

## N-Channel Power MOSFET

700V, 3.5A, 3.3Ω

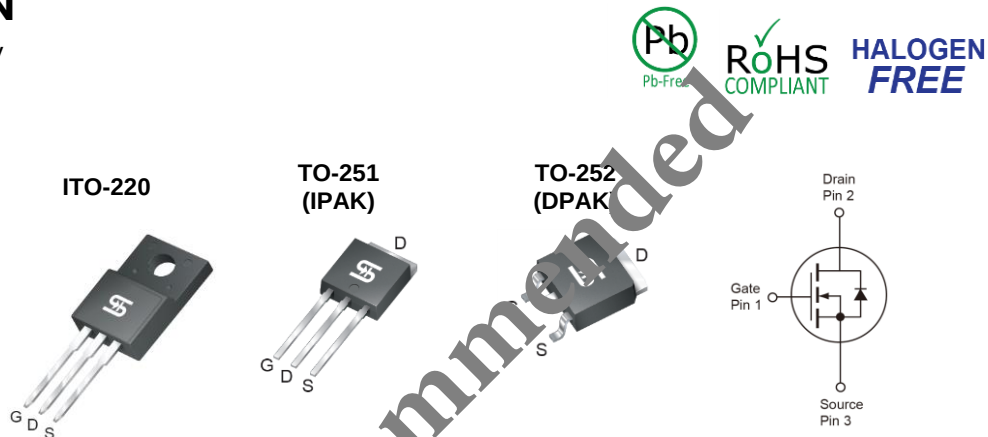
### FEATURES

- High power and current handling capability
- Pb-free plating
- RoHS compliant
- Halogen-free mold compound

### APPLICATION

- Power Supply
- Lighting

| KEY PERFORMANCE PARAMETERS |       |      |
|----------------------------|-------|------|
| PARAMETER                  | VALUE | UNIT |
| $V_{DS}$                   | 700   | V    |
| $R_{DS(on)}$ (max)         | 3.3   | Ω    |
| $Q_g$                      | 14    | nC   |



**Notes:** MSL 3 (Moisture Sensitivity Level) for TO-252 (DPAK) per J-STD-020

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

| PARAMETER                                          | SYMBOL         | LIMIT        |           | UNIT |
|----------------------------------------------------|----------------|--------------|-----------|------|
|                                                    |                | ITO-220      | IPAK/DPAK |      |
| Drain-Source Voltage                               | $V_{DS}$       | 700          |           | V    |
| Gate-Source Voltage                                | $V_{GS}$       | ±30          |           | V    |
| Continuous Drain Current (Note 1)                  | $I_D$          | 2            | 3.5       | A    |
|                                                    |                | 1.3          | 1.6       |      |
| Pulsed Drain Current (Note 2)                      | $I_{DM}$       | 8            | 14        | A    |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ | $P_{DTOT}$     | 38           | 56        | W    |
| Single Pulsed Avalanche Energy (Note 3)            | $E_{AS}$       | 43           |           | mJ   |
| Single Pulsed Avalanche Current (Note 3)           | $I_{AS}$       | 3.5          |           | A    |
| Operating Junction and Storage Temperature Range   | $T_J, T_{STG}$ | - 55 to +150 |           | °C   |

### THERMAL PERFORMANCE

| PARAMETER                              | SYMBOL          | LIMIT   |           | UNIT |
|----------------------------------------|-----------------|---------|-----------|------|
|                                        |                 | ITO-220 | IPAK/DPAK |      |
| Junction to Case Thermal Resistance    | $R_{\theta JC}$ | 3.6     | 2.2       | °C/W |
| Junction to Ambient Thermal Resistance | $R_{\theta JA}$ | 62      | 50        | °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 4)                  |                                                                        |              |     |      |           |          |
| Drain-Source Breakdown Voltage   | $V_{GS} = 0V, I_D = 250\mu A$                                          | $BV_{DSS}$   | 700 | --   | --        | 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  | $V_{DS} = 700V, V_{GS} = 0V$                                           | $I_{DSS}$    | --  | --   | 25        | $\mu A$  |
| Drain-Source On-State Resistance | $V_{GS} = 10V, I_D = 2A$                                               | $R_{DS(on)}$ | --  | 2.5  | 3.3       | $\Omega$ |
| Dynamic (Note 5)                 |                                                                        |              |     |      |           |          |
| Total Gate Charge                | $V_{DS} = 480V, I_D = 4A,$<br>$V_{GS} = 10V$                           | $Q_g$        | --  | 14   | --        | nC       |
| Gate-Source Charge               |                                                                        | $Q_{gs}$     | --  | 3    | --        |          |
| Gate-Drain Charge                |                                                                        | $Q_{gd}$     | --  | 6    | --        |          |
| Input Capacitance                | $V_{DS} = 25V, V_{GS} = 0V,$<br>$f = 1.0MHz$                           | $C_{iss}$    | --  | 595  | --        | pF       |
| Output Capacitance               |                                                                        | $C_{oss}$    | --  | 80   | --        |          |
| Reverse Transfer Capacitance     |                                                                        | $C_{rss}$    | --  | 20   | --        |          |
| Switching (Note 6)               |                                                                        |              |     |      |           |          |
| Turn-On Delay Time               | $V_{DD} = 300V,$<br>$R_{GEN} = 25\Omega,$<br>$I_D = 4A, V_{GS} = 10V,$ | $t_{d(on)}$  | --  | 18   | --        | ns       |
| Turn-On Rise Time                |                                                                        | $t_r$        | --  | 17   | --        |          |
| Turn-Off Delay Time              |                                                                        | $t_{d(off)}$ | --  | 40.5 | --        |          |
| Turn-Off Fall Time               |                                                                        | $t_f$        | --  | 19   | --        |          |
| Source-Drain Diode (Note 4)      |                                                                        |              |     |      |           |          |
| Forward On Voltage               | $I_S = 2.5A, V_{GS} = 0V$                                              | $V_{SD}$     | --  | --   | 1.5       | V        |

**Notes:**

- Current limited by package
- Pulse width limited by the maximum junction temperature
- $L = 7mH, I_{AS} = 3.5A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- Pulse test:  $PW \leq 300\mu s$ , duty cycle  $\leq 2\%$
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

**ORDERING INFORMATION**

| PART NO.      | PACKAGE       | PACKING             |
|---------------|---------------|---------------------|
| TSM4N70CI C0G | ITO-220       | 50pcs / Tube        |
| TSM4N70CH C5G | TO-251 (IPAK) | 75pcs / Tube        |
| TSM4N70CP ROG | TO-252 (DPAK) | 2,500pcs / 13" Reel |

**Note:**

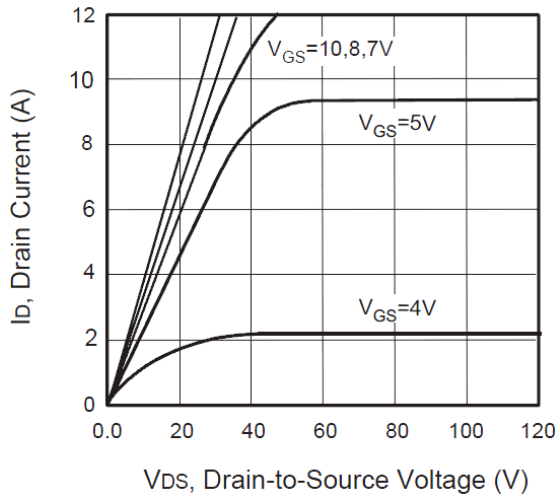
1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

Not Recommended

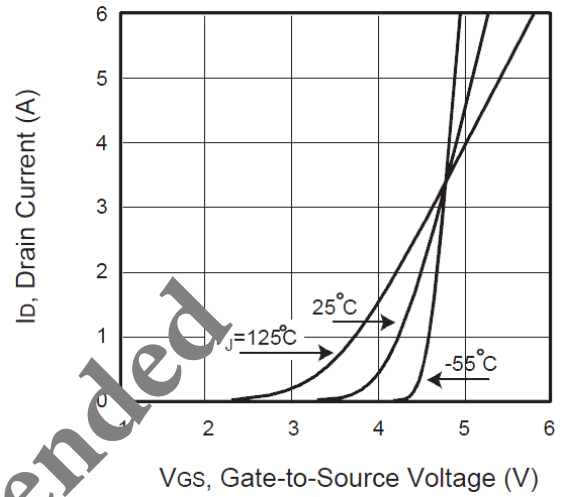
## CHARACTERISTICS CURVES

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

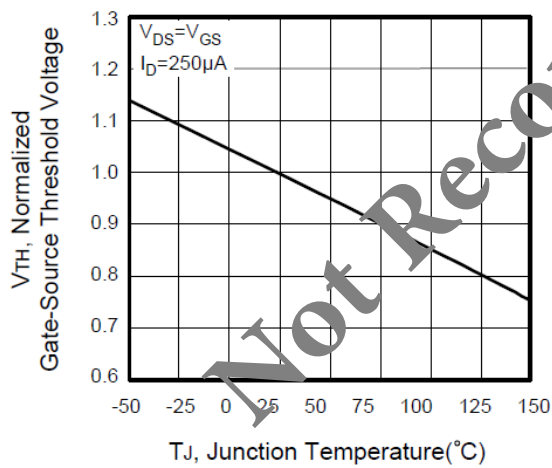
**Output Characteristics**



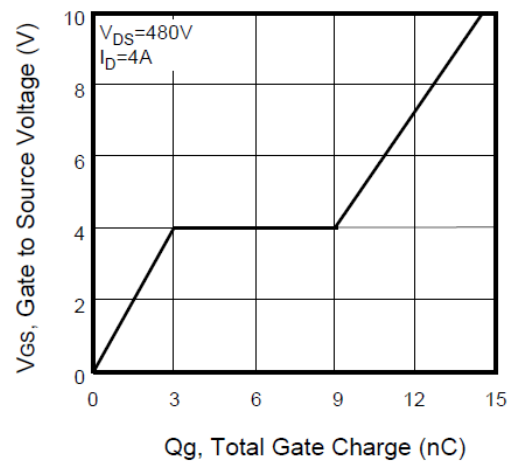
**Transfer Characteristics**



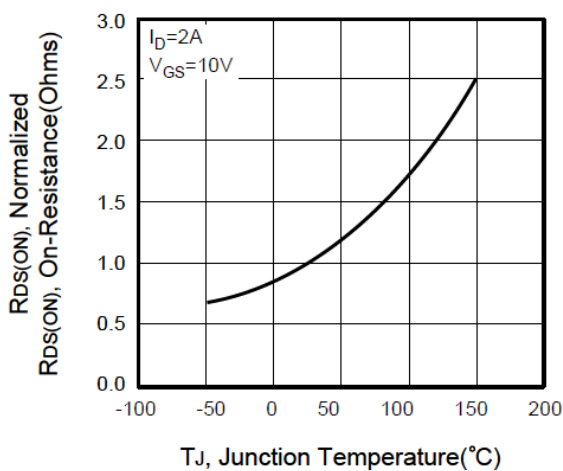
**Normalized  $V_{th}$  vs. Junction Temperature**



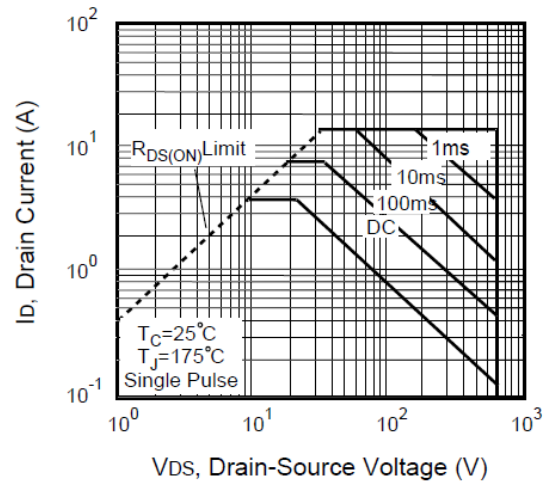
**Gate Charge**



**On-Resistance Variation vs. Temperature**



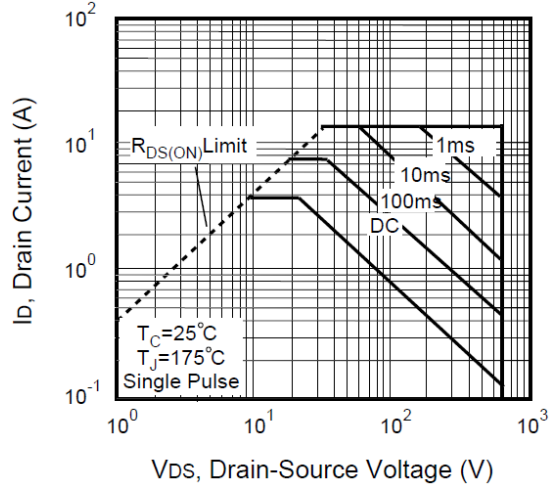
**Maximum Safe Operating Area (ITO-220)**



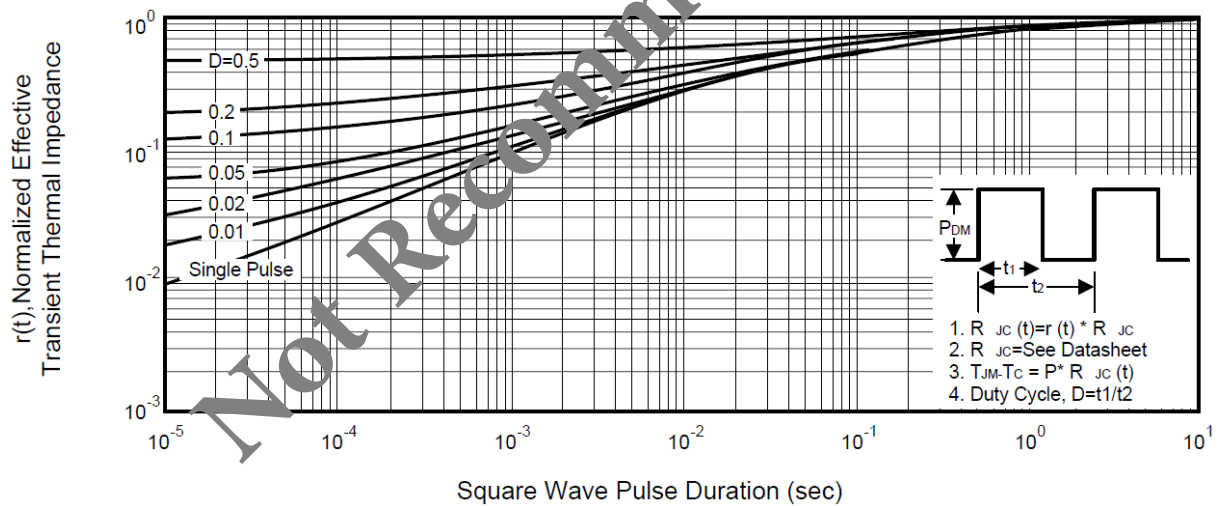
## CHARACTERISTICS CURVES

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

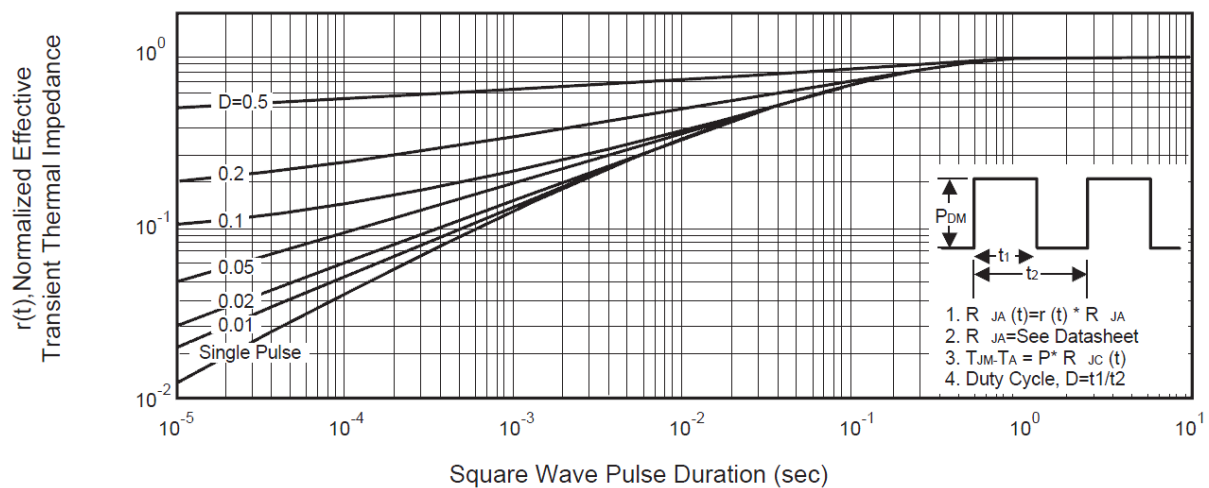
**Maximum Safe Operating Area (DPAK,IPAK)**



**Normalized Thermal Transient Impedance Curve (ITO-220)**

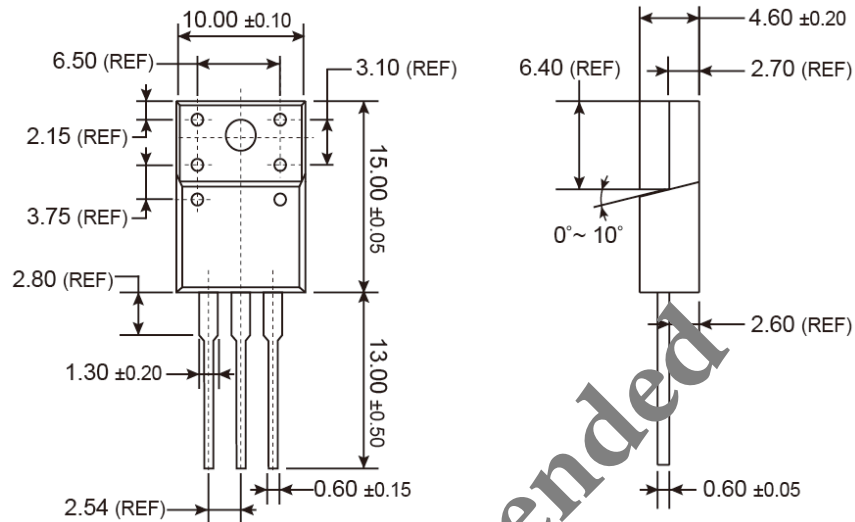


**Normalized Thermal Transient Impedance Curve (DPAK,IPAK)**

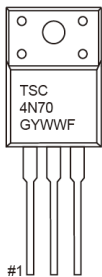


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**ITO-220**



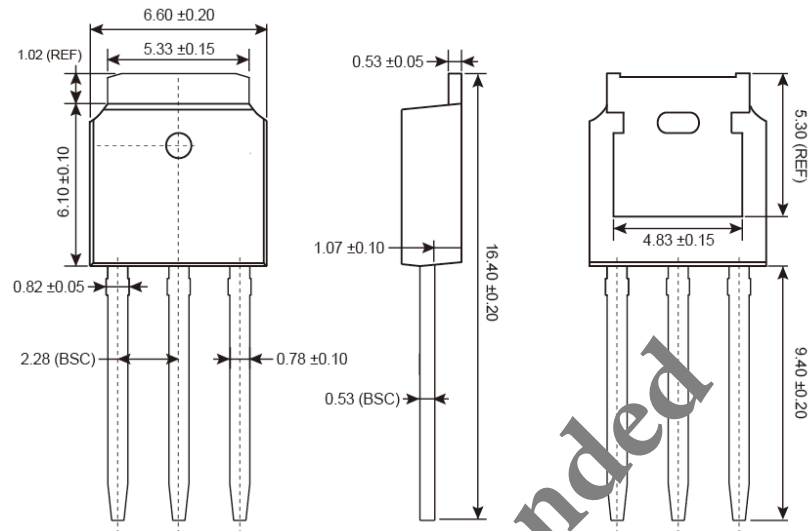
**MARKING DIAGRAM**



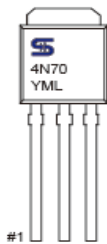
- G** = Halogen Free
- Y** = Year Code
- WW** = Week Code (01~52)
- F** = Factory Code

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

**TO-251 (IPAK)**



**MARKING DIAGRAM**



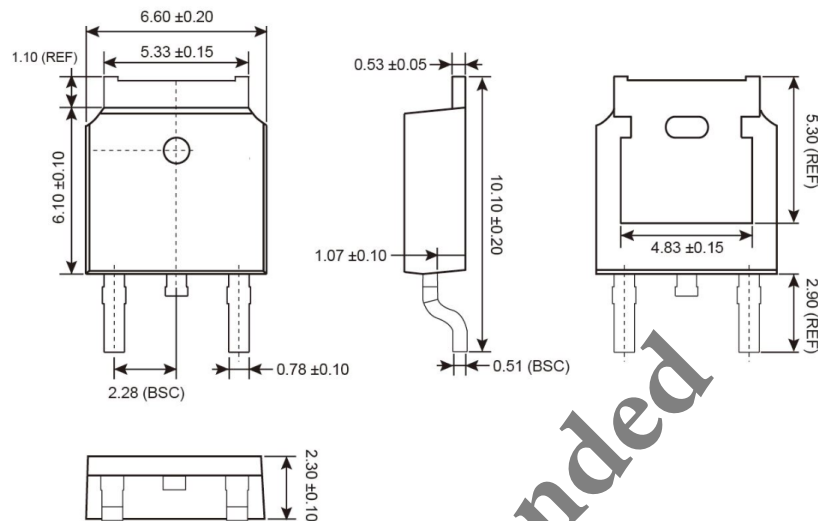
Y = Year Code  
M = Month Code for Halogen Free Product

|         |         |         |         |
|---------|---------|---------|---------|
| O = Jan | P = Feb | Q = Mar | R = Apr |
| S = May | T = Jun | U = Jul | V = Aug |
| W = Sep | X = Oct | Y = Nov | Z = Dec |

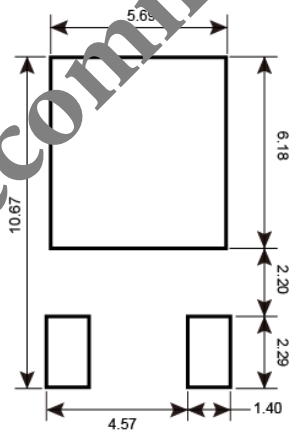
L = Lot Code (1~9, A~Z)

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

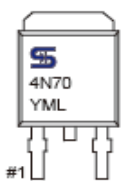
**TO-252 (DPAK)**



**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)

*Not Recommended*

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