

## N-Channel Power MOSFET

900V, 4A, 4.0Ω

### FEATURES

- Low  $R_{DS(ON)}$  4Ω (Max.)
- Low gate charge typical @ 25nC (Typ.)
- Improve dV/dt capability

### APPLICATION

- High efficiency switch mode power Supply
- Lighting

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
$V_{DS}$	900	V
$R_{DS(on)}$ (max)	4	Ω
$Q_g$	25	nC



**Notes:** Moisture sensitivity level: level 3. Per J-STD-020

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)				
PARAMETER	SYMBOL	TO-220	ITO-220	UNIT
Drain-Source Voltage	$V_{DS}$	900		V
Gate-Source Voltage	$V_{GS}$	±30		V
Continuous Drain Current <sup>(Note 1)</sup>	$I_D$	$T_C = 25^\circ\text{C}$	4	4*
		$T_C = 100^\circ\text{C}$	2.2	2.2*
Pulsed Drain Current <sup>(Note 2)</sup>	$I_{DM}$	16	16 *	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_{DTOT}$	123	38.7	W
Single Pulsed Avalanche Energy <sup>(Note 3)</sup>	$E_{AS}$	474		mJ
Single Pulsed Avalanche Current <sup>(Note 3)</sup>	$I_{AS}$	4		A
Repetitive Avalanche Energy <sup>(Note 2)</sup>	$E_{AR}$	12.3		mJ
Peak Diode Recovery <sup>(Note 7)</sup>	dV/dt	4.5		V
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	- 55 to +150		°C

THERMAL PERFORMANCE				
PARAMETER	SYMBOL	TO-220	ITO-220	UNIT
Junction to Case Thermal Resistance	$R_{\theta JC}$	1.01	3.23	°C/W
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	62.5		°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.

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
<b>Static</b> (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	900	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	2	--	4	V
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = 900V, V_{GS} = 0V$	$I_{DSS}$	--	--	10	$\mu A$
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 2.0A$	$R_{DS(on)}$	--	3.2	4.0	$\Omega$
Forward Transconductance	$V_{DS} = 30V, I_D = 2.0A$	$g_{fs}$	--	6	--	S
<b>Dynamic</b> (Note 5)						
Total Gate Charge	$V_{DS} = 720V, I_D = 4.0A,$ $V_{GS} = 10V$	$Q_g$	--	25	--	nC
Gate-Source Charge		$Q_{gs}$	--	4.8	--	
Gate-Drain Charge		$Q_{gd}$	--	10.2	--	
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$	$C_{iss}$	--	955	--	pF
Output Capacitance		$C_{oss}$	--	80	--	
Gate Resistance	$F = 1MHz, \text{open drain}$	$R_g$	--	--	4	$\Omega$
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{DD} = 450V,$ $R_{GEN} = 25\Omega,$ $I_D = 4.0A, V_{GS} = 10V,$	$t_{d(on)}$	--	49	--	ns
Turn-On Rise Time		$t_r$	--	38	--	
Turn-Off Delay Time		$t_{d(off)}$	--	146	--	
Turn-Off Fall Time		$t_f$	--	50	--	
<b>Source-Drain Diode</b> (Note 4)						
Forward On Voltage	$I_S = 4.0A, V_{GS} = 0V$	$V_{SD}$	--	--	1.5	V
Reverse Recovery Time	$V_{GS} = 0V, I_S = 4A$	$t_{rr}$	--	487	--	ns
Reverse Recovery Charge		$di_f/dt = 100A/\mu s$	$Q_{rr}$	--	2.8	--

**Notes:**

1. Current limited by package.
2. Pulse width limited by the maximum junction temperature.
3.  $L = 56mH, I_{AS} = 4.0A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}.$
4. Pulse test:  $PW \leq 300\mu s, \text{duty cycle} \leq 2\%.$
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.
7.  $I_{SD} \leq 4A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}, \text{Starting } T_J = 25^\circ\text{C}.$

**ORDERING INFORMATION**

<b>PART NO.</b>	<b>PACKAGE</b>	<b>PACKING</b>
TSM4N90CZ C0G	TO-220	50pcs / Tube
TSM4N90CI C0G	ITO-220	50pcs / Tube

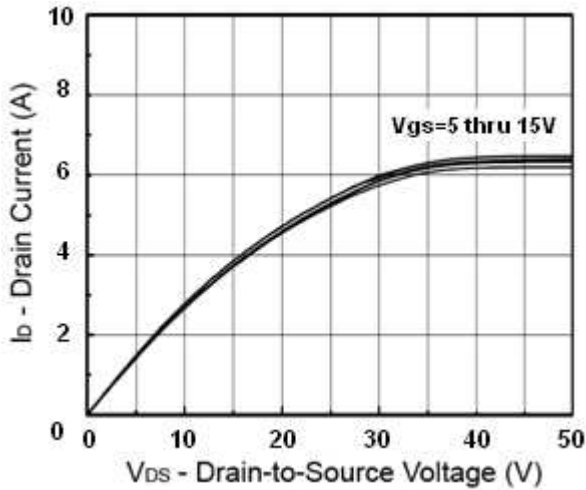
**Note:**

1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

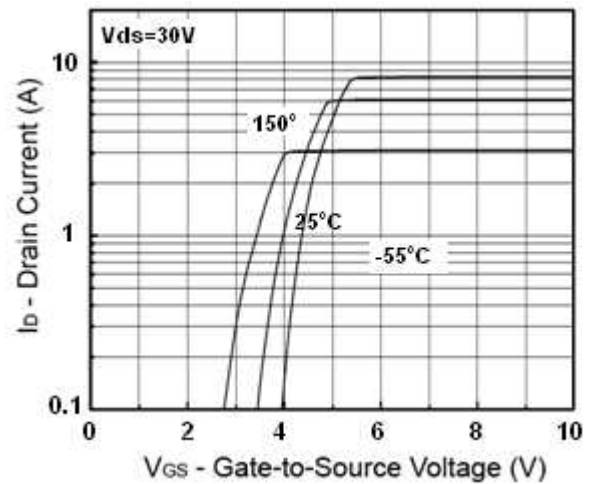
**CHARACTERISTICS CURVES**

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

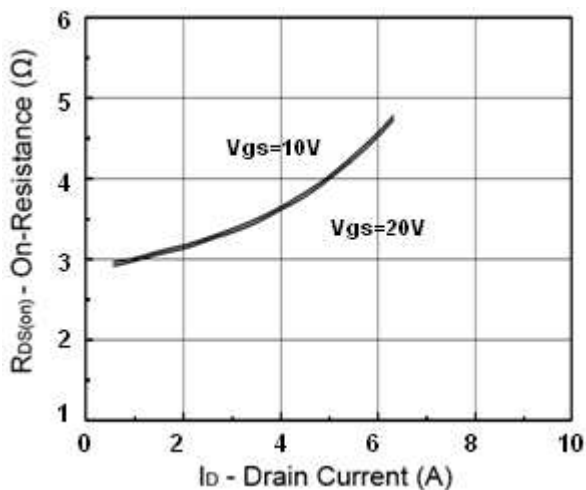
**Output Characteristics**



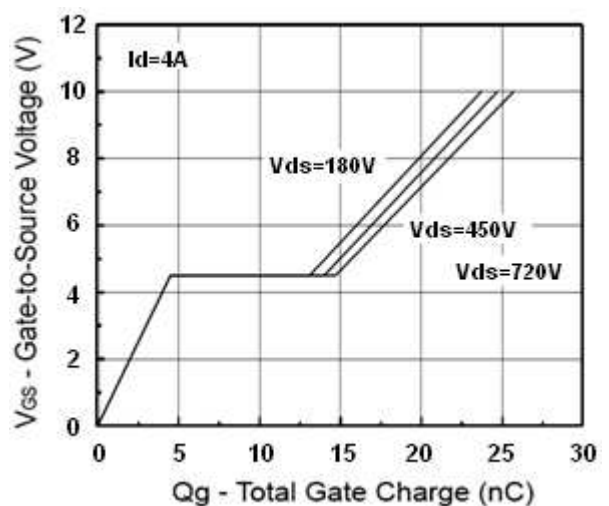
**Transfer Characteristics**



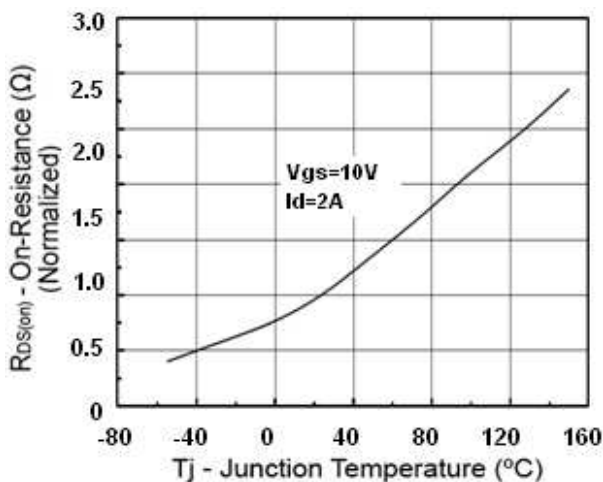
**On-Resistance vs. Drain Current**



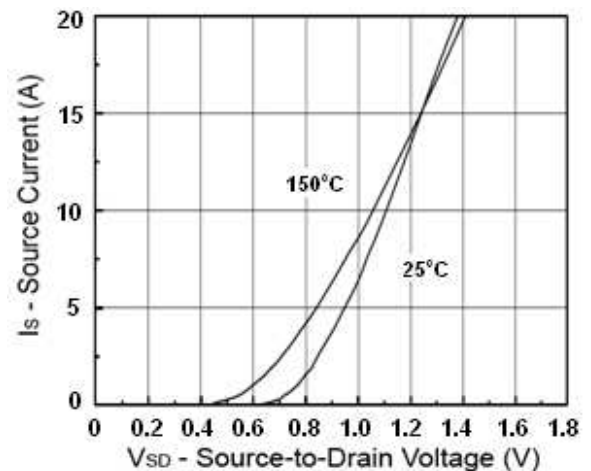
**Gate Charge**



**On-Resistance vs. Junction Temperature**



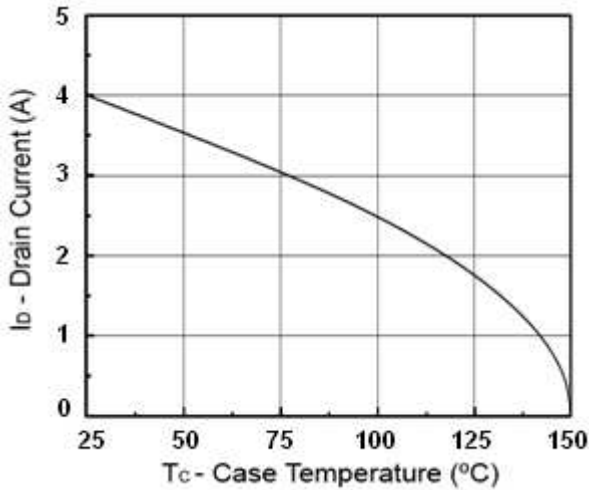
**Source-Drain Diode Forward Voltage**



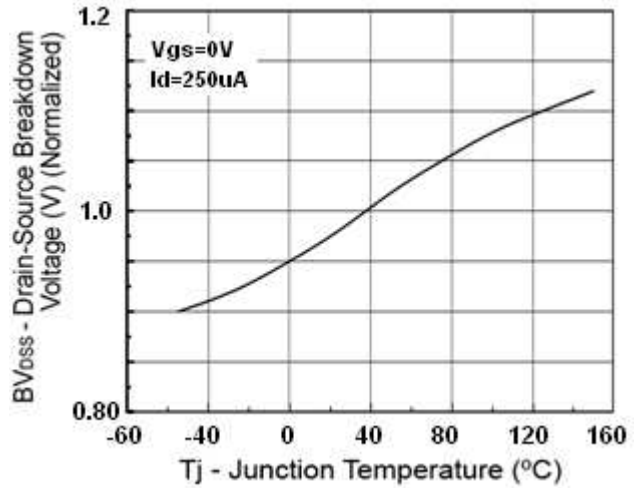
**CHARACTERISTICS CURVES**

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

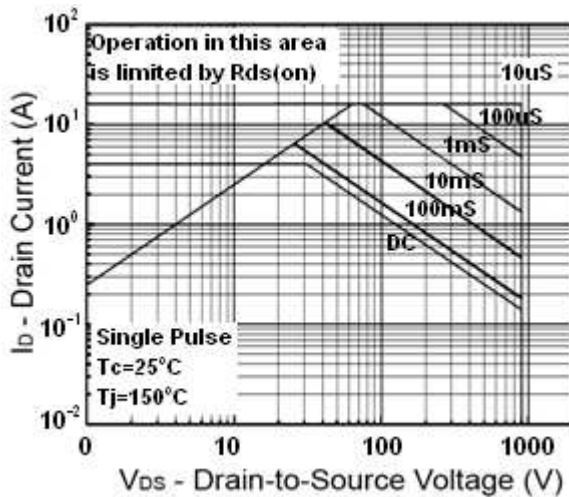
**Drain Current vs. Case Temperature**



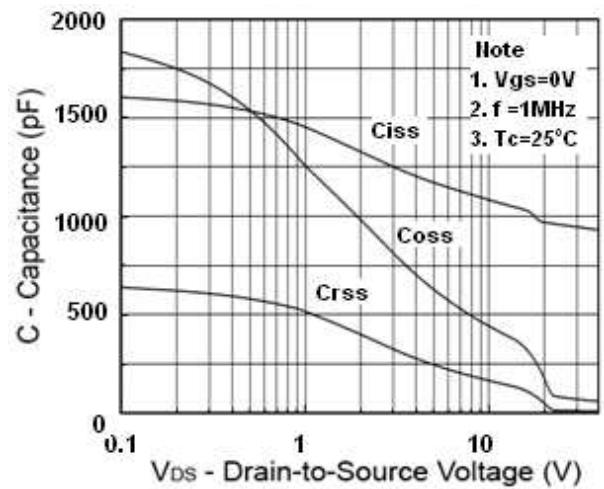
**$BV_{DSS}$  vs. Junction Temperature**



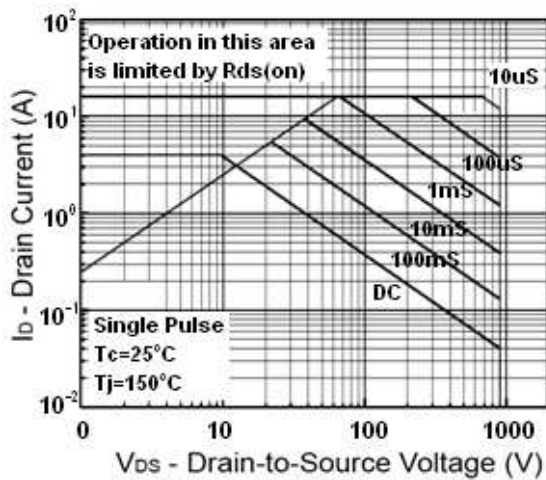
**Maximum Safe Operating Area**



**Capacitance vs. Drain-Source Voltage**



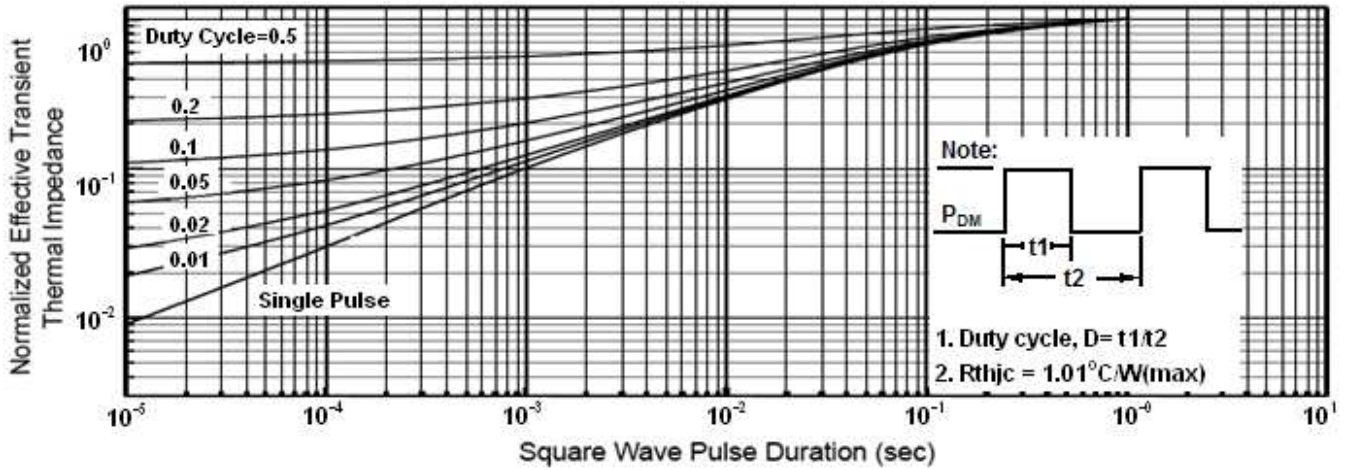
**Maximum Safe Operating Area (ITO-220)**



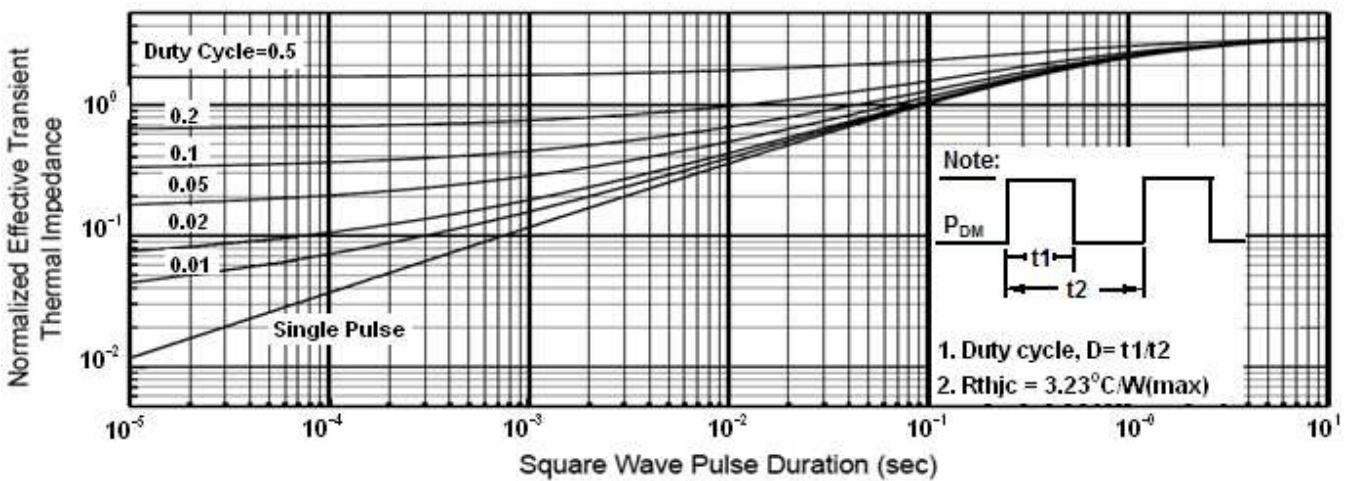
**CHARACTERISTICS CURVES**

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

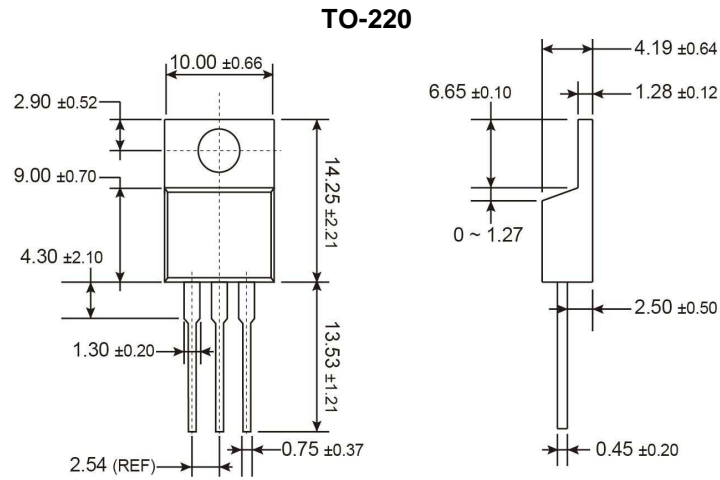
**Normalized Thermal Transient Impedance, Junction-to-Ambient (TO-220)**



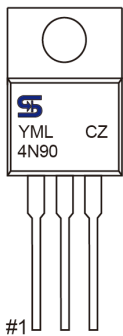
**Normalized Thermal Transient Impedance, Junction-to-Ambient (ITO-220)**



**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

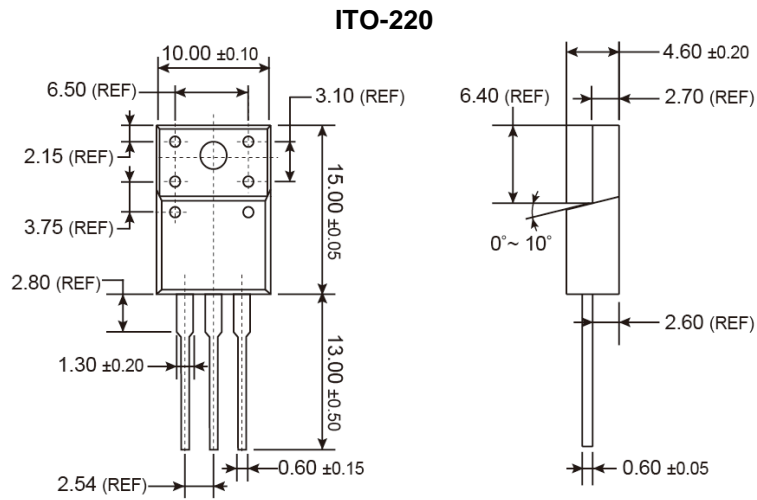


**MARKING DIAGRAM**

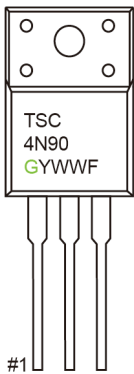


- Y** = Year Code
- M** = Month Code for Halogen Free Product
  - O** =Jan    **P** =Feb    **Q** =Mar    **R** =Apr
  - S** =May    **T** =Jun    **U** =Jul    **V** =Aug
  - W** =Sep    **X** =Oct    **Y** =Nov    **Z** =Dec
- L** = Lot Code (1~9, A~Z)

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)



**MARKING DIAGRAM**



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



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