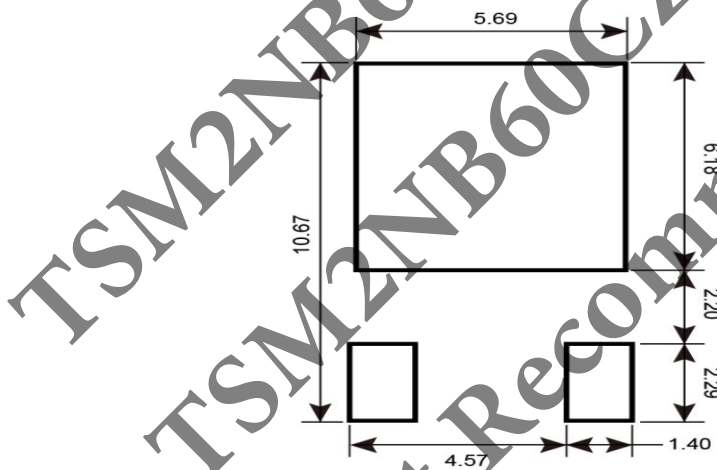


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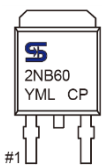
PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)



SUGGESTED PAD LAYOUT (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 (1~9, A~Z)

TSM2NB60CI
TSM2NB60CZ
Not Recommended

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